

Networking Concepts

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Friends, you must have seen many people use mobile phones. Mobile phones use wireless network for connectivity. Networks help us to connect with each other via computers, phones, and so on. There are different types of networks, such as social, professional, and electronic networks. In this chapter, you will learn about different types of computer networks.

Let's Learn About

- ◆ Computer Network
- ◆ Advantages of Networking
- ◆ Types of Network: PAN, LAN, MAN, and WAN
- ◆ Network Components
- ◆ Network Architecture
- ◆ Network Topology
- ◆ Network Security

COMPUTER NETWORK

When a number of computers are connected in order to communicate or share information, they form a network, which is called **computer network**.

Internet is an example of a computer network. The purpose of computer networking is to build communication between computers. This communication includes exchange of data and information with the help of software applications installed in computer systems.

A computer network can be formed between two or more computers linked together in a room or a building, a town, a city, and across the globe. A computer network can also include peripheral devices, such as printer, scanner, and so on.

The computers within a network that originate, route, and terminate the data are called **Nodes**. A **host** is a computer that is accessible over a network. Hosts, such as personal computers, mobile phones, servers, and networking hardware are included as nodes. The nodes are wired or wireless media interconnected through networking hardware. Every network has a control centre, which allows the different nodes to communicate.

A network can be of two types:

Intranet: It refers to a network that is private to an organization.

Internet: This network is open to all. Anyone can connect to it.



ADVANTAGES OF NETWORKING

There are many advantages of computer networking. Some of them are:

- ▶ **Cost Effective:** Besides software, hardware devices like printer, scanner, and modem can be shared by all the computers on a network. Thus, it saves a good amount of money by eliminating the need of buying additional hardware and software.
- ▶ **Backup:** Suppose a computer in a network faces some technical issue or hardware failure. In this case, the work can be allocated to another computer in the same network. Networking helps to keep the data and information preserved by backups on a central location.
- ▶ **Communication Tool:** It is a convenient mode of communication for any organization which has branches at different locations.
- ▶ **Easy Access to Remote Database:** One can instantly book railway or airline tickets from anywhere. Hence, it saves time and effort.
- ▶ **Accelerates Efficiency:** It allows the upgradation of software and data from a single point, thus the efficiency of a working system enhances to a great extent.
- ▶ **Reduces the Need of Hard Copies:** There are times when a copy of a document is to be circulated among many members in an organization. In such a scenario, a soft copy of the document can be shared among the members over the network.
- ▶ **Real-Time Delivery:** One can instantly share data and information across the globe.

Info Box >>>>



Intranet that is partially accessible to outside users are usually the trusted partners of any organization which have access to relevant information.



TYPES OF NETWORKS

The computer networks are classified into various categories based on the coverage of geographical areas. They are:

Personal Area Network (PAN)

A **PAN** allows communication among devices that are in the proximity of an individual. These devices include a personal computer, mobile phone, digital camera, tablet, and so on. This kind of a network has a range of few meters. It is widely used to transfer small files between devices. PAN can be easily set up between two devices. It is built using USB cable (wired media) or bluetooth (wireless media).

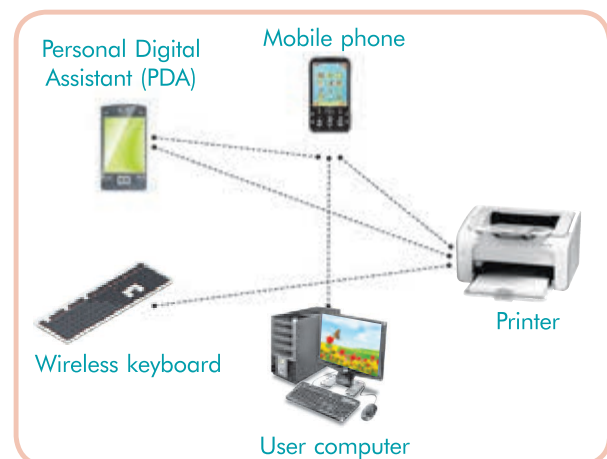


Fig. 1.1 Personal Area Network

Local Area Network (LAN)

It is a network of computing devices, such as computers, smartphones, and peripheral devices (printer or scanner) within a room, a building or a small campus. **LAN** has a range of few kilometres, and usually links the devices in that area. LAN is owned and controlled by a single person or an organization. Therefore, it is private in nature. An office building or an institutional compound are usually connected to a single LAN. In this type of network, computer terminals are physically connected with wires.



Fig. 1.2 Local Area Network

Metropolitan Area Network (MAN)

As the name suggests, it is a kind of network which connects computing devices, which are geographically located at separate areas, but within the same city. **MAN** can cover a range of few hundred kilometers in radius. MAN allows a high-speed network sharing of resources for a group of institutions, organizations, branches of banks that function within a same city, and so on.

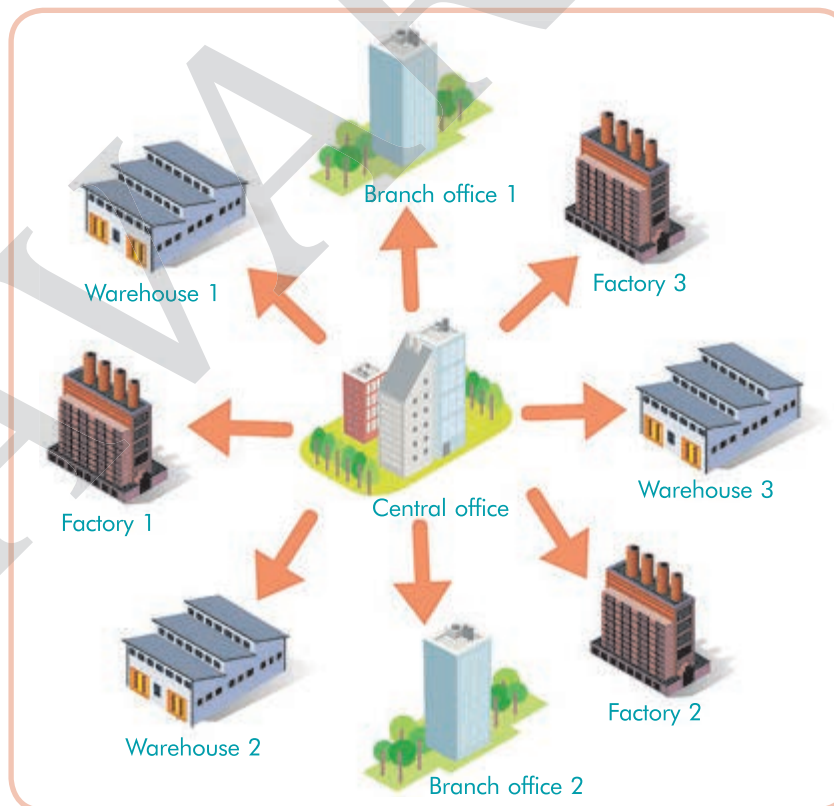


Fig. 1.3 Metropolitan Area Network

Wide Area Network (WAN)

WAN can cover a large geographical area, such as a country, a continent, or even the whole world. It connects multiple computing devices located at distant locations (multinational organizations, branches of government offices spread across a country, national and international network of banks and ATMs). In this network, nodes are linked through telecommunication or satellite signals.

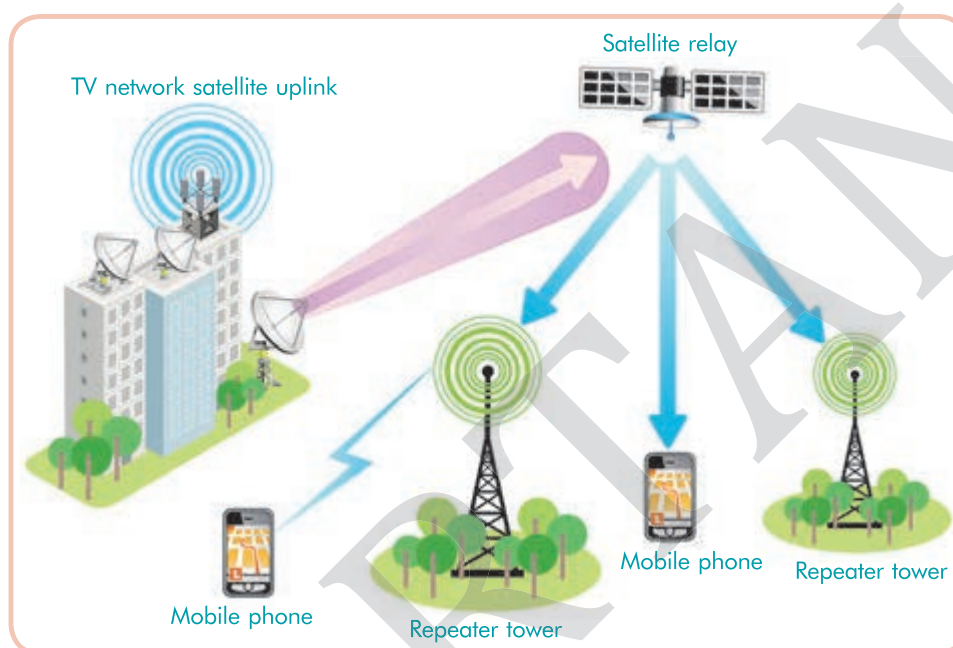


Fig. 1.4 Wide Area Network

NETWORK COMPONENTS

Network components include hardware, like computer, peripheral devices, interface cards, and other equipments that are required for communication and data sharing. To create a computer network, some hardware components are required, which are:

Network Interface Card (NIC)

This card provides the interconnection between network and computers (or nodes). Most computer motherboards usually have a built-in Network Interface Card.

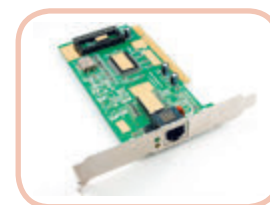


Fig. 1.5 Network Interface Card

Network Cable

Registered Jack 45 (RJ45) is an eight-wire network cable. It is a connector which is commonly used to link the Network Interface Card (NIC) with a hub.



Fig. 1.6 Network cable

Hub

It is a network device which connects several devices to exchange data between them. Each hub has some ports which determine the number of devices to be connected to it. For example: 6, 8, 12, 24, and so on. A hub can also be linked to the NIC through an RJ45 cable. The information is received only by the intended computer(s) and automatically rejected by the other computers over the network.



Fig. 1.7 Hub

Switch

The function of a switch is similar, but intelligent as compared to that of a hub. It not only checks data packets as they arrive, but also determines the source and destination of each packet, before sharing them. Switches are preferred over hubs due to their efficiency. In addition, a switch prevents data collision and reduces network congestion, thereby increasing the network performance.

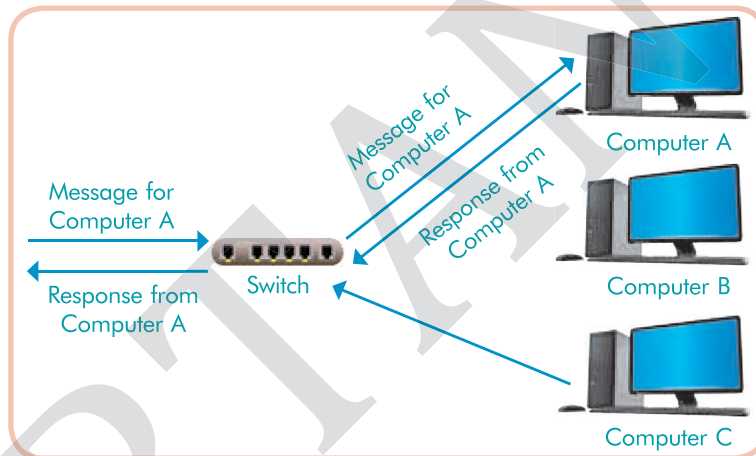


Fig. 1.8 Message for and response from Computer A

Let's Review >>>>

Answer in one word.

1. Name a networking cable.
2. Which is the most popular wireless networking technology?
3. What are the devices over a network called?
4. It is a eight-wire network cable.
5. It can be easily set up between two devices.

NETWORK ARCHITECTURE

Network architecture refers to the overall framework of an organization's computer network. To establish network communication a detailed view of all the accessible resources in it is required. Network architecture includes the following:

- ▶ Hardware components used for communication
- ▶ Wired or wireless connection

- ▶ Topology
- ▶ Protocols

Network architecture are of two types. They are as follows:

Peer-to-Peer

This type of network architecture is suitable for a small environment, usually up to 10 computers. Each computer connected over the network has equal capability. These computers must have specific rights to use or share the available resources.

In Peer-to-Peer network, there is no dedicated network administrator or central server. That means all the computers can act as a server or as a client as well. This network is easy to set up and inexpensive.

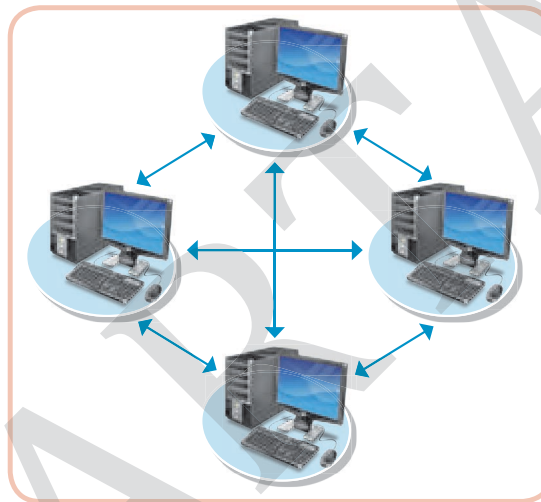


Fig. 1.9 Peer-to-Peer model

Client-Server

There is no limit to the number of computers that can be added in this network. Here, all the computers are called **clients**. These computers are linked to the main computer which is called the **server**. A server in a network is a computer that controls all the connected computers, shared devices, and other resources. It holds responsibility for rendering services to the clients, whereas a client is a computer or workstation that requests services, like data storage and retrieval from the server.

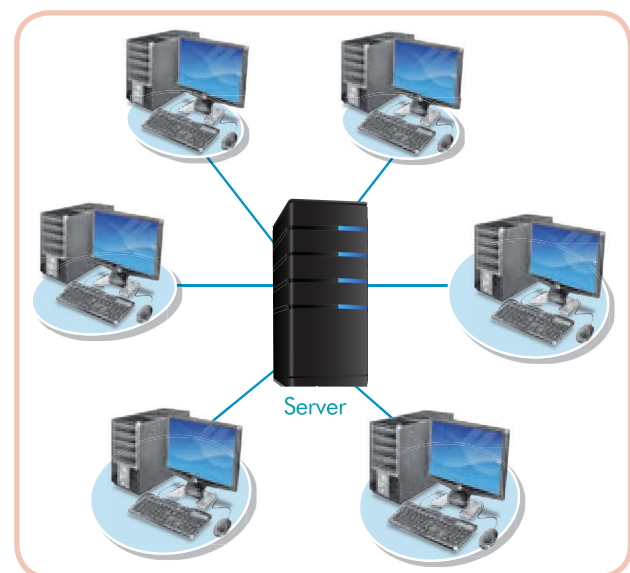


Fig. 1.10 Client-server model

NETWORK TOPOLOGY

It is necessary that the computers that are to be connected must have access to the same network for sharing resources. Let us learn how a network is created. To understand this, first you need to know about its topology.

Network topology refers to the schematic description of the different nodes in a network. It determines how data flows within a network, irrespective of its physical structure. The most commonly known network topologies are:

Point-to-Point (PTP) Topology

It is the simplest and the most conventional model of topology. In this topology, two nodes are directly linked to each other. For example, a computer system is directly connected to a printer. In this network, a dedicated link is formed between two devices, i.e. a sender and a receiver. It is faster and more reliable, for there is a direct connection between the devices. This network can only be used for small areas.



Fig. 1.11 Point-to-Point topology

Bus Topology

In this type of topology, all the devices are connected to a linear cable called bus or trunk. The bus acts as a backbone of this network. This topology is the simplest way to connect multiple users. It uses ethernet for the connections. This network is easy and inexpensive to implement for small networks. In bus topology, one of the computers in the network typically acts as a server. The advantage of this network is that if one computer system breaks down, it does not affect the other systems over the network.

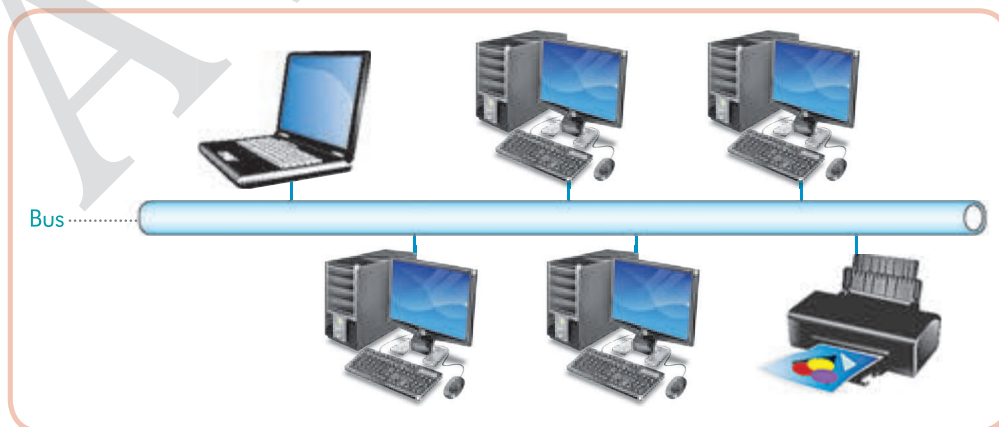


Fig. 1.12 Bus topology

Star Topology

In this network, all the devices are connected to a central device called hub or switch. Each device is linked to the central hub through a separate cable, thus requiring more cables. But the benefit of using separate cables is that if there is a cable failure it would affect only the functioning of a single system on the network. Unlike the Bus and Ring topology, no disruption is caused at the time of addition or removal of a system from the network. Here, all the information or data first goes to the central device, i.e. a hub or a switch, and then to the respective systems. Therefore, a hub controls the network communication.

The threat of a single point failure increases because all the data passes through the hub. It means that if the hub or central device fails, then all the systems connected to it will be disconnected.

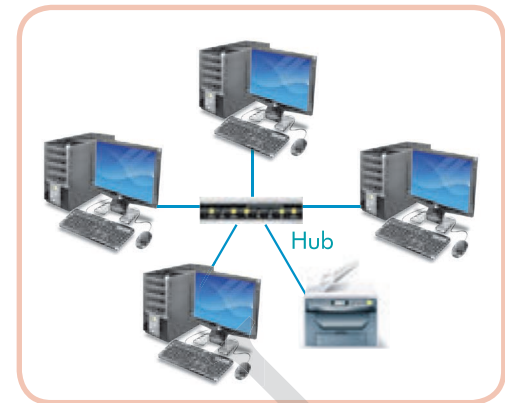


Fig. 1.13 Star topology

Ring Topology

In this topology, all the computers and peripherals are connected to one another in the form of a ring. In this network, data travels in a circular fashion. Ring shaped networks offer high bandwidth and can span large distances. This topology is losing its popularity because it offers only unidirectional data flow. Like Bus topology, in Ring topology too, addition and removal of systems could cause network disruption. Moreover, a single break in the connection could disrupt the entire network.



Fig. 1.14 Ring topology

Tree Topology

A Tree topology connects a Star network to another Star network. Thus, Tree topology is formed when a group of Star networks is connected to a bus. Therefore, this topology is also called **Star-Bus topology**. In this topology, if the main cable that connects two Star topology networks fails, then those two networks would not be able to communicate with each other. However, the systems on individual Star topology would still be able to communicate internally.

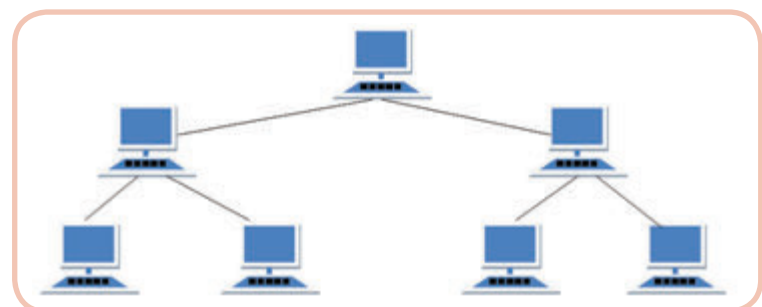


Fig. 1.15 Tree topology

Mesh Topology

In this topology, each node has point-to-point link between each other. A single computer does not act as a server. In this network, every node not only sends its own signals but also relays data from other nodes. This network is also known as **Meshnet**. It provides data security and privacy, since data is transmitted through dedicated channels. It can manage high data traffic.

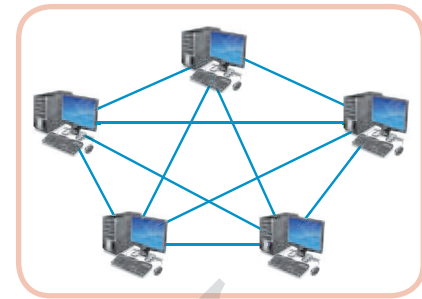


Fig. 1.16 Mesh topology



NETWORK SECURITY

When a computer is connected to a network, there are chances that data may face risks such as misuse of information, unauthorized access, and so on. Therefore, it is advisable to protect your data and secure the network.

The purpose of network security is to secure information of an organization and also protect the computers on a network from any attack.

There are various methods to keep your network secure, which are as follows:

- ▶ **Access Control:** It is used to block unauthorized users.
- ▶ **Application Security:** Always protect the applications stored in a computer system.
- ▶ **Data Loss Prevention:** Any member of an organization may send or upload sensitive information outside the network. This can be stopped by **Data Loss Prevention** technologies.
- ▶ **Firewall:** Firewall is a security system that protects a computer from an unauthorized access over a network. A firewall can be implemented using hardware or software, or a combination of both. Firewall follows a set of rules that determines what data can enter and leave a network.

Info Box >>>>

Microsoft has more servers (over one million) than **Google** (900,000).



Flashback



- ▶ A computer network is formed when a number of computers are connected in order to communicate or share information.
- ▶ Intranet is a network that is private to an organization.
- ▶ Internet is a network that is open to all. Anyone can connect to it.
- ▶ The computer networks are classified into various categories, such as LAN, PAN, MAN, and WAN.
- ▶ Network Interface Card provides the interconnection between network and computers. This card lets the computer communicate over the network.

- ▶ Hub is a network device which connects several devices and makes them eligible to send and receive data between each other.
- ▶ Network architecture refers to the overall framework of an organization's computer network.
- ▶ A server in a network is a computer that has centralized control over all the connected computers, shared devices and other resources.
- ▶ Topology is the schematic description of different nodes in a network.
- ▶ Network security refers to securing the information of an organization and also protecting the computers on a network from any attack.



Exercises

A. Tick (✓) the correct answers.

1. It is not an advantage of networking.
 - a. Cost effective
 - b. Real-time delivery
 - c. Very expensive
2. Which of the following computer networks is built using USB cable?
 - a. PAN
 - b. WAN
 - c. MAN
3. It is an eight-wire networking cable.
 - a. Hub
 - b. RJ45
 - c. Switch
4. This network topology is formed with a group of star networks.
 - a. Tree topology
 - b. Star topology
 - c. Ring topology
5. It is a network security system.
 - a. Star Topology
 - b. Wireless
 - c. Firewall

B. Fill in the blanks.

1. Devices connected on a network are called _____
2. Most computer motherboards usually have built-in _____
3. _____ spans from several blocks of buildings to the entire city.
4. In _____ topology, each device is linked to the central hub through a separate cable.
5. _____ and _____ are the different types of network topology.

C. Write T for True and F for False.

1. Bluetooth is used to form a wireless Personal Area Network. _____
2. Networking is a very expensive communication tool. _____

3. Each hub has ports which determine the number of devices connected to it. _____
4. A computer system directly connected to a printer is an example of Point-to-Point topology. _____
5. Mesh topology is quite poor at managing high data traffic. _____

D. Answer the following questions.

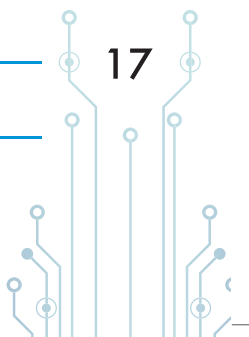
1. What do you understand by computer networking? Name the types of computer networks.

2. Differentiate between Personal Area Network and Metropolitan Area Network.

3. Describe the client-server architecture.

4. Define the term topology.

5. Explain the various measures to keep network secure.





Ava's Activity Zone

A. Expand the following:

1. LAN: _____
2. NIC: _____
3. WAN: _____
4. PTP: _____
5. MAN: _____

B. Collect and paste the pictures of various networking components in the space provided below. Write the name of each component next to it.

Empty space for pasting pictures and writing names of networking components.



Group Discussion

Divide the class into three groups, each group will discuss the following topics:

- ▶ Computer Networking has revolutionized the communication technology.
- ▶ A Switch is smarter than a Hub.
- ▶ Topology is the blueprint of computer networking.



Teacher's Notes

- ▶ Discuss the concept of networking with the help of real-life examples.
- ▶ Describe the difference between wired and wireless networking technologies.
- ▶ Tell the students why different types of networks are needed.