

Cisco Visual Networking Index: Forecast and Methodology, 2014–2019



May 27, 2015

This forecast is part of the Cisco Visual Networking Index™ (Cisco VNI™), an ongoing initiative to track and forecast the impact of visual networking applications. This document presents the details of the Cisco VNI global IP traffic forecast and the methodology behind it. For a more analytical look at the implications of the data presented in this paper, refer to the companion document, [The Zettabyte Era—Trends and Analysis](#), or the [VNI Forecast Highlights tool](#).

Executive Summary

Annual global IP traffic will surpass the zettabyte (1000 exabytes) threshold in 2016, and the two zettabyte threshold in 2019. Global IP traffic will reach 1.1 zettabytes per year or 88.4 exabytes (one billion gigabytes) per month in 2016. By 2019, global IP traffic will pass a new milestone figure of 2.0 zettabytes per year, or 168.0 exabytes per month.

Global IP traffic has increased more than fivefold in the past 5 years, and will increase nearly threefold over the next 5 years. Overall, IP traffic will grow at a compound annual growth rate (CAGR) of 23 percent from 2014 to 2019.

Busy-hour Internet traffic is growing more rapidly than average Internet traffic. Busy-hour (or the busiest 60-minute period in a day) Internet traffic increased 34 percent in 2014, compared with 26 percent growth in average traffic. Busy-hour Internet traffic will increase by a factor of 3.4 between 2014 and 2019, while average Internet traffic will increase 2.8-fold. Busy-hour Internet traffic will reach 1.7 petabits per second (Pbps) by 2019.

Metro traffic will surpass long-haul traffic in 2015, and will account for 66 percent of total IP traffic by 2019.

Globally, metro traffic will grow nearly twice as fast as long-haul traffic from 2014 to 2019. The higher growth in metro networks is due in part to the increasingly significant role of content delivery networks, which bypass long-haul links and deliver traffic to metro and regional backbones.

Content delivery networks will carry over half of Internet traffic by 2019. Globally, Sixty-two percent of all Internet traffic will cross content delivery networks by 2019 globally, up from 39 percent in 2014.

Over half of all IP traffic will originate with non-PC devices by 2019. In 2014, only 40 percent of total IP traffic originated with non-PC devices, but by 2019 the non-PC share of total IP traffic will grow to 67 percent. PC-originated traffic will grow at a CAGR of 9 percent, while TVs, tablets, smartphones, and machine-to-machine (M2M) modules will have traffic growth rates of 17 percent, 65 percent, 62 percent, and 71 percent, respectively.

Traffic from wireless and mobile devices will exceed traffic from wired devices by 2019. By 2019, wired devices will account for 33 percent of IP traffic, while Wi-Fi and mobile devices will account for 66 percent of IP traffic. In 2014, wired devices accounted for the majority of IP traffic at 54 percent.

Global Internet traffic in 2019 will be equivalent to 64 times the volume of the entire global Internet in 2005. Globally, Internet traffic will reach 18 gigabytes (GB) per capita by 2019, up from 6 GB per capita in 2014.

The number of devices connected to IP networks will be three times as high as the global population in 2019. There will be three networked devices per capita by 2019, up from nearly two networked devices per capita in 2014. Accelerated in part by the increase in devices and the capabilities of those devices, IP traffic per capita will reach 22 GB per capita by 2019, up from 8 GB per capita in 2014.

Broadband speeds will double by 2019. By 2019, global fixed broadband speeds will reach 43 Mbps, up from 20 Mbps in 2014.

Video Highlights

It would take an individual over 5 million years to watch the amount of video that will cross global IP networks each month in 2019. Every second, nearly a million minutes of video content will cross the network by 2019.

Globally, consumer internet video traffic will be 80 percent of all consumer Internet traffic in 2019, up from 64 percent in 2014. This percentage does not include video exchanged through peer-to-peer (P2P) file sharing. The sum of all forms of video (TV, video on demand [VoD], Internet, and P2P) will be in the range of 80 to 90 percent of global consumer traffic by 2019.

Internet video to TV doubled in 2014. Internet video to TV will continue to grow at a rapid pace, increasing fourfold by 2019. Internet video to TV traffic will be 17 percent of consumer Internet video traffic by 2019, up from 16 percent in 2014.

Consumer VoD traffic will double by 2019. HD will be 70 percent of IP VOD traffic in 2019, up from 59 percent in 2014.

Content delivery network traffic will deliver over half of all internet video traffic by 2019. By 2019, 72 percent of all Internet video traffic will cross content delivery networks, up from 57 percent in 2014.

Mobile Highlights

Globally, mobile data traffic will increase 10-fold between 2014 and 2019. Mobile data traffic will grow at a CAGR of 57 percent between 2014 and 2019, reaching 24.2 exabytes per month by 2019.

Global mobile data traffic will grow three times faster than fixed IP traffic from 2014 to 2019. Global mobile data traffic was 4 percent of total IP traffic in 2014, and will be 14 percent of total IP traffic by 2019.

Regional Highlights

IP traffic is growing fastest in the Middle East and Africa, followed by Asia Pacific. Traffic in the Middle East and Africa will grow at a CAGR of 44 percent between 2014 and 2019.

IP traffic in North America will reach 49.7 exabytes per month by 2019, at a CAGR of 20 percent. Monthly Internet traffic in North America will generate 9 billion DVDs' worth of traffic, or 35.4 exabytes per month.

IP traffic in Western Europe will reach 24.7 exabytes per month by 2019, at a CAGR of 21 percent. Monthly Internet traffic in Western Europe will generate 5 billion DVDs' worth of traffic, or 20.8 exabytes per month.

IP traffic in Asia Pacific will reach 54.4 exabytes per month by 2019, at a CAGR of 21 percent. Monthly Internet traffic in Asia Pacific will generate 11 billion DVDs' worth of traffic, or 44.1 exabytes per month.

IP traffic in Latin America will reach 12.9 exabytes per month by 2019, at a CAGR of 25 percent. Monthly Internet traffic in Latin America will generate 3 billion DVDs' worth of traffic, or 11.3 exabytes per month.

IP traffic in Central and Eastern Europe will reach 16.9 exabytes per month by 2019, at a CAGR of 33 percent. Monthly Internet traffic in Central and Eastern Europe will generate 4 billion DVDs' worth of traffic, or 15.8 exabytes per month.

IP traffic in the Middle East and Africa will reach 9.4 exabytes per month by 2019, at a CAGR of 44 percent. Monthly Internet traffic in the Middle East and Africa will generate 2 billion DVDs' worth of traffic, or 8.8 exabytes per month.

Global Business Highlights

Business IP traffic will grow at a CAGR of 20 percent from 2014 to 2019. Increased adoption of advanced video communications in the enterprise segment will cause business IP traffic to grow by a factor of two between 2014 and 2019.

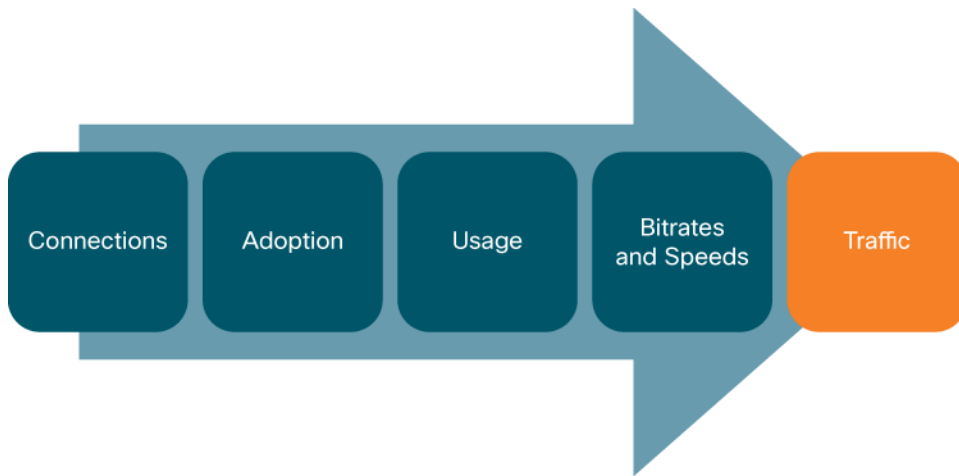
Business Internet traffic will grow at a faster pace than IP WAN. IP WAN will grow at a CAGR of 23 percent, compared with a CAGR of 20 percent for fixed business Internet and 51 percent for mobile business Internet.

Business IP traffic will grow fastest in the Middle East and Africa. Business IP traffic in the Middle East and Africa will grow at a CAGR of 26 percent, a faster pace than the global average of 20 percent. In volume, Asia Pacific will have the largest amount of business IP traffic in 2019, at 9.6 exabytes per month. North America will be the second at 8.0 exabytes per month.

Overview of VNI Methodology

The Cisco Visual Networking Index Forecast methodology has been developed based on a combination of analyst projections, in-house estimates and forecasts, and direct data collection. The analyst projections for broadband connections, video subscribers, mobile connections, and Internet application adoption come from SNL Kagan, Ovum, Informa Telecoms & Media, Infonetics, IDC, Gartner, AMI, Arbitron Mobile, Ookla Speedtest.net, Strategy Analytics, Screen Digest, Dell'Oro Group, Synergy, comScore, Nielsen, and others. Upon this foundation are layered Cisco's own estimates for application adoption, minutes of use, and kilobytes per minute. The adoption, usage, and bitrate assumptions are tied to fundamental enablers such as broadband speed and computing speed. All usage and traffic results are then validated using data shared with Cisco from service providers. Figure 1 shows the forecast methodology.

Figure 1. Cisco VNI Forecast Methodology Incorporates Fundamental Enablers of Adoption and Usage



Following the methodology through each step for a single application category (in this case, Internet video) illustrates the estimation process.

Step 1: Number of Users

The forecast for Internet video begins with estimations of the number of consumer fixed Internet users. Even such a basic measure as consumer fixed Internet users can be difficult to assess, because few analyst firms segment the number of users by both segment (consumer versus business) and network (mobile versus fixed). This year, the number of consumer fixed Internet users was not taken directly from an analyst source but was estimated from analyst forecasts for consumer broadband connections, data on hotspot users from a variety of government sources, and population forecasts by age segment. The number of Internet video users was collected and estimated from a variety of sources, and the numbers were then reconciled with the estimate of overall Internet users.

Step 2: Application Adoption

After the number of Internet video users has been established, the number of users for each video subsegment must be estimated. It was assumed that all Internet video users view short-form video in addition to other forms of video they may watch. The Internet video users that watch long form video (based partially on comScore Video Metrix figures for video sites whose average viewing time is longer than 5 minutes), live video, ambient video and Internet personal video recorder (PVR) is estimated.

Step 3. Minutes of Use

For each application subsegment, minutes of use (MOU) are estimated. Multiple sources are used to determine MOU: the Cisco VNI Usage data collection program provides a minute-per-subscriber baseline for many applications, the Cisco Connected Life Market Watch survey provides MOU for markets that are not covered by the Usage program, and comScore Video Metrix provides PC-based MOU for online video. Special care is taken to help ensure that the total number of Internet video minutes is well within the total number of video minutes (including television broadcast) for each user. For example, if the average individual watches a total of 4 hours of video content per day, the sum of Internet, managed IP, and mobile video hours should be a relatively small portion of the total 4 hours.

Step 4. Bitrates

After MOU have been estimated for each subsegment of video, the next step is to apply kilobytes (KB) per minute. To calculate KB per minute, first the regional and country average broadband speeds are estimated for the years 2014 through 2019. For each application category, a representative bitrate is established, and this representative bitrate grows at approximately the same pace as the broadband speed. For video categories, a 7-percent annual compression gain is applied to the bitrate. Local bitrates are then calculated based on how much the average broadband speed in the country differs from the global average, digital screen size in the country, and the computing power of the average device in the country. Combining these factors yields bitrates that are then applied to the MOU.

Step 5: Rollup

The next step in the methodology is to multiply the bitrates, MOU, and users together to get average petabytes per month.

Step 6: Traffic Migration Assessment

The next step is to reconcile the Internet, managed IP, and mobile segments of the forecast. The portion of mobile data traffic that has migrated from the fixed network is subtracted from the fixed forecast, and the amount of mobile data traffic offloaded onto the fixed network through dual-mode devices and femtocells is added back to the fixed forecast.

The sections that follow present quantitative results of the forecast and details of the methodology for each segment and type.

Global IP Traffic Growth, 2014–2019

Table 1 shows the top-line forecast. According to this forecast, global IP traffic in 2014 stands at 59.9 exabytes per month and will nearly triple by 2019, to reach 168.4 exabytes per month. Consumer IP traffic will reach 138 exabytes per month and business IP traffic will surpass 29.6 exabytes per month.

Table 1. Global IP Traffic, 2014–2019

| IP Traffic, 2014–2019 | | | | | | | |
|-------------------------------------------|--------|--------|--------|--------|---------|---------|-------------------|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | CAGR 2014–2019 |
| By Type (Petabytes [PB] per Month) | | | | | | | |
| Fixed Internet | 39,909 | 47,803 | 58,304 | 72,251 | 90,085 | 111,899 | 23% |
| Managed IP | 17,424 | 20,460 | 23,371 | 26,087 | 29,274 | 31,858 | 13% |
| Mobile data | 2,514 | 4,163 | 6,751 | 10,650 | 16,124 | 24,221 | 57% |
| By Segment (PB per Month) | | | | | | | |
| Consumer | 47,740 | 58,137 | 71,453 | 88,730 | 111,015 | 138,415 | 24% |
| Business | 12,108 | 14,289 | 16,973 | 20,258 | 24,469 | 29,563 | 20% |
| By Geography (PB per Month) | | | | | | | |
| Asia Pacific | 20,729 | 24,819 | 29,965 | 36,608 | 44,223 | 54,434 | 21% |
| North America | 19,628 | 23,552 | 28,219 | 33,641 | 41,458 | 49,720 | 20% |
| Western Europe | 9,601 | 11,231 | 13,506 | 16,396 | 20,046 | 24,680 | 21% |
| Central and Eastern Europe | 4,087 | 5,270 | 6,896 | 9,385 | 12,601 | 16,863 | 33% |
| Latin America | 4,297 | 5,373 | 6,663 | 8,299 | 10,355 | 12,870 | 25% |
| Middle East and Africa | 1,505 | 2,180 | 3,178 | 4,659 | 6,800 | 9,412 | 44% |

| Total (PB per Month) | | | | | | | |
|----------------------|--------|--------|--------|---------|---------|---------|-----|
| Total IP traffic | 59,848 | 72,426 | 88,427 | 108,988 | 135,484 | 167,978 | 23% |

Source: Cisco VNI, 2015

Definitions

- **Consumer:** Includes fixed IP traffic generated by households, university populations, and Internet cafés
- **Business:** Includes fixed IP WAN or Internet traffic generated by businesses and governments
- **Mobile:** Includes mobile data and Internet traffic generated by handsets, notebook cards, and mobile broadband gateways
- **Internet:** Denotes all IP traffic that crosses an Internet backbone
- **Managed IP:** Includes corporate IP WAN traffic and IP transport of TV and VoD

The following tables show cross-tabulations of end-user segment and network type for the final year of the forecast period (2019). Consumer Internet remains the primary generator of IP traffic, but mobile data has the highest growth rate and begins to generate significant traffic by 2019 (Table 2).

Table 2. Exabytes per Month as of Year End 2019

| | Consumer | Business | Total |
|--------------|------------|-----------|------------|
| Internet | 91 | 21 | 112 |
| Managed IP | 27 | 5 | 32 |
| Mobile data | 21 | 4 | 24 |
| Total | 139 | 30 | 168 |

Source: Cisco VNI, 2015

Table 3 shows the same data as Table 2, but in terms of annual traffic run rates. These run rates are based on the monthly traffic at the end of 2019.

Table 3. Exabytes per Year as of Year End 2019

| | Consumer | Business | Total |
|--------------|--------------|------------|--------------|
| Internet | 1,097 | 251 | 1,348 |
| Managed IP | 322 | 60 | 382 |
| Mobile data | 247 | 44 | 291 |
| Total | 1,666 | 356 | 2,021 |

Source: Cisco VNI, 2015

Consumer and business traffic are both dominated by Internet traffic, although business traffic is more evenly distributed across public Internet and managed IP (Table 4).

Table 4. Traffic Share by End-User Segment as of Year End 2019

| | Consumer | Business |
|--------------|-------------|-------------|
| Internet | 66% | 71% |
| Managed IP | 19% | 17% |
| Mobile data | 15% | 12% |
| Total | 100% | 100% |

Source: Cisco VNI, 2015

Consumer traffic accounts for the majority of IP traffic in every network type segment. Consumer traffic will be 81 percent of all fixed Internet traffic, 84 percent of all of managed IP traffic, and 85 percent of all mobile data traffic (Table 5).

Table 5. Traffic Share by Network Type as of Year End 2019

| | Consumer | Business | Total |
|-----------------|------------|------------|-------------|
| Internet | 81% | 19% | 100% |
| Managed IP | 84% | 16% | 100% |
| Mobile Internet | 85% | 15% | 100% |
| Total | 82% | 18% | 100% |

Source: Cisco VNI, 2015

Consumer Internet traffic will represent over half of all IP traffic, followed by consumer managed IP (VoD), which represents 16 percent of traffic (Table 6).

Table 6. Overall Traffic Share as of Year End 2019

| | Consumer | Business | Total |
|--------------|------------|------------|-------------|
| Internet | 54% | 12% | 67% |
| Managed IP | 16% | 3% | 19% |
| Mobile data | 12% | 2% | 14% |
| Total | 82% | 18% | 100% |

Source: Cisco VNI, 2015

Metro and Long-Haul Traffic, 2014–2019

Metro-only traffic (traffic that traverses only the metro and bypasses long-haul traffic links) surpasses long-haul traffic in 2014, and will account for 62 percent of total IP traffic by 2019. Metro-only traffic will grow nearly twice as fast as long-haul traffic from 2014 to 2019 (Table 7).

Table 7. Metro and Long-Haul Traffic, 2014–2019

| Metro and Long-Haul Traffic, 2014–2019 | | | | | | | |
|----------------------------------------|--------|--------|--------|--------|--------|--------|-------------------|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | CAGR 2014–2019 |
| Metro-Only (PB per Month) | | | | | | | |
| North America | 14,860 | 18,402 | 22,778 | 28,061 | 36,048 | 45,012 | 25% |
| Asia Pacific | 8,459 | 10,903 | 14,129 | 18,389 | 23,365 | 30,524 | 29% |
| Western Europe | 5,517 | 6,920 | 8,934 | 11,569 | 15,043 | 19,700 | 29% |
| Central and Eastern Europe | 896 | 1,381 | 2,148 | 3,376 | 5,115 | 7,766 | 54% |
| Latin America | 917 | 1,389 | 2,033 | 2,856 | 3,923 | 5,286 | 42% |
| Middle East and Africa | 215 | 384 | 668 | 1,127 | 1,845 | 2,838 | 67% |
| Long-Haul (PB per Month) | | | | | | | |
| Asia Pacific | 12,270 | 13,916 | 15,836 | 18,219 | 20,858 | 23,911 | 14% |
| Central and Eastern Europe | 3,190 | 3,889 | 4,748 | 6,009 | 7,486 | 9,097 | 23% |
| Latin America | 3,380 | 3,984 | 4,630 | 5,443 | 6,432 | 7,584 | 18% |

| | | | | | | | |
|-----------------------------|--------|--------|--------|---------|---------|---------|-----|
| Middle East and Africa | 1,290 | 1,796 | 2,510 | 3,532 | 4,955 | 6,573 | 38% |
| Western Europe | 4,085 | 4,311 | 4,572 | 4,827 | 5,003 | 4,980 | 4% |
| North America | 4,769 | 5,150 | 5,441 | 5,580 | 5,410 | 4,708 | 0% |
| Total (PB per Month) | | | | | | | |
| Total IP traffic | 59,848 | 72,426 | 88,427 | 108,988 | 135,484 | 167,978 | 23% |

Source: Cisco VNI, 2015

Content Delivery Network Traffic, 2014–2019

With the emergence of popular video-streaming services that deliver Internet video to the TV and other device endpoints, content delivery networks have prevailed as a dominant method to deliver such content. Globally, 62 percent of all Internet traffic will cross content delivery networks by 2019, up from 39 percent in 2014. Globally, 72 percent of all Internet video traffic will cross content delivery networks by 2019, up from 57 percent in 2014 (Table 8).

Table 8. Global Content Delivery Network Internet Traffic, 2014–2019

| CDN Traffic, 2014–2019 | | | | | | | |
|------------------------------------|--------|--------|--------|--------|--------|--------|-------------------|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | CAGR 2014–2019 |
| By Geography (PB per Month) | | | | | | | |
| North America | 7,162 | 9,518 | 12,951 | 17,603 | 23,922 | 31,920 | 35% |
| Asia Pacific | 4,218 | 5,740 | 7,988 | 11,181 | 15,636 | 22,029 | 39% |
| Western Europe | 3,842 | 4,972 | 6,690 | 9,043 | 12,250 | 16,683 | 34% |
| Central and Eastern Europe | 660 | 1,064 | 1,742 | 2,839 | 4,529 | 7,079 | 61% |
| Latin America | 657 | 967 | 1,400 | 2,005 | 2,832 | 3,961 | 43% |
| Middle East and Africa | 179 | 322 | 574 | 998 | 1,676 | 2,629 | 71% |
| Total (PB per Month) | | | | | | | |
| CDN Internet traffic | 16,719 | 22,582 | 31,345 | 43,670 | 60,845 | 84,301 | 38% |

Source: Cisco VNI, 2015

Consumer IP Traffic, 2014–2019

As shown in Table 9, global consumer IP traffic is expected to reach 139 exabytes per month in 2019. Most of today's consumer IP traffic is Internet traffic.

Table 9. Global Consumer IP Traffic, 2014–2019

| Consumer IP Traffic, 2014–2019 | | | | | | | |
|------------------------------------|--------|--------|--------|--------|--------|--------|-------------------|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | CAGR 2014–2019 |
| By Type (PB per Month) | | | | | | | |
| Internet | 31,545 | 37,908 | 46,511 | 58,115 | 72,933 | 91,048 | 24% |
| Managed IP | 14,145 | 16,799 | 19,344 | 21,709 | 24,495 | 26,824 | 14% |
| Mobile data | 2,050 | 3,430 | 5,599 | 8,906 | 13,587 | 20,544 | 59% |
| By Geography (PB per Month) | | | | | | | |
| Asia Pacific | 16,433 | 19,735 | 24,012 | 29,681 | 36,110 | 44,896 | 22% |
| North America | 16,609 | 19,971 | 23,913 | 28,401 | 35,012 | 41,707 | 20% |
| Western Europe | 7,506 | 8,808 | 10,634 | 12,996 | 16,001 | 19,785 | 21% |
| Central and Eastern Europe | 2,831 | 3,826 | 5,181 | 7,283 | 9,949 | 13,579 | 37% |

| | | | | | | | |
|-----------------------------|--------|--------|--------|--------|---------|---------|-----|
| Latin America | 3,412 | 4,338 | 5,455 | 6,877 | 8,649 | 10,838 | 26% |
| Middle East and Africa | 948 | 1,460 | 2,259 | 3,493 | 5,295 | 7,610 | 52% |
| Total (PB per Month) | | | | | | | |
| Consumer IP traffic | 47,740 | 58,137 | 71,453 | 88,730 | 111,015 | 138,415 | 24% |

Source: Cisco VNI, 2015

Consumer Internet Traffic, 2014–2019

This category encompasses any IP traffic that crosses the Internet and is not confined to a single service provider's network. Internet video streaming and downloads are beginning to take a larger share of bandwidth and will grow to more than 80 percent of all consumer Internet traffic by 2019 (Table 10).

Table 10. Global Consumer Internet Traffic, 2014–2019

| Consumer Internet Traffic, 2014–2019 | | | | | | | |
|--------------------------------------|--------|--------|--------|--------|--------|---------|-------------------|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | CAGR 2014–2019 |
| By Network (PB per Month) | | | | | | | |
| Fixed | 31,545 | 37,908 | 46,511 | 58,115 | 72,933 | 91,048 | 24% |
| Mobile | 2,050 | 3,430 | 5,599 | 8,906 | 13,587 | 20,544 | 59% |
| By Subsegment (PB per Month) | | | | | | | |
| Internet video | 21,624 | 27,466 | 36,456 | 49,068 | 66,179 | 89,319 | 33% |
| Web, email, and data | 5,853 | 7,694 | 9,476 | 11,707 | 14,002 | 16,092 | 22% |
| File sharing | 6,090 | 6,146 | 6,130 | 6,168 | 6,231 | 6,038 | 0% |
| Online gaming | 27 | 33 | 48 | 78 | 109 | 143 | 40% |
| By Geography (PB per Month) | | | | | | | |
| Asia Pacific | 12,193 | 14,571 | 17,871 | 22,472 | 28,380 | 36,401 | 24% |
| North America | 8,911 | 11,087 | 14,085 | 17,943 | 22,886 | 28,616 | 26% |
| Western Europe | 5,831 | 6,860 | 8,390 | 10,469 | 13,208 | 16,768 | 24% |
| Central and Eastern Europe | 2,595 | 3,508 | 4,775 | 6,746 | 9,362 | 12,892 | 38% |
| Latin America | 3,152 | 3,915 | 4,823 | 6,026 | 7,558 | 9,514 | 25% |
| Middle East and Africa | 912 | 1,397 | 2,165 | 3,364 | 5,126 | 7,400 | 52% |
| Total (PB per Month) | | | | | | | |
| Consumer Internet traffic | 33,595 | 41,338 | 52,110 | 67,021 | 86,520 | 111,592 | 27% |

Source: Cisco VNI, 2015

Definitions

- **Web, email, and data:** Includes web, email, instant messaging, and other data traffic (excludes file sharing)
- **File sharing:** Includes peer-to-peer traffic from all recognized P2P systems such as BitTorrent and eDonkey, as well as traffic from web-based file-sharing systems
- **Gaming:** Includes casual online gaming, networked console gaming, and multiplayer virtual-world gaming
- **Internet video:** Includes short-form Internet video (for example, YouTube), long-form Internet video (for example, Hulu), live Internet video, Internet-video-to-TV (for example, Netflix through Roku), online video purchases and rentals, webcam viewing, and web-based video monitoring (excludes P2P video file downloads)

Web, Email, and Data

This general category encompasses web browsing, email, instant messaging, data (which includes file transfer using HTTP and FTP), and other Internet applications (Table 11). Note that data may include the download of video files that are not captured by the Internet video to PC forecast. This category includes traffic generated by all individual Internet users. An Internet user is here defined as someone who accesses the Internet through a desktop or laptop computer at home, school, Internet café, or other location outside the context of a business.

Table 11. Global Consumer Web, Email, and Data Traffic, 2014–2019

| Consumer Web, Email, and Data Traffic, 2014–2019 | | | | | | | |
|--------------------------------------------------|-------|-------|-------|--------|--------|--------|-------------------|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | CAGR 2014–2019 |
| By Network (PB per Month) | | | | | | | |
| Fixed web and data | 4,989 | 6,342 | 7,436 | 8,731 | 9,906 | 10,625 | 16% |
| Mobile web and data | 865 | 1,352 | 2,040 | 2,976 | 4,096 | 5,467 | 45% |
| By Geography (PB per Month) | | | | | | | |
| Asia Pacific | 2,083 | 2,700 | 3,274 | 3,973 | 4,753 | 5,548 | 22% |
| North America | 1,568 | 2,009 | 2,422 | 2,884 | 3,255 | 3,562 | 18% |
| Western Europe | 1,094 | 1,286 | 1,459 | 1,662 | 1,865 | 1,956 | 12% |
| Central and Eastern Europe | 396 | 681 | 1,014 | 1,488 | 1,972 | 2,489 | 44% |
| Latin America | 499 | 653 | 745 | 868 | 995 | 1,095 | 17% |
| Middle East and Africa | 213 | 364 | 563 | 833 | 1,162 | 1,443 | 47% |
| Total (PB per Month) | | | | | | | |
| Consumer web, email, and data | 5,853 | 7,694 | 9,476 | 11,707 | 14,002 | 16,092 | 22% |

Source: Cisco VNI, 2015

File Sharing

This category includes traffic from P2P applications such as BitTorrent and eDonkey, as well as web-based file sharing. Note that a large portion of P2P traffic is due to the exchange of video files, so a total view of the impact of video on the network should count P2P video traffic in addition to the traffic counted in the Internet video to PC and Internet video to TV categories. Table 12 shows the forecast for consumer P2P traffic from 2014 to 2019. Note that the P2P category is limited to traditional file exchange and does not include commercial video-streaming applications that are delivered through P2P, such as PPStream or PPLive.

Table 12. Global Consumer File-Sharing Traffic, 2014–2019

| Consumer File Sharing, 2014–2019 | | | | | | | |
|-------------------------------------|-------|-------|-------|-------|-------|-------|-------------------|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | CAGR 2014–2019 |
| By Network (PB per Month) | | | | | | | |
| Fixed | 6,044 | 6,081 | 6,046 | 6,080 | 6,147 | 5,961 | 0% |
| Mobile | 46 | 64 | 84 | 89 | 84 | 78 | 11% |
| By Subsegment (PB per Month) | | | | | | | |
| P2P file transfer | 5,103 | 4,954 | 4,714 | 4,476 | 4,212 | 3,728 | -6% |
| Other file transfer | 987 | 1,192 | 1,416 | 1,692 | 2,019 | 2,310 | 19% |
| By Geography (PB per Month) | | | | | | | |
| Asia Pacific | 2,526 | 2,499 | 2,438 | 2,445 | 2,421 | 2,354 | -1% |
| North America | 797 | 858 | 932 | 1,019 | 1,145 | 1,204 | 9% |

| | | | | | | | |
|-----------------------------|-------|-------|-------|-------|-------|-------|------|
| Western Europe | 1,179 | 1,142 | 1,111 | 1,089 | 1,074 | 1,007 | -3% |
| Central and Eastern Europe | 839 | 870 | 865 | 856 | 878 | 820 | 0% |
| Latin America | 629 | 660 | 677 | 671 | 653 | 604 | -1% |
| Middle East and Africa | 120 | 117 | 107 | 87 | 60 | 50 | -16% |
| Total (PB per Month) | | | | | | | |
| Consumer file sharing | 6,090 | 6,146 | 6,130 | 6,168 | 6,231 | 6,038 | 0% |

Source: Cisco VNI, 2015

Internet Video

With the exception of the Internet video to TV subcategory, all of the Internet video subcategories consist of online video that is downloaded or streamed for viewing on a PC screen (Table 13). Internet video to TV is Internet delivery of video to a TV screen through a set-top box (STB) or equivalent device. Much of the video streamed or downloaded through the Internet consists of free clips, episodes, and other content offered by traditional content producers such as movie studios and television networks.

Table 13. Global Consumer Internet Video, 2014–2019

| Consumer Internet Video 2014–2019 | | | | | | | |
|------------------------------------|--------|--------|--------|--------|--------|--------|-------------------|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | CAGR 2014–2019 |
| By Network (PB per Month) | | | | | | | |
| Fixed | 20,485 | 25,452 | 32,981 | 43,226 | 56,771 | 74,319 | 29% |
| Mobile | 1,139 | 2,014 | 3,475 | 5,842 | 9,407 | 14,999 | 67% |
| By Category (PB per Month) | | | | | | | |
| Video | 18,437 | 22,940 | 30,242 | 40,907 | 55,931 | 76,771 | 33% |
| Internet video to TV | 3,188 | 4,526 | 6,214 | 8,160 | 10,248 | 12,548 | 32% |
| By Geography (PB per Month) | | | | | | | |
| Asia Pacific | 7,579 | 9,366 | 12,150 | 16,039 | 21,184 | 28,469 | 30% |
| North America | 6,535 | 8,207 | 10,712 | 14,009 | 18,443 | 23,794 | 29% |
| Western Europe | 3,550 | 4,422 | 5,807 | 7,696 | 10,239 | 13,766 | 31% |
| Central and Eastern Europe | 1,359 | 1,956 | 2,894 | 4,398 | 6,506 | 9,577 | 48% |
| Latin America | 2,022 | 2,600 | 3,399 | 4,483 | 5,905 | 7,808 | 31% |
| Middle East and Africa | 579 | 915 | 1,495 | 2,443 | 3,902 | 5,905 | 59% |
| Total (PB per Month) | | | | | | | |
| Consumer Internet video | 21,624 | 27,466 | 36,456 | 49,068 | 66,179 | 89,319 | 33% |

Source: Cisco VNI, 2015

Definitions

- **Internet video to TV:** Video delivered through the Internet to a TV screen by way of an Internet-enabled set-top box (for example, Roku) or equivalent device (for example, Microsoft Xbox 360), Internet-enabled TV, or PC-to-TV connection
- **Video:** Video includes the following underlying categories:
 - **Short form:** User-generated video and other video clips generally less than 7 minutes in length
 - **Video calling:** Video messages or calling delivered on fixed Internet initiated by smartphones, non-smartphones, and tablets
 - **Long form:** Video content generally greater than 7 minutes in length

- **Live Internet TV:** Peer-to-peer TV (excluding P2P video downloads) and live television streaming over the Internet
- **Internet PVR:** Recording of live TV content for later viewing
- **Ambient video:** Nannycams, petcams, home security cams, and other persistent video streams
- **Mobile video:** All video that travels over a second-generation (2G), 3G, or 4G network

Consumer Managed IP Traffic, 2014–2019

Managed IP video is IP traffic generated by traditional commercial TV services (Table 14). This traffic remains within the footprint of a single service provider, so it is not considered Internet traffic. (For Internet video delivered to the set-top box, see Internet video to TV in the previous section.)

Table 14. Global Consumer Managed IP Traffic, 2014–2019

| Consumer Managed IP Traffic, 2014–2019 | | | | | | | |
|----------------------------------------|--------|--------|--------|--------|--------|--------|-------------------|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | CAGR 2014–2019 |
| By Network (PB per Month) | | | | | | | |
| Fixed | 14,145 | 16,799 | 19,344 | 21,709 | 24,495 | 26,824 | 14% |
| By Geography (PB per Month) | | | | | | | |
| North America | 7,698 | 8,884 | 9,827 | 10,458 | 12,126 | 13,092 | 11% |
| Asia Pacific | 4,240 | 5,164 | 6,141 | 7,208 | 7,730 | 8,495 | 15% |
| Western Europe | 1,675 | 1,948 | 2,244 | 2,526 | 2,793 | 3,017 | 12% |
| Latin America | 260 | 423 | 632 | 851 | 1,091 | 1,325 | 38% |
| Central and Eastern Europe | 236 | 318 | 406 | 537 | 587 | 686 | 24% |
| Middle East and Africa | 36 | 62 | 93 | 128 | 169 | 209 | 42% |
| Total (PB per Month) | | | | | | | |
| Managed IP video traffic | 14,145 | 16,799 | 19,344 | 21,709 | 24,495 | 26,824 | 14% |

Source: Cisco VNI, 2015

Business IP Traffic

The enterprise forecast is based on the number of network-connected computers worldwide. In our experience, this basis provides the most accurate measure of enterprise data usage. An average business user might generate 4 GB per month of Internet and WAN traffic. A large-enterprise user would generate significantly more traffic, 8–10 GB per month (Table 15).

Table 15. Business IP Traffic, 2014–2019

| Business IP Traffic, 2014–2019 | | | | | | | |
|---------------------------------------|-------|-------|--------|--------|--------|--------|-------------------|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | CAGR 2014–2019 |
| By Network Type (PB per Month) | | | | | | | |
| Business Internet traffic | 8,364 | 9,895 | 11,794 | 14,136 | 17,152 | 20,851 | 20% |
| Business managed IP traffic | 3,279 | 3,661 | 4,028 | 4,378 | 4,779 | 5,034 | 9% |
| Business mobile data | 464 | 733 | 1,152 | 1,744 | 2,537 | 3,677 | 51% |
| By Geography (PB per Month) | | | | | | | |
| Asia Pacific | 4,296 | 5,084 | 5,953 | 6,927 | 8,113 | 9,538 | 17% |
| North America | 3,019 | 3,581 | 4,307 | 5,240 | 6,446 | 8,012 | 22% |
| Western Europe | 2,096 | 2,423 | 2,872 | 3,401 | 4,046 | 4,895 | 18% |

| | | | | | | | |
|-----------------------------|--------|--------|--------|--------|--------|--------|-----|
| Central and Eastern Europe | 1,255 | 1,445 | 1,715 | 2,102 | 2,652 | 3,284 | 21% |
| Latin America | 885 | 1,035 | 1,207 | 1,422 | 1,707 | 2,031 | 18% |
| Middle East and Africa | 557 | 720 | 919 | 1,166 | 1,505 | 1,802 | 26% |
| Total (PB per Month) | | | | | | | |
| Business IP traffic | 12,108 | 14,289 | 16,973 | 20,258 | 24,469 | 29,563 | 20% |

Source: Cisco VNI, 2015

Definitions

- **Business Internet traffic:** All business traffic that crosses the public Internet
- **Business managed IP traffic:** All business traffic that is transported over IP but remains within the corporate WAN
- **Business mobile data traffic:** All business traffic that crosses a mobile access point

Mobile Data Traffic

Mobile data traffic includes handset-based data traffic, such as text messaging, multimedia messaging, and handset video services (Table 16). Mobile Internet traffic is generated by wireless cards for portable computers and handset-based mobile Internet usage.

Table 16. Mobile Data and Internet Traffic, 2014–2019

| Mobile Data and Internet Traffic, 2014–2019 | | | | | | | |
|---------------------------------------------|-------|-------|-------|--------|--------|--------|-------------------|
| | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | CAGR 2014–2019 |
| By Geography (PB per Month) | | | | | | | |
| Asia Pacific | 977 | 1,622 | 2,616 | 4,114 | 6,245 | 9,459 | 57% |
| North America | 563 | 849 | 1,287 | 1,897 | 2,704 | 3,798 | 47% |
| Central and Eastern Europe | 242 | 464 | 832 | 1,409 | 2,231 | 3,488 | 72% |
| Middle East and Africa | 199 | 383 | 690 | 1,194 | 1,927 | 3,051 | 73% |
| Western Europe | 341 | 504 | 760 | 1,137 | 1,653 | 2,392 | 48% |
| Latin America | 201 | 354 | 581 | 915 | 1,380 | 2,032 | 59% |
| Total (PB per Month) | | | | | | | |
| Mobile data and Internet | 2,524 | 4,176 | 6,765 | 10,666 | 16,140 | 24,221 | 57% |

Source: Cisco VNI, 2015

For More Information

For more information, refer to the companion document [The Zettabyte Era—Trends and Analysis](#). Inquiries can be directed to traffic-inquiries@cisco.com.



Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at www.cisco.com/go/offices.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: www.cisco.com/go/trademarks. Third party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1110R)

Printed in USA

FLGD 12352 06/15