CHAPTER 14

THE NEXT PHASE, APPLICATIONS USING THE CONVERGED NETWORK

Recently, the main driving force behind the deployment of converged networks has been saving money. The theory has been that developing, deploying, operating, and servicing a single network is less expensive than doing all of that in multiple, application-specific networks. This is often quite true. However, with reductions in the cost of items such as network bandwidth and cabling and the increased cost of typical converged networks and devices, this cost savings is sometimes hard to find.

The real driving force behind converged networks is the ability to deploy new applications that take advantage of the converged infrastructure. The unique advantages of a converged infrastructure stem from the fact that devices on the converged network can access voice services as well as traditional data services simultaneously. This allows these devices to use these combined services in new ways.

In this final chapter we will discuss many of the applications that are driving the deployment of converged networks. Some examples of these applications are Converged, Multichannel Contact centers, Unified Messaging, and Teleworkers. There are also new applications under development that will utilize the unique features of the converged network such as presence, intelligent agents, and "IP Centrex".

We will discuss each of these topics in detail.

Contact Centers/Customer Relationship Management (CRM)

One of the most popular converged applications that takes advantage of the capabilities of the converged network is the Multichannel Contact Center. A multichannel contact center expands on the traditional telephony contact center

by adding items such as email, web access, and video access streams into the contact center. The multichannel contact center also provides for tighter integration between the customer-facing agents and back-office databases and functions. This can give a business a distinct advantage by giving their customers many different ways in which to contact them.

New technologies that support Internet applications, telecommunications, and knowledge management have resulted in a new, unified approach to managing customer relationships through the integration of enterprise resources into a seamless CRM solution. This unifying solution, which embodies a distributed contact management capability, is known as a multichannel contact server. This contact server provides a platform that enables the integration of business operations, business management, and business intelligence capabilities. It is driven by business rules and processes so as to meet the major objective of providing superior and consistent customer service.

The multichannel contact server

- Interacts with front-office and back-office applications.
- Manages customer contacts from a variety of media and communications channels.
- Routes contacts to appropriate resources based on predefined business rules.
- Integrates information from corporate databases to support the customer interaction.
- Broadcasts the real-time status of available resources to other applications.

Multichannel contact servers are facilities that pull all of these capabilities and resources together around business processes, making them easily accessible for both front-office and back-office uses. Figure 14.1 illustrates the major components of a multichannel contact server, linking communications channels, customers, and back-office operations with customer and business intelligence.

The contact server brings all of the necessary knowledge and capabilities together in the context of specific business processes that are driven by flexible business rules. With a contact server in place, the enterprise can bring its collective resources to bear on each event to ensure a consistent, personalized customer experience. It enables the collection of information about each transaction, and improves customer relationships during future customer interactions.

The contact server is fundamentally a software platform that integrates front-office, eCommerce, and multichannel contact center applications into one centrally managed system. The contact server supplies the foundation for an effective CRM strategy by allowing enterprises to communicate with their customers regardless of the contact type, and to manage the end-to-end business

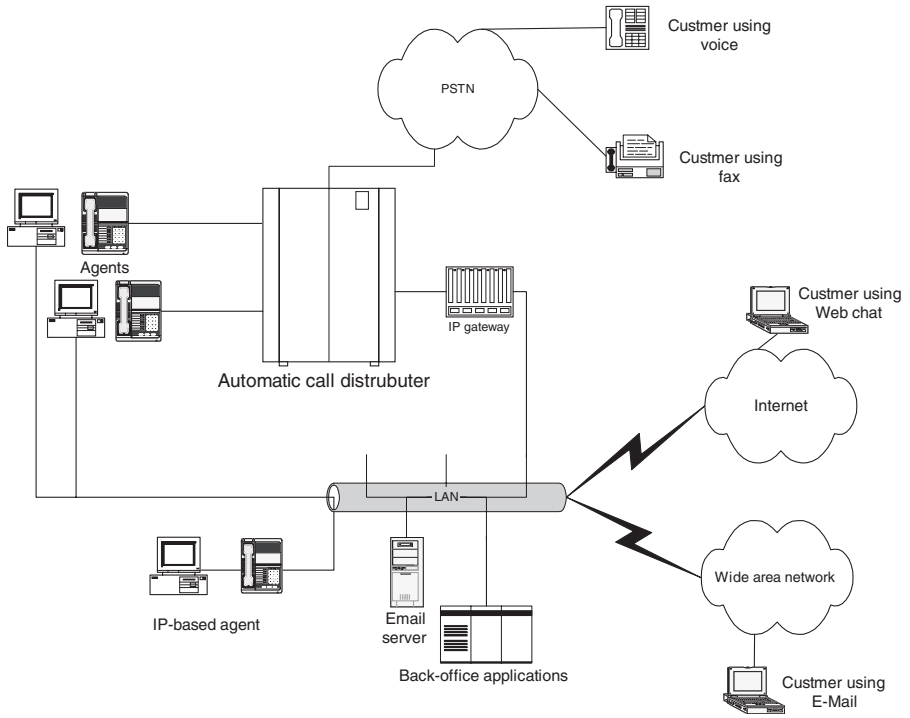

Figure 14.1

A multichannel contact center.

processes necessary to interact efficiently and profitably with customers. It manages customer contacts from a variety of media in a consistent fashion, routes them to appropriate resources based on predefined business rules, integrates information from customer databases into the customer transaction, and broadcasts the real-time status of available resources to other applications.

The integration of contact center resources with front-office and back-office systems extends computer telephony integration (CTI) capabilities such as data-directed routing, "screen pop," and coordinated data transfer to transactions performed via media other than telephony. Customer case histories, account and credit information, inventory data, shipping information, and much more can be instantly and automatically available to both automated and human resources at the exact moment the customer makes contact, no matter what channel the customer uses.

This conceptual architecture supports an enterprise-wide approach to business operations, management, and intelligence. With it, all channels are supported within a single, integrated information framework to ensure high levels of data

integrity, quality, and usability. With the contact server, front-office and back-office applications are integrated into the contact server directly, through operational data stores (ODS), through data marts, and through direct data interchange between the underlying components. The contact server becomes the place for business users to manage, execute, and monitor every business process that involves customer interaction.

As with traditional enterprise portals or Web portals, the contact server is more of a place to bring together the capabilities of the enterprise than a place to build capabilities. With the contact server, the context of these groupings of capabilities is the business process. The business rules engine acts as the brain of the contact server, bringing everything else together and managing customer interactions within the other components of the architecture.

Multichannel Support

In most businesses, communication channels can be categorized as follows:

- *Voice:* Telephone, fax, interactive voice response (IVR), and related media.
- *Data:* Computer-to-computer traffic—Web email, chat rooms, forums, and other Internet media.
- *In person:* Sales calls, seminars, trade shows, deliveries, and service calls.
- *Business partners:* Distributors, resellers, consultants, and others.
- *Direct mail:* Catalogs, order confirmations, bills, deliveries, and marketing messages.
- *Mass media:* Television, radio, magazines, newspapers, and other mass media vehicles.

The contact server must consistently align these varying channels around business processes. Contacts in some channels occur in real-time, with customer contacts taking place in highly interactive media such as telephone or Web. Others may occur over a day or more, such as email and fax. Clearly, real-time customer interactions are the most challenging to manage and integrate.

The capabilities supported by the contact server can be categorized as dealing with contact center channels, back-office and front-office operations, as well as collaboration, business management, and business intelligence. The contact server wraps around all of these capabilities and enhances them with the business rules engine to drive specific business processes and knowledge-based applications.

Standards in the Contact Server Architecture

In contemporary networking, it is important that systems be built on open standards and architectures in order for enterprises to leverage their existing investment in their infrastructure and applications. The contact server architec-

ture is based on industry standards as well as solid de facto standards to ensure long-term viability. It enables the interoperability of the contact server with current and future technical components used to support CRM.

Due to the key role of multichannel contacts in most enterprises, technical interoperability extends beyond just the information systems to the telecommunications systems. The need for interoperability is especially critical in the CRM arena because of the rapidly evolving and consolidating field of diverse technologies used by companies to interact with their customers.

One need look no further than the new generation of personal wireless devices, voice over IP, and Internet-ready home appliances and vehicles to get a glimpse of the importance of applying industry standards to a contact server. This is essential if the contact server is to continue to be successful over the long haul.

Some key standards include

- *ODBC (Open Database Connectivity)*—ODBC is a widely accepted API for database access. It is based on the call-level interface (CLI) specifications from X/Open and ISO/IEC for database APIs and uses structured query language (SQL) as its database access language.
- *XML (Extensible Markup Language)*—A key tool in the enterprise contact server is the extensible markup language, XML. XML is a clearly defined set of rules for a common communication language on the Web. Through XML, various industries have been defining standard documents to use within their community (purchase orders, invoices, etc.), and it has become a favorite for integrating heterogeneous and distributed systems. XML enables the minimum representation necessary for message and data exchange between different components or bodies. The core specification is extremely simple and has proved itself to be extensible, robust, and flexible. While the Internet is always going to be made up of different operating systems running on different platforms using applications written in different programming languages, XML provides the basis for them to seamlessly interoperate in a distributed environment. XML was created so that richly structured documents could be served, received, and processed over the Internet. It maintains the separation of the user interface from the actual data, allowing for increased flexibility and ease of administration. XML is used to describe the actual content and structure of a document and individual applications interpret how the document is to be viewed. HTML (hypertext markup language) and WML (wireless markup language) are used to display the information held in XML documents.
- *ActiveX*—ActiveX is a suite of software technologies that enable components to interact with one another in a networked environment, regardless of the language in which the components were created. This is done through

a series of ActiveX user interfaces called ActiveX controls that are small, fast, and powerful. These controls make it easy to integrate and reuse software components in a Windows environment.

- *CORBA*—The dominant distributed object technology used on the Web today is the Common Object Request Broker Architecture, CORBA. CORBA is an open industry standard that provides an object-based middleware to support different platforms. It has proven to be an effective mechanism for system integration and for providing Internet access. CORBA is used in UNIX-type environments and interfaces with JavaBeans.
- *JavaBeans*—Sun published the first version of its Enterprise JavaBeans (EJB) specification, which is a Java-based, component-oriented framework for developing, deploying, and managing distributed, transactional applications. CORBA, with its services and EJB, addresses the issue of application development across multiple platform types. Although the two specifications have been developed independently, it turns out that the two technologies are complementary. These software solutions work in conjunction with HTML, dynamically generated either by servlets or Java Server Pages (JSP). The middleware center of the contact server controls business logic and provides access to various back-end systems, including relational and object databases, application software packages, and legacy systems.
- *VoIP Gateway H.323 and SIP—A* key capability of the contact server is to integrate voice traffic into the full set of Web-based interactive functions. This is accomplished through a set of standards that operate on various gateways, application servers, and switches. Among the most important are H.323 and Session Initiation Protocol (SIP). These provide the translation services from voice to data, so that voice traffic can be integrated into the IP-based traffic stream.

Functional Concerns of Multichannel Contact Servers

A successful contact server includes several important functions, as follows:

- *Scalability*—As the nerve center to customer interactions across the enterprise, the contact server must be based on a sound and flexible technology architecture to ensure its ongoing success. The architecture must be scalable, meaning that it must be able to grow with the enterprise without discarding the existing technology investments. Aspects of scalability include growth of processing power, growth of memory, growth of disk storage, and growth of network from both data and telecommunications perspectives.
- *Enterprise-Wide Perspective*—CRM requires an enterprise-wide perspective, and optimally supports customer contacts across all possible communication channels. Likewise, the contact server must support all customer-facing functions, including marketing, sales, fulfillment, and services, as well as some cross-functional capabilities such as risk management. Interactions involving customers, partners, or the supply chain should be managed to

ensure a consistent experience for the customer and a profitable long-term relationship for the enterprise.

- *Interaction and Response Templates*—The business process should support interaction and response templates. An example of an interaction template is a contact center script that directs an agent through an interaction step by step. A response template may be a template email that is easily customized by an automated system, a salesperson, or a contact center agent to respond to a certain type of request.
- *Rules Engine*—In order to support a flexible, business-process-oriented capability, the contact server must have a robust rules engine that executes processes and makes independent decisions based on rules defined by business analysts. These business rules provide routing of interactions across channels and functions, provide appropriate scripts and response templates, and personalize the customer experience based on individual customer profiles.
- *Integration Functions*—These combine platform middleware functions with the ability to transform data and route it according to a set of rules, enabling peer-to-peer real-time integration between applications, including enterprise resource planning. In a sense, it is a "push" technology moving data quickly to a CRM application so it is always available for use. The integration solution relies on an approach to data management where data is classified and treated according to its classification.
- *Contact Classification and Prioritization*—There are many different types of customer contacts. A customer interaction may be a product order, a request for information, a problem report, a product registration, or an invoice payment. Though these contacts are given different priorities, before they can be prioritized, they must be classified. The contact classification, in conjunction with the customer profile and the available staff, allows the business rules engine of the contact server to properly route and prioritize each contact with the enterprise. The priority of each contact is then based on the importance of the contact to the customer, the importance of the contact to the enterprise, and the relative value of the customer relationship. Even the time of day may result in different priorities for the same contact. The role of the contact server rules engine is to properly prioritize based on the customer profile, the classification of the contact, and any other information to which the business can apply a rule.
- *Customer Data*—Customer profile information contains attributes of the customer such as name, address, date of birth, and so on. It is defined in the customized database schema of the CRM application. In the CRM solution, this data is under the control of the CRM application, and it can only be changed by the CRM application. Any changes made to the customer data by the CRM application will be made available throughout the system as needed. Specific customer attributes hold information about the customer, based on the real-time analysis performed in the business processes. These include attributes about customer value, their propensity to continue to

engage, relevant products to attempt to cross sell, and so on. These values are generated in real time and as a back-office function.

- *Minimum Product Data Sets*—This is the minimal set of product data that the CRM application requires for interactions with the customer. It is often stored in a customized area of the CRM application and can be changed by the CRM application. The contact server will propagate any changes made by the CRM application to the minimum product data set.
- *Extended Product Data Sets*—This is additional information about products or services from the underlying core business systems that is accessed by CRM application. This is a compromise between the size of the CRM application database and the ability to function efficiently. The intent is to ensure that the bulk of customer transactions are handled by the minimum product data set. This extended data is usually not stored permanently within the CRM application but in a customized area of the CRM application used for staging purposes. Attempts to access this data will cause it to be fetched in real time from the relevant system and stored temporarily in the CRM application. Any changes made will be propagated back to the core system.

The multichannel contact server solution represents a proven technology that meets the challenges of our rapidly changing business environment. The contact server plays a key role in integrating eCommerce and the Web with traditional customer interactions. The emergence of the Internet has done more than change our technology and our business. It has fundamentally changed the entire global marketplace and society as a whole.

Customer expectations are continually rising. With products and services now only a click away from hundreds of sources, retaining customers requires more than simply doing business as usual. It requires attention to individual customer relationships in a consistent and efficient manner across the enterprise. Depending on the industry and markets, the contact server may provide competitive advantage, increase revenues, and streamline interactions with individual customers—or it may simply mean survival for the enterprise.

The multichannel contact server integrates the front-office, eCommerce, and multichannel contact centers into one centrally managed eBusiness system. It allows media blending, workforce management, and customer self-service. It brings the power of business intelligence to bear for increased efficiency and customer satisfaction. It reduces application development time, cutting development costs and realizing quicker return on investment (ROI), allowing the enterprise to respond rapidly to changing business conditions.

The contact server becomes the view of the enterprise into this capability to maximize the value of each customer relationship. The rules engine serves as the nerve center, directing traffic based on rules-based workflow, moving data from one point to the next as the customer interacts with the enterprise. The emergence of Web is the primary catalyst behind the need for capability because now

there are two highly interactive, diverse means of communicating with customers—the telechannel and email. Coordinating these two sets of communications media in the context of ever-increasing customer expectations for consistency and dependability requires more than yesterday's tools.

The consistency expected by today's customers requires a means to bring together a diverse set of business strategies, people, and technologies in a constantly changing marketplace. This is the role of the multichannel contact server.

Unified Communications/Messaging

Another key application that is evolving to use the power of the converged network is the concept of Unified Messaging. Unified messaging is a generic term for a set of applications that links all voice mail, e-mail, fax, and other messaging types into a single coherent messaging platform.

Effective communication is critical to the success of businesses today. Messaging has become a key component of corporate communications, allowing organizations around the world to communicate across distances and time zones easily and efficiently. Workers today constantly check their voicemail via telephone, their email via PCs and laptops, and their faxes on various fax machines. However, these disparate messaging systems may evolve into isolated information "islands" that add to workers' stresses and actually erode their efficiencies. For mobile workers and telecommuters the situation is even more serious because not all message types can be accessed by telephone, the only ubiquitous terminal device available. Most companies with multiple locations around the world rely on a number of different messaging systems to support multiple languages as well. In addition to end-user problems, it is also difficult for information technology departments to manage and provide customer support for several different messaging systems.

Unified messaging is a new technology that unites disparate systems into a single, unified mailbox and enables access from the PC or from any touch-tone telephone. This streamlined access to and management of information dramatically enhances the productivity and responsiveness of office workers, telecommuters, mobile employees, and IT staff throughout an organization. The people within the enterprise are better equipped to make fast, effective business decisions in the office or on the road.

A unified system brings together voice, e-mail, and fax-messaging systems—and in the future, video-messaging applications—to allow a user to access all messages from a single unified mailbox via a PC or telephone. This system also supports user-customizable rules-based access that allows users to flag and prioritize important messages by subject or sender. This capability can be particularly

useful to mobile professionals who need quick access to their messages, anytime, anywhere, and from the most convenient device.

Technical Overview

Companies have a choice of architecture that best suits their enterprise topology. A unified architecture allows system administrators to manage a single scalable and converged voice/data messaging system with a single message store.

Alternatively, a company may wish to deploy unified messaging via an integrated architecture with multiple message stores.

In small organizations, or for limited implementations in larger organizations, these systems can be configured to provide comprehensive voice, fax, and email messaging services all on the same server (see Figure 14.2).

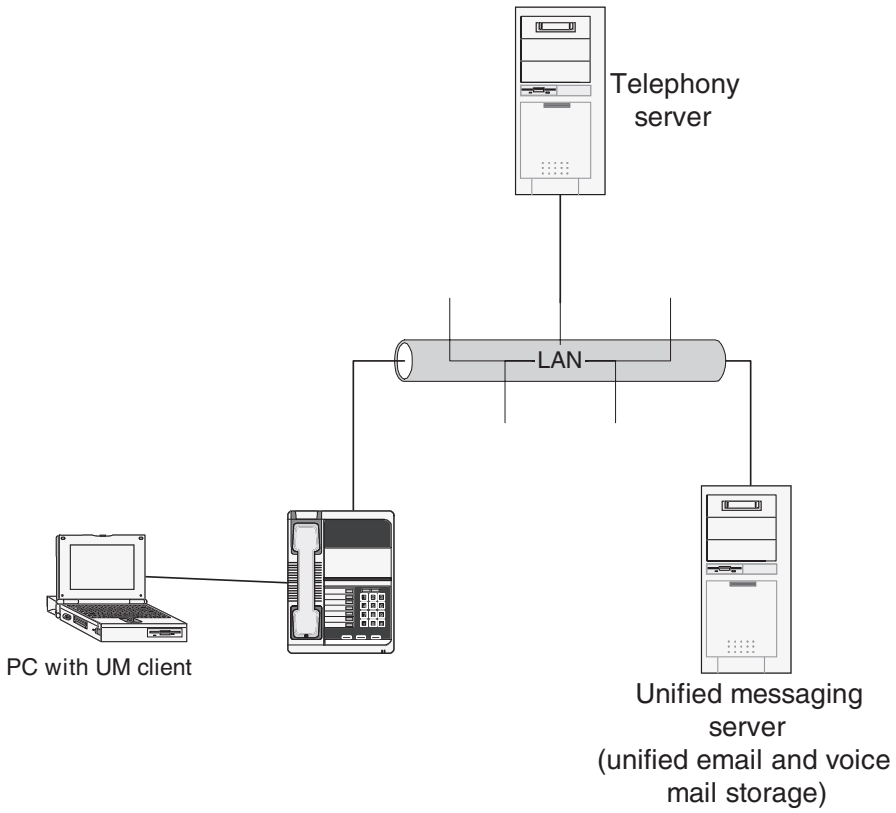

Figure 14.2

Unified messaging on a single storage device.

For larger installations, these functions can be divided up among separate servers. This enables customers to take advantage of in-place resources, such as a common message store or global address lists. It also allows enterprises to distribute their unified message store among their existing email servers, or use the unified messaging server to store a subset of user messages (see Figure 14.3).

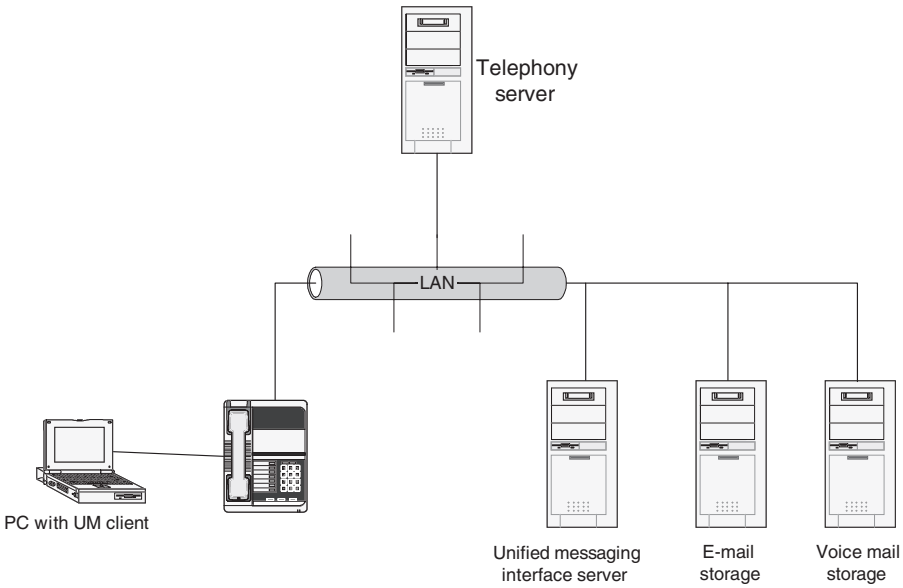

Figure 14.3

Unified messaging with separate voice and email storage.

High-end systems will also provide a single directory service that simplifies both message addressing as well as system administration. Many of these high-end solutions integrate the messaging components to each other and to the rest of the network services using the Lightweight Directory Access Protocol (LDAP) services.

End-User Access

End users can use mail clients, such as Microsoft Outlook or Lotus Notes, to visually access voice, fax, and email messages. Unified messaging systems augment users' email clients with custom forms that enable voice messages to be played and recorded, and faxes to be created, viewed, and printed.

In most unified messaging systems, users can also access their messaging using a telephone user interface (TUI). The TUI gives access to messages via DTMF (touch-tone) commands. Many systems can support test-to-speech services to deliver text-based email messages over the TUI. Some newer systems even allow for access to mail via voice commands.

Voice messages are easily played and recorded from a multimedia-enabled PC, but users that don't have multimedia PCs can still leverage the systems multimedia capabilities. Many systems also allow the user to re-direct the voice playback to a phone number the user specifies. Then a user can use the telephone to play and record voice messages, while still managing messages with the convenience and flexibility of an email client interface.

The system may have a web-based personal administration interface, which enhances productivity and message control by providing an easy-to-use web interface managing mailbox functions. Advanced features such as outcalling schedules and personal distribution lists can be managed easily using the web interface, making these features much more readily usable for all users.

System Administration

System administration for the unified messaging application often uses a centralized applications server with either a client- or web-based interface that streamlines installation, maintenance, updates, and other system administration tasks, minimizing the need for separately administering the discrete system components. Remote system administration can be supported as well. A unified messaging system often also takes advantage of LDAP services, which provide a standard enterprise-wide format for storing, exchanging, and updating user information. Instead of constantly recreating directories, system administrators can use LDAP services to update directories throughout the enterprise. For example, customers that integrate their system with an Exchange network can use the Exchange Directory service to perform directory maintenance and replication across sites. Lotus customers can have this same access in their Domino Domains.

Unified Messaging Applications

With unified messaging, workers have flexibility in managing their voice, fax, and email messaging. Common applications for Unified Messaging Include

- *Converged Message Management*—Workers can access all their incoming messages from one inbox using either a PC or a telephone. Workers can

exchange voice messages from their desktops using PCs. Remote and mobile workers can access their fax and email messages via the telephone using integrated fax store and forward capabilities, which allows subscribers to direct stored faxes to any convenient fax machine.

- *Messaging Morphing*—Many workers have some difficulty dealing with messages sent to them in a non-preferred format. Unified messaging greatly reduces this problem by letting users choose the most appropriate medium to receive and reply to their messages. For example, a user might receive a voice message but choose to answer it via email. Or a user might receive an email message and decide to forward it to another user as a fax document. Users can also use the telephone to have their email messages read to them by using a text-to-speech application. Some systems even allow users to blend message formats and create "compound messages" that combine voice with fax or email.
- *Intelligent Agent*—A unified messaging system can feature an intelligent call-handling feature that enables personal auto attendant applications. These applications allow users to configure a custom menu of routing options for callers when they reach a subscriber's mailbox. A typical application may give callers options to reach an assistant, try a cellular phone, send a fax, or leave a message. Personal auto attendant makes it easy for callers to reach subscribers through a variety of methods from a single telephone number, eliminating the need for users to give out multiple phone/pager numbers.
- *Personal Assistant*—Using a web browser screen or client application, individual users can configure different notification options to a variety of devices to increase their ability to be alerted of critical incoming messages. For example, by using a daily schedule set by each user, users can be notified of specific message types with a certain level of importance, to whichever device they choose. This feature can be made accessible via any touch-tone phone as well as via a browser screen or client application.
- *Fax Management*—Fax management capabilities allow users to store, forward, and reply to fax messages just as they do voice and email messages. Instead of being printed at a fax machine, fax messages are stored in the subscriber's unified mailbox. Subscribers decide where and when to print fax messages, ensuring privacy and security. Mobile workers can use the telephone to send fax messages or email messages to a local fax machine when it is convenient. This functionality gives workers easy access to incoming faxes even while traveling, again keeping them in touch with customer or coworker requests for information. The ability to also print any email to the nearest fax machine further enables mobile workers to access key information received as email, even while not sitting at their computer. Fax messages can also be annotated with voice comments using compound messaging capabilities.

Teleworkers

Probably the one application that most enterprises have embraced for their first converged application is teleworkers. The teleworking applications allow users to access voice functions over their already-existing remote IP access applications.

Large enterprises in particular are faced with an increasingly dispersed workforce. Current market research shows that only one-third of enterprise employees actually work in main office locations. The majority of this market's workforce is employed in branch office and remote locations. As much as 16 percent of the entire enterprise workforce currently telecommutes at least three days a week. As companies seek to remain competitive in local and global markets, further fragmentation is expected to increase the number of remote workers, especially the percent of teleworkers, making up the enterprise workforce.

In today's economy, intellectual capital is a key business asset, and the value of knowledge workers continues to grow. Regardless of the state of the economy, employers are challenged with hiring and keeping quality employees, particularly in the high-technology sector. As a result, the best and brightest of these potential employees can dictate their own terms, and may not want to relocate or even commute on a regular basis. If companies want their services, they may have to employ them where they are.

Clearly, there is increasing awareness of and interest in teleworking throughout the labor pool. And these would-be teleworkers have the government on their side. The federal government recently mandated that teleworking be made available to a portion of federal employees whose jobs are suited to it. Many local governments are using tax breaks and other incentives to motivate businesses to embrace teleworking as a way to reduce congestion and air pollution in population centers.

However, market forces are much more compelling. Forward-looking companies recognize that teleworking is a win–win proposition for employer and employee. With a good teleworking solution in place, corporate facilities don't have to be over-provisioned to meet peak demands. Companies can recruit the best people from anywhere, and don't have to limit themselves to the local talent pool.

The most notable benefit of teleworking can be measured through personal productivity gains. There are countless studies that suggest employees who work from home outperform in-office workers by as much as 15 to 40 percent. This is due to uninterrupted work time, better concentration, and longer work days. Eliminating a commute on telework days not only reduces

stress and fatigue, but can also add one or two hours of productive work time to the day.

In addition to productivity gains, offering telework as an option helps to attract and retain employees. Businesses with a telework option experience less employee absenteeism and greater employee retention. Both employers and employees can also realize significant savings on real estate spending. Workers can get more home for their money by locating farther from the office in areas with lower real estate prices, and businesses can employ an "office hoteling" model that saves space on corporate campuses by eliminating the traditional 1:1 ratio of employees to desks.

Teleworking can also enable large companies to extend their presence into regional and local markets without the costs of opening a branch or satellite office. By locating customer-facing employees such as sales representatives, customer support personnel, and insurance claims adjusters in the local community, companies can provide better customer service, increase revenue, and stay one step ahead of their competitors.

Besides these tangible savings, teleworking benefits also include reduction in air pollution and traffic congestion. This establishes the company as not only supportive of its employees, but of community and environmental concerns as well.

Early teleworking solutions relied on remote data access, and did not integrate the remote worker into the corporate communications infrastructure. Teleworkers were viewed and treated as part of a different community of workers. This bred isolation and caused management challenges. Legacy PBX suppliers began extending corporate voice applications to the teleworker, but they often had poor voice quality and reliability, and were too expensive to implement and manage on a large scale. On the data side, teleworking solutions have made great strides, especially since the advent of broadband network access. Many people can now get high-speed DSL or cable access that can support media-rich content and real-time collaboration.

The IP-based converged network can exploit the growing ubiquity of inexpensive broadband access and extend the corporate voice and LAN infrastructure to remote employees. By using an IP remote access scheme such as dialup or VPN, the user can gain access from a remote site to the local area network. Once the remote user has access to the LAN, that user can then access both the data applications and electronic messaging applications, and also access the voice media servers and messaging as well. The teleworker can deploy an IP voice endpoint or a converged voice/data endpoint (for example, an IP softphone) to access the functions of the converged network (see Figure 14.4).

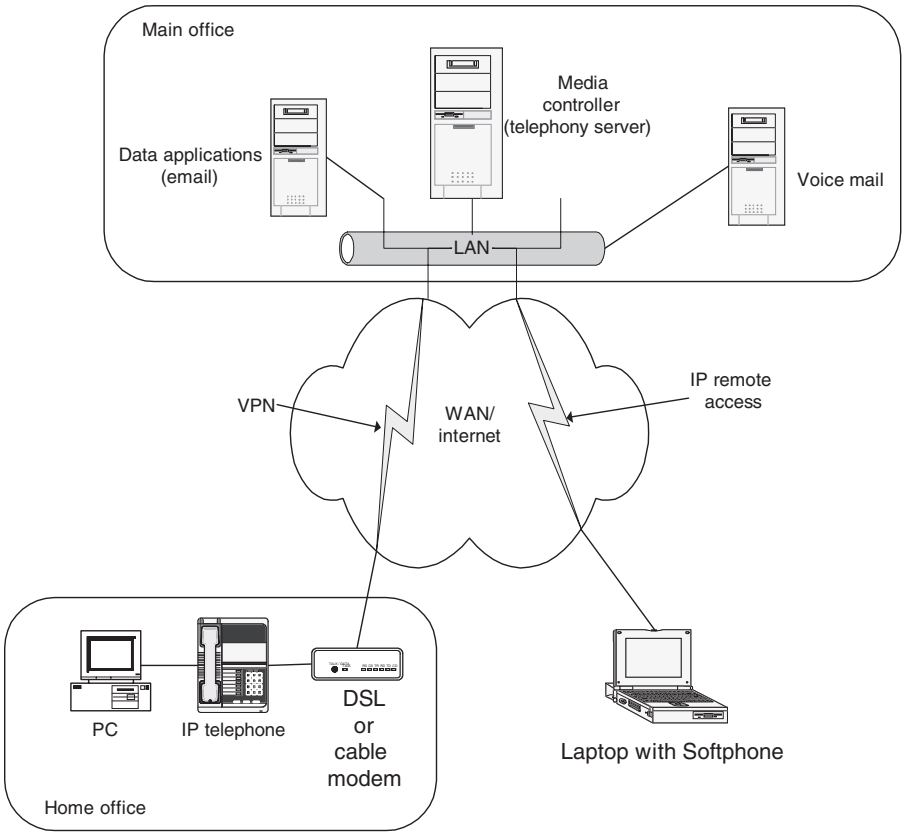

Figure 14.4

Example teleworker configurations.

There are several user types that can benefit from the deployment of teleworking applications.

Executives. Managers who work at home only occasionally, but need full, secure, real-time voice and data connectivity can get this access of the remote access link.

Key Knowledge Workers. Highly skilled people are often difficult to find, and the company sometimes needs to be brought to them if it is to avail itself of their services.

Occasional Teleworkers. Rank-and-file office workers who want to work at home occasionally. can access full office functionality over the remote link.

Mobile Employees. Employees who travel a great deal or whose job functions make them work out of the office can also access full corporate voice and data services from a remote access link.

Call Centers: Teleworking is having a major impact on call centers. As technology products become increasingly ubiquitous and commoditized, customers take for granted their complexity and expect instantaneous response from call center agents. As a result, call center employees are being forced to evolve from phone operators to full-fledged knowledge workers.

Experienced call center employees are hard to find and even harder to hire. Allowing them to operate from home, as part of a virtual call center, may be an effective solution to the labor shortage problem. This means extending call center stations to the employee's home with a teleworking solution that delivers the same functionality, reliability, and security of a seat in a traditional bricks-and-mortar call center.

By moving key call center components to open systems on the IP data infrastructure, you can build a very cost-efficient solution that is easy to operate, distribute, and scale to accommodate peak demands and future growth.

The remote location of the agent can be made completely transparent to the callers. By extending the control of the call center over a remote link such as VPN, the call center measurement and reporting tools can also monitor and support the remote agents in exactly the same way as the on-site agents.

Executives, call center professionals, and key knowledge workers need the full corporate campus voice functionality and experience extended into remote sites. Deploying IP-based solutions has made such high-end teleworking affordable and easy to implement.

SIP, Presence, and Intelligent Agents

Yet another one of the new applications being developed for the converged network stems directly from the development of the Session Initiation Protocol (SIP). SIP is a signaling protocol for establishing calls and conferences over IP networks. The session setup, change, or tear down is independent of the type of media that will be used in the call; a session may include different types of data, including audio, video, and many other formats. Those who are most excited about SIP believe this development is as significant as the HTTP protocol, the technology behind web pages, that allows a single page with clickable links to connect you to text, audio, video, and other web pages. This possibility is behind SIP's rapid adoption as a Voice over IP standard. The protocols supporting SIP are discussed in more detail in Chapter 9.

SIP is modeled after other Internet text-based protocols such as SMTP and HTTP, and was designed to establish, change, and tear down calls between one or more users in an IP network in a manner totally independent of the media content of the call. Like HTTP, SIP moves control over the application to the endpoint, eliminating the need for a central switching function.

SIP Architecture

Main components of the SIP architecture are

1. SIP User Agent—The User Agent is the SIP endpoint or end-station software. The User agent functions as a client when initiating session requests, and also acts as a server when responding to a session request. Thus, the basic architecture is client/server in nature. The User Agent is "intelligent," in that it stores and manages call state. The User Agent places calls using an email-like address, or a telephone number (E.164). As an example: SIP: user@university.edu. This makes SIP URLs easy to associate with a user's email address.
2. SIP Server
   a. SIP Proxy Server One type of SIP intermediate server is the SIP Proxy Server. Proxy Servers forward requests from the User Agent to the next SIP server, and also retain information for accounting/billing purposes. In addition, the SIP proxy server can operate with stateful (i.e., circuit-like) or stateless (i.e., TCP-like) communication. The stateful SIP server can "fork" incoming calls so that several extensions are rung at once and the first to answer takes the call. SIP proxy servers can use multiple methods to try to resolve the requested host address, including DNS lookups, database lookups, or relaying the request to a "next" proxy server.
   b. SIP Redirect Server—A second type of SIP intermediate server is the SIP Redirect Server. The Redirect server responds to the User Agent's request by providing information about the requested server's address so that the client can contact that address directly.

   The role of these SIP servers is to provide name resolution and user location. The combination of Proxy and Redirect servers gives SIP great architectural flexibility; the user can employ several schemes, simultaneously, to locate users. The SIP architecture is particularly well suited to support mobility.
3. SIP Registrar—The SIP Registrar provides a location information service; it receives information from the User Agent and stores that registration information.

The SIP Architecture allows for the support of a number of new, intriguing applications on the converged network. These new applications are built based on a concept called "presence." Presence is the combination of the User Agent along with the functionality of the SIP proxy and redirect servers as well as the SIP registrar to build information on the status and preferences of a given user.

SIP Presence services can be used in many applications.

Specialized "call forwarding" allowing users to specify where they are so that incoming calls can be forwarded there, or to choose to forward calls to "voice mail" or any other answering service.

Presence, in conjunction with translation gateways, can even be used to alter the message type. For example, a message could be taken in email, but based on the user's preferences the message could be translated into a web instant message and sent to the user's terminal.

Call participants can manage the call; this allows one or more callers to decide to bring in a new call participant or to cancel a connection in the call.

The user has the ability to return different media types. For example, allowing an incoming call to be answered by a web page with information that can be used to complete the call.

The User Agent can be used to indicate whether the user is present (available to take the call) or absent (not able to take the call). The user agent could also be used to determine where a call should be routed, so a call that is intended for the office could be re-routed to a cell phone based on preferences stored in the user agent.

The Presence information can be used for a wide variety of exciting new services, such as

- Establish an Instant Messaging text chat session,
- Make a phone call when the called party becomes available,
- Invoke an instant conference when all the desired parties are online,
- Get a notification when a cell phone is on the air,
- Get a notification if an agent becomes available,
- Specific vertical applications, such as monitoring delivery vehicles or employees on the move.

Notice that SIP-based Presence and Instant Messaging can be supported not only on PC/laptop computers, but due to the small GUI footprint and low computational requirement, can also be supported on intelligent SIP phones, palm computers, and even mobile phones.

Many desktop software vendors have great expectations of SIP and presence being tied into their applications. A good example of this is to tie the user agent into a calendaring software package, so that calls can be re-directed automatically based on entries in the calendar.

SIP and the concept of "presence" may well be a tool that redefines a lot of what we are used to in modern communications.

IP-Based Public Services

IP Network Access

Converged network services are not exclusive to the enterprise network. Network service providers are also looking very closely into converged networks for supporting their customers as well.

All of the features and applications that we have discussed throughout this book could equally apply to service provider-based networks. In fact, there are several carriers that are providing converged services such as Voice over IP network access today.

By using VoIP technology, service providers can give their customer direct voice, data, and video access to their network backbones. One of the biggest advantages of this is to give very high bandwidth (10 Mbps to 1 Gbps) access at a relatively low cost.

By providing a converged access to their network, service providers can not only gain the advantages and cost savings of combining voice and data access connections. They can also build converged applications in their network and sell these as value-added services.

Network service providers are also some of the strongest supporters of the SIP architecture. This is because SIP gives a simple standard interface to converged services. Because of the simplicity of SIP, carriers see this as a way to support simple, low-cost, vendor-independent VoIP terminal devices as well as advanced network services such as

- Global ENUM service for phone number to Internet address conversion,
- Global presence on IP, PSTN, and mobile networks,
- Global roaming,
- Global call routing,
- Gateways to the global PSTN,
- Inter-enterprise conferencing.

All of these services can be applied across the entire public network infrastructure and give users access to advanced business features regardless of location. The service providers also enjoy new opportunities in new markets.

IP "Centrex"

A major area where public carriers are using VoIP technology is for providing enterprise telephony services from the carrier network. This is essentially a

redefining of a service that has been around for many years, known as "Centrex."

Centrex or Centranet, as it is sometimes called, is a service where a carrier provides functionality similar to a business PBX over a public network interface. The idea behind Centrex was to provide advanced features such as extension dialing, call forwarding, hold, call transfer, and messaging services to customers without those customers having to deploy on-site telephony equipment.

The issue that often stifled Centrex deployment were that user features and the protocols to support them were not standardized. That led to Centrex having fewer user features than a typical premise PBX and also made the service fairly expensive, especially in large implementations. Centrex also had the issue that the users did not control the infrastructure. This meant that changes were typically more difficult and often involved service charges from the carrier.

By using VoIP, and especially SIP, in the carrier's network, carriers can offer full feature functionality over standardized interfaces. By use of presence and proxy servers either at the user's or carrier's location, SIP calling services and features can be managed on a much more flexible basis. Using SIP technology, service providers can offer new, value-added services to their business customers. SIP services such as re-direction, translation, and message forwarding can all be offered to customers as extra options. SIP also holds the promise of relatively inexpensive, standardized endpoints.

IP Centrex could, in theory, deliver all of the benefits and applications of a converged voice/data network that we have discussed throughout this book, without having to support voice equipment at the enterprise's location. This may prove to be a very tempting solution, especially for smaller locations.

Many network carriers fully believe that VoIP and SIP will bring about renewed interest in service provider network-supported business functionality. It will be interesting to see how well IP-Centrex is accepted as it is further deployed in the real world.

Summary

Throughout the course of this book we have mostly discussed the technologies and protocols necessary to design and deploy a converged, IP-based network. While the technology of the converged network is the main topic of this book, it is meaningless unless that new network gives access to new solutions and applications. In the real world, no one will deploy new technology just for the sake of technology.

In this chapter we have discussed some of the major applications driving convergence today. These are applications such as Multichannel Contact Centers, Unified Messaging, and Teleworkers. We also discussed new, emerging applications such as Presence, Intelligent Agents, and IP Centrex.

In the end it is these new applications, along with several others that may not yet be defined, that will be the real drivers of the Converged Voice Video and Data Networks.