Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2009-2014

February 9, 2010

The Cisco® Visual Networking Index (VNI) Global Mobile Data Traffic Forecast Update is part of the comprehensive Cisco VNI Forecast, an ongoing initiative to track and forecast the impact of visual networking applications on global networks. This paper presents some of Cisco's key global mobile data traffic projections and growth trends.

Executive Summary

Globally, mobile data traffic will double every year through 2014, increasing 39 times between 2009 and 2014. Mobile data traffic will grow at a compound annual growth rate (CAGR) of 108 percent between 2009 and 2014, reaching 3.6 exabytes per month by 2014.

Almost 66 percent of the world's mobile data traffic will be video by 2014. Mobile video will grow at a CAGR of 131 percent between 2009 and 2014. Mobile video has the highest growth rate of any application category measured within the Cisco VNI Forecast at this time (see Appendix A for applications details).

The Middle East and Africa will have the strongest growth of any region at 133 percent CAGR, followed by Asia Pacific at 119 percent and North America at 117 percent (see Appendix A for region details).

Year in Review: Mobile Data Traffic Growth in 2009

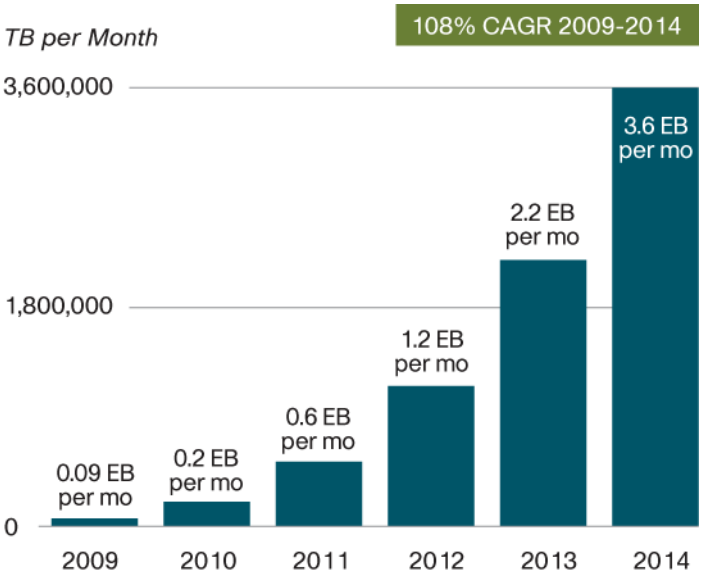
In spite of the economic downturn, which many regions only now are starting to slowly rebound from, the demand for mobile services has remained constant and has in fact grown in many areas. Our global estimates show that mobile data traffic increased 160 percent from calendar year-end 2008 to calendar year-end 2009. And individually, some mobile carriers have published some dramatic traffic increases. For example, the United Kingdom-based O2 reported that its mobile data traffic in Europe doubled every three months in 2009; Telecom Italia announced that its

mobile traffic grew 216 percent from mid-2008 to mid-2009; and AT&T has reported that its mobile traffic increased 5000 percent in the past 3 years.

The Impact of Video and Advanced Devices on Mobile Traffic

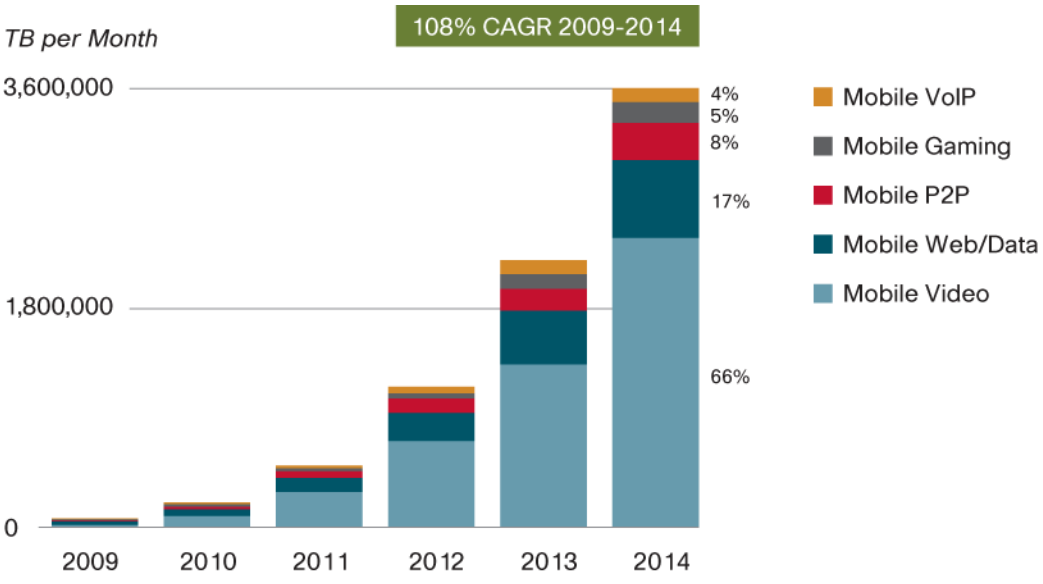
According to the Cisco VNI Global Mobile Data Traffic Forecast, video will be responsible for the majority of the traffic growth between 2009 and 2014. As Figures 1 and 2 show, overall mobile data traffic is expected to grow to 3.6 exabytes per month by 2014, and over 2.3 of those are due to mobile video traffic.

Figure 1. Cisco Forecasts 3.6 Exabytes per Month of Mobile Data Traffic by 2014



For more details, see Appendix B: Forecast and Methodology.
Source: Cisco VNI Mobile, 2010

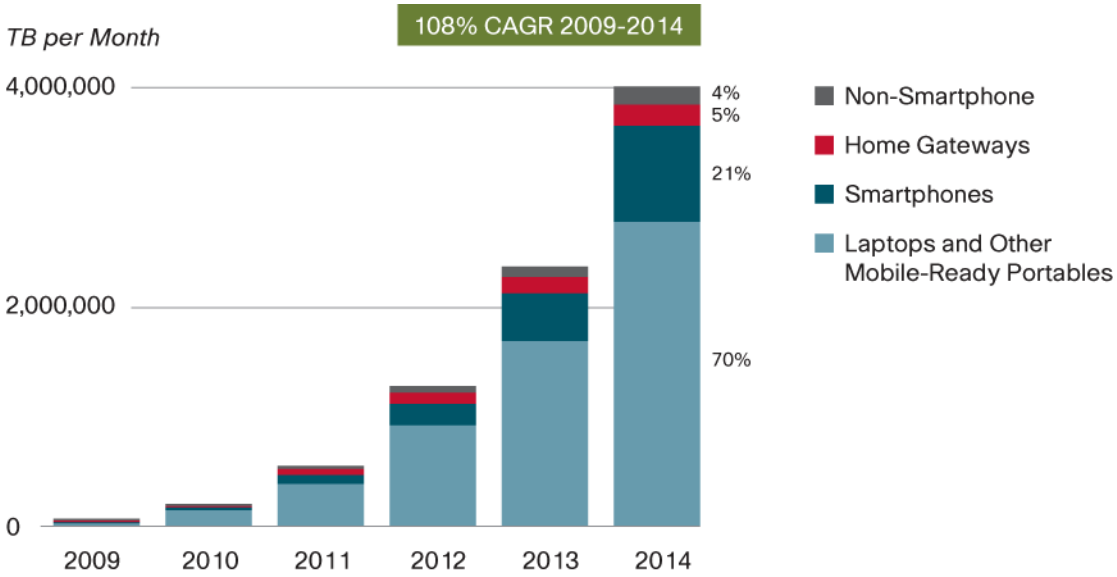
Figure 2. Video Will Account for 66 Percent of Global Mobile Data Traffic by 2014



Source: Cisco VNI Mobile, 2010

Figure 3 shows the devices responsible for mobile data traffic growth. Smartphones and portables will account for 91 percent of all mobile data traffic by 2014. This is primarily due to the much higher usage profile of laptops and the suitability of mobile broadband handsets for high-speed, high-quality video.

Figure 3. Laptops and Smartphones Drive Traffic Growth



Source: Cisco VNI Mobile, 2010

The average smartphone user generates 10 times the amount of traffic generated by the average non-smartphone user. Handset traffic is highest in regions with the highest smartphone penetration. Currently, Italy has the highest smartphone penetration, and will continue to be the smartphone leader through the forecast period. Starting at a low base, India will experience the highest increase in smartphone penetration, which will triple over the forecast period, and number of smartphone users, which will grow 5.5 fold by 2014.

Table 1. Percentage of Install Base of Smartphones over all Mobile Handsets

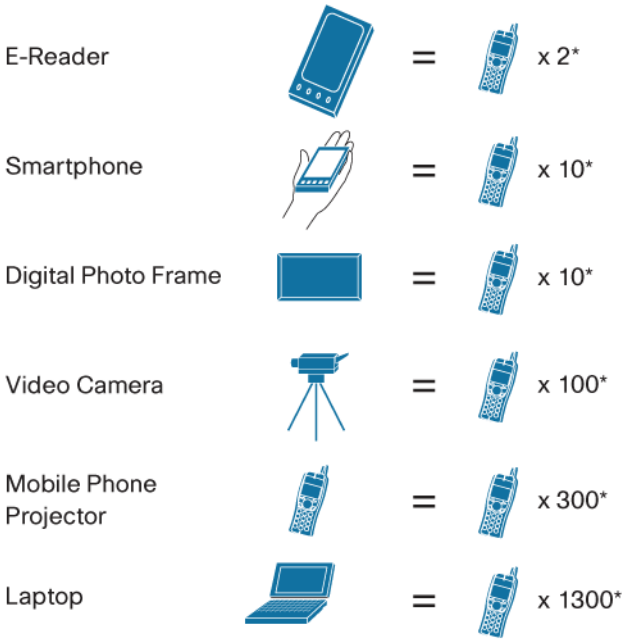
Region or Country	2009	2010	2011	2012	2013	2014
Asia Pacific						
China	10%	11%	13%	15%	18%	21%
India	4%	5%	6%	8%	10%	12%
Korea	14%	15%	17%	21%	25%	30%
Rest of Asia Pacific	8%	8%	9%	10%	11%	12%
Total Asia Pacific	8%	9%	10%	12%	14%	16%
Central and Eastern Europe (CEE)						
Rest of CEE	5%	7%	9%	11%	13%	16%
Russia	6%	7%	9%	11%	15%	17%
Total CEE	6%	7%	9%	11%	14%	16%
Japan						
Japan	4%	4%	5%	6%	7%	8%
Total Japan	4%	4%	5%	6%	7%	8%
Latin America						
Brazil	1%	1%	1%	2%	2%	2%
Mexico	3%	4%	5%	7%	10%	12%

Region or Country	2009	2010	2011	2012	2013	2014
Rest of Latin America	1%	1%	1%	1%	2%	2%
Total Latin America	1%	1%	2%	2%	3%	3%
Middle East and Africa (MEA)						
Rest of MEA	3%	3%	4%	5%	6%	7%
South Africa	1%	2%	2%	3%	4%	4%
Total MEA	3%	3%	4%	5%	6%	7%
North America						
Canada	30%	31%	34%	40%	47%	50%
United States	32%	33%	37%	44%	51%	55%
Total North America	32%	33%	37%	44%	51%	54%
Western Europe						
France	16%	18%	21%	27%	29%	33%
Germany	17%	19%	22%	25%	29%	33%
Italy	36%	40%	47%	54%	63%	67%
Rest of Western Europe	31%	36%	41%	49%	58%	64%
United Kingdom	17%	18%	20%	23%	29%	32%
Total Western Europe	25%	28%	32%	37%	44%	49%
Global	9%	10%	11%	13%	15%	17%

Source: Cisco VNI Mobile, Informa Media and Telecoms, In-Stat, Gartner, 2009, 2010

The advent of laptops and high-end handsets onto mobile networks is a key driver of traffic, since these devices offer the consumer content and applications not supported by the previous generation of mobile devices. Chief among these new sources of traffic is video, but other applications such as peer-to-peer (P2P) are already making an impact. As shown in Figure 4, a single laptop can generate as much traffic as 1300 basic-feature phones, and a smartphone creates as much traffic as 10 basic-feature phones. iPhones, in particular, can generate as much traffic as 30 basic feature phones.

Figure 4. High-End Handsets and Laptops Can Multiply Traffic

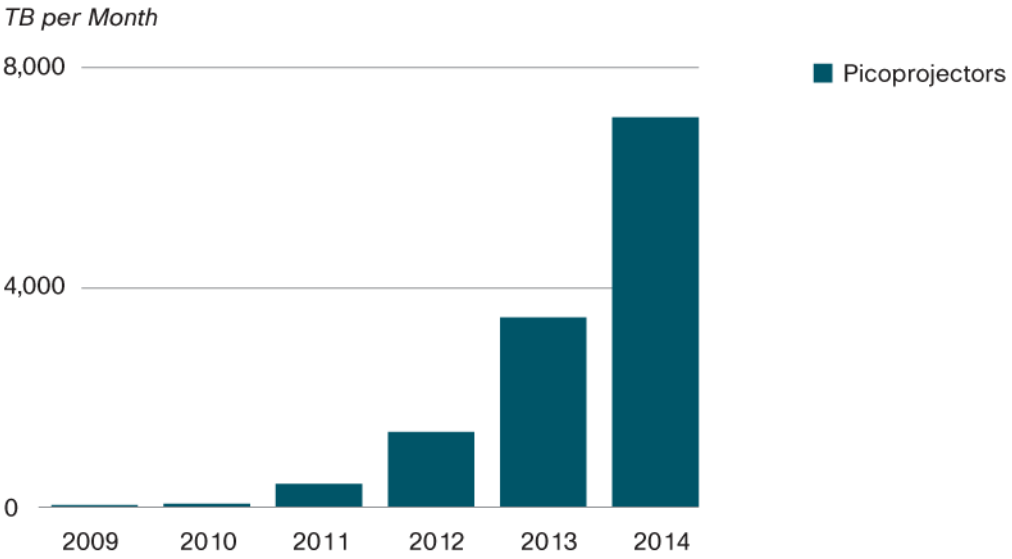


** Monthly Basic Mobile Phone Data Traffic*

Source: Cisco VNI Mobile, 2010

Picoprojectors are a nascent feature addition to smartphones. Although very small in number, this category promises to create higher multiples of traffic due to the high bandwidth required to project images and videos from an advanced mobile device.

Figure 5. Mobile Picoprojector Traffic



Source: Cisco VNI Mobile, 2010

Traffic Migration from Mobile to Fixed

Much mobile data activity takes place within the user's home. A survey conducted by Cisco's Internet Business Solutions Group (IBSG) helps quantify the amount of home-based mobile Internet use. As shown in Table 3, the percentage of time spent using mobile Internet at home ranges from 28.2 percent (Mexico) to 48.6 percent (South Africa). The amount of mobile data traffic that is literally "in motion" ranges from 23.7 percent (India) to 45.2 percent (France).

Table 2. Mobile Internet Time at Home, at Work and On The Move

	Percentage of Mobile Internet Time at Home	Percentage of Mobile Internet Time at Work	Percentage of Mobile Internet Time On the Go
United States	37.8%	19.6%	42.6%
United Kingdom	45.6%	17.8%	36.6%
Germany	43.4%	15.3%	41.3%
France	33.1%	21.7%	45.2%
Italy	39.6%	21.4%	39.0%
South Africa	48.6%	21.4%	30.0%
Mexico	28.2%	27.6%	44.2%
Brazil	36.7%	24.7%	38.6%
Korea	33.7%	31.7%	34.6%
India	45.9%	30.4%	23.7%
China	30.1%	32.7%	37.2%

Source: Cisco IBSG Connected Life Market Watch, 2009

The relatively high percentage of home-based mobile data use suggests that operators may be able to offload traffic onto a fixed network, either by offering their subscribers dual-mode mobile phones or through deployment of femtocell technology.

Cisco has estimated the amount of smartphone traffic that can be offloaded through dual-mode devices or femtocells (see Table 3). The offload factor for each country is a combination of smartphone penetration, dual-mode share of smartphones, percentage of home-based mobile Internet use, percentage of dual-mode smartphone owners with Wi-Fi fixed Internet access at home.

Table 3. Dual-Mode and Femtocell Traffic Offload as a Percentage of Smartphone Traffic

	2009	2010	2011	2012	2013	2014
China	15%	15%	15%	16%	16%	17%
India	22%	23%	20%	16%	12%	8%
Korea	20%	22%	22%	23%	24%	25%
Rest of APAC	22%	23%	25%	26%	27%	29%
Rest of CEE	26%	26%	26%	26%	27%	27%
Russia	26%	27%	29%	30%	31%	32%
Japan	24%	25%	25%	24%	24%	23%
Brazil	18%	18%	19%	19%	19%	18%
Mexico	14%	12%	10%	9%	9%	8%
Rest of LATAM	16%	16%	15%	14%	14%	13%
Rest of MEA	20%	21%	19%	19%	19%	19%
South Africa	23%	24%	23%	22%	22%	22%
Canada	13%	16%	18%	21%	23%	24%

	2009	2010	2011	2012	2013	2014
US	13%	16%	18%	20%	22%	23%
France	23%	24%	24%	26%	27%	28%
Germany	30%	31%	32%	33%	32%	31%
Italy	25%	23%	22%	22%	21%	21%
Rest of WE	27%	28%	29%	30%	29%	28%
UK	31%	32%	34%	35%	35%	35%

Source: Cisco VNI Mobile, 2010

In many developing countries and regions, the offload percentage declines, while in developed regions, the offload factor steadily rises throughout the forecast period. The declining offload factor in developing markets is due to a decreasing number of mobile data users with Wi-Fi at home.

Since dual-mode devices are primarily smartphones, the overall offload amount in the current year is much smaller than shown above, since non-smartphones still account for approximately half of handset traffic.

Traffic Migration from Fixed to Mobile

While a significant amount of traffic will migrate from mobile to fixed networks, a much greater amount of traffic will migrate from fixed to mobile networks.

In many countries in Europe, mobile operators are offering mobile broadband services at prices and speeds comparable to fixed broadband. Though there are often data caps on mobile broadband services that are lower than those of fixed broadband, some consumers are opting to forgo their fixed lines in favor of mobile. Mobile broadband substitution has a familiar ring to it from the mobile voice substitution effect that began in the late 1990s and is continuing today.

Below are Cisco's estimates for the number of mobile-only data users for each country covered by the forecast. The adoption rates for mobile-only data users were estimated by analogy, using each country's historical mobile-only voice adoption curves as a guideline. Tables 4 and 5 show the status of mobile-only voice adoption and Cisco's estimates for mobile-only data adoption, worldwide.

Table 4. Mobile-Only Voice Access by Country, 2009

	Individuals with Mobile-Only Voice Access	% of Population with Mobile-Only Voice Access	% of Households with Mobile-Only Voice Access
India	285 million	24%	11%
U.S.	78 million	25%	18%
Brazil	67 million	35%	23%
China	47 million	4%	2%
Japan	40 million	31%	20%
Russia	37 million	26%	14%
Mexico	29 million	26%	16%
South Africa	24 million	48%	28%
Italy	23 million	39%	26%
UK	11 million	18%	13%
Germany	10 million	12%	10%
France	9 million	14%	11%
Korea	9 million	18%	12%

Source: Cisco VNI Mobile, ITU, Informa Telecoms and Media, 2009–2010

Table 5. Mobile-Only Data Users by Country, 2009–2014

	2009	2010	2011	2012	2013	2014
India	163,689	828,683	3,888,314	17,256,707	73,829,086	308,851,560
China	190,146	518,583	1,383,970	3,642,164	9,443,822	24,300,965
Korea	376,500	602,666	957,999	1,516,525	2,393,976	3,771,869
Japan	111,394	359,198	1,150,448	3,670,717	11,683,890	22,854,370
Brazil	827,558	3,040,933	10,931,351	38,697,116	60,403,090	78,730,025
Mexico	971,776	3,948,432	15,768,396	25,198,155	30,515,904	34,612,380
Italy	3,916,047	6,857,703	11,931,072	20,667,916	22,410,783	24,974,231
UK	600,749	1,552,295	3,985,042	7,133,489	8,947,340	11,918,730
Germany	25,647	52,075	105,116	211,393	424,078	6,570,142
France	54,576	168,444	515,510	1,569,244	4,759,895	6,844,943
U.S.	1,385,555	2,870,536	5,895,539	12,037,664	24,481,704	57,908,159
South Africa	2,088,276	4,713,732	10,554,417	16,657,697	20,701,824	24,924,337
Russia	2,137,895	4,165,446	7,995,997	15,187,490	28,634,331	29,505,517

Source: Cisco VNI Mobile, 2010

Beyond the Substitution Effect: New Behaviors

Mobile devices increase an individual's contact time with the network, and it is likely that in the early stages of mobile Internet, this increased contact time will lead to an increase in overall minutes of use per user. However, not all of the increase in mobile data minutes-of-use can be attributed to the amplified use of the same applications that dominate the fixed network. Some uniquely mobile applications are already emerging.

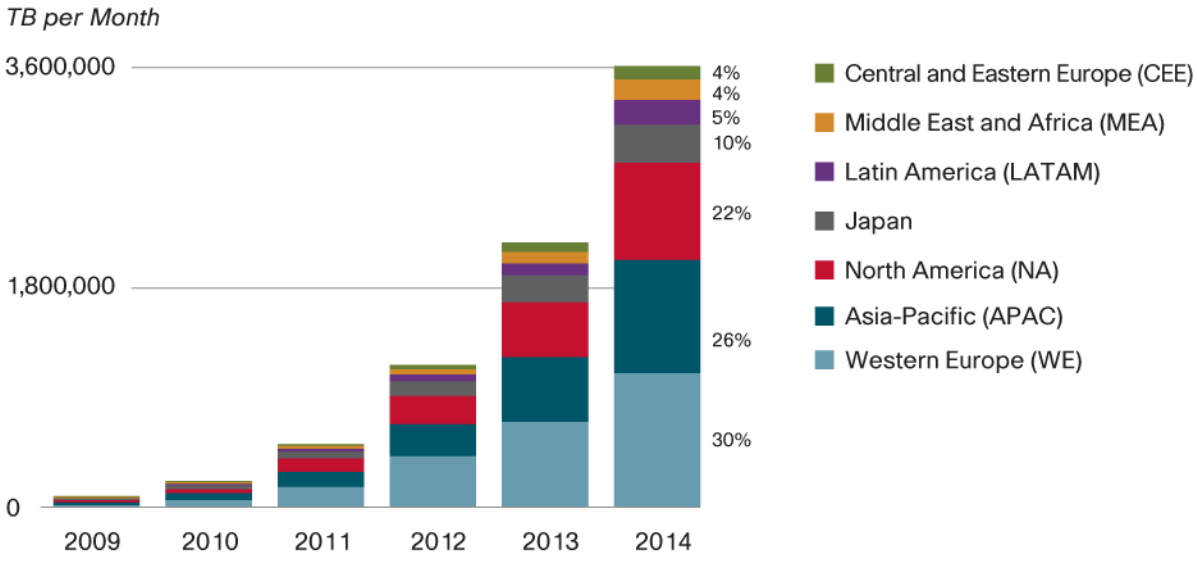
A lot of excitement has been building around a category of iPhone and Android applications in a new category called "augmented reality" applications or "social augmented reality" mobile location-based services.

These applications combine virtual data into the physical real world by utilizing the iPhone 3GS or an Android phone's compass, camera, and GPS. The result is that users can view the location of a tweet (Twitter) and local restaurants in the physical world, even if they are miles away. An example is the Sekai Camera iPhone application in Japan—users can leave text messages, photos, and audio recordings that appear as floating bubbles in the location they are created. Other users can point their Sekai Camera at the location to see what kind of content has been posted there.

Regional Trends

Western Europe and Asia Pacific will account for over 56 percent of global mobile, as shown in Figure 6. The emerging market regions (Central and Eastern Europe, Latin America, and Middle East and Africa) will have the highest growth and will represent an increasing share of total mobile data traffic, from 9 percent at the end of 2009 to 14 percent by 2014.

Figure 6. Global Mobile Data Traffic Forecast by Region



Source: Cisco VNI Mobile, 2010

Each region's mobile data traffic is strongly correlated with the average mobile speed available in that region. Below are smartphone speed test results from Cisco's Global Internet Speed Test (GiST) application.

Table 6. Average Smartphone Mobile Speed by Region

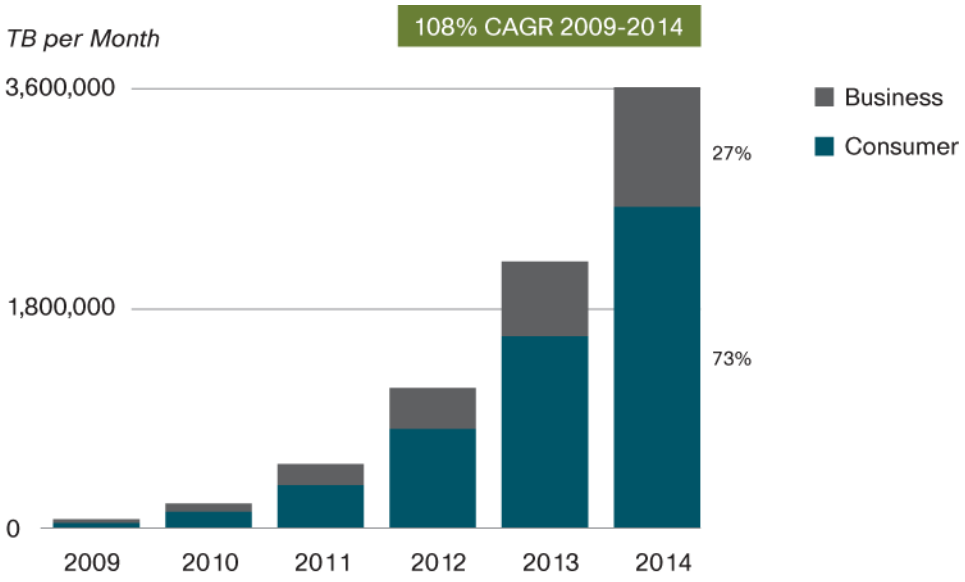
Average Smartphone Mobile Speed by Region	
Region	**kbps**
Asia Pacific	280
Japan	690
Western Europe	691
North America	418
Latin America	321
Middle East and Africa	106
Central Europe	263

Source: Cisco GiST, January 2010 (learn more at www.ciscovnipulse.com)

Emergence of Prosumers: Comparison of Consumer and Business Mobile Traffic

Consumer and business mobile IP traffic is on the rise with increased smartphone and portables adoption. Consumer mobile data traffic is growing and will continue to gain higher momentum due to the emergence and growth of the prosumers as well the adoption of Smartphones with advanced music and video capabilities. In 2009, consumers represent 67% of the total mobile data traffic while business mobile users contributed is 33% of total mobile data traffic. By 2014, consumer mobile Internet traffic will account for 73% of all mobile data traffic.

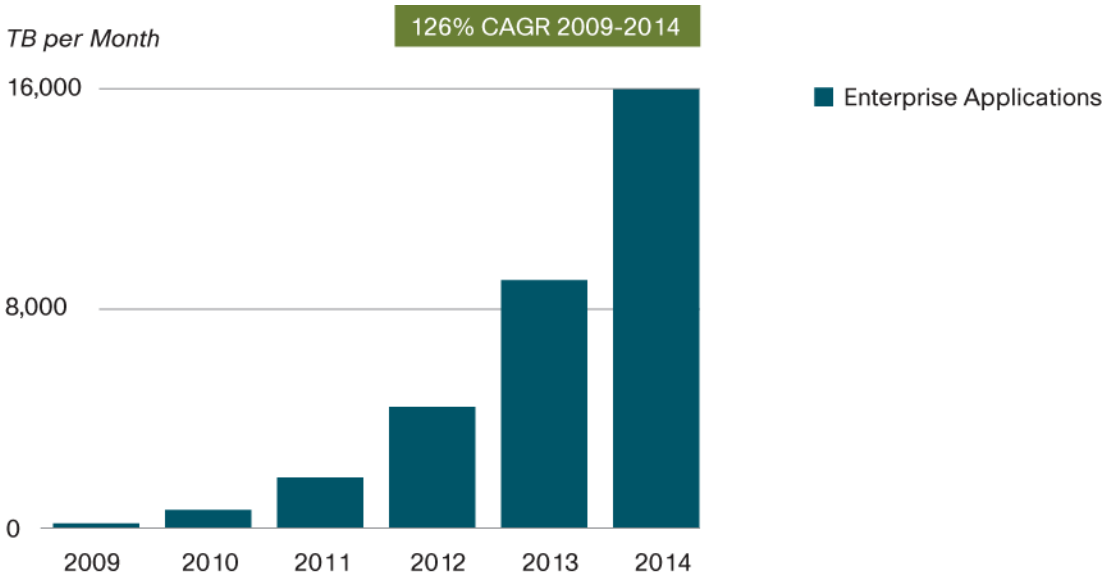
Figure 7. Global Business and Consumer Mobile Data Traffic Forecast, 2009-2014



Source: Cisco VNI Mobile, 2010

One of the key contributors to the growth of business mobile data traffic is enterprise mobile applications. Examples include fleet tracking of vehicles, assets and personnel, real time location of multiple devices and automated location based alerts. Initially assumed to be text and map image based, this category will evolve in volume of traffic as well as develop into multimedia grade mobile traffic.

Figure 8. Enterprise Mobile Applications on the Rise, 2009-2014



Source: Cisco VNI Mobile, 2010

Long-Term Outlook: Device Diversification and Ubiquitous Mobility

Mobile voice service is already considered a necessity by many, and mobile data, video, and TV services are now becoming an essential part of consumers' lives. Mobile subscribers are growing rapidly and bandwidth demand due to data and video is increasing. Mobile machine-to-machine (M2M) connections continue to increase. The next five years are projected to provide unabated mobile video adoption despite the recent economic downturn. Operators are rolling out increased bandwidth through Enhanced Data rates for GSM Evolution (EDGE), Evolution-Data Optimized (EV-DO), High-Speed Downlink Packet Access (HSDPA), and related upgrades. There is a need for backhaul capacity to increase in order for mobile broadband, data access, and video services to engage the end consumer as well as keep costs in check.

Deploying next-generation mobile networks requires greater service portability and interoperability. With the proliferation of mobile and portable digital devices, there is an imminent need for the network to allow for all these devices to be connected seamlessly. This openness will broaden the range of applications and services that can be shared, creating a highly enriched mobile broadband experience. The expansion of wireless ubiquity will lead to an increase of consumers who access and rely on mobile networks, creating a need for greater economies of scale and lower per-bit cost.

A win-win situation needs to be formed for the service providers and the over-the-top providers. New partnerships, ecosystems and strategic consolidations are expected as mobile operators, content providers, application developers (et al.) seek to monetize the video traffic that traverses mobile networks. Operators must solve the challenge of effectively monetizing video traffic while investing and increasing infrastructure capital expenditures. It is imperative to become more agile and disruptive by changing course in a short amount of time and provide innovative services to engage the Web 3.0 consumer. As the net neutrality regulatory process and business models of the operators evolve, there is an unmet demand for highest quality and speeds by consumers. With wireless technologies aiming to provide wired experiences, the next few years will be critical for operators and service providers to plan their future network deployments.

For More Information

Inquiries can be directed to traffic-inquiries@cisco.com.

Appendix A: The Cisco VNI Global Mobile Data Traffic Forecast

Table 7 shows a detailed breakout of the Cisco Global Mobile Data Traffic Forecast.

Table 7. Global Mobile Data Traffic 2009–2014

Mobile Data Traffic 2009–2014							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**CAGR 2009–2014**
By Application Category (TB per month)							
Video	35,897	113,094	298,981	652,846	1,322,219	2,336,732	**131%**
P2P	15,496	23,783	50,740	104,969	177,250	276,952	**78%**
Gaming	4,615	11,716	27,038	62,199	110,981	173,177	**106%**
VoIP	4,579	11,245	24,918	55,821	100,028	156,829	**103%**
Web/Data/Other	30,242	60,251	133,827	273,782	451,264	621,610	**83%**
By Device Type (TB per month)							
Non-Smartphones	7,179	15,678	33,965	63,938	103,350	142,612	**82%**
Smartphones	9,390	27,446	78,199	192,392	407,870	748,713	**140%**
Portables, Netbooks, Tablets	69,857	166,229	397,056	836,510	1,543,097	2,495,710	**104%**
Broadband Gateways	4,402	10,735	26,283	56,776	107,425	178,265	**110%**
By Geography (TB per month)							
North America	16,022	40,607	103,141	230,738	451,395	773,361	**117%**
Western Europe	29,236	69,962	168,084	356,244	661,233	1,076,290	**106%**
Asia Pacific	18,432	47,301	121,513	274,652	542,383	937,299	**119%**
Japan	18,159	39,425	84,792	158,127	252,393	342,132	**80%**
Latin America	4,267	10,494	25,908	56,424	107,612	179,976	**111%**
Central Eastern Europe	2,905	7,251	18,157	40,083	77,446	131,151	**114%**
Middle East and Africa	1,807	5,047	13,907	33,349	69,278	125,092	**133%**
Outer Space	0.0006	0.0064	0.0425	0.0923	0.1634	0.2934	**284%**
By Application (TB per month)							
Content Uploads	73	155	326	589	899	1,140	**73%**
Email	1,710	3,430	6,612	10,471	12,690	9,382	**41%**
Games Downloads	164	345	711	1,252	1,837	2,177	**68%**
Instant Messaging (IM)	0.02	0.04	0.09	0.18	0.32	0.48	**94%**
Enterprise Applications	274	733	1,948	4,535	9,193	16,258	**126%**
Mobile Internet	523	1,147	2,500	4,743	7,744	10,836	**83%**
Music Downloads	291	690	1,646	3,461	6,372	10,283	**104%**
Music Streaming	4,196	10,118	24,499	52,336	97,927	160,707	**107%**
Gaming	26	61	141	289	516	806	**98%**
Picoprojector	–	87	422	1,360	3,410	7,031	**–**
Picture Downloads	125	265	554	997	1,513	1,896	**72%**
Text Messaging	7	14	27	41	49	32	**36%**
Social Networking	810	1,960	4,760	10,201	19,148	31,524	**108%**
Application Downloads	14	33	79	168	313	511	**106%**
Tethering	599	3,313	12,592	36,758	87,406	174,317	**211%**
Video Downloads	37	85	199	410	737	1,158	**99%**
Video Messages	23	50	110	210	346	490	**85%**

Mobile Data Traffic 2009–2014							
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**CAGR 2009–2014**
Video Messages and Calling	5	11	23	44	73	103	**84%**
Video Streaming	7,694	16,143	34,767	73,590	147,818	293,690	**107%**
PC-Based Web/Email/Files	19,861	41,240	88,904	179,972	311,104	469,321	**88%**
PC-Based P2P	10,406	24,192	51,779	106,569	198,601	310,350	**97%**
PC-Based Internet Gaming	4,424	11,511	26,739	61,606	120,456	198,110	**114%**
PC-Based Internet Voice	4,851	11,438	25,428	56,672	111,586	183,882	**107%**
PC-Based Internet Video	31,218	87,094	237,400	502,402	913,143	1,424,220	**115%**
PC-Based Internet video communications	3,499	9,758	24,297	58,459	120,577	205,410	**126%**
Total (TB per month)							
Total Mobile Data Traffic	90,829	220,088	535,503	1,149,617	2,161,741	3,565,300	**108%**

Source: Cisco VNI Mobile, 2010

Definitions

Portables: This category includes laptops with mobile data cards, USB modems, and other portable devices with embedded cellular connectivity.

Appendix B: The Cisco VNI Global Mobile Data Traffic Forecast Methodology

The Cisco VNI Global Mobile Data Forecast relies in part upon data published by Informa Telecoms and Media, Infonetics, Cahners In-Stat, Datamonitor, Gartner, IDC, Dell'Oro, Synergy, Nielsen, comScore, and the International Telecommunications Union (ITU).

With the February 2010 update, the Cisco VNI methodology for the mobile data traffic forecast has been significantly expanded and enhanced. In general, the forecast methodology still begins with the number and growth of connections and devices, applies adoption rates for applications, and then multiplies the application's user base by Cisco's estimated minutes of use and kilobytes per minute for that application. Within that general outline, the methodology has evolved to link assumptions more closely with fundamental drivers, to use data sources unique to Cisco, and to provide a high degree of application, segment, geographic, and device granularity.

1. **Inclusion of fundamental drivers**. As with the fixed IP traffic forecast, each Cisco VNI Global Mobile Data Forecast update increases the linkages between the key assumptions and fundamental drivers such as available connection speed, pricing of connections and devices, computational processing power, screen size and resolution, and even device battery life. This update focuses on the relationship of mobile connection speeds and the kilobyte-per-minute assumptions in the forecast model. Proprietary data from the Cisco Global Internet Speed Test (GIST) application was used as a baseline for current-year smartphone connection speeds for each country.
2. **Device-centric approach**. As the number and variety of devices on the mobile network continue to increase, it becomes essential to model traffic at the device level rather than the connection level. This Cisco VNI Global Mobile Data Forecast update details traffic to smartphones, non-smartphones, laptops/tablets/netbooks, e-readers, digital still cameras, digital video cameras, digital photo frames, in-car entertainment systems, and handheld gaming consoles.
3. **Estimation of the impact of traffic offload**. The Cisco VNI Global Mobile Data Forecast model now quantifies the impact of dual-mode devices and femtocells on handset traffic. Proprietary data from Cisco's IBSG Connected Life Market Watch was used to model offload effects.
4. **Increased application-level granularity**. The forecast now offers a deeper and wider range of application granularity. The Cisco VNI Global Mobile Data Forecast, 2009–2014 white paper includes data on 20 separate applications, compared to the 9 application groups that were published in the previous version of the forecast.
5. **Business and consumer split**. Like the fixed IP traffic forecast, the Cisco VNI Global Mobile Data Forecast now separates business mobile data traffic from consumer mobile data traffic.
6. **Bottoms-up forecasting from the country level**. While country-level detail was included in last year's Cisco VNI Global Mobile Data Forecast, individual country forecasts were estimates based on the overall forecast of that region. This year's forecasting process started with individual country forecasts, which were subsequently aggregated into regional summaries.

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