# Devices

## Hub

Network hubs are a Layer 1 device consistent with the Open Systems Interconnection (OSI) reference model. They operate at the physical layer as against a software application. These hubs use by forwarding packets of data to all or any other computers connected to the device. When a packet arrives at one among the ethernet ports, it's then copied to the opposite ports so that all segments of the connection can access the knowledge stored within the packet. These are common connection points for network devices, which connect segments of a LAN (local area network) and should contain multiple ports – an interface for connecting network devices like printers, storage devices, workstations, and servers. A knowledge packet arriving at one Hub's port could also be copied to other ports, allowing all network segments to possess access to the info packet. It Hub may be a networking device that permits you to attach multiple PCs to one network. It's wont to connect segments of a LAN. A hub stores various ports, so it's copied to multiple other ports when a packet arrives at one port. A hub has the following features:

- It works with broadcasting and shared bandwidth.
- It has one broadcast domain and one collision domain
- Works at the physical layer
- A virtual LAN can't be created employing a hub
- Provides support for half-duplex transmission mode
- A hub has just one broadcast domain
- It does not support spanning tree protocol
- Packet collisions occur mainly inside a hub


**Figure 1: HUB**

## Repeaters

The repeater may be a network hardware device that's worked at the physical layer, and it helps to amplify or regenerate the signals before retransmitting them. The repeater is additionally referred to as "Signal Boosters." A repeater can increase the info signal from one network segment then pass it to a different network segment, thus scaling the dimensions of the network. The repeater allows the transfer of the info through an outsized area distance. It can ensure security and quality of knowledge and retransmitting the information with securely preserving the signals. This device has limited use in specific situations. They do not read the info frames in the least. It makes sure that data is repeated out on each port. These are analog devices that employment with signals to which they're connected. A sign appearing on one port is regenerated and placed on another port; this extends the LAN strength. It doesn't understand packets or frames. It only understands the symbol, which converts bits as volts.

- **Restriction for Number of Repeaters:** you've got the only limitation within the number of repeaters used on the distinct network. If you are trying to attach more repeaters to the web, it'll generate the noise on the wire and enhance the probabilities for packet collision.
- **Less Segmentation:** A repeater isn't the ability to segment the network. For example: if you employ two different types of cables, each with segments. So, it's unable to generate separate traffic from one thread to another.
- **Collision Domain:** When all information is moved to varied domains, repeaters aren't ready to separate the connected network devices. Moreover, the repeater cannot spot if it's an associated unit of the same collision domain.
- **Bandwidth Usage:** A wireless repeater can transmit the signals in both directions in between the router and computer. When the computer attaches to the wireless repeater, then bandwidth is effectively halved.
- **Network Architecture:** A repeater cannot attach networks alongside different network architectures. So, to satisfy this purpose, you'll use the gateway or router.


**Figure 2: Repeater**

## Switch

Switches are essential building blocks for any network. They connect multiple devices, like computers, wireless access points, printers, and servers, on an equivalent network within a building. A switch hence, enables connected devices to share information and ask one another. A network switch may be a device that operates at the info Link layer of the OSI model—Layer 2. It takes packets being sent by devices connected to its physical ports and sends them out again, but only through the ports that cause the devices the packets are intended to succeed in . they will also operate at the network layer--Layer 3, where routing occurs. Switches are a standard component of networks supported by ethernet, Fibre Channel, Asynchronous Transfer Mode (ATM), and InfiniBand. Generally, though, most switches today use ethernet. Once a tool is connected to a switch, the switch notes its media access control (MAC) address, a code baked into the device's network interface card (NIC) that attaches to a coaxial cable that connects to the switch. The switch uses the MAC address to spot which secured outgoing device packets are sent and where to deliver receiving packets.

The MAC address identifies the physical device against the network layer (Layer 3) IP address, which may be assigned dynamically and change over time. When it sends a packet to a different device, it enters the switch, and therefore the switch reads its header to work out what to do with it. It matches the destination address and sends the packet out through the acceptable ports in the destination devices. To scale back the

prospect for collisions between network traffic getting to and from a switch and a connected device at an equivalent time, most switches offer full-duplex functionality during which packets coming from and getting to a tool have access to the complete bandwidth of the switch connection.

**Figure 3: Switch**

### Switch Features

- **Connect multiple hosts**: Normally, a switch provides excessive ports for cable connections, allowing star routing. It's usually wont to connect multiple PCs to the network.
- **Forwards a message to a selected host**: a bridge, a switch uses an equivalent forwarding or filtering logic on each port. When any host on the network or switch sends a message to a different host on an equivalent network or an equivalent switch, the switch receives and decodes the frames to read the message's physical (MAC) address portion.
- **Manage traffic**: A network switch can manage traffic either coming into or exiting the network and may connect devices like computers and access points with ease.
- **Keep electrical signal undistorted**: When a switch forwards a frame, it regenerates an undistorted square electrical signal.
- **Increase LAN bandwidth**: A switch divides a LAN into multiple collision domains with independent broadband, thus significantly increasing the bandwidth of the LAN.

## Router

A router may be a device that connects two or more networks or subnetworks. It does two primary functions: It manages traffic between these networks by forwarding data

packets to their intended IP addresses and allowing multiple devices to use an equivalent Internet connection. There are several routers, but most routers pass data between LANs (local area networks) and WANs (wide area networks). A LAN may be a group of connected devices restricted to a selected geographical area. A LAN usually requires one router. A WAN, against this, may be an extensive network opened up over a vast geographical area. Large organizations and corporations that operate in multiple locations across the country, as an example, will need separate LANs for every site, which then hooks up with the opposite LANs to make a WAN.

Routers guide and direct network data, using packets that contain various sorts of data—such as files, communications, and straightforward transmissions like web interactions. The info packets have several layers or sections, one among which carries identifying information like sender, data type, size, and most significantly, the destination IP (Internet protocol) address. The router reads this layer, prioritizes the info, and chooses the most straightforward route for every transmission.

- Routers are multi-port devices with high–speed backbones
- It also supports filtering and encapsulation like bridges
- Like bridges, routers also are self-learning, as they will communicate their existence. To other devices and may learn of the presence of the latest routers, nodes, and new LAN endpoints.
- They route the traffic by considering the network as an entire. This characteristic makes them superior to hubs and bridges because they view the network on a link-by-link basis.
- The packet handled by the router may include:
    - A destination address.
    - The priority level of the packet.
    - The least-cost route for the packet.
    - Minimum route delay.
    - Minimum route distance.
    - Route congestion level of the packet.
- Routers constantly monitor the conditions of the whole network as an entire to dynamically adapt to changes within the state of the network.
- They typically provide some level of redundancy so that they're less vulnerable to catastrophic failure.

**Figure 4: Router**

## Gateway

A gateway may be a network node that forms a passage between two networks operating with different transmission protocols. The network gateway's foremost common sort of gateways operates at layer 3. A gateway can work at any of the seven layers of the OSI model. It acts because the entry-exit point for a network since all traffic that flows across the networks should undergo the gateway. Only the interior traffic between the nodes of a LAN doesn't experience the gateway.

- Gateway is found at the exit of a network and manages all data in and out from the network.
- It forms a route between two different networks that want to operate with one other using transmission protocols.
- A gateway also operates as a protocol converter, providing compatibility between the various protocols utilized in the two different networks.
- The feature that differentiates a gateway from other network devices is that it can operate at any OSI model layer.
- It also stores information about the routing paths of the communicating networks.
- A gateway node could also be supplemented as a proxy server or firewall when utilized in an enterprise scenario.
- A gateway is usually implemented as a node with multiple NICs (network interface cards) connected to different networks. However, it also can be configured using the software.
- It uses a packet switching technique to transmit data across the networks.


**Figure 5: Gateway**