



Chapter 7

Telecommunications, the Internet, and Wireless Technology



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Chapter 7: Telecommunications, the Internet, and Wireless Technology

Components of Networks and Key Networking Technology

- **Networking and Communication Trends**
 - **Convergence:**
 - Telephone networks and computer networks converging into single digital network using Internet standards
 - **Broadband:**
 - More than 74 percent U.S. Internet users have broadband access
 - **Broadband wireless:**
 - Voice, data communication are increasingly taking place over broadband wireless platforms



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Components of Networks and Key Networking Technology

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



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Components of Networks and Key Networking Technology

- **Networks in large companies**
 - Hundreds of local area networks (LANs) linked to firmwide corporate network
 - Various powerful servers
 - Web site
 - Corporate intranet, extranet
 - Backend systems
 - Mobile wireless LANs (Wi-Fi networks)
 - Videoconferencing system
 - Telephone network
 - Wireless cell phones



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Components of Networks and Key Networking Technology

- **Key digital networking technologies**
 - **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



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Components of Networks and Key Networking Technology

- Key digital networking technologies (cont.)
 - **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



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Components of Networks and Key Networking Technology

- **Key digital networking technologies (cont.)**
 - **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 Internet
 - Department of Defense reference model for TCP/IP
 - Four layers
 - » Application layer
 - » Transport layer
 - » Internet layer
 - » Network interface layer



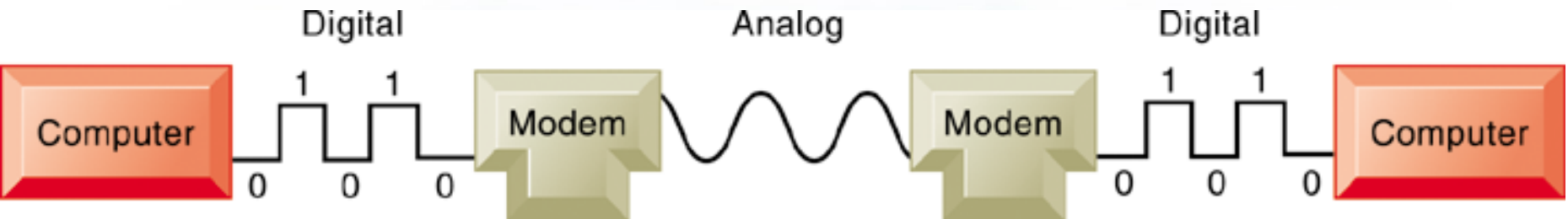
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Different Types of Networks

- **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)**



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Different Types of Networks

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



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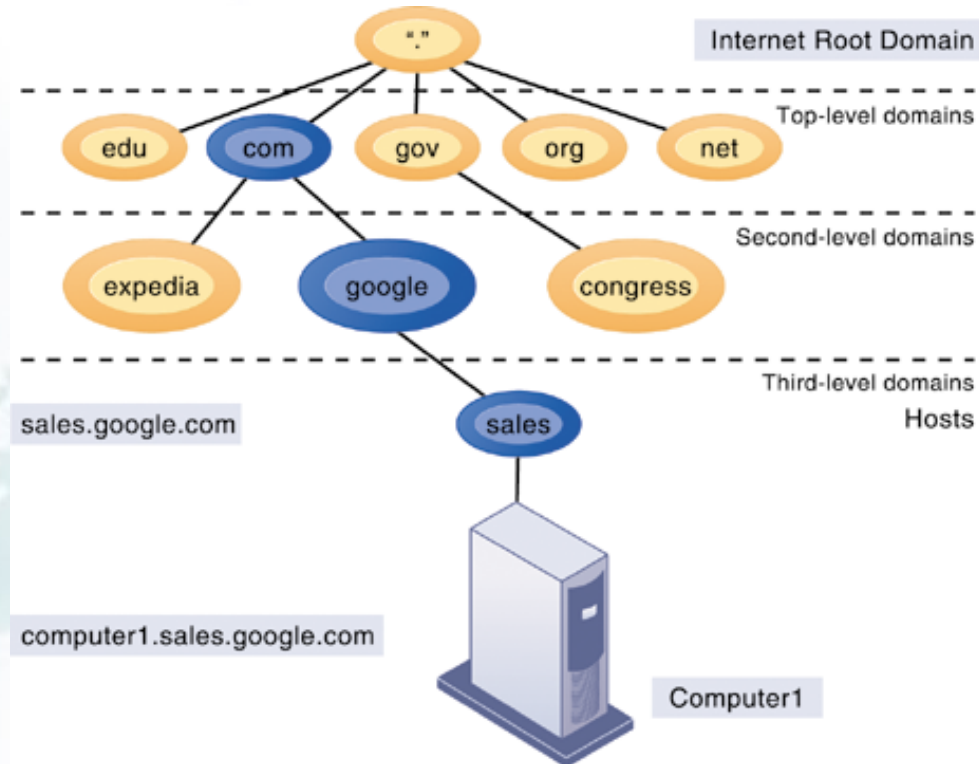
The Internet and Internet Technology

- **Internet addressing and architecture**

- Each device on Internet assigned Internet Protocol (IP) address
- 32-bit number, e.g. 207.46.250.119(IPv4)

- **The Domain Name System (DNS)**

- Converts IP addresses to domain names
- Hierarchical structure
- Top-level domains





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The Internet and Internet Technology

- **The Future Internet: IPv6 and Internet 2**
 - **IPv6(128bits)**
 - New addressing scheme for IP numbers
 - Will provide more than a quadrillion new addresses
 - **Internet2**
 - Advanced networking consortium
 - Universities, businesses, government agencies, other institutions
 - Developed high-capacity 100 Gbps testing network
 - Testing leading-edge new technologies for Internet



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The Internet and Internet Technology

- **The Web**
 - **Hypertext Markup Language (HTML)**
 - **Hypertext Transfer Protocol (HTTP):**
 - Communications standard used for transferring Web pages
 - **Uniform resource locators (URLs):**
 - Addresses of Web pages
 - <http://www.megacorp.com/content/features/082602.html>
 - **Web servers**
 - Software for locating and managing Web pages



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The Internet and Internet Technology

- **Search engines**
 - Started as simpler programs using keyword indexes
 - Google created page ranking system
- **Mobile search: 50 percent of all searches in 2014**
- **Search engine marketing**
- **Search engine optimization (SEO)**
- **Search engine algorithms**
 - Google's Hummingbird (2013)
 - Sentence evaluation
 - Knowledge graph



The Internet and Internet Technology

- **Web 2.0**
 - **Second-generation services**
 - **Enabling collaboration, sharing information, and creating new services online**
 - **Features**
 - Interactivity
 - Real-time user control
 - Social participation (sharing)
 - User-generated content



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The Internet and Internet Technology

– Web 2.0 services and tools

- **Blogs:** chronological, informal Web sites created by individuals
 - RSS (Really Simple Syndication): syndicates Web content so aggregator software can pull content for use in another setting or viewing later
 - Blogosphere
 - Microblogging
- **Wikis:** collaborative Web sites where visitors can add, delete, or modify content on the site
- **Social networking sites:** enable users to build communities of friends and share information



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The Internet and Internet Technology

- **Web 3.0: The “Semantic Web”**
 - A collaborative effort led by W3C to add layer of meaning to the existing Web
 - Goal is to reduce human effort in searching for and processing information, making Web more intuitive
 - Increased communication and synchronization with computing devices, communities
 - Internet of Things
 - Visual Web
 - Increased cloud computing, mobile computing



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Technologies and Standards for Wireless Networking

- **Wireless computer networks and Internet access**
 - **Wi-Fi (cont.)**
 - 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



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Technologies and Standards for Wireless Networking

- **Radio frequency identification (RFID)**
 - Use tiny tags with embedded microchips containing data about an item and location
 - Tag antennas to transmit radio signals over short distances to special RFID readers, which send data over network to computer for processing
 - Common uses:
 - Automated toll-collection
 - Tracking goods in a supply chain
 - Requires companies to have special hardware and software
 - Reduction in cost of tags making RFID viable for many firms



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Technologies and Standards for Wireless Networking

- **Wireless sensor networks (WSNs)**

- Networks of hundreds or thousands of interconnected wireless devices embedded into physical environment to provide measurements of many points over large spaces
- 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”