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Lab Practical #03:

Study of different network devices in detail.

Practical Assignment #03:

1. Give difference between below network devices.
   - Hub and Switch
   - Switch and Router
   - Router and Gateway
2. Working of below network devices:
   - Switch
   - Router
   - Gateway

Hub and Switch

No.	Hub	Switch
1	Hubs function on Physical layer of the OSI framework.	Switches function on Data Link layer of the OSI framework.
2	Hubs are less intelligent devices and always send all information to all connected devices.	Switches record MAC addresses in a table to learn which devices to transmit information to
3	Hubs group Ethernet devices on a LAN, broadcasting all data to all devices.	Switches connect devices to a singular LAN to transmit data from one device to another.
4	Hubs operate at half duplex, making them slower and forcing devices to share bandwidth equally.	Switches can operate at full duplex or half duplex, using all available bandwidth, creating faster and more efficient networks.
5	Hubs send information using bits.	Switches send information using data packets.
6	Hub have 4/12 ports.	Switch can have 24 to 48 ports.
7	Hub cannot be used as a repeater.	Switch can be used as a repeater.
8	In hub, Packet filtering is not provided.	In switch, Packet filtering is provided.
9	Speed of original hub 10Mbps and modern internet hub is 100Mbps.	Maximum speed is 10Mbps to 100Mbps.

Switch and Router

No.	Switch	Router
1	It connects multiple networked devices in the network.	It connects multiple switches & their corresponding networks.
2	It works on the data link layer of the OSI model.	It works on the network layer of the OSI model.
3	It is used within a LAN.	It can be used in LAN or MAN.
4	A switch cannot perform NAT or Network Address Translation.	A router can perform Network Address Translation.
5	The switch takes more time while making complicated routing decisions.	A router can take a routing decision much faster than a switch.

6	It provides only port security.	It provides security measures to protect the network from security threats.
7	It works in either half or full-duplex transmission mode.	It works in the full-duplex transmission mode. However, we can change it manually to work on half-duplex mode.
8	Switches can only work with the wired network.	Routers can work with both wired & wireless networks.
9	Switches are available with different ports, such as 8, 16, 24, 48, and 64.	A router contains two ports by default, such as Fast Ethernet Port. But we can also add the serial ports explicitly.
10	It uses the CAM (Content Addressable Memory) table for the source and destination MAC address.	It uses the routing table to get the best route for the destination IP.

Router and Gateway

No.	Router	Gateway
1	Usually, routers run on the 3rd layer of the protocol and transmit the packets from one system to another. A router chooses the network's path to transport the data packets.	Gateway interprets the network system as endpoints from one packet to another.
2	It is available only to dedicated applications	It is hosted on the dedicated application, physical servers, and virtual applications
3	It routes the data packets via similar networks.	It connects two dissimilar networks.
4	It is deployed on the router hardware in a specific appliance.	The gateway is deployed as the virtual or physical server or the specific appliance.
5	It can operate only on **3** and **4** layers.	It can operate only on the **5** layers.
6	Router supports dynamic routing.	Gateway doesn't support dynamic routing.
7	The additional features provided by a router are Wireless networking, Static routing, NAT, DHCP server etc.	The additional features provided by a gateway are network access control, protocol conversion etc.

Working of below network devices:

1. Switch

The Switch is a network device that is used to segment the networks into different subnetworks called subnets or LAN segments. It is responsible for filtering and forwarding the packets between LAN segments based on MAC address.

Switches have many ports, and when data arrives at any port, the destination address is examined first and some checks are also done and then it is processed to the devices. Different types of communication are supported here like unicast, multicast, and broadcast communication.

- It operates in Data Link Layer in OSI Model.
- It performs error checking before forwarding data.
- It transfers the data only to the device that has been addressed.
- It operates in full duplex mode.
- It allocates each LAN segment a limited bandwidth.
- It uses Unicast (one-to-one), multicast (one-to-many), and broadcast (one-to-all) transmission modes.
- Packet Switching techniques are used to transfer data packets from source to destination.
- Switches have a more significant number of ports.

- **Working :**

When the source wants to send the data packet to the destination, the packet first enters the switch and the switch reads its header and finds the MAC address of the destination to identify the device then it sends the packet out through the appropriate ports that lead to the destination devices.

Switch establishes a temporary connection between the source and destination for communication and terminates the connection once the conversation is done. Also, it offers full bandwidth to network traffic going to and from a device simultaneously to reduce collision.

2. Router

A router is a device that connects two or more packet-switched networks or subnetworks. It serves two primary functions: managing traffic between these networks by forwarding data packets to their intended IP addresses, and allowing multiple devices to use the same Internet connection.

There are several types of routers, but most routers pass data between LANs (local area networks) and WANs (wide area networks). A LAN is a group of connected devices restricted to a specific geographic area. A LAN usually requires a single router.

- **Working :**

A router works by using a protocol called the Internet Protocol (IP), which is a set of rules that govern how data is transmitted across the internet. When a device on your network sends data, the data is broken up into small packets, which are then sent to the router.

The router then examines the destination IP address of the packet to determine where it should be sent. If the destination IP address is on your network, the router sends the packet directly to the device with that IP address. If the destination IP address is not on your network, the router sends the packet to the modem, which then sends the packet to the internet.

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In addition to directing traffic between devices, a router also performs other important functions, such as providing security for your network. Routers often include features such as firewalls and network address translation (NAT), which help protect your network from unauthorised access.

Routers connect computers and other devices to the Internet. A router acts as a dispatcher, choosing the best route for your information to travel. It connects your business to the world, protects information from security threats, and can even decide which computers get priority over others

3. Gateway

A gateway is a network node used in telecommunications that connects two networks with different transmission protocols together. Gateways serve as an entry and exit point for a network as all data must pass through or communicate with the gateway prior to being routed. In most IP-based networks, the only traffic that does not go through at least one gateway is traffic flowing among nodes on the same local area network (LAN) segment. The term default gateway or network gateway may also be used to describe the same concept.

- **Working :**

All networks have a boundary that limits communication to devices that are directly connected to it. Due to this, if a network wants to communicate with devices, nodes or networks outside of that boundary, they require the functionality of a gateway. A gateway is often characterized as being the combination of a router and a modem.

The gateway is implemented at the edge of a network and manages all data that is directed internally or externally from that network. When one network wants to communicate with another, the data packet is passed to the gateway and then routed to the destination through the most efficient path. In addition to routing data, a gateway will also store information about the host network's internal paths and the paths of any additional networks that are encountered.

Gateways are basically protocol converters, facilitating compatibility between two protocols and operating on any layer of the open systems interconnection (OSI) model.