UNIT 1: INTRODUCTION AND NETWORKING BASICS

Unit Structure

1.0 Learning Objectives

After learning this unit, you will be able to understand:

- About computer network
- About Internet
- About Topologies
- About connecting media

1.1 Introduction

Networking involves association among two or more computers. The two computers will be connected across the world with the help of web and networking. There are two forms of modem one is with wires that's connected inside the computer system and other is wireless, that are more comfortable and accessible today. There are certain optical storage devices like CD and DVDs where information will be stored from 10 MB to 4.6 GB.

1.2 Advantages of computer networking

Basically, Networking is a connection between two or more computers. The main purpose of a network is to share the information among different users. Figure 1.1 shows the networking of two computers:

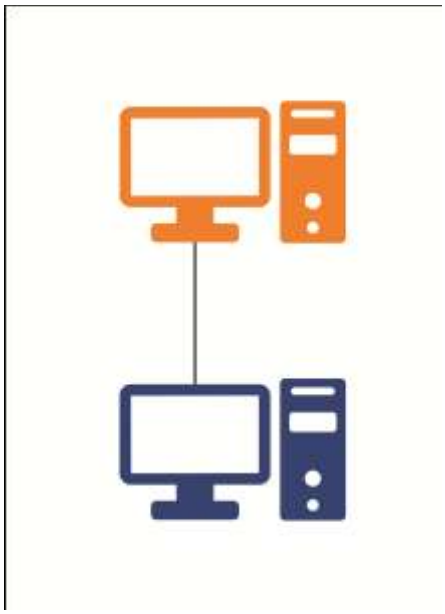

Fig 1.1 Computer in network

Computer network consist of the following:

- Two or multiple computers that can be a Server or a Client.
- A Network Interface Card (NIC).
- Connection medium that can either have wires or no wires.
- Network Operating system like MS Windows, NT or MS 2000, Novell NetWare, UNIX and Linux.

Internet is a setup of computers across the globe. Every computer that is connected to the internet is considered as a part of that network. Fig 1.2 shows the arrangement of computers in a network.

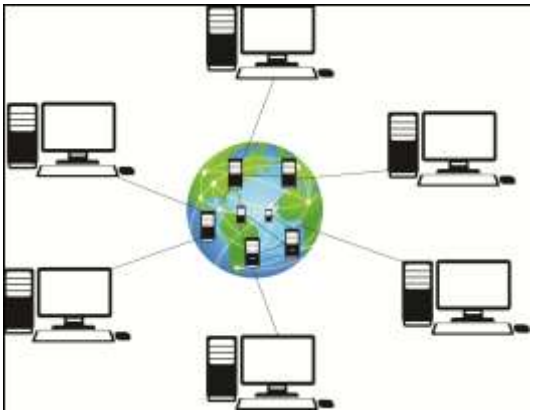

Fig 1.2 Computers connected by Internet

In order to share the information among people quickly and easily, we use the Internet. Internet is a collection of computers where many computers grouped together to share their information. In this case the information can be sent by the Sender and the Receiver receives that information. In this chapter we will study about Internet and it's working.

Advantages of Computer Network

- Resource sharing
- Remote login (Access to remote data base)
- E-Mailing (person-to person communication)
- Entertainment
- Internet services
- Video conferencing
- Exchange of messages
- Sharing information at Low Cost
- Storing Files in server allows data to be shared easily
- Fast and Quick backing up of Files
- Software and resources can be easily managed.
- Network software have fast installation

- Devices can be shared easily
- Accessing files from any workstation

Check your progress 1

1. What are the advantages of computer networks?
   a. Resource sharing
   b. Internet services
   c. File storage
   d. All of these

1.3 Computer networks and the Internet

On internet you'll be able to do chatting and exchange of information with many services offered by it. As internet is collection of computers where several computers grouped together share their data, the results of such sharing will led to spread of virus on host computer, that the user download any infectious attachment send by someone.

Network is usually the connection between the Sender and also the Receiver

The figure 1.3 shows two people sitting in a network.

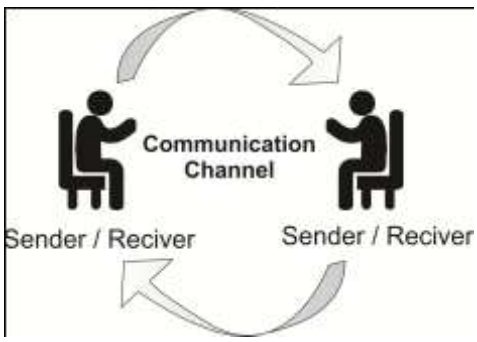

Fig 1.3 Networks

The general network comprises of:

- Sender
- Communication Channel Medium
- Receiver

A computer network is an interconnection of two or more computer systems located at the same or different places. It is a network that can connect two computers as shown in fig 1.4.

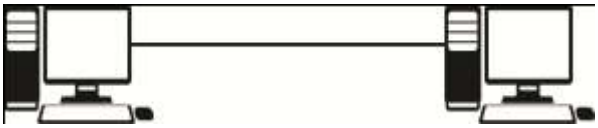

Fig 1.4 Computers in network

A computer network is a collection of two or more connected computers. When these computers are joined in a network, people can share files and also share the peripheral devices such as modems, printers, tape backup drives, or CD-ROM drives as shown in figure 1.5.

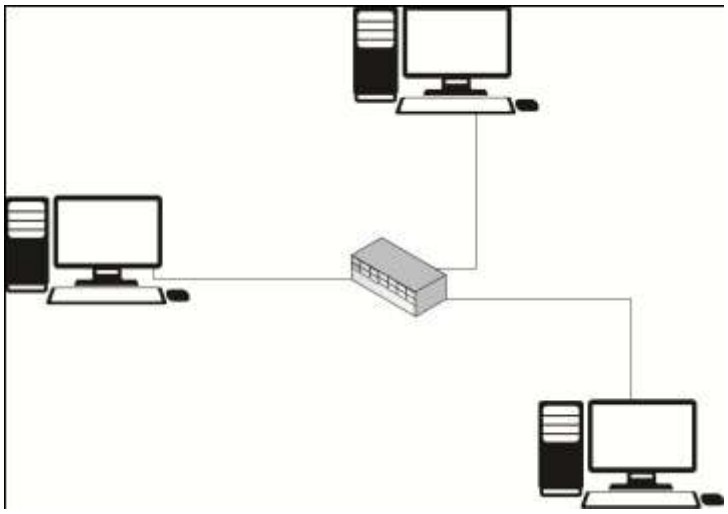

Fig 1.5 Network of computers

Computer network consist of:

- Two or more computers Server or Client workstation.
- Networking Interface Card's (NIC)
- A connection medium i.e. wires or wireless.
- Network Operating system software, such as Microsoft Windows NT or 2000, Novell NetWare, UNIX and Linux.

Check your progress 2

1. Internet is:

a. Network of Computers

b. Connecting Single Computer in network

c. Connecting different Computers in network

b. All of these

1.4 WAN, LAN and PAN

Networking is a connection between two or more computers. The purpose of network is to share the information among different users. If more than two computers are to be connected in a network, this requires a HUB or a PORT as shown in fig 1.6.

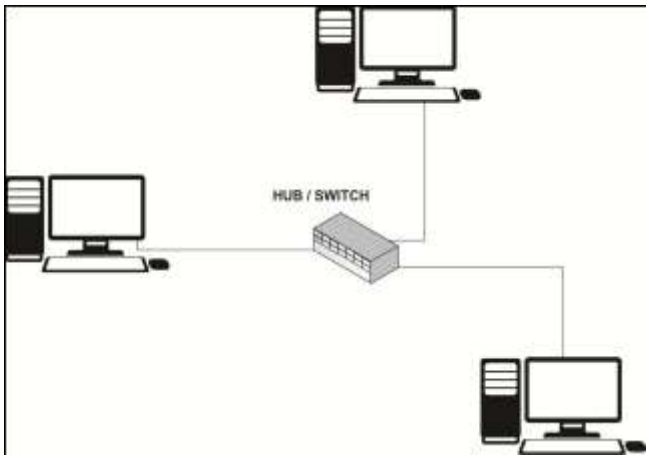

Fig 1.6 Network with HUB

Some of the common networks are:

LAN - Local Area Network

WLAN - Wireless Local Area Network

WAN - Wide Area Network

MAN - Metropolitan Area Network

SAN - Storage Area Network, System Area Network, Server Area Network, or sometimes Small Area Network

CAN - Campus Area Network, Controller Area Network, or sometimes Cluster Area Network

PAN - Personal Area Network

DAN - Desk Area Network

LAN and WAN are the original categories of area networks. The other networks have actually emerged over many years out of technology evolution.

LAN

It is a typical network which is named as local area network or LAN. This network consists of group of computers along with its connecting devices that has a common communications channel. In this there will be only one main computer with which the rest of the computers are connected and they also shared a common processor speed as shown in fig 1.7.

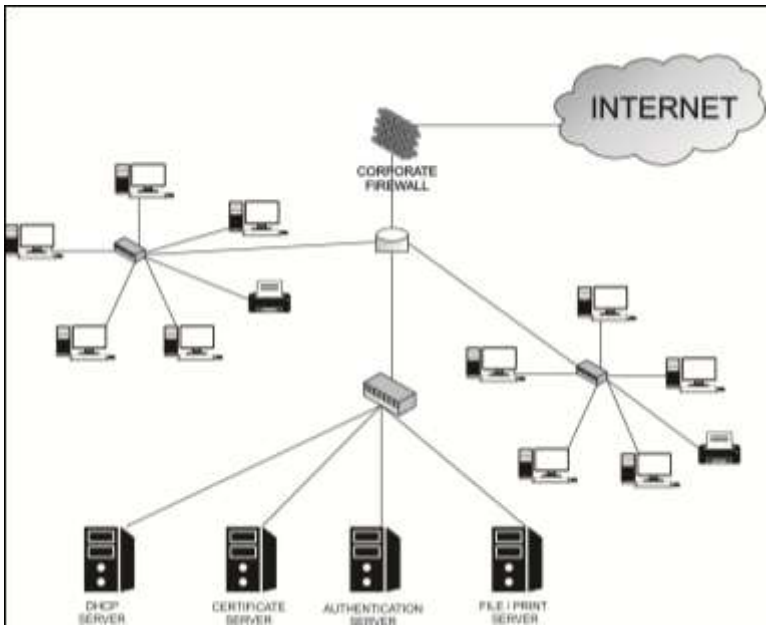

Fig 1.7 LAN Network

It is normally installed and available in an office building, school and university. In LAN Network, the server contains an applications and data storage that are commonly shared by many computer users. Such network serves as few as two or three users up to many thousands of users. A LAN server may also be used as a web server provided it is safely handled and precautions are carried to safe its internal applications and data from outside access.

WAN

WAN is a network that connects users across larger distance. It is mainly used to connect across cities, states, or countries. The figure 1.8 shows the arrangement of WAN across the globe.

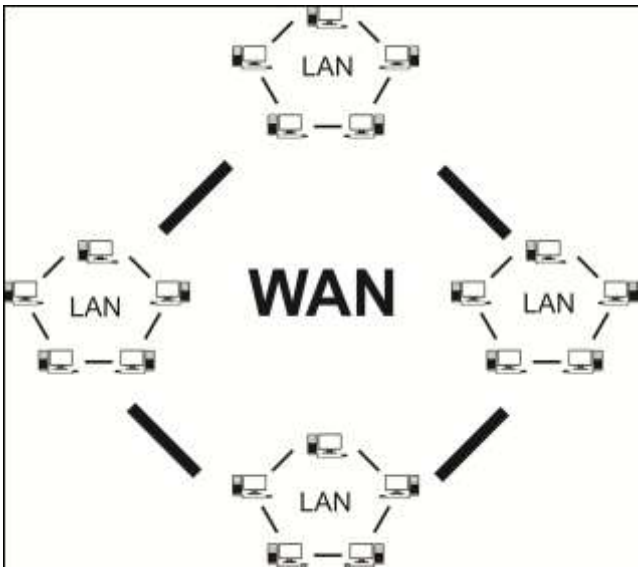

Fig 1.8 Computer in WAN

WANs normally uses public telephone network & satellite links for data transmission. Data transmission rates are below 1 Mbps for WAN. It is normally owned by multiple organizations. The transmission time is more for WAN because of longer distances & different transmission medium used.

Different Types of Area Networks:

Apart from LAN and WAN, there are many other computer networks such as:

MAN or Metropolitan Area Network: It is a network that uses much larger area as compared to LAN but smaller than WAN. It is a computer network that is owned and operated by an individual.

CAN or Campus Area Network: It is a network which spreads in area which covers multiple LANs and covers lesser area as compared to MAN.

SAN or Storage Area Network: It is a network that uses fibre optics channel for communication and connects servers to data storage devices through such technology.

SAN or System Area Network: It is another type of network that links with high performance computers having high speed connections in a zigzag configuration. It is also known as Cluster Area Network.

Check your progress 3

1. Which network is used to connect people globally?

   a. Local Area Network

   b. Wide Area Network.

   c. Metropolitan Area Network.

   d. None of above.

1.5 Topologies

Another way to classify computer networks is based on the underlying topology used for constructing the networks. Topology is defined as the geometrical arrangement of nodes. Nodes are the various computer resources and communication devices.

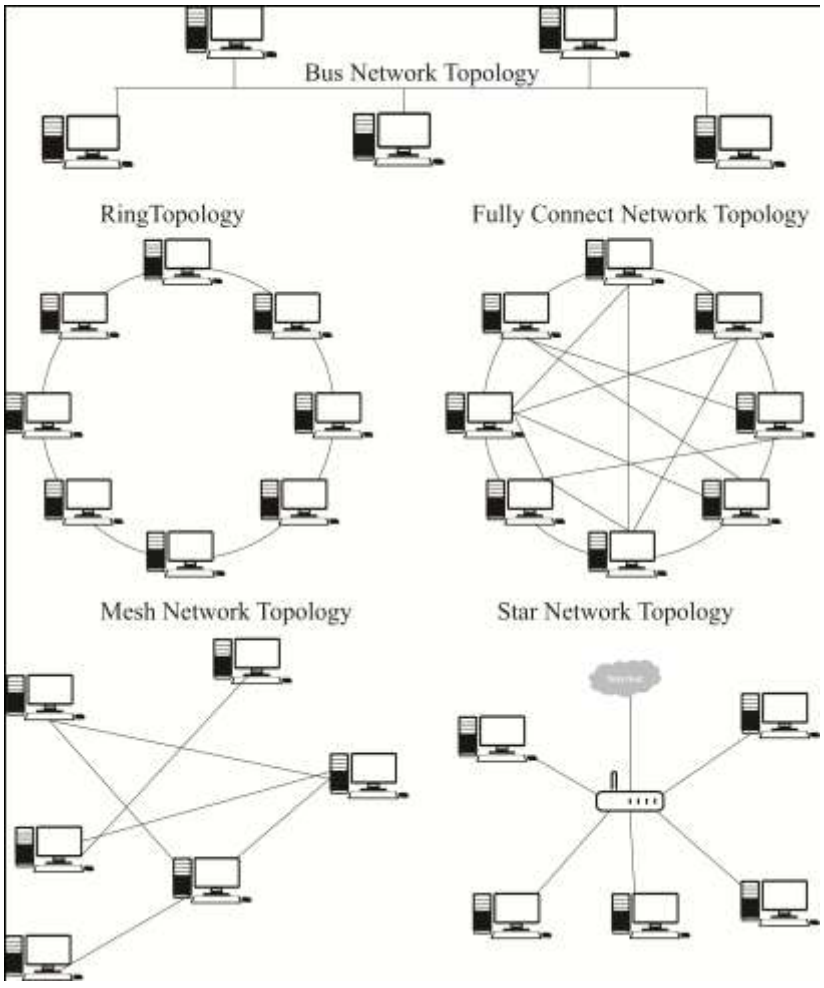

Fig 1.9 Network Topology

Different Types of Topologies

Following are the different classes of network based on the topological structure.

- Bus Network
- Star Network
- Ring Network
- Mesh Network
- Tree Network

Bus Network: in a bus network, all nodes are connected to one line known as bus. it is conjointly referred as a time-shared bus. The bus permits just one pair of nodes to establish communication at a time. This property restricts the total number of nodes connected to form a reliable bus network. However, several protocols were developed for a bus to form communication more efficient and reliable. CSMA/CD and Token bus protocols ar sensible examples. The structure of a bus network is shown in Figure 1.10.

Advantage of a bus network is its ability to connect any number of nodes without extensive hardware. Nodes can also be removed from the bus simply. It's straightforward to maintain the bus network.

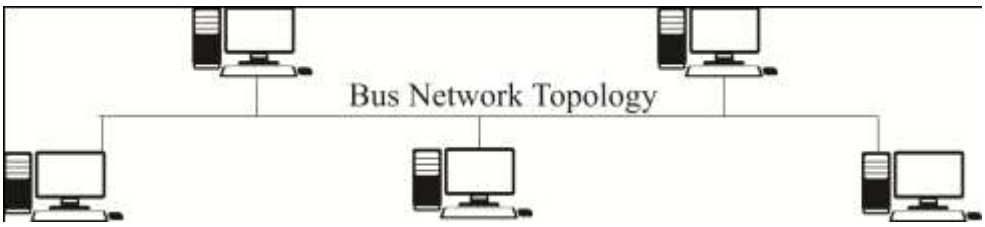

Fig. 1.10 Bus network

Star Network: In a star network, each node is connected by means of a dedicated point-to-point(P2P) channel to a central node called server that will act as a switch. The central server will provide the connectivity for all pair of nodes willing to communicate with each other. But, if the central server fails, the whole network will also fail. The transmission media may be a twisted pair, coaxial cable or optical fibre. Structure of a star network is shown in Figure 1.11.

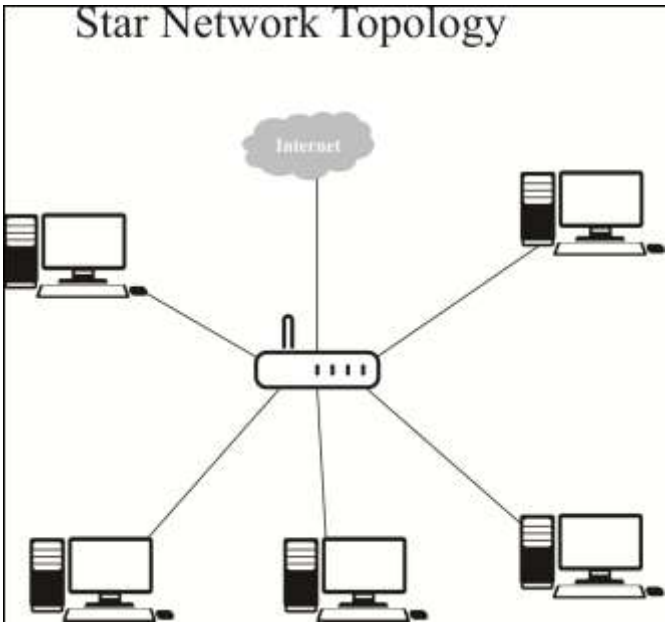

Fig. 1.11 Star network

Some of the advantages of star network are:

- Easy implementation
- Centralized control
- Simple access protocols

The main disadvantage of star network is that they suffer from the problem of central node failure. They also require long cable length; each new device requires an exclusive cable. Campus PBXs are often implemented using star network topology.

Ring Network: Nodes in a ring network are connected in the type of a closed loop. One communication channel is commonly implemented to provide the connectivity. Data from the sending node circulates round the ring till it reaches the destination. a ring will be unidirectional or bi-directional. In a unidirectional ring, data moves in one direction solely. In a bi-directional ring, data can move in both directions, but moves in one direction at a time. Single node failure may paralyse the transmission of information to a set of nodes in a unidirectional ring. but messages will be sent to nodes in either side of the affected node. .

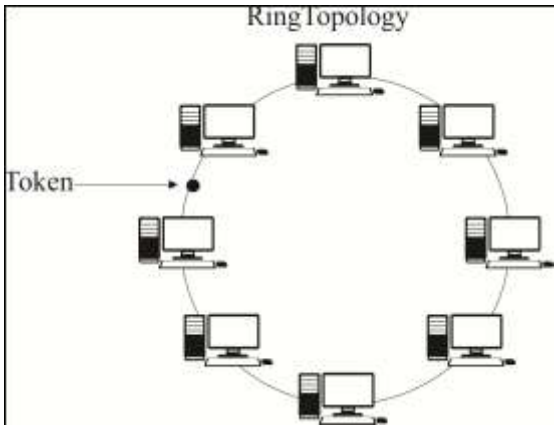

Fig. 1.12 Ring network

Ring network with a method called token passing (Token Ring) was proposed by IBM and approved by IEEE as one of the standards for LAN. Advantages of a ring network are its short cable length, suitability for optical fibre implementation and its flexibility to include new nodes which is also called as Network expansion. Disadvantages of ring networks include the failure of entire network in the presence of a single node failure, difficulty in diagnosing faults and its non-adaptability to structural changes.

Mesh Network: In a mesh network, each pair of nodes is connected by means of an exclusive point-to-point link. Each node requires a separate interface to connect with the other device. Mesh networks are seldom constructed in practice. They are useful in situations, where one node or station needs to frequently send messages to all other nodes. Otherwise, a considerable amount of network bandwidth got wasted. The advantages of mesh network are excessive amount of bandwidth and inherent fault-tolerance. The structure of a mesh network is shown in Figure 1.13.

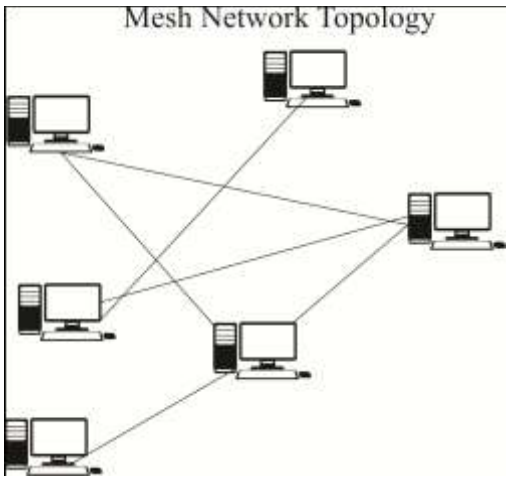

Fig. 1.13 Mesh network

Tree Network: A tree network is another form of bus network. Several nodes are connected into a hierarchical form as shown in diagram

The root node may be a powerful server or a mainframe computer often called a head-end. Tree networks are suitable for organizations, where head offices need to communicate with regional offices and regional offices needs to communicate with remote offices. Advantages of a tree network are its ease of expansion, identification and isolation of faulty nodes whereas its disadvantage is that, it also suffers from the problem of the network being highly dependent on the root node.

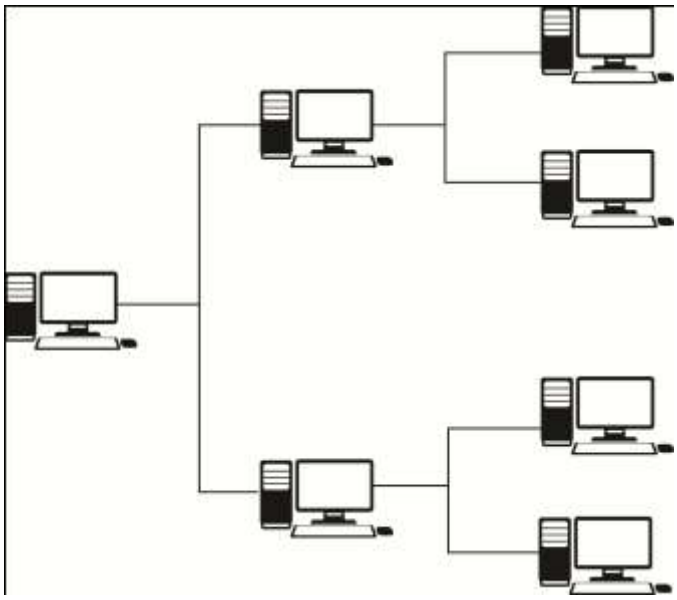

Fig. 1.14 Tree network

Check your progress 4

1. Which is not a network topology?

   a. Bus topology

   b. Star topology

   c. Brush topology

   d. Ring topology

1.6 Connecting Media: Wired and Wireless and their characteristics

Nowadays, internet users wish to enjoy accessing the internet even when they are away from their home and office place. Wireless modem is a modem that sends or receives network signals without the use of cable connections. It can access the internet without using any wired connectors or cable. Because of being wireless, it is much faster, reliable and is less expensive.

Today, many companies are into manufacturing wireless modems. These are designed as per the user requirements and are not expensive. Some of the famous and common wirelesses modems which are available include connect cards, USB sticks, Wi-Fi devices and wireless routers.

Connect Cards

It is the starting series of wireless modems which first appeared in two versions:

- PC data cards
- Connect cards

Such wireless modems are very small and compact. They are used to provide internet facility in laptops, personal computers or routers.

USB Sticks

It is a type of stick that is connected with the wireless modem and gives good internet speed in desktops and laptops. The size of USB stick is same as the size of a pen drive. The stick fits correctly into the USB port available in either the desktop or laptop. These sticks are not plug_and_play because it requires certain installation drivers in order to work. Such type of USB sticks are very easy to carry and can work anywhere.

Mobile Hotspots

Wireless modems serve as a portable internet hotspots. Internet products such as Novatel's Mi-Fi routers get a wireless broadband network and move the signal to a particular range in the same way as Wi-Fi hotspots. It will make the respective devices with Wi-Fi features along with wireless broadband network that can be of much use to the user who use Computers, Smartphone and tablets while moving here and there.

Wireless Routers

These are routers which are especially designed for home users as there is no need of a transmission cable. This router works without the internet cable and can receive or send the signal faster than a normal router.

Check your progress 5

1. Wireless modem requires _____.

   a. Cable

   b. A Sockets

   c. Some Wires

   d. No Wires

1.7 Introduction to NIDs and their specifications

NIDs are an efficient method of providing operational and capital savings to service providers. A NID is installed at the customer premise and provides a demarcation point between the service provider and customer's network. Network Interface Devices allow end-to-end Operations, Administration and Maintenance (OAM) functionality for the service provider.

While the operational savings of NIDs are often shown with their features and capabilities for remote troubleshooting, easy installation and service Level Agreement (SLA) monitoring to reduce SLA penalties, it's necessary for service providers to be aware of the additional revenue streams and services that can be achieved once employing a NID at the demarcation purpose.

An NID may also be known as a network interface unit (NIU),telephone network interface (TNI), system network interface (SNI), or telephone network box

Check your progress 6

1. What do you understand by the term NID?

   a. Network Interface Design

   b. Network Identification Design

   c. Node Interface Design

   d. None of these

1.8 Let Us Sum Up

In this unit we have learnt that networking involves arrangement of 2 or more computers that are connected across the world with the help of web and networking. It is studied that a workstation model is a basic arrangement where system comprises of workstations which are high end personal computers spread across the building or campus and are joined or connected through high speed LAN

It is found that a computer network is a group of interconnected computers which may be classified as per wide variety of characteristics. It is noted that a personal area network (PAN) is a computer network used for communication among computer devices close to one person.

The Metropolitan Area Network is a network that connects two or more Local Area Networks or Campus Area Networks together but does not extend beyond the boundaries of the immediate town/city. It is noted that CAN network may be considered as MAN network which in general is limited to smaller area as compared to typical MAN.

1.9 Answers for Check Your Progress

Check your progress 1

Answers: (1–d)

Check your progress 2

Answers: (1-d)

Check your progress 3

Answers: (1–b)

Check your progress 4

Answers: (1-c)

Check your progress 5

Answers: (1-d)

Check your progress 6

Answers: (1–a)

1.10 Glossary

1. **Network -** It is a relationship between the Sender and the Receiver.
2. **Computer network -** It is an interconnection of two or more computer systems located at either same or different places.
3. **Networking -** It is a connection between two or more computers.
4. **Wireless Modem -** It is a modem that sends or receives network signals without the use of cable connections.

1.11 Assignment

Define LAN and WAN.

1.12 Activities

Can a Wireless modem be taken anywhere to connect to the internet? Study and comment

1.13 Case Study

Study the network topology of your college.

1.14 Further Readings

1. Basic of Internet by Er. Nishit Mathur

2. Internet and the World by Ahmed Ansari