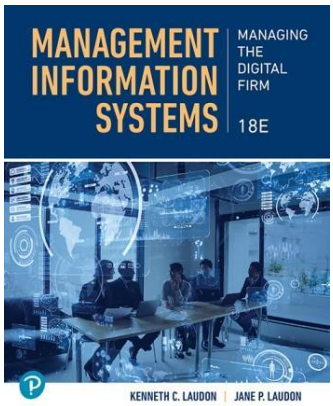
Management Information Systems: Managing the Digital Firm

Eighteenth Edition



Chapter 7

Telecommunications, the Internet, and Wireless Technology

Learning Objectives (1 of 2)

7.1 Describe key components of telecommunications networks

7.2 Describe key digital networking technologies

7.3 Describe the different types of networks

7.4 Understand what the Internet is and how it works

Learning Objectives (2 of 2)

7.5 Explain how Internet services support business

7.6 Discuss how the web works and how it can be used in business

7.7 Describe the principal wireless technologies and standards

7.8 Understand how the information in the chapter can help your career

Describe Key Components of Telecommunications Networks (1 of 4)

- Firms in the past used two fundamentally different types of networks: telephone networks and computer networks
- Telephone and computer networks have converged into a single digital network
  - Using shared Internet-based standards and technology
- Voice and data communication networks have become
  - More powerful (faster)
  - More portable (smaller and more mobile)
  - Less expensive

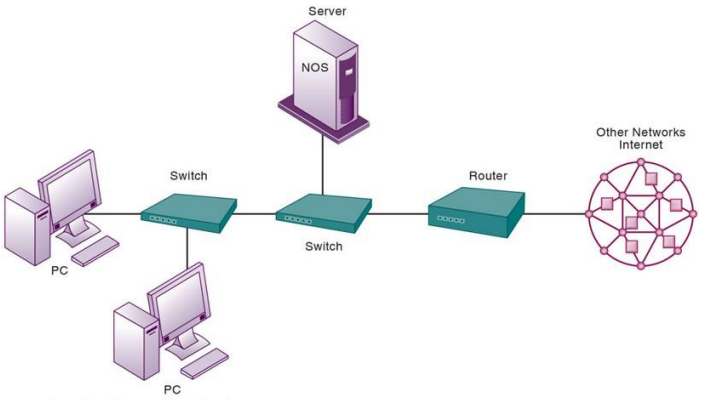
Describe Key Components of Telecommunications Networks (2 of 4)

- Convergence
  - Telephone networks and computer networks converging into single digital network using Internet standards
- Broadband
  - Defined by the Federal Communications Commission as providing Internet service at a minimum of 100 megabits per second (Mbps) for downloads and 4 Mbps for uploads
  - Majority of U.S. households have high-speed broadband

Describe Key Components of Telecommunications Networks (3 of 4)

- What is a computer network?
  - Two or more connected computers
  - Major components in simple network
    - Client and server computers
    - Network interface controllers (N I C s or network interface cards)
    - Connection medium
    - Network operating system (N O S)
    - Hubs, switches, routers
    - Software-defined networking (S D N)

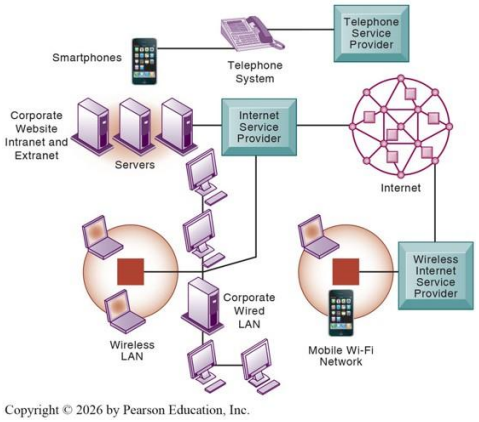
Figure 7.1 Components of a Simple Computer Network



Describe Key Components of Telecommunications Networks (4 of 4)

- As a firm grows, its small networks can be tied together into a corporate-wide networking infrastructure
  - Powerful servers support a corporate website, a corporate intranet, and perhaps an extranet
  - Servers on the network may also link to other large computers supporting back-end systems

Figure 7.2 Corporate Network Infrastructure



Describe Key Digital Networking Technologies (1 of 5)

- Contemporary digital networks and the Internet are based on three key technologies
  - Client/server computing
  - Packet switching
  - Development of widely used communications standards for linking disparate networks and computers
    - Transmission Control Protocol/Internet Protocol (TCP/IP) is the most important

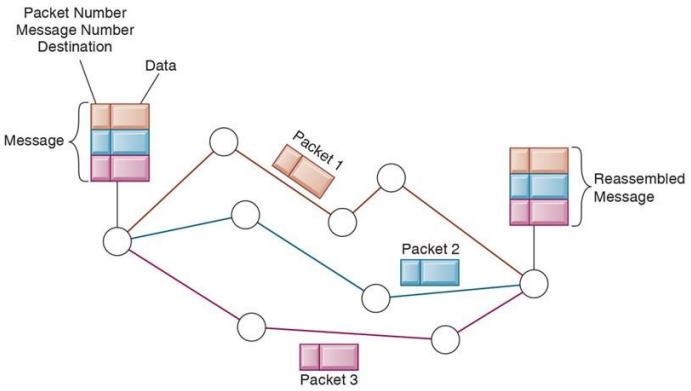
Describe Key Digital Networking Technologies (2 of 5)

- 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 is the largest implementation of client/server computing

Describe Key Digital Networking Technologies (3 of 5)

- 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



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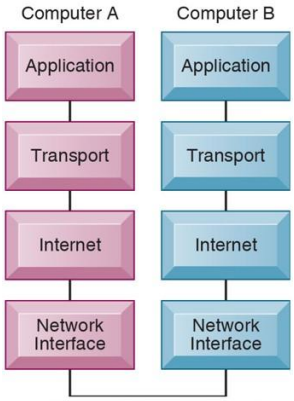
Describe Key Digital Networking Technologies (4 of 5)

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

Figure 7.4 The Transmission Control Protocol/Internet Protocol (T C P/I P) Reference Model



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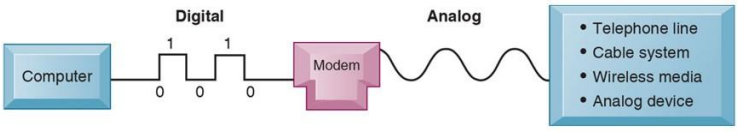
Describe Key Digital Networking Technologies (5 of 5)

- There are two ways to communicate a message in a network
  - Digital signals
    - Discrete, binary waveform rather than a continuous waveform
  - Analog signals
    - Represented by a continuous waveform that passes through a communications medium and is used for audio communication
- Modem: translates digital signals into analog form (and vice versa)

Figure 7.5 Functions of A Modem



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Describe the Different Types of Networks (1 of 2)

- Types of networks
  - Local area network (L A N)
    - Connect desktop computers and other digital devices within a half-mile or 500-meter radius
    - Ethernet is the dominant LAN standard at the physical network level
    - Client/server vs. peer-to-peer
  - Wide area network (W A N)
  - Metropolitan area network (M A N)
  - Campus area network (C A N)

Describe the Different Types of Networks (2 of 2)

- Physical transmission media
  - Twisted copper pair wire
  - Coaxial cable
  - Fiber-optics cable
  - Wireless transmission media and devices
- Bandwidth
  - Measures how much data can be transferred over a communications medium within a fixed period of time
  - Measured in bits per second (Bps), kilobits per second (Kbps), megabits per second (Mbps), gigabits per second (Gbps), and, for very advanced communications media, terabits per second (Tbps)

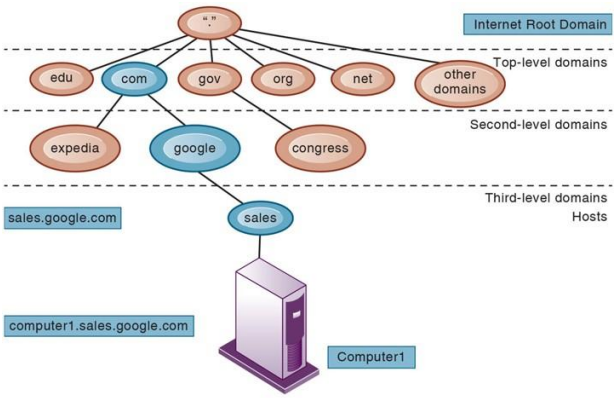
Understand What the Internet Is and How It Works (1 of 5)

- The Internet
  - World's most extensive public communication system
  - Internet service providers (I S P s)
    - Provide connections
    - Two versions of IP addressing currently in use
      - IPv4 and IPv6

Understand What the Internet Is and How It Works (2 of 5)

- Each device on the Internet is assigned an Internet Protocol (I P) address
- The Domain Name System (D N S)
  - Converts domain names to IP addresses
  - Hierarchical structure
  - Top-level domains are the two- and three-character names you are familiar with from surfing the web
    - For example, .com, .edu, .gov, and the various country codes such as .ca for Canada, .it for Italy, and .br for Brazil

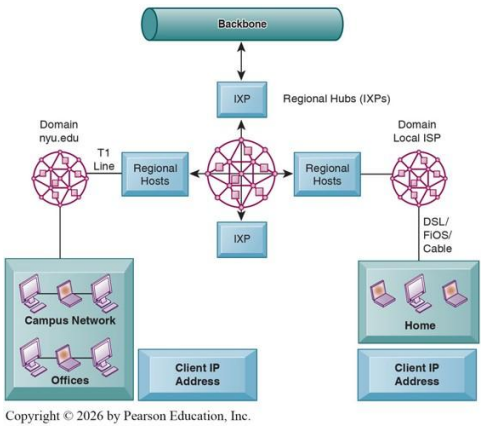
Figure 7.6 The Domain Name System



Understand What the Internet Is and How It Works (3 of 5)

- Internet data traffic is carried over transcontinental, high-speed backbone networks that generally operate in the gigabit range
  - Trunk lines typically owned by long-distance telecommunications companies
    - Tier 1 ISPs
    - Tier 2 ISPs
    - Tier 3 ISPs
      - Referred to as Internet-service providers (ISPs)
      - Charter Spectrum, AT&T, Verizon, etc.

Figure 7.7 Internet Network Architecture



Understand What the Internet Is and How It Works (4 of 5)

- Broadband services are provided by
  - Digital subscriber line (DSL)
  - Fiber-optic service (FiOS)
  - Cable Internet
  - Satellite Internet
  - T lines

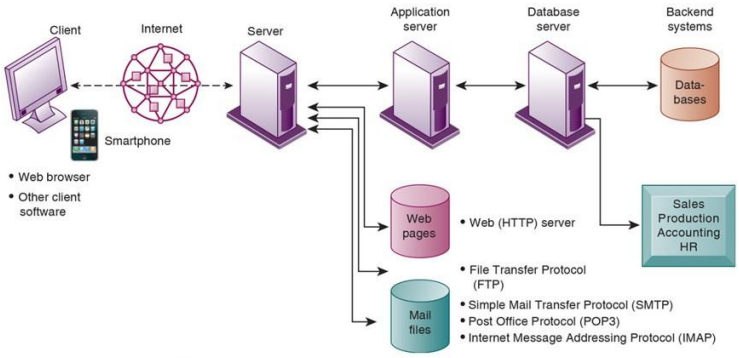
Understand What the Internet Is and How It Works (5 of 5)

- Internet governance
  - No one owns the Internet, and it has no formal management
    - However, worldwide Internet policies are established by a number of professional organizations and government bodies
      - Internet Architecture Board (IAB)
        - Helps define the overall structure of the Internet
      - Internet Corporation for Assigned Names and Numbers (ICANN)
        - Manages the domain name system
      - World Wide Web Consortium (W3C)
        - Sets Hypertext Markup Language (HTML) and other programming standards for the web

Explain How Internet Services Support Business (1 of 3)

- Internet services
  - Email
  - Instant messaging (chat service)
  - File transfer (F T P)
  - Voice transmission (VoIP)
  - World Wide Web (the Web)

Figure 7.8 Client/Server Computing on the Internet



Explain How Internet Services Support Business (2 of 3)

- Email
  - Enables messages to be exchanged from computer to computer
  - Routing messages to multiple recipients, forwarding, attaching documents, etc.
- Instant messaging
  - Type chat service for private chats
  - Google Chat, Facebook Messenger

Explain How Internet Services Support Business (3 of 3)

- Voice over IP (VoIP)
  - Digital voice communication using I P, packet switching
  - AT&T, Verizon, Comcast
- Unified communications
  - Communications systems that integrate voice, data, email, conferencing
- Virtual private network (V P N)
  - Secure, encrypted, private network run over Internet

Figure 7.9 How Voice over IP Works

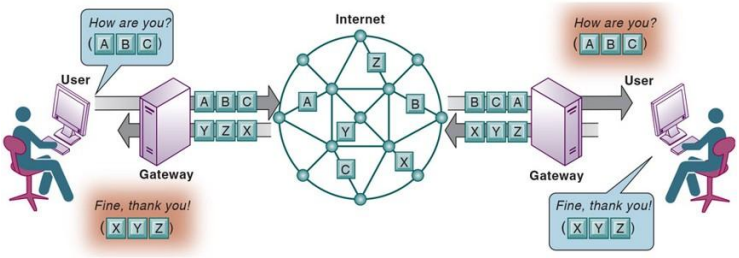
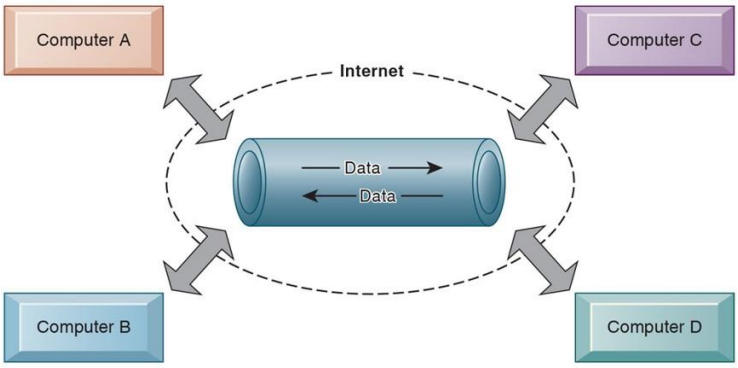


Figure 7.10 A Virtual Private Network Using the Internet



Discuss How the Web Works and How It Can Be Used in Business (1 of 5)

- The web is the most popular Internet service
  - Website
    - Collection of web pages linked to a home page
  - Web page
    - Online "page" formatted using Hypertext Markup Language (HTML)
    - May contain embedded links (hyperlinks) that connect documents to one another and that also link pages to other objects
  - Hypertext Transfer Protocol (HTTP)
    - Communications standard that transfers pages on the web
  - Uniform resource locator (URL)
    - The address of a web page

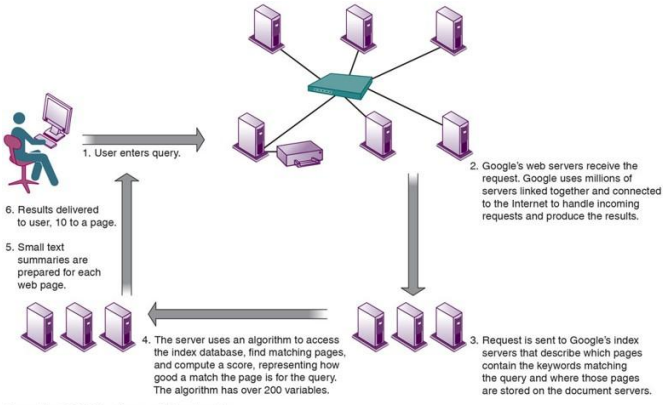
Discuss How the Web Works and How It Can Be Used in Business (2 of 5)

- Web servers
  - Software for locating and managing stored web pages
  - Locates the web page a user requests on the computer where it is stored and delivers the web page to the user's computer

Discuss How the Web Works and How It Can Be Used in Business (3 of 5)

- The surface web is the part of the web that search engines visit and about which information is recorded
  - Deep web
  - Dark web
- Search engine
  - Attempts to solve the problem of finding useful information on the web nearly instantly

Figure 7.11 How Google's Search Engine Works



Discuss How the Web Works and How It Can Be Used in Business (4 of 5)

- Mobile search
  - Searching via smartphones and tablets
  - Makes up more than 60 percent of all searches
  - Expected to continue expanding rapidly in the next few years

Discuss How the Web Works and How It Can Be Used in Business (5 of 5)

- Search engine marketing
- Search engine optimization (S E O)
- Semantic search and predictive search
- Predictive search
- Visual search

Sharing Information on the Web (1 of 2)

- A blog (weblog)
  - An informal, yet structured website used by individuals and businesses to publish content online
- RSS
  - Really Simple Syndication or Rich Site Summary
  - Pulls specified content from websites and feeds it automatically to users' computers

Sharing Information on the Web (2 of 2)

- Wiki
  - Comes from the Hawaiian word for "quick"
  - A template that defines layout and elements common to all pages
  - Displays user-editable software program code, and then renders the content into an HTML-based page for display in a web browser
- Social network
  - Enables users to build online communities of friends and professional colleagues

The Future Internet/Web Ecosystem

- Internet2
  - An advanced networking consortium focused on the development of next-generation Internet technologies
- Metaverse
  - A visual, three-dimensional (3D) virtual reality
- Web3
  - More decentralized than the current Internet
  - Would be controlled by its users rather than dominated by big corporations

Describe the Principal Wireless Technologies and Standards (1 of 5)

- Mobile is now the leading digital platform
  - 3G network
  - 4G network
  - 5G network (the newer generation of wireless communication technology)
    - Designed to support transmission of much larger amounts of data in the gigabit range
      - Fewer transmission delays
      - Ability to connect many more devices at once
  - 6G network
    - Will provide substantially higher transmission capacity

Describe the Principal Wireless Technologies and Standards (2 of 5)

- Bluetooth (802.15)
  - Links up to 7 other devices within 10 meters
  - Useful for creating a small personal networking (P A N)
- Wi-Fi (802.11)
  - Set of standards: 802.11
  - Used for wireless L A N and wireless Internet access
  - Use access points: device with radio receiver/transmitter for connecting wireless devices to a wired L A N

Figure 7.12 A Bluetooth Network (PAN)

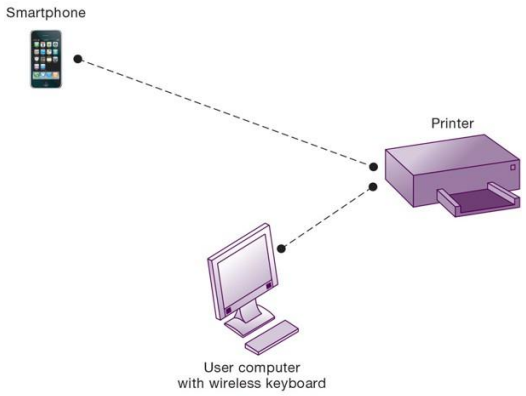
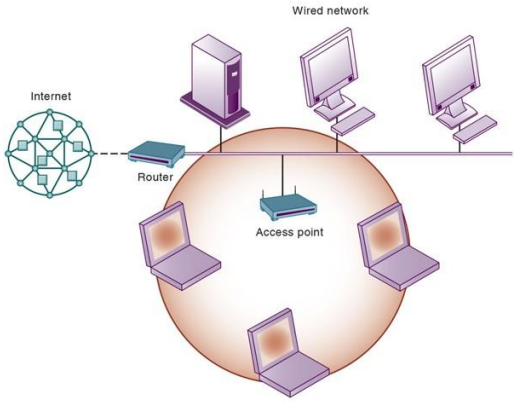


Figure 7.13 An 802.11 Wireless LAN



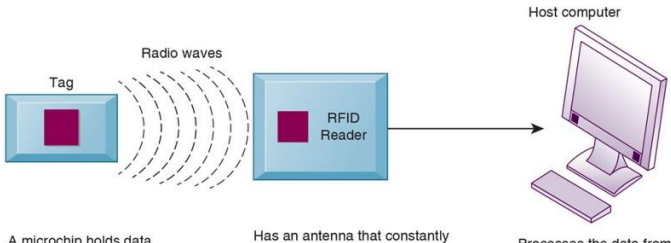
Describe the Principal Wireless Technologies and Standards (3 of 5)

- Hotspot
  - One or more access points in public to provide maximum wireless coverage for a specific area
  - Weak security features
- W i Max (802.16)
  - Worldwide Interoperability for Microwave Access
  - Wireless access range of 31 miles
  - Require W i M a x antennas

Describe the Principal Wireless Technologies and Standards (4 of 5)

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

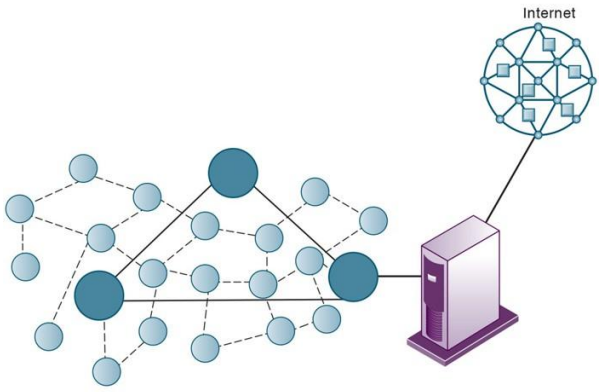
Figure 7.14 How RFID Works



Describe the Principal Wireless Technologies and Standards (5 of 5)

- 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
- Wireless Sensor Networks (WSNs)
  - Networks of interconnected wireless devices embedded in the physical environment to provide measurements of many points over large spaces
  - Devices have built-in processing, storage, and radio frequency sensors and antennas

Figure 7.15 A Wireless Sensor Network



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