



Voice-over-IP: The Future of Communications^{*}

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I. INTRODUCTION

Technologies that use the Internet and Internet protocol (“IP”) networks to deliver voice communications have the potential to reduce costs, support innovation, and improve access to communications services within developing countries and around the world.

However, these new technologies pose challenges for regulators, because they do not fit neatly within the regulatory model of the recent past, which in many countries has traditionally treated voice and data services differently. Especially in end-to-end applications, the introduction of voice over IP poses issues regarding: collection of universal service funds and obligations to provide universal service; payment of access or other settlement charges among local and long distance carriers and international carriers; quality of service; and the impact on the revenue of still-existing monopolies for long distance and international voice service.

Nevertheless, there seems to be a growing recognition in national and international bodies that these issues need to be resolved in ways that permit IP technologies to be used for voice communications. On balance, removing regulatory barriers to the use of IP technologies for voice can (a) advance the goal of affordable service and (b) support the deployment of the broadband networks and services that represent the future of communications in the era of digital convergence.

This memo reviews arguments as to why regulators should adopt policies that promote – or at least do not impede -- the role of IP networks in the future of communications.

II. BACKGROUND

A. *VoIP, Internet Telephony, Voice-over-the-Internet: What are they?*

The terms Voice-over-Internet Protocol (“VoIP”), IP telephony, Internet telephony, and Voice-over-the-Internet (“VoN”) are given different meanings by different commentators and in fact have no universally agreed-upon meaning. There are, however, distinctions to be kept in mind, for IP can be used in various ways for the transmission of voice. As used in this memo, –

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- VoIP is a generic term that refers to all types of voice communication using Internet protocol (IP) technology instead of traditional circuit switched technology. This includes use of packet technologies by telecommunications companies to carry voice at the core of their networks in ways that are not controlled by and not apparent to end users.
- VoN, also called Internet telephony, on the other hand is a service that end users decide to use -- it is a specialized form of VoIP in which a regular voice telephone call is transmitted via the public Internet, thus bypassing all or part of the public switched telephone network (PSTN). Internet telephony can occur between computers (computer-to-computer), between a computer and a phone (computer-to-phone), and between phones (phone-to-phone).*

B. Transmission Of Voice Using IP Networks: How Does It Work?

Here is how a VoIP transmission is completed:

Step 1: Because all transmissions must be digital, the caller's voice is digitized. This can be done by the telephone company (which is how carriers use IP in their networks), by an Internet service provider (ISP), or by a PC on your desk.

Step 2: Next using complex algorithms the digital voice is compressed and then separated into packets; and using the Internet protocol, the packets are addressed and sent across the network to be reassembled in the proper order at the destination. Again, this reassembly can be done by a carrier, and ISP, or by one's PC.

Step 3: During transmission on the Internet, packets may be lost or delayed, or errors may damage the packets. Conventional error correction techniques would request retransmission of unusable or lost packets, but if the transmission is a real-time voice communication that technique obviously would not work, so sophisticated error detection and correction systems are used to create sound to fill in the gaps. (This process stores a portion of the incoming speaker's voice, and uses a complex algorithm to "guess" the contents of the missing packets and create new sound information to enhance the communication.)

Step 4: After the packets are transmitted and arrive at the destination, the transmission is assembled and decompressed to restore the data to an approximation of the original form.

As this explanation suggests, technology that works fine for sending data may be less than perfect for voice transmissions. The technology is improving, but still the quality of a voice transmission using packet technology is inferior to a circuit-switched connection, and that difference in quality would normally be obvious to any listener. As IP technology improves, the quality advantage for voice communication enjoyed by the circuit-switched will decrease, but most experts see parity in quality as still a distant prospect.

* These definitions are based on the ones used by the European Commission in its communications.

C. Advantages of IP for Voice

Telecommunications carriers around the world have already introduced IP into their networks because it provides economic benefits over traditional telecommunications networks.

Greater Efficiency: The conventional circuit-switched technology of the PSTN requires a circuit between the telephone company's switch and the customer's premise to be open and occupied for the entire duration of a call, regardless of the amount of information transmitted. In contrast, on IP networks, all content -- whether voice, text, video, computer programs, or numerous other forms of information -- travels through the network in packets that are directed to their destination by diverse routes, sharing the same facilities most efficiently.

Lower Cost: IP systems will offer a more economical means for providing communication connections. Also -- and this is one of the sources of concern on the part of incumbent voice long distance carriers -- Internet technology makes available to anyone with a personal computer and modem the ability to bypass the long distance PSTN.

Higher Reliability: In some respects, IP networks also offer the potential for higher reliability than the circuit-switched network because IP networks automatically re-route packets around problems such as malfunctioning routers or damaged lines. Also, IP networks do not rely on a separate signaling network, which is vulnerable to outages.

Supporting Innovation: IP is a nonproprietary standard agreed on by hardware and software developers, and is free to be used by anyone. This open architecture allows entrepreneurial firms to develop new hardware and software that can seamlessly fit into the network. In contrast, the circuit switched network operates as a closed system, thus making it more difficult for innovative developers to build and implement new applications.

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Telecom carriers using IP for their internal networks can reap these benefits. However, individual users seeking to use VoIP over their PCs encounter other limitations. Specifically, IP technologies currently lack a guaranteed quality of service. The ordinary telephone network (if properly installed and maintained) is designed to offer end users a very high quality of service for real-time communications. The Internet Protocol was not designed for voice; instead, it is based on a "best efforts" principle, which means that some packets are "lost" and have to be resent, introducing time delays that are inconvenient at best for voice communications.

Despite quality of service concerns and the policy issues that need to be resolved (discussed more fully in the next section), there are several arguments why carriers stand to benefit from VoIP even in end-to-end applications:

- Faced with an uncertain landscape and increased competition, incumbents must retain customers. By offering VoIP, in and of itself, carrier's can retain customers and increase traffic.
- Moreover, introduction of IP allows carriers to offer integrated services (voice, text, audio, video) over a single connection, thereby further enhancing value to their customers and contributing to profits.
- Especially given the possibility of long distance savings, VoIP can boost consumer demand for local telephone service.
- Carriers stand to realize substantial cost savings as the IP switching equipment becomes less expensive.
- IP helps spur innovation and development. Infrastructure development on IP can take far less time and cost much less compared to the enormous costs of building out and maintaining a state-of-the-art PSTN network.

See "The Impact of VoIP in China and Asia-Pacific" by Lena Chung, Managing Director, Concert Global Clearinghouse, http://www.connect-world.com/docs/articles/cwasia2001/chung_ConcertGC_cwasia2001.asp

D. Concerns Raised by Regulators and Incumbent Carriers

Incumbent carriers and some regulators have raised a variety of concerns about Internet telephony, including:

- ***Concern:*** *Internet telephony bypasses the public switched telephone network and thus reduces the revenue of incumbents, especially long distance and international carriers.*

Response: This is really a question of how strictly and for how long a country wants to maintain telecommunications monopolies. Countries interested in promoting economic development should seek to hasten, not impede, the introduction of telecommunications competition. Competition drives down prices, thereby increasing access, and promotes innovation. Long distance and/or international voice monopolies, albeit granted for what seemed to be legitimate reasons, are in almost all cases turning out to be a drag on the development of the affordable, globally-linked communications services that are necessary to support economic development in the information age. Thus, governments addressing Internet telephony issues must ask the question: is it appropriate to revise the terms of the monopoly concession? Some governments have "bought out" long distance monopolies, concluding that it was worth the expenditure of public funds to shorten the monopoly and introduce competition.

- **Concern:** *In the same vein, Internet telephony upsets the long distance and international settlement payment mechanism.*

Response: The process of properly compensating local, long distance and international carriers for transporting and completing calls across multiple networks is a complex issue, of which VoIP is only one aspect. These complex issues need to be resolved equitably, in a way that benefits the end user while protecting the investment of carriers. But the importance and complexity of the issue should not stand in the way of the prompt introduction of new technologies. Looking at the ICT sector as a whole, the introduction of Internet telephony will increase overall usage and thereby increase overall sector revenues.

- **Concern:** *Providers of Internet telephony, if not classified as telecommunications service providers, may be exempt from the charges that are used to support universal service.*

Response: Universal service is an important objective that must be supported regardless of the treatment of one technology or another. The question of allowing Internet telephony is distinct from the question of whether providers of Internet telephony service should be required to pay universal service charges. That is, the questions of who is taxed to create a universal service fund, and what fees are charged, and how they are passed on to the consumer (or taxpayer) need to be addressed regardless of whether Internet telephony is permitted or not. The concept of universal service is being expanded to include digital services. Just because a government distinguishes for some regulatory purposes between telecommunications services on the one hand and information services or value added services on the other says nothing about the question of who bears the universal service obligation.

- **Concern:** *Quality of service (QOS) standards cannot be guaranteed by IP today's technology.*

Response: Quality of service standards are sometimes consumer friendly, and sometimes a barrier to entry. Concern for quality standards can stifle innovation. Incumbent providers frequently urge regulators to set exceedingly high quality standards that provide little marginal benefit to consumers but make entry by other providers prohibitively expensive.

Of course, basic quality standards are important and can provide consumer benefit, but they must be standards that actually benefit consumers and not simply stem from a misguided notion that higher standards are always better. Consumers are better off if they can make price and quality choices along a continuum, in which some consumers opt for high quality and high prices, while others choose low prices and relatively lower quality. In the telecommunications arena, consumers may be willing to accept reduced quality for a low price, on the theory that a bad connection (at a low price) is better than no connection at all (because a good connection is too expensive). Provided that there is sufficient information

available to consumers to inform them ahead of time of the quality trade-off, and that is an area where government oversight is critical, these quality/price choices serve an important role in the marketplace.

- **Concern:** *Internet telephony exacerbates the "digital divide."*

Response: In terms of the "digital divide," there is concern that PCs are expensive and therefore those who cannot afford PCs will be further left behind. However, a countervailing fact is that long distance traffic in many countries is so expensive that it denies long distance service to those at many income levels. Making long distance calls more affordable for some but not all does not exacerbate the digital divide -- it reduces the number of persons on the down side of the divide.

IV. DEVELOPMENTS IN IP VOICE POLICY

A. *European Union ("EU")*

In 1998 and again in 2000, the European Commission considered the implications of VoIP. First, the Commission made it clear that the use of IP by telecommunications operators in the core of the PSTN is merely an alternative to the circuit-switched transmission technology and therefore falls within the traditional regulation of voice telephony. Focused on the capability of the service, the Commission concluded that the use of IP within the core of the PSTN does not affect the regulatory posture of the companies concerned.

Second, in terms of Internet telephony offerings to end users, the Commission concluded that Internet telephony (VoN) should be treated differently from regular voice telephony. In the 2000 communication, this judgment was based mainly on the conclusion that Internet telephony did not offer the same level of reliability and speech quality as produced by the public circuit-switched network and thus did not involve direct speech transport in real time, which is the EU definition of telecommunications. Thus, Internet transmissions were not subject to the regulatory regime of traditional phone companies.

In the 2000 communication, the Commission noted that the EU is moving towards a regulatory scheme that will put an end to the distinction between voice telephony and other telecommunications services. Under this new approach, all services will be largely freed from any licensing scheme. That is, in light of the ongoing convergence of digital media, Europe is moving towards a scheme with even fewer restrictions on the provision of electronic communications services.

B. *International Telecommunication Union Policy ("ITU")*

On March 9, 2001, the ITU World Telecommunications Policy Forum ("WTPF") released a final Report of the Secretary-General and adopted four "Opinions" on IP telephony.

The WTPF does not produce decisions with binding force. Instead, it prepares reports and where appropriate, Opinions for consideration by Member States. As a result, the Report and Opinions reflect the widely disparate views of the ITU membership on the issue of Internet telephony. Some developed countries led by the U.S advocated market-based, open architecture, decentralized policies that will promote the development of advanced networks and services. Other developed nations advocated a functional approach based on the service offering to determine the applicable regulatory framework. Less developed countries expressed concern on the impact of Internet telephony on international settlement revenue, which is used to provide basic telecommunications services. These nations generally supported policies involving government regulations and subsidies on advanced broadband services including VoIP.

Nonetheless, the ITU-WTPF Report and Opinions provide general principles supporting pro-competitive goals and encouraging support for more widespread use of IP technology. In his Report, the Secretary-General underlined the following points:

- 1) IP-based networks represent a significant new opportunity for the membership of the ITU and are already an important part of the emerging new market environment, in terms of volume of traffic carried and level of investment committed.
- 2) From a technical perspective, IP-based networks hold the promise of providing multimedia telecommunications services and new applications, merging voice and data. IP may well become the unifying platform for emerging converged networks.
- 3) From an economic perspective, the use of IP-based networks promises to reduce prices to consumers, and the costs of market entry for operators, especially for long-distance and international calls.
- 4) From a regulatory perspective, the development of IP telephony is forcing a reassessment of existing telecommunications regulation, which may need to be reviewed in the light of the opportunities opened up, and the challenges posed, by this new technology.
- 5) IP telephony poses a dilemma for developing countries: on the one hand it offers cheaper prices and lower costs, but it may also undermine the pricing structure of the incumbent public telecommunication operator. The transition to IP-based networks also poses significant human resource development challenges.

Likewise, the first of the four Opinions stated:

- a. that IP Telephony applications are best supplied in a market in which consumers have choices among multiple, alternative sources or means to address their needs, because only then will citizens, businesses and the overall economy reap the benefits of innovation and cost effectiveness;
- b. that government regulation should aim to foster an effective competitive environment and that regulation may be appropriate where there is market failure or when public interests cannot be adequately met by industry (e.g. universal

- access and service); for some countries, there may be other reasons for regulators to intervene, for example to ensure the rebalancing of tariffs;
- c. that Member States should examine the implications of applying existing regulatory regimes to IP-based services and applications.

The Opinion went on to "invite" Member States to consider the possibility of the introduction and deployment of IP technologies and IP applications, including the exchange of information; to review their current regulatory frameworks with a view to encouraging investment, spurring innovation and advancing development; achieving public policy goals in the context of a converged communication services environment; and considering the possibility of opening their communication services market with respect to IP Telephony by adopting a competition-oriented approach in order to achieve clearly defined public policy goals, taking into account, among other things, the concept of technology neutrality for fully-substitutable services.

C. United States

Overall, the U.S. Federal Communications Commission (the "FCC") has taken a competitive, market-based, non-regulatory approach to the Internet and IP services. As a general matter, basic telephone service is regulated but data services are not. The FCC's policy is based on a belief that a competitive, non-regulatory model will facilitate the wide-spread deployment of networks and services by multiple providers, driving down prices to the benefit of consumers without government intervention. The FCC's decision to take a hands-off approach has been credited with contributing to the phenomenal growth of the Internet and IP services in the U.S.

Because data services are not regulated, they are not required to pay special fees ("access charges") to subsidize local telephone companies, nor are they required to contribute to the universal service fund. Consequently, a transmission that is classified as a data service enjoys a pricing advantage over a transmission that is part of basic telephone service.

In confronting how to classify voice services over IP -- whether they should be classified as a telecommunications service or as a data service -- the FCC has determined that IP telephony is essentially a data service and should remain unregulated. The Commission took note of the inferior quality of the IP transmission of voice and found that the service had potential but was not a serious threat to the incumbent providers. However, the FCC allowed that it would review on a case-by-case basis whether certain phone-to-phone voice communications using the Internet should be subject to regulation.

In 1998, in response to a request from Congress, the FCC reexamined its Internet policies and reaffirmed that Internet Service Providers (ISPs) are not required to pay access charges to support the local telephone company, as providers of telecommunications services would. The FCC determined that its decision would not erode financial support for local telephone companies because ISPs lease lines from telecommunications carriers and thereby contribute to the revenues of local telephone companies. Thus, as ISPs grow the revenue received by local telephone companies grows proportionately. Further, the FCC decided to generally decrease the amount of the special fees that all carriers have to pay -- thus reducing any price advantage created by regulatory classifications. The FCC determined that IP telephony serves the public

interest because it would introduce alternative calling options in markets that otherwise face little competition.

D. United Kingdom

The commercial provision of VoIP services is permitted in the UK, and the UK imposes no technical standards or quality of service requirements on VoIP services. In the UK, the provision of telecommunications services using any technology is permitted, and the UK Office of Telecommunications (Ofcom) has a technology-neutral approach to the regulation.

Under the Telecommunications Act 1984 ('the Act'), anyone running a telecommunication system in the UK is subject to the licensing regime set out in the Act. Section 4 of the Act defines what a 'telecommunication system' is in very broad terms: "a system for the conveyance, through the agency of electric, magnetic, electro-magnetic...of speech, music and other sounds; visual images, signals serving for the impartation...of any matter otherwise than in the form of sounds or visual images..." The provision of VoIP is caught by this definition. Anyone running a telecommunications system in the UK is subject to the licensing regime set out in the Act. In broad terms, this means all telecommunication networks of all types in the UK need to be run under a license, but whether a particular service requires the *prior authorization* of a license depends on whether the service constitutes "public voice telephony."

Not all VoIP services are considered to be public voice telephony. For example, many Internet telephony services are not used by customers as a substitute for their existing telephone service. Ofcom considers that a VoIP service should be regulated as public voice telephony if any of the following apply:

- the service is marketed as a substitute for traditional Public Switched Telecommunication Network (PSTN) voice services; or
- the service appears to the customer to be a substitute for public voice telephony; or
- the service provides the customer's sole means of access to the traditional circuit switched PSTN.

If the provision of the VoIP service is considered to be providing public voice telephony, the provider of the VoIP service may have to apply to the government for a license.

However, where a VoIP service is clearly being offered as an adjunct to a traditional circuit switched PSTN voice telephony service or as a secondary service, it is likely not to be considered as public voice telephony. If an operator is selling services to the public but not constructing its own extensive infrastructure, it is likely to operate under the Telecommunications Services Class License (TSL), for which no individual application is required.

If the operator intends to build an extensive network of its own, then it may need to apply to the Department of Trade and Industry for an individual license.

Oftel has powers to impose technical interface standards for telecommunications services and interconnection, but has not done so in the case of VoIP, consistent with its overall preference for a co-regulatory approach with the industry. Oftel also has powers to impose standards for Quality of Service (QoS), but again has refrained from doing so in the case of VoIP, on the ground that, in competitive markets, there may be a demand for cheaper services that offer lower quality.

As of April 2002, an industry task group was studying the implications of VoIP technology on end-to-end quality in the public telephone network.

V. CONCLUSIONS

The EU and the U.S. have concluded that IP telephony should not be subject to the same regulatory burdens as traditional telephone service. Imposing the heavy-hand of regulation now would stunt the development of this technology before it reached its potential. As the EU and FCC determined, if IP telephony technology improves to seriously challenge traditional telephone service, then a country can always revisit the question. But now is not the time to regulate this young technology that holds such promise.

The promise Internet telephony offers is to enable people to communicate with others around the country and around the world at affordable rates. Countries would be smarter to not regulate IP telephony and to permit it to develop and provide benefits to the public. People everywhere will benefit most from a policy that enables many users and providers to take advantage of the technological capability offered by the Internet. The policy guidelines embodied by the ITU Report and Opinions provide a framework within which these same goals may be achieved.

Resources:

Materials of the ITU on IP Telephony <http://www.itu.int/osg/spu/ni/iptel/index.html> The Opinions of the ITU-sponsored World Telecommunication Policy Forum are at <http://www.itu.int/newsarchive/wtpf/Opinions.html>

U.S. Federal Communications Commission Report to Congress on Universal Service (includes extensive discussion starting at para 83 of the application of the USO to various Internet services (April 1998) http://ftp.fcc.gov/Bureaus/Common_Carrier/Reports/fcc98067.txt

Communications of the European Commission on the status of voice on the Internet under Community law (1998 and 2000) <http://europa.eu.int/comm/competition/liberalization/legislation/>

GIPI submission in response to the Indian regulatory authority's Consultation Paper on Internet Telephony, December 20, 2001 <http://www.internetpolicy.net/practices/011220india.pdf> In this submission to the Telecom Regulatory Authority of India (TRAI), GIPI emphasized the

importance of allowing all service providers to offer Internet telephony without further licensing so as to increase competition in the telecom sector and make telecom services available to the masses at affordable rates, as envisioned in the National Telecom Policy of 1999.

Telecom Regulatory Authority of India recommendations on VoIP, February 20, 2002
<http://www.trai.gov.in/internet-telephony-index.htm> . The Department of Telecommunications, in the Ministry of Communications and Information Technology, did not accept the full recommendation of the TRAI, but instead adopted guidelines that allow only ISPs to offer Internet telephony in India and only PC to PC, thereby limiting the potential of the technology to expand communications opportunities. The guidelines are at
<http://www.dotindia.com/guidelinesInternettelephony.doc>

OFTEL (Office of Telecommunications -UK), Frequently asked questions on the regulation of Voice over Internet Protocol services, 2 April 2002, available in PDF at
<http://www.internetpolicy.net/telco/>

The Growth Of Internet Telephony: Legal and Policy Issues, by Emir A. Mohammed (1999)
http://www.firstmonday.dk/issues/issue4_6/mohammed/

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