Broadband Internet:
The Power to Reconfigure Access

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Summary

Since the dawn of the 21st century, government and industry initiatives to stimulate the diffusion of broadband links to the Internet have generated debates over the social and economic impact of this advance in technological capacity. This paper, based on a forum held at the Oxford Internet Institute (OII), highlights the critical role that broadband Internet can play in reconfiguring access to people, services, information and technologies.

The long-term societal implications of reshaping access for individuals, communities, organisations, nations and regions across the world are of major significance, but are not predetermined by the technology. Instead, they will unfold over time through the complex interplay among the many actors, participating in many arena, who shape these outcomes through a wide range of social, policy and technical choices, some as simple as whether or not to go online. Many of the choices that will shape the future of broadband Internet and its societal implications are highlighted in this paper, which draws on discussions and background position papers at the OII Forum.

The Forum focused on the issues surrounding 'broadband divides', which often mirror and reinforce existing social and economic divides – but may also create new ones. The experts who participated in the Forum represented diverse government, industry, and academic views. They sought deeper understanding of the social, economic and technological implications of the widespread availability and use of broadband Internet.

This paper provides a record of the event for a larger audience, and a synthesis of that debate to take forward research and action to policy makers, practitioners and researchers. Its summary of the main issues, insights, background data, ideas and recommendations that emerged at the Forum cover topics such as:

- the extent and equity implications of uneven availability and adoption of broadband;
- differences and commonalities in approaches across regions, nations and cultures;
- roles of industry, government and academia in broadband developments;
- broadband's relationship to economic, business and industrial competitiveness; and
- outcomes of broadband use in homes, communities and public services.

Part I of the paper focuses on Forum debates defining broadband and why it matters. Part II identifies the key broadband divides and dividends. Part III focuses on broadband in developing countries, a major theme of the Forum. The Forum found both striking communalities and divergences between nations. Key policy issues are summarised in Part IV. Part V concludes with a suggested framework for understanding how access is being reconfigured by an ecology of choices shaping the future of broadband Internet. Appendix 1 lists Forum participants. Appendix 2 is a glossary to assist readers unfamiliar with some specialist topics covered.

Foreword

This is the first Forum-based discussion paper produced by Oxford University's Oxford Internet Institute (OII). It is different from more traditional summaries of research findings, or reports on events such as forums. While it draws on the research of many Forum participants, it is informed not only by research but also by the relevant knowledge of individuals with practical experience in business, industry, government and public agencies. It draws on wider sources for background than those covered at the Forum. And its authors use a framework that captures themes of the discussions which they hope will be of value in shaping discussion of research, policy and practice around the development and use of broadband Internet.

Acknowledgements

The Broadband Divides Forum was convened by the OII, in collaboration with the Massachusetts Institute of Technology (MIT), Syracuse and Tufts Universities. It took place at Oxford University's Saïd Business School on 27–28 March 2003. As one of a team, I am particularly grateful to my co-convenors, and co-authors, Sharon Gillett, Executive Director of the MIT Program on Internet & Telecoms Convergence, and Lee McKnight, Professor at Syracuse and Tufts Universities, for their support, enthusiasm and informed advice. The other author, OII Editorial Consultant Malcolm Peltu, made an important contribution in helping to compile verbatim comments from a recording of the Forum and collating related material after the event. The authors greatly appreciate Anu Mundkur's assistance in preparing Part III. Dr Victoria Nash, Policy & Research Officer at the OII, also played a vital role in the Forum's organisation and success.

We are especially indebted to all participants in the Forum. Their expert, lively and questioning – but never acrimonious – contributions to the discussion provided a rich source of material for this paper, even where we could not credit specific individuals. I would like to thank, in particular, Dr David Clark, an early architect of the Internet, Senior Research Scientist at the MIT Laboratory for Computer Science and Chair of the Committee on Broadband Last Mile Technology of the US National Research Council's Computer Science and Telecommunication Board (CSTB). His opening lecture got the Forum off to a stimulating start that facilitated subsequent discussions.

Finally, we also greatly appreciate the financial support and encouragement of the Forum's sponsors: the South East England Development Agency (SEEDA), Advantage West Midlands (AWM), the Cambridge MIT Institute (CMI), Cisco UK and Oracle.

The usual complexities of organising an international event were exacerbated by the fact that the Forum took place at a time of heightened international tension. Special credit is therefore due to the team at the OII who made the arrangements work so smoothly, including Miranda Turner and Kirsty Wedderspoon, in addition to Dr Nash.

Professor William H. Dutton
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PART I: WHAT IS BROADBAND – AND DOES IT MATTER?

To what extent is broadband relevant to solving social and economic problems?

Soon after the Labour Party was re-elected in June 2001, British Prime Minister Tony Blair called in one of his advisers, Ed Richards, to explain what broadband is, why it matters to Britain and what should be done to ensure the country doesn't miss out on its benefits. At the OII Forum on Broadband Divides, Richards said the Prime Minister maintains a keen personal interest in broadband, including asking for thorough regular updates of broadband progress. Similar high-level policy priority for broadband has been shown by many other governments throughout the world, and in cross-national bodies and major non-governmental organisations (NGOs) such as the World Bank, Organisation for Economic Cooperation and Development (OECD) and UNESCO.

David Clark, Senior Research Scientist at the MIT Laboratory for Computer Science, gave a sense of why there is such interest when he predicted that 'broadband can be as big a revolution as the Internet'. In the business arena, many surveys have identified the positive impact on productivity of Information and Communication Technologies (ICTs) in general, and the Internet and broadband in particular.[1] Many examples were also highlighted at the Forum to illustrate how broadband can assist in education, life-long learning, health, social and economic development, research, group interactivity, entertainment, game playing and many other areas.

Nevertheless, suppliers in most countries have been struggling to find enough people to use broadband to make it a profitable proposition. Even in business and industry where the dividends from broadband are most clear-cut, many firms are failing to take up available broadband opportunities. For instance, James Saunby, Head of ICT at the regional development agency Advantage West Midlands in the UK, said that in his area 'e-enablement among SMEs [small and medium sized enterprises] has fallen below the basic level needed to attract inward investment from large manufacturers seeking a sophisticated supply chain'.

Clark was convinced of broadband's long-term revolutionary potential, but explained that at present it is difficult to find arguments to justify why users should spend extra money on bringing broadband to their homes as 'people do little that is unique via broadband at present: it is seen mainly as a faster way of doing Web searches and downloads on the Internet'. At the same time, he said it is a matter of perception as to whether broadband diffusion is viewed as 'a glass that is half empty or half full'.

[1] For example, the Commission of the European Communities (2001) concluded: 'Statistical evidence has allowed the emergence of a broad consensus that ICT is, indeed, increasing the rate of growth of productivity.' The specific role of broadband in productivity gains has been endorsed in studies such as Crandall and Jackson (2001), Gartner Dataquest (2001) and the Mayor of London (2002). The Net Impact Study (**www.netimpactstudy.com**) estimated that the Internet will account for 0.43 percentage points of the future increase in US productivity growth, and has contributed cost savings of €9 billion and increased revenues of over €86 billion in Europe

For instance, many Forum participants working at the broadband supply industry 'coal face' stressed the difficulty of making a profit from the market in its current state of development. But a more optimistic Robert Pepper, Chief of the Office of Plans & Policy at the US Federal Communications Commission (FCC), argued: 'Broadband is following a natural technological diffusion curve, but at a faster rate than any other household consumer technology in the last 60 years, except for black-and-white TV and DVDs.'

A major reason for the more pessimistic view is the way confidence in the relentless progress of telecommunications growth and ICT innovation was seriously undermined by the bursting of the 'dotcom bubble' at the turn of the century. There were frequent references at the Forum to the seriousness of the continuing inhibiting effects of the collapse of ICT investment within user organisations and the telecom infrastructure in general, following the busting of the dotcom bubble. Many Forum participants suggested that, in these circumstances, much work is needed to gather evidence to make the case for broadband in terms of both core productivity gains and wider social benefits. This should include studies at the micro level to demonstrate more clearly what factors combine to achieve these benefits, including organisational change, managerial competence and social policy. 'Those who work in this area are in danger of assuming benefits are self-evident, but they aren't,' Richards warned.

The ICT relevancy fallacy

Michael Best, a Research Scientist at the MIT Program on Internet & Telecommunications Convergence, warned against the 'fallacy of the relevancy question' in trying to explain how technology can deliver better social and economic outcomes on a broad front. The main relevancy fallacy, he suggested, is the claim that the actual problem is not about access to personal computers (PCs) and the Internet, but access to medical, education or other social facilities. Best felt this has derailed a lot of people's thinking because it was like asking for the 'house construction outcome' of a hammer. Hammers are valuable tools in house construction but are not expected to achieve construction outcomes. Similarly, he argues, the most important question for ICTs is not to ask what they do for a 'social development outcome', but how they can be used as tools towards achieving wealth generation, food security, women's empowerment and a community's other legitimate social and economic objectives.

The OII's Director, William Dutton saw two distinct narratives emerging from the Forum: 'One story is that these new technological innovations will create new divides, because each new technology has early adopters; as the innovations diffuse, costs come down and competition goes up in a natural diffusion curve. The other is that some of these technologies will be transformative in the way in which they may allow a great percentage of the public to get access to a technology that changes their relationships with each other, government, business, information and other resources. If broadband is to make the real qualitative and quantitative difference promoted by the transformative view, the euphoria of the techno enthusiasts needs to be credible.'

Towards a better understanding of what broadband means

At the end of Forum, Lee McKnight, Professor of Information Studies at Syracuse University, commented ironically that even after the intensive discussions he wasn't sure what 'broadband' meant and whether 'divide' is the right word – but he felt that progress had been made towards finding a common vocabulary that can help clarify what is at stake for policy makers, academics and those at the coal face of broadband use. For instance, the difficulty in reaching clear-cut definitions on basic terms eventually resulted in discussions at the Forum that illuminated a number of key areas where overly-simplistic assumptions can distort debates and decisions.

Pinning down the broadband moving target

The word 'broadband' has generally brought to mind a physical communication delivery channel as it is derived from 'bandwidth', a measure of the capacity and speed of a telecommunications link. It is often likened to a 'pipeline' because a wider bandwidth allows for the flow of more bits more quickly. For example, the copper wire connections in traditional telephony networks provided by incumbent 'telco' telephone companies can operate at up to about 48-56K bits per second (bps). This is regarded as 'narrowband', which can be sufficient for basic e-mail and Web access requiring limited volumes of data. However, multimedia animation, graphics, music, teleconferencing, live 'streaming' of radio and video cameras, games, movies and other media require the delivery of more bits in faster flows. Unlike dial up, where connections are made and broken with each call, broadband is always on while the computer is switched on and plugged into the telecom network, with charges typically based on a fixed monthly fee rather than the time-based per-call rate of dial up.

Forum participants generally felt a good starting point for moving forward the discussion on the nature of broadband to take account of its wider context of use, not just its physical manifestation, was the broader definition of broadband reached by the US National Research Council's Committee on Broadband Last Mile Technology report *Broadband: Bringing Home the Bits* (CSTB 2002). Dr Clark, who had chaired the Committee's work, said it had concluded that continuing innovation made broadband a 'moving target', so it should be defined in a 'dynamic and multidimensional way'. For this, the Committee formulated two non-numerical classifications:

1. <u>The performance of the local-access link should be fast enough to ensure it could not be the limiting factor on a user's experience in running today's applications</u>. This was translated by many at the Forum as: 'Faster than what I can get now, irrespective of what the speed is now'. Pepper said that experiments had shown that users notice significant improvement when moving from 100 Kbps to 1 Mbps, but less so when going from 1 to 10 Mbps. The issue of local access is frequently critical because the connection to the user's local access point is the limiting factor on broadband performance, as demonstrated by the slow speeds obtained by narrowband dial-up access even when much higher performance can be delivered by the main broadband infrastructure involved in completing connections.

Broadband access should have high enough performance – and wide enough penetration of that performance – to encourage the development of new applications. This was widely felt by Forum participants to be the more interesting definition as it emphasises the significance of applications that attract users, but which work properly only with higher speeds. Users' expectations are likely to change as the technology improves and they become attracted to new applications that depend on broadband's more advanced always-on multimedia capabilities. Many participants look to applications that support shared creative interactivity among many users as typifying such broadband-specific innovations.

Much Forum debate explored further the second CSTB definition: how users can exploit broadband innovatively to make it relevant to the lives of individuals, families, communities, nations, businesses and societies in general. Stephen Coleman, Visiting Professor of e-Democracy at the OII, argued that broadband should be viewed as what he referred to as 'a process of mediation' rather than a 'mechanism for delivery'. In this context, he defined the processes of mediation as being about the problem of large complex societies needing to connect people in ways that are culturally specific. He said this makes broadband central to 'critical social relationships engendered through a cumulative cultural process'. But he felt: 'Too much discussion about broadband had focused on it as a pipeline through which something is delivered that hits someone and makes them feel better. That's like a bad 1960s approach to motorways, and will be equally bad for broadband.'

Saunby felt this view is significant for policy makers because it indicates how much the relevancy of broadband 'seems only to be related to the extent to which it allows users to interact with each other or with resources with which that they would not otherwise be able to interact'. He said it indicated that social and economic divides could not be closed by just providing broadband access or specific broadband content, but only by also ensuring the 'quality of content of education and other social and business institutions is sufficient to encourage people to care enough to want to interact with, and through, broadband'. Dutton reinforced Saunby's view of the central role of broadband in providing the potential for users, producers and policy makers to strategically reconfigure access to a wide range of resources.

More than fast pipelines

The main technologies currently employed for broadband 'pipelines' into the home are summarised in Table 1, of which DSL (Digital Subscriber Line) and cable from facilities-based incumbent suppliers are the most widely used.

Any transmission speed above 56 Kbps seems to have been classified as broadband by someone; for instance, Carlos Osorio, a student at the MIT Program on Internet & Telecommunications Convergence, reported that some 'broadband lite' services at a promised 64 Kbps were being offered in Chile. About 1 Mbps has become the typically-assumed broadband level in most OECD countries, although in practice many

'broadband' services offer speeds of only about 128 Kbps – while up to 100 Mbps is available in Japan (see Paltridge 2003).

Table 1: Broadband pipelines into the home

Type	*Technology*	*Typical supplier*
DSL (Digital Subscriber Line)	Boosting the bandwidth of traditional copper-wire telephony networks.	Traditional incumbent 'telco' telephony suppliers; ISPs offering competitive service using the telco's infrastructure.
Cable	Coaxial cables, which have a higher bandwidth than copper wires but lower than optical fibre.	Cable TV suppliers offering an expanded range of services including telephony and broadband.
Fibre-to-the-home (FTTH)	Optical fibre directly to the home.	Telco, cable and other telecom infrastructure players.
Satellite	Wireless links to geostationery satellites, currently at lower broadband speeds; Very Small Aperture Terminal (VSAT) technology enables small satellite terminals to be used to offer lower-cost and more flexibly located links.	Specialist satellite communications companies.
WiFi (Wireless Fidelity)	Wireless local area networks based on the IEEE 811 Ethernet protocol.	Commercial Wireless Internet Service Providers (WISPs); not-for-profit communitarian networks.
Fixed wireless	Microwave line-of-sight links to fixed locations.	Specialist telecommunications suppliers.
Third generation (3G) mobile	Mobile cellphones, likely to be limited to lower broadband speeds.	Mobile telephone companies with 3G licences (which required very large investments in some countries).
Powerlines	Electric powerlines adapted to carry broadband.	Electric utilities; intermediate service agents.

Norman Lewis, Director of Technology Research at Internet service provider (ISP) Freeserve.com, was concerned that suppliers who were finding it difficult to make money from broadband could be tempted to use this confusion over the definition of the technology to sell applications that attract customers, but which use up so much bandwidth allocation that the quality of service drops. 'This would lead to a deterioration in relationships with customers and in users' impressions of broadband, which would be setting things up for a fall,' he cautioned.

The notion of a 'digital divide' also has roots in a physical perception of ICTs, as the concept was initially framed in the 1990s primarily in terms of 'information haves' and

'havenots' who do or don't have access to ICTs.[2] At first, access to a PC was seen as a key defining factor of the divide, but increasingly from the mid-1990s access to digital networks like the Internet became more significant in determining the demarcation lines of the digital divide. Discussions about bridging the divide have therefore also often been anchored in extending the supply of physical equipment and links to all sections of society. Michael Duggan, Head of Broadband & Internet Policy at the UK Department of Trade & Industry, commented that access to both PCs and the Internet are legitimate divides, for instance because a typical migration path is from PC to narrowband to broadband.[3]

Walter Baer, an Analyst in Restructuring for Deregulation and New Markets at RAND Corporation captured the mood of the Forum when he recommended: 'I would like to see the discussion of "divides" focus less on access and more on proficiency in using broadband content and services for other individual and societal objectives. This means paying attention to the development of human capital and organisational capital, as well as the technological infrastructure. For computers and basic Internet, there now seems ample evidence that deploying the technology is only the initial step, and that subsequent individual and organisational learning is more important to achieving favourable outcomes. I expect the same lessons will apply to broadband.'

The capabilities that make broadband special: reconfiguring access

The identification of characteristics that make broadband matter became one of the themes of the Forum. But finding what is unique to broadband wasn't self-evident from the discussions because 'Internet' and 'ICTs' were often used synonymously with 'broadband'. Many examples cited of broadband benefits also apply to non-broadband ICTs. But much of the focus on broadband's transformative potential centred on the way in which the strategic use of broadband Internet, as Saunby and Baer noted above, can reconfigure access to people, services, information and technologies and thereby the relative power of different actors involved in the production, consumption, use and governance of ICT content, services and technology (see Table 2). For example, many saw broadband Internet's potential to transform access as being located primarily in its ability to enable collaboration that creates proximity in ways that are not feasible otherwise, for example for a virtual classroom of pupils in multiple locations to share specialist teaching resources or overcome geographical constraints.

Robert Bruce, a Partner in the legal firm Debevoise and Plimpton, expects the sharing of human interactivity and ICT resources through broadband communications will create valuable new forms of consultative and consensus-building mechanisms: 'These could be virtual fora in which new levels of dialogue and interaction can be developed among

[2] e.g. see DTI (2000); Compaine (2001); Norris (2001); the series of reports from 1995 by the US National Telecommunications and Information Administration (NTIA) on 'Falling through the Net' (www.ntia.doc.gov/ntiahome/digitaldivide); and Chen and Wellman (2003).

[3] Duggan noted that within a couple of years of broadband becoming more widely available in the UK in 2001, about 20% of PC owners in the country with access to affordable broadband had subscribed to it.

Table 2: How use (and non-use) of broadband Internet reconfigures access

Broadband Internet provides access to:	*Kind of broadband Internet activities*	*Examples*
People Reconfigures how you interact with people, who you communicate with, who you know, where and when you interact with them.	Inter-creativity between individuals and within groups; other one-to-one, one-to-many, many-to-many communication.	Always-on messaging and e-mailing; collaborative online working; online lectures to virtual classrooms; video conferencing and streaming; children producing digital content; developing a multimedia presentation between many people; online game playing; Internet-based interpersonal interactions, from chatrooms to e-democracy consultations.
Services Influences what you can do online, when you can do it and how much it costs to do it; where and when you buy other products and services; who pays what to whom – and how it is paid.	Conducting electronic transactions and obtaining electronic services from distant or nearby sources.	Fast online delivery of multimedia products and services, to any location, involving large amounts of data, e.g. 'downloading' music and video; digital art collections; access by doctors to X-rays at remote locations; e-shopping, e-banking, and other e-business interactions.
Information Affects how and what you read, hear, see – and know.	Retrieving, analysing and transmitting images, video, sounds, statistics, etc.	Online news streaming; listening to or watching archived or live radio and TV programmes; exchanging large amounts of multimedia research or statistical data; Web searches for a huge variety of information sources.
Technologies Shapes how and when you access the Internet and other ICTs.	Producing and using broadband knowhow, equipment and techniques to shape access to, and use and consumption of, the Internet and other ICTs.	Broadband telecommunications infrastructures; wireless network connections; Internet infrastructures; new digital multimedia; 'browsers' to find information in Web searches; network security; anti-virus, anti-spam and child-protection software.

Source: Adapted from Dutton (1999a): Table 1.1, p. 5

geographically disparate communities with converging interests, for instance to help reform public sector institutions and processes, especially in education and health sectors. In education, for instance, there would be huge process-related adjustments in new sets of relationships between students and teachers, parents and teachers, students and parents and among teachers within and outside the school.'

Coleman argued that broadband has a huge capacity for reinvigorating democratic processes. He said this goes beyond just institutional reengineering of government because it opens possibilities for new relationships between citizens and their representatives which could overcome the growing disengagement between citizens

and governments in many countries. Some also felt that new mass communications paradigms would emerge in the long term, involving greater interaction as broadband Internet uses and applications evolve.

However, Dutton warned that broadband Internet should not be seen as a substitute for radio or TV, but a new and very different communication model that complements broadcast media: because it is effective for many-many and one-to-one communication, as well as one-to-many. This could be of great value in the developing world where, for instance, it could enable development and economic officers to communicate with one another and share information resources across national and geographical boundaries.

Inter-creative innovation from left field

OII Visiting Fellow Jo Tacchi spoke of the importance in the wider context of people's lives and social and cultural structures of what she calls 'inter-creativity': the creative interaction between people (see Slater and Tacchi forthcoming). She claimed much innovation in broadband use comes from inter-creativity, especially through the 'unfinished interaction' where people engage with the technology to create or add content. This could forge new roles and relationships between users, producers and consumers of content when people become so engaged with the technology that they wish to contribute their own Web sites, audio and visual streaming and other idea. Tacchi mentioned the Youth Internet Radio Network (YIRN) research project she is involved with in Queensland, which is exploring inter-creativity using broadband, radio and other technologies (see Box 1).

Tacchi said YIRN typifies the kind of 'left field, marginal spaces where broadband innovation is most likely to come from, as people working with less access to resources often come up with more imaginative solutions'. And Lewis remarked: 'The next generation will grow up with the technology and will unleash creativity that will move them ahead of policy makers and regulatory thinking.'

Many other Forum participants emphasised the important role of young people in generating enthusiasm for broadband. Kevin Jones, Broadband Consultant at the South-East England Development Agency (SEEDA), pointed to a town in the UK with no broadband for the community but a 2 Mbps link going into a school. As a result of pressure from schoolchildren on their parents, pre-registrations on the British Telecom broadband database for that town shot up, he said.

David Mitchell, Market Development Director at Oracle Corporation UK, pointed to a school in the North East of England where professionally-produced and streamed digital content for history lessons had a poor impact. However, history results improved greatly when children were engaged in the process of creating their own history content by using video cameras to record elderly people in the community talking about the impact of World War 2 bombing on the local built environment. At the same time, the children improved their skills with IT equipment, film making and digital video editing and there was a closing of the divides between age-related gaps, particularly between 16-year-old

Box 1: Inter-creativity research on the Queensland Youth Internet Radio Network

The Youth Internet Radio Network (YIRN) has attracted widespread support from local and state government organisations across Queensland, Australia to undertake research into how young people interact as both producers and consumers of new media content and technology. The project will examine how creativity, access, networks and connectivity work together, and what factors motivate young people to interact and become creative and engaged when appropriate access and training is given to diverse and dispersed groups.

YIRN is establishing a network of young content providers across urban, regional, remote and indigenous locations. Participants come from different socio-economic, gender and racial heritage backgrounds. They will be provided with a streamed Web site offering a rich range of audio material, supplemented by text and visuals. This material can be archived for time-shifted consumption to produce a mosaic of local content reflecting the diversity of the lives of young people across Queensland, as well as their shared experiences and interests.

A mix of narrowband and broadband, older and newer streaming and digital technologies will be used in different areas. For instance, young people in some locations will have access to broadband so they can stream directly from their location to contribute their own content. In areas poorly served with telecom services, content may have to be saved on computers as MP3 files and downloaded through narrowband Internet access; if the line is not good enough, they may need to save content onto a CD or minidisk and post it to the YIRN central site.

The diversity in the types of groups and technologies within YIRN will assist to compare different uses and outcomes as a way of understanding the factors influencing inter-creativity in different communicative ecologies. The technology mix ensures involvement from a variety of groups with different levels of access to infrastructure and equipment. It will also help to uncover innovative connectivity solutions.

Source: Based on Tacchi (forthcoming)

males and the elderly. These kinds of processes that enlist the active interest of students in shaping content were widely regarded as being of great value, although professionally-produced educational content was also seen as having an important role.

Hotspots of grassroots innovation: the WiFi phenomenon

Debates about the need to have broadband applications that people really care about converged with discussions about policy governing the supply of broadband in the topic that generated the most excitement at the Forum: the nerdy sounding ‘WiFi’, a shortening of Wireless Fidelity (see Box 2).

Since 2001, there has been an explosive growth in WiFi wireless local area networks (LANs) using unlicensed radio spectrum.[4] These ‘hotspots’ provide local access to wired broadband infrastructures over a limited range to a number of different users, for example among a few houses, a neighbourhood or in an airport lounge. Such hotspots

[4] See Johnston and Snider (2003) for an analysis of such unlicensed use of radio spectrum. For a broader discussion of spectrum management issues, see for example www.spectrumreview.radio.gov.uk and the Spectrum Policy Program page at www.newamerica.net.

also offer a new form of wireless link to complement wired and wireless LANs local to an institution, such as a firm or individual home. WiFi is also an alternative to – or complements (depending upon one's point of view) – regional, national and international cellular mobile networks.[5]

Box 2: The WiFi phenomenon

WiFi is a wireless-based local area network (LAN) that can be used to offer 'hot spot' broadband local access points to the Internet infrastructure. A basic WiFi antenna can exchange signals with devices such as laptop computers over distances up to about 300 metres. This coverage can be extended by technologies such as directional antennas and amplifiers, and by grouping hot spots into 'clouds'. Techniques known as 'roaming' or 'war driving' can be employed to offer continuous operation when moving between hotspots, but at present this is not as smooth or reliable as mobile cellphone technology. WiFi employs the IEEE Ethernet 802.11 standard, currently mainly using 802.11b (transmitting at 2.4 Ghz and up to 11 Mbps) but with some with 802.11a (5 GHz at up to 54 Mbps).

WiFi start-up costs are lower, and its installation more flexible, than other broadband options because it uses unlicensed radio spectrum and relatively low cost, easily installed and compact equipment. WiFi equipment also has low power consumption, making it ideal for use in areas with limited or no power supplies, such as developing countries and rural and remote areas in developed countries. These advantages have enabled an enormous number of WiFi 'hotspots' to be established around the world since 2001, in a wide variety of contexts and locations: urban and rural, small local communities and cities, developed and developing countries, homes and offices, cafés and gaming clubs, etc. (e.g. see www.personaltelco.net, www.geog.ucl.ac.uk/casa/martin/atlas/wireless.html and *Business Week* 2003). This growth has been accompanied by the flourishing of many small new 'Mom and Pop' Wireless ISPs (WISPs) and WiFi system suppliers (see www.wi-fi.org/OpenSection/index.asp).

WiFi has been widely adopted by a libertarian grassroots movement, similar to that which gave rise to the Internet, personal computers and open-source software. For instance, a number of organisations are committed to developing 'community wireless' capabilities that remain open to all and keep any barriers to access as low as possible, e.g. see the Wireless Commons manifesto (www.wirelesscommons.org) and FreeNetworks.org (www.freenetworks.org). The Freenet project (www.freenetproject.org) supports this approach by offering free software to avoid censorship on the Internet.

WiFi is of broad interest to the telecommunications industry and beyond (e.g. see WiFi supplement in *Business Week* 2003) because of its potential to be a driver of broadband growth through the establishment of quick and efficient new hotspots linked to established broadband infrastructures. It could complement or compete with current incumbents in wired and wireless telecommunications. WiFi is also an effective solution for some non-telecom applications or purely internal connections, such as in conference rooms.

[5] The MIT Program on Internet & Telecoms Convergence considers the development of 'personal routers' to enable flexible 'nomadic' (McKnight 2003) movement between different wireless architectures to be a key element in the creation of a more open market, based on a new economic model, for wireless access to broadband and other services (e.g. Clark and Wroclawski 2001; http://itc.mit.edu).

WiFi was generally perceived as an important means of accelerating the availability and adoption of broadband as it can be deployed more rapidly than other links to help provide ubiquitous coverage. Pepper said WiFi had renewed the FCC's optimism in wireless as a major broadband player after the failure of its initiatives over a six-year period to promote fixed wireless links that use licensed spectrum across wider areas than WiFi.[6] Wireless communication technology, particularly WiFi and satellites, now generally provides a practical alternative for building out broadband services in places where no advanced, or even any, telecom infrastructure exists, for example in rural environments and developing countries.

The main excitement about WiFi at the Forum did not come from the technology as such, which currently has limitations in terms of reach and security. It was the grassroots, anarchic culture from which the technology has flowered that was the centre of much attention. For instance, Richards praised WiFi communities for their 'sense of innovation, experimentation and the creation of new possibilities' and Clark referred to it as 'a classic bottom-up, organic, see-if-it works experiment'.

According to Pepper: 'What's happening now in the unlicensed spectrum is nothing short of the equivalent of the way the Internet was reinvented – and it is being done by the same kind of people. This time it is being done by little start ups in the form of "Mom and Pop" WISPS [Wireless ISPs] who are appearing everywhere because they are able to break even with just a few hundred customers, such as one in West Aurora, Illinois is providing WiFi for a few farms.'

Larger corporations are also making strong inroads in the WiFi marketplace. For example, T-Mobile, a subsidiary of Deutsche Telekom AG, has established 2000 hotspots in the USA at airports, Starbucks coffee houses and Borders stores (www.t-mobile.com). AT&T, IBM and Intel have joined together to form a WiFi network provider, Cometa, which has announced the introduction of hotspots to McDonalds restaurants (www.cometanetworks.com). In April 2003, Inspired Broadcast Networks, with support from Ericsson and Intel, announced what it claims to be Europe's largest WiFi network, encompassing pubs, clubs, casinos, motorway stations, universities and other sites across the UK (www.inspiredtg.com).

In addition to the Mom and Pop WISPs, about 250 community wireless groups in almost thirty countries were listed at www.personaltelco.net in April 2003 as having hotspots offering free, open WiFi networks. By Autumn 2002, there were over 13,700 hotspots on New York's Manhattan Island alone (www.neca.org/media/PeterPitsch.pdf). In Korea, online access is particularly popular on university campuses and in online gaming rooms known as 'baangs', which led by April 2003 to over 8,500 hotspots being run by KT Corp, the former monopoly telecommunications authority (*Business Week* 2003).

[6] The FCC's positive attitude to WiFi was highlighted in August 2003 when it announced free WiFi access to visitors at its Washington office. FCC Chairman Michael K. Powell explained: 'We're embracing the power of WiFi and the freedom and convenience of wireless Internet access it gives to consumers' (FCC 2003*a*).

Although official detailed figures on WiFi are not yet available in most countries, these examples illustrate why there was agreement at the Forum that WiFi has grown rapidly across the world in a broad variety of contexts and applications. Bill Lehr, who is at the MIT Program on Internet & Telecommunications Convergence, predicted that hotspot local network services 'will expand the range and usability of the next generation of Internet services, enabling follow-me anywhere, always-on accessibility'. Lewis noted that potential disruption could be caused to the broadband marketplace by what consumers are doing with WiFi and the way WISPs have been setting up broadband access for local communities, because this suggests established broadband businesses might have to play 'catch-up' with them.

Many believe WiFi will evolve a set of important new marketing and entrepreneurial practices. Pepper noted that WiFi introduces a novel financing model in telecom terms as it shifts costs to the end user, who must make an upfront investment in the communications equipment rather than just 'plugging in' to an existing telecom infrastructure. According to Bruce: 'The real resilience and allure of the hotspot model may be its potential to mobilise entrepreneurship at the micro or grass roots level. The opportunity and challenge for policy makers is therefore to energise the spread of WiFi networks through regulatory initiatives that encourage, rather than thwart, innovation.'

WiFi's potential to 'fill in' broadband access gaps and stimulate innovative applications with strong user appeal helped to illustrate important aspects of the central theme of the main discussions at the Forum: how broadband affects social and economic divides, and the policy choices that determine how effectively dividends from the use of broadband's potential for technological innovations can help to narrow those gaps.

PART II: MAPPING BROADBAND DIVIDES AND DIVIDENDS

Minding the gaps and building bridges

The main questions raised about 'broadband divides', the Forum's title, also reflected polarities that arise from the definition of broadband as a physical pipeline. In a similar fashion to discussions on the definition of broadband, participants generally felt the divides were not just about access to technology or delivery channels. Rather, they were primarily concerned with how people could, or could not, use the technology effectively to reconfigure access in the world around them, and the way this capability is shaped by a broader range of human, economic, social and organisational capital.

Some participants felt uneasy about using 'divides', as it could be seen as a loaded term that implies too stark and insurmountable a division; 'minding the gap' or 'building bridges' were mentioned often. Many interrelated factors other than the technology were identified as influencing social and economic outcomes, and warnings were given that – as with any technology – potential broadband implementation problems could arise. However, there was wide agreement that attention should be paid to understanding how many of the potential dividends from the use of broadband could be used to build

bridges and narrow divides, for example in education, health, democratic processes and economic, industrial and business development.

The Forum was structured to ensure participants gave substantial attention to such broader social, economic and policy issues, as well considering the most tangible aspects relating to physical access to broadband links. The following subsections and Part III summarise the main divides/gaps and dividends/bridges identified at the Forum:

- broadband availability and deployment;
- drivers of supply and demand;
- gaps between expectations and realities;
- patterns of success in closing divides, including the key role of the public sector;
- educational opportunities in and outside schools;
- engagement and disengagement in democratic processes;
- business divides by size;
- a legal and regulatory framework to balance conflicting interests; and
- similarities and divergences in developing countries.

Broadband availability and deployment

Divides between rich and poor, rich and rich

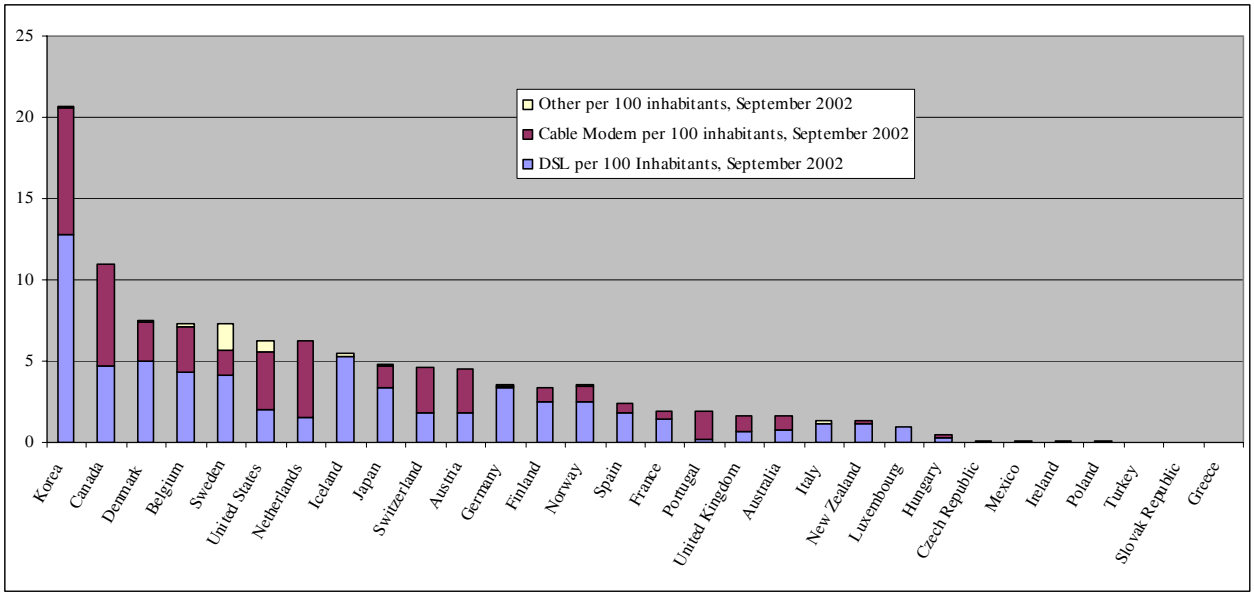
The most easily quantifiable broadband divides are measured by statistics on how many people are close enough to a connection to gain access to a broadband service ('availability') and how many people with such access actually choose to take it up ('deployment', 'take-up' or 'penetration'). According to OECD figures, by the end of 2002 there were five subscribers per 100 inhabitants in OECD countries, with 18% to 25% of all fixed network Internet subscribers having broadband.[7] Sam Paltridge, OECD Communication Analyst, told the forum that this compares with only 0.2 per 100 people in other nations, mainly developing countries.

There are also significant divides between 'rich and rich'. For instance, in the OECD league table of broadband subscribers shown in Figure 1 in September 2002 Korea had double the number of subscribers per 100 inhabitants (over 20%) than Canada in second place (over 10%). Denmark, Belgium, Sweden, the US, Netherlands and Iceland follow, all in the 5-7% range that is becoming a benchmark for developed countries.[8] The UK is 18th out of the thirty countries, but the growth rate began to pick up in 2001. On a worldwide basis, Hong Kong would be number two above Canada and Chinese Taipei number four. In the last quarter of 2002, the fastest growth rates in the

[7] See also Paltridge (2003) and www.itu.int/osg/spu/ni/promotebroadband/presentations/02-paltridge.pdf for more OECD broadband statistics.
[8] US broadband penetration figures of 18% overall and 30% of Internet users quoted at the Forum are based on household counts. Paltridge said these are about three-times more than the OECD's population-based figures.

OECD were in Iceland, Finland, Switzerland, Japan and Belgium, with the Slovak republic, Greece, Turkey, Mexico and Poland the slowest.[9]

Figure 1: Broadband subscribers in the OECD area



Source: OECD (updated at www.oecd.org/EN/document/0,,EN-document-13-nodirectorate-no-1-39262-13,00.html)

Support for the view that broadband supply was at least approaching a 'half-full glass' come from OECD figures on broadband growth: the total number of subscribers across the world grew by more than 30 million to over 62 million in 2002, representing an increase of more than 70% (Paltridge 2003).[10] Paltridge estimated the total broadband subscription market was worth over $22 billion worldwide in 2002, but added that the market was at an early stage and still very small in terms of the overall telecom market. The 70% increase meant the availability of DSL had grown faster than expected in the OECD. Around half of the thirty OECD countries are likely to have DSL available to more than 85% of their population by the end of 2003; some already reach more than 90% (Paltridge 2003: Table 1). The question now of how to get to the last 10% became a consistent refrain at the Forum.

The divides in broadband supply also relate to the capacity and price of exactly what is available and what is being adopted. For instance, Paltridge said the fixed network pricing options and capacity choice for users in Korea and Japan are significantly better than anything available, on a similar scale, in the rest of the OECD. A user in Japan can pay $21 per month to receive 8 Mbps access via DSL, which Paltridge said is around half the average for baseline access in Europe (typically only at 256 Kbps or 512 Kbps). A user in Japan could alternatively opt for fibre to the home at 100 Mbps for less than

[9] See www.itu.int/osg/spu/ni/promotebroadband/presentations/02-paltridge.pdf.
[10] The need for caution in predicting future growth is illustrated by a slight downturn in growth rate of broadband lines from 27% in the first half of 2002 to 23% between June and December 2002 (FCC 2003*b*).

$60 a month. In much of the rest of the OECD, that price would purchase 1 to 2 Mbps, the maximum speed on offer through retail suppliers.[11]

Such OECD figures demonstrated the substantial progress that had been made recently in both broadband availability and, increasingly, in take-up. However, many cautioned against over-hasty expectations for broadband roll-out as it can involve much money and effort. Keeping these expectations realistic was seen as an important way of avoiding disillusion and anxiety, when actual take-up is likely to be following a natural speed of deployment that is lower than the heightened expectations (e.g. see Chileshe et al. 2002).

Local variability

CSTB (2003) defined three main types of broadband coverage areas to take account of the fact that national averages don't reveal enough of the variable patterns within countries:[12]

- Type 0: no provider (although satellite might be ubiquitous).
- Type 1: one terrestrial facilities-based provider.
- Type 2: two terrestrial facilities-based providers.
- Type 3: one or more facilities-based providers who install new infrastructure to compete with the incumbents.

Clarke pointed out: 'No matter what you do, you will get each of these outcomes in different locations, particularly when there is diversity in as many factors as in the US, from dense urban to incredibly rural areas. You therefore need to plan for all outcomes simultaneously within the national footprint.'

Tyranny of the take-rate

A key issue in the pace and pattern of broadband deployment is what Clark said has been called 'the tyranny of the take-rate'. This arises because the economics of wired facilities-based broadband supply are dominated by the percentage of customers who take up the service when it passes close enough to give appropriate access. Many 'wiring up' costs are fixed according to the distance covered, i.e. the number of houses and business passed per mile of cable or fibre laid. The lower the overall broadband take-up rate, the higher is the 'threshold' level of the minimum number of likely subscribers required before many telcos and cable companies would bring broadband to an area.

These kinds of calculations put pressure on suppliers to prioritise new broadband links in areas with the highest density, where the greatest number of passings can be obtained for a given investment – even if some areas within that high-density region

[11] See www.itu.int/osg/spu/ni/promotebroadband/presentations/02-paltridge.pdf, showing that in March 2003, services of over 2 Mbps in OECD countries were available in Korea (20M bps in some parts), the US, Iceland, Canada and Belgium.
[12] Although these categories are based on US experience, they seem to be echoed around the world.

have lower-than-average take-up rates. This can create gaps in coverage in less densely populated areas, but is also a reason for a positive spin-off in helping to close broadband availability divides between rich and poor in urban areas – as broadband is also made available in many deprived areas within high-density locations. For example, Jones reported that broadband is available in the twenty most deprived local electoral wards in south-east England, which are in such high-density urban areas.

One of the benefits of WiFi is that it bypasses the threshold barrier because a small number of users can gain local access to the broadband backbone without waiting for a wiring up of the whole nearby region. More visionary incumbent suppliers with confidence in broadband as the prime telecom future are also deciding to bring down thresholds as a matter of policy. For instance, Paltridge said that in Finland, which has one of the highest broadband take-rates, some telcos are saying they will provide broadband to an area even if only one subscriber wants it.

Drivers of supply and demand in the divided kingdoms of broadband

A comment by Clark that 'economics is king' in terms of determining broadband supply and demand was frequently endorsed. During the Forum, a number of other sometimes competing, sometimes cooperating 'kings' who contribute to driving and influencing broadband supply and demand were highlighted. The following are some of the main kings of the broadband realm.

1. Economics. As Clark put it: 'Money, not technology, gates broadband.' Price was frequently said to be the number one factor in determining the take-rate. Participants also emphasised the need to understand who will have to spend money to build the infrastructure, who will make money from it and how the two are linked. Bruce said it was vital for policy makers to create a sound financial basis for the extension of infrastructure, as it is not possible to close divides in an environment where the infrastructure can't grow. 'But we are dealing with a telecommunications sector in a very distressed state because of many past errors in judgement and technological assessment,' he commented.
2. Content. This provides the value to users. But as the discussion on interactivity and inter-creativity indicated, broadband could transform relationships between users, consumers and producers of content. McKnight quipped: 'We are all content producers now'.
3. Convergence. One key to attracting consumers to broadband could be what Rob Lloyd, President of Cisco Europe's Middle East & Africa (EMEA) Operations, called 'creative bundling' of different services to include aspects everyone is accustomed to value highly, such as entertainment and telephony. For instance, he reported that the FastWeb network in Italy achieved the highest average revenue per user of consumer broadband in Europe by offering a package of telephony, high-speed Internet and television services.
4. Mergers. One of the consequences of convergence is that broadband carriers, ISPs, content suppliers and others are coming together in new industry and application

configurations that are creating a wide variety of new ways to exploit convergence through packaged broadband services.

5. Providers of local access. The ISP or other service providers play a critical role in demand patterns by bringing customers to the table.
6. Public-sector initiatives. The public sector was widely seen as having a strong role to play in helping to close divides and in maintaining a fair competitive environment.
7. Technological innovation. The potential value of WiFi highlighted the vital role new technologies can have in stimulating wider broadband availability. Another key technology emphasised by many Forum participants is the Grid (Box 3), a powerful new way – similar to an electricity grid – of connecting individuals and organisations to enormous shared computing power, storage and software applications. 'The Grid could rewrite the broadband demand equation because it represents a whole new paradigm and a new phase in the development of the Internet,' according to Nelson. WiFi combined with the Grid could create a 'wireless grid' that is in touch with people wherever they are, and so become an integral part of their personal lives (McKnight et al. 2002). The Grid and other technical developments also open options for rethinking the design of the Internet (e.g. see Blumenthal and Clark 2001).

Gaps between expectations and coalface realities: is there a 'killer app'?

The effectiveness with which broadband divides and gaps are bridged ultimately depends on how many people believe broadband can be of benefit to their own lives and those of the people they care about. In this context, David Baxter, Director of Strategic Relations at BT, criticised 'the gap between the realities in the broadband market where we have to deal with real people and the faith, hope and expectations of what ought to be possible that we hear so much about from many technologists, policy makers and academics'.

Broadband supply-demand tensions had resulted in the same conundrum faced by many mass-market technological innovations, which Clark called 'a clichéd chicken-and-egg problem': the technology will reach wider audiences if more users are attracted by more compelling and varied applications – but these will be produced only when there is sufficiently widespread penetration of high-performance broadband to encourage the development of those applications. The point at which the conundrum is overcome is when the broadband glass will actually become at least half full rather than half empty. This has led to what has become another cliché in the ICT world, the hunt for 'killer applications' to stimulate explosive market growth, in the way that e-mailing and Web browsing were killer applications for the Internet, and teenagers' texting for a wave of mobile cellphone growth.

Most at the Forum felt there would probably not be one 'killer app', but that a range of compelling applications will emerge for different people in different situations. Many candidates for such breakthrough applications were mentioned, from education, e-democracy and news streaming to what Lewis called 'the 3Gs really driving broadband':

girls, gambling and gaming'.[13] Osorio emphasised that even something as technologically basic and familiar as e-mail or Web browsing can be extremely attractive to users who haven't experienced them before, or who do not have access to telecom or computer capabilities that can offer something more advanced.

Box 3: The Grid: a new phase in the development of the Internet

The Grid is an enabler of 'on-demand computing' that allows the use of relatively low-cost, stripped-down devices to 'plug' into a massive shared ICT utility whenever and wherever they want to access computing and software capabilities (e.g. see Foster and Kesselman 1998 and www.ibm.com/OnDemand). This is equivalent to plugging electric devices into an electricity grid and removes the need for users to buy and maintain their own complex and costly IT systems. The Grid uses tools from the Globus Project (www.globus.org), sponsored by US government defence and research organisations, to treat all the systems attached to it as an integrated, virtual distributed supercomputer within which users and the information systems they access work together as an integrated virtual organisation.

It emerged from large scientific laboratories with extensive budgets, top scientific talent and strong IT support. Such 'Big Science' applications have been backed by governments in Europe, Asia and the US, for instance in the £98 million e-Science programme of the UK Research Councils (www.rcuk.ac.uk/escience). But the technology's potential to create huge broadband-based systems that can share multimedia materials in collaborative interactions among a million or more users in a wide variety of applications makes it of great value in many other activities (e.g. see www.ibm.com/grid).

For example, the Grid's efficient resource sharing, low maintenance costs and increased reliability, security and flexibility make it attractive to: government departments; businesses of all sizes; education at all levels; entertainment (e.g. audio and video streaming), game playing (e.g. Butterfly.net is building a 1K-node Grid to allow a million players to take part in interactive games); and economic development (by sharing infrastructure, reducing wasted ICT investment and encouraging the sharing of knowledge and skills).

The pace of Grid development and deployment depends on how quickly standards for it are agreed and the speed at which the basic technology matures. In addition to creating and maintaining university Grids, Nelson and Feldman (2003) argue that government policy can be a significant influence on wider take-up of the Grid by adopting telecom policies aimed at fostering investment in high-speed networks for companies and organisations of all sizes, as well as by revising procurement policies to encourage government agencies to use Grid computing rather than investing in more of their own IT hardware.

Source: Summarised from Nelson and Feldman (2003)

According to Baxter, the gap between hype and practice can be closed in the long-run only by focusing more on behaviour, culture and education. Lehr emphasised that making it easier for people to get hands-on experience of broadband and educating them in how to use it is likely to be the best way of encouraging take-up, as indicated by

[13] Dutton noted that a case could be made for saying that almost every new mass medium has initially found popularity through these kinds of pornographic and gambling interests, but also that these activities alone cannot sustain long-term business development.

surveys showing very high levels of praise for the technology among people who have had broadband and then had it taken away. The migration path from what users first do online to how they subsequently change was also seen as significant, because the use of relatively simple tasks like email and Web searches can stimulate demand for more innovative applications with great consumer appeal.

Patterns of success in closing divides: the key role of the public sector

Lloyd said 'patterns of success' were emerging from different parts of the world where significant progress has been made in closing digital divides. He explained: 'This has tended to start with government funding of universities and research institutions and networks, then moves to government funding of broadband access to schools, followed by government becoming the first and best customer of the first level of infrastructure to get things underway.' He added that another important element in these patterns is the nurturing of a competitive environment in which there are many investment sources to provide money for extending broadband reach and infrastructure deployment.[14]

Lloyd referred to a number of countries where such patterns of success through government support had been followed, particularly in most countries at the top of the broadband league table in Figure 1, such as Canada, Denmark, Belgium and Sweden. He cited the Canadian province of Alberta, where the provincial government is sponsoring the building of the SuperNet fibre optic networks to connect every government office, school and hospital, with the private sector having the responsibility for working out how to deliver the 'last mile' link from user locations to the shared infrastructure (see www.albertasupernet.ca).

'Many European countries also view this kind of investment as a social not a regulatory responsibility, and fund it from general tax revenues,' Lloyd emphasised. He likened this to the vital role of public investment in developing road and aviation systems, and said a similar approach could also be effective in eastern Europe and developing countries. Courtney Jackson, Deputy Director of the Jamaican Office of Utilities Regulation, pointed out that investment in broadband for use in public institutions can have a wider impact, for instance by enabling SMEs wary of the technology to find out how to use it and what it can do. Phil Smith, Business Development Director of Cisco Systems UK, noted: 'The real drive around innovative broadband developments is generated from a true community basis, such as in neighbourhood regeneration.'
Tony Blair's commitment to boosting broadband is reflected in a broader range of policies for promoting the widespread deployment of ICTs in the UK (see www.broadband.gov.uk). This includes the general promotion of ICT use in public administration and in the electronic delivery of public services.[15] Examples of this include a commitment in November 2002 to spend over £1 billion bringing broadband access to all schools (www.dfes.gov.uk), the People's Network creating over 4,000

[14] Noam (2003) addresses the question of competitiveness in the Internet market, concluding that in the long-term: 'the Internet might move from an entrepreneurial and libertarian model to one of market power, and of regulation resembling or even exceeding that of other electronic media'.
[15] The blueprint for this was outlined in a White Paper on modernising government (Cabinet Office 1999).

centres to link all public libraries to the Internet (www.peoplesnetwork.gov.uk) and the Wired up Communities (WuC) project in deprived areas to explore ways of closing the digital divide (Box 4). There are also varied and wide ranging ICT and broadband initiatives involving local government[16] and regional development agencies.[17]

Forum participants generally agreed that broadband can help greatly to improve efficiency and quality in the delivery of public services – but only if innovation is well managed and the technology is not seen as an unproblematic fix to all problems. OII Policy and Research Officer Vicki Nash pointed to findings about the low take-up of broadband in the WuC project even when access was available, as an indication of how solutions to social problems depend more on the outcome of the complex interactions of many crucial variables than just on technological innovation. She warned that when government investment in improving public services is promoted simultaneously with the rollout of broadband, as it is in the UK, people could become disillusioned in the technology if they do not experience tangible improvements in public services, even when the failure is not attributable to the technology. Nash emphasised that this concern does not mean she was questioning the potential value of broadband and ICTs in public service when their introduction is managed effectively.

The public sector's 'unfair' long-term investment advantage

Clark explained why the public sector could play a crucial role as an investor in projects with long-term payoffs, such as broadband: 'The stock market looks for a return on investment within a small number of quarters. But if a local community builds a broadband infrastructure by borrowing under a municipal bond that has to be paid off over 15 to 20 years, it gains an unfair advantage over the incumbent telecommunications companies borrowing on the open market, because the longer period brings a different perspective on future proofing the investment. Under Wall Street pressure, the commercial model of investment involves tiny baby steps to justify itself, but long-term public investment is big bang.' He noted that the most obvious 'future proof' technology is 'home-run fibre', direct from a telecoms supplier to the home.

A public-sector stimulus is also especially important in the current climate where telecom investment continues to be dampened in the aftermath the dotcom crash. The resultant nervousness among venture-capital investors has been compounded by uncertainties over the speed of the take-rate. While the maintenance of a competitive environment in ICT and related industries was widely supported, the main reservations expressed at the Forum were about how much the market could do on its own. Dutton observed that this kind of discussion on the limits of telecommunications competition had changed substantially from the sorts of debates occurring just a year before, with the emergence of a much more consensual and more nuanced approach.

[16] e.g. see www.socitm.gov.uk, the Web site of the Society of Information Technology Managers (Socitm), and www.broadband.gov.uk/html/ukbroadband_task_force/SOCITM%20Briefing.pdf for a copy of Socitm's (2002) report on broadband in UK local government.
[17] e.g. see www.seeda.co.uk for the South East region; www.advantagewm.co.uk for the West Midlands.

Box 4: Wired up Communities: a UK project to bridge the digital divide

Wired up Communities (WuC) was launched in 2000 by the Department for Education and Skills (DfES), backed by £10 million of government funding, to investigate how the digital divide can be bridged by enabling communities to use ICTs to access jobs, learning opportunities, government and other services. The funding helped to provide Internet links for homes in seven disadvantaged communities in inner city and suburban estates, rural communities and villages in the UK (see www.dfes.gov.uk/wired). A medium-term objective was to promote economic inclusion and improve the employment prospects of people in these communities. In the longer term, the programme aimed to improve social cohesion.

An assessment after two years (Devins et al. 2003) identified some notable WuC successes in encouraging participants to get online. For instance: 74.5% of respondents to surveys in WuC areas had used the technology to access the Internet; 85% indicated their Internet use had increased since receiving the technology; almost half used the Internet daily, about 40% to shop or bank online; and 82% continued to use the Internet after the WuC subsidy ended.

In meeting wider social cohesion needs, only about 6% said their employment situation had changed, in variable directions: some moving into work, some out of work and some into education. About 15% of WuC Internet users had used it to find information on democratic and community based organisations, with less than 5% using it to send information to such groups.

However, despite being provided with the technology in the home, a quarter of survey respondents had not used it to access the Internet. Failures of the technological platform, lack of interest and inadequate skills and knowledge were factors affecting these non-users.

Devins et al. (2003) emphasised how the WuC initiative had shown the importance of a 'joined up' approach to link the development of strategic aims and objectives with operational implementation at a local level in order to develop collaborative policy interventions between local and national government to bridge the digital divide. They also highlighted the need to retain a policy emphasis on those who are 'not interested' or have 'lost interest' in the use of the Internet, as well those who become engaged with the technology.

Source: Summarised from Devins et al. 2003

Building on local initiatives

As indicated by the enthusiasm of many for WiFi, local initiatives were highly valued as a source of innovative public and private enterprise that can stimulate broadband use because they are rooted in grassroots community aspirations and needs.

While supporting this view, Sharon Eisner Gillett, Executive Director of the MIT Program on Internet & Telecommunications Convergence, also emphasised that the involvement of higher layers of government is equally essential – even if difficulties caused by the lack of adequate broadband services typically become manifest as a local problem. She explained: 'Any individual community's broadband deficit is not purely a result of local forces: regional, national and international policies (or the lack thereof) also play a role. Further, local governments rarely have the expertise, funding resources or scale necessary to execute effective interventions independently. The problems of insufficient

broadband availability and adoption therefore need to be addressed cooperatively at all levels of government authority.'

Gillett highlighted a range of potential interventions, including:[18]

- initiatives to assess, encourage or aggregate demand, which may be appropriate at multiple levels of authority depending on geographic density;
- policy changes that can be undertaken only by government authorities with appropriate jurisdiction over the rules in question;
- the disbursement of funds or subsidies in various forms, which is an option available to all levels of government but is often most effective at the higher layers with their larger budgets;
- the construction, operation or financing of infrastructure, which is most often seen at the local or sub-regional level.

What can be achieved at each level obviously depends a great deal on how power is devolved in particular areas. In the US, a key local person in broadband policy is the town manager, who can raise municipal bonds and negotiate terms and conditions with broadband infrastructure suppliers, for instance in the provision of special local-access TV channels. In other countries, there may be less local freedom of manoeuvre.

One of the benefits of a technology like WiFi is that it can be used to develop a local-access broadband network at reasonably low cost, for example for just one household, a cluster of a few houses, an apartment block, village or other local neighbourhood. In developing countries, NGOs, such as UNESCO and the World Bank, can help to support local developments. WiFi is of value for more than just intra-local communications, as it connects to the rest of the Internet through the backhaul infrastructure. 'Thus, while WiFi may solve the first mile problem, it may simultaneously make the second-mile problem more noticeable,' Gillett noted.

Mitchell highlighted cities as an arena where 'we are likely to see some of the biggest potential impacts by broadband on the digital divide'. This is illustrated by the plans announced in October 2002 by Hull City Council to make Kingston upon Hull a 'digital city' and a World Top 10 Information Age City by 2005.[19] It is doing this by developing the UK's first public-service broadband portal that combines TV and Internet access. This will open out local government to its communities, and as a platform for the BBC's extensive interactive programming and lifelong learning initiatives. The Scottish cities of Aberdeen, Dundee, Edinburgh, Glasgow and Inverness are also pursuing focused digital city strategies, backed by a coordinated 'e-City Network' project to evaluate progress (see www.businesslab.co.uk).

The value of adopting different approaches in different contexts was also highlighted by Dutton (2003), in pointing to the importance of historically anchored cultural differences in shaping public responses to innovations such as broadband. This was echoed in the

[18] See Gillett 2003: Table 1 for many specific examples.
[19] See www.hullcc.gov.uk/news/02_oct/78ce02tcm.php

recommendation that came closest at the Forum to being a universally applicable proposal: 'In praise of diversity', the title of Gillett's (2003) position paper to the Forum.

Using demand aggregation to boost broadband use

McKnight noted that 'demand aggregation' is one of the most significant emerging strategies for broadband success. This can be used by community leaders to reduce the investment risk of private sector investors by bringing together a number of people and groups to build sufficient demand to establish a viable new service.[20] Richards agreed: 'The most important way for governments to boost broadband availability and deployment would be to get public-sector aggregation right, with sensitivity to local areas. That is the best and most effective way of engaging people, but requires much management skill to overcome cross-departmental barriers in the public sector. A multiplicity of local broadband initiatives also offers a greater diversity of solutions.'

Demand aggregation projects can range from: broadband in schools and libraries, as targeted by the UK government; to stimulating local business uses of broadband (see Box 5 for a US example); to the availability of broadband in apartment blocks, which is being developed especially successfully in a growing number of countries, such as Finland, Canada and Korea.

Paltridge pointed out that a significant reason why Finland has one of the fastest broadband growth rates is that residents in apartment blocks have begun to discover that they can share the costs of bringing business-level broadband connections into their building at charges as low as 10 Euro a month (e.g. see www.elisa.com).

The Canadian Research and Innovation Network (CANARIE) has been promoting the use of 'dark fibre': unused optical fibres included when connections are initially laid, as a vehicle for subsequent low-cost demand aggregation. It claims that dark fibre can be used to create 'customer-empowered' networks (see www.canarie.ca for Canadian cases), which it describes as 'publicly-owned, publicly-administered infrastructure reaching every home and business in the country'. [21] Paltridge noted that aggregations in apartment blocks can also blossom in countries with high population densities, such as Korea, where competition leads to easy and widely available broadband access.

Educational opportunities in and outside schools

A key theme throughout the Forum was the importance of relationships between broadband and schools. This went further than just the use of broadband in school education to also encompass the effects on parents and society at large. Stephen Uden of Microsoft's Education Relations pointed out that serious issues are at stake if even only a small percentage of the population don't have access to the same richness of educational resources or breadth of curriculum as those with access to broadband. He

[20] See www.sis.pitt.edu/~demand/Overview.htm, the Web site of the International Working Group on Telecommunications Demand Aggregation.
[21] See www.canarie.ca/advnet/cen.html

also noted that distance learning and other e-learning innovations could have profound implications for the organisation of schools and the range of subjects available.

However, Baer said there is 'scant evidence' that the 'education-rate' and other subsidies for ICTs in the US have led to better learning outcomes or increased Internet use outside the school. He highlighted criticisms that the use of the Internet in schools has been ineffective and has taken time away from more important learning tasks. Others emphasised the 'relevancy question' articulated by Best: what is most important is not what else could be done, but how people can use broadband as a tool to enhance educational experiences and outcomes. Lewis acknowledged that broadband could help in education, but warned: 'When the government's education policy is social inclusion rather than paying teachers decent wages and not allowing standards to drop, it is not a technology problem but a political, ideological and cultural one.'

What wasn't questioned was the impact that introducing broadband to schools can have in giving children a hands-on taste of its potential. The enthusiasm this generates can then affect their parents' interest in, and demand for, broadband in the home. Uden cited research for the Microsoft Anytime Anywhere Learning (AAL) laptop-in-schools programme (www.microsoft.com/uk/aal), mainly conducted in deprived inner-city areas in the UK, which had found that even parents who had never considered having a computer at home got engaged with their children's systems when they brought laptops home.

'This created more proximity between parents and schools, and greater engagement of parents with their children's school work,' Uden observed. Pepper endorsed the significance of this engagement: 'One of the most important variables in a student's success at school is parents' involvement with the child and school. Computers at home encourages parents ability to look at homework assignments, e-mail teachers and get involved.'

However, Uden said expecting parents to go to schools to use equipment often doesn't work well if the culture of the local community makes it difficult to persuade adults who had a negative educational experience to go back into schools. Richards agreed that the effect on the home was a key argument for broadband in schools, but also warned that introducing ICTs to schools could fail if teachers were not trained properly to be competent and confident in using the technology.

Debates about educational uses reflected a number of different perspectives. Some, such as Coleman and Richards, welcomed the BBC's Curriculum Online national venture, [22] while others stressed the value of locally created content in which students became producers and teachers. Neil Worman, who deals with creative and cultural sectors at SEEDA, contended that nurturing the development of a private sector market for educational content should also be a longer-term objective. He said this sector in the

[22] See www.bbc.co.uk/info/news/news368.shtml

UK is currently fragmented between a number of creative small companies who depend greatly on public-sector commissions, and their role should be supported as part of a competitive environment that is not centred solely on the BBC.

Box 5: Local demand aggregation: Berkshire Connect, Massachusetts

Berkshire County is a community of about 135,000 people on the far western edge of Massachusetts. Although it is a rural, low-density county, average education and income levels are on par with national averages. When local discussions in 1997 identified a lack of advanced telecommunications as a key issue hindering entrepreneurial activity in the region, the Berkshire Connect Task Force was established, including partners from government, academia and industry (see www.bconnect.org).

In order to stimulate take-up by SMEs, a key component of the requirement specified after intensive investigations was that the high-speed Internet connectivity offered by Berkshire Connect should have the same affordable charges for delivering the same service to businesses of any size, at any location in the county. Local civic leadership, supported by political leadership in Boston and Washington D.C., convinced larger companies that they should be good corporate citizens by accepting their implicit subsidy to smaller and/or more remotely-located firms. In February 2000, Global Crossing - the only bidder that proposed to build new facilities in the region – was awarded the contract to build the network. It invested approximately $3 million to do this.

By autumn 2001, Global Crossing was receiving an estimated $350,000 in monthly revenue from over 50 businesses in 15 of the 32 towns in Berkshire County. The $550-$750 per month costs for Internet connectivity are estimated to be a 70% reduction on the prices from the incumbent supplier at the time Broadband Connect began. An example of benefits achieved was a 60% cut in telecommunications costs for the largest hospital in the region, Berkshire Medical Centre. It also improved medical care, for instance by allowing radiologists to view X-rays remotely when it would not have been feasible travel the required distance. Other businesses have used the new telecom capabilities to improve efficiency and open opportunities for new ways of doing business.

Key lessons learnt that could be of value to others include:

- Have a clear and well-defined focus. The decision to focus on broadband requirements for SMEs but not residential or SOHO (small office/home office) users opened the initiative's political backers to some criticism, but it was critical to the projects success.
- Undertake significant preparatory work to demonstrate the region's attractiveness as a business opportunity to service providers.
- Initiative leadership must be local and passionate.
- High-level political support is essential.

Source: Summarised from Gillett (2001)

Addressing democratic engagement and disengagement

Coleman drew a distinction between 'government' and 'democracy' that reflected the distinction he had made between broadband as a delivery mechanism or mediator in relationships: 'Governments tend to deliver, even if not what we want, when we want it and at the quality we expect. Democracy is a relationship. And we can't have one

without the other.' He was sure broadband can play a crucial part in enabling the public to interact in new, more effective and closer ways with institutions of government they now see as too remote.

He illustrated this potential with examples of developments in what he described as two British institutions that have been 'in a state of crisis and have tried to do something about it': Parliament and the BBC. He reported that Parliament has addressed 'its seemingly intractable problem of declining interest from the public, media, etc.' by setting up a series of consultations on policy issues that have been popular with the public and politicians. And he said the BBC's development of a fresh interactive approach to sharing knowledge between local communities was a key outcome of its in-depth analysis of why interest in political coverage has dropped significantly.

Coleman also observed: 'There is a correlation between governments who get broadband right and those with the most vigorous, creative, inventive, proactive e-government processes, such as Canada, Denmark and Sweden. In those countries you are not seeing an attempt to replicate offline services online but an approach to value-added e-government at the broadest level, in a highly thought-out way and with a significant democratising element.' He suggested that an important evaluative criterion for assessing broadband's impact on society would be whether diversity increases within the next five to ten years: 'This means finding out whether broadband can produce different voices, not just deliver more films or music, by asking: Are there different types of films or music being produced? New sorts of communities being heard? New sorts of languages being spoken? New sorts of things being said from citizens to government, and from government to citizens?'

Lewis was concerned that Coleman may be investing too much expectation in broadband. 'The problem with government today is not that people aren't able to e-vote, but that there is no politics, no legitimacy in the institutions. People are disengaged with the social processes. The Internet might be a facilitator in some instances. But broadband and the Internet are not going to solve the more fundamental problems, as they are broadly social and to which there is no technological solution. We are inventing a problem for ourselves by putting forward a false proposition with false solutions.'

Business divides by size

One of the fundamental reasons why broadband was said to matter is the substantial dividends that can be achieved by business and industry, especially in productivity gains and opportunities for transforming how companies and whole industries are structured and run. Such benefits have been experienced by enterprises of all sizes and types, but the Forum identified a significant divide between SMEs and larger organisations. This was illustrated by Saunby's reporting of the low broadband deployment by SMEs in the English Midlands. Lloyd noted that the wide deployment of broadband for residential use could stimulate take-up by SMEs, as he says has been the case for the telco Telefonica in Spain.

Jenny Searle, Business Development Director at Oracle Corporation UK, said a key reason why many SMEs have failed to adopt the Internet in general, and broadband in particular, is a lack of trust in ICT suppliers. This was based on experiences with earlier ICT systems and applications that proved to be far more costly and difficult to implement than had been promised. She added that these problems are exacerbated by generally inadequate levels of ICT skills in SMEs and the lack of simple to install and use packaged solutions, together with the complexity of pulling together their own solutions in terms not only of technology and application but also in associated management changes. To overcome these difficulties, Searle recommended: 'Broadband should make the IT industry rethink the arguments and solutions it puts to SMEs, as well as stimulating SMEs to rethink the effort they need to put in to understand what they should do to take advantage of broadband's potential for enhancing an SME's role in the supply chain.' But she acknowledged that the chicken-and-egg problem means the demand to stimulate better solutions from IT suppliers won't be there unless many more SMEs get the right computer and telecommunications capabilities.

Lloyd sees SMEs as having advantages in their flexibility to change management attitudes, organisational culture and business compared to larger organisations. These could be used by SMEs to gain a competitive edge by being leaders through broadband-based innovation. Searle agreed that some SMEs had gained 'first mover' advantages, such as the UK company that was the first to offer online conveyancing of documents in property transactions, which enabled it to win financial and market-share advantages and set standards for bigger companies. 'But such examples are still isolated, so I doubt if SMEs have any general advantage,' Searle noted. She recommended that one way of increasing the number of SME winners would be to gather and disseminate more examples of Internet and broadband best practice in SMEs, as most best practice advice is derived from large companies and does not translate easily and effectively to SME contexts.

A legal and regulatory framework to balance conflicting interests

Policies to promote smooth digital traffic flows

Pepper drew an analogy between broadband and motor highways, which he said could work efficiently only within a framework of insurance, registration, safety and other rules in a complex legal and regulatory infrastructure. In a similar way, he noted, broadband growth depends on establishing a new legal framework and regulatory structures that promote efficient, safe and secure digital traffic flows. Forum participants identified a number of important elements in this framework, including:

- Digital Rights Management (DRM), which encompasses traditional Intellectual Property Rights (IPR) and copyright concerns;
- security;
- privacy;
- e-commerce trading arrangements; and

- protecting consumers from being faced with unwanted and unpalatable content, including unwanted ‘spam’ junk e-mail.

Building trust in Internet communications by establishing a framework that fairly balances the diverse interests of producers, consumers, citizens and government was seen as a prerequisite for stimulating and sustaining broadband growth. Uden stressed: ‘Policy needs to create an environment in which innovators on the ground will come up with compelling applications. Potential blockages to making that happen should be removed wherever possible.’ But Clark has a major worry: ‘There has been a pernicious corrosion of the philosophy of the Internet. Initially, there was a simplifying assumption that everyone using it could be trusted, so it was an excessively transparent net. Now, people put in firewalls to say what we can be permitted to do, which is a serious barrier to innovation – and I know of innovations that can’t be rolled out because of such firewalls. On the one hand, people are not prepared to pay for security; on the other hand, they are prepared to have innovation turned off. However, addressing security needs thoroughly by rethinking some fundamental principles and architectural features of the Internet is unlikely to be feasible with the current international institutions governing the Internet.’

Searle pointed out that anything that inhibited user demand would hamper broadband applications and supply because take-up would not be fast enough to recompense the companies investing in the technology. Yet Lewis feared: ‘Instead of developing standards that ensure reliability and robustness in computer systems, we are in danger of raising different kinds of standards that could make interoperability and access to a rich array of application and content more difficult.’ Duggan contrasted the UK Government’s expressed intention to keep specific regulation of Internet content to a minimum with the approach taken by some other countries. For example, government rules in China and Saudi Arabia enable filtering of Internet content through a limited number of servers linked internationally. The Australian Government also attempts to place strict controls on Internet content.

Managing information and communication convergence

One of the trickiest areas facing regulators is in dealing with the convergence of ICTs, which is a critical dimension of broadband’s transformational potential. Worman explained that one of the consequences of convergence is that bodies regulating one activity can start regulating more and more, as different aspects come together. For example the Office of Communications (Ofcom) was formed in 2002 in the UK to take over the functions of the national bodies that had dealt with telecommunications, TV and radio. Duggan stressed that the Communications Bill then before Parliament was framed to ensure broadcasting regulations are not extended to telecommunications and Internet content, even when TV and radio programmes are delivered over the same physical networks as the Internet.

The complex range of issues raised by convergence was illustrated by the Voice over Internet Protocol (VoIP) service that transmits ‘telephone’ voice conversations over the

Internet. Pepper said the FCC does not want to intervene unnecessarily in something as new and innovative as this, so it had decided to accept that VoIP operating computer-to-computer should be considered as a computer application at a similar level to software, and therefore not regulated as a telecom service. If VoIP operates telephone-telephone with VoIP in the middle, he said it might look like a telecom service but the FCC would consider each case on its merits. The most difficult case, according to Pepper, is where a VoIP call starts in the computer but terminates in the public switched telephone network (PSTN).

One of the few VoIP cases the FCC has had to deal with related to Pulver.com's Free World Dial-Up service, which offers free phone calls through the Internet using VoIP. When the FCC went out to consultation on a petition from Pulver.com asking for Free World Dial-UP not to be regulated as a telephone service, the only strong objections came from the FBI and Department of Justice as they were concerned that their wire-tapping needs might not be covered. The petition hadn't been resolved at the time of the Forum.

Convergence also brings into focus some strong conflicts of interests. For instance, some consumer advocates are concerned that big industry players will use the vertical integration of convergent services into broadband packages as a lever to build powerful cross-media positions. In March 2003, two major US consumer groups – the Consumers Union and the Consumers Federation of America – petitioned the Federal Trade Commission and US Justice Department's antitrust division to investigate cable pricing structures that tie together TV and Internet services.[23] Yet, FastWeb's success in Italy with a low-cost multi-service broadband package shows that such bundled service can be very popular with some consumers. Clark also raised the question of whether bundled vertical integration could lead to restrictions being placed on content by ISPs who are part of a conglomerate which includes a content provider. Nevertheless, he hoped ISPs understood that such a restriction on consumer choice could backfire if people didn't like one of the partners in the package.

Digital Rights Management: Goliath v David or J-Lo v Bill Gates?

DRM is one of the most visible aspects of the legal framework that directly affects broadband traffic. The growing popularity of downloading music and video on the Internet has been met with fierce resistance from the music industry and the Motion Picture Association (MPA), which represents Hollywood and the rest of the film industry.[24] Gillett warned that 'DRM could kill broadband if it becomes too restrictive'.

According to Peter Davies, OII Visiting Fellow specialising in IPR and copyright, the law inevitably plays catch-up because it always lags behind the fast pace of technological innovation. He does not see current sharp debates over DRM as being a battle between the Goliath of Hollywood versus the David of consumers, as it has been depicted by

[23] See www.consumersunion.org/telecom/cable-price.htm
[24] The MPA estimates annual losses of at least $3 billion worldwide due to piracy (www.mpaa.org/anti-piracy/content.htm).

some. He views it more as 'Goliath v Goliath', because the anti-Hollywood side includes telecommunications and ICT companies with substantial resources, as well as strong consumer lobbies. However, McKnight joked that it might not be a fair fight to win the lobbying battle when it is between Bill Gates and J-Lo, the media celebrity Jennifer Lopez. Davies acknowledged that the contest may be evenly balanced in terms of the money available, but agreed that Hollywood is winning the legal battle at the moment, particularly in the US.

Davies thinks that 'Hollywood is probably going too far in trying to protect its investment in content'. But he also stressed: 'DRM is not a simple story of the good consumer cowboys in the white hats versus the bad big-producer cowboys in the black hats. The content lobby does have a case, although it may not be as big a case as is made out in terms of mass-market, industrial-scale piracy – even if that is the way they present their position effectively in getting the ears of the legislators.'

The difficulties involved in unravelling the complexities associated with DRM and the controversies it raises is illustrated by delays in turning the EU Copyright Directive into national legislation, which was meant to be implemented by the end of 2002. By March 2003, only two EU countries had enacted such national legislation. The UK Patent Office had intended to implement it by 31 March 2003 through an amendment to the Copyright, Designs and Patent Act 1988, but has said this deadline would not be met.[25]

'The confusion will get even worse when IPR and copyright infringements become mixed up with issues of privacy and security, when we will see claims for stronger IP protection on the grounds of security, including national security,' Davies added. 'To deal with this complexity, we need a more even-handed analysis than at present. Scares are being generated by both sides, through visions of whole industries crashing or masses of people being jailed. That is creating a high level of fear, uncertainty and doubt which in itself could inhibit broadband use,' he concluded.

Pepper cited an example of what such a coming together of issues could mean: the states of Massachusetts and Texas were preparing to consider a bill to extend the US Digital Millennium Copyright Act of 1988 to say it will be illegal to possess, purchase or use technology that conceals from the communications service provider the existence or place of origin or destination of any communication. This would take away the right to security and anonymity for an individual or group in order to give more security for IPR content.

PART III: BROADBAND IN DEVELOPING COUNTRIES[26]

Similarities in broadband patterns and issues

Most participants, including the many who have experience of ICT-based projects in developing countries, agreed that a strong and somewhat unexpected emergent theme

[25] www.patent.gov.uk/copy/notices/2003/implementation.htm viewed on 7 August 2003.
[26] The authors greatly appreciate Anu Mundkur's assistance in preparing this section, particularly Table 2.

of Forum discussions was the degree to which the issues and many patterns in the divides were similar in developed and developing countries. This includes the need for appropriate regulatory and legal frameworks to address the divides and dividends mapped in the previous section.

In developing countries, most governments and their NGO advisers also reflect the view adopted in the OECD that broadband and other ICTs can play an important role in business and industrial growth. In addition, the technology is seen as having great potential to contribute to wider development as, what Best described as, 'a tool towards achieving legitimate social and economic development objectives relating to existing divides in wealth, education, health, gender inequality and other areas'.

This view has led to a growing and wide range of broadband-based initiatives in developing countries (see Table 3). Although broadband use in developing countries is too new and of limited availability to be analysable for clear trends, Best – who has extensive experience of ICT developments in Africa and Asia – pointed out that: 'There is a lot of compelling and robust evidence from data on voice telephony in developing countries showing the positive impact of telecommunications on growth.'

For example, Best reported that, at the macro level, every 10% increase in tele-density resulted in a roughly 3% increase in GDP; at a micro-economic level, there is a 'consumer surplus' of at least 1.5 on all telephony activity, which means that for every rupee spent the consumer gets back about over 1.5 (e.g. see Bedi 1999). An International Telecommunication Union report (Selian 2002: 40) has also concluded that ICTs are 'vitally important tools for democratisation'.

Nevertheless, Best and others agreed that it is as difficult in developing countries as elsewhere to pin down the precise impacts of broadband on broader social issues. Research by Osorio (2003), for instance, found that investment in broadband deployment at the national level in developing countries is 'highly likely to be secondary to other aspects, such as lower corruption, higher levels of civil liberties, an open economy and well-educated and healthy populations'. He notes that these 'other aspects' are also enabling factors for the effective use of the infrastructure.

Differences in contexts: extreme divides in wealth and infrastructure

The similarities of issues faced across the world did not mask some stark differences that remain, which Forum participants highlighted as important issues for the world community to address. Annalee Babb, a doctoral student at Syracuse University who had worked in the Barbados Foreign Service, emphasised that care is needed when considering the context in which technology is introduced in developing countries, for instance where – as she said is the case in Barbados – the private sector is very risk averse and not very innovative, with a colonial legacy that includes a government ethos

with strong hierarchical barriers to more flexible ways of organising and operating government business.[27]

Table 3: Broadband projects in developing countries

Project	*Description*	*Further information*
Gangetic Plain Digital Bridge, India	A WiFi corridor covering over 75 km between Kanpur and Lucknow that cuts across the river Ganges. It offers high-quality voice, video and data connectivity to villages in surrounding areas.	www.medialabasia.org
Remote IT Village, Laos	WiFi, a Laos-language version of Linux and low-wattage computer driven by bike-pedalled power provide a wide-are network connecting five remote villages in Laos to the outside world.	www.jhai.org
Solar.net Villages, Honduras	Solar-powered WiFi and satellite communications bringing telephony, distance education, health service and e-business to remote villages.	www.onsatnet.com/solarnet/
Vaancha Project, India	Training disadvantaged youth in ICT skills and developing solar-powered broadband wireless ICT training centres ('vaancha' means 'a wish').	www.vaanchaict.org
Village Area Network (VAN), Bohechio, Dominican Republic	Satellite and WiFi capabilities to support a wireless VAN, mainly to help with agricultural and educational needs.	http://edev.media.mit.edu
Information on other broadband and ICT projects in developing countries can found at: Development Gateway www.developmentgateway.com; Digital Divide Network www.digitaldividenetwork.org; Media Lab Asia www.medialabasia.org; UN ICT Task Force www.unicttaskforce.org; World Resources Institute www.digitaldividend.org; World Bank Global ICT Development (GICT) http://info.worldbank.org/ict		

The importance of understanding local contexts was emphasised by Lewis when he expressed a concern that agendas imposed by institutions like the International Monetary Fund and World Bank to encourage the liberalising of industries and opening

[27] Babb has sought to assist policy makers in developing countries to become aware of the need to establish a coherent range of policies dealing with broadband and other ICTs that address a broad range of social and economic issues through her development of a layered 'model of societal access policy' that encompasses issues such as financial resources and Internet literacy, not just basic physical access (Babb 2003*a*: Table 1, 2003*b*).

up markets ‘could lead to attempts by some developing countries to innovate according to these externally-derived agendas’, thereby establishing ‘a developmental imperative which is geared to external interests, rather than locally-determined goals and needs.’

The most dramatic divides between developing and OECD countries relate to extremes: of poverty and telecommunications infrastructure development. ‘In most developing countries there are enormous levels of poverty, which means that it will not be possible in the foreseeable future to have broadband deployment beyond a level much larger than the ‘last 10%’ gaps in the OECD,’ Osorio emphasised. The historically low levels of availability of telephony in developing countries is reflected in the 5% v 0.2% gap in broadband penetration between OECD and developing countries, highlighted in the section ‘*Divides between rich and poor, rich and rich*’ at the start of Part II.

Best quoted figures from two countries in which he has much experience: a ‘tele-density’ of 3% in India, a middle-ranking developing country, and just 1% in Ghana at the lower end of the scale, of which 70% is in Accra. In major metropolitan areas in India, Best said fibre-to-the-street was being installed and DSL services of no more than 128 Kbps are being promised – but dial-up Internet access at more than about 9 Kbps is not possible outside these areas. In Ghana, Best reported there is some fibre to the south but very little in two-thirds of the country, and he had not heard of any supplier even talking about offering broadband DSL or cable. Jackson noted that over 90% of schools in Jamaica do not have access to the Internet. Lehr also pointed out that telecommunications prices per capita income in the developing world are generally substantially higher than elsewhere.

Wireless capabilities offer particularly attractive opportunities to overcome the infrastructure gap, especially through satellite and WiFi technology (see Box 2). Anuradha Mundkur, a student at Syracuse University, commented that this indicated how important it is for developing countries to have technology-neutral policies. They would then be able to look ahead without being tied down to one technology and constantly having to rewrite policies. Many Forum participants also saw the poor state of basic telecom infrastructures in developing countries as signalling the need to also pay attention to relatively low-tech capabilities, some of which could be transformational in these contexts.

For example, the Kothmale Community Radio project in Sri Lanka integrates the Internet and radio by asking people to write questions to the radio station, which then broadcasts answers obtained via the Internet (Pringle 2001; www.kothmale.net). In Bangladesh, the Grameen Village Phone programme builds on Grameen Bank's experience with village-based ‘micro enterprises’ to enable women to own and make a living from mobile phones that are used by other people in the village and adjoining areas as a public call office (www.grameen-info.org). In West Bengal, the UNESCO-sponsored Nabanna project is focusing on innovative uses of a mix of low- and high-tech ICTs, radio and other media to see how they can contribute to poverty reduction

strategies.[28] Nabanna is also exploring how people's lives could be enriched by using the technology to promote inter-creativity, for instance by enhancing the use of, and access to, indigenous knowledge by developing structured information modules from unstructured stories on the lives of rural women.

The generally high levels of poverty and low GDP in developing countries also leads to a lack of leverage in dealing with large suppliers and in developing a competitive market. In addition, low rates of development create a lag compared to the pace of economic and social evolution in OECD countries, for example in the way many developing countries are still in very early phases of opening up their markets to competition in telecommunications supply. These issues were brought into sharp focus at the Forum by Jackson's description of the difficulties faced by Jamaica in seeking to build a strong broadband capability to assist its social and economic well being.

Policy issues affecting global Internet access: the case of Jamaica[29]

The western Caribbean island of Jamaica passed a Telecommunications Act in February 2000 requiring termination over the following three years of the existing exclusive licenses for telecom services. Exclusivity in international data and voice communication was the final service to be opened to competition, in March 2003. The wide availability and affordability of voice technology equipment, together with policy and regulatory intervention, provided good prospects for the early emergence of competition in international voice services based on satellite services. Jamaica's main telecom difficulty, according to Jackson, has been in enabling competition in international data services, including submarine cable-based facilities.

By early 2003, the incumbent monopoly supplier, Cable & Wireless, continued to be the dominant owner of the facilities for international data services and the sole Internet backbone provider and source of cable, fibre and coaxial connection to the global Internet. Jackson explained: 'The absence of competition in this backhaul connectivity to primary Internet backbones has allowed the monopoly incumbent to extract monopoly rents by charging exorbitant prices which are completely out of line with actual costs. For example, Internet connection rates are over $1000 more than satellite service charges, which contrasts with international charging patterns where cable is the less costly alternative.' For backbone access at the lowest level of broadband (84 Kbps downstream and 56 Kbps upstream), he said an ISP is charged $93 per month; even if Jamaica had businesses that could carry such costs, the unsustainable low margin for ISPs has caused many to go out of business.

According to Jackson, 'This has led to a great restriction on broadband supply capacity, with the incumbent favouring its own vertically-integrated ISP, while others have been driven from the market. The resultant high prices for both narrowband and broadband access has stifled demand for both, while the incumbent's stranglehold on access has

[28] Nabanna's team leader Wijayananda Jayaweera (w.jayaweera@unesco.org) or its coordinator Ian Pringle (ipringle@pcmedia.org) can provide further information on the project.
[29] For more on this case, see Jackson (2003).

made it difficult to build a competitive telecom market. This has placed serious constraints on Jamaica's ability to use broadband to help meet its need for substantial economic development.'

Jamaica's situation was seen by many participants as being typical of the experience of many countries emerging from telecom monopoly ownership and control who are seeking to introduce competition in order to reduce costs of telecommunications services, which are seen as a critical contributor to economic growth. For example, Jackson said: 'In the face of the kind of choke-hold on the middle mile held by the incumbent supplier in Jamaica, many developing island nations and isolated land-locked communities may not find it easy to adopt the solutions of recently liberalised countries. Without action to ensure adequate bandwidth capacity and reduced prices of middle-mile facilities, the benefits of wide availability of broadband access in driving socio-economic development will not be realised.'

Understanding the particular concerns of developing countries

Best highlighted an issue of special concern for many developing countries: the way international Internet connection costs are shared internationally compared to the traditional arrangements for international telephone calls. This had been raised internationally in 2000 through a report of the Australian National Bandwidth Inquiry (www.noie.gov.au) on International Charging Arrangements for Internet Services (ICAIS).

Best explained: 'If I am in Ghana and surf the net or send an e-mail to the US, the Ghanaian ISP pays to route the package coming and going; but if I surf a Ghanaian Web site or email to Ghana from the US, I freeload the international portion of that network – Ghana pays for everything. With traditional voice telephony, however, developing countries gain much income from the termination of international calls on the PSTN. For example, the Indian Treasury receives about $1 billion a year from international calls. This revenue could be cut substantially if voice conversations start to go over the Internet through VoIP technology.'

Best acknowledged that the situation on international telephony had allowed for the continuation of high local telephony charges in developing countries, often without the extra revenue being used to build up a competitive local telecommunications market. But he said the potential loss of substantial income had to be taken into account, as many countries are so concerned about it that some might be prompted to erect Internet barriers, for instance in the way ISPs in Ghana had been closed down and their equipment removed because they were offering VoIP.

Paltridge noted that the OECD had produced several reports on Internet traffic exchange, including the situation in developing countries (e.g. OECD 2002). He was sure the answer is not to tinker with tariff structures, particularly not in trying to impose telephony structures on Internet traffic. Instead, he recommended the adoption of telecommunications reform that encourages competition. Pepper agreed, adding that

developed countries can have an important role in addressing the needs of developing countries by helping them to build inter-country, intra-regional and international infrastructures.

The intervention through various forms of censorship by authoritarian governments was also seen as a significant potential threat in developing countries, where government is often the sole or main provider of local content. On the other hand, governments in developing countries are generally in a much weaker position than those in the OECD when it comes to financial support for broadband innovations, such as the ability to provide public-sector investment for infrastructure development and demand stimulus. This leads to a dependence on external agencies for support, which might come with attached strings and attitudes that are not necessarily in the receiving country's long-term interests.

PART IV: POLICY PRIORITIES

The surprising common ground

When participants were asked at the end of the Forum to pinpoint what had most surprised them about the discussions, a common response was to say how interesting it was that there had been so much agreement among such a diverse group, on issues ranging from policies on infrastructure to the nature of the many local and global divides and dividends, bridges and gaps tied to broadband. This was indicated by the emergence of a number of policy suggestions for which there was much broad agreement, even though many people had different takes on the precise course of action in each and the relative weighting between them.

Baer suggested three categories in which policy towards broadband matters most:

1. availability, which involves infrastructure questions;
2. take-up, revolving largely around questions of costs and competition; and
3. usage and outcomes, where consideration is given to the way content, applications and interactivity impact on broader social and economic issues.

Box 6 summarises some of the main policy priorities identified during the Forum within each category. Background discussion on issues not discussed earlier in the paper are reported in the remainder of this Part.

Promoting broadband availability

Sustaining a healthy investment flow

The main policy instruments that have been used since the 1970s to influence telecommunications supply have been aimed at stimulating competition through the growing regulatory liberalisation and privatisation of telecom markets across the world. Forum participants largely supported such policies for broadband supply, while

acknowledging the important role of long-term public infrastructure investment. However, Baer gave a stark prediction: 'Broadband is coming and it will be disruptive.'

Box 6: Summary of policy priorities identified at the OII Broadband Divides Forum

1. Support infrastructure efforts to ensure the availability of broadband by:

- creating and sustaining a healthy competitive environment for broadband supply;
- encouraging wide availability quickly, without raising over-hasty expectations;
- stimulating and nurturing a wide range of content, service and applications sources, including an investigation into how this could be aided by logical-layer unbundling;
- considering new, technology-neutral rules of regulatory engagement to inspire innovation and investment opportunities that overcome the dotcom hangover;
- taking advantage of the public sector's 'unfair advantage' in long-term investments;
- adopting a flexible approach to retail price regulation relevant to broadband needs;
- understanding the impacts of different cultures, business models and regulatory regimes on the behaviour of different types of broadband supplier;
- taking account of the 'cost of delay' and 'opportunity costs' in the pacing of deployment;
- using benchmarking (e.g. on pricing) to stimulate the take-up of best practices;
- investigating new, more consensual forms of regulatory dispute resolution;
- giving similar priority to broadband as to roads and other infrastructure developments.

2. Encouraging widespread broadband take-up by:

- removing, or at least minimising, potential regulatory and legal barriers to the growth of broadband, while building trust in broadband transactions and communication;
- safeguarding personal, consumer, business and national interests when updating laws on privacy, security, IPR, e-commerce, media regulation and related areas;
- ensuring all relevant areas of the public sector are early and effective users;
- making use of public-sector leverage in demand-aggregation initiatives;
- stimulating hands-on broadband use by sharing facilities in schools, libraries and other community spaces;
- gathering and widely disseminating best practice experience in public sector applications, local initiatives, SME innovations and many other contexts;
- avoiding unnecessary restrictions on packaging services to exploit convergence;
- investing in education and training to improve ICT literacy and skills in using broadband;
- supporting and encouraging uses of the Grid beyond e-science.

3. Seeking equitable and imaginative outcomes by:

- ensuring joined-up policy making across all relevant government activities enables broadband to be used to help improve education, health and other public services;
- making firm progress towards ubiquitous broadband coverage in a flexible way, e.g. by considering new forms of infrastructure pump priming and subsidies to consumers;
- exploring broadband e-democracy initiatives to reinvigorate democratic processes;
- promoting applications that exploit broadband's inter-creativity opportunities;
- assisting developing countries to build their own inter-country, intra-regional and international broadband infrastructures;
- developing a fair international pricing and cost-sharing telecommunications regime;
- undertaking a wide range of research on the use of broadband and its outcomes;
- learning about demand, the market and technologies by encouraging and monitoring widespread and diverse use, not by presupposition.

To deal with such a challenge, Bruce argued that some basic elements of regulatory policy elements will need to be re-examined in order to meet what he regards as a prime policy aim: to create a sustainable, healthy flow of investment into the telecom and related Internet sector (see Bruce and Macmillan 2002). For instance, Bruce questioned whether retail price regulation of fixed-line services is still necessary, given the increasing substitution of mobile for fixed services. He and others called for regulatory complexity to be significantly reduced in the light of new market-related and financial conditions, and there was much support for the recommendation by the CSTB (2002) for a generally lighter and more flexible touch in broadband-related regulations. Policy makers were called on to resist the temptation to intervene in a manner that prevents or inhibits the growth of promising innovations, as in the case of the imposition of conditions on WiFi use sought by the Independent Communications Authority in South Africa (see www.icasa.org.za). Bruce also recommended the exploration of new, more consensus-driven approaches to reducing regulatory wrangling and deadlock (see Bruce and Marriott 2002).

The public sector was also seen as having an important role in providing and encouraging broadband investment, but Duggan noted that it was difficult for government to know when there has been a market failure requiring greater intervention, as indicated by the 'glass half full/empty' analogy. Richards also highlighted the delicate balance needed in making trade-offs between availability and competition. For example, the UK had a relatively slow start by relying on competition between cable and telecommunication networks, whereas Germany went for a faster rollout by the incumbent, Deutsche Telecom, with less concern for competitive outcomes. But Richards and Paltridge said the UK should be in better long-term shape because it has placed greater emphasis on a competitive environment, a view supported by the way broadband growth has picked up in the UK since 2001.

Two important reasons for encouraging wide broadband availability that are rarely made explicit are the 'cost of delay' and 'opportunity cost'. In general telecom terms, the cost of delay in creating a competitive market can result in a much lower GDP because the closed market makes telecom costs unreasonably high and restricts access by local industry to world markets. Baer said there was always a cost of delay wherever competitive forces are at work because: 'If you don't do something advantageous in time, someone else could do it for you – or to you.' However, he added that this may not apply as directly in areas without the same competitive pressures, such as education, where the cost of not doing something might be felt more in terms of lost opportunities.

Battle of the broadband pipelines: in search of the 'third pipe' Holy Grail

The focal point of policy discussion at the Forum about physical 'broadband pipelines' into the home focused on a search for what Pepper described as the 'Holy Grail' of broadband competition: to find the 'third pipe into home' in addition to the current top two of DSL and cable. Pepper quipped: 'Three is a magic number, but not as good as five – although that is when it really becomes disruptive.'

Most of the strongest contenders for the third pipeline are wireless-based (see Table 1). WiFi's local-access opportunities were cited most frequently as the most promising contender as, in Clark's words: 'Getting a third technology to become a major competitor in broadband supply is hard because of the existence of so many vigorous cable and DSL suppliers. However, with WiFi you can just cut into the market. It could change the equation enough to make broadband really work.'

Clark said DSL and cable won't vanish for a long time because of the large investment in them by incumbent suppliers, although the technologies would increasingly look alike because both depend on getting optical fibre further into the system to get as close as possible to the home. However, he noted that incumbent suppliers might remain anchored to their distinctive telco and cable cultures and business models, which have been shaped by their experiences within different regulatory regimes and marketplaces. This could create opportunities for innovative 'new kids on the block', like WiFi and powerline capabilities.

Pepper noted that WiFi could become particularly disruptive for incumbent telcos and cable operators if the local-access broadband 'holes' it fills eventually mesh into much larger networks, thereby creating a *de facto* facilities-based third platform. At the same time, WiFi and other wireless technologies have much potential to complement wired infrastructures by offering alternative points of local access. Nevertheless, there could be some contentious battles. Bruce is especially concerned that companies who paid huge sums for licences to some governments for 3G [third generation] multimedia mobile licences 'will have leverage with those governments to impede the "viral" spread of WiFi if they see it is a threat not an ally'.[30] For example, £22.5 billion was paid to the UK government in an auction for five licences for 3G spectrum in 2000. Similar auctions in other European countries, such as France and Germany, also involved large investments for providers of 3G mobile services.

Creating an innovative and diverse competitive environment

In terms of broadband supply, Pepper had no doubts: 'The most important driver is competition.' He recognised that the key issue in broadband supply is now 'down to the market not regulatory processes', as he felt diffusion was going at a reasonable pace and regulatory intervention with the best of intentions could slow things down. Bruce recommended that regulatory policy should seek to establish an appropriate balance on issues such as pricing, the terms and conditions of access to leased lines or cable modem connections, interoperability and billing arrangements.

In the past, one of the main competitive issues for telecommunications regulators like the FCC has been to prevent monopolists dominating and stifling the market. However, Clark questioned the need for such special regulatory priority when general competitive

[30] For a discussion on WiFi and 3G, see Lehr and McKnight (in press). In April 2003, Gemplus and Transat technologies announced a smart card to roam between WiFi and mobile cellphone networks (www.gemplus.com/companyinfo/press/2003/bdg/securewlanaccess03042003.html).

policy applies to other industries: ‘It is not illegal to be a monopolist in a market economy. So why is telecoms such a national asset that regulators need special anti-monopolist powers, when we don’t think that necessary in adjacent ICT industries, for instance in dealing with Microsoft in software?’ Lehr, however, thought it would be ‘wrongheaded to leave this sector to general competition law, as that is too reactive rather than proactive – particularly when broadband’s future competitiveness is still ambiguous’. There was a general recognition that it would be difficult for regulators to just close their eyes and leave the broadband industry purely to market forces, as it can be difficult to deal with a monopolist’s power once it dominates a market.

To make the broadband market work more efficiently, Lloyd said a broader view is needed of the sources of income and investment: ‘The market has enough revenues to solve the problem of more ubiquitous access to broadband. The only problem is the way in which markets organise those revenues.’ Paltridge’s estimate of the broadband subscription market at about $22 billion in the world in 2002 needs to increase substantially to cover the investment going into building the infrastructure. However, Lloyd noted: ‘If you add together revenues from fixed and mobile telephony, Internet access, entertainment and related activities, there is more than enough for the market to sort it out. The problem is that the revenues are flowing into different buckets.’ Lloyd thinks developing countries may be in a better position to break away from entrenched traditions to forge a more efficient organisation of broadband-related revenues.

Clark warned that the introduction of increased competition in some contexts could lead to a higher cost for providing broadband services because the cost of passing homes with the technology remains at the same level even when the potential number of customers is cut substantially by new competition. Clark commented: ‘It will be difficult to raise prices to consumers in this situation. To gain a penetration advantage, suppliers will then have to rely on greater product differentiation or other techniques, such as being a first mover into an area or providing services at a loss to capture a cost advantage through a large penetration of the market. This means supply could be unstable, leading in some areas to competition that ends up with a monopoly provider.’ However, Pepper noted that the marginal cost of adding a DSL customer had fallen from about $1400 in 1998 to around $300 in 2003, which he expects to fall further to about $200 to $250. Such drastic cuts could be made by increased automation; Pepper said there had previously been ‘outrageously high’ administrative labour costs – in one case 28 people had touched pieces of paper for each order.

Telecom unbundling at physical and logical layers

Pepper praised the role of telecom ‘unbundling’ in encouraging new forms of competition that no longer revolve around just facilities-based competitors. Such unbundling opens out elements of a telecom infrastructure that were previously bound into a package under the control of the incumbent supplier. Physical unbundling started in the 1990s to ensure incumbents allow competitors to offer alternative service packages, by using the access gained to the copper wires and switches of the telephony network. Pepper said the spur from competitors who take advantage of

physical unbundling has been important in helping to speed up the deployment of DSL by telcos, even though most of the initial new contenders in the US failed financially. Physical unbundling had opened up some competitive opportunities, but the potential to exploit the new options is greatly limited in practice because of the substantial costs and technical knowhow required to get these unbundled services operating effectively. 'Something more is needed to assert the openness to competing high-level service providers, not just the ISP, which is a principle virtue of the Internet,' Clark stressed.

The CSTB (2002) broadband committee sought to achieve this through a recommendation for 'logical-layer unbundling'. This aims to establish standards for open access that will make it easier for a diverse range of competitive services and applications to be built on the telecom infrastructure, for example by enabling cable networks to support multiple ISPs. Clark hopes that having multiple service suppliers using its network will make good business sense to cable networks, but Pepper said this has occurred in the US so far only when there has been a Federal Trade Commission consent decree requiring it to happen.

New rules of regulatory engagement

The kind of regulatory rethink recommended by Bruce is already happening in some areas. For instance, the FCC decided in February 2003 on a 'new wires, new rules' approach to deregulate broadband investment on a forward-looking basis, for example by doing away with unbundling requirements for networks using fibre, WiFi or other new technologies. This was not done for existing networks as the wires and cables already exist, so removing unbundling rules in these cases offers little scope for new investment in such outdated technologies. Pepper explained the thinking behind this new approach: 'The FCC wants to create incentives for new investment in technologies that will bring fibre to the home and further out into the network, which is a policy priority. This means it is therefore likely to choose not to regulate investments in new technologies that are risky for everyone. When appropriate, some unbundling from incumbents might be required.'

An area where Pepper said there is still a monopoly that needed to be challenged is in the control of call termination, where carriers refuse to hand-off to competitors or charge large amounts to do so. He suggested: 'The right response to this should be to emphasise competition at the originator. However, this is not yet an issue on the Internet, where arrangements generally work well – except in situations like the problem in Jamaica regarding access to the global Internet.'

Learning from experience to encourage widespread take-up and innovative use

As discussed above, demand for broadband is crucially shaped by policies such as: public-sector initiatives; a healthily competitive open marketplace; local innovations; a legal framework that protects without setting up barriers to innovation; and support for potentially important new technologies and applications, such as those offered by WiFi, the Grid and other technologies.

In addition, one of the strongest areas of consensus at the Forum was the importance of gathering and sharing broadband case study experiences so that lessons can be learnt from good practice to stimulate new ideas and offer guidance on pitfalls and opportunities. This was felt to be particularly important to support initiatives in local communities and among SMEs, as these kinds of users often do not know what can be achieved with the technology and may be wary of, or fail to comprehend, what they are told and sold by suppliers and techies. Bruce said developing and learning from case knowledge on broadband-based innovations that work well in public-sector reform should be a priority for government, citizens, industry and academic institutions, for instance in an activity such as the use of laptops in schools that is being explored in projects like the Microsoft AAL programme and the State of Maine's laptop-based Learning Technology Initiative.[31]

Mitchell and others recommended the establishment of a 'clearing house' of broadband cases. Gillett said she is currently collecting cases of local broadband initiatives (e.g. see Gillett 2001, 2003; Clark et al. 2002). Bruce pointed out that broadband Internet is an effective vehicle for communicating case studies. He also noted that benchmarking information can be another helpful guiding hand, for instance by clearly laying out data on what is happening around the world to try to set standards on competitive pricing.

Babb brought a note of caution to the recommendations on case studies by emphasising the importance of also understanding the specificity of local contexts within which lessons from cases and benchmarks are to be applied.

Seeking equitable and imaginative outcomes

Understanding the unpredictability of emergent outcomes

There was general agreement that it is extremely difficult to pin down precisely what links can be made between broadband and general social and economic outcomes because of the complex intertwining of a myriad of competing and complementary influences on the outcomes that eventually emerge, and co-evolve further. 'Given this complicated entanglement, there will inevitably be unintended consequences that cannot be predicted, so there will be no final form of broadband outcomes as we will be continually exploring the spaces,' Clark observed.

An awareness of such complexities led to a wariness at the Forum about suggesting policy prescriptions that could be said to ensure broadband use will have a specific outcome in narrowing divides or gaps, although some participants detected an element of technological determinism in the enthusiasm of some for broadband capabilities. But even those who are most convinced of broadband's positive transformational potential acknowledged that the outcomes would ultimately be shaped by wider factors.

In this context, Nash made one of the strongest recommendations. She said it was important to address broadband through 'joined-up' government policy making:

[31] For details of the Maine programme, see www.apple.com/education/profiles/maine

‘Regulatory policy is important, but it must be allied to an understanding of how such technological innovation is shaped by policies in all other areas of government, from planning development and e-democracy initiatives to what is happening in schools, the health service and local government.’ A study of the political economy of broadband investment in the UK by the OII (Chileshe et al. 2002: 13) also concluded that ‘if the government wants to fully seize the opportunities presented by broadband, it should first ensure that its policies and practices, and those of its organs, are clear, consistent and coherent’. The Forum discussions on developing countries also indicated the importance of such coherent policy making at an international level.

Is there a need for a broadband universal service obligation?

Fairness and equity were underlying themes of all Forum discussions about closing divides and bridging gaps. The traditional approach in telecommunications to addressing this was through a Universal Service Obligation (USO) on the monopoly supplier to provide a telephone service to every area, although 100% coverage might not usually be achievable. Subsidies to suppliers to support USO have been common.

Most people at the Forum felt that the ubiquitous availability of broadband is similarly important, because of the personal, social, business and economic costs and advantages of having always-on broadband. However, a warning against seeking to bring in new USO regulations that might be ineffective was signalled by the inability of the Forum or CSTB broadband committee to define precisely what broadband means even in terms of a minimum speed. Baxter highlighted these doubts by asking: ‘If there is USO for broadband, to what service and at what speed would it apply? With what technology would it be provided – DSL, cable, WiFi or satellite? At what stage would the obligation be applied – when 70%, 80% or 90% coverage is reached? And in a competitive market for broadband supply, on which supplier will the service obligation be imposed?’

The difficulties in answering these kinds of questions led many participants to caution against any over-hasty attempt to implement a broadband USO, as it might have negative unintended consequences. ‘Be patient. Broadband is happening faster than we thought it would in terms of DSL availability – and implementing USO now will be a lot more expensive than it will be in a few years time,’ Paltridge advised. Lloyd acknowledged that the problems surrounding a USO for broadband might be too complex to solve, but emphasised that providing the basic infrastructure to support a universal service is a social responsibility that needs government support in some way.

A number of suggestions were made for new ways of achieving this. For instance, Pepper said any obligation should be portable, not imposed on particular suppliers. In urban areas this could be made into a business opportunity where users have a choice of suppliers. Bruce recommended: ‘Policy makers may ultimately find it much more attractive and promising to prime entrepreneurial pumps than to establish elaborate and highly bureaucratic mechanisms for subsidising telephony or Internet-related projects. Instead of focusing on how services can be supported by subsidies drawn from telecom

service providers, it may be much more effective to rely on direct subsidies of users or of institutions that use Internet services in carrying out their public mandates.'

The US Department of Agriculture's $1.5 billion Rural Utilities Services initiative has signalled a new approach to supporting moves towards wide telecom provision: through low-interest loans for broadband infrastructure to rural areas. But Pepper noted: 'Most economists would argue that the least distorting way to pay an infrastructure subsidy is through tax revenues, but that's unlikely to happen for political reasons.'

PART V: TOWARDS A REFORMATION OF COMMUNICATIVE POWER

Some issues, such as IPR, privacy and security, had less time spent on them at the Forum than their importance warranted. This was affected by the particular structure and dynamics of the Forum, but illustrated how difficult it is to maintain a comprehensive picture of all the many interconnected issues tied to broadband innovation. In this section, this paper's authors suggest a framework to help take forward the Forum's debates and explorations of solutions to the main challenges identified in order to be of wider value in shaping broadband Internet research, policy and practice.

The ecology of games shaping broadband Internet policies and their outcomes

One of the features of the Forum was the large degree of agreement on the main policy issues among the diverse group of participants, as indicated in the discussions reported in this paper. Nevertheless, many disagreements were also expressed on particular points. Clark noted that one of the most important features of the CSTB's Broadband Committee had also been the range of perspectives brought to discussions by its members. Such differences in perspectives and interests are typical of most policy debates, although underlying conflicts, divergences and power plays in the 'real world' mean they often involve much stronger conflicts and barriers to resolution.

The many people and interests mentioned at the Forum with a stake in broadband Internet who are actors in shaping outcomes from its developments included: telecom incumbents and challengers, regulators, ISPs, business enterprises, community groups, citizens, government, commercial content providers, consumers of content, policy makers, technology determinists, and techno-sceptics. There are many, many more.

The behaviour and decisions of all these many actors affect the behaviour and decisions of other actors. For instance, action by content providers to protect their copyright will constrain the choices consumers can make, while those consumers who find ways round copyright protection undermine revenues for content providers. WiFi providers give new choices for accessing broadband, but might threaten the large investments in facilities of incumbent suppliers. Governments committed to a competitive market can help less powerful players in ways that limit the power and freedom of manoeuvre of large players, while global power-broker companies can decide, or threaten, to move operations to other areas as a lever in policy bargaining.

And so on, with outcomes unfolding as the products of countless strategic and everyday decisions made by a myriad of players in many different games in different arenas.

Table 4 (on page 50) illustrates some important games shaping the implications of broadband Internet. Within each 'game', players follow an established set of traditions, rules and disciplines. All players have a role in shaping outcomes, playing different roles in different games. Broadband Internet could indeed change the rules of some games, for instance through media convergence, and open new roles for those who have been communicatively empowered by broadband access, for instance with media consumers becoming media producers.

These games can be seen as taking place within a broader 'ecology of games' (Dutton *1999a*), with players able to participate in many games at the same time. Seeing outcomes of broadband Internet policy-making and actual use of the technology as resulting from such a continuous interplay between different stakeholders in different games is an important step towards enhancing an understanding of why broadband Internet is not on a predetermined path that will produce predictable results.

Underlying all Forum discussions was an implicit search to find what, if anything, is unique to broadband. Technically, its special characteristics are that it is always on and can carry more data, more quickly to deliver many high-quality multimedia services to users through the same link. In practice, it is when these capabilities are allied to the use of the Internet that the technology's full transformative potential can be seen. For instance, being always-on brings an important degree of readiness for immediate communication and interaction that is characteristic of productive communication between individuals and groups, which could creating a new form of 'nomadicity' that would make broadband not just always on, but also always in touch with people's lives (see McKnight et al. 2002; McKnight 2003).

Changes to communicative power through the reconfiguring of access

Broadband Internet enables people to engage strategically in an interwoven web of technology and people that reconfigures access to resources in ways that can shift the relative communicative power of the different actors involved (Dutton 1999*b*). This was most clearly expressed in discussions at the Forum about the use of broadband to explore new ways of interacting, inter-creating, inter-discussing, inter-negotiating and stimulating other new forms of ICT service and content provision and use. These include young people creating their own video histories or music programmes; Mom & Pop WISPs becoming telecom providers, and individuals doing deals with a few neighbours to share WiFi local access; Web sites offering news and related decision forums from a myriad of perspectives not seen in mass media; patients being empowered through discussions and information gathering by communicating with others with experience of the same ailment; citizens finding new forms of civic power through communication with other citizens; governments searching to revivify engagements with citizens; and villagers and governments in developing countries sharing experiences and information on how to address common problems.

Table 4: Illustrative games shaping the implications of broadband Internet

Game	*Main players*	*Rules*
Telecom regulation	Telecom firms, regulators, investors, consumers	Regulators umpire moves of competing firms, taking account of conflicting and complementary goals of players.
Broadband pipeline supply	Telco, cable, wireless, and other broadband suppliers	Suppliers compete for market share and the position as the third main broadband pipeline (with DSL and cable).
Internet service provision	ISPs, WISPs, telecom and IT firms	ISPs use broadband applications and infrastructure access to win customers.
Communitarian	Neighbourhoods, community groups, Net enthusiasts	Individuals and groups seek free or low-cost, open-access to the Internet, sometimes competing with commercial users or providers.
Economic development	Governments, public agencies, investors	Players build ICT infrastructures to attract business, investment and jobs to localities, nations and regions.
Developing country	Governments, NGOs, local activists, investors	Players seek to close social as well as economic divides in developing countries by the appropriate use of suitable ICT infrastructures.
E-games	Pro/anti e-enablement players in government, business, education, etc	Organisations put their vitality at stake through over/under investment in online infrastructures and applications.
Implementation	Users, ICT product and service suppliers, consultants	Users struggle to implement and maintain broadband in order to reap the potential benefits.
Consumer protection	Consumers, consumer groups, suppliers, regulators	Legislators and regulators respond to competing views of the consumer's interests in broadband Internet provision.
New-media publishing	Media giants v. Internet entrepreneurs, media novices v. professionals	Established and emerging producers of Internet content compete to reach audiences.
Copyright, IPR, digital rights management	Content providers v. consumers and ICT industries; regulators	Telecom, media industries and users compete over interpretations of rights in access to information and services.

Such examples highlight how broadband Internet can reconfigure access to people, services, information and technology in ways that substantially alter social, organisational and economic relationships across geographical and time boundaries (as summarised in Table 2, page 11). Those who understand the centrality of broadband Internet and related ICTs in reconfiguring access to local and global resources are in a better position to decide whether, and how to, use this technology to reap dividends that can enhance their own situation and help to close social, economic, education, health, age, gender and other divides. Access to broadband Internet, and related ICTs, is an important limitation on use. But the central issue is designing the use (non-use) of broadband Internet to strategically reconfigure access – open up or close off networks.

This conception of Reconfiguring Access (RCA) involves a significantly different perspective on 'access'. Conventional analytical views of the role of 'access' in shaping outcomes and generally sees access leading to particular patterns of use and impact (Figure 2, page 52). RCA, however, identifies the reconfiguring of access through an ecology of games between multiple players as the key outcome (Figure 3, page 52). The interaction of social and technical choices within a changing ecology of games means outcomes are unpredictable, but the analysis shows that actors can have an impact on these outcomes through the choices they make in different games.

RCA also highlights the quintessential social nature of broadband, showing how its ultimate value to individuals, organisations, government and the whole of society is intrinsically bound up in how it enables actors to make vital choices about what they do, with who they do it, when they do it and how they do it. This analysis also demonstrates why conceptions of 'information' as the key element in ICTs should give way to an appreciation of the significance of how the use of ICTs can reconfigure 'access' not only to information, but also to people, services and technologies (Table 4). This was encapsulated at the Forum by Clark's observation: 'Five years ago it was clear the Internet was a large tail attached to a computer dog. But the communication tail has become sufficiently important for many people to begin to say that if they can't get broadband, they won't get a computer. The tail of the dog is becoming its head.'

The analysis summarised in Table 4 might not represent a revolution: people without broadband Internet have access to other avenues of power and negotiation, and broadband Internet cannot in itself overturn entrenched and deeply rooted power bases and cultural and social influences. But the power-shifts enabled by the technology could be seen as opening up possibilities for a New Reformation, in which many traditional doctrines and rituals can be rethought and reinvigorated.

Figure 2: Conventional perspective on access and the digital divide

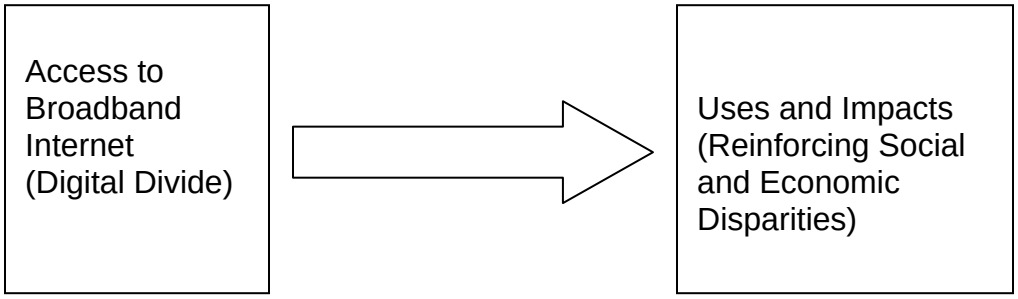
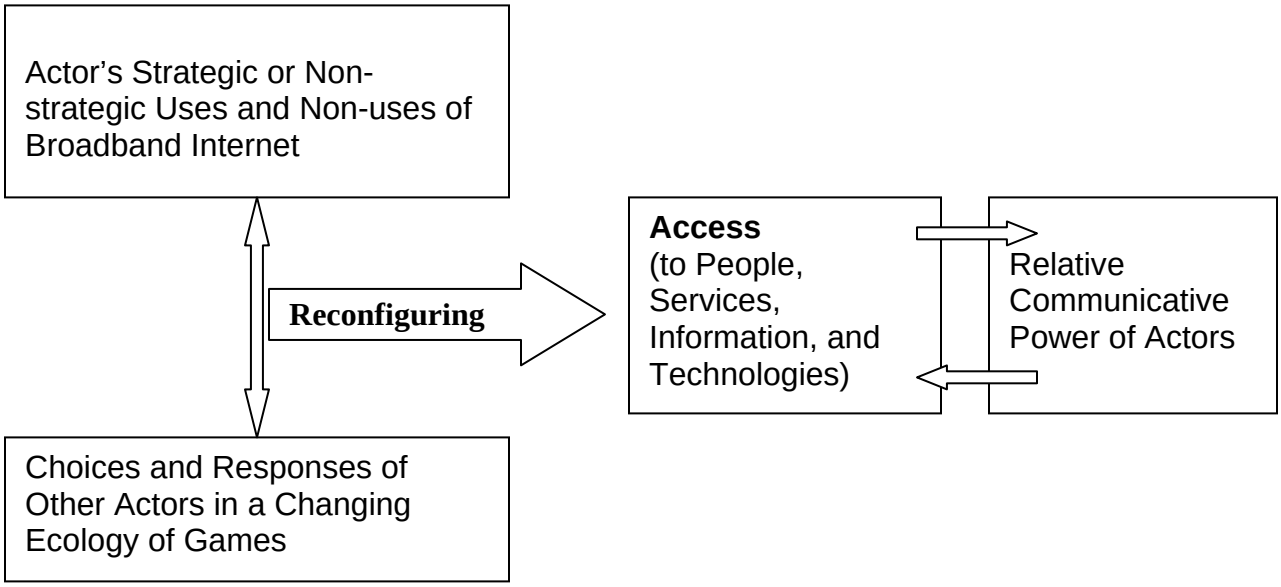


Figure 3: An alternative focus on 'reconfiguring access'



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APPENDIX 1: FORUM PARTICIPANTS

The following attended the OII Broadband Forum on 28 March 2003 or contributed a position paper. Job titles are as they were at the time of the Forum.

Annalee Babb, Student, Tufts University
Walter Baer, Analyst, Restructuring for Dereg. and New Markets, RAND
David Baxter, Director, Strategic Relations, BT
Michael Best, Research Scientist, MIT Program on Internet & Telecoms Convergence
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Tim Burke, Vice-President and Director, Motorola
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Stephen Coleman, Cisco Visiting Professor of e-Democracy, OII
Peter Davies, Visiting Fellow, OII
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Bill Dutton, Director, Oxford Internet Institute
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Courtney Jackson, Deputy Director, Jamaican Office of Utilities Regulation
Kevin Jones, Broadband Consultant, South-East England Development Agency
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David Mitchell, Market Development Director, Oracle Corporation UK Ltd
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Vicki Nash, Policy & Research Officer, Oxford Internet Institute
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Malcolm Peltu, Editorial Consultant, OII
Bob Pepper, Chief, Office of Plans & Policy, Federal Communications Commission
Ed Richards, Advisor, Prime Minister’s Policy Directorate,
James Saunby, Head of ICT, Advantage West Midlands
Jenny Searle, Business Development Director, Oracle Corporation UK Ltd
Richard Sills, Operations Director, Ombudsman's Office
Phil Smith, Business Development Director, Cisco Systems UK
Jo Tacchi, Visiting Fellow, OII
Stephen Uden, Coordinator, Education Relations, Microsoft
Stefaan Verhulst, Chief of Research, Markle
Neil Worman, Creative and Cultural Sectors, South East England Development Agency

APPENDIX 2: BROADBAND JARGON BUSTER

Glossary of terms

3G mobile technology: Multimedia mobile technology with the potential for using bandwidth at the lower end of the broadband range.
Asynchronous (telecommunications): Where different speeds are used for sending and receiving information through the same telecoms link.
Baang: Online gaming room in Korea.
Backbone: Broadband network providing the main long-distance Internet connections.
Backhaul: See *second mile*.
Bandwidth: Indication of the amount of information a telecommunication channel can carry (usually measured in *bits per second*).
Broadband: Always-on high performance multimedia telecommunications capability that can help to shape how people access, and interact with, other people and a variety of services, information and technologies.
Coaxial cable: Telecoms link consisting of a central wire surrounded by insulation and other wiring.
Cloud: A grouping of *WiFi hotspots* that can be interconnected through roaming.
Communicative power: The power that comes from the ability to access and use effectively different communication media.
Cyber Roaming: See *Roaming*.
Dark fibre: Unused *optical fibres* included when connections are first laid, in order to enable the addition of new subscribers at low cost, for instance in a publicly-sponsored *demand aggregation* strategy.
Demand aggregation: Reducing investment risk by combining a number of people or groups to build sufficient demand to establish a viable new broadband service.
DSL (Digital Subscriber Line): Technology that enables traditional copper-wire telephony lines to be used for broadband.
Digital Rights Management: *IPR* within a digital ICT context.
Ethernet: Widely used *local area network* architecture, e.g. used by *WiFi*.
Facilities-based competition: Market competition between suppliers of broadband services based on investment in physical telecommunications facilities, such as telephone copper wires, *coaxial cable* or *optical fibre*.
Fibre to the home: *Optical fibre* links to homes using a *Passive Optical Network* (PON) or *home-run fibre* architecture.
First mile: User-centred view of *last mile* local access to broadband
Fixed wireless networks: Terrestrial microwave point-to-point transmission from large-dish rooftop aerials serving users within several miles; uses techniques such as *LMDS* and *MMDS*.
Giga: 1 billion
Grid: Distributed computing systems that use broadband to share very large computing resources among mass audiences, individuals and large and small organisations and groups.
Home-run fibre: *Fibre-to-the-home* architecture in which the fibre between the provider's premises and the home is not shared with other users.

Hotspots: *WiFi local access* networks.
Internet 2: University-based network used to test advanced Internet capabilities.
Last mile: Local-access link to broadband *middle mile, backhaul* and *backbone*.
Local access: *Last mile/first mile* link from a house, office, laptop computer or other user location to the rest of the network.
Local area network: ICT network covering a relatively small local area, such as a house, school, office, coffee bar, farm or neighbourhood (see *Ethernet*).
Logical-level unbundling: Unbundling of the telecommunications infrastructure to offer open access to different layers of broadband applications and services, at a higher level than the basic unbundling of copper wires.
Middle mile: See *second mile*.
Mom and Pop WISPs: Colloquial name for small start-up *WISPs* serving a few customers, for instance in a rural area.
Multiplexing: Combining a number of telecommunications signals to share one link.
Net Stumbling: See *roaming*.
Optical fibre: High-speed broadband telecommunications medium that transmits data as pulses of light down hair-thin glass fibres.
Passings: Measure of the number of people able to gain access to broadband links passing close to their home or work location.
Passive Optical Network: *Fibre-to-the-home* architecture using *multiplexing* to share network connections between many homes.
Peer-to-peer: Sharing ICT resources through direct exchanges between computers, for example in exchanging music downloads and playing games .
Roaming: Moving around a neighbourhood or city with a laptop or PC that searches out WiFi hotspots to offer continuous broadband connectivity; *cyber roaming*, *net stumbling* and *war driving* are synonyms.
Second mile: Telecommunications link between *local access* and the broadband *backbone*.
Streaming: Continuous audio-visual downloading of TV news, radio programmes and live online events.
Tele-density: Percentage of the population with access to a telephone.
Third generation: Cellular mobile technology offering video and other advanced communication capabilities, in addition to basic telephony and texting.
Unbundling: Opening access at a physical or higher logical layer to enable competitors to access the telecommunications infrastructure.
War Driving: See *roaming*.
Wide area network: ICT network covering a broad geographical span, e.g. a nation or the world
WiFi: Local wireless area network based on *Ethernet* 802.11 standards (see *clouds* and *hotspots*).
Wireless Commons: Term used by WiFi grassroots campaigners for community wireless networks dedicated to remaining free and open.

Abbreviations and acronyms

3G	*Third generation*
802.11	IEEE wireless *LAN* standard for *WiFi* (e.g. 802.11a and 802.11b)
ADSL	*Asynchronous* DSL
ATM	*Asynchronous* Transfer Mode
bps	Bits per second
DRM	*Digital Rights Management*
DSL	*Digital Subscriber Line*
DSLAM	*Digital Subscriber Line* Access Multiplexer
FCC	Federal Communications Commission (US)
FTTH	*Fibre To The home*
G	Giga
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force (main standards organisation for the Internet)
ILEC	Incumbent Local Exchange Carrier
IP	Internet Protocol (works with higher level *TCP*)
IPng	Internet Protocol next generation (see *IPv6*)
IPR	Intellectual Property Rights
IPv6	IP version 6 (current *IPng* being considered by *IETF*)
ISP	Internet Service Provider
K	1,000 (or 1024 in some digital contexts)
LAN	*Local Area Network*
LMDS	Local Multipoint Distribution System
M	Million
MMDS	Multipoint Microwave (or Multichannel Multipoint) Distribution System
NTIA	National Telecommunications and Information Administration (US)
Ofcom	Office of Communications (UK)
P2P	Peer-to-peer
PC	Personal Computer
PON	*Passive Optical Network* (an FTTH architecture)
PSTN	Public Switched Telephone Network
PTO	Public Telecommunications Operator
PTT	Post, Telegraph and Telephone authority (traditional telephone monopoly)
QoS	Quality of Service
R-LAN	Radio LAN, equivalent to *WLAN*
SIP	Session Initiation Protocol, a Microsoft XP *VoIP* capability
SOHO	Small Office/Home Office
TCP	Transmission Control Protocol (works with higher-level *IP*)
USO	Universal Service Obligation
VoIP	Voice over Internet Protocol
VSAT	Very Small Aperture Terminal (for satellite communications)
WAN	*Wide Area Network*
WiFi	Wireless Fidelity
WISP	Wireless Internet Service Provider
WLAN	Wireless LAN