



## Are You Ready For Voice-Over-IP?

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**For many years, the concept of combining voice and data traffic over the same network has been the dream** of many businesses looking for a way to save money and to streamline management of their voice and data networks. This convergence of voice and data, also known as IP telephony, is a simple concept whose time has come.

Simply stated, IP telephony, or Voice-over-IP (VoIP), utilizes the IP (Internet Protocol) to transmit voice traffic. This is the same protocol used by your LAN and by the Internet. The voice message is digitized and loaded into packets which can be transmitted over your corporate LAN or Internet to distant branch offices.

Thousands of these individual packets each contain a small portion of the digital information that makes up a voice transmission. The packets travel independently of each other and they may take different paths; but once they arrive at their destination, they're reassembled in the correct order. All of this is transparent to the users, unless there's a problem with the transmission.

### Benefits of VoIP

Because not all systems are the same, the benefits will depend on which type you choose and how it's implemented. With that in mind, let's look at some of the possible benefits of a VoIP system:

- Saves money on CPE hardware (Customer Premise Equipment)
- Simplifies network management
- Reduces maintenance and support costs
- Eliminates long distance toll charges
- Allows remote-user access
- Allows unified messaging and video conferencing
- Call center integration

### Implementing VoIP

There are two basic ways to implement Voice-over-IP. And as you might expect, there are many variables to each method. Let's review the two types, keeping simplicity of explanation in mind.

#### 1. Replace the existing Private Branch Exchange (PBX)

Larger companies that have a huge investment in telephone equipment are least likely to replace their PBX with an IP-based network. However if their PBX is old and the company is planning to replace it anyway, perhaps during an office relocation, moving to an IP-based solution would make sense. This decision is made even easier once the company considers the potential benefits and cost savings of VoIP.

#### Stand-alone office

Rather than implement an entirely new PBX, the company could buy a few rack-mounted boxes and some IP-based telephones. Often the main box is an Ethernet switch, similar to the switch used in their LAN. All employees are patched into a port on the switch, which is then connected to a call processor unit that switches circuits and manages the voice traffic. IP-based telephones are still a little more expensive than regular digital phones, but the high cost of a centralized PBX may be eliminated. Many implementations allow using PCs as "soft" telephones, although this requires speakers and a microphone.

It's also possible to allow remote access to the system. Telecommuters and traveling employees could access the IP-based network from anywhere via any telephone, PC, or PDA (handhelds such as Palm Pilot®, Blackberry®, etc.).

This requires installation of a gateway to the Public Switched Telephone Network. A gateway would also allow employees to use their old analog or digital telephones, saving even more money. The gateway would connect to a port in the LAN switch, as would all IP-based phones and PCs. All traffic would be routed and managed by a call processor that attaches to the LAN switch. Even call center or help-desk agents can be remotely located without compromising their access to the network.

#### **Home office with one or more branch offices**

All the benefits of an IP-based system in a stand-alone office would be enjoyed, plus some very significant costs could be eliminated. If the home office installs a router to the Internet (an IP WAN), all long distance phone calls are free, temporarily. No high-speed data lines, such as T-1s or ISDN lines, are needed. But if the company already has a corporate WAN utilizing T-1 or ISDN services for data traffic, they already pay for the flat-rate leased lines, and the additional voice traffic is virtually free. They won't pay for individual phone calls. Companies with many remote offices and users can save a bundle. Remote users can simply dial an extension to talk to any other user, regardless of location.

**One of VoIP's greatest benefits is unified messaging.** The home office installs text-to-speech software in their facility, which translates email to voice mail and vice-versa. Now any user, in any office, can access all their mail and messages in email or voice mail format. Voice mail headers can be viewed via PC, and users can delete unwanted voice mail messages without listening to them. Similarly, phone access allows users to screen unwanted emails in the same manner.

Network management is now centralized. All call processing is done in the home office, where the important equipment and software reside. No on-site staff is required in the branch offices. This has a huge cost savings potential. Management time and expense is focused on a single network. Support time is also reduced.

When the traditional PBX is eliminated, maintenance costs will also drop. A vendor won't have to be called in for moves, adds or changes to the telephone system. These costs are eliminated. A single LAN or WAN can be managed, maintained and supported by the IT staff. This could also reduce employee training costs. Standardizing a single implementation for all offices will likely result in a productivity increase as well.

New applications can be launched over the IP-based system. Video conferencing allows users in remote offices to meet with each other face-to-face, without the expense of traveling to the main office. This technology can also be used for training sessions and e-learning. In large companies this has a huge savings potential. VoIP systems can also integrate streaming video without running separate networks.

Converging voice and data over a single network has exciting potential for Call Center applications. By integrating the company's web site with a database and VoIP system, a customer service rep can hold a conversation with a customer, already knowing the customer's name and web activity. Customers can choose how they want to communicate with the company—via email, live web chat, traditional voice or facsimile. Intelligent routing of these requests assures the proper handling by the right person. Incoming emails can be scanned for subject matter that matches Frequently Asked Questions. Auto-responders can handle these emails, while more complex inquiries are prioritized and routed to trained personnel. Productivity is improved.

## **2. Add IP Telephony capability to your existing PBX**

A company with a huge investment in traditional PBX equipment and software will likely implement an IP-based voice system in conjunction with their existing PBX. This can be done by adding cards to the PBX cabinet that will expand its capabilities. Gateway cards and routers to either the Public Switched Network or the Internet bring the same features and benefits as a stand-alone IP-based system, but still maintain their investment. However, not all PBX models have this capability.

If the remote offices already have their own PBX, many of the benefits of a stand-alone system are lost. Network management is required in every office. Long distance calls would still be free, but the major cost savings compared to a PBX are lost. Also, the cost of the new gateways, routers, switches and software outweighs the existing PBX investment and upkeep.

### **Potential Problems with VoIP**

The scenarios described above are conceptual. Every vendor has a different approach and offers a different set of options or implementations. Products offered will have to be examined for possible weaknesses. Nothing is perfect, and the early implementations of VoIP products had plenty of weaknesses. Here, in summary, are the major problems that an IP-based system must overcome.

**In the industry, Quality of Service, or QoS, is a critical issue.** An analog phone transmission over the Public Switched Network has a reliability factor of 99.999%. This means that the system is functioning perfectly 99.999% of the time. IP-based voice traffic must have the same QoS to “5 nines” as the phone company enjoys. The goal with IP QoS is to deliver dependable voice traffic that sounds just like a telephone call via a PBX. However, if the IP-based system is any less dependable, there are problems. Voice packets that are lost or arrive late result in delayed or garbled transmissions. This is intolerable for a business phone call.

The good news is data traffic on your LAN doesn't have to be such a problem. Error correction and routing issues can be handled quickly enough to make transmission problems invisible to LAN users. But voice traffic must move in real-time streams. Thus, voice packets that travel in the same network with data packets must be given a higher priority for routing to the destination address than data. If traffic will travel to remote offices, the existing WAN must be upgraded to achieve the “5 nines” QoS demanded by voice applications.

The availability of service, or Service Level Agreement, is a guarantee of service provided by your ISP or WAN dedicated line service provider. They promise predetermined levels of network availability, voice quality, latency, packet loss, and system downtime. The network is managed by sophisticated equipment at your service-provider's facility.

### **Limited # of users**

Some earlier implementations of VoIP systems limited the number of simultaneous users on the network. Because the voice packets were traveling through the same LAN that carried data packets, total network traffic increased to intolerable levels. Since the voice packets must be prioritized in order to provide the required QoS, this effectively limited the amount of voice traffic allowed on the LAN.

Newer vendor offerings for larger-size companies have built scalability into their products. Thousands of IP addresses can be created, and up to a million users can be accommodated.

### **Features**

Early versions of VoIP didn't have all the functions that would normally be expected in a phone system. Simple things like putting a call on hold weren't possible. Conference calling, a technically complex function; call forwarding, and other functions such as least-cost routing and SMDR (call detail reports) weren't available.

Voice mail integration was a sore point for many companies. Messages were lost, callers were cut off in mid-message, and users could not access the voice mail system. Call center functions were lacking or severely restricted.

Vendors have begun to address most of these problems. While they are far from perfect, most of the problems of early implementations are resolved. The buyer must beware of systems that claim to have all the functionality of traditional PBXs. Ask specific questions and make the vendor prove their capabilities before buying. I recently learned that, generally speaking, IP phone systems can't page all the phones in the system simultaneously. You'll need a separate paging system if you need this functionality in your business.

### **Security**

Voice traffic that travels over the corporate LAN in your office enjoys the same security as your data traffic. But sending voice packets over the Internet is far from secure. This is the "show-stopper" for many companies looking into VoIP solutions. Yet routing IP traffic over the Internet will eliminate both long distance toll charges, and the need for leased data lines.

Virtual Private Networks, or VPNs, can solve the security issue. Available in either a network-based or premise-based version, the VPN encrypts the data traveling to and from the Internet. These use complicated encryption algorithms that make it almost impossible for hackers to enter your network. It's as if you had your own Public Switched Network, but it's not really a physical link over copper and fiber cables. It's a virtual connection, sending packets everywhere to be reassembled later. The encryption software is what makes the transmission safer.

As an added security measure, most companies have Internet firewalls that use software to police the traffic between the company LAN and the public network. In concert with VPN encryption services, a firewall can add another level of security by filtering packets to authenticate their source and destination.

In addition to Internet firewalls, companies are implementing Network Address Translation routers between their LAN and the Internet. This uses a table of internal IP addresses that are not broadcast to the Internet. No one on the outside can determine the IP address of individual users within your LAN.

### **Standards**

There are standards under development for every aspect of VoIP transmission. These affect network operating systems, software interfaces, ISP and WAN access methods, security solutions, network scalability, digital encoding, encryption methods, call processing techniques, quality of service, and service levels.

The goal of open standards is to allow interoperability between vendor systems, and dependable transmission (99.999%) over any manufacturer's implementation. Vendors and service providers must comply with all standards in order to offer a true open system. These standards are new and some are still being developed; and until they're stabilized, many vendor offerings will remain proprietary. This is a big consideration. No one wants to spend a fortune on a new "converged" system, only to discover that it's a proprietary, non-standards-compliant solution.

### **Management**

A stand-alone IP-based system can be entirely managed by an in-house staff, as long as the staff has the required knowledge and capabilities. However, most WAN and Internet connections to remote offices will involve several vendors who have an intricate knowledge of the hardware and software. Tight coordination between the IT staff, vendors and service providers will be necessary. This is a job for someone with significant experience and credentials in both data and voice disciplines. A large organization may have such a staff, but most companies will depend at

least in part on outsourcing the day-to-day management of their IP-based system to an expert. Convergence does not necessarily mean simplification.

## **What VoIP Will Not Do**

### **Save money on cabling**

One of the advertised savings touted by vendors of VoIP hardware is the cabling or wiring of your office. This is usually a hollow promise for several reasons. First, there is no standard established yet for a single VoIP system. There are PBX-based systems, LAN-based systems, and even hosted systems where all equipment resides in the phone company's basement. Each of these systems has different wiring requirements.

A PBX or Centrex-based system uses the existing phone jack and wiring in the office, just as a traditional PBX or a Centrex hosted solution would require. LAN-based systems use the LAN or data jack/wiring in your office. Some systems use an IP phone, and require this to be connected to the LAN jack. The PC then plugs into a port on the IP phone. Other vendor offerings work the other way around, with the PC being plugged in first. This sounds like all you need is one data-grade cable and jack for each user. However, this isn't true, since different vendors have different wiring requirements. Some require a separate cable/jack for the VoIP system, even though the data and voice travel over the same network.

Beyond the requirements of your VoIP system, the cabling industry is governed by a different set of standards. The EIA/TIA-568 standards set the requirements of commercial building cabling. At a minimum, this standard requires two jacks/cables per user. One of these circuits must be data-grade (Category 5 or better). The other circuit can be voice-grade (Category 3).

In order to have a standards-compliant cabling system, both jacks/cables must be present. If not, the cable plant is not certified, and the manufacturer's extended warranty cannot be obtained. The EIA/TIA standard takes a "worst-case scenario" approach to wiring. Your office should be wired to provide for any combination of voice and data usage. Just because you may want to install a VoIP system now doesn't mean that your needs will be met indefinitely.

The promise made by vendors that your cabling costs are reduced is, therefore, not true. Do not factor this into your decision to buy a VoIP system.

### **Eliminate the need for network management**

The allure of converging your voice and data applications into a single network, eliminating duplicate effort, and centralizing and simplifying network management are all valid benefits of a VoIP system. But you won't eliminate the need for competent network management in your main office and at least some basic level of management at your branch offices. In fact, you may discover that your LAN manager is not competent to take on the additional responsibility of VoIP management.

Yesterday's LAN guru does not automatically become today's telephony expert. Network managers must be schooled in both voice and data disciplines. Just because the voice and data packets travel over the same network doesn't mean that they're the same. As we've discussed, voice packets must be prioritized over data packets, and other Quality of Service factors must be managed if VoIP systems are to function properly. Traffic allocation and bandwidth management become more complex by adding VoIP services to an already busy LAN. Because VoIP call processors and gateways use such complex software, network managers must be able to understand its features and functions in order to troubleshoot problems.

Branch office problems can't entirely be solved by a network manager in the home office. In a distributed VoIP system, certain components must reside in the each branch office. Network management at the local level must exist in some form. Even if it's just the Office Manager,

someone must have a basic understanding of what the equipment does, and must be able to hold intelligent conversations with the head network guru when problems arise.

The promise of reduced network management is a real one, but not to the extent that many vendors claim. Network management software need not be deployed in every branch office in a VoIP system. Many systems can be centrally managed using a web-based SNMP program loaded on the server in the home office. The exact requirement for network management will depend on the type of implementation you purchase.

### **Eliminate Training Costs**

Many IP telephones have the same look and feel of traditional phones. But, some level of user training will still have to be provided, just as it would for a new digital PBX. Users need to know how these new phones are similar, and how they differ from the old phones. New features must be explained and users must feel comfortable using them, or the assumed productivity gains will not materialize. This is especially true if unified messaging capability has been added.

If you select a system that uses “soft phones”—PCs that are equipped with speakers and microphones, with click-to-dial capability—users must be trained in using the PC instead of a telephone. The same goes for remote users of PDAs. They must also be trained to access features and functions such as voice mail and email.

### **The Bottom Line**

There are many types of VoIP systems available to meet a variety of needs. Every company’s needs are unique, and there’s no simple answer to finding the right system for your company. There are many potential benefits and cost savings, but these will depend entirely on which system you implement. This is still a developing technology, so tread carefully and get a handle on the Total Cost of Ownership (TCO) before you buy.

### **About the author**

Chip Chapman is a Registered Communications Distribution Designer with over 24 years of experience as an entrepreneur, business owner, speaker and author on the subject of Technology S.P.A.C.E. planning. He has been involved in all phases of building, expansion, adjusting and relocating of businesses large and small. This background has led him to develop unique insights into how businesses can actually prevent potential problems and overcome many challenges when it comes to creating a solid relocation game plan. He can be reached at 614.985.4815 or visit [www.ibswebsite.com](http://www.ibswebsite.com) for more details.