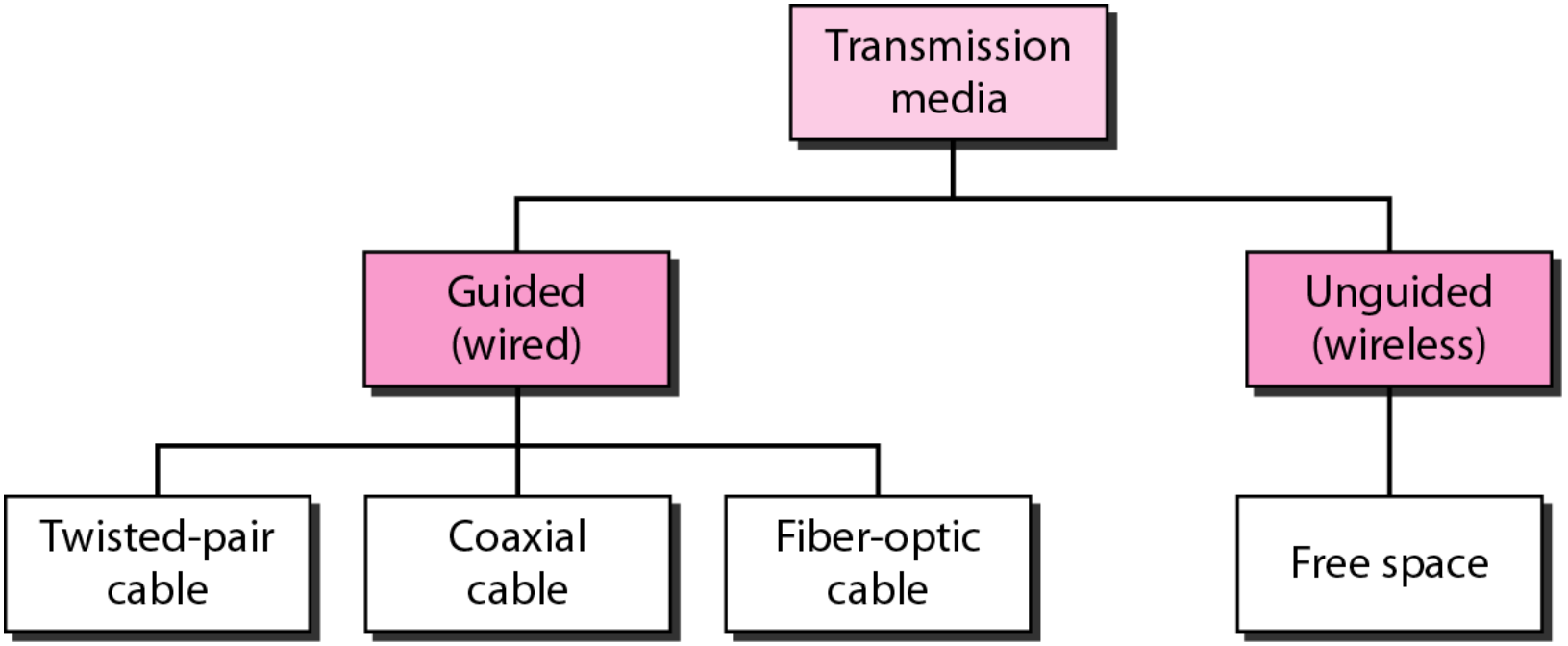
# Transmission media

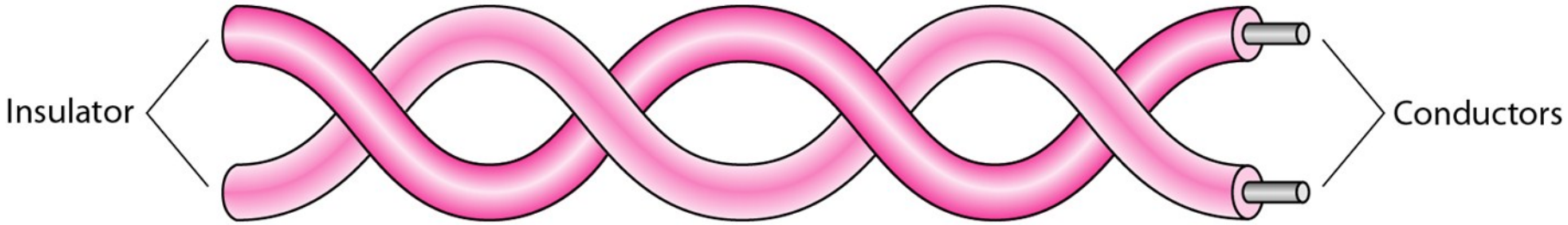
Transmission media is a pathway that carries the information from sender to receiver. We use different types of cables or waves to transmit data. Data is transmitted normally through electrical or electromagnetic signals.



# Guided Media

Guided media, which are those that provide a conduit from one device to another, include twisted-pair cable, coaxial cable, and fiber-optic cable.

# Twisted-pair cable




**Twisted pair** is the ordinary copper wire that connects home and many business computers to the telephone company. To reduce crosstalk or electromagnetic induction between **pairs** of wires, two insulated copper wires are **twisted** around each other.

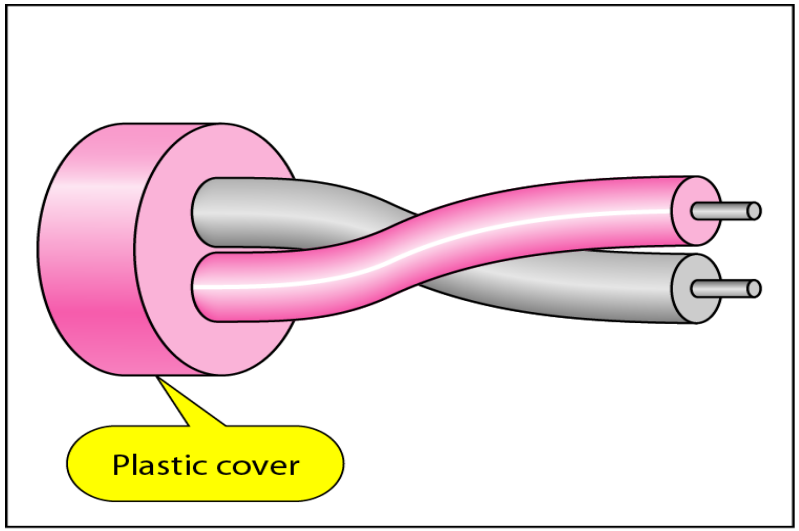
# STP and UTP

A **Twisted Pair** is a pair of copper wires, with diameters of 0.4-0.8 mm, twisted together and wrapped with a plastic coating. The twisting increases the electrical noise immunity, and reduces the bit error rate (BER) of the data transmission.

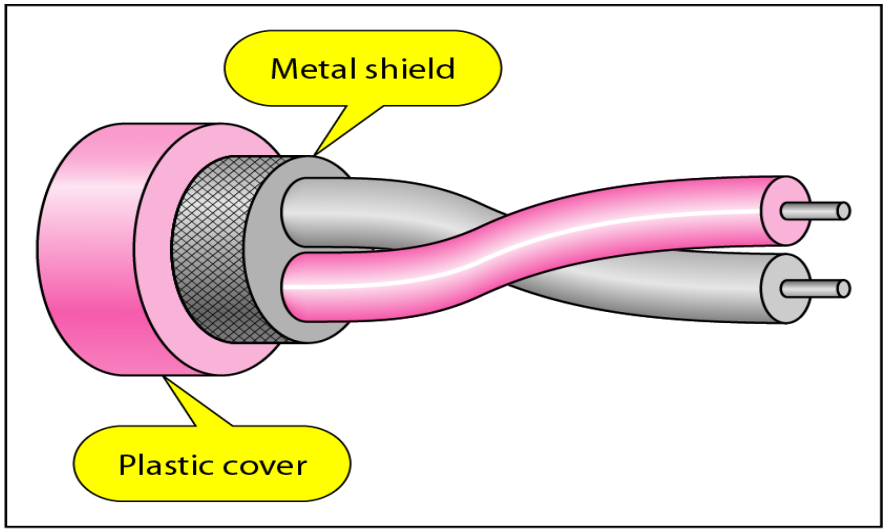
**UTP** is a very flexible, low cost media, and can be used for either voice or data communications. Its greatest disadvantage is the limited bandwidth, which restricts long distance transmission with low error rates.

**STP** is heavier and more difficult to manufacture, but it can greatly improve the signaling rate in a given transmission scheme. Twisting provides cancellation of magnetically induced fields and currents on a pair of conductors. Magnetic fields arise around other heavy current-carrying conductors and around large electric motors.

# UTP and STP cables




a. UTP




b. STP

- "STP" is masked and "UTP" does not.
- STP price higher than UTP.
- UTPS is more common in computer stores.
- STP is heavy use, while UTPS generally used for home and office.
- STP the maximum allowed bandwidth, UTP does not.

# Performance and Applications of Twisted –Pair Cable

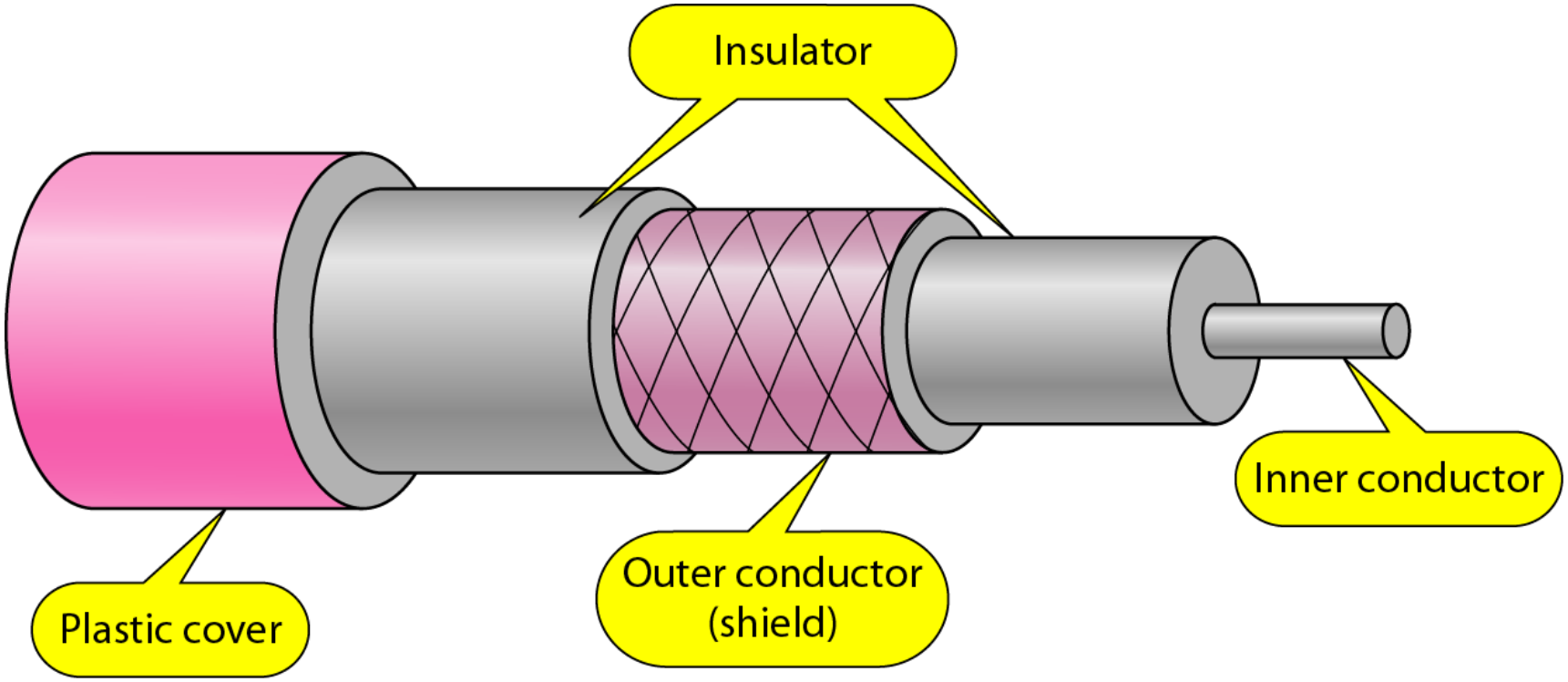
**Performance:**

One way to measure the performance of twisted-pair cable is to compare attenuation versus frequency and distance. A twisted-pair cable can pass a wide range of frequencies.

**Applications:**

Twisted-pair cables are used in telephone lines to provide voice and data channels. The DSL lines that are used by the telephone companies to provide high-data-rate connections also use the high-bandwidth capability of unshielded twisted-pair cables.

# Coaxial cable



# Performance and Applications of Coaxial Cable

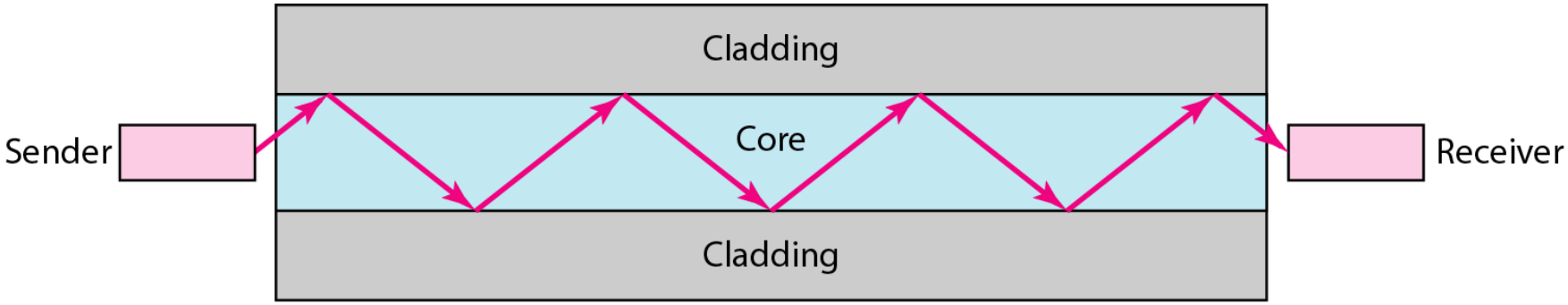
**Performance:**

Coaxial cable has a much higher bandwidth, the signal weakens rapidiy and requires the frequent use of repeaters.

**Applications:**

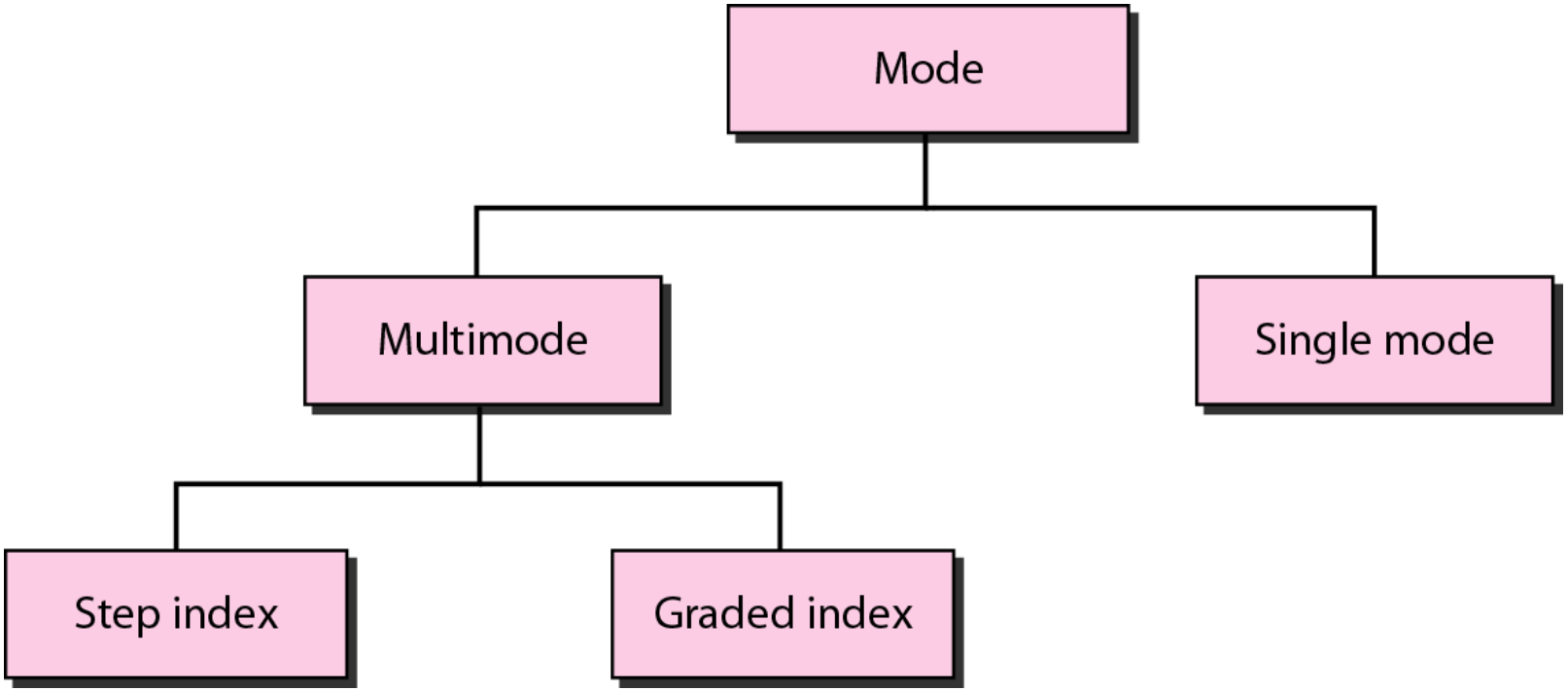
Cable TV networks use coaxial cables. In the traditional cable TV network, the entire network used coaxial cable. Later, cable TV providers replaced most of the media with fiber-optic cable. Another common application of coaxial cable is in traditional Ethernet LANs because of its high bandwidth.

# Optical fiber




**Optical fiber** is made of glass or plastic and transmits signals in the form of light. In fiber optic cable light only moves in one direction for two way communication to take place a second connection must be made between the two devices. It is actually two stands of cable. Each stand is responsible for one direction of communication. A laser at one device sends pulse of light through this cable to other device. These pulses translated into “1’s”and “0’s” at the other end.

# Propagation modes



# Propagation Modes

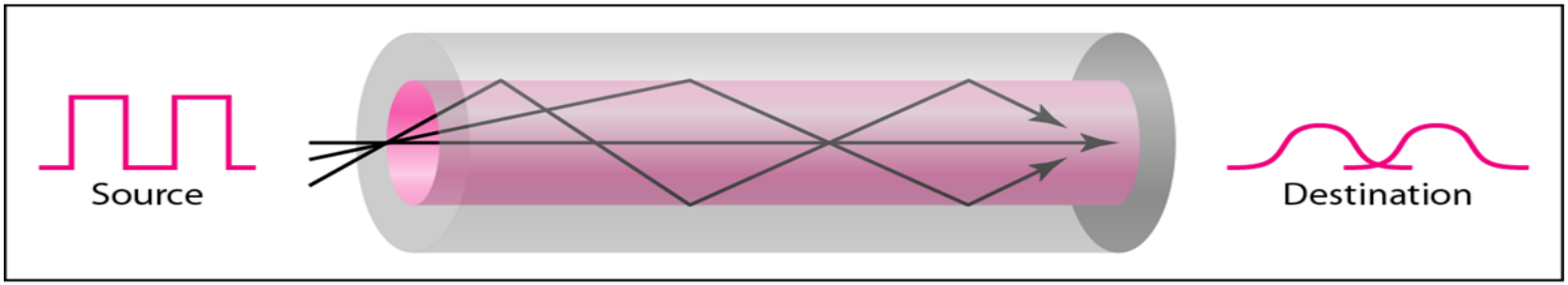
**Multimode**: It is so named because multiple beams from a light source move through the core in different paths. These beams move within the cable depends on the structure of the core.

**Multimode Step-index Fiber**: The density of the core remains constant from the center to the edges. A beam of light moves through this constant density in a straight line until it reaches the interface of the core and the cladding. At the interface, there is an abrupt change due to a lower density; this alters the angle of beam's motion. The term step-index means the suddenness of change contributes the distortion of the signal.

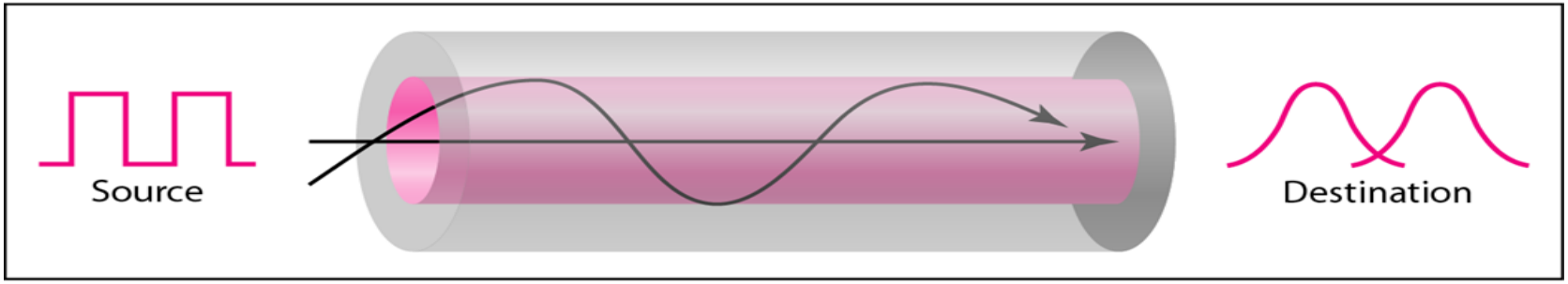
**Multimode Graded-index Fiber**: It decreases this distortion of the signal through the cable. The word index here refers to the index of refraction. A graded-index fiber is one with varying densities. Density is highest at the center of the core and decreases gradually to its lowest at the edge.

**Single-Mode:** Single mode uses step-index fiber and a highly focused source of light that limits beams to a small range of angles, all close to the horizontal. It is manufactured with a much smaller diameter than that of multi-mode fiber, and substantially lower density.

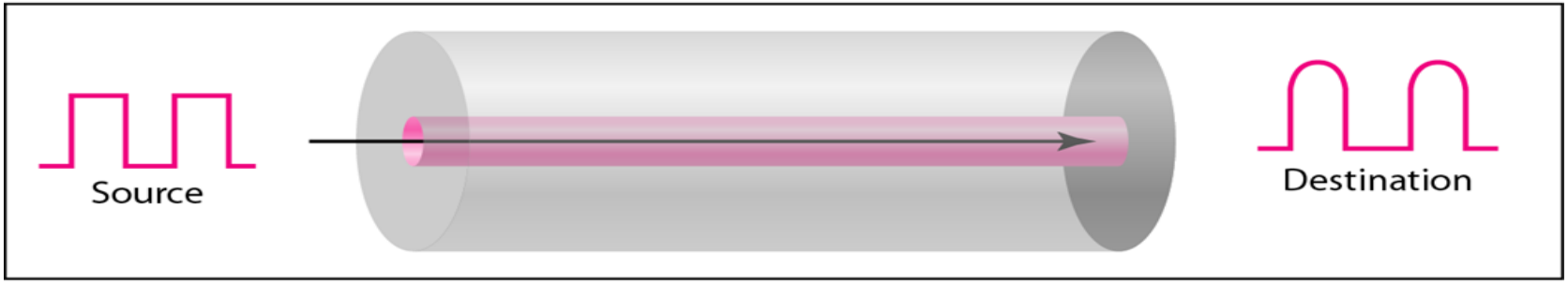
# Propagation modes




a. Multimode, step index




b. Multimode, graded index




c. Single mode

# ADVANTAGES OF OPTICAL FIBRES

- Not affected by electrical and magnetic interference as the data travel in for of light.
- **higher bandwidth**
- Thin, lighter , small in size
- Can easily be grouped in one bundle.
- Glass can be laid in different environments.
- **Attenuation** is very low. Attenuation =10 log 10 transmitted power/receieved power. It is measured in decibels.
- Provide Security against wire tappers as they do not leak light
- No cross-talk problem.
- Lower cost as material used in them silica glass is easily available.
- Information carrying capacity is much higher.
- Transmission rate:45 mb/s to 9.6 gb/s

# DISADVANTAGES OF OPTICAL FIBER

- **Fragile**

  *More easily broken than wires.*

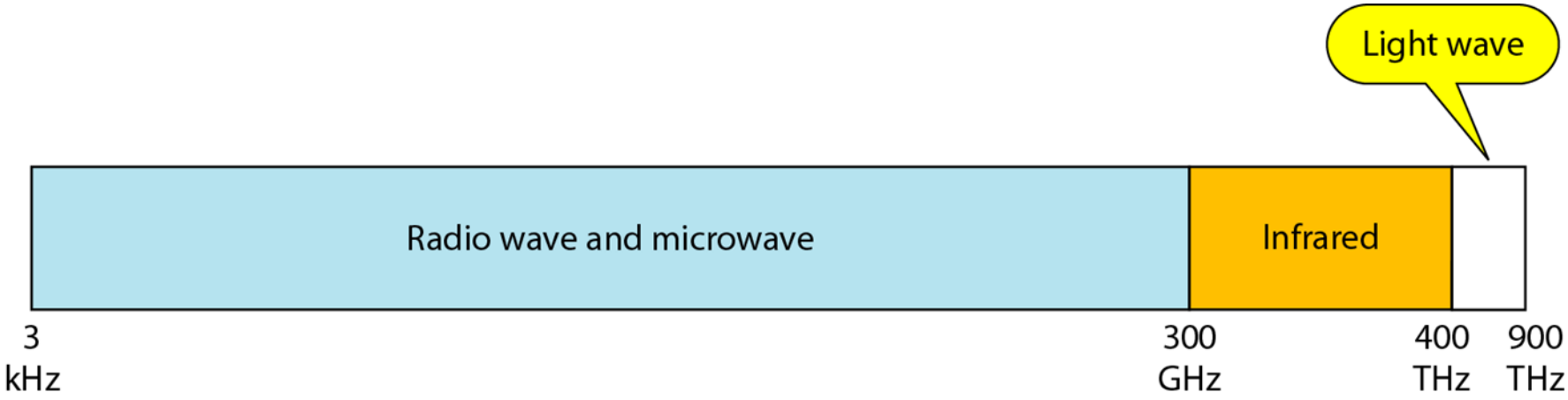
  *Need to be put deep into land. Causes lot of installation cost.*

- ***Being new in technology require skilled people for administration and maintenance***
- ***Optical fibers are unidirectional for two –way communication, two fibers are required.***

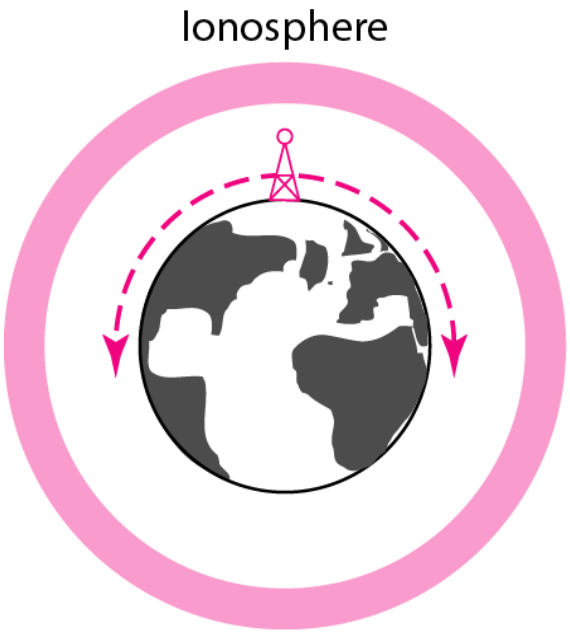
# Unguided Media: Wireless

Electromagnetic waves do not require a medium to propagate. This means that electromagnetic waves can travel not only through air and solid materials, but also through the vacuum of space.

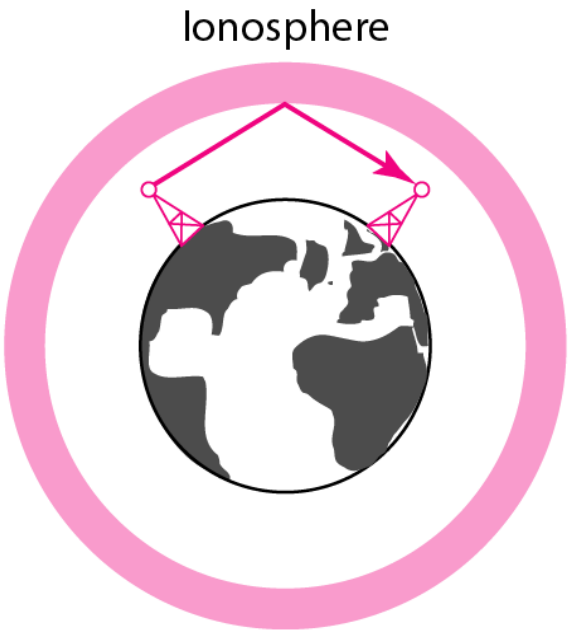
Unguided media transport electromagnetic waves without using a physical conductor. This type of communication is often referred to as wireless communication.



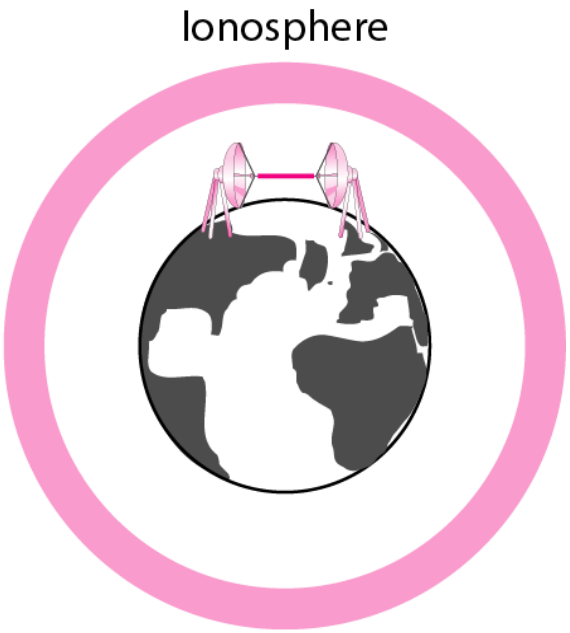
# Propagation methods




Ground propagation
(below 2 MHz)




Sky propagation
(2–30 MHz)




Line-of-sight propagation
(above 30 MHz)

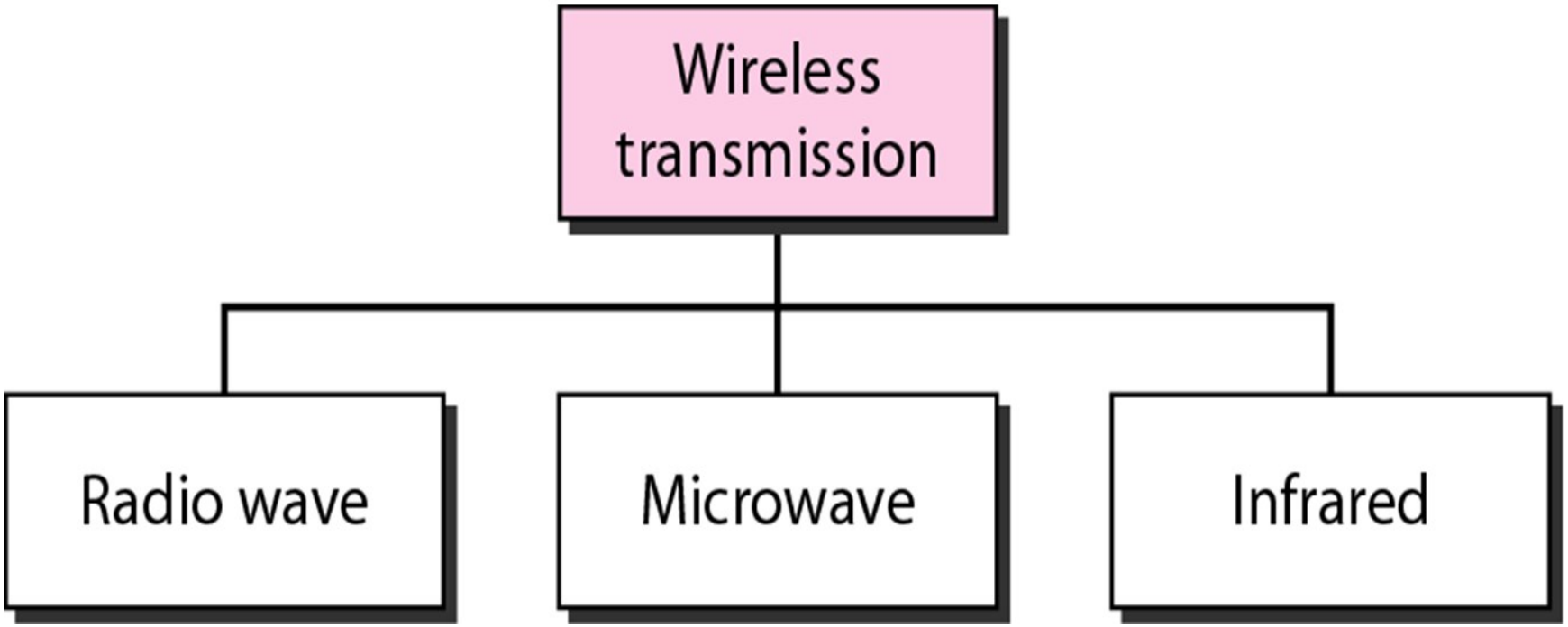
# Propagation methods

**In ground propagation,** radio waves travel through the lowest portion of the atmosphere, hugging the earth. These low-frequency signals emanate in all directions from the transmitting antenna and follow the curvature of the planet. Distance depends on the amount of power in the signal: The greater the power, the greater the distance.

**In sky propagation,** higher-frequency radio waves radiate upward into the ionosphere (the layer of atmosphere where particles exist as ions) where they are reflected back to earth. This type of transmission allows for greater distances with lower output power.

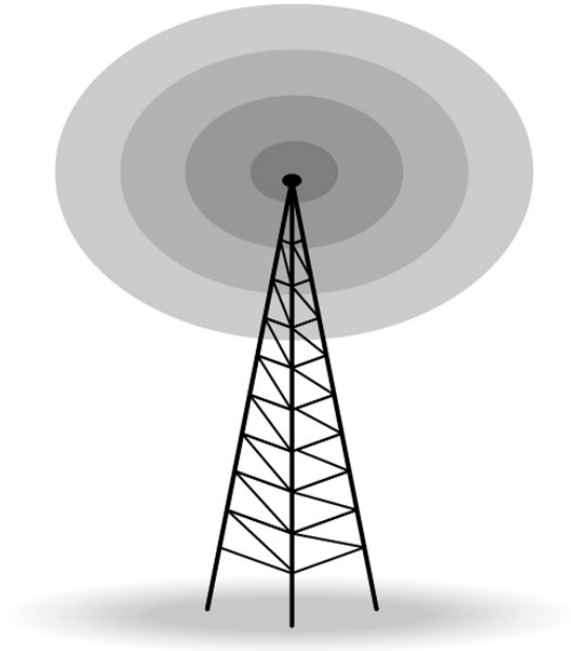
**In line-of-sight propagation,** very high-frequency signals are transmitted in straight lines directly from antenna to antenna. Antennas must be directional, facing each other. Line-of-sight propagation is tricky because radio transmissions cannot be completely focused.

# Wireless transmission waves



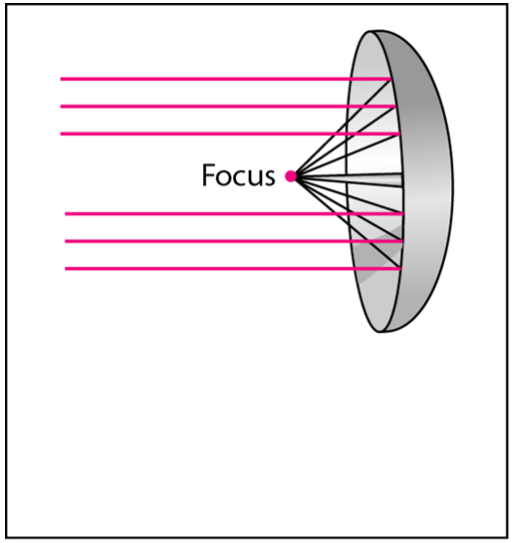
# Radio Waves

- Radio waves are used for multicast communications, such as radio and television, and paging systems.
- They can penetrate through walls.
- Highly regulated.
- Use omni directional antennas

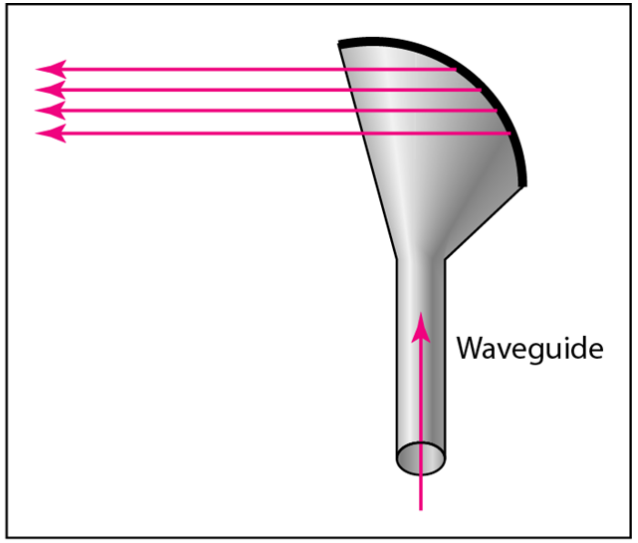


# Microwaves

- Microwaves are used for unicast communication such as cellular telephones, satellite networks, and wireless LANs.
- Higher frequency ranges cannot penetrate walls.
- Use directional antennas - point to point line of sight communications.



a. Dish antenna



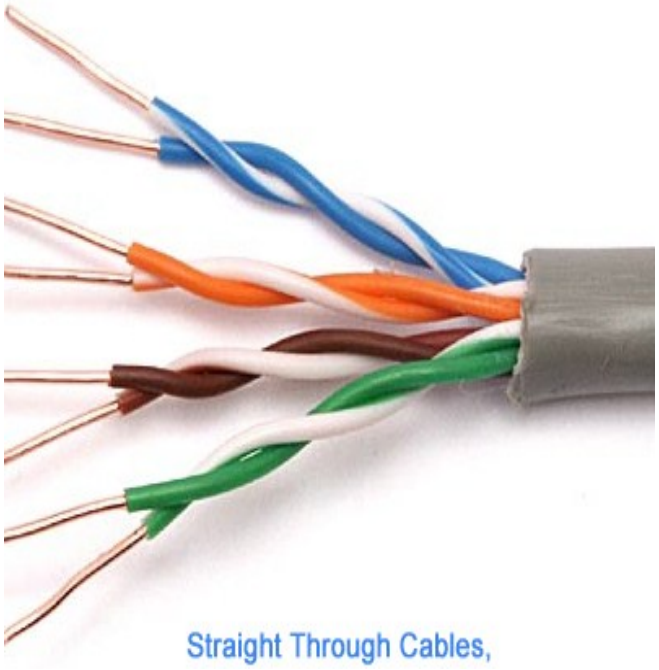
b. Horn antenna

# Infrared Signals

- Infrared signals can be used for short-range communication in a closed area using line-of-sight propagation.
- It allows computing devices to communicate via short-range wireless signals.
- With infrared, computers can transfer files and other digital data bidirectionally.
- The infrared transmission technology used in computers is similar to that used in consumer product remote control units.

# Straight Through Cable

Straight Through Cables, as the name signifies are used for linking dissimilar devices. Straight Through Cable is used for connecting a LAN port to a computer, hub or switch. It is an 8 wired patch cable. It is also used when connecting a PC to a switch and also for connecting router to a hub, or a printer to the router etc. Its main purpose is to connect a host to the client.



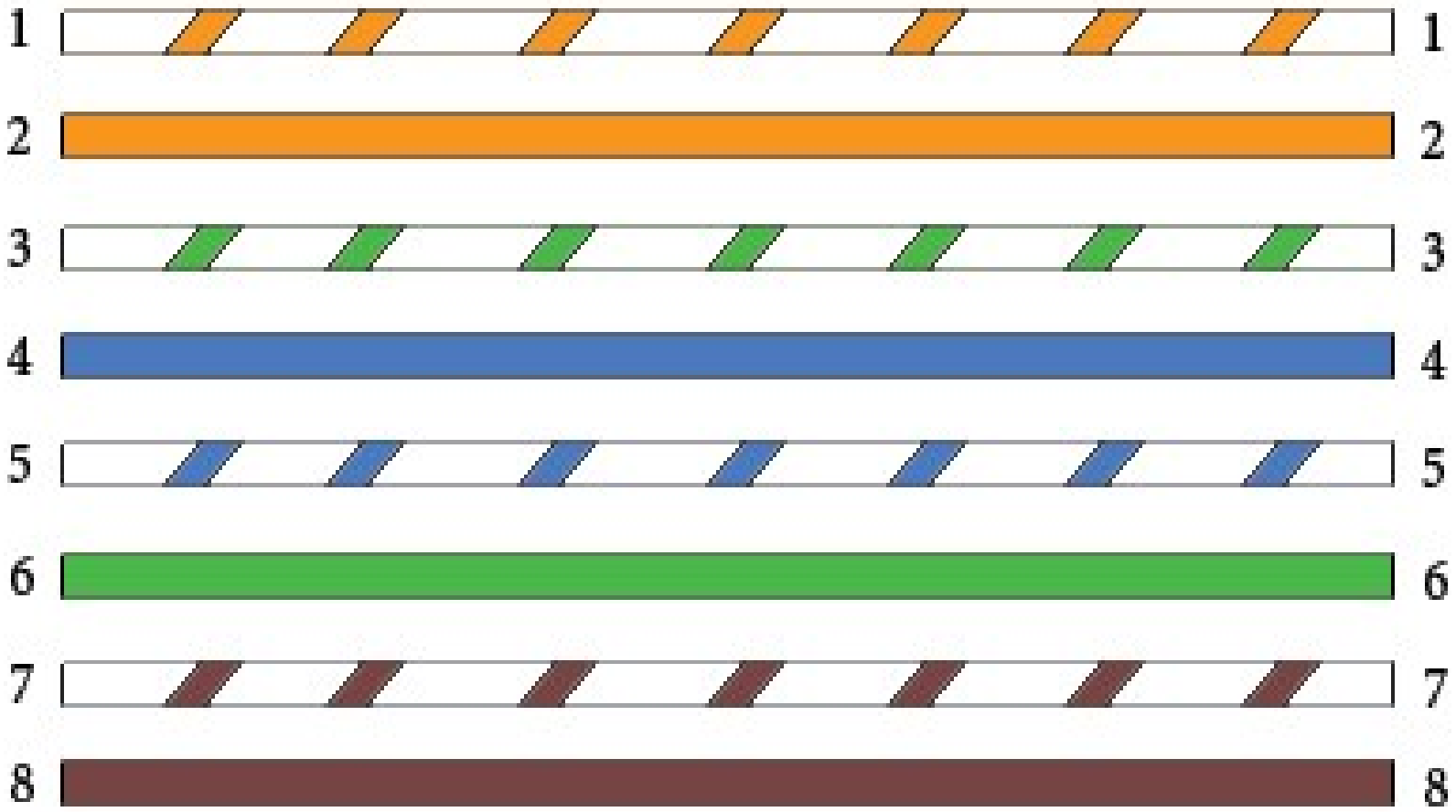
Straight Through Cables,

Use a straight-through cable when:

1. Connecting a router to a hub
2. Connecting a computer to a swtich
3. Connecting a LAN port to a switch, hub, or computer

# Straight Through Wiring Guide

## 568-B



# Crossover Cable

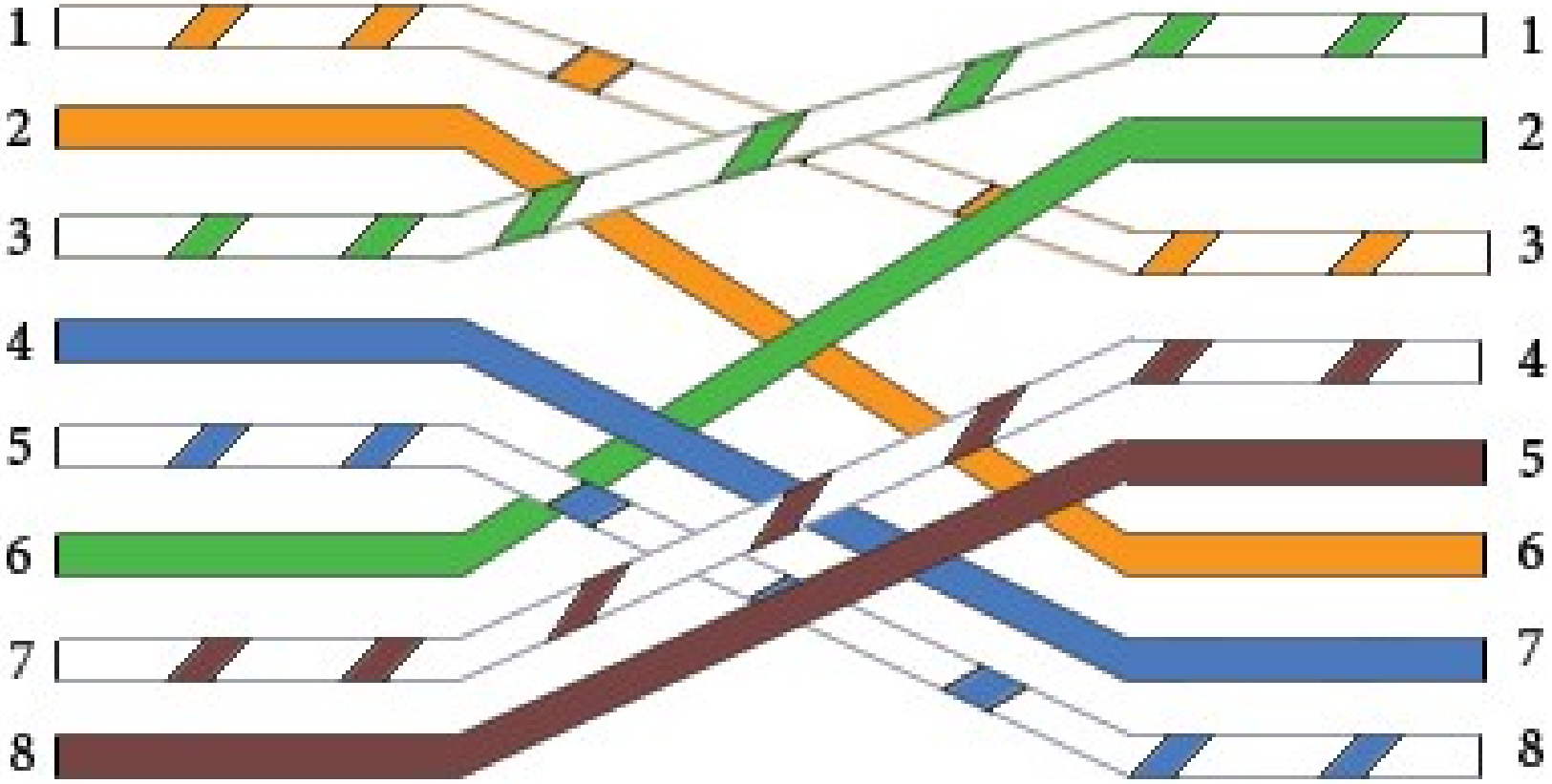
Crossover Cables are planted to connect two hosts together. The cables are crossed wired to let the two computers or hosts get connected directly. It can also be said that primarily Crossover Cables are used when like or same devices are intended to be connected. The pairs of wires crisscross each other which makes the communication path for the two devices to communicate at the same time.

Crossover Cables

Use a crossover cable when:

1. Connecting a computer to a router
2. Connecting a computer to a computer
3. Connecting a router to a router
4. Connecting a switch to a switch
5. Connecting a hub to a hub

# Crossover Wiring Guide
## 568-B



# Rollover Cable

Rollover wired Cables connects any device or a computer terminal to a network switch console port. The cables connected in a rolling manner are not responsible for the connectivity of the network or transmitting data rather they only establish an interface with the device.

Rollover wired Cables

# Rollover Wiring Guide
## 568-B