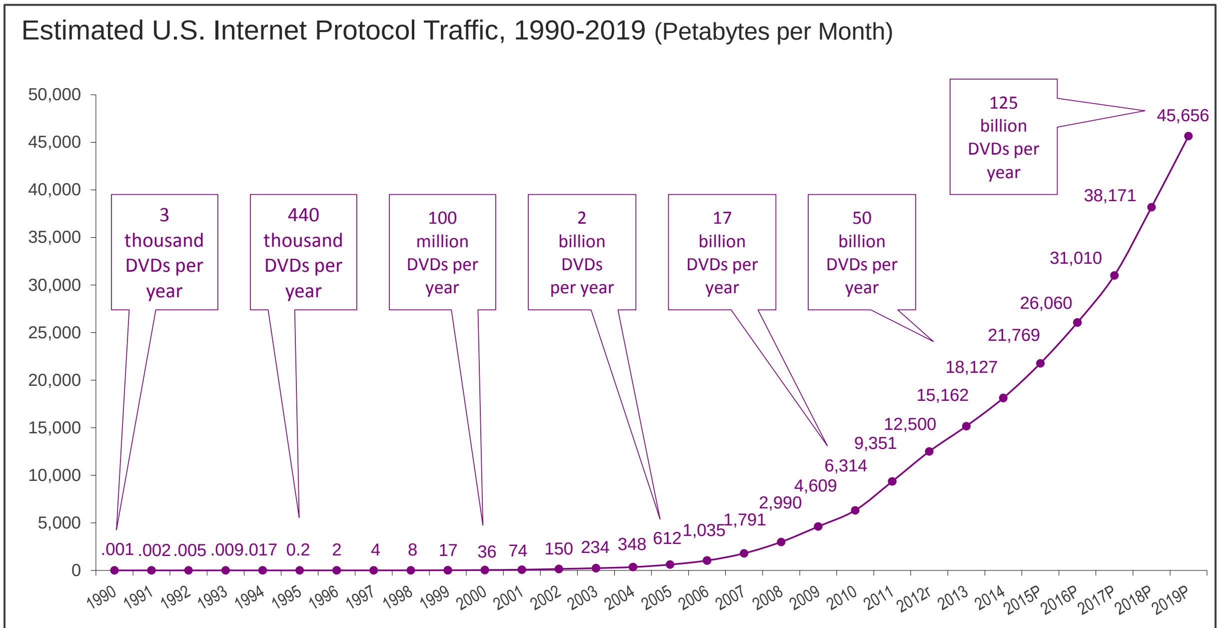
U.S. INTERNET USAGE AND GLOBAL LEADERSHIP ARE EXPANDING

By Patrick Brogan, Vice President of Industry Analysis

A new USTelecom analysis of the latest annual Internet Protocol (IP) traffic data from the Cisco Visual Networking Index (VNI) shows that U.S. IP traffic quadrupled over the last five years, and it is expected to grow two-and-a-half times again over the next five years. See Chart 1. The acceleration toward online and mobile video, and other new applications such as the Internet of Things and analytics, will be significant drivers of traffic growth and network investment in the coming years. The U.S. today remains a world leader in Internet usage, having closed the gap with current world leader South Korea and expanded its lead over other industrialized nations. In fact, the VNI projects that in the next several years the U.S. will overtake South Korea. See Chart 5. Thus, compared to global peers the U.S. has been gaining ground.

Chart 1 – Historical and Projected Growth of U.S. IP Traffic



Source: Cisco Visual Networking Index and USTelecom Analysis. DVD equivalents are annualized, rounded, and assumed to store a two-hour movie. The 2012 figure is revised from previously reported volumes based on Cisco VNI statements and is a rounded estimate.

Massive investment in broadband infrastructure, along with the development of compelling applications and content, has driven U.S. global leadership in Internet usage. Since the commercialization of the Internet in the 1990s, U.S. firms have built an Internet ecosystem that is the envy of the world under a bipartisan light-touch regulatory framework. Ongoing investment in broadband networks, especially wireline networks, will be critical in accommodating expected traffic growth, attaining the economic benefits of increased migration to IP networks, and maintaining our international leadership. The recent Federal Communications Commission (FCC) shift to regulate broadband providers with utility rules under Title II of the Communications Act imposes burdens on and creates uncertainty for network providers, putting pressure on broadband investment over time and risking U.S. global leadership.

The risk that regulation may slow investment and usage over time is especially pertinent with the Internet since IP network evolution is a rapid and dynamic process. For example, according to Cisco VNI analysis, the acceleration toward online video is pushing an increasing portion of IP traffic from long haul backbones to metro area networks. This is because more and more content is being stored locally on content distribution networks, which interconnect with broadband providers in the metro area to distribute the content to users. Network, content, and application providers will have to work together quickly and flexibly to craft network solutions to accommodate shifting video traffic patterns arising from online video and other media. Yet under Title II the FCC has extended its authority to include interconnection among these players, and offered only general standards for case-by-case adjudication, leaving it unclear which practices may or may not be allowed or penalized. The approval process and uncertainty with respect to standards and enforcement all cut against quick and flexible network investment. Similar issues are likely to arise with the growing adoption of currently nascent applications, such as the Internet of Things, data analytics, and many others.

U.S. Internet Traffic Continues to Grow Rapidly

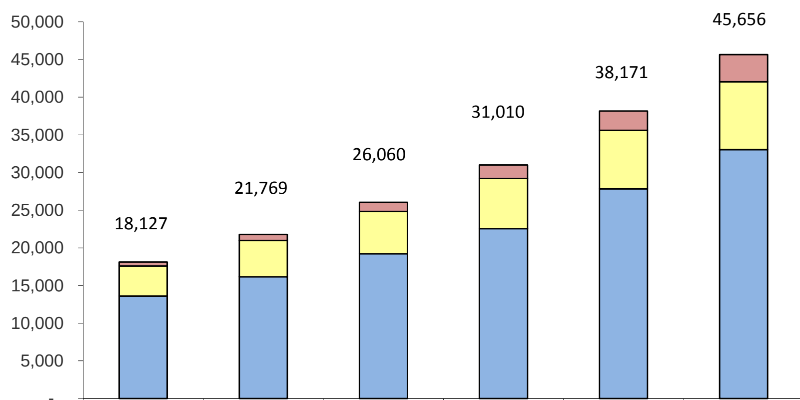
U.S. Internet Protocol (IP) traffic in 2014 was 18.1 exabytes, per month. See Chart 1 (1 exabyte = 1,000 petabytes or one trillion million bytes). This is the equivalent of more than 4 billion DVDs per month or 50 billion DVDs per year. In 2014, the U.S. generated approximately five hundred times more IP traffic than it generated in the year 2000, one million times more than in 1994, and almost 18 million times more than in 1990. Through 2014, U.S. IP traffic grew at an average compounded annual rate of 100 percent since 1990 and 56 percent since 2000. From 2009 to 2014, U.S. IP traffic grew at an average compounded annual growth rate of 32 percent, quadrupling over the five-year period. Double-digit annual growth continued last year as traffic grew 20 percent from 2013 to 2014. Furthermore, Cisco projects U.S. IP traffic will grow again by a factor of two-and-a-half over the next five years. From 2014 through 2019, Cisco projects traffic will grow to 45.7 exabytes per month, or the equivalent of 125 billion DVDs. See Chart 1. During this period, traffic will continue to grow at an average 20 percent compounded annual rate. To put this in perspective, on average, for each of the next five years, U.S. networks will have to accommodate an additional 66 exabytes of data per year, which equals 66 trillion million bytes, or the equivalent of 15 billion DVDs per year and approximately 30 percent of the amount of all U.S. traffic carried in 2014.

Online Video is the Biggest Driver of Traffic Growth

Consumer video over fixed networks generates the largest share of traffic growth by volume. Assuming the share of consumer file sharing that is video grows from 76 percent in 2014 to 86 percent in 2019, USTelecom estimates that 13.6 exabytes per month of fixed network consumer IP video traffic in 2014 will grow to 33.0 exabytes by 2019. Thus, consumer video represented three-quarters of 2014 traffic and accounts for more than 70 percent of traffic growth in the next five years. Mobile data is the fastest growing segment of U.S. traffic at a 47 percent compounded annual rate over the next five years, but it remains a small portion of overall traffic: 532 petabytes per month in 2014, or 2.9 percent of all traffic, growing to a projected 3.6 exabytes per month in 2019, or 7.9 percent of all traffic. See Chart 2.

Chart 2 – Composition of U.S. IP Traffic

U.S. Internet Protocol Traffic, 2014-2019 (Petabytes per Month)



	2014	2015	2016	2017	2018	2019
Mobile	532	802	1,218	1,796	2,559	3,592
Fixed Consumer Data and Business	4,010	4,795	5,636	6,658	7,769	9,024
Fixed Consumer Video	13,586	16,172	19,206	22,555	27,843	33,039

Source: Cisco Visual Networking Index and USTelecom analysis. Mobile and business include video; consumer data includes all consumer non-video.

Broadband Investment is Essential to Ongoing Internet Usage Growth

As noted in a July 2015 USTelecom Research Brief, broadband providers invested $78 billion in 2014 and more than 1.4 trillion dollars since 1996 in large part to build and expand the broadband network capacity needed to accommodate traffic growth. Broadband provider investment yields complementary investments in information and communications technology (ICT) across the economy. U.S. private firms invested $650 billion in ICT in 2014, including broadband communications networks, software, computer hardware, research and development in computing and semiconductors, and long-lived content. Meanwhile nearly all U.S. businesses use the Internet, interconnecting their employees, suppliers, and customers to maximize the productivity of their investments in ICT and create new business opportunities. Similarly, as of January 2014, 87 percent of U.S. consumers were using the Internet, and at least 73 percent had adopted broadband technology at home as of 2013 to use with a growing array of bandwidth-intensive devices, including increasingly powerful computers, television set-tops, consoles, handsets and tablets.

Large capital investments to upgrade broadband capacity will be essential to accommodate continued growth in consumer demand and enable ongoing IP traffic growth and innovation in ICT for both businesses and consumers. As indicated in Chart 3, fixed consumer video traffic is the greatest driver of current and projected usage, approximately three-quarters of traffic. While wireless data is likely to remain a small portion of total traffic, it has generated a great deal of innovation and popular interest, and it is growing at the fastest rate of all types of traffic. Meanwhile, business and consumer web and other data traffic will more than double over the next five years. Underlying all of this usage is the ongoing shift to the network infrastructure of the future, with more powerful mobile and IP-based networks, with more capital-efficient content and service delivery via data centers in the so-called "cloud."

Wireline providers will have to build faster and smarter broadband access for growing online video, mobile, and cloud services, as well as nascent applications like the tele-health, online education, the Internet of Things, data analytics, and much more. They will need to upgrade access, metro, long haul, and cell backhaul networks, as well as connectivity for data centers and content distribution networks. According to the Cisco VNI online data, the average end-user fixed broadband connection speed in the U.S. is projected to double from 22.2 megabits per second (Mbps) in 2014 to 45 Mbps in 2019. In addition, traffic utilizing only metro area networks without crossing long haul Internet backbone networks will triple in the next five years as video traffic delivered via content distribution networks (CDNs) increases. CDNs store content on servers located closer to end-users for faster delivery. Meanwhile, long haul traffic is still expected to grow about 12 percent through 2018, before dropping back to current levels in 2019. According to the Telecommunications Industry Association (TIA) Market Review and Forecast 2015-18 (subscription required), data center construction spending grew from $15.0 billion in 2010 to $23.4 billion in 2014, and was projected to grow to $31.3 billion by 2018. Finally, while mobile traffic is the fastest-growing segment, nearly all wireless traffic utilizes wireline networks, whether via cellular backhaul or WiFi extensions of fixed broadband access networks.

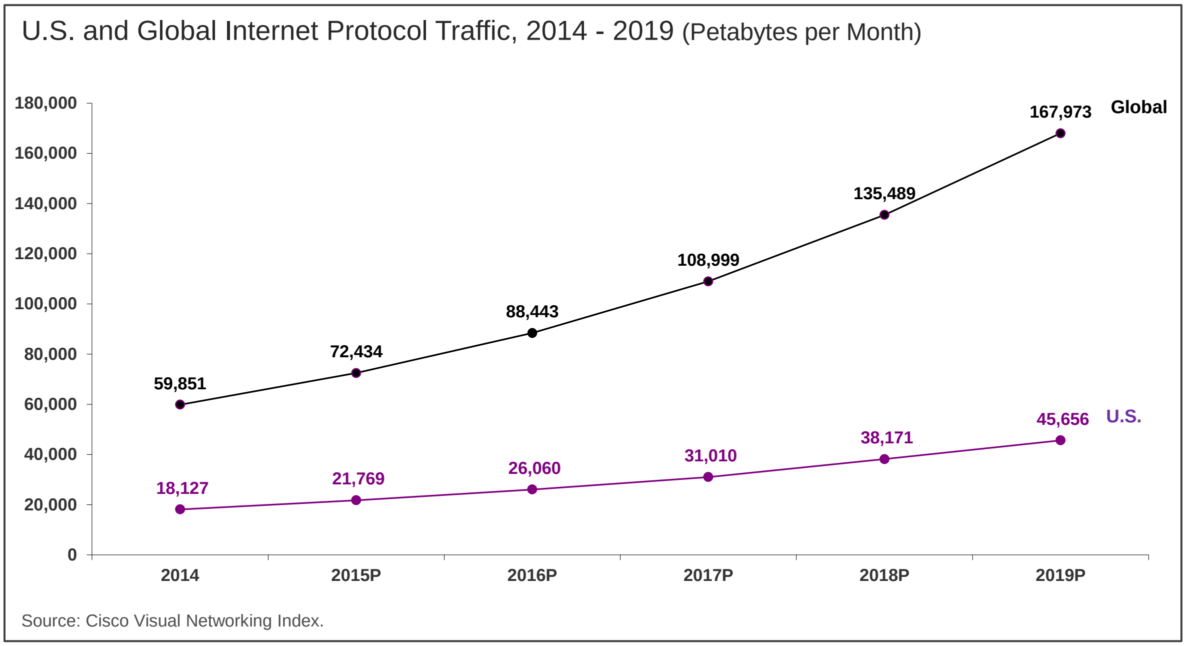
These upgrades across the network will all require significant investment. Moreover, according to the Cisco VNI, peak time traffic is growing faster than overall traffic. Since network providers build to peak demand, more incremental investment will be needed. So, continued investment in broadband networks, including wireline networks, remains critical to meeting growing demand for data.

The United States is Expanding Its Global Leadership in Internet Usage

On an absolute basis, not adjusted for country size, the U.S. generates more Internet traffic than any other nation by far. In 2014, U.S. traffic was nearly double that of the next largest country, China, and was nearly double that of all of Western Europe. By 2019, U.S. traffic will be *more than* double that of both China and Western Europe. Detailed country and region data are available in Appendix A.

On a proportional basis, U.S. data traffic comprises a large share of global traffic. The U.S. accounted for more than 30 percent of global IP traffic in 2014 despite having only 4.5 percent of the world's population. The U.S. share will hover around that level over the next five years, starting to decline slowly near the end of that period toward 27 percent in 2019. See Chart 3. It is natural that the U.S. share should decline, given the relatively advanced state of U.S. Internet deployment and adoption relative to most of the globe, especially developing countries. In fact, it is somewhat surprising that the relative U.S. share will remain so high for so long, given large expected increases in penetration in large developing areas.

Chart 3 – Comparison of U.S. and Global IP Traffic



The U.S. also ranks very well when measuring average usage by consumers. Usage comparisons by region and country are derived by taking Internet traffic data and dividing by the number of Internet users (see appendix for more detail). On a regional basis, North America has the heaviest Internet usage, with more than double the usage of Europe and four times that of Asia. See Chart 4. Comparisons among smaller areas are limited by the data. For example, data for U.S. states and many smaller countries are not available. Nonetheless, the available data show that to date the U.S., taken as a whole, is surpassed only –and just barely – by South Korea.

In stark contrast to inaccurate reports that the U.S. is lagging in Internet capabilities by those seeking aggressive U.S. regulatory policy, Internet usage data show the United States is ahead and gaining ground on this important metric. Since 2009, the U.S. has moved to near the top of the pack in global Internet usage comparisons and closed much of the gap with the global leader, South Korea. See Chart 5. From 2009 to 2014, the U.S. traffic per user grew more than 250 percent, from 19.2 GB/user/month to 66.4 GB/user/month, while South Korea grew by less than 67 percent, from 40.7 GB/user/month to 67.9 GB/user/month. In 2009 there was a 53 percentage point gap between the U.S. and South Korea; in 2014 the gap was only 2 percentage points. The U.S. also consumes more data per user than Japan, Western Europe, and Australia, areas which are typically cited as performing better than the U.S. Large continental European countries in particular are lagging. France, Germany, Italy, and Spain were all generating less than 25 GB/user/month in 2014. Even countries that grew fairly rapidly over the last couple of years—such as Canada, the U.K., Australia, and Japan—lag the U.S. by substantial margins. In 2013 Cisco included data for Sweden, which provided information regarding one of the Nordic countries typically cited as strong broadband performers. The U.S. per user consumption was greater than that of Sweden in 2013 and remained greater in 2014.

Chart 4 - Comparison of Internet Usage among Regions

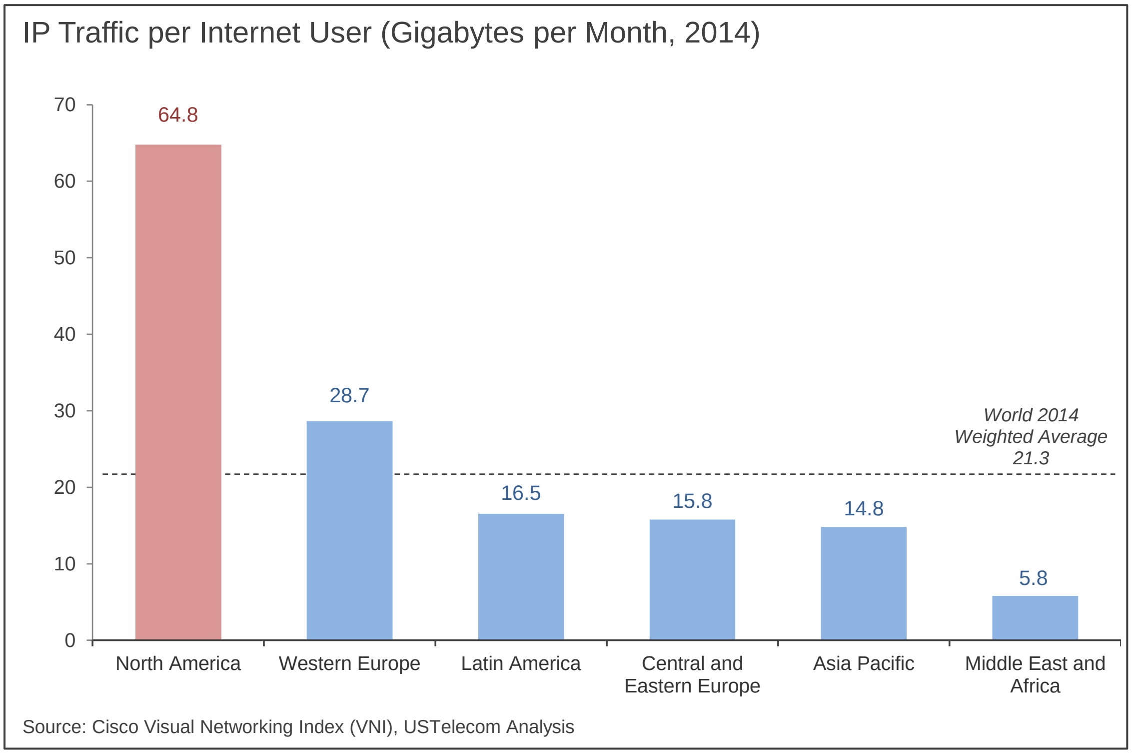
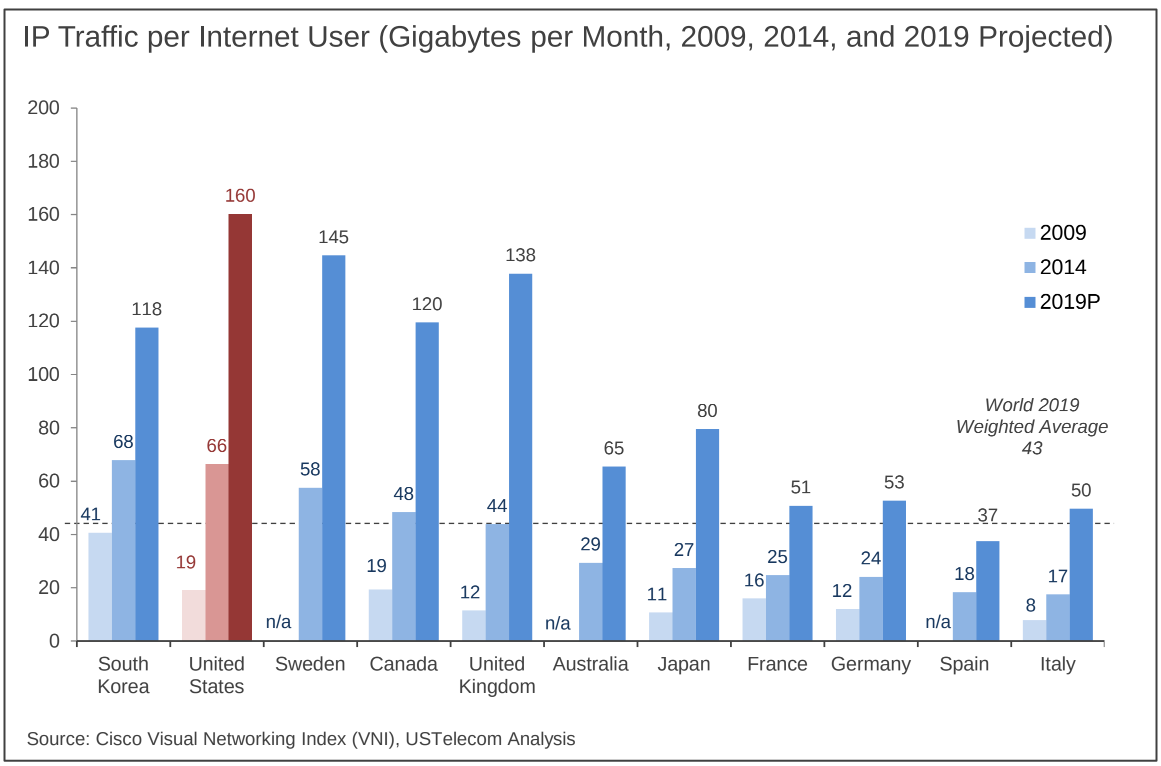


Chart 5 - Comparison of Internet Usage among Selected Industrialized Countries



Looking forward, the U.S. is currently projected to overtake South Korea to become the clear world leader and widen its global leadership position in the next several years. According to the Cisco VNI data, U.S. Internet traffic per user will grow almost two-and-a-half times from 2014 to 2019, from 64.8 Gigabytes per user per month to 160.2 Gigabytes per user per month. During the same period, worldwide, traffic per user is expected to grow by a factor of 2.0, from 21.3 Gigabytes per user per month to 42.8 Gigabytes per user per month. By 2019, according to Cisco VNI projections, the U.S. traffic per user will be 36 percent greater than South Korea. During this five-year period, South Korea will see traffic per user grow by a factor of 1.7, from 68.9 Gigabytes per user per month to 117.7 Gigabytes per user per month. (The UK and Canada will have eclipsed South Korea, too, by 2019). Cisco VNI data indicate that the U.S. is now, and will remain, among the top countries in the world in connected devices per capita, along with South Korea and Japan. The number of connected devices per capita is an indicator of the growth of the Internet of Things, which leverages the Internet to bring a range of economic and social benefits to those who adopt it. From 2014 to 2019, devices per capita are projected to grow from 6.24 to 11.76. For South Korea, the corresponding figures are 5.56 and 11.82; for Japan they are 5.45 and 11.07; and for Western Europe, they are 4.43 and 8.19.

Appendix A - Internet Usage Calculations by Region and Country

Regional and Country Internet Traffic per User and per Capita, 2014

	IP Traffic 2014 (PB/Month)	Growth (CAGR) 2014-19	Consumer Traffic 2014 (PB/Month)	Business Traffic 2014 (PB/Month)	Internet Users 2014 (millions)	Population 2014 (millions)	IP Traffic per User (GB/Month)	IP Traffic per Pop (GB/Month)	Consumer IP Traffic per Pop (GB/Month)	Business IP Traffic per Pop (GB/Month)	Users per Capita 2014
Global	59,848	23%	47,740	12,108	2,817	7,243	21.25	8.26	6.59	1.67	38.9%
North America	19,628	20%	16,609	3,019	303	358	64.78	54.83	46.39	8.43	84.6%
United States	18,127	20%	15,429	2,699	273	323	66.40	56.12	47.77	8.35	84.5%
Canada	1,501	22%	1,180	321	31	36	48.42	41.69	32.78	8.91	86.1%
Western Europe	9,601	21%	7,506	2,096	335	418	28.66	22.97	17.96	5.01	80.1%
France	1,410	17%	1,173	237	57	65	24.74	21.70	18.05	3.65	87.7%
Germany	1,544	18%	1,192	352	64	83	24.12	18.60	14.36	4.24	77.1%
Italy	682	26%	530	151	39	61	17.48	11.17	8.69	2.48	63.9%
Spain	659	16%	494	165	36	47	18.30	14.02	10.51	3.51	76.6%
Sweden	460	20%	363	97	8	10	57.50	46.00	36.30	9.70	80.0%
United Kingdom	2,417	27%	2,039	378	55	63	43.94	38.36	32.36	6.00	87.3%
Rest of Western Europe	2,431	18%	1,715	716	76	90	31.98	27.01	19.05	7.95	84.4%
Central and Eastern Europe	4,087	33%	2,831	1,255	259	483	15.78	8.46	5.86	2.60	53.6%
Russia	1,818	30%	1,210	609	80	142	22.73	12.81	8.52	4.29	56.3%
Poland	537	32%	427	110	21	38	25.59	14.14	11.24	2.89	55.3%
Rest of Central and Eastern Europ	1,731	35%	1,194	537	158	302	10.96	5.73	3.95	1.78	52.3%
Asia Pacific	20,729	21%	16,433	4,296	1,400	3,955	14.81	5.24	4.16	1.09	35.4%
Australia	500	22%	298	202	17	24	29.38	20.81	12.40	8.41	70.8%
China	9,671	18%	7,581	2,090	650	1,394	14.88	6.94	5.44	1.50	46.6%
India	967	33%	763	204	274	1,267	3.53	0.76	0.60	0.16	21.6%
Indonesia	333	36%	262	71	88	253	3.78	1.32	1.04	0.28	34.8%
Japan	2,664	26%	1,911	753	97	127	27.46	20.98	15.04	5.93	76.4%
South Korea	3,121	13%	2,826	296	46	50	67.86	62.43	56.51	5.92	92.0%
New Zealand	105	20%	84	22	4	5	26.35	21.08	16.70	4.38	80.0%
Rest of Asia Pacific	3,368	27%	2,710	658	223	837	15.10	4.02	3.24	0.79	26.6%
Latin America	4,298	25%	3,412	885	260	623	16.53	6.90	5.48	1.42	41.7%
Argentina	431	21%	335	96	22	42	19.59	10.26	7.97	2.29	52.4%
Brazil	1,851	19%	1,485	366	88	202	21.04	9.16	7.35	1.81	43.6%
Chile	278	23%	229	49	9	18	30.93	15.47	12.72	2.74	50.0%
Mexico	841	29%	712	130	56	124	15.02	6.78	5.74	1.04	45.2%
Rest of Latin America	896	31%	652	244	85	238	10.54	3.76	2.74	1.02	35.7%
Middle East and Africa	1,505	44%	949	557	260	1,405	5.79	1.07	0.68	0.40	18.5%
South Africa	268	44%	178	91	15	53	17.87	5.06	3.35	1.71	28.3%
Saudi Arabia	293	44%	203	90	23	29	12.72	10.09	6.99	3.10	79.3%
Rest of Middle East and Africa	945	45%	568	376	222	1,322	4.26	0.71	0.43	0.28	16.8%

Source: Cisco Visual Networking Index (VNI) and USTelecom Analysis

Appendix A - Internet Usage Calculations by Region and Country (Continued)

Regional and Country Internet Traffic per User and per Capita, 2019 Projected

	IP Traffic 2019 (PB/Month)	Growth (CAGR) 2014-2019	Consumer Traffic 2019 (PB/Month)	Business Traffic 2019 (PB/Month)	Internet Users 2019 (millions)	Population 2019 (millions)	IP Traffic per User (GB/Month)	IP Traffic per Pop (GB/Month)	Consumer IP Traffic per Pop (GB/Month)	Business IP Traffic per Pop (GB/Month)	Users per Capita 2019
Global	167,978	23%	138,416	29,563	3,924	7,639	42.81	21.99	18.12	3.87	51.4%
North America	49,720	20%	41,708	8,012	319	373	155.86	133.30	111.82	21.48	85.5%
United States	45,656	20%	38,575	7,081	285	335	160.19	136.29	115.15	21.14	85.1%
Canada	4,064	22%	3,133	932	34	37	119.54	109.85	84.67	25.18	91.9%
Western Europe	24,680	21%	19,785	4,895	350	424	70.51	58.21	46.66	11.54	82.5%
France	3,046	17%	2,536	510	60	66	50.77	46.15	38.42	7.73	90.9%
Germany	3,478	18%	2,830	648	66	82	52.70	42.42	34.51	7.90	80.5%
Italy	2,138	26%	1,698	440	43	61	49.72	35.05	27.83	7.22	70.5%
Spain	1,386	16%	1,057	329	37	48	37.46	28.88	22.02	6.86	77.1%
Sweden	1,158	20%	917	241	8	10	144.73	115.78	91.66	24.12	80.0%
United Kingdom	7,858	27%	6,608	1,250	57	65	137.86	120.89	101.67	19.22	87.7%
Rest of Western Europe	5,616	18%	4,140	1,476	79	92	71.09	61.04	45.00	16.04	85.9%
Central and Eastern Europe	16,863	33%	13,579	3,284	336	487	50.19	34.63	27.88	6.74	69.0%
Russia	6,863	30%	5,287	1,576	90	141	76.25	48.67	37.50	11.18	63.8%
Poland	2,153	32%	1,839	314	25	38	86.10	56.64	48.39	8.26	65.8%
Rest of Central and Eastern Europ	7,848	35%	6,453	1,395	221	308	35.51	25.48	20.95	4.53	71.8%
Asia Pacific	54,434	21%	44,896	9,538	2,123	4,126	25.64	13.19	10.88	2.31	51.5%
Australia	1,375	22%	987	388	21	25	65.46	54.98	39.48	15.50	84.0%
China	21,908	18%	17,846	4,061	890	1,428	24.62	15.34	12.50	2.84	62.3%
India	4,024	33%	3,509	515	545	1,340	7.38	3.00	2.62	0.38	40.7%
Indonesia	1,556	36%	1,363	193	183	267	8.50	5.83	5.11	0.72	68.5%
Japan	8,357	26%	6,570	1,788	105	126	79.59	66.33	52.14	14.19	83.3%
South Korea	5,648	13%	4,898	750	48	51	117.67	110.75	96.04	14.71	94.1%
New Zealand	267	20%	212	56	4	5	66.85	53.48	42.34	11.14	80.0%
Rest of Asia Pacific	11,300	27%	9,512	1,788	327	885	34.56	12.77	10.75	2.02	36.9%
Latin America	12,870	25%	10,838	2,031	371	655	34.69	19.65	16.55	3.10	56.6%
Argentina	1,118	21%	945	174	30	44	37.28	25.42	21.48	3.94	68.2%
Brazil	4,413	19%	3,780	633	134	210	32.93	21.01	18.00	3.01	63.8%
Chile	791	23%	651	140	13	19	60.87	41.65	34.26	7.38	68.4%
Mexico	3,030	29%	2,598	432	69	131	43.91	23.13	19.83	3.30	52.7%
Rest of Latin America	3,517	31%	2,865	653	125	253	28.14	13.90	11.32	2.58	49.4%
Middle East and Africa	9,412	44%	7,610	1,802	425	1,574	22.15	5.98	4.83	1.14	27.0%
South Africa	1,647	44%	1,222	426	27	55	61.00	29.95	22.21	7.74	49.1%
Saudi Arabia	1,797	44%	1,553	243	29	32	61.96	56.15	48.54	7.61	90.6%
Rest of Middle East and Africa	5,968	45%	4,835	1,133	369	1,488	16.17	4.01	3.25	0.76	24.8%

Source: Cisco Visual Networking Index (VNI) and USTelecom Analysis

Appendix B – Technical Discussion of Data and Methodology

Broadband rankings frequently focus on penetration and theoretical measure such as capacity, and price per bit. According to several studies (see OECD, Berkman Center, New America Foundation), the U.S. ranks in the middle of the pack on these measures. Such measures largely ignore actual usage of the Internet (i.e., actual consumption).

USTelecom agrees with the Federal Communications Commission's 2010 National Broadband Plan, which stated, "Many international broadband plans emphasize speeds and networks, focusing only on technical capacity as a measure of a successful broadband system. Our plan must go beyond that. While striving for ubiquitous and fast networks, we must also strive to use those networks more efficiently and effectively than any other country. *We should lead the world where it counts—in the use of the Internet* and in the development of new applications that provide the tools that each person needs to make the most of his or her own life." [NBP Page 4, emphasis added.]

There are however, relevant measures available that take into account actual usage, such as traffic volume, traffic per user, and traffic per capita. On these, the U.S. ranks very high. We believe that international rankings would paint a more accurate picture if they took into account these factors as alternative or additional criteria. For example, while measures of investment are important, they are often "nominal," in other words not adjusted for prices and increasing technological prowess. The usage data enhances our understanding of the "real" impacts of broadband and information technology investment by accounting for what consumers are actually doing with the Internet. This is especially helpful when other measures such as capacity are often theoretical, i.e., they do not account for what users actually consume. Measures of throughput capacity are moderately helpful, but they are also often theoretical – consumers use less than maximum capacity available. Therefore, the amount of data users are actually consuming to pull value from their broadband connections provides an additional, more practical gauge of how successfully a country's broadband networks are providing residential and business consumers with what they demand.

How Can Usage Data Improve Rankings and Studies?

Usage could improve rankings and studies in several ways. First, usage, or bits/bytes consumed, is a better proxy for value received than simple capacity, either advertised or actual. For example, price per bit analyses are typically based on bit per second capacity rather than how consumers use such capacity and what they consume with it. Assuming legitimate pricing or revenue data were available – a big assumption, as discussed in the next paragraph – prices could be adjusted to account for data actually consumed, in other words, what did users get for their money? Furthermore, usage – including business usage – may be a more precise explanatory variable than, say subscribers or penetration, when attempting to assess the economic impacts of Internet usage.

There are, no doubt, challenges associated with usage data. For example, if underlying pricing data are of a poor quality, adjusting with usage data will not make the pricing data useful. In fact, it remains very difficult to find meaningful pricing and revenue data since these data do not typically account for variation in underlying costs structures. Price means very little but in relation to cost; but there is wide variation in cost among providers and countries resulting from differences in regulation, subsidies and public investment levels, demographics, geography, density, and allocation of costs among shared network services. In addition, traffic-based metrics reduce usage to bits, not distinguishing among applications which may have different economic and consumer benefits.

Nonetheless usage data has clear advantages over other metrics that are commonly used in broadband rankings. Therefore, usage data could be used in place of or, at a minimum, as a complement to other comparative metrics.

Data Approximation: Consumption per Internet User

This analysis has provided a rough approximation of bandwidth consumed per Internet user across several regions and selected countries. In order to be useful, the data must be normalized. For example, when comparing country performance, it may make sense to normalize consumption either per Internet user or per capita. Normalizing for users may be more appropriate when looking at how individuals utilize Internet technology. In this case, a per capita measure may be skewed due to significant variation in Internet adoption rates across countries. On the other hand, a per capita measure may be more appropriate when analyzing broader macroeconomic impacts of Internet diffusion, e.g., business usage.

- Cisco publishes projected global IP traffic data and forecasts from 2014-2019 for the various regions of the world and selected countries. Regional aggregates are available from the Cisco Visual Networking Index: Forecast and Methodology, 2014–2019 (May 27, 2015). Within each region, Cisco reports data for selected countries and the "rest of" the region. Selected country data are available from Cisco VNI Forecast Widget for the Cisco Visual Networking Index IP Traffic Forecast, 2014-2019 at http://www.ciscovni.com/vni_forecast/index.htm (visited August 3, 2015).

- Cisco also publishes data on population and the number of Internet users in each country and region for which it provides IP traffic data. These data are available at http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html (visited August 3, 2015). The IP traffic data can be normalized across the countries by number of users or by population. NOTE: This is a change from previous analyses in which USTelecom developed estimates of population and Internet users independently based on data from the International Telecommunications Union (ITU) and the United Nations (UN). Cisco had provided country-region mapping information. While previous USTelecom estimates were developed and checked rigorously, using Cisco data throughout the analysis ensures an even greater level of internal consistency.

Using these data sources, average consumption per user and per capita in each region can be *approximated*. Specifically, the Cisco regional global IP traffic estimates, in Petabytes per Month, is divided by the number of Internet users and population in that region, in millions. The traffic data includes *all* IP traffic – business and residential; fixed and mobile; IP voice, video, and data; and private and public Internet. This is appropriate because all of these types of traffic contribute to the economic and consumer impacts of IP data usage.

On a regional level, North America consumes a significantly larger amount of bandwidth than other regions: 64.8 Gigabytes per user per month compared to a global average of 21.3. Of course, a regional approach does not account for variation within regions. For example, while Cisco provides aggregate data for Western Europe or Asia and selected countries, it does not provide data for many countries that are generally ranked highly in broadband rankings, e.g., many northern European countries, Switzerland, Hong Kong or Singapore. The inclusion of Sweden in this year's data helps by providing additional granularity reflecting Northern Europe. On the other hand, data are not available for individual U.S. states, which would provide more appropriate comparisons with smaller, denser countries.

Normalizing country and regional traffic by Internet users has several limitations that imply some imprecision; but the broad results and relative country and regional performance should be directionally accurate. First, historically USTelecom has used data from several different sources and some inconsistency among sources is possible. As noted above, this latest analysis uses data from a single source: Cisco. But Cisco likely faces the same cross country reporting inconsistencies that USTelecom did in its historical data. Moreover, USTelecom did not have access to historical population and Internet user data from Cisco. As a result our historical comparisons for 2009 and 2014 are based two different user and population data sources, the former based on independently developed USTelecom estimates, the latter based on Cisco estimates. Second, the Cisco data reflect all IP traffic, which is a broader than just Internet traffic. There is no user data on IP adopters; USTelecom assumes Internet users are a reasonable proxy.

Finally, a few notes on interpretation: First, volume of traffic is one useful indicator of comparative activity and normalizing by users or population makes it more useful; but volume of traffic does not necessarily equate to value of traffic. These data cannot determine whether any country is using the Internet in a more or less economically productive or socially beneficial manner compared to other countries. To a certain extent, such judgments would be at least partially subjective. Second, the calculations of traffic per Internet user and population are by definition means, as opposed to medians. Both measures have their place. If the mean is significantly greater than the median in a country, it may indicate there is a preponderance of high-bandwidth outliers. Finally, regions where there is widespread legacy of multi-channel video adoption (i.e., North America) undercount a great deal of video traffic currently delivered via radio frequencies. Should such consumption be ignored because it is not currently delivered via IP? Should non-IP voice traffic be excluded because it is delivered by a different type of network? Arguments could be made either way, given the enhanced capabilities of IP video and telephony, but often the video or voice service is not consumed differently on an IP versus a legacy network. Over time, these differences are diminishing as more U.S. adoption and consumption migrates to voice and video delivered via IP services—but a significant number of traditional users remain, particularly in cable video.