INTERNET CONVERGENCE, PRICING AND COMMUNICATION REGULATION

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.[i] 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.[ii] 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.[iii] 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.[iv] Moreover the Chairman of VocalTec has stated that he expects 7 million users by mid-1996.[v] 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.[vi] 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.[vii] 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.[viii]

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.[ix] 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.[x]

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.[xi] Significantly Telescape is allowing users to download the software for free, something other suppliers had only permitted for limited trial periods.[xii] 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.[xiii] 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.[xiv] 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.[xv]

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.[xvi]

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."[xvii]

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'.[xviii] 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."[xix]

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."[xx]

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!"[xxi]

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."[xxii]

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."[xxiii]

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."[xxiv]

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.[xxv] 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.[xxvi]

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.[xxvii]

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.[xxviii] 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.[xxix] 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.[xxx] 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.[xxxi] 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.[xxxii] 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."[xxxiii] 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."[xxxiv] 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'.[xxxv] 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.[xxxvi] 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.[xxxvii] 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.[xxxviii] 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.[xxxix] 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 1. 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.[xl] 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.[xli] 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.[xlii] 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.[xliii] 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.[xliv] 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.[xlv] 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.[xlvi]

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.[xlvii] 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."[xlviii]

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.[xlix] 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.[l] 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.[li] 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.[lii]

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.[liii] 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.[liv] 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.[lv] 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.[lvi] 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 2. 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.[lvii] 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.[lviii] 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

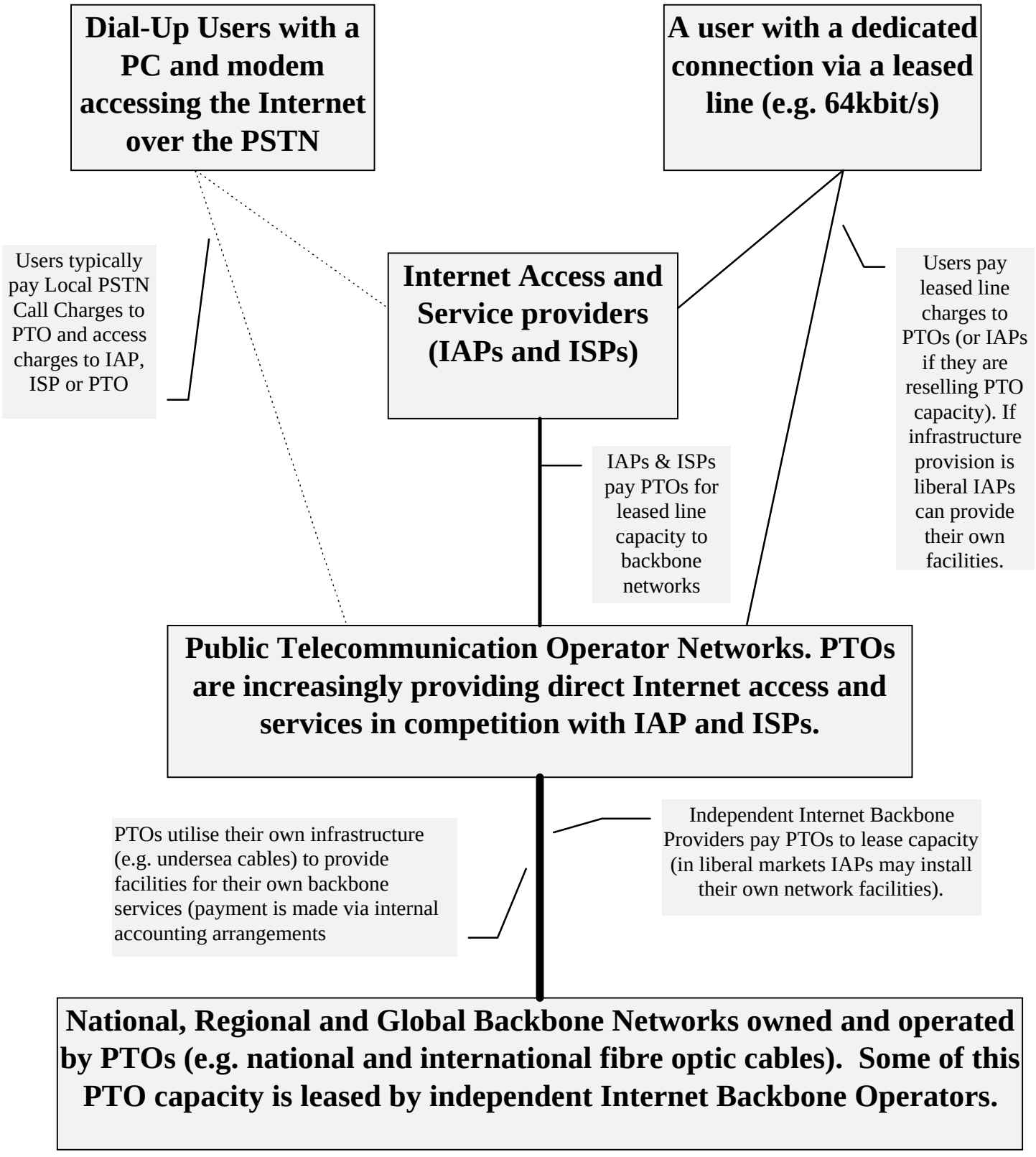
BABEL: A Glossary of Computer Oriented Abbreviations and Acronyms
http://cs.jbu.edu/science/compsci/babel95c.html

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

[i] The information on the Internet Phone in this box is taken from the VocalTec Home Page description of services and press releases.

[ii] The Internet Phone software uses a voice compression algorithm to minimise the amount of bandwidth required. Bandwidth usage is around 7.7 kbit/s of raw audio data and by adding a voice compression card VocalTec says you can reduce this to 6.72 kbit/s. The minimum connection is a modem SLP\PPP connection of 14,400 baud.

[iii] IPhone Directory, Internet, July 1995.

[iv] Refer Netwatch: http://www.pulver.com/netwatch/topten/tt24.htm

[v] Alan Cane, "VocalTec to widen range of services on Internet", *Financial Times*, 26 October 1995. p 22.

[vi] To subscribe to the mailing list, send e-mail to majordomo@pulver.com, leave the subject blank, and in the body write: subscribe free-world-dial-digest.

[vii] "IDT to offer Internet calling service", 24 October 1995.

[viii] "Company to offer 'Callback" Service Using Internet", *Telecommunication Reports*, Vol. 61, No. 3, 30 October 1995. p 30.

[ix] "Quarterdeck Launches its Qweb Phone, called WebTalk, at Comdex; offers full duplex live chat over the Internet", PR Newswire via News Page, 8 November 1995.

[x] Christian Huitema, "Keynote Address given at Internet@Telecom 95", Geneva, 7-8 October, 1995.

[xi] "Telescape Launches TS Intercom(TM), the First Software for Toll Free Long-distance Calls with Video Exchange, Realtime Quality Sound and Images Simultaneously over the Internet; Download a fully functional copy Free", PR Newswire via NewsPage, 8 November, 1995.

[xii] The Telescape site is at http://www.telescape.com and the Quarterdeck site at http://www.quarterdeck.com

[xiii] Kenneth Hart, "Startups, industry mainstays add to Internet phone menu", Communications Week International, 27 November 1995. p 6.

[xiv] Based on international telephone charges for January 1, 1994 shown in the "Communications Outlook", OECD, Paris, 1995.

[xv] *Ibid*

[xvi] Spain has elected not to take up the extension.

[xvii] Department of Trade and Industry, "Guidance notes for companies wishing to provide international resale services", Telecommunications Division, October 1994.

[xviii] *Ibid*

[xix] Jim Clark, "Keynote Address given at Internet@Telecom 95", Geneva, 7 October 1995.

[xx] Bay, Op.cit.

[xxi] Remarks made by Vinton Cerf, "Session 1: State of the Internet", Panel Discussion, Internet@Telecom 95, Op.cit.

[xxii] Remarks made by Robba Benjamin, "Session 1: State of the Internet", Panel Discussion, Internet@Telecom 95, Geneva, 7 October 1995.

[xxiii] Remarks made by Jim Clark, "Session 1: State of the Internet", Panel Discussion, Internet@Telecom 95, Geneva, 7 October 1995.

[xxiv] Remarks made by Vinton Cerf, "Session 1: State of the Internet", Op.cit.

[xxv] Cambridge Strategic Management Group and CSC Index, "The Macro-Economic Effects of Near-Zero Tariff Telecommunications", Paris 1994.

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[xxvii] Petrillo, Op.cit.

[xxviii] Remarks made by Vinton Cerf, "Internet@Telecom 95 - Session 2: Internet Strategies of On-line Services", Op.cit.

[xxix] "Trial Marketplace in Japan", Net News, Delphi Australia, 17 November 1995.

[xxx] "Telstra Doubles Investment", *The Australian*, via Net News, Delphi Australia Home Page, 22 November 1995.

[xxxi] ICCP, "Restructuring in Public Telecommunications Operator Employment", OECD/GD(95)99, Paris 1995. This document is available on the OECD/ICCP home page at http://www.oecd.org

[xxxii] "Ameritech Preparing to offer Cable TV on Chicago's South Side", *PR Newswire via NewsPage*, 20 November 1995.

[xxxiii] Clark, Op.cit.

[xxxiv] Petrillo, Op.cit.

[xxxv] "Rev Entertainment, the leading developer of Enhanced CD music releases, and NETCOM On-line Communications Services Inc...", Business Wire via News Page, 9 November 1995.

[xxxvi] OECD, "Communications Outlook 1995", Paris, 1995.

[xxxvii] ITU, "World Telecom Development Report", ITU, Geneva, 1995. p 50.

[xxxviii] Telstra, "Steady Improvement at Telstra", *Press Release*, 11 September 1995.

[xxxix] Telstra, "Telstra's Financial Results for the Year Ended 30 June 1995", Refer Telstra Home Page: http://www.telstra.com.au/press

[xl] For example an area of regulation which will come under immediate challenge by Internet developments, is the prohibition in some countries of gambling, or the placing of bets, over communication networks. Already home pages have been developed outside the OECD area as 'electronic casinos' which enable anyone connected to the Internet to gamble. While these sites may contain disclaimers warning people in a particular country that they may be breaking the law in their own country by participating in a gaming activity over the Internet, enforcing such a prohibition may not be practical.

[xli] The information on HotJava is taken from Sun Microsystems home page.

[xlii] Refer World's Incorporated Home Page : http://www.worlds.net

[xliii] "The Internet Grows Up/Domain Name Services No Longer Subsidised by Taxpayers", PR Newswire, 14 September 1995.

[xliv] The information on registered domain names is available from the world wide webs site of Internet Info, a company which specialises in analysis of commercial domains registered with InterNIC.

[xlv] AT&T, "An Online Strategy for the Age of the Internet", *Op.cit.*

[xlvi] "Comdex -Prodigy Emphasizes the Internet", *Op.cit.*

[xlvii] David Bradwell, "Pleasant shock for Internet users", *The Sunday Times*, 12 November 1995. p 6.14 Refer macromedia home page at http://www.macromedia.com

[xlviii] The information on Progressive Network's technology can be found at the RealAudio web site http://www.RealAudio.com.

[xlix] Refer VDOnet Home Page at: http://vdolive.com

[l] "Attention news providers! TV stations! Entertainment industry! Xing StreamWorks squeezes video through 14.4 and 28.8 dial-up modems", *Business Wire*, 17 October 1995.

[li] "Xing Technology Corp. unveils revolutionary stream propagation product; mass network distribution technology added to StreamWorks product line", Business Wire, 17 October 1995.

[lii] Louise Kehoe, "Oracle set to bring interactive video to the Internet", *Financial Times*, 6 October, 1995. p 1.

[liii] Intercast, "Leaders in PC, Broadcast and Cable Industries Announce Formation of Industry Group to promote New Digital Medium for the Home PC.", *Press Release*, 23 October 1995.

[liv] Intercast, "The Intercast Medium: Intercast Strategic Overview", October 1995. Refer http://www.intercast.org

[lv] "Web erodes TV", Net News, Delphi Australia Home Page, 11 November 1995. refer http://www.delphi.com.au The survey was conducted by Inteco.

[lvi] "BellSouth, Grand Alliance Transmit HDTV via ATM Network: Field Tests Underscore Digital HDTV's Flexible Capabilities", PR Newswire via NewsPage, 8 November 1995. The HDTV Grand Alliance includes

the David Sarnoff Research Center, AT&T, General Instrument, MIT, Philips Consumer Electronics, Thomson Consumer Electronics and Zenith Electronics Corporation.

[lvii] Presentations by the Independent Television Commission at the PICT International Conference on "The Social and Economic Implications of Information and Communication Technologies", The Queen Elizabeth II Conference Centre, Westminster, London, 10-12 May 1995.

[lviii] 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.