

Introductions to Communication Medium

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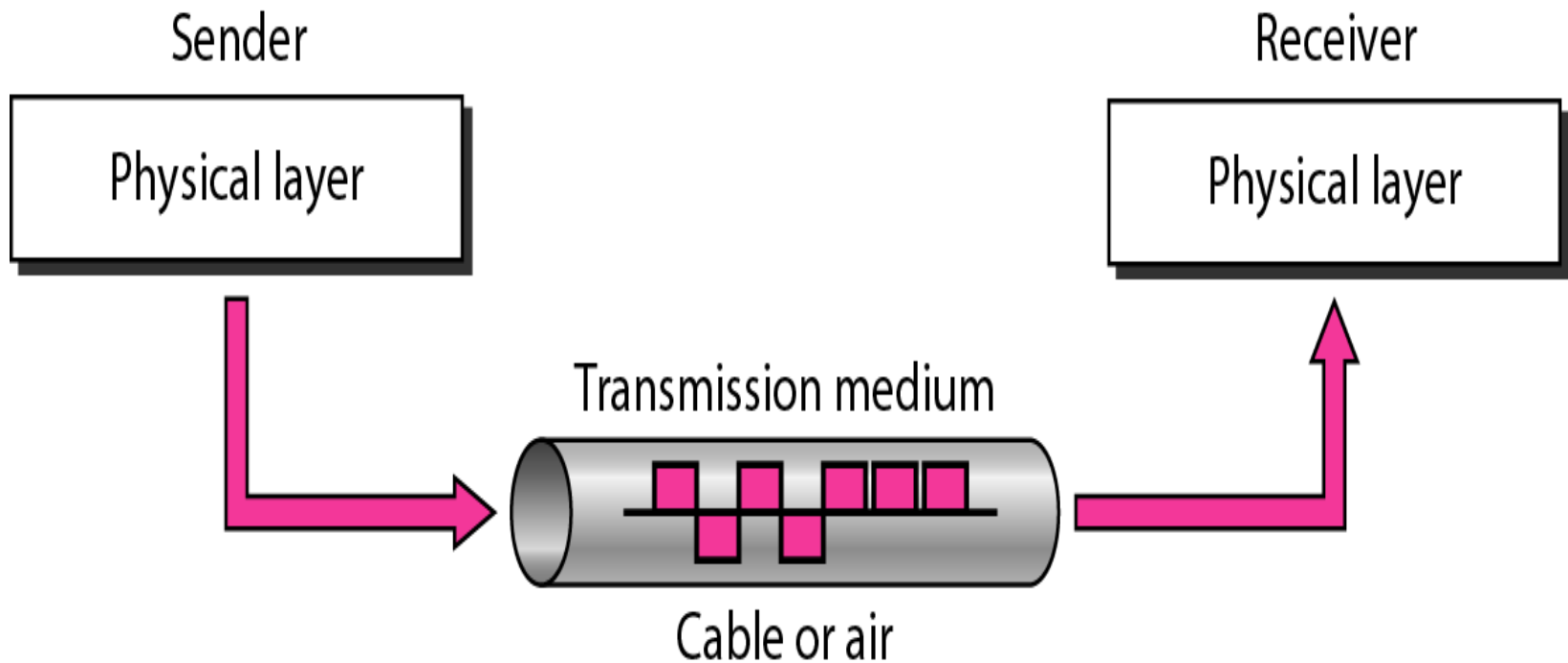
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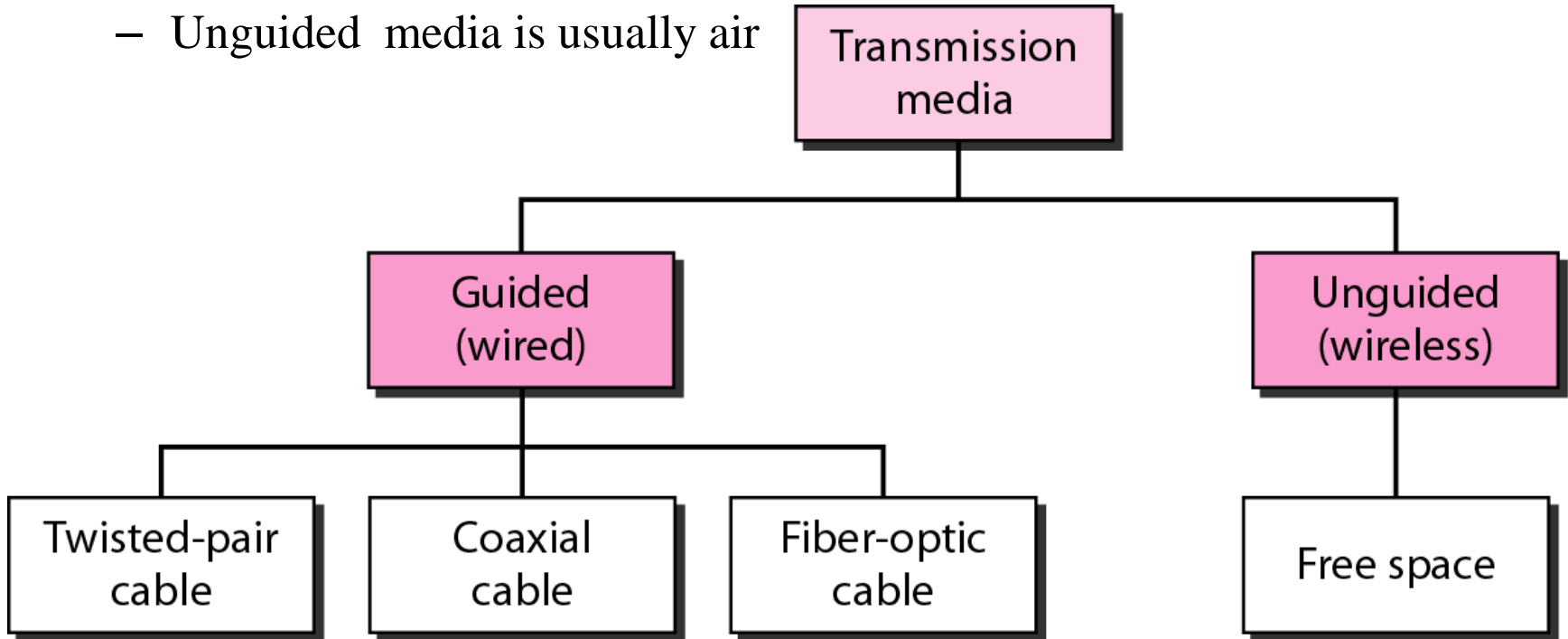
Transmission Medium



Transmission Medium

Transmission media can be divided into two broad categories:

- Guided media include twisted-pair cable, coaxial cable, and fiber-optic
- Unguided media is usually air



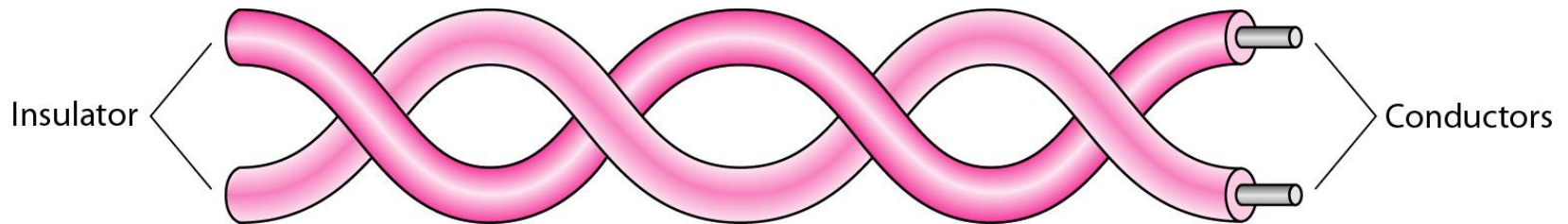
Guided Media

- Guided media, which are those that provide a conduit from one device to another, include twisted-pair cable, coaxial cable, and fiber-optic cable.
- A signal traveling along guided media is directed and contained by the physical limits of the medium
- Twisted-pair and coaxial cable use metallic (copper) conductors that accept and transport signals in the form of electric current
- Optical fiber is a glass cable that accepts and transports signals in the form of light

Twisted-Pair Cable

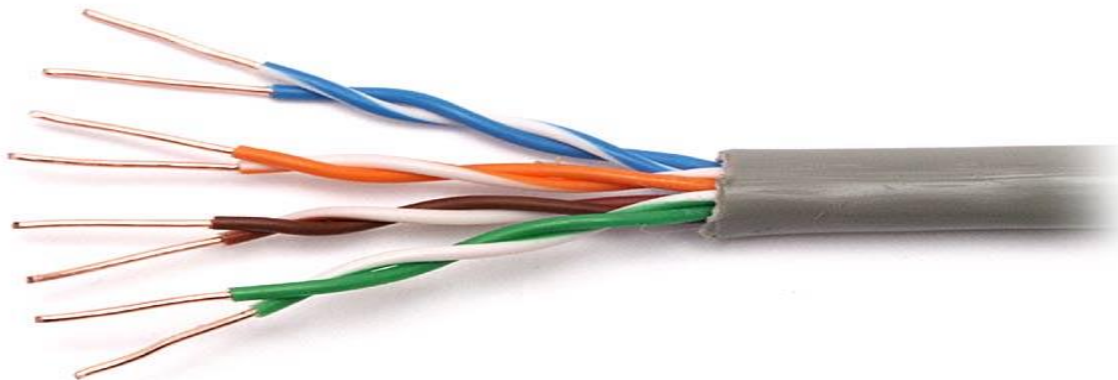
Consists of

- two conductors (normally copper)
- each with its own plastic insulation
- twisted together



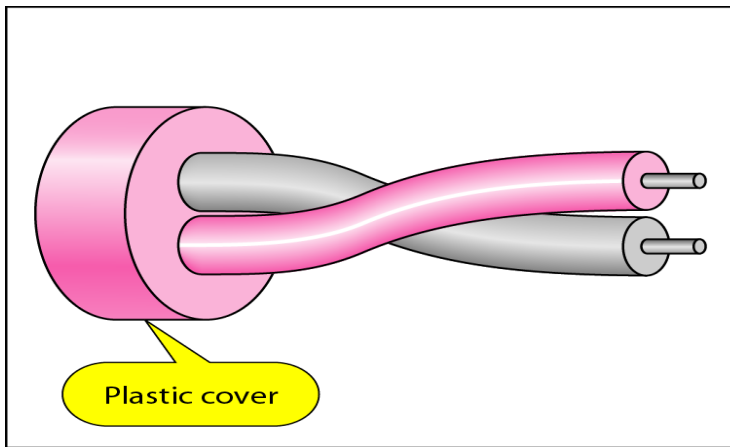
Twisted-Pair Cable

- One of the wires is used to carry signals to the receiver
- And the other is used as a ground reference
- Receiver uses the difference between the two-level
- Interference (noise) and crosstalk may affect both wires and create unwanted signals
- The number of twists per unit of the length (e.g. inch) determines the quality of the cable
 - More twists mean better quality

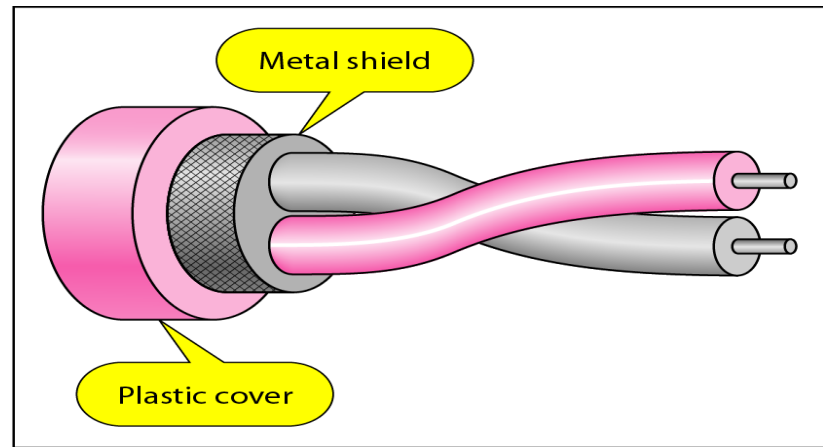


Unshielded versus Shielded

- Two common twisted-pair cable used in communications
 - Unshielded twisted-pair (UTP)
 - Shielded twisted-pair (STP)
- STP has a metal foil or braided-mesh covering
 - Preventing the penetration of noise or crosstalk
 - It is bulkier and more expensive



a. UTP

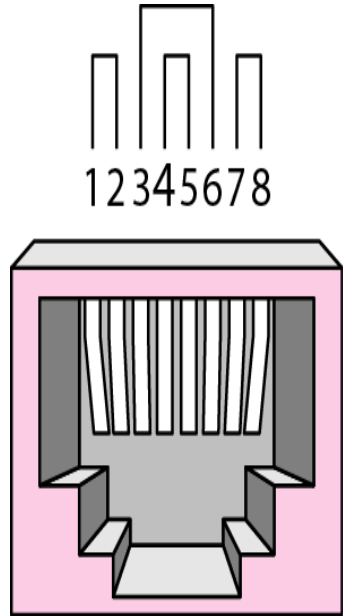


b. STP

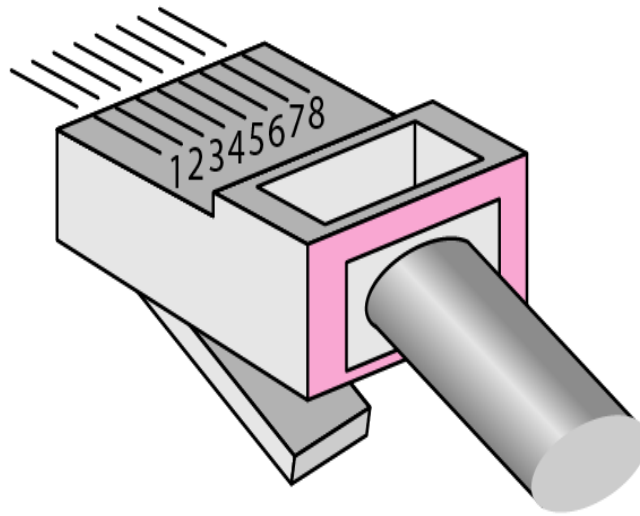
Connectors

The most common UTP connector is RJ45

- R J stands for Registered Jack



RJ-45 Female



RJ-45 Male

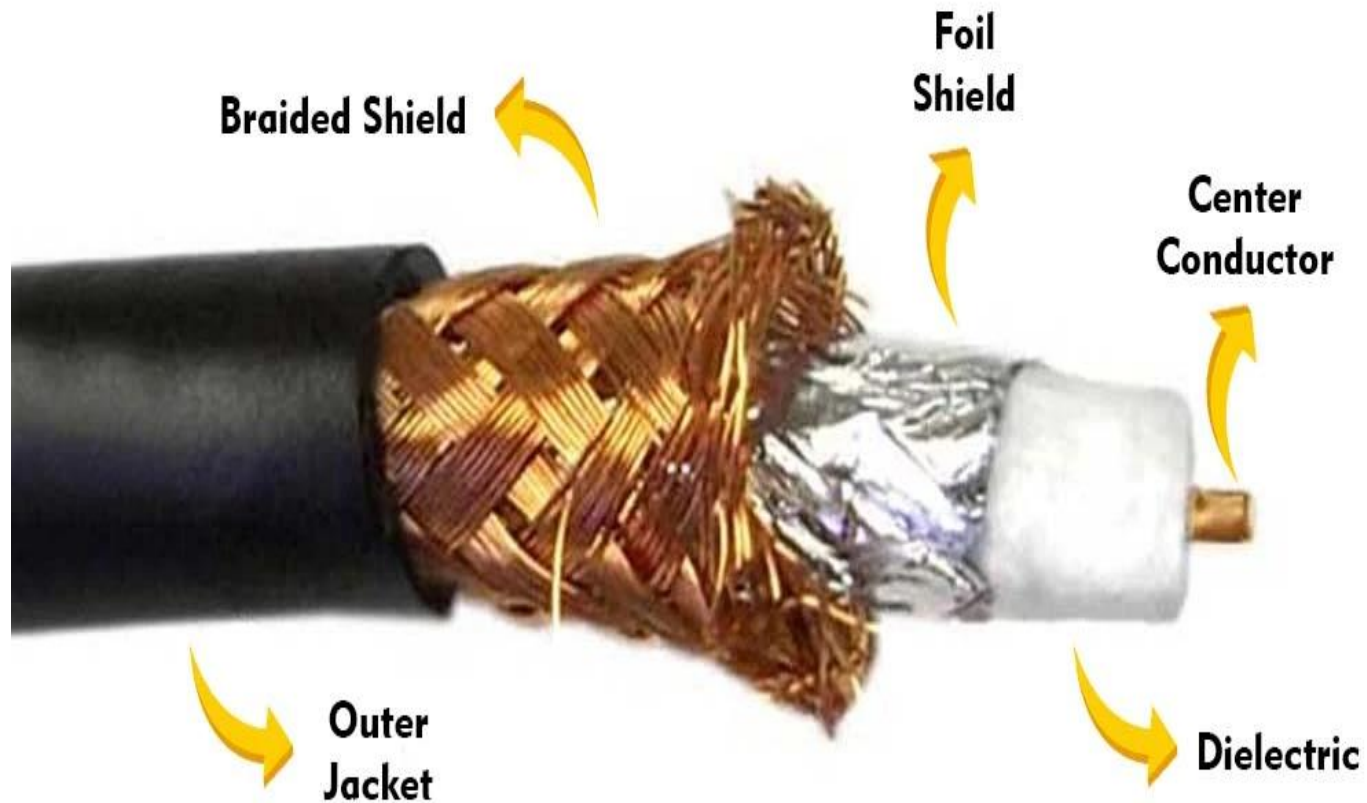


RJ45 Connector

Applications

- Used in telephone Lines (UTP)
- DSL lines (UTP)
- Local area networks

Coaxial Cable

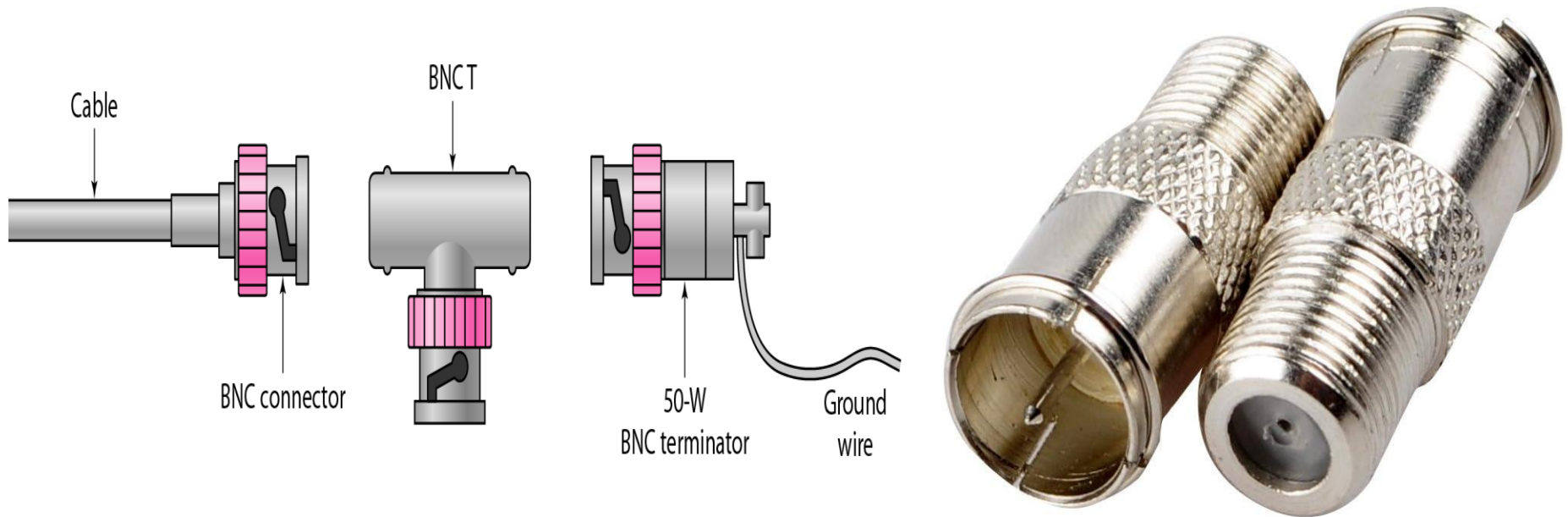


Coaxial Cable

- Carries signals of higher frequency ranges than twisted-pair cable
- Coax has a central core conductor of solid or stranded wire (usually copper)
- Encased in an outer conductor of metal foil, braid, or a combination of the two
- The outer metallic wrapping services as:
 - Shield against noise
 - Second conductor (completes the circuit)
- Outer conductor is also enclosed in an insulating sheath
- Whole cable is protected by a plastic cover

Coaxial Cable Connectors

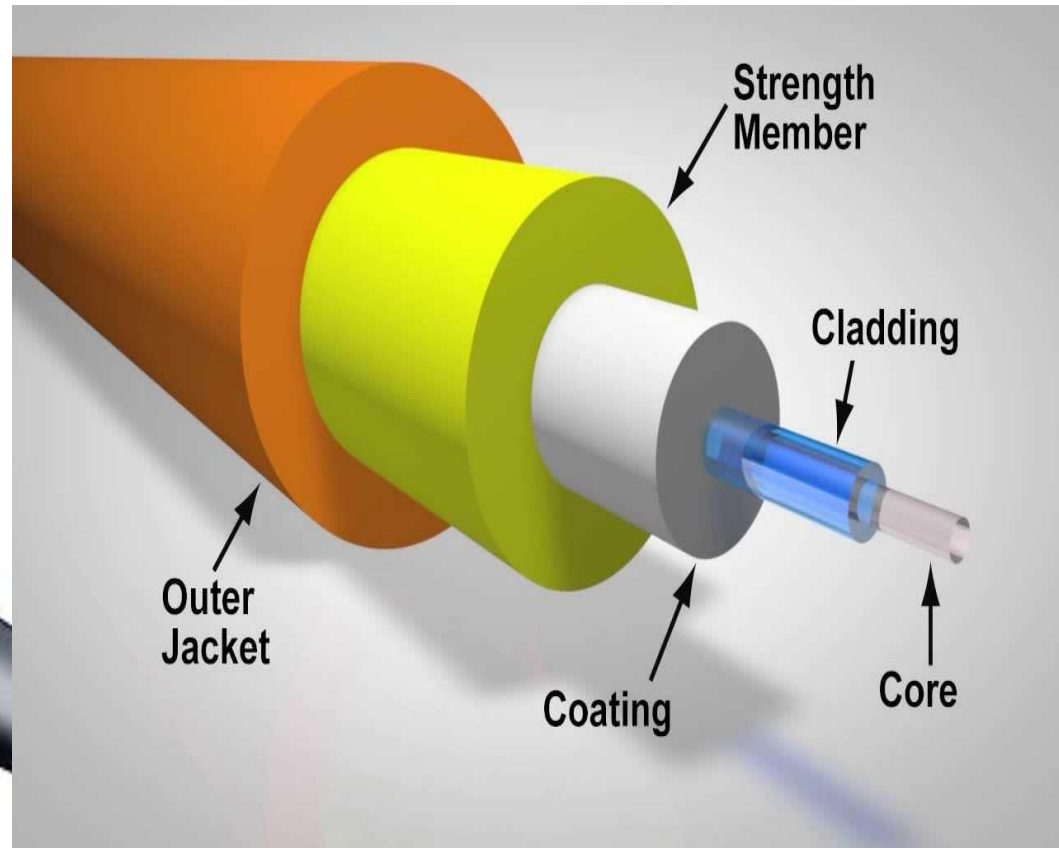
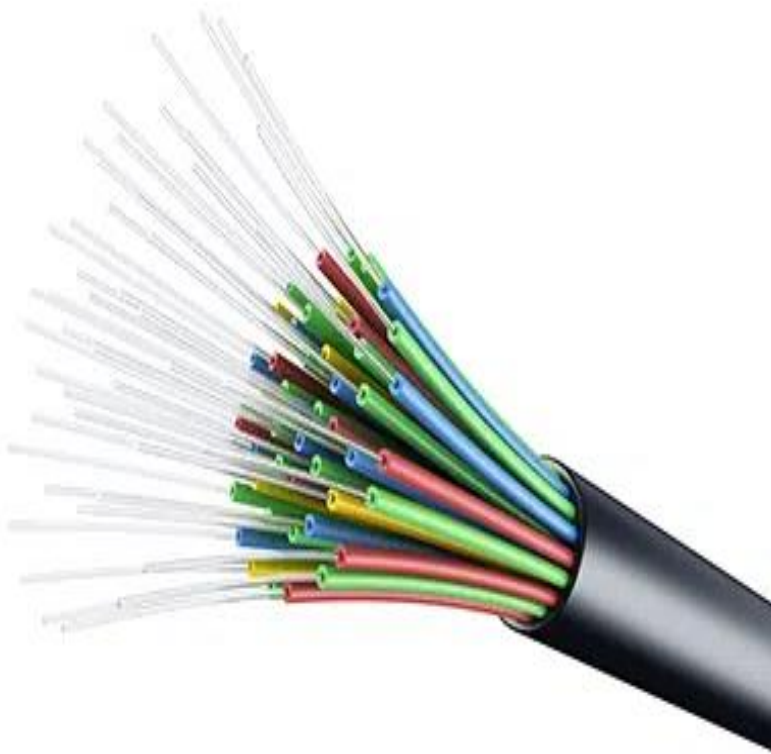
- Coaxial cable connector is BNC (Bayone-Neill-Concelman)
- Figure shows the BNC connector, the BNC T connector, and the BNC terminator



Applications

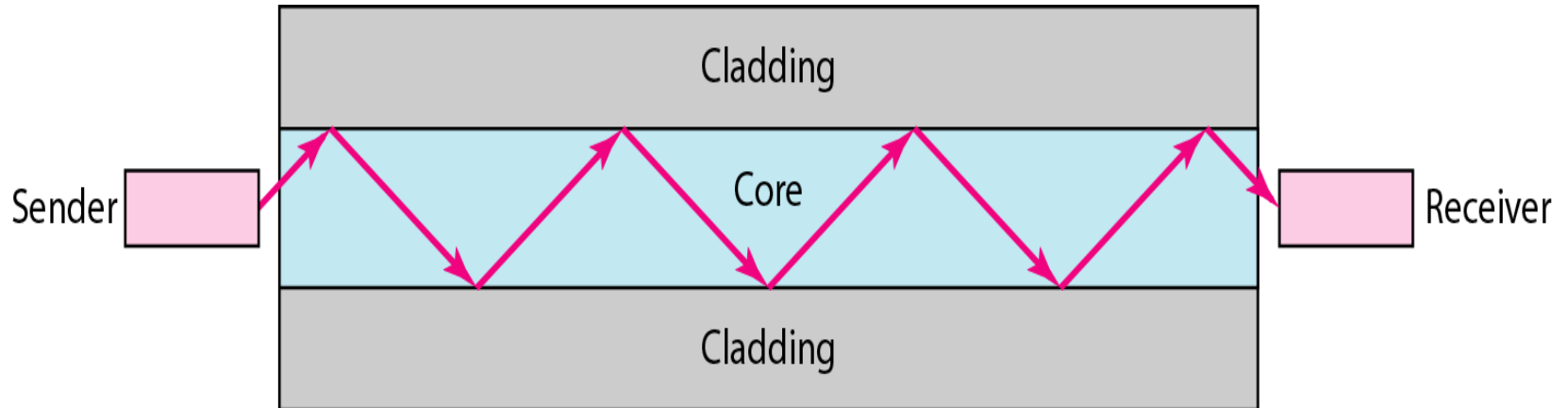
- It was used in analog and digital telephone networks (replaced by fiber-optic)
- Cable TV networks (replaced by fiber-optic)
- Traditional Ethernet LANs

Fiber-Optic Cable



Fiber-Optic Cable

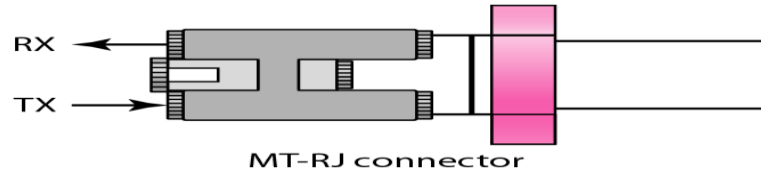
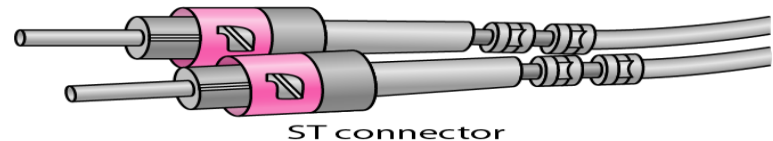
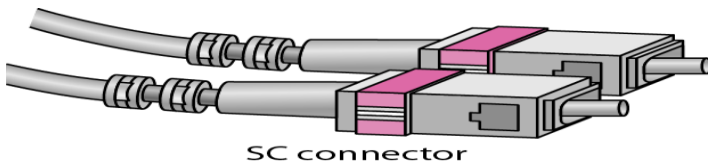
An optical fiber is a very thin strand of plastic or glass that is used to transmit messages via light



Fiber-Optic Connector

Fiber-optic use three different type of connectors

1. Subscriber Channel (SC) connector
 - Used in cable TV and it uses a push/pull locking system
2. The Straight-Tip (ST) connector
 - Used for connecting cable to networking devices
3. MT-RJ in new connector with the same size as RJ45



Fiber-Optic Connections

Applications

- It used in backbone networks
- For cable TV with coaxial cable (a hybrid network)

Advantages of Optical Fiber

Advantages over twisted-pair and coaxial

- Higher bandwidth
- Less signal attenuation
 - Signal with fiber-optic can run for 50 km with requiring regeneration
 - 5 km for coaxial or twisted-pair cable
- Immunity to electromagnetic interference
 - Electromagnetic noise cannot affect fiber-optic cables
- Resistance to corrosive materials
 - Glass is more resistant to corrosive materials than copper
- Light weight
- More immune to tapping
 - Fiber-optic cables definitely more immune to tapping than copper cables

Disadvantages of Optical Fiber

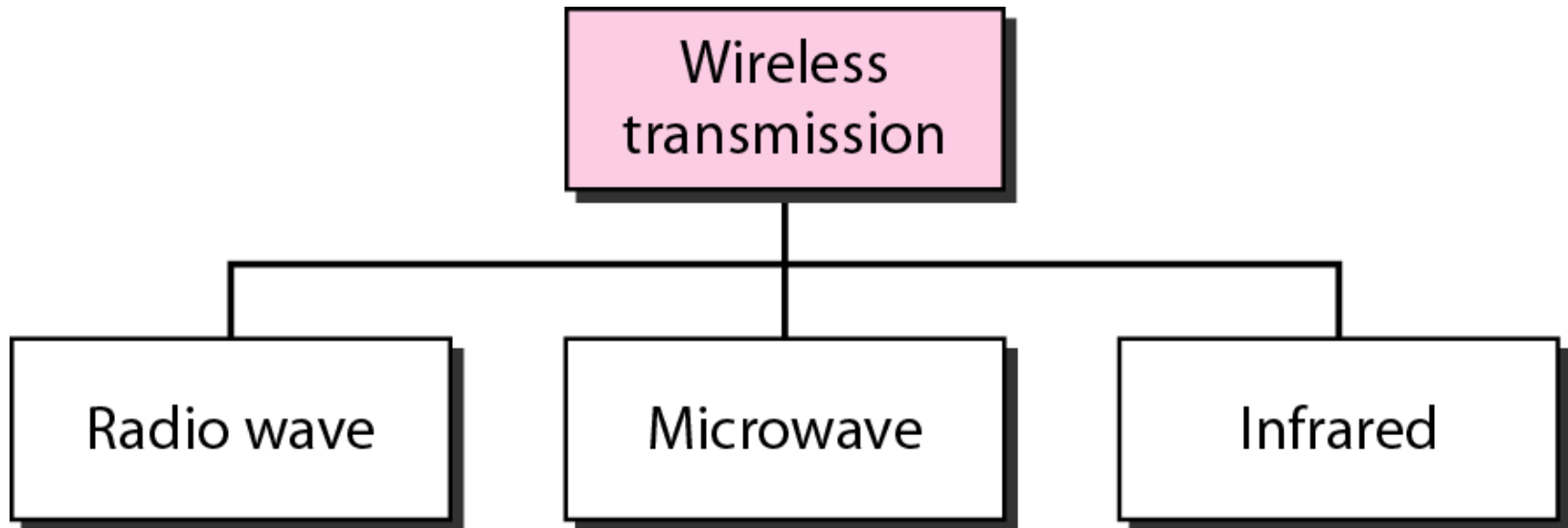
Disadvantages

- Installation/maintenance
 - Because it is new technology, need expertise
- Unidirectional
 - If we need bidirectional we need two fibers
- Cost
 - The cables and interfaces are expensive

UNGUIDED MEDIA: WIRELESS

Wireless transmission can be divided into:

- Radio waves
- Microwaves
- Infrared waves



UNGUIDED MEDIA: WIRELESS

Radio waves

- Radio waves: waves range in frequencies between 3 KHz and 1 GHz
- Microwaves: waves ranging in frequencies between 1 and 300 GHz
- Radio waves are omnidirectional (propagated in all directions)
- The sending and receiving antennas do not have to be aligned
- Useful for multicasting: Radio, television. Cordless phones and paging system

UNGUIDED MEDIA: WIRELESS

Microwaves

- Microwaves are unidirectional
- Antenna need to be aligned
- Advantage: pair of antenna can be aligned without interfering with another pair
- Microwave propagation is line-of-sight
- For long distance communication
 - Very tall towers
 - Repeater
- Very high-frequency microwaves cannot penetrate walls
 - Disadvantage if receiver inside a building

UNGUIDED MEDIA: WIRELESS

Applications

- Due to unidirectional properties, microwaves are useful when unicasting (one-to-one) communication
 - Cellular phones
 - Satellite networks
 - Wireless LANs

UNGUIDED MEDIA: WIRELESS

Infrared

- From 300 GHz to 400 THz (wavelengths from 1 mm to 770 nm)
- Use for short-range communication
- It has high frequency, cannot penetrate walls
 - Prevents interference between one system and another
 - Remote control not interfere with our neighbors
- Can not be used outside because sun's rays contain infrared waves (interference)
- (IrDA) Infrared Data Association established standards for communicating between devices:
 - Keyboards, mice, PCs and printers