akamai's [state of the internet]

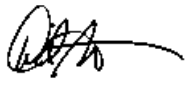
It has been seven years since Akamai published the first *State of the Internet Report*, and over that time the report has both evolved and improved in significant ways. The first issue, weighing in at a svelte 17 pages, did not include any connection speed data, instead highlighting high broadband adoption (defined as >5 Mbps), broadband adoption (>2 Mbps), and narrowband adoption (<256 kbps) at a global level, in addition to the top originating countries and ports for observed attack traffic. Over time various data has come and gone from the report, including: city-level data, per-capita penetration, DNS/domain name growth, de-peering events and routing issues, and major new connectivity announcements. We've also added (and kept) insight into other important metrics, including IPv6 adoption, mobile connectivity, network outages, and last, but not least, average and average peak connection speeds. In addition, to accompany and complement the report, we've also developed a dedicated Web site, mobile applications for iOS and Android platforms, and data visualizations that allow users to generate, save, and share custom maps and graphs for key *State of the Internet* metrics. This last year has also seen a radical redesign of the report's look and feel, reflecting its growing importance as a reference document for those concerned about the progress of broadband deployment as well as Internet security.

That final point is important, as it is an area that will see some changes going forward. With Akamai's 2014 acquisition of Prolexic, their quarterly *Global DDoS Attack Report* has joined the *State of the Internet* family, and is now being published as the *State of the Internet / Security Report*. To that end, this quarter's report is the last time the *State of the Internet Report* will include a Security section covering attack traffic, reported DDoS attacks, and other security observations. Starting with the 1st Quarter, 2015 issue, all insight into these topics will be published exclusively in the *State of the Internet / Security Report*.

Growth of Internet connection speeds around the world has also driven changes within the report over time. As noted above, references to broadband and high broadband originally used baselines of 2 Mbps and 5 Mbps respectively. However, as a result of the United States Federal Communications Commission (FCC) 2010 redefinition of broadband at 4 Mbps downstream, we chose to align with that definition — evolving the broadband threshold to 4 Mbps and the high broadband threshold to 10 Mbps. Last year we added a 4K readiness metric that uses a 15 Mbps threshold. However, in January of 2015, the FCC updated the broadband threshold to 25 Mbps (*http://www.fcc.gov/document/fcc-finds-us-broadband-deployment-not-keeping-pace*), leapfrogging the thresholds currently used for the key metrics being tracked within this report. Although the United States is just one country of many around the world working to improve Internet connectivity, in light of this update we will be reviewing how we define the metrics included in the report, as well how we present the data in future issues. In order to address some confusion about the above-mentioned metrics, we recently published an updated blog entry (*http://akamai.me/sotimetrics*) to clarify how the report's key metrics are calculated.

In addition to continuing to enhance the stand-alone security-focused report, we plan to add a media-focused report to the *State of the Internet* portfolio in 2015. We are also working on adding an IPv6 perspective to the connection speed metrics, as well as enhancing the Real User Monitoring (RUM) data included in the report.

As always, if you have comments, questions, or suggestions regarding the *State of the Internet Report*, the Web site, or the mobile applications, connect with us via e-mail at *stateoftheinternet@akamai.com* or on Twitter at *@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

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

This quarter's report includes data gathered from across the Akamai Intelligent Platform during the fourth quarter of 2014, covering attack traffic, Internet connection speeds, and broadband adoption across both fixed and mobile networks, as well as trends seen in this data over time. In addition, this quarter's report includes insight into several high-profile security vulnerabilities, attacks, and toolkits; the state of IPv4 exhaustion and IPv6 adoption; Internet disruptions that occurred during the quarter; and observations from Akamai partner Ericsson regarding data and voice traffic growth on mobile networks.

Security / During the fourth quarter of 2014, Akamai observed attack traffic originating from source IP addresses in 199 unique countries/regions. Note that our methodology captures the source IP address of an observed attack, and cannot determine attribution of an attacker. China once again remained the top attack source, though its percentage declined to 41% in the fourth quarter from 49% in the previous quarter. Second place United States also saw a decline to 13% of total observed attack traffic. Likewise, the overall concentration of observed attack traffic decreased, with the top 10 countries/regions originating 75% of observed attacks in the fourth quarter. For the third consecutive quarter, Port 23 was the most targeted port for attacks, and the percentage of attack traffic targeting Port 23 saw a large jump to 32% — more than 2.5x previous levels. During the fourth quarter, Akamai customers reported being targeted by 327 DDoS attacks, or 57 more than in the third quarter. Slightly more than half of the attacks were reported by customers in the Americas region, while nearly twice as many were reported by customers in the Asia Pacific region than those in EMEA. With the exception of the Enterprise segment, all industries saw increases in the number of attacks as compared with the third quarter, with Public Sector targets seeing the greatest growth. In addition to the increased frequency of DDoS attacks, a number of notable attack methods came to the forefront in the fourth quarter, including Poodle, which targets a severe SSLv3 vulnerability; Yummba Webinject tools, aimed at committing banking fraud; and DDoS amplification methods using Universal Plug and Play (UPnP) devices and DNS flooder mechanisms.

Internet and Broadband Adoption / In the fourth quarter, Akamai observed a 1.5% quarterly increase in the number of unique IPv4 addresses connecting to the Akamai Intelligent Platform, growing to nearly 803 million — about 12 million more than were seen in the third quarter of 2014. Belgium remained the global leader in IPv6 adoption, with 32% of its connections to Akamai in the fourth quarter occurring over IPv6. Looking at connection speeds, the global average connection speed remained at 4.5 Mbps, virtually unchanged from the third quarter, while the global average peak connection speed grew 8.4% to 26.9 Mbps. At a country/region level, South Korea continued to have the highest average connection speed, despite a 12% decline from the third quarter to 22.2 Mbps, and Hong Kong again had the highest average peak connection speed, growing slightly to 87.7 Mbps. Globally, high broadband (>10 Mbps) adoption grew by 2.9% quarterly to 24%, and South Korea remained the country with the highest level of high broadband adoption at 79%. In the fourth quarter, global broadband (>4 Mbps) adoption declined very slightly quarter over quarter to 59%, with Bulgaria overtaking South Korea as the country with the highest broadband adoption rate at 96%. "4K-ready" (>15 Mbps) connections grew minimally to 12% on a global basis, and South Korea, with a 61% readiness rate, was once again the global leader

Mobile Connectivity / Average mobile connection speeds (aggregated at a country/region level) ranged from a high of 16.0 Mbps in the United Kingdom to a low of 1.0 Mbps in New Caledonia in the fourth quarter of 2014. Average peak mobile connection speeds were up significantly from the third quarter, ranging from 157.3 Mbps in Singapore to 7.5 Mbps in Argentina. Four countries — Venezuela, Denmark, Saudi Arabia, and Sweden — had 97% of unique IP addresses from mobile providers connect to Akamai at speeds above the 4 Mbps "broadband" threshold, while two countries — New Caledonia and Bolivia — had 1% or fewer at those speeds. Based on traffic data collected by Ericsson, the volume of mobile data traffic grew by 11% between the third and fourth quarters of 2014, similar to the growth pattern seen between the previous two quarters.

Analysis of Akamai IO data collected during the fourth quarter from a sample of requests to the Akamai Intelligent Platform indicates that for traffic from mobile devices on cellular networks, Apple Mobile Safari accounted for nearly 36% of requests in the fourth quarter, while Android Webkit and Chrome for mobile (the two primary Android browser bases) accounted for 25% and 13%, respectively. For traffic from mobile devices across all networks, Apple Mobile Safari was responsible for close to 48% of requests, down from 50% last quarter, while Android Webkit and Chrome Mobile made up just over 27% and 12% of requests, respectively.

[SECTION][1] SECURITY

Akamai maintains a distributed set of agents deployed across the Internet that monitor attack traffic. Based on data collected by these agents, Akamai is able to identify the top countries from which attack traffic originates, as well as the top ports targeted by these attacks. Note that the originating country as identified by the source IP address is not attribution — for example, a criminal in Russia may be launching attacks from compromised systems in China. This section provides insight into port-level attack traffic, as observed and measured by Akamai, during the fourth quarter of 2014.

It also includes insights into DDoS attacks that targeted Akamai customers during the fourth quarter of 2014, as well as information about Poodle, UPnP and DNS flooder amplification techniques for DDoS attacks, and Yummba Webinject tools. Within this report, all representations denote our view of the best and most consistent ways of attributing attacks we have seen — based not only on published claims, but on analysis of the tools, tactics, and methods that tend to provide a consistent signature for different adversaries.

1.1 Attack Traffic, Top Originating Countries / During the fourth quarter of 2014, Akamai observed attack traffic originating from 199 unique countries/regions, in line with the 201 seen in the third quarter. As shown in Figure 1, China once again remained well ahead of the other countries/regions in the top 10, originating more than 3x the observed attack traffic from the United States, which saw an approximately 20% quarter-over-quarter decline, back down to second-quarter levels. China and the United States were again the only two countries to originate more than 10% of observed attack traffic during the fourth quarter – the remaining countries/regions were all below 5%. Germany and Hong Kong joined the top 10 this quarter, pushing out Indonesia and Venezuela, while India was the only remaining top 10 country to see observed attack traffic percentages decline, dropping slightly from 2.9% in the third quarter to 2.4%. The overall concentration of observed attack traffic decreased in the fourth quarter, with the top 10 countries/regions originating 75% of observed attacks, down from 84% and 82% in the second and third quarters, respectively.

In the fourth quarter, 59% of all observed attack traffic originated from the Asia Pacific region, down from 64% in the third quarter and marking its second straight quarter of decline. Europe had the next-highest concentration of observed attack traffic at 19%, up significantly from 11% the previous quarter, pushing North America into third place with 15% of observed attacks (comprised mostly of attacks originating in the United States), down from 19% in the previous quarter. South America and Africa both originated less than 10% of observed attacks, responsible for 5% and 1% respectively, just as in the previous quarter.

1.2 Attack Traffic, Top Ports / As shown in Figure 2, the percentage of observed attack traffic targeting Port 23 (Telnet) increased significantly in the fourth quarter to more than 2.5x previous levels. This may indicate a growth in attacks relying on brute-force login attempts or those that exploit default usernames and passwords to gain access to vulnerable systems. These attacks can be perpetrated by bots that scan for systems with Port 23 open then try to login when finding such a port. Interestingly, all other ports in the top 10 increased their percentages as well, with significant increases for Ports 445 (Microsoft-DS), 8080 (HTTP Alternate), 3389 (Microsoft Terminal Services), and 22 (SSH), among others. In total, attack traffic to the top 10 ports made up 79% of all observed attack traffic in the fourth quarter, a substantial increase from 38% in the previous quarter.

Port 23 remained the most popular target of attacks observed to originate in China, accounting for almost half of all attacks originating there — nearly 6x the volume of Port 1433, the second-most attacked port from China. Port 23 was also again the most-targeted port for attacks from Turkey, South Korea, India and Hong Kong, while Taiwan, Russia, and Brazil had the most attacks targeting Port 445, with Port 23 not far behind in each case. Ports 80, 445, and 3389 each comprised roughly 10% of the attacks originating from the United States.

1.3 Observations on DDoS Attacks / Akamai customers reported 327 DDoS attacks in the fourth quarter, up over 20% from the previous quarter, as shown in Figure 3. The total number of reported DDoS attacks in 2014 showed little change from the previous year, with 1,150 attacks reported to Akamai in 2014, compared with 1,153 in 2013, representing a decline of approximately a quarter of a percent year over year. The most significant change from 2013 to 2014 has been the distribution of who is being attacked, with High Tech and Public Sector targets showing notable growth, while the Enterprise segment actually saw fewer attacks in 2014. However, in the last quarter of 2014 the Commerce and Enterprise segments experienced the majority of attacks.

Figure 4 illustrates the number of attacks reported in the fourth quarter broken out by sector. With the exception of the Enterprise segment, all industries saw an increase in the number of attacks over the third quarter. Public Sector targets saw the greatest growth

	Country/Region	Q4 '14 Traffic %	Q3 '14 %
1	China	41%	49%
2	United States	13%	17%
3	Taiwan	4.4%	3.8%
4	Russia	3.2%	2.1%
5	Turkey	2.9%	1.3%
6	South Korea	2.8%	1.4%
7	India	2.4%	2.9%
8	Brazil	2.3%	1.9%
9	Germany	1.8%	0.6%
10	Hong Kong	1.3%	0.8%
–	Other	25%	18%

Figure 1: Attack Traffic, Top Originating Countries/Regions (by source IP address, not attribution)

Port	Port Use	Q4 '14 Traffic %	Q3 '14 %
23	Telnet	32%	12%
445	Microsoft-DS	15%	8.1%
8080	HTTP Alternate	6.6%	2.5%
80	HTTP (WWW)	6.4%	4.6%
3389	Microsoft Terminal Services	5.9%	2.6%
22	SSH	4.7%	1.8%
1433	Microsoft SQL Server	4.2%	2.9%
3306	MySQL	1.8%	1.1%
443	HTTPS (SSL)	1.7%	1.3%
9064	(Unassigned)	1.6%	0.1%
Various	Other	21%	–

Figure 2: Attack Traffic, Top Ports

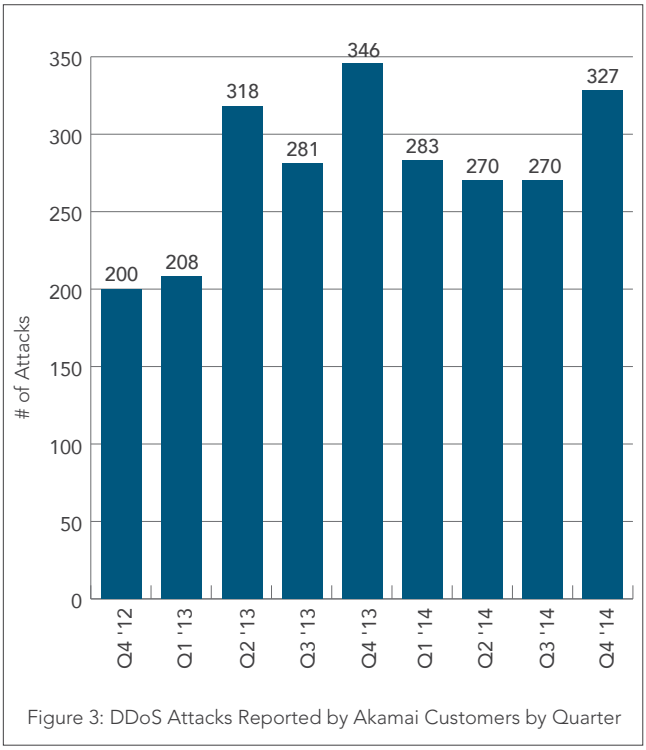


Figure 3: DDoS Attacks Reported by Akamai Customers by Quarter

in attacks at 73%, increasing from 22 reported attacks to 38. The High Tech segment also saw a significant surge, with 47% more attacks reported in the fourth quarter than in the third. In contrast to these two segments, Enterprise attacks decreased 5% from the previous quarter, down from 106 reported attacks to 100.

Attacks against Public Sector targets reported throughout 2014 appear to be primarily motivated by political unrest, while the targeting of the High Tech industry does not appear to be driven by any single event or motivation.

As shown in Figure 5, the final quarter of the year saw increased attacks in all regions, with the Americas experiencing the majority of the growth with 35% more reported attacks than the previous quarter. The Asia Pacific region saw a 17% quarterly increase in the number of attacks, while the Europe, Middle East, and Africa (EMEA) region experienced marginally greater growth at 18%. While no one industry showed a marked difference for the increase in attacks, the holiday season and attacks on companies who rely on an Internet presence continued to fuel attacks in the final quarter of the year.

Akamai has been analyzing Distributed Denial of Service (DDoS) attacks aimed at our customers for the *State of the Internet Report* since the end of 2012. The Akamai platform is a massively distributed network of systems designed to serve Internet traffic from systems as close to the end user as possible. Part of the value of the Akamai platform is its ability to enable customers to deal with sudden spikes in Web site requests, such as during holiday sales or flash mobs created by news events. Malicious traffic frequently attempts to overload sites by mimicking this type of event, and the

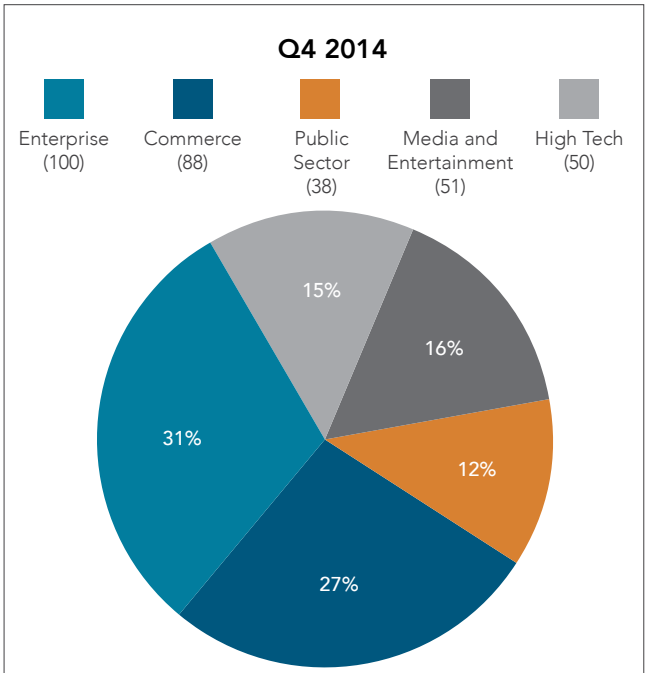


Figure 4: Q4 2014 DDoS Attacks by Sector

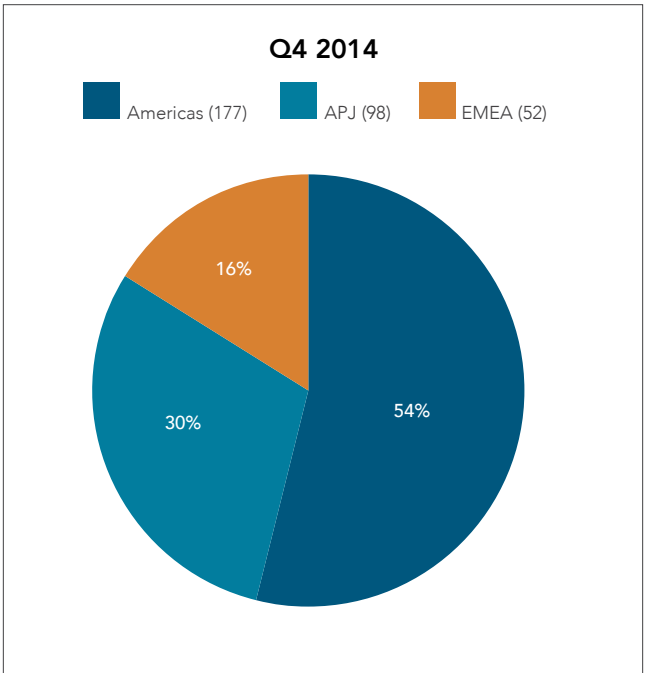


Figure 5: Q4 2014 DDoS Attacks by Region

difference is often only distinguishable through human analysis and intervention. Akamai combats these attacks by serving the traffic for the customer while the analysis is being performed and creating specific Web Application Firewall rules or implementing other protections such as blocking specific regions or IP addresses as necessary.

An additional aspect of the Akamai platform is that some of the most common methodologies used in DDoS attacks are simply ignored. Attacks that target the lower levels of the TCP/IP stack, such as UDP floods and SYN floods, hit the edge of the Akamai platform and are dropped. Specifically, Layer 1 – 4 traffic does not contain the information needed by Akamai to route it to a specific customer and is automatically assumed to be either malicious or malformed traffic.

The vast majority of attacks that Akamai is reporting on are based on traffic in layers 5 – 7 of the TCP stack, such as volumetric attacks — like HTTP GET floods and repeated file downloads — or application and logical layer attacks — which require much less traffic to be effective. These statistics are based on the higher level attacks reported by our customers.

1.4 Additional Security Observations / The final quarter of 2014 began with Poodle ("Padding Oracle On Downgraded Legacy Encryption"), a severe vulnerability affecting SSLv3. As the quarter progressed, attackers used Universal Plug and Play (UPnP) devices and DNS flooder tools to amplify their DDoS activity and Yummba Webinject tools to commit banking fraud.

Poodle / The Poodle vulnerability was the latest in a string of severe vulnerabilities in 2014, including Shellshock and Heartbleed. At Poodle's core was a vulnerability in Secure Socket Layer version 3 (SSLv3) that attackers could exploit to calculate the plaintext (cleartext) in secure connections, effectively defeating SSL protection

The SSL protocol was designed to protect communications on the Internet by wrapping them with encryption to preserve the confidentiality and integrity of communications. It is often used for banking transactions, shopping, secure messaging, instant messaging, and email. The vulnerability affected SSLv3 and did not affect newer encryption protocols such as Transport Layer Security (TLS).

In an advisory, Akamai offered actions that organizations could take to mitigate the impact of Poodle. Recommendations included:

- Disabling SSLv3 wherever possible.
- Applying patches and updates from vendors, especially in cases where SSLv3 cannot be disabled.
- Accelerating deprecation of SSLv3 as well as earlier versions.

To help protect customers, Akamai deployed support for TLS Signaling Cipher Suite Value (SCSV). SCSV prevents downgrading or fallback attacks to SSLv3 or earlier versions in case of a man-in-the-middle attack.

UPnP Attacks / In October 2014, researchers discovered attackers using Universal Plug and Play (UPnP) devices to launch massive DDoS assaults.[1] Akamai PLXsert found 4.1 million Internet-facing UPnP devices that were potentially vulnerable to being employed in reflection DDoS attacks — approximately 38% of the 11 million UPnP devices found.

This kind of attack deliberately misuses communications protocols that come enabled on millions of home and office devices — including routers, media servers, Webcams, smart TVs, and printers. The protocols allow devices to discover each other on a network, establish communication, and coordinate activities. Attackers have been abusing the protocols on such devices to generate floods of traffic and cause Web site and network outages.

Akamai replicated the technique in a lab environment and described it this way in an advisory:

> *"In the first step of the attack process, a SOAP request (M-SEARCH) is sent to a UPnP-enabled device. The M-SEARCH packet identifies vulnerable devices, and the device responds to the request with the HTTP location of its device description file — an XML file. After gathering a list of vulnerable devices, the attacker will send malicious requests to cause a reflected and amplified response to the attacker's target. The size of the response and amplification factor may vary depending on the contents of the device description file, such as response header, banner, operating system, and UUID. While replicating this attack vector in a LAN laboratory environment, PLXsert measured an amplification factor of approximately 33 percent."*

The advisory outlined actions to blunt the threat, including a recommendation to block source port 1900 traffic to the host in order to prevent bandwidth loads to services that do not use UPnP services, such as Web hosting or possible exploitation attacks.

DNS Flooders / DNS amplification attacks generate large response packets with relatively small requests. Attackers create large DNS TXT(text) records to increase amplification, magnifying the impact of a DDoS attack. Several campaigns observed after October 4, 2014, contained fragments of text taken from press releases issued by the White House. PLXsert suspected that DNS flooder tools were used.

"By crafting their own TXT records, attackers can amplify responses as desired and direct this traffic to targeted sites, including — but not limited to — DNS servers," Akamai said in an advisory[2] at the time. "The amplified traffic response could eventually overwhelm the targeted site and render it unable to respond to any requests."

This was not the first time attackers used large TXT records in reflection attacks. Previous victims of this technique included *isc.org* and many .gov sites. The new twist was that attackers were crafting the TXT records to provide the largest response size possible, thereby amplifying the impact. The TXT records in the October

2014 attacks came from the *guessinfosys.com* domain. The main targets of the attacks were the entertainment, education, and high-tech consulting sectors, and the attacks reached a peak bandwidth of 4.3 Gbps.

Akamai noted that DNS reflection attacks can be blunted at the network edge. An access control list (ACL) would suffice, but only in cases where available bandwidth exceeds attack size. Some DNS servers will attempt to retry the response using TCP, but when the request is sent to the target host no transfer will occur and the attempt will fail. DDoS cloud-based protection services, such as the ones provided by Akamai, were recommended.

YUMMBA WEBINJECT / In November, Akamai researchers observed attackers using Yummba Webinject tools to target banks and other enterprises. Zeus crimeware has a history of being used to build botnets, steal banking credentials, and launch DDoS attacks—targeting platform-as-a-service (PaaS) and software-as-a-service (SaaS) infrastructures. The added capabilities of Yummba custom webinjects made the malware even more dangerous.

Webinject attacks available for sale in the wild vary in sophistication—from simple attacks that report account information and credential theft to highly advanced webinjects that utilize ATSEngine for automated fund transfers to attacker-controlled accounts. Portions of these attacks might also be used in cross-site scripting (XSS), phishing, and drive-by download attacks.

Open source intelligence sources, including WHOIS information for the domain associated with the toolkit's Jabber ID, supported the belief that the creator of the Yummba Webinjects tool was located in Russia, as previously identified by other researchers. The author, known as "Yummba," appeared to specialize in writing webinjects that target financial entities. Yummba was, and still is, fairly active in the carding community—sometimes giving advice to other developers, but most often identifying stolen and leaked versions of his products and blacklisting the parties responsible.

Some advanced webinjects, such as those that support the ATSEngine, automate the process of wiring a victim's funds to a third-party account. The victim's active, authenticated session is hijacked to perform these unwanted actions.

The custom Yummba Webinjects were meant to be used with the ATSEngine, an add-on component for popular crimeware and botnet software that allows malicious actors to inject dynamic content into a Web site and then automatically transfer funds from the victim's compromised online banking accounts. The engine allows malicious actors to update their configurations easily, without having to recompile or reinfect their victims. The JavaScript code is packed using a common obfuscator.

To mitigate the threat, Akamai suggested the following actions:

- User awareness: Because end users are the target of these attacks, training and education are needed to help them identify suspected phishing attacks. Red flags are generic salutations, grammatical errors in URLs, unexpected attachments, and attachments sent from unknown entities. In general, clicking unfamiliar links in e-mail messages should be discouraged. Users should not respond to e-mail requests with sensitive information and should contact their financial institutions with questions about suspicious banking emails. It's a good idea to browse directly to a financial institution instead of clicking a link.
- System hardening: Group Policy Objects (GPOs), Software Restriction Policies (SRPs), and commercial endpoint security products can help mitigate this type of threat. In addition, using antivirus software and other signature-based measures can help, although there may be very low levels of detection for some threats.
- Deep packet inspection: Monitoring via deep packet inspection can help mitigate these threats with a recognizable traffic signature. Some illegitimate URLs served during these attacks can be spotted and blocked for outbound traffic.
- Community cleanup: Projects such as Shadowserver, MalwareMustDie, and ZeuS Tracker help the commercial sector and law enforcement verify and take down malicious hosts serving attacks. Remediation and takedown is needed to stop further infestation and damage.

[SECTION]^2 INTERNET PENETRATION

Through its globally-deployed Intelligent Platform, and by virtue of the approximately two trillion requests for Web content that it serves on a daily basis, Akamai has unique visibility into levels of Internet penetration around the world. In the fourth quarter of 2014, nearly 803 million unique IPv4 addresses, from 239 unique countries/regions, connected to the Akamai Intelligent Platform — 1.5% more than in the third quarter of 2014, and 2.5% more than in the fourth quarter of 2013. Although we saw over 800 million unique IPv4 addresses, Akamai believes that this count represents 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 have multiple IPv4 addresses associated with them, due to their use of multiple connected devices. Unless otherwise specified, the use of "IP address" within Section 2.1 refers to IPv4 addresses.

2.1 Unique IPv4 Addresses / As seen in Figure 6, the number of unique IPv4 addresses seen globally by Akamai grew by about 12 million quarter over quarter, more than recovering the loss of 7 million two quarters prior. As noted in last quarter's report, we expect that the global number of unique IPv4 addresses seen by Akamai may decline again in the future, and/or see smaller quarterly increases, as more carriers implement carrier-grade network address translation (CGN) solutions in an effort to conserve limited IPv4 address space or preferably increase support for and availability of native IPv6 connectivity for subscribers. Among the top 10 countries in the fourth quarter, the unique IP count in the United States was the only one to decline — showing a 3.4% loss compared with the previous quarter. The United Kingdom and South Korea showed the largest gains, at 8.1% and 6.6%, respectively, while Japan, Brazil, and Germany all saw increases of approximately 4%.

Globally, IP address growth was stronger than in the third quarter. Two-thirds of the countries saw a quarter-over-quarter increase in unique IPv4 address counts, with 54 countries/regions growing 10% or more. Of the countries that saw unique IPv4 address counts decline, 23 lost 10% or more as compared with the previous quarter.

Looking at year-over-year changes, Brazil was once again the only country among the top 10 to see a double-digit percentage increase. At 28%, it was significantly larger than the other countries within the top 10. Seven other countries on the list also saw yearly increases, with South Korea's 8.4% the largest. The United States and Italy saw year-over-year declines of 8.2% and 5.2%, respectively. The losses seen in these countries are not indicative of long-term declines in Internet usage within these geographies but, as noted previously, may more likely be related to changes in IP address management/conservation practices, increased IPv6 adoption, and/or updates to the underlying database used by Akamai for IP address geolocation.

	Country/Region	Q4 '14 Unique IPv4 Addresses	QoQ Change	YoY Change
–	Global	802,818,414	1.5%	2.5%
1	United States	151,386,342	-3.4%	-8.2%
2	China	125,400,588	2.7%	4.0%
3	Brazil	47,254,335	3.9%	28%
4	Japan	42,348,735	4.2%	4.9%
5	Germany	38,184,416	3.8%	2.7%
6	United Kingdom	28,910,888	8.1%	0.8%
7	France	28,813,162	1.9%	3.7%
8	South Korea	22,085,941	6.6%	8.4%
9	Russia	19,277,054	3.5%	4.9%
10	Italy	18,783,459	0.9%	-5.2%

Figure 6: Unique IPv4 Addresses Seen by Akamai

On a global basis, 70% of countries/regions around the world had higher unique IPv4 address counts year over year. Yearly growth rates of 100% or more were seen in seven countries/regions; four of them had fewer than 2,000 unique IPv4 addresses, showing small changes can result in large percentage shifts. In all, 27 countries saw yearly growth rates above 50%, while three countries saw IPv4 address counts decline more than 50%.

2.2 IPv4 Exhaustion / The fourth quarter saw continued depletion of available IPv4 address space as Regional Internet Registries (RIRs) assigned/allocated blocks of IPv4 address space to organizations within their respective territories. A reference table translating the /nn notations used below to unique IP address counts can be found at *https://www.arin.net/knowledge/cidr.pdf*.

Leveraging data[3] collected by Geoff Huston, Chief Scientist at APNIC,[4] 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 are shrinking over time. In addition, the report uses data published by the individual RIRs to highlight IPv4 address space delegation activity within each region over the course of the quarter.

Figure 7 illustrates the data made available by Mr. Huston, showing how the size of available IPv4 address pools at each RIR changed during the fourth quarter of 2014. ARIN showed an extremely aggressive rate of depletion, delegating nearly 7.2 million IPv4 addresses — or nearly 49% of its available IPv4 space. LACNIC, APNIC, and AFRINIC were more reserved, with LACNIC and APNIC handing out just 266,000 and 946,000 IPv4 addresses, respectively — or roughly 7% of each of their available pools – while AFRINIC delegated 3.1 million addresses — or 6% of its IPv4 address pool. Although AFRINIC is the only remaining RIR with a substantial pool of IPv4 addresses remaining, as of December 7 it has less than 40% of its total pool left to delegate.[5]

As available IPv4 address space becomes increasingly scarce, it is interesting to see data emerging on IPv4 market transfer prices — that is, the effective cost per IPv4 address in the private transfer market. According to a limited set of data shared by a single address broker,[6] fourth-quarter transfers of IPv4 address space within the ARIN region went for anywhere between $8.00 USD to $13.57 USD per address, with listed address block sizes ranging from a /24 to a /20. This range of prices is slightly smaller than the range seen during the third quarter, but with few data points it is difficult to make generalizations about pricing trends. Analysis of available historical data does suggest[7,8] that larger address blocks are somewhat less expensive on a per-address basis.

Figure 8 illustrates the IPv4 allocation/assignment activity across each of the RIRs during the fourth quarter of 2014. Overall, there was slightly more activity during the fourth quarter than was seen in the third quarter. APNIC, RIPE, and LACNIC all saw slow, consistent delegation activity, with no specific days during the quarter where it appeared that significant assignments/allocations were made. At AFRINIC, three dates stand out for large allocations

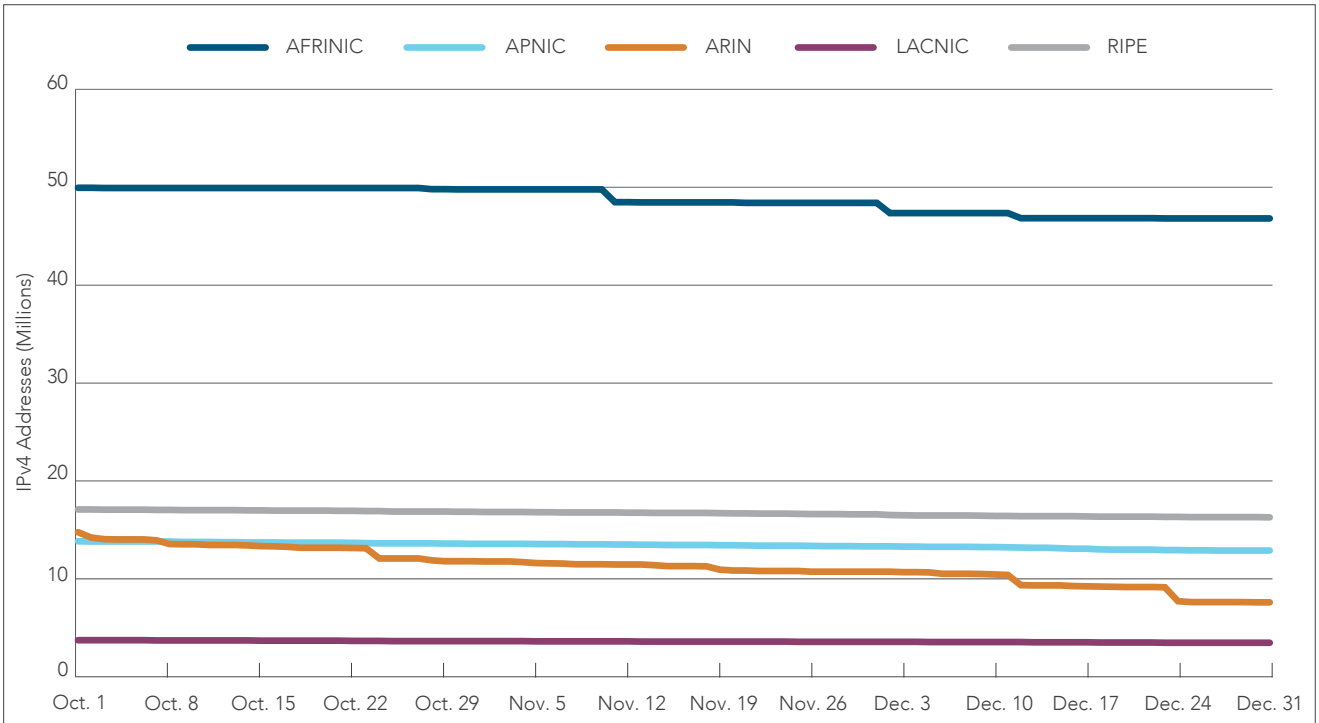


Figure 7: Available IPv4 Address Pool Size by RIR, Q4 2014

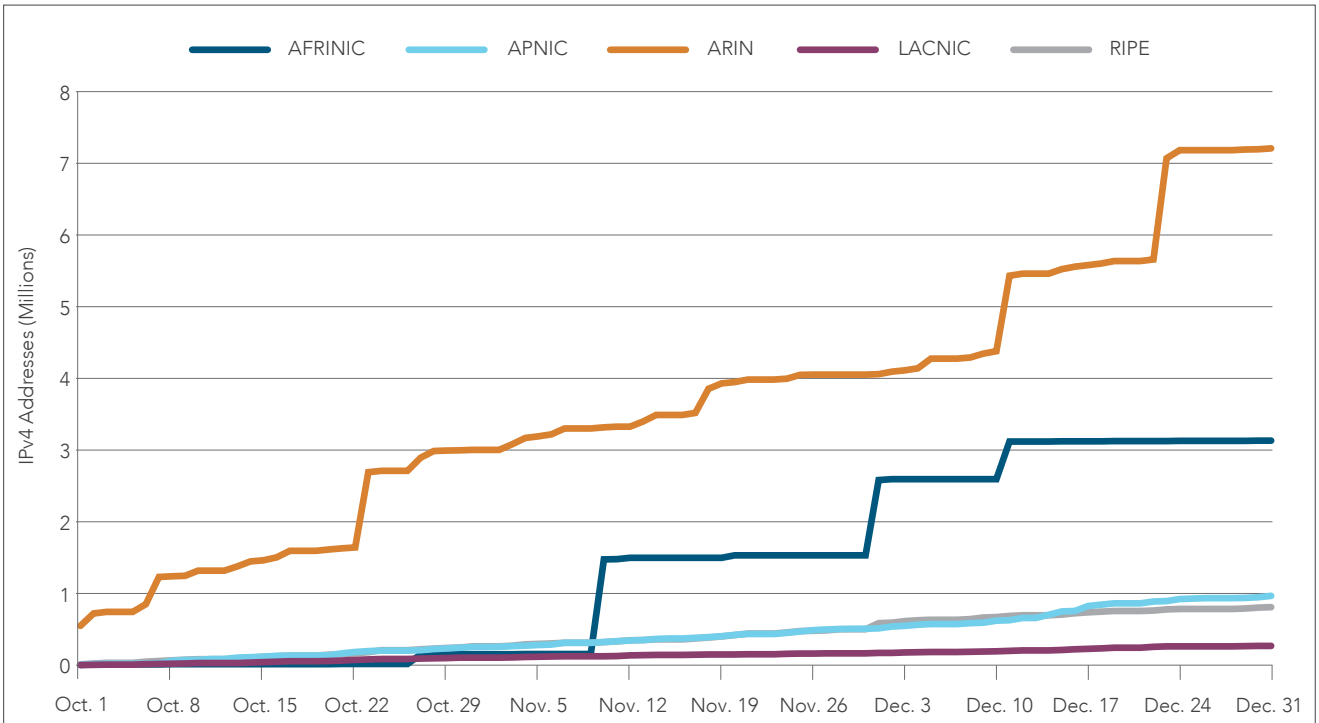


Figure 8: Total Number of IPv4 Addresses Assigned/Allocated by RIR, Q4 2014

during the fourth quarter. On November 10, Maroc Telecom,[9, 10] the largest telecommunications provider in Morocco, was allocated a /12 and a /14. On December 1, a /12 was allocated to Cloud Innovation Limited,[11] a Seychelles corporation associated with the Netherlands-based ISP Outside Heaven. Finally, on December 11, a /13 was allocated to Mobinil,[12] one of the three mobile-phone operators in Egypt. At ARIN, the three largest allocations in the fourth quarter were made on October 23, when a /12 was allocated to Amazon Technologies;[13] December 11, when a /12 was allocated to AT&T Internet Services;[14] and December 23, when a /12 and /14 were allocated to Charter Communications,[15, 16] a cable and Internet service provider in the United States.

2.3 IPv6 Adoption / Starting with the *Third Quarter, 2013 State of the Internet Report*, Akamai began including insight into IPv6 adoption across a number of vectors based on data gathered across the Akamai Intelligent Platform. The traffic percentages cited in Figure 9 and Figure 10 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. As previously discussed, 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 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 that 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 of 2014 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* Web site at *http://www.stateoftheinternet.com/ipv6*.

Figure 9 highlights the 10 countries/regions with the largest percentage of content requests made to Akamai over IPv6 in the fourth quarter. European countries continued to be heavily dominant, taking 8 of the 10 spots. Newcomer Norway, with an 88% quarter-over-quarter jump in IPv6 traffic, pushed France out of the top 10. Belgium again maintained its clear lead, with 32% of content requests made over IPv6 — more than double the percentage of second-place Germany. The only two non-European countries among the top 10 were the United States and Peru, both of which saw robust quarterly improvements, ending the quarter with 12% and 11% adoption rates, respectively. Only one country in the top 10, Romania, saw a quarterly decline — dropping 5.5%. Gains ranged from 4.6% in Switzerland to 88% in Norway, with the next largest increase seen in Greece at 38%.

Figure 10 lists the top 20 network providers by the number of IPv6 requests made to Akamai during the fourth quarter. Cable and wireless/mobile providers continued to drive the largest volumes of IPv6 requests, many of which are leading the way for IPv6 adoption in their respective countries. Among this group of providers, both Verizon Wireless and Brutele again saw more than half of their requests to Akamai made over IPv6, with Telenet close behind at 49%. All three saw their percentages go up compared with the third quarter. German carriers Kabel Deutschland, Kabel BW, and Unitymedia once again had more than a quarter of their requests to Akamai over IPv6, joined this quarter by U.S. providers T-Mobile and Comcast, both of which saw sizable increases in IPv6 traffic in the fourth quarter. Only Telekom Malaysia and Greek provider Hellas On Line had IPv6 request volumes below 10%, though with the growth rates regularly seen, these providers are likely to cross this threshold soon.

Though not represented in the top 10, carriers in other parts of the world are turning on IPv6 as well, as highlighted in the World IPv6 Launch blog (*http://www.worldipv6launch.org/blog/*). Several such carriers were noted in our third-quarter report and are joined by SK Telecom, one of the largest South Korean mobile carriers, in the fourth quarter.[17]

	Country/Region	Q4 '14 IPv6 Traffic %	QoQ Change
1	Belgium	32%	18%
2	Germany	14%	32%
3	United States	12%	29%
4	Luxembourg	12%	32%
5	Peru	11%	25%
6	Switzerland	9.5%	4.6%
7	Norway	8.2%	88%
8	Czech Republic	7.0%	21%
9	Romania	6.7%	-5.5%
10	Greece	6.4%	38%

Figure 9: IPv6 Traffic Percentage, Top Countries/Regions

Country/Region	Network Provider	Q4 '14 IPv6 Traffic %
United States	Comcast Cable	29%
United States	AT&T	20%
United States	Verizon Wireless	62%
United States	Time Warner Cable	12%
Germany	Deutsche Telekom	20%
United States	T-Mobile	33%
Belgium	Telenet	49%
France	Proxad/Free	20%
Peru	Telefonica Del Peru	14%
Japan	KDDI Corporation	22%
Germany	Kabel Deutschland	35%
Malaysia	Telekom Malaysia	9.1%
Romania	RCS & RDS	16%
Germany	Unitymedia NRW GmbH	28%
Belgium	Brutele (Voo)	62%
Belgium	Belgacom	17%
Switzerland	Swisscom	19%
Germany	KabelBW	30%
Portugal	Sapo	12%
Greece	Hellas On Line SA	7.3%

Figure 10: IPv6 Traffic Percentage,
Top Network Providers by IPv6 Request Volume

[SECTION]3 GEOGRAPHY *GLOBAL*

The data presented within this section was collected during the fourth quarter of 2014 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. For the purposes of classification within this report, the "high broadband" data included below is for connections to Akamai at speeds greater than 10 Mbps, and "broadband" is for connections of 4 Mbps or greater.

In addition to providing insight into high broadband and broadband adoption levels, the report also includes 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. (See the blog post at *https://blogs.akamai.com/2013/04/clarifying-state-of-the-internet-report-metrics.html* for more information on how these metrics are calculated.)

Traffic from known mobile networks is analyzed and reviewed in a separate section 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 subsequent regional "Geography" sections.

3.1 Global Average Connection Speeds / The global average connection speed was virtually unchanged in the fourth quarter of 2014, increasing a scant 0.7% to 4.5 Mbps and remaining above 4 Mbps for the third consecutive quarter. As Figure 11 shows, quarterly changes were mixed across the top 10 countries/regions, with six seeing increases, three seeing decreases, and Switzerland remaining unchanged. Among those seeing average connection speeds grow quarter over quarter, the largest increase was seen in Sweden, with a modest 3.5% gain — while the lowest was in the Czech Republic, with a negligible 0.1% gain from the third quarter. Among the countries/regions seeing declines, South Korea led the pack with a 12% drop from the third quarter. Ireland also saw a sizable 8.9% drop, while Latvia saw a more modest 2.6% decline.

The average connection speeds among the top 10 all remained well above the 10 Mbps "high broadband" threshold, with South Korea, Hong Kong, and Japan again all falling above the 15 Mbps "4K readiness" threshold as well. Globally, a total of 98 qualifying countries/regions saw average connection speeds increase in the fourth quarter, with growth rates ranging from 78% in Nepal (to 2.5 Mbps) to a meager 0.1% in the Czech Republic (to 12.3 Mbps). Quarter-over-quarter losses were seen in 44 qualifying countries/regions, with declines in connection speeds ranging from 0.2% in Albania (to 4.6 Mbps) to 73% in Sudan (to 1.0 Mbps).

Year-over-year changes were consistently positive in the top 10, with eight countries/regions boasting double-digit gains. Finland, Sweden, and Hong Kong all posted increases of more than 30% compared with the fourth quarter of 2013. South Korea and the Czech Republic were the only countries in the top 10 to see yearly growth below 10%, posting increases of 1.6% and 8.4%, respectively.

On a global basis, the average connection speed increased 20% year over year. Increases were seen in 132 qualifying countries, with growth rates ranging from 0.3% in Morocco (to 2.4 Mbps) to 146% in Congo (to 1.3 Mbps). In addition to Congo; Qatar, Madagascar, Jersey (one of the Channel Islands located off the coast of France), and Bangladesh all saw average connection speeds more than double from the previous year. Yearly declines were seen in just 10 countries/regions, with losses ranging from 1.7% in Paraguay (to 1.4 Mbps) to 47% in Sudan (to 1.0 Mbps).

In the fourth quarter, four qualifying countries had average connection speeds below 1.0 Mbps, up from three in the third quarter. Sudan, Botswana, and Yemen had average connection speeds of 0.96 Mbps, 0.96 Mbps, and 0.94 Mbps, respectively, while Libya again had the slowest speed at 0.7 Mbps.

3.2 Global Average Peak Connection Speeds / In the fourth quarter, the global average peak connection speed saw an increase of 8.4% to 26.9 Mbps. As shown in Figure 12, only one country among the top 10 saw average peak speeds decline quarter over quarter, with Israel losing 2.1% to 60.5 Mbps. Among the remaining countries/regions in the top 10, quarterly growth rates ranged from just 1.2% in Singapore to an impressive 50% in Qatar. We believe Qatar's large quarterly advance in average peak connection speeds (as well as its high broadband adoption rates) may be related to a move by Ooredoo Qatar, the country's primary telecommunications provider, to provide a major speed upgrade for free to its residential broadband customers. As of October, Ooredoo customers in the 1 Mbps tier were upgraded to 10 Mbps, while customers in the 10 Mbps tier were bumped to 25 Mbps.[18] This may have played a significant role in vaulting Qatar into eighth place globally for average peak connection speeds in the fourth quarter, up substantially from twenty-ninth place in the third quarter, pushing Luxembourg out of the top 10. Hong Kong again had the highest average peak connection speed at 87.7 Mbps, but all of the top 10 saw average peak speeds greater than 60 Mbps.

	Country/Region	Q4 '14 Avg. Mbps	QoQ Change	YoY Change
–	Global	4.5	0.7%	20%
1	South Korea	22.2	-12%	1.6%
2	Hong Kong	16.8	3.4%	37%
3	Japan	15.2	1.0%	16%
4	Sweden	14.6	3.5%	34%
5	Switzerland	14.5	0%	21%
6	Netherlands	14.2	1.7%	15%
7	Latvia	13.0	-2.6%	25%
8	Ireland	12.7	-8.9%	24%
9	Czech Republic	12.3	0.1%	8.4%
10	Finland	12.1	2.8%	33%

Figure 11: Average Connection Speed by Country/Region

	Country/Region	Q4 '14 Peak Mbps	QoQ Change	YoY Change
–	Global	26.9	8.4%	16%
1	Hong Kong	87.7	3.7%	29%
2	Singapore	84.0	1.2%	42%
3	South Korea	75.4	1.6%	17%
4	Japan	69.0	6.0%	30%
5	Romania	67.0	14%	32%
6	Taiwan	64.2	17%	25%
7	Uruguay	63.3	8.1%	73%
8	Qatar	62.8	50%	72%
9	Israel	60.5	-2.1%	11%
10	Latvia	60.2	3.7%	23%

Figure 12: Average Peak Connection Speed by Country/Region

On a global basis, a total of 114 of the 142 qualifying countries/regions saw average peak connection speeds increase from the third quarter, with growth ranging from a negligible 0.1% in Slovenia (to 39.3 Mbps) to a sizable 90% in Congo (to 10 Mbps). Qatar and the United Arab Emirates both saw quarterly increases of over 50%. Only 28 qualifying countries/regions saw lower average peak connection speeds in the fourth quarter, as compared to 77 in the third quarter, with losses ranging from 0.5% in Georgia (to 23.3 Mbps) to 51% in Sudan (to 7.0 Mbps).

Looking at year-over-year numbers, all of the top 10 countries/regions saw double-digit increases in average peak connection speeds. Uruguay led the group again, with an increase of 73% over the fourth quarter of 2013, with Qatar close behind showing a 72% increase. Israel had the lowest yearly increase among the top 10, with an 11% gain. Looking across all of the qualifying countries/regions, a total of 106 saw average peak connection speeds increase from the fourth quarter of 2013. Yearly growth ranged from 0.6% in Costa Rica (to 13.2 Mbps) to a 125% increase in Syria (to 19.7 Mbps). Four additional countries/regions — Mozambique, Jersey, Iran, and Luxembourg — joined Syria in seeing average peak connection speeds more than double year over year. Thirty-six countries/regions saw a yearly decline in average peak speeds, with Zambia and Libya experiencing the largest drops — at 38% (to 6.0 Mbps) and 46% (to 8.4 Mbps) respectively.

In the fourth quarter, Kenya was the country/region with the lowest average peak connection speed, dropping 27% to 5.8 Mbps. Zambia, which held the last-place position the two previous quarters, saw an average peak speed of 6.0 Mbps, a 3.4% drop from the third quarter. In addition to Kenya and Zambia, six other countries, all in Africa, saw average peak connection speeds below 10 Mbps in the fourth quarter. Though Internet access is very slow, limited, and expensive in many parts of Africa, there were some indicators of progress in the fourth quarter, as a group of investors set up a well-connected Djibouti data center with the goal of providing faster connectivity at lower costs to countries in east Africa.[19] This data center is the first one in the region with fast connectivity to the main Internet cables between Europe and Asia, and is hopefully a harbinger of increased Internet connectivity throughout the region.

	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
–	Global	24%	2.9%	25%
1	South Korea	79%	-3.0%	11%
2	Hong Kong	60%	8.5%	60%
3	Switzerland	56%	3.6%	34%
4	Japan	56%	2.7%	14%
5	Netherlands	56%	5.0%	24%
6	Romania	55%	11%	258%
7	Sweden	47%	7.1%	44%
8	Latvia	46%	1.8%	44%
9	Bulgaria	45%	5.7%	180%
10	Denmark	44%	15%	35%

Figure 13: High Broadband (>10 Mbps) Connectivity

3.3 Global High Broadband Connectivity / In line with the quarterly increase seen in the peak connection speed metrics, the global high broadband adoption rate increased 2.9% in the fourth quarter, after seeing a slight decline in the third quarter. Except for South Korea, which saw a 3% decline in observed high broadband adoption, all other countries/regions in the top 10 saw quarterly increases, ranging from just 1.8% in Latvia to Denmark's 15% — which pulled it into the top 10 this quarter. However, South Korea's 79% high broadband adoption rate remains far ahead of second-place Hong Kong's 60% adoption rate.

Among the 65 qualifying countries/regions for this metric, 42 saw quarter-over-quarter increases, ranging from Norway's slight 1% bump to 35% high broadband adoption to Qatar's significant 282% jump to 20% adoption (again likely due to Ooeredo Qatar's free speed upgrades for its broadband customers). The United Arab Emirates was the only other qualifying country to see adoption percentages more than double, enjoying a 164% increase to 9.2% adoption. Quarterly losses were seen in 23 qualifying countries/regions, with declines ranging from a negligible 0.3% drop in the United States (to 39% adoption) to a 31% decline in Georgia (to 5.7% adoption).

Looking at year-over-year changes, the global high broadband adoption rate was up 25% — slightly higher than the 22% increase in the third quarter, though lower than the 65% increases seen in both the first and second quarters of 2014. All of the top 10 countries/regions saw double-digit increases, ranging from South Korea's 11% increase to Romania's 258% jump. Bulgaria also saw adoption more than double, with a 180% year-over-year increase.

When looking at all of the qualifying countries/regions, only China saw year-over-year declines in high broadband adoption — dropping a surprisingly high 37% (to a 1.1% adoption rate). Across the other 63 geographies, yearly increases ranged from 8% in Austria to a massive 2000% in Qatar (to 20% adoption). Besides Qatar, an additional 27 qualifying countries saw adoption rates more than double year over year, ranging from a 100% increase in South Africa (to 2.6% adoption) to Bosnia and Herzegovina's 660% increase (to 6.3% adoption).

Due to a 21% quarterly drop, China had the lowest high broadband adoption rate in the fourth quarter at 1.1%, just edging out India, which held the last position in the third quarter. India also had a 1.1% rate in the fourth quarter, representing a small 0.7% drop from the previous quarter.

3.4 Global Broadband Connectivity / Figure 14 shows that the global broadband adoption rate decreased very slightly in the fourth quarter, dropping 0.7% to a 59% adoption rate. Among the top 10 countries/regions, Denmark saw the biggest gain at 3.5% with Hong Kong the next highest, showing a 2.5% increase in broadband

	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
–	Global	59%	-0.7%	7.8%
1	Bulgaria	96%	0.4%	17%
2	South Korea	95%	-0.1%	2.0%
3	Switzerland	93%	0.2%	2.5%
4	Denmark	92%	3.5%	11%
5	Israel	92%	0.9%	12%
6	Netherlands	91%	0.9%	4.7%
7	Hong Kong	91%	2.5%	13%
8	Romania	89%	0.6%	16%
9	Isle Of Man	89%	-1.2%	2.0%
10	Japan	88%	1.1%	4.8%

Figure 14: Broadband (>4 Mbps) Connectivity

adoption rates. Bulgaria had the highest level of broadband adoption in the fourth quarter at 96%, just edging out the third quarter's leader, South Korea, which saw a 0.1% fourth-quarter decline in its adoption rate. Two of the top 10 saw lower broadband adoption rates as compared with the third quarter — with Isle of Man losing 1.2% and South Korea losing 0.1%. Seven of the top 10 countries/regions had at least 90% of unique IP addresses connecting to Akamai at average speeds above 4 Mbps, up from 6 of the top 10 in the previous quarter.

Globally, a total of 104 countries/regions qualified for inclusion for this metric, and 76 of them saw quarterly growth in broadband adoption rates. Quarter-over-quarter increases ranged from just 0.2% in Switzerland to 186% in Nepal (to 17% adoption). In addition to Nepal, Nigeria and Sri Lanka saw broadband adoption rates more than double in the fourth quarter, with increases of 135% (to 22% adoption) and 119% (to 45% adoption), respectively. Quarter-over-quarter declines were seen across the remaining 28 qualifying countries/regions, ranging from 0.1% declines for Malta (to 87% adoption) and South Korea to a sizable 87% decline for Indonesia (to 4.6% broadband adoption).

The global broadband adoption rate increased 7.8% from the fourth quarter of 2013, a slower yearly growth rate than the 12% seen in the previous quarter, continuing the downward trend of yearly growth rates that has been observed over the last several quarters. Broadband adoption rates were up year over year across all of the top 10 countries/regions, with increases ranging from just 2% in South Korea and Isle of Man to 17% in Bulgaria. In addition to Bulgaria, four other countries/regions in our top 10 saw yearly increases greater than 10%.

Looking across all of the qualifying countries/regions, all but three saw broadband adoption levels increase over the past year. Yearly growth rates ranged from 0.2% in the Czech Republic (to 84% adoption) to 1,000% in Algeria (to 2.2% adoption). Vietnam and Peru also saw impressive yearly growth, increasing 590% (to 19% adoption) and 553% (to 39% adoption), respectively. In total, 26 of the 104 qualifying countries/regions saw yearly growth of 100% or more. Of the three countries/regions that saw broadband adoption rates fall year over year, losses were minimal for China, with a 2.3% decline (to 27% adoption), but were more significant for Morocco and Kenya, posting declines of 36% and 43%, respectively (resulting in broadband adoption rates of 5.7% and 2.4%).

In the fourth quarter, Egypt remained the country with the lowest level of broadband adoption at 1.4%, despite a 32% quarterly increase and a 136% yearly increase. Venezuela, which held the last-place position earlier in the year, remained just ahead of Egypt with a broadband adoption rate of 1.7%, down 33% quarter over quarter.

It is interesting to note that while broadband adoption and broadband speeds are generally steadily increasing across the world, there is still a significant portion of the world population without Internet connectivity. A recent McKinsey & Company study finds that 4.4 billion people around the world do not go online, including over a billion people in India and over 700 million in China.[20] Even in the United States, 50 million people — or roughly 16% of the population — are not connected to the Internet. The countries with the highest offline percentages are Myanmar, Ethiopia, and Tanzania, with 99.5%, 97.8%, and 95.4% of their respective populations unconnected.[21]

3.5 Global 4K Readiness / Given the growing interest in the streaming delivery of 4K[22] ("Ultra HD") video, we thought it would be interesting to begin tracking a "4K readiness" metric in the *State of the Internet Report*. With 4K adaptive bitrate streams generally requiring between 10 – 20 Mbps of bandwidth, the rankings presented within this section identify candidate geographies most likely to be able to sustain such streams within this range. (Note that this bandwidth estimate currently applies to AVC encoded content, and the 15 Mbps threshold may change once alternate codecs, such as HEVC or VP9, are deployed.)[23, 24] The rankings presented here are not intended to specify who can/cannot view 4K content but rather which countries/regions have higher concentrations of 4K "capable" connectivity, resulting in a larger complement of subscribers being able to enjoy a quality experience when streaming 4K content. The notion of "readiness" presented here also does not consider the availability of 4K-encoded content within a given geography or the availability/affordability/uptake of 4K-capable televisions and media players.

As Figure 15 shows, in the fourth quarter 12% of unique IP addresses connecting to Akamai globally had average connection speeds of 15 Mbps or above, up just 0.6% from the third quarter. South Korea remained the country with the highest level of 4K readiness, despite a 7.7% decline to a 61% readiness rate. The remaining countries/regions in the top 10 all saw quarterly increases, with Lithuania showing the largest jump at 50%. The other increases were more modest, ranging from Latvia's 1.4% to Romania's 12%.

	Country/Region	% Above 15 Mbps	QoQ Change	YoY Change
–	Global	12%	0.6%	37%
1	South Korea	61%	-7.7%	16%
2	Hong Kong	41%	11%	84%
3	Japan	34%	2.5%	24%
4	Sweden	31%	9.2%	61%
5	Switzerland	30%	2.6%	50%
6	Netherlands	30%	1.9%	35%
7	Latvia	29%	1.4%	63%
8	Lithuania	26%	50%	209%
9	Romania	23%	12%	320%
10	Norway	22%	2.9%	50%

Figure 15: 4K Ready (>15 Mbps) Connectivity

Across the 55 qualifying countries/regions, China again had the lowest rate of 4K readiness at 0.2%, down 13% from the third quarter. Overall, quarterly gains were seen in 35 of the 55 countries/regions. The United Arab Emirates showed the biggest quarter-over-quarter increase at 123% (to 2.1% readiness), while the smallest rate of growth was found in Portugal, at 0.9% (to 9.6% readiness). The remaining 20 countries/regions saw 4K readiness rates drop quarter over quarter, with losses ranging from Poland's 2.5% decline (to 11% readiness) to Moldova's 23% drop (to 12% readiness).

Year over year, the global 4K readiness rate climbed 37%. Yearly growth rates were also strong among the top 10, with Romania and Lithuania posting especially strong gains of 320% and 209%, respectively, while South Korea saw the smallest yearly gain at 16%. China was the only one of the 55 qualifying countries to see a yearly decrease, posting a 29% decline (to 0.2% readiness). Among the countries/regions that saw growth, the smallest yearly increase was seen by Austria, with a 15% gain (to 13% readiness). A total of 18 countries/regions saw 4K readiness more than double from the previous year, with Turkey seeing the largest increase — an incredible 621% jump (to 77% readiness). The continued strong yearly gains are an encouraging long-term trend and point to ongoing improvements in broadband connectivity around the world.

[SECTION]4 GEOGRAPHY *USA*

The metrics presented here for the United States are based on a subset of data used for Section 3 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.

4.1 United States Average Connection Speeds / The top 10 states in the fourth quarter showed a great deal of volatility — half of the states saw quarterly gains in average connection speeds while the other half saw losses. Virginia posted the largest gain at 22%, pushing it into first place from sixth in the previous quarter, while New York, Oregon, North Dakota and Rhode Island saw more moderate quarterly gains — ranging from 2.6% to 4.7%. Washington saw the biggest loss at 18%, dropping it from the number two spot in the third quarter to the number seven spot. The District of Columbia, Massachusetts, Delaware, and Utah saw more modest losses — ranging from 0.9% to

5.8%. Only Virginia and Delaware had average connection speeds above the 15 Mbps "4K readiness" level, but all of the top 10 — as well as an additional 24 states across the country — saw average connection speeds above the 10 Mbps "high broadband" threshold. Overall, 32 states saw positive quarter-over-quarter changes, ranging from Idaho's 0.1% increase (to 11.1 Mbps) to Virginia's 22% jump. For the 19 states that saw average connection speeds decline compared with the third quarter, losses ranged from a negligible 0.3% in New Hampshire (to 12.5 Mbps) to sizable 18% drops for both Connecticut (also to 12.5 Mbps) and Washington. Connecticut's large drop in average connection speed (along with its related drops in several other metrics in subsequent sections) is not necessarily indicative of overall trends for the state, but instead appears to be related to the shift of a large block of IP addresses into the state that have an average connection speed significantly lower than the other major network providers there.

On a year-over-year basis, all 51 states saw increases in average connection speeds compared with the fourth quarter of 2013, and all of the states in the top 10 saw double-digit gains. Massachusetts's 11% yearly increase was the smallest of the top 10, while Delaware's 33% jump was the largest. Across the entire country, Missouri saw the largest yearly gain at 37% (to 9.8 Mbps), while New Hampshire and New Mexico saw the smallest increases at 5.4% (to 12.5 Mbps and 7.9 Mbps, respectively). Maryland was the only other state in the country to see a yearly growth rate below 10%, although it came close at 9.9% (to 12.0 Mbps).

Despite a 2.6% quarterly increase to 7.4 Mbps, Alaska remained the state with the lowest average connection speed in the fourth quarter. Kentucky, New Mexico, and Arkansas round out the bottom four, each with average connections speeds just below 8 Mbps.

4.2 United States Average Peak Connection Speeds / In the fourth quarter of 2014, 8 of the top 10 states showed quarter-over-quarter increases in average peak connection speeds, as seen in Figure 17. The smallest increase occurred in New Jersey — with a 0.3% gain — while Virginia saw a 19% jump, similar to its large quarterly increase in average connection speeds. The next highest increase was seen in Rhode Island with a 9.7% gain. On the losing side, Delaware saw a slight 0.5% quarterly loss but still maintained its position as the state with the highest average peak connection speed in the country at 75.4 Mbps. Connecticut, however, lost a sizable 18%, dropping its position from second place in the third quarter to tenth place in the fourth quarter due to the IP address block shift referenced previously.

Looking across the entire country, all but seven states had higher average peak connection speeds as compared with the previous quarter. Observed gains ranged from North Carolina's slight 0.2% increase (to 44.5 Mbps) to Virginia's 19% surge. Only three states grew by 10% or more, as compared with 15 states in the previous quarter. Five of the seven states where average peak connection speeds fell saw modest losses of 3.1% or less, but Washington lost 7.8% (to 57.8 Mbps) and Connecticut lost 18% in the fourth quarter.

Year-over-year changes were consistently positive within the top 10 states, with increases in average peak connection speeds ranging from Connecticut's meager 1.8% to Delaware and North Dakota's 43% and 44% growth rates. Seven of the top 10 states showed double-digit gains when compared with the fourth quarter of 2013. In the third quarter, all states across the country saw double-digit yearly gains. However, in the fourth quarter of 2014, five states saw declines as compared with the fourth quarter of 2013. These losses ranged from 1.4% in Hawaii (to 42.7 Mbps) to 6.3% in New Hampshire (to 53.1 Mbps). Among the 46 states showing year-over-year increases, the smallest was seen in Washington, with a mere 0.6% bump (to 57.8 Mbps). Just as it led the pack in yearly gains in average connection speed, Missouri also saw the biggest yearly gains in average peak connection speed, with a 47% jump (to 49.1 Mbps).

After holding the spot for two consecutive quarters, Arkansas moved out of last place in the country for average peak connection speed, with its 6.2% quarterly increase (to 35.1 Mbps) allowing it to just beat out Kentucky — which moved into last place despite a 3.0% increase (to 34.0 Mbps).

	State	Q4 '14 Avg. Mbps	QoQ Change	YoY Change
1	Virginia	17.7	22%	23%
2	Delaware	16.4	-5.6%	33%
3	District Of Columbia	14.4	-0.9%	18%
4	Massachusetts	14.2	-1.4%	11%
5	Rhode Island	14.1	4.7%	20%
6	Utah	13.9	-5.8%	22%
7	Washington	13.3	-18%	16%
8	Oregon	12.9	3.6%	16%
9	North Dakota	12.7	4.6%	24%
10	New York	12.6	2.6%	14%

Figure 16: Average Connection Speed by State

	State	Q4 '14 Peak Mbps	QoQ Change	YoY Change
1	Delaware	75.4	-0.5%	43%
2	Virginia	73.5	19%	25%
3	District Of Columbia	65.9	4.4%	25%
4	Massachusetts	65.5	2.8%	9.1%
5	Rhode Island	64.6	9.7%	23%
6	North Dakota	61.9	6.8%	44%
7	Utah	60.2	1.0%	27%
8	New York	59.8	7.5%	15%
9	New Jersey	59.4	0.3%	5.5%
10	Connecticut	57.9	-18%	1.8%

Figure 17: Average Peak Connection Speed by State

Following the trend of the past few quarters, announcements made during the fourth quarter continued to point towards a strong likelihood of positive growth in average peak connection speeds going forward. Many of the efforts to increase connection speeds are being taken at a local/municipal level and may not have an immediate state-wide impact upon completion, but are part of ongoing initiatives that are becoming more widespread across the country. For example, in the fourth quarter there were numerous announcements of gigabit-speed Internet rolling out to various communities, including Jackson, Mississippi (in partnership with C Spire);[25] Baldwin City, Kansas (through a partnership between the Reflective Group, a local cloud technology startup, and regional utility construction company K&W Underground);[26] and several New Hampshire communities (via TDS Telecom)[27]. In December, Calix rolled out gigabit-speed service to Sandy, Oregon and Sebewaing, Michigan, both being the first communities in their respective states to enjoy gigabit services.[28] Finally, after announcing earlier in the year that it would be bringing gigabit Internet to homes in all of its markets by the end of 2016, Cox Communications began rolling out its ultrafast service in the fourth quarter to residents of Irvine, California and Phoenix, Arizona.[29, 30]

There have been a number of statewide and multi-state high speed broadband initiatives as well, such as the founding of Next Century Cities — a group of 50 cities across the U.S. whose mayors have committed to promoting the spread of high-speed Internet in their communities and positioning broadband as being as critical to city infrastructure as roads and electricity.[31] Other initiatives include Kentucky's partnership with Macquarie Capital to build a $250 to $350 million fiber backbone[32] aimed at making high-speed Internet service available throughout the state, as well as the CTgig Project[33] in Connecticut — a public/private initiative comprised of 46 cities, serving roughly half of Connecticut's population and committed to the goal of bringing gigabit-speed, fiber-optic Internet to homes in their communities.

Finally, in some areas, the speed envelope is getting pushed even further. Minneapolis residents, who already have access to 1 Gbps service for $65/month through US Internet, are now being given the opportunity to access 10 Gbps service for $400/mo.[34] The fact that FCC Chairman Tom Wheeler has pushed to change the definition of "broadband" to 25 Mbps from 4 Mbps is also indicative of the continued march towards faster connectivity in more and more places.[35]

4.3 United States High Broadband Connectivity / As shown in Figure 18, despite a 1.2% quarter-over-quarter drop, Delaware once again held the top spot in the country for high broadband adoption rates, with nearly 7 of every 10 unique IP addresses from the state connecting to Akamai with average connection speeds of 10 Mbps or above. Quarter-over-quarter changes among the top 10 states were a mixed bag, with three states seeing declines and seven seeing increases. Connecticut's 18% drop was the largest, as it lost all of its gains from the previous quarter. (See the discussion in Section 4.1 about the likely reason for the large quarterly declines seen in Connecticut.) Among the other decliners, New Jersey lost 5.0% and Delaware saw only a 1.2% decline. Increases among the other seven states ranged from Washington's meager 0.7% to North Dakota's robust 18%. North Dakota was the only state to see a double-digit quarterly growth rate. All 10 states had at least 50% of unique IP addresses with average connection speeds above high broadband rates (up from seven last quarter). North Dakota's 18% increase was also the largest in looking across the whole country, but 46 states in all enjoyed quarter-over-quarter gains — with eight states (including North Dakota) showing double-digit jumps. Among the five states that saw high broadband adoption rates fall from the previous quarter, losses ranged from just 0.7% in South Carolina (to 38% adoption) to Connecticut's 18% drop.

	State	% Above 10 Mbps	QoQ Change	YoY Change
1	Delaware	68%	-1.2%	43%
2	Rhode Island	61%	5.5%	16%
3	Massachusetts	58%	3.8%	10%
4	New Hampshire	54%	8.2%	10%
5	New Jersey	53%	-5.0%	6.8%
6	Virginia	52%	6.3%	16%
7	Connecticut	52%	-18%	21%
8	North Dakota	52%	18%	52%
9	Washington	50%	0.7%	22%
10	New York	50%	6.3%	15%

Figure 18: High Broadband (>10 Mbps) Connectivity by State

Similar to the third quarter, yearly changes in high broadband adoption among the top 10 states were all positive, and fairly strong, in the fourth quarter. Year-over-year changes in these states ranged from a low of 6.8% in New Jersey to a high of 52% in North Dakota, with Delaware also seeing a strong 43% increase. Across the country, Montana saw the largest yearly growth rate, at 91% (to 33% adoption), while New Jersey saw the smallest. Besides New Jersey and Maryland (which saw a 9.3% growth rate, to 47% adoption), all states enjoyed double-digit yearly growth in high broadband adoption rates.

Consistent with the past two quarters, Arkansas remained the state with the lowest level of high broadband adoption in the fourth quarter with a 22% adoption rate — despite a 9% quarterly increase and a 49% yearly increase. Idaho again remained just ahead of Arkansas with a 23% adoption rate.

4.4 United States Broadband Connectivity / Delaware once again continued its slow but steady march toward complete broadband adoption in the fourth quarter, edging up just 0.1% to 96% adoption, as shown in Figure 19. The only other state with at least 9 of every 10 unique IP addresses connecting to Akamai at average connection speeds above 4 Mbps during the fourth quarter was Rhode Island, though Hawaii was not far behind with an 89%

	State	% Above 4 Mbps	QoQ Change	YoY Change
1	Delaware	96%	0.1%	1.1%
2	Rhode Island	92%	0.8%	0.2%
3	Hawaii	89%	1.2%	2.5%
4	North Dakota	86%	4.6%	10%
5	Massachusetts	86%	1.9%	3.9%
6	South Dakota	86%	3.4%	4.6%
7	Connecticut	85%	-10%	0.4%
8	New York	85%	5.0%	3.3%
9	New Hampshire	85%	1.9%	0.2%
10	Florida	84%	3.6%	3.1%

Figure 19: Broadband (>4 Mbps) Connectivity by State

	State	% Above 15 Mbps	QoQ Change	YoY Change
1	Delaware	38%	-4.0%	80%
2	Rhode Island	30%	18%	71%
3	Massachusetts	30%	1.9%	17%
4	Virginia	28%	16%	39%
5	District Of Columbia	27%	3.6%	33%
6	Washington	27%	-2.4%	45%
7	Oregon	25%	10%	59%
8	New Hampshire	25%	7.0%	16%
9	North Dakota	25%	19%	80%
10	New Jersey	24%	-8.3%	22%

Figure 20: 4K Ready (>15 Mbps) Connectivity by State

adoption rate. Connecticut was the only state among the top 10 to see its broadband adoption rate fall quarter over quarter, with a sizable drop of 10%. The other nine states saw modest positive quarterly changes, with New York's 5.0% gain being the largest. Nationwide, all but four states saw broadband adoption rates rise. Illinois's 7.0% quarterly increase (to 68% adoption) was the largest, while Delaware's 0.1% was the smallest. Connecticut had the largest loss at 10%, while Wyoming, New Jersey, and Washington saw more modest declines of 4.9%, 3.4% and 1.1% (to adoption rates of 68%, 82% and 81%, respectively).

Yearly changes across the top 10 states were all positive but fairly muted—ranging from a mere 0.2% in Rhode Island and New Hampshire to 10% in North Dakota. Across the entire country, only one state, Louisiana, saw a year-over-year drop in broadband adoption, though the decline was negligible at 0.3% (to 70% adoption). Iowa and New Jersey were virtually unchanged (at 64% and 82% adoption, respectively), while yearly increases ranged from New Hampshire's 0.2% to Montana's 16% (to 70% adoption). Six states in total saw yearly increases of at least 10%.

For the fifth consecutive quarter, West Virginia remained the state with the lowest broadband adoption rate, with 58% of its connections to Akamai at average connection speeds above 4 Mbps—up 2.3% from the previous quarter and up 4.6% from the fourth quarter of last year.

4.5 United States 4K Readiness / As described in Section 3, given the growing interest in the streaming delivery of 4K ("Ultra HD") video, we thought it would be interesting to begin tracking a "4K readiness" metric in the *State of the Internet Report*. With 4K adaptive bitrate streams generally requiring between 10–20 Mbps of bandwidth, the rankings presented within this section provide insight into the states most likely to be able to sustain such streams within this range. Note that the rankings presented here are not intended to specify who can/cannot view 4K content but rather which states have higher concentrations of 4K "capable" connectivity, resulting in a larger complement of subscribers being able to enjoy a quality experience when streaming 4K content. The notion of "readiness" presented here also does not consider the availability of 4K-encoded content within a given state or the availability/affordability/uptake of 4K-capable televisions and media players.

Looking at the top 10 states shown in Figure 20, 4K readiness rates saw significant volatility in the fourth quarter, similar to the previous quarter. Three states saw declines, ranging from Washington's 2.4% decrease to New Jersey's 8.3% drop. Among those seeing gains, four states saw double-digit increases—North Dakota led the pack with a 19% jump. Massachusetts saw the smallest change with a 1.9% gain. Expanding our perspective to the full country, 40 states posted quarterly gains, ranging from West Virginia's slight 0.2% increase (to 12% readiness) to Wyoming and Maine's 27% gains (to 16% and 12% adoption, respectively). In total, 15 states showed increases of 10% or more compared with the previous quarter. Across the 11 states where 4K readiness rates declined quarter over quarter, losses ranged from a drop of 2.2% in Oklahoma (to 16% readiness) to a decline of 25% in Connecticut (to 24% readiness). New Mexico was the only state (in addition to Connecticut) to see quarterly losses greater than 10%—its readiness rate dropped 11% (to 7.8%).

Year over year, all of the top 10 states saw significant increases in 4K readiness rates in the fourth quarter, with Delaware and North Dakota leading the group with 80% growth. The lowest yearly increase among the group was seen in New Hampshire, which added a still solid 16% over the previous year. Montana, which led the country in yearly growth rates for broadband and high broadband adoption, also led the nation here—posting a 132% gain (to 13% 4K readiness) as compared with the fourth quarter of 2013. Wyoming, Nevada, and Alabama all more than doubled their 4K readiness rates compared with the previous year, while a total of 29 states grew by more than 50%. New Mexico had the smallest yearly growth rate at 9.3%.

Despite a 15% quarterly increase and a 46% yearly gain, Alaska remained the state with the lowest 4K readiness rate in the fourth quarter, with a 7.0% readiness level. Hawaii and Kentucky followed close behind, with 7.2% and 7.3% readiness rates, respectively.

[SECTION]5 GEOGRAPHY *AMERICAS*

The metrics presented here for the Americas region (North and South America) are based on a subset of data used for Section 3 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.

5.1 Americas Average Connection Speeds / In the fourth quarter of 2014, the United States continued to have the fastest average connection speed among surveyed Americas countries, though Canada closed the gap to less than 0.5 Mbps, compared with a 1.2 Mbps gap in the third quarter. As shown in Figure 21, the United States and Canada remained well ahead of the other countries in the region, with Canada staying nearly 5 Mbps faster than Uruguay. Quarter-over-quarter changes were all positive, with the exception of the 3.7% decline seen in the United States. The largest quarterly increase occurred in

Global Rank	Country/Region	Q4 '14 Avg. Mbps	QoQ Change	YoY Change
16	United States	11.1	-3.7%	15%
20	Canada	10.7	3.9%	19%
50	Uruguay	5.9	7.9%	87%
60	Chile	5.0	23%	49%
69	Argentina	4.5	6.8%	48%
70	Mexico	4.5	8.5%	12%
77	Peru	4.0	11%	50%
80	Ecuador	3.7	3.7%	10%
81	Colombia	3.7	9.0%	25%
89	Brazil	3.0	1.6%	11%
90	Panama	2.9	2.0%	6.7%
94	Costa Rica	2.8	3.4%	37%
130	Venezuela	1.4	8.5%	-3.4%
134	Paraguay	1.4	1.7%	-1.7%
136	Bolivia	1.2	10%	20%

Figure 21: Average Connection Speed by Americas Country

Global Rank	Country/Region	Q4 '14 Peak Mbps	QoQ Change	YoY Change
7	Uruguay	63.3	8.1%	73%
22	United States	49.4	1.2%	16%
27	Canada	46.3	6.0%	14%
56	Chile	32.5	25%	60%
72	Colombia	24.7	8.6%	47%
74	Mexico	24.3	6.6%	15%
76	Argentina	23.4	6.1%	19%
78	Peru	23.1	12%	26%
84	Brazil	21.9	6.6%	7.2%
86	Ecuador	21.7	4.8%	-2.7%
110	Panama	14.9	5.2%	0.9%
119	Costa Rica	13.2	6.4%	0.6%
126	Venezuela	11.7	14%	13%
131	Bolivia	10.2	9.5%	-5.4%
132	Paraguay	10.1	8.9%	-4.6%

Figure 22: Average Peak Connection Speed by Americas Country

Chile, up 23% from the third quarter, followed by Peru and Bolivia, which grew 11% and 10%, respectively. The smallest gains were seen in Brazil and Paraguay, with 1.6% and 1.7% increases, respectively.

In the fourth quarter, just as in the third quarter, both Paraguay and Venezuela saw year-over-year declines in average connection speeds, shedding 1.7% and 3.4%, respectively. All of the other surveyed countries saw yearly increases, mostly in the double-digits. Peru, Chile, and Argentina saw the largest gains, of 50%, 49%, and 48%, respectively, while Panama saw the smallest increase at 6.7%.

Seven of the surveyed Americas countries have an average connection speed at or above the 4 Mbps "broadband" threshold — up from six in the third quarter — while only two countries have speeds above the 10 Mbps "high broadband" threshold, consistent with the previous quarter. Ongoing quarterly improvements will likely drive Ecuador and Colombia above 4 Mbps before too long, but the United States and Canada will probably remain the only two countries above 10 Mbps for the foreseeable future.

5.2 Americas Average Peak Connection Speeds / Despite having a significantly slower average connection speed than the United States and Canada, Uruguay once again takes the lead among the surveyed Americas countries for having the highest average peak connection speed. As shown in Figure 22, in the fourth quarter Uruguay increased its lead over the United States and Canada, now leading the United States by nearly 14 Mbps and besting Canada by 17 Mbps. While all the surveyed countries saw average peak connection speeds go up in the fourth quarter, increases ranged from a meager 1.2% in the United States to a hearty 25% in Chile. Most of the countries saw moderate increases in the single digits.

Looking at year-over-year changes, three of the surveyed countries saw declines, though all fairly modest. Bolivia had the largest decline at 5.4%, followed by Paraguay's 4.6% and Ecuador's 2.7%. The other 12 countries saw increases ranging from a negligible 0.6% in Costa Rica to a significant 73% in Uruguay (though this number still pales in comparison to Uruguay's yearly increase of 334% in the third quarter). The next largest increase was in Colombia, with a 47% gain year over year.

5.3 Americas High Broadband Connectivity / Though Uruguay made some progress with a 37% quarter-over-quarter increase, the significant gap in high broadband adoption rates observed over the past year showed no signs of closing in the fourth quarter. As seen in Figure 23, the United States continued to have the highest rate of adoption among the surveyed Americas countries at 39%, with Canada close behind at 38%, and Uruguay a distant third at 9.9%. Brazil, the qualifying country with the lowest adoption rate, saw a 19% quarterly increase (to 1.9% adoption). It will be interesting to see whether Brazil's ranking here will rise over the next few years, as broadband connectivity appears to be on the national agenda. Brazilian President Dilma Rousseff has pledged that if she is re-elected, the government would invest the equivalent of $16 billion USD in an initiative to bring broadband fiber to 90% of Brazilian households — doubling Brazil's broadband connections and increasing average Internet speeds to 25 Mbps by 2018.[36]

Five of the seven non-qualifying countries remained at adoption rates below 1%, while Peru managed to rise to 1.3% adoption with a 66% quarterly growth rate. Unlike the third quarter, where quarterly declines outnumbered gains by 2:1, in the fourth quarter the only qualifying country to see a quarterly loss was the

Global Rank	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
17	United States	39%	-0.3%	20%
18	Canada	38%	14%	44%
45	Uruguay	9.9%	37%	371%
50	Argentina	7.4%	32%	444%
53	Chile	5.8%	73%	371%
59	Mexico	3.5%	27%	77%
62	Colombia	2.0%	73%	528%
63	Brazil	1.9%	19%	125%
–	Ecuador	2.4%	0%	105%
–	Peru	1.3%	66%	674%
–	Panama	0.9%	13%	79%
–	Costa Rica	0.8%	2.3%	111%
–	Venezuela	0.2%	-11%	166%
–	Bolivia	0.1%	0%	89%
–	Paraguay	0.1%	73%	418%

Figure 23: High Broadband (>10 Mbps) Connectivity by Americas Country

Global Rank	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
18	Canada	85%	2.4%	3.1%
40	United States	74%	0.4%	1.7%
50	Uruguay	63%	6.8%	217%
59	Chile	53%	35%	103%
69	Mexico	43%	22%	25%
72	Peru	39%	33%	553%
73	Argentina	38%	6.2%	69%
76	Colombia	31%	24%	113%
77	Ecuador	30%	11%	29%
80	Brazil	26%	4.9%	21%
89	Panama	17%	5.3%	14%
90	Costa Rica	14%	9.5%	249%
103	Venezuela	1.7%	33%	23%
–	Bolivia	1.4%	4.7%	97%
–	Paraguay	1.2%	18%	223%

Figure 24: Broadband (>4 Mbps) Connectivity by Americas Country

United States — with a negligible 0.3% decrease. Among the seven qualifying countries seeing gains, the increases were all double-digit — ranging from 14% in Canada to 73% in Chile and Columbia.

From a yearly perspective, all of the surveyed countries in the region showed strong gains, with the United States seeing the most modest increase at 20%. Five of eight qualifying countries had yearly gains greater than 100%, led by Colombia (528%) and Argentina (444%). Uruguay, which led the pack in the third quarter with an astonishing 3,015% yearly growth rate, saw a lower but still impressive 371% growth rate in the fourth quarter.

5.4 Americas Broadband Connectivity / As Figure 24 demonstrates, there is also a significant gap in broadband adoption rates across the qualifying Americas countries, with Canada leading at 85% adoption and Venezuela trailing at 1.7% adoption. It is likely that this gap will remain quite sizable for the foreseeable future. While quarterly changes were a mixed bag in the third quarter, all of the surveyed countries saw increases in the fourth quarter. These ranged from a negligible 0.4% in the United States to a robust 35% in Chile. Six qualifying countries in total had quarterly gains of more than 10%.

Year-over-year changes were also all positive in the fourth quarter. Canada and the United States saw the smallest increases — at 3.1% and 1.7%, respectively — while all other countries enjoyed double- or triple-digit gains. Among these, Panama had the smallest gain at 14% while Peru saw a significant 553% jump. Costa Rica, Paraguay, Uruguay, Colombia, and Chile all saw year-over-year adoption rates more than double, although Paraguay did not qualify for inclusion in the broadband connectivity metric.

5.5 Americas 4K Readiness / As described in Section 3, given the growing interest in the streaming delivery of 4K ("Ultra HD") video, we thought it would be interesting to begin tracking a "4K readiness" metric in the *State of the Internet Report*. With 4K adaptive bitrate streams generally requiring between 10 – 20 Mbps of bandwidth, the rankings presented within this section provide insight into the countries most likely to be able to sustain such streams within this range. Note that the rankings presented here are not intended to specify who can/cannot view 4K content but rather which countries have higher concentrations of 4K "capable" connectivity, resulting in a larger complement of subscribers being able to enjoy a quality experience when streaming 4K content. The notion of "readiness" presented here also does not consider the availability of 4K-encoded content within a given country or the availability/affordability/uptake of 4K-capable televisions and media players.

As Figure 25 shows, nearly half of the surveyed countries in the Americas region failed to qualify for inclusion in the 4K readiness metric in the fourth quarter. Among the eight qualifying countries, the United States and Canada continued to have 4K readiness rates well above those seen in both the remaining countries as well as the seven countries that did not qualify. Among those seven, four countries had a readiness rate of at least 1.0%, a significant improvement from just one country in the third quarter. Most of the eight qualifying countries saw 4K readiness rates increase significantly compared with the previous quarter, with gains ranging from 11% in Mexico to 73% and 75% in Colombia and Chile, respectively. Only two qualifying countries saw declines, with Brazil dropping 5.9% and the United States dropping 3.1%. Among the countries that failed to qualify, the quarterly changes were highly mixed.

Looking at year-over-year numbers, all of the qualifying and non-qualifying Americas countries showed extremely positive growth rates. Among the qualifying countries, gains ranged from 39% in the United States to 560% in Colombia. Argentina, Chile, and Uruguay also saw readiness rates more than double from the previous year, with increases of 439%, 383%, and 294%, respectively. Note, however, that in cases of very low readiness rates, even small shifts in the underlying data can appear as significant changes over time. In general, however, the long-term trends observed across the surveyed Americas countries are extremely encouraging, and point to improved availability and adoption of high speed Internet connectivity across the region over time.

Global Rank	Country/Region	% Above 15 Mbps	QoQ Change	YoY Change
17	United States	18%	-3.1%	39%
20	Canada	16%	19%	78%
42	Uruguay	3.2%	46%	294%
48	Chile	1.4%	75%	383%
50	Argentina	1.3%	26%	439%
51	Mexico	1.0%	11%	72%
52	Colombia	0.5%	73%	560%
53	Brazil	0.5%	-5.9%	76%
–	Ecuador	0.5%	-18%	36%
–	Costa Rica	0.4%	-5.4%	84%
–	Panama	0.2%	6.8%	72%
–	Peru	0.2%	41%	451%
–	Venezuela	0.1%	-15%	238%
–	Bolivia	<0.1%	-30%	31%
–	Paraguay	<0.1%	183%	325%

Figure 25: 4K Ready (>15 Mbps) Connectivity by Americas Country

[SECTION]6 GEOGRAPHY *ASIA PACIFIC (APAC)*

The metrics presented here for the Asia Pacific region are based on a subset of data used for Section 3 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.

6.1 Asia Pacific Average Connection Speeds / Despite a 12% quarter-over-quarter decline in average connection speed in the fourth quarter, South Korea remained steadfast in its position as the country in the Asia Pacific region (and the world) with the highest average connection speed, as shown in Figure 26. Hong Kong, the closest contender, had an average connection speed nearly 5.5 Mbps slower than South Korea. This quarter, Taiwan joined South Korea, Hong Kong, Japan, and Singapore as the only surveyed Asia Pacific countries/regions to have average connection speeds above the 10 Mbps "high broadband" threshold. In addition to South Korea, three other surveyed countries/regions saw quarterly losses — with

Singapore, China, and Indonesia seeing average connection speeds decline 4.3%, 9.1%, and 50%, respectively. The other 10 countries saw modest quarterly increases, ranging from 0.7% in Malaysia to 11% in Taiwan. Similar to the last two quarters, 9 of the 14 surveyed Asia Pacific countries/regions had average connection speeds above the 4 Mbps "broadband" threshold. Indonesia, at 1.9 Mbps, just edged out India, at 2.0 Mbps, as the surveyed country with the lowest average connection speed in the region. However, Indonesia's drop to last place is due to the unexpectedly large quarterly loss mentioned above. A review of the underlying data set indicates that this loss is related to a significant quarter-over-quarter decline in the average (and average peak) connection speed measured at one of the country's largest network service providers. Additional investigation is needed to determine why this has occurred.

Looking at year-over-year changes across the Asia Pacific region, we see that all of the surveyed countries/regions experienced growth in average connection speeds. South Korea and China experienced very modest yearly growth, at 1.6% and 2.1%, respectively. All of the other countries/regions saw double-digit growth, ranging from 16% in Japan and Indonesia to a high of 47% in Singapore.

As noted previously, the strongly positive nature of the long-term trends is very encouraging, and points to ongoing improvements in Internet connectivity across the region. Some notable recent announcements include the opening of China's broadband market to private enterprises (in hopes of fostering competition and working toward the goal of 50 Mbps Internet speeds in cities by 2020),[37] as well as a joint effort between Spark New Zealand, Vodafone, and Telstra to invest $70 million in a new 20 Tbps cable in the Tasman Sea — significantly improving connectivity to New Zealand via Australia.[38]

6.2 Asia Pacific Average Peak Connection Speeds / As seen in Figure 27, in the fourth quarter Hong Kong and Singapore were once again the only two surveyed Asia Pacific countries/regions with average peak connection speeds above 80 Mbps. Hong Kong's average peak speeds are nearing the 90 Mbps level, with South Korea not far behind the two leaders at 75.4 Mbps. Much like the third quarter, the fourth quarter saw mixed changes in average peak connection speeds. Three of the 14 surveyed countries showed declines, with Malaysia and China posting very moderate losses of 0.8% and 1.3%, respectively, while Indonesia saw a severe drop of 48%. The remaining 11 countries saw fairly modest gains in average peak connection speeds, ranging from Singapore's 1.2% increase to Taiwan's 17%. These mixed quarterly changes and mostly modest increases are in sharp contrast to the changes seen in the third quarter, when all but two of the surveyed countries saw double-digit quarterly growth.

Year-over-year changes in the Asia Pacific region were mostly strong, though not as strong as in the previous quarter. Twelve of the 14 surveyed countries saw increases, ranging from 5% in Australia to 59% in New Zealand. Seven countries had yearly growth rates of at least 25%. Only two countries saw a negative yearly change: Malaysia with a 1% decrease and the Philippines with a 33% drop.

6.3 Asia Pacific High Broadband Connectivity / Figure 28 shows South Korea once again led the region (and the world) in high broadband adoption, despite a 3.0% decrease from the third quarter. Its 79% adoption rate still sits significantly ahead of Hong Kong and Japan, the closest contenders, each of which enjoyed modest quarterly increases to 60% and 56% adoption, respectively. Among qualifying countries, China and India again had the lowest adoption rates at 1.1% each. Quarterly changes were once again extremely mixed, with five qualifying countries showing declines and six showing increases. Among the qualifying countries where

Global Rank	Country/Region	Q4 '14 Avg. Mbps	QoQ Change	YoY Change
1	South Korea	22.2	-12%	1.6%
2	Hong Kong	16.8	3.4%	37%
3	Japan	15.2	1.0%	16%
12	Singapore	11.7	-4.3%	47%
22	Taiwan	10.6	11%	26%
42	Australia	7.4	6.1%	27%
43	New Zealand	7.3	4.1%	39%
45	Thailand	7.1	6.8%	46%
75	Malaysia	4.1	0.7%	35%
82	China	3.4	-9.1%	2.1%
99	Vietnam	2.7	5.6%	48%
101	Philippines	2.7	8.2%	36%
116	India	2.0	2.1%	28%
122	Indonesia	1.9	-50%	16%

Figure 26: Average Connection Speed by APAC Country/Region

Global Rank	Country/Region	Q4 '14 Peak Mbps	QoQ Change	YoY Change
1	Hong Kong	87.7	3.7%	29%
2	Singapore	84.0	1.2%	42%
3	South Korea	75.4	1.6%	17%
4	Japan	69.0	6.0%	30%
6	Taiwan	64.2	17%	25%
26	Thailand	46.3	11%	20%
45	Australia	36.9	2.5%	5.0%
49	New Zealand	34.3	6.5%	59%
62	Malaysia	29.6	-0.8%	-1.0%
83	Philippines	21.9	2.8%	-33%
95	China	17.8	-1.3%	30%
99	Vietnam	17.3	4.5%	37%
112	India	14.5	4.1%	19%
118	Indonesia	13.4	-48%	7.1%

Figure 27: Average Peak Connection Speed by APAC Country/Region

Global Rank	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
1	South Korea	79%	-3.0%	11%
2	Hong Kong	60%	8.5%	60%
4	Japan	56%	2.7%	14%
15	Singapore	40%	-6.1%	108%
20	Taiwan	37%	52%	59%
41	Australia	16%	8.6%	62%
43	New Zealand	15%	9.4%	122%
44	Thailand	13%	34%	325%
58	Malaysia	3.7%	-6.1%	115%
64	China	1.1%	-21%	-37%
65	India	1.1%	-0.7%	104%
–	Philippines	0.6%	-21%	180%
–	Vietnam	0.4%	24%	405%
–	Indonesia	0.3%	-92%	95%

Figure 28: High Broadband (>10 Mbps) Connectivity by APAC Country/Region

Global Rank	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
2	South Korea	95%	-0.1%	2.0%
7	Hong Kong	91%	2.5%	13%
10	Japan	88%	1.1%	4.8%
16	Thailand	86%	2.2%	59%
17	Taiwan	86%	10%	25%
29	Singapore	81%	-2.4%	20%
30	New Zealand	80%	4.7%	47%
44	Australia	69%	4.5%	28%
71	Malaysia	40%	1.5%	57%
79	China	27%	-21%	-2.3%
87	Vietnam	19%	33%	590%
93	Philippines	9.8%	11%	173%
95	India	7.8%	13%	86%
99	Indonesia	4.6%	-87%	150%

Figure 29: Broadband (>4 Mbps) Connectivity by APAC Country/Region

high broadband adoption rates fell from the third quarter, the smallest loss was in India at 0.7% while the largest was in China at 21%. Gains were varied as well, with Japan seeing a modest 2.7% increase while Taiwan enjoyed a 52% jump.

Year-over-year changes were strong across the surveyed Asia Pacific countries/regions with the exception of China, which saw a 37% decline. South Korea and Japan saw the smallest yearly growth rates in the region, increasing 11% and 14%, respectively, while 5 of the 11 qualifying countries saw high broadband adoption rates more than double compared with the fourth quarter of 2013. Thailand led the pack with 325% yearly growth, followed by New Zealand and Malaysia, with 122% and 115% growth, respectively. Strong yearly growth rates were also seen in the three non-qualifying countries — the Philippines, Vietnam, and Indonesia. However, with such low high broadband adoption rates and fewer than 25,000 unique IPv4 addresses connecting to Akamai at speeds over 10 Mbps in the fourth quarter, there is not enough data to truly establish the long-term trends in these countries.

6.4 Asia Pacific Broadband Connectivity / In the fourth quarter, South Korea continued to lead the region in broadband adoption, with 95% of its IP addresses connecting to Akamai at average connection speeds above 4 Mbps. As Figure 29 shows, 7 out of the 14 surveyed countries/regions in Asia Pacific enjoy broadband adoption rates of 80% or higher. In sharp contrast to these, the Philippines, India, and Indonesia all had less than 10% broadband adoption — with Indonesia seeing the lowest adoption rate this quarter after an 87% decline, which erased all of the 250% gain from the third quarter. Four countries saw quarter-over-quarter declines, ranging from South Korea's negligible 0.1% decrease to Indonesia's 87% drop, while quarterly increases ranged from Japan's modest 1.1% to Vietnam's healthy 33%.

Year-over-year changes in Asia Pacific were generally very positive. Only one country — China — saw a decline, albeit a very minimal one at 2.3%. Growth rates were modest for South Korea (2%) and Japan (4.8%), but the remaining 11 countries all saw double-digit growth percentages. Three countries — Indonesia, the Philippines, and Vietnam — saw broadband adoption more than double compared with the previous year, with growth rates of 150%, 173%, and 590%, respectively.

6.5 Asia Pacific 4K Readiness / As described in Section 3, given the growing interest in the streaming delivery of 4K ("Ultra HD") video, we thought it would be interesting to begin tracking a "4K readiness" metric in the *State of the Internet Report*. With 4K adaptive bitrate streams generally requiring between 10 – 20 Mbps of bandwidth, the rankings presented within this section provide insight into the countries/regions most likely to be able to sustain such streams within this range. Note that the rankings presented here are not intended to specify who can/cannot view 4K content, but rather which countries/regions have higher concentrations of 4K "capable" connectivity, resulting in a larger complement of subscribers being able to enjoy a quality experience when streaming 4K content. The notion of "readiness" presented here also does not consider the availability of 4K-encoded content within a given country/region or the availability/affordability/uptake of 4K-capable televisions and media players.

Although maintaining its global and regional leadership position as the country with the highest percentage of unique IP addresses making requests to Akamai at average speeds above 15 Mbps, South Korea's 4K-readiness rate saw a quarterly decline of 7.7% to 61%. Hong Kong was again in second place, with an 11% gain to 41% readiness — still well below South Korea's level. Of the eight remaining qualifying surveyed countries in this region, three others saw decreases this quarter — with declines ranging from Singapore's

3.2% to China's 13%, while five saw increases — ranging from Japan's modest 2.5% to Thailand's substantial 35%. India and China maintained the last two positions in the ranking, with readiness rates below 0.5%. Malaysia, the Philippines, Indonesia, and Vietnam all failed to qualify for inclusion; in addition to extremely low rates of 4K readiness, all also saw negative quarter-over-quarter changes. Again, Indonesia's quarterly drop of 89% was particularly extreme, undoing the large gains seen in the previous quarter.

Similar to the broadband and high broadband metrics observed in the fourth quarter, year-over-year changes in the 4K readiness metric for qualifying Asia Pacific countries/regions were all positive — with the exception of China, which saw a 29% drop. The remaining nine countries saw yearly increases ranging from South Korea's 16% to Thailand's 312%. In addition to Thailand, Singapore and New Zealand saw readiness rates more than double compared with the previous year. As has been noted previously, the observed long-term trends are extremely encouraging and point to improved availability and adoption of high-speed Internet connectivity across the Asia Pacific region over time.

Global Rank	Country/Region	% Above 15 Mbps	QoQ Change	YoY Change
1	South Korea	61%	-7.7%	16%
2	Hong Kong	41%	11%	84%
3	Japan	34%	2.5%	24%
15	Singapore	21%	-3.2%	167%
18	Taiwan	17%	37%	43%
36	Australia	6.5%	12%	73%
39	New Zealand	4.7%	9.3%	151%
40	Thailand	3.8%	35%	312%
54	India	0.4%	-11%	91%
55	China	0.2%	-13%	-29%
–	Malaysia	0.9%	-14%	112%
–	Philippines	0.2%	-17%	127%
–	Indonesia	0.1%	-89%	88%
–	Vietnam	0.1%	-1.2%	176%

Figure 30: 4K Ready (>15 Mbps) Connectivity by APAC Country/Region

[SECTION]7 GEOGRAPHY *EUROPE, MIDDLE EAST, AND AFRICA (EMEA)*

The metrics presented here for the EMEA region are based on a subset of data used for Section 3 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 EMEA region, based on classification by Akamai's EdgeScape geolocation tool.

7.1 EMEA Average Connection Speeds / With a 3.5% increase in the fourth quarter to 14.6 Mbps, Sweden pulled just ahead of Switzerland for the top spot in average connection speeds among the surveyed EMEA countries. Having held the top spot for the last three quarters, Switzerland fell to second place with a 14.5 Mbps average connection speed this quarter, unchanged from the previous quarter. These two countries, along with 10 others in the survey, had average connection speeds above the 10 Mbps "high broadband" threshold. Austria was among this group in the third quarter, but with a 6.1% quarterly decrease fell just shy of the inclusion threshold with a 9.8 Mbps average connection speed. Like last quarter, all but one of the

surveyed countries had average connection speeds above the 4 Mbps "broadband" level. Once again, only South Africa — at 3.2 Mbps — failed to reach either threshold. Quarterly changes were mixed across the surveyed countries, with 9 countries seeing average connection speeds decrease quarter over quarter, 15 seeing increases, and 1 remaining flat. Similar to the third quarter, changes in the fourth quarter were moderate on both sides, with the United Arab Emirates seeing the only double-digit gain at 23%. The other increases ranged from the Czech Republic's 0.1% to 5.9% in Denmark. Losses ranged from 0.3% in Norway to 9.9% in South Africa.

Year-over-year changes in average connection speeds were consistently positive for EMEA. The smallest increase was seen in Austria, which grew only 3.9%. Three additional countries also saw yearly increases below 10%. On the other end of the spectrum, Romania had the highest yearly growth rate at 61%, followed by Turkey at 44%. In addition to these two, 14 more countries grew by at least 20%. Across the EMEA region, these highly positive long-term growth trends continued to be reflective of ongoing improvements in Internet connectivity within the surveyed countries.

7.2 EMEA Average Peak Connection Speeds / As shown in Figure 32, the fourth quarter saw mostly positive but muted changes in average peak connection speeds across the EMEA countries, following a mixed third quarter and strong second quarter. The United Arab Emirates stood out for its 54% quarterly gain, while the other 21 countries with increases this quarter ranged from Portugal's 1.3% to Romania's 14%. The large jump seen in the United Arab Emirates pushed it into the ranks of EMEA countries with average peak connection speeds above 50 Mbps, making a total of eight countries in this group as compared with seven in the third quarter. Romania, also with a significant gain, moved past Israel in the fourth quarter to become the EMEA country with the highest average peak connection speed at 67.0 Mbps. Israel saw a quarterly loss for the second quarter in a row, dropping 2.1% to 60.5 Mbps. Only two other countries — South Africa and Belgium — saw declines in the fourth quarter, losing 12% and 2.0%, respectively.

Global Rank	Country/Region	Q4 '14 Avg. Mbps	QoQ Change	YoY Change
4	Sweden	14.6	3.5%	34%
5	Switzerland	14.5	0%	21%
6	Netherlands	14.2	1.7%	15%
8	Ireland	12.7	-8.9%	24%
9	Czech Republic	12.3	0.1%	8.4%
10	Finland	12.1	2.8%	33%
11	Denmark	11.9	5.9%	20%
14	Romania	11.6	2.6%	61%
15	Norway	11.4	-0.3%	28%
18	United Kingdom	10.9	1.4%	15%
19	Belgium	10.8	-4.6%	12%
21	Israel	10.6	-6.3%	30%
24	Austria	9.8	-6.1%	3.9%
27	Russia	9.0	-1.7%	21%
29	Germany	8.8	1.4%	15%
30	Poland	8.8	1.5%	17%
32	Hungary	8.7	-1.3%	27%
36	Spain	8.2	5.5%	23%
37	Slovakia	8.2	-5.5%	24%
38	Portugal	8.0	0.2%	33%
44	France	7.1	2.5%	7.3%
52	Turkey	5.8	3.9%	44%
53	United Arab Emirates	5.7	23%	38%
54	Italy	5.6	0.8%	7.2%
87	South Africa	3.2	-9.9%	38%

Figure 31: Average Connection Speed by EMEA Country

Global Rank	Country/Region	Q4 '14 Peak Mbps	QoQ Change	YoY Change
5	Romania	67.0	14%	32%
9	Israel	60.5	-2.1%	11%
11	Sweden	57.3	6.0%	33%
12	Switzerland	57.0	4.8%	29%
13	Netherlands	56.4	5.9%	29%
16	Ireland	52.1	3.3%	38%
18	Belgium	51.6	-2.0%	20%
19	United Arab Emirates	51.2	54%	23%
21	Russia	49.6	5.4%	39%
24	United Kingdom	48.8	4.4%	12%
25	Finland	47.4	9.2%	40%
29	Czech Republic	45.7	5.3%	19%
30	Hungary	45.5	4.3%	20%
31	Portugal	44.3	1.3%	19%
32	Denmark	44.1	13%	26%
33	Norway	42.5	2.4%	29%
35	Austria	41.1	1.8%	9.4%
37	Germany	41.0	4.7%	15%
38	Poland	40.7	8.6%	30%
41	Slovakia	39.9	4.3%	26%
42	Spain	39.6	9.5%	27%
52	Turkey	33.7	5.1%	24%
58	France	31.5	8.3%	19%
66	Italy	26.9	6.5%	22%
109	South Africa	15.1	-12%	67%

Figure 32: Average Peak Connection Speed by EMEA Country

Global Rank	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
3	Switzerland	56%	3.6%	34%
5	Netherlands	56%	5.0%	24%
6	Romania	55%	11%	258%
7	Sweden	47%	7.1%	44%
10	Denmark	44%	15%	35%
11	Belgium	43%	-4.0%	23%
13	Czech Republic	41%	4.0%	11%
14	Israel	41%	-8.7%	97%
16	Finland	40%	8.6%	36%
19	United Kingdom	38%	5.9%	25%
21	Norway	35%	1.0%	38%
22	Ireland	33%	-6.4%	29%
25	Russia	29%	-4.5%	42%
27	Hungary	28%	-0.8%	80%
29	Austria	26%	-6.0%	8.0%
30	Poland	26%	4.6%	37%
31	Portugal	25%	-1.0%	138%
32	Germany	24%	5.7%	33%
33	Spain	22%	17%	78%
38	Slovakia	20%	-5.2%	61%
42	France	15%	9.7%	26%
47	United Arab Emirates	9.2%	164%	167%
48	Turkey	9.0%	48%	429%
55	Italy	5.7%	8.6%	23%
60	South Africa	2.6%	-24%	100%

Figure 33: High Broadband (>10 Mbps) Connectivity by EMEA Country

Global Rank	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
3	Switzerland	93%	0.2%	2.5%
4	Denmark	92%	3.5%	11%
5	Israel	92%	0.9%	12%
6	Netherlands	91%	0.9%	4.7%
8	Romania	89%	0.6%	16%
11	Sweden	87%	3.5%	20%
13	Belgium	87%	-0.6%	11%
14	Austria	87%	0.8%	2.1%
20	Czech Republic	84%	1.0%	0.2%
22	Poland	83%	4.6%	18%
23	Finland	83%	5.0%	19%
24	United Kingdom	83%	1.4%	4.7%
26	Hungary	82%	4.5%	18%
27	Russia	82%	2.5%	12%
31	Germany	80%	2.3%	6.7%
32	Norway	80%	5.5%	44%
34	Spain	78%	4.5%	10%
38	Portugal	75%	2.3%	14%
43	France	70%	3.2%	1.0%
45	Slovakia	68%	-2.9%	14%
46	Ireland	68%	-0.8%	6.0%
49	Turkey	63%	-3.8%	64%
51	United Arab Emirates	62%	23%	58%
52	Italy	61%	0.6%	4.6%
86	South Africa	19%	-17%	161%

Figure 34: Broadband (>4 Mbps) Connectivity by EMEA Country

Year-over-year changes for the surveyed countries in the EMEA region were consistently positive, though slightly less strong than in the third quarter. Austria, with a 9.4% increase, was the only country with yearly growth of less than 10%. The other countries saw increases ranging from 11% in Israel to 40% in Finland and 67% in South Africa, again indicating strongly positive trends for Internet connection speeds in the region.

7.3 EMEA High Broadband Connectivity / Three of the surveyed EMEA countries had more than half of their unique IP addresses connecting to Akamai at average speeds above 10 Mbps in the fourth quarter. Romania's robust 11% quarter-over-quarter increase pushed it back up to 55% high broadband adoption, after dropping to 49% in the previous quarter. As Figure 33 shows, a total of 17 countries saw at least 25% of their connections at high broadband speeds during the fourth quarter, just as in the third quarter. Four countries continued to see broadband adoption rates below 10%, although the United Arab Emirates and Turkey, with large quarterly increases of 164% and 48%, found themselves close — at 9.2% and 9.0% adoption, respectively. Across EMEA, quarter-over-quarter changes were mixed. A total of nine surveyed EMEA countries saw high broadband adoption rates fall on a quarterly basis, with losses ranging from 0.8% in Hungary to 24% in South Africa (the latter reversing its 37% gain in the third quarter). The remaining countries saw high broadband adoption rates rise during the quarter, but most gains were moderate — with the exception of the large jumps seen in the United Arab Emirates and Turkey. Other quarterly increases ranged from 1.0% in Norway to 17% in Spain.

Looking at year-over-year growth, all of the surveyed EMEA countries saw significant gains. Turkey once again saw the largest increase, with an impressive 429% gain. Romania, the United Arab Emirates, Portugal, and South Africa also all saw high broadband adoption rates more than double as compared with the previous year. Austria, with an 8% gain, was the only country to see its adoption rate grow less than 10%. Among the remaining surveyed countries, the year-over-year adoption rate increases ranged from 11% in the Czech Republic to 97% in Israel.

7.4 EMEA Broadband Connectivity / As Figure 34 shows, four countries in the list of surveyed EMEA countries saw broadband adoption rates above 90% — up from three in the third quarter — as Denmark's 3.5% increase pushed it to 92% adoption. Overall quarterly trends were mostly positive but modest, although four countries did see adoption rates decline. Turkey, Slovakia, and Belgium all had modest decreases, but South Africa saw a sizable 17% drop to 19% — partially offsetting the impressive 81% growth it saw in the third quarter. On the other end of the spectrum, the United Arab Emirates was the only country to see double-digit growth, with a 23% quarterly increase in broadband adoption. Among the remaining countries, increases were small, ranging from 0.2% in Switzerland to 5.5% in Norway. Still, all but one of the surveyed countries in the EMEA region had more than 60% of their unique IP addresses connecting to Akamai at average speeds above 4 Mbps in the fourth quarter. The lone outlier was South Africa, which failed to have even one-fifth of its addresses at that rate.

On a year-over-year basis, all of the surveyed EMEA countries saw broadband adoption increase and, despite an adoption rate of just 19%, South Africa led the pack in yearly growth with a 161% increase from the fourth quarter of 2013. While none of the other surveyed EMEA countries saw speeds more than double, another 15 had double-digit percentage growth rates — again led by Turkey with a 64% increase. The Czech Republic and France saw the smallest yearly increases, at 0.2% and 1.0%, respectively.

The fourth quarter did see a number of announcements indicating significant investments into broadband infrastructure in Europe. For example, in November the Hungarian government declared its plans to spend €586 million bringing broadband Internet to the entire country by 2018.[39] That same month, the European Commission announced a €315 billion plan aimed at infrastructure and broadband improvement. We expect this will spur broadband initiatives across the European Union over the next few years.

7.5 EMEA 4K Readiness / As described in Section 3, given the growing interest in the streaming delivery of 4K ("Ultra HD") video, we thought it would be interesting to begin tracking a "4K readiness" metric in the *State of the Internet Report*. With 4K adaptive bitrate streams generally requiring between 10 – 20 Mbps of bandwidth, the rankings presented within this section provide insight into the countries most likely to be able to sustain such streams within this range. Note that the rankings presented here are not intended to specify who can/cannot view 4K content but rather which countries have higher concentrations of 4K "capable" connectivity, resulting in a larger complement of subscribers being able to enjoy a quality experience when streaming 4K content. The notion of "readiness" presented here also does not consider the availability of 4K-encoded content within a given country or the availability/affordability/uptake of 4K-capable televisions and media players.

Figure 35 shows that nine of the surveyed EMEA countries had at least one of every five IP addresses connecting to Akamai at average speeds above 15 Mbps, while another eight had at least 1 in 10 at those speeds — the same as in the third quarter. Just as with the average connection speeds metric, Sweden pulled ahead of Switzerland, with a 9.2% gain this quarter, to take the spot as the EMEA country with the highest 4K readiness rate at 31%. However, both Switzerland and the Netherlands remain very close behind, with 4K readiness rates of 30%. Eight countries in the survey had readiness rates below 10%, with the lowest being South Africa's 1.4% after a 21% drop — reversing its 24% gain in the third quarter. Eight other countries also saw declines this quarter, with losses ranging from Poland's 2.5% to Israel's 17%. With strong quarterly gains across all of the broadband metrics, the United Arab Emirates saw by far the largest quarter-over-quarter increase in 4K readiness rates among the EMEA countries, jumping 123% to a 2.1% readiness rate and qualifying this quarter for inclusion in the metric. Turkey saw the next largest quarterly increase at 77%, while the remaining countries had far more modest increases, ranging from Portugal's 0.9% to Spain's 18%.

Year over year, the surveyed EMEA countries saw very strong increases in 4K readiness across the board. Six countries had readiness rates more than double compared with the fourth quarter of 2013, led by Turkey and Romania — with 621% and 320% gains, respectively — while an additional nine countries had yearly increases above 50%. Austria and the Czech Republic saw the smallest gains, at 15% and 16% each. These observed long-term trends are extremely encouraging and point to quickly growing availability and adoption of high-speed Internet connectivity across the EMEA region. Notably, several European governments have announced plans to bring ultrafast connectivity to rural areas that might otherwise be neglected by commercial broadband providers. Under the Broadband Delivery U.K. program, for example, rural villages in Northamptonshire, U.K., are set to benefit from government plans to bring broadband speeds of more than 24 Mbps to over 500 homes by the end of 2015.[40] Likewise, the Irish government recently announced an initiative to invest hundreds of millions of euro to bring gigabit-speed fiber-optic broadband connections to 700,000 homes and businesses within rural towns and villages over the next few years.[41, 42]

Global Rank	Country/Region	% Above 15 Mbps	QoQ Change	YoY Change
4	Sweden	31%	9.2%	61%
5	Switzerland	30%	2.6%	50%
6	Netherlands	30%	1.9%	35%
9	Romania	23%	12%	320%
10	Norway	22%	2.9%	50%
11	United Kingdom	22%	9.7%	42%
12	Finland	21%	4.4%	55%
13	Denmark	21%	13%	50%
14	Czech Republic	21%	3.1%	16%
16	Belgium	19%	-9.8%	22%
21	Ireland	16%	-11%	37%
22	Israel	15%	-17%	121%
24	Austria	13%	-14%	15%
26	Russia	11%	-11%	62%
27	Poland	11%	-2.5%	33%
29	Hungary	11%	-7.2%	94%
30	Slovakia	10%	-8.1%	68%
32	Spain	9.7%	18%	102%
33	Portugal	9.6%	0.9%	204%
34	Germany	9.4%	3.0%	40%
38	France	5.5%	10%	40%
41	Turkey	3.5%	77%	621%
45	Italy	2.2%	5.0%	39%
46	United Arab Emirates	2.1%	123%	170%
49	South Africa	1.4%	-21%	93%

Figure 35: 4K Ready (>15 Mbps) Connectivity by EMEA Country

[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. 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.

Starting with the *First Quarter, 2014 State of the Internet Report*, we have changed the connection speed data presented within this section. Previous to that time, the report included data for a selected set of providers with a minimum of 1,000 unique IP addresses connecting to Akamai during the quarter, where Akamai believed that the entire autonomous system (AS) was mobile. As discussed in the past, Akamai is now leveraging mobile device identification data to greatly expand the number of networks that are considered to be mobile. However, the number of networks now identified as mobile is significantly larger than could be manageably published within the report. As such, similar to the methodology employed

for Sections 3 – 7 of the report, we are now publishing mobile connectivity metrics aggregated at a country/region level. This section also uses the 25,000 unique IP address threshold to qualify countries/regions for inclusion within the section.

8.1 Connection Speeds on Mobile Networks / Figure 36 shows that across the 50 countries/regions around the world that qualified for inclusion in the mobile section, the United Kingdom had the fastest average connection speed at 16.0 Mbps. The next closest country, Denmark, had just over half that speed, at 8.8 Mbps. New Caledonia had the lowest average mobile connection speed, at 1.0 Mbps. Iran, which was in the last position in the third quarter, saw its average connection speed increase to 1.2 Mbps.

While the United Kingdom was the only country with an average mobile connection speed above the 10 Mbps "high broadband" threshold, 30 countries achieved speeds above the 4 Mbps "broadband" level. Within the individual continental regions, the following countries had the highest average mobile connection speeds:

- **Africa**: Morocco, 3.0 Mbps
- **Asia Pacific:** Japan, 8.3 Mbps
- **Europe:** United Kingdom, 16.0 Mbps
- **North America:** United States, 3.2 Mbps
- **South America:** Venezuela, 6.3 Mbps

In reviewing the average peak mobile connection speeds for the fourth quarter, we see unusually high speeds of 484.4 Mbps and 386.7 Mbps in Saudi Arabia and Kuwait, respectively. These do not represent realistic speeds for today's mobile networks and are most likely due to the heavy use of proxies by mobile network providers. The connection speeds for these two countries are more likely to be indicative of the speeds achieved between Akamai and these proxies (residing in data centers) rather

Country/Region	Q4 '14 Avg. Mbps	Q4 '14 Peak Mbps	% Above 4 Mbps
AFRICA			
Egypt	2.9	18.5	14%
Morocco	3.0	35.8	20%
South Africa	1.5	7.7	9.5%
ASIA PACIFIC			
Australia	4.8	129.9	56%
China	5.0	15.6	60%
Hong Kong	6.3	34.0	63%
India	1.9	12.2	5.2%
Iran	1.2	7.7	1.9%
Japan	8.3	116.3	81%
Kuwait	6.6	386.7	94%
Malaysia	2.6	20.1	12%
New Caledonia	1.0	8.2	0.7%
Pakistan	1.6	12.2	4.2%
Saudi Arabia	6.6	484.4	97%
Singapore	8.2	157.3	85%
Sri Lanka	3.0	29.1	14%
Taiwan	4.8	34.1	57%
Thailand	2.1	39.6	1.5%
EUROPE			
Austria	5.7	25.8	70%
Belgium	6.4	29.6	81%
Czech Republic	5.1	18.8	60%
Denmark	8.8	43.8	97%
France	7.7	45.9	72%
Germany	5.4	48.6	35%
Hungary	3.3	20.8	19%
Ireland	7.1	40.1	66%
Italy	5.2	41.2	58%
Lithuania	4.2	23.4	36%
Moldova	5.1	26.7	42%
Netherlands	6.3	29.2	70%
Norway	6.9	32.3	88%
Poland	5.1	31.4	65%
Russia	7.2	47.0	68%
Slovakia	7.3	37.6	72%
Slovenia	5.0	22.2	68%
Spain	4.4	25.0	38%
Sweden	8.2	40.7	97%
Turkey	4.6	69.1	46%
Ukraine	7.3	28.6	89%
United Kingdom	16.0	61.8	88%
NORTH AMERICA			
El Salvador	2.6	16.0	11%
United States	3.2	14.3	17%
SOUTH AMERICA			
Argentina	1.3	7.5	4.0%
Bolivia	1.9	10.9	0.8%
Brazil	1.8	14.4	2.2%
Chile	2.0	14.0	4.1%
Colombia	2.2	11.3	3.0%
Paraguay	3.1	20.6	25%
Uruguay	3.5	25.6	38%
Venezuela	6.3	28.3	97%

Figure 36: Average and Average Peak Connection Speeds, Broadband (>4 Mbps) Connectivity for Mobile Connections by Country/Region

than speeds achieved between Akamai and the mobile devices themselves. We will therefore disregard these two countries for the remainder of our analysis of this particular metric.

As has been seen in the prior quarters, average peak mobile connection speeds spanned an extremely broad range in the fourth quarter, from 157.3 Mbps in Singapore to 7.5 Mbps in Argentina. Excluding Saudi Arabia and Kuwait, Japan and Australia were the only two countries (in addition to Singapore) to see average peak speeds above 100 Mbps, and only two more — Turkey and the United Kingdom — had speeds above 50 Mbps. However, as more countries begin rolling out higher-speed mobile technologies like LTE-A, the successor to 4G LTE, we can expect to see increasing average peak speeds. For example, Telecom Italia announced in November that it had begun rolling out LTE-A in 60 towns across Italy, with download speeds of up to 180 Mbps (increasing to 225 Mbps the following year).[43]

In the fourth quarter, all but four countries — New Caledonia, Iran, South Africa, and Argentina — saw average peak mobile connection speeds above 10 Mbps. Within the individual continental regions, the following countries/regions had the highest average peak mobile connection speeds:

- **Africa:** Morocco, 35.8 Mbps
- **Asia Pacific:** Singapore, 157.3 Mbps
- **Europe:** Turkey, 69.1 Mbps
- **North America:** El Salvador, 16.0 Mbps
- **South America:** Venezuela, 28.3 Mbps

Similar to the global and regional connectivity sections of this report, we are also including insight into broadband adoption levels for mobile connectivity — that is, the percentage of unique IP addresses connecting to Akamai from mobile network providers within the qualifying countries/regions at average speeds of over 4 Mbps. In the fourth quarter, Venezuela, Denmark, Saudi Arabia, and Sweden led the pack, each with a tremendous 97% level of mobile broadband adoption. At the other end of the spectrum, Bolivia and New Caledonia both had adoption rates below 1%. Within the individual continental regions, the following countries had the highest mobile broadband adoption rates:

- **Africa:** Morocco, 20%
- **Asia Pacific:** Saudi Arabia, 97%
- **Europe:** Denmark and Sweden, 97%
- **North America:** United States, 17%
- **South America:** Venezuela, 97%

8.2 Mobile Browser Usage Data / In June 2012, Akamai launched the "Akamai IO" destination site (*http://www.akamai.com/io*), with an initial data set that highlighted browser usage across PCs and other connected devices connecting via fixed and mobile networks. The data and graphs below are derived from Akamai IO.

Figure 37 illustrates mobile browser usage by users identified to be on cellular networks in the fourth quarter of 2014. Whereas in previous quarters, we focused on the usage of Android Webkit and Apple Mobile Safari, with all other browsers designated as "Others" in the graph, this quarter we have also broken out metrics for Chrome for mobile (which was previously bundled into "Others").

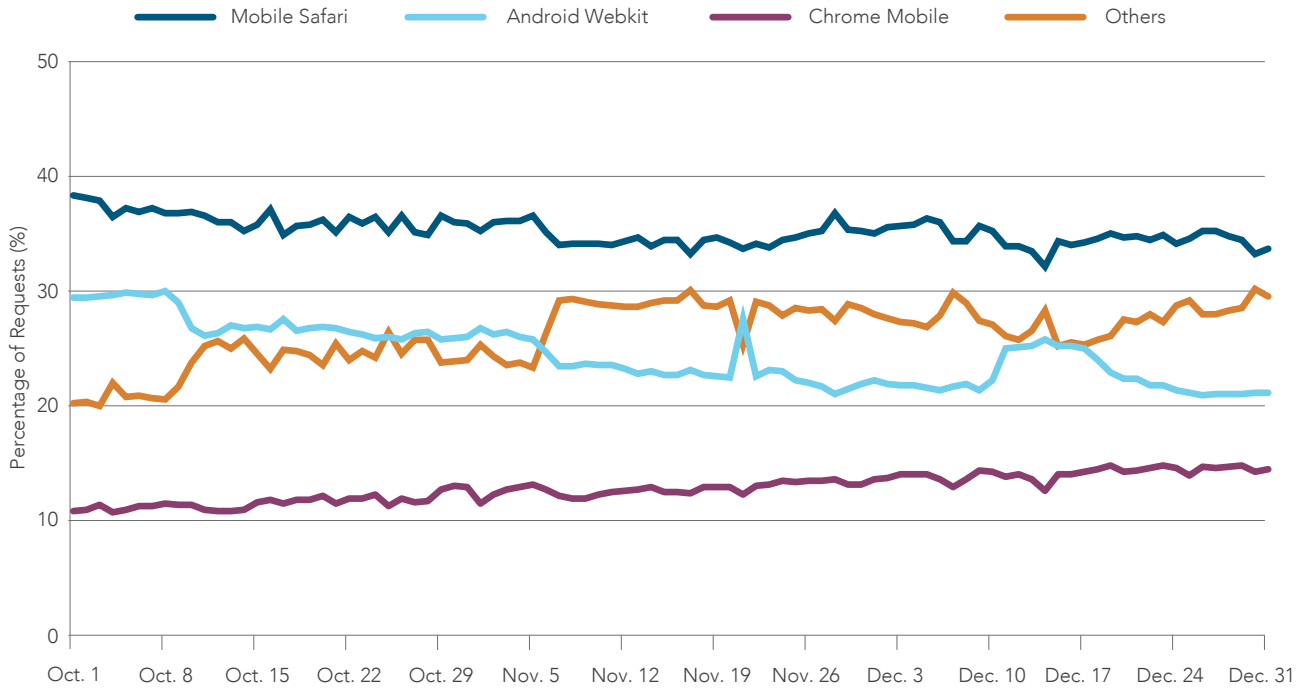


Figure 37: Leading Mobile Browsers Seen Across Cellular Networks, Q4 2014

As of Android version 4.4 (KitKat), Chrome has replaced Webkit as the default Android browser engine, so when comparing Android versus iOS platforms, we combine metrics from Android Webkit and Chrome for mobile to get an Android platform number. We expect that over time, Webkit traffic will decline and Chrome traffic will increase, as older Android versions are retired.

As the graph shows, at the start of the fourth quarter Mobile Safari led Android Webkit by about 9 percentage points, and Webkit led Chrome by about 18.5 percentage points. Throughout the quarter, both Mobile Safari and Webkit trended down a few percentage points while Chrome (and "Others") trended up. At quarter end, Mobile Safari's lead over Android Webkit had widened to over 12 percentage points, while Webkit's lead over Chrome had narrowed significantly to under 8 points. In comparing iOS versus Android platforms, however, we see a slight two-point lead for Android holding fairly steady throughout the quarter. Overall, iOS comprised about 36% of requests during the fourth quarter, while Android was responsible for 38%.

Expanding the set of data to all networks (not just those defined as cellular), we see a much wider gap between Mobile Safari and Android Webkit, as shown in Figure 38. At the start of the quarter, Mobile Safari usage was roughly 20 percentage points higher than Android Webkit, and this gap remained fairly consistent throughout, narrowing briefly in mid-December before widening slightly to 24 percentage points at the end of the quarter. The gap between Android Webkit and Chrome Mobile began the quarter at 18% but narrowed to under 10% as Webkit trended downward and Chrome picked up speed. Overall, the iOS platform held a 9.8 percentage point lead over Android at the beginning of the quarter, narrowing slightly to 9.3 percentage points at quarter end. Averaged across the entire quarter, iOS accounted for about 48% of requests, while Android accounted for roughly 40% of requests.

8.3 Mobile Traffic Growth Observed by Ericsson / In mobile networks, the access medium (spectrum) is being 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, regions, and operators, due to their different customer profiles.

Figure 39 shows total global monthly data and voice traffic. It depicts a strong increase in data traffic growth with a moderating rate of growth and almost flat voice traffic development. The number of mobile data subscriptions is increasing rapidly and driving growth in data traffic along with a continuous increase in the average data volume per subscription. Data traffic grew 11% quarter over quarter, and over 54% year over year.

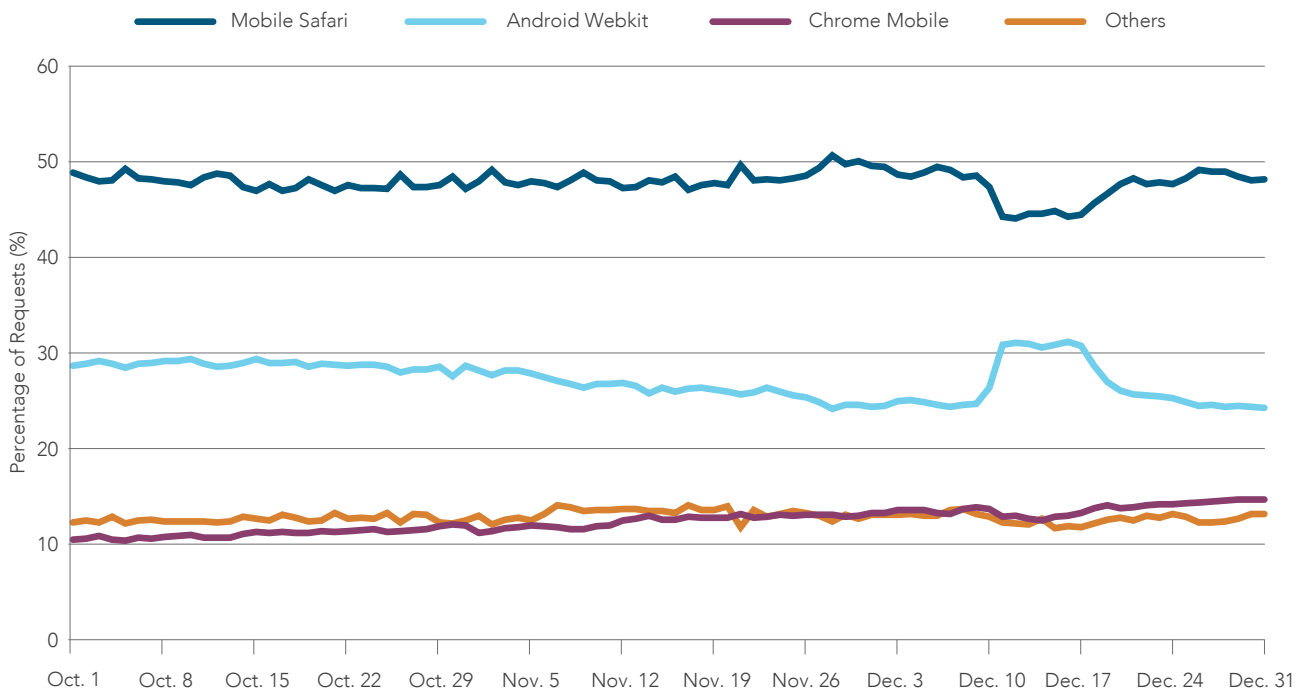


Figure 38: Leading Mobile Browsers Seen Across All Networks, Q4 2014

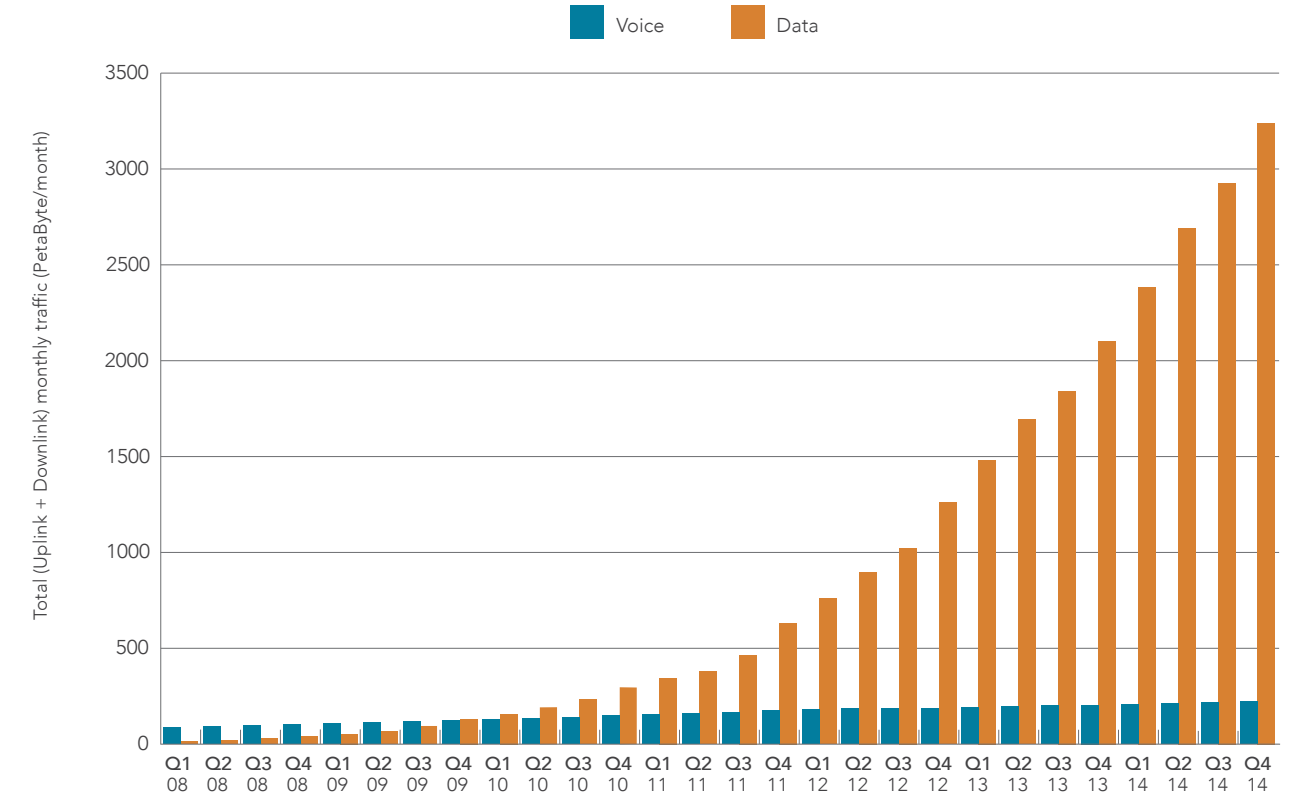


Figure 39: Total Monthly Mobile Voice and Data as Measured by Ericsson

[SECTION]9 SITUATIONAL PERFORMANCE

In June 2013, Akamai announced[44] the latest release of Ion, a solution designed to meet the unique challenges of optimizing both the desktop and mobile Web experience. One component of Ion is a capability known as Real User Monitoring (RUM), which takes passive performance measurements from actual users of a Web experience in order to provide insight into performance across devices and networks. RUM is a complementary capability to synthetic testing, and the two can and should be used in conjunction to gain a comprehensive picture of user experience.

Note that there are a few different RUM measurement methodologies. The first is using what is known as "navigation timing"[45] ("navtiming"), which allows JavaScript to collect page load time component information directly from the user agent (browser) through an API. The second is to use a framework for timing Web pages, like Web Episodes[46] — which leverages JavaScript events such as "onload." While navtiming is the preferred methodology for collecting RUM measurements, not every user agent supports it at this time.[47] One key

observation is the current lack of support in Apple's Safari browser, both on OSX and iOS. In addition, Android first added navtiming support starting with version 4.0 ("Ice Cream Sandwich") of the operating system, and Microsoft's Internet Explorer in version 9 of the browser. It was discovered in July that a beta version of Safari for OSX and iOS 8 included support for the navigation timing API, meaning that Akamai will be able to collect RUM data from these browsers once production support for navtiming is available.[48] However, it appears that this support may have been short-lived, at least on iOS, as the iOS 8.1.1 release notes state: "The Navigation Timing API has been disabled only on iOS due to performance issues."[49] Presumably, Apple will enable the functionality again in the future, once the performance issues have been addressed.

Figure 40 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 2014. The underlying data was collected with navtiming; therefore, as noted above, it does not include measurements from users of Safari on iOS devices or OS X systems, older versions of Android, or older versions of Internet Explorer. The countries included within the table were selected based on several criteria, including the availability of measurements from users on networks identified as broadband as well as networks identified as mobile, and more than 90,000 measurements (1,000 per day, on average) from mobile networks across the quarter. Note that these criteria are subject to change in the future as we expand the scope of RUM measurements included within the *State of the Internet Report*.

In reviewing the average page load time measurements for broadband connections shown in Figure 40, we find the lowest values (i.e. fastest page load times) in Japan, Turkey, and Hong Kong, with average load times all around 2 seconds. This was less than one-third the time measured in the slowest country, Brazil, where pages took roughly 6.6 seconds to load on average. Australia and Paraguay rounded out the bottom three in terms of broadband measurements, both with load times of approximately 5.4 seconds.

In terms of mobile page load times, Spain surprisingly topped the list as the only country with a sub-second average load time. Spain's ultrafast 850 ms time for the fourth quarter is more than half a second faster than its 1462 ms measurement for the third quarter. Note that page load time measurements do not just reflect mobile network speeds, as they can be influenced by factors such as average page weight as well. Turkey and Iran were the next fastest countries, seeing average mobile page load times of 1.2 and 1.6 seconds, respectively. At the other end of the spectrum, Taiwan, Brazil, and India had the highest average load times for mobile connections, with Taiwan and Brazil taking an average of 9 seconds each, and India seeing average page load times just shy of 7 seconds. These numbers are all higher than in the third quarter, which may be a result of more content-rich pages being downloaded over mobile devices.

In comparing the average broadband page load times to those observed on mobile connections, we find a variance in what we have dubbed the "mobile penalty" — that is, how much slower a page loads on average through mobile connections vs. broadband connections. Surprisingly, of the 42 countries/regions included in Figure 40, 17 had a mobile penalty lower of 1.0x or less, meaning that the average page load times were faster on mobile connections than on broadband connections. The lowest mobile penalty was observed in Spain, with a 0.3x penalty, followed by Colombia, Turkey, Indonesia, and Iran, all with 0.6x penalties. The highest mobile penalties of 2.0x and 2.4x were seen in Hong Kong and Taiwan, meaning that pages loaded at least twice as fast on average through broadband connections compared with mobile connections.

As more customers integrate Akamai's RUM capabilities, and as more platforms support the navigation timing API, we expect that we will be able to expand the scope of the Situational Performance measurements presented within future issues of the *State of the Internet Report*.

Region	Country/ Region	Avg. Page Load Time Broadband (ms)	Avg. Page Load Time Mobile (ms)	Mobile Penalty
APAC	Australia	5406	5694	1.1x
APAC	China	4692	6213	1.3x
APAC	Hong Kong	2093	4126	2.0x
APAC	India	4460	6972	1.6x
APAC	Indonesia	4486	2692	0.6x
APAC	Iran	2592	1637	0.6x
APAC	Japan	1961	3354	1.7x
APAC	Kuwait	2925	2005	0.7x
APAC	Malaysia	4658	5028	1.1x
APAC	Singapore	4446	6528	1.5x
APAC	Sri Lanka	4752	4079	0.9x
APAC	Taiwan	3870	9177	2.4x
APAC	Thailand	3404	3822	1.1x
EMEA	Austria	2342	3146	1.3x
EMEA	Czech Republic	2528	2778	1.1x
EMEA	Egypt	3456	2632	0.8x
EMEA	France	3263	3839	1.2x
EMEA	Germany	3211	5524	1.7x
EMEA	Hungary	2552	2643	1.0x
EMEA	Ireland	3067	4546	1.5x
EMEA	Italy	3602	4885	1.4x
EMEA	Morocco	2883	2287	0.8x
EMEA	Norway	2969	4139	1.4x
EMEA	Poland	2583	3112	1.2x
EMEA	Romania	2237	1825	0.8x
EMEA	Slovakia	2651	2642	1.0x
EMEA	Spain	2565	850	0.3x
EMEA	Sweden	2255	3281	1.5x
EMEA	Switzerland	2570	3480	1.4x
EMEA	Turkey	2005	1198	0.6x
EMEA	Ukraine	3049	2494	0.8x
EMEA	United Kingdom	3798	5014	1.3x
N. America	Canada	3187	4817	1.5x
N. America	El Salvador	3546	3326	0.9x
N. America	United States	2863	4068	1.4x
S. America	Argentina	3833	3906	1.0x
S. America	Brazil	6553	8954	1.4x
S. America	Chile	2989	3340	1.1x
S. America	Colombia	3061	1759	0.6x
S. America	Paraguay	5413	4248	0.8x
S. America	Uruguay	3479	4121	1.2x
S. America	Venezuela	4470	4467	1.0x
N. America	USA	2863	4068	1.4x
S. America	Argentina	3833	3906	1.0x
S. America	Brazil	6553	8954	1.4x
S. America	Chile	2989	3340	1.1x
S. America	Colombia	3061	1759	0.6x
S. America	Paraguay	5413	4248	0.8x
S. America	Uruguay	3479	4121	1.2x
S. America	Venezuela	4470	4467	1.0x

Figure 40: Average Page Load Times Based on Real User Monitoring

[SECTION]10 INTERNET DISRUPTIONS + EVENTS

Internet disruptions are, unfortunately, still all 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 in response to unrest). Because Akamai customer content is consumed by users around the world, the results of these disruptions — whether brief or spanning multiple days — is evident in the levels of Akamai traffic delivered to the affected country/region.

In working with leading content providers, Akamai also has a unique perspective on how major events — whether sports, entertainment, or software related — drive increasingly larger volumes of Internet traffic.

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

10.1 Yemen / On October 28, traffic to Yemen became severely disrupted for about 3.5 hours. As shown in Figure 41, Akamai traffic to the region dropped severely starting just after 5:00 A.M. UTC, with the decline lasting until roughly 8:30 A.M. During this period, traffic levels were generally down to less than one percent of normal. A Twitter post from network monitoring firm BGPmon corroborates that "nearly all" of the Internet in Yemen was down during this the time. The outage came on the heels of three days of violence in central Yemen where 250 people were reportedly killed, though it is not clear whether the two events are related.[50]

10.2 Bangladesh / At 5:30 A.M. UTC on November 1, Akamai saw a sudden 35% drop in traffic to Bangladesh, as seen in Figure 42. Traffic continued to decline further throughout the day before eventually recovering nearly 12 hours later, around 5:15 P.M. UTC. Dyn Research, the Internet monitoring company formerly known as Renesys, noted severe latency impacts in traffic to Bangladesh during this time period as well.[51] The disruptions were due to a country-wide power outage affecting millions for most of the day. Reports indicate the blackout may have been caused by an issue in the transmission line bringing electricity from India to Bangladesh, and took more than 12 hours to fully resolve.[52]

10.3 Turkmenistan / Turkmenistan lost connectivity to the Internet for roughly 2 hours on November 11, from about 8:10 P.M. UTC to 9:55 P.M., as Turkmen Telecom, the country's sole gateway and Internet Service Provider, went down. Akamai traffic to Turkmenistan dropped

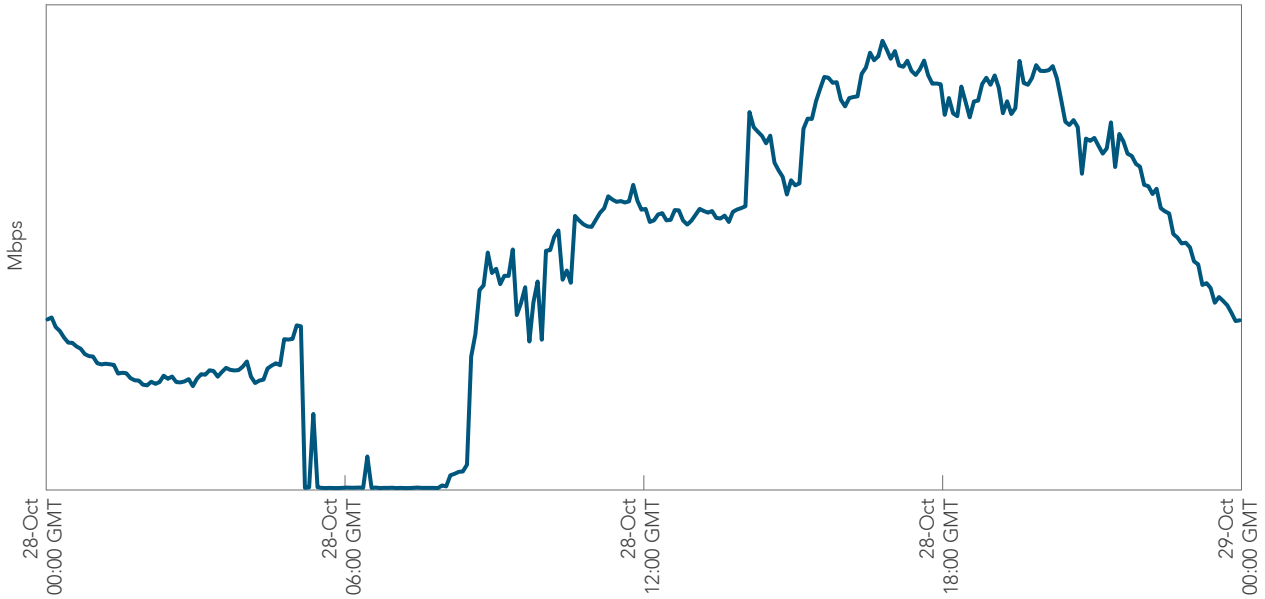


Figure 41: Akamai Traffic Served to Yemen, October 28, 2014

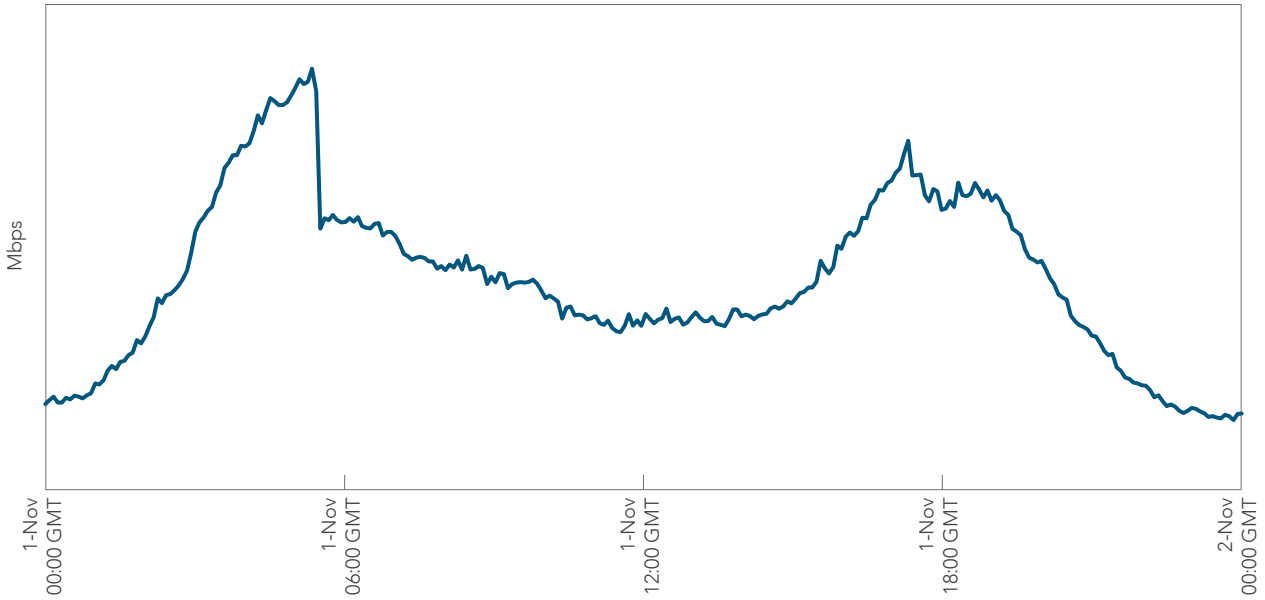


Figure 42: Akamai Traffic Served to Bangladesh, November 1, 2014

nearly to zero during this time, as seen in Figure 43. The outage was also noted by Dyn Research, although we do not have any specific information about the cause.[53]

10.4 Iraq / Just as it has over the last several quarters, in the fourth quarter Iraq experienced Internet disruptions. At 6:00 p.m. UTC on December 19, Akamai saw a sharp decline in traffic to Iraq, with traffic levels dropping nearly 50% within half an hour's time, as shown in Figure 44. Traffic to Iraq began to recover around 7:20 p.m. and fully recovered around 7:50 p.m.. Dyn Research noted that Earthlink, a major Iraqi ISP, had lost connectivity to IQ Networks during this period.[54] IQ Networks is one of two major Kurdish ISPs (the other being Newroz) that sell transit to Iraq, providing connectivity for roughly three-fourths of Iraqi networks.[55] Not depicted in the figure below is another outage on October 14, when, as Dyn Research observed, 41% of Iraq's Internet went down due to an IQ Networks failure.[56]

10.5 North Korea / North Korea suffered a series of widely reported Internet outages in late December 2014. The longest outage lasted nearly 10 hours, beginning just after 4:00 p.m. UTC on December 22 and lasting until nearly 2:00 a.m. UTC on December 23. Akamai traffic to the region was extremely spotty throughout the day, as shown in Figure 45, dropping to zero 6 times throughout the morning for intervals ranging from 10 to 30 minutes each, and then followed by an outage of slightly more than 2 hours starting at 12:20 p.m. UTC before finally succumbing to the prolonged outage that began just after 4:00 p.m. Tweets from

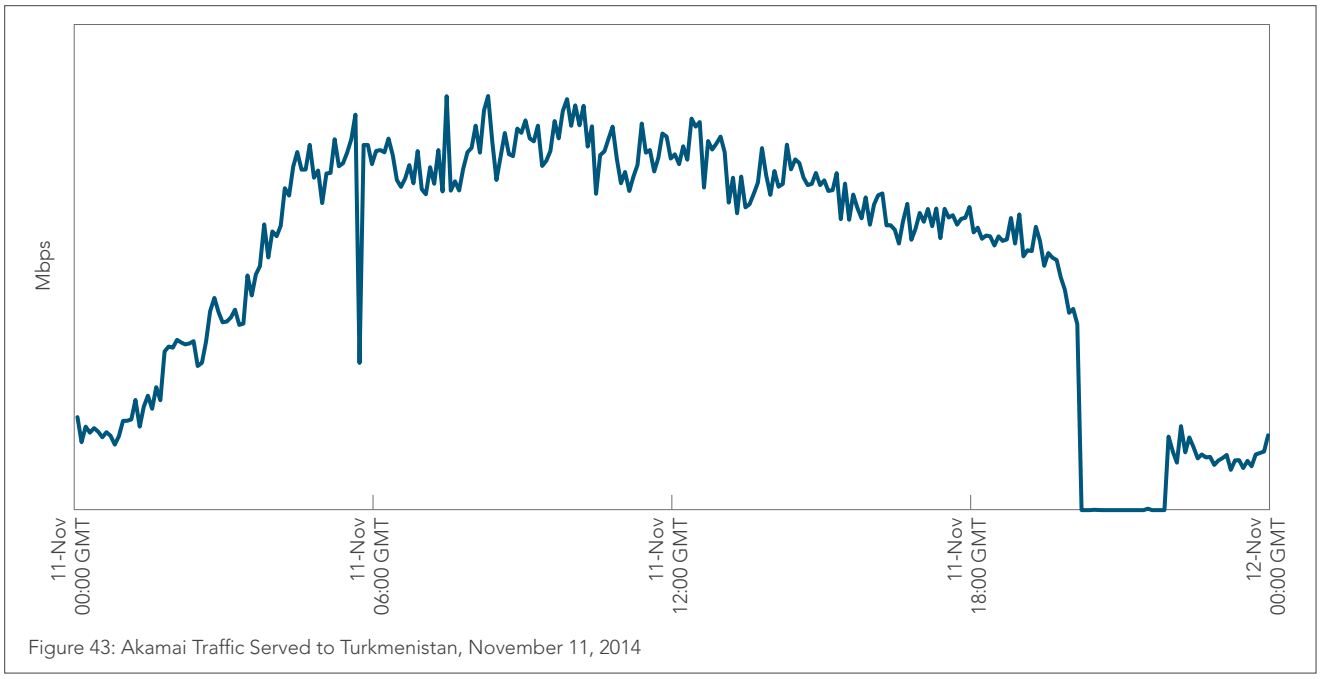


Figure 43: Akamai Traffic Served to Turkmenistan, November 11, 2014

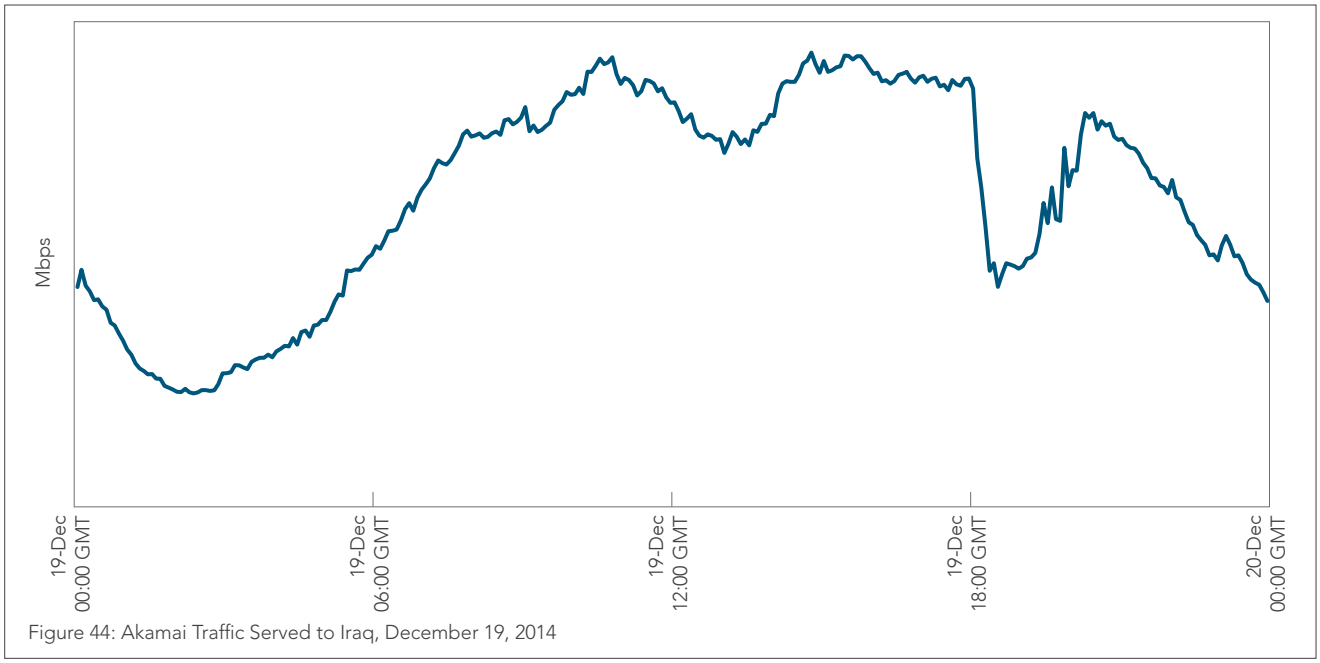


Figure 44: Akamai Traffic Served to Iraq, December 19, 2014

BGPMon and Dyn Research also reflect that all of North Korea's networks were unreachable at these times.[57, 58] Connectivity remained poor for the rest of the day on December 23, dropping to zero several times, including a one-hour outage at 6:25 A.M. UTC. A few days later, on December 27, Akamai saw traffic to North Korea drop to zero again for four and a half hours, from around 10:30 A.M. to 3:00 P.M. UTC, followed by spotty traffic outages throughout the day, as shown in Figure 46.

These outages may be the result of denial-of-service attacks against North Korea,[59] related to a series of events beginning with a hacking attack against Sony Pictures that came to light on November 24.[60] The Sony hack involved a breach of Sony's computer systems, installation of Wiper malware (designed to erase data), and the theft and public release of confidential company and employee data — including several unreleased films.[61, 62] In addition, there were threats of terror attacks on movie theaters, should the Sony movie *The Interview* be shown.[63] The U.S. government has accused North Korea of being behind the Sony attacks,[64] while North Korea has accused the United States of being behind its Internet outages in wrongful retaliation. However, the United States has unofficially denied involvement in the outages,[65] and hacktivist groups Anonymous and Lizard Squad have hinted at taking credit. The United States government began rolling out sanctions against North Korea in early January 2015 as official retribution for the Sony attacks.[66]

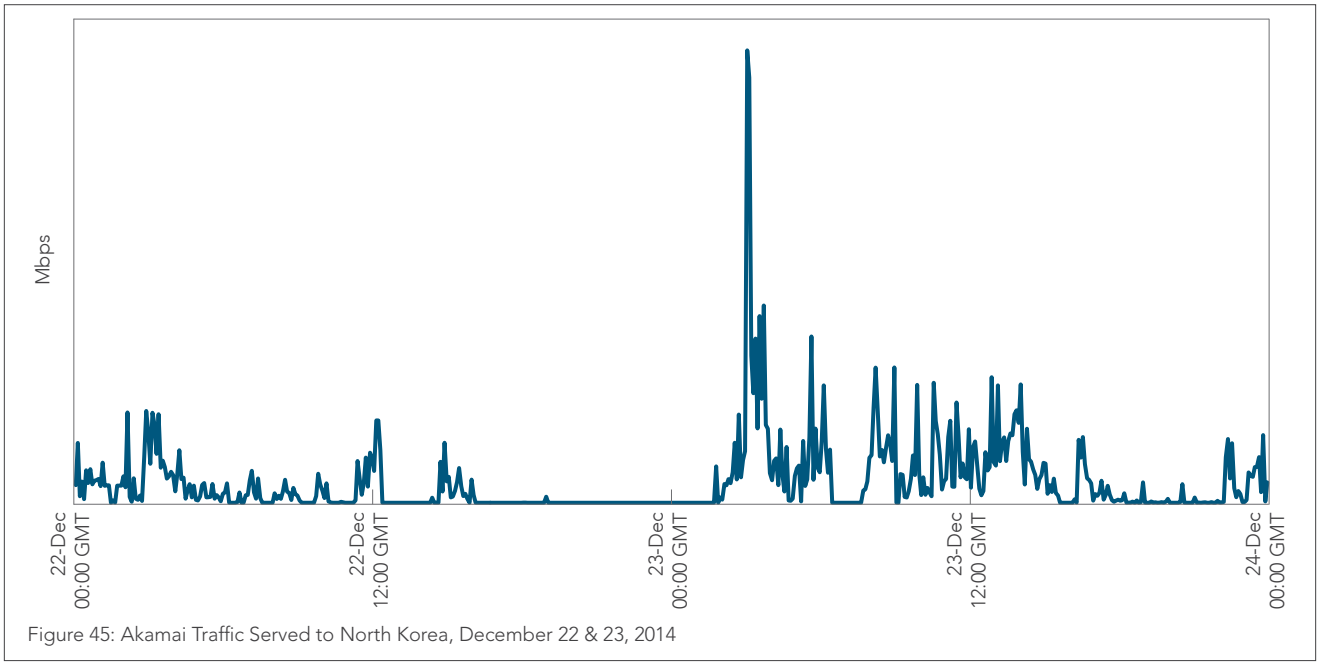


Figure 45: Akamai Traffic Served to North Korea, December 22 & 23, 2014

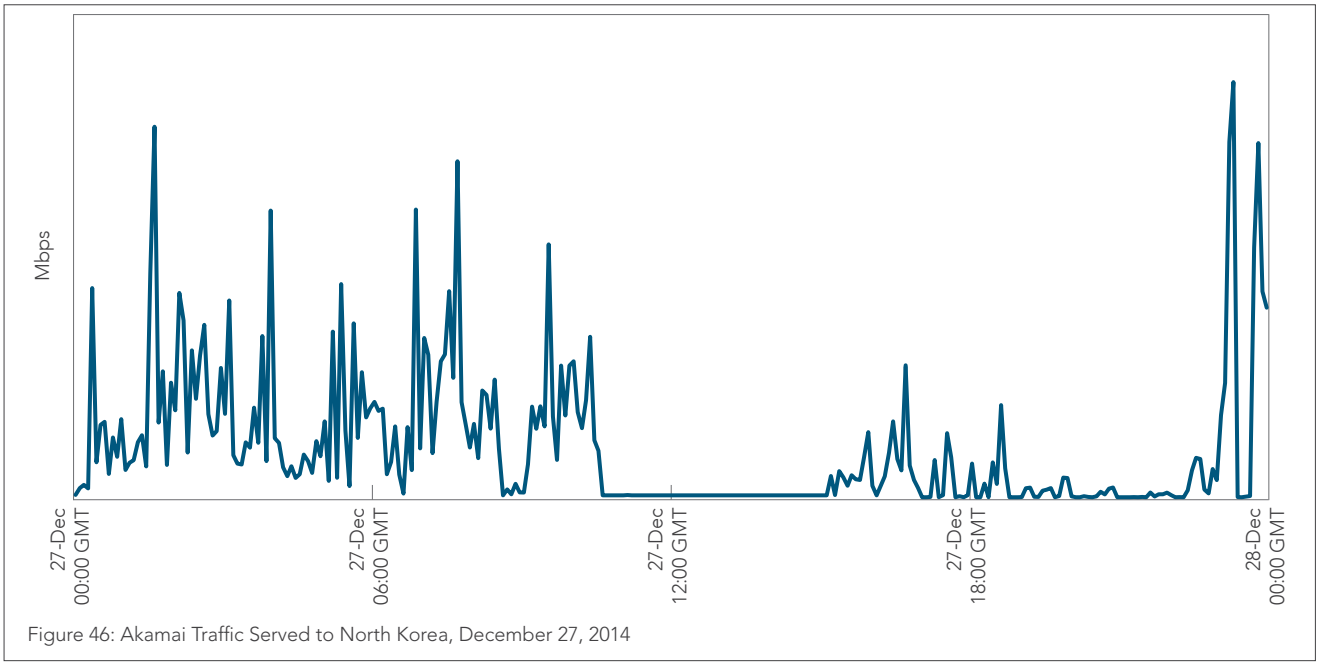


Figure 46: Akamai Traffic Served to North Korea, December 27, 2014

Region	% Attack Traffic	Unique IPv4 Addresses	Average Connection Speed (Mbps)	Peak Connection Speed (Mbps)	% Above 10 Mbps	% Above 4 Mbps	% Above 15 Mbps
AMERICAS							
Argentina	0.7%	7,500,411	4.5	23.4	7.4%	38%	1.3%
Bolivia	<0.1%	561,393	1.2	10.2	0.1%	1.4%	<0.1%
Brazil	2.3%	47,254,335	3.0	21.9	1.9%	26%	0.5%
Canada	0.9%	14,512,083	10.7	46.3	38%	85%	16%
Chile	0.3%	3,999,555	5.0	32.5	5.8%	53%	1.4%
Colombia	0.5%	11,235,012	3.7	24.7	2.0%	31%	0.5%
Costa Rica	<0.1%	471,372	2.8	13.2	0.8%	14%	0.4%
Ecuador	0.1%	999,930	3.7	21.7	2.4%	30%	0.5%
Mexico	1.0%	12,989,798	4.5	24.3	3.5%	43%	1.0%
Panama	0.1%	442,400	2.9	14.9	0.9%	17%	0.2%
Paraguay	<0.1%	181,956	1.4	10.1	0.1%	1.2%	<0.1%
Peru	<0.1%	1,149,874	4.0	23.1	1.3%	39%	0.2%
United States	13%	151,386,342	11.1	49.4	39%	74%	18%
Uruguay	0.2%	1,245,722	5.9	63.3	9.9%	63%	3.2%
Venezuela	1.3%	3,782,243	1.4	11.7	0.2%	1.7%	0.1%
ASIA PACIFIC							
Australia	0.4%	9,016,245	7.4	36.9	16%	69%	6.5%
China	41%	125,400,588	3.4	17.8	1.1%	27%	0.2%
Hong Kong	1.3%	3,113,786	16.8	87.7	60%	91%	41%
India	2.4%	18,240,827	2.0	14.5	1.1%	7.8%	0.4%
Indonesia	0.7%	6,045,022	1.9	13.4	0.3%	4.6%	0.1%
Japan	0.8%	42,348,735	15.2	69.0	56%	88%	34%
Malaysia	0.6%	2,113,530	4.1	29.6	3.7%	40%	0.9%
New Zealand	0.1%	2,126,509	7.3	34.3	15%	80%	4.7%
Philippines	0.3%	1,391,627	2.7	21.9	0.6%	9.8%	0.2%
Singapore	0.2%	1,669,997	11.7	84.0	40%	81%	21%
South Korea	2.8%	22,085,941	22.2	75.4	79%	95%	61%
Taiwan	4.4%	11,035,501	10.6	64.2	37%	86%	17%
Thailand	1.0%	3,396,808	7.1	46.3	13%	86%	3.8%
Vietnam	1.0%	5,850,654	2.7	17.3	0.4%	19%	0.1%
EUROPE, MIDDLE EAST & AFRICA							
Austria	0.2%	2,993,977	9.8	41.1	26%	87%	13%
Belgium	0.2%	4,999,410	10.8	51.6	43%	87%	19%
Czech Republic	0.2%	2,014,572	12.3	45.7	41%	84%	21%
Denmark	0.1%	3,003,393	11.9	44.1	44%	92%	21%
Finland	<0.1%	2,944,764	12.1	47.4	40%	83%	21%
France	1.0%	28,813,162	7.1	31.5	15%	70%	5.5%
Germany	1.8%	38,184,416	8.8	41.0	24%	80%	9.4%
Hungary	0.4%	2,937,718	8.7	45.5	28%	82%	11%
Ireland	0.1%	1,994,451	12.7	52.1	33%	68%	16%
Israel	0.3%	2,477,430	10.6	60.5	41%	92%	15%
Italy	1.1%	18,783,459	5.6	26.9	5.7%	61%	2.2%
Netherlands	1.2%	9,295,569	14.2	56.4	56%	91%	30%
Norway	<0.1%	3,906,601	11.4	42.5	35%	80%	22%
Poland	0.7%	8,145,998	8.8	40.7	26%	83%	11%
Portugal	0.1%	3,660,508	8.0	44.3	25%	75%	9.6%
Romania	1.1%	3,247,317	11.6	67.0	55%	89%	23%
Russia	3.2%	19,277,054	9.0	49.6	29%	82%	11%
Slovakia	<0.1%	1,095,857	8.2	39.9	20%	68%	10%
South Africa	0.1%	6,378,613	3.2	15.1	2.6%	19%	1.4%
Spain	0.5%	15,000,985	8.2	39.6	22%	78%	9.7%
Sweden	0.3%	6,298,071	14.6	57.3	47%	87%	31%
Switzerland	0.4%	3,755,302	14.5	57.0	56%	93%	30%
Turkey	2.9%	9,591,189	5.8	33.7	9.0%	63%	3.5%
United Arab Emirates	0.2%	1,442,321	5.7	51.2	9.2%	62%	2.1%
United Kingdom	0.9%	28,910,888	10.9	48.8	38%	83%	22%

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