Survey of International Broadband Offerings

Michael Kende
Principal Consultant

4 October 2006
Our ref: 248-386

Analysys Consulting Limited
919 18th Street NW, Suite 220
Washington DC 20006
Tel: (202) 331 3080
Fax (202) 331 3083
consulting@analysys.com
www.analysysconsulting.com

Survey of International Broadband Offerings

Michael Kende

Contents

This survey has been funded by AT&T.

Analysys is responsible for all research, analysis, and conclusions.

Analysys

1 Introduction

Many commentators, surveying the state of broadband internationally, have focused on headline statistics, such as penetration rates, the maximum speed of new broadband service offerings, or prices of service. Often, these comparisons have entered the policy arena in the USA to influence policies intended to advance the deployment and use of high-speed data networks. Indeed, surveys of international broadband markets are often one of the few sources of information available to policymakers on the capabilities and pricing of advanced networks. But such surveys often focus only on advertised statistics and fail to measure the underlying characteristics that are truly useful in evaluating the desirability and effects of alternative broadband policy choices.

In this report, we use an international survey to help to inform two issues of relevance to current debates about the state and direction of broadband markets and policies, in the USA:

- Assessments of broadband deployment status typically have focused primarily, if not exclusively, on the advertised speed of those connections and the implied price of a megabit of download speed. Here we show how these advertised speeds differ from the true speeds experienced by users, and also use this to get a more realistic measure of the cost of broadband services across countries.

- A variety of service offerings are available within and across the countries that we surveyed. These offers display many variations in pricing beyond those found in the USA. First-movers in providing advanced services such as IPTV also provide interesting observations on how operators are choosing to provide such services in the absence of any regulatory restrictions in those countries.

1.1 Summary

The analysis presented here collects and looks more deeply into country-by-country differences and similarities in broadband services and pricing. In particular, we collect more accurate measures of the actual speeds at which customers can connect with the Internet in different countries and we look more closely at the way that services are offered in these countries. We find that:

- Differences in actual bandwidth speeds among the offerings of broadband service providers internationally are less significant than simple advertised rates imply.

- Broadband providers around the world offer a variety of pricing and service models as they respond to increased overall demand and more varied customer usage patterns.

- When international broadband service providers offer IP-based entertainment television services (IPTV), they are doing so within segregated managed 'slices' of their networks and not as unmanaged best-efforts applications.

While these findings show that domestic and international broadband providers are utilizing a wide variety of service offerings and pricing plans, our investigations also show these providers to be deploying substantial upgrades to the capacities of their networks and improving the services available over these networks. Thus, as governments consider new regulations on broadband network engineering and pricing, policymakers may wish to focus on the following questions:

- What might be the impact of regulations designed to limit broadband pricing flexibility (e.g., by imposing restrictions on the ways in which providers can recover their costs) on customer choice and welfare – for example, could such regulations limit the availability of certain advanced services or reduce broadband take-up rates among low-income or low-use segments of the population?

- What might be the impact of regulations limiting the ability of broadband operators to manage bandwidth use of their networks on the dissemination of increasingly-demanded advanced services such as IPTV?

We believe this report, which examines more closely broadband network capacities, service packages and pricing around the world will provide policymakers with a more informed basis for determining the status of broadband service offerings and pricing in the USA – as well as the potential benefits and costs of establishing new regulations on permitted engineering and pricing of broadband access and the Internet.

1.2 Background on Internet usage

Up to now, the Internet activities of the vast majority of residential consumers have centered on lower bandwidth or non-real-time applications, such as e-mail, instant messaging, web browsing, shopping and visits to other relatively static informational sites. With this type of usage, most consumers consume bandwidth sparingly – in intermittent bursts or over brief periods of modest continuous use. Indeed, even during the busy hour today's typical broadband consumer demands only about 50Kbit/s of bandwidth on average – or less than 3% of most broadband line maximum capacities.[1]

As described further in Annex A below, current broadband networks are designed to efficiently accommodate these traditional usage patterns. Much as airlines overbook flights in confidence that statistically-predicted cancellations or no-show customers will enable all passengers who actually show up at the gate to board the flight, network providers around the world rely on oversubscription of limited shared network capacity. By engineering the shared portions of their networks in recognition of most customers' 'bursty' traffic demands, providers have been able to meet customers' demands while keeping costs down. Each broadband provider may provision capacity in its network differently, and this will in turn impact the effective speed that consumers receive.

[1] "Everything on the Net", PowerPoint Presentation, Hank Kafka, Chief Architect, BellSouth Corporation, March 14, 2006.

However, consumer usage patterns are changing rapidly, with increasing use of applications such as peer-to-peer file sharing, streaming video and VoIP, which require high-bandwidth and/or must be delivered in real time. These increases in demand have already begun to strain the capacity of existing networks. While today's average customer may require only single-digit Mbit/s maximum connection speeds and offer average busy-hour loads only in the 50Kbit/s range, some customers have already begun using high volume services, and tomorrow's typical consumer may demand orders of magnitude more broadband capacity. Indeed, to satisfy future entertainment video use, bandwidth-intensive households could demand 23 Mbit/s of sustained download access speed, requiring a significant increase over the engineering capabilities of current networks.[23]

News media and other commentators have focused attention on new Internet applications such as streaming video and VoIP, and their assessments of broadband have concentrated on the advertised speed of connections and the price of these services. However, the picture they present may not be an accurate one. The following analysis looks at broadband service packages on a country-by-country basis, and provides increased richness by examining more closely the plans' actual download speeds and associated pricing plans, including newly emerging usage-based pricing plans. This report provides valuable international perspective at a time when USA policymakers are considering proposals to limit the service and pricing options available to broadband network operators. Some observers have suggested that international experience demonstrates that such limitations would improve customer satisfaction with USA broadband services.[4] This analysis demonstrates that such conclusions may be founded upon an incomplete review of the international evidence.

---

2 This implies that for these households, their measured access speed will have to be 23Mbit/s in order to meet their bandwidth demands.

3 "Everything on the Net". Analysys Consulting recently worked on a Green Paper for the Broadband Stakeholder Group in the UK in which we calculated that household bandwidth demand reaches 23Mbit/s by the year 2012. *See* "Predicting UK Future Residential Bandwidth Requirements," Broadband Stakeholder Group Green Paper, May 2006.

4 *See* "Broadband Reality Check II, The Truth Behind America's Digital Decline," S. Derek Turner, Research Director, Free Press, August 2006, at 35.

1.3 Survey methodology

In order to survey international broadband offers, we examined high-end residential broadband offers from 14 incumbent carriers in 13 highly developed countries around the world, as follows.

Europe	*Asia*	*North America*
Belgium	Hong Kong	Canada (cable)
France	Japan	USA (cable and xDSL)
Germany	Singapore (cable)	
Italy	South Korea	
Netherlands		
Sweden		
United Kingdom		

Exhibit 1:

Countries surveyed

The examined broadband services are xDSL in all countries other than Canada and Singapore. In these countries cable modem services are prevalent and these are the services we examined. In the USA, we examined broadband services from both an xDSL provider (AT&T) and a cable modem provider (Comcast). In addition to this selection of broadband services provided by incumbent carriers in these countries, we also profile high bandwidth broadband offers from alternative operators in France and Italy (using xDSL technology), and Japan and Sweden (using fiber to the premises, or FTTP).

We collected information on the advertised speeds, prices, capabilities and usage limitations of these different service offers from the providers' websites or telephone calls to their customer information or support lines. We then gathered measures of the actual speeds of broadband connections in each country, using speed test utilities available from numerous websites that aim to quantitatively measure the actual download speeds on broadband lines. End-users in each country use these utilities to measure the speeds of their connections, and many post them on the websites to help inform other customers. Because the values obtained from such tests may vary, we averaged multiple tests where possible, to minimize possible biases from

idiosyncratic individual observations.[5] While we believe the results we obtained are reasonably indicative of country-to-country differences in broadband line performance, because it is impossible to control for all inter-country variations in test situations, we cannot assign any specific statistical confidence level to our results. These data were gathered in April and May of 2006.[6]

Prices of the examined broadband services were also collected and adjusted to remove any embedded taxes and to include an amortization of any required installation or other fixed charges. If the purchase of an ancillary service such as voice telephony was required, this cost was noted as well.[7] In addition to the prices paid for the service, any limiting conditions such as maximum levels of monthly usage, etc. were also recorded. Finally, we reviewed how new services such as IPTV or video game services were offered when provided by the network operator.

2 Survey results

While a more detailed description of the sampling methods and resultant speed, price and quality measurements is contained in the underlying report, we highlight the most significant of our conclusions here. These can be broken up into two categories: basic bandwidth issues and service offer characteristics.

---

5 Such variations may come from location of the test server, number of users accessing the server at the same time and the configuration of the PC and/or home network used.

6 We recognize that there are frequent upgrades in broadband offers, some of which may have taken place between the time that we gathered these data and produced this report. For instance, Telecom Italia recently introduced a broadband offering with an advertised maximum speed of 20Mbit/s. However, this offer is so recent that we have been unable to collect a large enough sample of measured speeds for this offering, and thus its data are not included in this report.

7 Such ancillary services may offer their own unique value to consumers.

2.1 Bandwidth measurements

Comparison of advertised versus actual bandwidth

Differences in available bandwidth between the offerings of broadband service providers internationally are less significant than simple advertised rates imply. Exhibit 2 below provides a summary of the difference between the maximum advertised speed and the average actual speed, for the incumbents' xDSL or cable services.

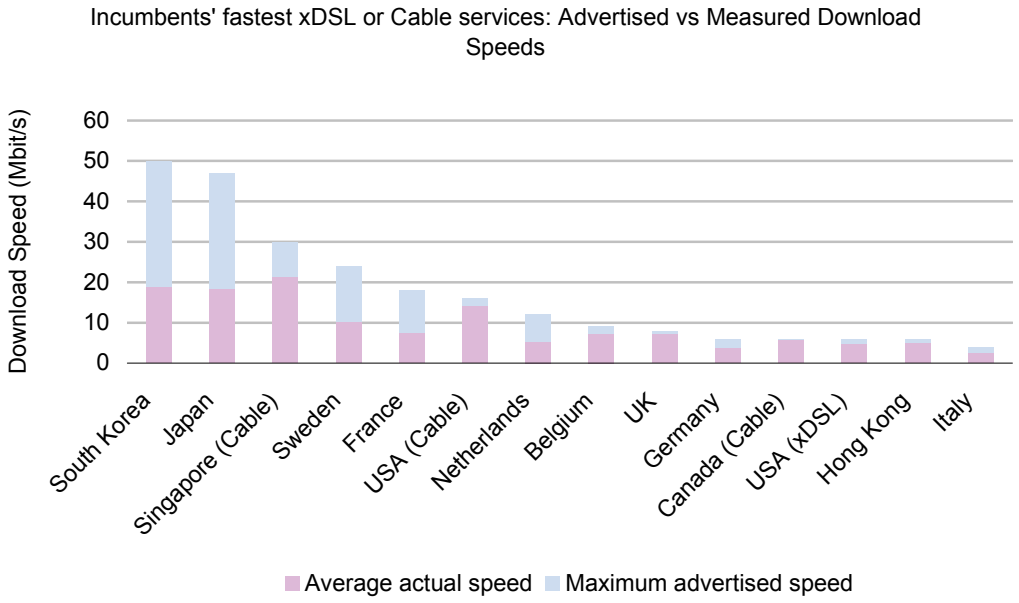

Exhibit 2: *Download speed comparison [Source: Analysys Consulting]*

The first finding is that actual data throughput performance of broadband lines typically falls short of the advertised maximum connection speed. As can be seen in the above chart, in both South Korea and Japan, the two countries whose incumbents boast the fastest advertised connection speeds using xDSL (50 and 47Mbit/s, respectively), actually achieved speeds are

just under 19Mbit/s – roughly 40% of the advertised speed. Similar overstatements of effective speed were also observed in Sweden and France, where advertised speeds are 24 and 18Mbit/s, but realized speeds are just under 10.4 and 7.5Mbit/s, respectively. This is between 43% and 41% of advertised speeds.

This disparity holds true of the non-incumbent providers as well. In France and Italy, the alternate xDSL providers advertise similar speeds to the incumbents and actually deliver roughly the same percentage of this speed as the incumbents. In Sweden and Japan, the alternate fiber carriers advertise speeds that are roughly two to four times as fast as the incumbents (100Mbit/s in each country), but deliver only 60% of that speed in Sweden and 35% in Japan.

The second finding is that, in general, the greater the advertised maximum connection speed, the greater the overstatement of advertised performance over actual performance. As just noted, four out of the top five countries in terms of advertised speed actually provide only about 40% of this speed in practice. On the other hand, the four countries with the slowest advertised maximum speeds provide actual speeds that are between 65% and 98% of the advertised speeds.

Price comparisons using actual download speeds

The prices charged for broadband services in the countries studied vary from US$84 to US$31 per month. In order to account for the differences in speeds across services, it is common to compute the cost per Mbit/s. However, this is typically done using the advertised speeds. When actual data download speeds are used, effective per Mbit/s prices for broadband lines may differ substantially from simpler 'dollars per advertised Mbit/s' measures. The following exhibit compares, for each country, the cost per Mbit/s of the incumbent's service calculated using the advertised speed, versus the cost per Mbit/s calculated on the basis of the actual speed.

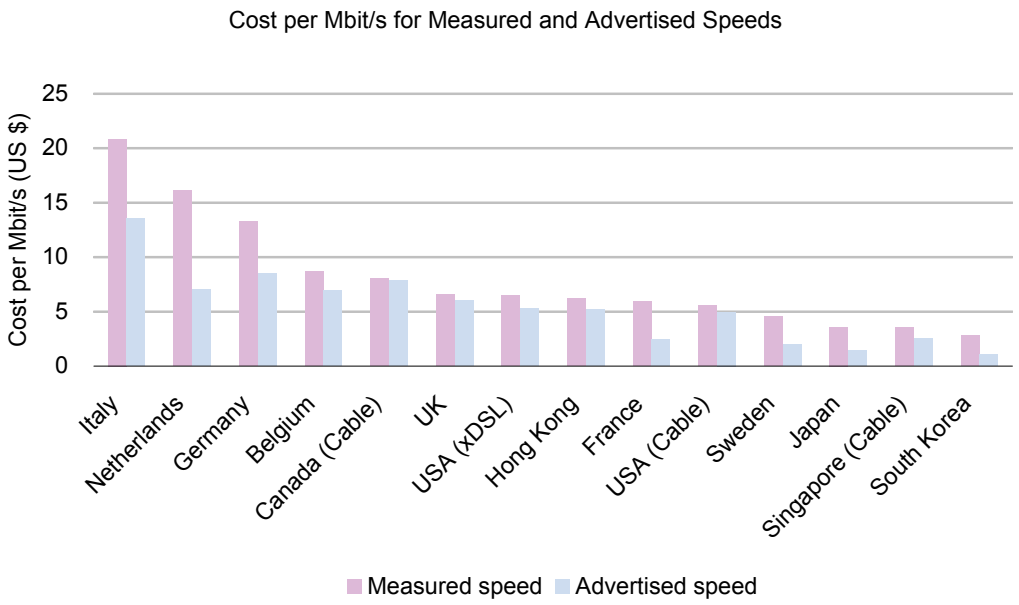

Exhibit 3: *Cost comparisons [Source: Analysys Consulting]*

While prices per advertised Mbit/s vary between US$1.07 and US$13.55, when prices are computed based on actual Mbit/s, rates are substantially higher: the lowest price remains in South Korea at US$2.82 per actual Mbit/s while the highest price, in Italy, is now US$20.84. Nonetheless, the vast bulk of the observations (8 out of 14) are found in the range of US$4.59 to US$8.70 per actual Mbit/s. This includes both USA cable (US$5.59) and xDSL (US$6.47).

USA position

The USA cable modem and xDSL operators offer customers broadband services that are comparable in effective performance and price to offers available in foreign countries, being neither among the very fastest nor the very slowest of the international group – and in terms of price per actual Mbit/s, they also fall into the middle of the group at positions 5 and 8.

3 Service offerings

Our international investigation also provides insight into the innovative ways that service providers around the world are offering broadband services, including very high bandwidth services such as IPTV.

3.1 Usage limitations

A number of the foreign broadband services incorporate explicit or implicit usage limitations. One example of this is British Telecom, which offers three different price plans. The interesting feature of these plans is that the maximum download speed is the same for all three plans, while the total usage per month increases with the cost of the plan, ranging from 2Gbyte per month to 40Gbyte. This differs from the current predominant pricing structure in the USA, where different download speeds may impact the pricing, but there are no limits on usage.

	Option 1	Option 2	Option 3
Price	GBP 9.95 per month for the first six months, GBP 17.99 thereafter, 18 month contract	GBP 14.99 per month for the first three months, GBP 22.99 thereafter, 12 month contract	GBP 22.99 per month for the first three months, GBP 26.99 thereafter, 12 month contract
Usage limit (monthly)	2 GByte	6GByte	40GByte
Extras	Basic security 250 FREE Wi-Fi minutes, free UK local and national VoIP calls	Norton security 250 FREE Wi-Fi minutes free UK local and national VoIP calls Wireless BT home hub	Norton security 250 FREE Wi-Fi minutes free UK local and national VoIP calls Wireless BT home hub BT hub phone
Speed	8Mbit/s	8Mbit/s	8Mbit/s

Exhibit 4:

British Telecom broadband offers [Source: British Telecom]

In other similar examples, Telekom Austria offers four usage-based packages that differ only in terms of total usage limits, along with a fifth premium package that offers higher speed in

addition to a higher usage limit. Likewise, Belgacom in Belgium offers packages that differ both by download speed and by total usage.[8]

Carriers may impose different types of "penalties" for exceeding monthly usage ceilings. For instance, BT terms and conditions state that if customers repeatedly exceed their usage limit, they may be upgraded to another option that is better suited to their usage needs, or the end-user may be charged for additional usage.[9] In a similar vein, Belgacom limits overall use by penalizing customers who exceed their limits by reducing the speed of their service for the balance of the month.

This suggests that one rationale for such usage-based plans is that network providers may hope these plans will enable them to control network congestion and more fairly apportion costs among customers who use only small amounts of bandwidth and so-called 'bandwidth hogs.' This rationale is echoed by several incumbents that do offer flat-rate packages, but place explicit or implicit total curbs on usage. For instance, KPN in the Netherlands does not set explicit usage limits, but prohibits users from actions that could generate high consumption levels and cause other users' service to deteriorate. Rogers Cable in Canada limits users to 100GByte of data transfer per month and reserves the right to penalize customers who breach this limit.

In addition to assisting in preventing a small number of high-intensity users from overwhelming the network at the expense of other customers, there are several other impacts of tiered usage-based offerings. At one end, charging more for higher usage tiers potentially provides additional revenues to pay for the expanded network capabilities required by increasingly high bandwidth applications. On the other hand, usage-based packages may provide affordable high-quality broadband services for low-usage or low-income users who might not otherwise subscribe to broadband.

---

8 Although outside of our study, we note that Eircom in Ireland also offers such packages. One of Eircom's entry-level packages even has a limit based on the total time of usage (twenty hours per month) rather than the download speed. This is primarily aimed at convincing dial-up customers to migrate to broadband.

9 *See* Terms and Conditions at http://www.bt.com/broadband/bb_info.jsp.

This spread of usage-based caps as a consumer pricing model could have significant implications for the future of Internet-based communications, services and businesses of all sorts – but it is too early to predict the precise outcome. For example, setting caps at levels that significantly restrict consumers' ability to consume available services could reduce incentives to develop new services and to expand network capacity. But if usage-priced plans are successful in managing congestion and reducing baseline costs, they could encourage deployment of advanced, new network resources and keep open broadband options for low-usage or low-income customers.

3.2 Network management

IPTV is beginning to be offered abroad, by incumbent and alternative telecom operators alike. These service offerings provide some clues about technical restrictions in offering IPTV services. In particular, when international broadband service providers offer IPTV, they appear to do so within segregated managed 'slices' of their networks. All of the 14 incumbent and four alternative operators that we surveyed already offer, or have announced plans to offer, IPTV services over their networks. But all do this on a managed basis within reserved slices of bandwidth – and not as an application that traverses the 'best-efforts' slices of their broadband networks.

Thus, it appears that bandwidth management has been adopted by IP network operators around the world as the most reliable and efficient way to provide streaming entertainment-grade television services over broadband networks. This may also suggest that the 'best efforts' segments of the international broadband networks services we examined may not currently be able to accommodate the technical and/or financial requirements of IPTV service, especially high definition IPTV service.

Annex A: Network quality and its implications

In comparing the quality of broadband services internationally, advertised connection speeds have been used as a proxy for quality. Such 'speeds' represent the maximum bit transfer rate that the access line is capable of. By this measure, the USA seems to be well down the list.[10] However, there can be substantial differences between advertised connection speeds and the actual throughput rates experienced by customers in all countries, no matter what technology employed.

There are many possible reasons for such a divergence between actual speeds and advertised speeds. The cause of such shortfalls can be insufficiency in any part of the network from the last mile connection to the customer all the way through to the connection to the Internet backbone that enables connectivity to the rest of the Internet.

Access line

One possible source of shortfall between advertised and measured speeds for xDSL services is the copper access line connecting to the premises. First, lines that are in poor condition can degrade the signal and thereby result in slower speeds. Second, xDSL is sensitive to the length of the copper line – lines that must run longer distances to reach active network nodes may have throughput rates that fall well short of advertised maximum speeds.

In cable modem systems, the coaxial last mile lines can pose a different problem. While the condition or length of the line may not reduce throughput speeds, unlike with xDSL services, last mile cable lines are shared among a group of residences connected to the same fiber node. Thus, all houses receive the same signal as their neighbors. While this is ideal for broadcast television, for which the system was primarily built, it means that everyone must also share the

10 See "Broadband Reality Check II," at 14-18. In addition to the caveats we discuss here relating to the difference between actual and measured speeds, we note that commenters such as the author of the study cited here appear to select a high-speed offering in each country without regards to the general availability of that offering throughout the country.

line for individualized services such as video on demand and broadband service. Thus, at peak-usage times each customer may experience slower times as a result of their neighbors' usage.

Shared network capacity

Another cause of delay is congestion or contention for shared resources. While the capacity of the last mile connections may or may not be shared among other broadband customers in a neighborhood, individual streams of broadband traffic are quickly commingled with traffic from other neighboring customers at aggregation points not too far away from customers' homes, regardless of whether the network is a xDSL network, a cable network or a fiber to the premises (FTTP) network. At these aggregation points, the broadband operator takes advantage of the fact that most consumers only use their broadband lines intermittently and non-continuously, allowing the operator to combine multiple customer bitstreams onto shared backhaul facilities that are much more limited in capacity than would in theory be required by the simultaneous maximum capacities of all their subtending access lines.

The precise ratio between last mile access line capacity and shared network capacity is called a contention ratio. While the contention ratio used in broadband network engineering generally is not publicized by broadband operators, BT states that its contention ratio is 50:1. This means that for every 50 customers with access line speeds of 8Mbit/s, BT actually provisions only 8Mbit/s of shared capacity to carry those customers' traffic on the shared portion of the network. For other operators, the contention ratios are not publicly available, but are generally considered to vary based on the usage characteristics of the customer class being served and the quality level that is sought for the service. Thus, low-usage customer communities may be engineered to higher contention ratios than high-usage communities, and business or premium residential broadband services may be engineered to lower contention ratios than standard residential services.

Internet connectivity

In addition to congestion on shared resources in the broadband provider's access network, full throughput to the Internet backbone may not occur unless the provider has secured adequate bandwidth in its connections to the backbone. This would typically occur through the purchase of 'transit' service from a backbone operator, who in exchange for the transit payment would route all traffic to and from the Internet to the customers of the broadband access provider. Some broadband access providers, as well as backbone operators themselves, may exchange traffic with one another through 'peering' arrangements, in which the providers exchange their own customers' traffic with one another for no fee at one or more connection points. These peering connections may be an additional source of congestion if they are not upgraded to keep pace with traffic growth.

Finally, even generous capacities in broadband access networks and backbone connections may be to no avail unless congestion on all the relevant parts of the Internet, including the backbone network(s) and the broadband access networks at the website's end of the packet transfer, are engineered and managed so as not to become bottlenecks.

Latency, packet loss and jitter

It is also important to note that throughput rates are not the sole determinants of service quality: the level of latency, packet loss and jitter is also important. If routers are congested, packets traversing them may be delayed in buffers, or dropped altogether. While latency measures delays in throughput, jitter measures variations in latency. Two-way real-time communications such as VoIP cannot tolerate much latency, packet loss or jitter – with latency, one party can start to speak before hearing that the other party is already speaking, a problem familiar to anyone calling countries using satellite connections, and packet loss or jitter can cause words to become unintelligible or drop out, or sever the connection completely. One-way broadcasts such as video streaming, on the other hand, can tolerate some latency, as long as it is relatively even. In other words, if a live sports broadcast is delayed by one second streaming over the Internet, that will not be perceptible to the viewer, but packet loss or jitter is

still a problem by creating annoying pauses or drop-outs in the stream. This may be overcome with a buffer, which stores a certain number of seconds of a stream in the end-device – thus even if there is a delay in input or a need to request retransmission of packets, it can continue to output from the buffer without any noticeable pause in the service. Advanced traffic management methods such as multiprotocol label switching (MPLS) can also be employed by network operators to ensure high quality, low latency and low jitter throughput of packets.

Conclusion

Thus, Internet access service networks are subject to congestion and delay depending upon the number of subscribers simultaneously using shared resources, network condition and engineering standards. While current networks can accommodate current usage profiles and provide a high quality of service, growing consumer demand for high-bandwidth, time-sensitive services like streaming video are likely to strain the existing capabilities, and in turn the offering of these services will be impacted by any resulting congestion. Our results show that, even, or especially, in those countries with high advertised speeds, the actual speed enjoyed by the customer is slower, impacting the services that customer can use. This means that network providers may need to implement additional management techniques, limit individual customers' bandwidth usage, expand capacity or embrace a combination of these approaches to meet consumers' future needs.

In particular, telecoms operators abroad that have chosen to provide IPTV appear to have done so within a managed portion of the network. This is likely the result of the characteristics of IPTV. IPTV differs in two significant ways from streaming video provided over the best-efforts Internet. First of all, IPTV is meant to be watched over a television, while streaming video is generally watched on a computer within an onscreen window that is typically smaller than a television screen. Thus IPTV requires significantly larger streams of data, and is much more susceptible to latency, packet loss and jitter, as well as potentially causing much more congestion in the network. Second, whereas IPTV is a paid service that must compete with broadcast or cable television which do not suffer from significant quality defects, streaming video is commonly a free service, leaving consumers less apt to complain about quality.

Annex B: Pricing and its implications

The usefulness or value of broadband services to consumers depends on the pricing of the service in addition to its raw capabilities. Extremely capable, expensive services may not be as useful or valuable to customers as slightly less capable services with more modest pricing. This is especially significant when low-income or low-usage customers are considered. If low-priced alternatives are not available to such customers, they may find broadband service unaffordable and, thus, not take any form of high-speed Internet connectivity.

Customers can vary greatly in the quantities of broadband service they wish to consume and in their financial willingness to pay for such services. While typical customers may consume less than 50Kbit/s of busy-hour bandwidth, current high-usage customers (who may engage in frequent peer-to-peer video file sharing, continuous media streaming, operation of a small website, etc.) may already display far higher usage levels.[11] Indeed, the most intense users or customers whose PCs may have been enlisted (knowingly or unknowingly) as Skype supernodes or BitTorrent relay sites may completely saturate the transmission capacity of their broadband line.[12]

In the face of such high-use customers, broadband operators have several choices. One is to leave network capacity unchanged and to allow service quality to diminish for all customers as the big users consume larger and larger shares of a fixed bandwidth pie – leaving smaller and smaller shares available for other users. Another option is to institute usage-sensitive pricing structures and/or monthly data transfer limits. A third is to install network management tools that permit users to obtain their desired applications over networks by employing bandwidth-saving technologies such as prioritization, caching and multicast.

---

11 See "BT cracks down on broadband 'hogs'", by Will Surgeon, CNET News.com, March 27, 2006 at http://news.com.com/BT+cracks+down+on+broadband+hogs/2100-1034_3-6054223.html and "The Broadband Incentive Problem," white paper by the Broadband Working Group of the MIT Communications Futures Program, September 2005 at http://cfp.mit.edu/groups/broadband/docs/2005/Incentive_Whitepaper_09-28-05.pdf .

12 See http://www.computerworld.co.nz/news.nsf/news/7AB67323D6305E49CC2570A1001698C0 or http://gigaom.com/2006/01/10/skype-the-bandwidth-hog/ for a discussion of the impact of Skype supernodes on usage.

By charging high-usage customers more than low-usage customers, operators can potentially limit usage as well as gain the revenues necessary to support network augmentation. Such directed investments may allow the high bandwidth demands of these customers to be accommodated – and at the same time keep service quality and prices advantageous for low-usage customers whose demands are much more modest. Similarly, offering service plans incorporating various levels of monthly data transfer limits encourages customers to evaluate their bandwidth demands and to inspect their PCs to determine whether all of their bandwidth consumption is for their own benefit, or is the result of virus/zombie hijacking, supernode activity or the providing of other third-party relay services.[13]

Network management also promises to provide both heavy and light users with more economical service options. By employing prioritization techniques, operators can preserve a high-quality Internet experience for light users. Such techniques can place 'governor'-type limits on high-volume traffic, and in so doing prevent the applications typically used by light users from being delayed or starved. Similarly, network management tools such as content caching and multicast streaming can make sure that shared network resources are used as efficiently as possible to satisfy multiple customer demands.

Finally, in addition to intensity of use, customers may differ greatly in their ability or willingness to pay for broadband services. Pricing options and cost-saving network management tools may be especially valuable in keeping broadband services affordable for large segments of the population – and in encouraging those persons who have not yet obtained a broadband connection to choose to do so.

---

13 For example, when utilities have installed individual water or electric meters, subscribers generally have become more assiduous at fixing continuously running toilets, ensuring that lights are turned off in unused rooms and checking that neighbors have not plugged extension cords into any of their outlets.

About Analysys

Analysys is the largest independent provider of telecommunications consulting services in the world. We provide strategy and management consultancy, information services and start-up support throughout the telecommunications, IT and media sector. We have developed unparalleled industry knowledge, techniques and data sources over the last 20 years, giving us – and our clients – a head start in the search for competitive advantage.

Our services include strategy and business planning; investment appraisal, profitability analysis, corporate finance and venturing; public sector policy definition, procurement support and major project implementation; market sizing and forecasting; and litigation support. These are complemented by wide-ranging market intelligence which informs customers worldwide on the issues, the companies and the trends affecting the industry.

Major players at the forefront of the sector confidently base their strategic decisions on the advice and information that we provide. Our international client base includes: network operators and media groups; equipment manufacturers; regulators and policy makers; banks, investment and legal institutions; corporate users; regional development organizations and local government bodies.

Our consultants and analysts share a passion and enthusiasm for the sector and are committed to securing tangible results and performance enhancement. We have over 160 staff in offices in Cambridge, London, Madrid, Milan, Paris, Singapore and Washington DC.

The author of this report, Michael Kende, is a Principal Consultant at Analysys Consulting, and the Head of our U.S. office. Michael is an economist by training, with a Ph.D. from MIT. After MIT, he spent five years as a professor of Economics at INSEAD, a business school near Paris, before joining the Federal Communications Commission. At the FCC, Michael worked on a wide range of policy analyses and regulatory decisions concerning broadband deployment, Internet issues, and mergers. At Analysys, Michael has worked on projects around the globe for clients including the European Commission, IDA (the regulator in Singapore), and TechNet.