

Twisted Pair Cable

- Twisted pair is the simplest, oldest and low priced cable medium.
- It is made up of two insulated copper wires, typically, twisted around each other in a continuous spiral.
- The purpose of twisting the wires is to reduce electrical interference (or noise) from similar pairs close by.
- Twisted pairs can run several kilometres without amplification, but for longer distances repeaters are needed.

CATEGORY

The twisted pair cable can be broadly categorized into the

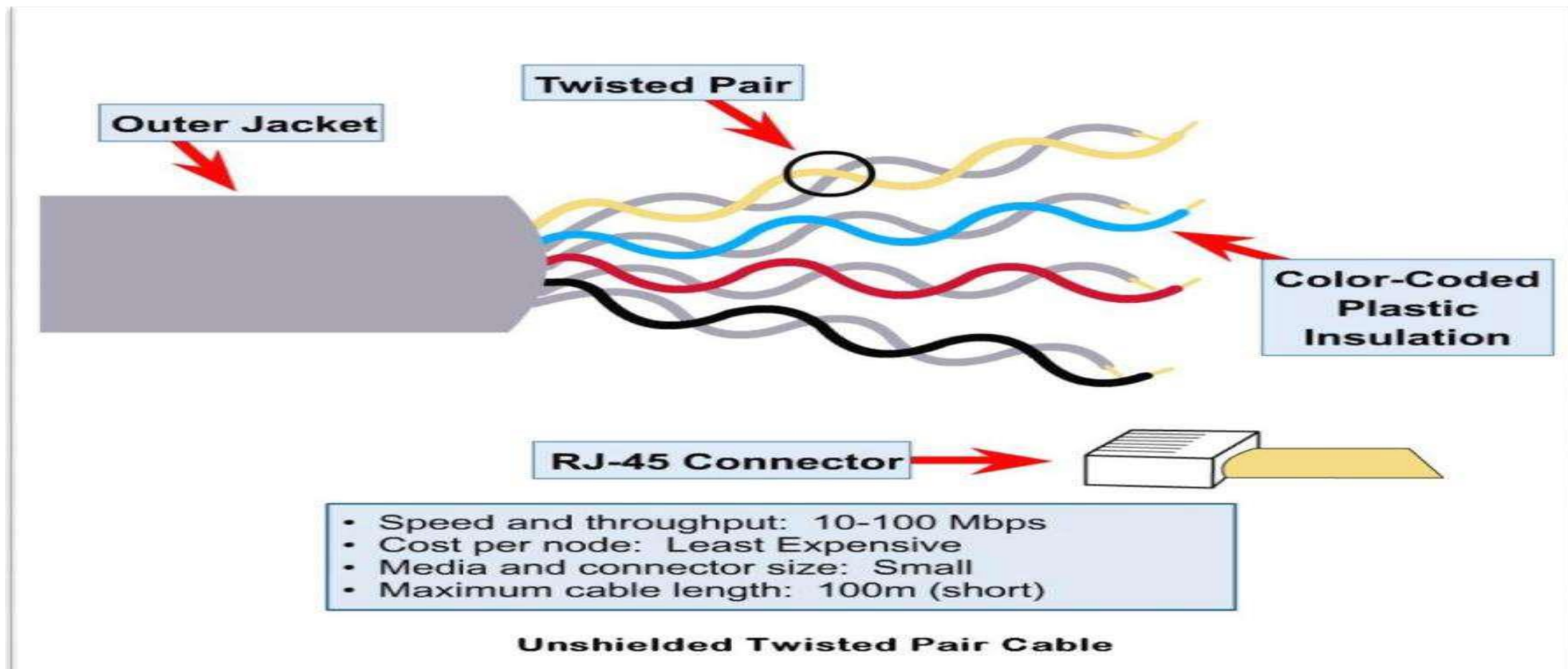
Two types:

- Unshielded Twisted Pair (UTP) Cable
- Shielded Twisted Pair (STP) Cable

Unshielded Twisted Pair (UTP) Cable

- Unshielded Twisted Pair (UTP) is the most common type of twisted pair cable used in telecommunication networks.
- The UTP consists of two copper conductors, each having their own insulating material (e.g. plastic), intertwined with each other to cancel induced current.
- The reason for placing twist in the pair of wires is to minimize the vulnerability of the twisted pair cable to external electrical noise.
- Its frequency range is suitable for data transmission as well as voice transmission (100 Hz-5 MHz).

Unshielded Twisted Pair (UTP) Cable



EIA CATEGORY

- The Electronic Industries Association (EIA) has developed
- five standards or categories for UTP :
 - Category -1
 - Category - 2
 - Category - 3
 - Category - 4
 - Category - 5

Category -1

- This category is used for voice
- transmission and it is basically used in
- telephone systems.
- It is efficient only for low speed data
- transmission.

Category - 2

- This category is used for voice
- transmission, but it is equally preferred for
- data transmission of upto 4 mbps

Category - 3

- This category is used for data
- transmission because it provides high
- bandwidth to achieve high data transfer rates.
- It is standard cable for most telephone systems.

Category - 4

- Provides much higher data transfer rate of 16 mbps.

Category – 5

Provides a maximum data transfer rate of 100 mbps.

For unshielded twisted pair generally RJ45

connectors are used.

Category 6

- A Category 6 cable (Cat 6 cable) is a type of twisted pair cable standard used specifically in gigabit (Gb) Ethernet-based computer networks. In 2002, it was jointly defined and specified by the Electronics Industries Association and Telecommunication Industries Association (EIA/TIA).
- The Cat 6 cable is fully backward compatible with previous versions, such as the Category 5/5e and Category 3 cabling standards.

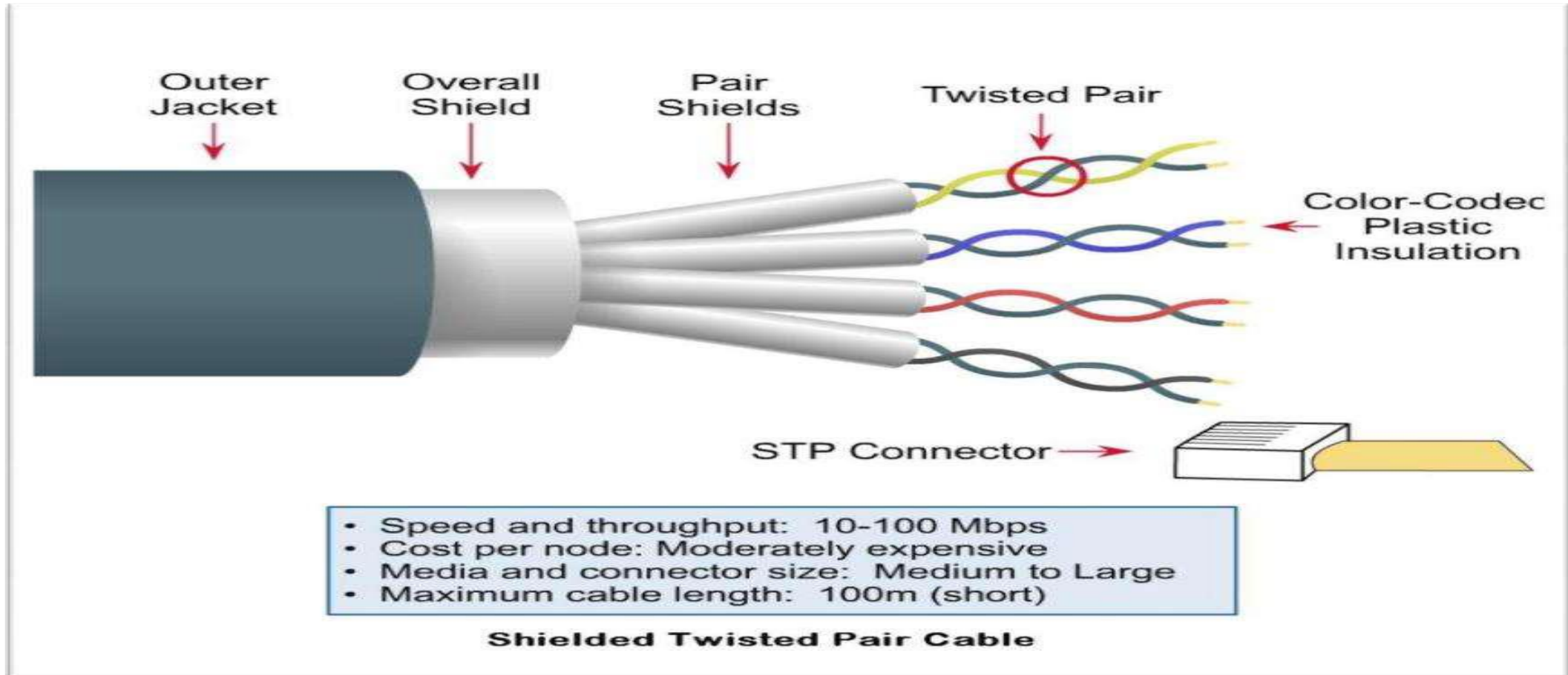
Advantages

- The advantages of UTP are its low cost,
- It is easy to installation procedure.
- It is basically used in LAN implementations

Shielded Twisted Pair (STP) Cable

- In Shielded Twisted Pair cable, each pair of insulated conductors is encased in a metal shield to prevent Crosstalk.
- The quality aspect of shielded twisted pair is same as the unshielded twisted pair but the shield must be connected to ground.

Shielded Twisted Pair (STP) Cable



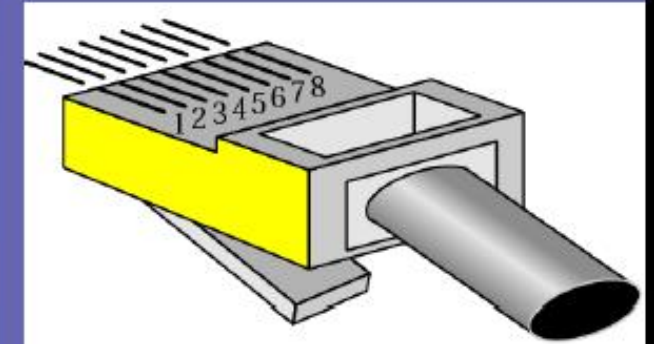
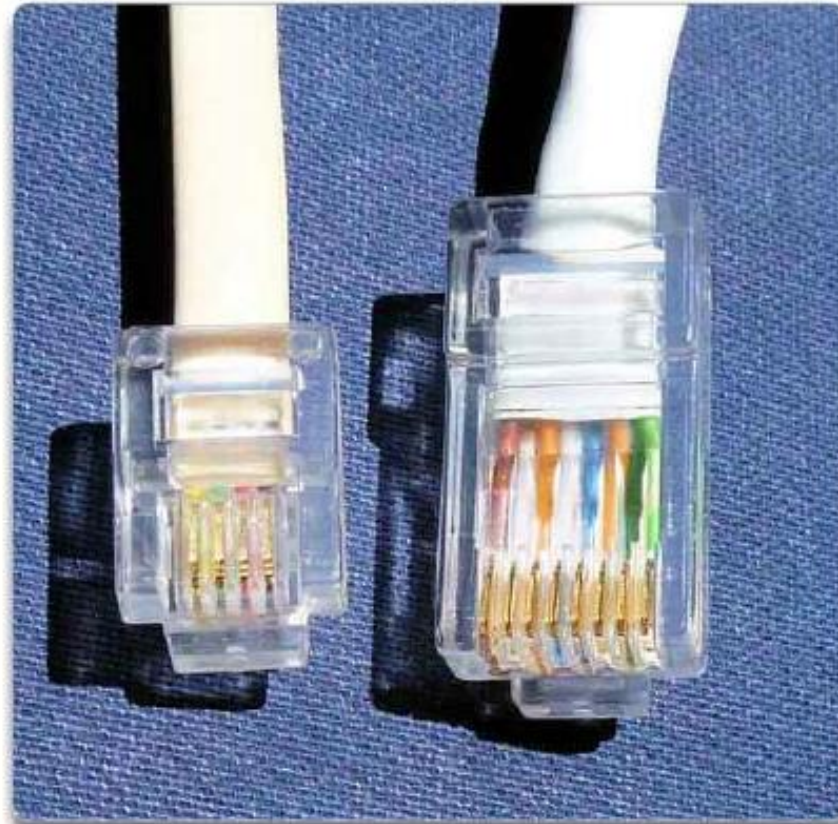
Uses

- STP cables use same connectors as UTP, and are more expensive than UTP cable.
- It is used for both analog and digital transmission.

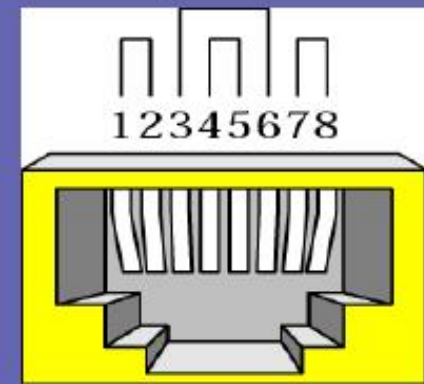
UTP connector



RJ-11 and RJ-45 Connectors



RJ-45 Male



RJ-45 Female

Difference between Optical Fiber and Coaxial Cable

- Both Optical fiber Cable and Coaxial Cable are the types of guided media.
- **Optical fiber Cable:**
- Optical Fiber is the type of guided media is made of plastics and glasses which is used to transmit the signal is in light form or optical form. It provides the high bandwidth (B). Its Installation and implementation is not so easy like coaxial cable.

Figure

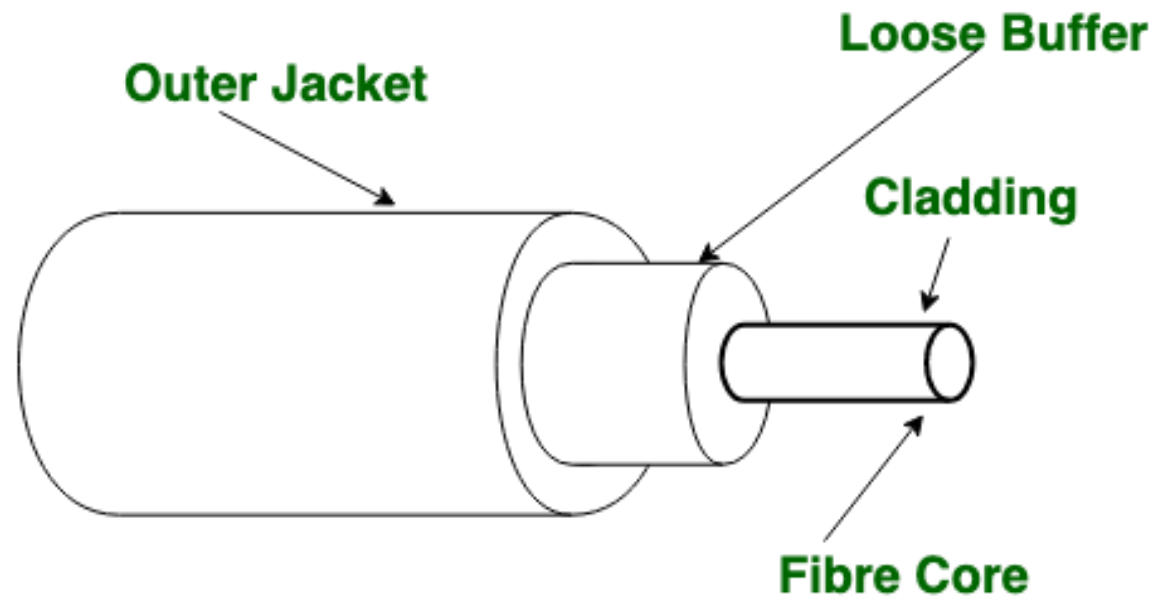


Figure of Optical Fibre Cable

Properties

- 100BASE-FX is the technical name of Fast Ethernet over fiber optic cables. It is a version of Fast Ethernet carrying data traffic at 100 Mbps (Mega bits per second) in local area networks (LAN). It was launched as the IEEE 802.3u standard in 1995. Here, 100 is the maximum throughput, i.e. 100 Mbps, BASE denoted use of baseband transmission, and FX denotes use of optical fibers in Fast Ethernet.
- This has two pairs of optical fibers.
- One pair transmits frames from hub to the device and the other from device to hub.
- Maximum distance between hub and station is 2000m.
- It has a data rate of 125 Mbps.

Coaxial Cable:

- Coaxial Cable is the type of guided media is made of Plastics, copper wires which is used to transmit the signal is in electrical form rather than light form. Its installation and implementation is easy but it is less efficient than optical fiber also it provides moderate high bandwidth (B) in comparison of optical fiber.



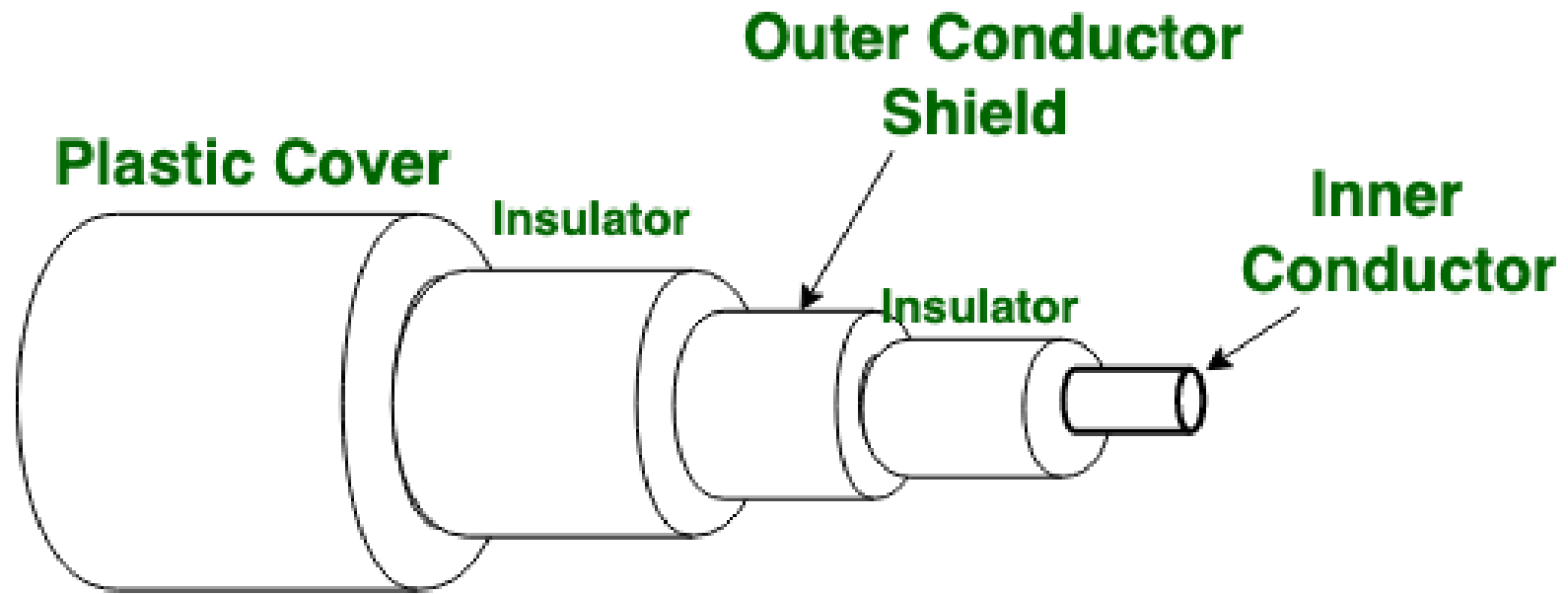


Figure of Optical Coaxial Cable

Ethernet Cable Color Coding Diagram

- Category-5 cables Category-5E cables
- Category-6 cables Category-6E cables

Two Type of colour coding Straight through and Crossover coding

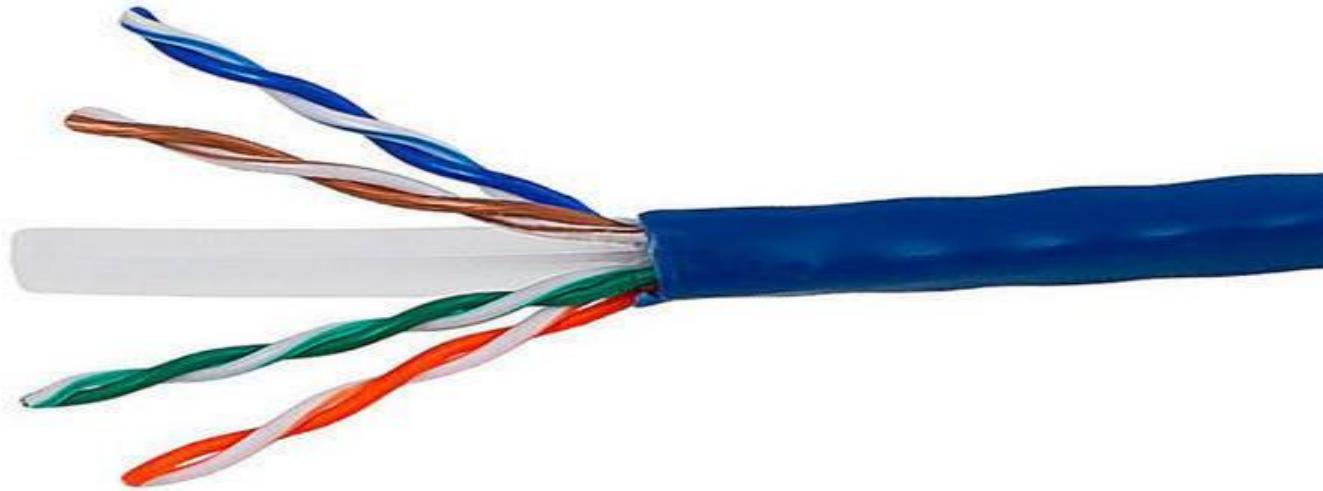
Straight-through cable is used to connect computers and other end-user devices (e.g., printers) to networking devices such as hubs and switches (**Different devices**)

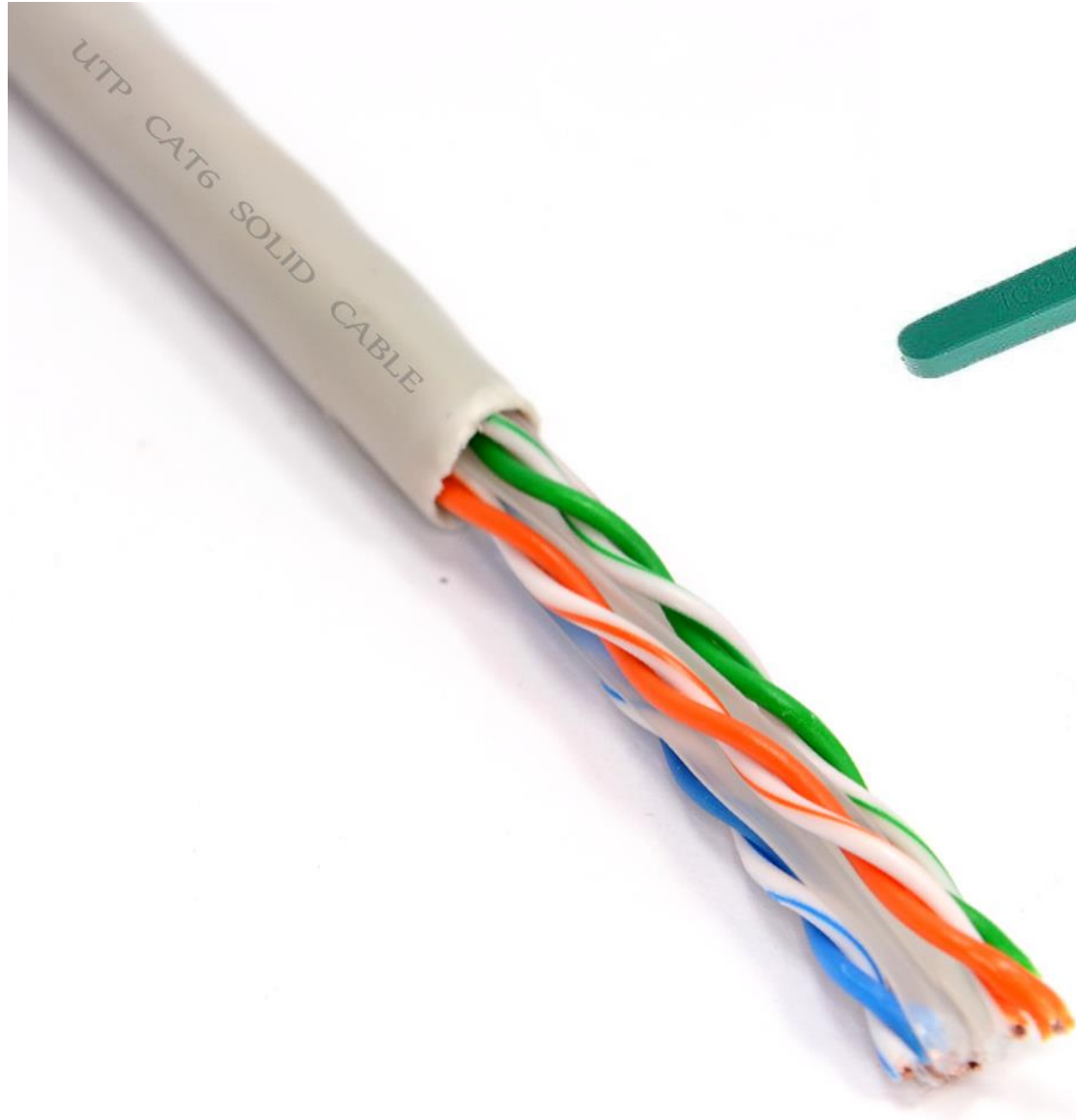
It can also be used to directly connect like devices (e.g., two hubs or two switches)

- Crossover cable is used to connect two like devices without the use of an uplink port.(Same devices)

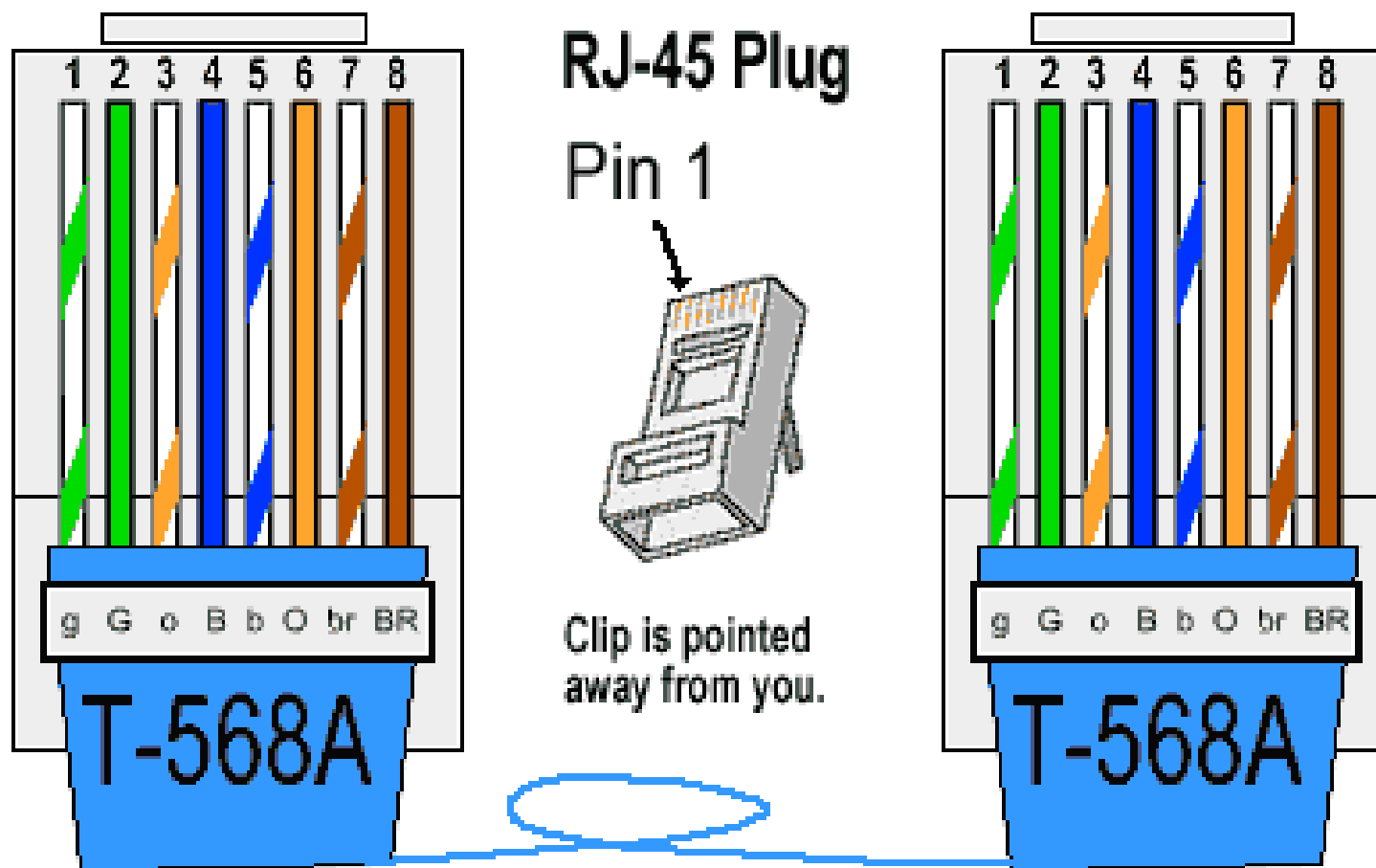
T568A & T568B

- **T568A & T568B** are network cable wire standards found in straight through and crossover cables.



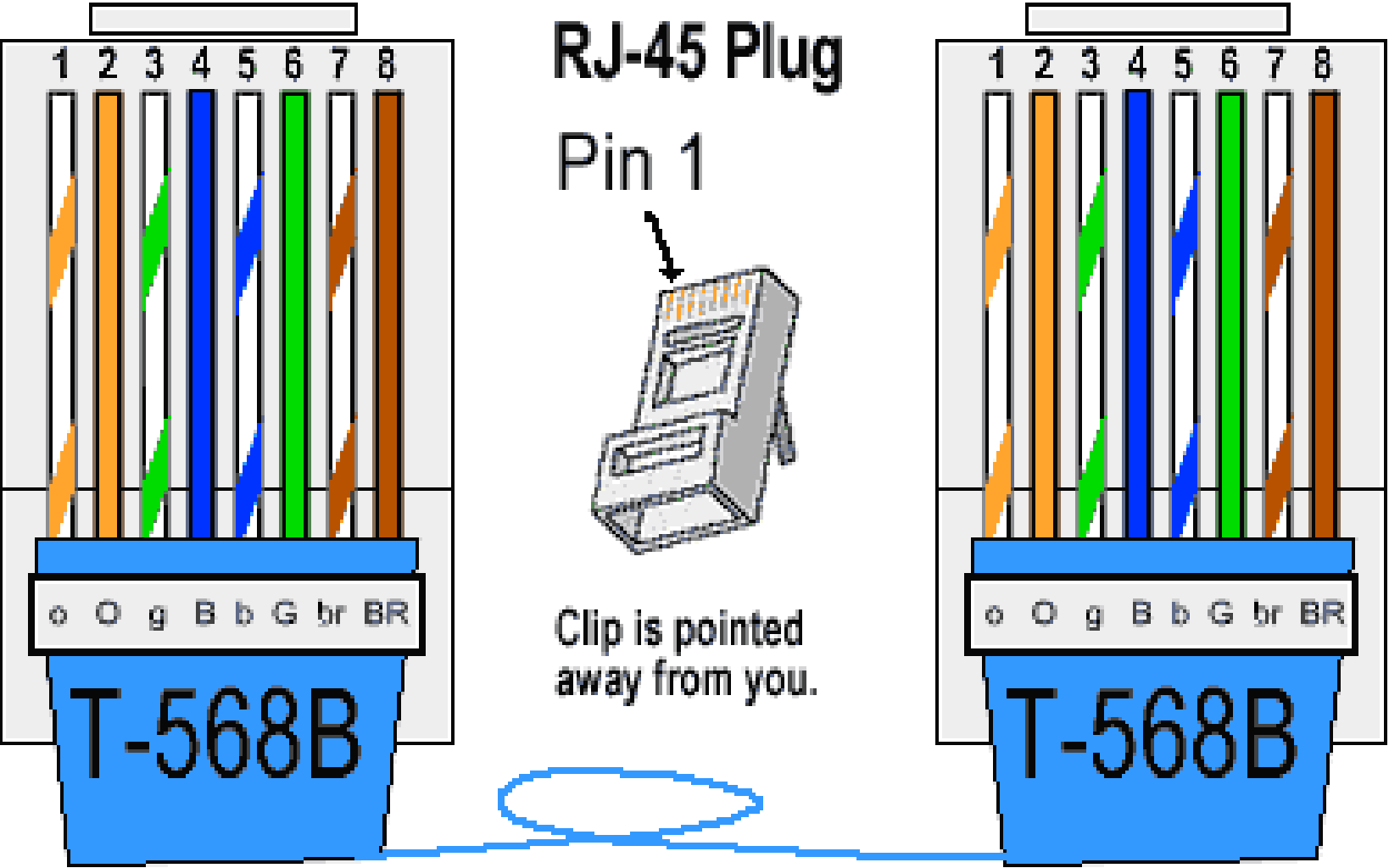


T-568A Straight-Through Ethernet Cable

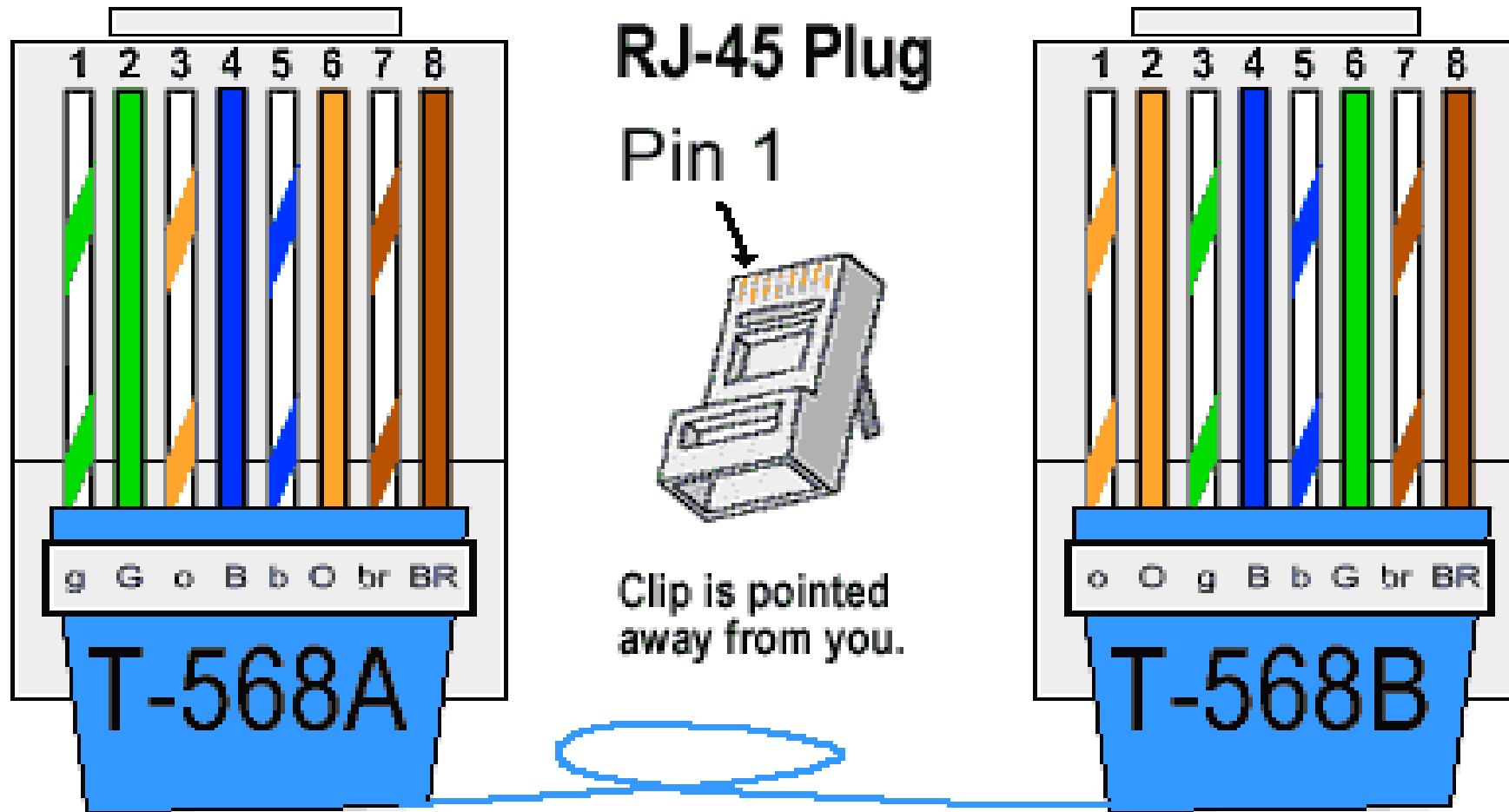


- The TIA/EIA 568-A standard which was ratified in 1995, was replaced by the TIA/EIA 568-B standard in 2002 and has been updated since. Both standards define the T-568A and T-568B pin-outs for using Unshielded Twisted Pair cable and RJ-45 connectors for Ethernet connectivity. The standards and pin-out specification appear to be related and interchangeable, but are not the same and should not be used interchangeably.

T-568B Straight-Through Ethernet Cable



RJ-45 Crossover Ethernet Cable



Introduction to Data Communication

- Data Communication is a process of exchanging data or information. In case of computer networks, this exchange is done between two devices over a transmission medium. This process involves a communication system which is made up of hardware and software. The hardware part involves the sender and receiver devices and the intermediate devices through which the data passes. The software part involves certain rules which specify what is to be communicated, how it is to be communicated, and when. It is also called as a Protocol.

Protocol

- **Protocol** It is an agreed upon set or rules used by the sender and receiver to communicate data. A protocol is a set of rules that governs data communication. A Protocol is a necessity in data communications without which the communicating entities are like two persons trying to talk to each other in a different language without know the other language.

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Data can be Analog or Digital.

Analog data refers to information that is continuous; ex. sounds made by a human voice.

Digital data refers to information that has discrete states. Digital data take on discrete values. For example, data are stored in computer memory in the form of 0s.

Signals can be of two types:

- 1. Analog Signal:** They have infinite values in a range.
- 2. Digital Signal:** They have limited number of defined values

DATA FLOW

- Two devices communicate with each other by sending and receiving data. The data can flow between the two devices in the following ways.
 - **1. Simplex**
 - **2. Half Duplex**
 - **3. Full Duplex**

Simplex

In Simplex, communication is unidirectional. Only one of the devices sends the data and the other one only receives the data. Example: in the above diagram: a CPU send data while a monitor only receives data

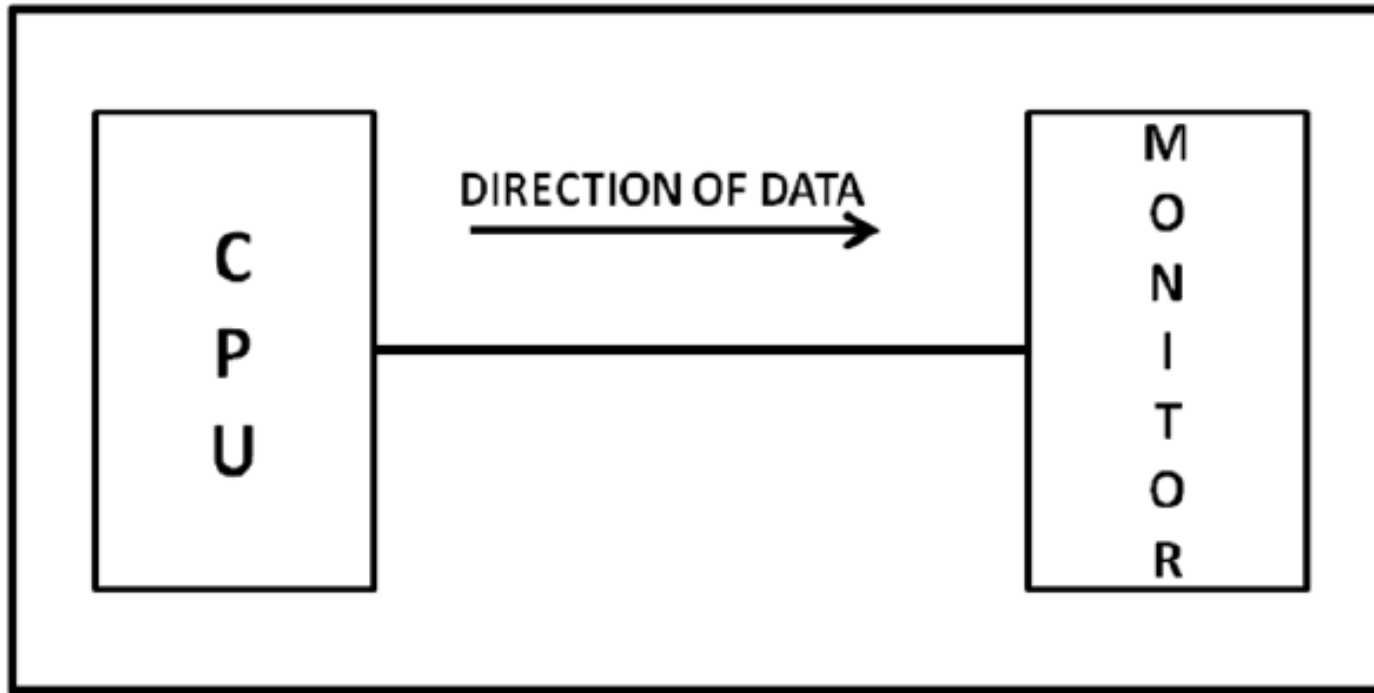


Figure: Simplex mode of communication

Half Duplex

- **In half duplex both the stations can transmit as well as receive but not at the same time.**
- **When one device is sending other can only receive and vice-versa (as shown in figure above.)**
- **Example: A walkie-talkie**

Figure of Half Duplex

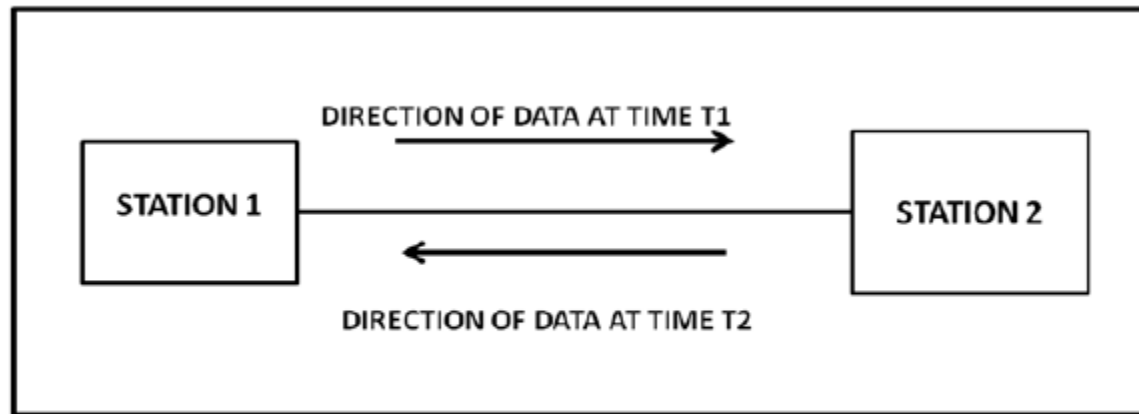


Figure: Half Duplex Mode of Communication

Full Duplex

In Full duplex mode, both stations can transmit and receive at the same time.

- Example: mobile phones

1.5.3 Full Duplex

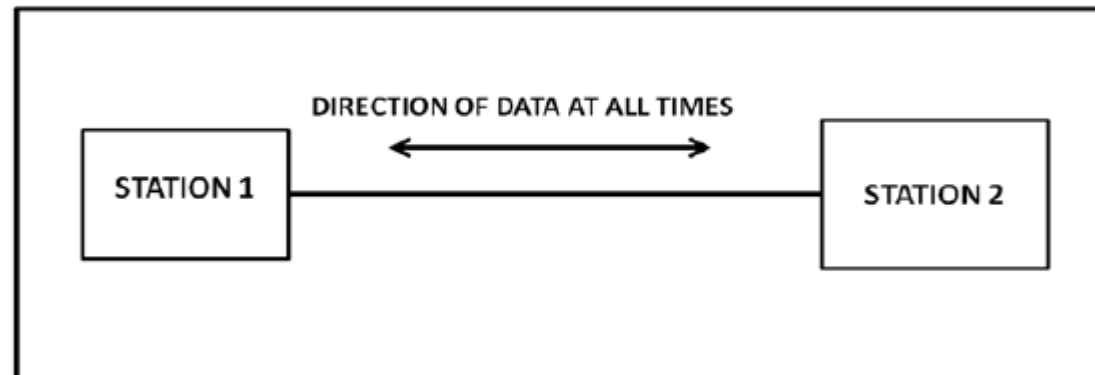


Figure: Full Duplex Mode of Communication

