Update on Internet Telephony

Michael Mueller and Claudine Tinellis look at the current state of Internet telephony in Australia

The ability to make telephone calls over the Internet is a phenomenon which has sparked worldwide interest and spawned huge industry growth in the last two years. Internet telephony is forecast to capture a significant portion of the long-distance and international call market by the turn of the century.

Continual improvements in technology are expected to overcome the technical shortcomings which are still inhibiting the widespread adoption of the technology. These improvements, coupled with significantly cheaper rates, may well see more people turn away from standard telephony, thereby reducing traditional revenue.

This paper examines the nature of Internet telephony, the base technology, its growth, regulation and the implications for the long-distance call market. Products currently available in Australia will also be discussed.

WHAT IS INTERNET TELEPHONY?

Internet telephony refers to the use of the Internet to make telephone calls. Although limited at one time to PC-to-PC communication, it now refers to the following five applications:

(i) voice mail or email with sound - a non real-time audio communication where one person sends a message to another person;

(ii) fax - a near real-time communication between two users which stores and forwards data;

(iii) voice telephony - real-time audio communication between at least two users;

(iv) desktop video conferencing - real-time audio and visual communication between at least two users; and

(v) application and document sharing - sharing of software applications and/or documents, in real-time, between at least two users.

Voice telephony over the Internet, in particular, has developed in three directions:

(i) PC-to-PC (communicating online through your PC);

(ii) PC-to-phone (making and receiving calls while connected to the Internet); and

(iii) phone-to-phone (a call is made and received using the normal telephone handset).

IP TELEPHONY GATEWAYS

Internet telephony gateways have enabled Internet telephony to extend beyond PC-to-PC communications. Gateways operate to bridge different networks. So, in the case of the Internet, gateways bridge the Public Switched Telephone Network ("PSTN") and the Internet to facilitate communication between them. More particularly, gateways facilitate voice conversations between users with telephones without needing computer or Internet access .

Calls made using gateways are carried over the local PSTN network to the nearest gateway server location. The gateway then extends the call to the destination local PSTN (the function normally performed by telecommunications companies ("telcos"). The gateways operate to digitise and compress the voice or fax signal for transmission over the Local Area Network ("LAN") and then over the Internet to the destination gateway .

Consequently, gateways have enabled communications involving voice mail, fax and voice telephony to be carried over the Internet despite that the communications may originate from and terminate to different devices including telephones, fax machines or PC's.

CIRCUIT SWITCHED VS PACKET SWITCHED

Internet telephony differs from the traditional method of voice telephony in that it is a "packet switched" network as opposed to a "circuit switched" network. This means that traditional voice telephony via the PSTN transmits data through a circuit from the user's handset to the telco's switch which is then, in turn, transmitted to the receiver's handset

Internet telephony, on the other hand, divides the data into short packets which each contain the destination address of the data. Each packet is transmitted through intermediate nodes (routers - which direct the packets towards their destination) where they are briefly stored before being transmitted to another node. The structure of the packets is defined by the Internet Protocol ("IP"), and the routing and transmission of the packets is controlled by the Transmission Control Protocol ("TCP").

Depending upon the traffic over the Internet at any one time, each packet may follow a different route to the destination address in order the achieve the most efficient transmission. The packets are reassembled into the original message once they have all reached the destination address.

RELIABILITY AND QUALITY

In circumstances where traffic conditions on the Internet are congested, routers can drop packets resulting in delayed reception of the data. Packet loss is an ongoing problem with Internet telephony as Internet usage increases. Packet loss results in clipped speech. As large packets of data are used, the loss of even one packet has an impact on the intelligibility of the transmission.

Clearly, for Internet telephony to be effective, it must be subject to imperceptible levels of delay and quality reduction, with both parties able to speak and be heard simultaneously. The real problem here is that IP was designed for data files and can tolerate delays, lost packets and retransmissions. Hence while Internet telephony uses an IP-based network, its quality will remain relatively poor.

However, improvements in the quality of Internet telephony are continually emerging. The enormous difference between bandwidth pricing for voice vis-a-vis data is too large an arbitrage opportunity for technological problems not to be overcome. The most significant

improvement came about through the introduction of gateways. In addition to providing the convenience of being able to use the telephone handset to make the call over the Internet (ie ease of connectivity), gateways also improve the quality of the transmission by providing silence and background noise suppression, echo cancellation and forward error corrections.

Improvement in voice quality through codec technology, better compression techniques and PC sound cards enabling two-way simultaneous calls are factors progressively making Internet telephony a competitive alternative to the PSTN. At best, at the moment, the quality of phone calls over the Internet is only as good as that offered by mobile telephones.

Finally, to be effective, Internet telephony will need to be able to locate and identify customers. Whereas traditional telephony assigns numbers to locations or customers, IP networks do not. This presents problems for online and other directory assistance.

ESTABLISHING INTRA-OPERABILITY STANDARDS

One difficulty preventing Internet telephony from becoming a real alternative to the PSTN is the current incompatibility of Internet telephony products. Development and adoption of standards is the key to ensuring interoperability between the products .

Progress is evident in Netscape's support of H.323, the telephony and video conferencing standard that Microsoft and Intel have promoted as an Internet telephony standard. The development of H.323 goes some way to facilitating interoperability of Internet telephony products. H.323 is a framework of standards defining how voice, data and video will be transported over the Internet. In addition, the Real-Time Protocol ("RTP") and the Real-Time Control Protocol ("RTCP") form part of this overall framework and define how delay-sensitive voice and video data will be given special priority - ensuring real-time communications.

IMPLICATIONS OF IP TELEPHONY

The major implication of Internet telephony is the competition it poses to telcos in the long-distance call market. Users can make long distance phone calls

via the Internet for the price of connection to the Internet Service Provider's (or "ISP's") network.

Internet telephony allows the placement of voice telephone calls which bypass part or all of the PSTN. So, in the case of long-distance or international telephone calls, users of Internet telephony will only pay the fee for Internet access which may well be fixed monthly fee. This pricing regime will apply irrespective of the duration and destination of the call. This may significantly affect the revenue telcos generate from the long-distance call market (a major source of their revenue).

The impact of Internet telephony on the long distance call market is evident in the reduction of international tariffs by as much as 90%. Examples of the tariffs offered by Internet telephony service providers are: 25 cents per minute to the US from Tokyo and Osaka; 24 cents per minute from Paraguay to the US; 10-20 cents per minute for global calling from Italy and South Korea; .07 cents per minute for a call to any point within Australia (in addition to a 25 cent access charge); and 35 cents per minute from any point in Australia to the UK, USA and New Zealand (in addition to a 25 cent access charge).

In Australia, Internet telephony charges compared with the charges of telcos Telstra and Optus, in 1997, are as follows: a 15 minute call from Sydney to Melbourne during business hours - $1.25 over the Internet compared with $4.21 for Telstra and $4.00 for Optus; and a 15 minute call from Sydney to the US over the Internet - $5.50 compared with $19.32 for Telstra and $17.97 for Optus.

IMPLICATIONS FOR THE CORPORATE SECTOR

Corporations can jump onto the Internet telephony bandwagon by utilising their own networks (intranets) to bypass the PSTN. In so doing, some US companies have reported savings of 80% off their telecommunications bills.

IMPLICATIONS FOR THE PSTN

Not only does the emergence of Internet telephony threaten to erode revenues derived from long-distance phone calls, but it also potentially undermines the existing infrastructure. By allowing end-users to bypass the PSTN partially or totally, Internet telephony may remove

incentives to upgrade networks and invest in new infrastructure .

In addition, ever-increasing Internet usage is resulting in lengthy local calls, causing significant congestion of the PSTN.

IMPLICATIONS FOR INTERNATIONAL ACCOUNTING RATES

By providing a mechanism to avoid using the PSTN, it is said that, at an international level, Internet telephony may also provide a method of evading international accounting rates for interconnection with the networks of foreign carriers.

GROWTH IN INTERNET TELEPHONY INDUSTRY

Two years ago, Internet telephony was a little known 'toy' used only by Internet hobbyists . Since then the industry has seen phenomenal growth - and that growth is set to continue.

Frost & Sullivan, an international marketing consulting firm, published a study in 1997 indicating that software and hardware manufacturers will earn US $1.89 billion in Internet telephony revenues worldwide by the end of 2001.

Between 1995 and 1996, the industry saw a 997% growth. In 1995, there was only one company selling Internet voice software. However, by the middle of 1997, there were at least 38.

A British report in 1997 predicted that 15% of all voice calls would be made via the Internet by 2000. While a US report valued 1997 sales of Internet telephony products at US$80 million . In addition, the market's worth is estimated to reach US$500 million by 1999.

Another US study published in 1997 foreshadowed that Internet telephony will steadily evolve into a reliable and broadly adopted technology for three reasons:

- quality will quickly approach acceptability;

- the economics are compelling; and

- huge markets are ripe for poaching.

The report concluded that US carriers will lose more than $3 billion to Internet telephony in 2004. Out of this, consumers

and businesses will spend nearly $2 billion on Internet telephony services and equipment (about 4% of the total long-distance calls) and save more than $1 billion.

COST SAVINGS: DRIVING GROWTH IN INTERNET TELEPHONY

The economics of Internet telephony are indeed very compelling. One can squeeze between five and ten voice calls over the same bandwidth as compared to traditional, circuit switched voice, and an even a greater number of fax sessions. The cost savings achieved by the use of Internet telephony derive from the following:

- Simple arbitrage

  ISP's lease high-capacity lines at low rates and provide Internet telephony at prices which are lower than those available from traditional voice carriers to end-users. The savings presented to ISP's by this process is similar to that provided to long distance resellers using traditional PSTN technology and leasing high capacity lines at T-1 and T-3 rates which are lower than purchasing lines separately. The opportunity for savings exists because the market for high capacity lines is competitive (as there is an oversupply of capacity which, therefore, increases buyer power), and the market for single lines is not.

- Benefits of advances in technology

  The technology which Internet telephony capitalises on enables real cost savings as compared with standard telephony. Digital compression and packet switching reduces bandwidth consumption and allows other services to use the network at the same time. The ability to functionally integrate voice, data and fax over a single link will create greater efficiencies in the use of access bandwidth.

- Regulatory regime imposing obligations on telcos but not ISPs

  For example, ISP's are not subject to the Universal Service Obligation ("USO"). The situation is similar in the United States where ISPs are free of the local access fee and Internet telephony providers generally are not

required to contribute to the Universal Service Fund. The regulatory impost on ISPs vis-a-vis telecos in Australia is discussed below.

FLEXIBILITY OF INTERNET TELEPHONY

Apart from cost savings, using the Internet to carry voice calls gives telcos greater flexibility in routing calls. For example, Telstra's voice-internet gateway (yet to be released) allows two simultaneous phone calls - one data, one voice - to be routed over the one domestic phone line. The same gateway could be used to integrate the phone system and the worldwide web, so that a user could place a voice call to a company simply by clicking on a button on the company's web-page.

In the future it is arguable that the further growth and widespread adoption of the Internet telephony will be driven more by its inherent flexibility than the cost savings it offers over traditional technologies. This is particularly so given that charges for more traditional telecoms services are closing the gap on voice-on-the-net charges. Indeed, Pulver.com's Mr Geoff Pulver and MCI's senior vice-president of data architecture Mr Vinton Cerf argue that it will be the greater flexibility of services and not price, that determines the success of Internet telephony.

AUSTRALIAN TELECOMMUNICATIONS REGULATION AND IP TELEPHONY

An ISP providing Internet telephony will be a carriage service provider within the meaning of section 87 of the Telecommunications Act 1997 (Cth) (the "Act").

In addition, such ISPs will be eligible carriage service providers within the meaning of section 245 of the Act, as they supply "a carriage service that enables end-users to access the Internet" (paragraph 245(a)(iii)). Paragraph 245(a)(i) is probably not applicable here as enquiries with the Telecommunications Industry Ombudsman ("TIO") indicate that the provision of Internet telephony is not considered to be a "standard telephone service" within the meaning of the Act.

TELECOMMUNICATIONS INDUSTRY OMBUDSMAN

As eligible service providers, ISPs must enter into the TIO scheme established under Part 10 of the Act: section 246(1). The TIO scheme enables the Ombudsman to investigate, make determinations and give directions relating to complaints about carriage services by end-users of those services eg. a complaint about billing or the manner of charging for the supply of carriage services.

UNIVERSAL SERVICE OBLIGATION

Carriage service providers, unlike carriers, are not subject to the USO. Consequently, carriage service providers are not required to contribute to the net universal service cost (a contribution to funding of losses incurred in fulfilling the USO in any financial year). This is one of the reasons why Internet telephony can be a more cost effective alternative to traditional voice telephony.

INDUSTRY DEVELOPMENT PLANS

Unlike carriers, carriage service providers are not required to prepare an Industry Development Plan and then comply with that plan in relation to their R&D activities, in addition to the specified reporting and consulting obligations (see Part 2 of Schedule 1 to the Act).

INTERCEPTION CAPABILITY REQUIREMENTS

At this stage, only carriers are required to prepare and lodge an annual interception capability plan with the Australian Communications Authority and the agency coordinator - a relatively burdensome obligation. No carriage service providers have yet been nominated by the Attorney-General under subsection 331(3) of the Act.

SPECIFIC REGULATION

Internet telephony may raise issues of pricing regulation in the future. Debate within the US context suggests that access charges will provide a subject for debate and, in turn, pressure for regulation in Australia.

Some people are calling for the US Federal Communications Commission to

take a lead in developing rules for Internet telephony providers worldwide. The intention here is to prevent the emergence of a myriad of country-specific Internet telephony regulations which is already occurring in the Czech Republic, Iceland and the European Commission. At the moment in Australia there are no regulations relating specifically to Internet telephony.

INTERNET TELEPHONY SERVICES IN AUSTRALIA

There are already a variety of service offerings on the Australian market which make use of Internet telephony.

In early 1997, ISP OzEmail launched what it said was the first commercial service in the world to provide Internet telephony using a standard telephone. The product is OzEmail Phone and it can be used to make long distance phone calls between most Australian cities, to New Zealand, the United States and Britain. OzEmail plans to offer a domestic service in the US this year, in addition to offering services throughout Europe, Japan and Hong Kong. OzEmail's Internet-based pre-paid card costs 35 cents a minute to any of its 70 international destinations.

In April 1997, Sydney-based ISP Knowledge by Design Pty Ltd became the first ISP to offer handset-to-handset phone calls over the Internet between Sydney and Hong Kong.

Australian company, Dynamic Bell, also offers an Internet telephony product - Net2Phone. This product allows computer to handset long-distance and international calls over the Internet. Dynamic Bell claims to offer savings of up to 85% off international call rates. Net2Phone uses a US central telephone switch which means that rates are not dependant on the country of origin. Effectively all calls originate from the USA. Some of the rates are as follows: Canada - US$0.13 per minute; UK - US$0.18 per minute; Australia - US$0.20 per minute; Singapore - US$0.26 per minute; and Japan - US$0.29 per minute.

Also, US-based company, USA Global Link plans to offer overseas and long distance phone calls in Australia for an initial price of 28 to 62 cents per minute . In addition, the company hopes to gain 5% of the Australian domestic and international long distance telephone market in its first year - increasing to 15 - 20% in the future.

While much of the early focus has been on ISPs, other more traditional telecommunications companies have experimented with Internet telephony. RSL Com is one of the first of what is expected to be a host of telcos offering Internet-based alternatives to their regular services.

RSL Com has released a prepaid phone card that uses internet technology to route calls at between half and one-third the cost of regular calls. It offers phone-to-phone and PC-to-phone Internet telephony services. RSL Com's service relies on a private version of the Internet, known as the Delta Three global intranet, rather than the public Internet. Calls to the US and Canada in Australia will cost a flat rate of 37 cents a minute, and calls to the UK and Ireland will cost 48 cents a minute, plus local charges to the gateway .

AT&T and Deutsche Telekom have both announced intentions in relation to Internet telephony that will impact on usage within Australia. Similarly, Optus said it was developing a voice-on-the-Internet system, and was looking to release it as a prepaid phonecard, but refused to say when such services would be available.

In 1997, Telstra unveiled its first two Internet telephony products: virtual second line ("VSL") and icon calling. VSL enables incoming calls to be diverted through Telstra's Internet PSTN gateway while the user's phone line is tied up browsing the Net. It also enables users to make outgoing calls. The icon-calling enables people browsing in organisation's website to use Telstra's popular 1800 FREECALL service to immediately talk to a person from that organisation". Icon calling is what Telstra's General Manager

of Internet Access Products, John Rolland, describes as a "convergence telephony product", that is, a product which bridges the gap between the 'voice world' and the 'web world'.

Telstra is also trialing a service which allows customers in Sydney to make telephone calls to London over the Internet. The trial, which will involve about 250 Telstra customers and last 6 months, is designed to provide Telstra with essential information to aid future product development decisions. Calls are made direct from one telephone handset, to another handset; no computer is required. So far the trial, in both customer and technical terms, has been extremely successful.

John Rolland has said that it is Telstra's intention to continue to play a leading role in all forms of telephony in Australia. Mr Rolland stated that "telephony across the Internet Protocol opens up a new technology option for Telstra over which we can continue to offer the range of telephony products." Once Telstra is satisfied that this technology can be used to offer customers reliable service, then it will consider whether to go to the next stage of integrated technology to offer a commercial service.

CONCLUSION

A new cost and revenue paradigm has arrived to challenge traditional methodologies. The Internet telephony revolution will have a significant impact on call revenues, as the industry channels more of its resources into embracing the opportunities that 'voice over the Internet' can provide. While advocates would concede that Internet telephony is not quite ready for mainstream communications, its capacity to reduce costs and integrate voice and data is already capturing the imagination of telcos and consumes alike.

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