A-Level
Computer Science

Network topologies

Lesson Objectives

Students will learn about:

- The different arrangements of various devices in a network.
- The advantages and disadvantages of each of the arrangements.
- How data is sent from sender to receiver
- Physical topolgy vs. logical topology

1.

Content

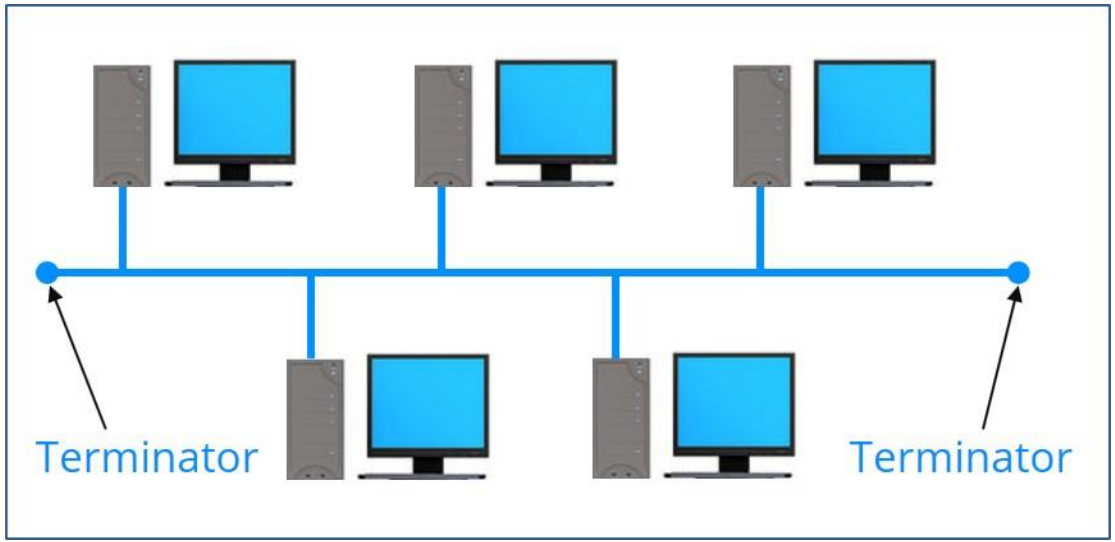
Topology

- The arrangement of the various devices in a network is called its topology.
- There are four main topologies such as bus, ring, star and mesh.

Bus topology

- In a bus network, devices such as computers, servers and printers are connected using one cable.
- A terminator is installed at the end of the cable to stop the reflection of signals back to the bus.

Bus topology

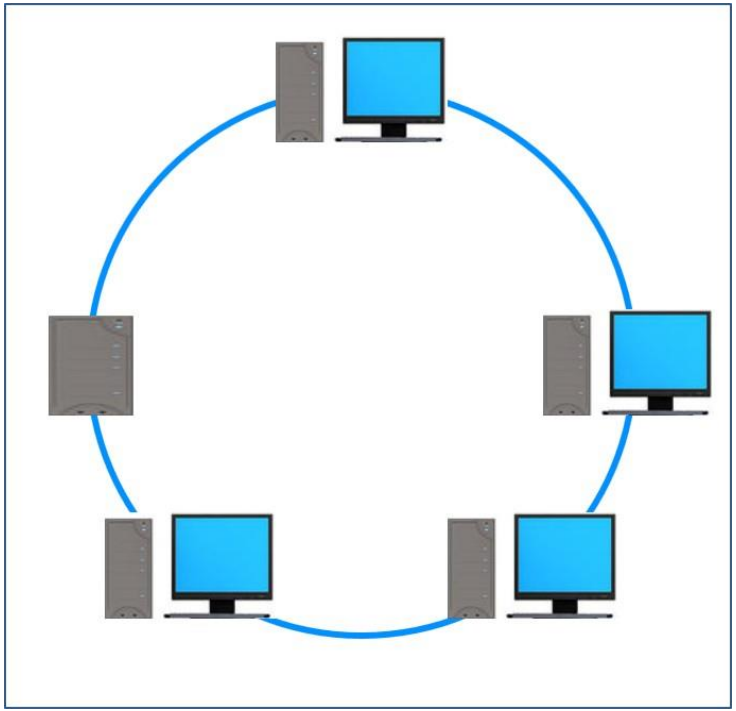


Bus networks

- Bus networks are easy and inexpensive to install as not too much cabling is required.
- If the main cable fails, the whole network fails.
- The connection of more computers slows down the whole connection because of the increase in data collisions.
- Bus networks do not offer a secured connection as the data is available to all the devices in the network.

Ring topology

- In a ring network, the computers and devices are connected in a closed-loop configuration.
- Each device is connected directly to its adjacent devices.



Ring topology

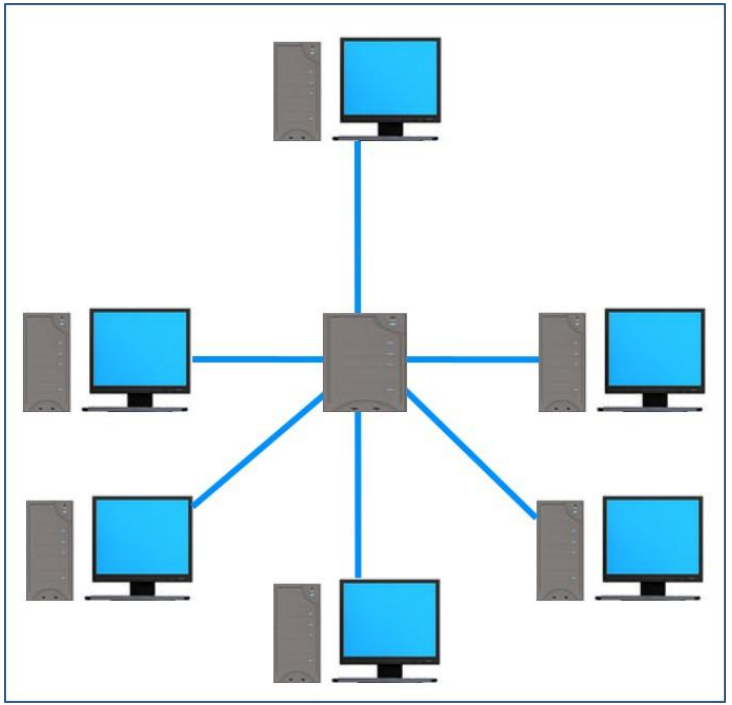
- A data packet transmitted must go through each device one-by-one until it reaches its destination.
- When a computer receives a data packet and it has some messages to be sent, it modifies the data packets and forwards it.
- Once the receiver computer receives it, it sends an acknowledgement to the sender.
- Acknowledgement is the message denoting that the data packets have been received.

Ring topology

- The number of data collisions is reduced in ring networks as data flows in one particular direction.
- If the cable or any device gets faulty, the whole network fails.

Star topology

- A star network is basically used in LAN networks and connects every device to a central hub (or switch) with a cable.
- If a cable fails, only the device connected through it is affected.
- This type of network is best suited for connecting five to six computers where speed is the priority as there are no data collisions.

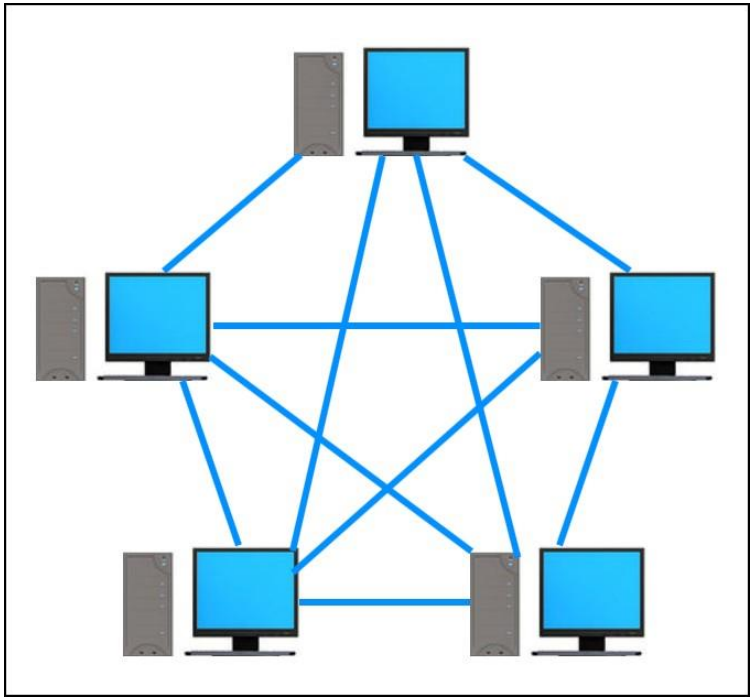


Star topology

- Star networks are expensive to install compared to bus and ring connections as a hub needs to be installed.
- If the central hub fails, the whole network fails.

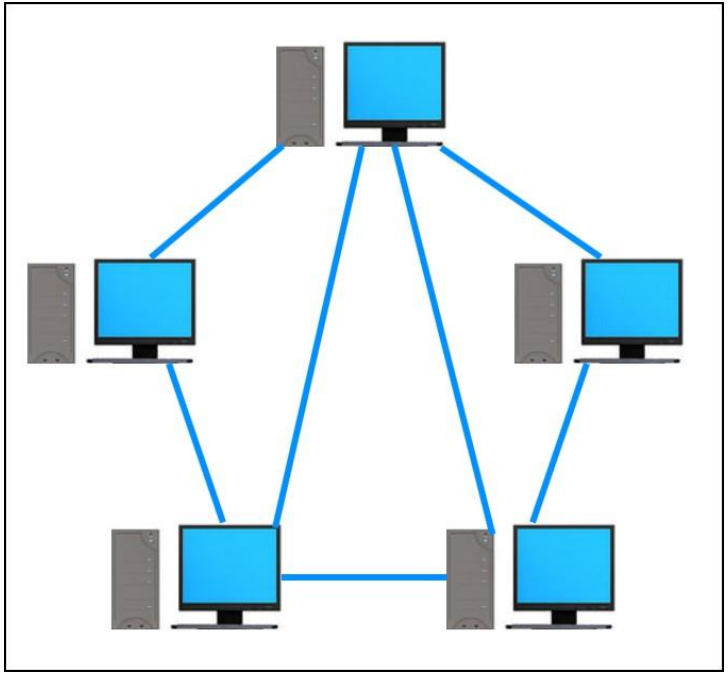
Full mesh network

- In a full mesh network, all devices are connected to each other.
- Therefore, each device can send messages directly to other devices.
- As seen in the figure, there are many routes available for a data packet to travel from the source to a destination. The complete network would never fail.



Partial mesh network

- In a partial mesh network, a device connects to all other devices but some devices are connected in a different topology.



Mesh network

- In a mesh network, a data packet is transmitted in either of these two ways:
  i. Sending to all the devices and the intended receiver will pick-up the data packet.
  ii. Routing the data packet to a particular device.
- In case a particular route is blocked due to failure, the data packet is then re-routed by algorithms. This characteristic of a mesh network is referred to as ‘self-healing’. As a result, mesh networks are comparatively reliable.

Physical vs. logical topology

- The physical topology describes the design used when building a network. The wiring of the network is based on physical topology.
- The logical topology describes the path taken by a data packet from its sender to receiver. Logical topology also describes the way the components communicate with each other in the network.

Physical vs. logical topology

- The physical topology and logical topology are different from each other.
- For example: Components of a network may be connected in star topology but behave like a bus network logically by using a bus protocol along with physical switching.

Let’s review some concepts

Topology

The arrangement of the various devices in a network is called its topology.

Bus network

In a bus network, devices such as computers, servers and printers are connected using one cable and terminators are placed at the ends.

Ring topology

In a ring network, the computers and devices are connected in a closed-loop configuration. Each device is connected directly to its adjacent devices.

Star network

A star network is basically used in LAN networks and connects every device to a central hub (or switch) with a cable.

Full mesh network

In a full mesh network, all devices are connected to each other.

Partial mesh network

In a partial mesh network, a device connects to all other devices but some devices are connected in a different topology.

2.

Activities

Activity-1

Duration: 10 minutes

1. Create a mesh network and star network of at least 4 devices.
2. What are the features of the networks designed in question 1?
3. Add a new device to the network designed in question 1. How many new cables were required to add a new device to:
   a) Mesh network?
   b) Star network?

3.

End of topic questions

End of topic questions

1. What are the advantages and disadvantages of a bus network?
2. What is acknowledgement? How is it useful in computer networks?
3. How is data collisions reduced in ring networks?
4. What is the importance of a central hub in a star network?
5. Why is a mesh network considered to be highly reliable when compared to other networks?
6. How is data packet sent from a sender to a receiver in a mesh network?
7. What is the difference between physical and logical topology of a network?