

10.10 NETWORK PROTOCOLS

A *protocol* means the rules that are applicable for a network. Protocol defines standardized formats for data packets, techniques for detecting and correcting errors and so on.

To understand the concept of a communication protocol, let us assume that *A* and *B* need to talk to one another. They want to exchange their ideas. But it turns out that, both, *A* and *B* are egoists. They start talking again simultaneously, then pause for breath simultaneously, and then start talking again. Now imagine the confusion and chaos. To avoid it, they must follow a set of rules while talking. For instance, say first *A* must talk, then he/she must give *B* a chance to put forward his/her ideas, and so on. This common set of rules would be known as communication protocol for *A* and *B*.

A protocol is “a formal description of message formats and the rules that two or more machines must follow to exchange those messages.” We need protocols every time we want to do something on another computer. Every time we want to print something on a network printer we need protocols. Every time we want to download a file we need protocols. Every time we want to save our work on disk, we don’t need protocols – unless the disk is on a network file server. Usually multiple protocols will be in use simultaneously. For one thing, computers usually do several things at once, and often for several people at once. Therefore, most protocols support *multitasking*¹⁰. Also, one operation can involve several protocols. For example, consider the NFS (Network File System) protocol. A write to a file is performed with an NFS operation, that uses another protocol to perform a function call on a remote host, that uses another protocol to deliver a datagram to a port on a remote host, that uses another protocol to deliver a datagram on an Ethernet, and so on.

PROTOCOL

A Protocol is a formal description of message formats and the rules that two or more machines must follow to exchange those messages.

Some most common protocols are being discussed below.

10.10.1 HTTP (Hypertext Transfer Protocol)

The **Hypertext Transfer Protocol** (HTTP) is an application-level protocol with the lightness and speed necessary for distributed, collaborative, hypermedia information systems. It is a generic, stateless, object-oriented protocol which can be used for many tasks, such as name servers and distributed object management systems, through extension of its request methods (commands). A feature of HTTP is the typing of data representation, allowing systems to be built independently of the data being transferred. HTTP has been in use by the World-Wide Web global information initiative since 1990.

Practical information systems require more functionality than simple retrieval, including search, front-end update, and annotation. HTTP allows an open-ended set of methods to be used to indicate the purpose of a request. It builds on the discipline of reference provided by the *Uniform Resource Identifier* (URI), as a *location* (URL) or *name* (URN), for indicating the resource on which a method is to be applied. Messages are passed to HTTP in a format similar to that used by Internet Mail and *Multipurpose Internet Mail Extensions* (MIME).

NOTE

HTTP (Hypertext Transfer Protocol) is the set of rules for transferring hypertext (*i.e.*, text, graphic, image, sound, video etc.) on WWW (World Wide Web)

10. Multitasking is a capability of a computer (in fact its CPU) to handle two or more tasks simultaneously.

HTTP is also used as a generic protocol for communication between user agents and proxies/gateways to other Internet protocols, such as SMTP, NNTP, FTP, Gopher and WAIS, allowing basic hyper-media access to resources available from diverse applications and simplifying the implementation of user agents.

The HTTP protocol consists of two fairly distinct items : the set of requests from browsers to servers and the set of responses going back to the other way. Although HTTP was designed for use in the web, it has been intentionally made more general than necessary with an eye to future object-oriented applications.

The HTTP has various built-in request methods which allow users to read a web page, or to read a web page's header, or to store a webpage, or to append to a named resource, or to remove the web page or to connect two existing resources or to break an existing connection between two resources.

10.10.2 FTP (File Transfer Protocol)

One of the original services on the internet was designed to allow for transferring files from one system to another. It goes by the name *ftp* which stands for *file transfer protocol*. Files of any type can be transferred, although you may have to specify whether the file is an ASCII or binary file. They can be transferred to any system on the Internet provided that permissions are set accordingly.

FTP (File Transfer Protocol) is a standard for the exchange of files across Internet.

FTP offers these advantages :

- (i) It is very useful to transfer files from one network in an organization to another.
- (ii) It is an effective way to get a geographically dispersed group to co-operate on a project.
- (iii) It is a potent and popular way to share information over the internet.

FTP isn't just the name of the protocol ; it is also the name of a program or command. Issue the command by typing *ftp* followed by the address of another site, and press enter.

FTP works as a client/server process. You give the command *ftp* using a remote address such as the following :

FTP newday.horizon.com

The *ftp* running on your system is client to an *FTP* process that acts as server on *newday.horizon.com*. You issue commands to the *ftp* process at *newday*, and it responds appropriately.

This protocol is mainly concerned with transfer of file.

Objectives of FTP are :

- ❖ to promote sharing of files (computer programs and/or data) ;
- ❖ to encourage indirect or implicit (via programs) use of remote computers ;
- ❖ to shield a user from variations in file storage systems among hosts ; and
- ❖ to transfer data reliably and efficiently. FTP, though usable directly by a user at a terminal, is designed mainly for use by programs.

10.10.3 TCP/IP (Transmission Control Protocol/Internet Protocol)

TCP/IP is a layered set of protocols. In order to understand what this means, it is useful to look at an example. A typical situation is sending mail. First, there is a protocol for mail. This defines a set of commands which one machine sends to another, e.g., commands to specify who the

sender of the message is, who it is being sent to, and then the text of the message. However this protocol assumes that there is a way to communicate reliably between the two computers. Mail, like other application protocols, simply defines a set of commands and messages to be sent. It is designed to be used together with TCP and IP. *TCP is responsible for making sure that the commands get through to the other end. It keeps track of what is sent, and retransmits anything that did not get through.* If any message is too large for one datagram, e.g., the text of the mail, TCP will split it up into several datagrams, and make sure that they all arrive correctly. Since these functions are needed for many applications, they are put together into a separate protocol, rather than being part of the specifications for sending mail. You can think of TCP as forming a library of routines that applications can use when they need reliable network communications with another computer. Similarly, TCP calls on the services of IP. Although the services that TCP supplies are needed by many applications, there are still some kinds of applications that don't need them. However there are some services that every application needs. So these services are put together into IP. As with TCP, you can think of IP as a library of routines that TCP calls on, but which is also available to applications that don't use TCP. This strategy of building several levels of protocol is called "layering". We think of the application programs such as mail, TCP, and IP, as being separate "layers", each of which calls on the services of the layer below it.

TCP/IP is the base communication protocol of the Internet. IP part of TCP/IP uses numeric IP addresses to join network segments and TCP part of TCP/IP provides reliable delivery of messages between networked computers.

Generally, TCP/IP applications use *four* layers :

- (i) an application protocol (such as mail)
- (ii) a protocol such as TCP that provides services need by many applications
- (iii) IP, which provides the basic service of getting datagrams to their destination
- (iv) the protocols needed to manage a specific physical medium, such as Ethernet or a point to point line.

DATAGRAM

A Datagram is a collection of the data that is sent as a single message.

10.10.4 SLIP/PPP

Slip (Serial Line Internet Protocol)

Serial Line IP (SLIP) was the first protocol for relaying IP packets over dial-up lines. It defines an encapsulation mechanism, but little else. There is no support for dynamic address assignment, link testing, or multiplexing different protocols over a single link. SLIP has been largely supplanted by PPP.

SLIP is for delivering IP packets over dial-up lines ; PPP is for transmitting IP packets over serial lines.

PPP (Point to Point Protocols)

PPP is the Internet Standard for transmission of IP packets over serial lines. The Point-to-Point Protocol (PPP), is currently the best solution for dial-up Internet connections, including ISDN. PPP is a layered protocol, starting with a Link Control Protocol (LCP) for link establishment, configuration and testing. Once the LCP is initialized, one or many of several Network Control

Protocols (NCPs) can be used to transport traffic for a particular protocol suite. The IP Control Protocol (IPCP), permits the transport of IP packets over a PPP link (see Fig. 10.19). PPP supports both synchronised and unsynchronised lines.

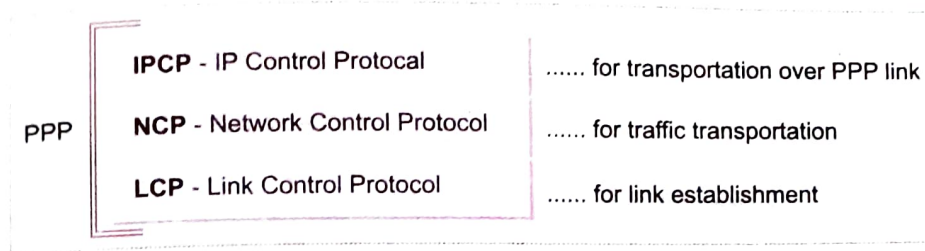


Figure 10.19 Layered PPP.

SLIP/PPP Overview

As we all are aware of the fact that a direct connection to the Internet represents the ultimate mode of access. But a direct connection (generally through leased lines) is too expensive for an individual user. The individual user rather shall opt for a dial-up connection, and this is where role of SLIP/PPP begins.

A compromise between a direct Internet connection and a dial-up connection is to use SLIP or PPP. Both SLIP and PPP are similar in many ways, hence we shall be referring to them as SLIP/PPP henceforth.

SLIP/PPP provides the ability to transport TCP/IP traffic over serial line (e.g., telephone lines) between two computers. Both of these computers are supposed to run some sort of TCP/IP based network software. This enables a home user to avail direct Internet access for her own PC via a simple modem and a telephone line, at a very low cost. The SLIP/PPP enables one to run one's favourite GUI based browser, ftp client etc. for one's own PC.

SLIP/PPP provides a form of direct Internet connection in the sense that :

- ❖ The home user's computer has a communications link to the Internet even if it is via a service provider (ISP).
- ❖ The home user's computer has the networking software that can speak TCP/IP with other computers on the Internet.
- ❖ The home user's computer has an identifying address (IP address) at which it can be contacted by other computers on Internet.

10.10.5 Protocols used in Email

Basically, a protocol refers to standard set of rules used at each end of a communication channel, in order to properly transmit information. In order to deal with your email you must use a mail client to access a mail server. The mail client and mail server can exchange information with each other using a variety of protocols. The protocols mainly used with email accessing are *IMAP*, *POP3*, *SMTP* and *HTTP*.

Let us briefly talk about these.

IMAP (*Internet Message Access Protocol*) is a standard protocol for accessing e-mail from local server. IMAP is a client/server protocol in which e-mail is received and held for the user by Internet server. As this requires only a small data transfer this works well even

over a slow connection such as a modem. Only if the user requests to read a specific email message, then it will be downloaded from the server. You can also create and manipulate folders or mailboxes on the server, delete messages etc.

POP3

The **POP** (*Post Office Protocol 3*) protocol provides a simple, standardized way for users to access mailboxes and download messages to their computers.

When using the POP protocol, all the eMail messages get downloaded from the mail server to user's local computer. The user can choose to leave copies of his/her eMails on the server as well. The advantage is that once messages are downloaded, the user can cut the Internet connection and read his/her eMail at own leisure without incurring further communication costs. On the other hand he/she might have transferred a lot of message (including spam or viruses), which may prove dangerous for data on PC.

SMTP

The **SMTP** (*Simple Mail Transfer Protocol*) protocol is used when you send email to another email users (the recipient). The SMTP protocol is used by the Mail Transfer Agent (MTA) to deliver the sent eMail to the recipient's mail server. The SMTP protocol can only be used to send emails, not to receive them. Depending on the network / ISP settings, user may only be able to use the SMTP protocol under certain conditions

HTTP

The **HTTP protocol** is not a protocol dedicated for email communications, but it can be used for accessing mailbox. Also called **web based email**, this protocol can be used to compose or retrieve emails from an email account. *Hotmail, Gmail, Ymail, Rediffmail* etc are good examples of using HTTP as an email protocol.

10.11 WIRELESS/MOBILE COMPUTING

This section is going to discuss about wireless and mobile computing technologies. But before discussing various wireless and mobile technologies, you must be clear about what wireless and mobile computing is and the difference between the two.

10.11.1 Wireless vs. Mobile Computing

Wireless refers to the method of transferring information between a *computing device*, such as a personal data assistant (PDA), and a *data source*, such as an agency database server, without a physical connection. Not all wireless communications technologies are mobile.

Mobile simply describes a computing device that is not restricted to a desktop. A mobile device may be a PDA, a "smart" cell phone or Web phone, a laptop computer, or any one of numerous other devices that allow the user to complete computing tasks without being tethered, or connected, to a network. Mobile computing does not necessarily require wireless communication. In fact, it may not require communication between devices at all.

Wireless communication is simply data communication without the use of landlines. This may involve cellular telephone, two-way radio, fixed wireless, laser, or satellite communications. Here the computing device is continuously connected to the base network.

Mobile, or "untethered," computing means that the computing device is not continuously connected to the base or

WIRELESS COMMUNICATION

Wireless communication is simply data communication without the use of landlines.

MOBILE COMPUTING

Mobile computing means that the computing device is not continuously connected to the base or central network.

central network. Mobile devices include PDAs, laptop computers, and many of today's cell phones (aptly called "smart phones"). These products may communicate with a base location with or without a wireless connection.

Following list gives you an idea of different computing devices, which can be either wireless or mobile or both.

Wireless vs. Mobile		Examples
×	×	Stationary computer
×	✓	Notebook in a hotel
✓	×	Wireless LANs in historic buildings
✓	✓	Personal Digital Assistant (PDA)
✓	✓	Smart phones, pagers

10.11.2 Wireless/Mobile Computing Technologies

Let us now talk about various technologies and interfaces used for wireless and mobile computing.

1. GSM

GSM is short for *Global System for Mobile communications*, which is one of the leading digital cellular systems. The GSM standard for digital cell phones was established in Europe in the mid 1980s. GSM has now become the international standard in Europe, Australia and much of Asia and Africa.

In covered areas, cell-phone users can buy one phone that will work anywhere where the standard is supported. To connect to the specific service providers in these different countries, GSM users simply switch **subscriber identification module (SIM)** cards. *SIM cards are small removable disks that slip in and out of GSM cell phones.* They store all the connection data and identification numbers you need to access a particular wireless service provider. Unfortunately, the 1900-MHz GSM phones used in the United States are not compatible with the international system.

GSM uses narrowband TDMA, which allows eight simultaneous calls on the same radio frequency. TDMA is short for *Time Division Multiple Access*, a technology for delivering digital wireless service using time-division multiplexing (TDM). TDMA works by dividing a radio frequency into time slots and then allocating slots to multiple calls. In this way, a single frequency can support multiple, simultaneous data channels.

GSM digitizes and compresses voice data, then sends it down a channel with other streams of user data, each in its own time slot. GSM systems use **encryption** to make phone calls more secure. GSM operates in the 900-MHz and 1800-MHz bands in Europe and Asia, and in the 1900-MHz (sometimes referred to as 1.9-GHz) band in the United States. It is used in digital cellular and **PCS-based** systems. GSM is also the basis for **Integrated Digital Enhanced Network (IDEN)**, a popular system introduced by Motorola and used by Nextel.

NOTE

TDMA works by dividing a radio frequency into time slots and then allocating slots to multiple calls. In this way, a single frequency can support multiple, simultaneous data channels.

NOTE

GSM uses narrowband TDMA, which allows eight simultaneous calls on the same radio frequency.

What is a SIM card ?

The SIM – Subscriber Identity Module – is a chip card, the size of a first class postage stamp. It is a key element in over 600 million *GSM (Global System for Mobile)* mobile phones – representing about 70 percent of the mobile handset market.

A SIM is actually a tiny computer chip that gives a cellular device its unique phone number. It has memory (for data and applications), a processor and the ability to interact with the user. Current SIMs typically have 16 to 64 kb of memory, which provides plenty of room for storing hundreds of personal phone numbers, text messages and other data.

2. CDMA

CDMA is short for *Code-Division Multiple Access*, a digital cellular technology that uses *spread-spectrum* techniques. Unlike competing systems, such as GSM, that use *TDMA*, CDMA does not assign a specific frequency to each user. Instead, every channel uses the full available spectrum. Individual conversations are encoded with a pseudo-random digital sequence. CDMA is a form of *spread spectrum*, which simply means that data is sent in small pieces over a number of the discrete frequencies available for use at any time in the specified range. All of the users transmit in the same **wide-band** chunk of spectrum. Each user's signal is spread over the entire bandwidth by a **unique spreading code**. At the receiver end, that same unique code is used to recover the signal.

CDMA is a military technology first used during World War II by the English allies to foil German attempts at jamming transmissions. The allies decided to transmit over several frequencies, instead of one, making it difficult for the Germans to pick up the complete signal.

NOTE

CDMA (Code Division Multiple Access) uses a spread-spectrum technique where data is sent in small pieces over a number of discrete frequencies. Each user's signal is spread over the entire bandwidth by unique spreading code. At the receiver end, the same unique code is used to recover the signal.

3. WLL

Wireless in Local Loop (WLL or WiLL), is meant to serve subscribers at homes or offices. **Wireless local loop** is analogous with local telephone service, but much more capable. A WLL system serves a local area by deploying a multiplicity of multichannel *transmit/receive base stations (transceivers)* that are within line-of-site of the intended customers. Each customer is equipped with a *mini-station of low power*, into which the telephone (or PBX) is connected. The WLL unit consists of a *radio transceiver* and the *WLL interface* assembled in one metal box. Two cables and a telephone connector are the only outlets from the box; one cable connects to a directional antenna and a phone receptacle to connect to a common telephone set. A fax or modem could also be connected for fax or computer communication.

When calls are made from the telephone, it signals the *base station* for a connection, which is subsequently established through a *switch center*, exactly as in conventional telephony. An incoming call is identified at the *switch center* and routed to the *base station* assigned to serve the telephone being called. The wireless connection is then made, and the call is completed in a conventional manner.

In WLL services, the telephone provided is expected to be as good as wired phone. Its voice quality must be high – a subscriber carrying out long conversation must not be irritated with quality; one must be able to use speakerphones, cordless phones and parallel phones. The telephone must support fax and modem communications and should be connectable to a Public Call Office.

The point-to-point signal transmissions occur through the air over a terrestrial microwave platform rather than through copper or fiber cables; therefore, fixed wireless does not require satellite feeds or local phone service. The advantages of fixed wireless include the ability to connect with users in remote areas without the need for laying new cables and the capacity for broad bandwidth that is not impeded by fiber or cable capacities.

The WLL system can operate with GSM Handsets/Mobile Units, as well as with GSM compatible Subscriber Units. The system is transparent to the Central Office and subscribers, and interfaces with the most standard Central Office Switches and subscriber telephone equipment.

Advantages of WLL

- (i) Lacking exterior plant, reliability is greatly enhanced; as well designed WLL facilities do not significantly suffer from weather damage, vandalism, and accidents.
- (ii) WLL system offers better bandwidth than traditional telephone systems.
- (iii) Most important, because the WLL system has much better bandwidth than traditional telephone systems, superior customer service features and quality can be provided.
- (iv) WLL systems support high quality data transmission, signaling services, and all the most advanced customer service features.

NOTE

WLL is a system that connects subscribers to the public switched telephone network (PSTN) using radio signals as a substitute for other connecting media.

4. GPRS

GPRS is the abbreviation for **General Packet Radio Service**. GPRS is used for wireless communication using a mobile device. With this service you can access the Internet, send emails and large data. You can also watch real time News, download games and watch movies.

GPRS

GPRS is a technology for radio transmission of small packets of data esp. between mobile devices and Internet.

How does GPRS work ?

You must be aware of how files are transferred from one location to another on your computer. They are broken down into Packets and sent across. Similarly GPRS also uses the same function to transfer data through a network. The information is split into smaller units or Packets and sent through the network and is reassembled at the receiving end. GPRS provides a high-speed data transfer, typically between 56 Kbits per second to 110 k bits per second. A user of the GPRS network is charged only on the amount of data is sent or received as opposed to the duration of the connection.

5. 1G, 2G, 3G, 4G and 5G Networks

The "G" in wireless networks refers to the "generation" of the underlying wireless network technology.

Technically generations are defined as follows :

1G networks (NMT, C-Nets, AMPS, TACS) are considered to be the first analog cellular systems, which started early 1980s. There were radio telephone systems even before that. 1G networks were conceived and designed purely for voice calls with almost no consideration of data services (with the possible exception of built-in modems in some headsets).

2G networks (GSM, CDMAOne, D-AMPS) are the first digital cellular systems launched early 1990s, offering improved sound quality, better security and higher total capacity. GSM supports circuit-switched data (CSD), allowing users to place dial-up data calls digitally, so that the network's switching station receives actual ones and zeroes rather than the screech of an analog modem.

2.5G networks (GPRS, CDMA2000 1x) are the enhanced versions of 2G networks with theoretical data rates up to about 104 kbit/s. GPRS offered the first always-on data service.

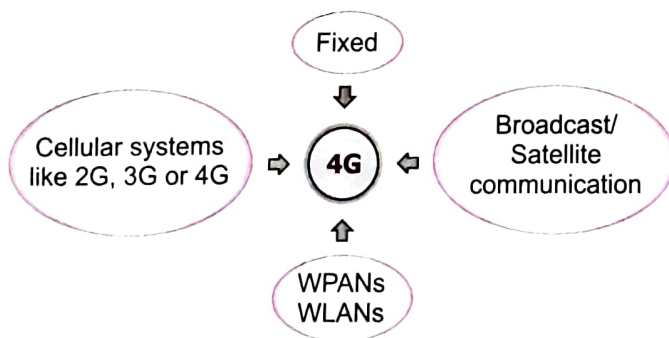
3G networks (UMTS FDD and TDD, CDMA2000 1x EVDO, CDMA2000 3x, TD-SCDMA, Arib WCDMA, EDGE, IMT-2000 DECT) are newer cellular networks that have data rates of 384kbit/s and more.

The UN's IMT-2000 standard requires stationary speeds of 2Mbps and mobile speeds of 384kbps for a "true" 3G.

4G networks. 4G is all about faster Internet speeds – it offers no improvement in making calls or sending texts but very fast web-experience compared to 3G. Fourth generation (4G) technology offers many advancements to the wireless market such as *downlink data rates well over 100 Mbps, low latency, very efficient spectrum use and low-cost implementations.*

4G is all about **convergence**; convergence of wired and wireless networks, wireless technologies including GSM, wireless LAN, and Bluetooth as well as computers, consumer electronics, communication technology and several others.

4G wireless technology is also referred to by "**MAGIC**" which stands for *Mobile multimedia, Any-where, Global mobility solutions over, Integrated wireless and Customized services.*



NOTE

4G is a Mobile multimedia, Network System width anytime anywhere Global mobility support, integrated wireless solution, and Customized Personal Service.

4G is an all IP-based integrated system will be capable to provide 100 Mbps for high mobility and 1 Gbps for low mobility, with end-to-end QoS and high security, and will offer *various services at any time as per user requirements, anywhere with seamless interoperability, at affordable cost.* The user services include *IP telephony, ultra-broadband Internet access, gaming services and High Definition Television (HDTV) streamed multimedia.* Underneath 4G will use technologies like WiMAX and LTE (Long Term Evolution) etc.

5G networks. 5G is the fifth generation of wireless communication technologies supporting cellular data networks. 5G networks promise to provide speeds of upto 100 gigabites per second. 5G is set to be 40 to 100 times faster than 4G networks.

Table 10.3 Comparison of Wireless Communication Technologies

Technology	1G	2G/2.5G	3G	4G	5G
Development	1970/1984	1980/1999	1990/2002	2000/2010	2014/2015
Bandwidth	2 kbps	14-16 kbps	2 mbps	200 mbps	> 1 gpps
Technology	Analog cellular	Digital cellular	Broadband/CDMA/IP technology	unified IP & seamless combo of LAN/WAN/WLAN/PAN	4G + WWW
Services	Mobile technology (Voice only)	Digital voice/ Short messaging (SMS), Media	Integrated high quality audio, video & data	Data + Voice converged over IP	Better quality voice with super high speed data transmission
Switching	Circuit	Circuit/Circuit for access network & air interface	Packet network	Internet	Internet

6. Some More Mobile Communication Technologies

Mobile communication technologies are ever evolving. Some other mobile communication technologies are listed below :

EV-DO

Shorthand for CDMA2000 1xEV-DO (also known as IS-856), a CDMA based 3G technology developed by Qualcomm and supported by the 3GPP2 that builds on 1X and supports entirely packet based networks. Rev A, the most deployed version of the technology, is capable of peak rates of 3.1 Mbit/s in a 1.25 MHz channel.

HSPA

High Speed Packet Access is an amalgamation of High Speed Downlink Packet Access (HSDPA) and High Speed Uplink Packet Access (HSUPA) that supports increased peak data rates of up to 10 Mbit/s in the downlink and 5.76 Mbit/s in the uplink. Evolved HSPA (also known as HSPA+) is a wireless broadband standard that provides data rates up to 84 Mbit/s in the downlink and 22 Mbit/s in the uplink (per 5 MHz carrier) with MIMO technologies and higher order modulation.

IMS

IP Multimedia Subsystem is an architectural framework for delivering Internet Protocol (IP) multimedia services, originally designed by the 3GPP as a part of the vision for evolving mobile networks beyond GSM.

LTE (Long Term Evolution)

A OFDMA based 3GPP standard, generally branded as 4G, that uses an all-IP flat network architecture and is capable of peak downlink speeds 100 Mbit/s and uplink speeds of 50 Mbit/s when deployed in a 20 MHz channel, and even higher rates if used with MIMO to deploy LTE in multiple channels.

X LTE-Advanced

A 3GPP standard that builds off LTE, offering even greater channel flexibility and peak data rates of more than 1 Gbit/s.

WiMax (Worldwide Interoperability for Microwave Access)

WiMax refers to set of implementations of the IEEE's 802.16 wireless network standards supported by the WiMax Forum, which certifies vendor equipment to ensure interoperability. WiMax requires an all-IP, network architecture and makes uses of OFDMA, and generally uses unpaired.

WiMax 2

The common name for 802.16m, which is truly 4G WiMax technology capable of mobile data speeds up to 120 Mbit/s in a single 20 MHz channel. 802.16m will succeed 802.16e, with which it is backwards compatible.

7. Mobile Processors

As per *Mobile World Congress 2017*, there will be about Five billion mobile phone users in 2017 in India. The popularity of mobile phones of today is because one small machine is capable of serving your various needs like communications, text creation, sending receiving messages, calculator, alarm clock, audio video recording, camera, music player etc.

All this and even more is delivered to you in a small compact machine. All this is made possible by one essential and often-overlooked element that's largely responsible for the speed, efficiency, and battery life of your smartphone—the **processor**.

Let's take a look at various parts of the processor that work together to enable seamless actions.

- ❖ **CPU, or Central Processing Unit.** It receives commands, makes instant calculations, and sends signals throughout your device.
- ❖ **GPU, or Graphics Processing Unit.** The GPU assists the CPU by handling the visuals, even for games and other graphically-rich applications.
- ❖ **Camera ISP (Image Signal Processor).** It provides instant image capture, high-resolution support, image stabilization, and other image enhancements.
- ❖ **Audio and Video.** It is a dedicated processing unit for handling audio and video.
- ❖ **Radio (RF Transceiver) & 3G/4G Modem.** The RF Transceiver receives and transmits voice connections and the modem enables your phone to send and receive digital signals over high-speed cellular wireless network or Wi-Fi connection.

Smartphones or the mobile phones you use today claim about their performance only because of the capabilities and power of their processors.

Some mobile processors of today's age are :

Qualcomm Snapdragon Snapdragon 835, Snapdragon 820 etc. ;

Samsung EXYNOS 8890, 7570, 7420 etc. ;

Huawei KIRIN 960, 955, 950 etc. ;

Nvidia TEGRA X1, K1 etc. ;

MediaTek Helio P10, P20, X20, X30 etc. ;

Apple A8, A9, A10 etc.

8. SMS

Short Message Service (SMS) is the transmission of short text messages to and from a mobile phone, fax machine and/or IP address. Messages must be no longer than some fixed number of alpha-numeric characters and contain no images or graphics.

Once a message is sent, it is received by a *Short Message Service Center (SMSC)*, which must then get it to the appropriate mobile device.

To do this, the SMSC sends a SMS Request to the *home location register (HLR)* to find the roaming customer. Once the HLR receives the request, it will respond to the SMSC with the subscriber's status : (1) inactive or active (2) where subscriber is roaming.

NOTE

Short Message Service (SMS) is the transmission of short text messages to and from a mobile phone, fax machine and/or IP address.

9. Chat

Chatting is the most fantastic thing on Internet. Chatting is like a text-phone. In a telephonic conversations, you say something, people hear it and respond, you hear their responses on the spot and can reply instantly. In the same manner, in chatting, you type a message on your screen, which is immediately received by the recipient ; then the recipient can type a message in response to your message, which is received by you instantly.

CHATTING

Online textual talk, in real time, is called Chatting.

10. Video Conferencing

The next dimension in Internet communication is the videophone. People who have a multimedia PC with a camera and video compression hardware, access to Internet over an ordinary telephone line, and videophone software can see each other while talking, which is what is called *video conferencing*.

VIDEO CONFERENCING

A two-way videophone conversation among multiple participants is called Video Conferencing.

11. Protocols for Chat and Video Conferencing

With the advent of Internet, communication formats such as chat and video- conferencing etc have gained popularity. In this section, we shall talk about some common chat and video conferencing protocols.

- ❖ Most common chat protocol is **IRC** (Internet Relay Chat)
- ❖ Most common video-conferencing protocols are: **H.323** and **SIP** (Session Initiation Protocol)

Chat protocol IRC

The IRC (Internet Relay Chat) protocol is a simple, text-based conferencing protocol, involving a number of users spread across a number of interconnected servers. These users may chat with other individual users, or may chat with groups of users on "channels" – what other chat systems refer to as "rooms" or "chat rooms".

A typical setup in *Internet Relay Chat (IRC)* network involves a single process (the server) forming a central point for clients (or other servers) to connect to, performing the required message delivery/multiplexing and other functions. The server forms the backbone of IRC,

providing a point to which clients may connect to talk to each other, and a point for other servers to connect to, forming an IRC network. The only network configuration allowed for IRC servers is that of a spanning tree where each server acts as a central node for the rest of the net it sees.

Video-conferencing protocol H.323

H.323 is a standard that specifies the components, protocols and procedures that provide multimedia communication services - real-time audio, video, and data communications - over packet-based networks (including the Internet). H.323 is part of a family of ITU-T (International Telecommunications Union) recommendations called H.32x that provides multimedia communication services over a variety of networks. These standards define how components that are built in compliance with H.323 set up calls, exchange compressed audio and video, participate in multiunit conferences, and operate with non-H.323 endpoints.

H.323 provides various services and, therefore, can be applied in a wide variety of areas - consumer, business, and entertainment applications. It can be applied in a variety of mechanisms :

- ⇒ audio only (IP telephony);
- ⇒ audio and video (video telephony);
- ⇒ audio and data;
- ⇒ and audio, video and data.
- ⇒ H.323 can also be applied to multipoint-multimedia communications.

Two popular video-conferencing protocols are :

- ❖ H.323
- ❖ SIP

Video-conferencing protocol SIP

SIP, short for **Session Initiation Protocol** is an IP telephony signaling protocol used to establish, modify and terminate VOIP telephone calls. SIP works with both IPv4 and IPv6. For Internet telephony sessions, SIP works as follows :

Callers and callees are identified by SIP addresses. When making a SIP call, a caller first locates the appropriate server and then sends a SIP request. The most common SIP operation is the invitation. Instead of directly reaching the intended callee, a SIP request may be redirected or may trigger a chain of new SIP requests by proxies. Users can register their location(s) with SIP servers. SIP addresses (URL) can be embedded in Web pages and therefore can be integrated as part of powerful implementations such as Click to talk.

SIP can establish, modify, and terminate multimedia sessions such as Internet telephony calls (VoIP - Voice over IP). SIP can also invite participants to already existing sessions, such as multicast conferences. Media can be added to (and removed from) an existing session. SIP transparently supports name mapping and redirection services, which supports personal mobility.

SIP has taken the VoIP world by storm. The protocol resembles the HTTP protocol, is text based, and very open and flexible. It has therefore largely replaced the H.323 standard.

12. Voice over Internet Protocol, VoIP

VoIP is a technology that enables voice communications over the Internet through the compression of voice into data packets that can be efficiently transmitted over data networks

and then converted back into voice at the other end. Data networks, such as the Internet or local area networks (LANs), have always utilized packet-switched technology to transmit information between two communicating terminals (for example, a PC downloading a page from a web server, or one computer sending an e-mail message to another computer).

The most common protocol used for communicating on these packet-switched networks is Internet protocol, or IP. VoIP allows for the transmission of voice along with other data over these same packet-switched networks and provides an alternative to traditional telephone networks, which use a fixed electrical path to carry voice signals through a series of switches to a destination.

13. Connecting Wirelessly to Internet

These days you can also connect to Internet wirelessly. Two most common ways to connect to Internet wirelessly are :

(i) Wi-Fi

Wi-Fi refers to *Wireless Fidelity*, which lets you connect to the Internet without a direct line from your PC to the ISP. For Wi-Fi to work, you need :

- ❖ A broadband Internet connection.
- ❖ A wireless router, which relays your Internet connection from the "wall" (the ISP) to the PC.
- ❖ A laptop or desktop with a wireless internet card or external wireless adapter.

Transmitting computer data without wires makes your data especially susceptible to hackers, computer users who can intercept your connection and steal your data. If you decide to use Wi-Fi at home, be sure that the network you set up is security-enabled.

Wi-Fi Hotspots. A hotspot is a venue that offers Wi-Fi access. The public can use a laptop, WiFi phone, or other suitable portable device to access the Internet through a WiFi Hotspot. Hotspots are public locations (such as libraries, hotels, airports, and local bookstores and restaurants etc.) with free or fee-based wireless Internet access. There are Wi-Fi hotspots in thousands of locations around the world. Figure 10.20(a) shows a WiFi Network.

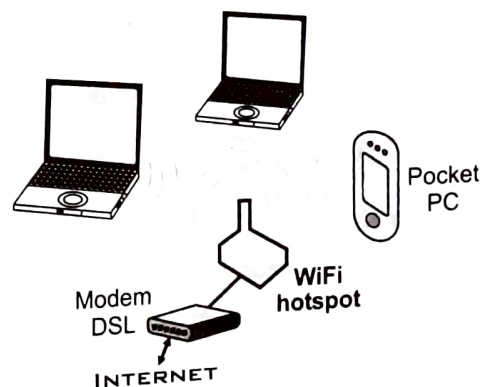


Figure 10.20 (a) A Wi-Fi Network

Check Point

10.4

1. Define Mobile Communication and Wireless Communication.
2. Define GSM, CDMA, WLL.
3. Compare 1G, 2G and 3G networks.
4. Define the following :
(i) 3G (ii) EDGE (iii) SMS (iv) TDMA.
5. Name some chat and video conferencing protocols.
6. What is VoIP ?
7. Discuss the two technologies to connect to Internet wirelessly.

(ii) WiMax

WiMAX is a wireless digital communications system. WiMAX can provide broadband wireless access (BWA) up to 30 miles (50 km) for fixed stations, and 3-10 miles (5-15 km) for mobile stations. In contrast, the WiFi wireless local area network standard is limited in most cases to only 100-300 feet (30-100 m).

WiMax requires a tower called *WiMax Base Station* [see Fig. 10.20(b)], similar to a cell phone tower, which is connected to the Internet using a standard wired high-speed connection. But as opposed to a traditional Internet Service Provider (ISP), which divides that bandwidth among

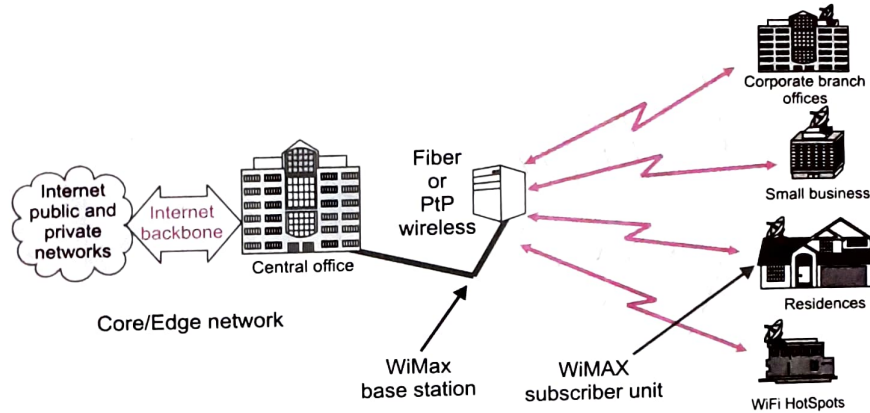


Figure 10.20 (b) WiMax Connection.

customers via wire, it uses a microwave link to establish a connection. In other words, WiMax does not depend on cables to connect each endpoint, the Internet connectivity to an end-user is provided through microwave link between the tower and the user-endpoint, known as WiMax Subscriber unit.

Wi-Fi

Range. 100 yards, covers a coffee shop, one floor of an office building, one home
Throughput. 11 Mbps
Security. Limited



WiMAX

Range. 6 miles, covers a small city with one base station.
Throughput. 72 Mbps
Security. Multilevel encryption

Figure 10.20 (c) Wi-Fi vs. WiMax

10.12 INTERNETWORKING TERMS AND CONCEPTS

In this section, we are going to discuss various internetworking terms and concepts. Let us begin our discussion with WWW.

10.12.1 WWW (World Wide Web)

The world wide web (WWW) is a set of protocols that allows you to access any document on the Net through a naming system based on URLs¹. WWW also specifies a way—the hypertext Transfer protocol (HTTP) – to request and send a document over the internet. With these standard protocols of WWW in place, one can set up a server and construct hypertext documents with links in them that point to the documents on the server.

NOTE

Some people mistake WWW for Internet. But in real terms, WWW is a small part of Internet. We can say that Internet is a highway that offers lot many services, features etc. And WWW is a truck that uses this highway.

1. URL means Uniform Resource Locator. It is a pointer to information on the WWW. It can include pointers to other types of resources such as ftp servers and gopher servers in addition to WWW servers.

Before WWW, Internet was mainly used for obtaining textual information. But post-WWW, the Internet popularity grew tremendously because of graphic-intensive nature of WWW. Therefore, we may attribute the explosion in use and popularity of Internet to WWW only.

WWW Attributes

Let us have a look at various attributes that have contributed to the success of WWW.

- (i) **User-friendly.** WWW resources can work easily with most Internet browsers, which are very user-friendly.
- (ii) **Multimedia Documents.** Information on the Web, which may be graphics, audio, video, animations and text is viewed in **pages**. A *web page* is a document on the Internet that can contain text plus any of these multimedia elements. WWW allows and supports the Internet users to create, link or display these multimedia web pages.
- (iii) **Hypertext and Hyperlinks.** A hypertext file is a document that can incorporate text, graphic images, audio and video tracks, and most importantly, *dynamic links* to related files or documents, even on net. These *dynamic links* are called **hyper links**.

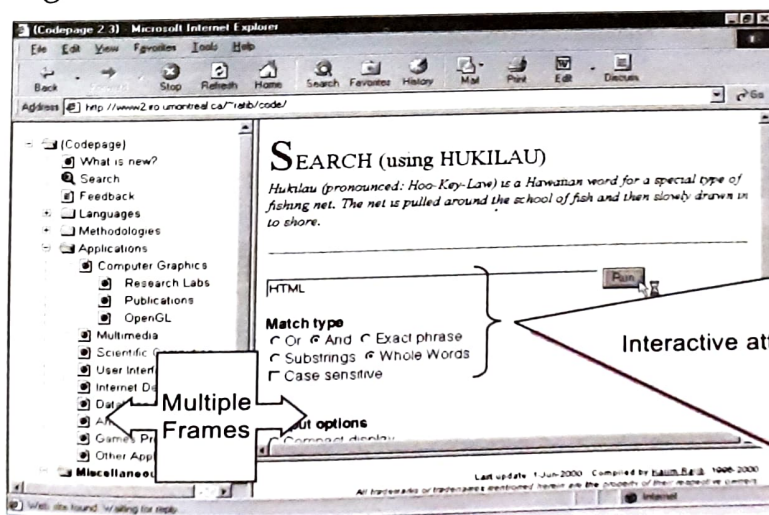
The WWW supports fully these hypertext files and hyperlinks. Thus net surfing seems very easy to the users.

- (iv) **Interactive.** WWW, with its pages, supports and enables interactivity between users and servers through one or more of the following ways :

- ❖ hyperlinks
- ❖ input boxes
e.g., radio buttons, check-boxes, text-boxes etc.

Fig. 10.21 shows such an inter- active web page on WWW.

- (v) **Frames.** WWW also supports frames. **Frames** is the display of more than one independently controllable section on single web page. Fig. 10.21 shows you a web page containing frames.



Traditionally, Telnet has been used by people who have logins on remote systems and want to do serious work there.

But Telnet has some additional uses that are more relevant to people who are exploring the Internet. Most notably, you can use Telnet to connect to thousands of catalogs at libraries around the world. This capability is wonderful for anyone doing serious research. Imagine being able to find out which books in your particular discipline are available at a number of specialty libraries in remote locations—all while you plug away at your desk.

To find out about available Telnet resources of all kinds, you may go to

<http://www.lights.com/hytelnet/>

In the following subsection, we'll run an example Telnet session, to make you understand the working and use of Telnet session.

TELNET

Telnet is an Internet utility that lets you log onto remote computer systems.

A Sample Telnet Session

To run a telnet session, you first have to run the Telnet client and then connect to the desired Telnet site.

All this is illustrated in following steps :

(i) Run Telnet Client

To do this, firstly, click at *Start* → *Run* command and then type *Telnet* or *c:\windows\telnet* in the Run dialog. [Fig. 10.22(a)]

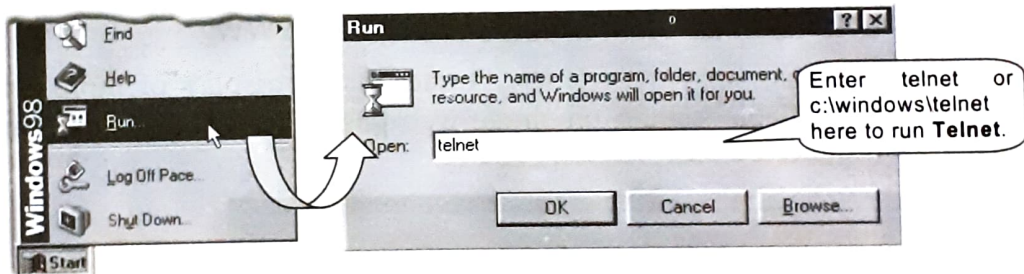


Figure 10.22 (a) Run Telnet client.

(ii) Connect to Telnet Site

Once you have telnet client running on your system, you need to connect to telnet site. This can be done by selecting *Connect* → *Remote System* in telnet window [Fig. 10.22(b)] and then by specifying the telnet site address in the *Host Name* : box [Fig. 10.22(c)] and then by clicking at *Connect* button. We typed the telnet address of an Australian university : *library.anu.edu.au*.

NOTE

The default port of telnet and default terminal of vt100 will do in most cases.

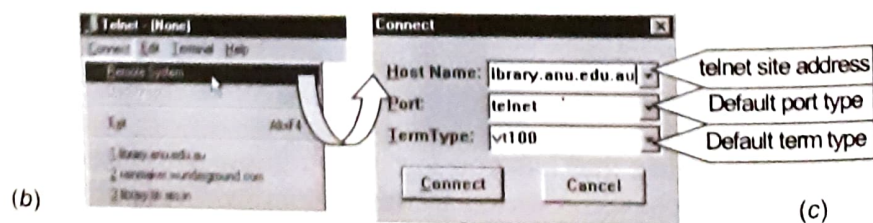


Figure 10.22 (b) Connect → Remote System in Telnet window. (c) Connect dialog.

(iii) **Start browsing**

Now you'll see the default menu of the telnet site [Fig. 10.23(a)]. Directions of using the site are available there. For example, to search a book by specifying its subject, we typed the letter S. And then we typed the word *computer* for the subject search [Fig. 10.23(b)].

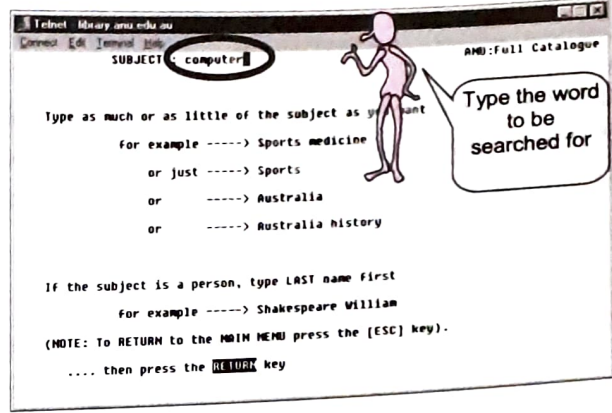
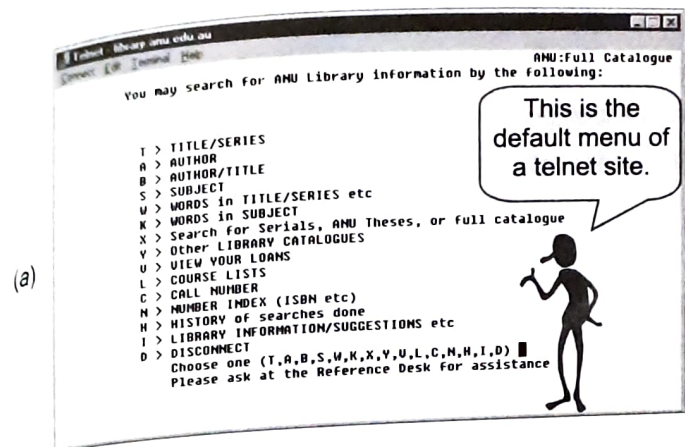


Figure 10.23 (a) Default menu of library.anu.edu.au. (b) Specifying the word to be searched.

(iv) After, it displays the details of the search [Fig. 10.23(c)] you can view further details by the options provided [Fig. 10.29(d)]. For example, in the screen shown in Fig. 10.23(c), we typed digit 3 to view the details of book numbered 3, shown in Fig. 10.23(d).

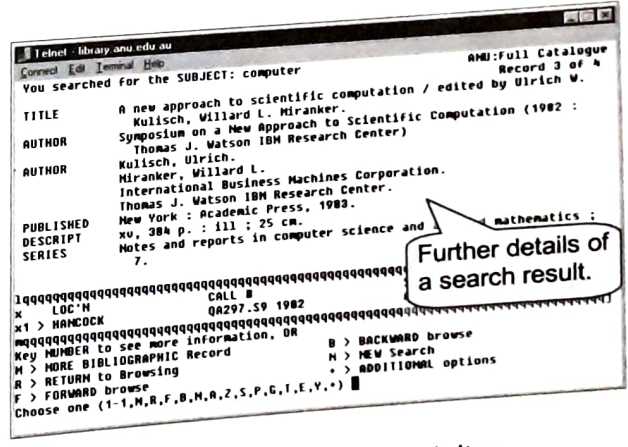
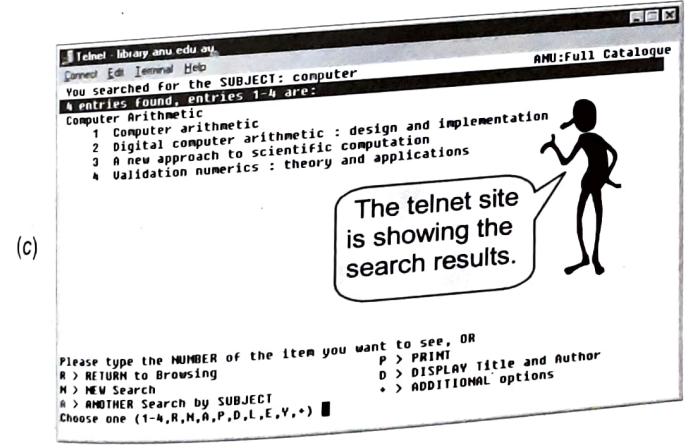


Figure 10.23 (c) Details of search conducted. (d) Viewing further details of a search item.

(v) **Finally Disconnect**

To disconnect, you can either choose the *Disconnect* command from *Connect* menu or you may even press Alt + F4 key combination.

10.12.3 Web Browser and Web Server

The World Wide Web (WWW) is based upon clients and servers. A WWW client is called **Web Browser** or simply a **browser** and a WWW server is called a **Web Server** or just a **server**. *Internet Explorer* and *Netscape Navigator* are two most popular web browsers.

WEB BROWSER

A Web Browser is a WWW client that navigates through the World Wide Web and displays web pages.

WEB SERVER

A Web Server is a WWW server that responds to the requests made by web browsers.

10.12.4 Web Sites, Web Addresses and Web Pages

A location on a net server is called a web site. Each web site has a unique address called **URL** (Uniform Resource Locator) e.g., the web site of microsoft has an address or URL called **http://www.microsoft.com**.

10.12.5 URL and Domain Names

Let us explore it further. The Internet structure of the World Wide Web is built on a set of rules called **Hypertext Transfer Protocol (HTTP)** and a page description language called **Hypertext Markup Language (HTML)**. HTTP uses Internet addresses in a special format called a **Uniform Resource Locator** or **URL**, URLs look like this :

type://address/path

where **type:** specifies the type of server in which the file is located, **address** is the address of server, and **path** tells the location of file on the server. For example, in the following URL

http://encycle.msn.com/getinfo/styles.asp

http: specifies the **type** of server, **encycle.msn.com** is the **address** of server and **getinfo/style.asp** is the **path** of the file **styles.asp**. The other examples of URLs are

ftp://ftp.prenhall.com, http://www.yahoo.com, news://alt.tennis etc.

Syntax Elements of URLs

By now you have come to know that a URL (Uniform Resource Locator) is an address of a file on Internet. Let us discuss the components or syntax elements of URLs.

A file's Internet address, or URL, is determined by the following :

- ⇒ The type of server or protocol
- ⇒ The name/address of the server on the Internet
- ⇒ The location of the file on the server (this location may be related as a "path" through the file hierarchy)

The intelligent browsers like *Netscape Navigator* or *Microsoft Internet Explorer*, can display files in just about any format available on any of the common types of servers. Table 10.4 lists the types of servers you may encounter, along with the protocol they use, and the type(s) of information they provide.

Table 10.4 Internet Servers and What They Provide

Server	Protocol	Information It Provides
ftp	File Transfer Protocol	Text and binary files that are organized in a hierarchical structure, much like a family tree.
gopher	Transfer Control Protocol/Internet Protocol (TCP/IP)	Text and binary files that are organized in a menu structure.
http	Hypertext Transfer Protocol	Hypertext/hypermedia files (i.e., multimedia documents that contain links to images, sounds, or other multi-media documents on the World Wide Web).
mail	Post Office Protocol (POP) Version 3 and Simple Mail Transfer Protocol (SMTP)	Messages sent via electronic mail.
news	Network News Transfer Protocol (NNTP)	Newsgroups that are organized in a hierarchical structure.

In any typical URL e.g., **http://www.khoj.com**, the "http" identifies both the protocol and server. According to standard URL syntax, a colon (:) and two forward slashes (//) follow the protocol/server.

The next component of the address is the name of the server, in this case, **www.khoj.com**. Server names have multiple components. Commonly a Web server's name will begin "www" for World Wide Web. The ".com" suffix (called a *domain* indicator) indicates that Khoj is a commercial entity, as opposed to a nonprofit organization (".org"), a school or university (".edu"), a branch of the government (".gov"), etc.

The naming scheme by which servers are identified is also known as the *domain name system*. Table 10.5 lists some most common domains. Another method of addressing servers is based on numbers e.g. 203.127.54.9. Such addresses are called *IP addresses*. (We are not getting into details of IP addressing method, as it is beyond the scope of this book).

URL

A URL (Uniform Resource Locator) specifies the distinct address for each resource on the Internet. An Internet address which is character based is called a **Domain Name**.

NOTE

The characters based naming system by which servers are identified is also known as **domain name system** (DNS).

Table 10.5 Some Most Common Domains

S.No.	Domain ID	Affiliation	Remarks
1.	com	Commercial	for commercial firms
2.	edu	Education	for educational firms
3.	gov	Government	for government organizations / bodies
4.	mil	Military	for Military
5.	net	Network resources	for ISPs/networks
6.	org	Usually non-profit organizations	for NGOs and other no-profit
7.	co	Company	for listed companies
8.	biz	business	for business
9.	tv	television	for television companies and channels

In addition to it, a two letter abbreviation indicating the country name may be used e.g.,

<http://www.microsoft.co.in>

here the last **in** suggests that it is based in India (.in). Similarly, the URL <http://www.clearnet.nz> suggests that it is based in New Zealand (.nz). Some country abbreviations are being listed below :

- | | | | |
|----|-------------|----|----------------|
| au | Australia | ca | Canada |
| dk | Denmark | fr | France |
| in | India | jp | Japan |
| nz | New Zealand | uk | United Kingdom |

Web Page

The documents residing on web sites are called **web pages**. The **web pages** use HTTP.

There are many associated terms which should be discussed for better understanding.

Let us discuss them :

1. **HOME PAGE.** It is the top-level web page of a web site. When a web-site is opened, its *home page* is displayed.
2. **WEB PORTAL.** It is a web site, which hosts other web sites. In other words, a web portal has hyperlinks to many other web sites. By clicking upon these links, the corresponding web sites can be opened. **www.yahoo.com** is an example of a web portal. Other examples are **www.indiatimes.com**, **www.khoj.com**, etc.

A web portal also offers a broad array of resources and services such as *e-mail*, forums (users with similar interests sharing ideas and information), *search-engine*, *on-line shopping malls* etc.

10.12.6 Web Hosting

As you have read in the previous topic that accessing information on the web requires data communication between a *web-browser client* and a *web-server application*. Web hosting is linked to this very thing. **Web Hosting** is a means of hosting *web-server application* on a computer system through which electronic content on the Internet is readily available to any *web-browser client*.

The computer system providing the web-hosting is known as **web-server** or the **web host**.

Basically, the web hosts allow their customers to place web documents, such as *html pages*, *graphics*, and other *multimedia files* etc. onto a special type of computer called a web server, which maintains constant, high speed connections to the backbone of Internet.

One can choose from various types of web hosting services such as free or virtual or shared or dedicated hosting.

Let us talk about these types of web-hosting, one by one.

1. **Free Hosting.** This type of hosting is available with many prominent sites that offer to host some web pages for no cost. Examples of such sites are : *geocities*, *tripod*, *homestead* etc.

Free is for fun. If you want to experiment with a site or put up a small, personal site for the fun of it, a free package will suffice.

2. **Virtual or Shared Hosting.** This type of hosting is provided under one's own domain name, *www.yourname.com*. With a hosting plan with the web hosting company, one can present oneself as a fully independent identity to his/her web audience.

Virtual hosting is where one's web site domain is hosted on the web server of hosting company along with other web sites. One can access and update to the site and its files are carefully secured. Through a logon-id and password, one has 24-hour access to maintain one's site.

Go "*shared*" if you are serious about doing some business or have a professional website that is much better off "*standing on its own.*" Or if you simply prefer your own domain name and space.

WEB PAGE

A location on a net server is called a **Web Site**. A document that uses HTTP is called a Web Page.

WEB HOSTING

Web Hosting is a means of hosting *web-server application* on a computer system through which electronic content on the Internet is readily available to any *web-browser client*.

3. Dedicated Hosting. In this type of hosting, the company wishing to go online, rents an entire web server from a hosting company. This is suitable for companies hosting larger web sites, maintaining others' sites or managing a big online mall etc. *Dedicated is for large, high-traffic sites, or for those with special needs such as e-commerce or security.* They are also good for those folks for whom money is no object.

4. Co-location Hosting. For those who do not fit the dedicated-server mold, hosting companies offer a similar, but less-restrictive hosting, known as co-location hosting. In this type of hosting, the company actually owns the server on which its site is hosted. That is, the company owning the site rather than the web hosting company, is responsible for all server administration. The web-hosting-company is only responsible for providing rack-space for server and meeting its physical needs. This generally includes a high speed connection to the Internet, a regulated power supply, and a limited amount of hands-on-technical-support, such as *data backup or hardware upgrades.*

Co-location hosting is similar to that of dedicated hosting except for the fact that the server is now provided by the user-company itself and its physical needs are met by the hosting company.

Co-location hosting is suitable for those with complex needs and for those who require the ability to make changes as per its changing requirement as and when.

10.12.7 Web 2.0

The arrival of Web 2.0 has added many new features to the web applications; it has revolutionized the information sharing, user-oriented design, interoperability on the Internet. This has provided information sharing in a way that was never dreamed about few years ago.

Web 2.0 provides a much independent solution to interact or commute thoughts with each other through the various online social media's. There are many Web 2.0 sites which have made the online information exchange very users interactive like: blogs, wikis, video-sharing websites, social networking websites, web applications etc.

The Internet based tools like RSS, social bookmarking, press release, online marketing, blog's, forums etc made an everlasting impression on people's lives as it has crossed the hurdle of socio-economic barriers. Web 2.0 tools are available free and are widely used by people; some of the most noticeable are :

- ❖ Facebook
- ❖ Myspace
- ❖ Digg
- ❖ Del.icio.us
- ❖ Flickr
- ❖ WordPress
- ❖ Twitter
- ❖ YouTube
- ❖ Blogger

All of the above provide an interactive platform where reviews, opinions, likes etc can be shared among the online users group. It has increased the rate of participation of users on online websites and hence given a wide horizon to the online community. Web 2.0 has definitely provided a better functionality and allows the visitor to communicate with the website in a much better prospective.

Web 2.0 refers to added features and applications that make the web more interactive, support easy online- information exchange and interoperability. Some noticeable features of Web 2.0 are blogs, wikis, video-sharing websites, social networking websites, RSS etc.

10.12.8 HTML

The World Wide Web is an exciting new medium, bringing information, images, advertising and what not to every desktop. Everything that you see on the *Web* is documents written in a special language called *HTML* or *Hypertext Markup Language*. This language tells the browsers like *Mosaic* or *Netscape* or *Internet Explorer* how to display text, pictures and links on the screen.

HTML is a document-layout and hyperlink-specification language *i.e.*, a language used to design the layout of a document and to specify the hyperlinks. HTML tells the browser how to display the contents of a hypertext document *i.e.*, a documents including text, images and other support media. The language also tells how to make a document interactive through special hyperlinks. Though HTML is a language that supports multimedia and new page layout features yet it has its limitations.

HTML is not a word processing tool ; it is not a desktop publishing solution or even a programming language. It is just a *page-layout and hyperlink specification language*.

HTML provides many layout commands, called **tags** that let you control the presentation of information on a web pages. For example, there are tags for various types of headings, lines, image alignment, paragraph alignment, hyperlinking etc.

10.12.9 XML (eXtensible Markup Language)

XML is a markup language for documents containing structured information.

Structured information contains both content (words, pictures, etc.) and some indication of what role that content plays (for example, content in a section heading has a different meaning from content in a footnote, which means something different than content in a figure caption or content in a database table, etc.). Almost all documents have some structure.

A markup language is a mechanism to identify structures in a document. The XML specification defines a standard way to add markup to documents.

So XML is Just Like HTML ?

No. In HTML, both the tag semantics and the tag set are fixed. On the other hand, XML specifies neither semantics nor a tag set. In fact XML is really a meta-language for describing markup languages. In other words, XML provides a facility to define tags and the structural relationships between them. Since there's no predefined tag set, there can't be any preconceived semantics. All of the semantics of an XML document will either be defined by the applications that process them or by stylesheets.

10.12.10 DHTML (Dynamic HTML)

DHTML refers to *Web* content that changes each time it is viewed. For example, the same URL could result in a different page depending on any number of parameters, such as :

- ❖ Geographic location of the reader
- ❖ Time of day
- ❖ Previous pages viewed by the reader
- ❖ Profile of the reader

DHTML refers to new *HTML* extensions that will enable a *Web page* to react to user input without sending requests to the *Web server*.

“Dynamic HTML” is typically used to describe the combination of HTML, style sheets and scripts that allows documents to be animated. Dynamic HTML allows a web page to change after it's loaded into the browser – there doesn't have to be any communication with the web server for an update. You can think of it as 'animated' HTML. For example, a piece of text can change from one size or color to another, or a graphic can move from one location to another, in response to some kind of user action, such as clicking a button.

10.12.11 Web Scripting

The process of creating and embedding **scripts** in a web page is known as **web-scripting**. A **script** or a *computer-script* is a list of commands that are embedded in a web-page normally and are interpreted and executed by a certain program or scripting engine. *Scripts* may be written for a variety of purposes such as for automating processes on a local-computer or to generate web-pages on the web.

The programming languages in which scripts are written are called scripting languages. There are many scripting languages available today. Most common ones are VBScript, JavaScript, ASP, PHP, PERL, JSP etc.

SCRIPT

A Script is a list of commands embedded in a web-page. Scripts are interpreted and executed by a certain program or scripting-engine.

Types of Scripts

Scripts are broadly of following *two* types :

1. Client-Side Scripts

Client-side scripting enables *interaction within a web page*. The client-side scripts are **downloaded** at the client-end and then interpreted and executed by the *browser*.

The client-side scripting is *browser-dependent*. That is, the client-side browser must be scripting enabled in order to run scripts.

Client-side scripting is used when the client-side interaction is used. Some sample uses of client-side scripting may be :

- ❖ to get data from user's screen or browser.
- ❖ online games.

- ❖ customising the display of page in browser without reloading the page *e.g.*, rollover a hyperlink highlights that link without reloading the page.

Some popular client-side scripting languages are VBScript, JavaScript, Hypertext Preprocessor (PHP).

NOTE

Client-side scripting supports interaction within a webpage.

Check Point

10.5

1. What is remote login ? What is Telnet ?
2. What is HTML ? Where it is used ?
3. What is URL ? What is WWW ?
4. Define webbrowser and webserver.
5. What is web hosting ?
6. What is web scripting ?
7. Name some web scripting languages.

2. Server-Side Scripts

Server-side scripting enables the completion or carrying out a task at the server-end and then sending the result to the client-end.

In server-side script, the server does all the work, so it doesn't matter which browser is being used at client-end.

Server-side scripting is used when the information is sent to a server to be processed at the server-end.

Some sample uses of server-side scripting may be :

- ❖ Password protection.
- ❖ Browser customization (sending information as per the requirements of client-end browser.)
- ❖ Form Processing.
- ❖ Building and displaying pages created from a data base.
- ❖ Dynamically editing changing or adding content to a web page.

Some popular server-side scripting languages are :

PHP (Hypertext Preprocessor), Perl, ASP (Active Server Pages), JSP (Java Server Pages) etc.

NOTE

Server-side scripting supports execution at server-end.

Comparing Client-Side and Server-Side Scripting

After discussing the basics of the two types of scripts, in this section, we are going to compare different features and uses of these script types.

S.No.	Client Side Scripting	Server Side Scripting
1.	Script code is downloaded and executed at client end.	The script is executed at the server-end and the result is sent to the client-end.
2.	Response to interaction is more immediate once the program code has been down-loaded.	Complex processes are more efficient as the program and associated resources are not down-loaded to the browser.
3.	Services are secure as they do not have access to files and databases.	Have access to files and data bases but have security considerations when sending sensitive information.
4.	Browser dependent	Does not depend on browsers
5.	Affected by the processing speed of user's computer	Affected by the processing speed of the host server.

10.13 NETWORK SECURITY CONCEPTS

The networking offers endless possibilities and opportunities to every user of it, along with convenience. But this convenience and endless benefits are not free from risks as there are many a risks to network security.

While ensuring network security, the concerns are to make sure that only legal or authorized users and programs gain access to information resources like databases. Also, certain control mechanisms are setup to ensure that properly authenticated users get access only to those resources that they are entitled to use. Under this type of security, mechanisms like *authorization, authentication, encrypted smart cards, biometrics and firewalls* etc. are implemented.

The problems encountered under network security can be summarised as follows :

- (i) *Physical Security holes*. When individuals gain unauthorized physical access to a computer and temper with files. Hackers do it by guessing passwords of various users and then gaining access to the network systems.
- (ii) *Software Security holes*. When badly written programs or 'privileged' software are compromised into doing things that they should not be doing.
- (iii) *Inconsistent Usage holes*. When a system administrator assembles a combination of hardware and software such that the system is seriously flawed from a security point of view.