Lab Practical #02:

Study of different network devices in detail.

**Practical Assignment #02:**

1. Give difference between below network devices.

* Hub and Switch
* Switch and Router
* Router and Gateway

1. Working of below network devices:
   * Repeater
   * Modem((DSL and ADSL)
   * Hub
   * Bridge
   * Switch
   * Router
   * Gateway

# Hub and Switch

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| No. | Hub | Switch |
| 1 | [Hub](https://www.geeksforgeeks.org/advantages-and-disadvantages-of-hub/) is operated on Physical layer of OSI model. | While [switch](https://www.geeksforgeeks.org/what-is-a-network-switch-and-how-does-it-work/) is operated on Data link [layer of OSI Model](https://www.geeksforgeeks.org/layers-of-osi-model/). |
| 2 | Hub is a broadcast type transmission. | While switch is a Unicast, multicast and broadcast type transmission |
| 3 | Hub has 4/12 ports. | While switch can have 24 to 48 ports. |
| 4 | In hub, there is only one collision domain. | While in switch, different ports have own collision domain. |
| 5 | Hub is a half-duplex transmission mode. | While switch is a full duplex transmission mode. |

# Switch and Router

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| No. | Switch | Router |
| 1 | While the main objective of switch is to connect various devices simultaneously. | The main objective of router is to connect various networks simultaneously. |
| 2 | While it works in [data link layer](https://www.geeksforgeeks.org/data-link-layer/). | It works in [network layer](https://www.geeksforgeeks.org/network-layer-gq/). |
| 3 | While switch is used by only LAN. | Router is used by [LAN](https://www.geeksforgeeks.org/lan-full-form/) as well as [MAN](https://www.geeksforgeeks.org/man-full-form/). |
| 4 | While through switch data is sent in the form of frame. | Through the router, data is sent in the form of packets. |
| 5 | While there is no collision taking place in full duplex switch. | There is less collision taking place in the router |

# Router and Gateway

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| No. | Router | Gateway |
| 1 | It is a hardware device that is responsible for receiving, analyzing, and forwarding data packets to other networks. | It is a device that is used for communication among networks that have a different set of protocols. |
| 2 | It supports [dynamic routing](https://www.geeksforgeeks.org/what-is-dynamic-routing-in-computer-network/). | It does not support dynamic routing. |
| 3 | The main function of a router is routing the traffic from one network to the other. | The main function of a gateway is to translate one protocol to the other. |
| 4 | A router operates on layer 3 and layer 4 of the OSI model. | A gateway operates up to layer 5 of the [OSI model](https://www.geeksforgeeks.org/osi-model-full-form-in-computer-networking/). |
| 5 | It is hosted on only the dedicated applications. | It is hosted on dedicated applications, physical servers, or virtual applications. |

# Working of below network devices:

1. Switch :

* It operates in the Data Link Layer in the [OSI Model](https://www.geeksforgeeks.org/layers-of-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](https://www.geeksforgeeks.org/lan-full-form/) segment to 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.

1. Router :

* A router determines a packet's future path by examining the destination IP address of the header and comparing it to the routing [database](https://www.geeksforgeeks.org/what-is-database/). The list of [routing tables](https://www.geeksforgeeks.org/routing-tables-in-computer-network/) outlines how to send the data to a specific network location. They use a set of rules to determine the most effective way to transmit the[data](https://www.geeksforgeeks.org/what-is-data/) to the specified IP address.
* To enable communication between other devices and the internet, routers utilize a modem, such as a cable, fibre, or [DSL modem](https://www.geeksforgeeks.org/digital-subscriber-line-dsl/). Most routers include many ports that can connect a variety of devices to the [internet](https://www.geeksforgeeks.org/internet-and-its-services/) simultaneously. In order to decide where to deliver data and where traffic is coming from, it needs routing tables.
* A routing table primarily specifies the router's default path. As a result, it might not determine the optimum path to forward the data for a particular packet. For instance, the office router directs all networks to its internet service provider through a single default channel.
* Static and dynamic tables come in two varieties in the router. The [dynamic routing](https://www.geeksforgeeks.org/what-is-dynamic-routing-in-computer-network/) tables are automatically updated by dynamic routers based on network activity, whereas the [static routing tables](https://www.geeksforgeeks.org/difference-between-static-and-dynamic-routing/) are configured manually.

1. Gateway:

* Gateways provide a wide variety of features.
* A gateway is situated at a network edge and manages all data that enters or exits the network.
* A gateway is distinct from other network devices in that it can operate at any layer of the [OSI model](https://www.geeksforgeeks.org/open-systems-interconnection-model-osi/).
* Gateways made the transmission more feasible as it queued up all the data and divided it into small packets of data rather than sending it bulk.
* Gateways provide security within the network.

1. Bridge:

* A bridge is a network device used to connect two or more network segments, making them function as a single network.
* Operates at the Data Link Layer (Layer 2) of the OSI model.
* Filters traffic based on MAC addresses.
* Forwards or blocks data based on the destination MAC address.
* Reduces traffic by dividing a large network into smaller segments.
* Improves performance and reduces collisions.
* Transparent Bridge: Learns MAC addresses automatically.
* Maintains a table of MAC addresses to identify which device is on which segment.
* Filters data so that it only forwards frames to the necessary segment.
* Used in small or legacy networks to segment traffic and reduce congestion.

1. Hub:

* A hub is a basic networking device that connects multiple computers in a LAN and transmits data to all connected devices.
* Operates at the Physical Layer (Layer 1) of the OSI model.
* Simply receives data and broadcasts it to all ports, regardless of the destination.
* A hub has no MAC address learning capability.
* It doesn’t differentiate between devices.
* All connected devices share the same bandwidth, which reduces overall network efficiency.
* All ports belong to the same collision domain, increasing the chances of collisions.
* Like switches and bridges, all ports in a hub are in the same broadcast domain
* Previously used in small, simple LANs, but now largely replaced by switches.

1. Modem(DSL and ADSL):

* **DSL:**
* DSL is a technology that enables high-speed data transmission over ordinary twisted-pair telephone lines.
* It allows for an "always-on" internet connection, eliminating the need to dial-up.
* DSL modems convert digital data from a computer into analog signals for transmission over telephone lines and vice versa.
* A DSL modem is essential for accessing the internet via DSL technology
* **ADSL:**
* ADSL is a specific type of DSL that provides faster download speeds than upload speeds.
* This is suitable for typical internet usage like browsing, streaming, and downloading.
* ADSL modems use a micro-filter on the subscriber's telephone line to separate voice and data signals, allowing for simultaneous phone and internet use.
* The "asymmetric" nature of ADSL means it allocates more bandwidth to downstream (download) traffic.

1. Repeater:

* A repeater is a network device that receives a signal, amplifies or regenerates it, and retransmits it to extend the range of a network.
* Operates at the Physical Layer (Layer 1) of the OSI model.
* Used to extend the distance over which data can travel in a network.
* Helps overcome signal attenuation (weakening of signals over long distances).
* Receives weak or corrupted signals.
* Regenerates the original signal.
* Transmits the restored signal to the next segment.
* Used in LANs to connect distant network segments.
* In wireless networks to extend Wi-Fi signal coverage.