

Voice Over IP

Business Voice Drives Market for Converged Networks



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special to dash30



VoIP Finally Comes of Age

Voice over IP (VoIP) services have come a long way over the past several years. Plagued by initial concerns over substandard quality and questionable reliability, VoIP vendors have stepped up, and solved these early problems. Many VoIP providers now deliver toll quality transmission, and quality of service (QoS) levels have significantly improved to match the integrity provided by traditional voice systems.

Whether or not they are convinced of its quality, companies can't ignore the fact that VoIP provides real benefits. In fact, the cost savings alone should make VoIP a "must have" technology. By integrating voice and data on a single converged network, companies save big on long distance charges, wiring fees and administrative costs. Further, for today's growing and highly decentralized companies, VoIP can give far-flung employees, telecommuters and remote offices access to corporate resources and communications systems. VoIP also will deliver next generation applications such as unified messaging, virtual call centers and interactive voice response (IVR), which will streamline operations and improve business communications.

While organizations have expressed concern about migrating to a converged IP network, studies show that the quality, resiliency and scalability of the technology either met or exceeded the expectations of 80-85 percent of the enterprises that have implemented VoIP.

So, with all the hoopla about VoIP services, why is it always next year's technology? Why do analysts continue to predict that while VoIP adoption is inevitable, it will be a slow growth opportunity? Where is the hold up?

Some experts blame the slow growth on the high cost of deployment during a weak market that for much of 2002 adopted a "If it ain't broke, don't fix it" attitude. Installed TDM (time division multiplexing) PBX systems have a long product life and are still very functional. Most

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companies have major concerns about protecting their investment in this traditional PBX technology, which needs to be fully depreciated. And, if they are unable to create a concrete ROI, VoIP providers are faced with justifying a large capital expenditure in an economy where cost cutting is at the top of the list.

Further, the benefits of converged networks still may not be compelling enough to justify the deployment of new systems. VoIP vendors have focused on parity with TDM Class 5 switch functions, which are the standard for voice services in the telecom world. “The current emphasis in VoIP is big on parity with TDM features,” says Christine Hartman, director at Probe Research. “But rather than (replicating) a feature the same way with VoIP, we need to look at what need drove the feature and ask whether there is a better way to solve the problem.”

VoIP vendors must go beyond meeting Class 5 levels, and offer new applications that will give customers a competitive advantage and differentiation in the marketplace. While many vendors have talked about next-generation applications, most of these are simply not ready for prime time. Customer facing solutions, such as call centers, require bulletproof technology that makes the changeover transparent to the end user. A recent study by *Network Magazine* found that advanced VoIP services seem to be rolled out in stealth mode, until the bugs can be fully worked out.

Finally, as with any new technology, companies have concerns about the success of implementation, and the resources required to cut over to a new system. VoIP falls somewhere between datacom and telecom services, and requires cooperation between both groups within an enterprise. Telecom managers are concerned that VoIP will compromise the quality of their voice services, which must meet very stringent reliability standards. IT managers worry that voice traffic will congest their existing networks and impact data transmission.

While the obstacles are real, analysts believe the benefits are far more important. VoIP will cut telecommunications costs, provide greater flexibility for the workforce, decentralize operations and provide a platform for new applications. Companies have more options than ever for deploying VoIP solutions, including outsourcing, which will ease the process of a changeover. Further, VoIP vendors have moved away from the all or nothing approach, and now allow companies to pick and choose implementation options. In addition, new standards have addressed interoperability concerns, allowing companies to install VoIP in selected locations and maintain their existing investment in PBX equipment.

VoIP Defined

With so many terms making the rounds, VoIP has suffered from somewhat of an identity crisis. At its most basic, VoIP is defined as the movement of voice traffic over IP-networks. In order to accomplish this, voice must be converted so that it can be transmitted over a packet-switched network rather than a circuit-switched network.

Internet telephony is often used interchangeably with VoIP, and usually refers to the equipment used to implement VoIP. Some analysts make the distinction that Internet telephony uses the public Internet to transmit voice packets. In comparison, many enterprise VoIP products transmit voice traffic over private IP networks. The distinction is important because private IP networks give an enterprise more control, and typically delivers high quality, reliable voice transmission over a data network.

Converged, or IP, communications is a superset of VoIP, and refers to the integration of data, voice and video solutions onto a single, IP-based network. Converged communications has been possible in the past through technological developments including Frame Relay and ATM, or asynchronous transfer mode, and optical switching. While these core technologies are still effective, IP has evolved as the universal protocol for access to voice and data applications. VoIP is the most mature and largest segment of the converged communications market, and will provide the core technology for next generation applications.

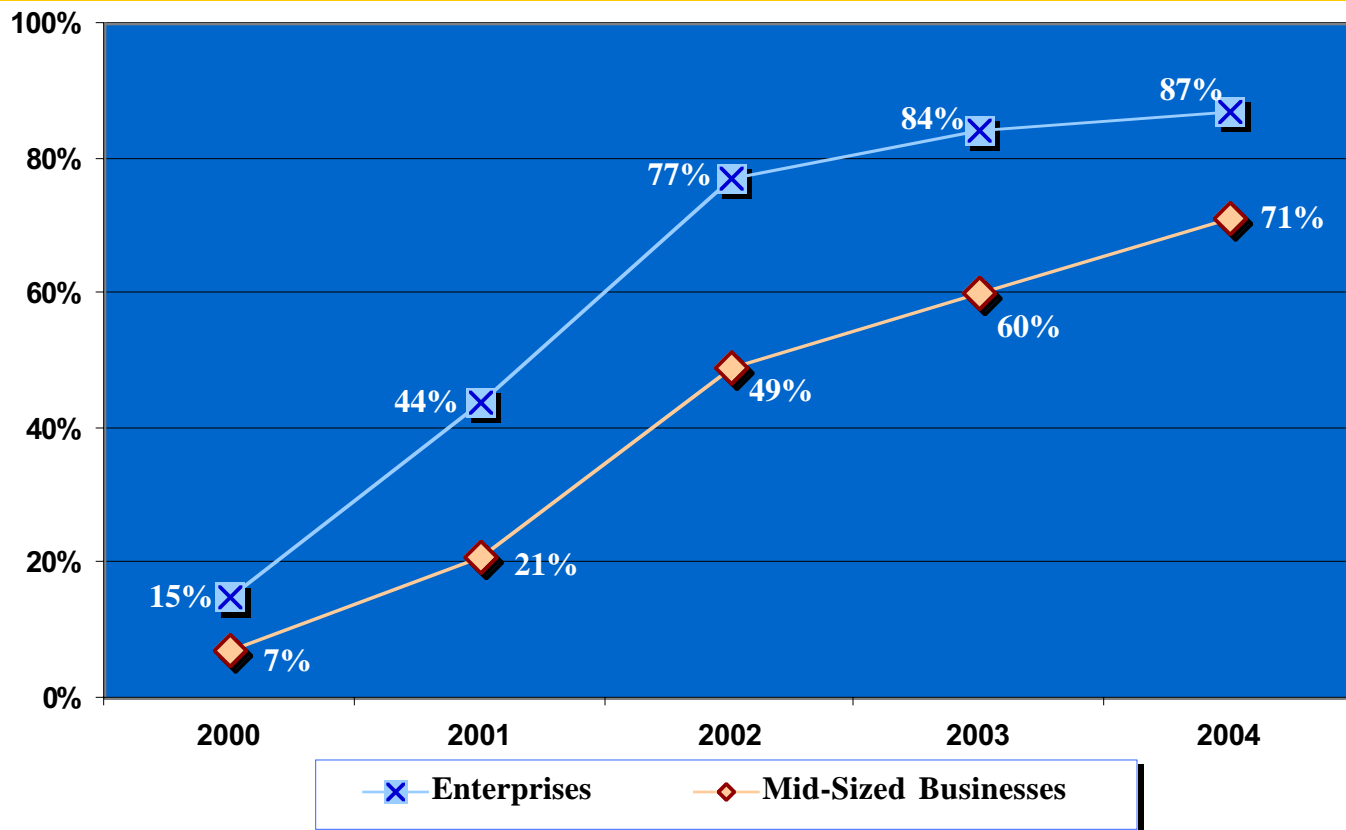
Market Drivers and Forecast

Analysts agree that the potential market for VoIP is enormous. According to Frost & Sullivan, VoIP will account for approximately 75 percent of world voice services by 2007.

Much of the growth in IP will be shifted away from the traditional PBX market. According to Allied Business Intelligence, revenue from IP PBX lines will outpace traditional PBX systems for the first time in 2003, reaching \$6.8 billion for IP PBX compared to PBX traditional shipments, which will total \$3.2 billion. Allied Business also states that new IP PBX lines will grow from 1.9 million lines in 2001 to 42 million in 2007.

Hosted services are also projected to grow. The Yankee Group predicts that hosted PBX and IP Centrex services will reach \$5 billion by 2005. These services offer customers the option of outsourcing integrated voice and data services from a service provider.

Timeframe to Begin Implementing IP Telephony



Source: Phillips InfoTech; © 2003

A recent Phillips InfoTech study found that 44 percent of enterprises are in the process of migrating to IP telephony and that 12 percent of all lines in 2001 will be IP station lines. Traditional PBX sales have declined by 25 percent in the last two years and 62 percent of voice and data decision-makers have postponed PBX technology investments, in anticipation of moving to an IP solution.

What is driving the market? The promise of reduced costs and enhanced business operations have made the evolution to VoIP services inevitable. Today's business environment is made up of global customers, employees, telecommuters, home office workers, and off site contractors, who need flexible access to voice systems, around the clock.

VoIP systems promise to deliver just that. Enterprises already are experimenting with these services, and many have major installations planned. According to attendees at a Network world VoIP seminar, 36 percent indicated they already had deployed VoIP in some form. While these users likely represent early adopters, the momentum for VoIP clearly is building as more service options become readily available.

The Evolution of Voice Services in the Enterprise

The platform for traditional voice services is the PBX, or private branch exchange. Instead of a telephone company extending a line for each phone from the central office to the customer location, the PBX acts like a mini central office at the customer's premises. While main lines from the central office still are needed, each main line can support many individual phones. A PBX is analogous to a mainframe computer, which connects terminals, in this case phones, and provides applications, in this case voice services.

Voice PBXs are rich in voice features and sophisticated applications, such as incoming call identification, automatic call distribution, priority ringing and three-way conferencing. Voice features can be highly customized to suit the complete needs of customer service centers or inbound sales organizations, or the relatively simple requirements of a small business. The average PBX comes standard with more than 400 features, covering a broad and flexible spectrum of voice options.

However, voice PBXs are, by design, centralized systems. The system intelligence resides in the PBX, and the telephones are largely dumb. It is difficult to extend functionality to a campus environment or to remote users. Companies frequently end up installing multiple PBX systems and tying them together through dedicated lines, which have to be engineered to accommodate peak traffic. As companies grow and employee needs change, it is increasingly difficult to centrally manage multiple locations and extend customized features to a widespread workforce.

Alternatively, VoIP systems are designed for flexibility and scalability. By using the Internet, or a private IP network, as the backbone, VoIP systems operate in a decentralized environment. IP is a low-cost transport mechanism that can deliver voice and data traffic to any location, over any type of media. Terminals can be standard phones, IP phones, PCs or PDAs, with varying levels of intelligence. With the growing number of devices and transmission types that need to be supported by most enterprises, IP provides the ideal foundation.

Early VoIP pioneers 3Com, Cisco, Clarent, Nuera Communications and Hypercom have been joined by traditional PBX vendors, including Alcatel, Avaya, Ericsson, Mitel, NEC, Nortel Networks and Siemens, and telecom companies WorldCom, Verizon and AT&T. IP PBXs, IP enabled PBXs, voice-enabled routers, IP phones and IP Centrex are some of the many products available that can be combined to address the needs of the organization.

Out with the PBX, in with IP

Today, businesses can choose from several options to deploy VoIP services. A company can opt to purchase an IP PBX, which resides on the customer premises and is operated and managed by the customer. The IP PBX replaces an existing voice PBX, and is a good solution for a company with older equipment that needs to be changed out, or for a greenfield location where no equipment exists.

The problem with the replacement approach is that the entire telecommunications system and all the supporting applications need to be ripped out and upgraded. Companies with well-established systems cringe at the thought of rebuilding an entire telecommunications system, especially since current IP PBX systems do not provide all the voice features available on a traditional voice system. Most IP PBX systems offer about 10 features including hold, conference and transfer. This pales in comparison to the hundreds of features available on standard PBXs.

In addition, traditional PBX systems are designed to deliver highly reliable service levels, reaching five nines (99.999 percent). Most IP PBX systems cannot yet guarantee service at these levels. This is a huge issue for companies with mission-critical call centers and a high requirement for call reliability.

However, as traditional voice PBXs reach the end of their product life, the IP PBX will become the new standard platform for voice. According to Network World, the IP PBX segment has experienced the most rapid growth in the VoIP market, more than doubling from year-end 1999 to year-end 2000. According to Synergy Research, the IP PBX market is expected to grow to \$3.9 billion by 2005, representing 20 percent of all traditional PBX sales. Vendors are introducing more comprehensive products. In addition, many companies opt to install an IP PBX in a single department or location, as a way of selectively adding the technology.

Extending the PBX

As an alternative to a full replacement of a PBX, companies can extend their existing PBX and its supported applications through hybrid IP solutions including VoIP gateways. VoIP gateways operate in parallel to an existing PBX, and extend the PBX's features out to remote locations and users. VoIP gateways connect to the digital line side of the PBX and forward voice packets and PBX applications to remote locations over the IP network. Remote locations can be managed as though they were locally connected.

Outsourcing

Hybrid IP solutions cause minimal disruption, and make use of equipment that a customer already has on premises, such as standard telephones, instead of forcing a company to invest in IP phones. Hybrid solutions also provide a migration path to an all-IP solution at low, per user monthly rates.

Outsourcing IP services is becoming a popular option for many companies. With outsourcing, companies can opt to have a service provider install and maintain the bulk of the equipment. "IP telephony will enter the enterprise from the outside in (as a service) much faster than enterprises will implement IP PBX solutions themselves," states Tom Valovic, an analyst with IDC.

IP Centrex

IP Centrex is becoming a popular option for companies choosing to outsource. Like traditional voice Centrex systems, IP Centrex is a network-based, hosted solution that delivers VoIP functionality, without requiring the customer to purchase premise equipment.

The IP Centrex technology is housed within the carrier network, and relies on either a Class 5 switch or softswitch at the central office. Softswitches separate the transport layer from the call control and signaling layers, acting as a mediator between the IP and PSTN networks, and providing the calling features. Companies pay a monthly fee for IP Centrex service, and get functionality similar to and, in some cases better than IP PBX systems. The monthly fee is usually based on the number of lines needed and often includes unlimited, local, domestic long-distance calls and data support.

IP Centrex systems deliver a customizable and comprehensive suite of features such as caller ID, conferencing, call forwarding, call blocking, repeat or speed dialing. For remote or traveling users, IP Centrex provides forwarding features and greatly improved flexibility. Users can unplug their phones on the LAN, move to another office, plug it in, and the IP Centrex will recognize the phone number. Because all phone numbers and calling features are tied to an IP address, the user only needs to connect to the corporate LAN to access the full functionality of the IP Centrex system.

IP Centrex offers some significant advantages over premise-based IP PBXs, particularly for small and medium businesses. For one, it allows companies to take advantage of cutting edge technology without investing time and resources in deploying a VoIP system. In ad-

dition, IP Centrex has a better disaster/survivability rate because it keeps working regardless of the condition of the customer's site. Further, customers can immediately take advantage of new features because they are implemented at the hosting location by the provider, relieving the customer of the hassles of upgrading and controlling new version releases at their premises. Finally, the provider manages the network and provides quality and reliability guarantees through service level agreements.

While outsourcing will be a popular option for many, some believe that long term it will appeal primarily to smaller companies. Brian Strachman, an analyst with Cahners In-Stat Group believes that IP Centrex will succeed only in smaller businesses because if a company has the capacity to buy, install and maintain its own phones and other telephony gear that option probably will be less expensive in the long run. "A lot of companies will be attracted to the service model because they don't want to mess with this stuff themselves," says IDC's Valovic. "Bigger enterprises that are more staffed up may be different."

Standards

Standards are a crucial issue in the VoIP market. Interoperability is key, as most companies have legacy systems and may purchase VoIP products from a variety of vendors. In addition, the rate of innovation is moving quickly, as VoIP vendors introduce new and upgraded products.

There are several competing standards in the marketplace today. According to Network World, in order for enterprise customers to replace existing telephone systems with VoIP products, point products must work together as an end-to-end solution. The many standards in the marketplace will likely continue to coexist, and ultimately, lead to interoperability between vendors.

H.323

In 1996, the International Telecommunications Union (ITU) developed the H.323 standard: a set of call control protocols that define how data, voice and video are transmitted over IP networks. H.323 and the newer version, H.323.2, is an umbrella document that outlines a set of protocols that handle end to-end communications. However, some vendors felt it was too broad a standard and did not guarantee business call voice quality.

SIP

The Internet Engineering Task Force (IETF) established a competing standard, Session Initiation Protocol (SIP). SIP was designed to be a real-time communication protocol for IP voice and has expanded into video and instant-messaging applications. SIP controls signaling features such as hold caller ID and call transferring. SIP benefits include its ability to provide converged and unified communication services. The fact that it is a text-based protocol makes it easy to write applications that incorporate the technology.

SIP places most of the intelligence for call setup and features on the SIP device or user agent, such as an IP phone or a PC, allowing SIP user agents to provide more features and operate in more of a peer-to-peer fashion. This is in contrast to H.323-based telephony, where the phones are “dumb” and the PBX or server supplies the intelligence.

MGCP

A third standard, Media Gateway Control Protocol (MGCP), developed by Telecordia and Level 3 with the support of Cisco, has been proposed. MGCP is a control protocol that assumes that all call control intelligence is external to the gateway controller.

Megaco, or H.248

The ITU and IETF now have joined together to develop a new standard that combines elements of MGCP and H.323. Called Megaco, or H.248, it allows greater scaling than H.323. It is also more complex than MGCP.

Industry participants believe that H.323 will become the enterprise legacy standard, while MGCP and H.248/ Megaco will be used between carriers' call agents and other media gateways. SIP likely will become the standard protocol for call agents and residential IP phones.

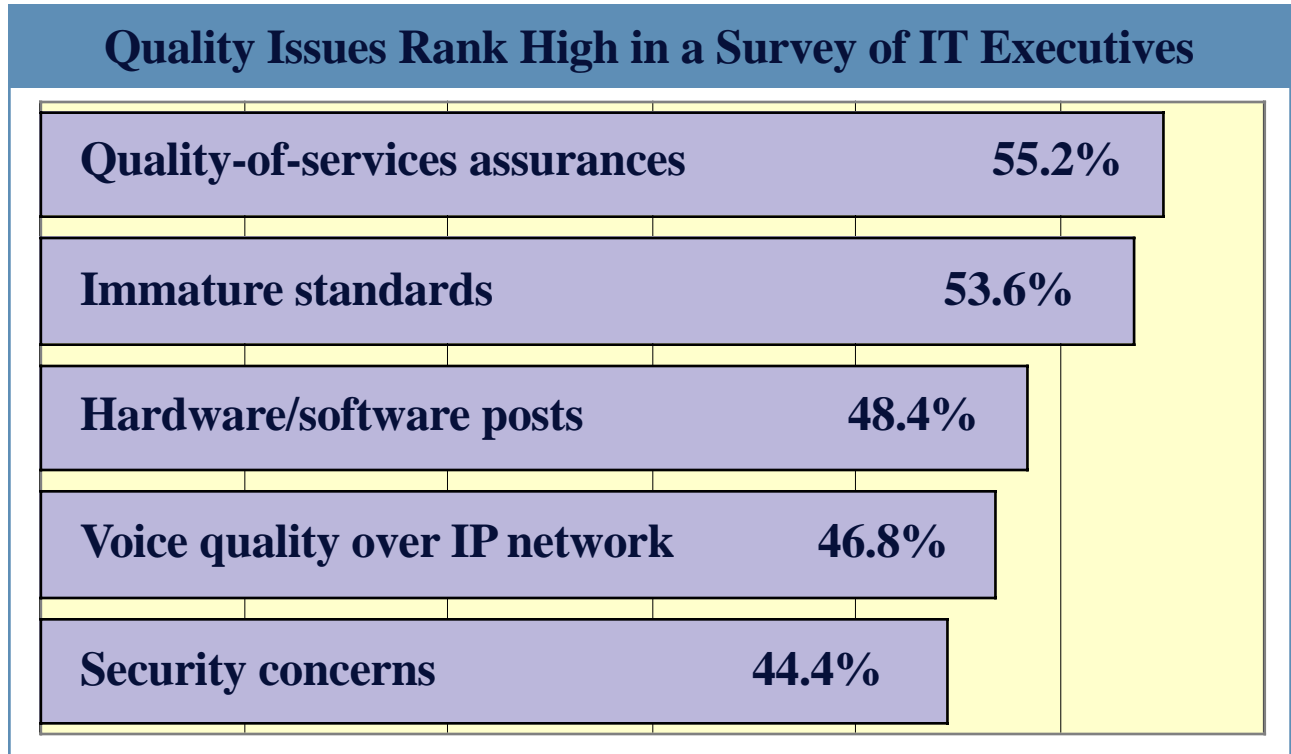
As the standards evolve, companies will choose the protocol that best supports their needs. Protocols will be chosen based on how the voice-over-IP equipment is implemented in the network. With the huge variety of VoIP options, these standards will need to gracefully coexist, particularly in the short term.

Quality of Service

In addition to standards for interoperability, the VoIP market continues to be plagued by perceptions about service reliability and voice quality. Despite the cost savings and other benefits of VoIP services,

telecom managers remain concerned about the reliability and quality of business voice service carried over IP networks.

A recent Network World survey of 250 IT executives revealed that the number one perceived drawback for network convergence was the lack of QoS assurance on corporate networks. Almost half of the executives surveyed said the quality of IP voice was a drawback.



Source: Morgan Stanley Survey of 250 CIOs; © 2003

QoS technologies are designed to guarantee timely delivery of application data or resources to a particular destination. Specific factors that affect voice quality include:

- **Latency:** the average travel time for a packet to pass through the network from destination to destination. Voice is a delay sensitive application; delayed packets result in low voice quality.
- **Jitter:** the variability in packet arrival at the destination. Unlike data packets, voice packets must arrive at regular intervals, to avoid a distortion in sound.
- **Packet Loss:** the percentage of undelivered packets in the data network. Data packets can request a retransmission, while voice packets are simply discarded, causing gaps in the conversation.

VoIP vendors use a variety of mechanisms to measure QoS; however, some believe that it is more art than science. The true test is the human ear. In addition, VoIP equipment is rarely the culprit for sub-standard voice quality. Instead, network latency has become the number one issue for VoIP vendors. “Some people have no idea how good or bad their network is for supporting real-time protocols like voice,” states Mike Hommer, manager of lab testing at Miercom, an independent IT testing and consulting firm.

“When we started testing VoIP products in 1997, 80 percent of the metrics we looked at were related to the performance and voice quality. Now that’s down to about 10 percent,” states Hommer. “The quality issues – as far as IP voice equipment being able to efficiently encode and decode voice – have become less of a concern.”

A data network must be able to detect voice traffic and assign it the right level of priority so that it can be delivered to its destination. QoS mechanisms ensure that voice traffic is tagged, prioritized and routed. Some of these QoS mechanisms are business policies and some are part of the application. A partial list includes:

- IP Precedence: tags voice packets as delay sensitive
- Differentiated Services (DiffServ): specifies and controls network traffic by class to classify and prioritize traffic
- Priority Queuing: manages bandwidth by creating separate queues for different types of traffic
- Multiprotocol Label Switching (MPLS): assigns a specific path through the network for a given sequence of packets, reducing the time it takes for a router to look up the routing addresses

Overall, voice quality is dependent on a well-managed network that supports QoS standards end-to-end. Reliable vendors offer service level agreements (SLAs) that guarantee the quality and reliability of VoIP services.

VoIP Applications

There are many promises of next generation voice applications. Some are beyond the imagination of most customers. In a focus group by New Jersey-based consulting firm CIMI Corp., “Buyers could not, without prompting come up with any suggestions for new apps,” states Tom Nolle, president of CIMI.

The lack of adoption of new applications begs the question: Does anyone really want next generation VoIP services? Most analysts believe they do. Historically, users are not reliable guides for what they may buy if it were available. Instead, they are largely influenced by the services available today.

The most promising application segments in VoIP are those that provide an enhanced version of an already existing technology suite, combining data and voice elements into a streamlined solution.

Unified Messaging

Unified messaging is probably the most hyped VoIP application and the one that holds the greatest promise. Unified messaging provides voice mail, email and fax access over a user's phone from one centralized location. Users can manage their communications using any device—from a PC to a phone or a PDA. According to the Radicati Group, unified messaging systems generate between 25 and 40 minutes of additional productivity per employee, per day. In addition, unified messaging can reduce administrative and IT support costs by up to 70 percent.

Remote Access

Providing remote or traveling employees with access to voice services has been a challenging and expensive proposition, costing up to \$1,500 per user. With VoIP, a company can securely extend voice capabilities to remote employees, using soft phone applications that run on a PC or hard IP phones. With enhanced remote access, companies can take advantage of capabilities such as virtual call centers, where call center employees can work from home or other offices, instead of being required to work in a centralized location. Applying the remote access capabilities to other remote situations will increase employees' productivity and reduce burn out. Features such as "find me/follow me" allow employees to move around within an enterprise, and still receive phone calls on the most convenient phone.

IP Videoconferencing

Videoconferencing is one of the most underutilized technologies in the industry. Although videoconferencing offers the potential to increase employee productivity and cut costs, dedicating a network for videoconferencing has been prohibitive for most companies. With VoIP, videoconferencing is brought to the desktop and becomes a tool for all employees. Rather than sending employees to a centralized location to access video-based training or meetings, VoIP allows employees to have face-to-face interactions from their desktop PCs over a converged network.

Multichannel Call Centers

VoIP-enabled customer service centers support a variety of communications channels, including email, chat, conferencing, messaging, voice and fax. In the past, callers were limited to interacting with service representatives via a voice phone call. VoIP call centers collect information from any channel, store the data and allow it to be accessed in real time. Customers can initiate contact through a Web site, and choose the “click to talk” option to be immediately connected with a customer service agent. This allows companies to collect invaluable customer information for use in sales, marketing and support activities. With these and other VoIP technologies, call centers can meet the needs of all customers, in the most convenient way for them, regardless of the point of contact.

Collaboration

VoIP promises to increase productivity and enhance business communication by allowing better information sharing between employees. Critical corporate information can be made available to employees, who can work interactively on projects in real time. For example, two employees at different locations could analyze a document together at the same time, or a group of people could walk through a presentation together. By combining voice, data and video on one converged network, companies can give their employees access to powerful communications options that will dramatically improve productivity. Collaboration can be applied to customer interactions as well, increasing vendor loyalty and customer satisfaction. According to Jupiter Research, 90 percent of online shoppers want some form of online human interaction.

VoIP Benefits

There are many good reasons to deploy VoIP solutions. Each company has its own list of requirements and will adopt VoIP as the need arises. However, the benefits of VoIP are compelling and include flexibility, reduced costs and next generation applications.

Flexibility

IP is a transport mechanism that allows companies to deliver voice traffic to any location, over any media, to any device. VoIP supports standard telephones, IP phones, PCs and PDAs, giving users the ability to access voice calls and messages from anywhere at any time. This flexibility allows customers to accommodate a variety of devices and easily make moves and changes. Customers log onto a Web portal that supports point and click moves and changes (MACs), to add features, such as conferencing or voice recognition, with no intervention required by the service provider. This cuts costs as well as simplifies administration and provides a new level of flexibility not available with traditional voice PBXs.

Reduced Cost of Ownership

VoIP systems reduce communications costs, particularly for long distance charges. Administrative move and change charges can be cut or eliminated. Companies can combine their telecom and datacom networks into one, single IP-based network. This eliminates the redundancies associated with operating separate voice and data networks, and the associated equipment and maintenance charges. Wiring costs are cut as well. With VoIP, companies can connect both a PC and a telephone through the same Ethernet port. The IP network can support applications that would normally require an expensive high-speed connection, such as a T1 line. Stand-alone voice applications, such as voice mail, can be integrated into the VoIP system and more easily managed.

Next Generation Applications

Advanced applications are possibly the most compelling aspect of VoIP solutions. As companies strive to become more competitive and reduce costs, employee productivity and efficient operations are key. VoIP provides the foundation for all types of new applications and services, which will improve communications, increase employee productivity and streamline administrative tasks. In particular, mobile employees stand to gain unprecedented access to company resources. Remote office employees, telecommuters, field service personnel and consultants can communicate and collaborate with headquarters-based employees and have access to resources at any time of the day or night. Whether a user is communicating on a wireless phone, a PDA, a PC or a standard voice phone, a converged network will provide new levels of application functionality.

Summary

While still in its infancy, VoIP promises to become a powerhouse market in the future. The need for a converged network is apparent, and companies, large and small, will recognize the cost savings and increased productivity it offers.

Standards and interoperability are two major obstacles that must be addressed to ensure the widespread deployment of VoIP. Industry leaders are working to make their products interoperable, to allow potential customers to pick and choose from a large variety of VoIP solutions. In addition, businesses can now choose to outsource VoIP or deploy their own, depending on their specific needs and capabilities. These flexible options will encourage companies to try VoIP as the need arises.

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