O N E

Telecommunications Evolution and Future

▲ Chapter Syllabus

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Telecommunications Evolution
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Balanced Tele-computing

This chapter describes the evolution of telephony (voice communications), data communications, and LAN systems. It highlights how new micro-electronic (small semiconductor chip), computer, and PC technologies are pushing the convergence of telephony, data communications, and LAN technologies. The future of telecommunications is postulated.

Telephony vs. Telecommunications

Telecommunications is the science of communicating over a long distance using telephone or radio technology. This involves using microelectronic (small semiconductor chip), computer, and PC technologies to transmit, receive, and switch voice, data, and video communications over different transmission media, including copper, fiber, and electromagnetic transmissions.

This definition implies that we are doing more than just voice communications. Further, it does not imply using analog transmission exclusively. Many forms of analog and digital transmission are employed in telecommunications today. Analog communication is like a dimmer switch for light because it has an almost unlimited number of brightness settings. In contrast, digital communication works like a simple light switch that has only on or off.

When people use the word "telecommunications," most think of the classical analog telephone. That is *telephony*. Telephony is focused on voice communications. Telecommunications has evolved into much more.

The telephone network was originally designed to carry human voice and not digital information such as data, music, or video. It supported telephony (voice communications), but not telecommunications (data, image, and video). Realizing this helps us to understand some of the problems occurring as telephony (voice communications), WAN, LAN, wireless communications, and PC technologies merge to become telecommunications in the next millennium.

The scary thought is that any person born today will not know a world without portable PCs to serve them. They will have no concept of products that last and last for years. Gone are the days of the old telephone that was designed to work for 40 years.

Telephony

Telephony is traditional voice communications. It is communications facilitated by the telephones we have all come to know and love. We dial the number of another phone and talk into the headset microphone while listening to the headset speaker. Our voice is sent from one phone to the other, regardless of the distance. The drawback is that a wire, or more accurately, a channel (a communications path similar to a trough of water) must connect the phones for the duration of the call. This channel is switched into place by the telephone network for the duration of the call. All telephones and telephone subscribers share the facilities of the telephone network. This means that we

cannot all talk at the same time because the telephone network is not designed to handle such a large load of telephone calls.

One reason people were told not to call each other just as the next millennium began was that everyone calling would overload the telephone network. The result would be everyone hearing the fast busy signal. Then they would think that the phone network was down because of some strange Y2K bug, when it was really brought down by an overload of unnecessary calls.

Today we occasionally have peak periods when the telephone network is overloaded, particularly during disasters when huge chunks of the telephone network infrastructure is incapacitated. Sometimes on Mother's Day the network also becomes overloaded.

The definition of telephony has been expanded by the telephone industry to embrace other types of transmission. They define telephony as the science of transmitting voice, data, video, or images over a distance that is greater than one can shout. Regardless of this expanded definition, telephony retains its largely voice communications flavor.

Telephony is used by the telephone industry to describe their business. Because they were voice network providers, this definition fit. As the use of communications networks changed, the telephone industry incorporated more than just voice communications; they began carrying data, and video. Further, they moved away from the traditional wired approach to delivering services to some new wireless delivery systems.

To better fit the new business model, the telephone industry used telecommunications to describe their business. Today, the telephone industry uses telecommunications to describe the transmission of voice, video, image, and data across today's telephone infrastructure.

Telecommunications and Convergence

Telecommunications is the merging of voice, data (WAN), LAN, video, image, and wireless communications technologies with PC and microelectronic technologies to facilitate communications between people or to deliver entertainment, information, and other services to people. Microelectronics is the technology of constructing electronic circuits and devices in very small packages such as computer chips. Telecommunications represents a convergence of these technologies into networks and systems that serve people planet-wide.

Traditional data communications, or WAN communications, were the transmission of data (at that time text and numbers) between sites. They encompassed all the necessary computer hardware, electronics, optical equipment, and signaling techniques required to send encoded information.

LANs distributed information around a single facility or a campus of facilities. Television required delivery of video information to distribution points (TV stations). Images were sent by facsimile (fax) transmission because the images could not be easily encoded as data. Wireless transmission evolved from early two-way radio systems (walkie-talkies) that permitted instant intercom-like communications between people, regardless of their physical location.

All these forms of communication have been hugely influenced by the rapid and incessant changes in microelectronic technologies since these changes helped to shrink all these devices. These technological advances are rapidly making the old Dick Tracy wrist TV a practical reality. They are the fuel for convergence and the rapid evolution of new products and communications services. The Internet provides a focal point of standardization (TCP/IP and HTML), and a platform for developing and delivering new services to consumers. The master of these technologies and the Internet will dominate the planet. This is a scary thought, but true.

Convergence Implications

Convergence occurs because data, voice, video, and other information is encoded as a stream of 1's and 0's, making them digital communications. Since everything is sent digitally, these types of transmissions can be combined and sent over the same high-speed transmission channels or pipes. That has been done for years in the telephone network. What is changing today is that the delivery of these diverse types of data is via one composite (or combined) digital stream on a single physical network to the business or residential site instead of delivering voice, video, and data communications via different digital streams on different physical networks. This will soon reach the telecommunications device that is attached to the "nut behind the keyboard"—me. We are beginning to implement composite stream Internet Protocol (IP) communications to business and residential sites. IP is used in the Internet to route data from source to destination points. IP uses physical network facilities more effectively than traditional analog and digital communications. Tomorrow it may be implemented in a wearable computer-communications appliance on my belt.

For example, DialPad.com provides a new, popular voice communications service. DialPad provides long-distance telephony from desktop PCs to phones anywhere in the continental U.S. This is the delivery of voice telephony by an IP network to a residential user. Voice over IP (VoIP) is simply putting voice communications over a digital packet network like the Internet instead of the traditional analog voice telephone network.

Another example is Cisco's VoIP router/gateways. These VoIP router/gateways are installed on a customer site and plugged into the Private Branch Exchange (PBX), or phone system, and data/LAN network connections. They also attach via a high-speed channel to an IP network. This IP network can be a private IP network or the Internet.

Cable modems (similar to analog telephone line modems) are used by cable companies to send digital data to residential users. They are a good example of how a coaxial copper cable carrying your television channels can also provide data connectivity into the Internet. Cable networks can carry simultaneous voice communications as well. Expect the cable companies to offer voice services as competition increases.

The total can be more than the sum of the parts because consumers will require all different communications services. Voice, video, and Internet access are the most visible today. This means that the business that synergistically provides these services as a single package is likely to dominate communications in this millennium. For example, companies like AT&T have allied themselves with TCI and @Home (Media One) to offer a variety of options to consumers, making them not only a "phone company," but also an overall communications company. They provide high-speed channels and connectivity into different target services—voice telephony, television and movies, and the Internet. They are becoming a single communications provider that does it all, a Broadband Integrated Communications Provider (BICP).

Table 1-1 shows the basic progression of computer technology over the last five years. The table compares CPU (Central Processing Unit) speeds, amount of RAM (Random Access Memory), disk drive size, and communication speeds.

Table 1.1 *Microelectronic and Communications Evolution*

Year	1995	1996	1997	1998	1999	2000
CPU Speed	60MHz	100MHz	200MHz	400MHz	600MHz	1GHz
PC RAM Size	8MB	16MB	32MB	64MB	128MB	256MB
PC Disk Drive Capacity	500MB	1.2GB	3.2GB	6.4GB	37GB	70GB
WAN Transmission Speed	28.8-Kbps Modem	33.6-Kbps Modem	56-Kbps Modem	56-Kbps Modem	400-Kbps to 800-Kbps Cable Modem	Mbps xDSL and Cable Modem

The CPU does all the work in the PC. Better-known CPU manufacturers are Intel and AMD. RAM is like chalkboard space for your PC. When you work on your PC, data is copied from the fixed disk drives into RAM, where it is manipulated by the CPU chip. The more chalkboard space or RAM you have, the more data you can manipulate at one time. Fixed disk drives are the physical location where data files are stored. Fixed disk drives are basically large file cabinets.

These are common values found in a computer system purchased during the designated year. Recently, IBM made another storage technology breakthrough that has the potential of increasing disk storage capacities 100-fold over what we have available today. This will be just in time, as we need more storage to contain the multimedia video information that is fast becoming part of our everyday lives.

In Table 1-1, the 1995 PC cost was about $2000 to $3000. Its main function was to perform word processing and spreadsheet analysis (number crunching), and to help you improve your Solitaire skills. In 2000, PCs still cost about $2000 to $3000. However, the tasks the PC performs have changed to focus on multimedia (data, sound, and video) tasks as well as continuing to improve your Solitaire skills. A computer is not usually purchased for faster word processing, but rather to support increased productivity by enabling voice dictation and videoconferencing. These are applications that would have choked and killed a 1995 PC.

So today, how much is that 1995 PC worth? It can still do word processing. However, the best you could probably get for the entire PC, monitor included, is about $150. Basically, old PCs are throw-away devices just like old telephones. How much will the 2000 PC be worth in two or three years? As PCs become cheaper and more disposable, the planet and our personal and business activities will be inextricably intertwined with computers.

Telecommunications convergence is tele-computing that combines voice, data, and LAN communications with PC technologies. Major communications companies such as AT&T, PSI Net, MCI, and Comcast are positioning themselves to be your one-stop communications provider of all communications, shopping, and entertainment services. These services require high-speed (millions of bits per second speeds) communications facilities that deliver data, image, voice, and video information to our office and home desktop (or kitchen countertop) computers. The communications network will attach to your office or in-home network, but a single connection may use wireless (microwave-like radio broadcast transmission) or a wired (coaxial cable or telephone wire) connection. Wireless connection means simply no wires, and a wired connection using wires is sometimes referred to as a wireline connection. Desktop, mobile, hand-held, and wear-

able PCs are the universal communications appliance that these service providers will plug their networks into to supply all your communication, shopping, and entertainment needs and more. Using one device, one network, and one provider is where telecommunications is headed. This book intends to help you understand exactly where we're going and how these technologies are merging as we move forward in this new millennium.

Brain Teaser

Describing a Communications Network Today and Tomorrow

How would you in the simplest terms describe a telecommunications network? Is it composed of fire, earth, water (a smoke signal network), copper, and other elements? What do you think?

It is important to understand and develop a simple approach to networking that gives us the practical perspective and reference points we need to cope with the dizzying changes in communications technologies. It needs to become your own simple conceptual framework for networking. You guessed it. I am stretching this out to give you time to ponder the question.

The simple view is that all networks are composed of hardware, channels, and software. Hardware is the tools and materials that we use to build our network. Today it is very reliable and, in many cases, redundant. Channels are the pipes interconnecting the network hardware components. Bits ("0's" and "1's") are stuffed in one end and spit out the other. Pipes come in various sizes and materials. Some are the quarter-inch copper pipes connected to the faucet in our kitchen sink; others are the 3-inch Poly Vinyl Chloride (PVC) drain pipes; and still others are the cement water mains delivering water to our neighborhoods. Finally, there is software. Software is the glue that holds all this stuff together. It is a complex glue, consisting of millions of programs written by millions of people. Actually, so many people are involved that it is a wonder it works at all. Fortunately, good, long-tested software code forms the building blocks or the foundation for new software. It is always easier to reuse electronic information than to create it from scratch.

Communications networks are all composed of hardware, channels, and software. Troubleshooting a communications network is identifying which component is malfunctioning or misconfigured. Building a communications network is selecting and purchasing the hardware and its associated software and the channels needed to interconnect all components. Then these are installed (connected together) and configured to make the network operate.

1. Which network component is the pipe?
2. Which network component functions as glue?
3. Which component is left?

The goal here is to provide a simple conceptual framework for understanding the complex telecommunications networks with which we live today.

Telecommunications Evolution

To understand the impact that computer and telecommunications technologies are having on your company, we need to understand the love/hate relationship between computer and telecommunications technologies. These two technologies are now combining to form balanced tele-computing (Telecomputing is Pete's word for the convergence of voice, data, and LAN communications with PC technologies. In an enterprise, it signifies the total integration of telecommunications and computing functions into a single organization-wide network) networks upon which most organizations are vitally dependent.

Telephony Evolution

Many telecommunications managers got their start by monitoring telephone bills from AT&T. In the mid-1970s to mid-1980s, telecommunications described the technologies for communicating voice. At that time, telecommunications management controlled communications expenses and telephone abuse within an organization. Soon, telecommunications began to incorporate image and messaging technologies. Telecommunications competition expanded when Judge Harold Greene completed divestiture in 1984. Soon, enterprise-wide communications networks began to integrate more non-AT&T services, and more importantly, a wider range of telecommunications technologies. Today we have entered in earnest the era of digital networking, that is, having widespread digital communications supporting voice, imaging, and data communications to the desktop (see Figure 1-1).

Why is a book on telecommunications focusing on the PC as the root cause of new telecommunications and computing technologies in the future? It is simply because the primary tool for most workers in any industry is a microprocessor-based PC. Such PCs range from desktop PCs to laptop PCs to special hand-held devices performing specific work functions (such as the PCs used by Federal Express and UPS to track shipments). These PCs are attached to telecommunications channels and services to perform their work activity support functions.

Today we are in the process of implementing a balanced tele-computing work environment. Balanced tele-computing is the label for matching both computing and telecommunications tools to an employee's work functions and job activities. It is the balance between the capabilities of the desktop or hand-held PC, the capabilities of the communications channels, and the pro-

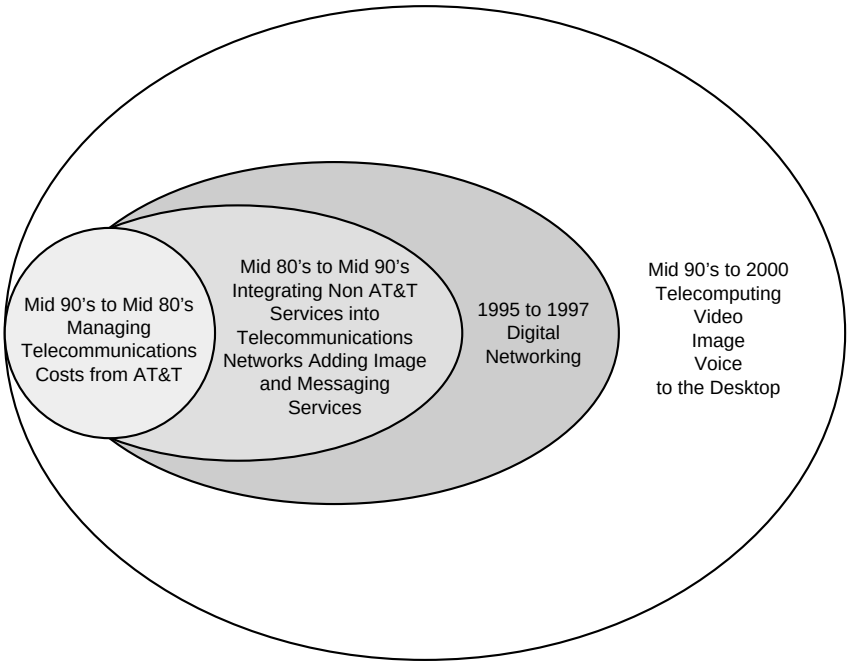

Figure 1–1 *Telephony evolution.*

cessing and database support provided by network servers. It is like technologically-oriented industrial engineering—giving an employee the computer and communications technologies that make them most productive in their job.

Not all concepts are wisely implemented. For example, thinking balanced tele-computing—matching computer tools to work functions—I purchased a pen-based laptop PC. The purpose was to have people that visited our booth at computer conferences complete a seminar interest form on the pen-based laptop PC, entering the data directly into an electronic database, and thus eliminating paper index cards. This would save trees, have the data electronically available more quickly, and more. Unfortunately, I lost perspective of the practicality of the pen-based laptop PC. After all, don't they do things like this in the movies? I discovered that by the time the first person completed the electronic form *correctly* using the pen-based laptop PC, a three-day conference would be over. It would have been easier and quicker for them to enter the data using the PC's keyboard than by using the electronic pen for input. Truly, at some point in time, this dream will become reality, but not today.

It is important today to understand voice, data, and LAN technologies because all are fast becoming part of telecommunications in the era of convergence. Convergence merges voice, video, image, and data over one network connection.

Data Communications Evolution

Any organization can be viewed as a large beast that performs useful functions for its customers as long as it is fed dollars of sales. Today, organizations also must be fed technology to live long and prosper. New technologies must be incorporated into business operations at a dizzying rate to assure an organization's competitive edge. The real difficulty here is that a technological edge like weaponry superiority is fleeting. Consequently, organizations must continually seek new technologies to maintain their competitive standing in their market.

One single piece of technology is driving this revolution in computing and telecommunications technologies—the microprocessor, or the computer on a chip. Its implementation into small desktop personal computers has caused a major restructuring of the computer industry. Companies that led the computer industry for years have suddenly found their major market strength is no longer a strength but rather a boat anchor. New companies created solely from PC-related products dominate American business today.

Old networks were based upon providing access to mainframe computers from terminals or later PCs spread throughout an organization. IBM's System Network Architecture (SNA) and Digital Equipment Corporation's DECnet were the dominant networking architectures. These are now labeled "legacy networks." Today's networks focus on PC LANs as the building blocks for enterprise-wide communications. In less than twenty years' time, the tinker toy PCs have broken apart the traditional role of computers in organizations. Also, these PCs reshaped the telephone and entertainment industries.

In the battle between computers and telecommunications, the computer people controlled centralized mainframe computers that provided information services—accounting, inventory management, and sales monitoring—to management. The computer people were powerful because the organization believed that they understood computers and that computers were complex machines. IBM promoted this image in its vain attempt to maintain its monopoly in the computer industry. In 1987, IBM made a marketing mistake. They introduced a proprietary PC following their traditional strategy for monopolizing the computer industry. It failed. In 1995, IBM

announced the demise of its micro-channel architecture PC. IBM is now the fourth-ranked PC manufacturer worldwide today.

The future of computers and telecommunications was shaped by a war between PC software rivals. It began with Microsoft and Novell. Each had technical and market strengths in different areas. Microsoft dominated PC operating environments, while Novell dominated PC LAN software. Each saw the impending battle over PC market share focused around PC communications. The war started in earnest in 1995 with the release of Windows NT servers and Windows 95 clients. The Transmission Control Protocol/Internet Protocol (TCP/IP) communications software built into these Microsoft products takes PC communications to new levels. Today, the Microsoft vs. Novell war is over before it really began, and Microsoft won.

But, a new war is developing between Linux and the legions of Linux followers and implementers, and Microsoft and Windows. Further, Microsoft is fighting on another front to dominate PC access to the Internet. The justice department monopoly litigation against Microsoft was started by Microsoft's competitive practices against Netscape, a rival Web browser manufacturer. The winners here will play a significant role in shaping how we use communications and computers in the office and at home. Every company in the computer and communications industry understands that any company dominating the Internet and the devices that deliver the Internet to our homes and offices can become the monopoly IBM was in the computer industry of the 1960s through 1980s.

Turf wars in the telecommunications industry are continuous. The goal for every organization is to become the company that delivers one device, one network, and the information and entertainment services everyone uses. PCs today are migrating toward one universal communications application, the Web browser! Microsoft has integrated into the Windows Internet Explorer the ability to view desktop publishing files produced by Microsoft Word. The Internet Explorer also permits users to listen to music. With Windows, active desktop news and other information is delivered to the desktop in video form as well. However, regardless of how integrated Microsoft's products are, Microsoft dominance of the PC is not assured. So, computer-communications turf battles continue (see Figure 1-2).

LAN Evolution

Local Area Networks have played a significant role in effectively integrating PCs and communications into the workplace. The need to easily and quickly share files and printers was obvious in the early days of PCs (the early 1980s). The first LANs emerged in 1983.

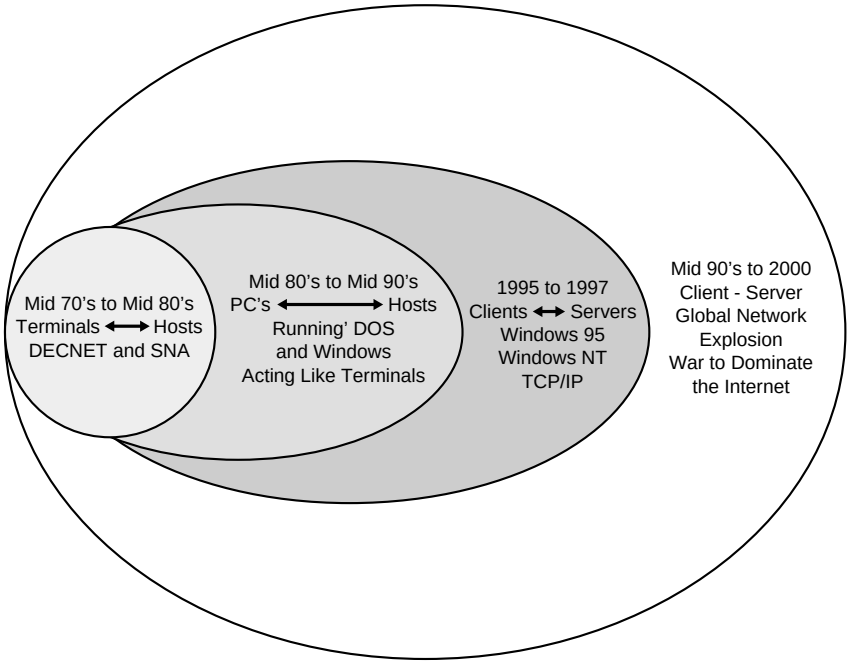

Figure 1–2 *Data communications evolution.*

Most businesses began connecting their PCs together with a network to facilitate sharing of financial and administrative data and collaboration on special projects. These LANs soon provided backbone communications for businesses. Today virtually every PC is connected to a LAN or some other form of communications to permit file and printer sharing and to provide email service and more sophisticated group collaboration on business projects.

Soon LANs will play a significant role in the home. Households with an old and a new PC are networking them together. As PC prices fall lower still and the number of PCs in a household increases, more households will have a LAN. Specialized PCs will be added to perform specific functions; for example, the entertainment center-controlling PC that plays MP3 music, records video for later viewing, and gathers the news like a newspaper for us to read at our desired down time. A LAN interconnects regular workstation PCs with specialized PCs and the Internet. This makes 24/7 functions possible.

For example, when backing up critical household data, most PCs today use PBB (Prayer-Based Backup—praying that nothing fails). However, off-

Figure 1–3 *Backup service advertised by SGII.com.*

site backup using connections over the Internet are now being offered. The SGII.com site is one of the first to offer this service (see Figure 1-3).

What makes these services and technologies possible is the LAN connectivity between PCs in a single facility or campus area. Connecting these business and household LANs to the Internet with high-speed transmission links opens the door to diverse information services and capabilities.

There are four key areas competing to provide high-speed LAN access to the Internet. They are:

- Cable modems—The first services out of the chute and being championed by AT&T and all cable television companies.
- Digital Subscriber Lines (DSLs)—A service promoted by the telephone companies. This looks to be the big, early competitor of cable modems.
- Radio Frequency (RF) broadband distribution—These services are easy to deploy via satellite or terrestrial links. We should see them in the next several years.
- Electrical power network links—These are the last dark horse competitor. Since there is good copper wire into every house, why let it go to waste?

These approaches are the key technical areas explored in this book. There is more on each of these areas in subsequent chapters.

The Influence of PC Technologies

PC CPU, RAM, and disk technologies are quickly advancing. The PC itself is rapidly becoming our home communications and entertainment appliance. For example, PCs are quickly becoming the music systems in our homes. Attach amplified speakers to a PC playing an MP3 and it rivals the music produced by the best home entertainment systems today. Soon they will exceed their capabilities. IBM's technical break-through in disk storage technology announced in March 2000 can increase disk storage capacity 100 times from current capabilities. This can have a profound impact in the amount of information retained by PCs at home and at work. It can also mean that every work of art, every movie, and every book ever written can be available on-line across the Internet.

Microcomputer technology pushes convergence because as computer speeds, storage capacities, and communications speeds to the Internet improve, they are not only used for word processing, Web surfing, and email, but also for increased voice and video communications. The common applications that we run in the future will be video/voice conferencing, voice recognition, and graphic editing. Microcomputers are simply the one-stop communications appliance of the present and the future.

At MIT, they are working on the Oxygen project, a $40 million research project. The goal is to make everyone a node on a network, reachable anytime, anyplace. Oxygen is based around four key components:

- The "Handy21," a portable unit appearing to be a cellular phone. It has a high-contrast screen, a digital camera, a Global Positioning System (GPS) module for locating it, an infrared transmitter-receiver in addition to the RF transmitter-receiver, and a powerful microprocessor. Handy21 can be a phone, a two-way radio, a television, a pager, a hand-held computer, a pointing device, and more, depending on the software dynamically loaded into it. This device reconfigures its hardware based upon the programs being run in it to perform the task desired by the person using it. The software is retained on servers attached to the network.
- The "Enviro21," a larger non-hand-held computer in an office, car trunk, or home closet. The "Enviro21" does everything hand-held "Handy21" does and more. An Enviro21 can control physical devices such as a furnace or door locks.
- The "N21" network, a new World Wide Web using steroids, linking all Handy21s and Enviro21s to servers. The N21 network connects everyone to everyone and everything.

- The last important component is the ability to communicate through voice commands and speech, as though you were talking to a person rather than a silicon-based device.

There are similar concepts that like Oxygen are designed through powerful microelectronic technology to provide the ability for a network to know where you are and what you need to use at any time. Out jogging with just an earphone and microphone? The hand-held device and network adjust to the way you can communicate. At home watching a movie? In that case, the network can determine whether to interrupt you or not.

Convergence and advanced microelectronic technologies will make these concepts reality within ten years.

Brain Teaser

Cellular Phones

Go to the Internet and shop for cellular phones. What are the key features you find today?
Is physical size a feature with the smaller the better? What is the smallest phone you have found?
Is battery life important? What descriptive terms are found for battery life? Standby and talk time are the common features.
Are there additional features? Do some act as pagers and display text paging? Are others able to surf the Web?
Our goal is to see what wireless phones are provided today and contrast their features with the features of the next-generation mobile communications information systems of the near future.

Telecommunications Future

Tele-computing has several implications. The first is that it should be tailored to the person at work or at home. The goal is to serve employees and residential users. This means it is end-user-driven. Technology must not be cumbersome. It must be very easy to use. Further, it must be reliable. Once people count on these PC-based devices for all their information needs, the devices and supporting networks cannot ever fail.

Our PCs will become video telephones, using flat panel displays that can be hung on any wall. PCs will also become more portable and wearable. They must, however, have a more reliable operating environment than Windows 95/98/ME and even Windows NT/2000. We will have special-use sys-

tems aimed at a primary function or two. They will be small but have big displays and make loud sounds. The most important PCs will be wearable and part of our garments, just as many cell phones are worn on the hip today.

Telecommunications and Telephony

All telephony will migrate to IP networks (for instance, the Internet). The voice telephone network as we know it is history. It is being transformed into a high-speed IP delivery system between distribution networks. Distribution networks will cover the last mile to the home or office using telephone wire, coaxial cable, radio frequency channels, or power wiring. Each of these will compete vigorously for the around $200 per month each household will spend on communications. New services will cater to consumer and business needs. Those that master these technologies, have the dollars of investment behind them, and meet present and future needs will become the Microsoft-like companies of tomorrow. Those that do not master these technologies will be absorbed like Digital Equipment Corporation.

Residential Telecommunications

Residential services will depend on high-speed Internet access. High-speed today is 100 Kbps to 900 Kbps. This will increase in the future to 1 Mbps to 10 Mbps for each household. This will be driven by the entertainment industry selling video over the Internet. At first, downloading a movie over several hours will be acceptable. But soon, only a few seconds will be tolerated. Several residential communications technologies, including cable modems, telephone company DSLs, radio frequency channels, and electric power distribution channels, will compete for consumer communications spending. Prices will drop because these services can be delivered effectively with few employees. The services must be highly reliable. Those that provide high reliability, high-speed, and low cost will dominate the market in the geographical areas they serve.

This means that people will no longer be bound to cities for high-paying jobs, provided high-speed communications are universally available in rural and other areas. This should radically change the way we work and manage workers.

Telecommunications and Business

Video telephony is anywhere and everywhere. We already wear cell phones. Some have push to talk (intercom-like) features and the ability to surf the

Web. GPS tracking/locating and more is on the way. The net result is that businesses will need to reinvent themselves on two fronts, how they deal with employees and how they deal with customers.

In dealing with employees, working hours and locations will become more fluid and less definable. Access to key data and public information must be provided securely to any working location. Network and PC operation can have no glitches. The cost of a single outage may not be the cost of lost time, but rather the loss of that million-dollar sale.

In dealing with customers, there are new opportunities to track and identify customers. These abilities must weighted against the invasion of customer privacy they produce or bring about. There are also opportunities to provide new products and services that are highly cost-effective. These services will rely heavily on electronic delivery, but will not be able to split themselves from other physical advertising and delivery mechanisms. Mouse clicks and mortar will beat mouse clicks every time. This means that the company that has the facilities and electronic presence (mouse clicks and mortar) will beat the electronic company (mouse clicks) every time.

Brain Teaser

Communications Service Availability

Check your local cable company and telephone company to see if they are offering cable modems or DSLs.
Is service available for your home?
What transmission speeds are advertised?
Is it possible to get 1.544-Mbps service from either cable modem or DSL service?
The goal here is to see what high-speed Internet access is available in your geographic area.

Balanced Tele-computing

Enterprise networks support a combination of telecommunications, data communications (WANs), and LANs. Enterprise networks are large networks that allow everyone in a business or government organization to communicate with one another from every facility on the planet 24 hours a day. Enterprise networks are not new. In the 1970s, enterprise networks provided communications between terminals and mainframe computers. In the mid 1970s enterprise networks were largely based upon IBM's System Network Architecture (SNA, software and hardware products from IBM, conforming

to IBM-developed communications procedures) and Digital's DECnet (software and hardware products from Digital Equipment Corporation (DEC), conforming to a set of DEC-developed communications procedures products. TCP/IP (software products conforming to standard international communications procedures that run the Internet) networks transformed enterprise networks with a worldwide addressing mechanism. Today's PC LAN-based enterprise networks also conform to international standard addressing specified by the International Organization for Standardization (ISO).

The big change in the 1990s was that any PC could get to any data on any server (provided the user was authorized) through an addressing scheme that was structured like an organization chart (NetWare Directory Services—NDS—Novell) or telephone directory (Domain Name Services—DNS—UNIX). The Domain Name Service (DNS) approach is used in the Internet and will become the dominant approach for connecting users with the information they seek in all networks. This is evidenced by Microsoft Windows 2000 moving to DNS addressing for enterprise networks. Enterprise networks using different addressing schemes are connected via Internet gateways. The implication here is that everyone on the planet connected to the Internet at any location can access any information on any computer planetwide (provided they are authorized).

Tele-computing is the convergence of voice, data, and LAN communications with PC technologies. This convergence delivers to the office or home PC data, image, voice, and video information. Tele-computing makes desktop, mobile, hand-held and wearable PCs universal communication appliances.

Balanced tele-computing extends this concept by simply matching computer-communications tools to job functions (see Figure 1-4). Balanced tele-computing becomes even more difficult as we move into the future because our tele-computing choices are forever growing. What is a good combination of computer and communications technologies today may not be the most effective combination tomorrow. So, balancing technology to meet information and communications needs becomes a interesting problem. When you think of balancing technologies to meet user needs, effective (not necessarily cheap) solutions seem more obvious. In the home, balanced tele-computing is matching the PC tools and communications services to the information and entertainment needs of the household. The focus is on providing the computer-communications tools and services that help people in their work and improve their personal lives.

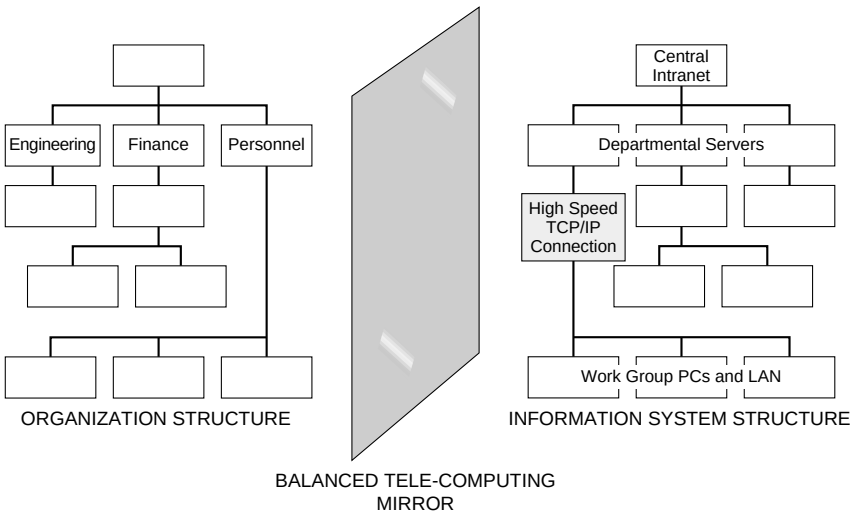

Figure 1–4 *The balanced tele-computing concept.*

How networks are built and how they work are much less important here than what they do for us. The driving force behind networks is how they make everyone more productive. This is what I call balanced tele-computing—matching the computer and communications capabilities to the work functions performed by an employee. The goal is to increase the employee's productivity. This goal is accomplished by balancing the computing done at the desktop (or in the wearable computer) with the available communications/transmission capacities and computing done in the supporting servers.

For example, the paperless office was a concept promoted in the 1980s and 1990s. Now I ask, are our offices any less paperless today? I think not! So what have all these PCs and networks done for us? They make the amount of information we digest daily increase by a factor of 50,000 or more (provided a picture is worth 1,000 words, what is a video worth? A 1,000,000 words?). Further, the information we see is filtered down to that information which is really important to us individually. So, our productivity and effectiveness is much greater than before. The information provided depends upon the PC, communications links, and servers gathering and filtering the information presented.

In the following sections, let's explore some examples of other ways balanced tele-computing can impact work.

Vending Machine Example

In the vending machine industry, what is the greatest cost? Our seminar students guess the cost of the machines, cost of servicing the machines, or the cost of space in which to place the machines. While these are all significant costs, the biggest cost is having the person standing in front of the machine with their dollar out ready to spend and having nothing in the machine to buy. Now the vending machine has lost the revenue and margin that pays all the other costs. Hold this thought for a second while we approach from another direction.

College students, especially the ones who work late at night in their computer labs (yes, I am a nerd who wore a bamboo slide rule in college), need sustenance. Food is no problem because there are usually several pieces of cold pizza or some Doritos left from the early evening meal. However, a beverage is needed, meaning the student has to leave the safe confines of their computer lab to go to the closest soda machine to acquire the needed thirst-quenching, caffeine-saturated beverage only to find often that the soda machine is empty.

Because they do not like risking leaving the safe confines of the lab and returning empty-handed, and because they are inventive, the students develop and implement electronic boards that track the sodas in the soda machine. Further, they connect these boards and the machines up to the Internet. This permits them to query the soda machine and determine the availability of soda right from the safe confines of the laboratory. In some cases, they can even set up an electronic account so that they can purchase the required soda without using coins. They debit their account and then issue the eject soda command to the soda machine. Then, a minute or two later, the machine spits out the selected soda.

Now back to our vending machines. We cannot put every vending machine on the Internet today. There are not enough IP addresses to go around—not at least until Internet II with 64-bit addressing comes along. However, it is possible to give every vending machine its own cell phone. Then the vending machine, like ET (the Extra Terrestrial), can phone home. The vending machines could report in late at night or, in the event of emergency (they ran out of products to sell), during the day as needed.

If a person winning the Darwin Award (an award given by nerds posthumously to people killing themselves in an incredibly stupid fashion and thus increasing the overall intelligence level of the planet) attempted to break into the vending machine, it could phone the police. One Darwin Award winner rocked a soda machine back and forth so it fell on them and caused their death. Soda machines weigh around 1,000 pounds. That soda machine

could have phoned 911 and said "Help, someone is breaking into me, oops too late."

This vending machine example combines communications technologies with microelectronic and PC technologies to make servicing vending machines much more productive and effective. It should reduce the number of cases when someone had the dollar ready to spend and was faced with an empty machine. It balances remote computing capabilities with cost-effective communications and central computing support.

Laptop Example

Laptop PCs are a second example. Today, most traveling businesspeople have a laptop PC that accompanies them everywhere they go. My job involves heavy travel as well. I teach seminars on telecommunications mostly throughout the U.S., but sometimes elsewhere on the planet as well. I also write. That means that wherever I go, I need to take all my work as well as the ability to write, occasionally using speech-to-text software. This means that my PC is industrial-strength, as compared to those carried by most travelers, which only need to send and receive email or enter orders into an automated order system.

Again, balanced tele-computing, matching computer and communications tools to job functions, is applied. I am balancing my remote computing needs with the available communications facilities and central site services.

PC in the Kitchen

Finally, why have PCs not invaded the kitchen? They could be productively employed for tracking household inventories, counting calories, preparing grocery lists, purchasing essentials, presenting recipes, and entertaining the cook and bottle washers. My guess is the large monitor. There is no counter space for it to sit upon. However, flat panel monitors are becoming increasingly cheaper and of better quality.

So soon, PCs connected with special kitchen-oriented software will appear there. They will be of course be connected to the refrigerator so that when anything is removed or added, they update their food inventory list. The inventory will be based upon special detectable tags and not bar codes. So when the door closes, the kitchen PC will hold roll call to see who has been added and who is missing and presumably eaten. It could then connect on-line to the grocery store and update our shopping list from the weekly specials or stores with the lowest prices. Also, the "Shame on us" message for eating too many calories would appear with the appropriate sonic alarm.

Brain Teaser

New Internet Services

New Internet services are aimed specifically at consumers. Can you find some on the Web? List three that you would use in the following spaces.

1.
2.
3.

The goal here is for you to see how balanced tele-computing is pushing new telecommunications technologies and services into our everyday lives. I personally like the lottery-like Web site iWon.com, the electronics shopping and most other shopping sites, and my email. These are my choices, not necessarily yours.

■ Summary

This chapter has presented the difference between telephony and telecommunications, introduced the concept of balanced tele-computing, and described in summary fashion how telecommunications evolved into what it is today as well as projected where it is heading in the future. Telecommunications is the convergence of voice, data (WAN), LAN, video, image, and wireless communications technologies with PC and microelectronic technologies to facilitate communications between people or to deliver entertainment, information, and other services to people. Balanced tele-computing focuses on matching computer-communications tools to job functions. The implication is that we balance what a PC or hand-held device does with what the supporting network and servers do. Finally, the future of constant and instant unobtrusive communications was described. This is a future moving toward one device, one network, one provider, and one application.

▲ Chapter Review Questions

1. *What ways will not provide high-speed access to the Internet to the home?*
   A. Cable modems
   B. Water pipe
   C. Cellular radio

D. Telco DSL connections

E. Satellite communications

F. Power lines

2. *DSL stands for*

A. Digital Subscription Line

B. Data Subscription Line

C. Digital Subscriber Line

D. Data Subscriber Line

3. *What units of measure are used to represent transmission speeds to the home?*

A. Bps

B. Kbps

C. Mbps

D. Gbps

4. *Cable modems operate at what speeds?*

A. Bps

B. Kbps

C. Mbps

D. Gbps

5. *Analog modems operate at what speeds?*

A. Bps

B. Kbps

C. Mbps

D. Gbps

6. *What technologies are converging?*

A. Voice, WAN, LAN, video, image, and wireless with microelectronic technologies

B. Voice, WAN, LAN, video, and wireless with microelectronic technologies

C. Voice, data, LAN, video, and wireless with microelectronic technologies

D. Voice, data, LAN, image, and wireless with microelectronic technologies

7. *What kind of company is promoting DSL?*
   - **A.** Electric power company
   - **B.** Retailer
   - **C.** Wholesaler
   - **D.** Cable television company
   - **E.** Satellite company
   - **F.** Telephone company

8. *Which provides the highest speed?*
   - **A.** Cable modems
   - **B.** DSL lines
   - **C.** RF links
   - **D.** Satellite communications
   - **E.** Power lines