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e is for everything?

Public policy and converging digital communications

December 2001
Report 170

Digital communications in the UK have changed greatly over the last five years. Over 70% of adults now own a mobile phone, more than one in three households have home internet access and a similar proportion have digital television. These technologies are starting to 'converge', so people can use similar services on a variety of devices - from sending email via a digital TV to viewing film clips on a PC or accessing internet content with a mobile phone.

These developments have wide-ranging implications for communications regulation and wider policy. In spring 2002, the Government plans to publish a draft Communications Bill. This will create a single communications regulator, OFCOM, merging current broadcasting and telecommunications regulators.

Key issues for the Government and the new regulator will include:

- the extent to which content supplied by different routes is regulated. At present, TV broadcast content is regulated while internet content is effectively unregulated. As these distinctions become blurred, new regulatory issues will be raised.
- encouraging UK take-up of high speed 'broadband' internet access, which is lower than in any other G7 country.
- the deployment of the next generation of mobile phones, for which operators paid £22bn in licence fees.
- switching off the analogue TV signal. The Government has set conditions for coverage and take-up of digital TV services which must be met before analogue TV can be turned off. It has stated that it may be possible to meet these conditions and switch to digital TV between 2006-2010, but a range of difficulties must be addressed before this will be feasible.
- the 'digital divide', where some members of society are disadvantaged because they lack the opportunity, means, skills or inclination to use new technologies.
- the future of public service broadcasting, in a world where a large proportion of viewers have hundreds of TV and radio channels to choose from, and many people use new media for information and entertainment.

In particular, it is unclear whether the Communications Bill will be flexible enough to cope with the rapidly developing communications environment for the next ten years, while still setting out enough detail for full Parliamentary scrutiny.

A 4-page summary of this report is available from POST, or at **www.parliament.uk/post/home.htm**

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1 Introduction

The world of communications is changing rapidly. More than seven out of ten adults in the UK now have mobile phones, over a third of households have home internet access, and a similar proportion have digital television. Little of this was predicted ten years ago, and even two years ago the current explosion of text messaging was unforeseen. Setting policy for such a complex and evolving environment is beset with difficulty. However, some trends are apparent. In particular, communications media such as television, mobile phones and the internet are increasingly 'converging', which poses a range of policy issues. This report considers the background to such convergence, when and how it might take place, and analyses the policy implications.

Convergence and its implications

As faster internet connections become available to home users, it will increasingly become possible to view film clips and television highlights, listen to radio, and play games over the internet on a home computer. In parallel, internet content and interactive services are available through digital TV, and are becoming accessible through mobile phones, games machines or personal organisers. These trends are examples of 'convergence' - the ability of different electronic devices to carry similar services – so music could be played on a mobile phone, or web pages viewed on the TV.

This does not imply that all communications will merge into a single medium or device. Rather, the different delivery mechanisms and content may be complementary, so customers have more choice over what services they receive and how and where they receive them. So, for example, a football fan could get scores sent to their mobile phone, use the world wide web to view team information and highlights clips, and watch the full match on digital TV.

Some commentators argue that such convergence could lead to a revolution in entertainment, information and communications, posing a challenge to traditional models. Others anticipate evolution rather than revolution, but such change will undoubtedly have implications for businesses that use the technology and those that supply it. It could also provide an opportunity for delivery of Government services and education. Opinions differ over the extent to which convergence will occur, what form it will take and over the likely timescale. Nevertheless, convergence already raises a range of policy issues. For example:

- At present TV broadcasting is licensed and regulated by statute, while internet content is not[1] - but if TV is viewed over the internet, will regulation of such 'broadcasting' be feasible?
- The Government plans to switch off the current analogue TV signal, so all TV broadcasting will be digital. It believes this may be possible between 2006 and 2010, although it has not yet announced any definite timing - any such announcement will have great impact on consumers and the market for digital TV.
- Increasing numbers of TV channels and new methods of communication will pose challenges for public service broadcasting.
- New technologies allow individuals' viewing habits to be monitored, raising concerns over privacy. Further, satellite positioning systems and mobile phones enable location-specific services, triggering questions over who people trust with information about their location and activities, and whether sector-specific regulation is necessary to protect that information.
- Ubiquity of these services raises the prospect of a 'digital divide', where products,

[1] See POSTnote 159, Regulating Internet Content, June 2001

entertainment and resources are unavailable to those without the opportunity, means, skills or inclination to access new technologies.

Within this Parliamentary Session, the Government plans to publish a draft Communications Bill, which will consider regulation of communications in the new environment and address some of the policy issues raised above. Its main proposal will be the establishment of a single communications regulator, OFCOM, replacing five current regulators. More details of the Communications Bill are given in Section 2.2, and the issues raised are discussed throughout this report. There is likely to be extensive legislative scrutiny of this important Bill, and informed Parliamentary debate will be vital to producing the right communications regulation environment for the next ten years.

To aid Parliamentary deliberation and debate on the issues raised by the Communications Bill, and wider consideration of media and communications policy, this report outlines three key aspects of convergence:

- **devices** on which users view information and communicate with each other
- the means by which information and communications are **delivered** to users,
- the **content and services** which users might access.

It then considers a range of policy questions related to convergence, examining content issues, access to services and overarching issues.

Devices - Chapter 3

At present, users view digital content and communicate on a range of devices – computers, televisions, fixed line and mobile phones, etc. However, we have already begun to see the convergence of these devices. Internet content can be seen and emails sent via the television, and it is possible to watch video clips on personal computers (PCs). New devices merge the functions of a mobile phone, web browser and personal organiser – and could potentially receive TV broadcasts. Another trend is towards content being held centrally, rather than on the device itself – for example, many people already use web-based email accounts, which hold the email on a central computer, but allow users access from anywhere, on a range of devices.

Some analysts have suggested that these trends could result in a smaller number of more generic devices. Another possibility is that a wide range of more limited devices will remain, albeit with some overlap in capabilities, each catering for distinct needs in a diverse market. The converged devices which are successful are likely to be those that offer real benefit to users, rather than just a gimmick - the radio alarm clock is a good example of this. However, it is worth noting that all forecasts of future trends are inevitably uncertain, given the complexity of innovation and consumer demand. Chapter 3 of this report will consider the devices currently available, looking at some possibilities for their evolution over the next ten years.

Delivery – Chapter 4

Digital content can be sent and received by users in a number of ways. For example, digital television can currently be accessed in the UK by three main methods - satellite, digital terrestrial television (through the TV aerial) and cable. There are also innovative service providers offering digital TV delivered down high speed phone lines. Similarly, users can connect to the internet via a range of options, including cable, down telephone lines, via optical fibre, mobile phone and even by satellite. Chapter 4 of this report looks at these various methods by which users can receive and send digital information, analysing the current status of each and considering their advantages and disadvantages. Policy issues are also discussed, including 'local loop unbundling', auctions for radio spectrum and the impact of local planning on infrastructure development.

Content – Chapters 5 and 6

It is currently easy to distinguish between a television programme and a web site. But already web sites include video clips and broadcast TV pictures ('webcasts'), while digital TV programmes have interactive options allowing text to be displayed. A telephone call made via the internet, which includes attached photographs and text, is not easy to categorise. New forms of content will also become available. For example, mobile phones and satellite navigation systems allow location specific services, such as informing customers of the nearest Post Office. Businesses can use new communications tools to help them operate more effectively. Education and government services may be delivered digitally to a wide audience.

These trends could have to far-reaching implications for the creators of content and services, and for their regulation. At present viewers have different expectations of TV and internet content and they are regulated differently[2]. In a converged world, such simple distinctions become less clear. Chapter 5 discusses the implications of convergence for content, considering different types of consumer content, business applications and delivery of government services. Policy issues related to content, such as intellectual property and regulating content are considered in Chapter 6.

Access – Chapter 7

Some groups (such as older people, those on low incomes and people in rural areas) are less likely than others to have access to communications services. As digital technologies become more integrated into many aspects of daily life, this 'digital divide' could exacerbate social exclusion, although evidence to date also suggests that digital communications can have positive social effects. Further, convergence may imply that more people have access to user-friendly devices such as digital TV and mobile phones for internet access. Chapter 7 analyses the policy issues related to universal internet access and access to high speed broadband internet services. It also considers the Government's plans for switching off analogue TV.

Predicting the future? – Chapter 8

It is by no means certain how, at what speed or to what extent convergence may occur - and the details are likely to differ from those set out here. Predicting which technologies will meet consumer demand, and how, is dependent on a complex interaction of innovation, the market, policy and individual choice. Some convergence indicators, such as access to digital television, are happening faster than predicted. Others, such as domestic broadband internet connection, have been less immediately successful in the UK. Chapter 8 discusses the ways in which convergence may develop, examining some of the scenario planning exercises that aim to understand and prepare for the main drivers of change. It then considers the broader issues raised. Some of these are related directly to the Communications Bill, such as competition policy and public service broadcasting, and others are more general, such as the implications for personal privacy.

[2] Reflecting Community Values: Public Attitudes to Broadcasting Regulation, Stefaan Verhulst, Programme in Comparative Media Law & Policy, Oxford University, April 2001 - for the Broadcasting Standards Commission

2 Background

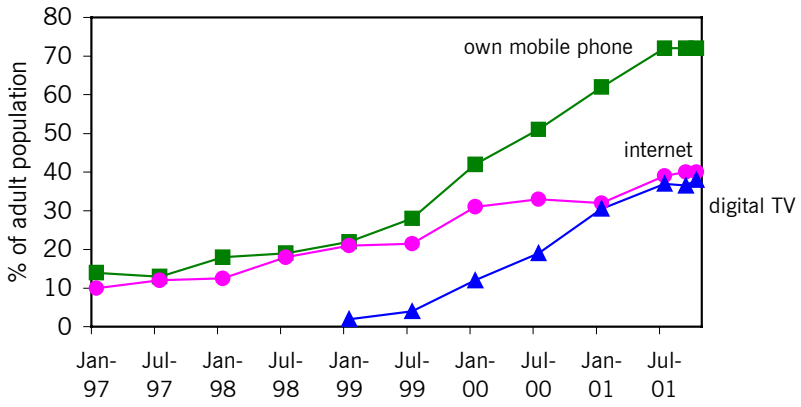
This chapter examines some of the background to convergence, considering the current take-up of digital communications tools (the internet, digital TV and mobile phones), and outlining relevant Government policy. It explains the concept of 'bandwidth' - the rate at which information is carried - which underlies much of the discussion of communications delivery and content. The difference between broadcasting and point-to-point communications is also considered.

2.1 Current take-up of communications

Summary

Communications in the UK have changed greatly over the last four years. Figure 1 summarises the increasing take-up of the three main new communications technologies - internet access, digital TV and mobile phones. Between July 2001 and October 2001, this increase appears to have levelled off for each technology, although it is still too early to say whether this is a long-term trend.

Figure 1: Use of communications technologies in the UK[3]



Internet access

UK

By June 2001, 9.4 million UK households had internet access.[4] This is over a third of all UK households. The vast majority (98%) of internet users connected via PCs, although National Statistics data from April 2000 includes other forms of access, such as via digital TV.

Around half of UK adults (23 million people) have used the internet at some time, and 40% had used it in the month prior to July 2001. There are some interesting demographic points about these figures:

- **young people** are more likely to use the internet than older people (88% of 16 to 24 year olds have accessed the internet at some point, but only 11% of those aged 65 and over).
- **Men** (56%) are also more likely to have used the internet than women (47%). There is also a gender divide in how often people access the internet. Of those doing so for private use, ~60% of men accessed it at least several times a week. The same was true for only ~40%

[3] e-Mori Technology Tracker, October 2001, www.mori.com/emori/tracker.shtml

[4] Internet access, September 2001, National Statistics www.statistics.gov.uk/pdfdir/int0901.pdf. Subsequent statistics in this section are from the same source, unless stated otherwise.

of women.

- **Professionals** are more likely to use the internet than unskilled workers (60% of individuals in households headed by a professional, compared with only 18% of those in an unskilled category.)[5]
- Access is most widespread in the **South-East and South-West** (43%), and least widespread in Wales (23%).
- 78% of users had accessed the internet **in their own home**. A third had used someone else's home, while 8% had used a library.
- There is some evidence for the first signs of **convergence**. 8% of those accessing the internet had done so using WAP phones – compared with less than 1% six months earlier. 6% had accessed the internet via digital TV.

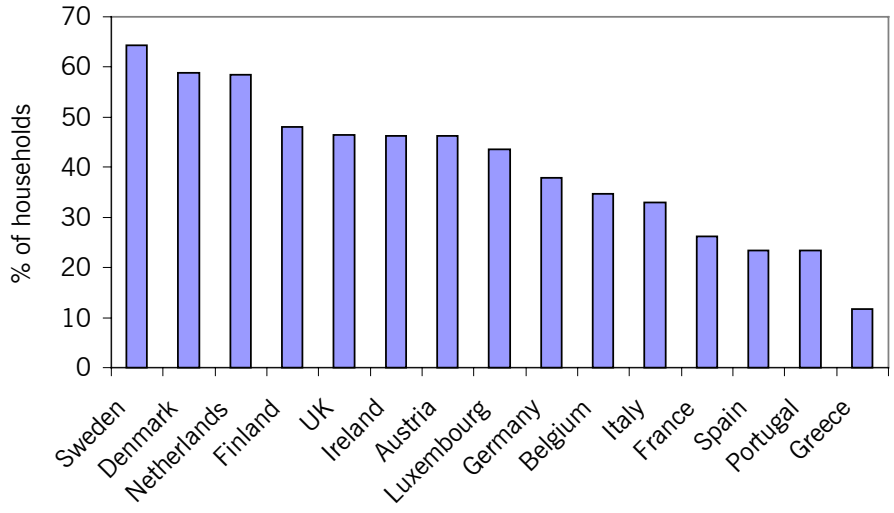
The figures suggest that universal connection to the internet may be some way off. Of those who have never used the internet, 54% were generally not interested in using it. 26% had no means of access, and 16% felt they lacked the confidence or skills to use it. Only 24% thought they would access the internet in the next year.

Of businesses, 94% of medium sized businesses are connected to the internet, compared with 60% of small businesses. The majority of small businesses use ordinary phone line/dial-up access to connect to the Internet, while medium-sized businesses are more likely to use ISDN or leased lines.[6]

International

Internet access in EU households in June 2001 is given in Figure 2. The UK, at 47%, had the fifth highest rate of internet access in the EU (behind, Sweden, Denmark the Netherlands and Finland). The UK was significantly above the EU average of 36%.

Figure 2: Internet access in EU households[7]



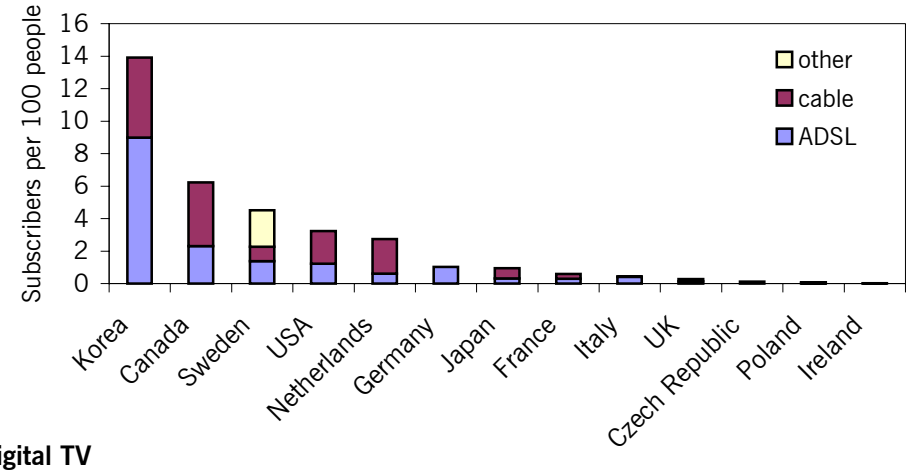
A similar picture emerged for the proportion of regular internet users in the population (although the UK was then seventh, behind Ireland and Austria). Greece had the lowest rate of internet

[5] e-Mori Technology Tracker, October 2001, www.mori.com/emori/tracker.shtml
[6] Business use of Internet – Oftel Small and Medium Business Survey Wave 6 August/September 2001
[7] From the EC's Eurobarometer 103: Internet and the public at large, June 2001. Note that the Eurobarometer survey gives a greater proportion of UK households with internet access than Oftel (39%) or National Statistics (37%) surveys.

users (21% of the population). OECD statistics[8] from January 2000 considered the number of internet subscribers[9] per 100 of population. On this measure, Korea (23 subscribers per 100) was the most connected of the OECD countries, followed by Sweden. The US was fifth, and the UK 12th from 26 nations. Hungary had the least subscribers, with less than 2 per 100.

When high speed (broadband) access to the internet is considered, the UK is lower down the league table. OECD figures from June 2001 are shown in Figure 3 (for selected countries). The UK was ranked 22nd for broadband penetration, from 30 countries considered. The UK had 0.28 broadband connections per 100 people – compared with nearly 14 for South Korea, and 6 in Canada. Such high levels of access in South Korea are commonly ascribed to intense competition by ADSL and cable providers, and strong encouragement from Government. Around 160,000 UK households had either ADSL or cable modem broadband access, split evenly between the two. However, the number of connections is increasing rapidly, and had risen to ~280,000 by November 2001. Section 7.2 considers broadband access in more detail.

Figure 3: International broadband access[10]



Digital TV

Take-up of digital television in the UK has been rapid. According to the October 2001 MORI technology tracker survey[11], 38% of UK households had digital TV. This is an increase from just 4% of households three years ago. Much of this has been driven by satellite and cable suppliers who invested in digital television services and have marketed these strongly. Some is also the result of analogue pay-TV subscribers switching to digital. Ownership is relatively consistent across social class (32% of lowest income groups, rising to 41% of skilled manual workers) [12]. Individuals with digital TV in their households are more likely to[13]:

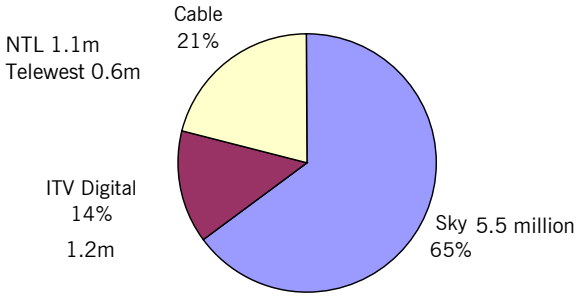
- be **male** than female (54% of those with digital TV are male)
- be **young** (47% of digital viewers are aged 15-34, compared to 35% of the population overall). Correspondingly, they are less likely to be over 55 (16% of digital viewers, compared to 32% of the population)
- use a **computer or the internet** (48% of digital viewers, compared to 39% of the general population).
- **have children** in their household (39% of digital viewers, compared to 31% of the population) – although these last two bullet points are partly a reflection of digital viewers' younger age

[8] OECD communications outlook 2001, pg 98
[9] Internet subscribers are those with registered internet accounts used over the last three months.
[10] The Development of Broadband Access in OECD Countries, OECD Working Party on Information and Telecommunication Service Policies, October 2001
[11] e-Mori Technology Tracker, October 2001, www.mori.com/emori/tracker.shtml
[12] e-Mori Technology Tracker, October 2001, www.mori.com/emori/tracker.shtml
[13] Digital Television 2001, Mori for the Department for Culture, Media and Sport, June 2001

profile.

Viewers in the UK can receive digital TV in three ways – via satellite, cable or digital terrestrial TV (DTT). In total, more than 8 million UK households subscribe to digital TV - the split between the three platforms is shown in Figure 4. There were also around 100,000 homes with free-to-air DTT services only by the end of June 2001, and around 60,000 homes with free-to-view satellite TV cards.[14]

Figure 4: UK Digital TV subscribers, latest figures end September 2001

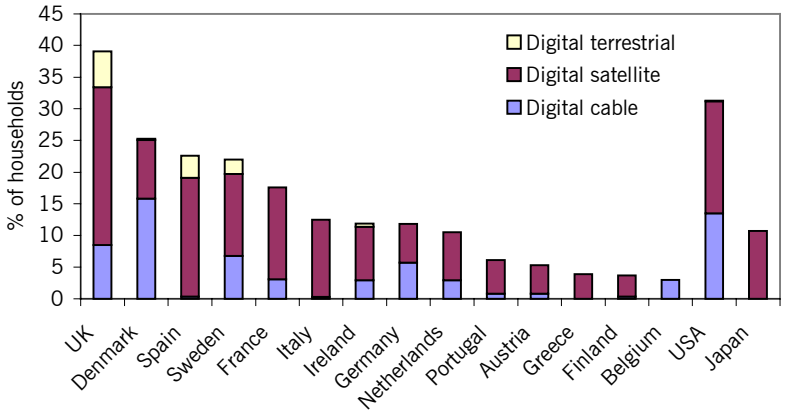


More than half the population say it is 'likely' or 'possible' they will get digital TV in the next five years. However, 15% of the population say they will 'never' get digital TV. Of those who are unlikely to switch in the next two years, a third say they don't need digital TV, while a further third see it as too expensive. There is a widespread misconception than digital TV means pay TV, and forthcoming advertising campaigns will address this point. Nevertheless, there are many light users of TV who are unlikely to move to digital while the analogue signal is available and analogue TV sets are cheaper than their digital equivalent (see Section 3.2).

International

The UK is at the forefront of access to digital television services. Forecasts for the end of 2001 published by the EC (prepared from data by Strategy Analytics) show the UK with the highest rate of digital TV penetration in the EU, and also leading the US and Japan. Figure 5 demonstrates this, and also shows the split between digital satellite, cable and terrestrial TV.

Figure 5: Digital television household penetration, forecast for end 2001[15]



[14] Satellite viewers who have stopped taking a subscription package can also continue to receive free-to-view services, but there are no publicly available figure for this.

[15] Seventh Report on the Implementation of the Telecommunications Regulatory Package, EC, COM(2001) 706, November 2001

In particular, the UK took an early lead in digital terrestrial television (DTT) which was launched in November 1998. Strategy Analytics forecasts that 5.7% of UK households will have DTT by the end of 2001, while the EU average will be 1.3% and only four other EU countries will have any DTT viewers at all. However, as in much of the EU, the majority of UK access to digital TV is via satellite. In the EU study, cable is forecast to have more digital TV viewers than satellite by 2001 in only two countries (Belgium and Denmark).

Mobile phones

UK

Mobile phone use in the UK has risen quickly. In January 2000, 27% of UK adults had a mobile phone - by August 2001 this had risen to 73%[16]. In total there are nearly 43 million mobile subscribers (including children and business subscribers)[17]. Nearly four out five of households have at least one mobile phone, the vast majority personally owned (rather than by employers). 7% of UK homes are without a fixed phone line, but most of these had a mobile phone, leaving only 1% of households without any home telephone. Mobile phones are most widely owned by:

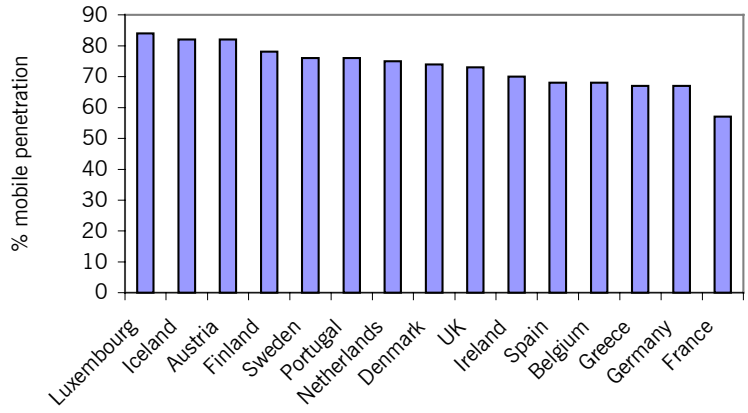
- **young people** (nearly 90% of 15-44 year olds have a mobile phone, compared with 24% of those older than 75. But 44% of 65-74 year olds have a mobile phone, so older consumers are by no means excluded form the market).
- **higher income households** (88% have a mobile phone, compared to 60% of those with the lowest income)
- people in the **Midlands and North** (although distribution is fairly geographically even, from 82% in the Midlands and North to 67% in Wales).

61% of small businesses and 85% of medium-sized businesses own at least one mobile phone[18]. Around 3% of SMEs used WAP phones[19].

International

Penetration of mobile phone use in EU countries is shown in Figure 6 (figures are from August 2001) - the UK is ninth from the fifteen countries, with mobile penetration in the UK exactly equal to the EU average (73%). Over the year to August 2001, the UK had seen 82% growth in mobile phone penetration – the fourth highest in the EU (with Greece having the highest growth).

Figure 6: Mobile phone penetration in EU countries, August 2001[20]



[16] Consumers' use of mobile telephony – Summary of Oftel residential survey, Q6 August 2001. Other figures in this section are also from this source unless stated otherwise.
[17] Oftel Market Information, Mobile Update, Q1 2001-02 (April - June 2001), published November 2001
[18] Business use of Mobile Telephony – Oftel Small and Medium Business Survey Q6 August/September 2001
[19] Business use of Mobile Telephony - Oftel Small and Medium Business Survey Q5 May/June 2001
[20] Seventh Report on the Implementation of the Telecommunications Regulatory Package, EC, COM(2001) 706, November 2001

2.2 Government policy

The Communications White Paper

In December 2000, the Government published the White Paper *A New Future for Communications*. A joint publication between the Department of Trade and Industry (DTI) and the Department of Culture Media and Sport (DCMS), it looked at regulation of communications in the new environment, proposing the introduction of a single communications regulator, OFCOM. This would replace five current regulators:

- Oftel, which regulates telecommunications services.
- Independent Television Commission, which licenses and regulates commercially funded television services.
- Broadcasting Standards Commission, which regulates standards and fairness in broadcasting.
- Radiocommunications Agency, which has responsibility for managing the radio spectrum.
- Radio Authority, which licenses and regulates all commercial radio services.

OFCOM would have concurrent powers with the Office of Fair Trading (OFT) under the Competition Act 1998, to regulate competition in the communications sector. It would also have additional sector-specific powers to promote effective competition for the benefit of consumers. For most service providers these sector-specific rules would cover only essential issues such as consumer protection, access and interconnection with other networks. However, for companies with significant market power, stronger sectoral competition rules would apply. The sectors subject to regulation by OFCOM would match very closely those currently subject to regulation by the existing regulators - so companies engaged in hardware, software and content production would not for the most part be subject to extra economic regulation in this sector post-OFCOM. Economic regulation and the roles of OFT and OFCOM are considered further in Section 8.2.

The Communications White Paper

The White Paper set out the Government's three key objectives in this area:

- "To make the UK home to the most dynamic and competitive communications and media market in the world
- To ensure universal access to a choice of diverse services of the highest quality
- To ensure that citizens and consumers are safeguarded."

The White Paper reaffirmed the Government's commitment to universal internet access by 2005, through access points at home, work, schools and in the community. It also confirmed that public service broadcast channels would continue to be available free at the point of consumption, both now and after switchover to digital television. Provisions for cable operators to carry public service channels (known as 'must carry') would be strengthened, and an obligation would be placed on public service broadcasters to make their public service channels available to viewers on all broadcast platforms ('must offer'). These provisions would include any digital services 'essential for social inclusion'. The White Paper considered electronic programme guides (EPGs), which give digital TV viewers details of scheduled programmes on each channel. As there can be more than 200 channels, it proposed that OFCOM have powers to ensure public service broadcasting channels are given 'due prominence' on EPGs (including, but not necessarily limited to, the five current analogue TV channels - see Section 8.3). Obligations on BT (and in Hull, Kingston Communications) to provide universal telephone services would continue.

OFCOM's regulation of broadcast content would be under a 'three tier' structure:

- **Tier one** would apply to all broadcasters, including setting universal 'negative content' standards[21], ensuring the impartiality and accuracy of news, and giving access to programming for those with disabilities. It would be regulated by OFCOM.
- **Tier two** would also be regulated by OFCOM, and would apply to broadcasters with a public service remit and to commercial radio. It would ensure the delivery of easily measurable public service obligations, such as quotas for independent productions, regional programming and news in peak time.
- **Tier three** would be principally regulated by the boards of public service broadcasters and would cover their general qualitative public service remit, such as education, arts and science coverage. As each public service broadcaster's remit is different, this tier would be more individual.

[21] Such as standards about bad language, violence and sexual content.

As discussed in the box on the previous page, there would be three tiers of regulation for broadcast content. The internet would remain outside this structure, in 'tier' zero. So, although internet content would still be bound by existing laws, such as defamation and obscenity, unlike broadcast television and radio it would not be regulated by licence. However, it was proposed that OFCOM would work with industry to "*ensure effective co- and self-regulatory approaches*" for maintaining content standards. In particular, OFCOM would promote rating and filtering systems so that individuals can control their access to internet content. Specifically, the work of the Internet Watch Foundation, an industry body which tackles illegal internet content, was praised. Such issues are considered further in POSTnote 159, *Regulating Internet Content* (published in June 2001), and in Section 6.2.

Mechanisms for regulating the delivery of telecommunications services were considered under the heading 'protecting the interests of consumers'. It was proposed that industry should develop codes of practice for service delivery, with powers for OFCOM to take action if an effective consumer protection regime was not forthcoming. A consumer panel would be established, to advise OFCOM on service delivery.

The three central regulatory objectives for OFCOM were therefore proposed as:

- protecting the interests of consumers in terms of choice, price, quality of service and value for money, in particular through promoting open and competitive markets.
- maintaining high quality of content, a wide range of programming and plurality of public expression.
- protecting the interests of citizens by maintaining accepted community standards in content, balancing freedom of speech against the need to protect against potentially offensive or harmful material, and ensuring appropriate protection of fairness and privacy.

Consultation on the White Paper closed in February 2001. 252 wide-ranging responses were received[22]. The Government plans to publish a full draft bill in this Parliamentary Session, but has already introduced a paving bill (The Office of Communications Bill, 2001) which will allow preparatory work towards OFCOM, such as setting up a Board for the new regulator, and the Office's establishment. In October 2001, the Government published a report by consultants Towers Perrin[23], which looked at the possible structure of the new regulator and set out a potential transition plan. However, OFCOM would not begin regulating until the full Communications Bill became law - by 2003 on the Government's proposed timetable.

As well a the Competition Act powers considered earlier, the full Communications Bill will include both new powers and powers held by the existing regulators or the Secretary of State that will be transferred to OFCOM. These existing powers are found in the Broadcasting Acts (1990 and 1996), the Telecommunications Act (1984) and Wireless Telegraphy Acts (1949 and 1998), although some of the powers in these Acts will be discontinued. It is intended that the Communications Bill will implement relevant EC Directives on communications (which deal with networks and services, rather than content). Full details of the powers the Government proposes to grant to OFCOM will be available in the draft Bill, in spring 2002.

Internet policy

In addition to the Communications White Paper, Government policy on the internet has been set out in a number of publications (see box on the next page). It is led by the e-Minister (currently the DTI Secretary of State, Rt Hon Patricia Hewitt MP) and the e-Envoy (Andrew Pinder, based

[22] As well as more than 6,000 replies in support of allowing religious bodies to hold broadcasting licences.
[23] OFCOM Scoping Project, Towers Perrin report to the Regulators' Steering Group, October 2001

in the Cabinet Office). The Government's UK online programme has three overarching objectives:

- to make the UK the best and safest environment in the world for e-commerce by 2002.
- to ensure that everyone who wants it has access to the Internet by 2005.
- to make all Government services available electronically by 2005.

Also, in its publication *UK Online: the broadband future*[24], the Government also set a target to have "*the most extensive and competitive market for broadband in the G7 by 2005*."

In December 2001, the Government published the second UK online Annual Report and associated action plan[25]. This set out recommendations under 26 main headings, including:

- an action plan with industry, to increase broadband internet take-up and deployment.
- a package of measures to improve internet access at home and in the community. This includes a network of 6,000 UK online computer-access centres to be completed by 2002.
- plans to maximise the benefits of digital TV and review progress towards analogue switch-off.
- investment in computer skills, both in schools and through lifelong learning.
- developing and encouraging the take-up of e-Government services.
- support (advice, marketing etc.) to encourage UK businesses to work online.

Government publications on ICT[26] policy

The White Paper **Our Competitive Future – Building the Knowledge Driven Economy,** published in December 1998. The White Paper established the Government's target that 'by 2002 the UK will have the best environment in the world for electronic trading'.

The **Modernising Government** White Paper, published in March 1999. It set out a long-term programme of improvement for the delivery of government services. Chapter 5 covers 'Information Age Government'. The White Paper proposed that 100% of the government's dealings with the public should be capable of being delivered electronically by 2008. This target was later brought forward to 2005.

The **e-commerce@its.best.uk** report by the Performance and Innovation Unit in the Cabinet Office, published in September 1999. The report set out a detailed strategy for meeting the Government's target for e-commerce set in the Our Competitive Future White Paper.

The **e.Gov - Electronic Government Services for the 21st Century** report by the Performance and Innovation Unit, published in September 2000. It detailed a strategy for electronic delivery of Government services.

The **UK Online Annual Report**, published by the e-Minister and e-Envoy in September 2000. This considered the progress made in meeting the Government's objectives for 'being at the forefront of the knowledge economy'. It also established the UK Online Strategy, the programme of work to drive forward future progress. The second annual report updated progress and was published in December 2001.

The **Opportunity for All in a World of Change** White Paper, published by the DTI in February 2001. This detailed the Government's policy on enterprise, skills and innovation, considering strategies to promote digital TV and broadband.

UK online: the broadband future, published in February 2001 (in parallel with the Opportunity for All White Paper). This set out an action plan for encouraging roll-out of broadband internet services, and is discussed in more detail in Section 7.2.

Source: Office of the E-envoy http://www.e-envoy.gov.uk/ukonline/progress/related_reps.htm

There have been two recent major pieces of legislation which affect digital communications:

- The Electronic Communications Act 2000 provides for electronic signatures to be admissible as evidence in legal proceedings, so they can be used as the basis for contracts. It also allows

[24] Office of the e-Envoy, February 2001
[25] Published by the e-Minister and the e-Envoy
[26] Information and Communications Technology

Ministers, by statutory instrument, to allow electronic alternatives where legislation currently specifies that transactions must take place on paper.
- The Regulation of Investigatory Powers Act 2000 sets out the regime for interception of communications in the UK. Its passage was particularly controversial, with debate focussing on the level of authorisation required for intercepting communications, types of information which could be demanded from service providers, who should meet the costs of interception and the means by which law enforcement agencies could decode encrypted data (see Section 8.4).

EU policy

The first phase of EU telecommunications policy was completed in 1998, with the liberalisation and harmonisation of the markets. Therefore, the next year, the Commission launched a Communications Review to consider the changing market and determine the future regulatory framework. This process led in July 2000 to the publication of six draft directives, which are detailed in the box overleaf. These cover all communications infrastructure, including telephones, internet, TV etc, but do not cover services carried over the infrastructure such as broadcasting or internet content. The Directives have yet to be adopted by the European Parliament; the earliest possible deadline for transposition into UK law is March 2003.

Apart from the Communications Review draft directives, there are a number of other directives that are relevant to converged communications. These include the:
- Television without Frontiers Directive[27], which aims to ensure that all EU citizens have access to broadcasts from all member states and is currently under review. It sets out the circumstances under which states can restrict other broadcasts (such as to protect children), and harmonises rules on advertising and sponsorship. It also stipulates the minimum amount of programme time that must be given to European programmes and to independently produced programmes.
- Copyright Directive[28], which controls the rights of intellectual property owners and the circumstances under which the public can make copies of material (for example, for private use). In particular, it allows copyright holders to use 'technical measures' (such as digital watermarks) to prevent their work being copied, and makes it an offence to circumvent those measures. It must be incorporated into UK law by December 2002.
- Electronic Signatures Directive[29], which sets out a harmonised legal framework for electronic signatures across the EU, covering issues such as liability and cross-border recognition. Its measures were largely incorporated into UK law by the Electronic Communications Act 2000.

In March 2000, the European Council set the objective that Europe become the most competitive and dynamic economy in the world. Among its aims, developing the internet was seen as a major priority. To this end, the eEurope 2002 Action Plan detailed around 60 actions, on three main themes:
- A cheaper, faster, secure internet
- Investment in people and skills
- Stimulating use of the internet.

[27] Directive 89/552/EEC, amended by 97/36/EC
[28] The harmonisation of certain aspects of copyright and related rights in the information society, 2001/29/EC
[29] Community framework for electronic signatures, 1999/93/EC

EU legislation

There are six proposed directives that together create a new framework for the regulation of electronic communications network and services:

Electronic communications networks and services. Containing the common provisions that underlie the other measures in the new framework. Key provisions are:
- the new definition of an undertaking with Significant Market Power, on whom regulatory obligations can be placed to guarantee effective competition.
- duties of national regulators, a right of appeal against regulatory decisions, and procedures for dispute resolution.

Authorisation of electronic communications networks and services. In particular it:
- replaces licensing regimes with general authorisations for all electronic communications networks and services (with separate rights of use for spectrum and numbers).
- strengthens the internal market, by ensuring that operators do not face widely divergent licence regimes or fees when they enter each Member State.

Access to, and interconnection of, electronic communications networks and associated facilities. To stimulate competing network infrastructures and interoperability of services. Key provisions are:
- a set of regulatory obligations (including non-discrimination, cost-oriented pricing, access to specific network elements) that regulators can impose on specific operators to guarantee fair competition.
- maintenance of existing obligations on providers of conditional access systems to offer access to their facilities on fair, reasonable and non-discriminatory terms.

Universal service and users' rights relating to electronic communications networks and services. Key provisions are:
- modernising existing measures on universal service.
- specific users and consumers rights e.g. on contracts, quality of service, transparency of information.
- recognising and codifying the right of Member States to impose proportionate 'must carry' obligations on network operators.
- underpinning industry's efforts to ensure interoperability of consumer digital television equipment.

Processing of personal data and the protection of privacy in the electronic communications sector. Updates the current Directive to ensure it is technologically neutral and can cover new communications services. Key changes are:
- Ensuring that location data available to mobile operators may be used only with the consent of the subscriber and providing subscribers and users with a simple means to temporarily deny processing of their location data.
- prohibiting 'spam' (unsolicited commercial emails) except where subscribers have 'opted in' - i.e. they have indicated that they want to receive such emails for direct marketing purposes.

Regulation on unbundled access to the local loop – introduced a requirement for local loop unbundling (see Section 4.1), designed to enter into force by 31 December 2000, in advance of the entry into force of the rest of the package.
In addition to the above package of measures, the Commission adopted a proposal to harmonise the regulatory framework for radio spectrum policy.

Source: European Commission
http://europa.eu.int/information_society/topics/telecoms/regulatory/userinfo/99comrev/index_en.htm

2.3 Broadcasting

In a consideration of convergence, it is worthwhile examining the difference between broadcasting and point-to-point communication. A broadcast signal is transmitted to all users simultaneously, without any request or feedback from the user. Point-to-point communications, such as telephony, video-on-demand and internet, are generally requested by the user and supplied on a dedicated circuit, such as a phone line.

Of course, this distinction need not be obvious to the user – so they may not know whether the information they are viewing has been broadcast or not. And some content blurs the distinctions – such as email mass marketing, which is sent to a large number of people without their request or feedback, but down a phone line. For world wide web pages, or video-on-demand, a content provider sends a separate copy of the same information to each user (usually down their phone

lines) – this is known as unicasting.

Using this definition, it can be seen that broadcast encompasses both traditional television and new forms of data broadcast such as digital radio, digital text, local community information etc. If the receiver has local storage, broadcast can also be used effectively to deliver frequently accessed internet pages. However, using broadcast methods to deliver information requested by an individual user is inefficient, and will quickly use up the available bandwidth if a large number of users request information at the same time.

Likewise, using a point-to-point communications method to broadcast the same information to many people can be inefficient, and may overload the communications channel as the number of users grows. For example, it may be difficult to use 3G to deliver live football footage to a large number of users.

The most efficient (and potentially cheapest) solution is to use each method in its place. One potential development is the merging of mobile phone technology with broadcasting, so that users can receive both types of communication on a mobile phone or PDA – with broadcasting used for widely-requested video and data, while the mobile network is used for one-to-one communications. Similarly, broadcast could be used as a guide to the available information, but specific requests from the user for more detail could be provided over a point-to-point communication channel. Current technical developments aim to switch seamlessly between the two. This is made easier by an 'always on' connection, so that the user doesn't have to wait while the device dials and connects.

2.4 Bandwidth

'Bandwidth' refers to the speed at which data can be carried - for example, down a phone line, or by a satellite (see box on the next page). The bandwidth needed by internet users depends on what they want to do. Current 'narrowband' internet access allows users to send and receive email and view web pages, and is likely be the preferred option for many people for some time. However, with higher bandwidth or 'broadband' internet access, faster data transmission speeds could allow users to watch video, play games, and more easily shop or work from home via the internet. But different delivery mechanisms can support varying data rates, and some applications need more bandwidth than others. The combination of these will determine which applications can be used successfully. In its publication *UK Online: the Broadband Future*[30], the Government defined three categories of bandwidth:

- higher bandwidth – speeds greater than 384 kbps (384,000 bits of information per second).
- current generation broadband: services provided at speeds of 2 Mbps (2,000 kbps) and over.
- next generation broadband: services provided at speeds of 10 Mbps and over.

However, there is little agreement on what constitutes 'broadband' - for example, the OECD has defined it as above 256kbps, and most current UK broadband technology offers speeds of 512kbps. As a general rule, this report will assume the OECD definition. Annex A gives more detail about the bandwidth required by different applications and that available through current delivery technologies. It is worth noting that from a customer point of view, the ability to run applications (such as full motion video) is the important factor, rather than the data rate itself. There remains room in many circumstances for improvements in data compression, so the range of applications available for a given bandwidth will increase. Indeed, the Government's Broadband Stakeholder Group has developed a service-based definition of broadband, "*Always on access, at work, at home or on the move provided by a range of fixed line, wireless and satellite*

[30] UK online: the broadband future, Office of the e-Envoy, February 2001

technologies to progressively higher bandwidths capable of supporting genuinely new and innovative interactive content, applications and services and the delivery of enhanced public services."

Users may have varying bandwidth requirements. For example, an individual using broadband at home to watch TV would require high download data rates, but may not send much content to the internet, so has less need for high data rates in the 'upstream' direction. Conversely, a business using broadband to share files with partners is likely to require substantial bandwidth in both directions. Similar considerations will apply to mobile phone use - already, the market offers a wide range of packages, including varying amounts of 'free' call minutes, cheap text messaging, use abroad, etc. In both mobile and fixed data communications, packages may also include guaranteed data rates or reliability standards. Actual requirements are currently a matter of speculation - only when broadband services are widely used will these become clear. Nevertheless the history of data communications implies that applications will develop to use all available bandwidth - so even 2Mbps symmetric broadband access is likely to become inadequate in time.

Connecting to the internet

At present, the internet is primarily used for email and downloading web pages. Email is usually in the form of plain text and, although web pages can include moving images and audio, they are primarily based on text and still pictures. The speed at which web pages appear on a PC depends on factors such as the modem being used, the internet service provider, the type of telephone line and the computer hosting the web page. Typically, a home internet user in the UK might use a modem capable of downloading 56,000 bits of information per second (56kbps). This is known as a 'narrowband' connection. In reality the speed is likely to be below this due to the factors mentioned above, and web pages can take minutes to download, while watching moving pictures in real-time is not possible - accessing the internet via a narrowband modem has been characterised as the 'world wide wait'.

Large institutions have been able to get around these problems by connecting directly to the internet backbone. Higher bandwidths - known as 'broadband' - are now also becoming available for home internet users and small businesses primarily via two technologies: ADSL (asymmetric digital subscriber line) and cable modems. ADSL uses normal copper telephone lines to transmit digital data, while cable modems use the cable networks which pass around half UK properties. Both currently offer services to domestic and business customers at rates of around 500kbps (although the actual rates received by the customer will depend on who else is downloading data - see the box on 'Sharing bandwidth' in Annex A). Such services have an 'always-on' connection - this means customers do not have to wait to connect to the Internet Service Provider, as the computer is connected permanently. They are also generally unmetered, so users pay a flat rate independent of how long they spend on the internet or how much data they download. Customers connected via broadband spend four times as long online as those connected via narrowband[31].

[31] UK online: the broadband future, Office of the e-Envoy, February 2001

3 Devices

This chapter analyses the devices used for communications, focussing on computers, mobile phones and digital TV, but also examining other devices such as games machines and music players. It then considers the possibilities for convergence and evolution of such platforms.

3.1 Computers and the internet

In the UK, nearly half of people have a computer at home[32] and their capability has increased exponentially over the last twenty years. Current computers tend to include an internal modem for connecting to the internet, a disk drive for floppy disks, a DVD or CD-ROM drive, a keyboard, mouse and monitor. As a rule of thumb, a computer for home use will generally cost around £1000 (with computer speed and memory doubling about every 18 months and existing computers becoming obsolete at the same rate). However, older computers can be obtained for a couple of hundred pounds and powerful laptops cost around £3000. RAND, a US policy think-tank, point out that in 1988, a Cray supercomputer weighed 5000lbs and cost $14m. A laptop today with comparable computing power would weigh 5lbs and cost less than $4000[33].

The invention of the internet in the 1960s and of the world wide web in around 1990, led to a revolution in computer use, allowing computer users to exchange information with other computers using 'Internet Protocol' (IP). The internet supports of a number of different applications, including:

- email: sending messages from one person to another electronically; the most widely used internet application.
- the world wide web (www): allows any computer to publish documents written in 'hypertext' combining links to other material (which may be on a different computer). Web pages are viewed by a 'browser' and can seamlessly integrate other applications such as music and video.
- chat - real time text or voice conversations between users, in an online 'chat room'.

3.2 Digital TV

The box on the next page gives details of how digital TV works, and how it is delivered in the UK. At present, around a third of UK homes have access to digital television (see Section 2.1 for more details). Traditional analogue televisions cannot receive digital signals, so viewers need either a set-top-box to convert the signal or an integrated digital TV set. With these, viewers can access a number of free-to-view channels (via satellite or through their aerial) without having to pay a subscription. These include digital versions of the five terrestrial analogue channels, plus other free channels.

Set-top boxes

Set-top boxes are expensive, so to stimulate the market digital TV operators currently subsidise set-top boxes to customers. For example, at present ITV Digital provides a free set-top box to customers who take out a monthly subscription for a year. A similar free set-top box option is also available for Sky customers (although an installation charge is payable) provided customers sign a contract to keep their set-top box connected to a phone line for a year. These free set-top box offers cost the TV operators around £100-150 per customer, which service providers aim to recover from long-term subscribers. Although this is a useful model for early adopters of digital TV, it seems unlikely that it can be extended to the whole population, many of whom may not

[32] Oftel residential survey of consumers' use of the internet, Nov 2000.
[33] The Global Course of the Information Revolution: Technological Trends. RAND Conference Proceedings. May 2000.

wish to pay for subscription channels[34]. Operators are also likely to charge for set-top boxes with more advanced functions. For example, in September 2001 Sky launched an integrated set-top box and personal digital TV recorder, at a price of £300 (see the box on the next page for further discussion of digital TV recorders). However, it seems possible that basic set-top boxes, allowing access to free-to-air DTT services only, could be available next year at a cost of around £100, with slightly more expensive variants available later that would allow customers to upgrade to subscription services.

Because the existing generation of set-top boxes have only one digital receiver, it is not possible currently to watch one channel of digital TV while recording another digital channel with a conventional video recorder. A personal TV recorder is now available with two digital receivers, which makes this feasible (although it is significantly more expensive than buying a conventional analogue video recorder).

What is digital TV?

Until 1998, all TV channels in the UK were received in analogue form – a continuously variable signal - whether by aerial, satellite dish or cable. Digital TV samples the original television picture and compresses it as a series of 1s and 0s so that it takes only a fraction of the 'space' in the radio spectrum compared to analogue TV. Advantages of this method of transmission include:

- More services can be delivered over the same radio-frequency channel – so a wider selection of services is possible.
- Many different types of information can be transmitted – such as sound, still or moving pictures, text and data. For example, as well as traditional programming, faster, more interactive and graphical teletext services are possible.
- Digital broadcasts may in the future be displayed on different devices, stored electronically and manipulated by computer.
- Interactive services are possible, such as using the remote control to obtain more information about programmes, or with a modem and phone line for broader interactivity (see Section 5.1).
- Because more services can fit into less radio spectrum, it may be possible to release some of the spectrum for other purposes (such as navigation or other communications). The Government argues that this re-use will have economic benefit. However, much of the released spectrum may still be used for digital TV, to provide greater coverage or increase the number of services available. Further, only limited spectrum could be reallocated without requiring viewers to change their receiving aerials.

In the UK, digital TV is delivered in one of three ways - although access to each of these varies (see Chapter 4):

- Digital Terrestrial Television (DTT) was launched on 15 November 1998. The regulatory framework for digital terrestrial broadcasting was set up by the 1996 Broadcasting Act, after which the Independent Television Commission awarded network licences. 68% of the population can currently receive all DTT services, which include a mix of over 50 subscription, pay- per-view channels and interactive services provided by ITV Digital, and free-to-view services provided by the BBC and others.
- Digital satellite television started on 1 October 1998. In addition to the free-to-view and audio channels, Sky Digital provides more than 200 subscription or pay-per-view channels and an interactive service called Sky Active. Sky turned off its analogue TV service in autumn 2001.
- Digital cable TV in the UK began in November 1999. It is provided by NTL and Telewest, and offers over 50 TV channels on a subscription basis, as well as pay-per-view and interactive services. Cable currently passes around half of UK homes.

Pricing via the three methods is comparable, ranging from around £10 per month for package of basic channels to around £40 per month for nearly all available channels. In addition, all operators offer pay per view channels for films and sporting events. Also, viewers can receive free-to-view channels only, via DTT or satellite.

Integrated digital TV sets

In 2000, only 100,000 digital TV sets (known as integrated digital TV, iDTV, rather than a separate set-top box) were sold in Britain, compared with more than 4 million analogue sets[35]. First generation iDTVs were all in the premium end of the market and significantly more

[34] Turn On, Tune In, Switched Off, March 2001, Consumers' Association
[35] Hot is the new cold where iDTV is concerned, Financial Times, 8 May 2001.

expensive than their analogue equivalents. The differential cost has now fallen to around £150, and is expected to continue to fall, but this difference is still a key factor for those replacing their TV sets. Digital TVs have built-in decoders to convert digital signals, and slots for pay TV service providers' smart cards (which are used to allow subscribers access to pay channels). Innovations can be introduced more quickly into set-top boxes than integrated TV sets, so set-top boxes tend to have higher quality at lower additional cost, and can be more easily replaced in future (although note that where TV operators have subsidised set-top boxes, they may be keen for them to remain in use and earning revenue for as long as possible). *Which? Magazine*'s view in February 2000 was that iDTVs did not then represent the best option for consumers and advised against buying them[36]. On average, TV sets are replaced every 8 years. The Government expects that it will meet the conditions for switching off analogue TV by 2010, but if this is to happen take up of digital TV sets will need to be encouraged; in particular, the price differential between analogue and digital sets will need to reduce. Issues surrounding analogue switch-off are considered in Section 7.3.

Digital videos

Within the last two years, digital video recorders have been launched in the UK – for example, the *TiVo* and the *Sky+* set-top box. Rather than recording programmes onto a tape, these use a large hard drive which can store up to 40 hours of programmes. This allows a number of differences from a conventional video recorder:

- As well as recording and playing back programmes, the device can pause live programmes for up to half an hour (by recording the parts transmitted after the pause).
- There is no need to fast forward or rewind tapes to search for programmes – a digital index of recorded programmes is maintained and can be shown on the TV screen.
- Viewers can watch one recorded programme while recording another.
- It can also learn viewers' tastes and record programmes without being asked or, for example, record all broadcasts of *Coronation Street*.
- When recording programmes, it can skip advertisements.

These devices cost £300, and have an ongoing subscription charge of £10 per month (users can also pay a one-off fee for a product lifetime subscription).

Such innovations have a number of possible commercial and social implications. To maintain up to date schedule information, the recorder is plugged into a phone line and calls back to the service provider every day. Data about people's viewing habits can also be transmitted, and because the hard disk is able to record details of all programmes watched, this raises privacy concerns. Should such recorders become widely used, the ability to skip advertisements may have ramifications for advertisers and commercial television channels, although broadcasters hope to increase the success of advertising spots by adding interactive content. Digital recorders are much easier to use than conventional recorders, which are infamous for the difficulty involved in programming them. Therefore, it is conceivable that these tools will be used more widely, allowing people essentially to schedule their own programming. This could have implications for regulatory structures such as the 9 o'clock watershed, and for the distinction between 'pulled' and 'pushed' services made in the Communications White Paper (see Section 6.2).

Standards and interoperability

Each digital TV platform operator has a different set-top box, operating to standards that are common in some respects and different in others. Therefore, if customers wish to switch provider, they must change their set-top box and content providers need to re-author content for interactive applications on each digital TV platform[37] (satellite, terrestrial, and two cable operators). As providers currently include set-top boxes in their package, this issue has not been a major problem for customers (although platform operators generally insist that users sign-up for a minimum of one year). But if viewers wish to buy a higher specification set-top box, for example including a digital video recorder, they tie themselves into a single TV platform and are unable to change without significant costs (which is particularly problematic if they move to an

[36] Widen your screens, but think twice about integrated TVs, Which? Press release, February 2000

[37] Although some re-authoring may still be needed even if common interactive standards were adopted, to take account of the different capabilities of each platform (for example, differing bandwidth).

area where the relevant platform is not available).

However, operators such as NTL argue that waiting for agreement on common standards would have delayed the development of digital TV in the UK. The issue of standards is noted in the Draft Digital TV Action Plan[38]. Within the industry, there is agreement supporting the development of a common interactive application standard (called the Multimedia Home Platform, MHP) and its adoption on a voluntary, market-led basis. Digital TV operators in some European countries are beginning to plan to use this standard. Nevertheless, this requires more memory and a more powerful processor than those in set-top boxes in use today in the UK, and would not make receiving equipment from different networks interoperable unless they also had additional tuners. Digital TV operators have invested heavily in their current systems and the costs of replacing them with a common standard are likely to be a major disincentive. There is also concern that the MHP standard is not completed or tested for its performance in practice. In the European Parliament, MEPs have introduced amendments to mandate MHP (to varying degrees), but the EC[39] and several member states, including the UK, have indicated that they oppose this. UK pay TV operators are also against mandatory MHP, although they are favourable in principle to the wider goal of ensuring the use of open standards on European digital platforms.

3.3 Digital radio

As with digital television, digital radio offers the opportunity for more channels, with better reception quality. It can also be used to broadcast text and pictures, and for interactive services. The BBC broadcasts six national digital radio channels, and has approval to add five more. There is one national independent digital radio multiplex licence (held by Digital One, which began broadcasting in November 1999), which provides 9 national radio services, 3 of which are simulcasts of the existing national commercial services and 6 of which are exclusive to digital. There is also a wide range of local digital commercial and public service radio stations. For example, in London there are forty digital radio stations. The roll-out of digital radio across the UK continues with a new local multiplex licence (each of which carries 7-9 services) awarded every 1-2 months.

To receive digital radio, listeners need a digital receiver, which currently cost at least £200 (although the price is reducing, and there should be receivers available for under £100 by Christmas 2001), compared with as little as £10 for an analogue radio set. There are few portable receivers - most need to be linked to a PC, home stereo or in-car system. However, it is possible to receive digital radio services on digital TV, and many broadcasters also make their output available on the internet. Analogue radio is already available on some mobile phones, and the next generation of phones may come installed with a digital radio receiver. As a 'secondary' activity, radio is well suited to use while browsing the internet or travelling.

Take-up of digital radio has been much slower than that of digital television, with only 50,000 receivers forecast to be sold by the end of 2001[40] - in comparison, there are 120 million analogue radios in the UK. A number of reasons have been proposed for this slow take-up, including:

- Digital radio sets are much more expensive than analogue sets. There is no equivalent of the digital TV set-top box, which could convert analogue radios into digital receivers.
- Hi-fi sets and 'ghetto blasters' do not come with digital radio included.

[38] DTI/DCMS, October 2001 - see Section 7.3.

[39] Amended proposal for a Directive of The European Parliament and of the Council on universal services and users' rights relating to electronic communications networks and services, EC, COM(2001) 503 final, September 2001

[40] GWR group, evidence to the Culture, Media and Sport Select Committee inquiry into the Communications White Paper, March 2001, Volume II pg 68

- All UK radio services are free-to-air, so there are no pay-radio platform operators to 'give away' or subsidise set-top boxes (although pay radio has recently launched in the US).
- Analogue radio sets typically last a long time, so listeners do not replace them often.
- Radio audiences are innately conservative (although this is more true for some services than others).

Digital coverage is not universal - the BBC's digital services only have coverage of around 60% although the BBC has announced it will expand this to some 80% of the population. Both the BBC and Digital One have enough spectrum to deliver national coverage, but are constrained by the costs of investing in transmission sites and the uncertainty of such investment. Although the Government plans to switch-off analogue radio, it seems unlikely to even set a target date in the near future. Nevertheless, the Culture, Media and Sport Select Committee[41] recommended that Government set out "*the main factors to be borne in mind in reaching a decision on radio analogue switch-off.*"

3.4 Telephones

Mobile phones

Mobile phones have been one of the technology success stories of the last few years, and are now owned by more than 70% of the UK population. In Europe (and much of the rest of the world), mobile phones currently use the 'second generation' (2G)[42] Global System for Mobile Communications (GSM) digital standard. As such, the same mobile can work in any European country, assuming the user is on a tariff with their service provider which allows international use (known as 'roaming'). As well as voice, GSM can also be used for data, fax and text messaging (short messaging service or 'SMS').

Mobile phones in the UK are purchased through one of three main business models:

- *pay-as-you-go* - users buy a phone and vouchers or electronic credits in advance for calls, but are not tied to a contract.
- *pay upfront* - a cross between pay-as-you-go and monthly rental. Users sign up for a rental contract, but pay the first year's charges when they buy the phone.
- *monthly rental* - users sign a contract to pay a monthly line rental fee (which usually includes some call time) and then are billed for calls.

In the UK, pay-as-you-go has been very successful: 71% of residential users have pay-as-you-go phones, 6% use pay upfront, and 23% have monthly subscriptions[43]. The cost of the phone itself depends on which tariff users choose. Under all tariffs phones are subsidised, but while pay-as-you-go phones cost generally between £20 and £100, phones for monthly rental are often 'free' provided users subscribe for a year, during which period operators recover the handset subsidy.

Mobile data services

GSM phones can receive data as well as voice communications, albeit slowly (at a fifth of the rate possible with a narrowband home computer and modem). Browser-based mobile data services were introduced in the UK in January 2000, and use 'WAP' - wireless application protocol - which facilitates mobile internet use. However, current mobile phones cannot display full web pages (in colour, with graphics) and WAP-delivered pages tend currently to consist of a few lines of text.

WAP has not met users' expectations, because it is not equivalent to 'surfing the web on your

[41] Report on the Communications White Paper, March 2001
[42] First generation devices were analogue.
[43] Consumers' use of mobile telephony – Summary of Oftel residential survey, Q6 August 2001

mobile phone'. Many mobile phones on sale are WAP enabled, and cost similar amounts to traditional mobiles, with calls to download data generally charged at 10p per minute. However, only around one in four WAP phone users employ the phone to do more than make voice calls or send text messages[44]. Nevertheless, some businesses have found it useful as a means of remaining in contact with a mobile workforce – 18% of medium sized businesses with mobile phones use WAP phones[45].

Several approaches are currently being deployed or developed to increase the data transmission rate to mobile phones, and hence make them more attractive for internet access – these are known as 2.5G and 3G technologies. Within the GSM standard, the 2.5G General Packet Radio Service (GPRS) is currently being deployed by mobile phone companies and increases mobile internet access rates for users with GPRS-enabled terminals. However, mobile phones will not be able to receive all these different standards interchangeably - there will be a trade-off between price and complexity of phones, and the number of standards they can receive. As 3G networks will take a number of years to roll-out, it seems likely that phones will at least continue to receive GSM calls, alongside 2.5G data. 2.5G and 3G standards are discussed in more detail in Section 4.2.

Such new services will allow mobile phones to receive colour web pages with graphics (note that even the lowest estimates for 3G data rates are still around the same access speeds as are now achieved by PC users with a modem and telephone line). With 'always on' technology, mobile email may be a key application. Neither browsing the web nor sending email is particularly user friendly with most current mobile phones, so the new services will pose design challenges for the next generation of mobile devices. They will need to:

- Have a relatively large screen, to show web pages (although content could be 're-purposed' for viewing on a smaller screen).
- Allow fast data entry, either by including a keyboard or by voice access.
- Remain small enough to be 'mobile'.

Some phones already on the market have a relatively large screen, a keyboard, allow web access, email and WAP, as well as voice and text messaging. However, another personal portable digital device is likely to have a major impact on mobile phone development - the PDA (Personal Digital Assistant).

PDAs

PDAs attempt to combine the portability of personal organisers with the functionality of laptop computers. Typically, they include an address book, diary and reminder note functions, and data can be exchanged between them and a desktop computer (to 'back-up' the information). Many also now support communications applications, such as email and web browsing. Their cost ranges from £100 to nearly £1000, depending on the type of device, memory, whether it is colour or black and white, etc.

PDAs can be split into two categories:

- Sub-notebooks, which open up and include a small keyboard (such as those made by Psion).
- 'Palm' type devices - these have a screen which takes up most of the device, so do not include a keyboard (although fold-up keyboards are available). Information is entered into the machine by a stylus, using handwriting recognition on a touch sensitive screen.

[44] JD Power and associates, May 2001
[45] Business use of Mobile Telephony Oftel Small and Medium Business Survey Q5 May/June 2001

Satellite phones

Mobile phones are also available which can link customers directly to communications satellites, without the need for terrestrial base stations. This can be particularly useful for mobile access in rural areas and developing countries, where full terrestrial mobile coverage is not available. Current satellite services do not allow high data rates, although as use by reporters in the recent war in Afghanistan has shown, they can support video telephony. Faster services are planned for the next few years.

At present, the terminals needed for such services can be bulky - more akin to a laptop than a mobile phone. Large antennae can be required (around A4 size) and terminals can weigh a couple of kilograms. New satellite constellations such as Iridium and Globalstar (see Chapter 4) use smaller terminals but handsets still cost over $1,000 and calls more than $1 per minute. Therefore, given price differentials and their larger size, these are unlikely to pose a challenge to terrestrial mobiles for individual use. However, for business use in areas where continuous coverage is essential, satellite phones offer a means of voice communication and data services, at costs within the budget of many companies.

3.5 Platform evolution

As well as the more widespread platforms, there are a number of other devices which provide information, communications or entertainment. Some of these, including games machines, MP3 music players, DVDs and location sensors, are examined in Annex B.

Digital platforms can be split into two general categories:

- those where the device and service provision are integrated. Examples include games machines (which can only play games designed specifically for that device); and digital TV set-top boxes, which are provided by the TV operator (Sky, ntl, etc.) and do not work with services from other operators.
- those where the service and device are independent. For example, PCs can run almost any programme and connect to any ISP; and mobile phones are generally connected to a specific operator when they are bought, but can be changed to any service provider.

Both of these models can raise a number of regulatory issues. Under the first approach, regulation may be used to ensure platform operators allow a variety of independent sources to deliver their content using the service. In the second, standardisation between devices needs to be addressed. Some of the regulatory questions are considered further in Section 8.2.

At present, many homes have a number of digital devices. Some of these serve single functions - for example, telephones, DVD players, games machines, or digital TV set-top boxes. However, others have a range of uses - for example, PCs can access the internet, play DVD videos, audio CDs and games, and be used for voice telephony. There are many ways in which digital devices can converge, in almost any combination. Convergence can also describe devices communicating with each other – for example, a diary held on a home computer synchronising with the diary on a personal organiser. Two possibilities are considered below: PC/ TVs and mobile phone/ PDAs.

Some analysts have suggested that these trends could result in three generic devices:

- A larger screen 'lean back' device, combining the features of TV, internet browser, video and stereo, for family or group viewing or listening to passive entertainment.
- A 'lean forward' device, for individual use, with greater facility for interactive applications such as playing games, writing documents or sending email.
- A 'personal mobile communicator', including the functions of a mobile phone, personal organiser, internet browser and MP3 player.

However, there is a question mark over how far consumers actually demand convergence in access devices. Converged devices can be successful if the synergy offers real benefits to the user and the new product is user-friendly. But such combinations can also make the device more difficult to operate and less appealing than two dedicated machines. Each platform has individual features, so while the boundaries between devices seem likely to blur, they may not merge into one all-encompassing 'home gateway'. Further, some commentators consider that manufacturers may find it more profitable to sell many separate devices, rather than a single all-purpose product. However, it is still early in the development of converged platforms, and while some will undoubtedly fail, there will also be successes. Other consumer devices, such as the PC, took some time before their interface was user-friendly.

Converging PCs and TVs.

Many people already watch TV while surfing the web (although not necessarily on the same device). There are estimated to be 44m 'telewebbers' in the US[46]. One possible route to convergence is through amalgamating the functions of the PC and TV, which could occur in two ways:

- a 'lean back' device - basically a TV with internet access (although perhaps more sophisticated than a current digital TV set-top box).
- a 'lean forward' device - based on a PC, but with the ability to show TV, radio, video etc.

In the first category, Microsoft's Web TV, a TV with internet and email functions, has around a million users in the US – and has even spawned a compatible chair, including a WebTV, keyboard tray, modem connector and drinks holder. Alba, the consumer electronics group, launched the Bush Internet TV in 2000 as a joint venture with Virgin.net. It allowed internet access and email, but initial sales were not as high as predicted, with about 170,000 users by late 2001. In November 2001 it was announced that Bush Internet would be incorporated into the ITV active portal.[47]

Other attempts have been made to combine PC and TV devices. However, many of these had a 'boot up' process when they were turned on, like a PC – a drawback for television viewers. In general, such dual-function machines have not been successful, although analogue TV cards can currently be added to most PCs.

Another approach to providing internet access through the TV is being taken by ITV Digital and NTL. ITV Digital provides a separate set-top box which allows users to access the internet through the phone line, using the TV as a monitor. NTL offers an integrated digital TV set-top box and cable modem. Internet access through digital TV is considered further in Section 5.1.

PDAs and mobile phones

Both categories of PDA ('sub-notebook' and 'palm') now include devices with communications access - incorporating wired or wireless modems, or attachments which allow the PDA to function as a GSM phone. This trend, along with the increasing complexity of many mobile phones (which can include games, address books, diaries and WAP access) has led many analysts and manufacturers to conclude that the two devices will merge into one 'personal mobile communicator'. This would incorporate the functions of a PDA with the communications technology of a mobile phone.

The 'Symbian' consortium, set up in 1998 by Psion, Motorola, Matsushita, Nokia and Ericsson, are developing operating systems for 3G mobile phones. This would support text messaging,

[46] Telewebbers on the Rise, Dataquest, June 2000

[47] Alba says loss making Bush Internet portal to be incorporated into ITV Digital, Ananova, 28 November 2001

WAP, standard web pages and Bluetooth wireless communication (see box on page 115), and could run on devices with a keyboard or a touch screen. Other operating systems for mobile devices include those by Microsoft and Linux. It seems unlikely that the PDA/mobile phone market will converge towards a single model. Rather, a range of converged devices may exist, including PDAs with mobile phone capability, smart phones with key pads or touch screens, and more basic mobile phones. However, all mobile devices will need to address the issue of battery life (see box below).

Voice recognition could also be an important technology. Some mobile phones already have this capability, and it is also implemented in customer service telephone systems and PC word processing software. Potentially, a successful voice recognition system could allow users to interact with their held-held devices without the need for keyboards or handwriting recognition. However, more development is needed before this can be widely implemented. In particular, user-independent voice recognition is notoriously difficult. Given time to learn the speech patterns of a single user, programs can recognise a wider range of vocabulary. However, speech varies significantly between individuals, so programmes which can understand all users are much more problematic. Further, distinguishing a user's voice from background noise is challenging - which could make it difficult to use such systems on the train or in a nightclub.

Battery life

A key constraint on the development of mobile devices will be battery life. At present, there are two main options. Some Palm-type PDAs use traditional disposable batteries, which generally give several weeks of normal use before they need replacement. Mobile phones, PDAs with colour screens and laptops, all of which require more power, use rechargeable batteries. For 3G mobile devices, which may have relatively large colour screens, rechargeable batteries will be a necessity. However, the operating life between recharges may be a problem. Some laptop PCs give only 2 hours of battery life, while new hard disk MP3 players can play 4 hours of music before needing to be recharged. Also, 3G devices will be 'always on', which will increase the drain on batteries. Devices will therefore need to be designed to minimise power consumption. The DTI's Foresight programme IT, electronics and Communications Group has identified the need for low power devices as one of its 'fertile areas for research'.[48]

[48] Foresight ITEC Group Report, Information, Communications and Media Panel, February 2001

4 Delivery

There are many ways in which individuals and businesses can receive digital communications. For example, of UK citizens with internet access, 9 out of 10 use standard telephone lines for access and 12% use cable. Around 10% use mobile phone networks or digital television to access a restricted number of suitable sites[49]. This chapter examines means of receiving and transmitting information, considering their relative merits and drawbacks and issues related to each delivery method. There are three main categories of digital network:

- Terrestrial wired - such as phone lines or cable;
- Terrestrial wireless - such as mobile phone networks and digital terrestrial TV; and
- Satellite - which is widely used in the UK for digital TV transmission.

4.1 Terrestrial wired networks

These include standard telephone lines (which can be used for voice communications and accessing the internet) and cable (for television, telephony and internet access). Optical fibres are used as the backbone of cable and telephony networks (to carry large amounts of data in bulk) but could also bring high speed communications services to users' homes. This section considers these technologies, their current position in the UK and issues about their use.

Telephone lines

Voice

93% of UK households have a fixed phone line, which is most people's main means of one-to-one voice communication[50]. On average, residential customers spend £76 a quarter on their fixed phone line - with younger people and those with home internet access spending more. Around seven in ten homes use BT as their only fixed telecommunications supplier, while three quarters of homes have both a fixed and mobile phone.

Businesses make extensive use of fixed lines, for voice, internet and fax communication. Small businesses have an average of five fixed lines, spending ~£280 per month, while medium sized businesses average 37 lines, spending ~£2700 per month.[51] However, medium sized businesses have a smaller number of lines and spend less per employee. As well as standard fixed and mobile telephone networks, it is also possible to send voice traffic over the internet - so it can then be integrated with data and video services, and use for applications such as voice enabled web pages. Such services can use PCs or telephones, and calls can be significantly cheaper than using traditional phone lines, especially for international calls. However, the quality of such services is variable, and they have not yet been as widely adopted as some analysts predicted.

Data

Over a third of UK telephone call volume is internet traffic[52]. There are four main ways telephone lines can be used to receive internet data; via:

- digital signals down standard copper telephone lines.
- ISDN (Integrated Services Digital Network), which transmits digital signals but uses a non-standard type of telephone line.
- DSL (Digital Subscriber Line), which uses standard copper wire but allows higher speed communications.

[49] Flash Eurobarometer 103 : Internet and the public at large, June 2001
[50] Consumers' use of fixed telecoms services - Summary of Oftel residential survey Q6 August 2001
[51] Business use of Fixed Telephony – Oftel Small and Medium Business Survey Q6 August/September
[52] 2000/01 effective competition review of dial-up Internet access, Oftel, 30 July 2001

- leased lines, where a telephone line is provided for a single customer's sole use.

Standard phone lines

Standard telephone lines are currently the most popular method of internet access:

- of the ~40% of UK homes connected to the internet, more than four out of five use standard phone lines[53].
- of the 60% of UK small businesses connected to the internet, three quarters use standard lines[54].

Internet users dial a local number to access their internet service provider (ISP), which then routes data to and from the internet (see box below). Internet access down these standard phone lines is relatively slow - for example, at a modem speed of 56kbps.

Accessing the internet

Internet service providers

To access the internet, individuals and businesses use an internet service provider (ISP) such as Freeserve or AOL. For large companies, the ISP can connect the organisation's telephone network directly to the internet. The vast majority of home internet users employ a modem to phone the ISP (on a local-rate number), which routes their communications to and from the internet. ISPs often supply software to make it easier to log on to their networks and usually provide space on their computers for customers' personal web pages and email.

Unmetered internet access

BT provides the majority of lines which connect telephone exchanges with customers' premises (local loops) in the UK. Until 1999, BT charged both its own customers and those using other service providers on a pence per minute basis for using the local loop (metered access). However in 1999, BT, responding to customer demand and pressure from Oftel, introduced flat rate tariffs for its own customers and other service providers. These are now employed by almost a third of UK home internet users, and allow them to pay a flat rate independent of time online (unmetered access). Customers using these unmetered packages spend nearly twice as long online (13 hours per week) as those on pay per use packages.[55]

Customers can pay for internet access in three main ways:

- through a subscription service, plus telephone call charges for each minute spent online (metered access)
- through a flat rate subscription service, where there are no extra phone call charges (unmetered access - see box above).
- through their telephone bill only (where 'free' ISPs take a proportion of call charges).

The types of ISP package used by home and business users are shown in Table 1. Note that more than a third of all users prefer unmetered packages. Customers also often use more than one ISP - this is true for a fifth of businesses[56] and home users[57].

Table 1: Internet access by business and residential users

User	Type of ISP package (% of users)		
	Unmetered (fully or partially)	Subscription + phone calls	Phone calls only
Residential	40	18	42
Small business	37	33	31
Medium-sized business	44	33	22

Sources: Consumers' use of Internet: Oftel residential survey Q6 August 2001

Business use of Internet, Oftel Small and Medium Business Survey, Wave 6 August/September 2001

[53] Consumers' use of Internet Oftel residential survey Q6 August 2001
[54] Business use of Internet – Oftel Small and Medium Business Survey Wave 6 August/September 2001
[55] Consumers' use of Internet Oftel residential survey Q6 August 2001
[56] Business use of Internet – Oftel Small and Medium Business Survey Wave 6 August/September 2001
[57] Consumers' use of Internet Oftel residential survey Q6 August 2001

In February 2001, Oftel conducted a study of internet access costs[58]. They found a wide range - for example, for a UK residential customer, using the internet for 20 hours off-peak each month, prices ranged from £152 to £332. This includes both ISP and telephone charges, considering both 'free' and subscription ISPs. Oftel also compared UK prices with those in the US, France, Germany and Sweden, for a range of usage patterns. The results are shown in Table 2, for residential and business use. Overall, the UK had the lowest prices for residential use. For limited business use, the UK was cheaper than the US and France, but more expensive than Sweden and Germany.

Table 2: International comparison of internet access charges

Country	Comparative cost for access (UK=100)					
	Residential Average metered, peak time	Residential Unmetered, peak time	Residential Average metered, off peak	Residential Unmetered, off peak	Business Average metered	Business Unmetered
UK	100	100	100	100	100	100
Germany	156	216	166	243	89	n/a
France	119	n/a	165	n/a	105	n/a
Sweden	201	n/a	166	n/a	96	n/a
US (California)	119	103	207	116	102	143

Leased lines

Leased lines are used primarily by businesses which need to transmit large amounts of data, such as financial institutions. They are also used by ISPs to offer high speed internet access to customers, and as the backbone for mobile services. The leased line market was worth £1.5 billion in 1999/2000, and is used by 1% of small businesses and 14% of medium sized businesses with internet access[59]. The market for leased lines - especially with fast data speeds - is competitive, although BT has an obligation to offer lines of up to 2Mbps throughout the UK. In December 2000, after a consultation, Oftel required BT to provide other operators with 'part leased lines' (equivalent to the 'local loop' for leased lines) on non-discriminatory terms and at controlled prices - Oftel believes this will enhance competition in the wholesale and retail leased lines markets.

ISDN

ISDN lines (such as BT's *Home Highway*) have multiple 'channels' , which allow more than one call to be made at a time, at speeds of 64kbps or more. This means that users can access the internet and talk on the phone at the same time. Costs vary depending on what package is chosen, but are generally around £200 for installation and between £20 and £60 per month for line rental, with some inclusive call charges. ISDN is mainly aimed at a business market in the UK - of those which have internet access, 26% of small businesses and 54% of medium-sized businesses use ISDN[60]. Only 10% of UK homes with internet access use ISDN - compared with 55% of internet homes in Norway and 39% in Germany[61] (where prices are around 15% cheaper than in the UK).[62]

DSL

DSL technology adapts copper telephone lines so that they can transmit broader bandwidth, but can only be used within 3km of a telephone exchange. DSL services offer rates of between a few hundred kbps and 10-20 Mbps, and an 'always on' connection, so users do not have to wait for a

[58] Oftel, International benchmarking study of dial-up PSTN Internet access, mobile and fixed line services, June 2001.
[59] Business use of Internet – Oftel Small and Medium Business Survey Wave 6 August/September 2001
[60] As above
[61] Source: Nordic countries lead European broadband usage, Netvalue, 1 October 2001, data from August 2001
[62] International benchmarking study of dial-up PSTN Internet access, mobile and fixed line services, Oftel, June 2001

modem to dial and connect to the internet. There are three main variants of DSL (which is more generically known as xDSL):

- HDSL gives the same data rate in both directions
- ADSL provides faster downstream (to the user) rates than upstream (from the user to the internet). This is suitable for most users, as they receive much more data from the internet (such as web pages , audio files etc.) than they send.
- VDSL gives the highest data rates, but can only be used over very short distances (a few hundred metres).

BT began to offer ADSL services in summer 2000. Due to the distance constraints on DSL, it is not able to cover the whole UK population, although in July 2001, BT started to deploy 'rate adaptive' ADSL, which can extend to within 5.5km of the exchange - in a typical exchange area, this includes 90% of premises. BT has over 6,000 local exchanges, and has ADSL-enabled 1,000 of these (serving 60% of households) but has told Oftel that it does not currently have plans to enable additional exchanges. In evidence to the House of Commons Culture Media and Sport Select Committee[63], BT envisaged that it would only be economic to convert exchanges with more than 20,000 lines. Hence, a large proportion of the population will be unable to take advantage of ADSL services - and this group of customers is likely to be in rural areas, and hence strongly correlated with those who do not have access to cable services either. Some have also argued that, as many of these customers may be geographically remote, the potential benefit to them of high speed broadband services is greater. Broadband coverage and the 'digital divide' are discussed further in Section 7.1.

Because it is 'always on', ADSL services cannot be charged by time online. There are two possible options - either a flat rate per month for unlimited access, or a charge related to the amount of data downloaded. In the UK, all ADSL services are at a flat rate, which for ~500kbps access is currently between £40 and £50 per month for home users (about three times the price of flat rate access using a standard phone line). Business charges are up to £160 per month (exc. VAT) for 2Mbps access. Users also have to pay installation charges, which are currently £75 for BTopenworld residential customers.

As well as internet access, DSL lines are also used to provide video-on-demand services by Kingston Communications in Hull and Video Networks in London (see Section 5.1).

BT sells wholesale ADSL packages to around 200 operators, so customers can buy such provision from either BT or another operator. Wholesale packages are sold to all service providers (including BT's in house provider, BTopenworld) at the same rates - this is in contrast to many other European countries, where incumbent operators restricted ADSL to their in-house ISPs. However, Oftel is investigating a range of issues about BT's wholesale ADSL provision, such as the terms and conditions, the margin between their wholesale and retail services, and recent price reductions by BT. In particular, critics claim that the small margin between BT's wholesale and retail prices means competitors cannot sell at comparable retail prices and still make a profit, and have suggested that BT's retail arm should be completely separated from the network business (including the local loop).

Oftel conducted a study earlier in 2001[64] comparing the price of ADSL and cable modems in the UK with that in France, Germany and the US. It considered the two cheapest packages in each country, comparing prices from October 2000. Table 3 shows the results. Key points are:

[63] The Communications White Paper, Second report, Session 2000-01, March 2001
[64] International Benchmarking of DSL and Cable Modem Services, January 2001

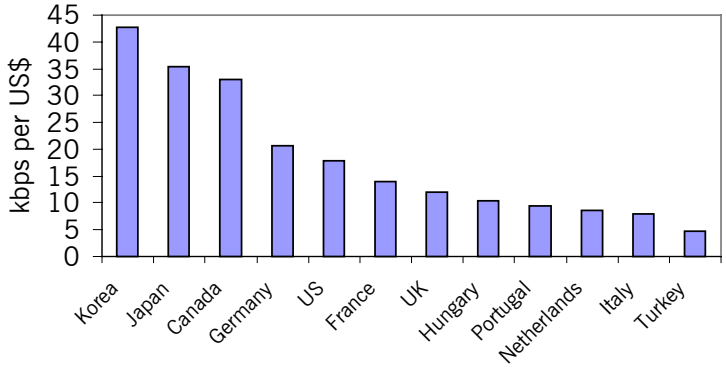
- UK residential services cost £40 per month[65]. France, Germany and the US are all cheaper (with US packages providing four times as much bandwidth - 2Mbps).
- Business results depend on the bandwidth requirements, but US prices were significantly cheaper than UK prices for all packages.

Table 3: Oftel international comparison of ADSL and cable modem prices

Country	£ per month - residential services		£ per month - business services (no minimum bandwidth)
	DSL only	DSL and cable modem	DSL and cable modem
UK	44	40	42
France	48	37	126
Germany	32	31	28
US	36	32	33

The OECD has also recently published international comparative figures for DSL pricing in March 2001. These attempt to take into account the differing speeds of access in various countries by comparing the bandwidth (upstream and downstream) made available to the user per US$ (where cost is the monthly fee, plus connection costs spread over four years). OECD considered the DSL packages on offer by incumbent operators in 24 countries – a selection of these are shown in Figure 7. Of the G7 countries, the UK was the 6th cheapest (only Italy being more expensive). Although the OECD did not produce directly comparable figures for cable modems, it did note that NTL offered the least expensive 512kbps cable modem service in the OECD.

Figure 7: DSL pricing in OECD countries, March 2001[66]



BT argues that European incumbents, who were not required to make wholesale ADSL available to competitors when they launched their retail services, had an incentive to charge low prices for ADSL to give their ISPs a head start in the market - and were not prevented by their regulators from doing this. Initial take-up of ADSL in the UK has been slow - in part due to problems with other operators accessing BT's infrastructure (see 'unbundling the local loop' below), but also due to the relatively high cost of such packages and low customer awareness. Section 7.2 discusses the reasons for low broadband uptake in the UK, both on demand and supply sides. DSL services started in Germany in August 1999, compared with July 2000 in the UK. In June 2001, there were 80,000 UK DSL subscribers - compared with 780,000 in Germany and 4.2 million in Korea.[67] Industry figures suggest that DSL penetration among UK businesses is less than 1%[68] -

[65] Although cable modem services now available for residential users from ~£20 per month.
[66] The Development of Broadband Access in OECD Countries, OECD Working Party on Information and Telecommunication Service Policies, October 2001
[67] Note that DSL services started in Germany in August 1999, compared with July 2000 in the UK.
[68] Business use of Internet – Oftel Small and Medium Business Survey Wave 6 August/September 2001

although a third of businesses with internet access said they would be likely to use DSL in the future.[69]

Oftel's survey of residential internet users in November 2000[70] found that at least 3 in 4 customers thought each of the individual features of ADSL were 'attractive', with the most attractive being higher speed access and the ability to make voice calls at the same time as using the internet. One in four internet homes claimed they would be likely to get it in the next year if it cost £40 per month – although actual take-up has been significantly less than this.

Local loop unbundling

BT, as the former state telecoms network, operates an extensive 'local loop' - the copper wires that run from telephone exchanges to customer premises[71]. As recently as 1996, Oftel policy was that BT should retain control of its local loop, to encourage other operators to develop alternative infrastructure such as cable and fixed wireless networks. However, many stakeholders argued that the cost of constructing alternative local networks, as the cable companies did, made it difficult for other operators to compete on equal terms with BT.

In July 1999, Oftel made a preliminary decision that BT should be required to 'unbundle' its local loops. Local loop unbundling is the process where the incumbent operator makes its local loop available to other operators. This allows those operators to upgrade individual loops using DSL technology and so offer services such as high speed internet access direct to the end user. Although BT had argued against this it agreed, in April 2000, to accept a licence condition obliging it to offer unbundling facilities (this came into force in August 2000). Also in April 2000, the EC recommended that local loop unbundling should occur across Europe, and a Regulation to this effect came into force in January 2001. [72] The box below sets out the options for access to the local loop.

Access to the local loop

Operators can currently connect their equipment to the local loop in two main ways:

- Physical co-location - within BT's exchange. BT offers operators space in the exchange, where each can place their telecommunications equipment.
- Distant location - where the operator's equipment is housed away from BT's exchange, and connected to it by a cable. This can be in a separate building or a roadside cabinet.

There are different forms of unbundling which operators can pursue:

- Full unbundling – the entire loop is handed over to an unbundling operator in order for it to offer DSL services to end users.
- Shared access - EU Regulation requires BT to offer line sharing. This means that a single local loop is split so that BT provides voice telephony at the same time as another operator provides DSL services.
- Sub-loop unbundling - where the line is handed over to the other operator at a point between the telephone exchange and the end user. This can be used for VDSL, where signals can be sent only a short distance on the copper telephone line.

Source: Oftel

When Oftel's first decisions on unbundling were made, there was great demand from operators for space in exchanges - so much so that BT believed that it would be unable to offer space to all those who requested it. However, the process to allocate space in exchanges did not go smoothly and by February 2001, demand from operators had fallen to such a low level that BT *could* now

[69] Business use of Internet – Oftel Small and Medium Business Survey, Q4 February 2001

[70] Consumers' use of Internet: Summary of Oftel residential survey Q3 November 2000

[71] Kingston Communications in Hull also owns local loops in its area, and is also required to offer unbundling. However, the incumbent operator is referred to as BT in this discussion, for simplicity.

[72] (EC) No 2887/2000 EU Regulations are directly binding - they do not have to be interpreted through national law.

meet all demand for co-location. The Select Committee placed blame for this situation on all parties - BT, other operators and Oftel.

By October 2001, 45 distant location sites and 10 physical co-location sites (see box above) had been completed. Therefore, it is likely that it will be some time before the benefits of unbundling are seen by end users. The charges by BT for co- and distance location have been investigated by Oftel and have resulted in price reductions in a number of areas. There is debate over the reasons for operators' withdrawals from the unbundling process, with suggestions including:

- difficulties with the process.
- concerns over demand for ADSL.
- wider restrictions on investment following the telecoms market collapse.
- that BT's wholesale ADSL service represents a more cost effective solution.

Local loop unbundling has been unsuccessful across much of Europe, for a variety of reasons, but experience in Germany has shown that it can work. Unbundling began in Germany in 1998 and over 500,000 lines are now unbundled[73] - more than the rest of Europe combined – although only 40,000 of these are used for ADSL. However, wholesale ADSL is not available in Germany, so ISPs have no choice but to use unbundled local loops.

Cable

Cable networks in the UK use a combination of co-axial and fibre optic cable to provide digital television, telephone and internet access (either narrowband or broadband, although not all networks are broadband ready). In the UK, cable has been slow to roll out high speed internet access – there were around 170,00 cable modem subscribers in November 2001. Cable services in the UK are provided by NTL and Telewest, and include:

- **Television** - both digital and analogue services. Of NTL's interactive TV services, the Games Channel has 6-7,000 users per week playing 15-20,000 games. NTL also offer full internet access viewed on the TV.
- **High speed internet access.** Both NTL and Telewest offer broadband internet access using cable modems, at speeds of up to 512kbps (although the cable modems work at speeds of up to 6Mbps[74]). These cost between £20 and £33 per month for residential users. NTL also offers a 128kbps always-on cable modem service for £14.99 per month. The number of cable modem customers is greater than that for ADSL, although still only a small proportion of UK internet users. This is in contrast to the Netherlands, where 20% of internet users have high speed cable modem access, and the USA with 5.5 million users.
  NTL also launched a service in summer 2001, which uses a combined cable modem and set-top box to offer broadband internet access. It is also testing a 'fibre-to-home' service in London, bringing optical fibre to users' doors with speeds of up to 10Mbps.
- **Narrowband internet access**, both metered and unmetered.
- **Telephone services**

Table 4 on the next page gives details of subscribers to cable services in the UK, at the end of September 2001.

[73] As of 30 September 2001, Seventh Report on the Implementation of the Telecommunications Regulatory Package, EC, November 2001, COM(2001) 706

[74] Although, because bandwidth is shared (see page 111), individuals will not receive access speeds as high as this.

Table 4: UK cable subscribers, September 2001

Cable company	Number of subscribers (thousands)				
	Analogue TV	Digital TV	PC narrowband internet (consumer)	Broadband internet	Telephone
ntl	1,183	1,144	709	79	2,615
Telewest	676	641	291	53	1,592

Optical fibre

Optical fibre can provide hundreds of Mbps of bandwidth, and is used for the backbone of the communications network. It is also used by businesses which transfer large amounts of data, but traditionally costs have been considered too high to allow roll-out of fibre to the home. However, these are falling, to the degree that they are becoming comparable to ADSL for new housing estates[75]. Because of the wide potential bandwidth, optical fibre is seen by some as being the only 'future proof' technology, where bandwidth can be increased as applications demand.

In Stockholm, a publicly owned company is installing a network of 'dark fibre' (with no communications equipment at either end). This can then be leased by operators to provide communications services, with the aim of allowing the market to provide highest transmission capacity at lowest cost. As a result, many broadband users are served by networks in their apartment buildings, which are then connected to the wider optical fibre network. The Swedish Government is also investing $1 billion with the aim of ensuring that broadband access reaches 98% of towns and villages. This includes subsiding a state-owned power company to deploy optical fibre networks to connect municipalities. In contrast, the UK Government's broadband policy has been technology neutral, with no subsidy for optical fibre, cable or ADSL to the home.

4.2 Terrestrial wireless communications

Ground-based wireless communications are used in a range of ways to receive and send digital communications. Methods include: digital terrestrial television, received by aerials on viewers' homes; mobile telephony for both voice and data; and fixed wireless radio, which may become available as a means of accessing the internet. This section will consider these three delivery mechanisms.

Digital terrestrial television (DTT)

Analogue terrestrial television has been delivered to UK households via television aerials for more than 50 years, and now 99.4% of the population is able to receive it. However, the TV signal can also be sent digitally, which can provide more services in the available radio spectrum, along with interactive content, all received through an aerial. DTT is not available to everyone in the UK - the 'core' DTT free-to-air services presently cover 78% of people (see box overleaf). Also, due to spectrum constraints, DTT is currently unable to offer as many services as satellite or cable TV.

Although DTT offers the possibility of better picture quality, its signal strength is currently being maintained at a low level so that it doesn't interfere with the analogue TV signal. Some rooftop aerials are unable to receive DTT, requiring viewers to install a new aerial. This is because, in many parts of the country, digital transmissions use frequencies outside the band of the existing aerial. Secondly, many existing aerials are old and corroded, or poorly installed. In such cases, a poor analogue signal can be tolerated, but a digital signal is too weak to be decoded. Also, set-top aerials and portable televisions are in general unable to receive DTT. Up to 40% of UK households use set-top aerials for at least one television in the house, but only 25% of homes may currently be able to receive DTT pictures using indoor aerials. Such coverage could be improved in two ways: by building new transmitters; and by increasing the power of the digital

[75] UK Online: the Broadband Future, Office of the e-Envoy, February 2001

signal (particularly when analogue TV is switched off and there is no longer any need to constrain power levels to avoid interfering with the analogue signals). The extent of the improvement will depend on the details of the Government's digital TV spectrum plan – this is discussed in more detail see Section 7.3.

DTT coverage

Services are carried on six different transmission networks, called multiplexes, each of which can carry 5-10 moving picture services and one or two data services. One multiplex is used by the BBC, and one by ITV, Channel 4 and Teletext, to digitally broadcast existing analogue services. These also broadcast additional services, such as BBC Choice and E4. The third multiplex is operated by SDN (S4C Digital Networks) and carries S4C and Channel 5. ITV Digital (owned by Carlton Communications and Granada) operate the other three multiplexes, offering a range of subscription services such as Sky Sports and pay-per-view services showing sport and films.

However, as there are only 80 digital TV transmitter sites at present (compared with over a thousand for analogue), DTT coverage is not as widespread as that for analogue TV. 81% of the population can receive the BBC multiplex, falling to 74% for one of the ITV Digital multiplexes, while 78% can receive the 'core' free-to-air services. At present slightly more than two thirds of the population have access to all six multiplexes[76] but there are plans to improve this to 73% of UK households. With constrained power increases (to avoid interfering with analogue TV), the coverage of the existing 80 transmitters could be raised somewhat but to increase coverage further would require new transmitters. Multiplex operators are under a general requirement to improve coverage as opportunities arise, but do not have specific coverage targets in their licences.

DTT offers free-to-air channels for those with a digital TV set or their own set-top box (see Chapter 3). Pay services are provided by ITV Digital, which offers TV channels and interactive services. As of December 2001, a basic package of channels cost £12, and a full package £35 per month (plus extra for individual channels such as Filmfour).

ITV Digital had 1.2 million subscribers[77] by September 2001, but has problems with a high 'churn' rate (the number of subscribers who join and then leave), which is currently at 23%. Commentators ascribe this to customers who bought a yearly pre-pay TV package but decided not to renew once the year was up. It has revised its subscriber targets, now hoping for 2 million by 2004, a year later than previously forecast, and it is estimated that Granada and Carlton will have invested £1.2 billion in the service before it breaks even.[78]

DTT, like other digital platforms, can include interactive services. ITV Digital also offers full internet access via its ITV Active service for £5 per month (plus call charges) - which is also available to those without a pay-TV subscription. This has a separate set-top box, which uses the phone line to access internet content, translating web pages so they can be viewed on the TV screen. In November 2001 ITV Digital announced a deal with Bush Internet TV. As a result, more than 250,000 ITV Digital and Bush Internet TV customers have ITV Active as their home portal. Internet access through the TV has particular implications for education and access to Government services, which are discussed in more detail in Section 5.5. Of homes with digital TV, 10% access the internet in this way[79]. Because those with digital TV and conventional dial-up internet access tend to be different (although overlapping) demographic groups, internet access though digital TV could potentially play a large part in the Government's plans for universal internet access by 2005. This will be considered further in the discussion of the digital divide in Section 7.1.

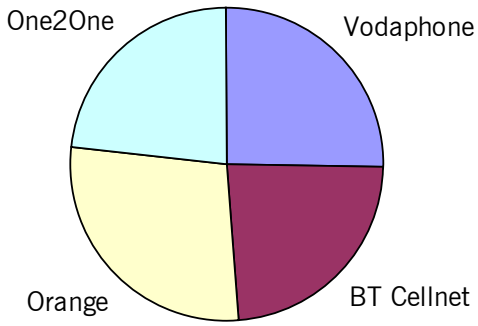
[76] Source: Digital TV Group.
[77] This is around 15% of digital viewers - worldwide only 5% of digital viewers use DTT (74% use satellite).
[78] The Observer, 1 July 2001, 'Does switch-off loom at Ondigital?'
[79] Consumers' use of digital TV - summary of Oftel residential survey, conducted August 2000

It could also be possible for viewers to *send* information via DTT, using their rooftop aerial. Standards have been approved for such an always-on wireless return path. However, it is as-yet unproven, and is frowned upon by many in spectrum management as it implies a large number of uncontrolled low power transmitters.

Mobile phone networks

There are four main mobile networks in the UK - the split of consumers is shown in Figure 8. In general, calls cost between 2p and 50p a minute in the UK, depending on when the call is made and whether it is to a land line or another mobile. Customers spend an average of £18 per month on mobile usage, with pay-as-you-go users spending a third as much as those with contracts[80]. As well as the four network operators, there are also 'virtual' mobile phone operators such as Virgin Mobile, which works on the One2One network. These virtual operators use their brand name and service packages to differentiate themselves from the network operator.

Figure 8: Subscribers on each of the main UK mobile phone networks[81]



The total number of minutes spent on mobile calls has increased rapidly (11 billion[82] minutes in April-June 2001, up 30% on the previous year). [83] However, as the number of pre-pay subscribers and text messages grows, the time spent per subscriber is decreasing.

Oftel undertook a survey in February 2001 which compared the costs of mobile phone packages and handsets in a number of European countries. Results are shown in Table 5 (which gives a price index, based on the two cheapest offers for a range of packages in each country), alongside the change in price compared to a similar survey in August 2000.

Table 5: International comparison of mobile phone costs[84]

Country	Average price index (UK=100)	Change in price since August 2000
UK	100	-2%
France	127	-2%
Germany	112	27%
Italy	146	5%
Sweden	116	15%

Oftel concluded that, on average, prices in the UK were lower than the other countries surveyed, and UK prices were particularly competitive for customers who did not use their phones often.

[80] Consumers' use of mobile telephony – Summary of Oftel residential survey, Q6 August 2001
[81] Oftel survey as above (figures are survey data, rather than industry subscriber figures, although they are broadly comparble). Note that One2One includes customers with Virgin, a 'virtual' operator which uses One2One's network.
[82] US billion: 1,000 million
[83] Oftel Market Information: mobile update Q1 2001/02 (April to June 2001), published October 2001
[84] International benchmarking study of dial-up PSTN Internet access, mobile and fixed line services, Oftel, June 2001

UK prices had also decreased in the previous 6 months, in contrast to an increase in most of the other countries surveyed.

Data services

Although mobile phones are currently primarily used for voice telephony, the introduction of a new generation of wireless standards in the next few years should see a move towards more data being sent and received through mobile networks.[85] As discussed in Section 3.4, mobile phones currently use second generation (2G) technology. The next generation 3G standards (and intermediate 2.5G) should allow increased speeds of data access (although opinions differ about how fast these services are likely to be). This section will examine the development and deployment of new data services, the future market, and policy issues raised by 3G spectrum auctions and planning concerns.

The first signs of a trend towards mobile data may already be apparent, with the emergence of text messaging and WAP (see box on page 38). Text messaging (SMS, or 'texting') has grown rapidly over the last two years, although this seems to have slowed down. The number of messages sent nearly doubled in the year to June 2001 (see Figure 9 below). Although text messaging is commonly considered the preserve of school children, it is used widely by other groups such as business. Indeed, a recent survey revealed that more than a million over-55s send text messages[86].

Oftel's survey of mobile telephony use by small and medium-sized businesses in February 2001 confirmed that use of mobile data services by business is already widespread. Figures are shown in Table 6, but of particular interest is:

- 60%-65% of small and medium-sized businesses used text messaging services.
- 26% of medium sized businesses used mobile email, and 22% mobile internet.
- 15% of medium sized businesses used WAP phones.

Figure 9: Number of text messages sent[87]

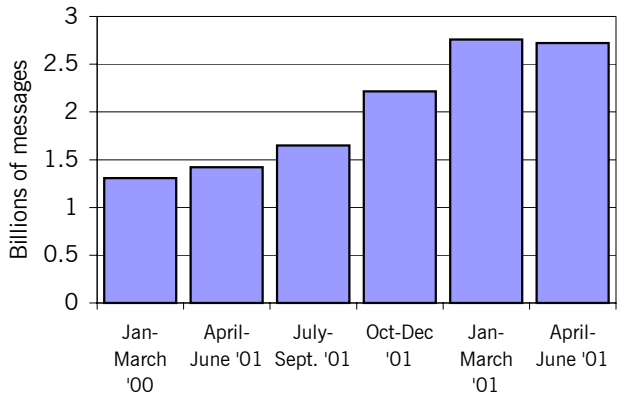


Table 6: SME use of mobile data services[88]

	Small businesses (%)	Medium businesses (%)
Text messaging	60	65
Email	10	26
Internet	9	22
WAP phone	10	15

[85] Note that this is not necessarily synonymous with the internet - many 2G mobile banking services, for example, connect users directly to their internal computers, avoiding the internet and consequent security concerns.
[86] Embracing Technology, Egg/Mori, 3 September 2001
[87] Oftel Market Information: mobile update Q1 2001/02 (April to June 2001), published October 2001
[88] Business use of Mobile Telephony, Oftel Small and Medium Business Survey, February 2001

'2.5G' technologies are already being introduced; BT Cellnet (now mmO2) launched the world's first 2.5G GPRS service in summer 2000, with a data rate of ~28kbps. Some of these standards are discussed in the box below. All 2.5G and 3G technologies can offer 'always on' access.

Mobile data services leading to 3G

2G - WAP services
As discussed in Section 3.4, all four UK mobile network operators now provide Wireless Application Protocol (WAP) services running on the 2G 'GSM' network, with data rates of 9.6 kbps. These allow mobile phones to view cut-down web pages, written in 'wireless mark-up language' (WML). World wide web pages (in hyper-text mark-up language - HTML) can be converted to WML, but this is complex, so some providers have written separate versions of their web pages in WML. However, this means that the number of web pages accessible by WAP phones is heavily restricted (there are 10,000 WAP enabled websites and 7.8m WAP pages, compared to over 2 billion HTML pages).

WAP calls are sent from user's mobile phones across the network to a WAP gateway, and hence to the web server requested. Each operator has its own WAP gateway but customers are able to access other operators' gateways (although in practice there seems little reason to do so at present). Calls to the customer's 'home' gateway are charged by the operators at 10p or 5p per minute.

However, WAP has not met many of the predictions for its use. A more successful example of a data service is Japan's i-mode, developed by NTT DoCoMo, which has over 20 million subscribers. i-mode is based on a rival standard to WAP, known as compact HTML, an adaptation of the standard web programming language. It also uses 'always-on' technology - rather than having to dial-up and wait for a connection to download data, access is immediate - so customers are charged according to the amount of data they download rather than the time online. i-mode's comparative success has been ascribed to a number of factors, including:

- a user-friendly terminal, with colour screen, using images and animation
- a large number of third party content providers, offering games, shopping etc.
- the 'always on' standard means users don't have to wait while a connection is made, and allows faster data transmission

GPRS (General Packet Radio Service)
GPRS 2.5G services are now beginning to be rolled out across the UK, offering data rates of ~28kbps - comparable to standard wired access using a modem. GPRS is an 'always on' service, so customers are charged according to the amount of data they download (rather than the time it takes to download, as with 2G). However, it remains to be seen how sustainable this model is: customers may prefer to pay a flat rate subscription (as with wired always on services such as ADSL), rather than be unsure how much it will cost to download a particular web page.
When launched in spring 2001, monthly contracts with BT Cellnet cost around £8, including receiving 1Mbyte of data per month (equivalent to around 500-1,000 WAP pages). Alternatively users could pay £4 per month, plus 2p per kbyte. Voice calls are charged separately. An alternative pricing model is used by the Blackberry device, an always on GPRS email device marketed by BT Cellnet, which costs a flat rate per month.

EDGE (Enhanced Data rates for GSM Evolution)
EDGE upgrades existing 2G networks to allow data rates of up to 384kbps (again, actual rates are likely to be lower). Compared with UMTS, it requires less extensive upgrades of infrastructure but has a lower maximum data rate. Service providers who failed to acquire 3G licences may choose to use EDGE instead - AT&T has announced its intention to take this path. Some analysts suggest that UMTS could be used in cities, while EDGE is deployed in other areas.

3G mobile services
There are five world standards for third generation mobile phone services. The UMTS (Universal Mobile Telecommunications System) standard will be deployed in Europe (and elsewhere), and has been designed allow higher data rates than 2G or 2.5G. In practice mobile operators suggest data rates for users are likely to be around 300-400kbps (although some analysts suggest rates as low as 20-30kbps). Even these lowest estimates are still comparable to current fixed narrowband links. Third generation phones hit the headlines in late 2000 with the Government's auction of radio spectrum for UMTS services, which raised £22bn and licensed 5 operators to provide 3G services. UK mobile operators aim to launch 3G services in the second half of 2002, initially in urban areas. They are required to roll-out networks to cover 80% of the population by

2007, which may need as much investment as buying the licences. However, as operators compete based on their networks' coverage, industry analysts suggest that roll-out could be faster than specified in the licence conditions.

NTT DoCoMo in Japan and Manx Telecom both launched trial 3G services in autumn 2001. Manx Telecom, a subsidiary of mmO2, is working in partnership with NEC and Siemens, and made its first test 3G video call in June 2001. NTT's service launched in Tokyo in October 2001, and is planned to launch commercially and extend to other Japanese cities by the end of the year. It aims to attract six million users, with 97 percent coverage, within three years. Initial reports were that the more expensive videophone-enabled handset sold out within a couple of days of launch. Originally planned for launch in early summer 2001, both DoCoMo and Manx Telecom's commercial services were delayed due to technical problems with handsets.

Mobile data services will undoubtedly have a range of uses, including mobile email and location specific applications. However, with the large amounts paid for spectrum licences (see below) and the high cost of building networks, commentators are considering where profits from 3G applications will be made. It is possible that providers will attempt to take a percentage commission on the cost of retail transactions conducted over the phone - similar to credit card companies. NTT DoCoMo already use this model. However, views differ as to whether 3G will lead to an increase in average revenue per user. Credit rating company Moody's predicted in April 2001 that 3G services would need at least four or five years of operation to break even.

Spectrum Auctions

In April 2000, the Government completed its auction of radio spectrum for 3G mobile phones. The five licences to run 3G services in the UK were sold for a total of £22.5bn - many times more than predicted by industry or analysts. Licences were won by the four current service providers - Vodafone, BT Cellnet (now mmO2), Orange and One2One - and Hutchison (65% owned by Hong Kong's Hutchison Whampoa). Auctions in varying forms were also employed by other countries, with differing results. Germany's auction raised over £30 billion, but the Austrian auction raised only ~£450 million, while Singapore attracted only three bidders for its four licences.

Spectrum in the UK is currently managed by the Radiocommunications Agency, although under the Communications White Paper proposals (see Chapter 2) this responsibility would fall to OFCOM. Until 1998, spectrum could be assigned only by administrative means. The possibility of spectrum auctions was introduced by the Wireless Telegraphy Act in 1998 and the 3G auctions were the first in the UK to test this new process. Coming at the height of the high-tech stock market bubble, the auctions were very 'successful' in terms of money raised. However, many commentators have criticised the amount which the auction winners paid, considering it a 'tax' on a rapidly growing and important sector of the economy and calling for some of the money to be refunded. Some, such as Vodafone, argue that the auction has resulted in a lack of capital and investment for fixed and mobile operators, and that this could have a long-term effect on network coverage.

Although there are undoubtedly concerns over the commercial viability of the new services given the amount invested in them, only time will tell whether the price determined by the market for the 3G licences was sensible and the auction's long term implications. The National Audit Office, in its report on the auction[89], noted that the price paid for the licences was decided by industry, not Government, and concluded, "*We have [...] found no strong evidence that the level of*

[89] The Auction of Radio Spectrum for the Third Generation of Mobile Telephones, Report by the Comptroller and Auditor General, HC 233 Session 2001-2002: 19 October 2001

proceeds of the auction will have a negative impact on the wider economic benefit of 3G in terms of taxation and employment in the UK." NAO also suggested, "*It is not evident that the cost of the licences will increase the price of 3G services to UK consumers*."

However, in the latest spectrum auctions for fixed wireless spectrum half the licences remained unsold (see page 42), although the Radiocommunications Agency notes that it did succeed in establishing the real market demand. The White Paper included proposals to allow spectrum trading - where a company can sell its spectrum rights to the highest bidder. Changes to EU law are proposed which will allow this trading. Under such a scheme, spectrum auctions would not be the only means of acquiring a delivery capability, and the Radiocommunications Agency hopes that it would facilitate competition, innovation and economic growth, while giving companies an incentive to use their spectrum allocation more efficiently. Such issues are currently being considered by an independent 'radio spectrum management review', set up by the Treasury and DTI. The review is led by Professor Martin Cave of Warwick University Business School and plans to report by the end of 2001. Around 70 responses were received to the consultation paper, which discussed issues including valuing the spectrum allocated to public service broadcasters[90], defence use of the spectrum and the role of spectrum management within OFCOM.

Health and planning issues

Over the last few years, concern has been expressed about the health risks of radiation from both mobile phone handsets and base stations. In the UK, the May 2000 Stewart inquiry into mobile phone health risks[91] found that the balance of evidence to date suggested that exposure did not cause adverse health effects, but proposed a precautionary approach, recognising that many significant uncertainties remain with potentially serious consequences. The report advised that children should be discouraged from using mobile phones for 'non-essential' calls and a Department of Health leaflet is now included when mobile phones are sold, which advises children against using them for long periods.

Concerns over the health effects of mobile phones and masts could have an impact on the success of 3G mobile phone systems. Operators express particular concern about potential difficulties in expanding the networks of masts. The industry recently signed up to 'Ten Commitments', which aim better to address public concerns about the siting of mobile phone masts and increase transparency. These commitments include greater consultation with communities, more information on site sharing, specific staff to respond to complaints about base stations and support for the Government's scientific research on mobile health issues. Planning requirements in England and the devolved administrations are also being strengthened to increase public consultation. Planning considerations are discussed more generally in the box on the next page.

[90] The Communications White Paper notes that the extent to which payment by broadcasters may be required for their use of the spectrum will need to take account of factors such as payments made under the Broadcasting Acts by commercial broadcasters, public service obligations and digital switchover. The application of spectrum pricing to broadcasting will be taken forward as part of the work on digital switchover.

[91] Mobile Phones and Health, Independent Expert Group on Mobile Phones (IEGMP) chaired by Sir William Stewart, May 2000

Planning

Local planning concerns are most often voiced in relation to mobile phone masts but also apply to infrastructure such as satellite dishes and streetworks for communications cables.

Mobile phone masts
Recent years have seen growing concern over the siting of mobile phone masts and base stations (such as antennae on buildings). Public disquiet has been especially strong for sites on or near buildings mainly occupied by children, such as schools and nurseries, As a result, Kent Council has introduced a moratorium for base stations on Council property (e.g. schools) and the Radiocommunications Agency is currently undertaking an audit of base stations on school sites. So far, the audit has found emission levels well within safety standards. In total, there are about 22,500 base station sites, of which around 6,000 are ground-based masts. It is estimated that about 3,000 extra masts will be needed in the next three years, although mast-sharing could reduce this number. Further masts could also be required for fixed wireless radio services. However, technological advances are introducing the possibility of small antennae at street level or under the eaves of buildings.

Until recently, masts above 15 metres required planning permission, while smaller installations needed varying degrees of prior approval and public consultation. The Stewart report proposed that all base stations should be subject to standard planning permission procedures. In Scotland, new planning regulations came into force in July 2001 so that all new ground-based masts require planning permission. Restrictions on the number and size of masts on buildings were tightened, with particularly strong restrictions in conservation areas, national scenic areas, heritage areas etc. With the introduction of the new regulations, companies were give two weeks to complete development already started - this timetable was criticised by mobile phone operators, who also expressed concern that the new rules would impede the roll-out of third generation mobile phones and fixed wireless broadband services in Scotland without improving the level of public consultation. The Environment Minister in Northern Ireland has indicated that full planning permission for new mobile phone masts may be introduced.

In England, the Government has stopped short of full planning permission for masts below 15m, but has strengthened public consultation requirements so that these are the same as for planning permission. It has also underlined that school governors must be consulted on proposals for masts on or near a school or college. To implement these changes, the Government issued new policy guidance on telecommunications mast planning in August 2001. Similar requirements are being introduced by the Welsh Assembly. Operators must already consider options for mast sharing under the conditions of their licences, and most sites are currently shared. Nevertheless, to encourage this further, the House of Commons Trade and Industry Select Committee[92] recommended that local authorities "*are entitled to be given proof positive that mast or site sharing has not only been considered but discussed with potential partners*." The new industry 'Ten Commandments' should make information about site sharing more publicly available. Concerns that infrastructure sharing could impact on competition appear to be diminishing.

Satellite dishes
In the UK, planning permission is not generally required for the installation of a satellite dish but it can be necessary if the property is in a national park or conservation area. Homes are restricted to one antenna (with planning permission required for a second dish), which could be a problem for people who wish to receive both TV and broadband internet services via satellite and for properties with multiple occupants. Although a single dish could theoretically receive both TV and internet services, this would require a degree of co-ordination among service providers - or regulation to ensure interoperability. The EC has recently adopted a Communication setting out individuals' right to use a satellite dish without undue planning obstacles. It notes that planning concerns can be met by solutions which minimise the visual and aesthetic impact of dishes (such as installing them indoors). However, it still allows for restrictions to "*preserve the consistency of an architectural whole and the aesthetic feel of neighbourhoods which have a special historical or artistic value*."[93]

Streetworks
Cable and telecommunications companies have a statutory right to lay their equipment in roads but since April 2001 local authorities have been able to charge utilities where works are not completed to an agreed timetable. In addition, two local authorities (Camden and Middlesborough) plan to conduct pilots of 'lane rental' schemes in January 2002 - whereby authorities can charge utilities up to £500 per day from the start of streetworks. The Department of Transport, Local Government and the Regions has recently concluded a consultation on regulations to allow this approach. However, the utilities argue that this would be a tax on them and a disproportionate response to a 'minute contributor' to the overall problem of traffic congestion.[94] As an alternative, they have launched a voluntary 'streetwise' charter, committing them to meet obligations in areas such as safety, duration of works, and environmental impact.

[92] Mobile Phone Masts, Tenth Report, Session 2000-1, March 2001, HC 300
[93] Commission Communication on the application of the general principles of free movement of goods and services - articles 28 and 49EC – concerning the use of satellite dishes (COM(2001)351), 7 June 2001
[94] Press release, National Joint Utilities Group, 14 August 2001

Fixed wireless

Broadband fixed wireless access uses the radio spectrum to provide high speed internet access without the need for telephone wires or cable. Depending on the frequency of the spectrum, maximum data speeds can be from 500 kbps to many Mbps. Users attach an antenna to the outside of their building (hence 'fixed' wireless) and receive data from a central transmitter. Fixed wireless access can offer advantages, for example in areas where ADSL or cable is unlikely to reach, although there may not be a business case for wireless broadband to rural communities, at least in the early years of the service. It also has problems with 'reach', can be subject to interference, and tends to have higher equipment costs than comparable wired services. An alternative version, called 'mesh radio', has recently been proposed, which allows the antenna at customer's site to link via other customers' sites. This creates a 'mesh', allowing infrastructure to grow organically, and reducing the transmitter power needed – such a solution may help increase coverage in suburban and semi-rural areas.

Although in its early days, fixed wireless access is now offered in the UK. A range of download speeds are available from 32kbps to 1 Mbps, but coverage is currently geographically limited. For a standard package of 512kbps to the user, customers would pay an installation fee of around £150-200 +VAT and £40 + VAT per month. This allows an unlimited amount of data to be transferred.

Licences for fixed wireless spectrum in 14 regions were auctioned by the Government in November 2000. Of the 42 available licences, only 16 were sold - half the regions were left without any licences. The areas where licences were sold cover 57% of the UK population, including Scotland and Northern Ireland. However, the lack of success in the auction has been interpreted by some as an indication that commercial fixed wireless services are not likely to be commercially viable in some areas.

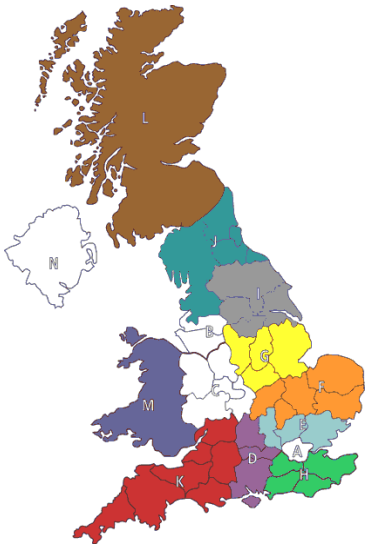
A Radiocommunications Agency report on the auction[95] found that the slump in the stock market in the six months prior to the auction had reduced companies' ability to fund major investment and made them risk averse. Comparisons with the 3G auction had led to concerns that prices would be too high to allow an acceptable return on investment, and commitment to rolling out services in other European countries had stretched operators' resources. In addition, the technology is commercially untested, and part of a competitive broadband access market.

The Government is currently running an auction for the unsold licences, which commenced in mid-October and will continue for a year. Areas where licences are available are shown on the map below (Figure 10). Reserve prices for each licence are £1 million or £2 million, and organisations which submit bids are required to place a 10% deposit of the reserve price. If no other bids are received within 20 days, a provisional licence will be awarded - if other bids are received, an auction will be held. Such a scheme has the advantage of allowing companies to apply for licences when they feel the time is right, but it remains to be seen whether this will be enough to ensure the sale of licences in all regions.

[95] Summary Report On 28 GHz Auction, 13 February 2001

Figure 10: Broadband fixed wireless licences for auction[96]

Shaded areas indicate available licences



4.3 Satellite services

Satellite is the third method of receiving communications data, alongside wired systems and terrestrial wireless. In the UK, satellite TV is popular but it is also now becoming possible to receive internet access direct via satellite. This section will consider these two techniques.

Satellite TV

BSkyB (generally known as Sky) is the leading provider of satellite TV services in the UK. As of November 2001, Sky had almost 5.5 million direct to home UK digital subscribers - Sky switched-off access to analogue services in September 2001. Churn (turnover of customers) for the year was 10%, compared with ITV Digital's 23%.

There are now over 300 channels on digital satellite in the UK, about 120 of which are retailed independently from Sky. The Astra satellites used are owned and operated by SES (Société Européenne des Satellites). As of 31 October 2001 these channels included:

- 50 free-to-view channels, such as *Sky News* and *BBC* channels
- 81 basic subscription channels
- 63 premium, à la carte and bonus channels
- 73 pay per view channels
- 80 audio music and radio channels
- 18 subscription channels (not retailed by Sky)

Sky Interactive, a division of Sky responsible for interactive services, provides access to a 'walled garden' which includes email, banking and shopping with high street retailers such as Argos and Dixons. While some of Sky Interactive's services are delivered as WML[97] from public internet sites, Sky Interactive does not yet offer an open world wide web internet product. Sky text, launched in December 2000, allows users to access additional broadcast information and is free-to-air. Sky Active, Sky Interactive's 'portal' is available to Sky viewers at no extra subscription cost, but some services require dial-up access which is usually charged at local rate. During the quarter to September 2001, £47m in revenues had come from interactive services, of which £27m related to betting. Sky Sports Quiz, an interactive service, had generated over 1 million

[96] Multimedia Access Auction of 28 GHz Broadband Fixed Wireless Access Spectrum Licences - Information Memorandum, Radiocommunications Agency, September 2001

[97] The language used to write content for WAP phones.

premium rate calls by June 2001.

Satellite internet

Satellite services offer a means of providing internet access to areas which wired, and even terrestrial wireless, systems do not cover. Such systems can provide both fixed and mobile services. Fixed services use a TV channel to transmit data to homes and businesses, at rates of up to 38Mbps. Data sent to each user is broadcast by the satellite, but encoded so that only the intended recipient can read it (although 'multicasting' can also be used, where the most commonly accessed web pages are broadcast and stored at the users' end, for access when needed). The return path to the satellite is generally via a phone connection, although it is also possible to send return data direct to the satellite. At the end of November 2001, BT launched a satellite broadband (500kbps download and 150 kbps upload) service, aimed at small and medium-sized businesses. For a single PC to connect, this costs £70 (plus VAT) per month with an installation fee of £899 plus VAT. So it is significantly more expensive than the comparable ADSL service, with particularly high upfront costs for installation. However, small businesses in rural areas may be able to receive support – for example, Highlands and Islands Enterprise have allocated £250,000 to help with one-off installation costs.

The Government's document *UK Online: the broadband future* suggests that the cost of user equipment could be an important issue for satellite broadband - although this is disputed by the Federation of the Electronics Industry[98], who note that the cost of such access depends on a range of elements, of which the service specification (data rate etc.) has the most impact on cost. Overall, the cost of user reception equipment could be similar to that for digital TV - and actual price to the user will depend on how service providers choose to combine installation, usage and connection charges.

Mobile data services via satellite are currently available globally, at rates of up to ~64 kbps. However, the commercial history of such technologies has not been smooth. The Iridium constellation of 66 satellites started to deliver communications services to satellite mobile phones in November 1998 - but by March 2000, fewer than 55,000 phones had been sold, and Iridium had filed for bankruptcy. Iridium's services were felt to be too expensive (at $2 per minute) and were unable to deliver data services. Even so, the satellite constellation was bought and the service re-launched in March 2001, including offering data services of up to 10 kbps. Inmarsat's services currently offer data rates of up to 64kbps and it is these which have been used by in Afghanistan to send video reports (although these do not use handheld terminals, but terminals the size of a laptop computer). There are several satellite constellations in operation and proposed by 2003, which may offer higher data rates, and local services (for example, covering Europe) already offer access speeds of up to 144kbps.

[98] Satellites in Future Broadband Services, FEI Satellite Working Group response to UK Online: the broadband future.

5 Content background

Convergence is already having effects on media content. Newspapers' web sites enable them to publish in-depth stories where they don't have space in the main paper, and host on-line chat services with politicians. Programmes such as Big Brother combine interactive television, internet and text messages. Even political parties send text messages and email updates to voters. Content will be the driving force behind the take-up (or failure) of new technologies. This chapter considers different types of content which may be available, focussing on:

- interactive services, including gambling and gaming
- commerce and business applications; and
- location specific services

Although convergence implies that similar services will be available on different media, this does not mean that exactly the same content will be provided. At present, each medium (for example, digital TV, the internet and WAP phones) uses a different standard, so an advertiser wishing to sell via all of these needs to create a separate format for each. However, even if they all used the same standard, each medium has different strengths and weaknesses which are likely to be reflected in its content. In the same way that films are often watched at the cinema but a soap opera is more usually watched at home on television, so some types of content will be more appropriate for specific media. Dense web pages full of text will never be ideal for digital TV - TV text services rarely have more than 10 or 12 lines of text. However, they would be suitable for e-book readers. Watching a three hour film on a mobile phone is unlikely to be enjoyable - but a two minute video clip could be fine.

So some content will be aimed at particular media, and convergence could contribute to a diversity of content. Other content is likely to be available in some form on all delivery channels. For example, advertisers already put across their message on many media, ranging from magazines and newspapers, through interactive TV, to text messages. Sports results are also available in many forms. Although these are all tailored to the devices on which they are delivered (watching a 90 minute football game is not possible by text message), the information content is similar. Central email servers allow users to access their email wherever they are and on a range of different devices from digital TV to mobile phones. The key point is that users can decide how they wish to receive these services.

5.1 Interactive applications

In traditional one-to-many communication, such as analogue television and newspapers, it was not possible for individuals to interact with the medium - beyond a letter to the editor or buying a product advertised. The internet and digital television have changed this, allowing users to play games, buy books and even gamble online. Convergence will encourage these interactive applications by enabling retailers and businesses to distribute their products in a number of ways, using mobile phones, interactive televisions and the internet. However, for such applications to be successful, they will need to meet users' expectations of speed and ease of use.

Interactive services on digital TV

There are three main types of interactive service which can be provided through digital TV (although these distinctions can be blurred):

- access to the internet or worldwide web.
- interactive services designed for the TV, which makes use of the TV browser's capabilities and offer services such as shopping malls, games or home banking.

- enhanced TV applications and games, where the interactive application is specifically written for the TV and supplements a broadcast programme (such as the news).

The four main digital TV operators in the UK offer various combinations of these services, which are considered below.

Internet access
Both ITV Digital and NTL offer access to the whole internet for any TV, either digital or analogue, and users pay a monthly subscription fee (which is separate from the cost of digital TV). ITV Digital, through its ITV Active equipment, provides open access to the internet through a separate set-top box which uses the telephone for both upstream and downstream communications. Essentially, the set-top box and TV screen replace the traditional computer/modem and monitor. NTL offer full internet access through the digital TV set-top box (also for analogue or digital TVs), again with the TV set acting as a monitor. More than 250,000 people now use ITV Active as the home portal for their internet TV service (including Bush Internet TV users – see Section 3.5).

Digital TV has advantages for internet access. Some users like being able to surf the internet while watching TV, and prefer having such access in the living room. However, some viewers express the opinion that the TV is a communal resource, and 'taking it over' for viewing interactive services is 'selfish' when others are watching – this is a concern for TV-specific interactive applications as well as full internet access.[99] Online banking via the TV in particular was rejected as not private enough and too analytical for what is essentially a casual home environment, although games were more successful.

Importantly, internet through the TV does not require a large initial outlay to buy a computer and people may be less worried about having the skills needed to operate the equipment. Operators suggest, therefore, that it is particularly appropriate for viewers who have never used the internet. They also propose that it may help to drive usage of the web by linking the content of people's favourite TV programmes directly to related web sites. For these reasons, it has been suggested that TV-based access could contribute to meeting the Government's goal of universal internet access.

The House of Commons Culture Media and Sport Select Committee recommended that, "The promotion of internet access through digital television become a more prominent element in Government policy for the internet."[100] In its response, the Government agreed that the TV and phone line could provide an easy means of gaining access to the internet for those without a computer, and that the digital television action plan would develop these synergies. However, it also observed that, "*much of the material available on the internet … is designed for access through a PC, and we must be careful to see that customers are not deterred from using the internet by a poor early experience through the television*."

TV web pages generally need to be 're-authored' for the TV screen, which has lower resolution than a PC screen and is viewed from further away. This process converts standard HTML pages for display on the TV screen, by increasing the font size, for example. Many standard web sites can be accessed through the TV, but more complex sites which use extra software may not be accessible. In addition, text-heavy sites will not be easily read on a TV screen. Web content creators are starting to write sites specifically for TV-based internet browsers, where the web site identifies which browser is being used, and sends a page in the appropriate format. TV operators' portals point users towards a selection of these TV-specific sites.

[99] Digital Television – Consumers' Use and Perceptions, Counterpoint Research, August 2001, prepared for Oftel
[100] Report on The Communications White Paper, March 2001.

As well as the fact that not all web pages translate well to TV, there are other disadvantages to accessing the internet via a television. Navigation does not use a mouse and is by means of arrow keys only – although this is not unusual for those who are not used to a PC. TV-specific content is designed to make it easier to navigate using arrow keys, but some other web pages may cause more difficulties. Also, there is generally no means of printing material off, and the set-top box is not as flexible as a PC for storing files, adding software etc.

Interactive services designed for the TV

All UK digital TV operators offer some TV-specific interactive services, such as shopping malls, online banking and email, although the extent of these services varies. All operators (satellite, cable and terrestrial) allow users to send and receive emails via their TV and a linked telephone line, and 1.75 million of Sky's 5.5 million subscribers have used this service. Cable operators use the cable itself as the return path, so there is no delay or cost associated with the use of the telephone line. However, there have been concerns over email via the TV, especially around compatibility with PC email and using attachments.

ITV Digital's TV set-top box (as opposed to the extra internet browsing box) currently offers a limited number of interactive services with a return path from the viewer, supporting only email and buying pay-per-view services (although ITV Digital plans to launch a full return-path service next year). Sky Interactive provides limited access to internet-type content through an enhanced WML browser, which uses the programming language developed for WAP phones. Only sites whose content is approved by the service provider and designed specifically for the TV can be accessed. Cable operators provide a similar service (in addition to the full internet access referred to in the previous paragraph). Research[101] shows that 8% of digital TV viewers had purchased goods via interactive TV in the previous six months, while 59% of NTL's digital TV viewers use interactive services weekly, and over one million emails are received each month through the TV by NTL customers.[102]

To gain access to these 'walled gardens', content providers must sign a contract with the platform operator which generally includes revenue for the operator – for example, directly from the content provider, a proportion of retail revenue or a proportion of phone call costs. Because each delivery channel uses a slightly different programming standard, each interactive service has to be tuned to support the browsers from both cable operators, ITV Active and Sky. These services are licensed by the ITC to ensure that material provided by the licensee complies with content codes, that children are not led to inappropriate content, and that viewers are not misled about whether other content is regulated or not. For example, Sky's WML browser receives some material from the internet using a modem – this content is not regulated by the ITC – while other WML content is broadcast and so is regulated. Although it is made clear to the viewer when the phone line is activated, it is uncertain to what extent viewers understand the regulatory distinctions.

Sky argue that the nature of the TV lends itself well to the delivery of specific services which are designed for the TV, while being less good at delivering the full experience of surfing all web sites. Also, with a 'walled garden' service, parents may have fewer worries about their children using it (although open internet access can also include parental controls – see Section 6.2). For purchases made on Sky's platform, the payment can be made via Sky's payment systems. Transactions are then passed to the retailer, so it may inspire less public concern over transaction security. It also allows Sky to build up a detailed picture of purchasing patterns (with potential privacy concerns).

[101] Mori survey for 4i, 4I press release, 23 May 2001
[102] NTL press release, 6 August 2001, NTL signs one millionth digital TV customer

Nevertheless, the value of information and services networks such as the internet is related to the number of sites on the network. Therefore, no matter how large the walled garden, wider access offers additional benefits, and users may prefer to choose whether to use the walled garden. It would be possible for Sky to open up its browser to all WML sites on the internet so that anyone could provide such content, but it has not yet announced any plans to do so.

Enhanced TV

Many of the interactive services (and full internet access) considered above can be viewed while the TV picture is showing on part of the screen. They can also be integrated with broadcast services – so, for example, the interactive services shown depend on the programme being watched. But some of the most successful applications of interactive services to date have been where they directly supplement the broadcast programme – this is known as 'enhanced TV'. The UK has already seen the first mass market applications of enhanced TV, which can include advertisements and commercial offers related to the programme. As examples, three interactive services from 2001 are considered in the box below: Channel 4's Big Brother, BBC's coverage of the Wimbledon tennis championships, and ITV's Who Wants To Be A Millionaire?.

Interactive TV services

Big Brother

A game show, where ten contestants are locked in a house for ten weeks and constantly observed by cameras, Big Brother was in its second season on UK TV . Each week, viewers voted to evict one member of the house, leaving a final winner after ten weeks. As well as daily updates from the house on Channel 4, the digital E4 channel (owned by Channel 4) showed up to 22.5 hours per day of live footage. Viewers could use their remote control to choose between four cameras in the house, and also to vote. Of the 2 million votes since its launch, 35 per cent of the total were through the Sky digital remote control. On 6 June, more than 30,000 votes were registered in 90 minutes through Sky remote controls. This was the first widespread use of interactive TV in the UK. Big Brother also offered SMS alerts on progress in the house, which had attracted 40,000 users within a week. In addition BT Cellnet offered Big Brother information via a WAP site - WAP usage in the UK increased by 20% in the first week of transmission.

Wimbledon

A first major use of interactive TV by a free-to-view channel was BBC's coverage of tennis from Wimbledon in June 2001. Their enhanced coverage included results, statistics, players' profiles and news reports, but different services were available to BBC viewers on satellite, cable and DTT. For example, BBC viewers watching on Sky had an ability to choose between live play on five different courts (or to watch all five at once), and 1 million digital satellite viewers accessed the interactive service each day. But footage of extra courts was not offered to DTT viewers - as there was no availability on any of the multiplex licences for the extra bandwidth required - or to cable viewers. This led to criticism from ITV that ordinary licence payers were not benefiting from the investment, and that BBC's promotion of the service on its public service channels was an abuse of the licence fee because it was essentially promoting only the satellite platform, which is not available to all viewers.

Who Wants To Be A Millionaire?

The interactive version of this quiz show launched in November 2001 and is available on the Digital Terrestrial platform on ITV2. Viewers use the number keys on their remote controls to play alongside the studio contestants and against other viewers also using the interactive version of the game. Viewers with the highest scores can put themselves forward for a prize draw.

Enhanced TV services are covered by the main broadcast licence and are lightly regulated to ensure that viewers do not move directly from a programme to advertising content, that material over which the licensee has direct control complies with ITC content codes, and that children are not led to inappropriate content. The ITC also requires that it be clear to viewers what material is not under the control of the licensee (and therefore potentially not regulated).

Gambling

Gambling is seen by some as a key driver of interactive services on digital TV. As mentioned in the last chapter, it currently constitutes the vast majority of revenue from Sky's interactive services. By pressing a button on their remote control, viewers are able to bet on the outcome of

a horse race, for example, even while the race is happening. Betting has also been successful on the internet. Datamonitor predict that online betting will be worth $2bn by the end of 2002.

Gaming

Online gaming, through internet, digital TV, dedicated games machines or even mobile phones is predicted to be a key driver of the games industry over the next ten years. All digital television providers currently offer online gaming, with 6-7,000 users playing weekly in NTL's games channel. Among the first applications of the internet were the 'Multi-user Dungeons' (MUDs), text-based virtual chat rooms in which users could play 'Dungeons and Dragons' type adventure games. The next generation of online gaming promises to be much more sophisticated and commercial, and is predicted by some analysts to be the key application of broadband internet. Online games can be played by single users, or can be interactive between users. In South Korea, the world's most developed broadband market, more than one in three Koreans subscribe to the HamGame.com site.

Streaming video

Content shown as it is received (rather than being downloaded, stored and shown later) is known as 'streaming'. Although it may remain true that the majority of video content is watched via television, there is still likely to be a significant audience for video shown through other devices such as computer screens and 3G mobile phones. Indeed, nearly three quarters of web surfers in South Korea accessed streaming video and audio content in February 2001[103]. Although current broadband offerings via ADSL and cable do not allow for high quality television pictures in real time, for some purposes such quality will be sufficient. For example, some web sites currently offer a cricket 'scoreboard' which can be positioned in the corner of a computer screen while other activities continue. A service that offered pictures of the match rather than just the score would undoubtedly have some appeal. Another idea is to allow 3G phone users at football matches to view replays of goals just scored (either in the game they are watching or in another game). Since the viewing screen is likely to be small, these could be transmitted at considerably lower data rate than conventional TV pictures (although network capacity may still be a problem).

Video-on-demand

Video-on-demand allows users to choose what film they would like to watch from a wide range, and download it digitally to be watched immediately or when desired. In the UK, video- and TV-on-demand is already supplied down ADSL lines in parts of London by Video Networks Limited through its HomeChoice service and by Kingston Interactive Television (KIT) in Hull. These were the first TV-on-demand services in Europe. As an example, HomeChoice Subscribers can access more than 1,000 films, with the ability to stop, pause, fast forward etc., and a range of subscription packages for music videos and TV programmes. Customers can also view time-shifted programmes such as current affairs and sporting events, which can be watched any time after the original broadcast ends. In addition, each family member can have different access codes, so children can be protected from viewing adult content at any time. However, Home Choice runs at a loss on each subscriber due to the high charges it pays for ADSL access.

Such services illustrate a number of issues that may affect the future of broadcasting. While at present the content of video-on-demand services is regulated by the ITC under licence, because they are delivered 'on demand' (analogous to videos hired from a shop) it is not yet clear whether they will be regulated as broadcast content by OFCOM. Of course, if the same content were delivered via traditional digital TV, it *would* be regulated through broadcasting regulation. This anomaly will become sharper if KIT and the main cable providers proceed with plans to make

[103] http://asia.cnn.com/2001/BUSINESS/asia/05/03/kr.topnetsurvey/

real-time 'broadcast' TV (such as BBC1 and ITV1) available through video-on-demand. And even videos are classified, so shops cannot sell or rent unclassified films. These issues are discussed further in Section 6.2. The fact that these services are requested by customers, rather than broadcast to a fixed schedule, raises questions over the watershed and the future of scheduled broadcasting (similar issues are considered in the section on digital video recorders in Chapter 3). Research indicates that public expectations of regulation do differ depending on the medium.[104] However, it may be that at some level of 'pull' viewing, expectations of regulation in this area align with those of TV, or vice versa. It is unclear whether OFCOM's regulatory framework will be flexible enough to address this potential shift without further primary legislation.

Adult content

The provision of pornography has been instrumental in driving the development of many communications systems, including cinema, video and the internet. Pay digital TV already includes a number of subscription 'adult' channels. It is possible that 3G mobile phones will be used to view adult content. The internet has made a range of adult photographs and short films easily available - with broadband networks, this will expand to include video, available on both a subscription basis and free. As well as commercial opportunities, this will raise issues of individual countries' laws and morality. For example, some adult satellite channels are currently proscribed by the Government so they may not be marketed in the UK. It is an offence to market the smartcards for these channels in the UK (although in practice they are easily obtainable by post from overseas and the Government's power to proscribe channels legitimately licensed in the EU has been challenged by the EC). If such content were delivered over broadband internet, no smartcards would be needed and any technical restrictions could very easily be bypassed by simple measures. Issues about regulating content are discussed further in Section 6.2, and summarised in POSTnote 159[105].

5.2 Commerce and business applications

Advertising

Interactivity raises issues concerning the regulation of advertising. 'Advertisement Features' in magazines, for example, are written to make them look like editorial content, but must be identified as adverts. Such rules can be enforced because magazines have a physical presence in the UK and are produced by a relatively small number of publishers. In interactive media this can be more difficult. On the internet, adverts can be constructed to look like search boxes, but rather than searching the page they take users to the advertiser's web site. Separating advertising from editorial content can be almost impossible - for example, some search engines are paid by companies to give higher priority to their web pages. Travel, music and sport sites can all be run commercially to generate retail sales, while some providers create and distribute games to encourage surfers to visit their site. Because the internet is global and difficult to regulate, its users may have different expectations from television viewers. Digital television can raise similar issues – ITC regulation of interactive services is considered in Section 5.1.

M-commerce

In addition to e-commerce, mobile data services provide the potential for m-commerce - the purchase of goods and services through the mobile phone. Customers in shops could go online to check whether they are purchasing at the best price, and potentially buy using their mobile phone from another store. Already mobile phones are used for financial and banking services: even limited functionality such as text messaging is suitable for alerting users to changes in share prices or their bank balances. Gambling 'in situ' at the racecourse or football match could also develop via mobile phones.

[104] For example, see A New Future for Communications, DTI/DCMS, December 2000, page 60
[105] Regulating internet content, POST, June 2001

An additional dimension to m-commerce is the employment of mobile phones in actually paying for goods. In Scandinavia, an experiment has allowed users to buy soft drinks from Coca-Cola machines by dialling a number on the side of the machine. The cost of the drink is then added to the users' phone bill. Although this could be a possibility for small payments, it is not particularly secure if the mobile phone is stolen, does not require any type of signature (even a digital one), and requires the mobile phone company to act like a bank, essentially providing credit. A different model is a 'smart card' which has value preloaded and is placed into a slot in the mobile phone. Each transaction then reduces the value stored on the card (in a way similar to current rechargeable phone cards) but this still raises concerns over authenticating the user. Issues around security, authentication and digital money are considered in Section 8.5.

Business applications

Converging communications media are likely to be widely used by business, internally and in business-to-consumer and business-to-business applications. 73% of UK businesses see e-commerce as very important to their competitive position in three years' time[106].

By September 2001, 60% of UK SMEs were connected to the internet - and 94% of medium-sized businesses[107]. In addition, 61% of small businesses owned at least one mobile phone - rising to 85% of medium businesses[108].

The Government aims for 1 million SMEs to be trading online by 2002, and has a number of initiatives to encourage business use of the internet, including:

- 100% capital allowances for investment in ICT.
- a £30 million expansion (over 3 years from 2001) of the UK online for business service.
- the 'businesslink.org' portal and related contact centre, which provides access points to a range of government information and services for businesses.
- sponsorship and dissemination of e-business analysis and research - 25 sectors were studied in 2000.

Businesses can employ new communications technologies for a wide range of purposes. The DTI's sector reports on business-to-business e-commerce point to six main areas[109]:

- Efficiency gains - in procurement, production and logistics processes, and in management of inventories and bureaucracy.
- Customer relations - better communications with, and management of, customers.
- Marketing and sales - increasing geographical reach, using intermediaries such as internet 'portals' and electronic marketplaces.
- Developing smarter companies - capturing information from electronic transactions, analysing it and using the results to alter how the company operates.
- Supply chain restructuring - allowing smaller companies into the supply chain, developing partnerships and widening procurement methods.
- New business development - creating new types of products and new business models for generating revenue.

Novel methods of interconnection can also help to improve business processes -one example is peer-to-peer networking, which allows computers to connect to each other directly, without going through a central processor (see box overleaf). In addition, convergence is likely to bring new business benefits. Companies are already using WAP phones to allow mobile workers access to

[106] UK online annual report 2000
[107] Business use of Internet – Oftel Small and Medium Business Survey Wave 6 August/September 2001
[108] Business use of Mobile Telephony – Oftel Small and Medium Business Survey Q6 August/September 2001
[109] Business-to-Business E-Commerce in the UK: A Synthesis of Sector Reports Commissioned by the Department of Trade and Industry, Dr Richard Hawkins and Dr Andrea Prencipe, December 2000

business databases - for example, delivery drivers can register when goods have been delivered and find the details of their next job. 3G services will permit a greater range of applications, with faster connection. Videoconferencing could potentially allow more flexible working, with fewer geographical constraints - although it is currently far from the ubiquitous tool many commentators predicted, use has increased in many companies since the attacks in the US on September 11. Broadband internet access could allow SMEs to gain from the e-business advantages set out above - but many are based in small towns or rural areas, where coverage is not yet available. Hence, universal access to communications (see Section 7.1) will be important for business as well as individuals.

Peer to peer networking

Napster, where internet users can swap MP3 music files, is the best known example of 'peer-to-peer' (P2P) networking. However, such applications are only one aspect of this new networking architecture, which may have widespread business use. P2P allows users to communicate directly with other computers, without necessarily going through a central co-ordinating computer server. Arthur Andersen sets out the potential business applications of P2P in its publication *P2P: potential to profit?* These include:

- **Sharing computer capacity**. This allows users with projects requiring large amounts of computer power to utilise some of the excess capacity in idle PCs. Seti@home, run by the SETI institute in the US, has more than two million subscribers whose computers search for extraterrestrial signals using spare processing power.
- **Knowledge sharing**. By making all the files in a company available to share automatically, all users can see what other workers are producing and ensure they have the most up-to-date information.
- **Direct business to business trading**. By cutting out the central authority in many current business to business trading schemes, P2P can help parties find and trade with each other, with up to date and complete information.
- **Collaborative commerce**. P2P allows companies' computers to connect with those of their business partners, to encourage collaboration.

However, there are difficulties with P2P. Security needs to be carefully considered on such networks, to reduce the risk of viruses and hacking. When everyone can see each others' files, intellectual property can be abused and privacy becomes an issue. Further, the availability of files on the network varies depending on who is connected and download times can be long, depending on the type of connection between computers.

5.3 Location specific services

As considered in chapter 3, mobile operators have always known their customers' general location. However, new technologies mean that customers' locations can be identified with increasing accuracy, either using mobile phone technologies or satellite-based navigation systems. These applications are likely to be accelerated by a US requirement that emergency services must be able to locate mobile phone '911' calls, and the EU is considering a similar requirement. Possible future applications of satellite navigation are considered further in POSTnote 150[110].

Such capabilities also raise the possibility of consumer services which are specific to a user's location. An oft-cited example is the ability to find the nearest Chinese restaurant. Another service could locate the nearest public convenience. These kinds of services are particularly suited to travel information. For example, an online guidebook could identify where a user is, show the position on a map, and even describe the surrounding cultural and commercial sights. Developments of current software could plan a route, perhaps including public transport timetables or details of traffic in the area.

High accuracy satellite navigation or mobile phone location identification also introduces new possibilities for tracking devices when they are switched on (although satellite navigation itself is passive, so a transmitter has to also be carried for tracking). The location of children, people with

[110] Galileo - a new European satellite navigation system, POST, December 2000

Alzheimer's disease or prisoners could be followed, and even their health monitored by sensors attached to their bodies - but such applications raise major civil liberties concerns.

Proponents of these services also see a prospective use for advertising and commerce. Potentially, customers could register which products they wish to buy at what price, and nearby stores could alert them to special offers or items for sale. However, the possible demand for such services is unclear at present, and they would have to be used carefully if customers are to find them useful rather than annoying. In particular users' position data would have to be carefully protected. Although customers can keep their identity private from networks if necessary (for example, by using an unregistered pre-pay phone), users' privacy requirements are likely to vary depending on circumstance and data sharing may be of particular concern. In general, all location services raise potential privacy issues, which are discussed further in Chapter 8.

Location services require accurate geographical information, including road maps, public transport and traffic data. Much of this information is held by public bodies, who can refuse to supply such data, or use their monopoly position to charge high rates for it. According to a DTI report, 15-25% of information needed for e-commerce is held by the public sector. Some UK data is made available by HMSO, but this doesn't include information held by some large agencies. A European 'e-content' programme has been set up, with a budget of 100m Euro, to promote access to public digital data, but implementation remains in the hands of national governments. In the US, all data produced with public money is freely available - for example, NASA remote sensing data. Unless European states make their data available at reasonable rates, it is possible that private sector enterprises may fill the market gap.

5.4 Content creators

Internet content

Unlike traditional broadcast media, internet content can be 'published' by anyone with a computer and internet access. Sending email or submitting information to news groups requires little technical knowledge. There are also web sites which help users create their own web pages, and ISPs may 'host' these for individuals. This liberated environment has been one of the reasons for the internet's rapid growth, enabling anyone, from school children or MPs to multinational businesses, to publish their own web pages which are then available worldwide. There are estimated to be over 2 billion publicly accessible web pages, although the most-accessed web sites are dominated by large companies.

Traditionally commercial internet sites were to be funded by advertising revenue. However, with the collapse of the dot com market, service providers are looking more to subscriptions to generate revenue. One of the keys to gathering and maintaining subscribers is seen as exclusive content, so many portals and major sites are now moving to sign up content providers, particularly in areas such as music and games. For example, Freeserve has 350 content providers.

Broadcast content

Content provided on digital TV is created and distributed in a way similar to traditional analogue TV content, although there is capacity for more services to be provided. Platform operators create varying degrees of content and obtain content from other sources - from the BBC to Manchester United FC. Content providers can also buy access to TV platforms (although see the box on 'Access to TV distribution networks' in Section 8.2).

The TV equivalent of personal home pages does not yet exist - community access TV has not been widely successful in the UK, although the Community Channel (www.communitychannel.org) does carry charity programmes on Sky and via the internet.

However, TV access is not generally possible for small groups or individuals, at least in part because the potential audience may not justify the large costs inherent in such broadcasting (although such costs are falling). On the other hand, webcasting (broadcasting over the internet) does not have such limitations. As with standard web pages, anyone can publish video or audio content on the internet, without the need for a licence or a potential market. So, academic lectures, business promotions, Parliamentary debates or party conference speeches could also be available online. More personally, wedding videos, school assemblies, even births and funerals, could all be placed on web sites for interested relatives to watch at their leisure. An early version of this, which does not require broadband internet access, can be seen with sites such as internet-based photo albums. These allow users to upload their digital photographs onto a central server, so that friends and relatives with the appropriate log-in ID and password can look at the pictures.

5.5 Delivering public services

The Government aims for all public services to be available electronically by 2005, and for universal access to the internet in the same time frame. By 2005, it seems likely that more than half the population will have access to digital TV, and 3G mobile services are expected to be available, offering new ways of interacting with Government. Although the Government's plans in this respect have been set out in publications such as the *UK Online Annual Report* and the Cabinet Office's Performance and Innovation Unit (PIU) report *Electronic Government Services for the 21st century*, they were not a major part of the Communications White Paper. Indeed, a House of Commons Culture Media and Sport Select Committee report[111] suggested that the White Paper had a missing chapter, on services for citizens. They pointed out that the proposals were focussed on consumers, rather than citizens. In particular, they recommended that the Government "*set out its views on the scope for the new regulator to have a specific duty to pursue the interaction between [the development and regulation of new services in the communications market and the electronic delivery of public services].*"

As the Government's target implies, almost all transactions with the public sector could take place online. [112] Some of the key central government priorities for electronic delivery of public services (known as e-government) are set out in the box overleaf. Local authorities could also deliver their services online, for example allowing residents to pay their council tax or to report repairs needed to council housing via digital TV, and online voting has been proposed as one potential means of increasing citizen participation (see POSTnote 156 'Online voting' for consideration of this). The Government web site www.ukonline.gov.uk, which is currently under development, aims to be a 'one stop shop' for public services. Although the PIU study concluded that at present less than 10% of citizens would currently prefer to interact with Government using the internet via PC[113], digital TV could eventually offer an easier means of access. Alternatively, broadband technology could allow more user-friendly interfaces, such as 'form filling' with the help of video assistants.

The Government's track record in implementing public services via the internet has so far been mixed, and unreliable implementation of such technology may discourage more citizens than it encourages. For example, in 2000, the Inland Revenue introduced a service whereby users could fill in their self-assessment tax forms online. The software took forty minutes to download over a standard modem, and required a user name to be sent through the post. Perhaps unsurprisingly, less than 1% of forms were submitted online. However, there are commercial applications, such as online banking, which require similar functions and have been more successful. Therefore,

[111] The Communications White Paper, Second Report Session 2000-01, March 2001
[112] See Electronic Government - IT and the citizen, POST Report 110, February 1998.
[113] Source: PIU report, Electronic Government Services for the 21st century, September 2000.

there may be potential for Government to adapt commercial applications, or to work in partnership with the private sector to deliver such services, rather than employing traditional procurement methods. In addition, for many of the proposed integrated services, a large amount of public data will need to be digitised (for example, medical records), and issues of practicality, data sharing and privacy may become paramount (see Chapter 8).

Key e-government indicators

By the end of 2002:
- All Higher Education Student Support application forms online
- 'Connexions' smart card for all young people to help with costs of participation in learning
- Small Business Service (SBS) – putting the SBS online to provide information and advice to small businesses covering support services and regulation (Department of Trade and Industry)
- VAT – online VAT registration and returns, trade statistics and electronic contact centres (Customs & Excise)
- Companies' registration – putting Companies House online to allow electronic registration of companies (Companies House)
- Modernisation of Common Agricultural Policy payment systems and farmers' portal providing online applications for agricultural grants and advice (Department for Environment, Food and Rural Affairs)
- Culture online – putting a large volume of cultural information across museums, libraries, art galleries, etc online, working in association within the private sector
- The option for local authorities to run small-scale experiments with online voting in local elections

By the end of 2005:
- Driving agencies – putting these online to deliver licence applications, car tax renewals, driving test applications, etc electronically, and establish links with car insurance databases (Department of Transport, Local Government and the Regions and agencies)
- Benefit applications – putting benefit applications and payments online (Department of Work and Pensions)
- Passport applications – putting passport applications and renewals online (Home Office)
- Conveyancing – enabling electronic land registration (HM Land Registry)
- Patents – enabling online patent filing (Patent Office)
- Modernisation of legal records – putting transactions between the public and the courts (e.g. civil claims), public records and Children and Family
- Court Advisory and Support Service into electronic, Internet-enabled formats (Lord Chancellors Department)

Source: PIU report, 'Electronic Government Services for the 21st century, September 2000

Provision of public information and services over the internet also raises questions over the digital divide. If such new technologies allow preferential access to public services, then existing social exclusion may be reinforced and new types of social exclusion could develop. Thus, expansion of these new provisions must go hand-in-hand with initiatives to encourage universal access. This is considered further in Chapter 7, which discusses issues such as the extension of universal service obligations - which require BT (and Kingston Communications in Hull) to offer services to everyone.

Education

New communications technologies have the potential to assist with education delivery in schools, colleges and universities, and with individual lifelong learning. For example, broadband access enables pupils to view a wide range of educational content, encouraging interactive individual learning and potentially allowing schools to offer a wider variety of subjects. It permits video and audio content to support learning, as well as reducing the waiting time for standard web pages[114]. A report by the British Education and Communications Agency[115] found that, for schools of comparable socio-economic status, GCSE results were better in those schools with 'good' ICT provision, compared with those with 'unsatisfactory' provision. In particular, GCSE

[114] Although a very high bandwidth would be required to allow a whole class to look at individual video content, this could be reduced delivering content to the school only once and storing it on site for individual use

[115] www.becta.org.uk, The Secondary School of the Future, February 2001

results were best where schools used ICT widely across the curriculum.

The Government has a number of initiatives in this area, which aim to deliver higher standards of education through ICT and maximise its effectiveness in schools. These include the 'National Grid for Learning', launched in 1998 as a portal for educational content on the internet. It now hosts 5,000 web pages, and indexes 300,000 pages. Many organisations are developing educational content, including the BBC, Channel 4 and Local Education Authorities. For example, the BBC's 'Blue Planet Challenge' website offers interactive content and is linked to short courses offered by the BBC in oceanography and marine biology, developed in conjunction with Hull University and the Open University. The Department for Education and Skills is also working to ensure the availability of a wide range of online curriculum resources for teachers and is currently considering responses to Curriculum Online – a Consultation Paper.[116] Curriculum Online aims to establish a means of providing high quality learning resources, with easy access for users, to raise standards. It requires, among other things, standards for ensuring quality and an effective distribution mechanism.

The Government aims that 20% of all schools (including all secondary schools) should have 2Mbps broadband access by the August 2002, and Local Education Authorities are working together in eleven Regional Broadband Consortia to procure this more effectively - see Section 7.2 for further discussion of similar schemes. Effective use of online educational content depends on the availability of computers in the classroom– according to EU statistics, there are 6.5 computers connected to the internet for every 100 pupils in UK classrooms. This puts the UK 5th in Europe (Denmark leads, with 22.7 computers per 100 pupils).[117]

Universities are also exploiting these tools. The Open University has led the way in distance learning and now has 75,000 students online but many other universities offer courses remotely using the internet. With broadband connections, lecturers could hold video conferences with their students, and educational institutions could deliver their content over digital TV. In addition, universities can offer their educational content online for free – the US Massachusetts Institute of Technology in particular has stated that it will place all its course materials on the internet, aiming for 500 courses to be available by 2004. It does not plan to award degrees from online courses, but hopes that individuals and other universities will use them to enhance their education.

However, online learning is still in an early stage of development, and (as with all educational material) the quality of the products offered is key. Many students who choose online learning fail to complete the course, and the 'real-world' support is very important. It seems unlikely that online learning will supplant the traditional university or school, but it could expand the range of material available and widen learning opportunities.

[116] Published by DfEE (now DfES) and the National Grid for Learning, consultation closed July 2001
[117] Flash Eurobarometer 101.0 Headteachers and 102.0 Teachers, June 2001

6 Public policy and digital content

This chapter examines policy issues related to the content of converged media - the future of the content market; how broadcast and internet content could be regulated; and the implications of convergence for intellectual property.

6.1 The content market

Open access or 'walled garden'?

In general, access is universally available to all content which is published freely on the internet. Nevertheless, there are a number of areas where content is selected by specific service providers and access may be restricted - these are generally known as 'walled gardens'. An example is AOL, where content is provided by AOL partners and available only to those with an AOL account. Although customers can leave AOL's online content at any time by typing in a different web address, 80% of AOL subscriber's time is spent with the AOL services (including online chat, email, instant messaging and web pages). AOL cite features such as parental access controls, key word searches, safe online shopping and ease of use as reasons for users to remain within its content.

It is possible to use the TV as a monitor for viewing internet content. Digital TV operators such as ntl and ITV Digital provide full internet access through set-top boxes. However, other digital TV providers do not allow access to the whole web, only to a limited subset of interactive content which is approved by the service providers. These distinctions are considered further in Section 5.1.

Some service providers have argued that such walled garden access is more suited to digital TV than unrestricted web access for a number of reasons. The web is text-based, while TV is visual, suited to video and audio, and likely to be viewed from a distance by more than one person. In addition, not all web sites can be easily to translated for viewing or navigating on a TV screen. Therefore, it is argued, it is appropriate that TV access be restricted to edited content. Walled gardens can also ensure that children don't access unsuitable content, and can make e-commerce services more secure.

However, walled gardens in general only include large, established content creators, and exclude many innovative new providers. Many customers prefer open access and do not want to be restricted by service providers, although some may choose limited access (and others may be unaware of the distinction). Further, unlike using a PC, customers who access interactive services though their digital TV are not able to select any 'internet service provider' – access is provided only through the company which operates the set-top box, who also determine the extent of access to the internet. If digital television is to contribute to Government's targets for universal internet access, digital TV operators may have to provide more than a walled garden. It remains to be seen whether there is enough demand for unfettered internet access via digital television to persuade digital TV providers to abandon their walls, although more advanced web pages would not be properly displayed on digital TV web browsers.

Similarly, video-on-demand customers currently use a specialised set-top box, connecting them directly to the service provider's content. There will be scope for this access to be expanded, allowing viewers to download video from any source, but again it is not clear whether there will be any incentive for providers to allow this. Likewise, 3G and 2.5G service providers will have a choice whether to allow open access to all interactive content, or to set up walled gardens with partners. Navigating within an organised walled garden could also have advantages for users -

typing in a web address on a mobile phone number pad is awkward, and many web pages may not be formatted appropriately for viewing on a mobile device. Walled gardens also allow mobile phone operators to take a percentage of m-commerce transactions. However, restricting access to the wider internet may limit the functionality and appeal of these services and some mobile operators argue that competitive pressures are likely to lead to open access. Therefore, the key is likely to be allowing users the option of whether to stay within the garden or to roam outside, with operators developing home 'portals' containing preferred services but still allowing wider access.

One-to-one, or one-to-many?

Convergence potentially brings together two different models - that of the telephone and email, for individual one-to-one communication; and that of the TV or web, used for distributing information to many viewers. It is unclear how the balance between these two will develop. Two schools of thought appear to be developing. The first is typified by analysis by JP Morgan and Arthur Andersen[118] which suggests that the revenue from wireless data services will exceed that from voice communication within a decade, with a large proportion arising from information services and multimedia applications - both one-to-many services. Similarly, the rapid take-up of subscription digital TV suggests that many people are willing to pay for one-to-many broadcast content.[119]

However, the second school of thought, exemplified by Andrew Odlyzko of the University of Minnesota[120], argues that one-to-one communication has historically been much more important to users than broadcasting and people have been willing to pay more for it. He points to email as the 'killer application' of the internet, the popularity of text messaging compared with WAP, and the relative failure of initiatives such as WebTV which are not ideally suited to individual communication. He sees this trend continuing, with voice communication providing the main use for 3G mobile phones and increased revenue arising from increased voice use. There is certainly scope for more voice calls - in the UK at present, on average people spend less than five minutes per day talking on their mobile phones. Of course, 3G would also encourage mobile email.

This debate also has implications for wired networks. If demand is mainly for one-to-many content, then the networks' current emphasis on providing 'downstream' bandwidth to the users is entirely appropriate. On the other hand, if demand is for one-to-one communication, operators may have to consider increasing their 'upstream' bandwidth from the user - so that, for example, individuals can exchange video clips or photographs. At present, most broadband technologies offer greater data rates 'downstream' to the user than upstream.

6.2 Regulating content

Spectrum scarcity has allowed the regulation of television broadcasting - there is not enough radio spectrum for everyone to transmit a TV channel, so a licence is needed. As a requirement for holding a licence, the Government can impose conditions on broadcasters – such as quality of content, regional variety etc. Such spectrum scarcity does not apply to the internet, and no licence is needed to publish internet content[121], so any regulation generally has to use different means (although this has not stopped countries such as Singapore from attempting to regulate internet content in the same way as broadcast content, requiring producers to obtain a licence).. If TV content were widely viewed via broadband internet, this would pose a direct challenge to

[118] Wireless Data - The World in Your Hand, October 2000

[119] Although a large proportion of this take-up was due to Sky analogue TV subscribers converting to digital.

[120] For example, in Content is not king, A. M. Odlyzko. First Monday 6(2) (February 2001)

[121] Although the ITC licences video-on-demand services such as Kingston Interactive Television and HomeChoice, which are delivered via ADSL. It could use these powers to licence certain internet content, but has declared that it will not do so.

the traditional regulation of TV. Alternatively, communication via a mobile phone has traditionally been one-to-one, and so, like other voice telephony, content is essentially unregulated. However, as mobile phones become able to access data, wider internet content regulation issues become applicable. This section looks at how content can be regulated, and the implications of convergence. For further consideration of other aspects of internet content regulation, such as chat rooms and e-commerce, see POSTnote 159.[122]

Internet content

The wide range of material on the internet inevitably means that some illegal content is distributed, such as child pornography, breaches of copyright, financial frauds, etc. Other universally available content is considered unacceptable by certain people for social, political and moral reasons - for example, adult pornography, racial abuse or political criticism. Estimates of the amount of objectionable material on the internet vary greatly, but research suggests that about 3% of web pages contain sexually provocative material and 0.7% have notably violent content[123]. Easy availability of such material has led to pressure for regulation.

However, opinions differ as to how - and indeed whether - the internet should be regulated. At one end of the spectrum are countries such as Saudi Arabia and China that have attempted to control users' access to the internet to suppress the dissemination of dissident ideas. In contrast are those who argue that regulating the internet would be undesirable because its open and unregulated nature, along with very low entry costs, have encouraged commercial and social innovation and self-expression, and promoted democracy. There are also concerns that regulation could jeopardise legitimate trade and national competitiveness.

Current broadcast content regulation

All programme service providers (both TV and radio), whether they provide services in broadcast form or on demand, are required to abide by certain standards for taste, decency, fairness, privacy, etc. Complaints on such topics are dealt with by the Broadcasting Standards Commission, a statutory body which provides guidance and can require broadcasters to broadcast its decisions (although it has no other sanctions). The Independent Television Commission also regulates taste and decency on commercial channels (see below). In addition, the EU imposes quotas for European and independent TV productions. Public service broadcasters also have a range of other obligations, relating to news, educational and religious content, etc (see Section 8.3). All of the BBC's activities are regulated by the Board of Governors, who are appointed by the Queen on the advice of the Prime Minister, in accordance with the BBC's Charter presented to Parliament.

Commercial TV channels (including those run by the BBC) are regulated by the Independent Television Commission (ITC), which issues and renews licences. Commercial programme service providers are obliged to abide by its programme code, covering topics including taste and decency, impartiality, religious programmes and undue prominence for commercial products. Service providers who fail to meet the requirements of the code can be subject to a range of sanctions, such as formal warnings, fines, and, in the most serious cases, even withdrawal of a licence. ITC also has other codes to regulate sponsorship and advertising, dealing with duration, scheduling and content of adverts - adverts which do not comply can be withdrawn. Similarly, the Radio Authority awards licences and regulates programming for commercial radio services, which must comply with its codes on topics such as advertising, sponsorship and programmes.

Under the proposals in the Communications White Paper, the functions of the ITC, the Radio

[122] Regulating Internet Content, POST, June 2001
[123] Risk and the Internet: Perception and Reality, E. A. Zimmer and C. D. Hunter, University of Pennsylvania

Authority and the BSC would be assumed by OFCOM, which would regulate many aspects of broadcast content (see Section 2.2). The responsibility of the BBC Governors would be modified to bring their public services within the purview of much of OFCOM's regulatory activity.

In contrast, the content of films, videos and some computer games is regulated by the British Board of Film Classification (BBFC). It classifies films on behalf of local authorities who license cinemas, and has a statutory responsibility to classify videos, DVDs and computer games[124] - without a classification, these should not be commercially sold or rented. Unlike regulators for broadcast media, the BBFC views films before they are seen by the public, and allocates them a classification (U to R18) based on the films' portrayal of violence, language, sex and drug use. The Communications White Paper suggests the continued need for a pre-classification system for videos, DVDs and computer games, but asks whether the BBFC should continue to have this role, or whether it should be part of OFCOM's remit. Any move towards films being more widely viewed over the internet could have implications for such regulation, with pre-classification and enforcement by trading standards officers becoming extremely difficult. But both the BBFC and the White Paper agree that such a shift in viewing habits is some way off.

Newspaper content regulation

In the UK, newspaper and magazine editorial content is overseen by the Press Complaints Commission (PCC), a self-regulatory body which ratifies an editors' Code of Practice but has no statutory functions. The Code of Practice covers topics such as accuracy, privacy, methods of news gathering and protection of vulnerable groups, and is written in to most editors' contracts. However, the PCC does not adjudicate on general matters of taste, only on complaints from people directly involved in a story. In 2000, 2,225 complaints were investigated and 57 were adjudicated on; if complaints are upheld, newspapers or magazines publish the judgement in full. Unlike broadcasters, newspapers are not bound by impartiality requirements. This raises interesting comparisons when considering online content. For example, Channel 4's online news content would be expected to remain impartial, while the Independent's would not. The Communications White Paper did not propose any new newspaper regulation, but stakeholders such as the Newspaper Society expressed concern that regulation of public service broadcasters' online content might be extended to newspapers' internet activities.[125] However, Ministers have stressed that they do not intend OFCOM to regulate online content (although public service broadcasters would be expected to maintain their broadcast standards online - it is not clear how this will be enforced).

Regulatory options

Because the internet is a global medium with no central control, it is impossible to monitor and remove objectionable content completely. However, it is possible to make it more difficult to access, and for barriers to be placed in the way of businesses providing such content. There are three main types of regulation:

- **Statutory regulation**. This is the model for broadcast TV in the UK (see above). However, the internet is international and providing content does not require a licence, so such traditional mechanisms are difficult. Illegal content may be removed using basic law and international agreements, but failure to enforce by any single country can result in continued universal availability.
- **Self-regulation by industry**. Because of a desire to avoid statutory regulation and the legal and practical difficulties of enforcement on the internet, this is often the preferred option – for example, the Internet Service Providers Association Code of Practice (www.ispa.org.uk).

[124] Some types of videos, DVDs and computer games are exempt - for example, sports, music and educational titles.
[125] The Communications White Paper, Second Report of the Culture Media and Sport Select Committee, March 2001, evidence pg 207

Where Government plays a more active role, this is known as co-regulation. However, self-regulation can lead to market openings for service providers who bypass such standards.

- **Individual regulation**. By using 'filtering' software, individuals can at least partially block access to content (see POSTnote 159 for further details of different types of rating and filtering). PINs and passwords can also be used by parents to restrict children's access. Such a system is, for example, available on the ITV Active digital TV platform. Parents can set the set-top box so that certain functions, such as internet access, can be used only when the smart card is in the box. It also uses a content rating system to discriminate between acceptable and unacceptable sites. Many TV set-top boxes allow users to select a code number, so that adult channels are available only if the code is used. Similarly, ISPs allow subscribers to set up a number of password protected accounts which permit various degrees of internet access. This avoids restricting the content at source, and can allow the user to set their own standards. But such software is a supplement rather than a substitute for parental supervision of children's internet use – filters are not always reliable and vary in the control they allow - and requires user education. Media literacy can also help users avoid objectionable content – for example, by knowing which web sites or TV channels are likely to be suitable.

Illegal content

Laws apply online in the same way as they do offline, but the international nature of the internet puts much of such content outside national jurisdiction. Although this makes policing content difficult, it also makes the internet a powerful tool for freedom of speech, enabling the publication of critical commentary in countries with restrictive regimes. A distinction thus needs to be drawn between that which is widely illegal (for example, child pornography) and that which is culturally specific (such as adult pornography or political criticism).

In the UK, the Internet Watch Foundation (IWF, www.iwf.org.uk) addresses illegal material on the internet, particularly child pornography. A number of other countries also host similar hotlines (the EU supports an association for such hotline providers, www.inhope.org). Funded by the internet industry and the EU, the IWF runs a hotline for users to report potentially illegal content. After assessing the report, the IWF trace the computer (server) hosting potentially illegal material. In the case of material which appears to have originated in the UK, the IWF forward details of the content and the apparent source to the National Criminal Intelligence Service (NCIS) and to specialist UK police units. UK ISPs hosting such content are also advised and potentially risk prosecution if they do not remove the material. In the case of overseas servers, details are passed to NCIS who forward details to the relevant law enforcement agency in the country of apparent origin. If IWF has an INHOPE partner in that country, a report is also forwarded to the hotline organisation.

Since its inception, the IWF has been instrumental in the removal of 28,000 images of child pornography from UK servers (although these images may remain accessible to UK residents on overseas servers). In the Communications White Paper, the Government expressed continued support for the IWF, whose remit is expanding to cover racially offensive material. However, the IWF's success to date is, at least in part, due to the consensus which surrounds the definition and illegality of child pornography. As possessing such material is illegal, ISPs can be held liable if they do not remove it. But this is not the case for other 'objectionable' content, which it is generally illegal only to publish or distribute (so ISPs are not liable - see discussion of ISP liability below), and which may be less easy to assess. Further, the IWF is not a public body, and extension of its role could raise questions over accountability.

Internet content is also monitored by ICSTIS, who regulate telephone, internet and interactive TV services where premium rate phone lines are used. They ensure that the costs involved are made

clear to customers and that content complies with UK law. Where they discover internet material that appears to be illegal, they pass it on to the IWF. ICSTIS is funded by industry, and has the power to fine companies and bar access to services if members breach its Codes of Practice.

In April 2001, the Government launched the National High Tech Crime Unit, to investigate serious and organised crime on the internet. Of the £25m funding allocated over 3 years, £10m will be used to develop local computer crime units.

Liability of service providers

Last year, a French judge ruled that French internet shoppers should be barred from accessing Yahoo! auction sites selling Nazi memorabilia. The sale of items which incite racial hatred is illegal in France. Although Yahoo! France web sites did not sell such material, Yahoo! sites in the US did. It would be impossible to block all French users from accessing such sites, but the court heard evidence that it would be feasible to block the 70% of surfers who use an easily identifiable French ISP. In fact, other internet retailers and auction sites employ similar methods, such as software which examines delivery addresses for goods, although these are by no means infallible. Yahoo! contested the validity of the ruling in a US federal court, where a judge ruled in November 2001 that the French order was not enforceable for Yahoo!'s US-based sites and it violated their right to free speech in the US. However, an appeal to a higher court is likely. The case raises questions over jurisdiction and service providers' legal duties in all countries where they have a presence. International agreement would be required to ensure compliance with any ruling in an overseas court.

Material held on web sites can contravene a wide range of laws, such as illegal use of trademarks or copyright. Under the EU Electronic Commerce Directive, which must be translated into UK law by January 2002, an ISP is not liable for information it transmits (it is a 'mere conduit'). In 1999, Demon Internet in the UK paid damages for failing to remove a defamatory posting on a newsgroup carried on its servers. Because Demon had been informed of the defamatory content, the judge ruled that the ISP was responsible for the postings. However, critics[126] have noted that such laws encourage ISPs to remove any potentially illegal content whenever it is notified to them, effectively casting the ISP in the roles of defendant, judge and jury.

Similar issues are likely to be raised for digital television and 3G mobile phone operators. At present, many interactive services on digital TV are walled gardens, so content is controlled (and generally originates in the UK, so international issues are not raised). However, as these walled gardens expand, or are opened up to wider access, the liability of platform operators will become more uncertain. It remains to be seen whether digital TV or 3G operators are considered equivalent to ISPs in legal liability.

Rating and filtering

Although the accuracy and reliability of filtering software is increasing, it is not failsafe - it can block access to potentially valuable web sites (such as www.parliament.uk, which does not have a rating label) while allowing objectionable content. Such software also varies in the extent to which users can customise the filters, although more recent products tend to be easier to use and more flexible. Further, third party rating raises issues of transparency and the imposition of values by unaccountable bodies, creating quasi-'walled gardens' (although ratings lists are available from a range of organisations, and users can choose which they use). It is also possible for service providers (or governments) to include filters without the user's knowledge, restricting individual choice and access to information – although technical solutions allow filters to be

[126] e.g. Yaman Akdeniz, director of Cyber-Rights & Cyber-Liberties (UK)

bypassed, for example by encrypting the web page.

Filtering can provide valuable protection for employers - according to a report by the Chartered Institute of Personnel Development, UK companies are losing £2.5m each year due to staff time spent surfing the internet - and 70% of pornography is downloaded from the internet between 9am and 5pm. But if companies wish to install filtering at work, employees must be made aware that it is in place.

The Government has expressed its support for rating and filtering, and the Home Office recently labelled its web site. Research by the European Commission is examining ways to improve such services. However, these schemes depend on widespread adoption of international standards. It has been suggested that originators be required by law to label their content, although international application and enforcement of such a proposal would prove difficult. In addition, if they are to employ these tools, users must be aware of their advantages and disadvantages. One of OFCOM's roles would be to promote media literacy, working with industry and educators. This could include increasing awareness of rating and filtering.

Implications for broadcast content

The Communications White Paper proposes that no statutory regulation by OFCOM be applied to the internet. This has been widely welcomed. However, some have expressed concern over the possibility of 'regulatory creep'. For example, the White Paper expects public service broadcasters to apply the same standards online as offline – such as in supplying impartial news. Ministers stressed in evidence to the House of Commons Culture Media and Sport Select Committee that the White Paper did not intend new proposals for internet regulation. To clarify this, the Committee recommended that OFCOM be "*excluded by statute from imposing regulatory obligations relating to internet content*", including on public service broadcasters[127].

It is envisaged that the regulatory structure established by the Bill would last for ten years, but legislating for the swiftly changing communications market is difficult. With faster internet connections, much licensed television content could also be available on the internet. Indeed, it is already possible to listen to many radio stations via the internet. These developments raise fundamental questions for broadcast regulation. A key current distinction is that between content 'pushed' into the home (such as broadcast television), and 'pulled' content (for example, selecting a web site). Under OFCOM, tier one regulation (see Section 2.2) setting universal negative content standards would apply to 'pushed' services, where viewers are seen as having less choice over what they receive.

With a much wider range of channels and interactive services, delivered over the internet or via digital TV, it is conceivable that this division could become irrelevant. The regulatory distinction will only remain tenable if it continues to be clear to people whether they are receiving a 'push' or 'pull' service and what this difference implies for regulation. For example integrated set-top boxes could receive digital TV and enable broadband internet access. Hence consumers could be unaware of whether the programme they are watching is arriving at the box via 'push' digital TV or 'pull' internet protocol. Similarly, material recorded on a digital recorder such as TiVo and then watched some months later was undoubtedly 'push' when originally broadcast; by the time it is stored on the recorder and then watched, it has become 'pull'[128]. It may also be difficult for broadcasters if there are different rues applying to their content shown via the internet rather than broadcast. On this subject, the Select Committee concluded that in future universal negative

[127] The Communications White Paper, Second Report of the House of Commons Culture Media and Sport Select Committee, March 2001

[128] Although this is also true of current analogue video, digital recorders may make such viewing more widespread.

content regulation would cease to be possible. However, they saw a case for continued positive programming requirements on broadcasters in receipt of direct or indirect public service subsidy. The distinction between 'broadcast' and 'on-demand' services is also contained in the EU's Television without Frontiers Directive, which is currently being reviewed. In their response to the Select Committee, the Government recognised that, "in such technologically advanced and fast developing sectors, there is a particular challenge in framing definitions which will stand the tests of time and change; the longer process of development of and consultation on the draft Communications Bill will provide an opportunity to draw on a wider range of expertise across the industries in order to get this aspect of the Bill right".[129]

One of OFCOM's duties will be to promote media literacy, helping people understand diverse media services and the differences between them. The White Paper suggests that the wider availability of material, for example on the internet, will necessitate people taking more individual responsibility for their own and their family's media use. But it still sees a role for industry in developing tools to aid navigation and control of communications media.

Electronic Programme Guides (EPGs)

Digital viewers navigate the large number of channels via an electronic programme guide, which gives details of current and future programmes and allows the selection of pay-per-view channels. Software controlling the guide is held on the set-top box, the information appears on the TV screen, and is accessed through the remote control. By not providing easy access to particular channels through the EPG, service providers could in effect restrict viewers' choice. In particular, the Communications White Paper proposes that OFCOM's powers will apply to EPGs and similar systems and that public service channels will be given due prominence. It also points out the possibility that viewers will be able to choose customised EPGs, which would reduce the need for regulation. If there is a proliferation of public service channels (and government services), then such 'due prominence' rules may need to be limited. Some service providers have also expressed concern that such regulation may in the future extend to EPGs held on the internet (for example, via video-on-demand networks). However, EC Directives about 'on demand services' may make such regulation difficult.

6.3 Intellectual property

Unlike analogue video or music, digital copies of DVDs, CDs etc. don't degrade with the number of subsequent copies - they are reproduced perfectly, thus increasing fears about piracy. In addition, the internet allows copyright laws to be broken easily, as material can be copied and distributed widely without the need for specialist equipment. Programmes such as Napster and Gnutella have shown how the internet can enable users to search each other's computers for music files on a large scale (at its peak, Napster had over 80 million registered users). This is known as peer-to-peer file sharing (see Section 5.2). Legal action has forced Napster to redefine its business model, levying a monthly charge for services and forming alliances with record companies. Nevertheless, other file sharing programmes do not rely on a central server, and so are less vulnerable to law enforcement. At present, concerns focus on music because these files are small enough to download in a few minutes. Nevertheless, with faster internet access, films, TV programmes and computer games could also be shared in similar ways.

Technical solutions are available, such as digital 'watermarks' which allow illegally copied music to be identified. Record companies have started to sell 'copy proof' CDs, and CDs which cannot be played in computer CD-ROM drives. However, incorporating inaudible watermarks in music is difficult, software solutions can be cracked by programmers and removing the ability to play CDs

[129] Government Response to the Second Report from the Culture, Media and Sport Select Committee Session 2000–2001, November 2001

on certain devices may provoke a customer backlash. The recently approved EU Copyright Directive[130] attempts to protect copyright holders while permitting private copying of audio and video material. It allows for 'technological measures', such as encryption, to prevent unauthorised copying, and makes it illegal to circumvent these measures.

Nevertheless, similar laws in the US, enshrined in the 1998 Digital Millennium Copyright Act (DMCA), have proved extremely controversial. In July 2001, a Russian programmer called Dimitry Skyralov was arrested by the FBI at a hacking conference in Las Vegas. Skyralov was one of the creators of software which removes copy protection from Adobe Acrobat e-Book Reader, and is the first defendant to be indicted under the DMCA. Critics such as the Electronic Frontier Foundation (EFF) argue that Skyralov's software allows legitimate 'fair use' of e-Books without the need for the publisher's permission - for instance, permitting users to copy the book to a laptop or PDA as well as the computer on to which it was initially downloaded - and Adobe have asked for the prosecution to be dropped. In another case, the EFF alleges that the Recording Industry Association of America threatened to use DMCA provisions in an attempt to prevent encryption researchers publishing a paper about cracking digital watermarks.

Attempts to circumvent protection on DVDs have also been prosecuted under the DMCA. The Motion Picture Association of America took an online hacker magazine to court to prevent it publishing or linking to computer code known as DeCSS, which could be used to copy DVDs. Some computer scientists contend that restricting access to such code is a violation of free speech, illustrating their point by selling T-shirts printed with the computer algorithm. DVDs and DVD players also contain regional coding which means they can be viewed only in the part of the world where they were bought - this allows distributors to 'stagger' the release of films around the world, so they can be released later in Europe than the US, for example. Nevertheless, technologies for modifying players to play disks from any region are ubiquitous and cheap.

Microsoft has introduced copy protection into their latest operating system, Windows XP, which requires users to 'activate' the software, either over the phone or via modem. Each time it is turned on, the system compares the hardware on the computer to that on which the product was activated - if the computer's configuration is changed more than six times, the software will stop working, and the user will have to reactivate it. This aims to stop users installing the software on a number of machines, or copying it. Such protection may lead to less casual copying, but its impact on consumers is not yet clear.

With convergence, protection of intellectual property for digital content is likely to become more important. For example, video-on-demand via broadband internet requires content protection to ensure that viewers do not save and copy films – without content protection, such services are unlikely to attract investment. Protections are also built into pay-per-view films on digital TV, so that they cannot be recorded by videos. But film studios have raised the possibility of adding such protection to freely broadcast programmes, raising concerns over 'fair use'. For example, viewers could be prevented from recording programmes and watching them later. The Digital Video Broadcast project is developing a copy management regime which aims to satisfy the requirements of film studios and European broadcasters, while maintaining freedom for customers to make recordings for personal convenience. More generally, it may be that customers buy the right to watch or listen to content a set number of times, rather than owning the CD or DVD itself. The appeal of this to consumers remains to be seen.

[130] Harmonisation of certain aspects of copyright and related rights in the information society, Directive 2001/29/EC, 22 May 2001

7 Access

This Chapter examines issues related to access to communications services. It considers both general issues around universal access, and two specific areas - access to high speed broadband internet connections, and the Government's plans for switching off analogue TV.

7.1 Universal access

The digital divide

Certain sectors of society and people in some locations are currently much less likely to have access to or use digital communications technologies. Originally coined in reference to computer or internet access, this 'digital divide' applies similarly to other converging technologies such as digital TV. Section 2.1 sets out the demographics of communications access, but in summary:

- Households headed by a professional are three times more likely to have home internet access than those headed by an unskilled worker[131].
- Only 11% of those 65 or over have ever accessed the internet (compared to 88% of 16 to 24 year olds)[132].
- Digital TV usage is more spread across the population than internet usage, but is still lower among the lowest income groups and those over 55. It is currently mainly used by subscribers to pay-TV, although a national campaign is underway to broaden its appeal for free-to-air viewers[133].
- Mobile phone ownership is highest among high income groups and younger consumers. Nearly 90% of 15-44 year olds have a mobile phone, compared with 24% of those aged 75+. However, overall levels of use are much higher than for internet or digital TV, and there is less digital divide driven by price - even among lower income groups and those not working, more than half have a mobile phone.[134] Also, the advent of pay-as-you-go mobile phones means that transient or uncreditworthy individuals can have ready telephone access – a social benefit which has been market-led, rather than brought about by regulation.

Although some of those without access to new communications media are undoubtedly discouraged by cost, many say they will never want such access (see box on the next page). This can be for a variety of reasons, including perceived irrelevance and concern over technical skills. However, although there are likely to be some who will never go online, particularly in older age groups, people's attitudes can change dramatically as new technology becomes widely used; their peers become aware of the benefits; and costs fall. For instance, mobile phones were widely seen as an unnecessary and expensive luxury, but are now owned by over 70% of the population. Similarly, although a lack of skills undoubtedly excludes many people from accessing the internet using a computer, more user-friendly devices such as digital TVs and mobile phones may require less computer literacy. It is impossible accurately to predict how people's attitudes and priorities will change in the next five years, so this chapter will look at ensuring access is available at an affordable price for those who want it.

[131] Consumers' use of Internet Oftel residential survey Q6 August 2001
[132] Internet access, National Statistics, www.statistics.gov.uk
[133] Consumers' use of Digital TV - summary of Oftel residential survey Q2 August 2000
[134] Consumers' use of mobile telephony – Summary of Oftel residential survey, Q6 August 2001

Can't or won't?

Internet
Of households without internet access, more than half (55%) claim that they do not want or do not need to go online[135]. The factors which would influence the most people to go online are cheaper subscription, call and installation costs, and cheaper equipment costs (each cited by up to 10% of people). Better information on the internet's uses and benefits, and on how to use it, would encourage a smaller proportion (5-10%).

Evidence from the Consumers' Association[136] also shows that the majority of non-users say they will never go online, with the main reasons for not being online given as irrelevance, cost and lack of understanding of the technology. However, knowledge of what can be done on the internet is limited - 29% of non-users said they didn't know what it was used for, with older non-users, lower social groups and those who don't want to go online knowing least about the internet.

Of non-users, 16% said that being able to access the internet via the TV would encourage them to connect, while fixed price packages for unlimited internet access appealed to 12%. But faster connections and mobile phone access were much less appealing and overall nearly 70% of non-users were not persuaded by any of the technology advances.

Digital TV
When it comes to digital TV take-up, around a third of those without digital TV thought they would never get it - rising to 50% of older and retired people. Key reasons for not going digital were the cost and not needing the extra channels. Among over 55s, lack of awareness and consideration of benefits was also a significant factor.[137]

A geographic divide

At present, fixed telephone (and therefore internet), mobile phone and TV infrastructures each cover close to 100% of the UK population. However, it is not yet clear to what extent new communications networks will cover all geographic areas and over what time frame these networks will be fully developed, so those in rural areas risk being excluded from some of these services, at least initially. In particular, broadband internet may not be available in these areas at affordable prices. For example, in its publication *UK online: the broadband future*, the Government reports an estimate that all of London will be covered by broadband and higher bandwidth services by 2003, while 45% of the population of Wales and the South West may still be unserved. 3G mobile roll-out will also concentrate initially on urban areas and the extent of roll-out into rural areas will depend on how quickly 3G becomes a commercial success. In addition, the Government have not yet indicated the level of coverage for digital terrestrial TV once analogue signals are switched off, although they have made a commitment to digital TV being widely available either terrestrially, or via cable or satellite. The box on the next page sets out some of the coverage issues.

Why worry?

New technologies can help individuals communicate, provide access to educational resources, and allow citizens to be better informed. The report of the DTI's Policy Action Team 15 *Information and Communication Technologies in Deprived Areas: Closing The Digital Divide*[138] suggests a number of reasons why new communications tools are important in the UK - and particularly in deprived neighbourhoods. These include:

- Basic computer skills boost employment prospects, and technology can be used to develop literacy, numeracy and other skills.
- ICTs can provide information relevant to the needs of local communities and individuals, such as carers or those with language problems. This can help them interact with others and develop confidence.

[135] Consumers' use of Internet: Oftel residential survey Q4 February 2001
[136] Which? Online Annual Internet Survey 2001, http://www.which.net/surveys/intro.htm
[137] Turn on, tune in, switched off - consumer attitudes to digital TV, Consumers' Association, March 2001
[138] March 2000, http://www.pat15.org.uk/downloads/pat_sum.pdf

- Community networks give people a chance to participate in decisions affecting them and can help foster a sense of community identity. Information kiosks, web sites, call centres etc. can also help communities function practically, allowing people access to information without the need for a lengthy and costly trip to council offices.

Geographical coverage

Coverage difficulties faced by the main delivery mechanisms include:

Satellite
The digital TV satellite signal covers ~98% of homes (taking into account factors such as tress, buildings or hills preventing satellite reception). A small proportion of homes are also subject to planning restrictions (in conservation areas and national parks). More common practical barriers are planning and landlord restrictions on individual satellite dishes in blocks of flats, although installing a communal satellite receiving system could address this.

Cable
Cable currently passes half of UK homes. This is increasing only slowly and there will always be areas where it is uneconomic to install.

Digital Terrestrial TV
Currently just under 70% of the population can have access to all DTT channels; analogue TV covers 99.4% of the population. Theoretically DTT could have similar coverage through building more transmitters, although it may not be possible to reach 99.4% before analogue TV is switched off (see Section 7.3). The industry Digital TV Group argues that the main stumbling block in building more transmitters is uncertainly over the future of the analogue TV spectrum, which affects the business case for investment by broadcasters.
In addition, the digital signal is currently weak to ensure it does not interfere with analogue TV. Trials are taking place to increase the power to improve coverage and trials of even higher power are being considered – ITV believe that further power increases can take place without degrading the analogue signal, and should occur before analogue TV is switched-off. Once analogue switch-off occurs there will be an opportunity to use some analogue spectrum and hence increase transmission power (and coverage) further. The extent of this increase will depend on the Government digital TV action plan and will affect the number of transmitters which will need to built.

Mobile phones
Coverage for current mobile phones now extends to 99% of the UK population and phone companies aim for 2.5G networks to also reach this level of coverage. However, on current plans, 3G networks will be concentrated initially on urban areas. There is a licence requirement to provide coverage to 80% of the population by 2007 although the Government has said that it expects commercial considerations to lead to greater and quicker roll out. How far and fast this network extends will depend not only on economic factors but also on success in siting telecommunications masts, and developments in planning law (see Section 4.2).

ADSL (high speed internet connection)
Because ADSL is available only near exchanges that are ADSL enabled, not all households will be able to receive it. Firstly, not all exchanges are ADSL-enabled – due to economic considerations it is possible that many rural exchanges will not be converted at all. By September 2001, BT had installed ADSL in 1,000 exchanges, covering 60% of the UK population. Secondly, even in an area where the exchange is ADSL-enabled, only households within a certain distance of the exchange can receive services. In July 2001 BT started to deploy a new version of ADSL ('rate adaptive' ADSL). This increases the distance over which ADSL works, so that over 90% of customers in a typical ADSL-enabled exchange area will be able to receive it - although for rural areas where customers are typically further from the exchange, this figure will be reduced.

Fixed wireless broadband
Fixed wireless access could provide services to areas without other access, but the Government's paper *UK Online: the broadband future* reports an estimate that less than 10% of the population will have fixed wireless access only.

However, the report also notes that communications technologies are not a panacea - people do not necessarily have the skills, access or inclination to use them. Such technologies should therefore be used to support activities which engage people's interest, rather than as the focus of the activity. Projects also need to be based in wider community regeneration - for example,

people can't benefit from internet shopping if they don't have a bank account or credit card. Further, communications technologies can have drawbacks, such as reducing social interaction.

Nevertheless, there is general agreement that public policy should aim to minimise the digital divide. But if the purported benefits of the communications revolution are to be realised, quality and range of access will also be important. Connections in community centres and libraries can theoretically give the whole community access, and can play an important role in helping new users go online and acting as a social space. But they do not offer the same ease of use as home connection, and may be inaccessible to some, such as people with disabilities or those with young children. Similarly, although giving excluded families refurbished computer equipment is potentially useful, such equipment may be unable to run recent programmes requiring more powerful computers, and people may not have the skills to use it. Also, if much content becomes written for broadband applications an old computer with a narrowband connection may find a large proportion of the internet inaccessible - even today many web pages don't work if the internet browser is too basic or particular software is not installed.

These difficulties are not restricted to computers. With the introduction of next generation mobile phones, a range of applications will be available which cannot be used with a simple voice handset. As the 3G network will not cover the whole country (at least initially), some areas may be excluded from high bandwidth mobile services. On digital TV, not all operators offer web access, with some providing only digital-TV specific interactive services. Although such walled gardens may have advantages and could be used to deliver public services, some of the benefit of these new communications tools is undoubtedly lost if only a restricted amount of information is accessible - imagine a telephone which could only dial one in ten numbers. Even those TV platforms which do provide complete web access are not currently able to translate more complex web pages. Therefore, any policy on the digital divide must aim to minimise the effects of 'two tier' access, where those who can afford it and live in urban areas get complete access at high speed in their own home, while others have to trek to the 'local' library.

Public policy

The Government has proposed a range of policies to combat the digital divide, focussing mainly on internet access. Underlying these policies is an assumption of technological neutrality - Government aims to encourage general internet access, without favouring one technology over another or distorting the market. Initiatives include:

- a network of 6,000 UK online centres and all public libraries to offer internet access with trained staff for support.
- a marketing campaign to raise awareness of the benefits of the internet and point users towards UK online services.
- 'Wired-Up Communities' pilots to encourage access in disadvantaged areas.
- encouraging the take-up of digital TV, which can offer an easy entry point for people to experience the internet (although not all digital TV providers offer full web access, as discussed above).
- working with industry to establish pilot 'digital neighbourhoods' where households will be loaned free-to-air digital TV equipment. The neighbourhoods will help Government and industry understand the social and economic aspects of analogue switch-off.
- 'learndirect', which offers courses online or through a network of 1200 learndirect centres.
- a number of programmes to put social, cultural and educational content online, and encouraging free public content.

While these initiatives aim to increase public exposure to and awareness of the value of the internet, they may not by themselves lead to high-quality internet access in all homes. Therefore

some analysts, such as Damian Tambini of the Institute for Public Policy Research[139], have suggested that a more fundamental approach is needed, combining universal service obligations (which aim to ensure that all groups have access to communications services) with rights of access to connections and content.

Universal service obligations

In digital television policy, there is already an assumption of near universal affordable access. Currently 99.4% of the population can receive analogue signals and the Government's plans for digital switch-over are based on the same levels of access to the digital signal (see Section 7.3). There has also, historically, been universal access to content. Although the main public service channels will remain free-to-view and universally accessible, new, additional channels are now also being provided on the multi-channel digital platforms to which access depends on the subscriber's tariff.

A universal service obligation (USO) also applies to the telephone industry, based on the concept that telephone services are necessary for social and economic inclusion. Details of the telephony USO are given in the box overleaf. Oftel's August 2001 review of the USO considered whether it should be extended to mobile, internet and broadband services. Some consumer groups argued that it should include mobile provision, to ensure mobile services were available in rural areas. However, Oftel disagreed, on the grounds that fixed services offered an alternative to mobile phones, that UK mobile networks typically cover 98-99% of the population and are increasing coverage in rural areas. Oftel noted that, although 75% of households had access to a mobile phone, it was not essential for social and economic inclusion. Further, pre-pay services already allowed anyone to buy a phone at reasonable cost.

Universal service - internet access

On narrowband internet access, Oftel concluded that the market and current regulation were making considerable progress towards universal internet access by 2005, so did not see a case for extending the USO. Almost all customers could access the internet over basic telephone lines and innovative packages such as unmetered charging were reducing costs. Oftel also supports public institutions working together to obtain reduced price internet access and encourages the telecoms providers to offer special packages to public bodies. However, there was some concern over the minimum data speed required under the USO, which is set to 2.4 kbps under European law. The new Universal Service Directive[140] (see box) will allow more flexibility on this, but won't be implemented until 2003.

Despite this analysis, universal narrowband internet connection remains some way off. There are two monetary costs involved with access - that of the computer or terminal, and line charges. The price of unmetered access, generally at around £15 a month, is likely to be off-putting for many people but 'free' ISPs who charge per minute may be more appealing for those who don't plan to use the internet extensively. On the other hand, PCs require a large outlay, no matter how infrequently consumers intend to use them. There are cheaper products which aim to overcome this problem, but many analysts suggest that internet access through digital television will be a key factor in combating the digital divide. Further, as a perceived benefit of digital TV, it could also help persuade people to switch from analogue. Indeed, the House of Commons Culture Media and Sport Select Committee, in their report on the Communications White Paper suggested that, "*Access to the Internet can be an important driver of the take-up of digital television, and the expansion of digital television services can be fundamental to achievement*

[139] Universal Internet Access: A Realistic View, IPPR/Citizens Online Research Publication No. 1 November 2000
[140] Proposal for a Directive of the European Parliament and of the Council on universal service and users' rights relating to electronic communications networks and services, Com(2000)392, EC

of the Government's objective of universal Internet access by 2005."[141] However, as discussed in Section 5.1, not all digital TV platforms offer full internet access (although all offer email). Therefore, if the Government wishes to promote the link between digital TV and the internet, it runs the risk of favouring some digital TV providers over others.

Universal Service Obligation

To ensure that people on low incomes, in rural areas and vulnerable groups have access to telephone services, BT (and Kingston Communications in Hull) are required to provide access to fixed line telephone services at an affordable price. They must meet all 'reasonable requests' for a phone line, and costs are geographically averaged, so that people in rural communities are generally covered at the same cost as those in urban areas. Obligations also include special services for people with disabilities and provision of a network of payphones.

The framework for universal services is set by the EU and defines a set of services and quality levels which nations have to meet. A new draft Directive on Universal Service and Users' Rights is currently in the process of being adopted by the EU. Oftel reviewed the USO in August 2001[142] and concluded it would remain unchanged in its main provisions.

Costs of complying with the USO are currently met by BT and Kingston Communications. In July 1999, Oftel calculated that the USO cost BT between £53m and £73m in providing a service to uneconomic customers but this was offset by a benefit of £61m. In Oftel's view, the benefit arose from four main areas, which are set out below (but there is some discussion over whether these are accurate figures). Under EU law, if the USO was imposing an 'unfair burden' on BT, a cross-industry fund could finance the USO, to which all the communications providers would contribute. Oftel plans to consider this in its review of retail markets, scheduled to report in 2002.

Benefits for BT of the USO

- **lifecycle** – by serving customers when this is unprofitable, BT has a better chance of retaining them when they become profitable for BT.
- **ubiquity** – customers moving between areas know BT as a potential supplier, but may not be aware of BT's competitors.
- **brand image** – enhancement of BT's image by serving all customers, areas and payphones.
- **payphones** – BT's payphones provide an advertising opportunity for BT and uneconomic payphones may become economic over time, so that a commercial operator would choose to retain some uneconomic payphones.

Source: Oftel Universal Service Obligation, A statement issued by the Director General of Telecommunications, 30 August 2001

Universal service - broadband

The standard telephone line needed for basic internet services is included in the current USO. In contrast, higher bandwidth services require specialist equipment, cost the consumer considerably more and are not covered by the USO. In the UK in particular, the broadband market is not yet mature and certainly not essential to social inclusion. Nevertheless, it *may* become so - in which case, a logical extension of the USO would give consumers the right to a higher speed connection. However, this would raise a number of issues, such as the speed of connection required, which could differ depending on the user. Perhaps more fundamentally, as discussed in Chapter 4, higher speed services are unlikely to be provided by a single delivery mechanism - they will include DSL, cable, satellite, fixed wireless access and mobile. Placing a USO on only one of these solutions would not be technologically neutral, so could distort the market and reduce consumer choice.

Therefore, Oftel concluded that a USO on broadband would be premature. The Communications White Paper stated that the Government would "*keep under review the case for requiring the communications industry to make higher bandwidth services available universally.*" Similarly,

[141] Second Report Session 2000-01, The Communications White Paper, March 2001
[142] Oftel, Universal Service Obligation, A statement issued by the Director General of Telecommunications, 30 August 2001

the new EU Directive rules out extending the scope of Universal Service to include broadband, but requires the EC to review this by 2005.

Assisting people with disabilities

A key part of providing universal access will be to ensure that people with disabilities are able to use new technologies, which can help them share fully in society[143]. BT is currently required to provide services such as a text-relay service for deaf or hard-of-hearing people who use text-phones. Similarly, some broadcasters must provide subtitles, signing and audio description on some of their programmes - subtitles are regularly used by 8.7 million people. The Government plans that DTT will carry subtitles on 80% of programmes by 2008 and aims to extend requirements to cable and satellite operators. ITV and Channel 4 are obliged to meet targets of subtitling on 80% of programmes by 2004, and the BBC will match this. Design of digital TV EPGs, remote controls, computer screens, keyboards and personal video recorders should take into account the needs of visually impaired people and those with reduced manual dexterity. On the internet, the Web Accessibility Initiative is developing standards to make the web accessible to people with disabilities.

Mobile phones also have great potential to help people with disabilities. The Royal National Institute for the Blind (RNIB) notes that wireless communications (e.g. Bluetooth) could link small devices to larger control panels designed for people with disabilities, or could allow the mobile phone to control a smart house or act as an alarm button for those in sheltered housing.[144] But small buttons, text read-out, and voice-only control all exclude certain parts of the population. In addition, GSM mobile phones interfere with hearing aids and similar problems may occur with 3G. As well as promoting access, inclusive design often makes technology more friendly for all users. RNIB propose an 'Accessibility forum', where inclusion issues can be discussed with the telecommunications industry.

7.2 Broadband access

The Government published its broadband policy *UK online: the broadband future*, in February 2001. This report sets out two main reasons why Government believes broadband is important - to encourage users to connect to the internet more often and for longer; and to enable new sorts of consumer and business services. Although Government recognises that these benefits are difficult to quantify, it suggests that they will play an important role in determining national competitiveness, and has therefore set an overall goal to have "*the most extensive and competitive broadband market in the G7 by 2005*".

However, there is some way to go. By June 2001[145] the UK had the 7th highest rate of broadband access in the G7. While Canada had one broadband subscriber per 17 people, the UK had only one per 360 - around 165,000 subscribers. South Korea had the world's highest proportion of broadband users, with 1 subscriber per 7 people. South Korea's success is generally ascribed to intense competition by broadband suppliers, encouraged by Government, who are investing more than $10 billion to deliver VDSL or fibre to 80% of the population by 2005. However, there are also examples of similar strategies which have not worked so well: in Singapore the Government has invested heavily in broadband infrastructure and has 99% availability, but although penetration is rising it is still only around 16%[146].

[143] See POSTnote 134, Technologies for Independence in Later Life, February 2000
[144] Call barred? Inclusive design of wireless systems. Tony Shipley and John Gill
[145] The Development of Broadband Access in OECD Countries, OECD Working Party on Information and Telecommunication Service Policies, October 2001
[146] Yong Ying-I, Singapore Infocomm Development Authority, July 2001, http://www.emarketer.com/analysis/easia/20010725_asia.html

The broadband future reports attempts to project what proportion of the UK population will have access to broadband services by 2003. These estimates conclude[147]:

- 50% will have ADSL and cable modem coverage.
- 25% will have ADSL but not cable modem coverage.
- less than 10% will have only broadband fixed wireless coverage.
- 15-20% of the population will have no broadband access.
- although satellite may fill some of these gaps, the cost of terminal equipment may be expensive.

However, there will be dramatic regional differences in coverage, and large (predominantly rural) areas of the country may be without any broadband access (see the box on geographical coverage in Section 7.1, and discussion of a broadband universal service obligation). One possible way of extending coverage would be to use digital TV broadcasting spectrum to carry data - for example, to download commonly accessed web sites, which can then be stored on the user's hard drive. This is known as multicasting and could be applied to satellite or DTT services - which, under Government's plans for analogue switch-off, will need to reach more than 99% of the population. DTT multiplex licences currently restrict the amount of data which can be carried to 10% of the service capacity and DTT broadcasting spectrum is already limited so DTT carries fewer services than cable or satellite. Nevertheless, there are other ways to broadcast data if operators pay for spectrum.

In terms of numbers taking-up broadband services, the report quotes a range of forecasts from different consultants, predicting between 22% and 37% of UK households with broadband connections by 2004. These forecasts seem somewhat optimistic, given the current rate of broadband-take-up in the UK, although less so when compared with some other countries. However, the question to be faced by the Government is whether the market alone can deliver such levels of connection, or whether significant Government intervention will be necessary - which would require serious debate and justification. Policy solutions to the development of broadband in rural and urban areas are likely to be different. For example, one option may be to subsidise rural customers to allow them to purchase satellite or fixed wireless broadband services at the same cost as DSL. Infrastructure in small towns could potentially be developed by opening up local education and government networks to private users. But in urban areas, there is general agreement that broadband will need to be delivered with sustainable private sector economics.

Many factors have been suggested to explain current low levels of broadband take-up in the UK, including:

- **Relatively slow roll-out of broadband by BT and cable operators, and poor quality of service**. In June 2001, there were nearly 800,000 DSL subscribers in Germany, compared with 80,000 in the UK (see Section 4.1 for discussion of this).
- **High price**. OECD examined DSL prices from incumbent operators in March 2001, weighted according to the amount of bandwidth offered. This placed the UK as 2nd most expensive of the G7 (with only Italy more expensive). However, for cable broadband services, the UK had one of the cheapest offerings[148].
- The ability of UK consumers to obtain **unmetered narrowband internet access**, which is used by heavy internet users who might otherwise switch to broadband. Such unmetered access is not available in many other European states. However, although internet access in the US is unmetered, broadband is relatively popular, and others argue that unmetered narrowband access can encourage users to move to broadband.

[147] It does not consider 3G mobile phone services, which should have commenced by 2003.
[148] The Development of Broadband Access in OECD Countries, OECD Working Party on Information and Telecommunication Service Policies, October 2001

- A lack of **broadband-specific content** or applications. Nevertheless, there are applications available, such as video-on-demand, which are currently uneconomic because of high access costs. For example, Video Networks Limited reported in January 2001 that they paid BT around £60 per month for each subscriber, plus a £600 connection fee (although this cost has now decreased) - while their customers only spent around £17 per month.[149]

It seems likely that some combination of these factors is responsible. In *The broadband future*, the Government sets out a number of actions to encourage broadband in the UK, which are detailed in the box below. More interventionist approaches to encouraging broadband were also discussed, such as tax incentives for broadband roll-out, funding universal broadband, or proposing a broadband universal service obligation at European level. However, the document suggested that such a route would be "*costly, of uncertain benefit, and with a range of potentially negative consequences for competition and consumer choice*". Nevertheless, many of the countries with relatively high broadband take-up have used public sector funding, tax incentives or subsidies.

UK Government Broadband initiatives

- Setting up a Broadband Stakeholder Group, with representatives from industry, Government, regulators, Regional Development Agencies etc. Chaired by the e-Minister, this group aims to report every six months on developing Government broadband strategy.
- Establishment of a £30 million fund, to support Regional Development Agencies in advancing innovative schemes for local access.
- Ensuring that at least 3,800 publicly funded *UK online* community internet access centres and all Business Links have broadband connections, to demonstrate their advantages to users.
- Co-ordinating public sector requirements for bandwidth. By amalgamating demand from schools, libraries, universities, the NHS, police stations etc, this aims to ensure cost-effective public sector procurement, and also to encourage suppliers to roll-out broadband into areas where it might otherwise be uneconomic.
- Stimulating the production of broadband content, through work with the Digital Content Forum and putting public and education services online.
- Research into the demand for and supply of broadband services.

Source: UK online: the broadband future

The work of the Broadband Stakeholder Group

In September 2001, the Government's Broadband Stakeholder Group (see box above) issued its first recommendations to Government[150], asking for comments from individuals and organisations by the end of October. Recommendations fell into four main areas, mirroring four workstreams set up by the Group:

- Competition and co-operation
- Content and demand generation
- Catalysing public and private sector broadband procurement
- Further research into the broadband market.

According to research by consultants Analysys, implementing all the Group's recommendations would increase UK broadband take-up by around fourfold by 2005 - although it seems unlikely that this would be enough to meet the Government's target of being the most "*extensive and competitive broadband market in the G7*".

The Stakeholder Group then submitted a full report and set of strategic recommendations to Government. These were published alongside a Government response and broadband strategy paper in December 2001. An ongoing question when considering broadband access has been

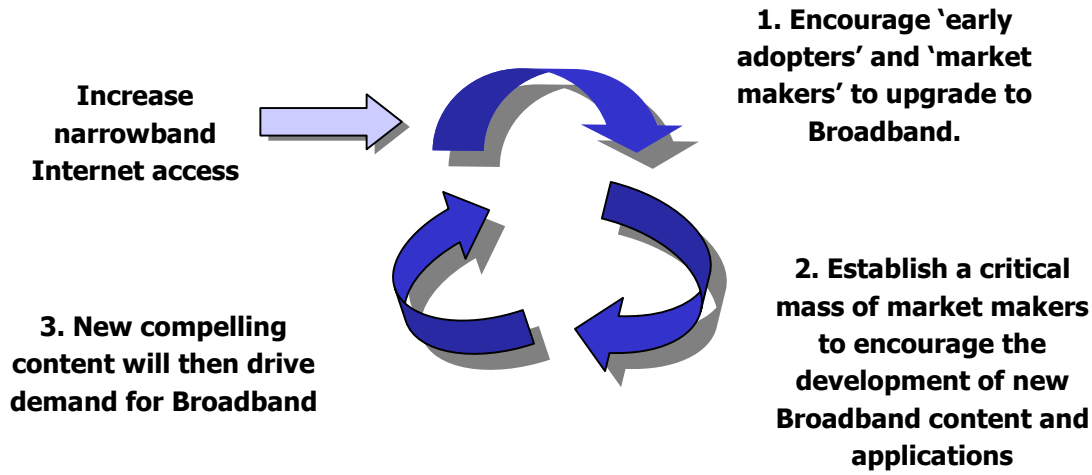
[149] Evidence to the Culture, Media and Sport Select Committee inquiry on the Communications White Paper, Session 2000-01, March 2001, Vol II

[150] The Next Steps for UK Broadband, http://www.e-envoy.gov.uk/ecommerce/broadband/bbsgrep_menu.htm

whether slow take-up is due to lack of infrastructure, or insufficient content. The Group proposed a 'virtuous circle' (Figure 11), with early adopters encouraging the development of content, which then drive further demand. The Stakeholder Group identified 15 specific recommendations, which are listed in the box on the next page, but pointed to three key measures which they deemed to be essential in the short term:

- Action to stimulate research into and development of broadband content and applications, to help drive future development of broadband.
- Fiscal measures to reduce the cost of broadband hardware and/or access charges to consumers to improve the price-benefit equation for early broadband adopters.
- Action to encourage the investment community to reopen the flow of investment capital for infrastructure investment.

Figure 11: The broadband 'virtuous circle'



Source: The Broadband Stakeholder Group, report and strategic recommendations, November 2001, published by the Office of the E-envoy

Government response

In its response to the Stakeholder Group, reflected in the Broadband Strategy, the Government proposed 24 actions under three main headings: maximising competition in the market; stimulating demand for broadband; and stimulating broadband supply. These included actions for Oftel and the Radiocommunications Agency, as well as Government departments. As the Stakeholder Group have pointed out, Government intervention in general should not distort the market and should be technology neutral.

Much of the Government's strategy agrees with the recommendations of the Stakeholder Group. In some areas, the Government agreed with the thrust of the recommendation, but not the detailed proposal. For example, the Stakeholder Group recommended a network of 'Broadplaces' to facilitate public access to broadband services, but the Government preferred to take this forward as part of the UK online centres initiative, where it had already committed to providing at least 3,800 public centres with 2Mbps connections. In *UK online: the broadband future*, the Government had already expressed support for other proposals raised by the Stakeholder Group, such as encouraging infrastructure sharing and aggregating public sector demand.

One major area of difference, however, is in the approach to funding infrastructure development. The Stakeholder Group proposed that the Government explore two methods to reduce the cost of capital for infrastructure development:

- Capital Cost Allowances (CCA): these allow companies to offset capital investment against taxable profit.

- Tax Credits, which tend to work in two ways: either a company may claim more of a given type of expenditure against tax than was actually spent, or loss making companies may surrender the ability to carry forward some losses in exchange for cash from the Exchequer.

However, the Government rejected such fiscal incentives for broadband infrastructure investment, arguing that, "*the use of the tax system to support particular types of investment should be limited to cases where there is clear evidence of market failure, sufficient to justify the costs of intervention, and the tax system is judged the most effective instrument for achieving policy goals. The Government does not believe that the criteria apply in this case.*" On the demand side, the Stakeholder Group proposed a range of tax incentives for customers (both individuals and business) to purchase broadband services. In response, the Government proposed to market existing measures more intensely (allowing small enterprises to offset ICT investment against taxable income; and relaxing personal benefit tax rules for employees who are provided with broadband connectivity at home by their employers).

The Government also rejected the establishment of a specific 'Content Development Fund' to stimulate creation of broadband content (which it suggested could have constituted illegal state aid in the form recommended). Instead, it proposed that the DTI should ensure its business support activities meet the needs of digital content providers and look at the scope to improve marketing of this support. On the customer side, the Government decided against grants for SMEs to cover the cost of acquiring broadband content and applications, arguing that raising awareness of broadband content benefits through *UK online for business* would be more effective.

Broadband Stakeholder Group recommendations

Accelerating Market Driven Deployment and Take Up
1. Implement supply side infrastructure support to reduce cost of capital
2. Encourage infrastructure sharing to reduce the need for capital
3. Promote increased competition in the BT Local Loop
4. Promote Broadband interconnection
5. Stimulate the supply of Broadband content, applications and services
6. Tackle skills needs for Broadband development
7. Introduce quality of service measures
8. Raise awareness and promote the benefits of Broadband to consumers and SMEs
9. Introduce demand side fiscal incentives to accelerate take up

Enabling Public Sector Driven Deployment and Use
10. Aggregate public sector demand for Broadband
11. Facilitate public access to Broadband facilities
12. Maximise efficiency and productivity gains in public services
13. Facilitate access to Broadband public services

Ensuring Appropriate Regulation
14. Enable a stable and predictable regulatory framework
15. Remove and prevent regulatory barriers to investment

Source: The Broadband Stakeholder Group, report and strategic recommendations, November 2001, published by the Office of the E-envoy

Public sector procurement

Aggregating public sector broadband procurement has been proposed for some time - as the House of Commons Culture, Media and Sport Committee noted in their 2001 report on the Communications White Paper, "*We would be more impressed with the innovativeness of this concept had we not ourselves raised the very same idea with Ministers nearly three years ago*

..."[151]. Potentially, it could allow schools, hospitals, doctors' surgeries, emergency services, further and higher education, libraries etc. to pool their demand for broadband, permitting more cost effective procurement, and perhaps even persuading communications operators to extend broadband to areas which otherwise would not be covered. However, it has not yet been implemented in any area of the UK. The Government's broadband strategy includes a pilot Broadband Brokerage service in one region, to allow companies, public sector organisations, communities and individuals to register their interest, and then broker aggregated solutions.

Scotland appears to be closest to a complete strategy for public sector procurement, with the publication in September 2001 of the Scottish Executive's paper *Connecting Scotland: our broadband future*.[152] It set out plans for 'zonal' procurement - where public sector demand would be aggregated in local zones, which providers would then bid to serve. This would avoid the creation of a Scotland-wide monopoly supplier, although there could be a monopoly within each zone. Two areas have been nominated as 'pathfinder' areas: the Highlands and Islands, and South of Scotland - in both of which the Scottish Executive believes the market would be unlikely to meet anticipated demand under current procurement practices.

Nevertheless, several concerns have been expressed about this strategy. Communications providers have little capital available for infrastructure investment, as pointed out by the Broadband Stakeholder Group, and any proposal will need the prospect of significant returns. So if public sector aggregation merely turns a proposition from a loss to a small profit, this is unlikely to guarantee investment. Even with aggregation, it seems doubtful that demand in very remote areas such as the Highlands and Islands will be enough to justify infrastructure investment - so further, more direct, measures may be needed for universal access. In addition, anticipated public sector demand is uncertain, so some providers have called for Government to guarantee a level of future demand. The prospect of creating a monopoly in a 'zone' has also been criticised, as not allowing for the benefits of competition. Practically, public sector bodies tend to be funded in different ways, with different timescales and expectations - so co-ordinating demand may prove difficult. Therefore, although such schemes have the potential to increase the appeal of broadband roll-out in some areas, their success is likely to depend on the detail of each scheme.

7.3 Switching off analogue TV

The radio spectrum is a finite resource (as made clear by mobile phone operators' willingness to pay £22bn for parts of it, although such values are unlikely to be repeated in the near future). Therefore, the Government plans to switch off analogue television services. As digital television is more efficient in its use of spectrum, it will then be possible to release some of the spectrum for additional uses (potentially including extra digital TV services). It is worth noting that there is a distinction between digital switchover, which aims to encourage viewers to move to digital TV, and analogue switch-off, which is when analogue signals would be stopped. However, there are issues concerning the desirability, availability and affordability of digital TV for much of the population which will need to be solved before analogue can be switched off. In September 1999, the Government outlined pre-conditions for analogue switch-off:

- availability - all 99.4% of viewers who can currently receive analogue television must be able to receive the main free-to-view channels digitally.
- affordability - digital TV must be within the reach of people on low or fixed incomes. As an indicator of this, 95% of consumers must have a digital receiver in the home.

The Government has said it may be able to satisfy these conditions and to switch to digital between 2006 and 2010. However, despite the fact that the UK is the most advanced digital TV

[151] Second Report Session 2000-01, The Communications White Paper, March 2001
[152] www.scotland.gov.uk/digitalscotland/csbc/csbc-00.asp

market in the world, 95% take-up by 2010 seems unlikely without a significant level of Government intervention. Some of the issues to be addressed are considered below.

Encouraging take-up

A recent survey for DCMS estimates that 55% of households will have digital TV by 2006.[153] Responses to an ITC, Oftel and OFT consultation[154] on digital TV pointed to between 55% and 79% penetration of digital TV by 2008 - a long way from the 95% target. The Consumers Association recently found that only half of those who are aware of digital TV know about Government plans for analogue switch-off[155] - and among the population as a whole, the figure is 44%[156]. Overall, 15% of the population claim that they will never get digital TV - this group is more likely to be female, in older age groups, and lower income households.[157] Although digital TV could offer them more channels and interactive services, there is lack of awareness of its benefits - and these may not be enough to make it universally desirable, even if it were affordable. Many of this group may therefore not subscribe to digital until the Government announces firm plans for switchover, giving them little choice.

Some commentators have proposed a Government subsidy, for example reduced VAT on digital products or a reduced television licence for digital viewers. Some have gone as far as to suggest that Government distribute free set-top boxes to those viewers who have not yet converted from analogue in the run-up to switch-off (although such an approach would have obvious implications for the market, as many viewers might delay converting in order to wait for a free set-top box). At present the Government is monitoring the market to see how the costs and technology develop, with a review due in 2002, but it has announced small-scale trials of free conversion to digital television.

Free-to-view services

Current take-up of TV has been driven almost exclusively by pay-TV subscribers. However, research[158] suggests that 30-40% of UK viewers have no interest in subscribing to pay TV. Digital TV is synonymous with pay TV in the minds of many viewers and few are aware of free-to-view digital channels or means of receiving them.

The Digital TV Group has co-ordinated an industry-led task force, which has produced "Free-to-View Digital TV – a guide for retail staff." Some 20,000 copies were distributed to retailers during November 2001. In addition, the BBC has been required to promote digital TV as part of the Government's agreement that it could launch new digital services (see Section 8.3). The House of Commons Culture Media and Sport Select Committee recommended a Government leaflet and information campaign to inform the public about digital TV, and ITV argue that information initiatives should have more Government backing and not be left solely to the industry. There are at present two means of obtaining free-to-view channels without paying a subscription:

- Buying a DTT set-top box or an integrated digital TV.
- Sky offer a free set-top-box to customers who agree to connect it to their phone line for a year, so they can receive interactive services. Non-subscribers pay a one-off charge of £100 for installation of the satellite dish and set-top-box.

However, not all areas of the country are able to receive DTT free-to-air services (see Coverage, below), and there is no free-to-view cable option. For the Government to meet its analogue

[153] Digital Television 2001, Mori for DCMS, June 2001
[154] Joint ITC, Oftel and OFT advice to Government on digital television, May 2000
[155] Turn On, Tune In, Switched Off, Consumers' Association, March 2001
[156] Digital Television 2001, Mori for DCMS, June 2001
[157] Digital Television 2001, Mori for DCMS, June 2001
[158] BBC Television services and the Take-up of Digital Television, prepared for the BBC, Nov 1999.

switch-off conditions, awareness and take-up of free-to-view digital access will have to rise considerably.

Integrated digital TV sets
Take-up and costs of integrated digital TV sets (iDTV) and set-top boxes are discussed in Section 3.2. iDTVs are currently much more expensive than analogue TVs (iDTVs tend to about £150 more than the equivalent analogue-only TV, and are generally available only at the top end of the market). Government is examining options for achieving a transition to the sale of only iDTVs. However, an outright ban on the sale of analogue only sets would require changes in European law and would be a major intervention. It could also be unpopular with viewers as around five million analogue TV sets are currently sold each year.

In March 2001, the Government announced plans for a 'digital kite mark'. A 'DVB' (digital video broadcasting) label should now be visible on the screen or box of all digital TVs in shops, so consumers can be sure that they are buying a digital receiver. But even many assistants in electronics stores seem to know little about digital TV options: a 'mystery shopper' survey of ten shops by the National Consumer Council[159] found that the majority of assistants did not give complete information on subjects such as the three ways of receiving digital TV (cable, satellite, terrestrial), possible coverage difficulties, the channels available on each, means of accessing the internet through digital TV or restrictions on video recording.

Multi-set households
Over two thirds of UK households have more than one TV set. Set-top boxes at present serve only one set at a time, so even in households with a digital TV in the living room there are likely to be one or more analogue-only TVs in other rooms. Similarly, analogue videos have tuners which can only receive analogue TV - so recording a digital signal on an analogue video requires a set-top box. There are an estimated 70 million television sets, and 25 million VCRs in the UK. Switching a household with three or four TVs and a video to digital is very expensive with current technology. Cheaper converter boxes could assist, as could greater take-up of integrated digital TVs when sets are replaced (although many households who buy a new TV keep their old set).

Digital TV coverage
Under the Government's conditions for analogue switch-off, 99.4% of the population must be covered by free-to-view digital services before analogue can be switched off. This level of coverage is likely to require a multi-platform approach, taking into account availability through satellite, DTT and cable. Coverage issues for digital TV platforms are considered in more detail in Section 7.1, but some key points are:

- Cable passes around half of UK homes, and coverage is only increasingly slowly. Also, there is currently no option to receive only free-to-view TV services via cable.
- Satellite TV can reach 98% of homes. For a proportion of viewers (such as those in national parks, conservation areas, flats) planning or other restrictions may make it difficult to install a satellite dish, although communal dishes can address some of the issues in multi-dwelling buildings. Other viewers may resist installing a satellite dish (although there might also be resistance to installing a new aerial for DTT reception – see below).
- 68% of the population can currently receive all DTT services. However, as discussed in Section 4.2, only a quarter of households may currently be able to receive DTT on a set-top aerial, and other viewers need to have new roof-top aerials installed in order to access the services. Building more transmitters could increase coverage, as could raising the power levels of the signal (which are kept low to avoid interfering with analogue TV signals, although increased power trials are underway). When analogue TV has been switched off, extra

[159] Digital Mystery Shopping, June 2001

spectrum could be allocated to digital TV and the power levels increased further – the extent of this depends on the Government's digital TV spectrum plan, and has not yet been determined.

Government plans

In October 2001, the DTI and DCMS published a '*Draft Digital TV Action Plan*' for consultation. This aims to draw together relevant strands of Government policy to promote take-up of digital TV and prepare for and manage analogue switch off, ensuring that no issues have been omitted. More detail will then be given in a comprehensive Action Plan to be published by the end of the year. The draft action plan mentions issues including:

- allocating spectrum for additional broadcasting and services.
- the relationship between switchover policy and internet access.
- possible TV access through high speed DSL services.
- extending the quality and reliability of DTT coverage.
- co-ordinating digital TV information campaigns

Many of the issues will be reported on between winter 2001 and 2003, and some, such as spectrum policy and interactive television policy, will be supported by full consultations. A number of bodies are also being set up to feed into the project; a group to oversee the pilot projects, a Stakeholders Group, Digital Television Group, Technology Group, Market Preparation Group and Spectrum Planning Group. These will include a variety of Government Departments, industry and consumer bodies and regulators. The draft action plan is ambitious in scope, but is only an outline - more scrutiny will be necessary once the full action plan is published. However, achieving switch-off by 2010 is a challenging target that will undoubtedly require close working between Government, industry and consumer groups if the fundamental concerns set out above are to be resolved.

8 Overarching policy issues

Convergence is likely to bring a major shift in the way individuals and institutions communicate, raising a number of major policy issues. This chapter considers some scenarios for the future of communications, discussing the factors which are likely to drive development. It then examines relevant policy issues, ranging from the implications for personal privacy to application of competition laws.

8.1 Scenarios

Quantitative predictions and forecasts of telecommunications development are inevitably inaccurate and uncertain. As an alternative, many analyses of convergence paint scenarios describing everyday scenes in a converged world to illustrate likely applications and their impact on lifestyle. Two examples from recent reports are shown in the box overleaf. Although these can be an enjoyable way of presenting ideas about the future of convergence, they are necessarily subjective. They have a tendency to exaggerate the extent of convergence and to concentrate on technical gimmicks - the fridge seems to play a central role. Nevertheless, more structured scenario planning is used by a range of organisations (including Shell and the UK Government's Foresight and Radiocommunications Agency programmes), and can be a helpful tool for encouraging stakeholders to discuss the future, compare possible developments and analyse implications for policy. Scenarios can also be updated as issues progress.

The Radiocommunications Agency, in its report *Mapping the Future of Convergence and Spectrum Management*[160], considered a converged world in 2010, defining four general scenarios which are also set out in the box overleaf. Using interviews with industry players and a workshop, the exercise considered a wide range of drivers – political, economic, social and environmental as well as technical, examining the potential timelines of a large number of events. The report stressed that these were not predictions and that the four scenarios were not mutually exclusive. Indeed, it went on to consider the linkages between the outcomes, concluding that the timing for different scenarios would differ. For example, the next five or so years would show whether restrictive 'walled gardens' (see Section 6.1) become more important than open networks.

Although the scenarios were generally supported, commentators such as the Digital TV Group[161] have expressed concern over the concept of scenario planning[162]. They feel that it can be helpful as a stimulus to debate but that in general it channels discussion along preconceived paths, with scenarios becoming 'self-fulfilling prophesies' and seen as alternative outcomes. They also point out that the speed of change is often much slower than advocates predict. Arguably, it has generally taken consumers ten years to adopt new technologies such as mobile phones or CDs and although even vocal advocates underestimated the speed of take-up of the internet and digital TV, neither are close to universal penetration. Overall, the Digital TV Group thought that broadcasting, as a cheap and efficient means of one-to-many communication, would remain the core of entertainment and that the voice of conservatism and consumer lethargy was lacking in the scenarios. Therefore, they proposed a fifth scenario - Conservatism Rules OK (see box).

[160] May 2000. This was updated by a workshop on 31 January/ 1 February 2001.
[161] An industry body with over 100 member companies www.dtg.org.uk
[162] The future of communications and e-commerce, Digital TV Group

'A day in the life' - scenarios of convergence

Living in the future: Gita
From the Foresight Electronic Commerce Task Force Report, March 2001
Gita unrolled her screen while the kettle boiled, and stuck it to the fridge while she padded around the kitchen. It played a tune she'd set it to search out overnight - she was teaching it her tastes, and this one was almost spookily up her street. She turned off the pulsing, colourful news links which were jostling for her attention and brought up the roof-cam, which turned her fridge door into a window on the world outside. [...]

The garden of e-den
From 'Report from the future' by Mike Teasdale and Zaid Hassan, New Media Knowledge, October 1999
Life had lost its meaning for Jack so he killed himself. Well he would have done, but when he wandered out to the garage to gas himself the car was gone. There was a note on the floor from the repair shop. The car had decided to run some routine diagnostics, wasn't happy with the fuel economy figures and had checked itself in for a service. "Nice of you to ask," he muttered.
But that was what life was like in 2004. A proliferation of intelligent devices, all networked over wireless links. 'A new generation of online labour-saving gadgets' trumpeted the advertising. "What if people like working?" he had shouted at his TV - just before he had worked out how to use the electronic programme guide to flick to another channel whenever advertising came up.
Now that suicide was off the immediate agenda, Jack was hungry. He shuffled back into the kitchen and flicked on the touch screen display on the e-fridge door. Up came a list of all the contents. A light was flashing next to the macaroni cheese - one day to go before its use-by-date expired. Seemed like a decent idea. He passed the tray of macaroni cheese in front of the bar code reader on his microwave. The recommended cooking times appeared on the display - he pressed the Accept button and put the dish in the microwave. Then he dropped the packaging into his new e-bin the local supermarket had just supplied. "Hey Jack, do you want to re-order?" asked the bin. "No thanks, Mr Bin," Jack replied. "I'm hoping to kill myself tomorrow." "We have a two-for-one special," said the bin. "Oh all right," said Jack. "Twist my arm". [...]

Scenarios for communications development

Adapted from: Radio Communications Agency, Mapping the Future of Convergence and Spectrum Management, May 2000
Internet convergence
- Telecoms, computing, entertainment, consumer electronics have converged around the Internet
- The Internet is part of the fabric of everyday life for consumers, businesses (& machines)
- Electronic Commerce is booming, regulation is streamlined and light-touch

Digital islands
- "Walled gardens" based on portals and interactive digital TV are popular for consumer services; cable does very well
- The Internet has fraud, privacy, and capacity problems - it is seen as unattractive
- Regulation is little changed, incumbent operators dig in, open access requirements are modest

Total Mobility
- Devices converge around mobile handsets that combine phone, e-wallet, digital ID, Internet access
- Wireless local networks and Bluetooth-style links (see Annex B) are common, there are plentiful, affordable public mobile services; wireless fixed access is common
- Greater industry self-regulation is used on many spectrum and infrastructure issues

Broadband revolution
- Technology leaps, especially optical fibre, improve broadband quality and reliability at affordable cost
- Uses like Video-on-demand, Virtual Reality and networked game-playing drive bandwidth demand
- Wireless can't match it, and is used only for true mobility and temporary or supporting roles; environmental and health concerns constrain mobile network and service development.

From The future of communications and e-commerce, Digital TV Group (Heading 5)
Conservatism Rules OK
- Consumers are apathetic to data-enabled phones and stick with GSM and text messaging.
- Pay TV does not penetrate more than 50% of households, digital TV sets make steady inroads but analogue TVs remain ubiquitous and continue to dominate the small screen market (due to lower price and the fact that digital cannot be received on a set-top aerial).
- Internet boxes which work with analogue TVs become cheap and popular for browsing and email. But a significant proportion of the population remain outside the digital revolution.
- Consumer resistance to turning-off analogue TV develops, as reality dawns that analogue TVs will cease to work.

There will undoubtedly be a number of different models of individual use, varying with the age, gender, social class and educational background of the user, as is true at present for all communications technologies. Business will also have different priorities, such as a greater need for reliability, bandwidth and security.

Clearly, such scenarios may or may not prove to be accurate descriptions of possible futures, but it is inevitable that convergence will be shaped by features which are not amenable to reliable predictions, but may be amenable to policy intervention. Among the most important identified to date are:

- Whether new technologies have universal access, and encourage social inclusion rather than exclusion.
- Access to broadband infrastructure and services.
- How content is regulated, both on the internet and via traditional broadcast channels.
- Market developments - how competition is regulated, whether the market becomes dominated by a few big players.
- The future of public service broadcasting and other free-to-view content, including Government services online or on digital TV.
- Confidence in the security and privacy of new services.

Access and content issues have been discussed in Chapters 6 and 7. The remaining overarching issues are considered in the rest of this chapter.

8.2 Competition and the future of the market

The new communications market is still in its infancy, and hence is changing rapidly. For instance, recent years have seen the emergence of new global companies such as Yahoo!, mergers creating large cross-media groups like AOL Time Warner, and new markets and challenges for established companies such as BT. On top of this flux is the market volatility of technology companies - with the collapse of the technology stocks in early 2001, many dot.com shares are now worth small fractions of their previous value. Further, the current general slowdown in the technology sector has led to even well-established companies (such as Marconi and Motorola) shedding hundreds of jobs, while there is little finance available for investment.

The Office of Fair Trading argue that for the purposes of competition regulation, it considers that the principles of competition policy hold good in the 'converged world'. For example, in many ways the internet is simply another delivery mechanism, with on-line shopping a substitute for mail order or high street shopping. However, they suggest that difficulties are more likely to be faced in terms of process and remedy when dealing with fast changing and innovative markets. This section considers the challenges for regulation of competition, examining issues such vertical integration, media ownership and potential revenue streams.

Vertical integration

Vertical integration is where a single company is active in more than one stage in the production and supply of a service - for example, where a network operator also provides enhanced services which are carried over the network, or supplies the consumer equipment needed to access services it provides. Sky argue that vertical integration can have benefits, pointing to the investment of more than £2 billion spent in building its digital platform and the risk that this entailed. It reasons that many small and independent channels would never have gone on air without Sky's infrastructure investment, and points to the large number of third-party, independent and specialist channels on digital satellite to support this. Sky also contend that their carriage payments have made market entry easier for a wide-range of non-owned programme services. Oftel also argue that vertical integration can bring consumer benefits by

speeding innovation.[163]

However, some[164] maintain that vertical integration can restrict the range of different types of content and services available (diversity), and the choice of service providers (plurality). Vertically integrated companies have an obvious incentive to favour content produced by their subsidiaries. Also, in the absence of regulation, only companies with a comparable market position would be able to negotiate on anything like a level playing field with vertically integrated distributors. Although the White Paper rules out banning vertical integration, it proposes that the regulator will have the power to judge when a network should be opened up to all content providers. It also proposes that where a vertically integrated company has a dominant position in one market, the regulator should take account of the effects of its activities on competition in any related markets.

The box on the next page sets out some of the issues associated with access to television delivery channels, such as 'conditional access' to satellite TV and 'must carry' rules for cable operators. As shown in the box, the main issue for each is how much broadcasters (but particularly public service broadcasters) - and hence customers - pay for access to delivery infrastructure. There is also an issue over how much access broadcasters have to information about viewers. Regulatory intervention to open up access to telephone networks is discussed in Section 4.1, in the section which considers 'unbundling the local loop'. Across all converging communications markets, standards and the ability of customers to switch providers is also likely to remain an issue - an example of this is given in Section 3.2 on digital TV, which considers set-top boxes.

Competition regulation

Under the Communications White Paper proposals, OFCOM would have concurrent competition powers with the Office of Fair Trading (OFT) to regulate the communications sector. Government expects that competition issues in the communications sectors would, in general, be dealt with by OFCOM rather than the OFT - although the OFT and Competition Commission would consider mergers, in consultation with OFCOM.

The new regulator would also have sector specific powers, covering issues such as consumer protection, access and interconnection. Stronger sectoral competition rules would apply to companies with significant market power.

Most respondents to the White Paper welcomed the proposal to give OFCOM concurrent powers with the OFT to exercise Competition Act powers for the communications sector. In their response, OFT suggested the following general split on concurrency issues:

OFCOM

- Telecoms network and services (including apparatus) and their substitutes and the services required to provide such.
- Commercial broadcast programme issues to include independent productions, provision of channels and programming e.g. BSkyB at wholesale and retail level.
- Conditional access, EPGs, and other gateways to broadcast content.

OFT

- Computer software, hardware and services e.g. hosting.
- Consumer facing content which may be in the same market as 'old economy' services and goods e.g. business-to-consumer and business-to-business e-commerce portals.
- Rights ownership, such as sports rights – i.e. not the programming itself but the deals which

[163] Open access: Delivering effective competition in communications markets, April 2001

[164] For example, see Media and Telecoms Regulation in Converging Markets, Harry M Shooshan III and Martin Cave, in e-britannia: the communications revolution, 2000, or Communications revolution and reform, Damian Tambini, IPPR 2001

involve ownership of rights which may cover a range of activities, some of which may ultimately lead to programming. These issues are one step removed from the programming itself.

Access to TV distribution networks

'*Conditional access*'
To operate pay digital TV, providers need to control who can watch each channel, so that only subscribers are able to access pay channels. This is achieved by encrypting the TV signals and equipping each set-top box with a 'smart-card'. The set-top box can then allow decryption of only the appropriate channels. Such a system of smart-cards, encryption and authorisation is known as 'conditional access' (CA). Encryption is not used by pay TV only - it is also employed by free-to-view services such as the BBC, ITV1 and Channel 4 when they are delivered by satellite. These channels do not need CA to raise revenues through subscription, but to prevent copyright problems as a result of signal overspill into other countries and to ensure that the appropriate regional services are delivered to UK viewers. An appropriate smart card is provided free by the public service broadcasters to UK residents who do not subscribe to pay-TV. In the UK, each of the digital pay-TV platform operators runs its own CA system. Similarly, each operator runs their own electronic programme guide (EPG), which allows customers to navigate around the different services – programme providers can also buy access to the EPG.

Any broadcaster can access the satellite platform, by renting the infrastructure to allow transmission to and from a satellite. This is how unencrypted channels such as CNN are broadcast. But channels which use encryption (such as the BBC, ITV and Channel 4) need access to Sky's CA system. Under EU regulation, this must be offered by Sky on a 'fair, reasonable and non-discriminatory basis'. Oftel regulates the precise interpretation of this requirement, which has been the subject of some discussion. Oftel has thus far applied the principles that:

- comparable service providers purchasing comparable services should pay comparable prices.
- where service providers are not providing directly competing services then discrimination in pricing is unlikely to have an adverse impact on competition and should not be prohibited.

This implies that CA does not have to be provided at equal cost to each broadcaster - for example, pay-per-view channels may pay a different price to subscription TV, which may again be different for free-to-view channels. In regulating these charges, Oftel allows Sky to recover its costs for establishing the satellite platform, plus a reasonable rate of return. However, there is fundamental disagreement between players over whether this regulatory structure is sufficient to ensure access for public service broadcasters at an appropriate price. Oftel is currently consulting on the mechanism used to regulate CA services and the exact price that can be charged for conditional access to different types of channels; it has asked for responses by 25 January 2002[165].

'*Must carry*' *and* '*must offer*'
It is the Government's intention that the main public service channels continue to be available on all platforms. To this end, it proposes an obligation on public service broadcasters to make their services available to all platform operators (this is known as 'must offer').

It also proposes provisions to ensure TV operators carry the relevant services. On DTT, public service broadcasters have been allocated their own spectrum capacity (chiefly for simulcasting their analogue services). Cable operators would be covered by a regime whereby they 'must carry' the qualifying public service channels, and public service broadcasters would not have to pay for this carriage. In return, public service broadcasters would provide their channels to cable operators without charge. This mirrors the arrangement that now exists in practice, but raises issues where the viewing of the PSB channel may be very low. In the case of satellite TV, current requirements to provide their conditional access systems on fair, reasonable and non-discriminatory terms would be maintained (although there is debate about the implementation of this - see above). There are, as yet, no plans for the extension of 'must carry' and 'must offer' requirements to potential digital TV platforms such as ADSL.

'Must carry' and 'must offer' would apply to the existing free-to-air public service channels and the BBC's new digital services. If the number of public service channels on offer continues to rise there would be scope for extension of the obligations. Cable operators argue that any increase in the number of channels they are required to carry free of charge reduces the commercial viability of their platform. The possible application of a 'must carry' approach to the introduction of Government service delivery via digital TV would raise a substantial new issue for all digital TV operators. The White Paper proposes that if additional public services are designated, this will be subject to reasonable compensation for the operator. It also notes that capacity constraints will need to be taken into account before adding channels to the list.

[165] The pricing of conditional access services and related issues, 30 October 2001

However, some stakeholders suggested that the OFT should have sole control over general competition regulation, with OFCOM exercising only sector-specific powers.[166] They noted that Oftel has tended to use its sector specific powers, rather than its concurrent powers. Others[167] argued that OFT should be the lead player in the partnership and that the strengthening competition in the communications sector means that a move to the same model of economic regulation as in other sectors might be appropriate. Whichever regulator takes the lead, it will be important to ensure that OFT and Oftel enforce competition law consistently and that overlaps in their roles are minimised.

One of OFCOM's primary objectives is proposed as, "*protecting the interests of consumers in terms of choice, price, quality of service and value for money, in particular through promoting open and competitive markets*." In the White Paper, the Government recognises that there may be conflict between and within these objectives - for example, short-term consumer protection may require regulation that is not necessarily compatible with longer-term goals of promoting open and competitive markets. According to the White Paper, conflicts would be resolved by OFCOM's governing board. But commentators, such as the ITC, have suggested that more specific guidance should be given about the priority of the different objectives. Alternatively, BT has suggested that OFCOM should explain how and why any trade-offs are made. In its response to the House of Commons Culture Media and Sport Select Committee report on the White Paper, the Government agreed that consumer protection and the promotion of competition should be stated as separate objectives, but reiterated that it would be for OFCOM to resolve any conflict between objectives on a case-by-case basis.

In addition to the debate about which agency should exercise competition powers, there is also the issue of the sector-specific powers that might be necessary. For companies with no significant market power, the White Paper proposes that OFCOM's ability to make sector-specific rules will be limited to 'essential' issues (such as consumer protection, access and interconnection rights, rights to use telephone numbers and spectrum, etc.). Mobile phone operators such as Vodafone point to their industry as an example of a sector with light economic regulation where competition has resulted in innovation and major market growth.

For those with significant market power (in itself a matter of some debate), the White Paper states that regulation may include:

- Non-discriminatory interconnection and cost-based pricing for interconnection to other companies.
- Requirements for vertically integrated companies to produce separate regulatory accounts.
- Rules against unfair cross-subsidies.
- Rules prohibiting undue discrimination or undue preference between the firm's own business and that of third parties.

Some industry stakeholders have stressed the potential for deregulation. BT, for example, has proposed that OFCOM should be under an obligation to review regulation regularly, and remove that which is no longer applicable. The Haskins report from the Better Regulation Task Force[168] looked at how Oftel measured up to its 'principles of good regulation' - transparency, accountability, proportionality, consistency and targeting. It makes five specific recommendations set out in the box on the next page. Plans for OFCOM will need to ensure the Haskins recommendations are taken into account.

[166] Reuters, Energis, The Operators Group
[167] Such as Vodafone
[168] Economic Regulators, Better Regulation Task Force, July 2001

Recommendations from the 'Economic Regulators' report of the Better Regulation Task Force

- Regulators' annual business plans should include a clear explanation of how they will prioritise their different objectives. Regulators should also explain how the decisions they take relate to their objectives.
- Economic regulators should be required to produce assessments of costs and benefits for proposals with a significant impact on business activity.
- The boards of regulatory bodies should include both executive and non-executive members. They should be appointed for their expertise rather than to represent stakeholder groups.
- Regulators should include in their work plans proposals to encourage an innovative approach to consultation, allow a real dialogue between different stakeholders and demonstrate how proposals have been amended following consultation.
- Regulators should set out a programme in their annual work plans to review market sectors for lifting price controls and the removal of outdated licence conditions. Companies should be able to challenge failure to complete these programmes.

Media ownership

Media ownership rules aim to promote competition and plurality of views in media markets, and were a major area of contention about the White Paper. The Government has since published a consultation[169] on this topic, with comments requested by 25 January 2002. Some of the proposed options are set out in the box below.

Current rules do not include new media such as the internet - one question is how far such media should be included in any new rules, and which of the approaches outlined in the box below might be the most appropriate. Large web sites can already receive as many 'readers' in one day as newspapers, and online content extends the plurality and diversity of media sources. In addition, newspaper web sites attract readers who are not included in their circulation figures. With the potential for broadcasting over the internet, any cross-media rules which do not take these developments into account risk distorting the market or simply becoming obsolete.

Consultation on Media Ownership Rules, November 2001

The consultation included the following options for change:

- The Government is committed to removing the 15% limit on share of TV audience. This could permit greater consolidation of the ITV network, allowing mergers such as Granada and Carlton. Views were requested on an alternative approach to prevent the joint ownership of ITV and Channel 5.
- Over 6,000 people submitted letters and emails to the previous Communications White Paper consultation in support of changing the ban on ownership of national radio licences by religious bodies. Others argued that the ban should be maintained, while a third view proposed a multi-faith national licence. (Note that religious bodies could already broadcast radio over digital satellite TV or the internet). The November consultation paper invited views on removing restrictions on religious bodies holding broadcast licences.
- Radio ownership is currently regulated based on the size of population covered by a licence. Views were invited on abolishing this and on options for ensuring plurality in local areas.
- Cross-media ownership rules prevent national newspaper owners from controlling radio and national TV services. Similar rules apply for local newspaper owners and local TV and radio. The White Paper mooted a number of potential ways of reforming the system and requested comments. Some organisations[170] proposed that increasing diversity and a more competitive market made cross-media ownership rules out-dated, so they should be scrapped, with general competition law ensuring plurality. Others argued that removing the rules could lead to concentration of media ownership and further vertical integration, reducing plurality. The consultation paper asked for views on retaining, reforming or abolishing these cross-media limits.

[169] Consultation on Media Ownership Rules, November 2001, DCMS
[170] For example, SMG plc, Daily Mail and General Trust plc, News International plc.

Marketing and revenue

A key question is how new media operators will make sufficient return on their investment. Although communications companies such as BT often make large yearly profits (and have large debts), others – such as ITV Digital - have required major investment and not yet made any profit. This is even more true of dot.com companies, as the internet has developed in a market where content and services have been provided for free and so this is what customers expect. In addition, traditional revenue models are under pressure. Advertising income for terrestrial TV operators is decreasing due to a number of different factors, including:

- Audience segmentation as new services launch.
- Increased new media marketing.
- The general economic slowdown.

Five years ago ITV had 80% of the television advertising market; this has now fallen to 56%.[171] Subscription services are increasingly popular for TV viewers but it is not yet clear how much impact innovations such as 'pay-per-view' and interactive digital TV will have on revenues.

Communications providers have been at the forefront of developing innovative revenue streams and marketing strategies. For example, rather than pay a monthly subscription, many UK users now connect to the internet through 'free' ISPs which take a percentage of per-minute call charges (see Section 4.1). This model was pioneered by Freeserve in 1998. In the mobile phone sector, the introduction of 'pay-as-you-go' phones opened up the market, to the extent that this tariff is now used by over 70% of UK customers. Similarly, digital TV has seen operators offer 'free' set-top boxes to consumers who sign up for their services. However, the sustainability of some of these models is unclear. Mobile phone operators have recently raised the price of pay-as-you-go phones, moving from cross-the-board subsidies to targeted subsidies for upgrades as penetration has increased and the initial race for market share slowed. Moreover, BT argues that 'free' ISPs mean customers have become used to not paying subscription charges for internet services and content, so there is less investment available to develop quality content or applications and hence little incentive to use broadband (although, conversely, as free ISPs have contributed to increasing internet penetration, they could also lead to greater take-up of broadband).

Overall, if investment in new services is to be recouped, individual and business spending on communications will need to increase. Given that users could obtain more services for their money, this is not implausible, although it could lead to as many as five bills for communication services per household (fixed phone, mobile phone, TV licence, pay TV and broadband internet). However, whether the balance of this increase comes through subscriptions, pay-per-use, indirectly through advertising or through some innovative revenue stream, OFCOM's regulatory powers will need to be flexible enough to protect consumers and ensure competition. Such flexibility could incorporate regular market reviews, and application of a range of regulatory approaches to achieving overall policy objectives. Regulatory options may include 'command and control', fiscal incentives, and potentially even more innovative schemes such as those seen in the energy markets to encourage renewable energy (see POSTnote 164[172]) - although some of these approaches would require decisions from Ministers, rather than being within OFCOM's gift.

8.3 The future of public service broadcasting

Convergence will certainly have implications for public service broadcasting but there is wide agreement that such services will continue to have a role for economic, democratic and cultural

[171] The Observer, 1 July 2001, 'Life or Death for ITV'
[172] Renewable Energy, POST, October 2001

reasons[173]. Public service broadcasting provides a range of benefits, such as universal provision, free-to-view content, UK production and regional content.

The UK currently has five analogue TV channels with a public service remit - BBC 1 and 2, ITV1, Channel 4 and Channel 5 - and teletext. In addition, S4C broadcasts in Wales. All have privileged access to the radio spectrum to broadcast their content, but they are funded by a variety of mechanisms. The BBC is funded by the licence fee; Channel 4 and S4C are statutory non-profit-making corporations, both funded by advertising and other commercial revenues - S4C also receives a Government grant. ITV and Channel 5 are commercial companies with shareholders, who pay for their broadcasting licences and are funded by a combination of advertising and sponsorship. In return for privileged access to spectrum and this sliding scale of funding arrangements, the channels have varying public service obligations, ranging from extensive requirements for the BBC and ITV to the lighter obligations of Channel 5. For example, the BBC has a wide range of obligations set out in its Charter and Agreement, including regional programming, provision for people with disabilities and producing "*programmes that stimulate, support and reflect, in factual programmes, drama comedy, music, and the visual and performing arts, the diversity of cultural activity in the UK*[174]". The White Paper supports the retention of these existing public service broadcasters, as well as suggesting that it may be appropriate to consider adding additional public services over time.

At present, public service channels are created in one of two ways, both controlled by the Secretary of State for Culture, Media and Sport. Firstly, the Government can decide that a new public service channel be established (such as Channels 4 or 5), and invite bids for the licence. Secondly, the Secretary of State must agree to new BBC channels funded through the licence fee, which would have a public service remit. In response to concern in the commercial sector, procedures have been put in place for the Secretary of State to formally consult about and agree any new such channel. As the number of digital TV channels grows, this ad-hoc approach to creating and controlling the number of channels may need to be reconsidered. The National Consumer Council, for example, has called for the development of an 'over-arching framework' for public service broadcasting[175].

The House of Commons Culture, Media and Sport Select Committee, in their report on the Communications White Paper, agreed there was a role for public service broadcasting but noted that its future would be different from the past. The Committee considered that new forms of public service content would emerge, including Government services and local television and set out three general principles for future provision:

- although 'privileged broadcasters' will continue to produce considerable public service content, it does not follow that their output can be equated with public service broadcasting.
- the direct and indirect costs of 'privileged broadcasters', to the public and the market, should be identified and assessed against other means of achieving the desired ends.
- public service content should be provided from whatever source is most appropriate, rather than protecting the privileges of certain broadcasters.

However, this is not the approach taken by the White Paper, which proposes that public service broadcasting will continue to be delivered by specific broadcasters.

Increasing numbers of television channels mean that the public service broadcasters' audience share will almost certainly decrease (in 2000, 116 new channels were licensed). For example,

[173] See the Communications White Paper, Chapter 5 for the Government's justification of this.
[174] Communications White Paper, Section 5.8.2
[175] House of Commons Culture, Media and Sport Select Committee, The Communications White Paper, March 2001, Evidence pg 2

both BBC 1 and ITV1's share of viewing in analogue homes is ~27%, compared with 18% in digital homes. However, most digital viewers watch only a small number of the available channels and public service broadcasters currently attract nearly two thirds of the audience in multi-channel homes. Digital broadcasts of the five analogue channels are therefore likely to retain a significant proportion of viewing - especially as around a third of viewers currently express no interest in subscribing to pay TV.

The public service broadcasters

BBC

Of the privileged broadcasters, only the BBC is funded by licence fees. It faces some of the biggest challenges, particularly in justifying its current funding arrangements in a converged future. The BBC plans to add more digital TV channels (see box below), for three main reasons: to give consumers an incentive to switch to digital beyond what the market would provide ; to offer more choice to those who are unable or do not wish to subscribe to pay channels; and because it sees a need to offer more niche channels to engage digital TV viewers. Similarly, it plans new digital radio channels to encourage the development of digital radio.

BBC digital plans

The BBC plans to expand its digital television channels. At present, as well as BBC1 and BBC2, it broadcasts four other digital channels - BBC News 24, BBC Parliament, BBC Choice and BBC Knowledge. Under the agreed plans, BBC1, BBC2, BBC News 24 and BBC Parliament would remain, but be supplemented by three new channels:

- BBC 4, which would offer extensive coverage of the arts, sciences, history, philosophy and current affairs and offer a forum for intellectual debate. It would be available from 7pm to 1am.
- a channel for children under the age of 6, which would offer a range of new, high quality, UK-produced education and entertainment programmes for young children during the day.
- a channel for 6-13 year olds, which would offer new drama, comedy, entertainment, news, factual programmes and world children's television during the day until 8pm.

A number of new digital radio stations are also planned:

- Network X (working title), which would be a new radio station focussing on black music, news and factual programmes for a primarily young audience.
- Network Y (working title), which would offer popular music from the BBC's archive from the 1970s to the 1990s.
- Network Z (working title), which would offer the best of current and archive radio programmes of comedy, drama, stories and features with regular sections devoted to programmes for children.
- BBC 5 Live Sports Plus, which would offer a new outlet for radio coverage of live sport complementing the existing service on BBC Radio 5 Live.
- BBC Asian Network, which would offer nationally the current range of programmes specially focussed on Asian audiences which is presently available only regionally.
- The BBC World Service would be broadcast digitally in the UK.

A consultation run by the BBC on these proposals received ~6,700 responses from organisations and individuals. A majority agreed with the digital TV proposals. Support for new radio services was less clear cut, with Networks Y and Z the most widely approved, but the other networks having greater approval among their target audience.

Source: DCMS press release 18 January 2001

These plans have raised questions over whether the licence fee should be funding channels which are not yet universally available (although there is a precedent in the limited availability of BBC 2 during its early years). Further, there are a number of commercial channels which, it is argued, already offer similar content, such as children's programming. However, none of these commercial channels is universally available or free at the point of delivery. The Secretary of State for Culture, Media and Sport agreed to the additional channels detailed in the box, based on criteria such as whether the services were consistent with the BBC's public service role; the likely impact of the BBC's proposals on other services in the market and what added value the

proposed new services would bring to viewers and listeners. On the new channels, high proportions of programmes would be made in Europe (for example, 90% of output on the channel for under sixes), and online and interactive services would be developed to support programmes. However, a proposed digital BBC 3 TV channel was turned down - this would have focussed on programmes (comedy, drama, music, etc.) for a young adult audience. The Secretary of State stated, in rejecting the BBC3 request, "*It was not clear that its proposals were truly distinctive in an already crowded market*"[176], but invited the BBC to put forward fresh proposals for the channel.

Channel 4

Channel 4 has a distinctive remit to provide information, education and entertainment; to appeal to tastes and interests not generally catered for by ITV; to encourage innovation and experiment and to have a distinctive character of its own. It is currently a non-profit making statutory corporation, but some commentators had suggested that it should be privatised. This was rejected by the White Paper but plans were proposed to review its remit to make it more positive. Channel 4 has also launched two extra digital channels (FilmFour and E4), and the rules ensuring these are not unfairly subsidised are likely to be clarified in the forthcoming Communications Bill.

S4C

Sianel Pedwar Cymru (S4C) provides range of programmes in Wales. It currently offers three channels - S4C shows programmes in English and Welsh, while S4C Digital offers 12 hours of Welsh programming each day. S4C2 offers coverage of proceedings from the National Assembly for Wales on digital TV. S4C and S4C Digital are regulated by the S4C Authority, and under the White Paper proposals this will continue alongside OFCOM, with S4C's role and remit remaining as at present.

ITV

The ITV companies have significant public service requirements and the Government believes their public service role should continue. ITV is a commercial public service broadcaster, primarily funded by advertising revenues - but these have decreased over the last few years, raising questions about its future funding and ability to deliver its public service obligations. The White Paper proposes a flexible regulatory framework for ITV, which would be able to review public service obligations after digital switchover. ITV has launched two new digital channels - ITV2 and ITV Sport. Although ITV1 and ITV2 are now available on satellite, this has only recently been agreed. ITV is also subject to media ownership rules which restrict the amount of consolidation possible among companies running different regional licences but the White Paper suggests that these might be amended, potentially allowing ITV to be run by a single company (see Section 8.2).

Channel 5

Channel 5 has lighter public service obligations, and unlike the other public service broadcasters is not universally available. Indeed, the Culture Media and Sport Select Committee queried Channel 5's status as a public service broadcaster. The White Paper notes that 'more popular programming' is increasingly available on cable and satellite and therefore intends to review Channel 5's public service requirements, with "*the aim of making the channel a far stronger competitor to the other public service broadcasting channels*".

[176] DCMS press release, 12 September 2001, Tessa Jowell announces decision on proposed new BBC digital services.

Public service broadcasting online

New media platforms also offer opportunities for public service broadcasters. The BBC web site (www.bbc.co.uk) is the most visited content site in Europe, with one third of all UK internet users accessing the site. It includes news, sport and education features – as an example, around two thirds of GCSE students use the GCSE Bitesize pages. Funded from the licence fee, in 2000/01 it cost £52million. There has been some discussion about the appropriateness of UK licence fees providing content which can be accessed worldwide, and the BBC has been asked[177] to look into means of charging users who access the site from outside the UK. However, it is generally very difficult to identify accurately where internet users are from (see Section 6.2 on content regulation), so such charging may not be straightforward. Commercial operators have challenged the BBC's use of licence fee money to fund internet services and other new media services which are not accessible by the whole population, and which they argue have distorted the development of the market.

The BBC also operates a number of commercial web sites, such as www.beeb.com for entertainment and e-commerce, which is funded through BBC Worldwide, the BBC's commercial subsidiary. As with their commercial partnerships to produce TV programmes, these funding and revenue streams are separate from public service funding. This is intended to remove the possibility of services funded by the licence fee cross-subsidising commercial services.

The role of public service broadcasters online is still developing. If their function should be solely to provide public service content, this could potentially be fulfilled by commercial providers using public funds - although the commercial branding of such services may raise some concerns. Alternatively, public service providers could continue to have a wider remit encompassing obligations such as ensuring universal access to content, reflecting diversity, supporting independent production and including regional content. If public service broadcasters are to have such objectives, there might be a case for applying positive regulatory obligations to online content, although this is not being proposed in the upcoming legislation.

The White Paper endorses the BBC Online service as "*high quality and distinctive*".[178] It does not propose direct regulation of internet content by OFCOM - internet content would be in 'tier zero', subject to general law and self-regulation. However, the White Paper does state that PSBs would be expected to apply the same standards online as offline. Some respondents expressed disquiet over this potential extension of content regulation to the internet. For example, they are concerned that ISPs will be required to give 'due prominence' to PSBs on their home pages - paralleling electronic programme guide requirements on digital TV - although Government Ministers have ruled out regulating internet content. Section 6.2 considers internet content regulation in more detail.

Delivering public services

The possibility of delivering public services via the internet and digital TV has been discussed in Section 5.5. Such plans could have wide implications for public service broadcasters, who may be seen as the logical partnership for delivering such services. An example is 'Curriculum Online', which the Department for Education and Skills (DfES) is developing in partnership with the whole industry. This would put core school curriculum material online, with public and private funding. The DfES has consulted on collaborative models for delivery of 'Curriculum Online' by public and private sector players, including the role that the BBC might play. Its conclusions are expected to be published shortly. In parallel, the BBC plans to invest £135m of licence fee

[177] The Future Funding of the BBC, Report of the Independent Review Panel, Chairman: Gavyn Davies, July 1999
[178] Section 5.9.1

money for the development of digital learning materials, but this will require approval from the Secretary of State for Culture Media and Sport and consultation across industry. The BBC's plans were initially criticised by commercial producers of educational textbooks and software, who were concerned that they could adversely affect their market. However, the BBC has stated that it will contract out half its funded content. It argues that by taking a leading role in the digital curriculum, but not providing all the content itself, it can bring public service attributes to the project while stimulating the wider commercial marketplace.

Regulating public service broadcasting

Under the Communications White Paper proposals, broadcasters would be regulated via a three tier structure (see Chapter 2). The first tier would apply to all broadcasters, and cover basic content standards (impartial news, advertising rules, EU content quotas etc.) The second tier, for all public service broadcasters, would regulate the 'quantifiable' obligations, such as quotas for regional production and the availability of news at peak times. These two tiers would be regulated by OFCOM and are relatively uncontroversial (although the definition of a 'broadcaster' remains contentious).

Under tier three, which has caused the most discussion, PSBs would be required to demonstrate publicly through an annual statement that they were meeting their individual public service broadcasting remit - for example, producing a mixed and high quality range of programmes, including those dealing with the arts, science, education and religion. OFCOM would report regularly about the provision of public service broadcasting across the board, including by the BBC. The BBC Governors would be expected to consider any observations made by OFCOM in drawing up their annual statement and all other PSBs would be expected to undertake a similar, formal process. There would also be backstop statutory powers for the commercial channels, so that OFCOM could intervene if self-regulation were deemed to be failing. The BBC Governors would retain their role in regulating the BBC under tier three, but their Agreement with the Secretary of State would be amended to reflect the new relationship with OFCOM in relation to tiers one and two. The Secretary of State and Parliament would retain backstop powers through the process of reviewing the BBC Charter.

A large number of parties (including the National Consumer Council, BSkyB, ITV and Channel 4) have opposed this route, arguing that the BBC should be fully included in OFCOM's regulatory remit. They contend that, by covering all broadcasters, OFCOM would be able to implement coherent regulation which takes into account the whole market. The Culture, Media and Sport Select Committee agreed, stating, "*By failing to provide for an integrated approach by the new regulator to all broadcasters including the BBC, the Government has left a large amount of unfinished business*".[179] Some have also argued that the distinction between the second and third tier, and hence between OFCOM's role and that of the broadcasters' Boards, may be difficult to determine.

Many wider regulatory issues also impact on public service broadcasting. In particular, as the public service broadcasters do not control the distribution networks for cable or satellite, the White Paper proposes that continued regulation on access to these networks and their EPGs will be necessary. Section 8.2 considers such proposals in more detail.

Restricted Services Licences (RSLs)

Restricted Services Licences (RSLs) are 4 year analogue licences for local television services. They use spare analogue spectrum. The services are free-to-air and advertising-funded. Sixty-

[179] Second Report Session 2000-01, The Communications White Paper, March 2001

five RSL licences are available from the ITC, and there are currently around 13 in operation. The ITC is currently undertaking a consultation about extending some public service obligations to RSLs. However, unlike the existing public service broadcasters, RSLs have no access to or guarantee of digital spectrum. This issue will need to be addressed in the Government's Digital TV Action Plan if licences are to continue to be available for local television services after analogue switch-off.

Public service radio

The BBC currently operates five UK-wide analogue radio stations, and six national digital channels (including the World Service), with new digital services approved (see page 92). Digital channels are available to those with a digital receiver (and like other radio services, can also be broadcast over the internet and via satellite). In its consideration of public service radio, the Communications White Paper refers to the existing arrangements for long term but small scale 'restricted service licences', predominantly for hospital and student radio, and very short term restricted service licences, often for specific events such as festivals, sports events or community projects. The White Paper asks for views on a new tier of public access radio, which would allow very small scale community radio stations to be established on a more permanent basis. In response to difficulties faced by community stations in raising non-commercial funding, the Radio Authority has suggested the establishment of an 'Access' Fund, run by OFCOM, to channel funding for community radio and the proposal was supported by the Culture Media and Sport Select Committee, who recommended that the fund be financed from general taxation.

8.4 Privacy

Convergence poses particular challenges for privacy. With different devices sharing the same information, it could increasingly become possible to gather and correlate information on individuals' use of a range of communications services – including fixed and mobile telephony, the internet, digital TV and possibly even music listened to or computer games played (although using a different provider for each of these services would increase the potential for privacy). If 'smart cards' and m-commerce become widespread, the time, place and details of every financial transaction will be recorded (as indeed they already are for debit or credit card transactions). With increasing numbers of mobile phone location-based services, large scale tracking of people's movements may become possible. Further, individuals' financial, medical and criminal records will be held on large databases and may be shared between organisations - making them more vulnerable to employees who are prepared to sell data corruptly. Because the internet is global, a great deal of data will be held on computers outside an individual's home nation. Thus protection against unauthorised data-gathering and sharing will be increasingly important, both to protect people's fundamental right to privacy and to engender trust in new technologies. This section examines methods of protecting privacy, and two major aspects of such protection - privacy from commercial organisations, and from state surveillance.

An underlying issue is authenticating people's right to access services - whether customers in electronic shopping malls, mobile phone users or subscribers to pay TV (see box on the next page). For example, a Government smartcard could allow online public services to authenticate individuals with greater security but would be likely to raise disquiet over the surreptitious introduction of a national ID card, and consequent privacy concerns. However, individuals can be authenticated without the service provider being aware of their identity - such technologies allow full security, and protection of privacy. There is scope for Government to adopt such methods for separating identity and authentication for some public service delivery situations, although the likely extent of this is currently unclear.

Authenticating people

At present, computer systems generally authenticate individuals using a combination of their log-in name and password. Although secure if used correctly, passwords have several practical disadvantages - they can be stolen or guessed, users can disclose their passwords to others, or forget them (forgotten passwords account for ~70% of helpdesk calls). Passwords are safest when they consist of a long string of random letters and numbers but people cannot generally remember these. Individuals may also have a large number of passwords and so tend to use the same word for each. Password safes allow users to store long and complex passwords which are then encrypted and some will generate random passwords, but such systems can be cumbersome. Although a password written on paper and saved in someone's wallet could be as secure as a 'smartcard' (see below), in practice the paper is likely to be stuck to the side of the computer, allowing anyone access.

Because passwords generate security weaknesses in practical applications, a number of more secure methods of authentication can be used. These include biometrics systems such as fingerprint scanners, voice, hand or face recognition, iris or retinal scanning and possibly DNA reading. Many of these are well established techniques - fingerprint scanners, for example, have been used to authenticate visitors to prisons in Northern Ireland. However, such systems currently tend to be relatively expensive, so cost may be a disincentive against installing them on every computer, and for ID card purposes they offer little benefit without a ubiquitous portable reading device. All biometrics systems also require 'enrolment' into a database, so are only as secure as the enrolment process and raise privacy concerns over who collects and uses the data. Further, individuals express anxiety about techniques such as retinal scanning damaging their eyes. For further analysis of biometrics, see POSTnote 165, November 2001.

Another option is to use 'smart cards' - a credit card-sized with a small microchip which can store and control access to a relatively large amount of information. These are not new technology - they are already used in TV set-top boxes to identify subscribers, in mobile phone 'Subscriber Identity Module' (SIM) cards, and by a number of European governments. Of course, such cards can be lost or stolen, so they may be combined with biometric readers to ensure that the right person is using the card. Nevertheless, independent tests have broken the encryption of some smart card designs.

Theoretically, such a card could have a range of uses, such as an ID card to verify a user's name; a credit/debit card; and a data storage device holding, for example, medical records. However, a multifunction card may require organisations who wanted to provide services via the card to 'rent' space on it, ceding control to the card issuer over what information is accessed and how. Further, users have no control over which pieces of information the card gives to each card reader (although this is a necessary feature of some applications - for example, drivers shouldn't be able to remove points from their licence). Any Government attempt to issue such a card may seem like the introduction of a national ID card, with consequent implications for privacy and civil liberties. An alternative outcome would be one where the smart card is used inside a device such as a mobile phone, from which the user can control which data is sent. However, complex multi-function smart cards are more likely to contain bugs which jeopardise security, and it would be extremely costly to eliminate serious risks. The Office of the e-Envoy has set up a Smart Card Policy Working Group, to agree an overall policy for smart card use in the UK - a consultation document will be published later in 2001.

In general, there are four methods for protecting privacy, although these are not mutually exclusive. The UK uses all four[180]:

- **A public official responsible for enforcing data protection law**. In the UK, the Information Commissioner promotes good data handling and encourages codes of practice for those who control data. In some countries, there is a variety of officials with a range of jurisdictions, and issues are resolved in court. In the UK, the Information Commissioner is responsible for enforcing the requirements of the Data Protection Act 1998, which applies to both the public and private sectors.
- **Specific sectoral rules**, covering issues such as financial and medical privacy - this is a model adopted in the US, which has no overarching privacy law. However, without a wider framework of privacy protection laws, this model runs the risk of omitting some sectors, or lagging behind when new technology is introduced. In the UK, sectoral rules such as the banking code are applied in addition to broader data protection legislation.
- **Self-regulation**, governed by industry codes of practice, which can have the advantage of

[180] Adapted from Privacy and Human Rights - An International Survey of Privacy Laws and Practice, Global Internet Liberty Campaign

reducing the costs and long timescales inherent in statutory regulation. But this raises questions about the extent of the codes, how they are enforced, redress, and whether individuals have rights which can be enforced by the state. As such codes are voluntary, some organisations may choose to remain outside them.

- **Individual control**. The Information Commissioner in the UK sees user education as a key part of her role. Individuals can choose to whom they wish to reveal their information, and can use programmes that help protect the privacy and security of communications. However, these vary in their effectiveness and require a high degree of technological literacy from users. Also, in practice the law may permit commercial offers to be conditional on providing personal information, rendering privacy protection programmes ineffective.

Privacy concerns fall into two broad categories: commercial use of individuals' information, and state surveillance.

Privacy from commerce

Information about individuals can be collected by commercial organisations in a number of different ways, many not visible to the user. Some are described in the box on the next page. Much information on the internet is available free of charge, and supported by advertising, so advertisers argue that data collection is beneficial because it allows retailers to target adverts at those who are most interested in them. Further, many people still give their personal data to sites without privacy statements[181], prompting some commentators to conclude that privacy is not a major concern.

At present, online data is often used for relatively innocuous purposes - for example, internet advertisers can vary the adverts shown depending what was previously typed into the site. Privacy advocates express more concern over individual marketing - such as the ability to identify an individual, and tie adverts to recent purchases off-line. Objections over such breaches of individual privacy have led to the abandonment of at least one marketing proposal. DoubleClick, a large US internet advertising company, planned to combine the data gathered online with offline data, to identify the name and address of users. This plan led to major opposition from privacy advocates and DoubleClick withdrew the proposal. However, such concerns are not unique to the internet - they also apply to other convergent technologies, such as personal digital video recorders (see box on the next page) and 3G mobile phones. Nevertheless, in the EU, there is a requirement for 'fair and lawful' processing of data. This requires transparency, so if new technologies are being used to collect information about users, then individuals should be made aware of this and of the implications. Industry analysts argue that additional sector-specific regulation would risk holding back innovation.

In the UK, research for the Information Commissioner found that three quarters of people are "*quite or very concerned*" about the amount of data stored on them, and 96% saw protecting people's personal information as "*quite or very important*".[182] Data protection complaints have quadrupled since 1991/92, and in 2000/2001 the Information Commissioner received 8,875 complaints, the majority of which concerned the accuracy of financial data held by credit reference companies, although complaints about the police computer system also featured prominently.

[181] Although sites without a privacy statement are not necessarily collecting and processing personal data illegally.
[182] http://www.dataprotection.gov.uk/ar2001/download/datasub.pdf

Collecting information

- Each internet server records the internet addresses of users who have accessed its web pages and some place 'cookies' on users' computers. These are small files which record people's internet activities on a particular site and can be used to remember people's favourite settings or their password. However, for example, large advertising firms can use cookies to track users' progress from one site to another within their advertising network. The user's name and address are not known, only the internet address of their computer. Nevertheless, this 'clickstream' can reveal highly personal information: for example, if researching medical topics, or job adverts (although if it cannot be linked to an identifiable person, it will not constitute 'personal data' under the Data Protection Act). It is possible to set-up internet browsers so that cookies are not accepted - but many web pages will not work without them. Although cookies can be deleted, many users do not even know they exist. 'Web bugs' within a site's computer code can also be used to track users' progress through a site, create profiles of site visitors and hence target advertising.
- More obviously, a large proportion of web sites ask for personal details - to access information, enter competitions or make purchases. In a 2000 report, the US Federal Trade Commission found that more than 97% of web sites in a random survey collected personal data from customers[183]. 88% of sites had some information about privacy practices, but only 20% implemented at least in part all four best practice principles (notice, choice, access and security – see box on Microsoft Passport). In the US, since April 2000, the law requires websites which collect personal information from children under 13 to obtain advance parental consent, but no such provision applies in the UK.
- Some larger ISPs record the web sites visited by their customers and the emails sent and received (if without informed consent, this would be in breach of the EU Telecommunications Data Protection Privacy Directive).
- Employers are able to monitor their employees' use of the telephone, computers and the internet, for example by installing software which tracks the keystrokes on a computer. Many employees undoubtedly use the internet at work for private matters - in a recent survey one third of men admitted spending over 40 minutes a day on personal email.[184] Under the terms of the 1998 Data Protection Act, such monitoring must address the specific risks that an employer faces, it must be a proportionate and graduated response to those risks, it must be conducted with no more intrusion than necessary and employers must be open with their employees about its existence. Nevertheless, the interpretation of these requirements has been the cause of some debate, particularly in concert with the introduction of the RIP Act (see page 101), under which the Lawful Business Regulations set restrictions on employer internet monitoring. US law does not contain any such limiting principles - so UK companies using commercial US monitoring software may breach the Data Protection Act.
- Telephone companies may keep records of the calls made by their customers while relevant for billing queries.
- When 3G mobile phones become available, mobile operators and service providers will be able to identify the location of users with greater accuracy (although individuals could maintain privacy by using pre-pay mobile phones and not registering their name and address). Satellite navigation systems can also identify an individual's location and combined with transmitters, could potentially be used to track criminals, elderly people or children. Regulation controlling the use of such technologies and protecting data about individuals' location is not yet developed.
- Personal video recorders, such as TiVo, keep records of programmes watched and purchases made, which are then transmitted to the operating company via telephone each night[185]. TiVo state that although they collect such data, names are stripped off and they are interested in aggregate viewing habits rather than individual behaviour. Such plans have led to attempted Californian legislation to ensure customers' consent is given before such data can be collected.

EU law sets strict constraints on what data can be collected, and where this can be transferred - the UK implementation of this is given below. Anyone processing personal data must comply with the eight enforceable principles of good practice[186]. Data must be:

- fairly and lawfully processed
- processed for limited purposes
- adequate, relevant and not excessive
- accurate
- not kept longer than necessary

[183] Privacy Online: Fair Information Practices in The Electronic Marketplace, A Report To Congress, US Federal Trade Commission, May 2000
[184] You've got Male…;-), Press release, edesigns.co.uk, 15 August 2001
[185] See TiVo's Data Collection and Privacy Practices, David Martin, Assistant Professor of Computer Science, University of Denver, www.privacyfoundation.org
[186] http://www.dataprotection.gov.uk/principl.htm

- processed in accordance with the data subject's rights
- secure
- not transferred to countries without adequate protection.

For example, to enable data transfer to the less regulated US environment, an arrangement of 'safe-harbours' has been implemented, whereby US companies agree to abide by data protection rules. However, very few US companies have signed up to the scheme and there are concerns over enforcement and whether the US Federal Trade Commission will be able to pursue individual complaints. Extension of regulation is being considered in a number of areas under the draft EU Directive on privacy - two of particular interest are:

- Restrictions on 'junk' email (also known as 'spam') - approaches to this problem are discussed in the box below.
- Extra protection for data about a user's location. This would ensure that location data available to mobile operators may be used only with the consent of the subscriber and would provide subscribers and users with a simple means temporarily to deny processing of their location data.

In general, much of the burden of protecting their privacy falls on the consumer, with consequent implications for media literacy and protection of children.

Marketing by email

Unlike paper mailings, there are virtually no overheads associated with sending emails, so the internet is an appealing tool for direct marketers. However, there can be a cost to the receiver in phone calls to download the email (10 billion euros per year worldwide, according to a study by the EU - although this is becoming less of an issue as more internet access is on unmetered tariffs). Therefore, some have suggested that such email marketing should be regulated. Under the EU E-commerce Directive[187], countries that allow unsolicited direct marketing email will have two choices:

- 'opt-in' - no unsolicited email marketing should be sent unless a user has given prior consent.
- 'opt-out' - users can sign up with a central register stating that they do not wish to receive email marketing. Advertisers should check this register regularly.

In the UK, the Direct Marketing Association (DMA) is a partner in the Email Preference Service, an international opt-out register. However, the EU, in its draft Communications Data Protection Directive is considering allowing only an 'opt-in' approach, which would prohibit all direct marketing email other than with the consent of a subscriber. Such restrictions were agreed by the EU Council of Ministers in September 2001 for financial services marketing, although they have yet to be agreed by the European Parliament.

The UK DMA argues that there should be a distinction between:

- 'spam' - bulk sending of untargeted email; and
- direct marketing - the use of targeted lists by legitimate companies.

It notes that current data protection legislation has the effect of prohibiting bulk untargeted email to email addresses which have been procured illegitimately, but this does not prevent abuses of spam - which can contain fraudulent or misleading material, sent from falsified email addresses. In addition, much spam comes from outside the EU, especially from the US (although some states have enacted anti-spam laws). Further, the DMA argues that an opt-in register would penalise legitimate companies that obey data protection legislation and abide by industry codes of conduct, and would have particular impact on small businesses who don't have a high profile. Conversely, opt-in proponents argue that it would increase consumer confidence online, encourage more innovative means of persuading customers to opt-in, and will result in a higher rate of response.

Privacy online is essentially a question of whom people trust with their personal data, and whether they appreciate the risks. One development is the establishment of 'trusted' intermediaries, who store personal information and allow individuals' to control how much data is released to other sites. One of the most popular examples is Microsoft's Passport, with around 160 million users, considered in the box overleaf.

[187] 00/31/EC

A confidence-based approach is the TrustUK scheme for online traders, which accredits existing industry codes of practice, whose members can then display the TrustUK logo showing that they meet certain privacy, security and consumer protection standards. It is endorsed by the Government and currently includes the owners of 4 codes of practice, covering around 4,500 online merchants. Key questions in the success of such a venture will concern its ability to enforce standards and its public profile (which does not appear to be high at present).

Microsoft passport

Once users have registered for the Passport, they can then sign into any of Microsoft's partner sites simply using their email address and password and their personal details can be shared with the site by Microsoft. The Passport can also be used to make online purchases. Microsoft ensures that its partners display privacy statements and its Passport privacy notice is based on widely accepted privacy standards:

- notice of how information will be used.
- choice about what information you want to share.
- consent to collection and distribution of personal information.
- access to your personal information at all times.

However, the scheme has attracted criticism from other online service providers[188], who argue that Microsoft has significant market power in this area and that it will allow them to exercise strategic control over all online transactions. In response, the Free Software Foundation is developing an alternative, decentralised authentication system called dotGNU, and other companies such as AOL Time Warner and Sun Microsystems are also developing competitor services. Hailstorm (recently renamed *.Net My Services*), another Microsoft service, has aroused similar criticisms. It uses Passport to authenticate users and aims to integrate diverse information, applications and services - so that, for example, users can change their personal details at a central point and then transfer the information to all devices which use it, including PDAs and mobile phones. Microsoft responded to these criticisms in September 2001 by announcing a strategy known as 'Federation'. This is designed to enable an interoperable single sign-in system across the internet by allowing other service providers to interact with Passport. Microsoft describe it as similar to the ATM bank network, where a card can be used at a range of cash machines whether or not the user holds an account with that bank.

Critics of Passport and *.Net My Services*[189] have also expressed concerns about the privacy implications of allowing one company to control a wide range of individuals' information. In response, Microsoft says it requires only a limited amount of information from users, which is used solely for authentication purposes and shared with participating sites only with the permission of the Passport user.

Privacy from the state

As off-line, there is a balance to be struck between individuals' right to privacy online, and surveillance for law enforcement. In the UK, the Regulation of Investigatory Powers Act (RIPA) 2000 attempts to regulate the circumstances and procedures by which state bodies can intercept communications. The box on the next page details some of the provisions of the Act.

The Bill's passage through Parliament and subsequent implementation have been extremely controversial - some particular points of contention about interception of communications and access to communications data are set out in the box 'RIP Act Concerns'. In addition, police powers to require hand-over of encryption keys (in part III of the Act) were also the cause of much debate and illustrate a significant challenge which technology poses for law enforcement. Individuals can now encrypt their information in ways which cannot be practically decoded by law enforcement bodies. Therefore, the Act sets in place powers so the police can demand decrypted information, or the 'key' to decode it - for example, from colleagues of suspects. Keys can safeguard commercially confidential information and once they have been compromised they should be changed immediately. However, the 'tipping-off' offence (see box above) implies that those at risk of their data being compromised may never be told that security has been infringed.

[188] http://www.sun.com/dot-com/perspectives/co-town.html

[189] Such as privacy advocacy groups the Electronic Frontier Foundation, the Electronic Privacy Information Centre and the Centre for Digital Democracy .

Nevertheless, as a standard part of computer key security, keys are routinely revoked and replaced. Therefore, some users have set policies in place whereby, if they revoke a key and will not reveal the reason why, other users should assume its security has been compromised by RIP investigations - thus potentially bypassing 'tipping-off' restrictions.

The RIP Act

Overall, the use of powers in the Act must be 'necessary' and 'proportionate' to what is sought to be achieved.

Interception and access to communications data (Part I)
This part of the Act deals with interception of communications and covers all communications service providers - including telephone companies and ISPs. Interception must be authorised by the Home Secretary. Individual communications providers can be required to maintain an intercept capability. This means that ISPs may have to install 'black boxes', capable of intercepting electronic communications. The instrument which can require ISPs to install such equipment must be approved by both Houses of Parliament and a joint law enforcement/industry Technical Advisory Board will be set up to comment on practical matters. Part I also includes statutory controls over access to communications data (such as details of emails sent), which must be authorised. 'Trawling warrants', authorised by the Foreign Secretary, allow all international communications to be searched for keywords with supercomputers - however, the Government has accepted that for internet communication, it may be impossible to limit the scope of these to international communication, so they may also pick up internal UK emails.

Surveillance and covert human intelligence sources (Part II)
This regulates the use of agents and informants and bugging and long-lens surveillance by public authorities listed in the Act.

Encryption (Part III)
This can require individuals to provide 'plain text' of encrypted information, or the 'key' to decode such information, whether or not they are suspects in a crime. If a person who has been given a notice to provide a key (or plain text) knowingly does not do so, they will be guilty of a criminal offence with a maximum sentence of two years in prison. A person served with a notice, or anyone else who becomes aware of it, may be required to keep it secret indefinitely, or face a maximum five year penalty (although employees can pass the information on to senior management). This is known as 'tipping off'.

Scrutiny (Part IV)
This sets out the oversight and complaints mechanisms for the powers in the legislation. This includes independent Commissioners (who must be judicial figures) with a statutory responsibility to oversee the exercise of the powers and an independent Tribunal to hear complaints.

Source: Home Office Press Release, 28/7/2000, RIP Bill receives Royal Assent
BigBrother.gov.uk: State surveillance in the age of information and rights. Yaman Akdeniz, Nick Taylor and Clive Walker [2001] Criminal Law Review (February) pp 73-90

Penalties for 'knowing' failure to comply with a decryption notice also attracted concern. An encryption key could be simply a password stored in the user's head, therefore it can be difficult for the police to prove that a suspect has the key. Hence, the initial draft Bill assumed that, if someone was once in possession of the key, they still had it, unless they could prove otherwise. Privacy advocates pointed out the difficulty of an individual proving that he or she had forgotten their password, and claimed that this was incompatible with the presumption of innocence. The Government did not concede the legal point but nevertheless the Bill was amended in Parliament. If the individual can "*adduce sufficient evidence*" that they are not in possession of the key (it is not clear what this entails), the onus is now on the prosecution to prove beyond reasonable doubt that they are.

Overall, privacy advocates argue that the powers for obtaining keys are fundamentally flawed for three main reasons:

- much encryption uses 'ephemeral' keys - which are created by the computer, may be used only once and are never known by the user.
- the 'tipping off' offence can be easily circumvented, as keys are routinely revoked (see above).

- sophisticated criminals can use 'steganography', where information is hidden in pictures, for example, rather than encryption. With such techniques, police may not even be able to prove that data is present in the image - so attempting to prove that an individual has the key will be consequently more difficult.

RIP Act concerns

Interception of communications content

- Interception of communications would be approved by the Home Secretary, rather than an independent judge. The Information Commissioner has stated that "*there are strong arguments in favour of ensuring that warrants for interception are subject to judicial scrutiny at the point of issue*".[190]
- The Government can require ISPs to install equipment enabling them to intercept communications. Much industry discussion here was around whether ISPs would have to pay for the equipment themselves - the Government has set aside £20m over three years (from April 2001) to contribute towards costs. ISPs also wished to filter their own information, and pass on only that data relevant to the specific warrant. However, the RIP Act states that the equipment would need to be sufficient to implement any warrant - including those which allow trawling of all communications. Further, prior to the RIP regime, law enforcement officials physically had to serve a warrant on an ISP. But the interception equipment can be operated remotely and critics argue that this removes an important physical restraint on officials.

Interception of communications data

- Communications data includes information such as the time of phone calls and number called. However, for internet communication, it can include the list of websites visited, geographic location data and identification of newsgroup articles. Privacy proponents are concerned that this type of communications data could reveal a great deal about an individual and access to it will have to be approved only by an office holder of the relevant body (see below), rather than the Secretary of State or a judge. So, while permission would be needed from the Home Secretary to obtain the contents of one email, for a complete map of a user's email communications, only a police superintendent's approval would be needed. The tests for approving such access to communications data are also much less stringent than those for intercepting content and data can be obtained in bulk on groups of individuals and thereafter exploited without restriction. The Information Commissioner commented that both intercepted communications and communications data "*provide insight into the private lives of individuals and should therefore be subject to equivalent controls and safeguards*".
- Communications providers, among others, expressed disquiet about the number of bodies which could be authorised to access such data - including the Department of Social Security, police and the Inland Revenue. Providers are concerned that it will not be clear when a request is genuine and valid. The recent Home Office draft code of practice on access to communications data[191] included law enforcement bodies, intelligence agencies, Inland Revenue and Customs and Excise, although other public authorities could be added.

Provisions for the retention of communications data in the RIP Act have recently come under further scrutiny. Providers currently retain communications data for billing purposes and for use by law enforcement agencies. However, some stakeholders have suggested that the period for which data are retained be extended - perhaps to as long as seven years. The 2001 Anti-Terrorism, Crime and Security Bill contains provisions to allow communications service providers to retain data about their customers' communications for access by law enforcement agencies and for national security purposes. It will also enable a code of practice to be drawn up in consultation with industry. These measures have attracted criticism for their potential technical and cost implications, as well as raising privacy concerns. The Information Commissioner commented, "*I am particularly concerned that leaving matters to a voluntary code of practice, or to agreements, may pose difficulties for data protection and human rights compliance*." [192]

[190] Response of the Data Protection Commissioner to the Government's Regulation of Investigatory Powers Bill - A Briefing for Parliamentarians, March 2000

[191] Accessing Communications Data Draft Code Of Practice, Home Office, August 2001 http://www.homeoffice.gov.uk/ripa/pcdcpc.htm

[192] Information Commissioner contributes to scrutiny of anti-terrorism bill, Press Release, Office of the Information Commissioner, 13 November 2001

Convergence allows new means for criminal activity but also new techniques for law enforcement and surveillance. Nevertheless, the Human Rights Act 1998 enshrines rights to privacy and to fairness in criminal processes. It is likely that a number of aspects of RIPA and its implementation will be challenged at some point in the courts, which will further highlight the difficulty of balancing policing of electronic communications with an individual's right to privacy. One suggestion[193] is the development of a hacking group who could work for security services and law enforcement - but any information gathered in this way would be likely to be inadmissible in court, as such a group could also manufacture evidence. However, this idea would be possible under existing law.

8.5 Security

As electronic communications increasingly become integral to every part of daily life, security of the network becomes vital. Since a single hacker or virus could cause havoc in all current systems the wisdom of connecting everything from traffic lights to electricity networks to the internet is under question. Equally, as people become more dependent on electronic networks to buy goods and communicate the security of such services becomes an important issue. This section will consider:

- threats to the security of electronic systems - hacking and viruses.
- two particularly vulnerable areas - financial transactions and email.

Security Threats

Hacking

Obtaining unauthorised access to a computer system (hacking) is an offence in the UK under the Computer Misuse Act 1990, punishable by a fine or prison sentence. Hacking can take many forms - hackers are classified by the National Criminal Intelligence Service into three categories:

- **Recreational** hackers are motivated mainly by the desire to beat security features protecting computers. Although benign, they can cause inadvertent or irresponsible damage. One example is a hacker who broke into a local telephone network and inadvertently disabled phone settings in the area, leading to air traffic control being unable to operate and the local airport closing.
- **Criminal-minded** hackers attempt to achieve some illicit goal from their hacking, such as financial gain or sabotage. This category includes attacking financial institutions, stealing credit card details, industrial espionage and vandalism.
- **Political** hackers (or 'hactivists') attack internet sites to further political aims. This can range from defacing the site to closing it down - in 1999 the Animal Liberation Tactical Internet Response Network effectively crashed the websites of two fur traders.

Hacking can be a major problem. As long ago as 1995, 98.5% of companies responding to a survey claimed to have been victims of computer-related crime. Even where companies know they have been hacked, many attacks are not reported, because of concerns over alarming customers or alerting other hackers to vulnerabilities. Some methods of hacking are set out in the box on the next page.

Computers can be hacked remotely only when they are hooked up to a network. At present, with dial-up access, most people are not generally on the internet for more than an hour at a time and are at their computer while they are logged on. However, with always-on broadband access the computer is constantly connected to the internet, and is therefore more vulnerable to hacking. Nevertheless, many hacking attempts can be simply defeated by turning off some of the features on internet browsers (such as Java), when using websites which are unfamiliar. Because the

[193] By Caspar Bowden, Director of the Foundation for Information Policy Research, www.fipr.org

software used to run home computers is much less complicated than that used by large corporations to run web sites, it can be less vulnerable to attacks but needs to updated regularly with 'patches' which close security holes. An alternative is to install a 'firewall' to protect the computer.

Hacking methods

Hackers can use a number of means to subvert security features, both by using vulnerabilities in the protocols used to run the internet, or by gaining access to passwords which protect systems. Techniques include 'trojan horses', which can show a false interface to the user so they are tricked into revealing their password, or brute force methods such as using a computer program to try every combination of letters. There are also a number of tools available on the web with which hackers exploit vulnerabilities in certain programmes or systems and which can be run with almost no technical knowledge - this is known as 'point and click' hacking. (Such tools also have legitimate uses, and were originally created by security administrators to automatically test system security). For example, a program called 'Back Orifice', by a group known as 'Cult of the Dead Cow' allows hackers remotely to control machines running Windows software. Its website claims that it, "*gives its user more control of the remote Windows machine than the person at the keyboard of the remote machine has*."

Another form of hacking is the 'denial of service' attack, where the aim is stop a computer functioning normally. One method is to bombard a computer with requests for information, so that it can't deal with legitimate demands. Such attacks come in three general forms. By persuading a large number of people to log on to a site at exactly the same time, the site could be shut down - under current legislation, this could be an act of terrorism. Alternatively, one computer could be set up by a hacker to fake requests so they seem to come from a variety of addresses. A hacker could also place 'a trojan horse' programme on a number of computers, so they all log on to the site simultaneously - but without the consent of their owners. Denial of service attacks have been executed successfully against a number of large web sites, and could be a particular problem for Government services delivered over the internet (for example, denial of service attacks could prevent people voting online during a General Election).

Because no system can be completely secure, vulnerabilities will continue to be discovered in all operating systems (and will only get worse as systems become more complicated). It is therefore extremely important that users keep patches up to date. For corporate users, patching needs to be incorporated into routine maintenance programmes, and for large organisations it is a non-trivial exercise. Many operators also wish to test patches thoroughly themselves before applying them. For home users, patching is a relatively simple process, particularly for individuals with high speed connections. However, many do not understand or are not aware of the risks or solution (or simply won't get round to it), and patching may not be a priority until an attack has occurred. As more people go online, this difficulty is likely to increase. User education will play a key part in encouraging basic security precautions online, but manufacturers also have a role to play in making their products easy to set-up securely and update. Some broadband ISPs have already disconnected customers whose computers have been infected with viruses, reconnecting them once the virus has been removed and anti-virus software installed.[194] Government policy on computer security for home users is currently unclear. Of further concern is the shortage of skilled information-security professionals - Home Office plans to license security personnel have the potential to exacerbate this problem (although Ministers state they have no plans to apply such requirements to computer security professionals).

Although much hacking so far has been directed at computers (and telephone networks), with convergence such efforts are likely to move into other new media, such as digital TV and mobile phones. Any interactive TV site which is connected to a wider network is potentially vulnerable to hacking, even if it runs a 'walled garden'. Similar concerns will apply to 3G (and even WAP) mobile content - 3G in particular can be 'always on', and so potentially vulnerable to individual handsets being hacked and contact details or credit card numbers being stolen. Also, the

[194] BBC Online News, 4 October 2001, Turning against worms on the web, Mark Ward

encryption used on new wireless delivery methods (such as '802.11' - see page 115) has been broken by researchers, showing that these networks are also at risk of being hacked[195].

Computer Viruses

Much media coverage has been given recently to computer viruses - programs spread via email, web sites, internet chat rooms or computer disks, which install themselves on the unwitting recipient's computer. Viruses can run from relatively innocuous programmes (such as flashing 'April Fool' on the screen on 1 April) to copying user names and passwords or deleting files. The 'Love Bug' virus in May 2000 infected millions of computers worldwide and was spread via a file with the subject 'I love you'. Users who opened the attachment in the email were infected and the virus then sent itself out to every contact in the computer's email address-book. Much of the virulence of viruses is attributable to tools in operating systems which allow email applications to automatically run other programmes.

A wide variety of anti-virus software is available that will screen incoming files. This needs to be updated regularly to ensure it includes recently released viruses, although one class of virus - polymorphic self-decrypting viruses - cannot be detected by virus scanners. More simply, users are advised not to open email attachments from strangers, and to confirm with friends if an unexpected attachment arrives. Downloading software from unfamiliar web sites can also lead to problems. Almost all viruses require users to execute a programme but they can be hidden in a variety of files, from word processed documents to 'amusing' cartoons, so users are warned not to forward 'joke' files of suspect origin. Email programmes are also now able to read web files - so can encounter viruses embedded in web features (such as Java). However, plain text files do not contain viruses, so simple emails are generally safe.

As people send and receive email and surf the internet over digital TV and mobile phones, viruses will increasingly attack these systems. Although it is not yet clear what such viruses could do, their potential is large - from wiping the programmes on a personal video recorder to sending text messages to all the contacts on a phone or copying stored credit card data. Indeed, there is already potential for mobile phone viruses which use text messaging, although mobile networks have security features which make distribution of such viruses difficult. As with protection against hacking, users will need to become familiar with taking appropriate security measures and manufacturers will need to consider security when developing services. Most computer users can install virus software - but other consumer devices such as mobile phones and set-top boxes do not allow users to access the operating system that runs the device. Therefore, if these become infected, they may need to be returned to the manufacturer (although for some devices operators can update software remotely) - and depending on the level of service offered, users may even decide to continue using the device with the virus.

Vulnerable services

Financial transactions

Lack of confidence over the security of financial transactions taking place on the internet is seen as one of the main stumbling blocks for e-commerce. Although the number of people who have bought goods electronically is increasing, concerns over security are unlikely to disappear. As with off-line purchases, credit card transactions are particularly vulnerable to abuse - purchases can be made using stolen or fraudulent credit cards and rogue traders can keep the number for re-use. Particular concerns about online use include hackers intercepting numbers as they are transmitted, stealing them from a database, or using computer programs to generate lists of valid

[195] Using the Fluhrer, Mantin, and Shamir Attack to Break WEP, AT&T Technical Paper, August 6 2001, Stubblefield, Ioannidis and Rubin, http://www.cs.rice.edu/~astubble/wep_attack.pdf

numbers. Growth rates for such fraud are high, although actual numbers are minor. More stringent authorisation processes could potentially reduce the risk but would cost more per transaction.

Secure e-commerce sites display a padlock in the corner of the browser, to signal that communication between the browser and website is encrypted; so instances of card numbers being intercepted in transmission appear to be very low. Nevertheless, there have been a number of high profile cases where hackers have accessed databases of credit card numbers, or even financial institutions. Large scale purchasing using stolen or fraudulent cards can also be a major problem.

In an attempt to encourage consumer confidence in electronic commerce, a number of e-cash or e-wallet schemes have been established. In these, a customer either registers credit card details with a trusted source (see discussion of the Microsoft Passport in Section 8.4), or buys 'electronic money'. The 'e-wallet' or 'e-cash' is then used at the vendor's site to buy the goods, without having to transfer credit card details to the merchant (and could, in practice, be anonymous). However, this depends on a large number of sites accepting the relevant e-wallet or e-cash and there are no universal systems working at present.

Customers can also buy goods over digital television and in will be able to make purchases using mobile phones. Digital TV platforms vary in the way they treat purchases. The Sky Active service has a 'shopping mall' and Sky can take a proportion of sales revenue. Because it is a walled garden, Sky suggest that it is more secure than the open internet. In contrast, open internet access through the TV (for example, using ITV Digital or cable) allows online purchasing in exactly the same way as on the internet, and is subject to the same security considerations. Security for purchases via mobile phones is also an issue. For instance, GSM phones encrypt messages using a different key for each phone that logs on to a network but researchers have been able to decrpyt these messages (although the task is far from straightforward). 3G phones will use stronger encryption, but they will also be more technically complicated and so at greater risk of hacking and viruses. However, it is worth noting that these encryption systems will be installed by the manufacturer rather than the user, so will be easily accessible for law enforcement purposes and will not raise many of the issues addressed by the RIP Act.

Protecting emails

Email has been likened to 'a postcard written in pencil' - almost anyone can read it and even change the contents if they wish.[196] Due to the structure of the internet, email is sent through a number of computers between its origin and destination - at any point, it can be intercepted and read, altered or forged. Therefore, users are advised not to send confidential information via email. An alternative is to encrypt emails, so that they can be read only by people with access to the encryption key (see POSTnote 114, *Internet Commerce - threats and opportunities, April 1998,* for further discussion of encryption). Encryption software is available to download or buy and often also includes electronic signature capabilities (so messages can be signed, encrypted, or both). A digital signature guarantees that the email is from the right person and hasn't been tampered with. Electronically signed messages are by definition identifiable, so electronic signatures may not be suitable for day-to-day transactions because of privacy concerns. However, there are other types of 'blind signatures', which allow authentication but don't identify the individual, so carry less privacy risk.

The UK Electronic Communications Act 2000 provides for electronic signatures to be admissible

[196] Email - A Postcard Written in Pencil, Larry Rodgers, http://www.cert.org/homeusers/email_postcard.html

as evidence in legal proceedings, so they can be used as the basis for contracts. In the US in particular, use of encryption has been seen as a threat to national security, as it potentially allows communication which the Government cannot decipher. The UK RIP Act has attempted to address these issues (see Section 8.4), but not without a great deal of debate.

9 Overview

Convergence brings together a wide range of disparate issues and poses challenges to 'joined-up Government'. There is no single policy or statute that can deal with all the main issues covered in this report. Some will be included in the Communications Bill, some in different Government plans, some in European legislation - and some fall into all three categories. Key areas include:

Communications Bill

- **Competition and plurality** - to include OFCOM's role, regulation of platforms and networks (including access issues) and media ownership.
- **Content regulation** - including regulating the public service obligations of broadcasters and the general self-regulatory approach to internet content (which is still developing).

Other Government initiatives

- **Broadband internet** - recommendations from the Broadband Stakeholder Group and the Government's response were published in December. Proposals are also being developed for aggregating public sector procurement.
- **Analogue TV switch-off** - a draft action plan was published by DTI/DCMS in October 2001, setting out the issues to be addressed before analogue TV can be switched off. After consultation, the full report is expected by the end of the year.
- **Universal access** - the UK online action plan includes a range of measures aimed at combating the digital divide.
- **Privacy** - ongoing implementation of the RIP Act is likely to cause debate over its privacy implications, and there is also concern over data-retention provisions in the new Anti-terrorism, Crime and Security Bill.

At European level

- **Intellectual property** - the recently approved EU Copyright Directive attempts to balance the protection of copyright holders' rights with customers' 'fair use' of products. It must be incorporated into national law by December 2002.
- **Universal access -** the potential for a broadband Universal Service Obligations is due to be reviewed by the EU before 2005.
- **Privacy** - the draft EU Privacy Directive includes issues such as 'opt-in' lists for email marketing and access to location data.
- **Cybercrime** - the Council of Europe adopted a convention on cybercrime in November 2001. This aims to harmonise laws and encourage international co-operation. It includes provisions about illegal online content and government powers to intercept communications.

However, some have questioned whether these arrangements adequately deal with issues such as online security and the future of public service broadcasting. In particular, it is unclear whether the Communications Bill will effectively address the fundamental changes which convergence may bring. For example, television is moving from a system run by the state to a more open market, which will create a very different regulatory climate. There is, therefore, an argument for flexible legislation, which would allow regulation to evolve along with the market. However, broad-brush, outline legislation is not always welcomed by Parliament, as it can leave Government scope fundamentally to alter policy without substantial Parliamentary scrutiny. This is an issue which will need consideration if the Communications Bill is to be flexible enough to cope with the communications environment for the next ten years, while still setting out enough detail to allow Parliament to fulfil their scrutiny role.

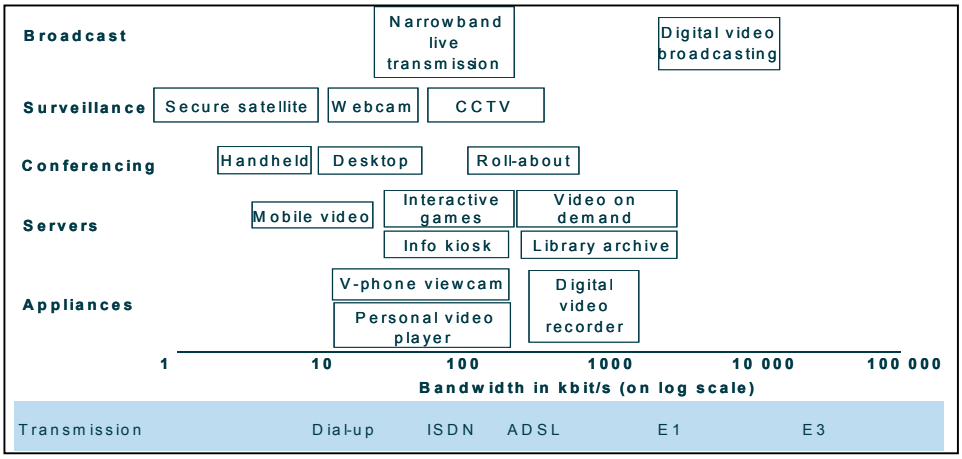
Annex A - Bandwidth

Bandwidth required by applications

Current domestic broadband services, operating at 0.5 Mbps, still do not provide enough bandwidth to view digital TV-quality moving pictures in real time via the internet (rather than downloading and watching them later). For example, digital TV channels can have a bandwidth of around 3 Mbps, while compression technologies can give VHS quality video at 0.4Mbps and DVD quality at less than 2Mbps. However, for high definition widescreen TV, closer to 20Mbps is required. For mobile services, the screen size will be smaller than that on a TV or PC. For an 8cm x 8cm (3" x 3") screen, a standard quality video would require 250kbps (with some compression techniques resulting in acceptable quality video at bandwidths as low as 50kbps).

Figure 12 below gives details of the bandwidth needed for various video applications. However, compression technology (how the information is coded before being transmitted) is improving, so these figures are likely to reduce.

Figure 12: Bandwidth for different video applications



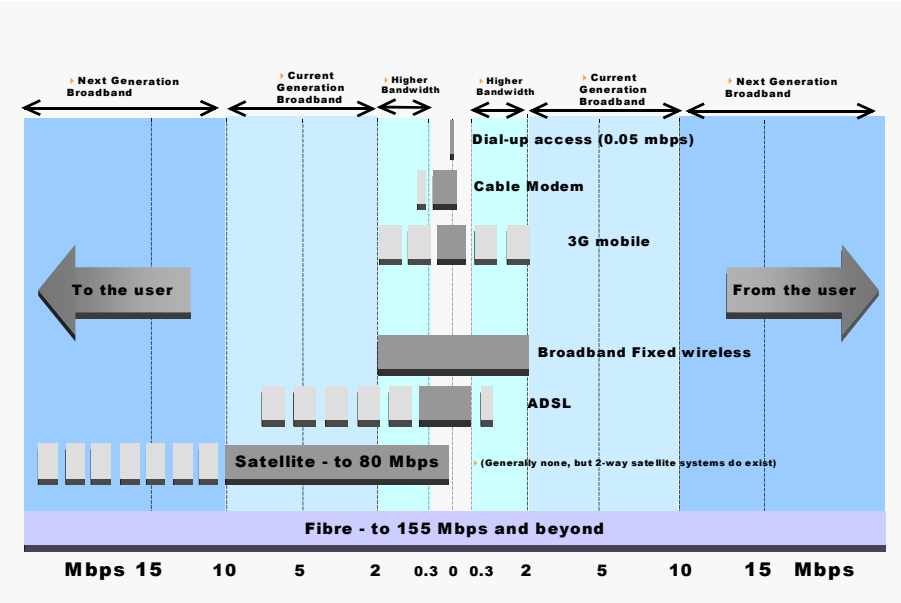
Source: UK Online: the broadband future (from Analysys, 2000)

The data rate provided by different delivery technologies can either be symmetric – the same both to and from the user – or asymmetric, so the 'downstream' rate to the user is greater than the 'upstream' rate from the user. Figure 13 sets out the current data rates for the main technologies, each of which is discussed in more detail in Chapter 4. However, in general these are not guaranteed data rates, and this bandwidth can be shared between users (see box on the next page about 'Sharing bandwidth'). There are a few key points to note:

- current domestic broadband technologies are capable of offering broadband services of more than 2Mbps – for example, ADSL can support 7Mbps and cable 27Mbps. However, to allow many users to send data down a given route, these services are usually capped by their providers at around 512kbps for domestic users, and even this can be shared (see box).
- fixed wireless internet access is not currently available in most of the UK. Speeds offered are around 512kbps.
- for satellite internet access, generally only the data to the user arrives via satellite. Upstream data is sent by the user over the telephone line. BT are introducing a business service for the UK (see Section 4.3).
- operators suggest that 3G services should typically offer 250 kbps and above depending on

demand and distance from a base station. However, estimates vary and some analysts predict lower data rates.

Figure 13: Bandwidth supplied by delivery technologies



Source: UK Online: the broadband future

Sharing bandwidth - 'contention'

Although services such as cable modems, ADSL and 3G mobile phones claim to offer data rates of 0.5 - 2Mbps, these are generally theoretical maxima. Unlike standard internet access via the phone line, these services do not allocate a dedicated 'channel' to each user. Instead, customers share the network, but use bandwidth only when they are actually sending or receiving data. This sharing of bandwidth is known as 'contention'.

On cable, data services are sent down one of the TV channels, which can carry 27 Mbps. But this is shared between local users and individuals are capped at around 512 kbps. However, even this 512knps may not be available at all times, depending on who else in the local area (the 'local loop') is sending or receiving data. For cable modems, the contention ratio is 15:1 - this means that the maximum bandwidth should be available to an individual if, at most, 1 in 15 of other local users are downloading data at the same time. Similarly, ADSL bandwidth is shared with other users - for most home ADSL services, the contention ratio is 50:1. (The higher the contention ratio, the more likely that a customer will have to share bandwidth with another user).

The actual data rate will depend on the number of users and the quantity of data they are receiving or sending. It is possible to pay more for a lower contention ratio. At present, contention is not extensive, because few people have ADSL or cable modems. If the number of subscribers increases, such congestion may become more significant. However, communications operators may be able to release greater bandwidth to combat this (for example, allocate more TV channels to carry data), or reduce the number of homes who share the network in each local area.

Annex B – Additional devices for accessing digital content

Chapter 3 considers some of the most common devices for accessing digital content – TVs, PCs and mobile phones. This Annex looks at some of the more popular emerging devices which are also used for such access, including games machines, MP3 players and DVD players. Note that this is not an exhaustive list, and there are many emerging devices not considered here, such as e-books and tablet PCs.

Games machines

Online gaming could contribute to convergence, with games machines already capable of playing DVDs and accessing the internet. The electronic game industry is worth around $20 billion per year, globally. Some games machines include a CD/DVD player, and they vary in the extent to which internet access is integrated into the console. For example, the Microsoft Xbox has an ethernet port, to allow high speed broadband internet access, while Nintendo plan to offer a broadband adapter for the Gamecube. In May 2001, Sony announced an alliance with AOL to give users in North America internet access via their Playstation 2 consoles.

In addition, it is possible that mobile phones could move into the online games market. Already they typically include a small number of simple games and mobile phone manufacturers are developing a platform for mobile games.

MP3 players

MP3 is a means of compressing digital music. Named after the Motion Picture Experts Group, who determined the standard, it is one of the most widely searched-for terms on the internet. Basic uncompressed audio files are around 10MB per minute of music, but MP3 can reduce this by a factor of ten, so that a four minute piece of music will be around 4MB; a tolerable size for sending over the internet. Services such as Napster enabled users to swap MP3 files with other users, and a large number of free music files are available on web pages. CDs can also be turned into MP3 files using low cost (or free) software. Programmes such as Windows Media Player, which is included in Microsoft Windows operating systems, allow computers to play MP3 files, or they can be played using a dedicated portable MP3 player.

MP3 players essentially consist of a portable digital memory, to which individual songs can be added using a PC. The size of the memory determines how much music can fit onto each player: a 64MB drive will play around an hour's music and typically costs a couple of hundred pounds. Some players also have upgrade slots, so more memory can be added. Other devices, such as mobile phones, digital cameras and PDAs are now beginning to include MP3 players, and combined CD and MP3 players are available. Also, portable devices using larger hard drives are being introduced, with several thousand MB of hard drive, capable of holding more than a hundred hours of music. Larger devices, meant for home use, are beginning to be launched by electronics manufacturers - for example, devices which can be used with stereo equipment and will allow users to download MP3 files without needing a computer. One example contains a 40GB hard drive and a CD read/writer, and also can be connected to a TV or PC. However, it will not allow users access to the whole internet - its manufacturers have created a 'walled garden' from which users will be able to download songs, videos or listen to internet radio. Worldwide, 3.3 million digital audio players were sold in 2000.

DVD players

DVDs (Digital Video Discs or Digital Versatile Discs) can be used to play digital music, films or store computer data. With larger memory than a CD or video cassette, a DVD can store more than 2 hours of high quality video (at about the same quality as a properly set-up analogue TV, or up to 30 hours of VHS-quality video), with options for different languages in the audio track, subtitles, and even different camera angles. DVD players are also able to read audio CDs (although not vice versa), and many have features such as parental locks, to stop children viewing unsuitable content. Since its launch in the UK in 1998, over 45 million video DVDs have been sold, and more than one million UK households have DVD players (it took 5 years for CDs to reach the same level of penetration). [197] Worldwide, by the end of 2000 there were more than 45 million DVD players, many of which are in games machines or PCs.[198] DVD players are not generally capable of recording information, but DVD recorders are now available (although expensive, at £1,000 or more).

As discussed in Section 6.3, DVD players all have regional codings, identifying the area of the world in which they were sold – although it is also possible to buy multi-region players. There are eight regions (the UK is in region 2, which covers Japan, Europe, South Africa, and the Middle East). When DVD discs are released, the producer can choose to include a regional coding on the disc, so that it will play only in DVD players from the same region. In this way, film studios can stagger the release of films worldwide - so they can be released in Europe after the US, for example. Discs are also encrypted, so they cannot be casually copied (again, see Section 6.3 for a wider discussion of copy protection).

Location sensors

Mobile phone service providers can currently identify a user's position by the 'cell' they are in - i.e. the base station they are using - to within 100m - 1km. Such methods are more accurate in urban areas, where base stations are closer together. By timing the signals emitted from the phone to different base stations, this can be reduced to around 50m. However, with new 3G mobile phones, this method will be able to identify users to within 5m.

Satellite navigation can also be used to establish a user's position, movement and time, by measuring the distance to at least four satellites. Currently, the primary satellite navigation system is the US Department of Defense's Global Positioning System (GPS). A similar Russian system, Glonass, does not presently have a full working constellation of satellites and is used mainly in conjunction with GPS. Signals from both systems are available globally for civilian use, free of charge. The European Union has agreed to establish a third system, named Galileo, by 2008. (See POSTnote 150 for more details). However, satellite navigation needs augmentation in urban areas, to compensate for 'shadowing' and reflection by buildings.

Satellite navigation receivers range from hand-held sets, costing less than £100, to units used for precise surveying which cost more than £10,000. Positioning accuracy can range from 1mm to 100m, depending on factors such as receiver type, the user's environment and processing techniques.

With a combination of GPS and mobile phone techniques, it should be possible to identify a user's location to within a few metres, in both towns and urban areas. This allows providers to offer services specific to the user's location (see Section 5.3). GPS receivers could potentially be built into all types of mobile devices, including mobile phones, laptops and PDAs (and are

[197] British Video Association, http://www.bva.org.uk/
[198] DVD FAQ http://dvddemystified.com/dvdfaq.html

already installed in many cars). Currently, a number of providers produce GPS receivers on PC cards, at a cost of around £200. However, to incorporate GPS into mobile phones, such receivers will need to be small, lightweight, cheap, and provide proven functions which cannot be received using the mobile's own positioning ability.

New devices

The development of wireless and broadband services, combined with ongoing miniaturisation, will see the introduction of a new range of products. For example, these could include wearable communication devices, such as mobile phone headsets embedded in glasses. Further, some analysts have suggested that wireless sensors could become ubiquitous, for example to sense motion or whether food has gone off (see the box below on 'Bluetooth' for discussion of local wireless communications).

Such sensors raise concerns over personal privacy, consent and security. For example, if intelligent sensors in a house always know who is home, what room they are in (and even what they are doing), this information could undoubtedly be useful to commercial entities, governments, and criminals. Privacy and security issues are considered further in Chapter 8.

Bluetooth

Bluetooth[199] is a standard which allows wireless communications between two devices over a range of up to 10m at rates of up to ~0.7Mbps. The first Bluetooth devices were launched in 2001, and the technology aims to allow a range of electronic devices to communicate. For example, mobile phone headsets could be connected via Bluetooth with a handset in the owner's bag. Printers could connect to PCs without wires, and watches to PDAs. With Bluetooth in ID cards, houses could know who is home and who is watching TV (with consequent privacy implications). Other products include a Bluetooth pen which digitises and transmits writing and a cash machine which would allow users with a Bluetooth handheld computer to collect money or download email and web pages. Both Bluetooth and other wireless standards (see below) can also be used to allow people passing through an area to connect their mobile devices to a local network - so, for example, coffee shops, airports, trains, hotels etc. could provide local networks for their customers, and some companies already operate wireless networks for their staff.

For this level of ubiquity, Bluetooth chips must be cheap - at the level of a few pounds each, perhaps. Some predictions suggest that even milk cartons could communicate their expiry date to the fridge via Bluetooth, which implies a cost of no more than a few pence.

There are also other wireless standards which use the same part of the radio spectrum (2.4GHz). HomeRF is designed to offer bandwidth up to 10Mbps, and Wireless LAN (also known as 802.11), aimed at corporate networks, up to 11Mbps. Although Wireless LAN has faster connection speeds, it is higher power and more expensive, so may not be suitable for some of the proposed Bluetooth applications. However, it is already widely used, particularly in the US, while Bluetooth devices are taking longer than predicted to roll out - for example, Microsoft's new Windows XP operating system does not currently support Bluetooth (although Microsoft plans to offer such support soon).

[199] Named by Ericsson engineers after Harald II, a unifying ruler of Denmark in the 10th century.

Abbreviations

3G	Third Generation (mobile phones)
ADSL	Asymmetric Digital Subscriber Line
BBFC	British Board of Film Classification
BSC	Broadcasting Standards Commission
CA	Conditional Access
DCMS	Department for Culture, Media and Sport
DfES	Department for Education and Skills
DMA	Direct Marketing Association
DMCA	Digital Millennium Copyright Act
DSL	Digital Subscriber Line
DTI	Department of Trade and Industry
DTT	Digital Terrestrial Television
DVD	Digital Versatile Disc
EDGE	Enhanced Data rates for GSM Evolution
EFF	Electronic Frontier Foundation
EPG	Electronic Programme Guide
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile communications
ICT	Information and Communications Technologies
iDTV	Integrated Digital TV
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
ITC	Independent Television Commission
IWF	Internet Watch Foundation
kbps	1 thousand bits per second
Mbps	1 million bits per second
MHP	Multimedia Home Platform
MP3	MPEG 3 – a standard used for compressing digital music files
NAO	National Audit Office
NCIS	National Criminal Intelligence Service
PCC	Press Complaints Commission
PIU	Performance and Innovation Unit
PSB	Public Service Broadcaster
OECD	Organisation for Economic Co-operation and Development
OFT	Office of Fair Trading
P2P	Peer-to-peer
PC	Personal Computer
PDA	Personal Digital Assistant
RIPA	Regulation of Investigatory Powers Act
SME	Small or medium-sized enterprise
SMS	Short Message Service (text messaging)
UMTS	Universal Mobile Telecommunications System
USO	Universal Service Obligation
VDSL	Very high bit rate Digital Subscriber Line
WAP	Wireless Application Protocol
WML	Wireless Mark-up Language

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