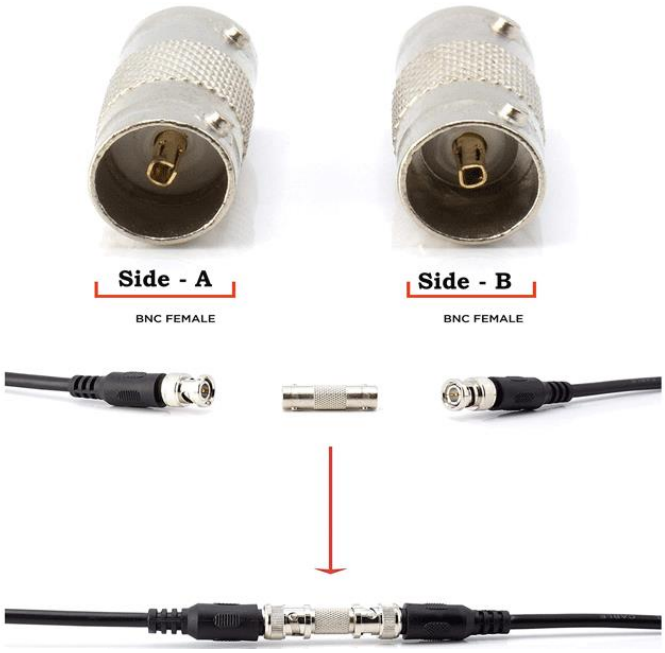
# Connectors

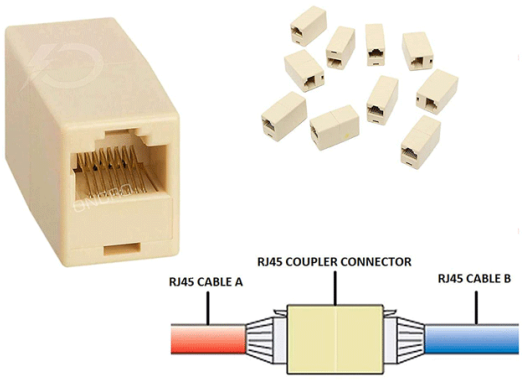
A device that eliminates a section of cabling or implements a state of access for network devices, including PCs, hubs, and switches. Connectors can be famous for their physical presentation and mating features, including jacks and attachment (male connectors) or attachments and ports (female connectors).Connectors are used to connect the guided (wired) transmission media to devices like the hub, server, workstations etc.

## Types of connectors -

**Barrel connectors -** Barrel connectors are used to join two cables. Barrel connectors are female connectors on both sides. They allow you to extend the length of a cable. If you have two small cables, you can make a long cable by joining them through the barrel connector. Barrel connectors that are used to connect coaxial cables are known as **BNC barrel connectors**. The following image shows BNC barrel connectors.




Barrel connectors that are used to connect STP or UTP cables are known as **Ethernet LAN jointers** or **couplers**. The following image shows Ethernet LAN jointers or couplers.



Barrel connectors do not amplify the signals. It means, after joining, the total cable length must not exceed the maximum supporting length of the cable. For example, a standard UTP cable supports a maximum distance of 100 meters. You can join two UTP cables if their sum is not more than 100.

For example, you can join the following cables.

Cable 1 (45 meters) + cable 2 (30 meters) = joint cable (75 meters = 45 meters + 30 meters)

*The length of the joint cable is less than 100 meters.*

But you can't join the following cables.

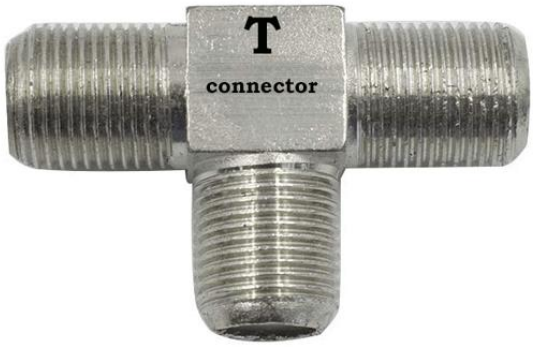
Cable 1 (65 meters) + cable 2 (45 meters) = joint cable (110 meters = 65 meters + 45 meters)

*The length of the joint cable is more than 100 meters.*

**F connectors-** An **F** connector is used to attach a coaxial cable to a device. **F** connectors are mostly used to install home appliances such as dish TV, cable internet, CCTV camera, etc. The following image shows F connectors.

**Terminator connectors -** When a device places signals on the coaxial cable, the signals travel along the end of the cable. If another device is connected to the other end of the cable, the device will receive the signal. But if the other end of the cable is open, the signals will bounce and return in the same direction they came from. To stop signals from bouncing back, all endpoints must be terminated. A terminator connector is used to terminate the endpoint of a coaxial cable. The following image shows terminator connectors.

**T type connectors -** A T connector creates a connection point on the coaxial cable. The connection point is used to connect a device to the cable.




**RJ-11 Connectors -** RJ-11 connectors have the capacity for six small pins. However, in many cases, only two or four pins are used. For example, a standard telephone connection uses only two pins, and a DSL modem connection uses four pins. They have a small plastic flange on top of the connector to ensure a secure connection.


**RJ-45 connectors-** RJ-45 connectors look likes RJ-11 connectors, but they are different. They have 8 pins. They are also bigger in size than RJ-11. RJ-45 connectors are mostly used in computer networks. They are used with STP and UTP cables. Some old Ethernet implementations use only four of the eight pins. Modern Ethernet implementation uses all 8 pins to achieve the fastest data transfer speed.

**DB-9 (RS-232) connectors -** A DB-9 or RS-232 connector connects a device over a serial port. It has 9 pins. It is available in both male and female connectors. It is used for asynchronous serial communication. The other side of the cable can be connected to any popular connector type. For example, you can connect one side of the cable with a DB-9 connector and the other side of the cable with another DB-9 connector or with an RJ-45 connector or with a USB connector. One of the most popular uses of a DB-9 connector is to connect the serial port on a computer with an external modem.


**Universal serial bus (USB) connectors**- USB connectors are the most popular. They support 127 devices in the series. All modern computers have USB ports. Most devices that you can connect to the system have USB ports. Some examples of devices that support or have USB ports are mice, printers, network cards, digital cameras, keyboards, scanners, mobile phones, and flash drives.

If the device has a USB port, you can use a cable that has a USB connector on both ends to connect the device to the computer. If the device does not have a USB port, you can still connect the device to the USB port. For that, you can use a cable that has a USB connector on one side and the corresponding connector on the other.

**Fiber cable connectors -** A variety of connectors are used to connect fiber cables. Some popular connectors are ST, SC, LC, and MTRJ. Let's discuss these connectors.

**Straight tip (ST) connectors -** Straight tip (ST) connectors are also known as **bayonet connectors**. They have a long tip extending from the connector. They are commonly used with MMF cables. They use a half-twist bayonet type of lock. An ST connector connects to a terminating device by pushing the connector into the terminating equipment and then twisting the connector housing to lock it in place.

**SC connectors -** SC connectors are also known as **subscriber connectors**, **standard connectors**, or **square connectors**. An SC connector connects to a terminating device by pushing the connector into the terminating device, and it can be removed by pulling the connector from the terminating device. It uses a push-pull connector similar to audio and video plugs and sockets.

**LC connectors -** LC connectors are known as **Lucent Connectors**. For a secure connection, they have a flange on top, similar to an RJ-45 connector. An LC connector connects to a terminating device by pushing the connector into the terminating device, and it can be removed by pressing the tab on the connector and pulling it out of the terminating device.

**MTRJ connectors -** An MTRJ connector connects to a terminating device by pushing the connector into the terminating device, and it can be removed by pulling the connector from the terminating device. It includes two fiber strands: a transmit strand and a receive strand in a single connector.

# Networking Cables

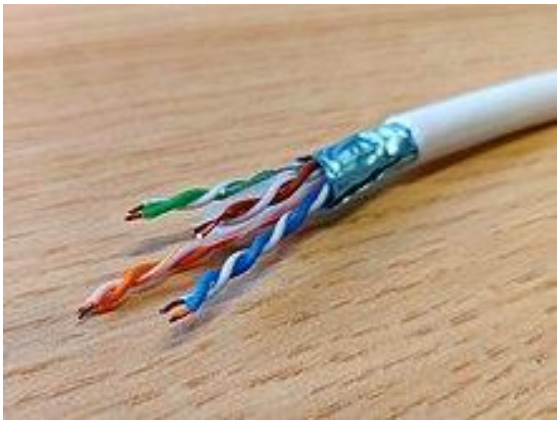
**Networking cables** are networking hardware used to connect one network device to other network devices or to connect two or more computers to share printers, scanners etc. Different types of network cables, such as coaxial cable, optical fiber cable, and twisted pair cables, are used depending on the network's physical layer, topology, and size. The devices can be separated by a few meters (e.g. via Ethernet) or nearly unlimited distances (e.g. via the interconnections of the Internet).

There are several technologies used for network connections. Patch cables are used for short distances in offices and wiring closets. Electrical connections using twisted pair or coaxial cable are used within a building. Optical fiber cable is used for long distances or for applications requiring high bandwidth or electrical isolation. Many installations use structured cabling practices to improve reliability and maintainability. In some home and industrial applications power lines are used as network cabling.

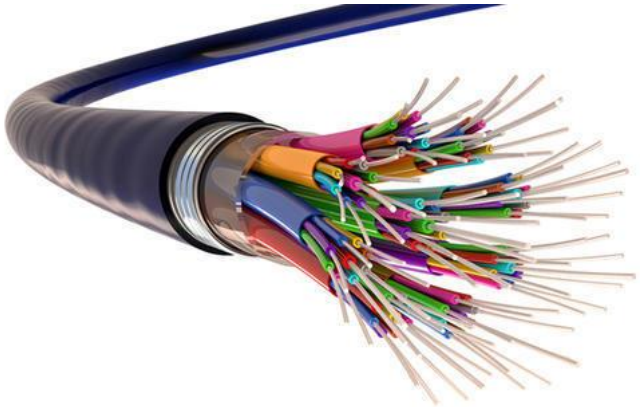
## Types of cables

**Twisted pair -** Twisted pair cabling is a form of wiring in which pairs of wires (the forward and return conductors of a single circuit) are twisted together for the purposes of canceling out electromagnetic interference (EMI) from other wire pairs and from external sources. This type of cable is used for home and corporate Ethernet networks. Twisted pair cabling is used in short patch cables and in the longer runs in structured cabling.

An Ethernet crossover cable is a type of twisted pair Ethernet cable used to connect computing devices together directly that would normally be connected via a network switch, Ethernet hub or router, such as directly connecting two personal computers via their network adapters. Most current Ethernet devices support Auto MDI-X, so it doesn't matter whether you use crossover or straight cables.

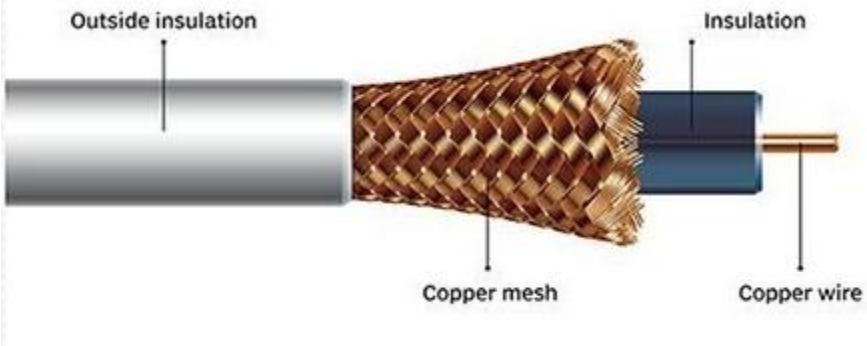


**Optical Fiber -** An optical fiber cable consists of a center glass core surrounded by several layers of protective material. Optical fiber deployment is more expensive than copper but offers higher bandwidth and can cover longer distances.[2] There are two major types of optical fiber cables: shorter-range multi-mode fiber and long-range single-mode fiber.



**Coaxial Cable -** Coaxial cables form a transmission line and confine the electromagnetic wave inside the cable between the center conductor and the shield. The transmission of energy in the line occurs totally through the dielectric inside the cable between the conductors. Coaxial lines can therefore be bent and twisted (subject to limits) without negative effects, and they can be strapped to conductive supports without inducing unwanted currents in them.

Coaxial cables are commonly used for television and other broadband signals. Although in most homes coaxial cables have been installed for transmission of TV signals, new technologies (such as the ITU-T G.hn standard) open the possibility of using home coaxial cable for high-speed home networking applications (Ethernet over coax).



**Patch -** A patch cable is an electrical or optical cable used to connect one electronic device to another towards building infrastructure for signal routing. Devices of different types (e.g. a switch connected to a computer, or a switch connected to a router) are connected with patch cables. Patch cables are usually produced in many different colors so as to be easily distinguishable,[1] and most are relatively short, no longer than a few meters. In contrast to on-premises wiring, patch cables are more flexible.

**Power lines -** Although AC power wires are not designed for networking applications, power line communication (PLC) allows these wires to also be used to interconnect home computers, peripherals or other networked consumer products. The HomePlug protocol family was an early PLC technology. In December 2008, the ITU-T adopted Recommendation G.hn/G.9960 as the first worldwide standard for high-speed powerline communications.[3] G.hn also specifies techniques for communications over the existing category 3 cable used by phones and coaxial cable used by cable television in the home.

# Layer 2 switches

A layer 2 switch is a type of network switch or device that works on the data link layer (OSI Layer 2) and utilizes MAC Address to determine the path through where the frames are to be forwarded. It uses hardware based switching techniques to connect and transmit data in a local area network (LAN). A layer 2 switch can also be referred to as a multiport bridge.

A layer 2 switch is primarily responsible for transporting data on a physical layer and in performing error checking on each transmitted and received frame. A layer 2 switch requires MAC address of NIC on each network node to transmit data. They learn MAC addresses automatically by copying MAC address of each frame received, or listening to devices on the

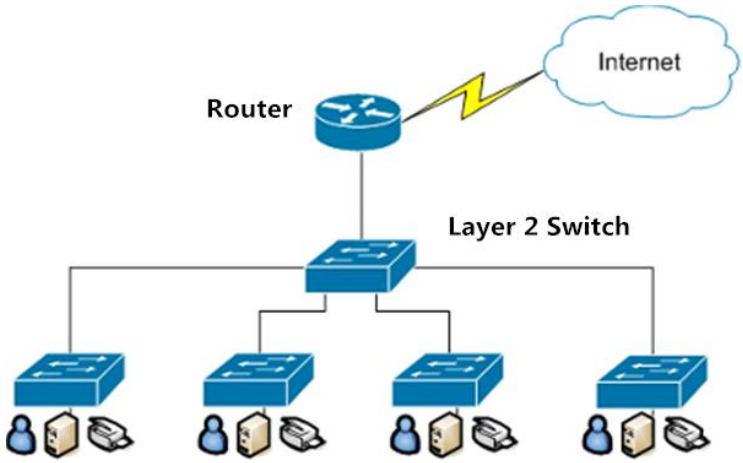
network and maintaining their MAC address in a forwarding table. This also enables a layer 2 switch to send frames quickly to destination nodes. However, like other layer switches (3,4 onwards), a layer 2 switch cannot transmit packet on IP addresses and don't have any mechanism to prioritize packets based on sending/receiving application.

**Layer 2 switching** (or **Data Link layer switching**) is the process of using devices' MAC addresses to decide where to forward frames. Switches and bridges are used for Layer 2 switching. They break up one large collision domain into multiple smaller ones.

In a typical LAN, all hosts are connected to one central device. In the past, the device was usually a hub. But hubs had many disadvantages, such as not being aware of traffic that passes through them, creating one large collision domain, etc. To overcome some of the problems with hubs, bridges were created. They were better than hubs because they created multiple collision domains, but they had limited number of ports. Finally, switches were created and are still widely used today. Switches have more ports than bridges, can inspect incoming traffic and make forwarding decisions accordingly. Also. each port on a switch is a separate collision domain, so no packet collisions should occur.

Layer 2 switches are faster than routers because they don't take up time looking at the Network layer header information. Instead, they look at the frame's hardware addresses to decide what to do with the frame – to forward, flood, or drop it. Here are other major advantages of Layer 2 switching:

- fast hardware-based bridging (using ASICs chips)
- wire speed
- low latency
- low cost




# Layer 3 switches

A Layer 3 switch is a special network device that has the functionality of a router and a switch combined into one chassis. It works in our network by simply allowing connected devices that are on the same subnet or virtual LAN (VLAN) to exchange information at lightning speed, just like a switch that operates in the data link layer of the OSI model, but it also has the IP routing intelligence of a router built into it.

It can inspect incoming packets in the network layer, support routing protocols, and even make routing decisions based on the source and destination IP addresses. With both its Layer 2 and Layer 3 capabilities, this device is popularly known also as a Multilayer Switch. Just be mindful that Layer 3 switches do not have WAN ports which should be considered while designing your network.

**How Layer 3 Switches Functions in the Network?**

Layer 2 switch dynamically routes traffic between its physical interfaces according to the MAC addresses of the connected devices, wherein Layer 3 switches use this feature to manage traffic in a LAN. A Layer 2 switch functions well in low to medium traffic in its VLANs, but these switches have their limitations once traffic increases.

The Layer 3 switch was conceived to augment this limitation by developing equipment that has routing capabilities within the same chassis. The hardware is where the main difference lies. Layer 3 switches have a mix of traditional switches and routers, except for the fact that the router's software logic is replaced by integrated circuit hardware to improve its performance further.

Layer 3 switches can perform on the OSI model's Layer 2 and Layer 3. The Layer 3 switching functionality can take either of two forms:

- **Cut-through switches** – will only look into the first packet of a series of packets to determine its logical Layer 3 destination IP address and then shift the remainder of the packets in the series using the MAC address leading to higher data throughput rates.
- **Packet-by-Packet Layer 3 (PPL3) switches** – will look into every packet to determine its logical Layer 3 destination IP address. A PPL3 switch basically functions as a high-speed router with the routing functionality built into its hardware instead of software. Similar to routers, aside from forwarding packets to their destination, PPL3 switches perform other functions that a standard router accomplishes, such as using the packet's checksum to verify its integrity, updating the packet's Time to Live (TTL) information after each hop, and processing any optional information in the packet's header.

In addition to performing Layer 3 switching functions and routing functions, these switches perform the Layer 2 switches functions, such as bridging functions, at each switch interface. You can group switching interfaces in various ways to allocate bandwidth and contain broadcasts, which makes Layer 3 switches a powerful, scalable technology for building high-speed Ethernet backbone networks.

**L3 Switch Benefits**

Layer 3 switches were developed to provide the network with the following advantages:

- Better fault isolation and traffic segregation
- Simplify security management
- Reduce broadcast traffic volume
- Easier VLAN configuration process
- Support Inter-VLAN routing
- Separate routing tables
- Reduce effort and time in troubleshooting
- Support flow accounting and high-speed scalability
- Lower network latency

## Difference between layer 2 and layer 3 switch

| Layer 2 Switch | Layer 3 Switch |
|---|---|
| Operate on layer 2 (Data link) of OSI model. | Operate on layer 3 (Network Layer) of OSI model. |
| Send “frames” to destination on the basis of MAC address. | Route Packet with help of IP address |
| Work with MAC address only | Can perform functioning of both 2 layer and 3 layer switch |
| Used to reduce traffic on local network. | Mostly Used to implement VLAN (Virtual Local area network) |
| Quite fast as they do not look at the Layer 3 portion of the data packets. | Takes time to examine data packets before sending them to their destination |
| It has single broadcast domain | It has multiple broadcast domain. |
| Can communicate within a network only. | Can communicate within or outside network. |