

Voice over IP

A Discussion of Business and IT Challenges

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Abstract

Recently, Voice over Internet Protocol (VoIP) based enterprise telecommunication solutions have become a popular implementation for companies who want to converge voice, data, and video applications onto the same network and benefit from lowered total communication costs.

A very healthy initial return on investment (ROI) and lowered total cost of ownership (TCO) are quite attractive elements to promote business and information technology (IT) decision of implementing this cutting edge technology in organizations. However, Voice over IP does come with its package of some hidden business governance, technology management, and security challenges which VoIP vendors are very reluctant to talk about.

This paper discusses the issues involving business governance, technology management, security management, and ROI from the customer's perspective for deploying VoIP in large scale organizations. This paper can also serve as a blueprint for evaluating IP Telephony for your organization.

A careful analysis of the findings might be quite surprising for some IT executives and may also require them to reconsider before making this business and technology decision.

In order to discuss the material presented in this paper one must understand some basic terms that IT and business executives will encounter when these vendors make their sales pitch.

What is Voice over IP?

Voice over Internet Protocol (VoIP) is the basic method of carrying voice calls over an IP network. This includes *digitization* and *packetization* of voice streams¹. In other words, it is a mechanism of sending voice traffic over a data network.

Illustration below shows a basic (VoIP) setup.

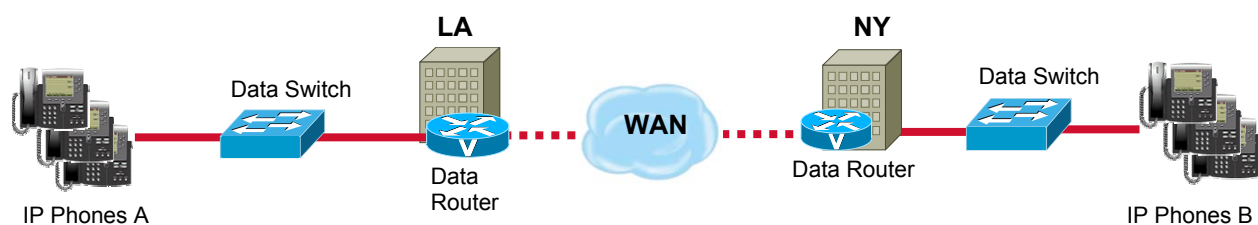


Figure 1: Basic Voice over IP

Phone A can call Phone B as long as they are both connected to same data network.

The basic idea behind VoIP is that it can send a telephone call over the same networks that carry data throughout a company, whether it be a local-area network (LAN), a corporate intranet, a wide-area network (WAN), or even the public Internet. To do so, the technology converts analog sound into tiny digital units called packets, then sends those packets over the network and reassembles them in the correct order on the receiving end².

What is IP Telephony?

IP Telephony uses VoIP standards to create telephony systems which offer all the features of a traditional private branch exchange (PBX) systems, as well as a range of integrated new software applications which can increase functionality and productivity.

These productivity applications, such as advance call routing, unified messaging, interactive voice response system, and call center applications are modular and tightly integrated through the use of industry standard protocols. Some examples of these protocols are SIP, H.323, MGCP, and SGCP. The definitions of these protocols are outside the scope of this study. To find out more about these you may visit IETF website.³ Illustration below is a basic IP Telephony setup:

IP Telephony Setup for an Office

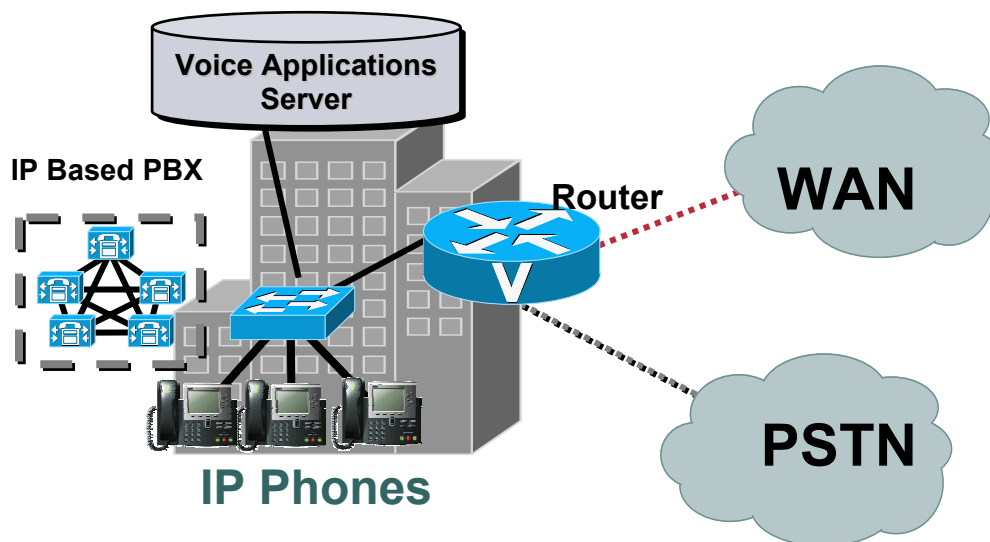


Figure 2: Basic IP Telephony setup

There are four basic components in an IP Telephony system namely, IP Phone, Data Switch, IP PBX, and a Voice Gateway. All of these components are connected to the data network. In a simple setup, a user dials a telephone number using an IP Phone. This telephone number is sent to the IP PBX. If the number was an internal extension then IP PBX sends the call to destination IP Phone. However, if the number was for a party outside of company then IP PBX sends the call to the Voice Gateway which dials outside party through PSTN(Public Switched Telephone Network).

Voice over IP and IP Telephony Trends

VoIP is an old concept which has just recently emerged as a threat and as well as an opportunity for telecommunication industry. Forward looking telecom companies see VoIP as an additional service offering and a competitive advantage, where as old-fashioned slow-moving companies view it as a serious threat to their survival.

Vonage Holdings Corp, a New Jersey based consumer VoIP company, recently completed five million VoIP calls. They have successfully implemented VoIP/IP Telephony as a competitive advantage over traditional local and long distance companies.

The table (see Chart 1) below shows the VoIP retail voice revenue compared to traditional telecom revenues over the last few years:

Chart 1: Impact of VoIP on retail voice revenue

Impact of VoIP on Retail voice revenue			
	Total voice revenues (US\$m) - VoIP percentage in brackets		
	2002	2003	2004
Asia-Pacific/Japan	76,074.6 (2.1%)	18,993.8 (2.8%)	80,641.3 (3.4%)
North America	165,935.1 (0.2%)	160,647.2 (0.35%)	160,305.9 (0.55%)
Western Europe	113,622.7 (0.9%)	112,984.9 (1.4%)	112,243.3 (2.0%)

Source: Gartner ⁴

Even though VoIP has a very small present market share, the trend is increasing towards it. According to a research report by Forrester Research:

“Voice over Internet Protocol (VoIP) is racing toward mainstream acceptance, steered by attractive price points--currently \$200 to \$500 per line--proven cost savings in early-adopter deployments and significant improvements in voice quality and reliability.” ⁵

In December 2003, Telezoo.com conducted a survey of more than 3 million queries from professional information technology managers on 4,000 products and services.

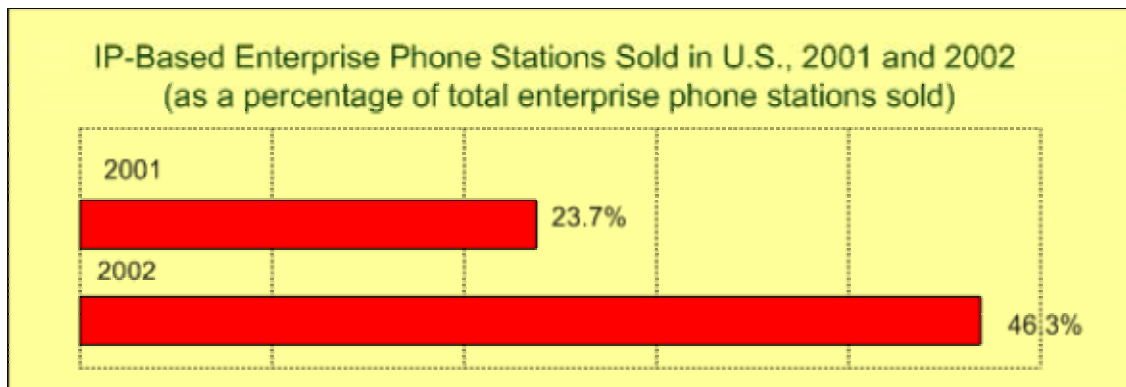
Worth some \$45 billion in potential sales, this survey revealed that corporations will increase spending on network gear in the first half of 2004 in several product categories. Those categories included call centers, Internet Protocol telephony, data services and security.⁶

According to a research report in November 2003 by Synergy Research Group:

“In Q3, 2003 the U.S. Enterprise IP Telephony market grew 15 percent sequentially and reached nearly one million IP lines shipped. North America was the fastest growing market for Enterprise IP Telephony in the quarter, followed by Asia/Pacific and EMEA, respectively.”⁷

A survey of 435 companies by Meta Group showed that the No.1 applications they are expecting to enable with IP telephony is teleworking.²

Chart 2: Enterprise VoIP Adaptation



Source: CIO Magazine, May 2003

The bottom line is that VoIP has come a long way and it is here to stay.

As high-productivity applications, such as unified messaging, Text-to-Speech (TTS), interactive voice response (IVR) system, mobility, audio conferencing and computer telephony integration (CTI) become more mature and reliable it will be very difficult to accept anything less than that as an enterprise technology standard.

Why this VoIP Trend?

Some companies have identified advanced IP Telephony features as competitive advantage for their businesses. These advanced features increase their business productivity and they hope it will lead to better bottom line at the end. To best understand why VoIP is on CIO's and IT Director's top list of 2004, we should look at some case studies.

In May 2000, BRM Capital, a New Jersey based venture capital company, decided to increase its investment activities and expand its service offerings to its portfolio companies by providing them an incubation facility. The new facility was to be built to provide hosted voice, video, and data communications services to all new BRM startup companies.

BRM Capital selected Cisco AVVID (Architecture for Voice, Video and Integrated Data) IP Telephony and Cisco Unity unified messaging system for the new facility. BRM was able to use single IP Telephony infrastructure for its multiple companies. The detailed IP billing and reporting features from Mind CTI PhonEx software allowed them to accurately charge-back telephony usage to proper entities. Business executives who were mostly on the road were able to login to single mailbox to retrieve all of their messages including e-mail, voicemail, and fax. The ease of phone administration and flexibility of phone moves was considered a strong benefit by BRM's IT team.

In the above example, BRM was most interested in the advanced IP telephony features. The top management supported the IP telephony project and was flexible in early adaptation of the technology to gain other business benefits. On the other hand, many companies have adapted this technology based on simple ROI analysis.

As a fast-growing metropolis—the fourth largest in the United States—the City of Houston has more than 151 separate facilities that support the city's 2 million inhabitants. The city initially installed stand-alone phone systems throughout its facilities for telephone communications. As that network system grew to include 23,000 phones from multiple system vendors, the city began experiencing inefficiencies, including network outages, expensive maintenance, and productivity barriers.

The City of Houston chose to transform its data network and standalone phone systems into a single, converged voice-data communications system based on Cisco AVVID.

This system will help the city resolve a critical emergency 911-dialing safety issue and will

enable greater efficiency and productivity through a centralized call-processing architecture. In addition, the new network is expected to generate \$6.2 million in annual savings for the city and its tax payers, which converts to a payback term of less than one year.²

In another example, a leading publishing company in US has over 15 offices around the country and employs over 7,000 workers nationally. The company has a variety of traditional PBXs installed at its 15 branch offices and utilizes Centrex based telephone system at its headquarters in New York for majority of its employees.

Most of the PBXs in remote offices are outsourced to local support companies. The company also has a centralized Telecommunication and Client Services team which is responsible for overall telecom support as well as the management of Centrex based systems. They have over 7,000 Centrex lines and over 1,000 analog fax lines. Additionally, the company pays for over 1,000 analog and digital lines across its remote branch offices.

The company recently implemented IP Telephony as a pilot project at one of their newly built remote office which houses over 400 employees. Based on their pleasant experience with IP Telephony, the company decided to investigate ROI if IP telephony was to be deployed throughout the enterprise.

Below (see Chart 3) are some estimated existing telecom costs:

Chart 3: Existing Telecom Costs

Location	PBX	Lines	Local Charges/Month	Long Distance Costs/Month
Headquarter	Centrex	7000	\$105,000.00	\$350,000.00
Remote Offices (10)	PBX	1000	\$20,000.00	\$50,000.00
Other NY	PBX	1000	\$20,000.00	\$50,000.00
Other Analog	Fax	1000	\$20,000.00	\$20,000.00
Total Phones Costs			<u>\$165,000.00</u>	<u>\$470,000.00</u>

The company is spending an estimated \$165,000/month on telephone line charges. Should the company go with VoIP, the connection charges would be reduced to an estimated \$23,500.00/month. This suggests that this company would save an estimated \$1.7 Million dollars a year. Cost of a VoIP system supporting 8,000 IP phones is an estimated \$8 million.

$$\begin{aligned} \text{ROI} &= 8/1.7 \\ &= 4.7 \end{aligned}$$

In the example like above, VoIP vendors can very easily convince CIOs and IT Directors to purchase an IP Telephony system. Who would not like to save almost 2 million dollars a year with an ROI of 4.7?

However, IT executives should beware of these types of ROI analysis. This is only an illusion created to get their attention and make them spend millions of dollars in new hardware and software. Frost & Sullivan reported that companies selling IP telephony equipment generated more than \$1 billion in revenues in 2000 and expects those revenues to exceed \$14 billion by 2006.⁸

A much more comprehensive and objective ROI is needed to make an educated business decision which should go beyond initial hard savings and costs. In the sections below, I will discuss some of the VoIP realities that will prepare IT executives to make a better business and IT decision before implementing IP Telephony.

The VoIP Challenges

As sexy as VoIP may sound, the reality is that IP Telephony comes with its own set of challenges. These include, but are not limited to technology, infrastructure, security, governance, and management related challenges.

The Technology Challenge

IP telephony is relatively a new technology. Organizations who are considering VoIP in their IT and Business strategy must weigh the possibility of a disastrous and poorly designed VoIP solution against its promising new productive and useful features and significant monetary savings.

A successful VoIP implementation requires a very careful study, design, and implementation. Additionally, maintenance of a VoIP system also requires highly comprehensive and sophisticated in-demand skill sets which can be very expensive. According to a quarterly index maintained by Footepartners.com, VoIP ranked No.1 as the hottest skill among 140 different IT skills and professions. (See Appendix A)

Furthermore, the VoIP standards are still evolving. Microsoft has shipped Session Initiation Protocol (SIP) possibly leading to an industry standard. While Cisco Systems, a market leader in IP telephony, is pushing Media Gateway Control Protocol (MGCP) as its standard. However, all other carriers have long standardized on H.323 protocol for transporting voice over data network. While some vendors support multi-protocol integration, they are not compatible with all VoIP systems. Organizations investing in this fairly young technology will always run a risk of purchasing non-industry standard application.

Companies who have implemented IP telephony also invest in post-implementation support and maintenance. They must invest in employee training, hardware and software upgrades, and vendor support agreements. A proper ROI analysis must include these costs as they reflect a more realistic real world scenario.

The Infrastructure Challenge

Unlike traditional telephone systems, an IP telephony system comprised of multiple components. IP telephony vendors often treat this as an advantage over traditional PBXs. Their argument is that the new system is modular and scalable. Although it is true that modularity makes it scalable, it typically translates to purchasing of multiple redundant components. A successful call in IP telephony systems requires each component to be available and functioning properly. For small and medium-size companies this means that their IT teams will most likely have to manage more components than a traditional single-box PBX system.

Traditional PBXs have little changed from when they were first brought into the enterprise markets and where they are today. Although there have been very few additions to functionality of traditional voice systems, they have become extremely reliable. As a matter of fact, the availability and quality of a phone system is often taken for granted.

Large organizations who are looking into IP telephony as a means of reducing telecommunications costs must evaluate their data network infrastructure and its IT team's skill-sets. Traditionally, end-users are more tolerant towards data network unavailability than voice system unavailability. As companies combine their voice and data traffic on to the same network, the availability of their telephone systems will be directly dependant on the availability of their data network resources.

Driven by new VoIP technologies and the need to reduce network costs, many enterprises are now designing new converged networks capable of handling both voice and data. The key challenge is to reconcile the performance requirements of voice with the unpredictable nature of data on a single network.

The motivation for running VoIP networks is to eliminate the expense of maintaining separate voice and data networks. It sounds easy enough to run voice over IP network – just encapsulate digitized voice in IP packets and go. Digitizing and “packetizing” voice is fairly straightforward, but there's one other key issue that is much tougher to deal with. The key challenge in building converged networks is performance. Voice communications has much more stringent performance requirements than data communications.

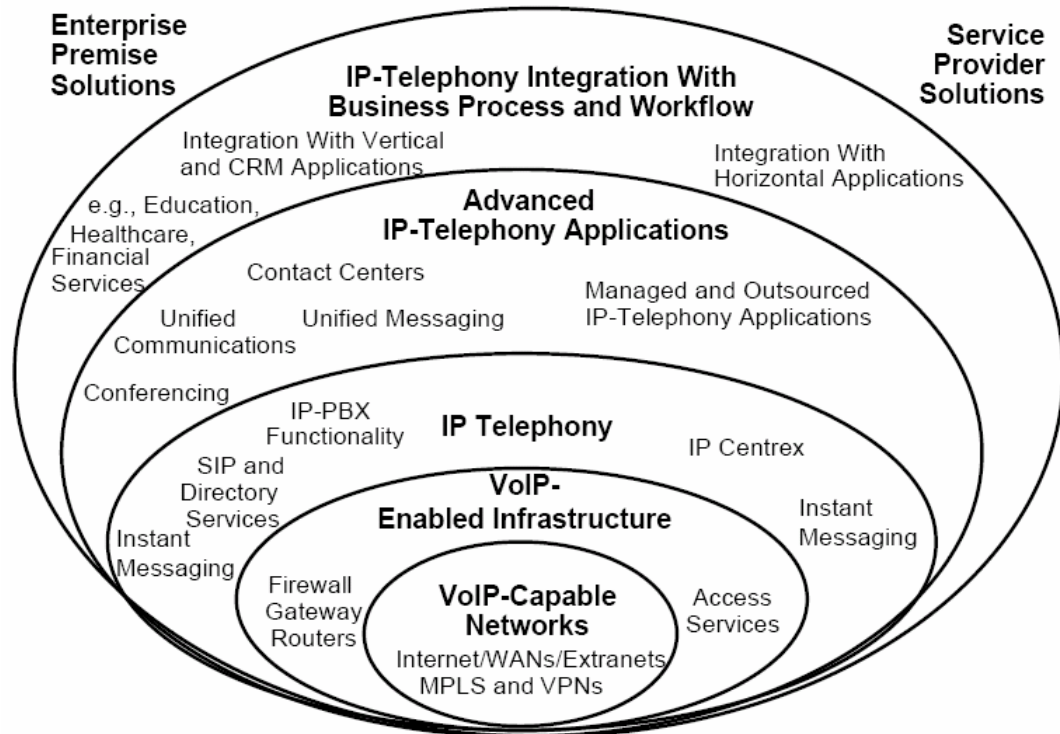
To ensure high availability, the organizations housing IP telephony require significant network management resources. This includes standardizing their hardware such as routers, switches, and cabling. This also includes proper network management and monitoring tools such as NetIQ, HP Open View, Cisco Works, Tivoli and others. Furthermore, these network management resources also include properly trained IT staff.

In most large organizations, these are already in place and are not additional expenses. However, for those organizations that have fallen behind in technology, resources, and skill sets, they should include an infrastructure upgrade prior to implementing IP telephony.

A recent research article from Gartner suggests that IP telephony deployment in enterprises should be classified in five layers.

“Enterprise architects and managers must explicitly define the end-to-end functional layers of their enterprise VoIP infrastructure and IP telephony application architecture; this will clarify the tasks of integration and cost justification.”⁹

Figure 3 below shows the five major functional layers in an enterprise deployment:



CRM = customer relationship management
 MPLS = Multiprotocol Label Switching
 PBX = private branch exchange
 SIP = Session Initiation Protocol
 VoIP = voice over Internet Protocol
 VPN = virtual private network
 WAN = wide-area network

Figure 3: Five functional layers in Enterprise IP Telephony deployment

Source: Gartner research, July 2003

The lower layers provide the enabling network and VoIP infrastructure, while the upper layers show the IP-telephony applications and communications-enabled business processes. Viewing the enterprise in terms of these functional layers clarifies the technical aspects because the products, vendors and replacement cycle for each layer differ.⁹

The Implementation Challenge

Having good technical skills and a robust scalable network is not enough to successfully implement IP telephony in an organization. Most large organizations' biggest challenge will be to design and execute a migration strategy to the new IP telephony system without disrupting normal business operations.

The migration strategy should include infrastructure upgrades, system preparation and testing, voice-circuit provisioning or migration for new system, and deployment scheduling.

The infrastructure upgrades not only consists of making sure that proper hardware, software, and bandwidth exist, but also includes implementation of a Quality of Service (QoS). QoS is a scheme to provide priority, dedicated bandwidth, and control jitter and latency for voice and data traffic throughout the enterprise network.

System preparation requires proper configuration and testing of the IP telephony system. Typically, this is least of the problems as experienced consultants can be hired to insure proper configuration and testing.

Voice circuit provisioning or migration is a very critical and high-risk task. Proper voice-circuit delivery and installation is usually beyond a company's control. During this process, a company is totally dependant on the telephone company. Since these companies have a monopoly in their business, they are not always responsive to problems that may arise. Additionally, these companies are well known for going on strikes which can be devastating for an enterprise that is undergoing a telephone system migration. A very careful and coordinated effort from the equipment manufacture, VoIP vendor, and the telephone service provider is required.

Last but not least, careful scheduling and planning is required to deploy IP telephones to replace the existing phones. When deploying new IP telephones, it is typically recommended to remove the users old phone and replace it with the new IP phone.

This places the user in a total immersion situation. This forces them to learn the new operational features of the IP Phone on a much quicker learning curve. It also prevents end-users' aversion to change as the change is already made for them.

Consultants have learned from previous migrations that leaving both phones in place contributes too much longer learning curves and allows for end-users to resist embracing the new technology. The end-users' learning curve can further be enhanced with formal training with delivery via live instructor-led classes, web broadcasts, or computer-based interactive training.

The Security Challenge

Security vulnerabilities when deploying VoIP in an organization is one topic that vendors do not like to talk about. The reason is simple; in most cases, it has not been addressed.

As companies put voice on their data network, all of the weaknesses that exist in their data networks also become weaknesses in their voice networks. The availability of telecommunication resources can be crucial to businesses and in some cases it is more important than their data networks.

Security is typically classified into three sections known as CIA (Confidentiality, Integrity, and Availability).

With voice traffic going on the same network as data, confidentiality can easily be lost through the use of a "sniffer" (a network monitoring tool that captures data packets and decodes them) by an attacker. An attacker can tap into a switch or a router to capture voice traffic packets and use an open-source packet sniffer such as Vomit (<http://vomit.xtdnet.nl/>). Vomit is a tool that allows an attacker to convert sniffed voice traffic into a wav file and listen to telephone conversation.

While system administrators have to worry about malicious attempts to sniff their networks, they may also have to allow their networks to be sniffed in the future. The FBI is currently pushing legislation and developing software to sniff VoIP networks as they currently have no ability to do so. They consider not having the ability to sniff voice networks a domestic security risk. If legislation passes Congress, system administrators may have to allow the very sniffing they are trying to protect their networks from.¹⁰

Furthermore, since IP telephony systems can record a detailed call history, an attacker can gain access to this call detailed records (CDR) database and retrieve confidential telephone records.

Many voice applications which have been written to provide advanced high-productivity functionalities that have little or no consideration for security. These poorly written applications

pose serious threats to voice system integrity. For example, an attacker can easily attack unified messaging systems and redirect voicemail messages to incorrect malicious parties.

In another example, Text-To-Speech (TTS) is a new high-productivity application which provides ability to listen to text messages using a phone. This can be a very useful tool for people traveling without a computer. With TTS, they can listen to their e-mail messages by simply dialing a telephone number to their IP telephony system and entering their voicemail pin number. This capability also weakens an enterprise's e-mail security. An attacker can very easily guess/or intercept a voicemail numeric PIN number and access possible confidential information. Once inside, an attacker can read, forward, or delete messages from the email inbox.

While it might be unlikely that an attacker may be interested in accessing confidential conversation through sniffing voice traffic, it is very likely that attacks on the data network will indirectly affect the voice applications' performance. It is very important to note that when an organization deploys voice traffic on their data network, all of the security vulnerabilities and weaknesses that existed in their data networks are also applicable to their voice applications. For example, a simple e-mail virus that floods a network with spam mail can also cause voice services to deteriorate dramatically.

VoIP is a perfect target for Denial of Service (DoS) attacks. Whether the DoS attack is on a network router, switch, or the server itself, VoIP service is sure to be disrupted. Features like Extension Mobility, which allows one to login to any phone and load their personal telephone profile, are highly venerable to DoS attacks. An attacker can login to any phone using someone else's PIN number denying service to the original user.

VoIP vendors have been lucky that virus writers have not yet targeted voice applications. Perhaps this is because there aren't many IP telephony implementations to gain access to and cause enough damage. As IP telephony popularity increases and more systems are deployed, virus writers will certainly target these highly vulnerable mission-critical enterprise voice systems.

Theft of service is another area of concern when facing the VoIP security challenge. An attacker can fairly easily access company VoIP resources to make long distance telephone calls. Any person can plug in an IP telephone anywhere in the data network and access telephone service. Additionally, advance features such as remote call forwarding can allow them to continue to steal voice services remotely from outside the company.

Special consideration needs to be given to security as organizations investigate IP telephony as a viable solution.

For example, the city of Houston's police department has separate network routers and switches for their use and the network is classified as secure by their IT department. Usually, all federal and state law enforcement and intelligence agencies have access to NCIC (National Crime Information Center), a massive database run by the FBI. Government agencies that have access to the NCIC database and implement VoIP on their data network run the risk of compromising security of that network.

The city of Houston is planning to deliver IP telephony services to all city offices, including major police stations and satellite substations. The project is expected to save the city over 6 Million dollars in five years. However, no one has studied impact of security vulnerabilities introduced due to implementation of IP telephony services into their "secured" network.

Another very sensitive area is the access to emergency services such as 911. When deciding on IP telephony for an organization, a manager must also question the vendors on how they are prepared to deliver voice services in case of emergency. With the country fighting cyber-terrorism, VoIP systems may become a frequent target of corporate espionage.

Is the department of Homeland Security prepared to operate on an unsecured network where a highly sensitive criminal database resides? IT Executives and Managers must carefully evaluate security impact of converged voice and data network. They must demand security solutions from the VoIP vendors. In some cases, it would be wise to keep voice and data in separate networks where Confidentiality, Integrity, and Availability of voice and data services are crucial to business operations.

The Governance Challenge

Telephone systems have traditionally been managed by a separate telecom teams in companies than their network teams. Unfortunately, the telecom and data teams are known to not always cooperate on joint projects.

The telecom people have been managing telephone systems for years and are extremely good at it. They know what it takes to communicate and negotiate with vendors like Verizon, ATT, Sprint, and others. They also know the ins and outs of what clients are expecting from their telephones. And above all they know how to live up to those expectations very well.

On the other hand, network teams are known to be busy putting out fires. Network teams are usually very analytical and study the in-depth cause of failures in order to prevent them from happening again. They are always under pressure for on-time delivery of new projects in addition to keeping thousands of applications up-to-date. Scheduled and sometimes unscheduled unavailability of network resources is generally more accepted within data services than voice services.

As companies deploy IP telephony on their data network, a natural shift of responsibility and power is bound to happen. VoIP becomes a mission critical application running on a data network. Network teams that are usually busy in maintaining many other applications also become responsible for maintaining IP based telephone systems.

While it is easy for a network team to understand how fragile this VoIP application is because it is dependant on their network availability, the end-users continue to expect same robust and reliable voice experience they received from traditional PBXs. Anything less than what they have been used to is considered unacceptable.

On the other hand, treating voice as just another data application running on the network can be devastating to IT department's reputation. Voice should be treated as voice because, unlike most data applications, voice requires very low latency (travel time) and absolutely no packet losses (loss of data packets due to congestions).

As IP Telephony introduced in a company, a natural shift in responsibilities is bound to happen. Telecom may feel threatened by data teams as they share control over a major responsibility.

While on the other hand, data teams usually would like to be responsible applications running on their data network. Most intelligent telecom engineers will make an effort to learn the new IP Telephony system and become involve with data teams to successfully deploy and make their transition. However, some people will create obstacles in the way of IP telephony in to their organization. The top management should be prepared and must get involve. They must promote the two parties to get on the same boat and make it a success for the company as a whole. This might also be an opportunity to introduce a new corporate culture where people are rewarded based on combined team efforts rather than individual performance.

According to Susan Cramm, former CIO of Taco Bell Corporation, “CIOs believe they can make almost any project succeed as long as they have enough business sponsors, subject matter expertise and money. This belief is wrong. Business sponsorship is a weak substitute for leadership. Many CIOs don't understand that full-cycle governance is an industrial-strength method of improving the success of IT projects. By driving project success, IT value becomes more than a projection—it becomes reality” ¹¹

Lack of cooperation from telecom or data teams can greatly jeopardize the success of an IP Telephony implementation. Top management support is a key ingredient to a project's success. IP Telephony is no different. IT executives will face some tough challenges in molding their IT organizations to align telecom and data teams together. However, merging the two will make telecom embrace the flexibility and ease of administration of the new VoIP applications and the data staff may come to appreciate voice-management practices and adopt policies such as frequently changing passwords on switches and routers to restrict access.

The bottom line is that the two (telecom and data) needs to get on the same boat and work together. It will be IT management's responsibility that it is done timely and with full support.

The Bottom Line

In conclusion, VoIP is in its early stages, but it is growing at a rapid pace. The more quickly protocols and hardware become standardized, the faster it is to be adopted.

Compared with the high costs of implementing and administrating traditional PBXs, business can no longer ignore the significant reduction in TCO by implementing IP telephony.

The cost savings combined with the unified messaging and many other features that IP telephony offers, allows businesses to be far more efficient. With a promise of such a huge savings, IT and business managers will certainly be tempted to implement VoIP in their organizations as soon as possible. Rather than falling into a very subjective ROI analysis, CIOs and IT Directors should conduct due diligence in all aspects of their individual organizations before making a final decision.

This should include a study of their present network infrastructure, employees' technical and project management skill sets, security requirements, and organizational structuring.

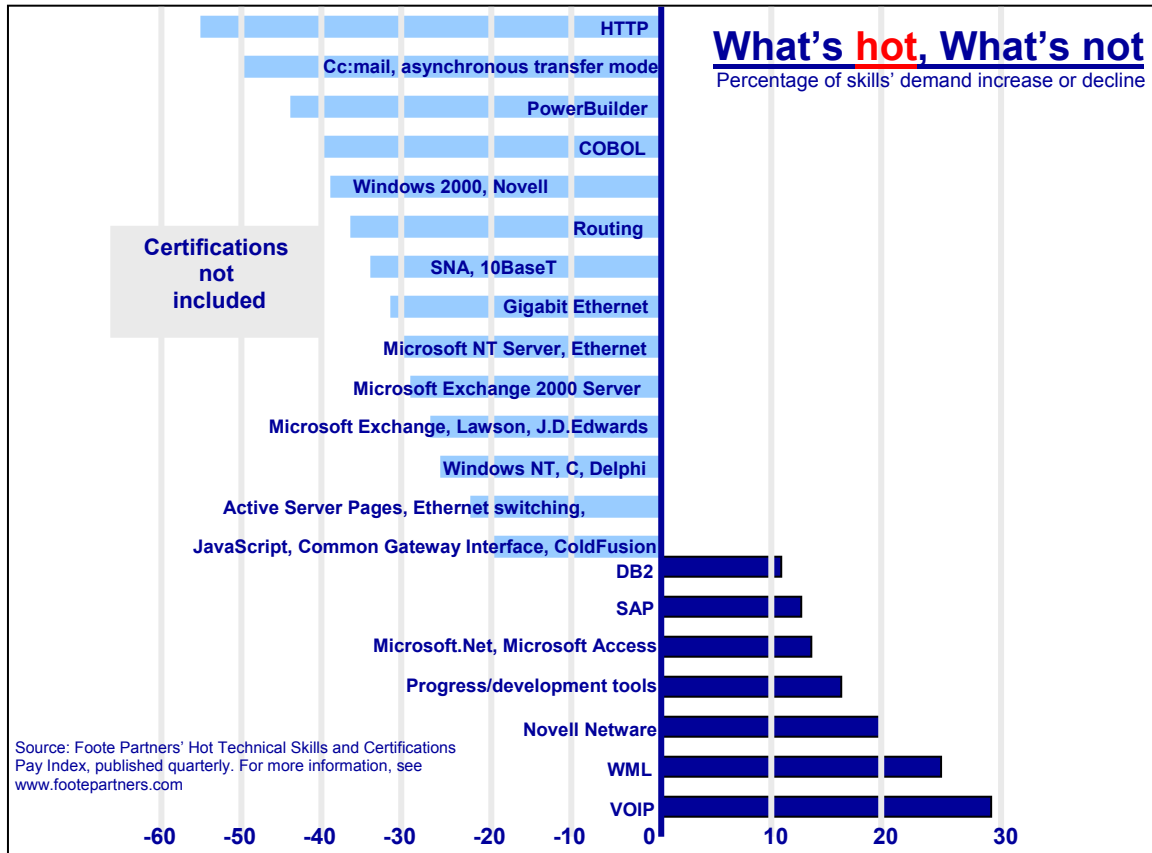
Businesses that retain legacy PBXs will be out-performed by their competitors who embrace this quickly-evolving technology early.

It is easy to conceive that IP telephony will be to traditional phone systems what e-mail is to the postal service, a faster, more fluid and dynamic communication medium that allows end-users to reach a greater number of people in a shorter amount of time with much more information.

As long as IP telephony can be secured, it has great potential for the future.

Appendix A: What's Hot, What's not?

Chart Taken from Stevens Institute of Technology Course Slides for MGT781, "Technology Scan"



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