

Physical Layer-I

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BLM 305 I Veri İletişimi

(Data Communication)

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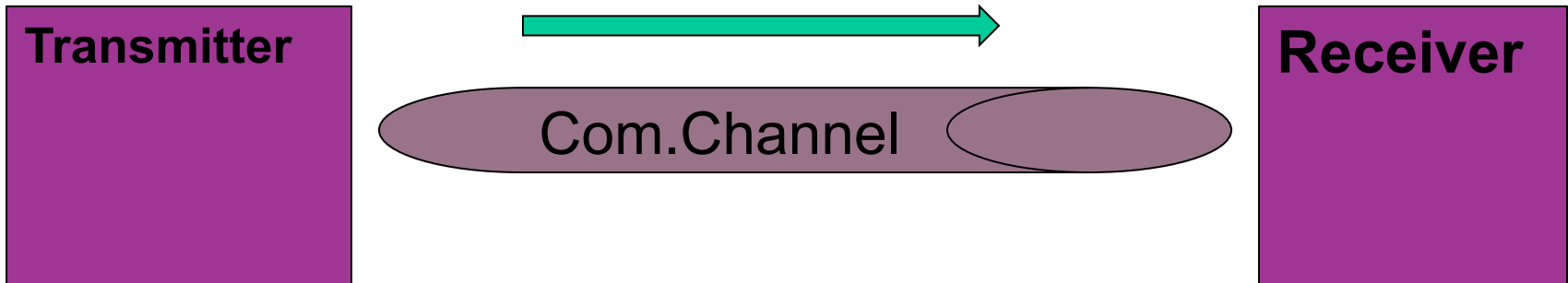
References:

- *Computer Networks*, Andrew Tanenbaum, Pearson, 5th Edition, 2010.
- *Computer Networking, A Top-Down Approach Featuring the Internet*, James F.Kurose, Keith W.Ross, Pearson-Addison Wesley, 6th Edition, 2012.
- **BLG 337 Slides** from İTÜ prepared by Assoc. Prof.Dr. Berk CANBERK

Basics of Physical Layer:

- ✓ PHY Transmission Terminology
- ✓ Wired Transmission Media
- ✓ PHY Transmission Impairments

Transmission Terminology

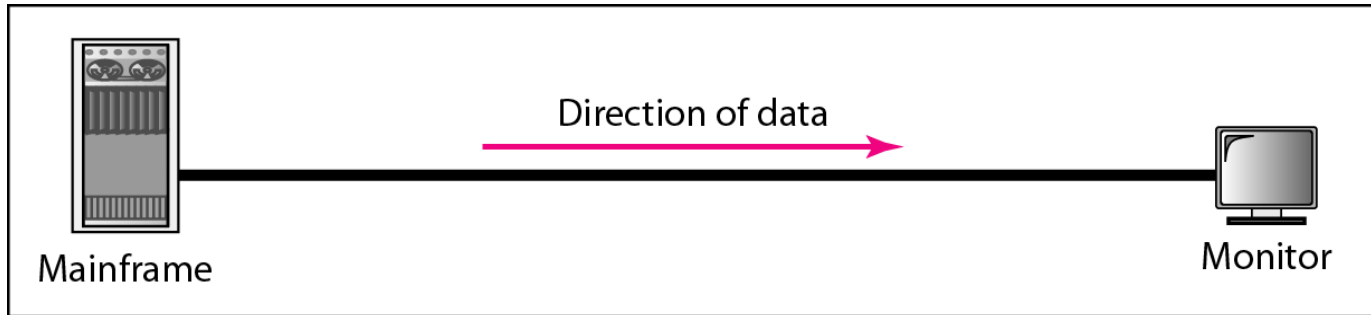


- ✓ **Transmitter:**
 - Provides energy for the transmission
 - Converts information to suitable signal form.
- ✓ **Receiver**
 - Receives energy from medium
 - Converts the signals to the original data.

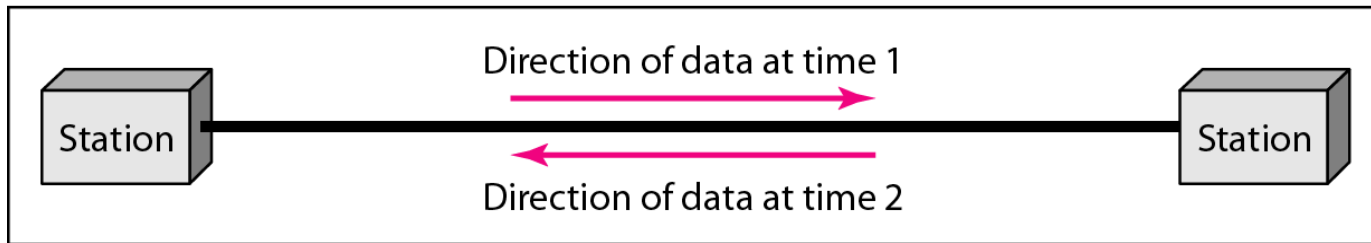
Transmission Terminology

- ✓ Data transmission occurs between transmitter and receiver over some transmission medium
- ✓ Communication is in the form of electronic waves
- ✓ Transmission medium can be in the form of ;
 - *Guided Media*
 - *Unguided Media*

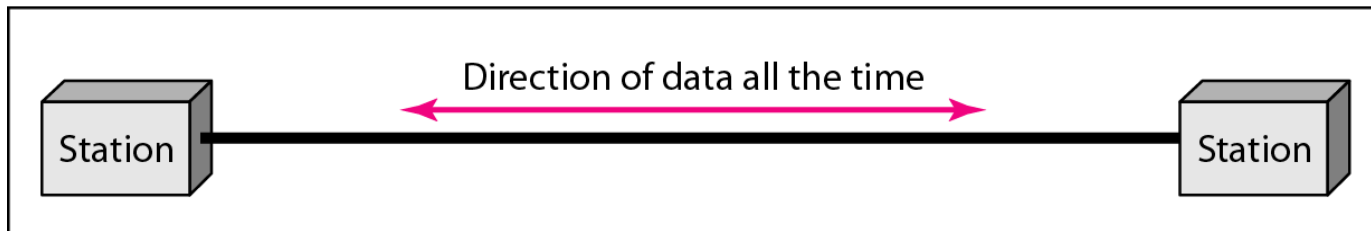
Transmission Terminology : Data Flow



a. Simplex

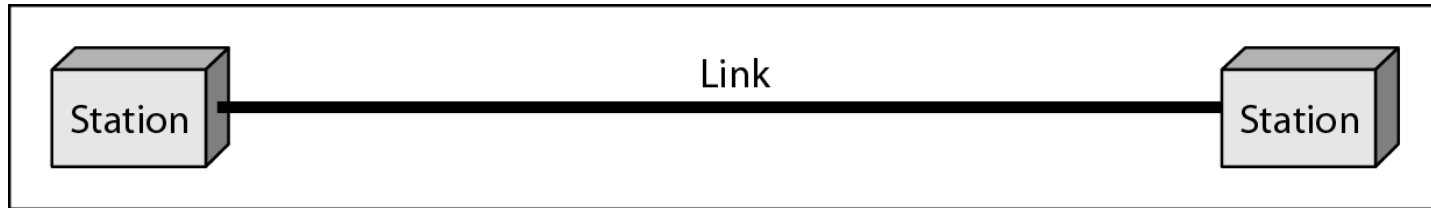


b. Half-duplex

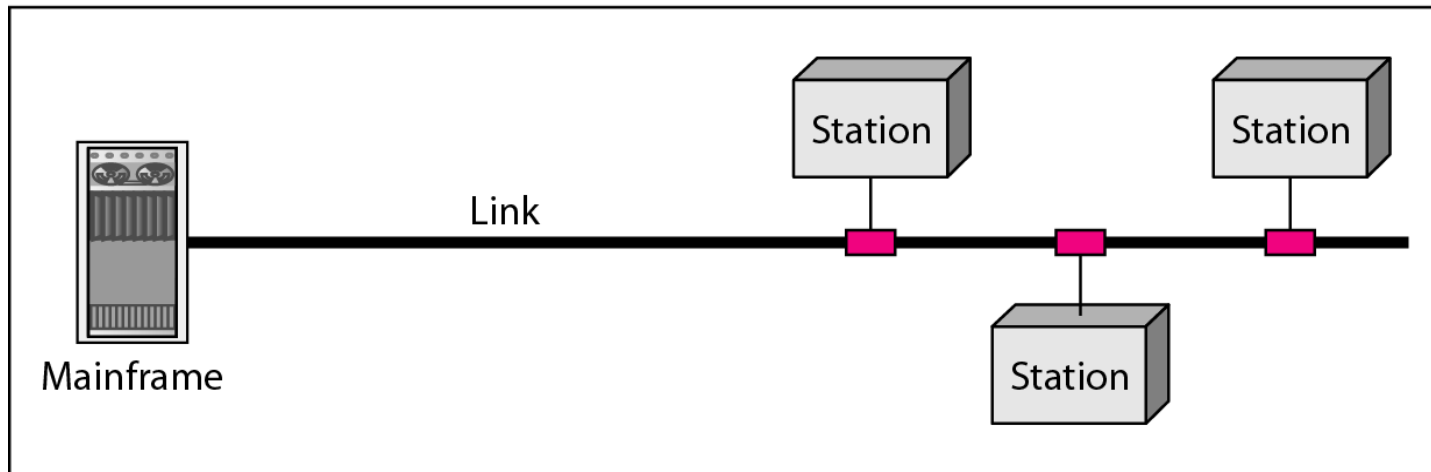


c. Full-duplex

Transmission Terminology :Types of connections



a. Point-to-point



b. Multipoint

Transmission Terminology : Signals

- ✓ **analog signal**

- signal intensity varies smoothly with no breaks

- ✓ **digital signal**

- signal intensity maintains a constant level and then abruptly changes to another level

- ✓ **periodic signal**

- signal pattern repeats over time

- ✓ **aperiodic signal**

- pattern not repeated over time

Analog & Digital Signals

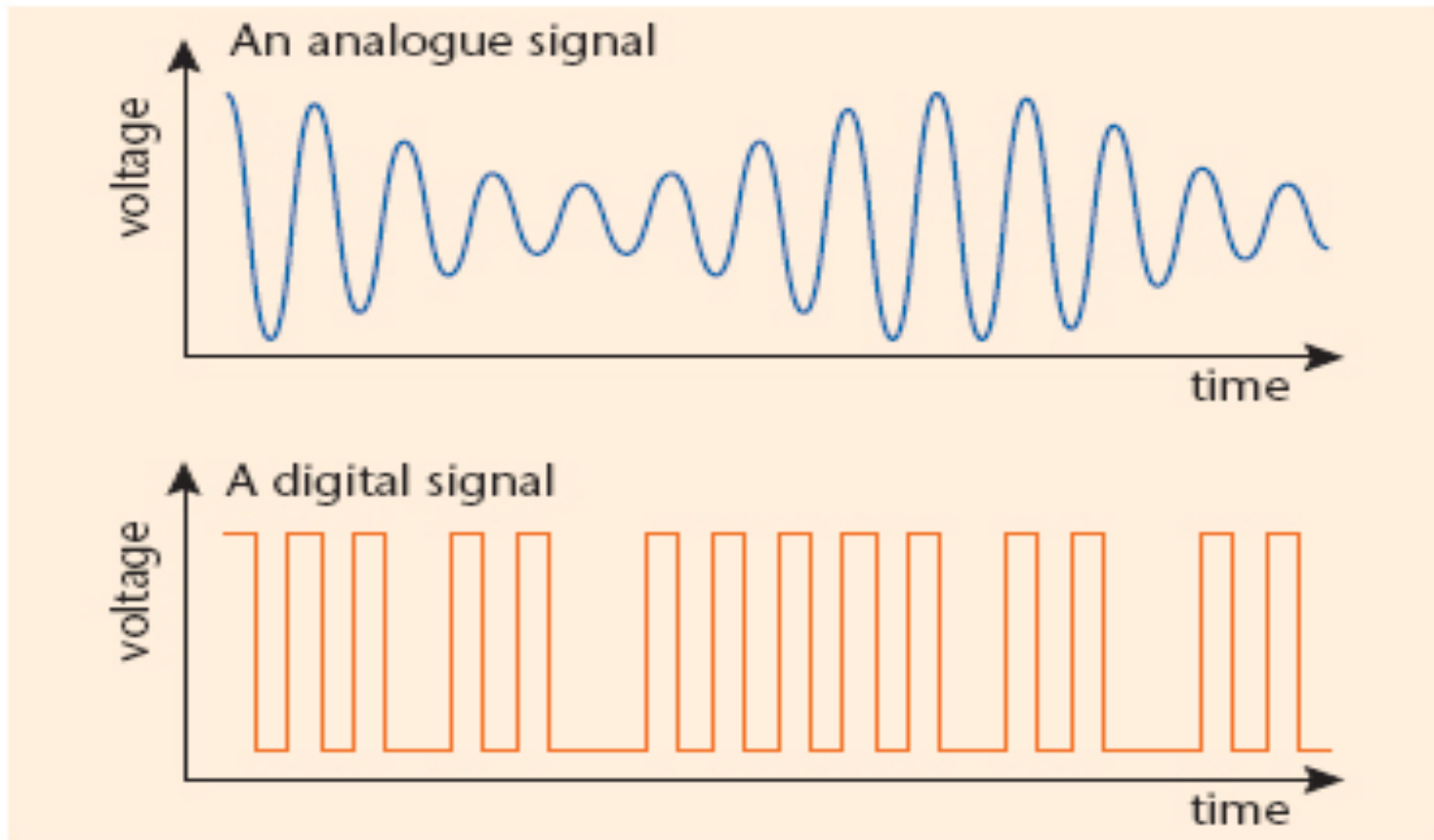
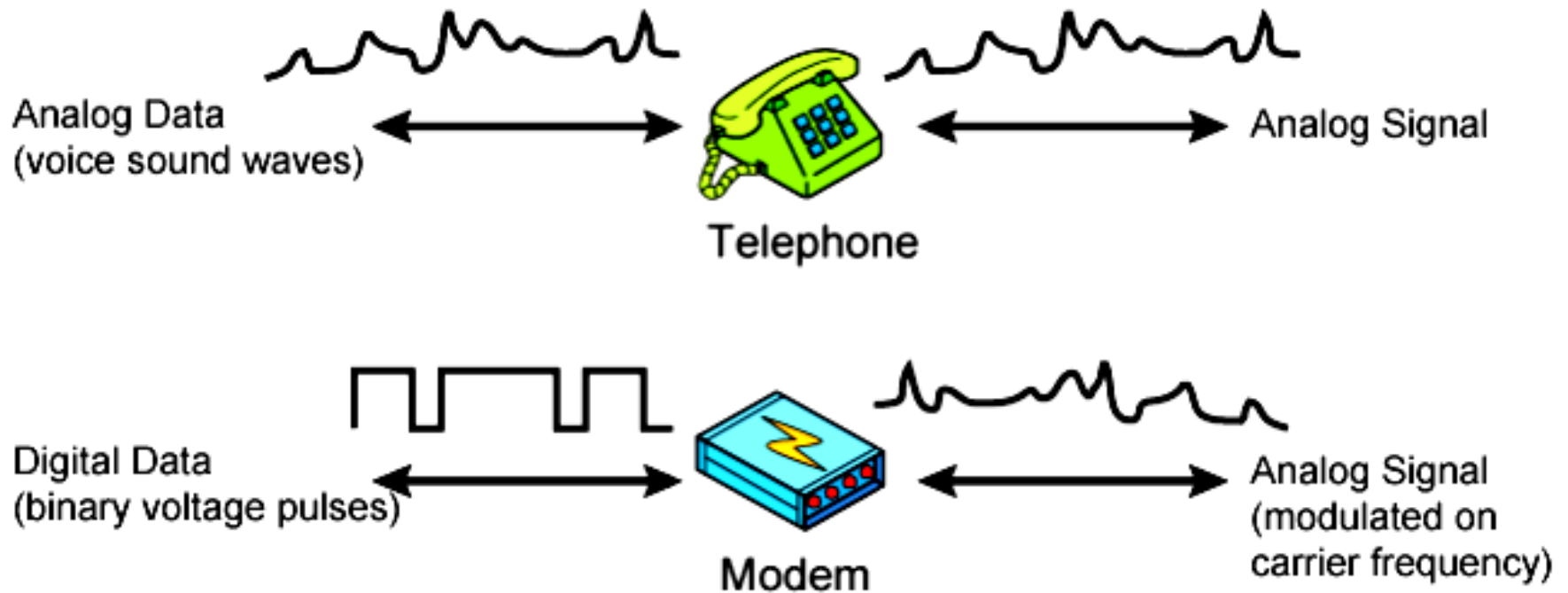


Fig. 12.4 How analogue and digital signals change with time.

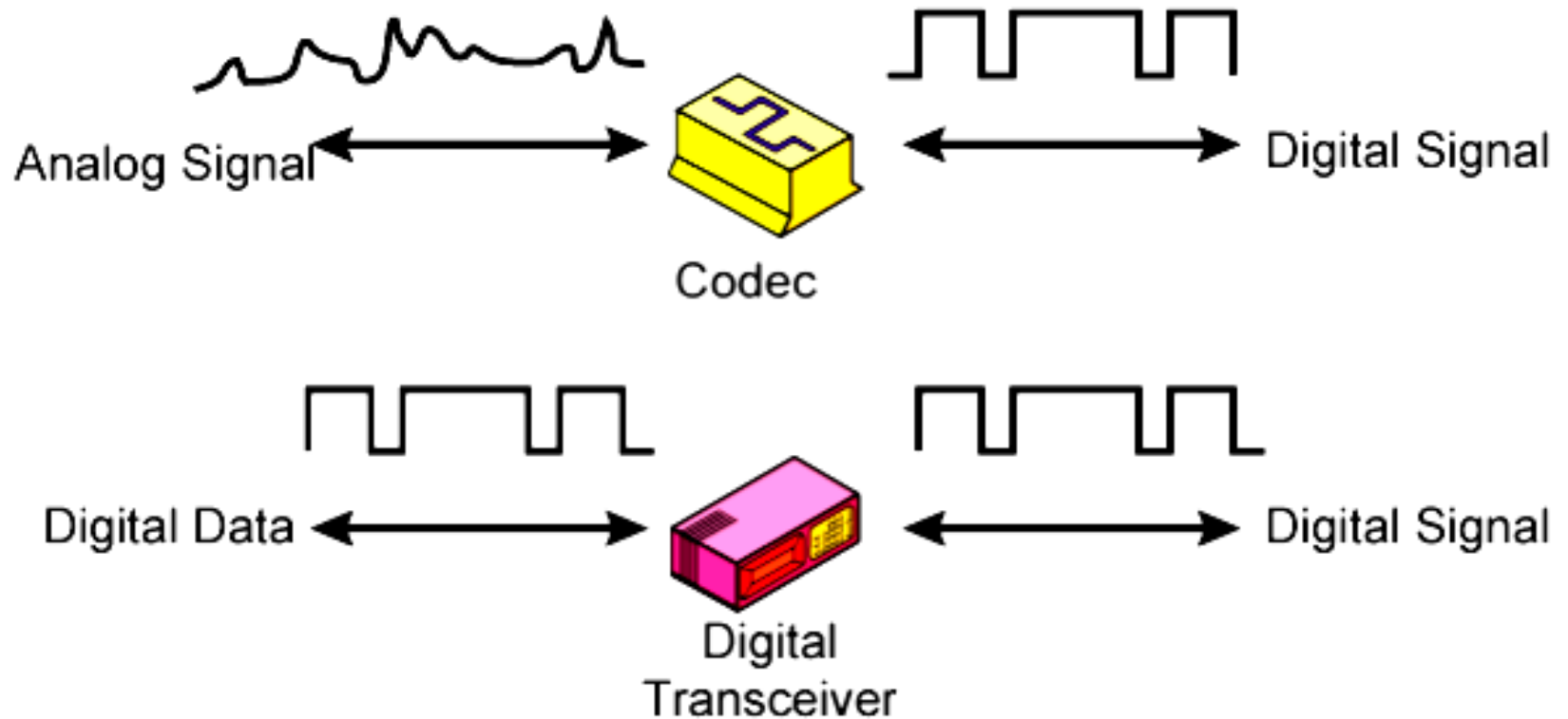
Analog Signals

Analog Signals: Represent data with continuously varying electromagnetic wave



Digital Signals

Digital Signals: Represent data with sequence of voltage pulses



Transmission Media

- ✓ Guided - wire
 - Twisted Pair
 - Coaxial Cable
 - Fiber Optic

- ✓ Unguided - wireless

Important Tips of Medium Design

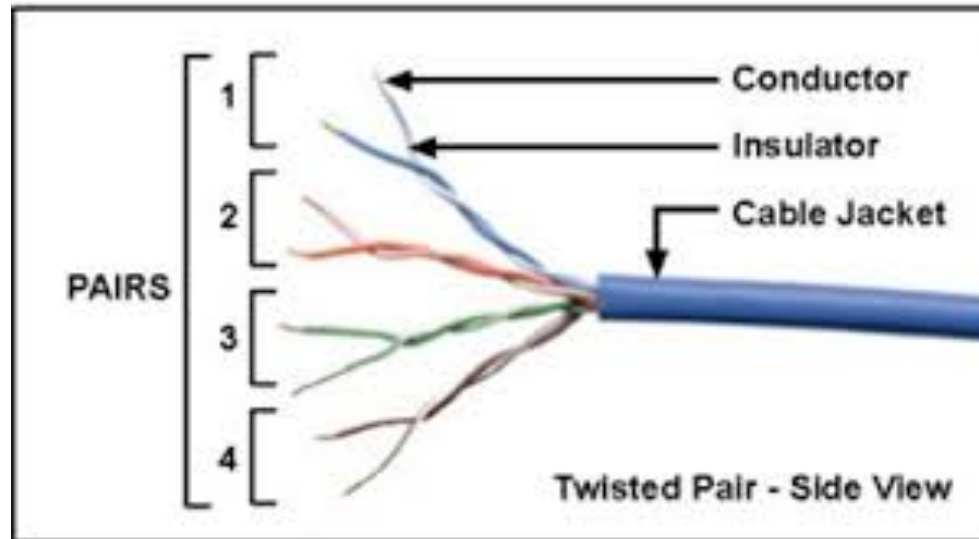
- ✓ Characteristics and quality depends on;
 - Guided → the medium
 - Unguided, → the bandwidth provided by the antenna
- ✓ Key concerns:
 - data rate
 - distance
- ✓ Bandwidth
 - Higher bandwidth gives higher data rate
- ✓ Transmission impairments
 - Attenuation
- ✓ Interference
- ✓ Number of receivers
 - In guided media
 - More receivers (multi-point) introduce more attenuation

Types of Guided Media

- ✓ Twisted Pair
- ✓ Coaxial Cable
- ✓ Optical Fiber

Twisted Pair

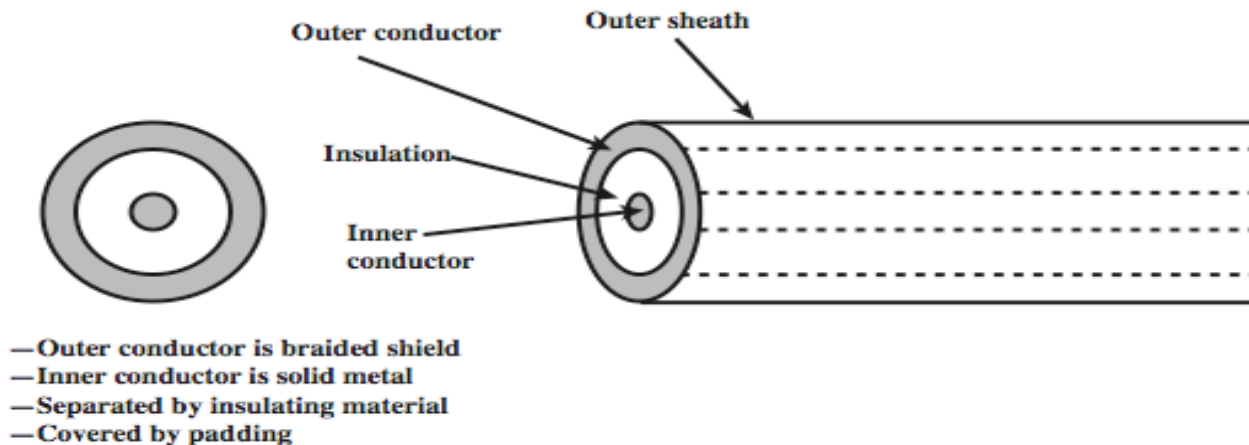
- ✓ consists of two insulated copper wires arranged in a regular spiral pattern
- ✓ Twisted pair is the least expensive and most widely used guided transmission medium.
- ✓ pairs are bundled together into a cable
- ✓ most commonly used in the telephone network and for communications within buildings



Types of Twisted Pair

BASIS FOR COMPARISON	UTP	STP
Basic	UTP (Unshielded twisted pair) is a cable with wires that are twisted together.	STP (Shielded twisted pair) is a twisted pair cable enclosed in foil or mesh shield.
Noise and crosstalk generation	High comparatively.	Less susceptible to noise and crosstalk.
Grounding cable	Not required	Necessarily required
Ease of handling	Easily installed as cables are smaller, lighter, and flexible.	Installation of cables is difficult comparatively.
Cost	Cheaper and does not require much maintenance.	Moderately expensive.
Data Rates	Slow comparatively.	Provides high data rates

Coaxial Cable



(b) Coaxial cable

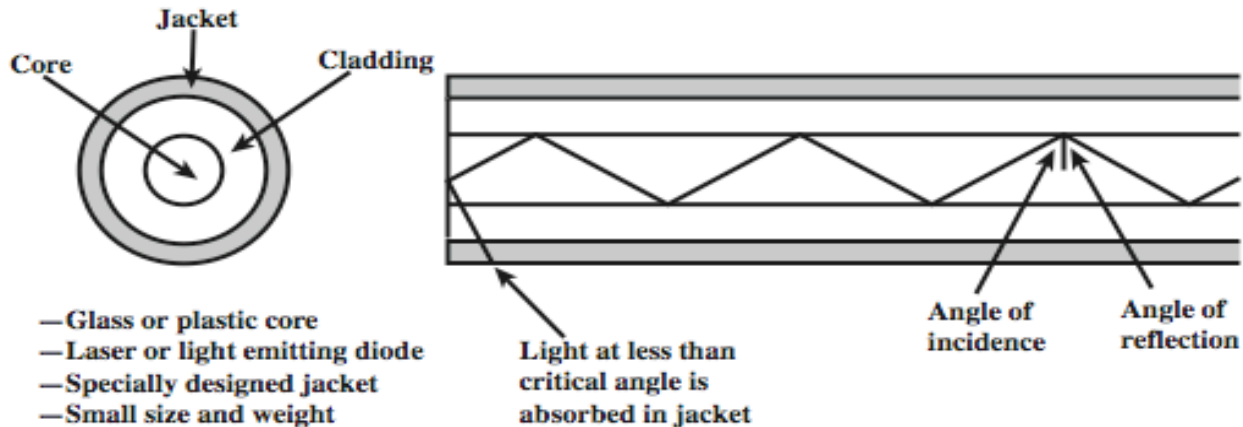
Advantages of Coaxial Cable

- Coaxial cable is still the most common means of data transmission over short distances.
- The advantages are:
 - They are cheap to make
 - Cheap to install
 - Easy to modify
 - Good bandwidth
 - Great channel capacity
 - Noise immunity due to low error rate

Disadvantages of Coaxial Cable

- Signals entering the cable can cause unwanted noise and picture ghosting, making it useless.
- A continuous current flow, even if small, along the imperfect shield of a coaxial cable can cause visible or audible interference.
- More expensive than twisted pairs and is not supported for some network standards.
- Its also has high attenuation, have the need to implement repeaters

Optical Fiber



(c) Optical fiber

- ✓ Wide bandwidth
- ✓ Immunity to electrostatic interference
- ✓ Elimination of cross talk
- ✓ Lighter weight and smaller size
- ✓ Lower Cost
- ✓ Security
- ✓ Corrosion
- ✓ Longer Life and easy to maintenance.

Transmission Impairments

- ✓ The difference between the signal send and signal transmitted
 - Analog - degradation of signal quality
 - Digital - bit errors
- ✓ The reasons:
 - Attenuation and attenuation distortion
 - Noise
- ✓ Measured by;
 - Signal to Noise Ratio and Capacity formulation.