UNIT 5   INTERNET CONNECTIVITY AND PROTOCOLS

Structure

5.0   OBJECTIVES

After reading this Unit, you will be able to:

- know the commonly used Internet protocols;

- features of various Internet protocols;

- learn the different ways of accessing Internet; and

- learn the differences between various ways of accessing Internet.

5.1 INTRODUCTION

In this unit, we shall discuss the concepts related to protocols with a special focus on Internet protocols. Protocols are very important in Internet world – so that networks using different hardware and software configuration can communicate and transmit data to each other.

Moreover, different clients use a network for different purpose such as e-mailing, web surfing, telnet, file transfer, etc. While the usage of a network may differ from user to user, all kinds of usage involve transmission of data. In every case, data is being transmitted from client to server and vice versa. Depending on the nature of the transmission, the protocol will be applied to data at the client side for appropriate presentation at the server end. There are a specific set of protocols pertaining to Internet which are discussed in this Unit.

Another topic for discussion in this Unit is the way to access Internet. People may be in need of Internet access when they are in office, home or on the way. The importance associated with the place where they intend to access Internet determines the way they need to access Internet. If they are in a vehicle, then they can access Internet from their mobile phone/laptop. At home they can access Internet from their home PC. In office, they can access Internet through their machine which is part of an office LAN. Of course, there are other ways of accessing Internet. In this unit, different ways of accessing the Internet is given along with illustrations wherever possible.

5.2 INTERNET PROTOCOLS

A **protocol** is the structure in which data is transmitted between two devices. The structure may vary from a set of devices to another set of devices for the data that is transmitted among themselves.

The following issues are directly associated with the protocol between the devices:

● What is the procedure that is to be followed to check the errors in the message.

● Is the message going to be compressed during transmission? If yes, what is the method that will be adopted?

● How does the receiver know that the message is received completely? (That is, the way to find the end of the message.)

● How will the receiver acknowledge to the sender that the former has received the message?

There are a number of protocols in existence. The protocols that are to be used are totally dependent on the computers that communicate with each other. In this unit, we shall focus on only those protocols that are related to the Internet.

There are some protocols which transmit the message/data in the form of packets. The message is divided into packets and these packets are then transmitted from the source to the destination. It is not essential that all the

packets travel in the form of a convoy from the source to the destination. Each packet may follow it's own route from source to the destination. Once, all the packets are received at the destination, the computer will recompile them into the original message.

Any computer that is connected to the Internet has an address. This address is called an *IP address*. IP address is made up of 32 bits. It is denoted by four numbers which are separated by periods. An example of IP address is 190.10.30.16.

A *modem* is a device that converts digital data to analog form and analog data to digital form.

5.2.1 TCP/IP : Transmission Control Protocol/ Internet Protocol

TCP/IP stands for *Transmission Control Protocol/ Internet Protocol*. TCP/IP is not a single protocol but is a set of communication protocols that are used to connect computers that have data to be transmitted over the Internet. Every machine on Internet transmits data. The client machine transmit queries, servers transmit answers.

TCP

A TCP connects the destination and source machines on the Internet. This enables both of them to transmit data between each other. The following are the advantages of TCP:

- The message is definitely delivered from the source to the destination

- The packets that make up the message are delivered in the same order to the destination as they are transmitted from the source.

IP

This protocol specifies the structure of the packet. That is, the place from where the data starts and where it ends inside the packet. Also, it is this protocol which specifies the position of this packet in the set of packets that form the message so that it can be used during the time of recompilation at the destination. The packets are also called *datagrams*. IP also specifies the addressing scheme for the packets. Several versions of IP are released since it's inception. The current version is IPv6.

When a computer (source) wants to send message/data to another computer (destination), then the source specifies the address of the destination and confirms that the message/data is to be sent. Then, IP comes into action. It splits the data into packets and specifies the addressing scheme. Once IP has done its job, TCP comes into action. It establishes a connection between the source and destination so that the packets can be transmitted between them. It is not necessary that only source sends data to destination. Once the communication starts, destination is also permitted to communicate with the source over the same connection. TCP also ensures that all the datagrams (packets) reach the destination and vice-versa. Also, it ensures that the order of receipt of packets at source/destination is the same as they are transmitted by the source/destination.

So, it is both TCP and IP which lead to communication between the source and destination. TCP/IP is the default standard for Internet based communication. Almost, all the network operating systems support them. That is the primary reason for Internet being a network of machines that are based on different operating systems. Needless to say, TCP/IP uses packet switching technology. The alternative is circuit switching technology in which the message/data travels along a fixed line from source to destination and the destination receives data in the same order in which it is sent from the source.

5.2.2   SLIP : Serial Line Internet Protocol

SLIP stands for *Serial Line Internet Protocol*. This is a protocol that is used to connect to Internet through telephone lines. So, if the Internet connection is a Dial-up connection, this protocol can be used. But, SLIP is a older protocol and very few Internet service providers are using it. It was developed when the speed of connection was around 2kbps. SLIP transmits data over serial lines. That is, data is transmitted one bit at a time which is time consuming.

5.2.3   PPP : Point to Point Protocol

PPP stands for *Point to Point Protocol*. This is another protocol that is used to connect to Internet through telephone lines. This is the protocol that is being used by most of the ISPs (Internet Service Providers) for dial-up access to Internet. This is a protocol that works comfortably with the speeds that even exceed 64kbps. It supports error detection (That is, any error that creeps in during the transmission of the message between the source/destination can be detected) and data compression. The packets that are generated by TCP/IP are sent by PPP to a server that in turn places these packets on the Internet.

5.2.4   FTP : File Transfer Protocol

FTP stands for *File Transfer Protocol*. This is the protocol that is used to upload/download files to/from the Internet. When files are to be exchanged between source/destination, FTP comes into action. FTP uses TCP/IP to enable the transfer of data between source/destination. Whenever a website is to be hosted, web pages are uploaded to the concerned web server. It is the FTP which enables the uploading of files.

5.2.5   HTTP : Hyper Text Transfer Protocol

HTTP stands for *Hyper Text Transfer Protocol*. This is the protocol that is used to transfer web pages between web browser and web server. HTTP does a wide variety of tasks. The way the data/message is to be formatted is specified by HTTP. The way the data/message is to be transmitted is also specified by HTTP. Whenever data is transmitted between web browser and web server, both browser and server need to respond to the commands of each other. The nature of response is also defined by HTTP. When you need to go to a particular website, it is the home page which is usually loaded into your browser. So, when you type the website address/URL in the location bar of the browser and press ENTER, or click at "go", it is the HTTP which guides the web server about the web page that is to be sent to the browser in response to the URL.

In the case of HTTP, both Browser and Web server will not be aware of the commands that are executed by themselves prior to the current command. This shows the statelessness of HTTP. This is one of the reasons for the existence of static websites. In the case of static websites, only web pages are transferred between the browser and the server depending on the URL entered or depending on the buttons/links clicked on the web page, but, the web pages cannot be interactive and are not dynamic. They cannot react to the user's data which is fed into a web page. Such reaction is possible in the case of dynamic web pages. Java script, Java, Cookies, Active-X, Php script, servlets and applets are used for generating dynamic web pages.

5.2.6   HTTPS : Secure HTTP

HTTPS stands for *Secure HTTP*. Whenever message/data is to be sent securely, HTTPS is used. It does not mean that whatever data is sent between browser/ server is secure. Only a particular message/data is secure when HTTPS is enabled during it's transmission. An analogy of such security is personal security guard for VIPs. So, irrespective of the number of people travelling through a particular route, only the VIP is provided security, and not every one who travels along that route.

5.2.7   SSL : Secure Sockets Layer

SSL stands for *Secure Sockets Layer*. SSL creates a connection between the client and server that is secure. This enables the transfer of *any* amount of data between source/destination. HTTPS and SSL are complementary to each other. Usually, websites which deals with the transfer of sensitive information such as credit card numbers, etc. use SSL. The URLs that require an SSL connection, start with *https://* instead of *http://*.

5.2.8   SMTP : Simple Mail Transfer Protocol

It stands for *Simple Mail Transfer Protocol*. Whenever an e-mail message is sent, it is SMTP which transfers this message to the destination.

5.2.9   TELNET

It is often the case that people go out of their offices and realise that they need to access the server available on their office LAN. Usually, they access their server from their terminal in the office. Now, since they are away from office, they cannot login to their server from their terminal. For them to login to their server, they need a machine which exactly behaves like terminal in their office. TELNET enables this task. It is a program which enables a machine to behave like the server to which you login. So, using TELNET, you can login to the server of your office, which you otherwise do from your terminal in the office. Now, you can execute commands from the terminal on which TELNET is running on the server without realising the fact that you are away from your office. TELNET enables you to logon to your office LAN and do work as you are doing while sitting in your office and accessing the LAN from a terminal which is connected to the LAN.

5.2.10   NNTP : Network News Transfer Protocol

It stands for *Network News Transfer Protocol*. USENET is a bulletin board

system on the Internet. Anyone who registers with USENET can access the bulletin board, post to it as well as receive the information that is added to the bulletin board through e-mail automatically. NNTP is used to access, post and receive information from the USENET.

5.2.11   WAP : Wireless Application Protocol

It stands for *Wireless Application Protocol*. It is used by wireless devices such as mobile phones, PDAs , etc. to access Internet. So, any person having a mobile phone which is WAP enabled can access the websites by connecting to Internet from his/her mobile phone.

5.2.12   ICMP : Internet Control Message Protocol

It stands for *Internet Control Message Protocol*. It is an extension of Internet Protocol (IP). Any packet which consists of error messages/control information/ any other information is supported by ICMP. For example, a PING command uses ICMP. PING is used to find the accessibility of an IP address.

5.2.13   IGMP : Internet Group Management Protocol

It stands for *Internet Group Management Protocol. IP multicasting* refers to the ability of a server to broadcast a message to a number of destinations at a time. IGMP is the standard for IP multicasting over the Internet. IGMP enables a single set of packets to be transmitted from a source to a number of destinations. Conventionally, when a message is addressed to more than one recipient, one set of packets is transmitted to each recipient separately. So, if you address ten recipients, ten sets of packets are transmitted from the source to all the ten recipients at a rate of one set of packets per recipient. But, IGMP enables just one set of packets to reach all the ten recipients.

5.2.14   IMAP : Internet Message Access Protocol

It stands for *Internet Message Access Protocol*. It is used to retrieve e-mail messages. The latest version of IMAP is IMAPv4.0. The latest version has some additional features such as enabling the user to retrieve only those e-mail messages which consist of specific keyword(s).

Self Check Exercise

1) Fill in the blanks.

   a) A _____ is the structure in which data is transmitted between two devices.

   b) A _____ is a device that converts digital data to analog form and analog data to digital form.

   c) In TCP, the packets that make up the message are delivered in the _____ to the destination as they are transmitted from the source.

   d) _____ creates a connection between the client and server that is secure.

   e) _____ refers to the ability of a server to broadcast a message to a number of destinations at a time.

   f) WAP stands for _____.

5.3   INTERNET CONNECTIVITY

There are different ways of accessing Internet. The way one accesses Internet directly depends on the infrastructure they possess at hand. A person who does not have a machine at his/her home or office may access Internet from a cyber café. A person who has a machine at his/her home may access Internet through a telephone line (Dial up connection) or cable (if s/he has). Apart from the above mentioned ways of accessing Internet from home, a person can also access Internet through his/her mobile phone (if it is WAP enabled). In case, they have a machine at their office and if the office is having a leased line for Internet, then they can access Internet from their office (of course, it depends on the System Administrator who enables access to Internet through various machines).

Now, let us elaborate on various methods connecting to Internet as mentioned above.

5.3.1   Dial-up Connection from a PC

If you have a telephone connection and a PC with modem, then the most popular way of accessing Internet is through a Dial-up connection from your PC. The digital data from the computer is converted by the modem to analog form and is passed on to the telephone line. At the other end, another modem is used which converts the analog data received to digital form and then passes onto the receiving machine. Essentially, what you do is that you open the dialer software (this is usually a part of your operating system) and click on the *connect* button (this button may vary from dialer to dialer.). Then, you will see your computer dialling the telephone number of your ISP (VSNL, MTNL, SIFY, DISHNET are some of the Internet Service Providers (ISPs) operating in India). Once the connection is established, you may be requested to enter user name and password, or you may supply the same in the window of the dialer before starting the process of dialing the ISP. After verification of user name and password, your PC is logged on to the Internet and you can start browsing the Internet.

The following are the requirements to access the Internet through a dial-up connection:

- A modem
- TCP software
- Internet account from an ISP
- Dialler software to connect to ISP
- Browser

Accessing Internet through dial-up connection is most popular among the users who access Internet from home.

The following are various steps that are to be followed to access Internet through dial-up connection:

Step 1: Open the dialler software (Refer to Figure 5.1)

Fig. 5.1: Dial-up Icon

Step 2: Enter user name and password. Then click on *Connect* button in the Connect To Dialog Box (as shown in Fig. 5.2).
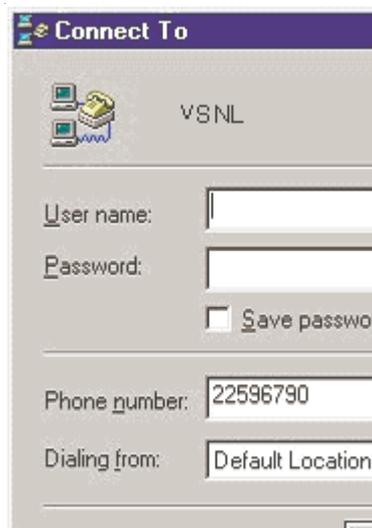

Fig. 5.2: Connect to Dialog Box

Fig. 5.3 depicts the PC dialling the number of the server of the Internet Service Provider (ISP)

Fig. 5.3: Dialog Box showing the Dialling Process

Fig. 5.4 depicts the verification of user name and password at the server end.

Fig.5.4: Dialog Box showing Verification of the User Name and Password

Fig. 5.4 depicts the PC logging onto the Internet.

Fig. 5.4: Dialog Box showing the Logging in Process

Once successfully logged into the Internet the connection complete Dialog Box appears as shown in Fig.5.5.
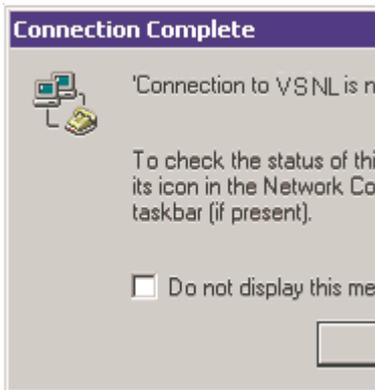
Fig. 5.5: Connection Complete Dialog-Box

If you are successfully connected, a little computer screen icon appears on the right hand side of the of Windows task bar that looks like the one shown in Fig. 5.6:

Fig. 5.6: Computer Screen Icon

This flashes with sent and received data indicating that the link is active. When you double-click on this icon, you will see a dialog box as shown in Fig. 5.7:

Fig. 5.7: Connected to Dialog Box

Step 3:   After logging onto the Internet, click on the browser button to start browsing.

It is important to set the Internet options for your PC before trying to access Internet by applying the above steps.

In very small organisations, Internet is accessed through a Dial-up connection from a single PC. The access speeds vary from 2400 bps to 56000 bps. Higher speeds are possible if ISDN connection is possible. ISDN (Integrated Services

Digital Network) is a technology that is designed for the existing telephone lines which enable them to handle higher data rates. ISDN can be implemented by installing the requisite processing equipment.

One of the most common ways of accessing Internet for the customers who do not have access at their home or office is to go to a cyber café. Most of the cyber cafés have LAN and customers can access Internet through nodes. The server (which is equipped with a modem) of the LAN is connected to Internet through dial-up connection. As long as the server is connected to the Internet, customers can access Internet through nodes connected to the Server. Customers are usually charged on hourly basis.

5.3.2 Accessing Internet through Leased Line

Usually, corporate offices access Internet through leased lines. A leased line is a dedicated communication channel which connects the company to the ISP. The significance of this mode of accessing Internet is that the company is *always* connected to Internet. It does not have to dial to the ISP as and when access is required. In other words, company and ISP are connected through hot line. The expenses involved for the user in accessing Internet through leased line are higher when compared to dial-up access, but the speeds are also higher. They vary from 56 kbps to 10 mbps. Different ISPs have different schemes of billing the customers for the leased lines. Some ISPs charge the user based on the volume of traffic. It means that your bill is directly proportional to the use of Internet. More you access, more you are billed. Some ISPs have a fixed charge per annum.

Employees of corporate sector access Internet through their nodes. A group of nodes are connected to a hub or a switch. For example, if an organisation is having three separate buildings as part of its office, then one probability is that each building will have a hub/switch and all nodes of that building are connected to that hub/switch. The hub or switch is in turn connected to the router and the router is in turn connected to the leased line (a telephone line which is dedicated to the organisation) for accessing Internet. A radio link is also a form of leased line wherein a radio antennae is used to establish virtual connection between a corporate office and an ISP. Several ISPs support radio link.

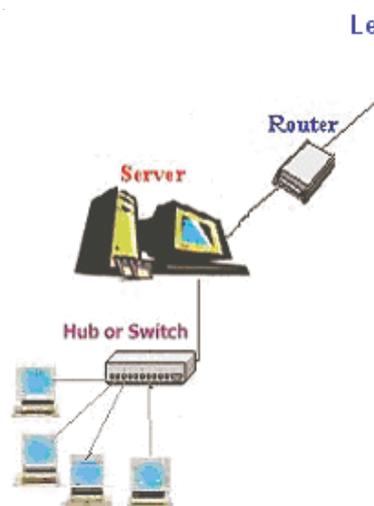Figure 5.8 depicts the connection to Internet through a leased line.

Fig. 5.8: Connecting to Internet through Leased line

5.3.3 Connecting to Internet through a Mobile Phone

Internet can be accessed through a Mobile phone which is WAP enabled. Here, a Mobile phone could be any WAP enabled device such as PDA, Laptop etc. When you click on the appropriate menu item in your mobile phone, then the WAP enabled device (a mobile phone in this case) contacts the concerned base station. In turn, the request is transmitted to a WAP gateway. A WAP enabled device can only access web pages which are developed using WML (Wireless Markup Language). But, web servers have web pages which are written using HTML. So, a filter is used for conversion from HTML to WML and vice-versa. The WAP gateway contacts the filter which converts the input WML request into HTML and contacts the appropriate web server. The web server transmits the response to the filter which converts the input HTML page to WML page, thus making it compatible to WAP enabled device. The other way for WAP enabled device to access web pages which are developed using WML directly is to contact the web server through the WAP gateway.

Figure 5.9 depicts the communication between a WAP enabled device and a web server.
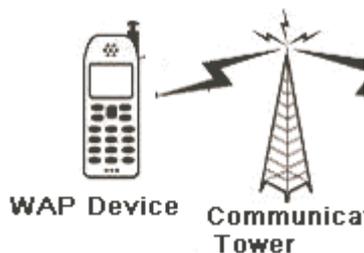

Fig. 5.9: WAP device connecting to the Web Server

5.3.4 Connecting to Internet through Cable Network

Cable television has become as popular as radio now-a-days. Almost, every person is having access to cable television and most of the households have cable connections. Internet can also be accessed through the cable that brings TV channels to our homes using a cable modem. To access Internet through a cable, there is a need for a cable modem. Cable modem acts as an interface between the computer and the cable. Cable modem separates digital and analog signals travelling on the cable and enables a PC to send and receive data using coaxial cable on the same frequencies used by the cable TV channels. The primary advantage of cable is the large bandwidth it offers. ISDN and DSL cannot match the bandwidth and speed offered by the cable. PSTN (dial-up) offers maximum of 56 kbps, ISDN offers a maximum of 128 kbps whereas cable starts with 64 kbps and can go upto 38 Mbps. Internet through cable is therefore, suitable for downloading multimedia such as movies, animation, etc.

The Internet through cable uses the existing cable that already connects TV in our home. This cable is capable of carrying both video signals and data signals at the same time. Neither television nor data signals are affected by simultaneous use. Internet through cable is right solution for bandwidth intensive applications and corporate customers. Though cable has immense potentials as an access technology, it has a long way to go in terms of infrastructure, quality of service, cost factor, security, etc. Siti Cable, Ice Network Pvt. Ltd., Innomedia

Technologies Pvt. Ltd., Mantra Online, BPL, Aptech Internet Ltd. and Zeenext offer Internet through cable TV in India.

Self Check Exercise

2) Fill in the blanks:

a) Accessing Internet through _____ is most popular among the users who access Internet from home.

b) A _____ is a dedicated communications channel which connects the company to the ISP.

c) A WAP enabled device can only access web pages which are developed using _____.

d) Fibre enables higher _____.

5.4 SUMMARY

In this unit we discussed about internet protocols and various ways of accessing the internet. A large number of protocols exist and some of these protocols which are related to the internet are TCP/IP, SLIP, PPP, FTP, HTTP, HTTPS, SSL, SMTP, TELNET, NNTP, WAP, ICMP IGMP, IMAP. We discussed all these protocols in this unit. There are a number of ways to connect to the Internet, ranging from leased-line connections to dial-up services. The leased-line connection is the traditional and most common method of accessing the Internet. It involves establishing a permanent link between a local network and the Internet. A leased line provides point-to-point-or machine-to-machine telecommunications. SLIP (Serial Line Internet Protocol), and the newer PPP (Point- to-Point Protocol) are protocols that support TCP/IP connections over standard telephone lines. Like a leased connection, SLIP/PPP allows the user's computer to be part of the Internet but only for the duration of the telephone call. Dial-up connections are established through a modem and phone line.

Users dial-up an Internet host, login with a password. The dial-up method has the advantages of simplicity and low cost, but there are limitations. First of all, only a subset of all Internet services may be available, depending on those the particular service provider chooses to mount on its Internet host machine. Second, users will likely be limited in the amount of disk space they can use to store e-mail etc. New connection options are now available which allow for greater speeds and flexibility, while keeping costs to a minimum. Some of these newer connection options are **Cable Internet, Satellite connections, Integrated Services Digital Network (ISDN), wireless etc. Cable Internet** systems allow your computer to connect to the Internet through the same cable that carries your TV signal. An ISDN line is a type of digital phone line that can transmit data many times faster than a conventional modem and phone line. Mobile phones also allow the option of accessing the internet as discussed in this Unit. Internet files can be downloaded via a satellite connection.

5.5 KEYWORDS

Analog	:	A transmission mode in which data is represented by a continuously varying electrical signal.

Bandwidth	:	The amount of data that can be sent from one computer to another through a particular connection in a certain amount of time.
Browser	:	An application program that is used to connect to sites on the World Wide Web.
Client	:	A software program that is used to contact and obtain data from a Server software program on another computer, often across a great distance.
Client	:	A program, such as a Web browser, that connects to a centralised server program and obtains information from it.
Digital	:	Digital refers to the way information is stored, in the language used by computers, as a string of separate bits that represent on/off states i.e. as a series of 0s and 1s, or binary digits.
Leased line	:	Refers to a phone line that is rented for exclusive 24 hour, 7 days a week use from your location to another location.
Modem	:	Short for Modulator/de-modulator. A hardware device that allows a computer to transmit and receive information over telephone lines. A modem converts digital data from computers into analog data that can be transmitted over the telephone lines.
Protocol	:	A set of standards used by computers to communicate and exchange information with each other.
Server	:	A piece of software or machine that acts as a centralised source of information or computing resources (such as Web sites, Gopher menus, FTP archives, and so on), available to clients.
Server	:	A Server is a computer, or a software application that provides a specific kind of service to client software running on other computers.
URL	:	Stands for Universal Resource Locator and means an Internet address expressed in a form that any Web browser can understand.
Web browser	:	Software program that allows you to access Web pages on the World Wide Web

Examples of browsers include: Internet Explorer, and Netscape Navigator.

Web server : A computer that stores Web documents and makes them available to the rest of the world.

5.6 ANSWERS TO SELF CHECK EXERCISES

1) a) Protocol

   b) Modem

   c) same

   d) SSL

   e) IP Multicasting

   f) Wireless Application Protocol

2) a) dial-up connection

   b) leased line

   c) Wireless Markup Language

   d) bandwidth

5.7 REFERENCES AND FURTHER READING

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