

Cisco Visual Networking Index Complete Traffic Forecast (2017–2022)

November 2018

Q Why did Cisco develop the Cisco Visual Networking Index™ (Cisco VNI™) Forecast and methodology?

A The ramifications of prior Internet traffic growth rates prompted Cisco to provide a realistic forecast that is based on multiple levels and sources of real data and projections. This data is of great interest to us, but we also expect that our customers (in all segments) and the industry at large can benefit from our findings.

Q What is visual networking?

A Consumer and business IP networking trends are significantly shaped by video, social networking, and collaboration services. This combination is termed visual networking. A visual networking experience can range from a videoconference meeting to the delivery of video to any device a consumer chooses, such as a TV, PC, tablet, or smartphone.

Q When did Cisco begin forecasting global IP traffic?

A The Cisco® VNI began in 2006. In that year, the company published its report internally, but also shared the forecast and projections with customers and prospects. Based on global service providers' interest in the initial report, Cisco began releasing these findings publicly in 2007.

Q What is the methodology behind the Cisco VNI Forecast?

A The forecast relies on analyst projections for Internet users, broadband connections, video subscribers, mobile connections, and Internet application adoption. Our trusted analyst forecasts come from SNL Kagan, Ovum, Ookla Speedtest.net, IDC, IHS, Future Source, Gartner, ABI Research, Strategy Analytics, Dell'Oro, Synergy, comScore, Nielsen, Media Partners Asia, Maravedis, and a variety of other sources.

Additionally, we evaluate public traffic growth reports from a variety of global service providers and we consult and compare projections from telecom industry trade associations (such as [CTIA](#)). These steps and data are used to validate and adjust the usage assumptions underlying the forecast model.

Q Have there been any methodological changes since the last forecast update?

A There have been no substantial changes to the methodology since the last update.

Q **Were there any changes to the basic assumptions or key influences on IP traffic used in the latest forecast update?**

A There have been no substantial changes to the basic assumptions or primary influences in the latest forecast update.

Machine to Machine (M2M) continues to lead the growth in devices and connections globally. We continue to see worldwide declining trend in the PC segment, low growth in tablets, but stronger growth in connected TVs and smartphones. There is a global increase in speeds for both fixed and mobile networks, and video continues to be the main contributor to IP traffic growth.

We have updated our assessment of Distributed-Denial-of-Service (DDoS) attacks and other security concerns about global IP traffic (with Arbor Networks). From an application perspective, we also continue to parse video/multimedia applications in more detail (for example, video surveillance, virtual reality/augmented reality, and live video content).

Q **What's the difference between IP traffic and Internet traffic?**

A The Cisco VNI IP traffic forecast encompasses both Internet and managed IP or non-Internet IP traffic. Internet traffic includes all IP traffic that crosses an Internet backbone, often traversing networks operated by different service providers and content delivery network providers. Managed IP traffic is limited to IP traffic that is managed from origin to destination by a single service provider, crossing only a single network. Managed IP traffic includes the IP transport of consumer Video on Demand (VoD), as well as corporate IP WAN traffic. Many forecast metrics vary significantly, depending on whether they include managed IP traffic or Internet-only traffic. For example, we project that Wi-Fi traffic will represent 51 percent of total global IP traffic (which includes managed IP) by 2022. Comparatively, we estimate that Wi-Fi traffic will represent 57 percent of total global Internet traffic (which excludes managed IP) by 2022. The lower Wi-Fi percentage for overall IP is because of the prevalence of wired devices, such as set-top boxes, that generate IP VoD traffic.

Q **How accurate is your forecast?**

A The Cisco VNI Forecast has been characterized as conservative by some industry analysts and academicians. In general, the actual growth rate has been within 10 percent of the projected growth rate. In 2013, we projected that the compound annual growth rate from 2012 to 2017 would be 22.6 percent. We now estimate that the actual growth rate for that timeframe was 27.4 percent.

Q **What is the future outlook for IP traffic growth based on the updated forecast?**

A In general, there is a solid increase in the global growth rate, compared to previous years' expectations. All regions are projected to experience Compound Annual Growth Rates (CAGRs) of 21 percent or higher over the forecast period (2017-2022). As mobile becomes a significant percentage of total IP traffic (9 percent of global IP traffic in 2017, growing to 20 percent of global IP traffic by 2022), the overall growth rates begin to reflect the higher growth rates of the mobile segment.

By 2022, global IP traffic will reach an annual run rate of 4.8 Zettabytes (up from 1.5 Zettabytes in 2017). Additional major findings from the Cisco Complete VNI Forecast, 2017-2022, include the following:

- Globally, IP traffic will grow 3-fold from 2017 to 2022, a CAGR of 26 percent.
- Globally, IP traffic will reach 396 Exabytes per month by 2022, up from 122.4 Exabytes per month in 2017.
- Asia Pacific will generate 44 percent of global IP traffic by 2022 (nearly 173 Exabytes per month by 2022), the highest share of any region. North America will generate 27 percent of global IP traffic by 2022 (more than 108 Exabytes per month by 2022). The Middle East and Africa will be the fastest-growing IP traffic region from 2017 to 2022 (6-fold growth, 41 percent CAGR over the forecast period). Asia Pacific will be the second fastest-growing region (4-fold growth, 32 percent CAGR).

- By 2022, non-PC devices will account for 81 percent of total Internet traffic, up from 51 percent in 2017. This demonstrates the effect that smartphones, tablets, web-enabled TVs, and Machine-to-Machine (M2M) connections have on consumer and business Internet reliance and demand.
- Mobile data traffic will represent 20 percent of global IP traffic by 2022, growing from 9 percent of global IP traffic in 2017.



How do you define your major application categories?



The following major application categories and corresponding definitions are used within our Cisco VNI Forecast framework:

- File sharing includes Peer-to-Peer (P2P) traffic from all recognized P2P systems, such as BitTorrent and eDonkey, along with other means of file sharing and one-click file hosting (for example, Rapidshare).
- Internet video to PC includes online video that is downloaded or streamed for viewing on a PC screen. It does not include P2P downloads or Internet delivery of video to a TV screen through a set-top box or equivalent device. Internet video viewed on PCs includes a growing volume of long-form commercial content, such as movies and TV episodes, as well as short-form content such as free user-generated clips.
- Internet video to TV includes video delivered by the Internet to a TV screen, through an Internet-enabled set-top box or equivalent device. Examples of devices and services that deliver this type of content include web-enabled TVs and Blu-ray disc players, Roku boxes, Apple TV, and gaming consoles that allow users to download movies and broadcast television content.
- Web and data include web browsing, email, instant messaging, newsgroups, and file transfer, but they do not include P2P and commercial file transfer such as iTunes. This general category encompasses data transfer (including file transfer using HTTP and FTP) and other Internet applications.
- Video on Demand is managed IP transport (traffic that remains within the footprint of a single service provider) generated by traditional commercial TV services, including Standard Definition (SD), High-Definition (HD), and Ultra-High Definition (UHD) cable and Internet Protocol Television (IPTV) VoD.



How does the Cisco Complete VNI Forecast define Internet Video and other forms of 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. 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.

- 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:** 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, nonsmartphones, 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
 - **Video Surveillance:** Nannycams, petcams, home security cams, and other persistent video streams
 - **Mobile video:** All video that travels over a second-, third-, or fourth-, or fifth-generation (2G, 3G, 4G, or 5G respectively) network

Q What is an Exabyte? What is a Zettabyte?

A An Exabyte is 1,000,000,000 gigabytes. A Zettabyte is 1,000 Exabytes. Figure 1 shows examples of data that reaches the Exabyte and Zettabyte scale.

Figure 1. The Zettabyte scale



[†] Roy Williams, "Data Powers of Ten," 2000.

[‡] Based on a 2006 estimate by the University of Pennsylvania School of Medicine that the retina transmits information to the brain at 10 Mbps.

All other figures are Cisco estimates.
Source: Cisco VNI 2018.

Q Does this forecast include signaling traffic?

A No, signaling traffic is not included. However, an estimate can be made using the standard rule that IP signaling traffic is approximately 3 percent of bearer traffic.

Q Are traffic patterns becoming more symmetric over time?

A No, we have observed that, despite the increase in consumer uploading of user-generated content and content providers making longer form content available online, the amount of downloading still exceeds uploading, and traffic patterns are increasingly asymmetric.

Q Does the forecast include both uplink and downlink traffic?

A For most services, the figures reflect both downlink and uplink traffic. To avoid double-counting, we excluded uplink P2P, VoIP, instant messaging, and video calling. In other words, we did not include uplink traffic for any application where one person's upload is another person's download. Uploads to servers (for example, YouTube) are included, however.

Q The Cisco Complete VNI Forecast appears to be focused on forward-looking data. Is there data showing how IP and Internet traffic have developed historically?

A Yes, we have historical data for global and regional Internet traffic going back to 2005. We are able to segment our historical views by fixed/wired, mobile, or total traffic (includes consumer and business Internet traffic, but does not include traffic on business IP WANs and private and mobile networks). We can also distinguish historical traffic by Internet, non-Internet (just managed IP), or both of those categories together.

Q What about satellite video traffic?

A Because satellite is similar to broadcast, in that it is a one-to-many service, the exclusion of satellite from the forecast is not expected to make a significant difference. However, Direct Broadcast Satellite (DBS) providers are now deploying set-top box services that simulate VoD. They send the top 25 programs to the set-top boxes overnight and support on-demand access to less-popular content through the subscriber's Internet connection. This on-demand streaming is certain to have an effect on traffic in the future, and it has been factored into the assumptions for Internet video.

Q What about digital terrestrial video traffic?

A Like satellite, Digital Terrestrial Television (DTT) is a one-to-many service, so the exclusion of DTT is not expected to materially affect the accuracy of the forecast. Also like satellite providers, pay-DTT providers may establish a broadband connection to the home so that they can offer on-demand content, Internet content, and interactive content. This scenario has not been included in this forecast, because the penetration of DTT remains low throughout the forecast period. DTT may be included in future versions of the forecast.

Q Can you share the application-level traffic data and country-level data you used to construct the regional traffic figures?

A Due to contractual agreements with our independent research partners, we are not able to share specific source data that serves as primary inputs to our forecast methodology. We do provide a publicly available [Cisco Complete VNI Forecast Highlights Tool](#), which can interactively generate a variety of projections at the global, regional and select country level.

Q Can my organization or I use or publish Cisco Complete VNI Forecast data?

A Yes. Cisco welcomes and encourages press, analysts, service providers, and other interested industry parties, whether business, regulatory, or academic, to use or publish the data. Cisco Complete VNI Forecast projections have been cited in equity and investment research, S-1 registration statements, Initial Public Offering (IPO) and Security and Exchange Commission (SEC) filings, and offering memorandums. We have shared our publicly published data with government regulators, press, industry analysts, academic institutions, technical conferences, journals, and other media outlets. We do require that proper Cisco attribution be given for any and all Cisco VNI data that is published or shared in private or public, print and electronic forms (for example, "Source: Cisco Complete Visual Networking Index [or VNI] Forecast, 2017-2022"). No further signatures or consent are required to refer to our publicly available white papers, reports, or web-based tools. We are always interested in the context in which our data is used. We appreciate when parties using our content are able to share copies of their completed work containing Cisco Complete VNI Forecast insertions. Post documents containing Cisco Complete VNI Forecast references to our [community page](#) or forward them to traffic-inquiries@cisco.com.

Q How can I ask questions about the Cisco Complete VNI Forecast?

A Post your questions or comments to our [community page](#) (preferred) or send your questions by email to traffic-inquiries@cisco.com.

For more information

For more information, refer to www.cisco.com/go/vni. You may also submit questions or comments to our feedback section at www.cisco.com/go/vni.