CENTRE FOR DIFFERENTLY ABLED PERSONS
BHARATHIDASAN UNIVERSITY

III BCA – VI SEMESTER

DATA COMMUNICATION AND NETWORKS
(20UCA6CC8)
UNIT - IV

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UNIT - IV

NETWORKING AND INTERNETWORKING DEVICES

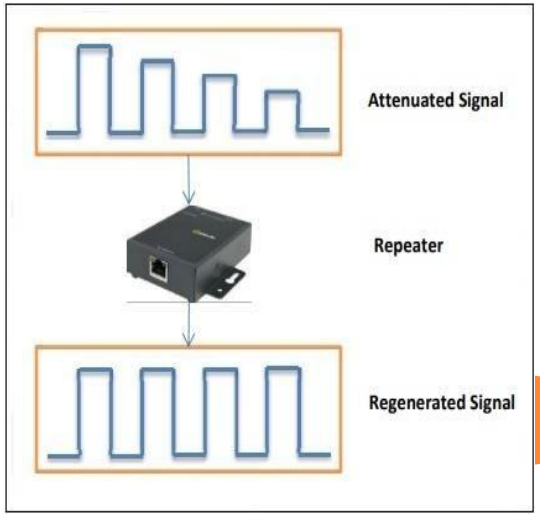
- Network devices are components used to connect computers or other electronic devices together they can share files or resources like printers / fax machines.
- An internetwork is a collection of individual networks, connected by intermediate networking devices, that functions as a single large network.

REPEATERS

- Repeaters are network devices operating at physical layer of the OSI model that amplify or regenerate an incoming signal before retransmitting it.
- They are incorporated in networks to expand its coverage area.
- They are also known as signal boosters.

Types of Repeaters

- According to the types of signals that they regenerate, classified into
  - Analog Repeaters − They can only amplify the analog signal.
  - Digital Repeaters − They can reconstruct a distorted signal.



According to the types of networks that they connect, categorized into

- Wired Repeaters − They are used in wired LANs.
- Wireless Repeaters − They are used in wireless LANs and cellular networks.

According to the domain of LANs they connect, divided into

- Local Repeaters − They connect LAN segments separated by small distance.
- Remote Repeaters − They connect LANs that are far from each other.

Advantages of Repeaters

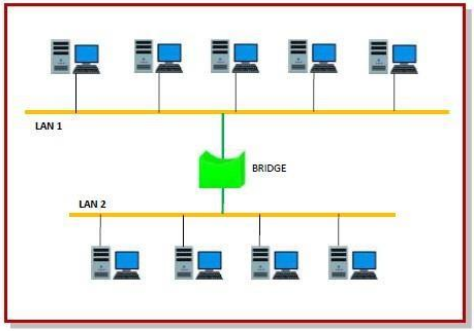
- Repeaters are simple to install and can easily extend the length or the coverage area of networks.
- They are cost effective.
- Repeaters don't require any processing overhead. The only time they need to be investigated is in case of degradation of performance.
- They can connect signals using different types of cables.

Disadvantages of Repeaters

- Repeaters cannot connect dissimilar networks.
- They cannot differentiate between actual signal and noise.
- They cannot reduce network traffic or congestion.
- Most networks have limitations upon the number of repeaters that can be deployed.

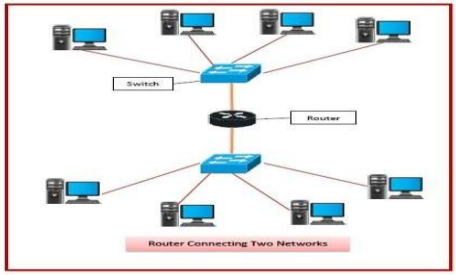
BRIDGES

- A bridge is a network device that connects multiple LANs (local area networks) together to form a larger LAN.
- A bridge connects the different components so that they appear as parts of a single network.
- Bridges operate at the data link layer of the OSI model and hence also referred as Layer 2 switches.



ROUTERS

- Routers are networking devices operating at layer 3 or a network layer of the OSI model.
- They are responsible for receiving, analysing, and forwarding data packets among the connected computer networks.
- When a data packet arrives, the router inspects the destination address, consults its routing tables to decide the optimal route and then transfers the packet along this route.



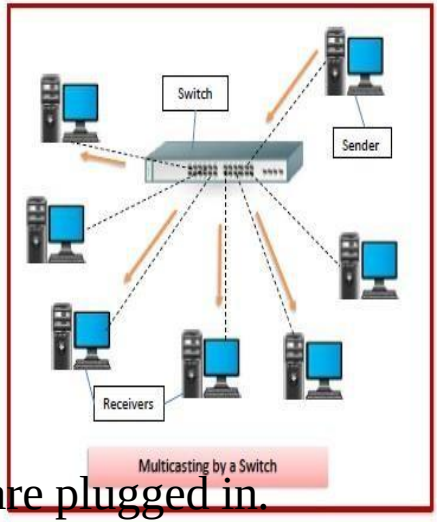
Features of Routers

- A router is a layer 3 or network layer device.
- It connects different networks together and sends data packets from one network to another.
- A router can be used both in LANs (Local Area Networks) and WANs (Wide Area Networks).
- It transfers data in the form of IP packets. In order to transmit data, it uses IP address mentioned in the destination field of the IP packet.
- Routers provide protection against broadcast storms.

Types of Routers

- A variety of routers are available depending upon their usages. The main types of routers are −
  - Wireless Router
  - Broadband Routers
  - Core Routers
  - Edge Routers
  - Brouters

SWITCHES



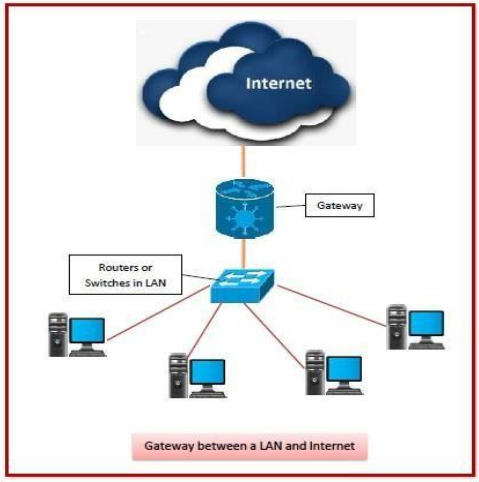
- Switches are networking devices operating at layer 2 or a data link layer of the OSI model.
- They connect devices in a network and use packet switching to send, receive or forward data packets or data frames over the network.
- A switch has many ports, to which computers are plugged in.
- When a data frame arrives at any port of a network switch, it examines the destination address, performs necessary checks and sends the frame to the corresponding device(s).
- It supports unicast, multicast as well as broadcast communications.

Features of Switches

- A switch operates in the layer 2, i.e. data link layer of the OSI model.
- It is an intelligent network device that can be conceived as a multiport network bridge.
- It uses MAC addresses (addresses of medium access control sublayer) to send data packets to selected destination ports.
- It uses packet switching technique to receive and forward data packets from the source to
- the destination device.

GATEWAYS

- A gateway is a network node that forms a passage between two networks operating with different transmission protocols.
- The most common type of gateways, the network gateway operates at layer 3, i.e. network layer of the OSI (open systems interconnection) model.
- However, depending upon the functionality, a gateway can operate at any of the seven layers of OSI model.



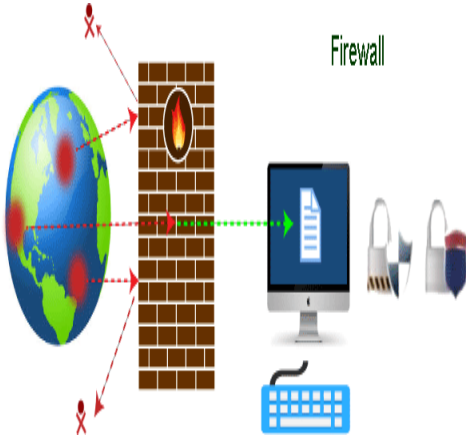
- It acts as the entry – exit point for a network since all traffic that flows across the networks should pass through the gateway.
- Only the internal traffic between the nodes of a LAN does not pass through the gateway.

Types of Gateways

- On basis of direction of data flow, gateways are broadly divided into two categories −
  - Unidirectional Gateways
  - Bidirectional Gateways

FIREWALL

- A special type of network security device or a software program that monitors and filters incoming and outgoing network traffic based on a defined set of security rules.
- It acts as a barrier between internal private networks and external sources (such as the public Internet).



- The purpose of a firewall is to allow non-threatening traffic
- Prevent malicious or unwanted data traffic
  for protecting the computer from viruses and attacks & it is a cyber security tool.
- That filters network traffic and helps users block malicious software from accessing the Internet in infected computers.

Types of Firewall

- Proxy Firewall
- Packet-filtering firewalls
- Stateful Multi-layer Inspection (SMLI) Firewall
- Unified threat management (UTM) firewall
- Next-generation firewall (NGFW)
- Network address translation (NAT) firewalls

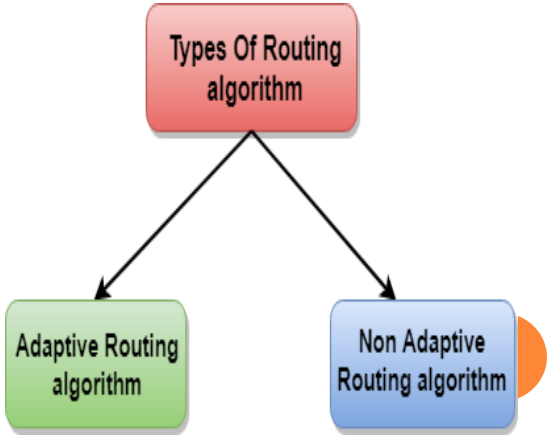
ROUTING ALGORITHM

- In order to transfer the packets from source to the destination, the network layer must determine the best route through which packets can be transmitted.
- Whether the network layer provides datagram service or virtual circuit service, the main job of the network layer is to provide the best route.
- The routing protocol provides this job.
- The routing protocol is a routing algorithm that provides the best path from the source to the destination.
- The best path is the path that has the "least-cost path" from source to the destination.
- Routing is the process of forwarding the packets from source to the destination but the best route to send the packets is determined by the routing

  algorithm.

CLASSIFICATION OF A ROUTING ALGORITHM

- Adaptive Routing algorithm
  - An adaptive routing algorithm is also known as dynamic routing algorithm.
- Non-Adaptive Routing algorithm
  - Non Adaptive routing algorithm is also known as a static routing algorithm.



DISTANCE VECTOR ROUTING ALGORITHM

- The Distance vector algorithm is iterative, asynchronous and distributed.
    - Distributed:
    - Iterative:
    - Asynchronous:
- The Distance vector algorithm is a dynamic algorithm.
- It is mainly used in ARPANET, and RIP.
- Each router maintains a distance table known as Vector.

Working of Distance Vector Routing Algorithm

- Knowledge about the whole network:
    - Each router shares its knowledge through the entire network.
    - The Router sends its collected knowledge about the network to its neighbors.
- Routing only to neighbors:
    - The router sends its knowledge about the network to only those routers which have direct links.
    - The router sends whatever it has about the network through the ports.
- Information sharing at regular intervals:
    - Within 30 seconds, the router sends the information to the neighboring routers.

Algorithm

At each node x,

Initialization

for all destinations y in N:

$D_x(y) = c(x,y)$ // If y is not a neighbor then $c(x,y) = \infty$

for each neighbor w

$D_w(y) = ?$ for all destination y in N.

for each neighbor w

send distance vector $D_x = [D_x(y) : y \text{ in } N]$ to w

loop

wait(until I receive any distance vector from some neighbor w)

for each y in N:

$D_x(y) = \text{minv}\{c(x,v)+D_v(y)\}$

If $D_x(y)$ is changed for any destination y

Send distance vector $D_x = [D_x(y) : y \text{ in } N]$ to all neighbors

forever

LINK STATE ROUTING

- A technique in which each router shares the knowledge of its neighborhood.3 keys are:
  - Knowledge about the neighborhood:
  - Flooding:
  - Information sharing:

Link State Routing has two phases:

- Reliable Flooding
- Route Calculation

Algorithm

Initialization

N = {A} // **A is a root node**. for all nodes v
if v adjacent to
A then D(v) =
c(A,v) else
D(v) = infinity

loop
find w not in N such that D(w) is a minimum. Add w to N
Update D(v) for all v adjacent to w and not in N: D(v) = min(D(v) , D(w) + c(w,v))
Until all nodes in N