

Part I: Communication System and Network Topology

Learning
Scope

Introduction, Communication System and its elements (viz. Network Components, Transmission Media, Transmission Signals, Communication Resources, Computer Network its need and advantages, Types of Networks (viz. PAN, LAN, CAN, MAN, WAN), Network Topology, Types of topologies (viz. Star, Ring, Complete, Hybrid, Multipoint))

Introduction

In today's world, technology plays a crucial role in bringing people closer to each other. In fact, the internet has played an important role in connecting people and bringing them together as global citizens. The BSNL's byline 'Connecting India' highlights the company's goal to act as a medium of effective communication between people belonging to far-off regions. You can access information directly by using your personal computer and connect with other internet users around the world.



Thus, a computer network is a system of interconnecting computers or terminals. It shares the resources through computers, peripherals and terminals. It is also used for the purpose of transmitting computerised data from one location to another. The data can be in the form of text, graphics, pictures, audios or videos.

Communication System

A communication system is a collection of individual communication networks which interconnect and inter-operate to form an integrated communication environment. The purpose of a communication system is to facilitate effective communication between the source and the destination. It involves the following elements:

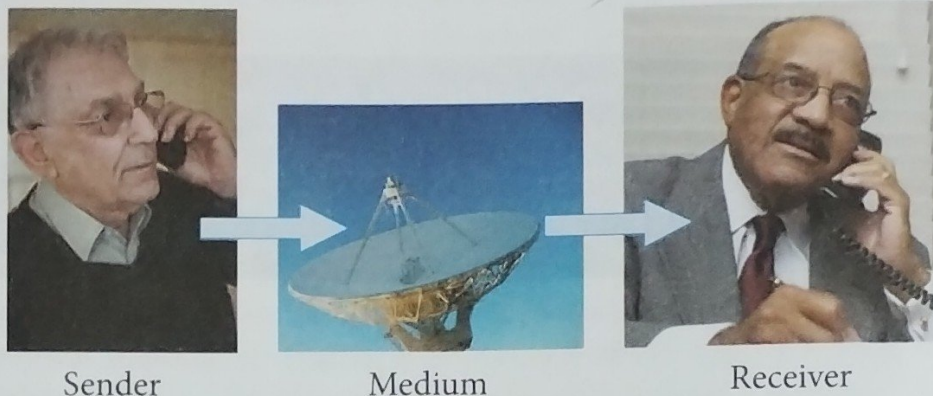
1. Network Components
2. Transmission Media
3. Transmission Signals
4. Communication Resources

Network Components

5-11
② The components which are needed to facilitate an effective communication from the source to the destination are referred to as network components.

These components help in transferring data from one point to another by using resources. This data may be analogous or digital in nature. In any communication process, three elements are essentially needed. They are:

1. **Sender:** It creates the messages to be transmitted.
2. **Medium:** It carries the transmitted messages to the destination.
3. **Receiver:** It receives the messages from the source.)



For example, when you talk to your friend over the telephone, you are the sender of the data. The telephone line through which your voice is being transmitted, is the medium and your friend will be the receiver. The same concept holds true for data communications in the field of the computer and its peripherals. In a computer system, the data transfer communication system, the sender and the receiver are generally machines. The transmission medium may be telephone lines, satellite links, microwave links, etc.

Transmission Media

The sender-medium-receiver concept has actually been around since a long time. However, the use of this concept has undergone a revolutionary change. Today, we have several types of physical channels (communication media), through which data can be transmitted from one point to another. The transmission media used for communication can be classified into two categories:

1. Wire-based Transmission Media

In this mode of transmission media, the communicating devices are interconnected via a cable. The signal flows from one device to another through a connecting wire.

For example, Twisted Pair Cable, Coaxial Cable, and Optical Fiber Cable.

2. Wireless Transmission

In case of wireless transmission, the communicating devices are not connected through wires. The signal from the transmitting device travels through the air in the form of electromagnetic waves to reach the receiving device.

For example, Radio Wave, Microwave (in Communication Satellite)

Transmission Signals

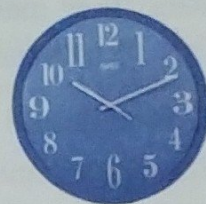
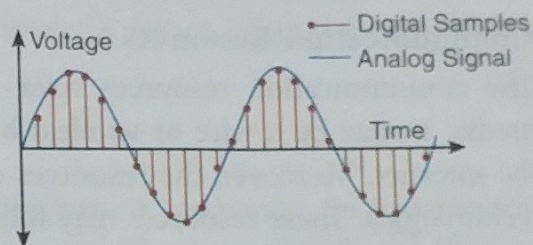
When data is propagated from one point to another, it is transmitted either in the form of electrical signals or digital signals. Computer-generated data is digital, whereas the telephone lines used for the data communication in the computer networks carry analog signals. The technique by which a digital signal is converted into its analog form is called Modulation and the reverse process is called Demodulation. Thus, a modem is used to perform modulation and demodulation for the data transmission.

1. Analog Signal

Any type of signal or wave which is continuously varying in nature is known as an analog signal. It always gives output in the form of a pattern which is referred to as the 'Sine' wave (shown in the adjacent figure). By observing the pattern of the output wave, we can conclude the results.

The best examples of analog signal are videos, human voice in the air, radio transmission waves, TV transmission waves, etc.

Some of the analog devices are thermometer, meter scale, wall clock, etc.

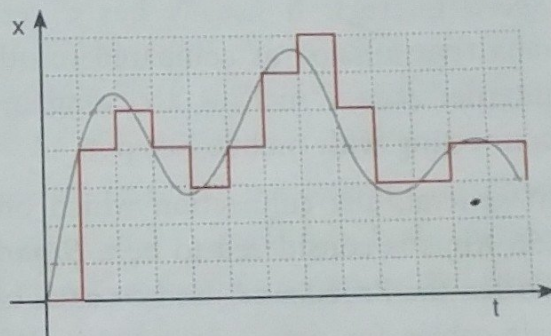


2. Digital Signal

A digital signal works on discrete data, which states only two conditions, i.e., 'True' and 'False' or 'High' and 'Low' or 'Present' and 'Absent'. These states represent either 1 (one) or 0 (zero). The pattern of the signal is referred to as the 'Square' wave which is shown in the adjacent figure.

An example of a digital signal would be the data transmission in a computer.

The most common digital devices are digital clocks, blood pressure measuring machines, computers, laptops, cell phones, etc.



Advantages of Digital Signal

There are many advantages of a digital signal as compared to an analog signal. Some of them are as listed below:

- They are more secure as they do not get damaged by noise.
- These signals have a low bandwidth. *Maximum amount of data transmitted over*
- They have a higher rate of transmission.
- We can translate the messages, audios and videos into different languages.

Differences between Analog Signal and Digital Signal

Analog Signal	Digital Signal
1. It signifies a continuous signal which keeps on changing with a fixed time period.	1. It signifies a discrete signal which carries binary data values (0 or 1).
2. Analog signals are continuous 'Sine' waves.	2. Digital signals are 'Square' waves.
3. It broadcasts the information in the signal form.	3. It broadcasts the information in the binary form.

Communication Resources

The communication resources refer to the data communication between devices or other media. It may be a wire or wireless based transmission to send or receive data connected to the internet. Moreover, the resources can be used directly or indirectly with the help of some technologies. These resources may follow some authentication (if necessary) while exchanging data. They mainly involve the following:

1. Broadband
2. Wi-Fi System
3. Bluetooth

1. Broadband

The broadband internet access is often shortened to just broadband which is referred to as **High-Speed** internet. It usually has a very high rate of data transmission as compared to other methods of internet access, such as accessing internet services, connecting with mobile hotspot.

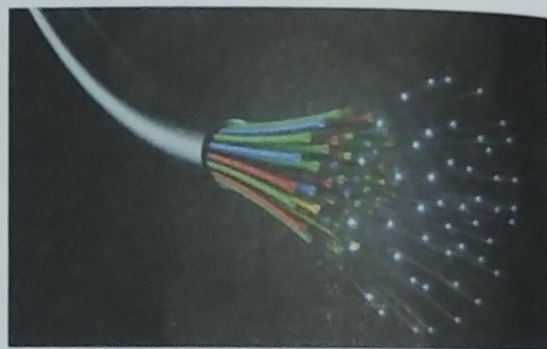
In general, any connection which offers more than 256 Kbps is considered to be a **Broadband Internet**. Earlier, the Broadband used co-axial cables or twisted pair cables for data transmission. With the development of technology, nowadays, it uses **optical fiber cable** also, which makes the data transmission reasonably high. Thus, one can access internet service with just a click. This marks a revolutionary change in the internet world.

Presently, the Broadband services are provided by BSNL, Airtel, Alliance Broadband, JioGiga Fibre, etc.

2. Wi-Fi System

Wi-Fi stands for wireless fidelity which allows wireless data transmission. Unlike mobile phones, a standard Wi-Fi device will work anywhere in the world and can transfer data through computers or mobile phones. Today, Wi-Fi is widely used in offices, hospitals, airports, corporate offices and university campuses worldwide.

A Wi-Fi enabled device such as a PC, video game console, mobile phone or a MP3 player can connect to the internet, when it is within the range of a wireless network, connected to the internet. Wi-Fi also allows connectivity in peer-to-peer mode (wireless ad hoc network), which enables devices to connect directly with each other.



Optical fiber cable

3. Bluetooth

Bluetooth is one of the latest technologies which enables wireless communication between low-power consumption devices within a short range (1 meter, 10 meters, 100 meters) by using radio frequency bandwidth. This technology makes it possible for different devices to communicate with each other when they are within the range. Bluetooth provides a way to connect and exchange information between devices such as mobile phones, telephones, laptops, personal computers, printers, Global Positioning System (GPS) receivers, digital cameras, etc. A personal computer must have bluetooth connectivity to communicate with other bluetooth devices (such as mobile phones, mice and keyboards). However, recent laptops come with an in-built bluetooth adapter to avail this service.



Computer Network

The term 'network' means a system of interconnected points or terminals. So a computer network is a system of interconnected computers or terminals. The network helps in sharing the resources of the series of interconnected computers, peripherals and terminals in the network. Apart from sharing resources, a computer network also facilitates the transmission of data from one location to another.

Need for Computer Network

In the year 1960, USSR and USA were involved in a Cold War. In order to send some urgent messages to its armed forces, USA used the medium of electronic text to communicate with their head offices. Similarly, the disaster of Titanic could have been prevented or the rescue operations could have been intensified, had the communication been done on time.

It is very important to have a good communication network since it helps to keep ourselves updated about the latest trends in the technology world as well as in other fields. It also serves several other purposes like keeping us updated about the election results, sensex in the share market, launching of a new product, etc.

Advantages of a Computer Network

The advantages of a computer network are:

- Information can be easily shared by people.
- It helps us in staying updated with the events in and around the world.
- It also helps in sharing resources.

For example, a colour laser printer connected to a network can print several hard copies.

- Interaction among people around the world becomes easy through chatting/video conferencing.
- Email allows us to send or receive mails effortlessly.

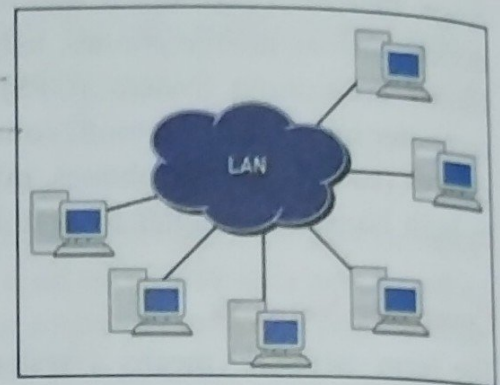
Types of Computer Networks

A computer network is a group of interconnected computers. Computer networks can be classified according to the hardware and software technology used in the networks.

The most commonly used networks classified on the basis of geographical distance they cover are listed below:

- ✓ 1. **Personal Area Network (PAN):** This network is used to establish communication among computer devices within the range of 20 to 30 feet. This network may be wired with computer buses (e.g. USB) or may be a wireless network through Bluetooth.
- ✓ 2. **Local Area Network (LAN):** A local area network (LAN) is a digital communication system which interconnects a large number of computers and other peripheral devices. This type of network is generally preferred within a smaller area such as an office building or a lab building (say, within the radius of half a kilometre).

The configuration of a LAN can be a star, a ring or a multipoint network. The transmission channels use coaxial or fiber optic cables for high-speed transmission.

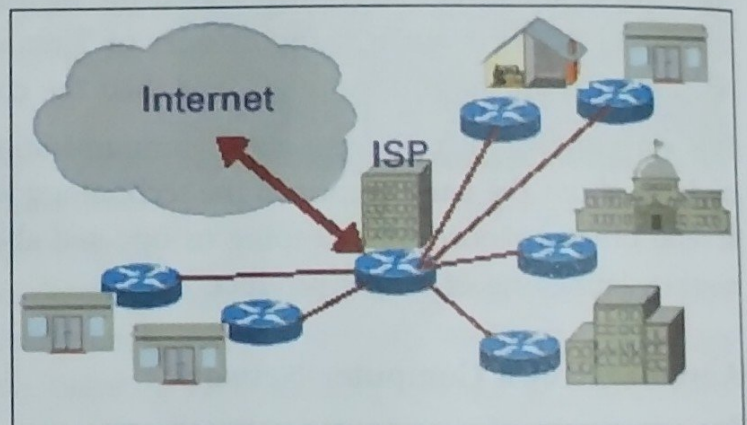


LAN

Ethernet, developed by Xerox Corporation, is an example of LAN.

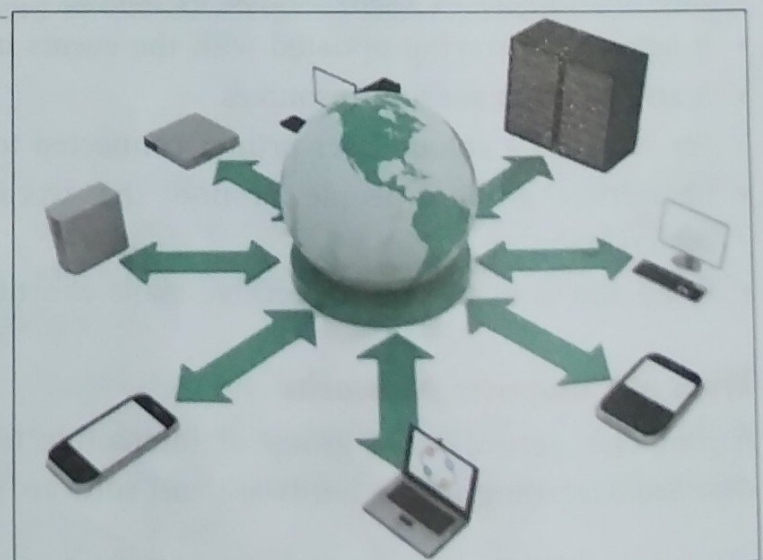
- ✓ 3. **Campus Area Network (CAN):** This network connects two or more LANs that are limited to specific geographical areas viz. college campus, office building, etc. It is generally limited to an area between the local area network and the metropolitan area network.

- ✓ 4. **Metropolitan Area Network (MAN):** This network connects two or more local area networks or campus area networks together. The MAN is bigger than the local area network but smaller than the wide area network. This network is located on a larger geographical area whose diameter usually ranges from 5 to 50 kilometers. It prefers routers, switches and hubs but doesn't extend beyond the boundaries of the immediate town/city.



MAN

- ✓ 5. **Wide Area Network (WAN):** A wide area network (WAN) is a digital communication system which interconnects a large number of computers in a wide area. This type of communication network can operate worldwide. In a WAN, telephone lines, microwave, satellite links, etc. can be used as transmission mediums.



WAN

The ARPANET (Advanced Research Project Agency) of the U.S. Department of Defense is an example of the WAN.

Differences between the LAN and the WAN

Local Area Network	Wide Area Network
1. A local area network is restricted to a limited geographical area.	1. A wide area network operates on a worldwide or nationwide basis.
2. In a local area network, the computers, the terminals and the peripheral devices are connected to each other through wires and co-axial cables.	2. In a wide area network, there may not be any physical connection between various computers.

Network Topology

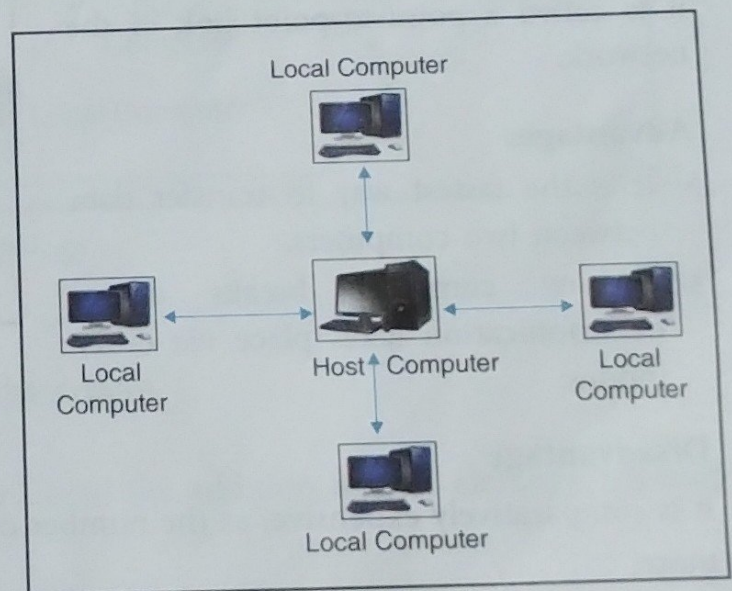
The term **Network Topology** refers to the arrangement of various elements (links, nodes, etc.) of a computer network, physically and logically. Essentially, it is the topological structure of a network. **Physical topology** refers to the physical placement of computers or nodes, including device location and cable installation. **Logical topology** is defined as the manner in which the data flows within a network, irrespective of the physical topology. The distances between the nodes, physical interconnections, transmission rates and/or signal types may differ between the two networks.

The different types of topologies are:

1. Star
2. Ring
3. Complete
4. Hybrid
5. Multipoint (Bus)

Star Topology

In this topology, there is a host computer storing all the data and information, which is connected to the local computers. The local computers are however not linked directly to each other. They communicate only *via* the host computer through multiple communication lines. The host computer is, thus, responsible for establishing communication among the local computers.



Star Topology

Advantages

- If any of the local computers fail or break, the transmission system of the network remains unaffected.
- The transmission delays between the two terminals do not increase by adding a new terminal.

Disadvantage

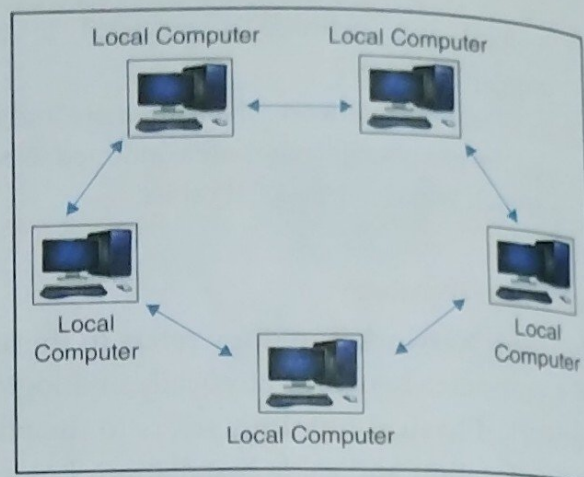
The entire system depends upon the host computer. If the transmission of the host computer fails, then the entire network fails.

Ring Topology

In this communication system, there is no host computer to transmit the data centrally. Thus, there is no 'controlling computer' in this network. All the local computers are connected to each other in a ring arrangement. Each computer in the ring communicates with the other computers. There is no master computer to control the other computers in the ring.

Advantage

In ring topology, all the traffic flows in only one direction and at a very high speed.



Ring Topology

Disadvantage

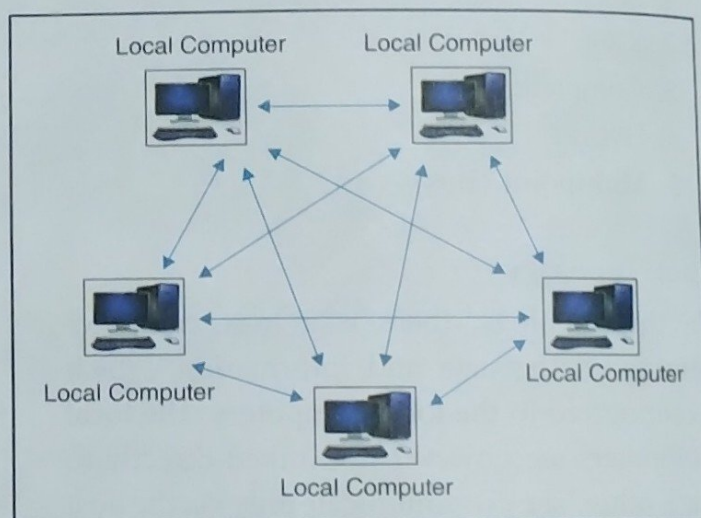
The addition of a new terminal in the network delays the communication.

Complete Topology

In this topology, all the computers are connected to one another. The control is given to each computer to decide its communication priorities. Since, each computer is connected to other computer, it is called a point-to-point link of the network.

Advantages

- It is the fastest way to transfer data between two computers.
- If any computer breaks down, communication takes place *via* other modes.



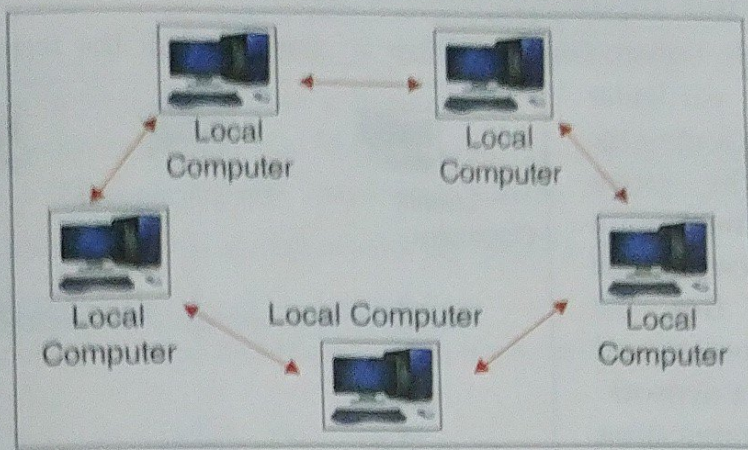
Complete Topology

Disadvantage

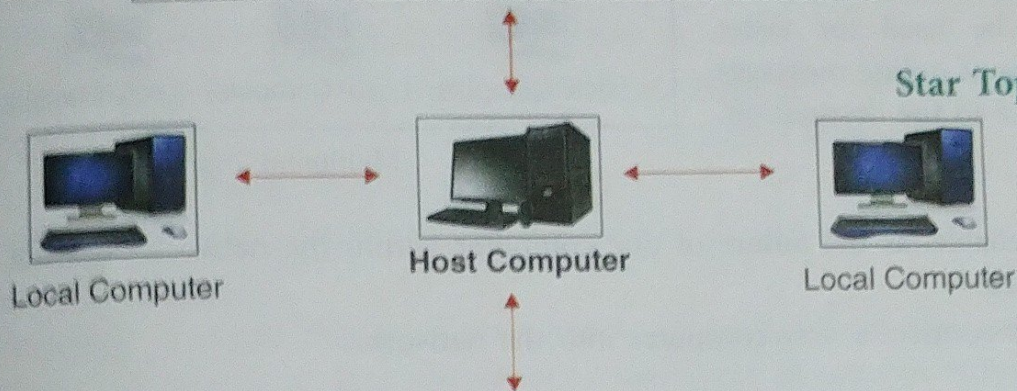
It is comparatively expensive, as the number of terminals/points connected to a computer are more.

Hybrid Topology

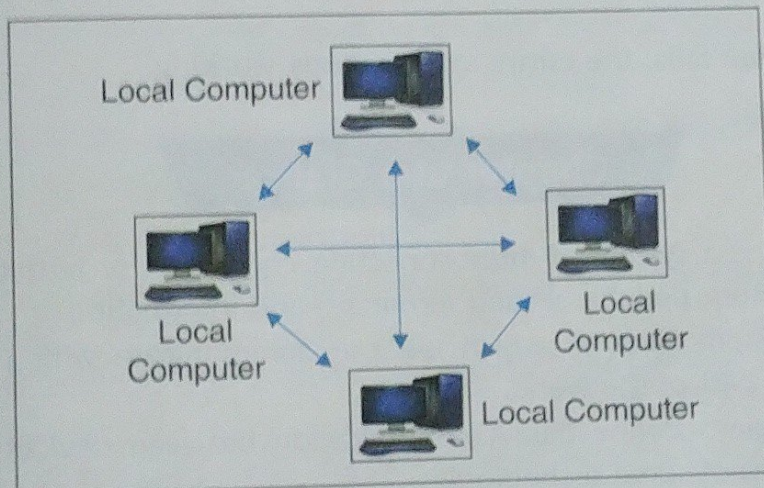
It is defined as the combination of two or more topologies. Here, you can find that the star topology is combined with the ring topology and the complete topology. In fact, the configuration of the network depends upon the needs of the organisational structure of the company.



Ring Topology



Star Topology



Complete Topology

Hybrid Topology

Advantages

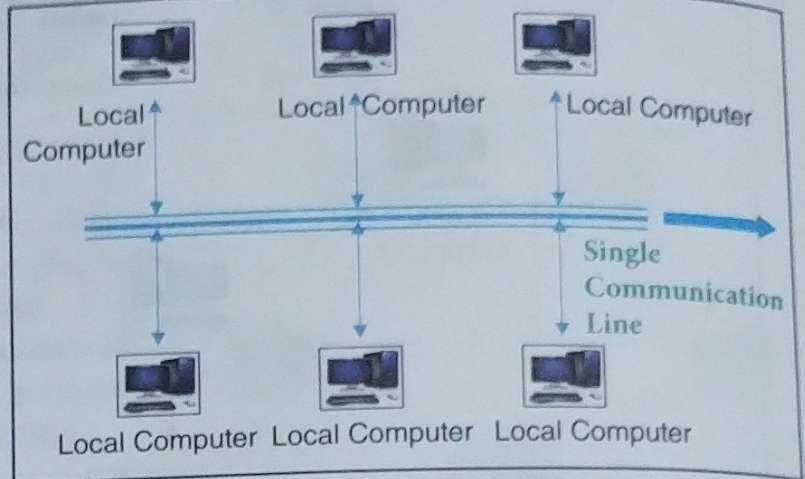
- It is reliable and easy to detect the fault of the system.
- It includes both wired and wireless network.
- It is easier to expand the size of the network with the addition of new elements without disturbing the existing architecture.

Disadvantages

- Sometimes, it is difficult to understand the design and the architecture.
- The cost of this topology is higher as compared to the other topologies.

Multipoint Topology (Bus Topology)

In this topology, a single transmission medium is shared by all the terminals as shown in the figure. When a particular computer wants to send a message to another computer, the system checks whether the communication line is free or not. As soon as the communication line is free, the message is transmitted online and thus, it sets up a local area network. A high-speed communication channel may be used for faster communication of online messages from the source to the destination.



Multipoint Topology

Advantages

- It is more reliable, as the failure of one computer within the network does not affect the entire network.
- It is easier to connect a new computer into the network.

Disadvantage

- If the communication line fails, the entire system stops working.

Chapter at a Glance

A computer network is a system of interconnecting computers or terminals. It shares the resources (viz. computers, peripherals and terminals) and information.

- The internet is a system through which we can communicate with people, or access information from any part of the world.

Communication resources define data communication between devices used directly or indirectly with the help of some technologies.

A communication system is a collection of individual communication networks which are inter-connected and inter-operated to form an integrated communication environment.

- The data can be transmitted from one point to another on the network with wires or without wires (wireless transmission).

- The two types of transmission signals are Analog and Digital.

- The analog and digital signals are used to transmit information, usually through electric signals.

An analog signal is continuous which means, that there are no breaks or interruptions.

- A digital signal works on discrete data which states only two conditions i.e., 'True' and 'False' or 'High' and 'Low' or 'Present' and 'Absent'.

A broadband internet access is often shortened to just broadband, which refers to a High-Speed Internet.

- Network Topology is the arrangement of various elements of a network, physically and logically.

REVIEW EXERCISES

S-I (3)

1. What is meant by communication resources?

Ans. Communication resources refer to the data communication between devices or other media. They may be a wired or wireless based transmission system to send or receive data.

2. Name the transmission signal that works on discrete data.

Ans. Digital signal

3. Name a wire and a wireless based communication resource to send or receive data connected to the internet.

Ans. (i) Wire based transmission: Broadband

(ii) Wireless based transmission: Wi-Fi system

4. Name the type of transmission signal that is in the form of:

(i) Sine wave

(ii) Square wave

Ans. (i) Analog signal is in the form of sine wave.

(ii) Digital signal is in the form of square wave.

5. Define star topology.

Ans. (i) The topology in which a host computer stores all the data and information is called star topology. (ii) The local computers are, however, not linked directly to each other rather they communicate only via the host computer through multiple communication lines.

6. Is there a host computer in Ring Topology? Comment.

Ans. No, there is no host computer in the ring topology. All the local computers are connected to each other in the formation of a ring.

7. **Assertion and Reason based question:**

Assertion (A): The transmission media used for communication works on sender-medium-receiver concept.

Reason (R): The transmission media used for communication can be either wire-based or wireless based.

Based on the above discussion, choose an appropriate statement from the options given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

(e) Both A and R are false.

Ans. (a) Both A and R are true and R is the correct explanation for A.

8. **Case Study based questions:**

Computer network is a system of interconnected computers or terminals. It helps to share the resources of a series of interconnected computers, peripherals and terminals in a network. However, a global networking system was initially developed to share the confidential messages among the US personnels of defense forces.

Identify them as per the descriptions of the various computer networks given below:

- (a) is a type of network connection in which the computers are located within a smaller area such as an office building or a computer lab.
- (i) Local Area Network (ii) Native Area Network
(iii) Office Area Network (iv) Metro Area Network
- (b) network employs routers, switches and hubs but doesn't extend beyond the boundaries of the immediate town/city.
- (i) Urban Area Network (ii) City Area Network
(iii) Metropolitan Area Network (iv) Office Area Network
- (c) Which of the following is applicable to Wide Area Network?
- (i) It uses a limited geographical area.
(ii) It doesn't require any transmission medium.
(iii) It uses co-axial cable for data transmission.
(iv) It uses satellite link for data transmission.
- (d) Which of the following network system was developed to share the confidential messages among the US personnels of defense forces?
- (i) TELNET (ii) ARPANET (iii) NSFNET (iv) BSFNET

- Ans.** (a) (i) Local Area Network
(b) (iii) Metropolitan Area Network
(c) (iv) It uses satellite link for data transmission.
(d) (ii) ARPANET

EXERCISES

Objective

I. Choose the correct option:

- Which of the following is a wire-based transmission media?
(a) Hi-Fi (b) Y-Fi (c) Wi-Fi ☒ (d) Coaxial cable
- Which of the following transmission signals is in square wave form?
☒ (a) Digital signal (b) Hybrid Signal (c) Analog signal (d) Clear signal
- Which of the following is an appropriate statement for broadband transmission?
(a) It uses electrical wire. (b) It uses twisted pair cable.
☒ (c) It uses an optical fiber cable. (d) It uses coaxial cable.
- Which of the following is not an analog device?
(a) Meter scale (b) Thermometer (c) Speedometer ☒ (d) Calculator
- What does the letter A signify in the word ARPANET?
(a) Army (b) Ariel ☒ (c) Advanced (d) American
- What is the other name given to multipoint topology?
(a) Media ☒ (b) Group (c) Bus (d) Van
- Which of the following statements is true regarding star topology?
(a) Computers are connected through a single communication line.
(b) Computers are connected in the shape of a ring.
(c) Computers are connected using different topological systems.
☒ (d) Computers are connected using a central host.
- Which is the full form of MAN?
(a) Micro Access Network ☒ (b) Metropolitan Area Network
(c) Medium Analytical Network (d) Monitored Area Network

II. Fill in the blanks:

- A system of inter-connecting computers is known as a network.
- A co-axial/telephone cable sends a analog signal during the data transmission.
- In a star topology, the host computer is connected to the local computers.
- A combination of different types of topologies is known as the hybrid topology.
- The Wi-Fi system means Wireless data transmission.
- In a Star topology, the local computers are connected to Central host computers.
- A digital signal works on binary data data which states only two conditions.
- The bluetooth is a wireless communication within a short range by using radio bandwidth.

III. State whether the following statements are True/False:

1. Modulation is the process of converting analog signals to digital signals. F
2. There is no difference between an analog signal and a digital signal. F
3. A medium carries the transmitted messages to the destination. T
4. A modem converts only analog signals to digital signals. F
5. Bus topology is also known as Multipoint technology. T
6. The word Wi-Fi stands for Wireless Frequency. F
7. Broadband uses twisted pair cable for high speed data transmission. F
8. The network topological structure is the combination of physical as well as logical network. T

IV. Name the following:

1. Three elements of communication system
(a) Network Components (b) Transmission media (c) Communication Resources
2. Three types of Network topologies
(a) Star (b) Ring (c) Bus
3. Three types of network components
(a) Sender (b) Medium (c) Receiver
4. Three types of computer networks
(a) LAN (b) MAN (c) WAN
5. Three types of cables used in data transmission
(a) Twisted Pair cable (b) coaxial cable (c) optical Fiber cable

V. Assertion and Reason based question:

Assertion (A): When data is propagated from one point to another, it is transmitted either in the form of electrical signals or digital signals.

Reason (R): The transmission of electrical signals work on discrete data whereas, digital signals work on Sine wave.

Based on the above discussion, choose an appropriate statement from the options given below:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true and R is not the correct explanation of A.
- ☒ (c) A is true but R is false.
- (d) A is false but R is true.
- (e) Both A and R are false.

VI. Case Study based questions:

Network topology is the arrangement of computers or devices in a network. It defines how data flows from one node to other in a network. We can connect computers in different forms. In one system, the computers are connected through a host, whereas in other system, they are connected in circular fashion. To promote flawless communication, we can also use multiple topological systems together.

Based on the above case, answer the following questions:

- Name the topological system that uses a host node. *Star Topology*
- Name the topological system that enables connection of computers in a circular fashion. *Ring Top*
- Name the topological system that is a combination of multiple topologies. *Hybrid Topology*
- Name the topology that enables point-to-point connection. *Mesh Topology*

Subjective

I. Define the following:

P-168 1. Computer Network:

P-168 2. Analog Signal:

P-168 3. Communication Resources:

P-169

P-168 4. Broadband:

P-163 5. Bluetooth:

P-166 6. Hybrid Topology:

P-168 7. Bus Topology:

P-164 8. Local Area Network:

II. State two differences between the following:

- Local Area Network and Wide Area Network *P-165*
- Analog Signal and Digital Signal *P-162*
- Star Topology and Ring Topology *P-169*

III. Short Answer Questions:

- P-168* 1. What is meant by the term communication system? Name all the elements of a communication system. *P-159*
2. What is Network Component? Explain with reference to a communication system. *P-160*
3. Explain the term Network Topology. Name the other types of topologies. *P-165*
4. What are the advantages of a computer network? *P-163*
5. Explain the arrangements in different types of computer networks. *are P-164*
6. What are the advantages of a Digital Signal over an Analog Signal? Explain. *P-161*
7. What are the advantages and disadvantages of?
 - (a) Complete Topology *P-166*
 - (b) Hybrid Topology *P-167*
 - (c) Multipoint Topology *P-168*



Activity

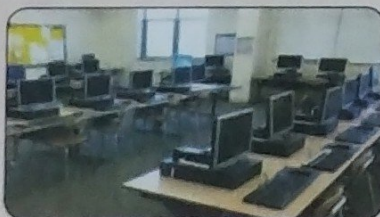
Group Discussion

Form a group of two and carry out a discussion on the following situation:

Suppose there are three computer labs in your school viz. Junior, Senior and Super Senior labs. But, there is no inter-connectivity among them and as a result data or files can't be transmitted or shared. How and what type of Network Topology should be established to enable the communication

of data among these computer labs. You need to consider the following:

- i. All your resources
- ii. Advantages and disadvantages of the topology
- iii. Cost effectiveness



Junior Lab



Senior Lab



Super Senior Lab

Learning Scope

Introduction, Intranet, URL, ISP, IP Address, DNS, Web Browsers, Website, Webpage, Web Portal, Modem, Types of Modems: Internal, External, GPRS, USB modem, Hub, Switch, Router, Gateways, Hyperlink and Hypertext, Bandwidth, Protocols: HTTP, FTP, IP, TCP, SMTP, Cloud Storage, Cloud Computing, Advantages of cloud computing, Uploading Files, Downloading Files, Sharing Files

Introduction

The internet is a system through which we can communicate with people or access information from any part of the world. The computer accesses and retrieves digital information with the help of some peripheral devices and communication systems. These include modems, protocols, URL, satellites, etc. which are discussed below.

Intranet

Intranet is a computer network which uses the internet protocol technology to share information, operational systems or computing services within an organisation. It is the common term used for a private computer network within an organisation. It uses network technology as a tool to facilitate communication between people or work groups to improve the data sharing capability and overall knowledge base of an organisation's employees. It has the following characteristics:

- It is a system in which multiple personal computers are connected with each other.
- The number of users involved in the intranet are limited.
- Each computer in the intranet is also identified by an IP address, which is unique to that particular computer.

Thus, the intranet is a network of computer designed for a specific group of users.



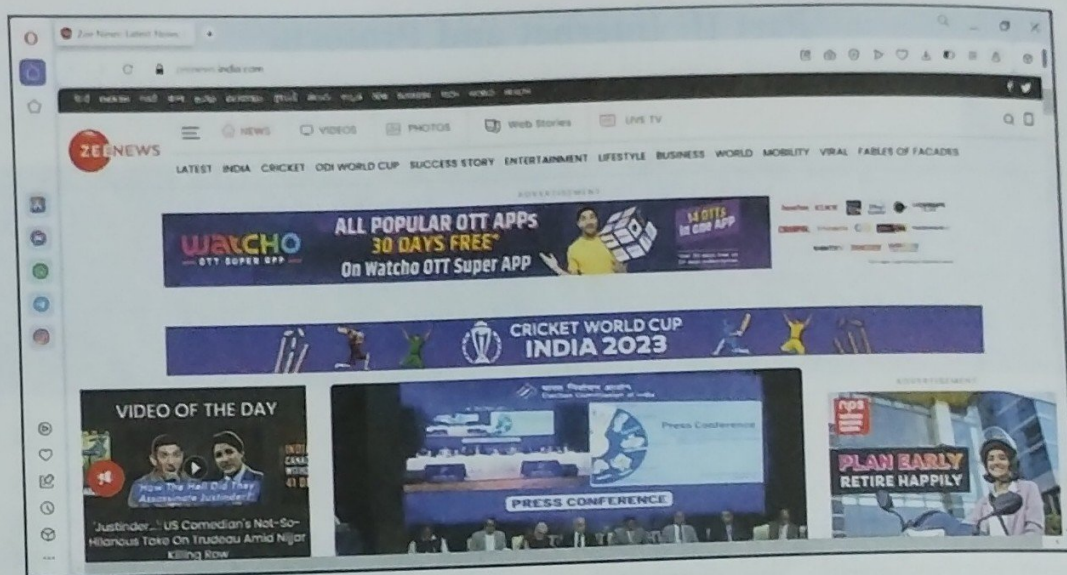
Knowledge Corner



An intranet may be accessible from the internet, but it is protected by a password and accessible only to authorised users.

Uniform Resource Locator (URL)

Every page on the internet has a unique address through which it is called. The address of a web page is called the Uniform Resource Locator or the URL.



The URL's (web address) of some common websites are given below:

<http://www.discovery.com>

<http://www.foxkids.com>

<http://www.disney.com>

<http://www.khoj.com>

<http://www.nationalgeographic.com>

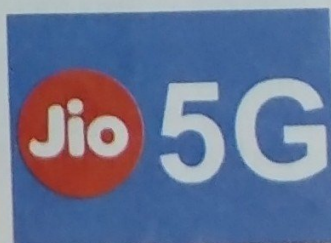
<http://www.cartoonnetwork.com>

<http://www.shopmool.in>

Internet Service Provider (ISP)

An Internet Service Provider (ISP) is an organisation which provides the facility of availing internet services against a fee. It is a link between the computer/laptop and the servers on the internet. An ISP includes various providers such as:

- Internet Cable Service Providers
- Internet Wireless Service Providers
- Internet Broadband Service Providers

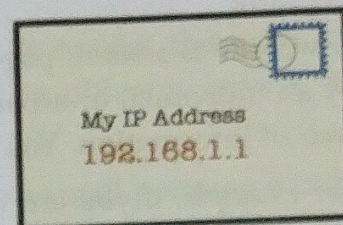


It is a gateway to the internet where you can send and receive emails, do online shopping, research work, etc. Among the largest national and regional ISPs are BSNL, Airtel, Reliance Jio, Vodafone, etc.

IP Address

IP stands for Internet Protocol. It is a set of rules which allows your computer to be linked on the internet and share information. IP address is a unique address (numeric code) assigned to a computer or a device by the ISP. Thus, your computer will be identified on the internet with the help of the IP address.

When someone sends a mail to an email ID, the ISP locates the computer for delivery, based on its IP address. If it is located, then the email is sent to your inbox, otherwise it remains undelivered.



Domain Name Servers (DNS)

The Domain Name Servers is like a phone book that is used to store phone numbers. DNS is a directory of domain names of different websites. Whenever a website needs to be accessed, its IP address is generated with the help of the DNS. The required computer or network is further approached for communication based on the generated IP address.



Web Browsers

A web browser is a software application which helps the users access and view different websites. A browser helps in the following ways:

1. It contacts the web server and sends a request for information.
2. It receives the information from the server and displays the content on the user's computer screen.

An information resource is identified by a Uniform Resource Identifier (URI). The information can be a web page, image, video or any other piece of content. Hyperlinks present in the resources enable the users to easily navigate their browsers.

Although, browsers are primarily intended to access the World Wide Web, they can also be used to access information provided by the web servers in private networks or files in the file systems.

The primary purpose of a web browser is to provide information resources to the user. When the user inputs the Uniform Resource Identifier (URI), the system processes the request with the help of browsers.



Microsoft
Edge



Mozilla
Firefox

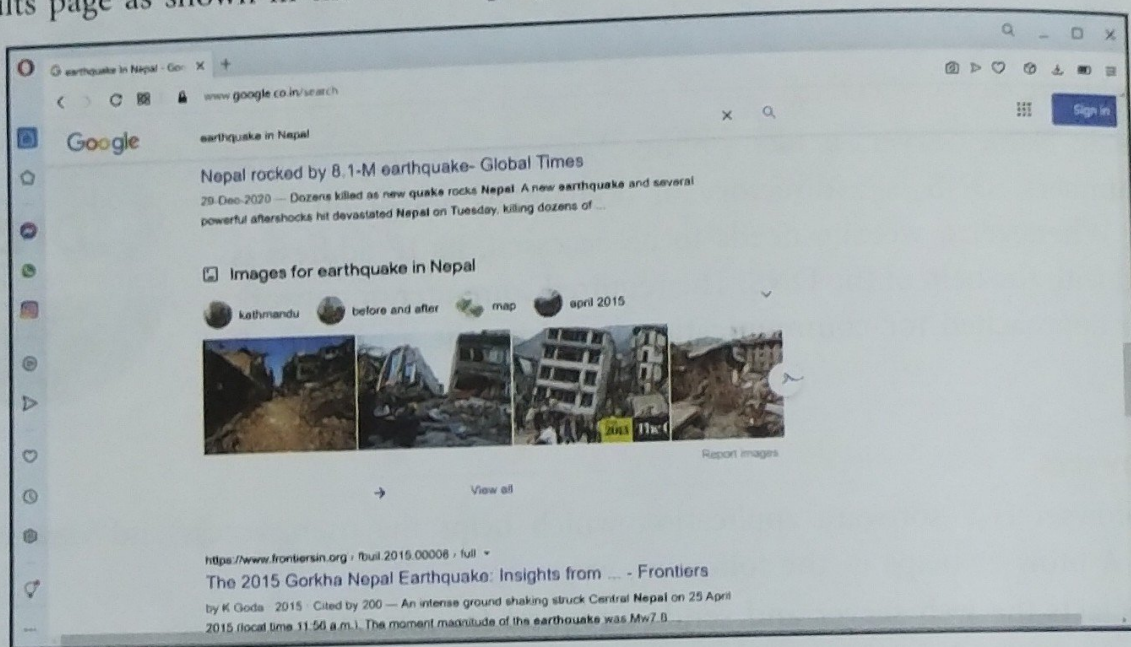


Safari

There are two important browsers viz. the Microsoft Edge and the Netscape Navigator. The Microsoft Edge, previously known as Internet Explorer, was a creation of the Microsoft Corporation, whereas the Navigator was developed by Netscape. However, you can also use other browsers such as the Mozilla Firefox, Google Chrome, Opera, etc. for the same purpose.

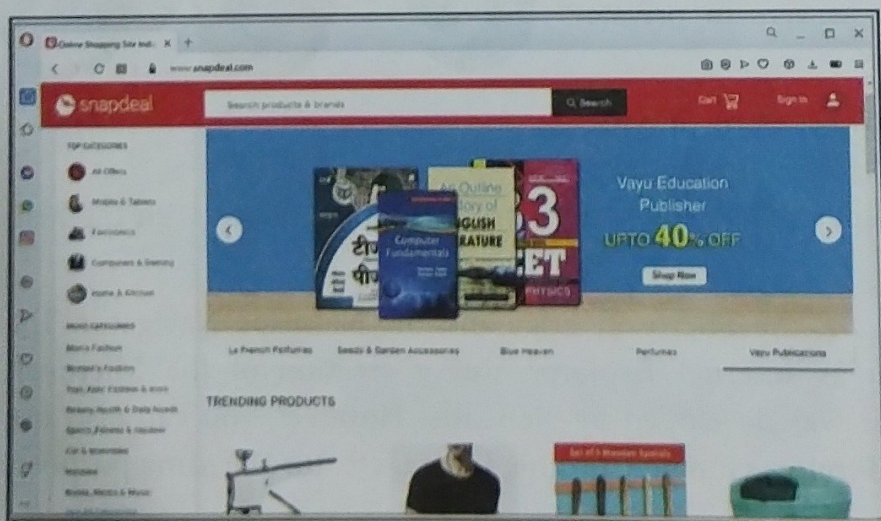
Website

A website is a set of pages of information on the internet about a particular subject published by an individual or an organisation. The web pages are linked to one another to form a global web of information. You can move from one page to another on a website through hyperlinks. For example, if you are working on a browser (say, the Google Chrome) and trying to access information on a certain topic (say, earthquake in Nepal), then you need to type the topic for the search in the search box. This will get you the complete information on that topic on the results page as shown in the following figure.



Web Page

A web page is a document commonly written using the Hyper Text Markup Language (HTML), which is accessible through the internet by using a browser. Multiple web pages make the World Wide Web. It contains text, graphics and hyperlinks to other web pages. A web page is accessed by entering the Uniform Resource Locator (URL) address, in the address bar of a browser. An example of a web page is shown as:



Knowledge Corner



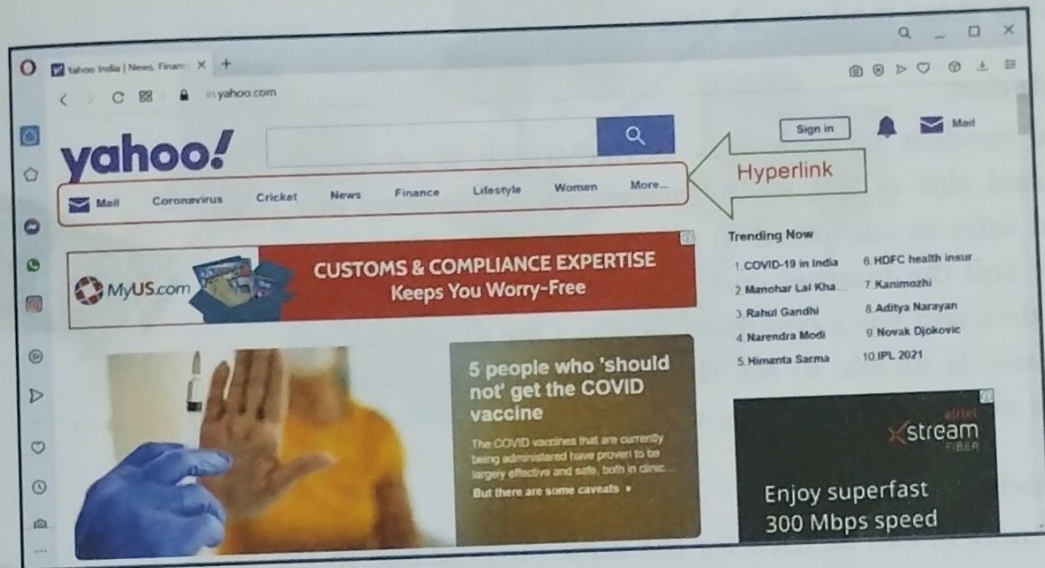
A website is a collection of webpages whereas a web page is an individual HTML document.

Web pages can be either static or dynamic. Static pages show the same content each time they are viewed. Dynamic pages have content which can change each time they are accessed.

Hyperlink and Hypertext

Hyperlink is the link, which when clicked, opens another document. It enables the users to navigate from one document to another, which may also be located on different servers. It can be text, icons, graphic or images.

When you hover over the mouse pointer on a hyperlink, it changes to a small pointing hand. This means that there is a hyperlink. You can then click on the hyperlink, to visit another web page.



A hypertext is a text with hyperlinks. When you place your mouse pointer on the hypertext, the shape of the pointer changes from an arrow to a hand and after clicking, it provides more information about the related topic (either on the same page or on a different page).

Web Portal

Suppose, your school maintains records regarding academics, sports, library, etc. on different websites. Then, if someone wants to retrieve information about your school, he/she may need to visit different websites. This problem can be solved by creating a single website which will include all the information about your school in a well-organised manner. Thus, a single website containing a lot of information about a particular organisation in a systematic manner is known as a web portal.

It is a single point access source which acts as a library to collect the information. The contents of a web portal are so organised that it can be easily accessed by the internet user.



Knowledge Corner



Single Point Access Source

It is a common platform which contains all the information of an organisation on the internet.

Modem

A modem modulates (or transforms) the outgoing digital signals from a computer or any other digital device to analog signals through the telephone lines. It demodulates the incoming

analog signals and converts it into a digital signal for the digital device. Users can select the modem as per their requirement and network structure.

Types of Modems

The different types of modems are categorised in the following manner. They are:

1. Internal Modem
2. External Modem
3. GPRS Modem
4. USB Modem

Let us discuss these modems in details.

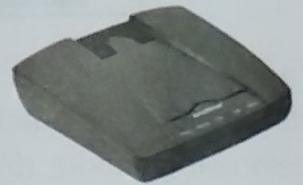
Internal Modem

An internal modem is a network device which is attached to the internal slot of the motherboard. These modems are cheaper and safer as compared to external modems. They are used for fax and the internet communications. They can also be used for data and voice communications. One disadvantage is that the user is unable to see the status of the modem in case internet access fails.



External Modem

An external modem can be used for the same purpose and in the same conditions as an internal modem. It is a small box which uses other kind of interfaces to connect to the computer. It is similar to internal modems connected to the communication port and is placed outside the CPU.



GPRS Modem

A GPRS (General Packet Radio Service) modem is a wireless modem used for data transmission with a wireless network. These modems are used to browse the internet and avail other communication facilities using GPRS services. It has a higher data transmission speed and can be used as the bearer of SMS. You also need it to send or receive MMS messages. GPRS services are quite costly compared to other communication services.



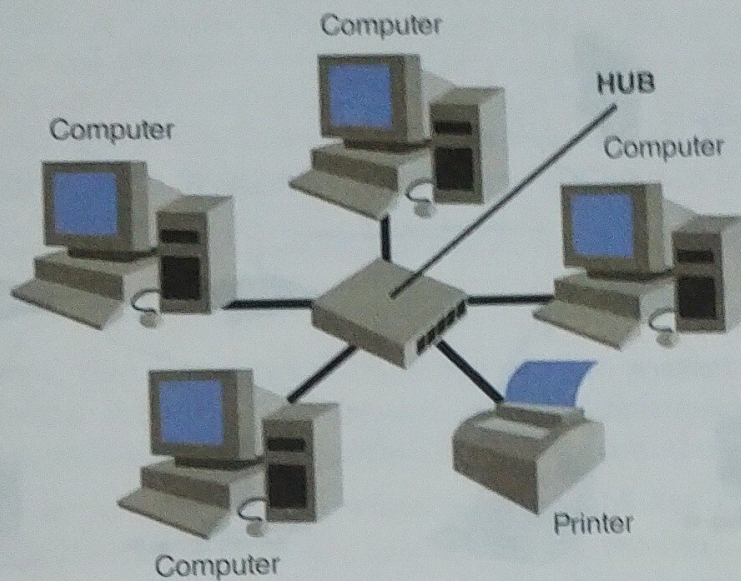
USB Modem

The USB modem refers to any type of data/fax/voice modem device which can be connected to a computer using the USB (Universal Serial Bus) port. The term 'USB modems' is commonly used for a specific portable wireless device which looks similar to a USB flash drive but is smaller in size. These small, portable USB modems do not require a power source and can be plugged into any USB port on your PC. They can be disconnected from the computer without turning off the system. For example, Intel, Huiwei, D-Link.



Hub

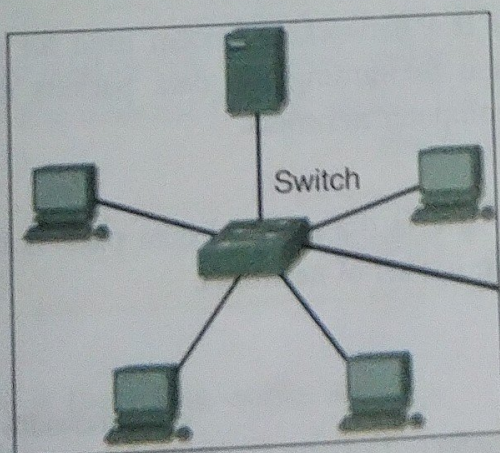
A hub is a mode of central distribution that connects multiple devices on the internet. When a user passes a message to the hub, it is broadcasted to every single device connected on the network. However, the message is delivered to the appropriate device after the verification of its IP address.



Switch

A switch is defined as a collection of various networking components as a single unit. It plays an important role at the time of sharing information which is designed with advance features. A switch adds IP address to the incoming messages, so that the appropriate computer is located for delivery of the message.

You know that the hub broadcasts the message to the entire network. But, unlike the hub, the switch finds the appropriate device to which the message is to be sent. It connects the source to the destination for direct communication between them.



Knowledge Corner



Source

It is a device or computer from where the information or data is sent.

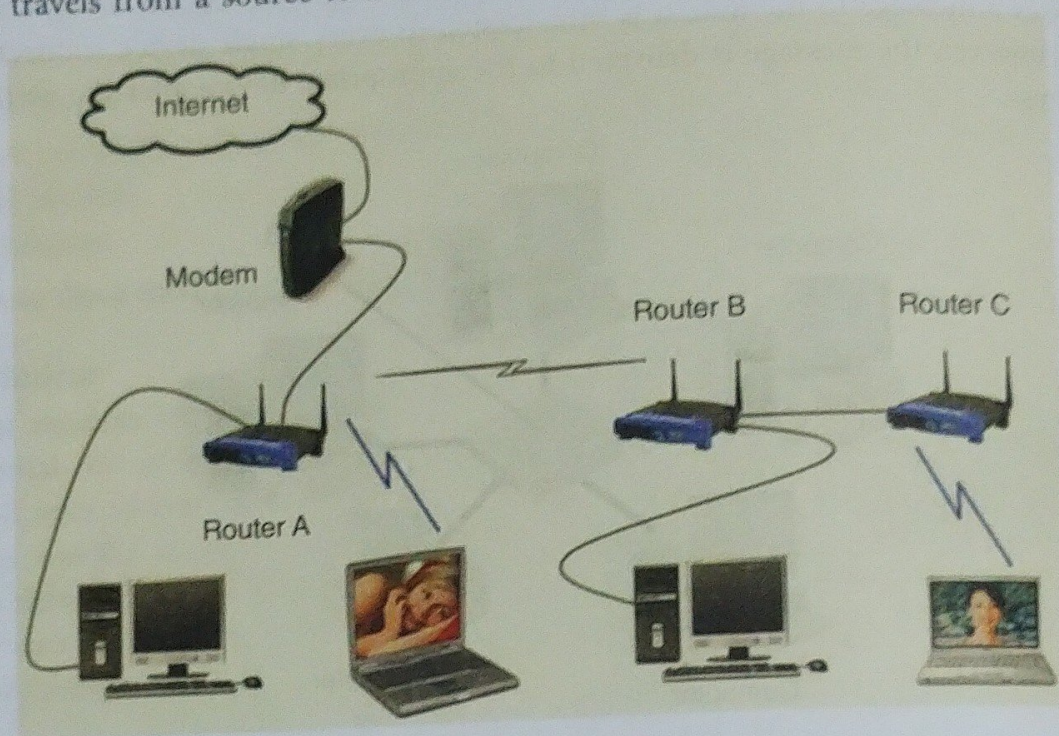
Destination

It is a device or computer which receives the information or data.

Router

The router is a physical networking component which allows communication when a single computer is linked with multiple computers on the internet. It acts as a traffic controller among

the devices connected on the internet. The router provides the route or the path through which a message travels from a source to a destination.



Gateways

Gateway is a networking device or a piece of hardware that acts as a gate between different networks utilising different protocols. Since, it communicates via many protocols, its operations are more complicated than a switch or a router.

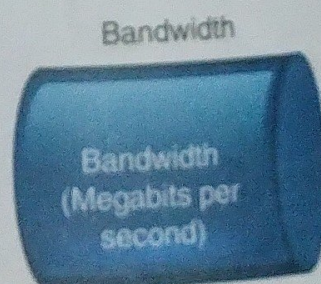
It usually works with a switch and a router to ensure a smooth routing process in a communicating system.

Differences between Gateway and Router

Gateway	Router
1. It is a device that acts as a gate among various available networks. It also acts as a node and serves as an entry point for various networks.	1. It is a networking system used for managing and forwarding the data packets to various computer networks.
2. It operates as a gate between different networks.	2. It directs the received data packets through a similar set of networks.

Bandwidth

The bandwidth measures the volume of the data transferred on the internet. Usually, data transfer on the internet is measured in terms of bps (bits per second), kbps (kilobits per second) and mbps (megabits per second).





Wireless Router

Routers incorporate a DSL (Digital Subscriber Line) modem or a cable modem and a Wi-Fi access point to transmit digital data over telephone lines. It is often set up in homes and other premises to provide internet access to all the devices connected (wirelessly or by cable) to them. One can also connect Wi-Fi devices without a router. Wi-Fi enables you to access the internet even at those places where generally there is no network such as kitchens, parks, garden sheds, etc.



Wireless Router

Protocols

In a computer network, data is transmitted from one point to another with the help of a data communication software. It directs the computer and its peripherals to the data which is to be transferred. These procedures are embedded in the data communication software.

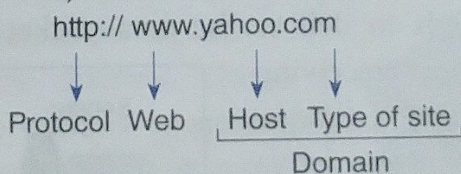
Thus, a protocol is a set of rules and procedures which establishes a link to control the data transmission between the two points (the sender and the receiver). It allows access to the information (text, images or videos) across a network through networking protocols. The commonly used protocols are:

1. Hypertext transfer protocol (HTTP)
2. File transfer protocol (FTP)
3. Internet protocol (IP)
4. Transmission control protocol (TCP)
5. Internet message Access protocol (IMAP)
6. Simple mail transfer protocol (SMTP)

Let us discuss these protocols in detail.

Hypertext Transfer Protocol (HTTP)

It is a set of rules which is responsible for transferring hypertext documents between two or more computers. The information on a World Wide Web (www) is transmitted with the help of the protocol http. The web addresses begin with http:// (Hypertext Transmission Protocol) which is followed by the website name. The letters http are always followed by a colon (:) and two forward slashes (/). The protocol is always embedded with websites which transmits web pages over the internet (world wide). The format used is shown below:



where,

Host : This is the name of the website.

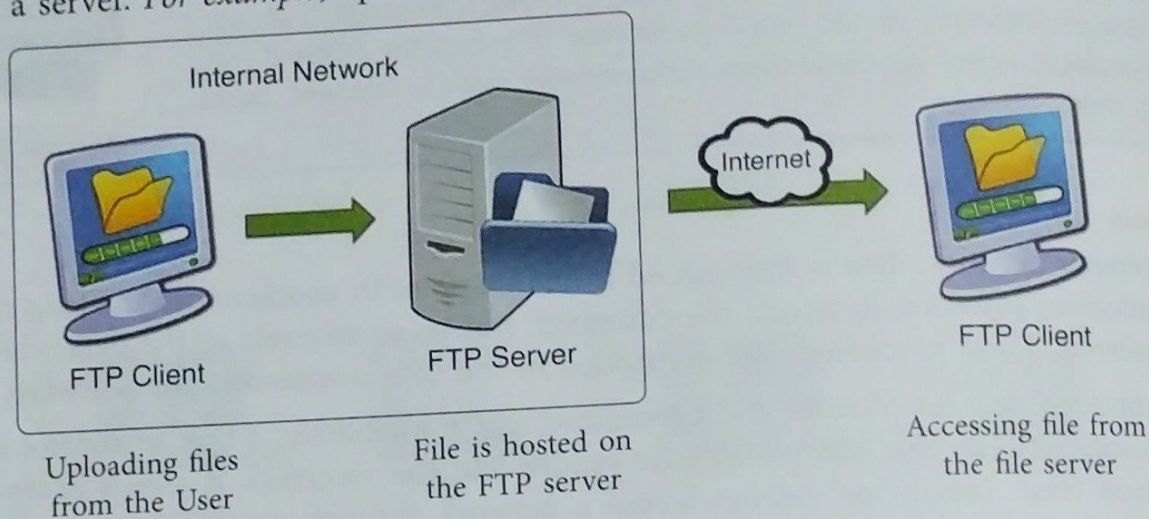
Type : This part of the web address defines the type of the website being referred, e.g.,

.com : commercial sites	.gov : government organisations
.org : non-profit organisations	.edu : educational institutions
.net : large networks	

The host and the type of the site are together called a domain. In the example given above, the domain name is yahoo.com

File Transfer Protocol (FTP)

The File Transfer Protocol (FTP) is a standard internet protocol. It is the simplest way to exchange files between the computers on the internet. FTP works in the same way as the HTTP, to transfer web pages from a server to a user's browser and the Simple Mail Transfer Protocol (SMTP) which transfers email. FTP uses the TCP/IP protocols to enable the data transfer. FTP is commonly used to download a file from a server via the internet or to upload a file to a server. *For example*, uploading a web page file to a server.



A File Transfer Protocol client is a software that establishes a connection between a host computer and a remote server. It facilitates the dual direction transfer of data and files between two computers over an internet connection. Whereas, a FTP server is a computer which has a file transfer protocol address and allows the downloading and uploading of files.

When downloading a file from the internet, you are actually transferring the file to your computer from another computer over the internet. This is why the transfer is referred to as a file transfer and the FTP protocol is used.

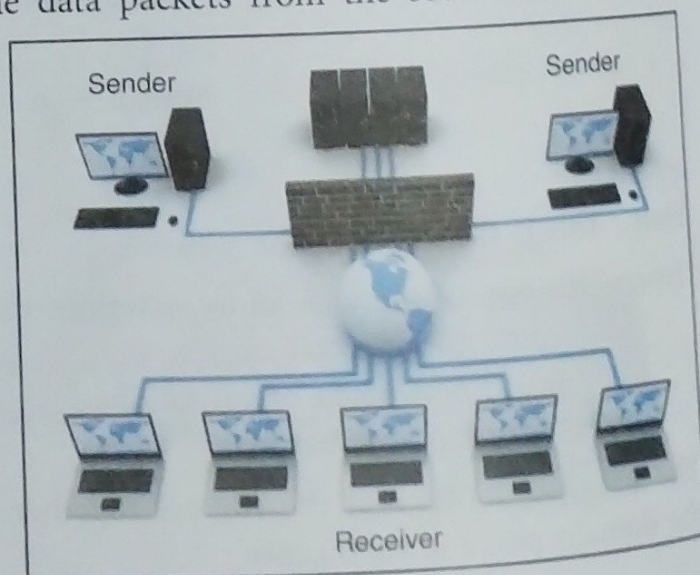
Internet Protocol

An Internet Protocol (IP) is defined as the communication protocol/rules to send digital messages and to exchange the messages (known as data packets) between the computers across a single network or a series of interconnected networks.

The main objective of the IP is to deliver the data packets from the source host (source computer) to the destination host (receiving computer). This is done by using a unique IP address assigned to each and every active recipient on the network.

Transmission Control Protocol

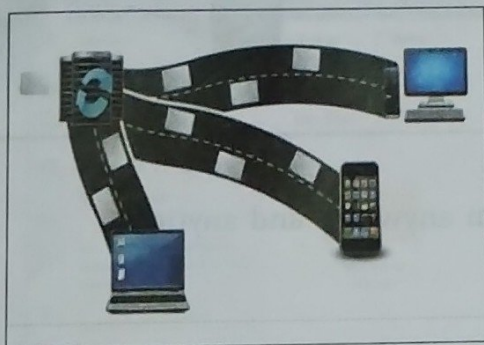
The Transmission Control Protocol (TCP) is a network communication protocol designed to send data packets over the internet. The TCP manages transmission of the message over the network. During transmission, the



messages are broken down into smaller units called packets. These packets are received by the corresponding TCP layer in the receiver and reassembled into the original message. In this communication, TCP works in collaboration with the Internet Protocol which transports and ensures the delivery of the data to the correct destination.

IMAP (Internet Message Access Protocol)

The IMAP is a protocol which is used to store the received mail in the computer of the recipient. The recipient can view the message easily as it is available locally on his/her computer. The message can be copied to a specific file, taken to a suitable platform (*i.e.*, Adobe Reader) and organised to meet the requirements of the recipient.



Knowledge Corner



Server: It is a machine which acts as a bridge between the sender and the receiver.

Recipient: The person who receives the mail is called the recipient.

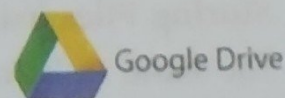
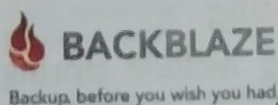
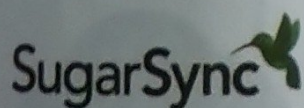
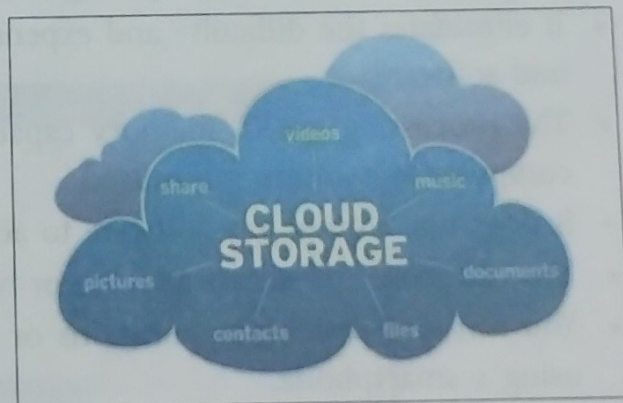
SMTP (Simple Mail Transfer Protocol)

The SMTP is a protocol used to send and receive a mail. It transmits the mail issued from the source computer to the server. It works with the combination of the IMAP. The SMTP transmits a mail to the server whereas the IMAP receives a mail from the server and delivers it to the recipient.



Cloud Storage

The Cloud Storage is a data storage system which allows the users to store the data over the internet. It means that the data stored is available in places other than your drive over the internet. This system, provides you with the options to store and share files, texts or images. However, it can be used only after successful registration with the cloud storage service provider. Some of the Cloud Storage Providers are:



Cloud Computing

When you store data or run programs from the hard drive, it is called *local* storage and computing. Cloud computing means storing and accessing data and programs over the internet using sources other than the hard drive of your system. It is a type of internet-based computing where different services such as servers, storage and applications are delivered to an organisation's computers and devices via the internet. Here, you will find that accessing your data from one or more computers on the local network is faster and easier. However, with an online connection, cloud computing can be done from anywhere and anytime.



Characteristics of Cloud computing

Microsoft, IBM and Google have great contributions in the research and development of cloud technology. Some of the features of cloud computing are listed below:

- The user is able to access information at any time, by logging onto the internet service.
- Information is easily accessible from any place or any location.
- It provides instant monitoring of the resources accessed by the users.
- It allows multiple resource sharing.
- It is a self-service technology where you can compute or store the information without human interaction or intervention.

Advantages of Cloud Computing

The advantages of cloud computing are:

- It eliminates the difficulty and expense of maintaining and upgrading computer hardware and software.
- The processing speed, memory capacity, software applications and the maintenance of a computer system are minimised.
- It does not require any software to access or manipulate any information.
- You can store and access any size or type of file, word process, play games or watch videos.
- You can also develop applications or make scientific calculations just like you do, simply using a smartphone.

Storing Files using Cloud Computing

The basic tasks of cloud computing include storing and sharing of files over the internet with different users. There are many service providers in cloud computing sector such as Google Drive, Dropbox,

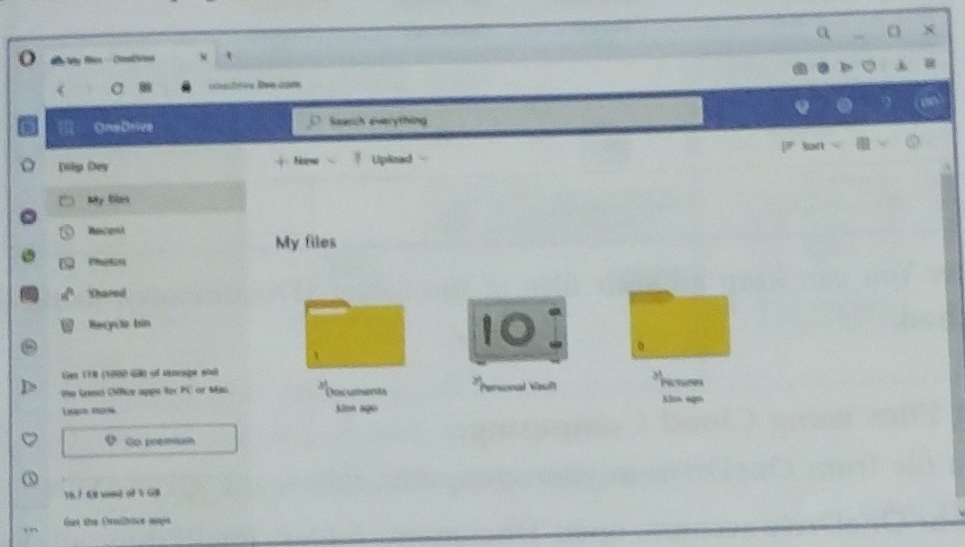


OneDrive, etc. You can choose any of the service providers to store and share files (Word, Excel or PowerPoint files), folders, photos, etc. Here, you will learn about storing (uploading) files using OneDrive.

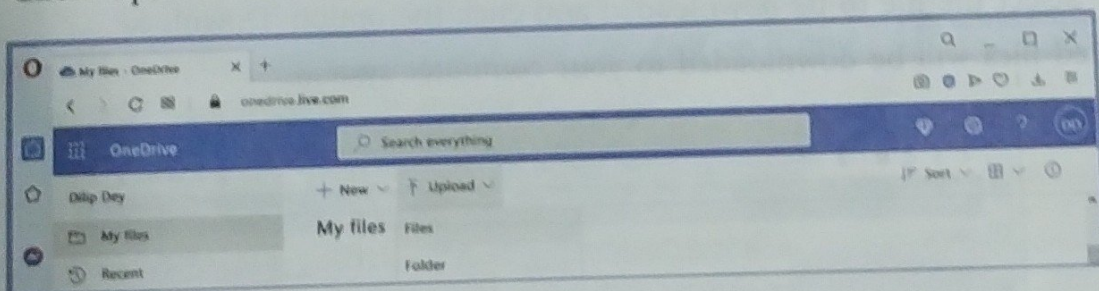
To use OneDrive you need to have an email address. To upload files on your OneDrive account, follow the given steps:

Step 1: Sign in to Microsoft OneDrive account.

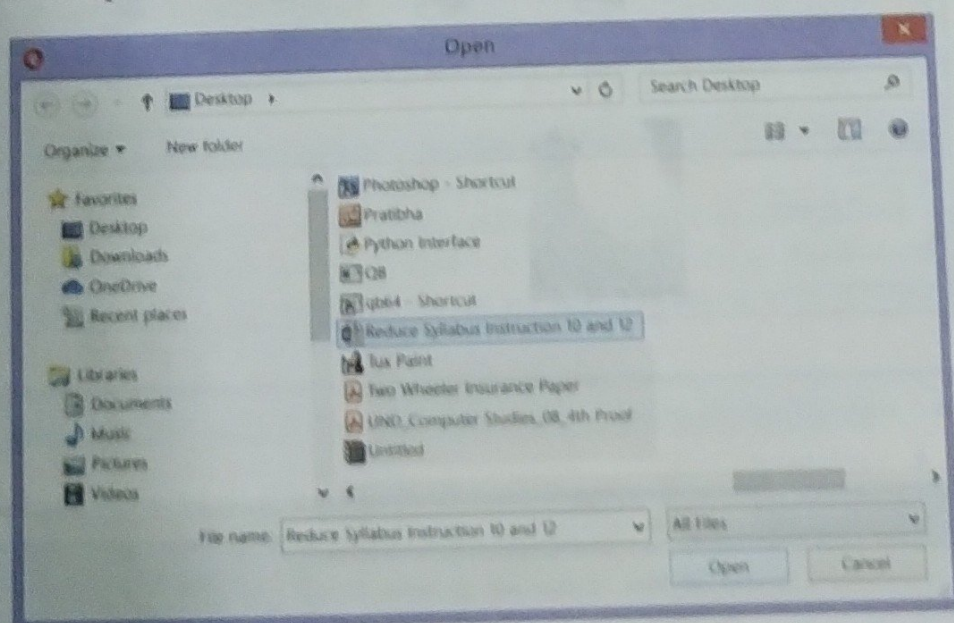
The OneDrive page will open (as shown below).



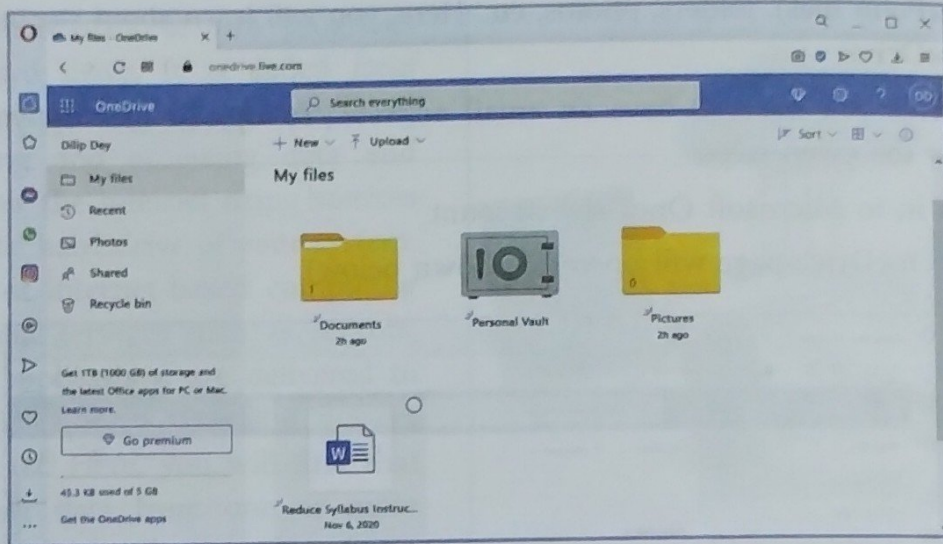
Step 2: Click 'Upload' and then select 'Files' from the dropdown list.



Step 3: The 'Open' dialog box will appear on the screen. Choose the file to be uploaded and click 'Open'.



The selected file will be uploaded on OneDrive under 'My Files' option (as shown below).



Note: You can keep all your files in the folder (Documents), using drag and drop method.

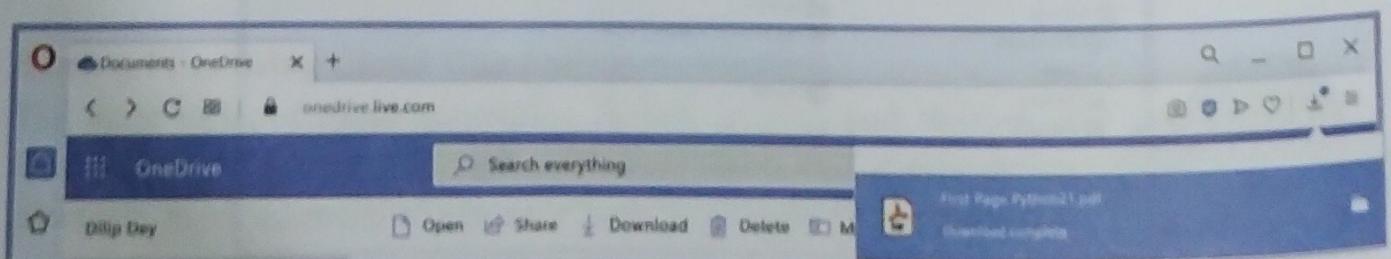
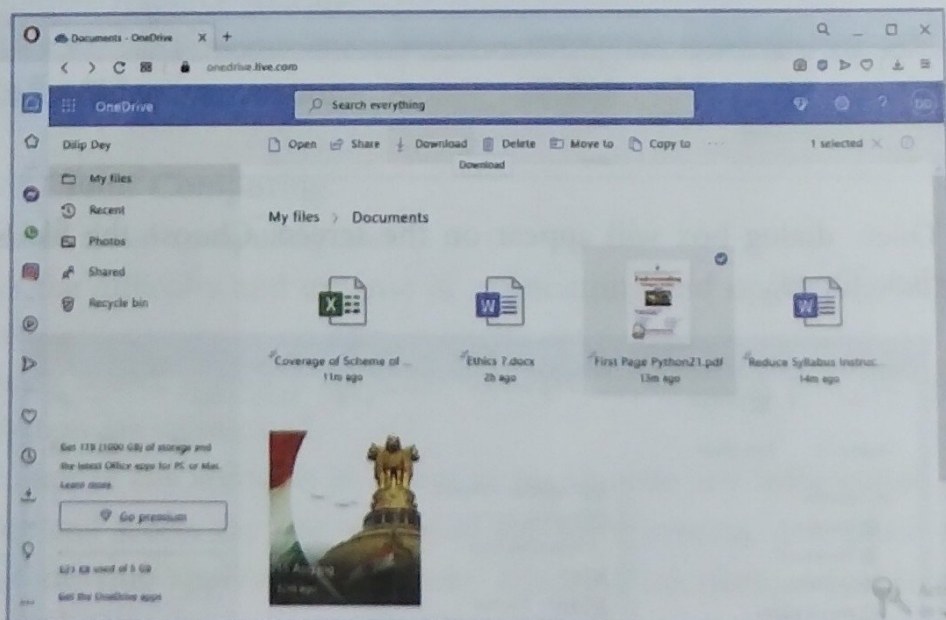
Downloading Files using Cloud Computing

To download a file from OneDrive to your computer, follow the given steps:

Step 1: In your OneDrive account, open 'Documents folder'. It will show all the files available in it.

Step 2: Select the file to be downloaded and click the option 'Download'.

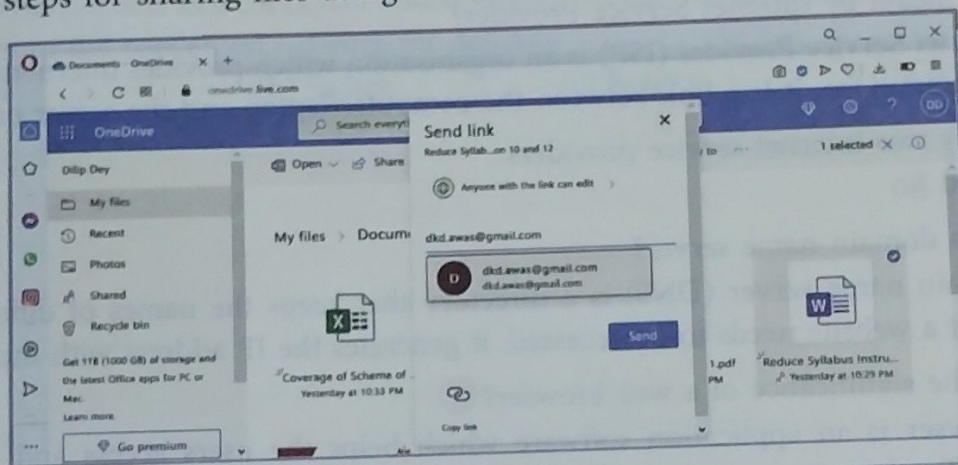
The selected files will be downloaded to your computer system.



Sharing Files using Cloud Computing

Sharing files is the process of using the cloud computing based technologies among different users. It utilises the cloud storage and enables file sharing over the internet among multiple users. The file shared through the cloud storage servers can be accessed at any time over the internet.

Follow these steps for sharing files using OneDrive:

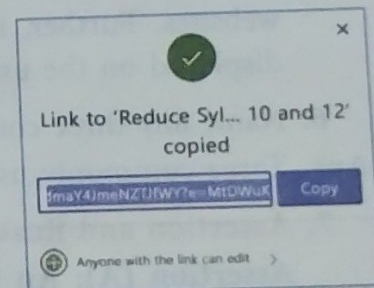


Step 1: Select the file to be shared with other people.

Step 2: Click 'Share' and enter email ID of the recipient.

Step 3: Click on 'Send' button.

You can also copy the link of the selected file and paste wherever you want. To do so, click on 'Copy Link' as shown at the bottom of the above image. It will generate a link and you can click on 'Copy' button as shown in the image given alongside.



Chapter at a Glance

- The internet is a system through which we can access information from any part of the world.
- An intranet is a network to share information or computing services with an organisation.
- DNS is direction of domain names of different websites Domain Name System (DNS) is like a phone book to share phone numbers among friends.
- The File Transfer Protocol is a standard protocol used to exchange files between the computers on internet.
- A web browser is a software that helps the users access and view different websites.
- A website is a set of pages of information on the internet about a particular subject published by a single person or an organisation.
- Hyperlink is the link which when clicked opens another document.
- A modem is of four types—Internal, External, GPS and USB.
- A switch is defined as a collection of various networking components as a single unit.
- A hub is a mode of central distribution which connects multiple devices on the internet.
- Router is a physical networking component which allows communication when a single computer is linked with multiple computers on the internet.
- Bandwidth is the measure of the data transfer on the internet.
- A protocol is a set of rules and procedures which establishes a link to control the data transmission between the two points (the sender and the receiver).
- Some commonly used protocols—HTTP, FTP, TP, TCP, IMAP, SMTP.
- Cloud computing means storing, accessing data and programs over the internet using other storage measures than the hard drive of your system.

REVIEW EXERCISES

1. How will you define intranet?

Ans. It is a computer network which uses the internet protocol technology to share information, operational systems or computing services within an organisation.

2. What is meant by Internet Service Provider?

Ans. An Internet Service Provider (ISP) is an organisation which provides internet services to the users against a fee. It is a link between the computer/laptop and the server on the internet.

3. Name any two internet service providers.

Ans. BSNL and Jio

4. What is a domain name server?

Ans. The domain name server (DNS) is a directory that keeps the names of different websites. Whenever a website needs to be accessed, it generates the IP address with the help of DNS.

5. What is the significance of a web browser?

Ans. Web browser is an application software which helps the users access and view different websites. Further, it contacts the web server and sends a request for information to be displayed on the user's computer screen.

6. Name any three commonly used web browsers.

Ans. Three commonly used web browsers are Microsoft Edge, Google Chrome and Opera.

7. Assertion and Reason based question:

Assertion (A): An Internet Service Provider (ISP) is an organisation which provides the facility of availing internet services against a fee.

Reason (R): It is a link between the computer/laptop and the servers on the internet.

Based on the above discussion, choose an appropriate statement from the options given below:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true and R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.
- (e) Both A and R are false.

Ans. (a) Both A and R are true and R is the correct explanation for A.

8. Case Study based questions:

While accessing internet services, you need primarily a computer system, an internet service provider with a broadband facility (if needed). Apart from these elements, you may also need peripheral devices to extend these services among the users. Some of the peripheral devices are as shown in the box below:

Gateway	Switch	Hub	Router
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Pick a suitable peripheral device from the above box for each of the description given below:

- (a) It is a mode of central distribution that connects multiple devices on the internet. When a user sends a message, it is broadcast to every single device connected on the network.

- (b) It is a collection of various networking components as a single unit that finds the appropriate device to which the message is to be sent.
- (c) The networking component which allows communication when a single computer is linked with multiple computers on the internet. It acts as a traffic controller among the devices connected on the internet.
- (d) This is like a router which provides a path between the computers located in similar networks. It acts as a checkpost which verifies the incoming messages and then forwards them to the concerned network for delivery.

Ans. (a) Hub

(b) Switch

(c) Router

(d) Gateway

EXERCISES

Objective

I. Choose the correct option:

1. Which of the following modems is attached to the internal slot of the motherboard?
(a) USB (b) Internal (c) External (d) Wi-Fi
2. Which of the following components enables communication among multiple computers on a network?
(a) Web browser (b) Web portal (c) Packet (d) Router
3. Which of the following is the measure of the volume of data transferred on the internet?
(a) Path (b) Data (c) Bandwidth (d) Route
4. Which of the following is not a web browser?
(a) Google+ (b) Google Chrome (c) Safari (d) Opera
5. Which of the following links enables the users to navigate from one document to other on clicking?
(a) Superlink (b) Newlink (c) Hyperlink (d) Movelink
6. What does the letter G signify in a GPRS modem?
(a) Google (b) General (c) Gypsum (d) Generic
7. Which of the following allows storage of data over internet?
(a) Air storage (b) Safe storage (c) Free storage (d) Cloud storage

II. Fill in the blanks:

1. means storing and accessing information over the internet from sources other than the hard drive of your system.
2. A is a set of rules and procedures to establish a link between the sender and the receiver.
3. is a computer network that shares information within an organisation.
4. The address of a web page is called a
5. The host and the type of site are together called a
6. is a software which allows the user to access and view different websites.
7. is a document written in Hyper Text Markup Language.
8. is a device that converts an analog signal to a digital signal and vice-versa.

III. Write the full forms of the following:

1. IMAP:
2. DSL :

3. GPRS :
4. URL :
5. USB :
6. ISP :
7. SMTP:
8. HTTP:
9. DNS :
10. TCP :

IV. Assertion and Reason based question:

Assertion (A): A web browser is a software application which helps the users in accessing and viewing different websites.

Reason (R): It contacts the web server and sends a request for information. Then, it receives the information from the server and displays the content on the user's computer screen.

Based on the above discussion, choose an appropriate statement from the options given below:

- (a) Both A and R are true and R is the correct explanation of A.
- (b) Both A and R are true and R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.
- (e) Both A and R are false.

V. Case Study based questions:

Protocol is a set of rules and procedures which establishes a link to control the data transmission between the sender and the receiver. Some of the protocols are given below:

Internet Protocol	Internet Message Access Protocol	Hypertext Transfer Protocol	Transmission Control Protocol
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Identify and name the appropriate protocol for each of the descriptions given below:

- (a) A network communication protocol designed to send data packets over the internet.
- (b) A protocol is used for storing mails in the computer of the recipient.
- (c) A protocol to exchange files between the computers on the internet.
- (d) A set of rules responsible for transferring hypertext document between two or more computers.

Subjective

I. Define the following:

1. Transmission Control Protocol:

2. Hypertext Transfer Protocol:

3. Internet Service Provider:

4. Modem:

5. Router:

6. File Transfer Protocol:

II. Give two differences between the following:

1. Internet and Intranet
2. Hyperlink and Hypertext
3. Internal Modem and External Modem
4. Website and Web Browser

III. Short Answer Questions:

1. What are the advantages of a USB Modem over an External Modem? Explain.
2. What is cloud computing? What are its characteristics?
3. What do you understand by Protocol? Name the different types of protocols.
4. What are the advantages of cloud computing? Explain.
5. What is a web browser? In what ways is it helpful while accessing the internet?
6. Write down all the steps with reference to cloud computing while:
(a) Downloading files
(b) Uploading files



Activity

Group Discussion

Form a group of two and discuss the digitilisation of the world around us. Your discussion should focus on how internet has made a revolutionary change in today's world. The concept of making a digital world has had a great impact on e-commerce, online shopping and go-cashless schemes.

