The Five Critical Considerations for Successful IP Telephony Deployments

WHITE PAPER

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Introduction

Based on its experience of deploying over 16,000 IP telephony systems around the world, 3Com can point to three areas of business activities on which the technology can have significant impact:

- *Cost control—network convergence reduces cabling costs; use of the "pass-thru" port of 3Com IP phones can minimize Ethernet port counts at the LAN switch. Users handle their own moves, adds, and changes, reducing the expense of service provider visits*
- *User productivity—workers at home, in branch offices, and at remote operations can fully participate in business activities with four or five-digit extensions and centralized voicemail services*
- *Customer interactions—customer call completions can increase with advanced IP telephony applications capable of delivering services such as voice mail as e-mail, find me/follow me, interactive voice response, and call announcement—not to mention support over the IP wide area network (WAN) for call center agents distributed across the business*

2005 will be a watershed year for the IP telephony industry. For the first time, more IP telephony lines will ship than digital telephony lines[1]. Even with this market momentum, there are risks and challenges in effectively choosing a competent supplier and a solution that meets business needs. This paper presents five key factors to consider when evaluating, selecting, and implementing an IP telephony solution:

1. *Carrier-class availability*
2. *Audio quality*
3. *Open, extensible product architecture and standards*
4. *Convergence applications*
5. *Vendor strength in network convergence (voice and data)*

Companies considering these factors in their decision cycles are better positioned to create a competitive advantage from the way their employees interact with each other and with customers.

[1] Compilation of forecasts of industry analysts: Gartner, Yankee, InfoTech, and Synergy Group.

Consideration #1: Carrier-Class Availability

Availability is the probability that service is available when requested. Carrier-class performance generally means greater than five 9's or 99.999%—a maximum of about five minutes of downtime per year. IP telephony vendors should be able to provide metrics of the performance of their software systems including an estimate of availability. Customers should expect a vendor to demonstrate how a network design uses both active and passive redundancy to achieve the availability metric, and how a recovery might occur in the event of a failure of the IP network, public switched telephone network (PSTN), or call controller device.

Availability of end point stations should be considered also. Their vulnerability to failure or power outages can be mitigated by devices that support IEEE 802.3af Power over Ethernet (PoE). 3Com IP phones with PoE support, for instance, provide a degree of availability over and above server performance and eliminate the need for power bricks (transformers) attached to the IP phone. Additionally, the presence of "pass-thru" Ethernet ports—when connected to laptops with battery-support— strengthens computing and telephony availability in the event of power failure. Of course, the servers and switches should be on an uninterrupted power supply (UPS), too. These devices can ensure no single point of failure, enable hours of business continuity, and provide for stable turndowns during sustained power outages such as those that might accompany natural disasters.

It shouldn't be surprising that availability is first on the list of considerations. It is a truly critical concern. If a solution gets high marks in all other categories except this one, that solution should be disqualified. The ability to pick up the handset of a telephone, get a dial tone, and place a call is an expectation resulting from over a hundred years of successful telephony and the demands of business obligations. It has to be there. And it has to be there all the time.

Consideration #2: Audio Quality

Audio quality ranks high in customer satisfaction indices. If users get frustrated with audio quality—are frequently asking customers to repeat themselves, or are disadvantaged by being "harder to work with"—complaints will overshadow good intentions and even otherwise excellent customer service.

Many factors determine audio quality, including the physical plant, network design, operations, and end devices. For modern communications, the physical integrity of the wiring, magnetic interference, and electrical noise are "table stakes". Practices for detecting and mitigating wiring issues are well documented, easily isolated, and inexpensively handled.

More common and more difficult to manage are the issues in network design and operations. Here the elements affecting audio quality include voice packet prioritization settings in LAN switches, configuration of voice traffic on a virtual local area network (VLAN), presence of echo cancellation mechanisms, and the physical distance between network endpoints. To minimize the administration of these factors, 3Com LAN switches can detect the presence of a 3Com IP phone on a switch port and automatically configure the LAN infrastructure for 802.1p packet prioritization service. The alternative solution might require an investment in time and engineering effort that would likely remove resources from more critical business functions.

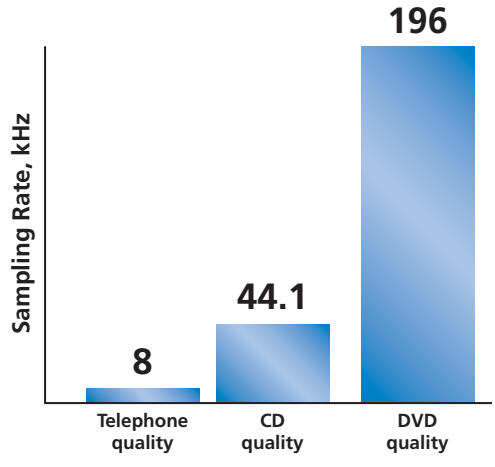


FIGURE 1: Sampling rates and audio quality.

Unlike legacy digital telephony systems, IP networks are not generally concerned with the bandwidth assigned to any one conversation. This capability lets wideband phones improve the fidelity of audio-enabling frequencies higher than 3.3 kHz and as high as 7 kHz. In fact, as shown in Figure 1, audio quality is related to sampling rate. DVD-quality audio is sampled at 192 kHz, CD-quality audio is sampled at 44,100 Hz, and classic telephony implementations use 8,000 Hz. Higher sampling rates enable harmonics that heighten satisfaction with ''music on hold'' and enhance perceived audio quality.

For hearing-disabled or older employees, wideband telephones may offer less frustration, fewer misunderstandings and repeated words or phrases, and higher productivity. The standards for wideband audio that are now appearing in telephony products are embodied in the quality of telephone microphones, speakers, and sampling rates of the audio devices. The 3Com 3102 IP phone was among the first to market devices designed to maximize audio quality in these ways.

Audio compression is also important in deploying effective IP telephony systems. Equipment should support industry standards such as G.711 ADPCM (Adaptive Differential Pulse Code Modulation) or G.729 compression. Standard methods for compression should not be left to the WAN routers. For better application performance and to help remote users more fully participate in end-to-end control of the session bandwidth, compression control should reside at the IP phone.

Additionally, the ability to view and adjust comprehensive aspects of a converged network's operation through an enterprise network management application is critical to network performance, and by logical extension, audio quality. Comprehensive management applications should provide status and operations data on each network component, including the IP telephony infrastructure (gateways, call controller, and IP phones). Such tools for effective management of employee and customer experiences should include network performance reports and engineering analyses of audio quality, such as packet loss by route. Equipped with these resources, staff can respond rapidly to reports of jitter or ineffective echo cancellation.

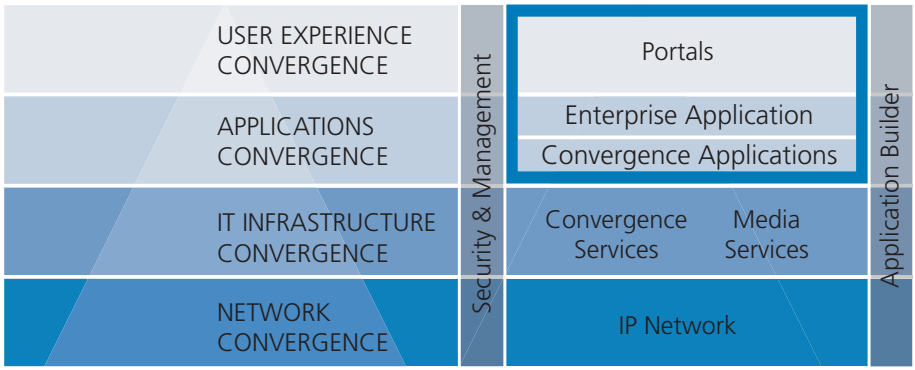
Each of these mechanisms for optimizing audio quality should be considered, but only after specialized tools and highly qualified technical experts have developed a thorough analysis of the WAN's IP telephony readiness. A third-party consultant or the professional services organization of a global vendor can provide an objective report card and roadmap that balances economics and audio quality.

Consideration #3: Open, Extensible Product Architecture and Standards

The open and flexible architecture required for IP telephony goes beyond dial tone. It extends from network devices through enterprise-wide IT infrastructures to applications that directly impact user activities. Businesses need an over-arching architecture that brings together, within a shared, standards-based and scalable architecture, IP telephony and its related services—IP messaging, IP conferencing, and IP contact center. Support for common authentication, presence, location and privacy services across a portfolio of such convergence applications unifies administration, policy management, and configuration requirements for a host of application services. Even support for popular enterprise IT infrastructures such as Lightweight Directory Access Protocol (LDAP), used for enterprise directory services or integration with the enterprise authentication service to enable single sign-on for both communications and enterprise applications, can balance effective security, user productivity, and IT support costs (a major use of IT support time and effort is responding to ''forgotten password'' help requests).

There are an estimated 945 million Internet users around the world today, making IP the world's most popular protocol and its most popular standard. Clearly, IP's open architecture and widespread support are promoting the rapid pace of communications innovation. Together, they have given organizations the freedom to choose from among a wide variety of vendors.

FIGURE 2: Four phases of convergence leading to complete integration of business processes.



Achieving Complete Enterprise Convergence

Depending on business goals, the use of an open and scalable communications architecture can promote innovation and deliver the freedom of multi-vendor network options. In practice, however, a business' choices may be limited by earlier decisions. Therefore, the goal should be to both maximize the integrity of previous investments as well as achieve the comprehensive business benefits of convergence. 3Com experience shows that a four-phased approach is often the path to a complete transformation of business communications for lower cost, higher productivity, and stronger customer interactions. These four phases include:

1. Network Convergence
2. IT Infrastructure Convergence
3. Convergence Applications
4. User Experience Convergence

As shown in Figure 2, convergence permeates multiple layers of a communications infrastructure. Beginning with network convergence, organizations can deploy switches and routers that support Power over Ethernet and Quality of Service so that real-time packetized voice can co-exist on a LAN infrastructure and within an IP WAN. As part of a genuine movement toward an integrated architecture, IT must also develop a convergence layer which includes shared call control, authentication (how many logins do you really want?), privacy, location, and presence management services. IT must also provide media services to ensure quality of service, user satisfaction, and cost control. Whether these are video- or speech-driven, they involve deployment of incremental and specialized application-sensitive hardware to support activities such as conferencing.

Relying on the common services of the IT convergence infrastructure, a Convergence Applications layer—including IP telephony, IP messaging, IP conferencing, IP contact center, personal assistants, and self-service applications—extends the advantages of convergence throughout an enterprise. For example, the value of knowing that someone is online can be enhanced by the knowledge that the person being sought is also off-hook in a conversation with someone else. With this type of information, voice mails can be reduced and callers can use their time more productively.

In many businesses, calling patterns follow the workflow of enterprise applications such as Customer Relationship Management or Enterprise Resource Planning. In these environments, it may be advantageous to integrate more closely convergence applications with enterprise applications to support customers, partners, and employees connecting with the business via its portal layer. Convergence services can facilitate access for mobile or handicapped users and for workers with bandwidth contraints.

Security and management services pervade all phases of an integrated converged business structure. Their common implementation can balance control and productivity. The applications builder referenced in Figure 2 adds customization capabilities to this shared structure, enabling convergence applications to be embedded into business processes and their supporting systems, into enterprise applications, and into portals. The builder can also create new applications that combine specific elements of each business process layer.

Integration and Interoperability in Action

As enterprises fully integrate convergence into business processes, they must leverage existing investments and execute cost-effective and easy-to-implement migration strategies. Standards-based protocols and industry interfaces deliver an interoperable environment that can facilitate deployment of advanced IP-based solutions. For example, if the IP telephony system's call controller supports the Session Initiation Protocol (SIP) standard, a customer can benefit from interoperability with a wide range of analog gateways, digital gateways, and video and telephone devices. Industry-standard SIP, a text-based mechanism similar to the hypertext transport protocol (HTTP), is used for establishing, confirming, and terminating multi-media communications sessions. It functions as the mechanism linking call control in the IT convergence infrastructure with the IP network in the network convergence layer.

For similar deployment flexibility, the availability of well-understood management procedures—such as Simple Network Management Protocol (SNMP) for reporting device health—lets users select among various SNMP management applications such as HP OpenView or 3Com Enterprise Management System (EMS). To avoid attempting session setups with devices that are in use or out of service, Java Database Connectors (JDBC) can be deployed to publish a device's status to the database system and the call control function.

In addition, both Voice eXtensible Markup Language (VXML) and its sister language Call Center XML (CCXML) are XML-based languages for creating and managing speech dialogs, including call control functions such as multi-party conferencing and outbound calling. These mechanisms enable advanced services for the personalized navigation of interactive voice response systems, auto attendants, and the like.

Consideration #4: Convergence Applications

IP telephony is the catalyst for a host of new applications for both central and remote users. Since these new applications can help justify a rapid IP telephony investment, they are an important consideration in the selection process. At a minimum, the following applications should be available within most effective organizations:

- An IP telephony PC application for mobile-user call support that works with leading operating systems including Windows, Mac OS, and Linux.
- Call management services for both the in-office knowledge worker and the mobile worker, allowing simplified outbound dialing, enterprise applications-coordinated screen pops to the desktop, call screening, and call optioning. Extensive call logs for analysis and user communications management should be available also.
- IP messaging to deliver a full-featured voicemail system that can be managed centrally, provide the ability to have messages forwarded among all users within the organization, and support VPIM networking. This application should let workers receive, manage, and send e-mail, voice mail, and faxes from a single inbox and enable access to all message types from a desktop e-mail application or via a telephone interface. It should also support a mix of media types to support capabilities such as voice message response to an e-mail. Find me/follow me services can add to the productivity value of IP messaging solutions, allowing the system to 1) locate a user based on user-defined caller types—for instance, "I am not in the office, press one to have my agent locate me"; 2) attempt to reach the user in at least three locations—e.g., cell phone, home phone, alternate office; and 3) be configurable by caller ID information.

  Believing in the value of sending employees in a time sensitive framework encouraging messages such as scheduled voice mail from the division president, many executives see a link between communications and performance. Being able to easily create distribution lists and record and schedule messages across a geographically-diverse business unit is a good business practice.
- IP conferencing for instant messaging, audio conferencing, video conferencing, and document sharing. Visual collaboration is an increasingly important mode of work and customer collaboration. Conferencing a third person into an existing call should be, and can be, as easy as click and drag.
- IP contact center software to control customer interactions by leveraging IP telephony systems with industry-leading call routing, management, and monitoring capabilities from vendors such as Aspect, Genesis, and Siebel.

Minimum performance is never enough for creating competitive advantage. In addition to this list of enterprise-wide convergence applications, leading enterprises will seek to benefit from additional services, such as:

- Centralized management of LAN, WAN, and IP telephony products
- Configuration and administration of all applications across a common call control function
- Branch office survivability[2] strategies for enabling distributed call control and backup that is instantly engaged in the event of call controller outage, IP network failure, or PSTN failure
- Call recording for compliance with industry oversight management

Convergence applications can enable new levels of user productivity and stronger customer interactions. In fact, they should become a standard component of IP telephony products and services and are gathering momentum as the next enabler of strong business performance.

Consideration #5: Vendor Strength in Network Convergence (Data and Voice)

Today's IP telephony solutions need to be integrated with telecommunications infrastructures (telephone interfaces, PSTN interface cards, voicemail administration, audio quality components, etc.) as well as with the data network (switching, IP routing, configuration management, bandwidth planning, etc.). Consequently, it is essential that a vendor have proven expertise in both data networks and IP telephony systems—and be able to demonstrate this integrated value.

For example, effective network convergence that enables functionality across both the IP telephony application environment and the data network requires:

- The LAN be able to automatically detect IP phones and enable IEEE 802.2q prioritization service within the LAN switching infrastructure
- IP phones support ''pass-thru'' Ethernet service and handle 802.1af PoE. This functionality can minimize total port counts and allow laptop users connecting through these Ethernet ports to sustain service in the event of power failure, provided switches, routers, and servers are on a UPS device
- The LAN and IP telephony applications work together to enable E911 emergency management support. For example, by linking the Media Access Control (MAC) address of an IP phone to its IP address and extension number, the emergency resource locator file can provide required information
- The enterprise management application present an integrated perspective on system operations, administration, and configuration

These interworking features simplify the job of the network manager and communications staff and reduce the time to implement IP telephony. However, this technology integration is probably easier in most organizations than integrating the voice and data teams of the company. That's where the convergence experience of the vendor can be invaluable. Working with professional and knowledgeable convergence experts who can speak ''telecom'' to the voice department, and speak ''data'' to the data networking team, is often more important than data vendors or voice vendors are willing to admit.

Vendor experience and products with proven suitability for both network convergence and IP telephony reduce risk to the business and increase the speed with which the corporation is able to capture the benefits of advanced business solutions.

[2] For additional information, download the 3Com white paper, IP Telephony in Branch Networks: The Case for Voice Boundary Routing, from www.3com.com/voip.

Summary: Choosing the Company You Keep

Businesses today have choices they may not have had even a few short years ago. Open, standards-based convergence solutions are now available to provide the productivity and cost savings often more difficult to achieve with proporietary, hardware-based systems. Vendors with a proven track record in both data and voice networking now offer enterprises the expertise needed for a smooth transition to secure converged voice and data communications. Together, standards support and vendor experience enable an overlay solution that can leverage existing systems and provide the immediate advantages of the latest converged technology—secure, feature-rich communications, end-to-end system management, and increased support for mobile workers and geographically distributed organizations.

After critical consideration of the issues involved in successfully deploying IP telephony and establishing an effective converged infrastructure, enterprises will realize that 3Com is their best choice now and the company they will want to keep as their communications needs evolve. 3Com solutions deliver

- Carrier-class availability
- Exceptinal audio quality
- Open, extensible product architecture and standards
- Robust converged applications
- Vendor strength in network convergence

There is no better time to advance your business goals with a next generation communications architecture that can lower cost, increase end-user productivity, and strengthen customer interactions. You can improve communications with your customers, partners, employees, and shareholders. 3Com can help. We're changing the way business speaks.

3Com has been a major contributor to the convergence industry since the introduction in 1998 of the world's first IP-PBX, the NBX® solution. In 1999, the company developed an architecture for a distributed softswitch for AT&T and brought the first commercially-deployed carrier softswitch to market. The 3Com VCX™, introduced in 2003, offers the world's first convergence applications suite.

Transforming business through innovation is not new to 3Com. The company holds over 900 patents and is the market leader in IP telephony for small to medium enterprises. 3Com operates in over 45 countries and has 1,900 employees.

About the Author

As vice president and general manager of the enterprise voice solutions division of 3Com Corporation, David Hattey oversees a business team defining, marketing, and implementing 3Com voice products for enterprises of all sizes.

Hattey has more than 20 years of experience in the high technology industry and extensive experience in successfully creating new business ventures. As president, he led the turn-around of EFJohnson Company, a publicly-traded company providing wireless communications systems for public safety, commercial, and government customers.

Hattey, the holder of 11 patents, earned bachelor's degrees in electrical engineering and computer engineering from the University of Michigan in Ann Arbor, Michigan and received his master's degree in business administration from the Fuqua School of Business of Duke University in Durham, North Carolina.

3Com Corporation, Corporate Headquarters, 350 Campus Drive, Marlborough, MA 01752-3064

To learn more about 3Com solutions, visit www.3com.com. 3Com is publicly traded on NASDAQ under the symbol COMS.

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