Cisco Visual Networking Index: Forecast Q&A

May 2013

Q. Why did Cisco develop the Cisco® Visual Networking Index (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 largely generated by video and by social networking, along with collaboration, such as Web 2.0 technologies. This combination is termed visual networking. A visual networking experience can range from a prearranged Cisco TelePresence® meeting to the delivery of video to any device a consumer chooses, such as a TV, PC, or mobile handset.

Q. When did Cisco begin forecasting global IP traffic?

A. The Cisco Visual Networking Index 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 the interest in and effects of the initial report, Cisco began releasing these findings publicly in 2007.

Q. What is the methodology behind the Cisco Visual Networking Index 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 Kagan, Ovum, Informa, Ookla Speedtest.net, IDC, Gartner, ABI, AMI, Strategy Analytics, Infonetics, Dell'Oro, Synergy, Screen Digest, Pyramid, comScore, Nielsen, Arbitron Mobile, Media Partners Asia, Machina, 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. The following enhancements have been incorporated into the methodology since the last update:

- Country-level forecast data for Poland has been added to the forecast. In previous forecast updates, this data was included in the "Rest of Central and Eastern Europe" category.

- Projections for global IP traffic (particularly video) transported over content delivery networks (CDNs) were added to this iteration of the forecast.

- Global analysis and comparison of metro and long-haul IP traffic were included in this year's report.

- New information on global IPv6 traffic growth is included in this year's study (complementing the global and regional IPv6-capable devices and connections projections that were included for the first time last year).

- Specific information on global and regional Wi-Fi speed, in addition to the standard fixed broadband speed analysis, has been added in this forecast period.

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

A. In one area, independent data sources were revised and restructured in the Cisco VNI regional distribution of Internet users. Specifically, Turkey was moved from the Middle East and Africa Region to the Central and Eastern Europe region. This change effectively reduced the current and projected number of users in the Middle East and Africa while increasing that current and future category for Central and Eastern Europe.

Also, as we reported in the February 2013 Cisco VNI Mobile Data Traffic Forecast, the slowed growth of PC and laptop devices (particularly in Western Europe and North America) led to a reduction in the global and regional device projections. Business desktops and consumer desktops and laptops in particular are experiencing negative growth rates. Conversely, tablets continue to be among the fastest growing device types in each region, but not at a rate that directly replaces the slowed or decreased rate of PC and laptop devices.

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 45 percent of total global IP traffic (which *includes* managed IP) by 2017. Comparatively, we estimate that Wi-Fi traffic will represent 56 percent of total global Internet traffic (which *excludes* managed IP) by 2017. The lower Wi-Fi percentage for overall IP is due to 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. This year, to improve our forecasting and data collection methodology, we made the following adjustments to 2012 IP traffic volumes: In Central and Eastern Europe and Latin America, the latest measurements show higher traffic per device than was previously projected (based on the best available data at that time). Therefore, the traffic volume was adjusted upward. In Western Europe, the latest measurements show slightly lower traffic per device than was previously reported, so the Cisco VNI traffic volume was adjusted downward.

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

A. In general, all regions experienced gradual reductions in growth rates. While for most regions the reductions were in line with the leveling of growth rates that is typical of S-curve growth, two regions had growth rates above or significantly below what was expected during the previous forecast period (2011-2016). In North America, steady growth of IP VoD led to an overall increase of projected growth rates compared to what was expected in last year's forecast. In Latin America, on the other hand, the projected growth rate has been reduced beyond what would normally be expected from S-curve decreases, in part because consensus forecasts for device growth in the region have been reduced. Latin America now has the lowest device growth compound annual growth rate (CAGR) from 2012 to 2017 of any region.
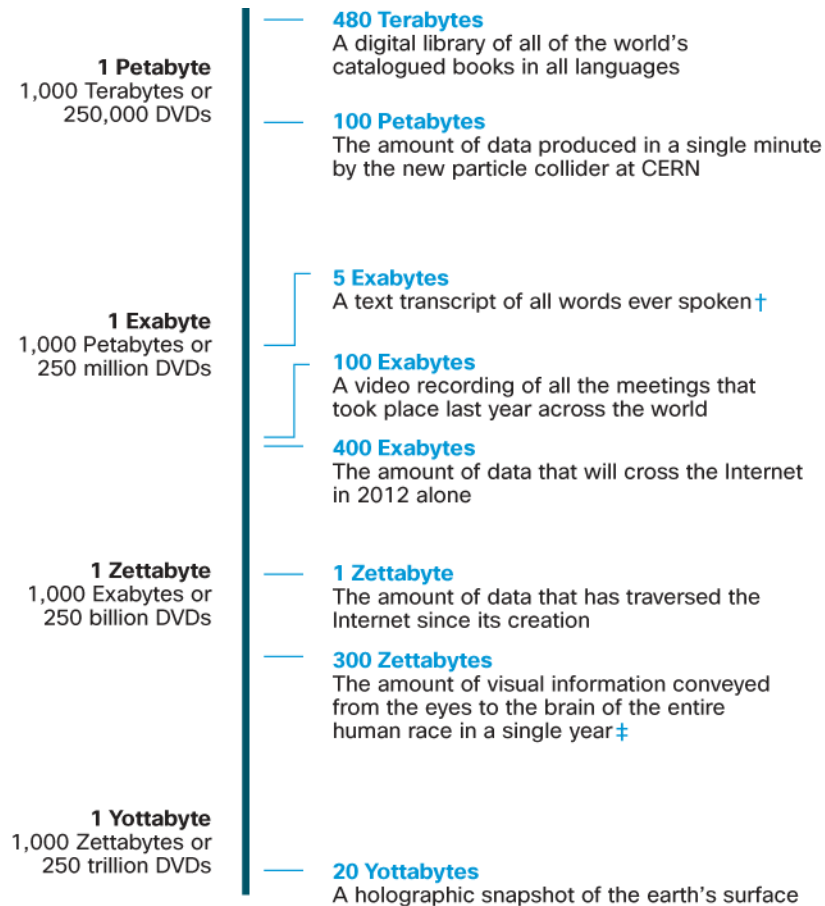
By 2017, we expect to enter the zettabyte era (Figure 1). Major findings of the Cisco VNI Global Forecast, 2012–2017, include the following.

- Globally, IP traffic will grow nearly threefold from 2012 to 2017, a CAGR of 23 percent.
- Globally, IP traffic will reach 120.6 exabytes per month in 2017, the equivalent of transporting 41 million DVDs each hour.
- Globally, IP traffic will reach an annual run rate of 1.4 zettabytes by the end of 2017, up from an annual run rate of 522.8 exabytes at the end of 2012.
- Asia Pacific will generate the most IP traffic by 2017 (43.4 exabytes per month).
- Middle East and Africa will be the fastest-growing IP traffic region from 2012 to 2017 (tenfold growth, 38 percent CAGR over the forecast period). Asia Pacific will be the second fastest-growing region (threefold growth, 26 percent CAGR) in this category.
- By 2017, non-PC devices will account for 49 percent of total IP traffic, demonstrating the effect of web-enabled TVs, tablets, and smartphones on the way consumers access and use the Internet.
- Mobile data traffic will be over 9 percent of global IP traffic by 2017, growing from 2 percent of global IP traffic in 2012.

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

1 Petabyte
1,000 Terabytes or
250,000 DVDs

480 Terabytes
A digital library of all of the world's
catalogued books in all languages

100 Petabytes
The amount of data produced in a single minute
by the new particle collider at CERN

1 Exabyte
1,000 Petabytes or
250 million DVDs

5 Exabytes
A text transcript of all words ever spoken†

100 Exabytes
A video recording of all the meetings that
took place last year across the world

400 Exabytes
The amount of data that will cross the Internet
in 2012 alone

1 Zettabyte
1,000 Exabytes or
250 billion DVDs

1 Zettabyte
The amount of data that has traversed the
Internet since its creation

300 Zettabytes
The amount of visual information conveyed
from the eyes to the brain of the entire
human race in a single year‡

1 Yottabyte
1,000 Zettabytes or
250 trillion DVDs

20 Yottabytes
A holographic snapshot of the earth's surface

† 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 2013

Q.   How accurate is your forecast?

A.   The Cisco VNI forecast has been characterized as conservative by some industry analysts and academicians.
However, last year's Cisco VNI projections have aligned with several actual growth reports from independent
third parties.

- Telegeography reported that global average international Internet traffic grew 40 percent in 2012.
  The Cisco VNI Internet traffic growth rates for the primary countries included in the Cisco VNI forecast
  ranged from 35 percent for 2012, which is consistent with the Telegeography findings.
- The International Telecommunication Union (ITU) reported that IP traffic will grow by nearly 14 exabytes
  per month in 2013, while Cisco VNI forecasts the IP traffic growth by 2013 will be 12 exabytes per month.

Q. Why isn't the projected global IP traffic growth rate as high as it has been in previous forecasts?

A. The updated global IP growth rate is not as high as in previous forecasts, but this is not a traffic reduction—it is a standard function of sigmoid curve (or S-curve) modeling. The initial stages of growth can be exponential, but that pace cannot continue indefinitely. However, in real terms, top-level traffic growth represents a huge amount of traffic. For example, in 2017 alone, more traffic will traverse global networks than all prior "Internet years" combined. IP traffic between the years 1984 and 2012 was 1.2 zettabytes, which is lower than the annual global IP traffic of 1.4 zettabytes of traffic in 2017.

Q. How do you define your major application categories?

A. 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 peer-to-peer 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.

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 Internet traffic has developed historically?

A. Yes, we have historical data for global and U.S. Internet traffic. Historical Internet traffic includes consumer and business Internet traffic, but it does not include traffic on business IP WANs and private and mobile networks.

Q. Why is broadcast TV traffic so low in comparison to VoD traffic?

A. Broadcast traffic is low because it is a one-to-many service rather than a one-to-one service, like VoD. For each VoD request, a new stream must be served. However, when hundreds of people tune in to the same television show, only one copy of this show crosses most of the network. When it is near the network edge, it is split and sent over each access line. In this forecast, the access-line traffic for broadcast TV is not included.

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 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 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, 2012–2017"). No further signatures or consent are required to reference our publicly available white papers, reports, or web-based tools. We are always interested in the context in which our data is used and would appreciate it if parties that use our content would share copies of their completed work containing Cisco VNI insertions. Please send these to traffic-inquiries@cisco.com.

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 Tool is an online resource that is publicly available. You can generate your own Cisco VNI Forecast charts based on segment, region, country, or other parameters. The forecast tool is available at www.ciscovni.com/vni_forecast/index.htm. We also have an advanced highlights tool. This tool generates important projections from the IP traffic and mobile data traffic forecast for each region and country covered by the research (refer to www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html).

Q. Where can I ask questions about the Cisco VNI Global IP Traffic Forecast data?

A. Please send any questions to traffic-inquiries@cisco.com.

For More Information

For more information, refer to www.cisco.com/go/vni. Inquiries can be directed to traffic-inquiries@cisco.com. You may also submit questions or comments to our feedback section at www.cisco.com/go/vni.

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