VOLUME 4, NUMBER 1

The State of the Internet

1ST QUARTER, 2011 REPORT

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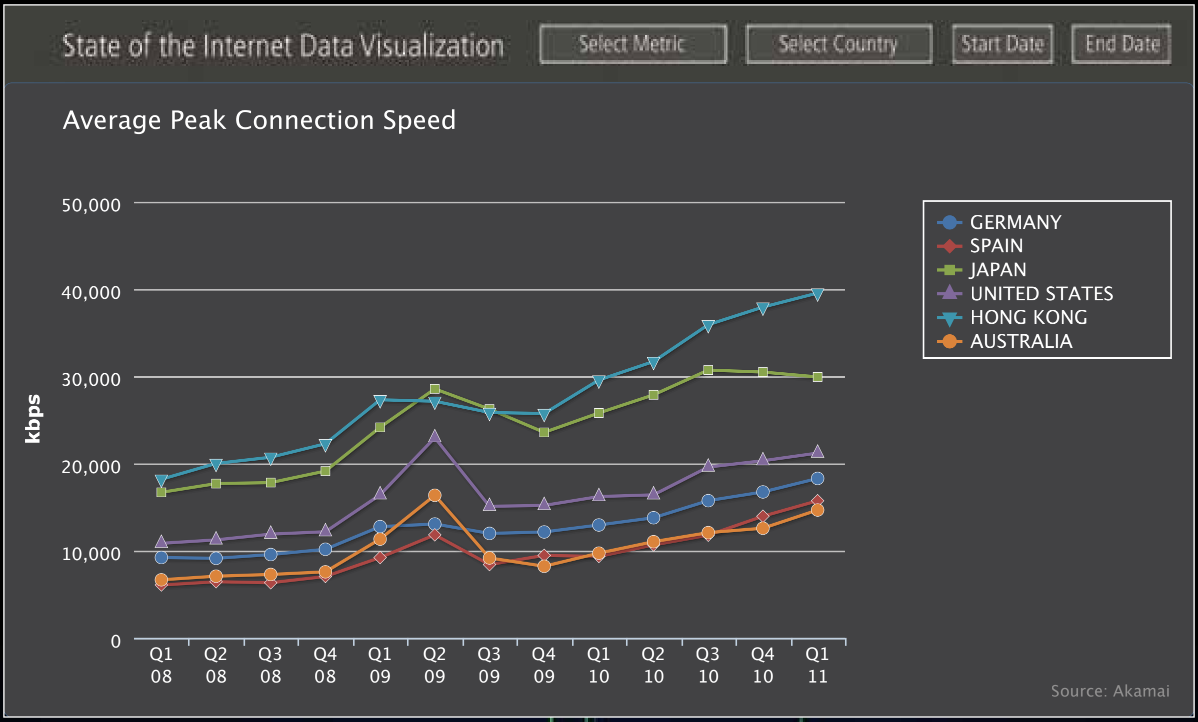

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Letter From the Editor

With the publication of this edition, Akamai's *State of the Internet* report enters its fourth year. Over the course of the previous three years, we've used our unique vantage point on the Internet and the incredible volume of data collected by the Akamai Intelligent Internet Platform™ to track the growth of Internet usage and Internet connection speeds around the world, trends regarding where Internet attacks are coming from and what these attacks are targeting, and the growing use of mobile devices to access the Internet.

While the content in the report covers the first quarter of 2011, callouts within the various sections highlight historical perspectives and trends seen over the last three years related to the various metrics.

In addition, alongside this quarter's report, we are launching a new data visualization tool, available at *www.akamai.com/stateoftheinternet*, which allows users to select metrics, time frames, and geographies of interest, and then generate (and download) graphs of the associated data. The tool currently includes the top 100 countries/regions by unique IP address count, and we plan to expand it to include state-level data for the United States in the future.

Though this report covers the first quarter of 2011, several Internet-related events of note occurred during the second quarter, including:

- The shutdown of Internet service in Syria, following similar outages in Egypt and Libya in the first quarter;
- World IPv6 Day, which was intended to be a "test flight" of IPv6 across a number of leading Web properties;
- APNIC implementing "austerity measures" around the assignment of IPv4 address blocks from a rapidly dwindling pool of available space;
- and streaming of the "Royal Wedding" of Prince William and Catherine Middleton, which broke traffic records on sites across the Web.

In next quarter's report, we will look at the impact these events had on the Internet, as well as continuing to expand the scope of content within the report, especially around security- and mobile-related topics.

David Belson

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Executive Summary

Akamai's globally distributed network of servers allows us to gather massive amounts of information on many metrics, including connection speeds, attack traffic, and network connectivity/availability/latency problems, as well as traffic patterns on leading Web sites. Each quarter, Akamai publishes a "State of the Internet" report. This report includes data gathered from across Akamai's Intelligent Internet Platform during the first quarter of 2011 about attack traffic, broadband adoption, and mobile connectivity, as well as trends seen in this data over time. In addition, this quarter's report also includes insight into the state of IPv4 exhaustion, IPv6 adoption, and several high profile Internet outages/disruptions seen in the first quarter.

Attack Traffic

During the first quarter of 2011, Akamai observed attack traffic originating from 199 unique countries around the world. Myanmar was the top attack traffic source, accounting for 13% of observed attack traffic in total. The United States and Taiwan held the second and third place spots respectively, accounting for just under 20% of observed attack traffic combined. Attack traffic concentration was lower than in the fourth quarter of 2010, with the top 10 ports seeing 65% of observed attack traffic, including a set of attacks that may have been looking to exploit the Internet privacy tool TOR as a means of hiding their tracks.

Internet and Broadband Adoption

Akamai observed a 5.2% increase (from the fourth quarter of 2010) globally in the number of unique IPv4 addresses connecting to Akamai's network, growing to over 584 million. From a global connection speed perspective, South Korea recorded the highest level of "high broadband" (>5 Mbps) connectivity, with 60% of connections to Akamai at speeds above 5 Mbps. South Korea also achieved the highest average connection speed at 14.4 Mbps. Hong Kong maintained its position as having the highest average peak connection speed, where the per-IP address maximum connection speed was averaged across all of the IP addresses seen from each country. Cities in Japan and South Korea continued to hold many of the top spots in the rankings of highest average and average peak connection speeds by city. In the United States, Delaware remained in the top position, with 72% of connections to Akamai occurring at 5 Mbps or greater. Delaware also maintained the highest average connection speed, at 7.5 Mbps, as well as the highest average peak connection speed across the United States, at 30.1 Mbps. Riverside, California was the United States city with the highest average connection speed (7.8 Mbps) in the first quarter, and North Bergen, NJ had the highest average peak connection speed (40 Mbps).

Mobile Connectivity

Reviewing first quarter observed attack traffic from known mobile networks, overall attack traffic concentration remained fairly consistent from the prior quarter, with the top 10 countries generating just under three-quarters of the observed attacks. The targeted ports were largely similar to the overall port list, and Port 445 continues to be the target of a significantly higher percentage of attacks as compared to the other ports in the top 10. In the first quarter of 2011, average measured connection speeds on known mobile providers around the world ranged from just over 6 Mbps down to 163 kbps. Average peak connection speeds on mobile providers around the world ranged from 22.7 Mbps to just over 1 Mbps. Looking at content consumption metrics, users on seven providers consumed, on average, more than one gigabyte (1 GB) of content from Akamai per month, while users on 77 additional providers downloaded more than 100 MB of content from Akamai per month during the first quarter. In addition, based on data collected by Ericsson, mobile data traffic saw 130% yearly growth in the first quarter, and is now more than double the measured volume of voice traffic.

Akamai maintains a distributed set of agents deployed across the Internet that monitor attack traffic. Based on the 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. (Ports are network layer protocol identifiers.) This section provides insight into attack traffic, as observed and measured by Akamai, during the first quarter of 2011.

1.1 Attack Traffic, Top Originating Countries

During the first quarter of 2011, Akamai observed attack traffic originating from 199 unique countries/regions, down from 207 at the end of 2010. As shown in Figure 1, the first quarter saw several changes in the list of the top 10 attack traffic sources, with Myanmar making its first appearance in the history of the report, India appearing for the first time since the fourth quarter of 2009, and Hong Kong appearing for the first time since the third quarter of 2008. Among the countries/regions more frequently seen on the top 10 list, the United States and Taiwan were responsible for higher percentages of attack traffic as compared to the prior quarter, while Russia, China, Brazil, Romania, and India all saw their percentages decline quarter-over-quarter.

This sudden appearance of Myanmar on the list of top attack traffic sources is certainly unusual, and appears to be related to attack traffic targeting Port 80 observed by Akamai in late February and early March. Interestingly, Myanmar managed to be responsible for 13% of the observed attack traffic in the first quarter even though only 25 unique ports were targeted, and of that, over 45% of the attacks targeted Port 80. (Contrast that with the United States, with 10% of the observed attack traffic and tens of thousands of targeted ports – very strongly indicative of general port scanning activity, as opposed to specifically targeted attacks.) A Web search for the IP address blocks from Myanmar that were observed to be originating the attacks returned reports on tracking sites ipillion.com and bizimbal.com of others seeing similar attack traffic from these IP address blocks as well.[1]

Aggregating observed attack traffic at a continental level, we find that nearly half of the observed attack traffic came from the Asia Pacific/Oceania region, nearly 30% came from Europe, and just over 20% came from the Americas.

	Country/Region	Q1 '11 % Traffic	Q4 '10 %
1	Myanmar	13%	N/A
2	United States	10%	7.3%
3	Taiwan	9.1%	7.6%
4	Russia	7.7%	10%
5	China	6.4%	7.4%
6	Brazil	5.5%	7.5%
7	India	3.8%	2.1%
8	Hong Kong	3.3%	0.3%
9	Romania	2.5%	2.6%
10	Italy	2.5%	3.6%
–	Other	36%	45%

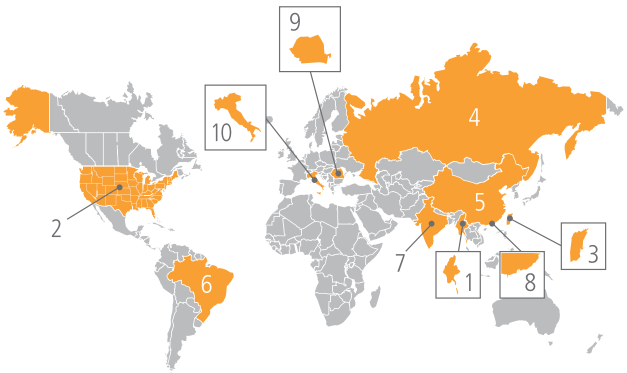

Figure 1: Attack Traffic, Top Originating Countries/Regions

1.2 Attack Traffic, Top Ports

Attack traffic concentration among the top 10 ports continued to drop from the concentration seen in the fourth quarter of 2010, with the top 10 ports responsible for just 65% of the observed attacks (down from 72% in the fourth quarter). Perpetual top target Port 445 (Microsoft-DS) dropped nearly 25% from the prior quarter, and Ports 23 (Telnet) and 22 (SSH) also saw significant percentage declines. However, Port 80 (WWW) saw attack traffic levels over 7x higher than at the end of 2010, and the percentage of attacks targeting Port 443 (HTTPS/SSL) also saw a massive increase over the prior quarter. As noted above, it is likely that the growth in attack traffic targeting Port 80 and Port 443 is related to the attacks observed to be originating from Myanmar and Hong Kong. The ongoing decline of attacks on Port 445 continues to underscore the success of efforts to mitigate the threat posed by the Conficker worm, which is now over three years old. A report released[2] by the Conficker Working Group in January 2011 claimed success in ultimately stopping Conficker from communicating with its creator, thus preventing it from updating into newer and more dangerous variants, though it also noted that Conficker still resides on anywhere from four million to 13 million computers across the world.

As shown in Figure 2, in addition to Port 443's first appearance in the list, Port 21 appears on the top ports list for the first time this quarter as well. While officially assigned to the File Transfer Protocol (FTP), several online security resources[3] also note that the port is used by a number of Trojans – malware hidden on a computer system that can steal information or harm the system. Port 9050 appears on the list for the first time in the first quarter, ostensibly replacing the "unassigned" Port 9415 that appeared on the list in the fourth quarter of 2010. While officially assigned[4] to "Versiera Agent Listener" (an enterprise network management & monitoring tool), it appears that Internet privacy tool TOR may also use Port 9050 for SOCKS proxy purposes.[5] (That is, for general proxying of TCP connections.) In reviewing ports targeted by the top 10 countries/regions, it appears that nearly all of the observed attacks on this port came from the United States, though it only accounted for 5.8% of the attacks observed from the United States. As such, it may represent attackers based in the United States looking to hide their tracks by leveraging the anonymity afforded by connecting through TOR.

When reviewing the top ports targeted by attacks originating in China, it is interesting to note that the top three targeted ports (1433, 3389, 445) accounted for just over 20% of the first quarter attacks observed originating from the country, and are all used by Microsoft software/protocols. Port 22 (SSH) and Port 3306 (mySQL) round out the top 5 within China, possibly indicating that attacks targeting these two ports are searching for systems with weak passwords that can be exploited for the installation of malware, or for use as members of a botnet.

Port	Port Use	Q1 '11 % Traffic	Q4 '10 %
445	Microsoft-DS	34%	47%
80	WWW (HTTP)	11%	1.5%
443	HTTPS/SSL	4.7%	0.2%
23	Telnet	4.1%	11%
22	SSH	3.3%	6.2%
1433	Microsoft SQL Server	1.7%	1.1%
25	SMTP	1.6%	0.4%
9050	Versiera Agent Listener	1.5%	< 0.1%
21	FTP	1.5%	0.3%
135	Microsoft-RPC	1.5%	1.1%
Various	Other	35%	–

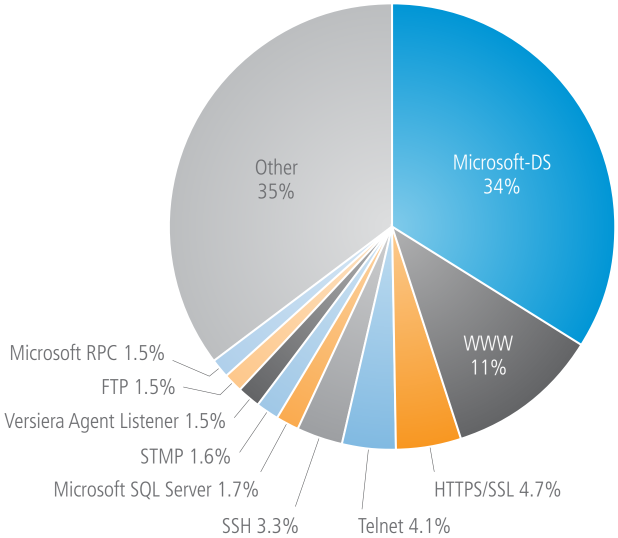

Figure 2: Attack Traffic, Top Ports

Internet Penetration

2.1 Unique IPv4 Addresses

Through a globally-deployed server network, and by virtue of the approximately one trillion requests for Web content that it services on a daily basis, Akamai has unique visibility into levels of Internet penetration around the world. In the first quarter of 2011, over 584 million unique IP addresses, from 237 countries/regions, connected to the Akamai network – 5.2% more IP addresses than in the fourth quarter of 2010, and 20% more than in the first quarter of 2009. Although we see more than half a billion unique IP addresses, Akamai believes that we see well over one billion Web users. This is because, in some cases, multiple individuals may be represented by a single IP address (or small number of IP addresses), because they access the Web through a firewall or proxy server. Conversely, individual users can have multiple IP addresses associated with them, due to their use of multiple connected devices.

As shown in Figure 3, nine of the top 10 countries remained consistent with the prior quarter, with Canada ceding its place on the list to Italy. All of the countries on the list saw quarterly growth, with Italy's 11% increase leading the way (and besting Canada's 0.6% increase, which dropped it to 11th place globally). Yearly growth across all of the top 10 countries was strong as well, with double digit percentage increases seen in all of the countries except France, which turned in a still respectable increase of nearly 7%. After showing year-over-year growth rates above 30% each quarter during 2010, China's growth appears to have slowed a bit in the first quarter of 2011, dropping slightly to 27%.

Concentration among the top 10 continued to be consistent with prior quarters, with those countries still accounting for nearly 70% of the observed IP addresses. In looking at the "long tail", there were 186 countries/regions with fewer than one million unique IP addresses connecting to Akamai in the first quarter of 2011, 134 with fewer than 100,000 unique IP addresses, and 31 with fewer than 1,000 unique IP addresses. The counts for all three thresholds were up slightly quarter-over-quarter.

	Country/Region	Q1 '11 Unique IP Addresses	QoQ Change	YoY Change
–	Global	584,821,069	5.2%	20%
1	United States	142,605,731	3.9%	10%
2	China	73,587,347	9.4%	27%
3	Japan	41,233,145	4.3%	24%
4	Germany	34,785,032	2.8%	12%
5	France	24,010,722	3.9%	6.8%
6	South Korea	22,538,305	2.3%	35%
7	United Kingdom	22,333,025	0.7%	11%
8	Brazil	14,153,991	4.6%	24%
9	Italy	13,632,661	11%	28%
10	Spain	12,915,356	3.7%	15%

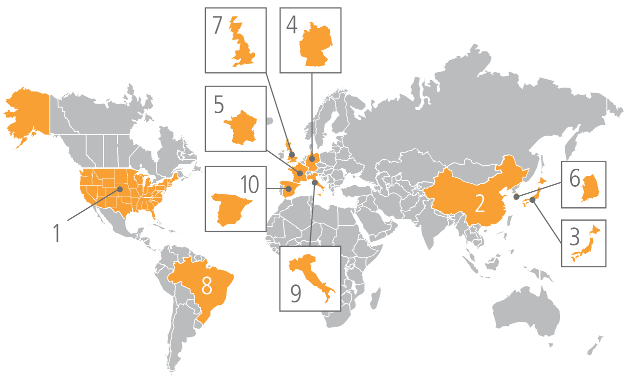

Figure 3: Unique IPv4 Addresses Seen By Akamai

DID YOU KNOW?

The number of unique IPv4 addresses seen by Akamai grew from 323 million in Q1 2008 to 584 million in Q1 2011 – up 80% over the three year period.

2.2 IPv4 Address Space Exhaustion

On January 31, the Internet Assigned Numbers Authority (IANA) distributed two of the remaining seven "/8 blocks" (comprising 16.8 million IP addresses per block) of IPv4 addresses to APNIC, the Regional Internet Registry (RIR) for the Asia-Pacific region.[6] This distribution ultimately led to an event that took place on February 3, at which the five remaining /8 blocks of IPv4 addresses were distributed to representatives of the five RIRs – one block to each. This final exhaustion of the central pool of IPv4 address space had been anticipated for quite some time and is considered to be a significant milestone for the Internet. With this exhaustion, each RIR now has a finite pool of IPv4 addresses that it can allocate to network service providers and carriers within its region. Each RIR will ultimately face exhaustion of its local pool of addresses and is adopting strict rules around requests for new address space and transfers of existing IPv4 address space. One such transfer made the news at the end of March, when Microsoft was required to satisfy the American Registry for Internet Numbers' (ARIN) transfer policies to receive the address space it agreed to buy from bankrupt telecom gear vendor Nortel – 666,624 legacy IPv4 addresses for $7.5 million USD.[7] However, John Curran, CEO of ARIN, noted that "At some point in the not-too-distant future, it will become more cost-effective for most users to acquire and use free IPv6 addresses than to buy legacy addresses, and the bottom will quickly fall out of the IPv4 aftermarket."[8]

On April 15, APNIC released a statement noting that it had reached its final /8 IPv4 address block, bringing the organization to what it termed "Stage Three" of IPv4 exhaustion in the Asia-Pacific region.[9] In this stage, each new or existing APNIC account holder is only eligible to request and receive delegations totaling a maximum of 1024 addresses (a "/22") from the APNIC IPv4 address pool, assuming it meets specific criteria.[10] Figure 4 was included in a February 2011 blog post[11] by Geoff Huston, Chief Scientist at APNIC, and shows predicted exhaustion dates (as of that date) for the other RIRs. In a message[12] to the North American Network Operator's Group (NANOG) mailing list, Huston explained that "…it is a probabilistic graph that shows the predicted month when the RIR will be down to its last /8 policy (whatever that policy may be), and the relative probability that the event will occur in that particular month." (Note that this graph has since been updated, and a more recent version can be found at *http://ipv4.potaroo.net*.)

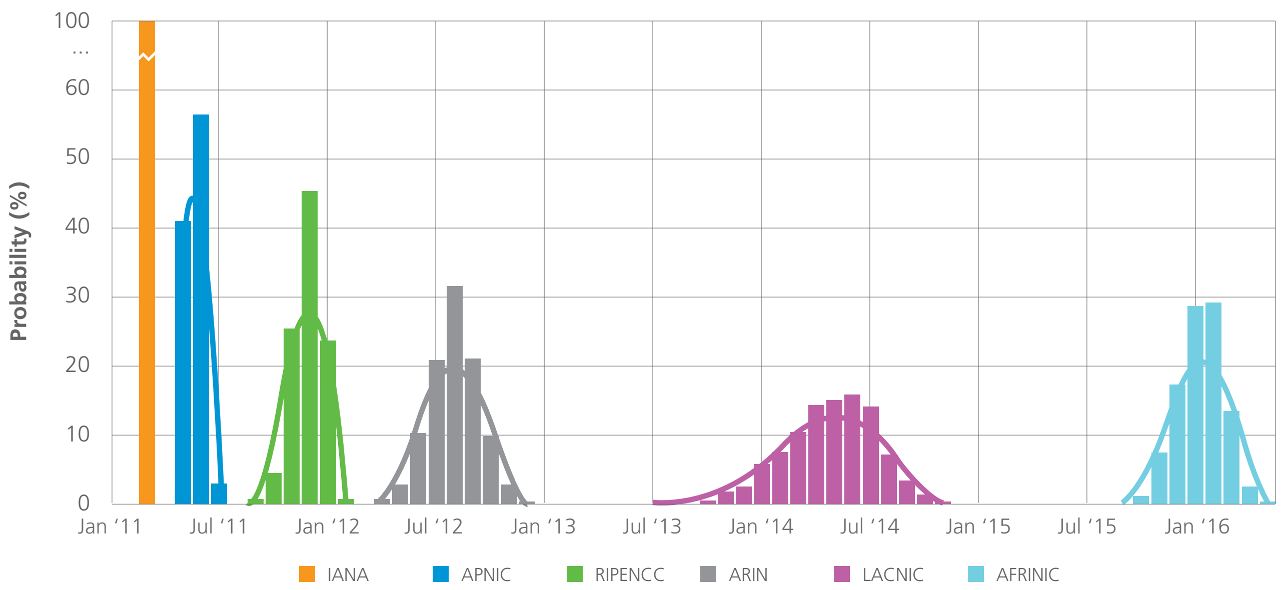

Figure 4: Projected RIR IPv4 Exhaustion Dates *(source: http://www.potaroo.net/ispcol/2011-02/rir.jpg)*

2.3 IPv6 Adoption

Figure 5 shows IPv6 adoption during the first quarter among the top one million[13] Web sites as ranked by Alexa. The graph shows the percentage of these top sites available via both IPv4 and IPv6 as measured by a monitor on Comcast's network, in cooperation with a project run by Professor Roch Guerin at the University of Pennsylvania.[14] IPv6 reachability of these sites appeared to remain fairly constant at approximately 0.25% through the first half of the quarter but jumped suddenly to the 3% range in mid-February. In an e-mail exchange, Professor Guerin noted that this increase in reachability was due to Google "white-listing" Comcast for IPv6 connectivity – as a result, the Comcast monitor was able to reach many blogspot.com hosts over IPv6. (blogspot.com is the domain name used by Blogger, a blogging tool owned by Google.) Guerin further noted that if these blogspot.com hostnames were removed from the results, then IPv6 reachability at the end of the quarter would be approximately 0.3%, a level similar to that seen by monitors running at the University of Pennsylvania. This jump in reachability due to "white-listing" of a network provider also highlights the fragmented interconnectivity of the IPv6 Internet – in Google's case, it has a number of requirements that network providers must meet before they can access Google services over IPv6.[15]

Internet security firm Arbor Networks has also studied IPv6 adoption and associated traffic levels. Leveraging ATLAS, Arbor's distributed sensor network that is a collaborative effort with over 100 service providers distributed across 17 countries, Arbor has examined IPv6 traffic growth trends over time and periodically publishes blog posts[16] examining its findings. Figure 6 is based on a graph published by Arbor that focuses on IPv6 traffic in six ATLAS participant network providers that can examine native IPv6 traffic. The graph shows IPv6 as an average percentage of all inter-domain traffic in these six providers, and though it only goes through the first half of the quarter, it shows that aggregate IPv6 traffic volumes generally ranged between 0.1 and 0.2 percent of Internet traffic. Arbor notes that this range corresponds with observations made by Google[17] and AMS-IX (the Amsterdam Internet Exchange). However, as the identities of these providers have not been published, it is not clear whether the observed IPv6 traffic volumes are broadly representative of other providers – it has been suggested that levels of IPv6 traffic are higher on providers that are actively marketing IPv6 services and that are taking an active role in IPv6 rollout.

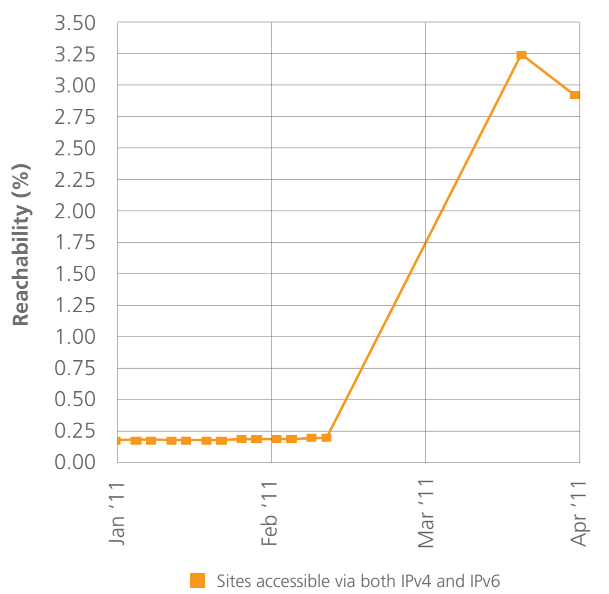

Figure 5: IPv6 Reachability Among Top 1 Million Web Sites *(source: http://v6monitor.kangaroo.comcast.net:8180/monitor/)*

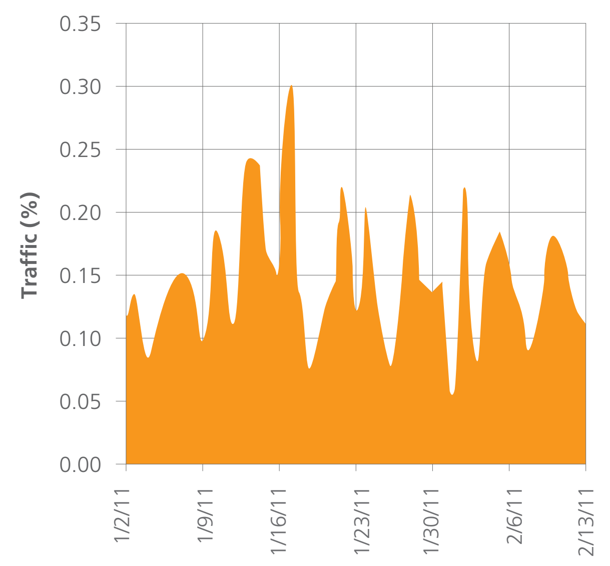

Figure 6: IPv6 Traffic as a Percentage of All Traffic in Six Selected Carriers *(Source: http://asert.arbornetworks.com/2011/04/six-months-six-providers-and-ipv6/)*

SECTION 3:
Geography – Global

By virtue of the approximately one trillion requests for Web content that it services on a daily basis through its globally-deployed server network, Akamai has a unique level of visibility into the connection speeds of end-user systems and, consequently, into broadband adoption around the globe. Because Akamai has implemented a distributed network model, deploying servers within edge networks, it can deliver content more reliably and consistently at those speeds, in contrast to centralized competitors that rely on fewer deployments in large data centers. For more information on why this is possible, please see Akamai's *How Will The Internet Scale?* white paper[18] or the video explanation at *www.akamai.com/whytheedge*.

The data presented within this section was collected during the first quarter of 2011 through Akamai's globally deployed server network and includes all countries/regions that had more than 25,000 unique IP addresses make requests to Akamai's network during the first quarter. (Note that the 25,000 unique IP address threshold is a significant change from the 1,000 unique IP address threshold that was used in the past – we believe that this new, higher threshold will enable us to better address the unfair comparison of extremely small countries with much larger countries.) For purposes of classification in this report, the "broadband" data included below is for connections greater than 2 Mbps, and "high broadband" is for connections of 5 Mbps or greater. In contrast to the "high broadband" and "broadband" classifications, the "narrowband" data included below is for connections to Akamai that are slower than 256 kbps. Note that the percentage changes reflected below are relative to the prior quarter(s). (That is, a Q4 value of 50% and a Q1 value of 51% would be reflected here as a 2% increase.) A quarter-over-quarter change is shown within the tables in several sections below in an effort to highlight general trends, and year-over-year changes are shown to illustrate longer-term trends.

As noted in previous editions of the *State of the Internet* report, in July 2010, the United State Federal Communications Commission (FCC) revised its working definition of broadband to include download speeds of at least 4 Mbps. We have considered aligning the definition of broadband within this report with the FCC's. However, additional research has shown that the term broadband has varying definitions across the globe – Canadian regulators are targeting 5 Mbps download speeds,[19] whereas the European Commission believes citizens need download rates of 30 Mbps,[20] while peak speeds of at least 12 Mbps are the goal of Australia's National Broadband Network.[21] As such, we believe that redefining the definition of broadband within the report to 4 Mbps would be too United States-centric, and we will not be doing so at this time.

As the quantity of HD-quality media increases over time, and the consumption of that media increases, end users are likely to require ever-increasing amounts of bandwidth. A connection speed of 2 Mbps is arguably sufficient for standard-definition TV-quality content, and 5 Mbps for standard-definition DVD quality video content, while Blu-Ray (1080p) video content has a maximum video bit rate of 40 Mbps, according to the Blu-Ray FAQ.[22] In addition to providing data on average connection speeds, we continue to report average peak connection speeds[23] around the world, from a country/region, state, and city perspective. This metric can provide insight into the peak speeds that users can likely expect from their Internet connections.

Finally, traffic from known mobile network providers will be 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.

3.1 Global Average Connection Speeds

After remaining flat in the fourth quarter of 2010, the global average connection speed saw healthy quarterly growth in the first quarter of 2011, increasing nearly 10% to just over 2 Mbps, as shown in Figure 7. In addition to this strong global growth, four countries within the top 10 saw quarterly growth of 10% or more, with Ireland seeing the greatest increase, at 16%. (Ireland's increase allowed it to displace Canada from the top 10 in the first quarter, forcing it down to twelfth place.) Globally, over 40 countries/regions saw average connection speeds increase by 10% or more in the first quarter. Only three countries/regions within the top 10 saw quarterly declines, all of which were fairly modest. All of the countries/regions in the top 10, as well as the United States (placing fourteenth), continued to maintain average connection speeds that exceeded the "high broadband" threshold of 5 Mbps.

The global average connection speed saw very healthy growth year-over-year as well, increasing 23%. Yearly growth of 20% or more was also seen in three other countries (South Korea, the Netherlands, and Belgium), and growth in excess of 10% or more was seen in another three countries in the top 10 (Czech Republic, Switzerland, and Ireland), as well as in the United States. Globally, year-over-year increases were observed in over 110 countries/regions, with nearly 100 seeing at least double-digit percentage gains, while a dozen saw annual growth rates in excess of 100%. However, of these dozen, the United Arab Emirates had the highest average connection speed at 3.9 Mbps, so even nominal increases in average connection speeds can equate to significant percentage changes.

During the first quarter, 36 countries/regions had average connection speeds of 1 Mbps or less. The slowest of this set was Libya, at 328 Kbps. Note that the shift to requiring 25,000 unique IP addresses to qualify for inclusion in Section 3 has shifted the perspective here, dropping approximately 40 additional countries from consideration, and excluding perennial connection speed laggards such as Cuba and Mayotte.

	Country/Region	Q1'11 Avg. Mbps	QoQ Change	YoY Change
–	Global	2.1	9.7%	23%
1	South Korea	14.4	5.0%	20%
2	Hong Kong	9.2	-1.7%	2.1%
3	Japan	8.1	-2.7%	2.7%
4	Netherlands	7.5	7.6%	25%
5	Romania	6.6	-4.9%	4.9%
6	Czech Republic	6.5	14%	19%
7	Latvia	6.3	6.7%	0.4%
8	Switzerland	6.2	10%	17%
9	Belgium	6.1	11%	29%
10	Ireland	5.6	16%	14%
…				
14	United States	5.3	4.7%	14%

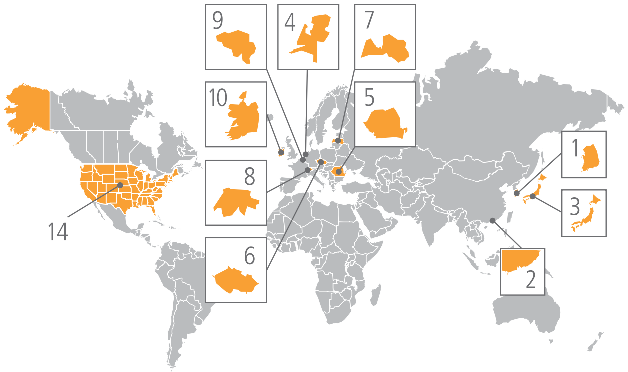

Figure 7: Average Measured Connection Speed by Country/Region

3.2 Global Average Connection Speeds, City View

As we have done in previous editions of the *State of the Internet* report, in examining average measured connection speeds at a city level, we have applied filters for unique IP address count (50,000 or more seen by Akamai in the first quarter of 2011) and academic institutions (removing data from known academic networks). In addition, as with the other data sets used in Section 3 of this report, traffic from known mobile networks has been removed as well.

As shown in Figure 8, Japanese cities Tokai, Shimotsuma, and Kanagawa topped the list of fastest cities in the first quarter, with average connection speeds of 13.2 Mbps, 12.9 Mbps, and 12.2 Mbps respectively. Including these three, 13 cities achieved average connection speeds in excess of 10 Mbps. The fastest city in Europe was Lyse, Norway, at 8.1 Mbps, and Riverside, California had the highest average connection speed in North America, at 7.8 Mbps.

Continuing the trend seen in the previous year, cities in Asia continued to dominate the top 100 list in the first quarter, holding two-thirds of the spots on the list. This included 61 cities in Japan, five in South Korea, and Hong Kong. Twenty-one cities from North America made the list, including 18 from the United States and 3 from Canada. Europe once again accounted for a dozen cities across ten countries (Romania was the only European country with more than one on the list – it managed three.)

In reviewing the full global list of more than 800 cities that qualified for inclusion in this section, the fastest cities in other geographies included Pretoria, South Africa (Africa), with an average connection speed of 1.5 Mbps; Riverwood, New South Wales, Australia (Oceania) with an average connection speed of 5.9 Mbps; and Munro, Argentina (South America) with an average connection speed of 3.4 Mbps.

DID YOU **KNOW?**

- *In Europe, the largest increase in average connection speed was seen in Georgia, which more than tripled over the last three years.*
- *China's average connection speed has grown by nearly half since Q1 2008, and exceeded 1 Mbps for the first time in Q1 2011.*
- *Canada's average connection speed grew over the last three years by nearly 70%, double the growth rate of 35% seen in the United States.*
- *Average connection speeds in Chile, Colombia, and Paraguay more than doubled from Q1 2008 to Q1 2011.*

	Country/Region	City	Q1 '11 Avg. Mbps
1	Japan	Tokai	13.2
2	Japan	Shimotsuma	12.9
3	Japan	Kanagawa	12.2
4	South Korea	Seocho	12.1
5	Japan	Asahi	11.9
6	Japan	Yokohama	11.7
7	Japan	Urawa	11.4
8	South Korea	Ilsan	11.3
9	Japan	Nagano	11.2
10	Japan	Hiroshima	11.2
11	Japan	Tochigi	10.9
12	Japan	Shizuoka	10.7
13	Japan	Nagoya	10.4
14	Japan	Ibaraki	9.9
15	Japan	Toyonaka	9.9
16	Japan	Chiba	9.7
17	Japan	Gifu	9.6
18	Japan	Marunouchi	9.6
19	Japan	Kyoto	9.5
20	Japan	Kobe	9.5
21	Japan	Hyogo	9.3
22	Japan	Nara	9.3
23	Japan	Sendai	9.1
24	Japan	Wakayama	9.0
25	South Korea	Seoul	8.8
26	Japan	Osaka	8.7
27	Japan	Yokkaichi	8.6
28	Japan	Fukuoka	8.6
29	Hong Kong	Hong Kong	8.6
30	Japan	Otsu	8.6
31	Japan	Fukui	8.3
32	Japan	Hakodate	8.2
33	Norway	Lyse	8.1
34	Japan	Fukushima	8.1
35	Japan	Niigata	8.1
36	Japan	Niho	8.0
37	Japan	Matsuyama	8.0
38	Japan	Tokushima	7.9
39	United States	Riverside, CA	7.8
40	United States	Staten Island, NY	7.8
41	South Korea	Yongsan	7.8
42	United States	San Jose, CA	7.8
43	Romania	Constanta	7.7
44	Japan	Tokyo	7.7
45	Japan	Kochi	7.7
46	Japan	Hamamatsu	7.7
47	Japan	Kanazawa	7.6
48	Japan	Hodogaya	7.6
49	Canada	Oakville, ON	7.6
50	Japan	Soka	7.6

	Country/Region	City	Q1 '11 Avg. Mbps
51	Japan	Yosida	7.5
52	Japan	Okayama	7.5
53	Japan	Mito	7.5
54	Japan	Kumamoto	7.4
55	Japan	Yamagata	7.4
56	Japan	Yamaguchi	7.4
57	United States	Fremont, CA	7.4
58	Czech Republic	Brno	7.4
59	Netherlands	Amsterdam	7.3
60	Japan	Utsunomiya	7.2
61	Japan	Saga	7.2
62	United States	Boston Metro, MA	7.1
63	Japan	Miyazaki	7.1
64	Japan	Kofu	7.1
65	Portugal	Porto	7.0
66	Romania	Timisoara	7.0
67	Japan	Kokuryo	7.0
68	Japan	Tottori	7.0
69	Japan	Kagoshima	6.9
70	Romania	Iasi	6.9
71	Canada	Victoria, BC	6.9
72	Spain	Valencia	6.8
73	United States	Jersey City, NJ	6.8
74	Belgium	Antwerp	6.7
75	United States	Marietta, GA	6.7
76	United States	Anaheim, CA	6.7
77	Japan	Toyama	6.7
78	United States	Traverse City, MI	6.6
79	Japan	Nagasaki	6.6
80	United States	Hollywood, FL	6.6
81	United States	Spartanburg, SC	6.6
82	United States	Santa Barbara, CA	6.6
83	United States	Hayward, CA	6.5
84	United States	San Mateo, CA	6.5
85	Japan	Oita	6.5
86	Japan	Iwaki	6.5
87	United States	Oakland, CA	6.5
88	Canada	Mississauga, ON	6.4
89	United States	Fond Du Lac, WI	6.4
90	United States	Union, NJ	6.4
91	Japan	Okidate	6.3
92	Japan	Naha	6.3
93	Latvia	Riga	6.3
94	Japan	Akita	6.3
95	Austria	Salzburg	6.3
96	South Korea	Taegu	6.3
97	Switzerland	Zurich	6.3
98	Japan	Kagawa	6.3
99	United States	Trenton, NJ	6.3
100	Japan	Sapporo	6.2

Figure 8: Average Connection Speed, Top Global Cities

3.3 Global Average Peak Connection Speeds

The average peak connection speed metric represents an average of the maximum measured connection speeds across all of the unique IP addresses seen by Akamai from a particular geography. The average is used in order to mitigate the impact of unrepresentative maximum measured connection speeds. In contrast to the average measured connection speed, the average peak connection speed metric is more representative of Internet connection capacity. (This includes the application of so-called speed boosting technologies that may be implemented within the network by providers, in order to deliver faster download speeds for some larger files.) Note that data from known mobile networks has also been removed from the source data set for this metric.

As shown in Figure 9, the global average peak connection speed jumped above 10 Mbps for the first time, growing an impressive 20% from the end of 2010, and up an even more impressive 65% from the beginning of 2010. Modest growth was seen across eight of the top 10 countries/regions, and the United States, which placed thirteenth. South Korea, Latvia, and Bulgaria all added more than 10% quarter-over-quarter. Japan and the United Arab Emirates were the only two countries that saw quarterly declines, though neither lost a significant amount. Looking at year-over-year changes, the nearly 4x growth seen in the United Arab Emirates was clearly the most significant, though three European countries grew 50% or more. Hong Kong, Romania, and the United States all saw average peak connection speeds more than 30% higher than in the same quarter a year prior.

Hong Kong remained the country/region with the highest average peak connection speed, landing just shy of 40 Mbps. South Korea and Romania also had average peak connection speeds above 30 Mbps. The remaining countries in the top 10, as well as the United States, saw peak speeds above 20 Mbps in the first quarter. In addition to those listed, five other countries (four in Europe plus Canada) had average peak connection speeds above 20 Mbps, while an additional 44 exceeded 10 Mbps. Under the new qualification guidelines, the country with the slowest average peak connection speed was Libya, at just 1226 kbps.

	Country/Region	Q1 '11 Peak Mbps	QoQ Change	YoY Change
–	Global	10.6	20%	65%
1	Hong Kong	39.5	4.2%	34%
2	South Korea	36.3	12%	11%
3	Romania	32.7	3.3%	31%
4	Japan	29.9	-1.8%	16%
5	United Arab Emirates	25.9	-4.8%	394%
6	Portugal	24.9	8.7%	56%
7	Belgium	24.7	8.1%	50%
8	Latvia	24.4	11%	29%
9	Bulgaria	22.4	18%	45%
10	Netherlands	22.0	7.1%	52%
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13	United States	21.2	4.3%	31%

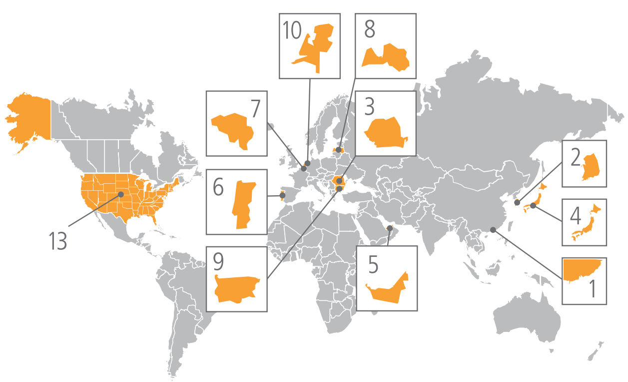

Figure 9: Average Peak Connection Speed by Country/Region

3.4 Global Average Peak Connection Speeds, City View

As we have done in previous editions of the *State of the Internet* report, in examining average measured connection speeds at a city level, we have applied filters for unique IP address count (50,000 or more seen by Akamai in the first quarter of 2011) and academic institutions (removing data from known academic networks). In addition, as with the other data sets used in Section 3 of this report, traffic from known mobile networks has been removed as well.

As shown in Figure 10, nine of the 10 cities with the highest average connection speeds were in Japan. Shimotsuma, Japan was the only city with an average peak connection speed in excess of 50 Mbps, though Tokai, Japan fell short by just 130 kbps. Including Shimotsuma, 16 cities had average peak connection speeds at or above 40 Mbps. An additional 37 cities had average peak connection speeds in excess of 30 Mbps, while the remaining 47 were all above 20 Mbps.

Cities in Asia once again dominated this metric, with the top 100 list including Hong Kong, Dubai, 54 cities in Japan, and 10 in South Korea. The top European city remained Constanta, Romania (which rounded out the top 10), and it was joined by six other European cities, including an additional three from Romania, as well as one each from Portugal, Norway, and the Czech Republic. In North America, 27 cities made the top 100 list, including 25 from the United States and two from Canada.

In looking at the full global list of over 800 cities that qualified for inclusion, the fastest ones in other geographies included Casablanca, Morocco (Africa) with an average peak connection speed of 10.4 Mbps; Canberra, Australia (Oceania) with an average peak connection speed of 22.5 Mbps; and Munro, Argentina (South America) with an average peak connection speed of 20.6 Mbps.

DID YOU KNOW?

- *In Europe, the largest increase (over 300%) in average peak connection speeds from Q1 2008 to Q 2011was seen in Bulgaria and Moldova.*
- *Average peak connection speeds in Australia and New Zealand have more than doubled over the last three years.*
- *While the average peak connection speed in the United States increased 95% from Q1 2008 to Q1 2011, Mexico's average peak connection speed grew 166% over the same period.*
- *Average peak connection speeds in Argentina, Brazil, Chile, Colombia, Paraguay, and Uruguay more than doubled from Q1 2008 to Q1 2011.*

	Country/Region	City	Q1 '11 Peak Mbps
1	Japan	Shimotsuma	50.2
2	Japan	Tokai	49.9
3	Japan	Kanagawa	48.5
4	Japan	Marunouchi	48.0
5	Japan	Yokohama	47.8
6	Japan	Urawa	47.1
7	Japan	Tochigi	44.2
8	Japan	Hodogaya	43.8
9	Japan	Nagano	43.7
10	Romania	Constanta	43.0
11	Japan	Soka	42.4
12	Japan	Chiba	42.4
13	Japan	Asahi	41.9
14	Japan	Shizuoka	40.2
15	Romania	Iasi	40.0
16	United States	North Bergen, NJ	40.0
17	South Korea	Taejon	39.5
18	South Korea	Seocho	39.5
19	Romania	Timisoara	38.7
20	Japan	Kokuryo	38.3
21	South Korea	Ilsan	38.2
22	Japan	Ibaraki	37.6
23	Hong Kong	Hong Kong	37.5
24	Japan	Nagoya	37.4
25	Japan	Utsunomiya	37.0
26	Japan	Hiroshima	36.2
27	Japan	Mito	35.2
28	United States	Staten Island, NY	35.0
29	Japan	Fukuoka	34.8
30	Japan	Sendai	34.8
31	Japan	Kyoto	34.5
32	South Korea	Taegu	34.4
33	Japan	Kobe	34.3
34	Japan	Gifu	34.2
35	Japan	Niigata	32.9
36	Japan	Yosida	32.8
37	South Korea	Kimchon	32.5
38	Japan	Yokkaichi	32.4
39	Japan	Kofu	32.3
40	United States	Van Nuys, CA	32.1
41	Japan	Nara	32.0
42	Japan	Hakodate	31.9
43	South Korea	Seoul	31.6
44	Japan	Niho	31.5
45	Japan	Otsu	31.3
46	Japan	Fukui	31.1
47	Portugal	Porto	31.1
48	Japan	Osaka	30.9
49	Japan	Wakayama	30.6
50	Japan	Fukushima	30.4

	Country/Region	City	Q1 '11 Peak Mbps
51	United States	Riverside, CA	30.4
52	Japan	Yamagata	30.3
53	Japan	Hamamatsu	30.1
54	South Korea	Suwon	29.9
55	Romania	Bucharest	29.8
56	South Korea	Yongsan	29.6
57	Japan	Kanazawa	29.6
58	Japan	Okidate	29.5
59	Norway	Lyse	29.4
60	United States	Hayward, CA	29.3
61	South Korea	Sangamdong	29.1
62	Japan	Matsuyama	29.1
63	Japan	Iwaki	28.8
64	United States	San Mateo, CA	28.8
65	United States	Hollywood, FL	28.6
66	South Korea	Anyang	28.3
67	United States	Arvada, CO	28.2
68	Japan	Okayama	28.1
69	Japan	Yamaguchi	28.0
70	Japan	Tokushima	27.7
71	Japan	Tokyo	27.7
72	United States	Jersey City, NJ	27.7
73	United States	Waco, TX	27.6
74	United States	Boston Metro, MA	27.6
75	Czech Republic	Brno	27.5
76	United States	Tallahassee, FL	27.4
77	United States	Fremont, CA	27.4
78	United States	Marietta, GA	27.4
79	Japan	Sapporo	27.4
80	United States	Ogden, UT	27.3
81	Japan	Akita	27.1
82	Japan	Hyogo	27.0
83	United States	Canton, OH	27.0
84	Japan	Toyonaka	27.0
85	United States	Oakland, CA	26.8
86	Japan	Kochi	26.8
87	Japan	Kumamoto	26.7
88	United States	Bellevue, WA	26.6
89	United States	Santa Barbara, CA	26.5
90	United States	Federal Way, WA	26.4
91	United States	Spartanburg, SC	26.3
92	United States	Mishawaka, IN	26.2
93	Japan	Morioka	26.2
94	Canada	Mississauga, ON	26.1
95	UAE	Dubai	26.0
96	United States	Vancouver, WA	26.0
97	United States	Saint Paul, MN	25.7
98	United States	Union, NJ	25.7
99	Canada	Kelowna, BC	25.6
100	Japan	Toyama	25.4

Figure 10: Average Peak Connection Speed, Top Global Cities

3.5 Global High Broadband Connectivity

In the first quarter of 2011, global high broadband adoption increased almost six percent quarter-over-quarter, with 25% of all connections to Akamai occurring at speeds of 5 Mbps or more. As shown in Figure 11, South Korea returned to the top slot, starting 2011 with a high broadband adoption level of 60% -- though this is up from the prior quarter, it is down 10% from the start of 2010. Quarterly growth among other countries/regions in the top 10 ranged from strong 26% growth in the Czech Republic to sub-1% increases in both the Netherlands and Latvia. Among the top 10 countries/regions, only Hong Kong, Japan, and Romania saw quarter-over-quarter declines, though all maintained high broadband adoption levels above 50%. The United States, ranked twelfth globally, saw a modest increase of almost 9% from the prior quarter, ending the first quarter of 2011 at a high broadband adoption rate of 39%.

On a year-over-year basis, global high broadband adoption jumped 15%, and yearly growth was seen in eight of the top 10 countries/regions, as well as in the United States. Only South Korea and Japan declined year-over-year, while growth in the other geographies in the top 10 ranged from a significant 44% increase in Belgium, down to a still respectable 5.4% increase in Denmark. Across the rest of the world, 13 countries saw high broadband adoption rates more than double year-over-year, with the United Arab Emirates growing 900% (to 26% adoption), and Argentina increasing over 500% (to a nominal 3.6% adoption rate).

Looking at high broadband adoption on a global basis, the first quarter saw six countries/regions with more than half of their connections to Akamai at speeds greater than 5 Mbps – this is up from four countries/regions in the prior quarter. Beyond that, there were an additional 19 countries/regions (consistent with the fourth quarter of 2010) where more than a quarter of the connections were at high broadband rates, and 17 more (down from 21 in the fourth quarter of 2010) where at least one in ten connections was faster than 5 Mbps. Of the 55 geographies that qualified for inclusion in this section, China and India were the only two with high broadband adoption rates below 1% – they achieved 0.5% and 0.4% adoption respectively.

Examining the percentage of connections to Akamai at speeds above 10 Mbps, we find that 6.7% of all connections globally exceeded this rate. South Korea, Japan, and Hong Kong were the only three countries/regions with more than a quarter of their connections in excess of 10 Mbps, with adoption rates of 31%, 26%, and 26% respectively. Five other countries, all in Europe, had more than 10% of connections to Akamai at speeds above 10 Mbps. Of the countries that qualified for inclusion, Turkey (0.6%), Mexico (0.3%), and China (0.1%) were the only three with adoption rates for 10 Mbps connectivity below 1%.

	Country/Region	% Above 5 Mbps	QoQ Change	YoY Change
–	Global	25%	5.9%	15%
1	South Korea	60%	17%	-10%
2	Netherlands	56%	0.6%	29%
3	Hong Kong	55%	-1.4%	18%
4	Japan	55%	-4.9%	-7.7%
5	Belgium	52%	11%	44%
6	Romania	51%	-1.6%	6.5%
7	Czech Republic	48%	26%	38%
8	Latvia	44%	0.5%	7.3%
9	Canada	44%	5.2%	29%
10	Denmark	43%	7.2%	5.4%
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12	United States	39%	8.8%	22%

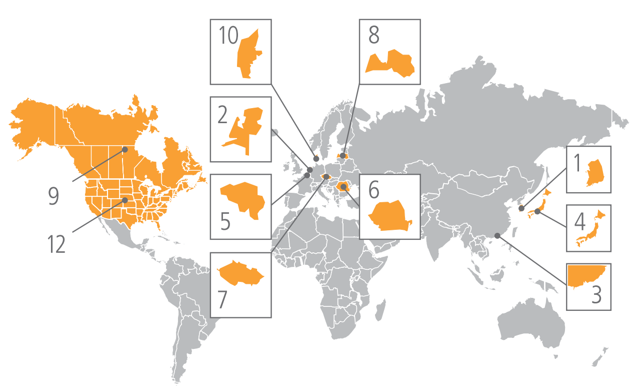

Figure 11: High Broadband Connectivity, Fastest Countries/Regions

3.6 Global Broadband Connectivity

In the first quarter of 2011, global broadband adoption continued to increase slightly, gaining 2% from the end of 2010, to reach 62%. As shown in Figure 12, all of the countries/regions in the top 10 had 90% or more of their connections to Akamai occurring at speeds of at least 2 Mbps in the first quarter. Interestingly, Europe is extremely well represented among the countries with the highest levels of broadband adoption, holding nine of the top 10 slots – perennial connectivity strongholds South Korea and Japan rank eighteenth (87%) and twenty-ninth (79%) globally, likely indicating that while they have fairly strong levels of high broadband adoption (connections above 5 Mbps), there is also a sufficient population of connections below 2 Mbps that forced them out of the top 10 for this metric.

Nine of the top 10 countries/regions, as well as the United States, saw increased broadband adoption rates quarter-over-quarter – Hong Kong was the only geography among the top 10 to see a quarterly decline. The increases were relatively modest, with Luxembourg's 7% growth the largest of the group. Globally, three countries (Ecuador, Turkey, and Serbia) more than doubled their levels of broadband adoption from the fourth quarter of 2010.

On a year-over-year basis, global broadband adoption grew 9.5%, a growth level similar to that seen in the Czech Republic and Romania. Luxembourg had, far and away, the largest yearly increase of the top 10 countries/regions, growing 33%. At just under 2%, Switzerland had the lowest yearly percentage increase of the top 10. Similar to the quarterly change, Hong Kong also declined very slightly (down 0.1%), and Belgium joined it as well, losing a minor 1.1%. Globally, 17 countries more than doubled their levels of broadband adoption as compared to the start of 2010, from a massive 2000% increase in Oman to 113% growth in the Ukraine. (However, just over 30,000 broadband IP addresses were seen by Akamai from Oman in the first quarter, as compared to just over 2 million from the Ukraine, so the relative growth levels must be considered accordingly.)

In the first quarter of 2011, 11 countries/regions (up from nine in the fourth quarter of 2010) saw broadband adoption levels of 90% or better. Another 42 countries/regions (down from 53 in the prior quarter) had at least half of their connections to Akamai at 2 Mbps or more, 14 additional countries/regions had broadband adoption of at least 25%, and another 12 countries/regions had at least one in ten connections to Akamai at 2 Mbps or more. (These counts are lower than seen in prior quarters due to the new unique IP address count thresholds for inclusion.) Of the countries/regions that qualified for inclusion, Venezuela had the lowest level of broadband adoption, at 1.7%.

	Country/Region	% Above 2 Mbps	QoQ Change	YoY Change
–	Global	62%	2.0%	9.5%
1	Bulgaria	95%	4.7%	6.6%
2	Czech Republic	94%	3.3%	9.5%
3	Switzerland	93%	1.1%	1.8%
4	Romania	93%	0.7%	9.9%
5	Luxembourg	92%	7.0%	33%
6	Hong Kong	92%	-1.6%	-0.1%
7	Hungary	91%	3.6%	16%
8	Germany	91%	3.7%	12%
9	Netherlands	91%	1.0%	8.1%
10	Belgium	90%	0.1%	-1.1%
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32	United States	77%	2.9%	8.2%

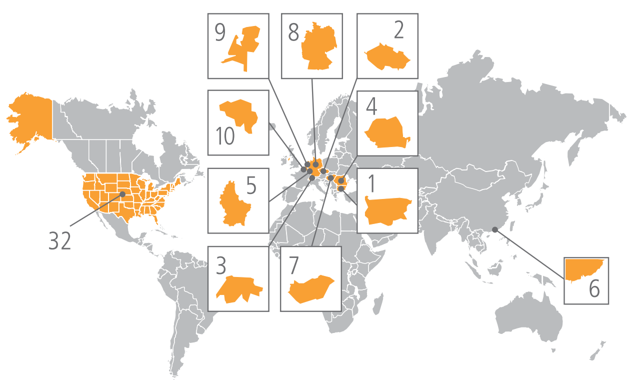

Figure 12: Broadband Connectivity, Fast Countries/Regions

3.7 Global Narrowband Connectivity

The impact of the change in the threshold for inclusion has been referenced in the prior subsections, but the impact of the change is most evident for the narrowband metric, as the countries that have been present in the top 10 list for the last three years, in general, no longer qualify for inclusion. Readers will note that the countries in the top 10 are different than have been seen previously, and that the United States' global rank is significantly higher, due to fewer countries/regions appearing on the overall global list.

As shown in Figure 13, the global level of narrowband adoption declined nicely in the first quarter of 2011, with 3.3% of all connections to Akamai at speeds below 256 kbps. This adoption level is 15% lower than at the end of 2010 and 36% lower than at the start of that year. Among the countries appearing in the top 10 in the first quarter of 2011, all but two saw quarterly declines. While India's 0.1% increase in narrowband adoption is notable, but not significant, the 252% increase seen from Libya in the first quarter is certainly of concern. However, we believe that this jump could potentially be related to extreme congestion caused by the government-imposed multi-day Internet shutdowns, during which traffic into and out of the country was severely restricted. (This is covered in more detail in Section 6.2 of this report.)

From a year-over-year perspective, only Indonesia and India saw increased levels of narrowband adoption, and the levels of growth are fairly significant for both countries. Though narrowband adoption levels grew 69% year-over-year in Indonesia, it appears that the government there is looking to actively improve the connectivity situation within the country, signing the "Jakarta Declaration For Meaningful Broadband" on April 14, 2011.[24] The declaration seeks to "bring the benefits of broadband-enabled services rapidly and meaningfully to at least 30% of Indonesian society by 2014" through new wireless network technologies, affordable broadband-capable connected devices, the completion of a national fiber-optic backbone infrastructure, and public/private partnerships. India is also planning to take aggressive steps to improve broadband connectivity throughout the country, with the proposed construction of a USD $13 billion national broadband network,[25] intended to connect all cities, towns and villages with a population of more than 500 in two phases targeted for completion by 2012 and 2013. Published reports [26] indicate that the network would be capable of supporting connection speeds of up to 10 Mbps in 63 of the country's metropolitan areas and larger cities by 2014, while speeds of up to 4 Mbps would be offered in 352 additional cities.

Of the countries/regions that qualified for inclusion, 18 recorded narrowband adoption levels below the global figure of 3.3% in the first quarter or 2011. Half of those saw narrowband adoption below 1%, with France recording the lowest level, at 0.3%.

	Country/Region	% Below 256 kbps	QoQ Change	YoY Change
–	Global	3.3%	-15%	-36%
1	Lebanon	61%	-7.7%	-11%
2	Uzbekistan	54%	-19%	-36%
3	Libya	52%	252%	-37%
4	Bolivia	51%	-14%	-25%
5	Nigeria	40%	-8.1%	-23%
6	Iran	38%	-2.4%	-17%
7	Indonesia	38%	-13%	69%
8	Nepal	36%	-40%	-36%
9	India	35%	0.1%	32%
10	Syria	20%	-22%	-5.1%
…				
28	United States	2.0%	-20%	-25%

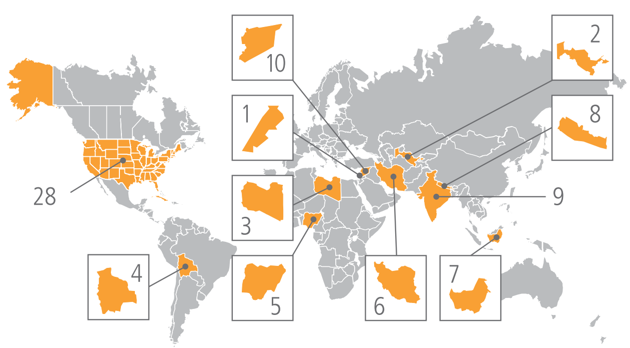

Figure 13: Narrowband Connectivity, Slowest Countries/Regions

Geography– United States

The metrics presented here for the United States are based on a subset of the data used for Section 3 and are subject to the same thresholds and filters discussed within the prior section. (The subset used for this section includes connections identified as coming from networks in the United States, based on classification by Akamai's EdgeScape[27] geolocation tool.)

4.1 United States Average Connection Speeds

Delaware continued to be the fastest state in the union, as shown in Figure 14, with an average connection speed of 7.5 Mbps, up 3.5% from the fourth quarter of 2010. Seven other states among the top 10 joined it in seeing quarterly increases, with both Virginia and California growing 10% or more. Across the country, 39 states saw average connection speeds increase quarter over quarter, from 13% in California to just 0.3% in Nevada. Among the top 10, only two states saw average connections speeds decline quarter-over-quarter, with Rhode Island dropping 1.1%, and Utah shedding 0.1%. A total of 11 states plus the District of Columbia had lower average connection speeds than in the prior quarter, from the 0.1% losses in Utah and Illinois to the more significant 16% decline in Vermont.

From a yearly perspective, Delaware was once again the only state among the top 10 to experience a year-over-year decline, though this quarter's decrease, at 0.7%, was lower than the 6% drop seen in the fourth quarter of 2010. Growth among the remaining states in the top 10 was, by and large, very solid, with seven of the states growing average connection speeds by more than 10% year-over-year. Across the whole country, 42 states posted yearly increases in average connection speeds, with growth of 10% or more in 23 of those states. Louisiana lost the least ground as compared to the beginning of 2010, dropping just 0.3%, while the District of Columbia's 27% yearly drop was the most significant.

	State	Q1 '11 Avg. Mbps	QoQ Change	YoY Change
1	Delaware	7.5	3.5%	-0.7%
2	Rhode Island	6.8	-1.1%	18%
3	Wisconsin	6.0	7.7%	16%
4	New Hampshire	6.0	2.5%	2.4%
5	Connecticut	5.9	6.3%	7.8%
6	Indiana	5.8	4.8%	11%
7	Maine	5.7	2.8%	15%
8	Virginia	5.7	10%	24%
9	California	5.6	13%	15%
10	Utah	5.6	-0.1%	11%

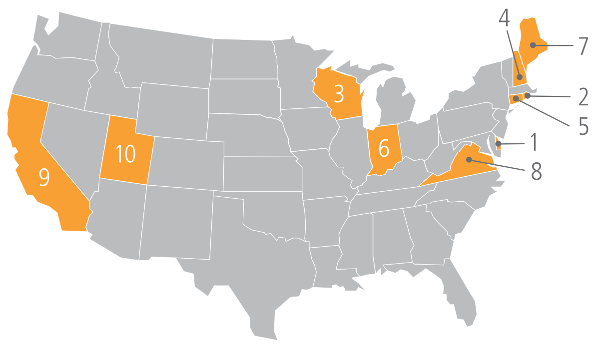

Figure 14: Average Measured Connection Speed by State

DID YOU **KNOW?**

The average connection speed in perennial speed leader Delaware has grown by less than six percent in total over the last three years.

4.2 United States Average Connection Speeds, City View

As with the Global Average Connection Speeds, City View presented in Section 3.2, connections from known academic and mobile networks were removed from the underlying data set for this metric, and the 50,000 unique IP address filter was used for this view as well.

As shown in Figure 15, Riverside, CA once again topped the list, with an average connection speed of 7.8 Mbps. (While the top three cities all have an average connection speed of 7.8 Mbps, this is due to rounding – Riverside's speed is actually just above that mark, while Staten Island and San Jose fall just below it). The average connection speeds in the top 10 cities all exceeded the "high broadband" threshold of 5 Mbps.

In the first quarter of 2011, California's dominance of the average connection speeds by city list continued to falter, with Californian cities taking only four of the top 10 slots. The East Coast is represented by five cities across New York, New Jersey, Massachusetts, Georgia, and Florida, and rounding out the list once again is Traverse City, Michigan.

	City	Q1 '11 Avg. Mbps
1	Riverside, CA	7.8
2	Staten Island, NY	7.8
3	San Jose, CA	7.8
4	Fremont, CA	7.4
5	Boston Metro, MA	7.1
6	Jersey City, NJ	6.8
7	Marietta, GA	6.7
8	Anaheim, CA	6.7
9	Traverse City, MI	6.6
10	Hollywood, FL	6.6

Figure 15: Average Measured Connection Speed, Top United States Cities by Speed

4.3 United States Average Peak Connection Speeds

Consistent with its standing as the fastest state in the nation, Delaware broke the 30 Mbps barrier for average peak connection speed in the first quarter of 2011, gaining 5.7% to reach 30.1 Mbps. As shown in Figure 16, the remainder of the states maintained average peak connection speed levels above 20 Mbps in the first quarter. Quarterly changes among the top 10 were largely positive, with eight of the top 10 seeing quarter-over-quarter increases, from New Hampshire's 1.6% growth to a solid 11% increase in Maine. Across the country, 33 states improved their average peak connection speeds as compared to the fourth quarter of 2010 – the greatest change was seen in Ohio, with 15% quarterly growth. The only two states in the top 10 to see their average peak connection speeds decline quarter-over-quarter were Rhode Island and Hawaii, which lost 2.7% and 3.7% respectively. Across the country, they were part of a group of 17 states, plus the District of Columbia, that saw lower average peak connection speeds in the first quarter. Losses ranged from 0.4% in Arkansas to a much larger 14% drop in Vermont.

From a year-over-year perspective, however, all of the states in the top 10 saw higher average peak connection speeds as compared to the same period a year prior. Growth among the group was rather strong as well, with three states seeing yearly growth above 30% and four states seeing yearly growth above 20%. New Hampshire was the only state within the top 10 that grew less than 10% year-over-year, falling just shy at 9.7%. Across the country, all 50 states saw higher average peak connection speeds in the first quarter of 2011 than they did in the first quarter of 2010, with 45 states increasing by 10% or more. Only the District of Columbia lost ground year-over-year, dropping 14%.

As noted in previous reports, the average peak connection speed metric represents, in essence, the speed that end users' Internet connections are capable of. Given that the long-term trends for this metric were positive across all states (except for the District of Columbia), and that the long-term average connection speed trend across the United States was positive for most states, it is not unreasonable to draw the conclusion that the state of broadband connectivity in the United States continued to improve heading into 2011.

	State	Q1 '11 Peak Mbps	QoQ Change	YoY Change
1	Delaware	30.1	5.7%	16%
2	Rhode Island	27.0	-2.7%	21%
3	Maine	24.3	11%	33%
4	Virginia	23.5	10%	33%
5	New Hampshire	23.3	1.6%	9.7%
6	Hawaii	23.2	-3.7%	17%
7	Wisconsin	22.6	8.8%	24%
8	Indiana	22.6	1.7%	20%
9	New York	22.4	8.2%	22%
10	North Carolina	22.0	7.7%	36%

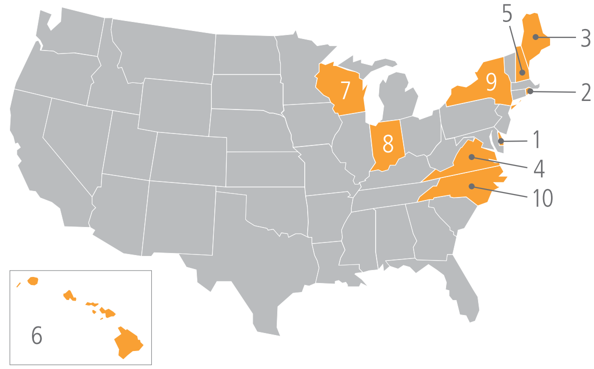

Figure 16: Average Peak Connection Speed by State

4.4 United States Average Peak Connection Speeds, City View

Topping the list of cities in the United States with the highest average peak connection speeds are cities in New Jersey and New York, at 40 Mbps and 35 Mbps respectively. Similar to the city view of average connection speeds in the United States discussed above, Figure 17 highlights that cities in California hold only four of the top 10 slots for the average peak connection speed as well. The list is rounded out by cities in Florida, Colorado, New Jersey, and Texas. In addition to North Bergen with its 40 Mbps average peak connection speed, three other cities achieved average peak connection speeds in excess of 30 Mbps – none of the cities in the top 10 in the fourth quarter of 2010 reached this level. All of the remaining cities in the top 10 once again had speeds in excess of 20 Mbps.

	City	Q1 '11 Peak Mbps
1	North Bergen, NJ	40.0
2	Staten Island, NY	35.0
3	Van Nuys, CA	32.1
4	Riverside, CA	30.4
5	Hayward, CA	29.3
6	San Mateo, CA	28.8
7	Hollywood, FL	28.6
8	Arvada, CO	28.2
9	Jersey City, NJ	27.7
10	Waco, TX	27.6

Figure 17: Average Peak Connection Speed, Top United States Cities by Speed

4.5 United States High Broadband Connectivity

In line with the generally positive trends seen across the United States for average and average peak connection speeds, quarterly changes among the top 10 states for high broadband adoption were all positive in the first quarter of 2011, including three states (Wisconsin, Virginia, Indiana) with growth of more than 10%, as shown in Figure 18. Across the entire country, 13 other states also saw quarterly increases of 10% or more, with Ohio's 32% jump leading the pack, and South Dakota and Alaska improving high broadband adoption levels in excess of 20% (25% and 23% respectively). Only eight states and the District of Columbia saw high broadband adoption levels decline quarter-over-quarter, with most of the losses relatively modest, except for Hawaii's unexpected 23% decline.

As compared to the beginning of 2010, high broadband adoption levels among the top 10 states were generally positive, except for a drop of just over 9% in Massachusetts. Very strong growth was seen in Rhode Island (72% increase) and Maine (69% increase), with Wisconsin and Virginia also growing 30% or more year-over-year. Across the whole United States, New Jersey had the largest increase in high broadband connectivity, growing a massive 172% year-over-year. Including those states mentioned above, 28 states saw high broadband adoption grow more than 10% since the same period a year earlier. Overall, 42 states experienced a positive yearly change, while seven states and the District of Columbia saw a yearly decline.

	State	% Above 5 Mbps	QoQ Change	YoY Change
1	Delaware	72%	7.2%	0.3%
2	Rhode Island	65%	5.1%	72%
3	New Hampshire	58%	7.3%	7.4%
4	Maine	45%	1.9%	69%
5	Wisconsin	43%	18%	31%
6	New York	43%	9.0%	6.3%
7	Massachusetts	42%	4.2%	-9.1%
8	Virginia	42%	15%	46%
9	Indiana	41%	12%	18%
10	South Carolina	41%	7.8%	29%

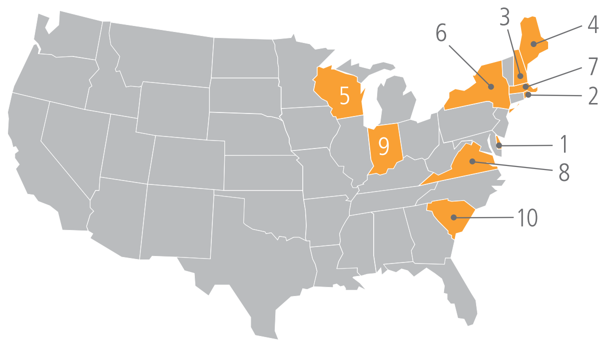

Figure 18: High Broadband Connectivity, Fastest U.S. States

(Vermont's high broadband adoption remained flat year-over-year.) Of the states that had lower high broadband adoption, only Maryland and the District of Columbia lost more than 10%, down 11% and 25% respectively.

4.6 United States Broadband Connectivity

As Figure 19 illustrates, broadband adoption rates among the top 10 states continued to be remarkably consistent from quarter-to-quarter, with fairly minimal growth seen in nine of the 10 listed states. Four of the states grew less than 1%, while Connecticut remained flat quarter-over-quarter. Adoption rates among the top 10 remained high, as Delaware, Rhode Island, and New Hampshire all had more than 90% of their connections to Akamai at speeds above 2 Mbps in the first quarter, with Delaware holding steady at the 97-98% range. Across the whole country, only six states and the District of Columbia had less than half of their connections below the broadband threshold. Quarter-over-quarter changes across the country as a whole were positive in 39 states, while eight states and the District of Columbia saw broadband adoption rates decline quarter-over quarter. The rates of change were fairly nominal, with increases ranging from 16% in California to just 0.2% in Maryland, and losses ranging from 0.2% in South Dakota to 8.8% in the District of Columbia.

Looking at year-over-year changes, all of the top 10 states saw broadband adoption levels increase as compared to the first quarter of 2010, with growth ranging from just 0.1% in first-place Delaware to 9.0% in second-place Rhode Island. Across the whole country, New Jersey saw a massive increase for this metric as well, growing 147% year-over-year. Four-teen additional states saw yearly growth of 10% or more, while 38 states overall saw year-over-year growth in their percentage of connections to Akamai at speeds over 2 Mbps. Eleven states and the District of Columbia declined year-over-year, with the District of Columbia seeing the largest decline at 28%. Arizona saw no change year-over-year.

	State	% Above 2 Mbps	QoQ Change	YoY Change
1	Delaware	98%	0.4%	0.1%
2	Rhode Island	93%	0.8%	9.0%
3	New Hampshire	92%	0.7%	2.8%
4	Hawaii	87%	4.0%	5.6%
5	Connecticut	85%	–	2.2%
6	Maine	84%	1.6%	6.2%
7	Vermont	81%	0.6%	5.1%
8	South Carolina	80%	2.8%	7.8%
9	Indiana	79%	4.4%	7.5%
10	Wisconsin	79%	3.6%	8.6%

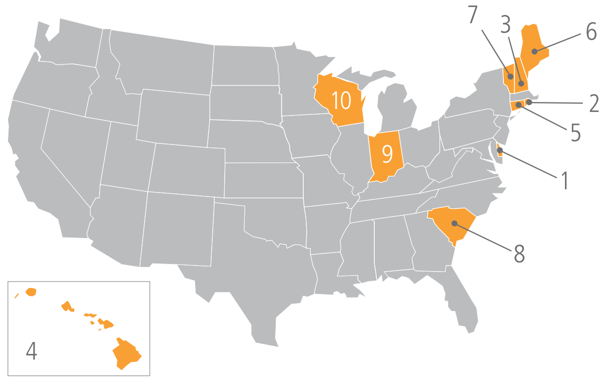

Figure 19: Broadband Connectivity, Fast U.S. States

4.7 United States Narrowband Connectivity

Both the short- and long-term trends in the percentage of connections to Akamai at speeds below 256 kbps among the top 10 states strongly indicate an ongoing move to higher speed connectivity. (Michigan's 1.4% year-over-year increase is the lone standout among this group, though the level of change is sufficiently low as to not be of significant concern.) As shown in Figure 20, all of the states in the top 10 saw narrowband adoption rates decline 10% or more quarter-over-quarter, with half declining more than 30%. In addition, all of the states in the top 10, except for Michigan, saw narrowband adoption rates decline 10% or more year-over-year, with half declining 50% or more.

Looking across the whole country, the quarterly trend also tends to support an ongoing move to higher speed connections, with 48 states and the District of Columbia all seeing lower levels of narrowband adoption quarter-over-quarter, and all losing 10% or more. Some of the most significant shifts were seen in states with fewer than 1,000 unique IP addresses connecting to Akamai at speeds of 256 kbps or less, so a shift of a comparatively small number of IP addresses can have a big impact. While not as supportive as the quarterly trends, the yearly trends observed in the first quarter also generally indicate a shift away from low-speed connections over time. The District of Columbia and 45 other states saw narrowband adoption rates decline year-over-year, while the remaining five, including Michigan, saw nominal increases.

In the first quarter, only the District of Columbia had a narrowband adoption level above 5%. Consistent with the prior quarter, 11 states saw narrowband adoption rates of 1% or less. Delaware remained the state with the lowest percentage of connections to Akamai below 256 kbps, with just 0.1% at that speed. However, with just a few hundred unique IP addresses connecting to Akamai at that speed, the adoption rate could be quite volatile over time, as the shift of just a few unique IP addresses to faster or slower speeds could cause a significant change in the adoption rate.

	State	% Below 256 kbps	QoQ Change	YoY Change
1	District Of Columbia	5.4%	-31%	-27%
2	Alaska	3.9%	-23%	-51%
3	Iowa	3.9%	-18%	-33%
4	Colorado	3.6%	-18%	-12%
5	Ohio	3.5%	-32%	-21%
6	Michigan	3.1%	-18%	1.4%
7	Georgia	3.1%	-32%	-54%
8	Washington	2.9%	-10%	-56%
9	Illinois	2.8%	-34%	-54%
10	Missouri	2.7%	-34%	-56%

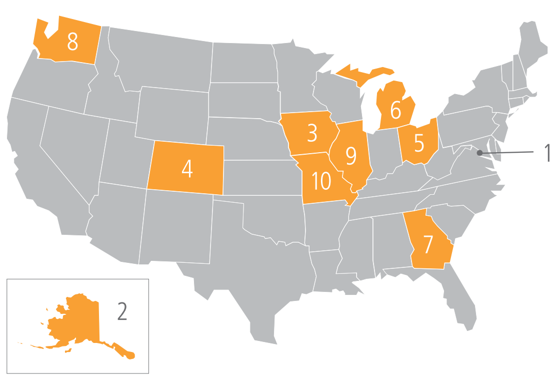

Figure 20: Narrowband Connectivity, Slowest U.S. States

DID YOU KNOW?

In Q1 2008, Washington state had the highest percentage (21%) of connections to Akamai at speeds under 256 kbps, while in Q1 2011, the level had dropped to just below 3%.

Mobile Connectivity

Building on the data presented in previous editions of the *State of the Internet* report, Akamai continues to identify additional mobile networks for inclusion in the report, as well as filtering out networks subsequently identified as having proxy/gateway configurations that could skew results. The source data in this section encompasses usage not only from smartphones, but also laptops, tablets, and other devices that connect to the Internet through these mobile networks. In addition, this edition of the *State of the Internet* report includes insight into mobile traffic growth and data traffic patterns contributed by Ericsson, a world-leading provider of telecommunications equipment and related services to mobile and fixed network operators globally. Akamai and Ericsson have partnered to develop the first ever end-to-end solution to address performance, scalability, and availability of mobile content and applications on a global scale.[28]

As has been noted in prior quarters, the source data set for this section is subject to the following constraints:

- A minimum of 1,000 unique IP addresses connecting to Akamai from the network in the first quarter of 2011 was required for inclusion in the list.
- In countries where Akamai had data for multiple network providers, only the top three are listed, based on unique IP address count.
- The names of specific mobile network providers have been made anonymous, and providers are identified by a unique ID.
- Data is included only for networks where Akamai believes that the entire Autonomous System (AS) is mobile – that is, if a network provider mixes traffic from fixed/wireline (DSL, cable, etc.) connections with traffic from mobile connections on a single network identifier, that AS was not included in the source data set.
- Akamai's EdgeScape database was used for the geographic assignments.

5.1 Attack Traffic From Mobile Networks, Top Originating Countries

In reviewing Figure 21, we find that the distribution of attack traffic sourced in mobile networks during the first quarter of 2011 had a fairly similar distribution to that seen in the prior quarter, though some countries saw slightly higher percentages, while others were slightly lower. Italy remained responsible for the largest percentage of observed attacks, but dropped to 25% (from 30%) this quarter. Of the top 10 countries, eight of them were also found on the list last quarter – the United Kingdom and Russia dropped out of the top 10, while Argentina and Australia replaced them on the list. Overall attack traffic concentration dropped slightly as compared to the fourth quarter of 2010, with the top two countries responsible for 34% of observed attacks (down from 40%), while the top 10 countries were the source of just under three-quarters of observed attacks.

	Country/Region	Q1 '11 % Traffic
1	Italy	25%
2	Chile	9.0%
3	Malaysia	7.7%
4	Australia	7.2%
5	Poland	6.4%
6	China	5.7%
7	United States	3.9%
8	Hungary	3.4%
9	Lithuania	3.1%
10	Argentina	2.9%
–	Other	26%

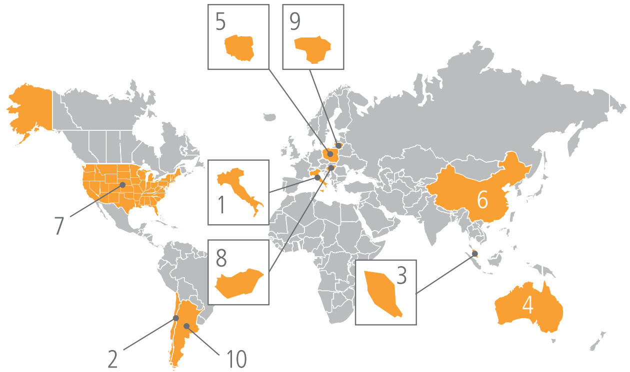

Figure 21: Attack Traffic from Mobile Networks, Top Originating Countries/Regions

5.2 Attack Traffic From Mobile Networks, Top Ports

In the first quarter of 2011, nine of the top 10 ports targeted by attack traffic sourced in mobile networks were the same as in the fourth quarter of 2010. In this quarter, Port 5900 (VNC Server) dropped from the list, replaced by Port 443 (HTTPS/SSL). The appearance of Port 443 on this list is in line with the massive growth in overall attack traffic targeting the port noted in Section 1.2 above. As shown in Figure 22, attack concentration continued to grow in the first quarter, with Port 445 responsible for 80% of the observed attacks, and the top 10 ports responsible for just over 97% of observed attacks (up from 96% in the fourth quarter). Interestingly, China was the only country among the top 10 that did not originate any attack traffic targeting Port 445 – it was the most targeted port across attacks from the other nine countries. As we have noted in prior reports, we believe that the observed attack traffic that is originating from known mobile networks is likely being generated by infected PC-type clients connecting to wireless networks through mobile broadband technologies, and not by infected smartphones or similar mobile connected devices.

Port	Port Use	Q1 '11 % Traffic
445	Microsoft-DS	80%
23	Telnet	5.1%
135	Microsoft-RPC	3.2%
80	WWW	2.0%
1433	Microsoft SQL Server	1.6%
139	NetBIOS	1.4%
22	SSH	1.3%
443	HTTPS/SSL	1.0%
3389	Microsoft Terminal Services	0.9%
4899	Remote Administrator	0.7%
Various	Other	2.8%

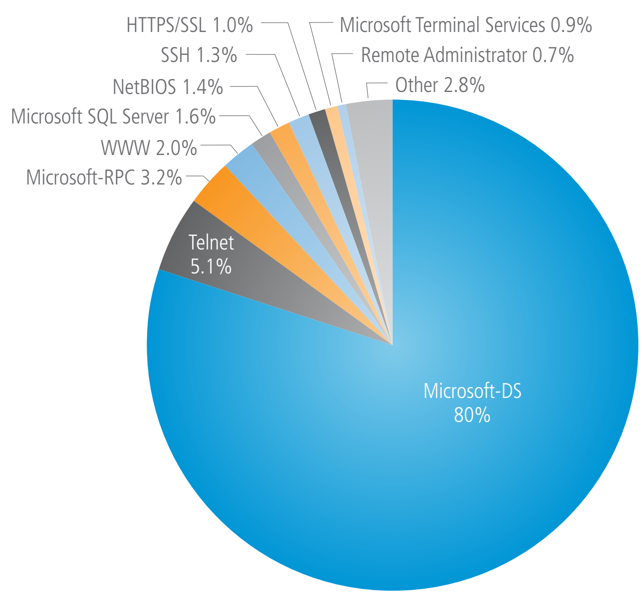

Figure 22: Attack Traffic from Mobile Networks, Top Ports

5.3 Connection Speeds and Data Consumption on Mobile Networks

In the first quarter of 2011, a mobile provider in Poland (PL-4) was the provider with the highest average connection speed, at just over 6.1 Mbps, bumping the faster provider in the fourth quarter of 2010 (GR-1) down to second place. Readers will note that a provider in Belgium (BE-3) is listed as having an average connection speed of over 15 Mbps, which should put it into first place. However, we believe that this provider may be leveraging a caching or gateway architecture that would be artificially inflating this figure; we will consider removing this provider from the underlying data set in future editions of this report. In reviewing the average connection speeds of the 105 providers listed in Figure 23, excluding the aforementioned Belgian provider, we find that PL-4 was the only provider with an average connection speed in the "high broadband" (>5 Mbps) range, while 24 total providers had average connection speeds in the "broadband" (>2 Mbps) range. An additional 45 mobile providers had average connection speeds of 1 Mbps or more. The mobile provider with the slowest average connection speed in the first quarter continued to be SK-1, though its average connection speed grew to 163 kbps, up from 134 kbps in the prior quarter.

In reviewing quarterly changes, it appears that none of the listed providers saw a doubling of average connection speeds, though GR-2 came close, growing its average connection speed nearly 97%. Only four of the listed providers (GR-2, ES-1, ID-1, UY-1) increased their average connection speeds by 50% or more quarter-over-quarter. Five providers recorded average connection speed growth of under 1%, while two others remained unchanged from the fourth quarter of 2010. In looking at yearly trends, three providers saw year-over-year average connection speed increases of more than 400%, with Ukrainian provider UA-1's 481% increase the largest. Interestingly, three of the listed providers saw no change from the same period last year.

In reviewing the average peak connection speed data for the first quarter of 2011, we find that a mobile provider in the United Kingdom (UK-3) once again had the highest average peak connection speed, at 22.7 Mbps (again, excepting provider BE-3 from consideration). Of the listed mobile providers, 26 had average peak connection speeds in excess of 10 Mbps, while an additional 44 had average peak connection speeds above 5 Mbps; all delivered average peak connection speeds of 1 Mbps or more. This quarter, a mobile provider in South Africa (ZA-1) had the lowest average peak connection speed, observed to be just over 1 Mbps. In reviewing quarterly changes, only a single provider (CL-3) saw its average peak connection speed double quarter-over-quarter. However, provider PT-1 in Portugal, did come close, though, growing 95%. The largest quarterly average peak connection speed decline was seen on provider NC-1 in New Caledonia, which lost just over 52%. Yearly changes were generally strong, with average peak connection speeds more than doubling at nearly 50 providers. The largest year-over-year declines were seen on providers UK-3 in the United Kingdom and CN-1 in China, which lost 34% and nearly 40% respectively.

For the first quarter of 2011, we found that, once again, users of seven mobile providers consumed, on average, more than one gigabyte (1 GB) of content from Akamai per month. (Excepting provider CA-1, which has been confirmed to be using a proxy architecture.) Users on an additional 77 providers around the world downloaded more than 100 MB of content from Akamai per month during the first quarter, while users on 20 other providers downloaded fewer than 100 MB. (It is interesting to note that provider BE-3 is in this group of 20 – while its connection speeds would seem to indicate the presence of a proxy, its download volumes do not – at least not a direct proxy, though it may be caching content, which could help explain the discrepancy.) Consumption grew more than 100% quarter-over-quarter on only a single provider (PT-1), while the largest quarterly decline was seen on Slovenian provider SI-1, which lost nearly 65%. Hong Kong's HK-1 saw the largest year-over-year increase in content consumption, gaining over 840%, with provider PT-1 the only other one increasing download volumes more than 500% since the first quarter of 2010.

Country/Region	ID	Q1 '11 Avg. kbps	Q1 '11 Peak kbps	Q1 '11 Avg. MB/ month
AFRICA				
Egypt	EG-1	482	3001	245
Morocco	MA-1	1118	9815	414
Nigeria	NG-1	267	4174	391
South Africa	ZA-1	364	1024	176
ASIA				
China	CN-1	1135	2870	162
Hong Kong	HK-2	1325	7251	492
Hong Kong	HK-1	2618	16358	3744
Indonesia	ID-1	459	8070	2966
Israel	IL-1	1873	7945	79
Japan	JP-1	1613	8240	168
Kuwait	KW-1	1857	8428	276
Malaysia	MY-1	590	3861	152
Malaysia	MY-3	879	6387	366
Pakistan	PK-1	876	5644	572
Qatar	QA-1	2061	8697	209
Saudi Arabia	SA-1	2021	8768	310
Singapore	SG-3	1382	7341	672
Singapore	SG-4	1858	8804	309
Singapore	SG-5	650	5772	467
South Korea	KR-1	1176	4134	101
Sri Lanka	LK-1	701	5311	307
Taiwan	TW-1	1280	6187	136
Taiwan	TW-2	742	3308	154
Thailand	TH-1	453	4154	90
EUROPE				
Austria	AT-1	3392	14619	195
Austria	AT-2	2649	15464	756
Belgium	BE-1	2623	10229	482
Belgium	BE-3	15366	43141	19
Belgium	BE-2	1744	4358	20
Czech Republic	CZ-1	1639	7925	80
Czech Republic	CZ-3	3296	9176	235
Czech Republic	CZ-2	849	4599	169
Estonia	EE-1	1058	5279	311
France	FR-2	1988	7084	1420
Germany	DE-1	843	3516	78
Germany	DE-2	3988	11735	1970
Germany	DE-3	1520	6468	141
Greece	GR-1	4560	17794	390
Greece	GR-2	798	4823	155
Hungary	HU-2	2307	11935	126
Hungary	HU-1	1651	11835	193
Ireland	IE-1	2685	12531	489
Ireland	IE-2	1732	12925	632
Ireland	IE-3	1734	12816	788
Italy	IT-3	2913	12304	568
Italy	IT-2	3565	17303	437
Italy	IT-4	1030	6720	215
Lithuania	LT-2	1543	9684	378
Lithuania	LT-1	2248	12395	525
Moldova	MD-1	1484	6437	129
Netherlands	NL-2	2212	5749	30
Netherlands	NL-1	1529	4016	31
Norway	NO-2	1717	5988	61

Figure 23: Average and Average Peak Connection Speed, Average Megabytes Downloaded per Month by Mobile Provider

DID YOU **KNOW?**

During the first quarter of 2011:

- *In the United States, for the first time, 51% of the devices sold were smartphones. Globally, the average is 26%.*
- *One-third of all smartphones sold were sold in the United States.*
- *Smartphones now account for 80% of the revenue of all phones sold in the United States.*

[Source: http://www.chetansharma.com/blog/2011/05/09/us-mobile-data-market-update-q1-2011/]

Country/Region	ID	Q1 '11 Avg. kbps	Q1 '11 Peak kbps	Q1 '11 Avg. MB/ month
EUROPE (CONTINUED				
Norway	NO-1	1127	4900	65
Poland	PL-1	3742	11952	141
Poland	PL-2	1456	7323	77
Poland	PL-4	6151	14893	141
Portugal	PT-1	711	4311	217
Romania	RO-1	674	3947	85
Russia	RU-3	1452	5235	125
Russia	RU-4	2571	10058	333
Russia	RU-2	857	3777	92
Slovakia	SK-1	163	1301	36
Slovakia	SK-2	2133	9340	1825
Slovenia	SI-1	1825	6474	35
Spain	ES-1	3385	19654	417
Spain	ES-3	950	5327	134
Spain	ES-2	958	3235	804
Turkey	TR-1	1934	9098	217
Ukraine	UA-1	1045	3101	69
Ukraine	UA-2	1619	6709	128
United Kingdom	UK-3	4206	22703	105
United Kingdom	UK-2	2413	11194	969
United Kingdom	UK-1	1605	11275	677
NORTH AMERICA				
Canada	CA-2	1051	2738	614
Canada	CA-1	3174	20058	23404
Curacao	CW-1	564	3551	295
El Salvador	SV-2	1601	8870	655
El Salvador	SV-1	1044	5627	300

Country/Region	ID	Q1 '11 Avg. kbps	Q1 '11 Peak kbps	Q1 '11 Avg. MB/ month
El Salvador	SV-3	622	3237	348
Guatemala	GT-2	1059	6791	686
Guatemala	GT-1	893	5434	188
Nicaragua	NI-1	1278	7426	608
Puerto Rico	PR-1	2230	9478	2249
United States	US-2	1092	3930	39
United States	US-1	1759	4468	103
United States	US-3	1007	2964	547
OCEANIA				
Australia	AU-3	1601	8109	243
Australia	AU-1	1201	10149	1640
Guam	GU-1	538	2595	80
New Caledonia	NC-1	674	2074	515
New Zealand	NZ-2	1445	8131	544
SOUTH AMERICA				
Argentina	AR-1	638	4066	94
Argentina	AR-2	752	4629	152
Bolivia	BO-1	214	3004	191
Brazil	BR-1	741	4163	156
Brazil	BR-2	792	4678	174
Chile	CL-4	960	6766	467
Chile	CL-3	1502	14242	203
Colombia	CO-1	1000	6893	283
Paraguay	PY-2	307	3312	314
Paraguay	PY-1	564	5441	172
Uruguay	UY-1	1842	15788	279
Uruguay	UY-2	456	3879	67
Venezuela	VE-1	752	5094	171

Figure 23 (Continued)

5.4 Mobile Traffic Growth As 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 enables Ericsson 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, WiFi, and Mobile WiMax).

These measurements have been performed for several years, pointing at a stable trend of traffic growth. However, 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.

As illustrated in Figure 24, mobile data surpassed voice on a global basis in Q4 2009. This finding is based on Ericsson measurements from live networks covering all regions of the world. The growth rate in mobile data traffic from Q1 2010 to Q1 2011 was 130%.

5.5 3G Data Traffic Patterns of Multiple Connected Device Types As Observed by Ericsson

A significant part of mobile Internet traffic is transferred over 3G mobile access networks. Figure 25 shows the volume (average values for networks with the smallest and the highest usage) of monthly data traffic per subscriber delivered over 3G networks for laptop, tablet and smartphone devices (including Android-based phones and Apple iPhones). As the figure shows, the average monthly traffic volumes per subscription over 3G access are undoubtedly the highest for laptop terminals (1 – 7 GB) followed by tablets (250 – 800 MB) and smartphones (80 – 600 MB).

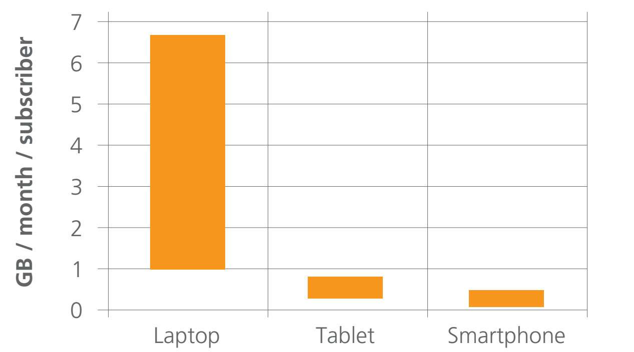

Figure 25: Monthly Traffic Volumes in 3G Mobile Broadband Networks per Subscriber

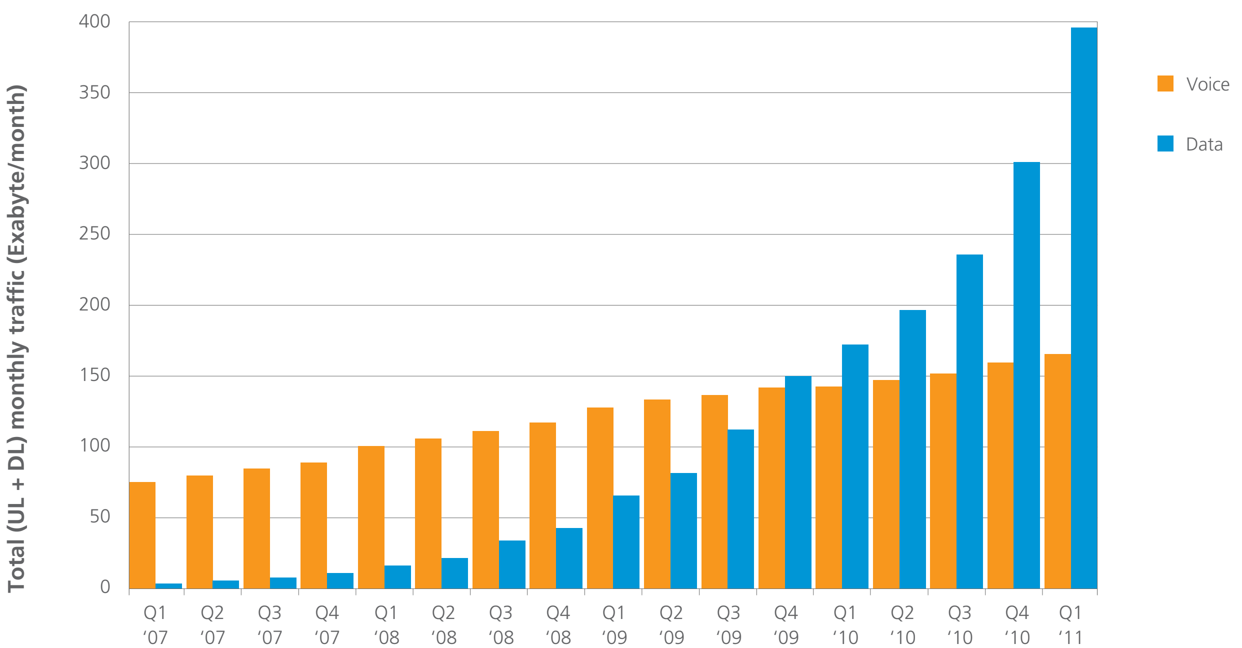

Figure 24: Total Monthly Mobile Voice and Data as Measured by Ericsson

Using 3G data traffic measurements performed by Ericsson from all major regions of the world, Figure 26 shows how the most widely used online applications contribute to overall mobile Internet traffic volumes, and how these contributions vary by the type of connected device, based on estimated worldwide average values from all measured networks. Note that WiFi offload traffic is not included in underlying data for Figures 25 or 26.

Regardless of device type, online video (30 – 40%) is the largest contributor to traffic volumes, followed by Web browsing (20 – 30%). On laptop-type devices, the amount of file sharing traffic can also be significant. On tablets and smartphone devices, online audio, e-mail, software downloads, and social networking traffic are also important contributors of 3G data traffic.

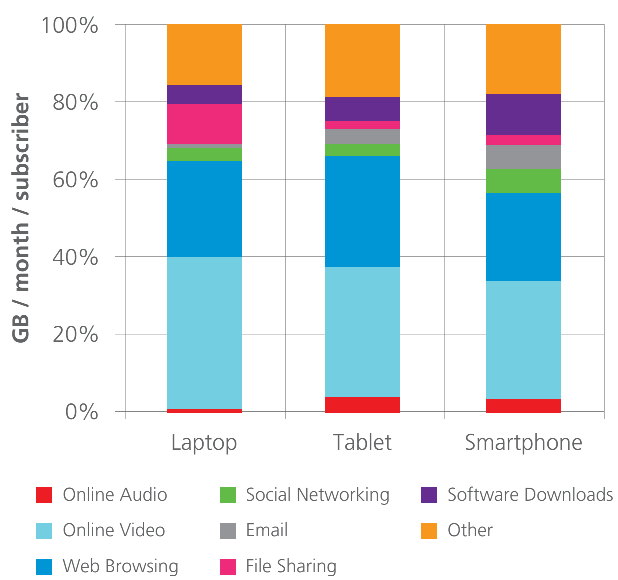

Figure 26: Average Application Volume Shares in Mobile Broadband Networks for Different Device Types

It is also interesting to examine the difference in mobile data traffic patterns generated by laptops, tablets and smartphones. Figure 27 shows sample network traffic for a 24-hour period (one day), where each horizontal line corresponds to one subscriber, and shading along these lines represent data traffic via 3G access from these subscribers along the timeline.

As illustrated by the figure, laptops have a few longer sessions mainly during daytime and the evening, but at dawn, most laptops are turned off. An examination of the underlying data for a selected five-minute period shows that active sessions for laptop-type devices are characterized by longer bursts of intensive usage from interactive applications (such as online video and Web browsing) and shorter low bandwidth data transmissions from background applications (such as instant messaging). In contrast, tablet and smartphone devices usually have frequent and short sessions typically during the whole day, sometimes showing a periodic nature. As shown in Figure 28, an examination of these sessions shows that they consist of low bandwidth background data transmission bursts (such as presence updates and periodic email checking), interspersed with a few more intensive interactive usage bursts.

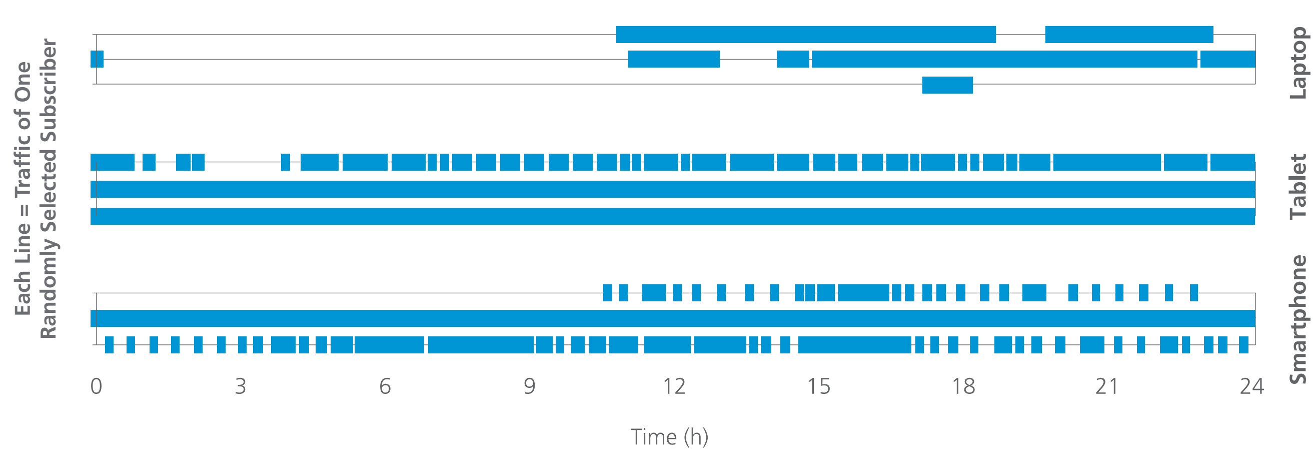

Figure 27: Mobile Broadband Traffic Patterns Visualized

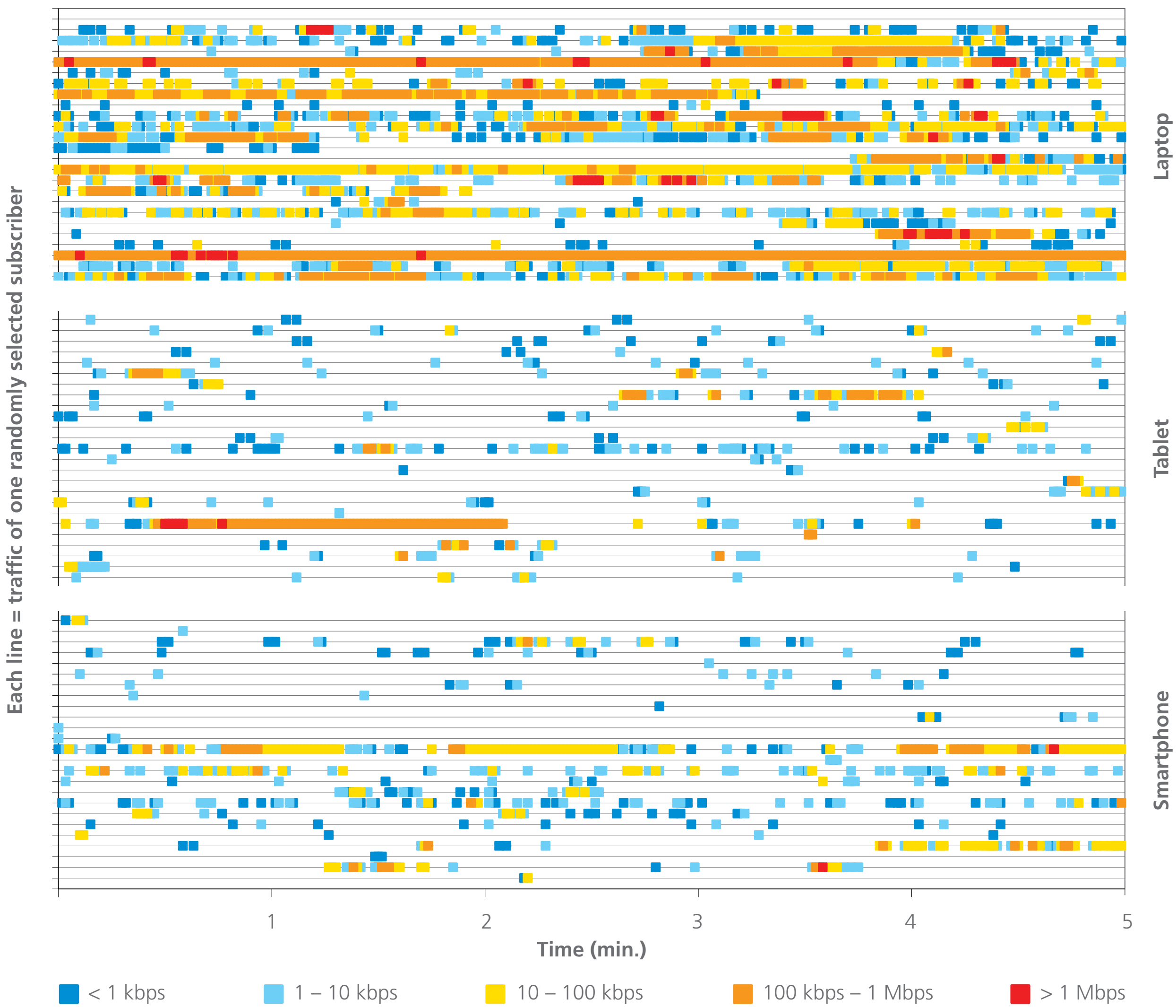

Figure 28: Data transmission patterns from laptops, tablets, and smartphones as examined over a five-minute period

It is interesting to note that tablet traffic patterns over 3G mobile networks are much closer to smartphone traffic patterns than to laptop traffic patterns. For example, on tablets, one could expect online video usage more similar to smartphones than to laptops. These traffic pattern similarities could potentially be due to several different factors:

- 3G access for laptops is often used as the main avenue for Internet access (replacing a wired connection), while tablets and smartphones are often used as secondary devices.
- Some portion of tablet and smartphone traffic is offloaded from 3G to WiFi.
- Monthly data subscription caps are often smaller for tablets and smartphones than for laptops
- The smaller screens on smartphones and tablets (as compared to laptops) may result in a more limited video and Web browsing experience

Network Outages and Disruptions

In the first quarter of 2011, Internet outages or disruptions of note occurred in several countries around the world due to government action in response to protests, natural disasters, or oddly enough, simply scavenging for scrap metal. In the sections below, we review some notable outages as seen by trends in traffic delivered by Akamai into these countries.

6.1 Egypt

According to published reports, in late January, the Egyptian government took the unprecedented step of cutting off nearly all of the country's Internet access in response to widespread protests.[29] The country's government ordered each of the four major Internet Service Providers within the country to shut down all international connections to the Internet on January 28. The shutdown was significant, cutting off an estimated 20 million Egyptian Internet users; as a blog post from Internet monitoring firm Renesys noted, "Every Egyptian provider, every business, bank, Internet cafe, website, school, embassy, and government office that relied on the big four Egyptian ISPs for their Internet connectivity is now cut off from the rest of the world."[30] The Egyptian government ended the shutdown several days later, on February 2.

As shown in Figure 29, the volume of traffic being delivered by Akamai to users in Egypt dropped precipitously concurrent with these providers being shut down, and remained at near-zero levels for the duration of the outage. Interestingly, upon restoration of Internet access, traffic peaked at a level slightly higher than that seen immediately prior to the shutdown, likely related to pent-up demand for news, social networking, and other types of content from Egyptian users.

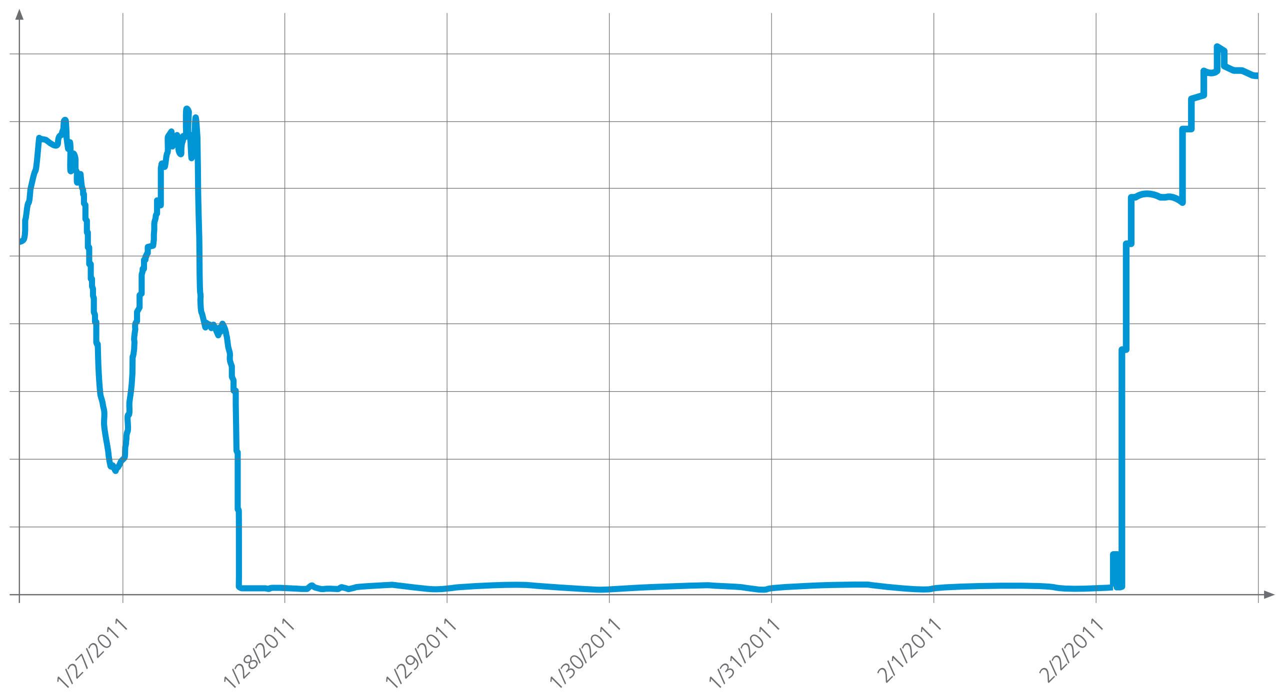

Figure 29: Multiday Internet Outage in Egypt lasted from January 27 through February 2

6.2 Libya

Following the Internet outages in Egypt that occurred in response to widespread protests, political unrest in Libya drove two brief disruptions in Internet connectivity in Libya in the third week of February, followed by a longer disruption that started in early March. According to published reports, two brief outages occurred during the February 18-20 period, after which Internet traffic returned at a level 60-80% of that seen prior to the disruption.[31] The graph of Akamai traffic delivered into Libya during the two week February 14-28 period, shown in Figure 30, has two clearly identifiable outage periods during the 18th-20th, and the peak traffic levels after those outages were a fraction of those seen in the days before.

Additionally, on March 3rd, as shown in Figure 31, Akamai traffic delivered into Libya fell to near-zero levels, and remained that way for over a week. A blog post from Internet monitoring firm Renesys found that, during this period, nearly every host inside Libya had become unresponsive. Renesys noted, "You could attempt to 'ping' them, send a traceroute along the path to them, try to retrieve pages, try to look up domain names ... but in nearly every case, there was no response."[32] Similar to what occurred in Egypt, the Libyan government apparently ordered Libya Telecom & Technology to throttle the flow of traffic "to the point of uselessness", rather than turning it off entirely[33] – this would likely explain why Akamai's traffic into the country did not drop completely to zero during this period.

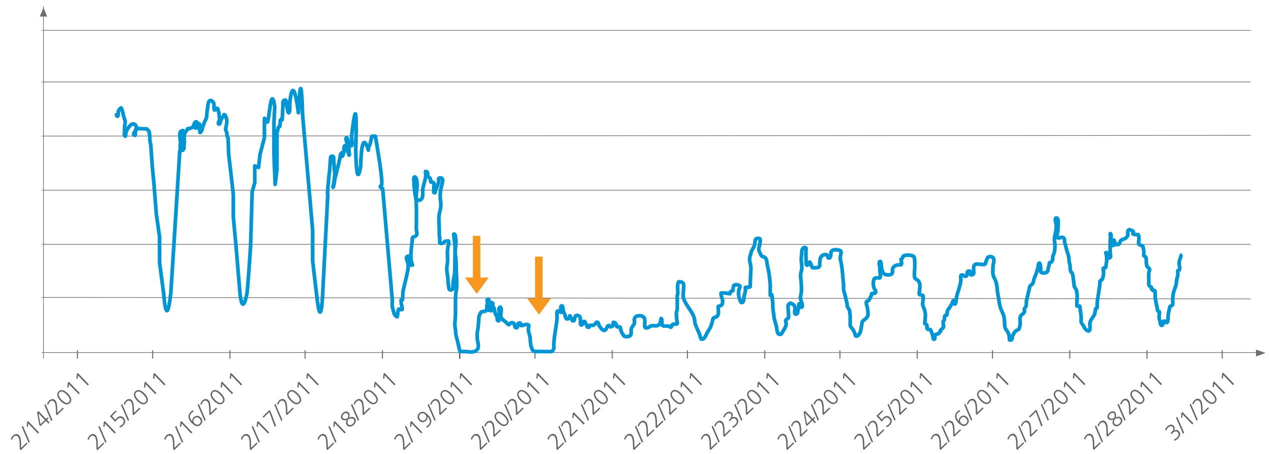

Figure 30: Two brief disruptions in Internet connectivity in Libya occurred during the third week of February

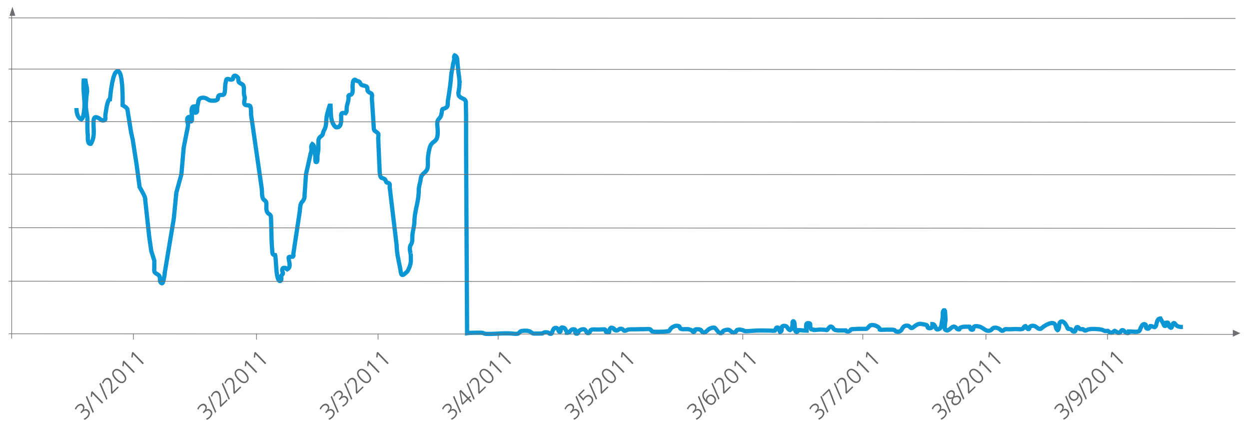

Figure 31: A longer disruption in Libya's Internet connectivity occurred in early March

6.3 Japan

On March 11, a magnitude 8.9 earthquake struck northeast Japan and spawned a tsunami with waves that reached up to six miles inland.[34] Despite damaging undersea cables belonging to telecommunications provider KDDI, these natural disasters did not otherwise cause widespread or long-term Internet outages within Japan. As shown in Figure 32, Akamai traffic delivered to Japan dropped approximately 27% immediately after the earthquake occurred but began to recover shortly thereafter. While not shown in the figure, Akamai's monitoring indicated that in the days after the earthquake, the peak levels for traffic delivered to Japan were higher than those seen prior to the earthquake, likely due to Japanese citizens turning to the Internet for updated news and information on the disaster, as well as in efforts to find and communicate with friends and family.

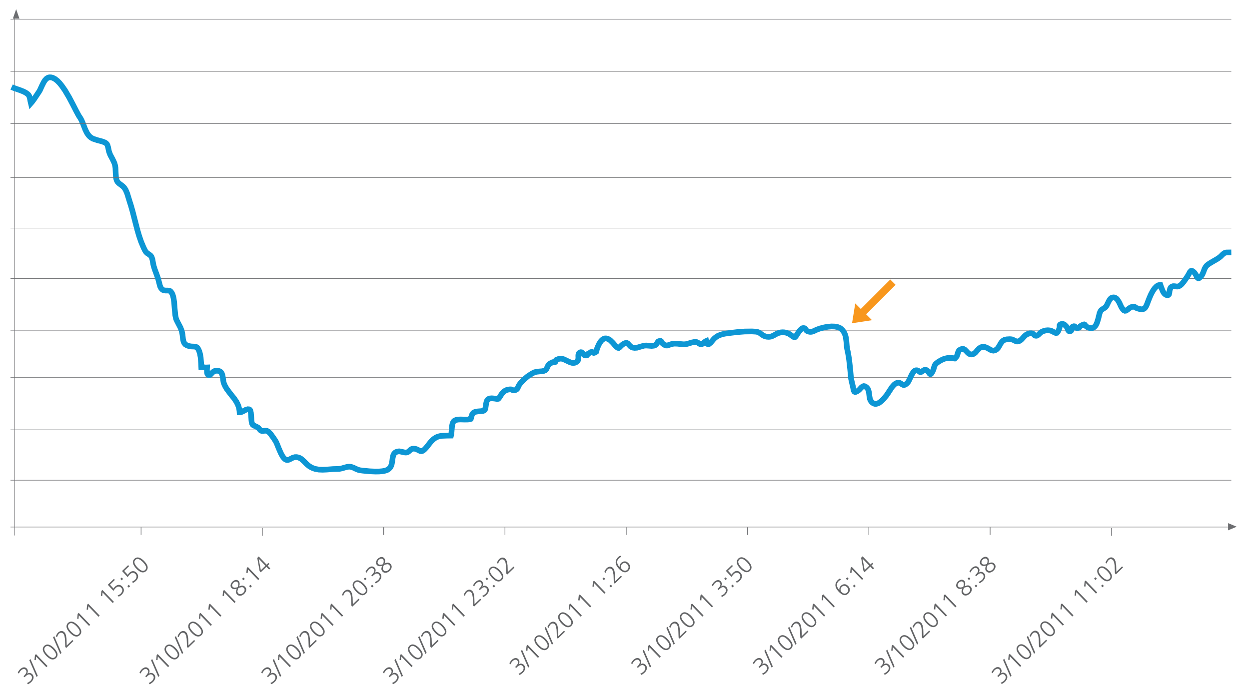

Figure 32: The earthquake occurred at 05:46 UTC, and resulted in a 27% drop in traffic

DID YOU KNOW?

- *In January 2008, a pair of cut submarine telecom cables in the Mediterranean just north of Egypt caused severe Internet outages and disruptions in the Middle East, Pakistan and India.*
- *In September 2008, Hurricane Ike caused extensive Internet outages across the United States.*
- *In December 2008, three key submarine cables in the Mediterranean were severed, which impacted Internet traffic in the Middle East and Indian subcontinent.*

6.4 Georgia/Armenia

While other notable Internet outages and disruptions in the first quarter were due to natural disasters or government action, published reports indicate that disruptions seen in late March in the eastern European countries of Georgia and Armenia had a far more unusual cause. These reports[35] claim that a 75-year old Georgian woman searching for scrap metal cut a fiber-optic cable belonging to Georgian Railway Telecom, which caused "90 per cent of private and corporate internet users in neighboring Armenia to lose access for nearly 12 hours while also hitting Georgian internet service providers." Figure 33 illustrates patterns in traffic that Akamai delivered to Georgia and Armenia between March 26th and 31st. As can be seen in the highlighted areas, otherwise cyclical traffic in both countries saw uncharacteristically large declines on March 28, likely related to the disruption in Internet access caused by this severed cable, as "Web users … were left twiddling their thumbs for up to five hours as the country's main internet providers … were prevented from supplying their normal service."[36]

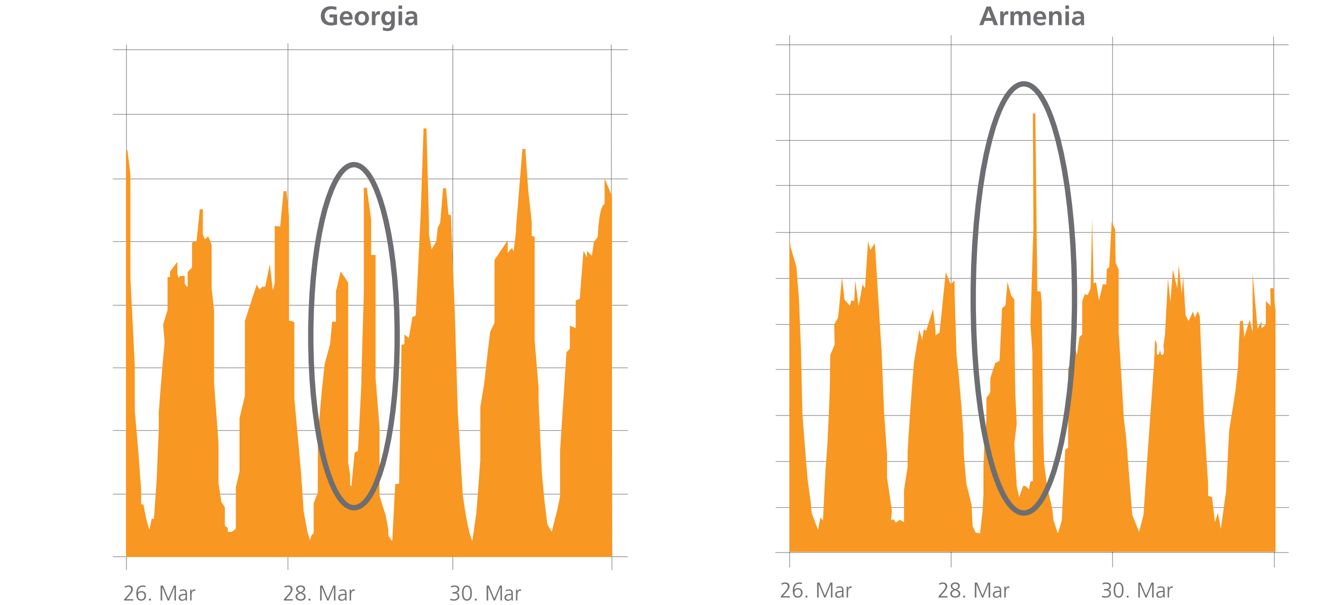

Figure 33: Note the uncharacteristically large dips in Akamai traffic delivered to Georgia (L) and Armenia (R) on March 28

DID YOU **KNOW?**

- *In June 2009, Internet connectivity in Iran experienced disruptions related to unrest around controversial elections within the country.*
- *In July 2009, damage to the undersea SAT-3 cable caused Internet connectivity problems in West Africa.*
- *In 2010, damage to submarine cables caused Internet outages in Haiti (January), Taiwan (March), the Middle East (April), and Malaysia (April).*

Country/Region	% Attack Traffic	Unique IP Addresses	Avg. Connection Speed (Mbps)	Peak Connection Speed (Mbps)	% Above 5 Mbps*	% Above 2 Mbps*	% Below 256 kbps*
EUROPE							
Austria	0.1%	2,861,052	4.4	15.7	24%	71%	–
Belgium	0.1%	3,920,493	6.1	24.7	52%	90%	–
Czech Republic	0.2%	2,054,599	6.5	20.7	48%	94%	–
Denmark	0.1%	2,463,216	5.6	17.4	43%	87%	–
Finland	0.1%	2,660,860	4.9	16.5	31%	68%	–
France	1.2%	24,010,722	3.6	14.2	13%	79%	0.3%
Germany	2.1%	34,785,032	4.7	18.3	27%	91%	0.6%
Greece	0.2%	2,459,685	3.5	17.0	9.1%	80%	–
Hungary	1.8%	2,111,588	5.1	21.4	35%	91%	–
Iceland	<0.1%	130,615	5.1	21.2	26%	87%	–
Ireland	0.1%	1,551,482	5.6	18.6	29%	81%	–
Italy	2.5%	13,632,661	3.7	14.9	11%	85%	0.9%
Luxembourg	<0.1%	173,290	4.5	16.2	20%	92%	–
Netherlands	0.2%	8,166,009	7.5	22.0	56%	91%	0.4%
Norway	<0.1%	3,030,551	5.4	18.5	35%	82%	–
Poland	1.9%	6,575,834	3.6	13.9	17%	65%	–
Portugal	0.2%	2,526,492	4.9	24.9	37%	88%	–
Romania	2.5%	2,531,466	6.6	32.7	51%	93%	–
Slovakia	0.1%	797,784	4.8	18.4	20%	90%	–
Spain	0.8%	12,915,356	3.4	15.7	11%	79%	0.6%
Sweden	0.2%	6,103,986	5.0	19.1	29%	66%	0.7%
Switzerland	0.1%	2,972,087	6.2	21.1	40%	93%	–
United Kingdom	0.7%	22,333,025	4.6	17.2	25%	89%	0.6%
ASIA/PACIFIC							
Australia	0.4%	11,749,126	3.4	14.7	16%	57%	2.2%
China	6.4%	73,587,347	1.0	4.1	0.5%	9.3%	7.9%
Hong Kong	3.3%	2,478,786	9.2	39.5	55%	92%	–
India	3.8%	6,974,771	0.8	5.2	0.4%	4.9%	35%
Japan	1.7%	41,233,145	8.1	29.9	55%	79%	1.1%
Malaysia	1.0%	2,045,067	1.6	8.9	2.4%	15%	2.7%
New Zealand	0.3%	1,562,272	3.5	13.7	15%	74%	4.5%
Singapore	0.6%	1,362,513	4.2	19.3	28%	69%	–
South Korea	1.2%	22,538,305	14.4	36.3	60%	87%	0.5%
Taiwan	9.1%	7,782,733	4.1	18.3	24%	75%	–
MIDDLE EAST							
Egypt	1.3%	1,330,239	0.8	7.0	–	4.4%	9.4%
Israel	0.5%	2,168,339	3.6	15.9	11%	83%	–
Kuwait	0.1%	357,971	1.5	9.0	–	16%	–
Saudi Arabia	0.2%	2,192,288	2.0	8.0	–	41%	–
Sudan	<0.1%	29,581	0.6	5.3	–	–	–
Syria	<0.1%	221,394	1.8	4.1	–	44%	20%
United Arab Emirates (UAE)	0.2%	915,638	3.9	25.9	28%	53%	–
LATIN & SOUTH AMERICA							
Argentina	1.5%	4,745,447	1.8	10.7	3.6%	27%	2.3%
Brazil	5.5%	14,153,991	1.7	8.9	3.5%	27%	9.1%
Chile	0.4%	2,580,353	2.6	14.7	4.3%	65%	–
Colombia	0.6%	2,858,414	1.9	9.6	–	37%	1.3%
Mexico	0.3%	8,930,278	1.9	9.5	1.1%	32%	1.5%
Peru	1.3%	738,094	1.4	8.6	–	11%	–
Venezuela	0.3%	2,308,463	0.8	4.8	–	1.7%	9.4%
NORTH AMERICA							
Canada	0.9%	12,583,683	5.6	20.1	44%	88%	1.3%
United States	10%	142,605,731	5.3	21.2	39%	77%	2.0%

** Countries listed with "–" had fewer than 25,000 unique IP addresses connecting to Akamai during the first quarter at this speed. Based on the revised threshold for inclusion, they were not included in the global ranking.*

Endnotes

[1] http://bit.ly/jJE5vg

[2] http://www.confickerworkinggroup.org/wiki/uploads/Conficker_Working_Group_Lessons_Learned_17_June_2010_final.pdf

[3] http://www.grc.com/port_21.htm, http://isc.sans.org/port.html?port=21, http://www.ictsc.com/IP_Port21.htm

[4] http://www.iana.org/assignments/port-numbers

[5] https://www.torproject.org/docs/tor-doc-windows.html.en

[6] http://news.cnet.com/8301-30685_3-20030105-264.html

[7] http://www.networkworld.com/community/blog/microsoft-pays-nortel-75-million-ipv4-address

[8] http://gcn.com/Articles/2011/03/04/IPv4-aftermarket-for-usused-address-space.aspx?p=1

[9] http://www.apnic.net/publications/news/2011/final-8

[10] http://www.apnic.net/policy/add-manage-policy#9.10

[11] http://www.potaroo.net/ispcol/2011-02/transtools-part1.html

[12] http://mailman.nanog.org/pipermail/nanog/2011-February/031788.html

[13] http://s3.amazonaws.com/alexa-static/top-1m.csv.zip

[14] http://mnlab-ipv6.seas.upenn.edu/monitor/index.html

[15] http://www.google.com/intl/en/ipv6/

[16] http://asert.arbornetworks.com/category/ipv6/

[17] http://www.google.com/intl/en/ipv6/statistics/ [Graph time scale narrowed to January 1, 2011 – March 31, 2011]

[18] http://www.akamai.com/dl/whitepapers/How_will_the_internet_scale.pdf

[19] http://www.crtc.gc.ca/eng/com100/2011/r110503.htm

[20] http://ec.europa.eu/information_society/newsroom/cf/pillar.cfm?pillar_id=46

[21] http://www.nbn.gov.au/frequently-asked-questions/#a558

[22] http://www.blu-ray.com/faq/

[23] The "average peak connection speed" metric represents an average of the maximum measured connection speeds across all of the unique IP addresses seen by Akamai from a particular geography. The average is used in order to mitigate the impact of unrepresentative maximum measured connection speeds. In contrast to the average measured connection speed, the average peak connection speed metric is more representative of what many end-user Internet connections are capable of. (This includes the application of so-called speed boosting technologies that may be implemented within the network by providers, in order to deliver faster download speeds for some larger files.)

[24] http://www.digitaldivide.org/wp-content/uploads/2011/04/Broadband_declaration_final_version__english_signed1.pdf

[25] http://www.telegeography.com/products/commsupdate/articles/2010/12/09/trai-releases-national-broadband-plan/

[26] Ibid.

[27] http://www.akamai.com/html/technology/products/edgescape.html

[28] http://www.akamai.com/ericsson/index1.html

[29] http://www.capacitymagazine.com/Article/2781237/Egypt-cuts-internet-in-attempt-to-silence-protests.html

[30] http://www.renesys.com/blog/2011/01/egypt-leaves-the-internet.shtml

[31] http://news.cnet.com/8301-31921_3-20035079-281.html

[32] http://www.renesys.com/blog/2011/03/what-libya-learned-from-egypt.shtml

[33] Ibid.

[34] http://articles.cnn.com/2011-03-11/world/japan.quake_1_hokkaido-tsunami-east-japan-railway?_s=PM:WORLD

[35] http://www.telegraph.co.uk/news/worldnews/europe/georgia/8442056/Woman-who-cut-internet-to-Georgia-and-Armenia-had-never-heard-of-web.html

[36] http://www.guardian.co.uk/world/2011/apr/06/georgian-woman-cuts-web-access

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