

Part One

Understanding Multimedia

CHAPTER 1

Definitions

CHAPTER 2

Taxonomy of
Multimedia Objects

People retain only 20% of what they see and 30% of what they hear. But they remember 50% of what they see and hear, and as much as 80% of what they see, hear, and do simultaneously.

—Computer Technology Research Corporation

Multimedia is the buzzword of the decade. Like most buzzwords, it has been used in many contexts. You find it on the covers of books, magazines, CD-ROMs, video games, and movies. It is used in advertising shoes, hairstyles, drugs, cars, computers, soft drinks, beer, kitchen floors, vacations, airplanes, televisions, telephones, houses, museums, newspapers, arcades, theme parks, Olympic Games, and shopping malls. Sometimes the term is used to add hype to products that have nothing to do with multimedia. The many uses and abuses of the word *multimedia* have led to confusion over just what multimedia is. For this reason, a book on multimedia literacy must begin by defining it.

Definitions

After completing this chapter, you will be able to:

- Define multimedia, describe why it is effective, and explain how it will be important to life in the twenty-first century
- Demonstrate how multimedia is changing the world through telecommuting, home shopping, electronic publishing, and computer-based education
- Show how fast multimedia is growing in business, industry, homes, online services, and education
- Identify and define the components of a multimedia PC
- Define the Internet and the World Wide Web and understand how they provide access to multimedia resources on a worldwide basis

- To define multimedia properly, one must go beyond stating what it is and put the term in context. In this chapter you will not only get a standard “textbook” definition of multimedia, but also learn why it is important, how fast it is growing, how it is changing the world, and who needs to know about it. The term **multimedia PC** will be defined, along with the nomenclature needed to understand the specifications of a multimedia computer. Then you will learn how the Internet and the World Wide Web are being used to distribute multimedia applications on a worldwide basis.

What Is Multimedia?

Multimedia is the use of a computer to present and combine text, graphics, audio, and video with links and tools that let the user navigate, interact, create, and communicate. As depicted in Figure 1-1, this definition contains four components essential to multimedia. First, there must be a computer to coordinate what you see and hear, and interact with you. Second, there must be links that connect the information. Third, there must be navigational tools that let you traverse the web of connected information. Finally, because multimedia is not a spectator sport, there must be ways for you to gather, process, and communicate your own information and ideas.

If one of these components is missing, you do not have multimedia. For example, if you have no computer to provide interactivity, you have mixed media, not multimedia. If there are no links to provide a sense of structure and dimension, you have a bookshelf, not multimedia. If there are no navigational tools to let you decide the course of action, you have a movie, not multimedia. If you cannot create and contribute your own ideas, you have a television, not multimedia.

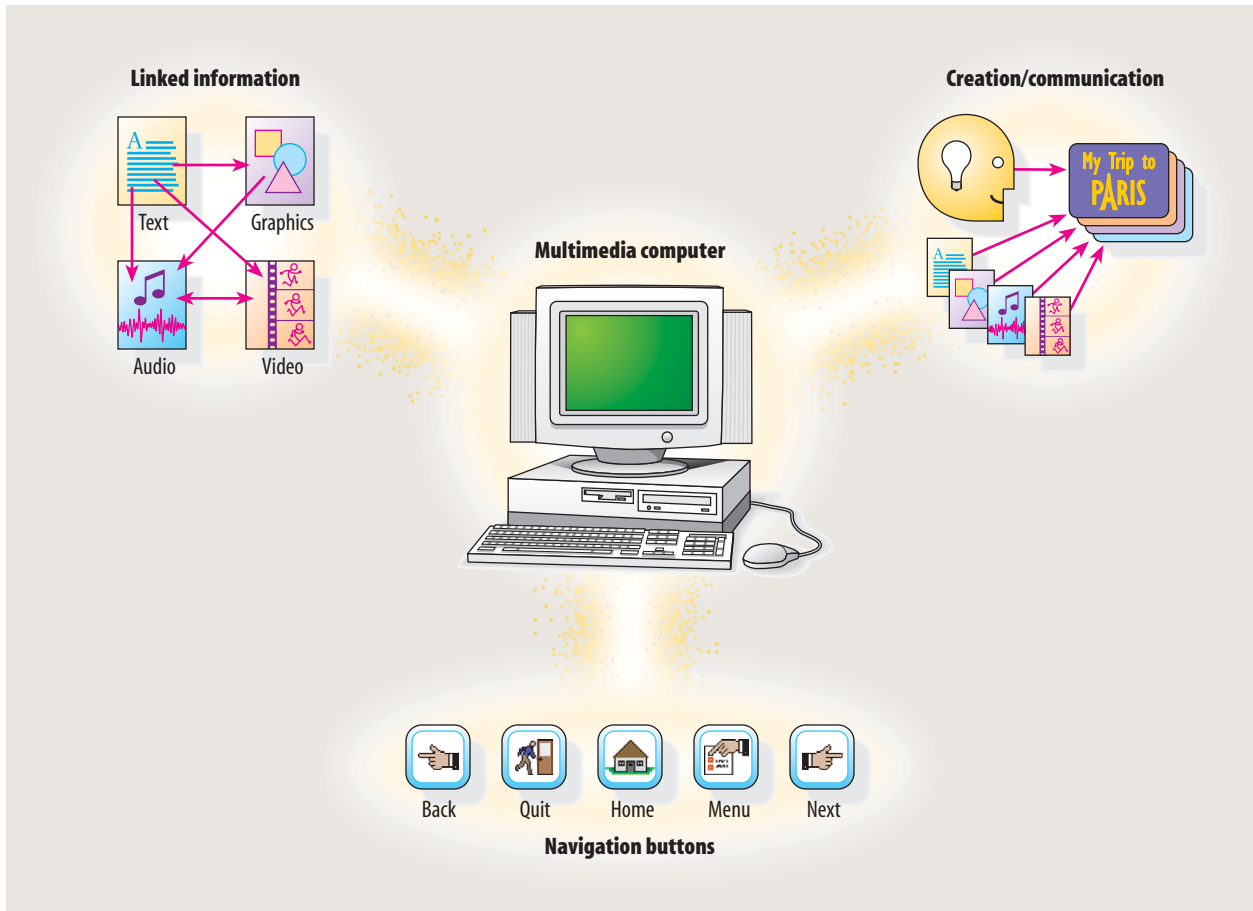


Figure 1-1 Multimedia is the use of a computer to present and combine text, graphics, audio, and video with links and tools that let the user navigate, interact, create, and communicate.

Why Is Multimedia Important?

Multimedia is fast emerging as a basic skill that will be as important to life in the twenty-first century as reading is now. In fact, multimedia is changing the nature of reading itself. Instead of limiting you to the linear presentation of text as printed in books, multimedia makes reading dynamic by giving words an important new dimension. In addition to conveying meaning, words in multimedia serve as triggers that readers can use to expand the text in order to learn more about a topic. This is accomplished not only by providing more text but by bringing it to life with sound, pictures, music, and video.

The more you learn about multimedia, the more books pale by comparison. For example, suppose you read a lengthy document and want to refer back to the page on which a certain idea was mentioned. You check the index, but the topic you want is not listed. Try as you might while paging through the book, you just cannot find what you read earlier. A multimedia document solves this problem by letting you search the full text for key words to find any topic or combination of topics. In fact, a multimedia document can refer not only to information within itself, but also to all the other documents to which it has been linked, and to all the documents to which they have been linked. Multimedia uses links to let you navigate the universe of connected information at the speed of light. Comparing this global network of multimedia to our highway system that lets motorists travel almost anywhere, the U.S. government has named the network the **Information Superhighway**.

Multimedia is highly effective. As research and publishing company Computer Technology Research (CTR) Corporation reports, people retain only 20% of what they see and 30% of what they hear. But they remember 50% of what they see *and* hear, and as much as 80% of what they see, hear, and do *simultaneously*. That is why multimedia provides such a powerful tool for teaching and learning.

Multimedia will help spread the Information Age to millions of people who have not yet used a computer. A Roper survey sponsored by IBM found that more than half of the respondents did not want a computer that required a manual to use it (*Washington Post* 12/27/93, Business: 13). Multimedia provides the computer industry with the key to reaching this untouched market, which will cause computer use to skyrocket.

How Fast Is Multimedia Growing?

As Figures 1-2 through 1-6 illustrate, multimedia is one of the fastest-growing markets in the world today. As the installed base of CD-ROM drives approaches the 200-million mark, DVD (digital video disc) drives have become one of the hottest consumer items. DVD drives can play CDs and also provide access to thousands of broadcast-quality movies with surround sound and up to 26 times more data storage.

Figure 1-2 shows that online subscriptions to the Internet passed the 50-million mark in significantly less time than more traditional forms of mass media reached their audiences. By the end of the twentieth century, nearly two-thirds of U.S. households already had home computers. Although the growth occurs in all market segments, the analyst agency Dataquest reports that first-time buyers are now coming from households in the lower socioeconomic levels, which may indicate that the digital divide between the haves and the have-nots may gradually be narrowing (*San Jose Mercury News* 2/8/99, *Multilit* Web site). By the time you read this, nearly half of American households will be connected to the Internet, as illustrated in Figure 1-3.

Looking at worldwide growth, the online business research firm eMarketer forecasts that the total Internet population will increase to 350 million users by 2003. As Figure 1-4 illustrates, this is a 267% increase from the 95 million people using the Internet at the end of 1998.

Fueling this growth are advances in technology (see Figure 1-6 on page 11) and price wars that have dramatically lowered the cost of multimedia computers. The growing number of consumers has created a larger market for multimedia titles, and new tools

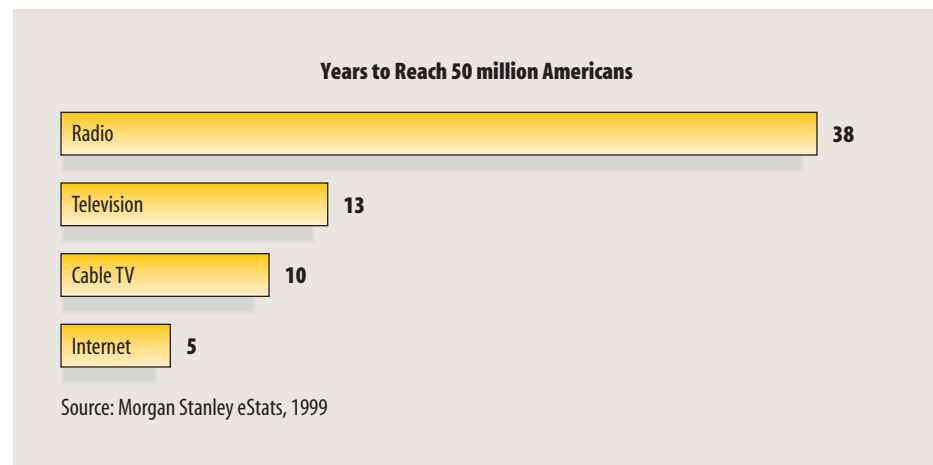


Figure 1-2 How many years it took for different forms of mass media to reach the 50-million mark. Source: Morgan Stanley eStats 12/2/99, *Multilit* Web site.

U.S. Net User Household Growth trends		
Year	Millions of Households	% of Total U.S. Households
1996	6.5	6.6%
1997	14.5	14.5%
1998	24.4	24.2%
1999	28.0	27.6%
2000	32.0	31.4%
2001	35.3	34.4%
2002	44.0	42.7%

Source: Morgan Stanley eStats, 1999

Figure 1-3 The growth of American households with home computers connected to the Internet.
Source: Morgan Stanley eStats 12/2/99, Multilit Web site.

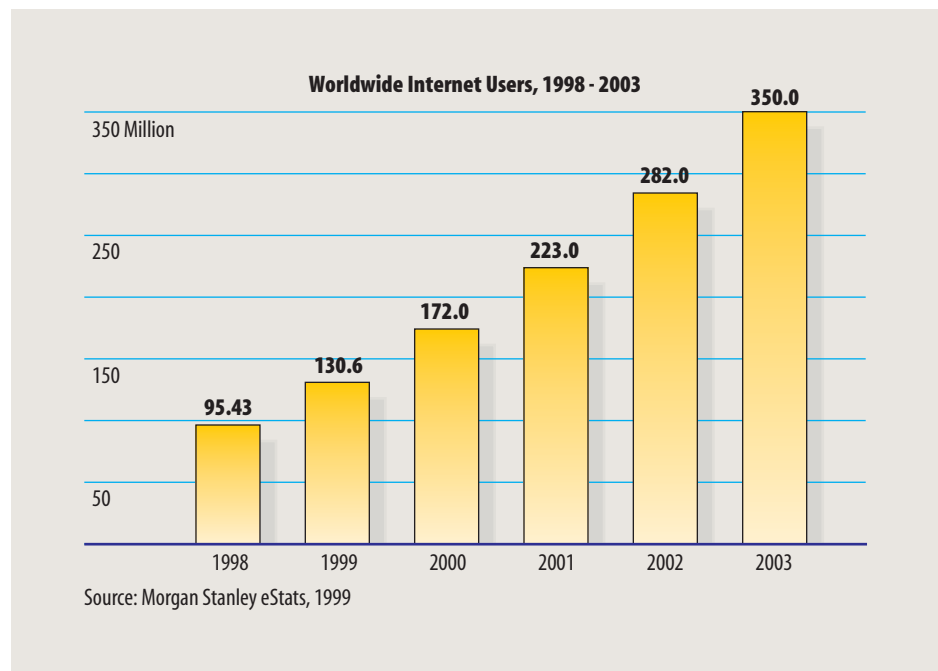


Figure 1-4 Forecasted growth of the Internet population.
Source: Reuters, CNET News.com 7/7/99, Multilit Web site.

are enabling more people to become developers. The second half of this book, for example, is a hands-on tutorial that will enable you to begin creating multimedia applications.

Online multimedia services are booming. By the end of the twentieth century, Cisco Systems estimated that the online infrastructure was generating \$115 billion in revenue annually and accounted for 372,462 high-tech jobs (*The Industry Standard* 6/20/99, Multilit Web site). Because only 27.6% of computer owners currently belong to an Internet service, there is plenty of room for growth. And grow it will! AT&T Broadband & Internet Services already provides cable television entertainment and information

programming services to more than 10 million customers across the country and is actively developing competitive local cable telephone services (AT&T news release 9/2/99, *Multilit* Web site).

Educational use of multimedia is also skyrocketing. According to the Software and Information Industry Association (SIIA), U.S. K-12 schools spent \$4.8 billion on instructional technology in 1998, with PC budgets increasing at a rate of about 20% per year (SIIA 1999, *Multilit* Web site).

For more statistics on the information technology industry, follow the *Multilit* Web site links to Dataquest Interactive. Once you subscribe to Dataquest, you can request up-to-the-minute statistics about trends in multimedia, networking, videoconferencing, and a wide range of personal computer products and services. Dataquest charges a small fee for each chart or graph you download.

How Is Multimedia Changing the World?

Multimedia is redefining the communication system that forms a significant part of the infrastructure of our society. An unprecedented number of mergers among companies jockeying for position in this fast-paced field are combining the telephone, television, and personal computer into a mass market multimedia utility.

Mergers and Alliances

Broadview investment service reports that 374 digital-media deals were made in the first six months of 1999, valued at \$36.5 billion. That was up from 112 mergers valued at \$4.6 billion in the first six months of 1998 (Broadview 7/28/99, *Multilit* Web site). All of these deals were overshadowed, however, by the \$36.75 billion merger of Viacom and CBS, proposed in September 1999, which was the largest media deal to date. As Reuters news service reported, "Viacom's acquisition of CBS has created an Internet powerhouse with interests that span entertainment, sports, finance, and all manner of e-commerce properties" (Reuters, *CNET News.com* 9/7/99, *Multilit* Web site). Follow the *Multilit* Web site link to the Viacom/CBS merger to see an overview of their combined holdings.

When Microsoft teamed up with the NBC network to create MSNBC.COM, the brand power of a TV network eased the transition of TV viewers to become online users, and the online service became a regular part of the way these people use television (*Broadcasting & Cable* 5/6/96: 43). In a similar move, America Online invested \$1.5 billion in Hughes Electronics Corporation, owner of the DirecTV satellite service, so AOL could market DirecTV enhanced with AOL's Internet-on-TV services (*San Jose Mercury News* 6/22/99, *Multilit* Web site). AOL then began the new millennium by announcing the largest media deal to date, namely, the \$182 billion acquisition of Time Warner. The new company, which is called AOL Time Warner, marries the world's biggest online service provider with the largest media conglomerate.

Telecommuting

Multimedia is changing our place of work. According to a Deloitte & Touche report, **telecommuting** (working from home using computers, modems, and fax machines) accounted for 45% of all new jobs from 1987 to 1992 (*Atlanta Constitution* 1/2/94: E2). By the middle of 1998, 15.7 million workers in the United States were telecommuting at least one day per month (Cyber Dialogue, 10/28/98, *Multilit* Web site).

A survey by Work/Family Directions research group found that 20 to 40% of employees would like to telecommute (*Wall Street Journal* 12/14/93: B1). More than half of U.S. businesses permitted telecommuting in 1996, with 1.5 million companies having

telecommuting policies then in place (*USA Today* 6/18/96: E7). The California earthquakes made many new converts to telecommuting, given the significant long-term damage to traffic routes around Los Angeles (*Investor's Business Daily* 1/27/94: 4). In addition to reducing traffic congestion, an Arthur D. Little study points out how telecommuting can cut gas consumption and air pollution. For example, a 10 to 20% reduction in the number of trips in the United States would save 3.5 billion gallons of gas per year (*Atlanta Constitution* 12/2/93: A19). Telecommuting has also had an impact on the clothing industry, causing suit sales to plummet as more people work from home (*St. Petersburg Times* 1/3/94: 19).

Microsoft provides the world with excellent telecommuting software for free. Called *NetMeeting*, it enables real-time voice and data communications over the Internet. Two or more people can thereby share applications, transfer files, view and illustrate a shared whiteboard, and chat with each other. Chapter 42 contains a step-by-step tutorial on using *NetMeeting* to share a PowerPoint application with other users. To download the *NetMeeting* software, follow the *Multilit* Web site link to *NetMeeting*.

Home Shopping

Multimedia is changing how the world shops. Instead of wearing yourself out trekking from store to store, trying to find the size and style you like and then waiting in line to pay for it, teleshopping services let you shop from home. According to a CommerceNet/Nielsen survey, by 1999 the number of online shoppers had increased to 55 million people. Of these, 28 million made purchases online, 9 million bought something online at least once a month, and a million made weekly purchases online (*CommerceNet* 6/17/99, *Multilit* Web site). By 1999, electronic shopping sales had surged to more than \$98 billion annually and are forecast to rise to \$1.2 trillion by 2003 (*eMarketer*, *CNET News.com* 7/7/99, *Multilit* Web site). Figure 1-5 shows how the percentage of online shoppers is expected to grow.

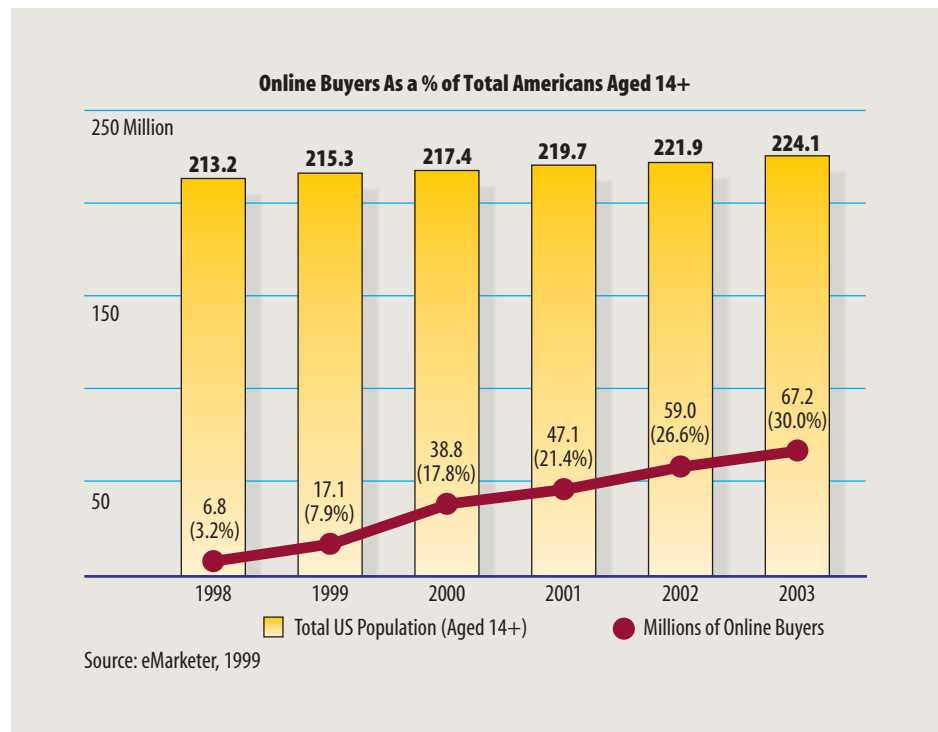


Figure 1-5 Projected growth in the percent of Americans shopping online.

Source: eMarketer, CNET News.com 7/7/99, Multilit Web site.

Business and Advertising

Multimedia is changing the face of business. Online shopping and banking are creating a cashless society by eliminating the need for printed money. American Express, for example, is enabling its cardholders to make deposits, invest in money market funds, purchase certificates of deposit, and pay bills through an online service called American Express Membership B@nking (*Wall Street Journal* 7/23/99.) The Gartner Group predicts that bill-paying over the Internet will become business as usual by 2002, when all banks will offer online bill payment (*USA Today* 8/4/99).

The online brokerage market is poised to lead the growth of the financial services sector with assets projected to grow from \$415 billion in 1998 to \$3 trillion by 2003 (NUA Internet Surveys 9/6/99, *Multilit* Web site). Online brokerages provide a way for the average citizen to purchase stocks online, instead of having to buy them through a traditional stockbroker. Forrester research predicts that buying stocks online will be particularly popular in Europe, with online brokerage accounts predicted to rise from 1.3 million in 2000 to 14 million in 2004. Giga Information Group predicts that worldwide, corporations will save as much as \$1.25 trillion by doing business over the Internet (*Washington Post* 8/4/99).

Advertising is paying for the costs of operating Web services, much like advertising covers the cost of television broadcasts so you can watch TV for free. For example, commercial ads pay for the popular search engine Yahoo at <http://www.yahoo.com>. In 1998, advertisers spent \$1.9 billion advertising on the Internet, exceeding the estimated \$1.6 billion spent on outdoor advertising that same year (*Internet Index* 5/31/99, *Multilit* Web site).

Electronic Publishing

Multimedia is changing how we read newspapers by eliminating the need for the paper and offering all the features of multimedia, including full-text search, graphics, audio, and video. According to the Kelsey Group, more than 2700 newspapers are experimenting with electronic ventures, compared to only 42 in 1989; contributing to the need for these experiments is the fact that half of young people aged 18 to 24 do not read newspapers at all (*US News & World Report* 5/16/94: 60). Table 1-1 lists a few of the newspapers you can read on the Web.

Table 1-1 A Few of the Newspapers on the World Wide Web

Newspaper	Web Address
<i>Chicago Tribune</i>	http://www.chicago.tribune.com
<i>Los Angeles Times</i>	http://www.latimes.com
<i>New York Times</i>	http://www.nytimes.com
<i>San Jose [CA] Mercury News</i>	http://www.sjmercury.com
<i>USA Today</i>	http://www.usatoday.com
<i>Virginian-Pilot</i>	http://www.pilotonline.com
<i>Wall Street Journal</i>	http://interactive.wsj.com
<i>Washington Post</i>	http://www.washingtonpost.com
4,000 other links to newspapers, magazines, broadcasters, and news services	http://www.newslink.org

Teaching and Learning

Electronic publishing also impacts the education industry. Schools are beginning to invest former textbook budgets in multimedia technology, for example, by equipping students with laptop computers to access course materials online (*Electronic-school.com* 6/99, *Multilit* Web site). After studying hundreds of controlled experiments in which computers were used in college and high-school courses, elementary education, and adult high-school equivalency programs, Kulik (1985, 1986, 1991, and 1994) reports overall learning gains averaging more than a letter grade higher (effect size = .32), and significant reductions in the time required for students to learn (averaging 34% in college and 24% in adult education). Chapter 4 surveys some of these applications and analyzes how computers are changing the nature of education.

Mass Media

The Internet is competing with television for people's free time. A survey conducted by the Emerging Technologies Research Group shows Internet users spending an average of 6.6 hours a week on the Net, time previously spent watching TV, listening to the radio, or making long-distance phone calls. The average session was 68 minutes (*Tampa Tribune* 1/12/96: B&F1). A Nielsen study reported similar results, concluding that Internet users spend more time online than TV viewers spend with their VCRs (*Dow Jones News* 10/30/95). The percentage of women using the Internet has increased steadily, from 33% of users in 1996 to 46% in 1999 (*CommerceNet/Nielsen Survey* 6/17/99, *Multilit* Web site).

Who Needs to Know About Multimedia?

Ask yourself a few historical questions:

- Who needed to know how to read books after the printing press was invented?
- Who needed to know how to drive cars after highways got built?
- Who needed to know how to call someone when telephones were invented?

Now ask:

- Who needs to know how to use a multimedia computer to access the Internet?

Anyone who plans to learn, teach, work, play, govern, serve, buy, or sell in the information society needs to know about multimedia. Just imagine the consequences of not knowing about it. For example, suppose you are a journalist who cannot create a hypermedia document and transmit it across a network; how long do you think you will be employable? What about paramedics who cannot upload a picture of a wound and get expert advice on how to treat it? Or architects and designers who cannot use computers to simulate and troubleshoot products before they are built? Or merchandisers who do not know how to advertise products on the network? Or teachers who cannot use multimedia to bring their classrooms to life? Or businesspeople who cannot access corporate data when it is needed to make the right decision? Or governments without the technology needed to detect and deter aggression?

To state the case succinctly: Everyone who plans to function productively in twenty-first-century society needs to know about multimedia.

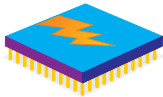
What Is a Multimedia PC?

A **multimedia PC** is a computer that has a CD-ROM or DVD drive and supports 8-bit and 16-bit waveform audio recording and playback, MIDI sound synthesis, and MPEG movie watching, with a central processor fast enough and a RAM large enough to enable you to play and interact with these media in real time, and with a hard disk large enough to store multimedia works that the user can create. In order for you to understand this definition of a multimedia PC, a few terms need to be defined.



RAM and MB

RAM stands for random access memory; it is the main memory at the heart of a computer in which multimedia programs execute. RAM is measured in megabytes (MB). *Mega* means million, and *byte* is the unit of measure for computer memory. A byte can hold a single character, and a megabyte can hold a million characters. Although some programs can run in smaller amounts of RAM, anyone serious about multimedia should have a computer equipped with at least 48 MB of RAM.



Processor and MHz

The **processor** is the brain in your computer where calculations and decisions get made. Processor speed is measured in MHz, which stands for megahertz. *Mega* means million, and *hertz* is one cycle per second.

Intel is the biggest manufacturer of the processors found in multimedia computers. Figure 1-6 shows how the relative power of the various Intel processors is a function of their model number and processor speed. The more powerful the processor, the faster the multimedia computer will respond. For the latest information on Intel processor speed comparisons, follow the *Multilit* Web site link to the Intel iCOMP index.



Hard Drive

A **hard drive** is a magnetic storage device on which computer programs and data are stored. Like RAM, hard drives are measured in megabytes, also called megs, or in gigabytes, also called gigs. A gigabyte is a thousand megabytes. The larger the hard drive, the more programs and data the computer can store. A multimedia PC should have at least 640 megabytes. The hard drive will hold, for example, the multimedia applications that you will create in the tutorial part of this book. If you plan to record digital video onto your hard drive, it needs to be as large as you can afford to make it.



CD-ROM

CD-ROM stands for compact disc—read-only memory. A CD-ROM can store about 680 MB (megabytes) of data. That is enough to hold the text of 200 Bibles. Because compact discs are inexpensive to produce yet provide so much storage, CD-ROM became the medium of choice for publishing multimedia applications in the twentieth century.

The speed of a CD-ROM drive is measured in how many thousands of characters (bytes) it can read per second. In computer spec sheets, the character *K*, which stands for *kilo* (the Greek word for thousand), is used to represent 1000 characters, or 1 kilobyte (KB). The first CD-ROM drives could transfer data at a rate of 150 KB per second. Double-speed CD-ROM drives can transfer data at twice that speed, or 300 KB per second.

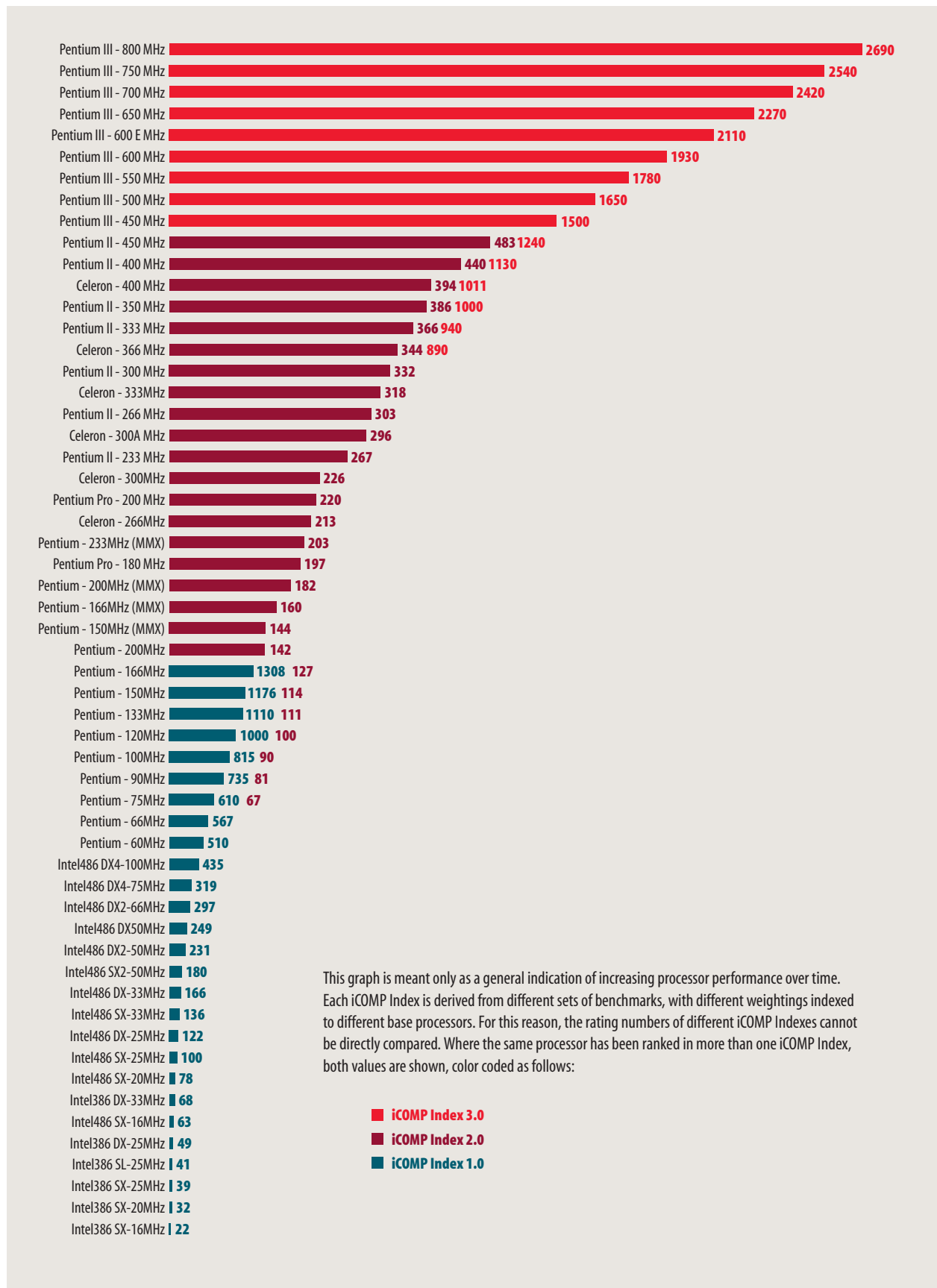


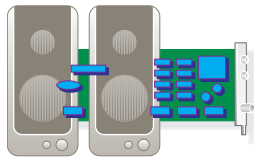
Figure 1-6 Intel's iCOMP index for i386 through Pentium III Processors.

Quadruple-speed drives, also called 4x drives, transfer data at 600 KB per second. Even faster drives are available, with speeds ranging from 17x (2550 KB per second) to 40x (6000 KB per second).



DVD

DVD stands for digital versatile disc. It can hold 4.7 GB (gigabytes) per layer, which is seven times more than a CD can hold. Dual-layer DVDs can hold 8.5 GB on a single side, with 17 GB on a double-sided, dual-layer disc. A DVD has the same diameter (120mm) and thickness (1.2mm) as a compact disc. DVD drives can play back CDs as well as DVDs, so you do not need a CD-ROM drive if your computer has a DVD drive. The most popular feature of a DVD is that it can play back full-length feature films with broadcast-quality video and surround sound.



8-Bit and 16-Bit Sound

The term **bit** stands for binary digit. A bit can have one of two values: 0 or 1. When a multimedia computer records a sound, a stream of bits gets recorded to represent the vibrations in the sound wave. The more bits that are used to sample the wave, the higher the dynamic range of the music you hear.

The earliest multimedia computers had 8-bit sound, which produces a dynamic range of 50dB (decibels). More recent computers also have 16-bit sound, which increases the dynamic range to 98dB. The greater the dynamic range, the more faithfully the volume levels in the music play back.



Synthesizer, Wavetable, and MIDI Playback

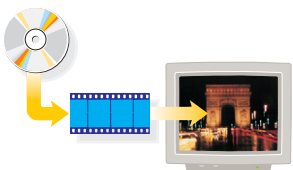
MIDI stands for Musical Instrument Digital Interface. MIDI is the most economical way for multimedia computers to make music, because instead of recording the entire waveform like a digital audio recording does, MIDI encodes only the performance information (such as note on, note off, louder, softer) needed for a synthesizer to play the music.

MIDI setups often involve external equipment, such as music keyboards and sound modules that play the music. This external equipment is costly, however. To let you play back MIDI without needing external devices, multimedia computers contain a MIDI synthesizer driver that can play MIDI songs through your computer's waveform audio board.

The synthesizer driver will rarely sound as good as the external equipment would, however. Enter the wavetable, which is a list of numbers that describe the desired waveshape of a sound. Every sound has a characteristic waveshape that determines the timbre or kind of sound you hear. You will learn more about waveshapes in Chapter 2. The wavetable helps MIDI do a better job of creating waveshapes that produce the desired sounds.

MPEG

MPEG stands for Motion Picture Experts Group. MPEG is the format that is emerging as the new digital video standard for the United States and most of the world. MPEG-1 is the noninterlaced version of MPEG designed for playback from ordinary CD-ROM players. MPEG-2 is the broadcast quality version used on DVD and satellite TV such as DirecTV. You will learn about other versions of MPEG in Chapter 15.



What Is the Internet?

The **Internet** is a worldwide connection of more than 72 million computers that use the Internet Protocol (IP) to communicate. The Internet Protocol was invented for the U.S. Department of Defense Advanced Research Projects Agency (ARPA). The goal was to create a network that would continue to function if a bomb destroyed one or more of the network's nodes; information would get rerouted automatically so it could still reach its address. As a result of this bomb-proof design, any user on the Internet can communicate with any other user, regardless of their location.

Figure 1-7 illustrates the web that is formed by the interconnections of computers on the Internet in the United States. More than 190 countries and territories around the world are similarly connected to the Internet, forming a worldwide telecommunications network.

Every computer on the Internet has a unique IP address. An IP address consists of four numbers separated by periods. The numbers range from 0 to 255, so that the smallest possible address is 0.0.0.0 and the largest is 255.255.255.255. The number of IP addresses this scheme allows is 256^4 , which is 4,294,967,296. This provides room for adding more computers as the network grows.

IP addresses can be hard to remember. For example, the Web server at the Library of Congress has the IP address 140.147.248.7. The White House is at 198.137.241.30. The Smithsonian is 160.111.7.240. If you had to remember numbers like these, the Internet would not be very user-friendly.

To make IP addresses easier for human beings to remember, a domain name system (DNS) was invented to permit the use of alphabetic characters instead of numbers. For example, instead of having to remember that the Library of Congress is at 140.147.248.7

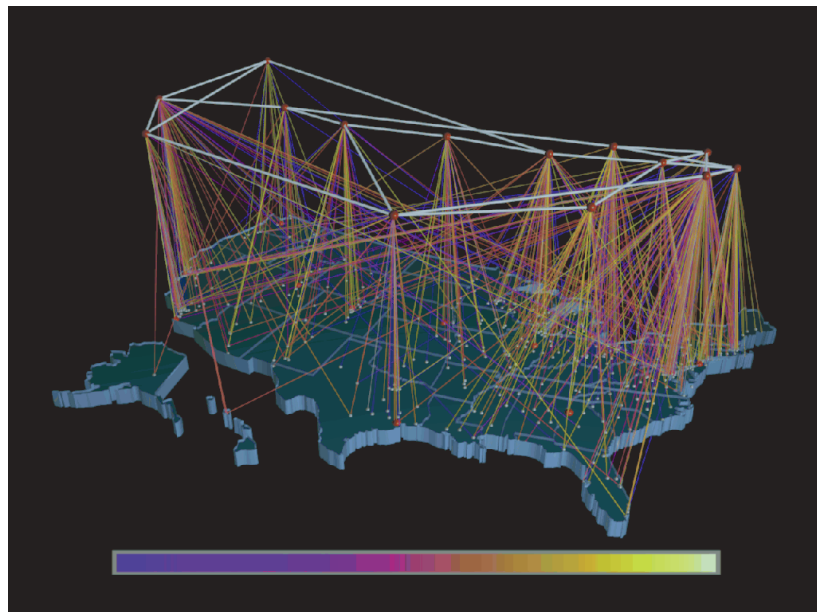


Figure 1-7 This image is a visualization study of inbound traffic measured in billions of bytes on the NSFNET T1 backbone for September 1991. The traffic volume range is depicted from purple (0 bytes) to white (100 billion bytes). The NSFNET is one of the most important parts of the Internet in the United States.

Source: Rendered by Donna Cox and Robert Patterson, National Center for Supercomputing Applications/University of Illinois. The data was collected by Merit Network, Inc.

you can use its domain name `www.loc.gov`. The White House is `www.whitehouse.gov`, and the Smithsonian is `www.si.edu`. Domain names have the format:

hostname.subdomain.top-level-domain

In the United States, top-level domains normally consist of one of the following:

.edu	educational
.com	commercial
.gov	government
.mil	military
.net	network support centers
.org	other organizations

In the rest of the world, top-level domains are usually country codes, such as *fr* for France. The subdomain refers to the network to which a computer is connected, and the host name refers to the computer itself. For example, in the domain name `www.louvre.fr`, which is the World Wide Web server at the famous Louvre museum in Paris, the top-level domain *fr* indicates that the server is located in France, the subdomain *louvre* tells you that the server is on the Louvre's network, and the host name *www* identifies this computer as the Louvre's World Wide Web server.

The International Ad Hoc Committee (IAHC) has proposed adding seven new top-level domain names. The new names are *.firm*, *.store*, *.web*, *.arts*, *.rec*, *.info*, and *.nom*. For more information about the new names and the status of this proposal, follow the *Multilit* Web site links to the *Generic Top Level Domain Memorandum of Understanding*.

What Is the World Wide Web?

The **World Wide Web (WWW)** is a networked hypertext system that allows documents to be shared over the Internet. Developed at the European Particle Physics Center (CERN) in Geneva, Switzerland, the Web's original purpose was to let researchers all over the world collaborate on the same documents without traveling.

Hypertext is a word coined by Ted Nelson (1965). It refers to text that has been linked. When you view a hypertext and click a word that has been linked, your computer launches the object of that link. The links give the text an added dimension, which is why it is called *hyper*.

When the Web started, it was purely text-based. In 1993, the National Center for Supercomputer Applications (NCSA) released Mosaic, a graphical user interface that made the Web extremely easy to use. In addition to text, Mosaic allowed Web pages to contain pictures, with links to audio and video as well. This led to the Web becoming the most popular service on the Internet.

In 1994, Netscape Communications Corporation was started by some of Mosaic's developers, and over the next few years, a program called Netscape Navigator became a very popular Web browser. Microsoft also created a Web browser called the Microsoft Internet Explorer, which rivals Netscape Navigator. The popularity of Microsoft Internet Explorer and Netscape Navigator diminished the need for continued work on Mosaic, and in 1997, the NCSA quietly discontinued work on it, opting instead to work on other advanced Internet technologies.

In the July 1996 issue of *Technology Review* is a fascinating interview with Tim Berners-Lee, the person credited with inventing the World Wide Web. You can find the interview online by following the *Multilit* Web site links to "The Web Maestro: An Interview with Tim Berners-Lee."

e x e r c i s e s

1. Give examples of how multimedia has affected (a) the nation as a whole, (b) your local community, and (c) your personal life.
2. In your chosen career or profession, would telecommuting be appropriate? How would it help or hinder your work?
3. This chapter described how multimedia is changing the world through mergers and alliances, telecommuting, home shopping, electronic publishing, and computer-based learning. How else do you see multimedia changing the world?
4. Compare the advantages and disadvantages of online shopping as you see them. What impact does online shopping have on traditional stores and shopping malls?
5. Think of an example showing how a computer helped you learn something. What was the subject matter? What role did the computer play? Did you learn better because of the computer? Why or why not?
6. Of all the different kinds of occupations you can think of, which ones need multimedia the most? The least? What is your chosen occupation? Why will you need to know about multimedia to do well in this line of work?
7. Find out the domain name of the computer network at your school or place of work. If you have an e-mail address on that network, the domain name will be the part of your e-mail address after the @ sign. For example, if your e-mail address is santa.claus@toymakers.northpole.com, the domain name is toymakers.northpole.com.