Internet Technologies
Chapter 1: Introduction to Internet

1.1 Internet

The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (often called TCP/IP, although not all applications use TCP) to serve billions of users worldwide.

It is a *network of networks* that consists of millions of private, public, academic, business, and government networks, of local to global scope, that are linked by a broad array of electronic, wireless and optical networking technologies. The Internet carries an extensive range of information resources and services, such as the inter-linked hypertext documents of the World Wide Web (WWW) and the infrastructure to support email.

1.2 Computer Networks

A computer network is the infrastructure that allows two or more computers (called hosts) to communicate with each other.

Definition

- *A network can be defined as a group of computers and other devices connected in some ways so as to be able to exchange data. -Each of the devices on the network can be thought of as a node; each node has a unique address.*
- *A computer network, often simply referred to as a network, is a collection of hardware components and computers interconnected by communication channels that allow sharing of resources and information.*

The network achieves this by providing a set of rules for communication, called protocols, which should be observed by all participating hosts.

> ***A communications protocol is a set of rules for exchanging information over a network***

The need for a protocol should be obvious: it allows different computers from different vendors and with different operating characteristics to 'speak the same language'.

1.2.1. Properties of Computer Networks:

a) Facilitate communications. Using a network, people can communicate efficiently and easily via email, instant messaging, chat rooms, telephone, video telephone calls, and video conferencing.

b) Permit sharing of files, data, and other types of information. In a network environment, authorized users may access data and information stored on other computers on the network. The capability of providing access to data and information on shared storage devices is an important feature of many networks.

c) Share network and computing resources. In a networked environment, each computer on a network may access and use resources provided by devices on the network, such as printing a document on a shared network printer. Distributed computing uses computing resources across a network to accomplish tasks.

d) May be insecure. A computer network may be used by computer hackers to deploy computer viruses or computer worms on devices connected to the network, or to prevent these devices from normally accessing the network (denial of service).

e) May be difficult to set up. A complex computer network may be difficult to set up. It may also be very costly to set up an effective computer network in a large organization or company.

1.2.3. Why Networks

a) Load Sharing: Both the program and data are transmitted to a remote computer to equalize the load between the two facilities.

b) Message Service: A network can be used to handle interpersonal message transmissions. This type of service can also be used for educational services and conference activities. However, it is not an important motivation for a network of scientific computers.

c) Data Sharing: The program is sent to a remote computer where a large data base exists. This type of operation will be particularly useful where data files are too large to be duplicated economically

d) Program Sharing

e) Remote Service

1.2.4. Network Terminologies

1) Intranet: An intranet is a set of networks, using the Internet Protocol and IP-based tools such as web browsers and file transfer applications, that is under the control of a single administrative entity. That administrative entity closes the intranet to all but specific, authorized users. Most commonly, an intranet is the internal network of an organization. A large intranet will typically have at least one web server to provide users with organizational information.

2) Extranet: An Extranet is a computer network used outside the intranet. An extranet is a computer network that allows controlled access from the outside, for specific business or educational purposes. In a business-to-business context, an extranet can be viewed as an extension of an organization's intranet that is extended to users outside the organization, usually partners, vendors and suppliers, in isolation from all other Internet users.

3) Local area network: A local area Network (LAN) is a network that connects computers and devices in a limited geographical area such as home, school, computer laboratory, office building, or closely positioned group of buildings. Each computer or device on the network is a node.

4) Wide area network: A wide area Network (WAN) is a computer network that covers a large geographic area such as a city, country, or spans even intercontinental distances, using a communications channel that combines many types of media such as telephone lines, cables, and air waves. A WAN often uses transmission facilities provided by common carriers, such as telephone companies.

5) Enterprise private network: An enterprise private network is a network built by an enterprise to interconnect various company sites, e.g., production sites, head offices, remote offices, shops, in order to share computer resources.

6) Virtual private network: A virtual private network (VPN) is a computer network in which some of the links between nodes are carried by open connections or virtual circuits in some larger network (e.g., the Internet) instead of by physical wires. The data link layer protocols of the virtual network are said to be tunneled through the larger network when this is the case. One common application is secure communications through the public Internet, but a VPN need not have explicit security features, such

as authentication or content encryption. VPNs, for example, can be used to separate the traffic of different user communities over an underlying network with strong security features.

1.2.5. Network topology

A network topology is the layout of the interconnections of the nodes of a computer network. Network topology signifies the way in which devices in the network see their logical relations to one another. The use of the term "logical" here is significant. That is, network topology is independent of the "physical" layout of the network. Even if networked computers are physically placed in a linear arrangement, if they are connected via a hub, the network has a Star topology, rather than a bus topology. In this regard the visual and operational characteristics of a network are distinct; the logical network topology is not necessarily the same as the physical layout. Networks may be classified based on the method of data used to convey the data, these include digital and analog networks.

Common layouts are:
1) Bus Network: all nodes are connected to a common medium along this medium.
2) A star network: all nodes are connected to a special central node.
3) A ring network: each node is connected to its left and right neighbour node, such that all nodes are connected and that each node can reach each other node by traversing nodes left- or rightwards.
4) A mesh network: each node is connected to an arbitrary number of neighbours in such a way that there is at least one traversal from any node to any other.
5) A fully connected network: each node is connected to every other node in the network.
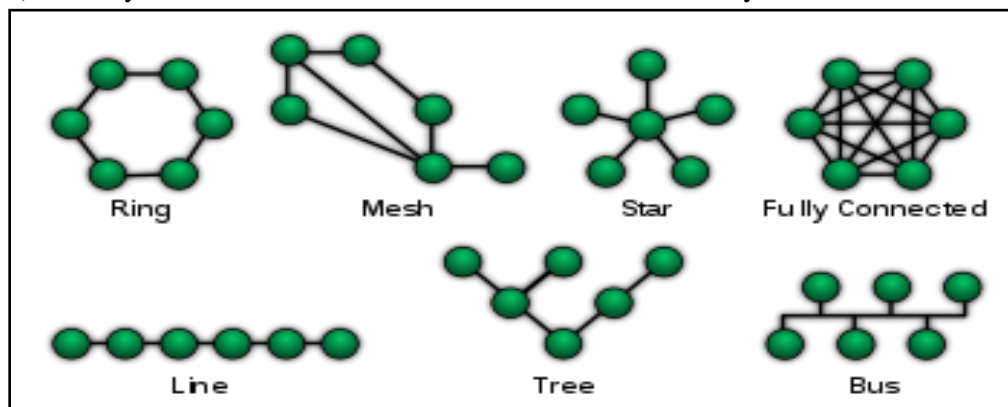
1.3.   History of Internet

In the late 1950's the *Advanced Research Projects Agency (ARPA)* was founded in the United States with the primary focus of developing information technologies that could survive a nuclear attack. (Internet History) In 1967 ARPA university and private sector contractors met with representatives of the Department of Defense to discuss possible protocols for sharing information via computers. In 1969, the U.S. Defence Department funded a project to develop a network, which can withstand the bombing. Basically the idea was to develop a very secure network which can work even after a nuclear attack. This project was known as *ARPANET*. The proposed network was not supposed to have a central control—which would be an obvious target. It connected four sites at the University of California at Los Angeles, the University of California at Santa Barbara, Stanford Research Institute, and the University of Utah. Throughout the 1970's researchers concentrated on developing protocols for

controlling networks, moving messages across a system of networks, and allowing for remote access to the networks. There were computers connected at about two dozen sites when the first email was sent in 1972, but the number of sites and messages soon mushroomed. By 1975 there were 63 sites.

Ten years of research brought Local Area Ethernet Networks (LANs) and workstations were developed to get connected to LAN. These workstations and LANs were then connected to the ARPANET. For next decade the ARPANET grew and its decentralized features helped its rapid expansion. Computers connected to ARPANET used a standard or rule to communicate with each other. This standard used by ARPANET is known as NCP (National Control Protocol). Protocol is a network term used to indicate the standard used by a network for communication. But the passing time and rapid change in information technology suppressed NCP and brought TCP/IP (Transmission Control Protocol/Internet Protocol) in to the world of networking. TCP "converts messages into streams of packets at the source, and they are reassembled back into messages at the destination. IP handles the dispatch of these packets. It handles the addressing, and makes sure that a packet reaches its destination through multiple nodes and even across multiple networks with multiple standards. This flexibility of TCP/IP to handle multiple networks with multiple protocols encourages other networks to get connected to ARPANET. Slowly the ARPANET became a massive network of networks and now it is known as 'Internet'.

The Internet has revolutionized the computer and communications world like nothing before. The invention of the telegraph, telephone, radio, and computer set the stage for this unprecedented integration of capabilities. The Internet is at once a world-wide broadcasting capability, a mechanism for information dissemination, and a medium for collaboration and interaction between individuals and their computers without regard for geographic location. The Internet represents one of the most successful examples of the benefits of sustained investment and commitment to research and development of information infrastructure.

Commercial Development
In 1963 during the early days of computers and six years before ARPANET, students at MIT developed the first computer game called Space War. It would be twenty years before the TCP/IP protocol stimulated the growth of various networks and nearly thirty years (1991) before the United States government opened the Internet to private enterprise (BBN Timeline), but this game foreshadowed the commercialization of the Internet. In the 1970's and 80's people who were online put out information about furniture and cars they wanted to sell. Debates raged about whether this was an appropriate use of the new research tool, the Internet, but when the Commercial Internet Exchange (CIX) was formed in 1991 the genie would not go back in the bottle.

Commercial contractors have been involved in the development of ARPANET from its inception. As Tang and Teflon began as curiosities of the space program and later became common consumer products, so too have email, web research, and home shopping on the Web. It has only been ten years since the first relay between a commercial entity (MCI Mail) and the Internet was made. Since that time technologies have emerged that have fuelled the growth of private enterprise on the Web. In 1992 Paul Linder and Mark McCahill at the University of Minnesota released Gopher, a tool that allowed researchers to retrieve specific data from myriad 8 locations. The next year Mosaic, a web browser, was developed at the University of Illinois by Netscape founder Marc Andreesen, the World Wide Web became a public

domain, and the Pentium processor was introduced by Intel to speed up the whole process. (The Past, Present, and Future of the Internet) As the technology advanced, the Internet became easier to use and the World Wide Web sites became more intricate and inviting. In 1994 shopping malls arrived on the Net. You could order pizza from Pizza Hut online or bank at First Virtual Bank, the first cyberbank. Of course, the advancements came with a downside. Vladimir Levin of Russia became the first publicly known Internet bank robber when he used the Internet to illegally transfer funds to his account

1995 saw the introduction of several emerging technologies such as JAVA and JAVAscript, Virtual Environments, and RealAudio which further enhanced the kind of product information which could be made available to consumers. Commercial users now outnumbered research and academic users by a two to one margin, and Bill Gates decided to redefine Microsoft as an Internet company. (The Past, Present, and Future of the Internet) Today one can shop online for books, food and wine, travel, and real estate. Other business activities include buying stocks and bonds, banking, and retirement planning. Online shopping accounted for over $9 billion in 1997 and is expected to be $30 billion by the year 2000. In light of this growth, the U.S. Commerce Department will begin studying the impact of online shopping on total retail activity. (Commerce Department to Measure Online Sales) Consumer spending via the Internet draws much interest, but business to business activity is also booming.

For further information on the history of the Internet, an extensive list of links may be found at the Internet Society Web site).

1.4. Connecting to the internet
1.4.1. **Requirements for connecting to the internet**
   * **Internet service provider –** an internet service provider provides you with a connection to the internet and the software you will need to navigate.
   * **Telecommunication line** – a telephone line is required to connect you to the internet service provider.
   * **Modem** – a modem converts a digital signal received from a computer into an analogue signal that can be sent along ordinary telephone lines, and back to digital at the other end.
   * **Web browser –** a web browser is software used to view and download Web pages and various types of files such as text, graphics and video. Examples are Microsoft Internet Explorer or Mozilla Firefox, Google Chrome.

1.5.   Services of Internet - E-mail, FTP, Telnet, WWW
But what does one do with the Internet? May be four things, basically: mail, discussion groups, long-distance computing, and file transfers. Internet mail is (e-mail or electronic mail), much faster as compared to normal postal mail. One can also send software and certain forms of compressed digital image as an attachment. News groups or discussion groups facilitate Internet user to join for various kinds of debate, discussion and new sharing. Long-distance computing was an original inspiration for development of ARPANET and does still provide a very useful service on Internet. Programmers can maintain accounts on distant, powerful computers, execute programs. File transfers service allows Internet users to access remote machines and retrieve programs, data or text.

1.5.1. E-Mail (Electronic Mail)

E-mail or Electronic mail is a paperless method of sending messages, notes or letters from one person to another or even many people at the same time via the Internet. E-mail is very fast compared to the normal post. E-mail messages usually take only few seconds to arrive at their destination. One can send messages anytime of the day or night and it will get delivered immediately. You need not to wait for the post office to open and you don't have to get worried about holidays. It works 24 hours a day, seven days a week. What's more, the copy of the message you have sent will be available whenever you want to look at it - even in the middle of the night. You have the privilege of sending something extra even such as a file, graphics, images etc. along with your e-mail. The biggest advantage to using e-mail is that it is cheap, especially when sending messages to other states or countries and at the same time it can be delivered to a number of people around the world.

Although e-mail is faster and cheaper, it has many of the components of regular mail. It allows you to compose note, get the address of the recipient and send it. Once the mail is received and read, it can be forwarded, replied. One can even store it for later use, or delete. In e-mail even the sender can request for delivery receipt and read receipt from the recipient.

a. **Features of E-mail:**
  - One-to-one or one-to-many communications
  - Instant communications
  - Physical presence of recipient is not required
  - Most inexpensive mail service, 24-hours a day and seven days a week
  - Encourages informal communication

b. **Components of an E-mail Address**

As in the case of normal mail system, e-mail is also based upon the concept of a recipient address. The email address provides all of the information required to get a message to the recipient from anywhere in the world. Consider the e-mail ID

john@hotmail.com

In the example above, "john" is the local part, which is the name of a mailbox on the destination computer, where finally the mail will be delivered. Hotmail is the mail server where the mailbox "john" exists, **.**com is the type of organisation on net, which is hosting the mail server.

1.5.2. FTP (File Transfer Protocol)

File Transfer Protocol, is an Internet utility software used to upload and download files. It gives access to directories or folders on remote computers and allows software, data and text files to be transferred between different kinds of computers. FTP works on the basis of same principle as that of Client/Server. FTP "Client" is a program running on the your computer that enables you to talk to, and get stuff from, remote computers. The FTP client takes FTP commands and sends them as requests for information from the remote computer or known as FTP servers. To access remote FTP server it is required but not necessary to have an account in the FTP server. When the FTP client gets connected, FTP server asks for

the identification in-terms of User Login name and password of the FTP client. If one does not have an account in the remote FTP server, still he can connect to the server using anonymous login.

Using anonymous login anyone can login in to a FTP server and can access public file archives, anywhere in the world, without having an account. One can easily Login to the FTP site with the username *anonymous* and e-mail address as password.

The basic objectives of FTP are
- to give flexibility and promote sharing of computer programs, files and data
- to transfer data reliably and more efficiently over network
- to encourage implicit or indirect use of remote computers using Internet
- to shield a user from variations in file storage systems among hosts.

The basic steps in an FTP session are:
- Start up your FTP client; by typing ftp on your system's command line/'C>' prompt (or, if you are in a Windows, double-click on the FTP icon).
- Give the FTP client an address to connect to. This is the FTP server address to which the FTP client will get connected
- Identify yourself to the FTP remote site by giving the Login Name
- Give the remote site a password
- Remote site will verify the Login Name/Password to allow the FTP client to access its files
- Look directory for files in FTP server
- Change Directories if required
- Set the transfer mode (optional);
- Get the file(s) you want; and
- Quit.

1.5.3. Telnet (Remote Computing)
Telnet or remote computing is telecommunication utility software, which uses available telecommunication facility and allows you to become a user on a remote computer. Once you gain access to the remote computer, you can use it for the intended purpose. The TELNET works in a very step by step procedure. The commands typed on the client computer are sent to the local Internet Service Provider (ISP), and then from the ISP to the remote computer that you have gained access. Most of the ISP provides facility to TELNET into your own account from another city and check your e-mail while you are travelling or away on business.

The followings steps are required for a TELNET session
- Start up the TELNET program;
- Give the TELNET program an address to connect to (some really nifty TELNET packages allow you to combine steps 1 and 2 into one simple step!);
- Make a note of what the "escape character" is;
- Log in to the remote computer;
- Set the "terminal emulation;"
- Play around on the remote computer; and

- Quit.

1.5.4. WORLD WIDE WEB (WWW)

WWW is the acronym for the World Wide Web. It is also commonly known as 'The Web'. The WWW is a system that we use to access the Internet. The WWW is hypertext based information retrieval tool, it uses the hypertext to access the various forms of information available on the world's different networks.

One can easily surf the Web by jumping from one document to another using the links in those documents. These documents can be in many formats, such as text, graphics, animation, sound and latest is video. They may also be a combination of all these.

All the information on Internet are presented to the user as a document or more popularly known as Web Page. All these Web Pages are link to each other or even to section within a Web Page. And these links are known as Hyper Links.

1.5.5. Newsgroup/ Usenet Newsgroups New

Newsgroups are much like the public message boards on old bulletin board systems. A Usenet newsgroup is a repository usually within the Usenet system, for messages posted from many users in different locations. Usenet newsgroups, are a similar e-mail conferencing system, but are less intrusive to the subscriber than list-servers since messages are posted to Usenet sites around the world instead of appearing in each subscriber's mailbox. Usenet refers to the huge collection of messages which are posted to tens of thousands of newsgroups worldwide. Millions of people around the world regularly read newsgroup messages, following their favorite topics of interest. New newsgroups are added and old ones deleted every day. Usenet can provide a unique information resource not readily accessible from any other source. If you are looking for personal anecdotes about products, especially computer-related hardware and software products, how-to information, practical advice, or the latest news stories, newsgroup archives may be a valuable resource.

Typically, the newsgroup is focused on a particular topic of interest. Some newsgroups allow the posting of messages on a wide variety of themes, regarding anything a member chooses to discuss as on-topic, while others keep more strictly to their particular subject, frowning on off-topic postings. The news admin (the administrator of a news server) decides how long articles are kept on his server before being expired (deleted). Different servers will have different retention times for the same newsgroup; some may keep articles for as little as one or two weeks, others may hold them for many months. Some admins keep articles in local or technical newsgroups around longer than articles in other newsgroups.

Newsgroups generally come in either of two types, binary or text.

Hierarchies

Newsgroups are often arranged into *hierarchies*, theoretically making it simpler to find related groups. The term *top-level hierarchy* refers to the hierarchy defined by the prefix before the first dot.

The most commonly known hierarchies are the *Usenet hierarchies*. So for instance newsgroup *rec.arts.sf.starwars.games* would be in the *rec.** top-level Usenet hierarchy, where the asterisk (*) is

defined as a wildcard character. There were seven original major hierarchies of Usenet newsgroups, known as the "Big 7":

- *comp.** — Discussion of computer-related topics
- *news.** — Discussion of Usenet itself
- *sci.** — Discussion of scientific subjects
- *rec.** — Discussion of recreational activities (e.g. games and hobbies)
- *soc.** — Socialising and discussion of social issues.
- *talk. ** — Discussion of contentious issues such as religion and politics.
- *misc.** — Miscellaneous discussion—anything which does not fit in the other hierarchies.

1.5.6. Web Conferencing / Video Conferencing

Many institutions are discovering new ways to integrate Internet communications into their organizations. One of the most popular ways is through the use of web or online conferencing.

Defn.: Conducting a conference between two or more participants at different sites by using computer networks to transmit audio and video data. Videoconferencing is the conduct of a videoconference (also known as a video conference or video teleconference) by a set of telecommunication technologies which allow two or more locations to communicate by simultaneous two-way video and audio transmissions. It has also been called 'visual collaboration' and is a type of groupware.

Web/Videoconferencing uses audio and video telecommunications to bring people at different sites together. This can be as simple as a conversation between people in private offices (point-to-point) or involve several (multipoint) sites in large rooms at multiple locations. Besides the audio and visual transmission of meeting activities, allied videoconferencing technologies can be used to share documents and display information on whiteboards.

Web conferencing is currently being used by businesses for employee training, meetings and general communication. Educational institutions are using web conferencing as a way to enhance on-site classes or distance education classes. Web conferencing is a tool which provides a way for "students" to share information, ask questions, get answers, discuss problems and work collaboratively. Conferencing provides opportunities to solve issues by providing a dynamic exchange of text, graphics, HTML links to information, audio, and video in a structured conversation organized by topic. Web conferences may take place in "real-time" where all participants are communicating at the same pre-arranged time.

Components
Codec (coder/decoder)
The core technology used in a videoconferencing system is digital compression of audio and video streams in real time. The hardware or <u>software</u> that performs compression is called a <u>codec</u> (coder/decoder).

The other components required for a videoconferencing system include:
- Video input : video camera or webcam
- Video output: computer monitor, television or projector

- Audio input: microphones, CD/DVD player, cassette player, or any other source of PreAmp audio outlet.
- Audio output: usually loudspeakers associated with the display device or telephone
- Data transfer: analog or digital telephone network, LAN or Internet
- Computer: a data processing unit that ties together the other components, does the compressing and decompressing, and initiates and maintains the data linkage via the network.

There are basically two kinds of videoconferencing systems:

1. **Dedicated systems** have all required components packaged into a single piece of equipment, usually a console with a high quality remote controlled video camera. These cameras can be controlled at a distance to pan left and right, tilt up and down, and zoom. They became known as PTZ cameras. The console contains all electrical interfaces, the control computer, and the software or hardware-based codec. Omni-directional microphones are connected to the console, as well as a TV monitor with loudspeakers and/or a video projector. There are several types of dedicated videoconferencing devices:
    1. Large group videoconferencing are non-portable, large, more expensive devices used for large rooms and auditoriums.
    2. Small group videoconferencing are non-portable or portable, smaller, less expensive devices used for small meeting rooms.
    3. Individual videoconferencing are usually portable devices, meant for single users, have fixed cameras, microphones and loudspeakers integrated into the console.
2. **Desktop systems** are add-ons (hardware boards, usually) to normal PCs, transforming them into videoconferencing devices. A range of different cameras and microphones can be used with the board, which contains the necessary codec and transmission interfaces. Videoconferences carried out via dispersed PCs are also known as e-meetings.

1.5.7. Internet Chat
Communication on the Internet goes even further than personal e-mail, newsgroups and mailing lists, to encompass real-time conversations (synchronous communication) among two or more people. Chat is available on the Internet through Internet Relay Chat or IRC. It consists of thousands of chat channels, each covering a different topic and with participants from all over the world.

Chat rooms
The term **chat room**, or **chatroom**, is primarily used by mass media to describe any form of synchronous conferencing, occasionally even asynchronous conferencing. The term can thus mean any technology ranging from real-time online chat over instant messaging and online forums to fully immersive graphical social environments.

Text-based chat
Online chat is a way of communicating by sending text messages to people in the same chat-room in real-time. Some chat rooms such as Yahoo! use both text and voice simultaneously. The oldest form of chat rooms are the text-based variety.

Graphical multi-user environments

Visual chat rooms add graphics to the chat experience, in either 2D or 3D (employing virtual reality technology).These are characterized by using a graphic representation of the user ([[Avatar (virtualing elements such as games (in particular massively multiplayer online games) and educational material most often developed by individual site owners, who in general are simply more advanced users of the systems. The most popular environments also allow users to create or *build* their own spaces.

Some visual chat rooms also incorporate audio and video communications, so that users may actually see and hear each other.

Chat room activities

The primary use of a chat room is to share information via text with a group of other users. Generally speaking, the ability to converse with multiple people in the same conversation differentiates chat rooms from instant messaging programs, which are more typically designed for one-to-one communication. The users in a particular chat room are generally connected via a shared interest or other similar connection, and chat rooms exist catering for a wide range of subjects. New technology has enabled the use of file sharing and webcams to be included in some programs.

## 1.6.   Ways of Connecting to the Internet

There are various type of connectivity to get hook on to Internet. They all can be broadly classified into following category.

1.6.1.   Broad Band Internet Connection

Definition: The term broadband refers to any type of transmission technique that carries several data channels over a common wire.

a). Gateway Access

Gateway Access is also known as Level-One connection. It is the access to the Internet from a network, which is not on the Internet. The gateway allows the two different types of networks to "talk" to each other. But the users of the Gateway Internet have limited access to the Internet. They might not be able to use all the tools available on Internet. The local Internet Service Provider (ISP) normally defines this limitation.
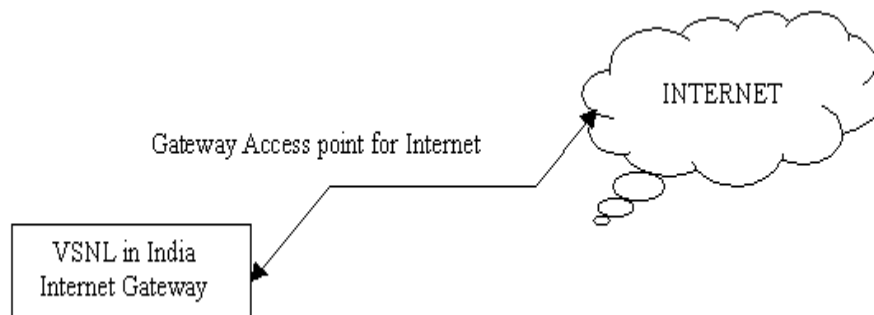
b). Leased Connection
Leased connection is also known as direct Internet access or Level Three connection. It is the secure, dedicated and most expensive, level of Internet connection. With leased connection, your computer is dedicatedly and directly connected to the Internet using high-speed transmission lines. It is on-line twenty-four hours a day, seven days a week. Leased Internet connections are limited to large corporations and universities who could afford the cost.
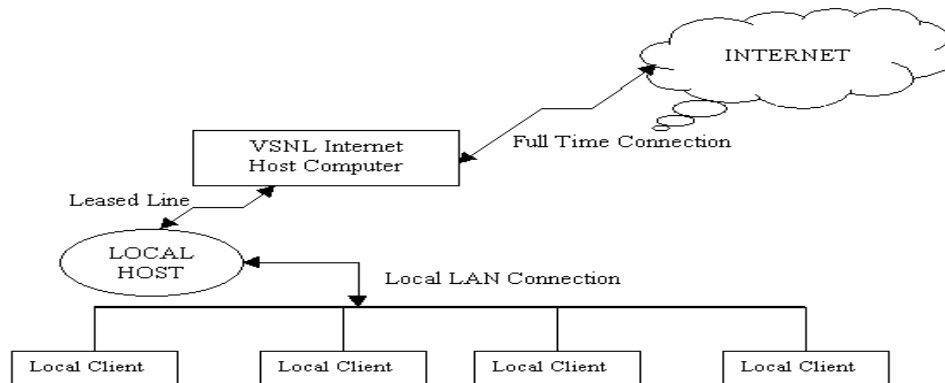
T-1 Lines
T-1 lines are a popular leased line option for businesses connecting to the Internet and for Internet Service Providers (ISPs) connecting to the Internet backbone. It is a dedicated phone connection supporting data rates of 1.544Mbps. A T-1 line actually consists of 24 individual channels, each of which supports 64Kbits per second. Each 64Kbit/second channel can be configured to carry voice or data traffic. Most telephone companies allow you to buy just one or some of these individual channels. This is known as fractional T-1 access.

Bonded T-1
A bonded T-1 is two or more T-1 lines that have been joined (bonded) together to increase bandwidth. Where a single T-1 provides approximately 1.5Mbps, two bonded T1s provide 3Mbps or 46 channels for voice or data. Two bonded T-1s allow you to use the full bandwidth of 3Mbps where two individual T-1s can still only use a maximum of 1.5Mbps at one time. To be bonded the T-1 must run into the same router at the end, meaning they must run to the same ISP.
  * T-1 Lines support speeds of 1.544 Mbps
  * Fractional T-1 speeds are 64 Kbps per channel (up to 1.544 Mbps), depending on number of leased channels.
  * Typical Bonded T-1 (two bonded T-1 lines) speed is around 3 Mbps.

T-3 Lines
T-3 lines are dedicated phone connections supporting data rates of about 43 to 45 Mbps. It too is a popular leased line option. A T-3 line actually consists of 672 individual channels, each of which supports 64 Kbps. T-3 lines are used mainly by Internet Service Providers (ISPs) connecting to the Internet backbone and for the backbone itself.
  * Typical T-3 supports speeds ranging from 43 to 45 Mbps.

c). Digital Subscriber Line (DSL)

Digital Subscriber Line (DSL) is the newest technology being used for Internet access. DSL connects your home or office to the Internet through the same telephone wire that comes from the telephone pole on the street. DSL service, combines separate voice and data channels over a single telephone line. In DSL, voice fills the low end of the frequency spectrum and data fills the high end. Like ISDN, with DSL, user can make and receive telephone calls while connected simultaneously to the Internet.

However, DSL service is limited in the distance that you can be from the provider's point of presence (POP). To use DSL you will need a DSL modem (also called a router), a Network Interface Card (NIC), and a telephone line. DSL is also relatively new technology that is just being introduced in many places. Hardware developers are working with service providers to make the service cost affordable for consumers. As time goes by, the service should become more widely available at a reasonable price.

d). Cable Connection

Through the use of a cable modem you can have a broadband Internet connection that is designed to operate over cable TV lines. Cable Internet works by using TV channel space for data transmission, with certain channels used for downstream transmission, and other channels for upstream transmission. Because the coaxial cable used by cable TV provides much greater bandwidth than telephone lines, a cable modem can be used to achieve extremely fast access.
- Cable speeds range from 512 Kbps to 20 Mbps.

Cable lines offer an extremely high bandwidth connection to the Internet. It divides the connection into lots of bands, and translates the data in the bands into signals that can be carried through cable lines. Cable modems change these signals into IP packets that your computer can understand. To use cable modems you will need a cable splitter, a cable modem, and the service from a cable company.

e). Wireless Internet Connections

Wireless Internet, or wireless broadband is one of the newest Internet connection types. Instead of using telephone or cable networks for your Internet connection, you use radio frequency bands. Wireless Internet provides an always-on connection which can be accessed from anywhere — as long as you geographically within a network coverage area. Wireless access is still considered to be relatively new, and it may be difficult to find a wireless service provider in some areas. It is typically more expensive and mainly available in metropolitan areas.

1.6.2.   Dial-up Connection

Definition: Dial up networking technology provides PCs and other network devices access to a LAN or WAN via standard telephone lines.

'Dial-up' connection is also known as Level Two connection. This provides connection to Internet through a dial-up terminal connection. User's computer connect to the Internet by dialing a phone number (which is provided by your ISP) to connect to the ISP computer that provides the internet access, and connects to the network. The computer, which provides Internet access is known as 'Host' and the computer that receives the access, is 'Client' or 'Terminal'. The client computer uses modem to access a "host" and acts as if it is a terminal directly connected to that host. So this type of connection is also

known as 'Remote Modem Access' connection. And the host to which the client gets connected is actually connected to the Internet by a full time connection (See Leased Connection).
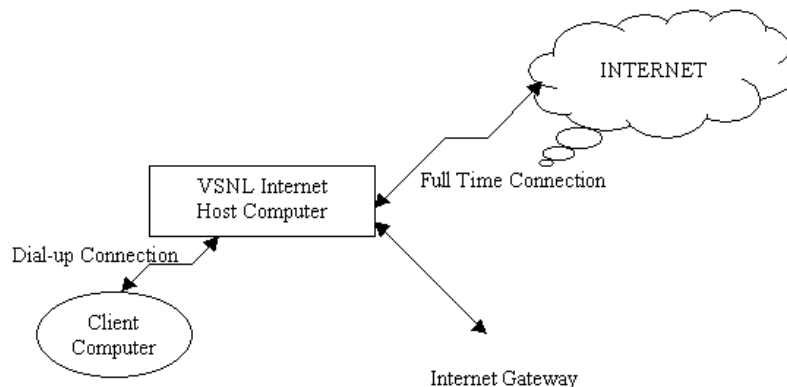
In dial-up connection to Internet, Host carries all the command that are typed on a client machine and forward them to Internet. It also receives the data or information from the Internet on behalf of the 'Client' and passes it to them. The client computer acts as a 'dumb' terminal connected to remote host.

Dial-up is an analog connection because data is sent over an analog, public telephone network. The modem converts received analog data to digital and vise versa. Because dial-up access uses normal telephone lines the quality of the connection is not always good and data rates are limited.

This type of connection can further be divided into three categories.

a). Shell Connection

In this type of Internet Connection, the user will get only textual matter of a Web Page. This connection does not support Graphics display. However the user will be able to surf the Internet, do FTP, receive mail. Shell Accounts were the only type of Internet access available for many years before the Internet entered in to the world of graphics and became more users friendly.

b). TCP/IP Connection

Today's graphical World Wide Web browsers provide easier access with multimedia sound and pictures. The major difference between Shell and TCP/IP account is that, Shell account can only display text and does not support graphics display, whereas TCP/IP can display both. Hence it is more popular Internet connection. Shell accounts are slowly phasing out from the Internet scenario.

c). ISDN

Integrated services digital network (ISDN) is an international communications standard for sending voice, video, and data over digital telephone lines or normal telephone wires. ISDN (Integrated Services Digital Network) offers Internet connectivity at speeds of up to 128 Kbps through the use of digital phone lines. ISDN is a dial-up service that has been provided by telephone companies for many years. This line combines two 64 Kbps channels to offer 128 Kbps band width broken into three bands: one band for the ringing signal of your phone, one band for your telephone conversation, and one band for data.

1.6.3. Satellite Internet

Satellite Internet is a form of high-speed Internet service. Satellite Internet services utilize telecommunications satellites in Earth orbit to provide Internet access to consumers. Internet over Satellite (IoS) allows a user to access the Internet via a satellite that orbits the earth. A satellite is placed at a static point above the earth's surface, in a fixed position. Because of the enormous distances signals must travel from the earth up to the satellite and back again, IoS is slightly slower than high-speed terrestrial connections over copper or fiber optic cables.

Satellite Internet service covers areas where DSL and cable access is unavailable. Satellite offers less network bandwidth compared to DSL or cable,

- Typical Internet over Satellite connection speeds (standard IP services) average around 492 up to 512 Kbps.

Review Questions

1. State whether the following statements are True or False.
    a. WWW is the acronym for the World Wide Web.
    b. In TCP/IP connection, the user will get only textual matter of a Web Page.
    c. Gateway Access is also known as Level-One connection.
    d. Good example of network with Level One connectivity within India is that of VSNL
    e. E-mail is known as URL (Uniform Resource Locator).
    f. Leased connection is also known as direct Internet access or Level Three connection.
    g. Explain in brief the concept of e-mail.
2. What are the basic objectives of FTP?
3. What is the difference between Leased connection and Dialup connection?
4. Explain in brief
    a) TCP/IP connection
    b) Telnet
    c) Gateway Access
    d) Shell connection
5. Explain in brief the working principle of cable modem connection.
6. How does a search engine gets the required information from the web? Write the names of 2 popular search engines.
7. Explain the following terms.
    a). DSL   b) ISDN