3COM

The Practical Communications Solution:
Converged Networking with 3Com® IP Telephony

Executive Summary

As enterprise organizations are pressed to make the most of their limited resources, many are turning to Internet Protocol (IP) telephony solutions built on a converged voice and data network infrastructure. A carefully selected IP telephony solution can help organizations meet the challenges of today's marketplace, enabling them to increase productivity, better support mobile and remote employees, and reduce their total cost of ownership (TCO).

Three key criteria are important to consider before investing in an IP telephony solution—its foundation architecture, application support, and ability to deliver multisite connectivity—all of which will impact ease of use, cost, and long-term value.

Open and standards-based architecture is critical for easy network integration and interoperability with third-party applications. The infrastructure should also deliver maximum Quality of Service (QoS) and high availability to support time-sensitive voice traffic and vital business processes.

A solution that offers built-in applications like voice mail, call center, automated attendant, call detail recording, and network management will let organizations quickly begin enjoying the productivity and cost benefits of a converged voice and data solution. A system that includes open application programming interfaces (APIs) will offer independent software developers support for creating specialized applications tailored to meet a variety of specific needs.

As organizations depend more and more on remote and mobile workers, and as business operations become more dispersed, a communications infrastructure must effectively support multisite networking. Organizations can benefit from a solution that offers both the simplicity and manageability of a unified architecture as well as the survivability and flexibility of a distributed design. A solution that offers robust site-to-site connectivity enables companies to economically improve collaboration by easily transferring callers, setting up conferences, and distributing messages among a dispersed workforce.

In the following pages, we'll review the potential business benefits and key technical requirements of a converged IP telephony solution, and illustrate how 3Com® IP telephony solutions enable organizations to maximize these benefits.

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The Business Case for IP Telephony

Businesses, educational institutions, and government agencies must contend with severe budget pressures, accommodate increasingly dispersed workforces, and ensure workplace productivity. To address these issues, many enterprise organizations are turning to IP telephony solutions that are built upon a converged voice and data network infrastructure.

IP has become the transport mechanism of choice, and many organizations are migrating their voice systems to IP telephony. In a survey of fifty enterprises by the Tolly Group, a third of respondents said that Voice over IP (VoIP) was already in production mode. And more than fifty percent reported that their company planned to prototype a VoIP network soon. IP voice solutions are already providing thousands of customers with a superior alternative to legacy PBX systems. Organizations are choosing IP telephony because it enables them to address their most compelling business issues today, while establishing a foundation for future growth.

Reducing TCO

The cost of a telephone system is much more than simply its purchase price. Its true total cost of ownership (TCO) includes equipment, long distance telecommunication costs, administration, upgrades, expansion, and other expenses such as adding users and applications. Many organizations are finding that a 3Com IP telephony solution offers a significantly lower TCO than a traditional circuit-switched phone system.

Interoperability Benefits

An effective IP telephony solution is based on an open, standards-based architecture that enables companies to keep infrastructure expenses in control. Network devices that make up the solution are interoperable with other standards-based products, which gives organizations the freedom to build a solution that will meet their needs—regardless of vendor. Rather than locking an organization in to a limited, proprietary system, standards-based solutions are designed to grow and change as business needs evolve.

Easy Scalability

IP telephony solutions are software-based, enabling organizations to quickly and easily scale their infrastructure to support new users or applications. For example, 3Com NBX® software features unit-based software licensing. Instead of purchasing licenses to support predefined numbers of devices, organizations can purchase and install incremental licenses for any number of units. This "pay as you grow" model makes it easy for growing organizations to rapidly implement an IP telephony solution, supporting only the users they require, then scale the network at their own pace.

Voice services such as voice mail and automated attendant are the primary applications used in telephone systems. Traditionally, these applications have been expensive, complex add-ons. Competitive pressures are forcing companies to move beyond these tools to deploy next-generation applications, such as unified messaging and call centers, that depend on the ability to converge voice, data, and even video. Adding these applications to traditional PBX systems with third-party or external devices can be expensive and complex, often making the network even more difficult to manage. An IP telephony solution, on the other hand, can scale to support new applications quickly and easily.

3Com NBX solutions offer built-in applications that include voice mail, automated attendant, hunt/call groups, call detail reporting, computer telephony integration (CTI), and PC-based visual voicemail/e-mail clients (IMAP4). For international companies, they also feature built-in support for multiple languages that can be quickly installed using a web browser.

Using CTI applications such as customer relationship management (CRM), text-to-speech (TTS), call centers, and unified messaging, organizations can dramatically improve employee productivity and the customer experience. With traditional phone systems, the costs to implement a packaged CTI application can far exceed the price of the software. 3Com NBX systems make these implementation costs negligible. What's more, open 3Com APIs provide support for additional applications through third-party solution providers through its Voice Solution Partner Program, giving organizations the option of application support that matches their company requirements.

Simplified Management and Administration

The TCO of a traditional voice network often includes proprietary enhancements, applications and services. Its administration is often expensive, especially when the system requires a vendor with specialized training or recurring service calls for implementing moves-adds-changes. The cost of a single device move on a traditional phone system can easily exceed U.S. $100, not to mention

> "The SuperStack 3 NBX scored excellent latency and voice quality metrics of 64 msec for both conditions tested, and a 4.7 voice quality score for its low bit rate vocoder over a WAN to go with a perfect 5.0 for LAN-based G.711 calls."
>
> —*Miercom 2003 testing report*

the lost user productivity that can result from scheduling delays.

Organizations can save tens of thousands of dollars in training and management costs with 3Com IP telephony solutions. Because the 3Com NBX family shares a common software and management architecture, network administrators can quickly and intuitively view and update system configurations. Organizations can even create departmental profiles to speed installation at larger locations. With standards-based Power over Ethernet (PoE), and self-locating NBX phones, users can move and install phones themselves eliminating the expense and potential scheduling hassles that can result from the need for service calls. Functionality and personalized features travel with the phone.

The NBX NetSet™ administration utility also includes online resources that make it easy for employees to learn about the capabilities of their telephones and customize features to meet their individual needs and preferences. Training is simple and self-directed, saving the expense of time- and effort-intensive instruction. Built-in call reports help administrators look for potential cost and employee productivity issues, as well as understand potential bottlenecks in the call handling capacity of staff.

3Com NBX systems can bring immediate and ongoing cost savings to a business, lowering capital expenses and expansion, staffing, and applications costs, while increasing productivity, multisite connectivity, and customer service. With a low TCO, organizations can more effectively address new challenges and generate additional revenue.

Maximizing Productivity with Network Applications

Today's organizations face an extremely competitive economy in which they're continually asked to do more with less. Decreased numbers of employees are expected to generate more business and accomplish more work, often with reduced resources. Management must focus more than ever on lowering costs and maximizing productivity. IP telephony applications can help organizations accomplish both objectives, enabling them to treat voice as just another data type rather than requiring a separate network and staff dedicated exclusively to voice communications. Messaging, customer care, and collaborative applications that used to be difficult and expensive to implement suddenly become intuitive and economical.

Intelligent Applications

IP telephony solutions offer organizations the intelligence of a data network and the convenience and immediacy of their phone systems. IP telephony applications let enterprises offload cumbersome, time-consuming tasks to the network, helping employees make the most of their time on the job.

For example, a healthcare foundation uses its 3Com NBX automated attendant application to answer all of its incoming calls, twenty-four hours each day. When no one is available at the main reception, calls are forwarded directly to appropriate medical staff. Because automated attendant can answer multiple calls simultaneously, the need for additional telephone staff during peak hours is minimized.

IP telephony applications can support sophisticated call center applications. For example, a newspaper uses the CTI interfaces in its 3Com NBX solution to support automated call distribution, messaging interactive voice response, and statistical functions. These advanced telephony services provide a high level of support to its CRM system and help the paper build a bridge for information interchange with customers.

IP telephony can also greatly enhance flexibility, enabling employees to customize their phone system to work the way they do. Sales associates can program their desk phone so that their most important customer calls are forwarded immediately to their current location, while less critical calls are sent directly to voice mail. And organizations can benefit from providing employees without desks with phantom mailboxes, a place to store voice messages that can be accessed from the office or remotely.

Availability and Quality

The phone system is a critical communications asset for most organizations, and even a brief downtime can be disastrous. IP telephony solutions must provide clear and reliable voice communications to deliver business benefits. 3Com IP telephony solutions work independently from a network server's operating system. They are designed to ensure that the phone system continues to function in the event of a network server failure, regardless of the type of LAN or operating system the network is using. NBX systems offer "four 9s" (99.99 percent) availability—on par with traditional PBX systems. The solutions offer built-in Quality of Service to manage latency, enabling organizations to enjoy the power and flexibility of a data network without sacrificing reliability.

Improving Network Management

Intelligent IP telephony applications can create significant productivity opportunities for organizations, but network administration is equally important. Network management continues to be a significant part of IT expenditures, so reducing management expenses can have a significant impact on a company's bottom line. To effectively streamline management, organizations need tools that are powerful, easy to use, and extend control out to users with self-service features.

The intuitive NBX NetSet utility lets network administrators easily configure and control the entire phone system from a web browser. They can use pull down menus rather than the cryptic command line interface (CLI) code of some traditional phone systems. And both administrators and users can perform self-directed moves-adds-changes. Employees can even use NBX NetSet to customize features on their own phones, such as messaging, voice conferencing, and speed dialing.

3Com NBX IP telephony solutions also include the NBX Backup Utility to perform automatic backups for NBX 100 and SuperStack 3 NBX products at the times administrators specify. Companies can install the software on a PC to save time and simplify NBX system administration.

The 3Com NBX Dial Plan Editor enables users to create NBX dial plans in a fraction of the time using a graphical interface to automate and simplify the process of creating, editing, and managing NBX dial plans.

3Com Network Supervisor is a network topology discovery, mapping, and monitoring tool. Included with the 3Com NBX system, it lets administrators monitor and manage applications simply, and makes maps of the converged voice and data network easier to comprehend and manage.

Supporting a Multisite Workers

Tight budgets and limited resources are not the only challenges facing organizations. Enterprises are becoming increasingly dispersed as telecommuting programs increase and branch offices are opened to serve new markets and locations. In-Stat/MDR estimates that only 33 percent of enterprise employees actually work in main office locations. Because much of the workforce is increasingly employed in branch office and remote locations, organizations increasingly need to provide secure, reliable access to voice and data resources anytime, anywhere. In-Stat/MDR also reports that 25.8 percent of interviewed participants indicated that multisite capabilities were the primary reason they implemented voice support over their LANs. As physical distance among co-workers increases so does the need for the collaboration benefits made available by IP telephony.

Improved User Experience

VoIP technology enables business applications to be shared over a common data network. Unlike traditional phone systems, 3Com NBX solutions let employees at remote sites contact each other as quickly and easily as if they were in the same building, whether using voice or data communications. With uniform dial plans that enable cross-site extension-to-extension dialing, a university librarian can request a book from a colleague at another campus by picking up the phone and dialing a four, five, or six-digit number. Or the librarian can transfer an incoming caller to another department, building, or city in seconds—without asking the caller to hang up and redial.

In the banking industry, call transfer and direct inward dialing allow employees to forward callers to any extension without requiring the customer to hang up and dial another number. Hunt groups ensure calls reach the first available employee in the relevant department, minimizing time spent on hold. They can also send calls to mobile phones when employees are away from their desks, ensuring that staff are always within easy reach. And healthcare providers can use IP telephony dial plans to establish four-digit dialing between offices, accelerating communications and optimizing patient care.

Cost-Effective Multisite Connectivity

Monthly toll charges are often a painful recurring cost for decentralized organizations. By leveraging a dedicated WAN line and a single dial plan to provide voice connectivity between branch offices, teleworkers, and the enterprise headquarters, organizations can substantially reduce or even eliminate recurring long distance charges. Remote sales staff or even call center staff can work from satellite or home offices, yet be fully integrated with the company phone system. Using IP telephony connectivity between offices also provides a high degree of scalability, enabling organizations to easily add or modify users.

"It's worth emphasizing that it's very rare for new technology to reduce operational expenditure. But, in our case, it's a fact." [3Com NBX telephony solutions enabled a 40 per cent saving on annual call charges, eliminating the need for the yearly subscription previously required for connecting ten buildings located across three sites to the PABX system."

—*Technical Director Grienenberger, Notre-Dame/Saint-Sigisbert*

Deployment Considerations

The business drivers for IP telephony are clear, and enterprise organizations are rapidly embracing the technology. However, before they begin the transition to an IP telephony system, organizations face an array of choices:

- A hybrid IP-PBX system consists of an IP gateway and IP cards added on to a traditional Time Division Multiplex (TDM) PBX. Often developed by traditional PBX manufacturers to keep up with IP telephony technology, hybrid systems use proprietary designs, and can be both costly and difficult to integrate and manage with an existing network. Their complexity may require that administration be outsourced— adding to recurring, ongoing expenses.

- An office in a box is a proprietary, PC-based system built on all-new dedicated routers, switches, and basic phones. Such systems offer limited functionality and generally use their own unique operating systems.

- A true IP telephony system is standards-based, easily managed, and practical to integrate with existing networks and new applications. Ongoing administration can be handled internally by existing IP staff using intuitive 3Com management tools. In some cases, end users can also customize and manage their phones themselves. The 3Com solution is a true IP telephony system that is designed from the ground up to process voice dynamically over Ethernet and/or IP networks in a full partnership with the data traffic infrastructure.

To realize the many benefits of IP telephony, including a lower cost of ownership, increased productivity, and cost-effective support for multiple sites, organizations must carefully evaluate their options in terms of architecture, application support, and ability to deliver multisite connectivity.

FIGURE 1: Intelligent Telephony Building Blocks

1. Foundation Architecture

The architecture of an IP telephony system is critical, because it represents the foundation of much of a business' voice and data communications. An effective IP telephony architecture should include:

- open interfaces for easy connection with multi-vendor network configurations

- standards–based integration and interoperability with third-party applications for investment protection and flexibility

- high availability for consistent delivery of business-critical applications

- ease of management so the network can perform with maximum efficiency

Building on an Open, Standards-Based Architecture

Enterprise networks are continually evolving to meet changing needs—business consolidation or staff increases. They must be able to seamlessly transport voice and data information across miles and among diverse systems. For reliable connectivity and interoperability within a local area network, the IP telephony platform should be fully compatible with recognized LAN standards such as:

- 10BASE-T Ethernet, a leading LAN networking protocol that provides 10 Mbps connectivity over twisted pair wiring.

- 100BASE-T Fast Ethernet, an enhancement to 10BASE-T Ethernet technology which offers 100 Mbps throughput over twisted pair wiring.

- Power over Ethernet (P0E), which delivers power to network devices without requiring additional electrical cabling. (See sidebar on page 6)

- IEEE 802.2, a standard for packet transmission over IPX networks.

- 802.3, a standard industry protocol for Ethernet transmission.

- IEEE 802.1p/Q protocol, which prioritizes time-sensitive voice traffic.

The IP telephony solution should also include support for telephony connectivity and compression standards such as:

- The Q.SIG protocol, which supports signaling for Private Integrated services Network Exchange (PINX) devices.

- Virtual Tie Line (VTL) technology, which enables multiple 3Com NBX systems to place calls between one another without using additional hardware, such as analog or digital line cards.

- G729a/b, which provides enhanced voice compression.

Furthermore, the IP telephony solution should be based on application standards—building blocks for intelligent telephony applications. Examples include:

- IMAP4, which lets users view and listen to voice mail with standard e-mail clients such as Microsoft Outlook and Eudora.

- TAPI/WAV, which supports connections to call center and unified messaging software

The advantage of a standards-based architecture is most compelling for organizations that are installing an IP telephony platform in an existing network and can benefit from compatibility throughout the network, over multiple vendor platforms.
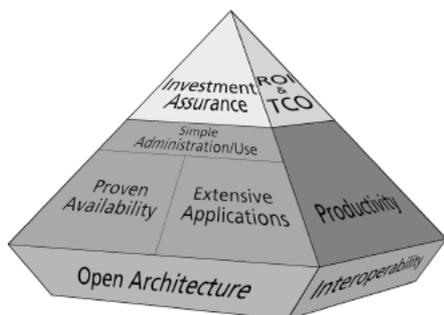
Reducing Costs with PoE

Power over Ethernet can eliminate the cost for additional electrical cabling, cutting total installation time and expense significantly, and helping to reduce the total cost of ownership when paired with Voice over IP solutions like the 3Com NBX. PoE benefits include:

• Ease of Use—Utilizing a PoE solution enables plug and use installation and simplifies configuration. 3Com PoE equipment integrates smoothly with existing Ethernet networks and is rack-mountable for easy installation. It supports 10 or 100 Mbps networks, letting organizations effectively leverage their existing equipment.

• Central Management of Power—Organizations can place network devices more flexibly because a central power source eliminates the need for local AC outlets and power cords or distributed power backups. Points of failure can be reduced by utilizing a central, secure power source location. PoE solutions, easily installed in the same wiring closet as network switches and patch panels, can simplify installation of wall-mounted phones as well as network devices in difficult-to-reach locations like warehouses.

• Intelligent Device Detection and Safety—There's no need to manage individual cables or jacks, because intelligent device detection insures that only cables that terminate with powered devices are powered. Intelligent device detection also eliminates concerns about employees accidentally exchanging cables, risking damage to existing network devices. And built-in overload protection provides additional peace of mind.

• Enhanced Availability—3Com PoE solutions ensure maximum uptime for mission critical network applications by providing a central power source for multiple network devices. With a single power source, organizations can apply centralized protection from power surges or spikes, or attach an uninterruptible power supply (UPS) to provide battery back-up of multiple phones, wireless access points or network jacks. There's no need to depend on desktop power sources to keep phones and network devices up and running.

• Investment Protection—3Com PoE is designed to deliver superior investment protection and maximum compatibility with existing equipment. It provides backward and forward compatibility for both NBX phones and electronic power sources (EPS), and is fully compatible with 10BASE-T and 100BASE-T Ethernet, as well as IEEE 802.3af standards to provide multi-brand interoperability.

A standards-based system can minimize the cost of deployment because it gives organizations an expanded range of choices and prices as they evaluate products. It also eases management concerns and maximizes performance by enabling organizations to choose the product that is most appropriate to their needs, rather than a limited choice of proprietary network devices from a single vendor. Thanks to the flexibility afforded by a standards-based architecture, organizations can implement the performance and solution they require.

A standards-based infrastructure is also a superior choice for organizations that are deploying a new network. Because open network architectures offer the best possible flexibility and scalability, they are a future-proof solution for businesses that expect to expand and grow.

The 3Com SuperStack® 3 NBX Networked Telephony Solution and 3Com NBX 100 Communications System deliver the standards-based platform and connectivity that enterprise organizations need today. Unlike other voice and data products such as hybrid IP-PBX systems, the 3Com NBX solutions offer true IP-based telephony. They were designed from the ground up as converged voice and data solutions, supporting leading networking and application standards. 3Com NBX solutions also leverage the company's experience of nearly twenty-five years as a major manufacturer of networking solutions and a pioneer in IP telephony technology.

Ensuring Quality of Service

A fully IP-based system includes advanced support for voice packetization and compression to efficiently move telephony traffic through the network. The network considers voice traffic to be simply another type of data running over the IP network, but lost or delayed packets can affect the quality of an IP telephony-based conversation, resulting in a clipping sound on the voice call. Packets that are delayed as a result of network congestion can also degrade sound quality. The time lag in communication becomes noticeable when latency exceeds 250 milliseconds. To deliver high audio quality, voice traffic should not be compromised by bandwidth competition with other network traffic. Quality of Service is a way to allocate resources in data switches and routers so that data can be prioritized, with the most time-critical data receiving higher priority.

To deliver QoS, a network device must identify and group specific packets—a process called packet classification. After a packet has been classified, the packet is marked by setting designated bits in the IP header. Network devices use the source and destination IP address in the IP header or the source and destination TCP or UDP port numbers in the header to identify voice, data, or video packets. This identification and grouping process is called classification and it is the basis for providing any QoS.

Once the packet has been marked and classified at the network edge, network devices are configured to identify these packets and provide the appropriate queuing mechanism to ensure that the QoS policy is maintained and that time-sensitive voice packets receive the highest priority. QoS must be maintained not simply by the telephony platform, but by associated switches and network devices as well (see Traffic Prioritization sidebar).

In a survey by Ashton, Metzler & Associates in conjunction with Key3Media, QoS was identified as the number-one challenge in Voice over IP deployment. Fortunately, the 3Com NBX solution includes a rich array of features designed to maximize QoS. Its prioritization tagging system ensures that time-sensitive voice traffic is handled before data application traffic, for maximum sound quality. And built-in silence suppression makes network utilization of bandwidth more efficient.

3Com offers QoS over multiple layers of the open system interconnect (OSI) network model. At Layer 2, the NBX system supports Ethernet 802.1Q and its associated specification, 802.1p. Both of these IEEE Ethernet standards define how Ethernet packets can be prioritized.

At Layer 3, the 3Com NBX supports IP Precedence, also called IP Type Of Service (ToS), to specify the class of service for each packet. The NBX also allows administrators to configure settings for the Differentiated Services (DiffServ) technology, which defines prioritizing over the WAN or LAN. All 3Com Layer 3 voice and control packets running on the NBX solution have DiffServ priority by default.

Maintaining Optimal Availability

Even the most advanced telephony system is of little use if it provides erratic, unreliable service. For some businesses, a phone outage of even a few minutes can result in thousands of dollars in lost revenue.

When deploying an IP telephony solution, organizations should choose a solution that offers the highest possible availability to support important business communications.

The 3Com NBX solution was created with enterprise-level availability in mind. It leverages the Wind River VxWorks embedded real-time operating system—the same operating system used for heart pacemakers. And it delivers advanced reliability features like support for redundant power systems and resilient network links, to ensure that the network infrastructure remains fully operational even if portions fail.

The 3Com NBX also builds in a high level of security to protect sensitive business communications. Its operating system offers protection against hacker attacks such as denial of service (DoS). All audio packets traveling over the system are automatically scrambled to further thwart intruders. For added protection, the 3Com Network Supervisor management utility can alert administrators to system misuse.

By migrating independent voice and data infrastructures to a converged IP network, network administrators can exercise complete control over both their voice and data networks from easy-to-use, browser-based management applications. 3Com Network Supervisor graphically discovers, maps, and displays network links and IP devices, including 3Com NBX telephones and third-party products. When the network changes, administrators can prompt 3Com Network Supervisor to regenerate the appropriate part of the map to ensure that all information remains current.

For granular management of the voice network, the NBX NetSet utility lets administrators easily configure and control the

Using Traffic Prioritization to Ensure Quality Voice Communication

To support crystal-clear voice quality, the 3Com SuperStack 3 Switch 4400 works seamlessly with 3Com networked telephony products, automatically identifying traffic and prioritizing it above time-insensitive data traffic. Both the 3Com SuperStack 3 NBX and NBX 100 systems can operate at Layer 2 (Ethernet) or Layer 3 (IP). Depending on the selected mode, these systems will use ARP, UDP Port 2093, DiffServe Code Point 46, or Ethernet Type 0x8868. The SuperStack 3 Switch 4400 can prioritize all of these traffic types, ensuring high-quality voice communications by minimizing latency and packet loss.

In addition, using its advanced Layer 4 capabilities, the Switch 4400 can prioritize network traffic for third-party IP telephony systems. By configuring traffic in the UDP and TCP port ranges of these systems—using 3Com Network Supervisor management software—the Switch 4400 can assign priority in much the same way it supports NBX IP telephony solutions.

This 3Com NBX Fastlane automatic network traffic prioritization exemplifies the company commitment to providing practical and affordable solutions to its customers.

The Switch 4400 also includes NBX Mode, which enables it to support an NBX phone and network login client on the same switch port. Using this mode, the Switch 4400 will always forward NBX traffic. The client device is connected to the user port on the NBX phone, which in turn is connected to the switch port, and traffic on the client device is forwarded when the user has been successfully authenticated.
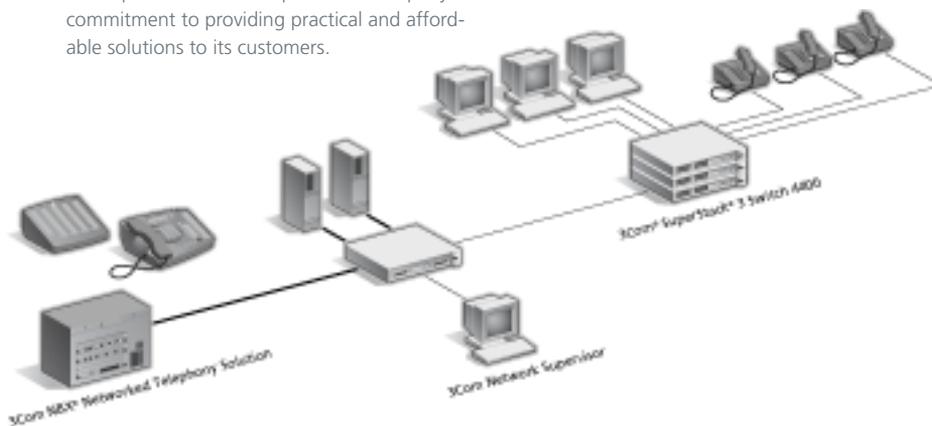
The 3Com SuperStack 3 Switch 4400 works seamlessly with 3Com NBX systems, prioritizing critical voice traffic. Additionally, Power over Ethernet solutions can power phones and other network devices without requiring extra cabling.

entire phone system from a web browser. With the NBX Backup Utility, organizations gain additional controls to ensure that their communications network is always meeting their needs.

After an NBX solution has been deployed, the only component that needs to change as the enterprise grows is the system's network call processor (NCP). Organizations can continue to use elements of the solution such as phones and interface modules without requiring costly "forklift" upgrades, and without losing service. Telephony hardware can be exchanged smoothly between the platforms.

Unlike other systems, the 3Com NBX architecture is designed to be up and taking calls in minutes—not days—without extensive interaction with a trained technician. And since the systems are software upgradeable, the latest capabilities can be available to users immediately upon their release.

2. Application Support
Robust support for a variety of value-add applications is another key consideration for organizations deploying IP telephony.

Enhancing Productivity
Organizations need a solution that enables increased employee productivity and efficiency. IP telephony applications make it easy to stay in touch with customers and partners whether at a desk or on the road. And they provide self-service options for customers who are trying to reach an employee or department over the phone.

An ideal IP telephony solution will offer a variety of telephony applications, including built-in tools for immediate benefit and third-party solutions that can easily be deployed to meet specific business needs. Application examples include:

Voice mail—An IP telephony voicemail system delivers powerful voice messaging features to companies without the need for additional equipment and substantial administrative time. The 3Com NBX solution enables organizations to implement a fully functional voicemail system right out of the box. Its built-in voicemail application provides up to 1,500 voicemail boxes and up to 1,000 phantom boxes.

The voicemail server included with the 3Com NBX solution is Internet Messaging Access Protocol 4 (IMAP4) compliant. This unified messaging protocol utilizes computer telephony integration technology, and

enables companies to create and manage Internet message folders over a telephone network. Organizations can set up Microsoft Outlook Express, Eudora, or any other IMAP4-compliant e-mail server so that telephone voicemail messages appear in e-mail in-boxes just as though they were e-mail messages. IMAP4 applications help companies run their business better, enhancing productivity and keeping employees more in touch with customers, colleagues, and partners.

A key investment protection capability is supported by Voice Protocol for Internet Mail (VPIM), a standard for exchanging voicemail messages between different voicemail systems on IP networks. To leverage existing VPIM-compliant legacy messaging systems, 3Com NBX VPIM Multisite Messaging Exchange licenses let employees compose a voice mail from any 3Com NBX phone and send it to one or many users in other locations, around the corner or around the world. The voicemail message is easily delivered to any user with a VPIM-enabled mailbox. VPIM also helps power advanced unified messaging applications, which enable users to receive, manage, and distribute voice, fax, and e-mail messaging using a single mailbox. And it provides investment protection by enabling companies to use existing voicemail systems if desired, until they are ready to migrate to an IP telephony system.

Call Center—Call center applications help companies maximize the value of customer relationships through a powerful application that integrates customer information management with sophisticated call management features. Call center agents can manage call flows with maximum efficiency and expediency, providing callers a superior customer experience. 3Com and its Voice Solution Providers Program partners offer a variety of call center applications so businesses can select the software that best matches their organization requirements.

Automated Attendant—Automated attendant software lets any size organization present a professional image to customers over the phone, twenty-four hours a day. Automated attendant applications limit repetitive tasks like transferring callers to employee extensions or providing information about company hours, holiday shutdowns, and directions. The 3Com NBX solution features built-in multilevel automated attendant support that lets organizations free their administrative employees to better focus on individual customer needs, while enabling outside callers to reach their parties more quickly.

Administrators can change or customize automated attendant preferences quickly and efficiently to reflect changing needs. For example, a school could update its holiday or events announcements in minutes, ensuring that callers always have the most current information.

3Com NBX Complement Attendant Software (CAS) simplifies complex information by showing a complete view of multiple inbound and out-bound calls, queuing the incoming calls at the top of the screen, and displaying caller information, call status, and transaction time. This optional software also retrieves internal name directory information right from the NBX call processor, so it's always up-to-date.

Call Detail Recording—Call Detail Recording (CDR) monitors system usage by employees or other users over a specific time period. It also measures an organization's usage of line capacity. Using CDR, administrators can set policies, configure the system, and take other actions to control telephone expenses. The 3Com NBX system has built-in CDR features that let organizations use a web browser to easily track who is using the phone, restrict access to long-distance or international calls, and identify toll fraud. Organizations can assign account codes, create detailed reports that illustrate exactly how much of a PSTN circuit is used, and periodically present their carrier with the utilization information needed to lower line costs.

Deploying Business-Specific Applications with 3Com Voice Solution Providers
Independent software vendors (ISVs) can bring additional value to an IP telephony solution, providing a variety of specialized applications that are tailored to meet specific needs. 3Com offers a broad choice of third-party applications by making available open APIs that together with the standards-based architecture of 3Com NBX systems, encourage software developers to create innovative solutions that support a wide range of industries. Some examples include:

Accelerated Transition to IP Telephony—For organizations that seek easy migration from an existing PBX, 3Com has teamed with industry partners to create solutions that support a smooth migration to IP telephony. (See CITEL sidebar on pageg 10).

Conference Phone Integration—3Com has teamed with global technology leaders to deliver a new IP-based conference phone that integrates fully with the 3Com NBX

platform. Its rich sound quality, paired with the 3Com NBX solution, gives organizations an exceptional conference phone for head-quarters and branch locations.

Conferencing—Using third-party conferencing tools, companies can easily set up conferences to support better collaboration between employees, customers, and business partners. Many of these software applications offer support for a variety of media, including audio and web conferencing.

Voice-Enabled Auto Attendant and Dialer Applications—These personal assistant applications integrate the networked telephony solution with users' personal and centralized contact databases, enabling users to manage and forward calls more efficiently. Callers are identified using speech recognition, enabling users to automatically accept the call, send it to voice mail, or forward it to an outside number.

IVR Solutions for Educators—Specialized interactive voice response (IVR) systems can be configured to notify parents of student absence situations, confirm school holidays, class registration, and other education-related information.

Voice Support for Wireless Mobile Devices—A range of applications are available to extend the benefits of networked telephony across wireless networks. Users of these applications can enjoy clear, cost-effective voice connectivity over wireless handheld devices and other mobile devices.

Call Accounting and Billing Solutions—A variety of comprehensive, centralized billing, accounting, and network communication management solutions are available for tracking calls and data across IP networks. These packages, often including reporting and analysis tools, help organizations control telephone use, manage telephone costs, and supervise personnel.

Compression and Bandwidth Control—These applications ensure maximum utilization of

available bandwidth on the LAN and WAN, for more efficient use of converged network resources.

Voicemail and E-Mail Integration—These applications are designed to fill the gap between networked telephony solutions and desktop productivity applications, providing a single point of delivery for voicemail messages.

3. Multisite Benefits

The need for a multisite networking solution becomes greater as organizations become increasingly decentralized. They require effective voice and data connectivity between sites to support employees at branch offices, telecommuters, or staff needing the flexibility of working from another office when needed. Companies also have to have the ability to deliver call coverage and off-site notification from the main office, and provide convenient, reliable access to network resources such as e-mail, corporate databases, groupware, fax, and web applications. The most efficient, reliable, and manageable way to deliver these benefits is through a distributed converged architecture.

Local Control, Full Connectivity

3Com NBX solutions were designed from their inception to harness the power, flexibility, and the value of a data network without sacrificing the reliability and familiarity of a traditional telephone system. They were created specifically for the unique IT needs of small and medium-sized businesses for maximum ease of use and manageability. The open standards-based architecture of 3Com IP telephony solutions offers local network control of voice communications, rich applications and features, and delivery of all the benefits of networked connectivity to users at disparate locations.

3Com IP telephony solutions can be dispersed among a company's main offices and branch offices. They are inherently fault tolerant and survivable in the event of unexpected system outages. With no single point of failure, the systems can continue to run and handle critical communications under adverse conditions. With 3Com NBX solutions, even if the WAN connection at company headquarters is disrupted, call control and a full set of features remain available at other locations. The 3Com architecture also enables organizations to enjoy greater operational flexibility. Because phone equipment resides at each site, they can custom-configure paging for each building, music for callers on hold, and automated attendant messages, such as hours of operation. Additionally, since all applications run locally at each branch, dependency on the WAN line for survivability and availability is minimized.

3Com voice solutions also offer application control from a single location for companies that are supporting a multisite deployment. NBX dial plans can provide a simple, unified user interface, with support for four- to seven-digit site-to-site dialing, making phone

connections fast and easy. To use bandwidth as efficiently as possible, NBX software can control WAN line usage for site-to-site calling. And because it leverages a single management platform, this unified telephony system also provides a low cost of ownership.

Realizing the Benefits of Site-to-Site Calling

Among the most compelling benefits of IP telephony is its ability to dramatically improve the way remote users and sites communicate over the phone. In the past, customers reaching an incorrect department might be asked to hang up and call another number. Instead of calling back, a customer might give up in frustration or take his or her business elsewhere. Although businesses understood the potential impact of this lost business, many were unable to afford the high costs associated with updating their PBX system, or even creating a dedicated, private voice network.

With the 3Com NBX solution, organizations can provide seamless site-to-site calling and, in turn, deliver better customer service. Using a unified dial plan, companies can transfer callers from location to location quickly and easily. Calls on the company network can be placed toll free, all over the world. Businesses can set up conferences quickly and easily, without the need for expensive third-party providers. And voice mails can be easily shared and distributed across workgroups.

The benefits of site-to-site calling extend to any type of industry with multiple locations. For example, colleagues at different university campuses can more easily collaborate over the phone and via voicemail messages. Doctors can speedily consult on critical patient care across geographic distances. Government agencies can efficiently coordinate emergency planning. Or a bank executive could easily alert branch managers about a new company policy or change in customer procedures, by broadcasting a voice message.

3Com IP telephony is equally important to remote users. Sales staff or call center staff can work from branch or home offices and be fully integrated with the company phone system. Companies also gain the advantage of controlling the phone numbers of remote locations, enabling calls to be forwarded or sent to voice mail as staff responsibilities change or new staff is hired.

Economic Office Linking

Businesses are becoming increasingly dispersed, with multiple remote offices to

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Easing Migration from an Existing PBX

A smooth migration path is essential for organizations that wish to transition from a legacy PBX infrastructure to an IP telephony system. 3Com and CITEL Technologies have developed solutions that help installed Nortel Enterprise PBX customers speed their migration to a more cost-effective infrastructure, assisting them whenever they move, renovate, or upgrade their existing Norstar or Meridian 1 PBX systems.

For example, the CITELlink IP Handset Gateway provides IP PBX interoperability for legacy PBX telephones across multiple vendor lines. The gateway communicates using legacy PBX protocol to traditional telephone handsets, and Internet Protocol to the IP PBX, and performs the translation between the two simultaneously. Enterprise customers can take advantage of increased scalability, easy migration, reliability, and lower cost of ownership by deploying next generation IP PBX applications on their traditional telephones.

The CITELlink gateway is a "slide in card" to the 3Com NBX chassis. Each card connects sixteen telephones to an NBX networked telephony system for a practical migration to the benefits of IP telephony. Multiple cards can be installed in an NBX chassis to support larger enterprise needs.

serve specific geographic regions or perform specific job responsibilities. In the past, traditional phone systems were too costly and complex for growing businesses to connect multiple sites.

3Com Virtual Tie Line technology enables multiple 3Com NBX systems to place calls between one another without using additional hardware, such as analog or digital line cards. The NBX IP Virtual Tie Lines application lets businesses easily migrate voice traffic to the data WAN backbone. Users can reach a co-worker or transfer a call to another location anywhere in the world by simply dialing a four- or five-digit extension.

The system can be configured to allow users to gain local dial tone access on any NBX system, bypassing costly long-distances charges. Businesses worldwide can create seamless, multisite telephony solutions, while reducing the costs of domestic and international calls via routing over the IP network.

Connecting sites and users with VTL technology is easy. Administrators simply install a 3Com NBX system on a LAN with a router, activate a VTL license on the 3Com NBX, as well as any VPIM-based telephony applications, and update the organization's dial plan to reflect the changes. To connect remote

users, companies can plug the phone into a LAN with a router, then add the appropriate IP configuration for the phone.

A phone handles the process of placing a site-to-site call using VTLs much like it would handle a local call. Call processors at each company site negotiate the telephony CODEC, setting up audio between the two extensions. After the call has been set up, both call processors drop out of the process, and the audio connection is maintained only by the extensions.

Using 3Com VTL technology for site-to-site connectivity lets organizations make the most of both their voice and data facilities by leveraging the data backbone for voice over IP calling. They gain the convenience of extension-to-extension dialing, and can reduce or eliminate corporate toll expenses for calls between sites. Perhaps best of all, companies can provide better customer service, and eliminate the inconvenience and lost business associated with asking callers to hang up and redial after reaching an incorrect number. Using a single dial plan architecture enabled by the NBX solution, 3Com VTL technology lets organizations transparently link offices with different phone numbers and support fast, convenient call transfers.

FIGURE 2: VTL technology enables organizations to dramatically reduce toll call charges between sites and gives them support for improving customer responsiveness and service.
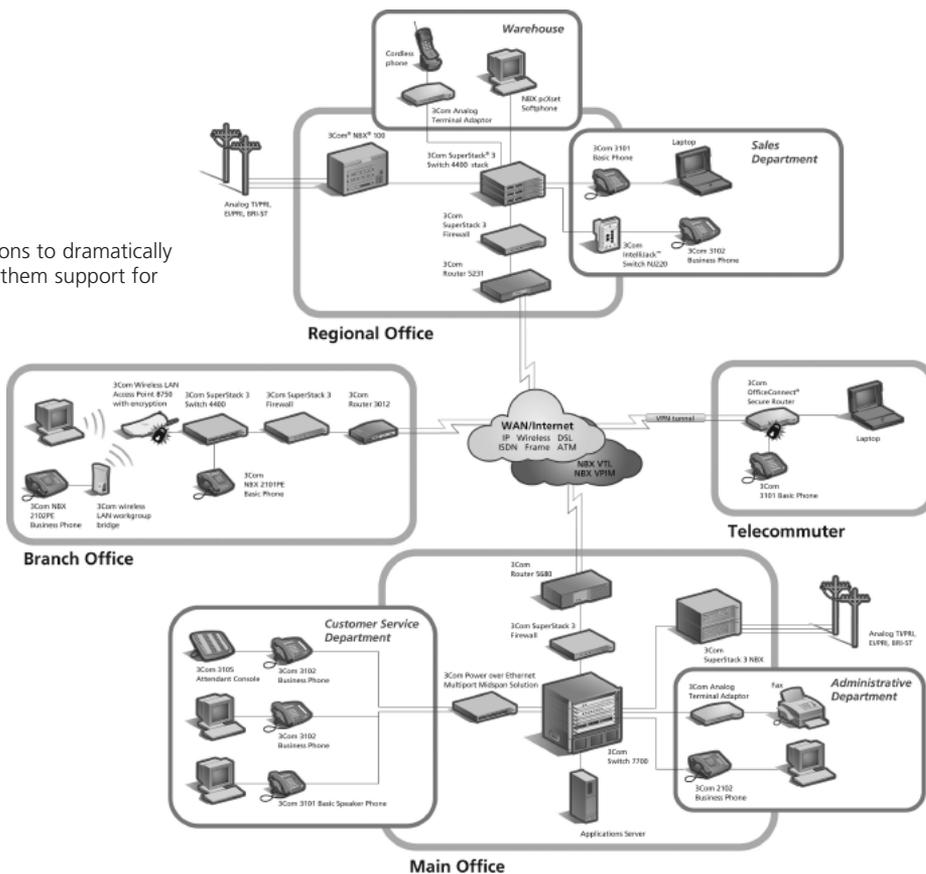
Why 3Com

3Com NBX IP telephony solutions provide the intelligence, power, and flexibility that enables organizations to reap the benefits of IP telephony. They offer powerful call processing, a robust set of built-in applications, and an ever-expanding suite of optional applications to deliver lasting value.

Along with its built-in features, 3Com enables organizations to customize their telephone systems with solutions from some of the best third-party application developers in the world. 3Com Voice Solution Providers offer a wide array of optional software for needs such as conference room phones, call center applications, recording and monitoring calls, or deploying voice-activated dialing services. Because the 3Com NBX solutions support standard Application Protocol Interfaces, developers are continually creating new applications, ensuring that users can make the most of innovations from an array of third parties. The variety and scope of applications enable organizations of all types to experience increased productivity and reduced costs.

3Com IP telephony solutions are at work in companies, state and local governments, and education institutions around the world.

For example, a financial institution needed to give its 40,000 members the most convenient access possible to its products and services. To link its contact centers, the enterprise deployed the 3Com SuperStack 3 NBX Networked Telephony Solution. Operating over the WAN, the NBX system automatically routes all incoming calls to the contact center, eliminating the need for receptionists at each branch office. Built-in caller ID allows staff to greet callers by name—a friendly feature that boosts customer satisfaction. Direct inward dialing makes long distance calls between branches unnecessary, trimming the credit union's annual phone bill by $7,200, or thirty percent.

Another customer, a rapidly-growing county in the U.S., needed to deliver fast, cost-effective services to a population of 92,000. Running over the county's existing Ethernet networks and cabling, a 3Com networked telephony solution enabled the county to replace its two hundred unreliable analog lines at one of its campus locations with three ISDN PRI circuits, reducing monthly carrier costs by $5,000.

With 3Com IP telephony solutions, designed with "pay as you grow" scalability, organization's can evolve their communications networks as their needs grow—easily adding phone sets, upgrading functionality with software rather than hardware, and incrementally expanding capacity with a variety of license options. 3Com telephone systems are designed from the ground up to support geographically dispersed work locations and provide a broad standards-based range of 3Com and third-party applications for practical deployment and investment assurance.

As a recognized pioneer in technological innovation, 3Com considers intellectual property one of its most strategic assets, and is an industry leader in patents. In a report issued by the U.S. Patent and Trademark Office for 2001, 3Com is listed among the top 100 companies with 220, ahead of much larger companies and industry competitors. This 3Com pioneering spirit drives the company to continue its development of networking solutions for organizations of all sizes—from small businesses with a handful of users at a single location to companies with hundreds of thousands of users integrated across a multisite environment of headquarters facilities, regional offices, small offices, and individual telecommuters. 3Com telephony solutions are designed to scale elegantly, accommodating all of a company's communication needs as it grows and matures.

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