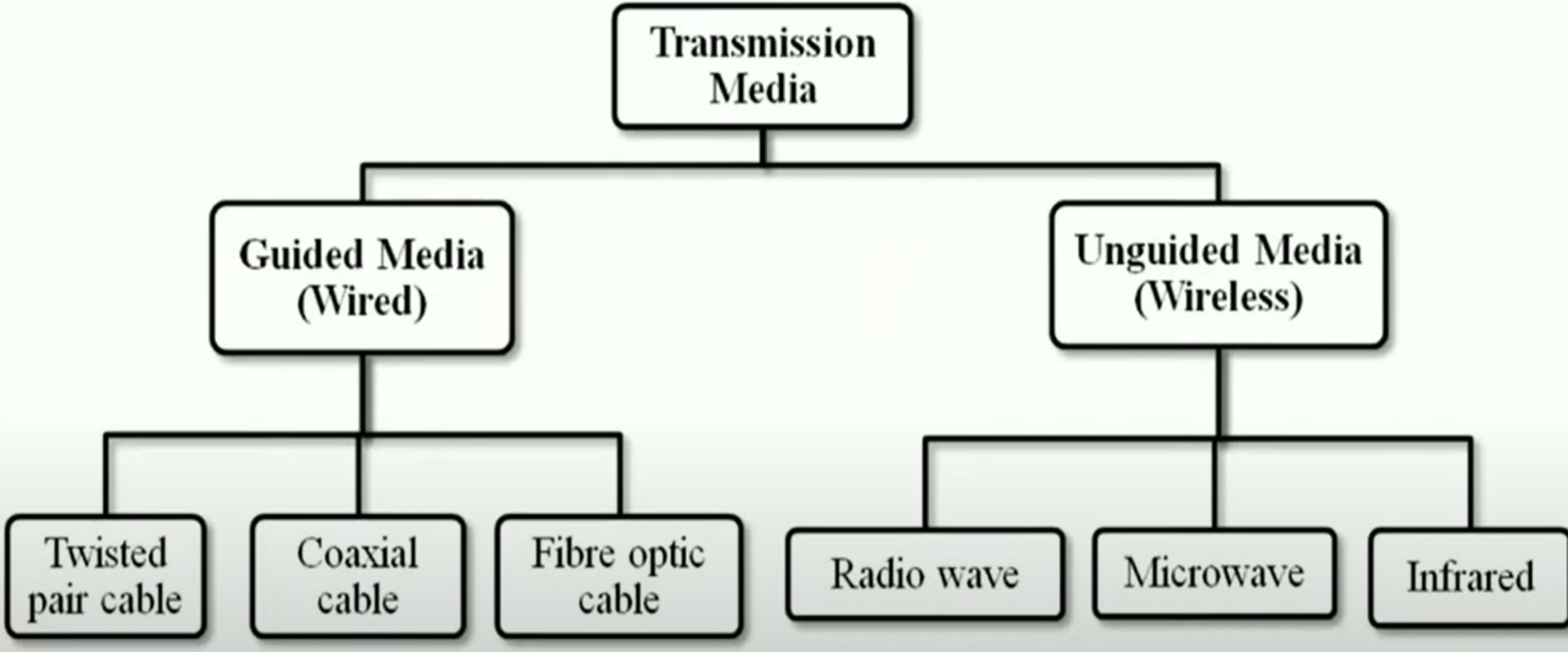
TRANSMISSION MEDIA

23PW09
23PW19
23PW20

Transmission Media

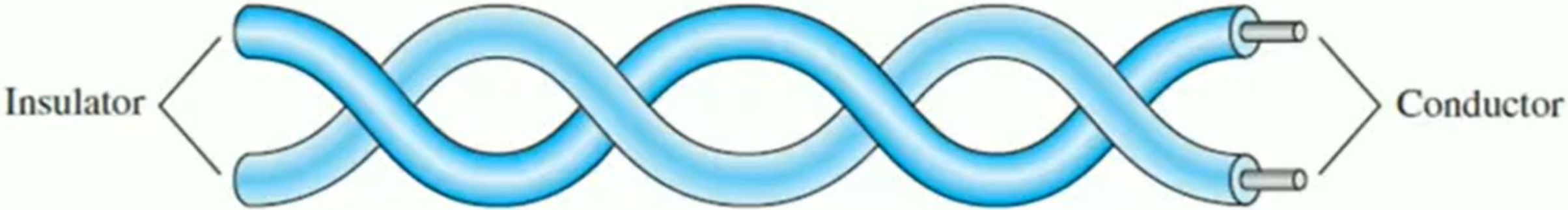
- Communication channel that carries information from sender to receiver
- Controlled by Physical layer

Classification of Transmission Media



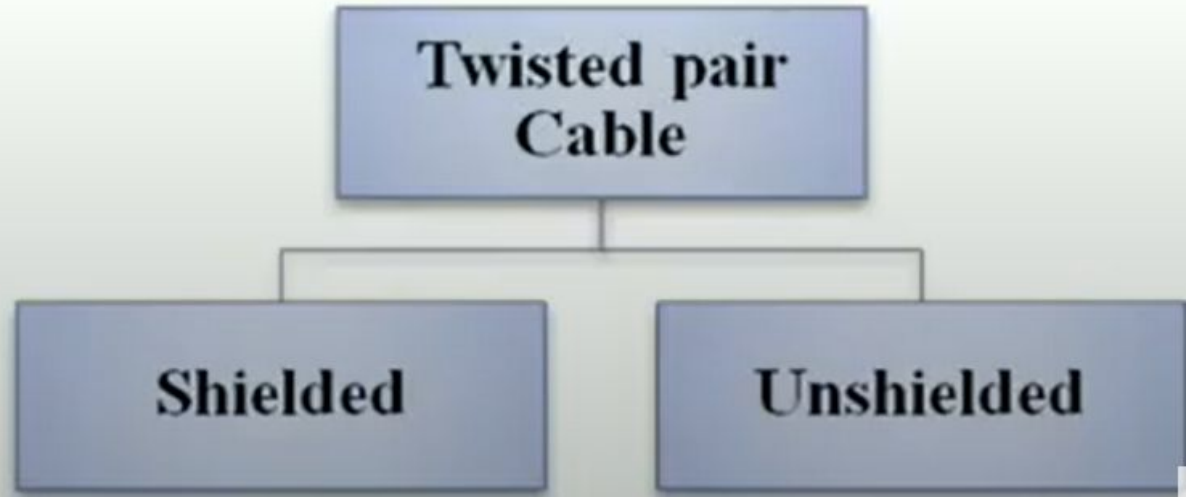
1. Twisted Pair Cable :

- Two insulated conductors twisted together

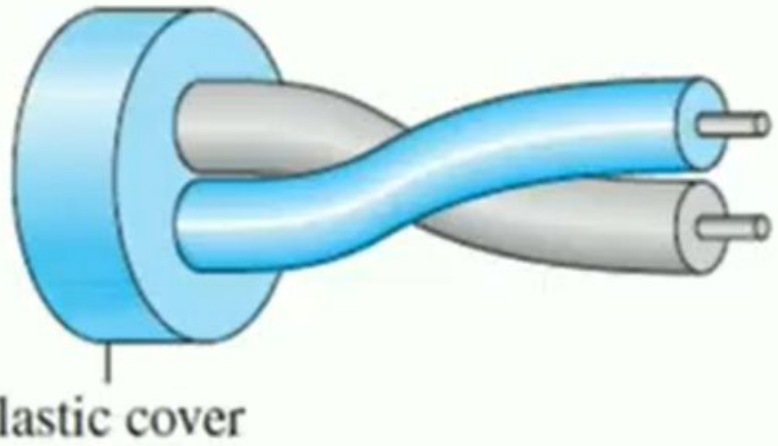


Applications:

- ✓ Telephone lines
- ✓ LANs (10Base-T, 100Base-T)



Unshielded Twisted pair Cable (UTP):



- Most commonly used twisted pair cable
- Commonly used UTP connector **RJ45** (RJ- Registered Jack)

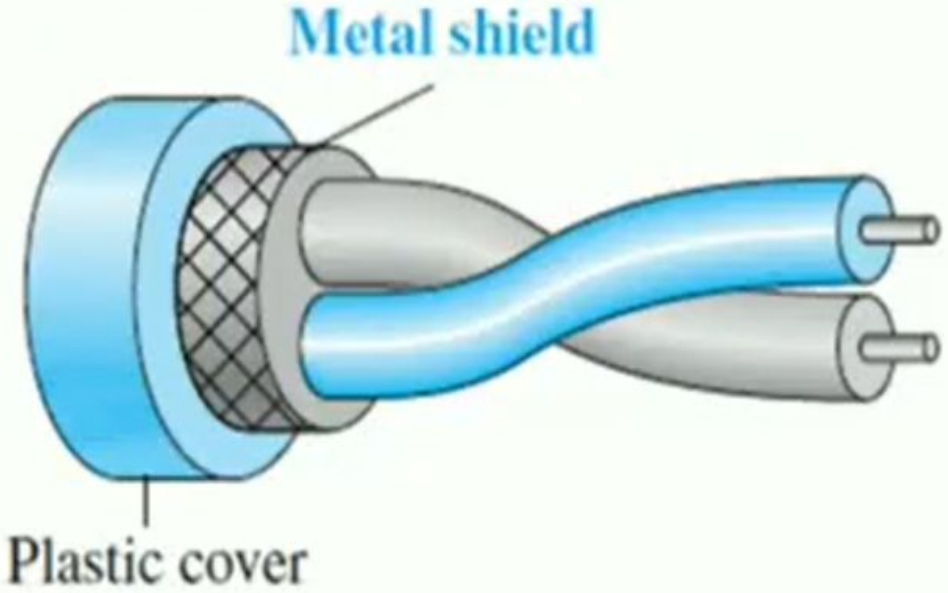
Advantages:

- ✓ Cheap
- ✓ Installation is easy
- ✓ Can be used for High speed LANs

Disadvantages:

- ✓ Can be used only for short distances because of attenuation
- ✓ Susceptible to external interference

Shielded Twisted Pair Cable (STP):



- Has special jacket to block external interference

Advantages:

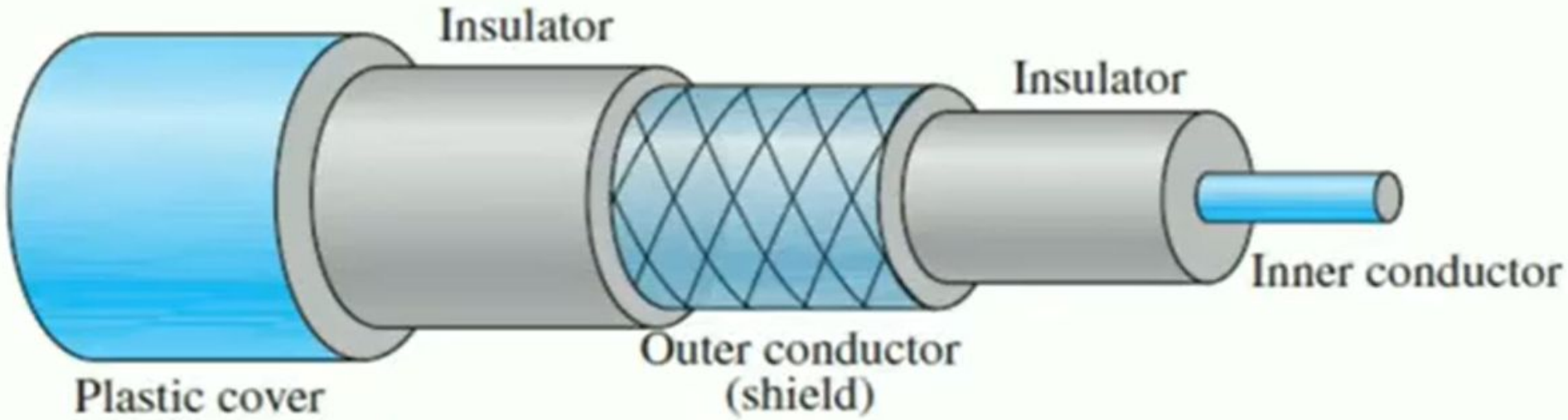
- ✓ Installation is easy
- ✓ provides the higher data transmission rate
- ✓ Eliminates crosstalk

Disadvantages:

- ✓ Expensive compared to UTP and Coaxial cable
- ✓ Heavy

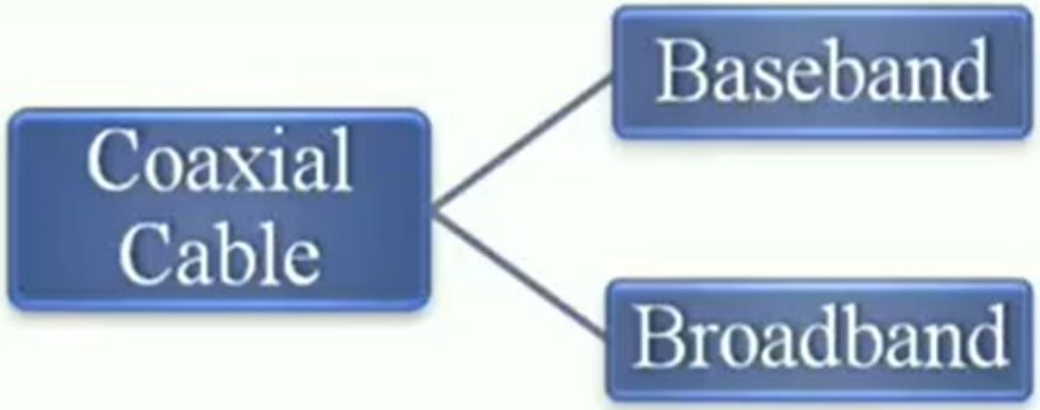
2. Coaxial Cable :

- Carries signals of higher frequency ranges than twisted pair cable



Applications:

- ✓ Cable TV Networks
- ✓ Ethernet LANs



1. Baseband:

- ✓ Digital transmission
- ✓ Mostly used for LANs
- ✓ Transmits single signal at a time with very high speed

2. Broadband

- ✓ Analog transmission
- ✓ Transmits several simultaneous signal using different frequencies
- ✓ Covers large area compared to Baseband

Commonly used Coaxial connector

BNC Connector **(Bayonet Neill- Concelman)**

Advantages:

- ✓ Bandwidth high
- ✓ Transmits signals at high rate

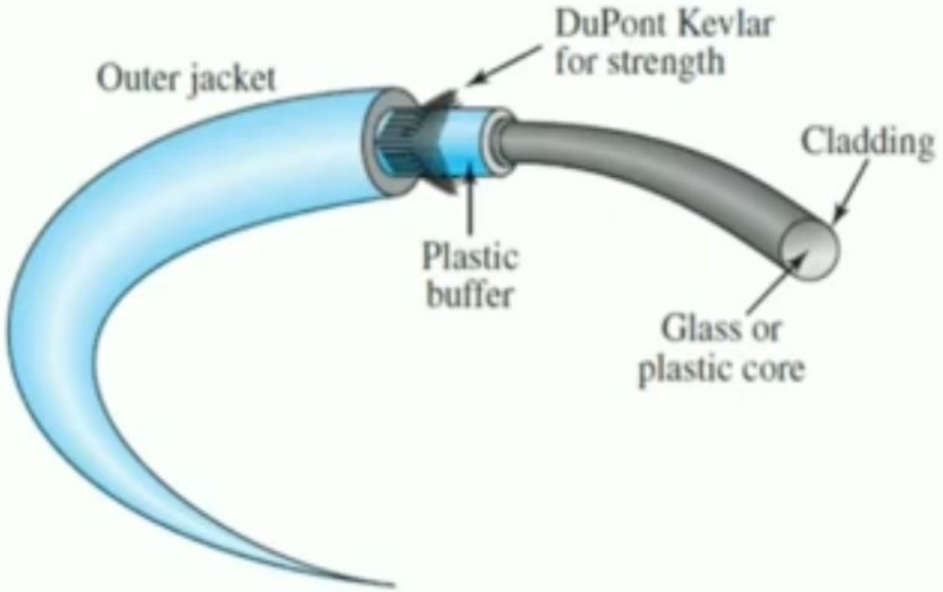
Disadvantages:

- ✓ Fault in the cable causes failure in the entire network

3. Fibre-optic Cable / Optical fibre:

- ✓ Made of glass or plastic
- ✓ Transmits signals in form of light
- ✓ **Principle :**

  Reflection of light



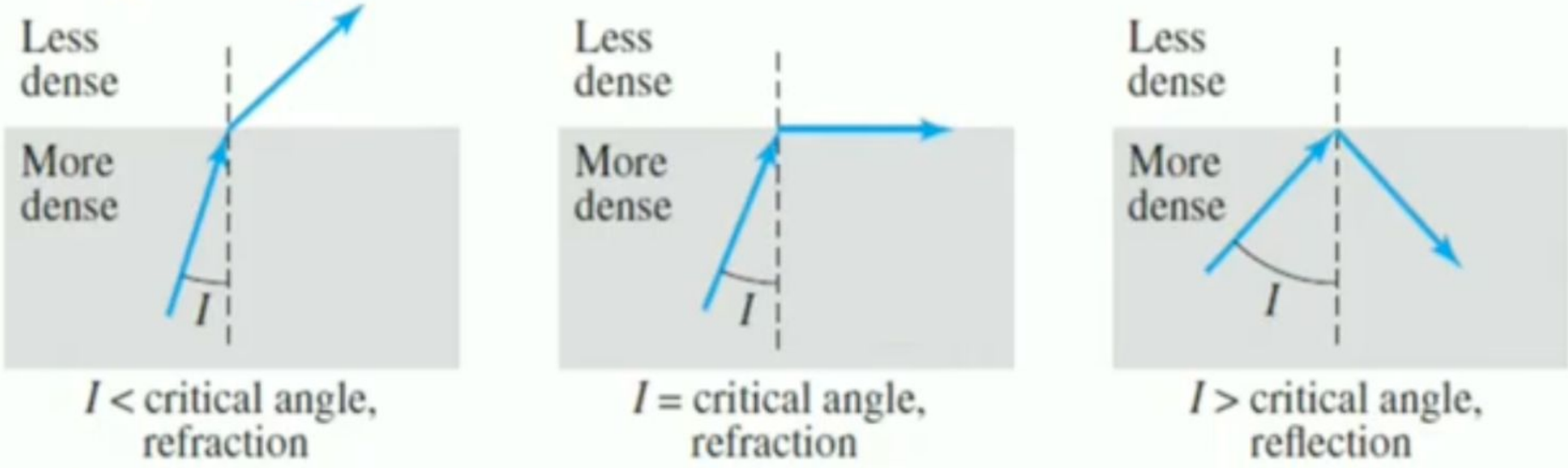
Fiber Composition

“Each layer of a fiber-optic cable plays a vital role:

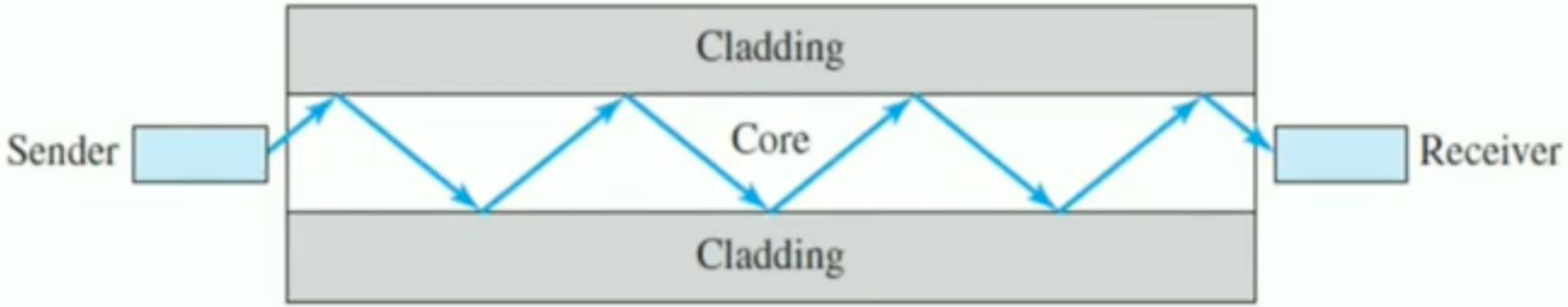
1. **Core**
2. **Cladding**.
3. **Coating**
4. **Strength Member**
5. **Outer Jacket**

Bending of light :

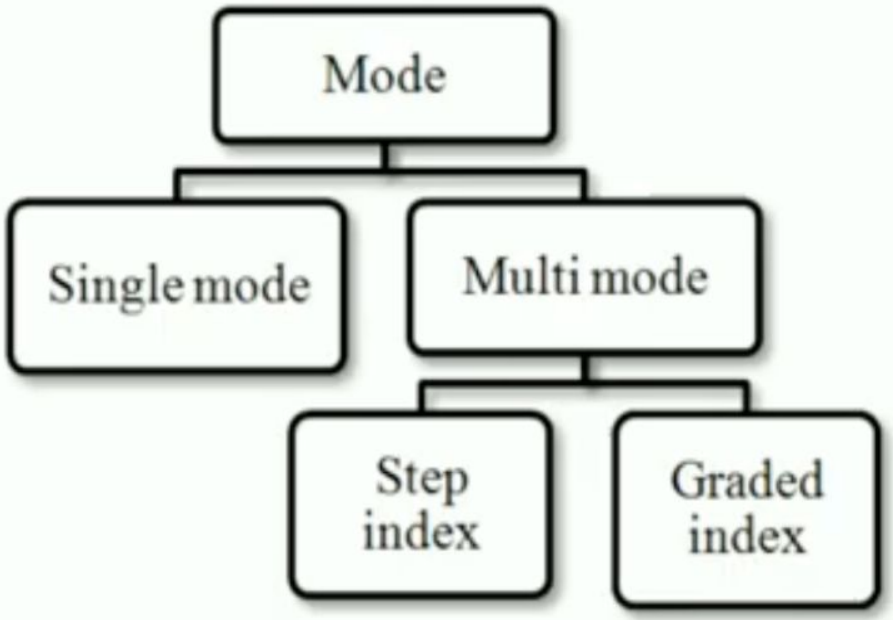
This phenomenon ensures the light stays trapped and travels efficiently through the cable.”



Critical angle : The angle of incidence beyond which total internal reflection occurs

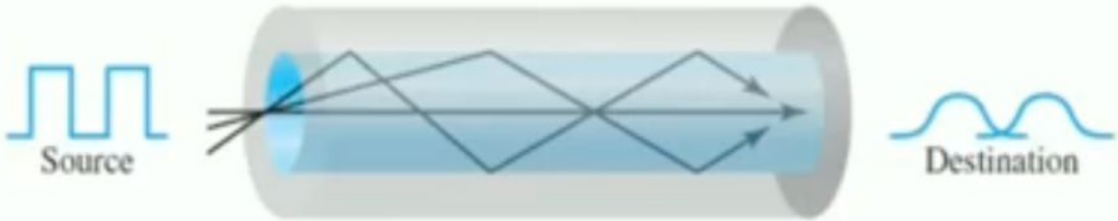


Propagation Modes :

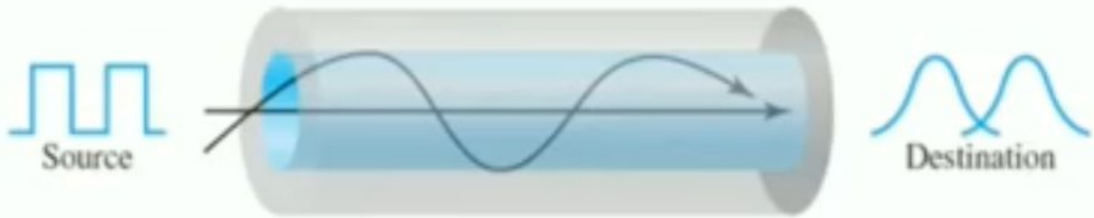


Single Mode fibre :

Multimode Step index fibre :



Multimode graded index fibre :



Propagation Modes: Step-Index vs. Graded-Index

“Fiber-optic cables use **multimode** or **single-mode** propagation for transmitting light.

Multimode Fibers:

- **Step-Index Fiber:**
  - The core has a constant density.
  - Light travels in straight lines but changes direction abruptly at the core-cladding boundary.
  - This sudden change causes **distortion**, making it less suitable for long distances.
- **Graded-Index Fiber:**
  - The core’s density gradually decreases from the center to the edges.
  - Light bends smoothly, reducing distortion and improving efficiency over longer distances.

Single-Mode Fiber:

- Uses a smaller core and a focused light source.
- Light travels nearly horizontally, with minimal distortion.
- Ideal for long-distance, high-speed communication.”

Fibre optic Cable Connectors:

- **Subscriber channel (SC) Connector** – used for Cable TV
- **Straight Tip (ST) Connector** – used for connecting Networking Devices
- **MT-RJ Connector**

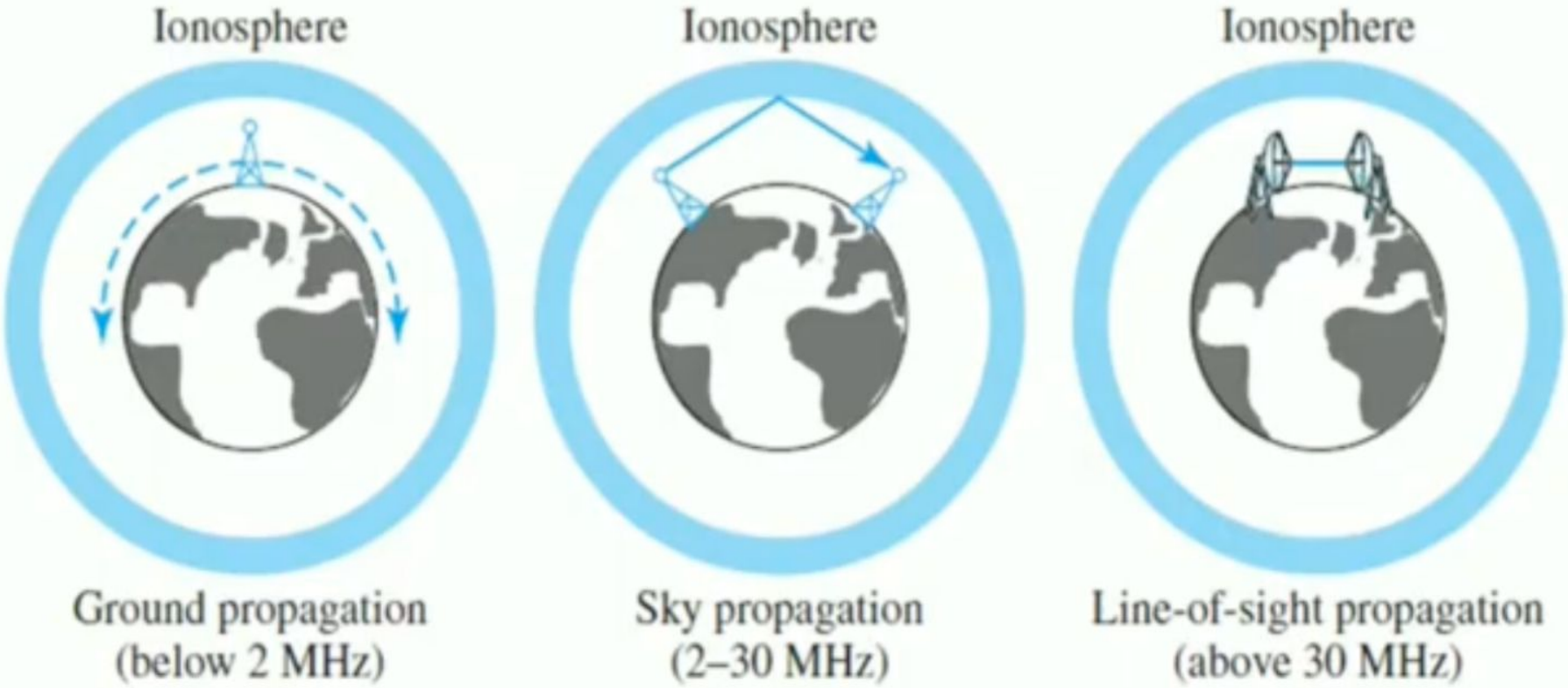
Advantages:

- Higher Bandwidth
- High Speed
- Long distance Transmission
- Less signal Attenuation
- Light weight

Disadvantages:

- Difficult to Install and Maintain
- High Cost
- Unidirectional

Propagation Modes :



Ground propagation
(below 2 MHz)

Sky propagation
(2–30 MHz)

Line-of-sight propagation
(above 30 MHz)

1. Radio wave :

- **Frequency range** : 3kHz to 1GHz
- **Omnidirectional**
- The omnidirectional property has **disadvantage**

The radio waves transmitted by one antenna are **susceptible to interference** by another antenna that may send signal using the same frequency or band

Omnidirectional antenna

- Low and medium frequency radio waves **can penetrate walls**

  Advantage : An AM radio can receive signals inside a building

  Disadvantage : We cannot isolate a communication to just inside or outside a building

Applications :

- ✓ **Multicasting**

  - AM and FM radio
  - Television
  - Cordless phones
  - Paging

2. Microwave :

- **Frequency range :** 1 GHz to 300 GHz
- **Unidirectional**
- The unidirectional property has an obvious **advantage**

  A pair of **antennas can be aligned without interfering** with another pair of aligned antennas

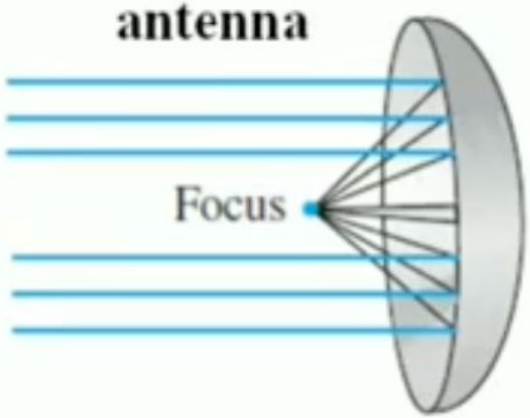
Characteristics of microwave propagation :

- Microwave propagation is **line-of-sight**
- Very high frequency microwaves **cannot penetrate walls**

  This characteristic can be a **disadvantage** if receivers are inside the buildings
- The microwave band is relatively wide, almost 299 GHz. Therefore, wider sub-bands can be assigned and a **high date rate is possible.**
- Use of certain portions of the band **requires permission** from authorities

Unidirectional antennas :

1. Parabolic dish antenna



2. Horn antenna

Applications :

- ✓ Unicasting
- ✓ Cellular phones
- ✓ Satellite Networks
- ✓ Wireless LANs

3. Infrared :

- **Frequency range :** 300 GHz to 400 THz
- Used for **short range communication**
- High frequency infrared waves **cannot penetrate walls**

Advantage :

- ✓ Short-range communication system in on room cannot be affected by another system in the next room
- ✓ Transmit digital data with a very high data rate

Disadvantage :

- ✓ Cannot be used for long range communication
- ✓ We cannot use infrared waves outside a building because **the sun's rays contain infrared waves that can interfere with the communication**

Applications :

- ✓ TV remotes
- ✓ Wireless mouse, keyboard, printers etc