Computer network Components

Router:

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 normally connect LANs and WANs together and have a dynamically updating routing table based on which they make decisions on routing the data packets. Router divide broadcast domains of hosts connected through it.

Example:TP-LINK TL-WR940N Wireless-N450 Home Router

No. of Ports:5 ports
Connector type:Rj45 jack
Data Transfer rate:450Mbits/sec
Wattage:7Watts

Brouter

It is also known as bridging router is a device which combines features of both bridge and router. It can work either at data link layer or at network layer. Working as router, it is capable of routing packets across networks and working as bridge, it is capable of filtering local area network traffic.

Hub:

A hub is basically a multiport repeater. A hub connects multiple wires coming from different branches, for example, the connector in star topology which connects different stations. Hubs cannot filter data, so data packets are sent to all connected devices. In other words,collision domain of all hosts connected through Hub remains one. Also, they do not have the intelligence to find out the best path for data packets which leads to inefficiencies and wastage.There are two types of hubs:

1. Active hub
2. Passive hub

Example:CP-Tech USB C Ethernet Type-C to 3-Port Hub RJ45 Gigabit LAN Network Adapter Converter with Silver-Aluminum Alloy Body for MacBook/pro/iMac/ChromeBook/Pixel/More Type-C Devices.

Switch:

A switch is a hardware device that connects multiple devices on a computer network. A Switch contains more advanced features than Hub. The Switch contains the updated table that decides where the data is transmitted or not. Switch delivers the message to the correct destination based on the physical address present in the incoming message. A Switch does not broadcast the message to the entire network like the Hub. It determines the device to whom the message is to be transmitted. Therefore, we can say that switch provides a direct connection between the source and destination. It increases the speed of the network.

Example: D-Link DES-1005C 10/100 Network Switch

Data Transfer rate :200Mbps
No.of Ports:5
Connector type:Rj45 jack
operating system - winxp/win7/win8/win 8.1 & Mac os 10.10 (Intel platform)

Gateway

A gateway, as the name suggests, is a passage to connect two networks together that may work upon different networking models. They basically work as the messenger agents that take data from one system, interpret it, and transfer it to another system. Gateways are also called protocol converters and can operate at any network layer. Gateways are generally more complex than switch or router.

Example:LEOXSYS 4G LTE CPE WiFi Router 4G Mobile Hotspot LAN 1 Dual Antenna 4G Home Gateway with 4g/3g/2g Sim Card Support LEO-300N-4G

Upto 300 Mbps Speed
1 LAN port
Dual Antenna

Modem

- A modem is a hardware device that allows the computer to connect to the internet over the existing telephone line.
- A modem is not integrated with the motherboard rather than it is installed on the PCI slot found on the motherboard.

- It stands for Modulator/Demodulator. It converts the digital data into an analog signal over the telephone lines.

  Based on Transfer rate Modems are divided into three categories:

  1. Standard PC modem
  2. Cellular Modem
  3. Cable modem

Example: Sanscord RD150 Wireless 150 Mbps ADSL2+ Modem (WiFi Modem for BSNL,MTNL)

Operating System:Windows,Mac

No. of Ports:4

Bridge

A bridge operates at data link layer. A bridge is a repeater, with add on the functionality of filtering content by reading the MAC addresses of source and destination. It is also used for interconnecting two LANs working on the same protocol. It has a single input and single output port, thus making it a 2 port device.

Types of Bridges:

- Transparent Bridges
- Source Routing Bridges

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.

Example:Netgear EX6110 AC1200 WiFi Range Extender

Extends 2.4 and 5 GHz to 1200Mbps

Data transfer rate:1200Mbps

NIC card(Network interface card)

- NIC is a hardware component used to connect a computer with another computer onto a network
- It can support a transfer rate of 10,100 to 1000 Mb/s
- The MAC address or physical address is encoded on the network card chip which is assigned by the IEEE to identify a network card uniquely. The MAC address is stored in the PROM (Programmable read-only memory).

Example:TP-Link TL-WN781ND 150Mbps Wireless N PCI Express Adapter

Data transfer rate :150Mbps

Wireless speed:

802.11n: Up to 150Mbps

802.11g: Up to 54Mbps

802.11b: Up to 11Mbps

Frequency range: 2.4~2.4835GHz

Connectors and Cables

Connectors: SC, ST, and LC,RJ-11, RJ-45

Wiring standards: T568A, T568B

Quality of Service (QoS) in Computer Network

Quality-of-Service (QoS) refers to traffic control mechanisms that seek to either differentiate performance based on application or network-operator requirements or provide predictable or guaranteed performance to applications, sessions or traffic aggregates. Basic phenomenon for QoS means in terms of packet delay and losses of various kinds.

QoS Specification:QoS requirements can be specified as:

1. Delay
2. Delay Variation(Jitter)
3. Throughput
4. Error Rate

There are two types of QoS Solutions:

- Stateless Solutions
- Stateful Solutions

Important flow characteristics of the QoS are given below:

1. Reliability

If a packet gets lost or acknowledgement is not received (at sender), the re-transmission of data will be needed. This decreases the reliability.
The importance of the reliability can differ according to the application.

For example:E- mail and file transfer need to have a reliable transmission as compared to that of an audio conferencing.

2. Delay

Delay of a message from source to destination is a very important characteristic. However, delay can be tolerated differently by the different applications.

For example:
The time delay cannot be tolerated in audio conferencing (needs a minimum time delay), while the time delay in the email or file transfer has less importance.

3. Jitter

The jitter is the variation in the packet delay.If the difference between delays is large, then it is called as **high jitter.** On the contrary, if the difference between delays is small, it is known as **low jitter.**

Example:

Case1: If 3 packets are sent at times 0, 1, 2 and received at 10, 11, 12. Here, the delay is same for all packets and it is acceptable for the telephonic conversation.
Case2: If 3 packets 0, 1, 2 are sent and received at 31, 34, 39, so the delay is different for all packets. In this case, the time delay is not acceptable for the telephonic conversation.

4. Bandwidth

Different applications need the different bandwidth.

For example:

Video conferencing needs more bandwidth in comparison to that of sending an e-mail.

Integrated Services and Differentiated Service

These two models are designed to provide Quality of Service (QoS) in the network.

1. Integrated Services(IntServ)

Integrated service is flow-based QoS model and designed for **IP**.In integrated services, user needs to create a flow in the network, from source to destination and needs to inform all routers (every router in the system implements **IntServ**) of the resource requirement.

Following are the steps to understand how integrated services works.

I) Resource Reservation Protocol (RSVP)

An IP is connectionless, datagram, packet-switching protocol. To implement a flow-based model, a signaling protocol is used to run over **IP**, which provides the signaling mechanism to make reservation (every applications need assurance to make reservation), this protocol is called as **RSVP**.

ii) Flow Specification

While making reservation, resource needs to define the flow specification. The flow specification has two parts:

a) Resource specification

It defines the resources that the flow needs to reserve. For example: Buffer, bandwidth, etc.

b) Traffic specification

It defines the traffic categorization of the flow.

iii) Admit or deny

After receiving the flow specification from an application, the **router decides to admit or deny the service** and the decision can be taken based on the previous commitments of the router and current availability of the resource.

Classification of services

The two classes of services to define Integrated Services are:

a) Guaranteed Service Class

This service guarantees that the packets arrive within a specific delivery time and not discarded, if the traffic flow maintains the traffic specification boundary.This type of service is designed for real time traffic, which needs a guaranty of minimum end to end delay.
For example: Audio conferencing.

b) Controlled Load Service Class

This type of service is designed for the applications, which can accept some delays, but are sensitive to overload network and to the possibility to lose packets.
For example: E-mail or file transfer.

Problems with Integrated Services.

The two problems with the Integrated services are:

i) Scalability

In Integrated Services, it is necessary for each router to keep information of each flow. But, this is not always possible due to growing network.

ii) Service- Type Limitation

The integrated services model provides only two types of services, guaranteed and control-load.

2. Differentiated Services (DS or Diffserv):

- DS is a computer networking model, which is designed to achieve the scalability by managing the network traffic.
- DS is a class based QoS model specially designed for IP.
- DS was designed by the IETF (Internet Engineering Task Force) to handle the problems of Integrated Services.

The solutions to handle the problems of Integrated Services are explained below:

1. Scalability

The main processing unit can be moved from central place to the edge of the network to achieve the scalability. The router does not need to store the information about the flows and the applications (or the hosts) define the type of services they want every time while sending the packets.

2. Service Type Limitation

The routers, route the packets on the basis of class of services define in the packet and not by the flow. This method is applied by defining the classes based on the requirement of the applications.