Networks: Communicating and Sharing Resources

Computer Literacy

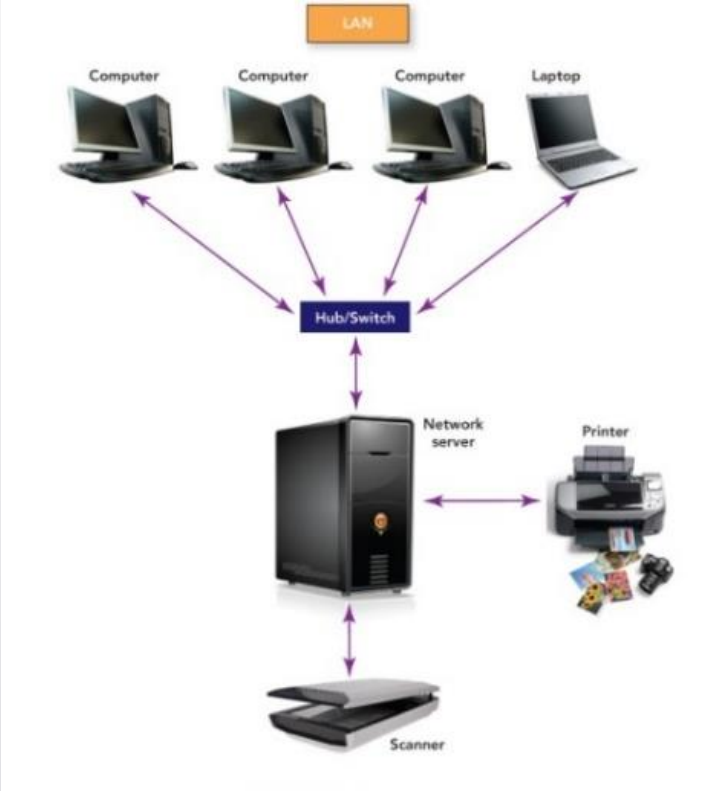
Networks

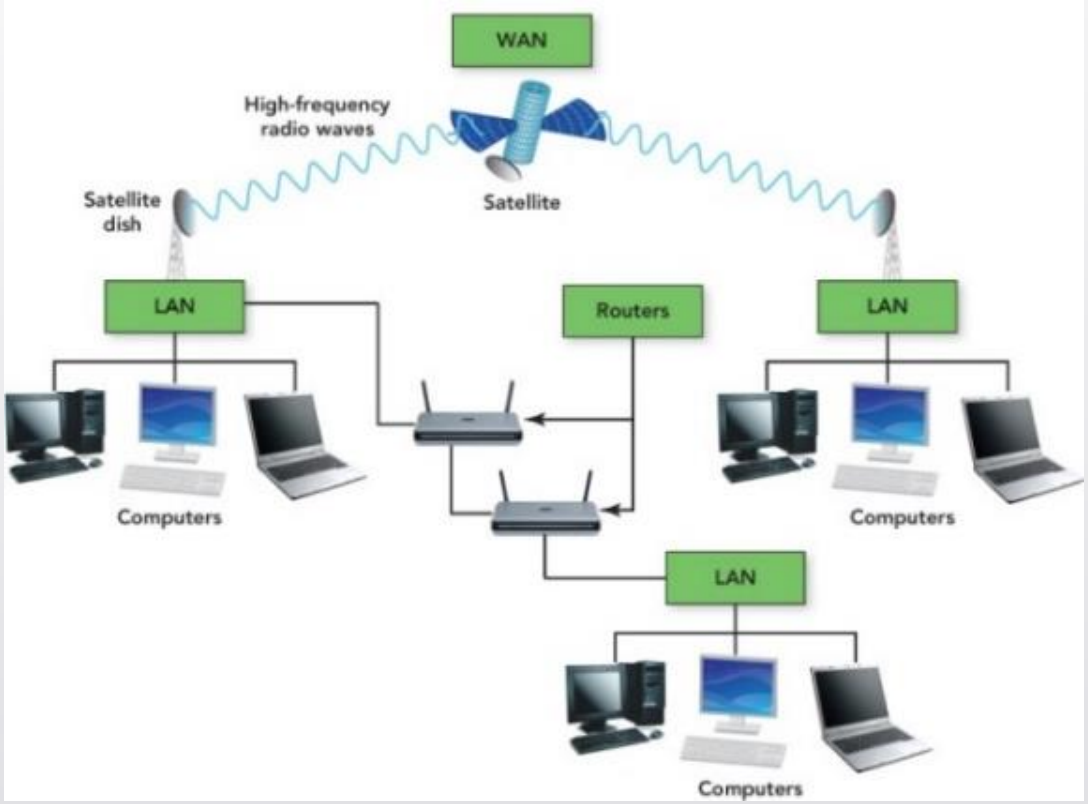
- Links multiple computer systems and enables them to share data and resources, using cables, radio waves, or infrared signals
- Some types of networks, from smallest spanning to largest spanning:
  - Personal area network (PAN)
  - Local area network (LAN)
  - Campus area network (CAN)
  - Metropolitan area network (CAN)
  - Wide area network (WAN)

Communication Devices Terminology

- **Node**
  - Any device connected to a network
- **Network interface cards (NICs)**
  - Expansion board or adapter that provides a connection between the computer and the network
- **Modems**
  - Connect to your ISP
- **Routers**
  - Connect two or more networks
  - Determine the best route to transmit data given source & destination
- **Switches**
  - Filter and forward data between nodes
  - Similar to routers but work within a single network
- **Hubs**
  - Joins multiple computers together in a single network
  - Does not manage traffic between the connections
- **Wireless access points (WAP)**
  - Joins wireless nodes to a wired network

Networks Example: LAN vs. WAN





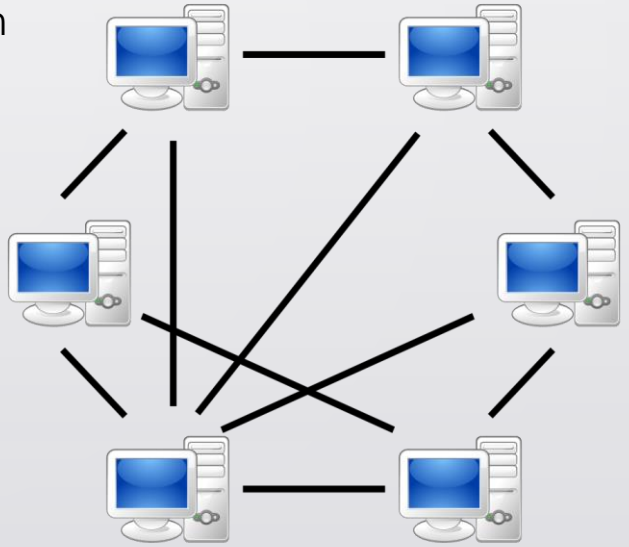
Local Area Networks (LAN)

Type of LAN: Wireless LAN (WLAN)

- Connects users through radio waves instead of wires
- Use includes networks in:
  - Homes
  - Hospitals
  - Colleges
- Secured with a radio transmission technique that spreads signals over a seemingly random series of frequencies.
- Effective inside range of between 125 and 300 feet

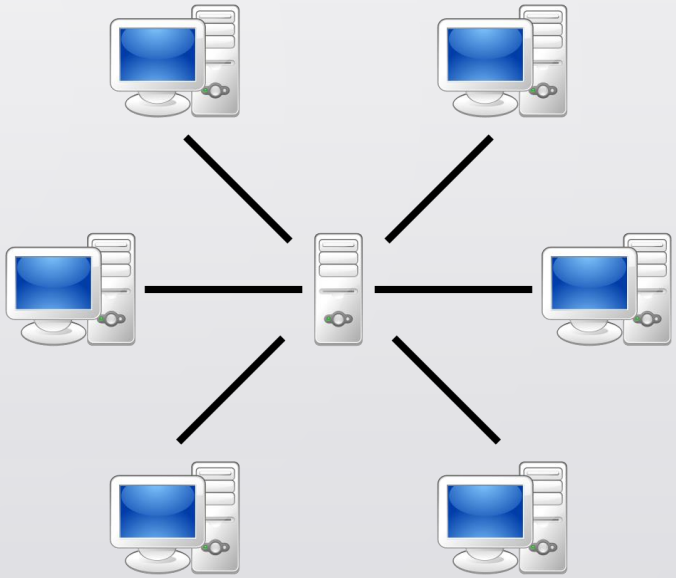
Type of LAN: Peer-to-peer (P2P) networks

- Share files without a file server
- Inexpensive to set up
- Best used for home or small offices with no more than 10 computers
- Do not require a network operating system
- Can be slow if there are too many users
- Security not strong



Type of LAN: Client/server Networks

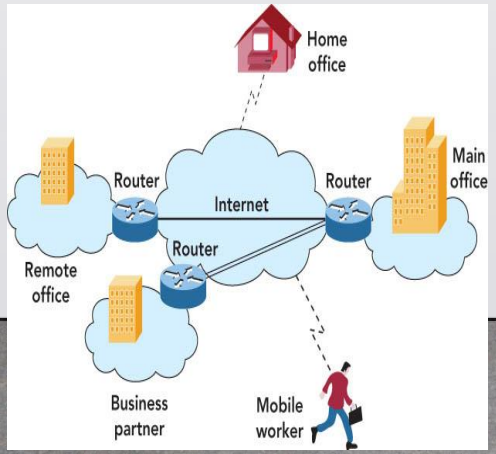
- Made up of one or more file servers and clients (any type of computer)
- Client software enables requests to be sent to the server
- Wired or wireless connections
- Do not slow down with heavy use



Other types of Local Area Networks

- Intranet
  - Password-protected network controlled by the company
  - Accessed only by employees

- Virtual private network
  - Operates over the Internet
  - Accessible by authorized users for quick access to corporate information
  - Uses secure, encrypted connections and special software



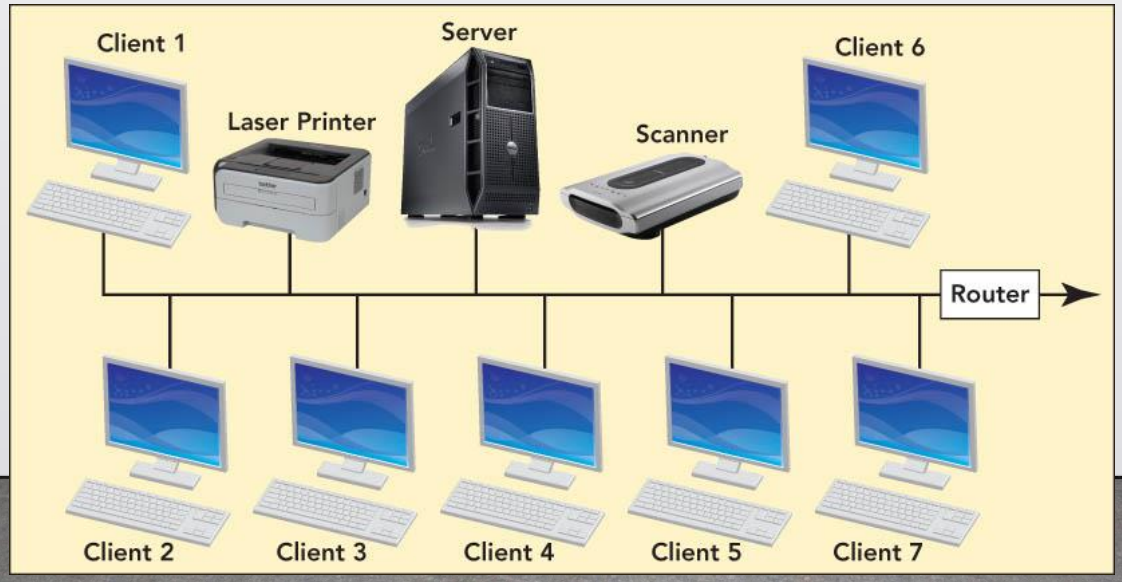
Local Area Network Topologies

- A network **topology** is the physical design of a LAN
- Topology can resolve **contention**, the conflict that occurs when two or more computers on the network attempt to transmit at the same time
- Contention sometimes results in **collisions**, the corruption of network data caused when two computers transmit at the same time

Types of Topologies

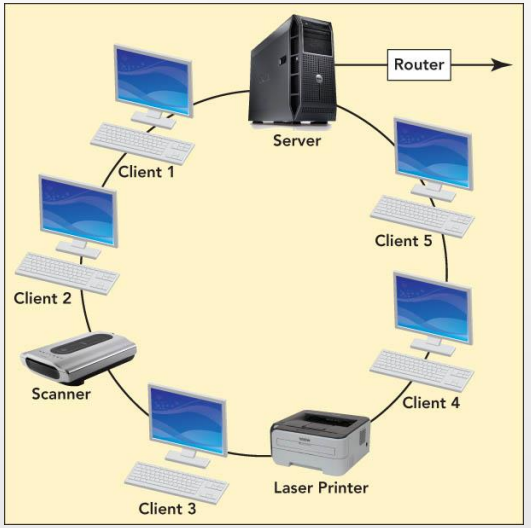
Bus Topology

- Practical for home or small office
- One node transmits at a time
- Terminators signify the end of the circuit
- Uses contention management
  - technique that specifies what happens when a collision occurs

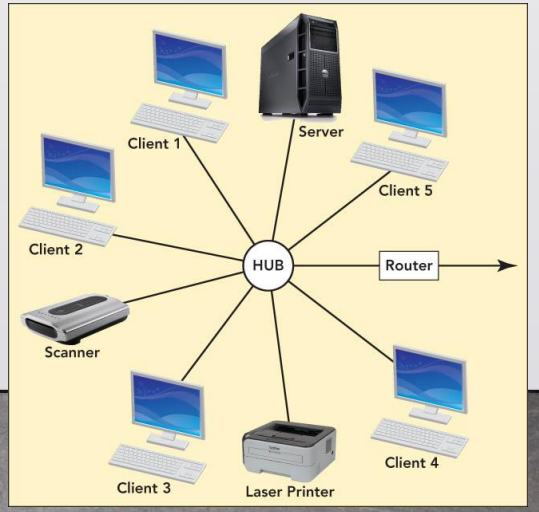


Types of Topologies

- **Ring topology**
  - For a division of a company or one floor
  - Not in common use today
  - Node can transmit only when it has the token
    - special unit of data that travels around the ring



- **Star topology**
  - For office buildings, computer labs, and WANs
  - Easy to add users
  - Most common and widely implemented



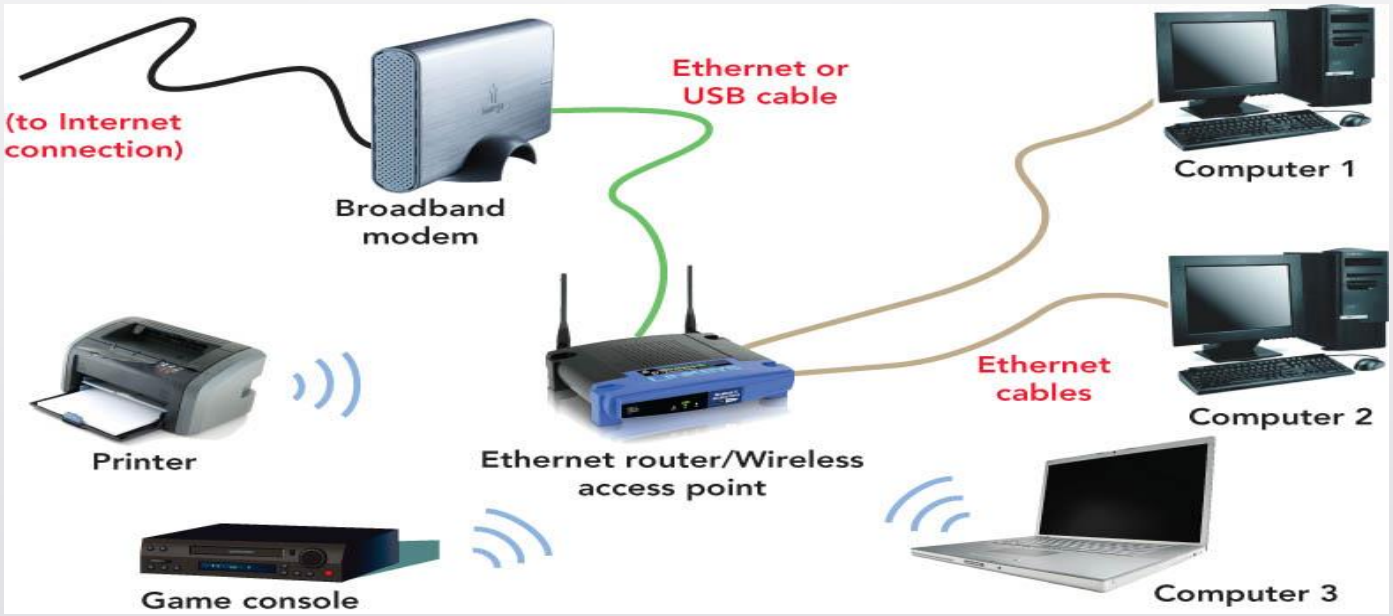
LAN technologies

- Ethernet
  - Most popular: Ethernet star networks
  - Faster bandwidth

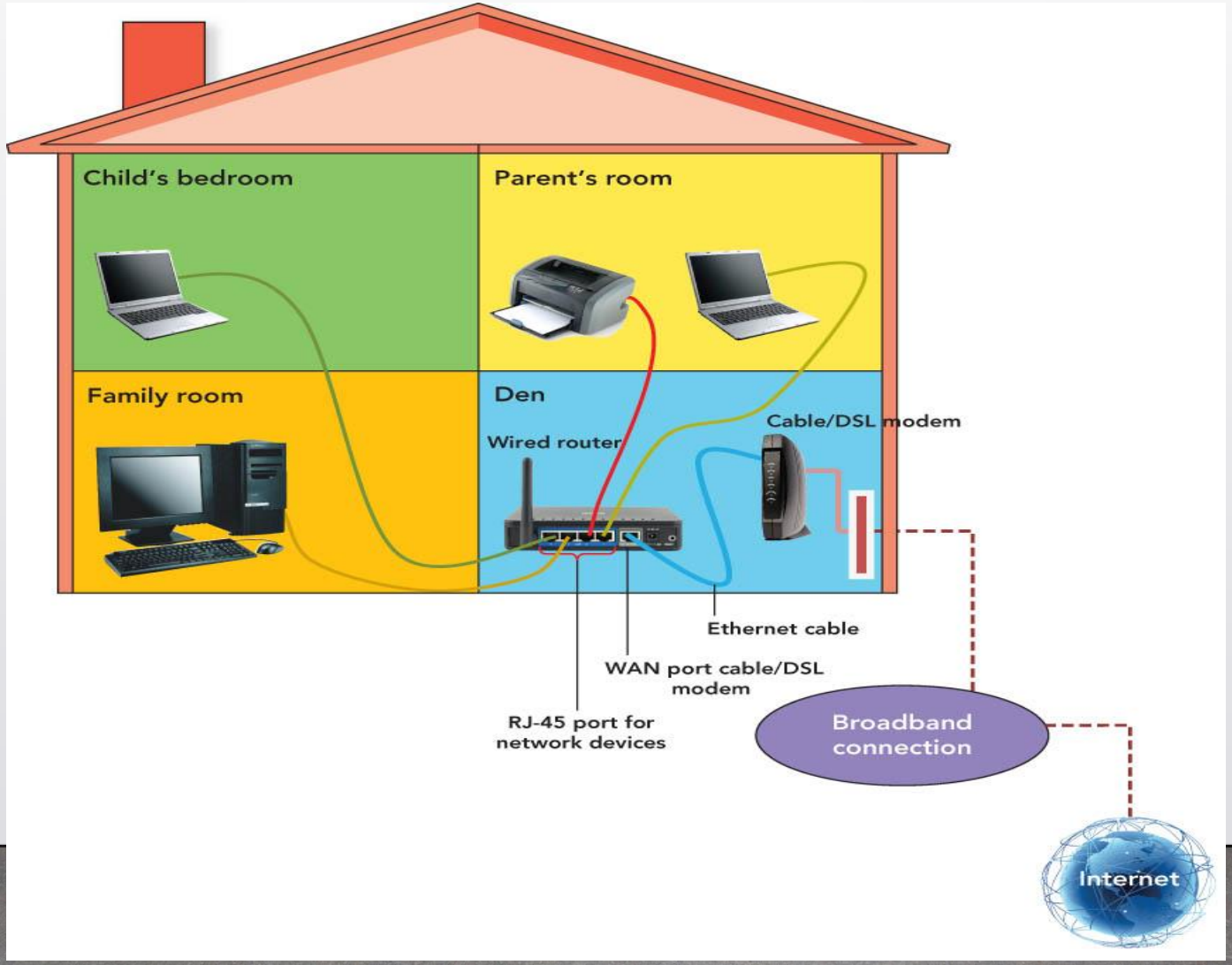
- Wi-Fi
  - Uses radio waves to provide a wireless LAN standard at (close to) Ethernet speeds
  - Needs a central access point—could be a wireless router
  - Higher latency
  - Higher interference
  - Less secure

Example LAN: Home Networks

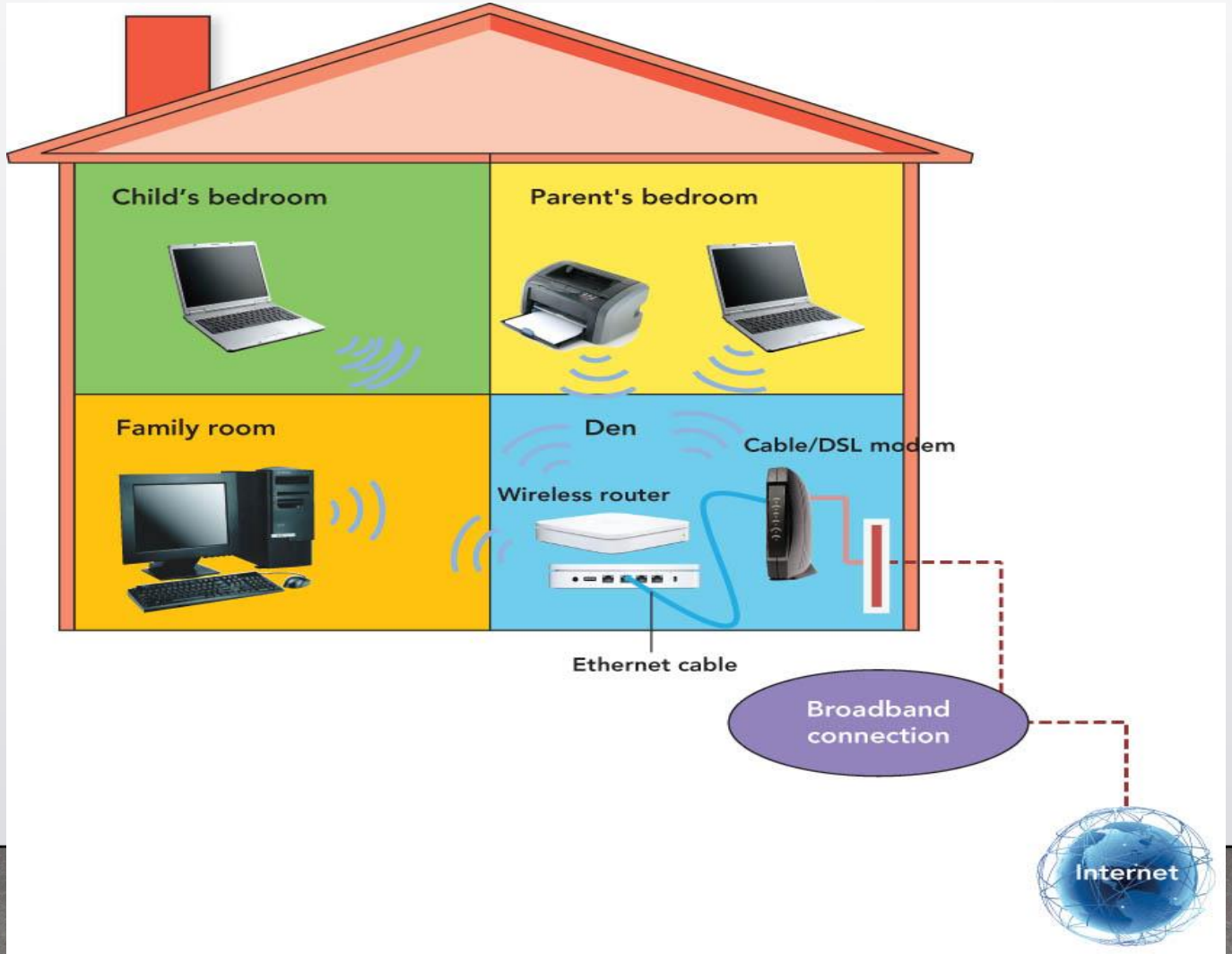
- Can be wired, wireless, or a combination of both technologies



Example LAN: Wired Home Network



Example LAN: Wireless Home Network



Future of home networking

- Convergence will allow you to use home networks to
  - Control and manage household devices
    - Appliances
    - Entertainment
    - Temperature regulation
    - Lighting
  - Protect homes with security systems

Wide Area Networks (WAN)

Wide Area Networks

- **Point of presence (POP)**
  - WAN connection point used to obtain access to the WAN
  - Wired or wireless

- **Backbones**
  - High-capacity WAN transmission lines
  - gigaPoP (gigabits per second point of presence)
    - transfers data exceeding 1 Gbps (1 billion bits per second)

WAN protocols

- **Circuit switching**
  - Provides a direct connection between devices
  - Used by the public switched telephone network to send data over a physical end-to-end circuit
- **Packet switching**
  - Used for computer communication
  - Divides and sends outgoing messages as packets, which are reassembled on receipt
  - More efficient and less expensive than circuit switching
  - **Latency**—delay introduced when a given packet is examined by many routers
  - **Congestion**—occurs when the network is overloaded, causing some packets to be further delayed

1 An outgoing message is divided into data units of a fixed size called packets.

1 Dear Christine,
Mike and I would like to meet with you.

2 We'll be in Boston next week on unrelated business.

3 I'll have Jodi B. set up a place and time. I'm looking forward to a productive meeting.
Sincerely,
Bill

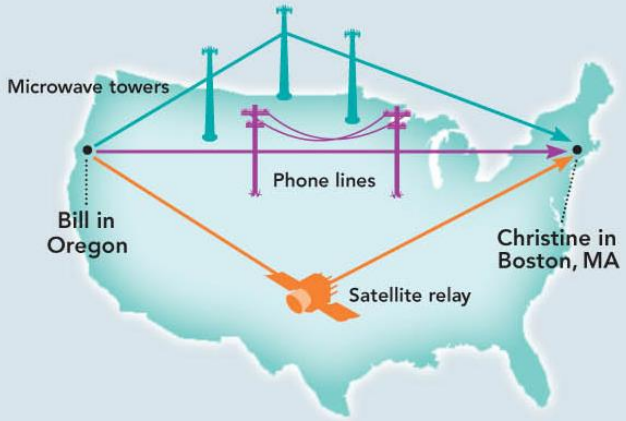
2 Each packet is numbered and addressed to the destination computer.

1 from: bill@oregon.edu
to: christine@aol.com

2 from: bill@oregon.edu
to: christine@aol.com

3 from: bill@oregon.edu
to: christine@aol.com

3 After reading the packet's address, the router consults a table of possible paths to the packet's destination. If more than one path exists, the router sends the packet along the path that is least congested.



4 On the receiving computer, protocols put the packets in the correct order and decode the message they contain.

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WAN applications

- E-mail, conferencing, document exchange, remote database access
- LAN to LAN connections connect two or more geographically separate locations
- Transaction acquisition—the instant relay of transaction information from a point-of-purchase sale.

Advantages and Disadvantages of Networking

Advantages

- Information sharing
- Resource sharing
- Collaboration
- Reduced costs (e.g., software licenses)
- Connecting people

Disadvantages

- Security threats
- Lack of privacy
- Loss of autonomy
- Can be expensive (e.g., cable, file servers, ISP)
- Can be addictive