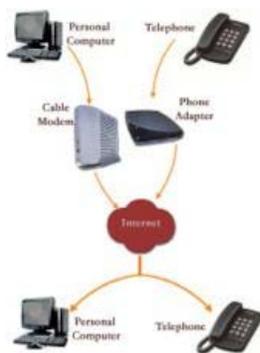


Guide to Voice Over IP (VoIP)

Introduction

Voice over Internet Protocol, also called **VoIP**, **IP Telephony**, or **Internet Telephony**, represents the latest in phone system technology. VoIP is a phone service which connects to your existing high-speed Internet connection for the purpose of making and receiving phone calls. With a traditional landline, you use your phone to make calls over the copper wires running over telephone poles and buried into the ground.



VoIP had been heralded as the next 'killer application' since it came onto the scene in the mid-90's, but issues with voice quality and complicated, expensive hardware prevented the technology from being widely adopted until recently. Now voice quality is on par with traditional landlines, and hardware costs are more reasonable.

According to industry analysts, worldwide revenues for **business-class** IP phone systems were 10 billion dollars in 2008, and up to **one-half of all voice traffic will be routed by IP systems**. As mentioned above, call **quality has improved dramatically**, technology has become less expensive, and business adoption has started to grow. Still, **VoIP technology is not the right solution for every company**. The more informed you are regarding the benefits and potential drawbacks of VoIP technology, the better able you will be to determine whether VoIP is the right solution for your company's needs. This guide to VoIP Systems is designed to provide you with the basic information you need to help find a VoIP system and provider that best meets your business needs.

Telecommunications Key Terms

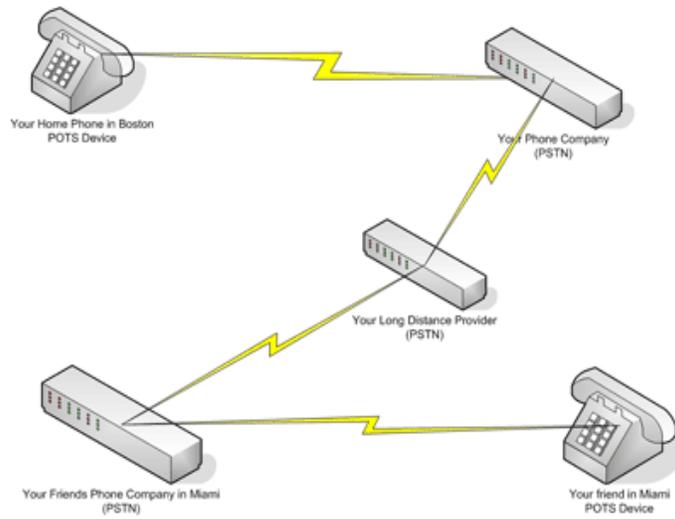
Before we proceed, it's important to understand some key terms related to how telephone calls have traditionally been routed prior to the advent of IP Telephony:

POTS – Plain Old Telephone Service If only every acronym were so simply effective! A POTS device (your telephone) connects directly to the PSTN.

IEC - Incumbent Exchange Carrier A fancy name for the local telephone company. As an example Qwest is an IEC.

PTSN - Public Switched Telephone Network A PTSN is owned and operated by an incumbent exchange carrier - Imagine you place a call from Boston to Miami. Using the **PSTN**, your call would travel from your office to your local telephone exchange, then to your long-distance provider, on to the local telephone exchange in Miami, and finally to the destination.

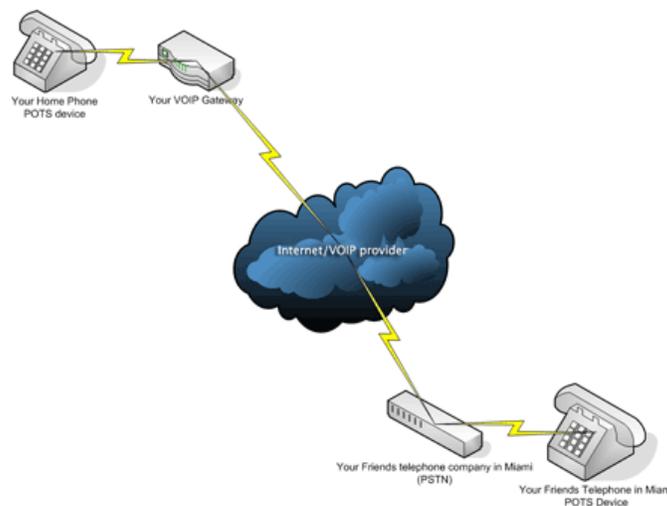
In the example below, the phone call has been routed through three different companies and has incurred a toll charge. This is traditionally how phone calls have been routed across the network.



VoIP – Voice over Internet Protocol

VoIP essentially works by converting a phone call from an analog to digital signal, and then transmitting it data packets over an IP network (the Internet or other private network), finally terminating the call on a PSTN. By routing phone calls over broadband Internet connections, **VoIP bypasses traditional phone service** and delivers no or low cost long-distance calling around the world.

Let's use the same call routing example above, only this time using basic VoIP service. The call originates from your local telephone, and is converted into a digital format and compressed if necessary. It will then travel to the Internet through your network to your VoIP service provider. Finally your call would be routed via the IP network to a local exchange, and terminated to the destination's POTS device (telephone).



VoIP has an advantage over the PSTN in the above example as it eliminates toll charges.

Types of VoIP Solutions

There are many types of IP Telephony solutions, but for the purposes of this guide we'll break them down into two basic type; one for home use and one for business application. Unfortunately, as with so many things tech-related there are a number of confusing terms and acronyms that only serve to make the technology seem even more complicated than it needs to be.

Voice Over IP Services - In its basic home version form, VoIP requires a **regular phone**, and **VoIP adapter**, **high-speed Internet access**, and a **user account with a VoIP service**. When you place a call, it's sent over the Internet as data until it nears the recipient's destination. Then the call is routed back onto a more traditional network, and completes the trip over standard phone lines, allowing for extremely cheap long-distance and international calls. Most VoIP service companies offer small business plans for this type of service, but are limited in users, depending on your hardware.

The second will be our focus. **Business Quality VoIP Phone Systems** – This is an IP PBX phone system and is defined as equipment that **routes internal phone calls over your corporate computer network**. With these business class systems, you can **unite multiple offices** on a single phone system. No matter how remote the locations, an 'IP PBX' phone system can completely eliminate long-distance calling charges between them. These systems replace or in some cases augment traditional PBX (private branch exchange) phone systems. IP PBXs are likely to replace traditional PBX phone systems over time however as prices fall and reliability improves.

Small Business Voice over IP Services

Today small business oriented companies are offering VoIP services, and plug-and-play hardware phone adapters and/or software. It's quick and easy to make the switch from a landline, by simply plugging a phone adapter in between your regular phone equipment and your broadband connection. The VoIP companies usually provide the box for free, and monthly unlimited call rates are ultra-competitive.



With 'small business' Voice over IP services, there are no long distance or local service charges.

This makes **this kind of service incredibly versatile for small businesses** that only need a few lines. Where local telephone company basic line rates for small businesses start at \$50-75 and up per-month, with long distance additional, and all the extra fees, VoIP services can look cheap by comparison. Small business VoIP plans start at about \$50 per-month, but many offer unlimited long distance calling anywhere in the USA and Canada, and relatively inexpensive international calling.

The best thing about VoIP phone services may be that **you have some enormously beneficial features and controls over your phone service that are not offered by any phone company.**

For example, with VoIP services you can simply **add a local line anywhere in the country** and have clients dial that number just like they would for the business down the street. With VoIP, the configuration options are endless and can be implemented very quickly, unlike traditional phone service provisioning, which can take weeks or even many months.

Small Business VoIP Services Considerations

- You must have digital high-speed Internet connection such as cable, FiOS, DSL, or T1 or better.
- VoIP phone service is dependent on your internet connection being operational.
- VoIP service is not free, but extremely competitive compared with phone line costs.
- The type of VoIP you need is dependent on the typical number of people on the phone at the same time.

Long-distance companies, cable companies, and broadband Internet providers are all competing with VoIP providers to offer cost-saving, feature-rich VoIP services. VoIP not only **offers savings of about 30 to 50 percent** depending on the service and your calling needs, but you also get feature sets usually found only on high-end phone systems, such as call routing and voicemail-to-email integration. And thanks to new portability laws, you can **keep your existing phone number** as well as remove the need for additional numbers when switching to VoIP.

In terms of voice quality with VoIP, you're **not likely to tell the difference between VoIP and a landline**, and you'll find it better than your cell phone connection. Two of the biggest early complaints about VoIP regarding the lack of white page listings and 411/911 access have been addressed. If these are important to you, be sure to check their cost and availability when selecting a plan.

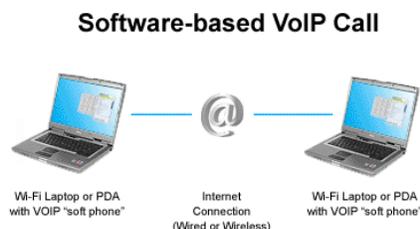
One flaw, however, will always remain: **VoIP only works if your broadband connection is working**. If your power goes out, or your connection drops, so will your phone service. On the other hand, one of VoIP's biggest savings comes from the relative lack of taxes and fees.

VoIP services are available in two basic flavors: **hardware-based services** that use a converter box between your broadband Internet router and a regular phone, and **software-based services** that require a computer. PC-based systems handle call-processing duties on your internet-connected computer instead of on a separate dedicated box or phone, and most lack complete call-and-receive interconnect services to public phone networks. You can use your computer's built-in speakers and microphone, or inexpensive USB headsets and handsets.

Software-Based VoIP Services

Software-based VoIP services require computers with compatible programs at both ends to place a call, as well as a broadband connection in between. Skype is the best know of these types of services. Some programs have the capability to call from computers to land line phones as well. This software based VoIP is referred to as a soft set when it comes to defining the type of phone used and many VoIP services provide this capability in addition to using a hand set for on the road use.

The illustration below demonstrates the flow of a software based VoIP call:



PC-based packages have greatly improved in sound quality over the years, but some are still **not at the same level of quality or ease of use as the hardware services**. Some only let you talk to other people using the same software; while others also let you make and receive calls from regular phone users at extra cost.

Many software-based VoIP packages are free or very affordable, however, and there are usually no call charges unless you want to be able to talk to regular landlines or cell phones. This solution doesn't have any real, practical applications for most business.

Hardware-Based VoIP Services

Connecting a VoIP phones is easy if you currently have a broadband connection, computer and network router.

The following illustration demonstrates the flow of a hardware based VoIP call:



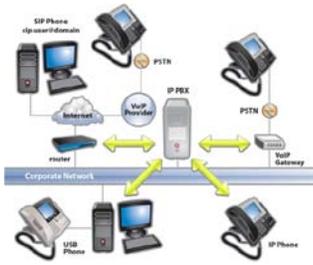
Hardware-based VoIP service providers have brought quality and reliability to the VoIP market, attracting the large telecom and cable carriers. Hardware-based systems usually offer higher voice quality, better reliability, and more features, such as white-page listings and 911 accesses.

Other lower quality systems even allow you to plug a standard phone into a converter box, which in turn connects to your broadband modem or router. Anyone can receive a call placed this way; **no special software or converter box is required at the recipient end.**

Local phone companies are almost as threatened by VoIP as long-distance carriers, and many now offer their own VoIP services. SBC, BellSouth, Qwest and others have VoIP services. They join **dozens of other providers that already offer VoIP services** to business customers.

IP PBX Phone Systems

The premise behind **Voice over IP is fairly straightforward**. Instead of using circuit-switched technology for call processing, VoIP phone systems convert voice signals to data, turning your words into packets of information that are sent over data networks. As they arrive at the other end of the call, the data is turned back into an audible voice signal.



To set up a business class **IP PBX** system, several elements are required. A **central device** manages the call processing, the way a private branch exchange (PBX) or key system unit (KSU) does in traditional phone systems. This can be a dedicated piece of hardware such as an IP PBX, a regular PBX that has been IP-enabled, or a server running specialized software. You will also need **phones** and a **data network**. In many cases, you may be able to use your existing digital phones and computer network, although you may need to upgrade some of your network hardware.

If your company has **more than 15 users** that are already connected to a corporate network, you are a **prime candidate for an in house IP PBX system; otherwise a hosted PBX** will most likely be the best decision. You can share the full features of your phone system across all your locations. In addition, even if you have one office in Florida and one in New York, VoIP allows calls between them via extension dialing, making it a zero cost call. For businesses with hefty monthly long distance charges due to calls between locations, **this can be a very appealing reason to upgrade**.

In many cases, **the best solution may be a system that uses existing phone wiring** within the main office and VoIP for calls between locations. This combination works well if you have relatively new telecom equipment, as many PBXs can be IP-enabled with software and minor hardware upgrades. Providers can also set up systems that use only traditional lines and extensions at first, but support later expansion to VoIP.

Hybrid Phone Systems

In what's known as a **Hybrid IP system**, internal calls are routed over your existing phone network or your computer network. Calls within the same office will typically be conveyed over the phone network, while calls to other company locations get routed over your computer network. Calls to external phone numbers get sent through the data network to a gateway, which connects to the public telephone network. **All calls connect seamlessly to any phone user**, so there is no compatibility issues to worry about.

According to some sales brochures you may have seen, **an IP PBX installation is NOT a guaranteed way to save money**. Advanced features alone are not reason enough to upgrade to an IP PBX, however there are some specific situations where this type of system can make an immediate positive impact on your business. An IP PBX phone system can also save money if you are setting up a new office as you will not have to run separate cabling for a phone system.



Benefits of an IP PBX Phone System

Multiple Locations - With an IP PBX, any and all offices on a corporate network can obtain the benefits of having a common office phone system, including extension dialing, seamless call transfers, and other features. Also, if they are on the company network, phone calls are no charge, even if your offices are located thousands of miles apart.

Streamlined Administration - There are other cost savings that stem from a streamlined network infrastructure and improved administration. With VoIP, network administrators only have one network to maintain instead of two.

The **Move, Add, Change (MAC)** process also is greatly simplified, because almost all VoIP systems are configurable through a web interface that can be managed by the administrator. This means lower ongoing costs as you will not need to call your provider for every MAC. And because multiple offices are seamlessly connected, they can share a single receptionist, auto-attendant, and voice mail system.

Remote Users - Another significant benefit of an IP PBX type system is for employees on the go. If your remote users connect to the company network via a Virtual Private Network (VPN), VoIP allows them to make phone calls from the road at no extra charge. One salesperson on an extended trip can save hundreds of dollars in cell phone or hotel long-distance charges.

Other familiar and essential phone system features like **caller ID, call forwarding, simultaneous ringing across multiple phones** and other features you would find in traditional business class PBX systems are available in most IP PBX systems. VoIP also works with advanced Computer Telephony Integration (CTI) applications, such as **ACD routing** and **call center management**. These popular applications can prioritize incoming calls based on the caller's identity, automatically bring up callers' account information as the phone is answered, and route the call automatically to the correct agent.

VoIP may help to reduce telecommunications costs and offers advanced applications and services.

For businesses, this is a great competitive advantage by enabling connected workforce, more productive telecommuters, and seamless integration of branch offices and HQs. Unified messaging is a new and powerful application made possible by VoIP that increases productivity per employee and can substantially reduce business support and administrative costs.

Along with the benefits of new service revenues and reduced capital and operating costs, VoIP networks present several design and implementation challenges to businesses.

The primary concern has been ensuring Quality of Service (QOS) i.e. making sure that a Voice over IP call has the same level of voice quality as a call made over a traditional telephone network. Techniques such as tagging are used to give voice packets the highest priority so data streams contending for bandwidth in the same network don't degrade voice calls.

Due to these QOS requirements, **it may be necessary to upgrade the capacity of your corporate network** when upgrading to an IP PBX.

Network Bandwidth

The biggest challenge to maintaining IP PBX call quality is **bandwidth** as high quality voice calls require quite a bit of it. The technology to compress audio and to reconstruct it has been improved to the point where **VoIP sound quality over a broadband connection is as good as or better than that of regular phones**. But some networks that have sufficient capacity for data are not up to the requirements of VoIP.

Computer networks are designed to handle data, and packets arrive out of order and sometimes are even lost. However, in most cases the data being sent can easily be reconstructed before it is needed. Voice

calls are not as tolerant of these kinds of disturbances, and each **packet has to arrive in the correct order**.

Because these voice packets are being sent in real time, if packets are lost, the conversation sounds distorted, choppy, or falls off all together. This is why VoIP services that rely on the Internet to transmit calls can have uneven phone quality.

QOS

If your company will be routing calls over private data networks, much of this potential problem is avoided. Companies looking at IP PBX systems generally have networks capable of handling high-quality voice conversations; however, they may need to be boosted with a **Quality of Service (QOS) application**.

QOS applications set aside a dedicated amount of bandwidth for voice traffic by giving voice data a higher priority as it is routed through the network. If there is network congestion, VoIP data is routed through first so call quality does not suffer. QOS applications are built in to some VoIP systems, as well as some routers. They can also be purchased separately as stand-alone upgrades. Most VoIP experts **agree running VoIP on a corporate network without QOS is a risky proposition**. If you have a network that routes data over the Internet, you can still run QOS applications, but there can be no guarantee of quality. Internet call quality can sometimes be improved upon in this situation if the various offices use the same Internet service provider.

Network Outages

Unlike regular phone systems that usually require little maintenance once installed, IP PBX systems require a great deal more attention.

Since regular phones systems get all the power they need through the phone line, they continue to work in the event of a power outage. In contrast, most **VoIP phones need to be plugged into a power source** to work. By definition, VoIP phones are also network-dependent. To most businesses, phone service is absolutely critical, and **this can be a concern** since computer networks can occasionally be brought down by a server crash or other problem. However a good IT staff can prevent most outages and react quickly when one occurs.

Unlike traditional PBX and Key phone systems, VoIP systems require a great deal more attention.

Selecting an IP PBX Provider

Purchasing an IP PBX for business from a certified local reseller is the best choice for most businesses. Manufacturer certified resellers have proven expertise, manufacturer support, and the ability to respond quickly to urgent issues requiring an onsite visit. **Ensure the provider you are considering has manufacturer support**. This is particularly important when buying an IP PBX system as maintenance and support upgrades are released regularly.

Keep in mind that some providers who focus on data networking may only sell IP PBX systems. This can increase your costs unnecessarily when a hybrid traditional/VoIP system might be better suited for your business requirements.



Many PBXs can be IP-enabled with software upgrades and minor hardware additions, and you may be able to use handsets (phones) you already own. **The potential cost savings are significant**, and you can also increase the overall reliability of your phone system.

Also watch out for providers who propose to add a VoIP system to your existing corporate network without thoroughly considering network performance and capacity. The provider may later attempt to charge you for upgrades if call quality falls short of your expectations.

Make sure you always get a thorough analysis of your current network and the impact VoIP will have on it to accurately **calculate total cost of ownership of the system**.

Always perform a thorough traffic analysis of your network, and consider the impact of VoIP.

When comparing phone systems, make sure you investigate features very carefully. Many systems may not include the specific features you require, and exactly what makes up a complete system can vary widely among providers. When looking at IP PBX systems, always be sure you are **comparing equivalent features**.

The last thing you need to remember is that **many common business devices require analog phone lines**. Not only fax machines, but credit card processors, some security systems, and other devices require an analog phone line connection. **Make sure your provider is aware of these requirements** when configuring your system.

Conclusion

As you can see, selecting the right Voice over IP system and provider for your business requires the consideration of many different factors. We hope this guide has helped to inform you about the features and functionality available today in VoIP technology, which will ultimately help you to select the right provider for your company's requirements.

Note: This guide provides general guidance and should not be construed as specific financial, technological, insurance, legal, or accounting advice. Always consult a qualified advisor for specific guidance in these matters.