Objectives Overview

Discuss the purpose of the components required for successful communications and identify various sending and receiving devices

Differentiate among LANs, MANs, WANs, and PANs

Differentiate between client/server and peer-to-peer networks

Differentiate among a star network, bus network, and ring network

Describe the various network communications standards and protocols

Explain the purpose of communications software

See Page 416 for Detailed Objectives
Objectives Overview

- Describe various types of communications lines
- Describe commonly used communications devices
- Discuss different ways to set up and configure a home network
- Differentiate among physical transmission media
- Differentiate among wireless transmission media

See Page 416 for Detailed Objectives
Communications

• Digital communications describes a process in which two or more computers or devices transfer data, instructions, and information.

Sending device  Communications channel  Receiving device
Communications
Networks

• A **network** is a collection of computers and devices connected together via communications devices and transmission media.

• Advantages of a network include:
  - Facilitating communications
  - Sharing hardware
  - Sharing data and information
  - Sharing software
  - Transferring funds
Networks

Reasons Businesses Use a Network

- Transfer funds
- Share software
- Share data and information
- Facilitate communications
- Share hardware
Networks

- A **local area network (LAN)** is a network that connects computers and devices in a limited geographical area.
- A **wireless LAN (WLAN)** is a LAN that uses no physical wires.
Networks

- A metropolitan area network (MAN) connects LANs in a metropolitan area
- A **wide area network (WAN)** is a network that covers a large geographic area
- A **personal area network (PAN)** is a network that connects computers and devices in an individual’s workspace with wired and wireless technology
Networks

- The configuration of computers, devices, and media on a network is sometimes called the network architecture.

**Client/server network**

**Peer-to-peer network**
Networks

• A **network topology** refers to the layout of the computers and devices in a communications network
Network Communications Standards and Protocols

- Ethernet
- Token Ring
- TCP/IP
- Wi-Fi
- Bluetooth
- UWB
- IrDA
- RFID
- NFC
- WiMAX
**Ethernet** is a network standard that specifies no central computer or device on the network (nodes) should control when data can be transmitted.

The **token ring** standard specifies that computers and devices on the network share or pass a special signal (token).

**TCP/IP** is a network protocol that defines how messages (data) are routed from one end of a network to another.
Network Communications Standards and Protocols

Example of How Communications Standards Work Together

TCP/IP:
Your computer uses the TCP/IP standard to establish a connection with the web server that stores the requested webpage, divide the webpage into packets, provide an address for each packet, and reassemble the webpage once it arrives at your computer. Routers send the packets over the Internet from the web server to your computer.

ETHERNET:
The Ethernet standard controls how devices (adapter cards, routers, modems, etc.) share access to the media (cables and lines) and how devices transmit data over the transmission media.
Network Communications Standards and Protocols

- **Wi-Fi** identifies any network based on the **802.11** standard that specifies how two wireless devices communicate over the air with each other.
- **Bluetooth** is a network protocol that defines how two Bluetooth devices use short-range radio waves to transmit data.
- **UWB** (ultra-wideband) is a network standard that specifies how two UWB devices use short-range radio waves to communicate at high speeds with each other.
- **IrDA** transmits data wirelessly via infrared (IR) light waves.
- **RFID** is a protocol that defines how a network uses radio signals to communicate with a tag placed in or attached to an object, an animal, or a person.
How Electronic RFID Toll Collection Works

Step 1
Motorist purchases an RFID transponder or RFID tag and attaches it to the vehicle's windshield.

Step 2
As the vehicle approaches the tollbooth, the RFID reader in the tollbooth sends a radio wave that activates the windshield-mounted RFID tag. The activated tag sends vehicle information to the RFID reader.

Step 3
The RFID reader sends the vehicle information to the lane controller. The lane controller, which is part of a local area network, transmits the vehicle information to a central computer that subtracts the toll from the motorist's account. If the vehicle does not have an RFID tag, a high-speed camera takes a picture of the license plate and the computer prints a violation notice, which is mailed to the motorist.
## Network Communications Standards and Protocols

<table>
<thead>
<tr>
<th><strong>NFC</strong></th>
<th><strong>WiMAX (802.16)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Protocol based on RFID</td>
<td>- Developed by IEEE</td>
</tr>
<tr>
<td>- Uses close-range radio signals</td>
<td>- Towers can cover a 30-mile radius</td>
</tr>
<tr>
<td>- Devices or objects should be placed within an inch or two of each other</td>
<td>- Two types are fixed wireless and mobile wireless</td>
</tr>
</tbody>
</table>
Communications Software

- **Communications software** consists of programs and apps that:
  
  - Help users establish a connection to another computer, mobile device, or network
  - Manage the transmission of data, instructions, and information
  - Provide an interface for users to communicate with one another
Communications Lines

- Dedicated line
- Cable
- DSL
- ISDN
- FTTP
- T-Carrier
- ATM
# Communications Lines

**Table 10-2 Speeds of Various Dedicated Digital Lines**

<table>
<thead>
<tr>
<th>Type of Line</th>
<th>Transfer Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable</td>
<td>256 Kbps to 52 Mbps</td>
</tr>
<tr>
<td>DSL</td>
<td>256 Kbps to 8.45 Mbps</td>
</tr>
<tr>
<td>ISDN</td>
<td>Up to 1.54 Mbps</td>
</tr>
<tr>
<td>FTTP</td>
<td>5 Mbps to 300 Mbps</td>
</tr>
<tr>
<td>Fractional T1</td>
<td>128 Kbps to 768 Kbps</td>
</tr>
<tr>
<td>T1</td>
<td>1.544 Mbps</td>
</tr>
<tr>
<td>T3</td>
<td>44.736 Mbps</td>
</tr>
<tr>
<td>ATM</td>
<td>155 Mbps to 622 Mbps, can reach 10 Gbps</td>
</tr>
</tbody>
</table>
Communications Lines

• ADSL is a type of DSL that supports faster transfer rates when receiving data
Communications Devices

- A **communications device** is any type of hardware capable of transmitting data, instructions, and information between a sending device and a receiving device.
Communications Devices

- A broadband modem sends and receives data and information to and from a digital line

- Cable modem
- DSL modem
Communications Devices

- A wireless modem uses a mobile phone provider’s network to connect to the Internet wirelessly from a computer or mobile device.
Communications Devices

- A wireless access point is a central communications device that allows computers and devices to transfer data wirelessly among themselves or to a wired network.
Communications Devices

- A router connects multiple computers or other routers together and transmits data to its correct destination on a network.
Communications Devices

- A network card enables a computer or device that does not have built-in networking capability to access a network
- Available in a variety of styles
Communications Devices

- A hub or switch is a device that provides a central point for cables in a network
Home Networks

• Many home users connect multiple computers and devices together in a **home network**
Transmission Media

- **Transmission media** carries one or more communications signals
- **Broadband** media transmit multiple signals simultaneously
- The amount of data, instructions, and information that can travel over transmission media sometimes is called the **bandwidth**
- **Latency** is the time it takes a signal to travel from one location to another on a network
## Table 10-3  Transfer Rates for Physical Transmission Media Used in LANs

<table>
<thead>
<tr>
<th>Type of Cable and LAN</th>
<th>Maximum Transfer Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Twisted-Pair Cable</strong></td>
<td></td>
</tr>
<tr>
<td>• 10Base-T (Ethernet)</td>
<td>10 Mbps</td>
</tr>
<tr>
<td>• 100Base-T (Fast Ethernet)</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>• 1000Base-T (Gigabit Ethernet)</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>• Token ring</td>
<td>4 Mbps to 16 Mbps</td>
</tr>
<tr>
<td><strong>Coaxial Cable</strong></td>
<td></td>
</tr>
<tr>
<td>• 10Base2 (ThinWire Ethernet)</td>
<td>10 Mbps</td>
</tr>
<tr>
<td>• 10Base5 (ThickWire Ethernet)</td>
<td>10 Mbps</td>
</tr>
<tr>
<td><strong>Fiber-Optic Cable</strong></td>
<td></td>
</tr>
<tr>
<td>• 10Base-F (Ethernet)</td>
<td>10 Mbps</td>
</tr>
<tr>
<td>• 100Base-FX (Fast Ethernet)</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>• FDDI (Fiber Distributed Data Interface)</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>token ring</td>
<td></td>
</tr>
<tr>
<td>• Gigabit Ethernet</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>• 10-Gigabit Ethernet</td>
<td>10 Gbps</td>
</tr>
<tr>
<td>• 40-Gigabit Ethernet</td>
<td>40 Gbps</td>
</tr>
<tr>
<td>• 100-Gigabit Ethernet</td>
<td>100 Gbps</td>
</tr>
</tbody>
</table>
Physical Transmission Media

Twisted-pair cable

Coaxial cable

Fiber-optic cable
## Wireless Transmission Media

<table>
<thead>
<tr>
<th>Medium</th>
<th>Maximum Transfer Transmission Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrared</td>
<td>115 Kbps to 4 Mbps</td>
</tr>
<tr>
<td><strong>Broadcast radio</strong></td>
<td></td>
</tr>
<tr>
<td>• Bluetooth</td>
<td>1 Mbps to 24 Mbps</td>
</tr>
<tr>
<td>• 802.11b</td>
<td>11 Mbps</td>
</tr>
<tr>
<td>• 802.11a</td>
<td>54 Mbps</td>
</tr>
<tr>
<td>• 802.11g</td>
<td>54 Mbps</td>
</tr>
<tr>
<td>• 802.11n</td>
<td>300 Mbps</td>
</tr>
<tr>
<td>• 802.11ac</td>
<td>500 Mbps to 1 Gbps</td>
</tr>
<tr>
<td>• 802.11ad</td>
<td>up to 7 Gbps</td>
</tr>
<tr>
<td>• UWB</td>
<td>110 Mbps to 480 Mbps</td>
</tr>
<tr>
<td><strong>Cellular radio</strong></td>
<td></td>
</tr>
<tr>
<td>• 2G</td>
<td>9.6 Kbps to 144 Kbps</td>
</tr>
<tr>
<td>• 3G</td>
<td>144 Kbps to 3.84 Mbps</td>
</tr>
<tr>
<td>• 4G</td>
<td>Up to 100 Mbps</td>
</tr>
<tr>
<td><strong>Microwave radio</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Communications satellite</strong></td>
<td>10 Gbps</td>
</tr>
<tr>
<td><strong>Communications satellite</strong></td>
<td>2.56 Tbps</td>
</tr>
</tbody>
</table>
Wireless Transmission Media

- **Broadcast radio** is a wireless transmission medium that distributes radio signals through the air over long distances.
- **Cellular radio** is a form of broadcast radio that is used widely for mobile communications.
Wireless Transmission Media

- **Microwaves** are radio waves that provide a high-speed signal transmission
Wireless Transmission Media

- A **communications satellite** is a space station that receives microwave signals from an earth-based station, amplifies it, and broadcasts the signal over a wide area.
Wireless Transmission Media

- A global positioning system (GPS) is a navigation system that consists of one or more earth-based receivers that accept and analyze signals sent by satellites in order to determine the receiver’s geographical location.
Wireless Transmission Media

How a GPS Works

Step 1
GPS satellites orbit Earth. Every thousandth of a second, each satellite sends a signal that indicates its current position to a GPS receiver.

Step 2
A GPS receiver (such as in a car, a smartphone, a wearable device, a handheld device, or a dog collar) determines its location on Earth by analyzing at least 3 separate satellite signals from the 24 satellites in orbit.

Other Examples of GPS Receivers

- Smartphone
- Wearable device
- Handheld device
- Dog collar
Various types of network architectures, topologies, and standards and protocols

Communications software

Communications lines and communications devices

How to create a home network

Physical transmission media and wireless transmission media