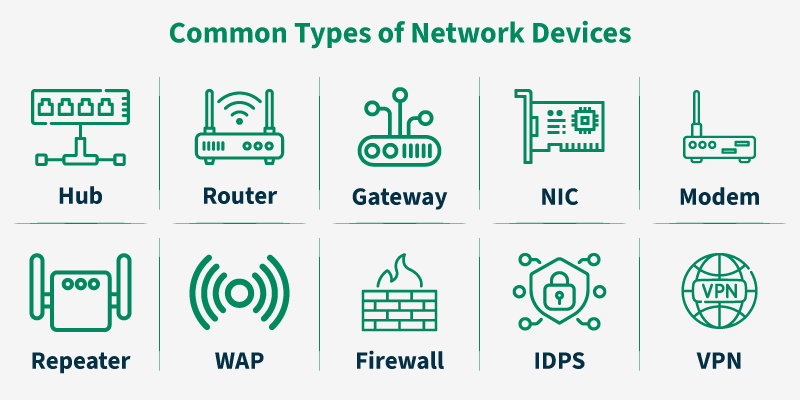
**Network Devices (Hub, Repeater, Bridge, Switch, Router, Gateways and Brouter)**

Network devices are physical devices that allow hardware on a computer network to communicate and interact with each other. Network devices like hubs, repeaters, bridges, switches, routers, gateways, and brouters help manage and direct data flow in a network. They ensure efficient communication between connected devices by controlling data transfer, boosting signals, and linking different networks. Each device serves a specific role, from simple data forwarding to complex routing between networks.



## Functions of Network Devices

* Network devices help to send and receive data between different devices.
* Network devices allow devices to connect to the network efficiently and securely.
* Network devices Improve network speed and manage data flow better.
* It protect the network by controlling access and preventing threats.
* Expand the network range and solve signal problems.

## Common Types of Networking Devices and Their Uses

Network devices work as a mediator between two devices for transmission of data, and thus play a very important role in the functioning of a computer network.

Below are some common network devices used in modern networks:

* Access Point
* Modems
* Firewalls
* Repeater
* Hub
* Bridge
* Switch
* Routers
* Gateway
* Brouter
* NIC

## Access Point

* An [access point](https://www.geeksforgeeks.org/what-is-a-wireless-access-point/) in networking is a device that allows wireless devices, like smartphones and laptops, to connect to a wired network.
* It creates a Wi-Fi network that lets wireless devices communicate with the internet or other devices on the network.
* Access points are used to extend the range of a network or provide Wi-Fi in areas that do not have it. They are commonly found in homes, offices, and public places to provide wireless internet access.

A modem is also used to convert analog signal back into digital signal. Modems are generally used to access internet by customers of an [Internet Service Provider (ISP)](https://www.geeksforgeeks.org/isp-full-form/).

[Modems](https://www.geeksforgeeks.org/what-is-modem/) is also known as modulator/demodulator is a network device that is used to convert [digital signal](https://www.geeksforgeeks.org/advantages-and-disadvantages-of-digital-signals/) into [analog signal](https://www.geeksforgeeks.org/difference-between-analog-and-digital-signal/) of different frequencies and transmits these signal to a modem at the receiving location.

These converted signals can be transmitted over the cable systems, telephone lines, and other communication mediums.

### **Types of Modems**

There are four main types of modems:

* **DSL Modem**: Uses regular phone lines to connect to the internet but it is slower compared to other types.
* **Cable Modem**: Sends data through TV cables, providing faster internet than [DSL](https://www.geeksforgeeks.org/digital-subscriber-line-dsl/).
* **Wireless Modem**: Connects devices to the internet using [Wi-Fi](https://www.geeksforgeeks.org/what-is-wi-fiwireless-fidelity/) relying on nearby Wi-Fi signals.
* **Cellular Modem**: Connects to the internet using mobile data from a cellular network not Wi-Fi or fixed cables.

## Firewalls

* A [firewall](https://www.geeksforgeeks.org/introduction-of-firewall-in-computer-network/) is a network security device that monitors and controls the flow of data between your computer or network and the internet.
* It acts as a barrier, blocking unauthorized access while allowing trusted data to pass through.
* Firewalls help protect your network from hackers, viruses, and other online [threats](https://www.geeksforgeeks.org/computer-security-threats/) by filtering traffic based on security rules.
* Firewalls can be physical devices (hardware), programs (software), or even cloud-based services, which can be offered as [SaaS](https://www.geeksforgeeks.org/software-as-a-service-saas/), through public clouds, or private virtual clouds.

## Repeater

* A [repeater](https://www.geeksforgeeks.org/repeaters-in-computer-network/) operates at the [physical layer](https://www.geeksforgeeks.org/physical-layer-in-osi-model/). Its main function is to amplify (i.e., regenerate) the signal over the same network before the signal becomes too weak or corrupted to extend the length to which the signal can be transmitted over the same network
* When the signal becomes weak, they copy it bit by bit and regenerate it at its star topology connectors connecting following the original strength. It is a 2-port device.

## **Hub**

* A [hub](https://www.geeksforgeeks.org/what-is-network-hub-and-how-it-works/) is a multiport repeater.
* A hub connects multiple wires coming from different branches, for example, the connector in [star topology](https://www.geeksforgeeks.org/advantages-and-disadvantages-of-star-topology/) which connects different stations.
* Hubs cannot filter data, so data packets are sent to all connected devices.  In other words, the 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.

### **Types of Hub**

* **Active Hub:**These are the hubs that have their power supply and can clean, boost, and relay the signal along with the network. It serves both as a repeater as well as a wiring center. These are used to extend the maximum distance between nodes.
* **Passive Hub:**These are the hubs that collect wiring from nodes and power supply from the active hub. These hubs relay signals onto the network without cleaning and boosting them and can’t be used to extend the distance between nodes.
* **Intelligent Hub:**It works like an active hub and includes remote management capabilities. They also provide flexible data rates to network devices. It also enables an administrator to monitor the traffic passing through the hub and to configure each port in the hub.

## **Bridge**

* A [bridge](https://www.geeksforgeeks.org/difference-between-bridge-and-repeater/) operates at the data link layer.
* A bridge is a repeater, with add on the functionality of filtering content by reading the [MAC addresses](https://www.geeksforgeeks.org/mac-address-in-computer-network/) of the source and destination.
* It is also used for interconnecting two LANs working on the same protocol.
* It typically connects multiple network segments and each port is connected to different segment. A bridge is not strictly limited to two ports, it can have multiple ports to connect and manage multiple network segments.
* Modern multi-port bridges are often called Layer 2 switches because they perform similar functions.

### **Types of Bridges**

* **Transparent Bridges:**These are the bridge in which the stations are completely unaware of the bridge’s existence i.e. whether or not a bridge is added or deleted from the network, reconfiguration of the stations is unnecessary. These bridges make use of two processes i.e. bridge forwarding and bridge learning.
* **Source Routing Bridges:** In these bridges, routing operation is performed by the source station and the frame specifies which route to follow. The host can discover the frame by sending a special frame called the discovery frame, which spreads through the entire network using all possible paths to the destination.

## **Switch**

* A [switch](https://www.geeksforgeeks.org/types-of-switches-in-computer-network/) is a multiport bridge with a buffer and a design that can boost its efficiency(a large number of ports imply less traffic) and performance.
* A switch is a data link layer device. The switch can perform error checking before forwarding data, which makes it very efficient as it does not forward packets that have errors and forward good packets selectively to the correct port only.
* The switch divides the [collision domain](https://www.geeksforgeeks.org/collision-domain-and-broadcast-domain-in-computer-network/) of hosts, but the [broadcast domain](https://www.geeksforgeeks.org/what-is-broadcast-domain/) remains the same.

### **Types of  Switch**

* **Unmanaged Switches:**These switches have a simple plug-and-play design and do not offer advanced configuration options. They are suitable for small networks or for use as an expansion to a larger network.
* **Managed Switches:**These switches offer advanced configuration options such as [VLANs](https://www.geeksforgeeks.org/virtual-lan-vlan/), [QoS](https://www.geeksforgeeks.org/difference-between-quality-of-service-qos-and-quality-of-experience-qoe/), and link aggregation. They are suitable for larger, more complex networks and allow for centralized management.
* **Smart Switches:** These switches have features similar to managed switches but are typically easier to set up and manage. They are suitable for small- to medium-sized networks.
* **Layer 2 Switches:** These switches operate at the Data Link layer of the [OSI model](https://www.geeksforgeeks.org/open-systems-interconnection-model-osi/) and are responsible for forwarding data between devices on the same network segment.
* **Layer 3 switches:**These switches operate at the Network layer of the OSI model and can route data between different network segments. They are more advanced than [Layer 2 switches](https://www.geeksforgeeks.org/difference-between-layer-2-and-layer-3-switches/) and are often used in larger, more complex networks.
* **PoE Switches**: These switches have Power over [Ethernet](https://www.geeksforgeeks.org/what-is-ethernet/) capabilities, which allows them to supply power to network devices over the same cable that carries data.
* **Gigabit switches:**These switches support Gigabit Ethernet speeds, which are faster than traditional Ethernet speeds.
* **Rack-Mounted Switches:**These switches are designed to be mounted in a server rack and are suitable for use in data centers or other large networks.
* **Desktop Switches:** These switches are designed for use on a desktop or in a small office environment and are typically smaller in size than rack-mounted switches.
* **Modular Switches**: These switches have modular design, which allows for easy expansion or customization. They are suitable for large networks and data centers.

## **Router**

A [router](https://www.geeksforgeeks.org/introduction-of-a-router/) is a device like a switch that routes data packets based on their IP addresses.

The router is mainly a Network Layer device. Routers normally connect LANs and [WANs](https://www.geeksforgeeks.org/wan-full-form/) and have a dynamically updating [routing table](https://www.geeksforgeeks.org/routing-tables-in-computer-network/) based on which they make decisions on routing the data packets.

The router divides the broadcast domains of hosts connected through it.

## **Gateway**

* A [gateway](https://www.geeksforgeeks.org/difference-between-gateway-and-modem/), as the name suggests, is a passage to connect two networks that may work upon different networking models.
* They work as 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 switches or routers.

## **Brouter**

* It is also known as the bridging router is a device that combines features of both bridge and router.
* It can work either at the [data link layer](https://www.geeksforgeeks.org/data-link-layer/) or a [network layer](https://www.geeksforgeeks.org/network-layer-in-osi-model/). Working as a router, it is capable of routing packets across networks and working as the bridge, it is capable of filtering local area network traffic.

## **NIC**

* NIC or [network interface card](https://www.geeksforgeeks.org/nic-full-form/) is a network adapter that is used to connect the computer to the network. It is installed in the computer to establish a [LAN](https://www.geeksforgeeks.org/lan-full-form/).
* It has a unique id that is written on the chip, and it has a connector to connect the cable to it. The cable acts as an interface between the computer and the router or modem. NIC card is a layer 2 device which means that it works on both the physical and data link layers of the network model.

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* **Modems:**A modem enables a computer to connect to the internet via a telephone line. The modem at one end converts the computer’s digital signals into analog signals and sends them through a telephone line. At the other end, it converts the analog signals to digital signals that are understandable for another computer.
* **Routers:**A router connects two or more networks. One common use of the router is to connect a home or office network ([LAN](https://www.spiceworks.com/tech/networking/articles/what-is-local-area-network/)) to the internet (WAN). It generally has a plugged-in internet cable along with cables that connect computers on the LAN. Alternatively, a LAN connection can also be wireless (Wi-Fi-enabled), making the network device wireless. These are also referred to as wireless access points (WAPs).
* **Hubs, bridges, and switches:**Hubs, bridges, and switches are connecting units that allow multiple devices to connect to the router and enable data transfer to all devices on a network. A router is a complex device with the capabilities of hubs, bridges, and even switches.  
  **Hubs:**A hub broadcasts data to all devices on a network. As a result, it consumes a lot of bandwidth as many computers might not need to receive the broadcasted data. The hub could be useful in linking a few gaming consoles in a local multiplayer game via a wired or wireless LAN.  
  **Bridges:** A bridge connects two separate LAN networks. It scans for the receiving device before sending a message. This implies that it avoids unnecessary data transfers if the receiving device is not there. Moreover, it also checks to see whether the receiving device has already received the message. These practices improve the overall performance of the network.  
  **Switches:**A [switch](https://www.spiceworks.com/security/network-security/articles/how-to-stop-network-switches-from-becoming-a-gateway-for-hackers/) is more powerful than a hub or a bridge but performs a similar role. It stores the MAC addresses of network devices and transfers data packets only to those devices that have requested Thus, when the demand is high, a switch becomes more efficient as it reduces the amount of latency.
* **Network interface cards**: A network interface card (NIC) is a hardware unit installed on a computer, which allows it to connect to a network. It is typically in the form of a circuit board or chip. In most modern machines, NICs are built into the motherboards, while in some computers, an extra expansion card in the form of a small circuit board is added externally.
* **Network cables**: Cables connect different devices on a network. Today, most networks have cables over a wireless connection as they are more secure, i.e., less prone to attacks, and at the same time carry larger volumes of data per second.
* **Firewall:**A [firewall](https://www.spiceworks.com/security/web-security/articles/what-is-firewall-definition-key-components-best-practices/) is a hardware or software device between a computer and the rest of the network open to attackers or hackers. Thus, a LAN can be protected from hackers by placing a firewall between the LAN and the internet connection. A firewall allows authorized connections and data-like emails or web pages to pass through but blocks unauthorized connections made to a computer or LAN.

