Instructor's Manual: Chapter 3
E-commerce Infrastructure: The Internet, Web, and Mobile Platform

Learning Objectives

After reading this chapter, your students should be able to:

- Discuss the origins of, and the key technology concepts behind, the Internet.
- Explain the current structure of the Internet.
- Understand the limitations of today's Internet and the potential capabilities of the Internet of the future.
- Understand how the Web works.
- Describe how Internet and web features and services support e-commerce.
- Understand the impact of mobile applications.

Key Terms

5G, p. 149
ad server, p. 167
Application Layer, p. 122
Applications layer, p. 134
attachment, p. 168
augmented reality (AR), p. 176
backbone, p. 135
bandwidth, p. 136
blog, p. 175
Bluetooth, p. 152
Border Gateway Protocol, p. 122
broadband, p. 137
cable Internet, p. 139
campus/corporate area network (CAN), p. 141
client, p. 125
client/server computing, p. 125
cloud computing, p. 127
database server, p. 167
differentiated quality of service (diffserv), p. 153
Digital Subscriber Line (DSL), p. 139
Domain Name System (DNS), p. 124
domain name, p. 124
download, p. 173
electronic mail (e-mail), p. 168
eXtensible Markup Language (XML), p. 162
fiber-optic cable, p. 148
File Transfer Protocol (FTP), p. 133
FiOS (fiber-optic service), p. 139

T1, p. 140
T3, p. 140
TCP, p. 122
Telnet, p. 133
Tier 1 Internet Service Providers (Tier 1 ISPs), p. 135
Tier 3 Internet Service Provider (Tier 3 ISP), p. 137
Tracert, p. 134
Transmission Control Protocol/Internet Protocol (TCP/IP), p. 122
Transport Layer, p. 122
Transport Services and Representation Standards layer, p. 134
Uniform Resource Locator (URL), p. 124
universal computing, p. 158
video server, p. 167
virtual reality (VR), p. 176
Voice over Internet Protocol (VoIP), p. 169
Web, p. 114
web browser, p. 167
web client, p. 167
web server software, p. 166
Wi-Fi, p. 150
wiki, p. 175

Brief Chapter Outline

Voice-controlled Intelligent Digital Assistants: Will They Revolutionize E-commerce?

3.1 The Internet: Technology Background
- The Evolution of the Internet: 1961—the Present
- The Internet: Key Technology Concepts
- The Mobile Platform
- The Internet "Cloud Computing" Model: Hardware and Software as a Service
- Other Internet Protocols and Utility Programs

3.2 The Internet Today
- The Internet Backbone
- Internet Exchange Points
- Tier 3 Internet Service Providers
- Campus/Corporate Area Networks
- Intranets
- Who Governs the Internet?
  - *Insight on Society: Government Regulation and Surveillance of the Internet*

3.3 The Future Internet Infrastructure
- Limitations of the Current Internet
- The Internet2® Project

Figures

Tables

Teaching Suggestions

This chapter provides a description of today's Internet, the Web (including Web 2.0 features and services), the mobile platform, and the future Internet that will emerge in the next few years. The key takeaway from this chapter is that the Internet has never been a static technology. Instead, it has evolved over a period of 60+ years into an unparalleled communication medium that combines elements of text, television, and radio. The challenge in this chapter is to understand the technical elements of the Internet (without becoming too technical), and understand their business implications while not becoming overwhelmed by the details.

The opening case study, *Voice-controlled Intelligent Digital Assistants: Will They Revolutionize E-commerce?*, describes the development of digital assistants and AI in emerging technologies like the Amazon Echo and its artificial intelligence, Alexa. Potential applications for these devices include managing home appliances, making online purchases, and much more. Class discussion questions for this case might include:

- What are intelligent assistants and why are they so popular?
- Do you use conversational AI assistants? If so, what for?
- What are the benefits of these assistants? The disadvantages?

- Are there any benefits/disadvantages to the proprietary nature of these assistants and chatbots?

Key Points

Section 3.1 covers the evolution of the Internet and the key technology underlying the Internet, including the development of the mobile platform and cloud computing, and various Internet protocols and utility programs.

Evolution of the Internet. The Internet has evolved over three stages: Innovation (1961 to 1974), Institutionalization (1975 to 1995), and Commercialization (1995 to the present). You may want to point out to students the length of time required to build the Internet as we know it today and the irony of the phrase "Internet time." You may also want to describe how long it took radio and television to develop into their current national and international networks.

Internet Foundation Technologies. The Internet relies on three foundation technologies: packet switching, TCP/IP, and client/server technology. You may want to illustrate each of these technologies, and in particular, describe how Internet addresses work. You should also note the sheer power of the computer chip as a driving technology force. Compare the power growth curves of the basic computer chip with that of trains, automobiles, and television. For instance, trains moved from 15 miles an hour in 1865 to over 100 miles per hour by 1965. Although this is impressive, it is nothing compared to computer chips. The cost performance of computers has improved by ten to the seventh power in the last forty years. A computer purchased in the year 2000 runs 10 million times faster than a computer purchased in the 1960s. A desktop computer purchased in 2016 comes with a terabyte drive and is approximately 3 million times faster than a year 2000 computer. There is every reason to believe this performance curve will be maintained in the short-term future. The business possibilities here are mindboggling and we can't count on so-called Internet experts and gurus to predict how these technologies will be used in business even three years from now.

The very nature of the client computer itself is changing by becoming much smaller and more mobile. Smartphones and tablet computers are leading the charge here, and in the next five years we should expect to see these devices continue to shrink by an order of magnitude while increasing in power.

Another important development to discuss with students is the growing importance of "cloud computing," which refers to a model of computing in which firms and individuals obtain computing power and software applications over the Internet, rather than purchasing the hardware and software, and installing it on their own computers. Cloud computing is the fastest growing form of computing right now, and radically reduces the cost of building and operating websites because the necessary hardware infrastructure and software can be licensed as a service from Internet providers at a fraction of the cost

of purchasing these services as products. Also note the differences between public, private, and hybrid clouds, since students need to understand what these terms refer to.

Internet Protocols and Utility Programs. The Internet relies on a number of communications protocols such as HTTP, SMTP, and POP mail protocols, FTP, and utility programs (software applications) such as Ping and Tracert. You can illustrate many of the protocols and programs in class.

The Internet Today. Section 3.2 reviews the Internet's current network architecture, which relies on four primary elements: the backbone, Internet Exchange Points (IXPs), campus/corporate area networks (CANs), and Tier 3 Internet Service Providers (ISPs), which provide the last mile of service to the home or office. You can use Figure 3.11 to illustrate how a message moves, from the client on the left of the figure to the client on the right. Also, Figure 3.10, the Hourglass Model of the Internet, is very useful for illustrating how Internet hardware and software relate to one another.

This may be a good time to discuss the *Insight on Society* case, *Government Regulation and Surveillance of the Internet*. Students might be surprised at the extent to which governments surveil the Internet. Class discussion questions might include the following:

- How is it possible for any government to "control" or censor the Web?
- Does the Chinese government, or the U.S. government have the right to censor content on the Web?
- How should U.S. companies deal with governments that want to censor content?
- What would happen to e-commerce if the existing Web split into a different Web for each country?

Section 3.4 focuses on the future Internet infrastructure, beginning with a review of the limitations of the current Internet, and an examination of the potential capabilities of the Internet of the future.

Limitations of the current Internet. To understand the potential benefits of the future Internet infrastructure, your students must first understand the limitations of the current infrastructure. To do so, you can review with them the bulleted list on page 146. It is helpful at this point to have students give examples of their own experience with Internet limitations. Students will usually experience this as extended wait times and lengthy or interrupted media downloads. The growth of Netflix's streaming movie service is beginning to cause bandwidth shortages, as is the growth of streaming music services such as Pandora. Cellular networks are similarly bandwidth-challenged.

Potential capabilities of the Internet of the future. The Internet2 project is doing some exciting work that is reviewed on page 147. It is also important for students to understand the idea of the "first mile" and "last mile" as it applies to Internet infrastructure (see pages 144 to 152). We have added a short section on some other innovative Internet

access technologies, such as drones, balloons, and white space, which students may have read about recently in the popular press. Finally, before leaving this topic, talk about the Internet of Things (IoT) (pages 154–155) and the advent of "smart/connected" things, which are likely to revolutionize many aspects of life in the future.

Insight on Business case, *The Apple Watch: Bringing the Internet of Things to Your Wrist*, examines the expansion of the mobile digital platform to wearable technologies like the Apple Watch and the new possibilities for e-commerce made possible by these devices. Although the functionality of the Apple Watch is still somewhat limited, Apple hopes that the device will popularize its mobile payment service. New capabilities will undoubtedly be introduced over time as developers master its features. Along with other services, the mobile platform is enlarging the opportunities for e-commerce and changing many business models. Possible class discussion questions for this case include the following:

- Are you or anyone you know using the Apple Watch? If not, why not? If so, what apps do you use the most?
- What are the potential benefits of wearable technology? Are there any disadvantages?
- What effects will features like the Apple Pay button and the Taptic Engine have?
- Are there any privacy issues raised by wearable technology?

How the Web Works. Section 3.4 covers the Web. Key concepts for understanding the Web are hypertext, URLs, HTML, XML, web servers, and web clients (see pages 158 to 168). You may wish to show the HTML code behind a popular web page such as Amazon. The *Insight on Technology* case, *The Rise of HTML5*, provides a good jumping-off point for the discussion of the impact that advances in technology can have on business. Class discussion questions include:

- What features of HTML5 are changing the way websites are built?
- Is HTML5 a disruptive technology, and if so, for whom?
- What are the challenges for websites and mobile apps moving to an HTML5 platform?

The Internet and the Web: Features and Services. Without the Web and the Internet, e-commerce would be a fraction of its current size. The Web has enabled e-commerce to explode rapidly because of its ability to store and display product information (enabling order entry), receive payments, allow consumers to search for products, and support a wide range of commercial communication. Section 3.5 begins with an overview of the various communication tools that the Internet and Web provide: e-mail, messaging applications, online message boards, Internet telephony, and video conferencing, video chatting, and telepresence. Next, it looks at search engines, providing a brief review of the history of search engines, including Google, and explaining how they work. Students may be particularly interested in Figure 3.17, How Google Works, given the importance that Google's search engine plays in everyday life. This is a new, enhanced infographic

that should help students better understand what goes on behind the scenes when they type a search query into Google. The section also briefly covers various types of downloadable and streaming media, as well as Web 2.0 applications and technologies that have had a significant impact on e-commerce, most importantly online social networks. The section concludes with a review of two new topics that are starting to make an impact on e-commerce: virtual and augmented reality and intelligent personal assistants such as Apple's Siri. Ask your students to offer examples of each of these features/services that they have used within the past month.

Mobile Apps: The Next Big Thing Is Here. Section 3.6 focuses on the explosion of mobile apps and their use as entertainment media and shopping tools. The section also briefly reviews the various mobile app development platforms and app marketplaces available.

In Section 3.7, we offer students information and tips about how the concepts they've learned in this chapter can help them prepare for an interview for an entry-level position as an e-commerce specialist.

The chapter-ending case study on Akamai in Section 3.8 focuses on a company that may be largely unknown to your students, but which is instrumental in providing the infrastructure for the delivery of online content.

Case Study Questions

1. *Why does Akamai need to geographically disperse its servers to deliver its customers' web content?*

   The Internet was originally developed to carry text-based e-mail messages among a relatively small group of researchers, not bandwidth-hogging graphics, sound, and video files to tens of millions of people all at once. Also, every 1,500-byte packet of information sent over the Internet must be verified by the receiving server and an acknowledgment sent to the sending server. Each packet can go through many different servers on its way to its final destination, multiplying by several orders of magnitude the number of acknowledgments required to move a packet from New York to San Francisco. This means that the Internet today spends much of its time and capacity verifying packets, causing "latency." One of the founders of Akamai, Daniel Lewin, came up with the idea to store copies of web content such as pictures and video clips at many different locations around the Internet. This is so that a client can always retrieve a nearby copy, making web pages load faster. Akamai's main product does just that—it allows customers to move their web content closer to end users, which increases the speed at which the content can be served.

2. *If you wanted to deliver software content over the Internet, would you sign up for Akamai's service? Why or why not?*

Bandwidth requirements of the software or content, the number of simultaneous downloads, and the customer requirements are all factors in determining whether a firm should use a service such as Akamai's. A small piece of software, less than one megabyte, can be downloaded from a single server to a single user in a few seconds using a DSL or cable modem. However, if 10,000 users sought to download the same software simultaneously, the time required to serve all users would be significantly higher—on the order of several minutes or more. Firms that expect this sort of demand would be well served by Akamai.

3. *Do you think Internet users should be charged based on the amount of bandwidth they consume, or a tiered plan where users would pay in rough proportion to their usage?*

Pay-for-use is a simple principle in economics that is widely accepted. Applied to the Internet in a way similar to telephone systems throughout the world, users would be charged a metered amount for their use of bandwidth. People who streamed Netflix all day long would pay more for their Internet service than people who just send e-mail messages. In general, the ISP industry, from AT&T, Verizon, and Comcast to little mom-and-pop local providers, support pay-for-use in large part because it would allow them to maximize revenue from their technology investments (and to gather up some of the profits that Google, Netflix, Amazon, and others produce). Supporters of net neutrality argue that Internet access should be available to all regardless of use, and paid for equally by all (sort of a "freeway") through flat fees. Charging for use would "discriminate" in their view against certain kinds of content, like high bandwidth video, streaming music, and perhaps games. In general, Internet companies such as Google, Amazon, Yahoo, Netflix, and many others do not want pay-for-use because they are concerned that it would hinder their ability to maximize revenue from their platforms. FCC regulations currently mandate net neutrality, but under the Trump administration, are likely to be repealed.

End-of-Chapter Questions

1. *What are the three basic building blocks of the Internet?*

The three basic building blocks are packet switching, the Transmission Control Protocol/Internet Protocol (TCP/IP) communications protocol, and client/server computing. Packet switching is a method of splitting messages up into parcels, routing them along available communications paths, and reassembling them at the destination point. The TCP protocol is the set of rules that specifies how these messages should be formatted, ordered, compressed, and error-checked. The IP protocol provides the addressing scheme for the Internet. Client/server computing refers to networks of powerful client computers that are connected to one or more server computers. The clients are powerful enough to display, process, and store very large files including graphics and sound files. The servers are dedicated to

common functions that all clients need including file storage, and they also house many software applications and utility programs that the clients frequently use.

2. *What is latency, and how does it interfere with Internet functioning?*

Latency is a delay in messages caused by the uneven flow of information packets through the network. It interferes with the functioning of the Internet today, because with streaming video or synchronous communication transmissions, there may be noticeable gaps causing the video or voice to arrive looking or sounding jerky.

3. *Explain how packet switching works.*

In packet-switched networks, messages are broken up into fragments (packets) and a digital code with the source address attached. Sequencing and error-control instructions are also added. Instead of being sent directly to their destination, the packets travel between router computers that interconnect the thousands of networks that make up the Internet. The routers use programs called routing algorithms to ensure that each packet takes the best available communication path toward its destination. If some lines are disabled or busy, the packets can be sent along any available line. At the destination point, the packets are reassembled and delivered. This method enables nearly full use of all available communication lines and capacity.

4. *How is the TCP/IP protocol related to information transfer on the Internet?*

The TCP/IP protocol determines how messages are formatted, compressed, error-checked, and how they are addressed, so that they reach the correct destination in the correct order and format. TCP establishes the connections between sending and receiving computers, and it handles the assembly of packets at the point of transmission and their reassembly at the receiving end. IP provides the Internet's addressing scheme and is responsible for the actual delivery of the packets.

5. *What technological innovation made client/server computing possible?*

The technological innovation that made client/server computing possible is the personal computer. Without the invention of the PC and local area networks, we would not have the Internet and the Web. In client/server computing, capacity can be expanded constantly by adding servers and clients to the network. A client/server network is much less vulnerable than the centralized computing architecture that preceded it because if one server malfunctions, backup servers can take over. If a client is down, the rest of the system continues to operate without a hitch. The processing load can be balanced over many powerful, smaller

machines rather than being concentrated in a single huge mainframe computer, and both the software and the hardware can be more economically built.

6. *What is cloud computing, and how has it impacted the Internet?*

Cloud computing refers to a model of computing in which firms and individuals obtain computing power and software applications over the Internet, rather than purchasing the hardware and software and installing it on their own computers. Cloud computing is the fastest growing form of computing. Cloud computing has impacted the Internet by radically reducing the cost of building and operating websites because the necessary hardware infrastructure and software can be licensed as a service from Internet providers at a fraction of the cost of purchasing these services as products. For individuals, cloud computing means individuals no longer need a powerful laptop or desktop computer to engage in e-commerce or other activities.

7. *Why are smartphones a disruptive technology?*

Smartphones are a disruptive technology because they have radically altered the personal computing and e-commerce landscape. They involve a major shift in computer processors and software from the 40-year dual monopolies established by Intel and Microsoft. The mobile platform also has profound implications for e-commerce because it influences how, where, and when consumers are able to shop and buy.

8. *What role does a Tier 1 ISP play in Internet infrastructure?*

Tier 1 ISPs own the long-haul fiber-optic networks that comprise the Internet backbone. Tier 1 ISPs have "peering" arrangements with other Tier 1 ISPs to allow Internet traffic to flow through each other's cables and equipment without charge. Tier 1 ISPs deal only with other Tier 1 or regional Tier 2 ISPs, and not with end consumers.

9. *What function do the IXPs serve?*

Internet Exchange Points (IXPs) use high-speed switching computers to connect the Internet backbone to regional and local networks. They function as the hubs, or interconnect points, where the backbone intersects with these regional and local networks; it is where the backbone owners connect with one another.

10. *What is the goal of the Internet2 project?*

The Internet2 is an advanced networking consortium of more than 450-member institutions including universities, corporations, government research agencies,

and not-for-profit networking organizations, all working in partnership to facilitate the development, deployment, and use of revolutionary Internet technologies. Its goal is to create an intelligent global ecosystem that will enable researchers, scientists, and others to "turn on" high-capacity network connections whenever and wherever they are needed. Other initiatives involve science and engineering (advanced network applications in support of distributed lab environments, remote access to rare scientific instruments, and distributed large-scale computation and data access), health sciences and health networks (telemedicine, medical and biological research, and health education and awareness), and arts and humanities (collaborative live performances, master classes, remote auditions, and interactive performing arts education and media events).

11. Compare and contrast intranets and the Internet as a whole.

An intranet is a TCP/IP network located within a single organization whose function is to fulfill the communication and information processing needs of the organization. An extranet, on the other hand, is formed when organizations allow outsiders to access their internal TCP/IP network. For example, a company may permit suppliers to gain access to their intranet to view information (like production schedules or inventory allotments) so that the suppliers will know when the company will need to restock. It is the exact same technology that enables the operation of the Internet. It provides capabilities for private or governmental organizations to operate their own internal networks and to create extranets to allow for the exchange of information across organizational boundaries. All protocols used on the Internet are also used on private intranets. Also, all applications available on the Internet are compatible with intranets.

12. What are some of the major limitations of today's Internet?

The major limitations of today's Internet are bandwidth, quality of service, network architecture, language development, and the primarily wired nature of the Internet. There is insufficient bandwidth capacity throughout the backbone, the metropolitan switching centers, and most importantly, to the houses and small businesses at the end of the information pipeline. Due to insufficient bandwidth and the circuitous nature of packet switching, video and voice traffic suffer from latency. This causes these types of messages to arrive with noticeable delays and a jerky quality. Because today's Internet uses "best efforts" quality of service, each packet is provided with the same level of service. This means that all packets traveling through the communication system are treated the same, no matter who is sending them or what type of messages they are. Network architecture restrictions also limit the performance of the Internet. A thousand requests for the same file result in a server having to download the file one thousand times rather than being able to transmit it once to all one thousand computers at the same time.

This significantly slows down network performance. HTML, the language for displaying web pages, is not well suited for displaying "rich documents" such as database files, business documents, and graphics, although the increasing use of XML and HTML5 is beginning to change this. Finally, although wireless access to the Internet has increased significantly, the Internet remains primarily based on physical cables, which is expensive.

13. What are some of the challenges of policing the Internet? Who has the final say when it comes to content?

One challenge of policing the Internet is that there are multiple organizations that influence the system and monitor its operations. It is hard to make the Internet conform to the laws of the sovereign nation states in which it operates, and it is difficult to enforce the various and often contradictory laws of all these nations. Many countries want to put far stricter restrictions on freedom of expression than the United States does. Different cultures have different social morals, and what is acceptable in some countries is decidedly not in others. The issue of who has the final say is also quite controversial and varies from country to country. For instance, in China, the Chinese government has "the final say" about what content is available to viewers who access the Internet from within China. Other countries also regulate the availability of certain types of content. Critics complain that attempting to create "legal harmony" will result in major content restrictions on the Internet with only content that is legally acceptable worldwide being made accessible.

14. Compare and contrast the capabilities of Wi-Fi and cellular wireless networks.

There are two basic types of wireless Internet connectivity: telephone-based systems and computer network-based systems. Wi-Fi is an example of a computer network-based wireless access system, and 3G/4G wireless networks are telephone-based wireless access systems.

Telephone-based wireless Internet systems such as 3G/4G systems connect the user to a telephone system and use a packet-switched technology that is more efficient and faster than traditional circuit-switched networks. The 3G/4G networks have speeds ranging from 384 Kbps for mobile users in a car, to up to 2 Mbps for stationary users. These networks are wide area networks of nearly unlimited range, and are the basis for smartphones, hybrid cellular wireless devices that combine the functionality of a computer with that of a cell phone, and require a cellular phone company service connection. They enable consumers to have voice conversations, send and receive text messages or e-mail, and enable Web use.

Computer network-based wireless Internet systems have a completely different history that is based on corporate local area networks. Here, the task is to connect stationary client computers to server computers within local areas of a few hundred meters. Wi-Fi was the first commercially viable standard for wireless local area networks. In a Wi-Fi network, a wireless access point connects to the Internet directly via a broadband connection (cable or DSL telephone or T1 line), and then transmits radio signals to other transmitters/receivers usually installed in laptop computers. Wi-Fi offers high bandwidth capacity (up to 11 Mbps), suitable for Web surfing and other corporate uses, but a much more limited range (300 feet).

15. What are the basic capabilities of a web server?

Web server software refers to the software that enables a computer to deliver web pages written in HTML to client computers on a network that request this service by sending an HTTP request. Aside from responding to requests for web pages, all web servers provide some additional basic capabilities such as security services, FTP, search engine modules that enable indexing of a site's web pages and content, and data capture tools. The term web server can also be used to refer to the physical computer that runs web server software.

16. What are the major technological advancements that are anticipated to accompany the Internet of the future? Discuss the importance of each.

The most significant advancements are coming in two areas—fiber optic trunk line bandwidth and wireless Internet services. Increased bandwidth availability fueled by fiber optic technology will increase the movement of the Internet from narrowband to broadband digital service. Increased use of wireless Web technologies, both 3G/4G and wireless LANs will move the Internet from predominantly a cable-based stationary service to mobile service. The coming Internet of Things will make it possible to connect nearly all the electronic devices in our lives to the Internet.

17. Why was the development of the browser so significant for the growth of the Web?

The development of the browser was an extremely significant breakthrough that enabled rapid growth of the Web. Once it progressed from a simple line interface device to a graphical user interface (GUI), it became possible to view documents with colored backgrounds, images, and animations. Besides the natural interest stimulated by viewing such documents, the graphical web browser also created the possibility of universal computing: the sharing of files including graphics, sound, video, and all sorts of different information by all computer users in the world, no matter what platform or operating system they are using. A browser could be made for each operating system, and web pages created for one system

could be displayed either exactly or nearly the same on a computer using a different operating system.

18. What advances and features does HTML5 offer?

HTML5 introduces features such as video playback and drag-and-drop that in the past were provided by plug-ins like Adobe Flash. It uses the newest version of Cascading Style Sheets (CSS3) and JavaScript, and another new tool, HTML5 Canvas, that can be used to render simple animations, which reduces page-load time. HTML5 also provides device independence for mobile applications, and can more easily access the built-in functionality of mobile devices, including GPS and swiping. HTML5 mobile apps work just like web pages.

19. Name and describe five services currently available through the Web.

There are a variety of services currently available through the Web, including:

- Communication tools such as e-mail, messaging apps, online forums, Internet telephony, and video conferencing, video chatting, and telepresence. E-mail is the most widely used application on the Internet and allows messages and file attachments to be transferred from one Internet user to another. Messaging apps include both instant messaging, which allows typed text to be displayed on a recipient's computer almost instantaneously, making real-time conversations between two people possible on the Web, and mobile messaging apps. Online message boards are web applications that enable Internet users to communicate with each other via a message board, bulletin board, or discussion group. IP telephony is a general term for technologies that use Voice over Internet Protocol (VoIP) and the Internet to send voice, fax, and other forms of audio communication over the Internet. Internet video conferencing is now accessible to anyone with a broadband Internet connection and a web camera. Video chatting is a more limited form of video conferencing, available via apps such as Skype and Apple's FaceTime. Telepresence takes video conferencing up several notches with higher broadcast quality and the sensation of "being there."

- Search engines, which enable users to locate information by matching keywords that the user provides to a list of documents containing those words or the closest matches
- Web 2.0 applications and services, including online social networks, which are services that support communication within networks of friends and colleagues; blogs (personal web pages created by an individual or corporation to communicate with readers), and wikis (web applications that allow a user to easily add and edit content on a web page)

- Virtual reality, which enables users to be immersed within a virtual world, and augmented reality, which involves overlaying virtual objects over the real world
- Intelligent digital assistants, such as Apple's Siri and Google's Google Now and Google Assistant, have natural language, conversational interface, and situational awareness and can carry out many tasks based on verbal commands by delegating requests to a variety of different web services.

20. Why are mobile apps the next big thing?

Mobile apps are the next big thing because the use of mobile Internet access devices and mobile apps has truly exploded, with more than 5 million apps available for download on the Apple App Store and Google Play. Mobile apps have usurped TV as the most popular entertainment medium, and are increasingly being used for shopping as well, with m-commerce in the form of purchases of retail and travel products and services via a mobile device expected to generate almost $230 billion in 2017.

Projects

1. Review the Insight on Business *case on Apple Watch. What developments have occurred since the date this case was written in August 2017?*

Students should conduct an online search using Google or another search engine on wearable technology, Apple Watch, and any of the other companies mentioned in the opening case to find new developments on this topic since August 2017. Answers will vary depending on when the search is conducted.

2. Call or visit the websites of a cable provider, a DSL provider, and satellite provider to obtain information on their Internet services. Prepare a brief report summarizing the features, benefits, and costs of each. Which is the fastest? What, if any, are the downsides of selecting any of the three for Internet service (such as additional equipment purchases)?

Student reports should include the name of the companies they called to request information, statistics on upload and download speeds, price, and availability. Students should discuss at least some of these issues in summarizing the features, benefits, and downsides of the three providers.

3. Select two countries (excluding the United States) and prepare a short report describing their basic Internet infrastructure. Are they public or commercial? How and where do they connect to backbones within the United States?

The purpose of this project is for students to understand the global Internet infrastructure and the significant jump the United States still has on the rest of the world. To prepare this report, students should consult online reference sources. They are likely to find that New York plays a significant role in connecting the United States to Europe. New York is the "capital" of the global Internet because it has the highest aggregation of Internet capacity that travels between the world's regions. The United States is still a key staging ground for the rest of the world's Internet. For example, France Telecom is not based in the United States, but it has a substantial presence in the United States. France Telecom, and other companies like it, must deploy bandwidth in the United States and connect with other ISPs to effectively serve their customers.

Students may also find that Miami has more Internet capacity into Latin American countries than any Latin American city does. If they choose an African country, they will likely find that there are few regional links in Africa, and that almost all upstream Internet circuits connect to the United States (with a few to the United Kingdom, Italy, and France).

ISPs in countries with borders shared with South Africa benefit from low tariff policies of the public South African telecom operator for international links to neighboring countries. As a result, South Africa is a hub for some of its neighbors: Lesotho, Namibia, and Swaziland. There are no other regional backbones or links between neighboring countries aside from Mauritius to Madagascar and the links to South Africa's neighbors, so much local traffic must go via the United States. This means that significant and rapidly increasing capital outflows from the region are occurring for Internet traffic between African countries paid to U.S. or European telecom operators and ISPs. Vast amounts of telecom transit payments a year leave the continent that could have been invested in local infrastructure. This project should help students grasp the extent of the worldwide digital divide.

4. *Investigate the Internet of Things. Select one example and describe what it is and how it works.*

RFID chips are one early example of the Internet of Things. RFID chips use radio waves to send information to RFID readers that can be connected to the Internet. RFID chips are commonly used for automated payment systems and in manufacturing and retailing to track the location of goods. Sensors in smartphones and embedded in devices are another example of the Internet of Things.

Companion Website, Learning Tracks, and Video Cases

You can also direct your students to the Companion Website for the book, located at www.e-commerce2018.com. There they will find a collection of additional projects and exercises for each chapter; links to various technology tutorials; information on how to

build a business plan and revenue models; information on careers in e-commerce, and more. Learning Tracks that provide additional coverage of various topics and a collection of video cases that integrate short videos, supporting case study material, and case study questions are also available for download from the book's Online Instructor Resource Center at www.pearsonhighered.com/irc. Video Cases for this chapter include:

- Video Case 3.1 How Freshdesk Uses Amazon Web Services
- Video Case 3.2 Compare.com Turns to Microsoft Azure and the Cloud
- Video Case 3.3 Facebook's Data Centers
- Video Case 3.4 Amazon Echo