Types of network and Topology

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Types of Network

PAN

It is used for communication among devices close to one person.

PAN include wired or wireless connection between devices.

PAN reaches at least 6-9 meters distance

LAN

It is capable of connecting large number of computers within a limited geographical area typically 1 km across.

Transmission channels are coaxial or optic fibres.

Transmission speed is very high.

Error rate is 10^{-8} to 10^{-12} and data rate is 10 Mbps to 10Gpbs

CAN

It made up of interconnection of LANs within a limited geographical area.

CAN is larger than LAN but smaller than WAN.

The main aim of CAN is to allow students to access the internet and campus resources.

It is limited to specific geographical area such as college campus.

MAN

It connects two or more LANs or CANs but not beyond the city or town.

It is owned and operated by single entity such as government body or large corporation.

Example: bank it's branches are connected using public telephone exchange

WAN

It covers broad area like computers distributed all over the country.

Router connects LAN to a WAN.

Transmission media is used here is telephone lines, microwave and satellite links.

Error rate is high such as 10^{-5} to 10^{-7} and data rate is 1200 bps to 6 mbps.

Example of WAN is internet.

GAN

This model supports mobile communication.

Internet is the global system of interconnected computer networks that use internet protocol suite.

To link devices worldwide.

It is a network of networks that consists of various local networks to global scope.

It supports human communication through mail ,chat rooms,newsgroups and allows people to work collaboratively from various locations.

Intranet:

It is a private network that contained within a enterprise.

It consists of interconnected LANs and WANs.

The main purpose of intranet is to share the company information and resources among employees.

It is private internetwork that created and maintained by private organization.

The content inside intranet is available only to the members of that organization.

Extranet:

It is a controlled private network that allows access to partners,vendors and suppliers or an authorized set of customers.

Normally it can be viewed as a part of a company's intranet that is extended to users outside the company.

Intranet is restricted to employees of the organization but extranet can be accessed by customers, suppliers and approved parties.

Network models:

To communicate and transmit data through efficient and ordered way we are using some standard models that is known as computer network models.

The two commonly used models are TCP/IP and ISO/OSI model.

We can classify the models as two that are

Protocol model and reference model

A protocol model closely matches the structure of a particular protocol suite.

Hierarchical set of related protocols in a suite represents the functionality to communicate with the network.

Example is TCP/IP model

Reference model

The primary purpose of reference model is to

Make the users to understand the functions and process involved in communication.

Ex: ISO/OSI

# Various Topologies of Network

Bus topology is a network type in which every computer and network device is connected to single cable.

In this configuration every computer shares the networks total bus capacities.

In this configuration adding more computers will reduce the access speed on the network.

Each computer communicates to other computers on the network independently this is referred to as   PEER-TO-PEER networking
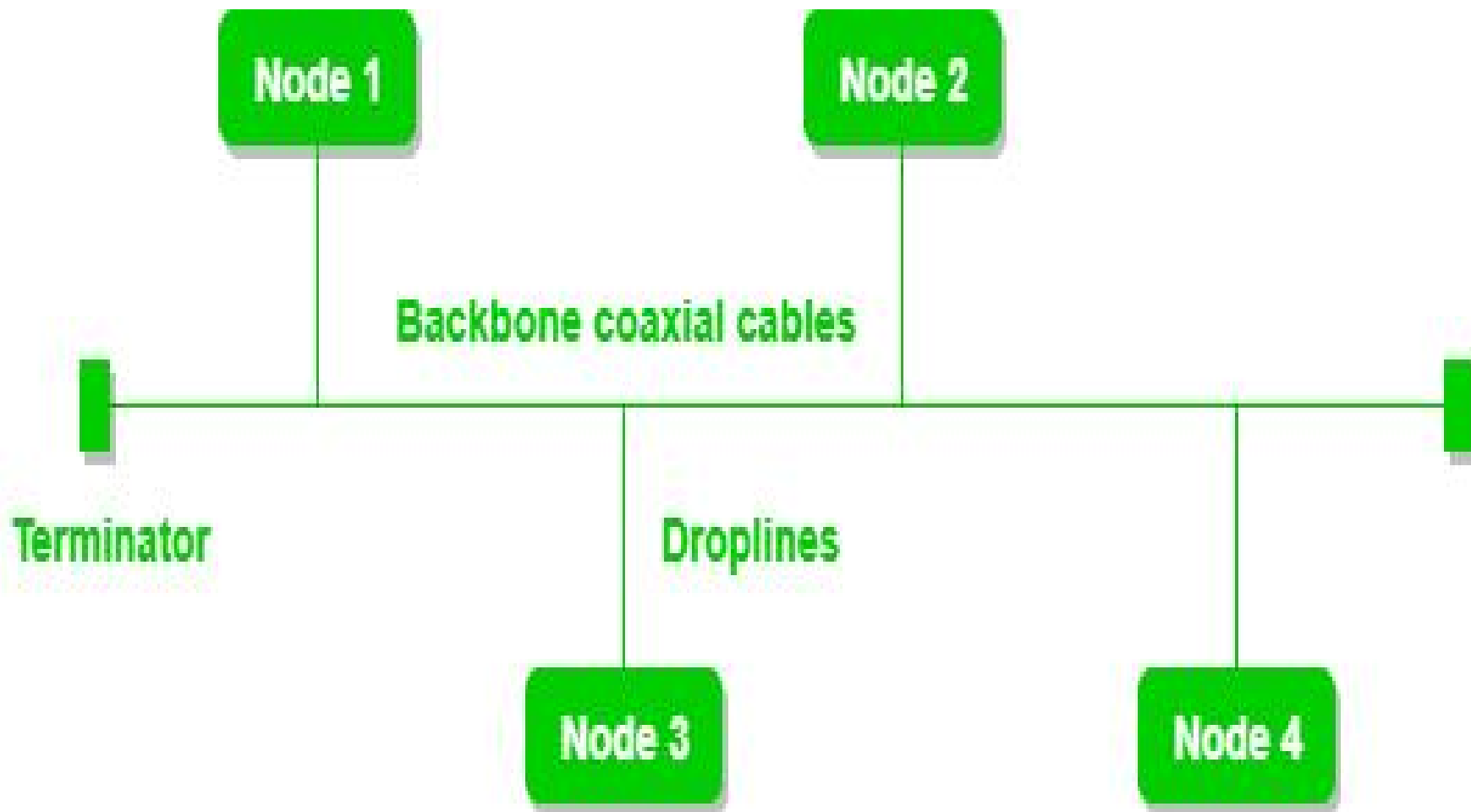
Bus Topology

All computers on a network have a distinct address.

A bus topology with shared backbone cable. The nodes are connected to the channel via drop lines.

a message would be send from one computer with the address of another computer attached to the message and the message is broadcasted to all the computers on the network until the addressed PC accepts the message.

To stop the message from bouncing back and forward down the wire both ends of the network are terminated with 50 resistors

Advantages and disadvantages

Cost of the cable is less as compared to other topology, but it is used to built small networks.

One of the main problems with this type of network is that a defect in the bus would affect the whole network.

If N devices are connected to each other in bus topology, then the number of cables required to connect them is 1 which is known as backbone cable and N drop lines are required.

If the common cable fails, then the whole system will crash down. If the network traffic is heavy, it increases collisions in the network.

Ring Topology

In Ring topology each node is connected to the two nearest nodes so the entire network forms a circle.

Data only travels in one direction on a Ring network.

A number of repeaters are used for Ring topology with a large number of nodes to prevent data loss repeaters are used in the network.

The transmission is unidirectional, but it can be made bidirectional by having 2 connections between each Network Node, it is called Dual Ring Topology.
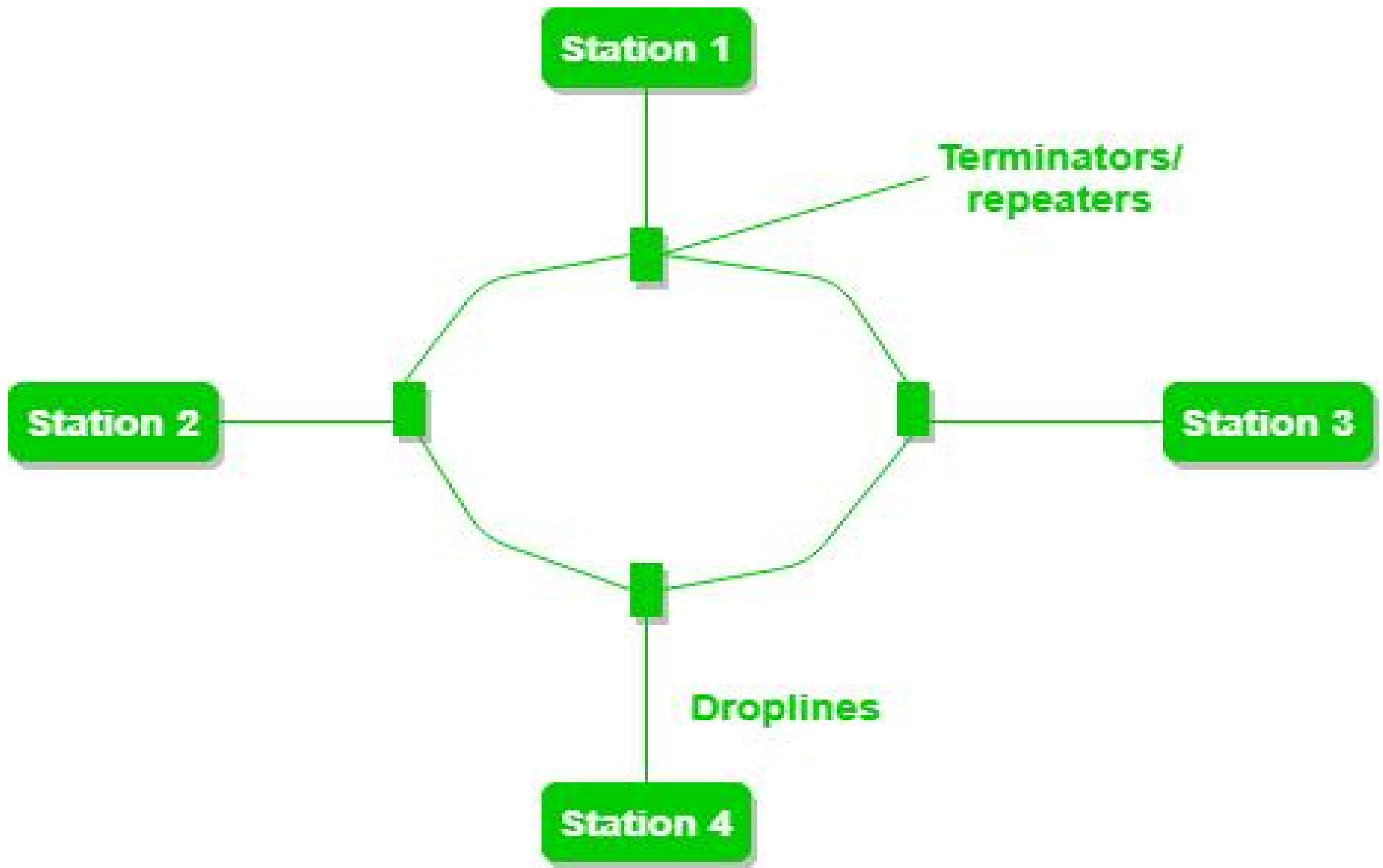
One station is known as monitor station which takes all the responsibility to perform the operations.

To transmit the data, station has to hold the token. After the transmission is done, the token is to be released for other stations to use.

When no station is transmitting the data, then the token will circulate in the ring.

There are two types of token release techniques : Early token release releases the token just after the transmitting the data and Delay token release releases the token after the acknowledgement is received from the receiver.

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The possibility of collision is minimum in this type of topology.
Cheap to install and expand.

The drawback to this type of topology is that a single malfunctioning workstation can disable the whole network

Addition of stations in between or removal of stations can disturb the whole topology.

In star topology, all the devices 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.
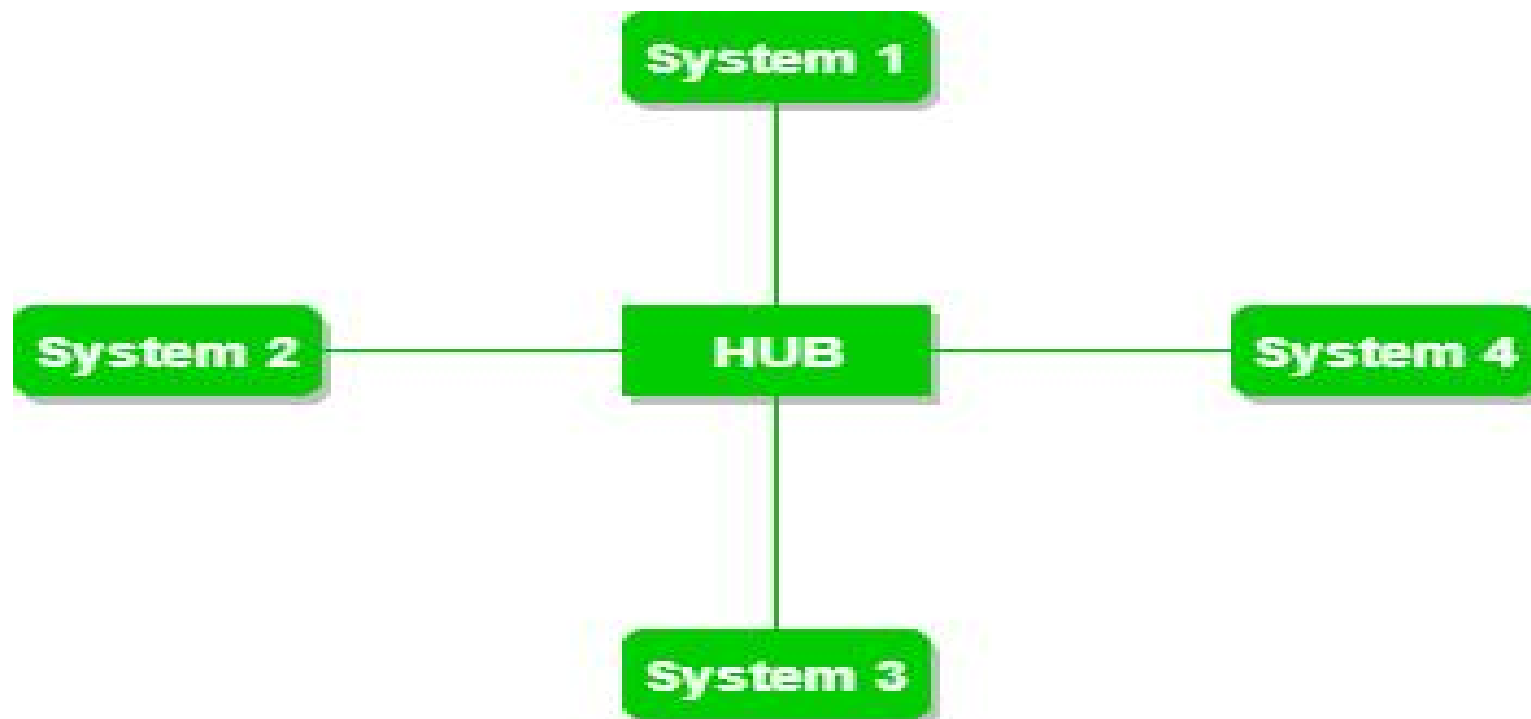
The upside of a star network is that if any one cable fails then only the node connected on that cable would be affected.

If N devices are connected to each other in star topology, then the number of cables required to connect them is N. So, it is easy to set up.

Each device require only 1 port i.e. to connect to the hub.

If the concentrator (hub) on which the whole topology relies fails, the whole system will crash down.

Cost of installation is high.

Performance is based on the single concentrator i.e. hub.

A hub is usually a small rectangular box, often made of plastic, which receives its power from an ordinary wall outlet

A hub joins multiple computers together to form a single network.

On this network segment, all computers can communicate directly with each other

A hub includes a series of ports that each accepts a network cable

Small hubs can network four computers together

They contain four or sometimes five ports

- Many times the fifth port is reserved for "uplink" which is the connecting of one hub to another hub or similar device (joining two segments together).
- Technically speaking, three different types of hubs exist

Passive

Active

Intelligent

Passive hubs

- **Passive hubs** do not amplify the electrical signal of incoming packets before broadcasting them out to the network

- amplify the electrical signal of incoming packets back to their original level before broadcasting them back out on the network . Active hubs have repeaters in them

- An intelligent hub is typically stackable (built in such a way that multiple units can be placed one on top of the other to conserve space).

This topology is the variation of Star topology. This topology have hierarchical flow of data.
In this the various secondary hubs are connected to the central hub which contains the repeater. In this data flow from top to bottom i.e from the central hub to secondary and then to the devices or from bottom to top
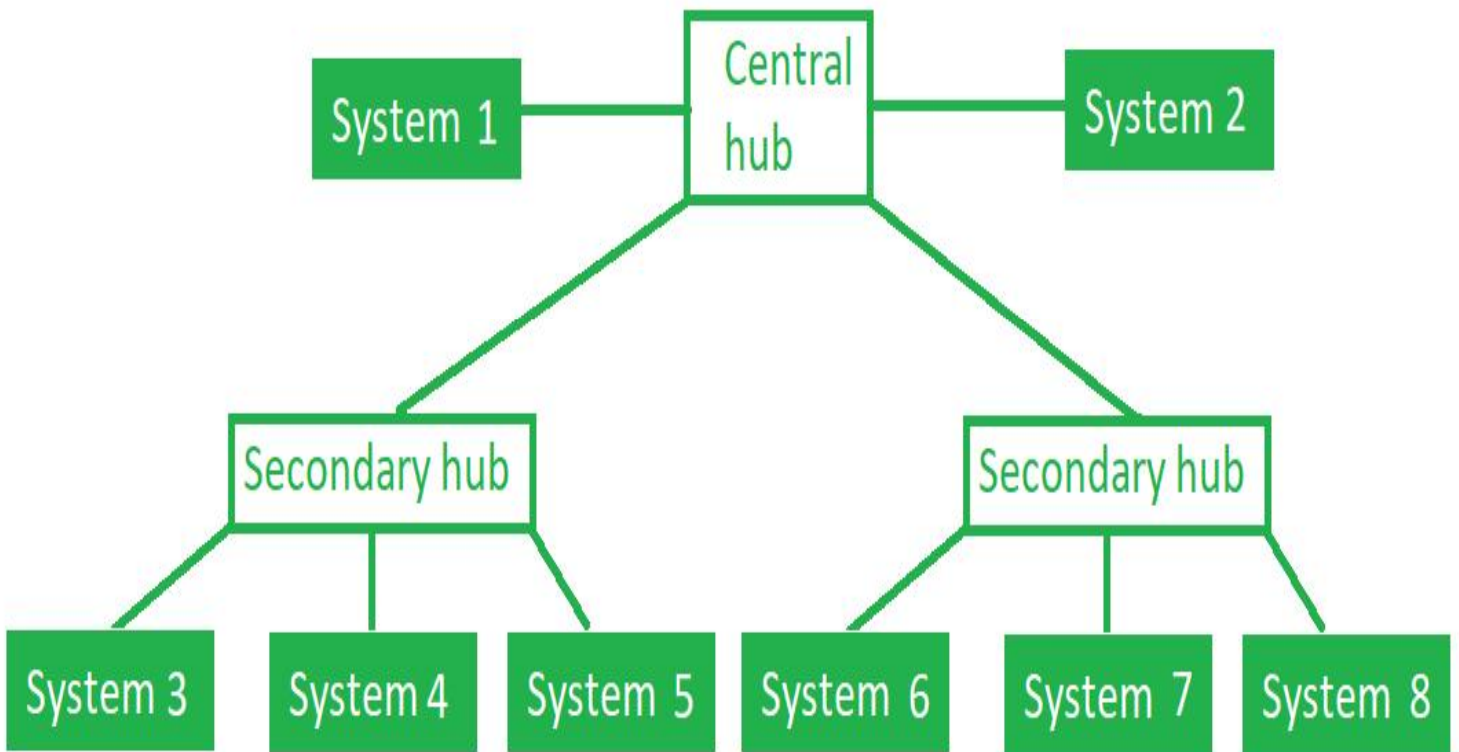
Advantages and Disadvantages

It allows more devices to be attached to a single central hub thus it increases the distance that is travel by the signal to come to the devices.

It allows the network to get isolate and also prioritize from different computers.

If the central hub gets fails the entire system fails.

The cost is high because of cabling.

In mesh topology, every device is connected to another device via particular channel.
Every device is connected with another via dedicated channels. These channels are known as links.

If suppose, N number of devices are connected with each other in mesh topology, then total number of ports that is required by each device is N-1

If suppose, N number of devices are connected with each other in mesh topology, then total number of dedicated links required to connect them is NC2 i.e. N(N-1)/2
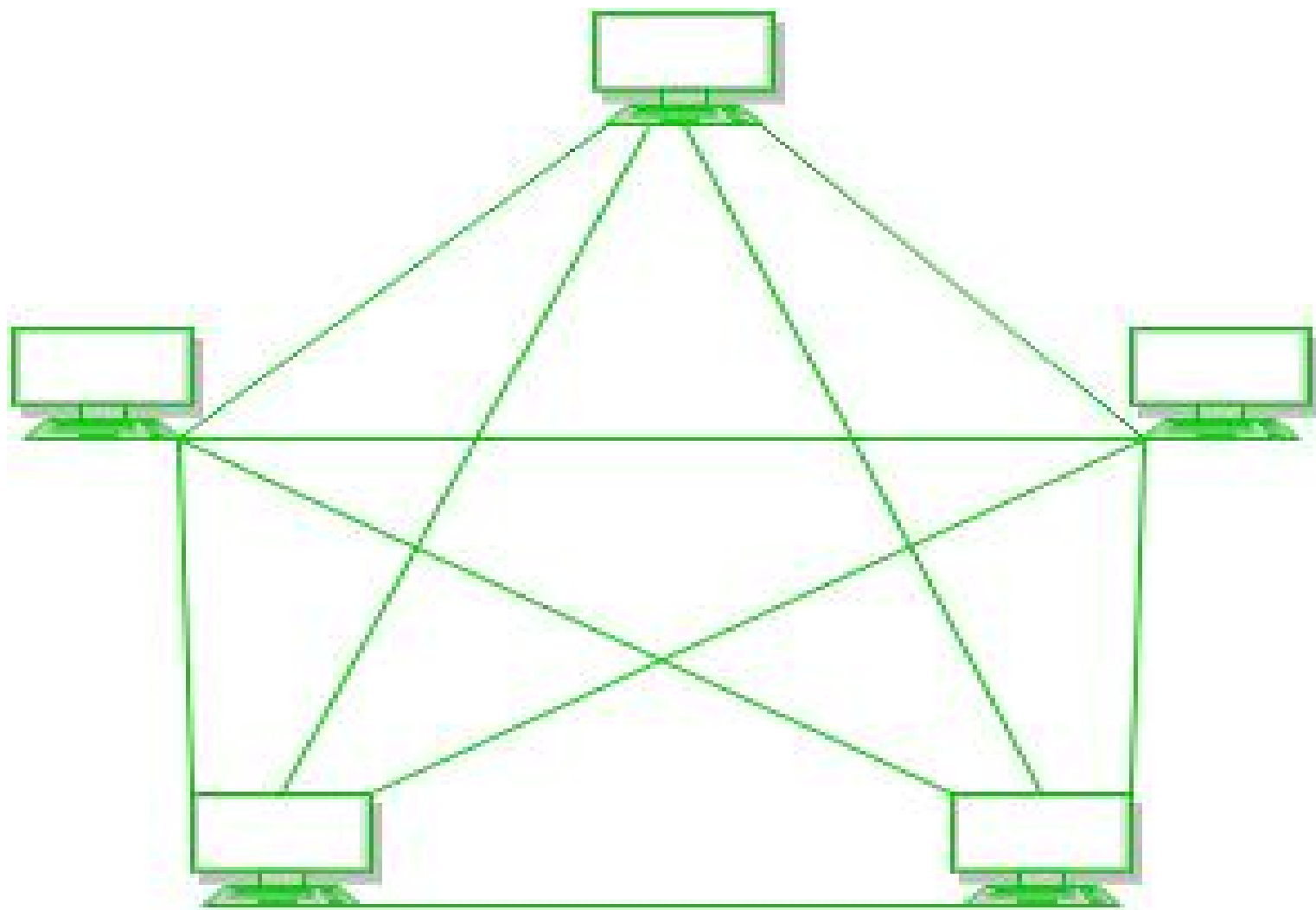
Advantages and disadvantages

It is robust.

Fault is diagnosed easily. Data is reliable because data is transferred among the devices through dedicated channels or links.

Provides security and privacy.

Installation and configuration is difficult.

Cost of cables are high as bulk wiring is required, hence suitable for less number of devices.

Cost of maintenance is high.