Terry Ann Felke-Morris

Basics of Web Design

HTML5 & CSS

SIXTH EDITION

Basics of

Web Design

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Sixth Edition

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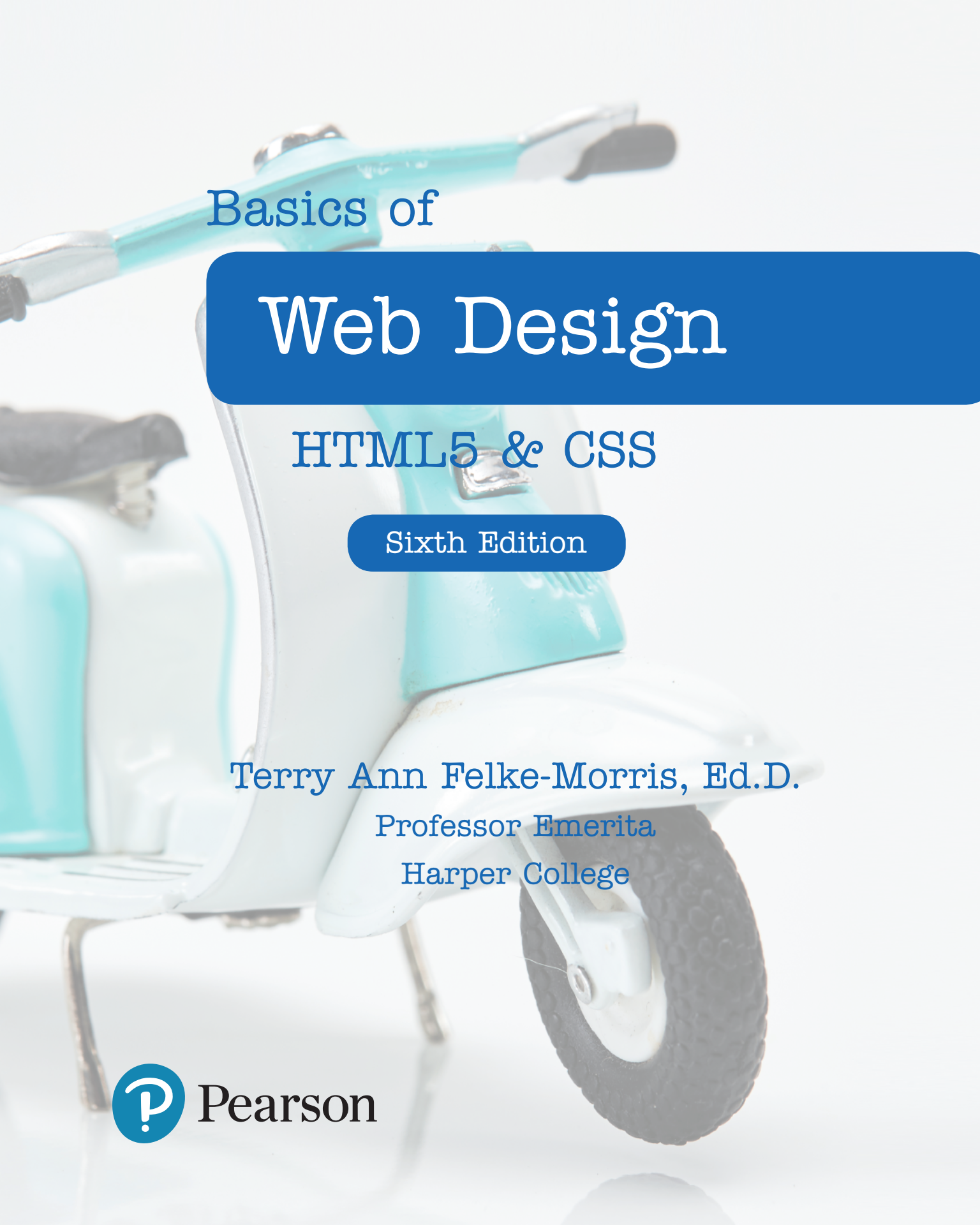

Basics of Web Design

HTML5 & CSS

Sixth Edition

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Pearson

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Preface

Basics of Web Design: HTML5 & CSS is intended for use in a beginning web design or web development course. Topics are introduced in two-page sections that focus on key points and often include a hands-on practice exercise. The text covers the basics that web designers need to develop their skills:

- Introductory Internet and World Wide Web concepts
- Creating web pages with HTML5
- Configuring text, color, and page layout with Cascading Style Sheets
- Configuring images and multimedia on web pages
- Exploring CSS Flexbox and CSS Grid layout systems
- Web design best practices
- Creating responsive web pages that display well on both desktop and mobile devices
- Accessibility, usability, and search engine optimization considerations
- Obtaining a domain name and a web host
- Publishing to the Web

Student files include solutions to the Hands-On Practice exercises, starter files for the Hands-On Practice exercises, and the starter files for the Case Study. The eText offers student file downloads by chapter (where used) wiithin each chapter introduction. Student files are also available for download from the companion website for this book at www.pearson.com/felke-morris.

Building on this textbook's successful fifth edition, the sixth edition features:

- Additional Hands-On Practice exercises
- Updated code samples, case studies, and web resources
- Updates for HTML5 elements and attributes
- Expanded treatment of page layout design and responsive web design techniques
- Expanded treatment of CSS Flexible Layout Module (Flexbox) and CSS Grid Layout systems
- Expanded coverage of responsive image techniques including lazy loading
- Updated reference sections for HTML5 and CSS

Features of the Text

Design for Today and Tomorrow. The textbook prepares students to design web pages that work today in addition to being ready to take advantage of new HTML5 and CSS coding techniques of the future.

Well-Rounded Selection of Topics. This text includes both "hard" skills such as HTML5 and Cascading Style Sheets (Chapters 1–2 and 4–11) and "soft" skills such as web design

(Chapter 3) and publishing to the Web (Chapter 12). This well-rounded foundation will help students as they pursue careers as web professionals. Students and instructors will find classes more interesting because they can discuss, integrate, and apply both hard and soft skills as students create web pages and websites. The topics in each chapter are typically introduced on concise two-page sections that are intended to provide quick overviews and timely practice with the topic.

Two-Page Topic Sections. Most topics are introduced in a concise, two-page section. Many sections also include immediate hands-on practice of the new skill or concept. This approach is intended to appeal to your busy students—especially the millennial multitaskers—who need to drill down to the important concepts right away.

Hands-On Practice. Web design is a skill, and skills are best learned by hands-on practice. This text emphasizes hands-on practice through practice exercises within the chapters, end-of-chapter exercises, and the development of a website through ongoing real-world case studies. This variety provides instructors with a choice of assignments for a particular course or semester.

Website Case Study. There are case studies that continue throughout most of the text (beginning at Chapter 2). The case studies serve to reinforce skills discussed in each chapter. Sample solutions to the case study exercises are available on the Instructor Resource Center available through https://pearsonhighered.com/felke.

Focus on Web Design. Every chapter offers an additional activity that explores web design topics related to the chapter. These activities can be used to reinforce, extend, and enhance the course topics.

FAQs. In her web design courses, the author is frequently asked similar questions by students. They are included in the book and are marked with the identifying FAQ icon.

Focus on Accessibility. Developing accessible websites is more important than ever, and this text is infused with accessibility techniques throughout. The special icon shown here makes accessibility information easy to find.

Focus on Ethics. Ethical issues related to web development are highlighted throughout the text with the special ethics icon shown here.

Quick Tips. Quick tips, which provide useful background information, or help with productivity, are indicated with this Quick Tip icon.

Explore Further. The special icon identifies enrichment topics along with web resources useful for delving deeper into a concept introduced in book.

Reference Materials. The appendices offer reference material, including an HTML5 reference, a Cascading Style Sheets reference, a WCAG 2.1 Quick Reference, an overview of ARIA Landmark Roles and a Web Safe Color Palette.

VideoNotes. VideoNotes are Pearson's visual tool designed for teaching students key programming concepts and techniques. These short step-by-step videos demonstrate how to solve problems from design through coding. VideoNotes allow for self-placed instruction with easy navigation including the ability to select, play, rewind, fast-forward,

and stop within each VideoNote exercise. Margin icons in your textbook let you know when a VideoNote video is available for a particular concept or hands-on practice.

Supplemental Materials

Student Resources. Student resources provide both reinforcement and practice of new concepts and skills include:

- VideoNotes
- Student Files containing the following:
  - Hands-On Practice starter files
  - Hands-On Practice solutions
  - Case Study starter files

Author's Website. In addition to the publisher's companion website for this book, the author maintains a website at https://www.webdevbasics.net. This website contains a page for each chapter with additional resources and updates. This website is not supported by the publisher.

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Very special thanks go to the people at Pearson, including Tracy Johnson, Carole Snyder, Scott Disanno, and Erin Sullivan.

Most of all, I would like to thank my family for their patience and encouragement. My wonderful husband, Greg Morris, has been a constant source of love, understanding, support, and encouragement. Thank you, Greg! A big shout-out to my children, James and Karen, who grew up thinking that everyone's Mom had their own website. Thank you both for your understanding, patience, and timely suggestions. Finally, a very special dedication to the memory of my father who will be greatly missed.

About the Author

Dr. Terry Ann Felke-Morris is a Professor Emerita at Harper College in Palatine, Illinois. She holds a Doctor of Education degree, a Master of Science degree in information systems, and numerous certifications, including Adobe Certified Dreamweaver 8 Developer, WOW Certified Associate Webmaster, Microsoft Certified Professional, Master CIW Designer, and CIW Certified Instructor.

Dr. Felke-Morris received the Blackboard Greenhouse Exemplary Online Course Award in 2006 for use of Internet technology in the academic environment. She is the recipient of two international awards: the Instructional Technology Council's Outstanding e-Learning Faculty Award for Excellence and the MERLOT Award for Exemplary Online Learning Resources—MERLOT Business Classics.

With more than 25 years of information technology experience in business and industry, Dr. Felke-Morris published her first website in 1996 and has been working with the Web ever since. A long-time promoter of web standards, she was a member of the Web Standards Project Education Task Force. Dr. Felke-Morris is the author of the popular textbook *Web Development and Design Foundations with HTML5*, currently in its tenth edition. She was instrumental in developing the Web Development degree and certificate programs at Harper College. For more information about Dr. Terry Ann Felke-Morris, visit https://terrymorris.net.

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VideoNote

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CHAPTER 1

Internet and Web Basics

The Internet and the Web are parts of our daily lives. How did they begin? What networking protocols and programming languages work behind the scenes to display a web page? This chapter provides an introduction to some of these topics and is a foundation for the information that web developers need to know. This chapter also gets you started with your very first web page. You'll be introduced to Hypertext Markup Language (HTML), the language used to create web pages.

You'll learn how to...

- Describe the evolution of the Internet and the Web
- Explain the need for web standards
- Describe universal design
- Identify benefits of accessible web design
- Identify reliable resources of information on the Web
- Identify ethical uses of the Web
- Describe the purpose of web browsers and web servers
- Identify Internet protocols
- Define URIs and domain names
- Describe HTML, XHTML, and HTML5
- Create your first web page
- Use the body, head, title, and meta elements
- Name, save, and test a web page

The Internet and the Web

The Internet

The **Internet**, the interconnected network of computer networks, seems to be everywhere today. You can't watch television or listen to the radio without being urged to visit a website. Even newspapers and magazines have their place on the Internet. It is possible that you may be reading an electronic copy of this book that you downloaded over the Internet. With the increased use of mobile devices, such as tablets and smartphones, being connected to the Internet has become part of our daily lives.

The Birth of the Internet

The Internet began as a network to connect computers at research facilities and universities. Messages in this network would travel to their destinations by multiple routes or paths, allowing the network to function even if parts of it were broken or destroyed. The message would be rerouted through a functioning portion of the network while traveling to its destination. This network was developed by the Advanced Research Projects Agency (ARPA)—and the ARPAnet was born. Four computers (located at University of California, Los Angeles; Stanford Research Institute; University of California, Santa Barbara; and the University of Utah) were connected by the end of 1969.

Growth of the Internet

As time went on, other networks, such as the National Science Foundation's NSFnet, were created and connected with the ARPAnet. Use of this interconnected network, or Internet, was originally limited to government, research, and educational purposes. The ban on commercial use of the Internet was lifted in 1991.

The growth of the Internet continues—Internet World Stats[1] reported that over 4.8 billion users, about 62% of the world's population, were using the Internet by 2020.

When the restriction on commercial use of the Internet was lifted, the stage was set for future electronic commerce. However, while businesses were no longer banned, the Internet was still text based and not easy to use. The further developments addressed this issue.

The Birth of the Web

VideoNote
Evolution of the Web

While working at CERN, a research facility in Switzerland, **Tim Berners-Lee** envisioned a means of communication for scientists by which they could easily "hyperlink" to another research paper or article and immediately view it. For this purpose, Berners-Lee created the World Wide Web. In 1991, Berners-Lee posted the code in a newsgroup and made it freely available. This version of the World Wide Web used **Hypertext Transfer Protocol** (**HTTP**) to communicate between the client computer and the web server, and it was text based, employing **Hypertext Markup Language** (**HTML**) to format the documents.

The First Graphical Browser

In 1993, Mosaic, the first graphical web browser, became available. Marc Andreessen and graduate students working at the National Center for Supercomputing Applications (NCSA) at the University of Illinois Urbana–Champaign developed Mosaic. Some individuals in this group later created another well-known web browser, Netscape Navigator, which is an ancestor of today's Mozilla Firefox.

Convergence of Technologies

By the early 1990s, personal computers with easy-to-use graphical operating systems (such as Microsoft's Windows, IBM's OS/2, and Apple's Macintosh OS) were increasingly available and affordable. Online service providers such as CompuServe, AOL, and Prodigy offered low-cost connections to the Internet. Figure 1.1 depicts this convergence of available computer hardware, easy-to-use operating systems, low-cost Internet connectivity, the HTTP protocol and HTML language, and a graphical browser that made information on the Internet much easier to access. The **World Wide Web**—the graphical user interface providing access to information stored on web servers connected to the Internet—had arrived!

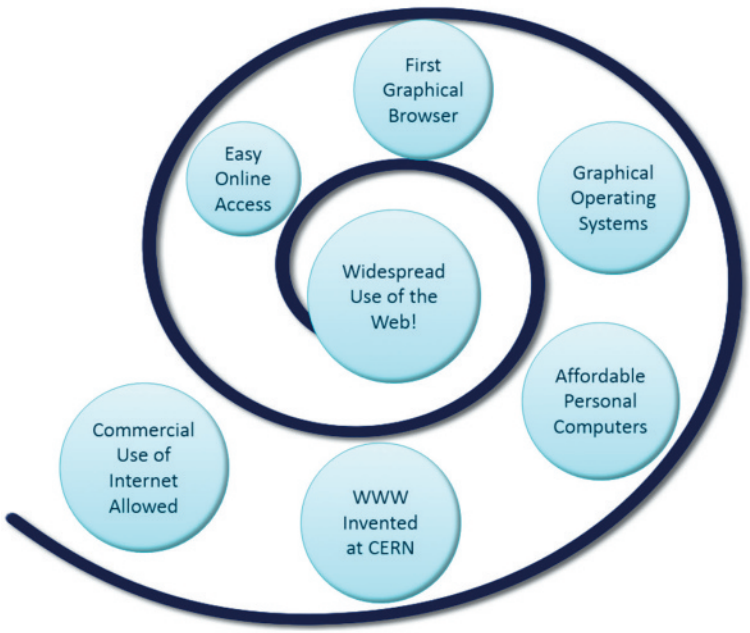

FIGURE 1.1 *Convergence of technologies.*

Web Standards and Accessibility

You are probably aware that no single person or group runs the World Wide Web. However, the **World Wide Web Consortium**, commonly referred to as the **W3C**, takes a proactive role in developing recommendations and prototype technologies related to the Web.[2] Topics that the W3C addresses include web architecture, standards for web design, and accessibility. In an effort to standardize web technologies, the W3C produces guidelines called recommendations.

W3C Recommendations

The W3C Recommendations are created in working groups with input from many major corporations involved in building web technologies. These recommendations are not rules; they are guidelines. Major software companies that build web browsers do not always follow the W3C Recommendations. This makes life challenging for web developers because not all web browsers will display a web page in exactly the same way. The good news is that there is a trend toward conforming to the W3C Recommendations in new versions of major web browsers. You'll follow W3C Recommendations as you code web pages in this book. Following the W3C Recommendations is the first step toward creating a website that is accessible.

Web Standards and Accessibility

The Web Accessibility Initiative, referred to as the WAI, is a major area of work by the W3C.[3] The Web can present barriers to individuals with visual, auditory, physical, and neurological disabilities. An **accessible website** provides accommodations that help individuals overcome these barriers. The WAI has developed the **Web Content Accessibility Guidelines** (**WCAG**) for web content developers, web authoring tool developers, and web browser developers to facilitate use of the Web by those with special needs.[4] The most recent version of WCAG is WCAG 2.1, which extends WCAG 2.0 and introduces additional success criteria including requirements for increased support of mobile device accessibility, low vision accessibility, and cognitive and learning disability accessibility.

Accessibility and the Law

The **Americans with Disabilities Act** (**ADA**) of 1990 is a federal civil rights law that prohibits discrimination against people with disabilities. The ADA requires that business, federal, and state services are accessible to individuals with disabilities.

Section 508 of the Federal Rehabilitation Act was amended in 1998 to require that U.S. government agencies give individuals with disabilities access to information technology that is comparable to the access available to others. This law requires developers creating information technology (including web pages) for use by the federal government to provide for accessibility. The GSA Government-wide IT Accessibility Initiative provides accessibility requirement resources for information technology developers.[5] As the Web and Internet technologies developed, it became necessary to revise the original Section 508 requirements. In 2017, an update to Section 508 Standards became official which requires meeting the requirements of WCAG 2.0 Level A & AA Success Criteria. This textbook focuses on WCAG 2.0 and 2.1 guidelines to provide for accessibility.

In recent years, state governments have also begun to encourage and promote web accessibility. The Illinois Information Technology Accessibility Act (IITAA) guidelines are an example of this trend.[6]

Putting It All Together: Universal Design for the Web

Universal design is a "strategy for making products, environments, operational systems, and services welcoming and usable to the most diverse range of people possible".[7] Examples of universal design are all around us. The cutouts in sidewalk curbs providing for wheelchair accessibility also benefit a person pushing a stroller or riding a Segway Personal Transporter (Figure 1.2). Doors that open automatically improve accessibility and also benefit people carrying packages. A ramp is useful for a person dragging a rolling backpack or carry-on bag.

FIGURE 1.2 *A smooth ride is a benefit of universal design.*

Awareness of universal design by web developers has been steadily increasing. Forward-thinking web developers design with accessibility in mind because it is the right thing to do. Providing access for visitors with visual, auditory, and other challenges should be an integral part of web design rather than an afterthought.

A person with visual difficulties may not be able to use graphical navigation buttons and may use a screen reader device to provide an audible description of the web page. By making a few simple changes, such as providing text descriptions for the images and perhaps providing a text navigation area at the bottom of the page, web developers can make the page accessible. Often, providing for accessibility increases the usability of the website for all visitors.

Accessible websites with alternate text for images, headings used in an organized manner, and captions or transcriptions for multimedia are more easily used not only by visitors with disabilities but also by visitors using a mobile browser. Finally, accessible websites may be more thoroughly indexed by search engines, which can be helpful in bringing new visitors to a site. As this book introduces web development and design techniques, corresponding web accessibility and usability issues are discussed.

Web Browsers and Web Servers

Network Overview

A **network** consists of two or more computers connected for the purpose of communicating and sharing resources. A diagram of a small network is shown in Figure 1.3. Common components of a network include the following:

- Server computer(s)
- Client computer(s)
- Shared devices such as printers
- Networking devices (routers, hubs, and switches) and the media that connect them

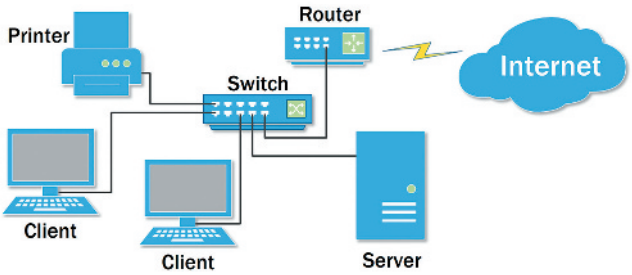

FIGURE 1.3 *Common components of a network.*

The **clients** are the computer workstations used by individuals, such as a PC on a desk. The **server** receives requests from clients for resources, such as a file. Computers used as servers are usually kept in a protected, secure area and are only accessed by network administrators. Networking devices such as hubs and switches provide network connections for computers, and routers direct information from one network to another. The **media** connecting the clients, servers, peripherals, and networking devices may consist of copper cables, fiber optic cables, or wireless technologies.

The Client/Server Model

The term **client/server** dates from the 1980s and refers to computers joined by a network. Client/server can also describe a relationship between two computer programs—the client and the server. The client requests some type of service (such as a file or database access) from the server. The server fulfills the request and transmits the results to the client over a network. While both the client and the server programs can reside on the same computer, typically they run on different computers (Figure 1.4). It is common for a server to handle requests from multiple clients.

The Internet is a great example of client/server architecture at work. Consider the following scenario: A person is at a computer using a web browser client to access the Internet. The person uses the web browser to visit a website, say http://www.google.com. The server is the web server program running on the computer with an IP address that corresponds to google.com. The web server is contacted, it locates the web page and related resources that

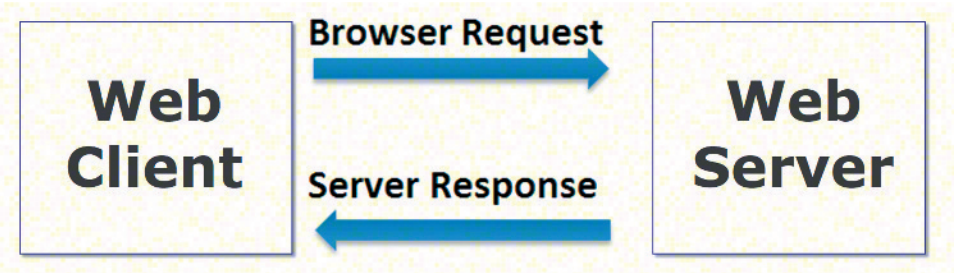

FIGURE 1.4 *Web client and web server.*

were requested, and it responds by sending them. Here's how to distinguish between web clients and web servers:

Web Client

- Connected to the Internet when needed
- Usually runs web browser (client) software such as Edge or Firefox
- Uses HTTP
- Requests web page from a web server
- Receives web page and associated files from a web server

Web Server

- Continually connected to the Internet
- Runs web server software (such as Apache or Microsoft Internet Information Server)
- Uses HTTP
- Receives a request for the web page
- Responds to the request and transmits the status code, web page, and associated files

When clients and servers exchange files, they often need to indicate the type of file that is being transferred; this is done through the use of a **Multi-Purpose Internet Mail Extensions (MIME) type**, which is a standard for the exchange of multimedia documents among different computer systems. MIME was initially intended to extend the original Internet e-mail protocol, but it is also used by HTTP. MIME provides for the exchange of seven different media types on the Internet: audio, video, image, application, message, multipart, and text. MIME also uses subtypes to further describe the data. The MIME type of a web page is text/html. MIME types of gif and jpeg images are image/gif and image/jpeg, respectively.

A web server determines the MIME type of a file before it is transmitted to the web browser. The MIME type is sent along with the document. The web browser uses the MIME type to determine how to display the document.

How does information get transferred from the web server to the web browser? Clients (such as web browsers) and servers (such as web servers) exchange information through the use of communication protocols such as HTTP, TCP, and IP, which are introduced in the next section.

Internet Protocols

Protocols are rules that describe how clients and servers communicate with each other over a network. There is no single protocol that makes the Internet and the Web work—a number of protocols with specific functions are needed.

E-Mail Protocols

Most of us take e-mail for granted, but there are two servers involved in its smooth functioning—an incoming mail server and an outgoing mail server. When you send e-mail to others, **Simple Mail Transfer Protocol** (**SMTP**) is used. When you receive e-mail, **Post Office Protocol** (POP; currently **POP3**) and **Internet Message Access Protocol** (**IMAP**) can be used.

Hypertext Transfer Protocol

Hypertext Transfer Protocol (**HTTP**) is a set of rules for exchanging files such as text, graphic images, sound, video, and other multimedia files on the Web. Web browsers and web servers usually use this protocol. When the user of a web browser requests a file by typing a website address or clicking a hyperlink, the browser builds an HTTP request and sends it to the server. The web server in the destination machine receives the request, does any necessary processing, and responds with the requested file and any associated media files.

Hypertext Transfer Protocol Secure (HTTPS)

Hypertext Transfer Protocol Secure (**HTTPS**) combines HTTP with a security and encryption protocol. Using HTTPS provides a more secure transaction because the information passed between the browser and the web server is encrypted. See Chapter 12 for more information on HTTPS.

File Transfer Protocol

File Transfer Protocol (**FTP**) is a set of rules that allows files to be exchanged between computers on the Internet. Unlike HTTP, which is used by web browsers to request web pages and their associated files in order to display a web page, FTP is used simply to move files from one computer to another. Web developers commonly use FTP to transfer web page files from their computers to web servers.

Transmission Control Protocol/Internet Protocol

Transmission Control Protocol/Internet Protocol (**TCP/IP**) has been adopted as the official communication protocol of the Internet. TCP and IP have different functions that work together to ensure reliable communication over the Internet.

TCP. The purpose of TCP is to ensure the integrity of network communication. TCP starts by breaking files and messages into individual units called **packets**. These packets (see Figure 1.5) contain information such as the destination, source, sequence number, and checksum values used to verify the integrity of the data.

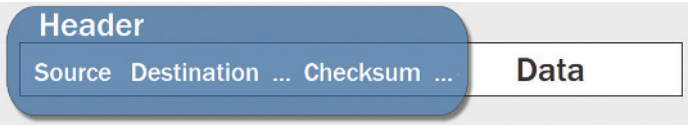

FIGURE 1.5 *TCP packet.*

TCP is used together with IP to transmit files efficiently over the Internet. IP takes over after TCP creates the packets, using IP addressing to send each packet over the Internet using the best path at the particular time. When the destination address is reached, TCP verifies the integrity of each packet using the checksum, requests resend if a packet is damaged, and reassembles the file or message from the multiple packets.

IP. Working in harmony with TCP, IP is a set of rules that controls how data are sent between computers on the Internet. IP routes a packet to the correct destination address. Once sent, the packet gets successively forwarded to the next closest router (a hardware device designed to move network traffic) until it reaches its destination.

IP Addresses

Each device connected to the Internet has a unique numeric **IP address**. These addresses consist of a set of four groups of numbers called octets. The current widely used version of IP, **IPv4**, uses 32-bit (binary digit) addressing. This results in a decimal number in the format of xxx.xxx.xxx.xxx, where each xxx is a value from 0 to 255. Theoretically, this system allows for at most 4 billion possible IP addresses (although many potential addresses are reserved for special uses). However, even this many addresses will not be enough to meet the needs of all of the devices expected to be connected to the Internet in upcoming years.

IPv6, Internet Protocol Version 6, intended to replace IPv4, was designed as an evolutionary set of improvements and is backwardly compatible with IPv4. Service providers and Internet users can update to IPv6 independently without having to coordinate with each other. IPv6 provides for more Internet addresses because the IP address is lengthened from 32 bits to 128 bits. This means that there are potentially 2^{128} unique IP addresses possible, or 340, 282, 366, 920, 938, 463, 463, 347, 607, 431, 768, 211, 456.

The IP address of a device may correspond to a domain name. The **Domain Name System** (**DNS**) associates these IP addresses with the text-based URLs and domain names you type into a web browser address box (more on this later). For example, at the time this was written an IP address for Google was 216.58.194.46.

You can enter this number in the address text box in a web browser (as shown in Figure 1.6), press Enter, and the Google home page will be displayed. Of course, it's much easier to type "google.com," which is why domain names such as google.com were created in the first place! Since long strings of numbers are difficult for humans to remember, the DNS was introduced as a way to associate text-based names with numeric IP addresses.

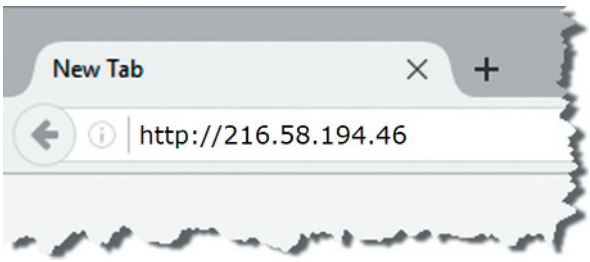

FIGURE 1.6 *Entering an IP address in a web browser.*