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Intelligent Broadband Networks

2009 Global Broadband Phenomena

Report findings include a dramatic shift in consumer behavior towards real-time "experience now" applications and away from bulk download "experience later" behavior. Compared to last year's results, real-time entertainment traffic (streaming audio and video, peercasting, place-shifting, Flash video) has exploded to now account for 26.6 percent of total traffic in 2009, up from 12.6 percent in 2008. This jump represents a doubling in the share of total bytes attributable to real-time entertainment applications and highlights the shifting nature of Internet traffic.

The research also shows that over an average month the top one percent of subscribers account for 25 percent of total Internet traffic, showing a vast difference between the data needs of most network users and the consumption kings.

Sandvine also observed a condensing in the number of hours during which the network is under near-peak usage, from 6:00pm to 11:00pm in 2008 and 7:00pm to 10:00pm in 2009.

Other notable findings include:

- Broad-based adoption of on-demand applications drives peak network utilization globally

- The network influences subscriber behavior

- On a per-subscriber basis, North Americans consume the most YouTube videos

- Storage and Back-Up services are becoming mainstream, lead by one-click download services

- Gaming consoles are increasingly used as sources of "traditional" entertainment such as movies and TV shows

- BitTorrent has emerged as by far the leading peer-to-peer filesharing network, but P2P filesharing has dropped by 25 percent as a share of total traffic to account for just over 20.4 percent of all bytes

Study Details

The 2009 Global Broadband Phenomena study consisted of analyzing data from more than 20 cable modem and digital subscriber line (DSL) broadband service providers' networks totaling 24 million subscribers. These networks were distributed across five regions: North America, Europe, Caribbean and Latin America, Asia-Pacific and Africa. Data was gathered between September 1st and 22nd, 2009, and captured the bits per second per protocol and the number of active hosts per protocol on the network at each hour. The same data was gathered for the top 500 users on each network, which was then averaged to create a profile of a "Top Subscriber". Data also included the total upstream and downstream bytes, from the subscriber's perspective, attributable to each subscriber for the 30 days, 7 days and 1 day preceding the time of collection.

The data gathered in Sandvine's global Internet traffic report is completely subscriber-anonymous. No identifiable information of any kind, including IP addresses, was collected during this study. Sandvine's network equipment analyzes data from an application utilization level and is not content aware.

The data sets 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 in a hierarchical manner:

- First, all networks sharing a common access technology (DSL or cable) in a particular region were combined by means of a weighted average, weighted by subscriber count per network, to develop profiles of an average cable or average DSL subscriber in each region

- Second, these two profiles were combined in a weighted average, this time weighted by market share for each access technology, to create a picture of an average broadband subscriber in each region

- Third, each profile of a regional cable or DSL subscriber was used in a weighted average, weighted by cable or DSL subscribers per region, to determine a global average for a subscriber on each access technology

- Fourth, the global DSL subscriber and global cable subscriber averages were combined, again weighted by total market share, with the result being the global average subscriber

Technology and regional market share data was provided by a leading industry analysis company, with Q3 2009 data used in this report. This method ensured fair and correct influence from each customer and region in all averages.

The upstream and downstream bytes per subscriber data sets were used to create independent percentile 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.

Key Findings

Report findings include a dramatic shift in consumer behavior towards real-time "experience now" applications and away from bulk download "experience later" behavior.   Compared to last year's results, real-time entertainment traffic (streaming audio and video, peercasting, place-shifting, Flash video) has exploded to now account for 26.6 percent of total traffic in 2009, up from 12.6 percent in 2008. This jump represents a doubling in the share of total bytes attributable to real-time entertainment applications and highlights the shifting nature of Internet traffic.

The research also shows that over an average month the top one percent of subscribers account for 25 percent of total Internet traffic, showing a vast difference between the data needs of most network users and the consumption kings.

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Other notable findings include:

- **Not the usual suspects:** broad-based adoption of on-demand applications drives peak network utilization globally. Peak-time usage is only slightly influenced by the top network users as measured over the previous month, suggesting that usage management and congestion management are distinct objectives.

- **The network influences subscriber behavior.** Mature broadband markets have embraced on-demand entertainment applications, while emerging markets still rely on peer-to-peer as the primary source of content.

- **Where do all those YouTube minutes flow?** On a per-subscriber basis, North Americans consume the most YouTube videos followed closely by subscribers in Africa; but by geography Europe is the destination for more YouTube minutes than any other region.

- **Storage and Back-Up services are becoming mainstream.** In 2009, networks are transporting almost 56% more data per subscriber to and from storage and back-up services than in 2008, led by one-click download services like Rapidshare and MegaUpload and continuing a trend that first came to prominence last year.

- **Are they "game consoles" or "entertainment consoles"?** Traffic to and from gaming consoles increased by more than 50% per subscriber, demonstrating not only the popularity of online gaming, but also the growing use of game consoles as sources of "traditional" entertainment such as movies and TV shows.

- **Are the P2P wars over?** BitTorrent has emerged as by far the leading peer-to-peer filesharing network both in terms of number of users and total bytes worldwide, although there are still regional variations.

- **At a global level, P2P Filesharing declined by 25 percent as a share of total traffic, to account for just over 20 percent of total bytes.** However, the decline is not consistent in every region - North America experienced a 20 percent relative decline, while the Caribbean and Latin America actually experienced an increase of more than 30 percent.

A Day in the Life...of a Network

- Local peak network utilization (upstream and downstream bandwidth utilization, number of subscribers) occurs between 7pm and 10pm – service providers with operations spanning multiple time zones may perceive a network-wide peak slightly outside of this period

- Traffic during peak time is driven more by an increase in per-subscriber bandwidth utilization than by the sheer number of subscribers coming online

- Subscribers (at least their computers) stay connected overnight

By examining how network usage varies over the course of an average day, broadband service providers are able to make informed engineering and maintenance decisions to maximize service quality and minimize network disruptions. The graph below represents a global average of traffic and subscriber variation of an average day and shows the interplay between subscriber numbers and traffic levels.
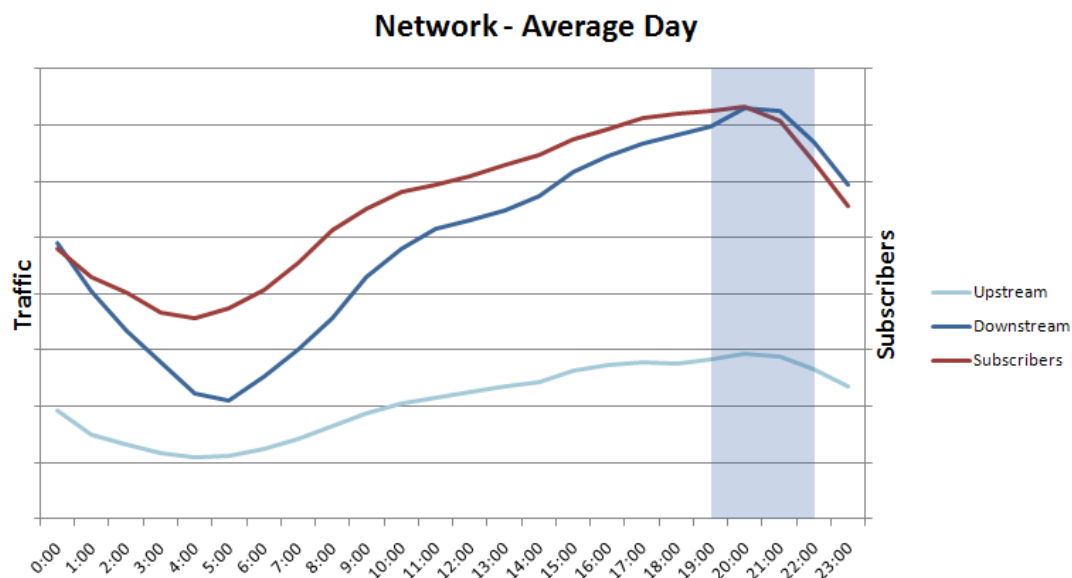
There is a huge variation in downstream traffic over the course of an average day, from a minimum at 5:00am (about 30% of peak) to the peak itself which is attained at 8:00pm. Upstream traffic shows a similar but slightly less extreme variation, reaching a minimum at 4:00am (about 35% of peak) and also peaking at 8:00pm. The number of subscribers on the network also exhibits a similar curve, reaching a minimum of about 50% of peak at 4:00am before embarking on a fairly steady rise (buoyed by a steeper incline in the mid-morning hours) to the 8:00pm peak.
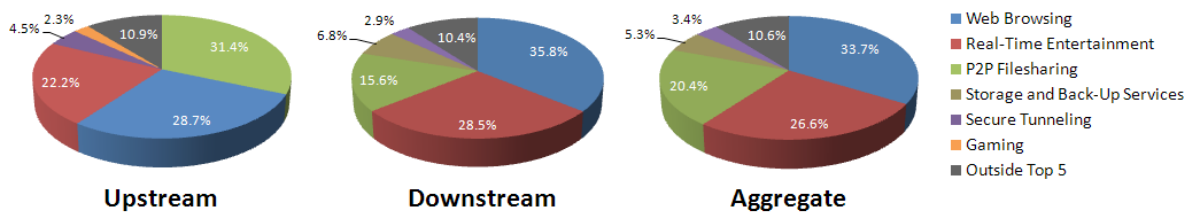
Close inspection of the curves during peak hours, from 7:00pm to 10:00pm, reveals that the rate of traffic increase exceeds the rate of new subscribers coming online, indicating that traffic during these hours is driven more by an increase in per-subscriber bandwidth utilization than by the absolute number of subscribers using the network. These peak hours represent the period during which network congestion might occur as the maximum number of subscribers all vie for a larger share of finite network resources.

The Ongoing Evolution of Internet Traffic

- On-demand is in demand: almost two-thirds of all Internet traffic is consumed as it arrives

- Real-Time Entertainment has almost doubled its share of total Internet traffic from 2008 to 2009, while Gaming has increased its share by more than 50%

- Storage and Back-Up services continue to gain more traction as subscribers embrace alternatives to P2P Filesharing networks such as one-click download services like Rapidshare and MegaUpload
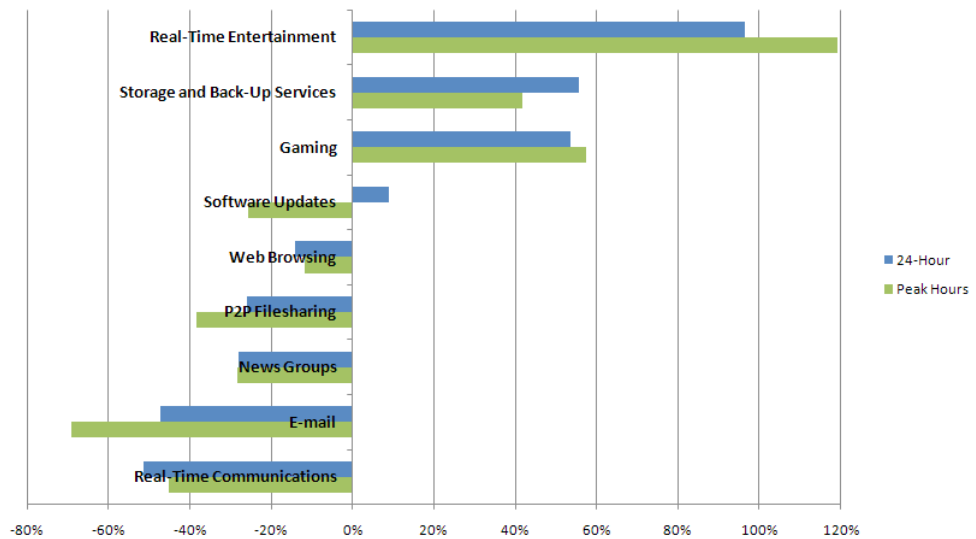
We are in the midst of a massive shift in subscriber behavior from a reliance on "download now, use later" content acquisition to an on-demand mentality where bytes are consumed as they arrive. Almost two-thirds of all Internet traffic in 2009 is enjoyed on arrival, including Web Browsing, Real-Time Entertainment such as video and audio streaming and peercasting applications, Gaming, and Real-Time Communications. We've also seen the widespread acceptance of Storage and Back-Up Services as sources of content, continuing a trend highlighted in the 2008 report.

2009 Average

Upstream: 2.3%, 4.5%, 10.9%, 31.4%, 28.7%, 22.2%

Downstream: 2.9%, 6.8%, 10.4%, 15.6%, 35.8%, 28.5%

Aggregate: 3.4%, 5.3%, 10.6%, 20.4%, 33.7%, 26.6%

Legend:
- Web Browsing
- Real-Time Entertainment
- P2P Filesharing
- Storage and Back-Up Services
- Secure Tunneling
- Gaming
- Outside Top 5

The success of these applications comes at the expense of traditional bulk data acquisition, most notably P2P Filesharing and News Groups. During peak hours, the explosion in popularity of Real-Time Entertainment and Gaming applications has resulted in an even larger yearly increase than that witnessed in the 24 hour average.

Did you know?

Microsoft regularly releases software updates on "Patch Tuesday", causing noticeable traffic increases on the world's broadband networks

Did you know?

For many Internet users, Facebook has replaced Instant Messaging and E-mail as the preferred means of communication

Aggregate Bandwidth Share Change (2008 to 2009)

Categories (top to bottom): Real-Time Entertainment, Storage and Back-Up Services, Gaming, Software Updates, Web Browsing, P2P Filesharing, News Groups, E-mail, Real-Time Communications

Legend:
- 24-Hour
- Peak Hours

Axis: -80%, -60%, -40%, -20%, 0%, 20%, 40%, 60%, 80%, 100%, 120%

Peak Time is Interactive

- Increases in the per-subscriber demand for interactive and user-driven applications such as Web Browsing and Real-Time Entertainment drive peak time traffic surges
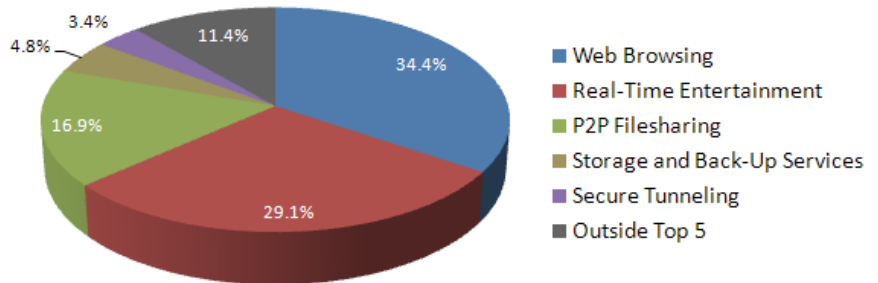
The composition of broadband networks during peak hours differs somewhat from the average throughout the day. Interactive applications such as Real-Time Communications and Gaming, and all entertainment categories see their slices of the bandwidth pie increase.
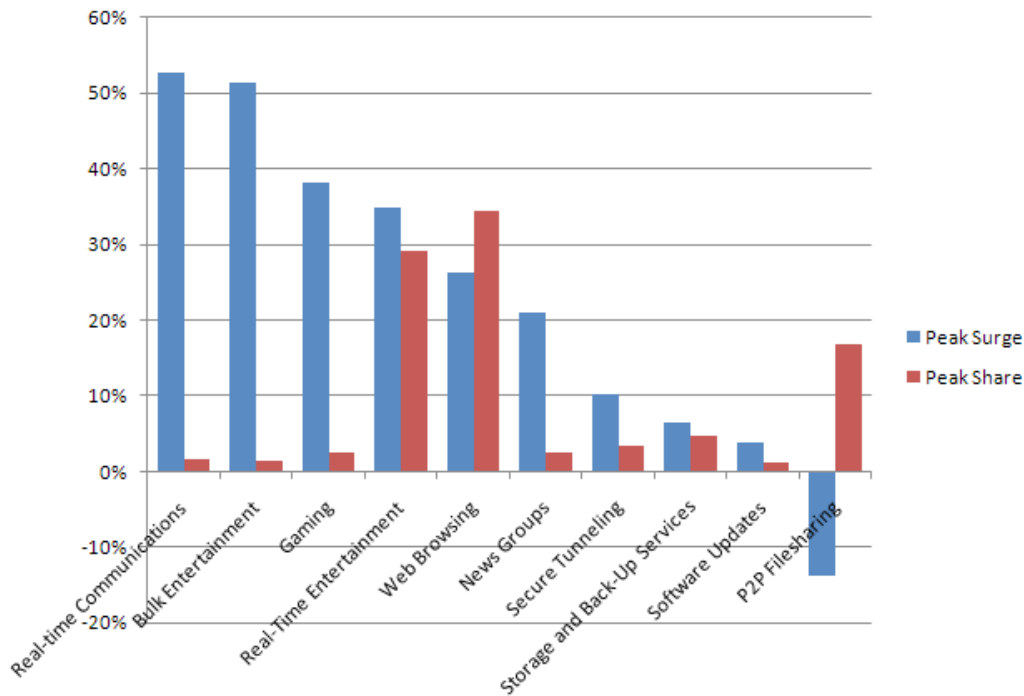
Did you know?

The following applications and services are each about 1% of global traffic

- Facebook (closer to 1.5%)
- iTunes
- Xbox Live and Xbox Live Marketplace
- Rapidshare
- MegaUpload

Peak Time Bandwidth Share

- Web Browsing — 34.4%
- Real-Time Entertainment — 29.1%
- P2P Filesharing — 16.9%
- Storage and Back-Up Services — 4.8%
- Secure Tunneling — 3.4%
- Outside Top 5 — 11.4%

The peak-time bump in traffic is almost completely attributable to the surging evening popularity of Real-Time Entertainment and Web Browsing – not only do both of these categories experience huge per-subscriber increases in bandwidth demand (rising by almost 35% and 26%, respectively), but these categories also make up a significant portion of the overall utilized bandwidth. Consequently, the increase places a much greater demand on the network in terms of total bytes than an increase in a category such as Gaming.

Did you know

On occasions like Mother's Day and New Year's Day, voice-over-IP traffic experiences a massive increase, thanks to all those people spreading good cheer

Who is Entertained the Most?

- On a per-subscriber basis, North Americans consume the most YouTube videos followed closely by subscribers in Africa; but by geography Europe is the destination for more YouTube minutes than any other region

- Asia-Pacific subscribers have the largest appetite for all forms of Real-Time Entertainment

For every one YouTube video that a subscriber in the Caribbean and Latin America watches, a subscriber in North America has watched 6.5, a subscriber in Africa has watched 6.3, a subscriber in Europe has watched 4.8, and a subscriber in Asia-Pacific has watched 1.4. When weighted by the total number of subscribers in each region, however, Europe emerges as the destination of most YouTube traffic (just edging out North America).

YouTube Minutes Share by Region

1.4% 4.6%
45.1%
46.8%
2.1%

- North America
- Caribbean and Latin America
- Europe
- Africa
- Asia-Pacific

Did you know?

YouTube alone is about 5% of global Internet traffic, and is about 10% of all Internet traffic in Africa
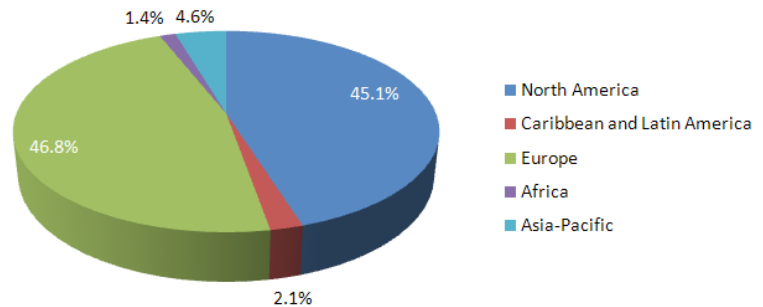
When one considers Real-Time Entertainment as a whole, Asia-Pacific subscribers truly are in a class of their own, consuming nearly double the total minutes as their North American counterparts, triple the minutes of a European, and roughly five times more minutes than subscribers in Caribbean and Latin America and Africa.

Again, taking the total number of subscribers into account, a slightly different picture emerges – one in which Asia-Pacific, North America, and Europe are all vying for regional leadership in terms of total minutes consumed.

Real-Time Entertainment Minutes Share by Region

29.6%
33.7%
0.5%
32.8%
3.5%

- North America
- Caribbean and Latin America
- Europe
- Africa
- Asia-Pacific

Did you know?

Each hour during peak time, about 10% of all households have seen a YouTube video, and almost 25% have seen a Flash video in general
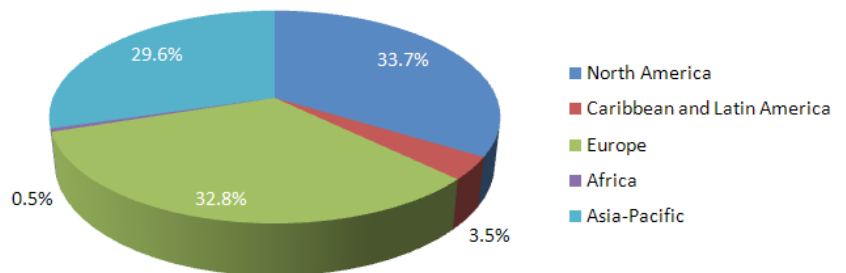
How does Subscriber Usage Vary?

- In an average month, the top 1% of subscribers account for 25% of total Internet traffic

- In the upstream direction, the top 1% of subscribers account for 40% of total traffic

- A heavy user is responsible for more than 200 times the total bytes of an average subscriber

When subscribers are ranked in order of total consumption and then the contribution of each percentile is computed and compared, it becomes apparent that the heaviest network users account for a hugely disproportionate amount of total Internet traffic. Over a month, the top 1% of subscribers are responsible for 25% of total bytes on the network. In the upstream, the top 1% account for 40% of total bytes, showing an even greater disparity in demand for network resources. Furthermore, the top 20% of subscribers account for fully 80% of total Internet traffic.

Did you know?

Each average subscriber accounts for twice as much Facebook and MySpace traffic than does each consumption king

**Percentile Byte Contribution (Monthly)**
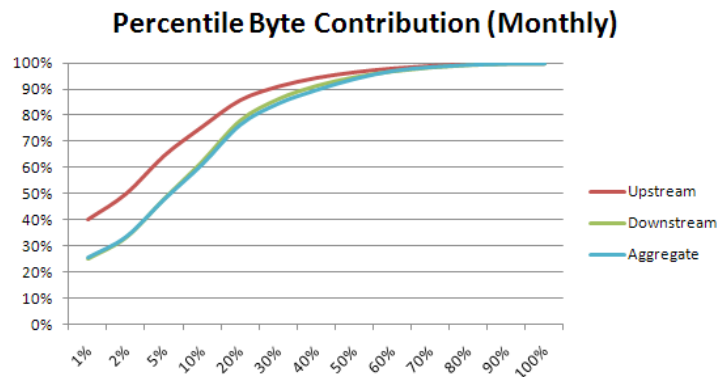
The same data also reveals that as the observation window decreases, the total percentage of bytes attributable to heavier network users increases. For instance, the consumption kings for any particular day account for 30% of total bytes, and represent a distinct (but over-lapping) set of subscribers when compared against the consumption kings for a month or a week. Similarly, past research conducted by Sandvine has demonstrated that in any peak time hour, the top users during that hour are responsible for an even higher percentage of total bandwidth, but again are largely distinct from the consumption kings of the preceding month. This observation supports the assertion that the heaviest users over a month only have a marginal impact on peak-time traffic levels.

This study also demonstrates that the monthly data consumption of a heavy Internet user exceeds that of an average user by a factor of about 200.

Two key factors contribute to this enormous variation in individual network requirements:

1. The network's top users exhibit relatively little change throughout the day, with constant heavy usage; conversely, most subscribers pop online and offline throughout the day and over the course of a month.

2. Top subscribers still rely heavily on bulk download applications like P2P Filesharing, Storage and Back-Up Services, and News Groups – applications that are responsible for massive amounts of traffic with very little user involvement.
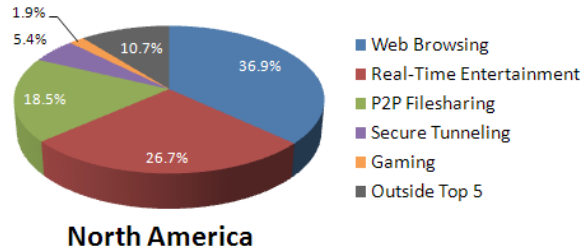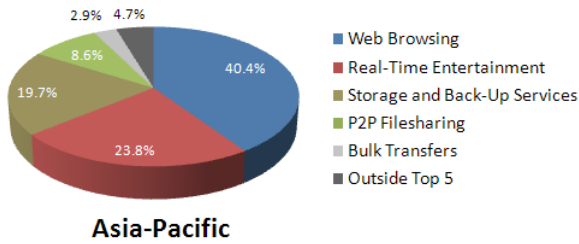
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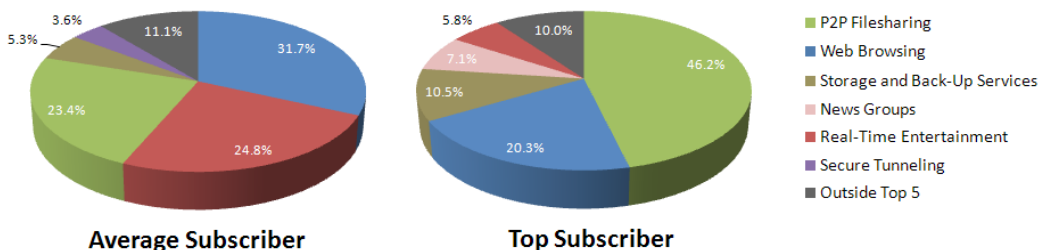
How do Regions Compare?

- Mature broadband markets favour interactive applications, while emerging markets are still driven largely by bulk download traffic

- BitTorrent is by far the world's dominant P2P Filesharing application, but there are still regional variations (for instance, Ares is vying for supremacy in the Caribbean and Latin America)

In Asia-Pacific and North America, we see the dominance of Web Browsing and Real-Time Entertainment, which when combined account for almost two-thirds of total traffic. The biggest difference between these two regions is the preference shown in Asia-Pacific for Storage and Back-Up Services, while North Americans continue to rely on P2P Filesharing for a large portion of content.

Asia-Pacific

- Web Browsing — 40.4%
- Real-Time Entertainment — 23.8%
- Storage and Back-Up Services — 19.7%
- P2P Filesharing — 8.6%
- Bulk Transfers — 2.9%
- Outside Top 5 — 4.7%

North America

- Web Browsing — 36.9%
- Real-Time Entertainment — 26.7%
- P2P Filesharing — 18.5%
- Secure Tunneling — 5.4%
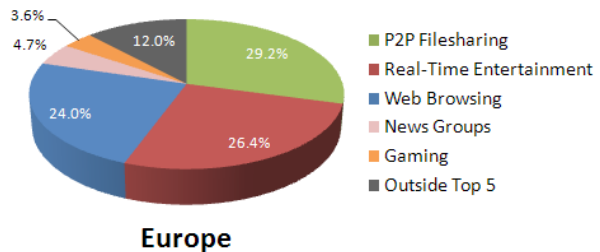- Gaming — 1.9%
- Outside Top 5 — 10.7%

In Europe, we see a time of change in which P2P Filesharing, Real-Time Entertainment, and Web Browsing are all vying for leadership. Europe represents an interesting mix of emerging and mature markets and that is reflected in the composition of the continent's bandwidth.
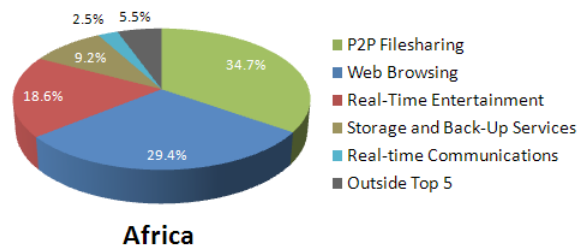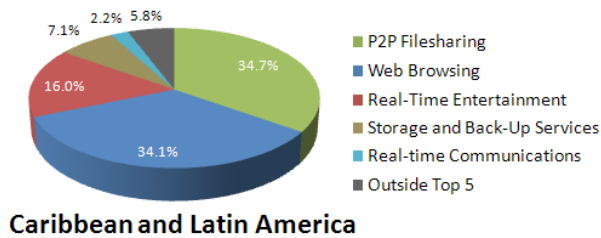
Did you know?

North America and Europe are the only regions where the Gaming category is in the Top 5.

Africa and the Caribbean and Latin America are the only regions where Real-Time Communications is in the Top 5

Europe

- P2P Filesharing — 29.2%
- Real-Time Entertainment — 26.4%
- Web Browsing — 24.0%
- News Groups — 4.7%
- Gaming — 3.6%
- Outside Top 5 — 12.0%

In the Caribbean and Latin America, as well as in the Africa, we see the significant presence of P2P Filesharing and only the early stages of the emergence of Real-Time Entertainment as a source of content. As these regions continue to mature, Real-Time Entertainment will continue to grow, primarily at the expense of P2P Filesharing but also somewhat by cannibalizing Web Browsing as networks become better equipped to deliver latency- and jitter- sensitive content.

Caribbean and Latin America

- P2P Filesharing — 34.7%
- Web Browsing — 34.1%
- Real-Time Entertainment — 16.0%
- Storage and Back-Up Services — 7.1%
- Real-time Communications — 2.2%
- Outside Top 5 — 5.8%

Africa

- P2P Filesharing — 34.7%
- Web Browsing — 29.4%
- Real-Time Entertainment — 18.6%
- Storage and Back-Up Services — 9.2%
- Real-time Communications — 2.5%
- Outside Top 5 — 5.5%

Did you know?

Owing to a Spanish language client Ares is huge in parts of the Caribbean and Latin America, where it accounts for as much as 34% of upstream traffic and 9% of downstream traffic, a far cry from its modest global contribution of about 1% of all traffic.

Did you know?

In Africa, almost 30% of active subscribers have Skype running. In the Caribbean and Latin America, the figure is almost 18%

Explanation of Categories

The table below describes each of the categories used in the 2009 Global Broadband Phenomena study. There are a few differences between the categorization for this year's study versus the categories used in 2008; most notably:

- Web Media and Peercasting/Placeshifting from 2008 have both been included in Real-Time Entertainment in 2009
- Instant Messaging and VoIP from 2008 have both been included in Real-Time Communications in 2009
- Bulk Entertainment and Bulk Transfers have become individual categories in 2009

These changes were introduced to better reflect 2009's Internet landscape and to place an increased focus on the behavior and motivations of individual subscribers when engaged in online activities.

Note that for all comparisons between 2008 and 2009, we recalculated 2008's results with the new categorization, so all year-over-year analysis is completely accurate.

As described previously, all data sets were gathered on a protocol basis, as opposed to a category basis. This per-protocol data was subsequently rolled up into the appropriate categories for high-level analysis.

Category	Description	Example Applications and Protocols
Anonymity	Protocols that mask or obfuscate application or individual identity	Tor
Bulk Entertainment	Entertainment that is acquired in bulk then consumed some time after arrival	iTunes, move download services
Bulk Transfers	Large data transfers using the File Transfer Protocol or its derivatives	FTP
E-mail	Service-provider and webmail e-mail services	SMTP, POP3, webmail (Hotmail, Gmail, etc)
Encapsulation Tunneling	Tunnels used for wrapping traffic	L2TP, GRE, Teredo, 6 to 4
Gaming	Console and PC gaming, console download traffic, game updates	Nintendo Wii, Xbox Live, Playstation 2, Playstation 3, World of Warcraft
Network Administration	Protocols and services used to administer the network	DNS, ICMP, NTP, SNMP
News Groups	Network news services (where "news" means "data" – it doesn't have to be actual news)	NNTP, NNTP over SSL
P2P Filesharing	File-sharing applications that use a peer-to-peer distribution model	BitTorrent, eDonkey, Gnutella, Ares, Winny, Share, Foxy
Real-Time Communications	Applications and protocols that allow interactive chat, voice, and video communication	Skype, MSN Messenger, ICQ, SIP, MGCP, AIM, IRC, Oovoo, Jabber, Gadu-Gadu
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), peercasting (PPStream, Joost, Octoshape), placeshifting (Slingbox)
Remote Connectivity	Protocols and services that allow remote access to network resources	Remote Desktop, VNC
Secure Tunneling	Encrypted tunnels typically used for Virtual Private Networks and secure web transactions	SSL, SSH
Software Updates	Application updates for software, firmware, and operating systems	Windows Update, anti-virus updates
Storage and Back-Up Services	Services that provide file hosting, network back-up, and one-click downloads	PDBox, Netfolder, Rapidshare, MegaUpload
Web Browsing	Web protocols and specific websites	HTTP, Facebook, MySpace

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