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INFORMATION INFRASTRUCTURE CONVERGENCE AND PRICING: THE INTERNET

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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FOREWORD

This report was presented to the Telecommunications and Information Services Working Party meeting in January 1996 and was recommended to be made available to the public by the Information, Computer and Communications Policy (ICCP) Committee in March 1996.

The report was prepared by Dr Sam Paltridge of the OECD's Directorate for Science, Technology and Industry. It is published on the responsibility of the Secretary-General of the OECD.

MAIN POINTS

There is growing recognition of the importance of the efficient provision of information infrastructure for economic and social development. OECD governments are increasingly articulating policies aimed at harnessing the potential of the convergence of communication and information technologies to improve services in areas such as health, education and boost national competitiveness. A central tenet of most government policies in these areas is ensuring the widest possible access to information infrastructure for business and residential users. If this goal is to be realised, this paper concludes that governments need to adopt policy frameworks that encourage innovation in pricing and responsiveness to the needs of users. Without such changes significant barriers to developing widespread access to information infrastructure, and the new applications made possible by very rapid technological change, will remain in place.

One of the highest profile developments in this process of convergence has been the Internet. Indeed, for some, the Internet has become the harbinger of an 'information superhighway'.[1] There are two reasons why this view is gaining increasing currency. First is the convergence of service possibilities over the Internet including increasing potential for interactivity between users and the audio/video capabilities that can be built into applications. Accordingly an increasing number of hardware, software and information companies are basing future plans on Internet developments. The second reason is the growing economic and social activity that is taking place based on expanded access to the Internet.

The aim of this report is to document the current state of development of the Internet in the OECD area and focus on the pricing of access and usage. These are important issues for governments for a number of reasons. First, and foremost, is that while there is increasing commercialisation of the Internet much of the underlying infrastructure in many countries remains under monopoly control. From this simple premise stems an enormous range of issues ranging from the level of pricing, availability of service and the potential for anti-competitive behaviour. For example the pricing of infrastructure has a fundamental relationship with the competitiveness of markets and the affordability of services for residential users. The available evidence indicates that competitive markets are delivering best practice pricing (for business and residential users) and providing infrastructure that is not available in monopoly markets.

If the Internet, or like services, are to play a core role in information infrastructure the evidence indicates that new pricing structures for use of communication networks are needed. Pricing structures built around voice telephony use of networks are in many cases not suitable for the new environment. Indeed, many of the aims outlined by OECD Governments could only be implemented at very high cost given current pricing structures. Monopolies may present severe problems in this area and there is growing evidence they do not encourage pricing innovation and responsiveness to new demands as quickly as markets with infrastructure competition. Moreover, it has been suggested by some users that the incentives for monopoly public telecommunication operators (PTOs) in Europe may be such that the required infrastructure will not be developed in a timely fashion or, if it already exists, may not be made available at cost oriented rates because it could provide a platform for alternative service provision in competition with PTOs. This is because of the potential for users to take advantage of new technologies to meet their needs while circumventing public switched telecommunication network (PSTN) charging practices, the foundations for which were laid in a world of monopoly PTOs. Nevertheless a number of new initiatives have been reported by leading European PTOs in monopoly markets aimed at improving available infrastructure for the Internet. At the same time regulation needs to be modified to reflect current technological capabilities and market realities or PTOs and other service suppliers will face greater hardships in restructuring to take advantage of opportunities, and meet the challenges posed by the changes brought about by converging markets.

This document provides information for policy makers on convergence and pricing issues using the Internet as an example. The first section presents some selected policy highlights for OECD governments considering the implications of these developments for information infrastructure. The second section describes the development of the Internet and provides analysis on market growth and new applications. The third and fourth sections respectively contain data and analysis of the current pricing of information infrastructure in relation to the Internet. The final section contains information and analysis on the implications of convergence, in respect to Internet developments, in the areas of telecommunication and broadcasting. The Information, Computer and Communications Policy (ICCP) Committee home page on the OECD world wide web site is at http://www.oecd.org/dsti/sti_ict.html.

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POLICY HIGHLIGHTS FOR INFORMATION INFRASTRUCTURE

PTO pricing of network access and capacity, which in certain cases is far in excess of cost, is a major challenge to OECD governments achieving the goals they have set out in information infrastructure policies. The following bullet points show a summary of the findings of this study:

-- If countries wish to take advantage of the enabling capabilities of networks such as the Internet, to implement information infrastructure initiatives, they need to urgently address the extent to which the underlying communication policies influence current growth rates.

-- The penetration of Internet hosts is five times greater in competitive than monopoly markets, and if allowance is made for the date of service commencement, Internet access in countries with telecommunication infrastructure competition has grown six times faster than monopoly markets.

-- The average price for leased line access to the Internet in countries with monopoly telecommunication infrastructure provision in 1995 was 44 per cent more expensive than countries with competitive provision of infrastructure.

-- In most OECD countries there are restrictions on who can supply telecommunication infrastructure for Internet access, because of monopoly or duopoly policies. As an increasing number of these PTOs enter the Internet access business policy makers will have to be vigilant against potential abuses of bottleneck control of infrastructure.

-- In countries without telecommunication infrastructure competition the need for policy reform is pressing because when Internet Access Providers pay steep charges to PTOs they must pass these costs on to business and residential users.

-- On average Internet Access Provider's prices for 'dial-up services' were nearly three times less expensive in countries with telecommunication infrastructure competition than those with monopoly markets in 1995.

-- For a basket of 30 hours per month of 'dial-up' Internet access (*i.e.* public switched telecommunication networks plus Internet Access Provider charges) seven of the eight countries with infrastructure competition are below the OECD average while 12 of the 17 countries without infrastructure competition are above the OECD average.

-- A major reason that a sufficient amount of local content is not available in some countries is because domestic producers and users do not have efficient access to networks. Those countries that do not provide efficient access for users will not develop a market attractive to national suppliers.

-- Users in the OECD area would, on average, have to pay more than three times the average OECD residential PSTN basket to access the Internet for 240 hours per year (at standard rates) and more than four times for access to 360 hours per year (at standard rates).

-- While many 'dial-up' users would take advantage of off-peak PSTN rates, to reduce their total bill, several categories of users would need to pay standard rates. This would impact heavily on government policies in areas such as education and small business development.

-- Even at off-peak rates a basket of Internet access is several times more expensive than the OECD residential basket of PSTN services in most OECD countries.

-- Whereas traditional use of telecommunication networks for telephony does not produce widespread differences in the OECD area, based on different charging practices for local calls, users of on-line services differ in the amounts they pay to PTOs by up to ten times for 20 hours per month and 20 times the price for 40 hours of local calls of per month. To put this into perspective the normal difference between the most and least expensive countries for an OECD basket of residential services is between two to three times the cost.

-- The current trend of rebalancing call tariffs, by lowering long distance charges and raising local charges, is increasing the cost of a basket of on-line services with users in monopoly markets being worst affected. The additional price paid on average by users in monopoly countries, although already far greater than the average for competitive markets, is growing.

-- The provision of second residential telecommunication mainlines appears to be an area of growth for PTOs in those countries where Internet access is rapidly expanding, but rebalancing is also increasing this cost in several countries.

-- While users will undoubtedly be prepared to pay higher charges for services they value it is also true that a major examination of charging practices will need to be undertaken by many PTOs if they are to foster efficient use of information infrastructure. Markets can be used by policy makers to assist in this process and eight of the 13 least expensive countries for dial-up services are applying competition policy to encourage further structural adjustment.

-- In monopoly markets there does not appear to be any innovation or structural adjustment to address new growth areas. Instead, the tariff rebalancing that is occurring is making the local charges in these countries even more expensive relative to those with competitive markets. Unless these countries implement policies to address this situation the economic and social benefits governments envisage for information infrastructure will be very slow to eventuate.

-- The real key to meeting the challenge posed by new network patterns of use, in terms of rebalancing prices, is to increase PTO efficiency. However it is important to recognise that even if the rebalancing process was halted in many countries new ways of pricing networks are going to be needed.

-- Traditional telecommunication charging practices might discourage business from locating outside urban centres, employees from opting for tele-work, or rural communities and residences from benefiting from services available to users in cities at more affordable prices.

-- Currently the most innovative solutions for expanding universal service, and other aspects of Internet access pricing for information infrastructure policies, are being developed in competitive markets. One example is an Internet Access Provider in the UK providing virtual points of presence so that callers in all parts of the country can reach the Internet at the cost of a local call.

-- A key outcome of the new environment is that infrastructure competition is the best policy to assist in the tariff rebalancing process because it encourages greater efficiency and innovation.

-- There is a danger that monopoly PTOs, by maintaining high underlying charges for capacity, could restrict the growth of ‘dial-up’ and leased line Internet access services until they are ready to enter the market or because they view some new Internet services as threats to traditional sources of revenue.

-- It may or may not be more efficient to use existing or upgraded cable communication infrastructure to provide some new information infrastructure services but many OECD countries restrict the telecommunication services which can be offered by suppliers other than PTOs.

-- Initiatives to lift restrictions on the provision of infrastructure for services which have been liberalised in the EU area (July 1996), such as data services, are very positive for Internet access expansion and will be complemented by the liberalisation of voice services.

-- Regulation needs to be modified to reflect current technological capabilities and market realities, or PTOs and other service suppliers will face greater hardships in restructuring to take advantage of opportunities, and meet the challenges posed by the changes, brought about by converging markets.

-- The key policy message is that while no one is certain which technologies will provide the mix of building blocks for the future, liberal markets are best placed to capture the benefits made possible by convergence of different industry sectors.

DEVELOPMENT OF THE INTERNET

Internet Origins and Growth

The Internet is an interconnection of more than 50 000 public and private networks world-wide that use a common communication protocol **(Table 1)** . Some 92 per cent of these networks are in the OECD area. The Internet has been grafted onto the world's public and private telecommunication networks via a myriad of leased lines and, increasingly, capacity internally allocated by PTOs as they become direct Internet access providers. Internet backbone networks are overwhelmingly made up of capacity owned by the world's PTOs.

The communication protocol which provides a common language for inter-operation between networks is called TCP/IP (Transmission Control Protocol/ Internet Protocol).[2] The origins of the Internet began with the US Department of Defence's Advanced Research Projects Administration (ARPA) in the late 1960s. The TCP/IP technology was developed to provide a standard protocol for ARPAnet users to communicate and share computing resources.[3] In 1969 ARPAnet connected four computers at different sites and this grew to around 2 000 connections by 1985.[4]

In the mid 1980s the US National Science Foundation (NSF) adopted the same protocol when it created the NSFNET in order to provide high speed communication between supercomputer centres. At this time interest was growing among other US government agencies, the wider educational community and business. In addition a number of equipment companies started to build and market 'routers', that act as gateways to the Internet. As the controls were relaxed over who could join the Internet a growing number of universities, research laboratories and commercial enterprises from around the world were connected **(Table 2)**.

The relaxation of the so-called 'acceptable use policy' encouraged many organisations operating as not-for-profit providers of Internet connections to make the transition to providing links for commercial enterprises and access for residential users.[5] These organisations became the first commercial Internet Access Providers (IAPs) by leasing capacity from PTOs to provide transmission services from their facilities to Internet backbone networks such as NSFNET. Business customers who require leased line access to the Internet, via IAP facilities, generally buy this capacity from PTOs.[6] This enables, for example, a dedicated link for a service provider to create 'home pages' that can be accessed by users. Residential and small business customers mostly use a personal computer (PC) equipped with a modem and access services via the PSTN. This is called 'dial-up' Internet access.

In July 1991 there were 535 000 computers (Internet hosts) connected to the Internet.[7] Around 430 000 of these hosts were in the US of which 48 per cent were registered under an educational domain name and 34 per cent in a commercial domain name.[8] In 1994 the number of commercial domain names exceeded the number of educational domain names for the first time. By July 1995 more than 40 per cent of US domain names were commercial and 33 per cent educational, with other domain name categories including sectors such as "organisations" and the "military". At this time there were 6.6 million Internet hosts in the world, of which 6.4 million were in the OECD area, and just under 4.3 million in the US. By January 1996 there were more than 9.1 million Internet hosts in OECD countries **(Table 3)**.

A major turning point in the development of the Internet came with the creation of user friendly navigational tools over the 'World Wide Web' (WWW). The WWW was developed at the CERN's European Laboratory for Particle Physics and was first used in experimental form in 1989.[9] These tools, sometimes known as 'browsers', enable users to treat data on Internet as a cohesive whole by fetching data, determining what it is and configuring it for display.[10] In 1993 the first such tool to have a major impact on the growth of the Internet, named Mosaic, was developed by the National Center for Supercomputing Applications at the University of Illinois.[11] Mosaic created a graphical interface for users that simplified Internet navigation and the research prototype -- distributed free over the Internet -- gained an estimated two million users in the following year. In April 1994 the principal architect of Mosaic was one of the founders of a commercial company, Mosaic Communications (renamed Netscape Communications in November 1994), which is now said to provide the navigational software for 70 per cent of Internet hosts.[12]

With the growing use of the Internet, and the increasing number of commercial users, the pricing for access and use of the Internet needed to be reformed. By 1995 some two thirds of Internet traffic was estimated to be internal data transfers within corporations as they recognised the potential for applying the technology to increase efficiency and create new business opportunities.[13] Anthony Rutkowski, the Executive Director of the Internet Society says the Internet is made up of a public Internet and a private enterprise Internet, with the latter having four to five times the number of registered Internet addresses.[14] At the same time a number of commercial alternative backbones had emerged in the US including Alternet, PSINet and SprintLink. Accordingly NSF seed funding for backbone networks was gradually reduced and the NSFNET backbone was shut down on 30 April, 1995. By this time there were at least 14 national and super regional high speed TPC/IP networks in the US.[15] By October 1995, for all practical purposes, 99 per cent of the Internet was being paid for by the people who use it.[16]

While defence, academic and research institutions played an important role in the development of the Internet, they were not well placed nor did they have the skills and incentives to create widespread access to Internet services. Yet expansion of access to the Internet, or like services, is fundamental to the information infrastructure policies of OECD governments. Even with the impressive growth rate of Internet users only a small percentage of people in the OECD area can access the available services. By July 1995 there were 6.7 Internet hosts per 1 000 people in the OECD area **(Table 4)**. If these hosts provided access to an average of 7 people each, it is possible that only 1 in 20 inhabitants in Member countries could access some part of the Internet. Showing OECD averages, however, tends to obscure the very uneven speed of development throughout different Member countries.

The OECD countries leading the development of expanded access to the Internet include Finland, Iceland, Norway and the US. In these countries the ratio of access to the Internet exceeds one in 10 inhabitants. Several other countries including Australia, New Zealand, and Sweden are approaching this benchmark. On the other hand for the ten OECD countries with the lowest penetration of Internet hosts, the ratio is greater than one in 50 inhabitants. If these countries wish to take advantage of the enabling capabilities of networks such as the Internet, to implement information infrastructure initiatives, they need to urgently address the extent to which the underlying communication policies influence current growth rates. This raises the question of market structure and the relative performance of those countries where there is competition or monopoly control of the PSTN.

Here lies the major barrier for Governments wishing to exploit the capabilities of information infrastructure networks. Access to the Internet is being increasingly commercialised but in most OECD countries there is still monopoly control of the facilities through which Internet Access Providers (IAPs) and customers connect. Of the 25 Member countries of the OECD only eight allow telecommunication infrastructure competition in fixed network facilities.[17] In the other 17 OECD countries IAPs, and their customers, have no choice in who provides the telecommunication network facilities. This fact is critical because, on average, the penetration of Internet hosts is five times greater in competitive than monopoly markets. When the rate of growth is compared, weighted by the time since service commenced, Internet access in countries with telecommunication infrastructure competition has grown six times faster than monopoly markets. Accordingly six of the nine countries with the highest penetration of Internet hosts have competitive provision of infrastructure.

To the extent that IAPs are classed as value added services suppliers, under the existing communication regulation in all OECD countries, the market is technically open. Already more than 2 000 entrepreneurial and innovative IAPs have emerged to develop the Internet access market.[18] In some OECD countries there is evidence that competition amongst IAPs is lowering prices. For example, one study of prices in the US found that the average price of a 56 kbit/s access from IAPs had a monthly price of $550 in 1995, some 30 per cent less expensive than 1994.[19] In other words competition amongst IAPs is driving their prices toward costs, much of which is made up by payments to PTOs. Yet it is also necessary to remember that, in this instance, the price mentioned excludes the direct payment by a user to the PTO for a leased line between the customer's premises and the IAPs facilities. This cost to users has not witnessed similar price reductions because competition is more intense at the national level than the local level in the US. An increasing number of US States are acting to open local markets and by November 1995 some 35 States allowed some form of competition compared to 17 States two years previous.[20] In countries without infrastructure competition the need for policy reform is even more pressing because when IAPs pay higher charges to PTOs they must pass these costs on to business and residential users.

As with any communication service there may be many reasons why growth rates vary from one country to another. These may include, among others, demographic, economic, geographic and historical factors. For example, if there are large differences in the level of basic literacy (and at another level basic IT literacy) between Members countries this could be an important factor in Internet penetration. Similarly if large differences existed between the age of populations, or in sectoral employment, in Member countries this may also contribute to the pace of take up of Internet or other on-line services. On the other hand rapidly growing gaps are emerging between OECD Member countries with high Internet penetration rates and those with very low rates. In Finland a user is four times as likely to have access to the Internet as the OECD average and eight times the EU area average. In respect to the Internet two additional factors have been forwarded to explain different growth rates, namely the penetration of personal computers and the relevance of content.

Impact of Terminal Equipment on Internet Growth

The influence of PC availability would seem intuitively obvious with the argument being that if there are more PCs the opportunities for connection to the Internet are higher. In practice this is difficult to prove because the available data for the penetration of PCs are mostly estimates and there are no reliable data available on the number of PCs with modems or connected to local area networks.

Despite the high level of caution which must be used in interpreting these data **Table 5** provides one indication of the impact PC penetration may be having on Internet expansion **(Box 1).** For some the penetration rate of PCs is only one of many factors to be taken into consideration. Anthony Rutkowski has stated, “Minimal regulatory constraints on Internet service providers, low cost private leased lines, low cost local access lines, reasonably priced computers, individuals and institutions skilled in designing and operating Internets, individuals capable of effectively using Internets and time of entry into the Internet world, all modulate the rate of diffusion.”[21]

Irrespective of what influence the penetration rate of PCs has had in the past, it is the efficiency of networking that is the fundamental premise for future growth. A range of new customer premise equipment ranging from Compact Disc Players, ‘Set Top Boxes’ (both using televisions as display screens) and Computer Game Machines are being developed with Internet access capabilities.[22] In November 1995, it was reported that Sony Corporation, Sega Enterprises, NTT and other partners would develop a joint venture to enable video games, karaoke and other entertainment services to be accessed on-line using computer game machines as terminals.[23] At the beginning of 1996, ViewCall Europe plans to launch a ‘set top box’ for Internet access priced at US$250.[24] ViewCall’s ‘set top box’ can be connected to both a television and a telephone line to display broadcast quality images on screen. Users can navigate the system by using a handset not unlike a remote control for a television. Moreover telephones capable of Internet e-mail applications will soon make their debut. What all these technologies share is the potential to dramatically reduce the cost of terminal equipment necessary to access the Internet for particular services. In the longer term, mobile modems, currently being tested in a number of US universities, could allow access to the Internet via radio waves.[25]

In the face of such developments some information technology manufacturers believe the PC has a limited future because less expensive and simplified ‘computer like’ terminals will take advantage of the improved capabilities of networks to provide Internet access. One such network capability would be higher access speeds enabling users to download the software required to run applications as necessary using programs such as Sun Microsystem’s “Hot Java” (discussed later).[26] Louis Gerstner, the CEO of IBM has stated,

> “...we’ve come to understand that client server is, in fact, not a full-blown phase of computing. It’s really the leading edge of what will be the next phase: network-centric computing. There are a lot of forces propelling us to this phase ... If you look at microprocessors, memory, software, storage ... the laggard of the technology family has been communications technology. PCs and servers have become enormously powerful, but they communicate through the equivalent of soda straws. Well, all of that is changing. Very powerful networking technologies -- principally ATM -- will be to the next phase of computing what the microprocessor was to the current phase. But I think the most profound implication of this new technology is that it will change the nature of computing itself. If the communications link between the PC and the network is cheap enough, fast enough and has virtually unlimited bandwidth, why not migrate a lot of the functions that currently reside inside the PC to the network -- the applications, the data, the storage, and even some of the processing?”[27]

On the other hand it is the relative inefficiency of current networks, and the potential for new applications to consume greater bandwidth, the expense of using PTO networks, and concerns about security which convinces a number of industry leaders of the ongoing need for computing power to be provided on the desktop rather than via telecommunication mainlines.

Where intelligence and functionality should best reside in networks, between the core (telecommunication exchanges) and the extremities (in all types of user equipment) is not a new debate in the communication and information technology industry. In the past it has typically been a matter of dispute between PTOs that owned core network facilities and the ‘computer industry’. Yet today the focus has shifted to whether intelligence and functionality will reside at the end of networks in networking technologies, such as those made by the Oracle Corporation, or in personal computers with software and hardware supplied by firms such as Microsoft and Intel.[28]

One reason for the dynamism surrounding the Internet, and the enabling software being developed to harness its potential, is that all the specifications and technical information have been made freely available. Vinton Cerf, a pioneer of the Internet from MCI, has pointed out that:

> "...because software is readily available to people in universities, we find a great deal of experimentation with new ideas for using the network simply because so much of this material is available. It's quite different from the telephone system where not very many people have access to the insides of the programming of telephone switches. And so there is a major distinction here because the Internet system is being driven by forces outside of the network. Its driven by people writing software in the computers that sit on the outside. Just as examples, the World Wide Web, IP telephone from VocalTec, the CU-SeeMe software from Cornell University for video conferencing, the Java software from Sun Microsystems all emerge from the outside of the network..."[29]

Whichever direction these developments take, it is the efficiency of networks that will determine the ability of business and residential users to take advantage of less expensive terminal equipment and the new capabilities of PCs. Telecommunication infrastructure competition is a tool available to policy makers to take advantage of this situation.[30] This is true both of efficiency in terms of technological capabilities such as high speed access and in the pricing of existing and future network capabilities. For example competition from alternative infrastructure providers, such as cable television operators (hereafter cable communication) racing to develop and deliver cable modems to the market, could increase the capacity available for users and spur innovation in PTO networks. At the same time the discipline and innovation cable communication companies can bring to the pricing of access to the Internet, and like services, will force PTOs to be more responsive to customer demands.

Encouraging Internet Content and Applications

In times past content questions have arisen more in terms of broadcasting than telecommunication policy making. How the Internet should be defined, given the trend of technological convergence, is a moot point and is discussed later in this document. While it would be expected that relevant content will promote the attractiveness of the Internet, it is often overlooked that a major reason that a sufficient amount of local content is not available in some countries is because domestic producers and users do not have efficient access to networks.

If Member countries do not provide efficient access for information and service suppliers then consumers will increasingly meet their needs from foreign producers. The policy choice is between a vicious and a virtuous circle with efficient information infrastructure access as a key premise. Potentially, this choice will impact on the whole range of information infrastructure initiatives. For example the potential for information infrastructure to improve education will not occur if educational institutions, businesses wanting to upgrade employee skills and individuals do not have efficient access to networks. As Apple Computer's Doug McLean has pointed out:

> "In the US alone there are 3 000+ medical and scientific journals, many of which have struggled for years with the costs required to publish on a regular basis. As the cost of paper has doubled in the last twelve months, many of these journals can not afford to publish at all. There is very

little doubt that many, if not most, of these journals will soon be available only on the Web; fully indexed with links to previous editions and to other journals and sources that deal with similar subjects."[31]

Simply put those countries that do not provide efficient access for users will not develop a market attractive to national suppliers. FCC Commissioner Susan Ness has noted:

"Internet service is relatively inexpensive in the US, in part because there is robust competition between service providers and carriers. Lower prices from the carriers directly translates into lower prices for consumers. For example, users in one European country pay almost four times the price for access that US users pay. In fact, US prices are so much lower that users in some countries are putting their home pages on US service providers. To browsers it looks as though the home page is located in their country, but in fact it is based thousands of miles away in the US."[32]

Similarly if businesses in some OECD countries can not access the Internet at competitive prices they will be at a disadvantage in trying to sell products to a global market. For example, it has been reported that 30 per cent of the Internet Shopping Network's customer base lies outside the US.[33] This raises the question of whether consumers are turning to offshore web pages because merchants in their own country, for whatever reason, do not have efficient access to the Internet.

Both Iceland and Finland have demonstrated, by their high penetration rates, that providing efficient infrastructure access for national content providers can assist in the attractiveness of the Internet for domestic users **(Table 6)** . At the same time the content question, particularly in relation to language, may be a distraction in terms of initial growth rates. If most data transferred over the Internet occurs within individual business enterprises, and assuming the vast majority of this traffic does not cross national borders, the question of language is of lesser importance. Certainly in terms of the initial use of American Standard Code for Information Exchange (ASCII) formats, some countries were at an obvious disadvantage since part of their alphabet, language characters or even the ability to write from left to right were not supported. It is only now that technology is catching up with demand. For example, in November 1995, Accent Software released a multilingual browser with full support for browsing Japanese Web pages under any language version of Microsoft Windows. Nevertheless some countries have delivered efficient access to business for enterprise networking, even in the face of all elements of their language not being supported. Scandinavian countries are leaders in expanding access to the Internet.

Some of the main business applications of the Internet are shown in **Table 7**. Over time the Internet may evolve into a widely used electronic marketplace, and if so suppliers of goods and services, and their customers (*e.g.* residential users), will depend crucially on efficient access. Leading edge businesses are already embracing the Internet to enhance the services they can offer customers. For example the Internet pages of Federal Express allow customers to monitor where parcels are throughout the entire process of delivery.[34] Instead of seeing new communication capabilities as a threat to the market for the 521 million document sized packages people in the US send every year (or perhaps because of the increased competition that may be provided), companies such as Federal Express are using the Internet to add value to their services.[35] Another example is provided by the insurance industry. In the UK, an Internet user can obtain quotes for motor vehicle insurance within seconds, from five different companies, by inputting data on the type of car and driver history.[36] In short, the Internet has tremendous potential for increasing the efficiency of markets by improving the information available to buyers and sellers.

A survey conducted by CommerceNet/Nielson, released in October 1995, found more than 2.5 million people in the US and Canada had purchased products and services over the WWW.[37] While still relatively small, compared to other applications for individuals and business users, the percentage of people to have used the Internet for purchasing is significant and growing. AT&T has stated that it wants to make the Internet as widely used for commerce as 800-services are today.[38] The company handles 15 billion toll free service number calls per year (*i.e.* 800 numbers). AT&T says that in 1994, US$350 million in goods and services changed hands over the Internet compared to US$100 billion in the '800 commerce market' and US$2.7 billion in the home television shopping industry. Competitive markets can best abet such developments and encourage PTOs to find new sources of revenue. In fact, by April 1994, AT&T's free phone traffic exceeded the paid business telephone usage and because of a shortage of 800 numbers, '888' has been introduced as an additional prefix.[39]

At the present time business is using the Internet more to gather information, including home page based surveys, internal communication and as a tool to collaborate and communicate with others. It is this function of enterprise to enterprise network that has prompted calls for Electronic Data Interchange (EDI) to evolve in a more Internet oriented direction.[40] According to IBM "...most of the Internet investments and spending today is actually done within enterprises and institutions and that by such they are enabling employees within an organisation to communicate and work together as well as joining up with outside organisations and customers."[41] The corollary is that communication networks are increasingly forming a fundamental platform for national competitiveness. In this environment no one company has all the best ideas, skills and solutions to meet national requirements.

For this very reason the growth of the Internet has in many ways astonished leading communication, information services and technology, software, media and entertainment companies. AT&T openly admits "Frankly, we at AT&T were surprised by this development. We knew that on-line services have the potential for revolutionising the way people work, play and interact with each other. But we didn't recognise just how enthusiastically computer users would respond to the World Wide Web and the new graphical interfaces for browsing the Web."[42] Bill Gates, the chairman of Microsoft, has stated "The Internet is kind of like a gold rush, the amount of excitement, the number of companies, it's really unbelievable".[43] Gates added the Internet is growing faster than any phenomenon he has seen and says it is his company's number one priority.[44] According to Microsoft Corporation, "We do believe the Internet is the most important phenomenon in the computer industry for the last 15 years ... We believe application development on the Internet, whether it is reaching out to an end customer or whether it is between business -- is going to be the next great wave of PC and computer industry applications. We believe, therefore, for Microsoft all our applications and all our services must embrace the Internet."[45] IBM says they: "... fundamentally believe that the Internet will become the future network of networks and, maybe more substantially, we believe IP is emerging as the common architecture that will connect governments, institutions, private enterprise and individuals."[46] Sun Microsystems have an interesting perspective on how software development and presentation may evolve because of the Internet. Geoffrey Baehr, Sun's Chief Networking Officer, has stated:

> "...World Wide Web browsers like Netscape and Mosaic and such have become the universal graphical user interface for the next 20 years. Every commercial system that I have seen in the last six months, are rewriting their system to use a World Wide Web browser to control the application, and to present the data -- Network management systems, Telco managements ...."[47]

Just as many industry leaders have been caught by surprise by the pace of developments, in which an entire industry direction can change in a six month period, public policy is inevitably lagging some way behind. In a growing number of areas, such as intellectual property, defamation, security, privacy, law enforcement and the regulation of activities such as gambling and pornography, Internet developments are raising many concerns. All these issues raise important questions for governments but go far beyond the scope of this document. Still it is worth noting that many of the same issues have been raised by other technologies, which are used to communicate information, and despite the best efforts to minimise the harm which may arise, problems continue to exist.

On the other hand it is possible that some of the concerns that have been raised as problems will, as technologies are developed to deal with them, turn out to as strengths of the Internet. One example, in the area of security, is concerns about the potential for fraud over the Internet. The potential for the theft of credit card numbers over the Internet has been described as “phenomenal at this point”, by a member of the US Federal Bureau of Investigation’s new Computer Intrusions unit.[48] A recent survey by Ernst and Young highlighted a growing awareness of this problem amongst business when it found that 80 per cent of the companies surveyed -- including Amoco, Boeing, Exxon, IBM and Motorola -- had appointed at least one full-time information security director.[49] Unless business and consumers are confident about the security of transactions over the Internet it will be a significant barrier to the development of on-line commerce. Several new forms of payment and encryption systems are being developed, which proponents say will meet these concerns.[50] With these developments in mind Internet fraud, when the Internet commerce market reaches sizeable proportions, is optimistically projected by Forrester Research to total US$1 per US$1 000 of transactions. This compares to current rates of US$1.41 per US$1 000 for credit cards, US$16 per US$1 000 for toll call fraud and US$20 per US$1 000 for cellular telecommunication fraud.[51]

Similarly concerns have been raised about children accessing undesirable content through the Internet. In response a number of software companies have developed products which shield what can be accessed by individual PCs by blocking particular words or phrases. A list of words or phrases can be entered and edited by parents or educators. One such product -- ‘Net Nanny’ -- made by Trove, a Canadian software security company, has the ability to refuse access or shut down the system if it detects undesirable traffic. In this sense an Internet product may enable parents or educators to have greater control over what children are accessing than many other communication systems.

Despite the attention many of these issues receive in the media, because of the high profile of the Internet, sometimes justifiably, in most cases the immediate challenges for communication policy makers are the underlying telecommunication regulatory regimes. Perhaps this is why, Vinton Cerf, widely credited as the ‘father of the Internet’ has stated:

> “....the Internet, despite all the cyberspace hype, is embedded in the real world, and I quite agree that there are many laws and conventions that we observe, both nationally and internationally, that still apply to the interactions that take place through the Net ... most of the difficulties and complaints that you hear about regulation are related to regulatory impact on telecommunications as opposed to the other legal frameworks ... Here I think is probably the biggest sensitivity -- it is not so much towards other kinds of libel and so forth, but it’s a question of regulatory reform in the telecommunications environment and the maintenance of a high degree of competitiveness in all of these various domains.”[52]

Table 1. **History of NSFNET Growth by Networks (1988-1995)**

	Jul-88	Jul-89	Jul-90	Jul-91	Jul-92	Jul-93	Jul-94	May-95
US Nets	208	551	1291	2074	3898	8294	20521	28470
US (per cent)	96	85	75	67	65	59	57	56
Total Non-US Nets	9	99	436	1012	2133	5827	15632	22296
Non-US (per cent)	4	15	25	33	35	41	43	44
Total Nets	217	650	1727	3086	6031	14121	36153	50766

Source: Merit

Table 2. **NSFNET Network Growth By OECD Country**

	Initial NSF Connection	Sep-91	Jun-92	Jun-93	Jun-94	Jan-95	May-95
Australia	May-89	96	120	189	401	569	1875
Austria	Jun-90	14	31	84	143	213	408
Belgium	May-90	3	7	14	55	70	138
Canada	Jul-88	144	197	429	859	1578	4795
Denmark	Nov-88	3	6	8	22	35	48
Finland	Nov-88	12	18	102	210	360	643
France	Jul-88	95	160	453	805	1078	2003
Germany	Sep-89	144	215	445	777	884	1750
Greece	Jul-90	3	6	11	36	46	105
Iceland	Nov-88	1	1	13	29	29	31
Ireland	Jul-90	3	10	24	56	86	168
Italy	Aug-89	30	80	169	270	306	506
Japan	Aug-89	73	105	257	601	868	1847
Luxembourg	Apr-92	0	1	4	9	19	59
Mexico	Feb-89	5	9	34	64	96	126
Netherlands	Jan-89	52	68	131	207	251	406
New Zealand	Apr-89	15	18	50	119	181	356
Norway	Nov-88	8	21	52	132	141	214
Portugal	Oct-91	0	12	35	66	71	92
Spain	Jul-90	7	18	39	96	128	257
Sweden	Nov-88	25	37	87	164	230	415
Switzerland	Mar-90	35	50	87	155	190	324
Turkey	Jan-93	0	0	9	33	53	97
UK	Apr-89	44	128	420	730	769	1436
US	Jul-88(1)	1758	2485	5571	11732	15920	28470
OECD Total		2570	3803	8717	17771	24171	46569
World Total		2958	4356	9239	19214	26274	50766
OECD/World (per cent)		87	87	94	92	92	92

1. This is the date Merit began managing the NSFNET backbone.

Source: Merit

Table 3. **Internet Hosts in the OECD Area**

	Jul-91	Jul-92	Jul-93	Jul-94	Jan-95	Jul-95	Jan-96
Australia	21774	48639	82157	127514	161166	207426	309562
Austria	2148	6489	11741	20130	29705	40696	52728
Belgium	343	1532	4361	12107	18699	23706	30535
Canada	18582	38929	70977	127516	186722	262644	372891
Denmark	1559	2733	6160	12107	25935	36964	51827
Finland	8761	15718	27033	49598	71372	111861	208502
France	9290	19192	39860	71899	93041	113974	137217
Germany	21109	43907	91987	149193	207717	350707	452997
Greece	216	616	1317	2958	4000	5575	8787
Iceland	194	400	1259	3268	4735	6800	8719
Ireland(1)	100	624	1728	3308	6219	9941	15036
Italy	1656	5147	14746	23616	30697	46143	73364
Japan	6657	15757	35639	72409	96632	159776	269327
Luxembourg	0	80	186	420	614	1516	1756
Mexico	220	789	2093	5164	6656	8382	13787
Netherlands	7382	21105	35629	59729	89227	135462	174888
New Zealand	1193	1831	3165	14830	31215	43863	53610
Norway	8264	14354	25151	38759	49725	66608	88356
Portugal	0	1318	1956	4518	5999	8748	9359
Spain	979	3603	8773	21147	28446	39919	53707
Sweden	11800	21021	31449	53294	77594	106725	149877
Switzerland	9918	17188	30697	47401	51512	63795	85844
Turkey	0	0	415	1204	2643	2790	5345
UK	6990	37776	89788	155706	241191	291258	451750
US	427817	733117	1257408	2044716	3178266	4268648	6053402
OECD Total	566952	1051865	1875675	3122511	4699728	6413927	9133173

1. Data for Ireland in July 1991 is an estimate.

Source: Network Wizards

Table 4. **Internet Hosts per 1000 inhabitants**

	Jul-91	Jul-92	Jul-93	Jul-94	Jan-95	Jul-95	Jan-96(1)	Internet Hosts weighted by time since first connection to NSFNet(2)
Australia	1.2	2.8	4.7	7.2	9.1	11.7	17.5	0.52
Austria	0.3	0.8	1.5	2.5	3.7	5.1	6.6	0.27
Belgium	0.0	0.2	0.4	1.2	1.9	2.4	3.1	0.13
Canada	0.7	1.4	2.5	4.4	6.5	9.1	13.0	0.36
Denmark	0.3	0.5	1.2	2.3	5.0	7.1	10.0	0.29
Finland	1.7	3.1	5.3	9.8	14.1	22.1	41.2	0.91
France	0.2	0.3	0.7	1.2	1.6	2.0	2.4	0.08
Germany	0.3	0.5	1.1	1.8	2.6	4.3	5.6	0.20
Greece	0.0	0.1	0.1	0.3	0.4	0.5	0.8	0.03
Iceland	0.7	1.5	4.8	12.6	18.2	26.2	33.5	1.07
Ireland	0.0	0.2	0.5	0.9	1.7	2.8	4.2	0.15
Italy	0.0	0.1	0.3	0.4	0.5	0.8	1.3	0.04
Japan	0.1	0.1	0.3	0.6	0.8	1.3	2.2	0.06
Luxembourg	0.0	0.2	0.5	1.1	1.6	4.0	4.6	0.34
Mexico	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.004
Netherlands	0.5	1.4	2.3	3.9	5.8	8.9	11.4	0.37
New Zealand	0.3	0.5	0.9	4.3	9.0	12.6	15.4	0.55
Norway	1.9	3.3	5.8	9.0	11.5	15.5	20.5	0.64
Portugal	0.0	0.1	0.2	0.5	0.6	0.9	0.9	0.06
Spain	0.0	0.1	0.2	0.5	0.7	1.0	1.4	0.06
Sweden	1.4	2.4	3.6	6.1	8.9	12.2	17.2	0.50
Switzerland	1.4	2.5	4.4	6.8	7.4	9.2	12.4	0.47
Turkey	0.0	0.0	0.01	0.02	0.04	0.05	0.1	0.01
UK	0.1	0.7	1.6	2.7	4.2	5.0	7.8	0.22
US (3)	1.7	2.9	4.9	7.9	12.3	16.6	23.5	0.65
OECD	0.6	1.1	1.9	3.2	4.9	6.7	9.5	0.01
EU Area	0.2	0.5	1.0	1.7	2.5	3.6	5.1	0.01
Infrastructure Competition	1.0	1.8	3.2	5.2	8.0	10.8	15.6	0.06
Infrastructure Monopoly	0.1	0.3	0.6	1.0	1.4	2.1	2.7	0.01

1. Weighted by 1993 population
2. Internet hosts divided by the number of days since the first connection per 1000 inhabitants (growth to July 1995).
3. For the US the date Merit began managing the NSFNET backbone is used as a proxy to determine growth over time.

Source: Network Wizards, OECD

Table 5. **Internet Hosts and Personal Computer Penetration**

	ITU Estimated PCs, 1994	PCs per 100 inhabitants	Hosts per 100 PCs (1)	Internet Hosts per 100 Inhabitants
Australia	3870000	21.92	5.36	1.17
Austria	850000	10.64	4.79	0.51
Belgium	1300000	12.99	1.82	0.24
Canada	5100000	17.74	5.15	0.91
Denmark	1000000	19.27	3.70	0.71
Finland	810000	15.99	13.81	2.21
France	8060000	13.98	1.41	0.20
Germany	11650000	14.35	3.01	0.43
Greece	300000	2.89	1.86	0.05
Iceland	n.a.	n.a.	n.a.	2.62
Ireland	490000	13.76	2.03	0.28
Italy	4121000	7.22	1.12	0.08
Japan	15000000	12.03	1.07	0.13
Luxembourg	n.a.	n.a.	n.a.	0.43
Mexico	2100000	2.30	0.40	0.01
Netherlands	2400000	15.69	5.64	0.89
New Zealand	669000	19.22	6.56	1.26
Norway	820000	19.03	8.12	1.55
Portugal	490000	4.96	1.79	0.09
Spain	2750000	7.04	1.45	0.10
Sweden	1500000	17.21	7.12	1.22
Switzerland	2050000	21.61	3.11	0.92
Turkey	530000	3.45	0.53	0.00
UK	8800000	15.22	3.31	0.50
US	77500000	30.05	5.51	1.66
OECD	152490000	15.82	4.21	0.67

1. Using host data for July 1995.

Source: ITU, Network Wizards, OECD

Table 6. **Internet Host Penetration Ranking of OECD Countries**

	Jul-91	Jul-92	Jul-93	Jul-94	Jan-95	Jul-95	Jan-96	
1	Norway	Norway	Norway	Iceland	Iceland	Iceland	Finland	41.2
2	Finland	Finland	Finland	Finland	Finland	Finland	Iceland	33.5
3	US	US	US	Norway	US	US	US	23.5
4	Switzerland	Australia	Iceland	US	Norway	Norway	Norway	20.5
5	Sweden	Switzerland	Australia	Australia	Australia	New Zealand	Australia	17.5
6	Australia	Sweden	Switzerland	Switzerland	New Zealand	Sweden	Sweden	17.2
7	Iceland	Iceland	Sweden	Sweden	Sweden	Australia	New Zealand	15.4
8	Canada	Netherlands	Canada	Canada	Switzerland	Switzerland	Canada	13.0
9	Netherlands	Canada	Netherlands	New Zealand	Canada	Canada	Switzerland	12.4
10	New Zealand	Austria	UK	Netherlands	Netherlands	Netherlands	Netherlands	11.4
11	Denmark	UK	Austria	UK	Denmark	Denmark	Denmark	10.0
12	Austria	Germany	Denmark	Austria	UK	Austria	UK	7.8
13	Germany	New Zealand	Germany	Denmark	Austria	UK	Austria	6.6
14	France	Denmark	New Zealand	Germany	Germany	Germany	Germany	5.6
15	UK	France	France	France	Belgium	Luxembourg	Luxembourg	4.6
16	Japan	Luxembourg	Luxembourg	Belgium	Ireland	Ireland	Ireland	4.2
17	Belgium	Ireland	Ireland	Luxembourg	Luxembourg	Belgium	Belgium	3.1
18	Ireland	Belgium	Belgium	Ireland	France	France	France	2.4
19	Italy	Portugal	Japan	Japan	Japan	Japan	Japan	2.2
20	Spain	Japan	Italy	Spain	Spain	Spain	Spain	1.4
21	Greece	Spain	Spain	Portugal	Portugal	Portugal	Italy	1.3
22	Mexico	Italy	Portugal	Italy	Italy	Italy	Portugal	0.9
23	Luxembourg	Greece	Greece	Greece	Greece	Greece	Greece	0.8
24	Portugal	Mexico	Mexico	Mexico	Mexico	Mexico	Mexico	0.2
25	Turkey	Turkey	Turkey	Turkey	Turkey	Turkey	Turkey	0.1

Source: OECD, Network Wizards

Table 7. **Internet Applications in the US and Canada**

Total WWW Use (Application)	Per cent of Individual respondents aged over 16 to ever used the WWW	Business WWW Use (Application)	Per cent of Business Respondents to ever use the WWW
Search for information on products/services	55	Collaborating with others	54
Search for information on companies/organisations	60	Publishing information	33
Search for other information	73	Gathering information	77
Purchase products or services	14	Researching competitors	46
Browse or explore	90	Selling products or services	13
		Purchasing products or services	23
		Providing customer service and support	38
		Communicating internally	44
		Providing vendor support and communications	50

Source: CommerceNet/Nielsen

Box 1: PC Penetration and the development of the Internet

There does seem to be some correlation between the number of PCs per 100 inhabitants, if it is taken to be a rough proxy for computerisation at a national level, and the number of Internet Hosts per 100 inhabitants **(Figure 1)** . Broadly speaking there would appear to be two groups within the OECD area. Those countries with a high penetration of PCs generally have a relatively high Internet host penetration and the opposite holds true for those countries with a low PC penetration rate. However of those countries with a leading PC penetration rate, Switzerland and Denmark have a lower penetration of hosts than might be expected while Norway and Finland have a higher penetration rate.

In those countries with mid range PC penetration rates France and Japan are doing less well than might be expected but Austria has a relatively high Host penetration rate relative to the number of PCs per 100 inhabitants. In France the impact of the Minitel system, acting as a substitute for some PC applications, may be one factor influencing growth rates. In Japan the limited ability of leading browsers to initially support Japanese language characters could also have been influential.

In times past the penetration of PCs has had little to do with communication because of the relatively low rate of PCs with modems. Of more interest today is the proportion of PCs that are connected to the Internet because this has a more likely relationship with a country's communication policy. For policy makers the key question is whether the existing regulatory framework encourages efficient networking for Internet users. One possible indicator of such developments is to compare the penetration of Internet hosts per 100 PCs to the penetration of hosts per 100 inhabitants **(Figure 2)** . Another is to compare the penetration of PCs per 100 inhabitants to the number of hosts per 100 PCs **(Figure 3)** . **Figure 2**, as might be expected, reveals a fairly strong correlation with major interest being why the two lines diverge such as in the case of Austria, Greece, Switzerland and the US. **Figure 3** goes some way to providing suggested answers to these questions and hints at the way Internet access may develop as telecommunication markets are increasingly liberalised.

For those countries with telecommunication facilities competition Finland, Sweden and New Zealand appear be networking computers at a relatively high rate, with Finland providing the outstanding example. All these countries have among the highest relative rates of Internet access. The US, has a leading Internet access penetration rate and the highest number of PCs per 100 inhabitants. However a lower proportion of them were connected to the Internet by July 1995 than Finland, Sweden and NZ **(Figure 3)**. One reason for this is that the US led developments in the personal computer market, at a time when few PCs had modems.

The US Electronic Industries Association say that, in January 1995, 10 per cent of US households owned a modem while more than 30 percent of households owned a PC. A better comparison may be with those countries with the next highest rate of PC penetration such as Australia (2nd), Switzerland (3rd) and Denmark (4th). Here an interesting correlation emerges between infrastructure competition and networking computers at a higher rate, with the US and Australia ahead of Denmark and Switzerland. Indeed markets with telecommunication infrastructure competition would seem to be capable of sustaining extremely high rates of growth in the future as the local market for Internet Access becomes more competitive and innovative services make it more attractive for users to purchase new PCs (with modems) or other Internet access devices. In November 1995, a Dataquest survey found that 15 per cent of US households plan to buy a PC within one year, with slightly more than half being first time buyers.[53]

In countries with PSTN monopolies Norway is the only country, amongst the leaders in Internet penetration, to have a relatively high proportion of available PCs connected (although data is unavailable for Iceland), with the next best performer being the Netherlands. In the case of Greece it would appear that the relatively low number of PCs per 100 inhabitants, and a flat rate for local PSTN access, has resulted in a relatively high percentage of Internet Hosts being connected. On the other hand the available evidence suggests that Belgium, Denmark, France, Germany and Switzerland have not taken advantage of their installed base of PCs and may have are large networking gap. The main point is that having a relatively large installed base of PCs is no guarantee of early take off of Internet access. If it was Denmark and Switzerland should be outperforming Finland and New Zealand.

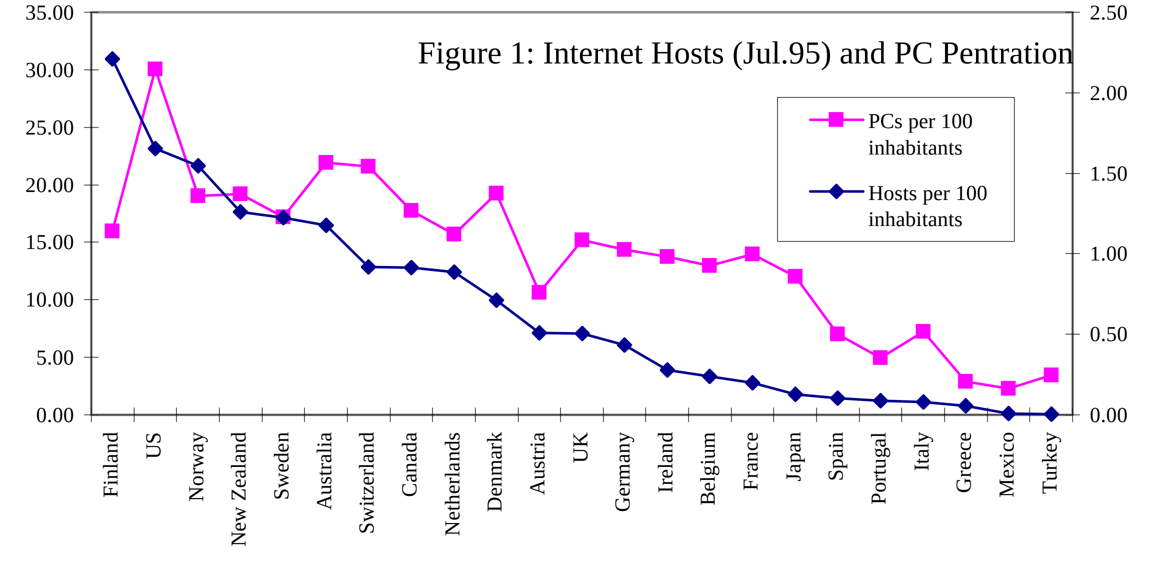
Figure 1: Internet Hosts (Jul.95) and PC Pentration
PCs per 100 inhabitants
Hosts per 100 inhabitants
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
2.50
2.00
1.50
1.00
0.50
0.00
Finland
US
Norway
New Zealand
Sweden
Australia
Switzerland
Canada
Netherlands
Denmark
Austria
UK
Germany
Ireland
Belgium
France
Japan
Spain
Portugal
Italy
Greece
Mexico
Turkey

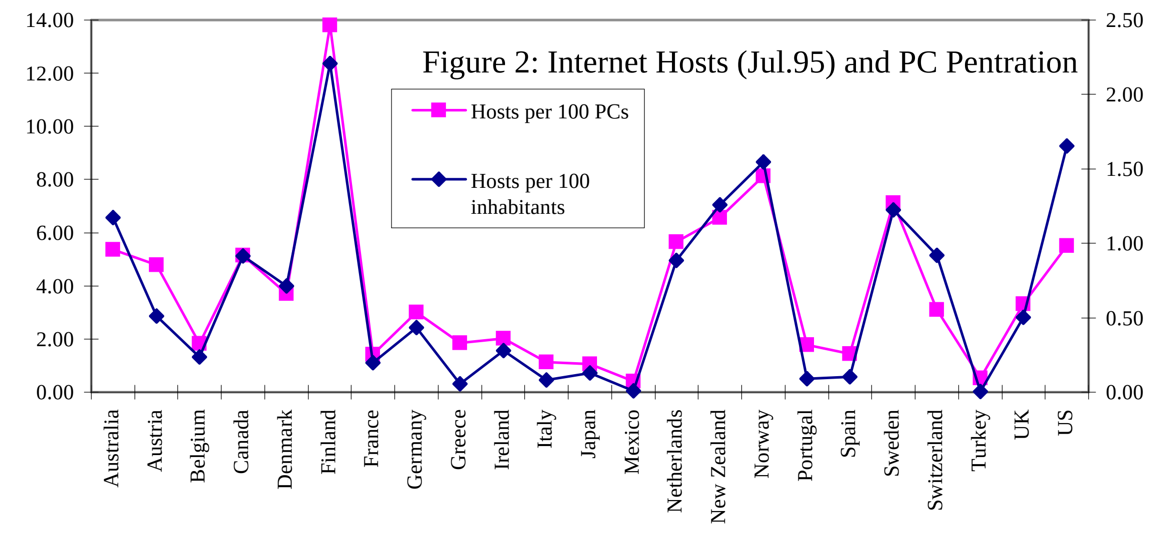
Figure 2: Internet Hosts (Jul.95) and PC Pentration
Hosts per 100 PCs
Hosts per 100 inhabitants
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
2.50
2.00
1.50
1.00
0.50
0.00
Australia
Austria
Belgium
Canada
Denmark
Finland
France
Germany
Greece
Ireland
Italy
Japan
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Netherlands
New Zealand
Norway
Portugal
Spain
Sweden
Switzerland
Turkey
UK
US

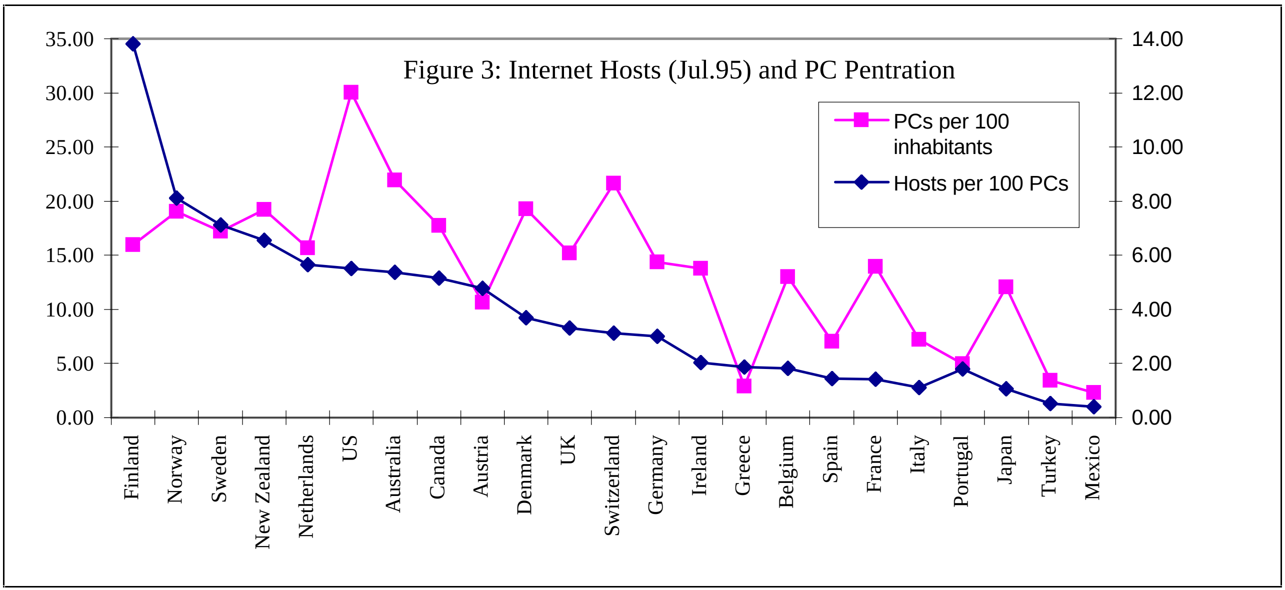


Figure 3: Internet Hosts (Jul.95) and PC Pentration
PCs per 100 inhabitants
Hosts per 100 PCs
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Finland
Norway
Sweden
New Zealand
Netherlands
US
Australia
Canada
Austria
Denmark
UK
Switzerland
Germany
Ireland
Greece
Belgium
Spain
France
Italy
Portugal
Japan
Turkey
Mexico

INTERNET ACCESS PRICING IN THE OECD

At present the pricing of leased lines by the PTOs is a fundamental part of the overall cost of accessing the Internet. IAPs need to lease lines from PTOs to connect their facilities to Internet backbone networks. IAP business customers need leased lines from PTOs to connect their premises to the facilities of the IAP. The influence of PTO pricing of leased lines also extends to customers accessing the Internet via 'dial up' services where traffic is initially carried by the PSTN. Here the underlying PTO charges to the IAP are reflected in their prices to 'dial-up' customers. In most OECD countries there are restrictions on who can supply telecommunication infrastructure to IAPs, and their customers, because of monopoly or duopoly policies. As an increasing number of PTOs enter the Internet access business, policy makers will have to be vigilant against potential abuses of bottleneck control of infrastructure.

Leased lines currently provide critical building blocks for the Internet. A recent survey undertaken by Matrix Information and Directory Services (MIDS) found that by far the majority of organisations access the Internet via 56 kbit/s and 64 kbit/s connection speeds with about 18 per cent each, or 36 per cent of all connections **(Table 8)** .[54] The authors or the MIDS study noted that once an organisation has reached the point of registering a domain and making itself visible on the Internet they were likely to have dedicated capacity.[55] This appears to indicate that access to the Internet via 56 kbit/s or 64 kbit/s leased lines is currently the most common way for organisations to provide services and content over the Internet. Some organisations are accessing Internet via ISDN at 64 kbit/s but they are still in the minority.[56]

This evidence suggests the pricing of access to the Internet via leased lines at 56 kbit/s and 64 kbit/s is currently critical to the development of services available over the Internet. In some cases this is because bandwidth at higher speeds is not available, or not available at affordable prices. As new applications are developed leased lines with higher access speeds can be expected to become more in demand, as evident from the popularity of 1.5 Mbit/s lines in North America and to a lessor extent 10 Mbit/s leased lines.

A major problem is that Internet access at speeds higher than 2 Mbit/s in Europe appear not to be generally available at attractive prices. In fact the different rates of access via 1.5 Mbit/s lines marketed in North America (12 per cent of respondents) and 2 Mbit/s lines in the rest of the OECD area (4 per cent of respondents), recorded in the survey shown in **Table 8**, is remarkable. It suggests that capacity at higher speeds is far more available in the competitive markets of Canada and the US. A recent study by DANTE investigating the non-technical barriers to developing high speed backbone pan European networks concluded:

> "The major concern of European PTOs with regard to providing high speed leased lines is the reselling of this bandwidth for carrying voice circuits. Up to bandwidths of 2 Mbit/s the cost per voice channel is sufficiently unattractive for reselling; 34 Mbit/s lines can carry approximately 1000 voice circuits, which makes reselling attractive if the costs are considerably less than 17 times the cost of a 2 Mbit/s circuit. Since international voice telephony is a highly profitable

business, the PTOs try to keep possible competitors out of their country either by not selling the bandwidth required or not at reasonable rates. Their monopoly status enables them to do so." [57]

Similarly Wim Vik from EUnet, a leading European IAP, has stated:

"We pay ten times or more than ten times as much for the same transport in Europe vis-à-vis the United States. We do not have commercially available 34 Mbit/s links within Europe. It is starting to be provided in Europe for the academic networks, but if we are talking about multimedia and other applications which we want in Europe, in order to be able to compete with our American friends, we are at a very large disadvantage vis-à-vis our American competitors."[58]

If the pricing of capacity at the 2 Mbit/s level and above is dictated by concerns about the development of competitors, including IAP providers, this forces up downstream prices for users. Much of the initial demand for high capacity links to the Internet backbone networks has come from the rapidly growing IAP industry in Canada and the US, and its ready availability enables IAPs to pass on lower prices to their customers accessing the Internet at lower speeds. These latter users make up the majority of organisations on the Internet. The MIDS study concluded "...most organisations on the Internet have small numbers of computers and people. A few organisations have very large numbers of computers and people, but they are rare, just as Fortune 500 companies are rare. The Internet consists mostly of small organisations, not large ones."[59] Accordingly the following sections contain an examination of pricing via 56/64 Kbit/s leased lines and 'dial-up' services over the PSTN.

Table 8. **Internet Access Connection Speeds, 1995**

	respondents	per cent of total
64 kbits	277	18
56 kbits	277	18
14.4 kbits	194	13
1.544 Mbits	177	12
9600 bits	102	7
19.2 kbits	90	6
10 Mbits	86	6
2 Mbits	63	4
128 kbits	62	4
28.8 kbits	36	2
512 kbits	34	2
256 kbits	32	2
100 Mbits	19	1
45 Mbits	10	1
2400 bits	10	1

Source: TIC/MIDS Internet Demographic Survey

Internet Access Prices (Leased Lines)

The cost of access to the Internet via 56 kbit/s or 64 kbit/s leased lines varies enormously throughout the OECD area **(Table 9)**. In countries such as Canada and Finland it is possible to get extremely inexpensive access to the Internet via 56 kbit/s and 64 kbit/s leased line connections. In fact, the price quoted for a 56 kbit/s leased line access to the Internet by the Helix Internet, an IAP in British Columbia, was less expensive than a listed 56 kbit/s leased line charge, over two kilometres, from the PTO used in OECD comparisons in the "Communications Outlook" to represent Canada.[60]

The reason Helix can offer a less expensive service is because it purchases capacity from a reseller of BC-Tel's network in British Columbia. If best practice pricing is defined as the lowest available prices then the suppliers in Canada (US$7 000) and Finland (US$6 000) appear to have set the current benchmarks. This finding is confirmed from within the Internet access industry by EUnet's Wim Vik who says Finland has the least expensive prices in Europe because of the competitive provision of infrastructure.[61] In fact very little separates the prices of these countries when it is considered the Canadian charge includes a router at the customer site. By way of contrast with the low prices found in Finland and Canada, ten OECD countries had a leased line basket price per annum higher than US$10 000, five a basket price higher that US$20 000 and a further three with charges higher than US$30 000. Overall the average price for leased line access to the Internet in countries with telecommunication infrastructure competition was 44 per cent less expensive than countries with monopoly provision of infrastructure.

The approach employed in the comparison in **Table 9**, consistent with the OECD's price comparison methodology in other areas, was to use the lowest price available to a customer for leased line access to the Internet. In other words if suppliers gave customers the choice of renting or purchasing equipment, as an unbundled charge, the price of the option excluding equipment (router or other) was selected. Some IAPs bundle the cost of renting a router in their overall price and do not list a price for customers wanting to purchase this equipment separately. The IAP supplier chosen to represent the US, Netcom, offers connection for $1 200 without a router and $3 400 with a router included. As the connection charge is spread over three years in the basket, this charge does not have a large impact on the total basket for those operators that bundle the purchase of equipment with their overall connection prices compared to those IAPs that unbundle these charges. In general the monthly rental charge is much more influential in determining the cost of an Internet access basket.

It is interesting to note that in eight of the ten least expensive countries, suppliers quote prices that include all PTO charges. By way of contrast in only one of the 15 more expensive countries -- Austria -- does a supplier include PTO charges. The most likely explanation for this trend is that the IAPs bundling PTO prices do not view them as an obstacle to customers purchasing access or that they can provide their own connection facilities. In fact five of the eight OECD countries that allow telecommunication infrastructure competition have amongst the lowest basket of Internet access prices for leased lines at 56 kbit/s and 64 kbit/s. Finland and Canada have the lowest prices, while the UK and Sweden are ranked sixth and seventh in Member countries. The US is ranked eighth and although less expensive prices were found for some IAPs based in particular cities it was decided to use Netcom because it is a national supplier. In October 1995 Netcom had 232 000 subscribers and more than 200 points of presence in the US. The pricing structures of the other countries that permit infrastructure competition, Australia, Japan and New Zealand, appear to be more expensive but this can depend on usage patterns.

The geographical location of Australia, Japan and New Zealand may contribute to higher international leased line charges, for backbone Internet capacity, that are passed on to IAP customers but it is difficult to determine how much impact this factor has on the overall price. It should be noted that the underlying prices for international leased lines between these countries and major Internet gateways would be bundled in IAP charges rather than the domestic leased line charges shown over 2 km in **Table 9**. In other words some part of the higher cost of the IAPs shown in Japan and New Zealand would reflect the underlying charges of PTOs such as KDD or Telecom New Zealand. In the case of Telstra it would be an internal cost to the company and presumably reflect tariffs charged to ordinary customers of international leased lines. In November 1995, Telstra increased the international capacity of its network from 6 Mbit/s to 10 Mbit/s.[62]

The IAPs in countries with monopolies over telecommunication infrastructure competition which bundle PTO charges in the price to users, all have PTO charges for the provision of national leased lines at 64 bit/s that are lower than the OECD average. In particular, Iceland, Switzerland and Ireland have among the least expensive prices for 64 kbit/s leased lines over short distances and this contributes to their relatively low basket price. To construct the 56/64 kbit/s basket shown in **Table 9**, where IAPs did not bundle PTO charges, standard leased line prices at two kilometres were applied to represent this cost.

In a competitive market, such as Australia, it is necessary to ask whether customers do actually pay these prices. Telstra's prices were selected to represent Australia because the company is a national supplier. Since there are two major infrastructure suppliers (Telstra and Optus) and numerous resellers, Australian IAPs do not necessarily have to pay Telstra's charges. This is the main difference between a competitive and a monopoly market in terms of Internet pricing. In a competitive market the IAPs can simply opt for an alternative Internet backbone provider. So for example, MCI and IBM have Internet connections/subscriptions in the US and use their international communication links to connect to their Australian facilities.

The extremely important feature of a liberal market is that the incumbent can not control the pace at which service is rolled out in an anti-competitive manner. Where a PTO has monopoly power over providing the underlying infrastructure for the Internet backbone network, all IAPs would have to pay that PTO's prices and they would set a baseline for IAP charges. In terms of market development this is crucial because if a monopoly PTO was not in the position to offer service, or did not want to offer more than a limited service, they could strongly influence market growth.

Some may ask why a monopoly PTO would want to do this given that an expansion of the Internet market increases the size of the overall communication market. There could be many reasons why a monopoly PTO would want to retard growth. For example, in August 1995, when the OECD surveyed Internet provision in Member countries it was not possible to obtain 'dial-up' Internet access as a service from many PTOs. Since that time a growing number of PTOs have announced they will launch a service or have commenced by offering leased line access with a view to entering the 'dial-up' business. In the interim, PTOs in monopoly markets have the option, if they so choose, of holding back the growth of their future IAP competitors by charging high prices for capacity. This may be as simple as not introducing a reduction in prices that would otherwise have been made or delaying the installation of a new order for a leased line. This is not likely to happen in a market with infrastructure competition and vigorous national and international resale.

Internet Capacity Charging Practices and Quality of Service

Much of the discussion of Internet charging practices has focused on the advantages and disadvantages of flat-rate and usage based pricing. As indicated in **Table 9**, in most OECD Member countries it is possible to obtain a 56 kbit/s or 64 kbit/s leased line at a fixed rate per month with unlimited usage. For the purpose of this comparison flat rate pricing options for 56 or 64 kbit/s access to the Internet via leased lines were selected. If a flat rate pricing option was not available from the suppliers contacted the lowest cost option is shown. Accordingly the baskets shown for Australia, New Zealand, Greece and Portugal are not wholly comparable with the other OECD countries.

Technically, some may view Telstra's charge at 100 per cent utilisation of a 64 kbit/s leased line Internet access as a maximum flat rate charge **(Table 10)**. This charge, and others for high rates of utilisation, are presumably set at a punitive level to encourage IAPs to shift to higher capacity leased lines, once they cross certain volume thresholds, and for end users wanting high speed access to utilise ISDN services. Indeed the theoretical price a customer would pay for 100 per cent utilisation of a 64 kbit/s leased line is US$ 80 000 per annum. Instead what the data for Australia, and the other countries with usage based charging show in **Table 9**, is the minimum price that can be paid by customers if they only use their 64 kbit/s access up to the level where additional usage charges would be incurred.

The main impact of Telstra's charging practices, in line with their underlying philosophy of using volume based charging to discourage saturated international links (see below), is that IAPs orient their services toward selling ISDN access to business customers rather than flat rate unlimited access via leased lines. A random survey of the home pages of several IAPs in Australia -- Acay Network Computing, Access One, AUSNet, Hutchinson Telecommunications, and Netspace, showed that their prices generally had a volume component for ISDN access to Internet. Only Access One offered 64 kbit/s ISDN access to the Internet without charges increasing beyond a certain utilisation level (US$1 838 for installation and US$827 per month).

In November 1995, more typical of Australian IAP prices, was Netspace, which was offering 64 kbit/s ISDN connections to the Internet for US$1 838, and a monthly charge of US$484 for 30 per cent utilisation levels (US$827 with a 60 per cent utilisation). For semi-permanent ISDN 64 kbit/s links, Hutchinson Telecommunications charged US$1 838 for a connection and US$514 per month. Naturally, these charges for ISDN access are much lower than the ones shown for Telstra in **Table 10**. IAPs are able to do this because they purchase capacity from Telstra, or another supplier, and resell this capacity among a number of customers. For example, an IAP might purchase a 128 kbit/s connection for US$3 680 per month. If this link was resold to two business users (both with 64 kbit/s ISDN access) at US$500 per month and 200 dial-up users at US$30 per month the IAP would receive US$7 000.

If the IAP access prices via ISDN connections were used to represent Australia, it would improve that country's position relative to other countries in **Table 9,** and significantly lower the average price for countries with competitive markets. In one sense the prices of the Australian IAPs are closer to those available in Canada and Finland than a initial examination of Telstra prices would suggest, although customers would also need to pay Telstra charges for ISDN transmission between their facilities and those of an IAP. On the other hand if the leased line prices available in Canada and Finland were matched by Telstra or other Australian backbone Internet providers, IAPs in that country could offer lower prices. How much the Australian pricing has to do with geography, rationing use, encouraging balanced traffic flows or other factors are the key questions. It is also true that in August 1995, Telstra had only recently taken over the provision of AARNET, an Australian Internet access provider for the academic community, and the inherited tariff structure may not reflect future pricing plans. In particular low bandwidth (64 kbit/s) seems relatively expensive compared to Canada and Finland while higher bandwidth (2Mbit/s) relatively inexpensive relative to many parts of Europe.

If using baseline prices had placed Australia (Telstra), New Zealand, Greece and Portugal at an advantage, in comparative terms, it may have been necessary to develop an assumption based on an average usage pattern to compare costs. This was not necessary because the baseline costs for permanent leased line access in Australia, Greece and Portugal are relatively expensive even before usage charges are considered. On the other hand, for comparisons between these four countries it should be recognised that New Zealand is very much advantaged relative to Australia, Greece and Portugal because it has far less usage included in the fixed rental. Telstra's charging structure is different from most other IAPs because it measures the average port utilisation of a leased line customer rather than expressing usage by the amount of data transferred. If a user in New Zealand, using ICONZ as their IAP, made similar use of their line to a Telstra customer, their charges would also be similar (in practice this is difficult to determine because ICONZ charges different rates for local, national and international traffic).

There are IAPs in several countries shown in **Table 9** with flat rate pricing that also offer usage based charging, such as Canada, Italy, and the Netherlands. Given certain usage patterns these options could be less expensive for customers. For example one option available in the Netherlands would be less expensive than the option shown in **Table 9** if a customer used the leased line at a level equivalent to that included in Telstra's charges. In the case of Turkey the maximum charge that can be incurred by a customer is shown in **Table 9**, although a user could pay less based on levels of usage much lower than included in Telstra's charge.

With the commercialisation of the Internet the choice of pricing structure has become a major issue. Should IAPs charge a flat rate, one based on utilisation, or a combination of the two. Generally PTOs prefer bandwidth or time based charges for most types of telecommunication services because it encourages users to ration network use. It is also said to allow operators to better predict patterns of use which enables more effective network planning. On the other hand many users prefer unmeasured pricing because they know in advance how much they will pay and, in the case of traditional leased lines, flat rates have represented a significant discount on standard PSTN charges beyond a certain point for the same volume of service.

If IAPs choose to charge for usage it raises the question of which aspects of usage will be charged and how this will be measured. Telstra's pricing is based on bandwidth and volume charges (measured by average port utilisation). Users only pay for utilisation for 'incoming traffic' rather than 'outgoing traffic'. According to Telstra, "The new tariff is designed to encourage Australian content provision to a global market, by not charging customers for sent traffic. The tariff has been structured to charge for received only traffic, to be fully distant independent (including both Australian and International traffic) and truly make Australia a competitive source of information content."[63] If the Internet becomes a significant market place for electronic commerce such a pricing policy may have a number of advantages for the export of information services. On the other hand it might be pointed out that a flat rate tariff for leased line access would achieve the same effect. Yet, over the longer term, if some type of international settlements scheme was ever implemented for the Internet, Telstra's pricing scheme may influence user behaviour by encouraging Australian users to ration consumption of incoming international traffic. Under a flat tariff structure this would not be a consideration for users.

Aside from the method of charging the main issues for Internet access are the level of price and the quality of service. Just because there is a certain price structure for network use does not mean it is expensive or inexpensive. Australia, Japan and New Zealand all have relatively expensive IAP charges for dedicated leased line access with three different price structures. What impact geography has on the relatively higher prices due to the cost of international backbone networks would require further analysis. On the other hand flat rate pricing is no guarantee of low charges as evident in countries such as Austria, Germany, Italy and Spain. Here the problem is not geography but the relatively high prices charged for international leased lines that do not need to bridge continents to access major Internet gateways. At the same time these issues can not be considered apart from the quality of service.

The quality of Internet access is emerging as an increasingly important issue. In the case of Internet access pricing this takes on the added issue of whether charging practices need to be used as a tool to manage, or in some cases ration, utilisation to maintain a certain quality of service level. Telstra says its pricing options are based on the principle that they will discourage 'saturated access links'.[64] The method chosen to achieve this is by increasing charges with average bandwidth utilisation (**Table 10**). In other words a user with an average loading of inbound traffic not exceeding 25 per cent of the total available bandwidth would pay US$18 500 per annum in IAP charges. On the other hand the theoretical charge for using the final 25 per cent of capacity available (*i.e.* from 75 to 100 per cent) would be at the rate of just under US$38 000 per annum. Presumably most organisations would under these circumstances ration their use of available bandwidth or shift to a higher access speed rather than maximise utilisation and incur punitive rates.

Depending on developments in areas such as network capacity, compression technologies and new applications (such as bandwidth demanding video services) such questions may come increasingly to the fore. This raises some interesting issues for policy makers. If regulation restricts the provision of telecommunication infrastructure to monopoly or duopoly providers, it is necessary to ask the whether it is acceptable for PTOs to ration service via price if other potential infrastructure providers are not allowed to meet a need in the market. In other words, if PTOs can not provide infrastructure, or will not provide infrastructure because of the potential for competition with their traditional sources of revenue, is regulation creating an artificial scarcity of connectivity? If more than 14 Internet backbone networks have been able to develop in the US, in a commercial environment, and relatively inexpensive flat rate tariffs are available to business users for high speed leased lines, it raises the question of why it is difficult to get equivalent high speed links in Europe at the same price.

As with other telecommunication services, price comparisons need to be complemented by quality of service analysis. A feature of Telstra's Internet access pricing agreement with customers is that the company will guarantee certain performance levels. According to Telstra its Internet Network will be engineered to provide a network service availability of more than 99.75 per cent, with a 2 hour response time, 24 hour repair time service for customers. Telstra is also providing customers with monthly reports on traffic statistics, network availability, faults and restoration. In respect to backbone networks:

-- For Internet traffic within Australia Telstra will provide a domestic Internet service that is designed to carry at least 98 per cent of network traffic between any two Telstra Internet Points of Presence with a transit time not exceeding 300 milliseconds. This includes transit and queue times at any intermediate points in the network. This measurement will be determined by random sampling conducted by Telstra over each week of the domestic network over Telstra's points of presence.

-- For Internet traffic, between the international gateway in Australia and the international gateway in the United States, Telstra will provide an International Network Service designed to carry at least 95 per cent of network traffic between Australia and the United States with a transit time not exceeding 300 milliseconds. This measurement will be determined by random sampling conducted by Telstra over each week of the international network between the Telstra Australian Internet gateway and the international Internet gateway located in the United States.[65]

The quality of service that is established in the backbone networks has a direct impact on the service available to 'dial-up' users. In the case of 'dial-up' access, an industry magazine in the UK has commenced publishing a comparison of the quality of service of IAPs.[66] The Magazine does this by using two computers constantly dialling the numbers of 10 of the largest IAPs in the UK. Essentially a computer dials the number, enters the account details and tests the Internet connection. If a line is engaged the machines repeat the exercise up to five times. Points are awarded on the basis of 5 for first time connection, four for the second, and so forth, with zero points for a failure to connect. This aspect of quality of service can be expected to be closely monitored because 'dial-up' users are paying PSTN charges during their log on process irrespective of whether they are eventually successful in accessing the Internet. Conscious of this there is a growing trend for IAPs to advertise the number of modems they have in an effort to attract customers.

Table 9. **Pricing for 56/64 kbit/s Leased Line Access to the Internet, August 1995.**

IAPs (Country)	Connection (US$ PPP)	Rental per month (US$ PPP)	IAP total per annum (1) (US$ PPP)	Unlimited Usage	PTO leased line included in IAP	Cost of leased line per annum (2)	Total basket: including PTO & IAP (volume charges = +)
Telstra (Aus.)	2574	1471	18505+	No (3)	No	9718	28223+
EUnet (Au.)	3500	1821	23024	Yes	Yes	3457	23024
EUnet (Bel.)	1072	1072	13226	Yes	No	4720	17946
Helix Int. (Can.)(4)	1200	556	7072	Yes	Yes	11820	7072
EUnet (Den.)	4789	604	8848	Yes	Yes	3200	8848
EUnet (Fin.)	2875	420	6003	Yes	Yes	1139	6003
Inter Way (Fra.)	2205	766	9923	Yes	No	4414	14338
Contrib.NET (Ger.)	0	1908	22891	Yes	No	3443	26334
FORTHnet (Gre.)	2438	1194	15141+	No (5)	No	4996	15141+
EUnet (Ice.)	1003	725	9029	Yes	Yes	775	9029
Cork Internet (Ire.)	6383	760	11246	Yes	Yes	1540	11246
I.Net S.pA.(Ita.)	0	1808	21691	Yes	No	5263	26954
Tokyo Int. (Jpn)	276	1083	13087	Yes	No	2917	16004
Europe On. (Lux.)	183	1003	12091	Yes	No	2294	14385
Giga-Com (Mex.)	300	600	7300	Yes	No	8782	16082
Dataweb (Neth.)	1878	2019	24851	Yes	No	4699	24851
ICONZ (NZ)	67	167	1222+	No (6)	No	12693	14716+
EUnet (Nor.)	2714	928	12042	Yes	Yes	3996	12042
EUnet (Por.)	1667	2500	30556+	No (7)	No	6309	30556+
EUnet (Spa.)	2311	1891	23459	Yes	No	12846	36305
TerraTel (Swe.)	2035	773	9956	Yes	Yes	2567	9956
Ping Net (Swi.)	439	483	5941	Yes	No	1574	7515
TRNET (Tur.)	500	1500	18167	Yes (8)	No	12106	30272
Demon Int. (UK)	1567	784	9927	Yes	Yes	3768	9927
NetCom (US) (9)	1200	400	5200	Yes	No	5946	11146
OECD	1727	1089	13648			5399	19047

1. The total is comprised of the cost of IAP installation divided by 3 plus the monthly charge x 12.
2. The total is comprised of the cost of PTO installation divided by 3 plus the monthly charge x 12 for a 56 or 64 kbit/s leased line at 2 km.
3. The monthly rental applies up to 25 per cent utilisation of a 64 kbit/s leased line per month..
4. Helix Internet operates in British Columbia. The price for leased lines shown here is from Bell Canada which does not operate in British Columbia, except as a member of Stentor.
5. The monthly rental includes 0.6 Gbyte per month of international traffic. Additional international traffic, up to 300 MBytes per month, is charged at US$0.005 per Kbyte. The total cost is capped at 60 per cent of the total cost (40 per cent for non profit organisations) of accessing Internet via an International link.
6. The monthly rate includes 40 MBytes. Additional international traffic is charged at US$1.16 per MB and additional national traffic at US$0.33 per MB. Additional local traffic is uncharged.
7. The monthly rate includes 500 Mbytes of international traffic. Additional international traffic is charged at the rate of US$3.75 per Mbyte. National traffic is uncharged.
8. The base monthly rate for TRNET is US$250 per month which includes 300 Mbytes of international traffic. After this point international traffic data are charged for at the rate of US$0.60 between 300 MBytes - 500 MBytes and US$0.90 between 500 MBytes - 700 MBytes. International data amounts over 700 MBytes are charges at the rate of US$1.25. National data is charged at a rate 60 per cent less than international traffic. There is an upper limit of US$1500 payment per month and this figure is used above as the equivalent of unlimited usage.
9. By October 1995 Netcom had lowered its connection fee for a 56 kbit/s leased line to US$500.

Source: OECD

Table 10. **Telstra Internet Access Pricing, August 1995 (US$PPP)**

Average loading	Monthly Payment (64 kbit/s)	Connection Charge (64 kbit/s access port)	Telstra IAP Charge per annum(1)	Telstra Leased line charge per annum (2)	Total Internet Access Basket
0-25%	1471	2574	18505	9718	28223
30%	1654	2574	20711	9718	30429
35%	1838	2574	22917	9718	32635
40%	2022	2574	25123	9718	34841
45%	2206	2574	27328	9718	37046
50%	2390	2574	29534	9718	39252
55%	2574	2574	31740	9718	41458
60%	2794	2574	34387	9718	44105
65%	3015	2574	37034	9718	46752
70%	3235	2574	39681	9718	49399
75%	3456	2574	42328	9718	52046
80%	3676	2574	44975	9718	54693
85%	3897	2574	47623	9718	57341
90%	4804	2574	58502	9718	68220
95%	5711	2574	69390	9718	79108
100%	6618	2574	80270	9718	89988

1. The total is comprised of the cost of Telstra IAP installation divided by 3 plus the monthly charge x 12.
2. The total is comprised of the cost of Telstra installation divided by 3 plus the monthly charge x 12 for a 64 kbit/s leased line rental at 2 km.

Source: Telstra

Internet Access Prices (‘Dial-Up’)

The most common way for residential or small business users to access the Internet is by using a personal computer, modem and the PSTN. This is called ‘dial-up’ access to the Internet. Indeed, by late 1995 the “home” had emerged as a major place for accessing the Internet.[67] One survey of more than 60 000 on-line users, by Jupiter Communications and the Yahoo corporation found that 55 per cent had primary access, and some 85 per cent had access to the Internet, at home. The majority of these users (50 per cent) access the WWW via a ‘dial-up’ service with an IAP, while 40 per cent accessed the Internet via ‘dial-up’ connections to the facilities of their employer. The remainder accessed the Internet through on-line Information Service Providers (ISPs).[68] The following sections compare the pricing of dial-up access to the Internet via IAPs and ISPs, as well as analysis of the underlying pricing of the PSTN for the development of such services.

Impact of PTO Infrastructure Prices and Quality of Service

The focus on the pricing of information infrastructure in this document until now has been on the cost of accessing the Internet via leased lines for business users. However the PTO pricing of capacity can also significantly effect the prices that IAPs charge end users for ‘dial-up services’ for low volume business and residential customers. In other words if PTOs charge high prices for backbone capacity these costs will be passed on to end users in the form of higher prices for ‘dial-up’ Internet services. Moreover the availability of capacity and the quality of service in its provision for backbone networks can impact on the IAPs ability to provide service to end users via 'dial-up' options. If PTOs can not, or will not, provide high speed capacity to IAPs economies of scale can not be passed on to others in the form of lower 'dial-up' prices. If capacity is available at low prices innovative service suppliers will take advantage of this situation **(Box 2).**

The charging practices and prices for 'dial-up' access to the Internet vary enormously throughout the OECD area (**Table 11**). In general the experience of OECD is that capacity, particularly high speed leased lines, is less expensive in those Member countries that allow telecommunication infrastructure competition.[69] Trying to compare the underlying cost of capacity for IAPs to access backbone networks would be extremely complex. For example it would need to take into account the cost of leasing capacity from the IAP facilities to those of the PTOs and, in some cases, the charges applied by the PTOs to IAPs based on the volume of traffic. For larger IAPs, that directly lease international capacity, the cost of international leased lines (which include the prices of two PTOs), would also need to be considered. In those cases where the PTOs are also the IAPs, it would be necessary to determine whether they paid, for the purposes of internal accounting, the prices listed for use of their own infrastructure.

Undertaking comparisons throughout the OECD area would be further complicated by geography. In other words it might be expected that the relatively high prices for international leased lines would be magnified in those countries with few near neighbours compared to those with many. While this would reveal the actual costs to users it could highlight geography rather than efficiency. Finally a comparison of listed prices would not take into account the discounts that tend to be more widely available in competitive markets, or the availability and quality of provision of high speed capacity.

Despite the difficulties in undertaking accurate comparisons of the underlying infrastructure prices paid by IAPs it is possible to compare their prices to end users for 'dial-up' services with the underlying market structure. **Table 12** shows a marked correlation between lower IAP prices for 'dial-up' services and the liberalisation of underlying telecommunication infrastructure provision. Six of the eight countries with the lowest cost for a basket of IAP 'dial-up' charges allow telecommunication infrastructure competition -- UK, NZ, Finland, the US, Canada and Sweden. If Australia's November 1995 prices were considered it would join this group. On average IAP prices for 'dial-up' services are nearly three times more expensive in countries without underlying telecommunication infrastructure competition than those with competitive markets.

Geography could be a factor in the two countries with competitive markets that were relatively expensive -- Australia and Japan -- in August 1995, where because they have few near neighbours there may be higher international cost components. That being said, if this is a factor, it might be suggested that the charges reflect price structures for leased lines derived from PSTN rates for international telephony, that now bear little relation to the cost of providing international capacity. More importantly prices are now spiralling downward in both countries. In Japan, prices were brought down dramatically between August and November 1995. In fact the price of Fujitsu's InfoWeb service in November 1995 was roughly half the price for Tokyo Internet recorded in August 1995.

In the case of Australia, competition among IAPs is rapidly reducing the price of access. By November 1995, Acay Network Computing, the company shown to represent Australian pricing had introduced an offer of US$29.41 per month which included 40 hours of use (with additional hours priced at US$1.47). Clearly this price is much less expensive for 20 or 30 hours of service than the August 1995 Acay price shown in **Table 11**. This change was not due to a reduction in Telstra charges which remained at the same level as **Table 10,** and was presumably in response to demand for consumers for a flat rate pricing structure and an increasingly competitive IAP market.[70] An important point, which is often overlooked in theoretical discussions of Internet pricing, is that in a competitive market operators will respond to the needs of the market in terms of pricing structures and making new facilities available.

Between 1994 and 1995 the number of IAPs is reported to have doubled in Australia from around 50 to 100. One of these IAPs, Netspace Online systems, launched a service option in October 1995 priced at US$10.40 for 20 hours of use per month and US$16.54 per month for 40 hours of use for non-commercial users. As at November 1995 these were probably the lowest prices for Internet access in the OECD area. Because Australia has a liberal telecommunication market the relatively high underlying Telstra listed prices seem to be having little impact on IAP prices in Australia. In a policy environment allowing infrastructure competition and national and international resale, IAPs can purchase capacity from alternative suppliers. In the US, the market had become so competitive by October 1995, that Pipeline USA, a PSINet company was offering unlimited Internet access for flat rate of US$19.95, including all software, no connection charge and a seven day free trial.[71]

It is also true that in some countries with monopoly markets for underlying infrastructure, but competitive IAP markets, the prices are being reduced. For example, in Spain the initial IAPs charged very high prices without really differentiating the market between business and residential users. In practice, of course, this meant the service was available only to business or individuals prepared to pay relatively high prices. The EUnet price shown in **Table 11** to represent Spain was selected because the EUnet network prices were readily available for most European countries in August 1995, and provided a European wide perspective on pricing. However in early August 1995 the only 'dial-up' tariff package available to EUnet users in Spain -- 'MyEUnetDial' -- was relatively expensive compared to most packages aimed specifically at the mass market.

At the beginning of September 1995, EUnet (Spain) revamped the pricing of its 'dial-up' option and aimed it more specifically at business users. Prices were actually increased for connection and the monthly charge doubled (with the time included increased from 3 to 6 hours) with additional hours being priced at one rate (instead of peak and off peak). For the general public EUnet (Spain) then recommended Abaforum, another IAP, and its prices are much more in line with the experience of most of the rest of the OECD (although around three times as expensive as Netspace in Australia). As with Australia and Japan it is tempting to include the latest information, and it is shown for these countries, to demonstrate the dynamic nature of change. However, like the Australian and Japanese data, the Abaforum prices are not included in any of the OECD averages because they are for November 1995.

The other OECD country with few near neighbours, New Zealand, has relatively low charges but 'dial-up customers' passing certain thresholds of national and international traffic would incur additional charges. On the other hand geography can not be used as a mitigating factor for most European countries which, on average, have very high charges. If there is a causal relationship in the correlation between backbone infrastructure competition and lower prices for 'dial-up' users it suggests OECD countries without competitive markets need urgent reform or they risk delaying widespread access to information infrastructure.

Impact of PSTN Prices on 'Dial-up' Access

An important element in the cost of using the Internet via 'dial-up' access is the cost of PSTN. One way to assess the comparative cost of using the PSTN to access the Internet would be to use the OECD's telecommunication comparison methodology for a residential user. The residential basket includes around 900 telephone calls per annum spread over different distances, duration and times of day. Inevitably this approach would have a number of drawbacks since the OECD basket is predicated on average use of a residential line for telephony rather than accessing on-line services. For example telephone users in Japan spend on average only 10 minutes and 36 seconds per day on the telephone.[72] Because this is a national figure that includes business traffic the average for residential users may be less again. In the case of on-line services it would be expected that a user would make less calls of a much longer duration than for telephony. Moreover, instead of being spread over different distances calls would all be made to a point of access within a local calling area. While the latter assumption may not hold true in all cases, especially for some inhabitants of rural and remote areas, it would be the case for most users in a major city.

The cost of accessing on-line services outside local calling areas would be prohibitively expensive for calls longer than the average telephony usage based on standard long distance charges. Accessing IAP and ISPs by 800 numbers, while less expensive than long distance rates, is also relatively expensive compared to local calls. For example, Concentric Network, a large US IAP, charges a subscription of US$10 to access the Internet via an 800 number which includes 2 hours on-line time per month.[73] After the initial 2 hour period customers pay US$5 for every additional hour. America Online charges US customers a surcharge of US$6 per hour to access its network via an 800 number.[74]

This raises many questions for policy makers in terms of universal service and regional development. If providing the widest possible access to information infrastructure meant that rural users should pay the same rates as those in urban areas, this would not be possible within the structure of traditional telecommunication charges when there was not a local Internet access point of presence. Indeed traditional telecommunication charging practices might discourage business from locating outside urban centres, employees from opting for tele-work, or rural communities and residences from benefiting from services available to users in cities at more affordable prices.

In times past universal service issues such as these have been used by many PTOs to justify monopolies in telecommunication infrastructure provision. Today the most innovative solutions are being developed in competitive markets. For example Demon Internet, the largest provider of Internet access in the UK, has introduced a service which enables any user in the UK, irrespective of geography, to access its service for the price of a local call.[75] For this service, customers call via BT's local access network to Demon Internet Numbers in every local charge group area via 'virtual points of presence'. These numbers are easily identifiable since the last three digits are '666' in each zone. The traffic is then carried by long distance service providers, (Energis or Mercury) to Demon Internet's operations centre which houses its modem stacks. Clearly such a pricing structure has major advantages for customers in rural areas in terms of universal service, and rural users in monopoly markets are going to justifiably ask why they can not obtain similar benefits.

The charging practices for local calls for residential users are set out in **Table 13**. The basket of calls shown in **Table 14** includes 20, 30 and 40 local calls of one hour duration per month at standard rates. In other words a user is assumed to be on-line for between five to ten hours per week. The Jupiter/Yahoo survey found that the average on-line user spent 80 hours per month and that the average session lasts slightly loner than one hour (75 minutes).[76] This may suggest that a comparison of longer periods than the one chosen by the OECD should be made. On the other hand it is also necessary to remember that this is an average that takes into account the use made by employees during office hours, including access via dedicated connections, and that based on PSTN and IAP pricing the experience throughout the OECD area is likely to be very mixed.

Moreover it has been found that surveys of Internet use, that are made over the Internet, tend to overestimate average on-line time. The CommerceNet/Nielsen Internet Demographics survey of the US and Canada, found that the average Internet use for individuals was just under 22 hours per month.[77] The

CommerceNet/Nielson study found that average use of on-line information services was just under 10 hours per month (*e.g.* CompuServe, America Online). The evidence of this survey suggests that baskets of Internet and on-line information service use between 20 and 40 hours provide a reasonable reference to the prices paid by average users. In future more data will be available on Internet usage patterns because the advertising industry wants to build a picture of on-line use to increase the effectiveness of their expenditure. In a similar manner to technologies that measure actual viewing patterns of television, the first 'PC-meter' software is now being implemented in the US, among participating consumers, to build up pictures of on-line use.[78]

Many residential users would, of course, take advantage of off-peak rates to reduce their PSTN on-line time and consequently the cost, but a more detailed knowledge of usage patterns would be necessary to construct a basket of proportional use between times with standard and off peak rates. **Table 15** shows the same basket as **Table 14** with PSTN charges at off-peak rates. The off-peak rate selected was the one available in OECD countries at 20:00 hours. For some countries the time of day does not matter because there is a flat rate or an unmeasured rate (Australia, Canada, Greece, Mexico, New Zealand, and the US (Florida)). On the other hand for Japan, Spain, Switzerland and Turkey the time is significant because major PTOs in these countries do not offer an off-peak rate at 20:00 hours.[79]

The other important information which needs research and analysis for comparisons of PSTN and Internet access is the impact household demographics have on on-line time. This would be true not only for the number of people but which members of a household accessed services at what time of day. Analysis of this type although still scarce can produce surprising results. For example, CompuServe conducted a survey of women's use of on-line services in which 5 000 subscribers participated.[80] Nearly 25 per cent of CompuServe's members world wide are women, although of course, many more would access services through a subscription in another name (*e.g.* a spouse). CompuServe reports that the survey found that, on average, of the leisure hours women subscribers have per day they spend more than four hours of that time on a computer. The seemingly high rate of computer use may indicate that these women spend more than the industry wide average of less than 30 minutes per day accessing the databases of information service providers. It is also indicative that on-line surveys produce results of the most enthusiastic early adopters of computer technology and services.

The features women respondents to the CompuServe survey ranked most highly in what they wanted from an on-line services were in areas such as children's education and health. Ranked number one of major concerns for respondents was the importance of children being comfortable with computers and other types of technology. While these results provide only one perspective on what users may be looking for from the world of on-line services and the Internet, they nevertheless suggest caution in simply assuming that analysis of off-peak rates is sufficient. While users will undoubtedly take advantage of off-peak rates for work and leisure related activities the needs people have for information infrastructure pricing are likely to be very diverse.

Accordingly there may be a number of reasons why 'standard rates', and off-peak rates no later than 20:00 hours, are an appropriate starting point for analysis of pricing in terms of information infrastructure. For example, with the increasing interest in information infrastructure applications for:

-- **tele-work**, an examination of rates during 'office hours' is apposite (and evening rates for employees taking work home);

-- **health applications**, analysis of the tariffs for the hours pertinent to medical consulting need to be considered;

- -- **social policies** aimed at improving the self reliance and home care for the elderly or disabled who may need to access services 24 hours per day;

- -- delivery of **public services** may in some cases need to be effected during ‘office hours’;

- -- **education**, where both the class room hours and the ‘home work hours’ after school predominantly fall in standard rate times (and to a lessor extent evening off-peak rate times);

- **--** **managing households** involves tasks that continue around the clock and may not all be able to be accomplished in off-peak times;

- -- **small business development** because for business users without dedicated capacity most transactions will occur during ‘office hours’ or early evenings;

The results of analysis of PSTN charges for a basket of on-line services in **Table 14** show an extraordinary range of prices for the same service. The tremendous differences in the cost of accessing the Internet, or other on-line services, via the PSTN are the result of pricing structures that, while not producing large differences in a basket of PSTN charges for average telephony use (mixture of calls over different distances, times of day and comparatively short duration), have a huge impact on the cost of on-line service access. Inevitably those countries with unmeasured local calls for residential users (Canada, New Zealand and some parts of the US) and un-timed calls (Australia, Mexico and Greece) have the lowest charges for accessing on-line service via the PSTN. These countries are followed by Finland, Iceland and Sweden who traditionally record low basket prices in OECD telecommunication comparisons. It is also note worthy that Finland has unmeasured calls during off-peak hours. Some of the more expensive countries, for standard PSTN charges, include Ireland, Switzerland and the UK because of its relatively high cost of local calls at standard rates.

Price rebalancing in these countries, and others with timed local calls, has contributed to the relatively high costs of their ‘on-line basket’ (see section below on rebalancing) and this issue is going to be at the forefront of discussion about consumer, schools, patients, tele-workers and small business access to information infrastructure. For example, users in Switzerland and Canada, countries with virtually identical levels of telephone penetration, would differ in the amounts they paid to the PTO by ten times for 20 hours per month of on-line access via the PSTN. At the same time, because the Canadian charges are fixed, the difference would increase to 20 times the price for 40 hours of on-line time per month. To put this into perspective the normal difference between the most and least expensive countries for an OECD basket of residential services is between two to three times the cost.

The dramatic difference in the results of alternative pricing structures for local calls is revealed by the domestic comparison of US charges. **Table 14** shows the prices that would be paid in four States -- California, Colorado, Florida and Texas where local calls are available at unmeasured rates compared to the prices of timed local calls for a user in New York City. The cost of a flat rate service in Florida is more than 10 times less expensive than a measured rate with 40 hours of local calls in New York.

To date, it has been the inherited local call pricing structure rather than competition that is the primary factor in determining the PSTN access cost of an on-line basket. Indeed, the country where local competition is most advanced -- the UK -- has relatively high charges for the PSTN component of an on-line basket at standard rates (**Table 14**). On the other hand the lower charges available for backbone capacity, where competition has had a far longer time to make an impact, in the UK have made it possible for the IAP component to be the least expensive in the OECD area (**Table 12**). It is also true that local call prices have been falling in the UK due to price regulation and local competition from cable telephony providers. As a result of these factors the UK has a price well below the OECD average for a total Internet access basket shown in **Table 16** and the least expensive at off peak rates in **Table 17**.

Several other interesting developments have emerged in the UK market where cable communication companies are providing competition in the provision of local telecommunication services.[81] First is the innovation they have brought to the pricing of local services ranging from volume discounts, inexpensive connections, discounted service packages (which include cable television and telephony), and relatively inexpensive or free calls between their customers during off peak times.

By way of example **Table 15** shows the pricing of Videotron, a UK cable communication company. Videotron's off-peak rates are shown where customers (with and without CATV) can call other Videotron subscribers, which include a number of IAPs, at no charge. While the innovation of free cable to cable customer calls was introduced to attract telephony customers to the networks of cable companies, the option is proving popular with users wanting to access on-line services. In fact 35 per cent of Videotron's telecommunication customers own a PC.[82] For Videotron customers uncharged local calls apply to voice and data telephone calls made in analogue form from a residential Videotron telephone customer to any other local Videotron telephone customer, between 7pm to 7am Monday to Friday, all day weekends and UK public holidays. As a number of IAPs in the Videotron area are also its customers, other Videotron customers can call these numbers free of charge during off-peak hours.

Some PTOs and IAPs have ambivalent feelings toward such options because users might tie up facilities for long periods with calls that do not generate revenue. In one trial of a flat rate tariff in Hull set up by Demon Internet and Yorkshire Electricity, users paid US$0.09 per call for a unlimited connection time.[83] This reportedly caused problems for Demon Internet because a number of users established near permanent links which prevented other users from logging on. This is perhaps why some IAPs in a number of countries where uncharged or unmeasured local calls exist, initially preferred to charge for usage (Australia, New Zealand, Greece). While in practice there is no incentive with unmeasured calls (Canada, US) to remain logged on, because users do not incur a new charge for additional calls, new communication capabilities may act change this situation. As more communication facilities are incorporated into PCs, including faxes, answering machines, the Internet telephone and audio/video capabilities users may wish to establish near permanent links if there is flat rate or unmeasured pricing.

A competitive local market has also brought forth benefits for BT customers. For BT customers, even where cable has not yet passed their homes, the incumbent PTO has improved its performance. First is that a competitive market for local service, and price regulation via a price cap, has acted to bring down the cost of local calls in the UK. In early 1994 BT brought its morning peak rate down to the level of its afternoon rate to create one standard day time rate. Moreover competition has encouraged BT to develop an innovative range of tariff options for residential customers. Accordingly a user subscribing to BT's premier line plan could benefit from a 15 per cent discount on call charges.[84] This could be combined with a "Friends and Family" option that would provide an additional 5 per cent discount on five numbers. What this means is that users subscribing to these plans could pay 20 per cent less for calls to an IAP point of presence (**Table 14**).

In the future local competition is likely to be the key policy instrument used by governments in the OECD area to expand affordable access to information infrastructure. For the present it can be noted that those countries with low PSTN charges (where the primary influence has been the inherited pricing structure) and those countries with low IAP 'dial-up' prices (where a contributing factor appears to be infrastructure competition driving down the cost of the underlying backbone capacity) are best placed to expand access to many new 'information infrastructure' applications. In the case of the UK where the inherited pricing structure at standard rates appeared to be inappropriate for the widespread development of access to the Internet, competition is being applied as tool to encourage PTOs, cable communication companies and IAPs to come up with innovative solutions.

One of the more promising developments, in terms of technology, are modems for cable television lines which may allow ordinary subscribers to take advantage of the broadband capabilities of cable communication networks.[85] A number of cable modem trials are underway in the US and PSI and Cablevision are reported to be offering a commercial service in Cambridge, MA.[86] In the US, Netscape has announced an alliance with TCI Technology Ventures to develop cable based Internet services for residential users. The two companies believe that the key to the new service will be the speed with which information is transported and estimate that transmission speeds more than 500 times faster than current Internet offerings will be available. Service is planned to be commenced in selected parts of the US during 1996.[87] In the UK, the Cable Communications Association, an industry group representing cable communication companies, has predicted that cable modems will be available for widespread use in early 1997.

The challenges before those OECD countries without competition in telecommunication infrastructure appear to be formidable. For the total basket of 30 hours per month of 'dial-up' Internet access (*i.e.* PSTN plus IAP charges) seven of the eight countries with infrastructure competition are below the OECD average while 12 of the 17 countries without infrastructure competition are above the same benchmark. The major barrier to a widespread expansion of 'dial-up' access to on-line services would appear to be the impact of PSTN rate structures based on telephony. For example, in 1995 the cost per annum of an average basket of residential telecommunication services in the OECD area was US$387 (**Table 18**). The average price for 'dial-up' access to the Internet, including PTO and IAP charges, was US$1 290 (@ 240 hours per year) or US$1 655 (@ 360 hours per year) at standard rates. On average, on-line users would pay three times their normal telephone bill for five hours per week of on-line time and five times their normal telephone bill for ten hours on-line time per week at standard rates. The situation is ameliorated somewhat by off peak charges but, on average, the baskets still represent a large increase in payment by the users compared to the cost of traditional telecommunication usage patterns.

While users will undoubtedly be prepared to pay higher charges for services they value it is also true that a major examination of charging practices will need to be undertaken by many PTOs if they are to foster efficient use of information infrastructure. Markets can be used by policy makers to assist in this process and eight of the 13 least expensive countries are applying competition policy to encourage structural adjustment. This is not to argue that these eight countries still don't face large challenges. For example only Canada, New Zealand and the US have a one to one ratio between a relatively inexpensive basket of residential PSTN services and on-line services (@ 240 hours per year) at standard rates. On the other hand the US performance varies where there are not unmeasured rates available for local calls (*i.e.* New York City).

Sweden and Finland, although having relatively inexpensive on-line baskets by comparison with other OECD countries, are relatively expensive at standard rates compared with their residential telephone baskets -- which it must be said are amongst the lowest in the OECD area. Nevertheless both countries have amongst the highest growth rates for access to the Internet and rates are reduced considerably during off-peak hours. For Australia and Japan the major barrier would appear to be the high cost PTOs charges to IAPs for capacity rather than the cost of local access via the PSTN, which is relatively inexpensive in both countries. By way of contrast the UK has relatively expensive local calls for an on-line user but inexpensive IAP charges made possible by competition in the provision of backbone capacity. The approach of the UK, since the end of the duopoly, has been to apply competition to the local market with a view to gaining similar benefits to those achieved in the pricing of backbone infrastructure. In summary the group of eight countries with competitive markets are either starting from a point where they have relatively inexpensive backbone capacity or local PSTN service for Internet access.

On the other hand far greater challenges are facing those countries that have not yet moved to liberalise their telecommunication markets. Of the monopoly countries, perhaps only Iceland will start from a relatively advantageous position. The other country with a monopoly market which is enjoying high growth rates in access to the Internet, Norway, has relatively expensive charges compared to most countries with competitive markets. The Netherlands also has relatively low prices for those countries with monopoly markets. Greece and Mexico have an advantage with their existing price of local access but the lack of competition in the provision of backbone infrastructure appears to result in higher IAP prices.

Most other countries with monopoly markets have far more severe problems because they have relatively high local PSTN access charges for a basket of on-line services and high prices for backbone capacity that IAPs pass on to customers. Unless these countries implement policies to address this situation the economic and social benefits governments envisage for information infrastructure will be very slow to eventuate. In monopoly markets there does not appear to be any innovation or structural adjustment to address new growth areas. Instead, the tariff rebalancing (refer later section) that is occurring is making the local charges in these countries even more expensive relative to those with competitive markets. It may or may not be true that higher tariffs for local service better reflect cost causation but the problem with monopoly provision of local service is that there is little incentive to reduce these costs. Overall this considerably raises the cost of universal service and makes many of the aims governments have for information infrastructure prohibitively expensive in these countries.

Table 11. **'Dial-Up' Internet Access Prices in the OECD Area, August 1995**

Name of service provider and country	Set-up Fee US$ PPP	Monthly rental US$ PPP	Hours or data volume included in Rental per month	IAP Usage Charge Per Minute US$ PPP	IAP charge for 20 - 30 hours online per month(1) US$ PPP	
Acay (Aus.)	0.00	14.71	0	0.04	51.47	77.21
Acay (Aus)(2)	0.00	29.41	40 hours	0.02	29.41	29.41
EUnet (Au.)	207.14	53.57	All	0.00	53.57	53.57
EUnet (Bel.)	40.21	13.40/107.24	0/All	0.11	107.24	107.24
Helix (Can.)	0.00	15.96	20h	0.02	15.96	27.96
EUnet (Den.)	114.03	11.40	0	0.05	64.31	96.47
Clinet (Fin.)	42.90	0.00/17.66/40.10	0/31h/All	0.01-0.02/0.01-0.003/0	17.66	17.66
Inter Way (Fra.)	44.41	75.04	10h	0.05	60.14	90.16
EUnet (Ger.)	0.00	9.00	0	0.09	108.06	162.09
Forthnet (Gre.)	99.50	74.63	10h/ 20 MB	(3)	74.63+	74.63+
Centrum (Ice.)	0.00	24.35	All	0.00	24.35	24.35
Cork Internet (Ire.)	75.99	0.00/151.38	0/All	0.15/0	151.38	151.38
EUnet (Ita.)	0.00	24.21/40.35	5h/10h	0.06	79.08	117.82
IIJ (Jpn)	165.75	1.29	0	0.17	198.90	298.34
Tokyo Internet (Jpn)	165.75	104.97	All	0.00	104.97	104.97
InfoWeb (4)	n.a.	11.05	4hrs	0.06	53.04	86.19
Europe Online (Lux.)	45.76	16.29/153.38	0/All	0.13/0	153.38	153.38
CMACT (Mex.)	52.63	78.95	All	0.00	78.95	78.95
NederNet (Neth.)	0.00	21.13	All	0.00	21.13	21.13
ICONZ (NZ)	33.33	13.33/26.67	5MB/20MB	1.16 per MB (International) 0.33 per MB (Nat.) Free local	n.a.	n.a.
EUnet (Nor.)	69.52	17.38/34.56/69.52	0	0.12/0.06/0.03	34.76	52.14
EUnet (Por.)	20.83	41.67	20h	0.04	41.67	66.67
EUnet (Spa.) (5)	168.07	42.02	3hr	0.21-0.25	214.29	340.34
Abaforum (Spa.)(5)	84.03	32.77	30hr	0.08	32.77	32.77
TerraTel (Swe.)	24.42	8.14/16.28/24.42	0/15h/All	0.01/0.01/0.00	24.42	24.42
EUnet (Swi.)	0.00	11.74/46.95	0/25hr	0.03-0.05	46.95	55.95
Dutnet (Tur.)	35.00	10.00/15.00	2h/4h	0.07	72.0	117.0
Total Conn. (UK)	10.97	14.37	All	0.00	14.37	14.37
Netcom (US)	25.00	19.95	40h prime time/free non-primetime	0.03	19.95	19.95

1. If 20 or 30 hours of usage were above the flat rate the latter figure was used. If a certain number of hours were included in the monthly fee they are discounted from the total. The least expensive option is shown in all cases for 20 and 30 hours.
2. Acay price at November 1995. This price was not listed in August 1995 and is exhibited here to show the trend in competitive markets.
3. International traffic above the monthly fee on Forthnet is charged at US$0.005 per Kbyte for the first 10MB; US$0.007 for the next 10 Mbytes and US$0.01 per Kbyte above that level.
4. InfoWeb prices are for November 1995.
5. The price shown for Eunet Spain was the price available for an individual user of a dial-up service (MyEUnetDial) at the beginning of August. Subsequently the Eunet company in Spain has concentrated on corporate customers and in November 1995 was recommending Abaforum, another IAP, for services to the general public. That companies prices are shown for November 1995 and like Acay's prices in Australia are not strictly comparable with the other countries.
6. Data in shaded squares is for November 1995.

Source: OECD

Table 12. **Ranking Internet Access Provider Charges ('Dial-Up'), August 1995, US$ PPP**

OECD Countries (Infrastructure competition exists in shaded countries)	20 hours per month (1)	30 hours per month (1)	Average	Possible extra charge based on usage
Australia (November 1995)(2)	10.45	16.54	13.49	
UK	14.67	14.67	14.67	
NZ	15.26	15.26	15.26	Yes
Finland	18.85	18.85	18.85	
US	20.64	20.64	20.64	
Netherlands	21.13	21.13	21.13	
Canada	15.96	27.96	21.96	
Iceland	24.35	24.35	24.35	
Sweden	25.10	25.10	25.10	
Australia (November 1995)(3)	29.41	29.41	29.41	
Spain (November 1995)(5)	35.10	35.10	35.10	
Norway	35.69	53.07	44.38	
Switzerland	46.95	55.95	51.45	
Portugal	42.25	67.25	54.75	
Austria	59.32	59.32	59.32	
Australia (August 1995) (3)	51.74	77.21	64.48	
Japan (November 1995)(4)	53.04	86.19	69.61	
France	61.37	91.39	76.38	
Greece	77.39	77.39	77.39	Yes
Mexico	80.41	80.41	80.41	
Denmark	67.48	99.64	83.56	
Turkey	72.97	117.97	95.47	
Italy	79.08	117.82	98.45	
Belgium	108.36	108.36	108.36	
Japan (August 1995) (4)	109.57	109.57	109.57	
Germany	108.06	162.09	135.08	
Ireland	153.49	153.49	153.49	
Luxembourg	154.65	154.65	154.65	
Spain (5)	218.96	345.01	281.99	
OECD	67.35	83.94	75.65	
Infrastructure Competition	33.97	38.66	36.32	
No Infrastructure Competition	83.05	105.25	94.15	

1. Includes 20 or 30 calls of one hour duration and connection (or set up charge) spread over 36 months.
2. Netspace price for non-commercial users in November 1995.
3. Acay price in November 1995 and in August 1995.
4. InfoWeb price for November 1995 and Tokyo Internet for August 1995.
5. Abaforum price for November 1995 and EUnet price for August 1995.
6. Excludes all PTO charges for dial-up access. In other words the prices shown are just those of the IAPs. Shaded countries allow infrastructure competition.
7. OECD average excludes Australian and Spanish data for November 1995.

Source: OECD

Table 13. **Local Charging Practices for Residential Users in the OECD Area**

	Standard rate charging structure (1)	Off-Peak rate charging structure	Off Peak Tariff at 20:00 hours as per cent of Standard tariff.	Value of Units/Calls Included (US$) in rental
Australia	Flat rate per call (Unmeasured)			
Austria	Measured	Measured	67	
Belgium	Measured	Measured	33.3	
Canada	Unmeasured			
Denmark	Measured	Measured	50	
Finland	Measured	Unmeasured	0	
France	Measured	Measured	70	
Germany	Measured	Measured	50	1.09
Greece	Flat rate per call (Unmeasured Analogue Pricing)(2)			
Iceland	Measured	Measured	50	0.46
Ireland	Measured	Measured	20	
Italy	Measured	Measured	56.6	
Japan	Measured	Measured/Flat Rate(3)	100	
Luxembourg	Measured	Measured	50	(4)
Mexico	Flat rate per call (after first 100)			100
Netherlands	Measured	Measured	50	
New Zealand	Unmeasured			
Norway	Measured	Measured	33	
Portugal	Measured	Measured	50	
Spain	Measured	Measured	100	
Sweden	Measured	Measured	50	
Switzerland	Measured	Measured	100	
Turkey	Measured	Measured	100	7.87
UK	Measured	Measured/Unmeasured	36.5/Uncharged	
US	Measured/Unmeasured		60/Uncharged	

1. The approach to pricing local calls in the following tables was to take the charge of a one minute of a call at 3 kilometres, and if it was at a measured rate, multiply it by 60 for the price at one hour.
2. Timed charges apply to digital telephone lines in Greece at US$0.044 per 3 minutes at standard rates and 8 minutes at off peak rates.
3. NTT has introduced a flat rate for late evening for certain specified numbers for which subscribers pay a higher rental.
4. Some untimed rates apply to specific numbers.

Source: OECD

Table 14. **Internet Access by PSTN (Standard PSTN Rates), January 1995, US$ PPP**

	PTO Fixed Charge(1)	PTO Usage Charge Per Month (Standard Rate Local Calls)(2)			Total PTO Charge per Month (fixed charge plus usage)(3)		
		20 Hours	30 hours	40 hours	20 Hours	30 Hours	40 Hours
Canada	9.32	0.00	0.00	0.00	9.32	9.32	9.32
Greece	7.63	0.90	1.34	1.79	8.53	8.97	9.42
US (Florida)	11.32	0.00	0.00	0.00	11.32	11.32	11.32
US (Texas)	11.42	0.00	0.00	0.00	11.42	11.42	11.42
US (California)	11.83	0.00	0.00	0.00	11.83	11.83	11.83
US (Colorado)	15.37	0.00	0.00	0.00	15.37	15.37	15.37
Australia	10.65	3.68	5.51	7.35	14.33	16.16	18.00
NZ	23.78	0.00	0.00	0.00	23.78	23.78	23.78
Iceland	5.08	9.33	14.23	19.12	14.41	19.31	24.20
Sweden	10.00	9.77	14.65	19.53	19.77	24.65	29.54
Mexico	31.66	0.00	0.00	0.00	31.66	31.66	31.66
Finland	17.80	15.84	23.76	31.68	33.64	41.56	49.48
Germany	11.08	20.52	31.33	42.13	31.60	42.41	53.22
Spain	15.43	19.16	28.74	38.32	34.58	44.16	53.74
Japan	10.60	22.10	33.15	44.19	32.70	43.75	54.80
Italy	11.04	34.72	52.08	69.44	45.76	63.12	80.48
Netherlands	13.26	33.80	50.70	67.61	47.07	63.97	80.87
Norway	15.12	33.37	50.06	66.74	48.49	65.18	81.87
Luxembourg	7.54	37.59	56.39	75.19	45.13	63.93	82.73
France	7.66	37.67	56.51	75.34	45.33	64.17	83.00
Portugal	17.31	38.33	57.50	76.66	55.64	74.80	93.97
Belgium	14.81	40.21	60.32	80.43	55.02	75.13	95.24
Denmark	10.57	43.79	65.68	87.57	54.35	76.25	98.14
Turkey	6.56	42.52	67.72	92.92	49.09	74.28	99.48
UK (Videotron)4	8.84	50.58	71.66	95.54	59.42	80.50	104.38
UK (Videotron)5	10.00	50.58	71.66	95.54	60.58	81.66	105.54
US (NY City)6	14.28	48.00	72.00	96.00	62.28	86.28	110.28
UK (BT)7	18.72	47.40	71.10	94.80	66.12	89.82	113.52
Austria	13.33	57.43	86.14	114.86	70.76	99.48	128.19
Ireland	22.07	54.71	82.07	109.42	76.78	104.13	131.49
UK (BT)8	15.42	59.25	88.87	118.50	74.66	104.29	133.91
Switzerland	13.77	90.14	135.21	180.28	103.91	148.98	194.05
OECD(9)	13.35	29.32	43.99	58.77	42.66	57.34	72.12

1. The fixed charge per month is made up of a residential connection spread over five years and the per annum rental divided by 12.
2. Usage charge is made up of 20, 30 or 40 calls with a duration of one hour at standard rates. For Iceland, Germany, Mexico and Turkey units or time included in the rental are discounted from the charge.
3. The total basket is the addition of the fixed monthly charge and 20, 30 or 40 hours of local calls.
4. Videotron standard rate for customers with CATV (direct debit payment option).
5. Videotron standard rate for customers without CATV (direct debit payment option).
6. Nynex charges for user in New York city are shown. Since there is no flat rate option in New York city usage charges are higher than the other parts of the US shown.
7. BT charge with PremierLine and Family and Friends discount. Family and Friends one-off subscription charge spread over 5 years.
8. BT standard charges excluding discounts.
9. The OECD average includes NY City and Florida only from the US examples and includes BT with the discount plan and Videotron without CATV.
10. All tariffs exclude tax.

Source: OECD

Table 15. **Internet Access by PSTN (Off-Peak PSTN Rates), January 1995, US$ PPP**

	PTO Fixed Charge(1)	PTO Usage Charge Per Month (Off-Peak Rate Local Calls)(2)			Total PTO Charge per Month (fixed charge plus usage)(3)		
		20 Hours	30 hours	40 hours	20 Hours	30 Hours	40 Hours
UK (Videotron)(4)	8.84	0.00	0.00	0.00	8.84	8.84	8.84
Canada	9.32	0.00	0.00	0.00	9.32	9.32	9.32
Greece	7.63	0.90	1.34	1.79	8.53	8.97	9.42
UK (Videotron)(5)	10.00	0.00	0.00	0.00	10.00	10.00	10.00
US (Florida)	11.32	0.00	0.00	0.00	11.32	11.32	11.32
Iceland	5.08	4.67	7.12	9.56	9.75	12.20	14.64
Finland	17.80	0.00	0.00	0.00	17.80	17.80	17.80
Australia	10.65	3.68	5.51	7.35	14.33	16.16	18.00
Sweden	10.00	4.89	7.33	9.77	14.89	17.33	19.77
NZ	23.78	0.00	0.00	0.00	23.78	23.78	23.78
Mexico	31.66	0.00	0.00	0.00	31.66	31.66	31.66
Germany	11.08	10.26	15.67	21.07	21.34	26.75	32.15
Norway	15.12	11.01	16.52	22.02	26.13	31.64	37.14
Belgium	14.81	13.39	20.09	26.78	28.20	34.90	41.59
Ireland	22.07	10.94	16.41	21.88	33.01	38.48	43.95
Luxembourg	7.54	18.80	28.20	37.60	26.34	35.74	45.14
Netherlands	13.26	16.90	25.35	33.81	30.16	38.61	47.07
Italy	11.04	19.65	29.48	39.30	30.69	40.52	50.34
UK (BT)(6)	18.72	17.30	25.95	34.60	36.02	44.67	53.32
Spain	15.43	19.16	28.74	38.32	34.59	44.17	53.75
Denmark	10.57	21.90	32.84	43.79	32.47	43.41	54.36
Japan	10.60	22.10	33.15	44.19	32.70	43.75	54.79
Portugal	17.31	19.17	28.75	38.33	36.48	46.06	55.64
UK (BT)(7)	15.42	21.63	32.44	43.25	37.05	47.86	58.67
France	7.66	26.37	39.56	52.74	34.03	47.22	60.40
US (NY City)(8)	14.28	28.80	43.20	57.60	43.08	57.48	71.88
Austria	13.33	38.48	57.71	76.96	51.81	71.04	90.29
Turkey	6.56	42.52	67.72	92.92	49.08	74.28	99.48
Switzerland	13.77	90.14	135.21	180.28	103.91	148.98	194.05

1. The fixed charge per month is made up of a residential connection spread over five years and the per annum rental divided by 12.
2. Usage charge is made up of 20, 30 or 40 calls with a duration of one hour at off-peak rates as at 20:00 hours. Shaded countries do not offer an off peak rate at 20:00 hours or, based on flat rate of unmeasured rates, pay the same amount as with standard charges. For Iceland, Germany, Mexico and Turkey units or time included in the rental are discounted from the charge.
3. The total basket is the addition of the fixed monthly charge and 20, 30 or 40 hours of local calls.
4. Videotron allows its telephony customers to call the numbers of Internet Access Providers in its service area at an un-timed rate during off peak hours. The rate shown is for customers who also subscriber to cable television.
5. Videotron rate for customers that do not subscribe to cable-television.
6. BT charge with ‘PremierLine’ and ‘Family and Friends’ discount. ‘Family and Friends’ one-off subscription charge spread over 5 years.
7. BT off peak charges excluding discounts.
8. Nynex charges for user in New York city are shown. Since there is no flat rate option in New York city usage charges are higher than the other parts of the US shown.
9. All tariffs exclude tax.

Source: OECD

Table 16. **Total 'Dial-up' Basket (Standard PSTN Charges), US$ PPP**

	IAP Charge per month (usage) +(connection/36)		PTO Charge per month (usage)+(connection/60)		Total (IAP+PTO)	
	20 hours	30 hours	20 hours	30 hours	20 hours	30 hours
US (Florida)	20.64	20.64	11.32	11.32	31.96	31.96
US (Texas)	20.64	20.64	11.42	11.42	32.06	32.06
US (California)	20.64	20.64	11.83	11.83	32.47	32.47
US (Colorado)	20.64	20.64	15.37	15.37	36.01	36.02
Canada	15.96	27.96	9.32	9.32	25.28	37.28
NZ	15.26	15.26	23.78	23.78	39.04+	39.04+
Iceland	24.35	24.35	14.41	19.31	38.76	43.66
Sweden	25.10	25.10	19.77	24.65	44.87	49.75
Finland	18.85	18.85	33.64	41.56	52.49	60.41
Netherlands	21.13	21.13	47.07	63.97	68.20	85.10
Greece	77.39	77.39	8.53	8.97	85.92+	86.36+
Australia	51.74	77.21	14.33	16.16	66.07	93.37
UK (TC/Vid)(1)	14.67	14.67	60.58	81.66	75.25	96.33
UK (TC/BT)(2)	14.67	14.67	66.12	89.82	80.79	104.49
US (NY City)	20.64	20.64	62.28	86.28	82.92	106.92
Mexico	80.41	80.41	31.66	31.66	112.07	112.07
Norway	35.69	53.07	48.49	65.18	84.18	118.25
UK(TC./BT)(3)	14.67	14.67	74.66	104.29	89.33	118.96
Portugal	42.25	67.25	55.64	74.8	97.89	142.05
Japan	109.57	109.57	32.7	43.75	142.27	153.32
France	61.37	91.39	45.33	64.17	106.70	155.56
Austria	59.32	59.32	70.76	99.48	130.08	158.80
Denmark	67.48	99.64	54.35	76.25	121.83	175.89
Italy	79.08	117.82	45.76	63.12	124.84	180.94
Belgium	108.36	108.36	55.02	75.13	163.38	183.49
Turkey	72.97	117.97	49.08	74.28	122.05	192.25
Switzerland	46.95	55.95	103.91	148.98	150.86	204.93
Germany	108.06	162.09	31.60	42.41	139.66	204.50
Luxembourg	154.65	154.65	45.13	63.93	199.78	218.58
Ireland	153.49	153.49	76.78	104.13	230.27	257.62
Spain	218.96	345.01	34.58	44.16	253.54	389.17
OECD (6)	65.55	81.51	41.98	56.41	107.53	137.91

1. Prices shown are for Videotron provision of residential line (with the customer not taking CATV service) and free calls to an IAP and Total Connectivity prices for 'dial-up' Internet access at peak rates (direct debit payment).
2. Includes discount BT rates for the provision and usage of a of a residential line and Total Connectivity prices for dial-up Internet access.
3. Includes standard BT rates for the provision and usage of a of a residential line and Total Connectivity prices for dial-up Internet access.
4. OECD average includes NY City and Florida only for the US examples and BT/Total Connectivity (with discounts) and Videotron (without CATV)/Total Connectivity with peak rates for the UK examples.
5. Countries with shaded squares have telecommunication infrastructure competition.

Source: OECD

Table 17. **Total ‘Dial-up’ Basket (Off-Peak PSTN Charges), US$ PPP**

	IAP Charge per month (usage) +(connection/36)		PTO Charge per month (usage)+(connection/60)		Total (IAP+PTO)	
	20 hours	30 hours	20 hours	30 hours	20 hours	30 hours
UK (1)	14.67	14.67	8.84	8.84	23.51	23.51
UK (2)	14.67	14.67	10.00	10.00	24.67	24.67
US (Florida)	**20.64**	**20.64**	**11.32**	**11.32**	**31.96**	**31.96**
Iceland	24.35	24.35	9.75	12.20	34.10	36.55
Finland	18.85	18.85	17.80	17.80	36.65	36.65
Canada	**15.96**	**27.96**	**9.32**	**9.32**	**25.28**	**37.28**
NZ	**15.26**	**15.26**	**23.78**	**23.78**	**39.04+**	**39.04+**
Sweden	25.10	25.10	14.89	17.33	39.99	42.43
UK (3)	14.67	14.67	36.02	44.67	50.69	59.34
Netherlands	21.13	21.13	30.16	38.61	51.29	59.74
US (NY city)	20.64	20.64	43.08	57.48	63.72	78.12
Norway	35.69	53.07	26.13	31.64	61.82	84.71
Greece	**77.39**	**77.39**	**8.53**	**8.97**	**85.92+**	**86.36+**
Australia	**51.74**	**77.21**	**14.33**	**16.16**	**66.07**	**93.37**
Mexico	80.41	80.41	31.66	31.66	112.07	112.07
Portugal	42.25	67.25	36.48	46.06	78.73	113.31
Austria	59.32	59.32	51.81	71.04	111.13	130.36
France	61.37	91.39	34.03	47.22	95.40	138.61
Denmark	67.48	99.64	32.47	43.41	99.95	143.05
Belgium	108.36	108.36	28.20	34.90	136.56	143.26
Japan	**109.57**	**109.57**	**32.70**	**43.75**	**142.27**	**153.32**
Italy	79.08	117.82	30.69	40.52	109.77	158.34
Germany	108.06	162.09	21.34	26.75	129.40	188.84
Luxembourg	154.65	154.65	26.34	35.74	180.99	190.39
Ireland	153.49	153.49	33.01	38.48	186.50	191.97
Turkey	**72.97**	**117.97**	**49.08**	**74.28**	**122.05**	**192.25**
Switzerland	**46.95**	**55.95**	**103.91**	**148.98**	**150.86**	**204.93**
Spain	**218.96**	**345.01**	**34.58**	**44.16**	**253.54**	**389.17**

1. Prices shown are for Videotron provision of residential line (with the customer also taking CATV service) and free calls to an IAP and Total Connectivity prices for ‘dial-up’ Internet access (direct debit payment).
2. Prices shown are for Videotron provision of residential line (with the customer not taking CATV service) and free calls to an IAP and Total Connectivity prices for ‘dial-up’ Internet access (direct debit payment).
3. Includes discount BT rates during off peak hours for the provision and usage of a residential line and Total Connectivity prices for ‘dial-up’ Internet access.
4. Countries with shaded squares have telecommunication infrastructure competition. Countries in bold do not offer an off-peak rate at 20:00 hours or, based on flat rate of unmeasured rates, pay the same amount as with standard charges.

Source: OECD

Table 18. **Internet Access Pricing and Average Residential Telephone Bills (Standard PSTN Rates), US$ PPP**

	Annual charge (@20 hours per month including IAP & PTO charges)	Annual charge (@30 hours per month including IAP and PTO charges)	OECD Residential Telecommunication Basket, 1995 (964 calls)	Annual Charge (@20 hours) / OECD Residential Basket Ratio (per cent)	Annual Charge (@30 hours) / OECD Residential Basket Ratio (per cent)
US (Florida)	384	384	389	99	99
US (Texas)	385	385	389	99	99
US (California)	390	390	389	100	100
US (Colorado)	432	432	389	111	111
Canada	303	447	266	114	168
NZ	468+	468+	385	122	122
Iceland	465	524	143	325	366
Sweden	538	597	187	288	319
Finland	630	725	313	201	232
Netherlands	818	1021	260	315	393
Greece	1031+	1036+	453	228	229
Australia	793	1120	394	201	285
UK (1)	903	1156	350	258	330
UK (2)	970	1254	350	277	358
US (Nynex)	995	1283	389	256	330
Norway	1010	1419	296	341	479
UK (3)	1072	1428	350	306	408
Portugal	1175	1705	670	175	254
Mexico	1345	1345	978	137	137
Japan	1707	1840	347	492	530
France	1280	1867	362	354	515
Austria	1561	1906	503	310	379
Denmark	1462	2111	235	621	896
Italy	1498	2171	412	363	527
Belgium	1961	2202	388	505	567
Turkey	1465	2307	603	243	383
Switzerland	1810	2459	445	407	553
Germany	1676	2454	362	463	678
Luxembourg	2397	2623	n.a.	n.a.	n.a.
Ireland	2763	3091	567	487	545
Spain	3042	4670	565	539	827
OECD (4)	1290	1655	387	334	428

1. Prices shown are for Videotron provision of residential line (with the customer not taking CATV service) and calls to an IAP and Total Connectivity prices for ‘dial-up’ Internet access at standard rates (direct debit payment).
2. Includes discount BT rates for the provision and use of a residential line and Total Connectivity prices for ‘dial-up’ Internet access. Prices include discounts.
3. Includes standard BT rates for the provision of a residential line and Total Connectivity prices for ‘dial-up’ Internet access. Prices exclude discounts.
4. OECD average includes NY City and Florida only for the US examples and BT/Total Connectivity (with discounts) and Videotron (without CATV)/Total Connectivity for the UK examples.
5. Countries with shaded squares have telecommunication infrastructure competition.

Source: OECD

Table 19. **Internet Access Pricing and Average Residential Telephone Bills (Off-Peak PSTN Rates), US$ PPP**

	Annual charge (@20 hours per month including IAP & PTO charges)	Annual charge (@30 hours per month including IAP and PTO charges)	OECD Residential Telecommunication Basket, 1995 (964 calls)	Annual Charge (@20 hours) / OECD Residential Basket Ratio (per cent)	Annual Charge (@30 hours) / OECD Residential Basket Ratio (per cent)
UK (1)	282	282	350	82	82
UK (2)	296	296	350	85	85
US (Florida)	384	384	389	99	99
Finland	440	440	313	141	141
Iceland	409	439	143	286	307
Canada	**303**	**447**	**266**	**114**	**168**
NZ	**468**	**468**	**385**	**122**	**122**
Sweden	480	509	187	257	272
UK (3)	608	712	350	174	203
Netherlands	615	717	260	237	276
US (Nynex)	765	937	389	197	241
Norway	742	1017	296	251	343
Greece	**1031**	**1036**	**453**	**228**	**229**
Australia	**793**	**1120**	**394**	**201**	**284**
Portugal	945	1360	670	141	203
Austria	1334	1564	503	265	311
France	1145	1663	362	316	459
Denmark	1199	1717	235	510	730
Mexico	**1345**	**1345**	**978**	**137**	**137**
Belgium	1639	1719	388	422	443
Japan	**1707**	**1840**	**347**	**492**	**530**
Italy	1317	1900	412	320	461
Germany	1553	2266	362	429	626
Luxembourg	2172	2285	n.a.	n.a.	n.a.
Ireland	2238	2304	567	395	406
Turkey	**1465**	**2307**	**603**	**243**	**383**
Switzerland	**1810**	**2459**	**445**	**407**	**553**
Spain	**3042**	**4670**	**565**	**539**	**827**
OECD (4)	1080	1354	387	279	350

1. Prices shown are for Videotron provision of residential line (with the customer taking CATV service) and Total Connectivity prices for 'dial-up' Internet access at off-peak rates (direct debit payment).
2. Prices shown are for Videotron provision of residential line (with the customer not taking CATV service) and Total Connectivity prices for dial-up Internet access at off-peak rates (direct debit payment).
3. Includes discount BT rates for the provision and use of a residential line and Total Connectivity prices for 'dial-up' Internet access.
4. Simple average excluding Videotron option with cable -TV.
5. Countries with shaded squares have telecommunication infrastructure competition. Countries in bold do not offer an off-peak rate at 20:00 hours or, based on flat rate of unmeasured rates, pay the same amount as with standard charges.

Source: OECD

Box 2: Banking over the Internet and Access Pricing

Internet access pricing may develop in a number of ways, some of which are difficult to foresee because they may evolve with specific applications. This does not mean that existing communication services do not offer some hints as to possible outcomes. One such development over recent years has been the use of '800 numbers' by business enabling customers to call either free of charge or at local rates. This raises the question of whether a similar development may occur with the Internet with services such as Home Banking or Shopping. Both these areas of 'on-line commerce' are growing significantly via telephone banking and home shopping via television (with orders being transacted over 800 numbers). Some believe the appeal of the Internet may be even greater. For example, it has been reported that the Wells Fargo Bank's site has logged as many customers in three months as it did in 10 years of offering its standalone PC-based banking service.[88] Accordingly, one study of the current strategies of US Banks is forecasting that they will significantly step up investments in Internet on-line systems during 1996.[89]

One interesting example of 'Internet on-line banking', in respect to access pricing, has taken place in the town of Apollo (population 2 300), near Pittsburgh, P.A., in the US. Apollo Trust Co, a community bank based in Apollo, is offering its customers free access to the Internet for one hour per day. Since the program started more than 900 people, of which 550 are from the bank's 8000 customers, have joined the service.[90] Around 100 Apollo customers are using the service for home banking. The Apollo Trust Company provided the service to non customers for the price of US$100 per annum and it is free for customers. The bank has donated free access to the town of Apollo's library, churches and two high schools and provides a bulletin board with a listing of community events. Prior to the bank offering its service, residents of the Apollo community could only access on-line services via the PSTN at long distance rates. This made access to on-line services very expensive for users in an area which has suffered substantial job losses in recent years due to restructuring in the steel industry.

The primary motive for the bank providing this service is to promote 'home banking' by Apollo Trust customers. Customers can check account balances, transfer money between accounts, review bank statements and receive information about Apollo Trust and its services. As the local telephone company has an unmeasured rate option for local telephone calls, customers can make use of their full hour per day without incurring additional PSTN charges. The bank has a 56 kbit/s leased line to an Internet backbone network for the service but they are currently looking to upgrade this to a T1 line. To date it is reported that the costs of the service have been met by the additional loans made to Internet customers. Initially approved as a one year trial the Bank now plans to continue the service. In 1996 the charging structure will be revamped, although the free hour per day will remain a permanent feature for bank customers. The primary reason for the price restructuring is to allow users to stay on-line for more than one hour per day for a fee.

Information Service providers such as America Online (AOL) are also moving to introduce banking services for their subscribers.[91] AOL and Intuit, a provider of financial software have announced that AOL subscribers will be able to carry banking services from the first half of 1996. The electronic banking service is planned to be incorporated into a normal AOL account such that subscribers can access their financial accounts in participating institutions and undertake tasks such as checking statements, balances, transferring funds and paying bills. AOL has stated that they will not have an additional surcharge on top of the normal monthly fee for the service and that the pricing of access will be at the discretion of each participating financial institution.

‘Dial-up’ Access and On-line Information Service Providers

The main focus of the previous section was the pricing of access to the Internet via ‘dial-up’ services with an IAP. It is also true that an increasing number of on-line ISPs are providing Internet access for their customers. Some of the leading ISPs include America Online, CompuServe, Delphi, the Microsoft Network (MSN), Prodigy, and prior to closure, Apple Corporation’s ‘eWorld’ **(Table 20)**. Information and Interactive Services Report (IISR) released the results of a survey for September 1995 showing that there were 9.85 million subscribers to on-line services, up 1.29 million from the same survey in June 1995 which was an increase of 78 per cent over the previous 12 months.[92] Taking onto account that approximately 15 per cent of subscribers are members of two services the household penetration rate is estimated by IISR to be around 8.4 million, which they projected would swell to 11 million by the end of 1995.

In Europe two new ventures were established in 1995, AOL-Bertelsmann Online and Europe Online, but they were yet to commence service at the time of writing.[93] As with IAP facilities, customers of ISPs generally access their networks via the PSTN. In the past the main difference between the two was that IAPs provided access to the Internet whereas ISPs provided access only to proprietary databases. In 1995 this distinction started to break down with a number of ISPs introducing Internet access and most others planning to follow in 1996.

Since several ISPs have very large and rapidly growing subscriber bases, compared to most IAPs, their decision to provide paths from their networks to the Internet will dramatically increase access. For example, by September 1995, AOL and CompuServe each had more than 3.5 million subscribers.[94] In the 3rd quarter in 1995, AOL added 800 000 additional subscribers (65 000 new subscribers per week toward the end of this period) while CompuServe added 320 000.[95] At the end of October 1995, AOL was already a leading provider of Internet access from the home and in early November 1995 passed the four million subscriber mark. According to AOL the company "...processes more than 13 million hits on the Web, delivers e-mail to four million people -- half of which is Internet mail, and AOL members post more than 70 000 messages to Newsgroups."[96] Microsoft’s MSN service added 525 000 subscribers in the first three months of service.[97]

In the past ISP pricing was based on providing customers with access to proprietary information rather than plain access to the Internet. Accordingly the price of Internet access from ISPs is much higher than IAPs because it includes access to proprietary databases. **Table 21** demonstrates the difference between accessing the Internet via several ISPs in the UK and an average of four IAPs. The basic CompuServe rate is three times more expensive for 20 hours per month and five times more expensive for 30 hours per month than the IAP average.

Recognising the need to adapt pricing to compete with IAPs, and facing the launch of MSN, a number of ISPs have been restructuring pricing. In February 1995, CompuServe reduced the price for connection charges 50 per cent to US$4.80 per hour while raising its monthly membership fee by US$1.[98] In September 1995, CompuServe further reduced its on-line charge to US$2.95 per hour while retaining the same monthly rate of US$9.95 **(Table 22)**. The option aimed at being competitive with IAPs is the ‘Super Value’ package which includes 20 hours per month of on-line time for US$24.95. This pricing option includes access to the Internet and CompuServe’s proprietary databases.

CompuServe’s US pricing is similar to the UK pricing except that customers pay a higher rate for additional hours under the ‘Super Value’ option. While CompuServe charges are generally uniform the reason CompuServe gives for charging more to customers in some parts of the world than the US is the high cost of leased lines from monopoly PTOs.[99] The same principle applies to all IAPs and ISPs paying relatively high charges to provide European connectivity.

It could be said that CompuServe's new prices are very competitive with IAPs, when access to proprietary databases is taken into account, although less so at higher levels of usage. AOL took a different approach in June 1995 when it purchased Global Network Navigator (GNN) so that its customers could subscribe to AOL's standard service with access to the Internet, or simply access to the Internet via GNN.[100] In October 1995, AOL announced the prices for accessing the Internet via GNN, without access to AOL's proprietary databases. The price for customers was US$14.95 for 20 hours of use at any time of the day and a further US$1.95 for each additional hour. The first month, including unlimited usage, is free. AOL's standard charges for its proprietary service at this time were US$9.95 per month, including five hours of on-line time, with additional hours priced at US$2.95. An additional complication in comparing prices is that ISPs periodically offer customers free on-line time for undertaking specific tasks (such as filling out questionnaires) or by paying their accounts in a particular way. For example, in November 1995, Prodigy was offering 10 free hours on-line to customers paying with a particular credit card rather than paper cheques.[101]

In practice both CompuServe and AOL are pricing 20 hours of on-line access to the Internet at US$14.95 with additional hours at US$1.95. This compares to Netcom's price for US users of US$19.95 for 40 hours with additional peak hours (9 am to midnight) being US$2.00 in October 1995. In terms of price the best option simply depends on a user's needs. Someone who only wanted 20 hours per week would be better taking, for example, the GNN option. On the other hand for someone requiring on-line time in excess of 22 hours it would be less expensive to sign up with a company such as Netcom. At the same time ISPs and IAPs are trying to differentiate their service in other areas. The major advantage Netcom has to offer 'dial-up' customers is access through more than 200 points of presence at speeds of 28.8 kbit/s. This speed is not yet offered universally by ISPs although networks are being upgraded apace. In 1995 only IAPs offer Internet access at speeds higher than 28.8 kbit/s. AOL plans to offer ISDN access to its services in 1996.[102]

Another way IAPs distinguish themselves is to offer browsers that have been developed in-house. Netcom offers a product called Netcruiser which is client/server interface to the Netcom network and, in turn, the Internet. ISPs such as CompuServe and AOL are acquiring specialist Internet companies and tools so they can incorporate Internet products with their services. In the 12 months to October 1995, AOL purchased eight companies designed to help strengthen their positioning in the Internet.[103] In March 1995 CompuServe bought SPRY Inc, a maker of an Internet navigational software, for US$100 million.[104] This acquisition enabled CompuServe to offer Spry's 'Mosaic' software through the CompuServe network. In other developments related to Internet navigation during 1995, AOL acquired the WebCrawler, an Internet search tool, while Yahoo Corporation's Internet Guide was incorporated into CompuServe's 'Mosaic in a Box'. In time certain search tools or upgraded versions of these tools, now free to use, may only be available to customers subscribing to a particular ISP or IAP. Another model would be for these tools to be advertiser supported, with IAPs and ISPs selling space in the same way broadcasters sell time over their networks.

The other major area in which ISPs and IAPs will increasingly distinguish themselves is in the area of content provision. While IAPs, in the main, initially provided plain access to the Internet with some links from their home page to search tools they are increasingly providing content. The entry of companies like AOL will probably increase this trend as they provide propriety information for their Internet only customers. This is where it becomes more difficult to make straight comparisons between companies such as GNN and Netcom. For example GNN provides subscribers with access to diverse information produced by, among others, celebrity travel writers, restaurant chefs, winery owners, and post modern authors. GNN will also be providing access to news and information from groups such as Reuters and 'The Sports Network'. In other words even the AOL's offer of Internet access via GNN without an opening to its proprietary databases, does not mean that value added content is not being built into the service.

The mixture of carriage and content to attract customers to Internet, and other on-line services, would appear to be the fundamental reason for a series of alliances and mergers. The investment made by MCI in News Corporation, prompting the merger of their on-line services, is a prime example. News Corporation purchased Delphi in 1993, while MCI has a long association with the Internet and says it is the world's largest carrier of Internet traffic with more than 40 per cent.[105] Following the News Corporation/ MCI alliance, was the creation of an alliance between AT&T and CNN Interactive to develop a range of multimedia and on-line services.[106] Indeed the Internet focus of the above companies is a prime example of the convergence of services with not only PTOs and media companies forming on-line joint ventures but IT companies, such as Microsoft through MSN and Apple Corporation via 'eWorld', establishing on-line services. In November 1995 Apple Corporation also acquired a 5.1 per cent stake in AOL.[107]

The importance of content in the new communication environment rightly receives much of the focus in the process of convergence which is bringing companies from previously diverse industries together. It is also important to realise that ISP and IAP services are significant, and increasing, platforms for communication. Jack Davies the President of AOL has stated,

> "The reality with America Online is more than 50 per cent of our usage has nothing to do with content. It is about chat, it is about e-mail, it's about posting messages on message boards. It's people communicating with other people. So anytime you hear somebody say content is king .... that is we believe a substantial myth and that the development of this medium is very much about community. It is about bringing content and community together in an interesting fashion and making it interactive and participatory rather than one way."[108]

As Internet based technologies evolve this role can be expected to increase. For example, in November 1995, a new service was announced by Mobilemedia and AOL which enables customers of AOL to send text messages to people with MobileMedia pagers.[109] The new service, which has the appearance of an e-mail service to the AOL customer, is available at no additional charge to the normal monthly fee. Like the 'electronic banking service' available to AOL subscribers, these services are evidence of an emerging trend for ISPs to provide value added communication services in a diverse range of areas. ISPs will try to add value to communities of interest that were once closed forums because they recognise that their customers want to be able to access information outside their proprietary worlds. In other words, by integrating technologies like HTML, ISPs can build in communication links from interest groups to related information for their subscribers.[110]

The other question that is raised by the entry of ISPs into the Internet access market is the impact their pricing may have on the development of IAP pricing throughout the OECD area. Compuserve's new 'Super Value' tariff structure, based on UK and US prices, could have a direct impact on IAP prices because it is less expensive than IAP prices in many OECD countries. CompuServe's new rates came into effect after the August snapshot of prices shown in **Table 11** was taken. The new rates aimed at Internet users, introduced in September 1995, were less expensive than the IAP prices for 18 countries for 20 hours of on-line time per month shown in **Table 12**. For 30 hours per month CompuServe's rates are less expensive than the IAPs shown in **Table 12** for 15 countries. CompuServe rates in the US are even more competitive because additional hours are less expensive. As they restructure their prices to compete with CompuServe other ISPs can be expected to set prices at or below these levels. Clearly for countries in which CompuServe has a local point of presence, allowing customers to call at local rates, their service will be very competitive. While AOL is less well established outside the US than CompuServe its prices to US users, for 20 hours of on-line time, are less expensive than all the representative IAPs shown in **Table 12** except for the UK for August 1995.

Most ISPs have not yet restructured their tariffs along the lines of CompuServe and AOL for the new environment but changes are expected as they introduce access from proprietary networks to the Internet. CompuServe provides on-line services to customers in more than 140 countries but unless there is a local point of presence allowing direct connections via local PSTN charges users need to pay communication surcharges. In October 1995, CompuServe had a local access points in all the Capitals of OECD countries and a large number of provincial centres, although penetration of points of presence varies from one country to another. In Germany and Japan, CompuServe has established local numbers in more than 60 cities while for several OECD countries only the Capitals have local points of presence. In Spain, for example the company has local points of presence only in Madrid and Barcelona, in Portugal only in Lisbon and Porto, and in Turkey, Ankara and Istanbul. Outside these areas, if there is not a national number CompuServe customers can reach without communication surcharges, the additional charges users pay mean the service would be significantly more expensive than an IAP with a local point of presence. For example users in New Zealand outside Auckland, Christchurch and Wellington would need to pay US$10 per hour prime time and US$6 per hour non prime time to access CompuServe. Nevertheless for the vast majority of users, Internet access is increasingly becoming global business with IAP/ISPs competing around the world irrespective of national borders.

Table 20. Selected On-line Information Service Providers

	Subscribers at 30 September 1995 (million)
America Online	3.80
CompuServe	3.54
Prodigy	1.72
Microsoft Network	0.20
Delphi	0.125
eWorld	0.115

Source: IISR via PR Newswire

Table 21. Internet Access via On-line Information Service Providers in the UK, US$PPP

	Joining Fee	Monthly	Hours Included	Additional Hours	Cost of 20 hours per month (excluding PSTN)	Cost of 30 hours per month (excluding PSTN)	Internet Access
Compuserve Standard	0	9.75	5	2.90	53.24	82.24	Yes
CompuServe Super Value	0	24.45	20	2.90	24.45	53.45	Yes
Delphi	0	15.67	4	6.27	115.99	178.68	Being introduced
eWorld	0	9.95	1	9.95	189.05	288.55	Being introduced
MSN (1)	0	7.18	2	5.09	98.88	149.82	Early 1996
Average IAP (2)	13.20	16.81	All	0	16.81	16.81	Yes

1. Microsoft monthly charges are for a customer paying a per annum fee (US$55 divided by 12).
2. The IAP average comprises the prices for Demon Internet, i-way, Total Connectivity and U-Net.
3. Prices for Europe on Line and AOL Bertlsmann Online had not been announced at the time of writing.

Source: Net Magazine, Internet Today, OECD

Table 22. CompuServe Pricing with Internet Access in the US

Features	February 1995	September 1995
Monthly Membership Fee and On-line Charges	$9.95/month; US$4.80/hour for extended services	$9.95 per month; $2.95/hour after 5 free hours
Free Hours Included in on-line Pricing	Unlimited Access to 120 basic services	5 hours of most services except premium services; basic services no longer differentiated
Electronic Mail	90 three page messages were included; extra charge for Internet mail	Mail pricing based solely on connect time; no extra charge for Internet mail
Internet Access	3 free hours; $2.50 for each additional hour	All access based on connect time
'Super Value Club'	Option not available	$24.95/month membership fee; $1.95 per hour after 20 free hours

Source: CompuServe

'Dial-up' Access and Telecommunication Tariff Trends

A process of rebalancing in the PSTN tariff structure has been occurring in the OECD area for more than a decade. The term tariff structure defines the balance between fixed and usage charges in the customer's total bill. Fixed charges comprise the price to a user for connection to the network and the rental of a line to a local exchange. Usage charges can be broadly categorised into three groups: prices for local calls, long distance calls and international calls. The major rebalancing process has been between usage charges, which have tended to fall over longer distances, and fixed charges which have tended to rise in respect to line rentals (**Figure 4**).

In general users in competitive markets have benefited more from the rebalancing process than those in markets without competition. For example while the total cost of a basket of business services continues to fall in competitive markets they have recently risen, on average, in those markets without competition (**Figure 5**). The main difference is that while fixed charges have risen in both monopoly and competitive markets between 1990 and 1995, the rise in competitive markets has been more than offset by falls in usage charges. On the other hand, in countries without infrastructure competition there has been a slight trend in the opposite direction with a recent rise in average usage charges.

There has also been a process of rebalancing underway within usage charges. In general the price of national calls over longer distances, and international calls, has been falling while the price of local calls has been rising. **Figure 6** shows the price trend for the cost of calls over different distances in competitive and non-competitive markets. The price reductions in markets with telecommunication infrastructure competition over longer distances are the most impressive. This is the market segment in which competition has been most fierce to date. Yet the average price of local calls has also been falling, due to price regulation and the introduction of local competition, in countries such as the UK. By way of contrast the trend in non-competitive markets between 1990 and 1995, has been for continuing rises in local call prices. Moreover the modest falls in long distance prices in non-competitive markets were eroded by increases between 1994 and 1995. To the extent local call charges are already a barrier to users accessing information infrastructure rises in local call prices in monopoly markets will exacerbate the problem.

In respect to rebalancing, PTOs say the new charges better reflect their costs of providing traditional telecommunication services. Nevertheless the rebalancing process has tended to be controversial because of the difficulty in precisely assigning cost causation to different parts of the network. Much of the costs involved in building and maintaining telecommunication networks are joint and common costs. Accordingly it can sometimes be an arbitrary decision as to which service has generated what share of the total cost. Moreover PTOs in a monopoly environment have generally not collected the information necessary to accurately assign costs. When the information is available separate studies can, and often do, come up with quite different results depending on their methodology. One example has been the endeavours in a number of countries to determine the cost of universal service where different methodologies have produced widely differing outcomes.

It is also true that the largest price falls in the rebalancing process have been in the most competitive market segments (long distance and international calls) and the largest rises have taken place in those market segments where competition is prohibited by regulation or is immature (local access and short distance calls). This is one of the main reasons telecommunication regulators have monitored tariff rebalancing to safeguard against PTOs unfairly shifting the burden of cost, or not passing the benefits of greater efficiency, to those market segments where there is not effective competition.

To date tariff rebalancing would have been academic if all users made use of telecommunication networks in the same way. In reality, of course, telecommunication users do not make equal use of the network. The reason that the cost of telecommunication has fallen faster for business users, than residential users, is their different use of various services. In general business users make greater use of more expensive long distance calls than residential users and consequently they have benefited more from the price reductions to long distance calls. In the new telecommunication environment a new division of users may occur, not so much between business and residential users, but users of on-line services (such as the Internet) and others continuing to only utilise traditional telecommunication services.

In future policy makers will need to be aware of the impact tariff restructuring may have on these two groups of users. Recent price restructuring introduced by France Telecom provides a good example of the impact tariff restructuring may have on different types of users.[111] Prior to the change France Telecom's customers were charged for calls within their local area in units of six minutes. In 1994, the size of most local calling areas was enlarged but the unit of call measurement was cut to three minutes. In other words subscribers could dial, at local rates, to a larger calling area but for calls beyond three minutes the charge increased (*i.e.* the price of a six minute call doubled to a location within the previous calling area but was much less expensive in the extended area). According to France Telecom almost three quarters of its local calls were unaffected by the change because they last less than three minutes. At the same time France Telecom brought down the cost of calls over longer distances by expanding the time in which units are measured from 17 second to 19 seconds.

For users of traditional telecommunication services, based on 'telephony patterns' of use, France Telecom calculated the overall restructuring represented a 2.4 per cent reduction in prices to customers.[112] In addition under the new scheme customers increased, by an average of seven times, the number of people they could call at local rates. On the other hand for 'on-line' users the changes represented a mixed blessing. While on-line users had an extended local calling area that might take in additional points of presence from IAPs, or other on-line service providers, the change doubled the cost of 30 hours of PSTN usage per month at standard rates from US$28 to US$56. Over the course of a year, while potentially having little impact on a telephony user, this would increase the bill for PSTN timed charges for an on-line user from US$339 to US$678.

The fundamental principle forwarded by France Telecom for these changes to the tariff structure was that because of technological change, distance counts less and less in the cost of providing telephony while the length of calls is becoming a key determining cost.[113] If this principle is correct France Telecom's new tariff structure better reflects underlying costs. Indeed, under the former system users of local calls at less than three minutes would appear to have been subsidising those making calls of longer duration. On the other hand the new price structure adds considerably to the cost of an on-line basket of services by making calls of a longer duration more expensive and may make such services less affordable. Yet any new policy aimed at reducing the cost of such a basket, along the lines of flat or unmeasured rate pricing would run counter to the principle behind the initial rebalancing. Such is the dilemma for PTOs in the new communication environment.

It is also true that France Telecom's changes, announced in 1993, may reflect the thinking of PTOs in the pre-competitive world of local telecommunication. For example, with increasing local competition in sight, NTT has introduced a flat rate tariff for off-peak hours which the company says is not based on distance or duration. In its "1995 Annual Report" NTT noted that affordable rate structures, that reflect diversified needs, will be increasingly important in the new telecommunication environment. Accordingly from August 1995, NTT introduced "Telehodai" a PSTN based service which allows users to place an unlimited number of calls to specified numbers during late night and early morning hours for a flat monthly rate.[114] NTT has also provided a similar ISDN based service. NTT's new pricing direction is contrary to the principle espoused by France Telecom but is clearly a response to an increasing need of some users to access information infrastructure at more affordable prices and for the company to have a pricing structure which enables new services to be developed.

While the issue of tariff rebalancing has been relatively controversial in the past this can be expected to increase in the future because of its impact on the use of information infrastructure for those countries heading in the France Telecom rather than the NTT direction. In the telecommunication trade press the issue of raising local call charges is just beginning to receive attention in respect to on-line services. For example, an article entitled "On-line Customers Hit by Telekom Price Hike" in *European Telecommunications* noted that while Deutsche Telekom was bringing down the cost of long distance calls its proposed tariff schedule will increase the cost of local calls by as much as 156 per cent.[115] The article quoted a user stating the belief that the new tariff structure would slow the development of information infrastructure. Barry Berkov, a CompuServe executive has stated:

> "Even if we have a CompuServe node in your local city and even if it is a local call, your local telecom costs are likely to be more than the cost of accessing CompuServe and paying CompuServe's charges itself. I think that's a situation that definitely needs to change if we are going to see the explosion that we would like to see in the use of on-line services."[116]

How the development of on-line and Internet services over the PSTN will develop is difficult to foresee. If consumption of ISP services is any guide it suggests consumers do not like to pay surcharges, and if they view communication carriage as an additional cost in the manner of a surcharge, they may be reluctant to pay. It has been suggested that CompuServe backed away from its initial pricing structure with surcharges because AOL was able to surpass its subscriber base in a relatively short time without surcharges. In other words PTOs that want to sell value added information and entertainment based services to their customers might have to re-evaluate the underlying pricing of carriage to take this factor into account. AOL's Jack Davies says their experience has been that:

> "What consumers tell us is pricing has to be simple and affordable. Our services are charged at US$9.95 per month, five hours free - no surcharges. What consumers tell us is that they don't like surcharges, they will not pay for services with surcharges .... they are going to want it packaged all together in one simple affordable price."[117]

Price Rebalancing, New Services and Delivery Methods

The emerging problem faced by PTOs in respect to rebalancing charges will be exacerbated as they introduce new services. For example if a PTO decided, using advanced communication capabilities, to introduce video on demand over the PSTN, existing charging practices would almost certainly have to be radically restructured. In the US and Canada, the CommerceNet Nielsen study noted that average time spent using the Internet and on-line services now exceeds time spent viewing rented videotapes.[118] However this is in North American markets where unmeasured local rates are widely available. For many other OECD countries, where unmeasured rates, flat rates or relatively inexpensive local calls are unavailable even this level of on-line use may be unaffordable. In Japan, on average, people spend more than 4 hours per day on the following activities -- television, radio, videos, CDs, newspapers and magazines.[119] Hence, as NTT recognises, if it would like to provide the carriage for telecommunication and information service access in all its forms over the PSTN, new charging practices will be essential.

This raises an interesting question in respect to the pricing of different types of multi-media services. Currently users generally receive television and radio in real time whereas other forms of media content in their traditional guises are received in pre-packaged form such as CDs, rented video tapes, and newspapers. For those users that continue to need to browse or receive content on-line in real time, local charges when expensive will continue to be an obstacle to use. On the other hand existing charging practices might be less of a hurdle if content could be downloaded in a relatively short time. In other words a PTO offering a video on demand service might ask the customer to pay for the content downloaded (*e.g.* a movie) with existing local call charges if it could be quickly downloaded for replay without on-line charges. This would be a step away from usual PTOs charging practices for high speed transmission by volume. From the customer's perspective the main question would be how long it would take to download a product?

At present cable communication companies, because their inherited systems have coaxial cable providing the link to residential premises, are ahead in terms of the speed with which signals can be delivered over what PTOs can provide over the PSTN using copper wires. For example, according to a recent report on interactive television by Frost and Sullivan, cable communication companies have upgraded the number of US households capable of receiving interactive (two-way) capabilities from 1.5 million in 1993 to 10 million in 1995.[120] By way of contrast Frost and Sullivan say US PTOs will equip 1.6 million homes with 'video dial-tone' services by the end of 1996 and that this will reach 5.5 million by 2001.

The problem at present is that because regulatory environments have in the past not allowed cable communication companies to offer telecommunication services, in most OECD countries, there has been no market for the development of cable modems and set-top boxes. Where regulatory restrictions have been lifted cable communication companies are racing to bring cable modems to the market. TCI and its partners say that their '@home' service will enable "...a high-volume cable connection that pushes information at 10 megabits a second through cable wiring - directly to your computer. A movie that currently takes 27 minutes to download will take only around 9 seconds to display."[121]

It is planed for '@home' to be launched in Sunnyvale California in early 1996 and TCI and its partners aim to have one million customers in the US by the end of that year. It is hoped that widespread demand will bring down the current cost of a cable modem from US$500 to US$300 or US$200.[122] Hewlett-Packard has announced its cable modem product "HP QuickBurst" is scheduled for launch in mid-1996.[123] The company says 'QuickBurst' will offer the same access to networks that telephone modems do only at speeds 'thousands of times faster' but has not yet announced pricing.

Where regulatory regimes allow PTOs to operate cable systems they are also experimenting with cable modems (*e.g.* Bell South with Intel modems in a Georgia trial). This raises the question of whether an alternative infrastructure will be developed by PTOs in parallel with the PSTN for final delivery into small business and homes. Under this scenario the transport of PSTN traffic for the final connection to the home may be gradually transferred to the new broadband links (hybrid fibre/co-axial cable) rather than the progressive introduction of new services over the PSTN. This might allow PTOs to side-step the difficult issue of how to integrate the pricing of new and existing services because the last link would be delivered on separate infrastructure. This network model would allow PTOs to charge for different services in the same way cable communication companies charge different rates for cable television and telephony in the UK.

By introducing cable television in 1995 Australia has started much later than many other OECD countries. In practice this has meant Telstra and Optus, the two carriers licensed to provide PSTN network infrastructure, have been free to select any technology to deliver new services. Both Telstra and Optus are actively using coaxial cable as part of their broadband network expansion. In the relatively short time work has been underway Telstra has passed 600 000 homes installing more than 7 000 kilometres of coaxial cable.[124] In late 1995 Telstra was passing up to 5 000 homes per day with coaxial cable. Use of coaxial cable by both Telstra and Optus suggests they believe that the last part of delivery of some new services by existing copper wires, is still some way off as a technology of first choice.

The view that hybrid fibre/coaxial cable networks will be the most prevalent network architecture, in the short to medium term, is also espoused by Frost and Sullivan.[125] Still, either because regulation prohibits PTOs offering cable television service or because they wish to more efficiently utilise existing infrastructure, many PTOs are conducting trials of new services, such as video on demand, over existing infrastructure. If fixed link transmission of video services, that has in the past required coaxial cable, can be squeezed down the existing copper wires that still provide the last part of the telecommunication connections to small businesses and virtually all homes, it might significantly reduce the future cable investment requirements of PTOs. In October 1995, hopes in this direction were boosted by AT&T Microelectronics announcing the development of a set of integrated circuits able to transmit switched digital video over 'ordinary phone wire' and disclosing that a number of other companies, such as France Telecom and Southwestern Bell, planned future deployments using the technology.[126] The technology enables the transmission of up to 51.84 MBit/s from 100 to 300 metres over ordinary unshielded twisted pair wiring. Moreover the encoded video is transmitted at a different frequency to the voice band used for telephony allowing simultaneous voice and interactive video to travel over the same copper wiring.

The major benefit of such a technology is that it would enable much of the existing PSTN, the part providing the final connection to premises, to be used for new services. Fibre optic cable would be used for transmission up until the final 100 to 300 metres. However wide deployment of technologies capable of transmission of 51 Mbit/s and the fibre optic cable necessary to transport signals over longer distances to all parts of public networks are still in the future. In November 1995, Bell Atlantic announced a commitment to use AT&T Paradyne's GlobeSpan technology. Bell Atlantic and AT&T Paradyne say this technology will enable services, such as video-on-demand and Internet access, at transmission rates of up to 6 Mbit/s over existing copper wires. At this speed the GlobeSpan technology would provide speed improvements that are more than 200 times faster than those supported by a 28 Kbit/s 'dial-up' modem.

In future what will become doubly difficult for PTOs with measured rates, and who say costs are driven by duration, is to price new services differently over the same copper wire infrastructure. If a regulated or monopoly PTO, with measured pricing, lowered prices for particular telephone numbers or new services, (*e.g.* video on demand), by introducing flat rates or unmeasured rates for customers, they will be in the position of having to explain why such pricing options are not extended to users of traditional telephony services. Since the new services may be causing additional investment in networks, that would not be required for traditional services, it will become increasingly difficult to explain price increases for telephone service at a time when discounts are being offered for new services. At the same time whatever pricing schemes PTOs introduce for the PSTN they will have to be available to all service suppliers on an equal access basis or PTOs would have an anti-competitive advantage.

Price Rebalancing and Fixed Charges

It is also interesting to consider the impact Internet and on-line information service access may have on rebalancing between fixed and usage charges. There is a clear trend in the OECD area toward raising fixed charges and lowering usage charges over longer distances. In general it is not the price of connection that is raised but the cost of the rental of a telecommunication mainline. This trend has implications for the new communication environment because the first signs of a significant increase in demand for second residential mainlines is appearing in those countries with rapidly expanding Internet access. By way of example the number of Bell Atlantic's access lines increased 3.3 per cent during the third quarter of 1995 supported by a 45 per cent higher sales of second residential lines.[127] Similarly, at the end of the 3rd quarter of 1995, the number of Bell South's access lines was up 4.7 per cent from a year previous with new second residential lines accounting for 207 000 of the 493 000 new residential lines.[128] Both companies posted increased revenues and profits based on this development. Indeed in November 1995 several Ameritech subsidiaries were offering 'second line sales' to attract customers with discounted installation.

If the increase in demand for second residential lines is due to users wanting additional access to on-line services it is a promising area of new growth for PTOs. In this context it will be interesting to follow whether demand for second residential lines occurs faster in those countries with uncharged local call rates, or low rates, which enable users to stay on line for longer amounts of time and thereby generate demand for additional household lines. On the other hand raising fixed charges may discourage a major new area of growth for PTOs and may also act to slow demand for information infrastructure services.

Given the new pressures on rebalancing how might policy makers proceed. Fortunately several very robust policies are emerging to deal with these problems particularly at the local level. First and foremost competition has been a major tool in assisting with the rebalancing process because it has encouraged operators to become more efficient in meeting customer demand. Tariff rebalancing should not be a process of shifting prices to cover inefficient provision of service. A reduction in costs brought about by greater efficiency can reduce the necessity to raise prices, particularly in those cases where there is a financial loss to the PTO due to a commitment to universal service. Indeed the cost of meeting universal service obligations should fall as PTOs become more efficient. Price rebalancing in competitive markets between 1990 and 1995 has been undertaken in a way that held average prices to residential users constant while passing benefits to business users who make greater use of long distance and international telecommunication. Prices should, of course, be cost orientated but PTOs need to ensure that those costs are as close as possible to best practice level.

When rebalancing has occurred in monopoly markets, it raises the question of whether the process is simply shifting the burden of cost between different services and categories of user. Those countries that delay the introduction of competition to 'assist in the rebalancing process' may actually be providing incentives for PTOs to rebalance in directions that will ultimately prove unworkable in the new telecommunication environment. While the real key to meeting the challenge posed by new network patterns of use for rebalancing prices is to increase PTO efficiency, it is also true that competition can assist in this process by encouraging technological and service pricing innovation.

In the case of access to the PSTN, opening local markets encourages technological innovation in both the conventional PSTN and alternative infrastructure. Developments in the UK are a prime example of this trend with companies striving to improve access via the PSTN, cable communication and wireless networks. Moreover as local competition develops in Australia, Canada, Finland, New Zealand, Japan, Sweden and the US, the potential market for local competition opens up from 27 million telecommunication mainlines in the UK to more than 270 million mainlines in those OECD countries permitting infrastructure competition by 1995. Whereas cable communication operators and manufacturers previously had no incentive to develop cable modems, a very large new market is being opened up by liberalisation. More significantly for the first time there is real market pressure on PTOs, and in turn their equipment suppliers, to lower the price of access to networks and reduce the pressure for rebalancing in that direction.

Even if the rebalancing process was halted in many countries new ways of pricing networks and services are going to be needed. This is the other major contribution a competitive market can make. Indeed the first signs of pricing innovation for on-line access to information infrastructure are already evident in competitive markets. The cable communication company Videotron's offer of uncharged local calls in off-peak periods, between its customers and IAPs, is a leading example of such a tariff innovation. Recognising there is a growing market for the installation of second residential lines Videotron also offers discounted connection prices. Similarly Diamond Cable, a UK cable communications company offers a 50 per cent reduction on the rental of second lines. It would be expected that innovative pricing by cable communication companies will be further boosted when cable modems become widely available.

Competition for the provision of service at the local level need not only come from cable communication companies. Fixed wireless competition for the provision of first and second lines is expected to emerge first in the UK during 1996. After several years of testing, Ionica has announced that it will commence its fixed wireless service in some areas of the UK in March 1996.[129] Nation-wide coverage using the Northern Telecom supplied equipment is expected within five years. The Ionica system uses digital radio signals to connect homes and businesses to local exchanges. An interesting feature of this technology is that it can support one or two 'lines' to a local exchange. In other words the customer can elect to subscribe with one or two lines and change their service configuration at any time without a visit by Ionica staff. The expected benefit of this service is that the reduced cost of infrastructure provision will allow lower prices to consumers.

Introducing wireless competition is also being examined in other parts of the OECD. In Mexico Telmex has a monopoly over long distance and international PSTN services until the 1st January 1997. However in theory the local telecommunication market in Mexico has been open for several years. In practice, local competition has not developed because any new market entrant could only offer local service and would have to interconnect their network to Telmex for long distance and international services. Telmex has had a monopoly over long distance and international calls. From 1997 Telmex is required to interconnect its network and any market entrant is permitted to offer a full range of PSTN services. To this end Iusacell, a mobile cellular company, has been conducting a trial with wireless technology in order to provide an alternative to those areas without service, a long waiting list or with a poor service. Iusacell's tariffs for the trial are higher than Telmex's although less expensive than local service in many other OECD countries **(Table 23)**.

In a country with a relatively low telephone penetration rate opening markets to new suppliers will have major benefits in terms of expanding service. The FCC's Susan Ness has stated, "We believe that competition can, in fact, provide faster and better opportunities to build out an infrastructure particularly where there is a low tele-density. The competition improves incentives for innovative network solutions..."[130] In OECD countries with higher telephone penetration rates, such as Finland, local competition is being used to provide customers with choice and boost the incentives PTOs have for innovation.

For their part PTOs will not sit still in the face of competition and this will impact on rebalancing. Indeed PTOs have shown, when they are faced with competitive markets, a remarkable ability to offer innovative pricing. Developments in mobile telecommunication pricing in liberal markets provide one example where low user schemes have made networks increasingly affordable for a wider range of users.[131] Faced with increasing demand from users with a choice of supplier PTOs will adapt pricing to the needs of their customers. They will also strive to bring new technologies to the market, often ones which have been developed by cable or wireless competitors, and improve the efficiency of their own service. In short, the new telecommunication environment may produce surprising directions in tariff rebalancing in response to competition and the need to price networks differently in the recognition that not doing so would limit the growth of revenues from new services. Restricting competition to allow monopolies to rebalance in directions that may, or may not, be appropriate could significantly delay many of the potential advantages of information infrastructure.

Figure 4 Time series of business and residential baskets

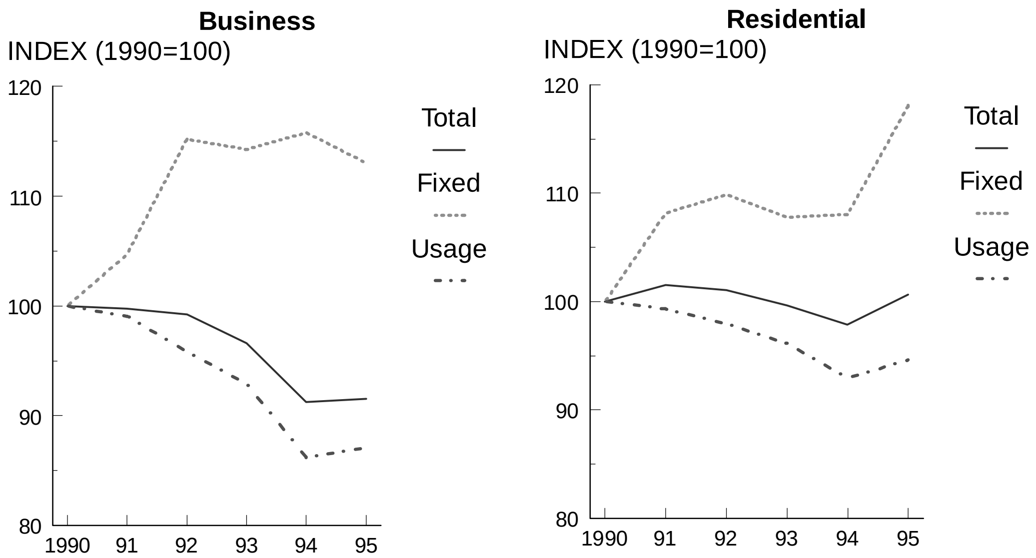


Figure 5 Comparison between different markets (Business basket)

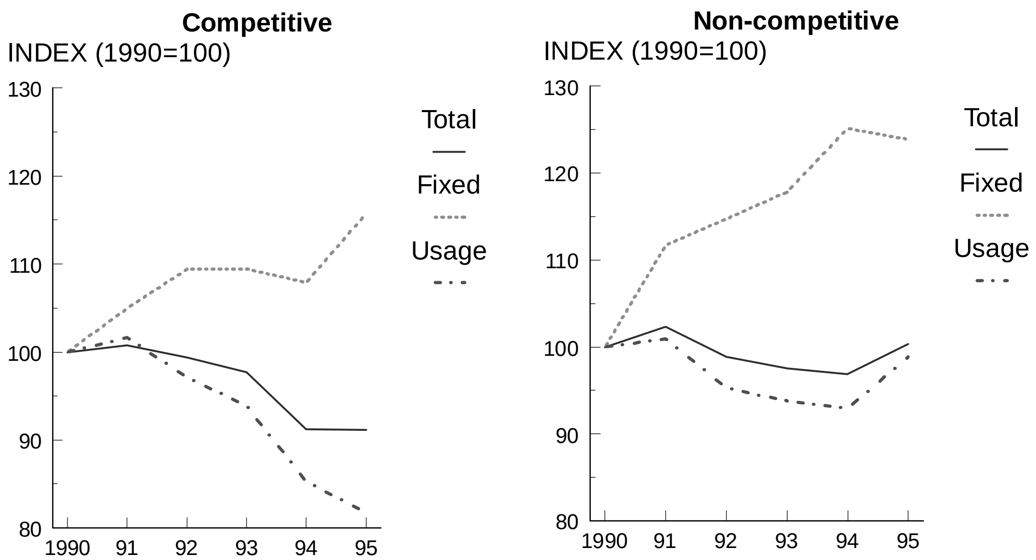


Figure 6 The impact of competition of usage charge rebalancing

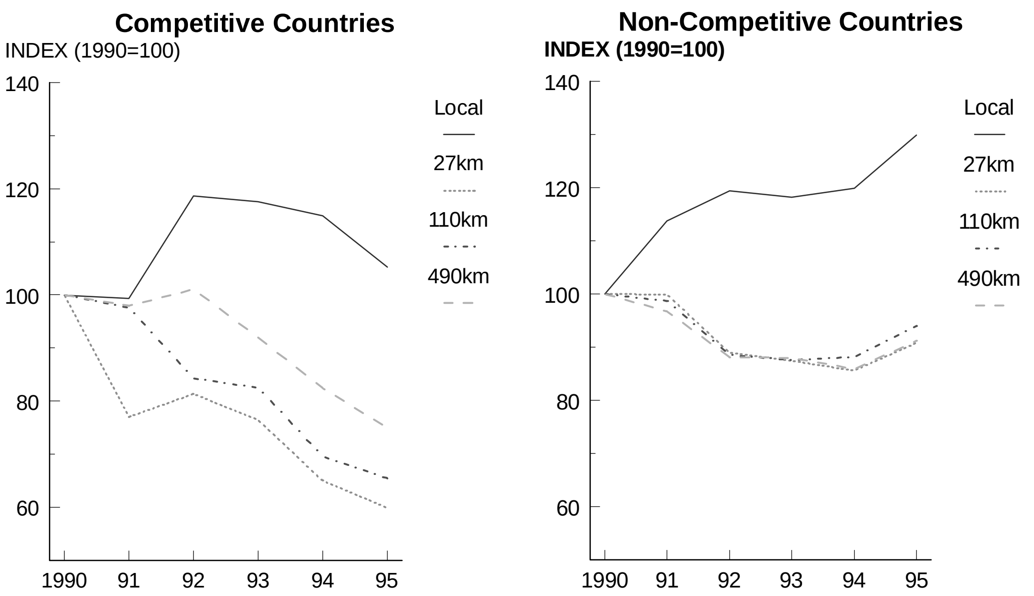


Table 23. Telmex and Iusacell Telecommunication Charges, US$

	Connection	Rental per Month	Included in Rental	Usage Charge
Telmex Business	478.00	10.67	0	0.08 per call
Telemex Residential	275.84	5.94	100 calls	0.08 per call
Iusacell Business (Trial)	723.00	42.46	1000 minutes	0.05 per minute (Standard) 0.03 per minute (Off-peak)
Iusacall Residential (Trial)	431.00	11.67	300 minutes	0.05 per minute (Standard) 0.03 per minute (Off-peak)

1. Telmex charge as at 26 October 1995 and Iusacell at 7 November 1995. The exchange rate used was 6.5 New Pesos to the US Dollar.

Source: Telmex, Iusacell, OECD

Case 1: Telephony and the Internet

In February 1995, a company named VocalTec announced it would be marketing a technology called the 'Internet Phone', which would allow users to hold voice conversations over the Internet.[132] VocalTec's Internet Phone is software that enables users to take advantage of the multi-media capabilities of personal computers to talk with other 'Internet Phone' users. Initially the technology could only enable one user to speak at a time (half duplex) in a similar manner to use of radio technologies such as citizen band radio. However in June 1995, VocalTec announced a full duplex version of the Internet Phone which enables users hold a conversation in 'real time' as they can with a call made over the PSTN.[133] The quality of the voice link is said by some to be inferior to the PSTN but acceptable.

The major initial disadvantage of the Internet Phone was that the externalities of the PSTN, in terms of the number of potential people to call, were not available based on computer to computer calls. Moreover a user could only call another party if they are both 'on-line'. The called party must have their computer switched on and be logged onto Internet. The telephone itself could, of course, be used to signal the called party either through a short call or a 'distinctive ring' where that service is available from a PTO. To expand the possibilities for calling, an on-line 'IPhone Directory' were established to enable access to a list of users. In addition the VocalTec software enables users to see who else is on-line at any one moment if the other user so wishes. In such a situation a user could then click on the name of another on-line user which results in a ringing tone at the receiver's end. The calling party is revealed to the receiving party in a similar manner to 'Caller ID' services over the PSTN.

There are no figures available for the number of users of the Internet Phone but a service has been established as a voluntary directory of users. In October 1995 there were 1 660 users registered in the 'IPhone Directory' of which 74 per cent were from the US and 8 per cent from Canada.[134] In some OECD countries there were no users registered in the directory. Nevertheless it is believed that the I-Phone directory tremendously under plays the development of the service with some 500 000 users reported to have tried the version which can be freely downloaded.[135] Moreover the Chairman of VocalTec has stated that he expects 7 million users by mid-1996.[136] Since the VocalTec IPhone was only one of a number of such products on the market by November 1995 (others include the Cyberphone, Digiphone, Netphone, Intercom(TM), WebTalk, and Webphone) it is difficult to make forecasts.

To put this in perspective, there are currently well over 400 million telecommunication mainlines, in the OECD area. Ironically, what was the major advantage of the PSTN in the initial stages of 'Internet telephony' may disappear as the technology evolves to provide computer to telephone calls. Internet telephony enthusiasts, in a mailing list created to follow this subject, reported the first computer to telephone calls in October 1995.[137] Essentially the technology works as follows. An FWD-Local Server (a PC with a soundcard and an appropriate voice modem) is used to connect with a Global FWD Server. This connection is used to send a message consisting of the telephone number prefixes (*i.e.* country code and area code) and the name of the Internet phone product being used at that site (*e.g.* IPhone, Cyberphone etc.). The next step is for a FWD-Local-Client to be used to send a local telephone number to a FWD-Local Server which then dials that number and passes voice traffic from the Internet Phone to an ordinary mainline. If the computer initiating the local call transfer does not have a dedicated connection two mainlines connected to a local exchange are needed.

Apart from ‘Internet Phone Hobbyists’, IDT Inc. has announced that it has filed a patent on a technology capable of performing the same function and that it plans to introduce a commercial service in 1996.[138] IDT, is a major provider of call back services and Internet access. An IDT spokesperson said the company planned to offer a service to be priced at US$0.10 per minute for calls made from a computer to any telephone line in the world. The service is reported to be planning to use half duplex technology for the launch with full duplex being introduced shortly after.[139]

A number of other developments are taking place that could make the service more widely available to the Internet community of users. VocalTec has announced a number of alliances aimed at making its service more widely available. In March 1995 the company announced an agreement with Motorola under which Motorola will offer the Internet Phone for distribution world-wide with Motorola’s Power Class 28.8 desktop modems. Motorola has already been bundling the ‘Mosaic browser’ with its modems. In addition a joint marketing agreement was announced with Cirrus Logic Inc., under which the Internet Phone software will be bundled with audio and modem chips sold to leading personal computer sound card and systems manufacturers. In April 1995, VocalTec and Netcom, a leading US Internet access and service provider, announced a marketing alliance. Netcom has adapted its graphical interface, known as ‘NetCruiser’, to allow it to be compatible with the Internet Phone.

In other developments during late 1995, Quarterdeck Corporation launched its WebTalk package with a full duplex Internet phone.[140] Included in Quaterdeck’s package was its Internet phone software, Mosaic browser a microphone from Labtec and one month of free Internet access with Netcom. The package was expected to be priced at less than US$50. In short, if VocalTec or Quarterdeck Internet Phones, or similar technology, is a standard option readily available to new Internet users via software bundled with other services it has the potential to expand as rapidly as Internet access.

‘Internet telephony’ technology is evolving in a number of interesting ways. For example Quaterdeck’s software comes with user controlled compression/decompression software allowing users to reduce the voice compression as needed to compensate for poor connections. The company says this technology will assist in improving clarity in the case of line noise or data loss over the Internet. Christian Huitema, Research Director of INRIA (France), has quipped that his laboratories are working on a new generation of Internet technology which will provide ‘hi-fi’ performance when the network is not congested, telephony quality when it is congested and military quality when extremely congested.[141]

Other companies are working on adding greater functionality to ‘Internet Telephony’ so that it simply becomes ‘Internet communication’. One example is the Canadian company Telescape, whose “ts-intercom(TM)” product is the first Internet software technology to enable users to exchange computer files and still images while talking to each other through an Internet connection.[142] Significantly Telescape is allowing users to download the software for free, something other suppliers had only permitted for limited trial periods.[143] Similarly, traditional telecommunication manufacturers are also developing Internet telephony products. L.M. Ericsson is reported to be incorporating a LAN Phone developed by Telecom Finland into its intelligent network platform for its entire range of public and private networks.[144] The technology is aimed at allowing corporations to take advantage of voice of the Internet by routing corporate traffic over the enterprise data networks. Ericsson is undertaking trials of the product in early 1996.

The obvious advantage of an Internet Phone is that it enables users to make national and international calls without paying the charges levied by PTOs for use of the PSTN. Of course there are costs associated with using an Internet Phone. For the IPhone a user is required to have a 486 personal computer running Microsoft Windows; a full duplex sound card or two standard sound cards; a 14.4 modem connection; a microphone; and it is recommended to have an earphone instead of a loudspeaker to eliminate acoustic feedback on full duplex connections. The IPhone full duplex software package was priced at US$69 and has been made available free to existing users in July 1995. VocalTec initially marketed a kit for US$349 that included the IPhone software, speaker phone and handset, and a PC sound card with voice compression for US$349. The new pricing structures of Quarterdeck and Telescape are clearly going to have an impact on the initial industry prices. For those users that access the Internet via 'dial-up' services over the PSTN charges would be levied according to standard PTO pricing, which in most cases would involve paying the cost of a local call(s). Moreover a user of an Internet Phone pays the IAP for providing access services via dedicated capacity or 'dial-up' options.

A user would not have to make many international calls to recoup the fixed costs of an Internet Phone. A caller who made one ten minute call per week at standard rates from France to Australia would normally pay usage charges of just under US$1 000 per year. [145] A caller who made one ten minute call per week at standard rates from Portugal to New Zealand would pay nearly US$1 500 per year while the same amount of calls from Spain to Japan would cost just under US$1 600 per year.[146]

High international rates for telephone calls have provided a growing market for international call back operators. This has prompted growing concern amongst several PTOs even though such calls still generate some revenue via accounting rates. This raises the question of whether portable computers, which can be loaded with the Internet Phone software for US$199, might be used by some of the current travelling users of international call back services. For example a European business user who travelled regularly to cities in the US could maintain a relatively inexpensive 'dial-up' Internet access account in the US and make calls back to a European head office at a fraction of the normal cost.

Netcom offers 'dial-up' connections up to speeds of 28 Kbit/s in over 40 states, and more than 200 points of presence in the US for a flat fee of US$19.95 per month. This rate includes 40 hours at primetime (weekdays, 9am to midnight, local time) with weekends and off-peak time free of charge. At current PSTN prices, the monthly Netcom charge represents the equivalent of between 10 and 20 minutes of international telephone calls per month to European countries. The price to a European business traveller making 30 minutes of calls per day for 20 days per month at standard rates from the US to their Paris headquarters would normally be US$600. In this case the potential saving for this business user by having a 'dial-up' account would be in the range of US$520 to US$580 depending on the cost of local calls. Indeed it is not difficult to imagine organisations such as airports and hotels offering 'dial-up' Internet access as a service to business customers. In fact these organisations may well lease lines from an IAP or PTO and provide a 'free' service to customers with portable computers.

On the other hand there is also potential for US business users travelling in Europe to access Internet via 'dial-up' accounts. A number of pan-European IAP networks are developing including EUnet and Pipex. EUnet offers a 'dial-up' option named 'EUnet Traveller' which allows subscribers to access the Internet via local points of presence in most European countries. Customers are charged US$36 to join the service and make a monthly payment of US$36 which includes three hours connection time. If a US business user made only three hours of calls per month to the US from various European countries the savings would range from US$81 to US$277. Additional connection time from EUnet would be priced at US$0.20 per minute which is a third of the cost of an international call between the UK and US, the least expensive PTSN route between the US and Europe. While the difference is impressive much greater savings could be made on more expensive routes where rates can be as high as US$1.74 per minute between European countries and the US.

Policy Implications of Internet Telephony

The major policy implication of ‘Internet telephony’, irrespective of the regulation of national and international telecommunication, is that it is not going to be possible to maintain monopolies in the new telecommunication environment. Service providers such as IDT or VocalTec and non commercial groups such as the ‘Free World Dial-up’ project can offer international ‘telephony like’ services, that while not emulating the quality of the PSTN in every respect, will enable circumvention of PTO international charging practices. Given the pace with which these technologies are developing the extension of monopoly provision of PSTN services agreed by the European Union for some of its Member countries -- Greece, Ireland, Portugal -- for five years beyond 1998 may not, in any meaningful sense, be practical.[147]

Inevitably, there will be discussion of whether such services fall within the bounds of what is permissible under the variety of communication regulation that exists throughout the OECD area. Whether it is permissible or not in each case could only be determined by how national authorities eventually come to define Internet telephony. There is no suggestion that past liberalisation, such as the ability of users to connect their own equipment to networks (including PCs) or the competitive provision of facilities for data communications will be wound back. Rather it depends on the definition of what type of telecommunication service ‘Internet telephony’ is defined as, in relation to existing regulation.

For example, ‘Internet telephony’ would be permissible in all OECD countries if it came to be seen as a value added service. In the UK value added services include services such as e-mail, voicemail, store and forward fax and videoconferencing. Since Internet telephony provides a number of features that telephony services do not, and could not, it might be expected that a strong case could be made that it is a value added service. However, the way telecommunication legislation is framed, value added services are sometimes defined by what they are not. To continue with the UK example, the official guidance in relation to telecommunication service licensing (TSL) states:

> “For the purposes of the TSL, a basic voice service is defined as one which consists of two-way live speech telephone calls, (and would be so even if there were other additional elements to the service), and a basic data service is one which consists of services not containing live speech and including only such switching, processing data storage or protocol conversion necessary for the real time conveyance of a message. Anything which does not fall into either of these categories can be regarded as a value added service for the purposes of a TSL.”[148]

Accordingly UK policy makers and their colleagues in other countries will need to decide where Internet telephony fits into a diverse range of national regulatory regimes. This will not be an easy task because Internet telephony is evolving into Internet communication. The Telescape service, which allows the transfer of images and files with voice, is an interesting case in point and the technology will continue to evolve. Many ISPs and IAPs are now moving to provide users with space for personal home pages (at no additional charge). It is not difficult to imagine services in the not too distant future whereby users freely exchange data (including voice and images) between these pages.

Additional complexity may arise for policy makers and regulators in the consideration of computer to telephone calls. When international Internet telephony calls are transferred back into the local PSTN, after being transported internationally through the Internet, this may be viewed under regulation pertaining to international resale. In the UK resale is defined as ‘One-end resale’ or ‘International simple resale’.[149] One-end resale refers to the situation in which a reseller sells services over private leased circuits to third parties and a call does not break out into the PSTN at both ends of the network. International simple resale on the other hand involves services which do break out into the PSTN at both ends of the network. In the case of the UK, international simple voice resale is only permitted by licensed providers to particular countries (Australia, Canada, Sweden and the US). While the UK allows international simple data resale to all EC and EEA countries without licences. Accordingly if Internet telephony was to be categorised under one of these categories of service, and service providers met the appropriate criteria, it would be permissible in the UK.

Those countries that do not allow 'one-ended international resale' or 'international simple resale' might regard a call commenced by a 'dial-up' user in one country, being transferred by the Internet to another country, and finally emerging in the PSTN of that country, as being prohibited by their national regulation. Of course it may be difficult to characterise or explain, such as service as resale, if no commercial transaction has taken place along the lines of the 'Free World Dial-up project'.

While Internet telephony may be bypassing voice services over the PSTN, and the associated charging practices (including the accounting rate system), payment is being made for every step in the process. The opportunity arises because of the radically different way of pricing international voice services made via the PSTN and the pricing of international leased lines. In other words, the argument made by some PTOs that 'call back' services are not paying for the network signalling function used to initiate a return call, would not be applicable to Internet telephony.

A user of an Internet telephone has to be connected to an IAP and the PSTN. When a call is made from Amsterdam to Paris, a caller would pay the cost of a local call from their premises to those of the IAP (to PTT Netherlands) and for the right to access the IAP facilities. The IAP has paid for the technology which manages traffic and for the leased lines necessary to connect their premises to an Internet gateway -- for example to the Commercial Internet Exchange. Some of the larger IAPs lease international lines to directly transport traffic between their facilities in different countries. At the point at which the call is completed in Paris, for a computer to computer call, another Internet user has paid an IAP for access and France Telecom for the cost of a local call. If it is a 'Free World Dial-up' computer to telephone call, involving a third party, then France Telecom is paid for two local calls.

Even if some Member countries eventually feel it to be desirable to legislate, or enforce regulation, against Internet telephony, it would be no easy task, as the experience of some countries outside the OECD area trying to restrict call-back services has shown. The major difference between the two is that Internet telephony has the potential to completely bypass the accounting rate system whereas call-back services or refile of traffic simply shift the flow of traffic. Internet telephony, on the other hand, bypasses international pricing completely by providing a PC/Server based alternative using data networks to national and international switching. Trying to regulate against individual business and residential users taking advantage of the increasing capabilities of their own equipment would be extremely difficult if not impossible.

If regulating against such service is not practical the obvious temptation for monopoly PTOs is to ration the amount of capacity available for Internet access. This would limit the growth of traffic capable of being carried by the Internet -- but at the cost of raising prices and other obstacles for the efficient use of networks by business users. In competitive markets PTOs will respond by providing more capacity and offering increasingly competitive tariffication. The extent to which either of these scenarios develops will depend on the speed of technological and market developments. Experts may disagree on the timetable but they generally see the broad thrust of technological developments in Internet telephony being in the same direction **(Box 3).**

The immediate impact of 'Internet telephony', like call-back services, is going to be to increase pressure for reform of accounting rates and international telephone pricing structures. In fact it may multiply the pressure because the accounting rate system ensured PTOs still receive a termination payment for a call which had been reversed by a call back operator. In the world of Internet telephony, a PTO may receive only the revenue generated by one or two local calls depending on whether it is a computer to computer or a computer to telephone call. In practice the potential for bypass will increase proportionately with the number of appropriately equipped PCs. Since no OECD government in future will permit PTOs to unreasonably limit available capacity because of the enormous cost to economic and social development this raises the question of how PTOs will react to the new environment.

Box 3: Views on Internet Development

Jim Clark, the President of Netscape Communications Corporation has stated:

"In my mind the Internet is nothing but a data communications equivalent to the telephone system. In other words, the Internet system is for data what the telephone is for voice. Now, obviously when you digitise voice it becomes data, so ultimately the Internet subsumes voice, and I think over the longer term voice communication will be just about as common place on the Internet as it is over the real time telephone system."[150]

Similarly Microsoft's Anthony Bay has stated:

"We believe that other devices, particularly as they become digital will just become other devices on the Internet, whether it is television, whether it is a personal communicator or a very small PC. Essentially over time the Internet will subsume and dominate all other networks ... Fundamentally, the effects of the Internet is its elimination of distance -- and we believe at some point in the not too distant future, usage time, connectivity and time and distance."[151]

Apart from the obvious current limitations of Internet telephony, MCI's Vinton Cerf has noted:

"I do not see these (Internet telephony products) as major threats and the reason I don't yet, anyway, is that the Internet can not carry a great deal of traffic yet .... I think that these are important technologies and we must fast track them and learn how to operate them. In the long run all those bits fall through a great many of the circuits that the carriers offer and sell. So we will get revenue from that traffic. We might make less revenue from it than we do today under the current tariffing arrangements but I am often fond of pointing out that if someone else is going to eat your lunch, it might as well be you!"[152]

Robba Benjamin from Sprint agrees saying:

"...the next area of convergence really is going to be all manner of communications, video, voice, text base converging and being carried over a variety of networks, both public networks and ... enterprise networks. I think that in the short run, as Vinton Cerf says, the quality of it (Internet telephony) and the capacity on the Internet does not allow for a lot of telephony but in the long run that is not going to be a constraint and we all need to be thinking about it because it is what people want."[153]

In respect to more general Internet developments and available capacity, Netscape's Jim Clark has observed:

"The capacity of the telecommunications system is much greater than the capacity that is currently being used in the Internet. If telecommunication companies operate these networks in the backbone and the local branches of the Internet, then they have, in real time, the ability to switch in and allocate more bandwidth. Lets face it, the Internet itself is derived by capturing just small fractions of the bandwidth of the telecommunications infrastructure in any given location. So I think the prospect of having the telecommunications companies operate these networks means they can allocate bandwidth as needed. That may require changes in protocols, it may not. It may be quite possible too that Internet protocols running on top of the ATM system enable use of the Internet protocols to establish the connections and one might actually get an allocated piece of bandwidth or an allocated circuit, a provision circuit as it is called in the teleco business, that has all the bandwidth you need to deliver whatever it is that you are doing."[154]

On the other hand Vinton Cerf has cautioned:

"The issue here is not necessarily absolute transmission capacity but switching capacity as well and .... you have to get the packets through the system fast enough in order to do everything and that is probably a bigger barrier than getting the actual transmission capacity."[155]

PTO Responses to the New Environment

The application of a robust competition policy is the best way governments can assist PTOs in meeting the challenges posed by alternative traffic routing at the national or international level. It is only through the application of competition that PTOs are likely to reach the efficiency targets that are going to be needed if restructuring of tariffs in innovative ways is going to be possible. Freed from regulatory environments that are no longer appropriate for governing international telecommunication, PTOs in competitive markets will respond by slashing the price of international calls for which the international infrastructure cost (via fibre optic cable or satellite) for a voice circuit can be measured in cents. This would remove the incentive for users to purchase a PC just to make less expensive international telephone calls.

It is difficult to foresee all the potential outcomes of a world of ‘near zero tariffs’ although a multi-client private study on this subject has been undertaken.[156] Demand will almost certainly increase by a substantial amount because of lower tariffs. The main question for PTOs is whether this will offset revenue losses **(Box 4)**. For those countries that continue monopoly regulation there is a danger of creating two classes of users connected to networks. One group of users, with appropriately equipped PCs, could take advantage of the Internet to make inexpensive international calls while all other users would have to pay the standard rates from the monopoly PTO. Since it will be impossible to stop the former, governments must act to ameliorate the latter. PTOs in the most competitive markets are already planning ways to harness the potential of Internet telephony before their new rivals gain too much of a lead. Telecom Finland is working with L.M. Ericsson to provide its corporate customers with technologies capable of voice over the Internet.[157]

At the same time PTOs, are going to want to create and offer new services. One strategy will be to add value to existing services. In the new telecommunication world it will be PTOs themselves that seek to combine content and connectivity in ways which use technologies pioneered by the ‘Internet telephony’ industry. AT&T plans to develop a service that will allow a user browsing over the content on a commercial WWW page, and wanting more information, to press a ‘Talk to Me” button. The user would then be connected automatically to the vendor of the product.[158]

AT&T has articulated a strategy for migrating the skills and services it has developed in the 800 number market into the Internet. Instead of just facilitating commerce over networks as they have traditionally done, PTOs will be vigorously marketing content. One example is the launch by MCI of an 800 number service which enables customers to sample music (in 15 to 20 second sound clips) and purchase CDs and cassettes. The service could be readily offered over the Internet, and enhanced, as technologies develop. At the same time PTOs will seek to differentiate and maintain the lead of ‘their telephony’ over Internet ‘telephony’. In October 1995, MCI announced it intended to provide a service whereby a telephone user, equipped with an appropriate set top box, could use their television as a video phone. The product is expected to be available in June 1996 for US$1 000 and would allow users equipped at both ends of the line to conduct a ‘video conference’ at standard PSTN rates.

A second strategy will be to provide content and it is in this respect that existing regulation will, in many cases, need to be reviewed. Sometimes PTOs describe this as moving up the value chain, because while current network pricing often means that carriage is more expensive for consumers than content, this is not a situation that is expected to prevail in the new telecommunication environment. Placing issues of competitive safeguards to one side it is incumbent on governments to ensure that regulation does not restrict PTOs from entering new markets if they are to adequately respond to the challenges of pricing information infrastructure. It is by generating new revenue sources, both from new services and utilising their skills and expertise in those parts of the world striving to upgrade their telecommunication networks, that PTOs can best adapt to the new environment. MCI has announced that it has a target for half its revenue to be derived from value added services by the year 2000.[159] NTT has joined a consortium led by Fujitsu to open the first electronic marketplace in Japan. The consortium believe they will be addressing an overall Internet commerce market for goods and services of US$410 billion by the end of the decade.[160] This is roughly four times the current market for goods and services traded over toll free numbers.

In Australia, between 1992 and 1997, Telstra plans to invest nearly US$15 billion in response to a competitive telecommunication market.[161] This is double what was originally planned and includes US$3 billion to provide broadband services including pay television. According to Telstra its future growth will not be in networks but in content provision for pay television and the Internet. An additional benefit of PTOs entering new markets is that it creates new jobs in a sector which is rapidly downsizing.[162] Telstra says its new endeavours have created 500 jobs in its multi-media subsidiary. Similarly Ameritech, says its 'New Media Enterprises' will create 1 800 jobs as part of plans to introduce competition to cable communication companies.[163] New services are however only one option for PTOs. Telstra, and many other PTOs, have targets for how much revenue they want to generate offshore by the same date particularly in installing telecommunication infrastructure in developing countries. Liberalisation or other markets openings in countries such as China, India and Indonesia with very low telephone penetration rates, represent new opportunities for PTOs from the OECD area.

A third strategy will most likely be to provide Internet access services. Netscape's Jim Clark says, "Another thing I am sure of is that the existing telecommunications companies will be the primary Internet access providers. Companies such as MCI, AT&T, France Telecom, Deutsch Telecom, BT, the regional Bell Operating Companies in the US, NTT in Japan, these are going to be the primary points that you will call to get connected to the Net."[164] Most PTOs are already offering Internet access via leased lines or ISDN. Internet access, for dial-up users, will most likely be added to PTO telephony services as an option for customers. The Internet networking access skills which PTOs and information technology companies have not developed, have in many cases been acquired by strategic investments or outright purchases of IAPs. In Australia, Telstra purchased ARNET and Tele-Denmark has invested in Dana-Data. In Germany Deutsche Telecom has taken a minority stake in a Bertelsmann/AOL joint venture aimed at offering information services and Internet access to the home. In New Zealand, PSInet and Clear Communications have announced their intention to develop a joint venture. In the US, AT&T has formed an alliance with BBN Planet. Microsoft Corporation has invested in UUNet and Uunet is the official Internet access provider to the MSN.

The advantages of PTOs go well beyond networking capabilities in respect to expanding Internet access. PTOs, in the OECD area, already have as communication customers the overwhelming majority of potential Internet users. As John Petrillo from AT&T notes, "...we're more than lucky enough to enjoy a few natural advantages that help us understand our customers better than many companies. We bill them every month which is a powerful form of correspondence. We know where they live, we know which ones communicate a lot, we know which ones buy for value and which for price. This is a massive infrastructural capability that cannot be easily replicated."[165] Based on the most strategic of all PTO assets, access to customers, operators will adapt and migrate many of the services they have developed in competitive telecommunication markets onto the Internet.

PTOs can not afford to solely rely on existing access to customers. In competitive markets cable communication companies would share some of the same advantages as PTOs. For broadcasters, the Intercast technology promises some the same benefits (see later section). By incorporating an icon for MSN in Windows 95 Microsoft has shown how software companies can also construct access strategies. For other companies Internet access software is rapidly being bundled with an enormous range of products from computer games to CD-Roms. For example, Netcom has teamed with REV Entertainment to bundle

Internet access software and its Netcruiser browser with 'Enhanced CDs'.[166] Nevertheless, PTOs where they have been tempered by competitive markets will be formidable competitors. These PTOs will be able to adapt the skills they have honed in competitive telecommunication markets to develop and pioneer new markets. On the other hand, the transition to the new environment for PTOs that have been shielded monopolies will be much harsher. The longer governments wait to introduce competition in areas that PTOs know well the harder it will be for these same PTOs to develop competitive services in those areas they do not know well.

Box 4: Tariff and Revenue Restructuring in PTOs

In 1992, on average, telecommunication users generated 36 minutes per person of international traffic over public switched networks in the OECD area.[167] In revenue terms this translated into US$41 per person or US$88 per mainline. The average contribution from international telecommunication to total PTO revenue was in the order US$36 billion. This represented 9.1 per cent of total PTO revenue in the OECD area. The loss of even a major part of these international revenues would not cripple PTOs that can find efficiency gains. Nevertheless a number of PTOs rely much more heavily on international traffic as a percentage of total revenue. For example, PTOs in Austria, Belgium, Denmark, Greece, Ireland, Luxembourg, the Netherlands, New Zealand, Norway and Switzerland all derive more than 20 per cent of total revenue from international telecommunication. With the exception of New Zealand all these countries have monopolies over the facilities for the provision of international PSTN services.

In times past the strategy of PTOs in the monopoly markets mentioned above would have been to rebalance tariffs by lowering international and long distance call charges but raising local call and fixed charges. Over time this would have had an effect on the structure of PTO revenues. Any change in the balance of revenues would, of course, be difficult to predict because lower prices for long distance and international calls, when efficiently marketed, generally stimulate greater demand for these services. Nevertheless, with the question of accounting rates placed to one side, such changes would have made PTOs in these countries less susceptible to bypass.

The problem in the new telecommunication environment is that rebalancing may be a less viable option for countries such as Austria, Belgium, Denmark, Ireland, Luxembourg, the Netherlands, Norway and Switzerland. All these countries have PSTN on-line baskets significantly higher than the OECD average for 20 hours of local calls per month **(Table 13)** . It may be true that Greece still has scope for rebalancing because it has relatively expensive long distance and international charges but inexpensive local charges. By having a flat rate system of charging for analogue services OTE could increase local call charges without dramatically increasing the cost of an on-line basket. This option is not available to the other PTOs given current pricing structures if users are going to stay on-line for longer than periods generated by traditional telephony.

Teléphonos de México (Telmex) provides one example of how restructuring can occur in a fairly short time period with a flat rate tariff for residential users. In the years prior to privatisation Telmex relied heavily on international services for its core revenues. Since 1989 the company's revenue streams have been restructured based on tariff rebalancing and network expansion. The number of Telmex mainlines in service increased from 4.3 million in 1988 to 7.3 million in 1993. At the same time the price for local services, including connection, monthly rental and local call charges, was increased. The combined impact of these factors has been to increase the proportional contribution of local services from 20 per cent to more than 40 per cent of total revenue **(Table 24).** At the same time the proportional contribution of international services decreased from 46.8 per cent in 1988 to 19.7 per cent in 1993.

Telmex’s rebalancing is interesting because, as with Telecom New Zealand and Telstra in Australia, it has been carried out in a way that did not significantly impact on the price of a basket on-line service. At the same time all these PTOs are very profitable. Historically Telmex has been one of the most profitable operators in the OECD area and had 31 per cent pre-tax profit as a percentage of revenue in 1994.[168] In New Zealand, another OECD country where a PTO has timed charges for business users and un-timed calls for residential users, Telecom New Zealand recorded 33 per cent pre-tax profit as a percentage of revenue in 1994. In Australia, Telstra experienced company wide record profitability in 1994, and bettered this in 1995, with a flat rate structure. While prices have fallen for long distance calls (9 per cent) and international calls (2 per cent) the price of local calls has remained the same for three years representing a real cost saving for customers of 7.7 per cent.[169] In other words rebalancing does not have to involve higher costs for a basket of local telephony or on-line services if efficiency gains can be made in the provision of service.

The Telstra, Telmex and Telecom New Zealand examples are, of course, only indicative of company wide profitability and not individual services. This means there is no firm indication, from publicly available sources, of what the long term impact restructuring may have on the profitability of individual services. Nevertheless they do show that improved performance can result in a rebalancing process whereby long distance charges can be lowered but the cost of an on-line basket not significantly increased. The key to PTOs in a most monopoly countries being able to achieve the same result is being given incentives to become more operationally efficient and innovative with the way they tariff services. Telstra has announced plans to reduce its product unit cost by 30 per cent to achieve world’s best practice benchmarks in the next two years.[170] Such a saving would more than double the total revenue brought in from the carriage of international telecommunication services and make the company far less vulnerable to any fragmentation of international revenues.

In this process Telstra is assisted by visible competition. Without competition that is visible, and bypass competition may not be visible or vigorous in the same way as full infrastructure competition, monopoly PTOs will themselves have difficulty in making the transition to the new telecommunication environment. A key outcome of the new environment is that infrastructure competition is the best policy to assist in the tariff rebalancing process because it encourages greater efficiency and innovation.

Table 24. The Changing Balance of Telmex's Revenue Structure

	1988	1989	1990	1991	1992	1993
International	46.8	42.0	29.0	23.1	21.2	19.7
National Long Distance	29.0	32.8	35.5	36.3	34.8	33.7
Local Service	20.2	20.1	31.6	36.4	40.7	42.8
Other	3.9	5.0	3.8	4.1	3.3	3.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Telmex

Case 2: Broadcasting and the Internet

The convergence of ‘Internet broadcasting’ and traditional broadcasting is going to gather pace in the next several years. Some rapidly evolving technological capabilities that could make ‘Internet broadcasting’ increasingly resemble traditional broadcasting mediums are that:

-- formerly static and one dimensional home pages will become increasingly interactive and have three dimensional characteristics;

-- home pages will increasingly resemble 'broadcasting stations' as audio and video capabilities are incorporated.

What is clear is that the new capabilities will increasingly be taken advantage of by traditional broadcasters, business, organisations and individuals to create a new class of 'broadcasting like' services. These developments raise many of the traditional issues of concern that have caused governments to regulate content of information transmitted over communication networks but, in general, most of the new services will be welcome. On the other hand in the border-less world of 'cyberspace' national enforcement of content judged undesirable or illegal is in all likelihood going to be increasingly difficult and probably impossible.[171] What can be illustrated here is the rapidly developing capabilities that will give rise to increasing pressure on existing broadcasting 'carriage' regulation. The relevance of this subject, in the context of this document, is that it is often in this area that governments have placed restrictions on PTOs.

Static to Dynamic Home Pages

To date most of the initial home pages on the world wide web have resembled not much more than what someone would see on a piece of paper. Browsers using HTML have allowed users to embed some object related information on WWW pages, including links to other pages with text, illustrations and low-quality audio and video.[172] A number of new browsers are being developed that allow interactive applications including Sun Microsystem's 'HotJava'. In September 1995 Netscape Corporation launched a new version of its browser which included 'HotJava'. By using technologies such as 'HotJava' interactive applications can be developed. For example an interactive science experiment can be simulated on screen rather than being presented as static picture with text.

Another approach to interactive home pages for the Internet is being developed by companies such as Silicon Graphics and Worlds Incorporated, who both produce navigable three-dimensional software. According to World's Incorporated, a firm using its technology could have a virtual representation of its business with information centres, sales and service departments, and training centres located on the clients desktop.[173] The advantage over traditional web pages is that images are in a three dimensional format. It is expected that improved browsers incorporating interactive capabilities will greatly improve the appeal of the Internet for marketing because users can create dynamic displays. In other words 'Internet broadcasting' is converging with traditional media for advertising and market expenditure.

Like traditional commercial media the challenge for business will be to attract potential customers to these sites. One method, for users interested in a specific category of products or a brand-name, which has not been traditionally available to broadcast media is the ability of browsers to use on-line searches to access corporate home pages. In such a world the ability to use certain keywords may become a critical resource because they can draw users interested in a specific product or need to a certain site. This potential has led to a number of businesses registering brand and product category names as domain addresses on the Internet. In 1993, Network Solutions, a company which provides registration services for the non-military portion of the Internet was registering 400 new domain names per month. In October 1994 this number had reached 2 000 names per month and some expect this to reach 20 000 names per month by the end of 1995.[174] The rush to register domain names had by September 1995 caused a five week delay. Accordingly Network Solutions commenced charging an initial fee of US$100 for two years, and an annual fee of US$50 thereafter, for the registration of second level domain names (*e.g.* nsg.gov; oecd.org or mit.edu).

In the first seven months of 1995 the number of commercial domains registered with Network Solutions' InterNIC, grew from 29 202 to 75 853.[175] A month later the number of registered commercial domains on the InterNIC had climbed to over 100 000. In the first two weeks of August 1995, Kraft Foods registered 133 product names (*e.g.* coolwhip-dom; goldencrisp-dom; handisnacks-dom; vegemite-dom) and Procter and Gamble some 52 product names (dishcare-dom; jif-dom; pampers-dom; vaporub-dom), as domain addresses. In the second two weeks of the same month both companies shifted to registering product categories as domain names. Kraft Foods registered an additional 21 domain names (*e.g.* beverages-dom; cereals-dom; cheeses-dom) and Proctor and Gamble an additional 36 domain names (*e.g.* antiperspirant-dom; beautiful-dom; headache-dom). PTOs have also not been slow to reserve addresses. As part of its strategy to make the Internet a new platform for commerce, AT&T has reserved all the current name listings in the 800 directory so that they can be used as web sites.[176] At the same time in recognition of the importance of words in e-mail addresses, Prodigy has announced that it will make this change for its subscribers.[177]

A second method, which has been the main way traditional commercial media has attracted potential customers, would be to create content to attract users to a specific site. The advantage the Internet has for business marketing products and services is that content can be created aimed at very targeted audiences in a similar way to specialist magazines. This could lead to the Internet providing a significant competitive platform for advertising to those of traditional media. On the other hand just because a corporation is good at making a product or supplying a service does not mean they have the skills to create content that will attract potential customers. This factor has created a new class of entrepreneurial companies that create home page designs for business, but in the longer term it may create a new market for those broadcasters and publishers that have also been content providers.

The creation of dynamic rather than static home pages will enable these companies to bundle content and advertising material in an interactive way which has not been possible with traditional media. Two mediums that will be increasingly used in such home pages will be audio and video technologies indicating that the Internet will progress from resembling the world of publishing to that of interactive broadcasting. Software tools such as Macromedia's Director, which allow users to create and publish multi-media content, are being developed in such a way that they are compatible with browsers and can be compressed to between half and one-eighth their original size.[178] Not only do such developments open up new opportunities for content and application producers but related developments open up the potential for 'Internet broadcasting'.

Audio and Video: The Development of 'Home Stations'

Currently users accessing the Internet with multi-media PCs and appropriate software can access audio and video services. One example is the audio technology developed by a company called Progressive Networks entitled 'Real Audio'. The real audio system consists of client server software which enables on-line users to access existing audio product for instant playback (the 'RealAudio' Player) and a technology called the Real Audio Server which enables media content providers to distribute audio over the Internet. According to the Progressive Networks company:

> "Even though audio programming has been available on the Internet and on-line services for some time, significant downloading delays have presented and obstacle to its informational, recreational and creative use. The RealAudio technology provides instant playback because it quickly and reliably plays digital audio information in its entirety direct from the server (or host) as soon as it is transmitted."[179]

Between April 1995, when this technology became commercially available, and August some 220 000 'RealAudio Players' were downloaded by users and more than 60 sites on the WWW commenced offering 'RealAudio' content. An example of a service made possible by this technology is that any user around the world can listen to a 24-hour radio news service from ABC, the US broadcaster, or music from Radio J-Wave in Japan. By November 1995, there were radio stations 'broadcasting' on the Internet in the following OECD countries -- Australia, Canada, France, Italy, Japan, Netherlands, Norway, Portugal, Sweden, the UK and US, using the real audio technology.

The hardware cost of setting up an audio site on Internet is such that the market goes well beyond established broadcasters (**Table 25**). The annual charge from Progressive Networks per simultaneous user stream ranges from US$99 down to US$34 and below. Among the business users with audio sites on the world wide web are companies marketing a diverse range of products from prescription eyeglasses, to travel and banking services. Some companies use audio technology to transmit the same advertisements as on traditional broadcasting services. As might be expected music products are also being transmitted over the Internet. Several music groups including 'Yothu Yindi' in Australia and the 'Rolling Stones' in the UK have audio sites which enable users to listen to their recordings and order products.

Major developments are also occurring in the field of video over the Internet. For example, VDOLive is a compression technology that enables motion video to be called up over the Internet.[180] The technology uses a scaleable compression algorithm and a communications protocol that allow compressed video images to run over a small amount of bandwidth. The VDOnet Corporation says the technology can enable motion video to be run at 10 to 15 frames per second with a 28.8 kbit/s modem. Similarly in October 1995, Xing Technology Corporation unveiled its "StreamWorks" software which it says will make real-time video and audio available to suitably equipped PC users accessing the Internet via 14.4 and 28.8 kbit/s modems.[181] The company says the 'StreamWorks' product enables PC users to view one or two frames per second of very high quality video while listening to FM radio quality across 28.8 kbit/s modems. At 14.4 kbit/s speeds, the company says, users can view high quality video at one frame every two seconds along with audio quality similar to AM radio.

According to the Chairman of Xing Technology, Internet television broadcasting is only one possible application with other potential uses including wider access to up-to-the-minute news programming and educational programmes. In an initial trial of the technology Xing Technology Corporation and Catholic Internet covered the Papal tour of the US in October 1995.[182] Oracle corporation has announced that it will launch a service during 1996 called WebTV, which will be aimed at providing real time video services to business users with high speed links over the Internet.[183]

While the convergence of communication and information technologies presents many new opportunities for PTOs, in respect to 'broadcasting', it is also enabling new platforms to be developed that will compete with the PSTN to deliver new services. A probable leading contender for this role is the technology being developed by the Intercast group based in the US.[184] Leading members of the Intercast group are media companies such as NBC, Turner Broadcasting's CNN Interactive, Viacom; programmer QVC; cable operator Comcast; software developers, America Online, Asymetrix, En Technology and Netscape Communications Corporation; PC manufacturers Gateway 2000, Packard Bell and technology provider Intel Corporation. The striking feature of this group, among those developing information infrastructure alliances, is the absence of PTOs. A likely reason for this is that the PSTN is not required for the broadcast delivery of ‘Internet like’ services.

The Intercast technology enables suitably equipped PCs to receive Web pages and other data combined with associated cable or broadcast television programming.[185] These pages are created in HTML format that include hyperlinks to information already stored on a users hard disk or that users can click on to reach other sites on the Internet. To users of Intercast equipped PCs the broadcast pages would appear just the same as those received over the Internet. It is at this stage if a viewer so elects that they can, using a modem and a ‘dial-up’ account with an IAP, access further WWW material from the Internet over the PSTN. The Intercast technology is being incorporated into navigational browsers such as Netscape. This means that with both the broadcast signal being received, and a connection to the rest of the Internet provided by the PSTN, the transition from one to the other will appear seamless.

The obvious advantage for the free-to-air or cable broadcaster is that they provide additional services to viewers and can sell additional services to advertisers. Content providers will be able to create interactive content -- text, graphics, video and data -- around programming. Users can watch a programme on one part of the PC screen and interact with information displayed on another. For example, an African wildlife documentary could have WWW pages broadcast with it that included background information on the animals or regions shown, contact information for local libraries or zoos. Advertisers, such as travel agencies or conservation groups, could pay to have information placed on these pages or direct hyperlinks established to their own home pages.

PTOs might have mixed feelings about the Intercast development. On the one hand Intercast represents a new source of encouragement for people to use the PSTN. In this sense Intercast is the same as advertisers on television inviting clients to ring telephone numbers to order products or the merchants purchasing 800 numbers for this purpose. In other words the PSTN is still supplying network interactivity. The Intercast technology has no backlink to a broadcasting station. Cable communication companies, where they are permitted to provide the appropriate infrastructure, could provide competition by providing an interactive link in the longer term. Yet from the launch of this service it is also true that a new competitor for the gateway to the Internet will have emerged.

By employing the Intercast technology, and attracting users with a rich variety of content, broadcasters can act as the gateway to a range of information services. For example, a consumer commencing an on-line session could begin from the home page provided by a broadcaster rather than their IAP (or their PTO if it was acting as an IAP). In that sense broadcasters could enjoy some of the benefits purported for the Microsoft Network having a built in icon on every PC running Windows 95. Moreover broadcasters have the ability to market Intercast through their existing services.

Intercast technology and broadcasts are expected to be available in the US in mid 1996 and widely available by 1997. Widespread use of Intercast technology would raise many interesting questions for the future development of the PSTN and the Internet. For example, how would networks cope with viewers of a popular programme calling up the same information at the same time. The PSTN has sometimes had problems in the past when radio or television stations have held competitions inviting the public to call a telephone number. Supporters of the Intercast product contend that this is one of the strengths of the technology. If service providers predict high levels of demand for certain information it can be part of the broadcast. On the other hand there may be a danger of creating a ‘web crush’ at particular sites as viewers compete to call up information that is not broadcast.

It is also interesting to consider what impact such a technology may have on the amount of average household 'on-line time'. In the US, on average, adults watch four to five hours of television per day. Toward the end of 1995 some of the first surveys in the area are suggesting that US citizens are starting to spend less time watching television and instead using this time on PCs in the home.[186] This trend may erode the amount of time spent watching television and boost the amount of time spent 'on-line'. If users of Intercast, or like technologies developed around broadcasting, decide they want 'interactivity' on demand as they consume broadcast services then on-line PSTN demand would considerably increase. However being on-line for four to five hours per day (112 - 140 hours per month) while watching PC based television would not be generally affordable in countries with timed local PSTN or IAP charges.

While the merging of televisions and PCs enables over the air broadcasting to act as another platform for information infrastructure, it also presents new opportunities for PTOs to utilise the increasing capabilities of their networks. For example Bell South and the Digital HDTV Grand Alliance have successfully relayed and received high-definition television images and sound over an asynchronous transfer mode (ATM) network.[187] According to Bell South digital HDTV makes it possible to merge high quality television with PCs, enabling a wide range of multimedia applications. Just as the new technologies threaten PTO's traditional sources of revenue they also bring new opportunities.

Table 25. Internet/On-line 'RealAudio' Prices, US$, August 1995

	Number of Simultaneous User Streams	One-time cost	Annual Charge
RealAudio Server A	10	1 495	995
RealAudio Server B	40	4 995	1 995
RealAudio Server C	100	9 995	3 495

1. Quotations of prices for simultaneous user streams above 100, and continuing above 1000, are available on request.

Source: Progressive Networks

Policy Implications of the Convergence of Internet Communication

To illustrate how the pace of convergence is overtaking communication regulation, the authorities responsible for broadcasting in the UK have stated that a user creating an Internet home page, without a broadcasting licence, is technically in breach of that country's communication regulation.[188] In practice, a regulatory transgression in this case would not be acted upon because it contravenes the letter rather than the intent of legislation, which was drafted and implemented long before the development of 'Internet broadcasting'. More serious are the potential regulatory barriers, which such anomalies highlight, being created by new technological and market developments in OECD countries.

In the OECD area local competition between PTOs and cable communication companies for a full range of infrastructure and service provision is only permitted in Australia, Finland, Japan, New Zealand, Sweden and some parts of the US. In the UK the country with the most advanced local competition for telecommunication services in the OECD area, competition for 'cable broadcasting' is only allowed in certain situations. Similarly, in Canada, cable communication operators are free to offer a full range of telecommunication services but PTOs are not yet permitted to offer broadcasting services.

Japan, one of the OECD pioneers in telecommunication liberalisation, does permit the small but rapidly growing cable communication companies to offer local telecommunication service. Only NTT and KDD are not allowed to provide broadcasting services.

At the close of 1995, all other OECD countries restrict competition in the provision of telecommunication infrastructure and services and some do not permit their monopoly PTOs from offering cable television service. The majority of these countries accept the benefits of competition, and many are moving to reform their market structures.[189] At the same time those countries with liberal telecommunication markets, but retaining some controls over what, or by what means, PTOs can deliver services are examining the timetable for increased liberalisation. In some cases this is to ensure that any remaining barriers to full and effective competition in the provision of local telecommunication services have been eliminated by incumbent PTOs or because governments have given undertakings to market entrants investing in new infrastructure that policy frameworks will remain unchanged for a certain defined time period.

If regulation is not modified to reflect current technological capabilities and market realities, PTOs and other service suppliers will face greater hardships in restructuring their businesses to take advantage of opportunities, and meet the challenges posed by the changes, brought about by converging markets. At the same time the definitions upon which much of regulation rests are being increasing blurred. While the pace of change does not make it easy, governments need to play a proactive role in identifying more serious obstacles to the development of information infrastructure. This must be given the highest priority by communication policy makers. Liberalisation of infrastructure by the European Union for services that have already been liberalised, such as data communication, is very positive but as the European Commission recognises this needs to be complemented by the lifting of restrictions on public switched voice services.

A fundamental starting point for this analysis is which actors in the communication, information and entertainment industries are able to offer services in what were formerly distinct markets, but which are rapidly merging into a single market. Broadcasting over the Internet provides one example of how digital communication technologies are drawing together previously distinct markets. Of course it could be pointed out that traditional broadcasting or cable signals are transmitted to the point of reception rather than being called up by the user. Nevertheless, this distinction will become increasingly semantic as the product of ‘Internet broadcasting’ comes to more and more resemble the output of traditional broadcasters.

It is true that, to date, the transmission of information via the Internet has been more akin to electronic publishing rather than broadcasting. A simple illustration of this is the use of the term ‘home page’ rather than terms associated with broadcasting (*e.g.* programme, channel, station). In other words because the Internet has had characteristics of the publishing industry, a sector which has traditionally been more lightly regulated, policy makers have rightly tended to regard the application of existing broadcasting regulation as inappropriate despite the fact that the carriage of Internet services would technically fall under broadcasting communication regulation in many OECD Member countries.

A further similarity between the Internet and the publishing industry is that any user with access to the Internet has the ‘cyberspace’ equivalent of printing press. The traditional scarcity of the radio frequency, and its practical implications for the number of broadcasting channels permissible, while still a fundamental principle in the shaping of broadcasting policy is clearly inappropriate to ‘Internet broadcasting’. While concerns have been raised that new Internet applications could create shortages of transmission capacity, a widely held view is that such problems can be overcome by allowing markets to upgrade networks and create new approaches to pricing.

If, as many envisage, the Internet is a precursor to the development of on-line electronic commerce, regulating the development of new applications over the Internet would place an unnecessary burden on all users and government agencies. Rather the dynamism of developments based on the Internet should be applied to boost economic and social development. If access to the Internet becomes as pervasive as many expect, governments are going to have to harmonise policies with technological convergence, because what appears over a telephone, television or PC may be entirely the same product or service. At the same time if the history of communication and information technologies is a good guide there will be many technologies to meet a diverse range of needs. The key policy message is that while no one is certain which technologies will provide the mix of building blocks for the future, liberal markets are better placed to capture the benefits made possible by convergence of different industry sectors.

INTERNET GLOSSARY AND REFERENCE SECTION

An excellent overview of the Internet written in lay terms is **"Economic FAQs About the Internet"** by Jeffrey K. MacKie-Mason and Hal R. Varian. The document provides answers to frequently asked questions about the Internet and an overview. It can be found at:

http://www.spp.umich.edu/ipps/papers/info-nets/Economic_FAQs/FAQs/FAQs.html

Jeffrey Mackie-Mason also administers **Telecom Information Resources** on the Internet which provides a starting point for navigating and finding information on all aspects of communication. It can be found at:

http://www.spp.umich.edu/telecom/technical-info.html

and there is a link from the OECD/ICCP page at: http://www.oecd.org/dsti/sti_ict.html

The glossary below provides a brief list of key terms and definitions found in this paper. More thorough explanations can be found in a plethora of glossaries on the Internet. A number of other Internet glossaries, although by no means an exhaustive selection, can be found at the end of the list. Some of the definitions in this glossary have been compiled using these reference sources.

Key Terms:

Client - software that requests services from another computer (called a server).

Dial-up - A way users connect to the Internet using a personal computer, a modem and the public switched telecommunication network.

Domain Names - Names that identify Internet computers in which each component refers to a different part of a network and terminal equipment (e.g. iccp.dsti@oecd.org).

Hosts (Internet) - A computer acting as an information and communication server with a direct connection to the Internet.

IAPs - Internet Access Providers (e.g. NetCom, EUnet) provide dial-up and dedicated access services using their own infrastructure (hardware and software) and that of public telecommunication operators. The initial IAPs only provided access services but many are now incorporating additional information services as part of their product range. In this respect they are converging with Internet Service Providers. A growing number of PTOs are also providing Internet access services direct to 'end users' where formerly they only provided telecommunication infrastructure.

Internet - the Internet is an interconnection of more than 50 000 public and private networks world-wide that use a common communication protocol. The Internet has been grafted onto the world's public and private telecommunication networks via a myriad of leased lines and, increasingly, capacity internally allocated by PTOs as they become direct Internet access providers. Internet backbone networks are overwhelmingly made up of capacity owned by the world's PTOs.

Internet Telephony - is software that enables users to take advantage of the multi-media capabilities of personal computers to talk with other 'Internet Phone' users.

ISDN - Integrated Services Digital Network is a telecommunication standard used to support the provision of multi-media services over the public switched telecommunication network.

ISPs - Information Service Providers (e.g. AmericaOnLine, CompuServe) formerly provided access only to proprietary databases of information. They are now converging with Internet Access Providers by providing a greater array of Internet access services.

Leased Lines - a dedicated connection between the premises of telecommunication infrastructure provider's network and a customer.

Home Page - A page on a World Wide Web site.

HTML - Hypertext Mark-up Language provides the coding mechanism for construction of home pages.

HTTP - Hypertext Transfer Protocol allows clients and servers connected to the World Wide Web to communicate.

PTOs - public telecommunication operators are telecommunication carriers that provide switched telecommunication services to the public.

PSTN - public switched telecommunication networks are the infrastructure (hardware and software) that are used by PTOs to provide services.

Router - a communication technology which directs packets of data over the most efficient route.

Server - a computer system that manages information for client computers.

SLIP/PPP - Serial Line Internet Protocol/Point-to-Point Protocol are dial-up accounts which give users access to the Internet while connected to a host computer.

Tariff Structure and Rebalancing: the term tariff structure defines the balance between fixed and usage charges in the customer's total bill. **Fixed charges** comprise the price to a user for connection to the network and the rental of a line to a local exchange. **Usage charges** can be broadly categorised into three groups: prices for local calls, long distance calls and international calls. The major **rebalancing process** has been between usage charges, which have tended to fall over longer distances, and fixed charges which have tended to rise in respect to line rentals.

TCP/IP - Transmission Control Protocol/ Internet Protocol is the communication protocol which provides a common language for inter-operation between networks. Protocols allow computers to exchange information over networks based on a common standard.

WWW - World Wide Web is a hypertext system that allows computers to communicate information over the Internet.

Other Internet Glossary Home Pages:

Glossary of Common Internet Terms
http://www.websecure.com/glossary.htm

Web-ese! Glossary of WEB Terms
http://www.tenet.edu/task/webese.html

Internet Glossary
http://www.ileaf.com/getstarted/GetStart/CL_GS_gloss.html

Words to surf the net by
http://www.vnm.com/glossary.html

Internet Glossary (University of Washington Libraries)
http://www.lib.washington.edu/libinfo/inetguides/inet2.html

WWW / Internet Glossary
http://spider.lloyd.com/~swhite/goldnet_html/wwwgloss.html

Glossary of Internet Terms
http://www.citenet.net/main/info/glossary.html

The Free On-line Dictionary of Computing
http://wombat.doc.ic.ac.uk/

Glossary for 'user-friendly Internet access'
http://grid.let.rug.nl/~bert/PROSA/rep-glossary.html

Key Internet Terms
http://www.oz.net/vr/other/terms.htm

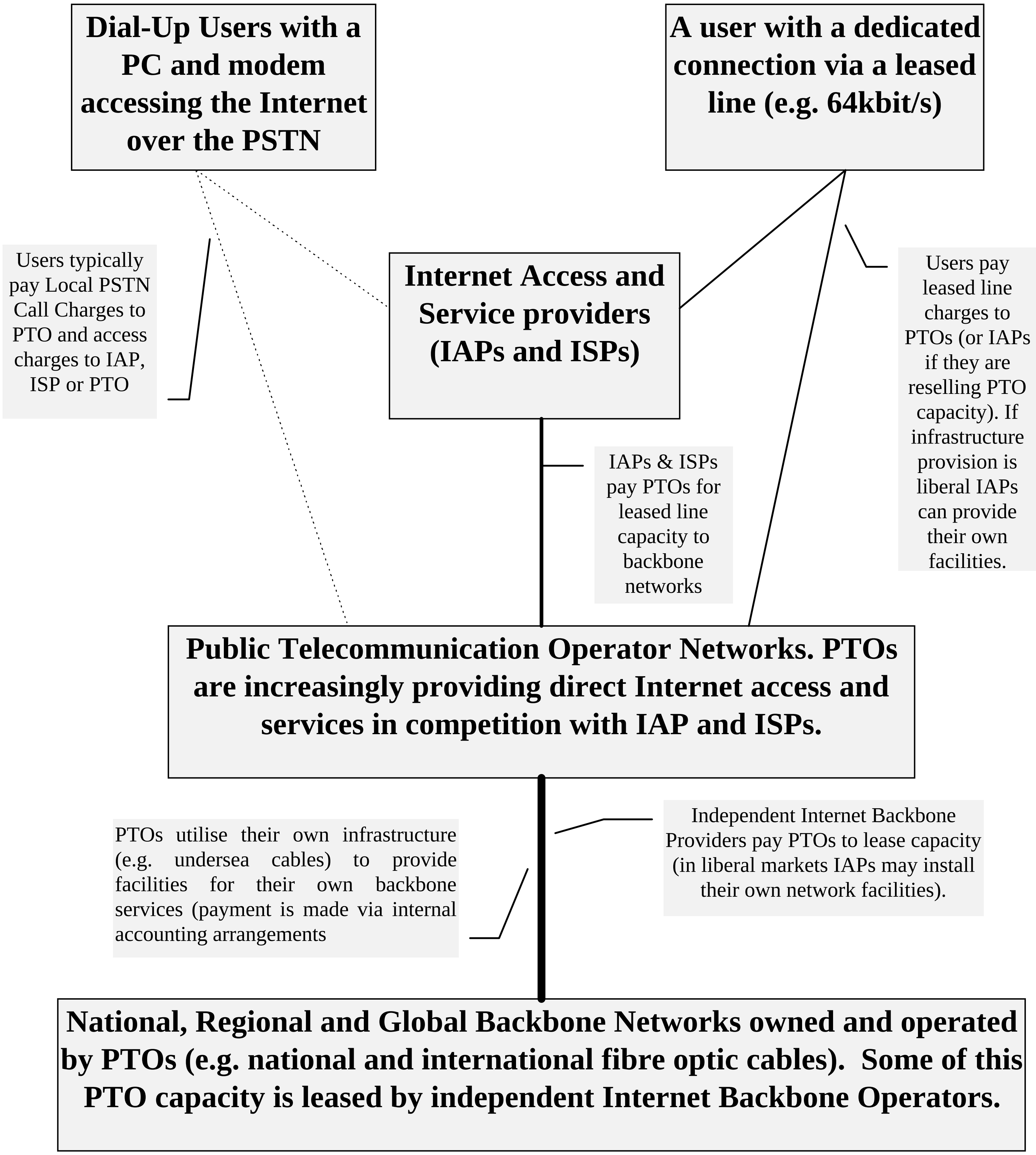
BABEL: A Glossary of Computer Oriented Abbreviations and Acronyms
http://cs.jbu.edu/science/compsci/babel95c.html

Electronic Commerce Glossary
http://www.av.qnet.com/~wearls/glossary.htm

Acronyms: Telecommunications
http://www.crimson.com/isdn/telecomacry.txt

Internet Model

The diagram below shows the relationship of the charging practices between the main actors described in this document.



NOTES

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189 For example Denmark allows cable companies to provide telecommunication services within their municipal area. However, like Mexico, the full impact of an open local market will only be realised when there is seamless competition across all telecommunication services. Denmark plans to introduce wider liberalisation in 1996.