The Communications Market: Broadband

Digital Progress Report

Research report

2 April 2007

Key points

- Half (50%) of all UK adults lived in households with a broadband internet connection in Q4 2006 - up from 39% a year ago and seven times the 2002 penetration level. In total, there were 13 million residential and SME (small and medium size enterprise) broadband connections at the end of 2006, up 31% over the year.

- Revenues from broadband access services continued to grow, reaching an estimated £1.8bn in 2006, an increase of 18% over the year and fifteen times 2001 revenues.

- In Q4 2006, over 40% of all adults with broadband at home took broadband alongside other communications services from the same provider; around 32% combined broadband with landline, and a further 12% combined it with landline and TV services.

- In Q3 2006, 63% of adults with broadband at home used it daily, while 30% went online at least once a week. Broadband users spent an average of 9.1 hours a week online compared to 4.4 hours for narrowband users.

- Around half (51%) of adults with broadband at home had accessed online video clips, with 26% saying they did this weekly, according to Ofcom's February 2007 survey. 43% of adults with broadband at home had uploaded images, while 15% had uploaded video content at least once.

- At the end of 2006 the estimated average headline connection speed was 3.8Mbit/s, up from 1.6Mbit/s in 2005. Headline speeds of over 2Mbit/s were used by 31% of homes and SMEs, compared to only 2% a year earlier. However, almost half (48%) of residential consumers were unaware of their headline connection speed.

- Up to 2Mbit/s headline speed connections were available for £15 a month in 2006, down from £50 in 2003. Headline speeds of 8Mbit/s were available for around £10 per month from some operators, compared to £40 when first offered in 2004. In addition, several providers offered a broadband service at no extra cost to consumers who also took other services in a bundle.

- At the end of 2006 there were 1.3 million residential and SME broadband unbundled lines, accounting for 10% of all connections compared to only 2% a year earlier. LLU growth continued in early 2007, reaching 1.7 million lines in February.

- There were around 12,000 commercial wireless hotspots across the UK in September 2006, an increase of 32% over twelve months. In February 2007, of the 21% of adults owning a WiFi-enabled laptop, over one in three (34%) had used it to access the internet via a WiFi hotspot.

- One in three UK adults said they owned an internet-enabled mobile phone in February 2007; however, only half had ever used it to go online. Lack of need or interest was the main reason cited (by 43% of users), with cost second (31%).

- Almost two-thirds (62%) of SMEs were connected to broadband in 2006, while 9% used dial-up internet access. Broadband penetration was higher among larger SMEs with 50-250 employees, at 70%.

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Introduction

This report is part of a series which supplements our annual Communications Market Report publications, focusing on specific areas of the UK communications landscape. It aims to provide a comprehensive overview of recent trends in the broadband industry and consumer use of broadband. We hope it will provide a useful source of data at a time when broadband is rapidly becoming a core part of the communications environment, transforming traditional industry structures and consumer behaviours.

For the purposes of this report, broadband is defined broadly as an 'always-on' service which allows simultaneous use of voice and data, and is faster than a dial-up connection.

The report covers developments up to the end of 2006 and includes more recent analysis where data were available at the time of writing. We have drawn on several sources:

- estimates of market size are based on broadband line and revenue data submitted to Ofcom by operators;
- consumer take-up and usage data are based on Ofcom's ongoing tracking studies of residential and SME consumers;
- we commissioned a bespoke survey to examine use of online content and wireless internet among residential consumers. The survey was carried out in February 2007 by ICM on behalf of Ofcom; and
- in addition, a range of external sources was used to supplement our own research where appropriate.

This report focuses on recent market developments, and should be viewed in the context of other Ofcom's forthcoming work examining the geographic and socio-demographic differences in broadband adoption, most notably:

- The Communications Market: Nations and Regions 2007, to be published in May, which will provide a detailed view of broadband availability, take-up and exclusion across the Nations and English Regions; and
- Ofcom's Access and Inclusion project, to commence in 2007/8, which will look to identify the nature of obstacles to the delivery and take-up of broadband.

We endeavour to ensure that the data in this report are comprehensive and the most accurate currently available. However, there will sometimes be omissions and occasional inaccuracies; Ofcom welcomes comment on the content and style of its Communications Market reports to help inform future publications. Suggestions and queries should be sent to: market.intelligence@ofcom.org.uk.

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We would like to thank the following organisations for granting us permission to use their data in this report: Informa, Nielsen NetRatings, PointTopic and Pure Pricing.

1. The UK broadband landscape

1.1. Overview

Surging take-up, falling prices and rising speeds

Broadband is becoming an integral part of the UK communications landscape; a source of everyday communication, information and entertainment in many homes and central to the strategic plans of many communications service providers.

A significant milestone was passed in Q4 2006 – over half of UK adults now live in households with a broadband connection. Development in the sector is being driven by growing competition in service provision, surging consumer take-up, market innovation and new regulatory arrangements.

At the end of 2006, there were 13 million residential and SME broadband connections compared with just over 300,000 in 2001 (Figure 1). Growth has brought with it a corresponding rise in revenue. We estimate that in 2006 residential and SME connections generated £1.84bn in retail revenue for broadband providers – a fifteen-fold increase in six years.

Figure 1:   Total broadband lines and retail revenues
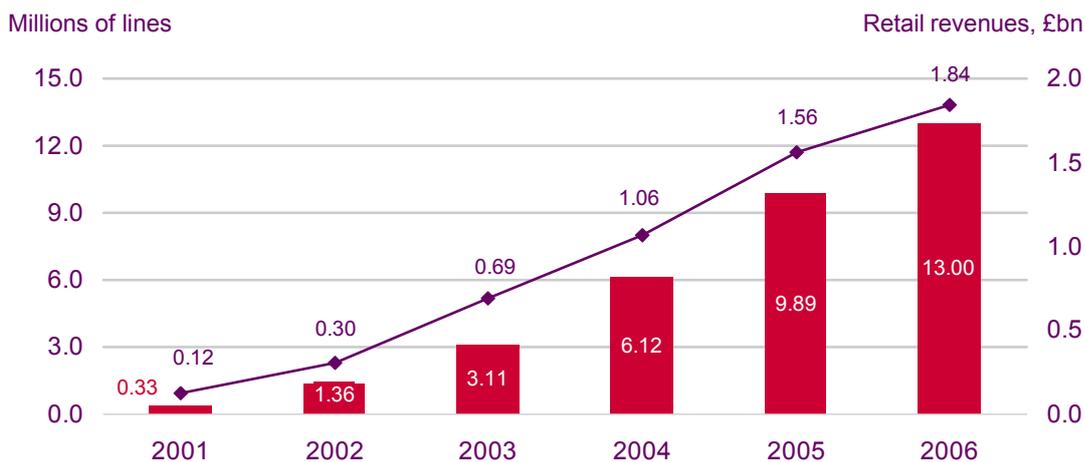
Source: Ofcom/operators

Broadband availability in the UK is among the highest in the world. In January 2006 BT reported that 99.9% of premises in the UK were connected to broadband-enabled exchanges (although not all of these premises are able to receive broadband due to local technicalities). In addition, 45% have access to digital cable infrastructure.

Growing competition among service providers over the past couple of years has resulted in significant declines in broadband prices during the past year. At the end of 2006, headline connection speeds of up to 2Mbit/s were available for £15 a month on a stand-alone basis, down from £50 in 2003. In addition, several operators offered free broadband as part of service bundles. At the same time, speeds continued to increase. In December 2006, the average UK broadband headline connection speed was 3.8Mbit/s, up from 1.6Mbit/s a year earlier. Some residential customers could achieve connection speeds as high as 24Mbit/s.

One factor stimulating sector growth over the past year was the introduction of a new LLU regulatory regime following Ofcom's Strategic Review of Telecommunications in 2005; by February 2007 there were over 1.7 million unbundled lines in the UK, compared to only 365,000 at the end of 2005. Over 1,300 of BT's 5,600 exchanges were LLU-enabled, extending the availability of LLU-based services to two-thirds of UK population.

An integral part of the UK's social fabric
It is not just infrastructure, price and speeds that are evolving: broadband also serves a growing range of informational, practical and communication needs. Broadband users spend over nine hours a week online and the majority (65%) go online daily.

In addition to basic surfing and emailing, seven in ten broadband-enabled adults have bought products or services online and over half have carried out banking transactions. Around half have downloaded music, movies or video via the internet and 44% have used broadband as a source of educational information.

Internet use by broadband adopters goes beyond informational or functional purposes, entering the social and creative realms. Social networking sites such as MySpace, Bebo and Friends Reunited are used by large numbers of people to communicate and share information with existing contacts as well as making new ones. Our research in autumn 2006 showed that 43% of those with broadband had used websites as a means to keep in touch with people. Internet users also create and share their own content online: 14% of internet users had contributed material to a website or blog, and 11% of internet users have a webpage or blog.

In addition to in-home use, wireless connectivity is becoming more prevalent. There are now nearly 12,000 public WiFi hotspots in the UK, allowing users with portable devices to go online in suitably equipped locations such as cafes, bars, hotels or airports. Our data show that of the 21% of adults with a WiFi-enabled laptop, one in three have used it to access the internet away from home; over one in ten do it weekly.

Mobile networks provide another alternative for accessing the internet on the go. According to our research, 31% of UK adults had an internet-enabled mobile phone in February 2007, and around half (48%) used their phones to go online. The most common reason for not accessing the internet via mobiles for the other half was lack of need or interest (cited by 44%), suggesting many remain unconvinced. Cost was the second highest barrier, mentioned by 31% of respondents.

Broadband is facilitating the move to convergence
Accessing content over broadband, once a minority activity, is becoming an established part of our media consumption. According to our research (February 2007), around half of all broadband users have accessed media content online, and over a quarter listen to audio or download video clips on a weekly basis. If 2005 was the year when audio downloads reached mass-market appeal, 2006 saw a step-change in the popularity of various types of online video content:

- **Video downloads over the open internet** have long been available, but gained widespread momentum in 2006, exemplified by the popularity of the Google-owned video sharing site YouTube. Online presence has also become a must for traditional media outlets, with all major players offering access to some content online. But the lines between traditional and new media providers are blurring, as demonstrated by the BBC's deal with YouTube, announced in March 2007, to distribute clips from BBC programmes on the site.

- Hundreds of **streaming TV** channels are now available online, both in the form of online-only channels (e.g. the 24-hour Music Plus TV), and those simulcasting broadcast channel content (e.g. Channel 4's web service). A growing number of online TV gateway portals such as ChooseandWatch.com and Beelinetv.com offer users one-point access to many streaming TV channels from around the world. In another development, Slingbox, a device which enables users to link their TV equipment to a home broadband connection and then watch their satellite, cable, digital or analogue TV over the internet from anywhere in the world, entered the UK market in June 2006.

- **ISP-managed IPTV services** also had a boost over the past year. In December 2006, BT launched its BT Vision service, combining Freeview and video on demand delivered via a broadband connection. ISP Tiscali launched its Tiscali TV service in March 2007 following the acquisition of the UK's IPTV pioneer, Homechoice.

- In addition, **mobile TV** services are available from several UK operators via 3G networks. Sky mobile TV bundles are available on Vodafone, Orange and 3UK. 3UK also allows the streaming of live TV captured via a Slingbox on its X-Series Gold plan.

However, despite these developments, many users are still reluctant to access video content over the internet. Our data suggest that the main reason for not doing so is a lack of interest or need, mentioned by more than two thirds of respondents in our February 2007 research, whereas only 3% mentioned connection speed as a limiting factor. Speed was only marginally more important for longer video content such as feature films and full TV programmes, with 6% of respondents citing it as a barrier.

Voice over internet protocol (VoIP) is another example of broadband-based convergence. Computer-based VoIP uptake has been increasing in the past year: according to our data, 18% of adults with broadband at home used the internet to make phone calls from their PCs in Q4 2006, compared to 13% a year ago. Standalone VoIP phones are also becoming more common and are helping to detach the service from the PC, opening up more possibilities such as wireless or mobile VoIP. Several WiFi or combined GSM/WiFi devices entered the market in 2006, allowing the use of VoIP over WiFi hotspots. One example is Truphone's wireless VoIP service offered through an agreement with WiFi operator The Cloud to allow Truphone subscribers to make calls over The Cloud's hotspots. At the same time, 3G-based mobile VoIP is also available to 3UK X-series customers using Skype-enabled mobile phones.

Evolution of the UK broadband market

The evolution of the broadband market in the UK needs to be seen in the context of four important developments:
- growth in the dial-up internet market in the UK during the late 1990s;
- the accelerated take-up of home computers during the late 1990s, boosted by MS Windows and Mac applications, and PC games;
- the global evolution of internet content and applications; and
- free broadband.

During the **mid 1990s**, internet applications – notably email and the World Wide Web – expanded from their historic user bases in education and the military, and became increasingly common in businesses and homes. This expansion was fuelled by the explosive growth in commercial web sites, and by a network effect in emails (i.e. as more people obtained personal email accounts, the use of email as a communications tool became more widespread).

The predominant means of in-home connection to the internet at that time was via a dial-up connection over a standard PSTN telephone line. Dial-up internet was therefore widely available (since virtually every home in the UK had a fixed-line connection), and required very little end-user equipment, other than a home computer (which typically had a dial-up modem built in). However, connection speeds were slow, requiring a lengthy 'handshake' connection at the start of each session, with the user needing to pay both a monthly subscription and a per-minute telephone call charge.

In 1998, electrical goods retailer Dixons Group Plc (now called DSG Plc) launched its own internet service provider, Freeserve, which abolished the monthly subscription component of internet charging in favour of purely per-minute pricing. As the largest UK high street retailer of computers, Dixons had the power not only to market Freeserve aggressively, but also to place the software in many of the personal computers that it sold. These factors led to steep growth in dial-up subscriptions; by 2000 Freeserve had over two million active subscribers, making it the largest UK ISP and helping to boost the UK dial-up subscriber base to over 10 million.

High-speed internet access (i.e. at 128kbit/s and higher, as opposed to dial-up's maximum 56kbit/s) had been available to large business users via a range of access technologies such as fibre optic connections since the mid- 1990s. Higher speeds could also be obtained by small business users and a very small number of high-end residential users via ISDN lines, which were relatively expensive and which required specialised equipment at the exchange and the user's premises.

Cable operators pioneered broadband access in the UK, and **by 1999** several cable operators were offering broadband internet via cable modem, but again it was relatively expensive and the operators did not actively market this option as a mass-market proposition at that time.

In autumn 2000, BT introduced broadband via DSL. The technology allowed consumers to achieve broadband connectivity via a standard PSTN telephone line, using a DSL modem, although local exchanges needed to be upgraded with new hardware. BT began to roll out DSL exchange upgrades in late 2000, concentrating first on London and other major metropolitan areas. In addition to offering DSL services direct to retail customers, BT also sold wholesale DSL connectivity to other ISPs, which then essentially resold the service to their own retail customers. Following the introduction of DSL, the cable operators also began marketing broadband via cable modem more aggressively to their customers.

By the end of 2001, however, broadband take-up in the UK was still low, with only around 300,000 users (compared with a dial-up subscriber base of around 13 million). This was due to a number of factors: the gradual upgrade of telephone exchanges to DSL, which limited availability; the relatively high cost of broadband (typically around £30/month for a 256kbit/s connection); the fact that consumers could see little added value in broadband over dial-up, since at that time the fastest available broadband connections were only around five times faster than dial-up; and, importantly, the limited amount of internet content and applications that required (or benefited from) a higher-speed connection.

Between 2002 and 2004, broadband take-up in the UK rose sharply as each of these constraining factors was overcome. By the end of 2004, over 96% of UK homes and businesses were connected to a DSL-enabled exchange; average broadband connection speeds had risen to 512Mbit/s (ten times faster than dial-up), with speeds of up to 2Mbit/s available to some premises, retail prices had fallen to £20 or below for basic broadband, and there was by now plenty of graphical, audio and video content available online, all of which benefited from broadband access.

By the end of 2004, there were 6.2 million broadband subscriptions in the UK, with the user base having roughly doubled each year between 2002 and 2004. BT was the largest broadband ISP, with 24% of the retail broadband market, and its wholesale product accounted for a further 44% of market share. 31% of the market was shared between the two cable operators, with the remaining 1% coming from the emergent local loop unbundling (LLU) sector. Broadband growth continued over the past two years, reaching 13 million residential and SME subscriptions in **December 2006**. LLU-based lines increased rapidly, and accounted for 10% of the market at the end of 2006. Virgin Media, formed as a result of merging of cable operators ntl and Telewest and including Virgin Net ADSL customers, became the largest retail broadband provider with an estimated 26% market share.

1.2.   Regulatory and policy developments

The UK's regulatory approach to the broadband market is underpinned by the European regulatory framework, which consists of five main directives. In the UK, the EC framework has been translated into the 2003 Communications Act, under which Ofcom has competition powers.

The Office of the Telecommunications Adjudicator (OTA) facilitates the implementation of the procedures which enable competitors to gain access to the incumbents' local loop, under a process known as local loop unbundling (LLU). The OTA is independent of Ofcom and the telecommunications industry.

Telecoms Strategic Review
In September 2005 Ofcom published its review of the telecoms market. At the same time, and as a result of the findings of this review, BT offered and Ofcom accepted legally binding undertakings under the Enterprise Act 2002. These undertakings required the full operational separation of BT's access network (local loops) and a new division within BT, called Openreach, was established to manage the access network. In October 2006, the impact of this review was assessed. Ofcom found that while UK fixed telecoms customers continued to see more choice, lower-cost bundled products, and a wider range of broadband speeds, service performance across a range of wholesale products had at times been poor, and promised improvements had not always been fully delivered or maintained.

Wholesale broadband access
Ofcom is required by the European Directives and the Communications Act 2003 to conduct periodic reviews of the UK's wholesale broadband markets. In November 2006, Ofcom published the first stage of its second review of the wholesale broadband access market. The first review was concluded in May 2004, as a result of which Ofcom mandated BT and Kingston Communications to provide wholesale broadband services to third party suppliers. The preliminary finding of the second review is that the broadband market has changed significantly since and Ofcom is now proposing to define sub-national (geographic) markets.

Spectrum liberalisation
Ofcom has developed a programme of spectrum awards to release available spectrum to the market. In December 2006 Ofcom published proposals for the two largest spectrum releases in the award programme: the band 2500-2690 MHz and the spectrum known as the Digital Dividend at 470-862 MHz (including 112 MHz of clear, nationally available, spectrum). In both cases, advanced mobile telephony, wireless broadband and mobile multimedia were identified as among the potential services for the bands. Ofcom is proposing to auction technology- and service-neutral licences, with awards potentially taking place in late 2007 for the band 2500-2690 MHz and in late 2008 for the Digital Dividend. Both awards could lead to significant developments in the provisions of wireless broadband services in the UK.

In February 2007 the European Commission published a Communication on Rapid Access to Spectrum which seeks to pave the way for more flexible spectrum management in a number of key bands. The Communication explains that market-based spectrum management combined with flexible spectrum usage rights are estimated to bring net gain (of €8bn-9bn per year) across Europe.

Audiovisual Media Directive
Another relevant policy under review is the EU Audiovisual Media Services Directive. The new directive, currently under discussion in the European Parliament and in the Council, would extend and update the 1989 TV Without Frontiers Directive to include services which are essentially similar to television but delivered on-demand (i.e., video-on-demand), irrespective of the technology used to deliver them. The final Directive is expected to be adopted in 2008, with implementation in the UK around mid-2009.

1.3.   International comparisons

The growth in broadband take-up among residential users in the UK between 2001 and 2006 is best viewed in an international context. Figure 2 below shows the end of 2006 the UK's take-up rate of 50% was similar to that of Japan, Sweden and the US, and over ten percentage points higher than in Germany or Italy. However, the UK, along with every other industrialised nation, had significantly lower broadband take-up than South Korea, which had 89% penetration by Q4 2006. In South Korea, residential broadband access has long been seen by the government as a key element underpinning general economic growth.

Figure 2:   Broadband connections per 100 households

Connections
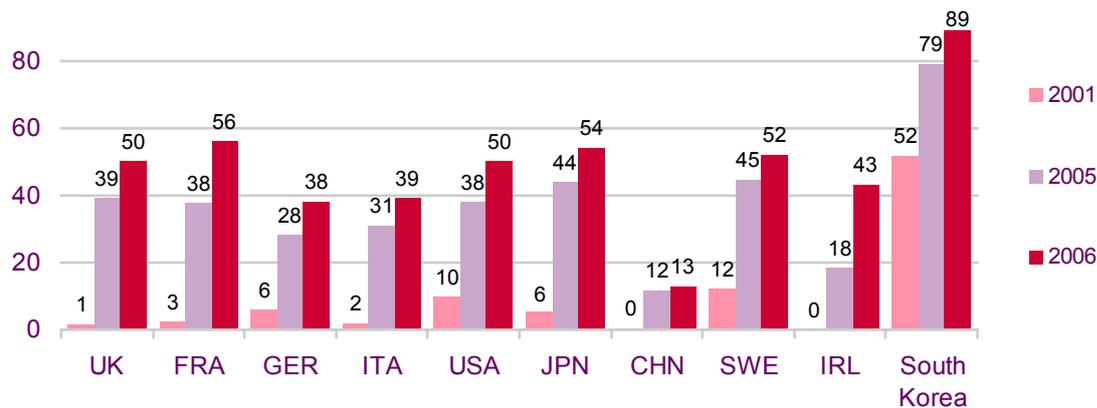
Source: IDATE / Point Topic / ECTA / National regulators / OECD / Ofcom

Note: The UK figure represents the proportion of adults with broadband at home. Some country data may also include SME connections.

Figure 2 also shows penetration levels in 2001, and demonstrates that, at that time, the UK lagged behind most other industrialised countries. The fact that the UK has since caught up with or passed many of its peers is attributable to a number of factors, including the development of the wholesale DSL market, the growth of cable broadband, and increased public awareness of broadband, stimulated by high levels of marketing by ISPs. Interestingly, even in 2001, South Korea had higher levels of broadband take-up than the majority of other countries around the world had achieved by 2006.

An examination of broadband access methods shows that by the end of 2006 just under a quarter of the UK's connections were via cable (Figure 3). This proportion was significantly higher than in many other European countries, and was due to the relatively high availability of the cable network in the UK. However, the UK's cable share has declined significantly, from around 60% in 2001, due to DSL-based broadband accounting for a large share of new subscriptions since then. Cable's share of connections was highest in the USA, with its long history of cable TV network. In South Korea, meanwhile, investment in very high-speed infrastructure, involving fibre to the kerb (FTTK) or fibre to the premises (FTTP), meant that by 2006 almost a quarter of connections were via these high-speed links.

Figure 3:   Broadband connection method, Q4 2006

% of broadband connections
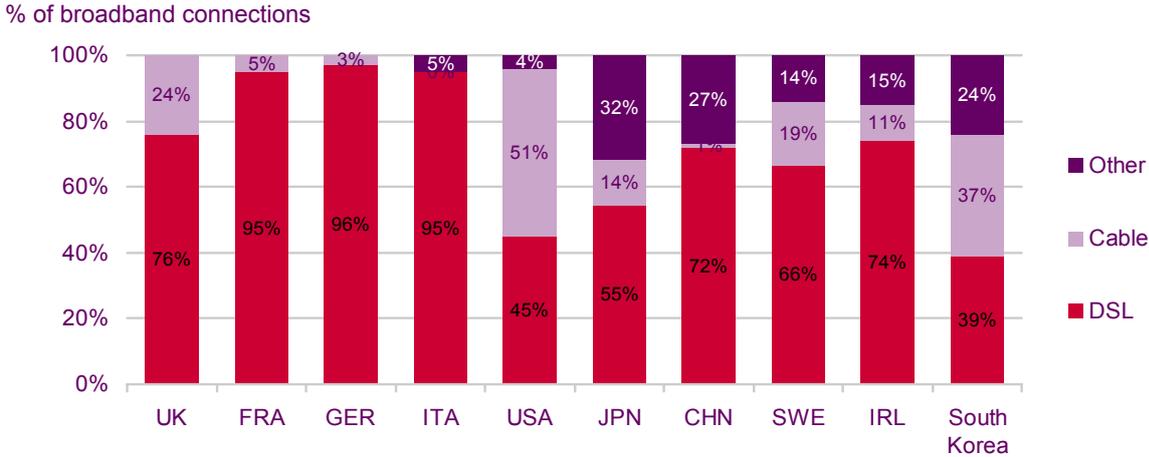
Source: Point Topic/Ofcom

The availability of public wireless hotspots, which enable users to connect wireless devices to broadband in areas such as cafes, restaurants and airports, has grown rapidly in most industrialised countries since 2004. Figure 4 shows that the UK had a high availability of hotspots at the end of 2006, ahead of the USA, Japan, France and Germany, at 18.4 hotspots per 100,000 population. The absolute number of hot-spots in the UK has been growing rapidly over the past few years, driven by, among other factors, by legislative changes in 2002 and 2003 which enabled the use of some licence-exempt bands for public WiFi access. Liberalisation of some spectrum bands coupled with relatively high population concentration in the greater Dublin area might have also stimulated growth in Ireland, which had the highest availability of hotspots at the end of 2006 of the countries included in the analysis, at 26 per 100,000 population.

**Figure 4:   Public wireless hotspots per 100,000 population, Q4 2006**

Number of hotspots
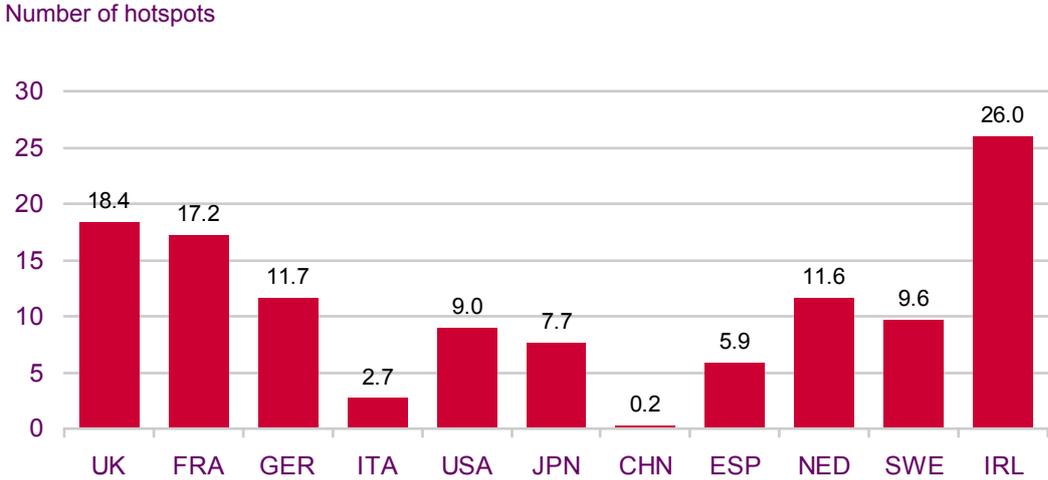
Source: Informa

2. Service providers, prices and revenues

2.1. Virgin Media and BT account for half of all retail connections

There are around 500 internet service providers (ISPs) offering broadband services in the UK, the vast majority of which are relatively small and have fewer than 250 employees. BT was the largest retail ISP in the UK with around 24% retail share of subscribers for several years until the merger between cable operators ntl and Telewest in March 2006. The merged company, re-branded as Virgin Media in February 2007 following the acquisition of Virgin Mobile, accounted for an estimated 26% of all retail connections at the end of 2006.

Figure 5:   Estimated ISP market shares, Q4 2006
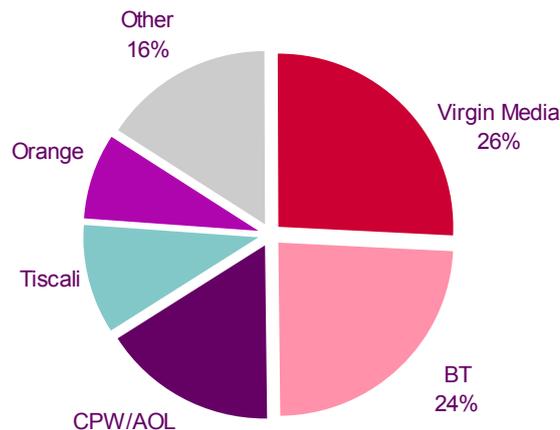
Source: Ofcom

BT

BT is the UK's incumbent fixed operator providing local, national and international voice services as well as broadband, dial-up internet access and IT solutions. At the end of 2006 BT had 3.2 million retail broadband connections (including corporate connections) and supplied a further 5.5 million wholesale DSL connections to other ISPs, making it the largest UK wholesale broadband provider.

In the face of falling traditional fixed-line voice revenues, BT is currently focused on driving what it classifies as 'new wave' revenues - those from retail and wholesale broadband, mobility and ICT. In 2006 new wave revenues of £7.1bn accounted for 35% of total revenue, up from 31% in 2005. Broadband and LLU revenues were £520m in the last quarter of 2006, up from £374m a year previously, accounting for 10% of total revenue.

In November 2006 BT acquired PlusNet with around 200,000 broadband customers for £67m. The main reason for the acquisition, as stated by BT, was not the additional customers but PlusNet's strong reputation for customer service and innovation. In December 2006 BT launched BT Vision, a service providing free-to-air channels via a Freeview decoder and pay video-on-demand IPTV services, signalling an attempt to move away from being a traditional infrastructure operator and towards becoming a content distributor.

Virgin Media

Virgin Media is the UK's largest provider of broadband services, with 3.3 million broadband customers, most of whom (3.1 million) receive service via the company's cable network. Virgin Media is the brand name of NTL Inc., the company formed by the merger of ntl and Telewest Broadband in March 2006. The company's cable network provides TV, broadband and fixed telephony services and passes around half of all UK households. In addition, the company owns DSL broadband provider Virgin Net and Virgin Mobile, the UK's largest MVNO.

NTL was originally the engineering division of the Independent Broadcasting Authority, the UK commercial television regulator in the 1970s and 80s, while Telewest Broadband was founded in 1984 as Croydon Cable. Both companies expanded significantly in the 1990s by acquiring other cable franchises around the UK. The two companies merged in 2006, creating the UK's largest retail broadband provider, with an estimated 26% subscriber market share (including Virgin Net DSL-based customers). In 2006, ntl:Telewest's combined revenues were £3.6bn, an increase of 8% on the previous year (which did not include any revenues generated by Virgin Mobile). Note that throughout this report we have referred to Virgin Media rather than ntl:Telewest even where the data covers periods prior to the re-branding.

With the company's re-branding as Virgin Media in early 2007 it announced new, simplified tariffs aimed at competing with BT Vision, Sky's See, Speak and Surf package and Tiscali's recently announced Tiscali TV service. Virgin Media plans to launch IPTV in 2008 to enable it to offer quad-play services to its DSL customers as well as cable customers.

Carphone Warehouse/AOL

Carphone Warehouse (CPW) is a UK-based mobile phone retailer and the largest independent retailer of mobile phones in Europe with over 2,000 stores. At the end of 2006 CPW was the third largest broadband supplier with 2.2 million customers, over 400,000 of whom received service through LLU.

Over the past few years Carphone Warehouse has undertaken a number of acquisitions of fellow Carrier Pre-Selection (CPS) operators, including Tele2's UK and Irish assets and Centrica in 2005. In October 2006, Carphone Warehouse announced the acquisition of AOL's UK internet service provider business with its 1.5 million broadband customers.

In April 2006 Carphone Warehouse announced a free broadband service for its customers taking a fixed line and calls package, and by December 2006 the company had already migrated 50% of existing TalkTalk fixed telephony customers onto its broadband service.

CPW plans to continue offering bundled broadband and telephony services under the TalkTalk brand while keeping AOL Broadband as the company's stand-alone broadband product using partial LLU. By the end of 2006 Carphone Warehouse had already unbundled 569 BT exchanges and had a target of unbundling 1,000 exchanges by May 2007.

Tiscali

Tiscali was founded in Italy in 1998, and during the late 1990s became one of the largest pan-European ISPs. At the end of September 2006 Tiscali had a total of 1.7 million broadband customers across Europe of which 1.3 million were in the UK, and over 250,000 LLU customers in Europe (of which 220,000 were UK-based).

The company's principal activity in the UK is the provision of broadband and dial-up internet access services, although it also provides teleworking solutions, leased lines and web hosting services. Tiscali plans to focus its efforts on the UK and on Italy's IP-based services market, offering fast internet, VoIP and IPTV services over an IP network in the UK and Italy which will be integrated by local ADSL access, provided either by LLU or wholesale access.

In August 2006 Tiscali confirmed the acquisition of a 100% share in Homechoice (owned by Video Networks International) for an estimated £50-60m. In return, Video Networks International received equity of 11.5% in Tiscali UK. The service, which already had over 40,000 subscribers, was re-launched as Tiscali TV on 1 March 2007. Tiscali plans to roll out its TV service over its entire local loop network by the end of 2008.

Orange Home UK

Orange Home is a wholly-owned subsidiary of Orange, the French incumbent formerly known as France Telecom. Orange Home's UK roots are in Freeserve, the UK ISP acquired by France Telecom in 2000 and initially re-branded as Wanadoo.

At the end of 2006 Orange Home had 1.0 million UK broadband subscribers who received their service through a combination of BT's wholesale products and partial LLU. Orange Home

provides broadband over BT's local loop while another operator (usually BT) provides voice services.

Orange's headline product in the UK is the Broadband Unlimited service which provides wireless broadband access at up to 8Mb through the 'Livebox' wireless router which also serves as a VoIP telephony port. In 2006 the operator started to offer a free basic broadband service to its mobile customers with an 18-month contract costing £30 a month or more, following the introduction of other free broadband offers including that from TalkTalk.

Pipex

Pipex can be traced back to 1997 when RadioTel Systems was awarded a licence to provide telecommunications services. The company went through a number of name changes before it bought the ISP Pipex in late 2003 and took on the Pipex name. In September 2006 Pipex paid £12m to acquire the 118,000 broadband customer base of Cable and Wireless' subsidiary Bulldog. The acquisition increased Pipex's total customer base to a total of 1.1 million customers of whom more than 500,000 took broadband services. Pipex signed up to use Cable & Wireless' unbundled local loop access network which covers 800 BT exchanges.

Pipex uses a hybrid network – a mixture of its own LLU footprint and wholesale – and although it now focuses on the SME market it still has a substantial residential broadband customer base. It was the first service provider to offer wireless broadband using WiMAX in the UK, with trial customers connected to a network in Milton Keynes and a second trial due to launch in Spring 2007 in Leamington Spa and Warwick.

BSkyB/Easynet

BSkyB is the leading pay-TV broadcaster in the UK, with over 8.4 million subscribers to its direct-to-home (DTH) satellite service at the end of 2006. In October 2005 BSkyB acquired the ISP Easynet, enabling it to provide high-speed broadband access to around 6 million UK households through unbundled local exchanges. Including Easynet's customer base the company now has around 300,000 active broadband connections.

Easynet had already unbundled 232 UK exchanges covering 4.4 million UK households prior to its acquisition by BSkyB. Following its purchase, Easynet has continued its investment in unbundling BT exchanges and in mid-2006 BSkyB began to offer broadband services to its DTH customers. The company aims to have 70% UK household LLU coverage by mid-2007.

2.2. There are around 450 small ISPs providing broadband services

In addition to the major players discussed above, there are many smaller ISPs providing a wide range of services both for business and residential consumers. Ofcom conducted a study examining smaller ISPs in April and May 2006. We identified 686 ISPs with fewer than 250 employees, of which 64% (around 450 in total) provided broadband services (Figure 6).

Figure 6: Services offered by small and medium-sized ISPs
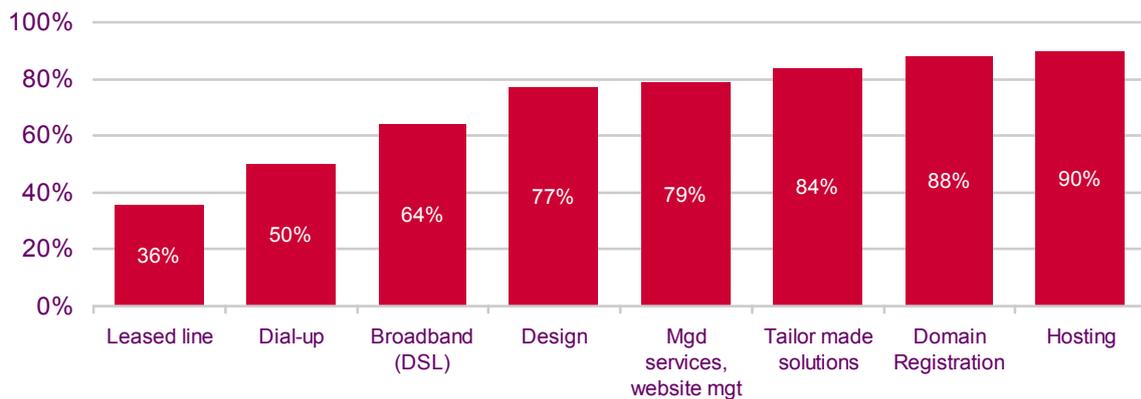
Source: Ofcom research

The vast majority (83%) of smaller ISPs have less than 20 employees, equally split between technical and non-technical staff. Most (90%) small ISPs are located in England, in particular, in the South: 27% are in South-East, 15% in London and 7% are based in South West. Ofcom estimates that smaller ISPs generated around £1.1bn in revenue in 2005/06, although 61% of them had an annual turnover of less than £1m; internet connection revenues comprised around 64% of their turnover and the remaining 36% came from additional services such as web hosting.

Smaller ISPs serve over 1.9 million customers; two-thirds (62%) provide services for business customers, of which 72% are sole traders or businesses with up to 30 employees (Figure 7).

Figure 7: Estimated split of UK customers served by smaller ISPs

Source: Ofcom research

2.3. Over one in ten broadband connections are LLU-based

Local Loop Unbundling

Local Loop Unbundling (LLU) is the process whereby incumbent operators (i.e. BT and Kingston Communications in the UK) make their local network (the lines that run from customers premises to the telephone exchange) available to other communications providers. The process requires the competitor to deploy its own equipment in the incumbent's local exchange and to establish a backhaul connection between this equipment and its core network.

There are two types of unbundled access. **Full access** provides exclusive use of the telephone line to deliver voice and ADSL services. **Shared access** provides use of the high-frequency channel only, which is capable of supporting ADSL broadband.

Compared to purchasing wholesale bit-stream products, LLU allows greater control over service characteristics, e.g. speed, quality of service and pricing. It became a legal requirement to offer LLU in the UK in August 2000, following the introduction of new obligations on BT and Kingston Communications.

The take-up of LLU was initially very limited. However, at the end of 2004 Ofcom required BT to significantly reduce its charges for LLU, in some cases by up to 70%. At the same time Ofcom established the Telecommunications Adjudicator to facilitate improvements in the LLU products and processes. These developments created renewed interest in LLU and take-up began to accelerate from 2005.

In 2006 LLU gained significant broadband share in the UK. By the end of 2006 over 1,300 of BT's 5,600 local exchanges were LLU-enabled, extending the availability of LLU-based services to two-thirds of the UK population. The number of LLU lines increased by over 500% in 2006 to 1.3 million, accounting for 10% of all broadband connections (Figure 8). Growth continued in early 2007, and in February there were more than 1.7m unbundled lines according the Office of the Telecoms Adjudicator.

LLU has become a major facilitator of product bundling in the UK, as it allows providers who operate in other communications sectors to enter the fixed telephony and broadband markets without the need for expensive access network investment. A number of LLU operators have been acquired by other communications providers as a means of extending their product portfolios so that they can offer a bundle of communications services.

Figure 8:   Unbundled lines
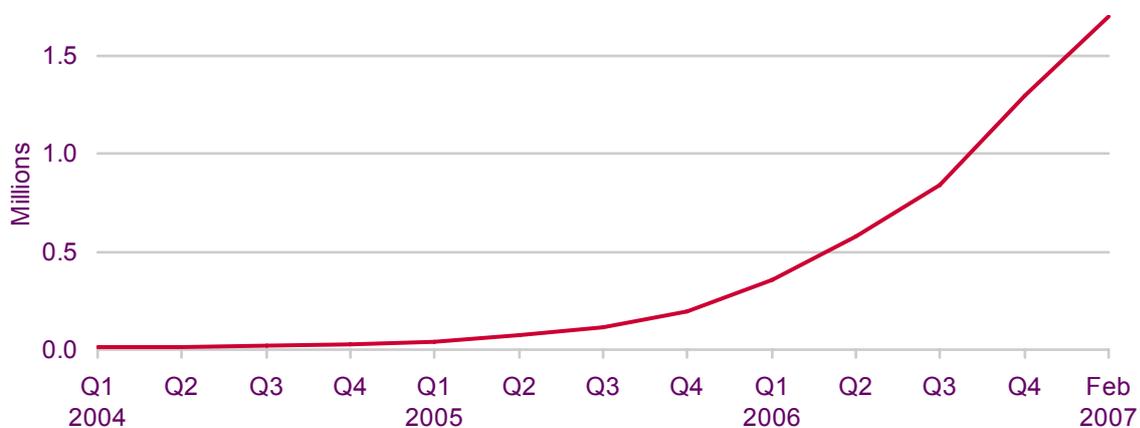
Source: Ofcom / operators

There are two main reasons for broadband providers to pursue LLU:

- It offers more **control over the services** that they can offer. This allows greater product differentiation and increases the number of services available to consumers.

- It provides **control over a greater part of the value chain** and exposes more of the underlying cost structure. This gives the provider a greater opportunity to introduce efficiency improvements and allows greater flexibility in tariffs.

LLU requires significant up-front investment in each local exchange for the operator to be in a position to serve the fist customer. For instance, space preparation, equipment and backhaul installation. These costs can vary significantly depending on the configuration, but based on statements made by LLU operators the cost for a typical large scale operator are likely to be in the range £30-50k per exchange. Subsequent costs are predominantly driven by the number of lines unbundled, e.g. modem-port costs (around £40 per line), line connection costs (around £35 per line), annual loop rental charges (£80 per line for full access and £16 for shared access) and operational costs such as power consumption and billing. Therefore, in order to achieve a 'low' average cost per end user, at a given exchange, it is necessary to achieve a 'high' number of unbundled lines.

Clearly, there is a greater possibility of achieving a 'high' number of unbundled lines in a larger exchange, that is, an exchange that serves a large number of consumers. It is for this reason that LLU is predominantly being used in large exchanges, which are generally located in densely populated areas.

The combination of high initial cost and the need to achieve 'high' volumes means that in general LLU will be attractive to larger players who have access to capital. However, irrespective of size, some operators prefer the option of purchasing wholesale products instead of using LLU. Also, if an operator uses LLU only in densely populated areas, it may continue purchasing wholesale products from BT outside these areas to achieve national coverage.

BT faces the same basic cost structure as LLU operators, in that the cost per end-user varies between individual exchanges and generally a lower cost is obtainable in larger exchanges. In April 2005 BT decided to change the tariff structure for its wholesale broadband products so that a lower price was introduced in certain qualifying exchanges. The qualifying exchanges were identified by BT as those where the unit cost of supply was considered to be lower than the national average. There is a strong correlation between BT's qualifying exchanges and the exchanges where LLU is being taken.

2.4. Broadband now cheaper than dial-up

Growing competition in broadband provision, in part as a result of LLU, has led to a continued decline in broadband prices. As Figure 9 below shows, connections of up to 2Mbit/s advertised headline speed were available for £15 a month in 2006, down from £50 in 2003 when they were first introduced. Headline speeds of 8Mbit/s were available for as little as £10 per month from some LLU operators, compared to £40 when first offered in 2004.

Figure 9: Indicative standalone broadband prices

£ per month
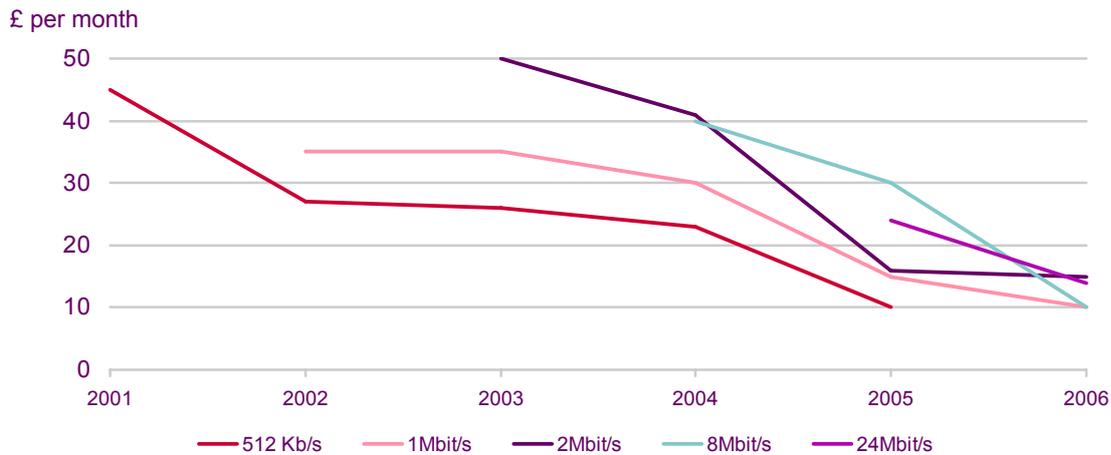
Source: Ofcom

Figure 10 below lists sample standalone broadband offers from major providers, showing the broad range of speeds, download allowances and tariffs available to consumers. Most operators now waive set-up and connection fees, and often grant discounts for an initial limited period or when customers order online.

Figure 10: Sample standalone broadband offers from major providers, March 2007

Operator	Broadband service	Headline speed	Download allowance	Connection /Activation	Monthly charge	Annual charge	Discount	Total annual cost
Tesco	1MB BB	1Mb	6GB		£17.97	£216		£216
Tesco	1MB BB Unlimited	1Mb	Unlimited		£19.97	£240		£240
AOL	Silver	2Mb	Unlimited		£14.99	£180	-£14.99	£165
Tiscali	2Mb Broadband	2Mb	Unlimited		£14.00	£180		£180
Virgin Media	Broadband Size M	2Mb	Unlimited	£25	£18.00	£216	-£46.12	£195
Tesco	2MB BB	2Mb	10GB		£19.97	£240		£240
Tesco	Tesco Finest	2Mb	Unlimited		£24.97	£300		£300
Virgin Media	Broadband Size: L	4Mb	Unlimited		£25.00	£300	-£10.00	£290
Pipex	Mini	8Mb	2GB		£14.99	£180		£180
Plus.net	BB PAYG	8Mb	2GB	£72	£14.99	£180	-£72.00	£180
Plus.net	Broadband Plus	8Mb	4GB(pk)	£72	£14.99	£180	-£72.00	£180
Plus.net	BB PAYG Basic	8Mb	450Mb	£72	£9.99	£120		£192
BT	BB Option 1	8Mb	5GB		£17.99	£216	-£15.00	£201
Tiscali	8Mb Broadband	8Mb	Unlimited		£17.99	£216		£216
Toucan	8Mb	8Mb	Unlimited		£17.99	£216		£216
Pipex	Midi	8Mb	15GB		£19.99	£240		£240
Orange	Unlimited	8Mb	Unlimited		£19.99	£240		£240
BT	BB Option 2	8Mb	8GB		£22.99	£276	-£24.00	£252
Plus.net	Brodband Premier	8Mb	20GB (pk)	£72	£21.99	£264	-£72.00	£264
Pipex	Max	8Mb	Unlimited		£24.99	£300		£300
BT	BB Option 3	8Mb	Unlimited		£26.99	£324	-£12.00	£312
AOL	Platinum	8Mb	Unlimited		£29.99	£360	-£29.99	£330
TalkTalk	Broadband	8Mb	40GB		£35.00	£420		£420
Virgin Media	Broadband Size: XL	10Mb	Unlimited	£25.00	£35.00	£420	-£10.00	£435
Be	Be lite	24Mb	4GB	£24.00	£14.00	£168		£192
Be	Be Unlimited	24Mb	Unlimited	£24.00	£24.00	£288		£312

Source: Pure Pricing UK Broadband, Bundling and Convergence Update, March 2007

Note: only packages of up to 12 months minimum term are included; discounts assume online ordering

As the prices of broadband connections continue to fall, narrowband is effectively being priced out of the market:

- Entry-level broadband is now available at the same price, or in some cases cheaper, than unmetered dial-up packages;

- Moreover, metered dial-up use can be more expensive than an entry-level broadband service: an average dial-up user browsing the internet for 4.4 hours a week would be spending over £11 per month on internet charges at 1p/minute rate, above the £10 broadband packages available from some providers;

- In addition, many providers offer a discounted broadband service as part of a product bundle. For example, Pipex offers a 2Mbit/s connection for £6.50 a month if bought with a voice call package; TalkTalk, Orange and Sky offer free broadband when taken with other fixed, mobile or pay-TV services;

It is increasingly difficult to monitor broadband prices due to the difficulty of identifying the separate pricing elements within a bundle of services. To overcome this issue, Ofcom has introduced a new price benchmarking methodology which examines the total household cost of communications services - see the International Communications Market 2006 publication for further details.[1]

In addition to price discounts, ISPs are looking for other ways to attract and retain customers, for example by including free equipment as part of the broadband package. At the time of writing, several ISPs including AOL and Orange offered wireless routers free of charge with some of their broadband packages. Another example is Redten Internet's offer of a free PC worth £500 for customers signing up to its 8Mbit/s broadband package for three years.

2.5. Broadband revenues up by 18% in 2006 despite falling prices

Despite falling prices, broadband revenues continue to increase as price declines are more than offset by growth in take-up (Figure 11). We estimate that retail revenues grew by 18% in 2006, reaching £1.84bn. This compares with just £0.12bn six years ago – a fifteen-fold increase. At the same time, decreases in broadband prices have meant that average revenue per line has been gradually declining.

**Figure 11:   Estimated retail broadband revenues**
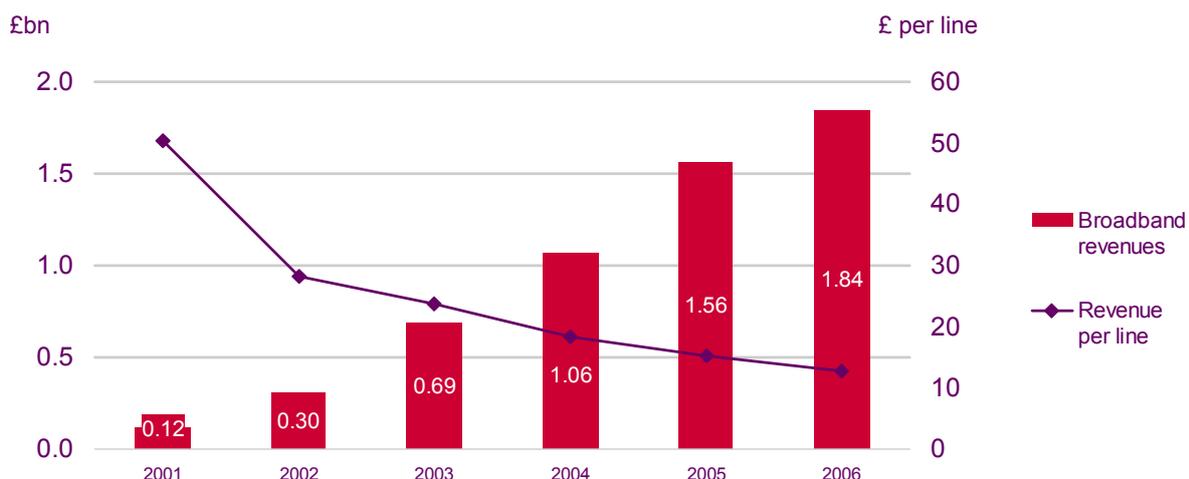
Source: Ofcom/operators

As fixed telephony revenues decline and mobile penetration reaches saturation point, telecoms operators view broadband as vital for sustaining or increasing turnover. However,

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[1] http://www.ofcom.org.uk/research/cm/icmr06/

with penetration growing penetration and sustained competitive pressure on prices, revenue growth rate has slowed over the past 18 months, as shown in Figure 12.

Figure 12:   Retail fixed, mobile and broadband revenue growth, % per year
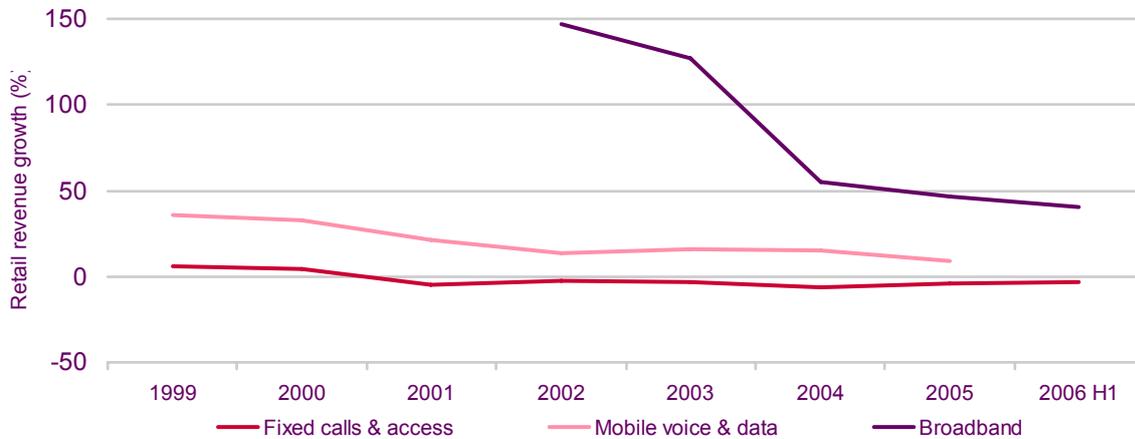
Source: Ofcom

Slowing growth in broadband access revenue raises important questions for telecoms operators seeking additional turnover in the face of continued declines in fixed voice revenues. As broadband access is becoming commoditised, ISPs are increasingly looking for ways to develop supplementary revenue streams, such as content sales and other services offered through ISP portals. In the longer term, ISPs may introduce charging (of either users or content and applications providers) based on quality of broadband service provided.

3. Take-up and use of broadband

3.1. Half of the UK population now have broadband

Broadband availability in the UK is among the highest in the world. In January 2006, BT reported that 99.9% of premises were connected to DSL-enabled exchanges. However, some premises within these exchange areas are not suitable for delivery due to local technicalities such as distance from the exchange or poor quality of networks. BT indicates that, taking these factors into account, its network has 99.6% coverage of DSL broadband at minimum speeds of 512 kbit/s. In addition, 45% of UK homes are passed by cable broadband.

According to Ofcom's research, in Q4 2006, half of all UK adults lived in a home with a broadband internet connection - a seven-fold increase in penetration over five years (Figure 13). Internet penetration as a whole has also grown, albeit at a slower rate: at the end of 2006, 63% of UK adults had an internet connection at home, compared to 57% a year earlier and 45% in 2002. Take-up of PCs and laptops has also increased over the past five years, from 54% of the adult population in 2002 to 69% at the end of 2006.

Figure 13:   Computer, internet and broadband take-up
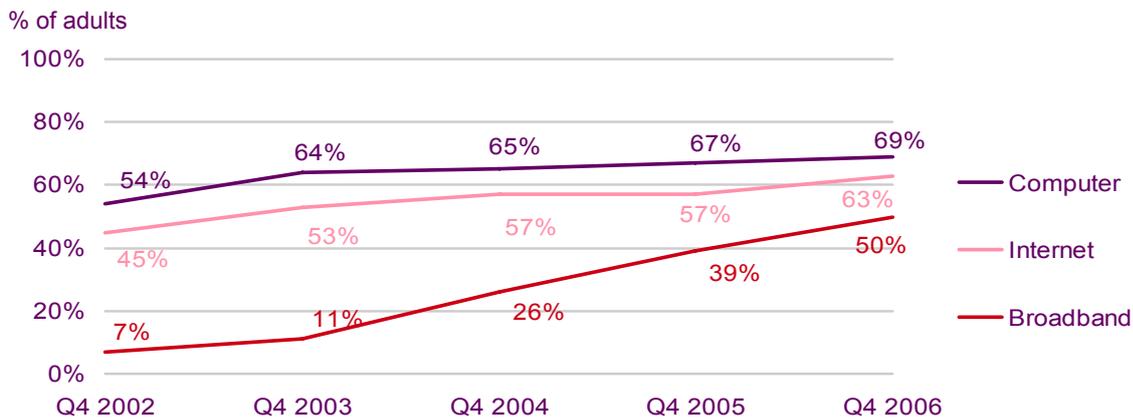
% of adults

Source: Ofcom research

In Q4 2006 around eight in ten adults who had internet access at home connected using broadband, compared to around six in ten a year ago. Unmetered narrowband packages accounted for a further 8%, while metered packages formed around 9% of connections. Around 4% were unsure whether their service was charged on a per-minute basis or whether they paid a flat monthly fee (Figure 14).

Figure 14:   Take-up of broadband and narrowband as share of all connections

% of adults with internet at home

Source: Ofcom research

Growth in broadband connections looks set to continue, according to Ofcom research carried out in Q3 2006. Almost a quarter (23%) of those without internet at home said they were likely to connect in the next year, with 76% saying they would take broadband. Half of all current narrowband users said they were likely to convert to broadband within the next 12 months. These results, however, are to be treated with caution; consumers' stated intentions are only indicative of their actual future behaviour.

3.2.   Penetration higher among younger age groups and ABC1s

Despite rapid growth in broadband penetration, there are differences in uptake by age and socio-economic group. While around six in ten adults under 55 live in a broadband-enabled household, less than a third of those over 55 had broadband in Q4 2006. An even more significant gap exists between ABC1s and C2DEs, with only 36% of C2DE adults connected to broadband at home at the end of 2006, compared to 62% among the ABC1 group.

Figure 15:   Broadband take-up by age and socio-demographic group

% of adults
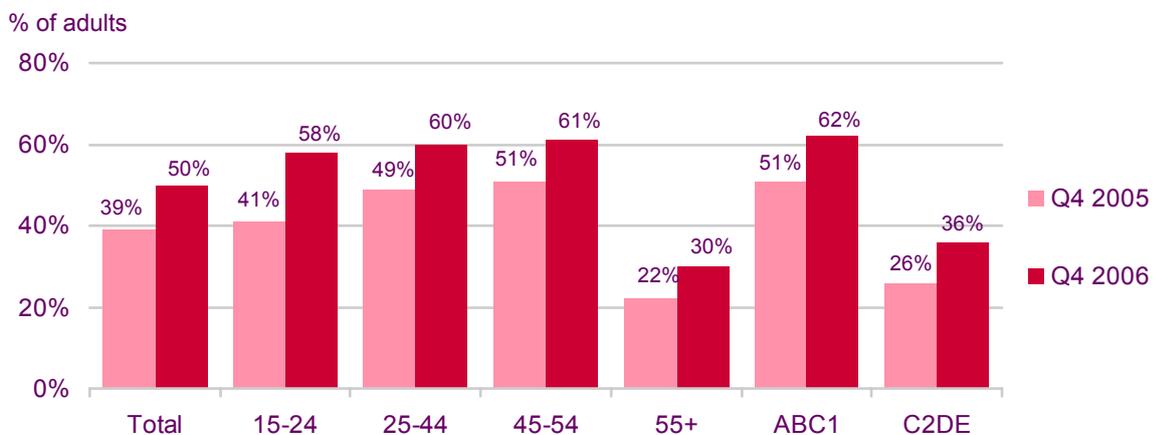
Source: Ofcom research

A more detailed analysis of socio-demographic differences in take-up reveals that those in work are significantly more likely to have broadband at home, at 61%, than those who are not working, at 34%. Take-up also varies significantly by income, with three-quarters of those earning £30k or more a year connected to broadband, compared to only a fifth of those with an annual income of under £11.5k.

The larger the household, the more likely it is to have an internet connection: only a quarter of single-person households have broadband at home, rising to 44% among two-person households and to over 60% for homes with three or more people.

Figure 16:   Broadband take-up by working status, income and household size

% of adults

Source: Ofcom research, Q4 2006

As part of ongoing consumer research, Ofcom tracks reasons why people do not acquire an internet connection at home, or decide not to convert to broadband once connected by dial-up (Figure 17). According to our Q3 2006 survey, 37% were prevented from acquiring internet at home for involuntary reasons, such as cost or lack of technical knowledge. The majority (59%) who chose not to connect cited voluntary reasons, mainly that of a lack of need.

Similarly, the majority of narrowband users, when asked about reasons for not converting to broadband, referred to voluntary reasons (65%). However, nearly one in three (29%) were limited by cost factors. Around one in five narrowband users said they were satisfied with their current connection, and one in ten cited lack of need for faster speeds as their reason not to adopt broadband.

Figure 17:   Reasons for not having internet and broadband at home

Reasons for not having the internet	% of adults without internet
Voluntary reasons (total)	59%
Involuntary reasons (total)	37%
No need	66%
Too expensive to set up	17%
Don't know how to use computers	12%
Charges are too expensive	8%
Computer is too expensive to buy	6%
Not interested	5%
Don't have a phone line	4%
Satisfied using elsewhere	2%
Old age/disabilities	2%
My computer is out of date	1%
Satisfied using at work	1%
Internet safety issues	1%
Other	3%
Don't know	2%

Reasons for not having broadband	% of adults with narrowband
Voluntary reasons (total)	65%
Involuntary reasons (total)	29%
Don't use Internet enough	40%
Too expensive	29%
Satisfied with current connection	21%
Don't need faster speeds	10%
Too much hassle to change	6%
Other	6%
Don't know	4%

Source: Ofcom research, Q3 2006
Note: 'Involuntary total' includes all respondents who mentioned at least one involuntary reason. Involuntary mentions prioritised over voluntary mentions in total count.

3.3.   Broadband users take advantage of a wide array of services

The multi-functional nature of broadband access in the home is illustrated by Figure 18 below. Broadband not only enables email access and general browsing – the two most popular activities – but is also used for a broad variety of information, communication and entertainment-oriented activities. Almost two in three (63%) broadband-enabled adults use it as a source of information; half download music or video content, 40% use instant communication applications and 38% play online games. Broadband is also used functionally: seven in ten adults with broadband at home report having made online purchases and over half have carried out banking transactions.

Given the differences in the amount of time taken to perform various activities via narrowband and broadband connections, it is unsurprising that the use of various services and applications is lower among narrowband users. The gap is especially pronounced for the higher-bandwidth activities of content downloading, communication applications, online gaming and trading websites.

Figure 18: Use of online services and applications

% of adults with internet at home

Source: Ofcom research, Q3 2006

On average, broadband users spent around nine hours a week online, compared to around four hours among narrowband users in 2006, according to our research. The vast majority of broadband users access the internet at least weekly, and 63% go online every day (Figure 19). The data suggest that, for at least a quarter of UK adults, the internet has become an everyday activity and has an ongoing presence in people's overall media and information exposure.

Figure 19: Frequency of using the internet at home and elsewhere

% of adults with internet access at home
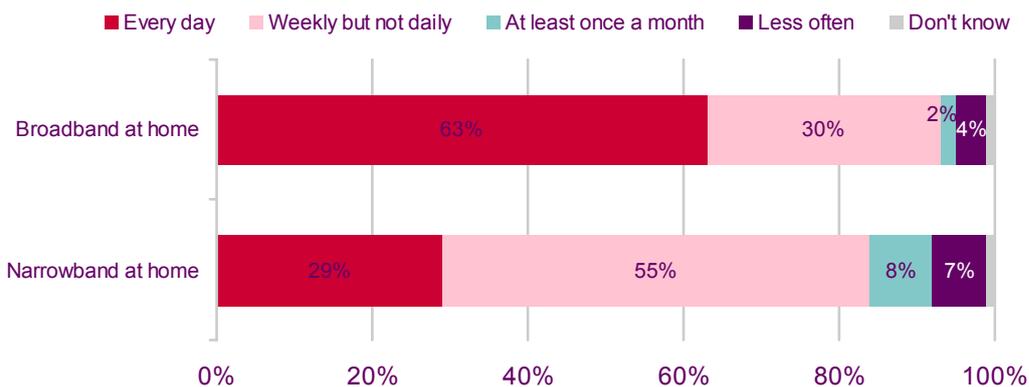
Source: Ofcom research, Q3 2006

The list of most visited websites is another indication of the breadth of internet use by many UK adults - it includes a variety of sites, from search engines to traditional broadcasters to online retailers. According to Nielsen Netratings' January 2007 audience statistics, Google led the pack with 24.6 million unique visitors, followed by MSN with 21.1 million. BBC and Fox Interactive Media were the only two traditional media outlets represented in the list, while YouTube, was also among the top 20. High-street retailers Tesco (5.6m) and Argos (4.6m) both attracted large audiences, but were significantly behind online retailer eBay with 15 million unique visitors.

Figure 20:   Top 20 websites by unique audience

Unique audience (millions)
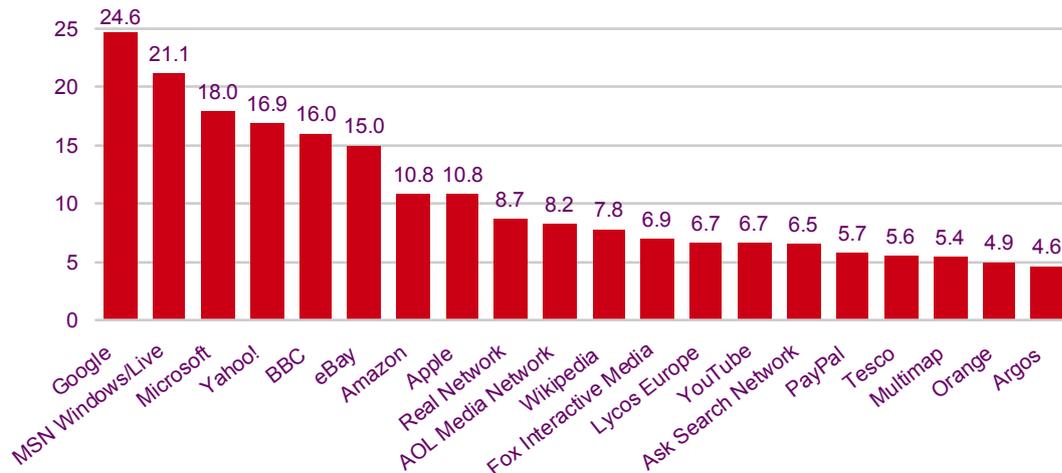
Source: Nielsen//NetRatings, NetView UK, January 2007

Internet use by broadband adopters is increasingly going beyond informational or functional purposes, and entering the social and creative realms. In the past year there has been an explosion in popularity of social networking sites such as Myspace, Bebo and Friends Reunited. Our research at the end of 2006 has shown that 43% of those with broadband had used websites to keep in touch with people, and as many as six in ten 18-24 year olds had done so. Websites for meeting new people were used by 35% of those with broadband (55% among 18-24 year olds).

Internet users also increasingly create and share their own content with others online. Ofcom research conducted in summer 2006 found that 11% internet users owned a blog, with much higher ownership among 18-24 year olds, at 19%.

3.4.   Use and awareness of computer-based VoIP is growing

Consumers are also increasingly using their broadband connections to make calls via the internet, also known as voice over internet protocol (VoIP) calls. VoIP calls to other computers are usually free, while calls to traditional fixed lines (PSTN lines) are available at cheaper rates than if using traditional telephone service.

Our research shows that both awareness and take-up of VoIP services has increased over the past year. At the end of 2006, one in ten UK adults said they were making calls over the internet, double the proportion that said they did this at the end of 2005. Of these, 14% said they did it daily and a further 30% did so several times per week. Both awareness and use of VoIP services is higher among adults with broadband at home: in Q4 2006 nearly eight in ten said they were aware of the possibility to make phone-calls via the PC, up from 68% a year ago. Almost one in five said they currently used it; a five percentage point increase (Figure 21).

However, despite growing take-up, the share of those who actually use computer-based VoIP services is still relatively low given the high awareness levels, suggesting there is some way to go before transforms from a niche service used by of technology-savvy consumers towards a mass-market one. Other products such as ATA devices (which connect traditional phones to the internet) or standalone VoIP phones may be better placed in driving the take-up of VoIP services.

Figure 21:   Awareness and use of VoIP

% of adults with broadband at home
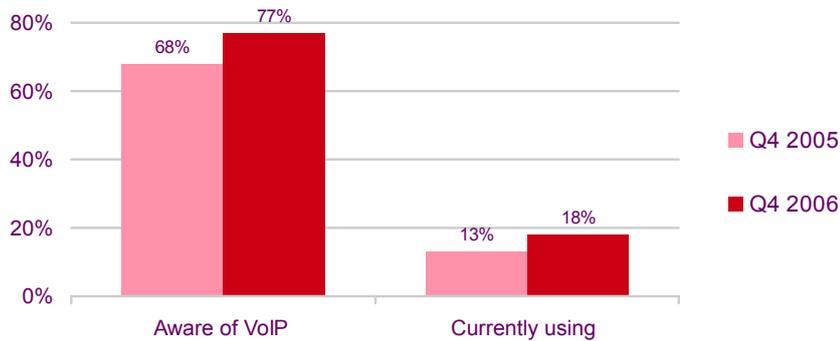
Source: Ofcom research

Note: awareness question: Before now, were you aware that you could make voice calls using the internet? use question: Have you or anyone in your household ever used one of these services to make voice calls using the internet at home?

The majority of computer-based VoIP users make phone calls via the internet at least weekly, according to Ofcom's research carried out in October 2006. Among the 500 VoIP users surveyed, 14% said they used it every day, a further 30% reported using it several times a week while a further 26% said they use it at least weekly.

Figure 22:   Frequency of VoIP usage

How frequently do you or someone in your household make voice calls using the internet?

% of adults who use VoIP services

Source: Ofcom research, October 2006

3.5.   Online content grows in popularity, led by 16-24 year olds

The role of the internet as a content distribution platform has evolved significantly during 2006, with a growing number of services offered and consumed via broadband connections.

According to our research, carried out in February 2007, around half of all adults with broadband at home have used online audio content such as music tracks or podcasts, and short video clips such as news clips or music videos. Over one in five have watched or downloaded longer video content via their broadband connections.

Content uploads are also popular, with 44% of broadband users saying they have uploaded pictures or photos onto a website. Video uploading remains a relatively niche activity, with 15% of broadband users saying they have ever uploaded video material online.

Use of all services was much higher among the 16-24 age group, confirming their position at the forefront of new media adoption. Seven in ten have used online audio, almost two in three have watched and downloaded video clips and 35% have viewed longer video content such as feature films and full television programmes via a broadband connection. The majority of young adults are also contributors of online content, with 65% reporting they have uploaded

pictures or photos and 23% saying they have uploaded video content online. Male users download more than females for all three content types. However, more females than males said they had uploaded pictures online, while uploading of video content was largely similar for both genders.

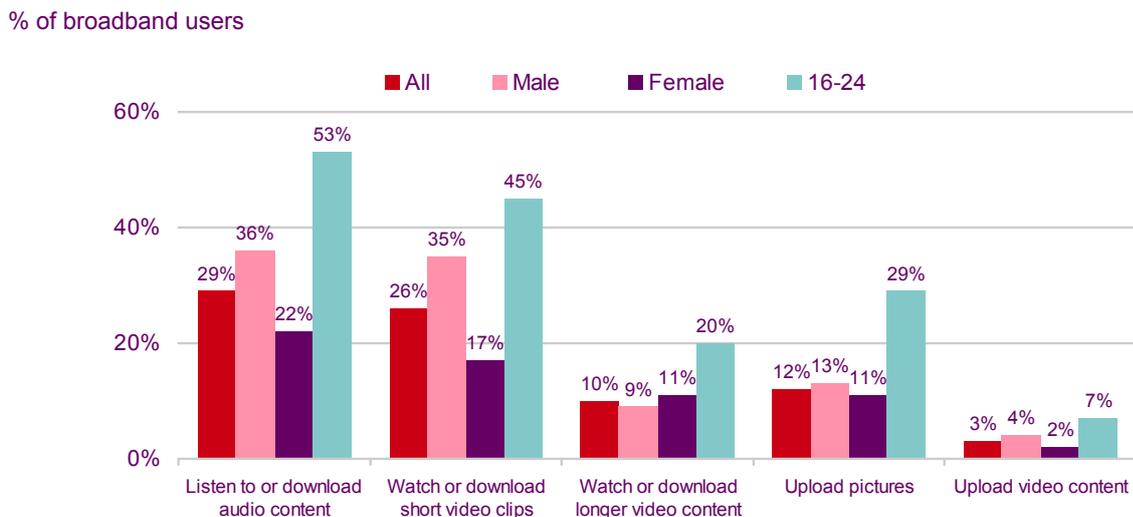**Figure 23:   Use of online content - % ever used**
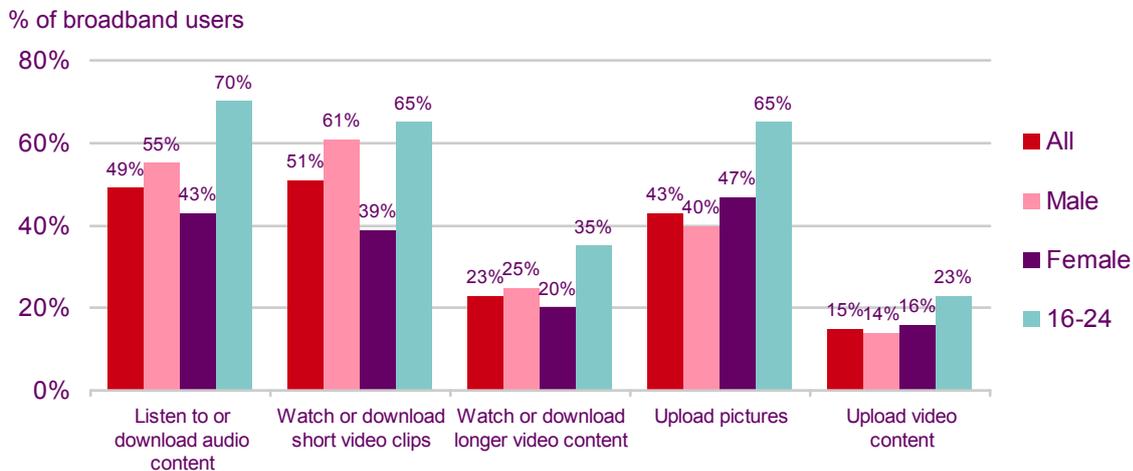
% of broadband users

Source: Ofcom research, February 2007

While many broadband users have at some point tried using different types of online content, weekly use provides a better indicator of take-up levels. Figure 24 below shows that the internet serves as a regular media outlet for a significant minority of broadband-enabled adults, potentially competing for attention with traditional media platforms. Over a quarter listen to online audio and/or watch short video clips and one in ten watch longer content such as feature films weekly.

Regular uploading is higher for pictures than video content currently only done by a fraction of broadband users on a regular basis. However, video uploads have the potential to increase in the future, given the growing popularity of video sharing (e.g. though the YouTube portal) and video blogging (online diaries which are based on videos recorded by their owners), which may lead to higher upload speed requirements in the future.

Figure 24:   Use of online content - % use weekly

% of broadband users
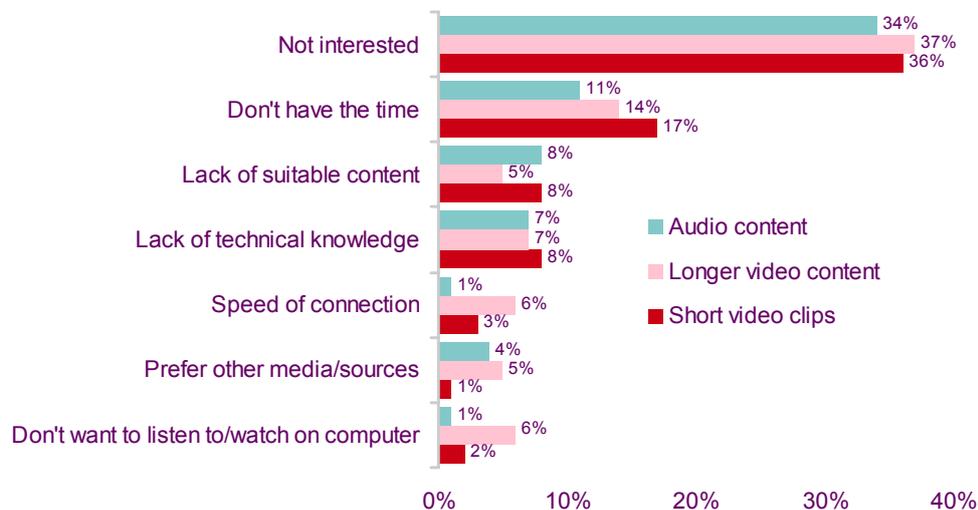

Source: Ofcom research, February 2007

We have also looked at the factors seen as barriers to the use of online content. Figure 25 shows the barriers mentioned by consumers to using online content at all (for those who do

not currently using it) and for using more of it (for those who do). Interestingly, most broadband users mentioned lack of interest in online downloads, rather than any technical or speed limitations. Lack of time was the second highest reason for all three types of downloads. Speed had a slightly higher significance for the use of longer video content such as full TV programmes or feature films. A small minority also said they did not wish to watch longer content on their computer (6%) or that they preferred other media (5%).

It is important to note that these results are based on consumer perceptions – the fact that only very few consumers identify speed or technical limitations as a barrier doesn't necessarily mean these do not limit consumers' experience of online content. Instead, the data suggest that only very few consumers currently feel restricted by specific technical issues, which may be due to their overall lack of interest in watching or listening online, and hence inability to identify specific technical issues which may act as barriers.

Figure 25:   Barriers to downloading online content, February 2006
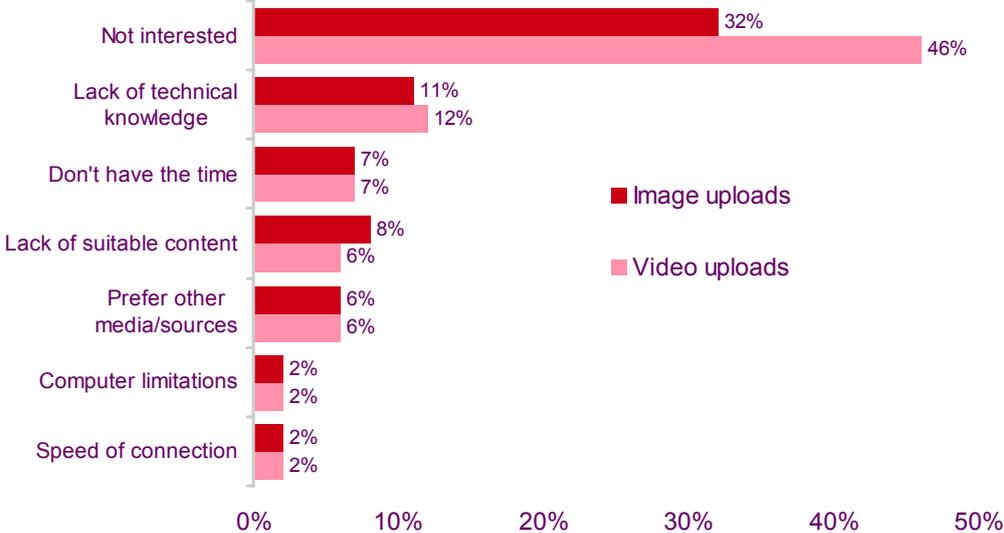
% of adults with broadband at home

Source: Ofcom research, February 2007

Similarly, lack of interest was the most often mentioned factor limiting respondents' use of pictures and video uploads. Interestingly, lack of technical knowledge was cited by more users in relation to content uploads than downloads. Here, again, speed of connections had a rather low score, with only 2% mentioning it as a factor limiting uploads. Again, importantly, these findings show that speed or computer limitations are not identified as such by consumers (rather than non-existent), indicating that lack of interest is a more important barrier to mass take-up of regular content downloads.

Figure 26: **Barriers to uploading online content**

% of adults with broadband at home

Barrier	Image uploads	Video uploads
Not interested	32%	46%
Lack of technical knowledge	11%	12%
Don't have the time	7%	7%
Lack of suitable content	8%	6%
Prefer other media/sources	6%	6%
Computer limitations	2%	2%
Speed of connection	2%	2%

■ Image uploads

■ Video uploads

Source: Ofcom research, February 2007

4. Residential speeds

What is 'broadband' speed?

The term 'broadband' is nebulous; it refers to always-on internet connectivity at speeds higher than narrowband's 56kbit/s - although very few providers offer headline speeds below 512kbit/s today. However, connection speeds are a significant factor, particularly when users are accessing rich content such as video, audio or any files with large amounts of data. This issue may become even more important with the growth of streaming video over broadband: while users with, for example, 512kbit/s broadband connections might still be able to download a music track, albeit more slowly than users with 8Mbit/s connectivity, they would have a poorer experience when trying to access streamed content such as TV over broadband.

The continuing growth of bandwidth-rich content, together with technology advances and growing competition among ISPs, has contributed to a greater focus on broadband speed by ISPs and consumers. UK broadband service providers aimed much of their marketing effort during 2006 at publicising the benefits of higher-speed connection; some, like Be Unlimited, made high-speed access their core proposition.

4.1. Residential broadband headline speeds increase significantly

During 2006 average broadband connection speeds to UK residential customers increased significantly (Figure 27). There was particularly strong growth in connections at 'up to 8Mbit/s' – from virtually none in December 2005 to an estimated 4 million by the end of 2006. Nearly a third (31%) of all connections as of December 2006 were at headline speeds of over 2Mbit/s, compared to only 2% a year earlier. Of the remaining connections, 47% were of up to 2Mbit/s, and 21% were 1Mbit/s or less. It must be noted that the increases in average headline connection speeds are not necessarily a result of consumers signing up for higher-speed packages as several major ISPs have been upgrading their customer connections to higher speeds at no additional charge.

Figure 27:   Broadband lines by headline download speed

Millions of lines
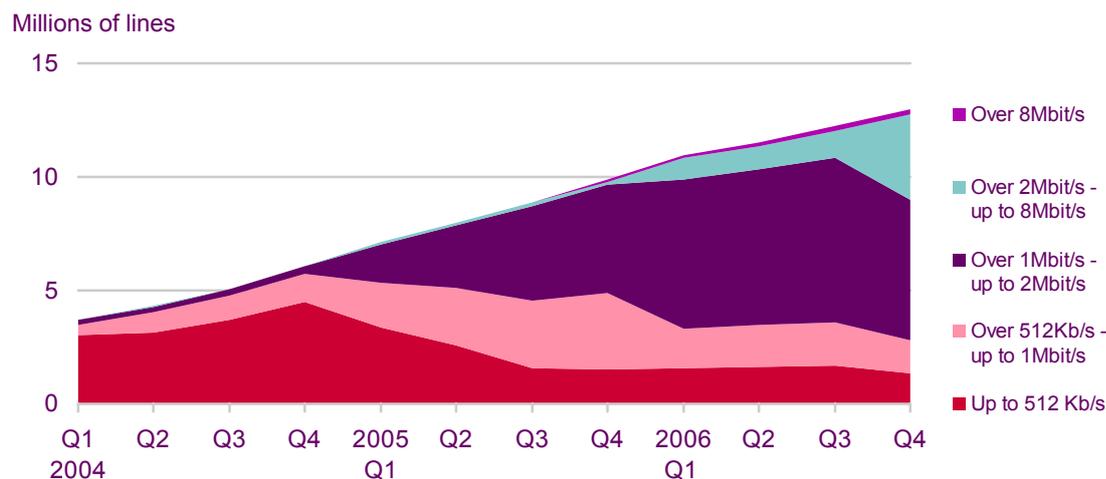
Source: Ofcom

Why 'up to' xMbit/s?

By the end of 2006, virtually all ADSL internet service providers in the UK offered their broadband service as 'up to' the specified headline speed e.g. 'up to 8 Mbit/s'. This is because headlines speeds are the theoretical maximum limit of what is achievable in the best case scenario using the DSL equipment installed at the exchange and the customer premises.

However, a number of factors, such as the quality and length of the physical line from the exchange to the customer, mean that the headline speeds may not be experienced in practice. ADSL service providers therefore cannot guarantee the specified 'up to xMbit/s headline speed for any particular customer. New customers ordering ADSL broadband service can get an estimate of achievable speeds in their postal code area via several online services.

DSL technologies

Digital Subscriber Line is family of technologies generally referred to as DSL, or xDSL, capable of transforming ordinary phone lines (also known as 'twisted copper pairs') into high-speed digital lines to support advanced services such as fast Internet access and video-on-demand. ADSL (Asymmetric DSL), HDSL (High data rate Digital Subscriber Line) and VDSL (Very high data rate Digital Subscriber Line) are all variants of xDSL.

ADSL, by definition, allows for higher download transfer speeds than upload speeds. ADSL1 is the first generation of ADSL, capable of data speeds of up to 8Mbit/s towards the customer and up to 640kbit/s from the customer. ADSL2/ADSL2+ are improved versions of ADSL, offering high speeds, especially on shorter telephone lines.

The proliferation of 'up to 8Mbit/s' broadband products highlights the current constraints on the legacy telephone access network using ADSL technology. The two major factors that affect the maximum speed achievable by any given premises using DSL technology are:

- the distance from local exchange; and
- the quality of the physical line running from the exchange to the customer's premises.

Figure 28 shows the maximum theoretical speeds obtainable by ADSL1 and ADSL2+ connections in relation to the length of the copper cable going from the exchange to the customer's premises. It shows that, using ADSL1 technology, maximum speed starts to diminish from a top rate of 8Mbit/s at a distance of about 1.5km from the exchange; this means that only 4Mbit/s is achievable at 4km, and less than 2Mbit/s at 5km.

Interestingly, while greater speeds (up to 24Mbit/s) are currently achievable using ADSL2+ technology to premises that are within around 500m of an exchange, line length has a much more detrimental effect on the speeds offered by ADSL2+: customers more than 3km away from the local exchange will not be able to obtain speeds significantly higher than those using an ADSL1 service.

**Figure 28:   Maximum achievable DSL speeds by distance from exchange**
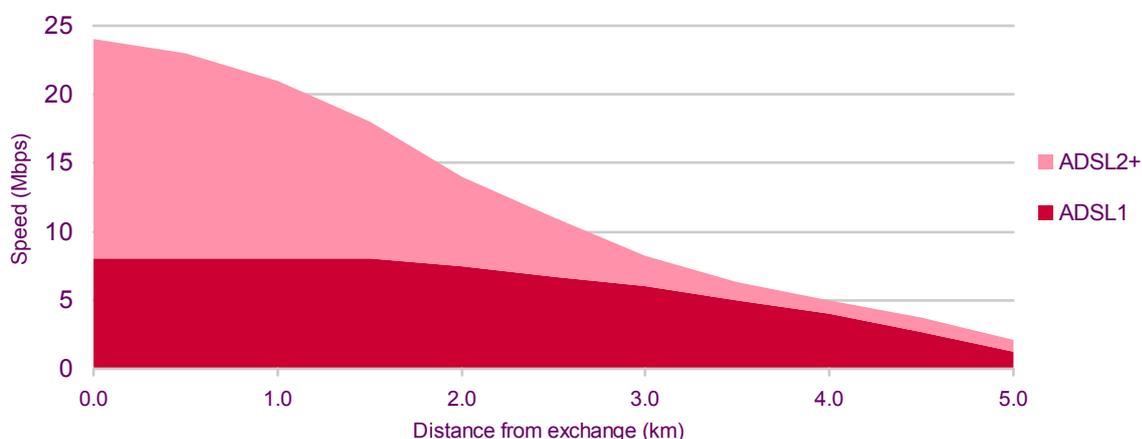
Source: TPG
Note: Distances in the above chart are straight-line distances

BT estimates that 93% and 78% of its exchange lines can support broadband download speeds of 2Mbit/s and 4Mbit/s respectively, but currently only 42% can receive speed of 6Mbit/s and above (Figure 29).

Cable access networks do not suffer from speeds reductions as the distance from the exchange increases, as a result of their differing architecture and physical properties of cable network infrastructure compared to DSL. However, download speeds on cable network do vary depending on the number of customers simultaneously using the final shared segment of the cable network. At the time of writing, the highest headline speeds for residential consumers offered by Virgin Media was 10 Mbit/s – lower than the highest DSL headline speeds, but above the majority of DSL offers. Virgin Media has announced plans to offer a 20Mbit/s headline speed in summer 2007, and is also trialling a 50 Mbit/s service.

Figure 29:   BT lines by ability to support specific download speeds
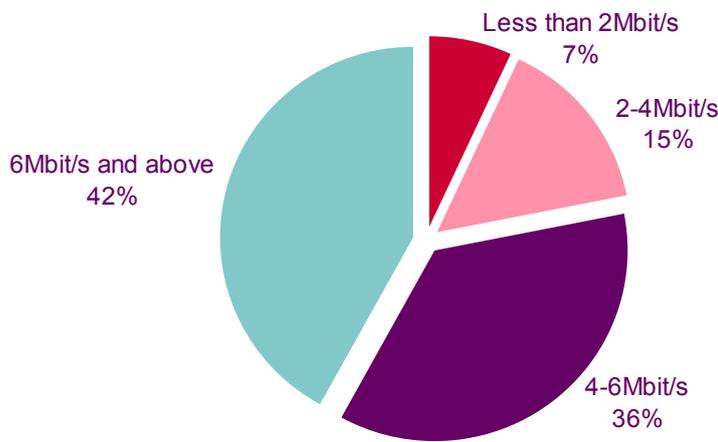
Source: BT

Why don't consumers often experience the speeds they thought they paid for?
When consumers buy broadband connections, they are usually advised of the theoretical maximum download speed that their broadband service will support. For example, a residential customer might buy an 'up to 8Mbit/s' product, but the actual broadband connection speed achieved on their line may be less due to its physical limitations, for example, 6Mbit/s. Even so, this customer will not always actually achieve data download speed of 6Mbit/s, and occasionally data transfer could slow down or even stop.

The reasons for this speed disparity are many and complex. Usually, they are due to a bottleneck somewhere in the wider network. Very often they are due either to problems with the host server (i.e. the place from which the user is trying to access content) having unusually high demand (for example, access to the BBC news website might slow down if a major news event took place). Occasionally there are problems in international connectivity, or at major internet gateways, and the ISPs themselves may sometimes experience technical problems either at their main hubs or at local exchanges, or congestion due to the effects of the contention ratio.

For all these reasons, consumers in the UK often find that access to the internet, particularly to US-based sites, is faster before around 2pm: this equates to 9am in the USA and is the time that traffic flow over the internet starts to rise as heavy US use builds.

A study carried out by thinkbroadband.com in February 2007 measured actual download speeds achieved by over 300,000 broadband users, using software installed on the users' home computers. It found that average download speeds across its whole sample size were around 2Mbit/s. Since the UK average headline connection speed is around 3.8Mbit/s, this suggests that consumers might on average be experiencing real-world download speeds around half that of their theoretical maximum achievable speeds.

How does speed affect the broadband experience?

As an illustration of the impact of download speed on the user experience, Figure 30 below shows the estimated time it takes to perform various online activities using dial-up internet and broadband connections of various theoretical maximum speeds. The analysis suggests that via a dial-up connection it takes prohibitively long to download anything more than a single music track, especially given dial-up's greater tendency to drop the connection (which often means the download has to be re-started).

Figure 30:   Theoretical time taken to perform online activities

	Headline connection speed				
	56kbit/s	**512kbit/s**	**2Mbit/s**	**8Mbit/s**	**24Mbit/s**
Download graphical webpage (250kB)	36 seconds	4 seconds	1 second	0.3 seconds	0.1 seconds
Download 5MB music track	12 minutes	1 minute 18 seconds	20 seconds	5 seconds	2 seconds
Download 25MB video clip	1 hour	6 minutes 31 seconds	1 minute 40 seconds	25 seconds	8 seconds
Download low quality movie (750MB)	29+ hours	3 hours 15 minutes	50 minutes	12 minutes 30 seconds	4 minutes 10 seconds
Download DVD-quality movie (4GB)	6+ days	17 hours 22 minutes	4 hours 27 minutes	67 minutes	22 minutes

Source: Ofcom

Figure 31 below shows the broadband speeds required to carry out a selection of online activities that are 'real-time' in nature. Connection speeds are more critical for such applications, as their continuous streaming nature requires consistency of download speed. Some applications, such as VoIP and gaming, are sensitive to other parameters of the broadband service as well as speed, such as latency (or time lag). The table shows that relatively low bandwidths (less than 256kbit/s) will support those services that do not require video transfer; however, IPTV services, especially those in high definition formats, which require increasingly high connection speeds. The introduction of MPEG4 compression has significantly lowered the downstream speed requirements of streaming TV, as the table shows; further advances in compression technology may reduce bandwidth requirements further over the coming few years.

Figure 31:   Estimated bandwidth requirements per application

Application	Downstream	Upstream
VoIP	80kbps	80kbps
Video telephony	124kbps to 2Mbps	256kbps to 2Mbps
Online gaming	256kbps	256kbps
Standard definition TV channel (MPEG2)	3 - 5Mbps	Signalling only
Standard definition TV channel (MPEG4)	1.5 - 3Mbps	Signalling only
High definition TV channel (MPEG2)	18 – 20Mbps	Signalling only
High definition TV channel (MPEG4)	6-10 Mbps	Signalling only

Source: Ovum

**Potential impact of contention ratios and usage caps**

There are two factors that may become increasingly relevant as average connection speeds increase and as users download (and upload) more and more content:

- **Contention ratio** is an indication of the number of customers who share the capacity available in an ISP's broadband network. The points in the network at which this capacity sharing occurs varies depending on broadband technology (ADSL, cable modem, wireless) and the design of the operator's central network. Some operators don't quote a specific figure for contention; for those that do, around 50:1 for residential and 20:1 for business services are typical. In theory, this means that a given residential customer's broadband connection speed might be reduced to a 50th of its usual figure, if all the ISP's customers tried to use the service at its maximum speed, all at the same time. In practice, however, this situation rarely, if ever, occurs currently since most broadband users, even when they are online, only access content or data in short bursts. This situation may change if large number of users were, for example, simultaneously accessing IPTV services. Historically, ISPs and network operators have effectively managed bandwidth supply as demand has increased, although this may become more difficult if a majority of customers adopt these new services.

- **Usage caps** are the monthly limits on the amount of data which broadband users can download and are set by ISPs, often with users being able to increase their usage cap by upgrading their broadband tariff. Typically, usage caps range from 2GB to 40GB and although lower download limits are likely to be sufficient for most casual surfers and downloaders, heavier users or those who access IPTV will need a higher cap. 40GB, for example, is equivalent to only around 30 hours of standard definition IPTV per month. Note, however, that many DSL services and all cable connections are not currently restricted by usage caps.

4.2. Half of residential users don't know their connection speed

Despite the increasing take-up of higher-speed connections, a large number of consumers remain unaware of their headline speeds. Almost half of respondents to our survey commissioned for this report said they did not know what their broadband connection speed was (Figure 32). Our earlier data show that this percentage has stayed largely unchanged for the past two years, despite the prominence of high-speed offers in the market.

Figure 32:   Awareness of connection speed, February 2007
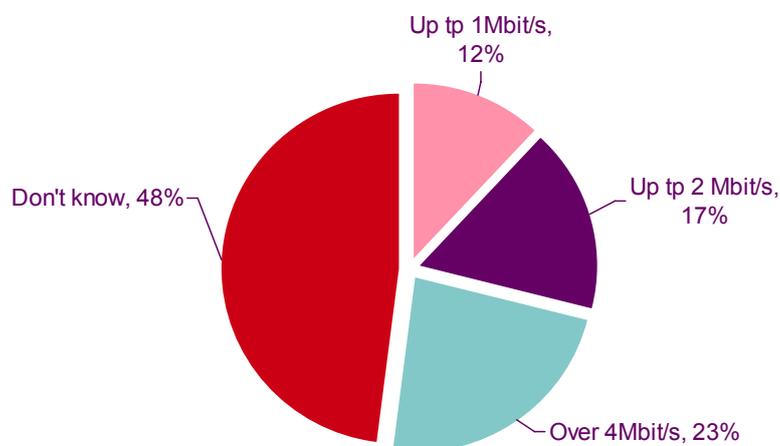
Source: Ofcom research

Our survey also showed that, as expected, users with higher connection speeds tended to use bandwidth-rich content and applications more than those with lower connection speeds (Figure 33) Interestingly, those who reported that they did not know their connection speed (48% of respondents) generally also reported lower use of these types of content.

Figure 33:   Use of online content by claimed broadband speed

% of adults with broadband at home
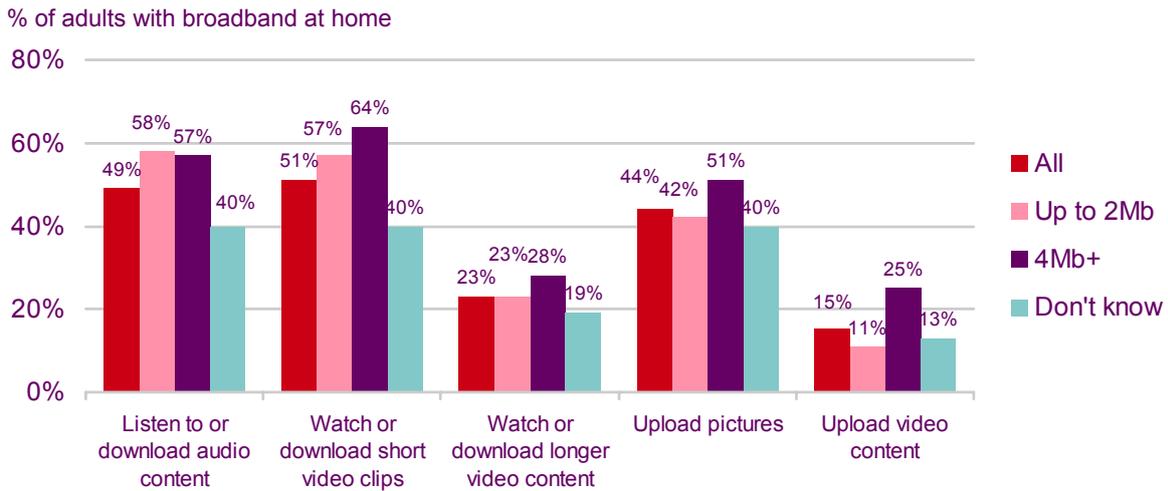
Source: Ofcom research

Ofcom's research suggests that there is high consumer satisfaction with the speed of UK residential broadband services despite the fact that almost half of respondents were unable to name their connection speed. In Q3 2006, 86% of residential broadband users said they were satisfied with the speed of their connection (within this number, 37% said they were very satisfied, and 49% were fairly satisfied). Separate research conducted by ICM for Ofcom in June 2006 showed that 77% of consumers thought that their broadband was uncapped; however, it is likely that for many of these respondents their service was capped and that they were unaware of the cap simply because they had never reached their download limit.

4.3.   Few users are responsible for most downloading

Figure 34 below is based on figures supplied to Ofcom by ISP PlusNet, showing that the top 10% of users download almost twice as much content per month as the other 90% put together (40.7GB compared with 21.2GB). It is important to note that there will be variations in usage across ISPs due to their targeting of customers with differing user profiles, and the figures exclude those users who PlusNet deem to have fallen foul of its 'fair and reasonable use' policy. However, the data are useful in that they show that even a 2GB usage cap would not currently appear to be an issue for most subscribers, but that a reasonable minority would even today lie outside most current usage cap boundaries.

Figure 34:   Average monthly download volumes per broadband connection by decile
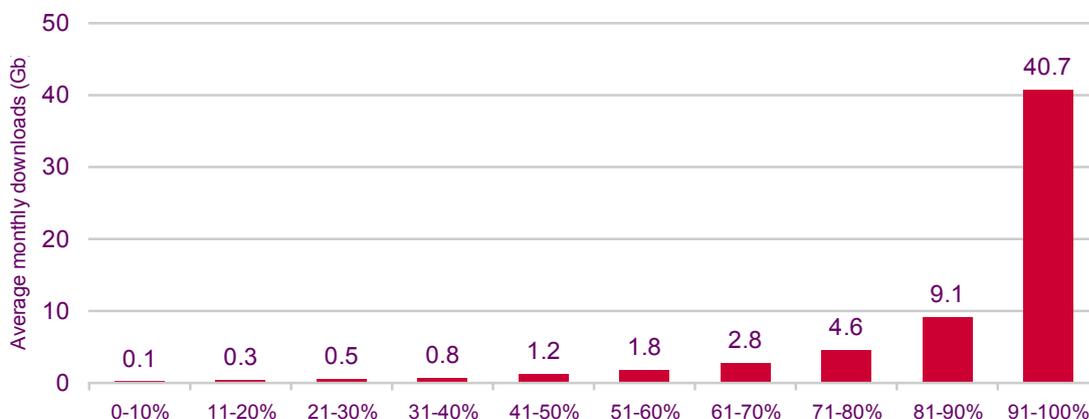
Source: PlusNet

Services such as IPTV would have a significant effect on usage, as they involve streaming of video – typically at least 2Mbit/s for a standard definition transmission and 8Mbit/s for high

definition. These volumes would mean that many broadband users would exceed their usage caps by a significant margin if they started to use IPTV. Currently this would mean being either forced to change tariff by their ISP or having the service limited; even 'unlimited download' broadband customers might in future encounter problems as a number of ISPs could limit a user's downstream speed once a certain threshold had been reached.

5. Bundling and switching

5.1.   One in five consumers take broadband as part of a bundle

The importance of service bundling as a factor affecting broadband market development has increased dramatically over the past year, with a proliferation of bundled offers on the market and increasing consumer take-up of these offers. Broadband has become a core element of bundled offerings, fuelling the move towards convergence, encouraging traditional fixed-line providers to add other services such as mobile and television to their portfolios while companies in other sectors are moving into broadband provision.

Broadband bundling is not new in the UK - cable operators pioneered broadband bundles in the early 2000s, when they started offering the service in addition to long-established fixed-line and TV services over their networks. DSL operators followed suit after the introduction of commercially-viable wholesale line rental (WLR) by BT, which made it feasible for other companies to re-sell voice and broadband services and combine these with other products.

Today, a number of major players in the UK market offer broadband as part of double, triple, and, since 2006, quad-play packages including broadband, fixed-line, television and mobile services (Figure 35).

Figure 35:   Bundled products offered by major service providers, March 2007

| Services offered	AOL	Be	BT	Orange	Pipex	Plusnet	Sky	TalkTalk	Tesco	Tiscali	Toucan	Virgin Media	Vodafone
Broadband and fixed, bundled or standalone	√	√	√	√	√	√	√*	√	√	√	√	√	√
Broadband and mobile			√	√				√	√		√	√	√
Broadband, fixed and TV			√				√*			√		√	
Broadband, fixed and mobile			√					√	√		√	√	√
Broadband, TV and mobile			√									√	
Broadband, fixed, TV and mobile			√									√	

It is a requirement to have a fixed line
Source: Pure Pricing UK Broadband, Bundling and Convergence Update, March 2007
Note: only consumer broadband services of 1Mbit/s and more and only digital TV packages are included;
international call packages are not included; note that the bundled products do not necessarily generate a discount

Most bundled offerings aim to attract consumers by offering a bundle of services cheaper than if bought individually. However, pricing strategies differ between players, with some offering broadband as the free or discounted bundle component, while others offer broadband at full price but include cheaper TV, free landline calls or discounted mobile services.

The benefits of lower cost, single billing and one-point customer service are proving attractive to consumers. According to our research, 37% of UK homes took more than one service from the same provider at the end of 2006, while over one in five (22%) combined broadband with other services. The landline and broadband combination was by far the most common type of broadband bundle, with 16% share of households, while triple-play packages comprising landline, broadband and multichannel TV accounted for a further 6% (Figure 36). Given that around half of UK homes now have broadband, this data suggest that over 40% of residential broadband subscriptions come alongside another service from the same provider; around 32% combined broadband with landline and around 12% combined it with landline and TV.

**Figure 36:   Proportion of households taking services from the same provider**

% households
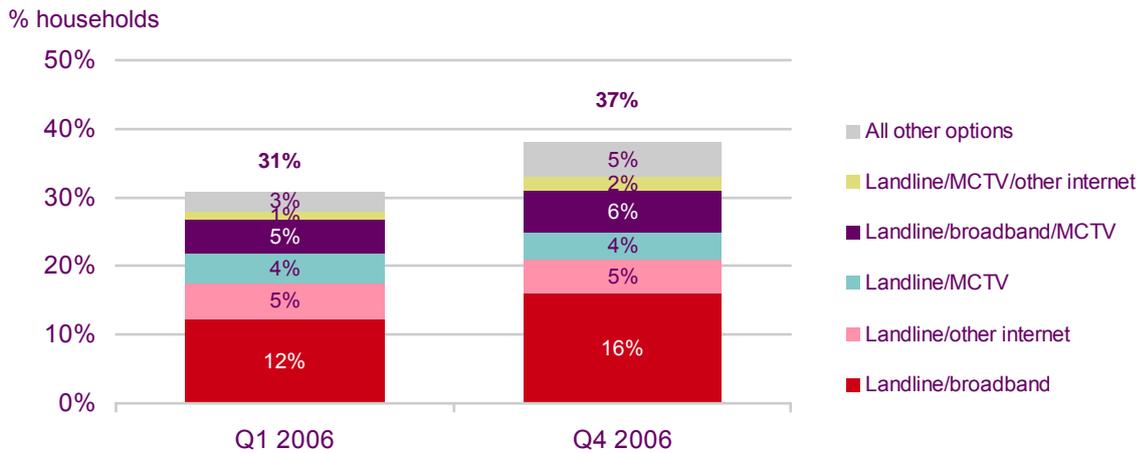
Source: Ofcom research
Note: Other internet includes dial-up access, ISDN and other non-broadband access

Figure 37 below shows the demographic breakdown of adults subscribing to television, broadband and landline from the same provider. It shows that triple-play bundlers are most likely to be between 25-44 years old and belong to the ABC1 group; the split between those with or without children is nearly equal.

Figure 37:   Socio-demographic split of triple-play bundlers, Q4 2006

% adults taking broadband, landline and TV services from the same provider
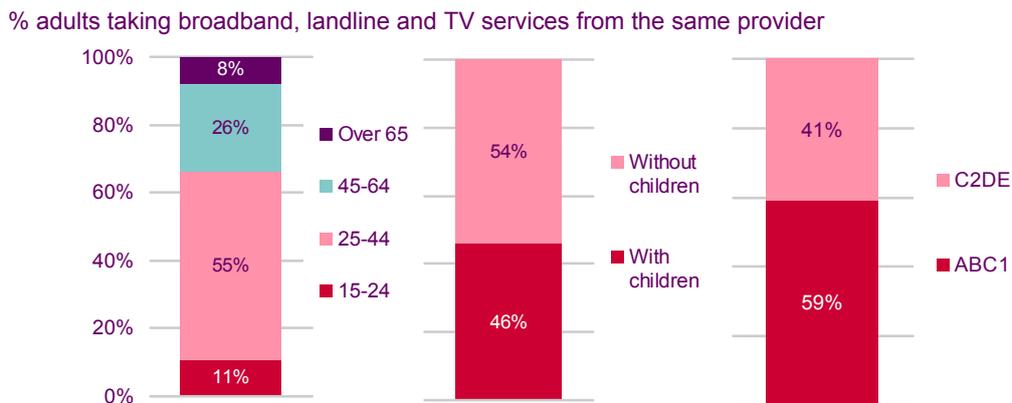
Source: Ofcom research

5.2.   Bundled services are an important factor when choosing an ISP

Our research commissioned for this report suggests that the availability of bundled services is an important factor for consumers when deciding which provider to choose. When asked about how they chose their current ISP, 17% of broadband users said it came as part of a bundle – second only to price, mentioned by 24% of respondents.

Figure 38: Factors influencing ISP choice - unprompted

Thinking back to when you chose your current internet supplier at home, how did you decide which ISP to use?

% adults with broadband at home

Price	24%
Acquired as part of bundle	17%
Worth of mouth/recommendation	14%
Already with that provider for phone	13%
Connection speed	9%
Reputation	5%
Customer service	5%
Reliability of connection	4%
Saw the advert	3%
Good offer	3%
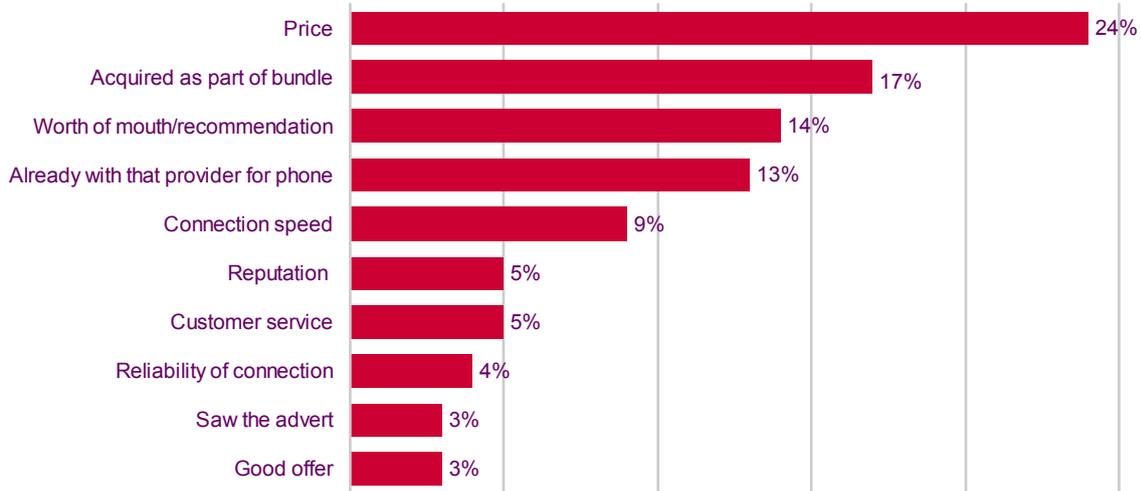
Source: Ofcom research, February 2007

When asked to choose from four factors - price, speed, bundling and customer service – bundling (27%) came out as important as price (27%) and speed (29%), while customer service had the lowest rating, at 10%.

Figure 39: Factors influencing ISP choice - prompted

Which one, if any, of these factors was most important overall?

% adults with broadband at home
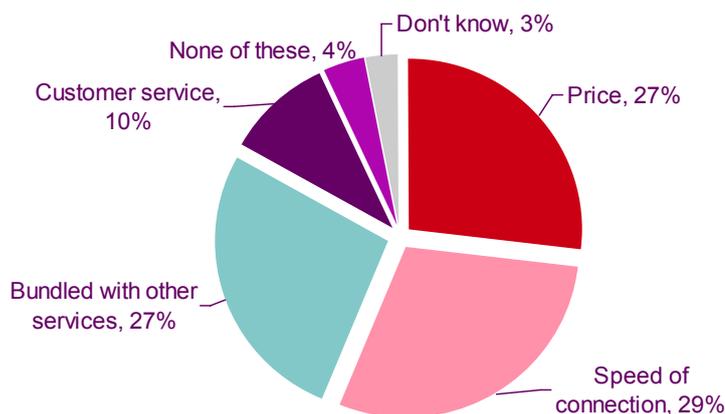
Source: Ofcom research

5.3. 30% of broadband users have switched ISP

Over a quarter (27%) of residential internet users surveyed in Q3 2006 said they had changed service provider – a slight increase compared to Q3 2005 when 25% said they had ever switched, with 11% saying they had switched in the past year. Among those with broadband at home 30% say they have changed supplier, and almost half did so over the past year - significantly above the switching levels among narrowband users. This is unsurprising; as the price of entry-level broadband is now close to that of flat-rate narrowband packages,

narrowband users are more likely to convert to broadband when changing provider, rather than look for alternative narrowband suppliers.

Figure 40:   Switching of internet service providers, Q3 2006

Apart from when you moved house, have you/your household ever changed your home internet service provider?

% of adults with internet at home
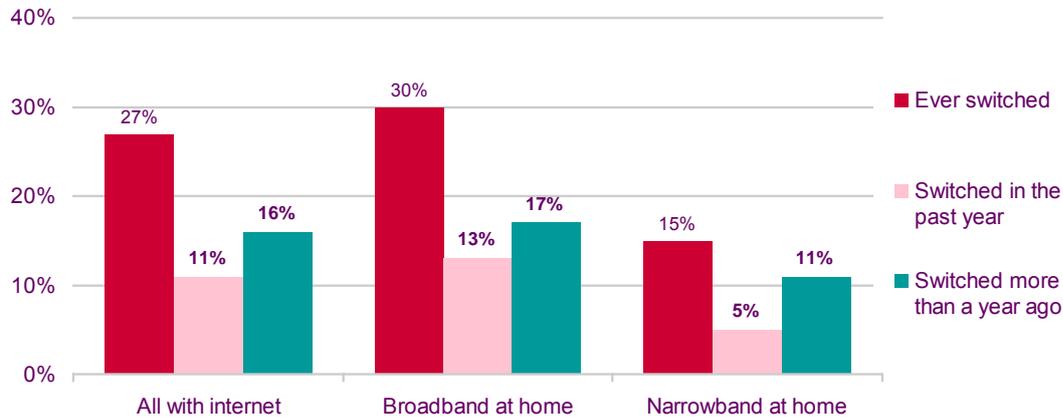
Source: Ofcom research

While switching behaviour is an important indicator of consumer participation in the internet services market, it is only part of the overall picture. Ofcom's in-depth study of consumer decision making, published in November 2006, found that non-switching does not necessarily indicate lack of participation, for example:

- consumers may decide not to switch their current service after shopping around and considering alternatives; and

- consumers may decide to change service with their current provider, e.g. by selecting a higher-speed package or negotiating a better deal for their existing package.

The fact that consumers are researching the market is more important than their ultimate decision whether or not to switch. The study found that while most consumers in the internet market had not switched ISP, only around a quarter (23%) were truly inactive, with the rest having done some kind of shopping around for alternative providers or packages.

Figure 41 lists the barriers to shopping around or switching ISP perceived by consumers. The possibility of getting locked into a contract with a new supplier was the factor mentioned by the majority of consumers (68%), followed by reluctance to leave a trusted provider. Many consumers also thought that switching would bring only short-term benefits because different ISP packages tend to offer similar benefits.

Figure 41:   The perceived barriers to shopping and/or switching suppliers

% of adults with internet at home

Barrier	Agree	Strongly agree	Total
Don't want to get locked into contract with new ISP	51%	17%	68%
Reluctant to leave provider I trust for one I don't know	49%	14%	63%
Only gives short-term gain, providers follow each other	47%	9%	56%
Big risk that something will go wrong in transition	39%	8%	47%
Strong sence of loyalty towards current ISP	35%	12%	47%
Shopping for new ISP too much of a hassle/chore	38%	8%	46%
Difficult to make comparisons b/w ISPs	39%	5%	44%
Don't have time to research options	30%	10%	40%
Don't want to lose current deal/package	29%	5%	34%
Don't know enough to make right choice	27%	5%	32%
Bound to feel stupid/put-of-date when I talk to staff	26%	6%	32%
Don't know where to find trusted into about options	21%	4%	25%

Source: Ofcom research, April 2006

5.4.   The majority think it would be easy to switch

Our latest research shows that the majority (69%) of internet users think it would be easy or fairly easy to switch ISP, with a further 17% perceiving it as a difficult process, while 15% have no opinion. The share of those who think switching ISP is easy is higher among those who have switched in the past, at 76%; of these, however, a higher share also say it was difficult or fairly difficult.

Figure 42:   Perception of difficulty of switching ISP, Q3 2006

How easy or difficult do you think it would be/was to change your home internet service provider?
% of adults with internet at home

	Very easy or fairly easy	Very difficult or fairly difficult	Don't know
All with internet at home	69%	17%	15%
All who have switched provider	76%	20%	5%

Source: Ofcom research

To help overcome the difficulties faced by a significant minority of consumers when changing broadband providers, Ofcom introduced new rules for broadband migrations in December 2006, which came into force on 14 February 2007. Among other things, the rules set out a requirement for all ISPs to comply with the Migration Authorisation Code (MAC) process and supply MACs on request to consumers changing provider.

MACs are numeric identifiers which enable the new broadband provider to identify the line used by the subscriber. This makes the process of switching the line quick and easy, without consumers having to wait for the line to be 'cleared' by the provider they wish to leave. While

the MAC process was used by some broadband providers on a voluntary basis in the past, the new rules require all ISPs to follow the MAC process for all migrations processes to which it applies, and to supply a MAC free of charge within five working days.

6. Wireless internet

A number of technologies enable wireless internet access, either at a fixed connection point in the home or office as an alternative to a conventional cable or DSL connection, or away from home or 'on the move'. Figure 43 below lists the technologies used in the UK, the compatible devices, and their deployment status.

Figure 43: **Wireless broadband technologies**

Technology	Services	Primary spectrum	Mobile or wireless access network	Devices	Current status
W-CDMA	Voice and data delivery	2.1 GHz	Mobile	Handset, datacard	Wide commercial deployment
HS(D)PA	Data delivery	2.1 GHz	Mobile	Handset, datacard	In deployment or service by all UK mobile network operators
TD-CDMA	Data delivery	1.9 GHz, 3.4 GHz	Mobile, fixed	Handset, modem, datacard	Fixed deployment by UK Broadband's 'Now' service at 3.4GHz in the UK
Wifi	Data delivery	2.4 GHz	Fixed, nomadic	Handset, datacard	Wide commercial deployment
Fixed wimax	Data delivery, Backhaul	3.4 GHz	Fixed	Roof mounted, modem	Trials launched. Small scale deployments in Milton Keynes, the Midlands and Isle of WIght

Source: Informa

At present, the most commonly used wireless broadband technology in the UK is WCDMA – a 3rd generation (3G) mobile technology, which can carry data as well as voice and provides internet access of up to 384kbit/s. Operators in the UK are starting to upgrade their networks to offer a high performance variant of WCDMA, called HSDPA, which offers average achievable download speeds of around 1-1.5Mbit/s today, with a theoretical peak of 14Mbit/s in the future.

WiFi was designed to offer a wireless alternative to the local area networks (LANs) used to connect computers together in an office. Today, it is often used in commercial or public areas such as cafés, airports and offices to provide 'hotspots' where people can access the internet from their laptop or compatible mobile device. Municipal WiFi areas exist where these hotspots overlap to provide greater coverage over an urban district.

WiMAX is designed to provide access over larger areas than WiFi; its coverage area is often called a Metropolitan Area Network (MAN). It is applicable to both fixed services, where the customer equipment is permanently mounted in or on a building such as an office or house, and mobile applications, for example to datacards or handsets. Unlike WiFi though, there are currently no mobile phones which are compatible with WiMAX.

6.1. Of the 31% adults with internet-enabled mobiles, half use them to go online

The first commercial 3G service in the UK was launched by new entrant 3 in early 2003; by 2005 all mobile operators offered the service. By Q3 2006, approximately 10% of all mobile subscriptions were 3G. 3 UK had the highest number, at 3.8 million, followed by Vodafone with 1.3m and O2 with 0.8m (Figure 44).

Figure 44:   3G deployments by operator

Operator	W-CDMA start date	W-CDMA subs: Q3 2006	W-CDMA subs: annual growth to Q3 2006	W-CDMA subs: % of total Q3 2006	HSDPA status
3	Q1 2003	3,799,400	15%	100%	In service
O2	Q1 2005	830,000	3220%	4.5%	In deployment
Orange	Q4 2004	690,000	337%	4.8%	In deployment
T-Mobile	Q4 2005	250,000	N/A (0 in Q3 2005)	1.5%	In service
Vodafone	Q4 2004	1,348,000	208%	9.5%	Data cards only

Source: Informa

From a consumer perspective, however, the difference between 3G (WCDMA and HSDPA) and 2.5G (GPRS) technologies might not be immediately obvious – our earlier research indicated that only around a third of consumers are aware of the term '3G'. Many of the same services can be accessed over GPRS networks with GPRS-enabled phones. Therefore, when surveying the use of mobile internet by consumers, we have looked at all internet use via mobile devices, rather than splitting out separate technologies.

According to our research, in February 2007 almost a third (31%) of UK adults owned a mobile phone capable of accessing the internet. Ownership was especially high among 16-24 year olds, at 58%. Take-up of data cards and handheld devices such as Blackberry was much lower, indicating that the take-up of these devices is still primarily used for mobile business communication. Ofcom data also indicate that, whereas more men than women own data cards and handheld devices, ownership of mobile phones that access the internet is equal for both men and women.

Figure 45:   Claimed ownership of mobile internet technologies

% of all adults
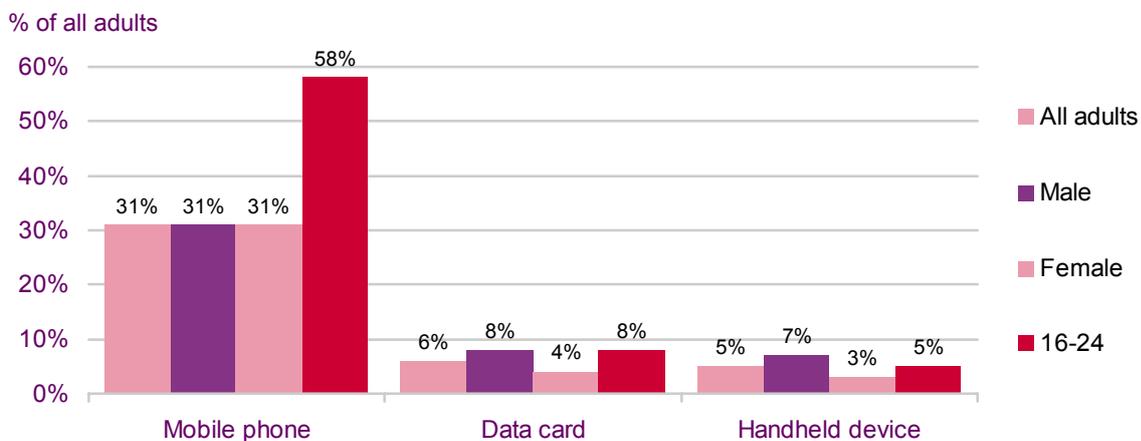
Source: Ofcom research

Around half of internet-enabled mobile phone owners have used their mobiles to go online at least once, suggesting that a significant number of subscribers receive an internet-enabled handset as part of their contract without being specifically interested in mobile internet use.

Among those who do use their phones to access the internet, one in five did at least weekly, suggesting that, as yet, regular use of mobile internet is confined to a small proportion of UK adults. Men were more likely to go online using mobiles than women, and do so more frequently.

Figure 46: Frequency of accessing internet via mobile

% of adults who own a mobile phone which can access the internet
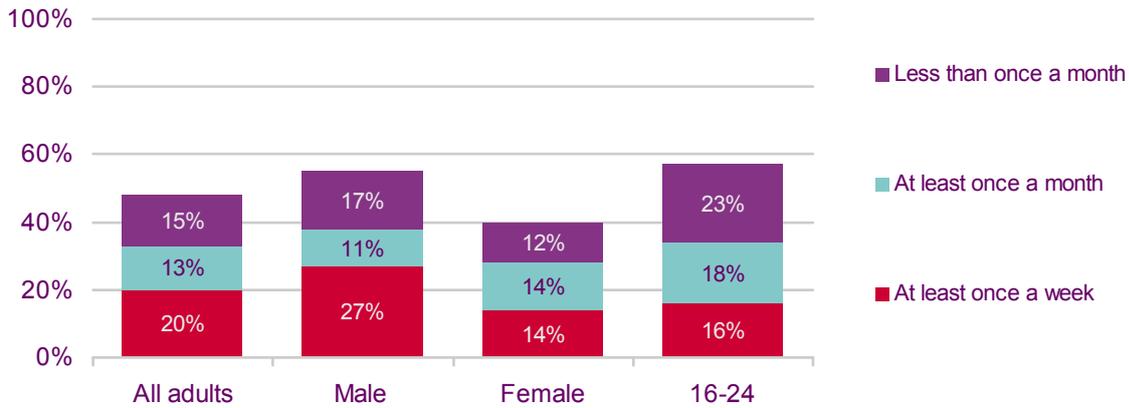
Source: Ofcom research

Internet via mobile phone is most used for accessing current, up-to-date information, according to our survey, with 59% of users saying they have accessed news, weather and sports headlines. Over half had used mobile internet for general browsing, and just under half had downloaded images, video or music content. Practical transactions such as banking or shopping were less popular.

Figure 47: Internet activities carried out on mobile phone

% of adults who use their phone to browse the internet away from the home or office
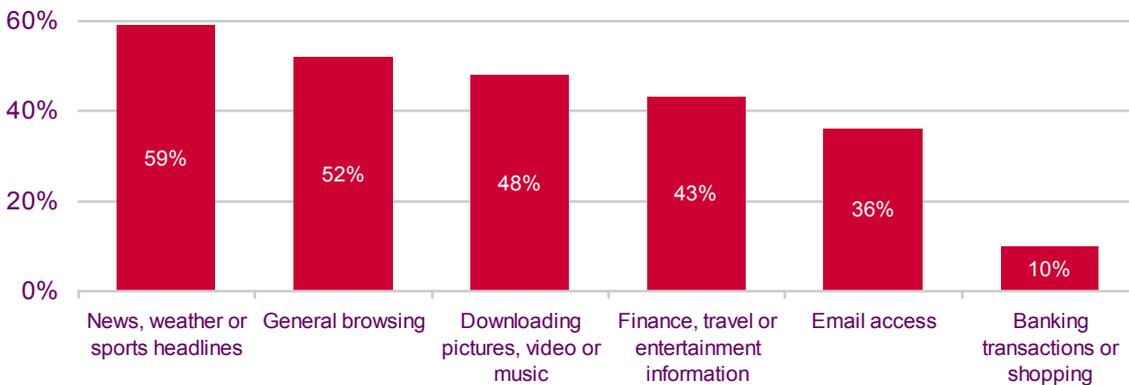
Source: Ofcom research

Figure 48 below shows why mobile internet-enabled mobile owners do not use their handsets to go online, or do so less than once a month (65% of all those who own an internet-enabled phone). Lack of need or lack of interest were the most cited reasons, indicating that a large number of users are yet to be convinced that this service is relevant to them. Cost emerged as the second highest barrier to adoption, mentioned by 31%, followed by inconvenience (12%). Perhaps surprisingly, speed of access and security concerns were much less significant.

Figure 48:   Reasons for not accessing the internet with a mobile phone

% of adults who own an internet-enabled mobile but regularly use it
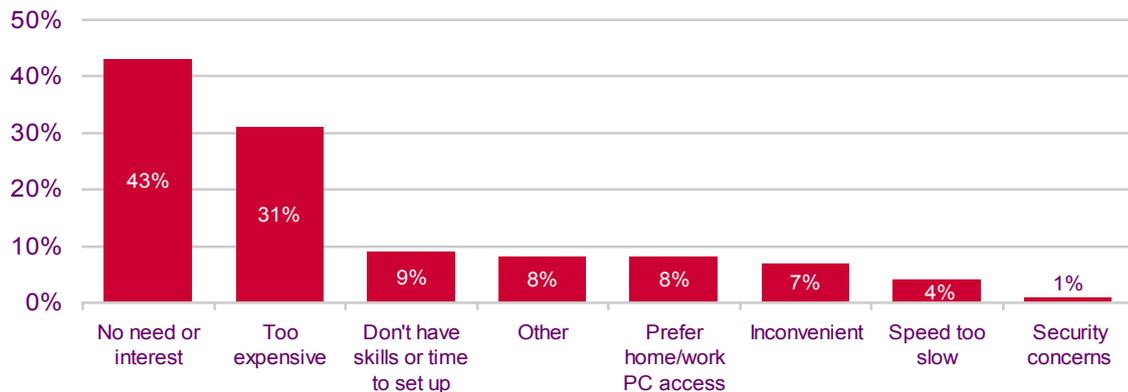
Source: Ofcom research

6.2.   Roll-out of commercial WiFi hotspots increases rapidly

WiFi is a technology which enables wireless access to the internet using the IEEE 802.11 standard. WiFi hotspots are locations where access points provide internet connectivity to users equipped with WiFi-enabled devices, most often laptops. There are three types of WiFi hotspots:

- **private hotspots**, provided by organisations such as firms or universities for the benefit of their members;
- **free of charge public hotspots**, usually in places where customers are already paying for another service such as accommodation, food or drink; and
- **commercial public hotspots**, the most common type, which allow users with a WiFi-enabled device to connect to the internet for a charge.

The first WiFi hotspots were launched in the UK in 2002, and the number has been growing rapidly ever since. In September 2006 there were 12,000 commercial public hotspots (according to Informa), representing a 32% increase over a year. The Cloud is the largest provider in the UK with over 7,400 hotspots (63% of the total), followed by BT Openzone, with over 1,800 and T-Mobile with 1,080. Most operators have roaming agreements to provide their customers with access to more hotspots without further investment.

Figure 49:   WiFi hotspots by operator

Operator	Type	Launch	Hotspots in Q3 2006	Growth in hotspots in last year
The Cloud	Startup	May 03	7400	37%
BT Openzone	Fixed and mobile	Aug 02	1803	22%
T-Mobile UK	Mobile	Aug 02	1080	51%
Swisscom Hospitality	Fixed and mobile	Mar 03	570	8%
Spectrum / Ready to Surf	Startup	Aug 02	372	2%
Surf n Sip	Startup	Mid 03	262	29%
STSN / iBahn	Startup	Mar 03	124	22%
Orange	Mobile	Dec 05	87	N/A
UK Explorer	Startup	Oct 02	72	-9%
Iyonder	Startup	Jul 03	42	20%

Source: Informa

There are several different ways of subscribing to a commercial hotspot. Pay as you go is the most common, used by over 90% of WiFi users, according to IDC market research. Pay as you go users either pay for one-off access or purchase a certain number of WiFi minutes to be consumed within a set period. Other means of paying for the use of WiFi hotspots include contract subscriptions for unlimited WiFi hotspot usage, as well as subscriptions which are a constituent part of a wider mobile operator or ISP package.

Over 60% of commercial hotspots are located in cafés, bars or restaurants (Figure 50). Certain providers have a relationship with chains of stores, for example T-Mobile is the WiFi partner of Starbucks Coffee and McDonalds and The Cloud is the WiFi partner of Coffee Republic and Little Chef.

Figure 50:   Location of WiFi hotspots, January 2007
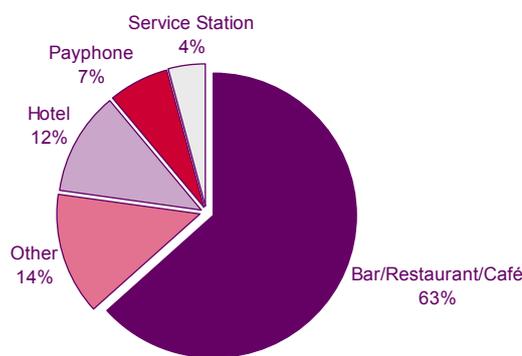
Source: BT

Source: BT
Note: 'Other' includes leisure centres, public buildings, airports and railway stations.

According to Ofcom research, 21% of UK adults owned a WiFi-enabled laptop in February 2007. Over a third of those equipped with a WiFi laptop had used public hotspots to access the internet. Among WiFi users, 12% did so at least once a week, with a further 11% accessing internet through a hotspot every month. Use was significantly higher than average among 18-24 year old WiFi laptop owners, with over one in five saying they used it at least once a week. Men were also more likely to use hotspots than women.

Figure 51:   Use of WiFi hotspots to access the internet

% of adults who own a WiFi-enabled laptop
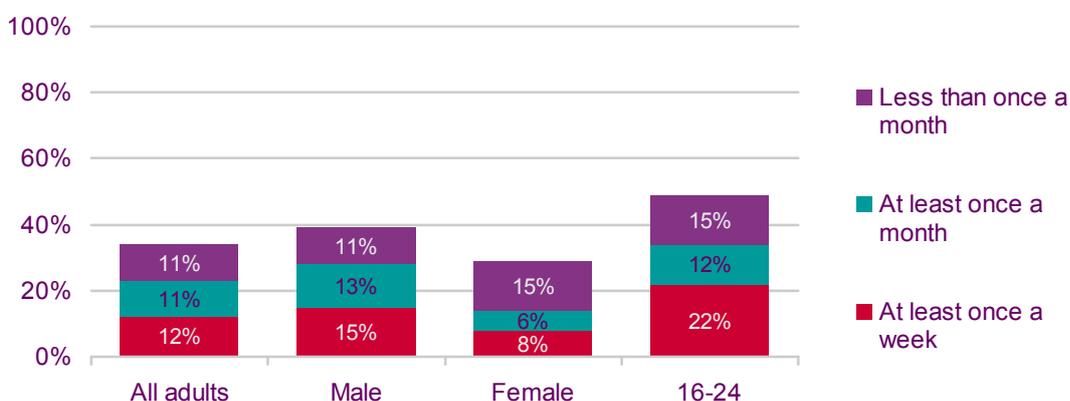
Source: Ofcom research, February 2007

Municipal WiFi deployments

Municipal WiFi deployments usually involve many overlapping WiFi hotspots covering a municipal area. The two dominant providers of municipal WiFi in the UK are the Cloud and BT. The first networks were launched in 2006, with the Cloud and BT often planning networks in the same city.

In February 2007 BT announced that it had met its target of 12 operational WiFi city networks, and that it was planning another five. BT's city networks are launched in partnership with local authorities, and the street furniture and lamp-posts generally become part of the wireless infrastructure.

In most cases, municipal networks allow access to public service information such as travel news free of charge, while access to the wider internet is paid-for. There are also free WiFi networks such as the one in Norwich, but these are restricted to lower speeds so that they do not compete with commercial WiFi.

WiMAX deployments

Pipex is currently the most active fixed WiMAX operator in the UK. It announced a six-month trial of the technology in August 2005, and reported it to be a success in August 2006. This was followed by two commercial trials, in Milton Keynes (launched in December 2006) and in Warwick and Leamington Spa (to be launched in Q2 2007). Further commercial trials are planned for 2007.

UK Broadband currently uses TD-CDMA, but it holds a UK fixed wireless access licence for the 3.5 GHz band and is planning to use WiMAX to deliver personal broadband services. It applied to Ofcom in March 2007 for a variation of its licence to allow delivery to portable devices.

Wight Cable has deployed fixed WiMAX in certain areas of the Isle of Wight. The service is available to both business and residential customers and offers internet access and a local and national VoIP telephone service.

7. SME use of broadband

7.1. Two thirds of SMEs are connected to broadband

According to Ofcom's research, in 2006 over eight in ten small and medium enterprises (SMEs) were equipped with at least one computer; 77% had an internet connection and 62% were using broadband as their main connection method. SMEs with over 50 employees, which account for only around 2% of the total number, had near-universal computer and internet take-up, while 70% had a broadband connection (Figure 52).

Figure 52:   Computer, internet and broadband penetration by SME size, 2006
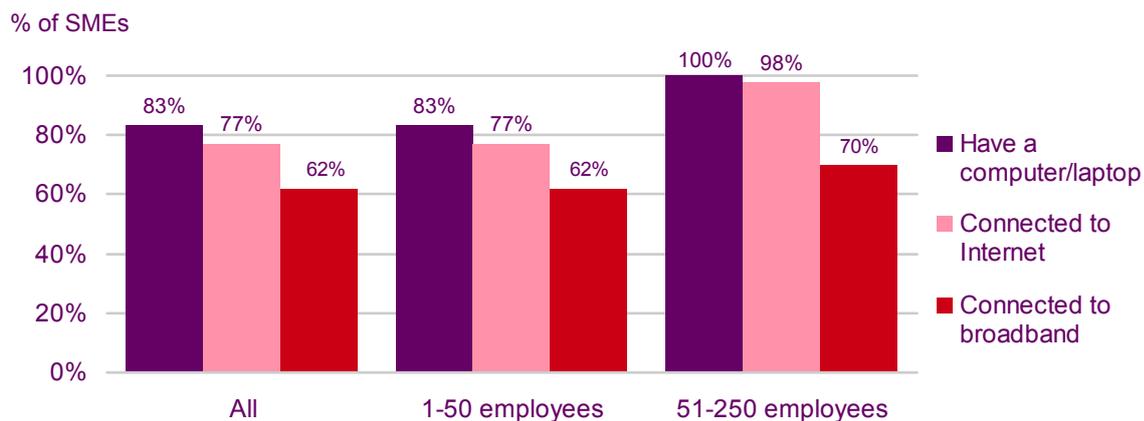
Source: Ofcom
Note: These figures are not directly comparable to Ofcom's previously published SME penetration statistics as the SME panel was changed in 2006 to exclude sole traders.

Broadband accounted for 79% of all SME internet connections, and a further 12% were dial-up. A small percentage of connections were through ISDN, while other methods such as leased lines, satellite and fixed wireless connections made up only around 3% of total SME connections (Figure 53).

Figure 53:   SME internet access by main connection method, 2006

% of SMEs connected to the internet
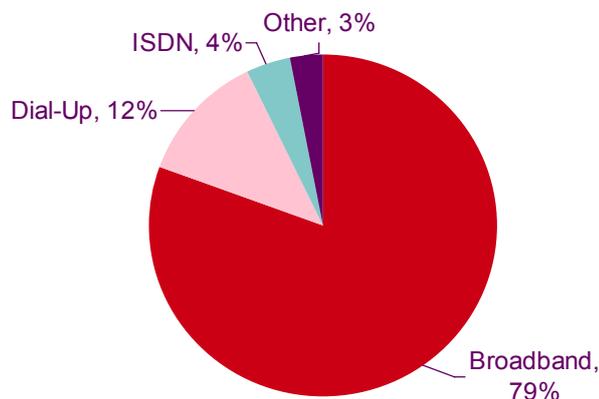
Source: Ofcom

Figure 54 shows the market shares of broadband providers in the SME sector. BT is by far the largest player, accounting for nearly four in ten connections. Virgin Media follows with 8%, while AOL accounts for 7%. No supplier has over 5% share within the remaining 41% of connections, reflecting the large number of smaller and specialised ISPs providing targeted services to the SME sector.

Figure 54: SME connections by main service provider, 2006

% of SMEs
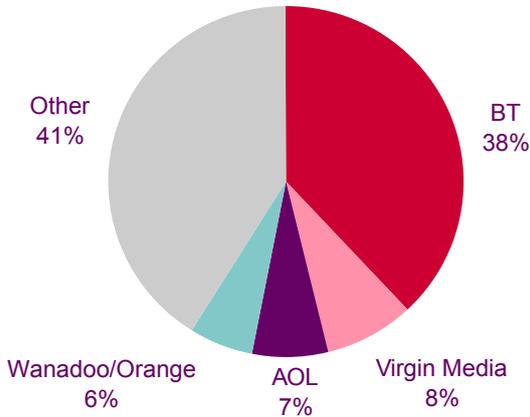
Source: Ofcom

Switching levels among SMEs were slightly below those reported by residential consumers: 27% of SMEs have switched their broadband supplier, with 11% having done so over the past 12 months. Switching is slightly higher among larger SMEs, at 31%, with 12% reporting having changed provider over the past 12 months.

Figure 55: SME switching of broadband suppliers, 2006

% of SMEs with a broadband connection
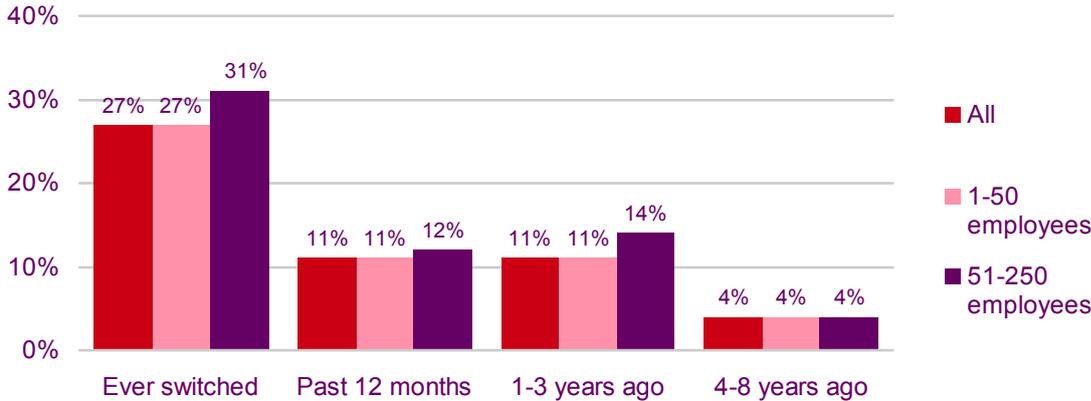
Source: Ofcom

Generally, SMEs show high levels of satisfaction with their broadband service, with 86% saying they were 'highly satisfied' or 'satisfied'. When asked to rate different features of their internet connection, over 80% said they were satisfied with the reliability and the speed of their connection, while three-quarters were satisfied with the value for money factor of the connection. The share of SMEs satisfied with the provider's customer service was slightly lower, at 68%.

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Figure 56: **Internet services satisfaction among broadband SMEs, 2006**

% of SMEs connected to broadband
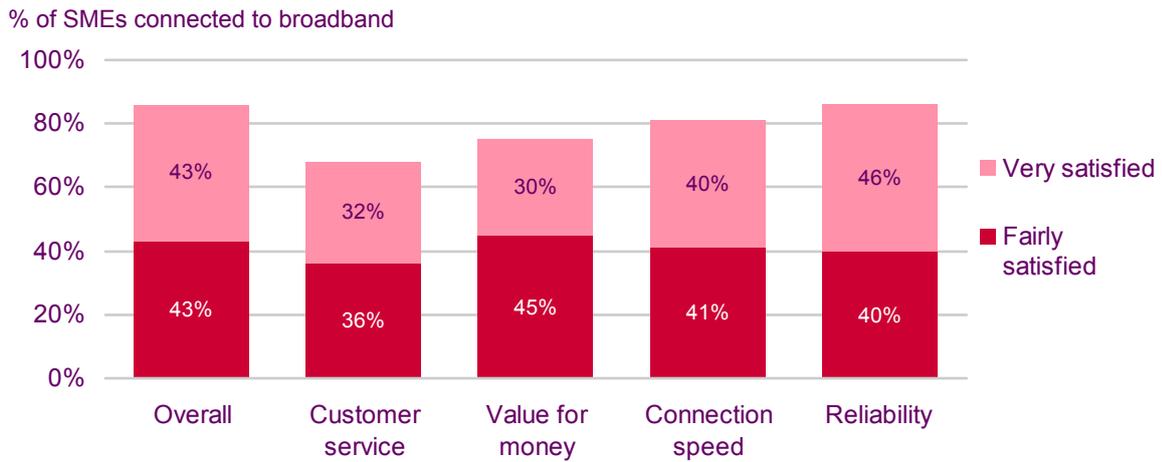
Source: Ofcom

7.2.   One in ten SMEs use VoIP

The use of VoIP services among SMEs was below that of residential users, at around 12% in 2006, with 73% aware of the service. Both awareness and use were higher among larger companies, at 85% and 19% respectively. This may in part be explained by the fact that larger companies are more likely to have multiple locations, making VoIP an attractive option, whereas smaller SMEs located on one site are less likely to benefit from this service.

Figure 57: **VoIP use among SMEs, 2006**

% of SMEs
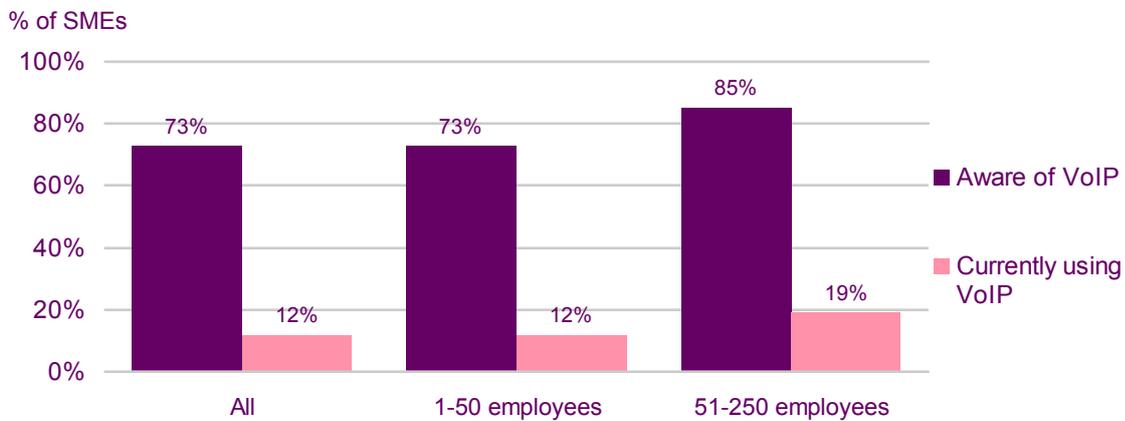
Source: Ofcom

Glossary

2G Second generation of mobile telephony systems. Uses digital transmission to support voice, low speed data communications, and short messaging services.

2.5G In mobile telephony, 2.5G protocols extend 2G systems to provide additional features such as packet-switched connections (GPRS) and higher speed data communications.

3G Third generation of mobile systems. Provides high-speed data transmission and supports multimedia applications such as full-motion video, video-conferencing and Internet access, alongside conventional voice services.

ADSL Asymmetric Digital Subscriber Line. A digital technology that allows the use of a standard telephone line to provide high speed data communications. Allows higher speeds in one direction (towards the customer) than the other.

ADSL1 The first generation of ADSL, capable of data speeds of up to 8Mbit/s towards the customer and up to 640kbit/s from the customer.

ADSL2/ADSL2+ Improved versions of ADSL, offering high speeds, especially on shorter telephone lines. In the case of ADSL2+, up to 24Mb/s can be delivered towards the customer.

Bit-rates The rate at which digital information is carried within a specified communication channel.

Bit-stream A wholesale service providing conveyance of data traffic, typically ATM or IP, from an end user's premise to a point of interconnection made available by the incumbent to a competitive provider.

Broadband A service or connection generally defined as being 'always on' and providing a bandwidth greater than narrowband.

Service bundling (or multi-play) A marketing term describing the packaging together of different communications services by organisations that traditionally only offered one or two of those services.

Communications Act Communications Act 2003, which came into force in July 2003.

Contention ratio An indication of the number of customers who share the capacity available in an ISP's broadband network. Figures of 50:1 for residential broadband connections and 20:1 for business are typical).

DSL Digital Subscriber Line A family of technologies generally referred to as DSL, or xDSL, capable of transforming ordinary phone lines (also known as 'twisted copper pairs') into high-speed digital lines, capable of supporting advanced services such as fast Internet access and video-on-demand. ADSL, HDSL (High data rate Digital Subscriber Line) and VDSL (Very high data rate Digital Subscriber Line) are all variants of xDSL).

DTI Department for Trade and Industry.

DTT Digital Terrestrial Television, currently most commonly delivered through the Freeview service.

GPRS General Packet Radio Service, a packet data service provided over so-called 2.5G mobile networks.

GSM Global Standard for Mobile Telephony, the standard used for 2G mobile systems.

HDTV High Definition Television. A technology that provides viewers with better quality, high-resolution pictures.

Headline connection speed The theoretical maximum data speed that can be achieved by a given broadband. A number of factors, such as the quality and length of the physical line from the exchange to the customer, mean that a given customer may not experience this headline speed in practice.

HSDPA High Speed Datalink Packet Access, an evolution of 3G mobile technology, often known as 3.5G, which offers higher data speeds.

Internet A global network of networks, using a common set of standards (e.g. the Internet Protocol), accessed by users with a computer via a service provider.

Internet-enabled mobile phone A mobile phone which allows its user to access the internet via in-built access technology such as GPRS or WCDMA.

IP (Internet Protocol) The packet data protocol used for routing and carriage of messages across the Internet and similar networks.

ISDN Integrated Services Digital Networks. A standard developed to cover a range of voice, data, and image services intended to provide end-to-end, simultaneous handling of voice and data on a single link and network.

ISP (Internet Service Provider). A company that provides access to the internet.

LAN (Local area network) A network for communication between computers covering a local area, like a home or an office.

LLU (Local Loop Unbundling) LLU is the process where the incumbent operators (in the UK it is BT and Kingston Communications) make their local network (the lines that run from customers premises to the telephone exchange) available to other communications providers. The process requires the competitor to deploy its own equipment in the incumbent's local exchange and to establish a backhaul connection between this equipment and its core network.

Office of the Telecoms Adjudicator (OTA) The Telecommunications Adjudicator has been established to facilitate swift implementation of the processes necessary to enable competitors to gain access to BT's local loop on an equivalent basis to that enjoyed by BT's own businesses.

Podcasting A way for digital audio files to be published on the internet, which can then be downloaded onto computers and be transferred to portable digital audio players

PSTN Public Switched Telephony Network.

SDSL Symmetric Digital Subscriber Line. A variant of DSL which, unlike ADSL, offers the same data speeds in both directions.

Simulcasting The broadcasting of a television or radio programme service on more than one transmission technology (e.g. FM and MW, DAB and FM, analogue and digital terrestrial television, digital terrestrial and satellite).

SME (Small to Medium sized Enterprise) A company with fewer than 250 employees

Streaming content Audio or video files sent in compressed form over the internet and consumed by the user as they arrive. Streaming is different to downloading, where content is saved on the user's hard disk before the user accesses it.

Telecommunications, or 'Telecoms' Conveyance over distance of speech, music and other sounds, visual images or signals by electric, magnetic or electro-magnetic means.

TD-CDMA Time Division Code Division Multiple Access. One of the family of 3G mobile technology standards.

TV over DSL/TV over Broadband/IPTV A technology that allows viewers to access TV content – either in a linear programme schedule, or on-demand – using Internet Protocol via broadband services, either on a PC or (via a set-top box) on a TV set.

UMTS Universal Mobile Telecommunications System. The family of technology standards used for 3G mobile networks.

Usage caps Monthly limits on the amount of data which broadband users can download, imposed by some ISPs.

VoB Voice over Broadband. A technology that allows users to send calls using Internet Protocol and a broadband service.

VoD Video on Demand. A service or technology that enables TV viewers to watch programmes or films whenever they choose to, not restricted by a linear schedule. Also Near Video on Demand (NVoD), a service based on a linear schedule that is regularly repeated on multiple channels, usually at 15-minute intervals, so that viewers are never more than 15 minutes away from the start of the next transmission.

VoIP Voice over Internet Protocol. A technology that allows users to send calls using Internet Protocol, using either the public Internet or private IP networks.

WAN Wide area network. A network allowing the interconnection and intercommunication of a group of computers over a long distance.

WAP Wireless Application Protocol.

WCDMA Wideband Code Division Multiple Access. One of the family of 3G mobile technology standards.

Wireless LAN or **WiFi** (Wireless Fidelity) Short range wireless technologies using one of the 802.11 family of standards, such as 802.11b or 802.11a. These technologies allow an over-the-air connection between a wireless client and a base station, or between two wireless clients.

Wi-Fi hotspot A public location which provides access to the internet using WiFi technology.

WiMAX A wireless MAN (metropolitan area network) technology, based on the 802.16 standard. Available for both fixed and mobile data applications.

List of figures