



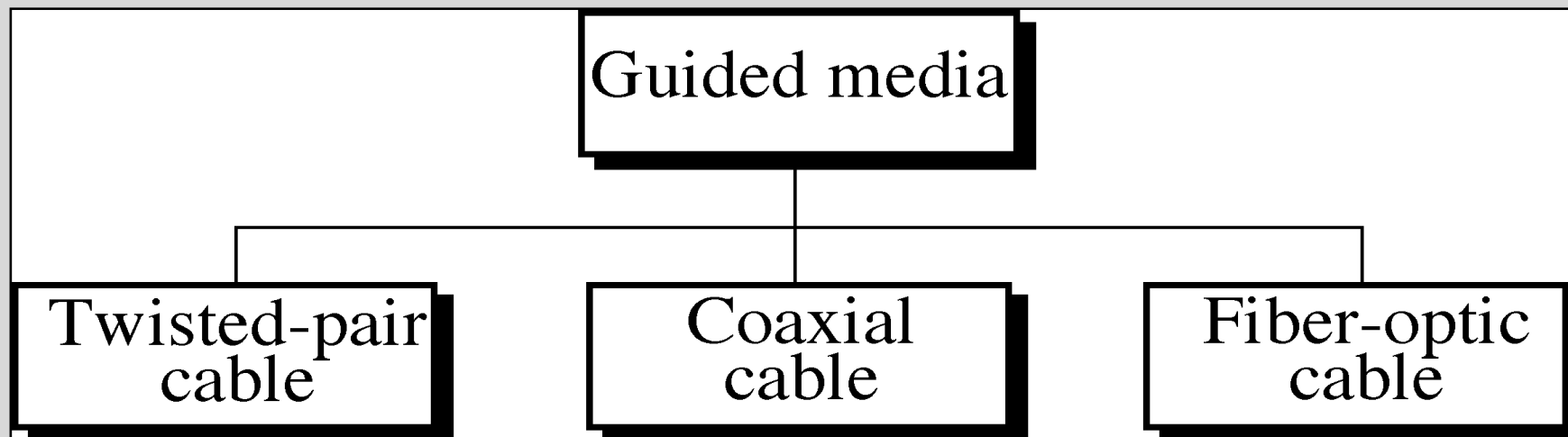
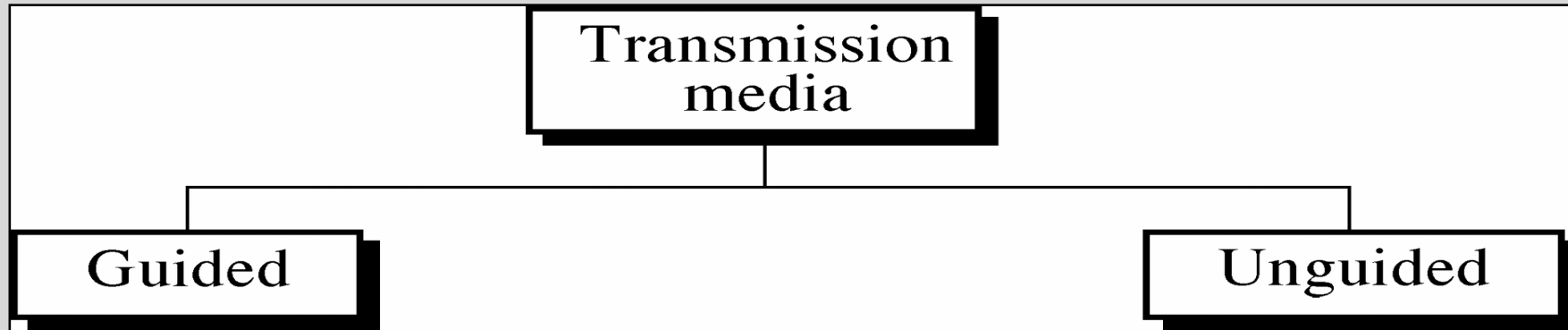
# TWISTED PAIR & COAXIAL CABLE

Sit Dolor Amet

# Chapter No. 02 The physical layer- I

- ✓Transmission media,
- ✓Magnetic media,
  - A. Twisted pair ,
  - B. coaxial cable,
  - C. Fiber optic ,
- ✓Wireless transmission,
- ✓Electromagnetic spectrum,
  - A. Radio transmission,
  - B. Microwave transmission,
  - C. Infrared,
  - D. light wave.

# Transmission Media



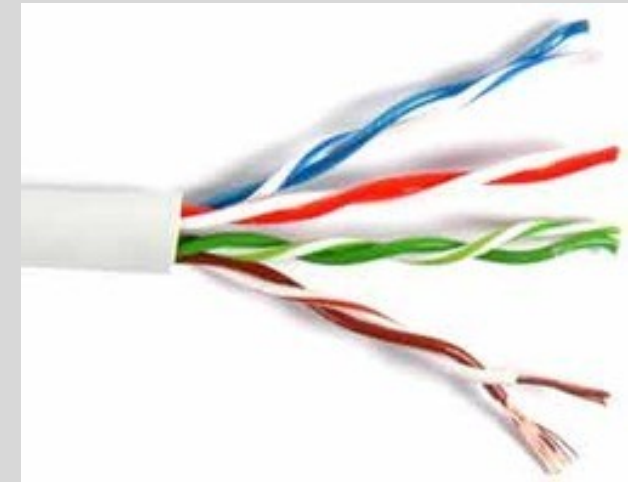
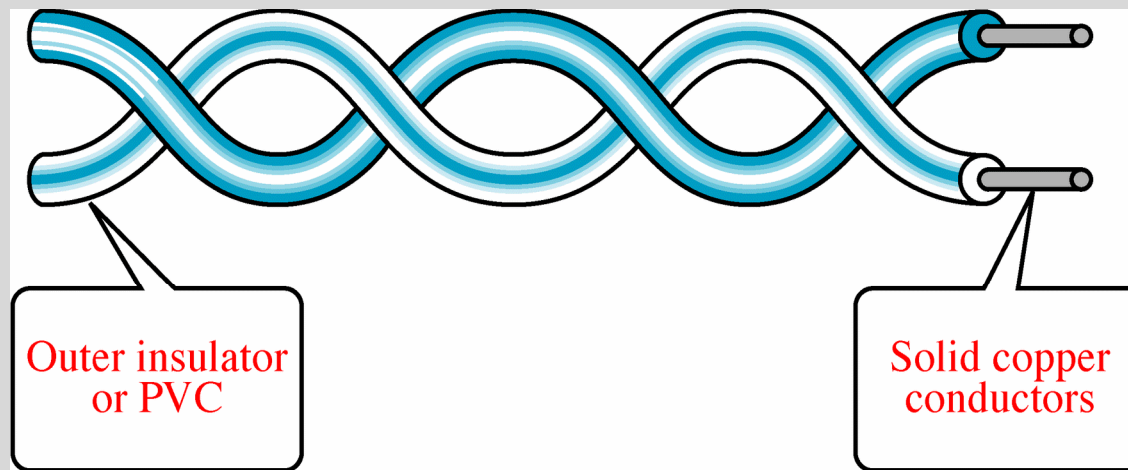
## 2.2 Guided Transmission Media

- **Transmission Media**: It is a physical path between transmitter and receiver in data communication system.
- Computers and telecommunication devices use **signals to represent data**. This signals are transmitted in the form of **electromagnetic energy**. Waves can travel through air, vacuum or wire etc.
- There are two types of transmission media: **Guided (Bounded)** and **Unguided (Unbounded)**
- In Guided media, waves are guided along solid medium such as Twisted Pair. Co-axial cable or fiber Optic cable.
- **TP and CC** use **copper conductor** that accept and transport signals in the form of **electric current**.
- **Optic Fiber** is glass or plastic cables that **accept and transmit signals in the form of light**.

## 2.2 Guided Transmission Media

- In **unguided media**, electromagnetic waves transport **without using any physical conductor**.
- **Atmosphere** and **outer space** are the examples of **unbounded media** which provide transmitting waves but do not guided them so called **wireless transmission**.
- Here signals are broadcast through **air, vacuum, sea water** and thus are **available to anyone** who has device capable of receiving them.
- For e.g. Radio transmission, Satellite Transmission, Cellular Telephone.

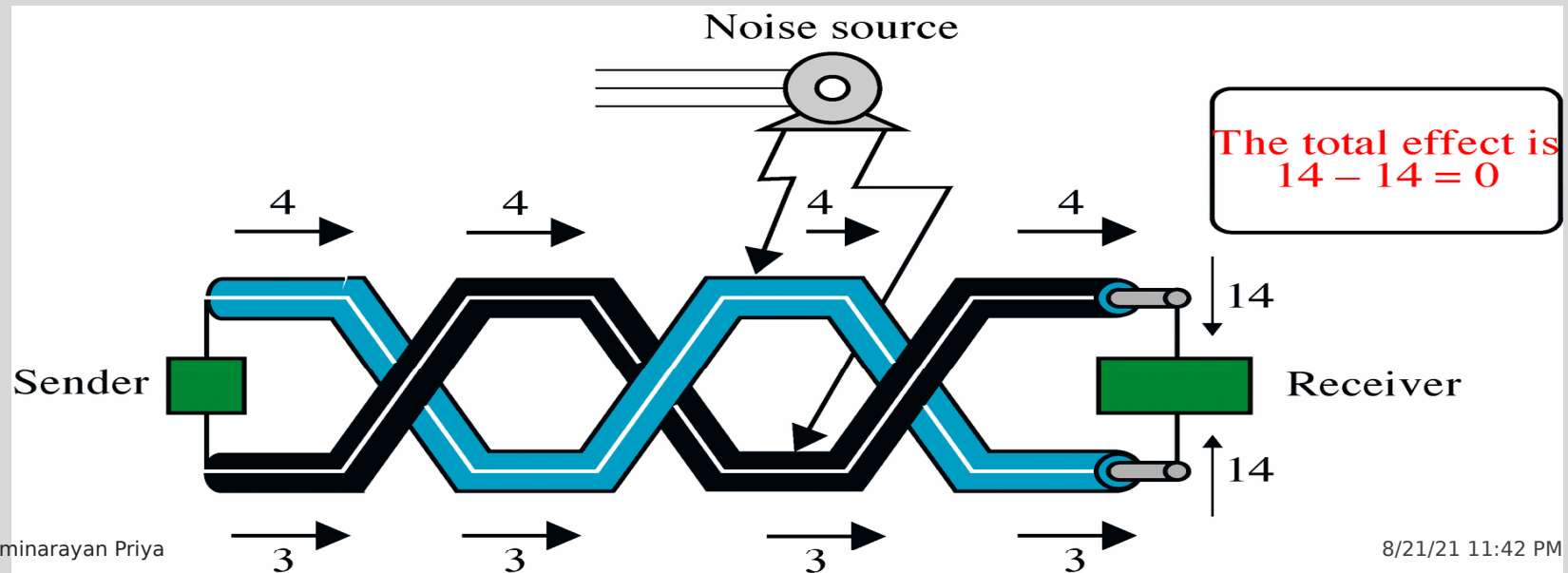
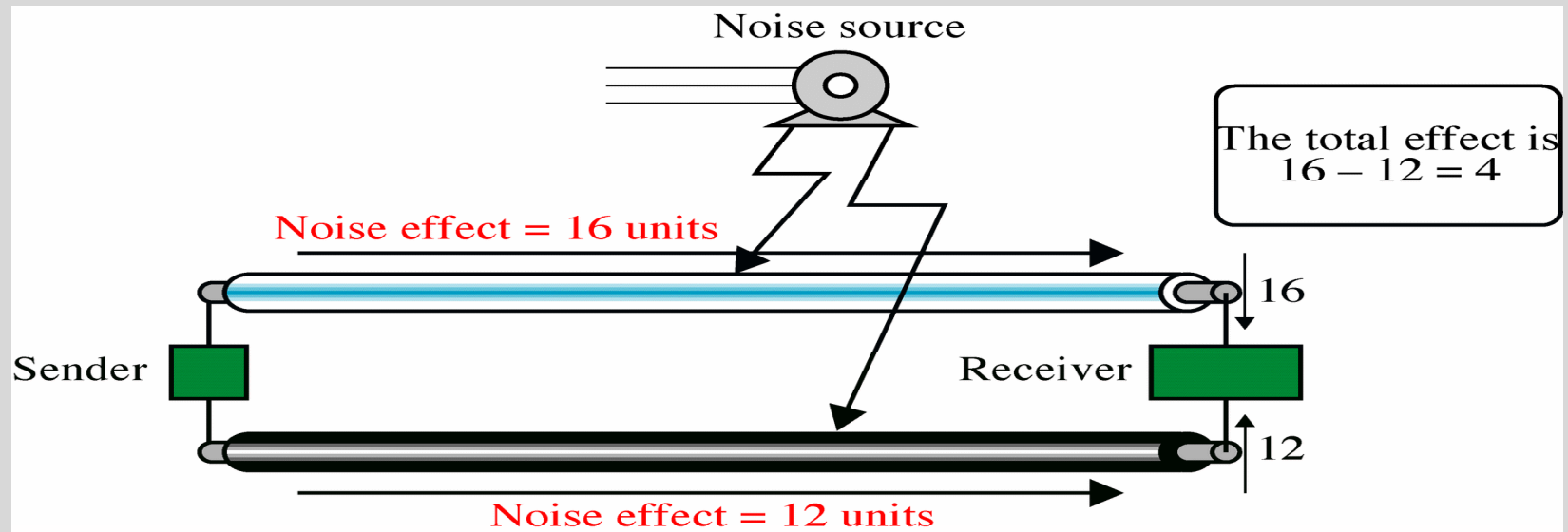
## 2.2 Guided Transmission Media (2.2.2 Twisted Pair )



- It is most common type of **telecommunication medium**.
- Frequency range for TP cable is **100 Hz to 5 MHz**, which is suitable for transmitting both **data and voice**.
- A TP consists of two conductors, each with its own colored plastic insulation. The plastic insulation is color-banded for identification.



# Effect of Noise on Parallel Lines

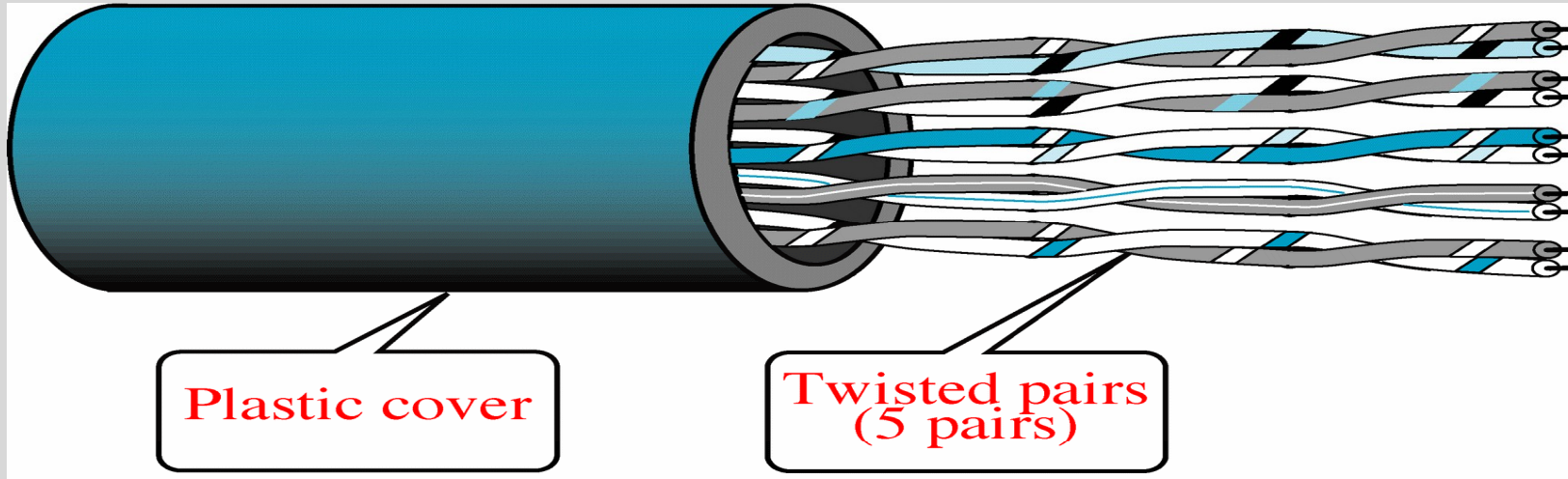


# Noise on Twisted-Pair Lines

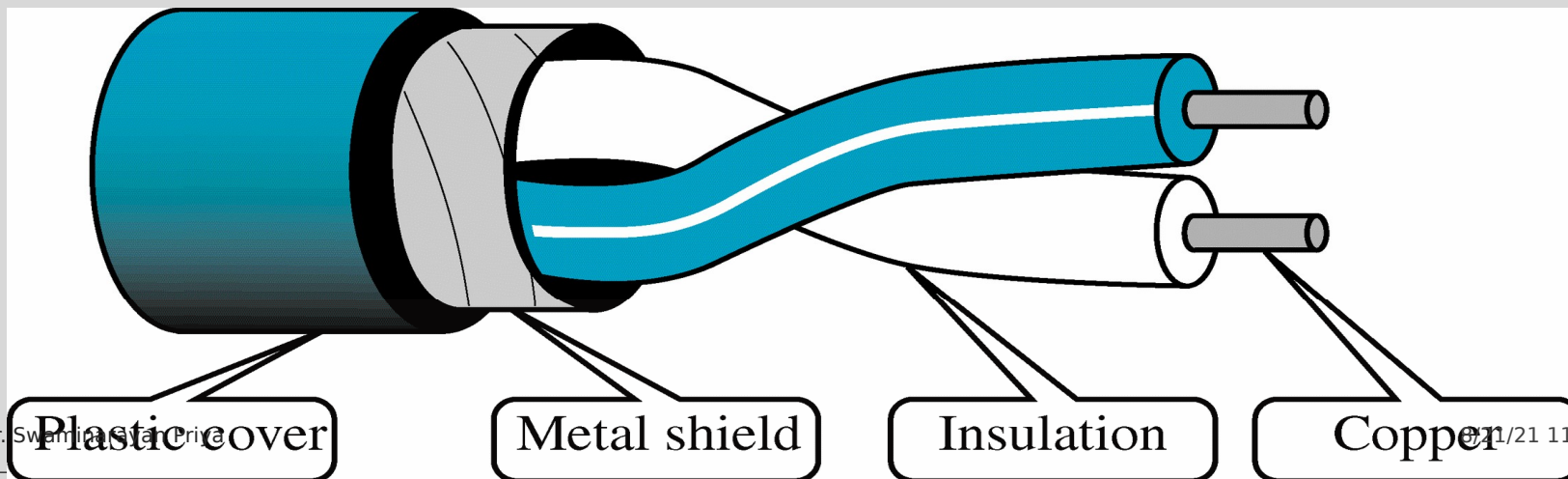
- In the past, two parallel flat wires were used for communication. The electromagnetic interference from devices such as motor can create noise over those wires. If two wires are parallel, the wire close to the source of the noise gets more interference and ends up with a higher voltage level than the wire farther away, which results in an uneven load and a damaged signal.
- If two wires are twisted around each other at regular intervals, each wire is closer to the noise regular intervals, each wire is closer to the noise source for half the time and farther away from for other half. At the receiving end, the cumulative effect of interference is same.
- Note: TP does not always eliminate the impact of noise, but it does significantly reduce it.



# Unshielded Twisted-Pair Cable



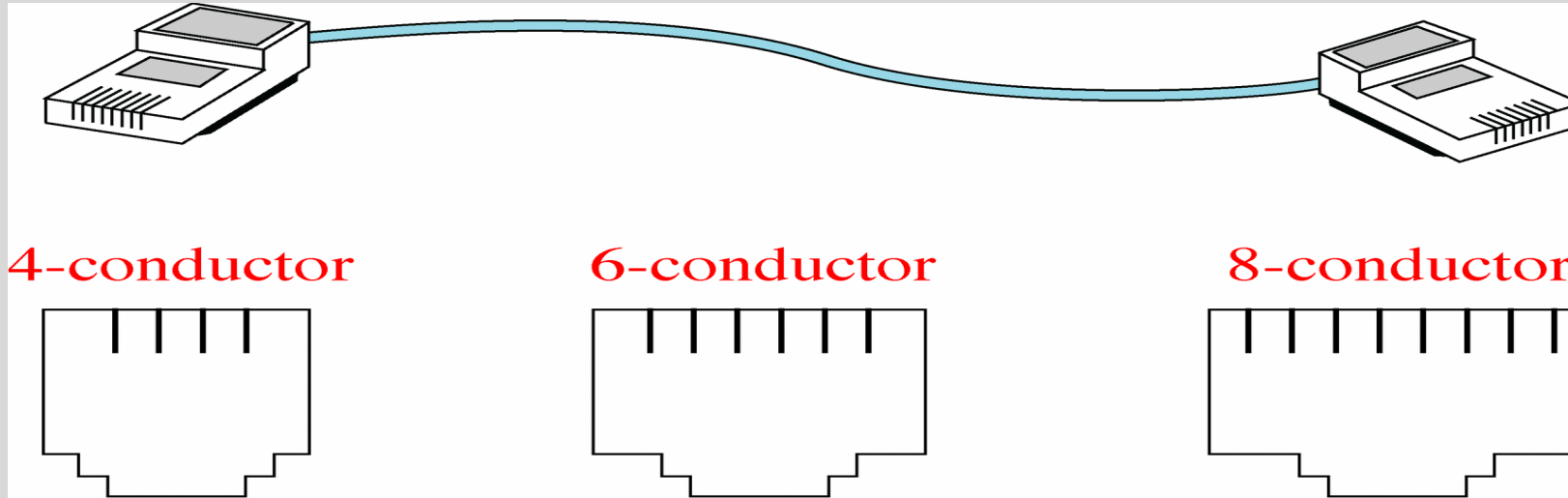
# Shielded Twisted-Pair Cable



## 2.2 Guided Transmission Media (2.2.2 Twisted Pair )

- IBM has produced a version of TP-cable known as **STP**.
- STP cable has a metal foil that encases each pair of insulated conductors, so it improve the **quality of cable** by preventing the **penetration of noise or crosstalk**.
- But it is **bulkier and more expensive**.

# UTP Connectors



- Conductors are either male (the plug) or female (the receptacle).
- Male connectors snap into female connector.
- Most common UTP connector is **RJ-45 (Registered Jack - 45)** with eight connectors, one for each wire of four twisted pair.

# Twisted-Pair Cable

- **Standards for UTP cable**
- The EIA (Electronic Industries Association) had developed standards for UTP cables by quality.
- **CAT-1 (Category-1):** It is used in telephone system. It is good for voice but inadequate for all.
- **CAT-2:** It is suitable for voice and for data communication up to 4 Mbps.
- **CAT-3:** It requires at least three twists per foot. It is used for data transmission up to 10 Mbps. Now it is the standard cable for telephone systems.
- **CAT-4:** It is also requires at least three twists per foot. The possible transmission rate is 20 Mbps.
- **CAT-5 :** it is used for data transmission up to 100 Mbps.

# Standards for UTP cable

Category	Bandwidth	Data rate	Digital/Analog	Uses
CAT-1	Very low	< 100 kbps	Analog	Telephone
CAT-2	< 2 MHz.	4 Mbps	Analog/Digital	T-1 Lines
CAT-3	16 MHz.	10 Mbps	Digital	LANs
CAT-4	20 MHz.	20 Mbps	Digital	LANs
CAT-5	100 MHz.	100 Mbps	Digital	LANs
CAT-6	200 MHz.	200 Mbps	Digital	LANs
CAT-7	600 MHz.	600 Mbps	Digital	



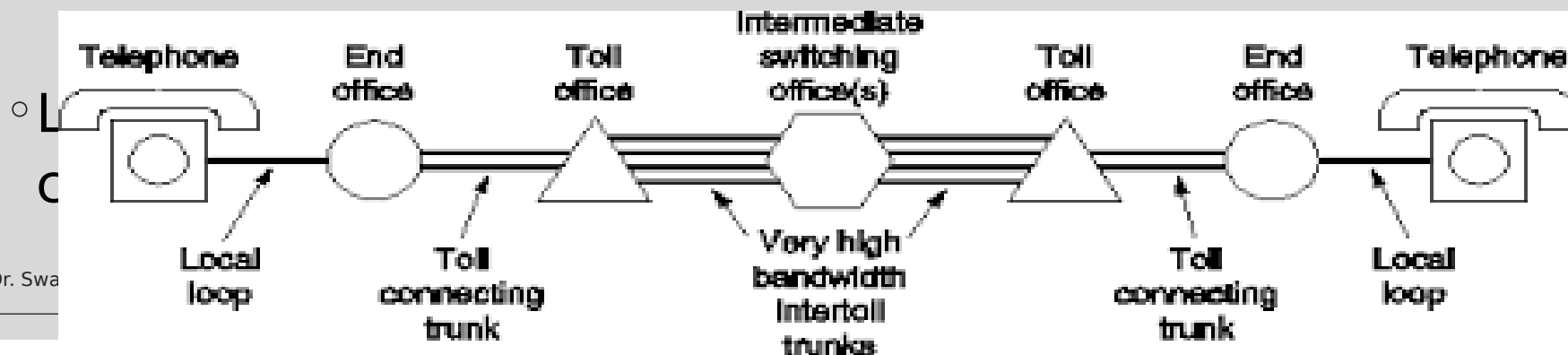
# Advantages of UTP

- UTP is cheap, flexible and easy to install.
- UTP are used in LAN technologies like Ethernet and Token Ring.



# Applications of TP

- It is used in **telephone lines** to provide **voice and data channels**. The local loop - the line that connect **subscribers to the central telephone office** - is most commonly UTP cables.
- UTP is used in **DSL (Digital Subscriber Line) technology**. DSL provide **high-speed access to the Internet**. DSL also supports **high-speed digital communication** over the existing local loops.

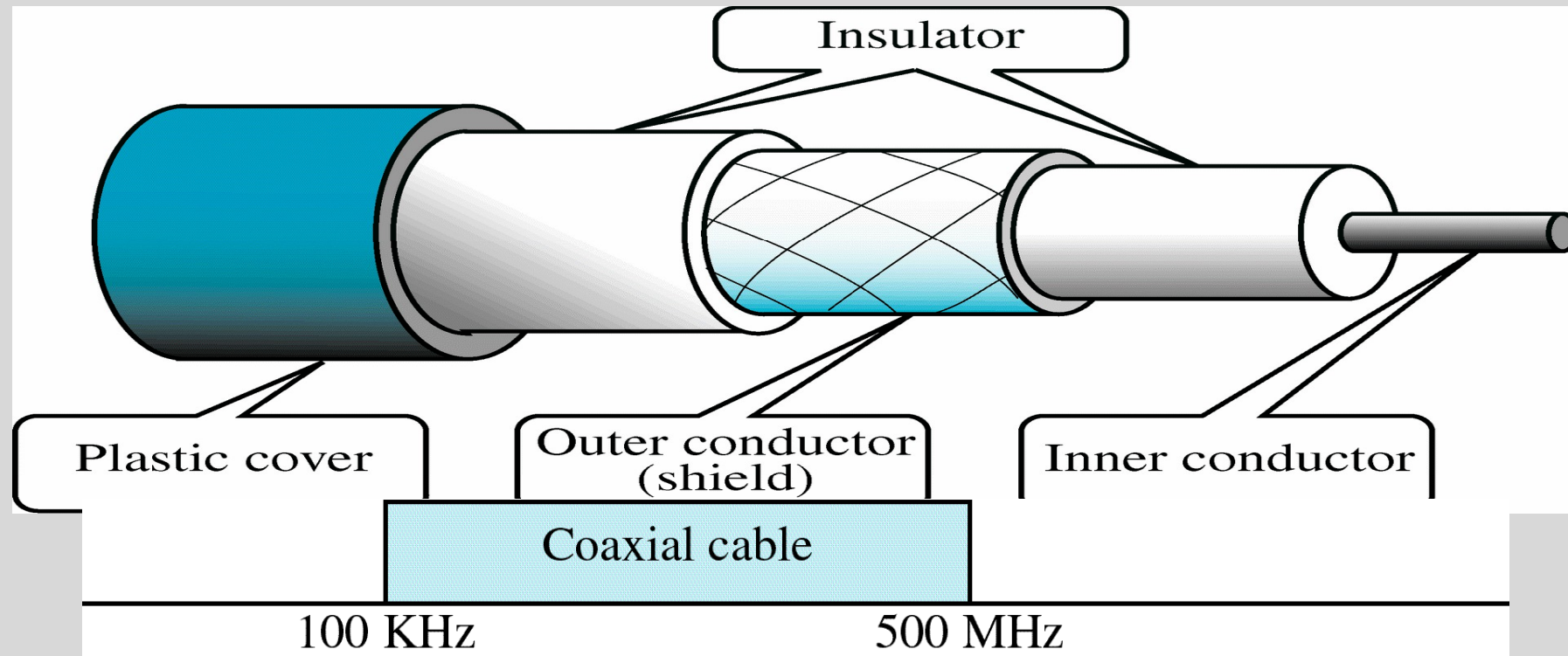


formal name	Common name	Formal IEEE name	Speed	Cable and Max Length	Suitable Cable
10 BASE-T	Ethernet	802.3	10Mbps	Copper,100m	category3, 5
100 BASE-T	Fast Ethernet	802.3u	100Mbps	Copper,100m	Category5
1000BASE-T	Gig Ethernet	802.3z	1000Mbps	Fiber,5000m	Category5e

- **Advantages of Twisted pair cable**

- 1.It can be used to carry both analog and digital data.
- 2.It is relatively easy to implement and terminate.
- 3.It is the least expensive media of transmission for short distances.
- 4.If portion of a twisted pair cable is damaged it does not effect the entire network.

## 2.2 Guided Transmission Media (2.2.3 Coaxial Cable)



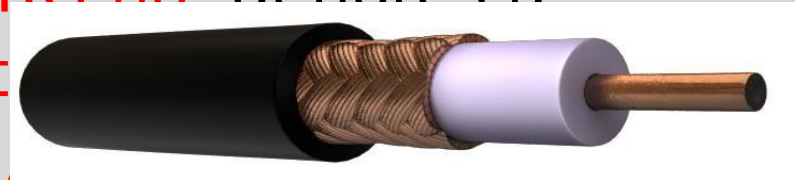
- One of the common transmission media. Usually called as **coax**.
- It has better shielding than twisted pairs, so it can **span longer distances** at **higher speeds**.
- Two kinds of coaxial cable are widely used.

## 2.2 Guided Transmission Media (2.2.3 Coaxial Cable)

- Instead of having two wires, coax has a central core conductor (Usually copper) enclosed in an insulating sheath, which is encased in an outer
- One kind, **50-ohm cable**, is commonly used for **digital transmission**.
- The other, **70-ohm cable**, is commonly used for **analog transmission**.
- A coaxial cable consists of a stiff copper wire as the core, surrounded by an insulating material. The insulator is encased by a cylindrical conductor, often as a closely woven braided mesh.
- The outer conductor is covered in a protective plastic sheath.
- The **construction and shielding of the coaxial cable** give it a good combination of **high bandwidth** and **excellent noise immunity**.

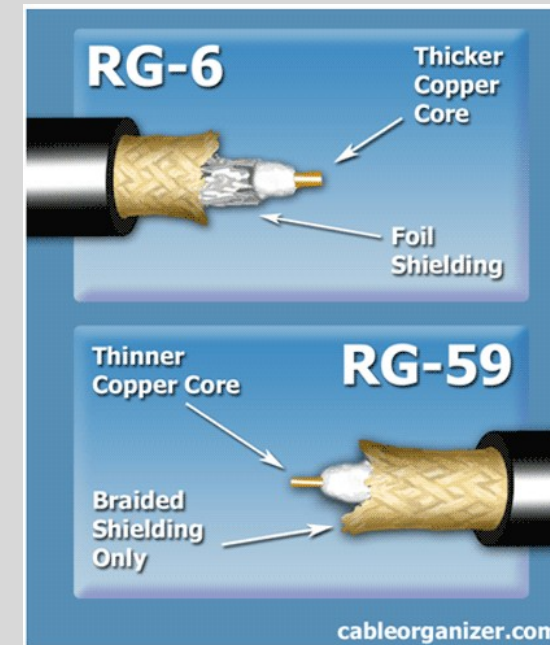
## 2.2 Guided Transmission Media (2.2.3 Coaxial Cable)

- Coaxial cables are categorized by their **radio government (RG)** ratings. Each **RG no** denotes a unique **set of physical specifications**.



- The **wire gauge** of the **inner conductor**.
- The **thickness and type** of the **inner insulator**.
- The **size and type** of **outer casing**.

1. RG-8, used in thick Ethernet
2. RG-9, used in thick Ethernet
3. RG-11, used in thick Ethernet
4. RG-58, used in thin Ethernet
5. RG-59, used for cable TV.





## 2.2 Guided Transmission Media (2.2.3 Coaxial Cable)

- **Coaxial cable connectors:** To connect coaxial cable to devices, coaxial connectors are needed.
- Most common types of connectors are as follows:

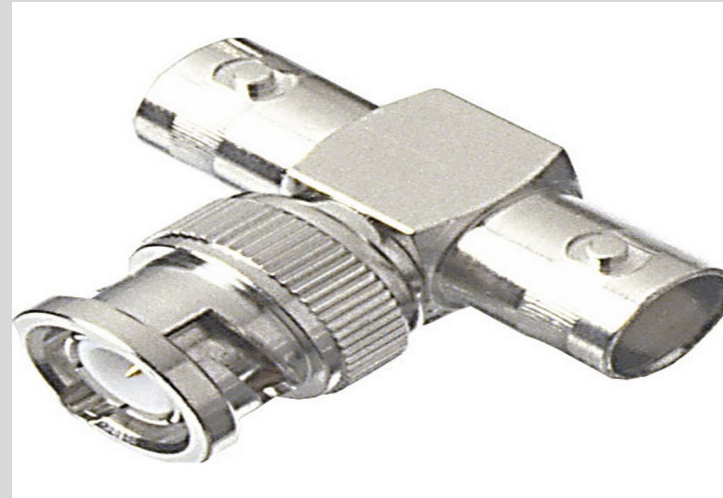
**1. BNC Connector**  
(Bayonet Neill-Concelman Connector)  
device at the TV set.



**N/W**  
connect the  
e, such as a TV

# Coaxial cable connectors

- 2. **BNC T Connector:** It is used in Ethernet n/w to branch out a cable for connection to a computer or other devices.
- 3. **BNC-Terminator:** It is used at the end of the cable to prevent the reflection of the signal.



## 2.2 Guided Transmission Media (2.2.3 Coaxial Cable)

- **Applications:**
- Coaxial cable were used in **analog telephone networks** where a single coaxial n/w could carry 10,000 voice signals, but after that it was used in **digital telephone networks** where a single coaxial cable could carry digital data up to 600 Mbps.
- Cable **TV networks** also uses coaxial cables. In past, the entire cable n/w used coaxial cable but now cable service providers replace most of the n/w with fiber optic cable.
- It is also used in **Ethernet LANs**.