

Cisco Visual Networking Index Complete Traffic Forecast (2016–2021)

June 2017



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



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.



What is visual networking?



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



When did Cisco begin forecasting global IP traffic?



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.



What is the methodology behind the Cisco VNI Forecast?



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, AMI, Strategy Analytics, Dell'Oro, Synergy, comScore, Nielsen, Media Partners Asia, Maravedis, and a variety of other sources.

In addition, a number of service providers share network traffic data and trends with Cisco, and this data is 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 a worldwide slowdown in the PC segment and growth in 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 46 percent of total global IP traffic (which includes managed IP) by 2021. Comparatively, we estimate that Wi-Fi traffic will represent 53 percent of total global Internet traffic (which excludes managed IP) by 2021. 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 **Have you changed any historic traffic projections in the latest forecast update?**

A Each year, we use what we believe to be the most accurate data and methodology possible to update the forecast. The following changes have been made since the last forecast. Significant volume adjustments were made to India, Russia, and South Africa. A volume adjustment is considered “significant” when the 2015 traffic volume published this year is more than 10 percent higher or lower than last year’s published number. Moderate volume adjustments were made to the United States, Sweden, Japan, and Brazil. A volume adjustment is considered “moderate” when the 2015 traffic volume is greater than 5 percent (but less than 10 percent) different from last year’s published figure.

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 2012, we projected that the compound annual growth rate from 2011 to 2016 would be 29.1 percent. We now estimate that the actual growth rate for that timeframe was 29.9 percent.



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

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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 20 percent or higher over the forecast period (2016–2021). As mobile becomes a significant percentage of total IP traffic (7 percent of global IP traffic in 2016, growing to 17 percent of global IP traffic by 2021), the overall growth rates begin to reflect the higher growth rates of the mobile segment.

By 2021, we will be firmly established in the double Zettabyte era (Figure 1). Major findings of the Cisco VNI Global Forecast, 2016–2021, include the following:

- Globally, IP traffic will grow threefold from 2016 to 2021, a CAGR of 24 percent.
- Globally, IP traffic will reach 278 Exabytes per month by 2021, up from 96 Exabytes per month in 2016.
- Globally, IP traffic will reach an annual run rate of 3.3 Zettabytes by the end of 2021, up from an annual run rate of 1.2 Zettabytes at the end of 2016.
- Asia Pacific will generate nearly 40 percent of global IP traffic by 2021 (nearly 108 Exabytes per month), the highest share of any region. North America will generate 30 percent of global IP traffic by 2021 (85 Exabytes per month). The Middle East and Africa will be the fastest-growing IP traffic region from 2016 to 2021 (6-fold growth, 42 percent CAGR over the forecast period). Asia Pacific will be the second fastest-growing region (3-fold growth, 26 percent CAGR).
- By 2021, non-PC devices will account for 75 percent of total IP traffic, up from 54 percent in 2016. This demonstrates the effect that web-enabled TVs, tablets, and smartphones have on the way consumers and business users access and use the Internet.
- Mobile data traffic will be more than 17 percent of global IP traffic by 2021, growing from 7 percent of global IP traffic in 2016.



How do you define your major application categories?

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The following major application categories and corresponding definitions are used within our Cisco VNI 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 Three-Dimensional (3D) cable and Internet Protocol Television (IPTV) VoD.

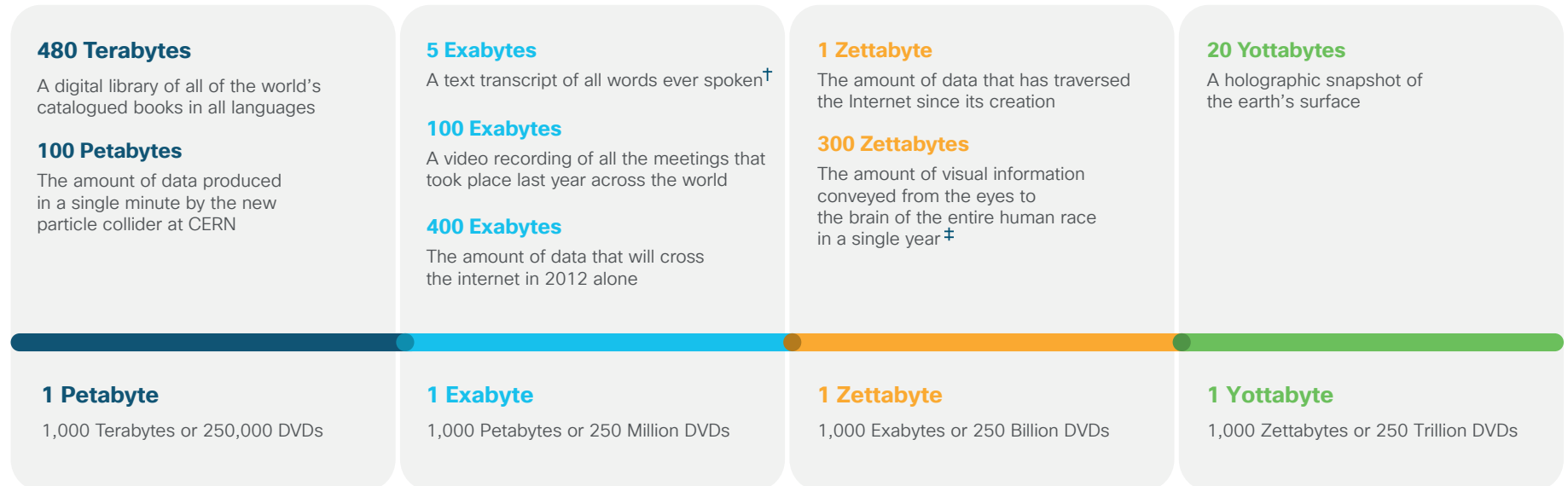


What is an Exabyte? What is a Zettabyte?



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 2016.

Q **Is there a way to customize this forecast for a specific set of variables?**

A Yes, we have two tools—one for fixed networks (CT-SPAN: www.cisco.com/go/span) and the other for mobile networks (M-SPAN: www.cisco.com/go/mspan)—that can generate customized forecasts based on inputs you specify. These tools use Cisco VNI assumptions for defaults and can take user inputs for a user-customized forecast.

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 **Cisco VNI 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 We are not able to share the specific source data that serves as a primary input to our forecast methodology, but we have developed an interactive tool that generates customized Cisco VNI data based on user requirements. The Cisco VNI Forecast widget is a publicly available online resource. You can generate your own Cisco VNI Forecast charts based on segment, region, country, or other parameters. The Cisco VNI Forecast widget is available at www.cisco.com/c/dam/m/en_us/solutions/service-provider/vni-forecast-widget/forecast-widget/index.html. We also have the Cisco VNI Complete Forecast Highlights Tool. This tool generates a variety of projections from the current complete and mobile data forecasts for each region and country covered by the research (refer to www.cisco.com/c/m/en_us/solutions/service-provider/forecast-highlights.html).

Q Can my organization or I use or publish Cisco 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 VNI 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 Visual Networking Index [or VNI] Global IP Traffic Forecast, 2016–2021”).

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 VNI insertions. Post documents containing VNI Forecast references to our [community page](#) or forward them to traffic-inquiries@cisco.com.

Q How can I ask questions about the Cisco 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.