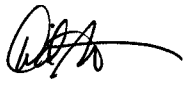
akamai's [state of the internet]

The so-called "Internet of Things" has seen spectacular growth over the last year, and it shows no signs of slowing, as evidenced by this year's Consumer Electronics Show. More and more devices are acting as Internet-connected sensors, generating an ever-increasing amount of data, while the number of devices and systems that are consuming, aggregating, analyzing, and acting upon that data is growing as well. While the Internet of Things will have positive impacts on global broadband trends, driving continued growth in Internet usage, IP address consumption, and Internet traffic, we need to ensure that we do not lose sight of related security and privacy concerns as well. In many cases, the communications protocols or APIs used by these connected devices are only secured as an afterthought, or worse, not secured at all, transmitting data in the clear. As the Internet of Things begins to play an increasingly more important role across our daily lives, the providers of these "things" and their associated services need to ensure that that their devices, protocols, and APIs are secure, with the goals of maintaining privacy of the associated data as well as ensuring that communications (including command/control messages and data exhaust) cannot be manipulated or injected by unauthorized third parties. While we are not breaking out traffic and usage from these Internet-enabled devices in order to analyze them for this report, recent *State of the Internet — Security* reports have highlighted the potential security threats both to and from these new Internet-enabled devices.

As mentioned last quarter, the recently launched *State of the Internet* Web site, at *www.stateoftheinternet.com* is a permanent home for this report and the quarterly *State of the Internet — Security* report series, as well as security threat advisories and data visualizations. Our goal is to regularly refresh the site with new and updated content, and to that end, an IPv6 visualization launched in October provides trends over time on IPv6 adoption at both a country and network level, while a refreshed connectivity visualization launching in conjunction with this quarter's report provides insight into key report metrics through regional maps that can be saved for external use or social sharing.

In addition to the *State of the Internet Web* site, a version of the *State of the Internet* application for Android devices was released on the Google Play app store in October, and we've made an updated version of the iOS application available through the Apple iTunes App Store in conjunction with this quarter's report as well. Links to both mobile applications can be found on the home page at *www.stateoftheinternet.com*.

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. And if you have access to the Akamai Community, look for the State of the Internet subspace, and interact with us there as well.



—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 third quarter of 2014, covering attack traffic and Internet connection speeds/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 third quarter of 2014, Akamai observed attack traffic originating from source IP addresses in 201 unique countries/regions. Note that our methodology captures the source IP address of an observed attack, and cannot determine attribution of an attacker. China remained the top source, growing once again to reach 49% of observed attack traffic. Second place United States saw a nominal quarterly increase, to 17%, while Indonesia, which was second to China last quarter, saw its share of observed attack traffic drop from 15% to 1.9% in the third quarter. The overall concentration of observed attack traffic decreased slightly in the third quarter, with the top 10 countries/regions originating 82% of observed attacks. Attack traffic targeting Port 23 was up 30% from the second quarter to 12%, making it the most targeted port in the third quarter, displacing Port 445 from the top slot for the second consecutive quarter, and the fourth time in the history of the report. During the third quarter, Akamai customers reported being targeted by 270 DDoS attacks, which was the same number reported in the second quarter. Just more than half of the total attacks were reported by customers in the Americas region, while nearly twice as many were reported by customers in the Asia Pacific region than in EMEA. An increasing number of the reported attacks targeted customers in the Enterprise and Media & Entertainment verticals, while customers in the High Tech, Commerce, and Public Sector verticals reported fewer attacks. In addition, the third quarter saw the emergence of multiple significant security vulnerabilities, the growth of several new DDoS and crimeware toolkits, and a set of attacks targeting sites associated with countries participating in World Cup matches.

Internet and Broadband Adoption / In the third quarter, Akamai observed a 0.3% quarterly increase in the number of unique IPv4 addresses connecting to the Akamai Intelligent Platform, growing to just over 790 million, or about two million more than were seen in the second quarter of 2014. Belgium remained the global leader in IPv6 adoption, with 27% of connections to Akamai in the third quarter occurring over IPv6. Looking at connection speeds, the global average connection speed dropped 2.8% to 4.5 Mbps, and the global average peak connection speed fell 2.3% to 24.8 Mbps. At a country/region level, South Korea continued to have the highest average connection speed at 25.3 Mbps but Hong Kong again had the highest average peak connection speed at 84.6 Mbps. Globally, high broadband (>10 Mbps) adoption dropped 0.5% but remained at 23%, and South Korea remained the country with the highest level of high broadband adoption, growing to 81%. Global broadband (>4 Mbps) adoption grew 1.0% quarter-over-quarter to 60%, and South Korea's broadband adoption rate increased slightly to 96% in the third quarter. "4K-ready" (>15 Mbps) connections declined 2.8% on a global basis; in global leader South Korea, 66% of connections to Akamai were at those speeds.

Mobile Connectivity / In the third quarter of 2014, average mobile connection speeds (aggregated at a country/region level) ranged from a high of 18.2 Mbps in South Korea down to a low of 0.9 Mbps in Iran. Average peak mobile connection speeds ranged from 98 Mbps in Singapore down to 3.3 Mbps in Iran. Sweden had 94% of its mobile connections to Akamai at speeds above the 4 Mbps "broadband" threshold, while four countries had 1% or fewer of connections at those speeds. Based on traffic data collected by Ericsson, the volume of mobile data traffic grew by approximately 10% between the second and third quarters of 2014.

Analysis of Akamai IO data collected during the third 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 39% of requests, with Android Webkit trailing at nearly 31%. For traffic from mobile devices on all networks, Apple Mobile Safari was responsible for just over 50% of requests, while Android Webkit drove just under 30%.

[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 third quarter of 2014.

It also includes insights into DDoS attacks that targeted Akamai customers during the third quarter of 2014, as well as information about Shellshock, World Cup-related attacks, the Blackshades RAT crimeware kit, newly discovered vulnerabilities in OpenSSL, the Spike DDoS toolkit, and Linux systems being exploited for DDoS attacks. 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 third quarter of 2014, Akamai observed attack traffic originating from 201 unique countries/regions, up significantly from 161 in the second quarter, and more in line with the 194 seen in the first quarter. As shown in Figure 1, China remained well ahead of the other countries/regions in the top 10, originating nearly half of the observed attacks, nearly 3x more than the United States, which saw observed attack volume grow by approximately 25% quarter-over-quarter. China and the United States were the only two countries to originate more than 10% of observed attack traffic during the third quarter — the remaining countries/regions were all below 10%. Indonesia was the only country among the top 10 to see observed attack traffic decline, dropping significantly from 15% in the second quarter to 1.9% in the third quarter. The overall concentration of observed attack traffic decreased slightly in the third quarter, with the top 10 countries/regions originating 82% of observed attacks, down from 84% in the second quarter.

Presumably related in part to the significant percentage decline seen in Indonesia, observed attack traffic concentration from the Asia Pacific region dropped to 64% in the third quarter, down from 70% in the previous quarter. North America had the next highest concentration, at 19% of observed attacks (comprised mostly of attacks originating in the United States), up from 14% last quarter, while Europe remained steady at 11% of observed attacks. South America and Africa both originated less than 10% of observed attacks, responsible for 5% and 1% respectively.

1.2 Attack Traffic, Top Ports / As shown in Figure 2, the volume of observed attack traffic targeting Ports 80 (HTTP/WWW), 443 (HTTPS/SSL), and 8080 (HTTP Alternate) dropped significantly in the third quarter, with all three ports seeing a fraction of the attack volume seen in the previous quarter. The volume of traffic targeting Port 445 (Microsoft-DS) also fell significantly quarter-over-quarter, moving Port 445 out of first place for the second quarter in a row, and the fourth time in the history of the report. Port 23 (Telnet) saw a nominal increase in observed attack traffic volume, as did Port 8088 — while officially assigned to "Radan HTTP", the port is also known to be used by open Web proxies, the "Lord of the Rings: Battle for Middle Earth" online game, Apple's Software Update, and the Hesive malware, which targets systems running Microsoft Windows.[1] The significant decline in the volume of attacks targeting Web-associated ports, coupled with the growth in attacks targeting Telnet, may indicate a shift in attack vectors from ones that target known exploits in Web-based software to ones attempting brute-force logins on the underlying server infrastructure.

Port 23 remained the most popular target of attacks observed to be originating in China, accounting for over 3x more volume than Port 80, the second-most attacked port from the country. Port 23 was also again the top targeted port for attacks from India, Turkey and South Korea. Although the United States, Taiwan, Russia, Brazil, and Venezuela all saw the largest number of attacks targeting Port 445, the ongoing decline in related attack volume targeting the port may indicate removal of systems harboring Conficker from the Internet — as these compromised systems age or fail, they may be replaced/upgraded with newer uninfected systems. Indonesia was the sole outlier among the top 10 countries, with the largest number of attacks from the country targeting Port 80, followed closely by Port 443. It appears that attacks originating in China were largely responsible for pushing Port 8088 into the top 10 for the first time — a search of the Web does not uncover any reported increases of related attacks, so this growth may have been caused by software searching for open Web proxies, either for the purpose of anonymizing the user's Web activity, or possibly to cloak the true source of a planned attack.

	Country/Region	Q3 '14 Traffic %	Q2 '14 %
1	China	49%	43%
2	United States	17%	13%
3	Taiwan	3.8%	3.7%
4	India	2.9%	2.1%
5	Russia	2.1%	2.0%
6	Indonesia	1.9%	15%
7	Brazil	1.9%	1.7%
8	South Korea	1.4%	1.4%
9	Turkey	1.3%	1.2%
10	Venezuela	1.2%	1.0%
–	Other	18%	16%

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

Port	Port Use	Q3 '14 Traffic %	Q2 '14 %
23	Telnet	12%	10%
445	Microsoft-DS	8.1%	14%
80	HTTP (WWW)	4.6%	15%
1433	Microsoft SQL Server	2.9%	6.7%
3389	Microsoft Terminal Services	2.6%	4.3%
8080	HTTP Alternate	2.5%	5.5%
22	SSH	1.8%	3.4%
443	HTTPS (SSL)	1.3%	7.7%
3306	MySQL	1.1%	2.1%
8088	Radan HTTP	0.8%	0.5%
Various	Other	62%	–

Figure 2: Attack Traffic, Top Ports

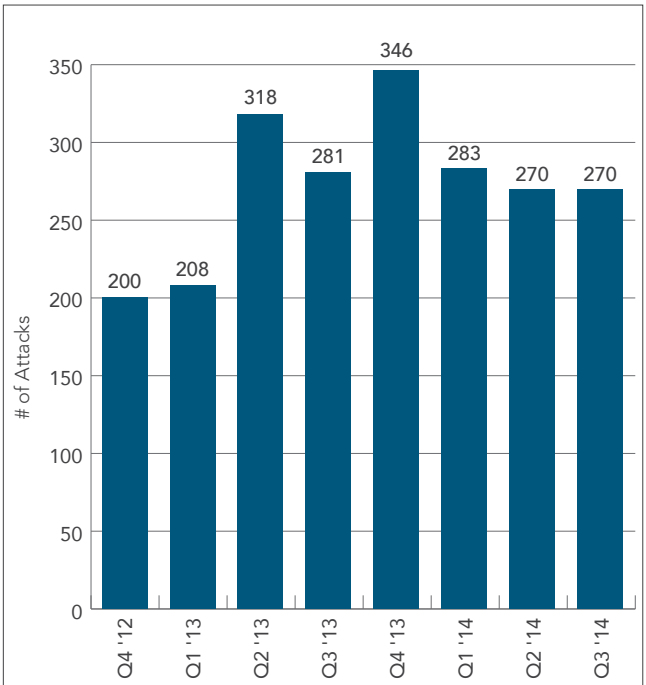


Figure 3: DDoS Attacks Reported by Akamai Customers by Quarter

1.3 Observations on DDoS Attacks / In the third quarter of 2014, the number of DDoS attacks reported to Akamai by customers remained consistent, with 270 attacks reported for the second quarter in a row, as shown in Figure 3. Overall, this represents a 4.5% reduction in attacks since the beginning of 2014 and a 4% decrease in comparison to the third quarter of 2013. Despite the increase in size and frequency of network layer attacks reported in the *Third Quarter, 2014 State of the Internet — Security Report*, higher layer attacks against applications and Web properties remain a steady problem.

As shown in Figure 4, the number of attacks fell in both the Americas, with 142 attacks, and in the Europe, Middle East, and Africa (EMEA) region, with 44 attacks. Meanwhile, the number of attacks in the Asia Pacific (APAC) region rose by 25% from the previous quarter, which brought the total number of attacks in the APAC region to 84 for the third quarter. This represents an 18% increase from the same quarter in 2013, when 71 attacks against targets in the region were reported. The increased number of attacks in the APAC region made up for the decreases in the rest of the world, maintaining consistency in the number of attacks worldwide.

Overall, attacks in the Americas fell 8% quarter over quarter, from 154 to 142, and the volume was 14% lower than the third quarter of 2013, dropping from 165 last year. While EMEA saw a 10% decrease in attacks from the previous quarter, a reduction from 49 reported attacks to 44, the numbers for the region remained fairly consistent with the same quarter in 2013, when 45 attacks were reported.

The third quarter saw a significant redistribution of the industries targeted by attacks, with both Enterprise and Media & Entertainment experiencing an increase in the number of attacks, while all other industries experienced fewer attacks, as Figure 5 illustrates. Commerce dropped 15%, from 78 to 66 attacks, while the High Tech vertical dropped from 42 attacks to 34, a 19% decrease. However, the largest decline was seen in Public Sector, with a 27% decrease in reported attacks, from 30 to 22.

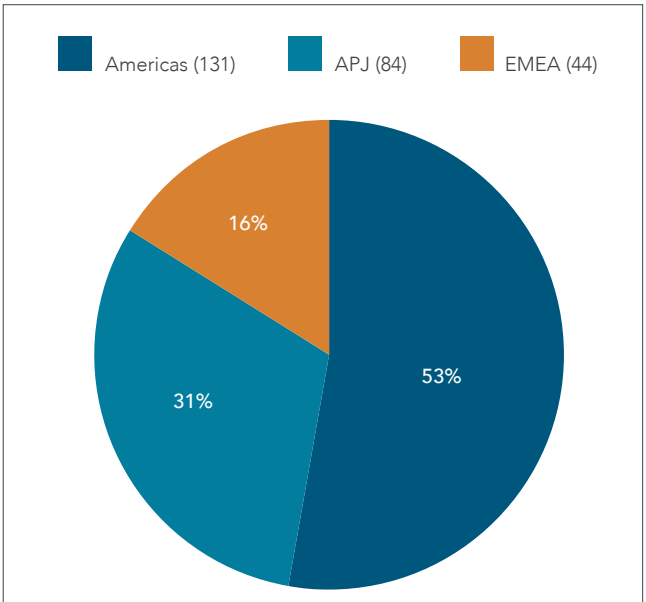


Figure 4: Q3 2014 DDoS Attacks by Region

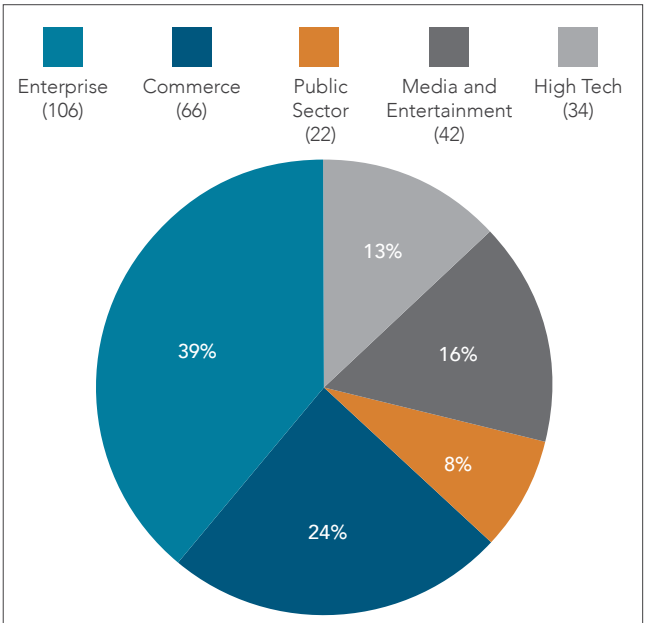
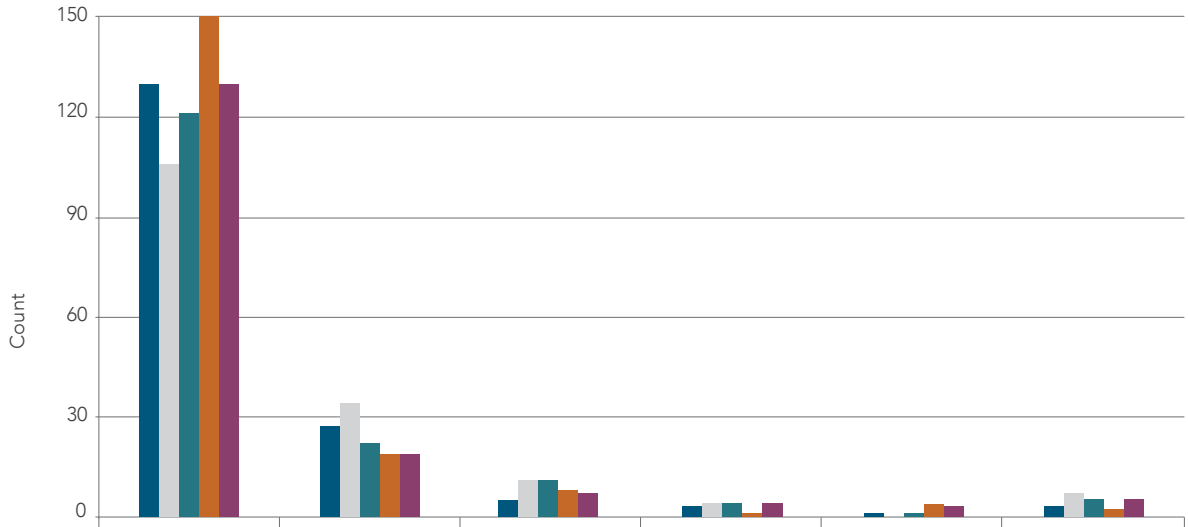


Figure 5: Q3 2014 DDoS Attacks by Sector



	1	2	3	4	5	>5
2013 Q3	130	27	5	3	1	3
2013 Q4	106	34	11	4	0	7
2014 Q1	121	22	11	4	1	5
2014 Q2	150	19	8	1	4	2
2014 Q3	130	19	7	4	3	5

Figure 6: Frequency of Repeated DDoS Attacks

Akamai saw an increase in the number of repeated attacks against the same target in the third quarter, returning to the 25% chance of a subsequent attack targeting the same organization, as Figure 6 highlights. This represents a drop in unique targets from 184 in the second quarter to 174 in the third quarter. A large number of the repeated attacks were in the APAC region, reinforcing the potential that many of the attacks in the region were motivated by civil unrest.

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 to enable our clients to deal with the sudden spikes in Web site requests, such as during holiday sales or flash mobs created by news events. Malicious traffic often attempts to overload sites by mimicking this type of event and the 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 that are 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 the attacks about which Akamai is reporting here 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 third quarter of 2014 was dominated by the Shellshock vulnerabilities and attack activity targeting Web sites critical to coverage of the World Cup. Akamai also saw an increase in the use of attack tools like Blackshades RAT and the Spike DDoS toolkit. The third quarter was also notable for DDoS attacks targeting vulnerabilities in Linux systems.

Shellshock / In late September, researchers revealed serious vulnerabilities in Bash (Bourne Again Shell), which came to be known as Shellshock. Bash is a common shell for evaluating and executing commands from users and other programs.

Researchers determined that Shellshock exists in a feature of Bash called "function importing," in which environment variables are imported into a Bash shell, and the text of that variable is parsed and evaluated by the shell as code. If the variable definition contains functions, those functions are then evaluated. It is a common

practice to pass structured data from a program to a sub-program by means of environment variables. In particular, CGI scripting uses environment variables to communicate HTTP headers and query parameters from a Web server to a Web application. There are a large number of ways in which these vulnerabilities can occur on any given system, and Akamai Security Researcher Daniel Franke offers several examples on his blog.[2]

There are two sets of vulnerabilities. One set (CVE-6271, CVE-7169, CVE-6277, and CVE-6278) is triggered by an import of a function with the string '() {' in it; these vulnerabilities can be mitigated in Web applications with a Web Application Firewall (WAF) rule. The other vulnerabilities (CVE-7186 and CVE-7187) require the ability to execute code in a Web application context; that capability is a greater risk than the vulnerabilities themselves.

Vendors published patches for these CVEs, but system administrators should take care to note that some patches only cover some of the exposure. The defensive options available to systems administrators included:

- Staying up-to-date on the patches as they change
- Taking a patch to disable function exporting entirely
- Switching to an alternate shell.

Other suggested mitigations included:

- Deploying WAF rules to filter traffic to vulnerable Web applications
- Reducing the number of users who have access to vulnerable systems through authenticated interfaces
- Disabling applications that may be exposed.

Akamai took actions to protect its own systems, developing a patch and outlining which systems were affected. Specifically:

- The function-import related vulnerabilities are covered by the patch published by Akamai, which completely removes the flawed feature.

- The stack and loop issues outlined above might remain, depending on whether upstream patches are picked up and applied.

- Issues outlined in the final CVE listed above may stem from the fact that slashes are allowed in function names. Akamai's patch fixes that as well.

Akamai also established a set of WAF rules to protect customers.

World Cup Attacks / The World Cup was the dominant sporting event during the Summer of 2014 and, as Akamai's CSIRT team had been predicting, attackers took full advantage of the media spotlight. According to statistics on Web application layer attacks collected by Akamai's Cloud Security Intelligence platform, the 2014 World Cup soccer matches spurred sophisticated cyber attacks between soccer-fan-hackers of competing sides.

In order to monitor and detect attacks correlated to World Cup soccer matches, Akamai's threat research team harnessed its unique visibility into the massive volume of traffic handled by the Akamai Intelligent Platform, and ran big data queries looking for attacks originating from source IP addresses related to countries participating in each soccer match, and targeting Web sites with a country-code top level domain associated with the countries playing in that match.

For example, the first match in the World Cup was held on June 12, 2014, and was between Brazil and Croatia. A relevant query would look for Web application layer attack events originating from IP addresses coming from Brazil (BR) or Croatia (HR), and targeting Web sites ending with either ".br" (Brazil's country-code top level domain), or ".hr" (Croatia's country-code top level domain). In order to make sure that spikes in malicious traffic were not something usual between the two countries, data was extracted for longer periods — for example, six days prior to the match, and six days after (when applicable).

Based on Akamai's data, there were several soccer matches that were accompanied by Web application hacking campaigns. Malicious users leveraged several different attack vectors, with the most prominent vectors being application-layer Denial of Service (DoS) attacks, SQL Injection, PHP code injection, and Remote File Inclusion.

Five games that spurred online hacking campaigns were:

- Brazil vs. Croatia (June 12th)
- Spain vs. Netherland (June 13th)
- Chile vs. Australia (June 16th)
- Cote D'Ivoire vs. Japan (June 17th)
- Brazil vs. Chile (June 28th)

A closer analysis of the Brazil vs. Croatia data reveals a clear spike in the number of attacks originating from Croatia around the same time that the match took place. The target of attack was a major Brazilian financial institution, and the attack vector was almost entirely made of attempts at exploiting SQL Injection vulnerabilities. Behind this attack were two separate Croatian IP addresses, belonging to different network providers. Upon analyzing the HTTP traffic and the attack payloads themselves, however, it was clear that a single entity was behind both attacks. In addition to the attack data mentioned above, we also identified one of the offending IP addresses in Akamai's client reputation database, which indicated that the same IP address has been actively performing SQL Injection attacks on other targets on the Internet.

The analysis of the Spain vs. Netherlands application layer attack events also revealed interesting findings. It seems that one attacker unhappy with the game's outcome decided to retaliate against the not-so-favorable match results with a focused application layer denial of service (DoS) attack against a Dutch news Web site. Interestingly, most attack requests came from a single Dutch IP address. The target page was the main sports section of the site, and

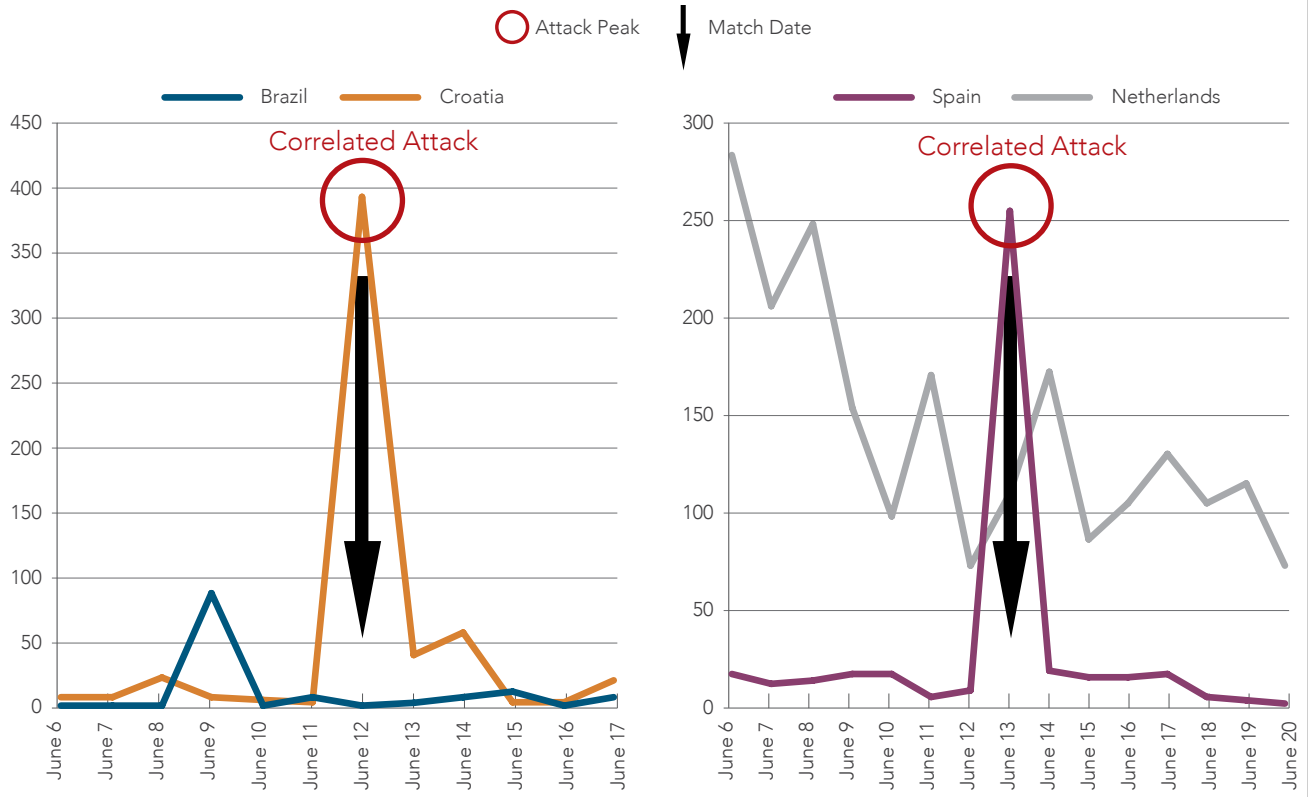


Figure 7: Attack Events Correlated With World Cup Matches (Thousands of Requests/Second)

the "Referer" header (the page from which the current request came from) pointed to a news article describing the glorious day for the Netherlands.

A close inspection of nearly 250,000 HTTP requests that were part of the attack revealed that the attacker definitely knew what he/she was doing; they used requests that could easily look like normal browser requests to the untrained eye, as they all included a valid "User-Agent" string (a header describing the type of Web client) and mimicked an AJAX request. The primary flaw in the attack was that all 250,000 requests were identical. They all carried the exact same payload and used the exact same session tokens, which is highly irregular and may point to the fact that someone was re-playing the same request over and over, in an attempt to crash the Web server.

In other matches, such as Chile vs. Australia and Cote D'Ivoire vs. Japan, we actually observed an initial downturn in average traffic, followed by a wave of attacks against the winning country after it became clear that the game was officially over. In what might be considered a similar trend, attackers worldwide seemed to take a break from exploits during the exciting finals match between Germany and Brazil. For those 2.5 hours, the cyber war seemed to take a break while the world tuned in. Argentina appears to have taken the loss in good sport as well, with a notable lack of attacks against Germany originating from Argentina in the days following the attacks.

BLACKSHADES RAT / In July, Akamai's Prolexic Security Engineering & Research Team (PLXsert) warned companies of stealth surveillance and computer hijacking attacks by the Blackshades Remote Administration Tool (RAT) crimeware kit. The advisory noted that when malicious actors infect machines with the Blackshades RAT malware, they gain the ability to monitor video and audio data, record keylogging information from the user, and harvest sensitive credentials for banking, E-mail, Web sites and applications.

Remote access capabilities also let attackers hijack victim machines to run executables and lock out owners' file access. Blackshades is among the most popular RATs in the criminal underground, and is equipped with an ample list of crimeware features:

- The surveillance feature mimics the capabilities of legitimate software.
- Victims have no idea they are sharing information.
- Webcam and screen captures provide tangible data about the victim.
- Keylog data can provide access to sensitive information in real-time as it is typed.

It is a threat that caught the attention of the FBI. By the second week of July, the agency had arrested close to 100 people allegedly connected to the Blackshades RAT operation.[3]

Payloads are tough to detect and challenging to defend against because a typical infection consists of a multi-stage attack, where the victim is tricked into downloading a file, which will subsequently download and execute the actual Blackshades payload.

Once the payload infects a system, it typically goes through several stages:

- The stealth stage, where the RAT tries to leave the smallest footprint possible on the infected system
- The "establishing persistence" stage, which allows the malware to survive system reboots
- Once stealth and persistence are attained, a multitude of illegitimate capabilities become available to the malicious actor.

PLXsert predicted the Blackshades RAT toolkit would gain more traction and continue to be a persistent threat for motivated cyber criminals. PLXsert continues to monitor the situation.

New OpenSSL Vulnerabilities / In early August, Akamai's Information Security team was made aware of new security holes in OpenSSL. At that time, the OpenSSL Project disclosed nine low-and moderate-severity vulnerabilities.[4] The vulnerabilities could potentially impact OpenSSL clients and servers worldwide.

Akamai determined that its services were not impacted by CVE-2014-3508, CVE-2014-3509, CVE-2014-3505, CVE-2014-3506, CVE-2014-3507, CVE-2014-3510, and CVE-2014-3512. However, Akamai deployed a fix to address vulnerabilities CVE-2014-3511 and CVE-2014-5139 for each of the company's relevant services.

Some of the vulnerabilities, as outlined in the advisory, include:

- An information leak in pretty printing functions
- A crash condition with SRP ciphersuite in Server Hello message
- A race condition in ssl_parse_serverhello_tlsext
- Double Free when processing DTLS packets
- A DTLS memory exhaustion condition
- DTLS memory leak from zero-length fragments
- An OpenSSL DTLS anonymous EC(DH) denial of service
- An OpenSSL TLS protocol downgrade attack
- An SRP buffer overrun

Spike DDoS Toolkit / In September 2014, PLXsert tracked the spread of Spike, a new malware toolkit that poses a threat to embedded devices, as well as Linux and Windows systems. Several versions of Spike can communicate and execute commands on infected Microsoft Windows systems, as well as desktop Linux and ARM-based devices running the Linux operating system (OS). Binary payloads from this toolkit are dropped and executed after the successful compromise of targeted devices, which may include PCs, servers, routers, Internet-connected consumer devices and appliances, and home-based customer premises equipment (CPE) routing devices.

The toolkit has multiple DDoS payloads, including SYN flood, UDP flood, Domain Name System (DNS) query flood, and GET floods. Several campaigns have been reported against hosts in Asia and the United States,[5] and several Akamai customers have been targeted by DDoS attack campaigns launched from this botnet, with one such attack peaking at 215 Gigabits per second (Gbps) and 150 Million packets per second (Mpps).

Principal indicators of infection by the Spike DDoS toolkit are the presence of a series of binaries that infect specific operating systems and architectures. PLXsert analyzed binary payloads associated with the Spike DDoS toolkit that targeted desktop Linux OSes and ARM-based Linux hosts. Russian anti-virus company Doctor Web also reported on what may be iterations of the toolkit, and evidence of the payloads being ported to Windows has surfaced. The binaries associated with the Spike DDoS toolkit consists of one binary, while the iterations found by Doctor Web may include several different binaries and other scripts associated with an infection.

The Spike DDoS toolkit was not particularly unique. It had the hallmarks of a garden-variety botnet, with a command-and-control panel, binary payloads and DDoS payload builders. Spike's ability to produce ARM-based payloads suggests the creators were after routers and IoT devices to hijack into their botnets. The PLXsert advisory called this part of the "Post-PC Era" of botnet proliferation.

The multi-architecture malware code found in this kit increased the threat's complexity and sophistication and made it necessary for those affected to apply hardening measures to each of the targeted operating systems and platforms.

The third quarter of 2014 was dominated by the Shellshock vulnerabilities and attack activity targeting Web sites critical to coverage of the World Cup. Akamai also saw an increase in the use of attack tools like Blackshades RAT and the Spike DDoS toolkit. The third quarter was also notable for DDoS attacks targeting vulnerabilities in Linux systems.

Linux Systems Exploited for DDoS Attacks / In September, Linux users had a new threat to worry about — a newly discovered weakness in Linux systems that can be exploited to expand botnets and launch DDoS attacks. The favored target in this attack was the entertainment industry, though other business sectors were at risk.

In this attack scenario, vulnerable Linux systems were infected with IptabLes and IptabLex malware. Attackers managed to compromise large numbers of Linux systems by exploiting vulnerabilities in Apache Struts, Tomcat and Elasticsearch.

Attackers used the Linux vulnerabilities on unmaintained servers to gain access, escalate privileges to allow remote control of the machine, and then place the malware onto the system. This allowed them to hijack those systems, which were then conscripted into botnets used to launch DDoS attacks.

Details from the Threat Adivsory[6] released by PLXsert at the time:

A post-infection indication is a payload named .IptabLes or .IptabLex located in the /boot directory. These script files run the .IptabLes binary on reboot. The malware also contains a self-updating feature that causes the infected system to contact a remote host to download a file. In the lab environment, an infected system attempted to contact two IP addresses located in Asia.

Command and control centers (C2, CC) for IptabLes and IptabLex are currently located in Asia. Infected systems were initially known to be in Asia; however, more recently many infections were observed on servers hosted in the U.S. and in other regions. In the past, most DDoS bot infections originated from Russia, but now Asia appears to be a significant source of DDoS development.

Patching and hardening Linux servers and antivirus detection were found to prevent an IptabLes or IptabLex infestation on Linux systems. PLXsert provided customers with Bash commands to clean infected systems, and also shared a YARA rule in the threat advisory to identify the ELF IptabLes payload used in an observed attack campaign.

[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 third quarter of 2014, over 790 million unique IPv4 addresses, from 246 unique countries/regions, connected to the Akamai Intelligent Platform — 0.3% more than in the second quarter of 2014, and 3.9% more than in the third quarter of 2013. Although we saw nearly 800 million unique IPv4 addresses, Akamai believes that this represents well over one 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 8, the global number of unique IPv4 addresses seen by Akamai grew by about two million quarter-over-quarter, a nominal step towards recovery after a loss of seven million in the second quarter. In line with what was 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. Looking at the top 10 countries in the third quarter, the unique IP address count in the United States was essentially flat quarter-over-quarter, seeing a gain of approximately 20,000 addresses. In addition to the United States, Brazil, France, and Russia also saw nominal quarterly increases in unique IPv4 address counts, while the remaining six countries saw unique IPv4 address counts decline from the second quarter — like the increases, the losses were fairly limited as well. Looking at the full global set of countries, 58% saw a quarter-over-quarter increase in unique IPv4 address counts, with 28 countries/regions growing 10% or more. Of the 37% of countries that saw unique IPv4 address counts decline, 13 lost 10% or more as compared to the previous quarter. Unique IPv4 address counts remained essentially unchanged in 12 countries/regions, with Akamai seeing just a single unique IPv4 address in eight of those countries/regions.

Looking at year-over-year changes, Brazil was again the only country among the top 10 to see a double-digit percentage increase — at 33%, it was significantly larger than the other countries within the top 10. Four other countries on the list also saw yearly increases, with Russia's 5.8% increase the largest. The United States, United Kingdom, South Korea, and Italy all saw slight declines year-over-year, with the United Kingdom's 8.2% drop the largest of the bunch. 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 IPv4 address management/conservation practices or increased IPv6 adoption, and/or updates to the underlying database used by Akamai for IP address geolocation. While Japan's unique IPv4 address count in the second quarter remained essentially unchanged from the prior year, it was Germany's opportunity to demonstrate such consistency in the third quarter. On a global basis, 69% 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 10 countries/regions, although two registered only two unique IPv4 addresses, while three more had fewer than 1,000 addresses, meaning that small changes can result in larger percentage shifts.

	Country/Region	Q3 '14 Unique IPv4 Addresses	QoQ Change	YoY Change
–	Global	790,661,514	0.3%	3.9%
1	United States	156,786,482	0.0%	-1.1%
2	China	122,119,656	-0.9%	5.9%
3	Brazil	45,469,490	3.1%	33%
4	Japan	40,659,122	-0.3%	1.6%
5	Germany	36,788,648	-0.1%	0.0%
6	France	28,284,527	0.7%	4.1%
7	United Kingdom	26,742,484	-5.2%	-8.2%
8	South Korea	20,710,138	-0.3%	-2.2%
9	Italy	18,620,207	-3.3%	-2.9%
10	Russia	18,617,926	2.6%	5.8%

Figure 8: Unique IPv4 Addresses Seen by Akamai

2.2 IPv4 Exhaustion / The third 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. However, as a result of LACNIC reaching its final /9 of available IPv4 address space in May, the RIRs received their first periodic allocation of address space from IANA (Internet Assigned Numbers Authority), taken from a 'recovered pool' of leftover and returned IPv4 address blocks. According to an announcement7 from RIPENCC (the European RIR),

> "*Following the exhaustion of IANA's free pool of IPv4 addresses in 2011, when the RIRs received their final /8s, a global policy caused* IANA *to create a recovered pool of leftover and returned IPv4 address blocks. This policy was ratified by all five* RIR *communities in 2012 and stated that* IANA *would begin making equal, periodic allocations from the recovered pool when the first* RIR *reached a /9 of remaining addresses.*"

On September 2nd, the RIRs each received the equivalent of a /12 of IPv4 address space, and will receive one-fifth of any recovered addresses in the pool every six months (every March and September). IANA maintains a Web page that tracks these allocations being made from the recovered IPv4 address space.[8] (A reference table translating the /nn notations used to express IP address block sizes used in this section to unique IP address counts can be found at *https://www.arin.net/knowledge/cidr.pdf*.)

Leveraging data[9] collected by Geoff Huston, Chief Scientist at APNIC,[10] 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 9 illustrates the data made available by Mr. Huston, showing how the size of the available IPv4 address pools at each RIR changed during the third quarter of 2014. Both ARIN and LACNIC continued to have the most aggressive rates of depletion, delegating just over 29% and 28% of their available IPv4 pool space respectively, amounting to a total of more than 4.9 million and 1.4 million IPv4 addresses. APNIC delegated over 1.6 million IPv4 addresses during the quarter, amounting to nearly 11% of its available pool. AFRINIC and RIPE were much more reserved in their depletion activity, with

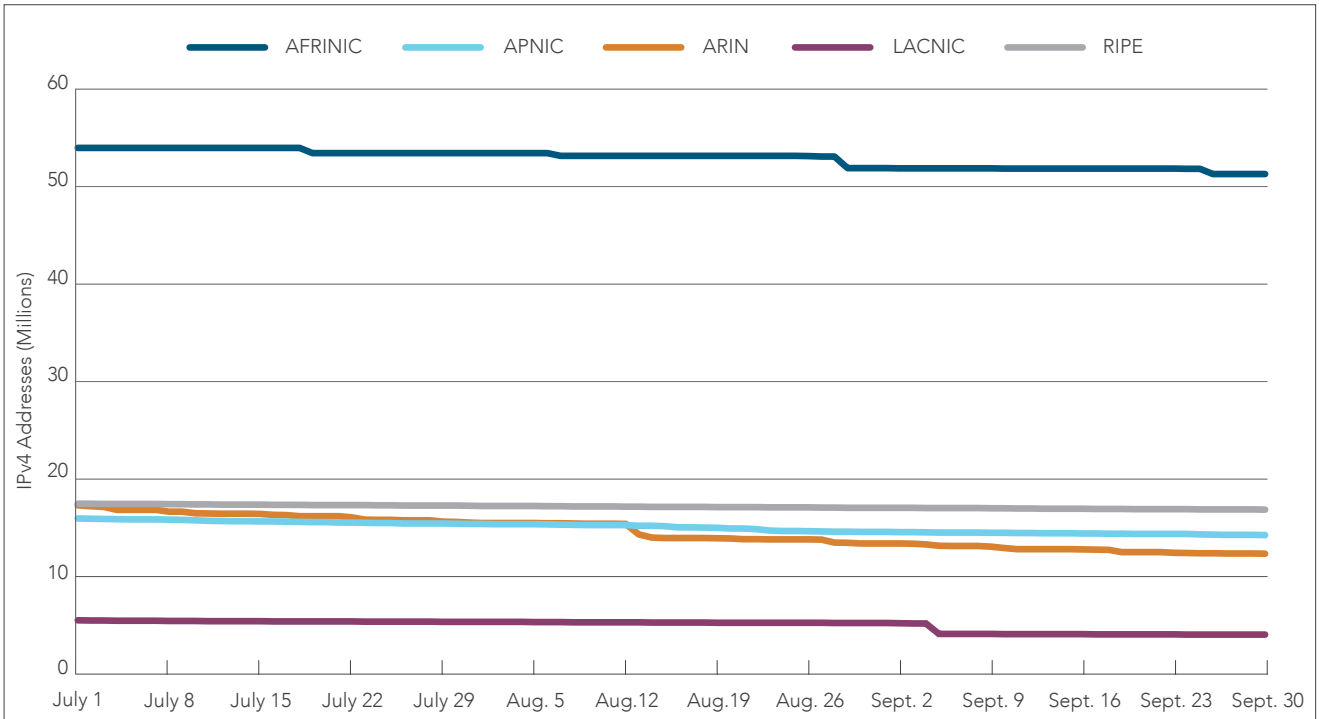


Figure 9: Available IPv4 Address Pool Size by RIR, Q3 2014

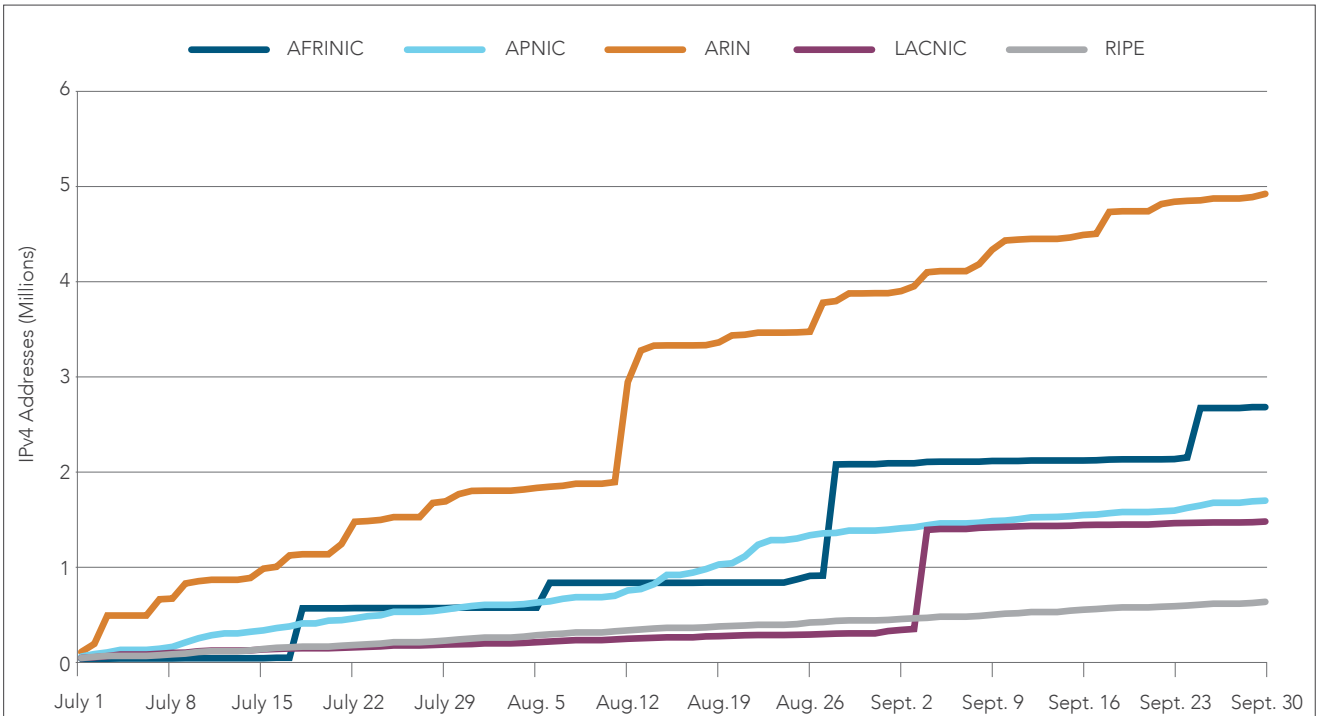


Figure 10: Total Number of IPv4 Addresses Assigned/Allocated by RIR, Q3 2014

AFRINIC handing out 5% of its remaining space, equivalent to just over 2.6 million IPv4 addresses, while RIPE delegated just under 600,000 addresses, or 3.5% of its available IPv4 address pool.

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,[11] third quarter transfers of IPv4 address space within the ARIN region went for anywhere between $7.00 USD to $18.06 USD, with listed address block sizes that ranged between a /24 to a /21. Analysis of available historical data suggests[12] [13] that larger address blocks are somewhat less expensive on a per-address basis.

Figure 10 illustrates the IPv4 allocation/assignment activity across each of the RIRs during the third quarter of 2014. Overall, it appears that there was less significant activity during the third quarter than was seen in prior quarters. Once again, APNIC and RIPE saw slow, consistent delegation activity, with no specific days during the quarter where it appeared that significant assignments/allocations were made. At AFRINIC, four particular days during the quarter stand out on the graph. On July 18, a /13 was allocated to Ooredoo, a Tunisian telecommunications provider.[14] On August 6, a /14 was allocated to Airtel Tanzania,[15] and on August 28, a /12 was allocated to Cell C, a South African mobile provider.[16] September 25 saw a /13 allocated to Zamtel, a telecommunications company in Zambia.[17] ARIN's most active day occurred on August 12, when a /12 was allocated to AT&T Internet Services.[18] At LACNIC, a /12 was allocated on September 4, but a check of WHOIS records[19] does not indicate a recipient/current owner. Further research indicates[20] that this particular block apparently overlapped with a block marked as "available" by ARIN, so LACNIC may have self-delegated it in order to prevent potential issues in the future.

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 11 and Figure 12 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 yet chosen to implement IPv6 delivery, 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 third 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 11 highlights the 10 countries/regions with the largest percentage of content requests made to Akamai over IPv6 in the third quarter. European countries increased their dominance in the third quarter, as significant quarterly growth vaulted Greece into the top 10, pushing China off of the list. Observed by others as well,[21] it appears that this growth was due to increased IPv6 deployment at Forthnet[22] and the Hellenic Telecommunications Organisation,[23] both of which saw significant increases in IPv6 capable/preferred connections during the third quarter. The only two non-European countries among the top 10 were the United States and Peru, both of which ended the quarter with an IPv6 adoption rate above 9%. Quarterly growth rates among the top 10 countries tended to be fairly strong for the most part, led by Greece's 361% increase, with only Luxembourg and Romania growing less than 10% (and Romania less than 1%). Quarterly declines in IPv6 adoption rates were seen in both Switzerland, which lost nearly 10% from the second quarter, and France, which lost just under 4%. However, as discussed in previous reports, this is due to the IPv4 request count growing more aggressively than the IPv6 request count, resulting in a decline in the calculated percentage of IPv6 traffic.

Figure 12 lists the top 20 network providers ordered by the number of IPv6 requests made to Akamai during the third 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 (United States) and Brutele saw more than half of their requests to Akamai made over IPv6, with Telenet close behind — Belgian carriers are clearly serious about IPv6 deployment. Users on Kabel Deutschland and Unitymedia, both German carriers, made more than a quarter of requests to Akamai over IPv6. Another dozen providers among the list of 20 sent at least one in 10 requests to Akamai over IPv6, while only Time Warner Cable and Telekom Malaysia had IPv6 request volumes below 10%. However, Telekom Malaysia has been growing aggressively during 2014, as its 6.2% IPv6 adoption rate in the third quarter was more than double the 2.7% adoption seen last quarter, which itself was more than double the first quarter IPv6 adoption rate.

While the network providers listed in Figure 12 are heavily concentrated in the United States and Europe, third quarter posts on the World IPv6 Launch blog highlight carriers from other regions around the world that are turning up IPv6, including Corporacion Nacional de Telecomunicaciones (the public telecommunications company in Ecuador) and Chunghwa Telecom/HiNet (the largest telecommunications company in Taiwan).[24, 25]

	Country/Region	Q3 '14 IPv6 Traffic %	QoQ Change
1	Belgium	27%	45%
2	Germany	11%	87%
3	United States	9.5%	40%
4	Peru	9.1%	48%
5	Switzerland	9.0%	-9.8%
6	Luxembourg	9.0%	2.7%
7	Romania	7.1%	0.4%
8	Czech Republic	5.8%	24%
9	Greece	4.7%	361%
10	France	4.6%	-3.9%

Figure 11: IPv6 Traffic Percentage, Top Countries/Regions

Country/Region	Network Provider	Q3 '14 IPv6 Traffic %
United States	Comcast Cable	19%
United States	Verizon Wireless	56%
United States	AT&T	15%
United States	Time Warner Cable	8.8%
Germany	Deutsche Telekom	15%
France	Proxad/Free	20%
Belgium	Telenet	46%
Peru	Telefonica Del Peru	11%
United States	T-Mobile	24%
Germany	Kabel Deutschland	34%
Japan	KDDI Corporation	17%
Romania	RCS & RDS	16%
Belgium	Brutele	55%
Germany	Unitymedia NRW GmbH	26%
Malaysia	Telekom Malaysia	6.2%
Switzerland	Swisscom	18%
Belgium	Belgacom	13%
Germany	KabelBW	26%
Czech Republic	O2 (Telefonica)	18%
United States	Hughes Network Systems (DISH Network)	21%

Figure 12: IPv6 Traffic Percentage,
Top Network Providers by IPv6 Request Volume

[SECTION]3 GEOGRAPHY *GLOBAL*

The data presented within this section was collected during the third quarter of 2014 through Akamai's globally deployed Intelligent Platform, and includes all countries/regions that had more than 25,000 unique IPv4 addresses make requests for content to 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 later 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; 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 saw a slight decline in the third quarter of 2014, dropping 2.8% to 4.5 Mbps, but remaining above 4 Mbps for the second consecutive quarter. As Figure 13 shows, quarterly changes were mixed across the top 10 countries/regions, with six seeing increases, and the remaining four seeing declines. Among those seeing average connection speeds grow quarter-over-quarter, the largest increase was seen in Singapore, which added 18%, while the lowest was in Japan, which was up only 0.8% from the second quarter. Ireland joined Singapore in seeing growth of 10% or more from the previous quarter. Similar to the quarterly decline observed in the global metric, losses seen among the top 10 were also nominal, ranging from 1.2% in Latvia to 2.6% in Switzerland. 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 all falling above the 15 Mbps "4K readiness" threshold. Globally, a total of 84 qualifying countries/regions saw average connection speeds increase in the third quarter, with growth rates ranging from 52% in Madagascar (to 1.9 Mbps) down to a meager 0.1% in the Dominican Republic (to 1.6 Mbps). Quarter-over-quarter losses were seen in 54 qualifying countries/regions, with declines in connection speeds ranging from 0.2% in Barbados (to 4.5 Mbps) to 18% in Sudan (to 3.6 Mbps).

In contrast to the quarterly declines in average connection speeds seen both globally and among some of the top 10 countries/regions, the year-over-year changes were much more positive, with the global figure up 25% from the third quarter of 2013, and strong yearly growth seen among the top 10. Yearly changes among the group ranged from an increase of 9.0% in the Czech Republic to an impressive 57% growth rate in Singapore. In addition to the Czech Republic, Japan and the Netherlands were the only two other countries among the top 10 to see yearly growth below 10%. On a global basis, yearly increases were seen in a total of 129 countries/regions, with growth rates ranging from 0.2% in Ecuador (to 3.6 Mbps) to 150% in Jersey, one of the Channel Islands located off the coast of France (to 9.7 Mbps). Jersey was joined by Indonesia, Uruguay, and Algeria in seeing average connection speeds more than double year-over-year. Yearly declines were seen in just 11 countries/regions, with losses ranging from 0.1% in Iraq (to 3.1 Mbps) to 17% in French Polynesia (to 1.9 Mbps).

In the third quarter, three qualifying countries had average connection speeds below 1.0 Mbps, up from two in the second quarter. Yemen and Botswana both had an average connection speed of 0.9 Mbps, while Libya again had the slowest speed, dropping 8.3% quarter-over-quarter to 0.5 Mbps.

3.2 Global Average Peak Connection Speeds / Similar to the average connection speed metric, the global average peak connection speed also saw a slight decline in the third quarter, dropping 2.3% to 24.8 Mbps. In addition, Figure 14 shows that several countries/regions among the top 10 also had average peak speeds decline quarter-over-quarter, with Israel losing 9.9%, Romania dropping 6.9%, and Taiwan seeing a decrease of 5.3%. Among the remaining countries/regions in the top 10, quarterly growth rates ranged from just 3.0% in South Korea to an impressive 67% in Luxembourg. A strong 28% quarterly increase in Singapore vaulted it past South Korea into the second-place position, and put it within striking distance of Hong Kong, which again had the highest average peak connection speed at 84.6 Mbps. On a global basis, a total of 63 qualifying countries/regions saw average peak connection speeds increase from the second quarter, with growth ranging from a slight 0.1% in the Netherlands (to 53.3 Mbps) to Luxembourg's previously mentioned 67% jump. Unfortunately, a larger number of qualifying countries/regions saw lower average peak connection speeds as compared to the second quarter, with losses ranging from 0.2% in Bahrain (to 22.7 Mbps) down to 36% in Pakistan (to 11.0 Mbps).

	Country/Region	Q3 '14 Avg. Mbps	QoQ Change	YoY Change
–	Global	4.5	-2.8%	25%
1	South Korea	25.3	2.7%	14%
2	Hong Kong	16.3	3.8%	29%
3	Japan	15.0	0.8%	9.3%
4	Switzerland	14.5	-2.6%	25%
5	Sweden	14.1	3.7%	35%
6	Netherlands	14.0	-2.5%	9.8%
7	Ireland	13.9	10%	47%
8	Latvia	13.4	-1.2%	12%
9	Czech Republic	12.3	-1.8%	9.0%
10	Singapore	12.2	18%	57%

Figure 13: Average Connection Speed by Country/Region

	Country/Region	Q3 '14 Peak Mbps	QoQ Change	YoY Change
–	Global	24.8	-2.3%	38%
1	Hong Kong	84.6	14%	29%
2	Singapore	83.0	28%	65%
3	South Korea	74.2	3.0%	17%
4	Japan	65.1	5.9%	25%
5	Israel	61.8	-9.9%	30%
6	Romania	58.7	-6.9%	29%
7	Uruguay	58.6	18%	334%
8	Latvia	58.1	8.0%	25%
9	Taiwan	55.1	-5.3%	26%
10	Luxembourg	54.4	67%	130%

Figure 14: Average Peak Connection Speed by Country/Region

The year-over-year trend was extremely positive among the top 10 countries/regions, with all seeing significant increases in average connection speeds compared to the previous year. Uruguay led the group with a year-over-year change of 334%, and Luxembourg also saw speeds more than double, up 130%. South Korea had the lowest yearly increase among the remaining set, at a still solid 17%. Looking across all of the qualifying countries/regions, a total of 135 qualifying countries/regions saw average peak connection speeds increase from the third quarter of 2013. Yearly growth ranged from 0.6% in Nicaragua (12.3 Mbps) up to the aforementioned 334% increase in Uruguay. While Nicaragua was the only country to see a year-over-year change of less than 1%, seven additional countries/regions joined Uruguay in seeing average peak connection speeds more than double, with Madagascar falling just short, having a 99% year-over-year change.

Zambia remained the country with the lowest average peak connection speed in the third quarter at 6.2 Mbps, despite a 63% quarterly increase. Zambia's speed was a full megabit slower than Libya's, which had the next lowest average peak connection speed.

3.3 Global High Broadband Connectivity / In line with the quarterly declines seen in the connection speed metrics, the global high broadband adoption rate fell 0.5% in the third quarter, after seeing strong quarterly growth earlier in the year. However, as Figure 15 shows, quarter-over-quarter changes among the top 10 countries/regions were generally positive, if limited, with increases ranging from just half a percent in Japan to 8.4% in Sweden. These limited quarterly changes are in sharp contrast to those seen in the second quarter, where the quarterly increases were much higher in general. However, South Korea's 81% high broadband adoption rate remains far ahead of Hong Kong and Japan, whose 55% adoption rates were the next highest. Switzerland and Romania were the only two countries among the top 10 to see lower high broadband adoption rates as compared to the previous quarter, falling 3.2% and 1.6% respectively. Among the 63 qualifying countries/regions for this metric, just 28 saw quarter-over-quarter increases. These ranged from a spectacular 534% jump in Indonesia (to 3.3% adoption) down to Japan's 0.5% increase. Indonesia was the only qualifying country to see a quarterly change above 100% — a 38% increase in Belarus was the next highest. Quarterly losses were seen in 35 qualifying countries/regions, with declines ranging from a minor 0.1% drop in Austria (to 28% adoption) down to a 43% decline in Chile (to 3.4% adoption).

Looking at year-over-year changes, the global high broadband adoption rate was up 22% — lower than the 65% increases seen in both the first and second quarters, but strong nonetheless. Among the top 10 countries/regions, Japan was the only one to see a year-over-year change below 10%, while both Romania and Israel saw adoption rates more than double. When looking at all of the qualifying countries/regions, the United Arab Emirates was once again the only country to see a year-over-year decline in high broadband adoption, dropping a surprisingly high 35% (to 3.5% adoption). Across the other 62 geographies, yearly increases ranged from 6.3% in Japan to a massive 3,015% in Uruguay (to 7.2% adoption). Tremendous yearly growth was also seen in Indonesia, which increased 2,403% year-over-year, while increases of more than 100% were seen in 21 countries/regions, ranging from 113% in Singapore (to 27% adoption) up to 550% in Argentina (to 5.6% adoption).

Due to an 11% quarterly loss, India was the country with the lowest high broadband adoption rate in the third quarter, at 1.1%. Colombia, which had the lowest adoption rate in the previous quarter, saw a 2.4% quarterly increase and had a high broadband adoption rate just four-hundredths of a percent higher than India.

3.4 Global Broadband Connectivity / Figure 16 shows that the global broadband adoption rate edged up slightly in the third quarter, gaining 1.0% and growing to 60%. Extremely small quarterly increases were seen across most of the top 10 countries/regions, with Israel the only one seeing its adoption rate increase more than 1%. South Korea remained the country with the highest level of broadband adoption, at 96%, with Bulgaria following close behind at 95%. (Due to rounding, the two countries are a full percent apart,

	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
–	Global	23%	-0.5%	22%
1	South Korea	81%	3.6%	16%
2	Hong Kong	55%	6.6%	43%
3	Japan	55%	0.5%	6.3%
4	Switzerland	54%	-3.2%	39%
5	Netherlands	53%	1.6%	16%
6	Romania	49%	-1.6%	147%
7	Latvia	46%	3.8%	21%
8	Belgium	45%	3.9%	26%
9	Israel	44%	4.8%	117%
10	Sweden	44%	8.4%	43%

Figure 15: High Broadband (>10 Mbps) Connectivity

	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
–	Global	60%	1.0%	12%
1	South Korea	96%	0.6%	3.0%
2	Bulgaria	95%	0.4%	18%
3	Switzerland	93%	0.1%	3.3%
4	Israel	92%	2.9%	14%
5	Netherlands	90%	0.8%	1.4%
6	Isle Of Man	90%	-1.9%	6.5%
7	Denmark	89%	-1.9%	7.9%
8	Hong Kong	89%	0.2%	9.5%
9	Romania	89%	-2.1%	13%
10	Curaçao	88%	0.6%	1.3%

Figure 16: Broadband (>4 Mbps) Connectivity

but the underlying data shows that they are separated by only 0.3%.) Three countries in the top 10 saw lower broadband adoption rates as compared to the second quarter, though the losses were extremely modest. The losses in Denmark and Romania meant that only six of the top 10 countries/regions had at least 90% of their connections to Akamai at speeds above 4 Mbps, down from seven of the top 10 in the previous quarter. Globally, a total of 99 countries/regions qualified for inclusion for this metric, and 55 of them saw quarterly growth in broadband adoption rates. Quarter-over-quarter increases ranged from just 0.1% in Georgia (to 57% adoption) and Switzerland, up to 120% in Tunisia (to 6.6% adoption) and 250% in Indonesia (to 35% adoption). Negative quarter-over-quarter changes were seen across the remaining 44 qualifying countries/regions, with losses ranging from declines of just 0.1% in Germany and Greece (to 79% and 63% adoption respectively) down to 46% in Sudan (to 28% adoption).

The global broadband adoption rate increased 12% from the third quarter of 2013. Although still strongly positive, the yearly growth rate has continued to decline over the last several quarters. Broadband adoption rates were also up year-over-year across all of the top 10 countries/regions, with increases ranging from just 1.3% in Curaçao to 18% in Bulgaria. In addition to Bulgaria, Israel and Romania also saw year-over-year increases greater than 10%. Looking across all of the qualifying countries/regions, all but nine saw broadband adoption levels increase over the past year. Yearly growth rates ranged from 0.7% in the Czech Republic (to 83% adoption) to 1,884% in Indonesia (to 35% adoption). Algeria and Uruguay joined Indonesia in seeing massive yearly growth, adding 1,447% (to 4.5% adoption) and 1,218% (to 59% adoption) respectively. An additional 16 countries/regions saw yearly growth of 100% or more. Of the nine countries/regions that saw broadband adoption rates fall year-over-year, losses ranged from just 0.3% in Jamaica (to 44% adoption) down to a drop of 32% in Morocco (to 8.9% adoption).

In the third quarter, Egypt remained the country with the lowest level of broadband adoption at 1.1%, even after a 21% quarterly increase and a 60% yearly increase. Venezuela, which held the last-place position earlier in the year, remained just ahead of Egypt with a broadband adoption rate of 1.3%, down 20% quarter-over-quarter.

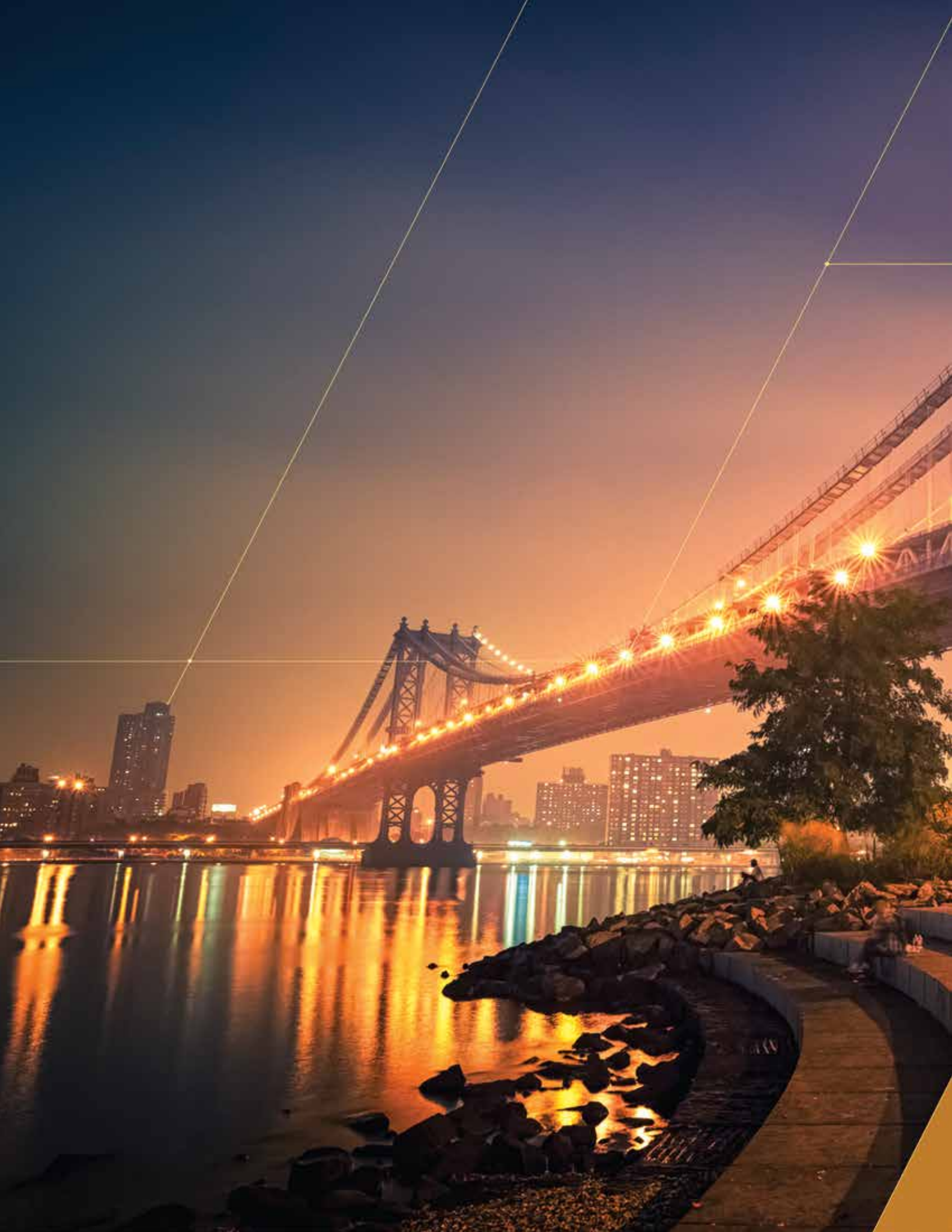
3.5 Global 4K Readiness / Given the growing interest in the streaming delivery of 4K[26] ("Ultra HD") video, we thought it would be interesting to begin tracking a "4K readiness" metric in the *State of the Internet Report*. With 4K adaptive bitrate streams generally requiring between 10 – 20 Mbps of 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 that the 15 Mbps threshold may change once alternate codecs, such as HEVC or VP9 are deployed.)[27, 28] 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, nor the availability/affordability/uptake of 4K-capable televisions and media players.

As Figure 17 shows, 12% of connections to Akamai globally were at speeds of 15 Mbps or above, down 2.8%, but consistent with the second quarter figure due to rounding. South Korea remained the country with the highest level of 4K readiness, with two-thirds of its connections to Akamai at or above 15 Mbps. However, the highest quarterly growth rates among the top 10 countries/regions were seen in Singapore, which added 47%, and Sweden, which increased 12%. The remaining three countries that saw quarter-over-quarter increases were all up less than 10%. Half of the top 10 countries/regions had lower 4K readiness rates as compared to the previous quarter, with declines ranging from just 0.4% in Belgium to 9.5% in Switzerland. Across the 52 qualifying countries/regions, China had the lowest rate of 4K readiness at 0.2%, down 23% from the second quarter. Overall, quarterly gains were seen in just 17 qualifying countries/regions. Consistent with the large gains seen across the other metrics, Indonesia led the way here as well, with a 459% quarterly increase (to 0.9% readiness), while the smallest rate of growth was found in Finland, at 0.4% (to 20% readiness). The remaining 35 countries/regions saw 4K readiness rates drop quarter-over-quarter, with losses ranging from Belgium's 0.4% down to 55% in Chile (to 0.8% readiness).

Year-over-year, the global 4K readiness rate climbed 32%. Yearly growth rates were also strong among the top 10, with Singapore more than doubling, up 174%, while Japan was the only country among the group with a yearly change below 10%. All of the qualifying countries/regions saw positive year-over-year changes in 4K readiness rates. A total of 18 countries/regions saw 4K readiness more than double from the third quarter of 2013, unsurprisingly led by Indonesia's massive 1,468% increase. Only Japan and Taiwan saw yearly increases below 10%, adding 8.5% and 4.9% (to 12% readiness) respectively. Continued strong yearly increases are an extremely encouraging long-term trend, and point to ongoing improvements in broadband connectivity around the world.

	Country/Region	% Above 15 Mbps	QoQ Change	YoY Change
–	Global	12%	-2.8%	32%
1	South Korea	66%	6.1%	27%
2	Hong Kong	37%	8.1%	57%
3	Japan	33%	-0.7%	8.5%
4	Switzerland	30%	-9.5%	61%
5	Netherlands	29%	-1.8%	20%
6	Latvia	29%	2.2%	27%
7	Sweden	29%	12%	64%
8	Norway	21%	-2.3%	49%
9	Singapore	21%	47%	174%
10	Belgium	21%	-0.4%	26%

Figure 17: 4K Ready (>15 Mbps) Connectivity



[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 / Quarterly increases in average connection speeds were seen in all but one of the top 10 states in the third quarter, as Figure 18 shows. Washington, Connecticut, and Utah all posted gains in excess of 10%, while the smallest increase (1.4%) was seen in both Michigan and New Jersey. Only Virginia saw a lower average connection speed quarter-over-quarter, but the loss was rather minimal, at just 0.6%. Delaware, Washington, and Connecticut were all above the 15 Mbps "4K readiness" threshold, and all of the top 10 states again had average connection speeds at or above the 10 Mbps "high broadband" threshold, as did an additional

25 states across the country. Quarter-over-quarter changes were generally positive, with a total of 41 states seeing higher average connection speeds as compared to the previous quarter. Utah's 16% increase was the largest seen, while Illinois grew just 0.1% to 10.0 Mbps. Of the 10 states that saw average connection speeds decline from the second quarter, losses ranged from 0.3% in Wisconsin (to 12.2 Mbps) down to 5.2% in Alaska (to 7.2 Mbps).

On a year-over-year basis, all of the states in the top 10 saw significantly higher average connection speeds as compared to the third quarter of 2013. Massachusetts' 12% yearly increase was the smallest of the group, while the 43% increase in Washington was the largest. Washington's increase was also the largest when looking across the entire country, while Kentucky's 4.6% yearly growth rate was the lowest. All but seven states saw yearly growth rates of 10% or more, in contrast to last quarter, when this was the case in every state.

A 5.2% quarterly decline pushed Alaska back into the position as the state with the lowest average connection speed in the third quarter. Last quarter's slowest state was Arkansas, which saw a 4.0% quarterly increase to 7.8 Mbps, moving it ahead of both Kentucky and Alaska in the national rankings.

4.2 United States Average Peak Connection Speeds / In the third quarter of 2014, quarterly changes in average peak connection speeds across the top 10 states were all positive, as seen in Figure 19. Delaware's 75.7 Mbps average peak connection speed was the highest in the country, and its 21% quarter-over-quarter change made it one of three states in the top 10 to grow more than 20% from the second quarter. It was joined by Connecticut and Utah, while Washington and North Dakota both had increases of more than 10%. The smallest quarterly increase within the top 10 was found in New Jersey, which added 3.1%. Looking across the whole country, all but three states had higher average peak connection speeds as compared to the previous quarter. Observed increases ranged from Alaska's tiny 0.1% bump (to 36.8 Mbps) up to Connecticut's 25% jump. A total of 15 states grew by 10% or more, and Alaska was the only state to grow less than 1%. Of the three states where average peak connection speeds fell, Oregon lost 1.1% (to 49.4 Mbps), Kentucky dropped 2.4% (to 33.1 Mbps), and New Hampshire declined 2.8% (to 51.4 Mbps).

Year-over-year changes remained very strong across the top 10 states, with all of them seeing significantly higher average peak connection speeds than the same period a year prior. Within the group, the smallest annual increase was found in Massachusetts at 27%, with Connecticut's 66% increase the largest. Interestingly, the District of Columbia, North Dakota, and Utah all saw 47% year-over-year growth in average peak connection speeds. Similarly strong growth rates were observed when looking across the whole United States. Ohio was the only country to see its average peak connection speed more than double year-over-year, growing 131% (to 41.4 Mbps). The lowest rate of yearly growth was found in New Hampshire at 13%.

Consistent with the second quarter of 2014, Arkansas remained the state with the lowest average peak connection speed, coming in at 33.1 Mbps in the third quarter, after 7.1% quarterly and 34% yearly increases.

Last quarter's report covered a number of announcements made in the second quarter that pointed towards the strong likelihood of continuing to see extremely positive growth in average peak connection speeds going forward. A number of similar announcements were made in the third quarter as well. As the announcements were generally related to local/municipal broadband infrastructure improvements, the related projects won't have an immediate state-wide impact upon completion, but are part of ongoing initiatives that are becoming more widespread across the country. In August, AT&T[29] announced that it had started to upgrade existing Gigapower customers in Austin, Texas to gigabit speeds, beating Google to the punch. Both Syracuse, New York[30] and Lexington, Kentucky[31] announced early-stage efforts to bring high-speed municipal Internet access to their cities, while Portland, Maine[32] announced a partnership with local provider Great Works Internet (GWI) to bring gigabit connectivity to the

	State	Q3 '14 Avg. Mbps	QoQ Change	YoY Change
1	Delaware	17.4	7.3%	37%
2	Washington	16.3	15%	43%
3	Connecticut	15.3	12%	38%
4	Utah	14.8	16%	28%
5	District Of Columbia	14.6	4.8%	21%
6	Virginia	14.5	-0.6%	14%
7	Massachusetts	14.4	4.1%	12%
8	Rhode Island	13.5	4.4%	14%
9	Michigan	12.7	1.4%	21%
10	New Jersey	12.5	1.4%	15%

Figure 18: Average Connection Speed by State

	State	Q3 '14 Peak Mbps	QoQ Change	YoY Change
1	Delaware	75.7	21%	57%
2	Connecticut	71.0	25%	66%
3	Massachusetts	63.7	9.0%	27%
4	District Of Columbia	63.1	6.3%	47%
5	Washington	62.6	11%	35%
6	Virginia	61.8	4.0%	29%
7	Utah	59.6	23%	47%
8	New Jersey	59.2	3.1%	28%
9	Rhode Island	58.9	4.7%	28%
10	North Dakota	58.0	17%	47%

Figure 19: Average Peak Connection Speed by State

city. The availability of gigabit connectivity was also announced by Atlantic Broadband for customers within its Miami, Florida area service footprint.[33] Finally, CenturyLink announced the availability of gigabit service to 2,000 households in Columbia, Missouri, at a cost of $152/month as a standalone service, or $80 when bundled with other CenturyLink services.[34]

4.3 United States High Broadband Connectivity / As shown in Figure 20, Delaware remained the state with the largest high broadband adoption rate, with nearly seven of every 10 connections to Akamai at speeds of 10 Mbps or above. Quarter-over-quarter changes among the top 10 states were generally positive in the third quarter, with eight of them seeing nominal increases. Connecticut's 18% jump was the largest, and the state was the only one among the top 10 to see a double-digit percentage increase; Virginia's 0.9% quarterly increase was the smallest. Only New Hampshire and New York saw high broadband adoption rates decline from the second quarter. A total of seven of the top 10 states had at least half of their connections to Akamai at high broadband rates (up from six last quarter), while the remaining three were not too far behind. Connecticut's 18% quarterly increase was also the largest when looking across the whole country, where it remained the only state to increase by more than 10% quarter-over-quarter. Thirty-nine additional states also saw high broadband adoption rates increase on a quarterly basis, with Wyoming's 0.4% increase (to 32% adoption) the smallest. Among the 11 states that saw high broadband adoption rates fall from the previous quarter, losses ranged from just 0.2% in New York and Maryland (to 44% adoption) down to 6.5% in Kentucky (to 24% adoption).

> As the announcements were generally related to local/municipal broadband infrastructure improvements, the related projects won't have an immediate state-wide impact upon completion, but are part of ongoing initiatives that are becoming more widespread across the country.

Yearly changes in high broadband adoption among the top 10 states were all positive, and fairly strong, in the third quarter. Yearly growth rates among these states ranged from a low of 3.9% in New York to a high of 53% in Connecticut. Similar improvements could also be seen across all states, with the largest year-over-year change seen in Kansas at 78% (to 31% adoption). In contrast to the second quarter, there were no states with growth rates above 100% this quarter. However, a total of eight states did see annual increases below 10%, with Maine having the smallest increase in the country at 2.0% (to 27% adoption).

Consistent with the second quarter, Arkansas remained the state with the lowest level of high broadband adoption in the third quarter, remaining at 20% adoption after a 4.2% quarterly increase and a 53% yearly increase. Idaho remained just ahead of Arkansas for a second quarter after being the state with the lowest high broadband adoption rate in the first quarter of 2014.

4.4 United States Broadband Connectivity / Delaware continued its slow but steady march to complete broadband adoption in the third quarter, growing 1.4% to 96% adoption, as shown in Figure 21. It remained just ahead of Connecticut, which

	State	% Above 10 Mbps	QoQ Change	YoY Change
1	Delaware	69%	7.0%	39%
2	Connecticut	64%	18%	53%
3	Rhode Island	58%	4.1%	9.1%
4	Massachusetts	56%	3.0%	6.7%
5	New Jersey	55%	4.7%	16%
6	New Hampshire	50%	-4.5%	5.0%
7	Washington	50%	5.5%	23%
8	Virginia	49%	0.9%	12%
9	Michigan	47%	2.2%	21%
10	New York	47%	-0.2%	3.9%

Figure 20: High Broadband (>10 Mbps) Connectivity, U.S. States

	State	% Above 4 Mbps	QoQ Change	YoY Change
1	Delaware	96%	1.4%	2.2%
2	Connecticut	95%	3.3%	14%
3	Rhode Island	92%	0.3%	0.4%
4	Hawaii	88%	0.4%	7.8%
5	New Jersey	85%	2.3%	5.6%
6	Massachusetts	85%	2.4%	0.2%
7	New Hampshire	84%	-0.1%	-2.1%
8	South Dakota	83%	0.6%	2.1%
9	North Dakota	83%	1.9%	2.5%
10	Virginia	82%	1.1%	4.4%

Figure 21: Broadband (>4 Mbps) Connectivity, U.S. States

grew to 95% broadband adoption during the quarter, joined by Rhode Island as the only other state with at least nine of every 10 connections to Akamai at speeds above 4 Mbps. New Hampshire was the only state among the top 10 to see its broadband adoption rate fall quarter-over-quarter, though the decline was a negligible 0.1%. The other nine states saw positive, though rather muted, quarterly changes, with Connecticut's 3.3% the largest. In looking across the whole country, all but four states saw broadband adoption rates increase from the second quarter, though growth rates were fairly limited across the board. Montana's 8.6% quarterly increase (to 68% adoption) was the largest, while Mississippi, New York, and New Mexico all added only 0.1% (to 65%, 81%, and 66% adoption respectively). The losses seen in Idaho, New Hampshire, Kentucky, and Maryland were minimal; Maryland's 0.3% decline (to 74% adoption) was the largest.

Yearly changes across the top 10 states followed a pattern similar to the quarterly changes, as overall increases were fairly nominal, with only New Hampshire seeing a loss. Among the other states, yearly increases ranged from 0.2% in Massachusetts up to 14% in Connecticut. Across the whole country, a total of 38 states saw positive year-over-year changes. Similar to the high broadband metric, the largest increase was seen in Kansas at 54% (to 73% adoption). An additional five states also saw broadband adoption rates grow in excess of 10% on a yearly basis. The smallest yearly increase was found in the District of Columbia at 0.1% (to 65% adoption). In the 13 states where broadband adoption rates fell from the previous quarter's levels, losses ranged from 1.1% in Louisiana (to 66% adoption) down to 7.8% in Missouri (to 59% adoption).

For the fourth consecutive quarter, West Virginia remained the state with the lowest broadband adoption rate, with 57% of its connections to Akamai at speeds above 4 Mbps.

4.5 United States 4K Readiness / As described above 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, nor the availability/affordability/uptake of 4K-capable televisions and media players.

Looking at the top 10 states shown in Figure 22, 4K readiness rates saw a variety of changes. Virginia and New Hampshire were the only two states among the group to see a quarterly decline while quarterly increases in the remaining eight states were evenly split, with four growing more than 10%, and the other four growing less than 10%. These increases ranged from 0.9% in Massachusetts to 24% in neighboring Connecticut. Expanding our perspective to the full country, quarterly changes were evenly split, with 25 total states seeing higher 4K readiness rates as compared to the second quarter. Connecticut's increase was the highest in the country, while Ohio's increase of just half a percent (to 11% readiness) was the lowest. Across the balance of the states where 4K readiness rates declined quarter-over-quarter, losses ranged from a drop of just 0.7% in Oregon (to 23% readiness) down to a decline of 25% in Kentucky (to 6.1% readiness). Kentucky was one of three states (along with Hawaii and Alaska) to see quarterly losses greater than 10%.

Year-over-year, all of the top 10 states saw 4K readiness rates increase, with Connecticut falling just short of doubling. The lowest yearly increase among the group was seen in New Hampshire, which added a still solid 14% over the previous year. Across the whole country, Oklahoma's year-over-year growth rate of 120% (to 16% readiness) bested Connecticut's near-doubling. Aside from Oklahoma, an additional 13 states also grew by 50% or more year-over-year, while all states had double-digit percentage increases, with the smallest seen in Ohio at 12%.

Due to a 22% yearly decline to 6.1%, Alaska became the state with the lowest 4K readiness rate in the third quarter. However, it was only 13 thousandths of a percent lower than Kentucky, which fell 25% in the third quarter, also to 6.1%.

	State	% Above 15 Mbps	QoQ Change	YoY Change
1	Delaware	39%	11%	72%
2	Connecticut	31%	24%	99%
3	Massachusetts	29%	0.9%	19%
4	Washington	27%	11%	45%
5	District Of Columbia	26%	2.3%	26%
6	New Jersey	26%	1.3%	36%
7	Rhode Island	26%	3.6%	41%
8	Utah	24%	14%	43%
9	Virginia	24%	-2.6%	24%
10	New Hampshire	23%	-8.9%	14%

Figure 22: 4K Ready (>15 Mbps) Connectivity, U.S. States

[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 third quarter of 2014, the United States continued to have the fastest average connection speed among surveyed Americas countries, more than a full megabit per second ahead of Canada. As shown in Figure 23, 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 somewhat mixed, though generally positive. The largest quarterly change was seen in Costa Rica, up 19% from the second quarter, followed by Peru, which grew 16%, while the United States, Colombia, and Ecuador all saw growth rates below 1%.

Among the six surveyed countries that saw average connection speeds decline on a quarterly basis, losses were fairly nominal and ranged from 0.5% in Argentina to 8.4% in neighboring Chile.

On a year-over-year basis, positive changes were seen across most surveyed countries within the Americas region. Only Paraguay and Venezuela saw long-term declines in average connection speeds, shedding 7.6% and 11% respectively. Across the other countries, there was an extremely wide spread of yearly increases, ranging from a meager 0.2% in Ecuador up to a massive 148% in Uruguay. While Uruguay was the only country in the region to see its average connection speed more than double, seven other Americas countries saw double-digit percentage growth rates.

Consistent with the observation made in last quarter's report, only six of the surveyed Americas countries have an average connection speed above the 4 Mbps "broadband" threshold, while only two have speeds above the 10 Mbps "high broadband" threshold. Ongoing quarterly improvements will likely drive Peru, Ecuador, and eventually Colombia, above 4 Mbps, but the United States and Canada will likely remain the only two above 10 Mbps for the foreseeable future.

5.2 Americas Average Peak Connection Speeds / With an 18% quarter-over-quarter change, growing to an average peak connection speed of 58.6 Mbps in the third quarter, Uruguay cemented its position as the surveyed Americas country with the highest average peak connection speed. As shown in Figure 24, Uruguay now leads the United States by nearly 10 Mbps, and is nearly 15 Mbps ahead of Canada. Uruguay's 18% quarterly increase was also the largest seen among the Americas countries, as the remaining increases ranged from 1.6% in Brazil to 8.4% in Colombia. However, quarterly changes within the region were mixed, with six of the 15 surveyed countries seeing lower average peak connection speeds. Among those countries, losses ranged from just 0.5% in Canada to 8.4% in Chile.

From a year-over-year perspective, the trend was overwhelmingly positive, with all of the surveyed Americas countries seeing higher average peak connection speeds as compared to the third quarter of 2013. Once again, Uruguay's yearly increase, at 334%, was far and away larger than the increases seen in the other countries. Among the rest of the countries, the next largest yearly change was Peru's 56%, while the smallest yearly increase was Paraguay's 9.2%. Paraguay was also the only country in the region to see a year-over-year change below 10%.

5.3 Americas High Broadband Connectivity / The significant gap in high broadband adoption rates observed over the last several quarters showed no sign of closing in the third quarter, as can be seen in Figure 25. The United States continued to have the highest rate of adoption among Americas countries, at 39%, while Bolivia's adoption rate fell to 0.1% and Paraguay remained below 0.1% high broadband adoption. Countries seeing lower levels of high broadband adoption quarter-over-quarter outnumbered those seeing higher adoption rates by a 2:1 margin in the third quarter. (The picture is even worse when looking at just the eight countries that qualified for inclusion, where only two saw higher adoption rates.) Among the five countries where adoption rates rose, the 1.6% increase in the United States was the smallest, while Venezuela's 23% growth rate was the largest. In the 10 countries where adoption rates fell quarter-over-quarter, losses ranged from 5.0% in Argentina to 43% in Chile. Interestingly, Argentina and Canada were the only two countries to see losses below 10% — it is not clear why so many

Global Rank	Country/Region	Q3 '14 Avg. Mbps	QoQ Change	YoY Change
12	United States	11.5	0.4%	21%
21	Canada	10.3	-1.1%	17%
53	Uruguay	5.5	-3.1%	148%
67	Argentina	4.2	-0.5%	49%
69	Mexico	4.1	-5.5%	6.1%
70	Chile	4.1	-8.4%	23%
79	Peru	3.6	16%	48%
80	Ecuador	3.6	0.2%	0.2%
87	Colombia	3.4	0.3%	11%
90	Brazil	2.9	1.6%	9.5%
93	Panama	2.9	3.9%	5.8%
95	Costa Rica	2.7	19%	27%
133	Paraguay	1.3	2.3%	-7.6%
134	Venezuela	1.3	-4.3%	-11%
136	Bolivia	1.1	3.3%	5.3%

Figure 23: Average Connection Speed by Americas Country

Global Rank	Country/Region	Q3 '14 Peak Mbps	QoQ Change	YoY Change
7	Uruguay	58.6	18%	334%
17	United States	48.8	7.6%	35%
22	Canada	43.7	-0.5%	25%
62	Chile	26.1	-8.5%	52%
72	Mexico	22.8	2.3%	33%
75	Colombia	22.7	8.4%	48%
79	Argentina	22.0	-6.1%	39%
84	Ecuador	20.7	-5.2%	12%
85	Peru	20.6	1.8%	56%
86	Brazil	20.5	1.6%	23%
110	Panama	14.2	-0.7%	21%
123	Costa Rica	12.4	8.7%	24%
130	Venezuela	10.2	8.6%	28%
132	Bolivia	9.3	4.3%	13%
133	Paraguay	9.2	-4.1%	9.2%

Figure 24: Average Peak Connection Speed by Americas Country

of the surveyed Americas countries saw quarterly declines in high broadband adoption rates, nor why the rates of decline were so large.

However, the outlook was much more positive when examining year-over-year changes across all of the countries in the region, as well as just those that qualified for inclusion. Unsurprisingly, Uruguay led the pack with a 3,015% growth rate from the same period a year prior, and it was joined by five additional surveyed Americas countries in seeing average peak connection speeds more than double on a yearly basis. Among these five countries, increases ranged from 120% in Venezuela up to 761% in Argentina, but adoption in these countries remained comparatively low. The balance of the countries in the Americas region all saw double-digit percentage growth rates, with adoption rates improving between 22% in the United States to 89% in Bolivia. While very strong, the year-over-year changes seen in the third quarter were more moderate than those observed in the second quarter, when Uruguay grew nearly 15,000%, along with Argentina and Peru growing more than 1,000%, and the United States and Canada being the only two countries that grew less than 100%.

5.4 Americas Broadband Connectivity / As Figure 26 demonstrates, there is also a significant gap in broadband adoption rates across surveyed Americas countries. In fact, the gap is more than double the one observed for the high broadband adoption metric. With moderate changes over time observed in the countries at both the top and bottom of the list, it is likely that this gap will remain quite sizable for the foreseeable future. Quarterly changes were almost evenly split, with six of the 13 qualifying countries seeing higher broadband adoption rates. Increases from the second quarter ranged from just 1.2% in the United States to a surprisingly high 64% in Peru; Uruguay and Costa Rica joined Peru in adding more than 10%. In the remaining seven qualifying Americas countries where broadband adoption rates declined, losses were generally nominal, and ranged from 0.7% in Argentina up to an unusually high 20% in Venezuela, which was also the only country to see a quarterly loss greater than 10%. Neither Bolivia nor Paraguay qualified for inclusion, but both saw minor quarterly increases in broadband adoption rates.

Year-over-year changes were nearly all positive in the third quarter, with Venezuela's 9.6% yearly decline the sole outlier. There was a broad range of increases seen across the remaining qualifying countries, as four countries grew by less than 10%, with Canada's 1.3% the smallest. The largest increases were seen in Uruguay, which grew by more than 1,200% year-over-year, Peru, which was up more than 700%, and Costa Rica, which added more than 200%. Bolivia and Paraguay both saw solid year-over-year growth as well, even though neither qualified for inclusion in the broadband connectivity metric.

5.5 Americas 4K Readiness / As described above 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.

Global Rank	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
14	United States	39%	1.6%	22%
21	Canada	33%	-5.9%	37%
46	Uruguay	7.2%	-31%	3015%
49	Argentina	5.6%	-5.0%	550%
55	Chile	3.4%	-43%	215%
58	Mexico	2.8%	-31%	63%
60	Brazil	1.6%	-14%	84%
62	Colombia	1.1%	2.4%	132%
–	Ecuador	2.4%	-12%	53%
–	Panama	0.8%	-17%	62%
–	Peru	0.8%	10%	761%
–	Costa Rica	0.7%	16%	63%
–	Venezuela	0.2%	23%	120%
–	Bolivia	0.1%	-20%	89%
–	Paraguay	<0.1%	-18%	27%

Figure 25: High Broadband (>10 Mbps) Connectivity by Americas Country

Global Rank	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
19	Canada	83%	-0.9%	1.3%
39	United States	73%	1.2%	1.8%
52	Uruguay	59%	11%	1218%
66	Chile	39%	-6.8%	65%
69	Argentina	36%	-0.7%	97%
70	Mexico	35%	-7.3%	8.4%
74	Peru	30%	64%	713%
79	Ecuador	27%	5.0%	7.1%
80	Colombia	25%	-4.0%	42%
81	Brazil	25%	-2.7%	22%
84	Panama	16%	8.2%	11%
87	Costa Rica	13%	40%	205%
98	Venezuela	1.3%	-20%	-9.6%
–	Bolivia	1.4%	6.2%	83%
–	Paraguay	1.0%	3.0%	71%

Figure 26: Broadband (>4 Mbps) Connectivity by Americas Country

The notion of "readiness" presented here also does not consider the availability of 4K-encoded content within a given state, nor the availability/affordability/uptake of 4K-capable televisions and media players.

As Figure 27 shows, more than half of the surveyed countries in the Americas region again failed to qualify for inclusion in the 4K readiness metric in the third quarter. Among the six qualifying countries, the United States and Canada continued to have 4K readiness rates well above those seen in the remaining four countries, as well as being well above the rates seen in the nine countries that did not qualify. Among those nine countries, only Uruguay had a readiness rate above 1.0%; three of the countries are at 0.1% or less. Surprisingly, all six qualifying countries saw 4K readiness rates decline quarter-over-quarter, with significant losses seen in all but the United States. However, within the nine countries that did not qualify for inclusion, quarterly changes were more mixed, with five seeing higher readiness rates, and four seeing declines. The percentage losses among this group were fairly significant as well.

Among the qualifying Americas countries, the year-over-year changes were all extremely positive, with all growing more than 10%, and two growing in excess of 100%. The balance of the countries in the region also saw extremely strong yearly increases, with the exception of Paraguay, which lost 25% from the third quarter of 2013. However, with a 4K readiness rate below 0.1%, even small shifts in the underlying data can appear as significant changes over time. In general, however, the observed 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
16	United States	19%	-2.3%	46%
25	Canada	14%	-15%	62%
46	Argentina	1.0%	-31%	497%
48	Mexico	0.9%	-32%	56%
49	Chile	0.8%	-55%	221%
50	Brazil	0.5%	-11%	65%
–	Uruguay	2.2%	-44%	3974%
–	Ecuador	0.6%	-24%	27%
–	Costa Rica	0.4%	18%	38%
–	Colombia	0.3%	3.0%	126%
–	Panama	0.2%	-15%	59%
–	Peru	0.2%	2.0%	488%
–	Venezuela	0.1%	36%	178%
–	Bolivia	0.1%	1.9%	135%
–	Paraguay	<0.1%	-54%	-25%

Figure 27: 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 / South Korea remained firmly entrenched in its position as the country in the Asia Pacific region (and the world) with the highest average connection speed, improving by 2.7% quarter-over-quarter to reach 25.3 Mbps, as shown in Figure 28. Hong Kong, Japan, and Singapore remained the only other surveyed Asia Pacific countries/regions to have average connection speeds above the 10 Mbps "high broadband" threshold. All four geographies saw positive quarterly changes, as did six other geographies within the region. Overall, quarter-over-quarter increases ranged from India's 0.5% increase to an unexpectedly high 49% in Indonesia. The Philippines saw its average connection speed remain

unchanged at 2.5 Mbps, while the three remaining countries experienced lower average connection speeds than in the second quarter; Australia lost 1.8%, Malaysia dropped 4.4%, and Vietnam lost 12% (after seeing an impressive 42% increase in the second quarter). Similar to the second quarter, nine of the 14 surveyed Asia Pacific countries/regions had average connection speeds above the 4 Mbps "broadband" threshold. In addition, India remained the country with the lowest average connection speed in the region at 2.0 Mbps.

Looking at year-over-year changes seen across the Asia Pacific region, we see that all of the surveyed countries/regions again experienced very strong growth in average connection speeds. In line with its strong quarterly gain, Indonesia also had the largest year-over-year increase at 149%. All of the other surveyed countries/regions saw yearly increases greater than 10%, with the exception of Japan's 9.3% growth rate; it also had the lowest annual rate of increase in the second quarter, although it was more than double this quarter's year-over-year change. As has been 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.

6.2 Asia Pacific Average Peak Connection Speeds / Figure 29 shows that strong quarter-over-quarter changes made Hong Kong and Singapore the only two surveyed Asia Pacific countries/regions with average peak connection speeds above 80 Mbps. Last quarter, Hong Kong and South Korea were the only two above 70 Mbps — Singapore was just shy of 65 Mbps. Changes seen in the remaining countries/regions were much lower than those seen in Hong Kong and Singapore, ranging from 1.4% in Thailand to 9.9% in Indonesia. Six of the surveyed countries/regions also saw average peak connection speeds drop from the second quarter, although the losses were fairly nominal, ranging from a decline of 1.1% in the Philippines to 8.6% in Vietnam. These mixed quarterly changes and nominal increases are in sharp contrast to the changes seen last quarter, when all but two of the surveyed countries saw double-digit percentage increases on a quarterly basis.

However, year-over-year changes in the Asia Pacific region were very strong. Once again, Indonesia had the largest yearly increase, at 166%, and was the only surveyed country to see its average peak connection speed more than double from the third quarter of 2013. Singapore, China, and New Zealand all saw average peak speeds up more than 50% over the previous year, while seven additional countries gained more than 25% on a yearly basis. The smallest increase seen in the region occurred in South Korea, which added a solid 17%.

6.3 Asia Pacific High Broadband Connectivity / Figure 30 shows that all but two of the surveyed Asia Pacific countries/regions qualified for inclusion in the global rankings for high broadband adoption. Of those that qualified, South Korea, Hong Kong, and Japan led the region in high broadband adoption, with South Korea's 81% adoption rate significantly higher than the 55% seen in both Hong Kong and Japan. The lowest adoption rates were seen in China and India, both just above 1%. In the Philippines and Vietnam, which did not qualify for inclusion, high broadband adoption rates remained below 1%. Quarterly changes were extremely mixed among the qualifying countries/regions. Growth rates covered an extremely wide span, ranging from 0.5% in Japan to 534% in Indonesia, which saw significant quarterly growth across other metrics as well. Among the five countries where high broadband adoption rates fell from the previous quarter, three saw losses above 10%, with Malaysia's 28% decline the largest. A significant decline was also seen in Vietnam, while the Philippines saw a slight quarterly increase.

Global Rank	Country/Region	Q3 '14 Avg. Mbps	QoQ Change	YoY Change
1	South Korea	25.3	2.7%	14%
2	Hong Kong	16.3	3.8%	29%
3	Japan	15.0	0.8%	9.3%
10	Singapore	12.2	18%	57%
27	Taiwan	9.5	0.7%	16%
42	New Zealand	7.0	4.0%	37%
44	Australia	6.9	-1.8%	25%
48	Thailand	6.6	4.9%	39%
71	Malaysia	4.1	-4.4%	27%
75	China	3.8	2.2%	32%
77	Indonesia	3.7	49%	149%
101	Vietnam	2.5	-12%	22%
105	Philippines	2.5	0.0%	39%
115	India	2.0	0.5%	29%

Figure 28: Average Connection Speed by Asia Pacific Country/Region

Global Rank	Country/Region	Q3 '14 Peak Mbps	QoQ Change	YoY Change
1	Hong Kong	84.6	14%	29%
2	Singapore	83.0	28%	65%
3	South Korea	74.2	3.0%	17%
4	Japan	65.1	5.9%	25%
9	Taiwan	55.1	-5.3%	26%
28	Thailand	41.9	1.4%	40%
44	Australia	36.0	-2.1%	22%
50	New Zealand	32.2	1.3%	58%
56	Malaysia	29.8	-2.1%	20%
64	Indonesia	25.8	9.9%	166%
81	Philippines	21.3	-1.1%	33%
93	China	18.1	4.1%	60%
100	Vietnam	16.6	-8.6%	38%
113	India	13.9	-3.8%	38%

Figure 29: Average Peak Connection Speed by Asia Pacific Country/Region

Year-over-year changes were very strong across the surveyed Asia Pacific countries/regions, including in the two that did not qualify for inclusion in this metric. Japan's 6.3% growth rate was the smallest in the region, while five countries/regions saw high broadband adoption more than double on a yearly basis, led by a massive 2,403% increase in Indonesia. Strong yearly growth rates were also seen in the Philippines, at 419%, and in Vietnam, at 163%. 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 third quarter, these large yearly changes are not necessarily indicative of significant improvements to Internet connectivity within these countries.

6.4 Asia Pacific Broadband Connectivity / South Korea continued its slow but steady march towards complete broadband adoption, with 96% of its connections to Akamai at speeds above 4 Mbps in the third quarter, as Figure 31 shows. In contrast, the Philippines and India were the only two countries within the Asia Pacific region with broadband adoption rates below 10%, at 8.8% and 6.9% adoption respectively. Quarter-over-quarter changes were generally positive, with 10 of the surveyed countries/regions seeing increases from the previous quarter. Hong Kong had the lowest growth rate, at just 0.2%, with South Korea and Australia also growing less than 1%. Consistent with its quarterly changes across the other metrics, Indonesia far and away led the pack here as well, seeing its broadband adoption rate increase by 250% as compared to the second quarter. Of the four surveyed countries/regions that saw lower broadband adoption rates, quarterly losses were modest in Taiwan, Malaysia, and India, but broadband adoption in the Philippines declined a comparatively high 29%.

Surprisingly, the three Asia Pacific countries/regions with the highest broadband adoption rates also had the smallest year-over-year changes, as they were the only ones to grow less than 10%. Once again, Indonesia led the balance of the other surveyed countries/regions with a yearly increase of nearly 1,900%, while Vietnam and the Philippines joined it in seeing broadband adoption rates grow more than 200% over the previous year. Although it grew 179% year-over-year in the second quarter, India fell just short this quarter of doubling broadband adoption on an annual basis, growing 97%.

6.5 Asia Pacific 4K Readiness / As described above 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, nor the availability/affordability/uptake of 4K-capable televisions and media players.

With a not-unexpected 459% quarterly increase, given its performance across the other metrics, Indonesia vaulted into and up the ranks of the qualifying Asia Pacific surveyed countries/regions. As Figure 32 demonstrates, none of the other countries/regions came even close to seeing that kind of growth, as Singapore's 47% quarter-over-quarter addition was the next largest. Among those that qualified for inclusion, only five saw high 4K readiness rates as compared to the previous quarter, while six saw those rates drop. Declines ranged from 0.7% in Japan to 23% in China. The highest rate

Global Rank	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
1	South Korea	81%	3.6%	16%
2	Hong Kong	55%	6.6%	43%
3	Japan	55%	0.5%	6.3%
11	Singapore	43%	29%	113%
33	Taiwan	24%	-5.7%	14%
40	Australia	14%	-6.5%	76%
42	New Zealand	14%	1.2%	117%
43	Thailand	9.6%	16%	296%
52	Malaysia	3.9%	-28%	84%
56	Indonesia	3.3%	534%	2403%
61	China	1.4%	-20%	37%
63	India	1.1%	-11%	153%
–	Philippines	0.7%	3.8%	419%
–	Vietnam	0.3%	-46%	163%

Figure 30: High Broadband (>10 Mbps) Connectivity by Asia Pacific Country/Region

Global Rank	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
1	South Korea	96%	0.6%	3.0%
8	Hong Kong	89%	0.2%	9.5%
12	Japan	87%	1.2%	4.0%
15	Thailand	85%	7.5%	54%
20	Singapore	83%	3.1%	22%
31	Taiwan	78%	-2.5%	24%
33	New Zealand	77%	7.1%	42%
47	Australia	66%	0.6%	28%
67	Malaysia	39%	-3.0%	43%
71	Indonesia	35%	250%	1884%
72	China	34%	5.5%	82%
86	Vietnam	14%	-29%	218%
90	Philippines	8.8%	6.9%	240%
92	India	6.9%	-3.8%	97%

Figure 31: Broadband (>4 Mbps) Connectivity by Asia Pacific Country/Region

of 4K readiness across the region was seen in South Korea, which had two thirds of its connections to Akamai in the third quarter at speeds above 15 Mbps, while the lowest level of readiness was seen in China, at just 0.2%. Malaysia, the Philippines, 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.

Observed year-over-year changes in qualifying countries/regions were all positive, and spanned an extremely wide range, from 4.9% in Taiwan and 8.5% in Japan to 1,468% in Indonesia. In addition to Indonesia, Singapore, New Zealand, Thailand, and India also saw 4K readiness rates more than double on a yearly basis, as did the Philippines and Vietnam. Aside from Taiwan and Japan, all of the remaining surveyed Asia Pacific countries/regions saw at least double-digit percentage improvements from the third quarter of 2013. 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	66%	6.1%	27%
2	Hong Kong	37%	8.1%	57%
3	Japan	33%	-0.7%	8.5%
9	Singapore	21%	47%	174%
27	Taiwan	12%	-6.8%	4.9%
36	Australia	5.8%	-13%	85%
39	New Zealand	4.3%	-3.8%	171%
41	Thailand	2.8%	26%	324%
47	Indonesia	0.9%	459%	1468%
51	India	0.5%	-8.9%	165%
52	China	0.2%	-23%	54%
–	Malaysia	1.1%	-29%	80%
–	Philippines	0.2%	-0.4%	279%
–	Vietnam	0.1%	-39%	145%

Figure 32: 4K Ready (>15 Mbps) Connectivity by Asia Pacific 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 / For the third consecutive quarter, Switzerland led the surveyed EMEA countries in the average connection speed metric at 14.5 Mbps, down 2.6% from the previous quarter. As Figure 33 shows, Switzerland was just ahead of both Sweden and the Netherlands. In addition to these three countries, an additional 10 countries had average connection speeds above the 10 Mbps "high broadband" threshold, while another 11 were above the 4 Mbps "broadband" threshold. Only South Africa, at 3.6 Mbps, failed to reach either threshold. Quarterly changes were mixed across the surveyed countries, with half seeing average connection speeds increase quarter-over-quarter, and the other half seeing speeds decline. Changes on both

sides were relatively moderate, with increases ranging from 0.1% in Hungary to 19% in South Africa and losses ranging from 0.7% in Russia to 4.5% in Italy. Overall, the quarterly changes seen were much more modest than in the second quarter, when all surveyed countries saw higher speeds quarter-over-quarter, with most growing more than 10%.

Year-over-year changes were much more positive than the quarterly ones, as all countries in the EMEA region saw higher average connection speeds as compared to the third quarter of 2013. The smallest increase was seen in the United Arab Emirates, which grew 3.8%. Four additional countries also saw yearly increases below 10%. However, South Africa had the highest yearly growth rate at 59%, followed by Ireland and Romania at 47% and 44%, respectively. In addition to these three, nine more countries grew by more than 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 / After seeing strong quarterly increases across the board in average peak connection speeds among surveyed EMEA countries in the second quarter, the third quarter brought mixed, and significantly more limited, changes in the third quarter, as shown in Figure 34. Israel remained the country with the top average peak connection speed, but suffered a quarterly loss of nearly 10%, falling to 61.8 Mbps. Quarterly losses were also seen across 11 additional surveyed EMEA countries, with the smallest declines being seen in Belgium and Portugal, which dropped 0.3% and 0.9% respectively. Israel's quarterly loss was the largest in the region. Among the EMEA countries that saw higher average peak connection speeds from the second quarter, growth rates ranged from just 0.4% in the United Kingdom up to an impressive 30% in South Africa. Despite the mixed quarterly changes across the region, the number of surveyed EMEA countries with average peak connection speeds above 50 Mbps grew from five in the second quarter to seven in the third quarter — Sweden and Ireland joined the list thanks to strong quarterly increases.

Global Rank	Country/Region	Q3 '14 Avg. Mbps	QoQ Change	YoY Change
4	Switzerland	14.5	-2.6%	25%
5	Sweden	14.1	3.7%	35%
6	Netherlands	14.0	-2.5%	9.8%
7	Ireland	13.9	10%	47%
9	Czech Republic	12.3	-1.8%	9.0%
11	Finland	11.7	1.5%	37%
13	Norway	11.4	-0.8%	28%
14	Belgium	11.4	1.6%	14%
15	Israel	11.4	3.3%	38%
16	Romania	11.3	-3.9%	44%
17	Denmark	11.2	-3.9%	18%
19	United Kingdom	10.7	-3.4%	17%
20	Austria	10.4	0.3%	6.6%
29	Russia	9.1	-0.7%	16%
30	Hungary	8.8	0.1%	32%
31	Germany	8.7	-2.4%	15%
32	Slovakia	8.6	6.0%	28%
33	Poland	8.6	6.3%	17%
37	Portugal	8.0	2.1%	36%
40	Spain	7.8	-2.7%	12%
45	France	6.9	-2.4%	5.4%
50	Turkey	5.5	1.3%	35%
51	Italy	5.5	-4.5%	16%
61	United Arab Emirates	4.7	1.7%	3.8%
81	South Africa	3.6	19%	59%

Figure 33: Average Connection Speed by EMEA Country

Global Rank	Country/Region	Q3 '14 Peak Mbps	QoQ Change	YoY Change
5	Israel	61.8	-9.9%	30%
6	Romania	58.7	-6.9%	29%
11	Switzerland	54.4	2.3%	42%
12	Sweden	54.0	8.5%	46%
14	Netherlands	53.3	0.1%	32%
15	Belgium	52.7	-0.3%	32%
16	Ireland	50.4	13%	60%
19	Russia	47.1	1.9%	44%
20	United Kingdom	46.8	0.4%	31%
23	Portugal	43.7	-0.9%	33%
24	Hungary	43.7	3.7%	40%
25	Czech Republic	43.4	0.7%	25%
26	Finland	43.4	6.3%	45%
30	Norway	41.5	3.4%	37%
31	Austria	40.4	-2.7%	27%
33	Germany	39.2	-6.3%	29%
35	Denmark	38.9	-4.4%	26%
38	Slovakia	38.3	6.5%	42%
40	Poland	37.5	3.0%	35%
43	Spain	36.2	-2.1%	34%
48	United Arab Emirates	33.2	-3.6%	-8.1%
51	Turkey	32.1	-1.5%	50%
60	France	29.1	-3.2%	32%
65	Italy	25.3	-4.2%	36%
97	South Africa	17.1	30%	151%

Figure 34: Average Peak Connection Speed by EMEA Country

Global Rank	Country/Region	% Above 10 Mbps	QoQ Change	YoY Change
4	Switzerland	54%	-3.2%	39%
5	Netherlands	53%	1.6%	16%
6	Romania	49%	-1.6%	147%
8	Belgium	45%	3.9%	26%
9	Israel	44%	4.8%	117%
10	Sweden	44%	8.4%	43%
13	Czech Republic	40%	-5.9%	12%
15	Denmark	38%	-5.4%	27%
16	Finland	37%	2.8%	45%
17	United Kingdom	36%	-0.3%	31%
18	Ireland	35%	5.3%	43%
19	Norway	35%	1.6%	37%
24	Russia	30%	-3.6%	28%
25	Austria	28%	-0.1%	14%
26	Hungary	28%	-1.2%	80%
29	Portugal	25%	10%	155%
31	Poland	25%	12%	35%
35	Germany	23%	-9.7%	32%
36	Slovakia	21%	10%	76%
37	Spain	19%	-5.2%	38%
41	France	14%	-6.9%	16%
48	Turkey	6.1%	20%	235%
50	Italy	5.3%	-20%	58%
53	United Arab Emirates	3.5%	-5.8%	-35%
54	South Africa	3.4%	37%	211%

Figure 35: High Broadband (>10 Mbps) Connectivity by EMEA Country

Global Rank	Country/Region	% Above 4 Mbps	QoQ Change	YoY Change
3	Switzerland	93%	0.1%	3.3%
4	Israel	92%	2.9%	14%
5	Netherlands	90%	0.8%	1.4%
7	Denmark	89%	-1.9%	7.9%
9	Romania	89%	-2.1%	13%
11	Belgium	88%	1.7%	8.6%
14	Austria	86%	0.9%	0.8%
16	Sweden	84%	-0.5%	19%
18	Czech Republic	83%	-0.8%	0.7%
22	United Kingdom	81%	0.4%	5.1%
24	Poland	80%	7.1%	18%
26	Russia	80%	2.2%	9.5%
27	Finland	79%	4.5%	16%
29	Germany	79%	-0.1%	5.1%
30	Hungary	78%	2.1%	19%
34	Norway	76%	3.7%	34%
35	Spain	75%	-2.1%	4.5%
38	Portugal	74%	-1.3%	15%
41	Slovakia	70%	0.7%	22%
42	Ireland	69%	0.5%	4.8%
44	France	68%	-1.2%	-1.2%
46	Turkey	66%	-1.3%	79%
50	Italy	60%	-7.3%	22%
57	United Arab Emirates	51%	6.9%	17%
82	South Africa	23%	81%	202%

Figure 36: Broadband (>4 Mbps) Connectivity by EMEA Country

Once again, with the exception of an 8.1% decline observed in the United Arab Emirates, year-over-year changes for the surveyed countries in the EMEA region were all strongly positive. As it did with the quarterly changes, South Africa also had the largest yearly change in its average peak connection speed, growing 151%. However, it was the only country to see speeds more than double on a yearly basis. Among the other countries, all had growth rates above 10%, with increases ranging from 25% in the Czech Republic up to 60% in Ireland. In reviewing the year-over-year changes discussed in the other regional sections, we find very similar patterns, with a single surveyed country seeing its speed more than double, with extremely strong growth rates observed in the remaining countries.

7.3 EMEA High Broadband Connectivity / Only two of the surveyed EMEA countries had more than half of their connections to Akamai at speeds above 10 Mbps in the third quarter, as Romania's 1.6% quarter-over-quarter decline dropped it down to 49% high broadband adoption. However, as Figure 35 shows, an additional 14 countries joined Romania in seeing at least a quarter of their connections at those speeds during the quarter. Four countries continued to see broadband adoption rates well below 10%. In looking at quarter-over-quarter changes, we find them to be mixed, similar to what was observed for the connection speed metrics. A total of 13 surveyed EMEA countries saw high broadband adoption rates fall on a quarterly basis, with losses ranging from 0.1% in Austria to 20% in Italy. Among the balance of the countries where adoption rates rose from the second quarter, the smallest increases were seen in Norway and the Netherlands, both of which grew 1.6%. In line with the connection speed metrics, the largest increase was observed in South Africa, which added 37% quarter-over-quarter.

Despite having the largest quarterly increase, South Africa did not have the largest yearly increase — that honor fell to Turkey, which saw its high broadband adoption rate grow 235% year-over-year. In addition to these two countries, Romania, Israel, and Portugal also saw high broadband adoption rates more than double from the third quarter of 2013. Double digit percentage changes were observed across the remainder of the surveyed EMEA countries with the exception of the United Arab Emirates, which had a high broadband adoption rate 35% lower than the same period a year earlier.

7.4 EMEA Broadband Connectivity / As Figure 36 shows, the third quarter saw Israel join the list of surveyed EMEA countries with broadband adoption rates above 90%, while it also saw Denmark and Romania leave the list, as minor quarterly losses dropped them both to 89% broadband adoption. Overall quarterly trends were rather similar to those seen for high broadband adoption, as changes were mixed and relatively nominal as well. Ten countries saw broadband adoption rates fall quarter-over-quarter, with the smallest decline of 0.1% seen in Germany, and the largest decline of 7.3% seen in Italy. Similar to the other metrics, South Africa had the largest quarterly increase, growing an impressive 81%, while Switzerland's adoption rate grew a slight 0.1%. The quarterly increase in the United Arab Emirates pushed it to 51% broadband adoption, meaning that all but one of the surveyed countries in the EMEA region had more than half of their connections to Akamai at speeds above 4 Mbps in the third quarter. The lone outlier was South Africa, which failed to have even a quarter of its connections at that rate.

Despite a broadband adoption rate below 25%, South Africa has made great strides over the past year, as it grew just over 200% from the third quarter of 2013. While none of the other surveyed EMEA countries saw speeds more than double, another dozen had double-digit percentage growth rates, led by the 79% increase seen in Turkey. Among the balance of the countries, the most limited growth was seen in Austria and the Czech Republic, which both saw year-over-year changes below 1%, adding 0.8% and 0.7% respectively. France was the only country that had a lower broadband adoption rate year-over-year, though its decline was minor, losing 1.2%

Although Switzerland only saw nominal quarterly and yearly increases, its top standing for broadband adoption is bolstered by the work of Swisscom in making high-speed broadband connections available throughout the country.

Although Switzerland only saw nominal quarterly and yearly increases, its top standing for broadband adoption is bolstered by the work of Swisscom in making high-speed broadband connections available throughout the country. In July, the telecommunications firm said[35] that it had connected over 1 million homes to "ultra-fast" broadband through a mixture of Fiber-to-the-Street, which offers speeds of up to 100 Mbps, and Fiber-to-the-Home, which offers speeds up to 1 Gbps. The company noted that it aims to roll out ultra-fast broadband to over 2.3 million homes and companies by the end of 2015, and to more than 4.6 million by 2020, throughout Switzerland.

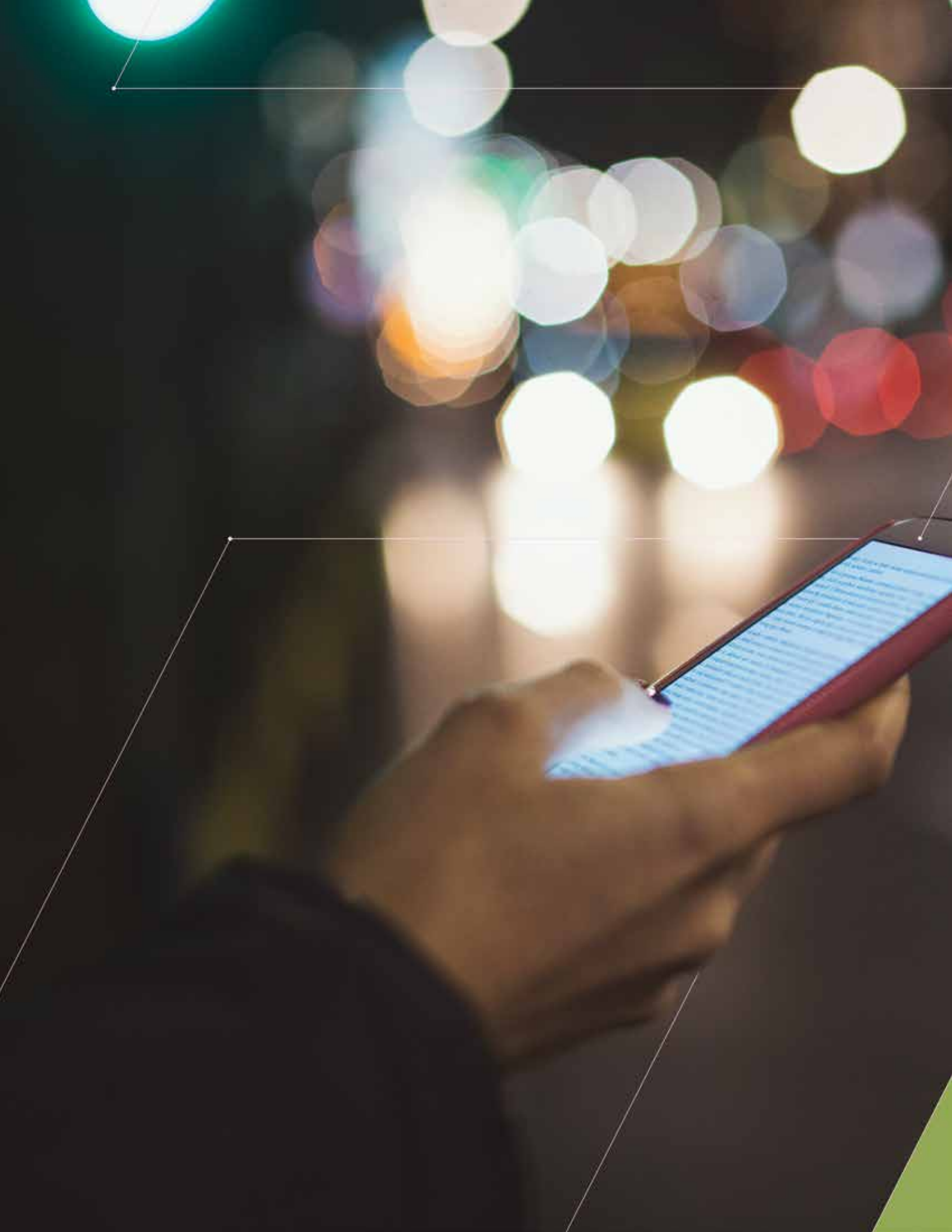
7.5 EMEA 4K Readiness / As described above in Section 3, given the growing interest in the streaming delivery of 4K ("Ultra HD") video, we thought it would be interesting to begin tracking a "4K readiness" metric in the *State of the Internet Report*. With 4K adaptive bitrate streams generally requiring 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, nor the availability/affordability/uptake of 4K-capable televisions and media players.

Figure 37 shows that nine of the surveyed EMEA countries had at least one of every five connections to Akamai at speeds above 15 Mbps, while another eight had at least one in 10 connections at those speeds. Switzerland remained the country with the highest 4K readiness rate at 30%, while South Africa remained the EMEA country with the lowest readiness rate at 1.7%. However, South Africa had one of, but not the, highest quarterly increases as it grew 24%, bested only by Turkey's 27% increase. Quarter-over-quarter growth was seen in only six other countries, with changes in those countries ranging from 0.4% in Finland to 14% in Portugal. Sixteen countries saw 4K readiness rates fall from the second quarter, with losses that ranged from just 0.4% in Belgium to 16% in Italy. Once again, the United Arab Emirates failed to qualify for inclusion in this metric, but it had a 4K readiness rate of just 1.0% after a 4.3% quarterly loss.

The United Arab Emirates was also the only surveyed EMEA country to see its 4K readiness rate decline year-over-year, while extremely strong increases were seen across the countries that did qualify. Six of the qualifying countries had readiness rates more than double those seen in the third quarter of 2013, with both Portugal and South Africa growing more than 200%. All of the rest of the surveyed countries saw growth rates above 10%, with the Czech Republic's 14% increase the smallest of the group. 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 EMEA region over time.

Global Rank	Country/Region	% Above 15 Mbps	QoQ Change	YoY Change
4	Switzerland	30%	-9.5%	61%
5	Netherlands	29%	-1.8%	20%
7	Sweden	29%	12%	64%
8	Norway	21%	-2.3%	49%
10	Belgium	21%	-0.4%	26%
11	Finland	20%	0.4%	84%
12	Romania	20%	-8.5%	179%
13	Czech Republic	20%	-11%	14%
14	United Kingdom	20%	-5.9%	49%
17	Denmark	19%	-10%	52%
18	Israel	18%	0.7%	156%
19	Ireland	18%	-3.7%	60%
24	Austria	15%	-2.2%	22%
26	Russia	13%	-8.8%	36%
28	Hungary	11%	-2.4%	101%
29	Slovakia	11%	7.2%	73%
30	Poland	11%	12%	34%
32	Portugal	9.5%	14%	214%
34	Germany	9.1%	-14%	41%
35	Spain	8.2%	-9.0%	49%
38	France	5.0%	-14%	33%
42	Italy	2.1%	-16%	57%
43	Turkey	2.0%	27%	185%
44	South Africa	1.7%	24%	226%
–	United Arab Emirates	1.0%	-4.3%	-22%

Figure 37: 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 that had 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 has been 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 38 shows that across the 54 countries/regions around the world that qualified for inclusion in the mobile section, South Korea continued to have the highest average connection speed, growing to 18.2 Mbps in the third quarter. Iran had the lowest average mobile connection speed, at 0.9 Mbps, and was the only qualifying country with an average speed below 1 Mbps in the third quarter. (Vietnam, which was in the same position in the second quarter, saw its average connection speed increase to 1.1 Mbps.) South Korea was no longer the only country/region with an average mobile connection speed above the 10 Mbps "high broadband" threshold, as it was joined by Slovakia, at 10.9 Mbps. An additional 29 countries/regions achieved an average mobile connection speed above the 4 Mbps "broadband" threshold. Within the individual continental regions, the following countries had the highest average mobile connection speeds — all five saw solid increases as compared to the second quarter:

- **Africa:** Egypt, 2.8 Mbps
- **Asia Pacific:** South Korea, 18.2 Mbps
- **Europe:** Slovakia, 10.9 Mbps
- **North America:** Canada, 7.9 Mbps
- **South America:** Venezuela, 6.0 Mbps

As has been seen in the prior two quarters, average peak mobile connection speeds again spanned an extremely broad range in the third quarter, from 98 Mbps in Singapore down to 3.3 Mbps in Iran. Nine countries/regions had average peak mobile connection speeds

Country/Region	Q3 '14 Avg. Mbps	Q3 '14 Peak Mbps	% Above 4 Mbps
AFRICA			
Egypt	2.8	16.3	10%
Morocco	2.2	15.0	1.8%
South Africa	2.5	9.3	13%
ASIA PACIFIC			
Australia	3.9	68.9	25%
China	6.2	16.7	74%
Hong Kong	6.0	33.5	54%
India	1.7	11.1	3.9%
Iran	0.9	3.3	0.8%
Japan	6.7	87.7	86%
South Korea	18.2	54.6	81%
Kuwait	4.8	86.2	53%
Kazakhstan	2.2	10.8	1.2%
Sri Lanka	2.6	26.5	5.9%
Malaysia	2.5	19.6	12%
New Zealand	3.3	21.0	32%
Pakistan	1.5	10.4	2.7%
Singapore	9.1	98.0	77%
Thailand	2.8	70.2	8.1%
Taiwan	3.5	25.8	15%
Vietnam	1.1	7.9	0.4%
EUROPE			
Austria	5.5	23.8	66%
Belgium	4.7	17.9	51%
Czech Republic	5.1	18.4	60%
Germany	5.4	56.0	18%
Denmark	7.9	39.4	94%
Spain	5.2	31.2	51%
France	7.1	44.7	71%
United Kingdom	8.1	51.0	81%
Croatia	2.7	12.0	0.5%
Hungary	4.4	18.5	34%
Ireland	6.2	31.9	49%
Italy	4.8	36.0	52%
Lithuania	4.2	23.7	39%
Moldova	4.3	19.3	34%
Netherlands	5.8	24.2	62%
Norway	5.9	24.0	72%
Poland	5.0	32.3	60%
Russia	7.0	44.4	67%
Sweden	7.3	36.9	94%
Slovenia	4.1	15.3	43%
Slovakia	10.9	49.5	85%
Turkey	4.2	59.5	43%
Ukraine	7.3	25.9	89%
NORTH AMERICA			
Canada	7.9	28.7	71%
El Salvador	2.6	13.7	10%
United States	5.8	16.9	26%
SOUTH AMERICA			
Argentina	1.3	7.3	3.1%
Bolivia	2.0	11.4	1.3%
Brazil	1.5	12.0	1.2%
Chile	1.8	12.9	3.0%
Colombia	2.1	10.7	2.8%
Paraguay	1.4	6.4	0.5%
Uruguay	2.4	17.2	17%
Venezuela	6.0	27.1	86%

Figure 38: Average and Average Peak Connection Speeds, Broadband (>4 Mbps) Adoption for Mobile Connections by Country/Region

above 50 Mbps, while another 40 saw speeds above 10 Mbps. In the second quarter report, it was noted that Australia's 108 Mbps average peak mobile connection speed was more than 2x faster than Japan's. Interestingly, Australia's second quarter 108 Mbps peak speed fell to 68.9 Mbps in the third quarter, while Japan's saw aggressive growth to 87.7 Mbps. Within the individual continental regions, the following countries had the highest average peak mobile connection speeds:

- **Africa:** Egypt, 16.3 Mbps
- **Asia Pacific:** Singapore, 98.0 Mbps
- **Europe:** Turkey, 59.5 Mbps
- **North America:** Canada, 28.7 Mbps
- **South America:** Venezuela, 27.1 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 connections to Akamai from mobile network providers within the qualifying countries/regions at speeds over 4 Mbps. In the third quarter, Sweden had the highest level of mobile broadband adoption, at 94%; it edged out Denmark, which held the top spot last quarter, by less than a tenth of a percent. Ukraine, which led in the first quarter, remained at 89% for the third consecutive quarter. In contrast to these countries with strong mobile broadband adoption, four countries (Iran, Paraguay, Croatia, and Vietnam) all had mobile broadband adoption rates below 1.0% in the third quarter. Within the individual continental regions, the following countries had the highest mobile broadband adoption rates:

- **Africa:** South Africa, 13%
- **Asia Pacific:** Japan, 86%
- **Europe:** Sweden, 94%
- **North America:** Canada, 71%
- **South America:** Venezuela, 86%

It is very interesting to note that across the top countries/regions for these metrics, all saw significant growth quarter-over-quarter. Ideally, this represents benefits of ongoing investment in improved mobile infrastructure within these geographies, but with only a couple of quarters to review, it is arguably too early to call this a long-term trend.

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. (Note that we are now rolling up all non-Webkit/Safari browsers within the "Others" line within the graph — previous editions of the report simply included the "Others" line as generated by Akamai IO.)

Figure 39 illustrates mobile browser usage by users identified to be on cellular networks in the third quarter of 2014. As in previous quarters, the figure focuses on the usage of Android Webkit and Apple Mobile Safari, with other browsers designated as "Others" in the graph. As the graph shows, a gap of approximately 5% separated Mobile Safari and Android Webkit at the start of the quarter. However, this gap began to widen towards the end of

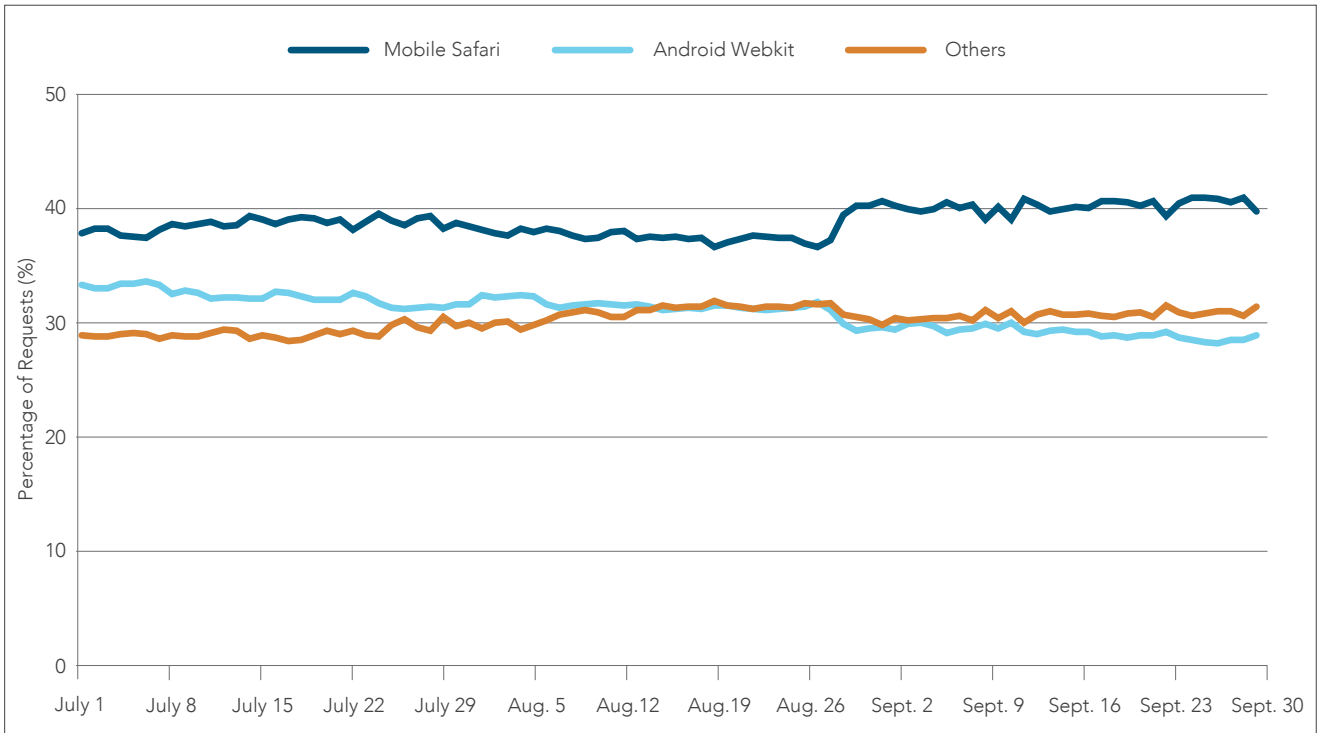


Figure 39: Leading Mobile Browsers Seen Across Cellular Networks, Q3 2014

August, growing to approximately 10% in early September, and ending the quarter in the 11 – 12% range. Looking at the Others line on the graph, it saw a gradual increase in early August, but then dropped in line with Android Webkit in late August. This is the second quarter in a row where Mobile Safari has held a significant lead over Android Webkit, and given the gap and trends observed after the close of the quarter, this is likely to be the case for the foreseeable future. Overall, Apple Mobile Safari trended to an average of 38.9% of requests, while Android Webkit trended to an average of 30.9% of requests.

Expanding the set of data to all networks (not just those defined as cellular), we see a usage pattern in Figure 40 similar to the one seen on cellular networks, though with a much larger gap. At the start of the quarter, Mobile Safari usage was more than 50% higher than Android Webkit, and this separation remained fairly consistent through late August. At that time, a noticeable shift occurs here as well, with Mobile Safari growing to more than 50% of requests, while Android Webkit drops below 30%. (Others saw a noticeable, but short-lived decline as well.) By the end of the quarter, the gap between the two browser platforms had widened, with Mobile Safari driving just over 50% of requests, and Android Webkit just under 28%. Averaged across the entire quarter, Apple Mobile Safari accounted for 50.4% of requests, while Android Webkit accounted for 29.8% 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 and regions, and also between operators due to their different customer profiles.

Figure 41 shows total global monthly data and voice traffic. It depicts a strong increase in data traffic growth with almost flat voice traffic development. The number of mobile data subscriptions has been increasing rapidly, driving growth in data traffic along with a continuous increase in the average data volume per subscription. Data traffic again grew around 10 percent between the second and third quarters of 2014, in line with the change seen between the first and second quarters.

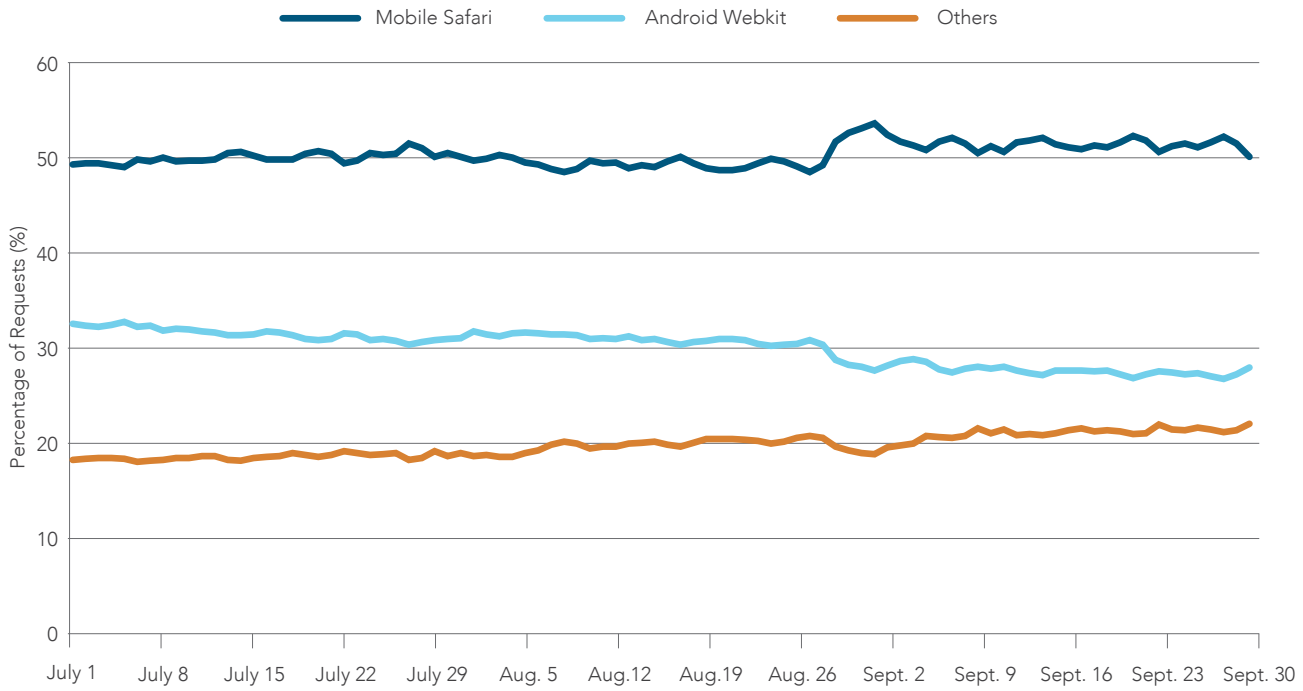


Figure 40: Leading Mobile Browsers Seen Across All Networks, Q3 2014

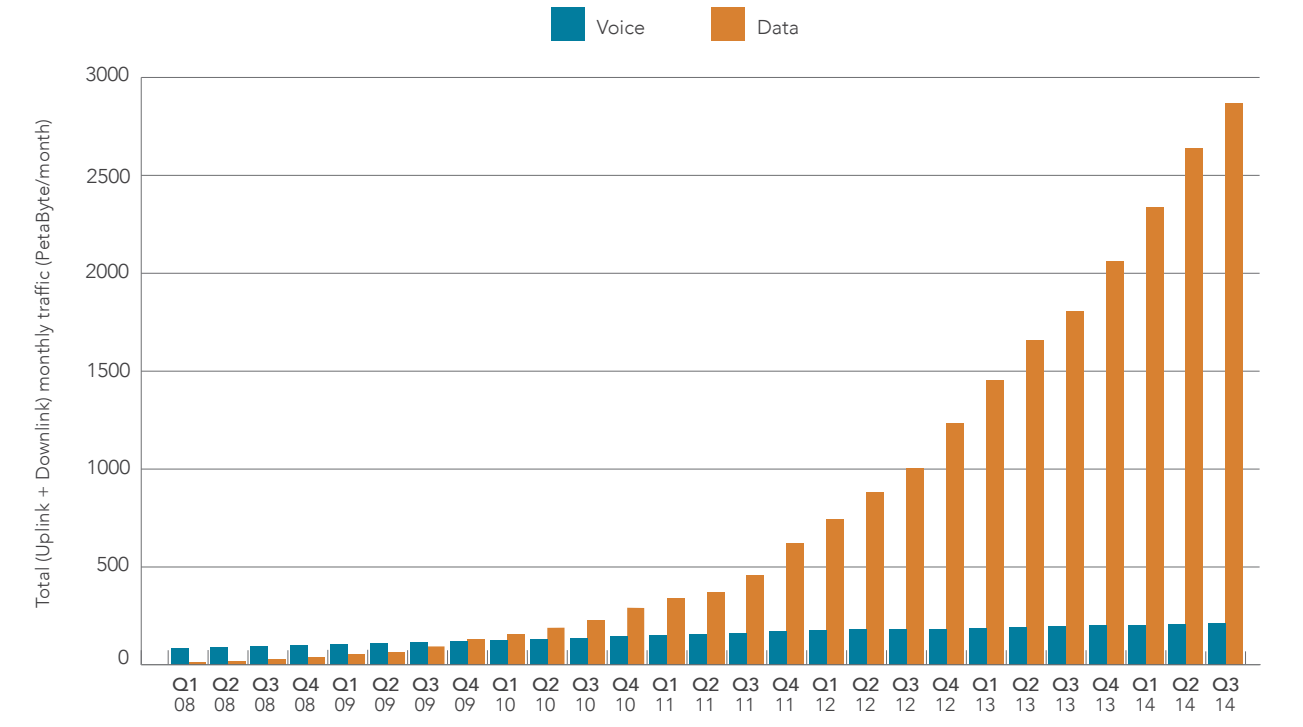


Figure 41: Total Monthly Mobile Voice and Data as Measured by Ericsson

[SECTION]9 SITUATIONAL PERFORMANCE

In June 2013, Akamai announced[36] 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 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 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"[37] ("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,[38] 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.[39] One key observation is the current lack of support in Apple's Safari browser, both on OSX and

iOS. In addition, Android first added support starting with v4.0 of the operating system, and Microsoft's Internet Explorer in v9 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.[40] 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."[41] Presumably, Apple will enable the functionality again in the future, once the performance issues have been addressed.

Figure 42 shows average page load times for users on both broadband and mobile connections, based on RUM data collected by Akamai during the third 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 OSX systems, users on older versions of Android, or users on 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 having been made 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 42, we find the lowest values (i.e. fastest page load times) in three Asia-Pacific countries/regions — Japan, Vietnam, and Hong Kong all had average load times below two seconds. This was more than 3x faster than the slowest countries, which were again both in South America — Paraguay and Brazil both had average load times above six seconds. Although Japan and Hong Kong have historically had strong broadband connectivity, seeing Vietnam at the top of the list as well was unexpected. Interestingly, Vietnam and Kazakhstan had the lowest average page load times for mobile connections; this is also unexpected, as neither has historically had particularly high mobile connection speeds (either average or peak). Both saw average page load times on mobile connections below one second, which could indicate a potential bias towards lighter content being presented to and consumed by mobile users in these countries. At the other end of the spectrum, China, India, and Brazil had the highest average page load times on mobile connections, with China and India above six seconds, while Brazil was just shy of 10 seconds.

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 on mobile connections vs. broadband connections. Surprisingly, of the 58 countries/regions included in Figure 42, 21 of them had a mobile penalty lower than 1.0x, meaning that the average page load times were faster on mobile connections than on broadband connections. The lowest mobile penalties were observed in Bangladesh and Kazakhstan, which were both below 0.3x. South Korea and Russia had mobile penalties on either side of 1.0x respectively, with average load times on the two connection types differing by just 7 ms in South Korea and 38 ms in Russia. The highest mobile penalties, all around 2x, were seen in Japan, Hong Kong, and Taiwan, meaning that pages loaded twice as fast on average on broadband connections than on 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
Asia Pacific	Australia	4230	4799	1.1x
Asia Pacific	Bangladesh	5724	1526	0.3x
Asia Pacific	Cambodia	2776	1795	0.6x
Asia Pacific	China	4030	6138	1.5x
Asia Pacific	Hong Kong	1959	4170	2.1x
Asia Pacific	India	4840	6772	1.4x
Asia Pacific	Indonesia	4612	3052	0.7x
Asia Pacific	Israel	4788	5318	1.1x
Asia Pacific	Japan	1430	2733	1.9x
Asia Pacific	Kazakstan	3342	966	0.3x
Asia Pacific	Kuwait	3029	1740	0.6x
Asia Pacific	Malaysia	2937	3930	1.3x
Asia Pacific	New Zealand	3640	4250	1.2x
Asia Pacific	Pakistan	3054	1051	0.3x
Asia Pacific	Singapore	3926	5333	1.4x
Asia Pacific	South Korea	2177	2170	1.0x
Asia Pacific	Sri Lanka	4636	4263	0.9x
Asia Pacific	Taiwan	2402	5551	2.3x
Asia Pacific	Thailand	3541	3382	1.0x
Asia Pacific	Vietnam	1844	686	0.4x
EMEA	Austria	2179	3105	1.4x
EMEA	Belgium	2175	2290	1.1x
EMEA	Czech Republic	2393	2711	1.1x
EMEA	Denmark	2842	3849	1.4x
EMEA	Egypt	4058	2587	0.6x
EMEA	France	3340	4478	1.3x
EMEA	Germany	2851	3626	1.3x
EMEA	Hungary	2305	2703	1.2x
EMEA	Ireland	2958	4852	1.6x
EMEA	Italy	3518	4547	1.3x
EMEA	Morocco	4183	3329	0.8x
EMEA	Netherlands	2487	2881	1.2x
EMEA	Norway	2842	4459	1.6x
EMEA	Poland	2469	3250	1.3x
EMEA	Romania	2171	2089	1.0x
EMEA	Russia	2960	2998	1.0x
EMEA	Slovakia	2501	2555	1.0x
EMEA	South Africa	5358	6131	1.1x
EMEA	Spain	2478	1462	0.6x
EMEA	Sweden	2502	4167	1.7x
EMEA	Switzerland	2450	3703	1.5x
EMEA	Turkey	2311	1447	0.6x
EMEA	Ukraine	3047	2932	1.0x
EMEA	United Kingdom	3888	5925	1.5x
N. America	Canada	2829	4279	1.5x
N. America	El Salvador	4084	3427	0.8x
N. America	Mexico	2663	1013	0.4x
N. America	Panama	3181	2306	0.7x
N. America	Puerto Rico	4302	2902	0.7x
N. America	United States	2828	4442	1.6x
S. America	Argentina	3897	5262	1.4x
S. America	Brazil	6638	9986	1.5x
S. America	Chile	3224	4117	1.3x
S. America	Colombia	3416	3480	1.0x
S. America	Paraguay	6451	5345	0.8x
S. America	Peru	3487	3616	1.0x
S. America	Uruguay	3667	5007	1.4x
S. America	Venezuela	4864	6131	1.3x

Figure 42: 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 third quarter.

10.1 Syria / Internet connectivity in Syria was again problematic, with significant disruptions occurring on several days throughout the third quarter, as Figure 43 illustrates.

On July 13, a disruption that started at 10:15 AM UTC and lasted just over two hours caused all networks in the country to become unreachable[42] and dropped Akamai traffic delivered to the country to zero. Figure 43 shows an additional brief disruption reflected in Akamai traffic to Syria occurring approximately two hours later, but this issue was not corroborated by reports from any third-party network monitoring firms. On July 20, another disruption lasting about an hour was observed, resulting in a sharp drop, but not complete loss, of Akamai traffic to Syria. A Twitter post from network monitoring firm BGPmon indicates that the disruption was related to the Syrian Telecommunications Establishment "disappearing" from the Internet[43] — that is, local networks that rely on the Syrian Telecommunications Establishment for Internet connectivity were no longer accessible from outside the country. Just over a week later, on July 28, Akamai monitoring showed another significant disruption occurring between 3:48 and 4:48 AM UTC — as the figure shows, it was a near-complete outage. Finally, on September 24, an outage starting at 8:45 AM UTC and lasting approximately a half hour was observed. According to BGPmon,[44] the instability impacted 55% of Syrian networks, ultimately resulting a significant drop, but quick recovery, of Akamai traffic to Syrian users.

10.2 Gambia / Figure 44 shows the impact of a multi-hour disruption in Gambia on September 11. Starting at approximately 7:45 AM UTC and lasting until 2:00 PM UTC, the issue initially dropped Akamai traffic to the country to zero for a brief period, after which it slowly recovered, but at levels significantly lower than would be expected from the normal daily traffic pattern. A Twitter post from Dyn Research, the Internet monitoring company formerly known as Renesys, notes that the observed disruption was due to Gamtel's loss of access to the Africa Coast to Europe (ACE) submarine cable, forcing it to revert to Senegalese satellite service as a backup.[45] A second similar issue also reportedly occurred on September 15,[46] although this disruption is not reflected in the figure.

10.3 Iraq / Taking place at roughly the same time on July 20 as the Syria disruption discussed above, Iraq also saw a disruption in Internet connectivity. As shown in Figure 45, Akamai traffic to Iraq dropped sharply at approximately 8:45 AM UTC, with the disruption lasting for over an hour until recovering around 10:00 AM UTC. BGPmon noted in a Twitter post[47] that the outage primarily impacted Earthlink, a major network service provider within the country. Figure 45 also illustrates the impact of a disruption that took place on September 11. Starting just before 3:30 PM UTC, the issue lasted for approximately one hour. Dyn Research noted in a Twitter post[48] that the outage downed "most of IQ Networks, major portion of transit via Iraqi Kurdistan." IQ Networks is a leading telecommunications service provider within Iraq.

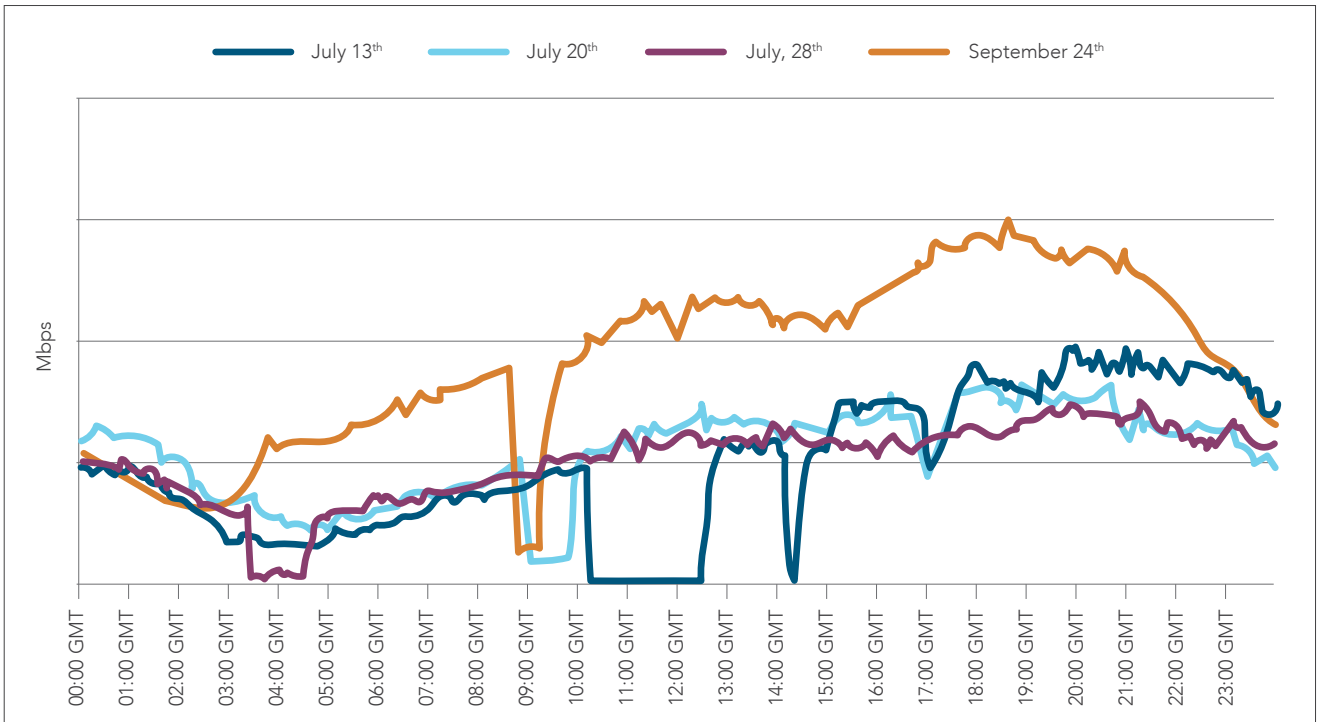


Figure 43: Akamai Traffic Served to Syria, July 13/20/28 & September 24th, 2014

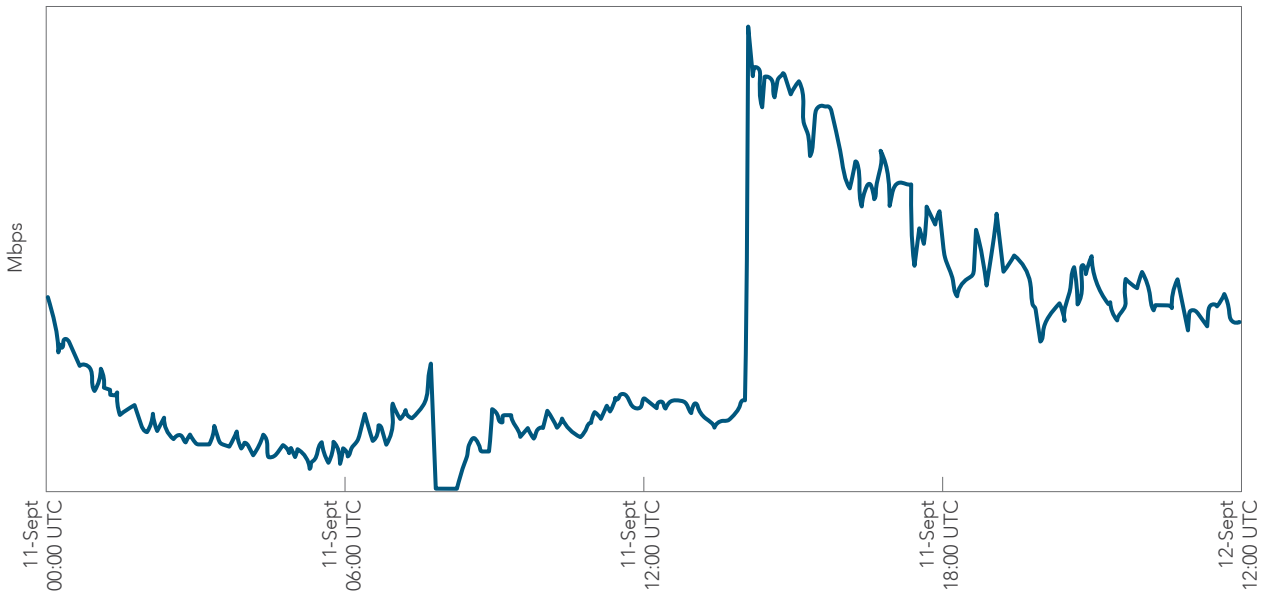


Figure 44: Akamai Traffic Served to Gambia, September 11th, 2014

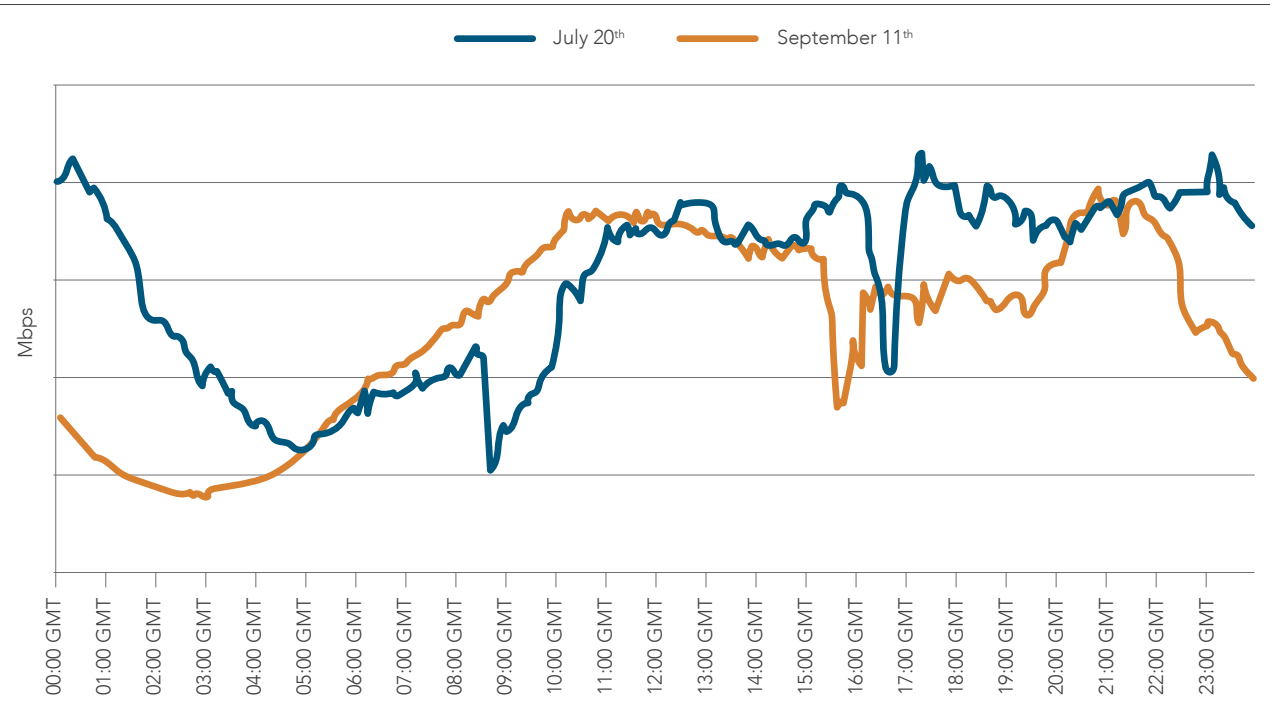


Figure 45: Akamai Traffic Served to Iraq, July 20th & September 11th, 2014

10.4 Liberia & Sierra Leone / On September 2, Akamai traffic to both Liberia and Sierra Leone simultaneously dropped to near zero just before 9:00 AM UTC, as shown in Figure 46. The disruption lasted just over an hour and a half. While no formal explanation for the disruption was ever published, research shows that both countries are connected to the Africa Coast to Europe (ACE) submarine cable, so a problem with the cable may have caused the disruption. However, in checking September 2 traffic patterns for several other neighboring countries also connected to the ACE submarine cable, no similar anomalies were found. In addition, any physical damage to the cable would take well more than an hour to repair.

10.5 Venezuela / On September 25, a power outage hit several states across Venezuela, causing a brief disruption in Internet connectivity for the country. According to a published report,[49] the blackout began about 1:30 PM local time and lasted for about an hour. This report aligns with the decline in Akamai traffic to the country shown in Figure 47, which occurs just after 6:00 PM UTC, with traffic levels beginning to recover approximately an hour later.

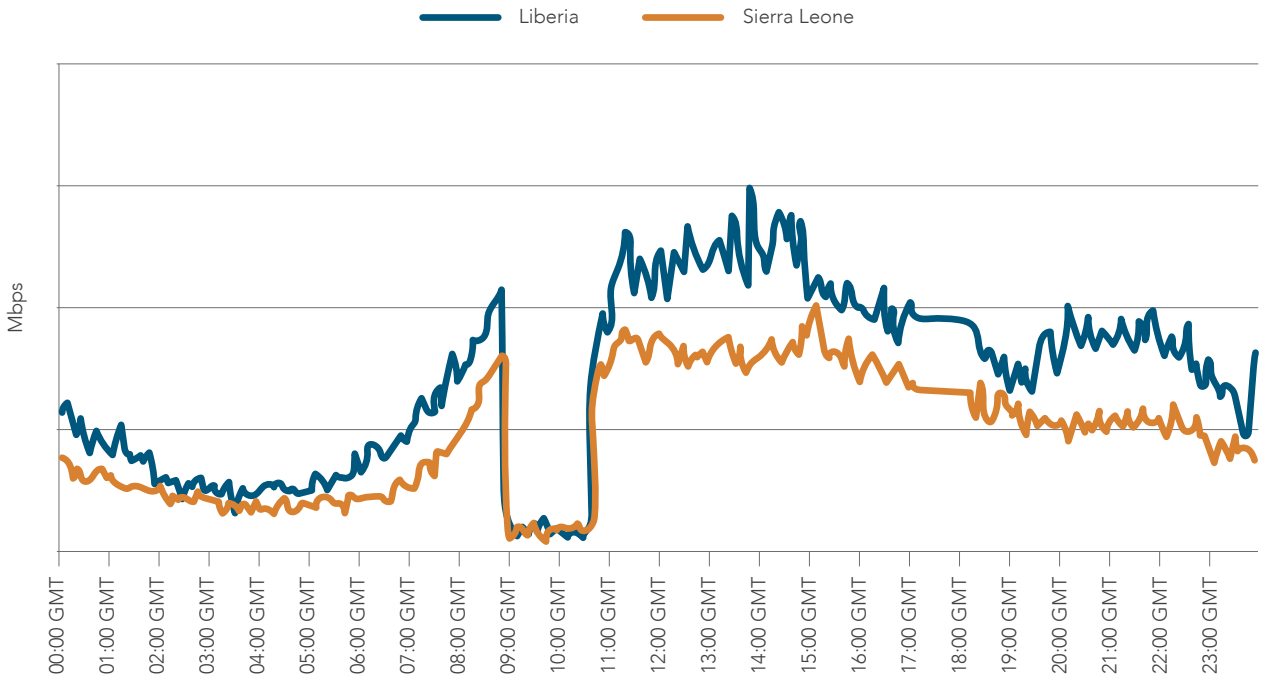


Figure 46: Akamai Traffic Served to Liberia and Sierra Leone, September 2nd, 2014

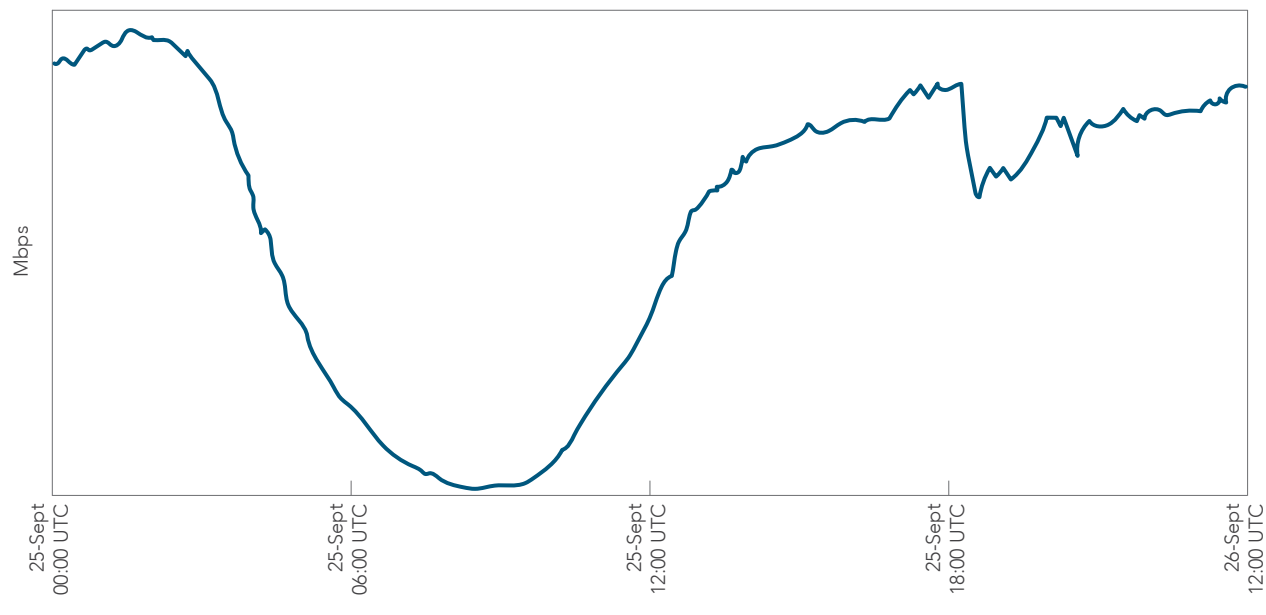


Figure 47: Akamai Traffic Served to Venezuela, September 25th, 2014

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	1.1%	7,557,395	4.2	22.0	5.6%	36%	1.0%
Bolivia	<0.1%	413,893	1.1	9.3	0.1%	1.4%	0.1%
Brazil	1.9%	45,469,490	2.9	20.5	1.6%	25%	0.5%
Canada	0.5%	14,266,931	10.3	43.7	33%	83%	14%
Chile	0.2%	4,486,567	4.1	26.1	3.4%	39%	0.8%
Colombia	0.6%	11,243,138	3.4	22.7	1.1%	25%	0.3%
Costa Rica	0.1%	465,448	2.7	12.4	0.7%	13%	0.4%
Ecuador	0.1%	921,891	3.6	20.7	2.4%	27%	0.6%
Mexico	1.1%	12,630,052	4.1	22.8	2.8%	35%	0.9%
Panama	0.1%	508,958	2.9	14.2	0.8%	16%	0.2%
Paraguay	<0.1%	712,224	1.3	9.2	<0.1%	1.0%	<0.1%
Peru	<0.1%	1,166,537	3.6	20.6	0.8%	30%	0.2%
United States	17%	156,786,482	11.5	48.8	39%	73%	19%
Uruguay	0.2%	1,216,385	5.5	58.6	7.2%	59%	2.2%
Venezuela	1.2%	3,918,941	1.3	10.2	0.2%	1.3%	0.1%
ASIA PACIFIC							
Australia	0.2%	9,077,961	6.9	36.0	14%	66%	5.8%
China	49%	122,119,656	3.8	18.1	1.4%	34%	0.2%
Hong Kong	0.8%	3,063,907	16.3	84.6	55%	89%	37%
India	2.9%	17,969,589	2.0	13.9	1.1%	6.9%	0.5%
Indonesia	1.9%	6,194,014	3.7	25.8	3.3%	35%	0.9%
Japan	0.4%	40,659,122	15.0	65.1	55%	87%	33%
Malaysia	0.4%	2,090,253	4.1	29.8	3.9%	39%	1.1%
New Zealand	<0.1%	2,051,030	7.0	32.2	14%	77%	4.3%
Philippines	0.2%	1,392,292	2.5	21.3	0.7%	8.8%	0.2%
Singapore	0.2%	1,600,272	12.2	83.0	43%	83%	21%
South Korea	1.4%	20,710,138	25.3	74.2	81%	96%	66%
Taiwan	3.8%	10,764,745	9.5	55.1	24%	78%	12%
Thailand	0.7%	3,561,861	6.6	41.9	9.6%	85%	2.8%
Vietnam	0.7%	5,685,003	2.5	16.6	0.3%	14%	0.1%
EUROPE, MIDDLE EAST & AFRICA							
Austria	<0.1%	2,953,649	10.4	40.4	28%	86%	15%
Belgium	0.1%	4,873,416	11.4	52.7	45%	88%	21%
Czech Republic	0.1%	1,920,539	12.3	43.4	40%	83%	20%
Denmark	<0.1%	3,009,305	11.2	38.9	38%	89%	19%
Finland	<0.1%	3,054,905	11.7	43.4	37%	79%	20%
France	0.5%	28,284,527	6.9	29.1	14%	68%	5.0%
Germany	0.6%	36,788,648	8.7	39.2	23%	79%	9.1%
Hungary	0.5%	2,955,699	8.8	43.7	28%	78%	11%
Ireland	0.1%	1,926,795	13.9	50.4	35%	69%	18%
Israel	0.3%	2,264,162	11.4	61.8	44%	92%	18%
Italy	0.6%	18,620,207	5.5	25.3	5.3%	60%	2.1%
Netherlands	0.7%	9,163,943	14.0	53.3	53%	90%	29%
Norway	<0.1%	3,937,070	11.4	41.5	35%	76%	21%
Poland	0.5%	8,488,020	8.6	37.5	25%	80%	11%
Portugal	0.1%	3,603,521	8.0	43.7	25%	74%	9.5%
Romania	1.0%	3,257,770	11.3	58.7	49%	89%	20%
Russia	2.1%	18,617,926	9.1	47.1	30%	80%	13%
Slovakia	<0.1%	999,748	8.6	38.3	21%	70%	11%
South Africa	0.1%	5,292,172	3.6	17.1	3.4%	23%	1.7%
Spain	0.4%	14,564,235	7.8	36.2	19%	75%	8.2%
Sweden	0.1%	6,094,512	14.1	54.0	44%	84%	29%
Switzerland	0.1%	3,612,398	14.5	54.4	54%	93%	20%
Turkey	1.3%	9,704,169	5.5	32.1	6.1%	66%	2.0%
United Arab Emirates	0.1%	1,444,916	4.7	33.2	3.5%	51%	1.0%
United Kingdom	0.4%	26,742,484	10.7	46.8	36%	81%	20%

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