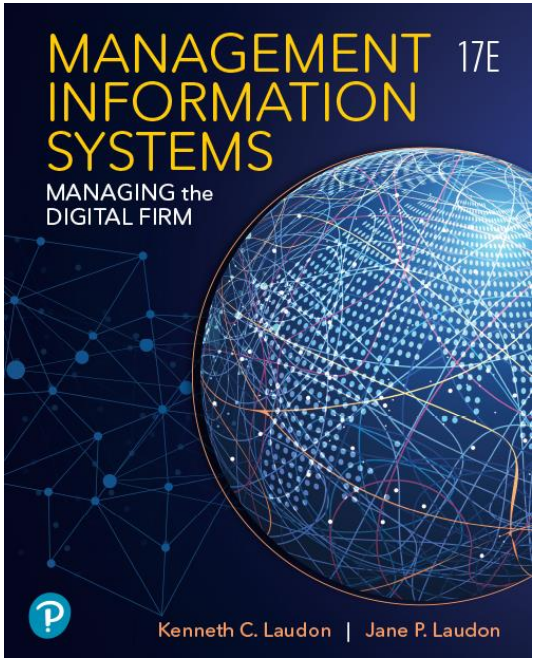
Management Information Systems: Managing the Digital Firm

Seventeenth Edition



Chapter 7

Telecommunications, the Internet, and Wireless Technology

Learning Objectives

7.1 What are the principal components of telecommunications networks and key networking technologies?

7.2 What are the different types of networks?

7.3 How do the Internet and Internet technology work, and how do they support communication and e-business?

7.4 What are the principal technologies and standards for wireless networking, communication, and Internet access?

7.5 How will MIS help my career?

Video Cases

- Case 1: Telepresence Moves out of the Boardroom and into the Field
- Case 2: Virtual Collaboration with IBM Sametime

The National Hockey League Scores with Wireless Technology (1 of 2)

- Problem
  - Challenging sport to track
  - Opportunities from new technology
- Solutions
  - Adopt digital strategy
  - Select wireless technology
  - Revise game tracking process
  - Wireless sensors
  - OASIS software
  - Cameras
  - Antennae

The National Hockey League Scores with Wireless Technology (2 of 2)

- Puck and Player Tracking System
- Demonstrates illustrates some of the powerful capabilities and opportunities provided by contemporary networking technology.
- Illustrates the ability of IT systems to expand fan base and deepen fan engagement by taking advantage of opportunities presented by wireless networking technology and the Internet of Things (IoT)

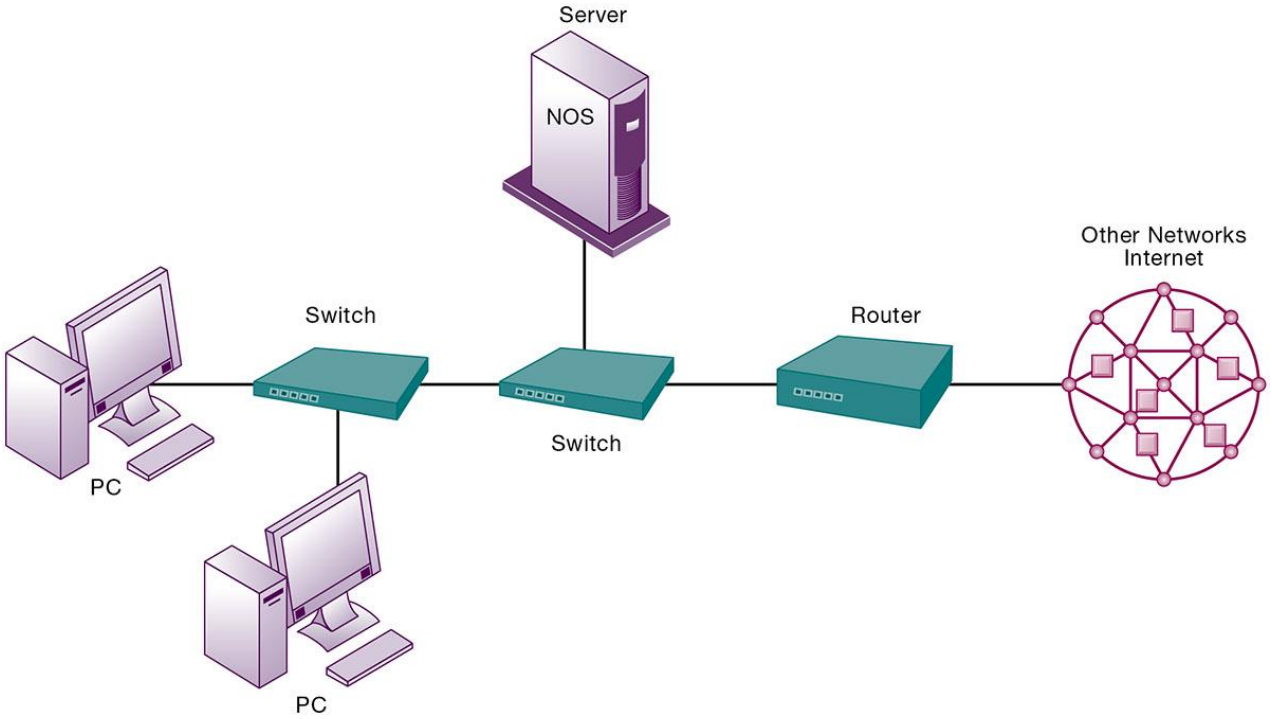
Networking and Communication Trends

- Convergence
  - Telephone networks and computer networks converging into single digital network using Internet standards
- Broadband
  - Majority of U.S. households have high-speed broadband
- Broadband wireless
  - Voice, data communication are increasingly taking place over broadband wireless platforms

What Is a Computer Network?

- Two or more connected computers
- Major components in simple network
  - Client and server computers
  - Network interfaces (NICs)
  - Connection medium
  - Network operating system (NOS)
  - Hubs, switches, routers
- Software-defined networking (SDN)
  - Functions of switches and routers managed by central program

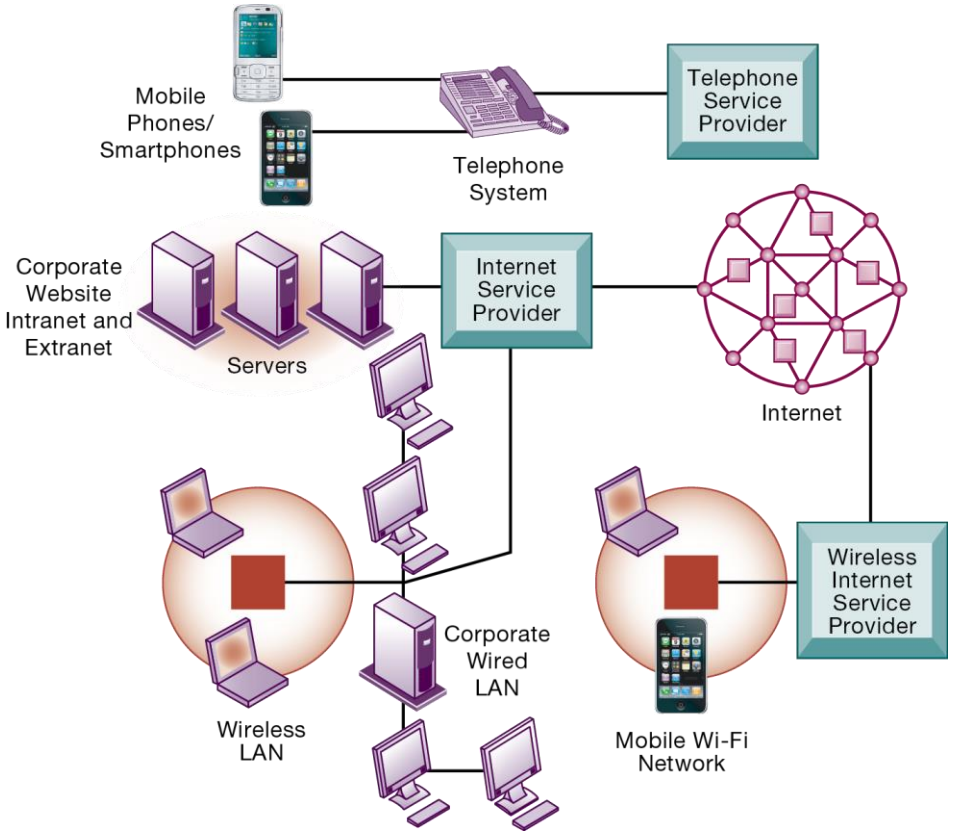
Figure 7.1 Components of a Simple Computer Network



Networks in Large Companies

- Large number of local area networks (LANs) linked to firmwide corporate networks
- Various powerful servers
  - Website, corporate intranet, extranet
  - Backend systems
- Mobile wireless LANs (Wi-Fi networks)
- Videoconferencing system
- Telephone network, wireless cell phones

Figure 7.2 Corporate Network Infrastructure



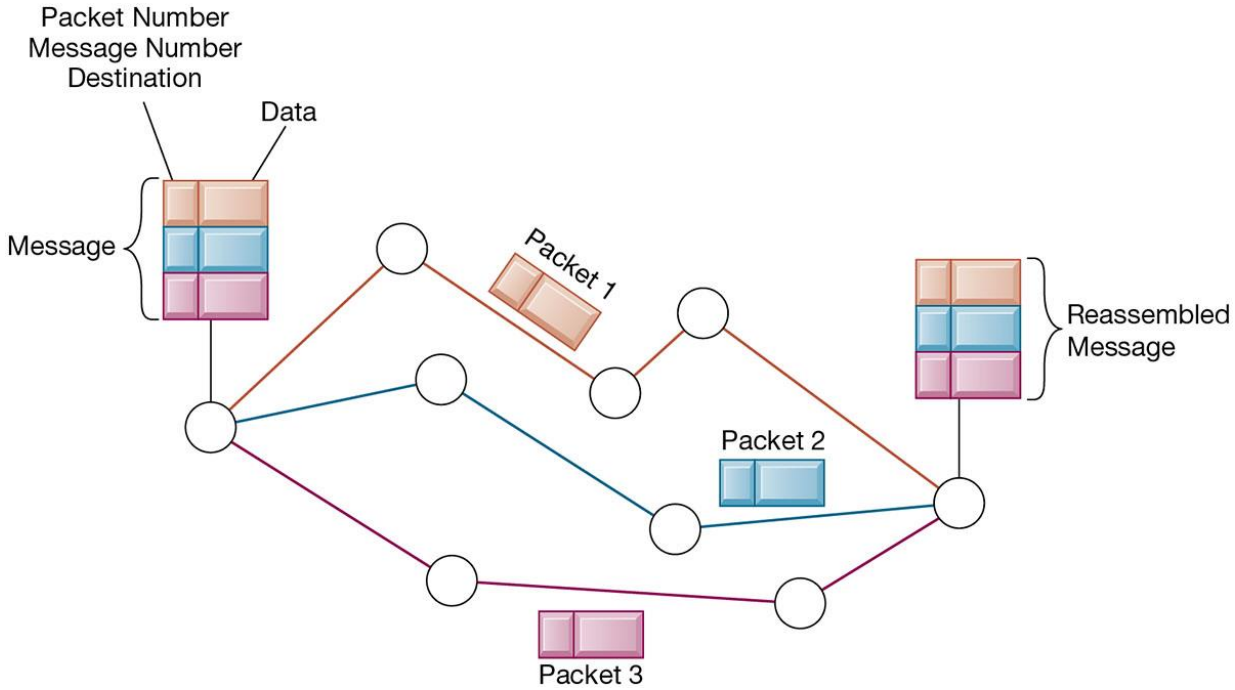
Key Digital Networking Technologies (1 of 3)

- Client/server computing
  - Distributed computing model
  - Clients linked through network controlled by network server computer
  - Server sets rules of communication for network and provides every client with an address so others can find it on the network
  - Has largely replaced centralized mainframe computing
  - The Internet: largest implementation of client/server computing

Key Digital Networking Technologies (2 of 3)

- Packet switching
  - Method of slicing digital messages into parcels (packets), sending packets along different communication paths as they become available, and then reassembling packets at destination
  - Previous circuit-switched networks required assembly of complete point-to-point circuit
  - Packet switching more efficient use of network's communications capacity

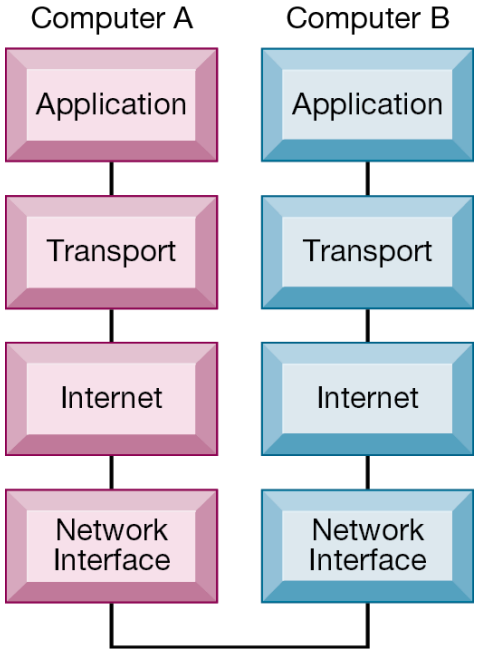
Figure 7.3 Packet-Switched Networks and Packet Communications



Key Digital Networking Technologies (3 of 3)

- TCP/IP and connectivity
  - Protocols: rules that govern transmission of information between two points
  - Transmission Control Protocol/Internet Protocol (TCP/IP)
    - Common worldwide standard that is basis for the Internet
  - Department of Defense reference model for TCP/IP
    - Four layers
      - Application layer
      - Transport layer
      - Internet layer
      - Network interface layer

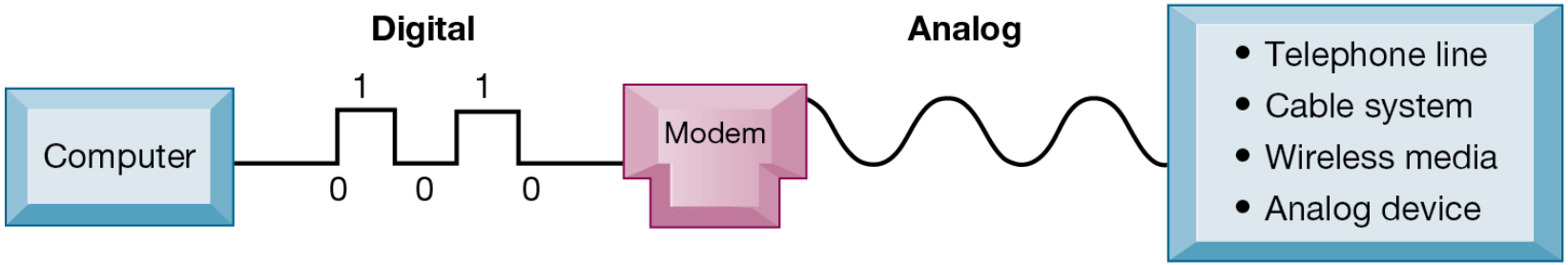
Figure 7.4 The Transmission Control Protocol/Internet Protocol (TCP/IP) Reference Model



Types of Networks

- Signals: Digital versus analog
  - Modem: translates digital signals into analog form (and vice versa)
- Types of networks
  - Local area networks (LANs)
    - Ethernet
    - Client/server vs. peer-to-peer
  - Wide area networks (WANs)
  - Metropolitan area networks (MANs)
  - Campus area networks (CANs)

Figure 7.5 Functions of the Modem



Transmission Media and Transmission Speed

- Physical transmission media
  - Twisted pair wire (CAT5 and CAT6)
  - Coaxial cable
  - Fiber optics cable
  - Wireless transmission media and devices
    - Satellites
    - Cellular systems
- Bandwidth: Transmission speed
  - Bits per second (bps)
  - Hertz
  - Bandwidth

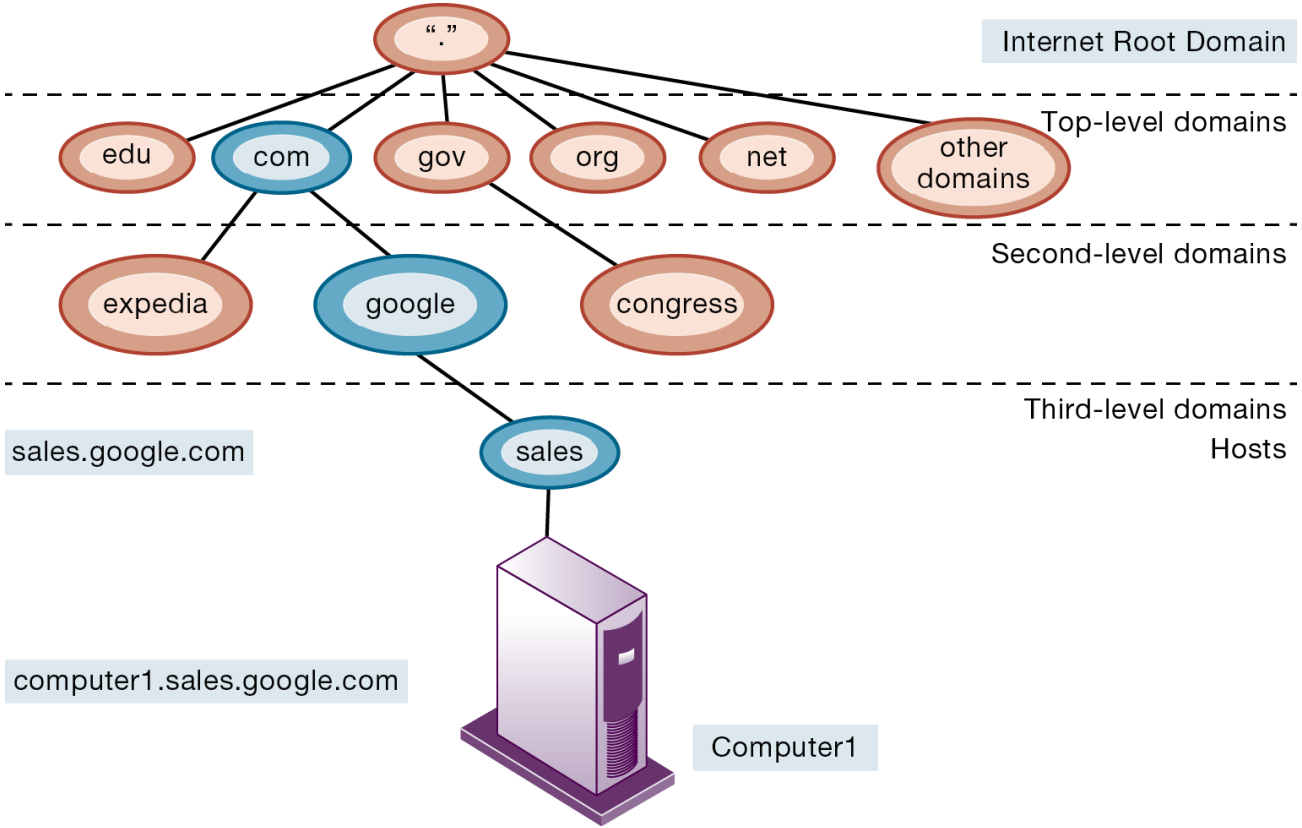
What Is the Internet?

- The Internet
  - World's most extensive network
  - Internet service providers (ISPs)
    - Provide connections
    - Types of Internet connections
      - Dial-up: 56.6 Kbps
      - Digital subscriber line (DSL/FIOS): 385 Kbps –100+ Mbps
      - Cable Internet connections: 20–100 Mbps
      - Satellite
      - T1/T3 lines: 1.54 Mbps/45 Mbps

Internet Addressing and Architecture

- Each device on Internet assigned Internet Protocol (IP) address
- 32-bit number, e.g. 207.46.250.119
- The Domain Name System (DNS)
  - Converts IP addresses to domain names
  - Hierarchical structure
  - Top-level domains

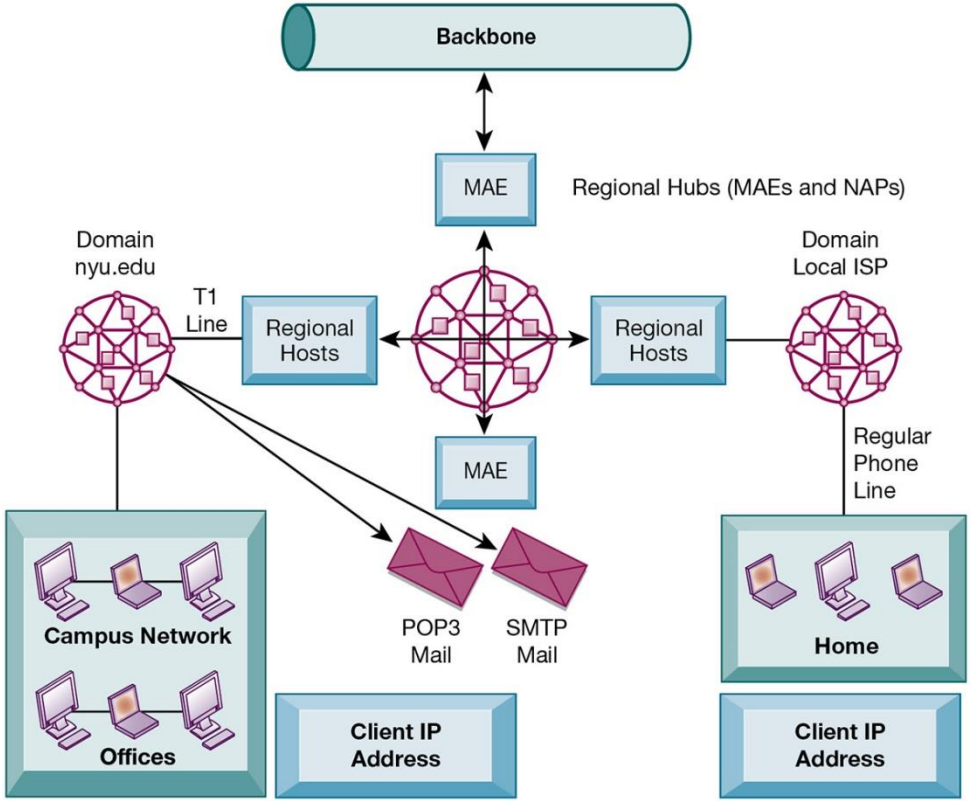
Figure 7.6 The Domain Name System



Internet Architecture and Governance

- Network service providers
  - Own trunk lines (high-speed backbone networks)
- Regional telephone and cable T V companies
  - Provide regional and local access
- Professional organizations and government bodies establish Internet standards
  - IAB
  - ICANN
  - W3C

Figure 7.7 Internet Network Architecture



The Future Internet: IPv6 and Internet 2

- IPv6
  - New addressing scheme for IP numbers
  - Will provide more than a quadrillion new addresses
  - Not compatible with earlier IPv4 addressing
- Internet2
  - Advanced networking consortium
    - Universities, businesses, government agencies, other institutions
  - Developed high-capacity 100 Gbps testing network
  - Testing leading-edge new technologies for Internet

Internet Services and Communication Tools (1 of 2)

- Internet services
  - E-mail
  - Chatting and instant messaging
  - Newsgroups
  - Telnet
  - File Transfer Protocol (FTP)
  - World Wide Web

Internet Services and Communication Tools (2 of 2)

- Voice over IP (VoIP)
  - Digital voice communication using IP, packet switching
- Unified communications
  - Communications systems that integrate voice, data, e-mail, conferencing
- Virtual private network (VPN)
  - Secure, encrypted, private network run over Internet

Figure 7.8 Client/Server Computing on the Internet

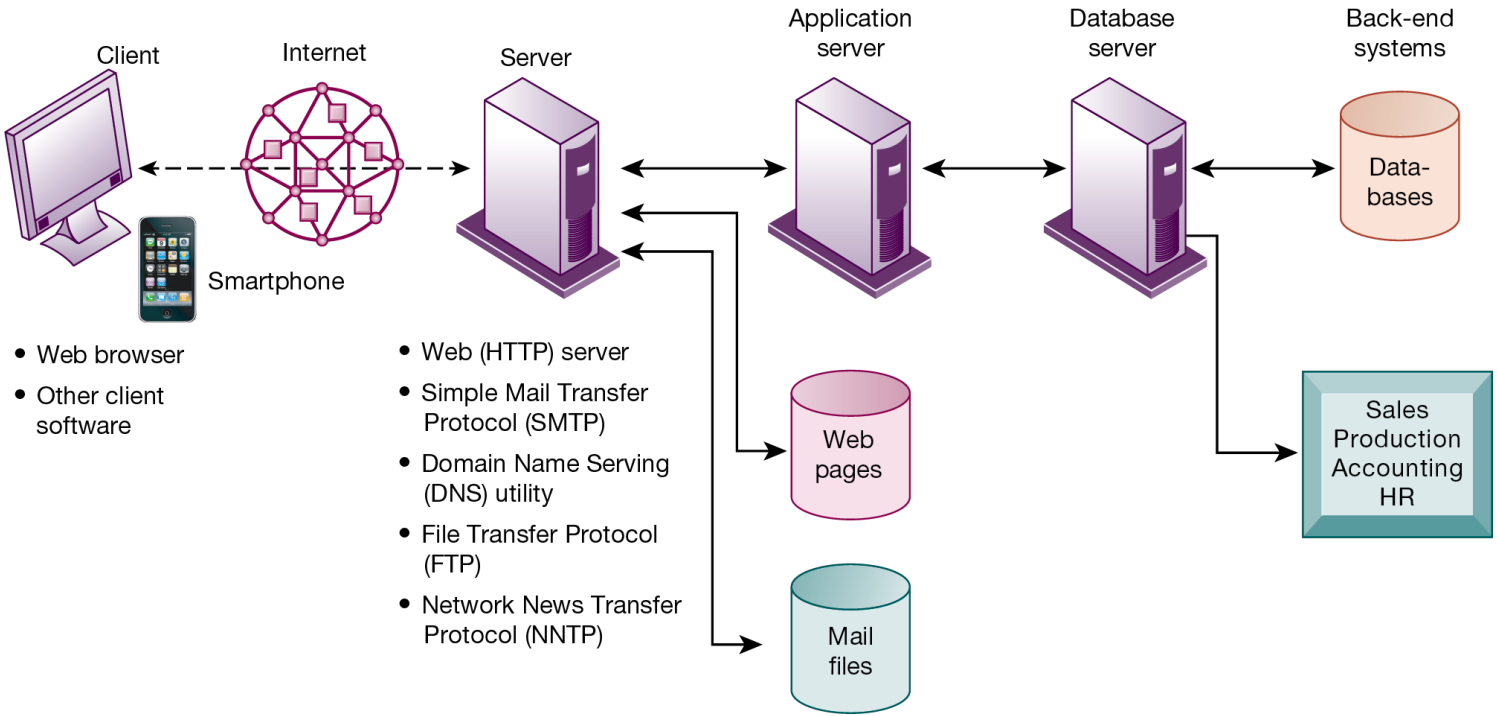


Figure 7.9 How Voice over IP Works

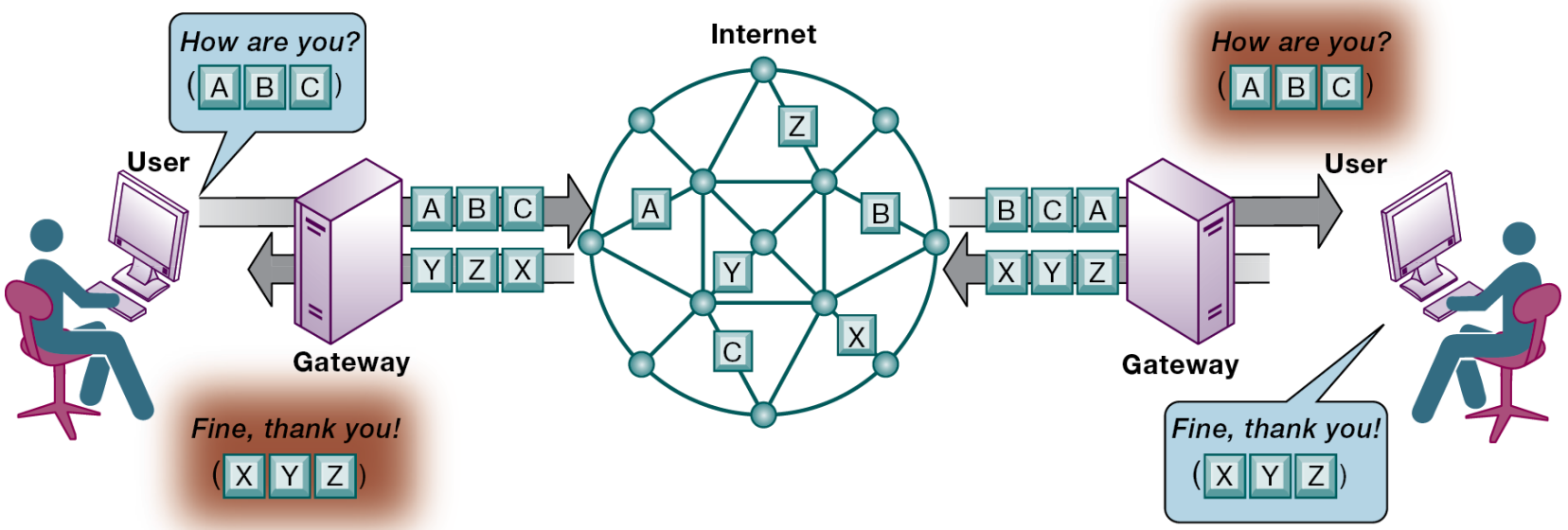
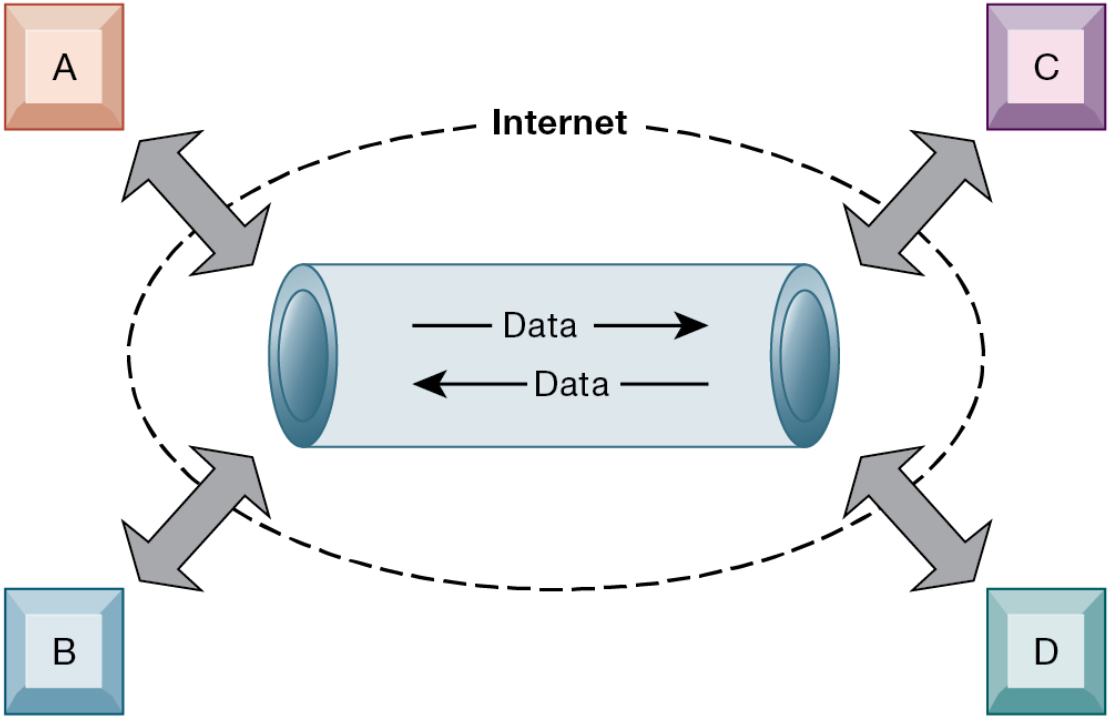


Figure 7.10 A Virtual Private Network Using the Internet



Interactive Session: Management: Monitoring Employees on Networks: Unethical or Good Business?

- Class discussion
  - Should managers monitor employee e-mail and Internet usage? Why or why not?
  - Describe an effective e-mail and web use policy for a company.
  - Should managers inform employees that their web behaviour is being monitored? Or should managers monitor secretly? Why or why not?

The Web

- Hypertext
  - Hypertext Markup Language (HTML)
  - Hypertext Transfer Protocol (HTTP):
  - Uniform resource locator (URL):
    - http://www.megacorp.com/content/features/082602.html
- Web servers
    - Software for locating and managing web pages

Searching for Information on the Web

- Search engines
- Mobile search
- Semantic search and predictive search
- Visual search
- Intelligent agent shopping bots
- Search engine marketing
- Search engine optimization (SEO)

Figure 7.11 Top Desktop/Laptop Web Search Engines Worldwide

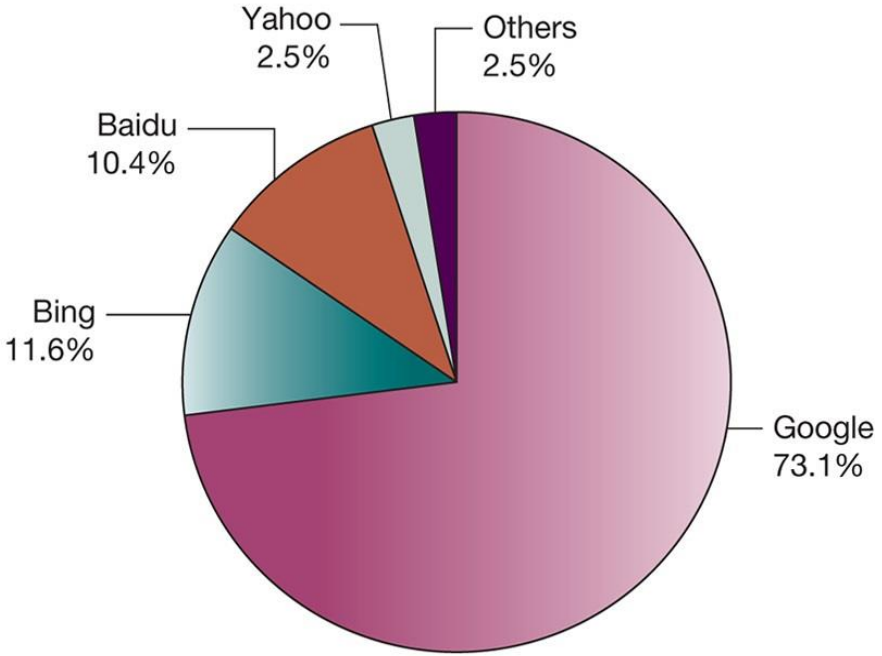
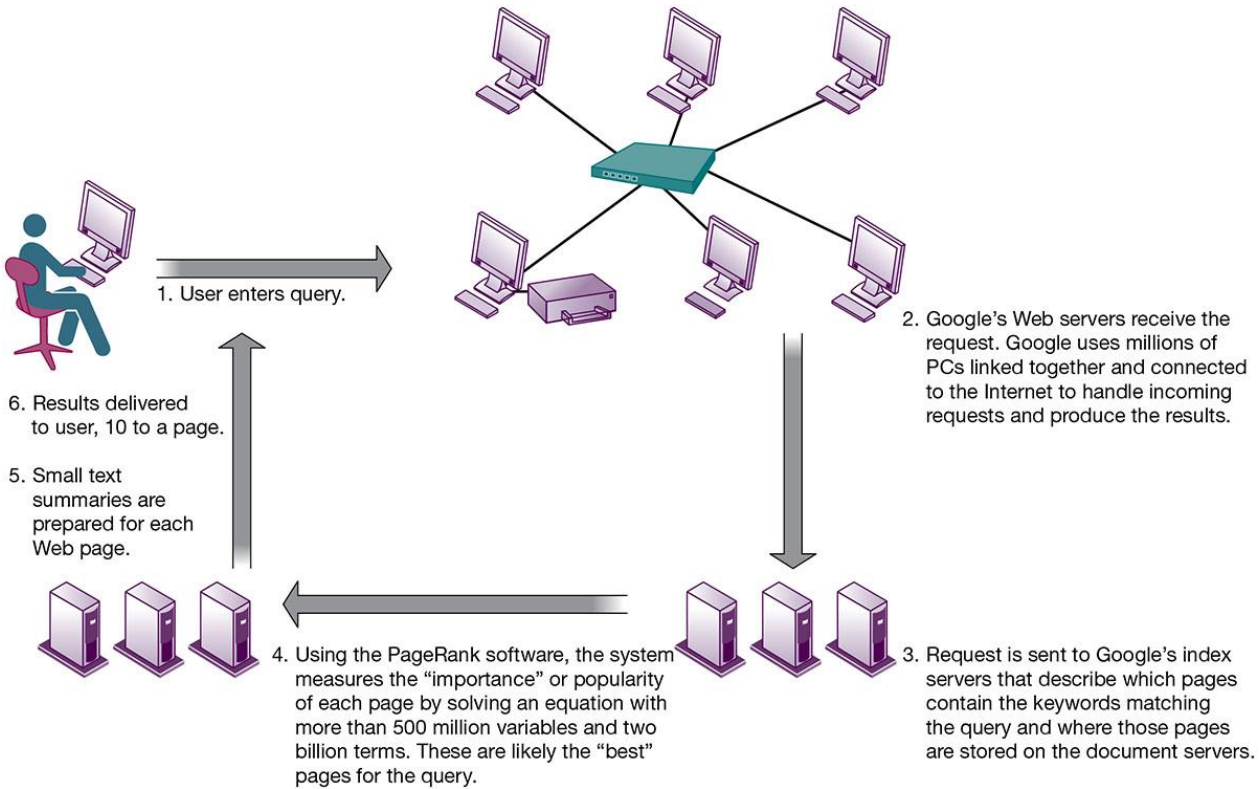


Figure 7.12 How Google Works



Sharing Information on the Web

- Blogs and microblogs
- RSS
- Wikis
- Social networking

The Future Web

- More tools to make sense of trillions of pages on the Internet
- Pervasive web
- Internet of Things (IoT)
- App Internet
- Increased cloud computing and SaaS
- Ubiquitous mobile connectivity
- Greater seamlessness of web as a whole

Interactive Session: Technology: The Internet of Things Aids Waste Management

- Class discussion
  - Identify the problem described in the case study. Is it a management problem, an organizational problem, or a technology problem? Explain your answer.
  - What role has information technology and the IoT played in helping cities deal with their waste management problems? Describe the IT applications that are being used for this purpose.
  - How successful are these IT applications as a solution? Explain your answer.

Cellular Systems (1 of 2)

- Competing standards
  - CDMA : United States only
    - Verizon, Sprint
  - GSM : Rest of world
    - AT&T, T-Mobile
- Third-generation (3G) networks
  - 144 Kbps
  - Suitable for e-mail access, web browsing

Cellular Systems (2 of 2)

- Fourth-generation (4G) networks
  - Up to 100 Mbps
  - Suitable for Internet video
  - LTE and WiMax
- 5G Networks
  - Gigabit capacity
  - Starting to be launched by AT&T, Verizon, and other carriers

Wireless Computer Networks and Internet Access (1 of 2)

- Bluetooth (802.15)
  - Links up to 8 devices in 10-m area using low-power, radio-based communication
  - Useful for personal networking (PANs)
- Wi-Fi (802.11)
  - Set of standards: 802.11
  - Used for wireless LAN and wireless Internet access
  - Use access points: device with radio receiver/transmitter for connecting wireless devices to a wired LAN

Wireless Computer Networks and Internet Access (2 of 2)

  - Hotspots: one or more access points in public place to provide maximum wireless coverage for a specific area
  - Weak security features

- WiMax (802.16)
  - Wireless access range of 31 miles
  - Require WiMax antennas

Figure 7.13 A Bluetooth Network (PAN)

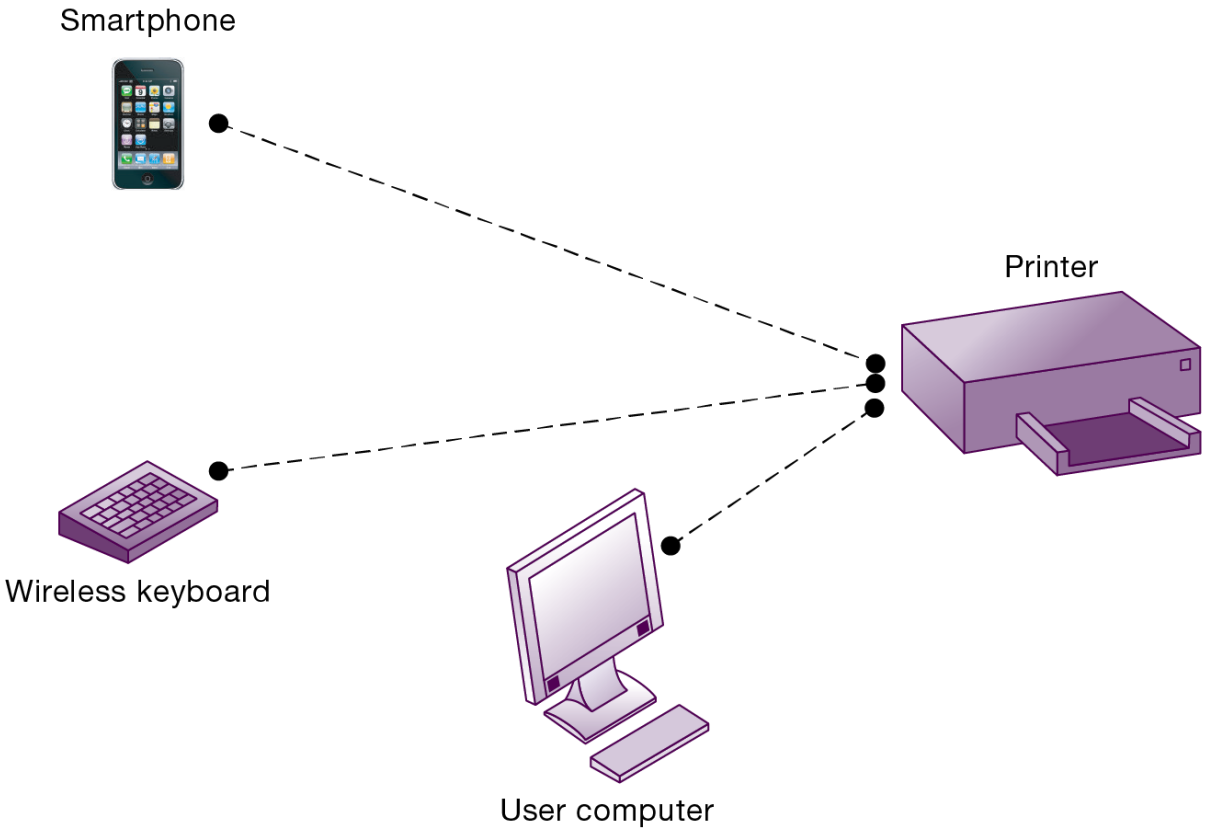
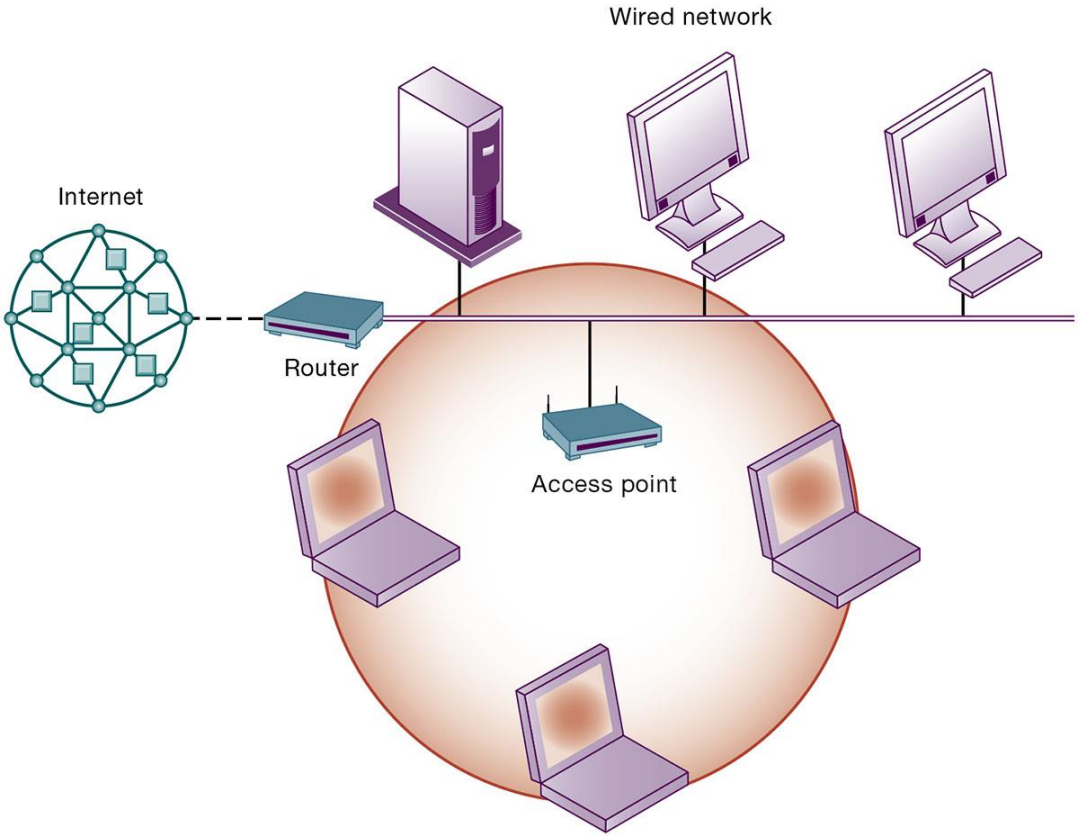


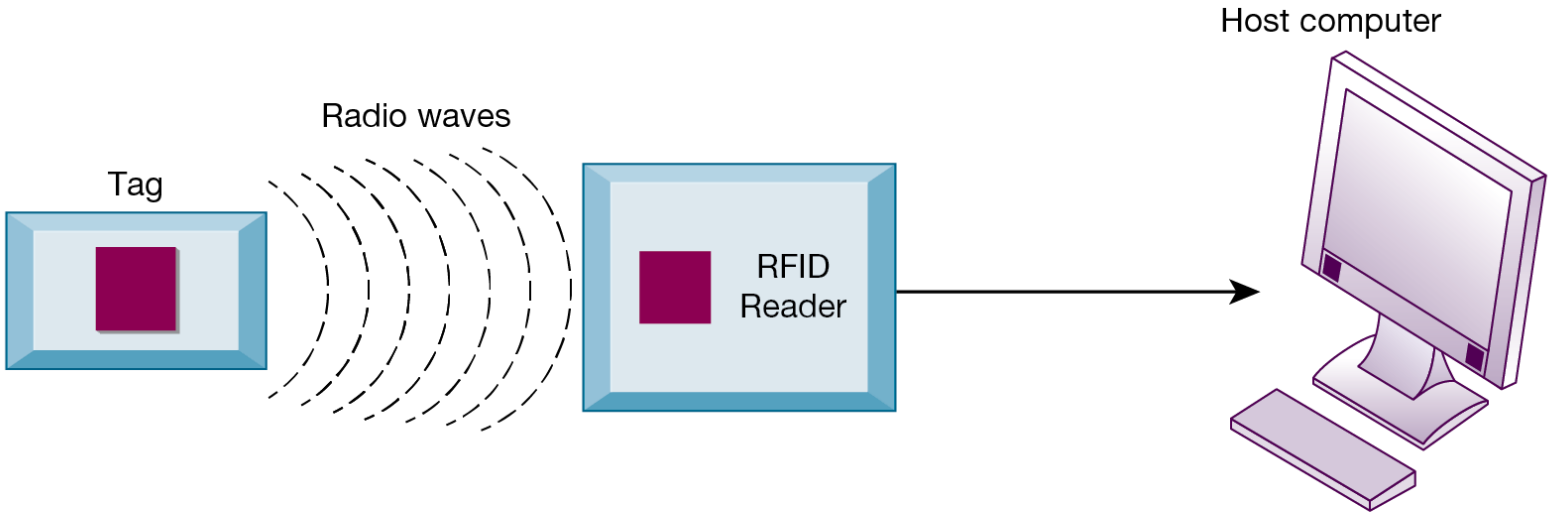
Figure 7.14 An 802.11 Wireless LAN



RFID and Wireless Sensor Networks (I of 3)

- Radio Frequency Identification (RFID)
  - Use tiny tags with microchips containing data about an item and location; tag antennas to transmit radio signals over short distances to special RFID readers
  - Common uses: Automated toll-collection; tracking goods in a supply chain
  - Reduction in cost of tags making RFID viable for many firms

Figure 7.15 How RFID Works



A microchip holds data including an identification number. The rest of the tag is an antenna that transmits data to a reader.

Has an antenna that constantly transmits. When it senses a tag, it wakes it up, interrogates it, and decodes the data. Then it transmits the data to a host system over wired or wireless connections.

Processes the data from the tag that have been transmitted by the reader.

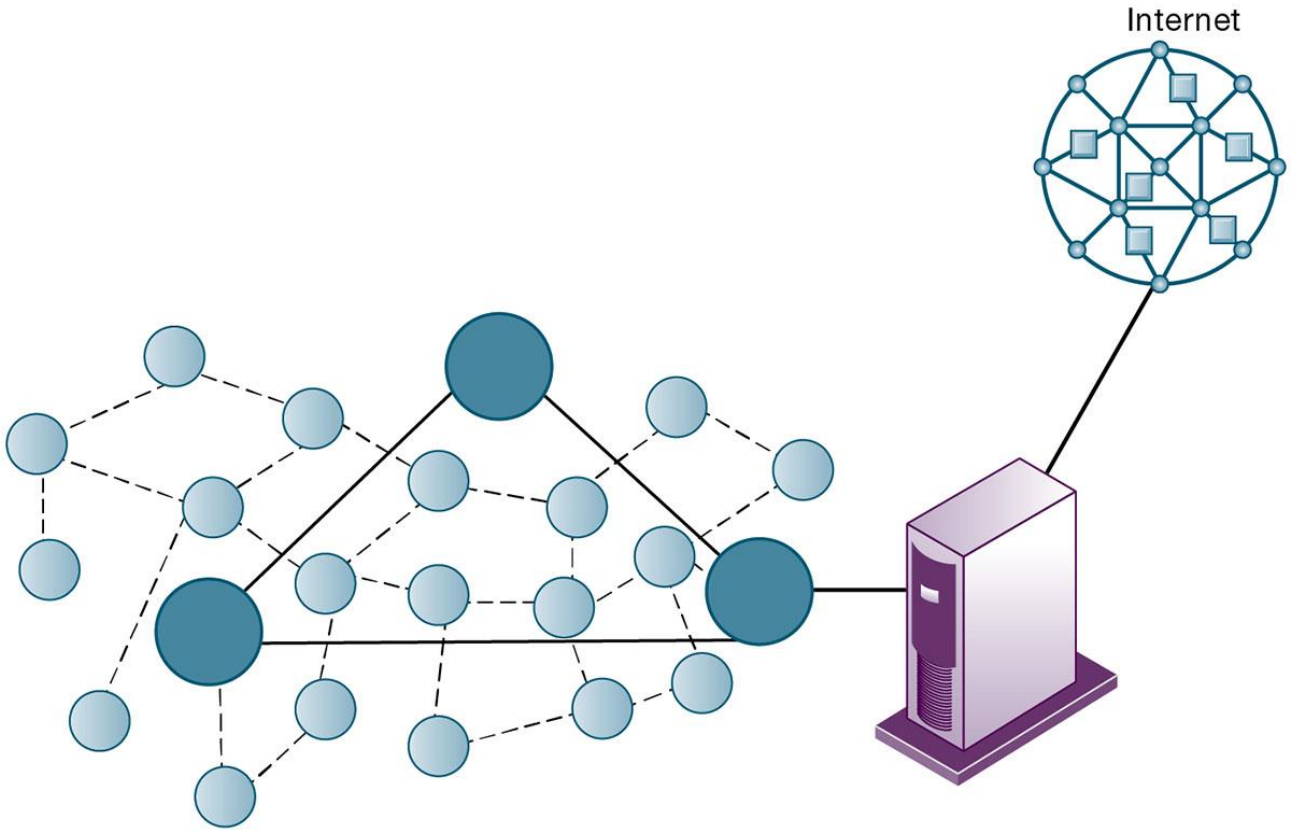
RFID and Wireless Sensor Networks (2 of 3)

- Near field communication (NFC)
  - RFID-related technology that uses very short-range wireless connectivity standard
  - Used by tap-and-go services such as Apple Pay, Google Pay

RFID and Wireless Sensor Networks (3 of 3)

- Wireless Sensor Networks (WSNs)
  - Networks of hundreds or thousands of interconnected wireless devices used to monitor building security, detect hazardous substances in air, monitor environmental changes, traffic, or military activity
  - Devices have built-in processing, storage, and radio frequency sensors and antennas
  - Require low-power, long-lasting batteries and ability to endure in the field without maintenance
  - Major sources of big data and fueling Internet of Things

Figure 7.16 A Wireless Sensor Network



How Will MIS Help My Career?

- The Company: A1 Western Car Dealers
- Position Description: Automotive digital advisor
- Job Requirements
- Interview Questions
- Author Tips

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