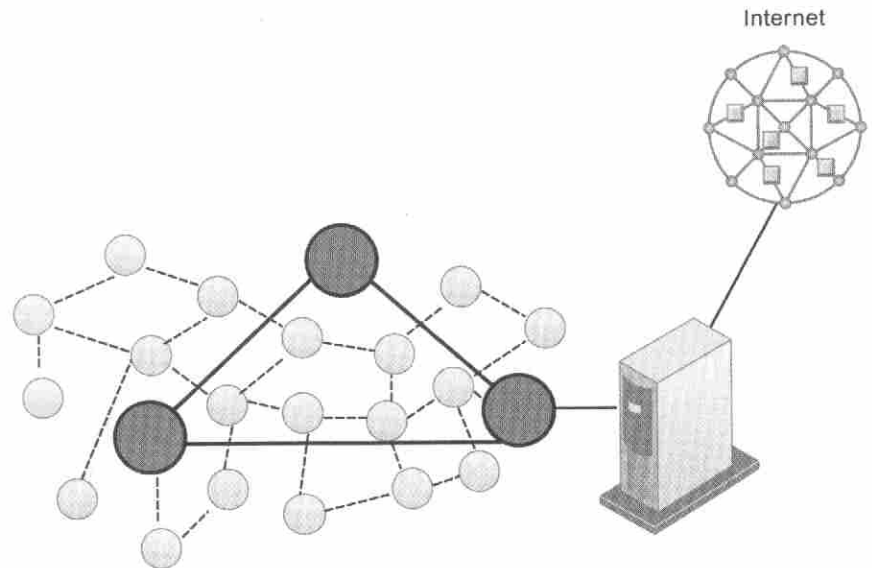


FIGURE 7-18 A WIRELESS SENSOR NETWORK

The small circles represent lower-level nodes and the larger circles represent high-end nodes. Lower-level nodes forward data to each other or to higher-level nodes, which transmit data more rapidly and speed up network performance.

Wireless sensor networks are valuable in areas such as monitoring environmental changes; monitoring traffic or military activity; protecting property; efficiently operating and managing machinery and vehicles; establishing security perimeters; monitoring supply chain management; or detecting chemical, biological, or radiological material.

7.5 HANDS-ON MIS PROJECTS

The projects in this section give you hands-on experience evaluating and selecting communications technology, using spreadsheet software to improve selection of telecommunications services, and using Web search engines for business research.

Management Decision Problems

1. Your company supplies ceramic floor tiles to Home Depot, Lowe's, and other home improvement stores. You have been asked to start using radio frequency identification tags on each case of the tiles you ship to help your customers improve the management of your products and those of other suppliers in their warehouses. Use the Web to identify the cost of hardware, software, and networking components for an RFID system for your company. What factors should be considered? What are the key decisions that have to be made in determining whether your firm should adopt this technology?
2. BestMed Medical Supplies Corporation sells medical and surgical products and equipment from over 700 different manufacturers to hospitals, health clinics, and medical offices. The company employs 500 people at seven different

locations in western and midwestern states, including account managers, customer service and support representatives, and warehouse staff. Employees communicate via traditional telephone voice services, e-mail, instant messaging, and cell phones. Management is inquiring about whether the company should adopt a system for unified communications. What factors should be considered? What are the key decisions that have to be made in determining whether to adopt this technology? Use the Web, if necessary to find out more about unified communications and its costs.

Improving Decision Making: Using Spreadsheet Software to Evaluate Wireless Services

Software skills: Spreadsheet formulas, formatting

Business skills: Analyzing telecommunications services and costs

In this project, you'll use the Web to research alternative wireless services and use spreadsheet software to calculate wireless service costs for a sales force.

You would like to equip your sales force of 35 based in Cincinnati, Ohio, with mobile phones that have capabilities for voice transmission, text messaging, and taking and sending photos. Use the Web to select a wireless service provider that provides nationwide service as well as good service in your home area. Examine the features of the mobile handsets offered by each of these vendors. Assume that each of the 35 salespeople will need to spend three hours per day during business hours (8 A.M. to 6 P.M.) on mobile voice communication, send 30 text messages per day, and five photos per week. Use your spreadsheet software to determine the wireless service and handset that will offer the best pricing per user over a two-year period. For the purposes of this exercise, you do not need to consider corporate discounts.

Achieving Operational Excellence: Using Web Search Engines for Business Research

Software skills: Web search tools

Business skills: Researching new technologies

This project will help develop your Internet skills in using Web search engines for business research.

You want to learn more about ethanol as an alternative fuel for motor vehicles. Use the following search engines to obtain that information: Yahoo!, Google, and MSN. If you wish, try some other search engines as well. Compare the volume and quality of information you find with each search tool. Which tool is the easiest to use? Which produced the best results for your research? Why?

LEARNING TRACK MODULES

The following Learning Tracks provide content relevant to topics covered in this chapter:

1. Computing and Communications Services Provided by Commercial Communications Vendors
2. Broadband Network Services and Technologies
3. Cellular System Generations
4. Wireless Applications for Customer Relationship Management, Supply Chain Management, and Healthcare
5. Web 2.0

Review Summary

1. *What are the principal components of telecommunications networks and key networking technologies?*

A simple network consists of two or more connected computers. Basic network components include computers, network interfaces, a connection medium, network operating system software, and either a hub or a switch. The networking infrastructure for a large company includes the traditional telephone system, mobile cellular communication, wireless local-area networks, video-conferencing systems, a corporate Web site, intranets, extranets, and an array of local and wide-area networks, including the Internet.

Contemporary networks have been shaped by the rise of client/server computing, the use of packet switching, and the adoption of Transmission Control Protocol/Internet Protocol (TCP/IP) as a universal communications standard for linking disparate networks and computers, including the Internet. Protocols provide a common set of rules that enable communication among diverse components in a telecommunications network.

2. *What are the main telecommunications transmission media and types of networks?*

The principal physical transmission media are twisted copper telephone wire, coaxial copper cable, fiber-optic cable, and wireless transmission. Twisted wire enables companies to use existing wiring for telephone systems for digital communication, although it is relatively slow. Fiber-optic and coaxial cable are used for high-volume transmission but are expensive to install. Microwave and communications satellites are used for wireless communication over long distances.

Local-area networks (LANs) connect PCs and other digital devices together within a 500-meter radius and are used today for many corporate computing tasks. Network components may be connected together using a star, bus, or ring topology. Wide-area networks (WANs) span broad geographical distances, ranging from several miles to continents, and are private networks that are independently managed. Metropolitan-area networks (MANs) span a single urban area.

Digital subscriber line (DSL) technologies, cable Internet connections, and T1 lines are often used for high-capacity Internet connections.

Cable Internet connections provide high-speed access to the Web or corporate intranets at speeds of up to 10 Mbps. A T1 line supports a data transmission rate of 1.544 Mbps.

3. *How do the Internet and Internet technology work and how do they support communication and e-business?*

The Internet is a worldwide network of networks that uses the client/server model of computing and the TCP/IP network reference model. Every computer on the Internet is assigned a unique numeric IP address. The Domain Name System (DNS) converts IP addresses to more user-friendly domain names. Worldwide Internet policies are established by organizations and government bodies, such as the Internet Architecture Board and the World Wide Web Consortium.

Major Internet services include e-mail, newgroups, chatting, instant messaging, Telnet, FTP, and the World Wide Web. Web pages are based on Hypertext Markup Language (HTML) and can display text, graphics, video, and audio. Web site directories, search engines, and RSS technology help users locate the information they need on the Web. RSS, blogs, and wikis are features of Web 2.0. Web technology and Internet networking standards provide the connectivity and interfaces for internal private intranets and private extranets that be accessed by many different kinds of computers inside and outside the organization.

Firms are also starting to realize economies by using Internet VoIP technology for voice transmission and by using virtual private networks (VPNs) as low-cost alternatives to private WANs.

4. *What are the principal technologies and standards for wireless networking, communication and Internet access?*

Cellular networks are evolving toward high-speed, high-bandwidth, digital packet-switched transmission. Broadband 3G networks are capable of transmitting data at speeds ranging from 144 Kbps to more than 2 Mbps. However, 3G services are still not available in most U.S. locations, so U.S. cellular carriers have upgraded their networks to support higher-speed transmission. These interim

2.5G networks provide data transmission rates ranging from 60 to 354 Kbps, enabling cell phones to be used for Web access, music downloads, and other broadband services.

Major cellular standards include Code Division Multiple Access (CDMA), which is used primarily in the United States, and Global System for Mobile Communications (GSM), which is the standard in Europe and much of the rest of the world.

Standards for wireless computer networks include Bluetooth (802.15) for small personal-area networks (PANs), Wi-Fi (802.11) for local-area networks (LANs), and WiMax (802.16) for metropolitan-area networks (MANs).

5. *Why are radio frequency identification (RFID) and wireless sensor networks valuable for business?*

Radio frequency identification (RFID) systems provide a powerful technology for tracking the movement of goods by using tiny tags with embedded data about an item and its location. RFID readers read the radio signals transmitted by these tags and pass the data over a network to a computer for processing. Wireless sensor networks (WSNs) are networks of interconnected wireless sensing and transmitting devices that are embedded into the physical environment to provide measurements of many points over large spaces.

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Review Questions

- What are the principal components of telecommunications networks and key networking technologies?
 - Describe the features of a simple network and the network infrastructure for a large company.
 - Name and describe the principal technologies and trends that have shaped contemporary telecommunications systems.
- What are the main telecommunications transmission media and types of networks?
 - Name the different types of physical transmission media and compare them in terms of speed and cost.
 - Define a LAN, and describe its components and the functions of each component.
 - Name and describe the principal network topologies.
- How do the Internet and Internet technology work and how do they support communication and e-business?
 - Define the Internet, describe how it works, and explain how it provides business value.
 - Explain how the Domain Name System (DNS) and IP addressing system work.
 - List and describe the principal Internet services.
- Define and describe VoIP and virtual private networks, and explain how they provide value to businesses.
- List and describe alternative ways of locating information on the Web.
- Compare Web 2.0 and Web 3.0.
- Define and explain the difference between intranets and extranets. Explain how they provide value to businesses.
- What are the principal technologies and standards for wireless networking, communications, and Internet access?
 - Define Bluetooth, Wi-Fi, WiMax, and 3G networks.
 - Describe the capabilities of each and for which types of applications each is best suited.
- Why are RFID and wireless sensor networks (WSNs) valuable for business?
 - Define RFID, explain how it works and how it provides value to businesses.
 - Define WSNs, explain how they work, and describe the kinds of applications that use them.

Discussion Questions

- It has been said that within the next few years, smartphones will become the single most important digital device we own. Discuss the implications of this statement.
- Should all major retailing and manufacturing companies switch to RFID? Why or why not?

Collaboration and Teamwork: Evaluating Smartphones

Form a group with three or four of your classmates. Compare the capabilities of Apple's iPhone with a smartphone handset from another vendor with similar features. Your analysis should consider the purchase cost of each device, the wireless networks where each device can operate, service plan and handset costs, and the services available for each device. You should also consider other capabilities of each device, including

Video Cases

You will find video cases illustrating some of the concepts in this chapter on the Laudon Web site along with questions to help you analyze the cases.

the ability to integrate with existing corporate or PC applications. Which device would you select? What criteria would you use to guide your selection? If possible, use Google Sites to post links to Web pages, team communication announcements, and work assignments; to brainstorm; and to work collaboratively on project documents. Try to use Google Docs to develop a presentation of your findings for the class.

Google Versus Microsoft: Clash of the Technology Titans

CASE STUDY

Google and Microsoft, two of the most prominent technology companies to arise in the past several decades, are poised to square off for dominance of the workplace, the Internet, and the technological world. In fact, the battle is already well underway. Both companies have already achieved dominance in their areas of expertise. Google has dominated the Internet, while Microsoft has dominated the desktop. But both are increasingly seeking to grow into the other's core businesses. The competition between the companies promises to be fierce.

The differences in the strategies and business models of the two companies illustrate why this conflict will shape our technological future. Google began as one search company among many. But the effectiveness of its PageRank search algorithm and online advertising services, along with its ability to attract the best and brightest minds in the industry, have helped Google become one of the most prominent companies in the world. The company's extensive infrastructure allows it to offer the fastest search speeds and a variety of Web-based products.

Microsoft grew to its giant stature on the strength of its Windows operating system and Office desktop productivity applications, which are used by 500 million people worldwide. Sometimes vilified for its anti-competitive practices, the company and its products are nevertheless staples for businesses and consumers looking to improve their productivity with computer-based tasks.

Today, the two companies have very different visions for the future, influenced by the continued development of the Internet and increased availability of broadband Internet connections. Google believes that the maturation of the Internet will allow more and more computing tasks to be performed via the Web, on computers sitting in data centers rather than on your desktop. This idea is known as cloud computing, and it is central to Google's business model going forward. Microsoft, on the other hand, has built its success around the model of desktop computing. Microsoft's goal is to embrace the Internet while persuading consumers to retain the desktop as the focal point for computing tasks.

Only a small handful of companies have the cash flow and manpower to manage and maintain a cloud, and Google and Microsoft are among them. With a vast array of Internet-based products and tools for online search, online advertising, digital mapping, digital photo management, digital radio broadcasting, and online video viewing, Google has pioneered cloud computing. It is obviously banking that Internet-based computing will supplant desktop computing as the way most people work with their computers. Users would use various connectivity devices to access applications from remote servers stored in data centers, as opposed to working locally from their machine.

One advantage to the cloud computing model is that users would not be tied to a particular machine to access information or do work. Another is that Google would be responsible for most of the maintenance of the data centers that house these applications. But the disadvantages of the model are the requirement of an Internet connection to use the applications, as well as the security concerns surrounding Google's handling of your information. Google is banking on the increasing ubiquity of the Internet and availability of broadband and Wi-Fi connections to offset these drawbacks.

Microsoft already has several significant advantages to help remain relevant even if cloud computing is as good as Google advertises. The company has a well-established and popular set of applications that many consumers and businesses feel comfortable using. When Microsoft launches a new product, users of Office products and Windows can be sure that they will know how to use the product and that it will work with their system.

And Google itself claims that it isn't out to supplant Microsoft, but rather provide products and services that will be used in tandem with Microsoft applications. Dave Girouard, president of Google's Enterprise division, says that "people are just using both [Google products and Office] and they use what makes sense for a particular task."

But cloud computing nevertheless represents a threat to Microsoft's core business model, which revolves around the desktop as the center for all computing tasks. If, rather than buying software

from Microsoft, consumers can instead buy access to applications stored on remote servers for a much cheaper cost, the desktop suddenly no longer occupies that central position. In the past, Microsoft used the popularity of its Windows operating system (found on 95 percent of the world's personal computers) and Office to destroy competing products such as Netscape Navigator, Lotus 1-2-3, and WordPerfect. But Google's offerings are Web-based, and thus not reliant on Windows or Office. Google believes that the vast majority of computing tasks, around 90 percent, can be done in the cloud. Microsoft disputes this claim, calling it grossly overstated.

Microsoft clearly wants to bolster its Internet presence in the event that Google is correct. Their recent attempts to acquire Internet portal Yahoo! indicate this desire. No other company would give Microsoft more Internet search market share than Yahoo!. Google controls over 60 percent of the Internet search market, with Yahoo! a distant second at just over 20 percent, and Microsoft third at under 10 percent. While Microsoft-Yahoo! would still trail Google by a wide margin, the merger would at least increase the possibility of dethroning Google. Microsoft's initial buyout attempts were met with heavy resistance from Yahoo!.

With its attempted acquisition of Yahoo!, Microsoft wanted not only to bolster its Internet presence but also to end the threat of an advertising deal between Google and Yahoo!. In June 2008, those chances diminished further due to a partnership between Google and Yahoo! under which Yahoo! will outsource a portion of its advertising to Google. Google plans to deliver some of its ads alongside some of the less profitable areas of Yahoo!'s search, since Google's technology is far more sophisticated and generates more revenue per search than any competitor. Yahoo! recently introduced a comprehensive severance package that critics dismissed as a 'poison pill' intended to make them less appealing for acquisition to Microsoft. In response to this and other moves he considered to be incompetent, billionaire investor Carl Icahn has built up a large stake in the company and has agitated for change in Yahoo! leadership and reopening of negotiations with Microsoft, but the advertising deal between the two companies casts doubt over whether Microsoft can actually pull off a buyout.

With or without Yahoo!, the company's online presence will need a great deal of improvement. Microsoft's online services division's performance

has worsened while Google's has improved. Microsoft lost \$732 million in 2007 and was on track for an even worse year in 2008. Google gained \$4.2 billion in profits over the same 2007 span.

Microsoft's goals are to "innovate and disrupt in search, win in display ads, and reinvent portal and social media experiences." Its pursuit of Yahoo! suggests skepticism even on Microsoft's own part that the company can do all of this on its own. Developing scale internally is far more difficult than simply buying it outright. In attempting to grow into this new area, Microsoft faces considerable challenges. The industry changes too quickly for one company to be dominant for very long, and Microsoft has had difficulty sustaining its growth rates since the Internet's inception. Even well-managed companies encounter difficulties when faced with disruptive new technologies, and Microsoft may be no exception.

Google faces difficulties of its own in its attempts to encroach on Microsoft's turf. The centerpiece of their efforts is their Google Apps suite. These are a series of Web-based applications that include Gmail, instant messaging, calendar, word processing, presentation, and spreadsheet applications (Google Docs), and tools for creating collaborative Web sites. These applications are simpler versions of Microsoft Office applications, and Google is offering basic versions of them for free, and 'Premier' editions for a fraction of the price. Subscribing to the Premier edition of Google Apps costs \$50 per year per person, as opposed to approximately \$500 per year per person for Microsoft Office.

Google believes that most Office users don't need the advanced features of Word, Excel, and other Office applications, and have a great deal to gain by switching to Google Apps. Small businesses, for example, might prefer cheaper, simpler versions of word processing, spreadsheet, and electronic presentation applications because they don't require the complex features of Microsoft Office. Microsoft disputes this, saying that Office is a result of many years and dollars of research indicating what consumers want, and that consumers are very satisfied with their products. Many businesses agree, saying that they are reluctant to move away from Office because it is the 'safe choice'. These firms are often concerned that their data is not stored on-site and that they may be in violation of laws like Sarbanes-Oxley as a result, which requires that companies maintain and report their data to the government upon request.

Microsoft is also offering more software features and Web-based services to bolster its online presence. These include SharePoint, a Web-based collaboration and document management platform, and Microsoft Office Live, providing Web-based services for e-mail, project management, and organizing information, and online extensions to Office.

The battle between Google and Microsoft isn't just being waged in the area of office productivity tools. The two companies are trading blows in a multitude of other fields, including Web browsers, Web maps, online video, cell phone software, and online health recordkeeping tools. Salesforce.com (see the Interactive Session in Chapter 5) represents the site of another conflict between the two giants. Microsoft has attempted to move in on the software-as-a-service model popularized by Salesforce.com, offering a competing CRM product for a fraction of the cost. Google has gone the opposite route, partnering with Salesforce to integrate their CRM applications with Google Apps and creating a new sales channel to market Google Apps to businesses that have already adopted Salesforce CRM software.

Additionally, both companies are attempting to open themselves up as platforms to developers. Google has already launched its Google App Engine, which allows outside programmers to develop and launch their own applications for minimal cost. In a move that represented a drastic change from their previous policy, Microsoft announced that they would reveal many key details of its software that they had previously kept secret. Programmers will have an easier time building services that work with Microsoft programs. Microsoft's secrecy once helped them control the marketplace by forcing other companies to use Windows rather than develop alternatives, but if they can't do the same to Google Apps, it makes sense to try a different approach to attract developers.

Time will tell whether or not Microsoft is able to fend off Google's challenge to its dominance in the tech industry. Many other prominent companies have fallen victim to paradigm shifts, such as mainframes to personal computers, traditional print media to Internet distribution, and, if Google has its way, personal computers to cloud computing.

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CASE STUDY QUESTIONS

1. Define and compare the business strategies and business models of Google and Microsoft.
2. Has the Internet taken over the PC desktop as the center of the action? Why or why not?
3. Why did Microsoft attempt to acquire Yahoo!? How did it affect its business model? Do you believe this was a good move?
4. What is the significance of Google Apps to Google's future success?
5. Would you use Google Apps instead of Microsoft Office applications for computing tasks? Why or why not?
6. Which company and business model do you believe will prevail in this epic struggle? Justify your answer.