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The Call Center Revolution

Converged Networks Enable Integrated
Customer Service Solutions

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Customer service centers have become profit centers for many businesses. According to the Direct Marketing Association, direct sales and marketing via call centers accounted for $244 billion or 45 percent of total business-to-business sales in 1996.[1]

The fact is, call centers have become essential to the survival of a growing number of businesses. What financial services institution could compete today without a call center? Companies of every size and type are beginning to realize that investing in state-of-the-art call center capabilities can be their single best competitive differentiator. A well-designed call center can enable the organization to:

- Improve customer intimacy and retention
- Increase competitiveness by taking advantage of emerging technologies
- Increase revenue through broader opportunities to sell
- Increase employee productivity by streamlining business processes

Infrastructure Advances Enable New Features and Lower Costs

One of the most exciting technology advances in call centers today is convergence—the merging of data, voice, and video communications over a common network infrastructure. Call centers are one of the first applications to take advantage of the growing trend toward convergence as businesses realize the benefits of multimedia. By taking advantage of integrated voice, video, and data, information can be delivered in a variety of compelling ways that encourage customer self-service and enhance the user experience.

While the call center has been at the heart of telecommunications-based customer service for decades, call center technologies have traditionally been based on proprietary hardware platforms and software applications. These legacy solutions require significant investments in integration and customization, and they are risky and expensive to deploy.

Today convergence, combined with complementary trends in PC systems and business software, is helping to fuel a call center revolution. The widespread adoption of open standards in the computer networking industry, support for multiple channels of communication, the availability of powerful, cost-effective PC systems, and the success of the Internet are all factors helping to enable dramatic advances in call center technologies. As the call center market shifts away from proprietary, highly customized solutions toward standard hardware platforms and packaged software applications, costs for the overall solution are rapidly falling. Meanwhile, these new solutions include a wealth of advanced features and capabilities.

Both voice and data processing vendors are delivering more integrated multimedia call center solutions out of the box. And the ability to integrate voice and data traffic across the corporate enterprise and the public Internet enriches call center interactions in ways never before possible. As convergence becomes ubiquitous, those companies that take early positions in the call center revolution will benefit from increased employee productivity, customer satisfaction, revenue opportunities, and market competitiveness.

New Call Center Applications

These technology advances are enabling different kinds of call centers to help companies meet a variety of business objectives. Advanced connectivity combined with intelligent, skills-based routing now allows organizations to fully exploit virtual call centers, a model that allows agents to work effectively outside the operational facility. For instance, an expert on a specific complex product offering can work in a remote engineering group and still provide second-level technical support to customers who call in to a central help desk. The advanced, skills-based routing intelligence in the call center software, combined with advanced network connectivity, allows the "agent" to maintain a work environment

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[1] WEFA Group, *Economic Impact: U.S. Direct Marketing Today: A Landmark Comprehensive Study, 1997*

optimized primarily for an engineering role, while still providing call center support.

However, to fully realize the benefits of converged communications, call centers must be Web-enabled. This enables them to fully leverage the growing power of the Internet. A call center that handles traditional calls and Web interactions can typically receive faxes and electronic mail inquiries as well. Realizing this, numerous vendors are now delivering comprehensive multimedia call center packages that combine all of these channels and enable businesses to offer their customers the benefit of multiple communications options. In essence, "call centers" are evolving to become "virtual customer care centers."

Virtual Call Centers

Virtual call center architectures let companies fully leverage their corporate knowledge base. Using skills-based routing across the enterprise, it is now possible for the proper employee, at any desk within a campus, to support any customer inquiry or business process (Figure 1). Virtual call center solutions help companies resolve customer problems quickly. They provide increased flexibility to support peak demands on the business, and they can offer agents the ability to work from home, lowering the amount of dedicated space a business must maintain while helping increase the retention of call center operators.
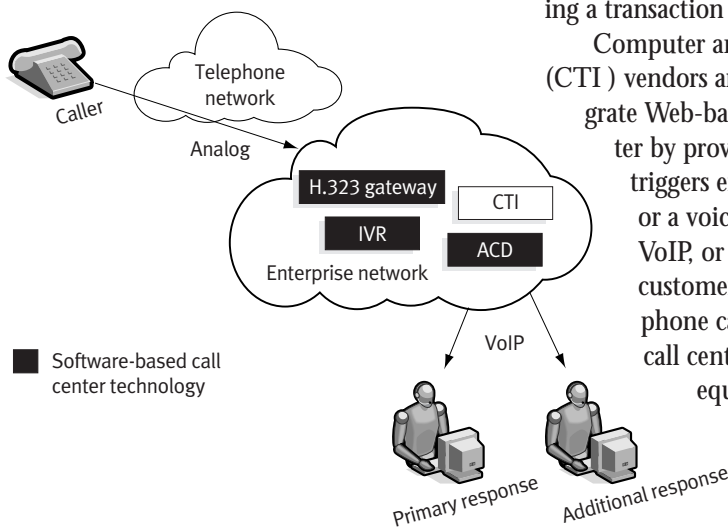

Figure 1. *Virtual Call Center*

² 1998 Gartner Group report quoted in *BCR*, June 1998, page 40.

Web-Enabled Call Center

The Internet offers customers a new communications channel into the call center. The challenge for businesses is to leverage their existing investment in a corporate presence on the Web into a round-the-clock, revenue-generating storefront or state-of-the-art customer support center.

Many companies have moved well beyond simply posting brochures and marketing collateral on their Web sites; they now offer transaction-based services most often completed as a self-service function. Perhaps the most successful company to use this approach is Federal Express, which supports nearly a million transactions each month on its Web site. Since the $3 to $5 cost per transaction via a self-service Web site is a fraction of the $20 to $25 cost of a live telephone exchange, it is easy to understand why Internet-based transactions are becoming increasingly common.²

However, self-service ordering and automated delivery services are not sufficient for many people who either prefer to speak to a live operator or are uncomfortable providing sensitive information such as credit card or Social Security numbers over the Internet. Just as people need a way to access an operator when they get frustrated with the complex menu system of a voice response unit (VRU), customers will need a way to access a live person when they are concerned about completing a transaction on a Web site.

Computer and telephony integration (CTI) vendors are already beginning to integrate Web-based contact into the call center by providing a "call-me" button that triggers either a traditional phone call or a voice-over-IP (VoIP) response. VoIP, or Internet telephony, allows a customer to initiate an IP-based telephone call through their PC to the call center. Customers with properly equipped multimedia PCs can then speak to the call center operator directly over the same line that connects them to the Web. Since almost all new consumer

PCs shipped today include a microphone, speakers, audio card, and H.323 client capabilities (H.323 is a standard for packetizing voice traffic for transmission over an IP network), call centers will soon be able to fully leverage these multimedia systems (Figure 2).

Full integration of the Web into the call center allows operators to know exactly where a customer is on a corporate Web site and provide context-specific support and even online Web calls. Clearly, integrating Internet access into the call center will provide businesses with a new level of customer service capabilities, as well as greater operator efficiency and increased cost savings.

Figure 2. *Web-enabled Call Center*

Multimedia Call Centers

Many call centers integrate and manage all communication media, allowing agents to simultaneously handle and prioritize voice calls, Web inquiries, e-mail, and faxes (Figure 3). This integration allows call centers to:

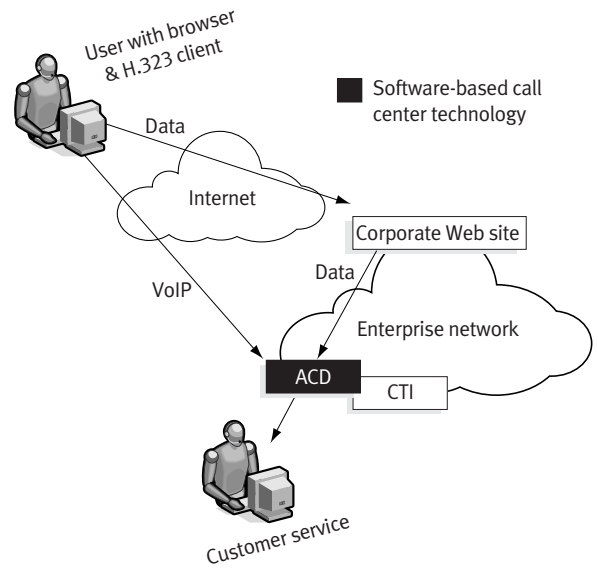• Provide improved communications with customers

• Manage the flows of queues and service levels for all media types

• Track media demand and network utilization for all media types

Most medium and large call centers already handle some multimedia messaging services, even if only for voice and fax communications. Once a company has established itself on the Internet, it will ultimately want to provide every call center agent with the capability to handle phone calls, e-mail replies, or Web-based responses to a customer request. Giving call center operators the ability to respond to voice calls, Web inquiries, e-mail, and faxed communications from their desktop system allows them to maximize their effectiveness and helps ensure that each customer receives a response appropriate to their inquiry.
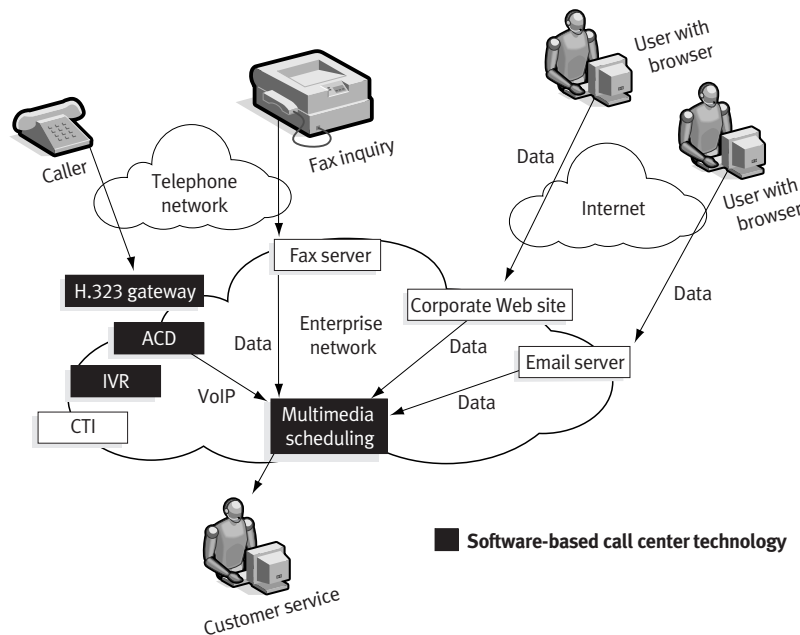
Figure 3. *Multimedia Call Center*

CTI applications that support agents using multimedia messaging also provide call center managers with the ability to proactively manage the service levels of each communications medium. For instance, the call center manager will want to make sure that employees reply to e-mail in a timely manner. Similarly, if a customer ordering from the corporate Web site selects the "call me now" button, the call center manager needs to make sure that an operator is available for an immediate callback to complete an online transaction or answer a specific question. The CTI applications within the multimedia call center can track and manage the demand for and use of each medium.

The "Net" Impact

The call center revolution will touch nearly every customer-facing organization in the coming decade. But in order to realize the full benefits of the network convergence and integrated call center solutions, the network infrastructure must be able to support new demands. Increased multimedia traffic across the enterprise network requires scalable network performance that can support voice, data, and Internet traffic. In addition, these multimedia solutions involve a new mix of diverse traffic types with a wide range of performance characteristics. In order to ensure that each type of traffic receives the appropriate level of service, networks must be equipped with policy-based management capabilities that let them respond automatically to changing conditions. And, as with any mission-critical implementation, the network must support defined security and reliability standards.

The call center revolution will enable established users of existing call center technologies, as well as those newly evaluating call center options, to leverage their network investments to deliver unprecedented levels of customer service and realize new operational efficiencies. An incremental investment in scalable bandwidth and policy-based networking capabilities will allow enterprises to adopt or migrate toward new call center solutions. At the same time, this investment will provide a converged networking infrastructure capable of handling a wide range of other emerging multimedia applications.

Call Center Migration

Remember when fax, e-mail, and Web sites didn't exist and call centers supported phone calls exclusively? The call center evolution
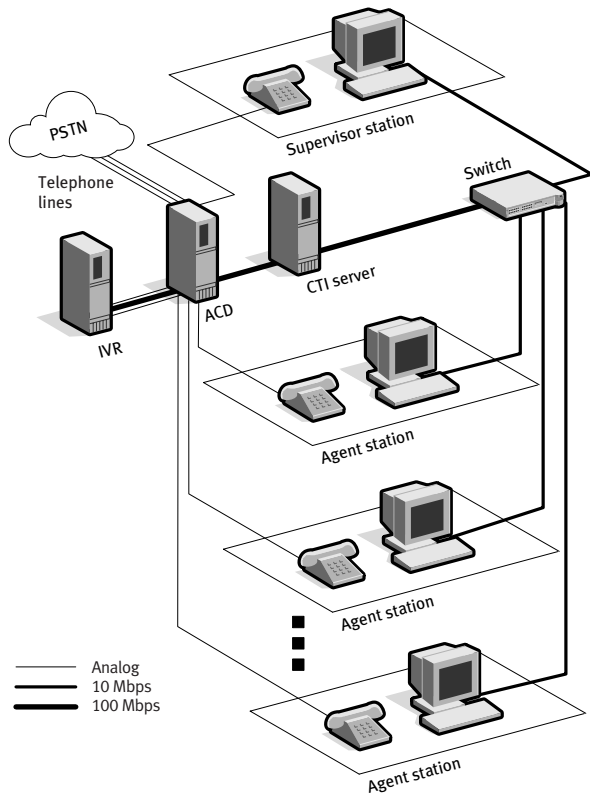
Figure 4. *Today's Call Center*

access the current call center by Web-enabling it. Figure 5 shows how an H.323 gateway can convert the VoIP call into a traditional telephone call that the existing automatic call distributor (ACD) can support. This simple step lets the organization begin to use Internet-based telephony to reach customers. However, there is typically no logical or physical connection between the customer's view of the Web pages and the agent's view of either Web content or CTI data. (This would require loading an agent or applet into the customer's browser that could send the additional data regarding the customer's location on the Web site.) As a result, the customer and agent often must talk through where they are in any buying or support process.

There are other possible intermediate steps in the process of developing an existing call center toward the advanced applications and open systems approaches. However, once an enterprise takes full advantage of the new software-based elements, the call center is dramatically changed, as shown in Figure 6. The

began more than a decade ago and will continue into the foreseeable future.

Figure 4 shows today's traditional call center, which relies upon mostly proprietary, telephone-based technology and offers only "logical" convergence. Such a call center incurs a low level of data networking demand with all agents receiving both the voice call and a preset pop-up screen from the CTI server. Thus, although physically separate, the two worlds of voice and data are logically merged from the perspective of the agent and the supervisor.

An initial step in the migration toward a software-based call center model is to provide access to the few Internet-based calls that may
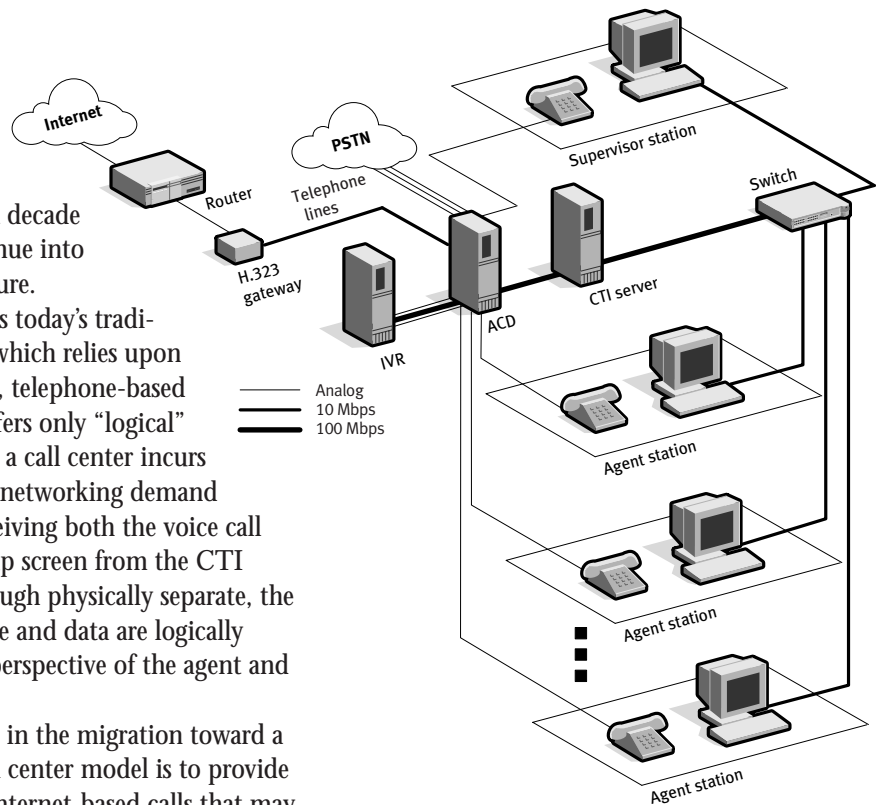

Figure 5. *Transition Call Center*

mix of voice and data swings to nearly pure data networking, and a single wire now supports the agent. Physical convergence has occurred and the enterprise has a new freedom to connect agents in a variety of ways. Moreover, additional software can be added incrementally as prices fall and new features become available. The overall solution can now support virtual call center as well as multimedia call center applications.

Figure 7 on page 8 shows a fully integrated Web- and software-based call center.

This system takes full advantage of the online communication that can take place between a customer, a call center agent, and a corporate Web site. For example, the agent can push new content to the customer, assist the customer in locating a specific page on the Web site, or even execute transactions. This model will support new and advanced "virtual customer care centers."

Figure 8 on page 9 shows another fully integrated Web- and software-based call center. However, this system further simplifies the
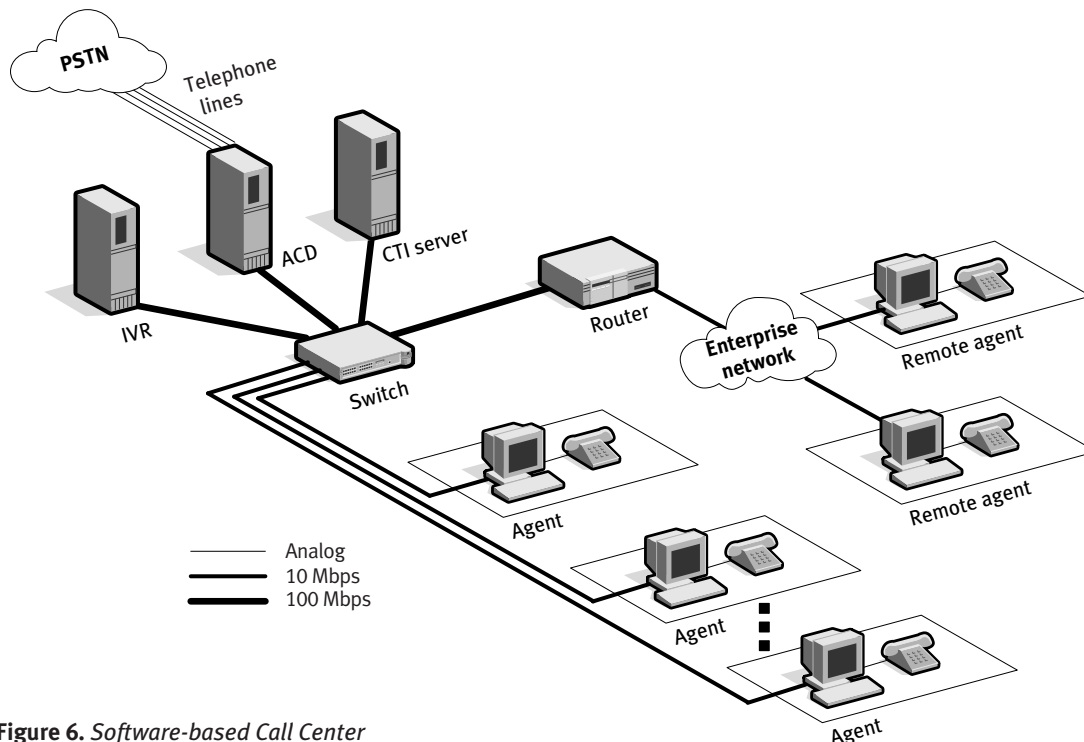

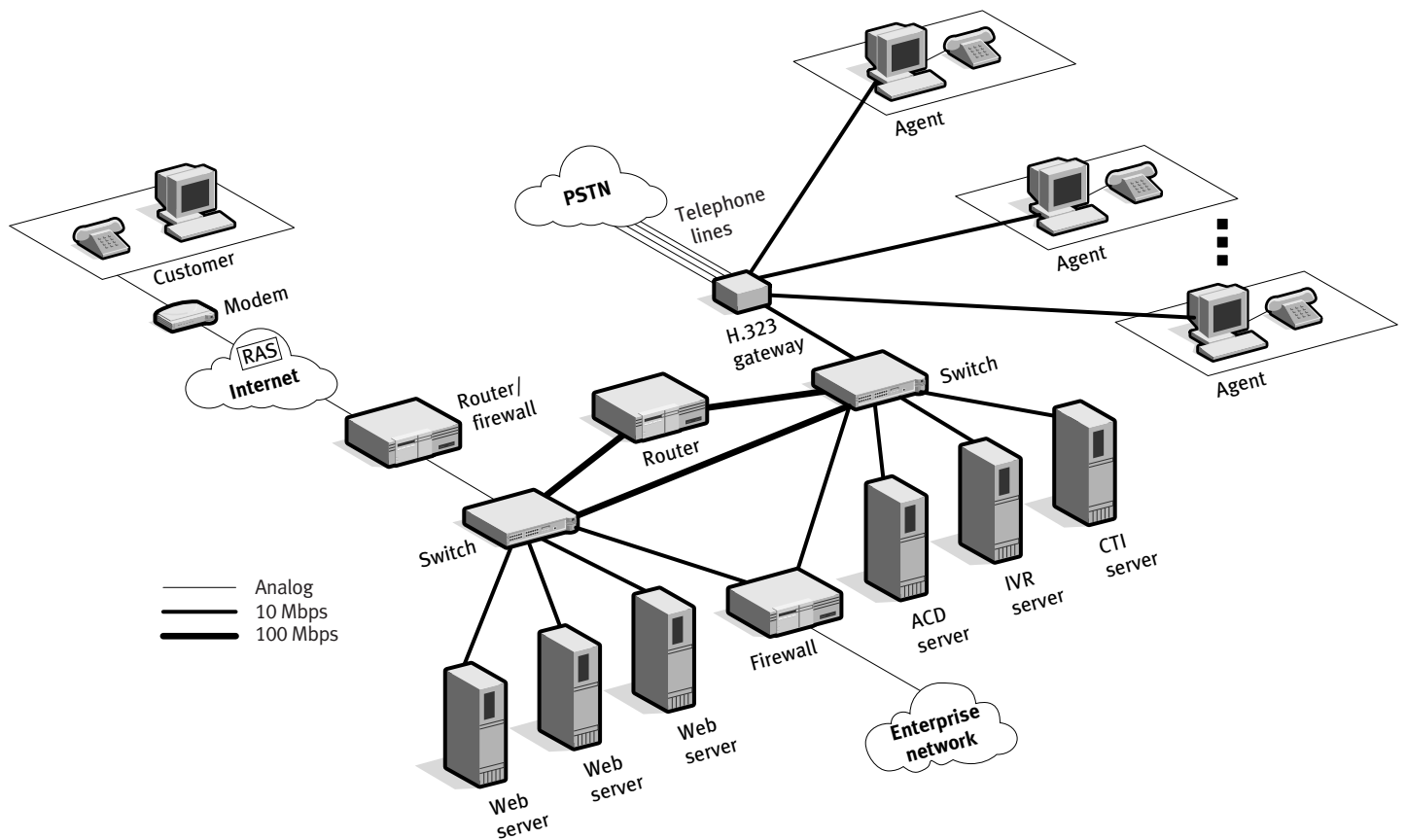**Figure 6.** *Software-based Call Center*

Figure 7. *Integrated Web and Software Call Center*

solution by combining multiple call center functions on a single server and eliminating the need for any hardware-based PBX or ACD systems. By collapsing parallel infrastructures into a single network and reducing the number of systems required to support the call center, this solution illustrates the cost and performance advantages associated with converged, software-based call center solutions. Furthermore, this solution lowers the cost of entry for small and mid-tier organizations as well as large enterprises.

Network Requirements to Support New Call Center Applications

Each of the new call center applications places new demands on the existing network infrastructure. Enterprises will be able to support these advanced call center applications if proper care is taken to preserve the performance relationship between the application

and the underlying infrastructure. There are two fundamental technology improvements that must be evaluated for the network infrastructure: increasing bandwidth and administering policy-based management for application traffic quality of service (QoS) across the enterprise. Different call center applications will require different mixes of bandwidth and control. The most flexible approach is to rely on a balance of both overprovisioning and advanced management and control.

Most effective QoS approaches include traffic prioritization techniques, such as IEEE 802.1p (now part of the IEEE 802.1D standard) at Layer 2 and IP Type of Service (ToS) marking at Layer 3. Call center applications that span a total enterprise network or utilize the Internet must incorporate an integrated approach in which prioritization techniques are maintained on an end-to-end basis. This implies the need for routers at the LAN/WAN

boundary that can map between 802.1p and ToS. Of course, any new call center technology that is adopted should include robust usage reporting and policy management capabilities.

Virtual Call Center Requirements

Virtual call centers challenge the campus network, since VoIP may now be directed to any desktop. A virtual call center-enabled campus may require upgrades for both bandwidth and QoS. All on-campus desktops should access the network on dedicated-switched Ethernet ports.[3] High-volume voice and data servers supporting the call center should access the network at 100 Mbps. This is particularly important for the software ACD server and any server hosting VoIP sessions. Proper engineering of the campus network also requires a bandwidth hierarchy that will likely "top out" at about 10 Gbps in the backbone. Of course, specific bandwidth needs depend on the particular nature of the campus, user population, and other applications.

But investing in bandwidth alone is probably not a sufficient solution for the campuswide call center. While providing switched 10 Mbps service to the desktop may alleviate congestion at the client access point into the network, voice sessions may still be impacted by other traffic on the campus. A large file transfer that competes for resources may add enough jitter or loss to degrade a VoIP session. As a rule, customers expect traditional toll-quality voice interaction, and the network must be engineered to provide such quality. The network should therefore provide precedence handling of the VoIP packets on an end-to-end basis (including all intermediary points) over other data application traffic flows. Advanced LAN switch architectures provide multiple physical queues within the switch for prioritizing traffic across separate physical paths.

Web-Enabled Call Center Requirements

Agents working in a Web-enabled call center will be able to establish a VoIP session across the Internet and the enterprise campus network. Ideally, the call center should be located close to the Internet access point on the campus to minimize network hops and latency-inducing equipment, such as firewalls. While some campus infrastructure upgrades may be required, supporting guaranteed levels of QoS

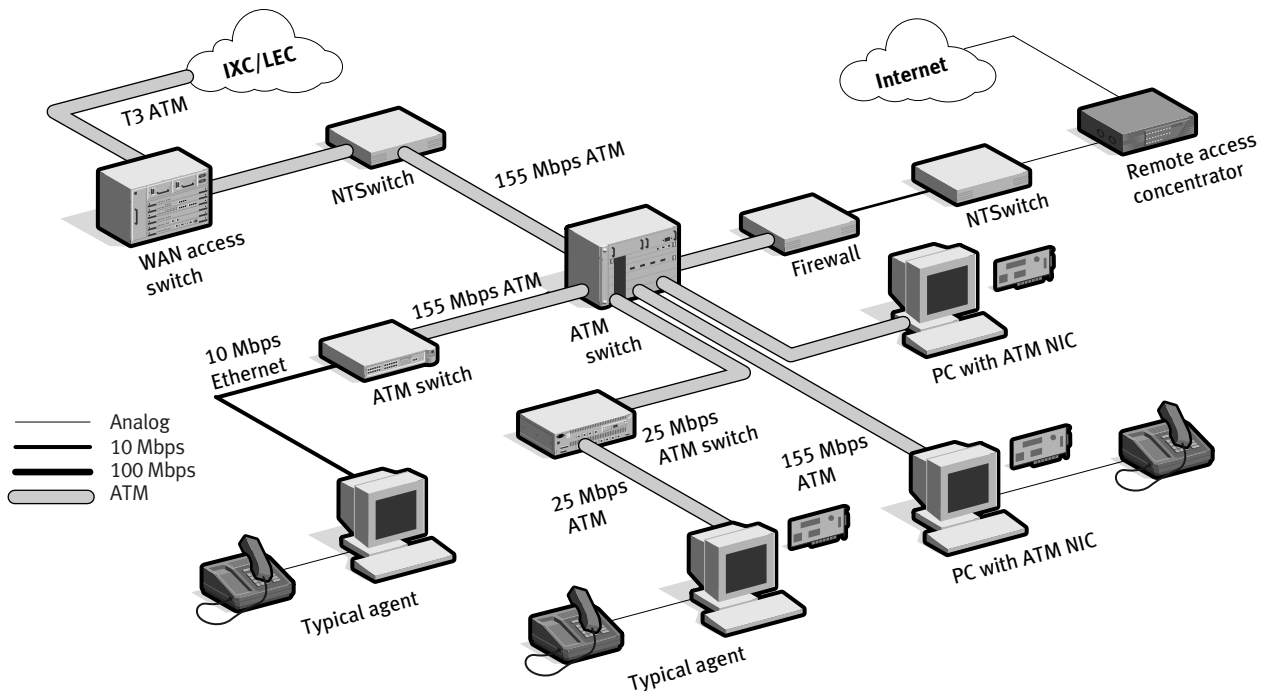**Figure 8.** *Fully Converged Virtual Customer Care Center*

[3] For virtual call center agents working at home, it is likely that data and voice connections will travel via separate paths. This can be accomplished by using either two telephone lines or an ISDN connection. Of course, an ISDN connection is more flexible; it can handle a wider range of data rates to adapt to the needs of the user.

Table 1. *Meeting the Call Center Network Challenge*

Application	Performance	Access	Management
Virtual call center	• Wire speed switching • Aggregate backbone bandwidth may reach 1 to 10 Gbps	• 10/100 Mbps NICs for all potential active user desktops • 100 Mbps NICs in ACD and IVR servers	• NICs must flag VoIP as high-priority traffic using 802.1p protocol • All switches must support 802.1p • Routers must convert 802.1p to IP ToS tagging and handling • VoIP traffic must be delivered with low latency and jitter
Web-enabled call center	• Must work on the weakest link • Wire speed switching from access router to ACD and IVR servers	• Campus: 100 Mbps NICs in ACD and IVR servers • WAN: At least T1/E1 Internet access line • User: 56 Kbps or faster Internet access	• RAS at ISP should tag VoIP with ToS • Routers at enterprise access line must provide ToS handling for VoIP traffic • VoIP traffic must be delivered with low latency and jitter
Multimedia call center	• Wire speed switching • Aggregate backbone bandwidth may reach 10 Gbps	• 100 Mbps NICs in ACD and IVR servers	• NICs must flag VoIP as high-priority traffic using 802.1p protocol • All switches must support 802.1p • Routers must convert 802.1p to IP ToS tagging and handling • VoIP traffic must be delivered with low latency and jitter

across the Internet portion of the VoIP session will be the most challenging portion of the Web-enabled network design.

The first step is to help ensure that the weakest links in the path (the two access points: the customer's access circuit and the campus access circuit) do not delay or drop packets. The H.323 software will probably establish a compression level commensurate with the data rate of the weakest link; however, that link will certainly also be carrying competing data traffic.

The Internet access line at the enterprise must be sufficient to carry all traffic at a low utilization level. The circuit should be over-provisioned to an average utilization below 20 percent and peak utilization below 40 percent. This is likely to mean that the site must access the Internet at full T1/E1 (1.5 Mbps/2.0 Mbps) or possibly fractional T3/E3 rates.

While users who place calls over the Internet today are already conditioned to a lower level of voice quality than available on the public phone network, it's important to consider user expectations with respect to audio quality. Remote users or customers must access the Internet at 56 Kbps or higher in order to make the voice-enabled session work well, although VoIP can operate at lower rates, depending on Internet distance and user tolerance.

Additional measures can be taken to ensure that voice quality does not degrade when data competes for bandwidth on the weakest links. ToS precedence handling can be enabled at the access routers. This provides point solutions without the need to add precedence over the complete Internet. Over time, however, it is expected that Internet service providers (ISPs) will add broader precedence-handling capabilities. For example, they may add ToS handling in all routers, or they may implement Resource Reservation Protocol (RSVP) to reserve the bandwidth needed for the VoIP sessions.

Multimedia Call Center Requirements
The multimedia call center is primarily a large concentration of data traffic with some VoIP sessions. Such a center typically operates in a

small area of a campus or even at a single workgroup. The needs of VoIP can be easily handled by adding sufficient bandwidth to the workgroup. In fact, the link from the H.323 gateway to the agent can be on dedicated 10 or 100 Mbps links with very little conflict. Of course, all the other bandwidth engineering principles still apply.

Figure 9 summarizes the basic engineering alternatives that are posed by the three call center models discussed earlier.

Another way to understand the impacts of advanced call centers is to review how they impact basic network requirements as shown in Table 1. This table summarizes the network requirements by using three criteria: performance, access, and management. Note the growing number of requirements at each point in the call center evolution.

Seizing the Opportunity

The next generation of call centers is being designed to support customer access over a wide range of media, including the public telephone network, the corporate intranet, and the Internet. Employees will be able to provide call center support from a remote office, manufacturing site, home, or on the road. Similarly, call center operators will be able to work outside the central call center location, virtualizing their support services.

To fully leverage the business benefits of these new call centers, the organization will need to invest in its network infrastructure. To realize the full benefits of voice/data convergence, there must be a single wire to the user throughout a broad area of the enterprise. Additional bandwidth will be needed, starting with switched 10 Mbps to the desktop to support distributed, multimedia call center applications, and building to multigigabit network backbones based on Gigabit Ethernet or Asynchronous Transfer Mode (ATM). Sophisticated, policy-based network management and control will also be required to provide the appropriate class of service handling to diverse traffic types across the enterprise.

The convergence of data, voice, and Internet traffic over a common network infrastructure is upon us. Organizations can begin positioning themselves to take advantage of next-generation call centers and other exciting convergence-based applications by investing today in incremental network infrastructure migration.

Conclusion

To be positioned as a market leader during the coming decade, businesses must provide best-in-class customer-service solutions. Companies must continue to invest in technology to improve their competitiveness, and must look for opportunities to leverage the Internet to streamline operations and make business practices more effective. In the era of converged networking, investment in network infrastructure is more critical than ever to corporate competitiveness and success. ❑
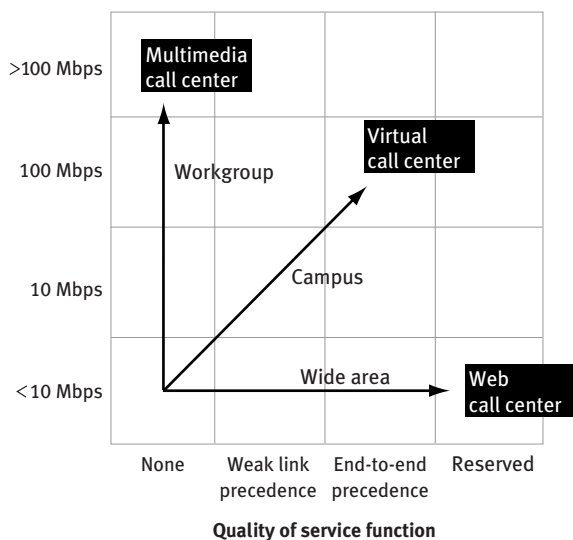

Figure 9. *Network Solutions to Call Center Requirements*

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