

Voice Over IP

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INTRODUCTION

In this paper the author will discuss (Voice over IP), also known as Internet Telephony. The author will describe VoIP, discuss its advantages and disadvantages, and address public policy implications.

WHAT IS VoIP?

VoIP is a method of real-time voice communication, which functions similar to a traditional telephone. Indeed an IP and POTS (Plain Old Telephone System) telephones appears almost identical. Both have a microphone, speaker, dialer, and hook (see Figure 1). What was once the realm of hobbyists and researchers, this technology is poised to alter the business model the established PSTN (Publicly Switched Telephone Networks) have been using for a century.



Avaya 6220 Analog Telephone



Cisco IP Phone 7902

Figure 1

VoIP is a fundamentally different technology from the PSTN. The PSTN uses *circuit-switching* technology, which Thomas Naugler defines as "... a process that establishes connections on demand and permits exclusive use of those connections

until they are released.¹" This means that for the duration of a phone call a single, continuous path exists between the two telephones. The telephone number is associated with the physical wire at a physical location. For example, the author's telephone number is associated with the wires that go from the Central Office to his house. To switch the physical destination of his phone number requires action on the part of the local telephone company.

With VoIP the audio (voice) is converted into a digital signal, then divided into IP packets, and sent over the Internet as datagrams. Each datagram finds the most efficient path over the Internet, and then the packets are reassembled in the right order at their destination. Because the packets use IP, the phone number becomes associated with an IP address, thus the hardware (telephone) on which the IP address resides. This means as long as the telephone is connected to the Internet, regardless of physical location, phone calls can be made and received.

WHAT ARE THE ADVANTAGES AND DISADVANTAGES OF VoIP?

There are many advantages and disadvantages of VoIP. Because VoIP transmits over the Internet as datagrams, it has the advantage of low cost of service and no long distance charges.

With traditional PSTN, a phone number is associated with a physical circuit, which limits where that phone number can be used. But with VoIP, the phone number is associated with an IP address, which is associated with the network adaptor. This means that after the IP address has been assigned, the physical location is unimportant; it just needs to be plugged into an Internet connection; this means the consumer can connect through any broadband Internet connection in the world to make and receive calls. The geographical limitations are virtually eliminated.

Since VoIP is a new technology, there are still some issues to be worked out. Due to bandwidth limitations and compression, VoIP may lack the sound quality and reliability of the PSTN. Because the signal is divided into packets, there is a risk of lost packets, delay, and echo.

VoIP cannot support TTY (a special "typewriter" that allows those who are deaf or hard of hearing to communicate over PSTN). Once technology allows the support

¹ http://jhunix.hcf.jhu.edu/~tnaugler/770.512/Common_files/CircuitSwitching/CircuitSwitching.htm

of TTY, there will still be risk of lost or mixed-up characters due to packet loss and delay.

When a customer uses a traditional telephone to dial 911, they are automatically connected to the emergency center in their geographic location. The emergency centers have systems, which allow them to immediately view the caller's location so that assistance can be sent, even without the caller giving their location. However, since VoIP is not tied to a physical location, there is no guarantee that 911 calls will be automatically directed to the closest emergency center, and the telecommunications systems at those centers may not be able to immediately view the caller's location.

WHAT POLICIES, LEGISLATION AND/OR REGULATIONS AFFECT VoIP?

As VoIP gains widespread popularity, the PSTN and government must reevaluate their revenue models of the old circuit-switched networks. As the convergence of packet-switched networks and traditional telephone systems continues, the concept of a "phone call" will become another application that uses IP packets. In fact, on an IP network, it is difficult to distinguish between a telephone call packet and any other type of data packet.

PTSN is defined by law as a telecommunication technology. Although VoIP has characteristics of both a telecommunication and information service, it has not yet been classified as either. Therefore it is not subject to the same federal regulation as PTSN. Some states have attempted to classify VoIP as a telecommunication system, which they may have the authority to regulate.

The Federal Communications Commission (FCC) is attempting to address this issue. On February 12, 2004, the FCC organized the FCC Internet Policy Working Group to "identify, evaluate and address policy issues that will arise as telecommunications services move to Internet-based platforms."² In addition, technical issues of law-enforcement access to IP-enabled services will be addressed through the Communications Assistance for Law Enforcement (CALEA).³

² Federal Communications Commission, "Voice Over Internet Protocol, IP Enabled Services", 2004, <http://www.fcc.gov/voip/>

³ <http://www.unc.edu/courses/2004spring/law/357c/001/projects/jennwill/VOIP/index.html>

State regulation is even more difficult with VoIP; there is not an easy way to determine the geographic origination of the call. A VoIP device may be located in one jurisdiction, but use an area code determined by a different jurisdiction. In the case of state regulation and revenue, it is unclear which state would receive the revenue from the calls.

Senator John Sununu (R-N.H), an outspoken ally of VoIP, has sponsored the "Regulatory Freedom Act" (S2281), which passed Senate Commerce Committee in July. Said the Senator about the bill,

"I thought, 'This is an adoption process that is likely to happen a lot faster than people in my current line of work, policy makers, think,'" he said. "In the fall of last year, I started worrying that if we weren't careful, there would be a lot of pressure to take the old regulatory system and impose it on these networks. The current system of telecom regulation...is based on local switchboards, operators and infrastructure connected by long-distance carriers. These carriers historically have been regulated by state public utility commissions, which determine pricing, services, and entry and exit requirements. This has no relevance to the IP world, where the "voice" provider—the entity that switches the calls or the signaling for calls—may be located anywhere in the country, or even abroad. These are global nets. We ought to have uniform standards, not 50 different sets of regulations imposing price limitations and hurdles on competition. VOIP needs national standards, he said, "so that participants would know what this playing field would look like. It's not an effort to try to apply favorable treatment, just a clear, stable environment, so that those taking the risks know what the rules will be."⁴

Senator Sununu anticipates that in the summer of 2005, congress will define VoIP as an interstate service. This would remove the possibility of local or state regulation. This is significant. According to the Senator there are four groups with a vested interest in how the legislation turns out, the state regulators (and the states themselves), the regional bells, rural and cooperative carriers, and law enforcement. By bringing VoIP under the federal government, there will be a consistent set of standards, regulations, and taxes.

⁴ <http://www.eweek.com/article2/0,1759,1679410,00.asp?kc=EWRSS03119TX1K0000594>

An area of concern to the government, both state and local, is revenue that is currently collected from the PSTN. It may seem logical to place taxes similar to the current taxes in place for the PSTN. However, a VoIP phone call is made up of packets on the network that would appear to be like any other data packet. Rather than attempt to differentiate between packets on the Internet and levy charges on specific packets, the revenue should be based on the infrastructure. The access to the Internet is an oligopoly, made up (where available) of the local teleco, cable company, and cellular phone service. The company is providing the service registers the MAC address of the modem (or other network device) and enables it. So there are two sources of possible revenue; the MAC address and the Internet connection.

CONCLUSION

The progress of VoIP is part of the movement towards convergence of communication from a circuit-switched architecture to a packet-switched architecture. The revenue models of the telcos and government must be based on the current and future technologies, not the technologies of the past. As businesses and consumers move more towards VoIP, both state and federal government agencies will be forced to classify this new technology, and enact necessary legislation.