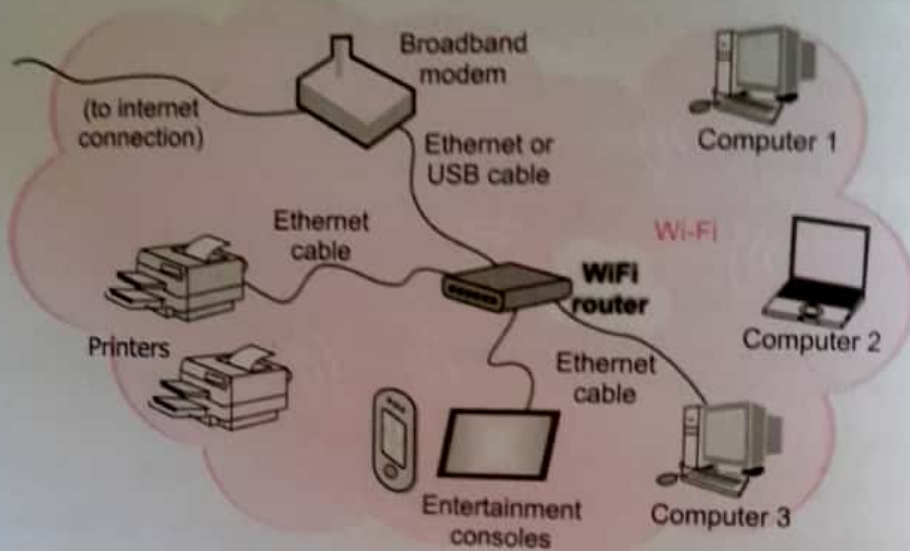


## 10.2 COMPUTER NETWORKS – AN INTRODUCTION

Two or more autonomous<sup>1</sup> computing devices connected to one another in order to exchange information or share resources, form a **computer network**. For example, if in your home, you can connect your *smartphone*, your *laptop* with your *smart TV*, *gaming console* and a *printer* simultaneously either using cables or through WiFi, it will be termed as a **Computer Network**.

Figure 10.1 shows a sample computer network.



### Advantages of Networks

★ **Share resources** : such as printers and scanners. This is cheaper than buying equipment for each computer.



★ **Share storage** – being able to access files from any machines on the network can share data.

★ **Can share software** : Software can be installed centrally rather than on each machine. Metering software can then be used to limit the number of copies being run at any one time. This is much cheaper than buying licenses for every machine.

★ **Improve communications** Messages can be sent - e.g., internal email.

### Disadvantages of Networks

★ The systems are more sophisticated and **complex** to run. This can add to **costs** and you may need specialist staff to run the network.



★ If networks are badly managed, services can become unusable and productivity falls.

★ If software and files are held centrally, it may be impossible to carry out any work if the central server fails. People become reliant on the communications; if these fail, it can cause havoc.

★ File security is more important especially if connected to WANs e.g. protection from viruses.

Figure 10.1 (a) A sample computer network. (b) Advantages and disadvantages of computer networks.

Computer networks are very useful in many ways. They facilitate **resource sharing** (resources such as storage, software etc. on the network can be shared), **enhanced communication** (communicating with devices on a network is easier), **cost reduction** (resource sharing cuts on costs) and so forth. Figure 10.1(b) shows some advantages and disadvantages of computer networks.

### NOTE

Please note that now onwards, we shall use the terms 'computer network' and 'network' interchangeably.

1. It means that no computing device on a network can start, stop or control other device(s).

- (e) **Connective medium** (such as cables, radio-links etc.)
- (f) **Software** (such as protocols, network operating system etc.)
- (g) **Network services** (such as BNS, File-sharing etc.).

Let us talk about these, briefly.

(a) **Host or Nodes.** The term **host** or **node** refers to the computers that are attached to a network and are seeking to share the resources of the network. Of course, if there were no nodes (also called *workstations*), there would be no network at all.

So your PCs, laptops, smartphones etc. when connect to a network become hosts.

(b) **Server.** A **Server** is a very important computer in a network. A **server** is responsible for making the networking tasks happen. In other words, a server facilitates networking tasks like *sharing of data, resource-sharing, communication among hosts* etc.

On small networks, sometimes, all the shareable stuff (like files, data, software etc.) is stored on the server. A network can have more than one server also. Each server has a unique name on the network and all users of network identify the server by its unique name.

On big networks, there can be servers dedicated to specialized tasks *e.g.*, a **file server** only handles files' related requests ; a **printer server** only handles printing requests and so on.

(c) **Clients.** Client is a related term. A client computer is a host computer that requests for some services from a server. In other words, a *server computer* serves the requests of client *computers*.

(d) **Network Hardware.** Other than hosts and wiring, a network requires specialized hardware to carry out various roles, such as establishing connections, controlling network traffic etc. There are many different types of hardware that are required in a network. Some examples of network hardware are :

- ❖ **NIC (Network Interface Card).** It is a network card attached to a host so as to establish network connections. Every NIC card has a unique physical address called the MAC address, which is a 6 byte (48 bits) address assigned by the NIC manufacturer. An NIC is also called **Network Interface Unit (NIU)** or **Terminal Access Point (TAP)**
- ❖ **Hub, switch, router.** These are connectivity devices.
- ❖ **many others.**

### NOTE

A computer becomes a workstation of a network as soon as it is attached to a network.

### SERVER

**Server** A computer that facilitates the sharing of data, software, and hardware resources (*e.g.*, printers, modems etc.) on the network, is termed as a **Server**.



(e) **Communication channel.** Hosts in a network interact with other hosts and servers through a *communication channel or communication medium*. The communication channel can either be wired or wireless :

- **Wired Communication channels.** When hosts and server(s) are connected with another through **guided media** like *network cables*, it is called a **wired communication channel/medium**. Examples of wired communication media are : *twisted-pair cables, coaxial cables, fibre-optic cables.*
- **Wireless Communication channels.** When hosts and server(s) are connected with another through **unguided media** like *radio waves, satellite etc.*, it is called a **wireless communication channel/medium**. Examples of wireless communication media are : *Microwaves, radio waves, satellites, infrared waves, laser etc.*

(f) **Software.** The software layers of a network make networking possible. These comprise of network protocols, network operating system etc.

A **protocol** refers to a pre-decided set of rules using which all parties of a network connect and interact with one another.

A **network operating system** is a specialized operating system that can handle *networking tasks*.

(g) **Network Services.** These refer to the applications that provide different functionalities over a network, such as DNS (Domain Name System), File sharing, VoIP (Voice over IP) and many more.

Armed with this basic knowledge of computer networks, let us further our discussion by talking about types of networks.

## 10.3 TYPES OF NETWORKS

A computer network means a group of 'networked' computers *i.e.*, computers that are linked by means of a communication system. A network can mean a small group of linked computers to a chain of a few hundred computers of different types (*e.g.*, PCs, minis, mainframes etc.) spread around the world. Thus, networks vary in size, complexity and geographical spread.

Let us discuss types of networks based on these parameters.

### 10.3.1 Types of Networks based on Geographical Spread

Based on network span or geographical spread, networks can be divided into *two* basic types

- (i) LAN (Local Area Network)
- (ii) WAN (Wide Area Network)
- (iii) PAN (Personal Area Network)
- (iv) MAN (Metropolitan Area Network)

#### 10.3.1A Local Area Network (LAN)

Small computer networks that are confined to a localised area (*e.g.*, an office, a building or a factory) are known as *Local Area Networks (LANs)*. The key purpose of a LAN is to serve its users in resource sharing. The hardware as well as software resources are shared through LANs. For instance, LAN users can share data, information, programs, printers, hard-disks, modems etc. Fig. 10.1(a) shows a Local Area Network.

In a typical LAN configuration, one computer is designated as the **file server**<sup>2</sup>. It stores all of the software that controls the network, as well as the software that can be shared by the computers attached to the network. Computers connected to the server are called workstations. On most LANs, cables are used to connect the **network interface cards**<sup>3</sup> in each computer.

**NOTE**  
Traditionally, LANs are said to have geographical spread of upto 1 km.

Figure 10.1(a) that you have seen earlier shows a LAN.

### 10.3.1B Wide Area Network (WAN)

The networks spread across countries or on a very big geographical area are known as WANs. A **Wide Area Network (WAN)** is a group of computers that are separated by large distances and tied together. It can even be a group of LANs that are spread across several locations and connected together to look like one big LAN. The WANs link computers to facilitate fast and efficient exchange of information at lesser costs and higher speeds.

Computers connected to a wide-area network are often connected through public networks, such as the telephone system. Sometimes they can be connected through **leased lines**<sup>4</sup> or satellites. The largest WAN in existence is the *Internet*.

Figure 10.2 shows you a LAN and a WAN.

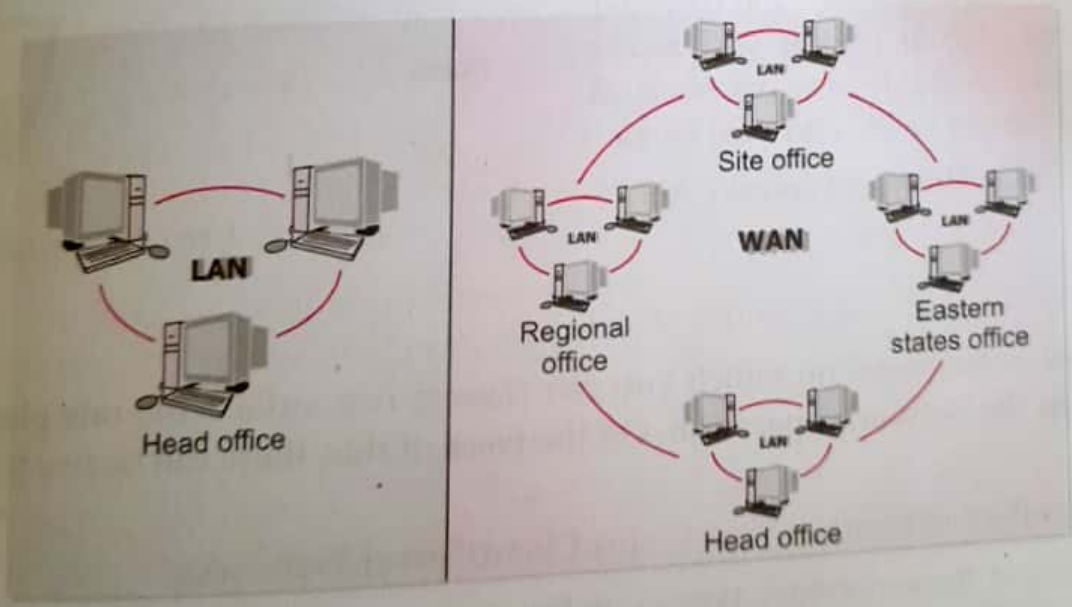


Figure 10.2 LAN vs. WAN.

**NOTE**  
The Internet is a giant WAN. The web is also a WAN. Please note that Web (World Wide Web) is a part of the Internet, not the complete Internet.

There has been traditionally another type of networks – **MAN (Metropolitan Area Network)**, which refers to a network that is spread over an area as big as a city. But these days, this term has become redundant.

server is a computer that just serves the requests of doing some tasks, made by other computers in its network. A **file server** serves the requests related to file sharing, storing etc. A **print server** serves the printer related requests, and so on. connection between the network and the computer workstation. a government-regulated organization that



Following table (10.1) lists some basic differences between LAN and WAN.

Table 10.1 LAN vs. WAN

S.No.	LAN	WAN
1.	It is spread over a small area.	It is spread over a very large area.
2.	It usually costs less to set it up.	It costs higher to set it up.
3.	It is usually a single network.	It is usually a network of many networks.

### 10.3.1C Personal Area Network (PAN)

A personal area network (PAN) is the interconnection of information technology devices within a range of an individual person, typically within a range of 10 meters.

For example, a person traveling with a laptop, a personal digital assistant (PDA), and a portable printer could interconnect them without having to plug anything in, using some form of wireless technology such as *Wifi*. Typically, this kind of personal area network could also be interconnected without wires to the Internet or other networks. You can use PAN networks to transfer files including email and calendar appointments, digital photos and music etc from your portable devices such as phones and tablets to PC and vice versa.

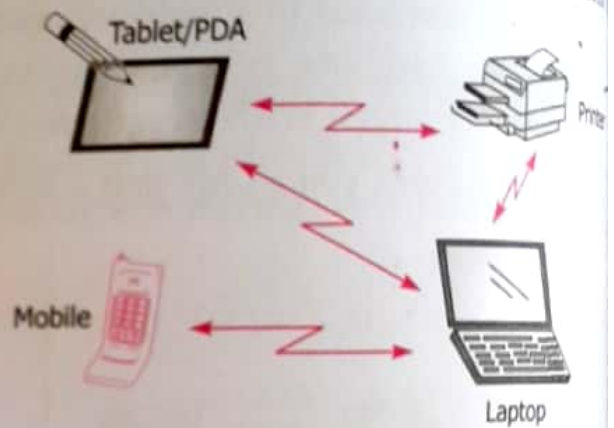


Figure 10.3 A Personal Area Network (PAN)

### 10.3.2 Types of Networks by Component Roles

Another parameter based on which you can classify networks is the **role played by network computers in the network operation**. On the basis of this, there can be two types of computer networks :

- (i) Peer-to-Peer networks
- (ii) Client/Server Networks.

Let us talk about these network types one by one.

#### 10.3.2A Peer-to-Peer (P2P) Networks

**Peer** refers to someone with equal standing, *e.g.*, look at these example sentences :

*The staff is trained by peers.*

*Peer group of children is really important.*

The peer-to-peer network literally implements the meaning of the word 'peer', *i.e.*, each computer on a peer-to-peer network is equal. That is, each computer can play the role of a client or a server. In other words, there is no computer designated as in charge of network operation. Each computer controls its own information and plays role of either a client or a server depending upon what is needed at that point.