Mobile broadband—Operator opportunities

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Ericsson intends to do with broadband what it did with telephony 20 years ago; that is, make it mobile and accessible to everyone, everywhere.

The authors describe the business opportunity, competition, drivers of broadband and mobility, strategies and business models. They also touch briefly on enabling technologies that build a strong technical case for mobile broadband.

Background

The internet revolution has created a huge demand for broadband access throughout the world, and as a result broadband is currently one of the fastest-growing telecommunications services. Ericsson estimates that the internet has reached one billion users and it foresees continued growing demand for broadband access as more and more users switch from dialup access and, apart from higher bit rates, begin asking for mobility and universal availability. Operators of third-generation mobile systems (3G) can introduce a range of competitive broadband internet-access services to address this fast-growing segment by drawing on existing assets and Ericsson's end-to-end mobile broadband offering. These new PC or laptop-oriented mobile broadband services will coexist with the many handset-oriented mobile data services that have given end-users a compelling mobile internet experience via WAP and MMS.

Today, 3G systems are evolving to the point where they can combine mobility and ubiquitous availability with the bit rates computer users have come to expect. This will give rise to a new service that truly deserves to be called mobile broadband (Box B).

Business opportunity

Despite the huge growth in broadband during the past few years, mobile operators have been unable to attract a competitive share of the market compared to conventional technologies, mainly because of

- lower bit-rates; and
- high costs of providing the required capacity.

The revenues from the estimated 175 million broadband lines in use today (Ericsson's estimate, May 2005) have thus mainly been claimed by the community of fixed telecommunications and cable operators who deliver services to homes and businesses over a range of digital subscriber lines (DSL), cable, and fiber technologies.

Previously, a number of technical limitations restricted capacity and pushed up costs. Mobile operators have thus focused their attention on a variety of data services that generate high revenue per megabyte of traffic. But thanks to technologies like high-speed downlink packet access (HSDPA), the evolution of 3G toward higher bit rates and improved capacity has greatly reduced the cost of delivering data services.

Not long ago, 1MB of mobile data traffic was typically priced at EUR 1. Today, in contrast, the typical price of a 1GB PC card data bucket is EUR 50. This is a twenty-fold reduction in price to the end-user and a ten-fold increase in speed. And one more significant increase in bit rates is waiting

BOX A, TERMS AND ABBREVIATIONS

3G	Third-generation mobile systems
3GPP	Third-generation Partnership Project
ADSL	Asymmetrical DSL
ARPU	Average revenue per user
CDMA	Code-division multiple access
CPE	Customer premises equipment
DSL	Digital subscriber line
DSLAM	DSL access multiplexer
EDGE	Enhanced data rates for global evolution
GPRS	General packet radio service
HSDPA	High-speed downlink packet access
IP	Internet protocol
IT	Information technology
MMS	Multimedia messaging service
PDA	Personal digital assistent
PSTN	Public switched telephone network
SIM	Subscriber identity module
SMS	Short message service
WAP	Wireless application protocol
WCDMA	Wideband CDMA

around the bend: 3G Evolved (compare the perceived typical rates of GPRS at 32kbps to 3G at 320kbps to 3G Evolved at more than 1Mbps).

With this significant increase in capacity, mobile operators would be wise to consider expanding their service offering to include low-revenue-per-megabyte services, because these services, which already have proven mass-market appeal in both the enterprise and consumer segments, are now set to generate significant revenues.

An essential benefit of 3G is the ability to mix services that have different characteristics. This trait allows operators to guarantee that spectral and network capacity are always being used to drive profitability.

Ericsson believes that the present emphasis on "revenue per megabyte" as a key indicator of service potential or relative performance is misleading and potentially harmful. A comparison of services based on this ratio (for example, a ring-tone service that generates more than USD 20,000 per megabyte of traffic) might lead one to conclude that operators should not bother with other kinds of services, such as voice, because they generate far less revenue per megabyte. Such a conclusion, however, is misleading because the lower revenue is more than made up for in volume. The paradigm of bit limitations is now over and the true challenge for operators is to find the optimum mixture of high- and low-revenue-per-megabyte services. This also explains why "revenue per megabyte" is no longer a useful benchmark for packet-data services. Operators need to shift their attention to other bottlenecks, such as total consumer spending on telecommunications.

In summary, instead of trying to maximize revenue per delivered bit, operator strategies should aim at maximizing the use of network and spectrum resources for generating profit. Given the abundance of capacity available from 3G technologies, it makes little sense to limit oneself with a strategy that solely focuses on high-revenue-per-megabyte services, because such a strategy does not exploit existing assets and runs contrary to the true multi-service potential of 3G, which can be used to profitably deliver any kind of service. Mobile broadband successfully creates permanent "background" data traffic that uses operator assets to generate revenue. Prioritization mechanisms provide operators with a means of instantly allocating capacity to high-revenue-per-megabyte services while also ensuring that spare capacity in the network is used.

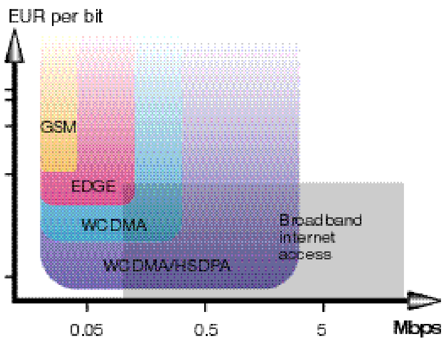


Figure 1
The introduction of HSDPA will enable considerably higher bit rates and make it possible to profitably deliver a wide range of mobile broadband services.

Broadband a safe bet

Given that more than 150 million lines were in use in the world at year-end 2004, broadband has clearly become one of the fastest-growing mass-market telecommunications services in history. In 2004 alone, more than 50 million new lines were added, and analysts expect this growth to continue. Indeed, the estimates for 2009 are 400 million broadband subscribers.[1] Until now, however, mobile operators have not been able to benefit from this growth. The good news is that by upgrading to 3G Evolved, they can increase capacity and significantly reduce their costs. This sets the stage for a clear broadband strategy and opens the door to an established and mature telecommunications service with significant growth prospects.

BOX B, 3G—ONE NETWORK, MULTI-SERVICE, MULTI-TERMINAL

Mobile broadband is defined as a fast, always-on internet access service based on the same business models as fixed broadband services; that is, flat-rate subscriptions. The service, which weds mobility and ubiquitous availability with user associations of broadband, is delivered using 3G technologies predominantly to users of laptop computers who require constant connection to the internet for web access, e-mail, and so on. The terminal—a PC card, PDA, stationary CPE (3G modem) and eventually laptop computers with embedded 3G—relies on a separate subscriber identity module (SIM) for the broadband service.

Operators should bear in mind that in the near future, end-users' typical telecommunications needs will be satisfied with two basic, albeit different, terminals:

- a mobile telephone handset, used for voice and small-screen data services at premium prices; and
- a personal computer (probably a laptop) that requires a fast, continuous internet connection.

In many countries, broadband internet access services generate monthly revenues that exceed the average revenue per user (ARPU) from mobile telephony services. Those operators who combine and bundle these two mass-market services will enjoy considerable competitive advantage. Delivering these services with the same network in true multi-service style will provide unmatched efficiency and great economy of scale (making it difficult for traditional or emerging single-service wireless technologies to compete).

Competitive landscape

Mobile broadband will differentiate itself in three distinct ways from conventional broadband alternatives:

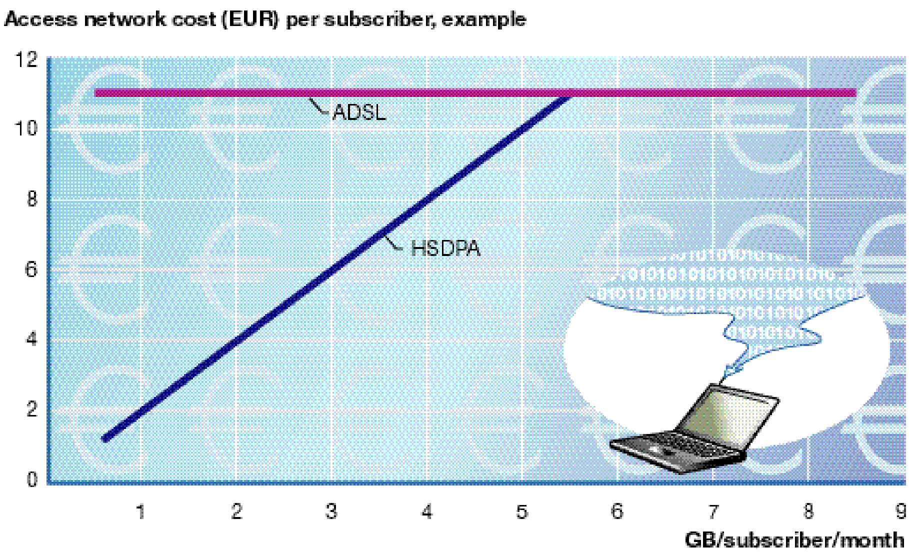
- It offers full support of device mobility.
- It provides universal coverage.
- In areas were the fixed network is not fully developed it might constitute the only alternative for obtaining broadband services.

In addition, mobile broadband combines competitive bit rates with low service-provisioning costs. Operators of 3G networks will thus be able to provide true mobile broadband services with universal broadband coverage in urban and rural areas that support mobility with seamless handovers and international roaming.

At present, apart from early adopters, few users can make use of the speeds that are being offered in many conventional broadband networks. Because not many end-user applications can take advantage of such high bit rates it can be argued that besides price, high bit rates solely serve as a means of differentiating the service offering. As a consequence, many fixed operators are now pursuing triple-play (telephony, internet and television services) strategies to better differentiate their service portfolios, relying on Ethernet technologies based on high-performance broadband.

Mobile broadband operators should feel secure in their ability to differentiate themselves with compelling voice and data offerings. The number of mobile 3G players in any given market is generally quite limited compared to the number of cable and fixed operators who today compete with similar offerings. Moreover copper-based technologies can hamper operator competitiveness

Figure 2
Cost of the access network per broadband subscriber. A mobile broadband operator can deliver several gigabytes of traffic to an end-user for the same cost that DSL operators are obliged to pay each month just to access the copper pair.



due to the high cost of maintaining the copper access network. Observations from Europe show that this cost is passed on to competitive service providers who must pay a monthly rental fee associated with the unbundled local loop. Typically this fee (per month) is more than EUR 11 per subscriber (Box B). The network cost of providing services over DSL can thus be considerable. Furthermore, manual intervention in the central office is needed to provision each copper pair. Mobile operators, in contrast, have no unbundling costs or cumbersome service activation. Figure 2 shows that a mobile broadband operator can deliver several gigabytes of traffic to an end-user for the same cost that DSL operators are obliged to pay each month just to access the copper pair.

BOX B, EUROPEAN UNBUNDLED LOCAL LOOP (ULL) PRICING

EUR per month	
UK	14.8
Germany	11.8
France	10.5
Netherlands	9.9
Spain	12.0
Italy	9.9
Greece	10.6
Portugal	12.0
Sweden	11.4
Average	11.4

Source: Credit Suisse First Boston Equity Research, 2004

Drivers of broadband and mobility

Device mobility

Initially, the primary mobile broadband terminal will be a laptop computer equipped with a cellular PC-card modem. Operators will focus on enterprise and mobile consumers, such as students and other groups that lack a permanent address and cannot obtain a fixed broadband connection. Laptop penetration is growing rapidly, and Ericsson believes laptops will eventually overtake traditional desktop computers for client applications. The proliferation of laptops is being fuelled by decreasing prices and a transition of the personal computer from being a shared household item to a personal, private device. This transition expands the addressable market both for computers and broadband services, and if exploited correctly, will position mobile operators as the obvious providers of mobile broadband connectivity.

Broadband serving society

Mobile broadband is also being driven by many government initiatives emerging in the EU and the US. The European Commission, for example, has explicitly identified mobile broadband as a key driver for improved productivity: "Anywhere, anytime availability will be essential requirements in an environment where mobility of people, goods and services is growing. The ability to update customer records wherever sales/support work occurs and to link the mobile workforce with the enterprise and its data resources as well as the ability to exchange large amounts of data will impact on working processes and organizational change, improving firms' efficiency."[2]

In the US, the discussion revolves around bridging the digital divide. The idea is that every citizen should have access to broadband internet. The creation of a competitive market environment will give end-users a wide choice of alternatives. In 2004, President George Bush expressed the need for a clear broadband strategy in the US. "We ought to have a universal, affordable access for broadband technology by the year 2007," he said. "And then we ought to make sure, as soon as possible thereafter, that consumers have plenty of choices when it comes to purchasing the broadband carrier."[3]

Broadband is thus expected to increase competitiveness, stimulate economic growth by creating new business and job opportunities, and facilitate distance learning and telemedicine. Mobile broadband will play a key role, in particular, by making broadband services available universally in a competitive and cost-effective manner.

Mobile broadband also addresses the politically sensitive issue of providing broadband services in rural areas, where, due to high costs, few fixed operators are willing or able to deliver broadband services.

Strategies and segmentation

As we have seen with telephony, mobility expands the addressable market for telecommunications services. This is especially ap-

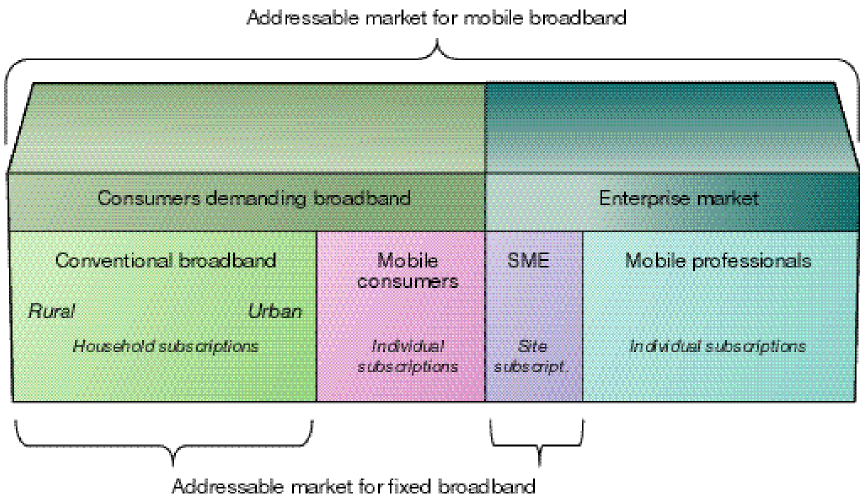


Figure 3
Addressable market of mobile broadband compared to that of fixed broadband.

parent in the consumer segment, where mobile services target specific individuals instead of a general household. The addressable market for mobile broadband services is thus much larger than the market for fixed broadband services. Mobile broadband provides an excellent and cost-effective broadband service to users who want greater mobility and to traditional non-mobile users who require broadband in their homes or offices.

Professional users

Mobile broadband is deemed to be an important driver of productivity. For this reason, IT departments (especially in the US) are eagerly awaiting the higher speeds that will enable workers to access corporate networks wherever and whenever necessary. When users leave the office, or even their desks, mobile broadband will enable them to access corporate networks and the internet in a fast, reliable and secure manner.

Given heavy corporate emphasis and strong government encouragement for implementation, Ericsson expects to see a wide range of industries adopt mobile broadband for their workforces. The public and private sectors each stand to benefit from increased productivity. In all likelihood, the fastest-growing, most price-tolerant, and profitable segment will be made up of corporate users.

Although the corporate segment values mobility it also requires a flat-rate pricing scheme that enables it to predict and manage its costs. In a recent study performed in Sweden, it was concluded that Swedish IT and manufacturing companies are willing to pay more than EUR 660 per employee each year for mobile broadband services.[4]

Consumers

To some extent, consumers also want mobility, although the need is not as pronounced as that of the enterprise segment. Nor are consumers as willing as enterprise users to pay a significant mobility premium. But some segments, such as one-person households, students, and mobility-oriented consumers, appreciate having the everywhere availability of mobile broadband services.

The increasing popularity of laptop computers will fuel demands. Today we can already observe considerable end-user interest in the short-range micro-mobility enabled by technologies such as WiFi. Mobile broadband will soon transform this micro-mobility into true mobility, relying on 3G for connectivity in every end-user situation whether at home, on the move, indoors or outside.

Note that subscribers will use mobile broadband individually; that is, they will have personal subscriptions. This means that the market for broadband services will gradually shift from providing generic services to the household and instead provide focused, personalized services for a specific individual as is already the case with mobile telephony services. Mobile operators are in an advantageous position to offer consumers bundled mobile telephony and broadband service packages. Combined offerings of this kind will also enable mobile operators to seek a bundling premium justified by the increased simplicity, ease of use, and combined invoices, which appeal to consumers.[5]

Residential broadband services

Mobile broadband operators are in a good position to address the enterprise and consumer segments. Moreover, they have an opportunity to address the traditional residential broadband segment. From an end-user perspective, a fixed wireless broadband access service of this kind, terminated in stationary customer premises equipment (CPE) or 3G modem is comparable to any conventional broadband service based on DSL or cable. These modems deliver sufficient output power and can be equipped with high-gain antennas that significantly improve bit rates in both the uplink and downlink over wide service areas.

Today, fixed operators face great difficulties in delivering ADSL services in rural areas where the length of the local loop cannot support them and the cost of bringing fiber closer to the customer is prohibitive. By contrast, mobile operators can successfully deliver broadband connectivity services with high bit rates over wide service areas. In rural areas, this approach might actually be the only cost-effective solution to offering broadband services.

A similar approach can be used in urban and suburban areas to deliver broadband to the home or office. High site density makes it easy to handle capacity limitations using additional carriers or increased antenna sectorization. Operators may thus provide high bit rates even when usage and service penetration levels are high. The main benefit compared to traditional service providers is the avoidance of the existing copper network with its associated high maintenance costs and, in some cases, insufficient quality for providing DSL services.

Business models

Embracing flat-rate and prepaid subscriptions

Predictability of costs and peace of mind are important end-user criteria. Therefore, Ericsson maintains that mobile broadband services should be offered at a flat monthly rate. Indeed, this is how broadband is priced in fixed networks. This pricing scheme came about in response to dialup internet access where end-users rely on traditional PSTN telephony and usage-based pricing, which gives them little control over spending. Mobile operators are thus advised to consider abandoning traditional usage and volume-based GPRS pricing schemes (for pure data connectivity) in favor of broadband business models that maximize the benefits of 3G technologies.

Today some mobile operators have adopted a hybrid-pricing model that relies on flat-rate pricing with a cap that serves as a transition point to usage-based pricing. Although this model makes sense in some circumstances, it should be recognized that fixed operators have already experimented with broadband caps of various types with only limited success.

To further expand the addressable market for mobile broadband services, operators might also introduce prepaid schemes for niche users, such as business travelers and other limited-use subscriptions. But again, it is highly recommended that the pricing of these services should be based on time (measured in days, weeks or months) and not absolute traffic volumes.

The peer-to-peer menace

Data traffic is always considered lower priority traffic that should not disturb high-priority voice and streaming services. Before operators may comfortably introduce flat-rate subscriptions they will need to adopt mechanisms that protect their networks from misuse or abuse without annoying end-users. Operators should acknowledge end-user interest in using peer-to-peer applications by introducing mechanisms that automatically protect the network when capacity is limited. Otherwise, service quality might suffer. Take, for example, the popular peer-to-peer file-sharing applications that often run in the background with little or no end-user intervention. Here, operators could protect their networks with mechanisms that automatically identify and reduce the priority of such data streams when the network cannot afford to support them. When capacity is available (at night, for example) these restrictions need not apply.

Additional revenues

Mobile operators should also seek to expand their broadband offerings in the same way as fixed operators have done, with a wide range of add-on services that are directly linked to the broadband service and can be used to generate additional subscription-based revenues. These services include e-mail accounts, web hosting, virus protection, and network security. For small and medium-sized enterprises, operators can offer hosted and managed solutions, such as the critical security and authentication services needed for accessing corporate networks.

Assessing the risks of competition from VoIP service providers

Some mobile operators are concerned about the threat of IP-based voice service providers, in particular, if combined with mobile broadband services. However, the mobile operators themselves hold the means of eliminating this risk. The pricing of voice services is currently transitioning from usage-based to packaged "bucket" schemes, which have already been successfully introduced in the US and parts of Europe. In essence, these packages (called buckets) can be considered a flat-rate subscription with a cap for voice services. They offer typical end-users more minutes of voice, SMS and video telephony than they can realistically consume in a month. The benefit of these schemes is that once end-users have paid the monthly fee, they perceive all subsequent usage as if it were free of charge. Therefore, end-users have little incentive to complicate matters with special client software and difficult interfaces.

Bundled offerings are based on a combination of bucket plans for voice and a flat rate for broadband. An offering of this kind fully caters for the typical end-user's two main communication needs:

- the mobile telephone—a small, easy-to-use device that is always available for voice communication and small-screen data services; and
- the personal computer, which is used for fast internet access, e-mail and other services such as instant messaging and surfing the web.

An operator's ability to bundle and offer services for these devices will be reflected in subscriber revenues, reduced churn, and the elimination of the risk of voice cannibalization.

Revenue quality

Ericsson considers revenues generated from mobile broadband services "high-quality" revenues. Although one may argue that there is no such thing as revenue quality, the characteristics listed below are certainly attractive and desirable in any business.

Potential

The most important aspect to consider when evaluating mobile broadband is that broadband is already a proven, mass-market service; therefore the associated risk is low compared to other, as yet unproven services. In addition, mobile broadband appeals to the traditional consumer segment, which has generated most of the historical broadband growth to date, and the enterprise segment, which constitutes a completely new segment. This does not mean that operators should avoid the consumer segment. Certainly, many users in this segment will prefer the benefits of mobility. Further down the road, mobile operators will be able to offer cost-effective broadband services to stationary modem devices, thereby expanding the addressable market to include segments that are currently served by conventional broadband technologies, such as DSL and cable.

Permanent revenue stream

Mobile broadband will have a significant and permanent impact on operator revenues. At present, a broadband connectivity service offered over conventional broadband technologies generates annual revenue in the range of EUR 200 to 600 per subscriber. Indeed, in many markets, the ARPU of fixed broadband is even more than that of mobile telephony. Moreover, the revenue stream from mobile broadband services is steady; that is, these subscriptions, which stem from a one-time purchase decision, give operators a permanent and recurring monthly revenue. Obviously, predictability facilitates successful financial planning and forecasting, which are vital attributes in any business. The foundation of these attributes is a flat-rate pricing scheme.

Simple business model

We have already determined that the addressable market for mobile broadband is of the same magnitude as that for traditional mobile voice services. Let us now take a look at the operator business model where the entire value chain is part of what can be called the core business of the traditional mobile operator. Mobile broadband services do not suffer from dilution or revenue sharing. What many operators have perceived to be an unattractive, bit-pipe role can, in reality, be a true opportunity to provide high-quality content in the form of free and publicly available internet content. Furthermore, one should not overlook the fact that mobile broadband connectivity services have a long product life cycle with a lifespan that is measured in years. Operators can thus enjoy reduced costs and greater margins because they need not constantly reinvent this basic service.

Mobility premium and competitive environment

Unique mobility, universal availability and high data transfer rates help differentiate mobile broadband from all other fixed and wireless broadband alternatives. Esteemed, valuable and easy-to-understand enhancements of this kind call for a premium. To date, conventional broadband operators have mainly relied on two variables with which to differentiate themselves in the marketplace: service bit rates and price. As a consequence, many markets have become fragmented by too many players with similar offerings in an environment where the path to profitability is economy of scale. This is less likely to happen to mobile broadband because the barrier of entry (limited 3G spectrum and license requirements) is simply too great. Mobile broadband will be a service that grants a premium and sidesteps many of the problems encountered in the conventional broadband arena.

Enabling technologies

Operators can implement Ericsson's mobile broadband solutions with any 3G technology—EDGE, CDMA2000 or WCDMA.

When addressing the enterprise segment, which values mobility the most, EDGE or WCDMA Release 99 will suffice. Future enhancements of CDMA2000 and especially WCDMA will greatly improve bit rates and system capacity, thus enabling mobile operators to successfully enter the consumer market with compelling and competitively priced broadband service offerings. These enhancements will be enabled by the introduction, in WCDMA, of HSDPA. In addition, the enhanced uplink feature, which is part of 3GPP Release 6, will bring the same kinds of enhancements to uplink bit rates and capacity as HSDPA brings to the downlink. A similar evolution exists for CDMA2000; that is, the introduction of CDMA2000 EV-DO Rev A.

WCDMA and CDMA2000 operators will thus be able to address the mass market with broadband connectivity services priced at competitive levels. Being future-proof technology, 3G has already made great strides and will continue to advance toward the Super 3G standard that will bring bit rates of 30 to 100Mbps.

Dimensioning of broadband services

Let us now briefly examine how typical service providers and fixed operators dimension their access networks for broadband services.

Most important at this stage is to differentiate between the concept of perceived end-user speeds and actual network capacity. Take for example a marketed 1Mbps broadband DSL service. In reality, this speed is only guaranteed over the first mile between subscriber and the central office DSL access multiplexer (DSLAM) where there is a one-to-one relationship between subscribers and resources (the copper pair). From that point onward, operators oversubscribe the second mile network, sharing capacity among multiple subscribers. This oversubscription or "contention ratio" is typically between 20:1 and 50:1 for consumers, and 4:1 for enterprise customers.[6] Therefore, a 1Mbps broadband service does not typically require more than 20-50kbps dedicated capacity in the access and core networks.

To derive these values we dissect a standard broadband traffic model where the typical end-user generates 5-6GB of traffic per month or roughly 177MB of traffic per day. Of this amount, about 10% or 17.7MB occurs during the busy hour. This translates into less than 142 megabits per hour during the busy hour.

Broadband traffic is bursty by nature and randomly distributed over time, making it difficult to measure. A simplified approach to measuring traffic is to determine how much capacity is needed to constantly stream the equivalent busy-hour traffic. A straightforward calculation, for example, shows that 142Mbph would require a constant stream of no more than 40kbps during the busy hour. Therefore, a service which is marketed as 1Mbps (and which the end-user perceives to be 1Mbps) does not necessarily require more than 40kbps dedicated capacity in the access and core networks. Statistical principles can best explain the rest.

WCDMA Enhanced with HSDPA could yield average sector/carrier throughput of 2.8Mbps (3GPP pedestrian B model).[7] This throughput easily accommodates more than 70 mobile broadband subscribers in each sector/carrier.

Conclusion

In the interest of consumers and society, Ericsson is making broadband mobile. Third-generation mobile operators are uniquely positioned to exploit the multi-service synergies that arise from the introduction of new evolutionary technologies, such as HSDPA. Mobile operators will thus be able to offer traditional handset-oriented services and mass-market broadband internet access services to consumers and enterprises. Moreover, they will be able to do so at unprecedented cost levels.

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