ITU INTERNET REPORTS:

BIRTH OF BROADBAND

Executive Summary

September 2003

INTERNATIONAL TELECOMMUNICATION UNION

This *Executive Summary* provides a brief *résumé* of the ITU report "*Birth of Broadband*", which has been specially prepared for the ITU TELECOM World 2003 Exhibition and Forum, to be held in Geneva, 12-18 October 2003. It includes a selection of charts, tables and boxes as well as a table of contents of the full report, which can be purchased online or in printed copy. This report is the latest in the "*ITU Internet Reports*" series, which includes the following titles:

- Internet for a Mobile Generation (2002)
- IP Telephony (2001)
- Internet for Development (1999)
- Challenges to the Network: Telecommunications and the Internet (1997)

Each of these publications is available for purchase online from the ITU website at www.itu.int/osg/spu, for CHF 100. Printed copies are also available from the ITU Sales Service (Fax: +41 22 730 51 94, e-mail: sales@itu.int), with reductions for ITU Member States and Sectors Members, and for purchasers from the least developed countries (LDC).

The full report (approximately 130 pages) gives an in-depth introduction to broadband and its effect on telecommunications around the world. It contains information on the latest broadband technologies and policy developments. Individual country case studies serve to illustrate these various aspects. A 60-page statistical annex to the report presents the latest available data on over 200 economies worldwide.

The report was prepared by a team from ITU's Strategy and Policy Unit (SPU) with assistance from the ITU Sectors and the General Secretariat. Much of the original research, including nine country case studies, was carried out for two workshops carried out under the ITU Secretary-General's New Initiatives Programme, with generous funding from a number of ITU Member States, including MPHPT Japan and MIC Korea. These workshops were held in Geneva on "Regulatory Implications of Broadband" (May 2001) and on "Promoting Broadband" (April 2003). For copies of the case studies, see the ITU website at www.itu.int/casestudies.

The views expressed in the report are those of the authors and do not necessarily reflect the opinions of ITU or its membership.

International Telecommunication Union (ITU), Geneva

Foreword to the 2003 ITU Internet Report: *Birth of Broadband*

"*Birth of Broadband*" is the fifth in the series of the "*ITU Internet Reports*", originally launched in 1997 under the title "*Challenges to the Network*". This edition has been specially prepared for the ITU TELECOM World 2003 Exhibition and Forum, to be held in Geneva from 12 to 18 October 2003. As one of the "hot topics" of the telecommunication industry in 2003, broadband is expected to be one of the highlights of this year's show. This new report examines the emergence of high-speed, dedicated Internet connections that will greatly expand the world's access to information. Broadband will also facilitate the long-expected convergence of three previously distinct technologies: computing, communications and broadcasting.

The introductory chapter of the report, *Broadband dreams*, explains what broadband can do for users, society and industry. Chapter two, *Technologies for broadband*, explains the different broadband technologies and how each can provide broadband access under different economic and network conditions. Chapter three, *Supplying broadband*, looks at how broadband has been successfully provided in certain economies and how certain policies can help expand the network. Chapter four, *Using broadband*, discusses the current and emerging applications that are driving broadband take-up along with applications and content models that show the most promise for the future. Chapter five, *Regulatory and policy aspects*, examines regulatory and policy frameworks in successful broadband markets. Chapter six, *Promoting broadband*, looks at the broadband experiences of several countries characterized by high penetration rates and extensive networks, including conclusions drawn from ITU country case studies on broadband, and examines why and how broadband should be actively promoted. Chapter seven, *Broadband and the information society*, looks at broadband as a component of a society built around ubiquitous access to information, including some of the benefits and pitfalls of total connectivity. The *Statistical annex* contains data and charts covering 206 economies worldwide, with original data on broadband and comparative information measured against a selection of variables. The *Executive Summary*, published separately, provides a *résumé* of the full report, focusing on each of the chapters.

ITU, the United Nations specialized agency for telecommunications, is committed to playing a positive role in the development of the information society and to extending the benefits of advances in telephony and new information and communication technologies (ICT), such as broadband, to all the world's inhabitants. This is in line with the Resolution of the highest administrative organ of ITU (Resolution 101 of the Plenipotentiary Conference (Minneapolis, 1998)), which calls upon ITU to "fully embrace the opportunities for telecommunication development that arise from the growth of IP-based services", and subsequent ongoing calls from ITU's Member States to continue to actively pursue this objective. The ITU Internet Reports are hopefully a significant contribution to that commitment.

1 Broadband Dreams

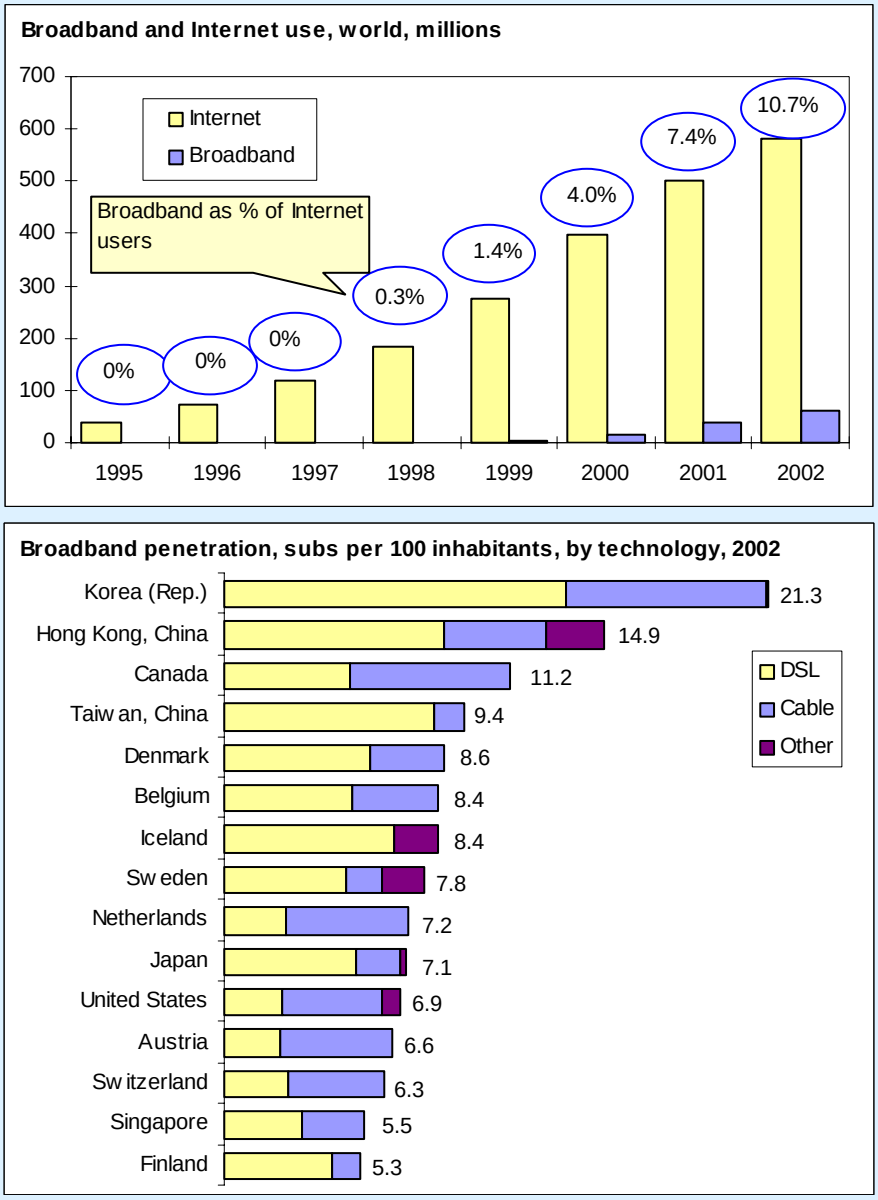
Like most technology-driven industries, the telecommunication sector has historically been characterized by steady growth punctuated by an occasional leap forward, usually when a new technology is introduced. In the latter part of the twentieth century, the almost simultaneous arrival of two major innovations—mobile phones and the Internet—not only changed the face of communications, but also gave fresh impetus for economic growth. However, as these innovations reach saturation—in the developed world at least—the search is on for possible drivers for a new wave of innovation and growth.

In the 2002 edition of ITU Internet Reports, "*Internet for a Mobile Generation*", we examined the likelihood that the coming together of the Internet and mobile communications will provide a major future driver for growth. This convergence of mobile and Internet technologies still seems likely to come to such fruition, though the indications are that it will take longer than expected. But in the meantime, a new technology is emerging that promises to provide a unifying platform for three converging industrial sectors: computing, communications and broadcasting. That technology is "broadband", and it is the subject of this report. The title "*Birth of Broadband*" reflects the view that broadband is still just at the start of its growth cycle, with the main phase of market expansion still to come.

Because of the nature of broadband (you have to use it to understand the benefits it offers), market take-off requires a certain critical mass of users. Currently, around one in every ten Internet subscribers worldwide has a dedicated broadband connection (see Figure 1, top chart), though many more share the benefits of high-speed Internet access, for instance, through a local area network (LAN), at work or at school. The world leader for broadband is the Republic of Korea (Figure 1, lower chart), which is around three years ahead of the global average in terms of converting Internet users to broadband. There, a critical mass was attained as early as 2000, when prices fell below US$ 25 per month; from which point onwards take-off was rapid (see Figure 1, bottom chart). Over 93 per cent of Internet subscribers in Korea use broadband (see Table on page 20).

Around the world, there were around 63 million "broadband" subscribers at the start of 2003 compared with 1.13 billion fixed-line users and 1.16 billion mobile phone users. Broadband users enjoy a range of service speeds from 256 kbit/s up to 100 Mbit/s. The number of subscribers is growing rapidly, with a 72 per cent increase during 2002. Digital subscriber line (DSL) is currently the most commonly deployed platform, followed by cable modems, Ethernet local area networks (LAN), fixed-wireless access, wireless LANs (WLAN), satellite and other technologies. The vast majority of today's users are in the developed world. But even among member countries of the Organisation for Economic Co-operation and Development (OECD), there are large disparities, not only in service availability but also in terms of quality of access and price per Mbit/s. But in developing countries, as broadband becomes cheaper, and wireless technologies evolve, broadband adoption can help countries to "leapfrog" traditional telephony technologies, as already illustrated in a number of initiatives.

Figure 1: Broadband penetration



Source: ITU World Telecommunication Indicators Database.

2 Broadband Technologies

"The term "broadband" is like a moving target. Internet access speeds are increasing all the time. As technology improves, even ITU's recommended speeds will soon be considered too slow."

Although most people have heard of broadband, few know exactly how they might define it. Broadband is often associated with a particular speed or set of services, but in reality the term "broadband" is like a moving target. Internet access speeds are increasing all the time. One can therefore only really talk about the "current" state of broadband, and make tentative extrapolations, based on planned or incipient developments, that may or may not come to fruition in the future.

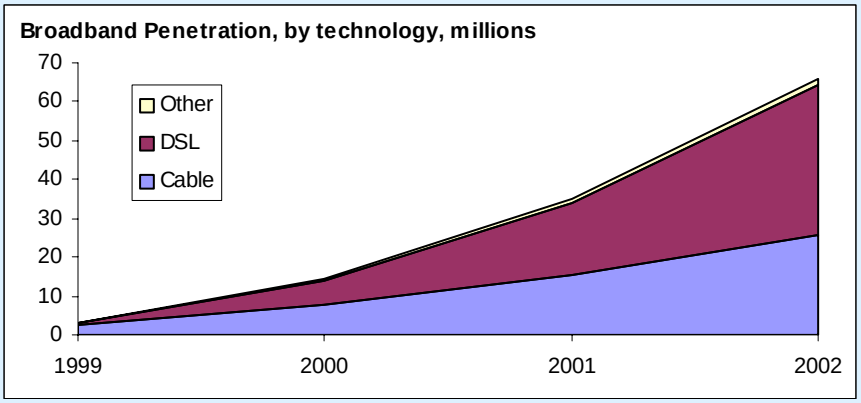
Broadband is commonly used to describe recent Internet connections that are significantly faster than today's dial-up technologies, but it is not a specific speed or service. Recommendation I.113 of the ITU Standardization Sector defines broadband as a transmission capacity that is faster than primary rate ISDN, at 1.5 or 2.0 Mbit/s. Elsewhere, broadband is considered to correspond to transmission speeds equal to or greater than 256 kbit/s, and some operators even label basic rate ISDN (at 144 kbit/s) as a "type of broadband". In this report, while not defining broadband specifically, 256 kbit/s is generally taken as the minimum speed.

The real gift of broadband is the greater scope it provides for developing applications and services, whether by enhancing existing ones, or enabling new ones. The availability of broadband depends primarily on existing networks, which vary according to the legacy infrastructure. For developed countries and urban areas for example, wireline technologies, based around twisted pair or coaxial cable, are already in place. In developing countries and rural areas, other newer technologies, based around wireless or satellite, may be more practical and cost-effective. Fibre offers the best possibilities for the longer term. Cultural, political, geographical, economic or other factors also play an important role, as do the regulatory framework and the supporting institutional arrangements.

Wired connections account for the vast majority (over 98 per cent) of current connections—although wireless technologies are starting to grow quickly. Of the fixed-line connections, digital subscriber line (DSL) and cable modem technologies are the most popular (see Figure 2, top chart). Until 2000, the majority of broadband users were using cable modems, and this is still the most popular form of access in North America. But worldwide, ADSL now accounts for more than half the connections, being particularly popular in Asia and Western Europe.

Where fixed-line connections are not so readily available or convenient to use, a number of wireless technologies such as Wi-Fi have been gaining in popularity too. While the full *Birth of Broadband* Report describes each of these wired and wireless technologies in detail, an overview of the different characteristics of the main technologies are given in the table in Figure 2.

Figure 2: Broadband technologies
Penetration by technology



Various broadband technologies, summary

Wired	Speed Mbit/s	Range	Notes
ADSL(G.dmt)	8	medium	Guaranteed bandwidth, uses splitter
ADSL(G.lite)	1.5	medium	Longer distances, slower
SHDSL	4.6	medium	Symmetric, fast
ADSL2	8	medium	No split, improved ADSL
ADSL2plus	16	medium	Increased bandwidth of ADSL2
VDSL	52	short	High speed, short distances
Cable	30	long	Fast, shares capacity among users
Fibre	10000	long	Very high speed, optical
Wireless			
802.11b (Wi-Fi)	11	100 m	Most popular and widespread
802.11a	54	50 m	Newer, faster, higher frequency
802.11g	54	100 m	Fast, backwards compatible with Wi-Fi
802.11e	54	NA	Adds QoS not present in a,b,or g.
802.16 (WiMax)	70	50 km	QoS, Very long distance, Metro net
RadioLAN	10	35 m	Specializes in wireless bridges
HomeRF	1	50 m	Replaced by HomeRF2
HomeRF2	10	100 m	QoS, better encryption, not widespread
HiperLAN2	54	150 m	European standard, QoS, for voice/video
HiperMAN	NA	50 km	European, compatible with 802.16a
Bluetooth	1	10 m	Personal area network [not WLAN]
Infrared LAN	4	20 m	Same room only

Source: ITU.

3 Supplying Broadband

"Broadband is increasingly seen as a catalyst for economic success. Supplying broadband is therefore an issue for both the private and public sectors."

Broadband is increasingly being seen as a catalyst for economic success in the information economy. More and more economies are focused on ensuring that access to broadband is both available and affordable to their populations. In many developed economies, broadband access has been driven largely by the private sector—particularly where effective competition is present in the market—and supported by government intervention only when necessary to correct market failure. But other governments, especially in Asia, have developed national strategies for broadband promotion, and for bringing broadband to regions, or to communities, that would not be among the first to be served through the operation of market forces.

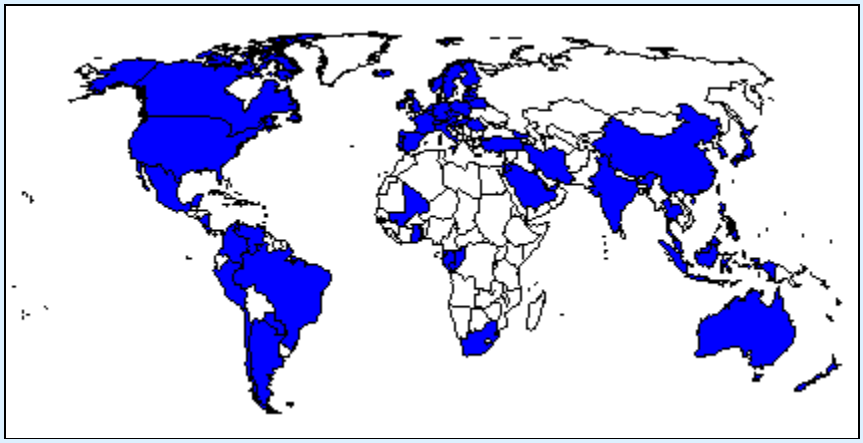
Many different companies have entered the broadband arena, but in the majority of ITU Member States, the incumbent fixed-line operator has emerged as the dominant provider, though not always the first-mover in the market. Those countries that have prospered often have a deep-pocketed second carrier that provides a real competitive challenge to the incumbent, such as Hanaro Telecom in Korea or Yahoo BB! in Japan. Countries where no cable TV network is available, or where the incumbent cross-owns both the telephone and cable TV networks, generally lag behind their counterparts in developing broadband.

As of year-end 2002, broadband services were commercially available in 82 out of over 200 economies worldwide (Figure 3, top chart). Since 2000, global broadband numbers have increased fivefold and now stand at over 60 million. As might be expected, penetration rates are quite closely correlated with gross national income (GNI) per capita (Figure 3, lower chart), although Korea is a clear outlier in this relationship.

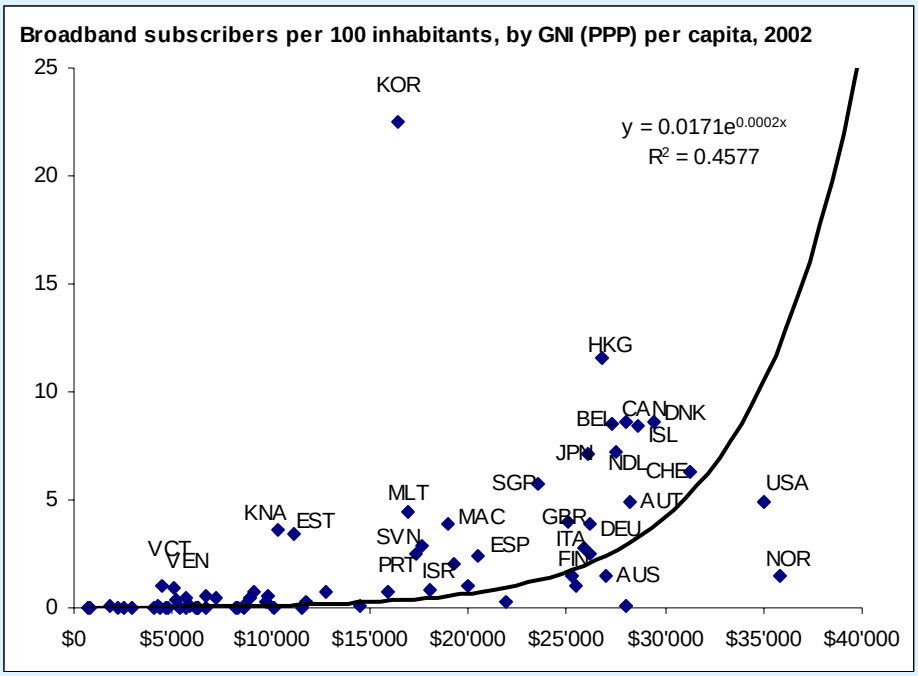
As broadband is entering the market at a time of technological convergence and change, supply models can vary considerably. Some end users even build their own fibre connections to their ISP. Typically, such initiatives—usually involving large companies or public institutions like schools and hospitals—aim to avoid the high costs associated with premium high-speed services from established broadband providers.

Under this model, a fibre consortium may be established, consisting of a group of customers who each own a predetermined number of dark-fibre strands within a fibre optic cable. Each customer is responsible for providing the electronics to light up the fibre, effectively creating separate private networks, which can then be connected to the backbone network. In practice, third-party professionals may carry out installation and maintenance. In Canada, this model has been deployed in the province of Quebec, where 26 school boards and the regional university research network have entered into arrangements with a number of providers. The model is also gaining in popularity among others wanting to avoid the high cost of commercial solutions. But supply has to be adapted to actual demand, and this requires market research to meet users' real needs.

Figure 3: Broadband penetration
Countries with commercially available broadband, (dark shading), 2002



The relationship between broadband penetration and national income (US$ PPP)



Source: ITU. *Note:* GNI = Gross National Income; PPP = Purchasing Power Parities, Luxembourg omitted from bottom graph but included in trend line calculations.

4 Using Broadband

"The Internet has already spawned the creation of a host of new applications and these are spreading from computers to other devices. Broadband accelerates this process."

Having examined the development of broadband infrastructure and technologies, and the challenges involved in providing the service at a reasonable price, the next question to be posed is "what to do with it?" In short, how is broadband used today, and what are the implications for future uses, for market development and for users?

The Internet has already spawned the creation of a host of new applications, including web surfing, instant messaging, file sharing, e-commerce and e-mail. With the advent of broadband and its faster always-on connections, the possibilities for the development of such services are growing dramatically, opening the path to interactive applications, especially online games, virtual reality and other high-quality digital services.

Broadband arrives at a time when the revolutionary potential of the Internet has still to be fully tapped, and is serving to accelerate the process of integrating Internet technologies into everyday life. This growth in itself has numerous implications for issues such as intellectual property rights (IPR) and security, as more and more material is made available in digital form. It also comes at a time of technological convergence, so that computer applications are now spreading to other devices (mobile phones, television sets, etc.), and *vice versa* (for instance, entertainment on computers) (see Box 1).

The report provides an overview of current and future applications for broadband technologies, including consumer-oriented services such as Internet browsing, voice services (e.g. voice over broadband or Internet Protocol), entertainment and information supply. Specific public domain services are also examined, including e-government, e-education and e-medicine, as well as e-commerce and business uses.

Broadband usage is of course interlinked with content and the evolution of models for the development and distribution of online content—raising associated regulatory and ethical issues—and possible bottlenecks in the commercialization and distribution of broadband services. These aspects are also examined in the report.

As regards Internet content, for example, IPR concerns enter strongly into play. With Internet content, the established IPR system has had to grapple with new areas of media diffusion. The IPR framework is being readapted, but much more work and negotiation will be necessary. With broadband, the type and quantity of content exchanged globally is set to increase drastically, raising the stakes even higher. In particular, since the well-known *Napster* case came to a head in 2000 over free music downloads; peer-to-peer (P2P) technologies have been seen as a threat by the commercial entertainment industry.

This problem is becoming even more apparent as broadband services allow a faster exchange of large files, allowing download of whole albums or even movies. The music industry alone claimed a loss of about 7 per cent in 2002 due to swapping of digital music, and the same is feared by the film and software industries.

Box 1: Internet TV and home networking in Japan

In the broadband era, personal computers and personal digital assistants (PDA) are not the only types of terminal for accessing the Internet. Since the advent of higher-speed networks, manufacturers have been developing various broadband terminals, which are thus far being used by only a minority of subscribers. Examples include video game consoles, Internet television (TV) appliances, set-top boxes (STB) and home servers.

In Japan, the Ministry of Public Management, Home Affairs, Posts and Telecommunications' (MPHPT) latest annual random sample survey concluded that there were 3.64 million people who accessed the Internet either from their game console or from a television set in 2002, although the precise number of units in use is not known. Internet TVs started to emerge in 1999 in Japan, but the products available at the time did not attract many consumers. However, technology has evolved since then and the user interface has also improved substantially while prices have fallen.

Sony's Airboard was one of the first products and it provided a state-of-the-art wireless video device at the time of launch. Improvements added over the past three years culminated in the IDT-LF3 version, which was released in January 2003. Airboard was created as a wireless Internet tablet rather than as audiovisual equipment.

Compliant with the IEEE 802.11b "Wi-Fi" standard, it can be connected to the Internet at up to 11 Mbit/s. The device can be used almost anywhere (within a 30-metre radius) in the home or garden and even in the bathroom (with a protective cover). One can watch TV as well as capturing video images of choice from the programmes one watches for printing or sending on as e-mail attachments. The battery life is currently quite short, but with improvements expected in the near future, devices like these will certainly change the way an increasing number of people use video information.

An STB is defined as a device that is connected to a TV, permitting access to various content, including pay-per-view. Although there are many possible uses, STBs can also be used for broadband content distribution. Broadband subscribers can watch broadband video programmes on their TV with an STB. In Japan, BB Cable TV, for example, offers STBs to its subscribers as does the fibre-to-the-home (FTTH) service provider, Bbit-Japan. One of the main benefits to subscribers with STB is that they can enjoy higher quality video than those with only a PC.

A new development in 2002 was the emergence of home servers, comprising an integrated PC, DVD, TV, etc. Sharp's Personal server (named HG-01S), launched in February 2003, is one example. It can interconnect a PC, mobile phone, TV, and other appliances. This device even enables the user to access their home network when absent from home, for example by setting the video timer via their mobile phone or watching recorded TV programmes on their PC.

Source: ITU case study on Broadband in Japan, at: http://www.itu.int/sgo/spu/casestudies/.

5 Regulatory and Policy Aspects

"Market opening by itself has often not been sufficient to bring about the development of meaningful competition. There is still a tendency for the incumbent to dominate."

Like other communications technologies, broadband raises a number of regulatory and policy issues. For example, should governments regulate broadband? What policy instruments are best suited to promoting competition? Research seems to indicate that where both the private and the public sectors interact to create the right framework, broadband growth makes greater headway. Tethered by government regulations and guidelines that are geared to fostering a healthy level of competition, broadband operators can still grow their services and networks profitably. Similarly, by lifting or modifying certain restrictive regulatory practices, governments can considerably boost the supply and demand cycle. From there, a virtuous circle of social gain and economic growth can emerge.

In addition to competition trends and policies, this part of the report looks at, *inter alia*, how regulation can facilitate the market entry of new broadband providers, ensure fair competition in the marketplace and promote near-universal broadband service provision.

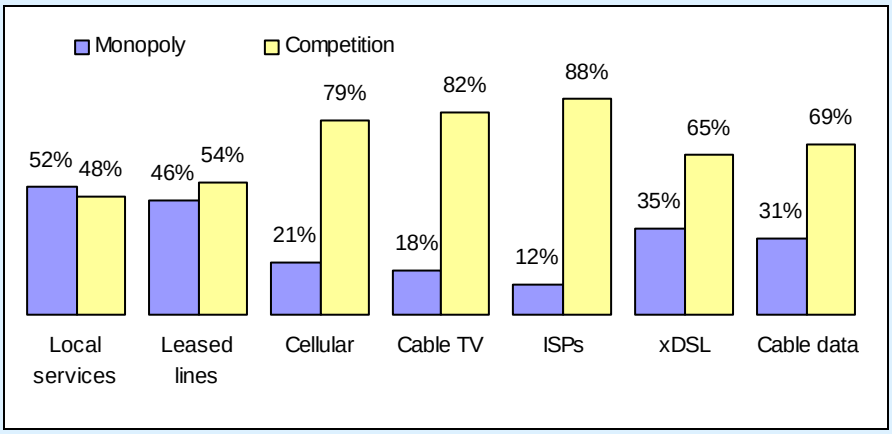
In spite of the trend towards market liberalization, especially in broadband services, there still remain significant concerns as to the true extent of meaningful competition in communications markets worldwide. Figure 4 (top chart) shows levels of competition across different sectors worldwide.

With broadband, one notable trend has been for incumbents to continue to dominate in markets where they have been allowed to compete alongside new entrants, and this is also true for historically competitive markets such as mobile and Internet services. In 2002, incumbents operating in member countries of the Organisation for Economic Co-operation and Development (OECD) controlled more than 80 per cent of the broadband access market, while those in the European Union (EU) controlled more than 90 per cent of the broadband market (see Figure 4, lower chart).

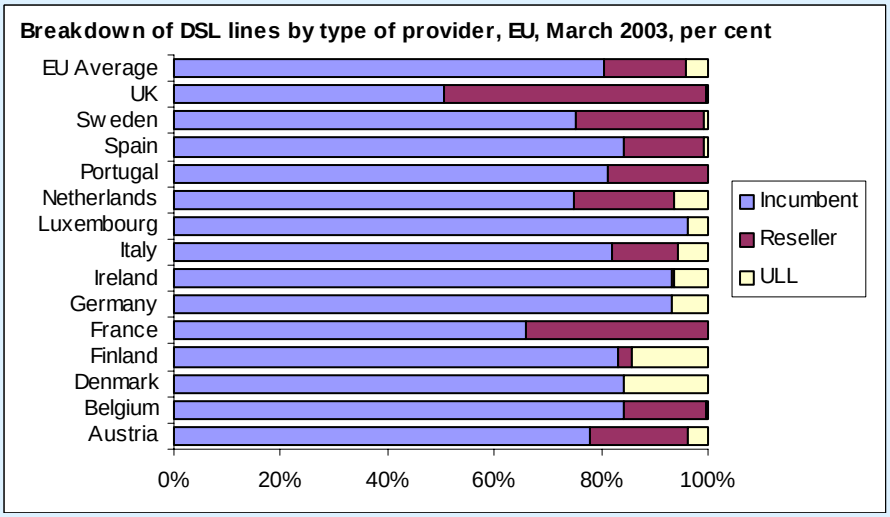
These figures corroborate the reality that, even in countries where telecommunications markets have been liberalized, market opening by itself has not been sufficient to bring about the development of meaningful competition. Of course, this in part reflects commercial realities such as limited market size, lack of economic stability, and poor returns on investment, as well as the recent collapse in investor confidence, all of which affect new players' ability to compete effectively with an established incumbent operator. But it also reflects current government processes for setting competition policy. In this context, it has become increasingly important for countries to have the necessary policies and institutions in place to deal effectively with the increasing quantity and complexity of competition issues that are retarding the development of meaningful competition. Once the policy environment is right, then it can then be left up to the dynamic between business and consumers to determine the pace and direction of broadband market development.

Figure 4: Broadband competition

Competition across different ICT market sectors



Incumbents still have the largest market shares in the European Union



Note: ULL = Unbundling the local loop.

Sources: ITU World Telecommunication Regulatory Database, ECTA.

6 Promoting Broadband

"It is one thing to perceive the pressing need to promote broadband, and another to engage actively and successfully in its promotion."

In reality, there is more than one answer to the question of why it is worth promoting broadband. On a general level, analysis consistently shows that economies that actively pursue promotion of new technologies most often fare better in terms of access, economic gain and technological impact. Broadband is no exception to this. Analysis also shows that consumers often remain ignorant about the benefits they might gain by switching to broadband, and need some convincing of what is in it for them.

For governments, broadband is a way of promoting economic development and certain social benefits. For instance, in the Republic of Korea and Hong Kong, China, which are currently the leading broadband economies, telecommunication expenditure as a percentage of GDP grew up to three times faster in the last ten years than the global average. As many countries have also experienced, broadband can also facilitate the provision of public services, such as e-learning, e-health and e-government.

For telecommunication companies, broadband offers a route to offset the current slowdown in the industry. In the Republic of Korea, the average revenue per user (ARPU) for a broadband user is up to seven times higher than for a narrowband user. For consumers, broadband makes possible a much wider and richer range of applications, especially when higher speed services are available. For instance, in a user survey in Japan, 70 per cent of users reported that broadband had increased their usage of the Internet. And in Iceland, some 40 foreign television channels are broadcast over the broadband network, greatly widening the choice of services available.

For businesses, in particular small- and medium-sized enterprises, broadband brings the advantages of access to high-speed communications, and the ability to reach a worldwide audience that were previously only available to larger companies. Broadband also adds flexibility to the workplace through teleworking and remote network access at fast speeds.

Prices play perhaps the most important role in promoting broadband demand. Successful broadband economies are characterized by low prices—typically as a result of flourishing competition and innovative pricing schemes that attract a wide variety of customers. As price plays such a vital role in users' adoption decisions, it is vital to understand how policies that reduce prices increase broadband penetration.

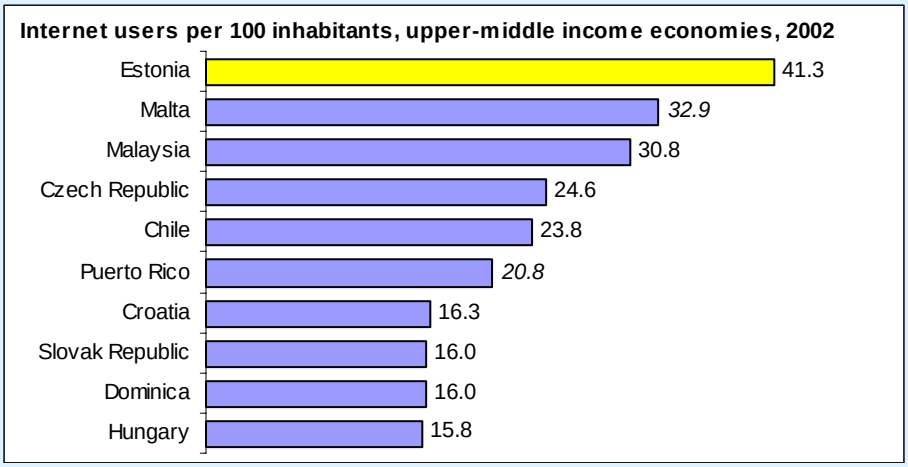
It is one thing to perceive the pressing need to promote broadband, however, and another to engage in its promotion actively and with success. This is where the experiences of economies that have done so provide valuable keys to what works, and what doesn't. For broadband growth and development, success factors vary from country to country. One thing that is clear though, is that those countries that tackle both supply and demand issues have had most success in raising availability of broadband and in the quality and choice of services. Judging from the experience of the most successful broadband economies, a proactive approach to broadband promotion is certainly one of the keys to success. Box 2 on Estonia, describes its successful broadband promotion strategy in schools.

Box 2: Estonia: Tiger, Tiger, Burning Bright
Broadband in education: Far-reaching benefits

Estonia launched the Tiger Leap National Programme in 1996 in an effort to make a developmental leap by introducing information and communication technologies (ICT) into secondary schools. The targets were to achieve the ratio of one PC per 20 students, an Internet connection to each school, and basic computer training for all teachers. Today, the programme has accomplished most of its goals. Through Tiger Leap, 75 per cent of all Estonian schools have broadband Internet connections and the remaining schools have a dial-up option. More than 63 per cent of teachers have received training courses, acquired basic computer skills, and have been given guidance in using contemporary ICTs in teaching.

Investment in IT education and the promotion of broadband access in Estonian schools has been a significant factor in spreading the use of ICTs more broadly, beyond the boundaries of the education system. The programme has attracted considerable backing from local governments, the private sector and international investors, and has helped to shape Estonia's progressive reputation. Today, 35 per cent of the Estonian population uses the Internet, 38 per cent uses personal computers, and 18 per cent have their own home computers. Furthermore, 90 per cent of government agencies' computers are connected to the Internet. These figures place Estonia as the leader in usage of IT in upper-middle income countries (see chart). Estonia's broadband penetration (at 3.4 subscribers per 100 inhabitants in 2002) ranks it among the world leaders.

Some six years after the introduction of Tiger Leap, a new generation of Estonians, accustomed to fast information access and equipped with ICT skills, is reaching university level. As these students grow older and continue to demand fast access to information in different areas of their lives, the demand for ICT-related competence can be expected to continue its rapid growth.



Source: International Bureau of Education (2002) http://www.ibe.unesco.org.; NDP Estonia (2002) http://www.undp.ee/tigerleap/2.html.

Note: 2002 Internet users data in italics are estimated figures.

7 Broadband and the Information Society

"Broadband's particular promise is in its capacity to enable multiple applications over a single network, and the related economic gains—meaning greater access at lower cost."

The weaving together of digital networks and information with the social networks of the twenty-first century has implications for everyone. No matter how we choose to define the "information society", there are many unanswered questions about how, and why, we should promote developments that give an increasingly central place to the use of information and communication technologies (ICTs) in our lives. Box 3 looks at some of the history of the information society vision, and some of the initiatives taken to build it.

In industrialized countries and especially developing countries, there is a pressing need to address the persistent exclusion of people, in some geographical areas and social groups, who are marginalized with regard to access to ICTs and the knowledge and skills to use them (i.e. the "digital divide"). Technological innovation alone is not enough to ensure a sustainable, growth-oriented information society. It takes multi-stakeholder cooperation.

While broadband is only one among many technologies present on the scene, its particular promise—viewed through an information society "lens"—lies in two areas: First, broadband's capacity to enable multiple applications (voice communications—for example using voice over broadband, Internet applications, and television/video and audio applications) over a single network. Second, the related economic gains, which also translate into lower costs for consumers. With increased data transfer and speeds, as well as the effects of competition among service providers; the tendency is for prices to drop, bringing access to information closer to more of the world's population. As well as these particular features of broadband, network security and ethical issues are among the topics addressed in this part of the report, as are particular examples of how broadband can help or pose risks to developed and developing societies in the transition to a global information society.

In some contexts, wireless broadband may hold particular promise. "Hotspots" (e.g. in airports, hotels, cafés) are now being expanded to create whole urban areas with wireless coverage. Although these initiatives are only in their incipient phases, organizations such as the United Nations have begun to embrace the potential that wireless technologies, such as Wireless LANs, may hold for developing countries, where basic wireline infrastructures are often lacking. As pointed out by the UN Secretary-General, Kofi Annan, "it is precisely in places where no infrastructure exists that Wi-Fi can be particularly effective, helping countries to leapfrog generations of telecommunications technology and infrastructure and empower their people".

As well as stand-alone initiatives though, standardization efforts are essential to harmonize interfaces and protocols between networks and to ensure network security. Governments and industry are already actively involved in such standardization activities, including through ITU. Coordination of the radio frequency spectrum also requires strong international cooperation, as does research and development (R&D), the cornerstone of future technological development. In these and other areas, international cooperation is an essential prerequisite to realize any kind of global vision of the information society.

Box 3: From technological innovation to a "knowledge-based society"

As well as numerous initiatives to set out "visions" for the information society, an emphasis on the need to foster "knowledge-driven economies" to underpin inclusive information societies began to gain currency in policy circles in the late 1990s. The European Union set targets for becoming the most competitive and dynamic knowledge-driven region in the world. In the United Kingdom, the Department of Trade and Industry (DTI) gave priority to building the knowledge-driven economy in a White Paper published towards the end of the decade. In the United States, there were strong hopes that investment in "new economy" services would continue to boom and that there would be substantial economic benefits from investment in digital technologies. The World Bank's 1998/99 Development Report made a strong case for greater investment in knowledge as a means of tackling poverty and a range of persistent development problems.

Discussions about the growing importance of knowledge accumulation and absorption were often accompanied by assertions about the impact of rapid innovations in ICTs and of increasing investment in digital networks and their applications. Many acknowledged that the new technological "tools" could have both positive and negative social and economic consequences. It was also recognized that there might not be a straightforward relationship between investment in digital technologies and services and positive gains for economies or social welfare. Nevertheless, the mobilization of concerned stakeholders around the problems posed by knowledge-driven growth continues to emphasize the technical and economic features of these developments over the social and cultural features.

The rush to develop information society visions and knowledge-driven economy strategies has not been limited to the industrialized countries. For instance, the United Nations Economic Commission for Africa developed the Africa Information Society Initiative (AISI); Singapore developed its "Intelligent Island" vision and others such as South Africa also developed their own visions and strategies. In the "hope department", many experts have argued that ICTs would provide the opportunity for the developing world to "leapfrog" over generations of technology and catch-up with—or occasionally even surpass—wealthy countries in the industrialized world. Just as the end of the *dot.com* boom abruptly curtailed many utopian dreams, contemporary economic realities have tempered idealism. More positively perhaps, visions are now more inclusive of progressive patterns of technological development and of local adaptation of ICTs into individual cultures.

The creation of the G8 Digital Opportunities Task (DOT) Force and the decision to hold a United Nations World Summit on the Information Society (WSIS), under the leadership of ITU, are indicators of the significance of these developments at the highest levels. Most participants in these, and many related forums admit today that social considerations are as important as the economic and technological dynamics of emerging information societies.

More information on the World Summit on the Information Society (WSIS), to be held in two phases in Geneva in 2003, and in Tunis in 2005, can be found at the website: http://www.itu.int/wsis. In addition to full information on the Summit and its working documents, the site also offers background resources; research papers; links to worldwide information society initiatives, ICT success stories, interest groups and organizations; press materials, and specialized documentation on specific subject areas.

Source: Adapted from "The nature of the information society: an industrialized world perspective", in Visions of the Information Society (ITU, 2003). More information can be found at: http://www.itu.int/visions.

8 Birth of broadband: Birth of a new information era?

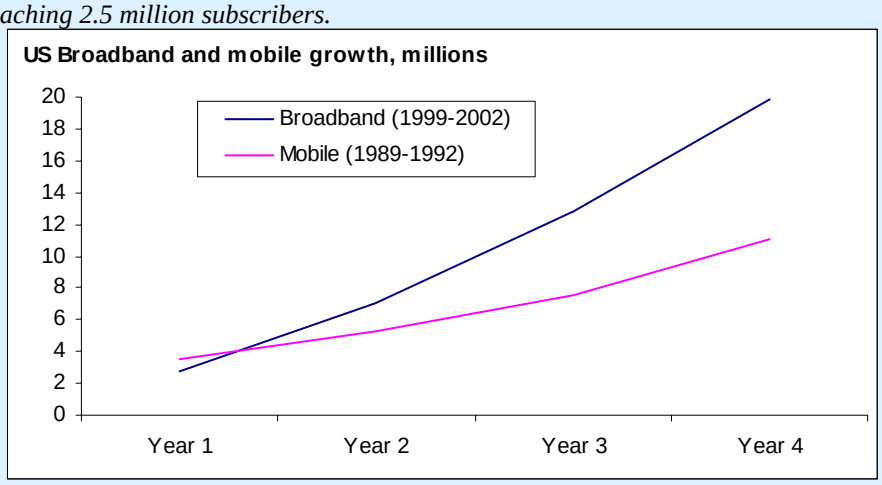
By mid-2002, with more than 60 million households and businesses actually subscribing to broadband, and other people accessing it through cybercafés or from connections at work or at school, it was estimated that operational broadband networks had a "reach" of well over 300 million people around the world. In certain markets, broadband is predicted to be one of the fastest-growing communications-based consumer services. In the United States, broadband is likely to reach the 25 per cent penetration mark more quickly than either PCs or mobile telephones did (see Figure 5).

Despite the overall growth in broadband penetration, certain economies have enjoyed more success than others. Most economies are still struggling to realize nationwide access principally because broadband network deployment comes with high fixed costs. Although much of the technology is available to provide broadband access on a scale matching that of fixed telephony, the availability of broadband has lagged behind—especially in developing economies.

Case study research, as well as information provided by ITU Member States, service providers and regulators worldwide (see, for instance, Box 4 on India), shows that with sufficient commitment, and with careful attention to users' needs, and to cultural and economic contexts, governments and industry can interact to promote and diffuse broadband to the benefit of all. The encouraging signs are that, thanks to innovation and the adaptability of technologies to local circumstances, broadband can serve to widen access to knowledge and information .

Figure 5: Growth in broadband penetration in the United States

US broadband growth has far outstripped mobile growth in the four years after reaching 2.5 million subscribers.

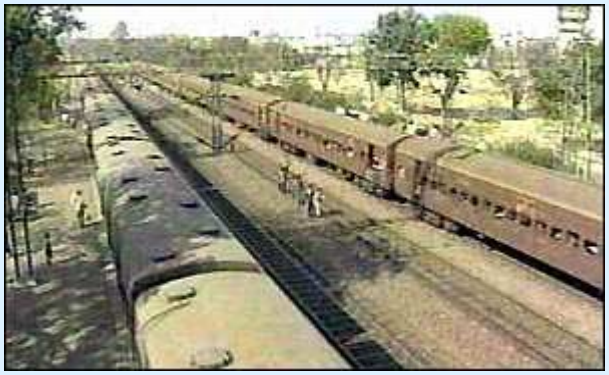


Source: ITU World Telecommunications Indicators Database.

Box 4: Railway lines lead to broadband access in rural India
Using excess capacity on existing signalling cable in India

India has one of the world's most widespread and dense rail networks with 8'000 train stations nationwide and an average distance of only eight kilometres between them. One approach to expanding access that has been applied in India, is to allow winning bidders for fixed-line services to convert their licences to wireless local loop (WLL) licences, which has led to the use of the railway network to provide Internet access.

In a plan launched in 2000, the Railroad Internet project aims to make use of some 65'000 kilometres of underused cable infrastructure already in place. This signalling cable (which is usually copper based, although fibre is used on several main routes) runs along the train tracks and has large amounts of spare capacity. It will be used to transmit Internet traffic to outlying areas, avoiding laying a new cable network.



Under the project, it is envisioned to set up special cybercafé kiosks (providing community Internet access and ticket services) at each train station, with computers networked together and linked up to the railway cable. The speed of the connections will vary according to the quality of cable segments. The railway system can link up to the standard telephone network through high-speed digital links at major towns. There is also the possibility of providing wireless Internet access within a 10 km radius of each station.

The project is being piloted in a small area along 40 km of railway track linking the southern towns of Vijaywada and Guntur. This initial phase has been launched through cooperation between Indian Railways (State owned) and private investors. Wide-scale rollout may however be delayed by regulatory issues, an unsure electrical supply, and bureaucratic processes.

Sources: Indian Railways (2001), http://www.indianrailways.com; BBC (2000), Fast track for Indian Internet, http://news.bbc.co.uk/1/hi/world/south_asia/769635.stm.

Statistical Annex: Broadband prices per 100 kbit/s, top 30 as % of monthly income

Measured by gross national income -GNI, and using purchasing power parities - PPP

Economy	Subscription/ month (US$)	Price per 100 kbit/s (US$)	Download Speed (kbit/s)	100 kbit/s as % monthly income
Japan	$24.19	$0.09	26'000	< 0.01%
Korea (Rep.)	$49.23	$0.25	20'000	0.02%
Belgium	$34.41	$1.15	3'000	0.05%
Hong Kong, China	$38.21	$1.27	3'000	0.06%
Singapore	$33.18	$2.21	1'500	0.11%
United States	$52.99	$3.53	1'500	0.12%
Canada	$32.48	$3.25	1'000	0.14%
Netherlands	$51.55	$3.36	1'536	0.15%
Macao, China	$38.34	$2.56	1'500	0.16%
New Zealand	$40.61	$2.71	1'500	0.16%
Germany	$33.93	$4.42	768	0.20%
Norway	$46.16	$6.56	704	0.22%
Denmark	$118.89	$5.81	2'048	0.24%
Israel	$20.40	$3.98	512	0.25%
Austria	$45.20	$5.89	768	0.25%
Slovenia	$79.54	$3.88	2'048	0.26%
Italy	$73.59	$6.13	1'200	0.29%
United Kingdom	$32.59	$6.37	512	0.30%
Finland	$165.89	$8.10	2'048	0.38%
Bahamas	$54.99	$5.37	1'024	0.40%
Luxembourg	$91.77	$17.92	512	0.42%
Sweden	$44.56	$8.91	500	0.43%
Switzerland	$57.84	$11.30	512	0.43%
Australia	$50.56	$9.87	512	0.44%
France	$51.46	$10.05	512	0.46%
Ireland	$61.69	$12.05	512	0.52%
Portugal	$39.64	$7.74	512	0.54%
Cyprus	$58.03	$9.07	640	0.60%
Iceland	$73.66	$14.39	512	0.60%
Lithuania	$12.80	$5.00	256	0.61%

Statistical Annex: Broadband subscribers, top 30, world, 2002

Total subscribers, penetration rate, and as percentage of all Internet subscribers

Economy	Broadband subscribers (total)	Broadband subs per 100 inhabitants	Internet subscribers (total)	Broadband as % of all Internet subs
Korea (Rep.)	10'128'000	21.3	10'784'678	93.9
Hong Kong, China	1'009'426	14.9	2'374'332	42.5
Canada	3'515'000	11.2	*5'624'000*	*50.4*
Taiwan, China	2'100'000	9.4	7'441'994	28.2
Denmark	462'000	8.6	2'441'044	18.9
Iceland	24'270	8.4	*50'000*	*20.8*
Belgium	870'000	8.4	1'694'384	51.3
Sweden	700'000	7.8	*2'849'000*	*12.5*
Netherlands	1'170'000	7.2	4'500'000	26.0
Japan	9'092'039	7.1	29'562'509	30.8
United States	19'881'549	6.9	*70'000'000*	*18.3*
Austria	539'500	6.6	1'200'000	45.0
Switzerland	460'000	6.3	2'550'000	18.0
Singapore	230'357	5.5	*927'000*	*16.3*
Finland	273'500	5.3	*950'000*	*5.5*
Malta	17'679	4.5	*60'000*	*15.3*
Germany	3'240'000	3.9	*15'000'000*	*14.0*
Macao, China	16'954	3.9	47'016	36.1
St. Kitts and Nevis	1'700	3.6	4'600	37.0
Estonia	45'700	3.4	121'000	37.8
Slovenia	56'735	2.8	*280'000*	*2.0*
Spain	1'077'405	2.6	*3'673'959*	*11.7*
Portugal	259'491	2.5	5'165'057	5.0
France	1'456'000	2.4	8'925'000	16.3
United Kingdom	1'370'000	2.3	13'100'000	10.5
Israel	135'000	2.0	*956'000*	*4.2*
Norway	*88'541*	*1.9*	*1'235'596*	*7.2*
Italy	850'000	1.5	*5'800'000*	…
Australia	283'600	1.4	4'600'000	6.2
New Zealand	43'500	1.1	*660'000*	*2.6*

Note: Numbers in italics represent 2001 or latest available data. These tables are extracts from the ITU Broadband Index included in the full *Birth of Broadband* Report. The Index measures, *inter alia*, how each of 206 economies is faring in terms of broadband penetration. Comparative charts are used to illustrate the findings.

Table of Contents

(**Table of Contents** …*cont.)*

Broadband Statistical Annex : Table of Contents