

This issue of the *State of the Internet Report* concludes its ninth year of publication. It is an honor to lead this initiative, and I look forward to continuing to drive it forward in the future. The *State of the Internet* is a group effort, and its success relies on a set of colleagues for source data, writing, review, production, visualization development, and external promotion. Thank you to everyone involved with the *State of the Internet* program for making it so successful over the last nine years. And of course, thank you to our readers as well—you have made the report a success through your ongoing interest in, and use of, its data. It makes me extremely proud that the data published within the report has become a de facto reference within the broadband industry.

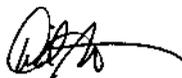
In past years, as we have wrapped up one year's reports, this letter has discussed changes that have occurred, or will be occurring, within the report—this year is no different. Within this issue, we have removed the mobile browser adoption section. However, the underlying data remains available at <https://www.akamai.com/us/en/solutions/intelligent-platform/visualizing-akamai/internet-observatory/internet-observatory-explore-data.jsp>. In addition, this will be the last issue that includes the “Situational Performance” average page load time section. Akamai is evolving our RUM tool (which is the source of the Situational Performance data), and our goal is to bring a richer set of data and associated insight back to the report in the future.

We have also promised to include IPv6 connection speed data within the report, and unfortunately, have failed to deliver. Including IPv6 insight is increasingly important as more network providers around the world make native IPv6 connectivity available to their fixed broadband subscribers. Furthermore, this insight is significant as mobile network providers move to IPv6-first connectivity to accommodate growing subscriber counts as well as increasing numbers of connected devices on their networks. We are making progress in this area, and we are working to include IPv6 connection speeds within the report as soon as it is practical.

Additionally, we are planning to make a significant change to the *State of the Internet Report* as we head into 2017, its tenth year of publication. Over the course of Volume 10, the intent is to move to a “digital-first” model. This model will make expanded data sets available online, along with associated visualizations. This shift will ultimately transition the long-form report from an exhaustive review of quarterly metrics to a shorter overview of highlights seen in the data over the past quarter. Moving to this digital-first model will enable us to make more data available, and to update it more frequently than once a quarter—both of which are regularly requested. Instead of waiting until the quarter ends to review highlights, we will publish regular social media updates and blog posts in support of the data. The transition will be gradual during the next year—you will see data sets moving from the report to the Akamai web site, as well as an associated shift in the commentary on the data within the report.

For readers who like to consume the *State of the Internet Report* on a tablet or e-reader, it is available for download in ePub format from online bookstores including amazon.com, [Barnes & Noble](http://Barnes&Noble.com), [Google Play](http://GooglePlay.com), [Apple iBooks](http://AppleiBooks.com), and [Kobo](http://Kobo.com). Specific download links are available upon registration at <https://www.akamai.com/stateoftheinternet>, and we encourage you to leave positive reviews of the report at your online bookstore of choice.

As always, if you have comments, questions, or suggestions regarding the *State of the Internet Report*, the website, or the mobile applications, please reach out to us via email at stateoftheinternet@akamai.com or on Twitter at [@akamai_soti](https://twitter.com/akamai_soti). You can also interact with us in the *State of the Internet* subspace on the Akamai Community at <https://community.akamai.com/>.



—David Belson

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Akamai's globally distributed Intelligent Platform™ allows us to gather enormous amounts of data on many metrics, including Internet connection speeds, network connectivity/availability issues, and IPv6 adoption progress, as well as traffic patterns across leading web properties and digital media providers. Each quarter, Akamai publishes the *State of the Internet Report* based on this data.

This quarter's report includes data gathered from across the Akamai Intelligent Platform during the fourth quarter of 2016, covering Internet connection speeds and broadband adoption metrics across both fixed and mobile networks, as well as trends seen in this data over time. In addition, the report includes insight into the state of IPv4 exhaustion and IPv6 adoption, Internet events and disruptions that occurred during the quarter, and observations from Akamai partner Ericsson regarding data and voice-traffic growth on mobile networks.

Data on attack traffic seen across the Akamai platform, and insights into high-profile security vulnerabilities and attacks are published in a separate *State of the Internet/Security Report*. The quarterly Security report provides timely information about the origins, tactics, types, and targets of cyberattacks, including quarter-over-quarter and year-over-year attack traffic trends as well as case studies highlighting emerging cybersecurity issues. The *State of the Internet/Security Report* can be found at <https://www.akamai.com/stateoftheinternet-security>.

INTERNET CONNECTIVITY / In the fourth quarter of 2016, Akamai observed a 0.1% quarterly increase in the number of unique IPv4 addresses connecting to the Akamai Intelligent Platform, rising to slightly fewer than 807 million — about 600,000 more than in the third quarter. In all, slightly more than 3 million IPv4 addresses were depleted from available pools at the Regional Internet Registries in the fourth quarter, leaving approximately 42 million addresses remaining. Belgium remained the clear global leader in IPv6 adoption with 47% of its connections to Akamai for dual-stacked content happening over IPv6, up 20% from the previous quarter.

CONNECTION SPEEDS & BROADBAND ADOPTION / The global average connection speed increased 12% quarter-over-quarter to 7.0 Mbps, a 26% increase compared with one year prior. At a country/region level, South Korea continued to have the highest average connection speed in the world at 26.1 Mbps, despite a 0.7% decline as compared with the third quarter.

Globally, 4 Mbps broadband adoption was 79% in the fourth quarter, up 3.2% from the third quarter, with South Korea having with the highest level of adoption worldwide at 97% (followed closely by the Guernsey and Malta, also with 97% adoption rates). The worldwide 10 Mbps, 15 Mbps, and 25 Mbps broadband adoption rates all saw robust quarter-over-quarter growth, increasing 12%, 14%, and 19% to adoption levels of 42%, 25%, and 10%, respectively. As it has for many quarters, South Korea continued to lead the world in all

three broadband tiers, with adoption rates of 83%, 64%, and 34% respectively, after moderate quarterly increases in 10 Mbps and 15 Mbps adoption and a small decline in 25 Mbps adoption.

MOBILE / In the fourth quarter of 2016, average mobile connection speeds (aggregated at a country/region level) ranged from a high of 26.8 Mbps in the United Kingdom to a low of 2.9 Mbps in Venezuela. Based on traffic data collected by Ericsson, the volume of mobile data traffic grew by 13% over the previous quarter.





[SECTION]¹ INTERNET PENETRATION

Through its globally deployed Intelligent Platform, and due to the more than 2 trillion requests for web content that it serves daily, Akamai has unique visibility into levels of Internet penetration around the world. In the fourth quarter of 2016, nearly 807 million unique IPv4 addresses from 241 unique countries/regions connected to the Akamai Intelligent Platform. This is a 0.4% decrease in the number of unique IPv4 addresses seen by Akamai as compared with the fourth quarter of 2015, and a 0.1% increase from the number seen in the third quarter of 2016 .

We believe the 807 million IPv4 addresses seen by Akamai represent well over 1 billion web users. In some cases, multiple individuals may be represented by a single IPv4 address (or a small number of IPv4 addresses), because they access the web through a firewall or proxy server. In other cases, individual users may be associated with multiple IPv4 addresses due to their use of multiple connected devices.

1.1 UNIQUE IPV4 ADDRESSES / The number of unique IPv4 addresses connecting to Akamai worldwide increased by about 600,000 in the fourth quarter of 2016, but still represents a decrease as compared with one year prior. As noted previously, we expect that the number of unique global IPv4 addresses seen by Akamai may continue to level off or decline modestly in the future. Akamai expects this shift as carriers increase the availability of native IPv6 connectivity for subscribers, and implement Carrier-Grade Network Address Translation (CGNAT) solutions more broadly to conserve limited IPv4 address space.

In the fourth quarter of 2016, 6 of the top 10 countries/regions saw modest quarterly gains in unique IPv4 address counts, three saw modest decreases, and the United Kingdom remained virtually unchanged, as in the previous quarter. As seen in Figure 1, gains ranged from 0.3% in South Korea to 5.4% in Italy, while declines ranged from 1.9% in China to 3.6% in Brazil. Across the globe, approximately half of the countries/regions surveyed saw a quarter-over-quarter increase in unique IPv4 address counts in the fourth quarter, down from approximately 55% in the third. Nineteen countries/regions saw IPv4 address counts grow 10% or more, while thirty-five saw counts decline 10% or more as compared with the previous quarter.

Year-over-year changes among the top 10 countries/regions were mixed as well, with half of them seeing IPv4 address counts increase and half seeing them decrease. Germany posted the largest increase at 4.8%, while Russia had the smallest at 0.2%. Among the countries/regions to see a yearly decrease in unique IPv4 address counts, China had the largest decline with a decrease of 5.7%, while Japan had the smallest at 0.5%. As noted previously, the declines seen in these countries are not indicative of long-term declines in Internet usage, but are more likely related to changes in IPv4 address management/conservation practices and/or increased IPv6 adoption.

Globally, roughly 50% of the countries/regions surveyed had higher unique IPv4 address counts in the fourth quarter compared with one year prior. Yearly growth rates of 100% or more were seen in

nine countries/regions, although several of them had a relatively small number of unique IPv4 addresses, so percentage shifts can appear deceptively large. Ten countries/regions saw IPv4 address counts decline at least 50%, but all ten had very small IPv4 address counts, with nine having fewer than 200 IPv4 addresses connect to Akamai in the fourth quarter.

1.2 IPV4 EXHAUSTION / As expected, in the fourth quarter of 2016, available IPv4 address space continued to decrease as Regional Internet Registries (RIRs) assigned and allocated blocks of IPv4 address space to organizations within their respective territories. A reference table translating the /nn notations used below to identify unique IP address counts can be found at <https://www.arin.net/knowledge/cidr.pdf>.

Leveraging data¹ collected by Geoff Huston, Chief Scientist at APNIC,² the *State of the Internet Report* provides a perspective on the size of the available IPv4 address pool at each RIR, and how the sizes of the available pools have been shrinking over time. In addition, the report uses data provided by the individual RIRs to highlight IPv4 address space delegation activity within each region over the course of the quarter.

Figure 2 illustrates how the size of available IPv4 address pools at each RIR changed during the fourth quarter of 2016 based on data made available by Mr. Huston. As noted in the *Third Quarter, 2015 State of the Internet Report*, ARIN fully depleted its pool of available addresses after allocating its final IPv4 address block on September 24, 2015. Its reported available pool has remained at zero since then.

LACNIC handed out approximately 420,000 addresses—roughly 60% of the number it distributed in the third quarter, and representing almost 60% of the addresses it had available in its pool at the beginning of the quarter. AFRINIC distributed more than 1.5 million addresses—less than half the number it handed out in the third quarter, and representing about 7% of its available pool. APNIC distributed almost 410,000 addresses—5% of its available pool and

	Country/Region	Q4 2016 Unique IPv4 Addresses	QoQ Change	YoY Change
–	Global	806,852,455	0.1%	-0.4%
1	United States	141,448,899	2.4%	-1.2%
2	China	119,912,960	-1.9%	-5.7%
3	Brazil	47,260,590	-3.6%	-1.4%
4	Japan	46,101,064	1.3%	-0.5%
5	Germany	38,433,814	3.9%	4.8%
6	United Kingdom	30,947,751	<0.1%	-2.2%
7	France	29,731,348	-3.3%	0.3%
8	South Korea	25,416,386	0.3%	4.6%
9	Russia	19,479,101	2.1%	0.2%
10	Italy	17,430,006	5.4%	4.2%

Figure 1: Unique IPv4 Addresses Seen by Akamai

roughly 70% of the number given out in the third quarter, and RIPE handed out about 900,000 addresses — 6% of its pool and slightly higher than the number it distributed in the previous quarter.

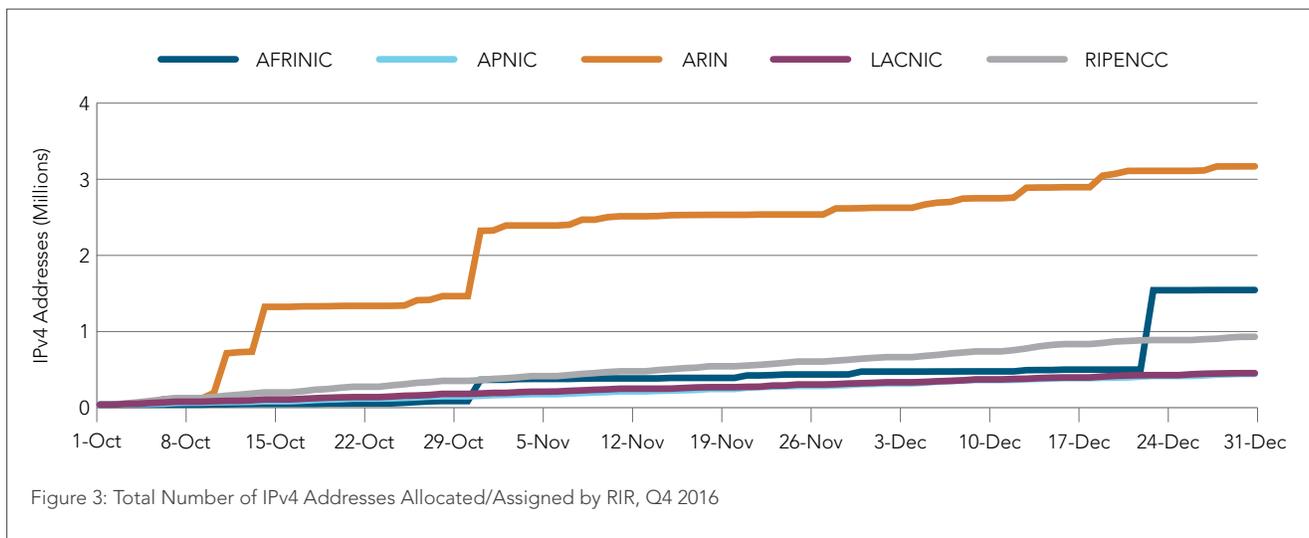
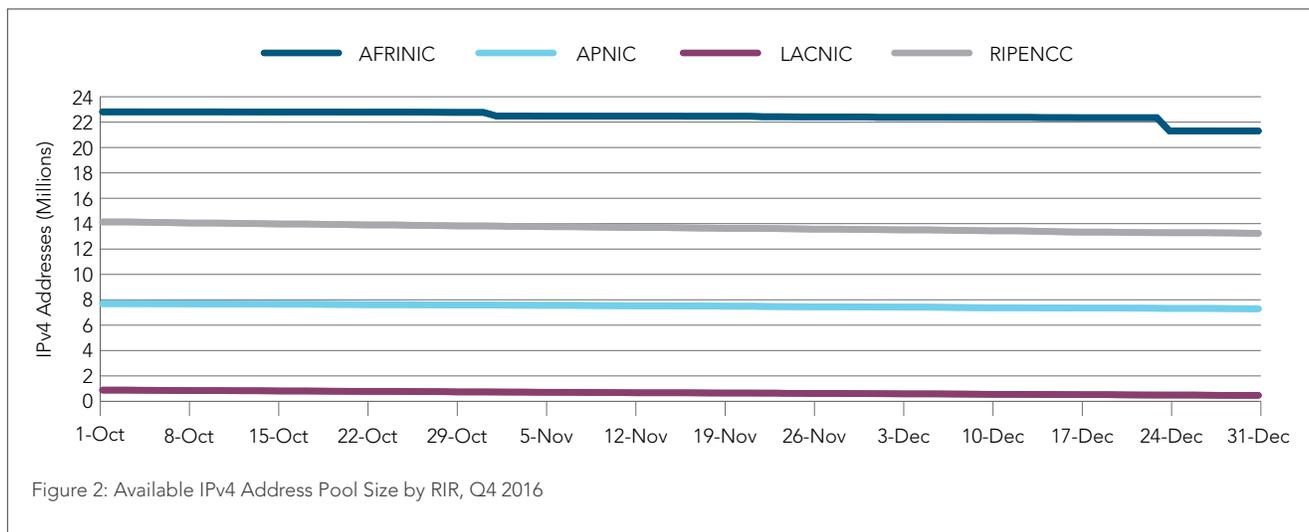
With slightly more than 21 million addresses available at the end of the fourth quarter, AFRINIC was again the RIR with the most substantial pool of IPv4 addresses remaining. At the end of the fourth quarter, RIPE and APNIC had roughly 13 million and 7 million available IPv4 addresses respectively; and LACNIC, with the smallest remaining pool, had slightly more than 310,000 available addresses remaining.

Figure 3 illustrates the IPv4 allocation/assignment activity across each of the RIRs during the fourth quarter of 2016. Compared with the third quarter, there was significantly less activity, as 6.4 million addresses were allocated/assigned in the fourth quarter versus 16 million in the third quarter. As noted in previous *State of the Internet Reports*, as available address pools dwindle, sizeable

portions of these transactions — most notably ARIN’s assignment/ allocation of 3 million addresses — are likely to be third-party transfers instead of direct RIR allocations.

Based on the data below, the most significant transactions at ARIN in the fourth quarter occurred on three dates in October. On October 11, a /13 was allocated to Google;³ on Oct 14, nine /16s totaling nearly 600,000 addresses were allocated to Oracle (Oracle Public Cloud);⁴ and on Oct 31, a /13 was allocated to Webpass (an ISP acquired by Google in October 2016)⁵ and five /16s were allocated to Oracle.⁶ As noted in previous *State of the Internet Reports*, these transactions were mostly likely IPv4 address block transfers between third-party companies. However, they appear as ARIN assignments in this data set because of the administrative logistics of the transfer process.

In the meantime, the remaining RIRs still have IPv4 addresses available to assign. AFRINIC’s largest allocation in the fourth quarter occurred on December 23, when Egyptian telecommunications company Mobinil, received a /12.⁷ In addition, on October 31, AFRINIC allocated a /14 to Ivory Coast telecommunications provider



MTN Côte d'Ivoire.⁸ Other than these two transactions, AFRINIC, APNIC, RIPE, and LACNIC all saw slow, consistent delegation activity in the fourth quarter, much like the third, with no specific days seeing assignments or allocations larger than a /17.

1.3 IPV6 ADOPTION / This section includes insight into IPv6 adoption based on data gathered from the Akamai Intelligent Platform. The traffic percentages cited in Figure 4 and Figure 5 are calculated by dividing the number of content requests made to Akamai over IPv6 by the total number of requests made to Akamai (over both IPv4 and IPv6) for customer web properties that have enabled Akamai Edge delivery via IPv6 — in other words, for dual-stacked hostnames. This reporting methodology provides something of a lower bound for IPv6 adoption, as some dual-stacked clients — such as Safari on Mac OS X Lion and Mountain Lion — will only use IPv6 for a portion of possible requests. While new versions of Mac OS X have addressed this issue, we are now finding that lack of IPv6 support in some consumer electronics (such as smart TVs and stand-alone digital media player devices) presents a barrier to growth in adoption, especially as the amount of content consumed on these devices grows over time. While not all of Akamai's customers have chosen to implement IPv6 delivery yet, the data set used for this section includes traffic from a number of leading web properties and software providers, so we believe it is sufficiently representative. Note that, in compiling the data for the figures in this section, a minimum of 90 million total requests to Akamai during the fourth quarter was required to qualify for inclusion.

A regularly updated view into the metrics discussed below can be found in the "IPv6 Adoption Trends by Country and Network" visualization on the *State of the Internet* website at <https://www.akamai.com/stateoftheinternet/ipv6>.

Figure 4 highlights the 10 countries/regions with the largest percentage of content requests made to Akamai over IPv6 in the fourth quarter. With a robust 20% quarter-over-quarter increase in IPv6 adoption, Belgium again maintained a significant global lead, with 47% of its content requests to Akamai made over IPv6. Belgium's IPv6 percentage was 17 percentage points higher than

	Country/Region	Q4 2016 IPv6 %	QoQ Change
1	Belgium	47%	20%
2	Greece	30%	22%
3	Switzerland	27%	28%
4	United States	25%	19%
5	Germany	25%	12%
6	Trinidad and Tobago	22%	143%
7	Estonia	18%	20%
8	Portugal	17%	4.5%
9	India	14%	-17%
10	Canada	14%	38%

Figure 4: IPv6 Traffic Percentage, Top Countries/Regions

second place Greece. Unlike the third quarter, where four countries/regions in the top 10 saw a drop in IPv6 adoption, only India posted a decline in the fourth quarter. India's adoption levels decreased 17% after a stunning 715% quarterly increase in the previous quarter. Trinidad and Tobago and Canada joined the top 10 in the fourth quarter — boasting the largest quarterly gains in the group, with increases of 143% and 38%, to IPv6 adoption levels of 22% and 14%, respectively. The remaining 8 countries in the top 10 saw more modest increases, with growth rates ranging from 4.5% in Portugal to 28% in Switzerland.

Figure 5 lists the top 20 network providers by the number of IPv6 requests made to Akamai during the fourth quarter. Once again, cable and wireless/mobile providers continued to drive the largest volumes of IPv6 requests, as many are leading the way for IPv6 adoption in their respective countries.

Again, in the fourth quarter, Verizon Wireless led the pack in adoption rates with 81% of its requests to Akamai being made over IPv6, up from 80% in the third quarter, followed by T-Mobile with 77% of requests, up from 75% in the third. In the fourth quarter, 17 of the top 20 providers had at least one in four requests for dual-stacked content to Akamai take place over IPv6 — up from 15 providers in the third quarter, and 12 in the second. All the top 20 had at least 15% of requests to Akamai occur over IPv6.

Country/Region	Network Provider	Q4 2016 IPv6 %
United States	Comcast Cable	50%
United States	AT&T	47%
United States	Time Warner Cable	27%
United States	Cox Communications	35%
India	Reliance Jio Infocomm Ltd	72%
United States	Verizon Wireless	81%
Germany	Deutsche Telekom	37%
United Kingdom	Sky Broadband	50%
United States	T-Mobile	77%
Canada	Rogers Cable	43%
Belgium	TELENET	65%
Canada	Telus Communications	49%
France	Orange	15%
Argentina	Telecentro	48%
France	Proxad/Free	28%
Japan	KDDI Corporation	42%
Australia	Telstra Direct	17%
Brazil	NET Serviços de Comunicação S.A.	16%
Germany	Kabel Deutschland	53%
Belgium	Belgacom Skynet	39%

Figure 5: IPv6 Traffic Percentage, Top Network Providers by IPv6 Request Volume

These consistent increases point to increasing IPv6 adoption, a trend that continues to accelerate. In its blog, ARIN noted several IPv6 milestones for 2016, including (i) Facebook seeing the majority (55%) of U.S. mobile access to its site coming over IPv6 compared with IPv4, (ii) Comcast aiming to have half of its traffic IPv6-enabled by year end, (iii) Apple requiring all iOS apps to support IPv6, and (iv) Google seeing worldwide IPv6 usage rise from 10% to 16.5% over the year.⁹ The World IPv6 Launch blog also noted that the percentage of Alexa Top 1000 websites reachable over IPv6 increased from 19.7% to 22.7% in the fourth quarter alone.¹⁰

Fourth quarter IPv6 news also included Liquid Telecom's announcement of native IPv6 support in Kenya, Zimbabwe, and Zambia;¹¹ Etisalat launching IPv6 support for all of its eLife subscribers across the United Arab Emirates;¹² BT publicizing the successful rollout of IPv6 across the vast majority of its U.K. network (available immediately to any subscriber with an IPv6-capable router);¹³ and British provider EE announcing deployment of IPv6 addresses for all new subscribers.¹⁴ Finally, the Internet Architecture Board, which is responsible for overseeing the technical and architectural development of the Internet, directed the Internet Engineering Task Force (IETF) and other standards development organizations to stop assuming IPv4 usage and start optimizing for IPv6 usage in all future work on protocols and other standards.¹⁵





[SECTION]² GEOGRAPHY GLOBAL

The data presented within this section was collected during the fourth quarter of 2016 through Akamai's globally deployed Intelligent Platform and includes all countries/regions that had more than 25,000 unique IPv4 addresses request content from Akamai during the quarter. The report features data on average and average peak connection speeds—the latter provides insight into the peak speeds that users can likely expect from their Internet connections. In addition, the report provides insight into adoption levels at different broadband threshold speeds; references to broadband tiers throughout this report refer to speeds greater than or equal to the specified threshold. To qualify for inclusion in a speed tier, a country or region must have more than 25,000 unique IPv4 addresses with average connection speeds that meet the given speed threshold. Note that connection speeds published within the *State of the Internet Report* are guidance based on the reach of Akamai's platform. See the blog post at <http://akamai.me/sotimetrix2016>, as well as previous posts referenced within, for more information on how these metrics are calculated.

Traffic from known mobile networks is analyzed and reviewed in Section 8 of the report. Therefore, mobile network data has been removed from the data set used to calculate the metrics in the present section, as well as in subsequent regional “Geography” sections. However, a small number of networks offer both fixed and mobile broadband service, and in some cases it may not be possible to accurately separate the two types of traffic within that network. Therefore, some data included in this section may be based on connections from mobile devices and/or mobile gateways. In most cases, we do not expect this data to have a significant bearing on the results presented below, but we will note instances where we feel the speeds presented may be substantively affected.

Beginning with the *Second Quarter, 2015 State of the Internet Report*, we have also removed traffic identified as coming from major cloud hosting providers, as cloud-services data centers typically have extremely fast Internet connections, which can skew connection speed metrics. We believe that removing this data from our calculations provides a more accurate picture of the end-user experience.

Note that the speed and broadband adoption data presented in Sections 2 through 7 of this report are meant to give an indication of speeds and broadband adoption rates as experienced by users connecting to Akamai in each country; it does not in any way reflect what portion of the population of each country is connected to the Internet or has subscribed to broadband Internet access services at specific speed tiers. In addition, the data is currently limited to connections made from IPv4 addresses only. Some countries, such as Luxembourg, have chosen to roll out new high-speed broadband services using native IPv6 connectivity. As such, these sections may under-report the connection speeds available to and achieved by broadband subscribers within these countries, as IPv6 speeds are not included.

Finally, due to data issues that affected peak speed calculations this quarter, we have removed the discussion and analysis of Average Peak Connection Speeds from Sections 2 through 7 of this report. However, we expect to continue including average peak connection speed data in future *State of the Internet* reports.

2.1 GLOBAL AVERAGE CONNECTION SPEEDS (IPv4) / In the fourth quarter of 2016, the global average connection speed was 7.0 Mbps, a 12% increase from the third quarter, as seen in Figure 6. Among the top 10 countries/regions, quarter-over-quarter changes were more positive than in the previous quarter, with 9 of the top 10 seeing gains. South Korea, which continued to lead the world in average connection speeds, was the only country/region in the top 10 to see a decline, as speeds dropped a slight 0.7% as compared to the third quarter. With a robust 25% quarterly jump in average connection speeds, Denmark joined the top 10 in the fourth quarter, pushing Latvia out. The remaining 8 countries/regions in the top 10 saw quarterly increases, ranging from 1.4% in the Netherlands to 18% in Norway.

	Country/Region	Q4 2016 Avg. Mbps	QoQ Change	YoY Change
–	Global	7.0	12%	26%
1	South Korea	26.1	-0.7%	-2.4%
2	Norway	23.6	18%	26%
3	Sweden	22.8	16%	20%
4	Hong Kong	21.9	8.9%	31%
5	Switzerland	21.2	15%	27%
6	Denmark	20.7	25%	29%
7	Finland	20.6	17%	24%
8	Singapore	20.2	11%	45%
9	Japan	19.6	8.6%	13%
10	Netherlands	17.6	1.4%	3.6%

Figure 6: Average Connection Speed (IPv4) by Country/Region

With an average connection speed of 26.1 Mbps in the fourth quarter, South Korea was once again the only country/region to exceed the 25 Mbps threshold, although second place Norway was not far behind, with an average speed of 23.6 Mbps. In all, 23 countries/regions worldwide posted average speeds of at least 15 Mbps, up from 17 countries/regions in the third quarter.

Quarterly changes across the globe were generally more positive than in the previous quarter, with 130 of 148 qualifying countries/regions seeing average connection speeds increase. In the third quarter, only 87 countries/regions saw quarterly increases. Growth rates ranged from a modest 0.2% in Gabon (to 1.9 Mbps) to a robust 106% in Syria (to 2.3 Mbps). Libya was the only other country/region to see average speeds more than double compared with the third quarter, as it saw a 102% rise (to 2.4 Mbps). Seventy-one countries/regions enjoyed double-digit gains, compared with seventeen in the previous quarter. Quarter-over-quarter declines were seen in 18 qualifying countries/regions, compared with 58 countries/regions in the third quarter. Declines ranged from 0.2% in Mexico (to 7.2 Mbps) to 19% in Egypt (to 2.2 Mbps).

Year-over-year, on a global basis, the average connection speed increased 26%. Each of the top 10 countries/regions saw yearly increases in the fourth quarter, excluding South Korea, which posted a 2.4% decline. Gains ranged from 3.6% in the Netherlands to 45% in Singapore. Worldwide, average connection speed improvements were seen in 138 countries/regions, compared with 137 in the preceding quarter, and yearly increases ranged from 0.2% in Moldova (to 11.1 Mbps) to 263% in Libya. Five additional countries saw average connection speeds more than double from the prior year. Yearly declines were seen in 9 countries/regions, with decreases ranging from 1.7% in Georgia (to 8.2 Mbps) to 16% in El Salvador (to 2.8 Mbps). Russia’s average connection speed remained unchanged at 11.6 Mbps compared with the previous year.

Despite posting an 85% quarterly increase to 1.3 Mbps, Yemen remained the qualifying country with the lowest average connection speed in the fourth quarter. Paraguay, Gabon, and Venezuela rounded out the bottom four — all with speeds below 2.0 Mbps.

2.2 GLOBAL 4 MBPS BROADBAND ADOPTION (IPv4) / In the fourth quarter of 2016, the global percentage of unique IPv4 addresses connecting to Akamai at average speeds above 4 Mbps increased by 3.2% to 79%, as seen in Figure 7. Guernsey, which led the world in the third quarter, fell to second place in the fourth, but each of the top three countries/regions — South Korea, Guernsey, and Malta — saw adoption levels of 97%. The rest of the top 10 followed closely behind, and all 10, as well as 11th-place Switzerland, had at least 95% of their unique IPv4 addresses connecting to Akamai at average speeds of 4 Mbps or faster. In the third quarter, only seven countries/regions had adoption rates of 95% or higher.

As expected, given the high adoption rates, quarterly changes were small across the top 10. With the biggest increases of the group, at 8.1% and 2.5% respectively, Macao and Singapore joined the top 10 in the fourth quarter, pushing out Iceland and Latvia. Other quarterly increases ranged between 0.1% in Guernsey and 1.3% in Israel. With a 2.3% drop in adoption levels, the Isle of Man was the only country/region to see a decline.

Globally, a total of 123 countries/regions qualified for inclusion within this metric, up from 118 in the preceding quarter. In total, 94 countries/regions saw quarterly growth in 4 Mbps broadband adoption rates, up from 52 in the previous quarter. Increases ranged from a modest 0.1% in Denmark, Jersey, Lithuania, and Guernsey (to adoption levels of 94%, 93%, 91%, and 97% respectively) to an amazing 1,311% in the Sudan (to an adoption level of 6%). Note that the Sudan had relatively few IP addresses that reached threshold speeds, and it did not qualify for inclusion in this metric in the previous quarter. Therefore, it is particularly susceptible to large percentage swings in its data. Seven additional countries posted triple-digit quarterly growth while thirty more saw double-digit growth. Quarter-over-quarter declines were seen in 29 qualifying countries/regions, compared with 62 in the previous quarter. Decreases ranged from 0.1% in the Ukraine and Romania (to adoption rates of 86% and 93% respectively) to 22% in Guatemala (to an adoption rate of 15%).

Year-over-year, the percentage of unique IPv4 addresses connecting to Akamai at average speeds of at least 4 Mbps increased by 15%, continuing the positive trend of the past several quarters. Adoption rates for 4 Mbps broadband were up on a yearly basis across 8 of the top 10 countries/regions in the fourth quarter, ranging from 0.6% in South Korea and Guernsey to 18% in Macao. Two countries/regions, the Isle of Man and the Netherlands, saw adoption levels decline, posting modest yearly drops of 0.2% and 0.5% respectively.

Across the globe, 103 of the qualifying countries/regions saw 4 Mbps broadband adoption levels increase year-over-year, compared with 109 in the prior quarter. Growth rates ranged from a mere 0.4% in Poland, Portugal, and Luxembourg (to adoption levels of 87%,

	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
–	Global	79%	3.2%	15%
1	South Korea	97%	0.7%	0.6%
2	Guernsey	97%	0.1%	0.6%
3	Malta	97%	0.6%	1.3%
4	Thailand	96%	1.1%	1.0%
5	Bulgaria	96%	0.4%	1.9%
6	Netherlands	96%	0.5%	-0.2%
7	Israel	95%	1.3%	1.6%
8	Macao	95%	8.1%	18%
9	Singapore	95%	2.5%	4.5%
10	Isle Of Man	95%	-2.3%	-0.5%

Figure 7: 4 Mbps Broadband Adoption (IPv4) by Country/Region

86%, and 88%, respectively) to an incredible 4,094% in the Sudan. The Palestinian Territories saw the second-largest annual increase at 971% (to 81.0% adoption), while 24 additional countries/regions posted 4 Mbps adoption rate gains of 100% or more. Canada and Hungary, with adoption rates of 88% and 92% respectively, held steady compared with one year prior, while 18 countries/regions saw adoption rates fall. Declines ranged from 0.1% in Russia and Hong Kong (to 90% and 93% adoption, respectively) to 14% in Guatemala (to 15% adoption).

In the fourth quarter of 2016, Venezuela and Algeria were the only two countries with 4 Mbps broadband adoption rates below 5%, while Pakistan posted a 99% quarterly increase to boost its adoption levels to 5.7% — enough to surpass 5%, but not enough to break out of the bottom three in the world for 4 Mbps adoption.

As shown in the data above, despite increasing levels of broadband penetration worldwide, there is still a large disparity in levels of adoption in different parts of the world. Fourth-quarter announcements reflected ongoing efforts to bridge this gap through satellite-based broadband, which could cost effectively bring access to hard-to-reach locations. In documents filed with the United States Federal Communications Commission (FCC), Elon Musk's SpaceX revealed plans to develop a global gigabit-speed broadband service provided by a fleet of satellites — initially 800 in number and eventually growing to more than 4,000.^{16, 17} Meanwhile, satellite provider OneWeb raised \$1.2 billion in additional funding for its high-volume satellite program, which may launch as early as 2019. OneWeb aims to produce satellites at a fraction of current costs, with the goal of providing affordable Internet connectivity to all regions of the globe, as well as for technologies like the Internet of Things and connected cars.¹⁸

2.3 GLOBAL 10 MBPS BROADBAND ADOPTION (IPv4) / In the fourth quarter of 2016, 42% of unique IPv4 addresses around the world connected to Akamai at average speeds above 10 Mbps, a 12% increase over the third quarter, as shown in Figure 8. Unlike the

mixed results seen in the third quarter, in the fourth quarter each of the top 10 countries/regions enjoyed quarterly gains in adoption. Romania had the strongest quarterly gains at 17% while Hong Kong had the smallest increase in the top 10 at 4.7%. Posting a 5.6% gain in the fourth quarter, South Korea remained the world leader with an adoption rate of 83% — 10 percentage points higher than second-place Japan. All the top 10 countries/regions enjoyed 10 Mbps adoption rates of at least 65%, up from six in the previous quarter.

Eighty-six countries/regions qualified for this metric, up from eighty-three in the preceding quarter. Unlike the third quarter's mixed changes, all 86 countries/regions posted quarterly gains in adoption in the fourth quarter, with increases ranging from 1.7% in Macedonia (to 24% adoption) to 212% in Iran (to 1.4% adoption). Nine countries/regions more than doubled their adoption rates, while an additional forty-three posted double-digit percentage gains.

Globally, there was a 31% increase in the percentage of unique IPv4 addresses connecting to Akamai at average speeds above 10 Mbps compared with one year prior. Once again, each of the top 10 countries/regions enjoyed year-over-year growth in adoption rates. Increases ranged from 2.7% in South Korea to 30% in Romania. Yearly changes were positive across the globe as well, excluding Georgia, where adoption rates fell a mere 0.4% year-over-year to 27%. Growth rates varied significantly, with South Korea seeing the smallest yearly growth at 2.7%, and Vietnam seeing the largest at 2,518% to 25% adoption. In total, 34 qualifying countries saw their adoption rates more than double compared with one year prior, while an additional 46 posted double-digit gains.

In the fourth quarter, with just 1.4% of its IPv4 addresses connecting to Akamai at average speeds of 10 Mbps or more, Iran was again the qualifying country with the lowest 10 Mbps broadband adoption rate, despite seeing a 212% quarterly increase (and a 1067% yearly increase). Tunisia again held the second-to-last place globally with a 2.4% adoption rate, up 97% from the third quarter. Seven countries/regions in all had less than 1 in 10 IPv4 addresses connecting to Akamai, at speeds of 10 Mbps or more in the fourth quarter, compared with 16 in the third.

	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
–	Global	42%	12%	31%
1	South Korea	83%	5.6%	2.7%
2	Switzerland	73%	14%	18%
3	Singapore	73%	8.8%	23%
4	Japan	72%	6.3%	15%
5	Netherlands	71%	8.8%	9.4%
6	Hong Kong	70%	4.7%	15%
7	Romania	69%	17%	30%
8	Denmark	68%	14%	14%
9	Norway	68%	7.0%	10%
10	Belgium	68%	5.4%	11%

Figure 8: 10 Mbps Broadband Adoption (IPv4) by Country/Region

2.4 GLOBAL 15 MBPS BROADBAND ADOPTION (IPv4) / As Figure 9 shows, 25% of unique IPv4 addresses globally connected to Akamai at average connection speeds of 15 Mbps or above in the fourth quarter of 2016, up 14% from the third quarter. Just as with the 10 Mbps adoption rate metric, the top 10 countries/regions all posted quarterly increases in the 15 Mbps adoption rate metric. Gains were robust, ranging from 4.3% in South Korea to 26% in Denmark and Switzerland, and 8 of the 10 saw double digit increases. Despite having the smallest quarterly gain, South Korea remained solidly in the lead worldwide with a 15 Mbps broadband adoption rate of 64%, 10 percentage points above second-place Norway.

Seventy-five countries/regions qualified for inclusion in this metric in the fourth quarter, up from seventy-two in the third. Quarterly gains were seen in 72 qualifying countries/regions, compared with 43 in the prior quarter. Bulgaria saw the smallest rate of growth at 1.0% (to 39% adoption), while Trinidad and Tobago enjoyed the biggest increase at 403% (to 16% adoption). Note, however, that Trinidad and Tobago had a very small number of qualifying IPv4 addresses, so their data is susceptible to larger percentage swings. In all, nine countries/regions saw their 15 Mbps adoption rates more than double, while an additional 48 posted double-digit growth compared with the third quarter. Three countries posted quarterly declines, ranging from 1.6% in Portugal (to 28% adoption) to 4.6% in Macedonia (to 7.1% adoption). Morocco, which did not qualify for inclusion in the third quarter, had the lowest 15 Mbps broadband adoption rate in the fourth quarter at 1.4%, after an 86% quarterly increase. China, which had the lowest adoption rate in the third quarter, tied with Colombia for the second-lowest adoption rate in the fourth quarter, at 2.2%.

Year-over-year, the global 15 Mbps adoption rate grew 37%, with growth across the board among all but two qualifying countries/regions worldwide. With a 1.6% gain, South Korea had the smallest increase in the top 10 — and the world. Singapore once again had the largest yearly increase among the top 10 at 62%, while Kenya once again had the largest in the world at 5,159%. As noted in last quarter's report, Kenya did not qualify for inclusion in the 15 Mbps adoption metric a year ago, so their yearly percentage change calculations may

	Country/Region	% Above 15 Mbps	QoQ Change	YoY Change
–	Global	25%	14%	37%
1	South Korea	64%	4.3%	1.6%
2	Norway	54%	13%	21%
3	Switzerland	54%	26%	43%
4	Hong Kong	52%	6.3%	38%
5	Singapore	52%	13%	62%
6	Japan	51%	11%	26%
7	Sweden	49%	13%	15%
8	Denmark	49%	26%	29%
9	Netherlands	46%	13%	19%
10	Finland	44%	19%	29%

Figure 9: 15 Mbps Broadband Adoption (IPv4) by Country/Region

overstate the magnitude of their actual gains. In all, 29 countries/regions saw adoption levels more than double year-over-year in the fourth quarter.

2.5 GLOBAL 25 MBPS BROADBAND ADOPTION (IPv4) / Globally, 10% of unique IPv4 addresses connected to Akamai at average connection speeds of at least 25 Mbps—a 19% increase compared with the previous quarter, as shown in Figure 10. Nine of the top ten countries/regions enjoyed quarterly gains in adoption rates, with Latvia’s 4.0% being the smallest and Denmark’s 58% the largest. South Korea was the only country in the top 10 to see 15 Mbps adoption levels fall in the fourth quarter, but despite a 1.0% decline, it retained its leadership position, sharing a 34% adoption rate with second-place Norway. In all, 15 countries/regions had 25 Mbps adoption rates of at least 15%, up from 12 in the previous quarter.

The number of countries/regions that qualified for inclusion in the 15 Mbps broadband adoption metric rose from 53 to 55 in the fourth quarter. Quarterly changes in adoption levels were robustly positive in general, with 48 countries/regions seeing gains and 7 seeing declines. Gains varied from a modest 2.1% in Estonia (to 6.0% adoption) to a robust 317% in India (to 2.0% adoption). In total, seven countries/regions more than doubled their adoption levels compared with the third quarter, though some of these countries/regions had relatively few IPv4 addresses connecting to Akamai at the threshold speed and therefore, are more susceptible to large percentage swings. Thirty-five additional countries enjoyed double-digit quarterly gains. On the declining side, South Korea had the smallest loss at 1.0%, while the Netherlands posted the largest at 8.5% (to 14% adoption).

Year-over-year, the global 25 Mbps broadband adoption rate increased by a robust 45%. Eight of the top ten countries/regions enjoyed gains, ranging from 34% in Japan to 201% in Singapore. South Korea and Latvia saw declines of 6.8% and 0.1% respectively. Across the globe, yearly increases were generally robust as well, with 48 countries/regions enjoying gains. Once again, outsized gains were posted by Kenya, jumping 10,084% (to 15% adoption).

As noted previously, Kenya did not qualify for inclusion one year ago. It has clearly seen tremendous growth in high-speed connectivity in the past year, but its year-over-year growth rates may overstate the magnitude of change. Fifteen additional qualifying countries saw adoption rates more than double, while Slovakia posted the smallest yearly gain at 2.3% (to 9.1% adoption). Among the seven countries/regions seeing yearly declines in adoption, declines were modest, ranging from 0.1% in Latvia and Portugal (to adoption levels of 18% and 9.0%, respectively) to 13% in Russia (to adoption levels of 4.8%).

While 25 Mbps adoption numbers are still relatively low worldwide, some companies remain hard at work continuing to push speed boundaries. In the fourth quarter, China’s Huawei announced the world’s first 25 Gbps DOCSIS prototype, improving on the current DOCSIS 3.1 technology that supports traffic speeds of up to 10 Gbps and is being deployed in cable networks worldwide.¹⁹ In the fiber arena, SK Broadband and Nokia claimed to have reached speeds of 52.5 Gbps across a single fiber to a set of apartments in Seoul. The trial was based on Nokia’s next-generation passive optical network (PON) technology, which combines multiple PON technologies within a single fiber, achieving the sum of their speeds.²⁰ Huawei and British Telecom (BT) announced a trial of similar technologies in the U.K., achieving similar speeds across a single fiber optic line between the University of Suffolk and BT’s research center at Adastral Park.²¹

	Country/Region	% Above 25 Mbps	QoQ Change	YoY Change
–	Global	10%	19%	45%
1	South Korea	34%	-1.0%	-6.8%
2	Norway	34%	37%	62%
3	Sweden	30%	30%	35%
4	Hong Kong	27%	10%	79%
5	Denmark	26%	58%	79%
6	Switzerland	24%	33%	75%
7	Singapore	24%	22%	201%
8	Finland	23%	28%	46%
9	Japan	23%	23%	34%
10	Latvia	18%	4.0%	-0.1%

Figure 10: 25 Mbps Broadband Adoption (IPv4) by Country/Region





[SECTION]³ GEOGRAPHY *UNITED STATES*

The metrics presented here for the United States are based on a subset of data used for Section 2 and are subject to the same thresholds and filters discussed within that section. The subset used for this section includes connections identified as coming from the United States, based on classification by Akamai's EdgeScape™ geolocation tool. For the purposes of this section, the District of Columbia is treated as a state.

3.1 UNITED STATES AVERAGE CONNECTION SPEEDS (IPv4) / In the fourth quarter of 2016, average connection speeds showed quarterly increases among nine of the top ten states, as seen in Figure 11, with gains ranging from 2.5% in Maryland to 11% in California. Utah was the only state in the top 10 to see a decline, as its average connection speed dropped 7.4% compared with the third quarter. The District of Columbia maintained the top spot in the country during the fourth quarter, posting an average connection speed of 26.7 Mbps, and surpassing the FCC's 25 Mbps broadband threshold for the first time — the only state in the nation to do so.

	State	Q4 2016 Avg. Mbps	QoQ Change	YoY Change
1	District of Columbia	26.7	7.8%	25%
2	Rhode Island	22.4	8.3%	17%
3	Delaware	22.4	4.3%	9.5%
4	Massachusetts	21.7	3.1%	17%
5	New York	20.6	8.6%	23%
6	New Jersey	20.4	4.9%	18%
7	Maryland	20.2	2.5%	15%
8	Virginia	19.9	4.7%	16%
9	Utah	19.8	-7.4%	11%
10	California	18.8	11%	23%

Figure 11: Average Connection Speed (IPv4) by State

Across the country, all 51 states once again saw average connection speeds above 10 Mbps in the fourth quarter, with 34 states seeing speeds above 15 Mbps, up from 30 in the previous quarter. Idaho again had the slowest speeds in the nation, connecting to Akamai at an average of 11.9 Mbps, up 5.8% from the third quarter. Seven states saw quarterly declines, ranging from a loss of 1.0% in Indiana (to 16.2 Mbps) to a loss of 7.4% in Utah. Among the 44 gaining states, quarter-over-quarter increases ranged from 0.7% in Vermont (to 16.9 Mbps) to 17% in Nevada (to 17.6 Mbps). In addition to Nevada, California was the only other state to post a double-digit gain.

On a year-over-year basis, all 51 states enjoyed gains, led by Alaska with a 34% increase (to 13.1 Mbps). Ten other states saw gains of at least 20% compared with the preceding year. Colorado had the smallest yearly increase at 4.4% (to 14.2 Mbps). Among the top 10, yearly increases ranged from 9.5% in Delaware to 25% in the District of Columbia.

In its sixth *Measuring Broadband America: Fixed Broadband Report*, released in December 2016, the FCC found that median broadband speeds across the country increased 22% in the past year, from 32 Mbps to 39 Mbps. The study was based on 13 ISPs representing more than 80% of U.S. subscribers. The study noted that the maximum advertised speeds among popular service tiers had increased ten-fold since 2011 when the annual report was first released. The survey also found that actual Internet speeds delivered by providers were typically at least as fast as those promised.²²

3.2 UNITED STATES 4 MBPS BROADBAND ADOPTION (IPv4) /

With a 98% adoption rate, Delaware remained the nationwide leader for 4 Mbps broadband adoption in the fourth quarter, with second-place Rhode Island close behind. Like the third quarter, the fourth quarter brought modest gains in adoption across the top 10 states. Increases ranged from 0.1% in Rhode Island and Utah to 1.1% in Massachusetts, as seen in Figure 12.

Quarterly changes were positive throughout the nation as well, apart from Wyoming and South Dakota, which posted small declines of 0.7% and 0.3% (to adoption levels of 85% and 90%, respectively).

	State	% Above 4 Mbps	QoQ Change	YoY Change
1	Delaware	98%	0.5%	1.9%
2	Rhode Island	97%	0.1%	0.5%
3	New Jersey	95%	0.7%	2.4%
4	Massachusetts	94%	1.1%	3.0%
5	Hawaii	94%	0.6%	1.9%
6	Maryland	93%	1.0%	2.0%
7	New York	93%	0.5%	3.0%
8	Florida	92%	0.5%	3.3%
9	Utah	92%	0.1%	3.2%
10	District of Columbia	92%	0.6%	5.4%

Figure 12: 4 Mbps Broadband Adoption (IPv4) by State

Increases in adoption levels were modest, varying between 0.1% in Nebraska, Utah, and Rhode Island (to adoption rates of 86%, 92%, and 97%, respectively) and 2.7% in Vermont (to an adoption rate of 81%). Seventeen states nationwide had 4 Mbps adoption levels of 90% or more, up from 14 in the third quarter.

Yearly changes were positive across all the states in the fourth quarter, except for Wisconsin, which saw its 85% adoption rate remain unchanged. North Dakota posted the smallest gain at 0.4% (to 91% adoption), while West Virginia and New Mexico posted the largest at 11% each (to 73% and 83% adoption, respectively). Among the top 10, increases ranged from 0.5% in Rhode Island to 5.4% in the District of Columbia.

Forty-eight states had 4 Mbps broadband adoption rates of at least 80%, up from forty-seven states in the third quarter. Despite leading the nation in its quarterly gain, West Virginia continued to lag the country in this metric, with a 4 Mbps broadband adoption rate of 73%, five percentage points below the next-lowest state, Arkansas.

As has been noted in previous *State of the Internet* reports, commercial, federal, state and local government-sponsored initiatives continue to push for the expansion of broadband access in communities across the United States, emphasizing efforts to reach underserved areas.

There were several announcements in the fourth quarter regarding commercial initiatives aimed at improving access to broadband Internet connectivity. Sprint unveiled its “1 Million Project”, which will roll out to a handful of cities in early 2017, offering free devices and 3 GB per month of free high-speed data to 1 million high school students from low-income families. Altice USA (formerly Cablevision and Suddenlink, both recently acquired by Netherlands-based Altice Group) launched a new Economy Internet tier, priced at \$14.99/month, available to seniors and eligible families in its New York tristate service area.²³ Comcast also announced that its low-cost Internet Essentials broadband service tier will now be available to anyone in public housing.²⁴

At the national level, the United States government released nearly \$100 million in funding in October as part of a \$300 million public-private investment package focused on smart-city technologies, such as connected traffic infrastructure and vehicle sharing, as well as small-satellite broadband development.²⁵ In New York, the state has petitioned the FCC to use money offered as part of the Commission's Connect America Fund, combined with \$500 million in state funding for rural broadband development, to build out broadband networks in rural areas of the state.²⁶

The fourth quarter yielded several additional announcements at the state level, as well. The California High-Speed Rail Authority and the Corporation for Education Networking Initiatives in California (CENIC) partnered to create an ultra-fast broadband network along California's high-speed rail system, providing connectivity for communities near the railway—particularly in the Central Valley, which has many low-income and rural communities that currently lack such access.²⁷ In Massachusetts, the state-supported Last Mile project announced deals with cable providers to expand service in a dozen rural communities.²⁸ It also began soliciting bids from providers to build out last mile access in 40 additional Western Massachusetts towns.²⁹ In Iowa, governor Terry Branstad unveiled an initiative charged with raising \$2 million in private funds to boost broadband expansion in rural communities throughout the state,³⁰ while Wisconsin governor Scott Walker asked his Legislature for \$35.5 million in funding over the next three years to improve rural broadband accessibility. Wisconsin's Public Service Commission also approved \$26 million in funds over the next two years, to go towards broadband and energy-related projects in rural areas.³¹

3.3 UNITED STATES 10 MBPS BROADBAND ADOPTION (IPv4) /

With an adoption rate of 83%, Delaware edged out third-quarter leader Rhode Island to take the top spot in the nation for 10 Mbps broadband adoption in the fourth quarter, as seen in Figure 13. Like the previous quarter, each of the top 10 states enjoyed quarter-over-quarter growth in the fourth quarter, ranging from 2.2% in

	State	% Above 10 Mbps	QoQ Change	YoY Change
1	Delaware	83%	3.8%	6.5%
2	Rhode Island	82%	2.2%	5.6%
3	New Jersey	80%	3.5%	11%
4	Massachusetts	79%	4.1%	11%
5	Maryland	76%	2.6%	10%
6	New York	75%	3.8%	14%
7	District of Columbia	74%	3.7%	15%
8	Virginia	71%	2.3%	10%
9	New Hampshire	68%	6.8%	11%
10	Pennsylvania	68%	4.5%	12%

Figure 13: 10 Mbps Broadband Adoption (IPv4) by State

Rhode Island to 6.8% in New Hampshire. Eight of the top ten had at least 70% of their unique IPv4 addresses connecting to Akamai at average speeds above 10 Mbps, the same as in the previous quarter.

Quarterly changes were mostly positive across the country in the fourth quarter, although more muted than in the previous quarter. Among the 46 states seeing increases in 10 Mbps broadband adoption, New Mexico posted the smallest gain at 0.5% (to 44% adoption), while Alaska posted the largest at 11% (to 53% adoption). Five states saw modest declines quarter-over-quarter, ranging from 0.3% in Indiana (to 58% adoption) to 4.1% in Colorado (to 51% adoption). Forty-five states had at least half of their unique IPv4 addresses connecting to Akamai at average speeds of 10 Mbps or more, up from forty-three states in the third quarter.

Year-over-year changes in 10 Mbps broadband adoption were positive across all 51 states, just as in the third quarter, and Alaska led the nation once again with a 41% gain (to 53% adoption), followed by Kentucky with a 30% improvement (to 50% adoption). At the other end of the spectrum, Rhode Island posted the smallest yearly gain in the country—and in the top 10—with an increase of 5.6%. The District of Columbia had the largest yearly increase among the top 10 states at 15%.

Despite a quarterly increase of 4.8% in the fourth quarter, Arkansas had the lowest levels of 10 Mbps broadband adoption in the country at 43%. Iowa, Idaho, and New Mexico shared the next lowest levels at 44% each.

3.4 UNITED STATES 15 MBPS BROADBAND ADOPTION (IPv4) /

With a 62% adoption rate, Rhode Island pulled four points ahead of third-quarter leader Delaware, taking the top spot in the nation for 15 Mbps broadband adoption in the fourth quarter, as seen in Figure 14. Eight of the top ten states enjoyed growth in adoption levels, though more modest than in the previous quarter. Increases ranged from 1.2% in Massachusetts to 15% in California. Delaware and Maryland experienced small quarterly declines, with adoption

	State	% Above 15 Mbps	QoQ Change	YoY Change
1	Rhode Island	62%	6.6%	18%
2	Delaware	58%	-0.4%	8.1%
3	District of Columbia	58%	5.7%	23%
4	New Jersey	57%	2.2%	20%
5	Massachusetts	55%	1.2%	17%
6	New York	53%	8.0%	31%
7	Maryland	53%	-0.2%	16%
8	Virginia	52%	2.3%	20%
9	Pennsylvania	47%	3.3%	19%
10	California	45%	15%	36%

Figure 14: 15 Mbps Broadband Adoption (IPv4) by State

levels dropping by 0.4% and 0.2% respectively. Eight states maintained 15 Mbps adoption levels of at least 50%, compared with seven in the preceding quarter.

Across the country, 41 states saw quarterly increases in the fourth quarter, compared with 50 states in the third. Gains ranged from 0.2% in Montana (to 31% adoption) to 22% in Nevada (to 45% adoption). Twelve states in all saw gains of at least 10%. Among the 10 declining states, decreases ranged from 0.2% in Maryland to 9.0% in Utah. All but one of the 51 states had at least one-quarter of their unique IPv4 addresses connecting to Akamai at average speeds of 15 Mbps or faster, compared with 48 states in the third quarter.

Similar to the previous quarter, year-over-year changes in 15 Mbps broadband adoption were positive throughout the country in the fourth quarter, although increases were more muted. Delaware posted the smallest gain in the country (and in the top 10) at 8.1%, while Alaska led the nation with a robust 85% lift (to 33% adoption). Two other states, Kentucky and Hawaii, also saw adoption increase by at least 50% compared with a year prior. Among the top 10, California posted the largest year-over-year gain with a 36% rise in adoption.

Despite seeing adoption levels grow 16% during the fourth quarter, Idaho was once again the state with the lowest 15 Mbps adoption rate, at 23%. Arkansas, Mississippi, and New Mexico tied for the next lowest spot, with adoption levels of 25%.

3.5 UNITED STATES 25 MBPS BROADBAND ADOPTION (IPv4) /

In the fourth quarter, the District of Columbia held on to the top spot in the nation in 25 Mbps broadband adoption, with an adoption rate of 34%, five points above second-place Rhode Island, as seen in Figure 15. Each of the top 10 states enjoyed quarter-over-quarter gains in adoption during the fourth quarter, with Delaware posting the smallest at 0.9% and California posting the largest at 32%. Four states had at least one in four unique IPv4 addresses connecting to Akamai at average speeds of at least 25 Mbps, up from two states in the third quarter.

Across the nation, 41 states posted quarterly gains in the fourth quarter, compared with 50 states in the third quarter. Increases ranged from 0.9% in Delaware to 57% in Nevada (to 20% adoption), and 26 states in all posted double-digit gains in the fourth quarter, as compared with 44 in the third. Declines among the remaining 10 states ranged from 0.1% in Minnesota (to 14% adoption) to 14% in Colorado to (11% adoption).

Year-over-year changes were positive across all 51 states, continuing the trend. Among the top 10, Delaware had the smallest yearly gain at 20% while New York enjoyed the largest at 68%. Gains across the rest of the nation were strong as well, ranging from 8.1% in Wisconsin (to 13% adoption) to 147% in Kentucky and Alaska (to 7.6% and 9.2% adoption, respectively). Thirteen additional states saw adoption levels increase by more than 50% year-over-year in the fourth quarter.

	State	% Above 25 Mbps	QoQ Change	YoY Change
1	District of Columbia	34%	13%	38%
2	Rhode Island	29%	21%	54%
3	Delaware	27%	0.9%	20%
4	Massachusetts	25%	7.1%	41%
5	New Jersey	24%	11%	54%
6	New York	24%	24%	68%
7	Virginia	24%	9.9%	45%
8	Maryland	23%	5.0%	38%
9	Pennsylvania	20%	9.9%	43%
10	California	20%	32%	67%

Figure 15: 25 Mbps Broadband Adoption (IPv4) by State

Nationwide, 25 Mbps broadband adoption rates remained low, though they have continued to improve. In all, 13 states saw adoption levels below 10%, down from 15 in the third quarter. Idaho had the lowest adoption rate in the country at 7.3%, despite posting robust quarterly growth of 25%. Mississippi and Arkansas shared the next lowest adoption rate at 7.4%.

Building on the trend of the last several quarters, the fourth quarter saw several developments for gigabit-speed Internet across the United States. AT&T expanded its fiber-based gigabit service (now branded “AT&T Fiber” instead of “GigaPower”) to 17 new metropolitan areas, for a total of 46 markets, with plans to reach 21 more by mid-2019,^{32,33,34} and regional provider MaxxSouth Broadband launched gigabit fiber-to-the-home (FTTH) services in Oxford, Mississippi.³⁵

Several cable companies also unveiled near term plans for gigabit-speed offerings powered by DOCSIS 3.1 technology. Comcast stated that, beginning in early 2017, it would offer such services to cities in California and the Pacific Northwest, as well as Denver, Salt Lake City, Kansas City, Indianapolis, Knoxville, and Jacksonville.³⁶ Mediacom revealed that its entire network footprint would be gigabit-capable by the end of 2016.³⁷ RCN announced it would launch DOCSIS-powered gigabit services in Chicago and New York City.^{38,39} Altice USA introduced gigabit speed services in New Mexico and Texas.⁴⁰ Pushing the speed envelope further, Charter Communications’ CEO alluded to working toward a 10 Gbps broadband service that he claimed could be built “at fairly low capital investments” using the Full Duplex extension to DOCSIS 3.1.⁴¹

Other notable gigabit-speed broadband launches in the fourth quarter included Goessel, Kansas, by Moundridge Communications;⁴² Conway, Arkansas, by the municipally-owned Conway Corp.;⁴³ and Red Lake Nation, by Paul Bunyan Communications, making it one of the first Native American reservations to be wired with gigabit fiber connectivity.⁴⁴ In addition, supported by the FCC’s Connect America Fund,

Hawaiian Telcom announced an expansion of its gigabit service (launched in 2015) to cover more than 125,000 homes and 5,600 businesses in Hawaii.⁴⁵

Meanwhile, as noted in the *Third Quarter, 2016 State of the Internet Report*, Google has decided to slow or suspend several of its Google Fiber rollouts. In October, Google announced a cut back in 11 city roll outs, as well as layoffs and the departure of Google Fiber chief Craig Barratt.⁴⁶ Some in the industry have cited high costs, coupled with a lack of urgency and lack of application for ultra-high speeds, as likely contributing reasons for the decision.⁴⁷



[SECTION]⁴

GEOGRAPHY

AMERICAS

The metrics presented here for the Americas region (North and South America) are based on a subset of data used for Section 2 and are subject to the same thresholds and filters discussed within that section. The subset used for this section includes connections identified as coming from networks within North and South America, based on classification by Akamai's EdgeScape geolocation tool.

4.1 AMERICAS AVERAGE CONNECTION SPEEDS (IPv4) / In the fourth quarter of 2016, the United States again had the fastest average connection speed among surveyed Americas countries at 17.2 Mbps, with Canada just 2.3 Mbps behind, as shown in Figure 16. As the only two countries in the region with average connection speeds above 10 Mbps, the United States and Canada remained well ahead of the other countries in the region, with Canada having an average connection speed more than 6 Mbps faster than third-place Mexico. The gap in average connection speeds between the fastest and slowest countries in the region also widened again

Global Rank	Country/Region	Q4 2016 Avg. Mbps	QoQ Change	YoY Change
14	United States	17.2	5.5%	21%
24	Canada	14.9	7.9%	13%
60	Chile	8.6	17%	39%
62	Uruguay	8.3	19%	35%
74	Mexico	7.2	-0.2%	22%
85	Brazil	6.4	16%	55%
87	Ecuador	6.3	23%	45%
91	Argentina	6.1	23%	31%
96	Panama	5.7	10%	47%
98	Peru	5.6	4.4%	24%
101	Colombia	5.4	13%	21%
116	Costa Rica	3.9	-1.2%	15%
135	Bolivia	2.6	9.5%	32%
145	Venezuela	1.9	6.6%	18%
147	Paraguay	1.4	-16%	-10%

Figure 16: Average Connection Speed (IPv4) by Americas Country

in the fourth quarter, from 14.6 Mbps to 15.8 Mbps. Twelve surveyed Americas countries saw quarterly increases in connection speeds and three saw declines. Argentina had the biggest gain at 23%, while Peru posted the smallest at 4.4%. The three Americas countries that saw speeds fall — Paraguay, Costa Rica, and Mexico — posted quarterly declines of 16%, 1.2%, and 0.2%, respectively.

Apart from Paraguay, which experienced a 10% year-over-year drop in its average connection speed, all other surveyed Americas countries saw growth on a yearly basis. Increases ranged from 13% in Canada to 55% in Brazil. Eleven of the surveyed Americas countries had an average connection speed at or above the 4 Mbps threshold — the same as in the third quarter — with Costa Rica not far behind, posting a 3.9 Mbps average connection speed.

4.2 AMERICAS 4 MBPS BROADBAND ADOPTION (IPv4) / With 88% adoption rates, the United States and Canada led the Americas region for 4 Mbps broadband adoption in the fourth quarter of 2016, as seen in Figure 17. The difference in adoption rates between the top and bottom qualifying Americas countries was a sizeable 85 percentage points, roughly the same as in the third quarter. As noted previously, this gap is likely to remain large for the foreseeable future. Changes in adoption rates were again mixed in the fourth quarter, with 8 of the 13 qualifying surveyed countries experiencing increases. Ecuador enjoyed the largest gain among the qualifying surveyed countries at 18%, while the United States saw the smallest at 0.5%. Changes were modest among the countries sustaining declines, as Peru posted the smallest loss at 1.0%, while Chile had the largest at 3.4%.

Looking at year-over-year changes, all 13 of the qualifying Americas countries saw gains, except Canada, which saw adoption rates remain unchanged as compared with one year prior. The United States had

Global Rank	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
35	United States	88%	0.5%	6.8%
37	Canada	88%	0.7%	0%
51	Uruguay	83%	12%	15%
69	Mexico	75%	-3.2%	10%
70	Chile	74%	-3.4%	10%
83	Ecuador	63%	18%	52%
86	Brazil	59%	13%	52%
88	Peru	58%	-1.0%	23%
89	Colombia	58%	12%	14%
91	Argentina	56%	11%	21%
92	Panama	56%	4.8%	49%
105	Costa Rica	33%	-3.1%	44%
123	Venezuela	3.3%	-1.5%	22%
–	Bolivia	9.5%	34%	186%
–	Paraguay	2.7%	-38%	15%

Figure 17: 4 Mbps Broadband Adoption (IPv4) by Americas Country

the smallest yearly gain at 6.8%, while Brazil and Ecuador posted the largest, each having a 52% increase. In all, 11 qualifying Americas countries saw 4 Mbps broadband adoption levels grow by double digits as compared with one year prior.

4.3 AMERICAS 10 MBPS BROADBAND ADOPTION (IPv4) / As shown in Figure 18, the United States and Canada once again remained the clear leaders in 10 Mbps broadband adoption among the qualifying surveyed Americas countries. The United States led with a 63% adoption rate, followed by Canada with 56% adoption. However, the gap between Canada and the next-highest country narrowed from 34 percentage points to 29 in the fourth quarter, while the gap between the top and bottom qualifying countries remained steady at 56 points. Fourth-quarter changes in adoption rates were positive across the Americas, with some countries seeing sizeable gains. Ecuador and Argentina both saw adoption rates more than double, enjoying increases of 103% and 137% respectively, while six additional countries posted double-digit gains. The United States and Mexico had the smallest quarterly increases in adoption at 4.1% each.

From a yearly perspective, all qualifying surveyed countries saw 10 Mbps broadband adoption rates rise, led by Panama and Brazil with jumps of 454% and 452% respectively. As seen in the third quarter, 9 of the 11 qualifying countries saw adoption rates more than double year-over-year in the fourth quarter, while Canada and the United States — the region's leaders in 10 Mbps adoption — saw the smallest yearly gains at 14% and 19% respectively.

4.4 AMERICAS 15 MBPS BROADBAND ADOPTION (IPv4) / As Figure 19 shows, 10 of the 15 surveyed countries in the Americas region qualified for inclusion in the 15 Mbps broadband adoption metric in the fourth quarter, as Peru and Ecuador joined the eight

Global Rank	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
16	United States	63%	4.1%	19%
22	Canada	56%	7.5%	14%
55	Chile	27%	45%	164%
56	Uruguay	25%	47%	185%
65	Mexico	17%	4.1%	111%
67	Brazil	16%	55%	452%
68	Argentina	16%	137%	258%
74	Ecuador	13%	103%	276%
79	Panama	11%	48%	454%
80	Peru	9.0%	24%	209%
82	Colombia	7.4%	74%	230%
–	Costa Rica	2.9%	29%	144%
–	Bolivia	1.0%	82%	243%
–	Venezuela	0.2%	11%	-9.1%
–	Paraguay	0.2%	17%	1.0%

Figure 18: 10 Mbps Broadband Adoption (IPv4) by Americas Country

qualifying countries from the third quarter. As with the other broadband adoption metrics examined thus far, the United States and Canada continued to have adoption levels that significantly exceed those seen in the remaining Americas countries. The gap between the United States and Canada remained steady at 8 points in the fourth quarter, while the gap between Canada and the next-highest country narrowed to 21 points. However, the gap between the top and bottom-ranking qualifying countries widened in the fourth quarter, from 38 to 40 points. All qualifying surveyed countries posted quarterly gains in adoption, ranging from a modest 6.1% in the United States to a tremendous 270% in Argentina, with three countries seeing adoption rates more than double compared with the previous quarter.

Year-over-year numbers were robustly positive across the qualifying surveyed Americas countries in the fourth quarter, just as they were in the third. Argentina posted the largest yearly increase in 15 Mbps adoption rates with a 665% gain, and 8 of the 10 countries saw adoption levels more than double compared with one year prior. Canada and the United States again had the smallest yearly increases — at 27% and 32% respectively.

In December, Canada’s telecom regulator CRTC ruled that speeds of 50 Mbps down / 10 Mbps up would be considered a “basic” (or essential) telecom service in Canada and should be made universal — leapfrogging the U.S. FCC’s 25 Mbps standard. While 82% of Canadians already enjoy access to these speeds, this “basic” telecom service is not available to those who reside in rural areas. The CRTC expects Canada can meet the target speeds for 90% of households by 2021 and 100% within 10 to 15 years. The CRTC requires providers to pay into a five-year, \$750 million fund that will help to finance the infrastructure needed to implement broadband

Global Rank	Country/Region	% Above 15 Mbps	QoQ Change	YoY Change
13	United States	42%	6.1%	32%
22	Canada	34%	12%	27%
51	Chile	13%	101%	365%
57	Uruguay	8.2%	53%	300%
64	Argentina	5.4%	270%	665%
65	Mexico	5.3%	15%	142%
67	Brazil	5.0%	74%	537%
68	Ecuador	4.7%	174%	516%
72	Peru	2.8%	45%	223%
74	Colombia	2.2%	89%	339%
–	Panama	3.8%	81%	686%
–	Costa Rica	0.9%	35%	79%
–	Bolivia	0.4%	118%	267%
–	Venezuela	0.1%	11%	-21%
–	Paraguay	0.1%	3.4%	-26%

Figure 19: 15 Mbps Broadband Adoption (IPv4) by Americas Country

in underserved areas. The government also announced it would provide funding of up to \$500 million to bring high-speed access to 300 rural communities by 2021.⁴⁸

At the other end of the spectrum, the Brazilian national telecom agency Anatel reported that 75% of households in the country still do not have broadband access, even though the Brazilian telecommunications market is the fifth largest in the world. Anatel’s new president, Juarez Quadros, has declared that improving access, with the ultimate goal of universal access, would be Anatel’s top priority.⁴⁹





[SECTION]⁵ GEOGRAPHY ASIA PACIFIC (APAC)

The metrics presented here for the Asia Pacific region are based on a subset of data used for Section 2 and are subject to the same thresholds and filters discussed within that section. The subset used for this section includes connections identified as coming from networks in the Asia Pacific region, based on classification by Akamai's EdgeScape geolocation tool.

5.1 ASIA PACIFIC AVERAGE CONNECTION SPEEDS (IPv4) / As shown in Figure 20, in the fourth quarter of 2016, South Korea was again the top country/region in the world for the average connection speed metric, despite a 0.7% quarter-over-quarter decrease in average connection speeds. The gap between South Korea and the slowest country/region in Asia Pacific remained steady at 22 Mbps. Excluding South Korea, the surveyed countries/regions in Asia Pacific all enjoyed quarterly gains in the fourth quarter, with increases ranging from 4.9% in Australia to 36% in India. Seven countries enjoyed double-digit quarterly gains, compared with three in the third quarter.

All 15 of the surveyed Asia Pacific countries/regions had average connection speeds above 4 Mbps, just as they did in the third quarter. Eight of these exceeded 10 Mbps, up from seven in third quarter. India and the Philippines once again had the lowest average connection speeds among surveyed Asia Pacific countries/regions, at 5.6 Mbps and 4.5 Mbps respectively.

Apart from South Korea, each of the surveyed countries/regions in the Asia Pacific region showed year-over-year growth in observed average connection speeds in the fourth quarter. Vietnam, with a 115% gain, was the only country to see its average connection speed more than double compared with the year prior, although India was not far behind with a 99% increase. Gains among the remaining countries/regions ranged from 13% in Japan to 72% in Indonesia. South Korea posted a modest 2.4% yearly loss in average connection speeds.

There was varied news in the fourth quarter for some of the region's laggards in broadband speeds and connectivity. In the Philippines, there is reason for optimism: as noted in the *Third Quarter, 2016 State of the Internet Report*, the new administration has made faster Internet speeds a national priority. In November, the government announced plans to cut red tape for cell tower building, deploy free nationwide broadband and Wi-Fi, and spearhead a January 2017 summit aimed at finding ways to improve connectivity and speeds in the country.⁵⁰ In more disappointing news, India's telecommunications regulator TRAI mandated that all wired broadband providers enable minimum download speeds of just 512 Kbps, despite having previously recommended minimum speeds of 2 Mbps.⁵¹ However, there were positive developments in the country as well, as Bharti Airtel launched its V-Fiber broadband service in the fourth quarter, offering 100 Mbps fixed broadband access. Initially rolling out in Chennai, Bharti's service was slated to become available to 87 cities in India within a few weeks.⁵²

Global Rank	Country/Region	Q4 2016 Avg. Mbps	QoQ Change	YoY Change
1	South Korea	26.1	-0.7%	-2.4%
4	Hong Kong	21.9	8.9%	31%
8	Singapore	20.2	11%	45%
9	Japan	19.6	8.6%	13%
19	Taiwan	15.6	5.1%	21%
31	Thailand	13.3	14%	44%
34	New Zealand	12.9	14%	38%
51	Australia	10.1	4.9%	24%
64	Vietnam	8.3	32%	115%
66	Malaysia	8.2	9.8%	56%
73	Sri Lanka	7.3	21%	52%
80	Indonesia	6.7	5.5%	72%
89	China	6.3	10%	53%
97	India	5.6	36%	99%
108	Philippines	4.5	7.9%	44%

Figure 20: Average Connection Speed (IPv4) by APAC Country/Region

5.2 ASIA PACIFIC 4 MBPS BROADBAND ADOPTION (IPv4) /

In the fourth quarter, South Korea once again led the Asia Pacific region in 4 Mbps broadband adoption, with 97% of its IPv4 addresses connecting to Akamai at average connection speeds above this threshold, as shown in Figure 21. Quarterly changes were positive across the board except for Australia, which posted a 1.9% decline in adoption. Vietnam and India were the only two countries/regions to enjoy double-digit growth, as they saw adoption rates increase 18% and 28%, respectively. Among the remaining countries/regions, increases ranged between 0.5% in Hong Kong and 9.5% in China.

Seven of the surveyed Asia Pacific countries/regions enjoyed 4 Mbps broadband adoption rates of 90% or higher — up from six in the third quarter — and the difference in adoption levels between the top- and bottom-ranked Asia Pacific countries/regions continued to narrow, dropping from 68 to 66 percentage points in the fourth quarter.

Looking at year-over-year changes, all surveyed countries/regions saw improvements in the fourth quarter, except for Hong Kong, which posted a negligible 0.1% decline. Yearly growth rates varied from a mere 0.6% in South Korea to a robust 126% in the Philippines, with Vietnam and India also seeing adoption rates more than double rates compared with one year prior.

5.3 ASIA PACIFIC 10 MBPS BROADBAND ADOPTION (IPv4) /

Four of the top ten countries/regions in the world for 10 Mbps broadband adoption were all found in the Asia Pacific region in the fourth quarter, with South Korea holding on to the top spot in the world, posting an 83% adoption rate — 10 percentage points above second-place Japan. As seen in Figure 22, the gap between South Korea and the qualifying Asia Pacific country/region with the lowest adoption level widened slightly to 75 percentage points in the fourth quarter from 73 in the third.

Global Rank	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
1	South Korea	97%	0.7%	0.6%
4	Thailand	96%	1.1%	1.0%
9	Singapore	95%	2.5%	4.5%
19	Taiwan	93%	1.8%	3.5%
20	Hong Kong	93%	0.5%	-0.1%
23	Japan	92%	0.9%	1.5%
30	New Zealand	90%	1.5%	2.9%
40	Sri Lanka	88%	7.9%	68%
52	Vietnam	82%	18%	107%
67	Australia	76%	-1.9%	4.2%
72	China	73%	9.5%	77%
76	Indonesia	71%	2.6%	97%
80	Malaysia	69%	0.7%	24%
102	India	38%	28%	123%
107	Philippines	31%	7.4%	126%

Figure 21: 4 Mbps Broadband Adoption (IPv4) by APAC Country/Region

Global Rank	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
1	South Korea	83%	5.6%	2.7%
3	Singapore	73%	8.8%	23%
4	Japan	72%	6.3%	15%
6	Hong Kong	70%	4.7%	15%
18	Taiwan	59%	7.8%	32%
21	Thailand	57%	23%	119%
36	New Zealand	45%	22%	75%
50	Australia	30%	7.5%	55%
54	Malaysia	27%	25%	397%
57	Vietnam	25%	128%	2518%
72	Indonesia	14%	23%	736%
73	India	14%	116%	418%
77	China	11%	58%	595%
81	Philippines	7.5%	39%	292%
-	Sri Lanka	15%	56%	310%

Figure 22: 10 Mbps Broadband Adoption (IPv4) by APAC Country/Region

All fourteen qualifying countries/regions saw quarterly growth in adoption rates in the fourth quarter, with Vietnam and India displaying the biggest gains at 128% and 116%, respectively. Six countries/regions saw double-digit increases, while Hong Kong again posted the smallest gain in Asia Pacific at 4.7%.

Year-over-year changes in 10 Mbps adoption were positive across the board as well, consistent with the previous quarter. Six qualifying Asia Pacific countries/regions saw double-digit increases in adoption rates, and six saw triple-digit jumps, and Vietnam posted an astounding gain of 2,518%. South Korea had the smallest yearly gain in the region at 2.7%.

5.4 ASIA PACIFIC 15 MBPS BROADBAND ADOPTION (IPv4) /

Unsurprisingly, South Korea continued to lead the region (and the world) in the 15 Mbps broadband adoption metric, with 64% of its IPv4 addresses connecting to Akamai at average connection speeds above 15 Mbps, up 4.3% from the third quarter. The spread between South Korea and China, the Asia Pacific country/region with the lowest adoption rate, widened slightly from 60 percentage points in the third quarter to 61 in the fourth, despite China's robust 118% quarterly gain in adoption.

As seen in Figure 23, all qualifying surveyed Asia Pacific countries/regions posted increases in 15 Mbps adoption in the fourth quarter, with gains ranging from 4.3% in South Korea to 179% in India. Vietnam and China also saw adoption rates more than double compared with the third quarter, and eight more countries/regions posted double-digit gains.

Yearly growth in the Asia-Pacific region was positive across the board as well, just as it was in the third quarter. South Korea posted the smallest increase in 15 Mbps adoption at 1.6%, while Japan

Global Rank	Country/Region	% Above 15 Mbps	QoQ Change	YoY Change
1	South Korea	64%	4.3%	1.6%
4	Hong Kong	52%	6.3%	38%
5	Singapore	52%	13%	62%
6	Japan	51%	11%	26%
23	Taiwan	33%	7.3%	36%
29	Thailand	27%	39%	236%
34	New Zealand	25%	35%	134%
49	Australia	16%	13%	95%
53	Malaysia	11%	43%	786%
58	India	7.3%	179%	622%
62	Vietnam	6.3%	146%	3075%
69	Indonesia	4.3%	38%	809%
71	Philippines	3.6%	52%	373%
73	China	2.2%	118%	690%
-	Sri Lanka	5.3%	108%	302%

Figure 23: 15 Mbps Broadband Adoption (IPv4) by APAC Country/Region

had the next lowest increase at 26%. Eight countries/regions more than doubled their adoption levels compared with the preceding year, and Vietnam once again saw the biggest yearly growth, with adoption levels rising an impressive 3,075% compared with one year prior. Note, however, that Vietnam did not qualify for inclusion in this metric one year ago.

Fourth-quarter announcements point to continuing improvements in high-speed broadband in the region. In October, Vodafone New Zealand launched its fiber-based gigabit speed broadband service across the country's national Ultra-Fast Broadband (UFB) network footprint.⁵³ As noted in last quarter's report, the government-owned UFB is expected to provide gigabit access to 80% of New Zealand's population when it is completed in 2022, while the already finished Rural Broadband Initiative delivers speeds of 50 Mbps to the remainder of the population.

Meanwhile, the Australian government announced the milestone of more than 1 million premises ready for connection to the state-run National Broadband Network (NBN) backbone, using a copper-based fiber-to-the-node (FTTN) strategy launched in September 2015. In addition, in October, the NBN achieved speeds of 8 Gbps over 30 meters of copper wire cables in a trial with Nokia's Bell Labs. The trial used XG-FAST technology, which is touted to enable speeds of up to 2 Gbps over 100 meters—a typical distance between street nodes and customer homes.⁵⁴ Finally, in commercial news, Singapore-based MyRepublic announced in the fourth quarter that it would launch NBN-based high-speed access to its Australian customers, offering the fastest speeds currently available via the NBN (100 Mbps for FTTP customers; 50 Mbps for FTTN customers). MyRepublic was the first ISP to offer gigabit speed access in Singapore (in 2014). The organization is also looking at offering high-speed access in other markets throughout Asia Pacific.⁵⁵





[SECTION]⁶ GEOGRAPHY *EUROPE*

Beginning with the *First Quarter, 2016 State of the Internet Report*, broadband metrics are presented separately for the European region and the Middle East/Africa region (previously presented together as the EMEA region), with expanded coverage to include more countries in both regions. The metrics presented here for the European region are based on a subset of data used for Section 2 and are subject to the same thresholds and filters discussed within that section. The subset used for this section includes connections identified as coming from networks in the European region, based on classification by Akamai's EdgeScape geolocation tool.

6.1 EUROPEAN AVERAGE CONNECTION SPEEDS (IPv4) / With a robust 18% quarter-over-quarter increase in its average connection speed, to 23.6 Mbps, Norway retained the top spot among the surveyed European countries, in the fourth quarter of 2016. As seen in Figure 24, the difference in average connection speeds between Norway and Cyprus, the slowest country in the region, was nearly 17 Mbps in the fourth quarter — up from 13 Mbps in the third. Twenty-seven of the

thirty-one surveyed countries had average connection speeds at or above 10 Mbps in the fourth quarter, up from 26 in the previous quarter. Quarter-over-quarter changes in average speeds were mostly positive, with Slovenia and Portugal seeing the only declines — both of which were negligible, at 0.8% and 0.6%, respectively. Among the countries seeing gains, increases ranged from 0.5% in Russia to 25% in Denmark.

Apart from Russia, which saw no change in average connection speeds compared with one year prior, all other surveyed European countries posted year-over-year gains in speeds in the fourth quarter. Lithuania had the smallest increase at 1.9%, while Denmark had the largest at 29%. Twenty surveyed countries enjoyed double-digit yearly gains.

Global Rank	Country/Region	Q4 2016 Avg. Mbps	QoQ Change	YoY Change
2	Norway	23.6	18%	26%
3	Sweden	22.8	16%	20%
5	Switzerland	21.2	15%	27%
6	Denmark	20.7	25%	29%
7	Finland	20.6	17%	24%
10	Netherlands	17.6	1.4%	3.6%
13	Czech Republic	17.3	8.4%	8.7%
15	Latvia	17.2	1.8%	3.0%
16	United Kingdom	16.3	10%	18%
17	Romania	16.1	8.5%	22%
18	Belgium	15.9	2.9%	12%
20	Bulgaria	15.6	0.7%	17%
21	Spain	15.4	6.3%	27%
22	Ireland	15.3	9.0%	20%
25	Germany	14.6	6.4%	13%
26	Lithuania	14.6	2.0%	1.9%
28	Hungary	14.3	8.0%	13%
29	Slovenia	14.0	-0.8%	13%
30	Austria	13.9	9.3%	13%
32	Slovakia	13.0	7.8%	3.9%
33	Malta	12.9	6.8%	9.4%
37	Portugal	12.6	-0.6%	3.9%
39	Poland	12.4	6.0%	12%
42	Russia	11.6	0.5%	0%
43	Estonia	11.4	2.0%	4.3%
45	Luxembourg	11.1	5.3%	12%
52	France	10.0	2.8%	12%
58	Italy	8.7	5.2%	16%
67	Croatia	8.2	4.3%	28%
72	Greece	7.5	8.0%	2.6%
76	Cyprus	7.1	6.4%	7.0%

Figure 24: Average Connection Speed (IPv4) by European Country

6.2 EUROPEAN 4 MBPS BROADBAND ADOPTION (IPv4) / In the fourth quarter, Malta led the European region in 4 Mbps adoption, with 97% of its unique IPv4 addresses connecting to Akamai at average speeds of at least 4 Mbps. As seen in Figure 25, many countries in the region have adoption rates that are not far behind, with 17 of the 31 surveyed countries having at least 9 in 10 IPv4 addresses connecting to Akamai at average speeds of 4 Mbps or higher — up from 16 countries in the third quarter. Changes in adoption rates were mixed and modest in the fourth quarter, with 16 countries seeing growth in adoption and 15 seeing declines. Gains ranged from 0.1% in Denmark and Lithuania to 1.4% in Slovakia, while losses ranged from 0.1% in Romania to 6.0% in France. In addition to the largest quarterly decline, France again had the

Global Rank	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
3	Malta	97%	0.6%	1.3%
5	Bulgaria	96%	0.4%	1.9%
6	Netherlands	96%	0.5%	-0.2%
11	Switzerland	95%	1.2%	1.0%
12	Belgium	94%	1.0%	1.2%
13	Sweden	94%	0.6%	1.1%
14	Denmark	94%	0.1%	-0.3%
15	Latvia	94%	-0.2%	1.5%
18	Romania	93%	-0.1%	2.4%
21	Finland	93%	0.9%	2.1%
24	Hungary	92%	-0.5%	0%
25	United Kingdom	91%	0.8%	2.5%
26	Norway	91%	0.2%	1.2%
27	Lithuania	91%	0.1%	4.1%
28	Austria	91%	-1.1%	-1.1%
29	Spain	90%	0.9%	2.4%
31	Russia	90%	0.5%	-0.1%
33	Germany	89%	-0.5%	-0.3%
36	Luxembourg	88%	-1.1%	0.4%
41	Poland	87%	-1.2%	0.4%
43	Portugal	86%	-0.6%	0.4%
45	Czech Republic	86%	-1.4%	-3.1%
46	Slovakia	86%	1.4%	0.6%
47	Estonia	85%	-1.1%	-0.3%
49	Slovenia	84%	-2.0%	-2.7%
50	Croatia	83%	-0.6%	9.4%
55	Ireland	81%	0.6%	3.5%
57	Greece	81%	0.5%	-3.2%
63	Italy	78%	-1.8%	-0.7%
75	Cyprus	72%	-3.2%	-6.3%
78	France	70%	-6.0%	-9.9%

Figure 25: 4 Mbps Broadband Adoption (IPv4) by European Country

lowest adoption rate in the region at 70% — nearly 27 percentage points lower than the regional leader. The gap between the top and bottom countries in the third quarter was 21 percentage points.

Year-over-year changes were mixed as well among the surveyed European countries, with 18 countries seeing growth in 4 Mbps adoption rates, 12 seeing declines, and 1 — Hungary — remaining unchanged. Among the gaining countries, yearly increases were modest, ranging from 0.4% in Poland, Portugal, and Luxembourg, to 9.4% in Croatia. Conversely, losses ranged between 0.1% in Russia and 9.9% in France.

6.3 EUROPEAN 10 MBPS BROADBAND ADOPTION (IPv4) /

With an adoption rate of 73%, Switzerland regained the top spot among surveyed European countries for 10 Mbps adoption,

Global Rank	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
2	Switzerland	73%	14%	18%
5	Netherlands	71%	8.8%	9.4%
7	Romania	69%	17%	30%
8	Denmark	68%	14%	14%
9	Norway	68%	7.0%	10%
10	Belgium	68%	5.4%	11%
12	Sweden	65%	8.9%	10%
13	Finland	65%	9.6%	14%
14	Bulgaria	65%	2.6%	20%
15	Latvia	63%	3.6%	17%
20	United Kingdom	57%	7.5%	15%
23	Spain	55%	7.1%	31%
24	Malta	54%	13%	10%
25	Czech Republic	54%	9.3%	5.8%
26	Hungary	54%	8.9%	13%
27	Lithuania	53%	7.8%	16%
28	Ireland	53%	17%	29%
30	Germany	50%	7.0%	16%
31	Portugal	49%	4.0%	12%
34	Russia	48%	3.5%	4.2%
35	Austria	45%	12%	19%
37	Slovenia	42%	2.3%	17%
38	Poland	42%	8.1%	17%
40	Estonia	41%	5.3%	16%
41	Slovakia	40%	22%	21%
47	Luxembourg	35%	13%	35%
52	France	28%	3.6%	15%
61	Italy	23%	19%	68%
62	Croatia	21%	18%	146%
70	Cyprus	15%	27%	58%
71	Greece	15%	50%	14%

Figure 26: 10 Mbps Broadband Adoption (IPv4) by European Country

surpassing third-quarter leader, the Netherlands. As seen in Figure 26, in the fourth quarter, 18 European countries had at least half of their unique IPv4 addresses connecting to Akamai at average speeds of 10 Mbps or higher, up from 15 in the third quarter. The gap between the highest and lowest adoption rates in the region widened from 55 percentage points to 58. Quarterly changes in adoption rates were positive across Europe, and Greece posted the largest gain at 50%, reversing its 29% quarterly drop in the third quarter. Increases among the remaining countries ranged from 2.3% in Slovenia to 27% in Cyprus.

All 31 surveyed European countries posted yearly gains in the fourth quarter as well, just as in the third. Croatia was the only country to see adoption rates more than double compared with the fourth quarter of 2015, with an increase of 146%. The remaining European countries saw gains ranging from 4.2% in Russia to 68% in Italy.

6.4 EUROPEAN 15 MBPS BROADBAND ADOPTION (IPv4) /

As seen in Figure 27, Norway held on to the top spot for 15 Mbps broadband adoption among surveyed European countries in the fourth quarter, tying second-place Switzerland with an adoption rate of 54%. As seen in the third quarter, Cyprus was the only surveyed European country that did not have enough unique IPv4 addresses connecting to Akamai at average speeds of at least 15 Mbps, to qualify for inclusion in this metric in the fourth quarter. Twenty-five of the thirty qualifying surveyed European countries had at least one in five IPv4 addresses connecting to Akamai at average speeds above 15 Mbps — up from 23 in the previous quarter — while two surveyed countries had adoption rates above 50%. Greece, the country with the lowest adoption level in the region, lagged nearly 49 percentage points behind top-performing Norway in the fourth quarter — widening the gap from 45 points in the third quarter.

Twenty-eight of the qualifying countries saw quarterly gains in adoption in the fourth quarter, compared with thirteen in the previous quarter. Greece led in growth, with a 69% increase that more than made up for its 27% loss in the previous quarter, while Bulgaria posted the smallest gain at 1.0%. Russia and Portugal were the only two countries to see quarterly declines, as their adoption rates dropped by 2.4% and 1.6%, respectively.

Year-over-year changes were positive across the European region in the fourth quarter, apart from Russia, which saw a modest 1.0% decline in 15 Mbps adoption compared with one year prior. Croatia again posted the largest increase in adoption at 147%, while the remaining gains ranged between 3.4% in Lithuania and 97% in Italy.

In the fourth quarter, Europe again saw a flurry of announcements that likely point to continued increases in broadband adoption and speeds over the coming years. In December, the European Commission announced a \$550 million (€500 million) Connecting Europe Broadband Fund (CEBF), with the aim of helping the E.U. achieve its stated objective of universal access at 100Mbps for all

households and 1 Gbps for all businesses by 2025. As noted in last quarter's *State of the Internet* report, the total cost of achieving the objective is estimated to be roughly \$550 billion (€500 billion).⁵⁶

One of the region's leaders, Sweden, which previously had a national goal of 90% access at minimum speeds of 100 Mbps, recently upgraded its connectivity targets, with a goal of providing gigabit-speed broadband for 98% of its population by 2025, with 1.9% having minimum service speeds of 100 Mbps, and the remaining 0.1% (in very remote locations) having access speeds of at least 30 Mbps.⁵⁷ Denmark, another regional broadband leader, aims to have 100 Mbps service available to all households and businesses in the country by 2020. Industry analyst BuddeBlog issued a report touting Denmark as having Europe's highest broadband penetration rates and estimating that it would have gigabit-speed access available

Global Rank	Country/Region	% Above 15 Mbps	QoQ Change	YoY Change
2	Norway	54%	13%	21%
3	Switzerland	54%	26%	43%
7	Sweden	49%	13%	15%
8	Denmark	49%	26%	29%
9	Netherlands	46%	13%	19%
10	Finland	44%	19%	29%
12	Romania	44%	20%	57%
14	Latvia	41%	3.2%	11%
15	Belgium	40%	5.2%	24%
16	United Kingdom	39%	11%	22%
17	Bulgaria	39%	1.0%	38%
19	Ireland	38%	29%	55%
20	Spain	36%	7.5%	50%
21	Czech Republic	36%	18%	17%
24	Lithuania	32%	2.9%	3.4%
25	Hungary	32%	18%	26%
26	Germany	30%	13%	34%
28	Portugal	28%	-1.6%	7.4%
31	Malta	26%	13%	19%
32	Austria	25%	22%	33%
35	Poland	25%	17%	34%
36	Slovenia	25%	1.4%	31%
38	Slovakia	23%	24%	16%
40	Russia	21%	-2.4%	-1.0%
41	Estonia	20%	3.8%	7.5%
44	Luxembourg	18%	18%	47%
48	France	16%	12%	50%
54	Italy	10%	28%	97%
59	Croatia	7.2%	26%	147%
66	Greece	5.1%	69%	45%
–	Cyprus	6.1%	44%	123%

Figure 27: 15 Mbps Broadband Adoption (IPv4) by European Country

to 65% of premises by the end of 2017, based on deployment of DOCSIS 3.1 technologies across its current cable infrastructure.⁵⁸ Finally, the German government announced a four-phase plan to achieve gigabit infrastructure across its country by 2025, supported by about \$11 billion in government funds. The first phase calls for universal coverage at 50 Mbps by 2018, although subsequent phases are less well-defined.⁵⁹ Additional information about government-led broadband goals and initiatives for European Union countries can be found at the European Commission's Digital Single Market website.⁶⁰

There was significant broadband activity in the fourth quarter in the United Kingdom as well. U.K. telecommunications regulator Ofcom released a proposal for achieving the government's Universal Service Obligation of 10 Mbps access by 2020. Ofcom estimated the cost of implementation to be between about \$1.3 and \$2.1 billion (£1 and £1.7 billion), a significant portion of which was attributed to providing access for the final 0.5% to 1% of premises.⁶¹ Ofcom also reported that 89% of U.K. premises now had Internet access with speeds of at least 30 Mbps, up from 83% in 2015. However, only 2% of U.K. premises had access to ultrafast broadband at speeds of at least 300 Mbps.⁶² A Point Topic report released in November also predicted that only 6.5% of U.K. homes would have gigabit access by 2020.⁶³

Meanwhile, to encourage broadband competition throughout the U.K. market, Ofcom announced it would require BT subsidiary Openreach to separate from its parent company. Openreach owns and operates the U.K.'s primary network infrastructure, used by BT as well as rival broadband providers.⁶⁴ The government also signaled intentions to support newer, fiber-based broadband providers in the market, noting that fiber deployments were strategic to the country's broadband future.⁶⁵ In November, Openreach launched its own gigabit fiber-to-the-premise (FTTP) service, following in the footsteps of several smaller fiber optic players in the U.K. Openreach's wholesale FTTP network — which previously supported maximum speeds of 330 Mbps — reaches more than 300,000 homes, and is slated to grow to 2 million premises by 2020.⁶⁶ Later that month, the U.K. government announced plans to invest more than \$1.4 billion (£1.1 billion) in the country's fiber broadband and 5G mobile infrastructure over the next four to five years.⁶⁷ Additionally, progress was announced on a number of specific broadband access projects supported (in whole or part) by national, regional, and local government funding initiatives, such as Broadband Delivery U.K., Better Broadband Subsidy Scheme, Digital Durham, Superfast Cymru, and CSW Broadband.⁶⁸

In the U.K., on the commercial side, Virgin Media announced plans to increase its FTTP buildouts to reach 2 million premises (up from an initial target of 1 million) as part of their Project Lightning initiative.⁶⁹ Virgin also announced a partnership with homebuilder Bloor Homes to offer 300 Mbps broadband services to 2,000 new homes across the U.K.⁷⁰ Meanwhile, TalkTalk confirmed it would expand its gigabit FTTP broadband trial to 40,000 additional premises over the next two years, after a successful and cost-effective initial rollout to 14,000 premises in York, England.⁷¹

Finally, BT announced a partnership with Intersection to offer free public Wi-Fi, phone, and mobile device charging services at hundreds of kiosks that will be distributed across London and other major U.K. cities. The services will be funded by advertising on 55” digital screens in the kiosks. In late 2015, Intersection began rolling out a similar offering in New York City (LinkNYC) that is slated to include 7,500 kiosks in the New York metropolitan area.⁷³

There were notable fourth-quarter announcements in Europe’s developing broadband markets as well. In Croatia, leading provider Hrvatski Telekom announced it would invest nearly \$300 million (HRK 2 billion) in fiber deployments over the next four years.⁷³ And Elta-Kabel, an Internet provider in Bosnia and Herzegovina (BiH), launched a FTTP-based broadband service, offering speeds of up to 200 Mbps to 30 cities.⁷⁴





[SECTION]⁷ GEOGRAPHY MIDDLE EAST + AFRICA (MEA)

Beginning with the *First Quarter, 2016 State of the Internet Report*, broadband metrics are presented separately for the European region and the Middle East / Africa (MEA) region (previously presented together as the EMEA region), with expanded coverage to include more countries in both regions. The metrics presented here for the MEA region are based on a subset of data used for Section 2 and are subject to the same thresholds and filters discussed within that section. The subset used for this section includes connections identified as coming from networks in the Middle East and Africa region, based on classification by Akamai's EdgeScape geolocation tool.

7.1 MEA AVERAGE CONNECTION SPEEDS (IPv4) / With its robust 36% quarterly increase to 15.0 Mbps, Kenya overtook third-quarter leader Israel to gain the top spot for average connection speeds among the surveyed MEA countries in the fourth quarter, as seen in Figure 28. In total, four surveyed countries in the region had average connection speeds above 10 Mbps in the fourth quarter—up from three in the

Global Rank	Country/Region	Q4 2016 Avg. Mbps	QoQ Change	YoY Change
23	Kenya	15.0	36%	198%
27	Israel	14.4	12%	24%
41	Qatar	11.9	9.4%	79%
48	United Arab Emirates	10.7	28%	54%
56	Kuwait	9.0	12%	96%
71	Turkey	7.6	13%	20%
81	South Africa	6.6	11%	62%
88	Saudi Arabia	6.3	28%	87%
103	Morocco	5.2	11%	42%
113	Iran	4.1	13%	105%
114	Nigeria	4.1	39%	53%
125	Namibia	3.0	23%	49%
142	Egypt	2.2	-19%	28%

Figure 28: Average Connection Speed (IPv4) by MEA Country

third quarter. In contrast, bottom-ranking Egypt posted an average connection speed of 2.2 Mbps—down 19% from the third quarter and nearly 13 Mbps slower than the regional leader. The gap between the top and bottom-ranked countries was 10 Mbps in the previous quarter. Two of the thirteen countries saw average connection speeds below 4 Mbps in the fourth quarter, down from four in the third quarter.

Twelve of the thirteen MEA countries posted quarterly gains in the fourth quarter, with Egypt seeing the only decline. Nigeria had the largest increase at 39%, while Qatar had the smallest at 9.4%.

Year-over-year changes were positive across the board in the MEA region in the fourth quarter, just as in the third quarter. Turkey again saw the smallest gain with a 20% increase, while Kenya again had the largest with a 198% jump. Iran also saw its average speed more than double compared with the previous year, while the remaining countries all posted double-digit yearly gains.

7.2 / MEA 4 MBPS BROADBAND ADOPTION (IPv4) / Israel maintained the top spot in the MEA region for 4 Mbps adoption in the fourth quarter with a 95% adoption rate, up 1.3% from the third quarter, as seen in Figure 29. Due to some strong quarterly gains in the region, 10 of the 13 qualifying surveyed countries in the region had at least half of their unique IPv4 addresses connecting to Akamai at average speeds of at least 4 Mbps—compared with seven in the previous quarter. However, the gap between the top and bottom-ranked MEA countries widened slightly, from 85 percentage points to 86, with Egypt remaining the bottom-ranked country in the region and, the only surveyed country with less than 1 in 10 IPv4 addresses connecting to Akamai with average speeds of at least 4 Mbps.

Global Rank	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
7	Israel	95%	1.3%	1.6%
17	United Arab Emirates	94%	2.8%	8.5%
42	Kenya	86%	8.9%	42%
48	Qatar	85%	2.7%	25%
62	Turkey	78%	5.0%	1.5%
77	Saudi Arabia	71%	37%	198%
87	Morocco	58%	12%	145%
93	Kuwait	52%	8.4%	15%
95	South Africa	51%	21%	87%
96	Iran	50%	28%	423%
101	Nigeria	41%	130%	202%
112	Namibia	22%	50%	221%
118	Egypt	9.1%	0.9%	450%

Figure 29: 4 Mbps Broadband Adoption (IPv4) by MEA Country

All surveyed MEA countries posted quarterly gains in the fourth quarter, led by Nigeria with a sizeable 130% increase. The next largest gain of 50% was seen in Namibia, while Egypt had the smallest gain at 0.8%. Five countries in all saw double-digit percentage increases, the same as in the third quarter.

On a year-over-year basis, the surveyed MEA countries enjoyed across-the-board growth in 4 Mbps broadband adoption in the fourth quarter. Egypt led the gaining countries once again, with a tremendous 450% yearly increase, and five additional countries saw adoption rates more than double as compared to the fourth quarter of 2015. Turkey and Israel had the smallest year-over-year increases in adoption at 1.5% and 1.6%, respectively.

7.3 / MEA 10 MBPS BROADBAND ADOPTION (IPv4) / As seen in Figure 30, 10 surveyed MEA countries qualified for inclusion in the 10 Mbps broadband adoption metric in the fourth quarter. This is the same number as in the third quarter; however, Kuwait joined the group this quarter, while Egypt dropped out. With 61% of its IPv4 addresses connecting to Akamai at speeds of 10 Mbps or higher, Kenya took the top spot for 10 Mbps broadband adoption among qualifying MEA countries, overtaking third-quarter leader Israel. Kenya and Israel were the only two countries in the region with adoption rates above 50% in the fourth quarter—a threshold that none of the MEA countries achieved in the third quarter. Both countries enjoyed robust quarterly gains, widening the gap between the top and bottom-ranked MEA countries to 59 percentage points in the fourth quarter from 46 in the third quarter. Eight of the ten qualifying surveyed countries had at least 10% of their unique IPv4 addresses connecting to Akamai at average speeds of 10 Mbps or higher in the fourth quarter, up from five in the third quarter.

Unlike the third quarter, where quarterly changes were mixed, in the fourth quarter, the qualifying MEA countries saw robust gains across the board. Iran led the region with a 212% increase, while

Global Rank	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
17	Kenya	61%	48%	1510%
19	Israel	58%	25%	50%
32	Qatar	48%	12%	235%
39	United Arab Emirates	41%	89%	261%
63	Kuwait	20%	104%	397%
64	Turkey	19%	50%	125%
76	Saudi Arabia	12%	138%	1873%
78	South Africa	11%	12%	189%
84	Morocco	5.7%	59%	1008%
86	Iran	1.4%	212%	1067%
-	Nigeria	3.3%	192%	412%
-	Namibia	1.8%	60%	197%
-	Egypt	0.3%	-95%	216%

Figure 30: 10 Mbps Broadband Adoption (IPv4) by MEA Country

Saudi Arabia and Kuwait also saw adoption levels more than double quarter-over-quarter. Qatar and South Africa had the smallest increases at 12%.

Yearly changes were also strongly positive across the board, with Saudi Arabia, Kenya, Iran, and Morocco experiencing outsized gains of more than 1,000%. However, as noted in last quarter's report, most of these countries did not qualify for inclusion in this metric one year ago, so their yearly percentage-change magnitudes can be misleading. Israel again posted the smallest annual increase in the region at 50%, while the other five MEA countries all saw adoption levels more than double compared with the fourth quarter of 2015.

7.4 / MEA 15 MBPS BROADBAND ADOPTION (IPv4) / As seen in Figure 31, eight MEA countries qualified for inclusion in this metric in the fourth quarter, the same as in the third quarter; yet, Morocco joined this group in the fourth quarter, while Kuwait dropped out. With a robust 85% quarterly gain to 44% adoption, Kenya led the region in 15 Mbps broadband adoption levels, followed by Israel with a 30% adoption rate. The gap between the top and bottom 15 Mbps adoption rates in MEA widened significantly in the fourth quarter, to 43 percentage points, up from 23 points in the third. Newcomer Morocco had the lowest adoption rate in the region at 1.4%.

Quarterly changes in 15 Mbps adoption were positive across the board, with South Africa posting the smallest gain at 7.3%. Five qualifying surveyed countries saw double-digit quarterly gains, while the United Arab Emirates and Saudi Arabia enjoyed the largest increases, at 161% and 185% respectively. In the fourth quarter, four MEA countries had more than 1 in 10 unique IPv4 addresses connecting to Akamai at average speeds of at 15 Mbps or more — up from three countries in the third quarter.

Global Rank	Country/Region	% Above 15 Mbps	QoQ Change	YoY Change
11	Kenya	44%	85%	5159%
27	Israel	30%	26%	86%
37	Qatar	24%	18%	467%
50	United Arab Emirates	16%	161%	499%
61	Turkey	7.0%	76%	138%
63	South Africa	6.2%	7.3%	225%
70	Saudi Arabia	3.9%	185%	3681%
75	Morocco	1.4%	86%	1250%
-	Kuwait	9.0%	36%	390%
-	Nigeria	0.9%	122%	287%
-	Namibia	0.5%	119%	303%
-	Egypt	0.1%	-97%	120%
-	Iran	0.1%	55%	97%

Figure 31: 15 Mbps Broadband Adoption (IPv4) by MEA Country

The MEA region saw robust, across-the-board growth in 15 Mbps broadband adoption on a yearly basis, with Kenya, Saudi Arabia, and Morocco experiencing tremendous gains of 5,159%, 3,681%, and 1,250%, respectively. As previously noted, these countries did not qualify for inclusion in this metric in the fourth quarter of 2015, so their data from one year ago was likely too small to be informative. Increases among the remaining countries ranged from 86% in Israel to 488% in the United Arab Emirates.

Although broadband adoption and speeds in many MEA countries tend to lag as compared to many other parts of the world, we are beginning to see significant improvements in some areas, as captured in the data above. The fourth quarter also saw news reports pointing to continued improvements in the region.

The AAE-1 cable, a 25,000 km submarine cable connecting nearly 20 hubs across Asia, Africa, and Europe, is now entering its final construction phase and is on track to launch in the first quarter of 2017.⁷⁵ In addition, Telecom Italia and the Libyan International Telecommunications Company announced a 100 Gbps upgrade to the cable connecting Libya to Italy, improving connectivity between the regions.⁷⁶ Meanwhile, as part of its Broadband for Africa initiative, satellite operator Eutelsat has struck an agreement with Abu Dhabi government-owned Yahsat. Eutelsat will gain capacity via Yahsat satellites to provide broadband services throughout Sub-Saharan Africa, launching in the first half of 2017.⁷⁷ Finally, Tunisie Telecom announced successful trials of G.fast technology over its network, achieving speeds of 800 Mbps over copper wires (across a distance of 100 meters).⁷⁸ Tunisie Telecom also secured a \$110 million (€100 million) loan from the European Development Bank to upgrade its mobile and broadband network infrastructure. The money is expected to be used to lay 2,000 km of fiber optic cable, as well as deploy 1,500 4G cell towers across the country.⁷⁹ Hopefully, these announcements are indicative of a larger trend of broadband investment in the region.





[SECTION]⁸ MOBILE CONNECTIVITY

The source data in this section encompasses usage from smartphones, tablets, computers, and other devices that connect to the Internet through mobile network providers. Mobile connectivity metrics are aggregated at a country/region level. In addition, this section includes insight into mobile voice and data-traffic trends contributed by Ericsson, a leading provider of telecommunications equipment and related services to mobile and fixed operators globally.

Beginning this quarter, we have removed the sub-section that reports on mobile browser usage data. This data is still available, and is updated daily at the Akamai Internet Observatory (Akamai IO) destination site (<http://www.akamai.com/io>). The Akamai IO site allows users to generate charts and other data visualizations for web and mobile traffic data, including browser usage across PCs and other devices connecting to Akamai via fixed and mobile networks, across custom date ranges.

Country/Region	Q4 2016 Avg. Mbps
AMERICAS	
Argentina	4.0
Bolivia	4.3
Brazil	4.7
Canada	10.3
Chile	5.9
Colombia	6.6
Costa Rica*	3.9
Ecuador*	4.4
Mexico*	7.6
Panama	3.6
Paraguay	8.3
Peru	6.7
United States	7.9
Uruguay	4.2
Venezuela	2.9
ASIA PACIFIC	
Australia	13.8
China	7.4
Hong Kong	7.2
India	4.8
Indonesia	9.8
Japan	13.3
Malaysia	3.9
New Zealand	12.5
Philippines*	14.3
Singapore	9.9
South Korea	12.7
Sri Lanka	5.8
Taiwan	12.0
Thailand	7.1
Vietnam	4.3
EUROPE	
Austria	14.6
Belgium	17.5
Bulgaria*	8.4
Croatia	9.0
Cyprus*	23.6
Czech Republic	7.7

Figure 32: Average Connection Speeds (IPv4) for Mobile Connections by Country/Region

Country/Region	Q4 2016 Avg. Mbps
Denmark	16.1
Estonia	11.4
Finland	20.1
France	12.1
Germany	22.4
Greece	11.1
Hungary	13.8
Ireland	12.8
Italy	11.2
Latvia*	15.9
Lithuania	9.3
Luxembourg*	10.5
Malta*	9.1
Netherlands	14.8
Norway	18.2
Poland	10.0
Portugal	8.2
Romania*	15.3
Russia	9.5
Slovakia	13.3
Slovenia	11.1
Spain	13.4
Sweden	14.2
Switzerland*	31.1
United Kingdom	26.8
MIDDLE EAST/AFRICA	
Egypt	10.6
Iran	8.4
Israel	9.4
Kenya	13.7
Kuwait	10.4
Morocco	8.8
Namibia	4.5
Nigeria*	4.0
Qatar*	12.6
Saudi Arabia	5.4
South Africa	7.2
Turkey	13.9
United Arab Emirates	17.2

* Fewer than 25,000 unique IPv4 addresses classified as mobile observed in Q4 2016

8.1 CONNECTION SPEEDS ON MOBILE NETWORKS (IPv4) / Beginning with the *Second Quarter, 2016 State of the Internet Report*, the countries/regions covered in this section, along with their categorization, have been altered slightly to align with the rest of the *State of the Internet Report*. This section will now provide mobile data and analysis for the same surveyed countries/regions covered in Sections 4 through 7 of this report, and the countries/regions will be categorized in the same way: Americas, Asia Pacific, Europe, and Middle East & Africa. Countries/regions marked with an asterisk in Figure 32 have not met the minimum requirement of 25,000 unique IPv4 addresses seen by Akamai and identified as coming from a mobile network during the quarter. These countries/regions do not qualify for inclusion this quarter and are not included in this section's analysis, although their data is included in Figure 32 for reference.

In the fourth quarter of 2016, 61 surveyed countries/regions around the world qualified for inclusion in the mobile section, the same as in the third quarter. Figure 32 shows that across these countries/regions, the United Kingdom once again had the fastest average mobile connection speed at 26.8 Mbps (up from 23.7 Mbps in the third quarter), with Germany in second place at 22.4 Mbps. Venezuela again had the lowest average connection speed at 2.9 Mbps (up from 2.2 in the third quarter), followed by Panama, with an average connection speed of 3.6 Mbps.

Among the qualifying surveyed countries/regions, 30 in total had an average mobile connection speed at or exceeding 10 Mbps (up from 24 in the previous quarter), while 58 achieved average speeds at or above 4 Mbps (up from 52). Within the individual continental regions, the following qualifying surveyed countries/regions had the highest average mobile connection speeds:

- **Americas:** Canada, 10.3 Mbps
- **Asia Pacific:** Australia, 13.8 Mbps
- **Europe:** United Kingdom, 26.8 Mbps
- **Middle East/Africa:** United Arab Emirates, 17.2 Mbps

Continuing the trend of quarters past, the fourth quarter saw continued rapid development in the mobile broadband market. Research towards pushing speed boundaries with LTE-A continued, as A1 (a subsidiary of Telekom Austria) and Nokia achieved speeds of 500 Mbps over A1's live network,⁸⁰ and Spain's Telefonica and Nokia achieved speeds of up to 800 Mbps in a live test,⁸¹ both using techniques such as carrier aggregation, 256QAM and MIMO 4x4 technology. Using similar technologies, Huawei Spain and Orange reached download speeds of 1.5 Gbps on a 4G network in Valencia,⁸² while Huawei and British operator EE achieved speeds of 2.1 Gbps using similar technologies in a U.K. lab test.⁸³

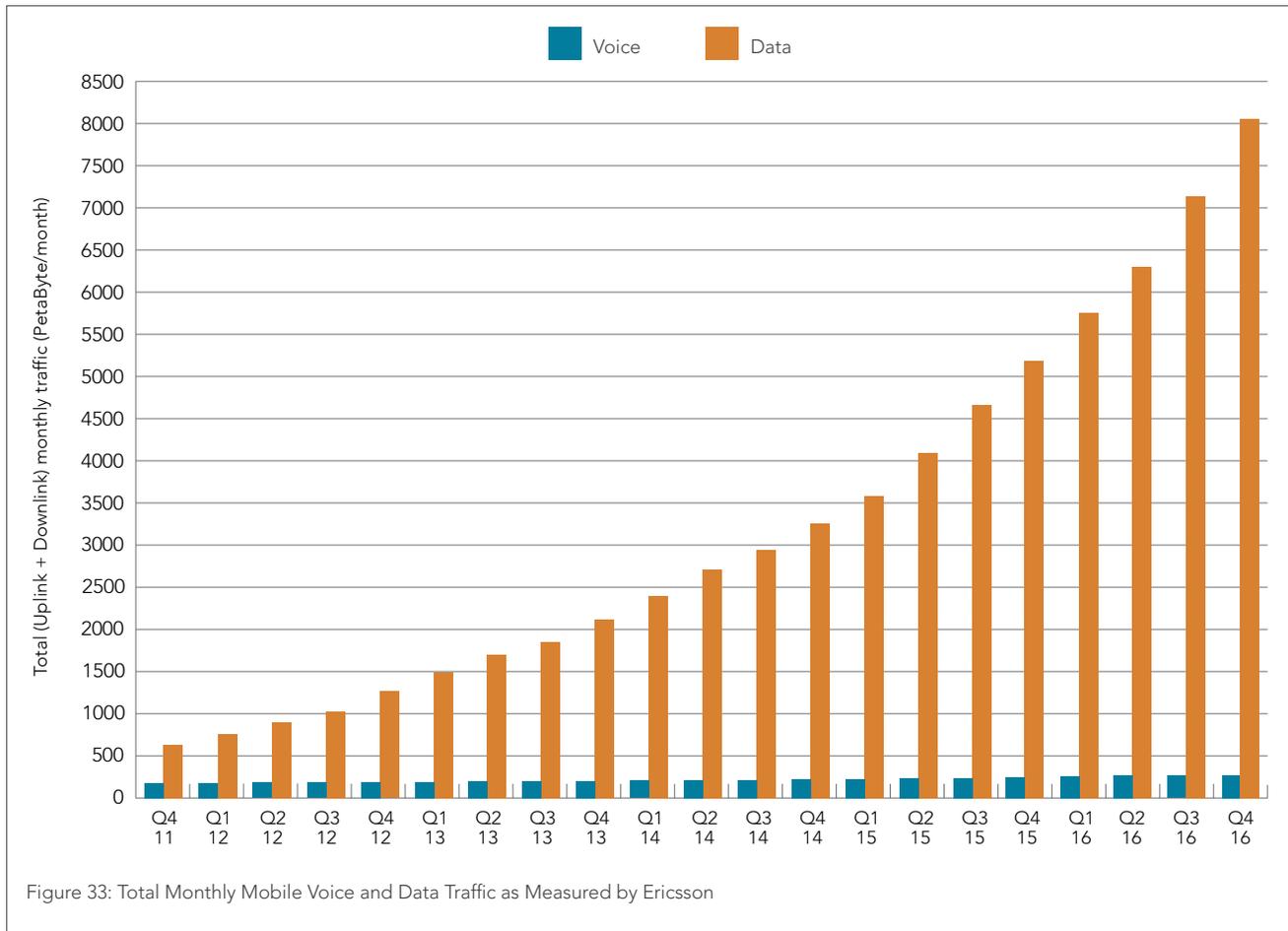


Figure 33: Total Monthly Mobile Voice and Data Traffic as Measured by Ericsson

The fourth quarter also saw developments related to 5G, which can deliver even faster speeds and lower latencies than 4G. Swedish mobile provider Telia partnered with Ericsson to successfully complete 5G field tests that reached speeds of up to 15 Gbps with sub-3 millisecond latencies. Telia called these tests the first of their kind in Europe, and expects to perform city-to-city testing of the 5G technology between Stockholm, Sweden, and Tallinn, Estonia in 2018.⁸⁴ Australia also saw its country's "first public showcase of 5G" in the fourth quarter, as Vodafone Australia and Nokia partnered to achieve speeds of close to 5 Gbps with 2.8 millisecond latencies.⁸⁵

Finally, a few fourth quarter announcements pointed to improving mobile data connectivity in underserved areas. Oman's telecommunications regulator TRA announced it would install 312 new cell towers, providing mobile connectivity to 410 villages across the country. The first phase, which includes 200 stations, is expected to be complete by March 2017.⁸⁶ In Nigeria, Globacom announced the introduction of 4G LTE services in six cities, with others soon to follow. Nigeria has low 4G penetration, and Globacom is only the third mobile network in Nigeria (after nTel and MTN) to offer 4G services.⁸⁷

8.2 MOBILE TRAFFIC GROWTH OBSERVED BY ERICSSON /

In mobile networks, the access medium (spectrum) is shared by different users in the same cell. It is important to understand traffic volumes and usage patterns in order to enable a good customer experience. Ericsson's presence in more than 180 countries and its customer base representing more than 1,000 networks enable it to measure mobile voice and data volumes. The result is a representative base for calculating world total mobile traffic in 2G, 3G, and 4G networks (not including DVB-H, Wi-Fi, and Mobile WiMAX). These measurements have been performed for several years. It is important to note that the measurements of data and voice traffic in these networks (2G, 3G, 4G/LTE) around the world show large differences in traffic levels between markets and regions as well as between operators, due to their different customer profiles.

Mobile data traffic has continued to grow, and Figure 33 shows total global monthly data and voice traffic from the fourth quarter of 2011 to the fourth quarter of 2016. It depicts a continued strong increase in data traffic, with voice traffic growth in the low single digits per year. The growth in data traffic is being driven both by increased smartphone subscriptions and a continued increase in average data volume per subscription, fueled primarily by increased viewing of video content. In the fourth quarter, data traffic grew more than 13% quarter-over-quarter and more than 54% year-over-year. Looking at the full five-year period shown in Figure 33, cumulative voice traffic growth was 31%, while cumulative data traffic growth was more than 1,200%.





[SECTION]⁹

SITUATIONAL PERFORMANCE

The metrics presented here are based on data collected through Akamai's Real User Monitoring (RUM) capabilities, which take passive performance measurements from actual users of a web experience to provide insight into performance across devices and networks. RUM is a complementary capability to synthetic testing, and both tools should be used together to gain a comprehensive picture of user experiences. Note that no Personally Identifiable Information ("PII") is used to generate this data.

Figure 34 shows average page load times for users on both broadband and mobile connections based on RUM data collected by Akamai during the fourth quarter of 2016. The underlying data was collected using navigation timing⁸⁸ (or "navtiming"), which allows JavaScript to collect page load time information directly from the user agent (browser) through an API. Navtiming is supported by most, but not all, of the browsers currently in use.⁸⁹ Navtiming is not supported by Safari prior

to version 8 on OS X and version 9.0 on iOS, Android before version 4.0, Internet Explorer before version 9, or any version of the Opera Mini browser, so data from these devices will not be included below.

Beginning with the *Second Quarter, 2016 State of the Internet Report*, the countries/regions covered in this section, along with their categorization, have been aligned with the rest of the *State of the Internet Report*. This section now includes the same countries/regions surveyed in Sections 4 through 7 of this report, categorized in the same way: Americas, Asia Pacific, Europe, and Middle East/Africa.

Countries/regions marked with an asterisk in Figure 34 have not met the minimum requirement of having more than 90,000 measurements from mobile networks during the quarterly data collection period and do not qualify for inclusion. In the fourth quarter of 2016, 72 of the 74 surveyed countries/regions worldwide qualified for inclusion in this section, with Cyprus and Malta being the two exceptions.

In reviewing the average page load time measurements for broadband connections shown in Figure 34, we find the lowest (i.e., fastest page load times) to again be in Israel, with a 1.4-second average load time. The country with the slowest broadband page load time was again Venezuela, where pages took 6.7 seconds to load on average—nearly five times as long as Israel—a larger multiplier than that seen in the third quarter. Nigeria and Paraguay had the next-slowest broadband page load times, at 6.0 and 5.9 seconds respectively. Note that these measurements do not just reflect broadband network speeds, but are also influenced by factors such as average page weight, page composition, and the Akamai customer content consumed by users within these countries.

Saudi Arabia had the fastest average page load time for mobile networks in the fourth quarter, with pages loading in 0.6 seconds. Israel, which had the fastest mobile times in the third quarter, took second place in the fourth quarter, with pages loading in 0.9 seconds. The third fastest country, Thailand, was significantly slower with an average page load time of 1.6 seconds. At the other end of the spectrum, Nigeria had the highest average load times for mobile connections at 9.0 seconds, followed by Kenya and Venezuela at 8.3 and 8.2 seconds respectively. Note again that these time measurements are all affected by average page weight and page composition as well as mobile network speeds, and may include content that is mobile-optimized.

In comparing the average broadband page load times to those observed on mobile connections, we again find significant variance in what we have dubbed the “mobile penalty”. The term “mobile penalty” refers to the ratio of average page load times on mobile connections versus average load times on broadband connections. As stated previously, this ratio should not be taken as a pure comparison of mobile versus broadband network speeds, as these speeds are just one factor in the overall user experience. Average

page weight, which is dependent both on the type of content requested as well as potential mobile-specific content optimizations, is another significant factor.

In the fourth quarter, the mobile penalty across surveyed countries ranged from 0.4x in Saudi Arabia to 2.3x in New Zealand, a variance slightly larger than that seen in the previous quarter. Of the 72 qualifying surveyed countries/regions, 12 had a mobile penalty lower than 1.0x, meaning that average page load times were faster on mobile connections than on broadband connections. Note that many of the countries with lower mobile penalties are countries which may have underdeveloped fixed broadband infrastructure and depend heavily on mobile; as such, the content citizens are consuming may also be heavily optimized for the mobile experience, with aggressively slimmed-down content being delivered to mobile devices. Conversely, New Zealand was again the only country to have a mobile penalty above 2.0x, while four additional countries had penalties above 1.5x. The average mobile penalty across all 72 qualifying countries was 1.2x, slightly lower than the 1.3x average seen as in the third quarter.

Country/Region	Avg. Page Load Time Broadband (ms)	Avg. Page Load Time Mobile (ms)	Mobile Penalty
AMERICAS			
Argentina	4638	6840	1.5x
Bolivia	4537	3476	0.8x
Brazil	4827	7391	1.5x
Canada	2759	3789	1.4x
Chile	3168	3467	1.1x
Colombia	3859	4785	1.2x
Costa Rica	2907	3829	1.3x
Ecuador	3988	5014	1.3x
Mexico	2511	2796	1.1x
Panama	2796	3597	1.3x
Paraguay	5921	4901	0.8x
Peru	3828	5470	1.4x
United States	2712	3757	1.4x
Uruguay	3808	4122	1.1x
Venezuela	6718	8184	1.2x
ASIA PACIFIC			
Australia	3535	4648	1.3x
China	2696	2311	0.9x
Hong Kong	2265	3534	1.6x
India	3848	5018	1.3x
Indonesia	3606	4892	1.4x
Japan	2133	2975	1.4x
Malaysia	3250	3386	1.0x
New Zealand	2064	4704	2.3x
Philippines	3925	6747	1.7x
Singapore	2133	2764	1.3x
South Korea	1898	2725	1.4x
Sri Lanka	2740	3044	1.1x
Taiwan	2236	3182	1.4x
Thailand	2361	1555	0.7x
Vietnam	2533	3758	1.5x
EUROPE			
Austria	2601	2988	1.1x
Belgium	2099	2303	1.1x
Bulgaria	1894	2892	1.5x
Croatia	2398	3349	1.4x
Cyprus*	2876	4579	1.6x
Czech Republic	1699	2292	1.3x

Figure 34: Average Page Load Times Based On Real User Monitoring

Country/Region	Avg. Page Load Time Broadband (ms)	Avg. Page Load Time Mobile (ms)	Mobile Penalty
Denmark	1788	2596	1.5x
Estonia	1738	2154	1.2x
Finland	2577	3624	1.4x
France	3273	3398	1.0x
Germany	2784	2554	0.9x
Greece	3363	3461	1.0x
Hungary	1805	2219	1.2x
Ireland	2353	3063	1.3x
Italy	5257	6081	1.2x
Latvia	1882	2281	1.2x
Lithuania	1650	2202	1.3x
Luxembourg	2586	2755	1.1x
Malta*	2333	3789	1.6x
Netherlands	2135	2514	1.2x
Norway	2121	2779	1.3x
Poland	2664	3346	1.3x
Portugal	2567	3411	1.3x
Romania	2009	2679	1.3x
Russia	2165	1920	0.9x
Slovakia	1771	2182	1.2x
Slovenia	1833	2666	1.5x
Spain	2621	3209	1.2x
Sweden	1908	2608	1.4x
Switzerland	2399	1675	0.7x
United Kingdom	2650	3370	1.3x
MIDDLE EAST & AFRICA			
Egypt	2765	2513	0.9x
Iran	3266	4354	1.3x
Israel	1364	937	0.7x
Kenya	5853	8326	1.4x
Kuwait	3476	1764	0.5x
Morocco	2520	2445	1.0x
Namibia	5845	7523	1.3x
Nigeria	6020	8981	1.5x
Qatar	2832	2704	1.0x
Saudi Arabia	1551	593	0.4x
South Africa	3721	4782	1.3x
Turkey	2309	3327	1.4x
United Arab Emirates	2751	1706	0.6x

* Fewer than 90,000 measurements from mobile networks observed in Q4 2016.



[SECTION]¹⁰

INTERNET DISRUPTIONS +EVENTS

Internet disruptions are unfortunately still too common—occurring in some countries/regions on a frequent basis. These disruptions may be accidental (backhoes or ship anchors severing buried fiber), natural (hurricanes or earthquakes), or political (governments shutting off Internet access). Because Akamai customer content is consumed by users around the world, the effect of these disruptions is evident in the levels of Akamai traffic delivered to the affected country/region.

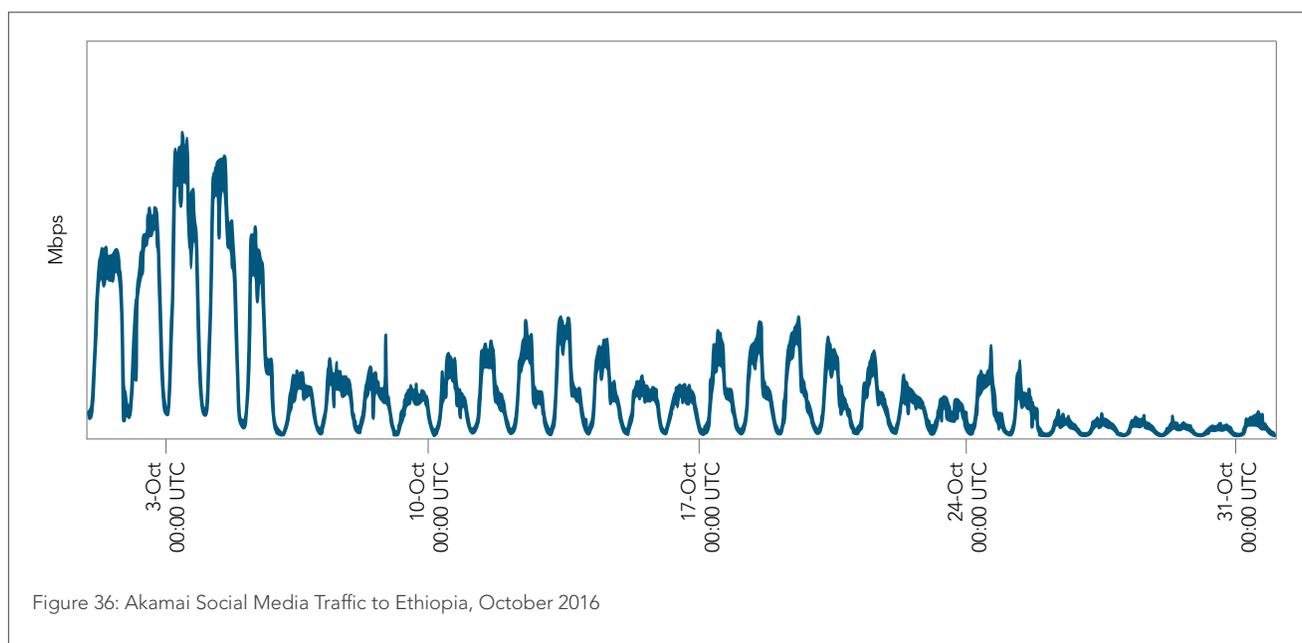
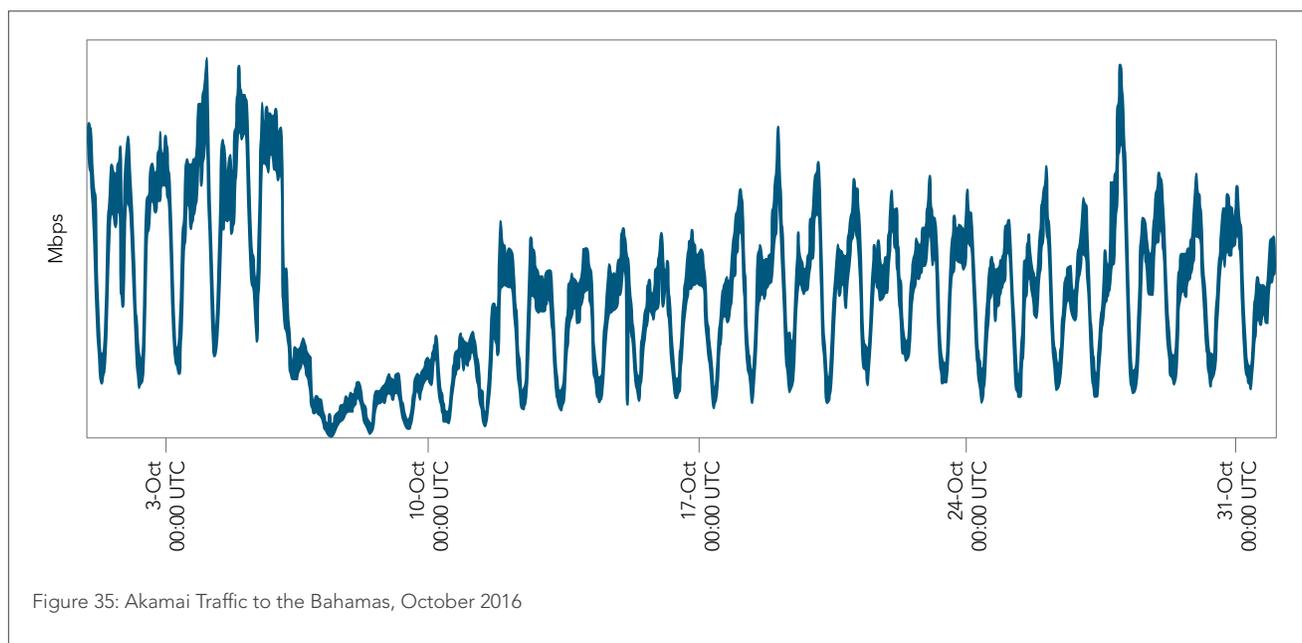
The content presented in this section provides insight into how Akamai traffic was impacted by major Internet disruptions, and other events, during the fourth quarter of 2016.

This quarter, three of the five disruptions highlighted below were government-ordered shutdowns, which are unfortunately growing more common. Access Now documented 56 such shutdowns in 2016, occurring in countries across Africa, Asia, and the Middle East. This represents a large increase from the 15 documented cases in 2015.⁹⁰ Though purported reasons for the shutdowns range from quelling protests, to stopping terrorists, to preventing cheating, the intentional repression of Internet communications can inflict wide-ranging effects on societies and economies. The Brookings Institute estimates that government-induced blackouts have cost countries more than \$2.4 billion in collective GDP over the past year alone, while human rights groups are concerned about the suppression of communications, censorship of media, and blocking of emergency services.^{91, 92}

10.1 BAHAMAS / Hurricane Matthew, the first Category 5 hurricane in the Atlantic Ocean since 2007, wreaked havoc across the Caribbean and the southeastern United States, and it was estimated to cause over 1,000 deaths (primarily in Haiti) and more than \$10 billion in damages.⁹³ Hurricane Matthew passed through the Bahamas as a Category 4 storm on October 6. Its damaging winds and floods closed ports and airports, toppled trees and power lines, and destroyed buildings.⁹⁴ As reflected in Figure 35, Internet traffic was disrupted as well, with Akamai seeing traffic levels to the Bahamas drop significantly starting in the morning hours of October 6. For the 24-hour period starting at 0:00 a.m. UTC on October 6 (beginning several hours before the storm hit), Internet traffic was roughly one-third of the levels seen in the preceding 24 hours. For

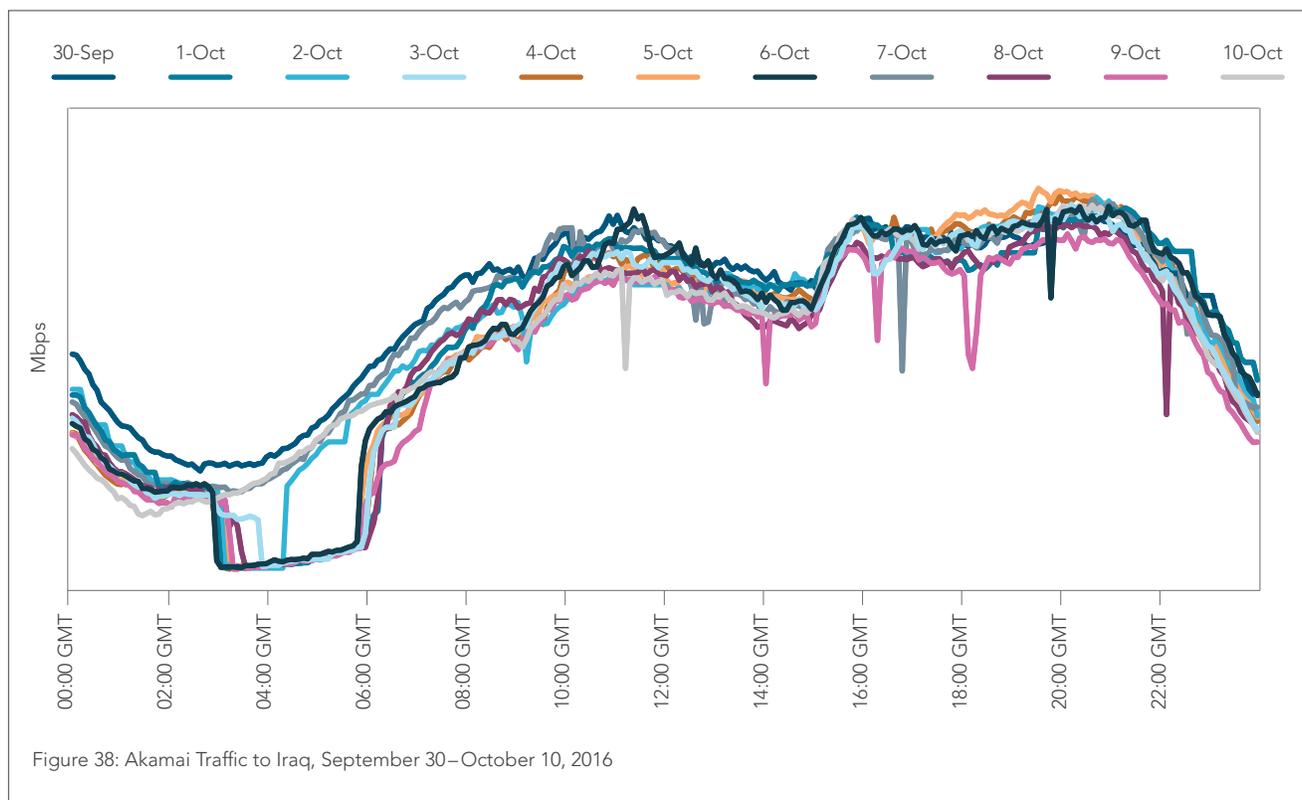
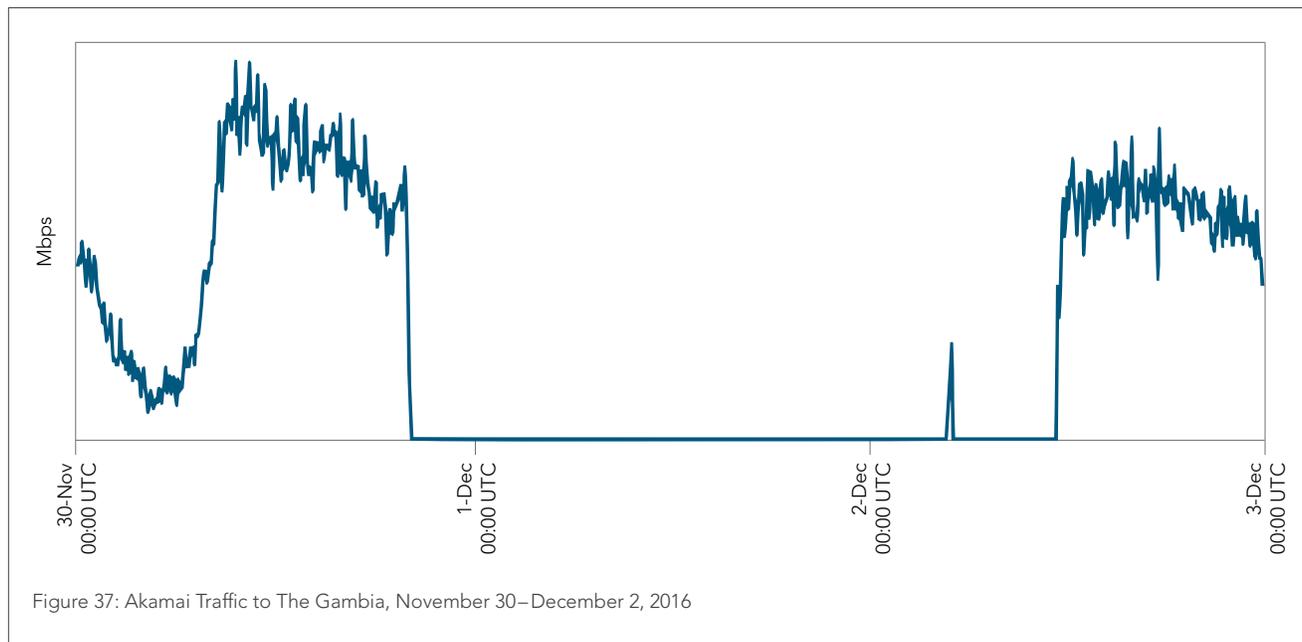
the 24-hour period starting at 0:00 a.m. UTC on October 7, traffic dropped to less than one-third of the levels seen on October 6 — and was roughly one-tenth of the levels seen on October 5. As seen in Figure 35, traffic levels took several days to fully recover.

10.2 ETHIOPIA / Figure 36 depicts levels of social media-related traffic served by Akamai to users in Ethiopia in the month of October. As seen in the figure, social media traffic dropped significantly beginning on October 6, with traffic hitting less than one-third of typical levels for most of the month, before tapering off to even lower amounts by the last week in October. The depressed levels of traffic were reportedly due to government-ordered social media and mobile outages following civil unrest in the country's Oromia and Amhara



regions. Reports indicate that protesters were using the Internet and social media to coordinate actions, and that Internet shutdowns may have been specific to regions where protests were occurring.⁹⁵ On October 9, the Ethiopian government declared a six month “state of emergency” in which it instituted a curfew and banned protests, social media, external broadcast media, certain gestures, and guns.⁹⁶ As of the end of the fourth quarter, Akamai-served social media traffic to Ethiopia remained depressed, at even lower levels than depicted here.

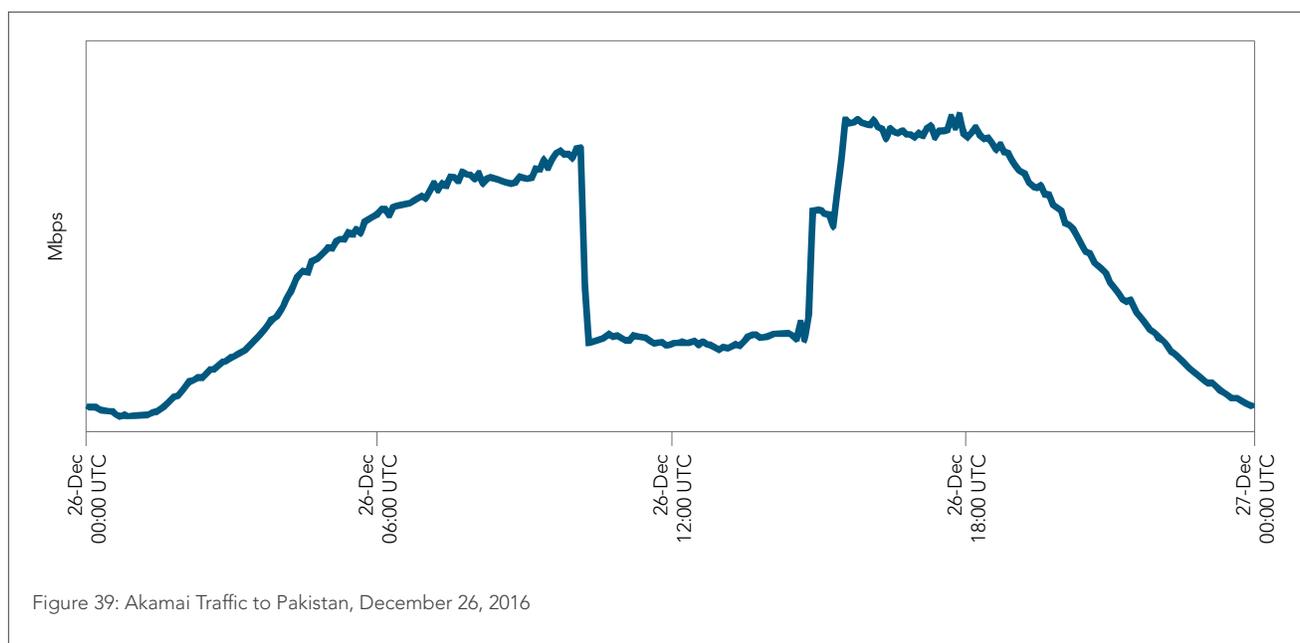
10.3 THE GAMBIA / As shown in Figure 37, Akamai saw traffic levels to the Gambia suddenly drop to zero at roughly 8:20 p.m. UTC on November 30, just ahead of the country’s elections on December 1. Gambian President Yahya Jammeh reportedly ordered the shutdown, in addition to banning protests and international telephone calls during the election.⁹⁷ Akamai saw Internet traffic to the Gambia resume around 11:20 a.m. UTC on December 2. Jammeh, who seized control of the Gambia by military coup in 1994, was



surprisingly defeated in the election by Adama Barrow. However, after initially conceding defeat, Jammeh rejected the results a week later, calling for a new election.⁹⁸

10.4 IRAQ / Just as in several previous quarters, in the fourth quarter of 2016, Akamai saw significant drops in traffic to Iraq on several dates, as seen in Figure 38. These disruptions reflect a continuation of the Iraqi government’s policy of blocking Internet access across the country (except in the independent region of Kurdistan) during middle and high school exams, to prevent cheating. The outages occurred roughly between the hours of 3 a.m. and 6 a.m. UTC from October 1 to October 9. Dyn Research confirmed the outages, noting the specific exams taking place on each date.⁹⁹ In addition to preventing cheating on exams, the Iraqi government has also shut down the country’s Internet access for other reasons; for example, as noted in the *Third Quarter, 2016 State of the Internet Report*, access was suppressed on July 15 following protests against government corruption.

10.5 PAKISTAN / As shown in Figure 39, Akamai saw traffic levels to Pakistan drop suddenly to around 40% of previous levels at approximately 10:15 a.m. UTC on December 26. Traffic recovered partially around 2:50 p.m. later that day, returning to typical levels shortly thereafter. The disruption was blamed on technical issues at the Pakistan Telecommunication Company Limited (PTCL), severely affecting Internet, landline, and cellular service to their users. PTCL also provides bandwidth to local ISPs, so many additional Internet users were affected.¹⁰⁰ Dyn Research noted that nearly 900 networks were impacted.¹⁰¹



Region	Unique IPv4 Addresses	Average Connection Speed (Mbps)	% Above 4 Mbps	% Above 10 Mbps	% Above 15 Mbps
AMERICAS					
Argentina	8,585,870	6.1	56%	16%	5.4%
Bolivia	578,840	2.6	9.5%	1.0%	0.4%
Brazil	47,260,590	6.4	59%	16%	5.0%
Canada	15,301,733	14.9	88%	56%	34%
Chile	4,492,515	8.6	74%	27%	13%
Colombia	8,669,099	5.4	58%	7.4%	2.2%
Costa Rica	517,712	3.9	33%	2.9%	0.9%
Ecuador	776,081	6.3	63%	13%	4.7%
Mexico	13,071,114	7.2	75%	17%	5.3%
Panama	529,926	5.7	56%	11%	3.8%
Paraguay	363,112	1.4	2.7%	0.2%	0.1%
Peru	1,060,757	5.6	58%	9.0%	2.8%
United States	141,448,899	17.2	88%	63%	42%
Uruguay	994,051	8.3	83%	25%	8.2%
Venezuela	2,668,598	1.9	3.3%	0.2%	0.1%
ASIA PACIFIC					
Australia	9,988,659	10.1	76%	30%	16%
China	119,912,960	6.3	73%	11%	2.2%
Hong Kong	3,160,853	21.9	93%	70%	52%
India	16,933,936	5.6	38%	14%	7.3%
Indonesia	3,094,932	6.7	71%	14%	4.3%
Japan	46,101,064	19.6	92%	72%	51%
Malaysia	1,996,740	8.2	69%	27%	11%
New Zealand	2,041,693	12.9	90%	45%	25%
Philippines	1,545,711	4.5	31%	7.5%	3.6%
Singapore	1,750,629	20.2	95%	73%	52%
South Korea	25,416,386	26.1	97%	83%	64%
Sri Lanka	203,438	7.3	88%	15%	5.3%
Taiwan	9,661,327	15.6	93%	59%	33%
Thailand	2,995,922	13.3	96%	57%	27%
Vietnam	8,249,514	8.3	82%	25%	6.3%
EUROPE					
Austria	2,953,084	13.9	91%	45%	25%
Belgium	4,950,019	15.9	94%	68%	40%
Bulgaria	1,696,145	15.6	96%	65%	39%
Croatia	1,626,563	8.2	83%	21%	7.2%
Cyprus	381,029	7.1	72%	15%	6.1%
Czech Republic	1,863,199	17.3	86%	54%	36%
Denmark	2,965,104	20.7	94%	68%	49%
Estonia	566,755	11.4	85%	41%	20%
Finland	2,538,756	20.6	93%	65%	44%

Region	Unique IPv4 Addresses	Average Connection Speed (Mbps)	% Above 4 Mbps	% Above 10 Mbps	% Above 15 Mbps
France	29,731,348	10.0	70%	28%	16%
Germany	38,433,814	14.6	89%	50%	30%
Greece	3,380,885	7.5	81%	15%	5.1%
Hungary	2,854,105	14.3	92%	54%	32%
Ireland	2,198,789	15.3	81%	53%	38%
Italy	17,430,006	8.7	78%	23%	10%
Latvia	840,915	17.2	94%	63%	41%
Lithuania	1,414,311	14.6	91%	53%	32%
Luxembourg	195,336	11.1	88%	35%	18%
Malta	179,216	12.9	97%	54%	26%
Netherlands	9,741,006	17.6	96%	71%	46%
Norway	3,125,835	23.6	91%	68%	54%
Poland	7,759,001	12.4	87%	42%	25%
Portugal	3,736,614	12.6	86%	49%	28%
Romania	3,668,634	16.1	93%	69%	44%
Russia	19,479,101	11.6	90%	48%	21%
Slovakia	1,030,828	13.0	86%	40%	23%
Slovenia	1,069,691	14.0	84%	42%	25%
Spain	15,988,030	15.4	90%	55%	36%
Sweden	6,094,580	22.8	94%	65%	49%
Switzerland	3,770,980	21.2	95%	73%	54%
United Kingdom	30,947,751	16.3	91%	57%	39%
MIDDLE EAST & AFRICA					
Egypt	10,262,655	2.2	9.1%	0.3%	0.1%
Iran	8,865,433	4.1	50%	1.4%	0.1%
Israel	2,397,131	14.4	95%	58%	30%
Kenya	2,571,874	15.0	86%	61%	44%
Kuwait	607,375	9.0	52%	20%	9.0%
Morocco	5,182,539	5.2	58%	5.7%	1.4%
Namibia	238,759	3.0	22%	1.8%	0.5%
Nigeria	204,047	4.1	41%	3.3%	0.9%
Qatar	337,574	11.9	85%	48%	24%
Saudi Arabia	4,107,551	6.3	71%	12%	3.9%
South Africa	5,906,363	6.6	51%	11%	6.2%
Turkey	8,581,580	7.6	78%	19%	7.0%
United Arab Emirates	1,491,710	10.7	94%	41%	16%

- ¹ <http://www.potaroo.net/tools/ipv4/>
- ² <https://www.apnic.net/about-apnic/team/geoff-huston/>
- ³ <http://www.whois.com/whois/35.184.0.0>
- ⁴ <http://www.whois.com/whois/129.213.0.0>
- ⁵ <http://www.whois.com/whois/136.24.0.0>
- ⁶ <http://www.whois.com/whois/130.61.0.0>
- ⁷ <http://www.whois.com/whois/154.128.0.0>
- ⁸ <http://www.whois.com/whois/154.232.0.0>
- ⁹ <http://teamarin.net/2017/01/03/tech-industry-takes-strides-toward-ipv6/>
- ¹⁰ <http://www.worldipv6launch.org/measurements/>
- ¹¹ <http://www.internetsociety.org/deploy360/blog/2016/10/liquid-telecom-deploys-ipv6-in-africa/>
- ¹² <http://www.itp.net/610263-etisalat-rolls-out-ipv6-for-home->
- ¹³ <http://www.ispreview.co.uk/index.php/2016/11/bt-broadband-lines-now-support-ipv6-internet-addresses.html>
- ¹⁴ <http://www.ispreview.co.uk/index.php/2016/11/ee-makes-progress-ipv6-upgrade-uk-mobile-network.html>
- ¹⁵ http://www.theregister.co.uk/2016/11/08/ipv6_ietf/
- ¹⁶ <http://www.zdnet.com/article/spacex-plots-launch-of-4000-satellites-for-home-broadband/>
- ¹⁷ <http://www.cnn.com/2016/11/17/spacex-wants-to-launch-4425-satellites-into-space-to-bring-super-fast-internet-to-the-world.html>
- ¹⁸ <https://techcrunch.com/2016/12/19/oneweb-softbank/>
- ¹⁹ <http://www.capacitymedia.com/Article/3593365/Huawei-unveils-25G-DOCSIS-prototype-at-Cable-Tec-Expo.html>
- ²⁰ <http://www.capacitymedia.com/Article/3593864/SK-Broadband-Nokia-claim-525Gbps-fibre-speeds.html>
- ²¹ <http://www.ispreview.co.uk/index.php/2016/10/bt-huawei-new-uk-trial-40gbps-ultrafast-ftp-broadband.html>
- ²² <https://www.fcc.gov/reports-research/reports/measuring-broadband-america/measuring-fixed-broadband-report-2016>
- ²³ <http://www.multichannel.com/news/distribution/altice-usa-bows-low-cost-30-meg-broadband-service/409384>
- ²⁴ <http://www.nytimes.com/2016/10/12/technology/free-broadband-initiatives-for-poor-and-rural-areas-with-eye-on-future.html>
- ²⁵ http://www.computerworld.com/article/3130742/internet-of-things/white-house-releases-money-for-small-satellite-broadband-smart-cities.html#tk_rss_news
- ²⁶ <https://www.bna.com/new-york-state-n73014449131/>
- ²⁷ <http://bbpmag.com/wordpress2/2016/11/high-speed-rail-and-cenic-join-forces-to-create-california-broadband-communities/>
- ²⁸ <http://nepr.net/news/2016/10/26/last-mile-broadband-expansion-gathering-momentum-western-mass/>
- ²⁹ http://www.masslive.com/politics/index.ssf/2016/11/massachusetts_seeks_bids_to_ex.html#incart_river_home
- ³⁰ http://www.kmaland.com/news/branstad-unveils-public-private-partnership-to-improve-broadband-access/article_dabca324-c15b-11e6-8378-bbf9ead29b99.html
- ³¹ http://host.madison.com/wsj/business/more-broadband-money-is-on-the-way-for-rural-wisconsin/article_7333ad7c-61f9-560e-b99d-8c527db7deab.html
- ³² <http://www.capacitymedia.com/Article/3591047/AT-T-plans-ultra-fast-broadband-in-67-US-metro-areas-11-this-year.html>
- ³³ <http://www.telecompetitor.com/att-fiber-locations-expand-to-four-additional-markets-now-reaches-3-million-locations/>
- ³⁴ <http://www.telecompetitor.com/total-att-fiber-markets-grow-to-46-with-new-additions/>
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