OSI Physical Layer

Network Fundamentals – Chapter 8

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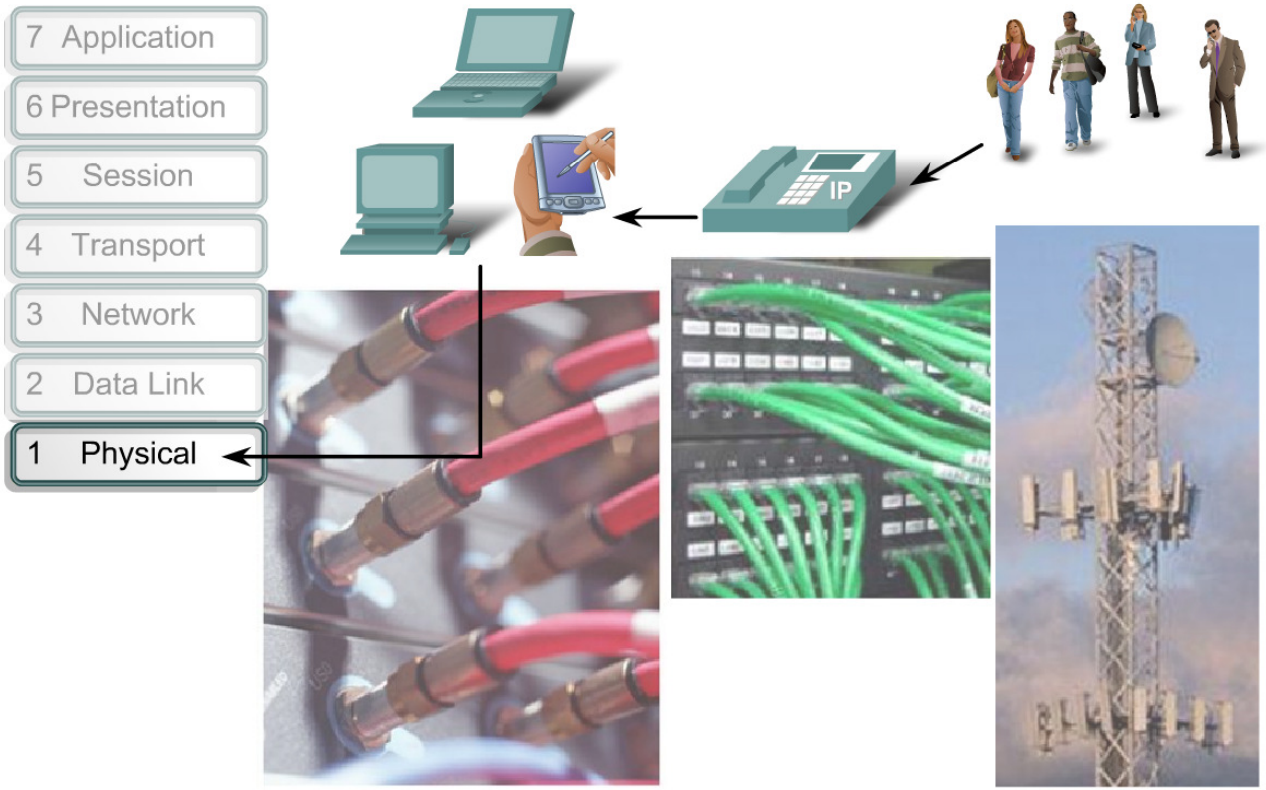
Objectives

- Explain the role of Physical layer protocols and services in supporting communication across data networks.
  - Describe the role of signals used to represent bits as a frame as the frame is transported across the local media
- Describe the purpose of Physical layer signaling and encoding as they are used in networks
- Identify the basic characteristics of copper, fiber and wireless network media
- Describe common uses of copper, fiber and wireless network media

Physical Layer Protocols & Services

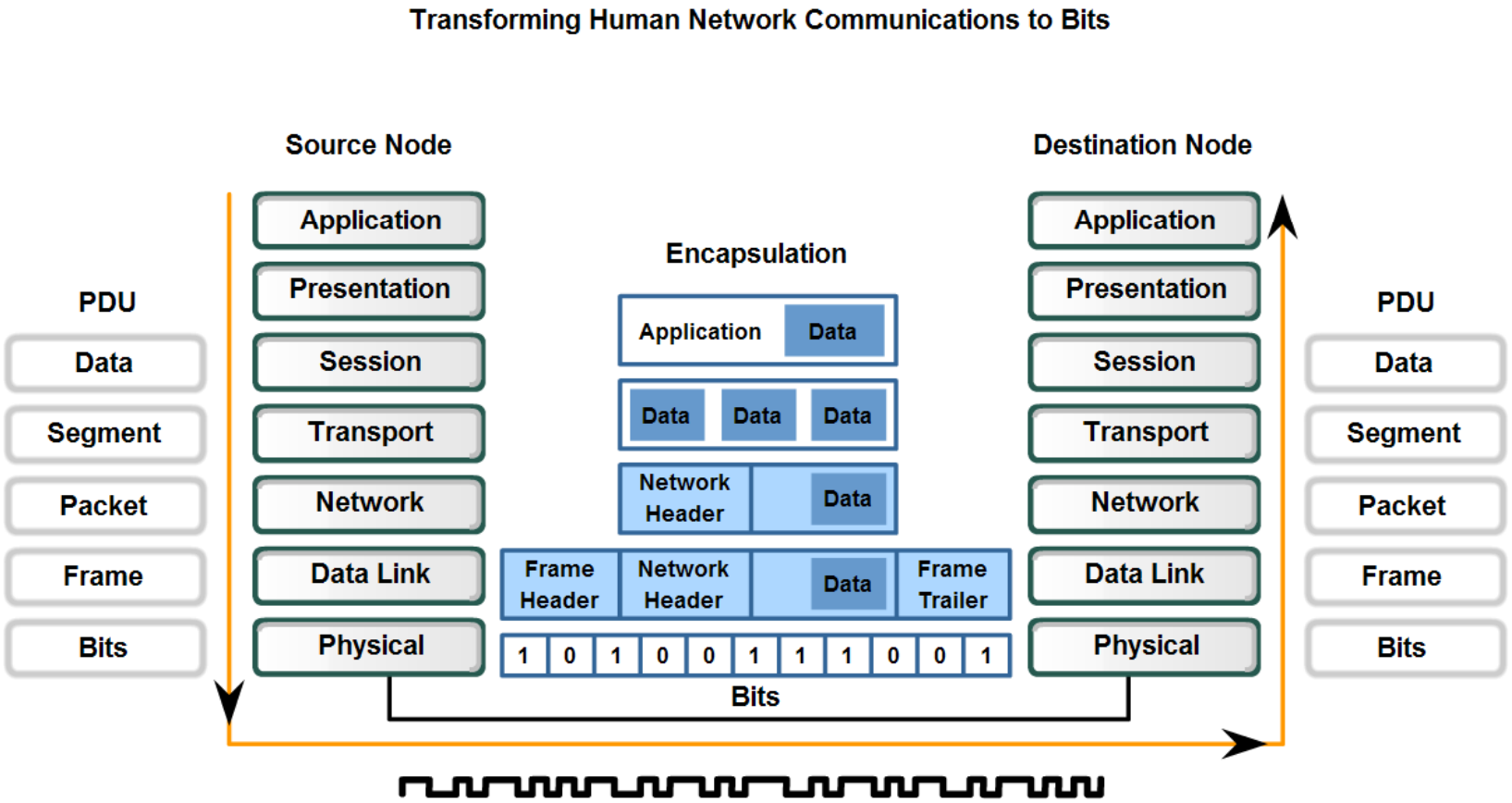
- Describe the purpose of the Physical layer in the network and identify the basic elements that enable this layer to fulfill its function



The Physical layer interconnects our data networks.

Physical Layer Protocols & Services

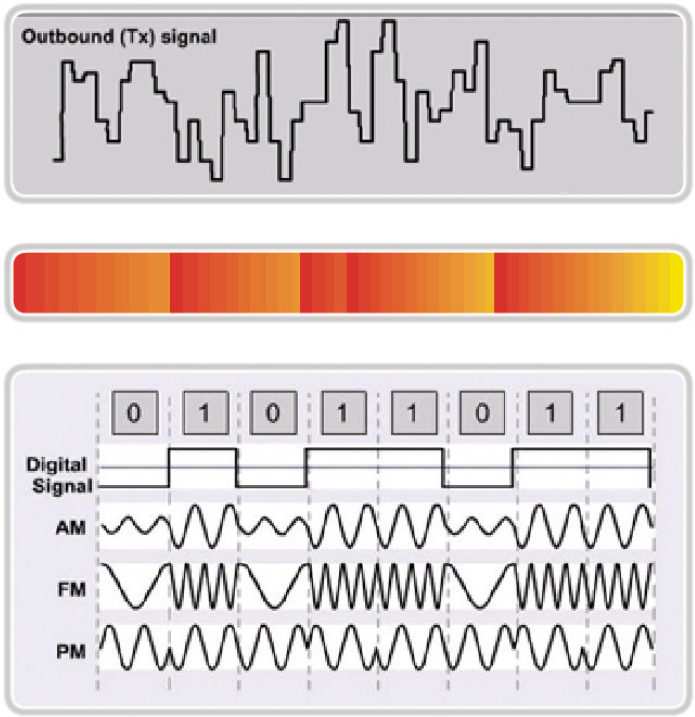
- Describe the role of bits in representing a frame as it is transported across the local media.



Physical Layer Protocols & Services

- Describe the role of signaling in the physical media.

Representations of Signals on the Physical Media



Sample electrical signals transmitted on copper cable

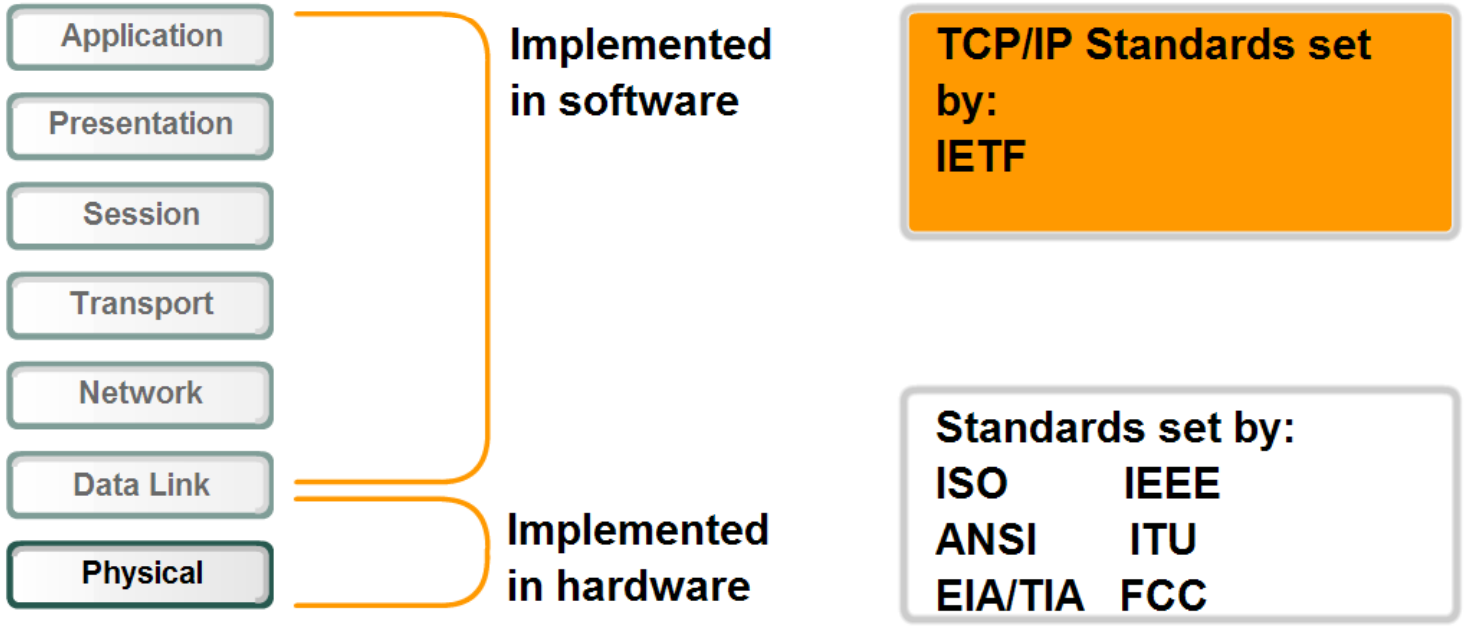
Representative light pulse fiber signals

Microwave (wireless) signals

Physical Layer Protocols & Services

- Distinguish who establishes and maintains standards for the Physical layers compared to those for the other layers of the network

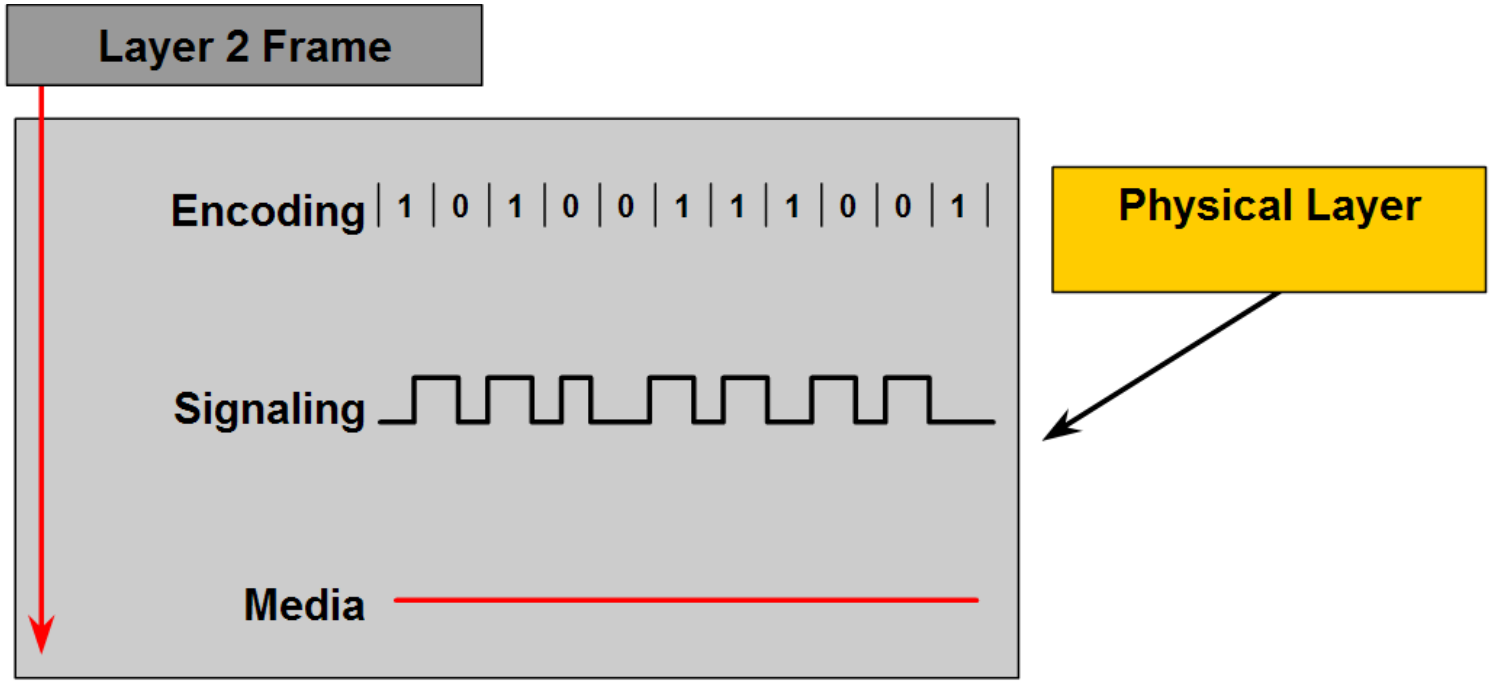
Comparison of Physical layer standards and upper layer standards



Physical Layer Protocols & Services

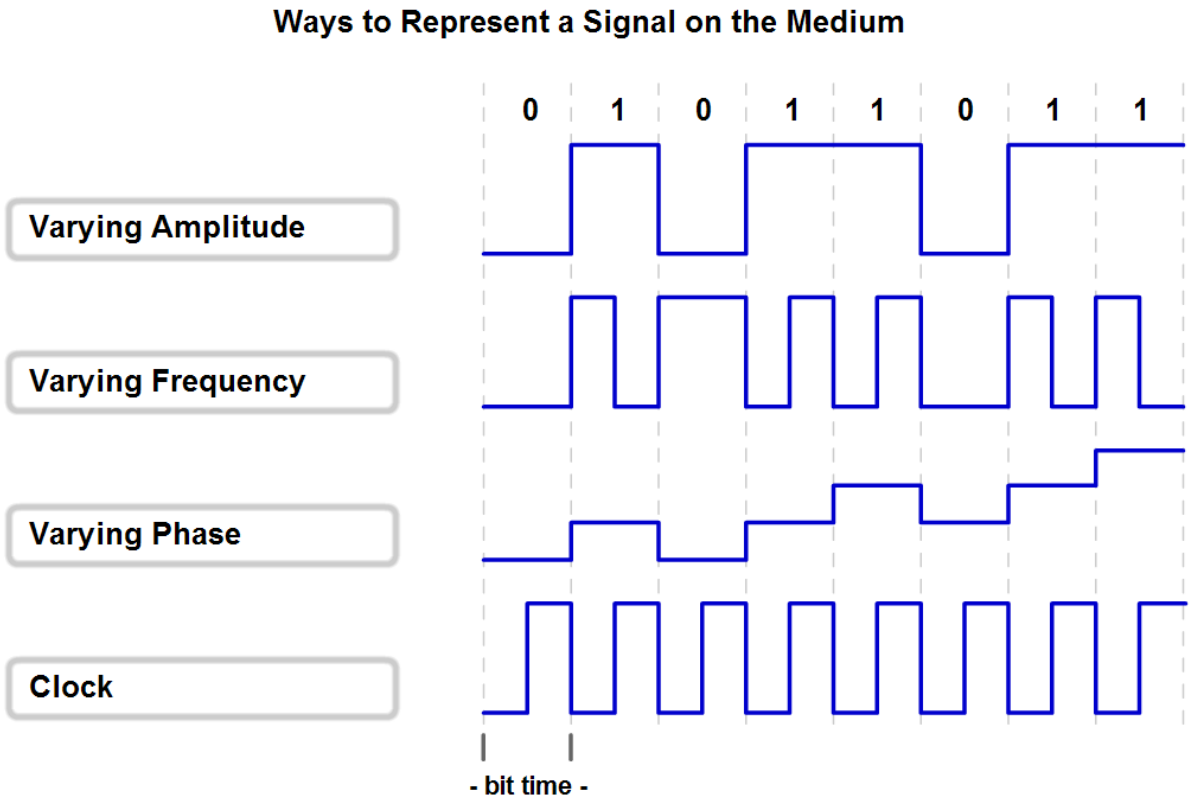
- Identify hardware components associated with the Physical layer that are governed by standards

Physical Layer Fundamental Principles



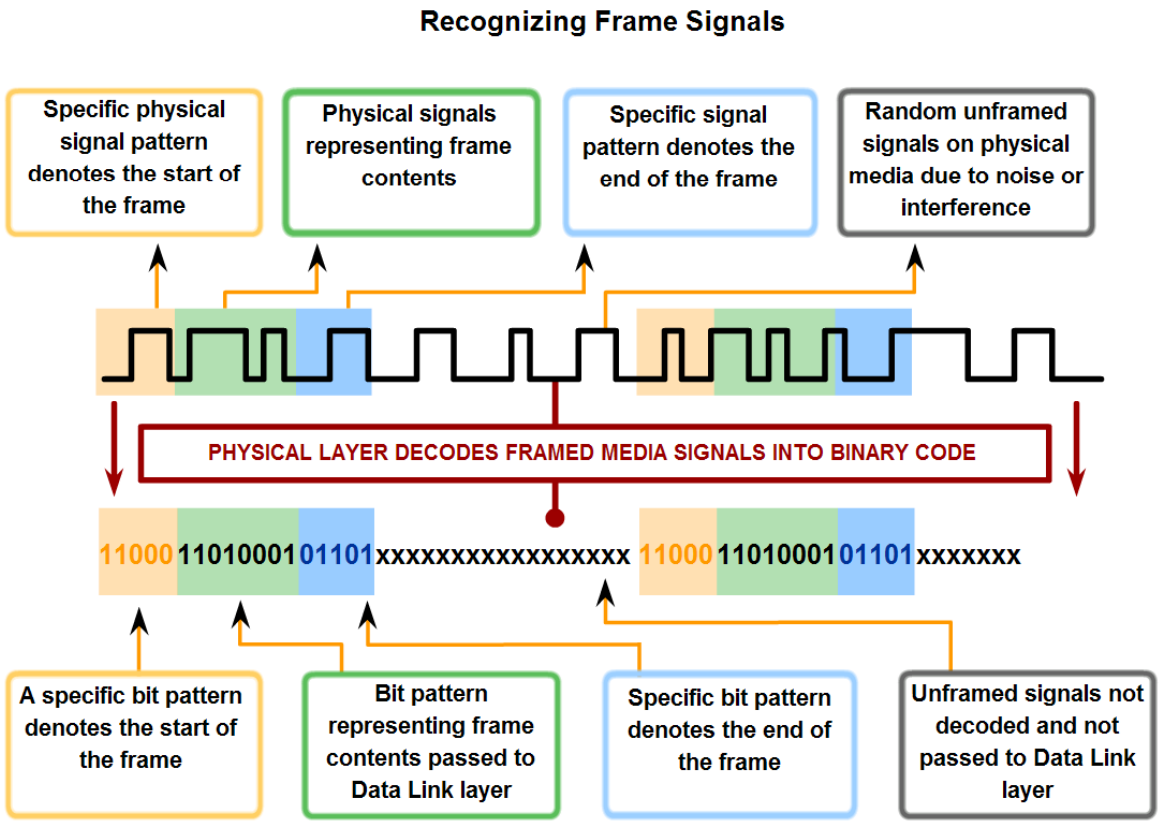
Physical Layer Signaling and Encoding

- Explain that network communication at this layer consists of individual bits encoded onto the Physical layer and describe the basic encoding techniques.



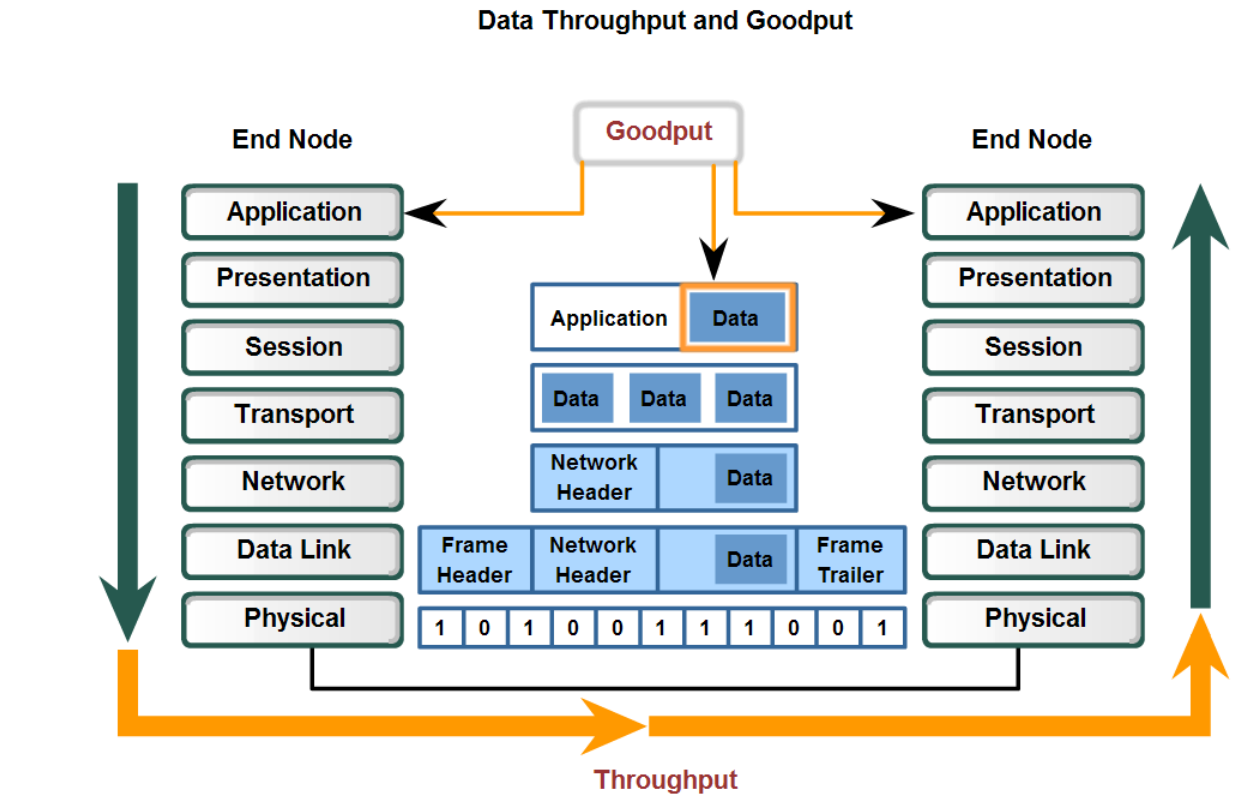
Physical Layer Signaling and Encoding

- Describe the role of encoding as it applies to the transmission of bits and explain the value of treating a collection of bits as a code.



Physical Layer Signaling and Encoding

- Define the terms bandwidth, throughput, and goodput



Data throughput is actual network performance. Goodput is a measure of the transfer of usable data after protocol overhead traffic has been removed.

Characteristics & Uses of Network Media

- Identify several media characteristics defined by Physical layer standards.

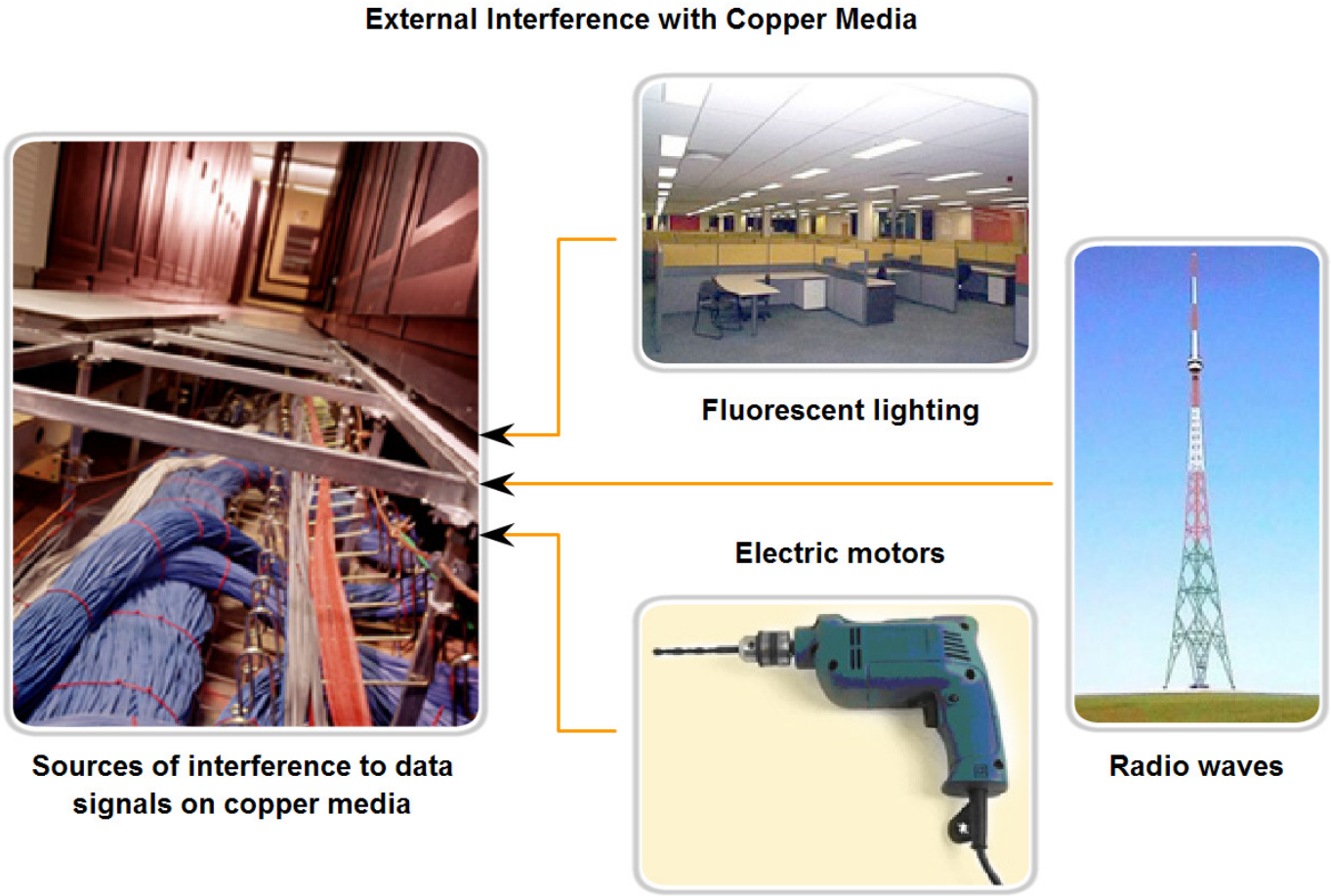
Physical Media - Characteristics

Ethernet Media

	10BASE-T	100BASE-TX	100BASE-FX	1000BASE-CX	1000BASE-T	1000BASE-SX	1000BASE-LX	1000BASE-ZX	10GBASE-ZR
Media	EIA/TIA Category 3, 4, 5 UTP, two pair	EIA/TIA Category 3, 4, 5 UTP, two pair	50/62.5 µm multi mode fiber	STP	EIA/TIA Category 3, 4, 5 UTP, four pair	62.5/50 micron multimode fiber	50/62.5 micron multimode fiber or 9 micron single mode fiber	9µm single mode fiber	9µm single mode fiber
Maximum Segment Length	100m (328 feet)	100m (328 feet)	2 km (6562 ft)	25 m (82 feet)	100 m (328 feet)	Up to 550 m (1,804 ft) depending on fiber used	550 m (MMF)10 km (SMF)	Approx. 70 km	Up to 80 km
Topology	Star	Star	Star	Star	Star	Star	Star	Star	Star
Connector	ISO 8877 (RJ-45)	ISO 8877 (RJ-45)		ISO 8877 (RJ-45)	ISO 8877 (RJ-45)				

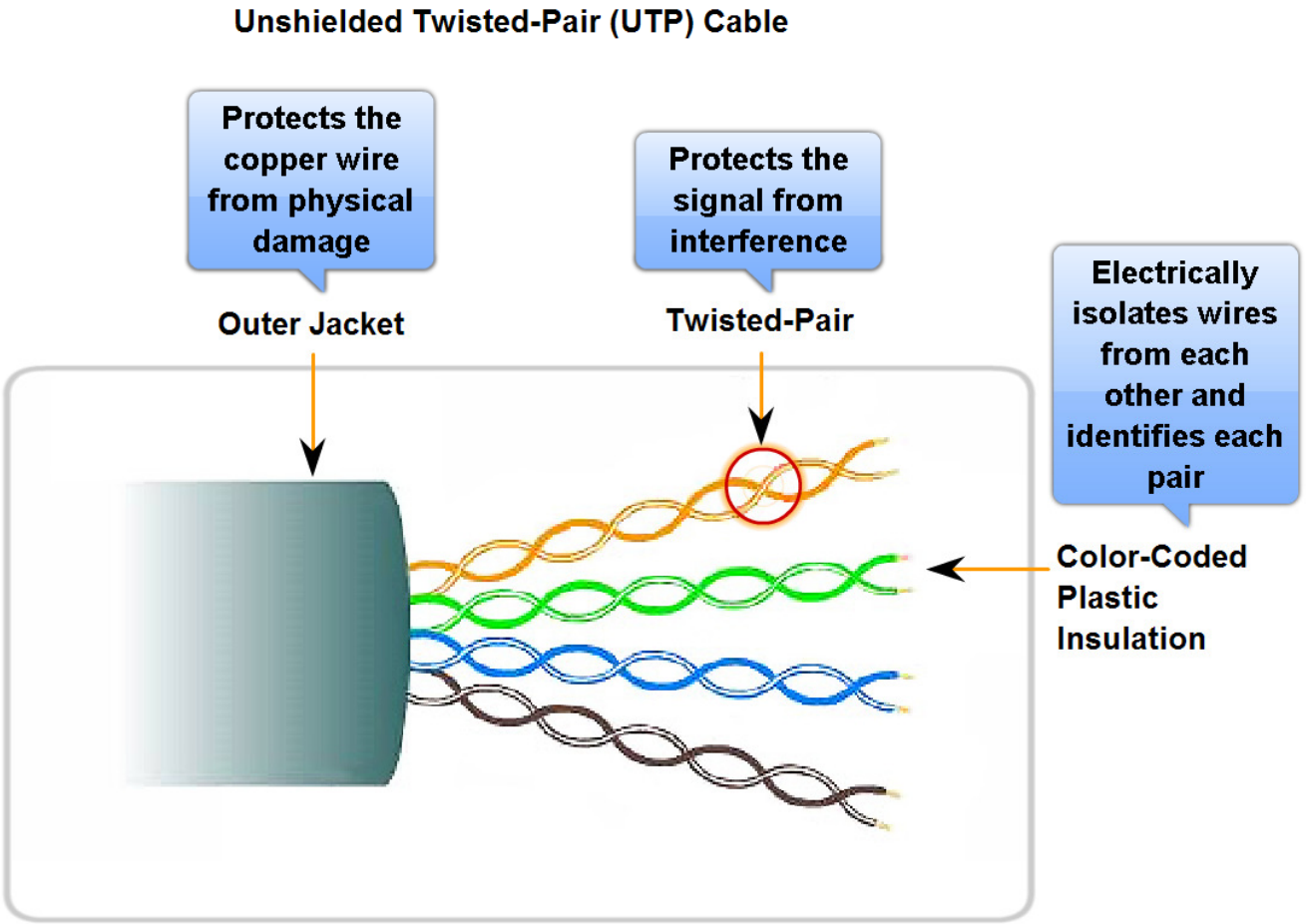
Characteristics & Uses of Network Media

- Describe the impact interference has on throughput and the role of proper cabling in reducing interference



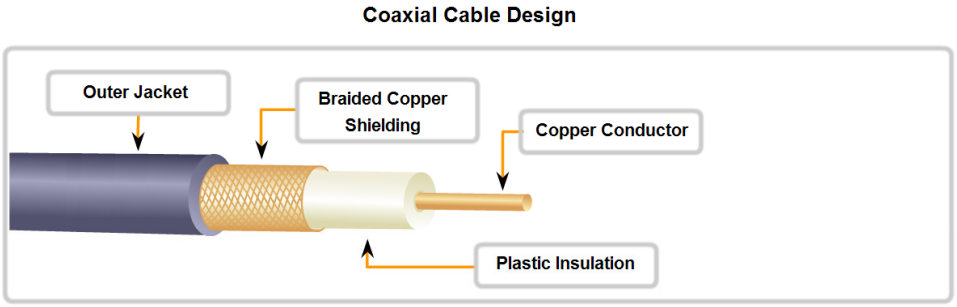
Characteristics & Uses of Network Media

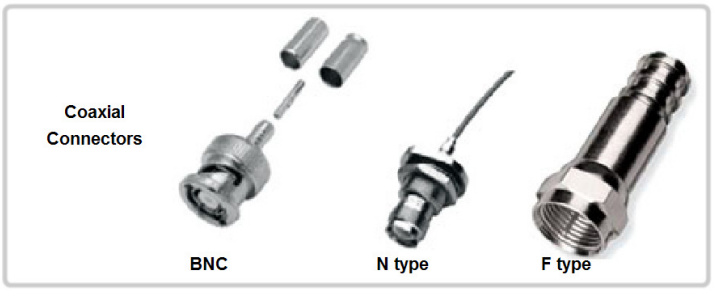
- Identify the basic characteristics of UTP cable

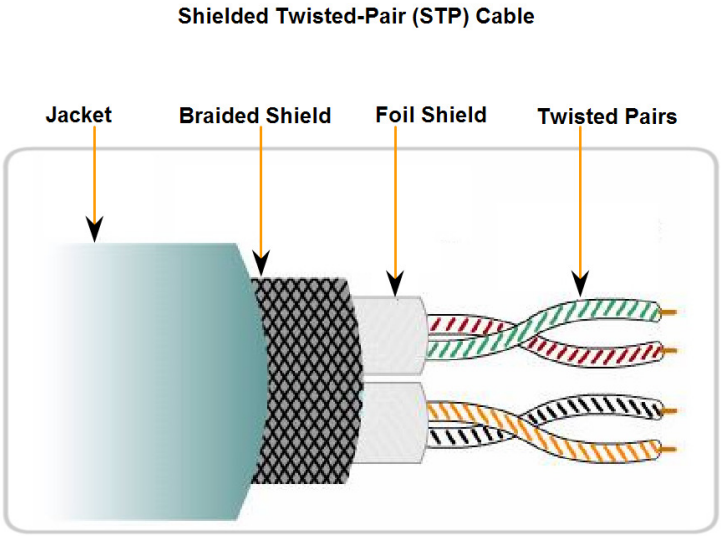


Characteristics & Uses of Network Media

- Identify the basic characteristics of STP and Coaxial cable



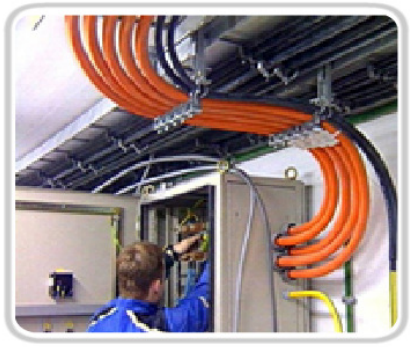




Characteristics & Uses of Network Media

- Identify types of safety issues when working with copper cabling

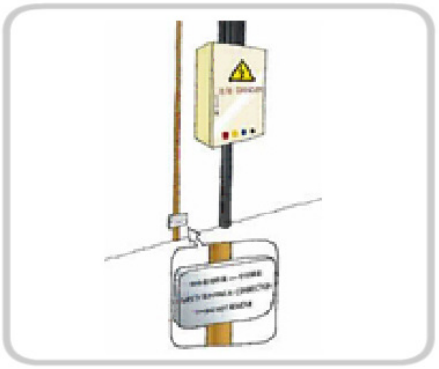
Copper Media Safety



The separation of data and electrical power cabling must comply with safety codes.

Cables must be connected correctly.

Installations must be inspected for damage.

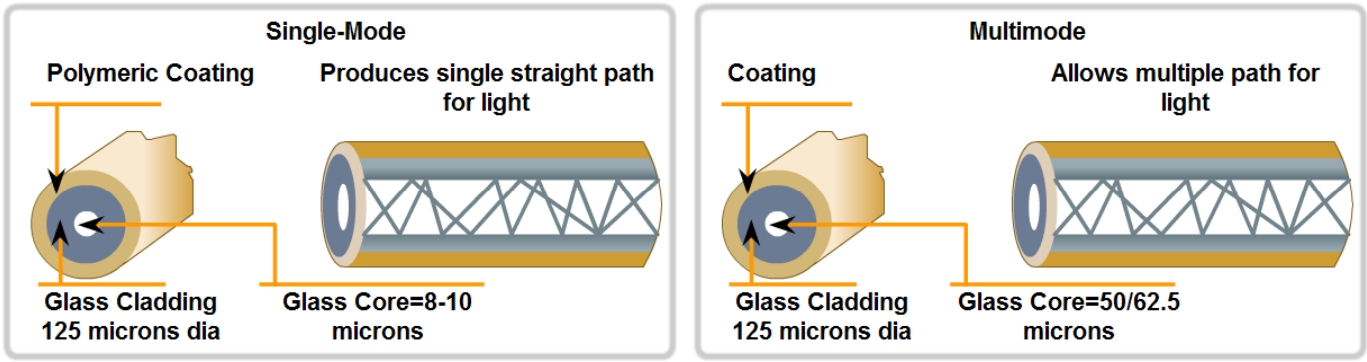


Equipment must be grounded correctly.

Characteristics & Uses of Network Media

- Identify several primary characteristics of fiber cabling and its main advantages over other media

Fiber Media Modes

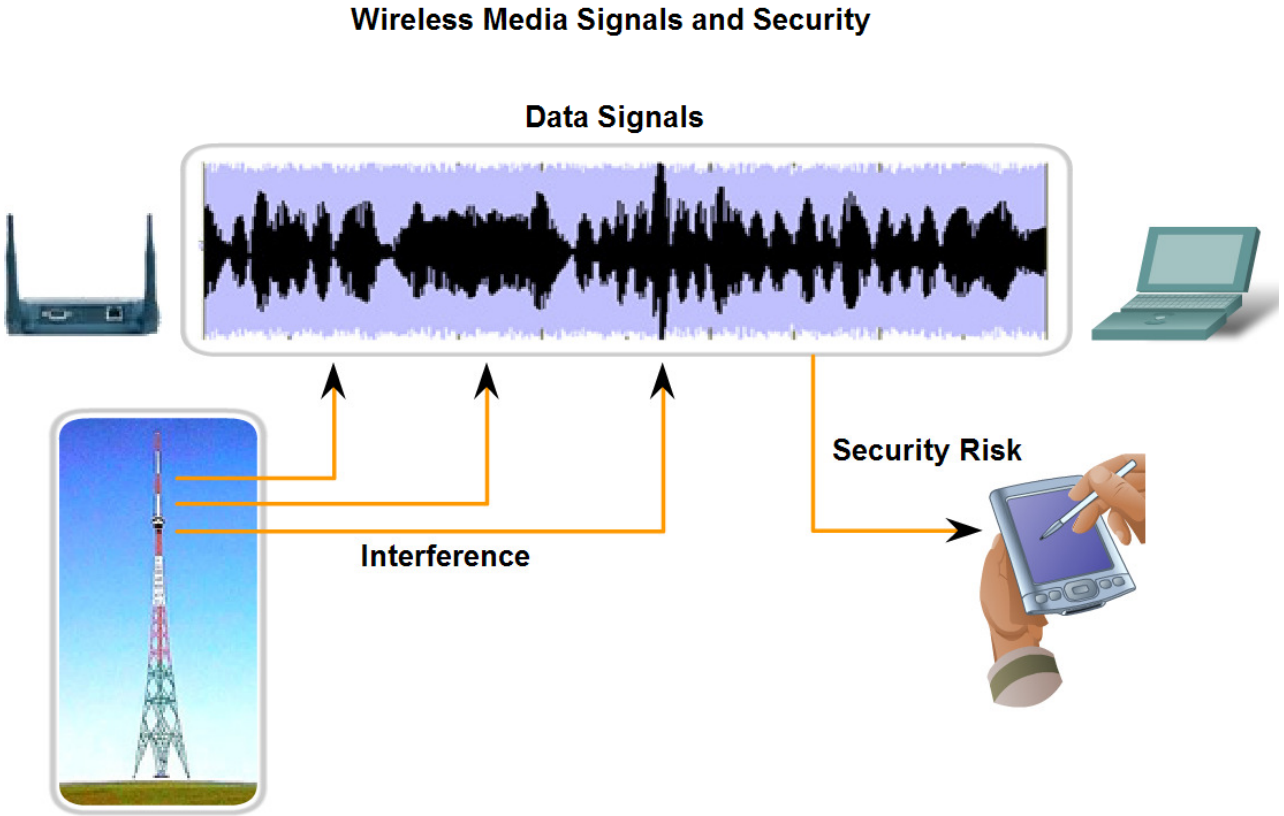


- Small Core
- Less Despersion
- Suited for long distance applications (up to 100 km, 62,14 mi.)
- Uses lasers as the light source often within campus backbones for distance of several thousand meters

- Larger core than single-mode cable (50 microns or greater)
- Allows greater dipersion and therefore, loss of signal
- Used for long distance appllication, but shoter than single-mode (up to ~2km, 6560 ft)
- Uses LEDs as the light source often within LANs or distances of couple hundred meters within a campus network

Characteristics & Uses of Network Media

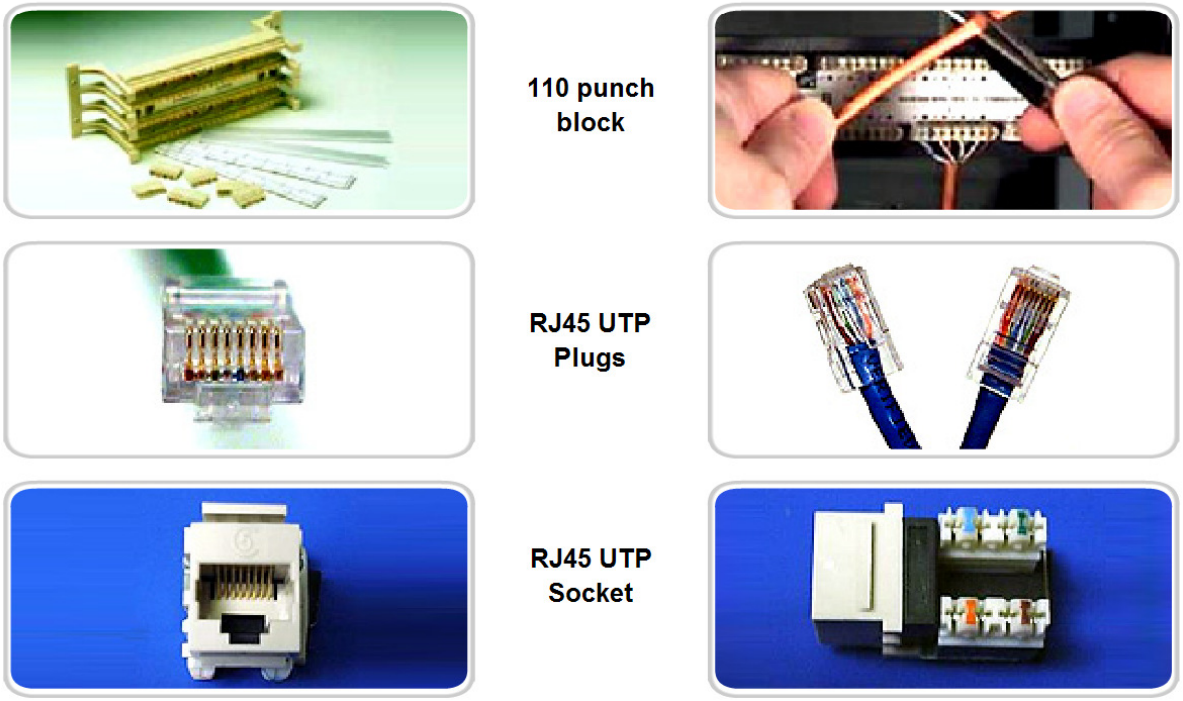
- Describe the role of radio waves when using air as the media and the increased need for security in wireless communications



Characteristics & Uses of Network Media

- Identify the characteristics used to categorize connectors, describe some common uses for the same connectors, and identify the consequences for misapplying a connector in a given situation

Copper Media Connectors



Summary

In this chapter, you learned to:

- Explain the role of Physical layer protocols and services in supporting communication across data networks.
- Describe the purpose of Physical layer signaling and encoding as they are used in networks.
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