Office of the Director of
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Regulation

CONSULTATION

Future Delivery of Broadband in Ireland

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Oifig an Stiúrthóra Rialála Teileachumarsáide
Office of the Director of Telecommunications Regulation
Abbey Court, Irish Life Centre
Lower Abbey Street, Dublin 1, Ireland
Tel. +353 1 804 9600 Fax. +353 1 804 9680 E-mail info@odtr.ie

FOREWORD

Telecommunications network reach and capacity are key enablers of a range of important services from traditional fixed and mobile voice to e-mail, web browsing and on-line purchasing, to the conveyance of major data flows which enable state of the art business management systems for major multinational companies and governments. Advanced services are important for Irish companies enhancing their communications and business processes and ensuring that they are individually and collectively seen as credible and effective e-business partners. Such services are also important for residential consumers in terms of inclusion in the Information Society and more generally as a market for and beneficiaries of cheaper, faster and more extensive ranges of competitive services than in the past.

Since the end of the Internet and ICT boom that we witnessed at the end of the last century, there is considerable uncertainty internationally as to the shape and extent of development and take up of services over the coming years. This is having an important knock-on effect on the scale and timing of telecommunications network deployment[1]. Ireland made considerable progress in the very short period from when telecommunications liberalisation took place at the end of 1998 to the softening in the markets in 2000, but did not catch up with the leaders who had started far earlier in developing their Internet and telecommunications capacity and market competition. Since 2000, growth here has been slower, leaving substantial gaps between Ireland and the leading countries on some indicators. Government funding is tighter than before.

Against this background it is useful to review the priorities to see what is most needed and what is most likely to quickly yield long lasting and sustainable results. Many of these matters are beyond the responsibility of the ODTR but we feel that we may be well placed to make a contribution to the discussion which may be helpful to decision makers. As noted by the OECD,

> *"There is sufficient evidence from OECD countries themselves that competition is the best way to diffuse new technologies rapidly. Where assistance of some kind is deemed necessary, it would be useful if regulators were involved in drawing up the assistance framework so they can be ensured that such assistance limits market distortions".*
>
> (OECD, 'Broadband Infrastructure Deployment: The Role of Government Assistance', May 2002).

This report presents independent research on the nature and structure of the demand for Internet products and services and the costs and technical issues concerning broadband networks. I hope that it will encourage the debate and provide some relevant information on the future delivery of broadband in Ireland.

Etain Doyle - Director of Telecommunications Regulation

[1] Here telecommunications is taken to include voice, data and video communications, delivered over fixed or wireless networks, and includes for example telephony, broadcast transmissions and Internet use.

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EXECUTIVE SUMMARY

Despite the implosion of the dot.coms and the deflation of some telecommunications speculative bubbles, there are fundamental changes in the market which are based on sound economic sense and can be important enablers of greater social inclusion. Information and Communication Technologies are major drivers in creating huge efficiencies within firms, for example in marketing and communications, sales and CRM. Ireland has made substantial progress on some of the relevant issues – almost 9 out of every 10 SMEs are connected to the Internet for example – but there is clearly more that needs to be done to put us in the forefront of developments, enabling Irish business and consumers to reap all the benefits of the information age. One area involving potentially the highest levels of capital expenditure is the competitive roll-out of broadband networks.

It is useful to consider where they fit in the range of measures that will further develop Ireland's involvement in the information economy, where clearly content, security and prices are some of the issues to be addressed. The delivery of broadband on its own is not a solution to the development of the information society and other elements may need to be given higher priority as we move forward.

This report aims to bring together some key issues for the future delivery of Broadband in Ireland including the regulatory framework, the current state of broadband deployment and the access technologies likely to deliver broadband to homes and businesses. The report considers the public policy initiatives at a National and European level, and introduces new independent research. This research includes estimates of the costs of enabling the existing networks in Ireland to deliver predefined capacities to homes and businesses. It also considers the likely demand for broadband applications and includes new research on the likely price points for Internet access products.

It is important therefore when considering such a future looking agenda to consider the current state of the Irish telecommunications market. The market, after almost four years of liberalisation, has delivered a lot in terms of retail price reductions and improved services to the end user. There is choice for end users in fixed and mobile telephony with a market share for alternative fixed operators steady at 21%. There are three GSM operators with almost 3 million subscribers. In broadcasting the cable operators continue to upgrade their networks to enable digital TV distribution and hopefully enable them to increase the roll-out of cable modems. Similar to the experience across the rest of Europe, Ireland has witnessed a lessening of competitive pressures in the past twelve months as global overcapacity in some sectors has impacted sentiment of investors to telecommunications.

Within this competitive framework Governments have been seeking to raise awareness of the benefits of broadband. The National Development Plan has brought forward a number of public-private initiatives to promote investment in infrastructure in Ireland. The experience in other countries in the past number of years has been that broadband supply needs stimulation from Government to

support the upgrade of networks and to encourage the delivery of services to end users.

The work of the ODTR in setting the frameworks for a liberalised market also assists the competitive delivery of broadband. The licensing of alternative technologies, including fixed wireless and the unbundling of the local loop allows alternative service providers to access the market. The ODTR believes its role, alongside the creation of regulatory frameworks, is to inform the sector on the key issues surrounding the delivery of broadband and this report presents findings from Ovum and MRBI on cost of supply and the possible demand for broadband.

The cost of supplying broadband enabled networks is substantial. The ODTR commissioned telecommunications consultants, Ovum to develop benchmark costings for the roll-out of new infrastructure and upgrade of existing systems, to provide broadband access to varying percentages of the Irish population. This report contains the key findings of the study which include estimates on the incremental cost of providing broadband access and backhaul at nominal speeds of 512kbit/s, 2Mbit/s and 5Mbit/s. Ovum considered demographic, technological and demand issues in coming to their findings. Ovum assumes that DSL over existing copper will be the predominant technology in the lower bandwidths when they consider the choice of the 'best-mix' of access delivery technologies. At the higher access speeds, Ovum's study assumes greater use of fibre in the network and consequently costs begin to increase quite rapidly.

It is important to note that this study is in effect a base case scenario primarily concerned with hardware requirements such as infrastructure and operational network management costs. As such this 'boxes and wires' approach means that the estimates provided by Ovum relate to the incremental capital costs of installing the required equipment plus Ovum's estimates of operational costs directly associated with the servicing of the equipment over the five year time frame. This study is not intended to serve as a business case and hence other costs that would have to be incurred in a commercial venture such as sales, general and administrative costs, interconnect charges for right of use, and costs for finance are not included. An estimate of the possible impact of all these ancillary costs is beyond the scope of this report but in Ovum's experience, over a five year period, the marketing and sales channel costs alone could double the costs for systems infrastructure and operational implementation.

The key findings of the Ovum report show that making 512kbit/s available to 85% of the population would have an incremental cost of around €450million. For 2MBit/s availability the cost rises to €2billion, and for 5Mbit/s availability the cost is estimated at €4.1billion. All these scenarios relate to coverage levels of 85% and subscription take-up of 60%.

The Ovum work suggests the need for those in the telecommunications sector to cost strategic objectives carefully. It would be a significant investment for government, industry or both to consider upgrading the access network to 5MBit/s capacities. However it can be seen from Ovum's study a progressive upgrade to high capacities over the time period considered is reasonable. Further work needs to be done however to examine the business case and ODTR would encourage such work.

A key element in any business case for investment in the telecommunications network and service provision is the prospective demand for any services offered. As part of the independent research conducted for this report, TNS MRBI interviewed over 700 people in the residential market and 400 SMEs to ascertain their attitudes to the Internet and the provision of high speed, always-on services in particular.

The research would appear to suggest that significant numbers of Irish people are getting online. However a majority of Internet users have yet to fully engage with the Internet and both residential and business use is predominantly for communications and research. The market segmentation performed as part of the residential research shows there is demand for accessing the Internet at home from those currently accessing it at work, if an Internet package which meets this segment's expectations in terms of price were to be offered.

Price is one of the key factors in encouraging broadband adoption amongst residential and SMEs users. From this research, it would appear that a broadband package at between €40 - €60 per month would attract a relatively high percentage of Irish SMEs. For residential users a targeted product emphasising broadband's fast and unmetered nature may gain some appeal, with €30 - €40 per month likely to represent the upper price range.

The survey results also point to content as a key factor in determining not only the interest in getting online but also in staying longer online. There was interest in the residential market for local content. In the SME sector most respondents were happy with their current usage of the Internet. Most SMEs confined their use of Internet to email and research, with a lower percentage using the Internet to transfer files or conduct e-commerce transactions.

Regarding the experience of other countries, this report highlights the coordinated approach they have taken in stimulating broadband adoption. It also highlights the role of government and industry in working together to accelerate the availability of broadband services and raising awareness of the benefits of broadband usage.

The ODTR's aim in informing the debate on broadband roll-out in Ireland with this report we believe is timely. The next decade will decide which countries will lead in the knowledge economies that will develop and consequently reap the benefits in terms of productivity and investment. There is an impression that Ireland is falling behind. However this report shows we have made inroads in terms of the availability of broadband products and we have a growing Internet enabled community willing to use this technology more. On these foundations we will have to build the future delivery of broadband in Ireland.

The ODTR would be interested to receive comments on the content and the independent data presented in this report. A number of questions are posed at the end of this report and interested parties are asked to submit comments to us before 25th October 2002.

1 INTRODUCTION

1.1 Informing the Debate

The term 'broadband'[2] is widely used with many meanings, including both high capacity networks and the range of telecommunications services and applications that require modern high-speed communications networks such as multi-media applications to serve end users. For the purposes of this paper, 'broadband' is defined as telecommunications network capacity of 512kbit/s[3] or above in the portion of a network that a customer uses to connect to a service provider – i.e. the access network.

The physical deployment of broadband networks is a complex matter involving numerous technical, topological, demographic and commercial issues. Despite recent rapid growth in the number of subscribers worldwide, the broadband market is still in its early stages with relatively stable technologies and sustainable business models only now beginning to emerge. The immaturity of the market means that returns on investments are by no means guaranteed and the decision to invest, particularly in the current economic environment, is still characterised by considerable uncertainty. Apart from ICT industry players and the interactions between them, Governments and regulators are seeking to understand and tackle issues relating to broadband deployment.

It will be the case that for many users of the Internet a basic connection with 56kbit/s capacity will be sufficient.

Given these variables, informed analysis of the broadband market is a difficult and uncertain process. Notwithstanding the extremely complex issues involved, the ODTR hopes this report will further inform the debate on broadband. The report includes expert analysis from telecom consultants Ovum Ltd. on the supply of broadband networks and from market research specialist MRBI on the likely level of demand for broadband Internet services respectively. Whilst not seeking to provide prescriptive actions it is hoped that these contributions, along with the ODTR's own analyses can make a useful contribution to the development of national policy.

1.2 Report Structure

This report is divided into a number of chapters each examining the different dimensions of the broadband debate:

- **Chapter 2** looks at the potential economic and social benefits that widespread broadband access could bring.

[2] See section 3.1. for a fuller explanation.

[3] 512kbp/s was selected as the minimum threshold for broadband as this is currently one of the most popular speeds provided for by cable and DSL providers in their subscription packages.

- **Chapter 3** seeks to provide a working definition of broadband, which it is hoped can assist in developing a general consensus on a common understanding. This chapter also contains a brief overview of the different broadband access technologies.

- **Chapter 4** provides an overview of the current Irish broadband market with some analysis of its overall size and structure and brief profiles of the major broadband groupings and their likely future strategies.

- **Chapter 5** outlines the regulatory framework within which the Irish broadband market currently operates. This includes an overview of the EU's main regulatory initiatives relating to broadband, along with an analysis of how the ODTR gives effect to these initiatives at a national level.

- **Chapter 6** examines public policy initiatives beyond the normal regulatory framework which are likely to impact upon the Irish broadband market. At a European level this includes the European Commission's e-Europe 2005, while at a national level it looks at Government's plans for broadband infrastructure and related supporting frameworks.

- **Chapter 7** provides a brief overview of a number of broadband initiatives from around the world which may be useful to consider in the context of Ireland's emerging broadband market.

- **Chapter 8** examines the demand for Internet and broadband services in Ireland and includes analysis from TNS MRBI's surveys of the residential and SME markets.

- **Chapter 9** contains a high-level summary of a study completed by Ovum, looking at the costs involved in rolling out broadband communications to varying levels of population coverage.

- **Chapter 10** includes the report's conclusions and suggests a number of questions to which readers may wish to respond.

2 BENEFITS OF THE INTERNET AND BROADBAND COMMUNICATIONS

The actual and potential benefits of the Internet and broadband communications are both economic and social.

2.1 Developing an Information Society

> *"The networking technologies of the Information Society allow new ways of interacting that challenge the boundaries of what is traditionally possible – in terms of both time and location. We are living through an era where the full potential of these new possibilities is unfolding. The implications are generally accepted to be as far-reaching as those of the industrial revolution".*
>
> (New Connections policy document, Department of the Taoiseach, March 2002.)

In an Information Society it is the creation, distribution, and manipulation of knowledge and information that becomes the single most significant economic and cultural activity. In this way, an Information Society may be contrasted with societies in which the principal economic underpinning is primarily Industrial or Agrarian. With a high level of information intensity in the everyday life of most citizens, organisations and workplaces, the new machine tools of the Information Society are computers and telecommunications, rather than the lathes and ploughs of old.

2.1.1 Key enabler of the Information Society

Broadband communications are likely to play a vital role in developing an 'Information Society', so long as the services derived from them are positioned and priced such that they yield tangible economic or social benefits. The ability to transmit, receive and exchange large amounts of digital data rapidly and efficiently means that consumers should be able to access information more quickly and conveniently. This will happen provided new information and communication services are easy to use and meet high quality standards. Such capabilities open up possibilities in many fields of economic and social activity, including e-business, e-learning, e-Government, and entertainment[4].

For some users, a broadband application is simply a substitute – albeit an improved substitute - for an existing application. So, for example, instead of filling in a tax return or purchasing an airline ticket from a travel agent, users should be able to achieve the same results quicker and more efficiently online.

[4] See ODTR document 02/45, Potential applications for next generation networks – briefing note

For users in the business sector, moving to adopt and incorporate information technology into their normal business practices requires evidence of measurable business benefits. The cost, effort and resources required for some businesses to adopt information and communications technology can, depending on the degree of implementation needed, be significant inhibiting factors (e.g. integrating multiple incompatible internal and external systems). In such cases the addition of broadband access services will need to be relatively simple and transparent to avoid further complication. Indeed, the availability of efficient systems management software to integrate businesses systems, making their implementation easier and linking them to external Internet-based applications (e.g. accounting packages, inventory controls), is likely to be a significant factor in terms of increasing the demand for broadband, by the SME sector in particular.

The promise of broadband communications can leave those who are unable to access facilities they require, through high costs or lack of availability, frustrated and unable to develop their businesses in directions that they want. For example, ordering and maintaining leased lines has not been as easy, quick and cheap as many users would like. This has caused some users to turn to or explore alternative solutions including those presented by new technologies.

It also likely that many businesses and residential users of Internet content and applications will be satisfied with lower capacity connections and for some online activities, e.g. booking travel, the need for higher capacity connections will not be required.

2.2 Broadband as an Engine of Economic Growth

As well as creating opportunities and providing improved productivities, a high-speed broadband infrastructure could also act as an engine of economic growth, potentially stimulating growth in research and development and higher value industries such as digital media content and billing/payment services.

For countries like Ireland, the widespread availability of inexpensive broadband can not only reduce the costs associated with servicing the traditional major markets (e.g. UK, Europe, US), but it can also open up hitherto untapped markets previously thought uneconomic to penetrate. High-speed reliable and cost-effective communications infrastructure should also help Irish companies to expand overseas.

Reliable and cost-efficient communication can also play a vital role in facilitating inward investment. In the past Ireland has been extremely successful in capturing a high proportion of foreign investment. However, with many of the jobs associated with such investment being in higher value knowledge-based activities, it is particularly important that Ireland continues to invest in the broadband communications infrastructure necessary to support these industries as well as in the re-skilling of its citizens.

2.3 Conclusions

In the 1980s and early 90s, the initial digitalisation of Ireland's telecom networks facilitated the development of new growth industries and made a significant contribution to Ireland's recent economic success. In this decade the development of a vibrant broadband sector has the potential to not only stimulate growth in a new set of higher-value industries, but also to open up new possibilities for all citizens, irrespective of geographic location.

3 OVERVIEW OF BROADBAND TECHNOLOGIES

Rapid progress has and will continue to be made in developing the many different technologies on which broadband networks and services are based. Incremental innovation (e.g. falling equipment costs) and technological discontinuities[5] combine to make it difficult to select a single most cost effective solution for broadband deployment, even over short timescales. Not surprisingly, such uncertainty has added to much of the confusion and lack of clarity that surrounds the 'broadband' debate.

3.1 Definition of Broadband

The concept of broadband is normally defined in terms of capacity[6] (or speed of data transfer) provided on a telecommunications network. A relatively high level of telecommunication capacity is generally referred to as 'broadband'[7].

However, this definition can create confusion as it raises the question as to what constitutes a 'relatively high level of telecommunications capacity'. In 1997, the ITU issued a recommendation that transmission rates greater than Primary Rate ISDN (i.e. approx. 2Mbit/s or above) be considered to be 'broadband'[8]. However in its studies, the OECD defined broadband as providing downstream access of 256kbit/s and upstream access of 128kbit/s. Elsewhere, in a study of 14 countries by the Canadian National Broadband Task Force, broadband definitions ranging from 200kbit/s to 30Mbit/s were reported[9]. The extent of the disparity reflects 'forward-proofing' by some countries[10].

Given this emergence of multiple definitions, there have been some suggestions recently towards defining broadband in terms of functionality rather than a specific minimum capacity. In 2001 the ITU suggested that any network capable of carrying full motion video could be considered broadband[11]. Such an approach would counter the problem of evolving end-users' expectations of broadband, but

[5] e.g. physical limitations of transmission media and major technological advancements such as dense wave division multiplexing

[6] The term 'bandwidth' is commonly used in place of capacity. Although both quantities are directly related, their relationship varies according to the type of transmission medium used (e.g. radio, twisted pair, optical fibre). For clarity, the term capacity is used where possible in this document.

[7] The term 'broadband' comes from the fact that a wide band of frequencies is available to transmit information. Hence, in contrast to single or narrowband connections, information on a broadband connection can be multiplexed and sent on many different frequencies or channels within the band concurrently. This allows more information to be transmitted in a given amount of time in much the same way as more lanes on a highway allow increased traffic to travel on it at the same time.

[8] ITU-T Recommendation I.113

[9] *'The Economic and Regulatory Implications of Broadband'*, ITU Briefing Paper, June 2001.

[10] i.e. some of the definitions exclude connection capacities which are considered to be broadband today, but which will be judged to be 'narrowband' in a few years time, because of the expected continued growth in the size of applications which is likely to render such connections inadequate.

[11] ibid

would exclude most of today's 'broadband' connections via cable modem and DSL technologies. In May 2002, in their most recent report, the OECD stated that "it may be better to think of broadband as a wide set of technologies that generate some minimum level of high speed bandwidth interconnection"[12]. By including the words 'high-speed', but not specifying a minimum capacity this definition brings us back to the earlier definition of ***"a relatively high level of capacity"***. Furthermore, the always-on or packet-based (e.g. IP based) characteristics of some broadband technologies (e.g. DSL, Cable) are becoming generally accepted as part of the broadband definition.

For the purposes of this report, we have decided to define 'broadband' as capacities of 512kbit/s[13] and above in the portion of a network that a customer uses to connect to a service provider – i.e. the access network[14]. However, we regard this as a somewhat arbitrary working definition, and we recognise that technological and market developments may require us to revisit this definition in the future. It should be noted that the definition excludes Basic ISDN connections (max. speed of 128kbit/s) of which there has been strong growth over the past 18 months.

3.2 Current Broadband Access Technologies

Telecommunications users are connected to service providers' networks through 'access networks'. These are also variously known as the 'last mile', 'first mile' or 'local loop'. They typically represent a substantial portion of operators' capital.

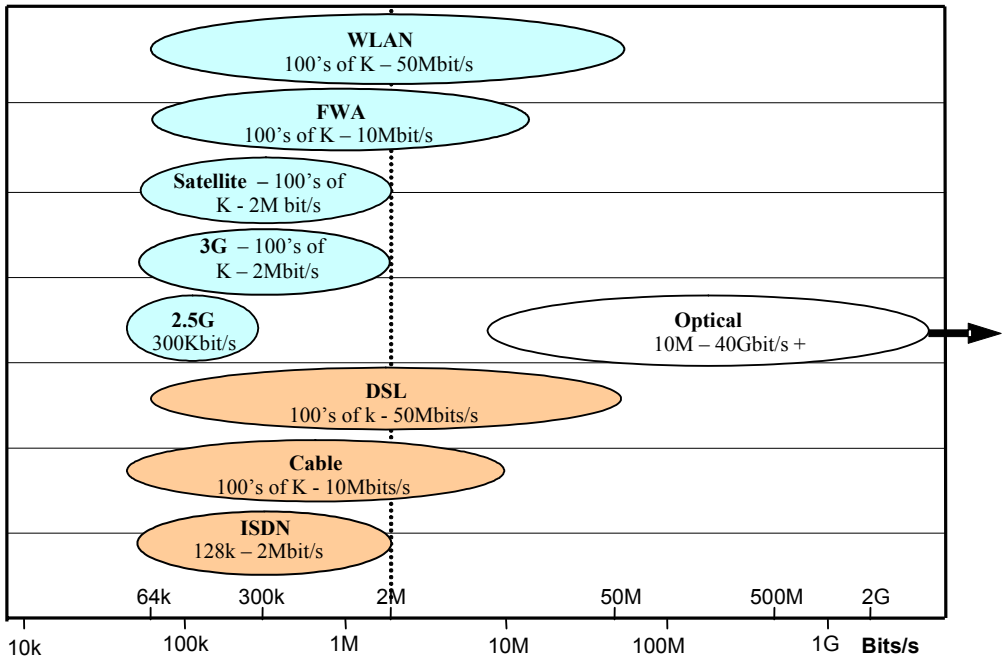
Some broadband access methods are suitable for large business users, while others are more suitable for those residential users who require comparatively low speed connections. Broadband access technologies can be either fixed line or wireless. Fixed line technologies include DSL, co-axial cable and optical fibre and require a cable to physically connect the users' equipment with the service providers (i.e. overhead or buried cables). Wireless technologies use radio waves or light to connect users to service providers through the air, examples being fixed wireless access, satellite, mobile (e.g. 3G) and optical wireless (or free-space optics). Some current and developing access technologies are briefly described below (more detailed information can be found in Annex 1).

[12] *'Broadband Infrastructure Deployment: The Role of Government Assistance'*, OECD Briefing Paper, May 2002.

[13] 512kbp/s was selected as the minimum threshold for broadband as this is currently one of the most popular speeds provided for by cable and DSL providers in their subscription packages.

[14] In core or backbone sections of telecommunications networks capacities several thousand times higher are typically needed. In this case a broadband core network must be capable of serving the broadband needs of all the users that are connected to its access networks.

Figure 3.1. Comparison of some access technologies[15]



3.2.1 ***Fixed Access Technologies***

3.2.1.1 Digital Subscriber Line (DSL)

DSL involves upgrading the capacity of a standard copper local loop (i.e. telephone lines) by replacing the equipment at both ends (customer premises equipment and local exchange equipment[16]) with digital technology. The distance that DSL can operate over depends on the type of DSL and the quality of the cable installed.

3.2.1.2 Cable

Broadband cable can make use of traditional cable TV operators' access networks, once sufficiently upgraded, to deliver broadband services. Broadband cable is likely to provide the greatest competition to DSL in urban areas, enabling services such as digital television, telephony, data and interactive services.

3.2.1.3 Optical Access

Using optical fibre to provide users with broadband access can offer the highest capacities with data rates far in excess of 100Mbit/s at distances beyond 20km. Deploying new optical fibre links can be expensive and is therefore currently likely to be most attractive to high demand business customers.

[15] The data rates indicated are only approximate.

[16] Local exchange equipment in a DSL system is called a DSLAM –DSL Access Module

3.2.1.4 ISDN

Primary rate ISDN can provide users with up to 2Mbit/s using existing copper telephone lines. This enables users to avail of broadband services on a digital dial-up basis.

3.2.2 ***Wireless Access Technologies***

3.2.2.1 Broadband Fixed Wireless Access

BFWA uses radio waves to deliver services and transmit information between fixed users and network operators, using radio antennas located on base stations and users' roofs. BFWA systems can operate over distances up to 35 km, depending on the frequency band used.

3.2.2.2 Satellite

This type of access uses antennas ('satellite dishes') to transmit information between users and network operators via satellites orbiting the earth. Broadband satellite is most suitable for serving relatively few, dispersed users.

3.2.2.3 Optical Wireless

Optical wireless technology or free-space optics facilitates broadband communication through the atmosphere using line of sight optical signals up to distances of a few kilometres. Compared to optical fibre and fixed microwave systems, optical wireless is an inexpensive solution which is quick and easy to install.

3.2.2.4 Wireless Local Area Networks (WLAN)

WLAN technology can be used to provide access to nomadic users with handheld devices or laptop computers, or to fixed users (e.g. residential users). Nomadic users can connect to WLAN networks installed in public areas such as train-stations, airports, hotels, conference centres, etc. WLAN and other licence exempt technologies[17] can also be configured to act like FWA systems, delivering broadband access to fixed users. In general this type of equipment is readily available and inexpensive.

3.2.2.5 Third Generation Mobile (3G) and 2.5G

3G mobile is likely to build upon high speed mobile data services available on 2.5G systems such as GPRS. 3G mobile systems are expected to be able to provide up to 384kbit/s, followed by up to 2Mbit/s in later versions.

[17] WLANs typically operate within un-licensed spectrum, although they must operate within certain limits. This can result in lower quality of service as many users attempt to share the same spectrum resources.

3.3 Backhaul Technologies

Backhaul is the section of an operator's network that connects the access network to the backbone network, linking points such as exchanges, DSLAMs, base stations, and other access points. Backhaul infrastructure carries data in both directions and predominately consists of optical fibre and fixed point to point microwave radio links. Fixed radio links are used extensively by mobile network operators for backhaul in Ireland.

3.4 Backbone Technologies

Backbone infrastructure is used to connect major towns and cities forming the core of a telecommunications network. These links, which connect together network nodes, are analogous to motorways in the road system –i.e. they carry large volumes of traffic between specific points. Telecommunications backbone infrastructure is generally formed in ring structures that pass through several towns and cities resulting in typical link distances of less than 70km[18] between points on a network. This is typically achieved with optical fibre technology and microwave radio links.

3.5 Conclusions

For the most part, broadband users are not concerned with the particular technology that is being used to deliver their broadband telecommunications services. They are more often concerned with issues such as availability, level of service (e.g. capacity), reliability and cost.

Rolling out broadband networks requires the use of different technologies to best suit different situations. There is no single technology that can cost effectively be deployed in every situation and operators must therefore look to a variety of different solutions for deploying broadband in Ireland. Technology developments will continue, enabling more cost effective and higher capacity broadband technologies, new access technologies or new methods of deployment (e.g. low cost fibre laying techniques). Over time, such developments will increase the viability of deploying higher capacity networks to a wider range of customers.

[18] International links usually involve far greater distances (e.g. transatlantic fibre optic cables).

4 THE IRISH BROADBAND MARKET

The aim of this chapter is to inform on the current state of the Irish Broadband market. It seeks to achieve this by providing an outline of the market's current size and structure, as well as quick overviews of the likely strategies of the major operator groupings.

4.1 Background to Broadband Market in Ireland

The market for Broadband services in Ireland can be broadly described as something of a dichotomy. At the lower end of the market are the overwhelming majority of Irish Internet users who currently go online over a standard 56kbit/s dial-up connection. Provided over *eircom*'s local network, many of these users are residential and SME customers and the vast majority are satisfied with this most basic connection. Given their limited use of the Internet, 56kbit/s dial-up access often represents the most cost-effective option for this group's current needs. At the top end of the market there are a limited number of more sophisticated corporate and business users. This segment demand significantly higher capacities from operators. The vast majority of users' needs in this segment are catered for by high capacity leased lines of 2Mbit/s and higher.

The development of a range of cost-effective options that can facilitate incremental increases in capacity for the first market segment will be critical in bringing broadband to the wider market. Currently, for many users frustrated with a 56kbit/s dial-up connection, a Basic ISDN line (64-128kbit/s) represents the only viable option. Recent strong growth in the number of ISDN connections may represent latent demand for higher capacity 'broadband' services.

4.2 Size and Structure of Broadband Market in Ireland

Currently it is estimated that there are between 3,000 and 4,000 high-speed data and Internet users in the Irish market. The vast majority of these users are business customers served by a combination of high capacity leased lines and more recently DSL services. As a percentage of customer premises, this figure equates to a broadband penetration rate of approximately 0.3%. This leaves Ireland trailing other countries – particularly those where broadband has expanded outside of the business market. In the UK, for instance, strong growth in residential broadband over the past 12 months means that leased lines now only account for a small proportion of total broadband. It is estimated that there are currently over 770,000 high-speed data and Internet users in the UK, which roughly translates into a broadband penetration rate of approximately 3%[19].

The main access methods used by high speed users are listed below.

[19] The estimate of 770,000 UK users is made up of 709,000 cable modem and DSL subscribers (Source: Oftel, July 2002) and 61,000 leased lines with capacities of 2Mbits or upwards (Source: Oftel, August 2000).

4.2.1 *Leased Lines*

Amongst the methods used to deliver broadband services in Ireland, leased lines continue to be the most predominant. As at June 2002 there were approximately 22,000 retail leased lines in the country, although only about 5% of these were above 2Mbit/s[20]. A broadly similar percentage are thought to have capacities between 256kbit/s and 2Mbit/s, while the remainder are analogue-based and hence can only provide voice or dial-up modem services. Given their limited capacity these analogue circuits would not be considered broadband.

Despite some initial loss of market share in the period immediately following liberalisation, *eircom* has retained the lion's share of the leased line market[21].

4.2.2 *DSL*

Increasingly considered as a cheaper alternative to sub 2Mbit/s leased lines, DSL services are steadily gaining in popularity as operators provide these services to the Irish market. DSL adoption has grown to approximately 1,200 lines at the end of August 2002. Although operators have been relatively slow to introduce these services to the Irish market, experience in other European markets suggest that DSL has significant potential to rapidly outnumber leased lines as the main means of delivering broadband.

As with leased lines, *eircom* is again the dominant player in this market, with installed DSL capability in 35 telephone exchanges in Dublin and plans to extend this to a further 8 exchanges in Cork, Limerick, Galway, Sligo, Tralee, Killarney and Westport later this year[22]. By the end of 2003 *eircom* claims that it will have DSL capability in 100 telephone exchanges as part of a 5 year €125m DSL investment. To date, the only challenger to *eircom* in the DSL market has been EsatBT. Much of EsatBT's planned DSL infrastructure will be located outside of Dublin[23]. Earlier this year EsatBT offered their first DSL services over unbundled loops in Limerick, which was closely followed by similar services in Ballina. By the end of 2002, EsatBT claim that they will have unbundled 40 exchanges as part of an accelerated DSL program estimated to cost over €25m[24].

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[20] Source: ODTR, Quarterly Review Commentary September 2002.

[21] In the 12 months to December 2001 *eircom*'s market share of the leased line market was estimated to be 85% (Source: ODTR SMP Determination June 2002). However, this calculation is based on revenues from the original rental or sale by operators and does not include the reselling of leased lines by other licensed operators. Given that almost all of the alternative fixed-line operators generate the bulk of their leased line revenues from the resale of *eircom*'s wholesale product, it is likely that this measure somewhat under-represents their true share of total leased line revenues. Notwithstanding this however, this figure still gives a good indication of *eircom*'s dominant position in the leased line market, particularly as it is broadly reflective of the level of control exercisable at an infrastructural level. The remaining 15% of this market would be accounted for by other operators that own leased line infrastructure, which would include EsatBT as well as a number of the other smaller operators.

[22] Source: *eircom* 17th April 2002. (http://mmm.eircom.ie/about/PressReleases/PressRelease.asp?id=378)

[23] This decision to focus outside the capital was partly influenced by the availability of over €10m of additional NDP funding for projects which extend broadband deployment in the less developed parts of the country. http://www.norcontel.ie/ndpcomms/docs/press160101.pdf

[24] Source: EsatBT, 29th April 2002 http://www.esatbt.com/esatcom/homepage/news_events/press_releases/archive_1997/pr20022904.htm

4.2.3 *Cable Modem*

A major challenge to DSL services - particularly in residential areas, is expected to come from cable modem services. At present it is estimated that there are approximately 1,000 cable modems subscribers in Ireland. However, upgrading of the cable networks has been slow with the huge expense involved resulting in roll-out on a phased basis in the respective franchise areas. This may mean that it could be some time before a significant proportion of the estimated 500,000+ cable TV households across the country are in a position to subscribe to broadband cable modem services.

Following a directive to sell-off its cable assets in 1999, the cable market is currently the only major broadband market in which *eircom* doesn't compete[25]. At present the largest cable operator in the Irish market is NTL, which controls substantial cable assets in Dublin, Galway and Waterford. Recently it launched a residential broadband product into a target area of 7,000 households in West Dublin following trials there earlier in the year[26]. The only other major cable operator is Chorus which owns cable networks in Cork, Limerick and a number of other large towns. Chorus also has plans to launch a broadband service, although it is still at the trialling stage with a small number of cable modems in some midland towns. Elsewhere, regional operator Casey Cablevision is also offering cable modem services to a small number of subscribers in Dungarvan, Co. Waterford.

4.2.4 *Alternative Broadband Technologies*

Outside of leased lines, DSL and cable modems, there are a number of alternative technologies providing broadband in Ireland, although generally speaking these deployments are currently quite limited. At present, three operators (*eircom*, EsatBT and Chorus[27]) are licensed to provide broadband fixed wireless services, and although two of these offer such services, the total number of customers is estimated to be less than a few hundred[28]. Elsewhere, there are also a number of operators proposing to use licence exempt spectrum to provide FWA/WLAN services. As this technology is relatively new, deployments are still limited, although there would appear to be significant potential for growth. Satellite technology is also used as an alternative broadband access method in Ireland, and can be particularly advantageous in areas with limited alternative broadband access. There are currently several operators in Ireland providing this type of service to approximately 300 users. Finally a number of network operators and

[25] It would appear that this is a necessary condition for broadband take-off, as in almost all of the leading broadband countries (e.g. Korea, the US, Canada, the Netherlands and the UK), competition between the cable and DSL providers has been one of the key drivers in spurring broadband deployment.

[26] Source: NTL Inc. Results for the three months to end-June 2002. http://www.sec.gov/Archives/edgar/data/1114937/000111493702000042/ntlform8k_2q2002earn.txt

[27] A fourth licensed FWA operator; Formus Communication Limited, whose core business was FWA, went into voluntary liquidation in December 2000.

[28] At the end of June 2002 there were approximately 4,500 residential and 750 business FWA subscribers in the Irish market. The vast majority of these subscribers are served with narrowband voice services.

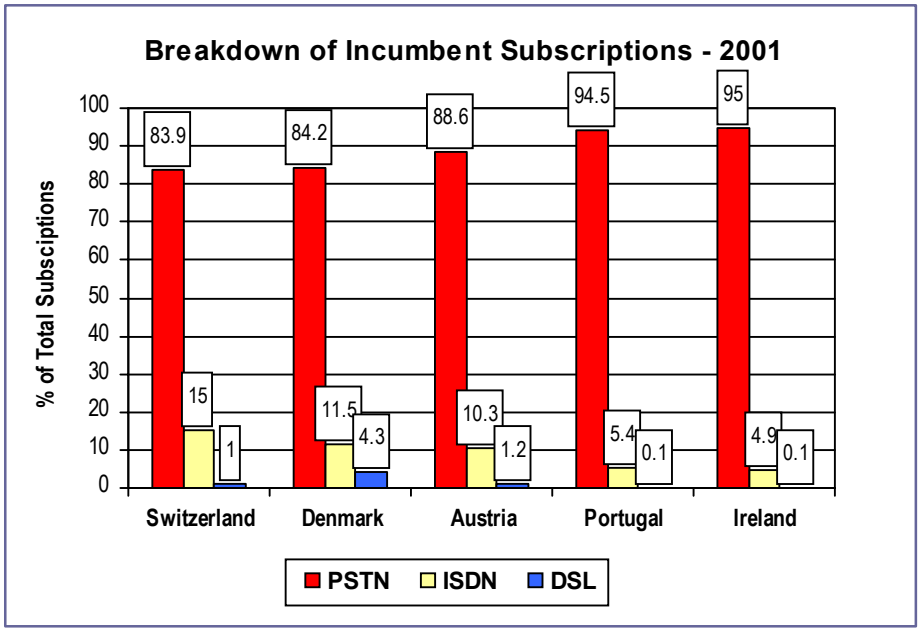
users have deployed Free Space Optics systems mainly so far on campuses in third level institutions and in private networks.

4.2.5 *ISDN Connections*

Although generally not considered a broadband technology, it is nevertheless interesting to track take-up of ISDN subscriptions as it can sometimes act as an indicator of future demand for higher-speed 'broadband' services. In the 12 months to the end of June 2002 the total number of ISDN access channels in Ireland grew by approximately 28% to 330,000. Although this figure includes access channels for basic, fractional and primary ISDN lines[29], it can be estimated that approximately half of the ISDN channels relate to Basic ISDN subscriptions[30]. With *eircom* controlling the vast bulk of ISDN subscriptions in the country, this enables one to approximately compare the breakdown of fixed-line subscriptions across a number of European incumbents (see Fig 4.1).

As can be seen from the graph below, Ireland has the lowest proportion of both ISDN and DSL subscriptions amongst the peer group. This may be reflective of a lack of a perceived need for higher-speed connections amongst Irish subscribers, or alternatively relatively higher prices may have suppressed user demand in Ireland compared to other countries. Based on indicative evidence from market research contained in this report as well as other sources, it is likely that a combination of both factors have contributed to the lower demand for higher value subscriptions in Ireland.

Fig 4.1: Incumbent Fixed-Line Subscriptions in Selected European Countries[31]



[29] Basic rate ISDN lines carry two 64kbit/s access channels, fractional rate ISDN line carry between fifteen and thirty 64kbit/s access channels, while primary rate ISDN lines carry thirty 64kbit/s access channels.

[30] The proportion of primary, fractional and basic ISDN access channels was 47%, 6% and 47% respectively (Source: ODTR, Quarterly Key Data, September 2002).

[31] Source: Incumbent Operators Financial Results Dec 2001. (The only exception is Ireland where the percentages relate to situation as at June 2002 and were sourced from the ODTR's Quarterly Key Data document, September 2002).

4.3 Future Strategies of Major Broadband Groupings

There are a number of broadly identifiable operator groupings currently competing in the Irish broadband market. The following section gives a brief overview of each of these groupings, their current market positions and the likely direction of their future strategies.

4.3.1 ***Major Fixed-Line Operators***

At present the most significant grouping in the Irish broadband market are the major fixed line operators. This grouping, which would include both *eircom* and to a lesser extent EsatBT, seem relatively well positioned vis-à-vis the other telecom players in the Irish market. Both have relatively large customer bases in both the business and residential markets and between them both operators control the bulk of the fixed-line infrastructure currently deployed in the country.

Given their relatively strong positions, it is not surprising that these operators have adopted a largely incrementalist approach towards introducing new broadband services. With large investments made in both the existing copper access network[32] and the fibre backbones that link into this local network, these operators' current broadband strategies appear strongly focused upon maximising value from their existing investments. Consequently new broadband services are generally copper-based solutions (i.e. xDSL) and these new services are being carefully integrated into a portfolio of broadband products which would also include leased lines. In terms of pricing, this has meant that these operators' initial broadband packages are still very much targeted at the business market with basic ADSL packages generally consisting of a once-off connection fee ranging from €125 - €165 and a monthly rental of approximately €90[33]. With this pricing beyond the reach of most residential users and little apparent demand amongst this group anyway, these operators will be keen to serve SME users frustrated by the slower speeds of a basic ISDN connection. These operators will be hoping to achieve this, while still maintaining a portfolio of higher capacity leased line products for larger corporate users.

Like most other telecom players, the major fixed-line operators' broadband strategies will also be influenced by their need to generate free cash flow[34]. Both *eircom* and EsatBT's new owners have stated that they will be looking for improved efficiencies and this goal is likely to have a bearing on their future broadband plans. In the case of *eircom* the new management team has already signalled its intention to cut costs and in line with other incumbents across Europe there have been significant reductions in capital expenditure.[35] *eircom* are also likely to look for efficiencies in staffing, where despite some recent improvement, their levels of efficiency are still below that of their European peers (see Fig. 4.2).

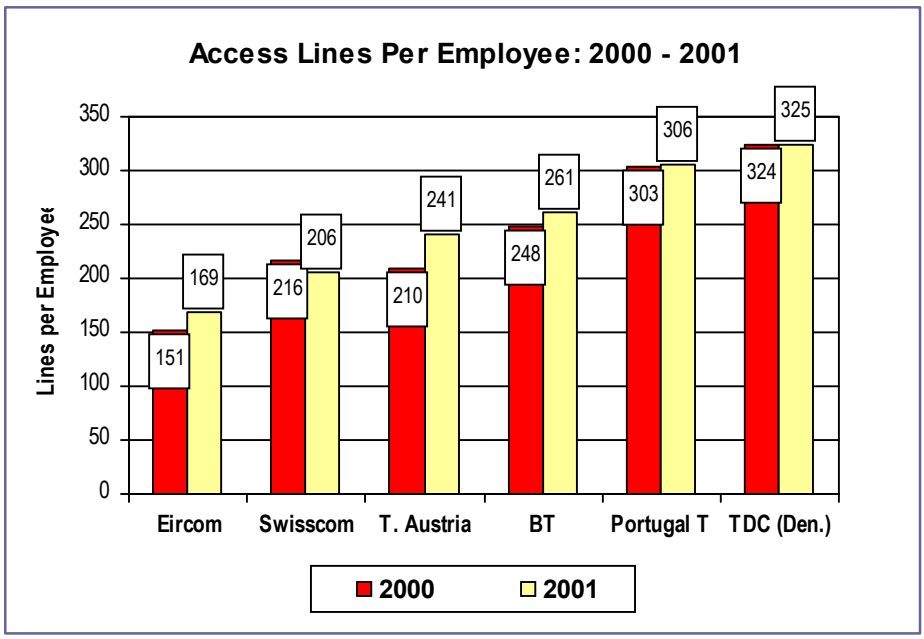
[32] This would apply to *eircom* only.

[33] This is for an ADSL product with 128kbit/s upstream and 512kbit/s downstream. (Note: *eircom* also charge a €0.03 per megabyte fee for each megabyte that exceeds the monthly data allowance of 3 GB). Prices are taken from Eircom and EsatBT's web-sites and exclude VAT or any additional equipment required (i.e. ADSL USB/Ethernet modem).

[34] Free cash flow can be roughly approximated to EBITDA less capital expenditure.

[35] *eircom*'s Financial Results for year ended 31st March 2002.

Fig 4.2: Access Lines per Employee for Selected European Fixed-Line Operations[36].



Like *eircom*, EsatBT has also embarked on a consolidation programme and earlier this year 200 job losses were announced at the company. With new targets introduced by the BT Group, EsatBT is now seeking to reach EBITDA positive for the full year ending March 2003 and cash flow positive for the year ending March 2004[37]. Although these represent ambitious targets given losses of €40m in 2001, progress has been made recently according to the company's recent announcement that it had achieved positive EBITDA for the three months to June 2002.

4.3.2 *Alternative Fixed-Line Operators*

Competing with the major-fixed line operators is a group of alternative fixed-line operators, many of which are Irish subsidiaries of larger global telecom organisations. These include such players as MCI Worldcom, Nevada Tele.com, Global Crossing and COLT Telecommunications, who are seeking to leverage their international reach to provide global solutions to multinational organisations. Initially attracted to Ireland by the high concentration of foreign owned MNCs here, many of these operators have since expanded their offerings to serve the wider business market, where they now compete with *eircom* and EsatBT, particularly in the larger urban centres.

Amongst the services provided by these alternative operators are leased lines, managed data services, web-hosting and voice products. Almost all have some fibre infrastructure in the Dublin region, but outside of the capital, network deployments have been limited. In the short term at least, the prospect of

[36] Source: Companies Financial Results. In the case of BT and *eircom* the figures relate to the financial year ending March (i.e. 2001 figures relate to the 12 month period to March 2002).

[37] Source: Business and Finance, 1st August 2002.

additional network roll-outs by these operators is slight. This is primarily due to funding difficulties being experienced by many of these operators at an international level. Although to date, the Irish operations of these companies have shown few signs of the problems being experienced by their parent organisations, the immediate concern of many these companies is to conserve their cash-flow as they implement group-level re-structuring plans.

4.3.3 ***Cable Operators***

Competition to *eircom* and EsatBT in the residential broadband market may come from the cable operators. This grouping, which is dominated by NTL and Chorus, has extensive cable TV distribution systems, which are being upgraded and can provide additional voice and high-speed Internet services.

Following the downturn in the capital markets however the Irish cable operators' ability to raise additional funds to finance their network upgrades was restricted. Irish investment proposals to access limited group funds must also compete with proposals from subsidiaries in other countries. In this constrained funding environment both NTL and Chorus have scaled back their broadband ambitions, with plans to offer a bundled 'triple play' of telephony, high-speed Internet and digital TV being replaced by a renewed focus on meeting their roll-out commitments for digital TV. This impetus to accelerate the roll-out of digital TV has been given an added significance in light of BSkyB's success in accumulating 245,000 Irish subscribers[38]. As at June 2002, both cable operators were ahead of their digital TV roll-out commitments with approximately 69% of all cable homes passed for digital TV services.

4.3.4 ***Fixed Wireless Operators***

Whilst fixed wireless access (FWA) has the potential to deliver rapid roll-out of alternative broadband access, to date network deployment from the FWA licensed operators has been limited. Although high equipment costs have often been reported as an inhibiting factor to network roll-outs, it would appear that FWA operators are choosing to focus on more established sections of their businesses (i.e. fixed line and broadcast services), awaiting evidence of actual demand before expanding their FWA networks.

The emergence of alternative operators using recently developed, lower cost equipment operating in licence exempt spectrum to provide FWA type services[39] could, through the threat of competition, cause existing licensed operators to accelerate their broadband roll-out plans. It is also possible that existing FWA, fixed line and mobile operators could adopt this lower cost technology to expand their service offerings.

[38] Source: BSkyB Annual Report 30th June 2002.

[39] The Department of Marine, Communications and Natural resources recently launched a call for expressions of interest in pilot trials of broadband Internet access using licence exempt spectrum www.marine.gov.ie/modules/pressreleases.asp

4.3.5 ***Mobile Operators***

With a penetration rate of 76%, which is one of the highest penetration rates in Europe and is considerably higher than that for household PCs, mobile devices have the potential to become a key means of access to the Internet.

There are currently three mobile operators offering services in the Irish market; Vodafone, 0_2 and Meteor. While the majority of mobile subscribers in Ireland use 2nd generation or GSM technology, 2002 saw operators move to address demand for broadband mobile Internet access with the introduction of 2.5G technology or General Packet Radio Systems (GPRS), operating at data rates around 40kbit/s. The introduction of 3rd generation (3G) mobile services is expected to provide even higher speeds of up to 384kbit/s initially, and in time up to 2Mbit/s. The ODTR have offered and received acceptances for three 3G licences to 0_2, Vodafone, and Hutchison Whampoa – a new entrant into the Irish market. Licensees are expected to roll-out services in Ireland by 2004.

4.4 Conclusion

Given its relatively small size and early stage of development, it is not surprising that the Irish broadband market is still largely controlled by *eircom*. The former monopoly commands the lion's share of the only two broadband markets of any note (i.e. leased lines and DSL), with its control over this markets re-enforced by its ownership of the bulk of the relevant infrastructure.

Comparing this picture to the competitive environment in countries where broadband penetration has taken off, we see that Ireland has yet to develop a vibrant level of competition between different networks and between networks with different technologies. In countries such as Korea, the US, Canada and Japan competition between DSL, cable and other broadband providers has spurred network deployments and consumers in these countries are now enjoying the benefits of faster speeds, lower prices and a greater choice of service offering. Across the world market competition has played a significant role in the development of broadband infrastructure thus far, and the OECD would argue there is sufficient evidence to suggest that competition is the best way to diffuse new technologies rapidly.

5 REGULATORY FRAMEWORK

In the context of helping develop the broadband market, the role of the regulator is largely one of facilitator. This is achieved through developing frameworks for different services such as Local Loop Unbundling (LLU) and through frameworks facilitating the roll-out of technologies e.g. Fixed Wireless Access. The ODTR also has responsibilities in the area of pricing of interconnect services and leased lines and the delivery of facilities against agreed service levels.

The regulator's role also involves informing and creating awareness of developments in the market which is being done through our series of Briefing Notes that outline the potential of various new and developing technologies, together with our quarterly reports and surveys.

The following outlines the European and Irish Regulatory Frameworks which impact on the delivery of broadband in Ireland.

5.1 European Regulatory Framework

The key regulatory framework for telecoms is set out in the current EU Directive[40]. A New Regulatory Framework for the regulation of electronic communications networks, services and associated facilities has been adopted by the European Commission. Five new directives replace the current regulatory regime[41]. The provisions of the New Regulatory Framework are to be applied from 25th July 2003 and the enactment of legislation is primarily a matter for the Department of Communications, Marine, and Natural Resources.

A major feature of the New Regulatory Framework is the extension of the scope of regulation to all electronic communications networks and services (as defined in Directive 2002/21 EC)[42]. This provides for a harmonised approach to all electronic communications networks and services and gives effect to a common set of rules covering developments regarding convergence. The New Regulatory Framework explicitly excludes all content regulation.

The broad thrust of the EU regulatory regime seeks to support the provision of competitive services of all kinds including broadband. There are, and will continue to be, special regimes for ensuring network access including interconnect, local loop unbundling and leased lines, while provision is also made for the licensing of spectrum.

[40] Directive 98/10/EC of the European Parliament and of the Council of 26 February 1998 on the application of open network provision (ONP) to voice telephony and on universal service for telecommunications in a competitive environment.

[41] All published in the Official Journal: L 108 Volume 45, 24 April 2002 and are available at http://www.europa.eu.int/eur-lex/en/oj/2002/1_10820020424en.html

[42] Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive)

The directives also make provision for a revised process for designating operators with Significant Market Power (SMP). The designations will apply only to those operators assessed as dominant in predefined markets. The assessment of dominance will only follow if a market analysis and review process concludes that a market is ineffectively competitive.

5.1.1 ***Key EU provisions relating to the provision of broadband***

The new EU Universal Service (USO) Directive[43] will have an impact on the future delivery of broadband in Ireland. A universal service is defined in the USO Directive as *"a defined minimum set of services of specified quality which is available to all users independent of their geographical location and in the light of specific national conditions, at an affordable price*". *eircom* is the current Universal Service provider who as a result is obliged to provide the specified voice services outlined in the Directive. Article 4(2) of the new USO Directive stipulates that functional Internet access is to be provided universally in each member state – ' *data communications, at data rates that are sufficient to permit functional Internet access, taking into account prevailing technologies used by the majority of subscribers and technological feasibility.*

As we have seen with the definition of broadband in chapter three, 'functional Internet' can also create confusion and the question is raised as to what data rate constitutes functional Internet access. Each member state is responsible for defining functional Internet access in light of national conditions.

Whilst no EU member state has yet fully addressed the definition of functional Internet, it is interesting to note a couple of initiatives in non-EU countries with regard to universal service obligations and Internet access/broadband. In Australia universal service subsidies to carriers have been redefined. A digital data service obligation is in place requiring provision of 64kbit/s Integrated Services Digital Network (ISDN) service, on demand, to at least 96% of the population. For the remaining 4% of the population unable to obtain such service on demand, universal service providers were required, from July 1, 1999, to provide a broadly comparable service using satellite technology.

In Canada, the Government announced its intention as far back as 1996 to develop a national access strategy to ensure affordable access to essential communications. Universal service in Canada aims "to render reliable and affordable telecommunications services of high quality accessible to Canadians in both urban and rural areas in all regions of Canada." [44] A further announcement in 2000 pledged to provide universal broadband access by 2004. [45]

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[43] Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive)

[44] Information on Australia and Canada was taken from the following report:

Yankee Group, Reviewing universal service policies in a competitive era: developments around the world, July 2002

[45]" ….the Government of Canada's goal of ensuring that broadband services are available to businesses and residents in every Canadian community by 2004." (National Broadband Task Force: Networking the nation for broadband access, 2001)

5.2 Irish Regulatory Framework

The ODTR work programme includes a number of work streams which facilitate the roll-out of broadband. The procedures and processes agreed by industry with the ODTR which facilitated unbundling the local loop allows other licensed operators to have access to the 'final mile' and to market broadband services directly to end users.

A number of additional work streams particularly relevant to broadband are detailed below.

5.2.1 ***Facilitation of broadband services***

Following protracted discussions, DSL services started to be rolled out in Ireland earlier this year. *eircom* plans to enable over 50 switches for DSL services, and EsatBT 40 by the end of December 2002. Entry into the market has been slow, but a new addition to the framework agreed in August, enabling OLOs to ask for bitstream on a customer by customer basis should help stimulate development.

ODTR work in respect of leased lines has concentrated on pricing issues and also in particular on the development and enforcement of service level agreements which have contributed to significant improvements in the delivery of leased lines by *eircom*. For example, the average delivery lead time for wholesale leased lines ordered by all *eircom* customers, has fallen from 61 days for July 2001 to 19 days for July 2002.

5.2.2 ***Licensing of Alternative Technologies***

In addition to the original awards of the FWPMA licences and in order to stimulate broadband roll-out in light of changing market conditions, new licensing regimes for fixed wireless access (FWA) are being introduced. It is now possible to use the licence exempt 5.8GHz frequency band for FWA at substantially increased power levels thus facilitating greater coverage and further enhancing the options available for WLANs. A licensing regime for local area FWA systems using spectrum in the 10.5GHz frequency band is also being developed. A rationalisation of the FWA spectrum in the 26 GHz band has been undertaken to provide greater flexibility for operators rolling out broadband wireless services in that frequency band both now and in the future.

5.2.3 ***Internet Development***

To aid the development of Internet usage in Ireland, additional access codes and number ranges were allocated by the ODTR for dial up Internet access. Also, in the context of the further development of next generation networks and services, work is currently being carried out by the ODTR on IP (Internet Protocol).

5.2.4 ***Awareness Raising***

The task of regulation generally speaking is made easier, if the market is well informed about the choices of technologies and services that are available to users and to network and service providers. So part of this Office's role is to help raise awareness in the industry and among members of the public, of significant developments that are likely to influence the development of the telecommunications market in Ireland. In particular the ODTR's series of Briefing Notes[46] is designed to raise awareness of new or developing technologies that could present significant opportunities or have important market implications, including in the area of broadband communications. Information on the current state of the market is also provided through our market commentaries and customer surveys which are conducted quarterly.

5.3 Conclusion

Clearly, the Regulatory framework has and will have a significant influence on the broadband market. European Regulations and Directives are transposed into the national law of each member state, and the ODTR, as the National Regulatory Authority in Ireland, is responsible for its implementation. Progress has been made in the Irish market in relation to LLU with DSL now available in some areas on a commercial basis; delivery times for leased lines have been greatly improved. Delivery of broadband in Ireland is also facilitated through the licensing of alternative technologies, the development of Internet codes and networks together with raising awareness of significant developments that will have an impact on the market.

[46] See for example ODTR Doc 01/88 – Next Generation Networks Briefing Note or ODTR Doc 02/29 – Optical Access Briefing Note

6 PUBLIC POLICY INITIATIVES

To date, most public policy initiatives aimed at encouraging broadband deployment have sought to achieve this through the strengthening of competition in the marketplace (e.g. LLU). Recently, however, increased delays in the roll-out of infrastructure have prompted many policy-makers to take a more active role in the market, with the launching of several initiatives that are not of a regulatory nature.

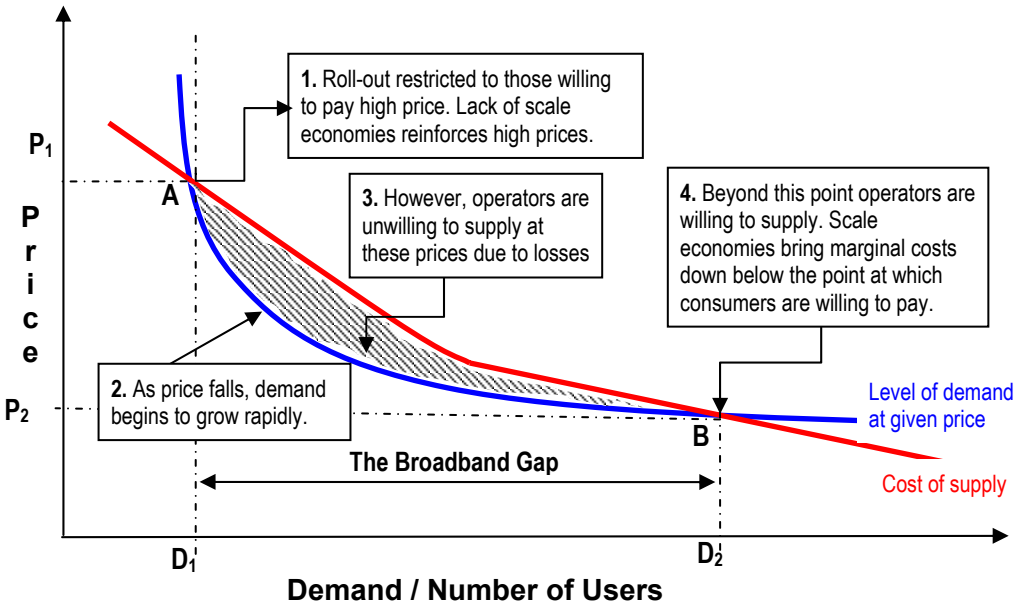
6.1 Rationale for Government Intervention

The rationale behind these initiatives is to 'kick-start' broadband development by boosting infrastructure supply and stimulating demand for broadband services. Such initiatives seek to overcome the 'broadband gap'. The 'broadband gap' relates to the tendency for service providers to restrict broadband roll-outs to predominantly large users in the main urban centres.

6.1.1 *The 'Broadband Gap'*

The diagram below outlines how the broadband gap emerges. In the area to the left of point A, broadband roll-out is restricted to price insensitive large businesses mainly concentrated in the major urban centres. This is due to the large fixed costs involved in establishing broadband networks, which invariably means that an initial high price is charged (P_1). This high price restricts demand to price insensitive users (D_1), for whom broadband is likely to be a critical input for their business.

Figure 6.1: Broadband Cost and Revenue Curves



Source: Analysys, Forfás.

Beyond point A as price falls demand for broadband begins to grow. However, the cost of serving this demand is above the price these users are willing to pay. This is because much of this demand is likely to be located outside of major urban centres and a large capital investment is necessary in order to serve these customers.

From point B onwards, however, the price customers are willing to pay (P_2) is higher than the costs of supplying broadband. Widespread deployment of broadband becomes feasible with large numbers of customers demanding broadband (D_2). This is the point where broadband penetration 'takes-off'.

6.1.2 ***Public Policy Initiatives***

In order to overcome the broadband gap, policy-makers have launched several initiatives aimed at both the supply and demand sides. Demand-side initiatives concentrate on raising the demand curve by either highlighting the value of broadband (e.g. through 'demonstration projects', training, more relevant content, etc...), or else lowering the costs associated with getting online (e.g. subsidising PCs). The objective here is to raise end-users' perceptions of the value of broadband and hence increase their likeliness to subscribe to broadband services as prices begin to fall.

In contrast to this, supply-side initiatives concentrate on lowering the 'Cost of Supply' curve for operators. This is usually achieved by providing operators with subsidies for infrastructural deployment, or alternatively developing public networks for onward lease to service providers. Both of these approaches seek to improve the incentives for operators to roll-out services to areas that they would otherwise not consider it profitable to do so.

The following section outlines some of the various European and national initiatives that are likely to affect the future of the Irish broadband market.

6.2 European Community Initiatives

6.2.1 ***eEurope 2005***

In March 2000 at the European Council meeting in Lisbon, EU leaders set themselves the goal to make Europe *"the most competitive and dynamic knowledge-based economy with improved employment and social cohesion by 2010"*.[47] As a means of working towards this goal, the Council endorsed an action plan drawn up by the Commission entitled "eEurope 2002". The main focus of this action plan was the reform of the regulatory environment for both networks and services, along with the facilitating of new generations of mobile and multimedia services. Also included in the plan were other initiatives aimed at re-skilling the workforce, encouraging governments and schools to go online and focusing attention on the issue of Internet security. With much of the new

[47] eEurope 2005: An Information Society for All, European Commission 22nd June 2002.

regulatory framework largely in place, the Council is now looking to build on the other aspects of the eEurope 2002 package with the adoption of a new action plan 'eEurope 2005'.

Adopted by the European Council in June 2002, this new action plan - 'eEurope 2005' is based on two groups of actions which it is hoped will reinforce each other[48]. On the one hand, the plan aims to facilitate widespread availability of broadband access and a secure information infrastructure. On the other hand it seeks to stimulate services, applications and content, covering both online public services and e-business. By adopting this twin track approach, the Commission is hoping to 'squeeze the broadband gap' by simultaneously lowering the cost of broadband supply and raising end-users' demand. Focusing on six key areas – broadband, security, eGovernment, eLearning, eHealth and eBusiness, the plan outlines a number of proposed targets with achievement of these targets largely left up to the discretion of individual states.

6.3 Irish Government Policies

Co-ordinating closely with the Commission's plans, the Irish Government announced its broadband action plan in the 'New Connections' policy report[49]. This report outlined the Government's key objectives along with details for funding broadband deployment under the National Development Plan. Following its re-election in May 2002, the Government reaffirmed its commitment to the objectives contained within this report and this document continues to form the cornerstone of the Government's broadband policy[50]. In this report the Government sets out three key objectives:

1. "[The] Government wants to see the widespread availability of open-access, affordable, always-on broadband infrastructure and services for business and citizens throughout the State within three years, on the basis of utilisation of a range of existing technologies and broadband speeds appropriate to specific categories of services and customers".

2. "We wish to see Ireland within the top decile of OECD countries for broadband connectivity within three years".

3. "In the medium term, we expect that broadband speeds of 5MBit/s to the home and substantially higher for business users will be the minimum standard within 10-15 years for broadband. We aim for Ireland to be the first country in Europe to make this level of broadband service widely available for its people".

Source: New Connections Policy Document, March 2002.

[48] Source: http://europa.eu.int/information_society/eeurope/news_library/documents/eeurope2005/eeurope2005_en.pdf

[49] New Connections - Government Action Plan, March 2002.

[50] Dail Debates (19th June 2002) http://www.irlgov.ie/debates-02/19Jun/Sect3.htm#5

6.3.1 ***NDP Infrastructural Broadband Programme***

As a means toward achieving these objectives, the Government has outlined its support for a number of supply-side and demand-side initiatives. On the supply-side, the Government's main policy initiative[51] is to provide funding for the construction of operator-neutral local area networks in 67 towns on a Public-Private Partnership (PPP) basis. Funding for this programme is divided into two phases, with phase 2 contingent upon the successful implementation of phase 1. Phase 1, with an allocation of €60m, consists of two parallel actions, which include:

1. A set of *pathfinder* projects in 19 towns involving the construction of metropolitan fibre networks with open-access co-location space. In addition, provision has been made for the possible trialling of a fixed wireless local broadband solution in a further three suitable areas.

2. Exploration of industry interest in participating in a national PPP-type arrangement for the management and operation of local access networks on an open-access, operator-neutral basis.

The purpose of phase 1 is to identify issues and test assumptions about costs, technical difficulties, management and maintenance issues, private sector interest and consumer response. If successful, subsequent phases will seek to maximise private sector investment with Government funding fulfilling the role of 'seed capital'. In this context, satisfactory evidence of private sector interest in making capital expenditure and remuneration of operating costs from network operating income become key issues. In total the Government has allotted €100m to phase 2 of the programme with the objective of covering the further 48 towns identified as priorities in the National Development Plan within three years. If this is successful, the intention is to then cover all 123 towns in the State with a population of over 1,500 within five years. No public funds, however, have yet been earmarked for this phase of the programme and the Government has emphasised that all target deadlines are necessarily tentative and to a large extent dependant upon the successful completion of phase 1.

A key feature of the Government's initiative is that the PPP partner contracted to manage the network would not be allowed to provide application services to end users. This, it is envisaged, will foster real competition amongst service providers companies on the basis of price and services and not on the basis of exclusive access to infrastructure. At the time of writing the Department of Communications, Marine and Natural Resources had just completed a consultation with the industry and interested players on a Code of Practice that would govern the administration, allocation and management of this publicly owned infrastructure.

[51] Other supply-side initiatives are predominantly focused on creating a supportive legal framework for conducting business and other activities online.

6.3.2 *Demand-side Initiatives*

To complement its infrastructure provision programme, the Irish Government has also undertaken several initiatives focused primarily on fostering a supportive environment in which to stimulate online services and applications. These supporting frameworks extend across several areas including eGovernment, eBusiness, R&D and initiatives aimed at bridging the digital divide. Brief overviews of some of the main initiatives are outlined below.

eGovernment

In June 2002 the European Commission identified Ireland as the strongest performer in the EU in the area of e-Government by the European Commission.[52] In particular the EC cited the REACH agency[53] and the Revenue Commissioners Revenue On-Line Service (ROS) as praiseworthy initiatives. Another noteworthy and complimentary initiative is the Public Service Broker which aims to act as a single access point or portal to multiple state agencies.

eBusiness

A number of state agencies are undertaking initiatives in the e-business sphere including Enterprise Ireland which in March 2000 established an eBusiness Accelerator fund to fast track significant scale projects designed to integrate ICTs into business practices. Elsewhere, Forfas has produced a number of reports that monitor the e-business environment, while the Chambers of Commerce of Ireland has delivered e-business and ICT training and awareness activities to its client base.

R&D

To develop the skills and knowledge base to leverage any investment in broadband infrastructure, the Government has allocated a fund of €2.5bn to government agencies for R&D activities and close to €700m to 3rd-level institutions for research activities. As part of this, the Science Foundation Ireland agency was charged with managing the Technology Foresight Fund which provides €635m to business and educational establishments for research activities in the fields of ICT and biotechnology.

Lifelong Learning

In 1997 the SchoolsIT2000 project was established to equip all Irish schools with PCs and Internet access and to equip teachers to be IT-literate by means of pre- and in-service training. By March 2002 over 56,000 PCs had been installed in Irish schools and every Irish school had at least one Internet connection. In 1998

[52] http://europa.eu.int/information_society/eeurope/benchmarking/list/source_data_pdf/2nd_measurement_final_report.pdf

[53] The REACH agency was established in 1999 to coordinate the roll-out of e-Government services to both citizens and businesses and to develop a strategy for delivery of public services electronically

the National Centre for Technology in Education (NCTE) was established to integrate IT training and skills into the educational curriculum at both primary and secondary levels. In addition to this, to ensure basic ICT training is extended across all age groups, the Government has also investigated ways to boost IT-literacy in adult education and has established a Taskforce on Lifelong Learning.

eInclusion

To ensure that the opportunities provided by ICTs are available to all, the Government has undertaken a number of initiatives aimed at reducing access barriers to IT brought about by remoteness, problems of disadvantage and disability. One of the key public agencies involved in this area is the re-formed Information Society Commission (ISC) which is tasked with highlighting the challenges and opportunities presented by Information Society developments and benchmarking Ireland's performance in its evolution as an Information Society. The ISC will co-ordinate its work with other groups and initiatives, such as the Equalskills project[54] which is an ICT literacy initiative that aims to provide 100,000 people in the South West and Shannon regions with the basic skills to use a PC, browse the Internet and use email. Other projects in the eInclusion area include the provision of over 1,400 Internet access points in libraries across the country and community-led schemes, such as the CAIT initiative[55], which provide funding for local groups seeking to engage late adopters of new technologies.

6.4 Conclusion

In seeking to bridge the 'broadband gap', policy makers, both at national and European level, have adopted approaches that seek to address both supply and demand side factors.

In its e-Europe plan, the Commission has adopted an approach based on the premise that infrastructure investment is driven by the availability of content and services and the development of new services and content depends on infrastructure deployment. Thus, this approach sees the infrastructure evolving and upgrading as new services and applications emerge and vice versa. By focusing on both elements at the same time, the Commission is hoping it can stimulate a positive feedback between infrastructure upgrading and service development.

In its policy approach, the Irish Government has tended to broadly dovetail much of the European Commission's e-Europe programme. On the demand side, Ireland is recognised as a world leader in eGovernment and in recent years substantial resources have been devoted to developing additional R&D capabilities in business and third level institutions, as well as ICT skills in schools and community groups. Notwithstanding this however, there has also been a large degree of policy emphasis on the supply side and on infrastructure provision in particular.

[54] www.equalskills.com

[55] www.cait.ie

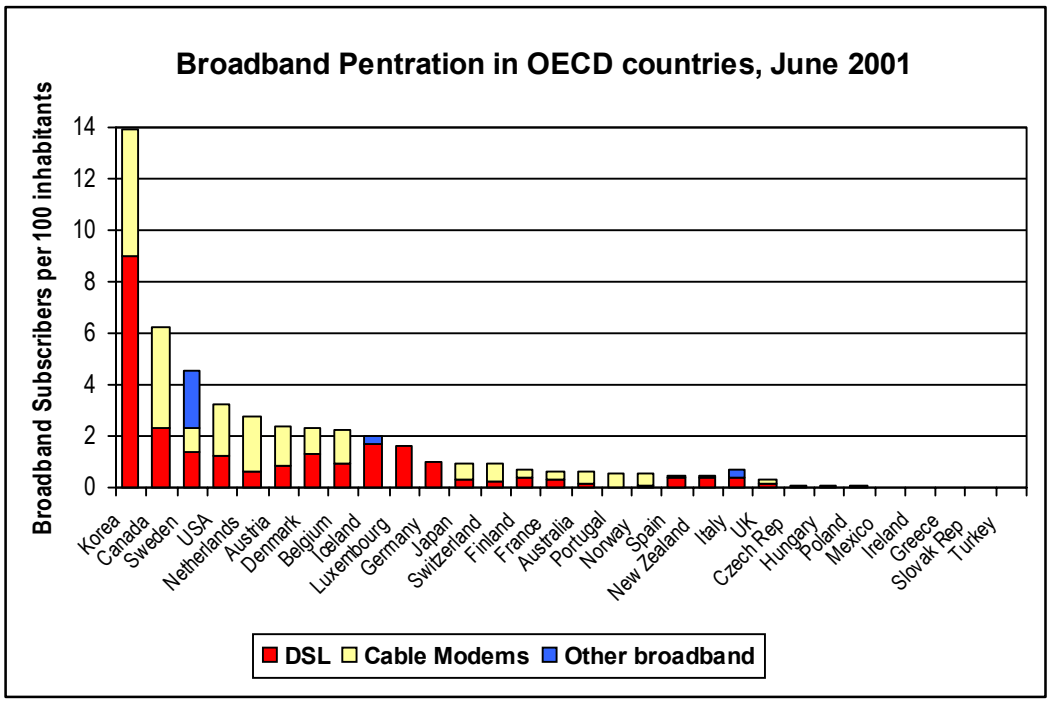
7 INTERNATIONAL BROADBAND INITIATIVES

Some governments fear that, left alone, the market may not deliver widespread broadband services, and are therefore examining the role of incentive programmes in supporting both infrastructure deployment and demand stimulation. Motivated by a twin desire to spur economic growth and bridge the 'digital divide', in many instances these programmes are moulding the environment in which national broadband markets are now taking shape. This section provides a brief overview of a number of broadband initiatives from around the world which may be useful to consider in the context of Ireland's emerging broadband market.

It should be noted that these initiatives do not necessarily reflect the views of the ODTR on broadband deployment policies. By highlighting certain policies and initiatives it is hoped that both government and industry can make an informed decision on the range of broadband policy options available.

This chapter concentrates on policy initiatives in countries considered to be most advanced in terms of broadband deployment, as measured by the OECD in June 2001.

Fig. 7.1 Broadband penetration in OECD countries, June 2001



NB: 'Other broadband' mostly includes high-speed fibre LAN services to apartment blocks.

7.1 Supply-side/Infrastructure Based Initiatives

The initial focus of many governments' initiatives has largely been concentrated on supply-side issues. Not surprisingly, this has seen a high degree of emphasis being placed on infrastructure provision with a wide variety of strategies being

adopted according to national policies and budgetary situations. Whilst no two approaches are exactly similar, it is possible to roughly classify these initiatives according to the level of emphasis placed on the role of the private sector in broadband deployment.

7.1.1 ***Direct Government assistance to Operators***

One of the most direct means of encouraging broadband deployment is to provide direct financial support to broadband providers. In Japan this approach has been in operation for a number of years with Government agencies providing a low interest financing system under their "e-Japan" strategy to subsidise loans for the purpose of building broadband infrastructure. Between 1995 and 1999 subsidies of up to 2% on the loan interest were available on almost €2.25bn worth of loan funds with corporate tax incentives also being offered via a special rate of depreciation on broadband assets.

A broadly similar initiative has been adopted in Korea under its Cyber Korea 21 Programme. Here, the funds to provide for development of a national fibre network were sourced from a number of areas. This included telcos' own efforts, overseas DR (depository receipt) issuance, and proceeds from stock sales and loans. At the same time, policy supports, such as treasury investments and loans, increases in local call charges, recategorization of telephone taxes into value-added taxes and joint usage of rights of way for cables, were carried out in parallel[56].

Whilst the US also provides various direct financial support to operators, this support tends to be through programmes aimed at reducing the digital divide (under the 1996 Telecommunications Act) rather than comprehensive national broadband programmes. One such example is the Rural Utilities Scheme (RUS) which offers a loan programme to finance the construction of broadband services in rural America. This has been supplemented by a pilot scheme proposing to offer grants to applicants proposing to provide broadband transmission service on a "community orientated basis". Similarly the Broadband Development Act of 2001 provides tax credits for 5 years to companies investing in broadband equipment to serve low-income areas and a 10% tax credit for broadband service delivery.

7.1.2 ***Government Ownership of Broadband Infrastructure***

An alternative approach to providing support directly to private operators is for the government or public sector to build, operate and own the broadband network. Such a model is based on the philosophy that telecommunications infrastructure should be provided as a 'public good' to facilitate access to advanced communications services for its businesses and citizens. In 1994, the Stockholm County Council chartered a company called Stokab to lay a public owned fibre optic network throughout the city to provide dark fibre to telecommunications operators and other users at cost-based rates. The fibre-optic ring is an open

[56] http://www.innovazione.gov.it/ita/intervento/banda_larga/corea_cyber.htm

access network, enabling all telecommunications service providers to use the network for the delivery of their services. Customers of the Stokab network include telecommunications operators, Internet service providers, cable television networks, mobile telephone operators, municipalities, county councils, major banks, insurance companies and new media companies.

7.1.3 ***Government Aggregated Demand/PPP projects***

Another approach to encouraging broadband deployment is to create a market sufficiently large to provide an incentive for the private sector to invest in regions where normally it may not be profitable to do so. Governments and the public sector can play a role in creating these markets by aggregating their own broadband needs and then 'asking' the private sector to invest in the construction of a network using its purchasing power. This approach was used by the government of Alberta when they announced the development of a high-speed broadband network called SUPERNET to link every school, hospital, library and government facility in the province by the end of 2003. As well as receiving US$125m to build the network, the private consortium was also able to factor the government's ongoing network expenditures into their financial models. This provided greater certainty in the business case and made building and operating the network a viable proposition.

A broadly similarly approach has been outlined in Korea. Here under the Korean Information Infrastructure-Government (KII-G) programme, the Ministry for Information and Communications (MIC) awarded a US$437m contract to provide broadband services capable of providing speeds of up to and above 100Mbit/s to all of its government agencies and public institutions. The two companies which won the contracts, Korea Telecom (KT) and Dacom, also received government funding to build the fibre optic network, which they then own, manage and maintain. In return for its up-front investment, the government has priority access to the network at a discounted market rate, which is written off against the infrastructure financing. This network is not exclusively for the public sector and as long as the providers meet the minimum requirements set under SLAs, they can also use the network for commercial services.

7.2 Demand-side Initiatives

Through the stimulation of end-users' demand for broadband services, policy makers can also play a role in facilitating broadband deployment. Demand-side initiatives concentrate on raising end-users' perception of the value of broadband thereby creating a commercial incentive for operators to provide services to satisfy this demand.

7.2.1 ***Subsidised Personal Computers***

One of the simplest ways of stimulating demand for Internet services is to lower the up-front costs of getting online. For many potential Internet users the cost of a personal computer (PC) represents a significant barrier to be overcome. In Sweden a Government policy was adopted to increase PC penetration in households. In 1998 the Swedish government purchased 500,000 PCs and made these available to members of the public at a subsidised cost. This scheme allowed employees to lease or buy PCs from their employer with the payment deducted from their annual salary. During 1998 Sweden recorded a 180% increase in its PC penetration rate[57].

7.2.2 ***IT Training and Raising Awareness***

Whilst subsidized PCs can assist in increasing the numbers of homes or businesses online, to ensure that this investment is fully utilized it may be appropriate for governments or public agencies to supplement this approach with IT training or awareness raising programs. In Cornwall, ACTNOW[58], a partnership comprising of BT, local business interests, Cornwall County Council and the regional development agency has been formed to offer businesses a choice of low-cost Internet packages. The project, which is partly subsidised by EU funding, offers tailored integrated solutions to SMEs[59] incorporating hardware, software, broadband connections, assistance and training. All broadband connections are provided via ADSL with BT coordinating with ACTNOW to ADSL-enable local exchanges when sufficient numbers of businesses within an area indicate an interest in the scheme. According to BT the project generated 600 DSL installations in the first two months and now the company is designing similar programs for seven other regions in the UK[60].

[57] A broadly similar scheme was launched in Ireland in 1997 as part of the *eircom* sponsored Information Age Town (IAT) project. In the first two years of the program over 5,600 PCs were distributed to homes in the town of Ennis at a cost of IR£260 (€330) each to the town's households. 82% of all eligible households took up the offer, while a further 500 PCs were provided to the town's schools in specially adapted computer labs. (Source: Irish Times 24th September 1999).

[58] www.actnowcornwall.co.uk

[59] The scheme is only open to businesses with 250 employees or more.

[60] Source: BT web-site

7.2.3 *Pre-Registered Demand*

As well as working with SMEs to develop the business case for ADSL-enabling exchanges, BT also has a similar facility on its web-site which gauges consumer demand for ADSL. This allows consumers and business people, via an ISP, to register demand at exchanges that have not yet been upgraded for ADSL. This information is fed back to BT which it then uses to make an informed decision as to which local exchanges should be enabled for ADSL. BT has stated that it will not consider upgrading an exchange until between 200 and 500 people have registered an interest in that area.

Although the scheme has only been in place since July 2002, within two months 595 exchanges had been earmarked by BT as being likely candidates for ADSL installation. BT has said that a further 201 exchanges will be reviewed by the end of September to see if they had reached their pre-determined trigger levels. When exchanges meet their trigger levels, the number of consumer/business registrations make the upgrading of the exchange economically viable.

7.2.4 *Internet Pricing*

One of the most effective ways of stimulating demand for 'always-on' high-speed broadband services is to make it cost-effective for users to spend more time online. Unmetered dial-up or flat-rate packages can facilitate longer Internet sessions by removing the cost factor from users' decisions on whether to stay online.

The first wholesale flat-rate product in Europe was introduced by BT in June 2000. This product made it viable for UK ISPs to offer unmetered Internet packages and following its introduction unlimited packages have shown strong growth in popularity amongst UK Internet users. This has not only lead to a large increase in the amount of time users spend online[61], but consumer research also suggests that many unmetered dial-up users are inclined to move to a broadband platform in order to allow them to surf the Internet while freeing up their main line for voice calls[62].

It should be noted that a number of ISPs are currently in the process of introducing flat-rate or un-metered Internet access models to the Irish market.[63] The ODTR welcomes the arrival of these products and considers that such developments should assist in stimulating increased future demand for broadband.

[61] By August 2002, the UK regulator Oftel estimated that 43% of Internet users were on un-metered packages and that 75% of dial-up Internet call volumes were accounted for by un-metered Internet traffic. (Source: Oftel, Market information: Fixed update, August 2002).

[62] Oftel, Consumer perceptions of broadband services, January 2002

[63] Irish Independent, Telcos in talks on net access, 4th September 2002

7.2.5 *Compelling Content and Applications*

Whilst cost may be a key concern for many users, for an equally large, if not greater constituency the lack of compelling and relevant content is often the main inhibitor to broadband adoption. Potentially, this could be the biggest obstacle to widespread broadband take-up as it runs the risk of creating a vicious circle whereby low levels of broadband adoption make the development of broadband content uneconomic, which in turn results in a lack of broadband availability, and further hampers the speed and level of broadband adoption.

However, even at higher levels of broadband adoption there a number of economic barriers that may prevent the profitable development of a viable content industry[64]. On the revenue side providers face customer resistance towards paying for content while industry fragmentation makes a business model based on advertising difficult to sustain. In addition to this, the cost of bandwidth can be relatively high, while content acquisition and production costs may also be significant. Finally many content owners are reluctant to make their content available for fears over piracy and the difficulty in maintaining geographically limited distribution rights.

To date government initiatives in this area have been limited, reflecting to a certain extent the limited ability to which individual jurisdictions can influence many of the commercial and international issues facing content markets. Notwithstanding this however, in several countries, governments are now taking a leadership role in developing content availability by increasingly offering public services online.

7.3 Conclusion

This chapter has focused on a number of initiatives internationally in the arena of broadband policy. In many instances, it is still too early to draw conclusions on the success or otherwise of one policy over another and often cause and effect are difficult to distinguish. What is apparent however is that any strategy adopted should be coordinated with all relevant bodies and must adopt a long-term view as there is no quick-fix solution available to policy-makers. As can be seen from some of the aforementioned initiatives, tangible results may take some time to achieve, but international experience would tend to suggest that it is a combination of supply and demand initiatives which have yielded most in terms of increased broadband penetration.

[64] It is interesting to note that even in countries with a high broadband penetration, a 'content-rich' environment has yet to emerge. In Korea for instance much of the content that has driven broadband penetration is end-user generated (e.g. gaming and online schoolwork).

8 BROADBAND DEMAND IN IRELAND

To inform the debate on the demand for Broadband/Internet services in Ireland, the ODTR commissioned TNS MRBI to conduct research amongst Irish SMEs and residential households on general attitudes to the Internet and to a high speed, 'always-on' service in particular. This section of the report presents the key findings from this research, which it is hoped can assist in informing the debate on the future needs for broadband in Ireland.

8.1 Residential survey

The research into the residential market comprised of 756 telephone interviews amongst a representative sample of the population of Irish adults aged 15+ years[65].

8.1.1 *General Attitudes to Technology and the Internet*

This research would appear to suggest that significant numbers of Irish households are now getting online. 61% of all respondents said that they owned a PC at home, while 49% stated that they had home Internet access[66]. Internet take-up was strongest amongst younger and higher-income households, while households in the Dublin region and those with larger families also exhibited above average levels of take-up.

Despite this increasing level of take-up, there is also evidence to suggest that the Irish public have yet to fully engage in the Internet. Online usage remains relatively low (see section 8.1.3) and users still see the main benefits of the Internet in terms of basic services such as sourcing information and emailing/communications (see Fig. 8.1). Levels of comfort with the Internet varied widely according to users' experience and age-group, although a significant number (53%) indicated that they would consider taking a training course to improve their Internet skills.

Fig. 8.1 Key Benefits of Internet (Base: All Respondents):

Key Benefits	Of all respondents
Information	48%
Keeping in touch/Email/Communications	30%
Education	10%
Speed/quick/fast/immediate	8%
Research	6%
Travel	6%
Online Shopping	6%

[65] Quota controls by key demographics were imposed to ensure representation of the population under study. Interviewing was conducted between 15th and 30th July, 2002.

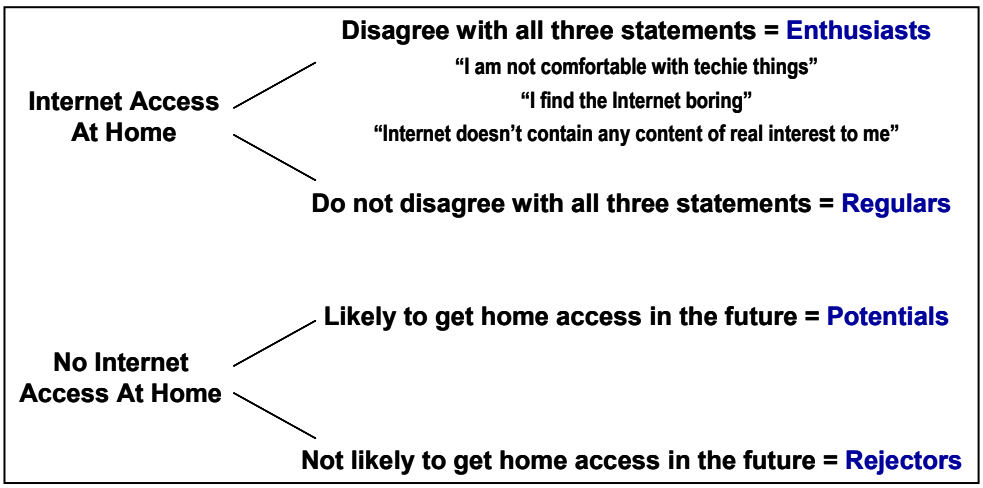
[66] It is important to note that fixed line household penetration in Ireland is currently estimated to be 85%. Consequently, telephone research will naturally exclude a proportion of the population for whom Internet access is not a feasible option (i.e. no phone line to connect). It is important to bear this in mind when interpreting the results.

Interestingly, despite the high levels of media interest, a rather surprising 49% of respondents said that they had never heard of the term 'broadband Internet', with a further 24% saying that they had heard of the term, but knew nothing of it. If technologies, such as broadband are to gain widespread acceptance, it is important that consumers are familiar with their uses and benefits and find them quick and easy to use. In this respect it is important to note that of all the technology products put to respondents[67], mobile phones scored highest in terms of access, usage and ownership. This clearly shows that mobile is a key communications technology – the one that consumers can access most easily, use most and own most. Whilst information services over a mobile[68] have to date experienced limited demand, as technological advances continue and compelling content becomes available, then mobile's ubiquity and simplicity has the potential to see it become a key provider of broadband services in the future. This potential is supported in the research with two thirds of respondents who ever had access to a WAP phone stating that they have at least trialled the service. This equates to approximately 22% of all respondents.

8.1.2 ***Individual Market Segments***

Although overall market figures can give a good indication of the general market direction, they can sometimes disguise underlying trends and drivers by aggregating conflicting patterns. Hence in order to fully capture the key motivators for specific groups of users, it was decided to segment the market into individual groupings. This was achieved by differentiating respondents with home Internet into two groups on the basis of their responses to a number of attitudinal questions ('Enthusiasts' and 'Regulars'). Respondents without home Internet were then also differentiated into two groups based on their plans towards getting home access in the future ('Potentials' and 'Rejectors'). A diagrammatical representation of how this segmentation was achieved is illustrated below.

Fig. 8.2: Market Segmentation Process



[67] These technology products also included TV with teletext, PC/lap-top, DVD, satellite dish and decoder.

[68] For the purposes of this market research information services over a mobile phone (i.e. WAP) were not considered as Internet services.

This market segmentation provided us with for distinct groupings – each with their own characteristics and motivators.

Enthusiasts (25%): Enthusiasts are the most pro Internet of all consumers. All have Internet access at home and all see the Internet as particularly relevant to them. Not surprisingly, Enthusiasts have been online for longer and spend longer online than users in general. This group is also more likely to have ever bought anything online.

Regulars (25%): Regulars also have home access to the Internet, but they are less effusive in their praise of the Internet. This is reflected in their usage of the Internet (less often, for less time, doing less). Demographically, Regulars exhibit a similar profile to Enthusiasts (younger, higher income households).

Potentials (30%): Potentials currently do not have home access to the Internet, but plan to have access in the future. Some have access at work and are therefore familiar with the technology. Most are interested in finding out more about the Internet, probably to gain the confidence they require before moving on to the next stage. A financial barrier may also exist, as suggested by the demographic profile of this group which is somewhat biased towards lower income households.

Rejectors (21%): Rejectors do not have home access and have no strong interest in having access in the future. The most obvious demographic characteristic of this group is a heavily skewed age profile – just 5% of 15-24 year olds are Rejectors, whereas 67% of 65+ year olds are Rejectors.

References to these market segments are made throughout the research to highlight the key characteristics and motivators amongst these four distinct groups.

8.1.3 ***Home Internet Users***

Of respondents with home Internet access, the majority of these have been online for over a year now (67%). Despite this degree of experience, usage levels amongst home Internet users remains relatively low with 31% of home users stating that they had not gone online at all in the seven days preceding the survey, while 45% of users said that they had only gone online between 1 and 5 times. In addition to relatively few sessions, these sessions tend to be quite short with the vast majority of users averaging half an hour or less (69% of users). Enthusiasts tend to stay on longer than Regulars with 36% of this group averaging 30 minutes per session compared to 27% for Regulars. When asked why they don't stay online for longer the most common response was that they 'Don't need it use it more often' (33%). Combined the second most popular response: 'No interest' (15%), this would suggest that a lack of a perceived benefit is a key constraint to increasing usage amongst residential users. One possible means of enticing people

to stay online longer could be to provide more relevant and local content. 21% of all respondents indicated that they would be 'very interested' in accessing more local content online, with a further 38% indicating that they would be 'fairly interested'.

Fig. 8.3 Main Reasons for not using the Internet at Home more (Base: All those online):

Main Reasons for not using Internet more	Responses
Don't need to use it more often	33%
No interest	15%
Lack of time/too busy	13%
Too expensive	11%
Have access at work	10%
Too slow	5%
At work/out	4%

Although usage levels were relatively low, the levels of e-commerce were more encouraging with 45% of those online having made a purchase over the Internet at home. Enthusiasts (55%) had a higher tendency than Regulars (35%) with the most common product/service purchased being holidays/travel (65%). The main reason given for not buying online was the lack of ownership of a credit card (33%), which was also tied with not wanting to give credit card details for security reasons (33%).

Fig. 8.4 Products/Services bought online at home (Base: All those online):

Product/Service	Responses
Holidays/travel	65%
Books	33%
Concerts/show tickets	29%
CD's	19%
Downloading Music	13%
Tickets for Sporting Event	12%

Although only 11% of responses specifically cited cost as a reason for not staying online more, there were indications that cost was still a factor in influencing Internet usage. Of all home users 80% accessed the Internet in the evenings, with 41% of these respondents doing so because 'it is less expensive at these times'[69]. In addition, across all respondents there was relatively strong interest in an unlimited Internet package. 18% said they were either 'extremely' or 'very' interested, while a further 29% stated that they were 'fairly' interested. Interest was highest amongst Potentials suggesting that cost could be one of the main reasons preventing this grouping from going online. For those not interested in an unlimited product 'No interest/not bothered/don't use Internet' was the most common answer – with this result heavily influenced by Rejectors who have little interest in the Internet generally and Regulars who tend to limit their time online to just meet their basic needs. Interestingly, however, a relatively high proportion of Enthusiasts (23%) stated that they would prefer a pay-as-you-go option as they

[69] This was just behind the most popular reason - 'I am not at home during the day', which was cited by 45% of users who go online in the evenings.

had not much usage. This suggests that some users would prefer to have control over their time online as they think they would not use the Internet enough to justify the cost of an unlimited product. This 'pay-as-you-go' way of managing expenditure is also evident in the mobile market, where the majority of users are currently on prepaid packages. At present, pay-as-you-go packages account for 65% of Internet users subscriptions, while 19% of users pay a monthly subscription and share cost of calls when online.

Fig. 8.5 Reasons for no Interest in Unlimited access Package (Base: All Respondents):

Product/Service	Total	Enthusiasts	Regulars	Potentials	Rejectors
No Interest / not bothered / don't use Internet	30%	25%	33%	18%	**37%**
Prefer Pay-as-you-go / not much usage	9%	**23%**	10%	8%	-
Cheaper / cost / value for money	5%	3%	8%	8%	3%
No reason	5%	1%	3%	4%	9%
No need	4%	2%	2%	-	9%
Lack of knowledge / confidence	3%	1%	3%	**9%**	3%

In relation to the reliability and speed of their connection, most respondents thought their connection to be 'reliable' or 'fairly reliable' (82%). In contrast to this however, attitudes towards the speed of connection were mixed. 33% of respondents considered the speed of their connection to be fast/very fast; 21% thought it to be 'neither fast nor slow'; while '39% thought it to be slow/very slow. This distribution of responses would tend to reflect the varying levels of sophistication amongst the large base of dial-up home users.

8.1.4 ***Respondents without Home Internet Access***

According to the research, just over half the population do not have Internet Access at home (51%). The reasons for not having home access vary considerably between the two 'non-Internet' market segments, as illustrated in the table below.

Fig. 8.6 Reasons for no Home Internet Access (Base: All without home access):

Reason	Total	Potentials	Rejectors
No PC/PC too expensive[70]	31%	**40%**	20%
Not interested	23%	6%	**44%**
Have at work/elsewhere	14%	**19%**	8%
Don't know how to use	12%	9%	**16%**

[70] When this group was asked whether they would consider a PC if it was subsidised 74% said they would. The price point at which most respondents indicated they would be prepared to pay was between €500 - €999 (26%). The next most popular price point was between €1,000 - €1,499 (21%). Only 11% of respondents said they would only pay up to €500, while just 6% were prepared to pay over €1,500.

For potentials cost appears to be the greatest barrier to home Internet access, either because it is prohibitive (40% - 'No PC/PC too expensive') or because work access simply represents better value for money (free and often faster speeds). Hence, the provision of cost-effective Internet services may entice this group online. In contrast, for Rejectors, price or cost of using the Internet is only one of the barriers which needs to be addressed. 44% of this group stated that they were simply not interested which suggests that this group may be difficult to 'actively' convert to home users.

8.1.5 ***Attitudes to High-speed Internet Services***

The survey also queried respondents' attitudes to high-speed broadband services. A description of broadband was provided[71] and respondents were asked about their likelihood of subscribing to such a service. 14% of respondents stated that they would be 'very likely' to subscribe, with a larger 32% stating that they would be 'fairly likely'. A key determinant in winning over this second grouping will be price. It was interesting to note that the generally positive, but cost-conscious Potentials were the largest representation amongst this 'fairly likely' group.

Fig. 8.7 Likelihood of Subscribing to Broadband (Base: All Respondents):

Product/Service	Total	Enthusiasts	Regulars	Potentials	Rejectors
Very Likely	14%	16%	21%	14%	4%
Fairly Likely	32%	38%	29%	44%	10%
Not very likely	14%	16%	17%	14%	9%
Not at all likely	25%	14%	21%	12%	61%
Couldn't Say/DKs	22%	16%	12%	16%	17%

Respondents were also asked about their attitudes to broadband pricing. Starting at €70 a month and subsequently reducing by €10 each time, respondents were asked about their likelihood to subscribe at different price points. Using this technique the upper price limit at which reasonable numbers of respondents signalled that they were 'extremely likely' to subscribe was between €30 and €40 per month. However the percentages of subscribers that were willing to subscribe at this point varied somewhat amongst the different market groupings. Of the group who had previously indicated that they were 'very/fairly likely' to subscribe to broadband, 23% stated that they were 'extremely likely' to subscribe at €40 a month. For Potentials the corresponding figure fell to 19% and for all those who currently have home Internet the figure fell further to 15%, which was the same result as across all respondents. This price range is broadly similar to premium TV/entertainment packages and this may indicate that respondents are evaluating the price of broadband against other entertainment services.

[71] "*Broadband relates to speed and enables much faster downloading of web pages and information, as much as ten times faster than nowadays. Unlike current analogue connections that require modems to 'dial in' to the Internet service provider every time the user wants to retrieve email or obtain access to the Internet, the broadband connection would always be on for a set monthly fee (i.e. no individual call costs relating to how long you are on-line"*

Fig. 8.8 Likelihood of subscribing to broadband at different price thresholds (Base: All Respondents):

	CUMULATIVE ANALYSIS						
Monthly Fee →	€70	€60	€50	€40	€30	€20	€10
	%	%	%	%	%	%	%
Extremely likely (6)	2	3	8	15	26	38	55
Very likely (5)	3	6	8	11	11	13	7
Fairly likely (4)	14	12	14	13	15	10	6
Fairly unlikely (3)	12	13	11	9	5	3	2
Not very likely (2)	16	17	14	11	7	4	3
Not at all likely (1)	45	40	34	30	25	21	17
Don't know	8	10	10	12	11	10	11

In terms of the most appealing aspect of broadband, cost concerns again came to the fore with 'unlimited access for the same fee' featuring prominently (37%), ahead of 'high-speed' (29%) and 'always-on no dial-up' (18%).

8.1.6 ***Residential Survey - Conclusions***

This research suggests that although Irish households are now starting to get online in significant numbers, they have yet to fully engage with the Internet which they still predominantly see as a tool for sourcing information and staying in touch. Usage levels remain relatively low with a lack of perceived benefit and cost being the main reasons for not going online more. A broadly similar attitude is evident in relation to a high-speed 'always-on' service, although there is some evidence to suggest that a targeted product emphasising its fast and unmetered nature may gain some appeal, with €30 - €40 per month representing the upper price range. More fresh and relevant content combined with a flat rate dial-up product which enables users to explore the Internet without any cost concerns may help to stimulate demand for future broadband services.

8.2 SME Survey

As well as surveying the demand for Internet services amongst Irish households, TNS MRBI also conducted research on general attitudes amongst Irish SMEs both to the Internet and to a high-speed, 'always-on' service. The research comprised of 400 telephone interviews amongst a nationally representative sample of Irish SMEs during the last two weeks of July 2002[72].

8.2.1 *General Attitudes to the Technology and the Internet*

As in the residential sector research, this SME research would appear to suggest that Irish society at all levels is steadily developing its level of adoption of ICT technologies. Over 90% of all SMEs reported that they used computers/PCs, with larger businesses and those in Dublin displaying increasingly high levels of sophistication. 85% of SMEs said that they had Internet Access, with most of these businesses online for over two years (61%). Of the small minority of respondents who were not yet online, the overwhelming reason for this was that the Internet was not relevant to their business (53%). This appears to suggest that for those who are interested in getting online, there doesn't appear to be any major barriers preventing them from making this initial first step.

8.2.2 *Current Usage*

When SMEs get online however, there are indications that some may have difficulties in maximising benefit from their investment. A sizeable proportion of online SMEs feel that the Internet 'hasn't helped their business to any great advantage' (22%). The majority of other online SMEs feel that it has made their business more efficient, but most see it as merely enabling them to keep pace with the competition and only a small proportion felt that the Internet gave their business a competitive advantage (5%), offered cost savings (6%) or was an essential business tool (4%).

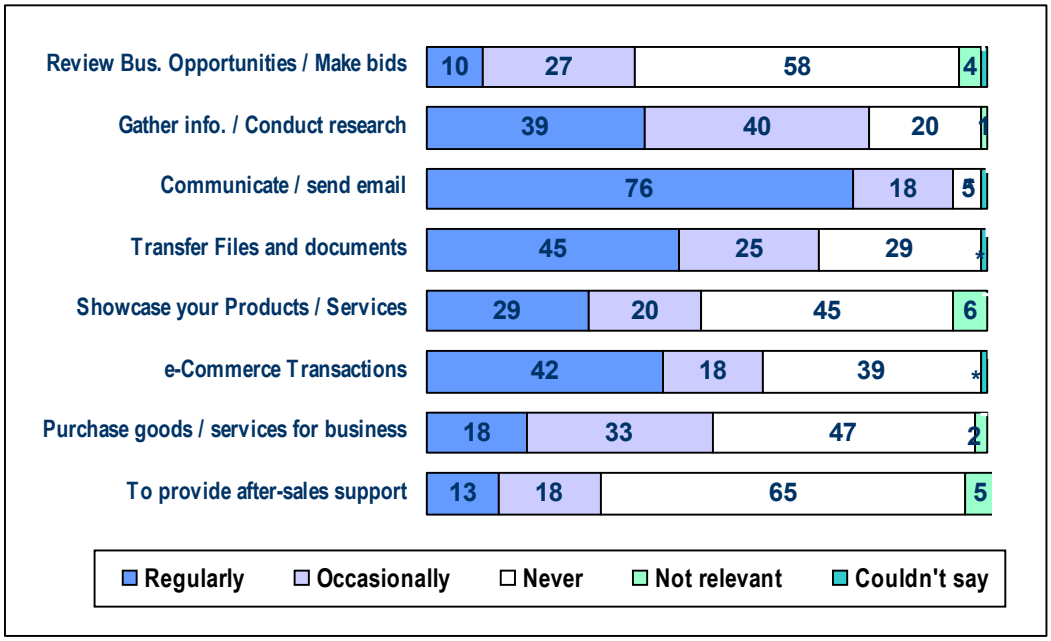
Fig. 8.9 How the Internet has helped SMEs (Base: All with Internet Access)

How Internet Has Helped SMEs Business	Responses
Saves time / Enables quicker work	30%
Has not helped my business to any great advantage	22%
Better communication with use of email / Faster comm. with clients	15%
Saved money / Cost savings	6%
Good source of information / Access information quicker	5%
Helped us gain competitive advantage	5%
Can do more research / Helps research new things	4%
Banking / Online banking particularly useful	4%
Promote the business through the web-site/ Advertise with customers	4%
Essential business tool / Could not function without it	4%

[72] For this study, SMEs were defined as having up to 99 employees and the sample was quota controlled by numbers of employees to ensure a representative number of firms across various categories for company size. Weightings were then applied across both company size and region to accurately reflect the representation of each group within the population. The research comprised of a telephone survey of individuals responsible for Telecoms/IT in their company.

When asked about the frequency of using online services, responses to this question appeared to support the argument that many SME have yet to avail of the full opportunities presented by conducting more of their business online. Not surprisingly, 'To communicate/send email' was the activity most regularly conducted online (76%), followed by transferring files and documents (45%) and e-commerce transactions (42%). It was interesting to note that while there was a large number of respondents who regularly conducted e-commerce transactions (42%), there was also a large number who never had (39%), along with a relatively small group who only conducted such transactions occasionally (18%). This would appear to suggest that once SMEs get over the initial barrier of conducting transactions online that they begin to avail of these services much more regularly. This phenomenon however, does not extend into more sophisticated activities which would require greater integration of IT and business processes (e.g. e-business, CRM), with activities such as 'Purchase good/services for business' and 'To provide after sales services' scoring lowly with SMEs in terms of regular use. This is despite the fact that 46% of SMEs reported that they had a web-site.

Fig 8.10 Frequency of Using Online Services (Base: All with Internet Access)

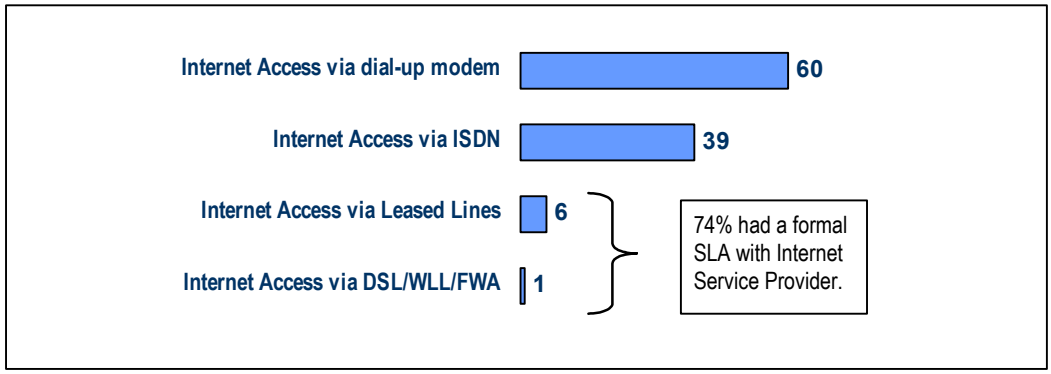


8.2.3 *Current Internet Connections*

In terms of Internet connections, the vast majority of SMEs still go online over a dial-up connection. 60% of SMEs reported that they used dial-up modems, while 39% said they availed of an ISDN connection. Always-on connections only accounted for approximately 7% of all Internet connections with the majority of these over leased lines. 74% of the SMEs with an always-on connection stated that they had a formal service level agreement (SLA) with their Internet supplier. Whilst respondents were generally aware of how they accessed the Internet, a very significant proportion (63%) were unable to say what their total bandwidth or speed of connection was.

Reliability was not considered as a problem by the overwhelming majority of SMEs with over nine in ten stating that their connection was either fairly reliable or very reliable.

Fig. 8.11 Internet Access in SMEs (Base: All with Internet Access)



Given that the vast majority of many SMEs access the Internet over a dial-up connection, it is not surprising that the most use a pay-as-you-go Internet package (44%). The second most popular option is a monthly subscription and a share of the cost of the calls while online (34%), while 12% of SMEs (generally larger businesses) reported that they pay a set fee for always-on access. 11% of SMEs couldn't say which package they were on, but it should be remembered that most SMEs rarely have a dedicate IT/telecoms specialist.

Fig. 8.12 Current Internet Package (Base: All with Internet Access)

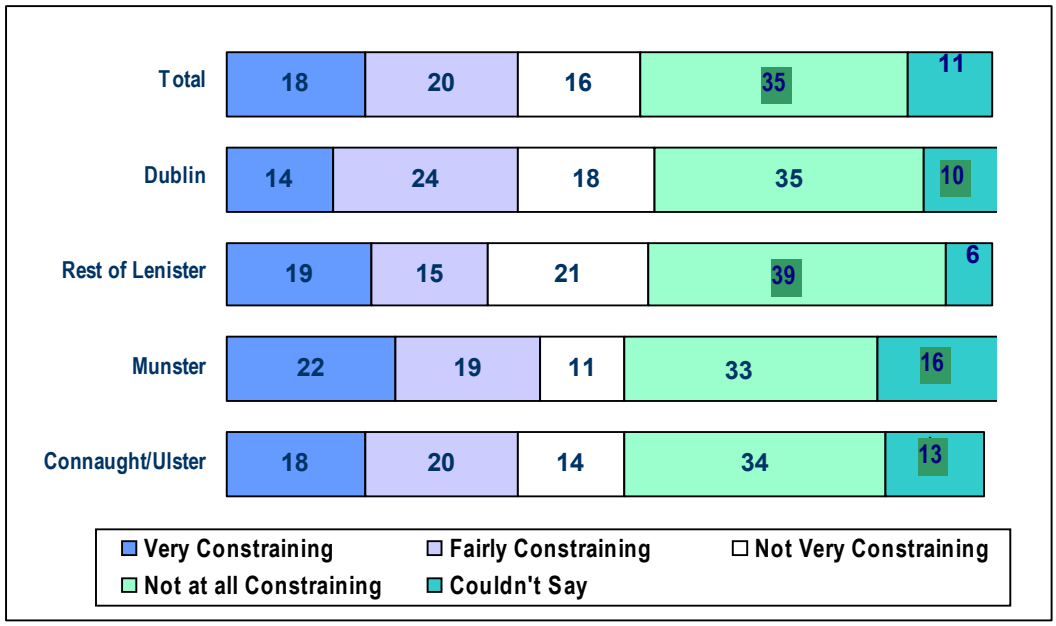
Current Internet Package	Responses
Do not pay a monthly subscription, only pay cost of calls when online	44%
Pay a monthly subscription & share of calls while online	34%
Pay a set fee for 'always-on' access	12%
Couldn't Say	11%

Regarding the speed of connection, amongst all online SMEs, most felt that their connection speed was 'just right' (60%). However, there was also a significant proportion who felt that it was 'too slow' (39%). Of those who were aware of their current bandwidth connection, the highest levels of dissatisfaction were evident amongst SMEs whose connection speeds were between 64kbit/s and 128kbit/s. This range of speeds broadly equate to those available to SMEs with ISDN connections. This suggests that there may be an element of frustration amongst some ISDN users who may feel hampered by the limited speeds possible using this technology, but who are not yet ready to make the step up to a leased line service.

As regards the proportion of SMEs who felt that a lack of broadband connections was a constraint on their use of technology, 18% of respondents said this was 'very constraining', while 20% said this was 'fairly constraining'. When broken down across geographic regions, SMEs in Munster and Connaught/Ulster had a slightly higher perception of a lack of broadband as constraining their business, but overall there were few significant differences. This may appear surprising given the divergence in broadband availability across the different regions, but it

should be remembered that if SMEs are content with dial-up access, then they are unlikely to perceive the lack of broadband as being a constraint on their business.

Fig. 8.13 Lack of Broadband Connection – Level of Constraint across Regions (Base: All Respondents)



8.2.4 *Broadband and SMEs' Future Needs*

Regarding their future needs, 57% of SMEs said that they didn't anticipate increasing their bandwidth connection over the next 12 months. This would seem to suggest that most SME are content with their current speeds and currently foresee no need to upgrade their connection. However, 29% of respondents indicated that they did plan to increase their bandwidth over the next 12 months – a figure that appears to correspond to the 30% of respondents who felt that their current connections were too slow. When we look at the breakdown of this 29% we see that plans to upgrade connections are most apparent amongst the SMEs with faster connections. This appears to validate the widely held belief that once users' upgrade to a faster service, their demand for even more capacity increases (See Table 8.5 below)

Fig. 8:14 Bandwidth Connections – Next 12 Months (Base: All with Internet Access)

Responses	Total	Modem	ISDN	DSL/Leased Line
Yes – Plan to Increase	29%	**23%**	**36%**	**46%**
No – do not plan to increase	57%	62%	53%	34%
Don't Know	15%	15%	11%	20%

This level of SME interest in upgrading their connections - particularly amongst more sophisticated users, would appear to bode well for the future up-take of broadband services. When asked about their likeliness to subscribe to a 'high-speed always-on Internet service', just half of all SMEs said they were either 'very likely' (14%) or 'fairly likely' (36%). The distribution of responses broadly mirrors the distribution received when this same question was posed to residential

subscribers. This may be an indication that for the SME sector, price may again be a key determinant in winning over the key generally positive, but not yet fully committed 'fairly likely' segment. Amongst those who said that they were not likely to subscribe to such a service, it was a lack of perceived need rather than any cost issues that appeared to be the reason for their lack of interest. 56% of these respondents replied to this question by saying that they had 'no need for it/wouldn't have the use for it/getting on fine without it'.

Fig. 8:15 Reasons why not likely to subscribe to 'Always on' high-speed service (Base: All not very likely/Not at all likely to subscribe to an 'always-on' package)

Reasons why not likely to subscribe to 'Always on' high-speed service	Responses
No need for it / wouldn't have the use for it / getting on fine without it	56%
Cost factor / expensive to set-up / hidden charges somewhere	10%
Happy with what we have	6%
Have it already	6%
Not relevant to our business	5%
Others / Don't Knows	20%

As in the residential survey, SMEs were also asked about their attitudes to broadband pricing. Starting at €150 a month and subsequently reducing by €10 each time, respondents were asked about their likelihood to subscribe at different price points. Using this technique the price range at which large numbers of respondents signalled that they were 'extremely likely' to subscribe was between €40 and €60 per month. At this price range, between 5 and 7 out of 10 of all SMEs indicated that they would be extremely likely to subscribe to an 'always-on' high-speed service. Despite this price range being somewhat higher than the residential price point, a proportionally higher number of SME respondents compared to residential households indicated a willingness to subscribe at these higher prices. This difference between the two sectors may be reflective of not only SMEs' larger budgets, but also perhaps of their relatively higher awareness of the Internet and the perceived benefits it can bring.

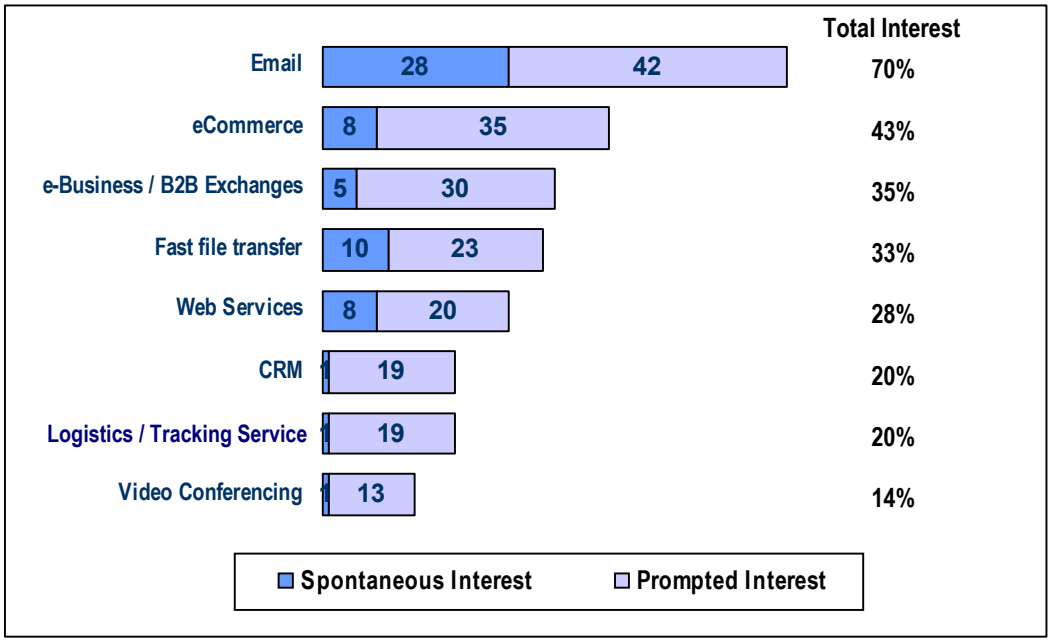
Fig. 8:16 Likelihood of subscribing to 'always-on' high-speed service (Base: All Respondents)

	CUMULATIVE ANALYSIS													
	MONTHLY SUBSCRIPTION FEE													
	€150	€140	€130	€120	€100	€90	€80	€70	€60	€50	€40	€30	€20	€10
	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Extremely likely (6)	18	22	24	25	34	38	44	47	51	61	69	74	82	85
Very likely (5)	3	2	3	3	4	4	4	6	7	9	10	8	5	4
Fairly likely (4)	15	14	13	13	12	11	10	9	9	5	4	2	2	1
Fairly unlikely (3)	14	14	12	14	14	13	12	10	7	4	2	2	1	1
Not very likely (2)	17	17	19	19	13	13	11	9	9	8	6	5	2	2
Not at all likely (1)	33	32	28	27	24	22	20	19	17	10	10	9	8	7

In terms of the most appealing aspect of broadband, as in the residential survey cost concerns again came to the fore. Across all respondents 'unlimited access for the same fee' was the most cited as the most appealing feature of a broadband service (35%), ahead of 'high-speed' (28%) and 'always-on no dial-up' (23%). This suggests that there might be some demand amongst SMEs for a flat-rate dial-up Internet product.

Finally in terms of the broadband services that SMEs feel that they would be interested in using, it seems that most businesses remain focused on traditional communication services such as email and file transfer. However, when prompted with some more sophisticated broadband services (e.g. e-Business with suppliers, E-Commerce, Web services), respondents expressed a relatively high degree of interest. However, it is difficult to ascertain what level of understanding these SMEs have of these broadband services.

Fig. 8.17 Interest in Broadband Services (Base: All likely to subscribe to a broadband service)



8.3 Conclusion

Although the bulk of Irish SMEs have been using the Internet for some time now, it would appear that for most of these businesses their current needs tend not to extend beyond email, file transfer and general surfing. Consequently, the majority of these SMEs are content with a dial-up connection and most don't perceive a need to upgrade their connection to a higher speed at current price levels. A competitively priced unmetered dial-up product may represent the most cost-effective solution for this segment's needs.

In contrast to these 'contented' SMEs, it would appear that there is also significant proportion of businesses for whom adequate capacity is currently a constraint on their business. These 'frustrated' users tend to have connection

speeds equivalent to Basic ISDN rates and appear quite likely candidates to subscribe to a competitively priced broadband product. A key challenge for Ireland going forward will be to ensure that it is possible for these businesses to simply and cost-effectively increase their bandwidth thereby enabling them to further develop their Internet capabilities. From this research, it would appear that a broadband package at between €40 - €60 per month would attract a high percentage of these businesses.

Finally there would appear to be a small proportion of SMEs who may be best described as 'sophisticated' users. These users are likely to already have a broadband connection, most likely via DSL or a leased line and may be looking to further increase their capacity still. The challenge for these businesses will be to integrate their business processes and IT functions so that they can efficiently conduct more of their business online. Ultimately this must be the long-term goal of all firms if the full benefits of the broadband are to be reaped and Irish businesses are to develop and maintain a competitive advantage in an increasingly global economy.

9 COST OF BROADBAND SUPPLY IN IRELAND

To help inform the broadband debate, the ODTR commissioned Ovum to conduct a high level costing study on broadband roll-out in Ireland. The ODTR is not aware of any previously published studies of this type and it is therefore intended to form a starting point to help orientate interested parties. This chapter contains a high-level summary of the report and its main findings, but for a more complete understanding, it is recommended that readers view the full report available on the ODTR's web-site.

9.1 Background to the Study

In June 2002, the ODTR commissioned Ovum to conduct a study on the future delivery of broadband in Ireland. The objective of this study was to develop costings for the roll-out of new infrastructure and upgrade of existing systems, to provide broadband access to varying percentages of the Irish population. This report contains the key outputs from this study which include estimates for the incremental cost of providing a 'best-mix' of broadband access and backhaul technologies providing nominal speeds of 512kbit/s, 2Mbit/s and 5Mbit/s to the Irish nation. In addition, Ovum has also estimated the costs associated with providing additional backbone capacity to cope with the expected increase in traffic. Ovum's analysis, based on two scenarios estimates the costs for growth of broadband uptake over a five year period until 2007.

At this point it is important to note that this study is in effect a base case scenario primarily concerned with hardware requirements such as infrastructure and operational network management costs. As such this 'boxes and wires' approach means that the estimates provided by Ovum relate to the incremental capital costs of installing the required equipment plus Ovum's estimates of operational costs directly associated with the servicing of this infrastructure over the five year time frame. This study is not intended to serve as a business case and hence other costs that would have to be incurred in a commercial venture[73] are not included. In addition Ovum have also assumed that existing infrastructure is available for use by all operators and can be deployed without extra cost. An estimate of the possible impact of all these ancillary costs is beyond the scope of this paper but in Ovum's experience, over a five year period, the marketing and sales channel costs alone could double the costs for systems infrastructure and operational implementation.

9.1.1 ***Definitions***

In order to derive meaningful analysis from coverage costings, it was necessary to make a clear distinction between the availability of a service and the penetration or take-up of the service. The following definitions were used by Ovum:

[73] Such costs, amongst others, would include network operators' and service providers' sales, general and administrative costs, interconnect charges for right of use, considerations about the sources and costs for finance and a reasonable return on capital

Availability of a Broadband Service

This is defined as the proportion of total consumer households that can be provided with broadband service within a reasonable time[74]. Thus, for example, if the broadband service is available to 1 million of a total of an assumed 1.36 million households in 2003, then the availability in 2003 is 73.5%.

Penetration of a Broadband Service

This is defined as the percentage take-up of the service by those to whom the service is available. If 1 million premises have availability and 400,000 are connected to a broadband service, then the penetration is 40%.

Using these definitions two scenarios (a 'most likely' scenario and a 'higher take-up' scenario) were developed for each of the nominal access speeds. These scenarios represent differing levels of penetration or take-up of the service by consumers. Penetration rates for these two scenarios were set at 30% and 60% respectively. Ovum's model assumes that broadband availability and penetration occurs in the most densely populated areas first.

9.1.2 ***Costs Included in the Modelling***

As noted earlier, Ovum's cost estimates are essentially an assessment of the incremental hardware and maintenance costs ('boxes and wires') for various levels of broadband roll-out. These costs, which account for both capital and operational costs over a five year period to 2007, include:

- the incremental capital expenditure to implement the access and backhaul network, including the customer premises equipment where necessary[75].
- backbone network growth where required, and the implementation of network and service management capability to allow services to be delivered.
- the provision of buildings (and their facilities such as power) to house network equipment where present installations prove to be inadequate (assumed to be 50% of locations).
- other costs involved in the establishment of the infrastructure, e.g. for network planning, installation and commissioning. Labour costs for these activities are assumed to be capitalised.
- incremental operational costs arising from day to day network management and other activities such as maintenance, upgrading and day-to-day running of the installed transmission, routing and switching systems.

[74] 13 weeks or less is assumed to be a reasonable activation time in this study and allows for operators to install any additional equipment associated with provisioning access – e.g. DSLAM line cards.

[75] CPE costs for FWA are included because they would be borne by a service provider. However costs for DSL CPE are not included because the trend is for this to be borne by the customer.

9.2 Assumptions in Ovum's Model

In developing their model Ovum needed to make many assumptions about the current status of Irish telecommunications infrastructure, candidate technologies, geographic coverage areas and potential usage levels of broadband access. Some of the key assumptions are listed below.

9.2.1 *Current status of Irish Telecommunications Infrastructure*

Using data provided by Forfás[76] and the ODTR, Ovum was able to make assumptions about the current level of backbone, backhaul and access infrastructure in Ireland, in terms of location, capacity, network structure and suitability for upgrade to higher capacities. This inventory of existing infrastructure does not take into account any future infrastructure plans by *eircom* or any other operators, nor does it take account of any proposed government infrastructure initiatives.

9.2.2 *Candidate technologies and their associated costs*

In the backbone network Ovum assumed the continued use of existing technologies such as optical fibre with Wavelength Division Multiplexing (WDM). In the backhaul network, where possible point to point fixed wireless links were assumed to be more cost-effective over the deployment of new optical fibre links and hence were used extensively. In the access network Ovum assumed a 'best-mix' of access technologies depending on the nominal access speed being considered, the geographic region to be covered, the user profiles to be served and the availability/penetration scenarios being envisaged[77]. Hardware costs were assumed to fall by between 3 and 10% p.a. over the forecast period.

9.2.3 *Geographic Areas*

In order to facilitate the selection of appropriate technologies and roll-out models, it was also necessary to divide the analysis into three main demographic regions. Using demographic information published by the Central Statistics Office (CSO) from the 1996 and 2002 censuses, Ovum was able to divide the analysis into three main demographic regions: Dublin region; Large Towns; and Rural areas. Assumed characteristics were attributed to these regions based on information from a variety of sources. It was assumed that recent trends in population growth and distribution would continue over the period up to 2007. A summary of some of the more important assumed characteristics of these regions are outlined in Fig. 9.1 overleaf.

[76] Forfás data from www.infrastructure.ie

[77] Ovum's model included the following access technologies: DSL (ADSL, SHDSL, VDSL), cable (HFC), optical access, fixed wireless access, and satellite. In developing its 'best-mix' of most cost-effective technologies, Ovum's analysis is based on reasonable assumptions about demand, technology developments and costs. The analysis takes into account broadband access technologies that are sufficiently developed in 2002 for envisaged commercial deployment in Ireland within the next five years. Exclusion of a technology from the analysis does not imply that it will not be deployed in Ireland, only that, in Ovum's judgement, on the basis of information available today, other technologies are more likely to play a role in bringing broadband access to the Irish nation.

Fig. 9.1: Assumed area types used in Ovum modelling

Area-type	Characteristics
Dublin regional area[78]	• high population density • 29% of population and 31% of households • 51% of all Irish SMEs and 64% of corporates
Large towns[79]	• Towns > 10,000 population and/or a national local exchange • Reasonably concentrated residential areas • 20% of population and 21% of households • 29% of Irish SMEs and 29% of corporates
Small towns and Rural areas[80]	• Towns < 10,000 population • Population may be very dispersed • 51% of population and 47% of households • 20% of Irish SMEs and 7% of corporates

9.2.4 ***Potential usage levels of broadband***

It was also necessary to make assumptions about the range and type of applications used and the distribution of usage levels by consumers. For each of the three nominal access speeds users are presumed to adopt a range of access capacities centred around the modal speed. For example, in the 2Mbit/s case some users would still be using 512kbit/s and other users, typically business users, would require 5Mbit/s. To determine their contribution to network traffic loading Ovum have assumed typical user profiles for both business and residential users. These profiles are based on assumptions regarding particular types of application (e.g. Video on demand[81]) and recently observed traffic growth trends[82].

[78] The Dublin region comprises the four Dublin County boroughs of Dublin City, Fingal, South Dublin and Dun Laoghaire/ Rathdown plus the towns of Leixlip, Bray, Ashbourne, Celbridge, Kilcock, Dunshaughlin, Maynooth, Newtownmountkennedy and Greystones.

[79] The Large Towns area-type includes include Cork City, Limerick City, Galway City, Waterford City, Dundalk, Drogheda, Tralee, Kilkenny, Sligo, Ennis, Clonmel, Wexford, Athlone, Carlow, Naas, Mullingar, Letterkenny, Portlaoise, Castlebar, Shannon, Mallow, Cavan, Birr, Bantry, Castleblaney, Castlerea, Navan, Newbridge, Killarney, Tullamore, Ballina

[80] All other towns, villages and rural areas

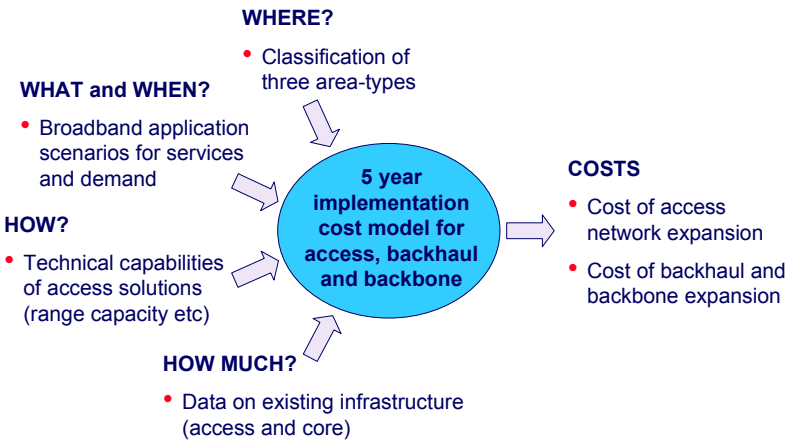
[81] In the case of video transmission Ovum has assumed the use of multi-casting technology, which can significantly reduce the amount of traffic produced.

[82] i.e. users with 512kbits/s service will generate average traffic 2-3 times higher than that from an typical average dial-up Internet user traffic. This traffic then rises progressively over the period modelled.

9.3 Summary of Model Inputs

All of this information was inputted into Ovum's model to determine the access and backhaul network costs and the additional costs of equipment and expansion in the backbone networks for the three nominal access speeds. The key variables, inputs and outputs of the model are shown in Fig. 9.2.

Fig. 9.2 Process to determine incremental costs



9.4 Results

Ovum presented their results in the form of three graphs for each of the three nominal access speeds. These graphs shows the incremental costs of the additional capital expenditure, plus five years operational expenditure associated with rolling out broadband networks to varying percentages of the population. On each of the three graphs there are two upwardly sloping lines. These lines reflect the costs associated with:

- Service take-up by 30% of those with service availability ('most likely' scenario)
- Service take-up by 60% of those with service availability ('higher take-up' scenario)

In addition at each of the access speeds, two 'Cost per User' figures are provided. These figures are based on the total cost for all types of access technology in each scenario divided by the corresponding number of subscribers. These levels are achieved in 2007 and it is assumed that service availability in the 'most likely and higher take-up scenarios is at 65% and 85% respectively. The cost per user reflects the falling cost of systems over the period.

A summary of all these cost figures is shown in Fig. 9.3 overleaf.

Fig. 9.3 Summary of Incremental Costs at access speeds of 512kbit/s, 2MB and 5MB

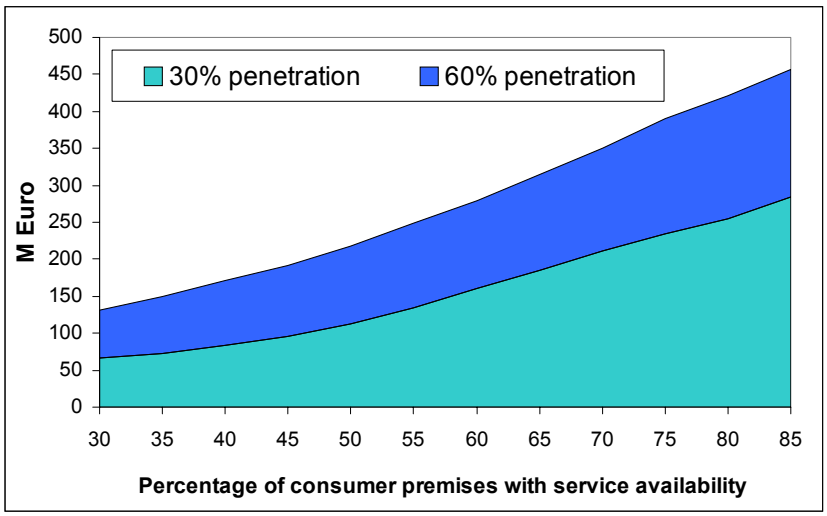
Nominal Data Rate Bit/s	'More Likely' Scenario (65% Availability; 30% Take-up)		'Higher Take-up' Scenario (85% Availability; 60% Take-up)	
	Total Cost (€)	Cost per user (€)	Total Cost (€)	Cost per user (€)
512k	185M	697	450M	536
2M	560M	2112	2000M	2384
5M	2280M	8600	4100M	5000

NB: These costs represent the incremental capital expenditure required to provide broadband service availability at the levels shown (65% and 85%), and connections to customers to achieve the penetrations shown (30% and 60%), plus five years operational expenditure to service the incremental plant and equipment provided.

9.4.1 Costs at 512kbit/s Access Speed

In the 512kbit/s scenario, at the lower levels of service availability, broadband services will primarily be provided through ADSL and cable technologies in Dublin and the larger towns. These technologies are assumed to have relatively lower per user provisioning costs and a high take-up of services in these areas is assumed. As the level of service availability increases, FWA and satellite begin to make a larger contribution and ADSL has to be enabled at smaller, more rural exchanges.

Fig. 9.4 – Total service establishment costs at 512Kbit/s for 85% availability in 2007



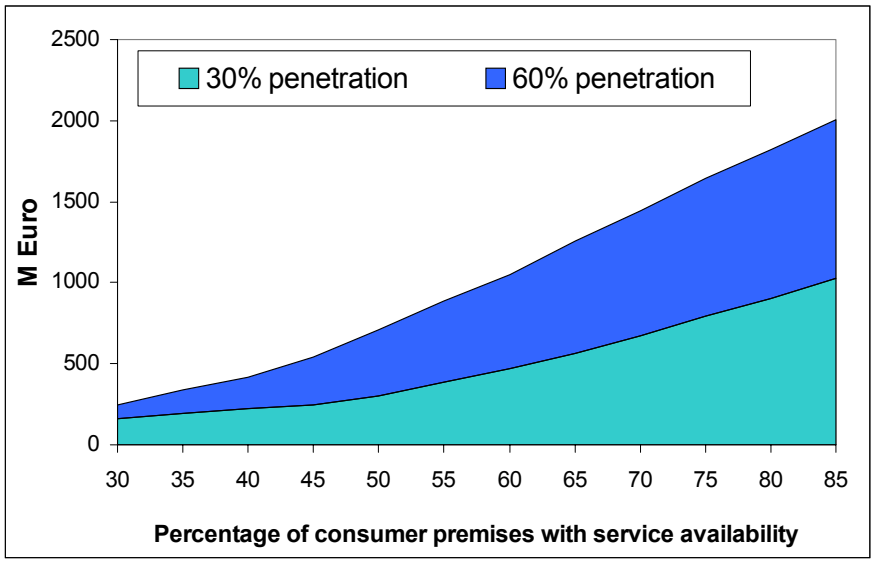
Initially the rate of cost increase is reasonably linear, due to the fact that the local loop and cable networks already exist. The cost of enabling 512kbit/s service at 85% availability and 60% take-up has a cost per user[83] of approximately €536. At 60% availability and 30% penetration, the cost per user is approximately €697, reflecting lower economies of scale. These costs include the capital costs of providing the broadband access systems, their installation and day-to-day operating costs over the 5 year period examined.

[83] The cost per user is derived from the total service provision costs over the period of the study (from the Ovum model) divided by the estimated average number of premises taking the service.

9.4.2 ***Costs at 2Mbit/s Access Speed***

In the 2Mbit/s scenario, at the lower levels of service availability, ADSL, SHDSL and cable modem are the prime delivery technologies. As availability increases above 45%, the cost of FWA base stations and terminal equipment at the user becomes very apparent. FWA has high fixed costs which dominate the more cost-effective ADSL solutions.

Fig. 9.5 – Total service establishment costs at 2Mbit/s for 85% availability in 2007

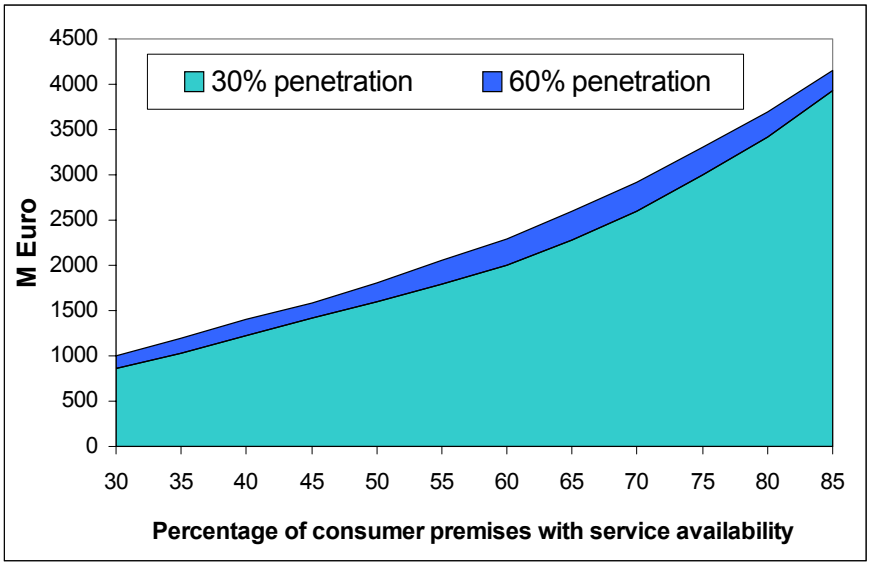


The cost of enabling 2Mbit/s service at 85% availability and 60% take-up has a cost per user of approximately €2384. At 60% availability and 30% take up, the cost per user is approximately €2112, which reflects that at these levels, ADSL and SHDSL usage will predominate. These costs include the capital costs of providing the broadband access systems, their installation and day-to-day operating costs over the 5 year period examined.

9.4.3 ***Costs at 5Mbit/s Access Speed***

The most significant increase in costs comes when 5Mbit/s services are made available. The cost profile rises very rapidly due to the fact that the VDSL and ADSL+ are assumed to be the prime access technologies. These services can only operate over local loops of about 1-2 km to deliver 5Mbit/s. For this reason a fibre local loop will be required in many areas of low population density. It has been assumed that all new fibre will be buried for reasons of network security, resilience and aesthetic appearance, which contributes a very high fixed cost to provide high availability, regardless of the number of users connected.

Fig. 9.6 – Total service establishment costs at 5Mbit/s for 85% availability in 2007



At the highest availability and take-up, the cost per user will be approximately €5000. At 60% availability and 30% penetration, the cost per user is approximately €8600, reflecting the fact fibre costs are being shared over far fewer users. These costs include the capital costs of providing the broadband access systems, their installation and day-to-day operating costs over the 5 year period examined.

9.4.4 Implications for Backbone Networks

For the scenarios at 512kbit/s and 2Mbit/s, Ovum expect the existing core backbone network to be able to accept the growth in traffic volumes, although some additional transmission equipment may be required. The costs for this expansion are likely to be quite modest compared with the costs for deploying the original fibre network. In the scenario for the 2Mbit/s at 85% availability and 60% take-up, Ovum estimate that an incremental investment of €31M will be required for the backbone network, which includes two additional points of presence on the network to reduce the local access backhaul to the core network.

In the 5Mbit/s scenario, Ovum estimates that there will be a need to expand the capacity of the core backbone network more significantly. Ovum estimates that an incremental investment of €42M will be required for the backbone network in this instance. This will cater for the main consumer applications for this level of broadband access, which include multiple television channels and video-on-demand. Ovum have assumed that these channels will use multi-cast technology, without which it would be difficult to cost-effectively deliver services.

9.5 Key Findings

From Ovum's analysis, it is possible to draw some key findings.

- 512Kbit/s is an attainable goal, even up to 85% availability at a total incremental cost of €450 million.
- 2Mbit/s is feasible in urban areas (i.e. the Dublin region and larger towns) however beyond this costs begin to rise quite rapidly with no apparent economies of scale.
- 5Mbit/s appears not to be a feasible option at present using current technologies and means of deployment. However, technological advances should bring this cost down in time.
- Current backbone capacity is broadly sufficient and future investment should therefore concentrate on bottlenecks closer to the user.

10 CONCLUSIONS/CONSULTATION

10.1 Conclusions

This report has presented new research on indicative costs of rolling out networks for broadband and on current market demand for Internet and broadband services. The report has also overviewed various public policy initiatives and summarised some of the initiatives of interest in countries where broadband penetration has been most successful.

The current state of the ICT sector in Ireland is reflective of the global sentiment to telecoms and Ireland, no less than other countries, has been impacted by capital constraint and scaled back investment plans. Nevertheless, as outlined in Chapter 4, broadband technologies are being offered to Irish end users. The recent launch of DSL and flat rate Internet products will hopefully increase the level of Internet access in the coming year. International experience tells us that it can be up to 18 months before operators reach a critical mass of broadband connections through a combination of investments in upgraded networks and exchanges and progressive reductions in retail pricing of broadband products.

It would be the ODTR's hope that cable operators can avail of the opportunities in this broadband market and we would hope to see in the short term increasing roll-out of cable modems in the market. It would also be hoped that alternative technologies including wireless technologies and mobile would contribute increasingly to the broadband rate in Ireland.

The research from MRBI suggests potential demand for broadband products and the ODTR would encourage demand side initiatives in terms of raising awareness and IT education and training, possibly promoted by government, which would enable more people to gain from Internet access. The role of education and training is equally important for SMEs.

The research by Ovum offers a benchmark for the industry to review and hopefully build on. The ODTR would welcome more debate of the issues raised on the supply side dynamics.

The objective of this report, as stated in the introduction is to inform the debate on the future delivery of broadband. The independent research and the technological and market data presented in this report we hope has enthused debate and contributed in some way to the further stimulation of broadband usage in Ireland.

The ODTR would be very interested in gathering views on the issues raised in this report and the following section includes some questions which interested parties may wish to respond to.

10.2 Further Consultation

1. Do you agree with the ODTR's analysis of the current state of the Ireland's broadband market as presented in chapter 4?
2. Do you consider that alternative ranges 512kbit/s, 2mbit/s and 5mbit/s are appropriate and why?
3. Do you agree with the analysis of initiatives adopted internationally and presented in chapter 7: which if any do you consider may have relevance for Ireland?
4. Do you agree with the conclusions of the TNS MRBI survey on demand for broadband in Ireland? Do you agree with the segmentation presented by MRBI? How important do you think demand stimulation is to the future delivery of Broadband?
5. What is your view of the Ovum work on network roll-out costs for broadband in Ireland? Do you agree with the assumptions, both demographic and technical, that Ovum have used to come to their cost conclusions? Are there alternatives you believe should be considered – please outline and give reasons?
6. The initiatives the ODTR is currently supporting which assist Internet usage/broadband are presented in this report. Please outline any further measures you consider we could adopt as appropriate?

All responses to this consultation should be clearly marked "Reference: ODTR Future Delivery of Broadband" and sent by post, facsimile or e-mail to:

FREEPOST
Ms Ruth Kenny
Office of the Director of Telecommunications Regulation
Irish Life Centre
Abbey Street
Dublin 1
Ireland

Ph: +353-1-8049600 Fax: +353-1-804 9680 Email: kennyr@odtr.ie

to arrive on or before ***5pm, October 25th 2002***.

11 APPENDIX 1 – TECHNOLOGY OVERVIEWS

11.1 Digital Subscriber Line (DSL)

DSL involves upgrading the capacity of a standard copper local loop. This upgrading involves replacing the equipment at both ends (customer premises equipment and local exchange equipment[84]).

There are several different types of DSL which range in capacity and application, although they are all designed to operate on existing copper (telephone) cables. Asymmetric DSL (ADSL) is suitable for users who typically receive more information than they transmit (e.g. residential users who download information from the Internet). Typical capacities are 2Mbit/s and 512kbit/s to and from the user respectively over a distance of up to approximately 5km. Ovum estimates that about 60% of exchange lines in Ireland are capable of supporting ADSL.

Symmetric DSL (SDSL/SHDSL) provides users with the same capacity in both to and from the network, making it more suitable for business users. SDSL can provide over 2Mbit/s in both directions over distances up to approximately 6km. Very high speed DSL (VDSL) is an emerging technology that can provide up to 52 Mbit/s to the user and 2.3 Mbit/s from the user over distances up to 1 km. The short distances and high capacities required by VDSL systems means that optical fibre has to be installed more extensively in an operator's network.

11.2 Broadband Cable/ Hybrid Fibre-Coax (HFC)

HFC will compete with DSL in urban areas, allowing services such as digital television, telephony, data and interactive services. In an upgraded HFC network, up to 10Mbit/s of shared capacity is typically available for data services, which may result in contention problems that can reduce individual capacities to 100s of kbit/s. Whilst HFC can provide broadband access, its major strength at present is as a delivery medium for broadcast services. Technologies for significantly increasing the data capacity are in development but are unlikely to be commercially deployable within the next few years. Due to the need for extensive infrastructure roll-out it is often only viable to do this in urban areas of reasonably high population density, and when a penetration rate of over 35% can be obtained[85]. Some 40% of Irish homes receive their television from cable companies, but a much higher percentage are passed by cable systems.

[84] Local exchange equipment in a DSL system is called a DSLAM –DSL Access Module

[85] 80% of households in the Dublin regional area and 49% in the large town area already subscribe to cable television. Source – Ovum.

11.3 Broadband Fixed Wireless Access (BFWA)

BFWA systems can provide capacities between 64kbit/s and 10's of Mbit/s over distances of between 1 and 35 km, depending on the frequency band used. As a wireless technology BFWA does not require existing infrastructure (e.g. buried cables) for the final access link. However, as with other wireless technologies, site acquisition[86] and potential delays in obtaining planning permission for masts could cause problems. BFWA systems are available that operate in different frequency bands to suit different situations and user requirements. For example systems operating in the 10GHz band typically have greater range, but lower capacity and user density than systems operating in the 26GHz band. In Ireland there are three broadband FWA licensees, but roll-out has been limited to date.

11.4 Satellite

Satellite is well suited to wide-area point-to-multipoint service delivery and its benefits have been demonstrated by the growth of satellite broadcasting. The use of satellites for data communications is less prevalent. Broadband satellite access systems (e.g. VSATs) typically offer asymmetrical capacities of between 100kbit/s and 2Mbit/s in the downlink (satellite to customer) and up to a few hundred kbit/s in the uplink direction. Satellite systems are often particularly suitable for serving geographically dispersed users. Several service providers are offering these services in Ireland, and pricing currently seems to be determined by market rates for equivalent services. .

11.5 Optical Fibre Access

Optical fibre offers the highest broadband access capacities with data rate capabilities far in excess of 100Mbit/s over distances up to 20km or more. Deploying new optical fibre links is relatively expensive at present and is therefore currently likely to be most attractive to high demand business customers[87]. Passive optical networks (PONs) eliminate the need for certain costly electronic components, providing more cost effective optical access. Typical data rates of 20-622Mbit/s can be achieved over PONs allowing Ethernet or multi-channel broadcast services to be delivered to business and residential users. Optical fibre access is used in some instances in Ireland for larger corporate users.

11.6 Optical Wireless

Optical wireless technology or free-space optics facilitates broadband communication through the atmosphere using line of sight optical signals up to distances of a few kilometres. Compared to optical fibre and fixed microwave systems, optical wireless is an inexpensive solution which is quick and easy to install. Optical wireless systems typically have capacities ranging from 100Mbit/s to over 1Gbit/s. Early systems have been in use in private networks for some

[86] i.e. base stations need to be situated so that they can be seen from each customer's roof-top – 'line of sight'

[87] Optical access may also be suitable for new residential developments.

years, and more recent and advanced versions are currently being deployed in Ireland. There are claims that recently developed systems, including purely wireless optical and hybrid optical wireless/radio versions, are capable of delivering 'carrier grade' access and backhaul links.

11.7 Point-to-point radio

Point-to-point radio links can be used for access, backhaul and in the backbone. Fixed radio links can typically provide capacities from 64kbit/s to 155Mbit/s[88] and operate in a number of licensed frequency bands, the selection of which depends primarily on distance and capacity required. In access networks, point-to-point radio may be used to provide voice and data links to customers where it is not economically viable to provide a copper or fibre link. As an access technology, point to point radio links have had limited deployment in Ireland.

11.8 Wireless LAN (WLAN) and Licence Exempt Technologies

WLAN technology can be used to provide access to nomadic users with handheld devices or laptop computers, or to fixed users (e.g. residential users). Nomadic users can connect to WLAN networks installed in public areas such as train-stations, airports, hotels, conference centres, etc. These 'hot-spots' can give users access to the Internet, private Intranets/Virtual Private Networks, and local information.

WLAN and other technologies that use licence exempt spectrum[89] can also be configured to act like FWA systems, delivering broadband access to fixed users. In general this type of equipment is readily available and inexpensive. Such networks are likely to develop in urban areas and rural areas where alternative broadband access is limited. Several service providers have begun to deploy these technologies in Ireland.

11.9 Third Generation Mobile

3G mobile is likely to build upon high speed mobile data services available on 2.5G systems such as GPRS. 3G mobile systems are expected to be able to provide up to 384kbit/s, followed by up to 2Mbit/s in later versions. The higher data rates will only be available to users who are stationary in certain well served areas (hot-spots). 3G networks will involve extensive infrastructure roll-outs. In Ireland 3G licenses have been offered to Hutchison Whampoa, O_2 and Vodafone.

[88] In some cases links can be aggregated to yield up to 622Mbit/s

[89] WLANs typically operate within un-licensed spectrum, although they must operate within certain limits. This can result in lower quality of service as many users attempt to share the same spectrum resources. For further details see 'Wireless Local Area Networks – Briefing Note' (www.odtr.ie/docs/odtr0216.doc), and 'Permitted Short Range Devices in Ireland' (www.odtr.ie/docs/odtr0271.doc)

11.10 Microwave Multipoint Distribution Service (MMDS)

MMDS operates in a broadly similar way to radio broadcast television systems in that radio signals are transmitted (broadcast) to multiple users. However, MMDS is a one way system that was not originally designed to allow end users to transmit data (i.e. the radio equipment does not enable this) and return paths have to be provided using different methods (e.g. dial-up modem, ISDN, FWA). MMDS is used extensively outside of the Dublin region and of the larger towns section in Ireland for broadcast television.

11.11 ISDN

Primary rate ISDN can provide users with up to 2Mbit/s using copper telephone lines (2 twisted pairs). This enables users to avail of broadband services on a digital dial-up basis. ISDN can typically be implemented using existing installations of copper wiring. At the end of June 2002 there were approximately 330,000 ISDN access channels in Ireland, which accounts for 6% of the total access paths.

11.12 Leased Lines

Leased lines are not a particular technology but are a telecommunications service arrangement offered by service providers, typically using technologies such as DSL, optical fibre and microwave radio –depending on the capacity required and the distance to an operator's point of presence. In some cases users may need to lease international circuits (International Private Leased Circuits), although for some business users virtual private networks (VPN) may be a more economic option than leased lines. At the end of June 2002 there were approximately 22,000 retail leased line circuits in Ireland.

Table 11.1: Summary of main broadband access technologies

Technology	Medium	Capacity and range	Deployment and operational costs	Advantages
DSL	Existing copper access network	2 Mbit/ at 4km[90] for ADSL 4 Mbit/s at 4 km for ADSL+ 2.3 Mbit/s at 2km Rate Adaptive up to 6km for SDSL 52 Mbit/s downstream and 2.3 Mbit/s upstream at 1 km for VDSL	High initial set up costs per exchange and then a much lower marginal cost per subscriber. Costs are falling because of mass market for DSLAMs[91] High fixed costs per subscriber because of need for fibre deployment and small number of subscribers which can be supported per unit. Costs will fall if mass deployment occurs	Uses existing infrastructure Commercially established Easy upgrade path from ADSL to ADSL+ for higher capacity Very high capacity
HFC	Upgraded CATV network	10Mbit/s shared so individual customer bandwidth may be 256kbit/s or less The reach is limited by the commercial viability of building a cable network.	Costs shared with delivery of entertainment services. High deployment costs then low cost per subscriber. Costs are falling because of mass market	Upgrade to existing infrastructure Commercially established
BFWA	Radio spectrum	64kbit/s – 10s of Mbit/s between 1 – 35 km, depending on modulation scheme and frequency used	Costs are higher than SDSL. Will fall as more systems are deployed but not by much.	Rapid deployment, once licensed and planning permission issues are resolved
Satellite[92]	Radio Spectrum	Today's systems: 400kbit/s – 1Mbit/s downstream VSATs: 2-40 Mbit/s Ka Band:10-100 Mbit/s May require larger antennas in western Ireland	High set up costs (i.e. satellite manufacture, launch and insurance). Very low marginal cost per subscriber.	True country coverage

[90] Distances are based on line length. Radial distances may be shorter depending on route taken by local loop.

[91] DSLAM – DSL Access Module

[92] ibid

Optical Fibre[93]	Optical fibre	PONs[94]: 20 - 622 Mbit/s, depending on extent of sharing at 20 km Gigabit Ethernet over PON: Up to 100Mbit/s up to 30 km.	High deployment costs which are unlikely to fall dramatically with time because of labour intensity. Cost per subscriber are high	Ideal long term solution for high capacity needs
Optical Wireless[95]	Line of sight free space	155M – 1 Gbit/s+ up to a few km	Some commercial deployments in LANs and carrier networks. Shared costs are low, costs of deployment offset by leased line or fibre savings	Rapid deployment. Suitable for by-passing difficult or high-cost fibre routes
Point-to-point radio[96]	Radio spectrum	64kbit/s to multiple 155Mbit/s links. Up to 35km in a single hop	Cost effective for one-off links	Rapid deployment. Cost effective
WLAN[97]	Radio spectrum	Shared 11Mbit/s or 54Mbit/s. Range from 30-100's of metres or up to a few km in point to point configuration.	Modest systems costs. Access costs depend on coverage	Allows remote Internet access in areas served
3G Mobile	Radio Spectrum	Initially up to 384kbit/s Later versions up to 2Mbit/s	Large costs associated with network infrastructure roll-out and licensing	Rapid deployment. Potential planning permission issues for masts
MMDS	Radio Spectrum	Up to 10Mbit/s downstream Range: approximately 40km	Systems would need alternative infrastructure for the upstream return path	Designed as a one way broadcast technology
ISDN	Existing copper access network	128kbit/s to 2Mbit/s	Well establish network infrastructure	Mature technology Commercially established

[93] See www.odtr.ie/docs/odtr0229.doc

[94] PON – Passive Optical Network

[95] See www.odtr.ie/docs/odtr0159.doc

[96] See www.odtr.ie/docs/odtr9814R2.doc

[97] See www.odtr.ie/docs/odtr0216.doc

12 APPENDIX 2 – NATIONAL DEVELOPMENT PLAN

Table 12.1: Phases of NDP Regional Broadband Programme

Phase 1	
Aim	To build 19 Pathfinder projects – "each consisting of metropolitan fibre and duct networks with co-location space available on an open-access basis. These fibre optic infrastructure projects will be adjusted, as necessary, to evaluate the effectiveness and value for money of fixed wireless solutions as a tail in bringing outlining areas to a central metropolitan ring". "In addition, a further 3 areas of an appropriate population size will be identified to trial a fixed wireless approach provide local access, subject to a favourable technical assessment and cost-benefit analysis".
Proviso	"The purpose of Phase 1 is to identify issues and test assumptions about costs, technical difficulties, technology, network configuration, management and maintenance issues and cost-effectiveness, private sector interest and consumer response".
Duration	Tenders already issued, due for completion by end 2003
Coverage	Waterford, Wexford, Carlow, Clonmel, Kilkenny, Cork, Shannon/Limerick, Galway, Athlone, Mullingar, Carrick-on-Shannon, Manorhamilton, Gweedore, Roscommon, Port Laoise, Letterkenny, Tullamore and Ballina[98]. The 19 towns selected cover approximately 13% of population[99].
Funding	90% Exchequer funded. Total cost to DPE estimate to be €60m

Phase 2	
Aim	"Widespread availability of advanced broadband infrastructure and services within 3 years, subject to the availability of the necessary public and private funding. The intention would be to cover the remainder of the 67 towns already identified as priorities in the NDP within 3 years".
Proviso	"Phases 2 and 3 will "seek to maximise private sector investment and will be contingent on successful implementation of Phase 1. However, the extent to which these are realisable deadlines and target will depend on the success of Phase 1 and the availability and of necessary public and private funding. In advance of firm tender prices and of further consultations with the private sector about its willingness to invest, these targets and timescales are necessarily tentative and will be reviewed."
Duration	A further 50 towns completion by end 2005
Coverage	Cavan, Buncrana, Ballyshannon, Donegal, Dundalk, Drogheda, Ardee, Monaghan, Carrickmacross, Sligo, Dublin City, South Dublin, Dun Laoighire/Rathdown, Fingal, Naas, Newbridge, Kildare, Athy, Navan, Arklow, Wicklow, Portarlington, Longford, Birr, Edenderry, Ennis, Thurles, Nenagh, Roscrea, Carrick-on-Suir, Tipperary, Cashel, Dungarvan, Enniscorthy, New Ross, Gorey, Mallow, Youghal, Fermoy, Charleville, Tralee, Killarney, Listowel, Ballinasloe, Tuam, Loughrea, Gort, Castlebar, Westport, Claremorris. In conjunction with the 19 towns selected in phase 1, the total population coverage of phases 1 and 2 equates to approximately 49% of population.

[98] Although all references in the 'New Connections' document refer to just the 67 towns identified as priorities in the NDP, the Government's proposed inclusion of Gweedore and Manorhamilton in the 19 towns to be covered in Phase 1 brings the total number of 'broadband' towns to 69 (http://www.irlgov.ie/tec/press02/March8th2002.htm).

[99] This is based on an assumption of a national population of 3.8m and the 1996 census figures for the populations of each of the towns.

Phase 2	
Funding	Total available funding on a PPP basis is €100m. This money is to be used as 'seed capital', which "by demonstrating in the initial intervention that resolving the specific infrastructural deficit will unlock latent commercial and domestic demand for broadband services, it is envisaged that the strategy will attract significant private investment in subsequent roll-out phases".

Phase 3	
Aim	Widespread availability of advanced broadband infrastructure and services in all towns with a population over 1,500 within 5 years. (Total 123 towns).
Proviso	As above in Phase 2.
Duration	A further 56 towns completion by end 2007 (19 + 48 + 56 = 123 towns in total)
Coverage	The 123 towns selected cover approximately 52% of population.
Funding	No details available.

13 Glossary

ADSL	Asymmetrical Digital Subscriber Line
ANSI	American National Standards Institute
APON	ATM over Passive Optical Network
CPE	Customer Premises Equipment
DPE	Department of Public Enterprise
DSL	Digital Subscriber Line
DSLAM	Digital Subscriber Line Access Modem
DWDM	Dense Wave Division Multiplexing
EBITDA	Earnings before Interest Tax Depreciation Amortization
EFM	Ethernet in the First Mile initiative
EPON	Ethernet Over Passive Optical Network
ETSI	European Telecommunications Standards Institute
FRIACO	Flat Rate Internet Access Call Origination
FTTH/B	Fibre To The Home/Building
FWA	Fixed Wireless Access
HDSL	High speed Digital Subscriber Line
HFC	Hybrid Fibre-Coax
IAD	Integrated Access Device
ICT	Information & Communications Technologies
IDSL	ISDN Digital Subscriber Line
IEEE	Institute of Electrical and Electronic Engineers (US)
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ITU-T	International Telecommunications Union-Telecommunications (formerly know as CCITT)
LAN	Local Access Network
LLU	Local Loop Unbundling
MAN	Metropolitan Area Network
MDF	Main Distribution Frame
MNC	Multinational Corporation
MTU	MultiTenanted Unit
NDP	National Development Plan

ONU	Optical Networking Unit
POP	Point Of Presence
PON	Passive Optical Network
PPP	Public-Private Partnership
SDH	Synchronous Digital Hierarchy
SDSL	Symmetrical Digital Subscriber Line
SHDSL	Symmetrical High bit-rate Digital Subscriber Line
SME	Small & Medium Enterprises
SMP	Significant Market Power
USO	Universal Service Obligation
VDSL	Very high speed Digital Subscriber Line
VOD	Video on Demand
VSAT	Very Small Aperture Terminal
WDM	Wavelength Division Multiplexing
WLAN	Wireless Local Area Network
WLL	Wireless Local Loop