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Intelligent Broadband Networks

Global Internet Phenomena Report

2H 2012

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Intelligent Broadband Networks

Executive Summary

The Global Internet Phenomena Report: 2H 2012 shines a light on fixed and mobile data networks around the world, identifying facts, fads, and the future trends that will shape the Internet's future. Within this report, we present a mix of high-level observations, regional-focused analysis, deep-dives into specific subjects, and educational tidbits. Communications service providers (CSPs) in particular are in the position to act on this information, but we believe that the findings will be of interest to a wide range of readers.

At the highest level, Real-Time Entertainment (comprised mostly of streaming video and audio) remains the largest traffic category on virtually every network we examined, continuing a trend that we expect to observe into the foreseeable future.

North America continues to lead in adoption of this traffic category, with almost two-thirds of downstream traffic during peak period being streaming audio or video. The dominance of Real-Time Entertainment is due in large part to the continued market leadership of Netflix, which now accounts for 33% of peak period downstream traffic. Competing video services such as Amazon (1.75%), Hulu (1.38%) and HBO Go (0.52%) are often mentioned in the same breath as Netflix, but the data shows these services are unlikely to challenge Netflix for market dominance anytime soon.

In other regions, YouTube continues to be largest single source of Real-Time Entertainment traffic in both fixed and mobile access technologies, making it the leading source of Internet video traffic in the entire world.

Home roaming (the use of tablets and smartphones in the home), which leads to more devices concurrently using the network, is one reason why median monthly usage on North America's fixed access networks has increased from 10.3 GB to 16.8 GB in just the past six months. Over the same period, mean monthly usage grew by over 70% increasing to 51.3 GB from 32.1 GB. Growing subscriber consumption is not limited to North America or fixed networks – in Asia-Pacific, mean mobile usage increased by almost 10% in six months.

This report includes analysis of fixed and mobile access networks in three regions, so readers will be able to see how traffic is evolving around the globe.

In addition to detailed analysis of global networks, we include focused featurettes that examine a particular emerging trend or observation. Interspersed among regional summaries, readers will find sections that tackle numerous topics including:

- Examining the new copyright alert system in the US
- Exploring the impact Apple product launches have on networks
- Predicting fixed and mobile growth in the US
- Reviewing the impact streaming the 2012 London Olympics in the US had
- Highlighting some important considerations of deploying LTE

The 2H 2012 Global Internet Phenomena Report also includes summaries of findings from five regional snapshots, all of which are available on www.sandvine.com:

- North America, Fixed Access
- North America, Mobile Access
- Europe, Fixed Access
- Europe, Mobile Access
- Asia-Pacific, Mobile Access

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Evolving Traffic Categories

Internet traffic is constantly evolving, and with that so must the Global Internet Phenomena Report.

Beginning with the 2H 2012 report, Sandvine will now be classifying traffic in ten distinct categories which better reflect how subscribers use various applications and services. The changes are inconsequential for most readers, but for keen observers and followers of our data, the table below gives an in-depth explanation of the new traffic categories.

Traffic Category	Description	Examples
Administration	Applications and services used to administer the network	DNS, ICMP, NTP, SNMP
Communications	Applications, services and protocols that allow email, chat, voice, and video communications; information sharing (photos, status, etc) between users	Skype, WhatsApp, iMessage, FaceTime, MSN Messenger
Filesharing	Filesharing applications that use peer-to-peer or Newsgroups as a distribution models	BitTorrent, eDonkey, Gnutella, Ares, Newsgroups
Gaming	Console and PC gaming, console download traffic, game updates	Nintendo Wii, Xbox Live, Playstation 2, Playstation 3, PC games
Marketplaces	Marketplaces where subscribers can purchase and download media including applications, music, movies, books, and software updates	Google Android Marketplace, Apple iTunes, Windows Update
Real-Time Entertainment	Applications and protocols that allow "on-demand" entertainment that is consumed (viewed or heard) as it arrives	Streamed or buffered audio and video (RTSP, RTP, RTMP, Flash, MPEG), peercasting (PPStream, Octoshape), specific streaming sites and services (Netflix, Hulu, YouTube, Spotify)
Social Networking	Websites and services focused on enabling interaction (chat, communication) and information sharing (photos, status, etc.) between users	Facebook, Twitter, LinkedIn, Instagram, Google+
Storage	Large data transfers using the File Transfer Protocol (FTP). Services that provide file-hosting, network back-up, and one-click downloads	FTP, Rapidshare, Mozy, zShare, Carbonite, Dropbox
Tunneling	Protocols and services that allow remote access to network resources, mask application identity, or provide encapsulation	Remote Desktop, VNC, PC Anywhere, SSL, SSH,
Web Browsing	Web protocols and specific websites	HTTP, WAP browsing

Table 1 - Updated Traffic Categories

North America, Fixed Access

Since our last study, North American fixed access networks have seen a significant increase in per-subscriber usage. Mean monthly usage has increased by almost 20 GB, rising from 32.1 GB to 51.3 GB in the past six months, while median usage increased at a similar pace jumping from 10.3 GB to 16.8 GB.

Monthly Consumption - North America, Fixed Access		
	Median	Mean
Upstream	1.4 GB	7.7 GB
Downstream	14.6 GB	43.6 GB
Aggregate	16.8 GB	51.3 GB
Downstream-to-Upstream Ratio	10.43	5.66

Table 2 - Mean Monthly Consumption (North America, Fixed Access)

We believe the bulk of this usage growth comes from the popularity of Real-Time Entertainment traffic which remains the dominant traffic category in the region and is responsible for over 65% of downstream bytes during peak period.

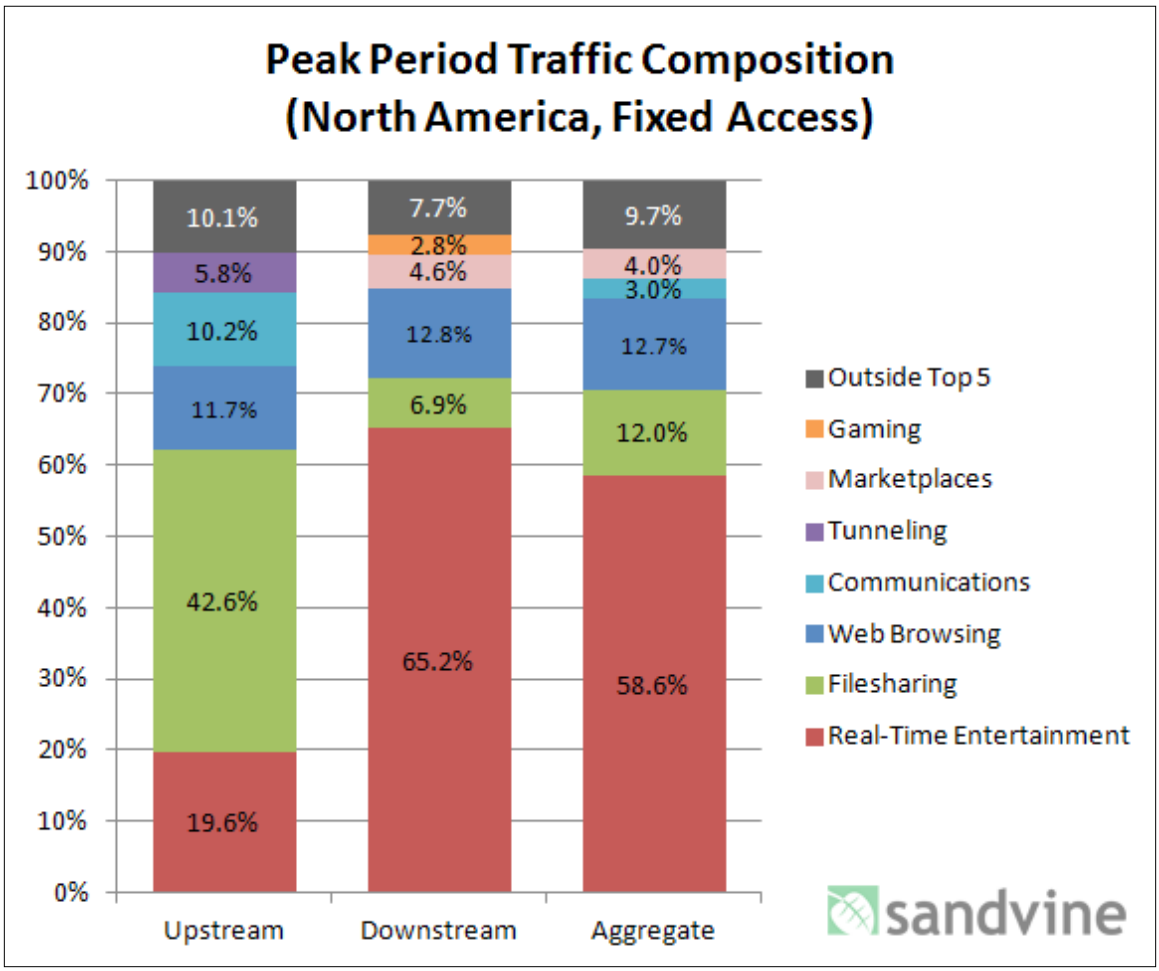

Figure 1 - Peak Period Aggregate Traffic Composition (North America, Fixed Access)

Netflix continues to be the unchallenged leader for traffic, now accounting for 33.0% of downstream traffic during peak period. While their share of traffic is virtually unchanged from our last report, the significant increase in subscriber consumption means that Netflix is continuing to increase the number of bytes they transmit each month.[1]

1. King, Rachel. "Netflix Streaming Tops 1 Billion Hours in Month for First Time." CNET News. CBS Interactive, 05 July 2012. Web. 01 Nov. 2012. <http://news.cnet.com/8301-1023_3-57467191-93/netflix-streaming-tops-1-billion-hours-in-month-for-first-time/>.

Competing video services such as Amazon (1.75%), Hulu (1.38%) and HBO Go (0.52%) are often mentioned in the same breath as Netflix, but the data shows these services are unlikely to challenge Netflix for market dominance anytime soon.

In absolute traffic level, BitTorrent has risen in volume by over 40%, but the application continues to exhibit a steady downward trend in overall traffic share, declining to 10.31% of total peak traffic from being 11.30% a half a year ago. As the most popular Filesharing application, BitTorrent's decline has had a major influence on the decline of the Filesharing (formerly P2P Filesharing) traffic category, which since 2010 has seen its traffic share decline from 19.2% to 12.0% of peak period aggregate traffic.

Did You Know?

Apple Photostream, iOS's automatic cloud photo backup, is the ninth largest application on the upstream.

	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	BitTorrent	36.8%	Netflix	33.0%	Netflix	28.8%
2	HTTP	9.83%	YouTube	14.8%	YouTube	13.1%
3	Skype	4.76%	HTTP	12.0%	HTTP	11.7%
4	Netflix	4.51%	BitTorrent	5.89%	BitTorrent	10.3%
5	SSL	3.73%	iTunes	3.92%	iTunes	3.43%
6	YouTube	2.70%	MPEG	2.22%	SSL	2.23%
7	PPStream	1.65%	Flash Video	2.21%	MPEG	2.05%
8	Facebook	1.62%	SSL	1.97%	Flash Video	2.01%
9	Apple PhotoStream	1.46%	Amazon Video	1.75%	Facebook	1.50%
10	Dropbox	1.17%	Facebook	1.48%	RTMP	1.41%
	Top 10	**68.24%**	**Top 10**	**79.01%**	**Top 10**	**76.54%**

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Table 3 - Top 10 Peak Period Applications (North America, Fixed Access)

With many cable and DSL providers considering implementing usage based billing, an examination of usage distribution is of interest to many. In North America, the top 1% of subscribers who make the heaviest use of the network's upstream resources account for 38.6% of total upstream traffic. The comparable downstream users account for 12.8% of downstream bytes. At the opposite end of the usage spectrum, the network's lightest 50% of users account for only 5.2 % of total monthly traffic.

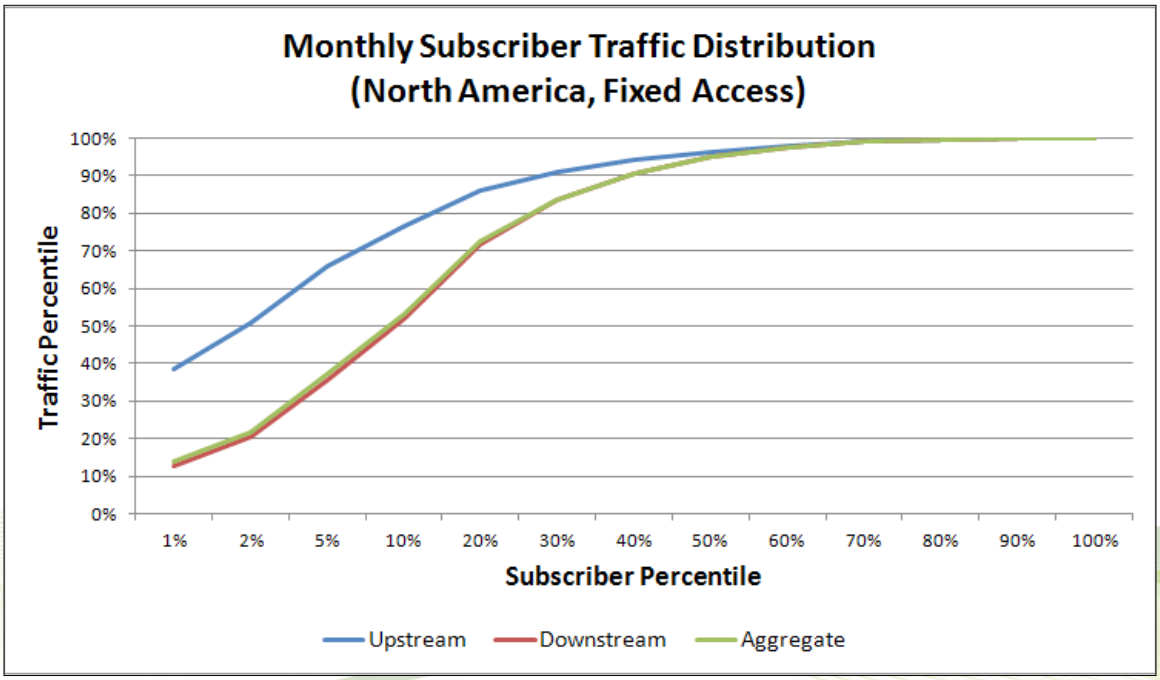

Figure 2 - Monthly Subscriber Traffic Distribution (North America, Fixed Access)

Six Strikes and You're Out….Understanding the US Copyright Alert System

On July 1st, 2012 television, movie, music businesses, as well as major communications service providers (CSPs) in the US (including AT&T, Verizon, Comcast, Cablevision and Time Warner Cable) started implementing a voluntary Copyright Alert System, often referred to as the "6-strikes rule", to reduce online copyright infringement in the US.[2] The agreement seeks to create balance between rights to privacy as well as rights to content, an argument which had put the CSPs in the middle.

Prior to this agreement, using the US Digital Millennium Copyright Act (DMCA), a content holder would typically go to a CSP and request the identity of a suspected infringer, and then notify them directly. This process has lead to a large number of blanket lawsuits and a large amount of operational effort for the CSP to lookup who had a specific IP address, which is why the Copyright Alert System was created.

Did You Know?

All piracy detection is done by a third party, not by your ISP.

So under the Copyright Alert System, how does the identification of suspected copyright infringement occur? Is your ISP snooping on you? In a nutshell: No. All detection is done by a third party, not by your ISP, and it is done off the network by companies generically termed 'media defenders'.

These media defenders follow torrent websites such as The Pirate Bay that are known to index large volumes of torrent files. Using the content on these sites, they obtain the names of the files, and then connect to the torrent trackers in order to obtain a list of the IP/port of subscribers who are downloading copyrighted material.

Under the new 'six-strikes model', the CSPs who are participants in the system now agree to notify their subscribers who have been identified as downloading infringing content on behalf of the media defender, but not to provide the identity of the subscriber to the media defender or attempt to determine what content is potentially being infringed.

With each alleged infraction, subscribers receive a notification from their CSP and once they receive a sixth-strike they may face mitigation measures that could include a temporary reduction in Internet speed or a redirection to a landing page with educational material.[3] Provided that a CSP has the technical means in place to contact particular subscribers or households, their is relatively little effort or involvement on their part.

Throughout the entire escalation process, the copyright owner still maintains their right to pursue legal action under the DMCA, although both CSPs and copyright owners who are participants in the alert system feel that there will be very few subscribers who after having received multiple alerts, will continue to infringe on copyrighted works.

The True Cost of Mobile Advertising

Ads are a hard thing to get away from when using the Internet. Content creators use ads on web pages, in videos, and especially in mobile apps to helps generate revenue from subscribers who use them.

With ads embedded in almost every way one can possibly use a smartphone, have you ever wondered how much traffic all that advertising generates each month and in turn what costs the subscribers?

Sandvine conducted a preliminary analysis on this phenomenon at several European mobile sites in an attempt to quantify just how much monthly traffic consisted of advertising.

This was done by gathering several leading adblock lists available online, and then counting the volume of traffic associated with the hosts on those lists.

It was revealed that, on average, approximately 2.5% of all mobile traffic in Europe consited of advertising elements. That works out to be approximately 6.0 MB of data each month per subscriber.

While that may not sound like a lot of data right now, as usage continues to increase, and video ads become more prevelant, we expects this number to increase significantly.

Sandvine will be keeping an eye on this trend, and will bring further analysis in future Global Internet Phenomena Reports.

2. Kelly, Heather. "Internet Providers to Begin Warning Customers Who Pirate Content - CNN.com." CNN. Cable News Network, 24 Oct. 1970. Web. 01 Nov. 2012. <http://www.cnn.com/2012/10/18/tech/web/copyright-alert-system/index.html>.
3. Unknown. "Copyright Alert System (CAS)." Center for Copyright Information. Center for Copyright Information, n.d. Web. 1 Nov. 2012.

North America, Mobile Access

Unlike our examination of fixed access networks in North America, monthly usage on mobile networks has experienced only minor growth. In the past six months Sandvine has observed mean monthly usage increasing moderately from 312.8 MB to 317.2 MB. More noticeable change can be seen in the median which has increased to 32.9 MB from 25.5MB just six months ago. This increase in median usage was a phenomenon we observed in our last study and believe it is closely tied to increasing first time adoption of smartphones by subscribers whose usage is well below that of smartphone power users that consume hundreds of megabytes each month.

Monthly Consumption - North America, Mobile Access		
	Median	Mean
Upstream	5.6 MB	34.0 MB
Downstream	26.1 MB	283.2 MB
Aggregate	32.9 MB	317.2 MB
Downstream-to-Upstream Ratio	4.67	8.33

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Table 4 - Monthly Consumption (North America, Mobile Access)

During peak period, Real-Time Entertainment traffic is far and away the most dominant traffic category, accounting for essentially half of all bytes sent and received on the network. Social Networking applications also continue to be very well represented on the network, which speaks to their popularity with subscribers as these applications in this category typically generate far less traffic than those that stream audio and video.

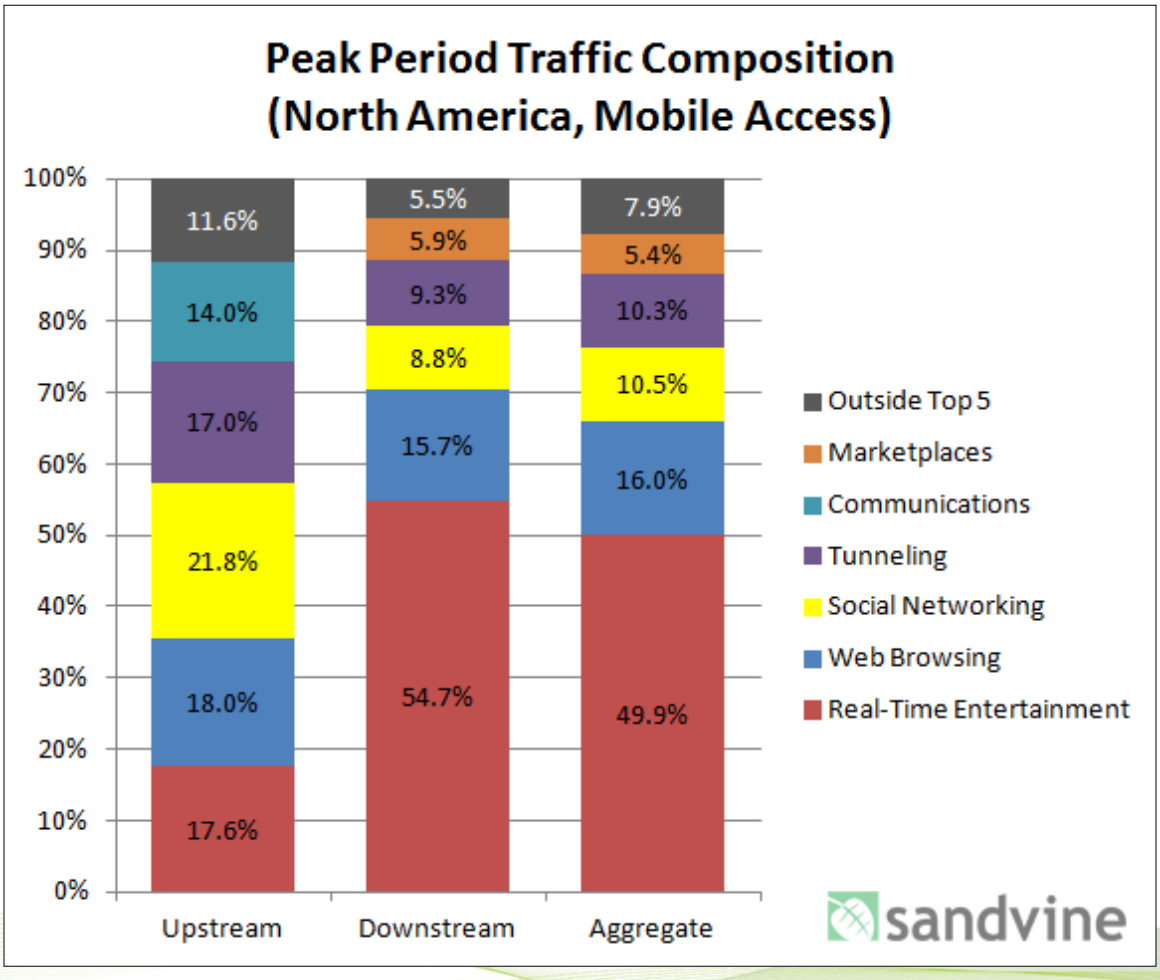

Figure 3 - Peak Period Aggregate Traffic Composition (North America, Mobile Access)

Much in the way Netflix has established themselves as the unquestioned traffic leader on fixed networks in North America, YouTube has entrenched itself as the dominant application on mobile networks, now more than doubling the second highest ranked application (HTTP) during peak period.

Streaming audio, a form of Real-Time Entertainment continues to grow in popularity among subscribers with Pandora Radio leading the way with 5.15% of downstream traffic peak period. Interestingly, Pandora Radio's share of traffic over a 24-hour period is actually higher than during peak period, accounting for 6.27% of daily downstream traffic. This phenomenon is likely due to subscribers using the service consistently throughout the day, while some other applications might have their usage concentrated during peak period.

	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	Facebook	15.43%	YouTube	30.97%	YouTube	28.03%
2	HTTP	13.60%	HTTP	14.37%	HTTP	14.28%
3	SSL	13.26%	SSL	8.92%	SSL	9.49%
4	YouTube	7.91%	MPEG	8.90%	Facebook	7.95%
5	Google Talk	2.23%	Facebook	6.83%	MPEG	7.93%
6	MPEG	1.92%	Pandora Radio	5.15%	Pandora Radio	4.74%
7	Pandora Radio	1.90%	Google Play	3.27%	Google Play	2.96%
8	Skype	1.56%	Netflix	2.69%	Netflix	2.42%
9	SMTP	1.52%	iTunes	1.46%	iTunes	1.34%
10	Yahoo! Mail	1.49%	Flash Video	1.18%	Flash Video	1.05%
	Top 10	**60.82%**	**Top 10**	**83.74%**	**Top 10**	**80.19%**

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Table 5 - Top 10 Peak Period Applications (North America, Mobile Access)

From a traffic distribution standpoint, the top 1% of subscribers who make the heaviest use of the network's upstream resources account for 23.9% of total upstream traffic. The comparable downstream users account for 18.7% of downstream bytes. At the opposite end of the usage spectrum, the network's lightest 50% of users account for only 0.8% of total traffic in large part due to the number of feature phones still in use by subscribers.

Did You Know?

Pandora Radio accounts for 6.27% of daily downstream traffic.

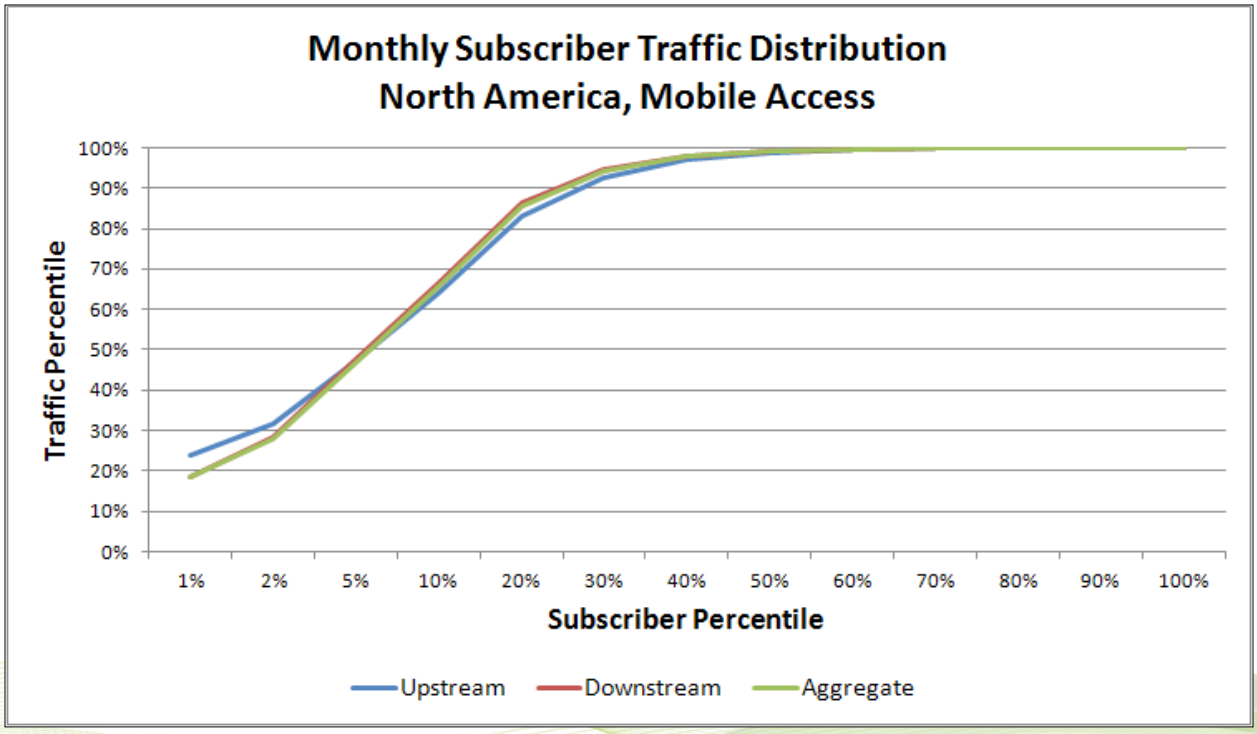


Figure 4 - Monthly Subscriber Traffic Distribution (North America, Mobile Access)

How Do You Like Them Apples?

"People who are really serious about software should make their own hardware." - Alan Kay

On more than one occasion, Apple has mentioned the above quote during their new product introductions. They are of the belief that by making both the hardware and the software, they can offer a superior product that better suits their users.

What that also means is that whenever Apple releases a hardware new product, a bevy of software updates are also released to better support existing products already in the market.

Below is a chart made using data from fixed access networks in the US that shows a comparison of iTunes and Mac App Store traffic from the launch day of iOS 6 with that of the average levels of the previous two Wednesdays in September.

Did You Know?

The livestream of the iPad Mini launch event also resulted in a significant spike in traffic.

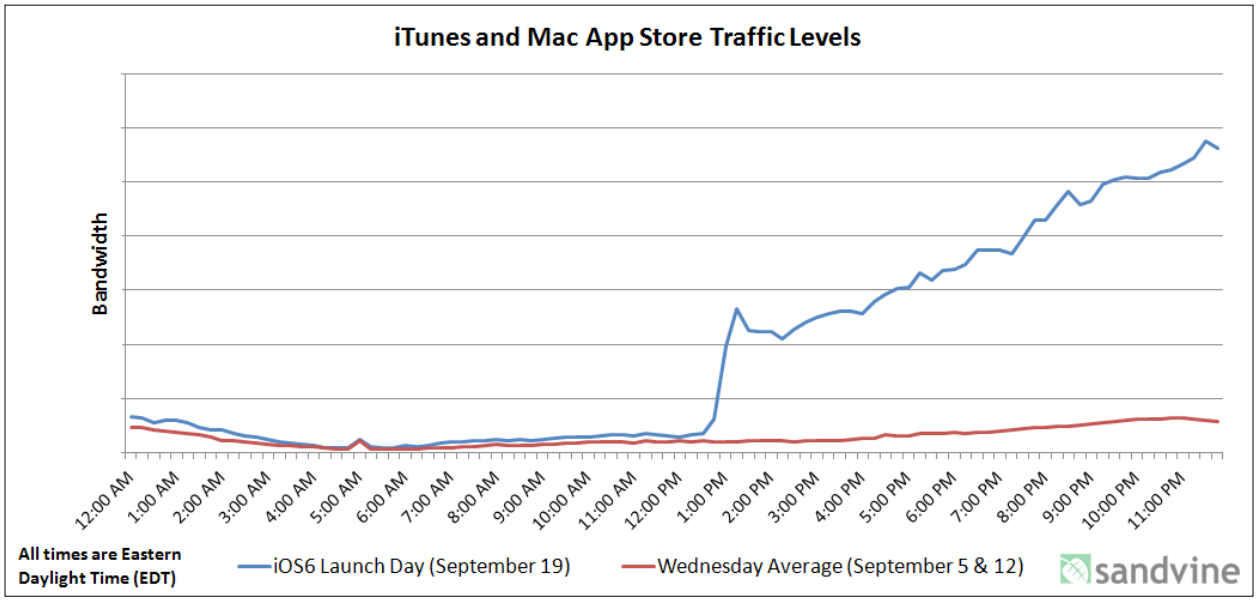


Figure 5 - iOS 6 Launch Day Traffic Spike

Notice that huge spike at 1:00PM EDT? That is when iOS 6 was officially released to the public.[4] This massive increase in traffic was then sustained throughout most of the day, and actually escalated as people got home from work in the evening. In total the release of iOS 6 resulted in traffic from Apple's servers being over 9 times their average Wednesday traffic levels.

This surge in traffic shouldn't come as a surprise for network operators, as Apple users have a history of driving huge spikes in traffic on product launch days. Below is a chart showing one such spike when Mac OS 10.8 Mountain Lion launched in late July of 2012[5] and resulted in a six-fold traffic increase. This phenomenon was not limited to North America. Many of our customers worldwide also reported seeing a massive increase in Apple traffic.

4. Elmer-DeWit, Philip. "Apple's IOS 6 Due for Release at 1 P.m. Eastern, 10 A.m. Pacific."Apple 2.0. Cnn.com, 19 Sept. 2012. Web. 01 Nov. 2012. <http://tech.fortune.cnn.com/2012/09/19/apples-ios-6-due-for-release-at-1-p-m-eastern-10-a-m-pacific/>.
5. Whittaker, Zack. "Apple Releases OS X 10.8 Mountain Lion: What You Need to Know."ZDNet. N.p., 25 July 2012. Web. 01 Nov. 2012. <http://www.zdnet.com/apple-releases-os-x-10-8-mountain-lion-what-you-need-to-know-7000001372/>.

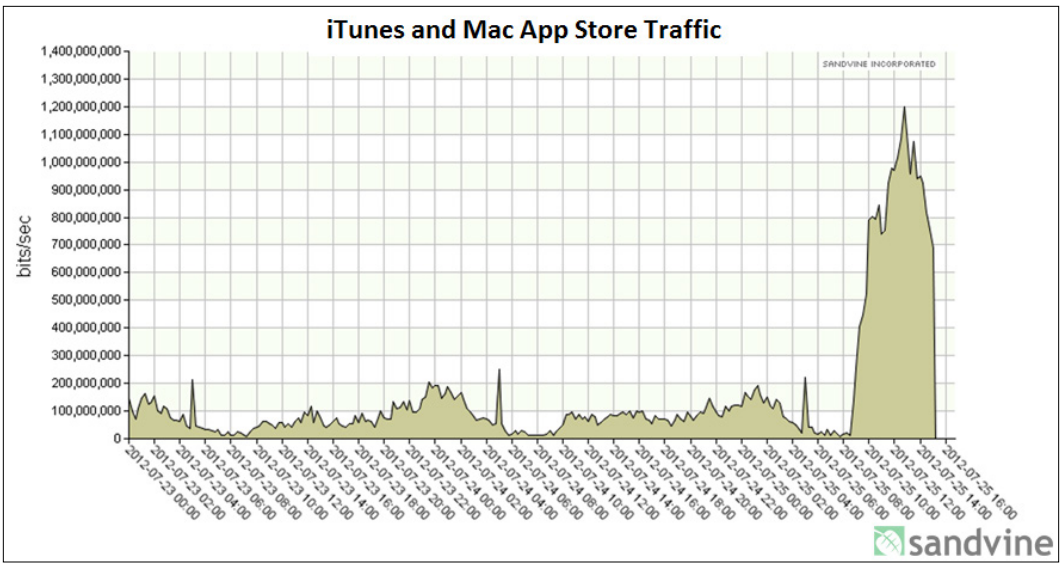


Figure 6 - iTunes and Mac App Store - OS X 10.8 Launch

So what's the lesson to be learned here? CSPs should be just as interested in Apple's next big thing as consumers are.

Fanboy Face Off

A person's smartphone is something they are fiercely passionate about.

Even the most non-tech savvy smartphone owner likely has their favorite apps, and probably has an opinion on what their favorite platform is (hint: it's likely the one they own).

When it comes to analyzing broadband trends, it can be challenging to conduct an analysis because of the numerous ways the data can be examined. Is it better to examine platforms (iOS, Windows, Android, BlackBerry), or to examine device manufactures (Samsung, Motorola, HTC, Apple, Research In Motion)?

All ways of examining the data have their merits, but for the purpose of this analysis, Sandvine decided to examine the usage of two flagship devices: Samsung's Galaxy S III running Android and Apple's iPhone 4S running iOS.

(Note: data collection occurred in September 2012 on a European carrier, so the iPhone 4S was chosen as the iPhone 5 had yet to be released)

Looking at just the number of handsets on the network, the iPhone 4S outnumbered the Galaxy SIII by over 700%. This difference is influenced by a number of factors including subscriber preference, device release date (Galaxy S III released in May 2012[1], iPhone 4S in October 2011[2]), and marketing initiatives conducted by the carrier themselves.

The more interesting figure, however, is how subscribers use these devices on a daily basis. On this network, daily usage of iPhone (15.8 MB) was double that of Samsung Galaxy S III users (7.8 MB).

Device	Mean Daily Usage
Apple iPhone 4S	15.8 MB
Samsung Galaxy S III	7.8 MB

Does this mean that across the world Apple users consume twice as much data as users on Android or Samsung manufactured devices? No. This data provides just a snapshot of one network, and it demonstrates the need for carriers to have similar insight so that they can better tailor their service offerings to subscribers no matter their smartphone allegiance.

1. Ziegler, Chris. "Samsung Galaxy S III Announced: Available in Europe May 29th, North America In June." The Verge. Vox Media, 3 May 2012. Web. 01 Nov. 2012. <http://www.theverge.com/2012/5/3/2996619/samsung-galaxy-s-iii/in/2760821>.
2. Millian, Mark. "Apple Unveils the Faster IPhone 4S." CNN. N.p., 04 Oct. 2011. Web. 01 Nov. 2012. <http://articles.cnn.com/2011-10-04/tech/tech_mobile_apple-iphone-announcement_1_iphone-siri-apple-co-founder?_s=PM:TECH>.

An Olympic Sized Impact in the US

One of the biggest questions going into the Olympics was how much of an impact streaming the games would have on the network. This was especially a consideration for North American networks because the 5-8 hour time delay behind London meant the majority of events would be taking place during business hours, which for many makes streaming a more viable option than watching on broadcast television.

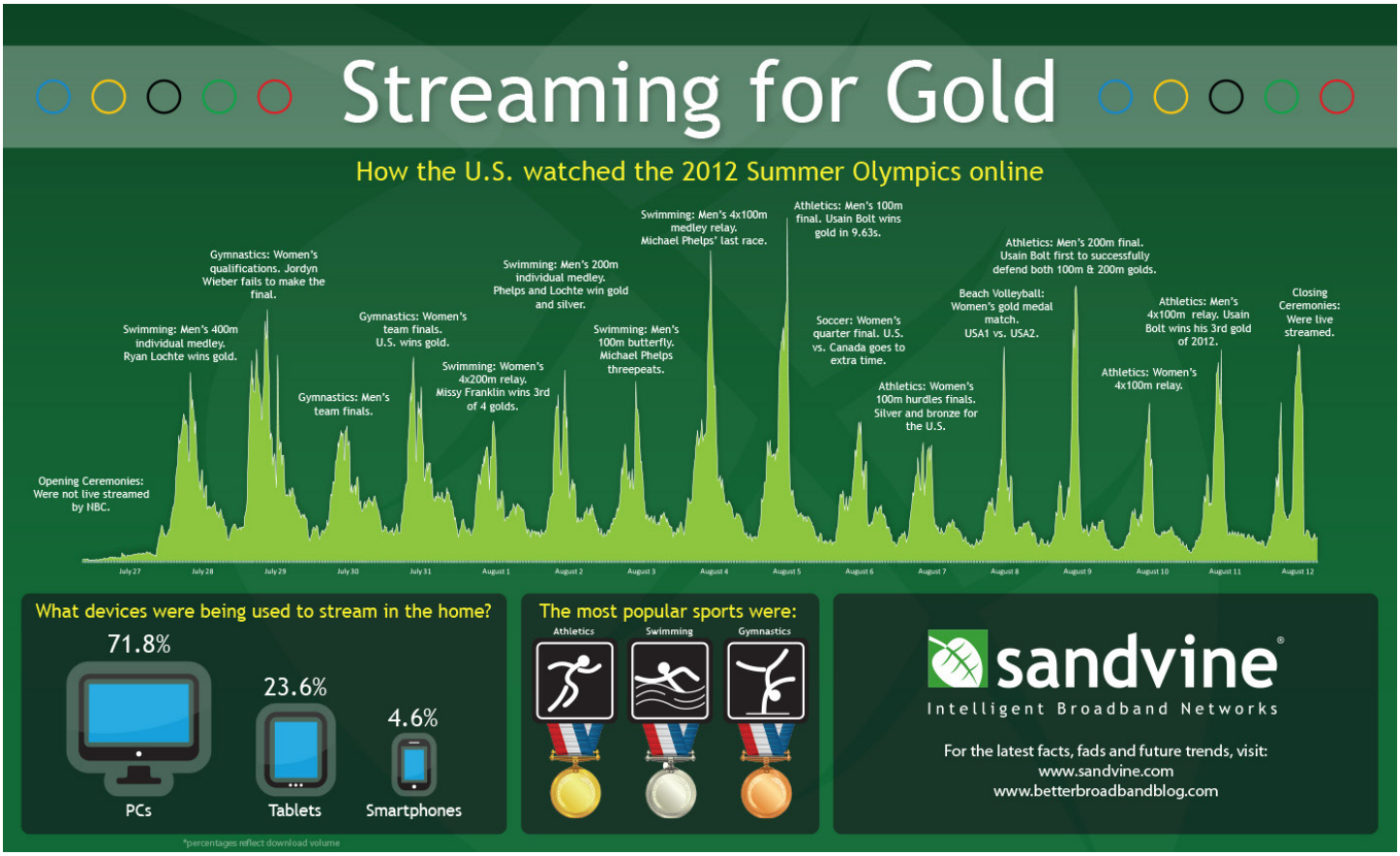
During the first week of the games, at its peak Olympic streaming traffic accounted for almost 22% of total network traffic. The event which caused the largest spike was the men's 100m track race, which eventually turned out to be the event that generated the greatest demand during the games.

At its peak daily levels, Olympic streaming traffic on average accounted for between 8-12% of network traffic in the US.

Did You Know?

At peak levels, Olympic streaming accounted for 8-12% of network traffic in the US.

While this is a significant amount of traffic, one key consideration to keep in mind is that because of the difference in time zones, most of the streaming occurred outside the traditional peak hours. This means, that while being responsible for a significant share of traffic throughout the day, most networks were perfectly able to carry the extra traffic.



Netflix Goes For Gold

In their Q2 2012 financial results, Netflix warned that "the Olympics are likely to have a negative impact on Netflix viewing and sign-ups".[6] The rationale behind this warning seemed sound, with Netflix's traffic potentially being impacted as people chose to watch an event that occurs once every four years over that of a movie or TV show they could stream at anytime.

So what actually happened? The chart below compares Netflix traffic levels from the opening weekend of the games, with the average traffic levels of the previous three weekends in July. Contrary to their own prediction, Netflix traffic remained relatively consistent with the other weekends in July.

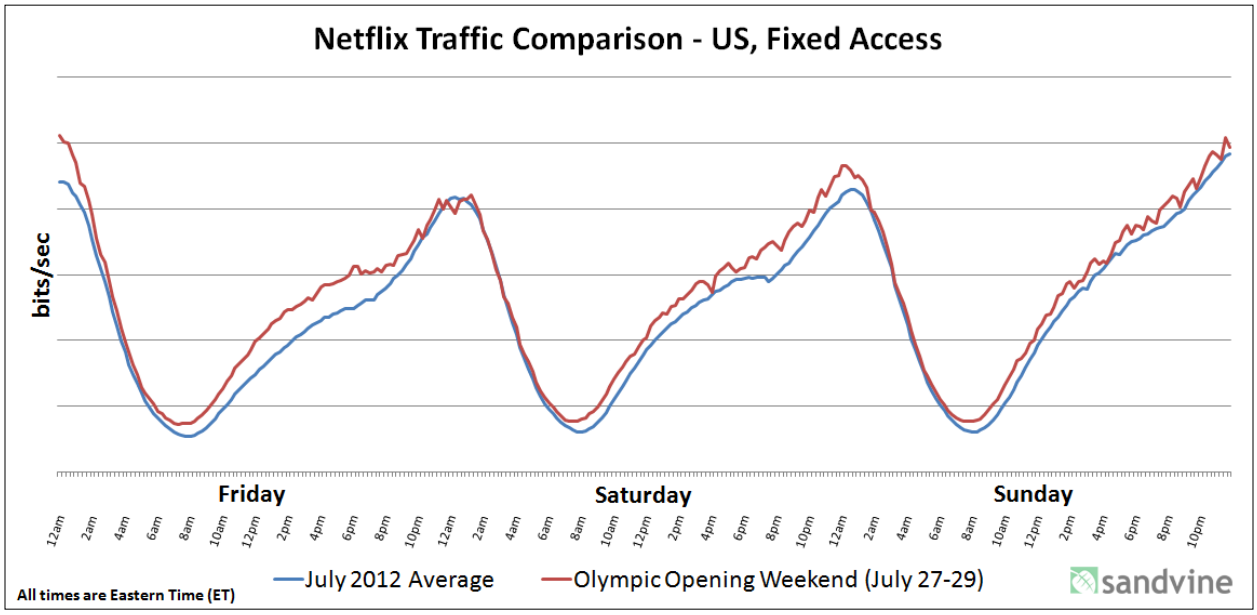


Figure 7 - Netflix Olympic Traffic Comparison

Finding the Right Sized Service Tier

Many fixed-access providers around the world have implemented, or are considering implementing usage based billing.

One of the biggest challenges in doing so is determining different service tiers to meet the varying needs and consumption habits of subscribers.

Based on fixed access consumption in the US, the table below details the percentage of subscribers who fall into different potential service tiers.

Potential Tier Size	% of Subscribers
>1TB	0.07%
>500 GB	0.5%
>300 GB	1.5%
>200 GB	4.1%
>100 GB	11.2%
>50 GB	22.4%
>10 GB	56.3%
>1 GB	86.7%

6. "Letter to Shareholders." Netflix Investor Relations. N.p., n.d. Web. 1 Nov. 2012. <http://files.shareholder.com/downloads/NFLX/1996851208x0x585175/818f7f39-011e-4227-ba2f-7d30b8ad3d23/Investor%20Letter%20Q2%202012%2007.24.12.pdf>.

A Hot-Spotlight

In previous Global Internet Phenomena Reports, Sandvine has focused exclusively on reporting fixed access usage metrics from networks where the majority of usage takes place within a subscriber's home. For the 2H 2012 report, Sandvine was given permission to collect and analyze data from one of our customers who operates a network of Wi-Fi hotspots in European coffee shops and restaurants.

Did You Know?

Traffic on these Wi-Fi networks peaks at 2pm, far earlier than traditional fixed access networks.

On most fixed access networks, traffic peaks in the evening after subscribers return home from work. On this Wi-Fi hotspot network however, the traffic patterns are very different with subscriber levels peaking around noon, and traffic levels peaking around 2 PM.

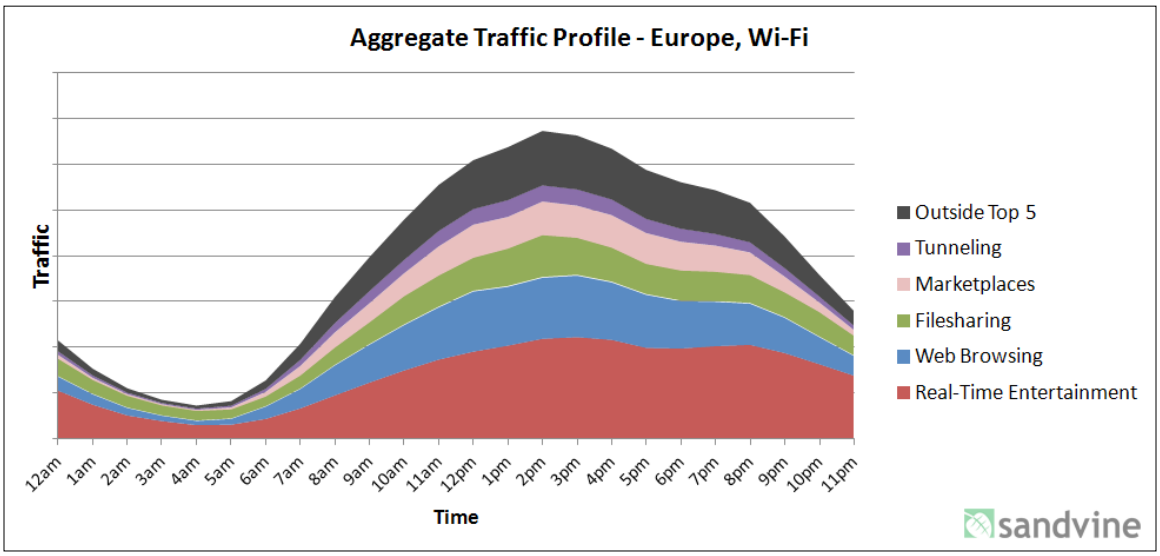


Figure 8 - Aggregate Traffic Profile (Europe, Wi-Fi)

While the time when subscribers use a Wi-Fi network varies greatly from a traditional fixed network, subscriber behavior does not. Real-Time Entertainment is still the highest ranked traffic category accounting for 34.76% of downstream traffic during peak period. This number is slightly lower than what is observed elsewhere in the region, but given the environments where Wi-Fi hotspots are often found (restaurants, airports, etc.), streaming audio and video might not always be practical to use.

	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	HTTP	13.5%	HTTP	16.2%	HTTP	15.6%
2	BitTorrent	11.8%	YouTube	14.4%	YouTube	13.0%
3	SSL	8.44%	BitTorrent	9.88%	BitTorrent	10.2%
4	YouTube	7.53%	iTunes	8.77%	iTunes	7.89%
5	Facebook	4.57%	Facebook	3.42%	SSL	3.89%
6	iTunes	4.21%	Regional Streaming Service	3.42%	Facebook	3.65%
7	Skype	3.39%	SSL	2.81%	Regional Streaming Service	3.08%
8	Dropbox	2.13%	MPEG	2.36%	MPEG	2.16%
9	Regional Streaming Service	1.73%	Flash Video	2.29%	Flash Video	2.02%
10	MPEG	1.35%	RTMP	1.50%	RTMP	1.35%

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Table 6 - Top 10 Peak Period Applications (Europe, Wi-Fi)

Note: "Regional Streaming Service" refers to a local Real-Time Entertainment application identified by Sandvine, but whose name has been changed to ensure anonymity.

Projecting Mobile Traffic Trends in the United States

What traffic will North America's mobile networks be carrying in the future? It's always both fun and informative to take a look, and we've done so again in Figure 9. These projections are based on a bottom-up analysis of measured traffic profiles, observed traffic trends, device usage characteristics, device market share, and a number of informed assumptions:

- The vast majority of tablet traffic will not be carried on mobile networks
- Smartphone market share will continue to grow, but feature phones will continue to make up a significant part of the North American subscriber base[7]
- Machine-to-Machine traffic will slowly, but eventually, emerge (but much slower than many are predicting)

When the dust from the number-crunching has settled, a number of interesting projections appear:

- Video and audio streaming applications will account for close to 70% of mobile usage by 2019
- Given enough time, Marketplaces will rise to become the second-largest source of mobile traffic
- Dedicated Web Browsing will gradually be replaced by use-specific apps (which contribute to other categories)
- Communications (including e-mail, instant messaging, voice-over-IP, and video calls) will account for a significant portion of traffic (recall that in the LTE world, everything is IP)

What about Storage, why is it so low? Well, a large (and increasing) amount of this traffic is carried via secure tunnels, so it is frequently indistinguishable from things like mobile banking and other encrypted applications. In fact, we've observed on many mobile networks a scenario in which a major mobile OS update triggers a step-function increase in levels of SSL traffic by introducing features like file synchronization over SSL.

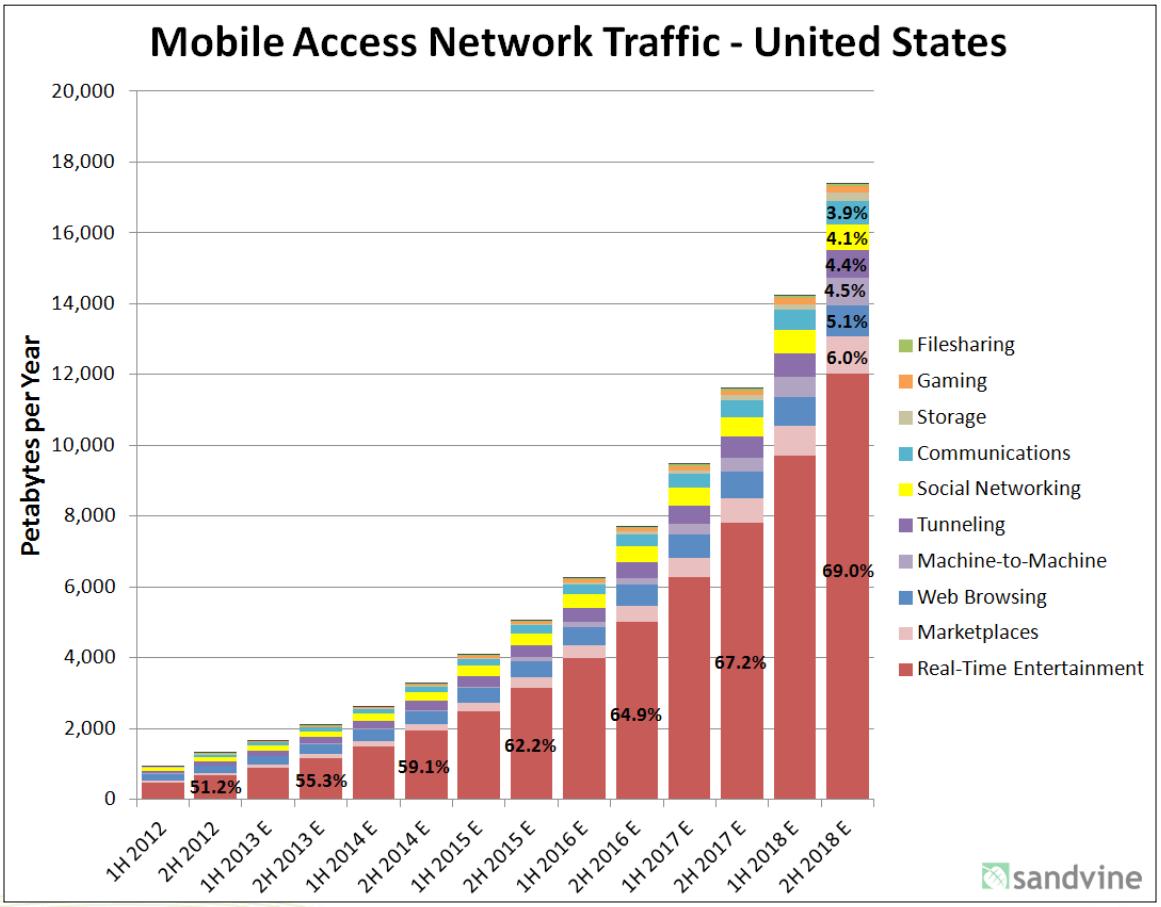

Figure 9 - Projection of Mobile Access Network Traffic in the United States

7. Focusing on sales figures alone can distract from the fact that there are many, many feature phones on North America's networks

Europe, Fixed Access

Europe presents a mix of mature and emerging markets, with a cultural, economic, technological, and linguistic diversity that combine to create traffic patterns that can prove to be challenging to roll-up into a regional analysis.

> **Did You Know?**
>
> Netflix in the UK accounts for 2.51% of peak downstream traffic.

One aspect that all countries examined have in common is a thirst for streaming and video, and that has made Real-Time Entertainment the top traffic category, accounting for 38.5% of peak downstream traffic in the region. Depending on the specific country however, this figure could range anywhere from 33.5% to over 50% of downstream traffic. This fluctuation in share is due in large part to the availability of legitimate over-the-top (OTT) video services in the varying countries; based on our observations, countries with lower Real-Time Entertainment figures typically have higher Filesharing traffic, which leads us to believe that subscribers are likely using applications like BitTorrent to procure audio and video content otherwise not available in their region.

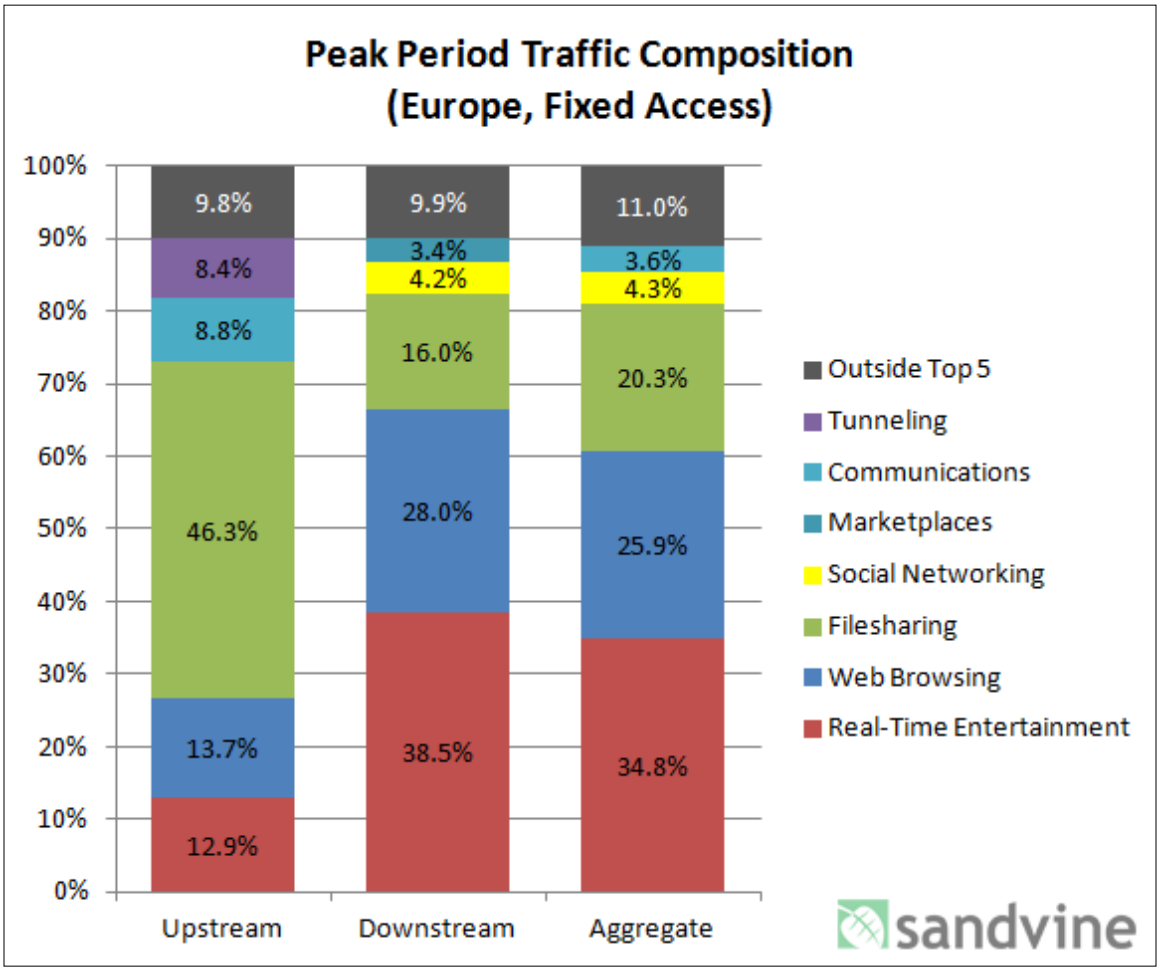

Figure 10 - Peak Period Traffic Composition (Europe, Fixed Access)

Generally, European networks have a consistent set of dominant applications and services that are available in each region which account for 80-85% of all traffic, and then a set of very local websites and region-restricted applications that make up the remainder. This can be seen in practice in the list of top 10 applications for the region, all of which have global availability.

Looking at a per country basis however, regionally restricted Real-Time Entertainment providers such as RTE Player (1.23%) in Ireland and BBC iPlayer (5.10%), Netflix (2.51%), Lovefilm (1.46%), and 4oD (1.10%) in the UK can generate significant traffic volumes to easily be among the top downstream applications within their home country. However because of their regional restrictions, those services fail to be among the continent's top 10.

	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	BitTorrent	31.8%	HTTP	26.3%	HTTP	24.1%
2	HTTP	11.4%	YouTube	22.3%	YouTube	20.1%
3	eDonkey	11.2%	BitTorrent	12.1%	BitTorrent	14.9%
4	YouTube	6.66%	Flash Video	3.95%	eDonkey	3.98%
5	Skype	6.00%	Facebook	3.71%	Facebook	3.76%
6	Facebook	4.07%	RTMP	2.90%	Flash Video	3.54%
7	Teredo	3.44%	eDonkey	2.78%	RTMP	2.63%
8	SSL	3.09%	MPEG	2.53%	MPEG	2.26%
9	Flash Video	1.09%	iTunes	2.25%	Skype	2.13%
10	RTMP	1.01%	Skype	1.48%	iTunes	2.04%
	Top 10	**79.76%**	**Top 10**	**80.30%**	**Top 10**	**79.44%**

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Table 7 - Top 10 Peak Period Applications (Europe, Fixed Access)

Projecting Fixed Traffic Trends in the United States

What traffic will North America's fixed networks be carrying in the future? It's always both fun and informative to take a look, and we've done so again in Figure 11. These projections are based on a bottom-up analysis of measured household traffic profiles, observed traffic trends, and a number of informed assumptions:

- Home roaming will play a prominent role in fixed access network profiles
- Legal streaming sites and services will remain active and well-stocked with compelling content
- Filesharing is here to stay, even if only within a dedicated community
- Video calls will never be commonplace (who wants to put on nice clothes and style their hair to make a call?)

What emerged is a future in which:

- Real-Time Entertainment applications dominate fixed access networks, accounting for two-thirds of total data usage in 2018, driven largely by ubiquitous integration between devices (e.g. smart TVs, set-tops, game consoles) and streaming services
- Filesharing and Web Browsing vie to be the second-largest source of traffic, with Web Browsing driven mostly by phones and tablets and Filesharing remaining the domain of traditional computing devices like laptops

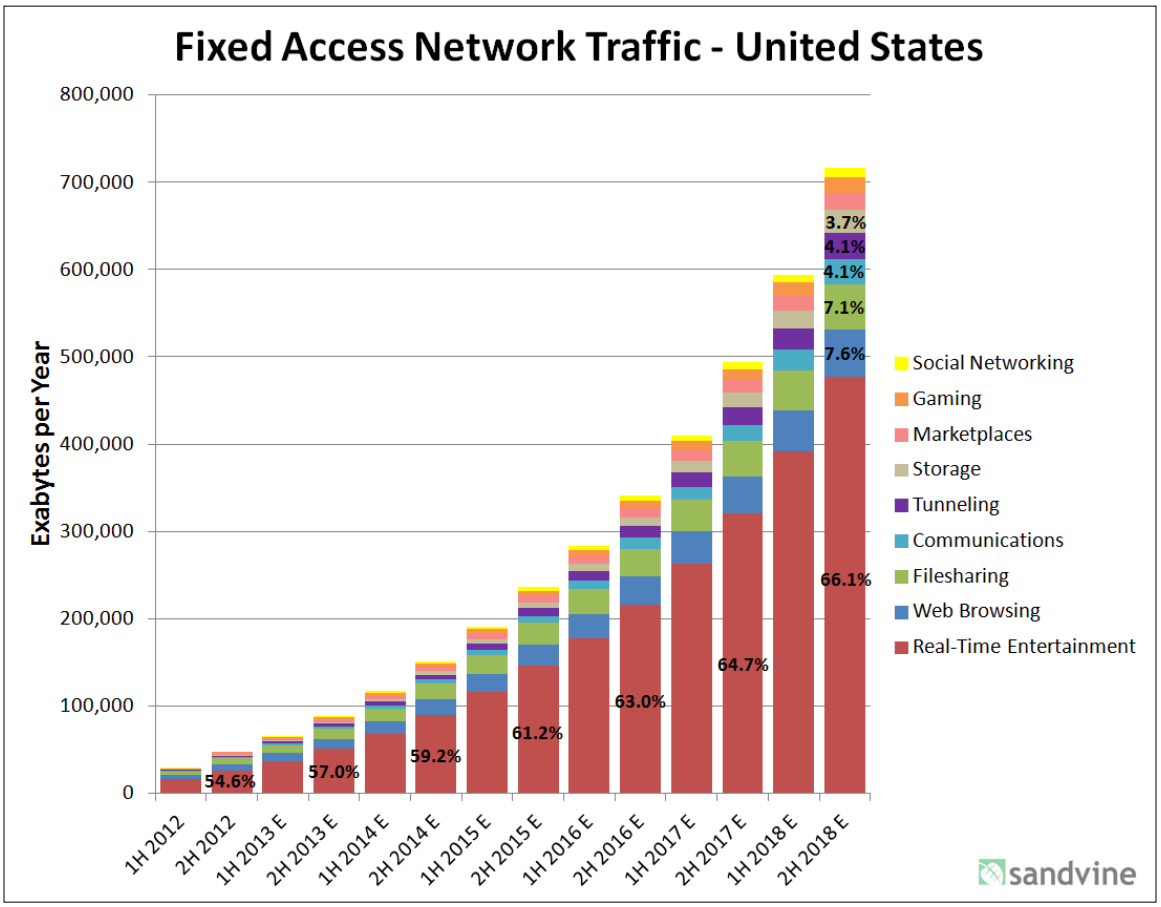

Figure 11 - Projection of Mobile Access Network Traffic in North America

Netflix Continues to Define a Market

"Internet TV is the future of television, and we are leading the change"

So said Netflix' CEO, Reed Hastings, when announcing the company's third-quarter 2012 financial results[8].

Since we initially revealed to the world the extent of Netflix' online dominance in the United States, back in 2010[9], we've carefully tracked the service's continued growth. Even in the face of increased competition from the likes of Amazon Prime, HBO Go and Hulu, Netflix continues to define the market for long-duration video streaming in North America.

> **Did You Know?**
>
> Netflix continues to define the market for long-duration video streaming in North America.
>
> Netflix traffic is more than 20x that of Hulu.

In the past six months, Netflix has crossed the 25 million subscriber mark in North America[10], increased service differentiation by focusing on the Just for Kids[11] experience, weathered competition from a certain large mid-year sporting event[12], committed to captioning all videos by 2014[13], and announced their OpenConnect network[14]. In July, Netflix announced that they had crossed an important threshold: 1 billion hours of video streamed in a single month[15].

In fact, Netflix has kept pace with (and largely driven) the overall growth of fixed access Internet traffic in North America for the past few years, maintaining a remarkably consistent share of peak period downstream traffic in that time. If observed trends with other applications continue, we expect our next report to show a slight decline in this share, but Netflix has surprised us before and has the potential to do so again.

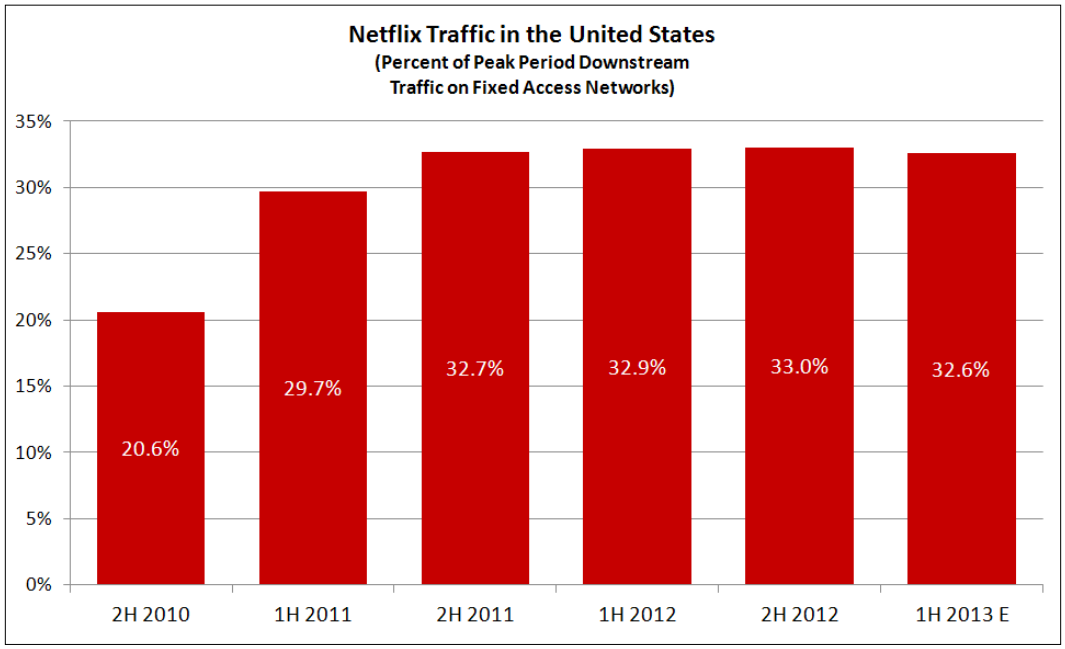

Figure 12 - Netflix Traffic on Fixed Access Networks in the United States

8. Lieberman, David. "Netflix Shares Fall After Q3 Report Shows Lighter Than Expected Sub Growth." Deadline.com, 23 Oct. 2012. Web. 01 Nov. 2012. <http://www.deadline.com/2012/10/netflix-shares-fall-after-q3-report-shows-lighter-than-expected-sub-growth/>.
9. Sandvine. "Sandvine Internet Report: Average Is Not Typical." N.p., 23 Mar. 2010. Web. 01 Nov. 2012. <http://www.sandvine.com/news/pr_detail.asp?ID=288>.
10. Ingarham, Nathan. "Netflix Surpasses 25 Million Streaming Subscribers in TheÂ US." The Verge. Vox Media, 23 Oct. 2012. Web. 01 Nov. 2012. <http://www.theverge.com/2012/10/23/3544740/netflix-25-million-streaming-us-subscribers-q3-2012-earnings>.
11. Toff. "The Official Netflix Blog : US & Canada: Netflix Launches Just for Kids." The Official Netflix Blog : US & Canada. N.p., 16 Aug. 2011. Web. 01 Nov. 2012. <http://blog.netflix.com/2011/08/netflix-launches-just-for-kids.html>.
12. Tooley, Matt. "Sandvine's Better Broadband Blog : Super Bowl Causes a Super Dip in Internet Traffic." Sandvine, 7 Feb. 2012. Web. 01 Nov. 2012. <http://www.betterbroadbandblog.com/2012/02/super-bowl-causes-a-super-dip-in-internet-traffic/>.
13. Alvarez, Edgar. "Netflix to Bring Closed Captioning to All Video Content by 2014." Engadget. N.p., 11 Oct. 2012. Web. 01 Nov. 2012. <http://www.engadget.com/2012/10/11/netflix-closed-captioning-2014/>.
14. Florance, Ken. "The Official Netflix Blog : US & Canada: Announcing the Netflix Open Connect Network." N.p., 4 June 2012. Web. 01 Nov. 2012. <http://blog.netflix.com/2012/06/announcing-netflix-open-connect-network.html>.
15. Liedtke, Michael. "Netflix Users Watched a Billion Hours Last Month." USATODAY.COM. N.p., 4 July 2012. Web. 01 Nov. 2012. <http://usatoday30.usatoday.com/tech/news/story/2012-07-03/netflix-online-video/56009322/1>.

Following the publication of each Global Internet Phenomena Report, we are inundated with questions about how Netflix' traffic levels compare to their competitors in the long-duration video streaming space. In the past, we haven't made a direct point of publishing these statistics, because they aren't particularly compelling; rather, we've usually compared Netflix traffic to YouTube traffic, because the two services are at least playing in the same order of magnitude (for the record, Netflix traffic is more than 2x that of YouTube in North America). However, we like to please our audience and genuinely appreciate the interest that's shown by people taking the time to ask questions, so let's take a look at how Netflix fares versus other players in the long-duration space. When measured by contribution to Internet traffic, Netflix is absolutely smashing its competition. Consider that Netflix traffic:

- Is more than 18x that of Amazon Video
- Is more than 20x that of Hulu
- Is more than 60x that of HBO Go

For the record, we expect these multipliers to change (especially if HBO launches a streaming-only option in North America[16]), and we should note that Hulu traffic varies dramatically depending on the release cycles of new programs. Nevertheless, for the time being Netflix is in a class all by itself.

So far, we've focused on fixed access networks, but what about mobile access? Netflix is expending effort on optimizing the user experience on mobile devices, including Android devices and iPhones, so clearly they believe that mobile is a worthwhile market.

We first noticed Netflix on mobile access networks a year ago, but it was largely hidden in the background noise. In the last year, Netflix has experience significant growth on mobile networks, rising to account for 2.69% of peak period downstream traffic in the United States. As mobile access speeds increase and subscribers in general become more accustomed to streaming content on-the-go, we anticipate seeing steady growth in levels of Netflix traffic.

It's too early to tell if Netflix will duplicate their fixed dominance, but mobile operators should take note and carefully monitor this trend.

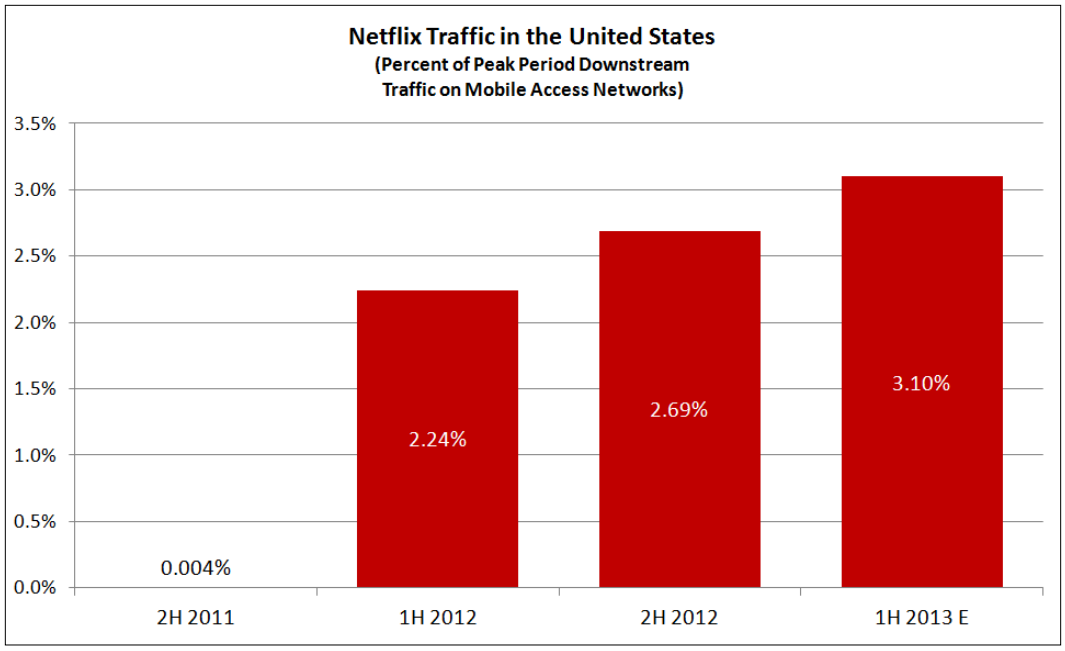

Figure 13 - Netflix Traffic on Mobile Access Networks in the United States

16. Wallenstein, Andrew. "Top News." HBO Cuts the Cord for International Launch. N.p., 30 Aug. 2012. Web. 01 Nov. 2012. <http://www.variety.com/article/VR1118058484>.

Watch out for that Bill Shock

Bill shock is a common complaint for subscribers obtaining post-paid wireless service - not knowing the cost of the service being used can result in enormous bills that a subscriber is unprepared or unwilling to pay. The most prevalent example of bill shock occurs when subscribers are roaming outside of their usual home network and using a smartphone to access internet data.

When subscribers contact their communication service provider (CSPs) to complain about bill shock, frequently the service provider ultimately waives the charge in question. These waivers represent lost revenue, but there is also the cost of the customer care call, as well as the cost of having provided the service. In the case of large bills due to data roaming, the loss to a CSP can be quite substantial. Nobody is happy about bill shock when it happens – subscribers, service providers and, increasingly, internet regulatory authorities. In response to this problem, service providers may introduce bill shock prevention management on their own accord or because regulatory authorities compel them to do so.

European Leadership

Last year, the European Union announced regulations setting a €50 limit on incremental charging for data roaming in mobile networks. For subscribers who choose not to opt out of the regulatory strictures, the following rules apply:

a. Subscriber shall be notified of data roaming charges on first use

b. Subscriber shall be notified of reaching 80% of their usage limit

c. Subscriber shall be notified of reaching their limit, and be provided a mechanism (e.g., SMS, e-mail, phone call or top up page) to be able to accept further usage of data roaming and associated charges.

Until the subscriber accepts the data roaming charges that will be incurred for further data usage, the subscriber is blocked from data access while roaming.

Elsewhere around the globe, CSPs are moving to get ahead of the curve, and an excellent example of this proactive investment is South America. As reported on its website, in September 2012, the GSMA announced that more than 40 Latin American mobile network operators (MNOs) have voluntarily launched a data roaming transparency scheme in the region that will provide consumers with greater visibility of their roaming charges and usage of mobile data services when travelling both within the region and abroad. The initiative is supported by operator groups including América Móvil, Antel, Entel Chile, Millicom, Oi, Orange, Telecom Italia and Telefónica, all of whom agreed to undertake a number of measures in the countries in which they operate to help mobile subscribers better understand their data roaming charges and more effectively manage their use of data services when visiting other countries. The MNOs participating in this initiative account for more than half a billion mobile subscribers across the region.[17]

Bill Shock Prevention: Doing it Right

But how will the program's participants implement the notification scheme? Mobile networks use GTP tunneling in which the outer IP identifies the serving network, and the inner IP identifies the user. If a service provider cannot evaluate these conditions accurately for roaming charge notification in near real-time, the result is bill shock. Sandvine provides a solution that insulates both service providers and subscribers from bill shock. By making real-time decisions about thousands or even millions of data flows per second by intersecting the network data stream. The ideal solution must also provide stateful inspection and counting of specific subscriber data usage encapsulated within an IP tunnel while simultaneously inspecting the outer-tunnel IP to invoke a roaming policy with real-time communication and enforcement. Only in this manner can the solution trigger subscriber notification and/or enforcement actions, such as shaping or blocking, the instant a subscriber accesses a roaming network or depletes their purchased quota. Any delay in notification, even a delay of 15 minutes, can result in an expensive charge to the subscriber or an angry customer support call and waiver from the CSP.

17. GSMA. "GSMA Latin America Launch Data Roaming Transparency Scheme." GSMA. N.p., 10 Sept. 2012. Web. 01 Nov. 2012. <http://www.gsma.com/latinamerica/gsma-latin-america-launch-data-roaming-transparency-scheme/>.

Europe, Mobile Access

Examining mobile networks in Europe provide the same set of regional analysis challenges as fixed networks because of the diversity in each country's culture, economy, languages, and deployed network technologies.

Did You Know?

Mean monthly usage on mobile networks in Europe is 239.9 MB

One metric that may not be impacted too significantly by some of these factors is monthly subscriber consumption. In our analysis, subscriber usage was relatively consistent across several southern and western European countries. Sandvine did not analyze European mobile networks for our 1H 2012 Global Internet Phenomena study, but it will be exciting to track how both the median and mean usage changes in the coming year as LTE networks get an expanded rollout.

Monthly Consumption - Europe, Mobile Access		
	Median	Mean
Upstream	1.8 MB	34.8 MB
Downstream	8.4 MB	205.1 MB
Aggregate	10.7 MB	239.9 MB
Downstream-to-Upstream Ratio	4.67	5.89

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Table 8 - Monthly Consumption (Europe, Fixed Access)

Much like other mobile networks, during peak period Real-Time Entertainment traffic is the clear leading traffic category. Web Browsing and Social Networking, as seen commonly in other regions, round out the second and third most popular traffic categories. What is most noticeable in Europe is the popularity of Communications application, which account for 23.1% of upstream traffic and 8% of total traffic during peak period.

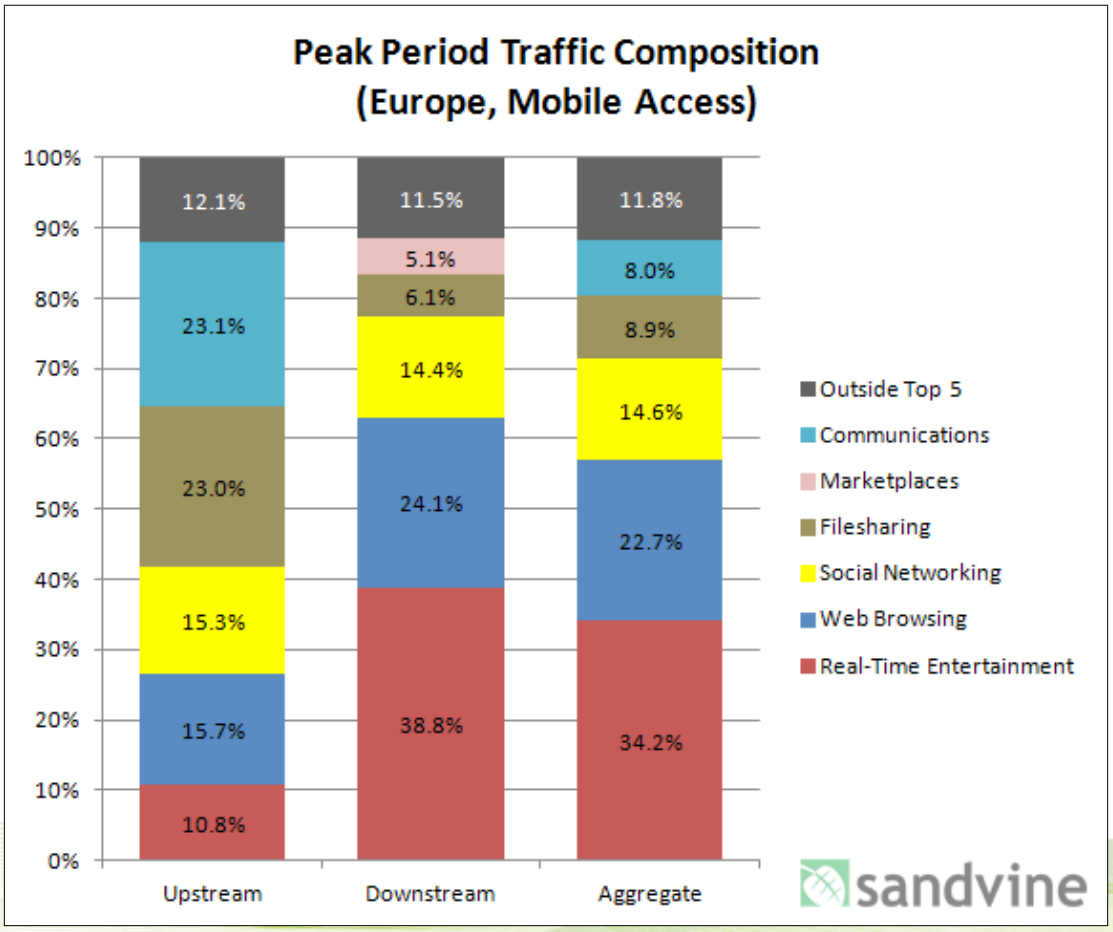

Figure 14 - Peak Period Traffic Composition (Europe, Mobile Access)

Skype appears to be the Communications application that drives the majority of this traffic, but MSN Messenger appears as the seventh most popular application on the upstream as well. The remaining 5.56% of traffic in the upstream category come from a range of applications including Gmail, Hotmail and other chat or email services that range in share between 0.50% and 1.0%.

Interestingly, HTTP is the application that generates the most bandwidth both in peak period and throughout the entire day, slightly edging out YouTube (which is often the top ranked application on many mobile networks we study). BitTorrent's appearance on the list also indicates that the use of air cards or dongles, possibly as fixed replacement is a popular practice in Europe, since running these applications on a smartphone or tablet is for the most part is impractical due to the impact on battery life.

	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	BitTorrent	17.03%	HTTP	22.16%	HTTP	20.62%
2	Skype	14.88%	YouTube	21.84%	YouTube	18.97%
3	Facebook	13.19%	Facebook	12.90%	Facebook	12.96%
4	HTTP	12.81%	BitTorrent	4.80%	BitTorrent	6.82%
5	SSL	4.48%	Flash Video	4.70%	Skype	4.74%
6	YouTube	4.41%	RTMP	4.10%	Flash Video	4.05%
7	MSN Messenger	2.66%	SSL	3.01%	RTMP	3.62%
8	eDonkey	2.24%	MPEG	2.91%	SSL	3.25%
9	RTMP	1.10%	Skype	2.75%	MPEG	2.52%
10	PPStream	0.97%	iTunes	1.90%	iTunes	1.66%
	Top 10	**73.77%**	**Top 10**	**81.06%**	**Top 10**	**79.21%**

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Table 9 - Top 10 Peak Period Applications (Europe, Fixed Access)

LTE - Long Term Evolution, Short-Term Headache?

Bigger pipes. Faster speeds. Higher data consumption.

With many of the world's mobile service providers rushing to expand their 4G LTE footprints' faster broadband speeds are becoming more accessible to a wider population. When combined with higher-resolution screens, longer battery life, faster smartphones and tablets consumers will be streaming more videos, at higher-resolutions, for longer periods of time.

The blazingly-fast mobile broadband speeds of LTE networks introduce several subscriber and network-specific challenges. How will periods of increased network congestion be handled on these newer, faster networks? How will LTE customers be kept informed as their usage zooms towards a monthly quota? And finally, how can operators quickly access information from within the network to translate subscriber and network utilization behaviors into revenue-generating services and prove that the move to LTE was the right investment for the company?

Bigger Pipes Won't Solve Congestion

As we've identified with broadband usage on other wireless networks, congestion does happen and will continue to happen, regardless of capacity expansion and advances in technology (for instance, LTE networks will exhibit congestion).[18]

Simply upgrading the network from 3G to LTE is not a congestion solution. In order to be effective, traffic and congestion management practices for newly-launched LTE networks must be implemented at day zero to maximize subscriber quality of experience (QoE) and ensure a great, high-speed experience for all subscribers.

Did You Know?

LTE can provides faster download speeds than many fixed access networks

Taking the Shock out of Monthly Bills

Reaching or exceeding your monthly usage quota faster than ever before is a scary proposition for consumers. Faster speeds means that within a matter of days of using your new LTE device to watch videos, or stream live content, you could run the risk of meeting or exceeding your monthly quota, and the cost of using your LTE device can really begin to add up.

To reduce the number of calls to customer service departments from frustrated customers in this situation, CSPs must implement measures to notify and inform customers when certain data thresholds and usage quotas have been reached. With advanced notification of monthly quotas and make usage information accessible in real-time, a subscriber's potential shock of receiving their monthly statement can be reduced.

18. Sandvine. "Sandvine Global Internet Phenomena – Networks 101: A Case of Congestion." Web. <http://www.sandvine.com/downloads/documents/Phenomena_1H_2012/Sandvine_Global_Internet_Phenomena_Report_1H_2012.pdf> page 17.

Caution! Speed Traps Ahead!

With the ability to watch live video or stream multimedia applications faster on LTE networks, subscribers are likely to watch longer duration videos more frequently, consuming more data than ever before. In some cases, new LTE customers have experienced as much as a 50% increase in their monthly broadband usage simply by moving from a 3G to a LTE network.[19]

Often referred to as "Speed Traps", the combination of high-speed LTE connectivity and strict monthly data quotas is proving to be a difficult dilemma for wireless providers. With broadband speeds of 2 Mbps - 1Gbps[20], strict monthly quotas could cause subscribers to exceed their cap in a matter of hours[21] or even as few as five minutes[22] - speeding past usage notifications and bill shock messaging as well.

Because of this, in order for LTE technologies to be fully utilized, consumers will either have to get used to paying more for their LTE service, or wireless providers will need to rethink their pricing models.

Smarter Tools for Faster Networks

In order to face these challenges head-on, a deep understanding subscriber of behaviors and the applications, devices, and locations contributing to mobile data consumption is required. A compulsory component of a complete LTE deployment strategy, network business intelligence tools must support internet working standards such as IPv6 and carrier-grade NAT as well as integrate seamlessly with CRM, B/OSS and other billing and third-party systems. Operators who neglect to build both network policy control and network business intelligence into their nascent LTE networks will find themselves losing ground to their more informed, more agile competitors.

19. Informa. "PR: LTE Smartphones and Tablets Drive Increased Data Usage of Both Cellular and Wi-Fi Networks According to New Research" August 1, 2012. Web. <http://bit.ly/MclK2k>
20. Endgadget. "Ericsson takes LTE-Advanced next-level, notches 1Gbps downloads in testing." Web. June 28th, 2011. <http://www.engadget.com/2011/06/28/ericsson-takes-lte-advanced-next-level-notches-1gbps-downloads>
21. The Wall Street Journal. "Video Speed Trap Lurks in New iPad" March 22, 2012. Web. <http://online.wsj.com/article/SB10001424052702303812904577293882009811556.html>
22. PC PRO. "EE 4G data caps that are broken in 5 mins" Web. <http://www.pcpro.co.uk/news/377695/ee-4g-data-caps-that-are-broken-in-5-mins>

Asia-Pacific, Mobile Access

Much like was observed on North American mobile networks, mean monthly usage in Asia-Pacific has made a small but noticeable gain of roughly 10% from 601.9 MB to 659.3 MB in the six months since we last examined the region. Asia-Pacific mobile subscribers have traditionally shown the highest consumption numbers among users across the globe, and Sandvine expects this consumption leadership to continue in the months to come.

Did You Know?

Asia-Pacific has the largest mean monthly mobile usage at 659.3 MB.

Monthly Consumption – Asia-Pacific, Mobile Access	
	Mean
Upstream	81.5 MB
Downstream	577.8 MB
Aggregate	659.3 MB

Table 10 - Monthly Consumption (Asia-Pacific, Mobile Access)

Real-Time Entertainment's upstream dominance is unique to Asia-Pacific and results from the use of the popular peercasting application PPStream, which sends and transmits video simultaneously over the network.

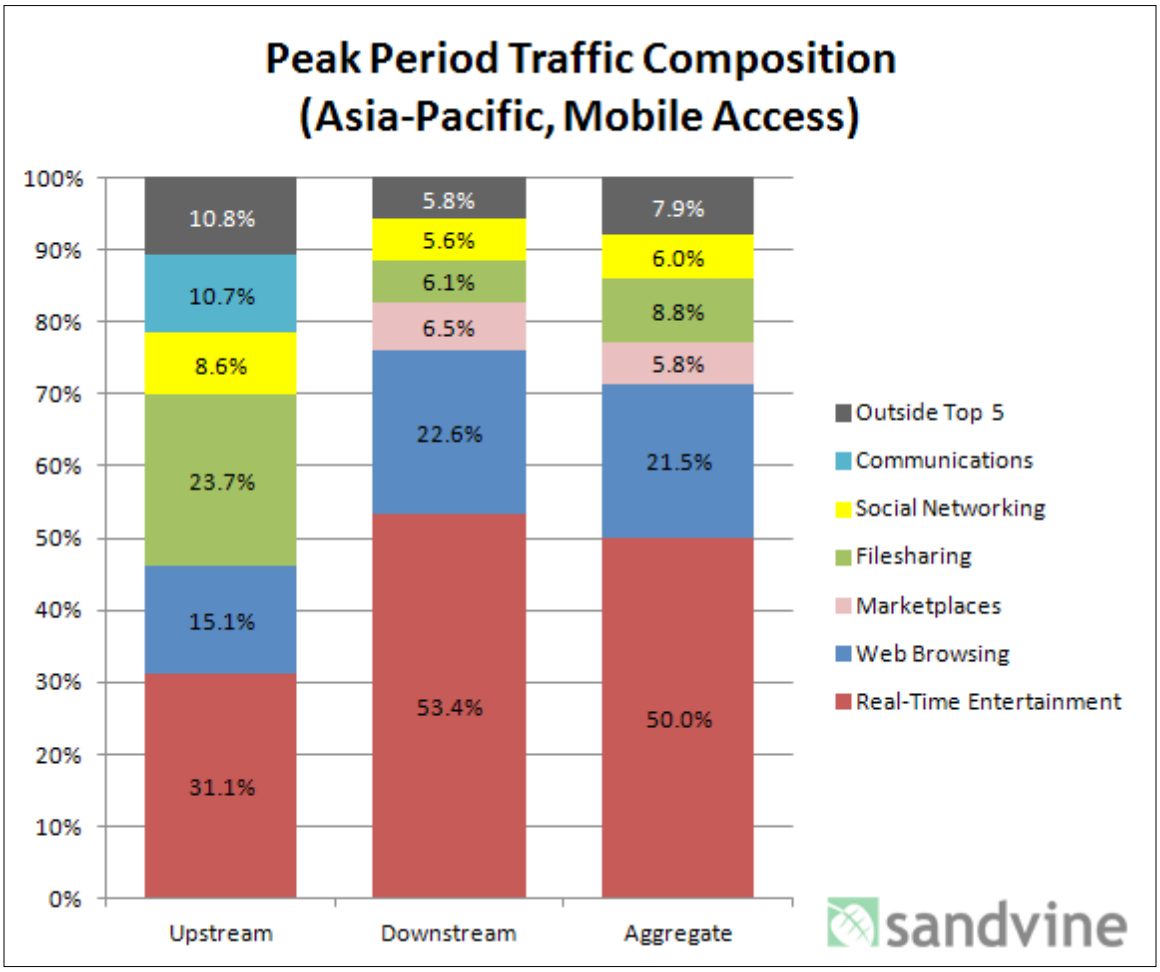

Figure 15 - Peak Period Traffic Composition (Asia-Pacific, Mobile Access)

The most notable change from Asia-Pacific's 1H 2012 figures is the disappearance of WhatsApp from the list of top 10 applications. WhatsApp did not suddenly fall out of favor with subscribers in the region, instead WhatsApp enabled encryption which helps to protect the confidentiality of their users' messages.[23] With this change, Sandvine had updated our identification, but at the time of data collection not all regional participants had updated their equipment to the latest version of that identifier. From the sites that had updated, we saw numbers that closely reflected our previous findings.

	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	PPStream	13.3%	HTTP	20.9%	HTTP	19.53%
2	BitTorrent	13.1%	YouTube	15.9%	YouTube	14.0%
3	HTTP	11.6%	PPStream	12.9%	PPStream	13.0%
4	Facebook	7.06%	MPEG	8.69%	MPEG	7.51%
5	Thunder	5.34%	Facebook	4.87%	Facebook	5.19%
6	SSL	4.51%	iTunes	3.96%	BitTorrent	4.85%
7	Funshion	3.47%	BitTorrent	3.35%	iTunes	3.49%
8	Skype	2.83%	HTTP Live Streaming	2.23%	SSL	2.24%
9	YouTube	2.72%	Google Market	1.99%	Thunder	2.16%
10	QVoD	1.29%	SSL	1.86%	HTTP Live Streaming	1.93%
	Top 10	58.32%	Top 10	70.66%	Top 10	67.49%

Table 11 - Top 10 Peak Period Applications (Asia-Pacific, Mobile)

In Asia-Pacific, the 1% of subscribers who make the heaviest use of the network's upstream resources account for 57.4% of upstream, 31.9% of downstream, and 34.2% of aggregate bytes each month.

At the opposite end of the usage spectrum, the network's lightest 80% of users account for only 13.4% of total traffic. This high concentration of users is likely due to the presence of a laptop air cards or dongles that consume significantly more data than a smartphone. This is supported by the fact that BitTorrent is almost 5% of total traffic during peak period, and that is an application typically not run on a smartphone or tablet.

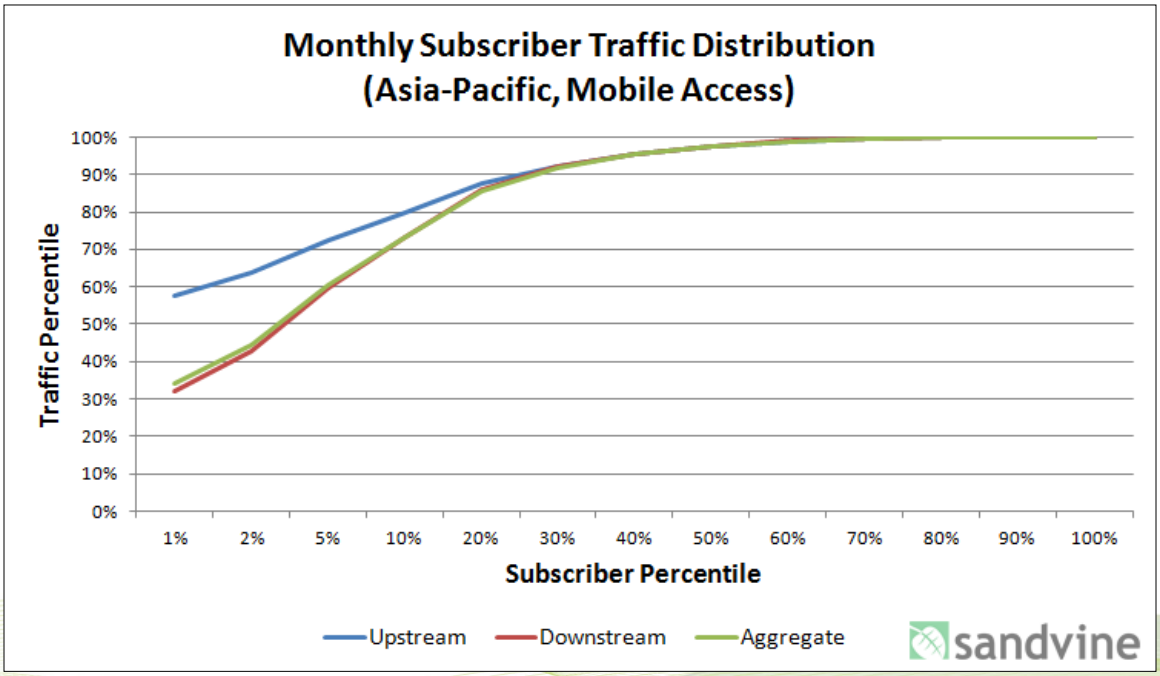

Figure 16 - Monthly Subscriber Traffic Distribution (Asia-Pacific, Mobile Access)

23. "WhatsApp Release Notes." App Shopper: WhatsApp Messenger (Social Networking). N.p., 27 Aug. 2012. Web. 01 Nov. 2012. <http://appshopper.com/social-networking/whatsapp>.

A Peek into Peak

For communications service providers, keeping up with today's increasing subscriber demands for data, and maintaining their quality of experience (QoE) is challenging. To address these demands, networks must be architected for peak utilization requirements, and doing so requires a detailed understanding of the factors driving peak period data consumption in order to optimize capacity planning decisions and maximize the return on infrastructure investments.

Peak period is defined as the entire period during which the observed value of peak bandwidth consumption is higher than a specified percentage (frequently the 95th percentile) of the peak value.

A glimpse at Sandvine's Peak Period Analysis Dashboard reveals the factors driving demand during peak times on the network and provides insight into the following areas:

- What applications are becoming more popular or less popular during peak times?
- How much data do subscribers use during peak periods and how does this vary by locations on the network?
- Which service plans contribute the most to peak period and which subscriber groups are most impacted by a congested network?
- What is the peak period on the network and how does it change over time and by location?

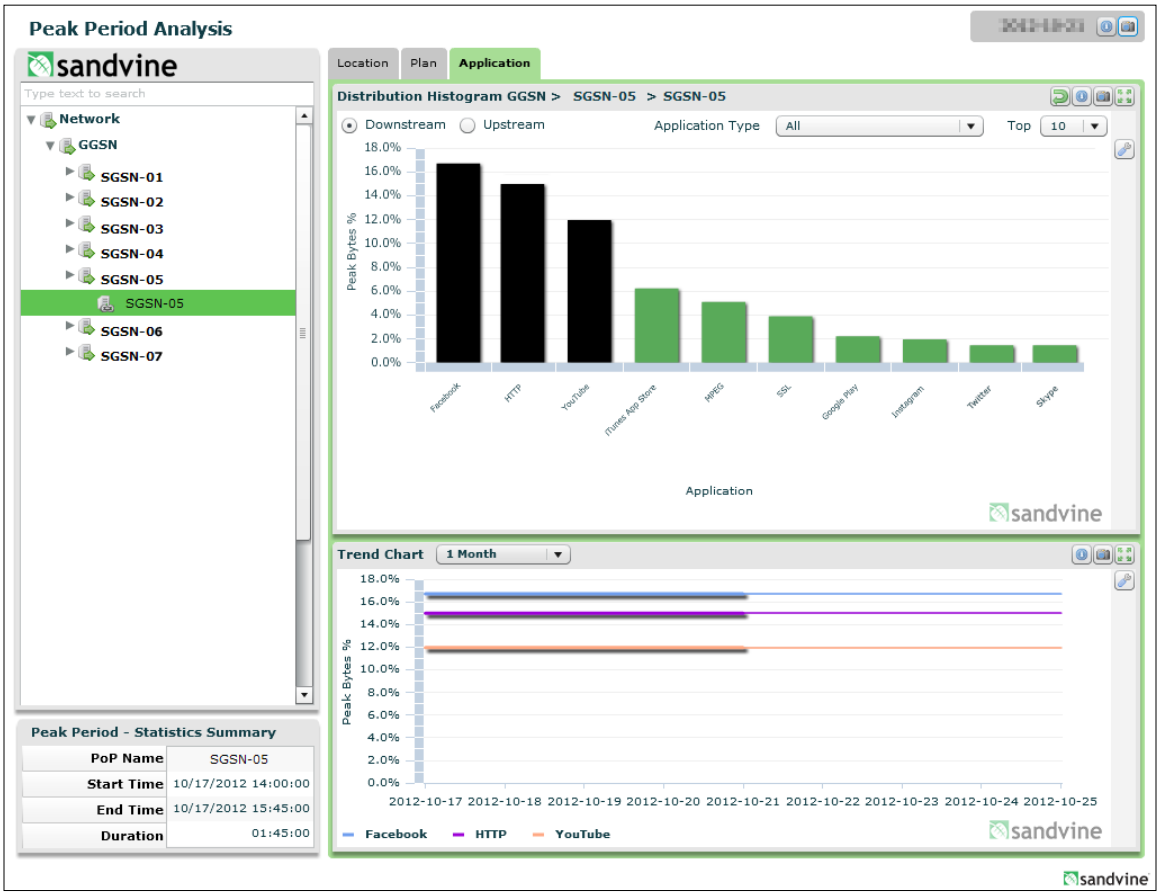

Figure 17 - Peak Period Analysis Dashboard: European Mobile Network Downstream Consumption at Peak

When examining peak period behaviors on a mobile network, the above chart reveals the mix of applications driving demand for bandwidth during peak times. We can see that Facebook, Web Browsing and YouTube combined are accounting for ~43% of all downstream bandwidth during peak.

The Peak Period Analysis Dashboard also reveals the length of time a particular network resource remains in peak state. For example, the duration of peak period for this particular node is 1 hour and 45 minutes, and starts at 2:00 PM.

When compared with other geographies and access types, the behavioral differences of applications, locations and resources during peak become more pronounced. For example, on fixed networks in North America, peak period often occurs much later in the evening with Real-Time Entertainment applications like Netflix and YouTube accounting for the bulk of downstream consumption.

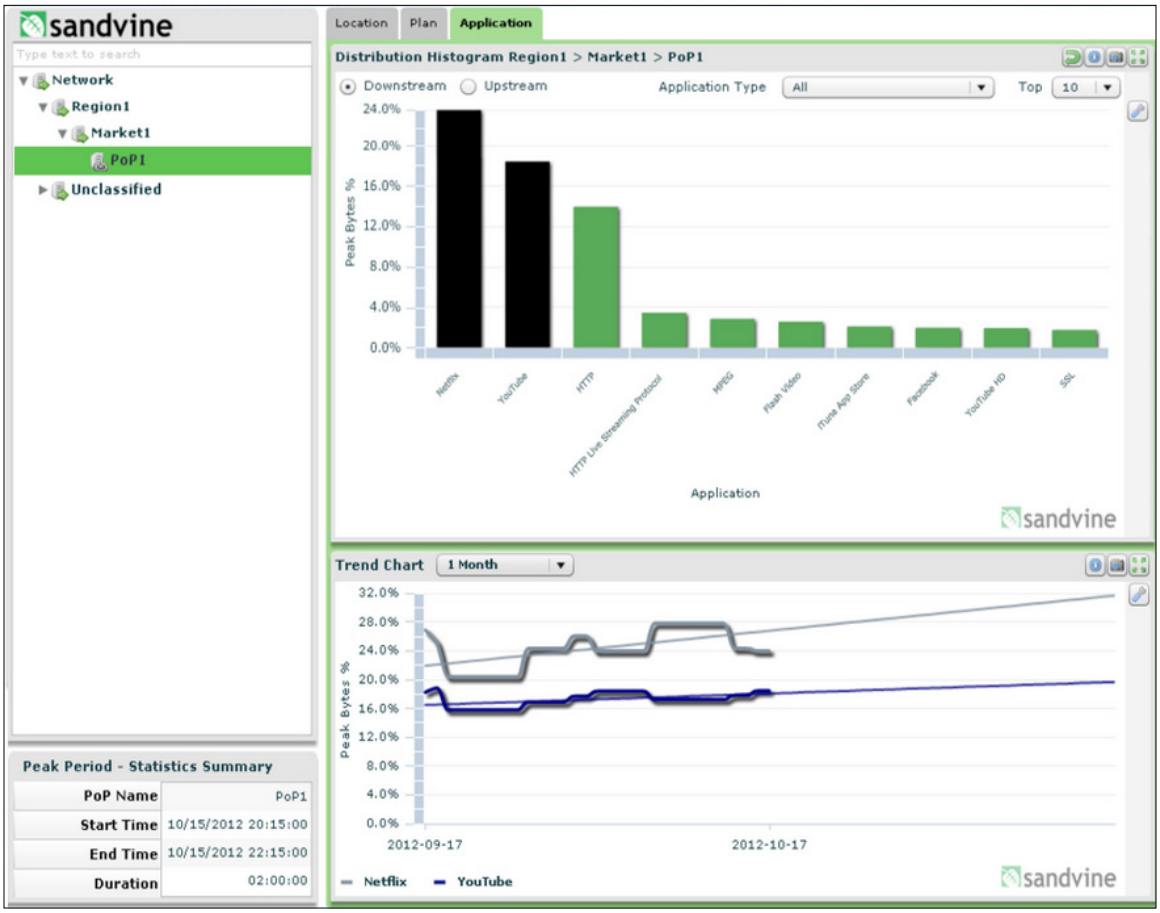

Figure 18 - Peak Period Summary - North American Fixed Access Network

Empowered with this information, a provider can compare an individual resource's performance to other network resources and identify areas that require immediate attention and prioritize network investments based on where additional capacity is needed the most.

Asia-Pacific, Fixed Access

Subscribers in Asia-Pacific have a reputation for being on the bleeding edge of the latest technology trends and their usage is indicative of this.

Consumption in this region is driven by the use of Real-Time Entertainment, which accounts for more than half (53.5%) of total downstream traffic during peak period. A unique characteristic of the Asia-Pacific region is the popularity of peercasting applications. In particular, PPStream (which allows users to stream live video) enjoys widespread use that makes it the second-largest application on the network.

Filesharing applications, led by the popularity of BitTorrent and Thunder, still make up a large percentage of traffic in Asia-Pacific, now accounting for 29.3% of total traffic during peak period, and 35.7% throughout the entire day.

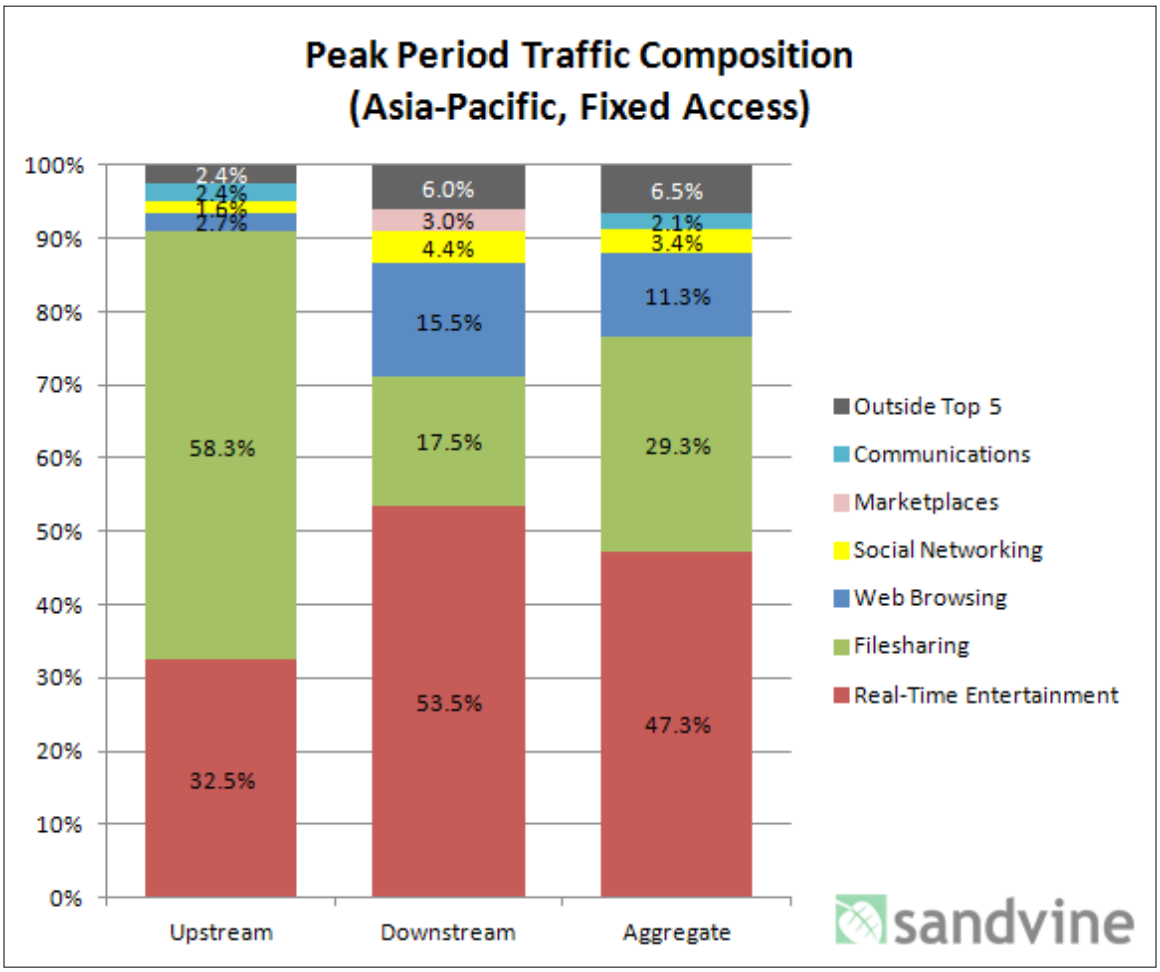

Figure 19 - Peak Period Traffic Comparison (Asia-Pacific, Fixed Access)

Sandvine's Crystal Ball: A Look Ahead to 2015

When pulling together the Global Internet Phenomena, Sandvine has access to an incredible wealth of anonymous data. Typically this is data used to present a highly detailed analysis of what is current happening around the globe, but it can also be used to help predict what will happen.

Using data collected for this report, Sandvine has created six predictions about what will be shaping the Internet in 2015.

Home Roaming Will Be A Home Run

In the 1H 2012 report, we revealed that Real-Time Entertainment applications on mobile devices (smartphone and tablets) being used on fixed access networks accounted for 9% of all traffic in North America.

By 2015, we believe this trend will be even more profound, with mobile devices accounting for 20% of all traffic on North American fixed access networks.

This prediction is based on the fact that smartphone ownership rates are still expected to grow, and tablets are still a new emerging product category, with many consumers yet to buy their first.

No Stopping Real-Time Entertainment

Real-Time Entertainment is the most popular traffic category on almost every network examined for this report.

In the past three years on North American fixed access networks, Real-Time Entertainment has almost doubled its share of traffic, now accounting for 58.6% of all peak period traffic.

Sandvine expects this growth to continue, with Real-Time Entertainment accounting for over two-thirds of peak period traffic by 2015.

Netflix Will Continue Its Dominance In North America

In recent years, competing pay over-the-top (OTT) video services from Amazon, Hulu, and HBO have all attempted to take on Netflix with only marginal success. Netflix currently accounts for 33.0% of downstream traffic during peak period in North America, with Amazon being the second place pay OTT video service, accounting for 1.75% of peak period downstream traffic.

Even with moderate growth of these competing services, Sandvine expects Netflix to maintain at least a ten-fold lead in traffic share amongst long form video services until at least 2015.

The 2014 World Cup Will Be The Most Streamed Event In Internet History

Operators from around the world saw significant adoption of live streaming of the London Olympic games.

With soccer being the most popular sport in the world, the 2014 World Cup should easily smash all sports streaming records set this year and also be responsible inflicting a great deal of bill shock.

BitTorrent's Backslide

In the last year, BitTorrent has declined from 18.87% of total traffic on North American fixed access networks to 12.44%. We believe that the reason for this slide is primarily due to the increasing number of legitimate and affordable Real-Time Entertainment options available to subscribers.

Based on the downward trend covered in the last several Global Internet Phenomena Reports, we predict that by 2015 BitTorrent in North America will be less than 10% of total daily traffic.

Service Plans Will Need Servicing

With a global rollout of LTE and demand for video continuing to grow, mobile users will demand service packages with ten times the monthly quota that is available in 2012.

Study Details

Sandvine's Global Internet Phenomena Reports examine a representative cross-section of the world's leading fixed and mobile communications service providers and are made possible by the voluntary participation of our customers. Collectively, Sandvine's customers provide Internet and data service to hundreds of millions of subscribers worldwide.

In the Global Internet Phenomena Report: 2H 2012, we examined three regions:

- North America
- Europe
- Asia-Pacific

The data gathered for these reports is completely subscriber-anonymous. No information regarding specific content or personally-identifiable information (including, but not limited to, IP or MAC addresses and subscriber IDs) was collected during this study.

This study reflects the traffic profiles of real service providers, including the impact of any network management (for instance, congestion management and traffic optimization) policies that may be in place.

The data collected includes the bandwidth per second per protocol and the number of active hosts per protocol on the network at each hour. Data also includes the total transmitted (upstream) and received (downstream) bytes, from the subscriber's perspective, attributable to each subscriber for a period of 30 days.

The datasets were used to create a 24-hour profile of each network, normalized by the number of active subscribers at each hour in the day. These profiles were then aggregated hierarchically for each region with weightings based on subscriber counts and access technology market share.

The transmitted and received bytes per subscriber data sets were used to create ordinal rankings of all subscribers on a network based on a combination of data direction (upstream, downstream, aggregate) and data period (day, week, month), for a total of nine ranked lists ordered by total byte usage. These lists enabled consumption analysis based on percentile ranking and cast light on the widely varying data needs of individual subscribers.

In parts of the report we reference industry publications, analyst studies, media articles and other sources. As such, we are indebted to the collective work and wisdom of a large number of individuals and organizations and have endeavored to correctly cite all sources and to identify the original creator of referenced material.

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