



Report on :
Computer Networks

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INDEX:

Sr. No.	Title	Page No
1.1	Computer	3
1.2	Network	3
1.3	Computer network	4
2	Networking cables	4
2.1	Twisted pair cable	5
2.2	Co-axial cable	5
2.3	Optical Fiber cable	6
3	Type of Network	6
3.1	LAN: Local Area Network	7
3.2	MAN: Metropolitan Area Network	7
3.3	WAN: Wide Area Network	8
3.4	PAN: Personal Area Network	8
3.5	SAN: Storage Area Network	9
4	Networking Topologies:	9
4.1	Bus topology	10
4.2	RING Topology	11
4.3	STAR Topology	12
4.4	MESH Topology	13
4.5	TREE Topology	15
4.6	HYBRID Topology	16
5	IP Address	17
5.1	IPv4 addresses	17
5.2	IPv6 addresses	18
6	Making Ethernet Cable	18
6.1	Crossover	20
6.2	Straight through	21

1.1:Computer :

A computer is a device that can be instructed to carry out sequences of arithmetic or logical operations automatically via computer programming. Modern computers have the ability to follow generalized sets of operations, called programs. These programs enable computers to perform an extremely wide range of tasks.



1.2:Network :

A network is a collection of computers, servers, mainframes, network devices, peripherals, or other devices connected to one another to allow the sharing of data. An excellent example of a network is the Internet, which connects millions of people all over the world.

1.3:Computer Network :

A computer network is a set of computers connected together for the purpose of sharing resources. The most common resource shared today is a connection to the Internet. Other shared resources can include a printer or a file server. The Internet itself can be considered a computer network.



Advantages :

- Sharing devices such as printers save money.
- Site (software) licenses are likely to be cheaper than buying several standalone licenses.
- Files can easily be shared between users.
- Network users can communicate by email and instant messenger.
- Security is good - users cannot see other users' files unlike on stand-alone machines.
- Data is easy to backup as all the data is stored on the file server.

Disadvantages :

- Purchasing the network cabling and file servers can be expensive.
- Managing a large network is complicated, requires training and a network manager usually needs to be employed.
- If the network device breaks down the files on the file server become inaccessible.

2. Networking cables

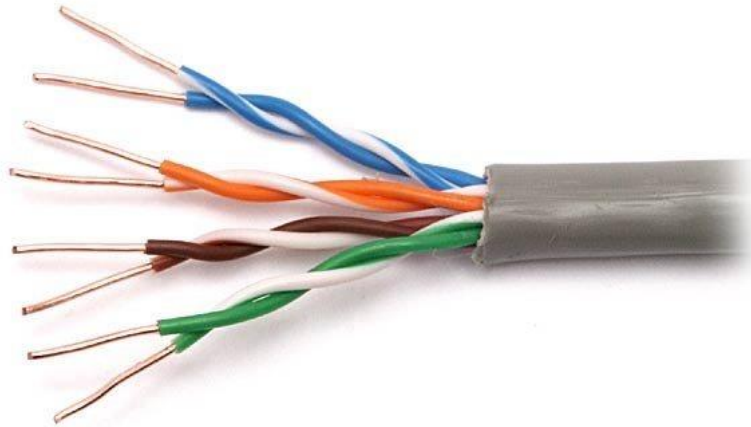
Networking cables are networking hardware used to connect one network device to other network devices or to connect two or more computers to share printers, scanners etc

Three types of cable :

- Twisted pair cable
- Co-axial cable
- Optical Fiber cable

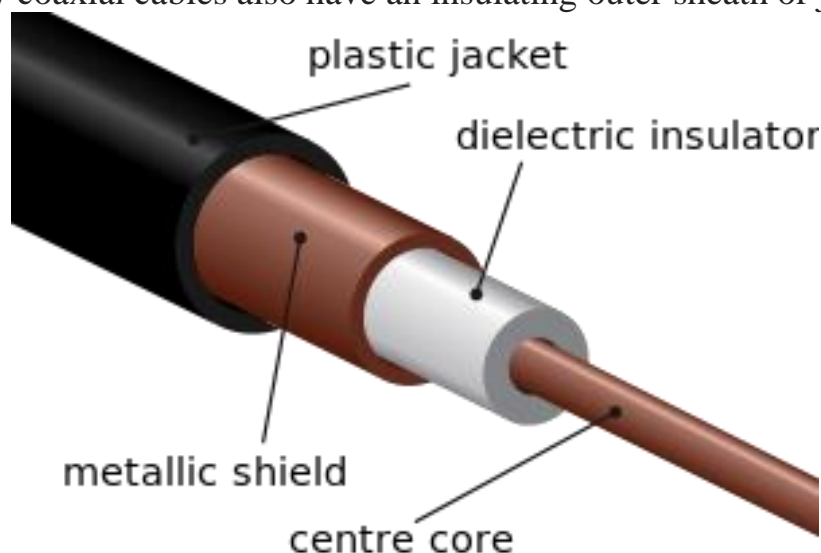
2.1:Twisted pair cable :

Twisted pair cabling is a type of wiring in which two conductors of a single circuit are twisted together for the purposes of improving electromagnetic compatibility



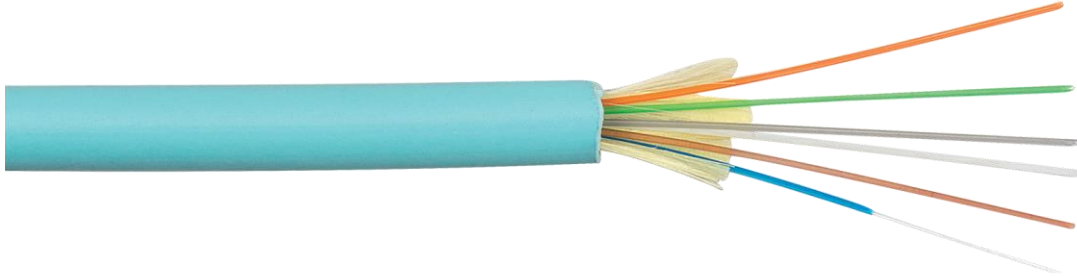
2.2:Co-axial cable

Coaxial cable, or coax, is a type of electrical cable that has an inner conductor surrounded by a tubular insulating layer, surrounded by a tubular conducting shield. Many coaxial cables also have an insulating outer sheath or jacket.



2.3:Optical Fiber cable

An optical fiber cable, also known as a fiber optic cable, is an assembly similar to an electrical cable, but containing one or more optical fibers that are used to carry light.

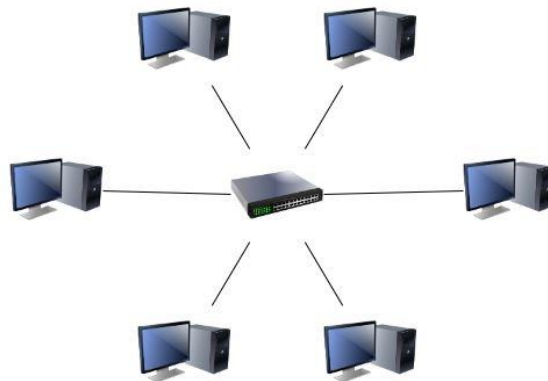


3.Type of Network:

- **LAN:** Local Area Network
- **MAN:** Metropolitan Area Network
- **WAN:** Wide Area Network
- **PAN:** Personal Area Network
- **SAN:** Storage Area Network

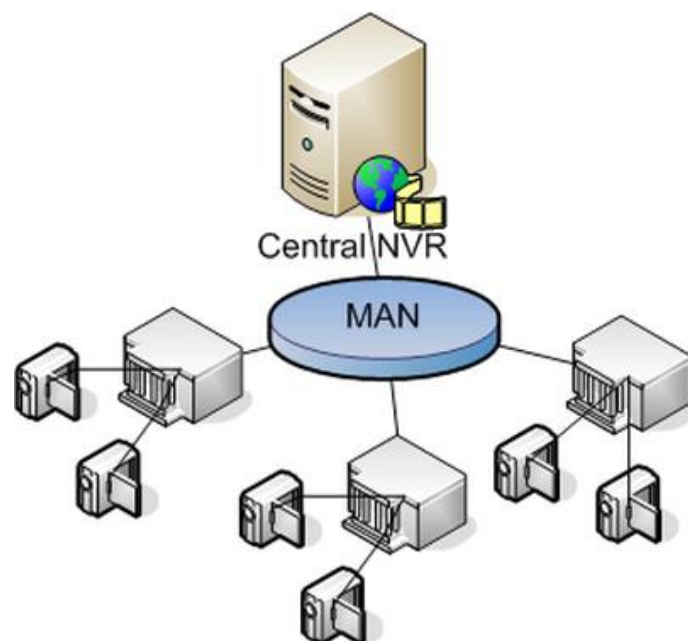
3.1:LAN: Local Area Network

A local-area network (LAN) is a computer network that spans a relatively small area. Most often, a LAN is confined to a single room, building or group of buildings, however, one LAN can be connected to other LANs over any distance via telephone lines and radio waves.



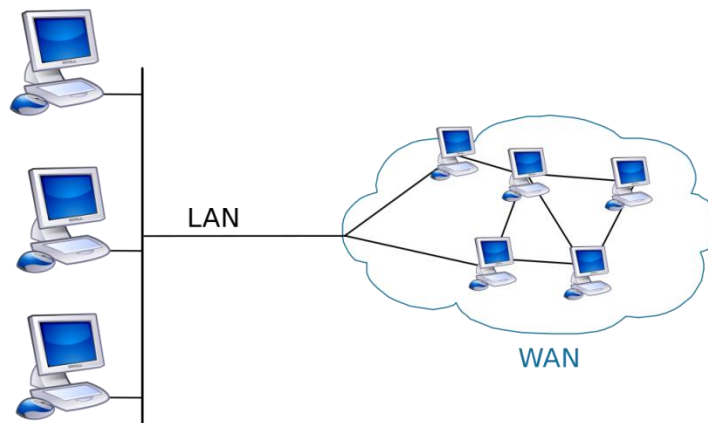
3.2:MAN: Metropolitan Area Network

A metropolitan area network is a computer network that interconnects users with computer resources in a geographic area or region larger than that covered by even a large local area network but smaller than the area covered by a wide area network



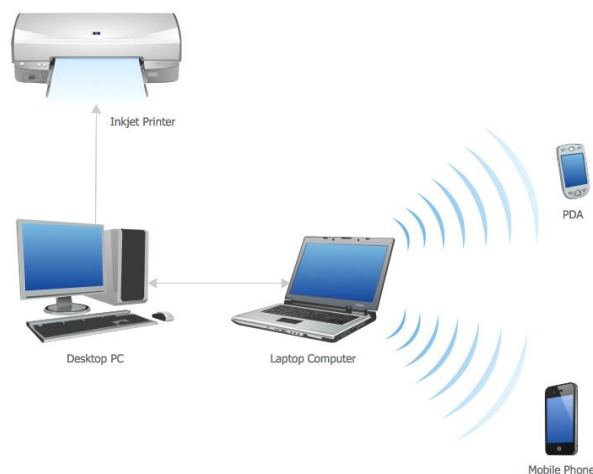
3.3:WAN: Wide Area Network

A wide area network is a telecommunications network or computer network that extends over a large geographical distance/place. Wide area networks are often established with leased telecommunication circuits.



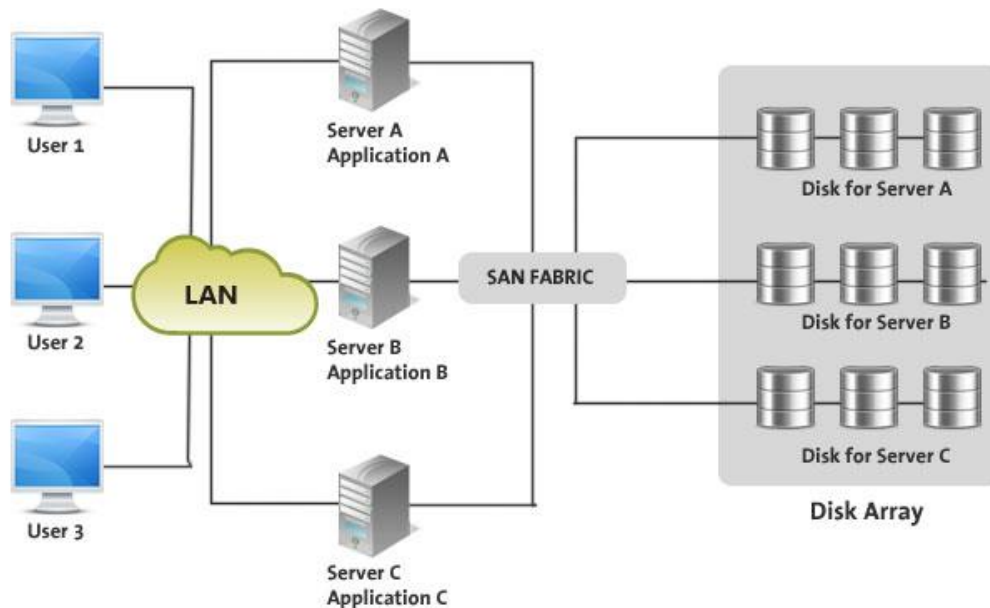
3.4: PAN: Personal Area Network

A personal area network, or PAN, is a computer network that enables communication between computer devices near a person. PANs can be wired, such as USB or FireWire, or they can be wireless, such as infrared, ZigBee, Bluetooth and ultra-wideband, or UWB.



3.5: SAN: Storage Area Network

A storage area network is a Computer network which provides access to consolidated, block level data storage.

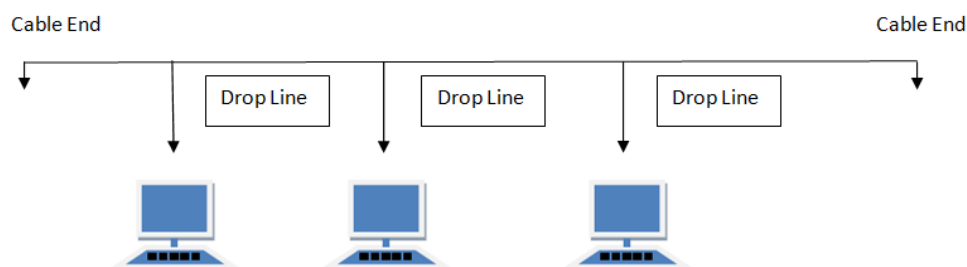


4:Networking Topologies:

Computers in a **network** have to be connected in some logical manner. The layout pattern of the interconnections between computers in a **network** is called **network topology**.

4.1: BUS topology

Bus topology is a network type in which every computer and network device is connected to single cable. When it has exactly two endpoints, then it is called **Linear Bus topology**.



Features of Bus Topology

1. It transmits data only in one direction.
2. Every device is connected to a single cable

Advantages of Bus Topology

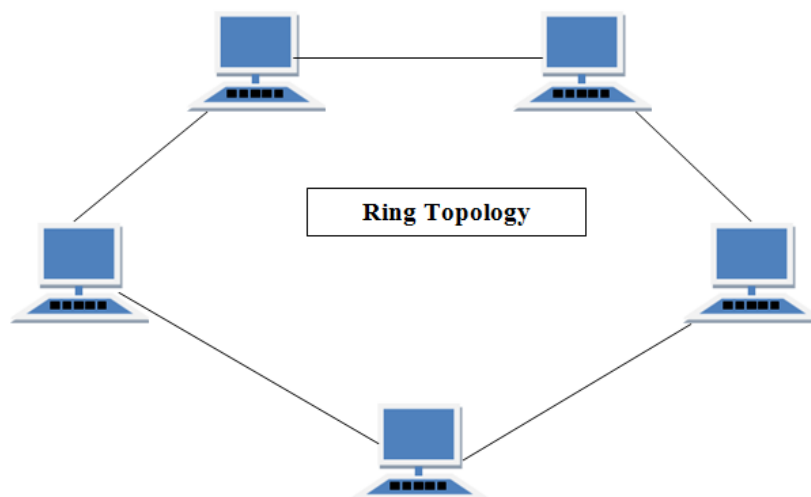
1. It is cost effective.
2. Cable required is least compared to other network topology.
3. Used in small networks.
4. It is easy to understand.
5. Easy to expand joining two cables together.

Disadvantages of Bus Topology

1. Cables fail then the whole network fails.
2. If network traffic is heavy or nodes are more the performance of the network decreases.
3. Cable has a limited length.
4. It is slower than the ring topology.

4.2:RING Topology

It is called ring topology because it forms a ring as each computer is connected to another computer, with the last one connected to the first. Exactly two neighbors for each device.



Features of Ring Topology

1. A number of repeaters are used for Ring topology with a large number of nodes, because if someone wants to send some data to the last node in the ring topology with 100 nodes, then the data will have to pass through 99 nodes to reach the 100th node. Hence to prevent data loss repeaters are used in the network.
2. The transmission is unidirectional, but it can be made bidirectional by having 2 connections between each Network Node, it is called **Dual Ring Topology**.

Advantages of Ring Topology

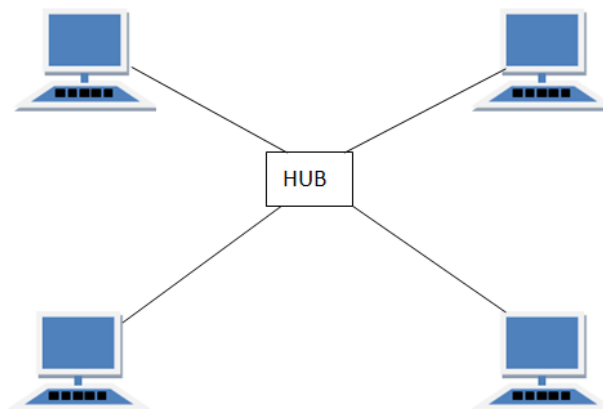
1. Transmitting network is not affected by high traffic or by adding more nodes, as only the nodes having tokens can transmit data.
2. Cheap to install and expand

Disadvantages of Ring Topology

1. Troubleshooting is difficult in a ring topology.

4.3:STAR Topology

In this type of topology, all the computers are connected to a single hub through a cable. This hub is the central node and all other nodes are connected to the central node.



Features of Star Topology

1. Every node has its own dedicated connection to the hub.
2. Hub acts as a repeater for data flow.
3. Can be used with twisted pair, Optical Fibre or coaxial cable.

Advantages of Star Topology

1. Fast performance with few nodes and low network traffic.
2. Hub can be upgraded easily.
3. Easy to troubleshoot.
4. Easy to setup and modify.
5. Only that node is affected which has failed, rest of the nodes can work smoothly.

Disadvantages of Star Topology

1. Cost of installation is high.
 2. Expensive to use.
 3. If the hub fails then the whole network is stopped because all the nodes depend on the hub.
 4. Performance is based on the hub that is it depends on its capacity
-

4.4:MESH Topology

It is a point-to-point connection to other nodes or devices. All the network nodes are connected to each other. Mesh has $n(n-1)/2$ physical channels to link n devices.

There are two techniques to transmit data over the Mesh topology, they are :

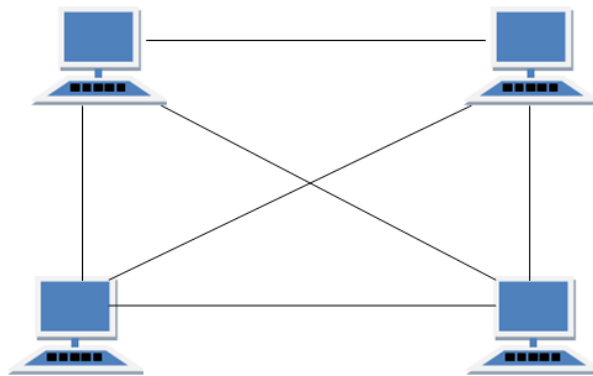
1. Routing
2. Flooding

MESH Topology: Routing

In routing, the nodes have a routing logic, as per the network requirements. Like routing logic to direct the data to reach the destination using the shortest distance. Or, routing logic which has information about the broken links, and it avoids that node etc. We can even have routing logic, to re-configure the failed nodes.

MESH Topology: Flooding

In flooding, the same data is transmitted to all the network nodes, hence no routing logic is required. The network is robust, and its very unlikely to lose the data. But it leads to unwanted load over the network.



Types of Mesh Topology

1. **Partial Mesh Topology :** In this topology some of the systems are connected in the same fashion as mesh topology but some devices are only connected to two or three devices.
2. **Full Mesh Topology :** Each and every nodes or devices are connected to each other.

Features of Mesh Topology

1. Fully connected.
2. Robust.
3. Not flexible.

Advantages of Mesh Topology

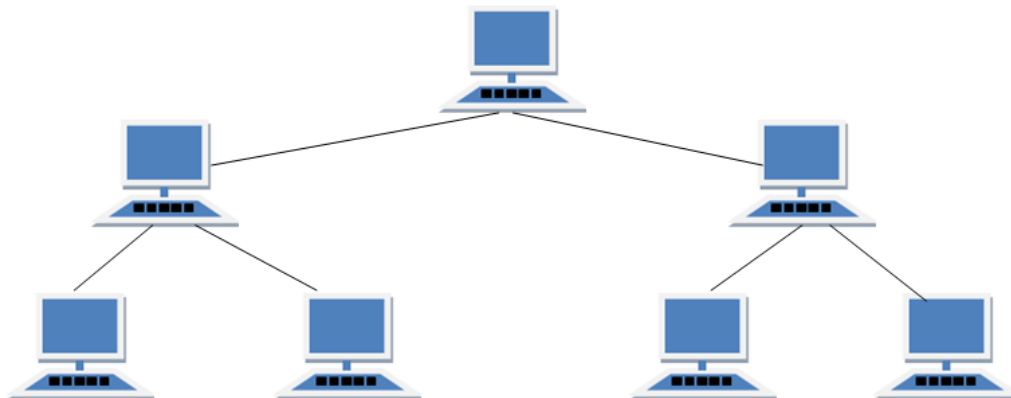
1. Each connection can carry its own data load.
2. It is robust.
3. Fault is diagnosed easily.
4. Provides security and privacy.

Disadvantages of Mesh Topology

1. Installation and configuration is difficult.
2. Cabling cost is more.
3. Bulk wiring is required.

4.5: TREE Topology

It has a root node and all other nodes are connected to it forming a hierarchy. It is also called hierarchical topology. It should at least have three levels to the hierarchy.



Features of Tree Topology

1. Ideal if workstations are located in groups.
2. Used in Wide Area Network.

Advantages of Tree Topology

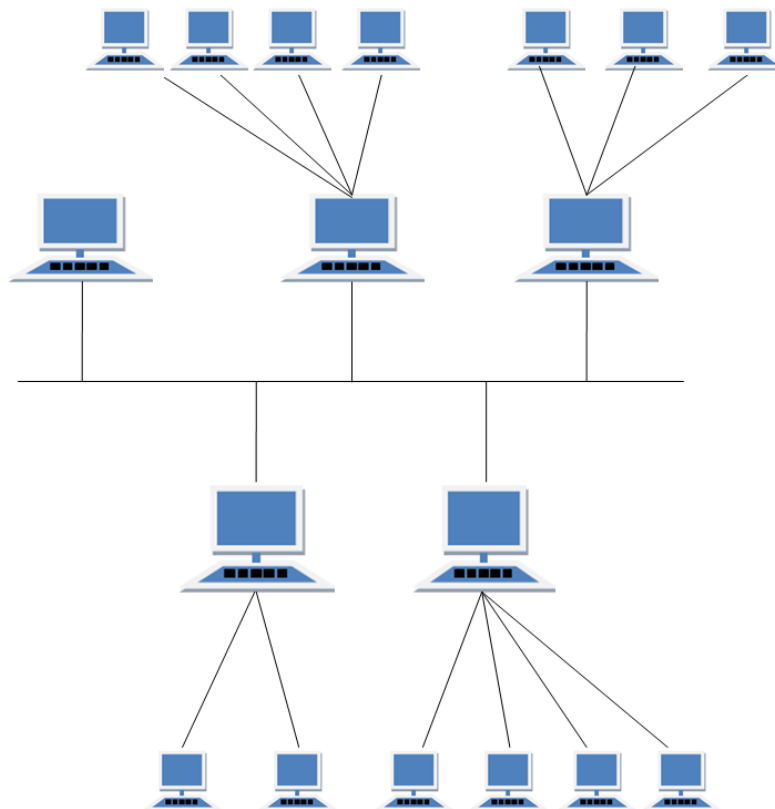
1. Extension of bus and star topologies.
2. Expansion of nodes is possible and easy.
3. Easily managed and maintained.
4. Error detection is easily done.

Disadvantages of Tree Topology

1. Heavily cabled.
 2. Costly.
 3. If more nodes are added maintenance is difficult.
 4. Central hub fails, network fails.
-

4.6:HYBRID Topology

It is two different types of topologies which is a mixture of two or more topologies. For example if in an office in one department ring topology is used and in another star topology is used, connecting these topologies will result in Hybrid Topology (ring topology and star topology).



Features of Hybrid Topology

1. It is a combination of two or topologies
2. Inherits the advantages and disadvantages of the topologies included

Advantages of Hybrid Topology

1. Reliable as Error detecting and troubleshooting is easy.
2. Effective.
3. Scalable as size can be increased easily.
4. Flexible.

Disadvantages of Hybrid Topology

1. Complex in design.
2. Costly.

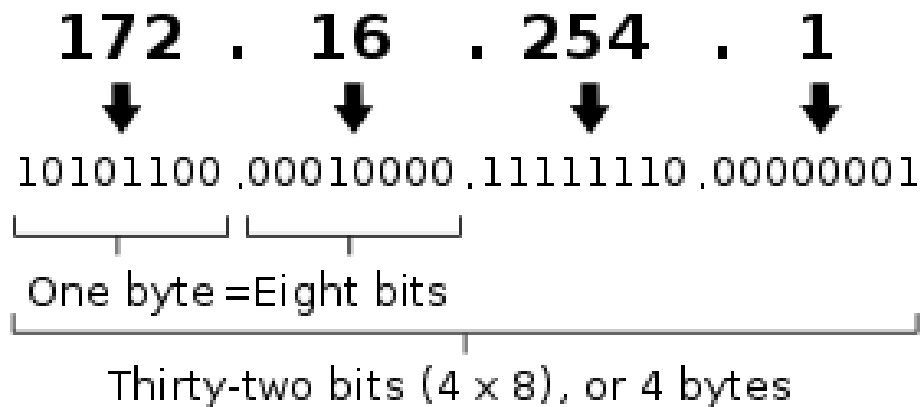
5.IP Address:

An Internet Protocol address (IP address) is a numerical label assigned to each device connected to a computer network that uses the Internet Protocol for communication. An IP address serves two principal functions: host or network interface identification and location addressing.

5.1:IPv4 addresses

An IPv4 address has a size of 32 bits, which limits the address space to 4294967296 (2³²) addresses. Of this number, some addresses are reserved for special purposes such as private networks (~18 million addresses) and multicast addressing (~270 million addresses).

An IPv4 address (dotted-decimal notation)



Classification of IPV4 :

Class	Start of range	End of range
A	10.0.0.0	10.255.255.255
B	172.16.0.0	172.31.255.255
C	192.168.0.0	192.168.255.255

5.2:IPv6 addresses

In IPv6, the address size was increased from 32 bits in IPv4 to 128 bits or 16 octets, thus providing up to 2^{128} (approximately 3.403×10^{38}) addresses. This is deemed sufficient for the foreseeable future.

An IPv6 address (in hexadecimal)

2001:0DB8:AC10:FE01:0000:0000:0000:0000

↓ ↓ ↓ ↓ Zeroes can be omitted

2001:0DB8:AC10:FE01::

00100000000000000001-0000110110111000-10101100000010000-11111110000000001-
00000000000000000000-000000000000000000-000000000000000000-000000000000000000

6.Making Ethernet Cables

HOW TO MAKE AN ETHERNET CABLE

Purchasing Ethernet cables can be quite expensive and pre-made lengths are not always the length you need. Making Ethernet cables is easy with a box of bulk Category 5e Ethernet cable and RJ-45 connectors that are attached to the cut ends of your preferred cable length.

Componants:

Bulk Ethernet Cable - Category 5e or CAT5e



Bulk RJ45 Crimpable Connectors for CAT-5e



RJ-45 Crimping tool

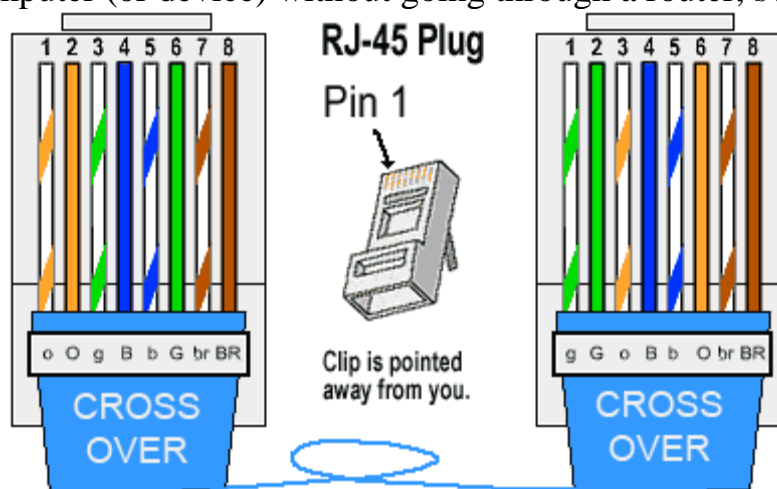


Two types of Ethernet cable

- Crossover
- Straight through

6.1 : Crossover

The purpose of a Crossover Ethernet cable is to directly connect one computer to another computer (or device) without going through a router, switch or hub.



6.2: Straight through

Ethernet cables are the standard cable used for almost all purposes, and are often called "patch cables". It is highly recommend you duplicate the color order as shown on the left. Note how the green pair is not side-by-side as are all the other pairs. This configuration allows for longer wire runs.

