Transmission Media

Guided Media

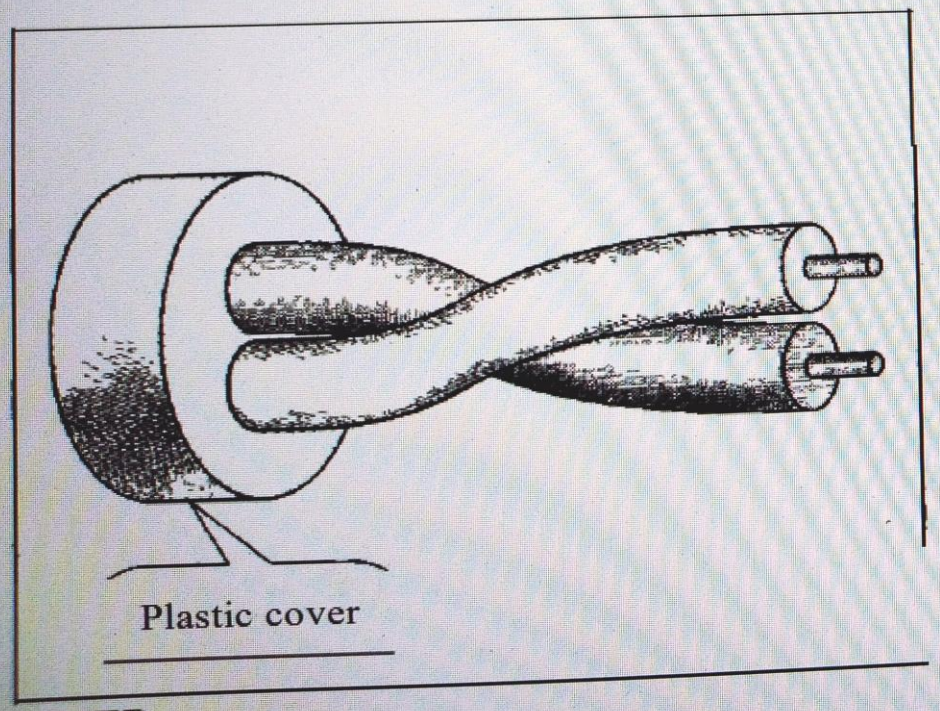
Twisted Pair Cable

- One of the wires is used to carry signals to the receiver
- The receiver uses the difference between the two
- Twisting makes it probable that both wires are equally affected by external influences (noise or crosstalk).
- This means that the receiver, which calculates the difference between the two, receives no unwanted signals.

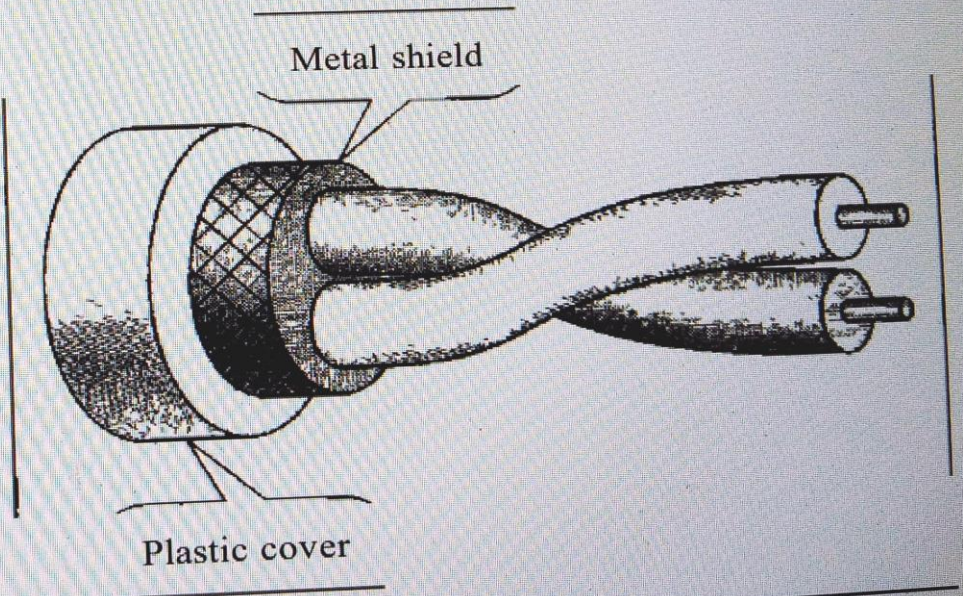
-Separately insulated
-Twisted together
-Often "bundled" into cables
-Usually installed in buliding when built

(a) Twisted pair

Figure 7.4 *UTP and STP cables*



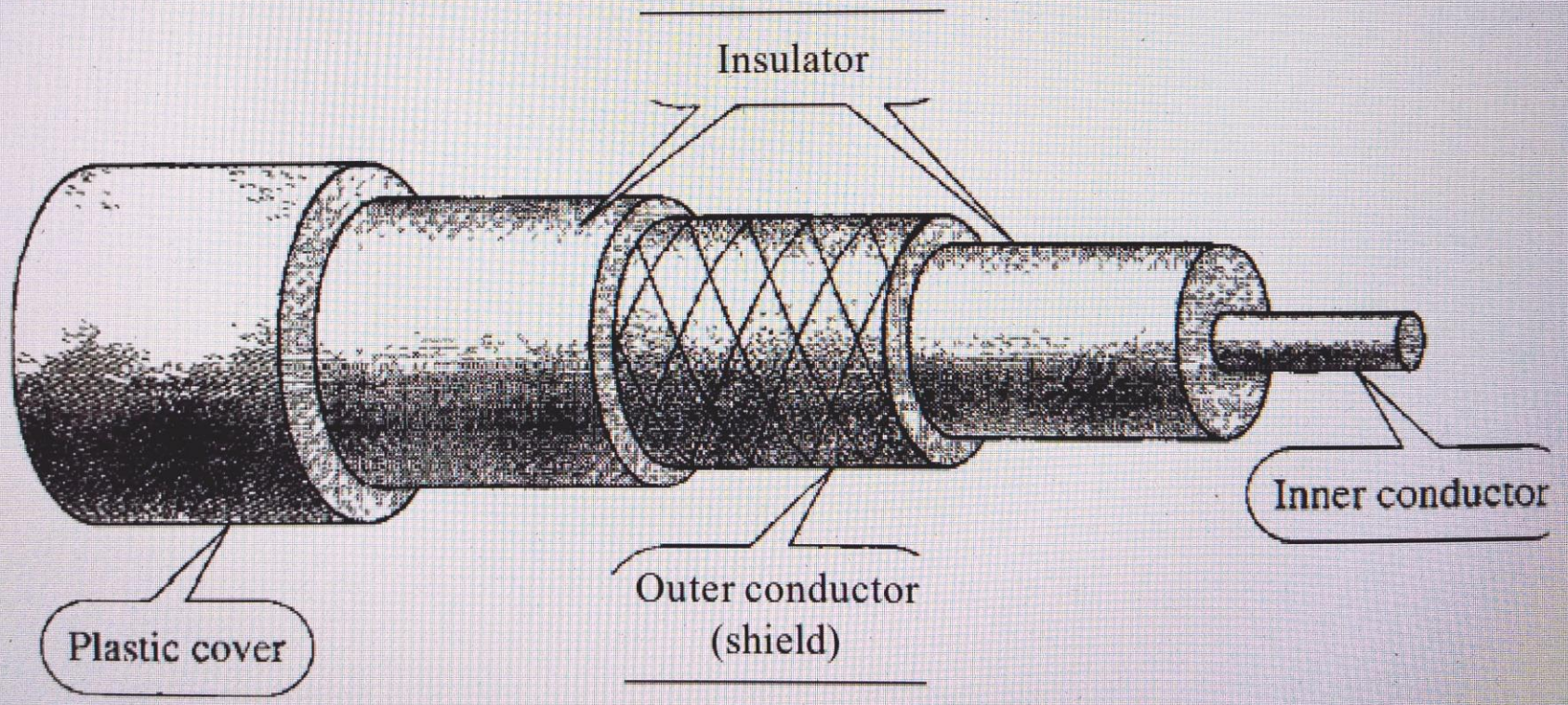
a.UTP



b.STP

- STP cable has a metal foil or braided mesh covering that encases each pair of insulated conductors
- Data rate in 0.1Mbps to 600Mbps
- For analog signals, amplifiers are required about every 5 to 6 km.
- For digital signals, repeaters are required every 2 or 3 km.
- Twisted-pair cables are used in telephone lines to provide voice and data channels
- Local-area networks, such as 10Base-T and 100Base-T, also use twisted-pair cables

Figure 7.7 *Coaxial cable*



Coaxial Cable

- A single copper conductor at its centre, encapsulated inside a plastic layer that provides insulation between the conductor and braided metal shield.
- The metal shield blocks any interface from the outside environment and is again protected by an outer shield of plastic material.
- Coaxial cable was widely used in analog telephone networks where a single coaxial network could carry 10,000 voice signals. Later it was used in digital telephone networks where a single coaxial cable could carry digital data up to 600 Mbps.
- It is used in 10Base2 and 10Base5 Ethernet and Cable TV
- Repeaters or Amplifiers required in every 1 to 10km

Fiber-Optic Cable

- An optical fiber cable consists of three concentric sections: the core, the cladding, and the jacket
- The core consists of one or more very thin strands, or fibers, made of glass or plastic
- A glass or plastic core is surrounded by a cladding of less dense glass or plastic.
- Beam of light moving through the core is reflected off the cladding instead of being refracted into it
- AT&T has developed a fiber transmission system that achieves a data rate of 3.5 Gbps over a distance of 318 km without repeaters

- Optical fiber systems are not affected by external electromagnetic fields
- The SONET network achieved data transfer rate of 1600 Gbps.
- Local-area networks such as 100Base-FX network (Fast Ethernet) and 1000Base-X also use fiber-optic cable
- The telephone network is going to replace his coaxial cable by fiber optic cable

Un-Guided Media

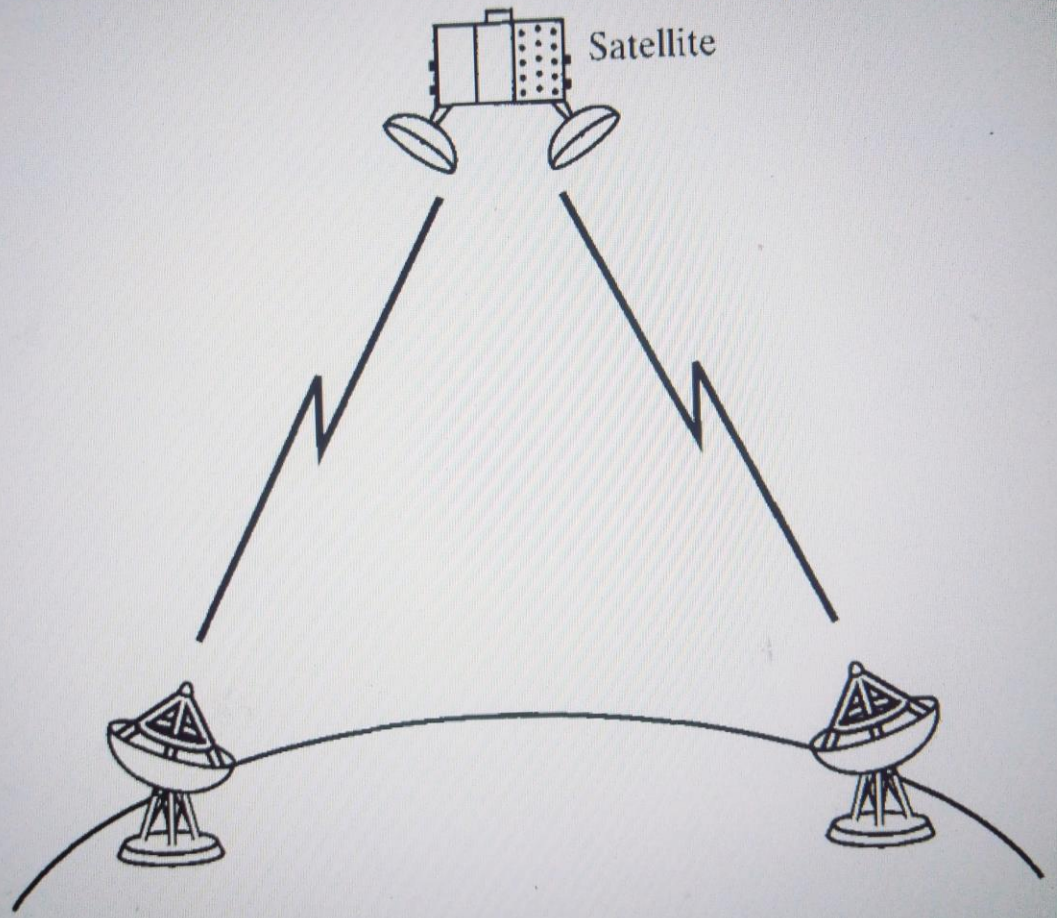
Terrestrial Microwaves

- For unguided media, transmission and reception are achieved by means of an antenna
- Microwave antennas are usually located at substantial heights above ground level in order to transmit over intervening obstacles.
- To achieve long-distance transmission, a series of microwave relay towers is used
- Common frequencies used for transmission are in the range 2 to 40 GHz.

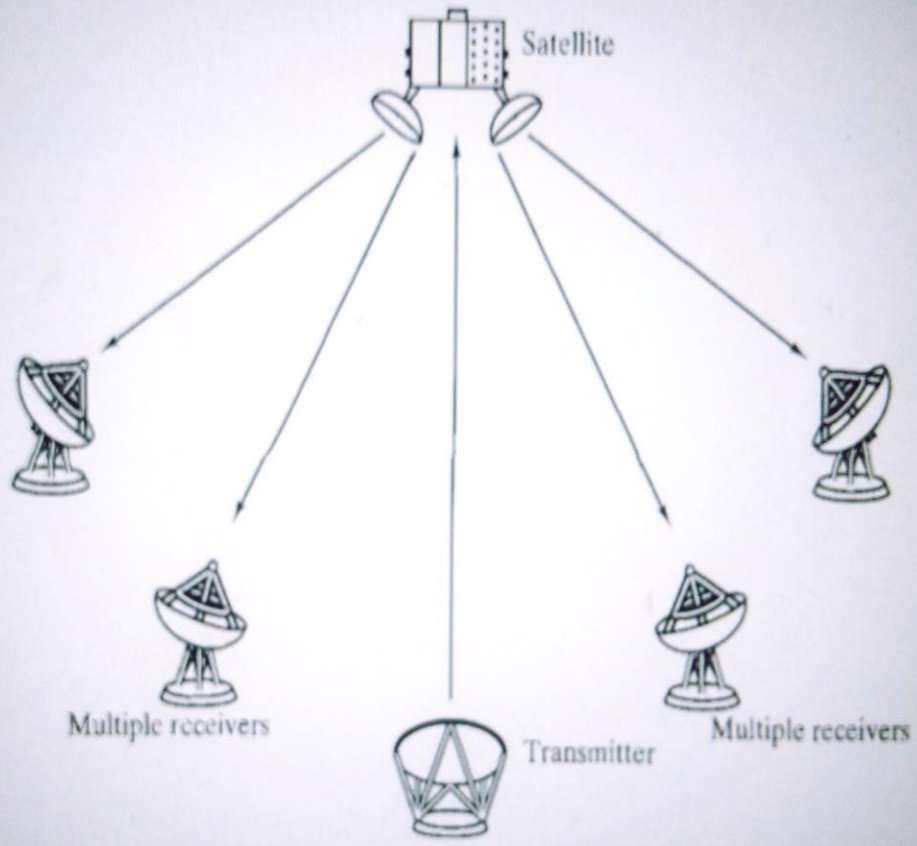
- The data rate provided by micro wave is 12Mbps to 274Mbps
- Repeaters or amplifiers, then, may be placed farther apart for microwave systems-10 to 100 km is typical
- Attenuation increases with rainfall, the effects of which become especially noticeable above 10 GHz

Satellite Microwave

- A communication satellite is, in effect, a microwave relay station
- It is used to link two or more ground-based microwave transmitter/receivers, known as earth stations, or ground stations.
- The satellite receives transmissions on one frequency band (uplink), amplifies or repeats the signal, and transmits it on another frequency (downlink)
- it is generally required that it remain stationary with respect to its position over the earth; otherwise, it would not be within the line of sight of its earth stations at all times.



(a) Point-to-point link via satellite microwave



(b) Broadcast link via satellite microwave

FIGURE 3.4 Satellite communications configurations.

- To remain stationary, the satellite must have a period of rotation equal to the earth's period of rotation.
- This match occurs at a height of 35,784 km
- Among the most important applications for satellites are • Television distribution • Long-distance telephone transmission • Private business networks
- The optimum frequency range for satellite transmission is 1 to 10 GHz

Broadcast Radio

- The range 30 MHz to 1 GHz is an effective one for broadcast communications
- This range covers FM radio as well as UHF and VHF television
- Because of the longer wavelength, radio waves suffer relatively less attenuation

Infrared

- Infrared waves, with frequencies from 300 GHz to 400 THz (wavelengths from 1 mm to 770 nm), can be used for shortrange communication.
- Infrared waves, having high frequencies, cannot penetrate walls.
- The short-range communication system in one room cannot be affected by another system in the next room