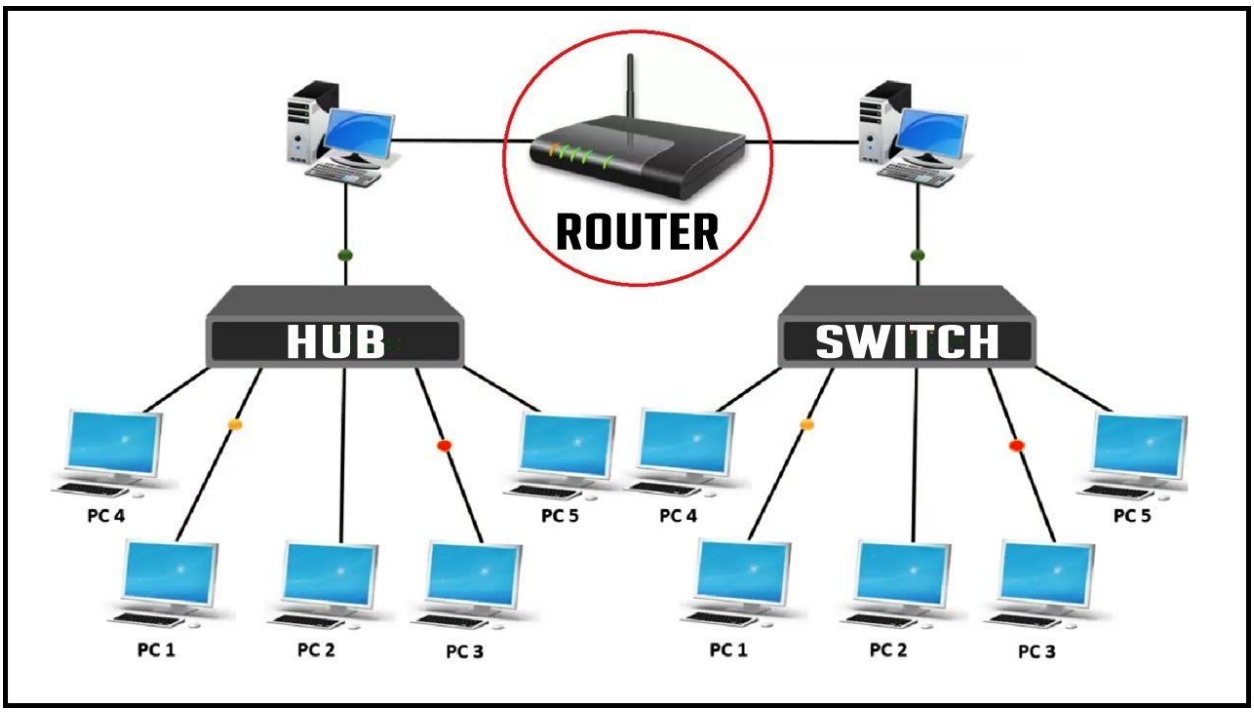
Switching and Routing in Network



3rd Class - Lecture two

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Difference between Hub Switch and Router

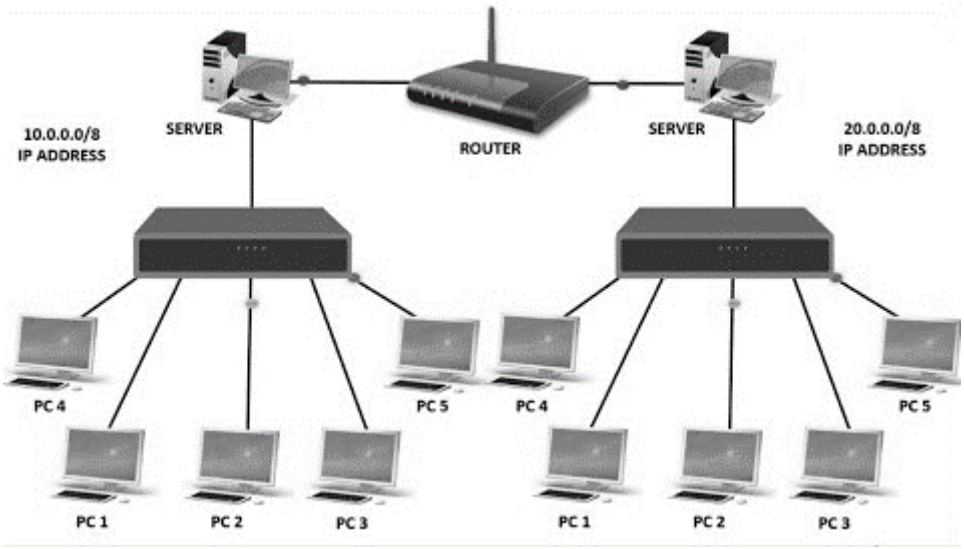

Fig. 1, Computer Network.

Hub Switch and Router are the most commonly used networking devices, Fig. 1, that are used to connect nodes such as PC, printer, scanner, projector, etc. in a network. We will answer about the question "What is the difference between Hub Switch and Router?", but, before that let's look at the basics of these networking devices.

What is Hub?

Hub is a networking device operates at the physical layer of OSI model. It is the simplest networking device hence has a low cost. Basically, a hub is a repeater with multiple ports. The function of a hub in a computer network is similar to a repeater. It transfers data in the form of binary bits and uses for broadcasting data. A hub is to send out a message from one port to other ports. For example, if there are three computers of A, B, C, the message sent by a hub for computer A will also come to the other computers. But only computer A will respond and the response will also go out to every other port on the hub. Therefore, all the

computers can receive the message and computers themselves need to decide whether to accept the message.

What is Switch?

A switch is a networking device works under the Data Link Layer of OSI Model, It transfer data in the form of frames and use for multi-casting. The switch is having an intelligence technology that can filter data packets and like this data can be sent to a particular user and it prevents from creating lots of traffic and wastage of bandwidth. The switch is also having a technology to store the MAC address of a device. A switch is able to handle the data and knows the specific addresses to send the message. It can decide which computer is the message intended for and send the message directly to the right computer. The efficiency of switch has been greatly improved, thus providing a faster network speed.

What is Router?

The router is a networking device works under the networking layer of the OSI model. It transfers data in the form of packets and used to connect two different networks with each other. The router is having the ability to create multiple paths for data transmission and select the best route to transfer the same. A router is quite common to find in a home, business, school, colleges, etc. which allows your network to communicate with other networks including the internet. Router is actually a small computer that can be programmed to handle and route the network traffic. It usually connects at least two networks together, such as two LANs, two

WANs or a LAN and its ISP network. Routers can calculate the best route for sending data and communicate with each other by protocols.

Difference between Hub Switch and Router (Table 1)

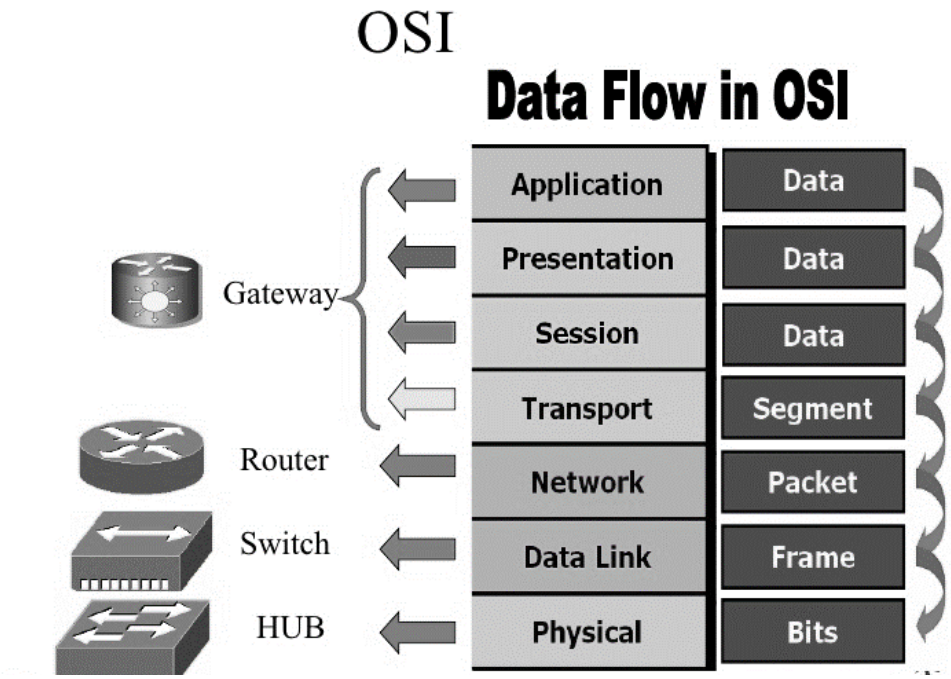

Fig.2, OSI Model.

Hub vs. Switch

A hub works on the physical layer (Layer 1) of OSI model, Fig.2, while Switch works on the data link layer (Layer 2). Switch is more efficient than the hub. A switch can join multiple computers within one LAN, and a hub just connects multiple Ethernet devices together as a single segment. Switch is smarter than hub to determine the target of the forwarding data. Since switch has a higher performance, its cost will also become more expensive.

Switch vs. Router

In the OSI model, router is working on a higher level of network layer (Layer 3) than switch. Router is very different from the switch because it is for routing packet to other networks. It is also more intelligent and sophisticated to serve as an intermediate destination to connect multiple area networks together. A switch is only used for wired network, yet a router can also link with the wireless network. With much more functions, a router definitely costs higher than a switch.

Hub vs. Router

As mentioned above, a hub only contains the basic function of a switch. Hence, differences between hub and router are even bigger. For instance, hub is a passive device without software while router is a networking device, and data transmission form in hub is in electrical signal or bits while in router it is in form of packet.

Table 1. The Difference between Hub Switch and Router.

	Hub	Switch	Router
1	Hub is a broadcast device.	The switch is a multicast device.	The router is a routing device.
2	Hub works in the physical layer of the OSI model.	The switch works in the data link layer and network layer of the OSI model.	The router works in the network layer of the OSI model.
3	Hub is used to connect devices to the same network.	The switch is used to connect devices to the network.	The router is used to connect two different networks.
4	Hub sends data in the form of bits.	The switch sends data in the form of frames.	The router sends data in the form of packets.
5	Hub works in half-duplex.	The switch works in full-duplex.	The router works in full-duplex.
6	Only one device can send data at a time.	Multiple devices can send data at a time.	Multiple devices can send data at a time.
7	Hub does not store any MAC address of a node	Switch stores the IP Address and MAC	Router stores the IP Address and MAC

	in the network.	address of nodes used in a network.	address of nodes used in a network.

Routing: Finding Paths

When building networks, we typically divide routing into two components: host and router. Routers handle traffic flowing between networks but hosts make many decisions long before the packets hit the network. Most routing protocols used to find pathways to destinations are router based, however.

Hosts are typically configured one of two ways: statically with an IP address, default gateway, and domain name server, or with values learned via the Dynamic Host Configuration Protocol (DHCP). Hosts send all traffic going off the local network to the default gateway, with the hope that the gateway can route the packets to the destination.

One of my favorite questions to ask is "What is the first thing that a host does before sending a packet?" Before doing anything else, a host must process its routing table. Historically, there have been some network technologies in which the hosts were more active. For example, IBM's Token Ring utilized discovery frames to find destination nodes on different network segments or rings. However, this is primarily a Layer 2 function, and is not part of contemporary Ethernet- and IP-based networks. Recent years have seen a return to utilizing the host of handling the routing function in the area of ad hoc networking.

Ad hoc routing typically does not run on the traditional network infrastructure. Applications include sensor networks, battlefield communications, and disaster scenarios in which the infrastructure is gone. In these situations, nodes will handle

forwarding of traffic to other nodes. Related ideas are the ad hoc applications and 802.11 ad hoc networks. It is important to realize that with the 802.11 standard, nodes can connect in an ad hoc network but do not forward traffic for other nodes. If a wireless node is not within range of the source host, it will miss the transmission.

Ad hoc routing protocols are designed to solve this particular problem by empowering the nodes to handle the routing/forwarding function. Interesting problems crop up when the "router" may not be wired into the network: things such as movement of the wireless nodes, power saving, processing capability, and memory may be affected. In addition, the application is important. Are the nodes actually sensors which have very little in the way of resources? Are they moving quickly? These challenges have resulted in several ad hoc routing protocols being developed, such as Ad hoc On Demand Distance Vector (AODV), Fisheye State Routing (FSR), and Optimized Link State Routing (OLSR).

The point being made here is that hosts and the host routing table are very active in the processing of packets. Historically, nodes on some networks were even more involved, and if ad hoc routing protocols are any indication, those days are not gone for good.

Routing Devices

Routers operate at the internetwork layer of the TCP/IP model and process IP addresses based on their routing table. A router's main function is to forward traffic to destination networks via the destination address in an IP packet. Routers also resolve MAC addresses (particularly their own) by using the Address Resolution Protocol (ARP). It is important to remember that Layer 2 (link layer)

frames and MAC addresses do not live beyond the router. This means that an Ethernet frame is destroyed when it hits a router.

When operating in a network, a router can act as the default gateway for hosts, as in most home networks. A router may be installed as an intermediate hop between other routers without any direct connectivity to hosts. In addition to routing, routers can be asked to perform a number of other tasks, such as network address translation, managing access control lists, terminating virtual private network or quality of service.

Basic router functionality is comprised of three major components:

• **Routing process**: The routing process is the actual movement of IP packets from one port to another and the routing table holds the information used by the routing process.

• **Routing protocols:** Routing protocols such as the Routing Information Protocol (RIP) or Open Shortest Path First (OSPF) are used to communicate with other routers and may end up "installing" routes in the routing table for use by the routing process. When a router is configured, the routing table is constructed by bringing interfaces up and providing the interfaces with IP addresses.

• **Routing table:** When processing packets, routers "traverse" the routing table looking for the best possible pathway match. The routing table indicates that the router knows of two networks: 192.168.15.0 and 192.168.20.0. Note that this router does not have a default gateway or "gateway of last resort." This means that if the destination IP address is anywhere beyond the two networks listed, the router has no idea how to get there. If you said to yourself, "Ahh, ICMP destination unreachable message," give yourself a gold star.

Routing tables can be comprised of several different route types: directly connected, static, and dynamic. These are the networks on which the router has an interface and are accompanied by the letter “C” and the particular interface, such as FastEthernet0/1. Directly connected routes have preference over and above any other route. The 0/1 from the interface is a designator for the blade and port in the router chassis.

Static Routes

Static entries are those that are manually installed on a router by the network administrator. For specific destinations, and in small or stable network environments, manually configured static routes can be used very successfully. By using static routes, the *network administrator* has determined the pathway to be used to a particular destination network. The static route will supersede any pathway learned via a routing protocol because of the administrative distance; another important idea that is central to routing is the *next hop*. The next hop is a router that is one step closer to the destination from the perspective of a particular router. The next hop is the router to send packets to next. In many networks, a series of next hops are used.