

Delivering broadband's full potential

Broadband has been one of the telecom industry's biggest success stories. Ensuring that broadband achieves its full potential – delivering economic and social benefits to all – requires timely and efficient infrastructure investment, with continued commitment and support of government and regulators.

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1 Executive summary

Broadband connectivity has become part of daily life – almost a basic utility – for many millions of people, especially for the ‘digital natives’ who have grown up with the always-on lifestyle that ubiquitous access to the Internet enables.

Delivered using multiple flavors of technology, broadband connectivity is driving innovation across all aspects of life, including travel, shopping, entertainment, education, healthcare and government.

But this is just the beginning. Broadband has the potential to do a lot more to enrich the economic and social well-being of everyone, by offering wider access to an increasing range of applications and services, over ever higher speed connections, using a wide variety of devices.

Ensuring that the full potential of broadband to deliver these benefits is achieved means vendors, operators, governments and regulators must continue their efforts to create an environment that is conducive to timely and efficient infrastructure investments. It is to the mutual benefit of all involved to encourage investment in technology that enables higher speeds and broadband coverage everywhere.

Full service broadband infrastructure is now available for operators to roll out advanced mass market multimedia services over broadband and generate the new revenues they need to continue to invest in the future.

2 Broadband: the success story so far

With over a billion users, the Internet is having an impact on every aspect of our lives – how we work, how we spend our leisure time and even how we are governed. Broadband access to the Internet represents the biggest communications revolution since the phone went mobile: the speed of adoption of broadband connections even surpasses that of the mobile phone.¹

From virtually none in 2000, Ericsson estimates that there are now more than 600 million fixed and mobile broadband subscriptions. By 2013, there are likely to be almost three billion broadband subscriptions, 80 per cent of which are likely to be mobile (as shown in Figure 1). According to Ericsson Consumer Lab research, every home in the Western world has 15 electronic devices on average, and around half of the homes are already ‘connected’ to the Internet in some way.

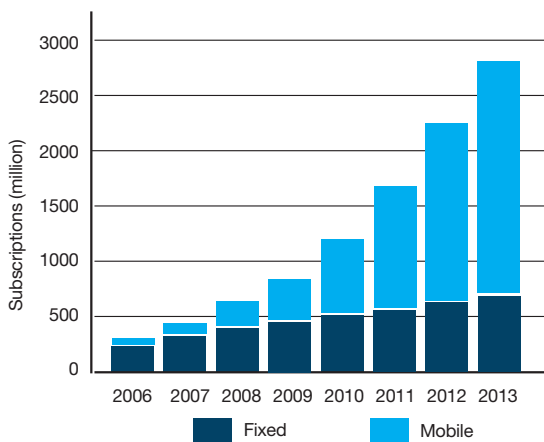


Figure 1. Estimated number of broadband subscriptions worldwide to 2013.²

We are moving from a world in which there is one broadband subscription per home to one in which every digital device or machine will have its own connection. The increasing popularity of mobile broadband is driving demand for higher speeds in the fixed broadband world, where user expectations of speed and quality are greater.

This surge in broadband uptake is both feeding and being driven by demand for new

services – especially new ways of accessing digital entertainment and socializing online – as service usage becomes more personal and more video centric. For example, the video sharing website YouTube attracts some 65,000 new video clips and 100 million views each and every day. Apple’s iTunes service has sold more than four billion songs, 125 million TV shows and 7 million movies online. Online game World of Warcraft has over 10 million players – a population bigger than many countries’.

As the voice market matures, operators are turning to multimedia services – data, music and video – to boost revenue growth. One good example is the distribution deals that various operators around the world have struck for Apple’s iPhone, which have resulted in significant growth in wireless data revenues as users readily take to personal communications, entertainment and social networking applications on the move. Fixed operators too are turning to services such as Pay TV and video-on-demand to offset reductions in the traditional voice market.

According to industry analyst Juniper Research, user generated content and social networking will be the driving forces behind the uptake of mobile Internet services. The total market for ‘Mobile Web 2.0’ will grow from USD5.5 billion in 2008 to USD22.4 billion in 2013. The key to this growth, according to the firm, is that Mobile Web 2.0 provides an ideal framework for the delivery of collaborative applications, further enhanced and contextualized by location-based services.

A generation that has grown up with mobile texting, instant messaging, music downloads and video calling now expects an affordable, interactive and personalized experience that is available everywhere via a wide range of devices. Ericsson Consumer Lab studies across five countries in 2007 found that 82 per cent of people use the Internet several times a day, and 50 per cent say that having high speed Internet everywhere is important to them.

¹ Compounded average growth from start of deployment is bigger for broadband than for the most successful mobile service of all, GSM. Source: Ericsson calculations based on EMC data.

² Sources: Ovum, Wireless Intelligence, Strategy Analytics, Gartner and Ericsson calculations/extrapolations

3 Where next?

So having established itself as an important part of modern daily life, what will broadband deliver to society in the future? Making firm predictions in the technology field is notoriously difficult, but let us begin by painting a picture of a digital society enabled by ubiquitous broadband networks.

In this broadband enabled world, people's personal lives will be enhanced by being able to access their favorite music, videos, photos and games – their complete digital library – with high quality, both inside and outside the home, from a range of devices. They will be able to have their health constantly monitored; have their car's engine automatically checked as they drive; and keep an eye on their homes when they are away. People will be able to make secure transactions using their mobile devices, without the need for cash or credit cards. And they'll have instant access to a wealth of location-based information, applications and services.

In their professional lives, people will have constant access to their company networks; co-workers will be able to collaborate

interactively even when thousands of miles apart, videoconferencing and sharing documents and images as quickly and simply as if they were sitting next to each other.

It soon becomes clear that this vision is not that distant: many of these capabilities are already available, and they are becoming more widespread as truly ubiquitous broadband connectivity becomes reality.

In the longer term, technology enablers like the broadband Internet will be seen even less as the 'end' and more as the 'means': people will expect ubiquitous, high speed access to all their information, communication and entertainment services. Computing and networking resources will be increasingly virtualized and dispersed, and available to all.

Exactly what this will mean for consumers and enterprises is hard to predict. What we can say is that open, ubiquitous broadband Internet access will provide the basis for the 'unanticipated innovation' that has already seen the rise of applications like Google, YouTube, Skype and Facebook – which no one could have predicted even five years ago.

3.1 New broadband ecosystem

A new ecosystem is becoming established in which innovation is continuously delivering new and unique applications for services like video telephony, connected navigation and Internet TV. Media, entertainment and Web application providers are working alongside network providers to deliver the fixed and mobile connectivity networks they need to reach consumers.

In this ecosystem, it is the operators that can provide end-to-end delivery solutions by integrating multiple distribution services – rather than focusing on owning and controlling individual channels – who will be the winners.

Network operators have an opportunity to build businesses around the real value they provide in delivering information, communication and entertainment where and when it is needed. They can become specialist logistics providers that seamlessly pull together the

multitude of fixed and mobile networks, content delivery systems and application partners. Whether operators choose the role of bit-pipe provider or full multimedia service and content player, the timely, reliable and secure delivery of bits and bytes has intrinsic value.

The consumer and professional software and gadget developers will continue to feed this ecosystem with a wide range of applications and connected devices – which will in turn drive demand for connectivity and overall network capacity. Market players are speeding broadband adoption by standardizing basic connectivity – making it easy to pre-integrate into devices and support the user at start-up. The rest will be taken care of by the millions of entrepreneurs out there, who are eager to capture new markets by making their products and Web based services more useful, interesting and attractive to users.

3.2 Connectivity fitted as standard

Of course, it is not just PCs that are enabling us to be connected these days. Many other types of devices are already connected, and connectivity is being built into many new types of device – including TVs, personal media players, digital cameras, personal health monitoring systems, electronic books and cars.

The increasing processing power and memory of modern devices are able exploit connectivity to broadband capable networks to deliver new services, based on extensible functionality and new applications.

According to a recent report from analyst firm Berg Insight, the number of mobile network connections used for machine-to-machine communication will grow at a compound rate of 37.9 per cent from 37.5 million connections in 2007 to 186 million connections in 2012.³

Another form of machine-to-machine connectivity, Near Field Communication (NFC), is also set for adoption across a wide range of applications, opening up myriad new product and proximity service opportunities. NFC is a short range wireless connectivity technology, based on Radio Frequency

Identification (RFID) technology that uses magnetic field induction to enable communication between electronic devices in close proximity. It enables users to perform intuitive, safe, contactless payments, access digital content and connect electronic devices simply by bringing devices into close proximity.

Ericsson Consumer Lab research across 11 countries has found strong consumer interest in such services; especially the convenience of paying for things and ticketing without the need for cash or credit cards.

We are entering a new phase of connectivity as more devices interact with the Web, and selective open interfaces are offered by the once closed systems of service providers – from telecom operators through e-commerce houses, universities, libraries, governments to search engine providers. Rather than merely connecting devices, people and services, the Web begins to connect information itself. This trend has already begun and will massively increase the value of broadband connectivity as enterprises and individuals alike find innovative and truly useful ways of simply and seamlessly linking information.

3.3 Real life value from the ‘virtual’ world

Connected gaming devices are increasingly using advanced features like 3D glasses, in-game conferencing and increasingly realistic force feedback joysticks. The rapid growth in Internet gaming is already attracting technology developers from other industries who are creating entirely new capabilities and add-ons, which will in turn increase the need for broadband. One such example is the application of software haptics generators – which enable the sensation of actually touching and feeling virtual objects – adopted by the gaming industry from medicine.

Until recently, haptic interfaces have mainly been used in healthcare, education, research, virtual modeling and CAD/CAM applications. However, as the price of hardware has fallen

from tens of thousands of dollars to reasonable ‘high street’ levels, many new possibilities are opening up for more consumer oriented applications. Haptic interfaces mean we can not only hear, see and steer what is happening in virtual worlds, but also feel the shape, texture and weight of an on-screen three dimensional object. With haptic interfaces built into everyday communications devices, we’ll be able to shake hands virtually over the Internet, and doctors will be able to diagnose and operate on patients remotely.

Healthcare is a good example of the real life value that technological innovation can bring. For instance, remote monitoring systems already use Bluetooth and cellular networks to transmit physiological readings such as

³ Report: HSPA Broadband Europe, Berg Insight 2008 <http://www.berginsight.com/>

ECG, blood pressure and glucose levels or heart rate to a remote monitoring center – enabling an accurate diary to be kept or alarms to be triggered. Remote expert systems analyze the data and can provide timely feedback to both doctor and patient. With the ageing population of many countries, these kinds of connected applications will be of substantial social and economic value.

We are beginning to see ‘robotic’ devices like automatic vacuum cleaners or lawnmowers connected over broadband for remote monitoring of dust levels or engine status, or tracking in the event of theft. While built-in

cameras in cuddly toys for keeping an eye on children might sound rather ‘Big Brother’, there is growing interest in home security solutions with applications like live video alerts to mobile phones.

Broadband connectivity enables highway authorities to change road signs with just one click, in the event of changing weather conditions, poor light or an accident. It also enables them to link speed cameras together to monitor road traffic flows and enforce speed limits, thereby ensuring safer driving conditions for everyone.

4 Enabling the connected lifestyle

The growth in broadband connections and multimedia traffic – for TV services and user generated video, for example – is driving demand for higher network capacity and quality. The moves to interactive and personalized High-Definition TV (HDTV) services, for example, will require high throughput, deep fiber access networks. Even though not all devices will require as

much bandwidth as gaming devices or HDTV sets, the total capacity needed is expected to increase exponentially.

In developing regions, broadband accesses are far more likely to be shared between family members and colleagues – most likely using mobile phones and low cost laptops connected over mobile broadband, especially in rural areas.

4.1 New converged network architecture

The profitable delivery broadband services to people at home, in the workplace and on the move requires the deployment of networks capable of scaling progressively while providing an attractive total cost of ownership over their lifetime.

Providing such ubiquitous broadband access does not require the parallel development of separate, distinct networks. Fixed and mobile solutions for delivering broadband are already developing in a complementary way, and the trend is towards a single converged network that offers multiple access types.

At the forefront of meeting this requirement is a standardized [full service broadband](#) architecture – a unique collection of technology components and associated services

designed to deliver ubiquitous broadband connectivity and compelling experiences for people and enterprises. Full service broadband architecture provides the essential components for scalable IP networks covering device ecosystems, broadband access, transport, control, applications, charging, services and operations management.⁴

The goal is to deliver access to personalized services on any device, from mobile phones, portable media players and games consoles, through desktop and laptop computers, to widescreen HDTV sets. This means evolving to networks that are able to personalize the digital media experience for users across platforms and standards, enabling users to access information, communication and entertainment on any device.

4.2 Unblocking network bottlenecks

One aspect of broadband service delivery that has caused some frustration among more demanding users is the lack of affordable high speed access that is available where and when they need it. However, broadband access speeds have improved dramatically in the past few years, and both fixed and mobile access networks are continuing to advance rapidly to meet the emerging demand for ubiquitous broadband.

Fixed broadband technology will, for the foreseeable future, have the advantage in terms of access speed per user and be more

suitable for individual services involving TV, video and large screens. Fixed broadband networks are undergoing a major modernization phase with the deployment of deep fiber access technologies such as Point-to-Point (P2P) Ethernet over fiber or Category 5 copper cabling, and Point-to-Multipoint (PMP) Gigabit Passive Optical Network (GPON), with an option of using Very High Speed Digital Subscriber Line 2 (VDSL2) in the last drop. P2P fiber and GPON based PMP are complementary approaches to deep fiber access, and could very well be deployed in the same

⁴ For more information on Ericsson's Full Service Broadband white paper http://www.ericsson.com/technology/whitepapers/WP_FSB_Arch_RevB.pdf

network to provide a flexible access solution.

Mobile broadband technology is important in making cost effective broadband accessible everywhere, and the fastest growing mobile broadband services worldwide are based on High Speed Packet Access (HSPA), with Long Term Evolution (LTE) as its evolution. HSPA is already widely deployed in many countries around the world and is igniting the mobile broadband revolution. New experiences for people and enterprises are being created and the value of anytime, anywhere connectivity is being discovered every day.

The choice of broadband access technology will reflect each operator's broadband strategy

for its target markets, as well as its existing assets, competition and regulatory framework.

Access heterogeneity needs to be managed to give users the best possible connectivity convenience, with low cost of ownership for operators. Multi-access edge systems offer access and application independent capabilities for subscriber management, mobility support, deep packet inspection, security, real time charging, media gateway and policy control. They also provide access interworking between fixed and mobile access networks, and a service interface that keeps access dependencies hidden from higher level services.

4.3 Reliable and secure transport network

Whichever access technology is deployed, there needs to be a reliable, secure and cost optimized transport network, designed to balance the short term needs of optimizing fixed broadband networks with the flexibility required for full service broadband. It needs to be simple and cost efficient enough for operators to add multi-access mobility, new access technologies and new services.

Many operators are turning to advanced Dense Wavelength Division Multiplexing (DWDM) optical solutions to deliver the capacity they need to serve these high speed access networks. While most DWDM networks today are connected at 10 Gbit/s, there are already 40 Gbit/s networks being deployed and 100 Gbit/s networks are being considered.

Any operator aiming to introduce full service broadband offerings needs to manage the evolution carefully, ensuring that they have the capacity to cope cost effectively with traffic growth from new services, not all of which they will own or control. This capacity must be able to maintain service levels and scale to meet future demand.

Full service broadband solutions promise standardized communications, content and media systems, offering telecom operators a way to deliver interactive, open, personalized multimedia services, no matter where the user is. The users will be in control, watching films, TV shows and customizing other information and content on demand whenever it suits them, wherever they are.

4.4 Enabling mass market multimedia services

Operators are implementing new service architecture that converts their core asset, the network, into a delivery platform for Information Communications Technology (ICT) services – opening up new areas of revenue creation, both among consumers and enterprises. Two key components in this architecture are [IP Multimedia Subsystem \(IMS\)](#) and [MMTel](#).

IMS is a standardized architecture for controlling and delivering multimedia services

that employ IP for transport and Session Initiation Protocol (SIP) for service signaling.

MMTel is a standard that uses IMS architecture to support fixed and mobile VoIP-based telephony and multimedia services. It enables operators to deliver a range of real time multimedia services, including voice, video, image and file transfer, instant messaging, active (presence enabled) phonebook and conference calls. Users can easily add or drop services and bring in new participants during the call,

or session. For example, users can start a session with messaging, upgrade to a voice and/or video session, add other people to the session, and send files, share pictures and more.

An industry initiative called Rich Communication Services (RCS) – formed by Ericsson,

Nokia, Nokia Siemens Networks, Orange, Telecom Italia, Telefónica, TeliaSonera, Samsung and Sony Ericsson – will speed up and facilitate the adoption of IMS-based applications and services that provide an interoperable, convergent, rich communication experience.

5 Ensuring broadband benefits all

There is a vast body of evidence to show the positive economic impact that broadband has on society in several areas. Broadband is a major contributor to boosting competitiveness, driving economic growth through new business start-ups and job opportunities, reducing global carbon dioxide (CO₂) emissions by avoiding unnecessary travel, facilitating

distance learning and telemedicine and, ultimately, helping to bridge the digital divide.

While studies from different parts of the world have somewhat different approaches to measuring the economic benefits of broadband, they all come to the same conclusion: broadband has a strong positive impact.

5.1 Social advantages

Research proves the socioeconomic value of Internet and broadband connectivity. Some 76 per cent of respondents in an American study supported freedom of information as a core ethic of online life and 75 per cent agreed that such a policy ensuring freedom of expression on the Internet should be adopted⁵. In the UK, BT reduced travel by 17 per cent (or 69 million miles) when around 10 per cent of its employees registered as home based teleworkers with remote office access.⁶

Broadband connectivity can be used to encourage equal opportunities for all a country's citizens, wherever they live. With a broadband connection, geography becomes less of an issue. Making it easy for people to live and work in rural areas helps avoid urbanization and improves a country's socio-geographic structure. It also enables employees to work efficiently from home, reducing traffic and congestion. Advances in videoconferencing mean meetings can be virtually face-to-face, even when participants are sitting in different locations.

In their ['Saving the climate @ the speed of light'](#) joint initiative, the Worldwide Fund for Nature (WWF) and European Telecommunications Network Operators' Association (ETNO) set out a vision for achieving a more sustainable world that puts ICT in the driver's seat. According to the WWF, the Information and Communications Technology (ICT) industry is ideally placed to spearhead moves to more sustainable business activity as it is accustomed to rapid change, is highly innovative and has a service focus. It argues for the decisive role of the ICT sector in

reducing carbon dioxide emissions through technologies that enable flexi-working, video and audio conferencing, e-learning and e-health.

Promoting the use of broadband technology – fixed and mobile – to reduce travel and transport needs would show decision makers that new technology can increase efficiency and quality of life, as well as reduce carbon dioxide emissions. Such technology can also help address the key challenge of sustainable urban solutions – especially in the mega-cities of emerging markets. ICT technologies can help emerging economies leapfrog in their development and reduce the impact development on the environment, as well as benefiting more advanced economies.

With help from broadband, companies in remote areas can still be in close contact with the world. This spurs entrepreneurial activity and enables start-ups in many areas, including design, importing and selling, education and digital media. Research and development companies and education establishments also benefit greatly from broadband connectivity.

The social impact of broadband cannot be underestimated. A nation's wellbeing can be improved through broadband connectivity in healthcare, and the general education level of its population benefits positively from e-education. Accessibility to government services improves, and their efficiency increases. While many of these services can be delivered over a narrowband connection, broadband improves their quality, usability and accessibility dramatically.

⁵ Source Pew Internet & American Life Project

⁶ Source British Telecom

5.2 Balancing competitiveness and regulation

Governments around the world increasingly value the benefits of broadband connectivity, and are acting to encourage its roll out and take-up, as entertainment, information and public services move online. They naturally want to ensure that their citizens and enterprise are not left behind, through policies for 'digital inclusion'. It is vital that governments and regulators continue to foster an environment that balances the need for social advancement with the need for long term investment and competitiveness.

While politicians at global and regional levels work to design and implement fair rules to ensure open competition, local politicians are often tempted to see broadband as a way to improve their own region's competitiveness and may encourage public spending on broadband coverage in competition with established commercial operators. This is fine as long as the offerings are subject to

normal commercial rules, but when broadband access is offered for free to local communities, the market becomes unbalanced. There is also a risk that public funds are wasted in the long term – it is costly to keep up with technology development.

A regulatory framework is needed to encourage commercial broadband build out in areas where it is not obviously commercially feasible – as in rural or remote areas. With some stimulation and coverage requirements as part of the license, mobile broadband technology offers an excellent way to provide rural regions with broadband access at the speeds and capacity needed.

It is also in governments' interest to ensure devices like computers are affordable for everyone. This can be achieved through tax deduction programs or initiatives for schools and universities.

6 Conclusion

Broadband has true mass market appeal and is becoming a basic necessity in today's information society. Growth is inevitable – once people use broadband, there is no going back. It is up to operators and their partners to enable this growth and ensure there are no barriers to further broadband penetration and usage.

By implementing a full service broadband architecture based on deep fiber access and mobile broadband – glued together by converged, intelligent core, metro and transport networks – operators can help their subscribers into the seamless, interactive digital world of tomorrow.

In the end, broadband connectivity encourages equal opportunity to all citizens, no matter where they happen to live. And governments and regulators can only benefit from encouraging investment in technology that enables higher speeds and broadband coverage everywhere.

[Full service broadband](#) infrastructure is ready for operators to roll out advanced mass market multimedia services over broadband and generate the new revenues they need to continue to invest in the future.

7 Glossary

CAD/CAM: Computer Aided Design/Computer Aided Manufacturing

ECG: Electrocardiogram

GPON: Gigabit Passive Optical Network

HDTV: High-Definition Television

HSPA: High Speed Packet Access

ICT: Information and Communications Technology

IMS: IP Multimedia Subsystem

LTE: Long Term Evolution

MMTel: Multimedia Telephony

NFC: Near Field Communication

P2P: Point-to-Point

PMP: Point-to-Multipoint

PDA: Personal Digital Assistant

RFID: Radio Frequency Identification

VDSL2: Very-high-speed Digital Subscriber Line 2

WDM: Wavelength Division Multiplexing