

UNIT-V

Network Hardware Components:

- Introduction to Connectors,
- Transreceivers and media convertors,
- Repeaters,
- Network interference cards and PC cards
- Bridges
- Switches
- Switches Vs Routers.

Connectors





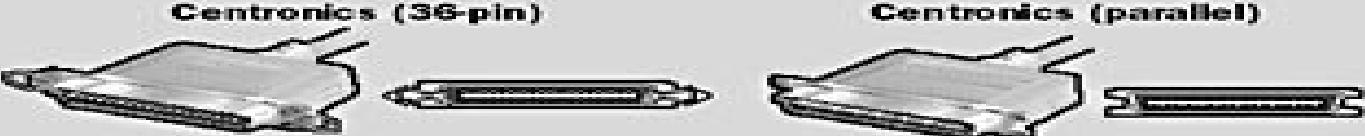



A connector is a device that terminates a segment of cabling or provides a point of entry for networking devices such as computers, hubs, and routers.

What is a Connector (device)?

A device that terminates a segment of cabling or provides a point of entry for networking devices such as computers, hubs, and routers. Connectors can be distinguished according to their physical appearance and mating properties, such as jacks and plugs (male connectors) or sockets and ports (female connectors).

- They can also be distinguished by their different pinning configurations, such as DB9 and DB15 connectors, which have 9 and 15 pins, respectively.
- In addition, connectors are distinguished by the kind of electrical interfaces they support.
Examples of different types of connectors include:
- Connectors for serial interfaces, such as RS-232 and V.35
- Ethernet connectors, such as RJ-45 and BNC connectors
- Fiber-optic cabling connectors, such as SC and ST connectors

- There are literally dozens of types of connectors used in networking, and the networking professional needs to be familiar with many of them. The illustration shows some of the common connector types used in different aspects of networking and telecommunications.

BNC				
DB				
V series				
Modular				
Centronics				
Fiber-optic				
HD				
SCSI				

RJ45 Connector

- RJ45 is the acronym for **Registered Jack 45**. **RJ45 connector** is an 8-pin jack used by devices to physically connect to **Ethernet based local area networks (LANs)**. **Ethernet** is a technology that defines protocols for establishing a LAN. The cable used for Ethernet LANs are twisted pair ones and have **RJ45 connector pins** at both ends. These pins go into the corresponding socket on devices and connect the device to the network.



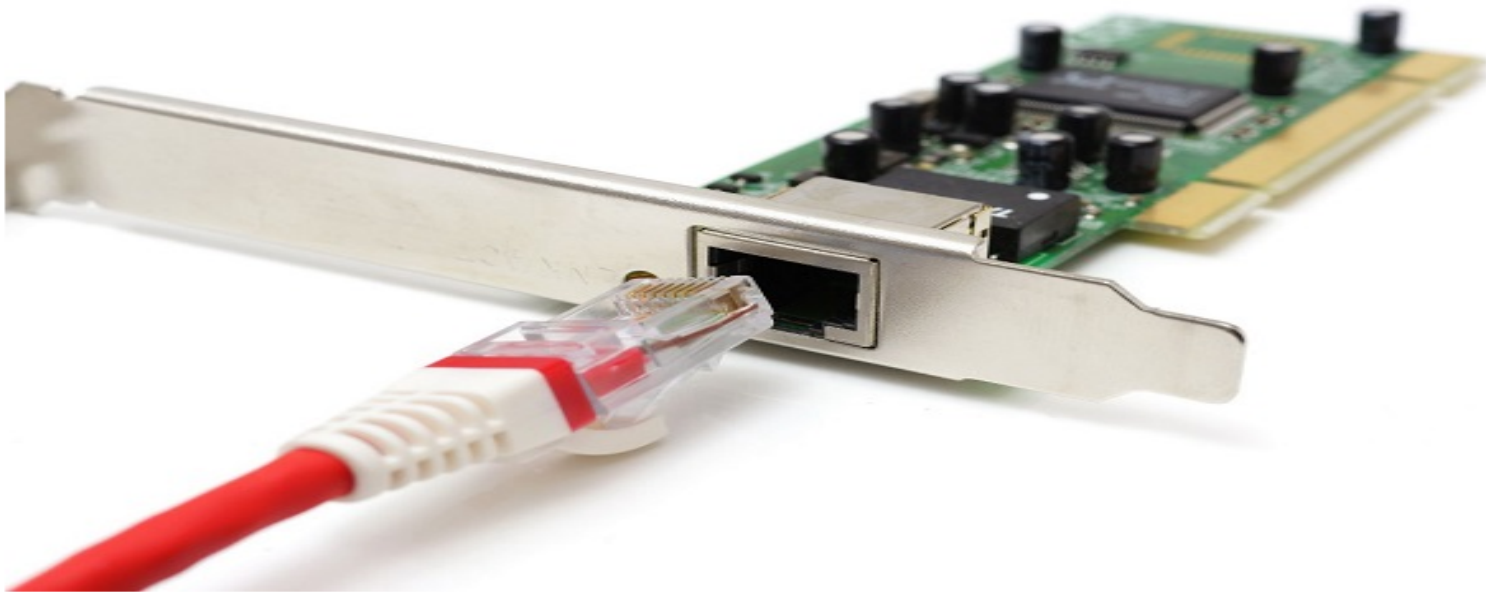
Transceiver

- An Ethernet transceiver is hardware used in Ethernet and IEEE 802.3 specifications. It is responsible for linking computer networks. It is a component of the physical layer in the network ISO model. Functions of an Ethernet transceiver include:
 - Collision detection
 - Digital data conversion
 - Processing on Ethernet interface
 - Providing access to the network
- Several workstations can be connected on a single connection of an Ethernet bus via a multi-port transceiver or MAU. Ethernet transceivers can be configured as a joined station, a discrete device or an Internet hub available for multiple connections.

Ethernet Card(NIC)

- **Ethernet card**, also known as **network interface card (NIC)**, is a hardware component used by computers to connect to **Ethernet LAN** and communicate with other devices on the LAN. The earliest **Ethernet cards** were external to the system and needed to be installed manually. In modern computer systems, it is an internal hardware component. The NIC has **RJ45 socket** where network cable is physically plugged in.

Ethernet card speeds may vary depending upon the protocols it supports. Old Ethernet cards had maximum speed of **10 Mbps**. However, modern cards support fast Ethernets up to a speed of **100 Mbps**. Some cards even have capacity of **1 Gbps**.



An Ethernet NIC

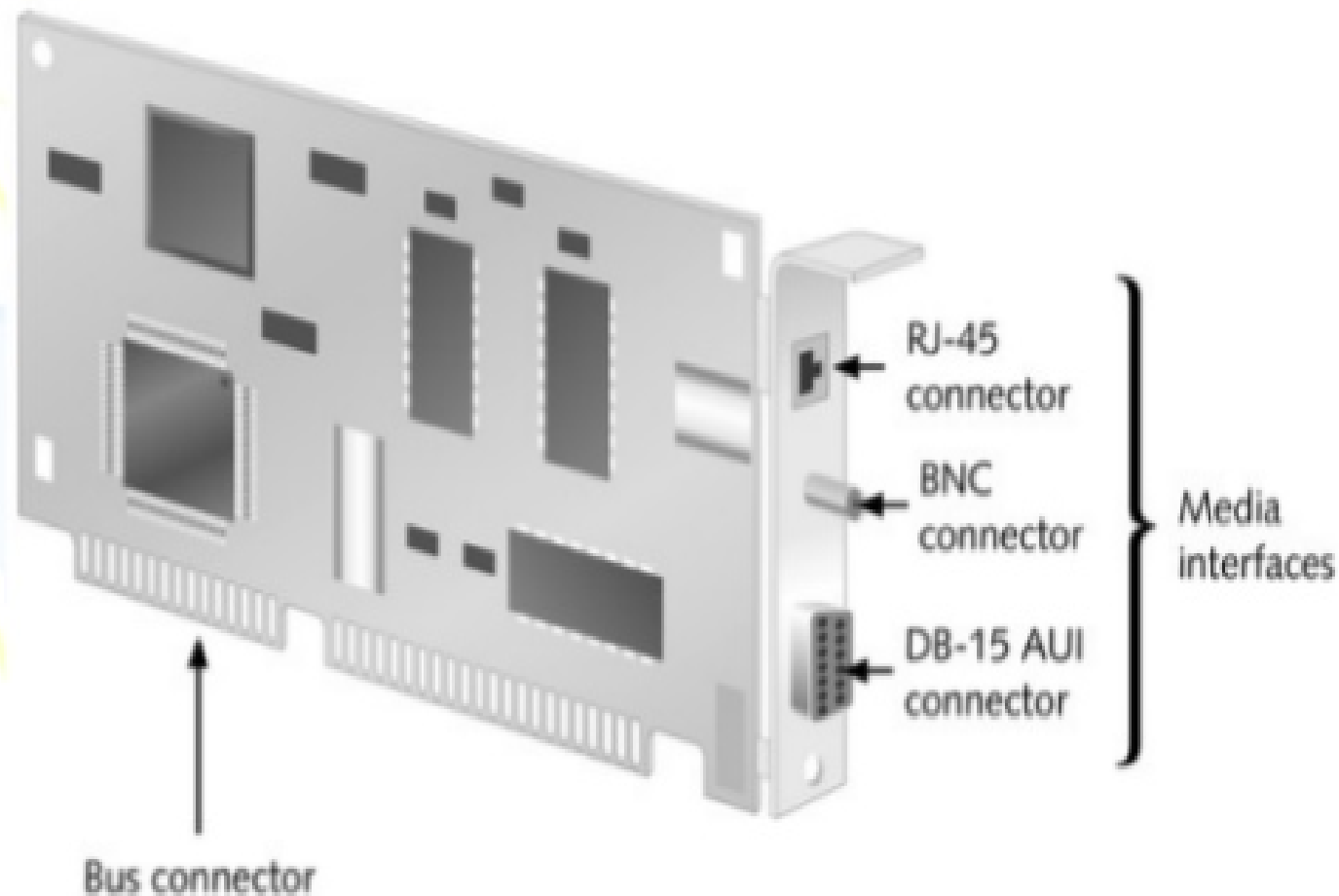
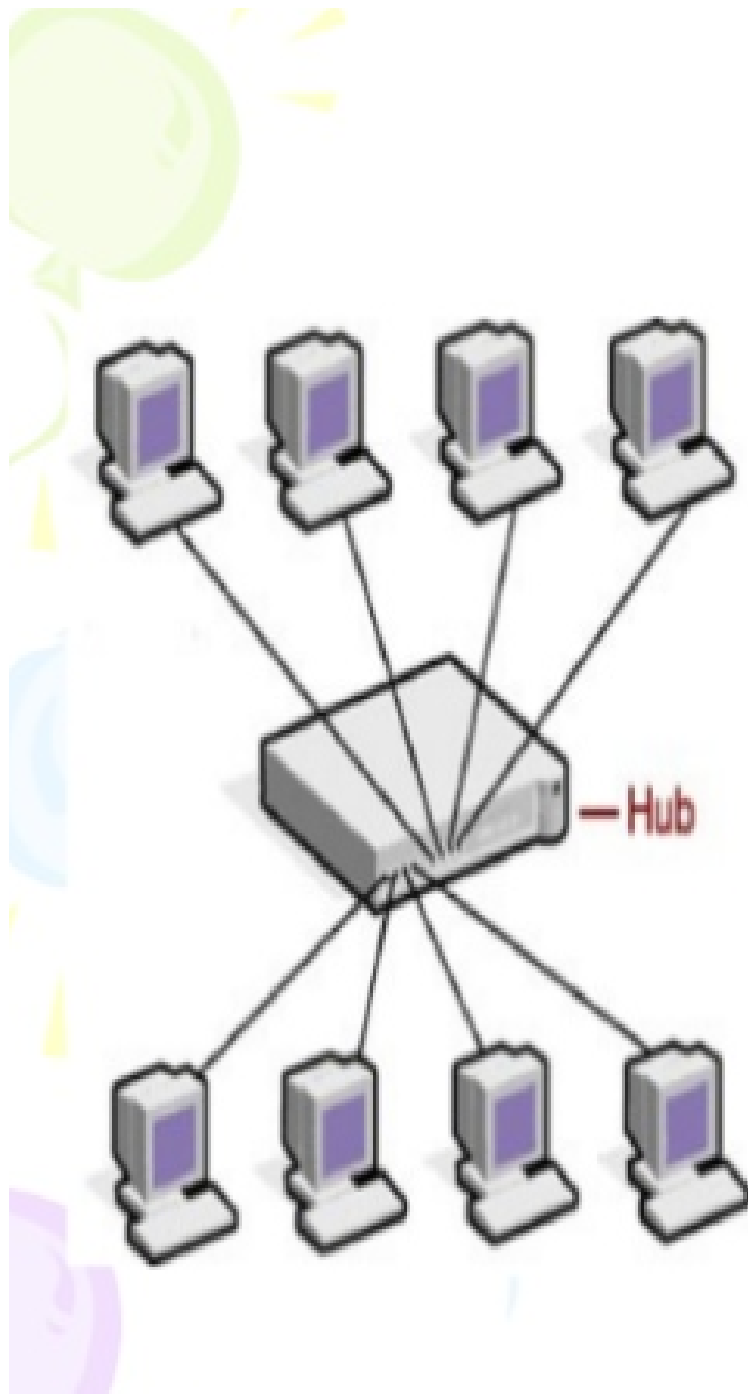


Figure Ethernet NIC with interfaces for thinnet (BNC), thicknet (AUI), and 10BaseT (RJ-45)

Hubs

- Hubs are devices used to link several computers together. They repeat any signal that comes in on one port and copy it to the other ports (a process that is also called *broadcasting*).
- There are two types of hubs: active and passive.
- *Passive hubs* simply connect all ports together electrically and are usually not powered.
- *Active hubs* use electronics to amplify and clean up the signal before it is broadcast to the other ports.
- In the category of active hubs, there is also a class called “intelligent” hubs, which are hubs that can be remotely managed on the network.

Hubs



Router

- A **router** is a **network layer** hardware device that transmits data from one LAN to another if both networks support the same set of protocols. So a **router** is typically connected to at least two LANs and the **internet service provider (ISP)**. It receives its data in the form of **packets**, which are **data frames** with their **destination address** added. Router also strengthens the signals before transmitting them. That is why it is also called **repeater**.

Routing Table

A router reads its routing table to decide the best available route the packet can take to reach its destination quickly and accurately. The routing table may be of these two types –

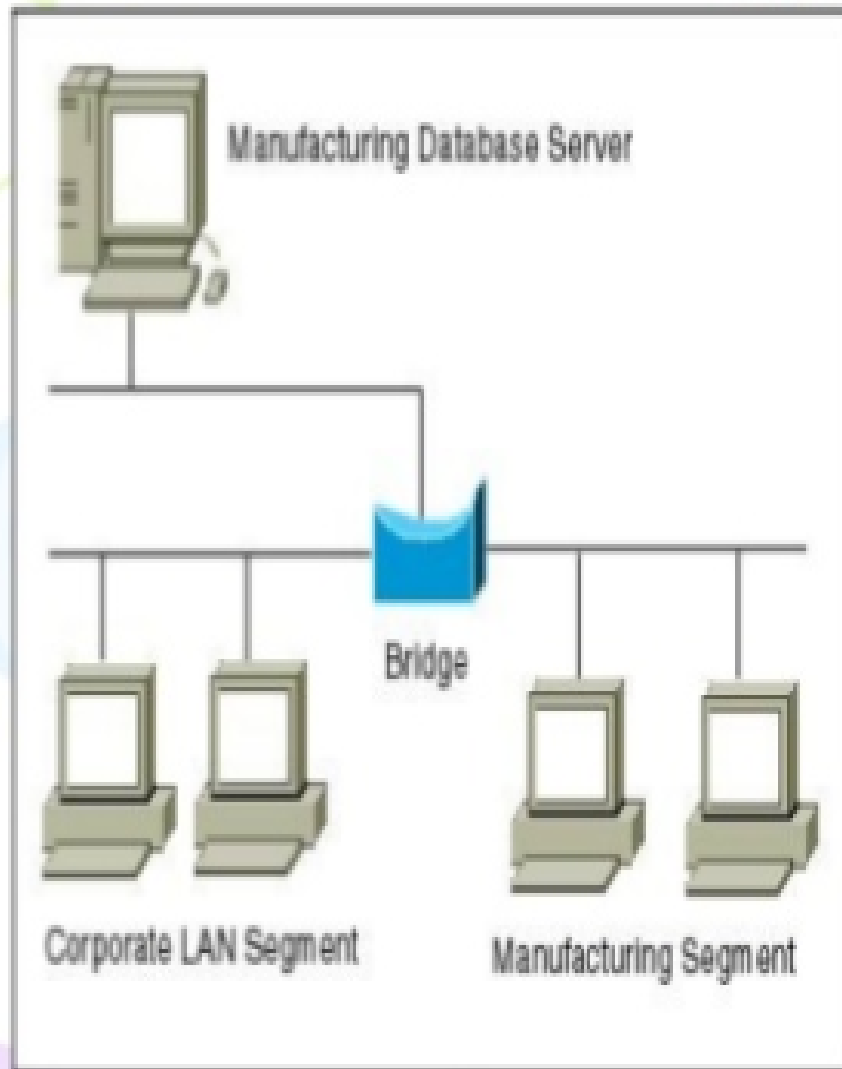
Static – In a static routing table the routes are fed manually. So it is suitable only for very small networks that have maximum two to three routers.

Dynamic – In a dynamic routing table, the router communicates with other routers through protocols to determine which routes are free. This is suited for larger networks where manual feeding may not be feasible due to large number of routers.

Bridges

- They join similar topologies and are used to divide network segments.
- For example, with 200 people on one Ethernet segment, the performance will be mediocre, because of the design of Ethernet and the number of workstations that are fighting to transmit. If you divide the segment into two segments of 100 workstations each, the traffic will be much lower on either side and performance will increase.
- If it is aware of the destination address, it is able to forward packets; otherwise a bridge will forward the packets to all segments. They are more intelligent than repeaters but are unable to move data across multiple networks simultaneously.
- Unlike repeaters, bridges *can* filter out noise.
- The main disadvantage to bridges is that they can't connect dissimilar network types or perform intelligent path selection. For that function, you would need a router.

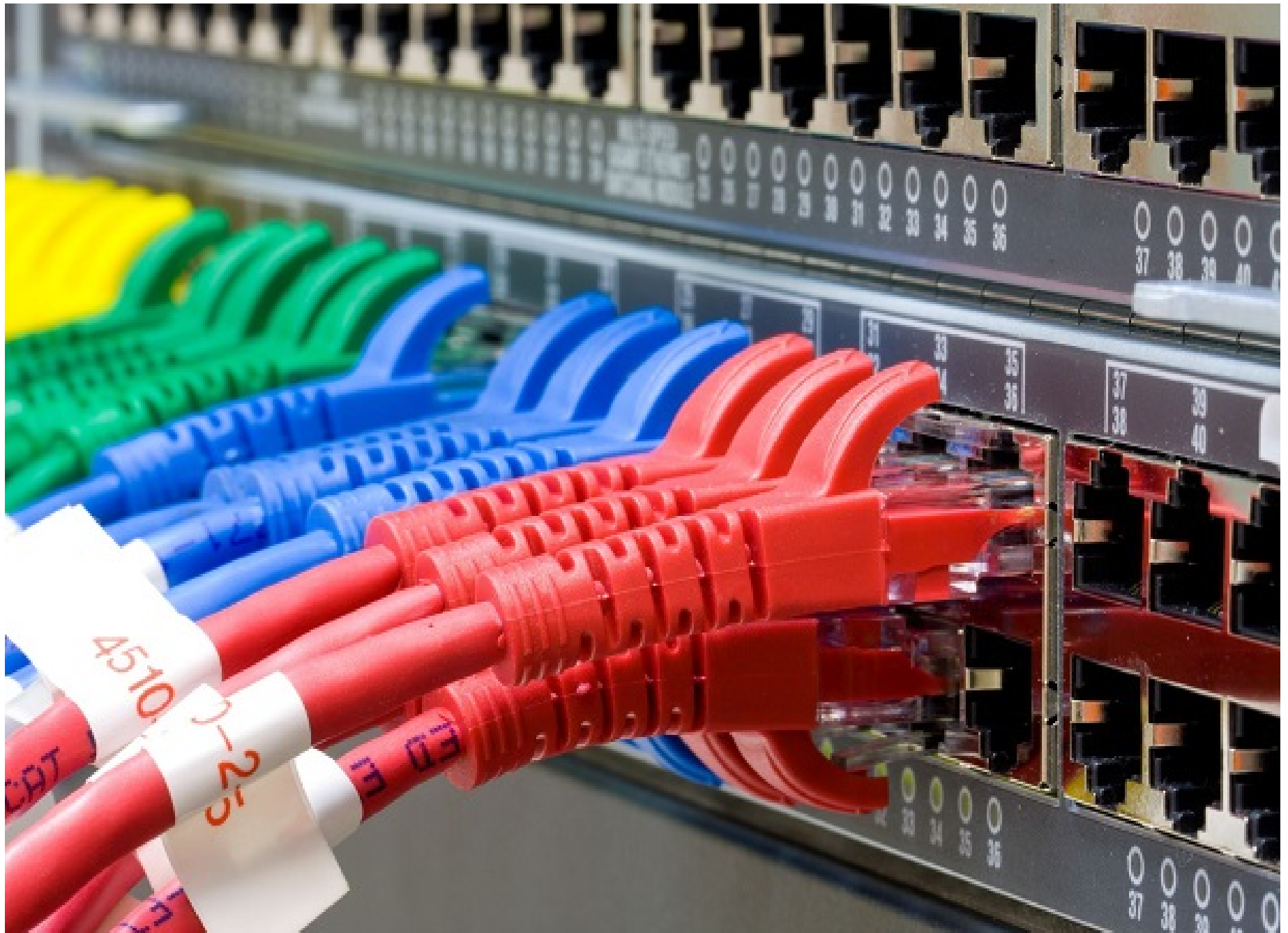
Bridges



A bridge is a Layer 2 (Data Link Layer) device.

Switch

- **Switch** is a network device that connects other devices to **Ethernet** networks through **twisted pair** cables. It uses **packet switching** technique to **receive, store and forward data packets** on the network. The switch maintains a list of network addresses of all the devices connected to it.
- On receiving a packet, it checks the destination address and transmits the packet to the correct port. Before forwarding, the packets are checked for collision and other network errors. The data is transmitted in full duplex mode



Gateway

- **Gateway** is a network device used to connect two or more dissimilar networks. In networking parlance, networks that use different protocols are **dissimilar networks**. A gateway usually is a computer with multiple **NICs** connected to different networks. A gateway can also be configured completely using software. As networks connect to a different network through gateways, these gateways are usually hosts or end points of the network.

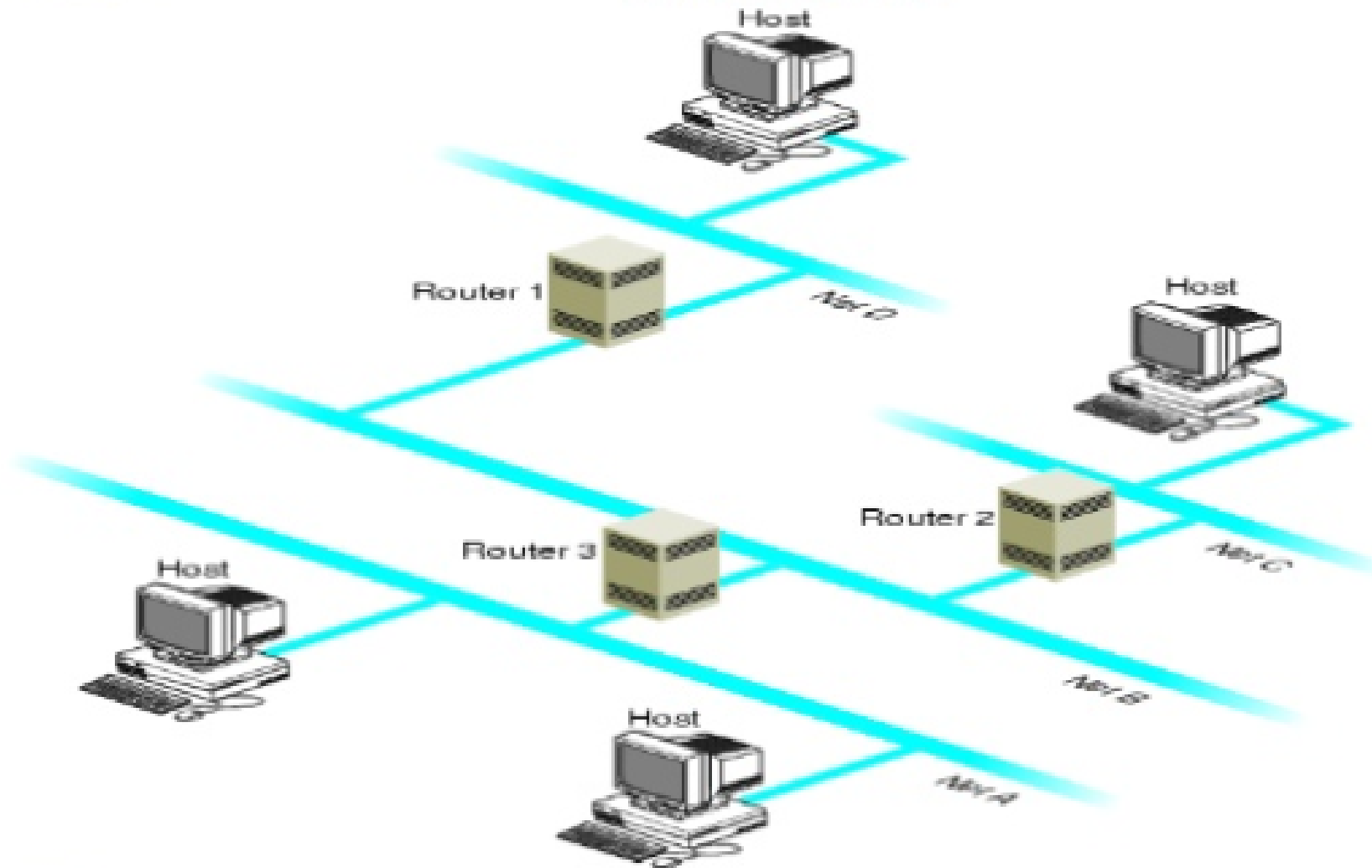
- **Gateway** uses **packet switching** technique to transmit data from one network to another. In this way it is similar to a **router**, the only difference being router can transmit data only over networks that use same protocols.

- **What is a Router?**
- A router is a networking device that connects computer networks, for example, connecting a home network with the Internet. Routers are the workhorses that transfer packets of data between networks to establish and sustain communication between two nodes in an internetwork. Routers operate at Layer 3 (network layer) of the OSI model; a router uses the destination IP address in a data packet to determine where to forward the packet.

Routers

- Routers are highly intelligent devices that connect multiple network types and determine the best path for sending data.
- The advantage of using a router over a bridge is that routers can determine the best path that data can take to get to its destination.
- Like bridges, they can segment large networks and can filter out noise.
- However, they are slower than bridges because they are more intelligent devices; as such, they analyze every packet, causing packet-forwarding delays. Because of this intelligence, they are also more expensive.
- Routers are normally used to connect one LAN to another. Typically, when a WAN is set up, there will be at least two routers used.
- Internetwork connectivity device

Routers

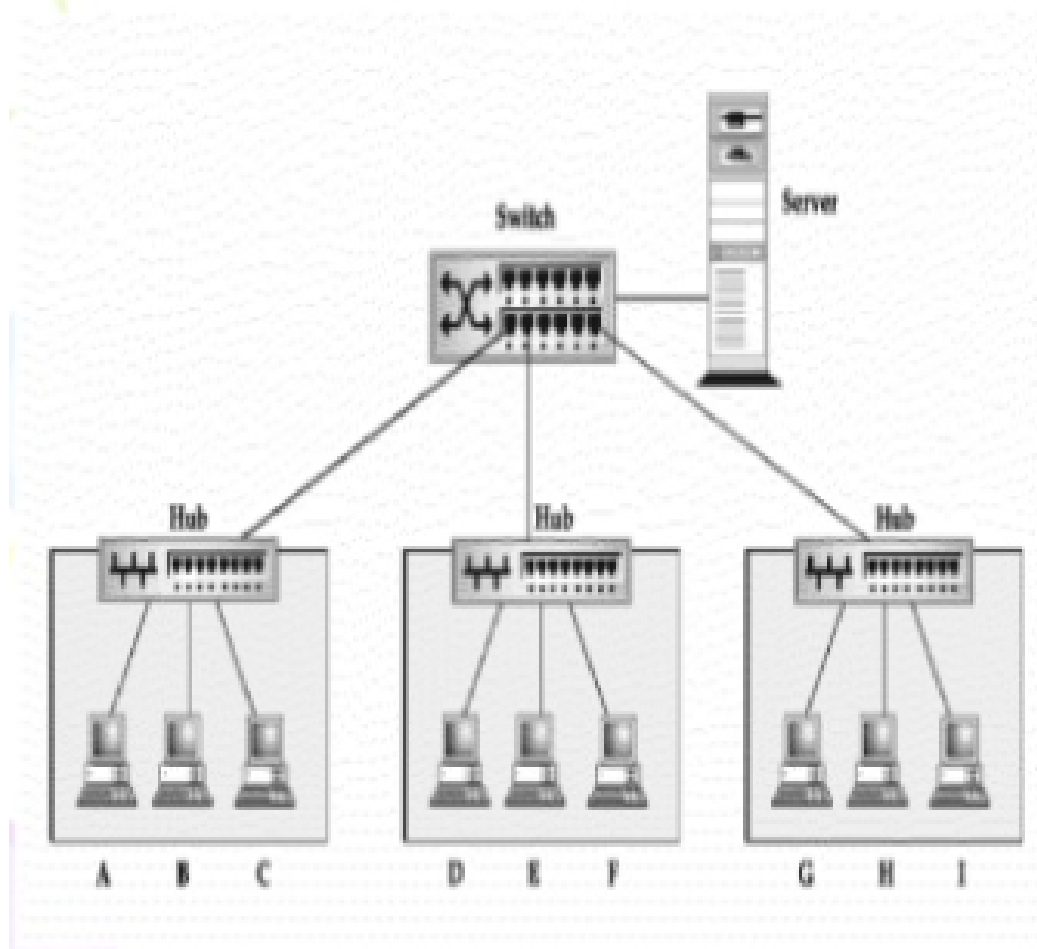


- **What is a Network Switch?**
- A network switch connects devices together on a single computer network. A switch is also called switching hub, bridging hub, or MAC bridge. Switches use MAC addresses to forward data to the correct destination. A switch is considered a Layer 2 device, operating at the data link layer; switches use packet switching to receive, process and forward data.

Switch

- A **network switch** is a computer networking device that connects network segments.
- Low-end network switches appear nearly identical to network hubs, but a switch contains more "intelligence" (and a slightly higher price tag) than a network hub.
- Network switches are capable of inspecting data packets as they are received, determining the source and destination device of that packet, and forwarding it appropriately.
- By delivering each message only to the connected device it was intended for, a network switch conserves network bandwidth and offers generally better performance than a hub.
- A **vital difference** between a **hub** and a **switch** is that all the nodes connected to a hub share the bandwidth among themselves, while a device connected to a switch port has the **full bandwidth** all to itself.
- For example, if 10 nodes are communicating using a hub on a 10-Mbps network, then each node may only get a portion of the 10 Mbps if other nodes on the hub want to communicate as well. But with a switch, each node could possibly communicate at the full 10 Mbps.

Switch



- **Function of a Switch vs. a Router**
- A router is a more sophisticated device than a switch. Traditional routers are designed to join multiple area networks (LANs and WANs). Routers serve as intermediate destinations for network traffic. They receive TCP/IP packets, look inside each packet to identify the source and target IP addresses, then forward these packets as needed to ensure the data reaches its final destination. In addition, routers often perform network address translation (NAT), which allows all devices on a subnetwork (e.g., all devices in a home) to share the same public IP address. Finally, routers that include built-in firewalls improve the network's security.
- A network switch is a small hardware device that joins multiple computers together within one local area network (LAN). Switches are incapable of joining multiple networks or sharing an Internet connection. A home network with a switch must designate one computer as the gateway to the Internet, and that device must possess two network adapters for sharing, one for the home LAN and one for the Internet WAN. With a router, all home computers connect to the router equally, and it performs the equivalent gateway functions.

	Router	Switch
Layer	Network Layer (Layer 3 devices)	Data Link Layer. Network switches operate at Layer 2 of the OSI model.
Function	Directs data in a network. Passes data between home computers, and between computers and the <u>modem</u> .	Allow connections to multiple devices, manage ports, manage VLAN security settings
Data Transmission form	Packet	Frame (L2 Switch) Frame & Packet (L3 switch)
Ports	2/4/5/8	Switch is multi port Bridge. 24/48 ports
Device Type	Networking device	Active Device (With Software) & Networking device
Transmission Type	At Initial Level Broadcast then Uni-cast & Multicast	First broadcast; then unicast & multicast as needed.
Used in (LAN, MAN, WAN)	LAN, MAN, WAN	LAN
Table	Store IP address in Routing table	Switches use content accessible

Router

Switch

Table Store IP address in Routing table and maintain address at its own.

Switches use content accessible memory CAM table which is typically accessed by ASIC (Application Specific integrated chips).

Transmission Mode

Full duplex

Half/Full duplex

Broadcast Domain

In Router, every port has its own Broadcast domain.

Switch has one broadcast domain [unless VLAN implemented]

Definition

A router is a networking device that connects a local network to other local networks. At the Distribution Layer of the network, routers direct traffic and perform other functions critical to efficient network operation.

A network switch is a computer networking device that is used to connect many devices together on a computer network. A switch is considered more advanced than a hub because a switch will only send msg to device that needs or request it

Speed

1-100 Mbps (Wireless); 100 Mbps - 1 Gbps (Wired)

10/100 Mbps, 1 Gbps

	Router	Switch
Necessary for Internet Connection?	No, but provides additional security and allows for multiple connections.	No
Address used for data transmission	Uses IP address	Uses MAC address
Connections	Can connect to multiple PCs or networking devices via Ethernet or WiFi	Can connect to multiple PCs or networking devices (L3 switches) via Cat5 , Cat5e
Device Category	Intelligent Device	Intelligent Device
Security	Provides security measures to protect network	Port security
Used for	Connecting two or more networks	Connecting two or more nodes in the same network (L2) or different network (L3)
Manufacturers	Cisco, Netgear, Linksys, Asus, TP-Link, D-Link	Cisco and D-link Juniper

	Router	Switch
Bandwidth sharing	Bandwidth sharing is Dynamic (Enables either static or dynamic bandwidth sharing for modular cable interfaces. The default percent-value is 0. The percent-value range is 1-96.)	There is no sharing port can be 10, 100, 1000 and 10000 Mbps individual
Routing Decision	Take faster routing decisions	Take more time for complicated routing decisions
NAT (Network Address Translation)	Routers can perform NAT	Switches cannot perform NAT
Faster	In a different network environment (MAN/ WAN), a router is faster than an L3 switch.	In a LAN environment, an <u>L3 switch is faster than a router</u> (built-in switching hardware)
Features	Firewall VPN Dynamic hadling of Bandwidth	Priority rt range On/Off setting of port VLAN Port mirroring
Examples	Linksys WRT54GL Juniper MX & EX series Cisco 3900, 2900, 1900	Alcatel's OmniSwitch 9000; Cisco Catalyst switch 4500 and 6500 (10 Gbps)

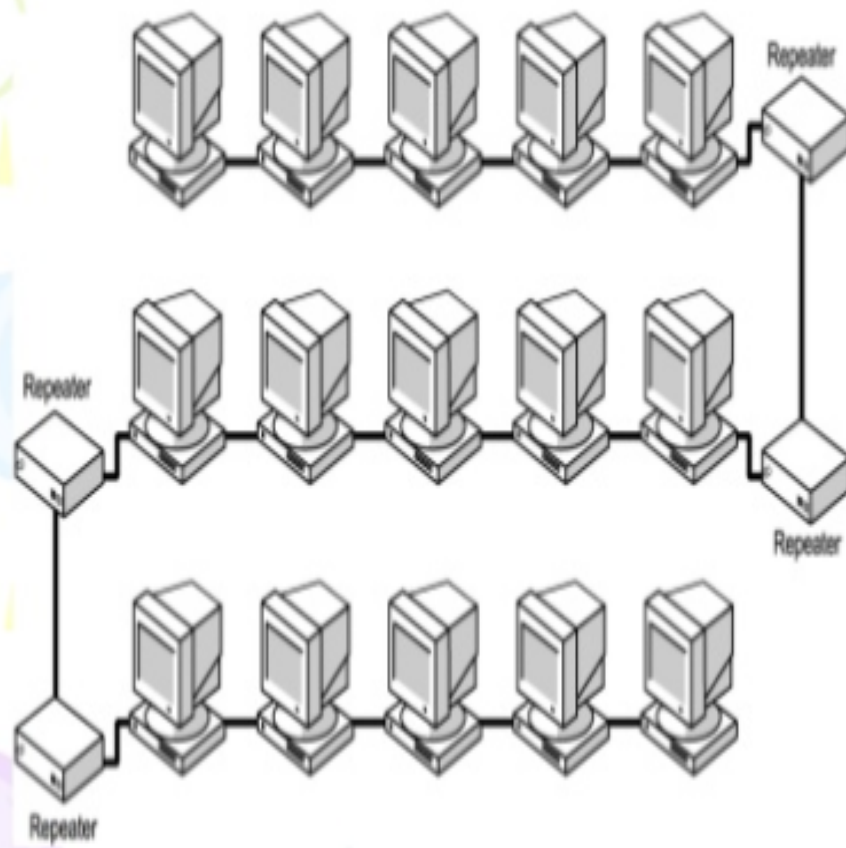
Repeater

- **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 so as to extend the length to which the signal can be transmitted over the same network. An important point to be noted about repeaters is that they do not amplify the signal. When the signal becomes weak, they copy the signal bit by bit and regenerate it at the original strength. It is a 2 port device.

Repeaters

- Repeaters are very simple devices. They allow a cabling system to extend beyond its maximum allowed length by amplifying the network voltages so they travel farther.
- Repeaters are nothing more than amplifiers and, as such, are very inexpensive. Repeaters can only be used to regenerate signals between similar network segments.
- For example, we can extend an Ethernet 10Base2 network to 400 meters with a repeater. But can't connect an Ethernet and Token Ring network together with one.
- The main disadvantage to repeaters is that they just amplify signals. These signals not only include the network signals, but any noise on the wire as well.

Repeaters



- <https://youtu.be/tM4LL1zmJHM>
- <https://youtu.be/XB9bQt7yogE>