Introduction to Computer Networks

We are living in a connected world. Information is being produced, exchanged, and traced across the globe in real time. It's possible as almost everyone and everything in the digital world is interconnected through one way or the other.

A group of two or more similar things or people interconnected with each other is called network

Some of the examples of network in our everyday life includes:
Social network
Mobile network
Network of computers

A computer network () is an interconnection among two or more computers or computing devices. Such interconnection allows computers to share data and resources among each other. A basic network may connect a few computers placed in a room.
The network size may vary from small to large depending on the number of computers it connects. A computer network can include different types of hosts (also called nodes) like server, desktop, laptop.

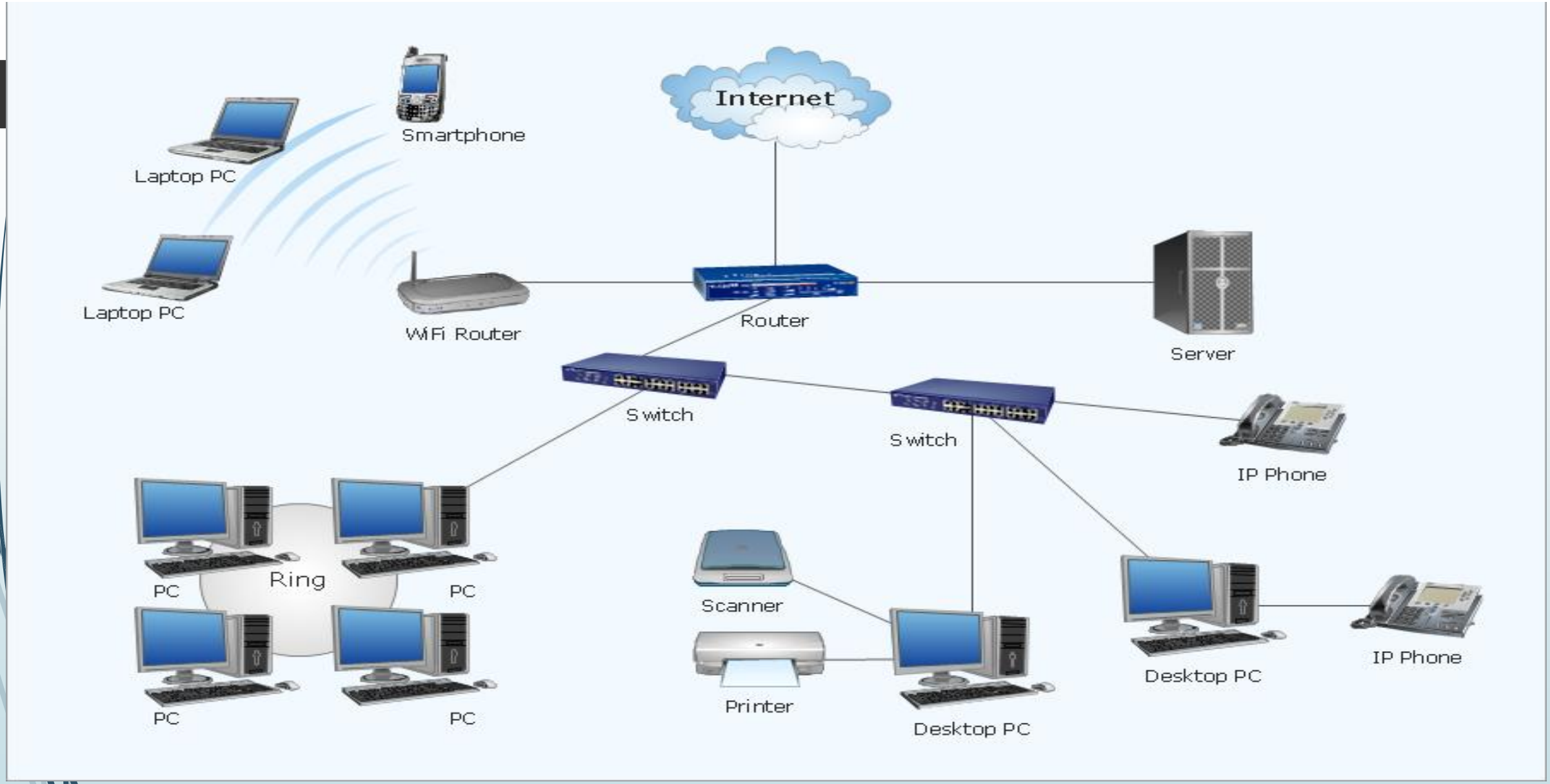


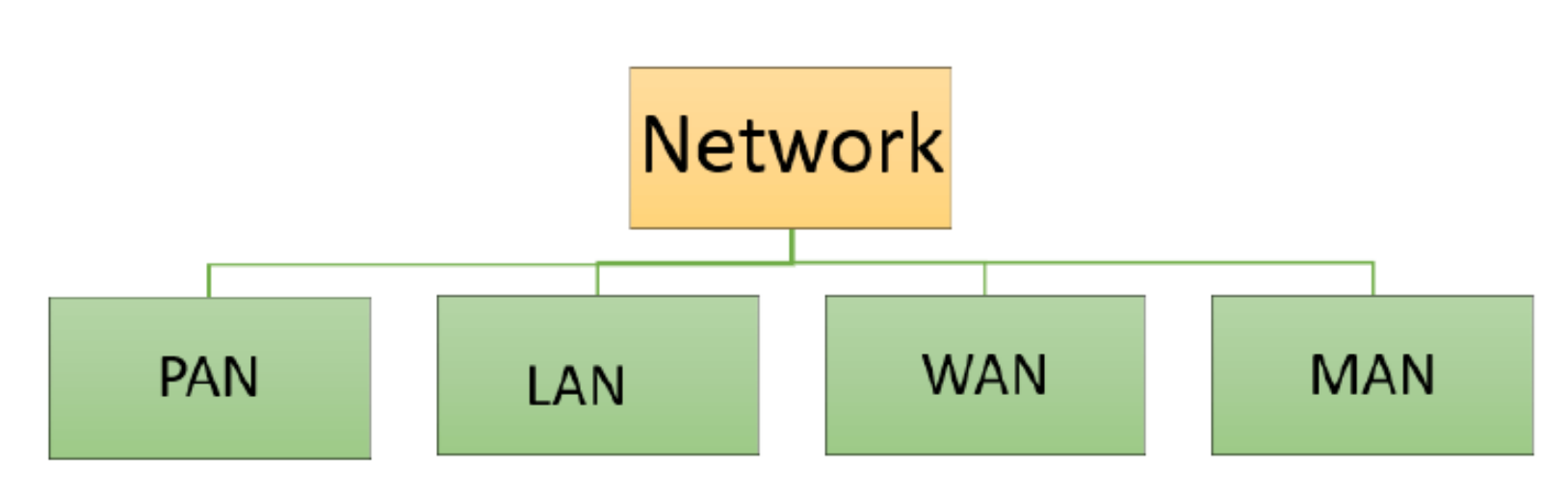
Figure 1 : A computer network

Apart from computers, networks include networking devices like switch, router, modem, etc. Networking devices are used to connect multiple computers in different settings. For communication, data in a network is divided into smaller chunks called packets. These packets are then carried over a network. Devices in a network can be connected either through wired media like cables or wireless media like air.

In a communication network, each device that is a part of a network and that can receive, create, store or send data to different network routes is called a node. In the context of data communication, a node can be a device such as a modem, hub, bridge, switch, router, digital telephone handset, a printer, a computer or a server.

There are various types of computer networks available. We can categorize them according to their size as well as their purpose.

The size of a network should be expressed by the geographic area and number of computers, which are a part of their networks. It includes devices housed in a single room to millions of devices spread across the world.



Some of the most popular network types are:

- PAN
- LAN
- MAN
- WAN

PAN (Personal Area Network)

PAN is a computer network formed around a person. It generally consists of a computer, mobile, or personal digital assistant. PAN can be used for establishing communication among these personal devices for connecting to a digital network and the internet.

features of PAN

- It is mostly personal devices network equipped within a limited area.
- Allows you to handle the interconnection of IT devices at the surrounding of a single user.
- PAN includes mobile devices, tablet, and laptop.
- It can be wirelessly connected to the internet called WPAN.

Advantages of PAN

- PAN networks are relatively secure and safe
- It offers only short-range solution up to ten meters
- Strictly to a small area

Disadvantages of PAN

- It may establish a bad connection to other networks
- Distance limits.

Personal Area Network **(PAN)**

A Local Area Network (LAN) is a group of computer and peripheral devices which are connected in a limited area such as school, laboratory, home, and office building. It is a widely useful network for sharing resources like files, printers, games, and other application. The simplest type of LAN network is to connect computers and a printer in someone's home or office. In general, LAN will be used as one type of transmission medium.

It is a network which consists of less than 5000 interconnected devices across several buildings.

Features of LAN

- It is a private network, so an outside regulatory body never controls it.
- LAN operates at a relatively higher speed compared to other WAN systems

Advantages of LAN

• Computer resources like hard-disks, DVD-ROM, and printers can share local area networks. This significantly reduces the cost of hardware purchases.

• You can use the same software over the network instead of purchasing the licensed software for each client in the network.

• Data of all network users can be stored on a single hard disk of the server computer.

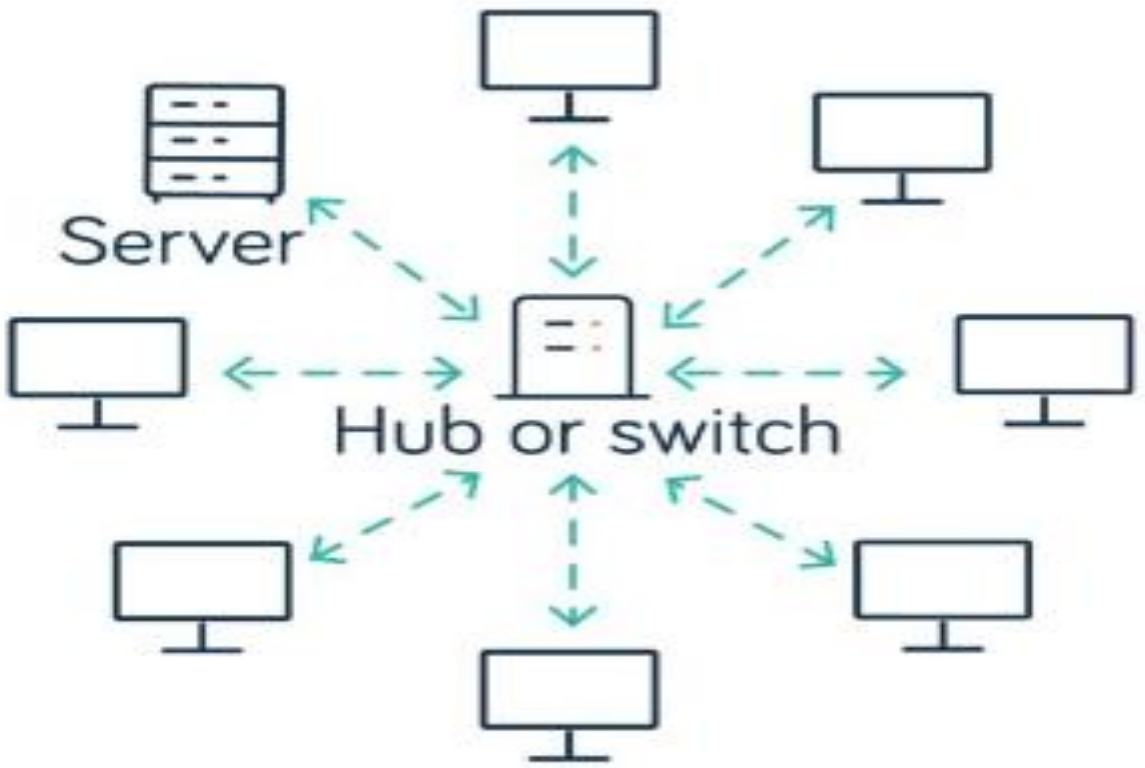
• You can easily transfer data and messages over networked computers.

• It will be easy to manage data at only one place, which makes data more secure.

• Local Area Network offers the facility to share a single internet connection among all the LAN users.

Disadvantages of LAN

- LAN will indeed save cost because of shared computer resources, but the initial cost of installing Local Area Networks is quite high.
- The LAN admin can check personal data files of every LAN user, so it does not offer good privacy.
- Unauthorized users can access critical data of an organization in case LAN admin is not able to secure centralized data repository.



Local area network (LAN)

WAN (Wide Area Network) is another important computer network that which is spread across a large geographical area. WAN network system could be a connection of a LAN which connects with other LAN's using telephone lines and radio waves.

Features of WAN:

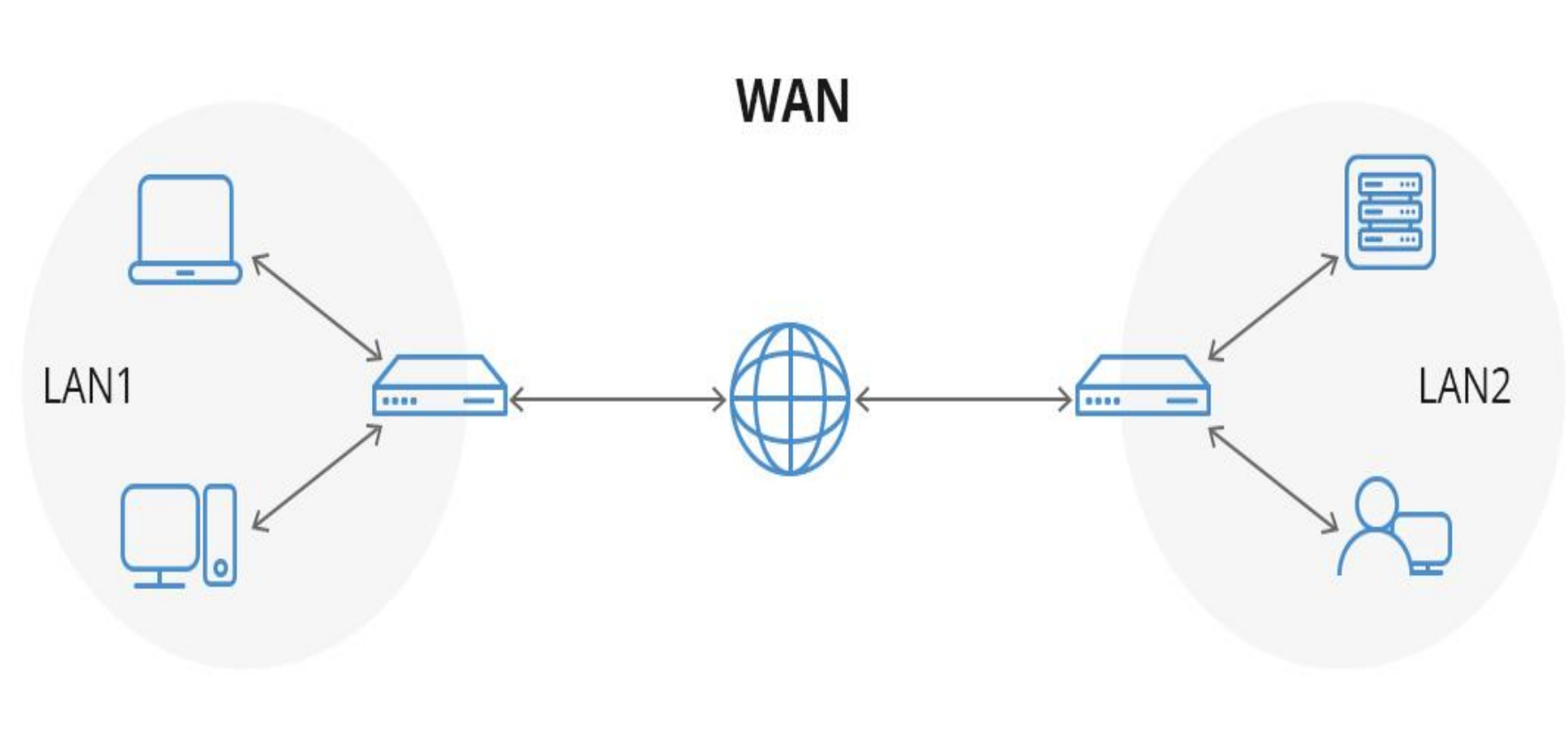
- The software files will be shared among all the users; therefore, all can access to the latest files.
- Any organization can form its global integrated network using WAN.

Advantages of WAN

- WAN helps you to cover a larger geographical area. Therefore business offices situated at longer distances can easily communicate.
- Contains devices like mobile phones, laptop, tablet, computers, gaming consoles, etc.

Disadvantage of WAN

- The initial setup cost of investment is very high.
- It is difficult to maintain the WAN network. You need skilled technicians and network administrators.
- There are more errors and issues because of the wide coverage and the use of different technologies.
- It requires more time to resolve issues because of the involvement of multiple wired and wireless technologies.
- Offers lower security compared to other types of networks.


WAN
LAN1
LAN2

A Metropolitan Area Network or MAN is consisting of a computer network across an entire city, college campus, or a small region. This type of network is large than a LAN, which is mostly limited to a single building or site. Depending upon the type of configuration, this type of network allows you to cover an area from several miles to tens of miles.

Features of MAN

Here are important characteristics of the MAN network:

- It mostly covers towns and cities in a maximum 50 km range
- Mostly used medium is optical fibers, cables

Advantages of MAN

. It offers fast communication using high-speed carriers, like fiber optic cables.
• It provides excellent support for an extensive size network and greater access to WANs.
• A MAN network mostly includes some areas of a city or an entire city.

Disadvantages of MAN

• You need more cable to establish MAN connection from one place to another.
• In MAN network it is tough to make the system secure from hackers

WLAN

WLAN (Wireless Local Area Network) helps you to link single or multiple devices using wireless communication within a limited area like home, school, or office building. It gives users an ability to move around within a local coverage area which may be connected to the network.

What are network devices?

Network devices are any items of hardware connected to the network architecture. Every network should be documented and mapped. Mapping enables managers to understand which devices require protection. Company networks generally rely on several device types:

1. Hub

A hub is a simple connectivity device that connects cables, forming a network segment. It serves as a repeater for long-distance data and retransmits without filtering.

2. Switch

A switch is more advanced than a hub. It intelligently forwards data based on hardware addresses. Switches enhance network efficiency and security by making forwarding decisions using TCP/IP protocol headers. Additionally, multilayer switches can function as both a switch and a router.

3. Router

Routers can filter and forward data using logical addresses like IP addresses. They store network information, act as packet-filtering firewalls.

4. Bridge

A bridge is a networking device that filters and forwards packets based on physical addresses, connecting different network segments. It manages data flow between segments and is beneficial for dividing large networks into smaller sections.

5. Gateway

A gateway, 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.

6. Modem

Modems enable computers to send or receive data over telephone or cable lines. They convert digital signals to analog during transmission and vice versa during reception.

7. Access Point (AP)

An access point connects wireless and Ethernet LANs, creating a wireless LAN. It includes a transmitter, receiver, and built-in antenna.

What is network security

Network security is the process of **protecting networks against potential threats**. It includes software and hardware designed to detect and block malicious agents. Securing networks also extends to access control, network organization, and security policies.

Networking security is closely related to cybersecurity and information security. Cybersecurity guards against digital threats. InfoSec focuses on data protection. Both feed into protecting a single computer connected to the network infrastructure against outside threats.

The main types of network security

There are several networking security policy ingredients. Common approaches include:

Firewalls – firewalls are the foundation of most security setups. They create a barrier between internal traffic flows and the external internet.

Access control – access control tools check all entry requests. Access management gateways ensure only users with the correct credentials can access network assets.

antivirus - An antivirus product is a program designed to detect and remove viruses and other kinds of malicious software from your computer or laptop.