UK Broadband Status Report June 2005

Covering the period end September 2004 to end March 2005

A Report for the Department of Trade and Industry

Contents

0 Executive summary

Broadband coverage now reaches 97.7% of UK household population

By the end of March 2005, 97.7% of the UK household population had access to a mass-market broadband technology such as ADSL, cable modem or fixed wireless access (FWA).

This represents a growth of over 3% since the end of September 2004, when the population coverage had reached 94% (ie with access to at least one mass-market broadband technology). Most of this growth is attributable to BT's accelerated roll-out of exchange enablement, as neither cable modem nor FWA availability has significantly grown since the end of September 2004.

UK coverage is estimated to reach over 99% by end 2005

Based on our estimates and reports from infrastructure operators, we expect the availability to continue to increase – again mainly driven by BT's DSL exchange enabling programme – to reach over 99% of the population by the end of 2005.

Broadband take-up reaches 7.1m connections and continues to grow

Total broadband connections (ADSL, cable modems, fixed wireless access and satellite) had reached 7.1m connections, a growth of over 35% in the six months from end of September 2004.

DSL growth in the six months was 31% whilst cable modem growth reached 19%.

Growth in infrastructure competition remains static

Non-DSL technologies such as cable modems and FWA will contribute a little to the growth of availability, but more to the development of infrastructure competition on a limited basis in urban and suburban areas. However, financial pressures continue to throttle back rapid development of cable modem enabled network and fixed wireless access network rollout has all but stalled.

Competition in the local loop

The Office of the Telecoms Adjudicator reported that around 40,000 lines had been unbundled by April. This number is behind the target set by the OTA of 50,000 lines by February. The OTA commented that the next few months for LLU deployment would be critical. The benefits of LLU have been demonstrated in recent months by high-speed, low-price offerings from Bulldog and UK Online who have taken advantage of LLU activity by their parent groups, Cable & Wireless and Easynet respectively. This has encouraged others to announce plans to unbundle.

Competition at the local loop still has a long way to go. There remains concerns that such competition will not exist beyond exchanges that serve around 40% of the

population. These concerns stem from the cost of unbundling being high, consequently unbundling is not economical for ISPs where the population is smaller.

1 Introduction

The DTI has commissioned Ovum to provide a series of reports on the current state of the UK broadband market and its likely development over the next ten years.

This report forms the main six monthly update on broadband coverage and take-up up to the end of March 2005. It will be supplemented with interim quarterly reports focusing on coverage developments.

The findings and analysis contained in the report are based on information provided by the major broadband infrastructure providers and additional research, analysis and forecasting carried out by Ovum, building on its comprehensive and continuous research programme.

Chapter 2 contains a summary of recent developments in the broadband market, focusing on the activities of key players.

Chapter 3 provides an analysis of the current state of broadband coverage in the UK, based on data provided by infrastructure players including BT, ntl, Telewest, Kingston, Pipex and UK Broadband.

Chapter 4 contains a summary of the current levels of broadband take-up and provides forecasts of future take-up by technology.

Chapter 5 summarises the key competition issues, building on recent developments outlined in Chapter 2.

Annex A contains a summary of the major current broadband technologies.

2 Recent developments

This chapter summarises the key developments in the UK broadband market arising over the last three months.

Below we have listed in chronological order some of the key announcements made by broadband operators and service providers.

January

- BT announced the next 500 exchanges that are to be upgraded to symmetrical DSL (SDSL)

February

- BT Northern Ireland in association with the Department of Enterprise, Trade and Investment (DETI) and the Building Sustainable Prosperity programme announced that it had enabled 100% of its exchanges with ADSL technology
- The Office of the Telecoms Adjudicator (OTA) reported that 31,000 lines had been unbundled by January 31, increasing from roughly 12,000 in May 2004

March

- Bulldog introduced a pay-as-you-go (PAYG) broadband service. The service was launched at a promotional rate of £10.75 per month until March 31
- BT announced plans to trial upping the speeds on lines that currently support 2Mbps services to deliver speeds between 2Mbps and 8Mbps.

2.1 Broadband coverage

BT Northern Ireland announced at the end of February that 100% of exchanges had been enabled with ADSL technology. Broadband is now available to 98.5% of the region. BT will provide wireless technology to the remaining 1.5% of homes not served. BT Northern Ireland won a contract to broadband enable all exchanges in March 2004. Funding is provided by the EU, Building Sustainable Prosperity programme.

SDSL

At the end of January, BT announced details of the second phase of exchanges (500 exchanges) that are to be upgraded as part of the company's commitment to deploying SDSL in 1,300 exchanges by April 2006. This follows the company's earlier announcement, in November 2004, of details of the programme and of the first 500 exchanges to be upgraded.

2.2 Subscribers and market share

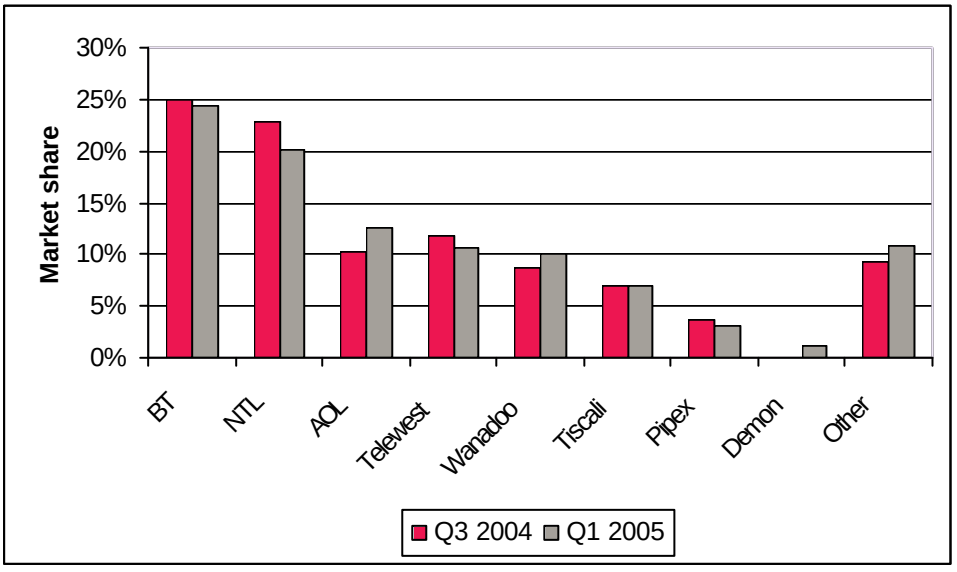
In the quarter ending March 2004, total broadband subscribers totalled 7.16 million. New subscriptions rose, over the previous quarter, by 17.8%.

As found in the Q3 2004 report, most net additions are a result of the take-up of DSL-based services. At the beginning of April, BT Wholesale announced that its milestone for the summer 2005 of 5 million wholesale lines, would be reached that week. This represents a 25% increase from BT Wholesale's previous connection figure of 4 million, announced on December 2004.

Total cable subscriptions at end Q1 2005 were 2.2 million, marking a 10% increase over the previous quarter.

Figure 2.1 shows the market share position of the major broadband service providers at end Q1 2005. With all broadband providers reporting growth in their net additions, changes occurred in their respective market shares in the overall market for the provision of broadband. Of the eight largest operators identified, AOL (market share 13% from 10%) and Wanadoo (10% from 9%) were the only operators to increase their market share. ntl's share of the market slipped to approximately 20%, from 22%, while BT's dipped 1% to 24%. The remaining broadband service providers', defined as 'Other', witnessed an increase in their overall market share, after experiencing declines in overall market share for the previous two quarters.

Figure 2.1: Market share of top UK broadband ISPs



Source: Ovum

2.3 Pricing and new product developments

The quarter witnessed an increase in the number of operators doubling broadband access speeds while keeping the per month charge the same. In addition, operators launched a number of promotional offers, particularly after the Christmas period. New product launches were typically services offering downloads speeds of between 2Mbps and 4Mbps.

Special Offers

At the beginning of January Bulldog launched a new year promotion offering new customers a 25% discount on their broadband and phone tariff for the whole of 2005. The offer, open to both businesses and consumers, was available on all of Bulldog's @ctive broadband services, who signed up before the end of January. Home users signing up to Bulldog's Inter@ctive service benefited from reductions from £40 per month to £30 per month, while those signing up to Super@ctive would pay £39 per month, as opposed to £52 per month.

UK Online launched a one month promotion to customers signing up to their Broadband 8000 (8Mbps) service. Customers signing up before the 21st of February would receive a free wireless router.

Pipex launched an offer to customers who migrate from a BT access product to their service, that would provide two months free service, if the customer owned his/her own modem. For those without, the Pipex offer was for one months free service.

In March, Bulldog offered another promotion for its 4Mbps broadband service. Bulldog offered new customers, both residential and business, a 30% saving on the service for up to 12 months, plus a connection fee of £1.

New products

Demon launched HomeOffice, its range of new broadband products aimed at SoHo businesses, small enterprises and heavy residential users. The new range includes a 1Mbps service 'Demon HomeOffice 1000', costing £29.99 a month, and a 500Kbps service 'Demon HomeOffice 500', costing £24.99 a month.

UK Online launched Broadband 2000, an unlimited 2Mbps service for £29.99 per month.

Bulldog introduced a pay-as-you-go (PAYG) service, Start@ctive, This was priced at a promotional rate of £10.75 per month until March 31 2005, from the normal rate of £15.50. Included in the cost is a phone line and 400 minutes of time online.

In February, Pipex launched a new service, Pipex Lite, which provides 2Mbps and a selection of monthly usage options (2, 5, or 15GB). The 2GB capped service is priced at £19.99, £14.99 for the first three months. The 5GB and 10GB capped services are priced per month at £23.44 and £27.99, respectively. Customers on each

of the three service types can purchase additional blocks of 1GB at a cost of £2.50 per GB

Doubling of speeds

HomeChoice announced that it was doubling the access speeds available to its existing customer base. For no additional charge, from February 1st, its 0.5Mbps service doubles to 1Mbps, 1Mbps to 2Mbps and the 2Mbps service to 4Mbps.

Existing UK Online 1Mbps customers received a free upgrade to the new 2Mbps service, Broadband 2000. The pricing of the new service also means that the existing customers save £60 a year.

At no additional cost per month, AOL doubled the speeds of each service it offers.

BT announced that its 0.5Mbps Broadband Basic service would be doubled to 1Mbps. All other products in the BT portfolio would be offered at 2Mbps.

8Mbps trials

BT announced plans to trial upping the speeds on lines that currently support 2Mbps services to deliver speeds between 2Mbps and 8Mbps. Trials will begin in April, and last for 10 – 12 weeks, and will involve up to 2,000 businesses and consumers in the Strathclyde region of Scotland and in Greater London. Following a successful technical pilot, BT intend to stage larger trials in the summer. BT Wholesale invited a number of ISPs to participate in the trials.

BT also plans to run initial trials of ADSL2+ technology to support higher speed services of up to 18Mbit/s.

Local loop unbundling

The Office of the Telecoms Adjudicator (OTA) published a progress update on the status of local loop unbundling. The OTA reported that 31,000 lines had been unbundled by January 31, increasing from roughly 12,000 in May 2004. The number falls short of the 50,000 lines which had initially been set by the OTA for unbundling by February. In a further update, it was reported that around 40,000 lines had been unbundled by April.

At the end of December, Cable & Wireless had unbundled lines in 68 telephone exchanges. The company reported that it had plans to unbundle lines in a further 317 exchanges. Cable & Wireless expect to have unbundled 400 exchanges by the end of May.

It was reported in February that Easynet was to spend a further £2 million on upgrading its local loop infrastructure.

Tiscali announced in April that it was to spend £61 million on unbundling lines in the UK over the next three years.

Video Networks also announced that it was to double the size of the footprint that its wholly owned subsidiary, HomeChoice, served. Through further unbundling of the local loop, HomeChoice will serve 2.4 million homes by June 2005. Video Networks claimed that 20% of all net additions in its launch footprint sign to HomeChoice.

It is believed that around 30% of exchanges unbundled by Cable & Wireless and Easynet are in the large metropolitan areas. Indeed alongside HomeChoice and other smaller players, London is the current main focus of unbundling. Cable & Wireless and Easynet, who have the most developed strategies, have unbundled exchanges across the country with their focus being the most densely populated areas.

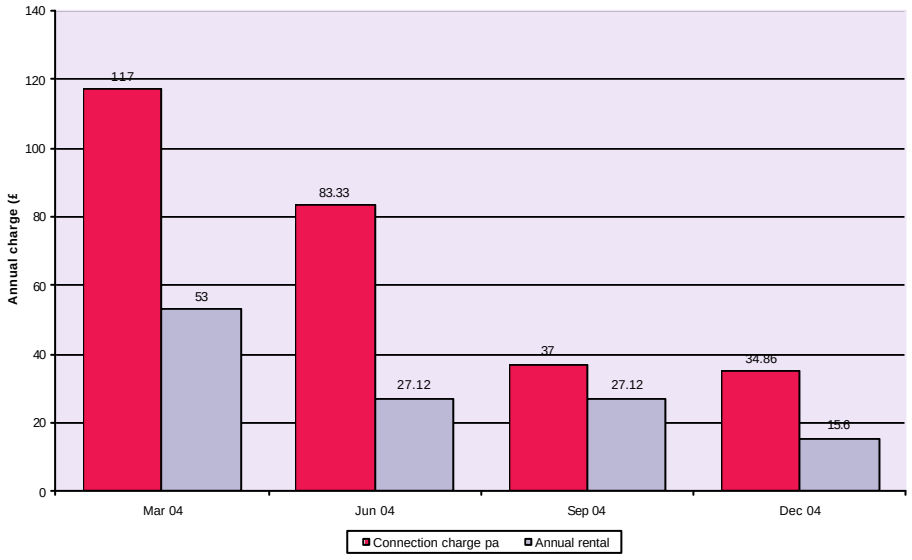
Local Loop Unbundling - Slow Progress to date

With only 40,000 lines unbundled by April 2005, much work is required to reach the OTA forecast of 1.5 million unbundled lines by the end of 2006. Unbundling has been slow to date however a more promising picture has emerged during the quarter. Cable & Wireless and Easynet continue to expand their plans for LLU. Additionally, two of the largest ISPs in the UK, Wanadoo and Tiscali, have committed to unbundling. Wanadoo announced plans to make "substantial and significant investments in LLU in the UK" in December 2004.

LLU price trends

Figure 2.2 shows how UK LLU prices have declined since March 2004. These are the prices charged by BT to other service providers for unbundled copper.

Figure 2.2: UK LLU price trends (Annual cost of connection and rental)



Source: Regulation @ Ovum

Retail prices

As observed in previous updates, competition in the market for broadband lines is intense. One of the prevailing trends is for operators to double access speeds at no extra cost to the subscriber.

Figure 2.3 provides a summary of several broadband packages available from service providers. Note that most providers have introduced daily or monthly usage caps which vary by package offered. Therefore comparisons between the attractiveness or competitiveness of packages must be made with caution.

The table illustrates the impact that the doubling of access speeds is having. 256kbps and 512kbps are beginning to be phased out, with 1Mbps now looking the entry level access speed to the majority.

There exists a minority, however, who are unable to receive 512kbps and above broadband. The primary reason for this is that the distance of the address from the exchange is too great. Other reasons include the quality of the telephone line being poor, and in some cases the capacity of the line not being sufficient to allow higher speed services.

Figure 2.3: Trends in broadband access pricing

	Mar 04	June 04	Sept 04	Dec 04	Mar 05	Usage caps
Broadband (256kbps)						
BT	-	-	-	-	-	
ntl	17.99	17.99	17.99	17.99	-	
Telewest	-	-	17.99	14.99	14.99	Unlimited
AOL	-	-	17.99	17.99	-	
Wanadoo	-	-	-	-	-	
Tiscali	15.99	15.99	15.99	15.99	15.99	30Gb
Broadband (512kbps)						
BT	19.99	19.99	19.99	17.99	17.99	1Gb
ntl	24.99	24.99	24.99	24.99	-	
Telewest	25.00	25.00	25.00	25.00	-	
AOL	21.99	21.99	20.00	24.99	17.99	Unlimited
Wanadoo	27.99	27.99	-	-	-	
Tiscali	24.99	24.99	24.99	19.99	17.99	30Gb
Broadband (1Mbps)						
BT	38.00	38.00	29.99	29.99	17.99	
ntl	34.99	34.99	34.99	34.99	17.99	3GB pcm
Telewest	35.00	35.00	35.00	35.00	19.99	Unlimited
AOL	34.99	34.99	29.99	29.99	24.99	Unlimited
Wanadoo	-	-	17.99	17.99	17.99	2Gb
Tiscali	-	-	-	15.99	15.99	2Gb
Broadband (2Mbps)						
BT	-	-	-	-	24.99	15GB
ntl	-	-	-	-	24.99	1GB per day
Telewest	35.00	35.00	35.00	35.00	35.00	Unlimited
AOL	-	-	-	-	29.99	Unlimited
Broadband (3Mbps)						
ntl	-	-	-	-	37.99	1GB per day
Telewest	-	50.00	50.00	-	-	Unlimited
Broadband (4Mbps)						
Telewest	-	-	-	50.00	50.00	Unlimited
Bulldog	-	-	-	-	15.50	PAYG

Note: usage caps have been introduced by most providers for some packages, but vary considerably by actual package offered. Hence it is difficult to give a precise comparison.

Source: Operators, Point Topic

Local loop unbundling by Cable & Wireless and Easynet continues to shake up the market as it has led to the introduction of high speed, low priced services by their ISPs.

Bulldog are also taking full advantage of their unbundled network. The company launched a 4Mbps pay-as-you-go (PAYG) service during the quarter. Their 8Mbps service offerings are also very competitively priced.

UK Online is taking advantage of its parents unbundled loop to offer very competitive broadband deals. At the beginning of April, UK Online announced a 512kbps entry level service for £9.99 a month to those who are within reach of Easynet's LLU footprint. Other UK Online prices include its 2Mbps service which costs £19.99 a month and a 8Mbps service, costing £29.99 a month.

2.4 Government and public sector

The Office of the Deputy Prime Minister is supporting a scheme called Wired Network which is to benefit 20,000 people living in the Shoreditch community in London. The scheme provides online education, video on demand and local telephone calls for around £3.50 per week.

An initiative was launched in Somerset to help over 1,350 small and medium sized businesses, 30 communities and 600 people understand how they can benefit from the broadband and IT revolution. The project, costing £2 million, is funded by the South West RDA, Somerset County Council, Somerset's five district councils, the European Social Fund and Business Link.

Hampshire Broadband was awarded £144,000 of funding, by the South East of England Development Agency, to promote the use of broadband technology in South East Hampshire over the next three years.

The results of a partnership between One North East and BT, to bring broadband to 150,000 households came to a close at the end of February, with the last twelve exchanges enabled. Over 100 telephone exchanges were upgraded as part of the £10 million project.

It was reported in April that Mesh Broadband were to cease trading. The Mesh wireless network is currently unsupported. This has particular significance in Bedfordshire, where Mesh were subcontracted by Cable & Wireless to provide wireless access in ADSL blackspots. Cable & Wireless were brought in when the East of England Development Agency provided a £375,000 grant to Bedfordshire County Council.

2.5 Regulation

In November 2004 Ofcom set out three basic options for the future regulation of telecommunications in the UK:

- deregulate now
- make a reference under the Enterprise Act
- create a regime for real equality of access (also called "equivalence")

BT published its response to phase 2 of Ofcom's strategic review of the UK telecommunications industry in February. BT has said that it agrees with the regulatory principles set out by Ofcom in November 2004. Its key proposals include:

- setting up an access services division to provide transparent and equal access to BT's local network
- setting out access ground rules for 21st Century Network (21CN)
- cutting a range of wholesale broadband prices and introducing faster services
- reaffirming commitment to LLU and proposing a further price cut
- increasing the commercial attractiveness of Wholesale Line Rental (WLR).

BT Wholesale stated that it planned to reduce the wholesale cost to service providers of BT IP Stream ADSL products by an average of about 8 percent in areas where there is a combination of high customer demand, high take up and lower costs. The reduction will be delivered as a rebate to the service provider.

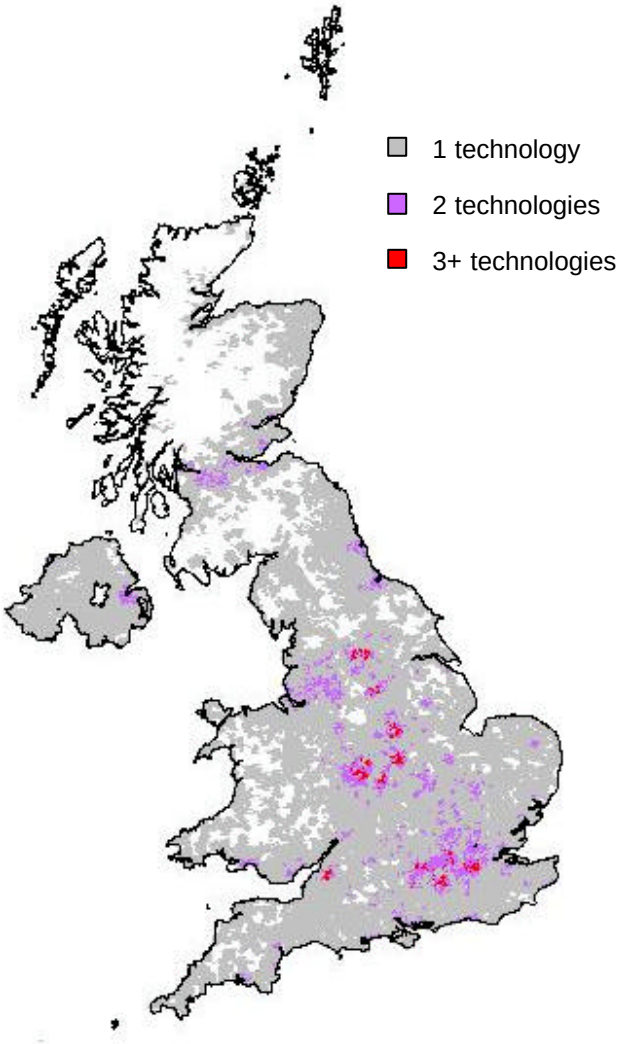
The flavour of equivalence runs through BT's response. As a package the response appears to go a long way to address the concerns that both Ofcom and industry have raised.

3 Coverage

3.1 Current UK coverage

Figure 3.1 shows the level of coverage of mass-market broadband technologies in the UK at end of March 2005 (Q1 2005).

Figure 3.1: Terrestrial broadband coverage of the UK at Q1 2005



Source: Ovum, BT, Kingston Communications, ntl, PCCW, Pipex, Telewest,

At the end of March 97.7% of the UK population (households) had access to a terrestrial mass-market broadband solution. This represents an increase of over 3% on the coverage estimates reported in the Q3 2004 report.

Figure 3.2 shows that ADSL provides the largest percentage of households covered with cable modem coverage at 48% and FWA coverage at 11%.

Figure 3.2: Proportion of households covered by broadband technology, Q1 2005

Technology	Current population coverage (%)
ADSL	97.4%
Cable modem	47.8%
FWA	11.2%
Satellite	100%
Total	97.7% (excluding satellite)

Source: Ovum

Figure 3.3: Proportion of households covered by broadband technology by geographical region, Q1 2005

	DSL	*Cable*	*FWA*	*Total*
East Midlands	97%	55%	21%	98%
East of England	97%	49%	0%	97%
London	100%	55%	37%	100%
North East	99%	49%	0%	99%
North West	99%	53%	3%	99%
Northern Ireland	100%	32%	0%	100%
Scotland	93%	42%	0%	94%
South East	98%	45%	7%	99%
South West	96%	40%	12%	96%
Wales	93%	25%	0%	93%
West Midlands	98%	63%	22%	98%
Yorkshire and Humberside	97%	43%	14%	97%
Total	97.4%	47.8%	11.2%	97.7%

Source: Ovum

Figure 3.4: Household coverage by mass-market broadband by area type[1], Q1 2005

	DSL	*Cable*	*FWA*	*Total*
Urban	99%	62%	16%	99.8%
Suburban	98%	37%	5%	99.8%
Rural	88%	7%	1%	88.6%

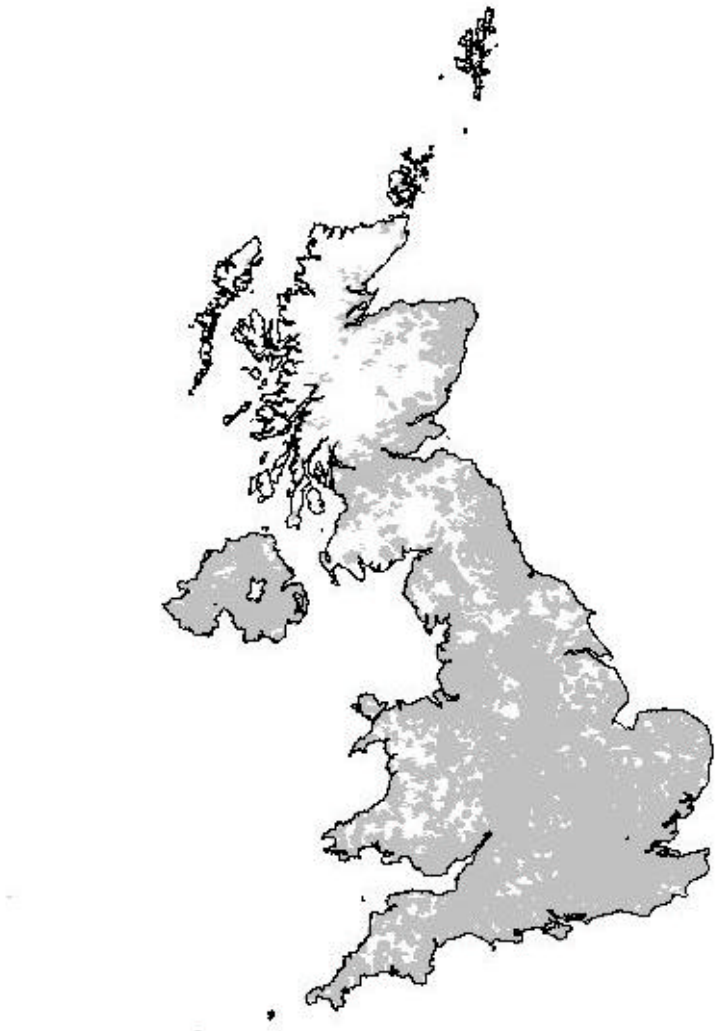
Source: Ovum

Current DSL coverage

Since BT's announcement in Spring 2004 that it would provide 99.6% population coverage by July 2005, the company has made good progress. The majority of the work has been in rural areas where BT has increased DSL availability from 72% in Q3 2004 to 88% at end March 2005.

[1] Area type definitions: Urban: > 500 households per sq km, Suburban: 100 – 500 households per sq km, Rural: < 100 households per sq km

Figure 3.5: DSL coverage in the UK, Q1 2005



Source: Ovum, BT, Kingston Communications

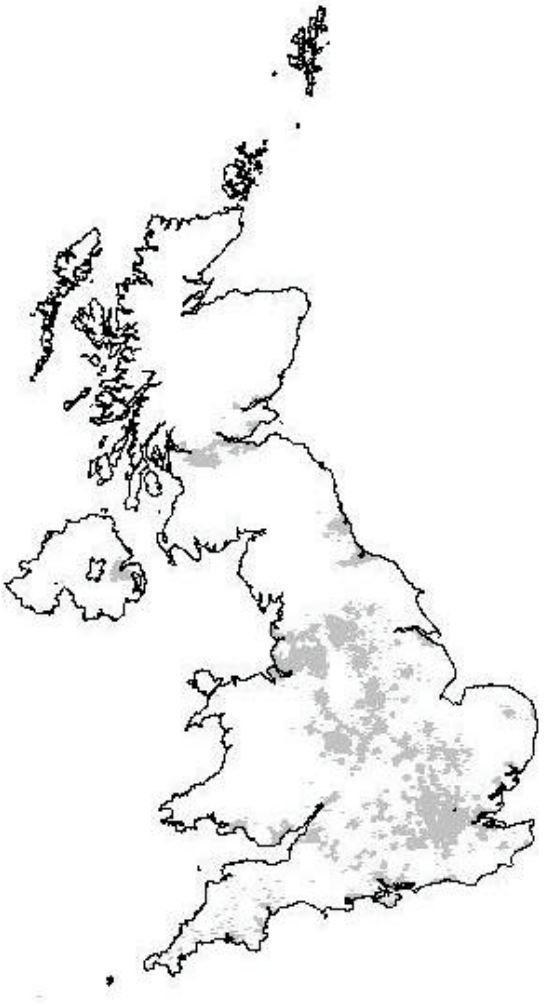
Figure 3.5 above shows the coverage of ADSL by postcodes across the UK.

Current cable modem coverage

Cable modem based services are restricted to within a cable operator's network reach. For the UK, it is estimated that 48% of households are passed by broadband enabled cable networks, based on the postcode data provided by cable network

operators[2]. This figure remains unchanged from the previous report since both ntl and Telewest have not indicated any expansion of their respective networks.

Figure 3.6: Cable modem coverage in the UK, Q1 2005



Source: Ovum, ntl, Telewest, Isle of Wight Cable

[2] ntl and Telewest

Current FWA coverage

Figure 3.7 shows the coverage provided by FWA networks. The networks currently cover about 11% of the UK household population.

Figure 3.7: FWA coverage in the UK, Q1 2005

Source: Ovum, PCCW, Pipex

FWA coverage is limited to a small number of regions across England. Over 45% of the current FWA residential population coverage is spread across London and the South East. The Midlands area constitutes around 30% of the total coverage. The

South West and Yorkshire and Humber each have around 10% population coverage, with the remainder being spread across the North West and East of England.

In addition to the two main FWA providers in the UK, Pipex and PCCW-owned Broadband UK, there are a number of other providers.

Telabria and Libera are wireless operators who are looking to expand through deploying WiMAX technology in order to serve businesses. Telabria intend to roll out WiMAX in the South East of England while Libera, from their base in Bristol, intend to roll WiMAX out to cover 75% of business over the next two years.

There exists a number of smaller providers who target areas, in particular villages, where ADSL blackspots exist. Langreen is an example of such a provider, Langreen currently serve over 50 communities across the UK. Langreen are partnering with local bodies to bring their expertise to blackspot areas in order to deliver broadband. However, the small nature of ADSL blackspots and their often rural location means that not all are being addressed. Consequently, there remains pockets of the population who are missing out on the broadband revolution.

Current satellite coverage

Broadband satellite coverage in the UK nears 100% (there are occasional satellite shadows) and can be considered ubiquitous. However, in the UK at least, it remains essentially a niche service with its main benefit being ultimate reach where no other technology can.

4 Take-up

Mass market broadband take-up has entered the phase of fastest growth in the UK as technology availability, consumer awareness, applications and content availability, pricing and affordability are coming together as strong forces driving demand.

4.1 Current take-up

Latest figures (end March 2005) indicate that total broadband connections (ADSL, cable modems, fixed wireless access and satellite) had reached 7.1 million at the end of March 2005[3], a penetration of 29% of UK households.

DSL growth in the six months to March 31 exceeded 50% while cable modem growth was just under 20%[4]. Estimated growth for FWA in the quarter was 8% and 7% for satellite broadband subscriber growth[5].

At the beginning of April, BT announced that five million DSL connections had been reached, either through its own retail service or through other service providers via its wholesale products. This was well ahead of the company's original target date of summer 2006.

Wholesale connections accelerated during the six month period since the previous report. Net additions increased by almost two million in the six months to March 2005. For purposes of comparison, one million new additions were added in the previous six month period from April to September 2004.

Figure 4.1 summarises estimates[6] of the current level of broadband connections by residential and business customers, by broadband technology.

Figure 4.1: Broadband connections, Q1 2005

	ADSL	*Cable modem*	*FWA*	*Satellite*	*Total*
Residential	4,248,806	2,102,189	1,754	1,332	6,354,081
Business	780,702	24,451	5,701	2,004	812,857
Total	**5,029,508**	**2,126,640**	**7,455**	**3,336**	**7,166,939**

Source: Ovum

[3] Point Topic

[4] Point Topic and operators' reports

[5] Point Topic

[6] Estimates are based on Ovum analysis, using operator data where available

The total residential broadband market in Q1, 6.3 million connections, represents a current residential take-up of almost 25%. The residential take-up rate has grown by over 7% since the Q3 2004 report where residential take-up was estimated to be 4.1 million lines, or 17% of the market.

The UK is benefiting from both the migration of dial-up users to broadband services and the addition of new internet users. The overall subscription base is, as a result, growing.

Current DSL take up

In the six month period to Q1 2005, the DSL market in the UK grew by over 50% to reach over 5 million lines.

Approximately 35% of DSL lines are retailed by BT, with the remainder provided by ISPs through wholesale DSL (predominantly from BT Wholesale).

Figure 4.2 shows how DSL connections are concentrated by geographical area.

Figure 4.2: ADSL connections, Q1 2005

	Residential	*Business*	*Total*
Urban	3,184,071	538,145	3,722,216
Suburban	661,090	143,707	804,798
Rural	403,645	98,849	502,494
Total	**4,248,806**	**780,702**	**5,029,508**

Source: Ovum

Current cable modem take-up

At end March 2005, total residential cable modem connections were approximately 2.1 million. Broken down, ntl had 1.33 million broadband subscribers while Telewest reported that it had 786,705 subscribers.

Figure 4.3 shows the current take-up of cable modems at end March 2005.

Figure 4.3: Cable modem subscribers, Q1 2005

	Residential	*Business*	*Total*
Urban	1,761,852	19,017	1,780,869
Suburban	295,487	4,598	300,085
Rural	44,849	836	45,685
Total	**2,102,189**	**24,451**	**2,126,639**

Source: Ovum

Current FWA take-up

Currently there are two major players operating in the UK: Pipex and PCCW, through its UK Broadband business. There are a number of other smaller players operating in unlicensed bands.

Neither operator publicises subscriber figures. Current estimates suggest there are approximately 5,000 FWA subscribers for licensed bands. However, this figure excludes subscribers from unlicensed WLAN schemes. Overall, we estimate there could be in excess of 7,000 FWA subscribers.

Current satellite take up

We estimate that there are currently about 6,000 2-way broadband satellite subscribers.

One of the major satellite broadband providers, Aramiska, claims that about 30% of its satellite terminals are provided in areas where alternative broadband infrastructure is available. Multi-national corporations appear to be one of the markets where satellite provision can be attractive whereby VPNs between enterprise sites can be set up readily and cost effectively using satellite technology. In addition, some customers use satellite broadband to provide back up services.

5 Competition

The competitive environment for broadband in the UK continued to develop in the six months since the previous report. As speeds have increased, prices have fallen. There has been a marked shift away from entry level services at 256kbps and 512kbps, with 1Mbps becoming the dominant entry level standard.

The competitive environment has been fuelled by a number of factors, including:

Ofcom's action in December to reduce the LLU prices set by BT Wholesale for fully unbundled lines and for shared access. This action brought LLU prices closer to those in Europe.

Infrastructure competition is still dominated by the cable players. Telewest and ntl continue to promote their triple play (TV, telephony and internet access) advantage. At the high end, the cable operators currently offer higher speed services than are available from those ISPs who wholesale from BT.

The local loop unbundlers are having an impact on the market. As the footprint of these players spreads, the companies are beginning to shake up the market with their high speed offerings.

5.1 Competition between operators

In an article published in The Times, Ben Verwaayen, the chief executive of BT Group, warned that 60% of British homes and businesses would not benefit from the broadband revolution unless Ofcom changes its approach. Verwaayen commented that LLU would be too costly outside of the top 600 exchanges in the UK, which serve about 40% of the population.

This is certainly consistent with the announced planned strategies of LLU operators. At the end of December Cable & Wireless stated that it had plans to unbundle a further 317 exchanges, in addition to the 68 already unbundled. Cable & Wireless expect to have 400 exchanges unbundled by May.

NTL announced in December that it was prepared to invest £65 million on unbundling up to 300 exchanges.

And more recently, following Wanadoo's announced plans for unbundling in December, Tiscali announced that it was to spend £61 million on unbundling lines in the UK over the next three years.

The benefits of unbundling are apparent, as an example, HomeChoice claim that they are winning 20% of net additions in areas where they have unbundled local loops. Consequently, they are expanding their footprint to serve 2.4 million homes by June 2005.

The cost of unbundling will remain the greatest issue in how far LLU will spread.

The Office of the Telecoms Adjudicator (OTA) published a progress update on the status of local loop unbundling. The OTA reported that 31,000 lines had been unbundled by January 31, representing an increase from roughly 12,000 in May 2004. The number fell short of the 50,000 lines which had initially been set by the OTA for unbundling by February. In a further update, it was reported that around 40,000 lines had been unbundled by April.

Wholesale access

On February 3, BT published its response to phase 2 of Ofcom's strategic review of the UK telecommunications industry. BT has said that it agrees with the regulatory principles set out by Ofcom in November 2004. Its key proposals include:

- setting up an access services division to provide transparent and equal access to BT's local network
- setting out access ground rules for 21st Century Network (21CN)
- cutting a range of wholesale broadband prices and introducing faster services
- reaffirming commitment to LLU and proposing a further price cut
- increasing the commercial attractiveness of Wholesale Line Rental (WLR).

Proposing to form an access services division could offer the transparency required by Ofcom and wholesale customers, who want greater assurance that access services would be offered on a more equal basis to BT Retail and its competitors. However governance of such an organisation would be the key to its success or failure. Although the division would remain part of BT it is proposed that it would have a separate board with independent members. BT has even suggested that one of those could come from Ofcom. It will require a leap of faith for some of BT's competitors to buy into this idea. Also, we wonder whether BT could be making itself a hostage to fortune by proposing this idea now.

The remainder of BT's proposals centre on making broadband access services and WLR more attractive commercial propositions to BT's competitors. The level of price cuts is a judgement. Wholesale customers will always want more for less, and, in the end, Ofcom will have to take a view on the reasonableness of the proposals. The most interesting aspect though is that BT is considering reducing prices in areas where there is high density of demand. This proposed reduction would be delivered to service providers in the form of a rebate.

On June 23, BT announced that it had agreed in principle with Ofcom to set up a separate Access Services Division as part of the proposed settlement to the current Strategic Telecommunications review. The unit (as yet unnamed) will have its own HQ, brand and will be set up in months with oversight by Equality of Access Board (EAB) appointed in consultation with Ofcom, but will remain part of BT.

BT has also said it will work with Ofcom to ensure there is Equivalence of Input - meaning all operators will have access to the same products, processes, and prices.

Ofcom is due to publish its full findings on the Strategic Review on 30 June; with a short consultation period to follow.

Following a request from Ofcom, BT agreed that it would not lower the price of its wholesale products, IPStream and DataStream, until there are 1.5 million unbundled lines in the UK. This move followed concerns by unbundlers that the process would become financially unviable in the face of price cuts by BT.

5.2 Impact of competition

Price

The UK currently remains ranked 4th in the price index table, Figure 5.1.

The price index is calculated as the price of the top 5 retail ISPs, weighted by market share. Prices used are for mainstream residential products and include connection fees amortised over a three-year period and are adjusted for purchasing power parity (PPP).[7] In order to give a value between 0 and 1 for this index a PPP price of USD200 or less (per year) is allocated a score of 1, with a PPP price of USD800 or more allocated 0. A linear scale is used between these points.

Figure 5.1: Price Index at Q1 2005

	Q1 2005	G7 rank Q1 2005	G7 rank Q3 2004	G7 rank Q1 2004
Japan	0.98	1	1	1
France	0.94	2	2	4
Canada	0.77	3	3	2
UK	**0.72**	**4**	**4**	**3**
Ireland	0.67			
Sweden	0.63			
Australia	0.63			
US	0.62	5	5	6
South Korea	0.53			
Italy	0.50	6	7	7
Germany	0.41	7	6	5

Source: Ovum

[7] Prices are converted from local currency to USD using the exchange rate from the same time as the PPP factors to ensure consistency.

Customer choice

At end of March 2005, 97.7% of the UK population (households) had access to a terrestrial mass-market broadband solution. This represents an increase of over 3% on coverage estimates in the Q3 2004 report. Similarly, 44% of the UK household population had a choice of two terrestrial broadband technologies, and 7% had a choice of three technologies.

We have calculated an availability index which is a measure of the percentage of the population with access to a terrestrial broadband solution (naturally a value between 0 and 1).

Figure 5.2: Availability Index at Q3 2004

	Q1 2005	G7 rank Q1 2005	G7 rank Q3 2004	G7 rank Q1 2004
UK	**0.98**	**1**	**1**	**3**
Korea	0.97			
Japan	0.95	2	2	1
Germany	0.90	=3	3	2
France	0.90	=3	6	6
Sweden	0.90			
US	0.89	5	7	7
Canada	0.86	6	4	4
Italy	0.85	7	5	5
Australia	0.80			
Ireland	0.74			

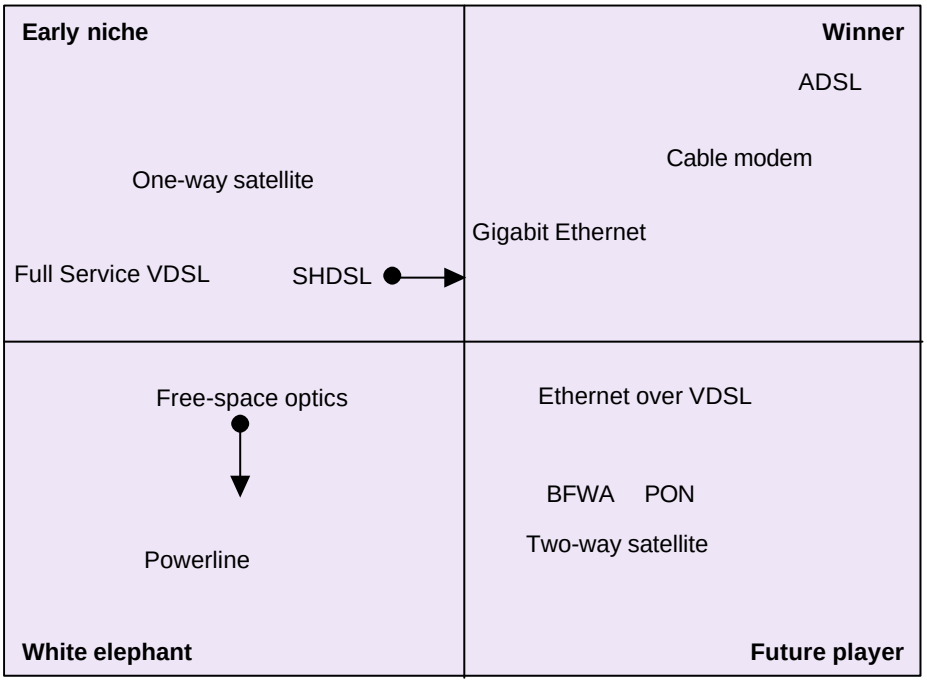
Source: Ovum

Figure 5.2 shows that the UK, with an index of 0.98, remains ranked first in availability in the G7.

Annex A: Broadband technologies

Figure A1 shows the access technology landscape as we see it today. This is a snapshot of the market and we expect technologies to move around the grid as time progresses. The arrows show how we expect some technologies to move in the medium term. For further details of each technology please refer to the individual documents within this series.

Figure A1 **Broadband access technology landscape**



Source: Ovum

Note: PON stands for Passive Optical Network

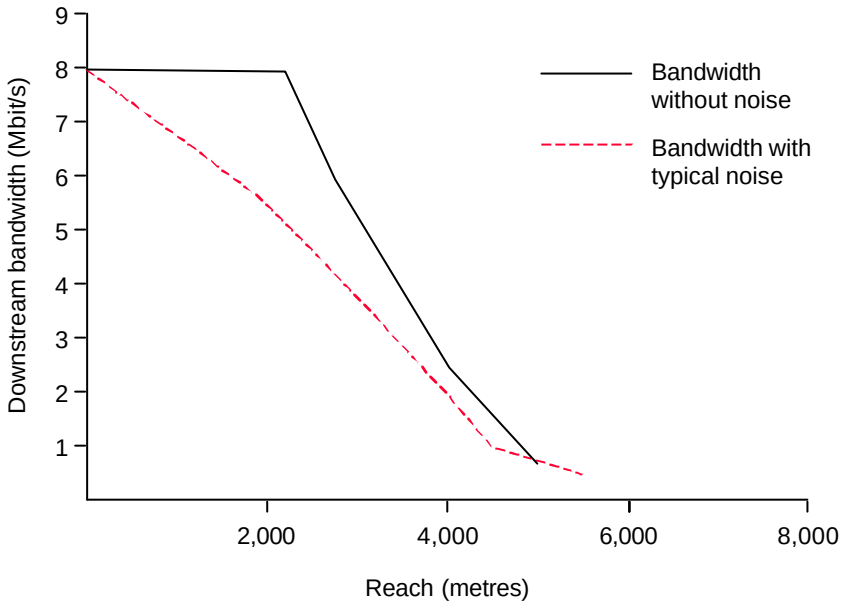
A1 DSL in general

DSL has a distinct advantage over other fixed access network technologies, as it enables the incumbent operator to re-use its investment in its copper infrastructure, which, at least in more developed countries, is already deployed to cover a high percentage of the population. For a typical incumbent operator, the access network can account for approximately 70% of its network costs, and it is therefore important to make this investment work as hard as possible. DSL is also important for competitive operators, as it allows them, either through local loop unbundling or

wholesale access, to gain access to broadband markets without having to deploy their own local access network.

However, DSL is not the perfect broadband technology, as there is a trade-off between reach and bandwidth. The decline of bandwidth with the length of the copper local loop is shown in Figure A2 for the most popular DSL technology, ADSL.

Figure A2 **ADSL – reach versus bandwidth**



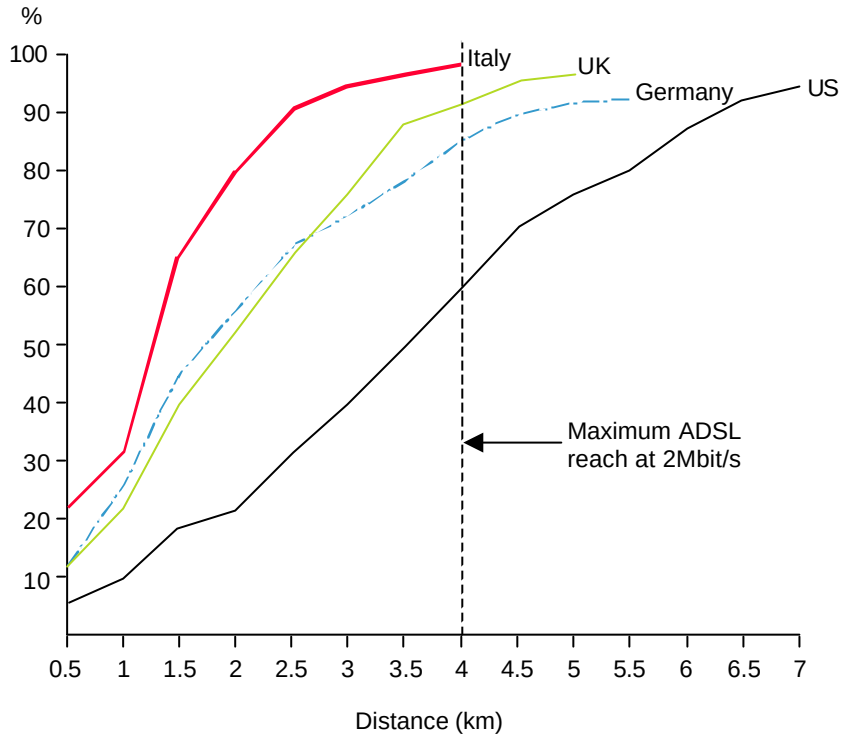
Note: these figures are for 0.5mm copper wiring. Reach depends on the size, age and quality of the wiring used

Source: Fujitsu

The practical implications of this trade-off vary between countries and regions. Different countries have different average local loop lengths, as shown in *Figure A3*. The proportion of customers within the range of 2Mbps ADSL services can vary from as little as 60% in the US to more than 90% in countries such as the UK and Italy, although in practice this simple picture is complicated by other factors.

Naturally, within countries, longer loops tend to be in rural areas and the outer suburbs, so there is a particular problem in providing broadband services by DSL in these areas.

Figure A3 **Local loop lengths in Europe and the US**



Source: IEEE Communications

Overview

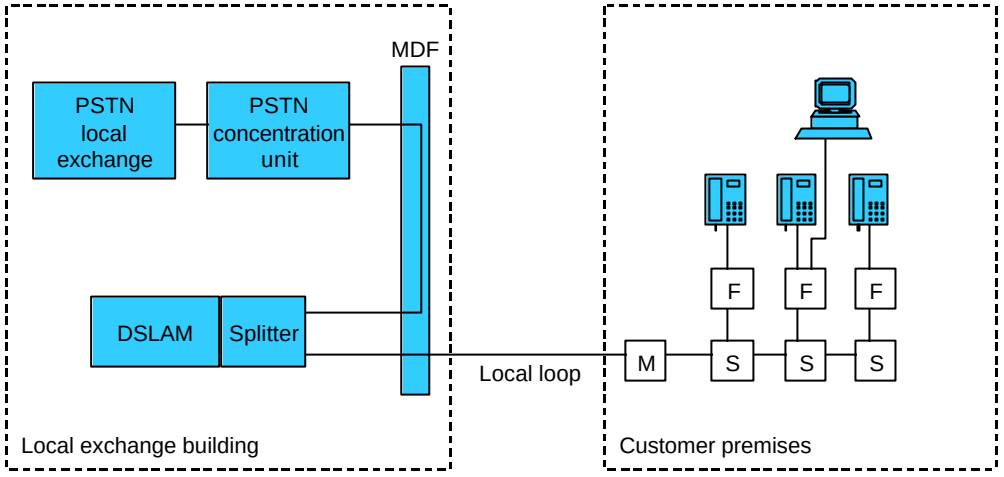
ADSL is an asymmetric broadband access technology that was specifically designed for the residential market. However, due to the lack of any other cheap broadband solution in this bandwidth range, ADSL is also proving reasonably popular in the SME market. Being asymmetric, it is ideal for any broadband service where the majority of the traffic flows in the downstream direction – which of course includes high-speed Internet access. So far, high-speed Internet access has been the main service offered by operators, and this is currently where the customer demand lies.

ADSL operators are now increasingly focusing on the development of new broadband services that will generate additional revenue streams. Today, most ADSL tariffs are based on a flat rate, offering unlimited Internet access for a fixed monthly charge. This simple service has succeeded in attracting customers, but does not allow operators to increase the revenues per user, which they now need to do.

Network architecture

On the whole, ADSL is thought of as an exchange-based solution. The basic architecture is shown in *FigureA4*.

Figure A4 **ADSL system implementation (exchange-based, with microfilters)**



M = master socket

S = extension socket

F = filter

MDF = main distribution frame

Source: Ovum

The installation of ADSL on a line leaves the traditional PSTN equipment for the delivery of PSTN voice services largely unchanged, which is a big advantage. All the local loops at an exchange terminate at a main distribution frame (MDF), which cross-connects each local loop to the corresponding copper pair from the PSTN concentration unit. When a customer orders ADSL, their local loop is diverted and plugged through to a DSL access multiplexer (DSLAM) via a splitter. The splitter separates out the ADSL and voice signals electronically. The voice channel is routed back through the MDF to the concentration unit, and the data signal is routed through the DSLAM to the backhaul data network. This re-routing of the local loop has to be done manually and can add significantly to costs, delays and errors in setting up DSL services.

The voice and data signals also need to be distinguished at the customer's premises. In the original architecture for ADSL, this is done by another splitter at the point of entry to the premises, which in effect divides the home network into separate voice and data parts. The problem with this is that installing such a splitter is a job for a telecoms engineer, making it very difficult to provide ADSL profitably, and at an acceptable price for the consumer mass market.

The solution has been not to split the home network at all, but to use microfilters instead. A microfilter is a low-cost device that filters out the high-frequency broadband signal on a DSL line. It is installed by plugging it into a phone jack and then plugging the telephone lead into the back of it – something customers can easily do for themselves. The microfilter protects the phone from interference due to use of the line for ADSL. The ADSL modem is plugged into the same shared home network and itself filters out the low-frequency voice signals to forward just the broadband data to and from the user's computer.

This microfilter-based approach is what has made user self-installation of ADSL possible. Self-installation is now virtually universal for consumer ADSL services and in each country where it has been introduced, it has stimulated rapid growth in DSL numbers at a much more attractive cost from the operator's point of view.

ADSL is the most successful broadband access technology today. In terms of subscriber numbers, it crept ahead of cable modems in late 2001. We predict that ADSL's advantage over its main competitors will continue to increase over the next five years.

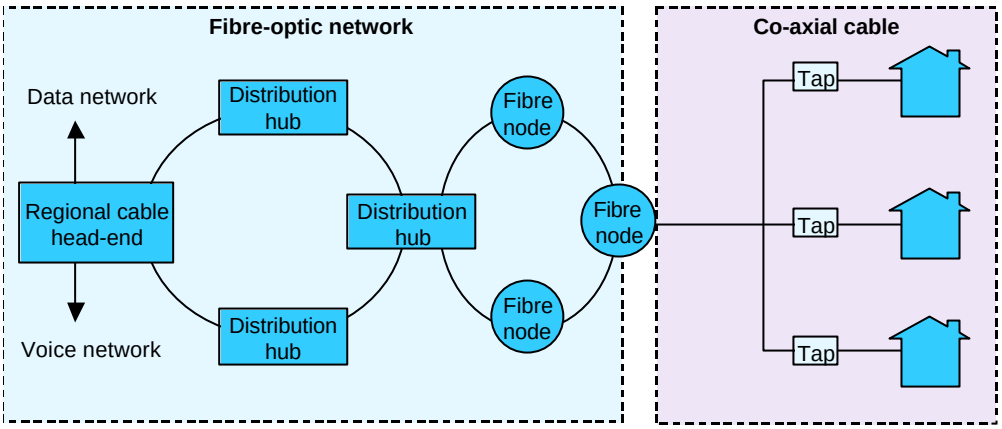
A2 Cable Modems

TV to Internet

Cable networks were originally deployed for the delivery of broadcast TV services. To make sure that standard TV sets could be used, the operators simply recreated the analogue TV signals on the co-axial cable. As the only service delivered was TV, there was no need to develop a two-way communications network, and thus the first cable networks were one-way only.

To deliver both TV and high-speed Internet access, and to support two-way communication, the newer cable networks use a hybrid fibre co-axial architecture, shown in *Figure A5*. Most older networks are in the process of being upgraded to this standard as well.

Figure A5 **Hybrid fibre co-ax cable architecture**



Source: Ovum

Cable and voice

To enable voice services over the cable connection, the network has to be further upgraded for the delivery of voice-over-IP. This means significant additional investment in telephony infrastructure. Operators need softswitch and gateway components and users need to be connected through DOCSIS 1.1 equipment. Deploying triple play may become inextricably linked to multimedia upgrades in the HFC network and a replacement programme for user CPE.

In the UK and Spain, this upgrade has been unnecessary as the operators have deployed combined HFC and twisted copper pair access networks, with voice services carried over the copper pair. However, as this is not a true multimedia solution, operators will need to upgrade over time as multimedia applications become more significant.

US and Europe: PacketCable and IP Cablecom

The Cable Labs-initiated PacketCable project was launched to define a method of carrying multimedia traffic, with varying levels of QoS, over cable infrastructure. Other objectives include support for VoIP network management, provisioning, security and billing. DOCSIS 1.1 was chosen as the technical starting point because of its enhanced QoS features.

In Europe, ETSI has developed additional standards for the European cable industry under the banner of IP Cablecom. Although these – for the most part – follow PacketCable closely, the need for a development path that includes existing circuit-switched telephony equipment is stronger in Europe. Many European cable

companies have deployed telephone service using conventional voice switching and separate voice pairs.

VoIP

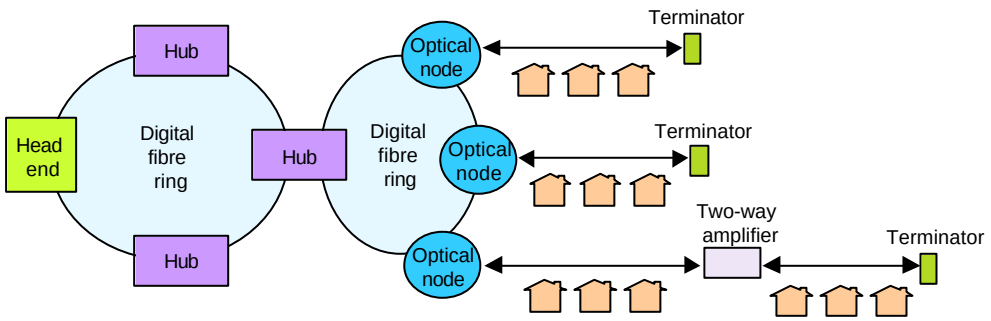
PacketCable was designed with the goal of absolute parity of voice services between cable and the PSTN. At the time that the PacketCable standards were developed, Internet usage was less and VoIP quality was much poorer than it is today.

VoIP quality is now very high, providing that network latency is sufficiently low. In any event, users' expectations of a phone service have decreased. Cellular phones offer a lower quality call – lower than VoIP – and are widely used. Against this background occasional periods of reduced quality have become acceptable within a phone service. This means that operators looking to move into voice do not necessarily have to go down the more costly PacketCable route as it is viable to launch a second-line voice service much more cheaply.

Providing QoS and voice – deep fibre architecture

In order to move beyond Internet services that can only provide a low guaranteed rate, in addition to voice-enabling the network, operators are carrying out deeper upgrades. For example, in the US, the need to have an extremely reliable backbone for telephony coupled with expansion of channels and offering of business services has led cable companies to push out fibre ring architecture deeper into the network, as shown in *Figure A6*.

Figure A6 **Deep fibre architecture**



Source: Ovum

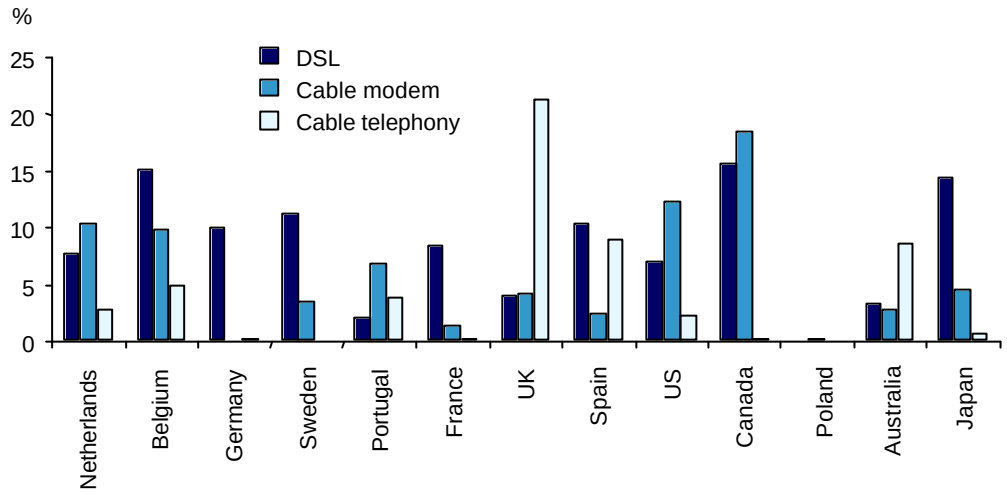
The architecture also removes amplifiers from the segments, making them entirely passive and hence more reliable. The number of homes per node generally needs to be reduced to 250 or fewer if passive segments are used.

On the whole, cable modems have been a success. However, ADSL has now overtaken cable modems in terms of worldwide subscribers, and its lead will increase. This is due to the following factors:

- availability of cable modems differs greatly between countries, depending on the extent of the local cable TV networks
- not all networks are upgraded to support cable modem
- operators have limited investment resources

Figure A7 shows the varying penetration of cable modem penetration compared to DSL and the existence of cable telephony (or not) in key markets.

Figure 3 **Cable modem, DSL and cable telephony penetration, end of 2002**



Source: Ovum

A3 FWA

Overview

Fixed wireless access (FWA) could be described as the most complicated of all fixed access technologies. At the last count, we listed more than ten acronyms for technologies in this area. The vice president of a telecommunications company once told Ovum that he would consider using FWA, if only he knew what it did! With the division between what is mobile and what is fixed blurring, this is getting even worse.

The basic facts of FWA

FWA bypasses the local loop by using radio technology to connect the customer to the exchange. Any issues related to local loop unbundling, digging optical fibre ducts and so on can therefore be ignored.

FWA services are allocated bands in the radio frequency spectrum. For example, mobile services usually operate in the 800–1,000MHz or 1,700–to 2,000MHz frequency bands. FWA services generally use higher frequency bands, with allocations somewhere in the range of 2.4GHz up to more than 40GHz. (Hertz, or Hz, is the unit of frequency and 1Hz is one cycle per second, so FWA signals are carried on radio waves with frequencies from 2.4 billion to 40 billion cycles per second.)

Essentially, the higher the frequency band the system works in, the greater the bandwidth available. However, as the frequency increases, so the range and the ability to receive signals that are not in the direct line of sight decreases. Less range means more base stations to cover the same area, and the line-of-sight requirement means lower penetration of the area covered, or installing even more base or repeater stations to fill the gaps.

Some parts of the spectrum are licensed and some are not. Licences can be expensive and carry strict conditions, but non-licensed spectrum can be 'noisy' and therefore susceptible to interference.

Most equipment can work at a range of different frequencies and so can be modified to suit different frequency allocations in different countries. This can even include mobile spectrum if it is not currently being used for mobile services.

Depending on the frequency and modulation scheme being used, radio service distances can range from 1 kilometre to 35 kilometres, and bandwidths can range from 64kbps to hundreds of Mbps.

Unlicensed bands (2.4GHz to 5GHz)

The lowest-frequency FWA bands, in the 2.4GHz and 5GHz regions, can be used without a licence in most countries. They are often known as the ISM (industrial, scientific and medical) bands and a huge variety of devices generate signals in this range, from microwave ovens to garage-door controls. They are now becoming increasingly important for low-cost fixed wireless services, and also as the frequency bands used by wireless LAN services.

With the agreement of the IEEE standard 802.11a/b, wireless LAN hotspots are being installed in thousands of locations. The UK has approximately 50% of the hotspots in Europe. The concept of a 'hotspot' is to have a small area, such as an airport lounge or a cafe, where people can access the Internet directly from a laptop computer using a very local radio signal.

Alternatively, independent operators can use this spectrum, using different signalling technology, for true broadband FWA – up to 1Mbps (burst) over 6 kilometres. Wireless ISPs have been using these frequencies to serve small groups of customers in the US and Latin America for some years, but up until now this has been rare in other parts of the world.

IEEE 802.16a/WiMAX

The advantage of 802.11 over other FWA technologies is that it is a standardised technology. This allows interoperability between equipment as well as economies of scale, which enables low equipment prices. However, 802.11 is not ideally suited for use in local access, albeit that some operators are using for just that. However, a third standard, 802.16, has been developed to have the same advantages as 802.11 but be better suited for use in the access network.

802.16, otherwise know as WiMAX, covers the frequency bands in the range between 2GHz and 11GHz. This flexibility and frequency range allows operators to tune into the frequency plan of its home country whilst allowing bandwidths of just under 100Mbps per sector.

Supporters of the technology claim it is not dependent on line of sight, but this will not be the case at frequencies over 3GHz in practical deployments.

3.5GHz

The 3.5GHz band shares the same technical characteristics as the 2.4GHz and 5GHz bands, but it is a licensed band in most countries. Most technologies that work in this area can also work in the 2.4GHz and 5GHz bands.

Early 3.5GHz systems concentrated on narrowband ‘wireless local loop’ type services – generally voice only. Ionica in the UK was a prime example. This is because at 3.5GHz, bandwidth is limited, and to reduce equipment costs, point-to-multipoint architectures are required. Therefore, to capture a large customer base, the bandwidth that is available must be shared out thinly. As voice requires only 64kbps (assuming no encryption), voice only over FWA seemed logical from a technology point of view. Unfortunately, the business case did not work and companies such as Ionica have disappeared.

However, new technologies have now been developed that enable operators to deliver broadband FWA with both voice and data (bursting at Megabit rates) to customers using the 3.5GHz band. At the same time, using the 3.5GHz band has benefits because it allows reasonably wide-area coverage. Although technically 3.5GHz is less dependent on line-of-sight access than higher frequency systems, in practice it must be considered as a line-of-sight technology.

MMDS (2.5–2.7GHz)

Multipoint multichannel distribution service (MMDS) was originally designed to induce competition in the US cable TV market. The initial systems therefore transported data only in the downstream direction, and so could not be classed as a true communication medium. However, the frequency plan has now been upgraded to allow communication in both directions.

Apart from the fact that they use slightly different frequencies, there is no fundamental difference between MMDS in North America and 3.5GHz FWA in the rest of the

world. The reason for the use of different frequencies was that the 2.5–2.7GHz frequency bands had already been assigned for other purposes in Western Europe and Latin America.

LMDS (over 20GHz)

Local multipoint distribution service (LMDS) is the term generally used in the US; in the rest of the world these bands are more often known by their frequency (26GHz and so on). LMDS was designed to be the radio world's answer to broadband access. Operating above 20GHz, LMDS can deliver bandwidths in the region of 150Mbps and above. Unlike MMDS, LMDS was designed from the start for two-way communications and was intended to be a true competitor to xDSL and even fibre-optic access.

Although there was a rush of interest in licensing and launching services in these bands at the time of the telecoms boom, the actual results have been disappointing. The costs proved too high, and the technical difficulties too great, to support viable services at frequencies over 20GHz. There are only a handful of end users of these services today, and these are generally on a trial basis. The most promising applications for the time being are probably in backhaul for mobile base stations.

Trials have been carried out with systems working at over 40GHz. One possible application is to provide infill for broadcast TV coverage in mountainous regions. The range at 40GHz is very short, but such services may be well adapted to cover a narrow mountain valley, for example.

Mesh

Mesh FWA uses the same frequencies as LMDS (but could be deployed at any frequency), but is a completely new access solution in terms of its architecture. A mesh system is fundamentally a multipoint-to-multipoint access solution. This means that a customer's receiver is also a transmitter, and paths are formed by hopping from one customer to another. By spreading receivers around a city, the issues of short reach and low penetration can be resolved.

The technical problems are challenging, such as those related to routing to achieve efficient coverage, but mesh systems could eventually provide the means to make LMDS a cost-effective and attractive broadband solution.

Wireless point-to-point

FWA solutions are generally point-to-multipoint, sometimes known as PMP. That is, a single central hub sends to, and receives from, a number of FWA users. The alternative of point-to-point (PTP) is used mainly for trunk connections within the backhaul network or to connect large business customers when an optical fibre connection is either impossible or not economically viable. An alternative use is for backup when there is only one fixed-line access into a building.

These systems are usually fully SDH-capable to provide carrier class of service, and are generally very expensive.

Outlook for FWA

It is fair to say that broadband FWA has not seen much success, and many analysts see it as a complete failure. We believe the failures are mainly due to the following problems:

- although licences are not required for all FWA bands, larger operators prefer to use licensed spectrum as it provides better quality. However, in many countries the licences have been expensive and are restrictive in their use
- in some countries (especially in Europe), many regulators forced the operators to achieve a certain geographic coverage in a specified amount of time. This led to operators deploying expensive network equipment in areas where there was little or no demand
- some business cases were just plain wrong. Deploying broadband FWA in large cities, where heavy competition already exists, was always going to be tough
- the downturn in the telecoms market caused much-needed investment to dry up
- differing frequency plans and licences around the world have hindered economies of scale, and therefore equipment is still expensive.

However, we do not believe that the broadband FWA market is dead. It still has potential in countries or areas where other forms of broadband access are not available. Some broadband FWA technologies could also be used in heavily populated areas to provide a cheap but low-quality connection for Internet access.

Changes in regulations and licensing procedures, together with great advances in technology, mean that there is light at the end of the tunnel for BFWA. WiMAX is also bringing equipment costs down and allowing self-installation for the very first time – both will improve BFWA's chances of some success in the future as a niche market product.

Broadband FWA will never be as large as ADSL or cable modems, but we believe that it does serve a certain need in the access market. Fixed-line technologies will never be able to reach every customer in every part of the world, and this is where FWA comes in. FWA will have more success in developing countries, where fixed-line infrastructure is poorly developed.

A4 Satellite

The history of satellite telecommunications, since the launch of the first civilian communications satellite, Telstar, in 1962, is one of missed opportunities and isolated spectacular successes that have been matched, in recent years, by spectacular failures. Over the last 40 years, satellite's relationship with terrestrial telecommunications has wavered between being a pre-cursor, a competitor and a complementary service.

Some fundamental strengths of satellite are consistent:

- satellite is an ideal wide-area point-to-multipoint delivery mechanism. This is central to the success of satellite broadcasting. It has also allowed very small aperture terminal (VSAT) services to achieve some success, particularly in North America, even in areas where terrestrial alternatives are available. VSATs are moderately-sized dishes that make it economical to provide communication services via satellite to widely spread business locations
- satellites provide coverage in areas that may be economically marginal for terrestrial technologies. A single geostationary satellite can see as much as 42% of the earth's surface
- in principle, a satellite network can be deployed in a fraction of the time it might take to implement its terrestrial equivalent.

Set against these advantages are some significant drawbacks of satellite solutions that have inhibited their mass-market adoption to date:

- line-of-sight is required between the user and the satellite
- the economics for providing point-to-point services have yet to be proven and remain doubtful in areas where terrestrial alternatives exist
- networks are only as flexible as the ground segment allows; adjustments to the space segment are impossible after launch
- even at the speed of light, it takes approximately 0.3 seconds for a signal to travel from a ground station to a geostationary satellite and back to Earth again. This unavoidable latency is a serious disadvantage for some realtime broadband applications such as video conferencing
- launch and in-orbit failures are unpredictable.

One-way satellite systems

Most current satellite Internet access traffic is from hybrid access, whereby the user connects to the Internet via a normal phone line but downloads via satellite to a small dish (similar to a satellite TV receive-only antenna). The technology takes advantage of the asymmetric nature of most Internet usage, with narrowband browsing combined with satellite's strength in wide-area broadband distribution services.

Two-way satellite systems

Two-way satellite systems are gaining ground rapidly. As precursors of future Ka-band systems, two-way Ku- and C-band services already account for almost as much revenue as the hybrid services.

Satlynx, a joint venture launched in June 2002 between Gilat Satellite Networks, SES Astra and Alcatel, offers two-way satellite packages that are re-sold by a number of carriers to extend their broadband services. Services based on this platform typically offer uplink speeds of up to 150kbps and downlink speeds up to 8Mbps. A proprietary protocol is used for the uplink, with the downlink using the DVB standard.

Practical transmission rates for these services vary widely – an inherent issue with satellite systems that are based on shared transponder capacity, because the ratio of user demand to available capacity changes rapidly as the system grows. The uplink speed seen by a user at peak times may drop to 50kbps, although the massive downlink capacity of a satellite transponder means that downlink congestion is less likely to be an issue.

VSAT and corporate services

All of these systems have developed out of traditional VSAT technology. Such systems were originally designed for distribution of data from a central hub to multiple receive-only terminals, such as at car dealerships. In these markets in North America, the one-to-many advantages of satellite systems have ensured that VSATs have held their own even where terrestrial networks are available. They have evolved to two-way networks with progressively smaller and cheaper remote terminal equipment and faster transmission speeds. For the most part, however, their cost and complexity limits their market to large or medium-sized corporations. Generally, equipment and airtime are bundled into a monthly rental spread over approximately three years.

The latest VSAT systems can offer faster download rates than are available from hybrid and two-way consumer services. For example, Gilat's Broadband Interactive system provides DVB-based downlink services at speeds from 2Mbps to 38Mbps (which can then be shared among multiple user PCs).

Future development with Ka-band

Now that the first broadband Ka-band systems are becoming available, we expect them to overtake existing VSAT, hybrid and two-way systems. The services planned represent a massive leap forwards from those available today, with 2Mbps uplinking by individual users and download rates of between 10Mbps and 100Mbps. User terminals are planned to cost under $1,000 (with a target of $500), but this is a circular equation, dependent on the achievement of mass-volume production.

A5 Other Broadband Access Technologies

Ethernet over VDSL

Ethernet over VDSL is currently a proprietary technology using Ethernet at the layer 2 rather than ATM. It is cheaper than full service VDSL, but due to the lack of standards is not deemed to be 'carrier class'. Therefore, this technology is currently being deployed in Gigabit Ethernet networks within the MTU buildings. As the technology is standardised, street deployments will be possible. With the technology being Ethernet-based, we see it as the next step on from ADSL2+ (which we believe will eventually also be mainly deployed as an Ethernet solution), and therefore is a future winner, eventually taking the place of full service VDSL.

SHDSL

Symmetrical high-speed DSL (SHDSL) fills a need in a certain niche market. It is the only ATM-based DSL technology that can currently provide a true leased line replacement service, and the only standardised DSL technology that supports pair bonding. Therefore, even though SHDSL has not taken off in the way everybody first thought, we believe it still has a place to play in the broadband future and will therefore eventually move out of the 'early niche' section and into the future winners.

Gigabit Ethernet

Although Gigabit Ethernet is still a young technology we believe it has already booked its place in the broadband future. As well as providing direct services, this technology will eventually replace SDH in the metro space. However, obstacles to its deployment still exist today. The main ones are immature technology solutions and the high cost of deploying optical fibre into the access network. Currently, its main successes are in the multi-tenant unit (MTU) and large corporate LAN interconnect markets.

Powerline communications (PLC)

Powerline technology is unlikely to be a mass-market success in the broadband access market and will find it challenging to compete effectively with DSL, cable modems or broadband fixed wireless access for two main reasons:

- Interference to wireless and other systems remains a major problem. In Europe, measuring and setting standards for this interference remains part of an ongoing debate on how to manage the problem while recognising in principle at least the potential of PLC for providing broadband access. A four-year EU-assisted project is underway to help to solve this problem but we do not expect any major breakthroughs.
- Difficulties in scaling up solutions based on PLC technology scale. A large number of nodes at sub-station transformers need to be powerline-equipped to provide any decent level of broadband availability in an area which negatively impacts the business case for deployment.

PLC may find opportunities inside the customer's premises. As home networks start to take off, using the existing electricity infrastructure could be attractive to homeowners. However, wired Ethernet and 802.11 wireless LAN (WiFi) are cheaper solutions, and are expected to dominate home networking.