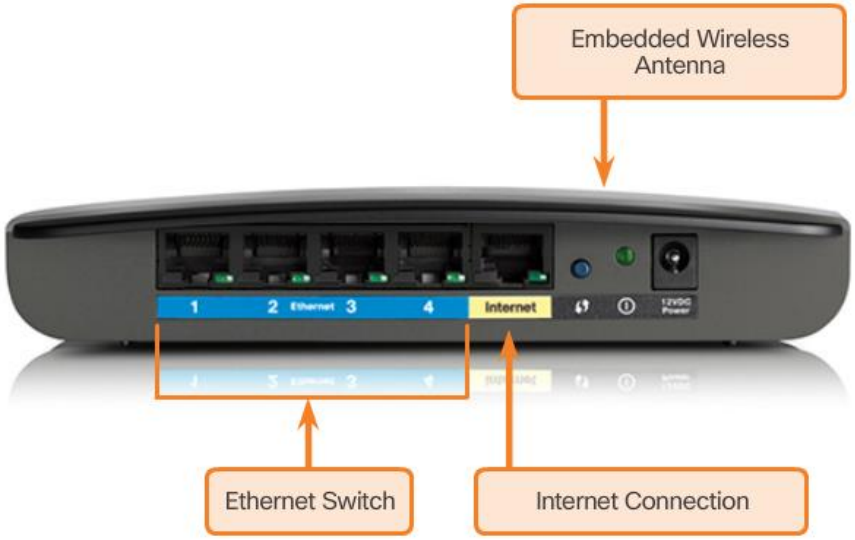
# Network Access

# Physical Layer Protocols

# Physical Layer Connection

# Types of Connections

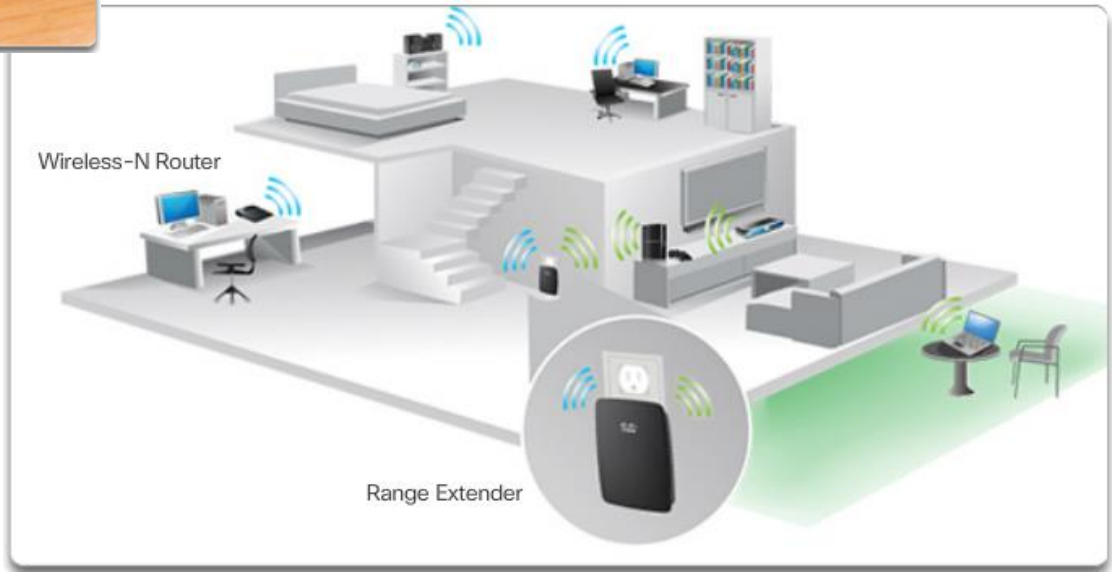



Home Router

Connecting to the Wired LAN

# Network Interface Cards

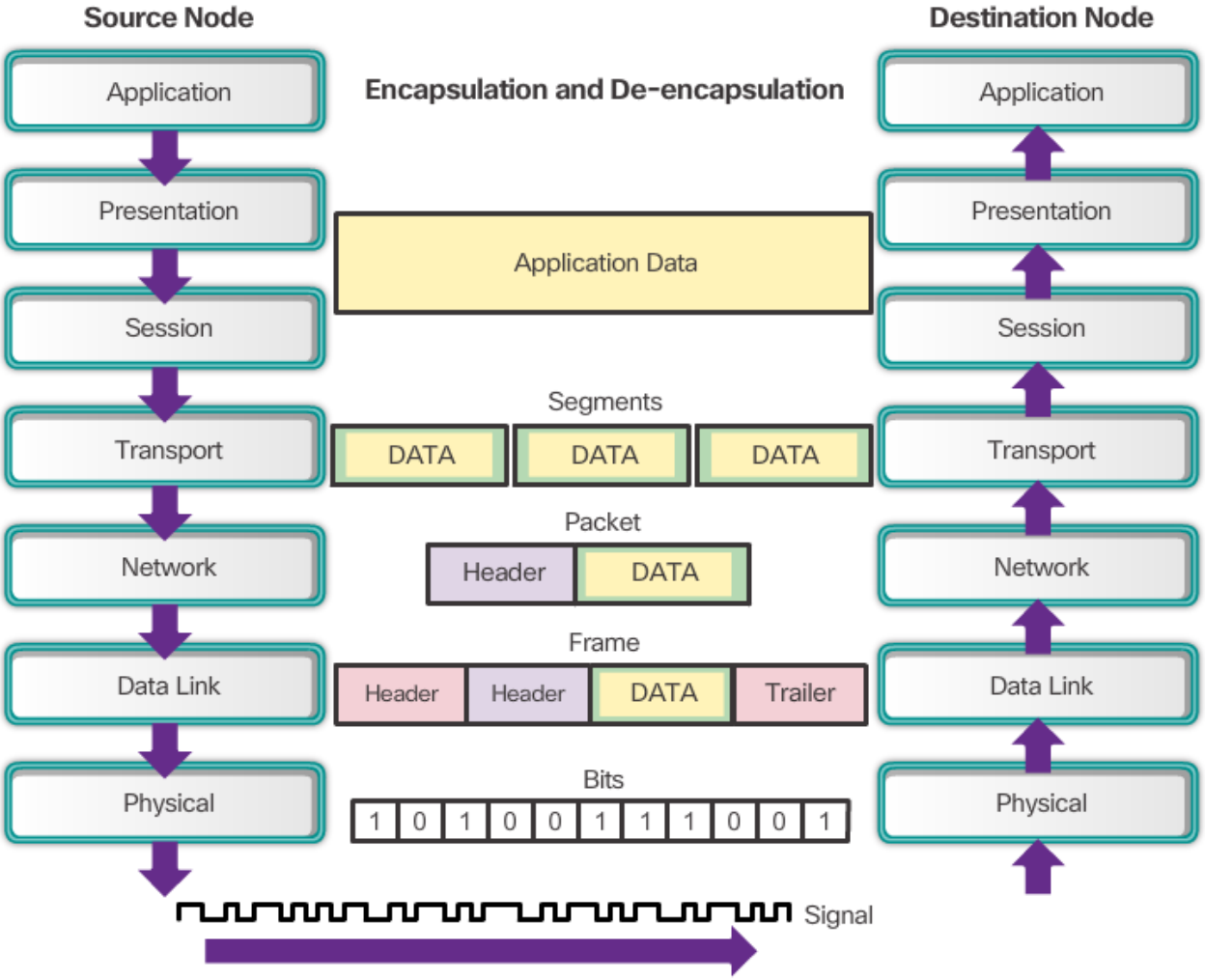
Wired Connection Using an Ethernet NIC



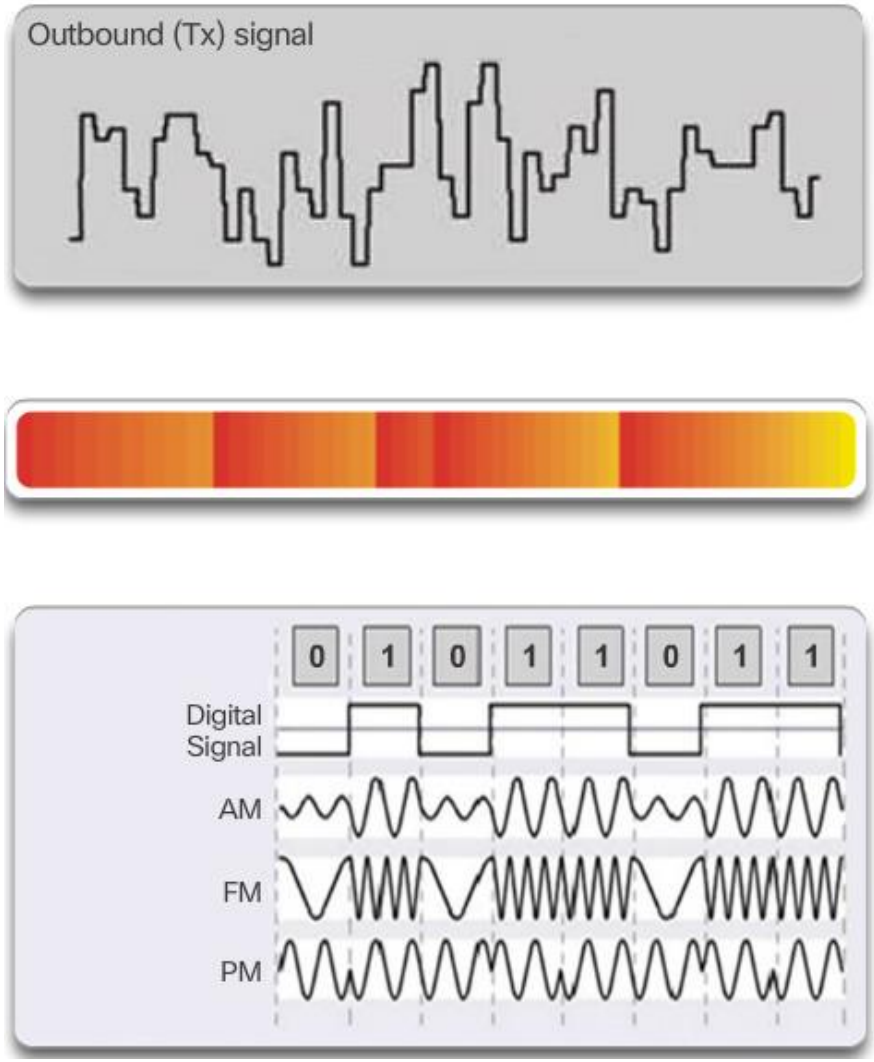

Connecting to the Wireless LAN with Range Extender

# Purpose of the Physical Layer

# The Physical Layer



# Physical Layer Media



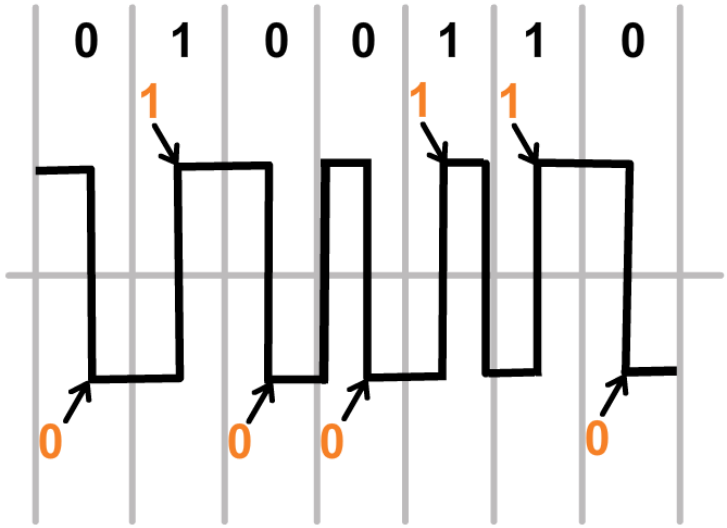

**Electrical Signals** – Copper cable

**Light Pulse** – Fiber-optic cable

**Microwave Signals** – Wireless

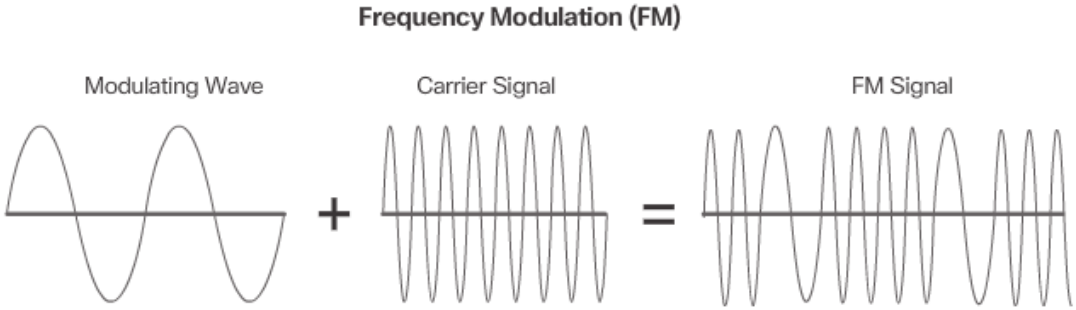
# Physical Layer Characteristics

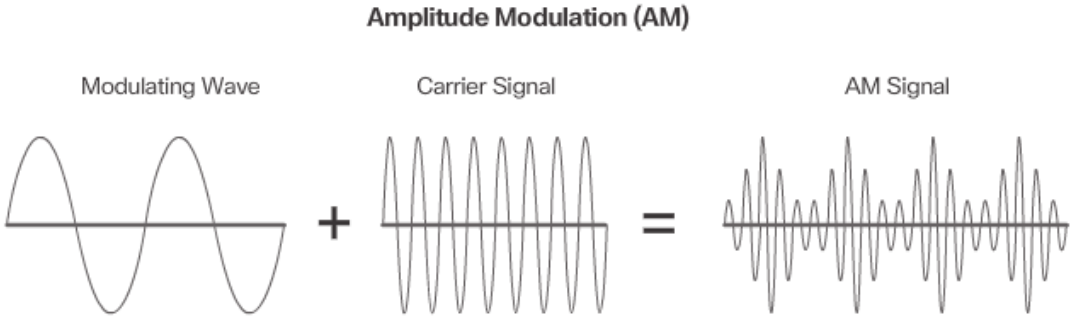
# Functions




## Manchester Encoding

## Modulation

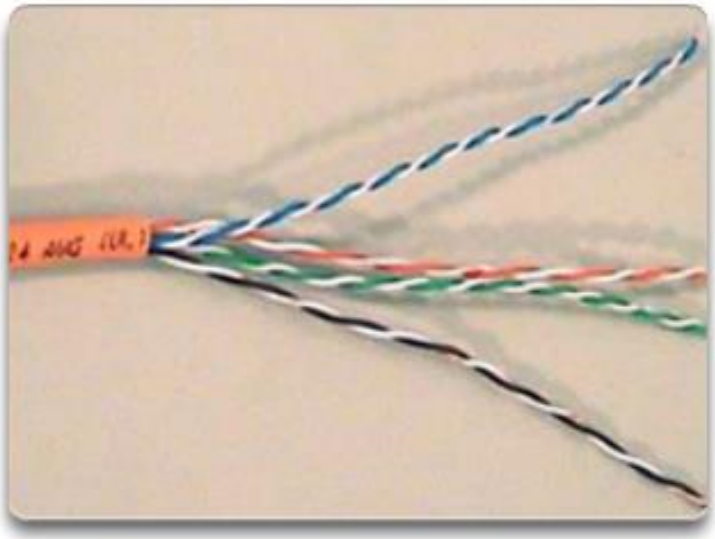


# Network Media

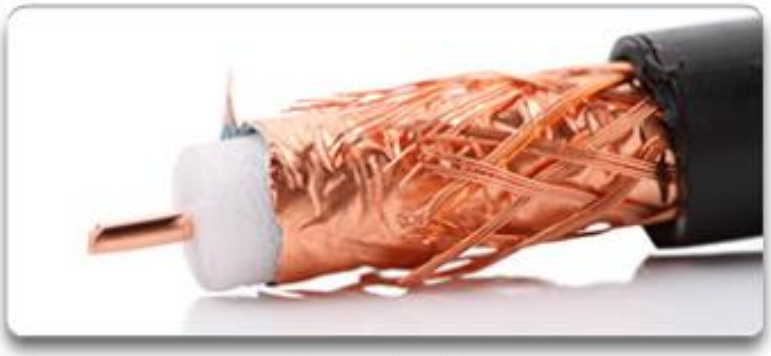
# Copper Cabling

# Copper Media



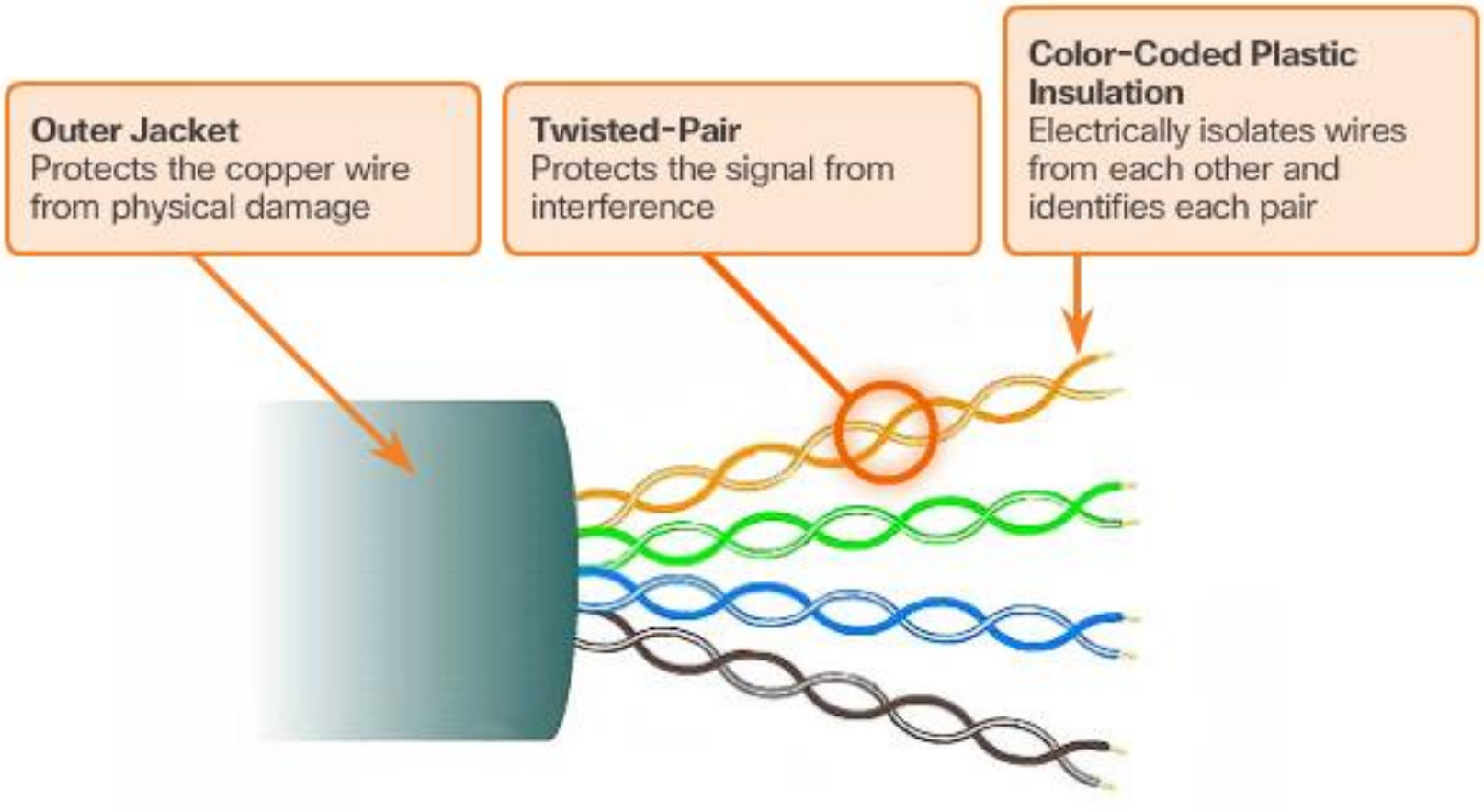
Unshielded Twisted-Pair (UTP) cable

Shielded Twisted-Pair (STP) cable

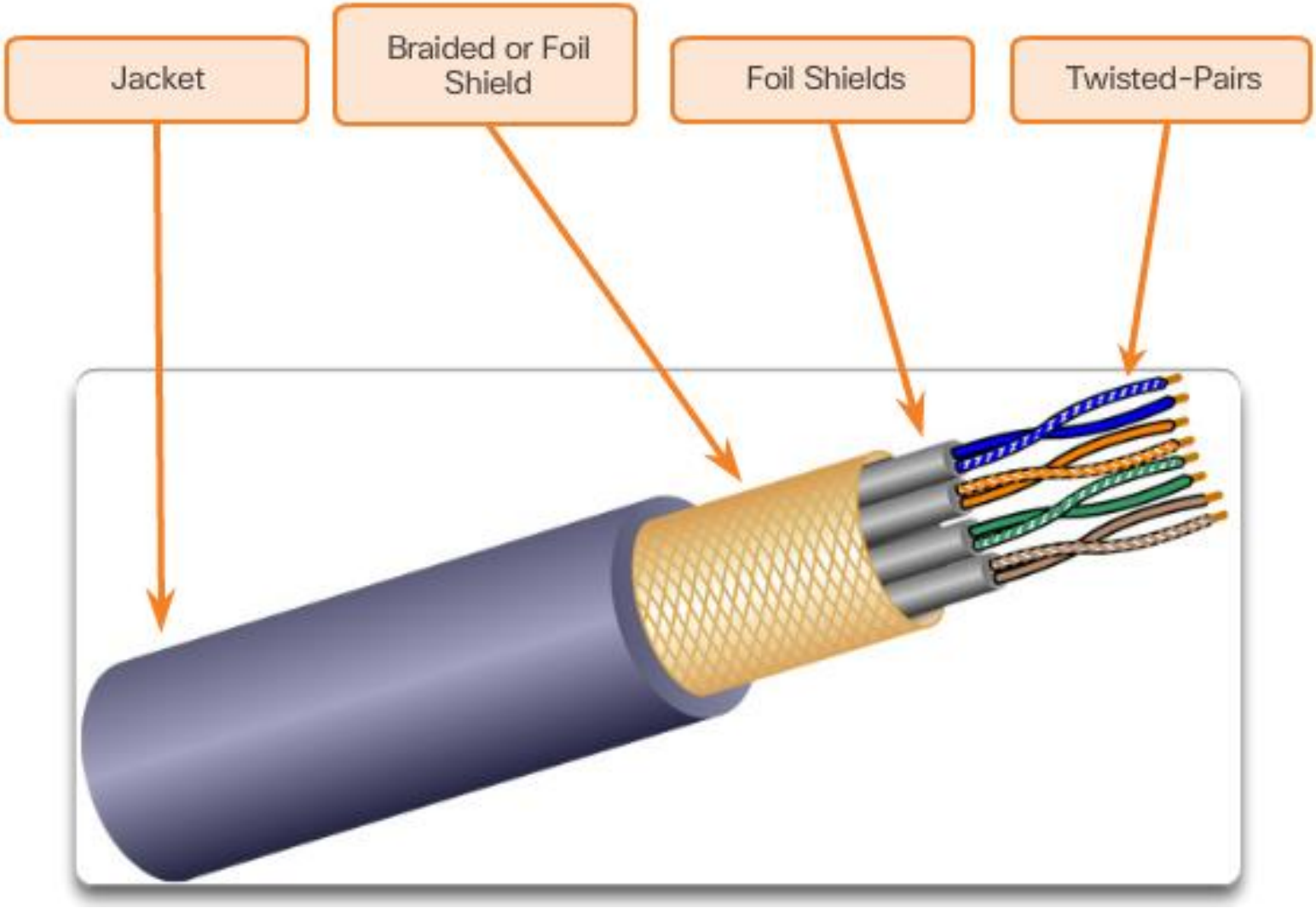


Coaxial cable

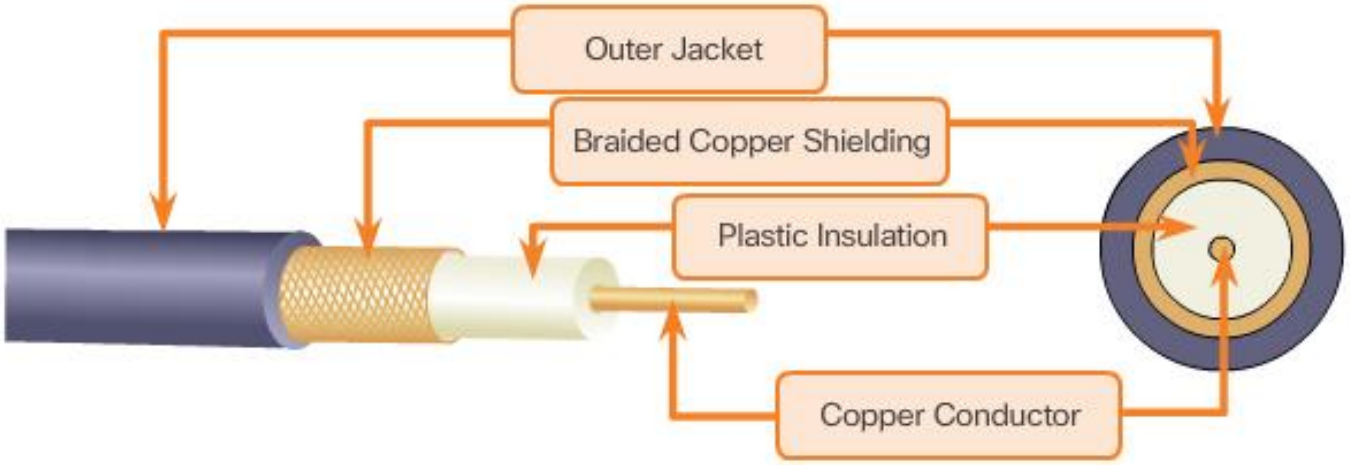
# Unshielded Twisted-Pair Cable



# Shielded Twisted-Pair Cable

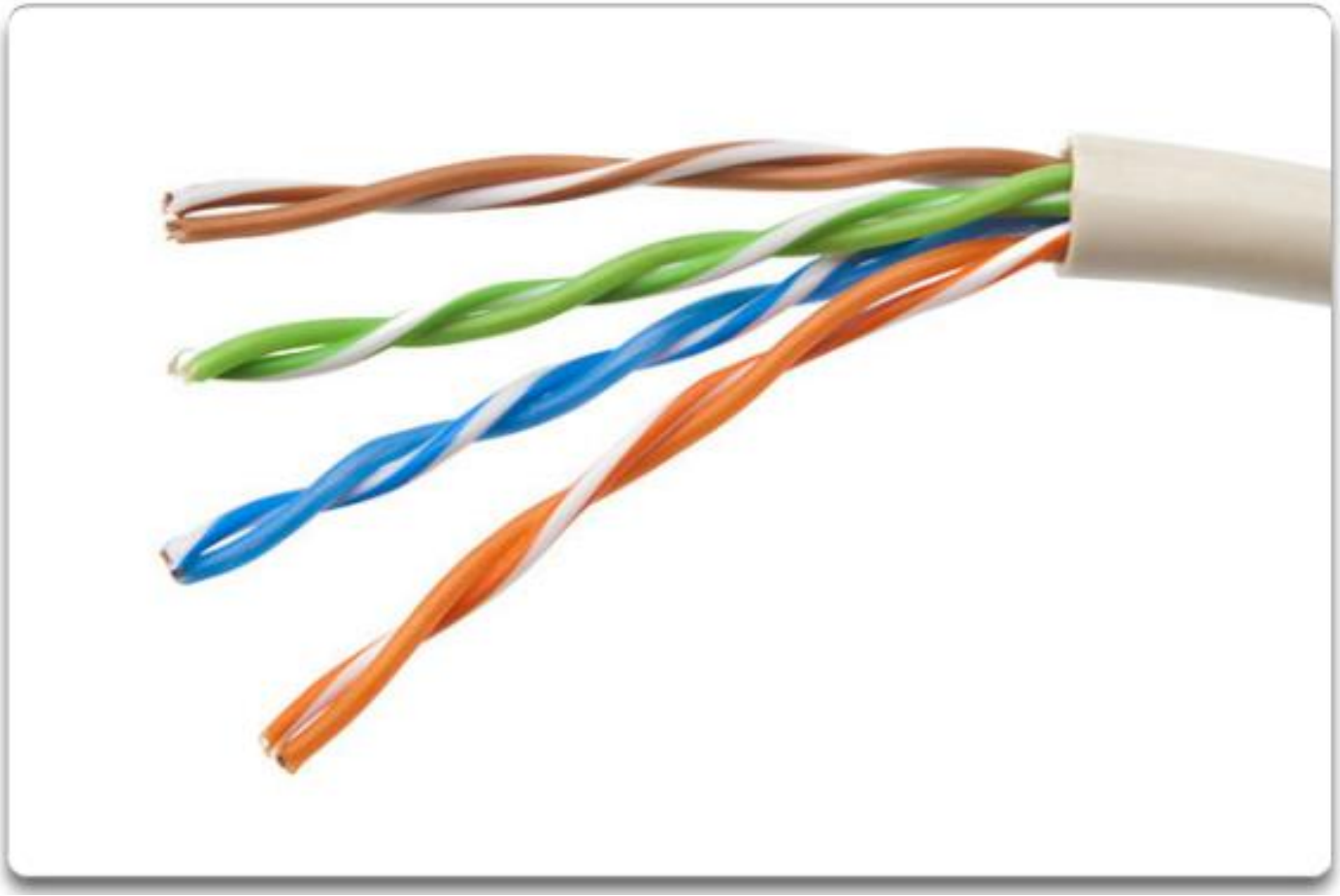


# Coaxial Cable

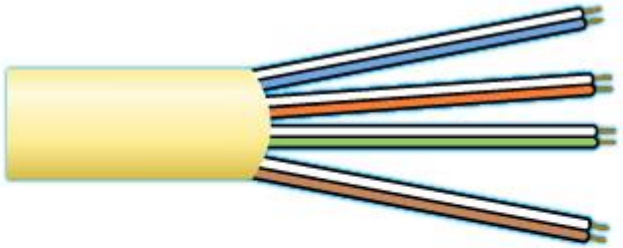



# UTP Cabling

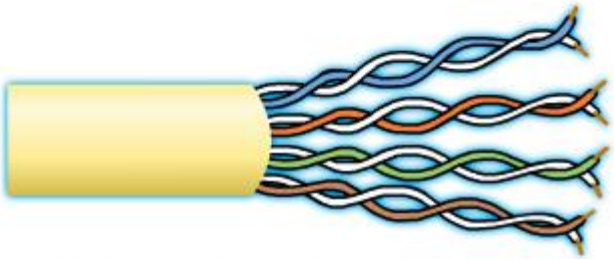
# Properties of UTP Cabling



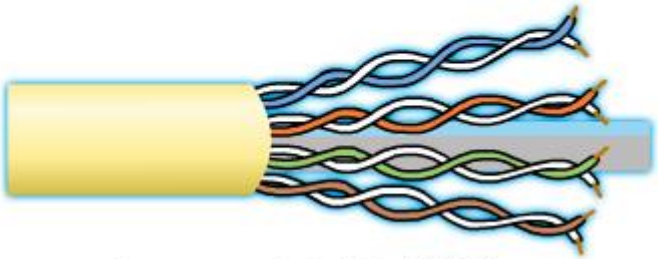
# UTP Cabling Standards



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)

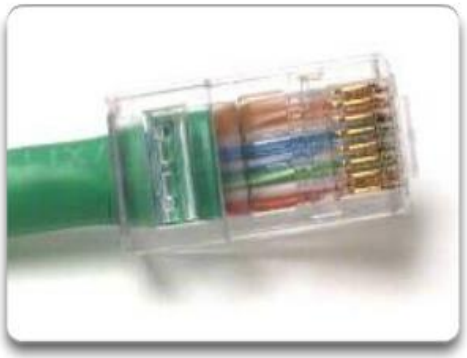
- Used for data transmission
- An added separator is between each pair of wires allowing it to function at higher speeds
- Supports 1000 Mb/s – 10 Gb/s, though 10 Gb/s is not recommended

# UTP Connectors

RJ-45 UTP Plugs

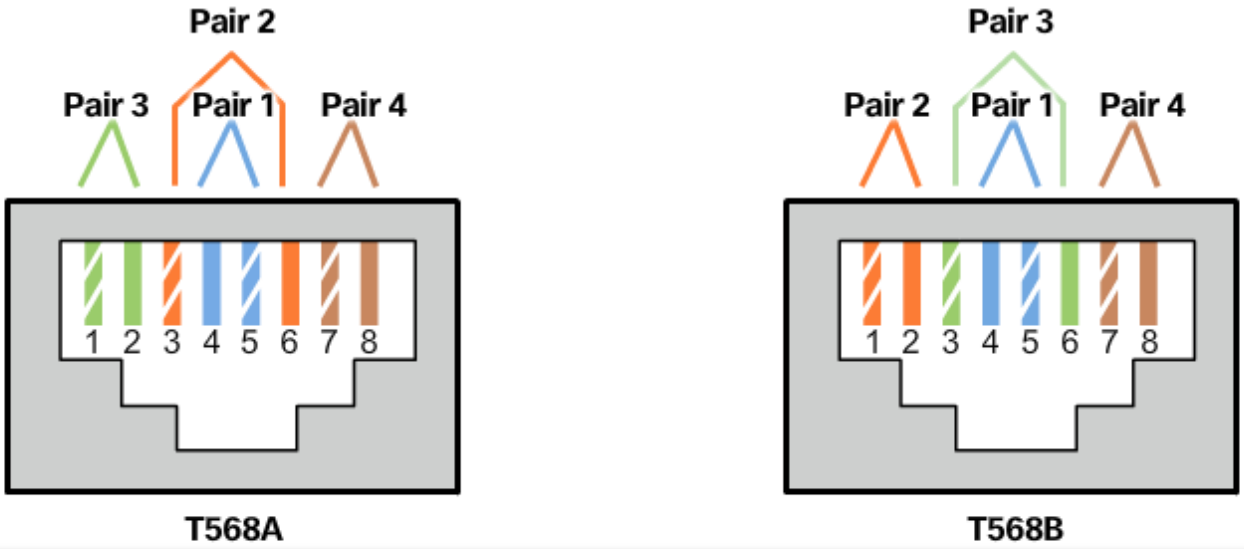
RJ-45 UTP Socket

**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




| 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<br>• 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. |

# 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.

**Buffer**

Used to help shield the core and cladding from damage.

**Cladding**

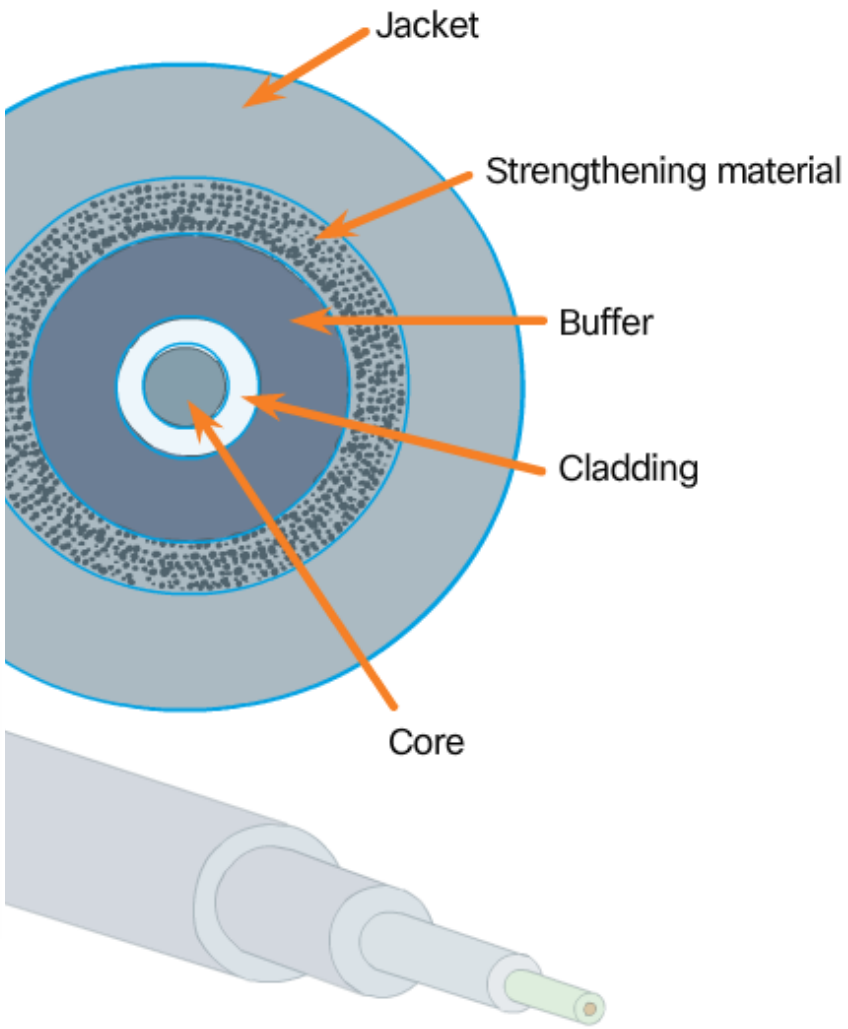
Made from slightly different chemicals than those used to create the core. It tends to act like a mirror by reflecting light back into the core of the fiber. This keeps light in the core as it travels down the fiber.

**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.

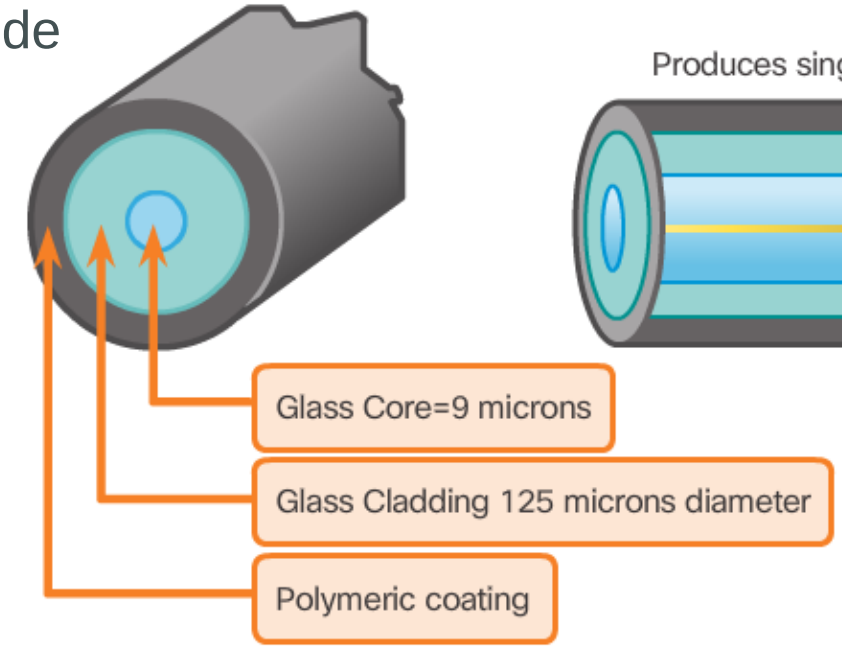
**Strengthening Material**

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

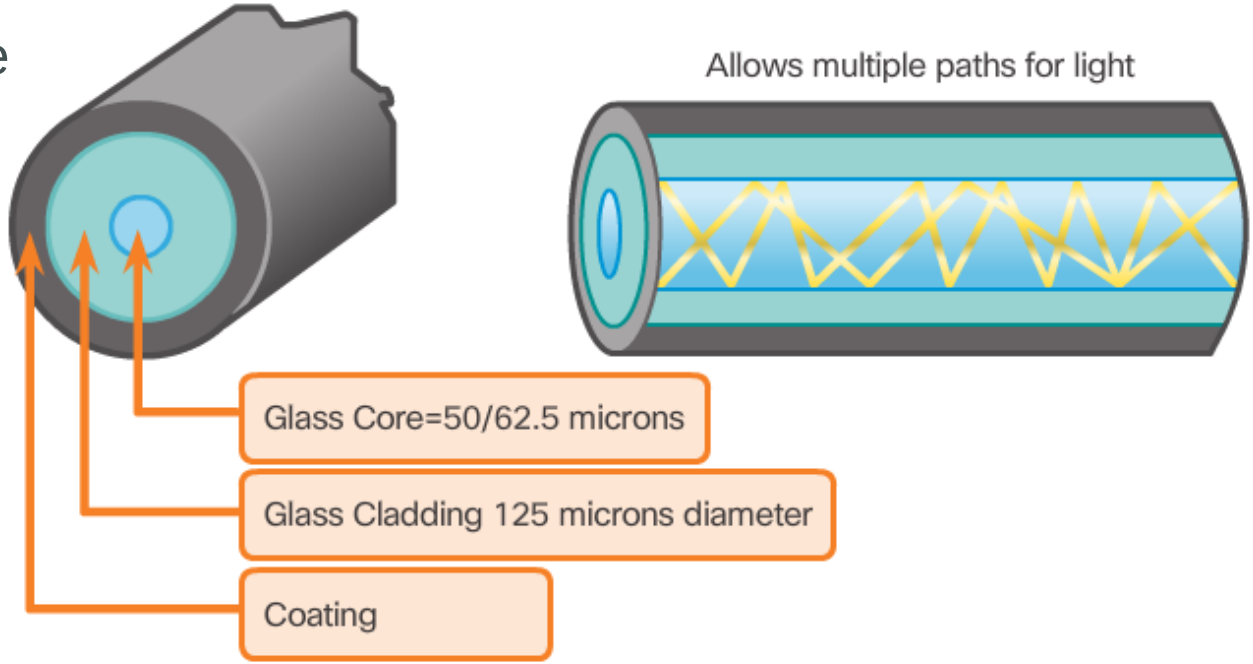
## Single Mode




- 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

# Types of Fiber Media (cont.)

## Multimode



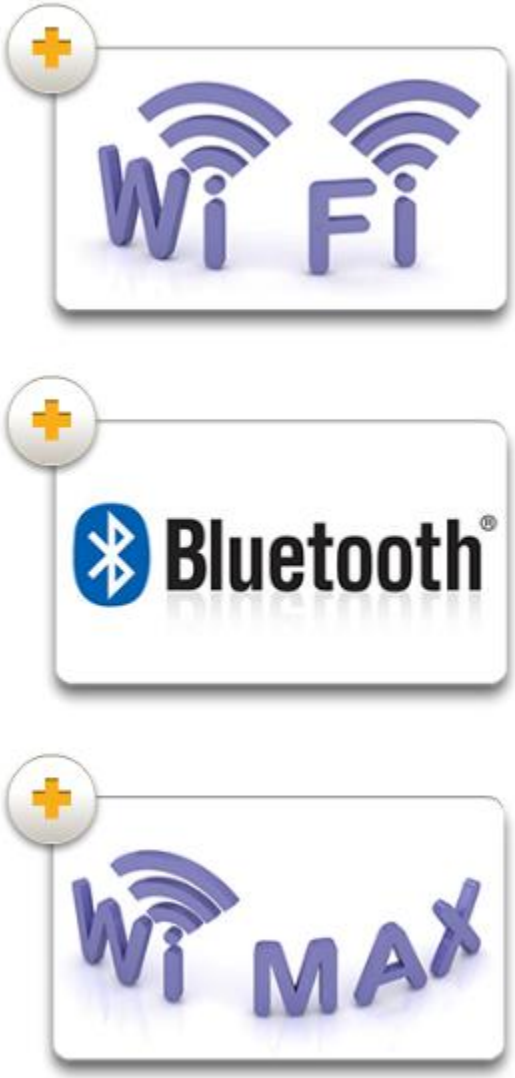

- Larger core than single mode cable
- Allows greater dispersion and therefore, loss of signal
- Suited for long distance applications, but shorter than single mode
- Uses LEDs as the light source
- Commonly used with LANs or distances of a couple hundred meters within a campus network

# 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 |

# Wireless Media

# Types of Wireless Media



# Wireless LAN