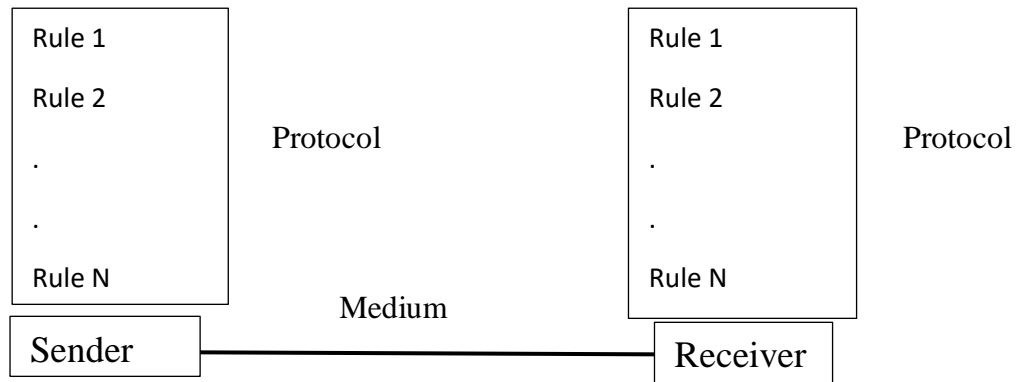# UNIT-III

# Computer Network Tools

- # **Introduction to computer network**

***Data Communication***: When we communicate, we are sharing information. This sharing can be local or remote. Between individuals, local communication usually occurs face to face, while remote communication takes place over distance.

• ***Components:***

A data communications system has five components.



• *Message.* The message is the information (data) to be communicated. Popular forms of information include text, numbers, pictures, audio, and video.

• *Sender.* The sender is the device that sends the data message. It can be a computer, workstation, telephone handset, video camera, and so on.

• *Receiver.* The receiver is the device that receives the message. It can be a computer, workstation, telephone handset, television, and so on.

• *Transmission medium.* The transmission medium is the physical path by which a message travels from sender to receiver. Some examples of transmission media include twisted-pair wire, coaxial cable, fiber-optic cable, and radio waves.

• *Protocol.* A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices. Without a protocol, two devices may be connected but not communicating, just as a person speaking French cannot be understood by a person who speaks only Japanese.

- # **Study of various networking devices**

Network devices, also known as networking hardware, are physical devices that

Allow hardware on a computer network to communicate and interact with one another. For example Repeater, Hub, Bridge, Switch, Routers, Gateway, Brouter, and NIC, etc.

1.  Repeater – A repeater operates at the physical layer. Its job is to regenerate the signal over the same network before the signal becomes too weak or corrupted to extend the
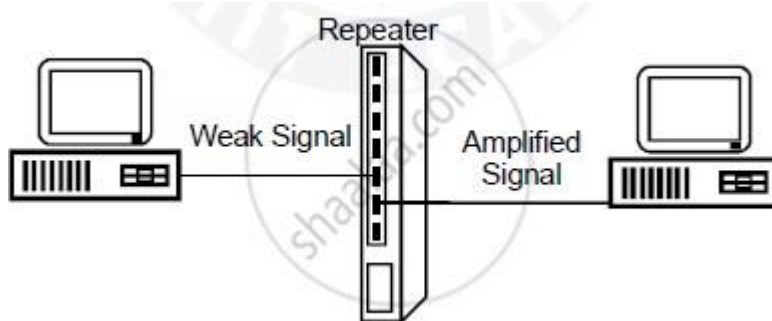


length to which the signal can be transmitted over the same network.

2.  Hub – A hub is a basically multi-port repeater. A hub connects multiple wires coming from different branches, for example, the connector in star topology which connects different stations.



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3.  Bridge – A bridge operates at the data link layer. A bridge is a repeater, with add on the functionality of filtering content by reading the MAC addresses of the source and destination.

4. Switch – A switch is a multiport bridge with a buffer and a design that can boost its efficiency (a large number of ports imply less traffic) and performance. A switch is a data link layer device.



5. Routers – A router is a device like a switch that routes data packets based on their IP addresses. The router is mainly a Network Layer device.



6. Gateway – A gateway, as the name suggests, is a passage to connect two networks that may work upon different networking models. They work as messenger agents that take data from one system, interpret it, and transfer it to another system.
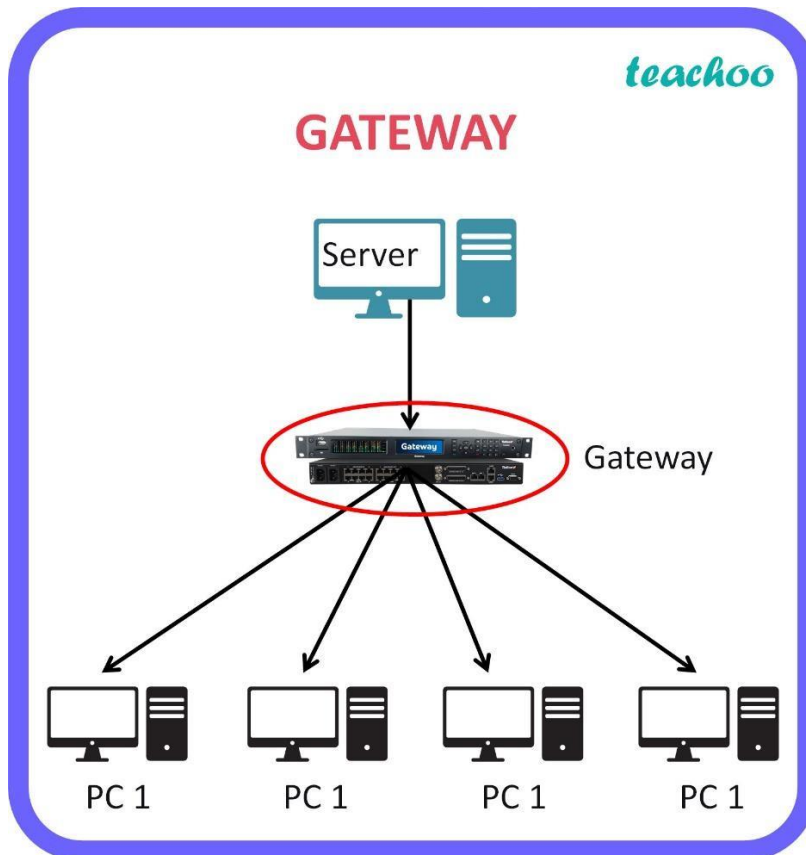
7. Brouter – It is also known as the bridging router is a device that combines features of both bridge and router. It can work either at the data link layer or a network layer.
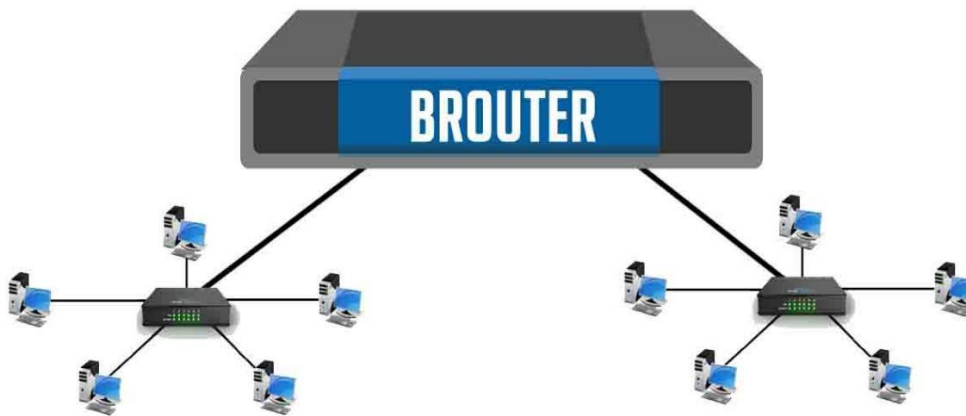


8. NIC – NIC or network interface card is a network adapter that is used to connect the computer to the network. It is installed in the computer to establish a LAN.

Gigabit Ethernet NIC

PCI connection

Ethernet port

TechTerms.com
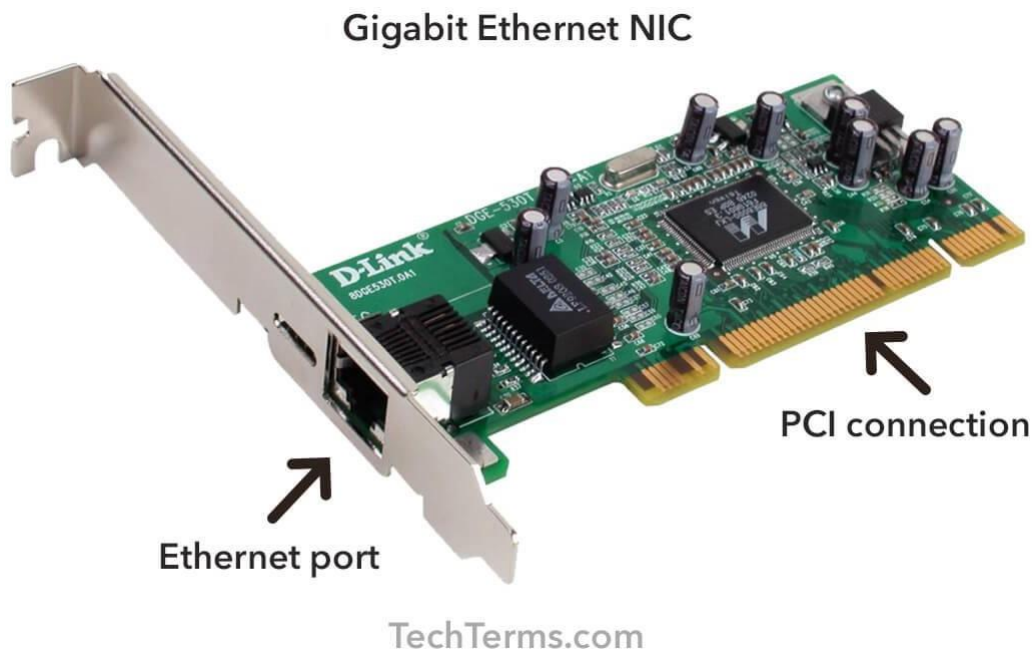
- # **Study of various topologies :**

*Topology*
The physical Arrangement of the computer system/node, which is connected to each other via communication medium is called topology.

*Mesh*: In a mesh topology, every node is connected to every other node in the network. This provides redundant paths between nodes and allows for every node to act as a router. A mesh topology is therefore very fault tolerant – if one link fails, there are alternate routes that can be taken.
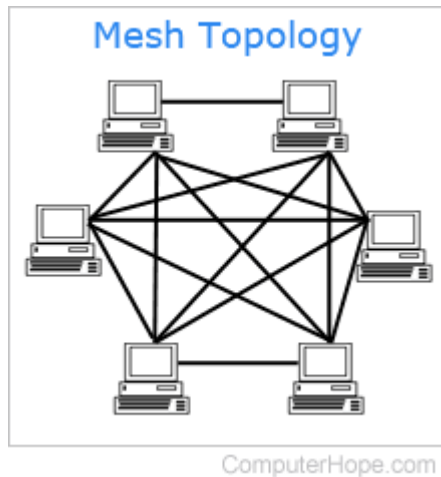
### Advantages of Mesh Topology:

- Failure during a single device won't break the network.
- This topology provides multiple paths to succeed in the destination and tons of redundancy.
- Data transmission is more consistent because failure doesn't disrupt its processes.
- Adding new devices won't disrupt data transmissions.

### Disadvantages of Mesh Topology:

- It's costly as compared to the opposite network topologies i.e. star, bus, point to point topology.

- Installation is extremely difficult in the mesh.
- Power requirement is higher as all the nodes will need to remain active all the time and share the load.
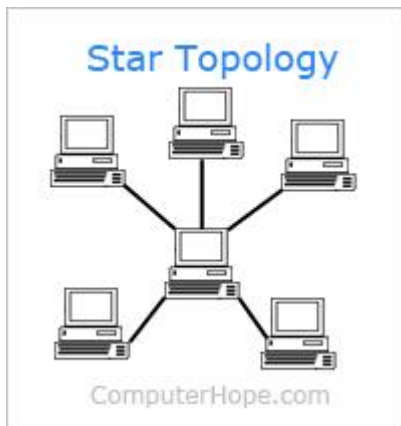


*Star Topology:* Star topology is a network topology in which each network component is physically connected to a central node such as a router, hub or switch.

**Advantages of Star Topology:**
- it is high-performing as no data collisions can occur
- Less expensive because each device only need one I/O port and wishes to be connected with hub with one link.
- Easier to put in
- Robust in nature
- Easy fault detection because the link are often easily identified.

**Disadvantages of Star Topology**
- Requires more cable than a linear bus.
- If the connecting network device (network switch) fails, nodes attached are disabled and can't participate in network communication.
- More expensive than linear bus topology due to the value of the connecting devices (network switches)
- If hub goes down everything goes down, none of the devices can work without hub.
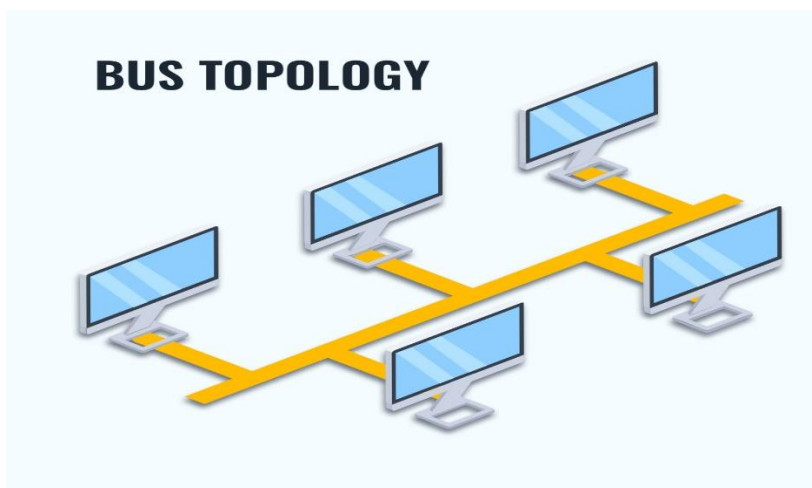
**Bus Topology:**
Bus topology is a type of network topology in which all devices are connected to a single cable called a "bus."

## Advantages of Bus Topology:

- The cost of the cable is less compared to other topologies, but it is used to build small networks.
- Bus topology is familiar technology as installation and troubleshooting techniques are well known.

**Drawbacks of Bus Topology:**

- A bus topology is quite simpler, but still, it requires a lot of cabling.
- If the common cable fails, then the whole system will crash down.
- If the network traffic is heavy, it increases collisions in the network. To avoid this, various protocols are used in the MAC layer known as Pure Aloha, Slotted Aloha, CSMA/CD, etc.
- Adding new devices to the network would slow down networks.



**Ring Topology**: In a ring topology, each device has a dedicated point-to-point connection with only the two devices on either side of it. A signal is passed along the ring in one direction, from device to device, until it reaches its destination. Each device in the ring incorporates a repeater.

**Advantages of Ring Topology**
- The data transmission is high-speed.
- The possibility of collision is minimum in this type of topology.
- Cheap to install and expand.
- It is less costly than a star topology.

**Drawbacks of Ring Topology**
- The failure of a single node in the network can cause the entire network to fail.
- Troubleshooting is difficult in this topology.
- The addition of stations in between or the removal of stations can disturb the whole topology.
- Less secure.
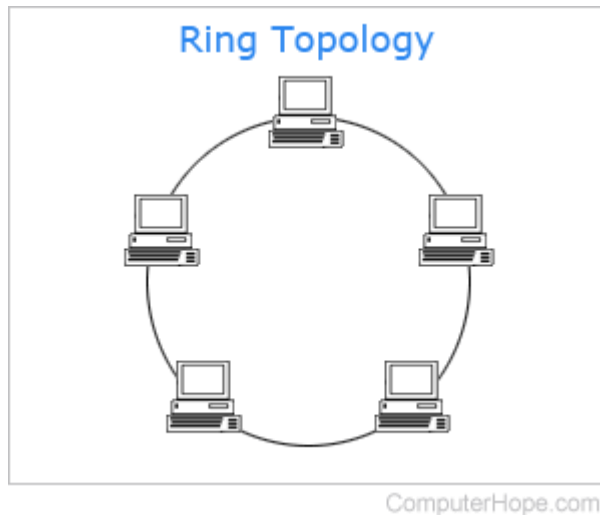


- # Network configuration commands :-

1. *Ping*

   It is used detecting devices on network and troubleshooting network problems. It will help to see the connection between your device and another device on the network.

2. *Ipconfig*

   It will find network information local devices like IP Address and default gateway.

3. *Tracert*

   when we face any network issue and to troubleshoot this issue Trace route will send that is the route of the packet from server to server as hope. It will show a delay between user and hop.

4. *nslookup*

   It stands for name server lookup. When we want to know the IP address of the domain we can use this command. Fact is if we run this command over and over, we will get different IP addresses for a website like google, yahoo, Flipkart because these domains have spread to different machines.

5. *netstat*

   It is used for network statics, diagnostics, and analysis. If we are managing a huge college campus network, then this tool is useful because it provides an advanced aspect of the network.

6. *arp*

It stands for address resolution protocol. It will find the MAC address and hardware address of the host from the IP address.

7. *HOSTNAME*
The HOSTNAME command displays the hostname of the system. The hostname command is much easier to use than going into the system settings to search for it. Command to enter in Prompt – hostname.

8. *SSH*
The ssh command provides a secure encrypted connection between two hosts over an insecure network. This connection can also be used for terminal access, file transfers, and for tunneling other applications.

# • **Study of various computer networks**

Computer networks can be classified based on several criteria, such as the transmission medium, the network size, the topology, and organizational intent. Based on a geographical scale, the different types of networks are:

1. **Nanoscale networks**: These networks enable communication between minuscule sensors and actuators.
2. **Personal area network (PAN)**: PAN refers to a network used by just one person to connect multiple devices, such as laptops to scanners, etc.
3. **Local area network (LAN)**: The local area network connects devices within a limited geographical area, such as schools, hospitals, or office buildings.
4. **Storage area network (SAN)**: SAN is a dedicated network that facilitates block-level data storage. This is used in storage devices such as disk arrays and tape libraries.
5. **Campus area network (CAN)**: Campus area networks are a collection of interconnected LANs. They are used by larger entities such as universities and governments.
6. **Metropolitan area network (MAN)**: MAN is a large computer network that spans across a city.
7. **Wide area network (WAN)**: Wide area networks cover larger areas such as large cities, states, and even countries.
8. **Enterprise private network (EPN):** An enterprise private network is a single network that a large organization uses to connect its multiple office locations.
9. **Virtual private network (VPN)**: VPN is an overlay private network stretched on top of a public network.
10. **Cloud network**: Technically, a cloud network is a WAN whose infrastructure is delivered via cloud services.