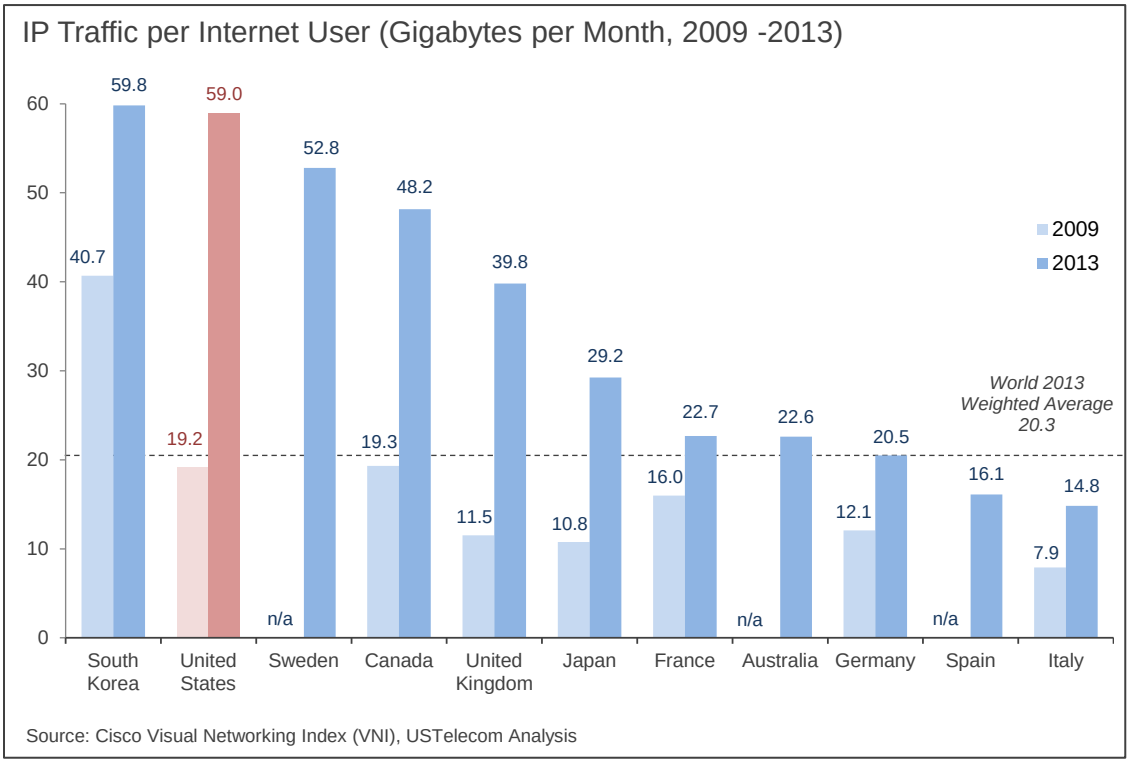
# INTERNET USAGE DATA REAFFIRM U.S. LEADERSHIP

*By Patrick Brogan, Vice President of Industry Analysis*

A new USTelecom analysis of the latest annual Internet Protocol (IP) traffic data from Cisco shows that U.S. demand for bandwidth has continued its rapid pace of growth and will continue to grow quickly in the coming years. U.S. consumers and businesses remain among the world leaders in Internet usage. In fact, the data show that in the last several years the U.S. has closed much of the usage gap with the world leader, South Korea, while expanding its lead over other industrialized countries (see Chart 1). Projections indicate the U.S. may take the lead over the next five years. Thus, compared to global peers the U.S. is gaining ground, not falling behind.

**Chart 1 – Change in Internet Usage for Selected Industrialized Countries 2019-2013**




As discussed in previous USTelecom research many measures of broadband performance, including international comparisons, focus on more theoretical measures based on capacity and largely ignore actual usage of the Internet. 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.] For example, while measures of investment are important, they are often "nominal," in other words not adjusted for prices and increasing technological prowess. We can add to nominal investment data by looking at "real" investment impacts based on what users are actually getting. 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 want.

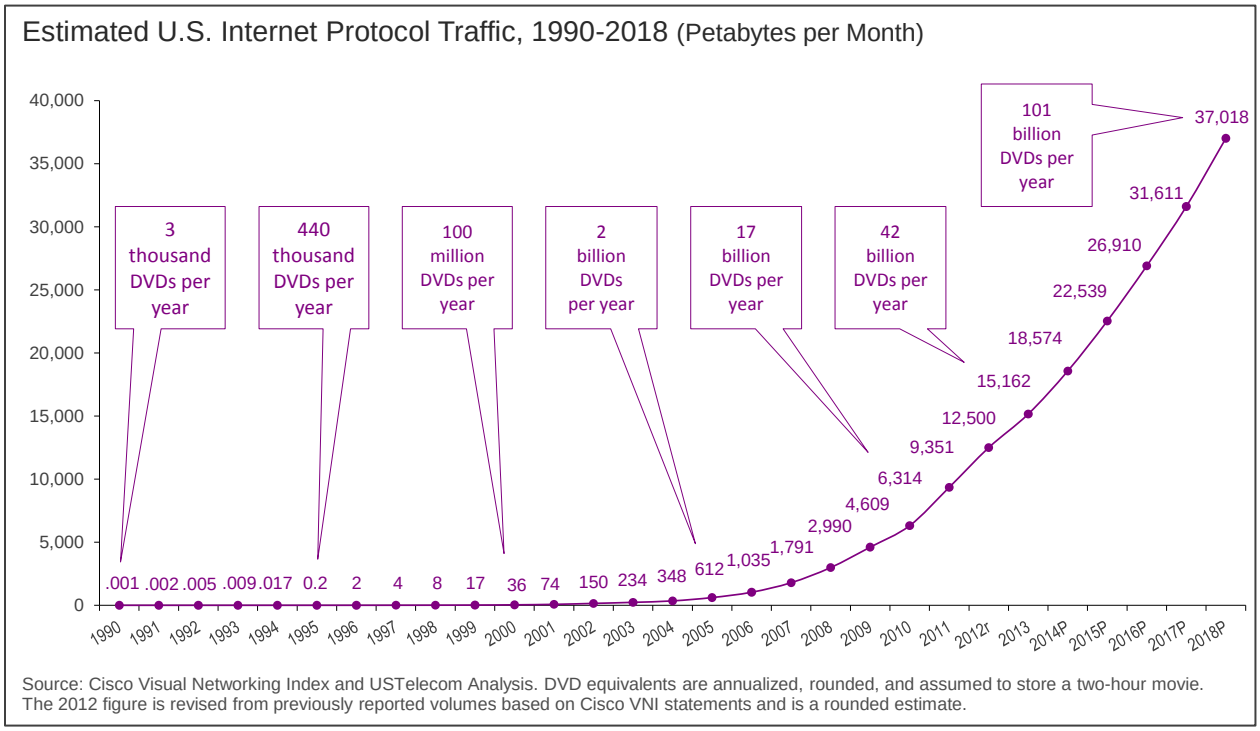
U.S. IP traffic has quintupled over the last five years, and it is expected to grow two-and-a-half times again over the next five years. Ongoing investment in broadband networks, especially wireline networks, will be critical in accommodating this expected demand growth. It will help us attain the economic benefits of increased migration to IP networks and maintain our international leadership. Contrary to the claims of those who favor aggressive regulatory intervention, placing additional burdens on broadband networks add unnecessary risk to the investment calculus and, thus, to our international leadership.

## Rapid U.S. Broadband Growth Continues

U.S. Internet Protocol (IP) traffic in 2013 was 15.2 exabytes, per month. See Chart 2 (1 exabyte = 1,000 petabytes or one trillion million bytes). This is equivalent of 3.5 billion DVDs per month or 42 billion DVDs per year. In 2013, the U.S. generated approximately four hundred and fifteen times more IP traffic than it generated in the year 2000, nine and a half thousand times more than 1996, and almost 15 million times more than 1990. Through 2013, U.S. IP traffic has grown at an average compounded annual rate of 105 percent since 1990, 71 percent since 1996, and 59 percent since 2000.[1] Furthermore, Cisco projects U.S. IP traffic will grow again by a factor of two-and-a-half over the next five years. From 2013 through 2018, Cisco projects traffic will grow to 37.0 exabytes per month, or the equivalent of 102 billion DVDs. See Chart 2. During this period, traffic will grow at an average 20 percent compounded annual rate with 22.5 percent growth in 2014. To put this in perspective, on average, for each of the next five years, U.S. networks will have to accommodate an additional 52 exabytes of data per year, which equals 52 trillion million bytes, or the equivalent of 12 billion DVDs per year and approximately 30 percent of the amount of all U.S. traffic carried in 2013.

[1] In previous releases, USTelecom reported the most recent annual growth rate. In 2013, Cisco revised its methodology but did not restate historical country data. So, a precise comparison to 2012 is not possible. In a Q&A document released with the 2013 VNI (available at http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/qa_c67-482177.html, visited October 21, 2014), Cisco states , "we made the following adjustments to 2012 and 2013 IP traffic volumes: In most regions, the actual volumes for fixed Internet traffic were adjusted downward by less than 10 percent." Based on this information, in Chart 2 below, the figure for 2012 is revised from the previously reported 13.1 exabytes per month to a rounded estimate of 12.5 exabytes per month. Growth from 2012 to 2013 was in excess of 20 percent.

**Chart 2 – Historical and Projected Growth of U.S. IP Traffic**




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 approximately three-quarters in 2013 to four-fifths in 2018, USTelecom estimates that 11.2 exabytes per month of fixed network consumer IP video traffic in 2013 will grow to 27.1 exabytes by 2018. Thus, consumer video represented nearly three-quarters of 2013 traffic and accounts for almost three-quarters of traffic growth in the next five years. Mobile data is the fastest growing segment of U.S. traffic at a 50 percent compounded annual rate over the next five years, but it remains a small portion of overall traffic: 360 petabytes per month in 2013, or 2.4 percent of all traffic, growing to a projected 2.7 exabytes per month in 2018, or 7.3 percent of all traffic. See Chart 3.

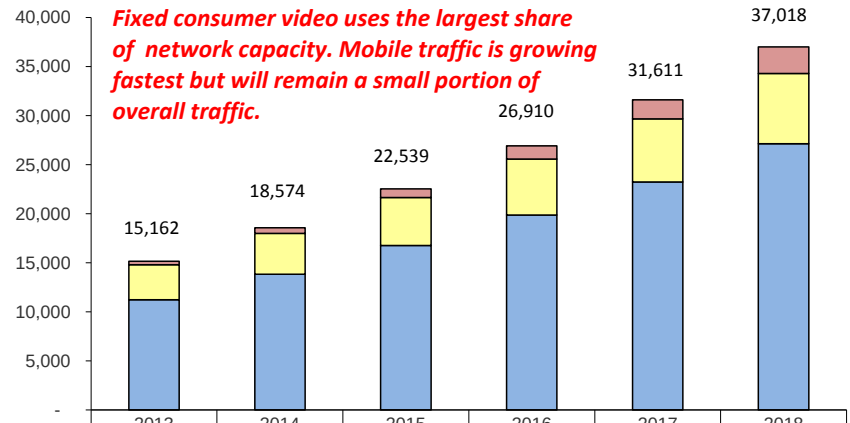
**Usage Data Reflects the Benefits of Broadband Investment**

As noted in a September 2013 USTelecom Research Brief, broadband providers invested $75 billion in 2013 and more than 1.3 trillion dollars since 1996 in large part to build and expand the broadband network capacity needed to accommodate traffic growth. Broadband provider investment propels a "virtuous cycle" of complementary investments in information and communications technology (ICT) across the economy. Inclusive of broadband network investment, U.S. firms invested $564 billion in ICT in 2013, including software, hardware, communications equipment and structures, 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 72 percent had adopted broadband technology at home as of year-end 2012. to use with a

growing array of bandwidth-intensive devices, including increasingly powerful computers, television set-tops, consoles, handsets and tablets.

**Chart 3 – Composition of U.S. IP Traffic**

U.S. Internet Protocol Traffic, 2013-2018 (Petabytes per Month)




| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|
| Mobile | 360 | 577 | 894 | 1,338 | 1,931 | 2,707 |
| Fixed Consumer Data and Business | 3,573 | 4,169 | 4,879 | 5,698 | 6,439 | 7,170 |
| Fixed Consumer Video | 11,230 | 13,828 | 16,767 | 19,874 | 23,241 | 27,141 |

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

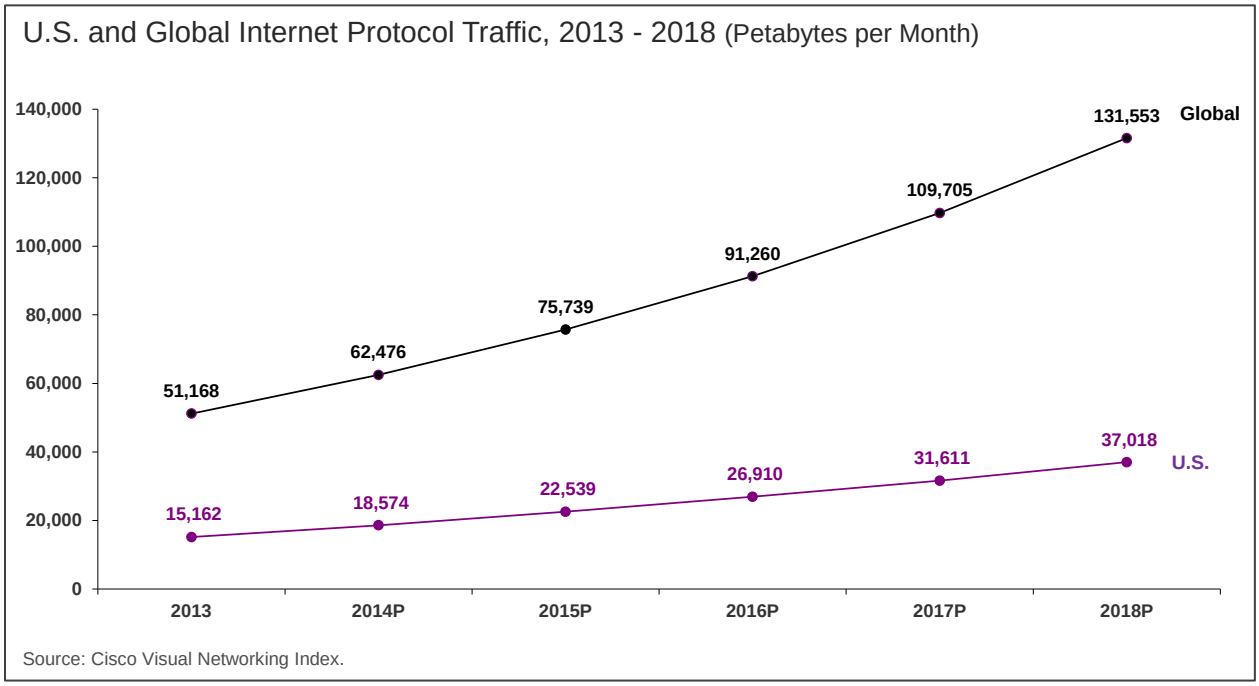
Large amounts of capital investment in broadband capacity will be essential to accommodate continued growth in consumer demand and enable ongoing innovation in ICT for both businesses and consumers. Broadband networks, including wireline networks, will play a critical role in enabling IP traffic growth. 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 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 WiFi access and 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 services such as online video and cloud computing. They will continue to upgrade capacity in order to accommodate rising traffic volumes across their networks, including: access for consumers and small, medium, and large enterprises; connectivity for data centers and content delivery networks; backhaul links, which carry nearly all mobile wireless traffic between cell sites and networks; and Internet backbones and transport.

**The United States Is a World Leader in Internet Usage**

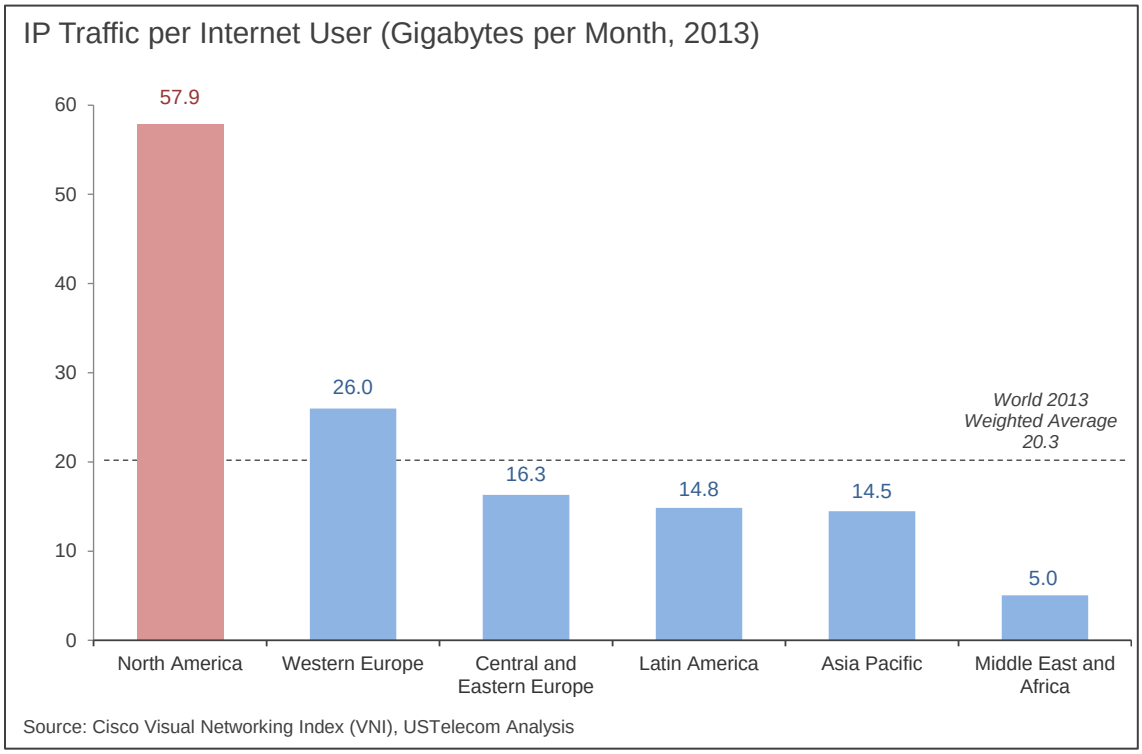
U.S. data traffic comprises a large share of global traffic. The U.S. accounted for just less than 30 percent of global IP traffic in 2013 despite having only 4.5 percent of the world's population. The U.S. share will hover around that level over the next five years, starting to decline slowly near the end of that period toward 28 percent in 2018. See Chart 4. It is not surprising that the U.S. share would decline, given its relatively advanced state of Internet deployment and adoption relative to most of the globe, especially developing countries. It is more surprising that its relative share will remain so high, given large expected increases in penetration in large developing areas.

**Chart 4 – Comparison of U.S. and Global IP Traffic**



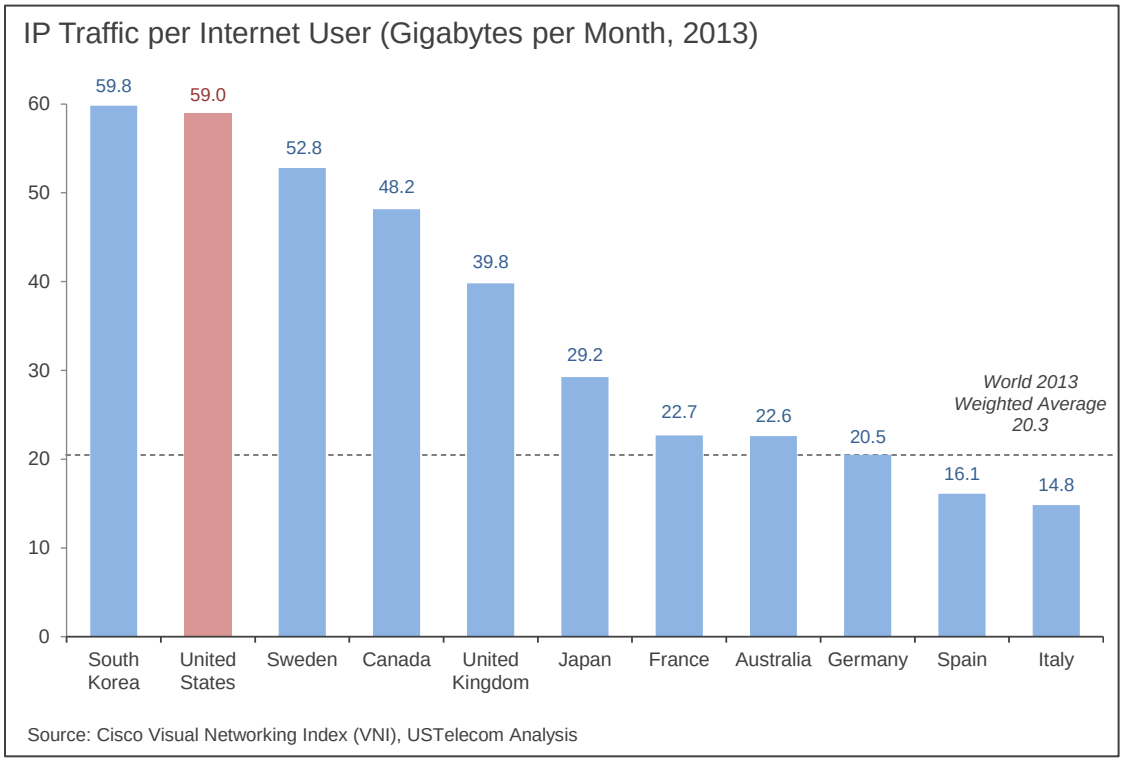

The U.S. also ranks very well when measuring average usage by consumers, as shown in the charts below which are derived by taking 2013 Internet traffic data and dividing it by the number of Internet users in particular countries and regions (see appendix for more detail). On a regional basis, North America, led by the U.S., has the heaviest Internet usage, with more than double the usage of Europe and quadruple that of Asia. See Chart 5. 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 the United States, taken as a whole, is surpassed only by South Korea. See Chart 6.

**Chart 5 - Comparison of Internet Usage among Regions**




The country per-user consumption data suggest that – in stark contrast to rhetoric that the U.S. is falling behind in the Internet – the United States is ahead of much of the world and is gaining ground on this important usage metric. Based on previous USTelecom research, 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 1 above. Claims that the U.S. is lagging are often cited by proponents of more aggressive interventionist broadband policies. Yet, these data provide an alternative viewpoint. From 2009 to 2013, the U.S. traffic per user grew more than 200 percent, from 19.2 GB/user/month to 59.0 GB/user/month, while South Korea only grew by less than 50 percent, from 40.7 GB/user/month to 59.8 GB/user/month. In 2009 there was a 53 percentage point gap between the U.S. and South Korea; by 2012 the gap was only 1 percentage point. The U.S. also consumes more data per user than Japan, Western Europe, and Australia, areas which are typically cited as evidence that the U.S. is falling behind in the Internet. Large continental European countries in particular are lagging. See Chart 1 above and Chart 6 below. France, Germany, Italy, and Spain were all generating less than 25 GB/user/month in 2013. Even countries that grew fairly rapidly over the last couple 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 allow us to look at one of the Nordic countries typically cited as strong broadband performers. The U.S. per user consumption was slightly greater than that of Sweden.

**Chart 6 - Comparison of Internet Usage among Selected Industrialized Countries**




More detailed country data are shown in Appendix A. There are two points worth noting. First, the data results are very similar among developed nations when considered on a per capita basis rather than per-user basis; however, there are some minor differences. Countries, such as South Korea, with relatively high Internet penetration do better when compared to other countries on a per capita basis than on a per user basis because the traffic is spread over relatively fewer non-Internet-users when moving from an Internet-user to a population denominator. On the other hand, countries with relatively lower Internet penetration, such as Sweden, do relatively worse, on a per capita basis than on a per user basis. But, overall, the U.S. position among developed countries doesn't change. Second, for the first time, USTelecom includes in the analysis estimated data consumption per user based on Cisco VNI projections. While caution is necessary since projections can change over time due to unanticipated developments, Cisco VNI projections indicate that the U.S. will overtake South Korea sometime in the next five years and maintain its lead over other developed and developing nations to become *the* leader in data consumption per user among the countries for which Cisco provides data.

# Appendix A - Internet Usage Calculations by Region and Country

**Regional and Country Internet Traffic per User and per Capita, 2013**

| | IP Traffic 2013 (PB/Month) | Growth (CAGR) 2013-18 | Consumer Traffic 2013 (PB/Month) | Business Traffic 2013 (PB/Month) | Internet Users 2013 (millions) | Population 2013 (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 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Global | 51,168 | 21% | 40,905 | 10,263 | 2,521 | 7,161 | 20.30 | 7.15 | 5.71 | 1.43 | 35.2% |
| North America | 16,607 | 20% | 14,059 | 2,548 | 287 | 355 | 57.86 | 46.78 | 39.60 | 7.18 | 80.8% |
| United States | 15,162 | 20% | 12,893 | 2,269 | 257 | 320 | 59.00 | 47.38 | 40.29 | 7.09 | 80.3% |
| Canada | 1,445 | 20% | 1,165 | 279 | 30 | 35 | 48.15 | 41.27 | 33.29 | 7.98 | 85.7% |
| Western Europe | 8,396 | 18% | 6,549 | 1,847 | 323 | 417 | 26.00 | 20.14 | 15.71 | 4.43 | 77.5% |
| France | 1,248 | 15% | 1,039 | 209 | 55 | 64 | 22.69 | 19.50 | 16.23 | 3.26 | 85.9% |
| Germany | 1,291 | 19% | 970 | 321 | 63 | 83 | 20.49 | 15.55 | 11.68 | 3.87 | 75.9% |
| Italy | 579 | 25% | 447 | 132 | 39 | 61 | 14.84 | 9.49 | 7.33 | 2.16 | 63.9% |
| Spain | 580 | 16% | 430 | 150 | 36 | 47 | 16.12 | 12.34 | 9.16 | 3.19 | 76.6% |
| Sweden | 370 | 20% | 289 | 81 | 7 | 10 | 52.80 | 36.96 | 28.87 | 8.10 | 70.0% |
| United Kingdom | 2,029 | 21% | 1,715 | 315 | 51 | 63 | 39.79 | 32.21 | 27.22 | 4.99 | 81.0% |
| Rest of Western Europe | 2,300 | 15% | 1,660 | 640 | 71 | 89 | 32.39 | 25.84 | 18.65 | 7.19 | 79.8% |
| Central and Eastern Europe | 3,653 | 23% | 2,508 | 1,146 | 224 | 482 | 16.31 | 7.58 | 5.20 | 2.38 | 46.5% |
| Russia | 1,629 | 22% | 1,095 | 535 | 86 | 143 | 18.94 | 11.39 | 7.65 | 3.74 | 60.1% |
| Poland | 433 | 23% | 329 | 105 | 28 | 38 | 15.48 | 11.40 | 8.65 | 2.76 | 73.7% |
| Rest of Central and Eastern Europ | 1,591 | 24% | 1,085 | 506 | 110 | 301 | 14.46 | 5.29 | 3.60 | 1.68 | 36.5% |
| Asia Pacific | 17,950 | 21% | 14,369 | 3,581 | 1,239 | 3,918 | 14.49 | 4.58 | 3.67 | 0.91 | 31.6% |
| Australia | 384 | 22% | 216 | 168 | 17 | 23 | 22.61 | 16.71 | 9.41 | 7.30 | 73.9% |
| China | 7,667 | 19% | 5,940 | 1,727 | 618 | 1,386 | 12.41 | 5.53 | 4.29 | 1.25 | 44.6% |
| India | 681 | 39% | 512 | 168 | 213 | 1,252 | 3.19 | 0.54 | 0.41 | 0.13 | 17.0% |
| Indonesia | 234 | 37% | 177 | 57 | 72 | 250 | 3.25 | 0.93 | 0.71 | 0.23 | 28.8% |
| Japan | 2,866 | 27% | 2,172 | 693 | 98 | 127 | 29.24 | 22.56 | 17.11 | 5.46 | 77.2% |
| South Korea | 2,811 | 15% | 2,576 | 235 | 47 | 49 | 59.80 | 57.36 | 52.58 | 4.79 | 95.9% |
| New Zealand | 83 | 21% | 65 | 18 | 4 | 5 | 20.63 | 16.50 | 12.92 | 3.58 | 80.0% |
| Rest of Asia Pacific | 3,226 | 19% | 2,710 | 516 | 171 | 826 | 18.86 | 3.91 | 3.28 | 0.62 | 20.7% |
| Latin America | 3,488 | 21% | 2,756 | 732 | 235 | 616 | 14.84 | 5.66 | 4.47 | 1.19 | 38.1% |
| Argentina | 327 | 19% | 248 | 78 | 21 | 41 | 15.56 | 7.97 | 6.06 | 1.91 | 51.2% |
| Brazil | 1,590 | 20% | 1,267 | 322 | 81 | 200 | 19.62 | 7.95 | 6.34 | 1.61 | 40.5% |
| Chile | 207 | 20% | 169 | 39 | 8 | 18 | 25.91 | 11.52 | 9.36 | 2.16 | 44.4% |
| Mexico | 648 | 23% | 542 | 106 | 53 | 122 | 12.22 | 5.31 | 4.44 | 0.87 | 43.4% |
| Rest of Latin America | 717 | 21% | 530 | 186 | 72 | 234 | 9.95 | 3.06 | 2.27 | 0.80 | 30.8% |
| Middle East and Africa | 1,074 | 38% | 664 | 410 | 213 | 1,372 | 5.04 | 0.78 | 0.48 | 0.30 | 15.5% |
| South Africa | 181 | 34% | 112 | 69 | 13 | 53 | 13.88 | 3.41 | 2.11 | 1.29 | 24.5% |
| Saudi Arabia | 199 | 35% | 132 | 67 | 14 | 29 | 14.24 | 6.87 | 4.55 | 2.32 | 48.3% |
| Rest of Middle East and Africa | 694 | 39% | 420 | 274 | 186 | 1,290 | 3.73 | 0.54 | 0.33 | 0.21 | 14.4% |

*Source: Cisco Visual Networking Index (VNI) and USTelecom Analysis. Data for South Africa and Saudi Arabia Revised January 2015.*

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

**Projected Regional and Country Internet Traffic per User and per Capita, 2018 Projected**

| | IP Traffic 2018 (PB/Month) | Growth (CAGR) 2013-18 | Consumer Traffic 2018 (PB/Month) | Business Traffic 2018 (PB/Month) | Internet Users 2018 (millions) | Population 2018 (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 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Global | 131,553 | 21% | 107,958 | 23,595 | 3,912 | 7,562 | 33.63 | 17.40 | 14.28 | 3.12 | 51.7% |
| North America | 40,545 | 20% | 34,319 | 6,225 | 317 | 370 | 127.90 | 109.58 | 92.75 | 16.83 | 85.7% |
| United States | 37,018 | 20% | 31,437 | 5,582 | 284 | 333 | 130.35 | 111.17 | 94.40 | 16.76 | 85.3% |
| Canada | 3,526 | 20% | 2,883 | 644 | 33 | 37 | 106.85 | 95.30 | 77.91 | 17.39 | 89.2% |
| Western Europe | 19,259 | 18% | 15,342 | 3,918 | 346 | 423 | 55.66 | 45.53 | 36.27 | 9.26 | 81.8% |
| France | 2,526 | 15% | 2,108 | 418 | 59 | 66 | 42.81 | 38.27 | 31.94 | 6.33 | 89.4% |
| Germany | 3,097 | 19% | 2,480 | 616 | 66 | 82 | 46.92 | 37.76 | 30.25 | 7.52 | 80.5% |
| Italy | 1,749 | 25% | 1,398 | 351 | 45 | 61 | 38.86 | 28.67 | 22.92 | 5.75 | 73.8% |
| Spain | 1,209 | 16% | 913 | 296 | 38 | 48 | 31.81 | 25.18 | 19.02 | 6.17 | 79.2% |
| Sweden | 916 | 20% | 721 | 195 | 8 | 10 | 114.55 | 91.64 | 72.12 | 19.52 | 80.0% |
| United Kingdom | 5,231 | 21% | 4,419 | 813 | 53 | 65 | 98.71 | 80.48 | 67.98 | 12.50 | 81.5% |
| Rest of Western Europe | 4,532 | 15% | 3,302 | 1,230 | 77 | 91 | 58.85 | 49.80 | 36.29 | 13.51 | 84.6% |
| Central and Eastern Europe | 10,221 | 23% | 7,952 | 2,269 | 339 | 486 | 30.15 | 21.03 | 16.36 | 4.67 | 69.8% |
| Russia | 4,321 | 22% | 3,213 | 1,108 | 126 | 141 | 34.29 | 30.64 | 22.79 | 7.86 | 89.4% |
| Poland | 1,210 | 23% | 1,019 | 191 | 33 | 38 | 36.67 | 31.85 | 26.81 | 5.04 | 86.8% |
| Rest of Central and Eastern Europ | 4,690 | 24% | 3,721 | 970 | 180 | 307 | 26.06 | 15.28 | 12.12 | 3.16 | 58.6% |
| Asia Pacific | 47,273 | 21% | 38,745 | 8,529 | 2,109 | 4,094 | 22.42 | 11.55 | 9.46 | 2.08 | 51.5% |
| Australia | 1,041 | 22% | 710 | 332 | 23 | 25 | 45.28 | 41.66 | 28.40 | 13.26 | 92.0% |
| China | 18,401 | 19% | 14,746 | 3,655 | 918 | 1,422 | 20.04 | 12.94 | 10.37 | 2.57 | 64.6% |
| India | 3,571 | 39% | 3,082 | 489 | 526 | 1,326 | 6.79 | 2.69 | 2.32 | 0.37 | 39.7% |
| Indonesia | 1,124 | 37% | 969 | 156 | 164 | 264 | 6.86 | 4.26 | 3.67 | 0.59 | 62.1% |
| Japan | 9,522 | 27% | 7,512 | 2,010 | 106 | 126 | 89.83 | 75.57 | 59.62 | 15.95 | 84.1% |
| South Korea | 5,720 | 15% | 5,095 | 625 | 48 | 50 | 119.18 | 114.41 | 101.90 | 12.50 | 96.0% |
| New Zealand | 218 | 21% | 180 | 38 | 4 | 5 | 54.58 | 43.66 | 36.02 | 7.62 | 80.0% |
| Rest of Asia Pacific | 7,675 | 19% | 6,450 | 1,225 | 320 | 876 | 23.98 | 8.76 | 7.36 | 1.40 | 36.5% |
| Latin America | 8,931 | 21% | 7,424 | 1,507 | 371 | 649 | 24.07 | 13.76 | 11.44 | 2.32 | 57.2% |
| Argentina | 784 | 19% | 656 | 128 | 29 | 43 | 27.03 | 18.23 | 15.26 | 2.97 | 67.4% |
| Brazil | 3,906 | 20% | 3,252 | 654 | 142 | 208 | 27.51 | 18.78 | 15.63 | 3.15 | 68.3% |
| Chile | 524 | 20% | 428 | 96 | 12 | 18 | 43.68 | 29.12 | 23.77 | 5.35 | 66.7% |
| Mexico | 1,826 | 23% | 1,577 | 249 | 70 | 129 | 26.08 | 14.15 | 12.22 | 1.93 | 54.3% |
| Rest of Latin America | 1,891 | 21% | 1,511 | 380 | 118 | 250 | 16.02 | 7.56 | 6.05 | 1.52 | 47.2% |
| Middle East and Africa | 5,324 | 38% | 4,177 | 1,147 | 431 | 1,540 | 12.35 | 3.46 | 2.71 | 0.74 | 28.0% |
| South Africa | 792 | 34% | 581 | 211 | 26 | 54 | 30.47 | 14.67 | 10.76 | 3.91 | 48.1% |
| Saudi Arabia | 895 | 35% | 707 | 188 | 20 | 31 | 44.76 | 28.87 | 22.80 | 6.07 | 64.5% |
| Rest of Middle East and Africa | 3,637 | 39% | 2,889 | 747 | 385 | 1,454 | 9.45 | 2.50 | 1.99 | 0.51 | 26.5% |

*Source: Cisco Visual Networking Index (VNI) and USTelecom Analysis. Data for South Africa and Saudi Arabia Revised January 2015.*

## Appendix B – Technical Discussion of Data and Methodology

Broadband rankings frequently focus on penetration, 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. There are however, other relevant measures which are often disregarded, on which the U.S. ranks very highly, such as usage (i.e., actual consumption). We believe that such analyses and rankings would paint a more accurate picture if they took into account these factors as alternative or additional criteria. This usage data enhances our understanding of the "real" impacts of broadband and information technology investment, especially when other measures such as capacity are often theoretical, i.e., they do not account for what users actually consume.

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. Assuming legitimate pricing (or revenue) data were available, prices could be adjusted to account for bandwidth 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 using it to adjust prices or revenues, it remains difficult to find meaningful pricing and revenue data (much pricing data does not account for differential costs structures of providers based on different regulation, subsidy and public investment levels, demographics, geography, density, and allocation of costs among shared network services). These metrics also reduce usage to bits, not distinguishing among applications which may have differential 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

Above we 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 2013-2018 for the various regions of the world and selected countries. Regional aggregates are available from the Cisco Visual Networking Index: Forecast and Methodology, 2013–2018 (June 10, 2014). 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, 2013-2018 at http://www.ciscovni.com/vni_forecast/index.htm (visited October 10, 2014).

- 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/c/en/us/solutions/service-provider/vni-service-adoption-forecast/vnisa_highlights_tool.html (visited October 10, 2014). From these we can normalize the IP traffic data 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 our previous estimates were developed and checked rigorously, using Cisco data throughout the analysis ensures an even greater level of internal consistency.

Using these data sources, we can *approximate* average consumption per user and per capita in each region. Specifically, we divide the Cisco regional global IP traffic estimates for 2013, in Petabytes per Month, by the number of Internet users and population in that region, in millions. The traffic data we use 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: 57.9 Gigabytes per user per month compared to a global average of 20.3. Of course, a legitimate criticism of a regional approach is that it 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 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 2013 are based on 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 tell us whether any country is using the Internet in a more or less economically productive or socially beneficial manner compared to other countries. To some 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.