Computer Network(CSC 503)

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Lecture 3 and 4

Introduction to Networking

- Introduction to computer network, network application, network software and hardware components (Interconnection networking devices), Network topology, protocol hierarchies, design issues for the layers, connection oriented and connectionless services

Interconnecting Components

1. Network Interface Card

    The network interface card (or NIC for short) is the network adapter that all devices must have in order to be part of a network. On desktop computers, network interface cards allow Ethernet cables to be plugged in, as this is the main method of establishing network connections on desktop computers.

* It is also called Ethernet card/network card/NAC/NIU/Terminal access point
* It has MAC address-Hardware identification number(6 bytes)

Gigabit Ethernet NIC
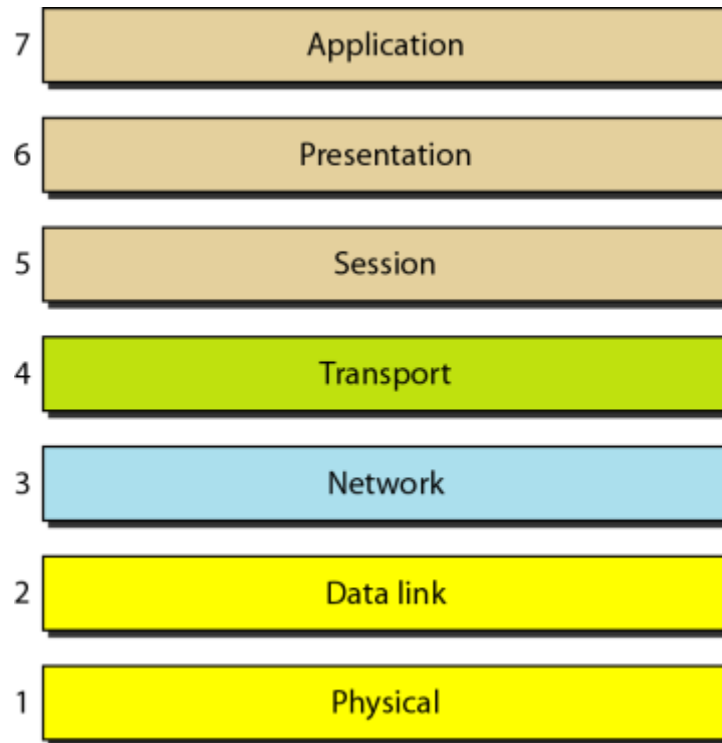
Ethernet port

PCI connection

TechTerms.com
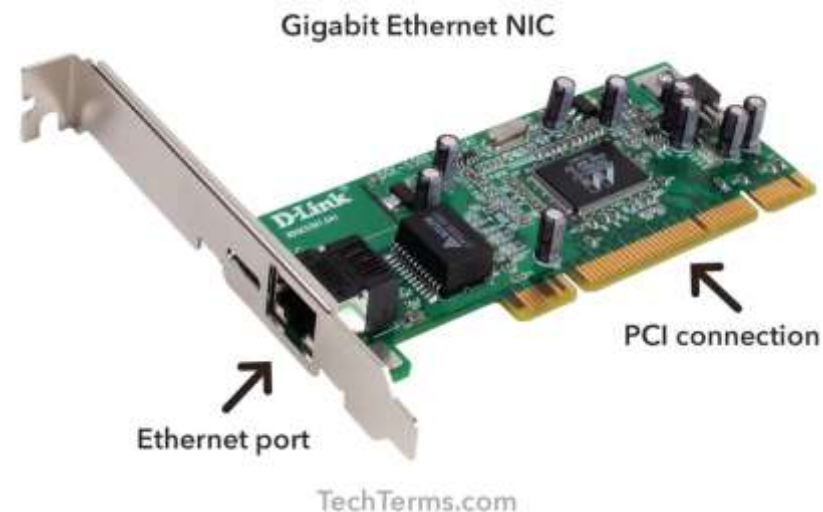
Interconnection networking devices

- Network Hub
- Network Switch
- Modem
- Network Router
- Bridge
- Repeater
- Gateway
- Brouter
- Firewalls

OSI Model

- ISO is the organization. OSI is the model

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7	Application
6	Presentation
5	Session
4	Transport
3	Network
2	Data link
1	Physical

Repeaters

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.
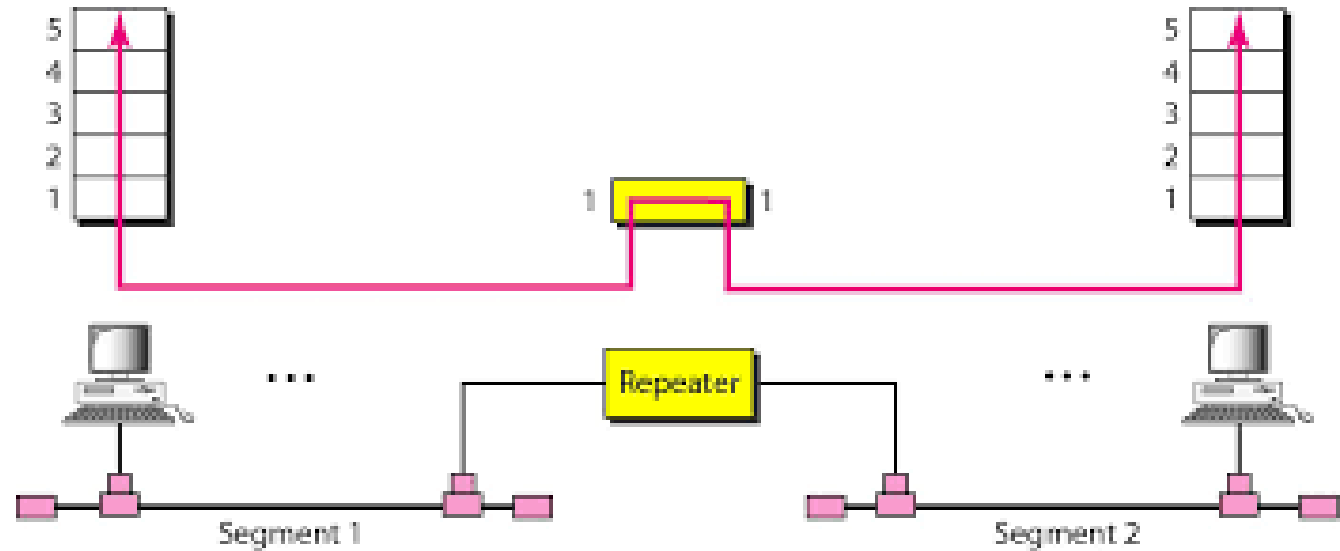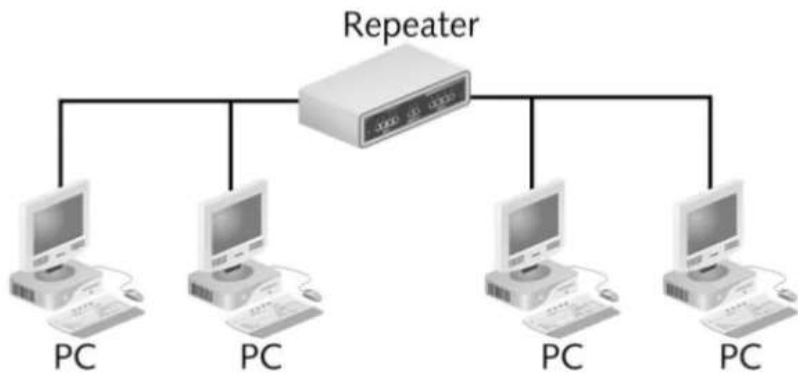
Hub

- A hub is basically a multiport repeater. A signal received at any port on the hub is retransmitted on all other ports. Network segments that employ hubs are often described as having a star topology, in which the hub forms the wiring centre of the star. Hubs cannot filter data, so data packets are sent to all connected devices. Also, they do not have intelligence to find out best path for data packets which leads to inefficiencies and wastage.
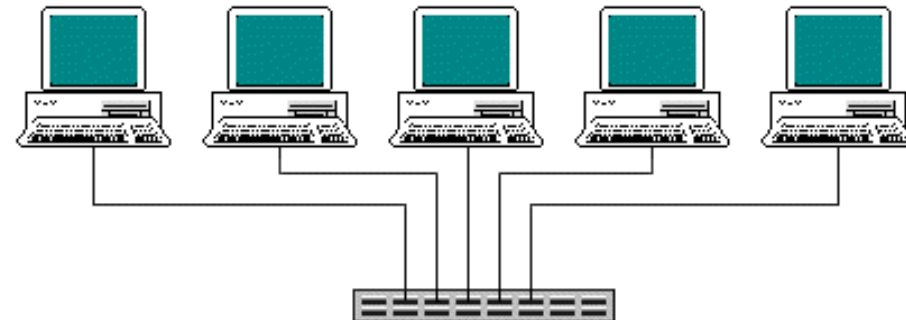
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If a message comes in destined for computer "A", that message is sent out to all the other ports, regardless of which computer "A" is.
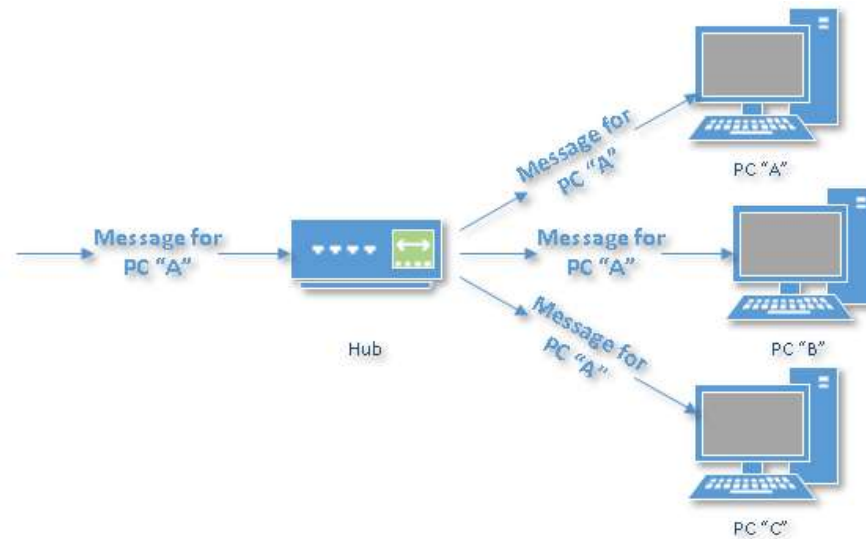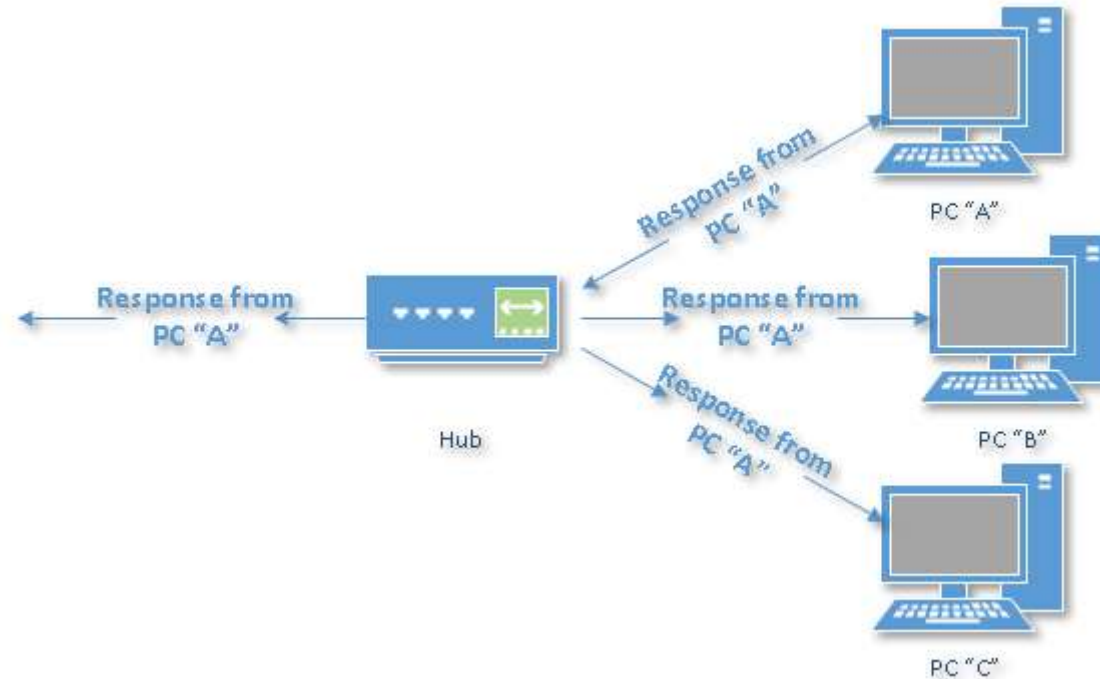

Incoming data passing through a hub.

- When computer "A" responds, its response also goes out to every other port on the hub.

- Every computer connected to the hub "sees" everything every other computer on the hub does. It's up to the computers themselves to decide if a message is for them and whether or not it should be paid attention to.

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Network hubs are classified as :

(i)   Active hub
(ii) Passive hub.
(iii) Intelligent hub

Active Hubs

- An active hub is actually a multiport repeater
- It is normally used to create connections between stations in a star topology
- Transmission from any station is received by all other station.
  – If two stations transmit at same time, there will be collision.
- Hubs can also be used to create multiple levels of hierarchy.
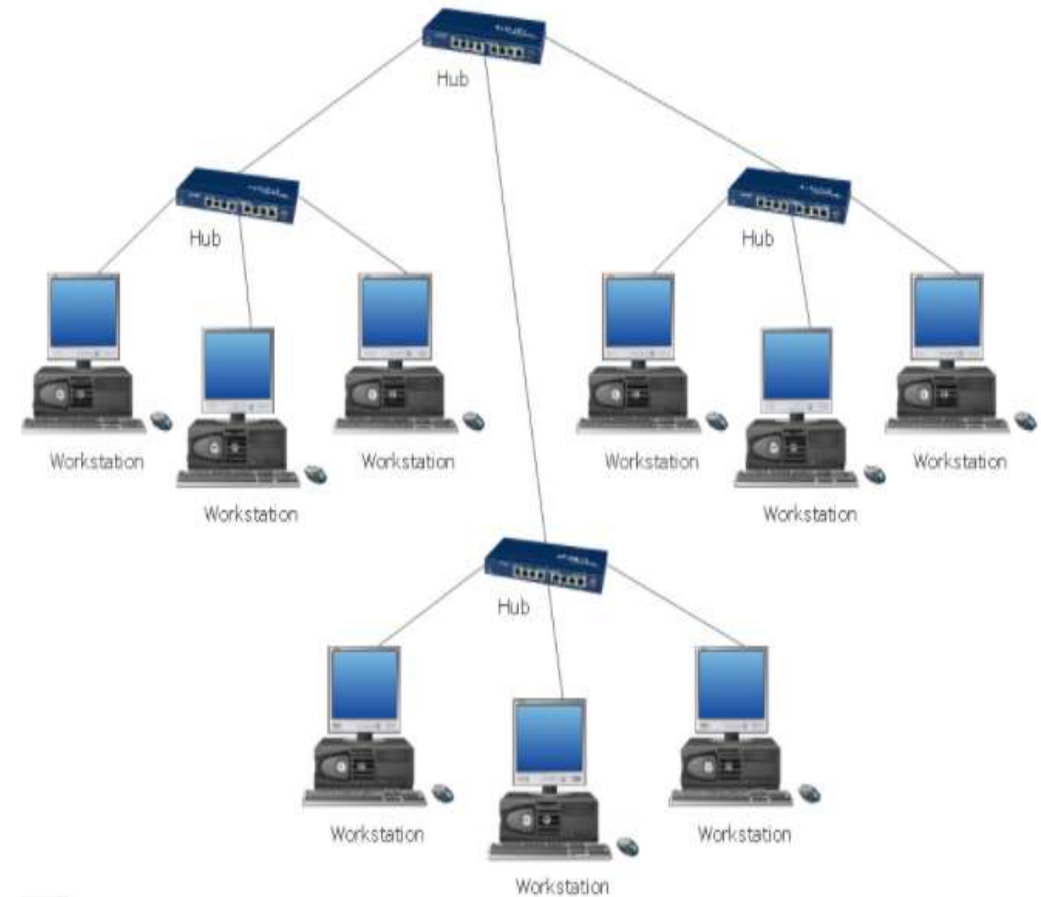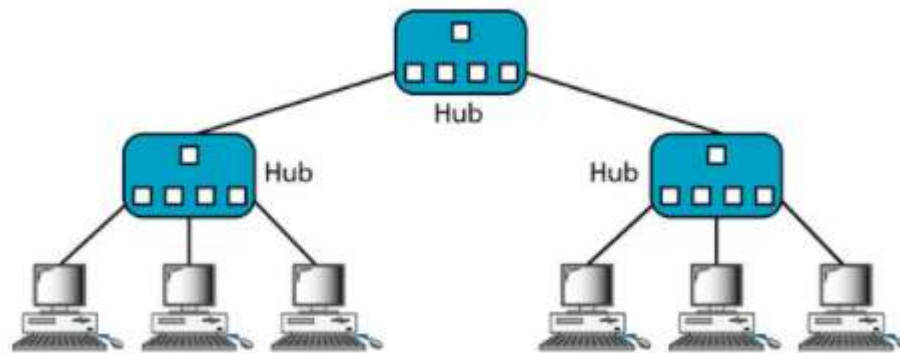
Bridge

Bridges can be used to connect two or more LAN segments of the same type. Secondly, most bridges have only 2 or 4 ports. A bridge operates at data link layer. A bridge is a repeater, with add on functionality of filtering content by reading the addresses of source and destination. It is also used for interconnecting two LANs working on the same protocol.
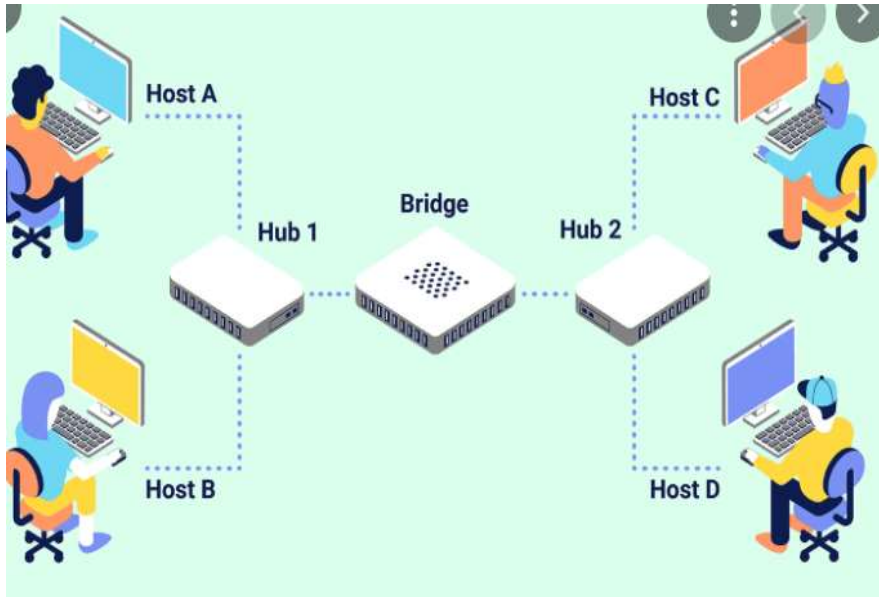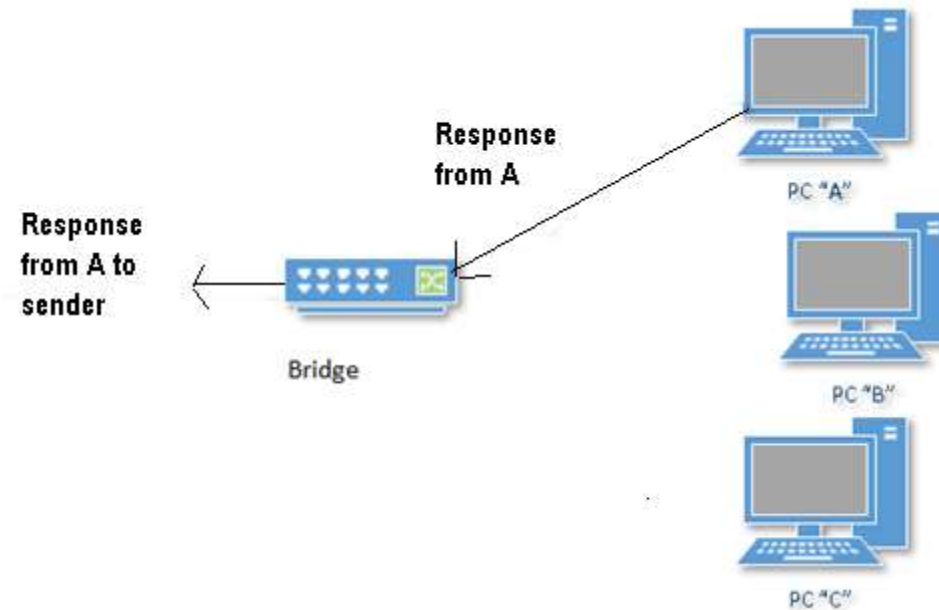

Two basic types of bridges
- Transparent Bridge
- Source routing Bridge
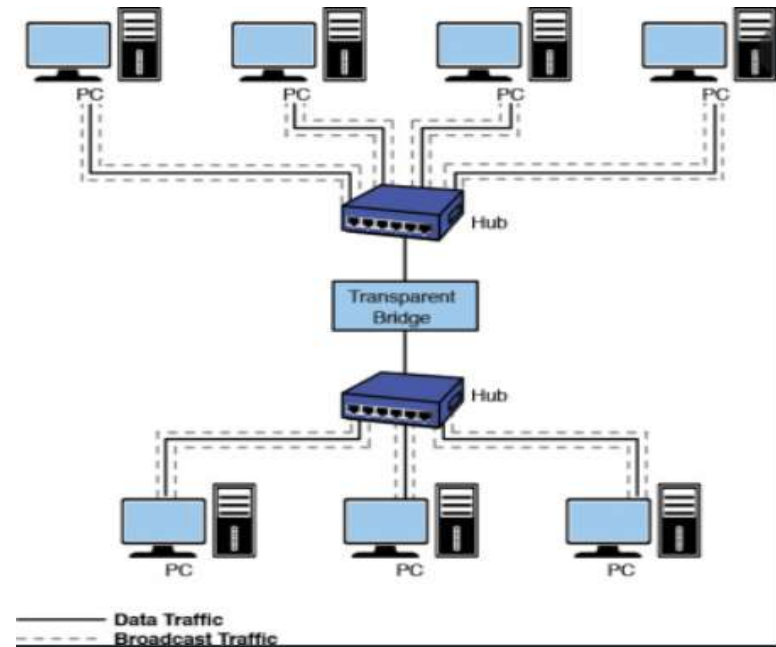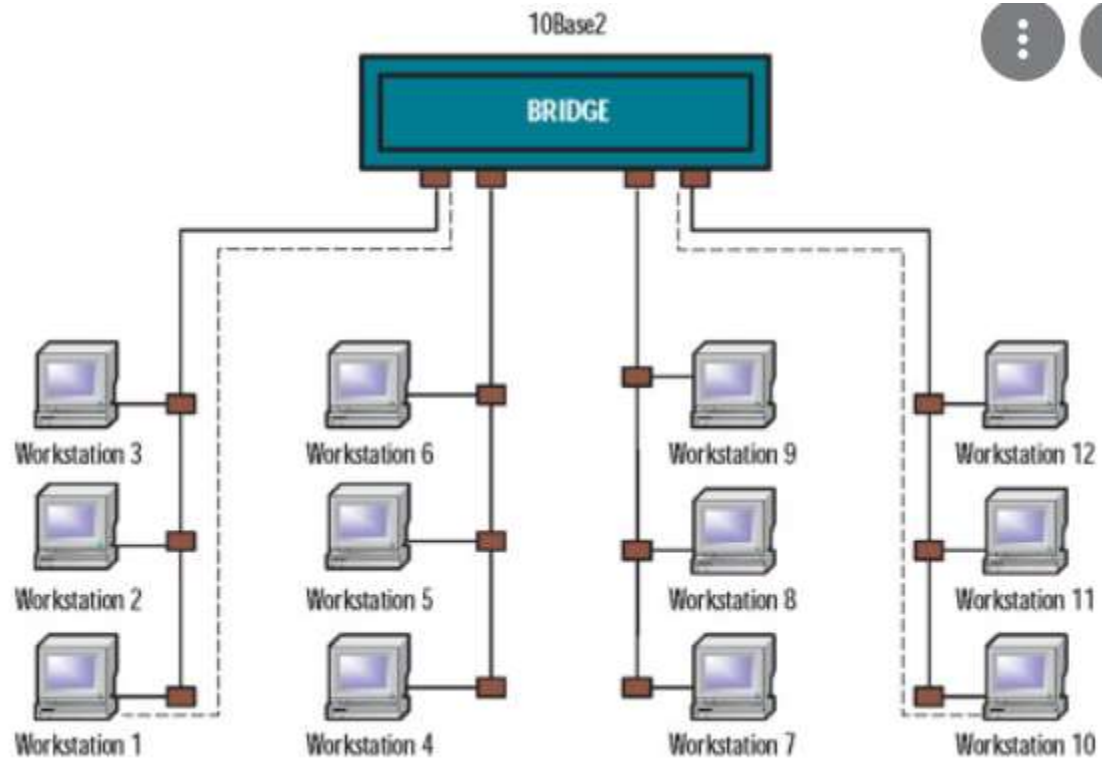
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Just by accepting that first message, however, the bridge has learned something: it knows on which connection the *sender* of the message is located. Thus, when machine "A" responds to the message, the bridge only needs to send that message out to the one connection.


Bridges learn the location of the devices they are connected to almost instantaneously. The result is, most network traffic only goes where it needs to, rather than to every port. On busy networks, this can make the network *significantly* faster.

Switch

Switch is data link layer device. A switch when compared to bridge has multiple ports. Switches can perform error checking before forwarding data, which are very efficient by not forwarding packets that have errors or forwarding good packets selectively to correct devices only. Firstly, a bridge can connect fewer LAN, while a switch can connect more networks compared to the bridge.

The switches are made based on two different strategies:

- Stored and forward
- Cut - through
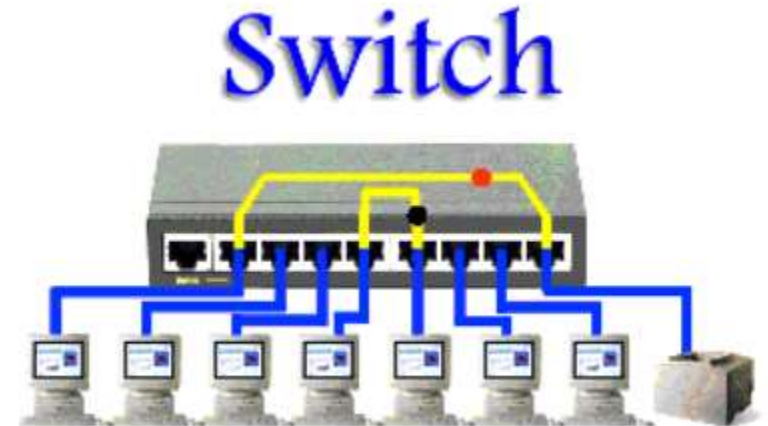
Routers
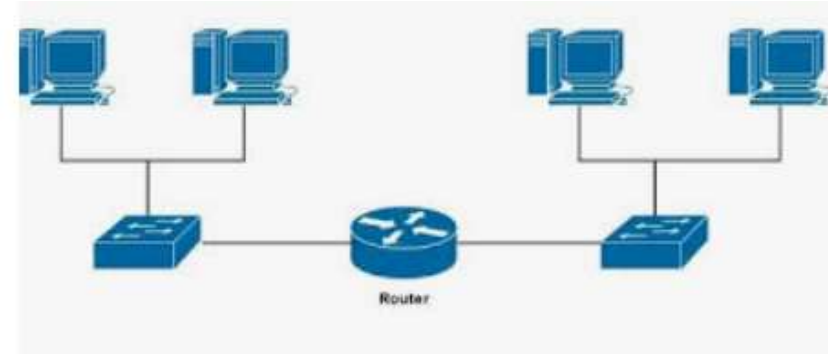
- A router is a device like a switch that routes data packets based on their IP addresses. Router is mainly a Network Layer device.

- Routers have the ability to make intelligent decisions as to the best path for delivery of data on the network.

- Routers normally connect LANs and WANs together and have a dynamically updating routing table based on which they make decisions on routing the data packets.

Types of routers
- Static
- Dynamic

- **Routers** are sometimes confused with **network** hubs, modems, or **network** switches. However, **routers** can combine the functions of these components, and connect with these devices, to improve Internet access or help create business **networks**.

- The **router** then creates and communicates with your home Wi-Fi **network** using built-in antennas. As a result, all of the devices on your home **network** have internet access.

Brouter

- The Brouter is also called **a bridging router**

- **Function :**

- The main function of this is to combine the **features of both router and bridge and router**.

- It performs either at the **network layer or the data link layer.**

- When it works as a **router**, it is used for **routing packets** across networks whereas it works as a **bridge**; it is **used for filtering LANs traffic**.

Gateways

- Gateways is a network device that connects two networks using different protocols together.
- It acts as a "gate" between two networks. It may be router, firewall, server or other device that enables traffic to flow in and ot on the network
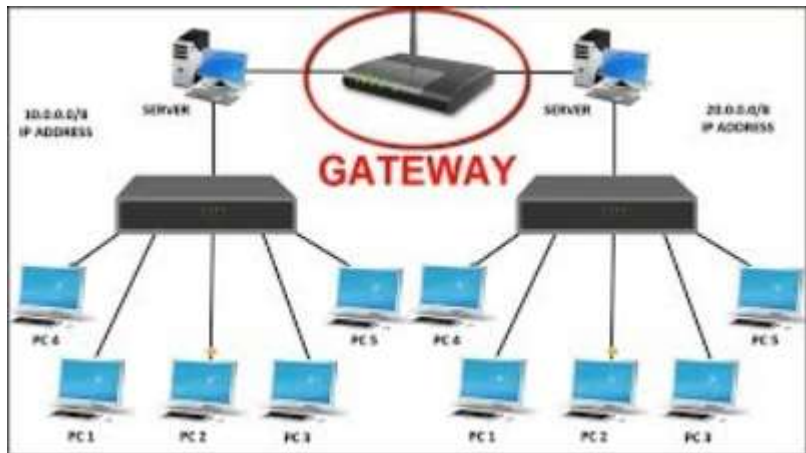
Why we use Gateway device in a network

- Router can communicate between two different network using the same protocol on the other hand A gateway is a network node that connects two networks using different protocols together.

- Gateway is also called protocol converter.

Modem

- **Modem** is short for "Modulator-Demodulator." It is a hardware component that allows a **computer** or another device, such as a router or switch, to connect to the Internet. It converts or "modulates" an analog signal from a telephone or cable wire to digital data (1s and 0s) that a **computer** can recognize.
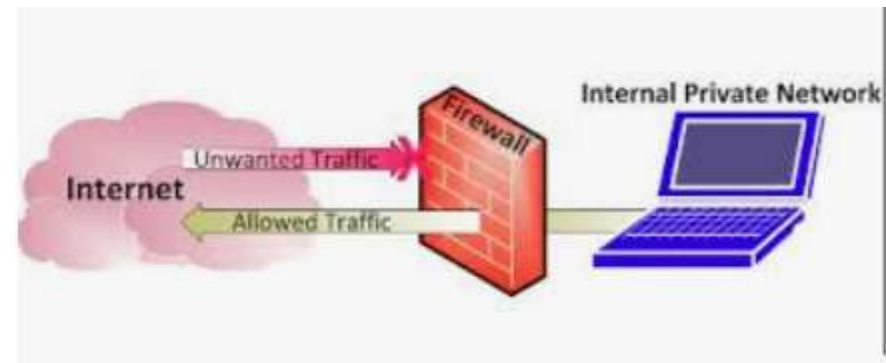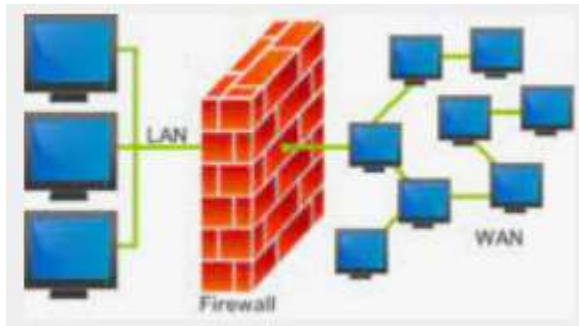
Internal Modem Vs External Modem

Types of modem
- Asynchronous
- Synchronous
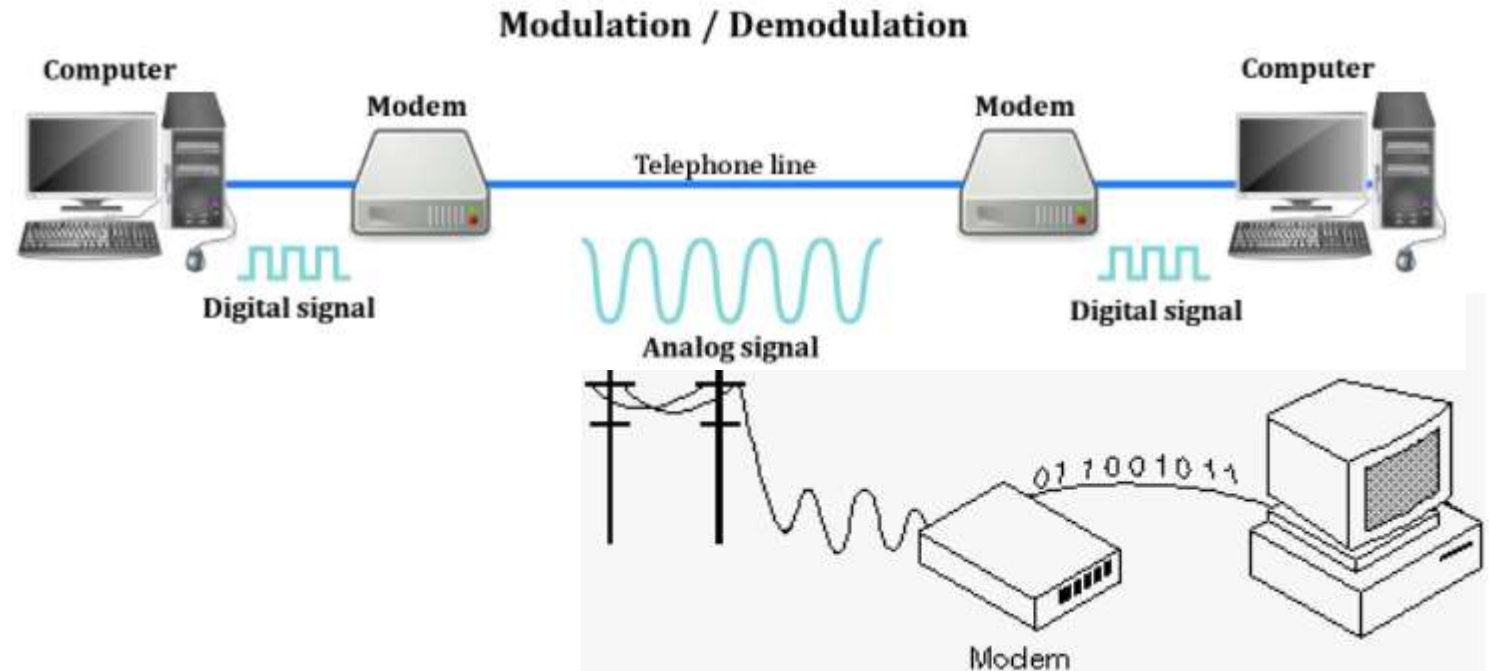
Firewall

- A **firewall** is a security device — **computer** hardware or software — that can help protect your network by filtering traffic and blocking outsiders from gaining unauthorized access to the private data on your **computer**.

- **Firewalls** can provide different levels of protection.

HUB	SWITCH	ROUTER
HUB works in Physical Layer of OSI Model.	SWITCH works in Data Link Layer of OSI Model.	ROUTER works in Network Layer of OSI Model
HUB is a broadcast device	SWITCH is a multicast device	ROUTER is a routing device use to create route for transmitting data packets.
HUB is use to connect devices in the same network.	SWITCH is use to connect devices in the same network	ROUTER is use to connect two or more different network.
HUB sends data in the form of packets.	SWITCH sends data in the form of frames.	ROUTER sends data in the form packets.
HUB only works in half duplex.	SWITCH works in full duplex.	ROUTER works in full duplex.
Only one device can send data at a time.	Multiple devices can send data at the same time.	Multiple devices can send data at the same time.
HUB does not store any mac/ IP address to transfer data.	SWITCH stores and uses MAC address of a devices to transfer data.	ROUTER uses IP address to transfer data.