

A Brief History of VoIP

Document One – The Past

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Introduction

This paper is the first in a three part series that will ultimately detail the past, present and future of Voice over Internet Protocol (VoIP). The purpose of this paper is to detail the history of VoIP and explore this technology/industry by examining its technological history, cultural history and its economic history. For the sake of brevity, this paper (and the two that follow) will focus on this technology and its place in the business world.

The goals for the second paper will be to focus on the present condition of VoIP in the business world and to draw connections to historic events. In a similar structure, the second paper will also focus on the technology, cultural and economic factors that define VoIP in current terms. In addition, the second paper will detail particular legal or ethical issues faced by the industry, the target audience for this industry, and will present the factors leading to an explanation the digital divide.

The goals for the third paper will focus on the future possibilities of VoIP in the business world and will draw connections from both the past and present states of the technology/industry. That document will draw together the hypotheses presented by leaders in the industry and will also include my own analysis of the future of the technology. Furthermore, I will include hypothetical events that may affect the technology, our culture and the industry's economics.

The use of VoIP by individual consumers was the beginning of a massive move from traditional telephone systems to a form of new media where voice and other forms of digital media could converge with an already established data network. Major advancements in the technology are the result of business development and adoption. This paper focuses on the history of VoIP and how this technology fits into the business setting.

Technology Overview

What is VoIP?

VoIP, also known as IP Telephony, is the real-time transmission of voice signals using the Internet Protocol (IP) over the public Internet or a private data network.¹ In simpler terms, VoIP converts the voice signal from your telephone into a digital signal that travels over the Internet. One of the most significant advantages of VoIP (over a traditional public switched telephone network (PSTN - also known as a legacy networks) is that one can make a long distance phone call and bypass the toll charge. This integrated voice/data solution allows large organizations (with the funding to make the transfer from a legacy network to a VoIP network) to carry voice applications over their existing data networks. Not only will this technological advancement have an impact on the large traditional telecommunications industry, it will alter the pricing and cost structures of traditional telephony.² Furthermore, when compared with circuit-switched services (yet another name for legacy networks), IP networks can carry 5 to 10 times the number of voice calls over the same bandwidth.³

How does VoIP work?

To transport voice over a data network, the human voice must be “packetized.” This process contrasts significantly with the circuit-switching mechanism used in traditional networks. Voice packetization involves appending headers with routing information to the voice data. Multiple voice samples are combined into a packet and the voice packet is

¹ Morris Edwards. "IP telephony ready to explode into corporate world. (Industry Trend or Event)." *Communications News* 38, no. 5 (2001): 96-97, Proquest.

² P.P. Francis-Cobley and A.A. Coward "Voice over IP versus voice of frame relay" *International Journal of Network Management* 14 (2004): 223-230, Proquest.

³ See #1

switched hop-by-hop through the network.¹ To summarize, the voice signal is broken up into small pieces (packets) and sent through the network one-by-one. The process of packetization compresses the caller's voice signal, transfers it over the IP network, and it is then decompressed at the other end.²

Technological History

There are two fundamental technologies that are necessary for the existence of VoIP. The first, and most widely used, is the telephone. The second technology is the Internet. The telephone was a direct result of the (independent) work of Alexander Graham Bell and Elisha Gray in the 1870s³. The first regular telephone exchange was established in New Haven in 1878. Early telephones were leased in pairs to subscribers. The subscriber was required to put up their own line to connect with another. In 1889, Almon B. Strowger, a Kansas City undertaker, invented a switch that could connect one line to any of 100 lines by using relays and sliders. This switch became known as "The Strowger Switch" and was still in use in some telephone offices well over 100 years later.⁴ To make a call, the user needed to push a button on their phone the required number of times to dial the receiver's phone number. This button was replaced in 1896. Interestingly, Philadelphia was the last city to give up the dual service (rotary and button) in 1943.⁵

About the same time the transistor was invented, mathematician Dr. Claude Shannon published "A Mathematical Theory of Communication," which promoted the

¹ P.P. Francis-Cobley and A.A. Coward "Voice over IP versus voice of frame relay"
International Journal of Network Management 14 (2004): 223-230, Proquest.

² Morris Edwards. "IP telephony ready to explode into corporate world. (Industry Trend or Event)."
Communications News 38, no. 5 (2001): 96-97, Proquest.

³ [About.com](http://inventors.about.com/library/inventors/bltelephone.htm). "The History of the Telephone"
<http://inventors.about.com/library/inventors/bltelephone.htm>
(accessed November 8, 2004).

⁴ [About.com](http://inventors.about.com/library/inventors/bltelephone7.htm). "Telephone History – Telephone Technology"
<http://inventors.about.com/library/inventors/bltelephone7.htm>
(accessed November 8, 2004).

⁵ Ibid

concept of communicating in binary code. Dr. Shannon's paper formed the basis of the entire digital communications revolution, from cell phones to the Internet.¹ 15 years later, in 1963, AT&T used Dr. Shannon's ideas and created "TouchTone" dialing. This evolution of technology allowed calls to be switched digitally and, later, enabled all manner of automated menus and functionality that eliminated the need for human operators.² In 1984 the US government broke apart AT&T – allowing home users to stop leasing their phones from AT&T and allowed them to purchase their own phones. These changes lead to a wave of new designs and functions for the home phone.³

In 1968 the Internet was first developed by ARPANET (Advanced Research Projects Agency Network), founded by the U.S. Department of Defense in 1957. ARPANET was developed to provide a decentralized communications network that would not be disrupted by a potential global war.⁴

Developed in the 1970s, and in parallel to the Internet, were time-share computer networks owned by large companies who would rent out their large mainframe computers during the evening and weekends when they lay virtually unused. In 1979 CompuServe started a time-share computer service to consumers during these evening downtimes. As the PC became popular, online service companies (e.g. Prodigy and AOL) formed to provide proprietary information and email services. Subscribers would dial into the network with their telephone lines would pay an hourly fee to receive the services offered.⁵

In 1989, Tim Berners-Lee and a group of researchers at CERN (an international

¹ Consumer Electronics Association - CEA. "Consumer Electronics Association: Digital America"
<http://www.ce.org/publications/books%5Fpreferences/digital%5Famerica/history/telecom.asp>
(accessed November 6, 2004).

² Ibid

³ See #1

⁴ Consumer Electronics Association - CEA. "Consumer Electronics Association: Digital America"
<http://www.ce.org/publications/books%5Fpreferences/digital%5Famerica/history/interconnectivity.asp>
(accessed November 6, 2004).

⁵ Ibid

scientific organization based in Geneva, Switzerland) created hypertext transfer protocol (HTTP) and a text format code called hypertext markup language¹. They also invented a universal resource identifier (later universal resource locator, or URL) to identify document locations. These inventions formed the foundation of the World Wide Web.²

Although the telephone and Internet were vital to the existence of VoIP, there is another technology that is closely related, and just as important. In 1972 Dr. Vint Cerf was the man who invented Transmission Control Protocol / Internet Protocol (TCP/IP) - the technical protocol that defines the form of net data packets and how they travel to their destinations.³

Now that the groundwork has been documented, we can examine the short brief of VoIP. From most accounts, VoIP started in February of 1995 by a small company in Israel called Vocaltec, Inc. Their product, *InternetPhone*, allowed one user to call another user via their computers, a microphone and a set of speakers. Additionally, this application/product only worked if both the caller and the receiver had the same software setup. By 1998 some entrepreneurs started to market PC-to-phone and phone-to-phone VoIP solutions. The phone calls were marketed as “Free” nation-wide long distance calls. When the caller would start the call he/she had to listen to advertisements before the call was connected. Another development in 1998 was the hardware’s foray into the market. There were three IP Switch manufactures that introduced VoIP switching software as a standard in their routing equipment. By the end of 1998 VoIP calls had yet to total 1% of all voice calls.

¹ Consumer Electronics Association - CEA. "Consumer Electronics Association: Digital America"
<http://www.ce.org/publications/books%5Fpreferences/digital%5Famerica/history/interconnectivity.asp>
(accessed November 6, 2004).

² Ibid

³ BBC NEWS. "What the net did next"
<http://www.bbc.co.uk/go/pr/fr/-/2/hi/technology/3292043.stm>
(accessed November 5, 2004).

By 2000, VoIP calls accounted for 3% and by 2003 that number had jumped up to 25%.¹

Cultural History

Depending on one's perspective, there are several supervening necessities that spurred the development of VoIP. The AfriSPA website (The Association of African Internet Service Providers) states that the development of VoIP was, in part, due to the unavailability of regular telephone service.² Daniel Berninger, a self-proclaimed "expert in the technical and regulatory aspects of the hostile takeover of telecommunications by communication applications of the Internet" believes that VoIP was developed to circumvent the traditional telephone systems' monopoly on communications.³ And others say that they just want to avoid the per-minute tolls associated with the legacy networks.

Along with the avoiding toll charges, there were other cultural reasons for using VoIP. The most basic is that the right (and ability) to communicate should be available to everyone.

On the business side of the topic, most multinational companies have adopted VoIP in an attempt to bring down the costs communications as well as simplify their information infrastructure. On a related note, some large organizations have used the power of VoIP to shift American call-center jobs to India (e.g. Bank of America). The implications of these decisions have a significant cultural impact on both the American's who've lost their jobs and the Indians who have gained jobs. Amitabh Pal, a reporter for *The Progressive* wrote a piece on Indian call-centers that train their employees to be more "American." She states,

¹ See #1

² AfriSPA. "Voice of IP"
<http://www.afrispa.org/voiceip.htm>
(accessed November 7, 2004).

³ Daniel Berninger. "Untitled Home Page"
<http://www.danielberninger.com/>
(accessed November 2, 2004)

“Welcome to the Anglo-American-ization of India, or at least of urban English-speaking youth. The call center industry is extracting a sliver of Indians who are actively de-Indianizing themselves and adopting Western names and identities, accents and culture.”¹

The technology of VoIP, on its own, won’t change human culture. I don’t pretend to be a technological determinist in that fashion. That is, it’s not the gun that kills – it’s the person shooting the gun. It’s how the technology is used that will have an impact on the culture.

Economic History

“The \$3 billion dollar budget at Bell Laboratories did not include a single project addressing the use of data networks to transport voice when VocalTec Communications released InternetPhone in February 1995. As of 2004, every project at the post-divestiture AT&T Labs and Lucent Technologies Bell Labs reflects the reality of voice over Internet Protocol. Every major incumbent carrier, and the largest cable television providers, in the United States have announced a VoIP program. And even as some upstart carriers have used VoIP to lower telephony prices dramatically, even more radical innovators threaten to lower the cost of a phone call to zero-to make it free.”²

-Daniel Berninger

The constant hype associated with VoIP is almost always directly related to the economics surrounding the technology, the future of the technology, and the investment opportunities in the companies developing the technology. Almost every article that references VoIP and some form of economics states that VoIP will have “some” kind of

¹ Amitabh Pal. "Indian by Day, American by Night."
[² Daniel Berninger. "Untitled Home Page"
<http://www.danielberninger.com/>
\(accessed November 2, 2004\)](http://gateway.proquest.com.offcampus.lib.washington.edu/openurl?url_ver=Z39.88-2004&res_dat=xri:pqd&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&genre=article&rft_dat=xri:pqd:did=000000704672581&svc_dat=xri:pqil:fmt=html&req_dat=xri:pqil:pq_clntid=899168, no. 8 (2004): 29, Proquest.</p></div><div data-bbox=)

impact on traditional legacy networks. The history of VoIP is directly tied to economics. VocalTec, Inc. created a business in 1993 (and launched the first VoIP product in 1995) on the premise that voice telecommunications could travel over a data network¹. And if we take a step back in history, we can clearly see that the monopolistic behavior of AT&T had a lot to do with people's perception of the telecommunications industry. For the first two thirds of the 20th century, AT&T had manned the "Berlin Wall" separating telecommunications and computing². Daniel Berniger (who I reference frequently in this section) states in his essay on voipdaily.com:

"The roots of the VoIP insurrection trace back to four synchronistic events in 1968. The Federal Communications Commission (FCC) ruled MCI could compete with AT&T using microwave transport on the Chicago to St. Louis route. The same year, the FCC's Carterfone decision forced AT&T to allow customers to attach non-Western Electric equipment, such as new telephones, and modems, to the telephone network. The Department of Defense's Advanced Research Project Agency issued a contract to Bolt Beranek and Newman for a precursor to the Internet. And in July 1968, Andrew Grove and Gordon Moore founded Intel. Innovation in the communication sector remained the proprietary right of AT&T for most the 20th century, but events in 1968 breached the barriers that kept the telecom and information technology industries apart."³

-Daniel Berniger

It was these events that brought us to our current communications environment.

The economic climate over the last 5-6 years has lead companies to cut costs in their

¹ Daniel Berniger. "Untitled Home Page"
<http://www.danielberniger.com/>
(accessed November 2, 2004)

² Ibid

³ OM Malik. "VoIP Daily: VoIP News Served Fresh Daily"
<http://www.voipdaily.com/>
(accessed October 29, 2004).

infrastructure spending. A supervening necessity of the VoIP was the need to cut telecommunication costs and converge their voice and data networks. However, many companies soon learned that the less-expensive VoIP calls were of a far less quality. This quality of service (QoS) presented a business opportunity to Internet Telephone Service Providers (ITSP). If they could guarantee quality (by upgrading the existing network), then they could charge a nominal fee. This is the primary business plan for most ITSPs.

With the hype of VoIP (and a few companies starting to make real money in the business), a form of marketplace congestion developed. With a lack of government regulation and the ability to transfer voice over a data network; several small “communications companies” sprung into existence. Most offered calling cards that would allow one to make international phone calls for 1 or 2 cents a minute. Worldwide Telco started a service whereby small telecommunications companies can resell VoIP minutes and make a 20% commission.¹ It appears that long-distance minutes are becoming a commodity item.

¹ Frank Ohlhorst. "More Channel Profits from Telco's Wipphone." *CRN*, no. 1104 (2004): 25, ABI/INFORM.

Conclusion

This paper is the first in a three part series that will ultimately detail the past, present and future of (VoIP). The purpose of this paper is to detail the history of VoIP and explore this technology/industry by examining its technological history, cultural history and its economic history. The telephone and the Internet were the foundation blocks that VoIP was built upon. It was the accumulation of 40+ years of work in both the telecommunications industry and the computing industry that allowed the existence of VoIP. It was also the behavior of the telecommunications industry and the openness and freedom of the Internet that brought this technology to the forefront of communications. And, it will be the economic forces that provide the motivation for companies to develop and use VoIP technology.

Glossary

B

Broadband

High-speed voice, data, and video networked services that are digital, interactive, and packet based. The bandwidth is 384 Kbps or higher, and 384 Kbps is widely accepted, as the minimum bandwidth required enabling full-frame-rate digital video.¹

C

Computer Telephony (CT)

The addition of computer intelligence to the making, receiving, and managing of telephone calls.²

D

Digital Subscriber Line (DSL)

A technology that allows a provider to use the excess bandwidth found in a copper line for the provision of data services. xDSL is used to describe all of the “flavors” of DSL in general.³

F

Federal Communications Commission (FCC)

The United States federal agency responsible for regulating interstate and international communications by radio, television, wire, satellite, and cable.⁴

I

Internet Protocol (IP)

A unique, 32-bit number for a specific TCP/IP host on the Internet normally printed in decimal form (for example, 192.168.1.1). Part of the TCP/IP family of protocols, it describes software that tracks the Internet address of notes, routes outgoing messages, and recognizes incoming messages.⁵

¹ David Greenblatt, *The Call Heard 'Round the World* (New York: AMACOM, 2003), 154.

² David Greenblatt, *The Call Heard 'Round the World* (New York: AMACOM, 2003), 155.

³ David Greenblatt, *The Call Heard 'Round the World* (New York: AMACOM, 2003), 156.

⁴ David Greenblatt, *The Call Heard 'Round the World* (New York: AMACOM, 2003), 158.

⁵ David Greenblatt, *The Call Heard 'Round the World* (New York: AMACOM, 2003), 161.

Internet Protocol Private Branch Exchange (IP PBX)

An enterprise-based IP data network device that switches VoIP telephone traffic.¹

Internet Protocol Telephony

Technology that allows voice phone calls to be made over the Internet or other packet networks using a PC via gateways and standard telephones.²

P

Private Branch Exchange (PBX)

A telephone switch owned privately, usually by a large company. If it owns a PBX, a company does not need to lease a telephone line for each telephone set at a site.³

T

T-1

Trunk Level 1. A high-speed (1.544 megabits per second) digital telephone line with the equivalent of 24 individual 64 Kbps channels, which are joined via time division multiplexing. A T-1 can be used to transmit voice or data, and many are used to provide connections to the Internet. Also known as a DS1 or Digital Signal 1.⁴

V

Voice Over Internet Protocol (VoIP)

Technology used to transmit voice conversations over a data network using the Internet Protocol.⁵

W

Wide Area Network (WAN)

A communications network used to connect computers and other devices across a large area. The connection can be private or public.⁶

¹ David Greenblatt, *The Call Heard 'Round the World* (New York: AMACOM, 2003), 162.

² David Greenblatt, *The Call Heard 'Round the World* (New York: AMACOM, 2003), 162.

³ David Greenblatt, *The Call Heard 'Round the World* (New York: AMACOM, 2003), 164.

⁴ David Greenblatt, *The Call Heard 'Round the World* (New York: AMACOM, 2003), 166.

⁵ David Greenblatt, *The Call Heard 'Round the World* (New York: AMACOM, 2003), 168.

⁶ David Greenblatt, *The Call Heard 'Round the World* (New York: AMACOM, 2003), 169.

Appendix – Abbreviations and Acronyms

ARPANET	Advanced Research Projects Agency Network
CT	Computer Telephony
DSL	Digital Subscriber Line
FCC	Federal Communications Commission
IP	Internet Protocol
ISP	Internet Service Provider
ITSP	Internet Telephony Service Provider
HTTP	Hypertext Transfer Protocol
PBX	Private Branch Exchange
PSTN	Public Switched Telephone Network
QoS	Quality of Service
SMBs	Small and Medium Sized Businesses
T-1	Trunk Level 1
TCP/IP	Transmission Control Protocol / Internet Protocol
URL	Universal Resource Locator
VAR	Value Added Reseller
VoIP	Voice of Internet Protocol
WAN	Wide Area Network

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http://gateway.proquest.com.offcampus.lib.washington.edu/openurl?url_ver=Z39.882004&res_dat=xri:pqd&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&genre=article&rft_dat=xri:pqd:did=000000704672581&svc_dat=xri:pqil:fmt=html&req_dat=xri:pqil:pq_clntid=899168, no. 8 (2004): 29. Proquest.

With it, we've connected over mountains, across oceans, and to opposite ends of the world. We can convey important information quickly and efficiently, and now, with cell phones and smartphones, we can send important data, capture memories, and explore the Internet, all from our mobile phone. The history of the telephone is an amazing timeline of experimentation and discovery. 1672: Robert Hooke created the first acoustic telephone in 1672. Very much like the two-soup-can toys you made as a child, Hooke found that sound could be sent over a wire or string from a mouthpiece on one side to ...[^] A Brief History of VoIP (PDF).