

Physical Layer

Chapter 3 *Summary*

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Topics

- Network Circuits
- Simplex, Duplex, Half Duplex
- Multiplexer
- Communications Media
- Media Attributes
- Digital Transmission
- Analog Transmission

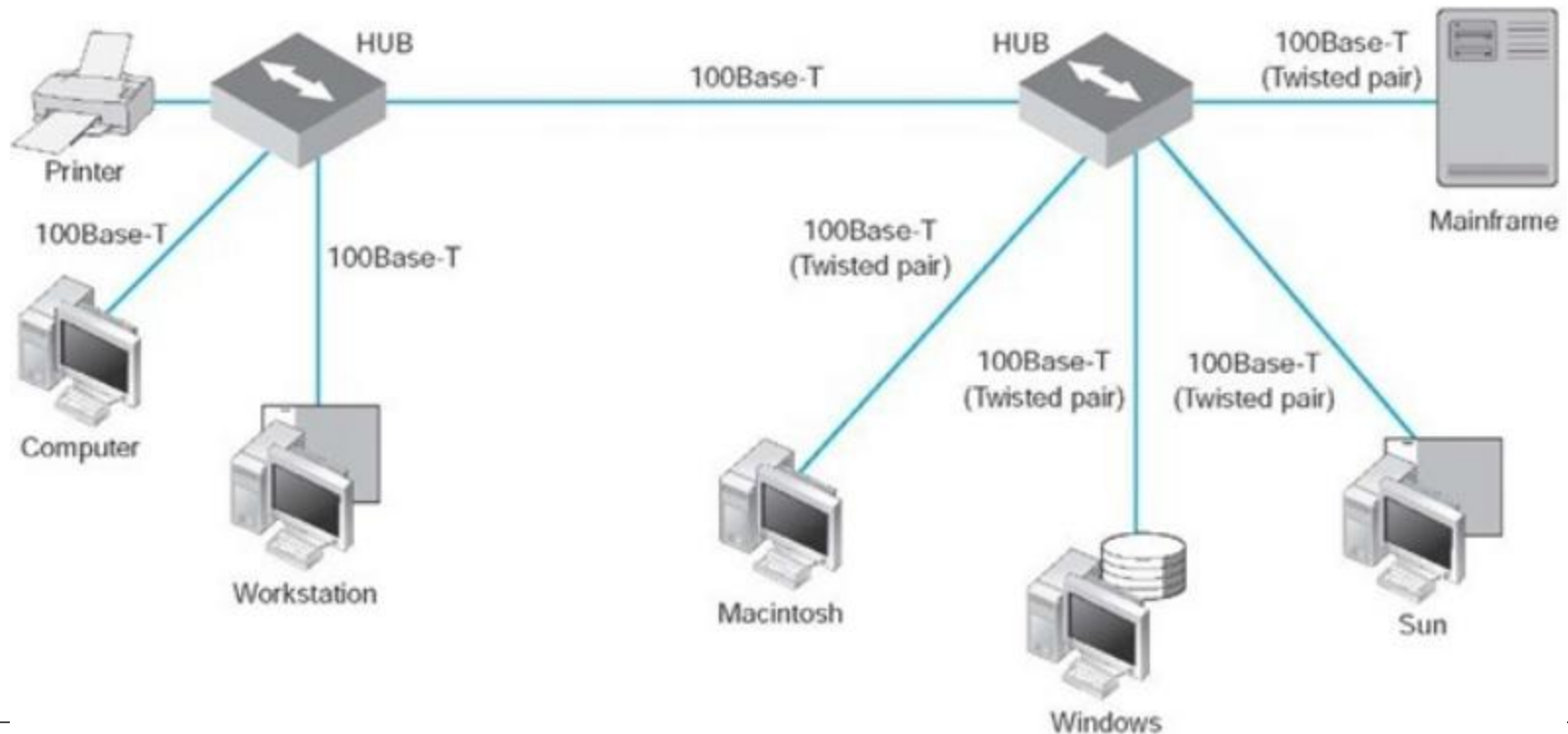
Network Circuits

Point-to-point networks

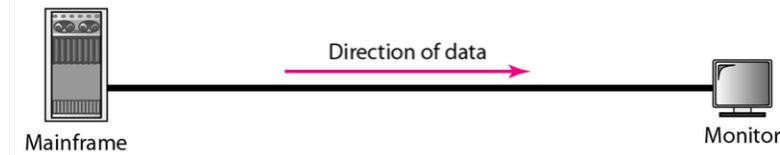
- Separate circuit from each client to the host

Multipoint networks

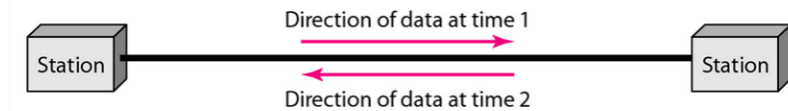
- Multiple clients share the same circuit.



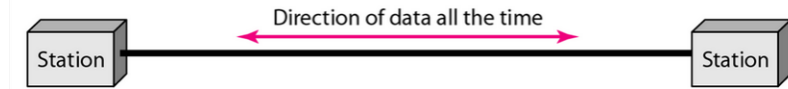
Simplex, Duplex, and Half-duplex



a. Simplex



b. Half-duplex



c. Full-duplex

Simplex

- Data flows one direction only

Half duplex

- Data flows either one direction or the other .

Full Duplex

- Data flows in both directions simultaneously

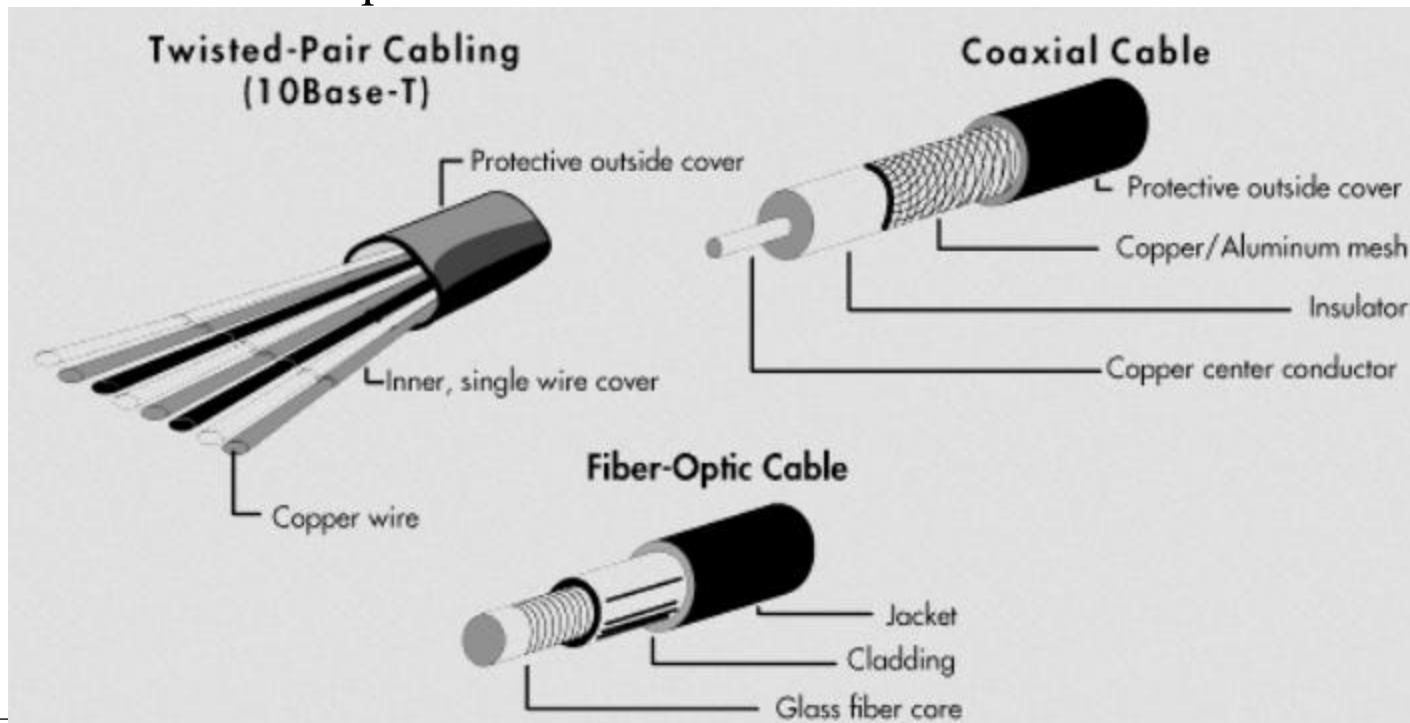
Multiplexer

- Device that combines several simultaneous low-speed circuits on one higher-speed circuit.
 - Each low-speed circuit believes it has a separate circuit.
- In general, transmission capacity of the high-speed circuit must equal or exceed the sum of the low-speed circuits.

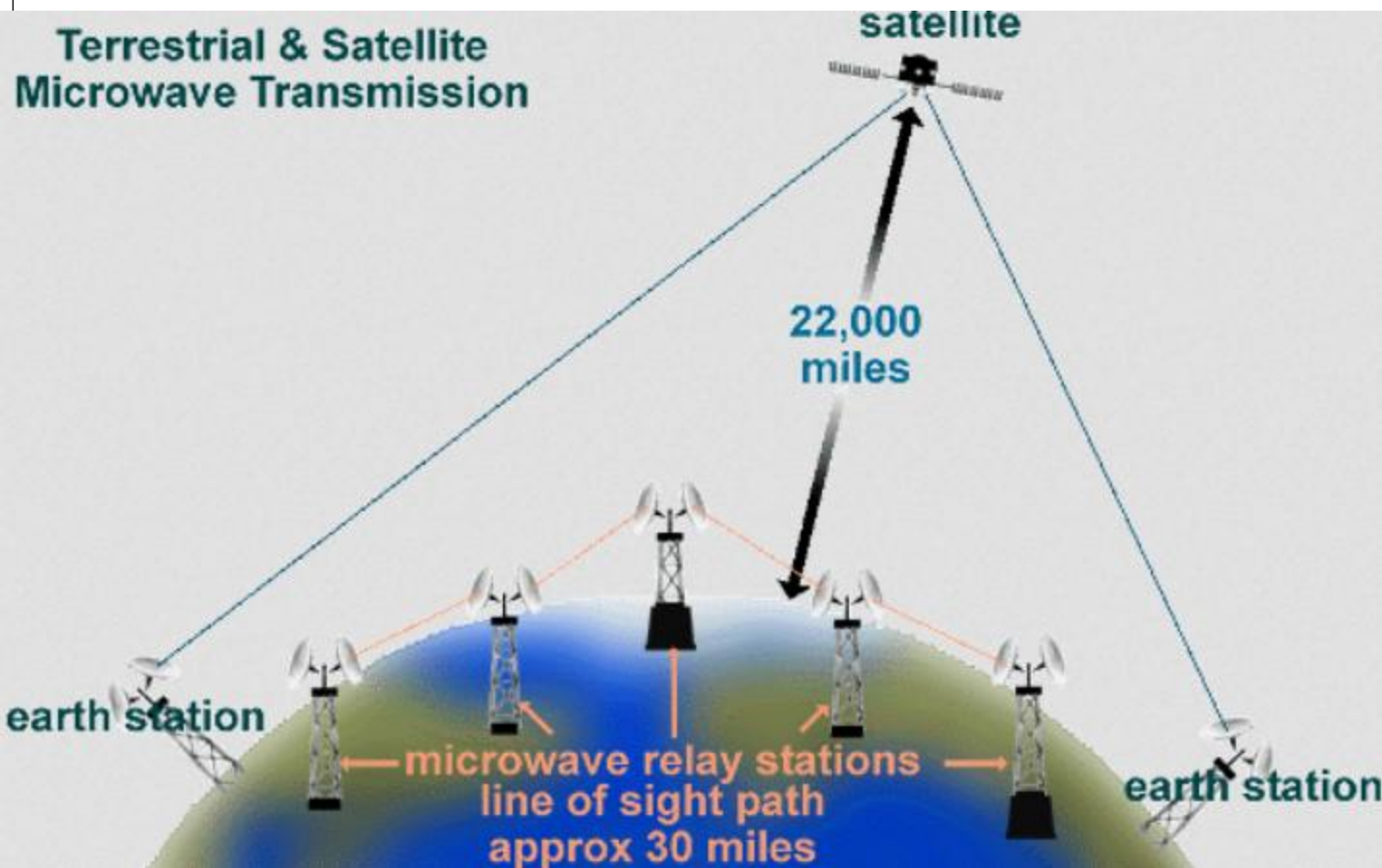


Communication Media

- Guided or Unguided media categories
- Signal travels through a physical cable (guided)
 - Twisted pair wires
 - Coaxial cable
 - Fiber-optic cable



Wireless signals broadcast through air (unguided)



- Radio
- Microwave
- Satellite

Media Attributes

Among guided media:

- Fiber-optic cable can transmit data the fastest with the fewest errors and offers greater security but costs the most...
- Twisted pair wire cheapest
 - Most commonly used.

Choice of wireless media depends more on distance than any other factor;

- Radio is cheapest for short distances
- Microwave is cheapest for moderate distances
- Satellite is cheapest for long distances.

Digital Transmission

Baseband transmission

- Digital Transmission of Digital Data Digital transmission is done by sending a series of electrical (or light) pulses through the media.
- Digital transmission is preferred to analog transmission because:
 - It produces fewer errors; is more efficient
 - Permits higher maximum transmission rates
 - Is more secure
 - Simplifies the integration of voice, video, and data on the same circuit.
- Ethernet uses Manchester encoding.

Analog Transmission of Digital Data

- Modems used to translate the digital data produced by computers into the analog signals for transmission in today's voice communication circuits.
- Both the sender and receiver need to have a modem.
 - Data transmitted by changing (or modulating) a carrier sound wave's amplitude (height), frequency (length), or phase (shape) to indicate a binary 1 or 0.
 - For example, in amplitude modulation, one amplitude is defined to be a 1 and another amplitude is defined to be a 0. It is possible to send more than 1 bit on every symbol (or wave).
- For example, with amplitude modulation, you could send 2 bits on each wave by defining four amplitude levels.
- The capacity or maximum data rate that a circuit can transmit is determined by multiplying the symbol rate (symbols per second) by the number of bits per symbol.

Digital Transmission of Analog Data

- Because digital transmission is better, analog voice data is sometimes converted to digital transmission.
- Pulse code modulation (PCM) is the most commonly used technique.
- PCM samples the amplitude of the incoming voice signal 8,000 times per second and uses 8 bits to represent the signal.
- PCM produces a reasonable approximation of the human voice, but more sophisticated techniques are needed to adequately reproduce more complex sounds such as music.

Questions?