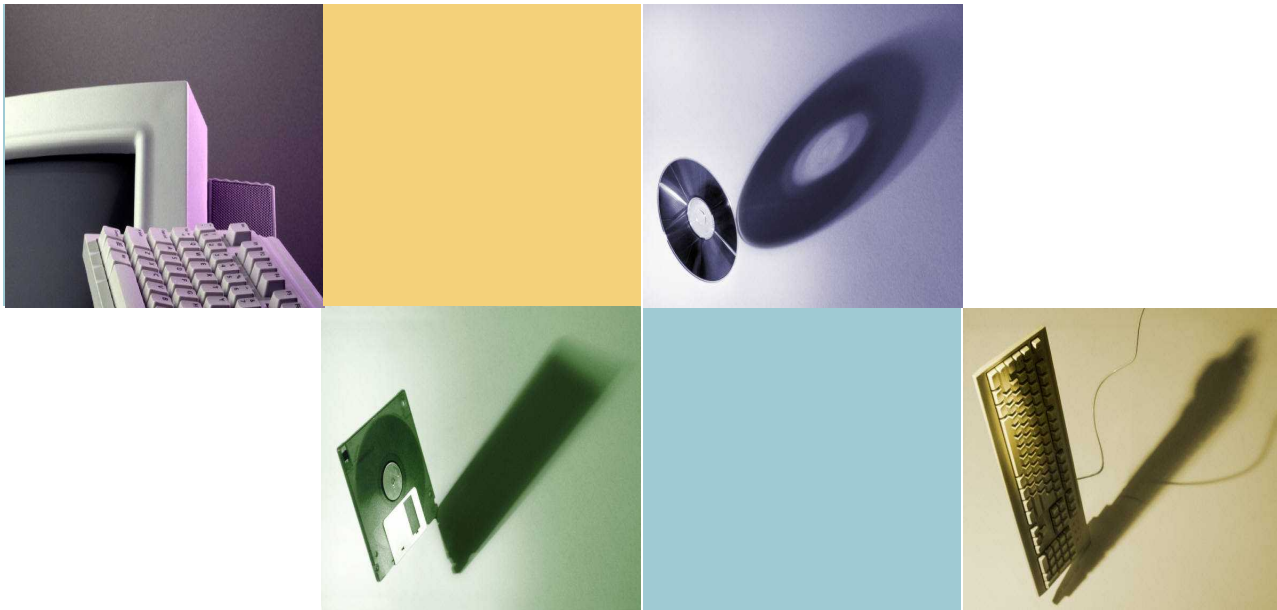


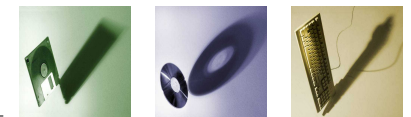
Physical Layer



Jaringan Komputer – Minggu ke-2

What is the Physical Layer

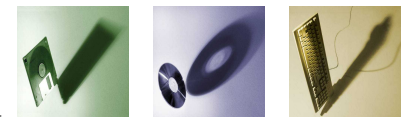
- The lowest layer of the OSI model
- Physical layer process the raw data stream, translating frame from data link into bits (electrical / optical / electromagnetic), and then send on the network. And vise versa
- In general perspective, physical layer = wire



Types of Medium

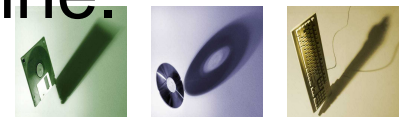
Medium can be classified into 2 categories.

- **Guided Media** : Guided media means that signals is guided by the prescence of physical media i.e. signals are under control and remains in the physical wire. For eg. copper wire.
- **Unguided Media** : Unguided Media means that there is no physical path for the signal to propogate. Unguided media are essentially electro-magnetic waves. There is no control on flow of signal. For eg. radio waves.



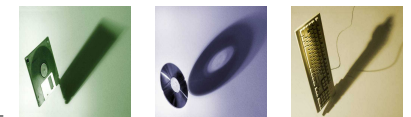
Communication Links

- **Simplex** : Communication can take place only in one direction. eg. T.V broadcasting.
- **Half-duplex** : Communication can take place in one direction at a time. Suppose node A and B are connected then half-duplex communication means that at a time data can flow from A to B or from B to A but not simultaneously. eg. two persons talking to each other such that when speaks the other listens and vice versa.
- **Full-duplex** : Communication can take place simultaneously in both directions. eg. A discussion in a group without discipline.



Links can be further classified as

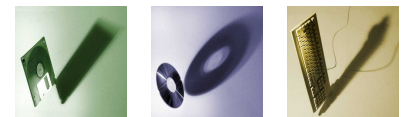
- **Point to Point** : In this communication only two nodes are connected to each other. When a node sends a packet then it can be received only by the node on the other side and none else.
- **Multipoint** : It is a kind of sharing communication, in which signal can be received by all nodes. This is also called broadcast.



Guided Transmission Media

In Guided transmission media generally two kind of materials are used.

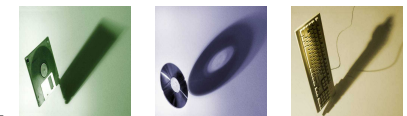
- Copper
 - Coaxial Cable
 - Twisted Pair
- Optical Fiber



Physical Characteristics of Wire

Three common physical elements

- Conductor : medium for the physical signal. ex : Copper ,glass/plastic fiber
- Insulation : protect conductor from “escaping” and “entering”
- Jacket. The outer sheath to protect conductor and insulation.
Material : PVC, Teflon



Physical Characteristics of Wire (cont..)

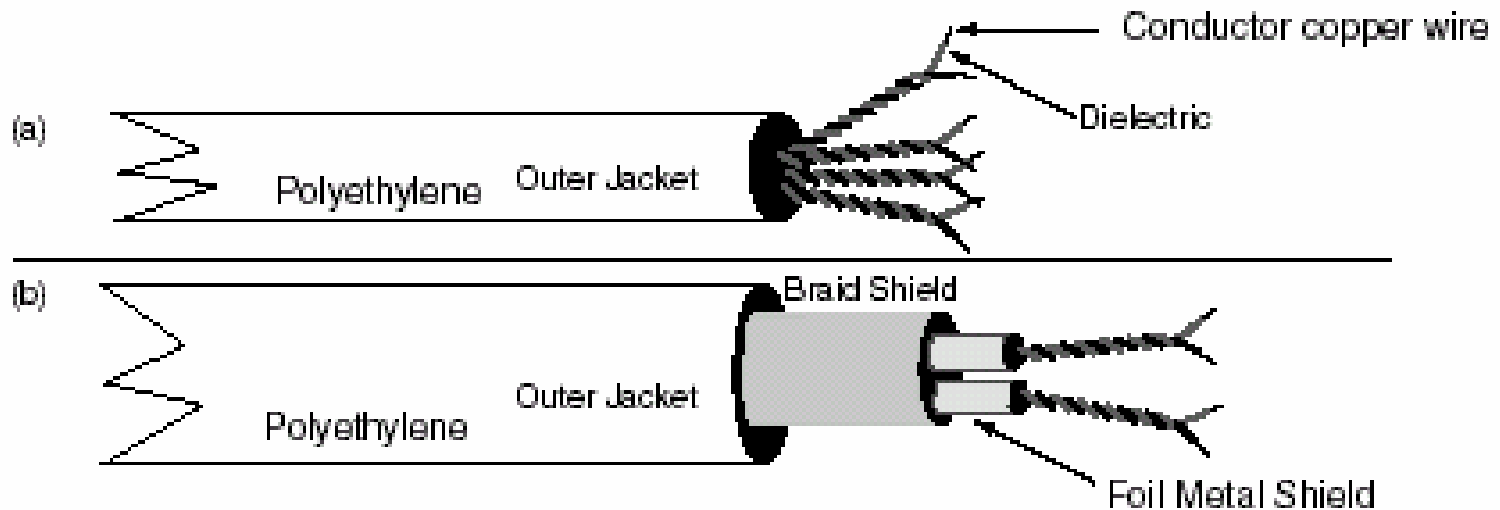
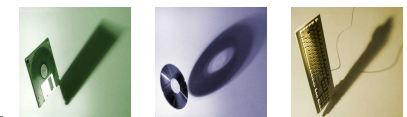


FIGURE 4.2 A UTP cable (a) and an STP cable (b). Pairs of wires are twisted around each other. One pair is used to transmit data; a second pair is used to receive data. Note the extra shielding in the STP cable.



Physical Characteristics of Wire (cont..)

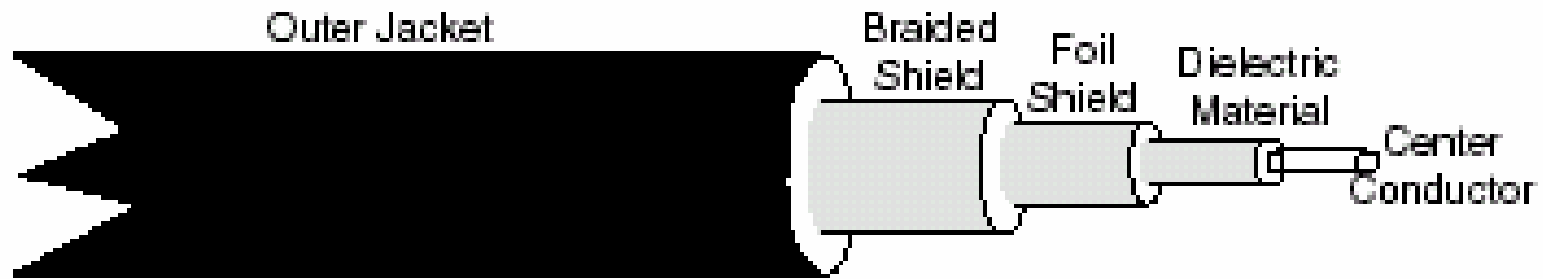
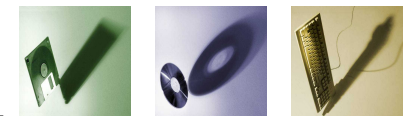


FIGURE 4.3 A coaxial cable typical of the types used in computer networks. Two layers of shielding provide protection against external noise and interference. The outer jacket protects the cable from the elements and may either be polyvinyl chloride (PVC) or Teflon; the latter is appropriate for cable runs in air plenums.



Physical Characteristics of Wire (cont..)

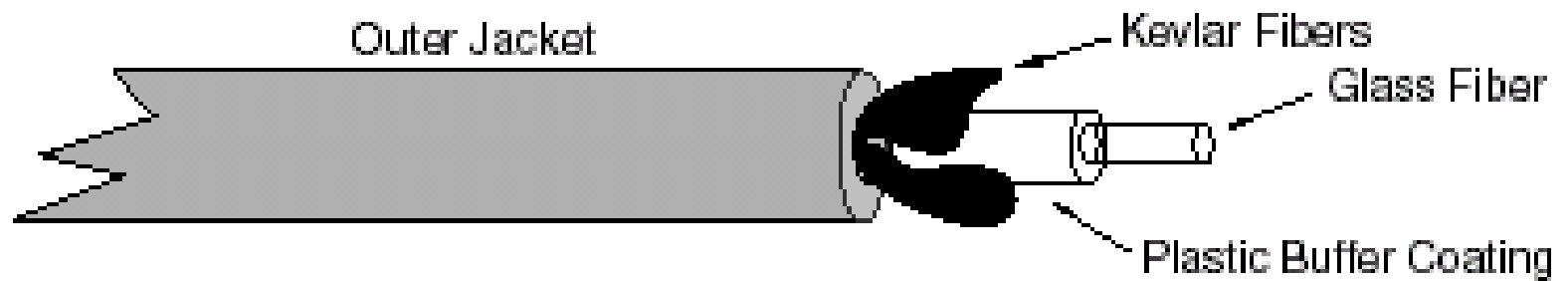
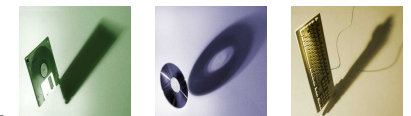


FIGURE 4.4 Fiber-optic cable consist of a glass fiber covered by plastic buffer coating and surrounded by kevlar fiber.

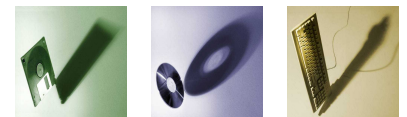


Electrical Characteristics of Wire

Three very important characteristics

- Capacitance :
= property of a circuit that permits it to store an electrical charge. Determine the ability to carry signal without distortion.

High quality cable has low capacitance. The lower the capacitance, the longer the signal can travel before signal distortion becomes unacceptable



Electrical Characteristics of Wire (cont..)

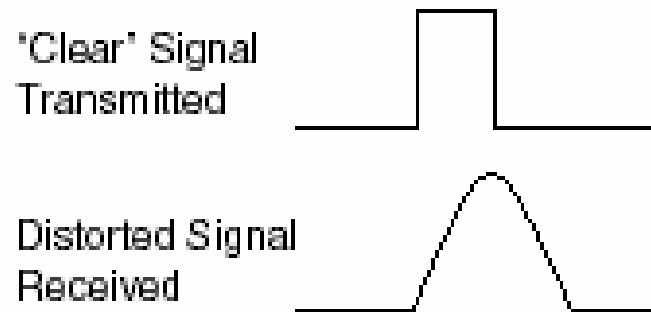
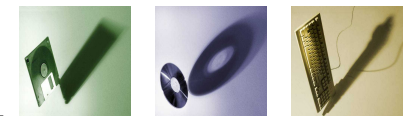
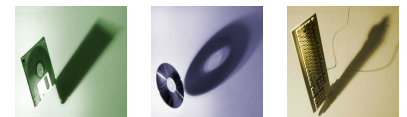


FIGURE 4.5 Capacitance eventually will distort a transmitted signal.



Electrical Characteristics of Wire (cont..)

- Impedance
= a measure of the opposition to the flow of electrical current. Measured in ohms (Ω)
- Attenuation
= the decrease in signal strength, which occurs as the signal travels through a circuit or a long cable. The longer the cable, the greater the attenuation



Electrical Characteristics of Wire (cont..)

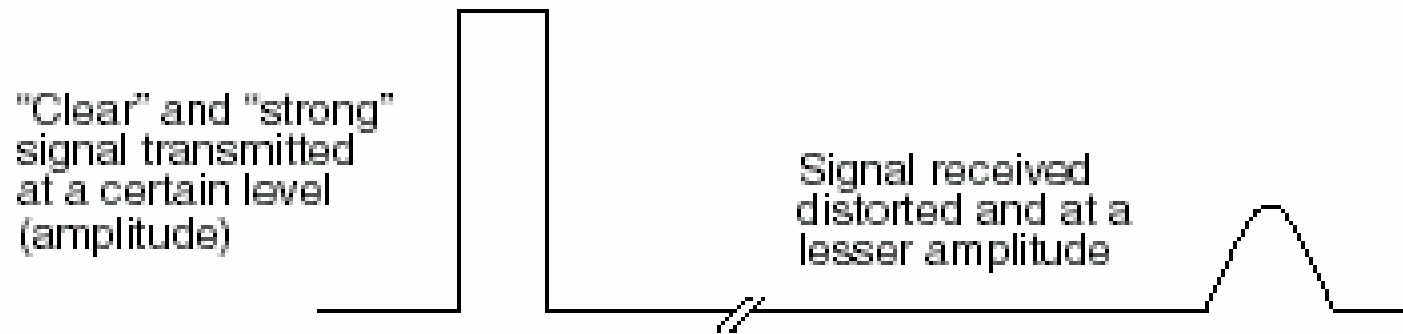
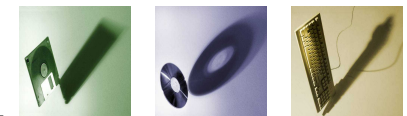


FIGURE 4.6 The combined effects of capacitance and attenuation result in a signal that is received distorted and weaker than what it was when transmitted. This can severely impact the performance of a network



Physical layer media (cont..)

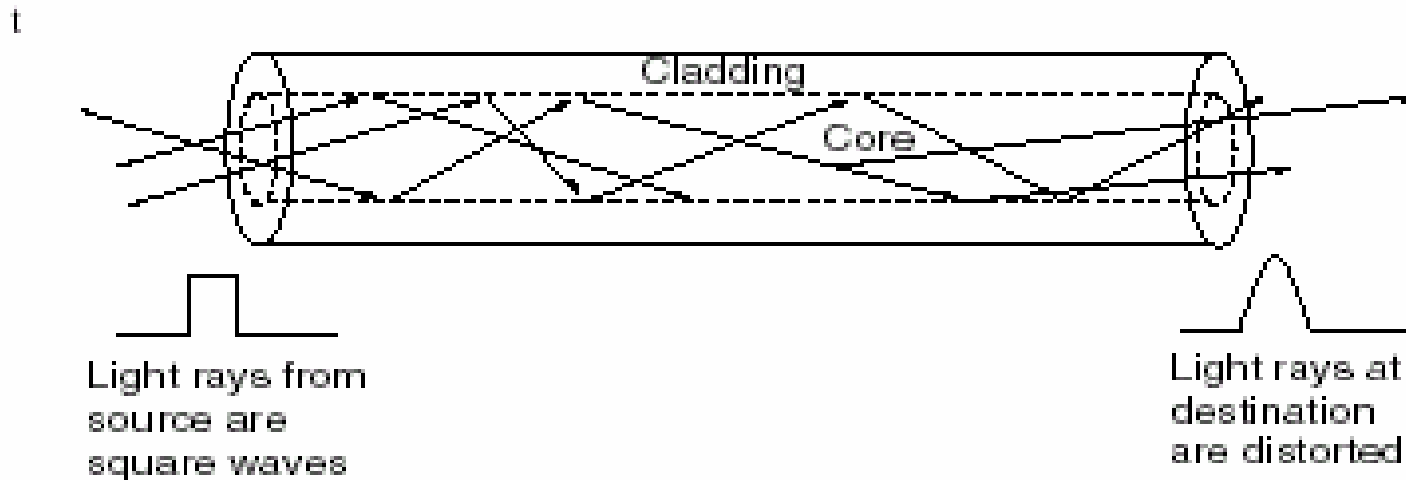
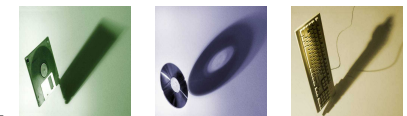


FIGURE 4.7 In multimode fiber, the distance light rays travel through a cable varies. Some rays travel longer distances from sending and receiving nodes; others travel shorter distances. The cladding layer reflects any stray light waves, causing signal distortion at the receiving end.



Physical layer media (cont..)

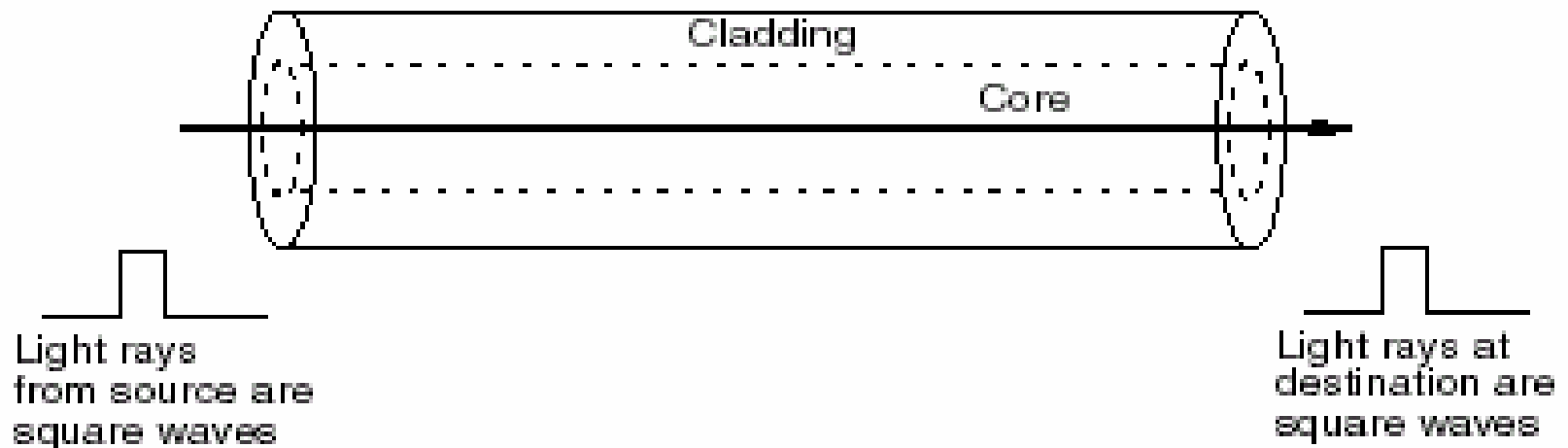
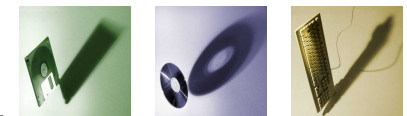
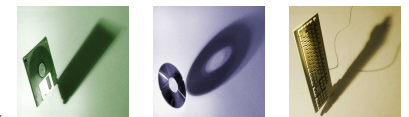


FIGURE 4.8 In single-mode fiber, all light rays travel the same distance from sending to receiving node. A direct consequence of this is no signal distortion at the receiving end, which results in higher bandwidth and lower attenuation per kilometer than multimode fiber. Single-mode fiber is the ultimate medium for long-distance connectivity.



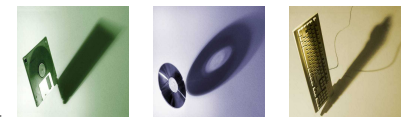
Wireless Transmission

- **Radio:** Radio is a general term that is used for any kind of frequency. But higher frequencies are usually termed as microwave and the lower frequency band comes under radio frequency. There are many application of radio. For eg. cordless keyboard, wireless LAN, wireless ethernet. but it is limited in range to only a few hundred meters.
- **Terrestrial microwave:** In terrestrial microwave two antennas are used for communication. A focused beam emerges from an antenna and is received by the other antenna, provided that antennas should be facing each other with no obstacle in between. For this reason antennas are situated on high towers. Due to curvature of earth terrestrial microwave can be used for long distance communication with high bandwidth. An advantage of wireless communication is that it is not required to lay down wires in the city hence no permissions are required.

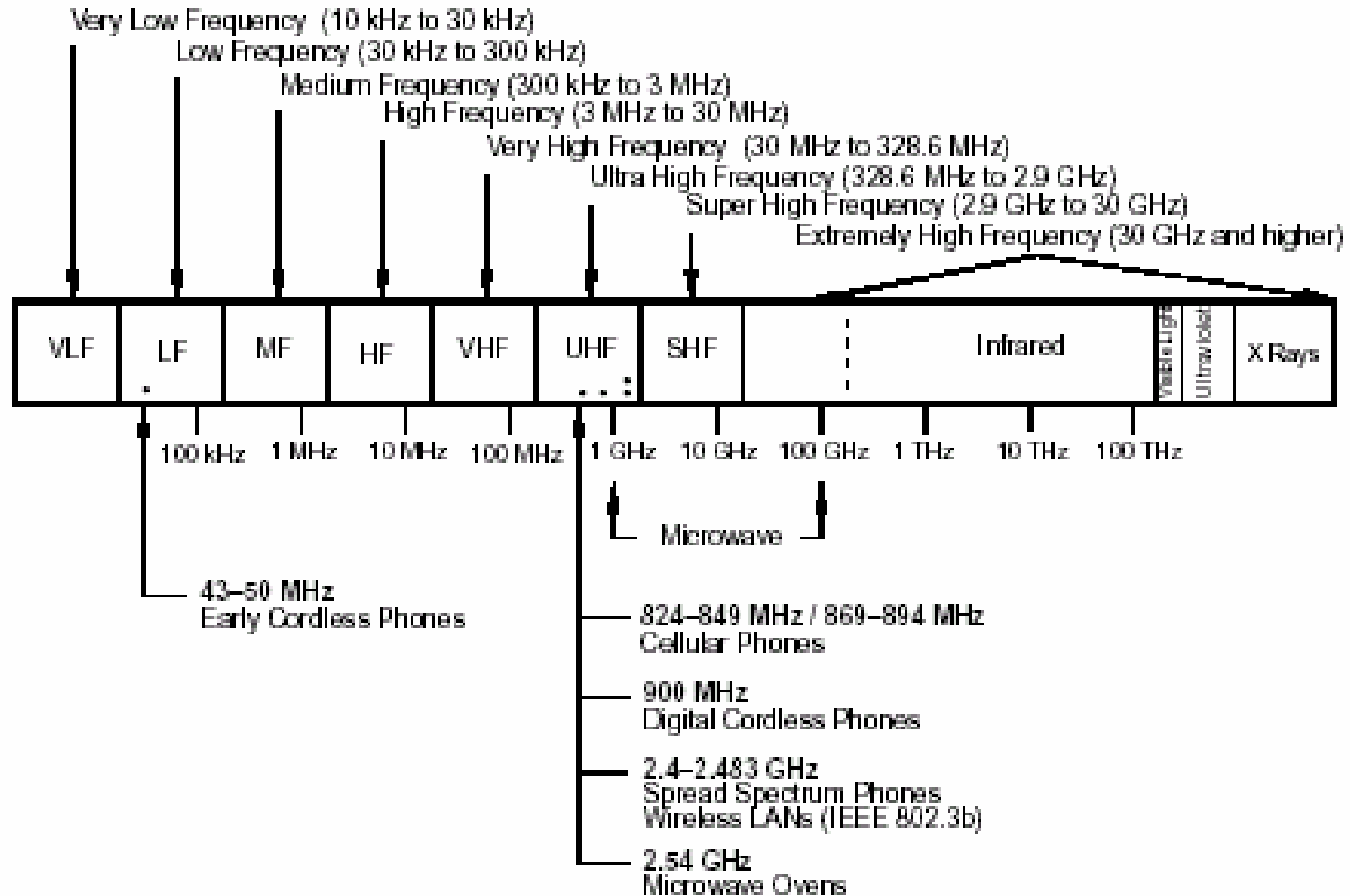


Wireless Transmission

- **Satellite communication:** Satellite acts as a switch in sky. On earth VSAT (Very Small Aperture Terminal) are used to transmit and receive data from satellite. Generally one station on earth transmits signal to satellite and it is received by many stations on earth. Satellite communication is generally used in those places where it is very difficult to obtain line of sight i.e. in highly irregular terrestrial regions. In terms of noise wireless media is not as good as the wired media. There are frequency band in wireless communication and two stations should not be allowed to transmit simultaneously in a frequency band. The most promising advantage of satellite is broadcasting. If satellites are used for point to point communication then they are expensive as compared to wired media.



Physical layer media (cont..)



Physical layer media (cont..)

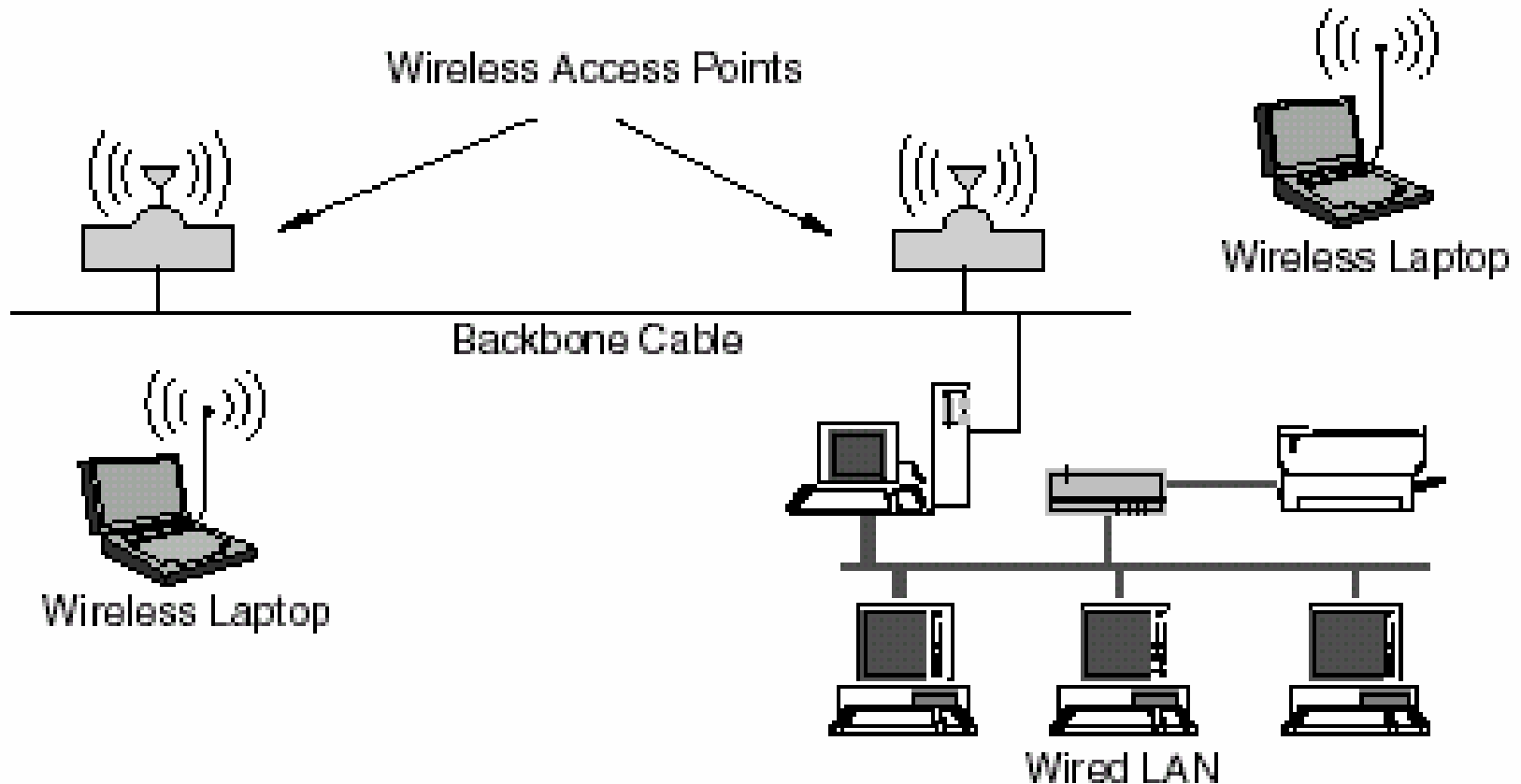
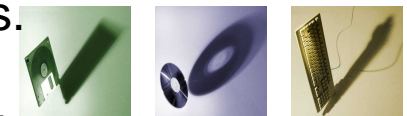


FIGURE 4.10 One example of a hybrid wireless environment. The “wireless access points” are directly connected to a backbone cable and serve as wireless repeaters for the wireless laptop computers. Completely wireless LANs also are possible



Physical layer hardware : Connector

- UTP Cable Connector

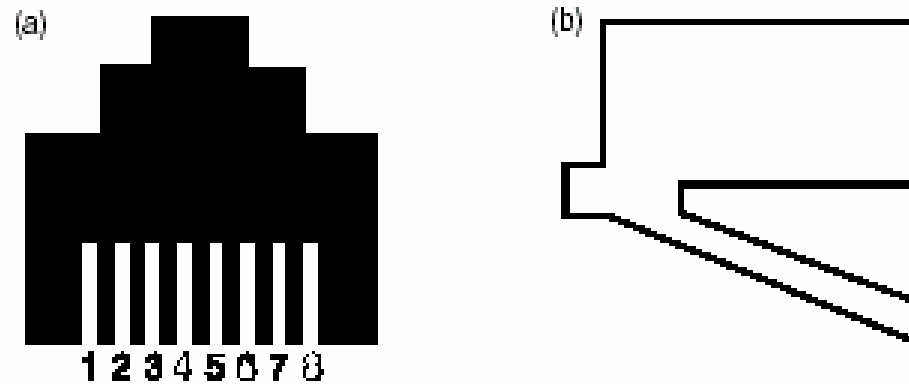
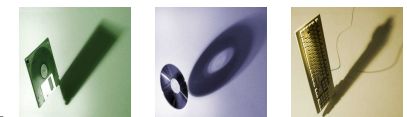


FIGURE 6.1 Top (a) and side (b) views of an RJ-45 connector. Formally known as eight-pin modular connectors, RJ-45s resemble standard telephone jacks and are used with UTP cable.



Physical layer hardware : Connector (cont..)

- Coaxial Cable Connector

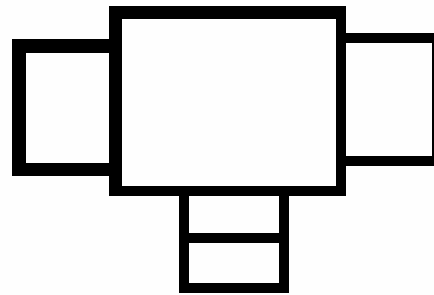
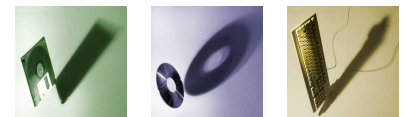


FIGURE 6.2 Example of a BNC T connector.



Physical layer hardware : Connector (cont..)

- Fiber-optic Cable Connector

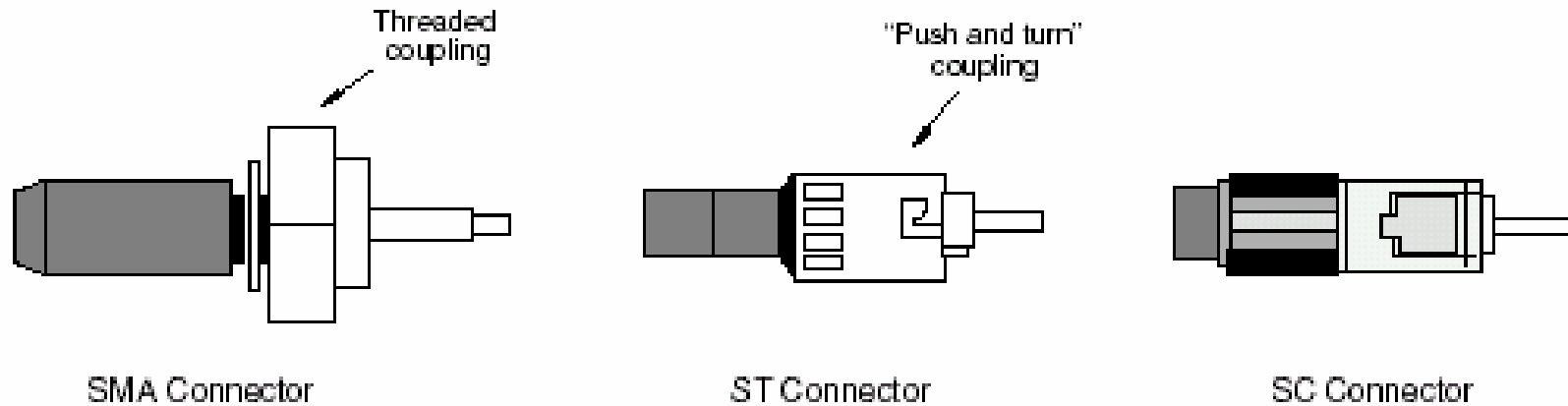


FIGURE 6.3 Examples of different types of fiber-optic cable connectors.

