

## A. Basic Concept of Network Fundamental:

What is Networking?

A computer network is a set of two or more computers connected to each other. Once joined together these computers can share files together and also share devices like printers which are on the same network.

The network is connected with wires, either physical wires or wireless links, so the various separate devices (known as nodes) can "talk" to one another and swap data. Nodes refer to desktop computers, laptops, tablets, mobile phones, smart TVs and Gaming Consoles.

**Nodes could mean desktop computers, laptops, tablets or mobile phones.**

The network is probably one of the best inventions in the history of the computer because you would not be sitting here now using Internet Explorer or Google Chrome (the world wide web – www) to view this tutorial without networking technologies. Yes, the internet is also a large network.

How do Networks help us?

technology helps us every day as we work and play!

### **Communication**

People can communicate with others all over the world at a very low cost using e-mail, chat, telephone, video telephone, video conferencing and SMS (Short Message Service and is also commonly referred to as a "text message") services

Video Conferencing has aided in more efficient and economic global communications.

### **Sharing Resources**

In a network, resources such as printers, scanners, fax machines and modems can be shared among the users.

Networking a printer allows everyone in the same classroom or office print to the same machine.

### **Sharing Software**

Application programmes (known as Apps) and software are generally stored on the central computer server and are accessible to any workstation connected to this network.

Programmes such as Microsoft Office can be stored centrally on the server and accessed by all workstations on the network.

## **Sharing Data**

Users on a network can access data stored on other computers and on the internet. Known as Databases, these systems are used in companies to hold information such as customer, product or employee information. Database information can be stored in-house on a computer server or in the Cloud. Cloud Services allow companies to store their data in large online servers using the internet. This makes this data accessible anywhere once there is an internet connection.

## **B. Types of Networks:**

### **1. Personal Area Network (PAN)**

The smallest and most basic type of network, a PAN is made up of a wireless modem, a computer or two, phones, printers, tablets, etc., and revolves around one person in one building. These types of networks are typically found in small offices or residences, and are managed by one person or organization from a single device.

### **2. Local Area Network (LAN)**

We're confident that you've heard of these types of networks before – LANs are the most frequently discussed networks, one of the most common, one of the most original and one of the simplest types of networks. [LANs](#) connect groups of computers and low-voltage devices together across short distances (within a building or between a group of two or three buildings in close proximity to each other) to share information and resources. Enterprises typically manage and maintain LANs.

Using routers, LANs can connect to wide area networks (WANs, explained below) to rapidly and safely transfer data.

### **3. Wireless Local Area Network (WLAN)**

Functioning like a LAN, WLANs make use of [wireless network technology](#), such as WiFi. Typically seen in the same types of applications as LANs, these types of networks don't require that devices rely on physical cables to connect to the network.

### **4. Campus Area Network (CAN)**

Larger than LANs, but smaller than metropolitan area networks (MANs, explained below), these types of networks are typically seen in universities, large K-12 school districts or small businesses. They can be spread across several buildings that are fairly close to each other so users can share resources.

## **5. Metropolitan Area Network (MAN)**

These types of networks are larger than LANs but smaller than WANs – and incorporate elements from both types of networks. MANs span an entire geographic area (typically a town or city, but sometimes a campus). Ownership and maintenance is handled by either a single person or company (a local council, a large company, etc.).

## **6. Wide Area Network (WAN)**

Slightly more complex than a LAN, a [WAN](#) connects computers together across longer physical distances. This allows computers and low-voltage devices to be remotely connected to each other over one large network to communicate even when they're miles apart.

The Internet is the most basic example of a WAN, connecting all computers together around the world. Because of a WAN's vast reach, it is typically owned and maintained by multiple administrators or the public.

## **7. Storage-Area Network (SAN)**

As a dedicated high-speed network that connects shared pools of storage devices to several servers, these types of networks don't rely on a LAN or WAN. Instead, they move storage resources away from the network and place them into their own high-performance network. SANs can be accessed in the same fashion as a drive attached to a server. Types of storage-area networks include converged, virtual and unified SANs.

## **8. System-Area Network (also known as SAN)**

This term is fairly new within the past two decades. It is used to explain a relatively local network that is designed to provide high-speed connection in server-to-server applications (cluster environments), storage area networks (called "SANs" as well) and processor-to-processor applications. The computers connected on a SAN operate as a single system at very high speeds.

## **9. Passive Optical Local Area Network (POLAN)**

As an alternative to traditional switch-based Ethernet LANs, [POLAN technology can be integrated into structured cabling](#) to overcome concerns about supporting traditional Ethernet protocols and network applications such as PoE (Power over Ethernet). A point-to-multipoint LAN architecture, POLAN uses optical splitters to split an optical signal from one strand of singlemode optical fiber into multiple signals to serve users and devices.

## **10. Enterprise Private Network (EPN)**

These types of networks are built and owned by businesses that want to securely connect its various locations to share computer resources.

## 11. Virtual Private Network (VPN)

By extending a private network across the Internet, a VPN lets its users send and receive data as if their devices were connected to the private network – even if they're not. Through a virtual point-to-point connection, users can access a private network remotely.

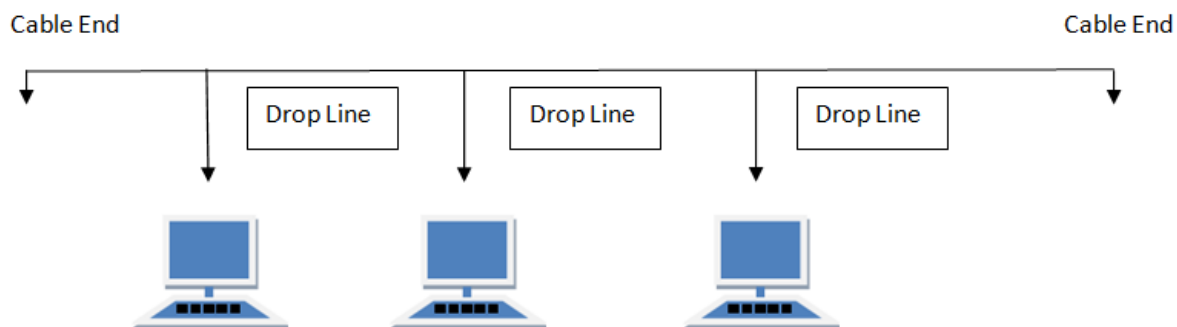
If you have questions about which type of [network](#) is right for your organization, or want to learn more about Belden's network solutions that improve uptime, maintain security, and help improve user access, check out [info.belden.com/lan](http://info.belden.com/lan).

## Network Topology:

The study of network topology recognizes eight basic topologies: point-to-point, bus, star, ring or circular, mesh, tree, hybrid, or daisy chain.

### 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.

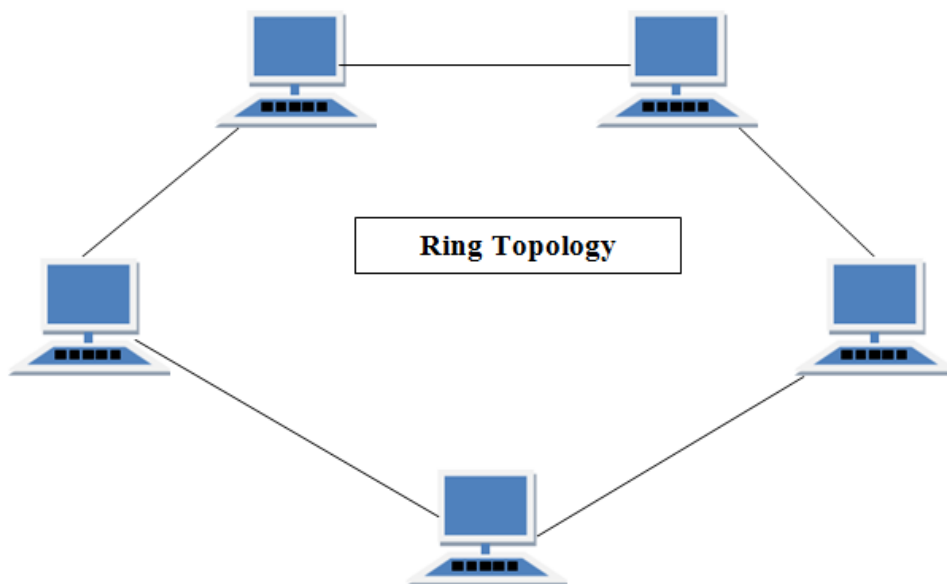
3. Used in small networks.
4. It is easy to understand.
5. Easy to expand joining two cables together.

### *Disadvantages of Bus Topology*

1. Cables fails then 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.
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## **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 neighbours for each device.



### *Features of Ring Topology*

1. A number of repeaters are used for Ring topology with 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**.
3. In Dual Ring Topology, two ring networks are formed, and data flow is in opposite direction in them. Also, if one ring fails, the second ring can act as a backup, to keep the network up.

4. Data is transferred in a sequential manner that is bit by bit. Data transmitted, has to pass through each node of the network, till the destination node.

### *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

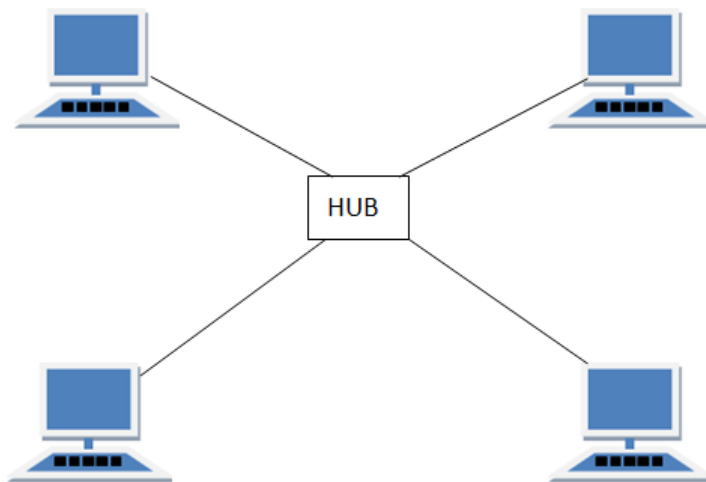
### *Disadvantages of Ring Topology*

1. Troubleshooting is difficult in ring topology.
2. Adding or deleting the computers disturbs the network activity.
3. Failure of one computer disturbs the whole network.

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## **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 others 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
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## **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 :

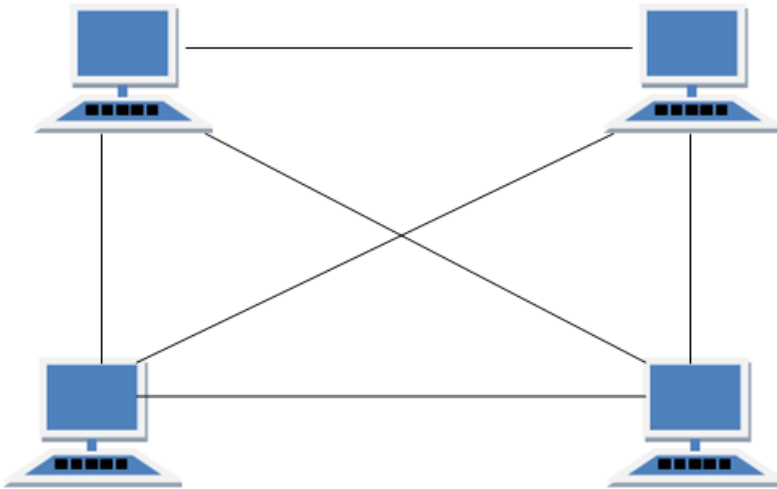
1. Routing
2. Flooding

### **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 those 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 it is 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*

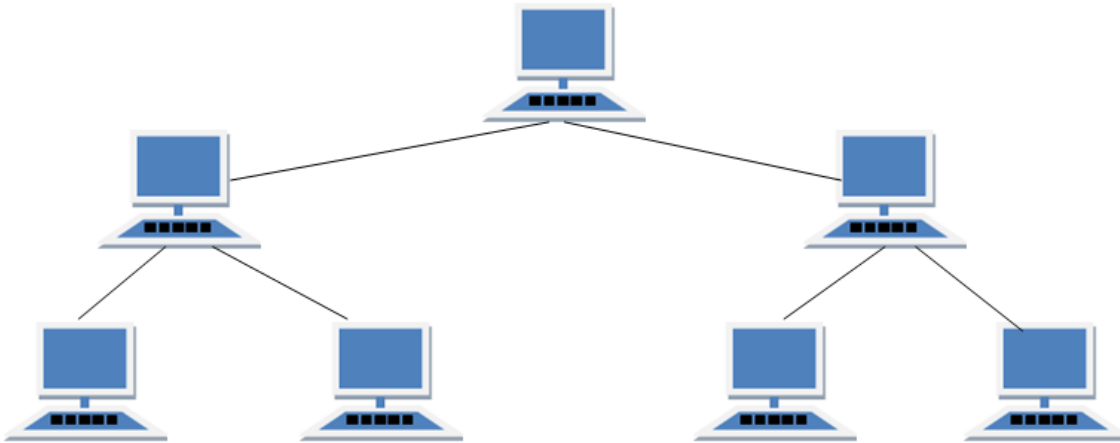
1. Installation and configuration is difficult.
2. Cabling cost is more.
3. Bulk wiring is required.

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## **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.

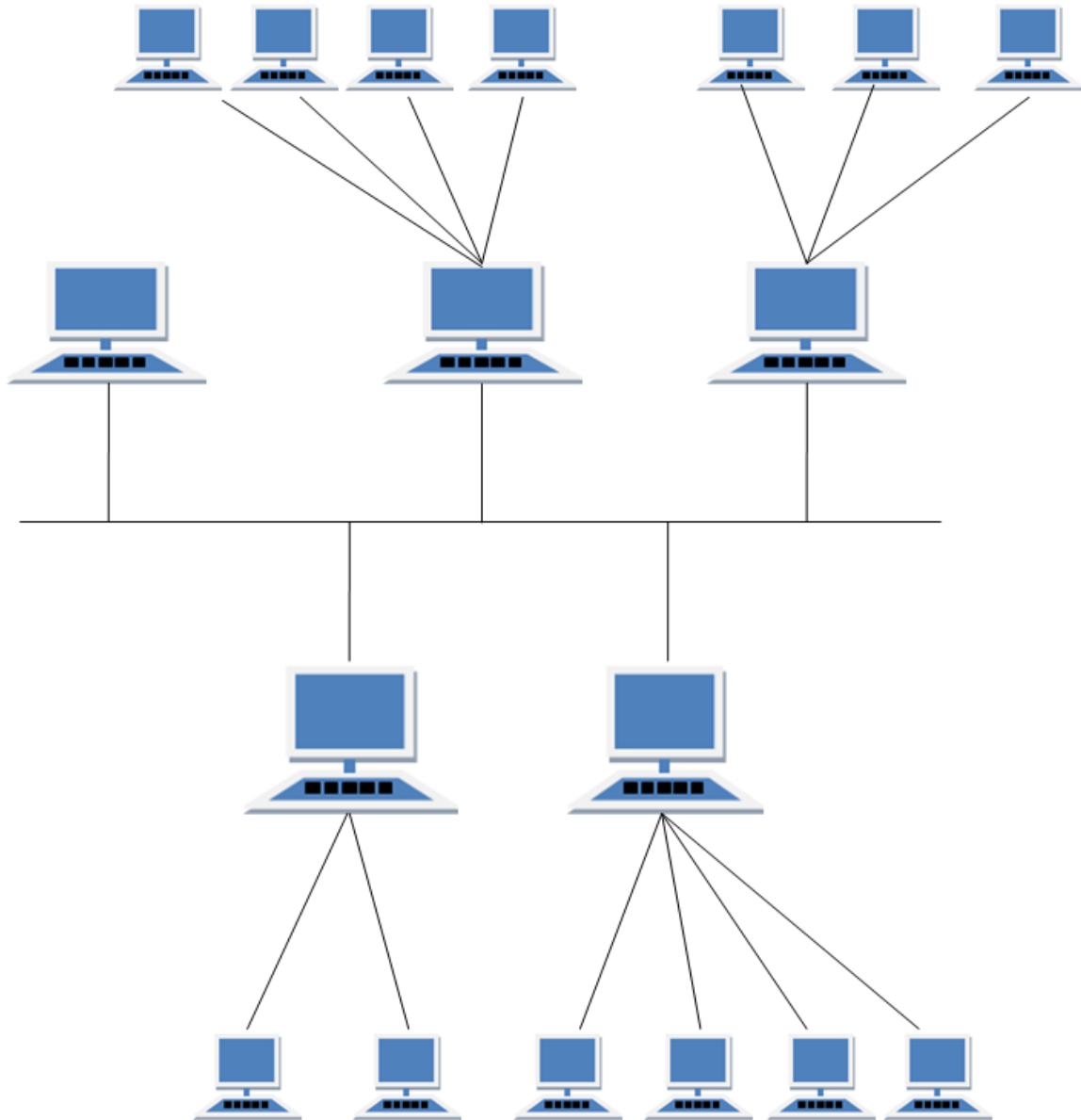
### *Disadvantages of Tree Topology*

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

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## **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 trouble shooting is easy.
2. Effective.
3. Scalable as size can be increased easily.
4. Flexible.

### *Disadvantages of Hybrid Topology*

1. Complex in design.
2. Costly.