Chapter 1

INTRODUCTION: UNDERSTANDING INFORMATION TECHNOLOGY

Our lives are awash in information. From the moment we arise each morning, we are surrounded by a seemingly endless array of sources that produce, store, or dispense information. Our alarm clocks are tuned to any one of hundreds of radio broadcast stations that greet us with news, weather, and entertainment. Television offers an equally wide assortment of similar broadcast and cable transmissions. At the breakfast table, for example, we can dine while consulting a single screen for the latest international news, current weather for the U.S., and stock market quotes from Wall Street or the foreign markets. Our telephones—wired or wireless—connect us to any point anywhere on the globe. Millions of conversations like ours flood the channels and airwaves. From our home computers, we can pay our bills and balance our checkbooks, send and receive correspondence, purchase goods and services, and read online magazines and newspapers. Even the appliances in our home keep track of things; in fact, they can be organized to send radio transmissions to exchange information and coordinate their activities. Overhead silent satellites gather data about the weather, population concentrations, and a host of other subjects.

Our own identities are traced by an electronic trail of school transcripts, credit histories, medical records, employment files, and so on. Should these records all disappear in an instant, we would have an unbelievably difficult time persuading others who we are. If you are not convinced of this: Think about the annoyances of merely completing a credit transaction without proper identification.

Business is information and information is business too. At most of our jobs, we spend a significant portion of the workday tending to communications, sifting through reports and records, deciding on what is important and what is not. At the end of the day, we have put in long hours, but very few of us have manufactured goods or products to show for it. What we produce is just as important, though more ephemeral. The financial world of banking is more about the electronic transfer of credits than moving money or gold. Commerce still offers goods and services, but its survival and well-being are no longer measured solely by these material goods and services. Every purchase we make at home or on the road is logged and stored in retail databases. Seasons, cycles, and trends are endlessly plotted and analyzed. Margins of profits and loss are no longer based on inventories, but less tangible things like supply chains. The stock market itself will more likely rise and fall due to reports, indicators, rumors, and predictions than traditional measures like company profits, capital investment, and debt. Everywhere information is the legal tender.

We are living in the Information Age. Our lives, work, and world are all about information. Computers and digital technology have contributed to this flood of information and they are the best means by which we can cope with it. In this book, we offer insight and skills for managing information. The key is learning how information is captured, preserved, processed, and exchanged in the digital domain. And, though digital information technology has significant advantages and promise, it also has distinct limitations and liabilities. Mastering the digital domain also means balancing these costs and benefits.

Objectives

- the importance of information for a wide assortment of enterprises

- understanding the roles of information technologies in shaping how we manage and preserve information
- how digital information technology subsumes and merges other information technologies
- how digital information technology is changing the quantity and quality of information affecting our lives, our work, and our world

The Nature of Information

This is indeed the Information Age, but information has had a central role in our existence since the beginning. Biologists tell us that one of the hallmarks of life is the ability of an organism to adapt to its surroundings. But, in order to adapt, it must first respond to the conditions of those surroundings. Thus, it is fundamental that all living things are sensitive to external stimuli. When a pin pricks your skin, a sharp pain results. The sudden appearance of a large object in your visual foreground produces the startle response—adrenalin surges in your body and your body prepares to respond to the potential threat. These are some simple examples of this essential characteristic of living things.

In a broader context, though, we can think of sensory responsiveness as a form of communication—that is, the conveyance of information. The sender transmits an encoded message that is interpreted by a receiver. The encoded message contains information that has meaning or significance for the receiver. Thus, organisms have evolved to interpret their natural environment as containing information. Visual perception, for instance, fits the communication model well. Human vision is tuned to a specific bandwidth of electromagnetic energies emanating from the environment--light. But, our receptors do not scan the full range of these frequencies; instead, they sample specific bands within this range (high, middle, and low). This is sufficient for the visual cortex to compose color information. Nor do we process all of the energies available in the visual environment. Instead, our perceptors are attuned to receive dramatic changes: sharp contrasts in the spatial field, and abrupt changes in the position of objects over time. Perception is not a passive process; it is attuned to a specific medium or channel and is highly selective in what it interprets (receives) as signals (encoded messages).

But the communication model is applicable in even broader contexts. Within the organism, its functioning at various levels involves sending and receiving of encoded messages (information). Cells in a organism must communicate in order to regulate growth and development. Some forms of communication are local; others are long-distance. Consider local cell-to-cell communication first. All cells have a resting potential, that is, they maintain an electrical charge across the plasma membrane of the cell. Some cells, however, such as neurons are excitable. They may be stimulated to create a tiny electrical current. Specifically, certain external conditions can reduce the charge across the membrane causing depolarization. If the voltage reduces beyond its threshold value, an action potential or nerve impulse is generated. The effect of external stimuli is all-or-nothing. As long as the threshold is achieved, a full action potential is generated. This is how neurons transmit signals locally from one cell to the next. Other forms of communication travel longer distances. For example, hormones are secreted by cells that travel in the bloodstream to distant target cells. Insulin is a case in point. It regulates the flow of glucose in the blood by stimulating cells to take up and store glucose as well as inhibiting its production. At a higher level of organization, nerve signals cause muscle fibers to contract or expand. These are just a few examples of how organisms send and receive information at many different levels of organization.

Of course, organisms have evolved to use encoded signals within the species as well. Encoded signals can be interpreting natural signs or direct communication. Migrating birds, for instance, often respond to changes in seasonal weather, the positions of the sun and stars to commence annual long distance treks. Anomalous animal behavior has often been observed with the onset of significant natural events such as earthquakes. Birds, fish, and mammals may be capable of interpreting environmental

cues that have eluded us in recognizing such events. Some animals respond to the shortening days, reduced sunlight, and decreasing food supply as signs inducing hibernating behavior. Reversing these cues can bring the same species out of hibernation.

The dances of the European honeybee are often cited as an animal communication system. Scout bees returning to the hive indicate the location and extent of a food source using characteristic dances. Ants use chemical secretions called pheromones for communication. There may be as many as ten different secretions/message complexes in an ant's repertoire. Simple carbon dioxide, for example, promotes clustering for working on larger tasks. Each colony has a unique odor that identifies it and its members. This separates neighbors from intruders. Likewise, foraging ants secrete special pheromones along the trail when returning food to the colony. The density of these trails acts a strong recruiting agent for other ants to follow. High-density trails are more impelling than lower density. As the food supply wanes (i.e., fewer returning foragers), the number of ants recruited naturally dwindles. Birdcalls have been identified as signaling the presence of predators. The calls are different depending upon whether the threat is from below or above.

These and other examples convince us that information is fundamental for life in general. But what exactly is information? We have said a lot of things about it so far without explaining what it is. The problem is that the concept of information is a lot like those of gravity and energy. These concepts are so fundamental, they act as primitives in their domains—everything else is based on them. Information basically refers to knowledge, facts, significance, and meaning—though none of these captures it entirely. Claude Shannon and Warren Weaver in their groundbreaking "A Mathematical Theory of Communication" (1949) described information as what is known beyond chance predictions. Information decreases uncertainty and therefore aids decision-making. In their view, information is measured by the extent to which it is ordered or organized. By contrast, noise is random and disordered. At the other extreme, though, predictable order is monotonous and uninformative. Information lies somewhere between. To some extent information is surprising, unexpected, or new; but it reduces our uncertainty about predicting states of the world.

Information in most instances is useless unless it is transmitted or communicated. As a species, we have developed natural forms of representing and communicating information: signals and natural languages. But, signs and speech are ephemeral; they are bound by the present. Perhaps the defining characteristic of our species is that we have developed technologies to extend these and other powers.

Technologies and Information Technology

Technologies are artificial instruments, processes, or systems that extend our natural capabilities. The wheel, for example, is an extension of the foot as a mode of transportation. Agriculture is an extension of our social institution for gathering food. The microscope and the electric light bulb extend our power of vision into unseen worlds. Technologies also alter and modify our environments. The influences of technologies on society and individuals are sometimes immense and obvious; but these changes can also be subtle and indirect. For example, the invention of the printing press had enormously significant and well-documented effects on the development of the modern world. But, on the other hand, as technologist Marshall McLuhan argued, the invention of the lowly stirrup contributed indirectly to the rise of feudalism in Western Europe.[1]

Of all forms of technology, information technologies are perhaps the most important. From the beginning, humans have extended natural forms of representing and communicating information to incorporate artificial or external forms. Writing, for example, is an artificial form of transmitting and storing the spoken word. As such, writing is a form of information technology. Writing preserves and

[1] Marshall McLuhan and Quentin Fiore. *War and Peace in the Global Village*. New York: Bantam Books, 1968, 26-34.

stores the spoken word externally to the speaker. Thus, it can go beyond the presence of the speaker in both space and time. Indeed, written language can preserve our knowledge and experience beyond our mortality. Certainly, most of what we have achieved as a civilization would not have been possible without our inheritance of the knowledge of generations that have preceded us. This fact alone, perhaps, makes written language the most significant information technology developed by our species. Yet, information technologies can have shortcomings, liabilities, and even ill consequences. The written word, for example, loses some of the richness of meaning conveyed by the spoken word. (Think of a the experience of listening to a talented story teller.) The written word has saved many but, unfortunately, has also helped condemn many men and women to their deaths unjustly. The bottom line is that technologies can yield both good and bad.

Digital Information Technology

Electronic digital information technology is the latest generation of information technologies. But, it represents a different brand of information technology. Previously, new information technologies have often competed with and replaced existing ones. The telephone replaced the telegraph for obvious reasons. Television has relegated radio to a subordinate niche. Digital information technology is different because it is a form of technology that extends other technologies. In short, digital information technology has the capability to imitate other technologies. Electronic printed documents mimic conventional typeset ones. Digital audio recordings reproduce sounds like their analog counterparts. To the listener, wireless digital telephony works like normal (wired) telephone service. But its imitation is not mere replication. Digital information technologies offer value-added features. Electronic documents, for example, can be automatically scaled for different media. The same content can be printed on paper, posted on the World Wide Web, transmitted to handheld personal digital assistants (PDAs) and cell phone screens with no extra formatting or fuss. Electronic databases—unlike conventional ones—can be searched and queried automatically revealing facts that would be difficult to find otherwise. Finally, digital information technology can extend the technologies that it imitates by merging them in new and interesting ways. The Web, for example, merges text, numeric data, images, sounds, and video into a seamless medium for posting and sharing content-rich documents.

In support of what we are arguing, consider the rapid acceptance of digital information technologies in so many different arenas and enterprises. As a species, we are a conservative lot. Only a few of us are automatically attracted to new things just because of their novelty. Most of us feel more comfortable with the familiar. On the other hand, we will adapt to and adopt those things that we perceive as us genuinely valuable. Digital information technology must be a case in point. Consider how quickly we have adopted it in so many forms. Would you be willing to give up the Web? E-mail?

Indeed the world of information is going digital. The evolution to digital forms of information has influenced the workplace, the marketplace, our schools, and our homes. In some instances, the changes have been dramatic; in others they have been subtle—almost imperceptible. Considered together, these changes have been highly significant, helping to redefine the ways in which we think about and use information to communicate with each other. An important goal in this book is to guide your exploration of what we call the digital domain. For the time being, consider these examples of the inroads that digital information technology has made in a few short years.

Digital Documents

Typewriters have become relics of an age forgotten in favor of electronic digital word processing. You can now create, edit, and format documents with a flexibility and speed unthought of before computers. The typesetting of books like this one now depend more on digital methods than traditional, conventional techniques. In the past, publishing was the province of the professional; today even school children can produce a typeset book. In short, digital documents are easier to create, store, transmit, and

manipulate. One consequence of digital document preparation is that we now create a lot more documents—notes, letters, reports, and books—than ever before.

Digital Numeric Processing

Since their first appearance more than fifty years ago, computers have assisted us in many tasks that involve numerical computation. The earliest computers supported national defense and other government functions. They calculated ballistic tables for artillery, performed computations for developing the first atomic bomb, processed census information, and even predicted presidential elections. Unfortunately, these early computers were expensive and required considerable skill and expertise to operate. Today, the accessibility of computers for numeric processing is widespread. Spreadsheets and statistical and mathematical software offer powerful tools for numerical computation and are easy to use. Most of these tools also have graphing and visualization features that convert large data sets and models to more convenient and accessible forms. Today anyone can command both processing power and productivity for "number crunching" from a desktop computer that far outstrips that of the early giant computers.

Digital Music

Most of the music that you listen to is recorded, stored, and played back using digital methods. Compared to phonograph and audiotape, compact disc digital audio offers much higher fidelity sound. Phonographs and tapes have inherent noise noticeable in playback; their media usually suffer from the wear and tear of constant replay as well. Not so for compact discs. CDs are less noisy and last longer, making digital recording a significantly better archive for important performances. Today we can only imagine how brilliant were the talents of performers such as Enrico Caruso, Toscaninni, and George Gershwin. Their surviving recordings are dim and fading replicas. On the other hand, today's artists can be preserved for all posterity. When you tell your grandchildren how they just don't make music like they used to, you'll be able to prove it by inflicting on them recordings of your favorites that sound just as new as they did the day you bought them.

Digital Photography

When the family is forcibly collected at the photography studio for a portrait, the photographer most likely uses digital methods to capture and process your likenesses. After the shooting, the photographer can use a computer system to display instantly the proofs that used to take days or weeks to process. Thus, you can be photographed and choose which shots you want almost instantly. At the same time, the photographer can show you samples of how these photos may be retouched or processed to make you look even better than you naturally do. Professional photography has made the move to digital methods. Journalistic photography today is often processed digitally; fewer "wet" darkrooms are left in the offices of newspaper and magazine publishers. Recently, consumer versions of digital cameras have become even more affordable. Armed with these and image processing software, you too can produce results that match those of many professionals.

Digital Graphic Arts

Computer graphics (CG) is the artificial generation of images. The field has evolved from computing curiosity to the mainstream. Today, commercial artists employ computer graphics extensively to produce images for newspapers, magazines, and television.

Computer-generated animation is used to create or enhance commercials, television shows, and full-length feature films. Indeed, very few films are produced without the benefit of computer-generated effects. The contributions of CG effects to films like the *Harry Potter* sagas and *The Lord of the Rings Trilogy* are abundant and obvious.

Even more importantly, digital processes are making inroads into areas of filmmaking that were the traditional province of analog methods, and not so obvious. For example, the film *O Brother, Where Art Thou?* broke new ground by incorporating digital intermediate processing exclusively. Cinematographer Roger Deakins wanted this Depression-era version of Mark Twain-meets-Homer to have a distinctive look with washed and faded colors. He achieved this by shooting the film using conventional 35mm stock. The film was then scanned and digitized. The digital version was processed to achieve the color and lighting effects that he desired. Afterwards it was converted back to film for theaters. If you see the film, notice that the sky is blue and that flesh tones are natural, yet the backgrounds are faded pastels. This would be impossible using conventional film and lighting effects. Although he did it to achieve special effects, Deakins recognized the general advantages of digital intermediate processing. It offers the cinematographer much greater control over the images of the film. Differences in lighting conditions and film stock can be minimized in postproduction. Likewise, the digital format is natural for archiving and other releases such as DVD. As the technology improves, we can expect its wider acceptance in the film industry. The day of the totally digital "film" is not far away.

Digital Television

Television is migrating to the digital domain as well. Today you can purchase a small, 18-inch diameter satellite dish and receiver for a few hundred dollars. In spite of its size, it can receive hundreds of television channels beamed directly from satellites in fixed orbit around the earth. The picture that you receive is crisp, detailed video, and the audio is multi-channel CD-quality stereo sound. All of this is possible because the transmission and processing are digital. Compared to conventional cable TV service, digital satellite television offers higher fidelity, greater choice, and fewer interruptions of service.

The future of television is undoubtedly digital. The U.S. standard for high-definition TV (HDTV) is a digital one. HDTV offers tremendous gains in resolution that mean unparalleled realism in picture quality. Many of your favorite network programs today are simulcast in HDTV. The FCC has mandated that all broadcast television stations convert to these digital standards for all programming over the next several years.

Virtual Reality

Virtual reality (VR) is a new technology that immerses the user into the illusion of a three-dimensional world built from 3-D graphic models and sophisticated animation techniques. In contrast to a viewer merely watching conventional graphics that are projected onto a video display, the viewer dons special video goggles, headsets, and even gloves for manipulating objects in a specially designed model world. The objective is to create an artificial experience of new phenomena, with the conjured experience having a natural look and feel. Early versions of VR have created artificial rooms and buildings, projected users on journeys across the surface of Mars, and produced trips to virtual art galleries—complete with an extensive collection of art objects. These applications of VR technology have been largely experimental or exploratory. In the near future, as the technology develops, more serious commercial applications will appear. For instance, VR promises to be an invaluable training medium. In medical applications, it can be used to train surgeons. Using ultrasound imaging, VR can also augment the surgeon during live operations as well as by providing additional "visual" cues about the displacement and location of a patient's organs and tissues.

Digital Communications

Person-to-person telephone service is a fact that we all take for granted. Compared to realizing radio and television broadcasting, achieving such service is incredibly complex. A radio transmission can be broadcast across the airwaves. Listeners can receive it merely by purchasing a receiver and tuning in the

signal. On the other hand, for conventional telephony, each user must be capable of reaching any other user at any time. The communication must be exclusive and two-way; simple broadcast methods will not do. Consider that there are billions of users worldwide and that sizable distances separate them. Under these circumstances, wired telephone service is amazing. Digital methods have helped to extend service to all points of the globe and have improved performance at the same time. Digitizing voice and data have made transmission faster. Digital techniques are used to combine and transmit thousands of conversations simultaneously on a single carrier. Digital switching systems process and route hundreds of thousands of calls per hour. As commercial communication carriers have converted to digital media and techniques, consumer services have expanded, but the costs have not. In the future, all-digital networks promise to add processing power and intelligence to our telephone service.

Digital methods have also enhanced our wireless communications technologies. Digital signaling methods have extended the range of our devices and permitted greater numbers of users over an already crowded bandwidth. The quality and reliability of the service has also improved in the digital domain.

The Internet

The explosive growth of long-distance networks and the creation of the global Internet are direct consequences of the digitization of commercial communication. Computer networks that were once restricted to a local area can now connect to thousands of other networks around the world. Dedicated network lines called backbones carry millions of individual packets of digital data. These packets hop from one network to another until they reach their intended destination. In this manner, you can send and receive electronic mail, transfer files of data and software, or browse through information on a computer system located thousands of miles away. All of this is possible almost instantly and from the convenience of your own desktop.

The World Wide Web

The use of the Internet has literally exploded over the past several years. A major force in this growth has been the World Wide Web (or Web for short) and the availability of user-friendly programs, called Web browsers (Netscape *Navigator* and Microsoft *Internet Explorer* are two of the most popular), for accessing its wealth of multimedia information. The World Wide Web is a confederation of computer systems that adhere to a common set of guidelines for storing and presenting information to users. These guidelines make it completely straightforward for computer users all over the world to publish multimedia information they have created or collected to all other Web users. Web browser programs exploit the Web's commonality to make all information on the Web accessible in an extremely easy-to-use graphical user interface. This ease of use has made the Web a universal success and phenomenon.

Collections of organized information stored and made available to Web users in a single location are often referred to as Web sites. You will shortly learn about the Web site that accompanies this text. The individual computer files that comprise a Web site are called Web pages. You can always scroll to view all the information on a Web page (although it may extend over several screens). You use the mouse to click over connecting links that access one Web page from another. Most Web sites contain several (perhaps many) Web pages connected to each other for easy access.

These examples illustrate the ways in which digital information has improved or supplanted other conventional forms and how such information can be made available worldwide almost instantly. Of course, none of these capabilities would be possible without the technology of the electronic digital computer. How will this technology ultimately change our world and our lives? Will these changes be for the better or the worse? No one knows the complete answers to such questions. What is clear is that life in the 21st century will be inextricably intertwined with a changing communications paradigm, and the new paradigm will exhibit an increasing dependence on and exploitation of computers and computer

networks. Preparation for life in this era will require, even demand, an understanding of the technologies underlying these fundamental changes. This book is intended as a guide to help you achieve this understanding.

Computing and Information Technology

A computer system is not merely a tool but rather itself a medium for representing, storing, manipulating, and communicating different forms of information: text, numbers, graphics, images, sounds, and video. The common denominator for these differing forms of information is that they all can be digitized for use by our computers. This data can be studied, combined, transformed, and transmitted with an apparent ease that belies the true complexities of these tasks. Digitized data and the systems that handle it constitute the digital domain.

We usually think of computers as tools. We use computers to do this and that. One of the goals of this book is to convince you that a computer system is a medium, not just a helper or instrument. A medium is a vehicle or agent for something. For example, air is the medium for sound; writing is a medium for words and thoughts. The computer is a medium for ideas and information. Computers can be used not only to express but communicate these ideas as well. They can store knowledge and facts. But more importantly, computer systems can store and manipulate information in many different forms.

Informational media include text, illustrations, photographs, animation, video, sounds, voice, and music. The modern computer is an all-purpose medium for informational media. Regardless of the media, the computer system represents, stores, and transmits all in its native digital form. That a computer converts text and graphics, for example, to a digital format means that it can process them in similar fashion and at the same time. Multimedia refers to the integration of various forms of information such as text, graphics, sound, and images.

The modern computer system is a multimedia machine; that is, it is capable of integrating two or more conventional forms of informational media in a single electronic document. Because we can express and combine various forms of information using a computer, we can interact, explore, and learn even more from that information. In this way, the computer becomes a vehicle for knowledge rather than just a tool that stores, distributes, and displays information.

This book describes how the computer can be used to create, express, and communicate ideas in various forms. Some of the ideas discussed in this book are new and evolving; others are as old as the advent of electronic digital computers more than fifty years ago. After all, modern computer systems are electronic digital machines; they have always had this capability for combining and transmitting informational media. However, desktop or personal computers have only recently had the power to exploit these capabilities for both multimedia and data communications over networks.

The remarkable advances in the price/performance ratio of computer hardware over the past few years, together with a new generation of computer software, are driving dramatic developments in this innovative computer use. In the early days of computing, it was recognized that the speed of computers was especially useful for processing large amounts of numeric and text information. Today, developments in software and hardware are creating opportunities to exploit the computer's capabilities for representing and processing different, richer forms of information that enhance our intellectual abilities. Thus, the traditional model of employing computation for numbers and text is being replaced by a new paradigm. At the heart of these developments is the emergence of two primary technologies: the ability of modern desktop computer systems to collect, store, retrieve, display, and generally manage information in a variety of media and the possibilities for cooperative work using fully interconnected computers and computer networks.

Computer networks are also playing a dominant role in integrating technology into our lives. Networks connect computers in our offices and labs; they also can link us to other computers across the nation and around the world. Using networks, computer systems can share resources and information. That many forms of information can be exchanged instantaneously over long distances has changed the way we work and play. For example, employees in many corporations and other organizations rely more on electronic mail than conventional mail for communication with coworkers.

Indeed, networks have created a new habitat, commonly called cyberspace. These new opportunities have a profound effect on ways we work and interact with one another. Not only is information more readily available, it is also richer and strikingly more dynamic. In cyberspace, you are immersed in and engaged by information rather than merely possessing it.

Communication technologies have existed for a long time. So, what is special about data communications over computer networks? First, the technology driving data communications offers far greater capacity and speed than any other previous form. For example, we now have the capability to store and send whole libraries of information much more quickly than sending a simple message by ordinary postal service. Because this data is represented digitally, we can combine and communicate various forms of information simultaneously, for example, text, audio, and images.

Connectivity means more than simply people communicating with other people. Computer networks also make it possible for individuals to communicate with other computers over long distances. For instance, from your home computer, you can easily borrow both software and processing power from a computer system far away. You can also ask the distant computer system to supply you with the latest stock market quotes, college basketball scores, or international news. When traveling, you can telephone your computer system at home or office to check for electronic mail or messages.

In the past, computers were isolated and largely incompatible. Today, networks support communication from computer to computer as well. Computer systems can request and receive services from other computers automatically and invisibly to the user. This offers a number of advantages. Borrowing processing from a remote system extends the capabilities of your own computer. It also means that computers of different scale and performance can exchange the results of processing almost seamlessly. Distributing the work of processing among cooperating computer systems is still in its infancy. We can expect that it will have a profound effect on computing in the future. Indeed, the idea of individual or autonomously functioning computer systems will very likely become archaic. Perhaps William Gibson's vision in *Neuromancer* of the worldwide network of cooperating computer systems called the Matrix holds more fact than fancy. (It was Gibson who coined the term "cyberspace" to denote this new dimension.)

Summary

Information refers to knowledge, facts, and meaning. As such, it is an essential ingredient of most human enterprises. Human history is marked by the development of significant information technologies that extend our natural capabilities for representing, using, and exchanging information. Digital information technology is the most recent and distinctive of these technologies. Digital information technology can subsume and merge older technologies in new and interesting ways. The development of the electronic digital computer is central to the emergence of digital information technology.

Today's computer systems are far more than computational and text processing tools. They provide a new communication paradigm for representing and communicating information in a wide variety of media: text, numbers, graphics, images, sounds, and video. All these differing forms of information can be digitized, combined, transformed, and transmitted with relative ease employing worldwide computer networks. This world of digital information is what we have dubbed the digital domain.

The digital domain has had a pervasive and transforming influence on the workplace, the marketplace, our schools, and our homes, redefining the ways in which we think about and use information to communicate with each other. That many forms of information can be exchanged instantaneously over long distances will continue to change the way we work and play. Electronic mail has already become the norm for communication with coworkers in many organizations; the World Wide Web is the information resource of first choice for many people; and a school or workplace without networked computers is becoming hard to imagine.

Questions for Review

1 What is information?

2 How is information important for living things?

3 How does information affect our daily lives, our work and leisure time as well?

4 What is a technology? How do technologies affect individuals and society? Explain.

5 What is information technology? How does digital information technology resemble and differ from other information technologies? Explain.

6 Describe some of the ways in which digital information technology affects how you work.

7 Can you think of ways, in addition to those catalogued in the text, in which information consumers can benefit from digital information technology?

8 Can you think of ways, in addition to those catalogued in the text, in which information providers can exploit digital information technology?

9 What is an informational worker? Give examples.

10 Can you think of ways, in addition to those catalogued in the text, in which informational workers can employ digital information technology?

11 What is a Web site? A Web page?

12 What is a Web browser?