



Final Report for the Department of
Trade and Industry (DTI)

Sophisticated broadband
services

28 November 2005
Our ref.: 307-445

Analysys Consulting Limited
St Giles Court, 24 Castle Street
Cambridge, CB3 0AJ, UK
Tel: +44 (0)1223 460600
Fax: +44 (0)1223 460866
consulting@analysys.com
www.analysys.com

Sophisticated broadband services

Final Report for the Department of Trade and Industry (DTI)

Contents

0	Executive summary	i
0.1	Fixed coverage	i
0.2	Mobile coverage	iii
0.3	Initial coverage conclusions	v
0.4	Initial usage conclusions	vi
1	Introduction	1
2	Coverage of sophisticated broadband services – methodology	3
2.1	Technical limitations of DSL technologies	4
2.2	Distribution of line lengths	5
2.3	UK-specific analysis	7
3	Coverage of sophisticated broadband services – results	8
3.1	Interpretation of the results	9
3.2	United Kingdom	10
3.3	Australia	15
3.4	Canada	17
3.5	France	19
3.6	Germany	22
3.7	Ireland	24
3.8	Italy	26
3.9	Japan	29
3.10	South Korea	30
3.11	Sweden	32
3.12	US	34

4	Usage of sophisticated broadband services – results	37
4.1	Methodology for business indicators	38
4.2	Methodology for residential indicators	40
4.3	Results for business indicators	42
4.4	Results for residential indicators	50
4.5	Trends analysis articles	57

0 Executive summary

This document is the second report of the study commissioned to Analysys by the Department of Trade and Industry (DTI) to examine the market for sophisticated broadband services across the G7,¹ Australia, Ireland, South Korea and Sweden. This report summarises Analysys's findings on the performance of these countries regarding both the availability (coverage) and usage of sophisticated broadband services. The availability (coverage) data is estimated at the end of the third quarter of 2005; the usage data is estimated mid-2005.

The coverage findings are based on a combined survey and desk research approach for fixed and mobile broadband infrastructure operators identified across the 11 countries under study. Coverage results are provided for downstream, upstream and mobile technologies.

The usage findings are based on estimates produced by Analysys through reference to free, publicly available data sources.

The next iteration of this study will be published in April 2006.

0.1 Fixed coverage

Exhibit 0.1 below shows the availability of 1, 2, 4 and 8Mbit/s *downstream* services in each of the countries included in the study. This chart (and similar ones later in the report) is ranked on the availability of 1Mbit/s services.

¹

Canada, France, Germany, Italy, Japan, UK and US.

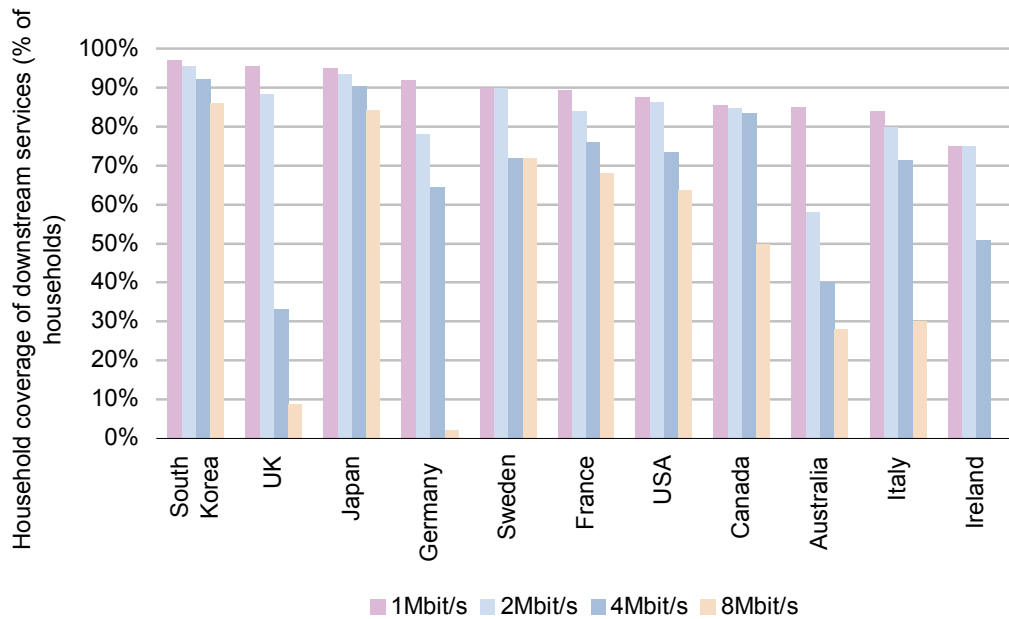


Exhibit 0.1: Availability of downstream sophisticated broadband services by country, Q3 2005
[Source: Analysys]

As can be seen from the chart above, the UK performs well in terms of the availability of 1 and 2Mbit/s services, but is currently not matching the performance of other countries included in the study in terms of 4 and 8Mbit/s availability. A number of operators have announced trials or launches of higher-speed broadband services over the last few months. For example, Be has recently launched ADSL2+ services running at up to 24Mbit/s (1Mbit/s upstream) to around 40 exchanges in London. BT has announced the expansion of its Max DSL trial, which examines the provision of rate adaptive DSL up to 8Mbit/s, with a plan to launch in Spring 2006. Operators including Easynet, Bulldog, Pipex, Wanadoo, Zen Internet and Tiscali have either announced ADSL2+ or LLUB trials or launches. These announcements, in addition to the upcoming speed upgrades from ntl and Telewest (up to 10Mbit/s downstream by the start of 2006), suggest that the availability of higher speed services in the UK is set to increase rapidly over the next six months.

The availability of 1, 2, 4 and 8Mbit/s *upstream* services in each of the countries included in this study is shown in Exhibit 0.2 below.

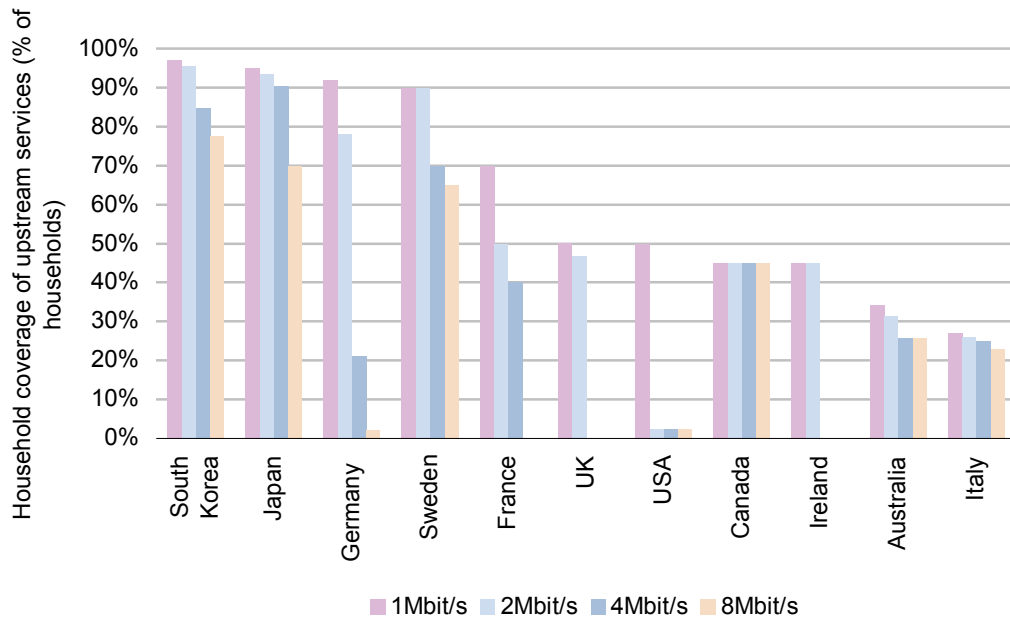


Exhibit 0.2: Availability of upstream sophisticated broadband services by country, Q3 2005
[Source: Analysys]

As can be seen from the chart above, the UK is towards the bottom of the rankings on the availability of upstream broadband services.² Increasing availability of higher downstream speeds could lead to wider coverage of 1 and 2Mbit/s upstream services. With the lack of fibre and wireless based services (which contribute to upstream availability across a number of countries), it is unlikely that the UK will improve significantly on the current position over the next year or so.

0.2 Mobile coverage

We also provide details on the current level of 3G availability and the penetration of public WLAN hotspots across the countries included in this study.

² Including business focused products such as BT Business Broadband and SDSL. This excludes leased lines and similar bespoke services.

0.2.1 3G coverage

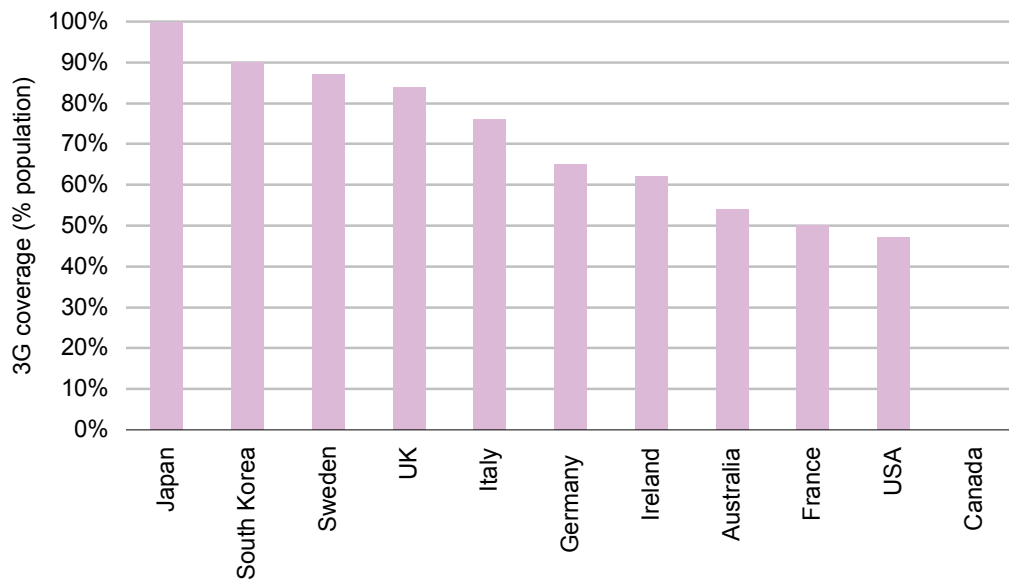


Exhibit 0.3: 3G coverage, Q3 2005 [Source: Analysys]³

Japan and South Korea lead the way in the availability of 3G mobile services, as well as leading the pack in higher-speed broadband coverage. There are currently no 3G services available in Canada. The high coverage in Japan and South Korea can be attributed to a number of factors, including the early launch of 3G services in these two countries and the high population density. South Korea may also have benefited from the award process, whereby contestants had to place bids for licences within a price range specified by the government. This may have left more funding available for network rollout than would have been the case had the licences been awarded at much higher prices.

3G licences often contain coverage requirements which must be met as a condition of the licence. For example, the Swedish licences originally contained a requirement for 99.98% population coverage by the end of 2003. This target has not been met and the regulator, PTS, has reiterated the requirement for this coverage level to be reached and has allowed the operators to share infrastructure and utilise 3G roaming to achieve this aim.

By comparison, the German 3G licences contain coverage conditions of 50% of population by the end of 2005, with operators allowed to share the passive components of their infrastructure.

³ No services have been launched thus far in Canada.

0.2.2 Public WLAN

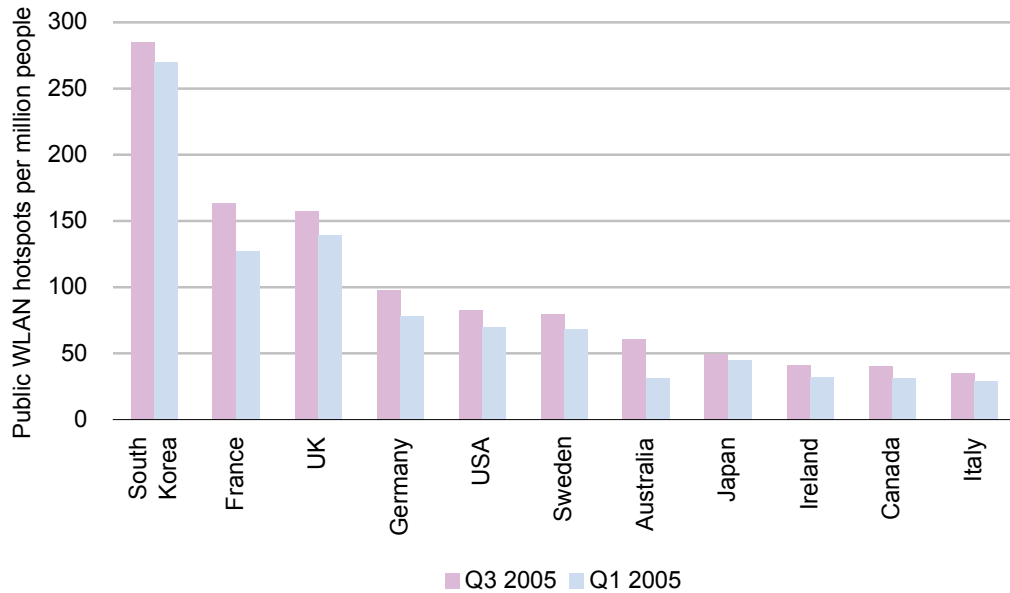


Exhibit 0.4: Public WLAN hotspots per million people, Q3 2005 [Source: Analysys, Informa Telecoms] Note: Q3 2005 estimated, Q1 2005 updated with actual data

The availability of public WLAN hotspots is considerably higher in South Korea than in any of the other countries included in the study on a per-capita basis, with France and the UK leading the group behind South Korea. The UK's figures are boosted by The Cloud's strategy of adding WLAN capability to many of its terminals in pubs and restaurants. As of June 2005, around 5000 WLAN hotspots were operated by this company.

0.3 Initial coverage conclusions

Exhibit 0.1 and Exhibit 0.2 above show that, unsurprisingly, the countries which have historically been viewed as broadband leaders (Japan, South Korea and Sweden) can also be considered as such regarding the availability of higher-speed downstream and upstream services. Following a rapid increase in the coverage of 512kbit/s broadband in the UK over the last two to three years, it is evident that the country is currently behind in terms of the availability of 4Mbit/s and higher downstream services, as well as in the overall availability of upstream services. In the short to medium term, it is likely that this picture will improve in the UK as local loop unbundlers and the cable operators introduce products with higher specifications.

For example, BT is examining the provision of rate adaptive DSL up to 8Mbit/s downstream, while a number of operators (including Be, Easynet, Bulldog, Pipex, Wanadoo, Zen Internet and Tiscali) have either launched or announced trials on LLUB or ADSL2+ services. From the start of 2006, ntl and Telewest will offer services running at 10Mbit/s downstream. However, there have been few announcements regarding increases in upstream availability. In fact, BT announced in August 2005 that their SDSL roll-out had been put on hold due to a lack of demand and, although the Max DSL service could partially fill the gap, there are few available services with comparable upstream data rates.

It is unlikely, in the short term, that the UK will be able to match the performance of Japan, South Korea and Sweden in terms of higher-speed broadband availability as these countries have benefited from a number of factors which are not directly applicable to the UK:

- government financial support for supporting network investment
- very favourable demographics for network rollout – specifically, a high proportion of multi-dwelling units (MDUs)
- a national culture of high-technology adoption and usage, and a comfort with new technology.

In terms of mobile and wireless local area network (WLAN) coverage, the UK is towards the top of the rankings thanks, in part, to the relatively early launch of 3G. True ‘nomadic’ wireless, where users can access high-speed services while on the move, is still to emerge; this may form a more compelling product than 3G for some users, though this very much depends on location and tariffs.

0.4 Initial usage conclusions

Exhibit 0.5 below shows the UK’s position compared to the other countries covered by this study for each of the indicators of Internet usage by broadband businesses (i.e. businesses with broadband Internet connections). Countries are ranked according to usage by broadband businesses.

It would appear that the UK is doing reasonably well in comparison with other countries. It is in the top half of the table for all metrics except paying government online and ordering online (where it has swapped places with Germany since 2004). It seems that the increased availability of broadband, combined with the UK government’s efforts to stimulate ICT usage, have had an impact on usage.

Rank	Ordering online	WLAN	VoIP	Paying government	Ecommerce revenue
1	Sweden	Sweden	South Korea	Sweden	South Korea
2	Canada	UK	Japan	France	Canada
3	Australia	Ireland	Ireland	South Korea	Ireland
4	US	Germany	UK	Ireland	UK
5	Germany	Australia	Sweden	Australia	Sweden
6	UK	Italy	Australia	UK	US
7	Ireland	US	US	Canada	Italy
8	Italy	Canada	France	Italy	Japan
9	Japan	Japan	Canada	US	Australia
10	France	France	Italy	Germany	Germany
11	South Korea	South Korea	Germany	Japan	France

Exhibit 0.5: Summary ranking of business indicators, Q2 2005 [Source: Analysys]⁴

Drawing detailed conclusions from the residential indicators is more problematic, due to the paucity of good source data, and the high degree of estimation that is therefore required to create them. The results must be treated with caution. Countries are only included in the summary table in Exhibit 0.6 below if they were able to produce a reasonable estimate. This means that not all 11 countries are represented for each indicator.

Rank	Downloading TV, video and movie clips	Use of online gaming	Use of VoIP	Ecommerce spend
1	South Korea	South Korea	Japan	UK
2	France	Sweden	France	France
3	Australia	Japan	Italy	Germany
4	UK	Australia	Sweden	Italy
5	US	US	USA	USA
6	Germany	Canada	South Korea	Canada
7	Italy	Italy	Australia	Japan
8	Sweden	UK	Canada	Ireland
9	Japan	France	Germany	
10		Germany	UK	
11		Ireland	Ireland	

Exhibit 0.6: Summary ranking of residential indicators, ranked by percentage of Internet users, Q2 2005 [Source: Analysys]

The UK appears in the bottom quartile for use of VoIP; the third quartile for Internet gaming; the second quartile for TV, video and movie clip downloads; and top of the group for ecommerce spend per Internet user.

⁴ The UK is second in the use of WLAN only alphabetically.

1 Introduction

The Department of Trade and Industry (DTI) has commissioned Analysys to examine the market for sophisticated broadband services across the G7, Australia, Ireland, South Korea and Sweden.

Over the past three years, the availability of ‘basic’ broadband services (i.e. a minimum 512kbit/s downstream service) has grown to over 80% in 10 out of the 11 countries included in this survey. This, combined with falling prices, has led to growing interest in both the availability of higher-speed broadband services and the usage to which individuals and organisations are putting their Internet connections – for example, use of VoIP, making purchases over the Internet, online gaming, and TV and video downloads. This study examines the market for higher-speed broadband services and usage of selected types of Internet-based content.

During a series of meetings between Analysys, the DTI and the Broadband Stakeholder Group (BSG),⁵ it was agreed that both the **coverage** and **usage** of sophisticated broadband will be tracked during the study, covering the following areas:

- **fixed coverage** – the availability, by downstream and upstream speed, of fixed broadband services (including fixed wireless access (FWA))
- **mobile coverage** – the availability of 3G mobile services, WLAN hotspots and other emerging mobile or nomadic technologies (such as WiMAX)
- **usage** – the take-up of key broadband-enabled applications and general Internet usage.

⁵ The meetings were held on 7 February, 10 March and 23 March 2005.

This document is the second report of this study and summarises Analysys's findings on the market for sophisticated broadband services. A further report will be produced as part of the study in April 2006.

The remainder of this document is structured as follows:

- *Section 2* – outlines the methodology that we have adopted for the coverage section of the study.
- *Section 3* – presents our findings on the availability (coverage) of sophisticated broadband services across the 11 countries under study.
- *Section 4* – presents our findings on the usage of sophisticated broadband services in the countries under study and the methodology employed; it also contains two short trends analysis pieces focusing on the state of a particular service and discussing market developments.

2 Coverage of sophisticated broadband services – methodology

Given the relative paucity of detailed and up-to-date broadband coverage information by speed available in the public domain, we have adopted a combined survey and desk research approach. We have identified a number of large⁶ and small fixed broadband infrastructure operators in each of the countries under study; additionally, for each of the 11 countries the mobile operators have also been identified. As shown in Exhibit 2.1, we have contacted 77 fixed operators across the 10 countries outside of the UK included in this study. In addition to these 77 operators, we have carried out desk research on a number of smaller fixed line operators to come to a complete picture of broadband availability for each country.

For the UK, we have contacted the major broadband infrastructure operators and obtained coverage data for these. We have combined this with a sophisticated geographical model to estimate broadband availability in each of the UK regions, with more details given in Section 2.3.

	<i>Operators targeted</i>	<i>Contacts identified</i>	<i>Data received</i>	<i>Refusals</i>	<i>No data supplied</i>
Australia	9	9	2	1	6
Canada	7	7	1	1	5
France	12	12	1	1	10
Germany	6	6	0	1	5
Ireland	10	9	3	1	5
Italy	6	6	3	1	2
Japan	6	4	2	0	2
South Korea	3	3	2	0	1
Sweden	7	7	3	2	2
USA	11	9	4	2	3
Total	77	72	21	10	41

Exhibit 2.1: Summary of fixed broadband operator survey [Source: Analysys]

⁶

More than 100 000 subscribers, with the exception of Ireland where we included eircom, ntl, Esat and Chorus.

Where large fixed operators have not supplied coverage information, we have estimated coverage levels using publicly available data. This estimation process is less preferable than sourcing the data directly from the operators and the results for any countries where this approach has been required for the bulk of operators (in Germany, for example) are subject to lower levels of confidence.

The data sources we have used for this estimation process include:

- operator Web sites
- press coverage
- industry resources/Web sites
- technological limitations of different technologies (for example, see Section 2.1)
- underlying demographic data.

As would be expected from such an exercise, the accuracy of any such estimations is heavily dependent on the amount and quality of the available source data.

In the case of mobile operators, data regarding 3G coverage on these operators was, where available, drawn from mobile operator profiles held by Analysys Research.

In summary, there are some gaps in the data that is available in the public domain. In these cases, we have had to make estimates based on our own experience. However, over time, we would expect the amount of estimation to reduce, both as more services become available and operators publicise their coverage more.

2.1 Technical limitations of DSL technologies

ADSL is currently the most widespread DSL variant for broadband, although ADSL2+ deployments are now becoming more commonplace. Exhibit 2.2 shows the maximum downstream speed achievable using these two variants of DSL by line length, and shows that ADSL and ADSL2+ offer similar speeds where the line length is over 3km, with ADSL2+ offering considerably higher speeds below this distance. Other variants, such as VDSL, offer even higher downstream speeds, but over much shorter distances.

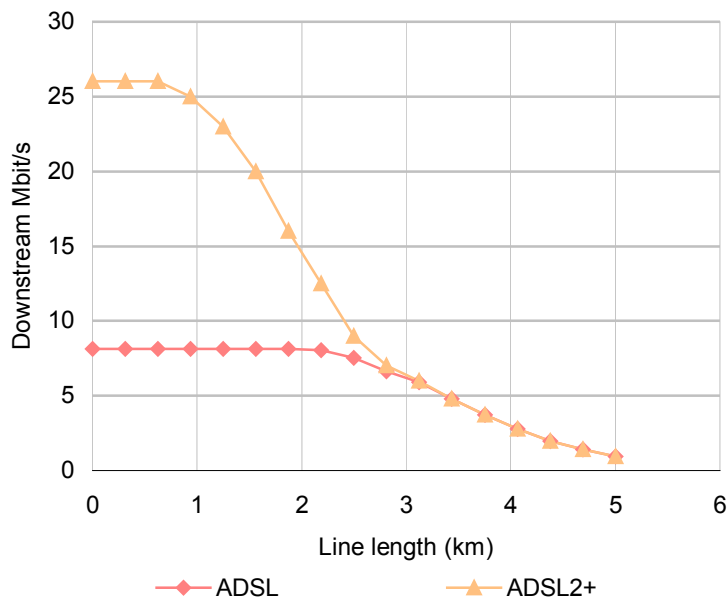


Exhibit 2.2:
Maximum
downstream speed
of ADSL and
ADSL2+ by line
length [Source:
Analysys]

The variation of performance with distance has implications for end-users and reduces the size of the addressable market for a given speed. In order to interpret this fully, the distribution of line lengths is needed.

2.2 Distribution of line lengths

Exhibit 2.3 below shows the distribution of the length of the incumbent's copper lines across a number of countries, ranked in order of increasing line length. Each individual exchange will have its own distribution of line lengths and this chart can only be used as an indication of the correction factor that will need to be applied to coverage statements due to technical limitations. For example, consider the case in which an organisation enabled sufficient exchanges in the UK with ADSL2+ to cover 50% of PSTN lines. The lines enabled by this organisation would not all be of 2km length or less, and so a correction factor would need to be applied to estimate the actual coverage of 15Mbit/s services (the maximum speed available over a 2km copper line).

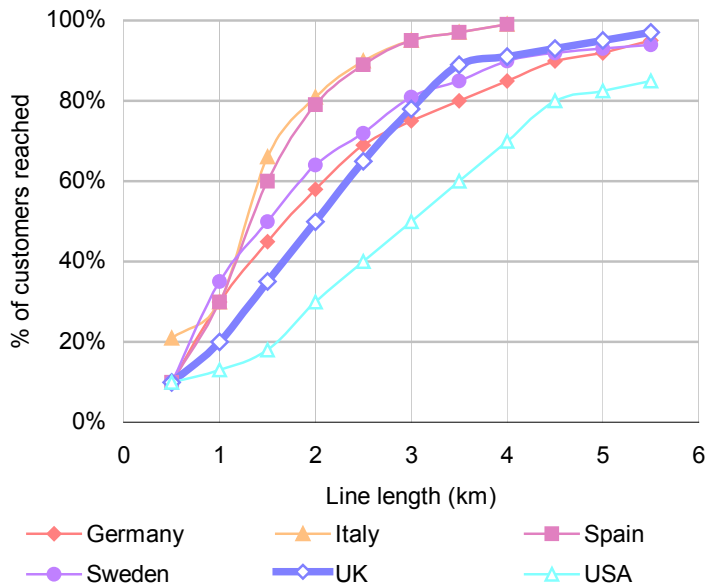


Exhibit 2.3:
Distribution of copper line lengths
[Source: IEEE, Telefónica]

The chart above can therefore be combined with Exhibit 2.2 to give an indication of the *theoretical distribution of maximum speed* (excluding issues of line material and quality of installation) using ADSL2+ and ADSL technologies that can be achieved in the UK, as illustrated in Exhibit 2.4 below. This shows that, for example, ADSL2+ technology could potentially offer approximately 15Mbit/s to 50% of lines compared to 8Mbit/s via ADSL. It also clearly shows that ADSL is limited to around 8Mbit/s downstream, whereas ADSL2+ offers up to 26Mbit/s but can only serve a relatively small number of lines to this speed.

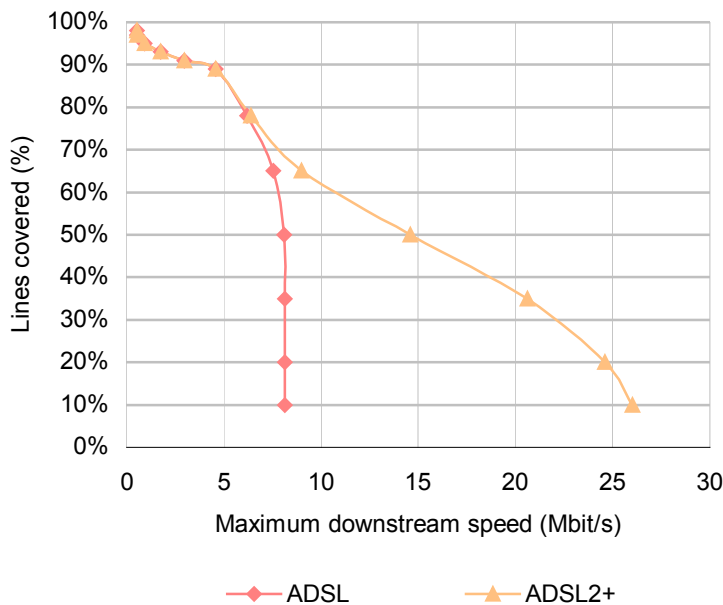


Exhibit 2.4:
Theoretical distribution of maximum ADSL2+ and ADSL speeds in the UK [Source: Analysys, IEEE]

2.3 UK-specific analysis

For the UK we provide a regional breakdown on the results in addition to the national picture. This has been calculated using a sophisticated geographic analysis by post-sector and exchange area.

For downstream and upstream xDSL coverage, we have combined lists of enabled exchanges by operator,⁷ products available from each operator, number of households for each exchange area, and estimations on the average percentage of households connected to an enabled exchange that can actually receive a service of a given speed (i.e. line length limitations) to calculate servable households per exchange by downstream and upstream speed.

For cable modem services, we have combined availability by post-sector, the number of households per post-sector and products offered by each of the cable network operators to calculate servable households by post-sector by downstream and upstream speed.

We subsequently generated the set of all areas where post-sectors and exchange areas overlapped; we then combined this with the data sets on servable households by xDSL and cable modem to arrive at the final result.

FWA services in the UK contribute little incremental coverage to that provided by xDSL and cable modem, and operate at speeds comparable to these two technologies.

⁷ Sources: individual operators and www.samknows.com.

3 Coverage of sophisticated broadband services – results

This section presents our findings on the availability (coverage) of sophisticated broadband services across the 11 countries under study.

The following three areas have been examined:⁸

- **downstream speed** – specifically services that are mass-marketed to residential and business customers and are not bespoke. Services in this category include ADSL, ADSL2+, VDSL (where affordable), cable modem and fixed wireless access (FWA); excluded are leased lines, LES (LAN extension services) and similar products
- **upstream speed** – as above, but covering the upstream speeds of the listed technologies
- **mobile/nomadic technologies** – including 3G, WLAN and emerging wireless technologies such as WiMAX.

We have excluded from our analysis those services that are available everywhere to allow the results to show differentiation in coverage between countries. For example, satellite services and leased line services have been excluded from the asymmetric and symmetric technologies respectively.

⁸

The previous version of this report covered asymmetric and symmetric services rather than upstream and downstream. It was felt that this categorisation did not accurately reflect the availability of higher-speed services in countries such as Japan and Sweden where symmetric services are widely available at mass-market residential prices.

In most markets, asymmetric services are targeted mainly at residential customers, with symmetric services targeted at businesses. In other words, higher speed upstream services tend to be focused on businesses rather than residential users and are priced at a premium. This approximation is not valid when specific asymmetric services are offered to businesses but not to residential users or where fibre-to-the-home (FTTH) services are offered as a mass-market proposition to residential customers (for example, by Fastweb in Italy or Yahoo! and NTT in Japan).

Mobile/nomadic technologies complete the overall picture by giving an indication of how ubiquitous broadband access is (for example, is it available even when someone is travelling?).

The three definitions above allow for the inclusion of technologies which might emerge over the duration of the study, which is due to end in April 2006.

In each of the following sections, we give details on the current (end of September/mid-October 2005) coverage of downstream and upstream speeds for each of the countries included in the study. We also briefly list the data that we have received from operators and the estimations that have been required to arrive at a national picture.

For the UK, we have provided tabular results containing coverage data for each of the UK regions. These have been generated using exchange-by-exchange data on availability of services where such data exists, along with post-sector level information on the availability of cable modem services (FWA services add a small incremental amount of coverage to that provided by xDSL and cable modem).

As would be expected, any estimations will mean lower levels of confidence in the results but, over time, we would hope that the need for estimations will decrease as more operators publish data on the availability of higher-speed services.

3.1 Interpretation of the results

The results contained in the following sections show the coverage of broadband services by downstream and upstream speed. For example, a bar at 2Mbit/s shows the percentage of households covered by a service of *2Mbit/s or higher*.

This study reports on the ‘headline’ speed of broadband products and takes into account technical limitations. For example, Tiscali France offers ADSL2+ services up to 20Mbit/s. Technical issues with xDSL technologies result in the actual availability of the maximum 20Mbit/s being less than the number of households connected to the exchange. We report the coverage level taking into account such technical limitations.

However, this study does *not* take into account contention and network performance issues, although from the end-users’ perspective, this can be significant – see, for example, Exhibit 3.1 below, which shows that a user who could theoretically receive 20Mbit/s is unlikely, in practice, to achieve this.

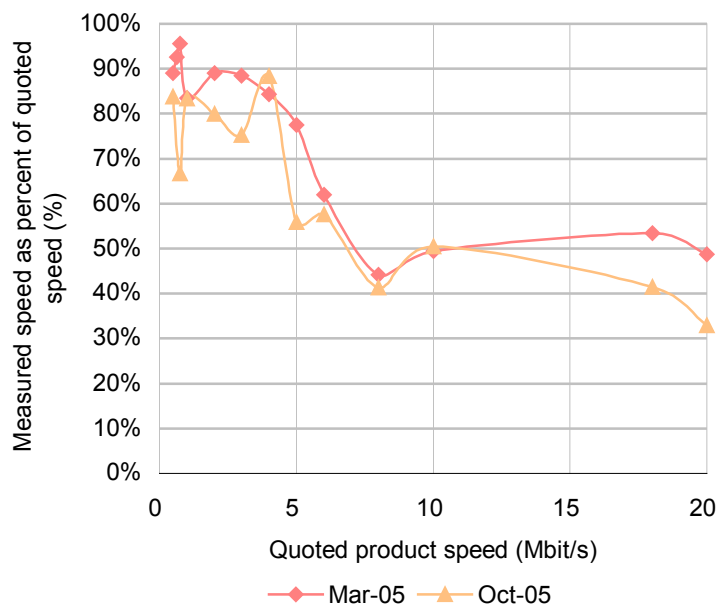


Exhibit 3.1:
Measured downstream speed versus quoted speed, France, 15 March 2005 and 27 October 2005
[Source: Analysys, www.grenouille.com]

3.2 United Kingdom

In the UK, broadband is primarily available through xDSL and cable modem. As of the end of September 2005, BT offered ADSL and SDSL services up to 2Mbit/s, with ADSL available from around 5300 exchanges (out of a total of approximately 6000) and SDSL from 800. The two main LLUB operators are Bulldog and Easynet: as of September 2005, Bulldog had unbundled around 400 exchanges and offered ADSL at 8Mbit/s and SDSL at 2Mbit/s; meanwhile, Easynet had unbundled 232 exchanges and offered ADSL at up to 8Mbit/s and SDSL at 2Mbit/s.

BT's ADSL services are available at upstream speeds of 256kbit/s for residential users and 512kbit/s for business users. Bulldog's services have a 400kbit/s upstream speed, while Easynet offers upstream speeds of up to 800kbit/s (on their 4 & 8Mbit/s ADSL products).

The two remaining large fixed broadband operators, ntl and Telewest, offered up to 3Mbit/s and 10Mbit/s cable modem services respectively. Telewest's 10Mbit/s services were available in limited areas of Scotland, the South-East and London, with the remainder of its network due to be upgraded from a maximum speed of 4Mbit/s to 10Mbit/s by the start of 2006. Similarly, ntl has announced that it plans to offer 10Mbit/s by the end of 2005, with this speed becoming standard for all customers by the end of 2006. It is unclear how the merger of the two cable operators will affect the broadband services on offer from both of them. Both ntl and Telewest currently have a maximum upstream speed of 300–400kbit/s.

A number of operators have announced trials or launches of higher-speed broadband services over the last few months. For example, Be has recently launched ADSL2+ services running at up to 24Mbit/s (1Mbit/s upstream) to around 40 exchanges in London. BT has announced the expansion of its Max DSL trial, which examines the provision of rate adaptive DSL up to 8Mbit/s, with a plan to launch in Spring 2006. Operators including Easynet, Bulldog, Pipex, Wanadoo, Zen Internet and Tiscali have either announced ADSL2+ or LLUB trials or launches.

The majority of these launches have not yet taken place and it is reasonable to assume that the next version of this report (due for publication in April 2006) will show significant changes in the level of high-speed coverage in the UK compared to the current situation.

Exhibit 3.2 and Exhibit 3.3 below respectively illustrate the coverage of downstream and upstream services in the UK. Much of the upstream coverage is available through business-focused products, with little in the way of high-speed upstream products available at residential prices. For example, Exhibit 3.4 shows UK upstream availability when BT's Business Broadband product (which offers 512kbit/s upstream) and SDSL services are excluded from the calculation.

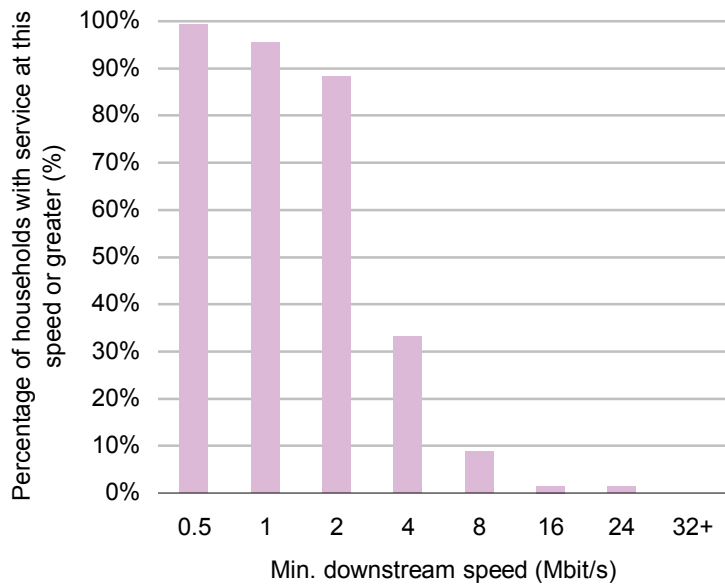


Exhibit 3.2:
 UK downstream
 coverage, Q3 2005
 [Source: Analysys]

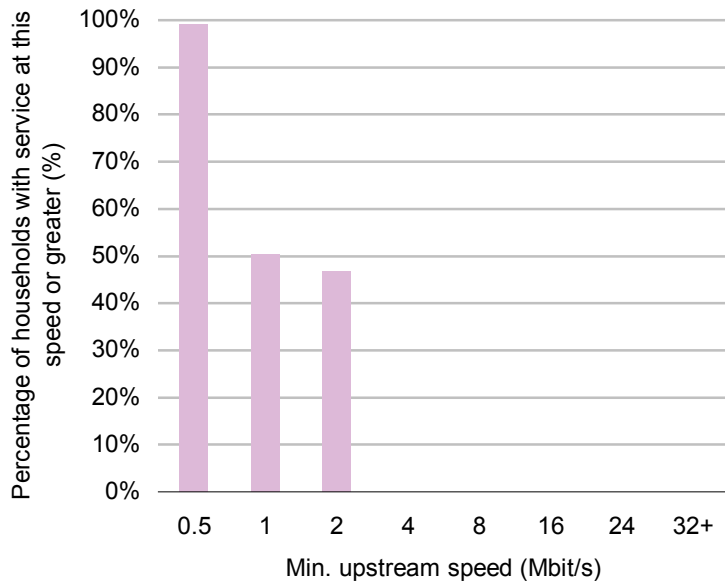


Exhibit 3.3:
 UK upstream
 coverage, Q3 2005
 [Source: Analysys]

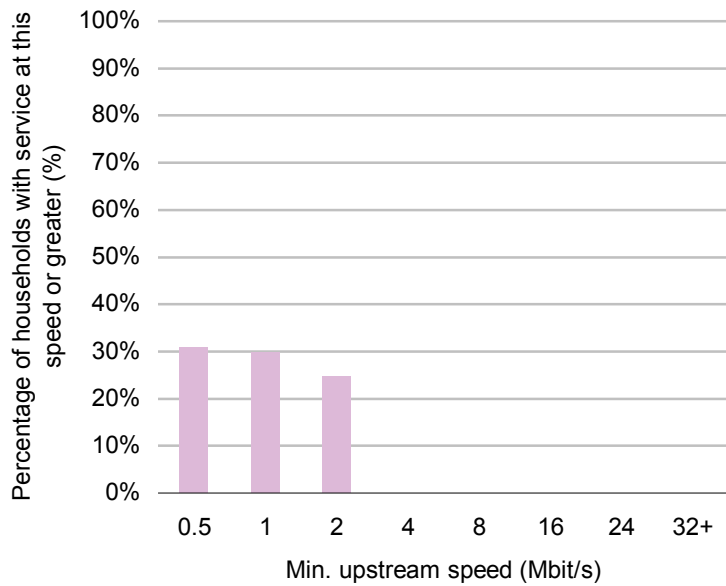


Exhibit 3.4:
 UK upstream coverage, excluding BT Business Broadband and SDSL, Q3 2005
 [Source: Analysys]

Regional coverage

Exhibit 3.5 and Exhibit 3.6 below show the household coverage by downstream speed and upstream speed in the UK in each of the regions.

	0.5	1	2	4	8	16	24	32+
East Midlands	99%	96%	89%	16%	5%	0%	0%	0%
East of England	100%	96%	89%	19%	5%	0%	0%	0%
London	100%	96%	92%	64%	30%	12%	11%	0%
North East	100%	96%	88%	28%	6%	0%	0%	0%
North West	100%	96%	90%	37%	8%	0%	0%	0%
Northern Ireland	100%	96%	87%	0%	0%	0%	0%	0%
Scotland	98%	94%	85%	37%	5%	0%	0%	0%
South East	99%	96%	88%	24%	11%	0%	0%	0%
South West	99%	95%	86%	25%	5%	0%	0%	0%
Wales	98%	95%	84%	8%	0%	0%	0%	0%
West Midlands	99%	95%	89%	51%	8%	0%	0%	0%
Yorkshire and Humberside	100%	96%	88%	37%	7%	0%	0%	0%
National	99%	96%	88%	33%	9%	2%	1%	0%

Exhibit 3.5: Coverage of households by minimum downstream speed, Q3 2005 [Source: Analysys] NOTE: '100%' entries are less than 100% due to rounding

	0.5	1	2	4	8	16	24	32+
East Midlands	99%	44%	41%	0%	0%	0%	0%	0%
East of England	100%	45%	42%	0%	0%	0%	0%	0%
London	99%	90%	84%	0%	0%	0%	0%	0%
North East	100%	30%	28%	0%	0%	0%	0%	0%
North West	100%	58%	54%	0%	0%	0%	0%	0%
Northern Ireland	100%	39%	37%	0%	0%	0%	0%	0%
Scotland	98%	38%	34%	0%	0%	0%	0%	0%
South East	99%	54%	51%	0%	0%	0%	0%	0%
South West	99%	36%	34%	0%	0%	0%	0%	0%
Wales	98%	27%	25%	0%	0%	0%	0%	0%
West Midlands	99%	53%	50%	0%	0%	0%	0%	0%
Yorkshire and Humberside	100%	38%	35%	0%	0%	0%	0%	0%
National	99%	50%	47%	0%	0%	0%	0%	0%

Exhibit 3.6: Coverage of households by minimum upstream speed, Q3 2005 [Source: Analysys]

As can be seen from Exhibit 3.5, the availability of downstream services of 4Mbit/s and above is markedly lower than the availability of those between 2 and 4Mbit/s. In particular, there are no such services in Northern Ireland, and 4Mbit/s is only available to 8% of households in Wales. We would expect this to increase over the next few months, mainly as ntl and Telewest roll-out 10Mbit/s services.

As shown below in Exhibit 3.7, coverage of basic 512kbit/s downstream services is primarily from BT, with the cable modem operators and local loop unbundlers also providing coverage, although these operators currently offer higher-speed services than BT.

	BT	Easynet	Bulldog	Be	ntl	Telewest
East Midlands	99%	11%	21%	0%	51%	0%
East of England	100%	10%	17%	0%	39%	9%
London	99%	49%	76%	28%	23%	30%
North East	100%	12%	3%	0%	26%	23%
North West	100%	16%	33%	0%	33%	21%
Northern Ireland	100%	0%	0%	0%	36%	0%
Scotland	98%	7%	26%	0%	15%	25%
South East	99%	18%	26%	0%	33%	5%
South West	99%	9%	14%	0%	10%	20%
Wales	98%	0%	12%	0%	26%	0%
West Midlands	99%	17%	30%	0%	15%	40%
Yorkshire and Humberside	100%	14%	23%	0%	19%	27%
National	99%	17%	29%	3%	27%	18%

Exhibit 3.7: Availability of 512kbit/s downstream services by region and broadband infrastructure operator (% of households), Q3 2005 [Source: Analysys]

3.3 Australia

The majority of lower-speed coverage in Australia is provided by the incumbent's (Telstra) DSL services, with higher-speed services being provided by Telstra and Singtel Optus' cable modem services as well as a number of local loop unbundlers (e.g. Agile/Internode, iiNet), some of whom are beginning to offer ADSAL2+ products. FWA providers such as BigAir and Access Providers offer some symmetric coverage.

Broadband coverage by downstream and upstream speeds in Australia is shown in Exhibit 3.8 and Exhibit 3.9 respectively.

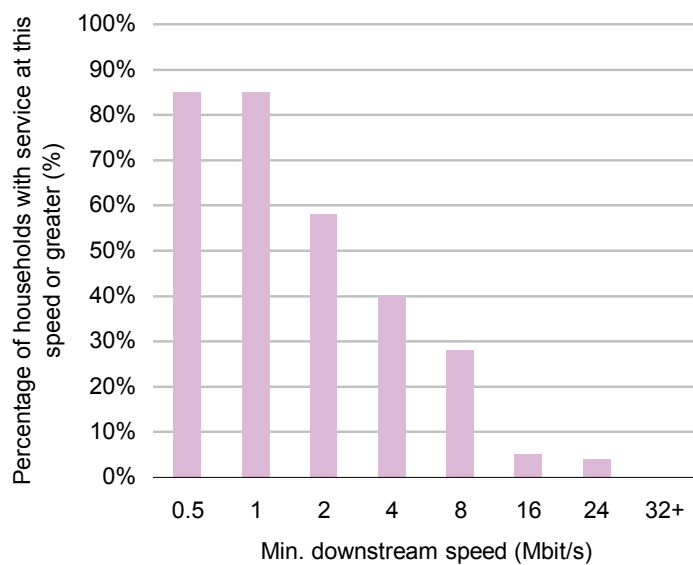


Exhibit 3.8:
 Australian downstream coverage, Q3 2005
 [Source: Analysys]

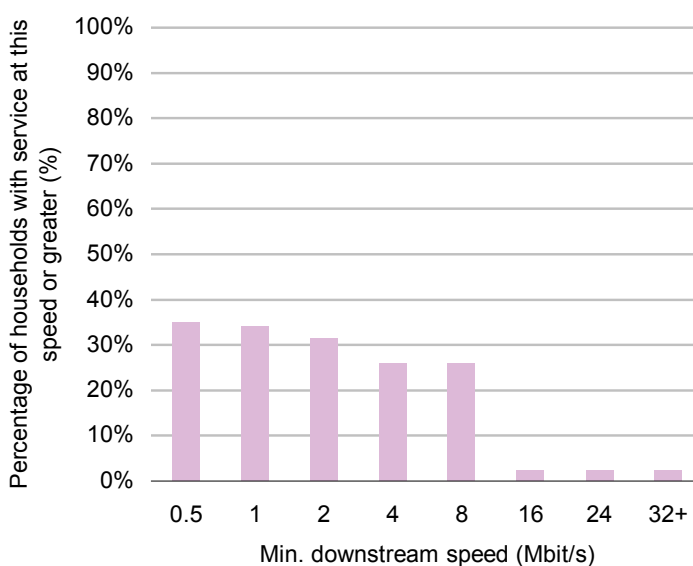


Exhibit 3.9:
 Australian upstream coverage, Q1 2005
 [Source: Analysys]

Data gathered and estimations

Telstra's ADSL services, available at downstream speeds of up to 1.5Mbit/s, cover 85% of Australian premises, with its cable modem service passing around 2.5 million homes (34%) and running at 'uncapped' downstream speeds at up to 5Mbit/s. Both services offer a maximum upstream speed of 256kbit/s.

Singtel Optus offers 'uncapped' asymmetric cable modem services over its cable network (covering 1.4 million households – 19% of the Australian total) which run at around 3.5Mbit/s.⁹ The company's ADSL services currently overlap with Telstra's and runs at speeds of up to 1.5Mbit/s.

Agile Communications and Internode offer ADSL2+ services running at up to 24Mbit/s downstream and 1Mbit/s upstream in 25 exchanges. We estimate that these exchanges serve 10% of the Australian population.

iiNet offers ADSL at speeds of up to 12Mbit/s (downstream) and 1Mbit/s (upstream) on its own network. The company has installed DSLAMs in 102 exchanges¹⁰ across Australia¹¹ and plans to target over 200 by the end of 2005. Analysys estimates that these exchanges cover approximately 25% of households, with technical limitations of ADSL restricting actual availability of 12Mbit/s services to lines under 2km in length. We have assumed a 50% overlap with Singtel Optus' cable network.

TransACT offers ADSL services at up to 2Mbit/s in the Canberra and Queanbeyan areas, although the company does not provide more details on coverage levels.

Primus offers ADSL up to 6Mbit/s downstream and 640kbit/s upstream on the 100 exchanges it has upgraded to date. Analysys estimates that the company currently covers 30% of the Australian population, although much of this will overlap with competitors such as iiNet.

⁹ Source: Singtel Optus' Web site: "downloading a 2MB song file will take: 5 seconds with the uncapped speed of Cable broadband; 35 seconds at 512kbps with DSL broadband".

¹⁰ Source: iiNet's Web site, 18 October 2005.

¹¹ Telstra has enabled over 700 exchanges (Source: Telstra).

PowerTel offers SHDSL services up to 2Mbit/s and 10 and 100Mbit/s symmetric Ethernet services to businesses.¹² As of the end of February 2005, PowerTel had enabled 120 exchanges, which Analysys estimates equates to 25% of businesses and households. No further information regarding PowerTel has been available.

Symmetric services are also available via Access Providers and BigAir, which offer up to 8 and 10Mbit/s respectively in parts of Sydney, Melbourne, Brisbane and Adelaide and share infrastructure. BigAir provides coverage to 75% of households in Sydney. Analysys estimates that the combined coverage of these operators is 25% of Australian households.

3.4 Canada

Higher-speed services in Canada (4Mbit/s and greater) are primarily offered by the cable network operators, with a number of FWA operators such as Alternative Broadband and TeraGo offering symmetric services. Coverage details for these FWA operators are not available and the results in this section are therefore subject to a lower level of confidence.

Exhibit 3.10 and Exhibit 3.11 below illustrate the respective coverage of downstream and upstream services in Canada.

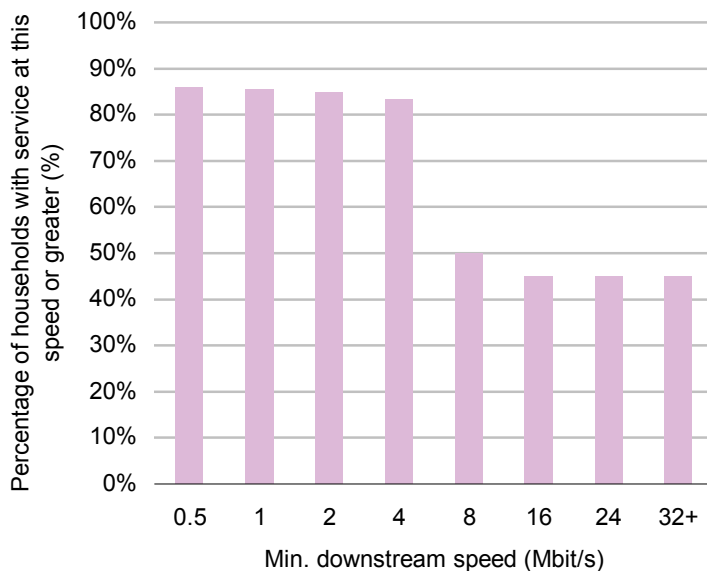
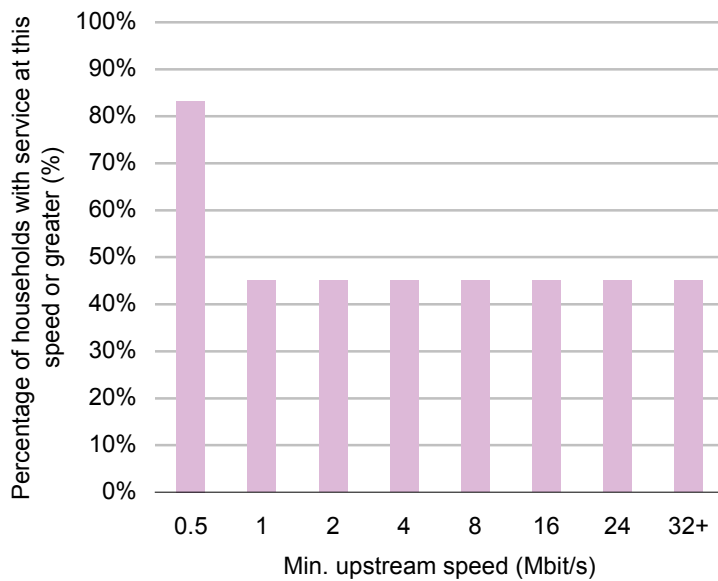


Exhibit 3.10:
Canadian downstream coverage, Q3 2005
 NOTE: coverage due to BFWA on this chart is subject to a lower level of confidence
 [Source: Analysys]

¹² For this reason, its asymmetric coverage has been excluded from the asymmetric measure for Australia.

**Exhibit 3.11:**

Canadian upstream coverage, Q3 2005.

NOTE: coverage due to BFWA on this chart is subject to a lower level of confidence

[Source: Analysys]

Data gathered and estimations

Bell Canada provides ADSL services up to 5Mbit/s to customers in Ontario, Quebec and Atlantic Canada. As of the end of 2003, the company served 78% of lines passed in Ontario and Quebec and 65% of homes in Atlantic Canada. Bell Canada has not supplied any further information.

Aliant provides ADSL services in Atlantic Canada (Newfoundland, Nova Scotia, Prince Edward Island and New Brunswick – 7.6% of the Canadian population), offering up to 5Mbit/s; it aims to cover 79% of households in the region by the end of 2005, up from 72% at the end of 2004.

TELUS offers ADSL services up to 2.5Mbit/s to households in Alberta, British Columbia and Eastern Quebec (4Mbit/s to businesses). Analysys estimates that its 2.5Mbit/s service is available to 13% of Canadian households, with the 1.5Mbit/s service available to 16% of households.

FCI Broadband offers ADSL services at up to 8Mbit/s downstream and 800kbit/s upstream in the Greater Toronto area. More precise coverage data is not available and we have assumed that the company covers 50% of Greater Toronto, which is equal to 6.5% of Canadian households.

For cable modem services, Rogers Cable offers up to 6Mbit/s (8Mbit/s for businesses) to 26% of the Canadian population (96% of the 3.2 million homes passed in Ontario, New Brunswick and Newfoundland), with upstream speeds available up to 0.8Mbit/s (1Mbit/s for businesses).

Cogeco Cable passes 1.43 million homes in Ontario and Quebec, of which 88% were cable modem capable, resulting in 11% of Canadian households being able to receive Cogeco's cable modem services up to 10Mbit/s. Shaw Cable passes 3.2 million homes in Alberta and British Columbia and thereby covers 27% of Canadian households, offering downstream speeds up to 7Mbit/s and upstream services up to 1Mbit/s. Vidéotron passes 2.4 million homes in Quebec (20% of Canadian households) and offers services up to 6.5Mbit/s, with upstream speeds of up to 900kbit/s.

Alternative Broadband and TeraGo offer symmetric FWA services across Toronto, Markham, Mississauga, Richmond Hill, North York, Rexdale, Brampton, Barrie, London, St. Catherines, Windsor, Winnipeg, Calgary, Kelowna and Victoria (Alternative Broadband) and British Columbia, Alberta, Manitoba, and Ontario (TeraGo). Neither of the two companies provides more accurate coverage information; both offer services up to 100Mbit/s. We have assumed that 50% of the population in the areas listed above are covered, equating to a total of 45% of the Canadian population. As a result, this estimate is subject to a lower level of confidence.

As of November 2004, 86% of the Canadian population had access to broadband.¹³

3.5 France

Local loop unbundling (LLUB) has proved popular in the French broadband market, with a number of operators launching services that offer speeds 'up to' (*'jusqu'à'*) a particular speed. In these cases, the subscriber receives the highest downstream speed available, up to a maximum limit, given their line characteristics. It is often the case that the line can support a higher speed than the user receives due to 'designed-in' contention. This study reports the maximum possible speed excluding this contention, rather than that actually experienced by end-users as this is dependent on the individual service provider.

¹³ Source: Canadian Radio-television and Telecommunications Commission.

In addition, the cable network operators offer high-speed broadband services up to 20Mbit/s.

Broadband coverage by downstream and upstream speeds in France is shown in Exhibit 3.12 and Exhibit 3.13 respectively.

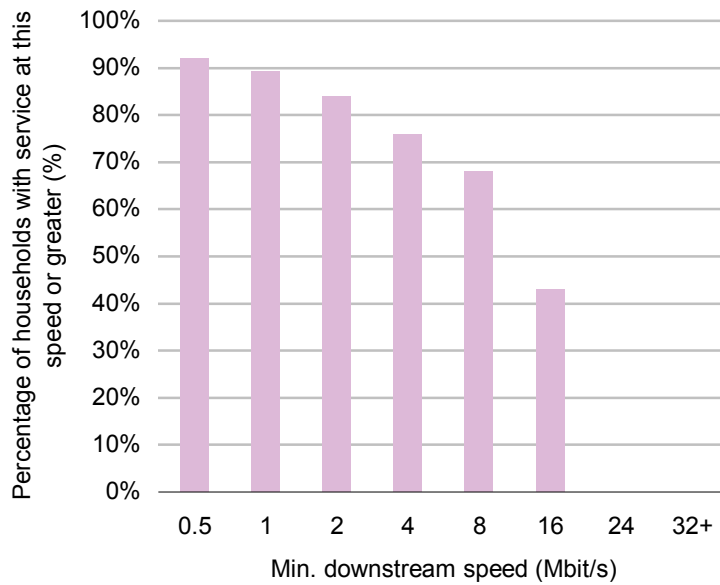


Exhibit 3.12:
 French
 downstream
 coverage, Q3 2005
 [Source: Analysys]

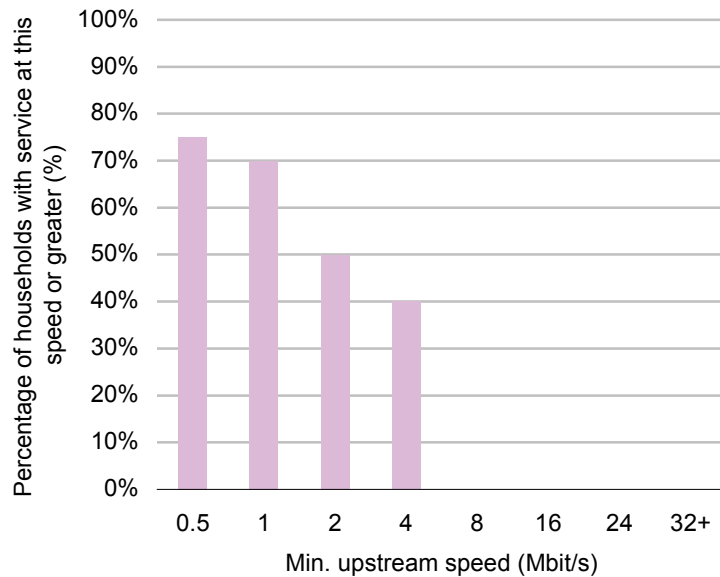


Exhibit 3.13:
 French upstream
 coverage, Q3 2005
 [Source: Analysys]

Data gathered and estimations

As of the end of April 2004, France Telecom covered 82% of the French population and expected to reach 95% by the end of 2005. We estimate that, as of the end of September 2005, France Telecom covered 92% of French households with 512kbit/s ADSL services, up to line-length limitations. According to Wanadoo's Web site, ADSL2+ services at up to 18Mbit/s downstream (and 1Mbit/s upstream) were available in approximately 150 cities in France by the end of September 2005. Analysys estimates that these cities cover approximately 30% of the French population. ADSL services are offered up to 8Mbit/s and symmetric services up to 4Mbit/s.

LLUB has proven popular in France, with 45% of households and 50% of businesses connected to unbundled exchanges as of the end of December 2004.¹⁴ Free (part of the Iliad group) has 'more than 1500 unbundled local areas'¹⁵ and offers ADSL2+ services up to 20Mbit/s (with 1Mbit/s upstream). For non-unbundled lines, the company offers up to 10Mbit/s downstream and 1Mbit/s upstream. Exact details on the number of lines connected to unbundled exchanges is not available. AOL France offers ADSL2+ services up to 18Mbit/s in unbundled areas but, again, the number of exchanges is not available. Tiscali France offers services up to 20Mbit/s in unbundled areas and we expect that this coverage overlaps entirely with other operators.

In May 2005, neuf telecom and Cegetel announced plans to merge. By March 2005, neuf telecom was able to serve 60% of the population via its ADSL network. Meanwhile, Cegetel offers LLUB services over a similar – but slightly more extensive – footprint; Analysys estimates that this covers 70% of the French population. Both companies also resell France Telecom's wholesale offering and offer services up to 20Mbit/s downstream with no information available from the operators regarding upstream speeds. Based on performance data,¹⁶ upstream speeds are in the region of 1Mbit/s.

¹⁴ Source: ORTEL (Observatoire Régional des Télécommunications).

¹⁵ Source: www.iliad.fr.

¹⁶ Source: www.grenouille.com.

AFORM (the Association Française des Opérateurs de Réseaux Multiservices) reported in June 2004 that there were 8.9 million households marketable by the French cable operators, of which 6.34 million (71%) were cable modem enabled (25% of French households).

During March 2005, Cinven acquired both NC Numericable (which passes 1.7 million Internet-capable homes out of 2.31 million total marketable homes) and France Telecom Cable (1.53 million marketable homes – Analysys estimates that 1.1 million of these are cable-modem capable). Both operators offer services up to 20Mbit/s (512kbit/s upstream).

As of June 2005, Noos and UPC operated as separate brands, although both were owned by UnitedGlobalCom Inc. (UGC). The combined companies offer services up to 10Mbit/s to 3.34 million French households, with upstream speeds of 512kbit/s. There are also a number of smaller cable network operators in France offering cable modem services (for example, Est Vidéocommunication) that account for less than 10% of the total marketable homes. The cable networks of these operators do not overlap.

3.6 Germany

We have received very few responses from German operators to our enquiries, and data on broadband coverage is hard to come by. The results in this section are therefore based on approximations using the small amount of data that is available and are subject to lower levels of confidence.

Exhibit 3.14 and Exhibit 3.15 below show the respective coverage of downstream and upstream services in Germany.

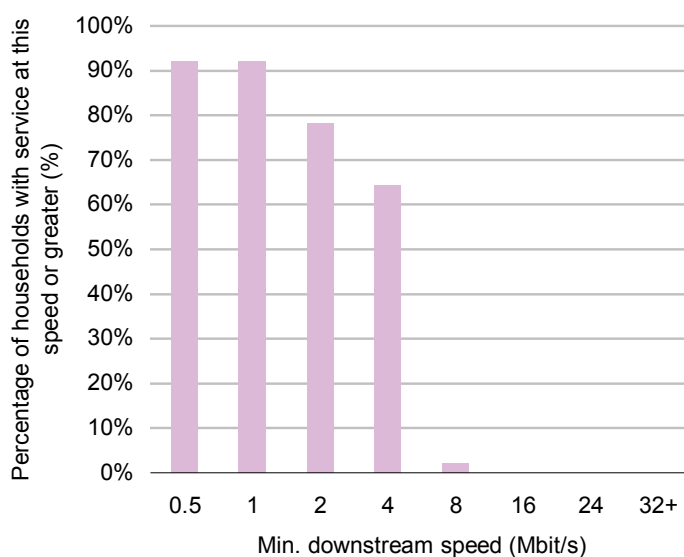
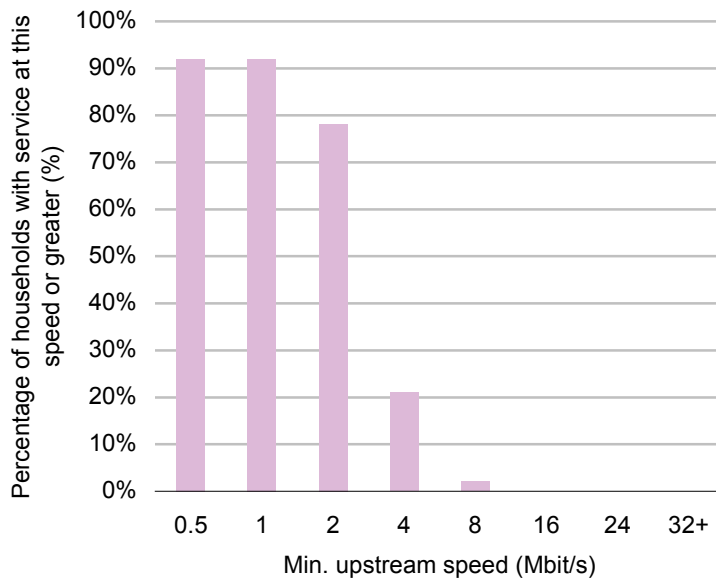


Exhibit 3.14:
 German
 downstream
 coverage, Q3 2005.
 NOTE: this chart is
 subject to a lower
 level of confidence
 [Source: Analysys]

**Exhibit 3.15:**

German upstream coverage, Q3 2005.

NOTE: this chart is subject to a lower level of confidence

[Source: Analysys]

Data gathered and estimations

T-Online offers basic DSL to over 90% of German households at speeds of up to 6Mbit/s (576kbit/s upstream). The company also offers SDSL services up to 2Mbit/s.

Arcor, Tele2 (which bought Versatel in July 2005) and Hansenet are all active in LLUB, offering ADSL services up to 6Mbit/s. QSC offers ADSL services up to 4Mbit/s. These operators also offer symmetric services of varying speeds (Hansenet offers SDSL up to 9.2Mbit/s). There is little in the way of coverage data available for these organisations. By June 2005, QSC was present in more than 100 cities,¹⁷ which account for around a third of the German population,¹⁸ although it is unlikely that QSC will cover this high a proportion. Hansenet operates in the Hamburg area of Germany and Telecom Italia, its parent company, has announced plans to increase Hansenet's footprint. Hamburg's population is approximately 2% of the German total.

¹⁷ Source: QSC quarterly report, August 2005.

¹⁸ Source: www.citypopulation.de.

Analysys estimates that local loop unbundlers in Germany are present in exchanges covering 25% of the German population. However, due to the lack of coverage information available from German operators, this estimate is subject to a lower level of confidence.

3.7 Ireland

The Irish broadband market has had a slow start, with little investment from eircom until recently and a low percentage of the cable networks being upgraded to offer cable modem services. FWA provides a significant amount of coverage and LLU is showing signs of an upturn, with interest from a number of players such as Magnet Networks, Smart Telecom and BT Ireland.

Broadband coverage by downstream and upstream speeds in Ireland is shown in Exhibit 3.16 and Exhibit 3.17 respectively.

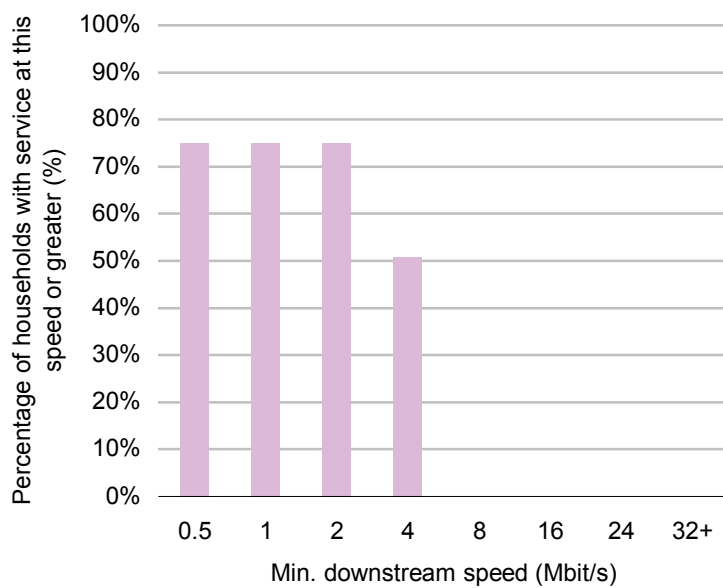
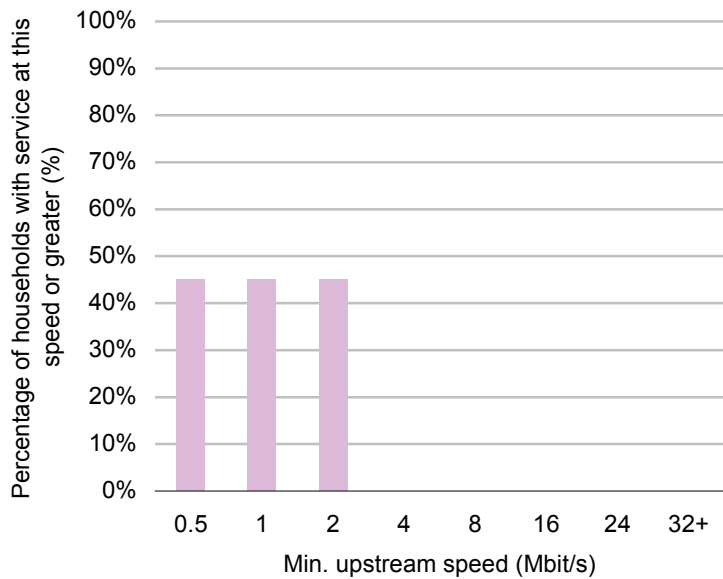


Exhibit 3.16:
Irish downstream
coverage, Q3 2005
[Source: Analysys]

**Exhibit 3.17:**

*Irish upstream
coverage, Q3 2005*

[Source: Analysys]

Data gathered and estimations

The prospectus issued by eircom prior to the acquisition of the Meteor Group (August 2005) states that, as of March 2005, approximately 77% of lines connected to DSL-enabled exchanges are capable of carrying ADSL at speeds from 1Mbit/s to 4Mbit/s. eircom aims to cover 90% of the Irish population by March 2006, up from 80% at March 2005. eircom can therefore currently supply ADSL services to around 65% of Irish households. The company offers residential services at 1Mbit/s and 2Mbit/s (128kbit/s upstream), with business services up to 4Mbit/s (256kbit/s upstream).

BT Ireland (Esat BT) offers ADSL services over unbundled local loops up to 2Mbit/s, as well as wholesaling eircom's products. A press release from June 2005 stated that a move to improve ADSL availability on some lines that were failing the line test could benefit up to 100 000 consumers and businesses. The press release also stated that approximately 20% of lines were failing the line test, which suggests an overall coverage of 500 000 lines.

Leap Broadband, purchased by Columbia Ventures (which also owns Magnet Networks) in July 2005, offers ADSL services at up to 2Mbit/s, SDSL services at up to 2Mbit/s and wireless services at up to 4Mbit/s (asymmetrical) and 2Mbit/s (symmetrical). Wireless services are available in Dublin, Galway, Cork and Limerick, with ADSL services offered

on both a wholesale basis from eircom and via unbundled local loops in the Dublin and Leinster region. Magnet Networks offers 4Mbit/s ADSL2+ services to approximately 40 000 homes and plans to increase coverage to 350 000 homes by the end of 2005 and 700 000 by February/March 2006. The company also offer a fibre-to-the-home (FTTH) service to a limited number of housing developments in Ireland.

At the start of September 2005, Digiweb launched its Metro service, offering wireless broadband services up to 6Mbit/s (in Dublin, Cork, Limerick, Galway, Waterford and Dundalk, with upstream speeds up to 2Mbit/s). DSL-based services are offered up to 4Mbit/s through approximately 140 enabled exchanges. The company plans to offer services to 70% of the population by Q2/Q3 2006.

Smart Telecom has begun a programme of unbundling exchanges and offers 2Mbit/s ADSL services. As of June 2005, the company had unbundled 18 exchanges and plans to reach 64 by the end of the year. For both Smart Telecom and Digiweb, detailed coverage data is not available.

A number of other FWA operators are active in the Irish market offering symmetric services up to 3Mbit/s, although, as is the case for most of the Irish market, coverage information has been scarce. Irish Broadband covers 500 000 households in 23 cities (37% of Irish households, including Dublin, Cork, Galway, Waterford and Limerick). Nova Networks operates in Cork city and its suburbs. Last Mile Broadband serves Westmeath, Offaly, Roscommon, Longford and some of the surrounding regions. Analysys estimates that up to 45% of Irish households can receive FWA services, although much of this will overlap with eircom's network.

ntl's cable network offers broadband services up to 3Mbit/s to 9.5% of Irish households. This coverage overlaps, on the whole, with eircom's DSL footprint. Chorus also offers cable modem services up to 1Mbit/s in Kilkenny, Clonmel and Thurles. Analysys estimates that 11% of households are covered by the combined footprint of Chorus and ntl.

3.8 Italy

The Italian market has provided a case study for FTTH in the form of Fastweb. ADSL speeds on offer have historically been low, but towards the end of March 2005, both Telecom Italia and Fastweb increased their maximum ADSL speeds from 1.28 to 4Mbit/s and from 4 to 6Mbit/s respectively. More recently, during October 2005, Tiscali launched ADSL2+ services up to 12Mbit/s.

Exhibit 3.18 and Exhibit 3.19 below show the respective coverage of upstream and downstream services in Italy.

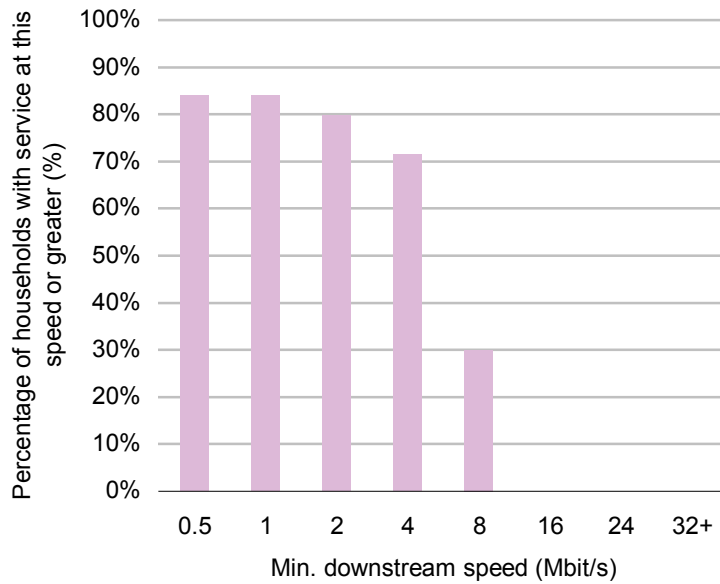


Exhibit 3.18:

Italian downstream coverage, Q3 2005

[Source: Analysys]

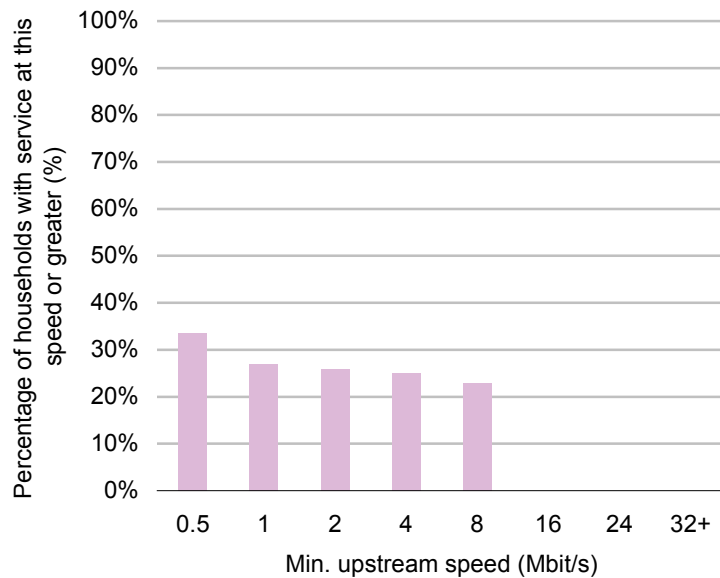


Exhibit 3.19:

Italian upstream coverage, Q3 2005

[Source: Analysys]

Data gathered and estimations

At September 2005, Telecom Italia had enabled exchanges covering 84% of Italian households and 91% of businesses, and aims to increase household coverage to 91% by the end of 2005. The company offers ADSL services up to 4Mbit/s (256kbit/s upstream), with the highest speed available to 85% of connections. The company also offers symmetric HDSL services to businesses, running at up to 8Mbit/s.¹⁹ There are no coverage figures for this service, but based on the UK ratio of asymmetric and symmetric coverage – and making some upward adjustment for the shorter average line length in Italy than in the UK, we estimate that this service is available to 25% of Italian households/businesses. In addition, the 8Mbit/s service will not be available to the full footprint.

Fastweb has unbundled exchanges covering 27% of the population and offers ADSL services of 6Mbit/s (at 512kbit/s upstream),²⁰ along with symmetric FTTH services of 10Mbit/s to a further 6.5% of the population. Wind is also active in unbundling and, as of May 2005, covered approximately 28% of the Italian population through 488 unbundled exchanges.²¹ The company offers ADSL services up to 4Mbit/s, with ADSL2+ up to 12Mbit/s (1Mbit/s upstream). Its ADSL2+ service was launched on 17 October 2005 and coverage from this is not included in this study, which examines coverage as of September 2005. When Fastweb was rumoured to be considering acquiring Wind during 2004, it was stated that the combined coverage of the two organisations would be 30% of the Italian population. The vast majority of Wind's coverage can therefore be expected to overlap with Fastweb.

At July 2005, Tiscali had unbundled exchanges serving approximately 30% of the Italian population. The company offers ADSL services up to 12Mbit/s.

¹⁹ Source: www.191.it; *Interbusiness Liberty* product.

²⁰ 10% of lines are unable to support video services due to loop length/quality.

²¹ Source: Presentation "Wind Strategy Update", 17 May 2005.

3.9 Japan

VDSL and FTTH are the main access technologies in Japan, with some cable modem coverage providing overlapping coverage. The broadband providers in Japan do not provide a breakdown of their coverage levels by speed.

The coverage of downstream and upstream services in Japan is illustrated in Exhibit 3.20 and Exhibit 3.21 respectively.

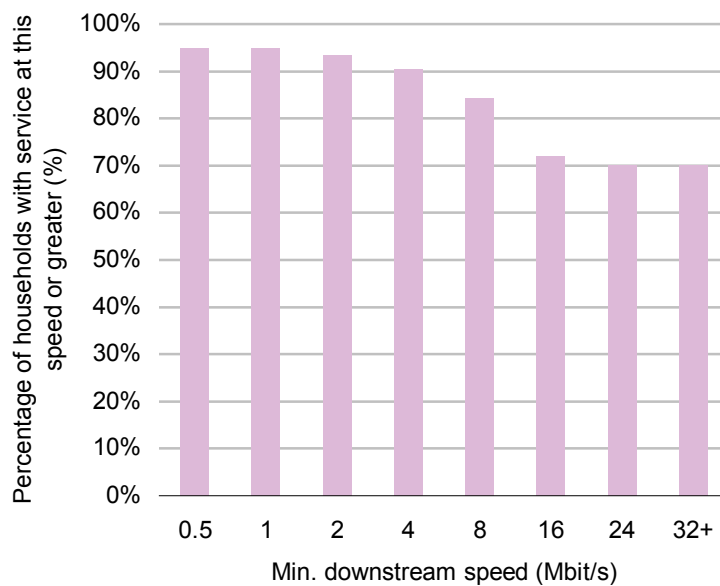


Exhibit 3.20:
Japanese
downstream
coverage, Q3 2005
[Source: Analysys]

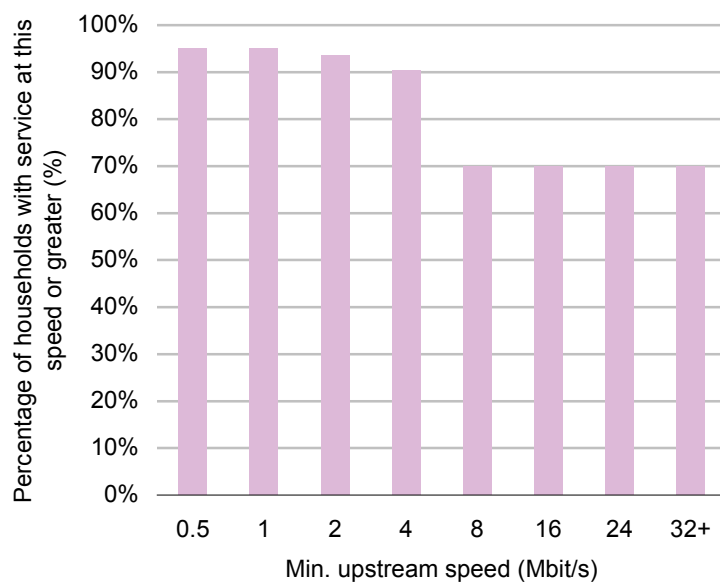


Exhibit 3.21:
Japanese upstream
coverage, Q3 2005
[Source: Analysys]

Data gathered and estimations

In Japan, fibre extends closer to the customer than in many other countries and, due to the short length of copper to the end-user, it can support much higher speeds than would otherwise be the case.

According to a survey released by the Ministry of Internal Affairs and Communications in December 2004, broadband is not available to 11.5% of Japanese municipalities. These municipalities are mainly in rural and mountainous areas and are not heavily populated, so the corresponding number for the percentage of population not covered is much lower.

NTT states that it offers VDSL broadband services to more than 95% of Japanese households at up to 50Mbit/s, but does not split this coverage down by speed. Similarly, Yahoo! states that it can serve 90% of telephone lines with VDSL services up to 50Mbit/s, but does not provide a breakdown by speed. It should be noted that the performance of VDSL falls off very much more rapidly than other DSL variants such as ADSL and ADSL2+. Exhibit 3.20 shows a conservative estimate of this in Japan given the short line lengths.

Symmetric services, particularly FTTH, are widespread in Japan, with NTT stating that it covers approximately 70% of households with 100Mbit/s fibre services. NTT also offers ADSL services at up to 47Mbit/s (5Mbit/s upstream). Yahoo! offers 100Mbit/s symmetric services to around 1500 central offices, with the main 2000 central offices serving 80% of the population.

3.10 South Korea

Korea Telecom, Hanaro and Thrunet control around 90% of the South Korean broadband market. In February 2005, Hanaro acquired Thrunet and expects to receive approval for the merger by the end of this year.

Exhibit 3.22 and Exhibit 3.23 below show the respective coverage of downstream and upstream services in South Korea.

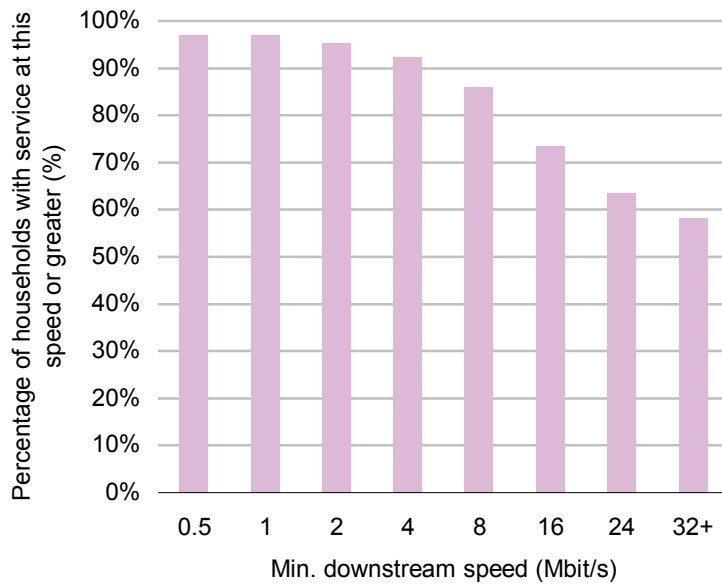


Exhibit 3.22:
 South Korean
 downstream
 coverage, Q3 2005
 [Source: Analysys]

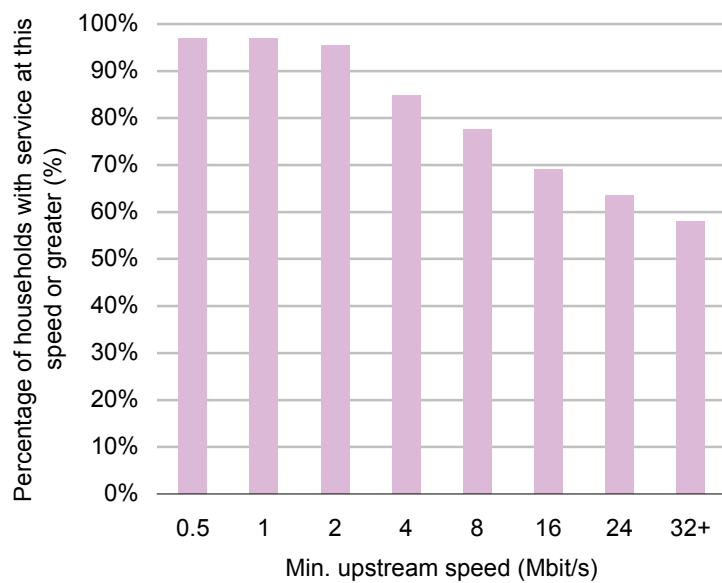


Exhibit 3.23:
 South Korean
 upstream
 coverage, Q3 2005
 [Source: Analysys]

Data gathered and estimations

Korea Telecom states that it covers 65% of the Korean population with its ADSL and VDSL services, running at up to 8Mbit/s over ADSL and 50Mbit/s over VDSL. Korea Telecom also offers FTTH services at up to 100Mbit/s.

The combined Hanaro-Thrunet organisation passes 8.5 million households (50% of the national total) with its hybrid fibre coax network offering up to 10Mbit/s, in addition to

offering ADSL and VDSL services (up to 20Mbit/s) to an unquoted number of households. It covers 4.4 million households (26% of the national total) with FTTH at 100Mbit/s and 160 000 households with FWA at 2Mbit/s.

Broadband availability in Korea was of the order of 97% as of the end of September 2004.²² We therefore estimate that the ADSL and VDSL coverage of Hanaro-Thrunet is at least 32%, which, combined with Korea Telecom’s stated 65% coverage, reaches a 97% total.

In South Korea, as is the case in Japan, fibre extends closer to the customer than in many other countries. xDSL technologies can therefore support much higher speeds than in other countries.

3.11 Sweden

ADSL2+ and VDSL services in Sweden, combined with FTTH availability from B2 Bredbandsbolaget and high-speed services available from the cable network operators, contribute to Sweden’s high availability of sophisticated broadband.

Exhibit 3.24 and Exhibit 3.25 below show the respective coverage of upstream and downstream bandwidths in Sweden.

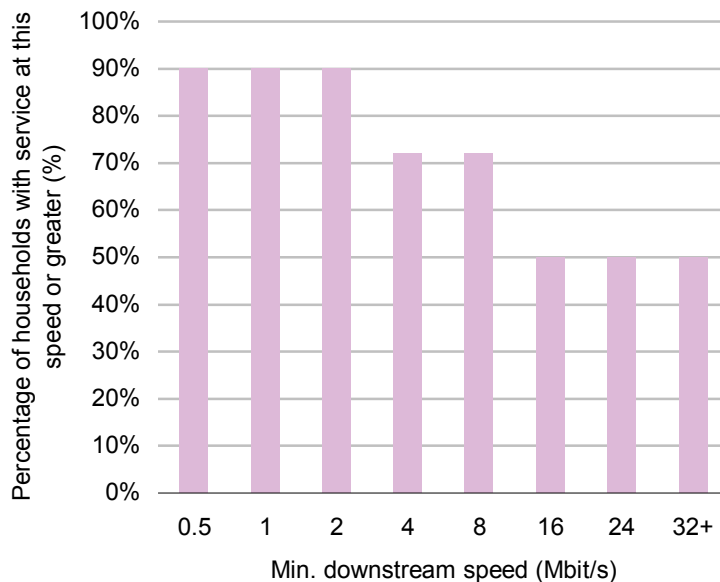
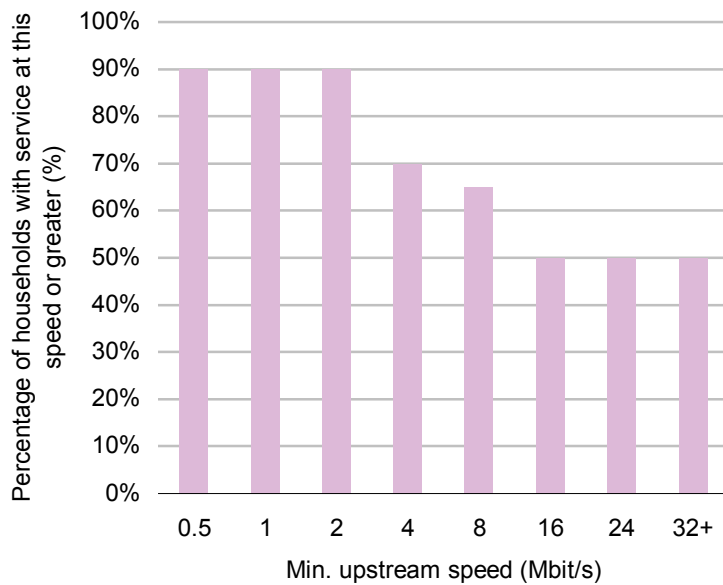


Exhibit 3.24:
 Swedish
 downstream
 coverage, Q3 2005
 [Source: Analysys]

²² Source: Ovum.

**Exhibit 3.25:**

Swedish upstream
coverage, Q3 2005

[Source: Analysys]

Data gathered and estimations

TeliaSonera offers ADSL, ADSL2+ and Ethernet services up to 24Mbit/s to the Swedish population, with 90% of households being able to receive services up to 2Mbit/s, falling to 20% for 24Mbit/s. The company's coverage overlaps 60% with competitors such as Telenor, Song Networks and B2 Bredbandsbolaget.

B2 Bredbandsbolaget offers ADSL, ADSL2+, VDSL, Ethernet and FTTH services running up to 100Mbit/s. FTTH is available to 300 000 households (7% of the national total).

Song Networks offers ADSL and ADSL2+ services to approximately 30% of the Swedish residential market. Meanwhile, Tele2 offers ADSL services up to 8Mbit/s.

In addition to xDSL and fibre providers, cable network operators such as comhem and UPC offer high-speed cable modem services to 19% and 6.8% of households respectively. UPC's services run at up to 24Mbit/s (8Mbit/s upstream), with comhem offering up to 8Mbit/s (1Mbit/s upstream).

Based on information from contacts within the Swedish telecoms industry, around 50% of Swedish businesses have access to upstream services, with fibre available on most business parks of an average size or greater. SDSL is widely available in Sweden. We have estimated fibre availability at 50% of households, with SDSL services available on a comparable basis to ADSL.

3.12 US

Both DSL and cable modem services offer high-speed services in the US, with DSL typically running up to 3Mbit/s (although Covad offers 6Mbit/s ADSL services). Cable modem services are available up to 10Mbit/s, although the available speed depends on the network.

Downstream and upstream coverage in the US is respectively shown in Exhibit 3.26 and Exhibit 3.27 below.

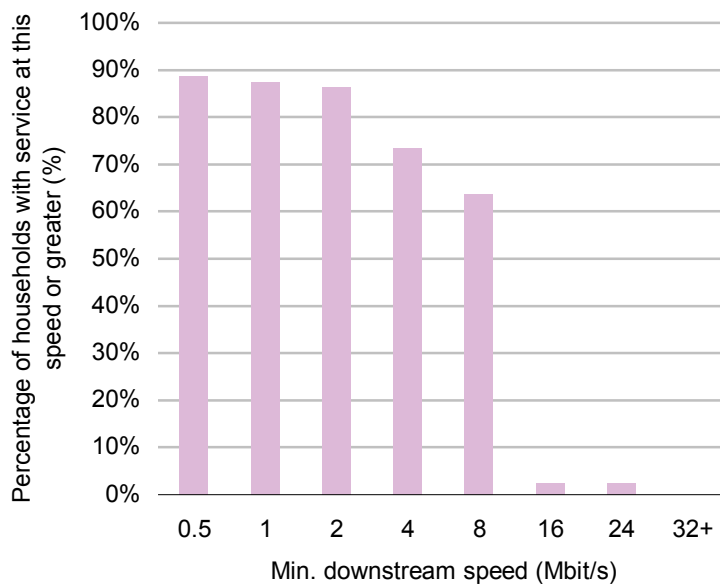


Exhibit 3.26:
US downstream coverage, Q3 2005
 [Source: Analysys]

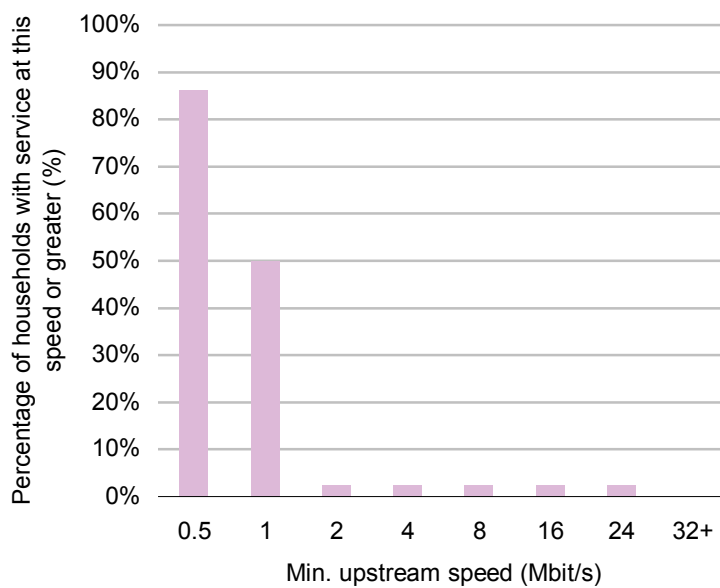


Exhibit 3.27:
US upstream coverage, Q3 2005
 [Source: Analysys]

Data gathered and estimations

DSL services are available from a wide range of ILECs and CLECs, with a number of cable network operators offering cable modem services. The ILECs are: Bellsouth, Qwest, Verizon and SBC.

Bellsouth offers ADSL services up to 3Mbit/s and symmetrical services to businesses up to 1.5Mbit/s. The company passes 16 million homes, of which 84% are DSL-enabled. Through the use of remote terminals, Bellsouth has been able to bring 80% of its DSL-enabled customers within range of 3Mbit/s services.

Verizon's network passes 33% of the US population. ADSL reach is approximately 80% due to line length/quality issues, resulting in ADSL coverage of 26% of US households from Verizon with speeds up to 3Mbit/s (768kbit/s upstream); the company estimates that more than 50% of homes passed can receive this speed. The company also offers upstream services through both FTTP²³ (which is on track to reach 3 million homes by the end of 2005 – 3% of the US total – at speeds of 5, 15 and 30Mbit/s) and by 'tuning' ADSL lines to offer upstream services up to 1.5Mbit/s.

SBC offers ADSL services up to 3Mbit/s (512kbit/s upstream) to 33% of the US population, as well as upstream services up to 1.5Mbit/s.

Qwest offers DSL downstream services up to 5Mbit/s to 7.2 million households (6.5% of national households) and has 15.5 million access lines in service. The upstream speed for the 5Mbit/s service is around 768kbit/s.

Covad offers ADSL services up to 6Mbit/s to 50% of national households, although this will be affected by line-length limitations; it also offers SDSL services up to 1.5Mbit/s over the same footprint.

Comcast offers cable modem services up to 8Mbit/s (768kbit/s upstream) to 41 million homes (37%). RCN offers cable modem services up to 10Mbit/s (800kbit/s upstream) over its network. Analysys estimates that RCN's network passes approximately 5% of US

²³ Fibre-to-the-premise.

households. Similarly, Mediacom, which passes 2.8 million homes, can provide cable modem services of up to 10Mbit/s (1Mbit/s upstream) to less than 3% of US households.

Cox Communications' cable network can provide cable modem service up to 5Mbit/s (768kbit/s upstream) to 9.6% of US households, with its network completely overlapping with DSL coverage from the ILECs and CLECs.

Charter Communications offers cable modem services up to 3Mbit/s to 10% of US households. Following its acquisition of a large part of Adelphia, Time Warner passes 26.5 million homes (24%), although not all of these may be able to receive its 8Mbit/s cable modem services.

4 Usage of sophisticated broadband services – results

This section contains the Q2 2005 results for sophisticated broadband usage in the countries under study. The following indicators are covered, with definitions for each indicator available in the results section below:

- business indicators
 - broadband businesses ordering online
 - use of wireless LANs
 - use of VoIP
 - broadband businesses transacting with government online
 - ecommerce revenue

- residential indicators
 - downloading TV, video and movie clips
 - use of online gaming
 - use of VoIP
 - ecommerce spend

The results for all of these indicators are based on estimates produced by Analysys through reference to free, publicly available data sources. The indicators have been estimated as at the end of Q2 2005. Estimations will be made for the end of 2005 in the next iteration of this report.

The residential indicators have been chosen following a BSG Metrics Group survey and approval of the choices by the DTI.

In addition, the report contains two short trends analysis pieces focusing on the state of a particular service and discussing market developments. In this iteration of the report, the following are included:

- usage of peer-to-peer networks
- residential and business use of VoIP (adding detail and commentary to the usage estimates).

4.1 Methodology for business indicators

The business indicators specifically look at usage by businesses with broadband, compared with usage by businesses with narrowband Internet access to see if there are discernible differences in usage or take-up patterns. A broadband business is defined as a business with at least one Internet connection that is faster than 256kbit/s. Businesses that have leased lines and fibre connections are therefore included, along with those that use mass-market broadband services based on cable modem, Ethernet or xDSL.

The indicators are based primarily on analysis of survey data collected for previous iterations of the *Business in the Information Age* study, undertaken by the DTI. As such, they are based on survey data covering all the countries addressed by this study. The numbers of responses in individual countries are sometimes quite small. For instance, while the average number of respondents per country claiming narrowband was 214 in 2002, by 2004 this had dropped to an average of 177 per country, and in Korea in 2004 the number of respondents using narrowband Internet in 2004 was only 10. Consequently, in these cases a higher error margin applies.

Exhibit 4.1 and Exhibit 4.2 below show the number and percentage of respondents to the *Business in the Information Age* study in 2004 who had either narrowband or broadband access. The total number of companies surveyed includes those without access to the Internet. In the UK, 2716 interviews were conducted in total, and 500 interviews were conducted in each of the other countries.

	<i>Broadband respondents 2004</i>	<i>Narrowband respondents 2004</i>
UK	1052	904
Australia	180	153
Canada	208	133
France	193	146
Germany	191	71
Ireland	195	141
Italy	216	89
Japan	219	73
South Korea	302	10
Sweden	252	82
US	213	144
Average	293	177

Exhibit 4.1: Sample sizes for the most recent study

[Source: Analysys]

	<i>Broadband respondents</i>	<i>Narrowband respondents</i>
UK	39%	33%
Australia	36%	31%
Canada	42%	27%
France	39%	29%
Germany	38%	14%
Ireland	39%	28%
Italy	43%	18%
Japan	44%	15%
South Korea	60%	2%
Sweden	50%	16%
US	43%	29%
Average	43%	22%

Exhibit 4.2: Implied broadband and narrowband

penetration [Source: Analysys]

The results in this study are not presented in the same way as in the *Business in the Information Age* study. In that study, the phrase ‘30% of businesses’ meant businesses representing 30% of *employees* in the country. In this study, ‘30% of businesses’ means 30% of all entities, irrespective of the number of employees they represent. This approach maximises the likelihood of identifying compatible data sets for other countries during the study period as other sources we have found are not presented in the same way as the *Business in the Information Age* study.

In addition to showing usage as a percentage of broadband and narrowband businesses, many of the business indicators show usage or take-up as a percentage of all businesses. This means take-up as a percentage of all businesses that participated in the survey, irrespective of whether they had an Internet connection or not.

Business in the Information Age has not been updated since the previous iteration of this report. Moreover, very few reliable mid-year statistics have been publicly available for the business indicators in this study, with relevant data only available for use of VoIP and ecommerce revenue. We have therefore estimated data from Q2 2005 on the basis of historic growth trends and by examining trends in comparable indicators, incorporating new data where available. Estimates made on the basis of historic growth trends were compared, where possible, with more complete data series for peer countries that historically have had a similar usage pattern for the metric in question at an equivalent point in their development. We have also cross-checked with other national indicators such as the recent growth of enterprise broadband usage and current levels of broadband penetration.

4.2 Methodology for residential indicators

For the residential indicators, very few data sets specifically cover broadband usage, with most data sets covering general Internet usage (i.e. both narrowband and broadband). Therefore, the residential indicators included within cover both narrowband and broadband usage. We would expect that broadband-specific data sets will become available over the duration of the study as broadband continues to increase its share of Internet connections; these will be incorporated as and when they are published.

Extensive effort has been invested to identify sources of data to underpin the residential Internet usage analysis. There are no single sources that provide all of the data sets for any one country, nor are there any metric-specific data sources that address all the countries covered by this study. Moreover, data sources often only cover a single year, or a single project, and have not been repeated. Mid-year data for many indicators has not been available, with data sets tending to lag the market by around a year (in other words, the latest studies reference surveys conducted in late 2004). As a result, Analysys has been required to normalise the different data sets to ensure (as far as is possible) that they cover the same things, and to create some estimates to fill gaps in the data.

The following rules have been used for normalisation and estimation:

- where possible, we have only used sources that are underpinned by a programme of primary market research, and ideally we have only used market research results based on reasonable numbers of responses (always over 250 responses per country, often over 1000 responses per country)
- where no relevant survey data exists for a particular metric in any given country, we have left a gap rather than attempt to estimate a number through comparison with other markets
- we have used linear interpolation to fill small numbers of gaps (one or two missing points) in historical time series
- where historical data exists – but no recent data does (e.g. for Q2 2005) – we have estimated by extrapolation, using the following processes:
 - historical growth rates have been extrapolated forwards
 - the resulting outputs have been compared with
 - more complete data series for peer countries that historically have had a similar level of usage for that metric at an equivalent point in their development
 - reference indicators for the country (such as the recent growth of Internet usage and current levels of Internet penetration)
 - where appropriate, the initial linear extrapolation highlighted above has been adjusted following the comparison process
- where two data sources apparently contradict one another, we have investigated whether:
 - there are definitional differences (e.g. video download *versus* streaming TV and video over the Internet). If this is found to be the case, we have selected the data set that most closely matches the definition of the indicator included in this study. We have used an average score if the definitions of both data sets appear valid
 - there are sampling differences underlying the data set (e.g. the exclusion of certain age groups). In these cases we have used the data with the most comprehensive survey sample
 - there are computational / base differences (e.g. the results have been calculated as a proportion of population, all Internet users, regular Internet users, all households, etc.). In these cases, we have recalibrated the outputs

Due to the fact that the estimates have been created by pulling together results from a wide range of studies and surveys, it is not possible to express the expected accuracy of the results in terms of a percentage error margin. We have therefore devised a colour coding mechanism for the residential usage charts, which provides information about the quality of the underlying information. The colour coding scheme shows comparative confidence levels between different countries within a given indicator. Those with the highest confidence levels do not necessarily have a small margin for error, but they are those data points that we believe are the most reliable.

<i>Colour coding on residential chart</i>	<i>Comparative confidence</i>
Full colour bar on chart	Highest confidence: based on reliable series of historical data points or based on one or more reliable, reasonably current data points where available. Normalisation may have been required
Hashed bar on chart	Mid-range confidence: extrapolation or estimation based on a number of historical data points, possibly from different sources. Normalisation is most likely to have been required
Empty boxed bar on chart	Least confidence: substantial extrapolation has been required to estimate from old or sparse data, or performance has been estimated from similar countries

Exhibit 4.3: *Colour coding scheme used for charts*
[Source: Analysys]

4.3 Results for business indicators

4.3.1 Sources used

The data for the business indicators has been derived principally from the survey responses underlying the *Business in the Information Age* study and aggregated together to a greater level of detail than that contained in the original study. This ensures a consistent set of historical data points for the years 2002 to 2004, on which to base estimates for Q2 2005.

The sample sizes for the 2004 data of the *Business in the Information Age* study are as follows – with the exception of the chart for ecommerce revenue which has a separate sample size table in Section 4.3.6.

Country	Broadband businesses	Narrowband businesses
UK	1052	904
Ireland	195	141
France	193	146
Germany	191	71
Italy	216	89
Sweden	252	82
US	213	144
Canada	208	133
Japan	219	73
Australia	180	153
South Korea	302	10

Exhibit 4.4: Sample sizes for business metrics [Source: Analysys]

4.3.2 Broadband businesses ordering online

Definition

The percentage of all broadband businesses in a country that, in the last year, have ordered goods or services from their suppliers using the Internet (irrespective of whether payment was made over the Internet, or whether invoicing was managed separately).

Results and comments

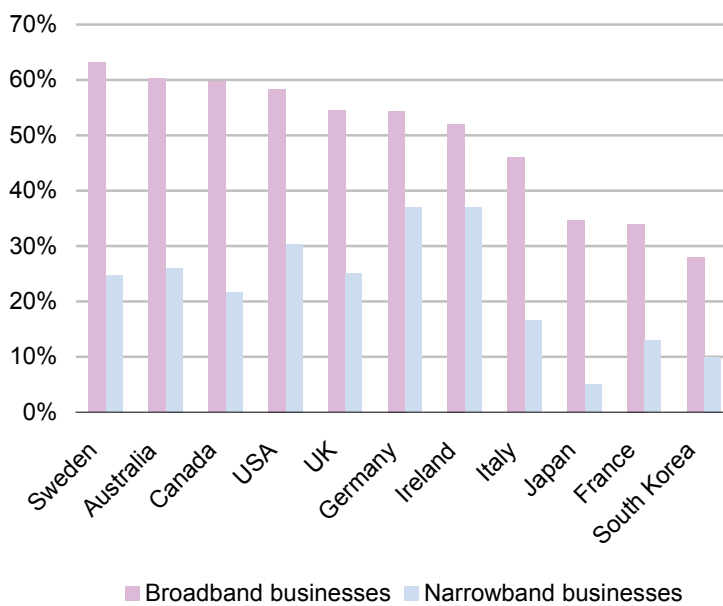


Exhibit 4.5: Percentage of broadband and narrowband businesses ordering online in the year ending June 2005 [Source: Analysys]

The percentage of broadband businesses ordering online is estimated to have increased through the first half of 2005, continuing the growth witnessed through 2004 will continue. As can be seen from Exhibit 4.5 above, in three of the countries covered by this study at least 60% of broadband businesses are estimated to be ordering online by June 2005, while seven countries are predicted to have more than 50% of broadband businesses ordering online. Japan and South Korea are towards the bottom of the ranking. One might expect that in countries with higher broadband penetration – such as Japan and South Korea – the broadband-using population would include a higher proportion of late broadband adopters (those that have only recently taken broadband). These late adopters might typically be reluctant to use their broadband connections for little more than emailing and Web browsing. This would mean that although a country has many broadband companies ordering online, that country has a low score when the indicator is expressed as a percentage of all broadband Internet users.

This data is derived by projecting forward the source data from the *Information in the Business Age* study, adjusted where necessary according to the process explained earlier.

4.3.3 Use of WLAN

Definition

The percentage of all broadband businesses in a country that, at the end of June 2005, have at least one private WLAN hotspot. This excludes businesses that merely allow their employees to make occasional use of public WLAN services.

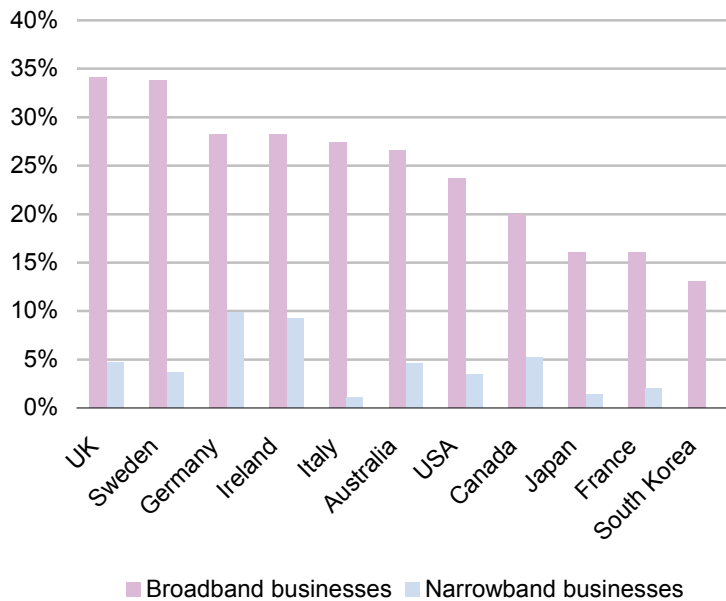


Exhibit 4.6:
 Percentage of
 broadband and
 narrowband
 businesses with a
 WLAN in June
 2005 [Source:
 Analysys]

The percentage of broadband businesses with a wireless LAN hotspot is estimated to have increased over the first half of 2005, in line with past growth trends. Japan, France and South Korea remain at the bottom of the ranking for the percentage of broadband businesses using private WLANs.

This data is derived by projecting forward the source data from the *Information in the Business Age* study, adjusted where necessary according to the process explained earlier.

4.3.4 Use of VoIP

Definition

The percentage of all broadband businesses in the country that, at the year end, were using IP telephony services. The measure includes occasional use as well as use across a sub-set of company sites. It includes voice over broadband solutions delivered by public network operators and also business site-to-site calling over the private corporate network. The measure excludes use of free PC-based software products that enable PC-to-PC calling.

Results and comments

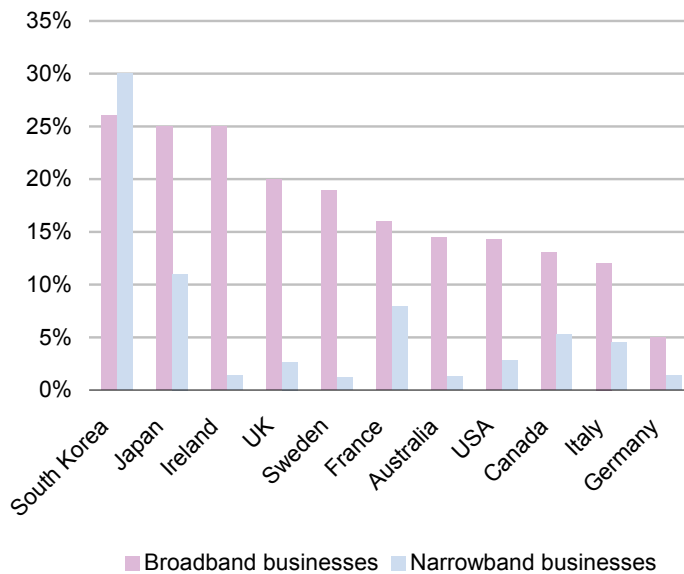


Exhibit 4.7:
Broadband and narrowband businesses using VoIP, June 2005
 [Source: Analysys]

Based on strong growth in consumer VoIP and strong growth in the percentage of broadband businesses using VoIP during the year to December 2004, the percentage of broadband businesses with VoIP has been predicted to have grown in all countries except Ireland during the first half of 2005. This is supported by findings from detailed research conducted by Analysys on enterprise spending on VoIP. With Ireland experiencing rapid growth in broadband penetration, VoIP users as a percentage of all broadband businesses is predicted to have declined slightly due to a dilution effect, with new broadband adopters being less likely than existing broadband users to adopt VoIP. This pattern is in line with that experienced in other European countries at equivalent stages in their broadband adoption cycle. However, because broadband penetration in Ireland still remains relatively low, mass market broadband businesses in Ireland will still tend to be more technologically literate than, for example, mass market broadband businesses in the UK or Sweden, where overall take-up is much higher. This early adopter effect explains why Ireland still ranks highly in terms of VoIP usage amongst broadband enterprises.

South Korea, where the broadband market is much more mature and where penetration rates have grown rapidly, enjoys a business base which is quick to take advantage of new technologies – this is a reflection of the cultural attitude in South Korea towards the early adoption of emerging technologies. The narrowband result shows that all Internet users are interested in new services, even in the relatively limited number of locations where broadband is not available.

This data is derived by projecting forward the source data from the *Information in the Business Age* study, adjusted where necessary according to the process explained earlier.

4.3.5 Broadband businesses transacting with government online

Definition

The percentage of all broadband businesses in a country that have made online tax or other financial payments to public authorities within the last year. This measure excludes businesses that only make payments by BACS (bankers automated clearing system).

Results and comments

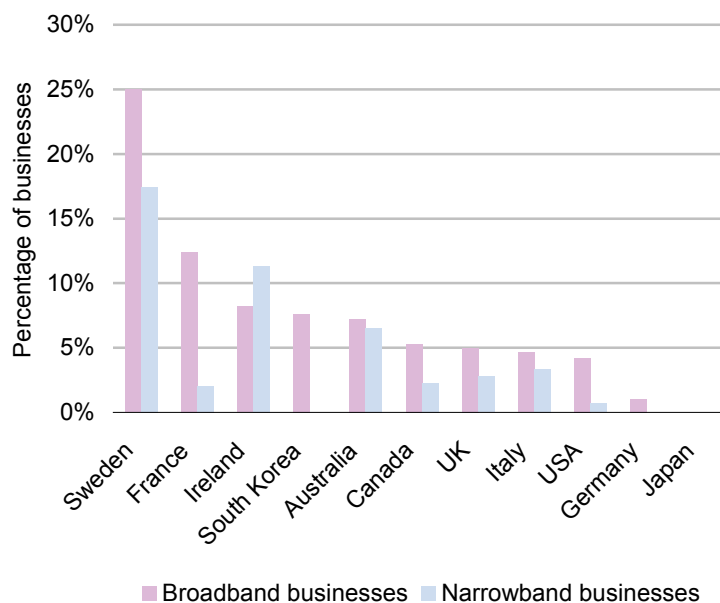


Exhibit 4.8:
 Percentage of
 broadband and
 narrowband
 businesses making
 tax and other
 payments to public
 authorities over the
 Internet, June 2005
 [Source: Analysys]

Surprisingly, given the high level of broadband availability, Japan is ranked last in terms of businesses making payments to public authorities over the Internet, with none of the survey respondents (219 broadband, 73 narrowband) answering the question positively. It may be the case that the Japanese government does not have the processes in place to allow businesses to make such payments, although there may be the capability to submit tax forms without submitting an online payment.

On the other hand, broadband businesses in France, where ecommerce spend by residential users is low as a result of attitudes to personal credit card usage, appear to be amongst the most willing to pay their government online, in contrast to the narrowband picture. This

may reflect a more structural difference in attitudes to online commerce between early adopters in France (broadband businesses) and those who are behind on the technology curve (narrowband businesses).

For most countries there is little change predicted between the end of 2004 and Q2 2005, based on past growth trends. However, it is expected that Sweden will have seen continued growth in the percentage of businesses making payments to public authorities online, given its strong historical growth between 2002 and 2004 for both broadband and narrowband businesses.

This data is derived by projecting forward the source data from the *Information in the Business Age* study. Very little public domain information is available for this indicator

4.3.6 Ecommerce revenue

Definition

For all of a country's broadband businesses that take orders over the Internet, the average of the total annual value of orders received via the Internet expressed as a percentage of each entity's total annual order volume. This includes all orders irrespective of whether payment is made over the Internet, or invoiced separately.

Results and comments

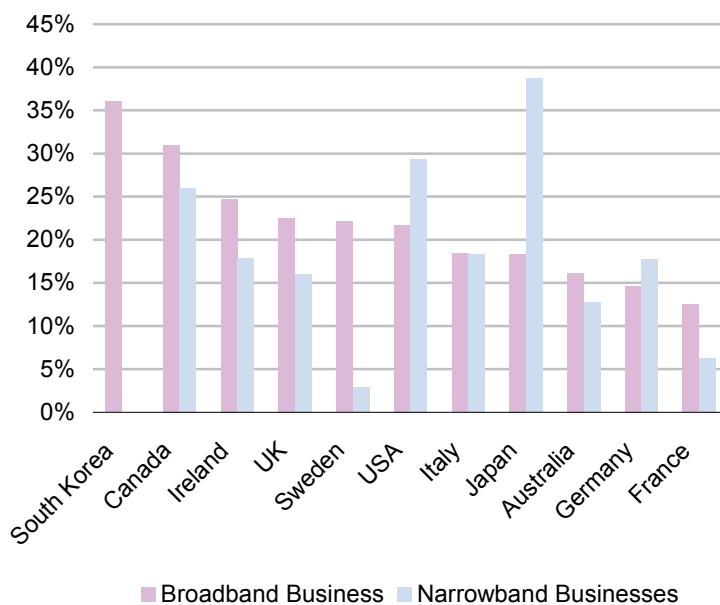


Exhibit 4.9:
 Percentage of total orders generated over the Internet, in the year to the end of June 2005 for all broadband and narrowband businesses already taking orders online
 [Source: Analysys]

Survey results from the *Business in the Information Age Study 2004* show that businesses that sell products and services online now generate significant proportions of their total order value over the Internet. Growth in orders over the Internet through 2004 are predicted to have continued through the first half of 2005. This premise is supported by data from similar, but not identical, metrics made available by sources including Statistics Canada, the Korean Ministry and Eurostat. We have assumed that the underlying increase in orders for businesses who have been engaged in ecommerce for some time is partially offset by a dilution effect as a result of additional businesses becoming newly engaged in ecommerce. Looking at broadband businesses, South Korean companies enjoyed the highest success online, while the French and German companies suffered from national reticence to use credit cards.

The results from the latest *Business in the Information Age* study, on which estimates are based, need to be treated with caution as sample sizes are sometimes very small. For instance, the Japanese data shows a very high percentage of all orders generated online (nearly 40%), but only six respondents out of the Japanese sample of 500 interviewees stated that they used narrowband, and that they sold goods or services online. Three interviewees reported that a very high percentage of their sales were generated online (in one case 80% of orders were generated online). In such a small sample, extreme responses have a dramatic impact on the output results. For this reason, close attention should be paid to the sample sizes shown on the chart. Exhibit 4.10 below shows the sample sizes for this metric.

<i>Country</i>	<i>Broadband businesses</i>	<i>Narrowband businesses</i>	<i>All businesses</i>
UK	263	155	630
Australia	52	41	113
Canada	62	23	68
France	35	12	138
Germany	54	12	127
Ireland	38	35	181
Italy	49	17	134
Japan	74	6	116
South Korea	110	3	150
Sweden	102	10	150
US	74	25	174

Exhibit 4.10: *Number of respondents that said they sold goods and services online [Source: Analysys]*

4.4 Results for residential indicators

4.4.1 Downloading TV, video and movie clips

Definition

Exhibit 4.11 below shows the percentage of all people in a country that have downloaded one or more TV, video or movie clips over the Internet within the last year. It includes individuals irrespective of whether the content is paid for or whether it is available for free. The metric is expressed as a percentage of Internet users and as a percentage of the total national population.

Results and comments

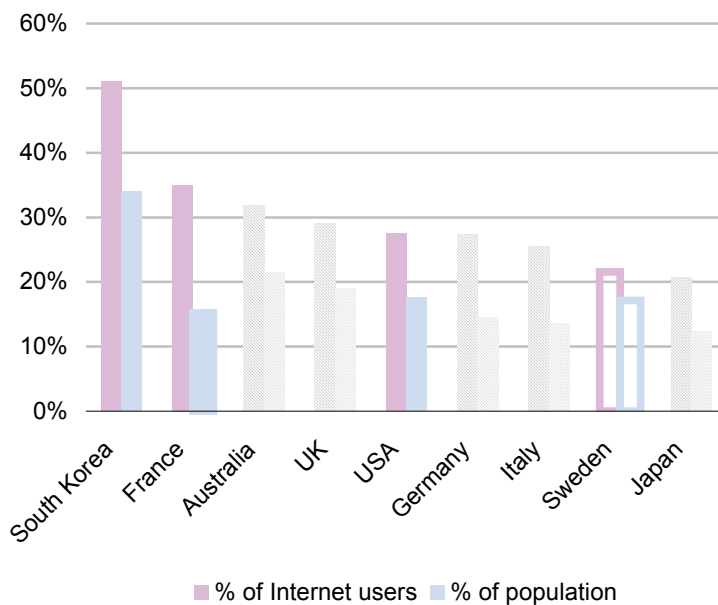


Exhibit 4.11:
TV, movie or video
clip downloading,
Q2 2005 [Source:
Analysys]

It initially appears surprising that, when measured as a percentage of Internet users, TV, movie or video clip downloading are low in Japan and Sweden in comparison with the other countries. As with other metrics, however, we believe that measuring usage amongst Internet users masks a saturation effect. We believe that those users who would download large volumes of movies and video clips form a core group within the early adopter segment. The Internet penetration in these two countries is high so many later adopters,

who use the Internet for more practical purposes such as sending emails and searching for goods and services, but who do not download movies and video clips, are reducing the countries' scores. This view is borne out by the fact that when plotted against percentage of population, Sweden is third and Japan is also much higher up the rankings.

The data for South Korea has been adjusted upwards significantly in this iteration of the report following new data from Park Associates which suggests that, as of the end of 2004, up to 48% of users stream or download video content every month (the previous data set focused primarily on paid-for content). The most likely explanation for this is the very high levels of broadband penetration – over 25% per head of the population – which is a little over 5% higher than the next highest country in this study (Canada). Meanwhile, video downloading in the UK is predicted to have grown strongly, based on strong past growth trends and also rapidly growing Internet penetration. For the US, data from PEW supports the trend of slow growth in TV, video and movie clip downloading. However, these estimates should be treated with high levels of caution due to the lack of a single data source data allowing for reliable cross-country comparisons.

France scores highly in comparison with other countries when looking at usage amongst Internet users. The French data, which is based on an ART survey conducted in mid-2004, includes downloading of video clips, etc. over peer-to-peer networks. It is possible that other surveys did not capture the effect of the peer-to-peer phenomenon (for instance, because of the way questions were phrased, or because they were conducted a little earlier in time).

It should also be noted that it is possible that the difference between countries in this metric falls within the possible margin of error. Substantial normalisation was required to produce this metric, and data for 2004 for Sweden was created by extrapolating from 2002 survey results. Our estimates could under-represent the popularity of movie clips downloading in the context of the growth of peer-to-peer file sharing.

Finally, Sweden, Japan and South Korea come top of the table of the next metric, online gaming, when usage is measured amongst Internet users. It is possible that in some cases TV and video clip downloading competes with gaming for leisure time amongst Internet users.

Sources used

A wide range of sources were used for this metric. These included national surveys commissioned by regulators and statistical offices into household use of the Internet, and published survey results from one-off surveys undertaken by commercial third-party information providers. Most data sources covered a single country, and they often measured slightly different service sets (e.g. inclusion of TV, or viewing of movies only), and slightly different periods of time (e.g. use in the last month *versus* use in the last year). Estimation was therefore required to normalise the results. A single source from the Motion Picture Association of America was informative – although its data only covered film downloads – as it did cover many countries covered by this study and was based on a survey conducted in 2004. New data from PEW and Parks Associates supplemented the data collected for previous iterations of the report.

4.4.2 Use of online gaming

Definition

Percentage of all Internet users in a country that have played an online game during the last year. Games are defined in their broadest sense to include massive multi-player online games, multi-player online console or PC games. It excludes games that are downloaded and played offline, as well as online gambling.

Results and comments

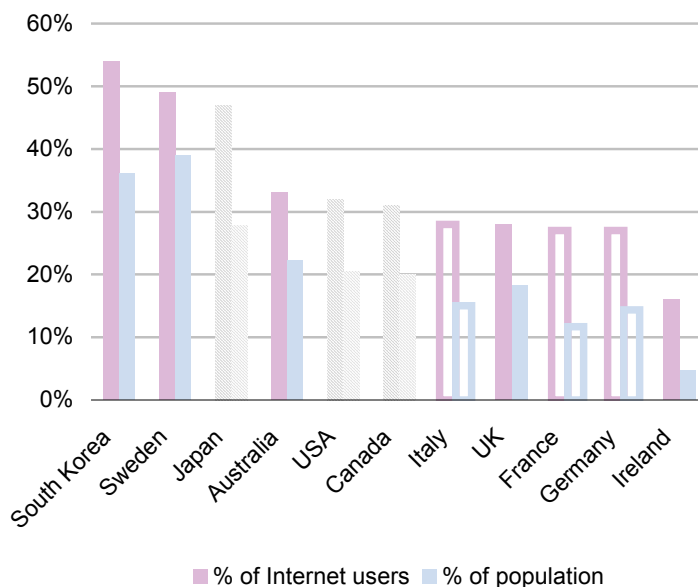


Exhibit 4.12:
Percentage of
Internet users and
population that play
online games, Q2
2005 [Source:
Analysys]

South Korea has a very large online gaming market. This is reflected by the very high score, which appears in spite of the high levels of Internet usage in the country. In other

words, late adopters are big gamers as well as early adopters. This is also true in Japan and Sweden. All three markets have high levels of broadband penetration, which is advantageous for serious online gamers. The lack of broadband penetration in Ireland could explain the low popularity of online gaming in that country.

Online gaming is estimated to have increased in most countries over the first half of 2005. Less growth is predicted for larger gaming markets where growth in broadband penetration is beginning to slow, for example Japan and South Korea. Meanwhile, countries which have experienced rapid growth in broadband penetration per head of population, such as the UK (which has grown from 10.2% to 13.3% in the first half of 2005), are predicted to have experienced a more rapid increase in online gaming on the assumption that a faster and more reliable connection will encourage a greater number of people to play online games.

Sources used

A wide range of sources were used to populate this metric. These included national surveys commissioned by regulators and statistical offices into household use of the Internet, as well as published survey results from one-off surveys undertaken by commercial third-party information providers. Most data sources covered a single country, and they often measured slightly different service sets (e.g. people who visited an online gaming site versus people who regularly play online games), and slightly different periods of time (e.g. use in the last three months versus use in the average week). Estimation was required to normalise the results.

4.4.3 Use of VoIP

Definition

Percentage of people in a country that, at the end of June 2005, were using *paid-for* VoIP services for personal purposes. The measure includes occasional use, use of an indirect access service for long-distance or international telephony, or use of a voice-over-broadband solution. The measure excludes use of free PC-based software products that enable PC-to-PC calling. It excludes use through work.

Results and comments

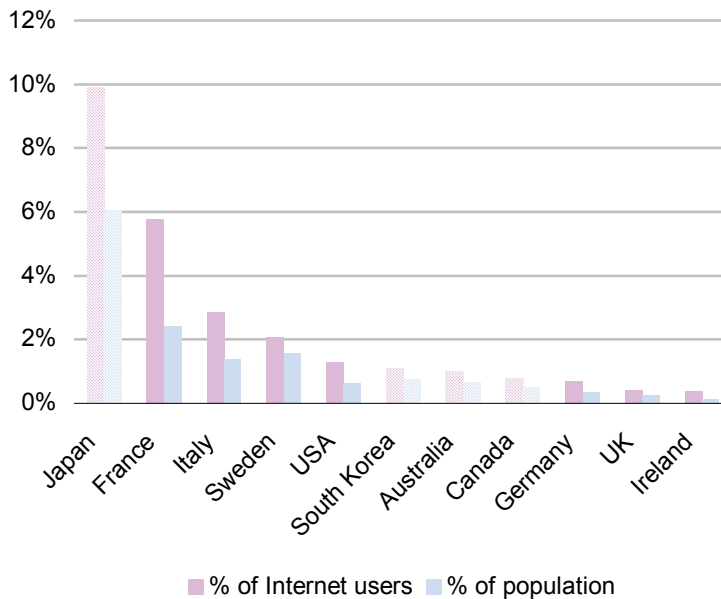


Exhibit 4.13:
Use of VoIP
services by
residential
consumers, Q2
2005 [Source:
Analysys]

There has been a flurry of VoIP activity across a number of countries during 2004 and the first half of 2005. These developments in VoIP activity are discussed in more detail in Section 4.5.2. There has been an overall increase in VoIP across the majority of countries in this study, with VoIP penetration in France showing a particularly rapid increase. In France, the local loop unbundlers such as Free (Iliad) have a comparatively large market share and offer direct-access VoIP packages without running the same risk of cannibalisation of revenues that France Telecom faces. Key players in the paid-for VoIP sector in France include France Telecom (which has responded to packages offered by unbundlers), Free, neuf telecom and Cegetel, Tiscali and Wengo. Meanwhile, in Italy, FastWeb, which had an estimated 542 000 customers in March 2005, offers VoIP as part of a bundled broadband package to all of its customers.

By June 2005, Japan remains by far the largest VoIP market (in terms of percentage take-up) and Yahoo! the largest player.

Sources used

More data has now become available on consumer VoIP following growth in availability and popularity. This includes data from a recent study of retail VoIP by Analysys

Research, as well as data from PointTopic. Both sources provide information on which to base mid-2005 estimates. Nonetheless, most data is expressed in the form of number of subscribers/lines, whereas we estimate the number of users. This means that, in spite of the availability of more reliable data than previously, there is still a large margin for error. The results for this metric are based upon Analysys’s estimates derived from operator data, press reports, information from regulators and Analysys’s research into the development of the supply-side of each country market.

4.4.4 Ecommerce spend

Definition

Average annual consumer ecommerce spend per Internet user per country. The metric includes consumer spend on all types of products and services. It excludes business-to-business ecommerce spend. Spend is defined as the total value of goods and services ordered over the Internet, measured in GBP.

Results and comments

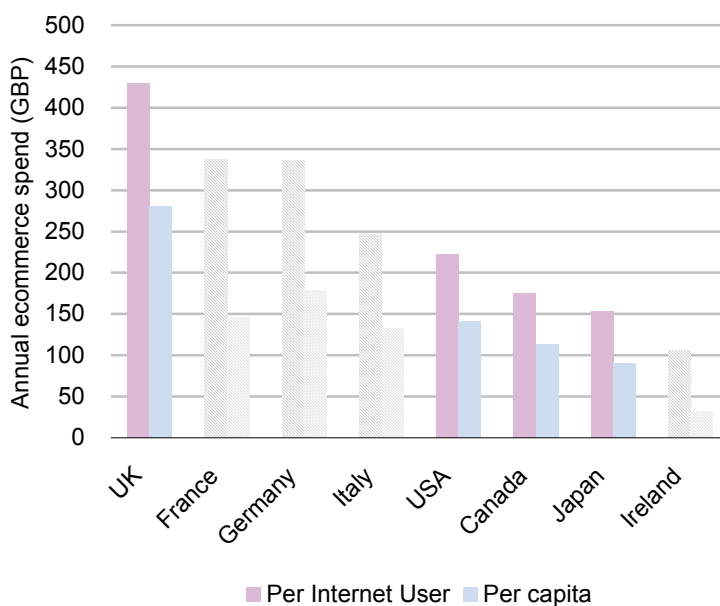


Exhibit 4.14:
Average annual ecommerce spend per Internet user and per person, year ending June 2005 [Source: Analysys]

The results suggest that the UK is a long way ahead of the other countries in terms of spend per Internet user. The results are in fact so far ahead that we have been concerned that we are understating the other markets in some way, or overstating the UK. The 2004 numbers are extrapolated from figures for 2003, published by the UK's national statistics office, which showed a doubling of national ecommerce spend from GBP6.4 billion in 2002 to GBP11.4 billion. We assumed a 30% growth in 2004 and a further 12% for the six months to the end of June 2005. Nonetheless, the figure estimated per user is lower than the 2004 spend estimated in the previous report. This is as a result of revised data on number of Internet users, which has been revised upwards by 6.9% for the year ending 2004 based on new data available from the ITU. Other countries significantly affected by this revision are Italy, with the number of Internet users revised upwards by nearly 6%, and the United States and Ireland, both of which were revised down by approximately 7%.

There is evidence to suggest that there has been some dramatic recent growth in the UK's ecommerce market, and that 30% for 2004 and an annualised rate of 24% for the first half of 2005 may be conservative. A recent survey commissioned by ISP Pipex found that out of 500 people surveyed in the UK, 51% of men and 43% of women purchased goods online in March 2005, and that the average spend level in March (i.e. for one month only) was GBP127 per capita.

A possible explanation of the disparity between UK numbers and numbers for other countries could be the inclusion of travel purchases (i.e. flights and hotels) in the UK number, which are not always included by other countries. Another difference could be the inclusion of transactional volumes on eBay (often excluded, or limited to eBay's retained revenue).

It is also possible, given the methodology used, that a recent worldwide boom in ecommerce has not been captured by our estimates. This will become clear when and if further data sets become available for future updates for other countries.

Sources used

We have predominantly used figures for business-to-ecommerce trade published by individual statistical bodies of the different countries (for example, the US Department of Commerce) and figures published by Eurobarometer, the programme of surveys of consumer behaviour run by the EU.

The source data sets typically provide time series data for 2000 to 2003. Most statistical authorities have yet to publish information for 2004, so 2004 and Q2 2005 results have been estimated from previous growth trends.

4.5 Trends analysis articles

This final section of this report contains two short trends analysis pieces. One examines the current and future importance of peer-to-peer (P2P) traffic and usage, whilst the second focuses on the use of voice-over-IP (VoIP) in more detail than has been covered in the business and residential usage indicators sections.

4.5.1 Peer-to-peer usage

Peer-to-peer (P2P) networks are commonly used for sharing large files between users, as well as for enabling certain VoIP services. These networks utilise the computing power and storage capacity of participating computers rather than placing the load entirely on a limited number of central servers. Well-known P2P networks/protocols include BitTorrent, eDonkey, Gnutella and WinMX.

This article examines the recent growth in P2P traffic, and how there could be a shift from illegal to legal usage of such networks in the near future as more content providers look to use P2P networks for efficient distribution of content.

CacheLogic, a provider of traffic management and network intelligence solutions, has supplied much of the data for this article. The data is derived from layer-7 deep packet inspection of traffic from ISPs around the world. Where this data, or data from other sources, has been used we have cited the original source.

Broadband penetration and growth in peer-to-peer traffic

P2P traffic as a percentage of all Internet traffic has shown rapid growth since 2000, growing from around 15% in 2000 to approximately 55% by the end of 2004, as shown in Exhibit 4.15 below.

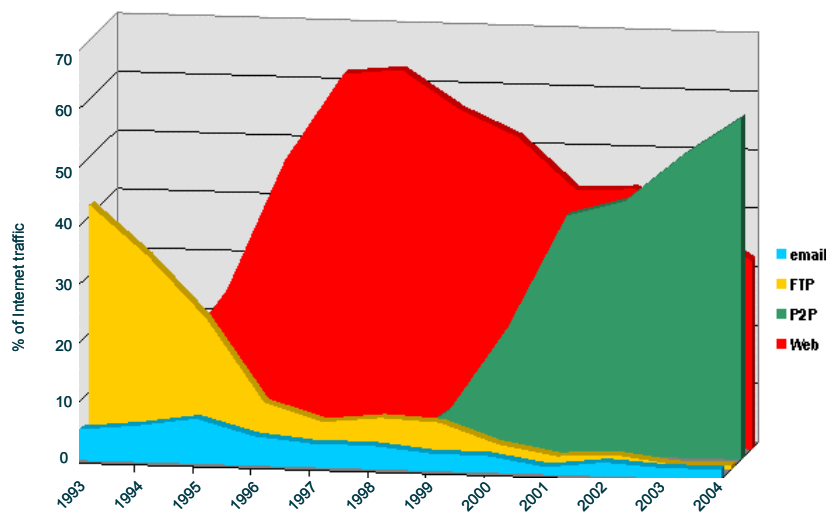


Exhibit 4.15:
*Internet
 Protocol trends
 1993–2004*
 [Source:
 CacheLogic]

Reliable data on the number of Internet users using P2P technology is scarce. However, inter-country comparisons provide supporting evidence for a positive correlation between levels of broadband penetration and P2P usage, with increased downstream speeds making it quicker and more convenient to download large music and video files. There will be other contributing factors to the growth in P2P traffic aside from increasing broadband penetration, such as the increasing availability of digital media (and ease of storing data on hard-drives) and the viral nature of growth in usage of such services, relying on word of mouth as a major driver of publicity.

Exhibit 4.16 below shows broadband penetration for the eleven studied countries. A recent OECD report²⁴ found that, on a per capita basis, the USA has fewer peer-to-peer users than Canada and more than France and Germany. This corresponds with the broadband penetration in the USA being lower than in Canada, but higher than in France and Germany, as shown in Exhibit 4.16.

24

Digital Broadband Content: Music, October 2004.

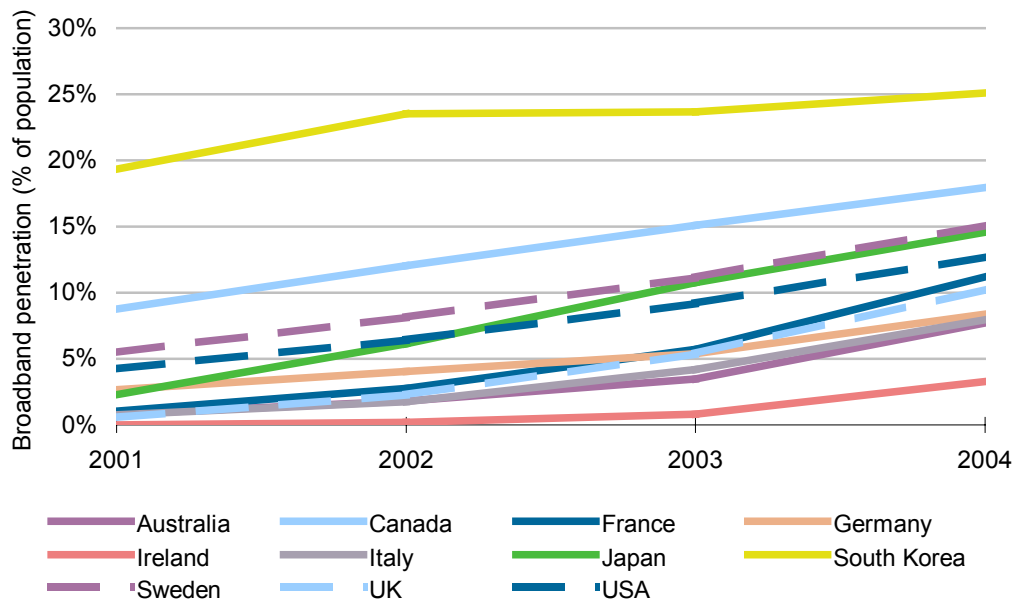


Exhibit 4.16: Growth in broadband penetration [Source: Analysys]

For some portion of broadband users, a faster downstream speed encourages the sharing of files by reducing download times. However, some broadband users would have based their decision to purchase a broadband connection on their desire to share files (rather than later finding that a high-speed connection enables them to do so). This is especially the case amongst young adults, who are more likely to be accustomed to fast Internet connections available on university campuses or in Internet cafes, and who may have engaged in file-sharing from these locations already.

As well as leading to an increase in the number of people using peer-to-peer software, increased broadband penetration has made it more practical to download video material. Indeed, video now represents an estimated 61.4% of total peer-to-peer traffic, as shown in Exhibit 4.17 below. This is not unexpected given the difference in average file sizes between music and video. Video content is likely to continue to increase as a proportion of all P2P traffic, and will contribute to further growth in overall traffic volume.

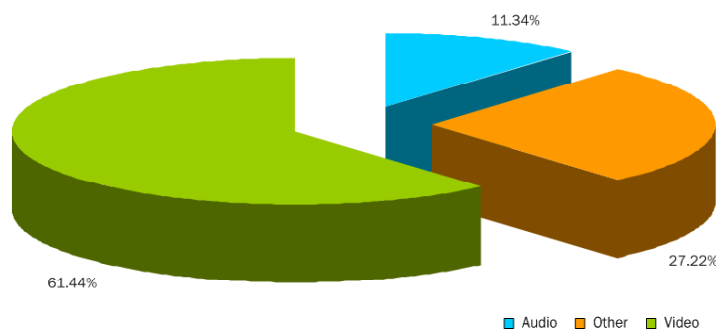


Exhibit 4.17:
Mix of file formats by volume over the entire peer-to-peer network
 [Source: CacheLogic, August 2005]

Legal issues and peer-to-peer usage

While peer-to-peer usage is strongly linked to broadband penetration, levels of adoption are also a function of cultural and legal factors. For example, data from Parks Associates²⁵ suggests that in Canada 32% of broadband users were sharing files in 2004, compared to 16% in the US. Arguably, this could be due to stricter US legislation on sharing copyrighted material but may also be driven by other factors.

If there is a strong link between crackdowns on illegal file-sharing and peer-to-peer usage, then we would expect peer-to-peer usage to decline. Earlier this year, Sweden passed legislation making the sharing of copyrighted material over the Internet illegal and the US introduced stronger penalties for those illegally sharing copyrighted materials, with those found guilty facing heavy fines and up to three years in prison. Additionally, the US Supreme Court has ruled that peer-to-peer network operators can be held liable for the activities of those illegally downloading material on their networks. Meanwhile, Canada will soon be holding parliamentary hearings on proposed copyright legislation.

It seems unlikely, however, that this spate of legal actions will have much impact on peer-to-peer usage. As Exhibit 4.15 shows, legal actions to date would not appear to have had a significant impact on overall levels of peer-to-peer network usage. In fact, the increased publicity of peer-to-peer networks gained through these actions may serve to slightly increase the number of users although legal actions have impacted significantly on the market share of different peer-to-peer network operators. By 2004, BitTorrent had emerged as the largest peer-to-peer network following legal pressure on Kazaa, although the

25

P2P Makeover: Showtime for DRM (<http://www.digitalhollywood.com/Images/P2P-Parks.pdf>).

company's market share has since declined due to the closure of key tracker sites as a result of legal pressures. eDonkey has subsequently emerged as an alternative to BitTorrent, establishing itself as a key player. The open-source nature of eDonkey's software means that there is no one individual or organisation to hold accountable. An alternative approach which peer-to-peer network operators may take is to relocate themselves in locations where they can escape legal actions.

These developments demonstrate the adeptness with which peer-to-peer network operators can sidestep legal restrictions in the short-term. In the medium to long-term, peer-to-peer usage patterns may shift to more legal applications as users find it difficult and frustrating to keep up with the constant changes necessitated by the game of "hide-and-seek" between peer-to-peer network operators and legal bodies.

For example, PlayLouder (an ISP in the UK) has entered into a deal with Sony BCG which will allow all users on the PlayLouder network to share music legally from Sony's main catalogue. Under this business model, PlayLouder's subscribers pay a monthly subscription for a broadband connection plus the capacity to share unlimited music files with other users on the PlayLouder network. The ISP will pay a share of its subscription revenues to Sony. Meanwhile, MashboxX, a technology which will connect existing peer-to-peer networks such as eDonkey, Kazaa and Gnutella, will allow users to download, free of charge, those files that copyright holders have not claimed, but will only permit downloads of claimed files when a payment is made. Furthermore, the BBC is currently piloting its interactive Media Player (iMP), which allows for the legal download of a time-limited back catalogue of the BBC's programmes over a peer-to-peer network.

There has already been an increase in the number of legal music-track downloads, with the International Federation of Phonographic Industries reporting that legal music track downloads reached 180 million in the first half of 2005, three times more than in the first half of 2004.

It therefore seems that, given increasing broadband penetration, the limited impact of legal action on illegal file-sharing and the potential for the growth of legal file-sharing in the future, peer-to-peer usage is set to increase even further.

The implications of peer-to-peer for broadband services

Given the large traffic volumes generated and the inherently symmetrical nature of peer-to-peer usage, where each downloader is also an *uploader*, the growth in peer-to-peer file sharing has significant implications for the structure of broadband offerings.

ISPs will have to cope with growing traffic volumes generated by peer-to-peer and this will encourage ISPs to cache files closer to the end user in an attempt to reduce overall network traffic and reduce off-net traffic to lessen peering and interconnection charges. In spite of this, ISPs may still have to increase the capacity of existing networks in order to cope with growing traffic volumes. In order to offset the costs of doing so, ISPs will need to develop business models that enable them to receive the benefits, not just the costs of peer-to-peer file sharing. As we have seen, PlayLouder has recently launched such a business model. Many ISPs are now placing download caps on services, with users either having to upgrade to a higher download cap or pay on a per-megabyte basis if they download volumes in excess of the cap. Currently, ISPs do not strictly enforce usage caps, choosing only to respond to those users who persistently exceed their cap by large amounts, but the structure is in place to monitor usage more rigorously if required.

Conclusion

Illegal file-sharing looks set to continue but there is growing potential for the development of legal peer-to-peer activity. Both ISPs and content providers will need to develop new business models in order to benefit from peer-to-peer technologies. From a technological and structural perspective, broadband network operators will need to adapt their networks in order to cope with the massive traffic volumes generated and fast upstream speed requirements of peer-to-peer usage. They will also need to develop strategies which enable them to gain extra revenues as a result of the high levels of traffic generated by peer-to-peer network usage. Meanwhile, content providers will need to develop clear and attractive pricing models and put in place effective digital rights management (DRM) to minimise illegal distribution and maximise the revenue opportunity.

4.5.2 VoIP usage

Broadband is essentially a *sine qua non* for VoIP. However, it would be crude to suggest that VoIP trends are exclusively driven by penetration of broadband. VoIP take-up, usage and cost is driven by a number of factors specific to individual national markets. These include broadband penetration, incumbent VoIP strategies, POTS pricing, evolution of current technologies and the strategies of cable companies.

In this section, we examine the recent growth in both residential and business use of VoIP, and whether a correlation exists between increasing broadband penetration and the use of VoIP services.

Residential VoIP usage

As shown in Exhibit 4.18, Japan is by far the world’s largest user of paid-for residential VoIP. Huge growth in Japan appears likely to be due to a one-off surge in adoption over the last six month driven primarily by Yahoo!’s aggressive undercutting of PSTN rates and the high existing broadband penetration. Also, VoIP growth has been strong as the Japanese population tends to be more open to new technology. Dramatically high levels of VoIP adoption are strongly driven by high levels of broadband penetration, in turn driven partly through geographic factors such as high urban population densities.

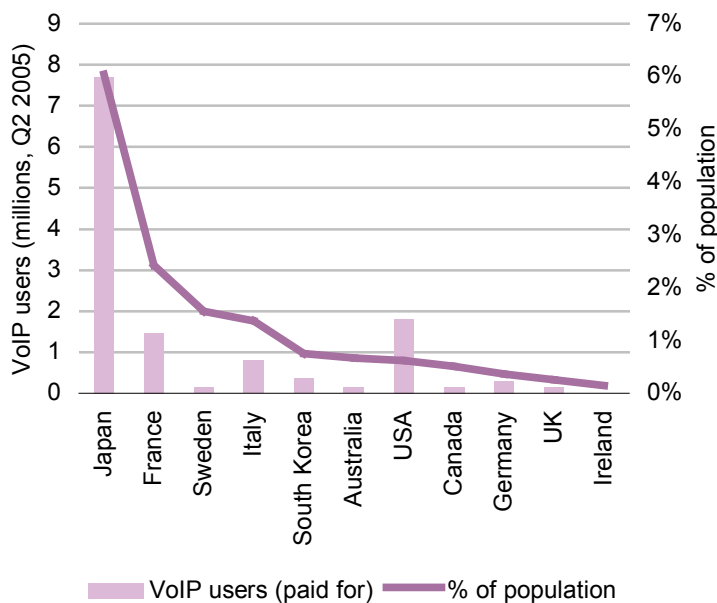


Exhibit 4.18:
Paid-for residential VoIP usage, Q2 2005 [Source: Analysys]

France and Sweden are the most established VoIP markets in Europe. France had around 1.5 million paid-for VoIP users by the end of the Q2 2005, with the majority of paid-for subscribers provisioned by Free and neuf using a plug-and-play set top box, with these often being used as second-line services. France Telecom has responded with its own service, and reported 400 000 subscribers at the end of Q2 2005. Sweden also has a dynamic VoIP market, spearheaded by TeliaSonera. Here the business model is slightly different: TeliaSonera targets the first line market and had 90 000 subscribers by Q2 2005.

In Canada and the USA highly integrated cable companies have had success with VoIP based telephony offerings – for example, Time Warner posted remarkable 70% growth in VoIP subscriptions for the first half of 2005). This is likely to drive those companies to invest in xDSL over unbundled loops in order to expand their footprint, and to continue to develop VoIP services.

In the UK, paid for VoIP services have not been widely available to date, with BT focussing on developing VoIP in the core network rather than promoting its residential retail VoIP service. The recent launch of freetalk (by DSG International) will increase the visibility of such services (including Vonage) in the UK and could lead to a relatively rapid growth in paid VoIP usage. However, the popularity of free VoIP services such as Skype and Microsoft Messenger, could hinder this growth.

Drivers of increased VoIP usage

The forces that drive short-term growth rates in emerging markets are subject to rapid changes, such as new market entrants, new service launches and merger and acquisition activity. Examples in VoIP are eBay's purchase of Skype and Microsoft's of Teleo; AOL's introduction of its "TotalTalk" service, and Motorola's demonstration of Sonus VoIP over Motorola's Canopy wireless broadband system. It is likely that for the next few months at least the major drivers of growth in residential VoIP use will continue to be these types of single events. In this section we highlight some of the impacts of such events in specific markets.

In Ireland, VoIP growth has been inhibited by low broadband penetration whilst in Germany VoIP usage over the last six months has seen rapid growth due to the entrance of new players in the last year. However, Deutsche Telekom's dominance of DSL may inhibit growth over the next year.

In Europe, a whole new set of telephony providers have emerged in the last 18 months. Examples are Gossiptel and Annatel, which launched services in the UK in Q1 2004, driving high growth rates through 2004 which have subsequently slowed. These companies' launches in France Germany and Sweden this year are responsible for very strong growth rates – though from a small base – in these nations. Vonage has moved into Europe from the US, where it had signed up an estimated 400 000 customers by the end of Q2 2005. At the same time, cable operators and LLU operators without significant PSTN customer bases have been introducing voice-over-broadband services.

VoIP trends for residential user spend and spend per minute

The low cost of VoIP in the USA is driven by low fixed voice prices, as unmetered calls are common in the US (at least for some types of calls) and the population has a cultural propensity to use telephone services more than Western European and South East Asian nations.

In Japan, a competitive market for VoIP has resulted in very low prices. VoIP users generally must retain their PSTN line and pay line rental – a situation often driven by regulation surrounding emergency services calls. This means that VoIP calls are generally priced at a very low level as the VoIP service is essentially a second line for very low cost or free out-bound calls.

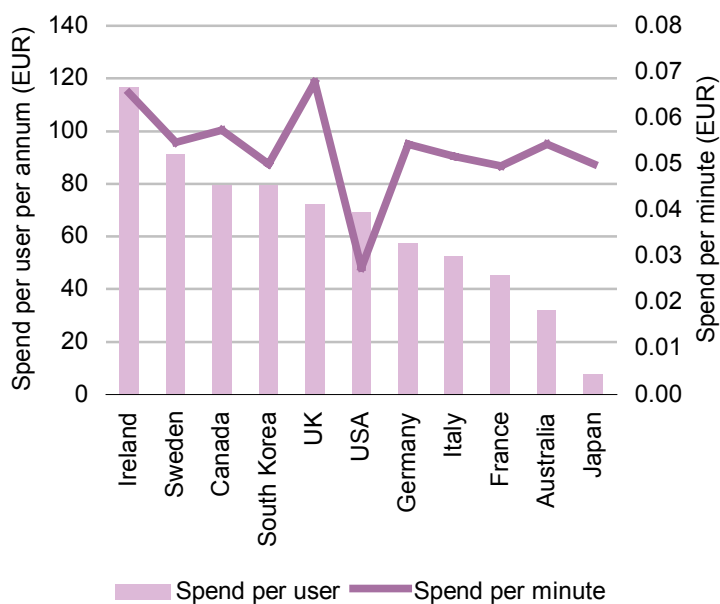


Exhibit 4.19:
2005 forecasted
annual spend per
user (EUR) and
spend per minute
[Source: Analysys]

Trends in business adoption of VoIP

Business VoIP adoption, as with residential, does not simply correlate closely with broadband usage as there are more sophisticated market forces which affect the voice strategies of enterprises. For enterprises, key factors in adoption of VoIP are cost savings, the maturity of the customer (i.e technical confidence and ability) and their trust in IP as a reliable, secure communications technology. For instance, Nextira One is finding that its customers now believe that VoIP is ready for deployment as “a viable alternative to traditional voice” because companies they know of in the USA, the UK and the Nordic region have already made this move or perhaps others in the same sector in their own country have already deployed VoIP. This is demonstrated by the growth in VoIP usage among broadband-enabled businesses, as shown below in

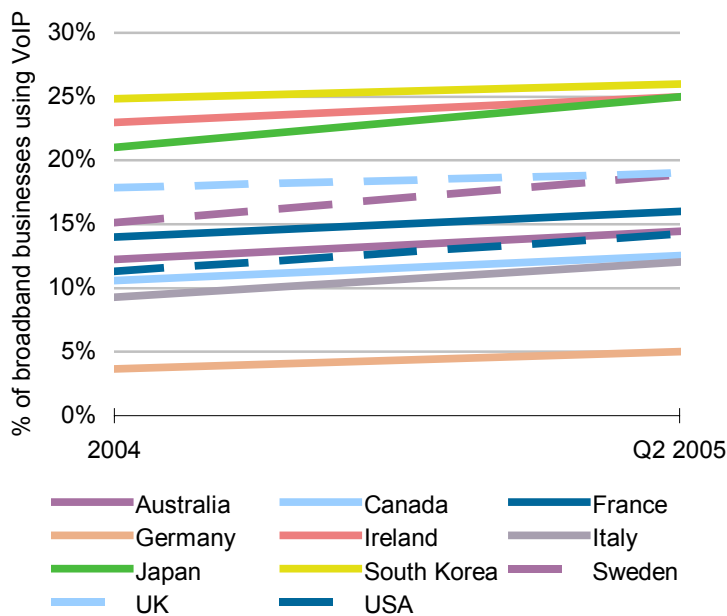


Exhibit 4.20:
Percentage of
broadband
businesses using
VoIP Q2 2004 – Q2
2005 [Source:
Analysys]

As shown in Exhibit 4.21, there would appear to be a weak correlation between VoIP businesses and broadband businesses

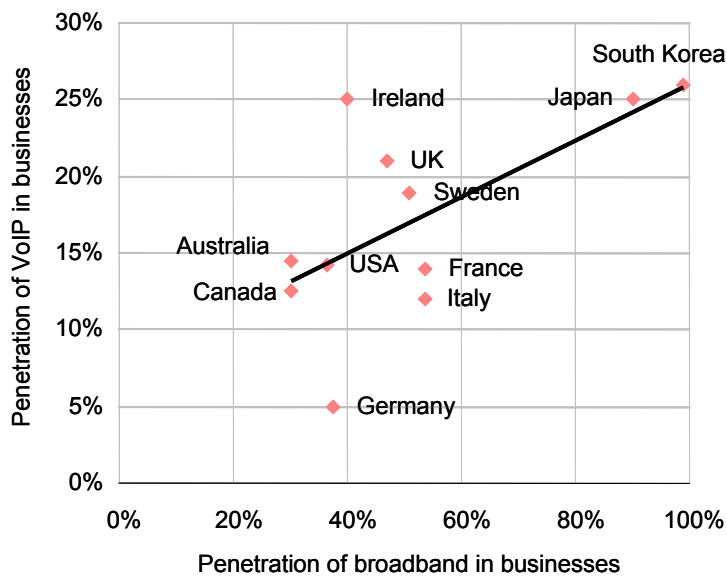


Exhibit 4.21:
*Business VoIP
 penetration against
 percentage of
 broadband
 businesses*
 [Source: Analysys]

South Korea, Japan and Ireland top the rankings for the percentage of broadband businesses using VoIP. In the case of Ireland this may be partially due to the relatively low take-up and availability of mass-market broadband in Ireland, combined with above-average mass-market broadband prices. As a result, broadband businesses in Ireland will tend to be more technologically literate than, for example, mass-market broadband businesses in the UK or Sweden, where overall take-up is much higher, and so be more likely to adopt VoIP early. In Germany low VoIP penetration is likely to be due to broadband being rolled out by incumbents who already had a TDM voice business. Japan and South Korea, where the broadband market is much more mature and where penetration rates have grown rapidly, enjoy a business base which has been quick to take advantage of new technologies – possibly a reflection of the cultural attitude in South Korea and Japan towards the early adoption of emerging technologies.