Cisco Networking Academy
Mind Wide Open

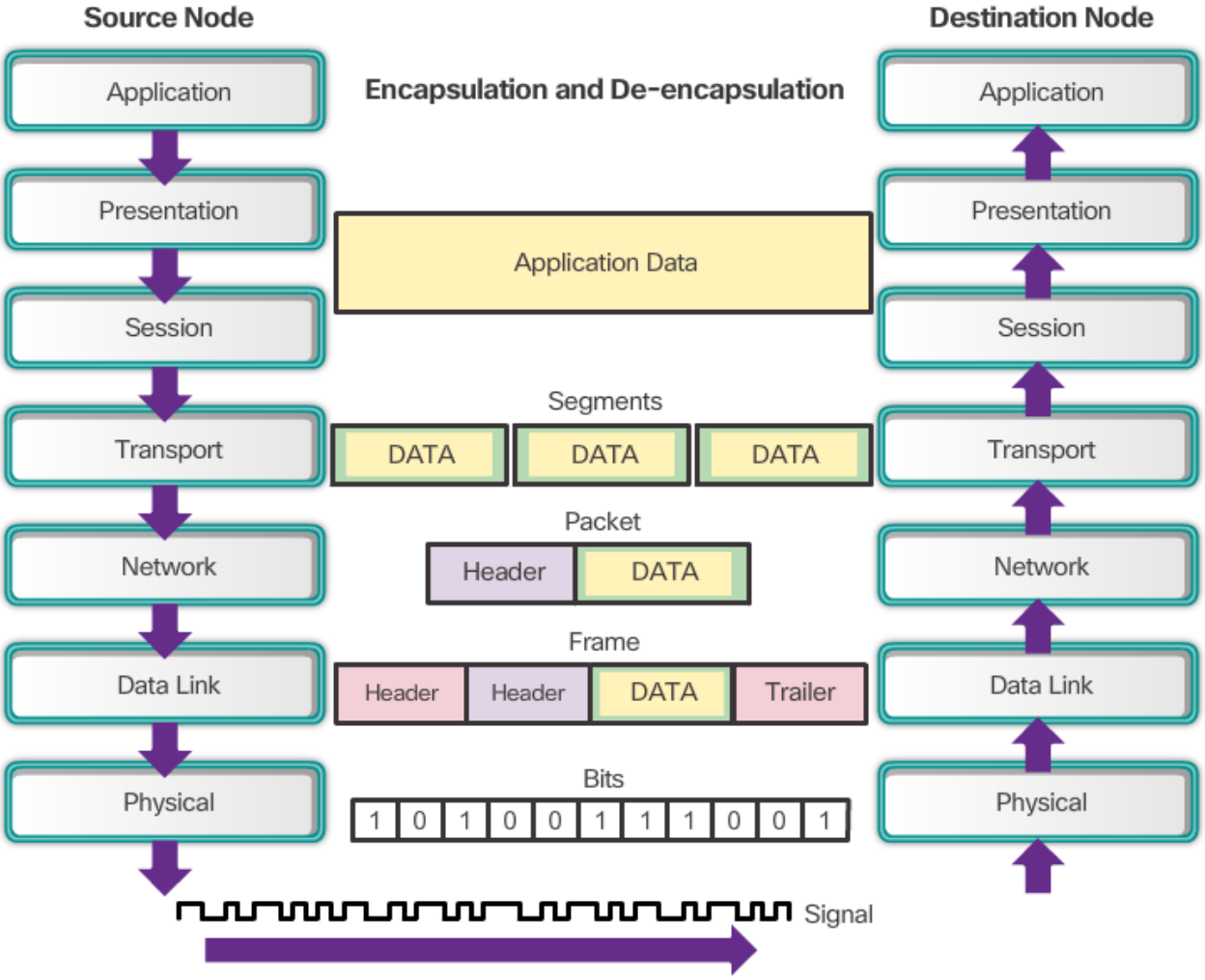
Chapter 4:
Network Access

Introduction to Networks v5.1

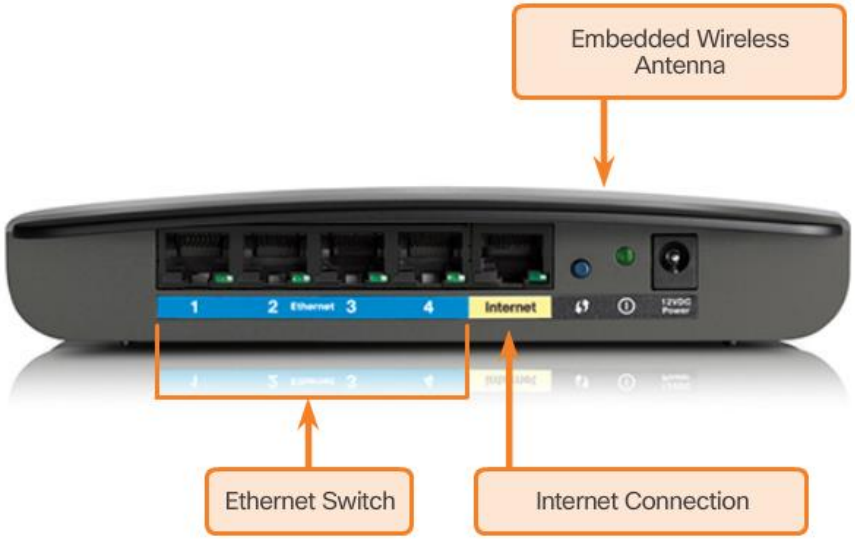
Marvin Krym

Topic 4.1.1:
Physical Layer Connection

The Physical Layer



Types of Connections



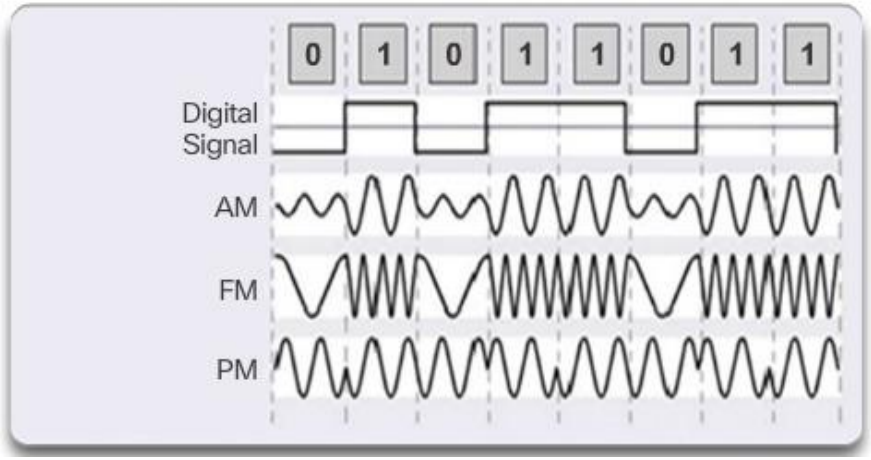
Home Router

Connecting to the Wired LAN

Physical Layer Media

Electrical Signals –
Copper cable

Light Pulse –
Fiber-optic cable



Microwave Signals –
Wireless

Bandwidth and Throughput

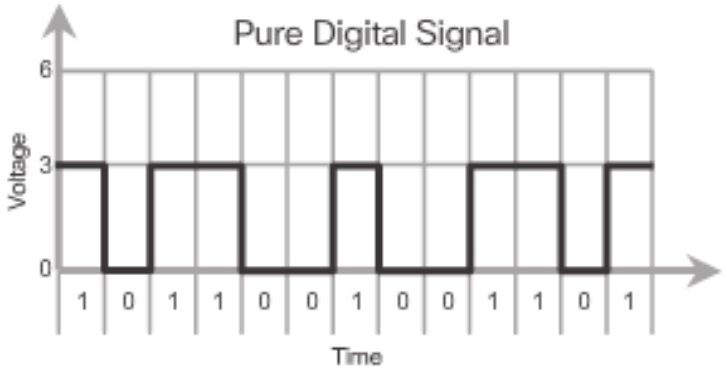
Unit of Bandwidth	Abbreviation	Equivalence
Bits per second	bps	1 bps = fundamental unit of bandwidth
Kilobits per second	kbps	1 kbps = 1,000 bps = 10^3 bps
Megabits per second	Mbps	1 Mbps = 1,000,000 bps = 10^6 bps
Gigabits per second	Gbps	1 Gbps = 1,000,000,000 bps = 10^9 bps
Terabits per second	Tbps	1 Tbps = 1,000,000,000,000 bps = 10^12 bps

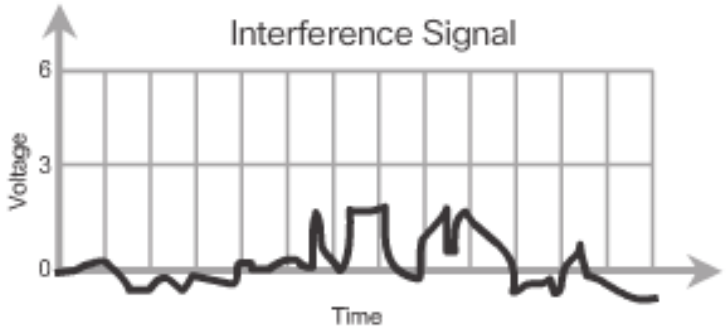
Bandwidth: Maximum bit rate supported by the channel

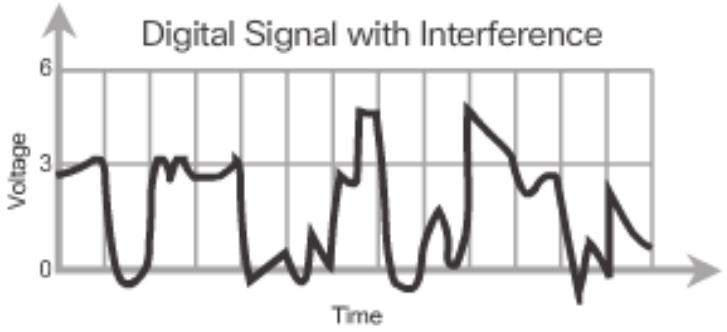
Throughput: Actual bit rate carried by the channel at a point in time

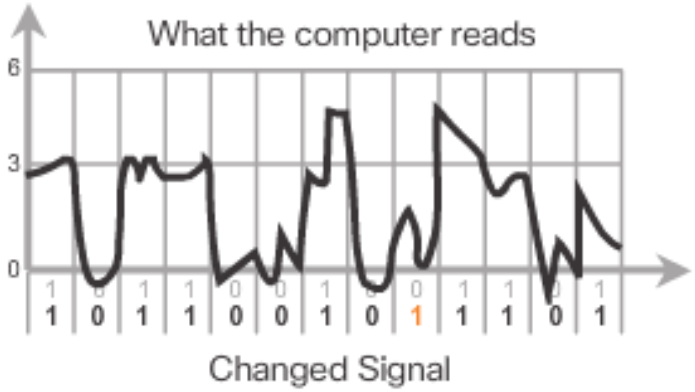
Topic 4.2.1:
Copper Cabling

Characteristics of Copper Cabling

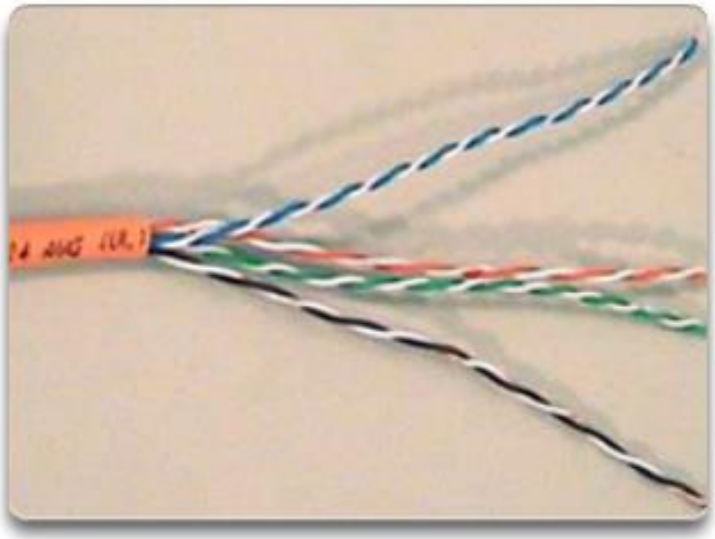






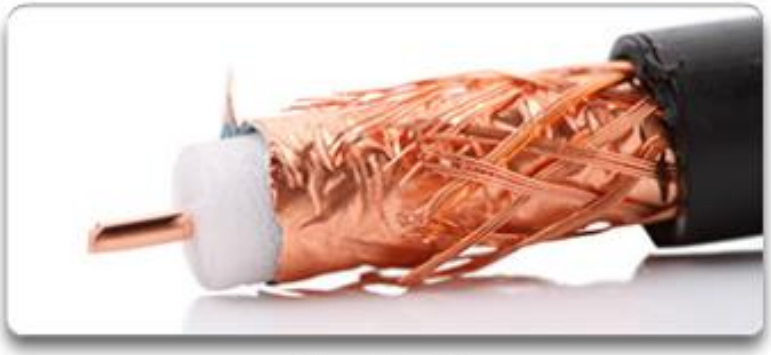


Copper Media



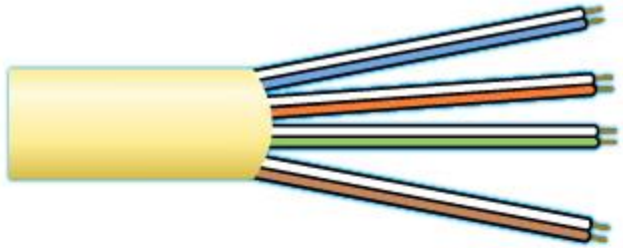
Unshielded Twisted-Pair (UTP) cable

Shielded Twisted-Pair (STP) cable

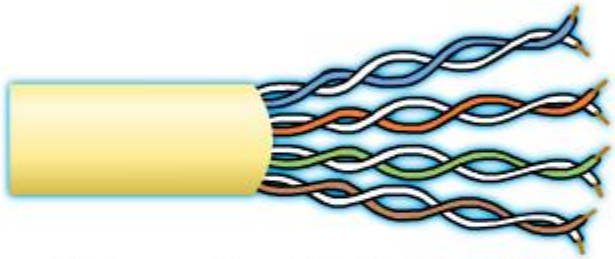


Coaxial cable

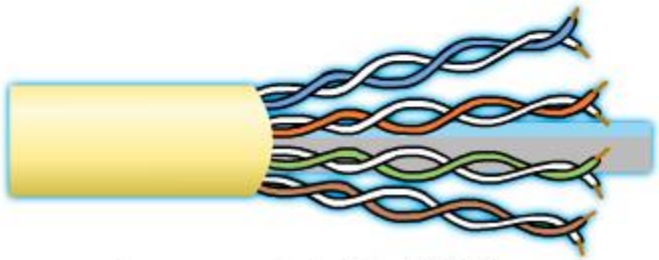
UTP Cabling Standards



Category 3 Cable (UTP)



Category 5 and 5e Cable (UTP)



Category 6 Cable (UTP)

Category 3 Cable (UTP)

- Used for voice communication
- Most often used for phone lines

Category 5 and 5e Cable (UTP)

- Used for data transmission
- Cat5 supports 100 Mb/s and can support 1000 Mb/s, but it is not recommended
- Cat5e supports 1000 Mb/s

Category 6 Cable (UTP)

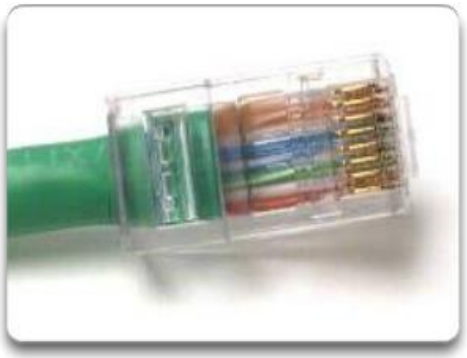
- Used for data transmission
- An added separator is between each pair of wires allowing it to function at higher speeds
- Supports 1000 Mb/s – 10 Gb/s, though 10 Gb/s is not recommended

UTP Connectors

RJ-45 UTP Plugs

RJ-45 UTP Socket

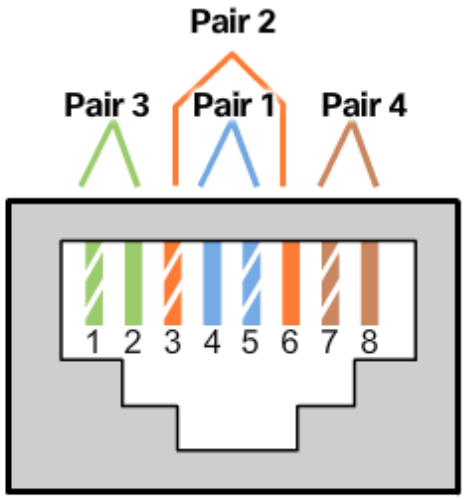
Bad connector – Wires are exposed, untwisted, and not entirely covered by the sheath.



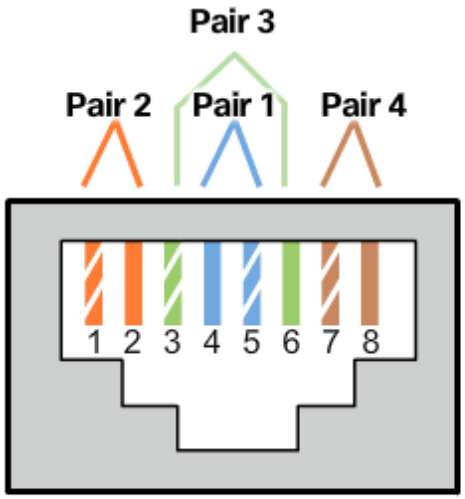
Good connector – Wires are untwisted to the extent necessary to attach the connector.

Types of UTP Cable

Colour Acronym:
BOGB



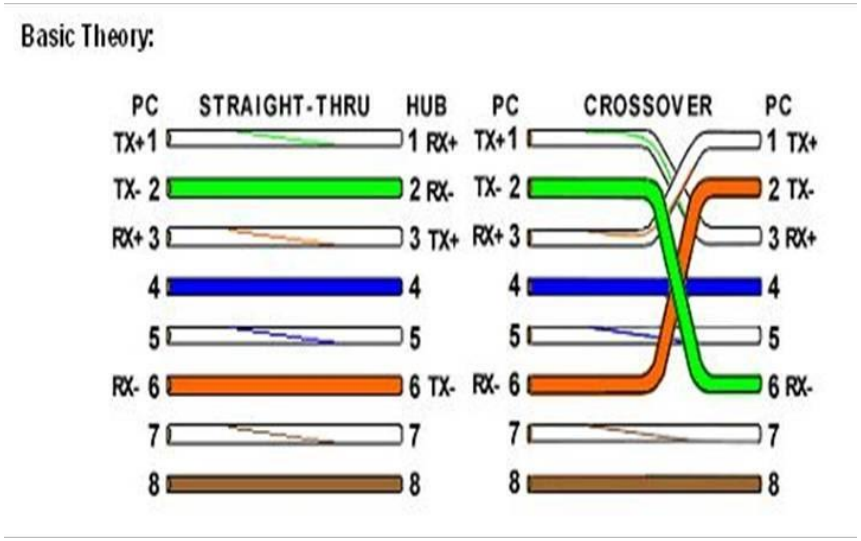
T568A

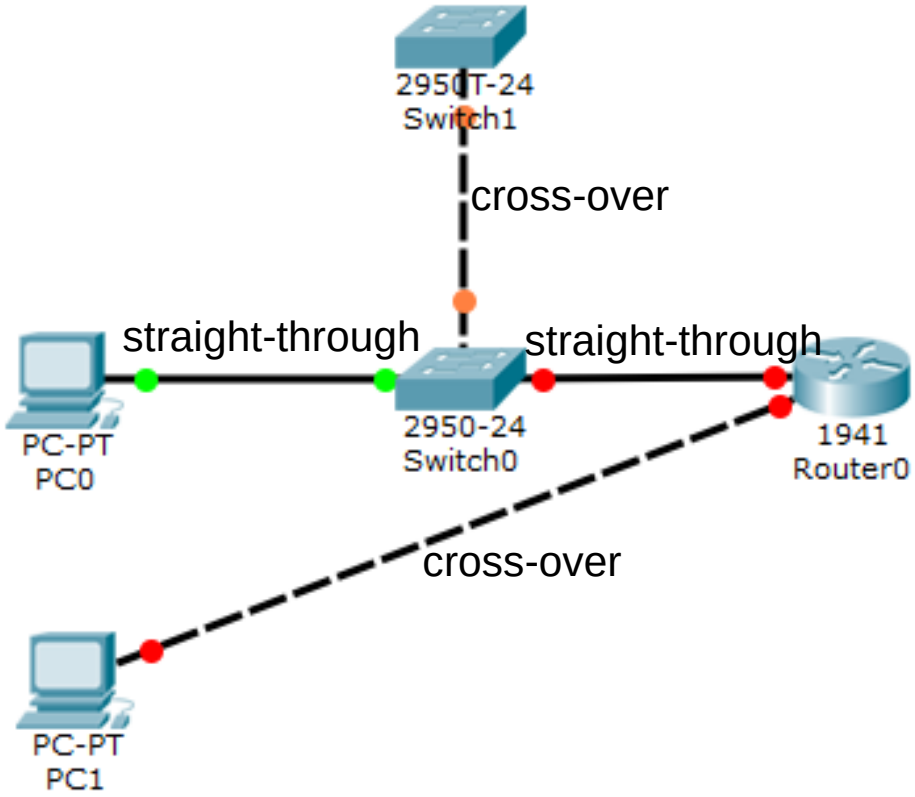


T568B

Cable Type	Standard	Application
Ethernet Straight-through	Both ends T568A or both ends T568B	Connects a network host to a network device such as a switch or hub.
Ethernet Crossover	One end T568A, other end T568B	• Connects two network hosts • Connects two network intermediary devices (switch to switch, or router to router)
Rollover	Cisco proprietary	Connects a workstation serial port to a router console port, using an adapter.

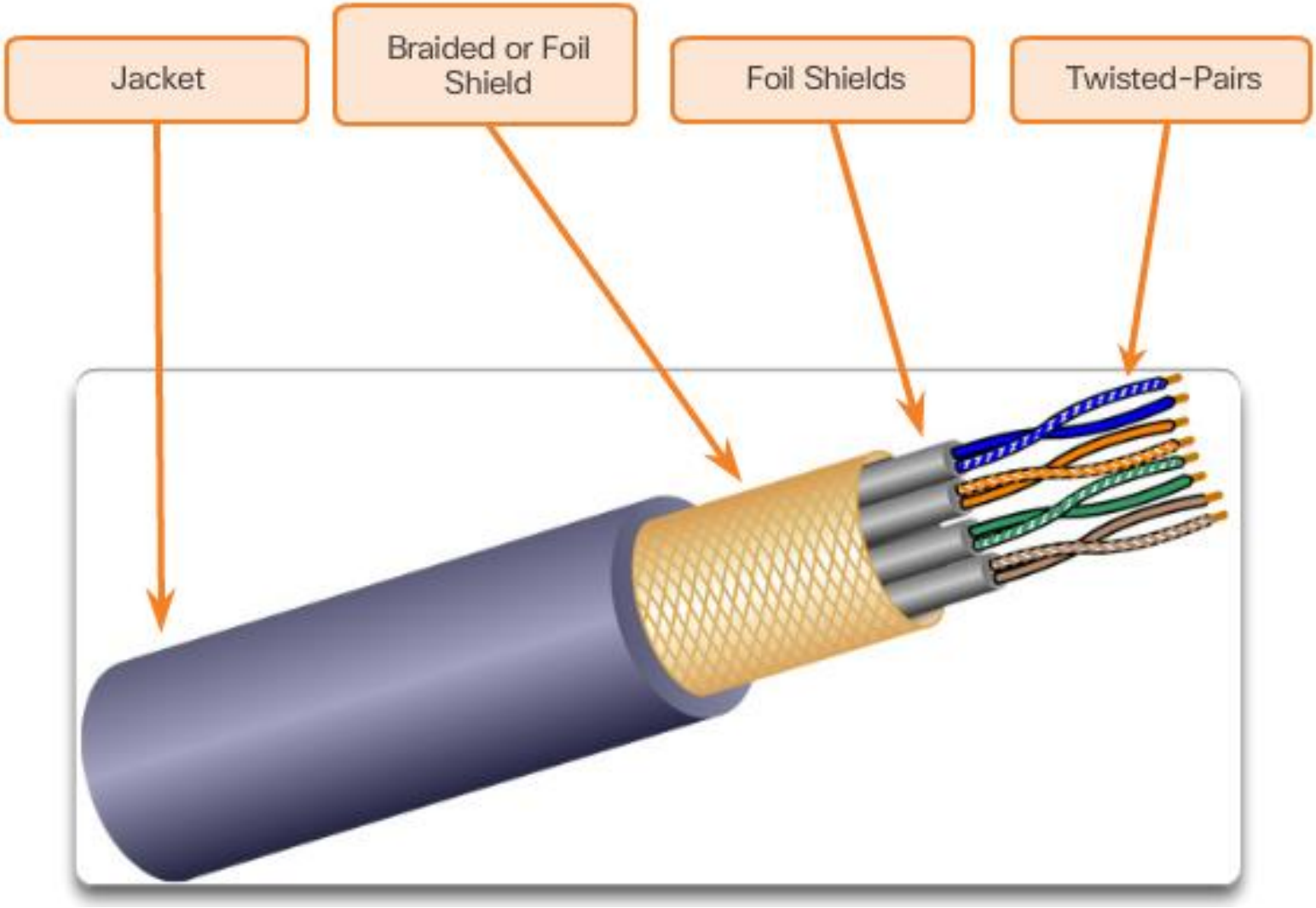
Ethernet Cable Connections



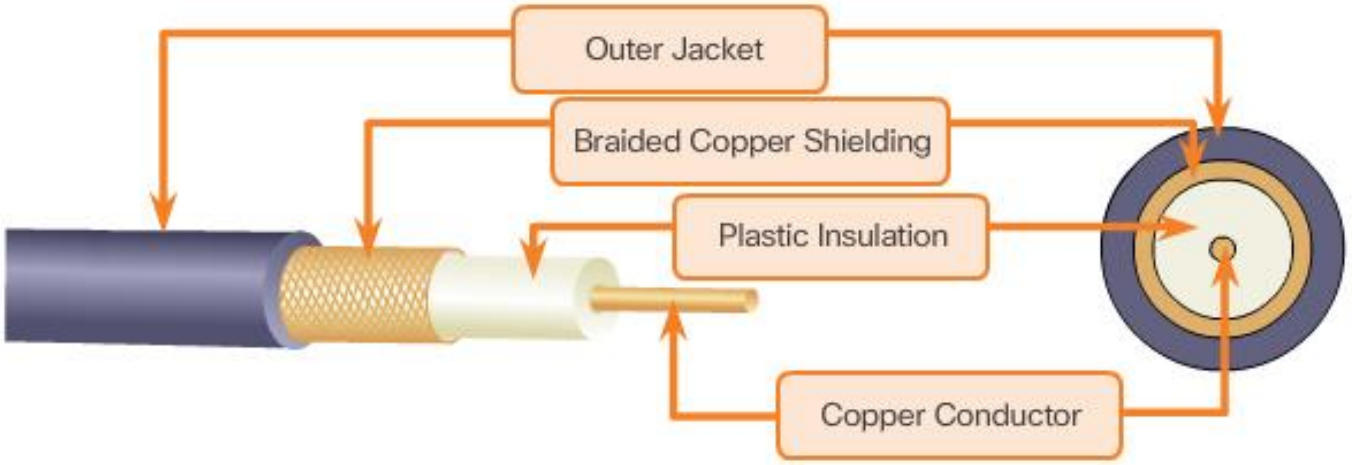


Use straight-through when connecting next layer device
Use cross-over when connecting same layer and jumping a layer

Shielded Twisted-Pair Cable



Coaxial Cable



Topic 4.2.3:
Fiber Optic Cabling

Fiber Media Cable Design

Jacket

Typically a PVC jacket that protects the fiber against abrasion, moisture, and other contaminants. This outer jacket composition can vary depending on the cable usage.

Core

The core is actually the light transmission element at the center of the optical fiber. This core is typically silica or glass. Light pulses travel through the fiber core.

Buffer

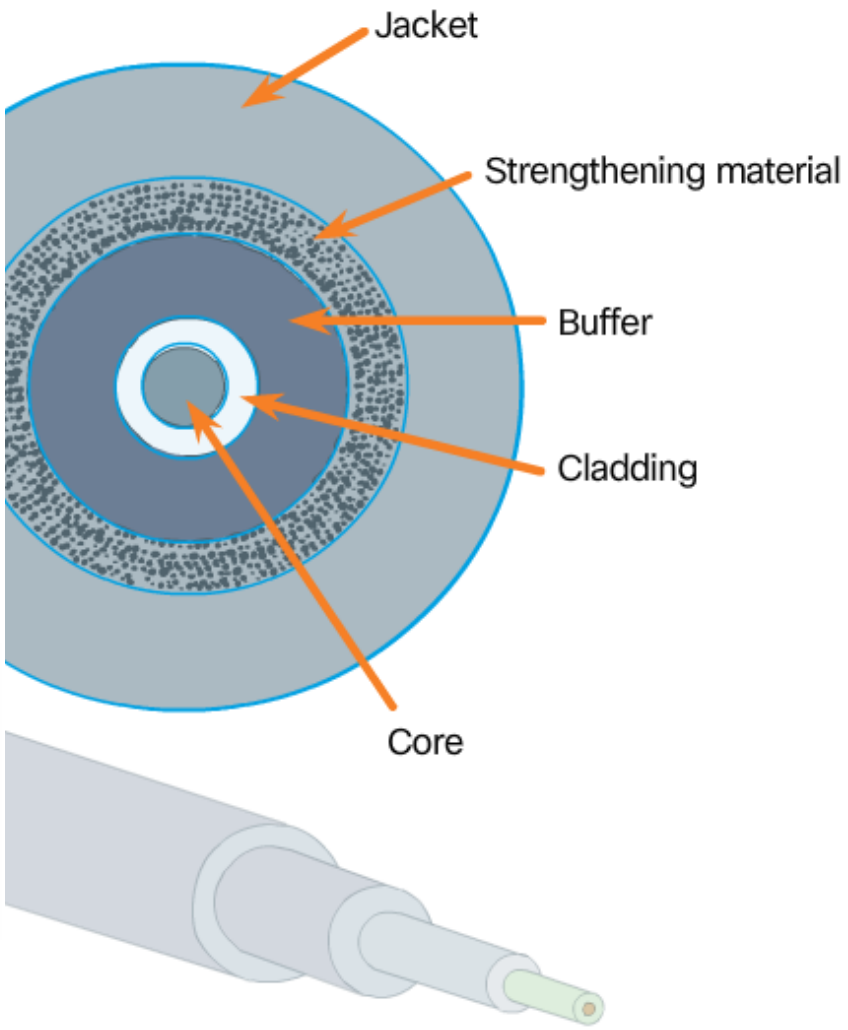
Used to help shield the core and cladding from damage.

Cladding

Made from slightly different chemicals than those used to create the core. It tends to act like a mirror by reflecting light back into the core of the fiber. This keeps light in the core as it travels down the fiber.

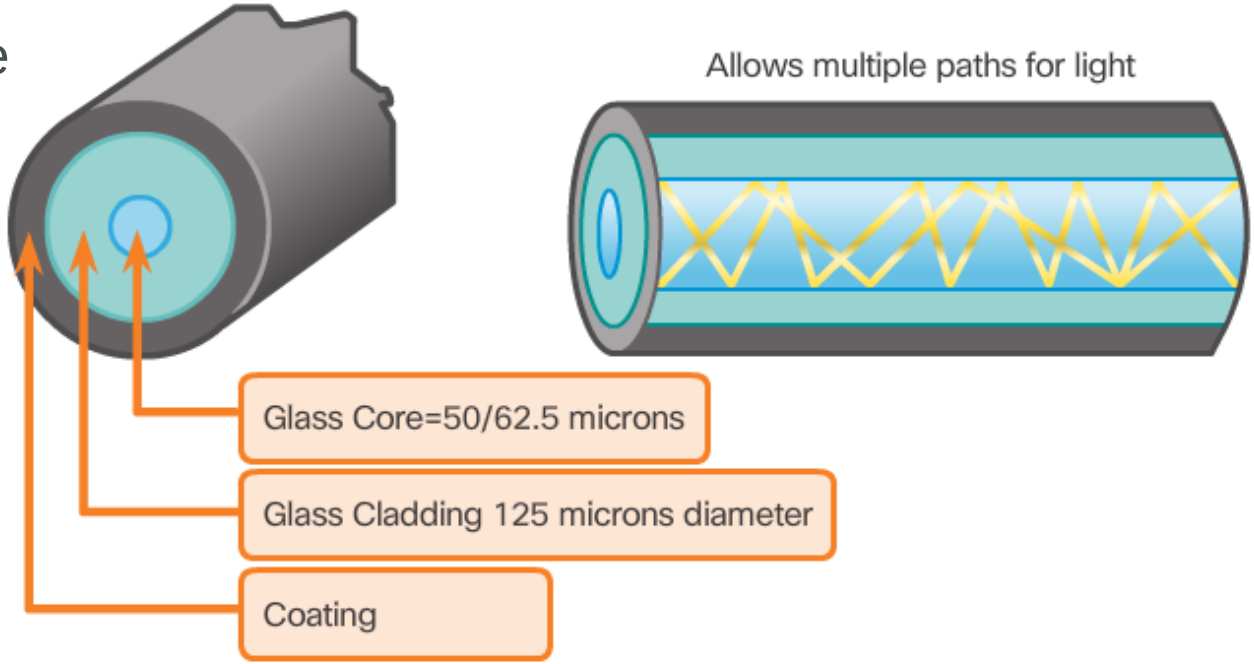
Strengthening Material

Surrounds the buffer, prevents the fiber cable from being stretched when it is being pulled. The material used is often the same material used to produce bulletproof vests.



Types of Fiber Media (cont.)

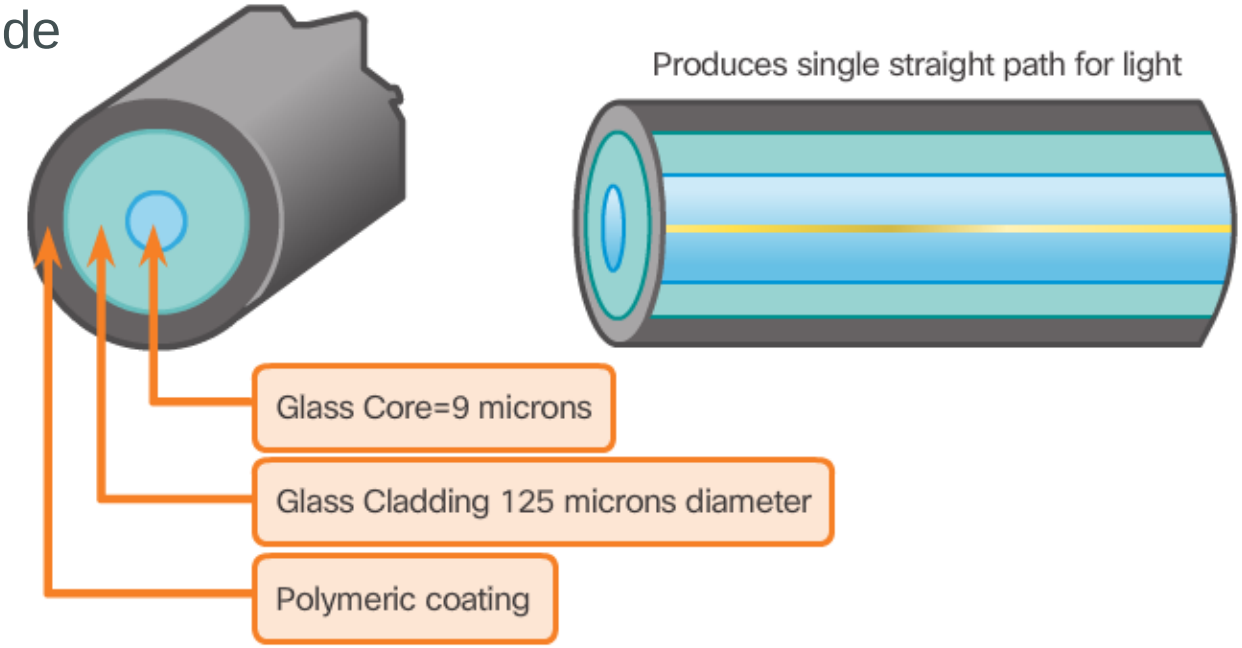
Multimode



- Larger core than single mode cable
- Allows greater dispersion and therefore, loss of signal
- Suited for long distance applications, but shorter than single mode
- Uses LEDs as the light source
- Commonly used with LANs or distances of a couple hundred meters within a campus network

Types of Fiber Media

Single Mode



- Small core
- Less dispersion
- Suited for long distance applications
- Uses lasers as the light source
- Commonly used with campus backbones for distances of several thousand meters

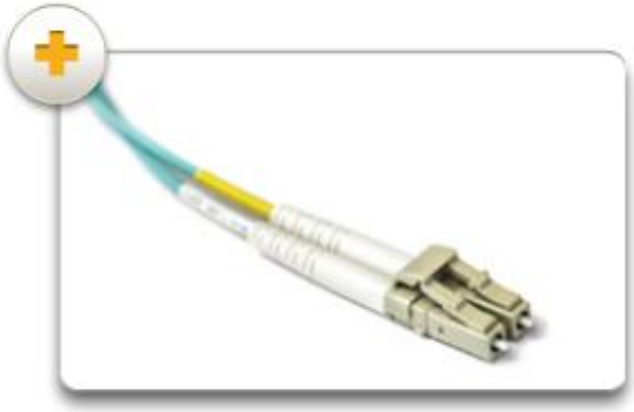
Network Fiber Connectors

Fiber Optic Connectors

ST Connectors

SC Connectors

LC Connector



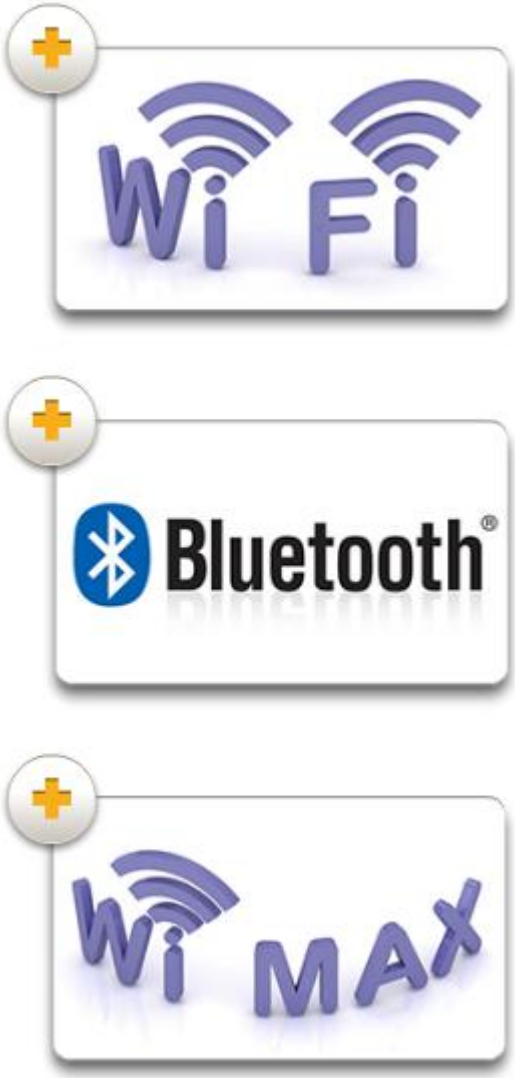
Duplex Multimode LC Connectors

Fiber versus Copper

Implementation Issues	UTP Cabling	Fiber-optic Cabling
Bandwidth supported	10 Mb/s – 10 Gb/s	10 Mb/s – 100 Gb/s
Distance	Relatively short (1 – 100 meters)	Relatively high (1 – 100,000 meters)
Immunity to EMI and RFI	Low	High (Completely immune)
Immunity to electrical hazards	Low	High (Completely immune)
Media and connector costs	Lowest	Highest
Installation skills required	Lowest	Highest
Safety precautions	Lowest	Highest

Topic 4.2.4:
Wireless Media

Types of Wireless Media



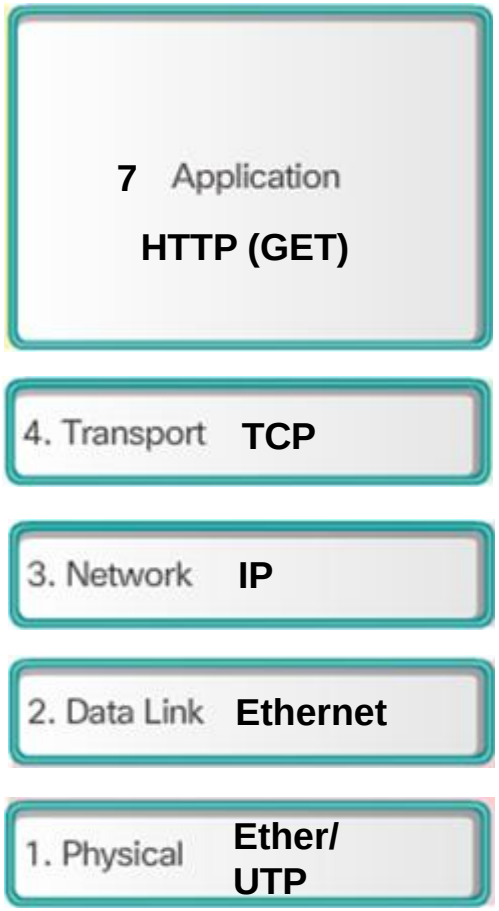
Section 4.3: Data Link Layer Protocols

Upon completion of this section, you should be able to:

- Describe the purpose and function of the data link layer in preparing communication for transmission on specific media.

Network Addresses

Network Addresses and Data Link Addresses

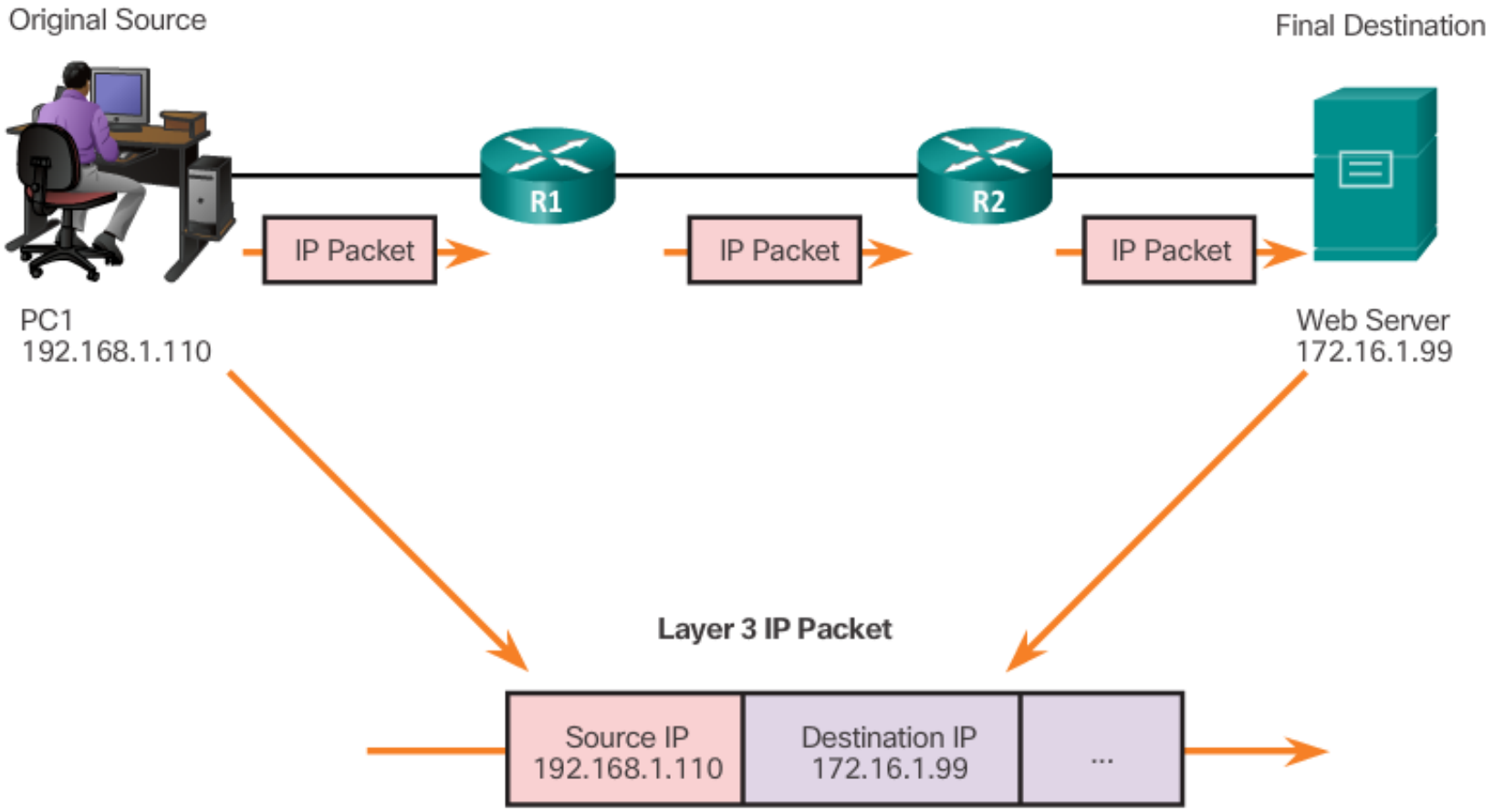


Network Layer Address (Global Routed)
Eg. IP Address

Link Layer Address (Locally Switched)
Locally Switched

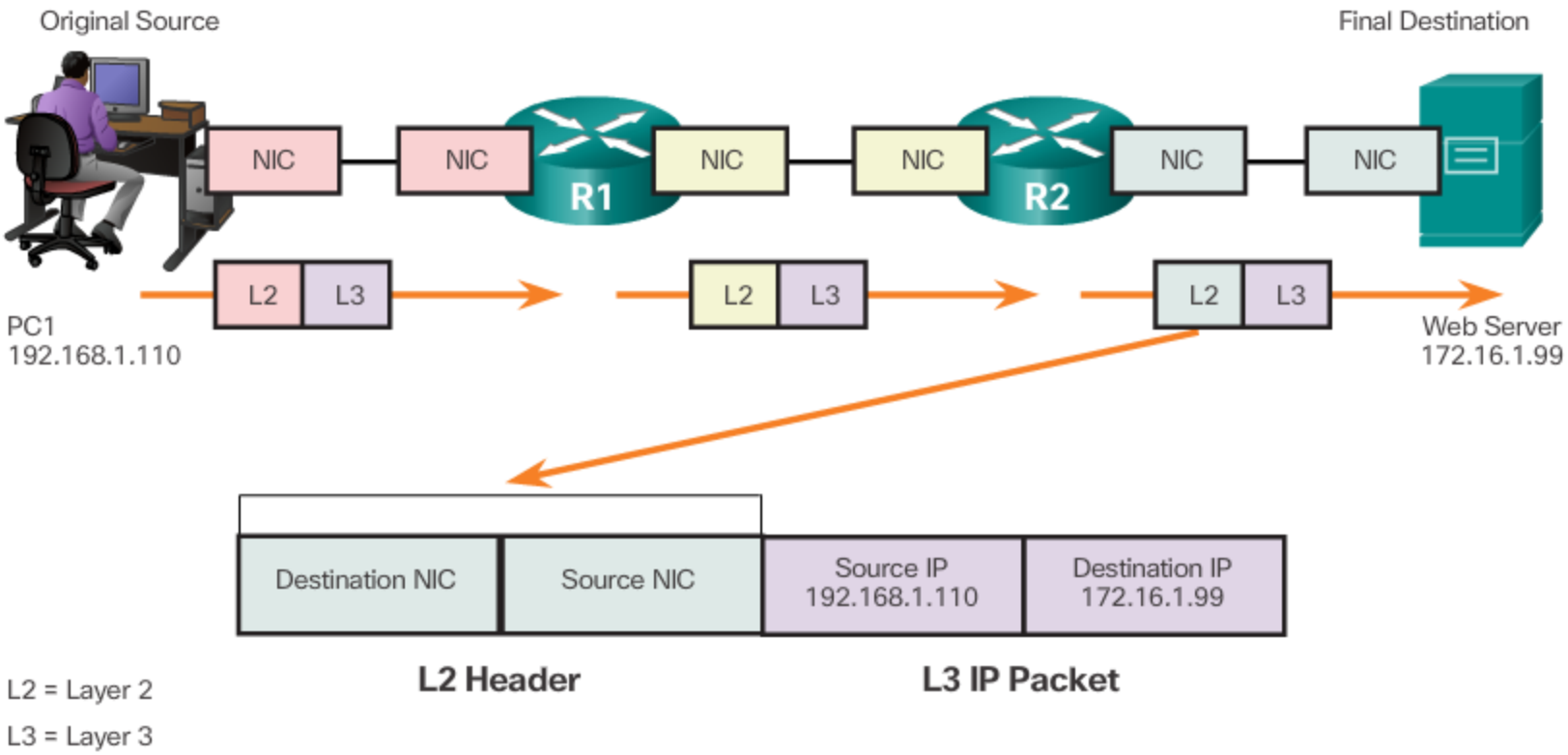
Network Addresses (cont.)

Layer 3 Network Addresses

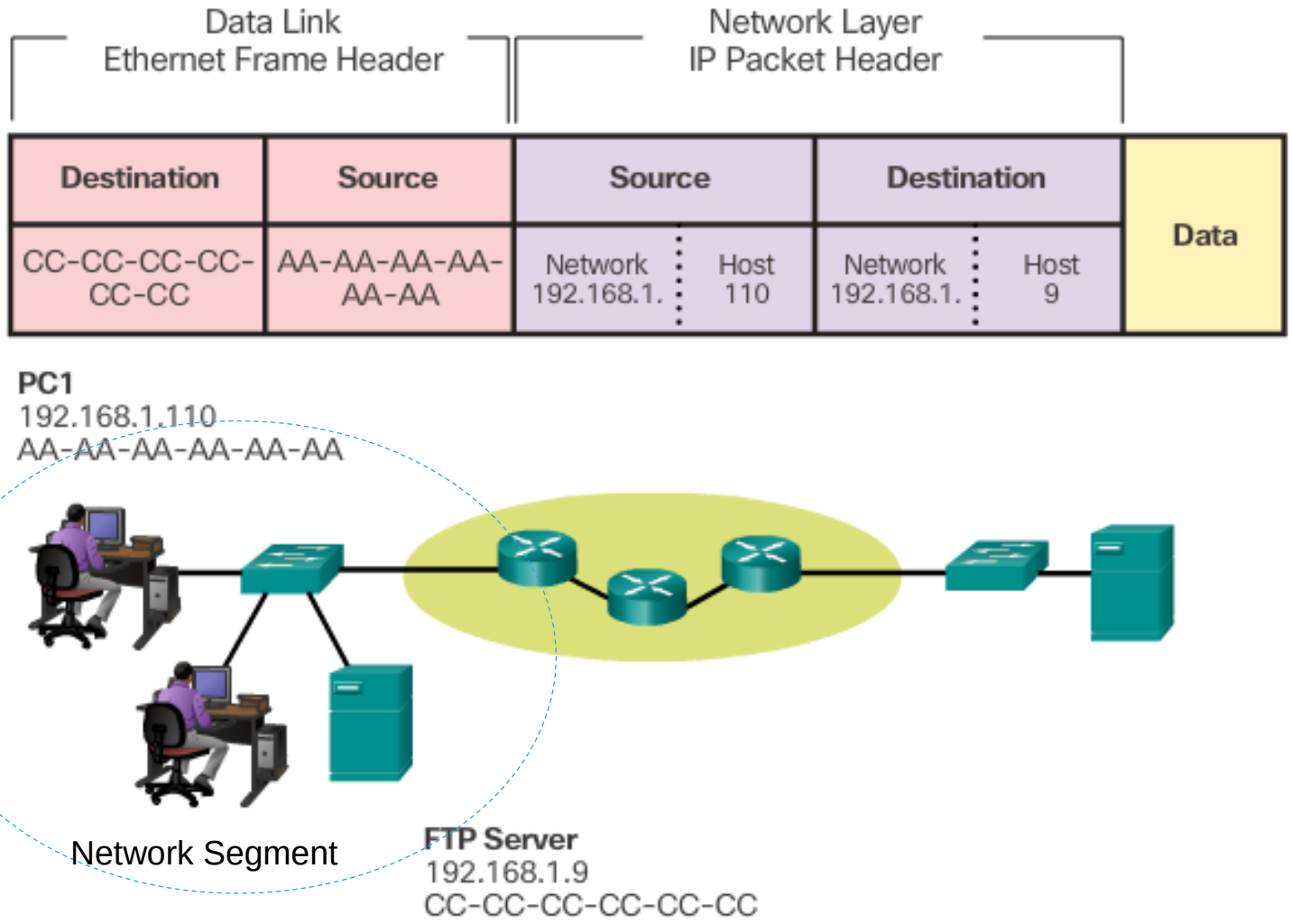


Data Link Address (cont.)

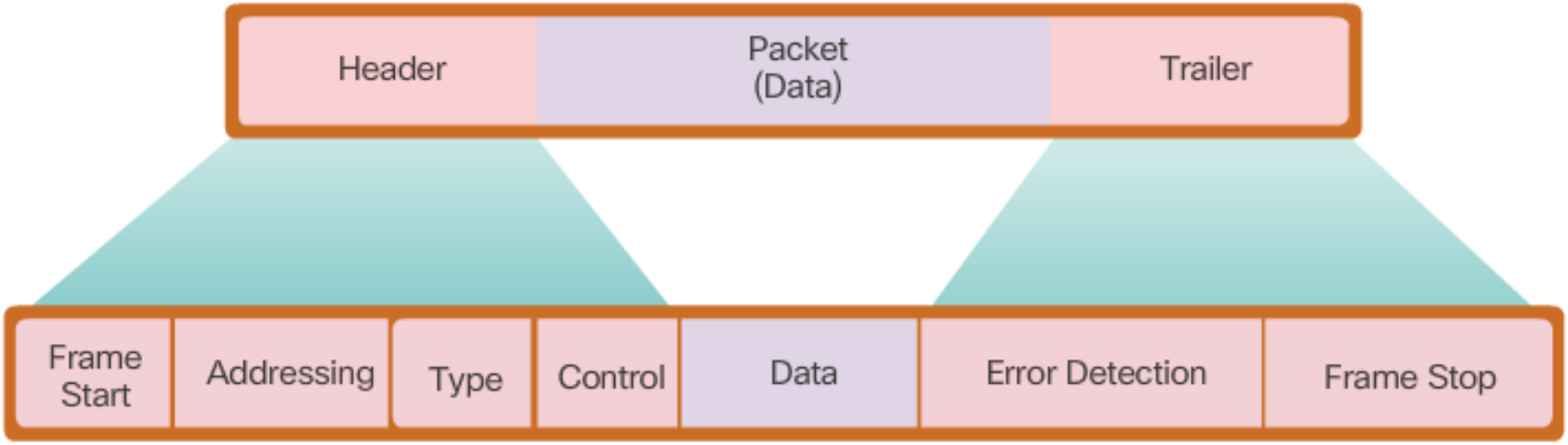
Layer 2 Address is Local Link Address
Layer 3 Address = Global Network Address



Devices on the Same Network



Frame Fields



Other

- Friday Jan 22 Lecture
  - Quiz : based on week 1 lectures
  - Background for Lab 3
  - General Review
  - Your Questions

- Complete Lab 2 prelab and post submission doc to drop box by end of Lab 2.
- Wednesday Jan 27 Lecture: Ethernet

Thank you.

Cisco Networking Academy

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