CHAPTER 6 INTERNET AND INTERNET SERVICES

LH-5

By: Rolisha Sthapit

CONTENTS

Introduction; History of Internet; The Internet Architecture; Managing the Internet; Connecting to Internet; Internet Connections; IP Address and Domain Name System (DNS); Client-Server Architecture; Hyper Text Transfer Protocol (HTTP); Electronic Mail (Email); File Transfer Protocol (FTP); World Wide Web; Remote Login (TELNET); Static and Dynamic Web Pages; Search Engines; E-Commerce; E-Governance; Smart City; Censorship and privacy issues

INTRODUCTION

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

•Internet is defined as an interconnection of networks scattered all over the globe by means of exchanging information worldwide.

•It is a worldwide collection of separate, but interconnected, networks accessed daily by millions of people using a variety of devices to obtain information, disseminate information, access entertainment, or communicate with others.

•The internet employs a set of standardized protocols which allow for the sharing of resources among different kinds of computers that communicate with each other on the network. Internet allows computers on different kinds of networks to interact with each other In Internet, a huge resource of information is accessible to people across the world.

- Information in every field starting from education, science, health, medicine, history, and geography to business, news, etc. can be retrieved through Internet.
- The Internet carries an extensive range of information resources and services, such as the inter-linked hypertext documents of the World Wide Web (WWW) and the infrastructure to support email.
- The terms Internet and World Wide Web are often used in everyday speech without much distinction. However, the Internet and the World Wide Web are not one and the same.
- The Internet establishes a global data communications system between computers. In contrast, the Web is one of the services communicated via the Internet.
- It is a collection of interconnected documents and other resources, linked by hyperlinks and URLS

HISTORY OF INTERNET

- Internet has evolved from a research prototype project to a full-grown commercial computer communication system.
- Growth of Internet can be discussed in three steps, as follows:

1. Internetworking Protocol - Transmission Control Protocol/Internet Protocol (TCP/IP) in 1970s

2. Usenet groups and Electronic mail in 1980s

3. World Wide Web (WWW) in 1990s

- US Department of Defense Advanced Research Projects Agency (DARPA) during 1970's developed the ARPANET as a WAN to connect different computers and later to connect computers on different networks (Internetworking). Internetworking became the focus of research at ARPA and led to the emergence of Internet.

DARPA goals included:

- the ability to interconnect different types of network
- to connect through alternate paths if some path gets destroyed, and
- to support applications of various types like audio, video, text etc.

Based on the design goals, a protocol named Transmission Control Protocol/Internet Protocol (TCP/IP) was developed for computer communication. TCP/IP has become the protocol for Internet.

- In late 1970s, the US National Science Foundation (NSF) designed a successor to ARPANET, called NSFNET, which was open for use to all university research groups, libraries and museums. This allowed scientists across the country to share data and interact with each other for their research projects.

- Internet grew exponentially when ARPANET was interconnected with NSFNET.

- In 1980s, many Internet applications like electronic mail, newsgroups, file transfer facility and remote login were developed. The Electronic mail facility allowed users to compose, send, and receive messages.

- Users having common interests could exchange messages using forums like Newsgroups. The Telnet command allowed users to login to a remote computer. The File Transfer Protocol program was used to copy files from one computer to another on the Internet.

- In the early 1990s, a new application World Wide Web (WWW) changed the way in which Internet was used.

- WWW is a system of creating, organizing, and linking documents, and was created by British scientist Tim Berners Lee. A protocol based on hypertext was developed that allowed the documents and content on WWW to be connected via hyperlink.

- In 1993, Marc Andreessen at the University of Illinois developed the Mosaic browser. The WWW along with the browser made it possible to set up number of web pages that may consist of text, pictures or sound, and with link to other pages.

INTERNETWORKING PROTOCOL

- Internetworking is the process or technique of connecting different networks by using intermediary devices such as routers or gateway devices. It ensures data communication among networks owned and operated by different entities using common data communication and the Internet Routing Protocol.
- Transmission Control Protocol/Internet Protocol (TCP/IP) is the most popular internetworking protocol.
- TCP/IP is the communication protocol for the Internet. The TCP/IP protocol has two parts: TCP and IP.

Transmission Control Protocol (TCP)

Transmission Control Protocol (TCP) provides reliable transport service, i.e. it ensures that messages sent from sender to receiver are properly routed and arrive intact at the destination.

TCP converts messages into a set of packets at the source, which are then reassembled back into messages at the destination. TCP operates with the packet switching technique, which is described as follows:

- The message is divided into small packets.
- Each packet contains address, sequencing information, and error control information.
- The address is used to route the packet to its destination.
- Since multiple users can send or receive information over the same communication line, the packets can arrive out of order at the destination. The sequencing information in the packet is used to reassemble the packets in order, at their destination.
- The error control information is used to check that the packet arrived at the destination is the same as that sent from the source (i.e. has not got corrupted).

Internet Protocol (IP)

- Internet Protocol (IP) allows different computers to communicate by creating a network of networks.
- IP handles the dispatch of packets over the network.
- It handles the addressing of packets, and ensures that a packet reaches its destination traveling through multiple networks with multiple standards.

TCP/IP protocol makes it possible for any pair of computers connected to Internet to communicate, despite their hardware differences

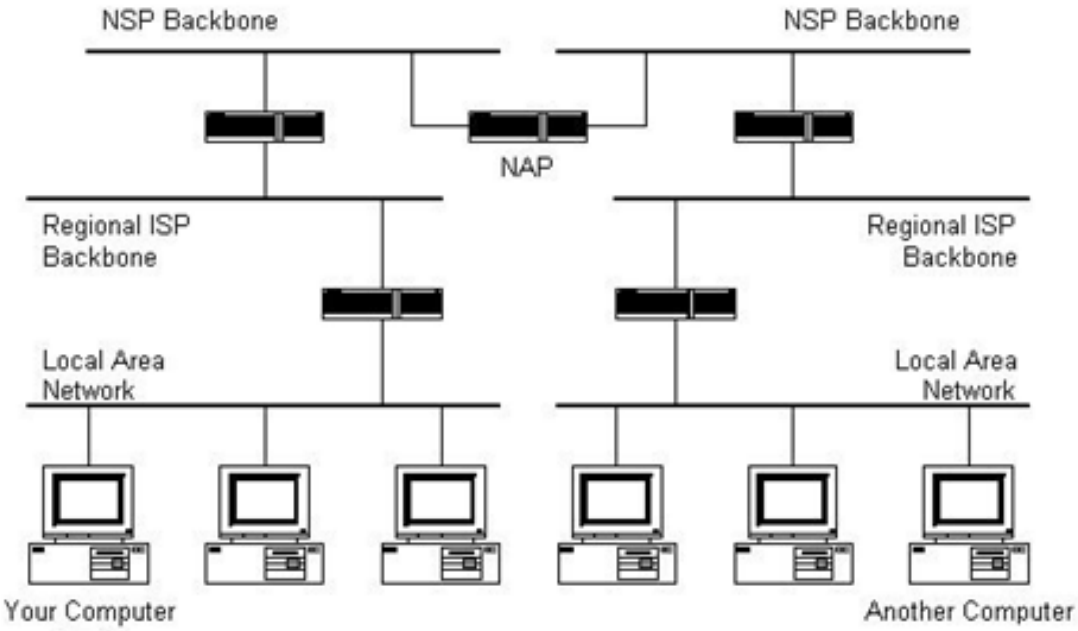
THE INTERNET ARCHITECTURE

Client

- Client (user of computer) at home or in a LAN network is at the lowest level in hierarchy.

Local ISP

- Local Internet Service Provider (ISP) is at the next higher level.
- An ISP is an organization that has its own computers connected to the Internet and provides facility to individual users to connect to Internet through their computers.
- Local ISP is the local telephone company located in the telephone switching office, where the telephone of client terminates. Examples of local ISP in Nepal are Nepal Telecom, World Link, etc.
- The client calls local ISP using a modem or Network Interface Card.


NSP Backbone
NSP Backbone
NAP
Regional ISP
Backbone
Regional ISP
Backbone
Local Area
Network
Local Area
Network
Your Computer
Another Computer

Regional ISP

- Regional ISP is next in the hierarchy. The local ISP is connected to regional ISP.
- A router is a special hardware system consisting of a processor, memory, and an I/O interface, used for the purpose of interconnecting networks. A router can interconnect networks having different technologies, different media, and physical addressing schemes or frame formats.
- The regional ISP connects the local ISP’s located in various cities via routers.
- If the packet received by regional ISP is for a client connected to this regional ISP, then the packet is delivered; otherwise, packet is sent to the regional ISP’s backbone.

Backbone

- Backbone is at top of the hierarchy.
- Backbone operators are large corporations like AT&T which have their own server farms connected to the backbone. There are many backbones existing in the world.
- The backbone networks are connected to Regional ISP's with a large number of routers through high speed fiber-optics.
- Network Access Point (NAP) connects different backbones, so that packets travel across different backbones.
- If a packet at the backbone is for a regional ISP connected to this backbone, the packet is sent to the closest router to be routed to local ISP and then to its destination; otherwise, packet is sent to other backbone via NAP. The packet traverses different backbones until it reaches the backbone of regional ISP for which it is destined.

MANAGING THE INTERNET

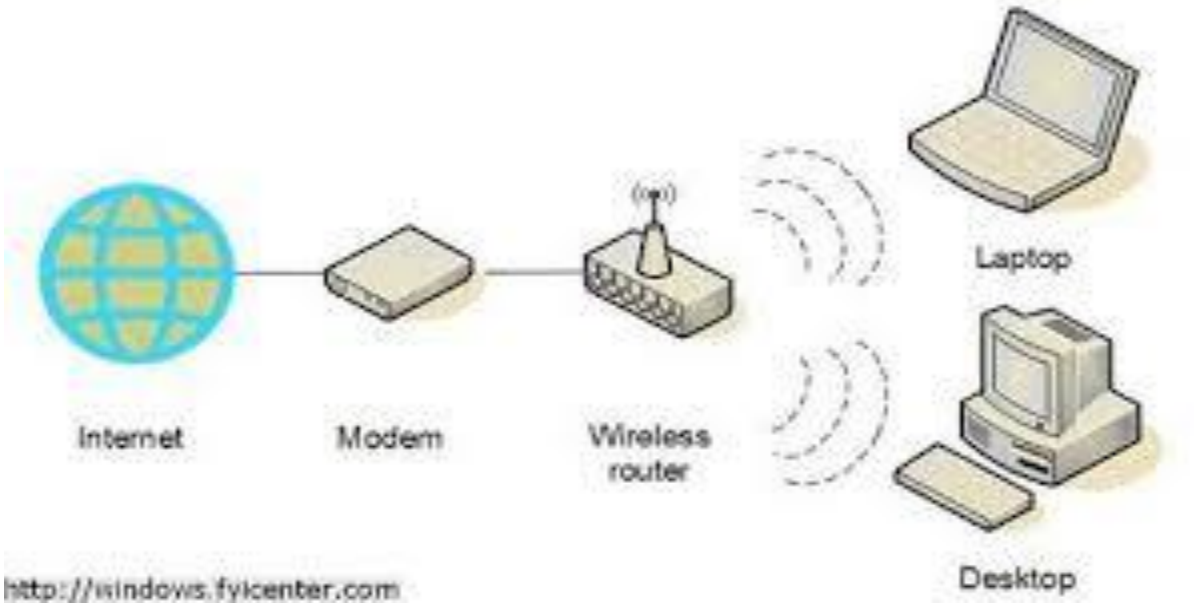
Internet is not controlled by any one person or an organization. A number of organizations manage the Internet. Some of the governing bodies of the Internet and their functions are as shown below:-

Governing Bodies of Internet	Functions
Internet Society (ISOC)	• Provides information about Internet • Responsible for development of standards and protocols related to Internet
Internet Architecture Board (IAB)	• Advisory group of ISOC • Responsible for development of Internet architecture
Internet Engineering Task Force (IETF)	• Community of network designers, operators, vendors, and researchers • Responsible for evolution of Internet • Open to all individuals
Internet Engineering Steering Group (IESG)	• Reviews standards developed by IETF
Internet Research Task Force (IRTF)	• Focuses on research towards the future of Internet (Internet protocol, architecture etc.)
Internet Assigned Number Authority (IANA)	• Allots IP address to organizations and individuals
Internet Network Information Center (InterNIC)	• Responsible for domain name registration
World Wide Web Consortium (W3C)	• Responsible for development of technologies for World Wide Web

CONNECTING TO THE INTERNET

Requirements for connecting computer to the internet are as follows:

1. **TCP/IP enabled computer**
2. **Internet service provider (ISP):** an internet service provider provides you with a connection to the internet and the software you will need to navigate.
3. **Telecommunication line**: a telephone line is required to connect you to the internet service provider.
4. **Modem:** a modem converts a digital signal received from a computer into an analogue signal that can be sent along ordinary telephone lines, and back to digital at the other end.
5. **Web browser:** a web browser is software used to view and download Web pages and various types of files such as text, graphics and video. Examples are Microsoft Internet Explorer or Mozilla Firefox, Google Chrome.


Laptop
Internet
Modem
Wireless router
Desktop
http://windows.fyicenter.com

INTERNET CONNECTIONS

- The ISPs provide Internet connections of different types. Bandwidth and cost are the two factors that help you (the user) in deciding which Internet connection to use.
- Bandwidth is the amount of data that can be transferred through a communication medium in a fixed amount of time. The speed of Internet access depends on the bandwidth. The speed of Internet access increases with the increase in bandwidth.
- ISPs offer low speed Internet connection like Dial-up connection, and high-speed Internet connection called broadband connection. Broadband are the services with more bandwidth than standard telephone service.
- DSL, Cable modem, and Integrated Services Digital Network are some of the existing broadband connections, each, having a different bandwidth and cost.
- Some of the Internet connections that are nowadays available for Internet access are:

Dial-up Access

- Dial-up access is a method of connecting to the Internet using an existing telephone line. When our computer is connected to the Internet, we cannot receive voice telephone calls on this telephone line during that time.
- In Dial-up access, we are assigned an account on the server of ISP along with some storage space on the disk of server. For example, agoel@vsnl.com is an account with an ISP named VSNL. We are also assigned a user-id and password.
- You connect to Internet by dialing-up one of the computers of ISP. For this, you use a telephone number provided by ISP and connect via a 56 Kbps modem. The computer that dials-up is the client or remote machine, and the computer of ISP is the server or host.
- The client enters the user-id and password, and gets connected to the Internet via the ISP.

Leased Line

- Leased line is a dedicated phone line that connects a computer (also known as gateway) to Internet, using special kind of modems. At the other end, the gateway is connected to a large number of computers, which access the Internet via the gateway.
- The gateway forms a domain on Internet, e.g. ekantipur.com, which is used to provide connection to the other computers on the Internet to connect to it.
- Leased lines provide reliable and high-speed Internet access.
- The entire bandwidth of leased line is reserved for the traffic between gateway and Internet.
- Leased lines are generally used by large organizations and universities that have their own internal network, and have large number of users.
- The leased lines are on-line, twenty-four hours a day and seven days a week. The leased lines are normally provided on a yearly contract basis. The charges for the leased line are fixed based on many criteria like the bandwidth, number of users etc. The fixed charges do not vary with the actual usage of Internet.

Integrated Services Digital Network (ISDN)

- ISDN is a digital telephone service that can transmit voice, data and control information over an existing single telephone line.
- Internet access is faster using ISDN than Dial-up access.
- ISDN is commonly used for business purposes. You are able to connect a computer, a fax machine or a telephone to a single ISDN line, and also use them simultaneously.
- ISDN is costlier than Dial-up connection. It requires a special phone service and modem.
- Nowadays, ISDN services are largely being replaced by high speed broadband connection.

Digital Subscriber Line (DSL)

- DSL is a broadband connection that allows connecting to Internet over the existing telephone lines. It does not affect your telephone voice services. DSL uses the modem provided by ISP.
- The data transmission speed of DSL ranges from 128 Kbps to 8.448 Mbps.
- Originally, telephone lines were designed for carrying human voice and the whole system worked according to this requirement. All frequencies less than 300 Hz and above 3.4kHz were attenuated, since 300Hz to 3.4kHz is the range for human speech to be clearly audible. When using DSL, a different kind of switch is used that does not filter the frequencies, thus making entire frequency available. DSL uses frequency beyond 3.4 kHz for Internet access.
- Asymmetric DSL (ADSL), a variant of DSL, provides high-speed delivery of download data (from Internet to user), than that for upload (from user to Internet), since most users download much more than they upload.
- The bandwidth of connecting wire is divided into three bands—

- 0–25kHz for regular telephone,
- 25kHz–200kHz for user to Internet (upload), and
- 250kHz–1MHz for Internet to the user (download). The available bandwidth for each direction for Internet is divided into channels of 4 kHz.

- DSL is almost ten times faster than Dial-up access and is an always-on connection.

Cable Modem

- The user can connect to the Internet via a cable modem through cable television. The cable modem provides two connections—one for television and other for computer.
- The cable modem sends and receives data through the coaxial cable which connects the cable modem to the cable service provider. Coaxial cables allow transmission of Internet data, audio, and video, and control over its several channels simultaneously. The user can access the Internet and watch television at the same time.
- Like DSL, cable modem provides high-speed Internet connection. However, while using cable modem, the bandwidth is shared by many users. If many users access the Internet simultaneously then the available bandwidth for each of the user reduces.

The type of Internet connection is chosen depending upon the end user's needs and the availability of a connection. Nowadays, in cities, broadband connection is becoming more popular as it is almost ten times faster than dial-up access. For commercial purposes, leased lines and ISDN are the preferred choices. In some areas, broadband connection using a cable modem is widely used.

IP ADDRESS

IP address is an unique identification numbers that identifies each computer/devices using the Internet Protocol to communicate over a network.

Your computer's IP is like your home's mailing address.

An IP address consists of four numbers called as octet, each of which contains one to three digits, with a single dot (.) called as period separating each number or set of digits.

Each of the four numbers can range from 0 to 255.

Here's an example of what an IP address might look like: 204.132.40.155 where value of each octet ranges from 0 to 255.

In fact, it is a 32-bit number subdivided into four bytes.

This is how your computer sees that IP:

11001100.10000100.00101000.10011011

This addressing scheme is called IP Version 4 i.e. IPV4 scheme.

An IP address can be split into:

network address, which specifies a specific network

host number, which specifies a particular machine in that network

The network portion of the IP address is allocated to the Internet Service Provider (ISP) by the InterNIC, under the authority of the Internet Assigned Numbers Authority (IANA). ISP then assigns the host portion of the IP address to the machined on the networks they operate.

- IP addresses are unique.
- They are unique in the sense that each address defines one and only one connection to the internet.
- Two devices in the internet can never have the same address at the same time.
- The IP Addresses are unique and universal.
- An IPv4 address is a 32-bit address that uniquely and universally defines the connection of a device (for example, a computer or a router) to the Internet

Notation of IP Address:

There are two common notations to show IP address

- Binary notation
- Dotted decimal notation

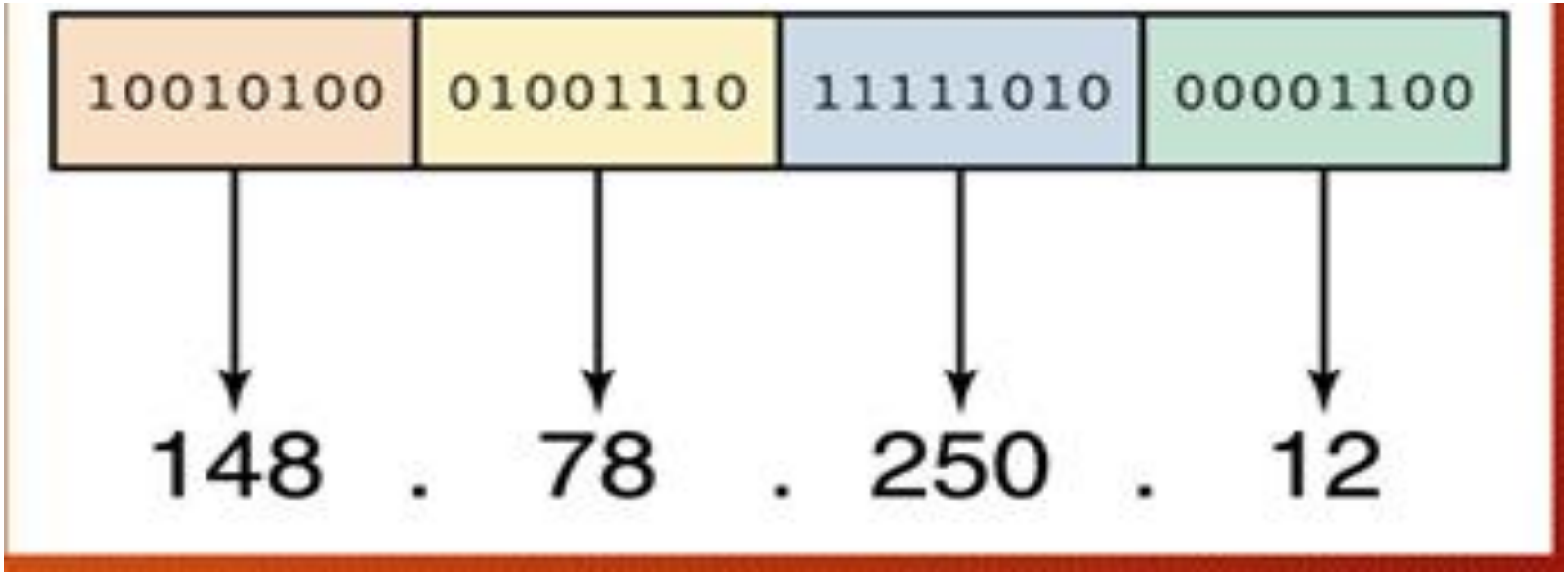
Binary Notation:

In binary notation, The IP address is displayed as 32-bits and this 32-bits is represented in 4-Octet (8bits) address or 4-bytes address. Example: 01110101 10010101 00011101 11101010

Dotted-Decimal Notation:

To make the IP address more compact and easier to read, IP addresses are usually written in decimal form with separating each byte by a dot (.). Each number in dotted-decimal notation is between 0 and 255.

For Example: 192.168.0.100


10010100
01001110
11111010
00001100
148 . 78 . 250 . 12

IP address can be assigned in two ways:

1. Static Address
2. Dynamic Address

Static Address: With static IP addresses, each computer has an IP address that don't change each time the computer reboots or restart its interface. It's IP address can be entered manually, since it is not assigned. We can do this at the installation time or later using the network configuration window. In summary static address is:

- Manually input by network administrator
- Manageable for small networks
- Requires careful checks to avoid duplication

Dynamic Address: With dynamic addresses, a client computer gets its IP address assigned from a server in the network when the client boots. The most popular protocol for dynamic address is called Dynamic Host Configuration Protocol (DHCP). With this method a client computer may not have the same IP address each time it boots. In summary, Dynamic address is:

- Assigned by server when host boots
- Derived automatically from a range of addresses
- Duration of ‘lease’ negotiated, then address released back to the server.

IP ADDRESS CLASSES

In classful addressing, the address space (i.e.32-bits) is divided into five classes: A, B, C, D, and E. A new architecture that was introduced in mid-1990 and proposed a concept of classless and such addressing is called classless addressing. However most of the Internet is still using classful addressing. In classful addressing IP address space is divided into five classes:

Class A: The range of Class A IP address is 1.0.0.0 to 127.255.255.255. This class is used for very large organizations such as a major international company. General format of class A is N.H.H.H where N represent network bit and H represent host bit.

Class B: The range of Class B IP address is 128.0.0.0 to 191.255.255.255 . This class is used for medium sized organizations. General format of class B is N.N.H.H where N represent network bit and H represent host bit.

Class C: The range of Class C IP address is 192.0.0.0 to 223.255.255.255. This class is used for small sized organizations. General format of class C is N.N.N.H where N represent network bit and H represent host bit.

Class D: The range of Class D IP address is 224.0.0.0 to 239.255.255.255. This class is used for unicasting and multicasting purpose.

Class E: The range of Class E IP address is 240.0.0.0 to 255.255.255.255. This class is used for research and future purpose.

IPV4 ADDRESSES

Q:Why we are running out of IPV4 Addresses ?

A:IPv4 uses 32 bits for its Internet addresses. That means it can support 2^32 IP addresses in total — around 4.29 billion. That may seem like a lot, but all 4.29 billion IP addresses have now been assigned to various institutions, leading to the crisis we face today.

What Next ?

A new version of IP Address i.e. IPV6

IPV6 ADDRESSES

- Unlike the familiar IPv4 addresses which are 32 bits long, written in decimal, and separated by periods, IPv6 addresses are 128 bits long, written in hexadecimal, and separated by colons.
- An example would be like: 3ffe:1900:4545:3:200:f8ff:fe21:67cf
- Each alphanumeric set of hexadecimal numbers separated by colon are called as group.
- Colons separate 16-bit fields. Leading zeros can be omitted in each field as can be seen above where the field :0003: is written :3:
- In addition, a double colon (::) can be used once in an address to replace multiple fields of zeros.
- For example:

fe80:0:0:0:200:f8ff:fe21:67cf can be written

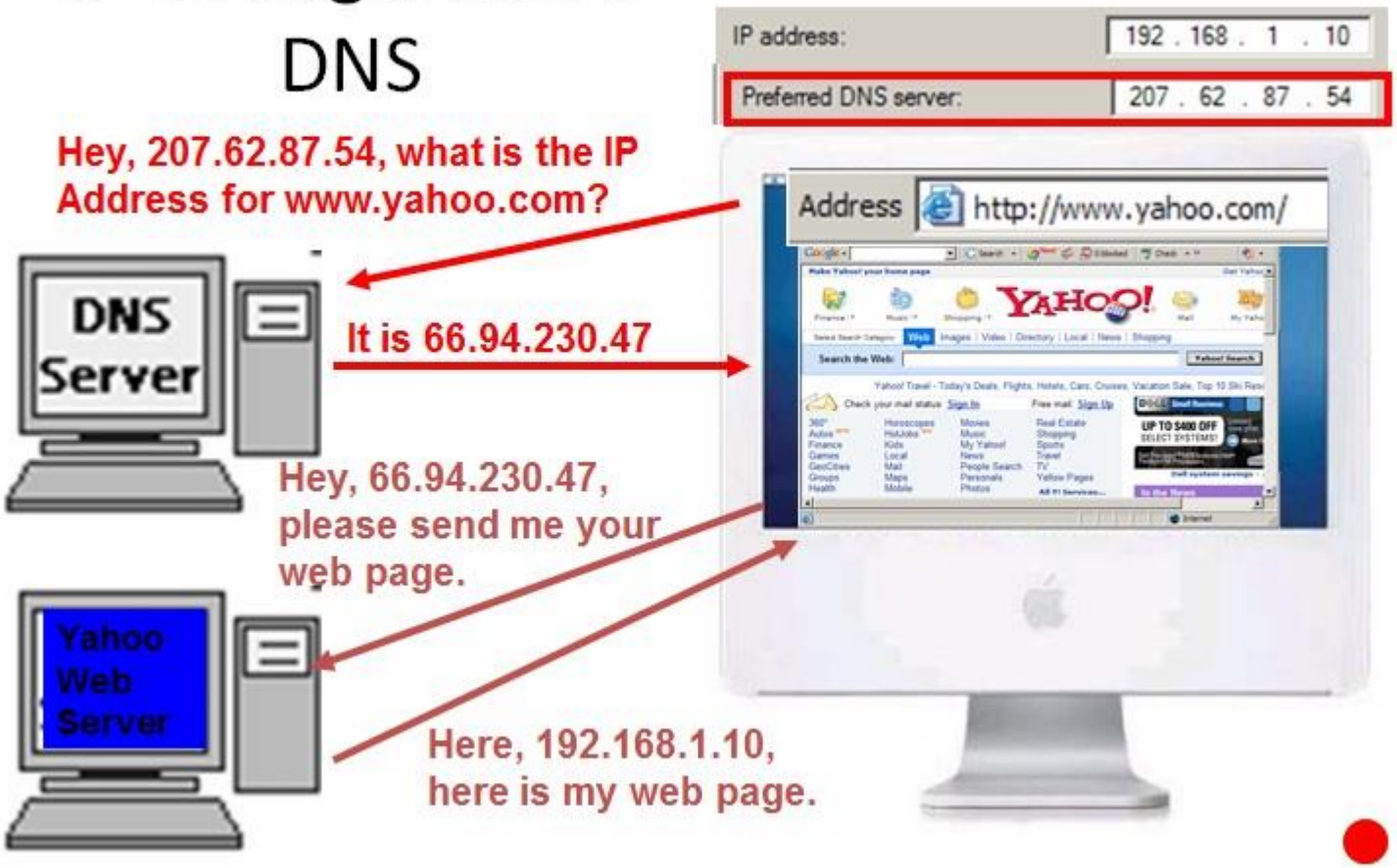
fe80::200:f8ff:fe21:67cf

DOMAIN NAME SYSTEM (DNS)

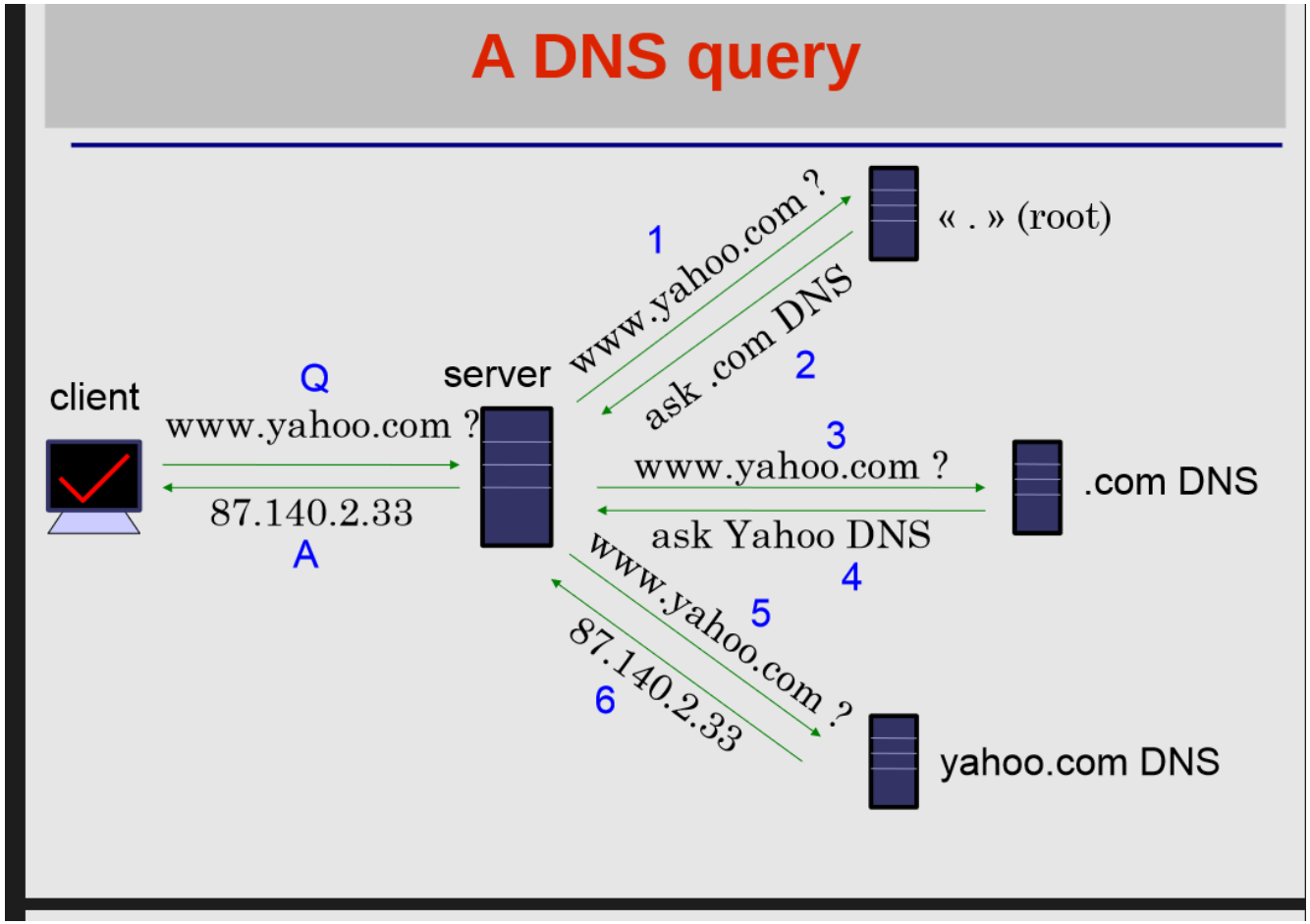
- IP address are tough for human to remember and impossible to guess. Domain Name System are usually used to translate a hostname or Domain name (eg. prime.edu.np) into an IP address (eg. 202.37.94.177).
- Domain name comprise a hierarchy so that names are unique, yet easy to remember.
- In fact, a hierarchical structure is employed. The site tu.edu.np indicates that it is an educational institute (edu) in Nepal (np).
- DNS is an Internet service that translates domain names into IP addresses. Simply, DNS is a TCP/IP application service that converts user-friendly names to IP addresses.

- Because domain names are alphabetic, they’re easier to remember. DNS maps domain names to IP address.
- When you use domain name to connect to a computer on Internet, a DNS server resolve the name to IP address.
- Every time you use a domain name, therefore, a DNS service must translate the name into corresponding IP address.

IP Configuration: DNS



A DNS query


« . » (root)
1
www.yahoo.com ?
ask .com DNS
2
client
Q
www.yahoo.com ?
server
3
www.yahoo.com ?
.com DNS
87.140.2.33
A
ask Yahoo DNS
4
5
www.yahoo.com ?
87.140.2.33
6
yahoo.com DNS

NAME SPACE:

- The name assigned to a machine must be unique because the addresses are unique. A name space that maps each address to a unique name can be organized in two ways:

1. Flat name space
2. Hierarchical name space

1. Flat Name Space: In flat name space, a name is assigned to an address. The name in this space is a sequence of characters without structure. This is simple name (com1, com2, etc.). The main disadvantage of flat name space is that it cannot be used in a large system such as internet because it must be centrally controlled to avoid ambiguity and duplication. Hierarchical name space overcomes the disadvantages of flat name space.

2. Hierarchical Name Space:

In this, each name is made of several parts in a tree structure and each part is separated by dot(.). Eg: www.ict.tu.edu.np.

First part: nature of the organisation (edu:education)

Second part: Name (tu: tribhuvan university)

Third part: department (ict: information and communication technology department)

So the authority to assign and control the name space can be decentralized.

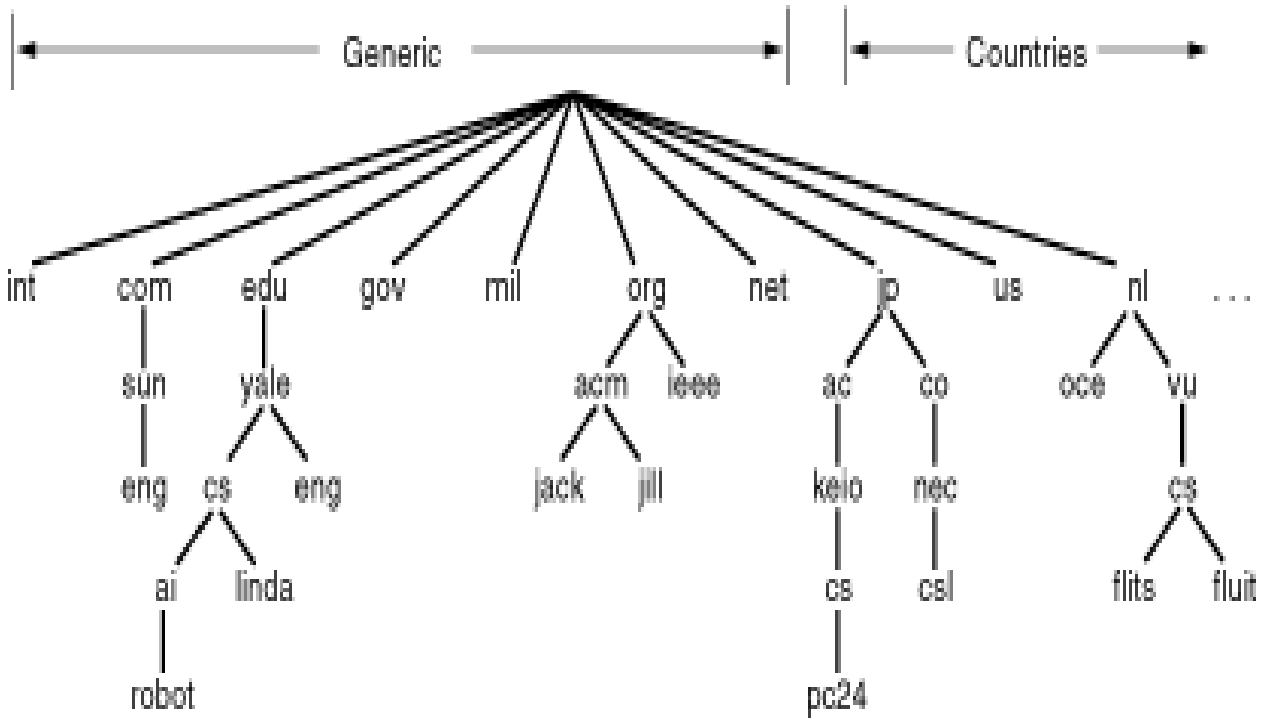
Suffixes can be added to the name to define the host or resources.

THE DNS NAME SPACE

- The DNS name space is hierarchical name space in which the names are defined in an inverted tree structure with the root at the top. The tree can have only 128 levels, level 0 to level 127. The root glues the whole tree together, each level of the tree define hierarchical level. This name space is also referred to as for internet domain name space.
- The address space is divided into different level of domains such as top level domain and subdomains. The internet is divided into over 200 top level domains where each domain covers many hosts.
- The last portion of the domain name is the top level domain name and describes the type of organisation holding that name.

- For example: in domain names gmail.com, asp.net, standford.edu, cancer.org, whitehouse.gov; com, net, edu, org and gov represents the top-level domain name.
- Each domain is partitioned into subdomains, these are further partitioned and so on. All these represented by tree. The leaves of tree represent the domains that have no subdomains.
- A leaf domain may contain a single host or it may represent a company and thousand of hosts. The top-level domain has two types:

1. Generic
2. Country


Generic
Countries
int
com
edu
gov
mil
org
net
jp
us
nl
. . .
sun
yale
acm
ieee
ac
co
ece
vu
eng
cs
eng
jack
jill
keio
nec
cs
ai
linda
cs
csl
flits
fluit
robot
pc24

The organization generic domains such as com, gov, edu, org, etc and listed as below:

- Com: commercial organisation
- Edu: educational institutions
- Gov: government institutuions
- Int: international organizations
- Net: networking organisations
- Org: non-profit organisations

Some new generic domains are:

- Biz: business
- Info: information
- Aero: aerospace industries
- Coop:co-operative

The country domain includes one entry for every country such as np, in, jp, us, ca, pk, etc. The country domain uses two character country abbreviations. The second level domain contains the name of the company such as yahoo.com, hotmail.com, google.com, nepalnews.com,etc

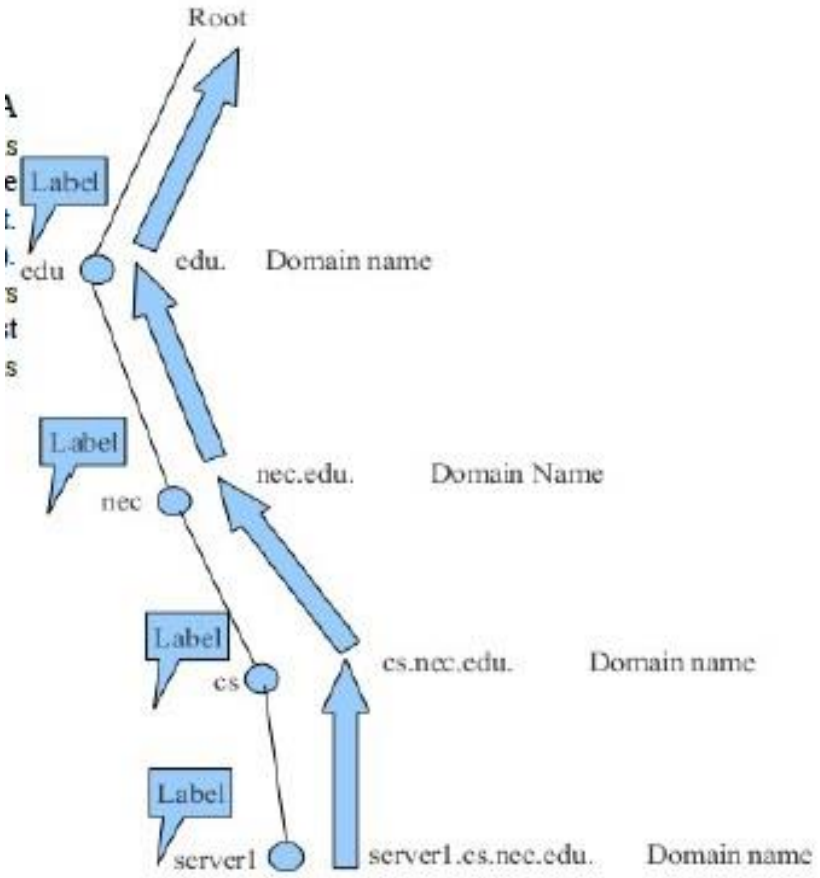
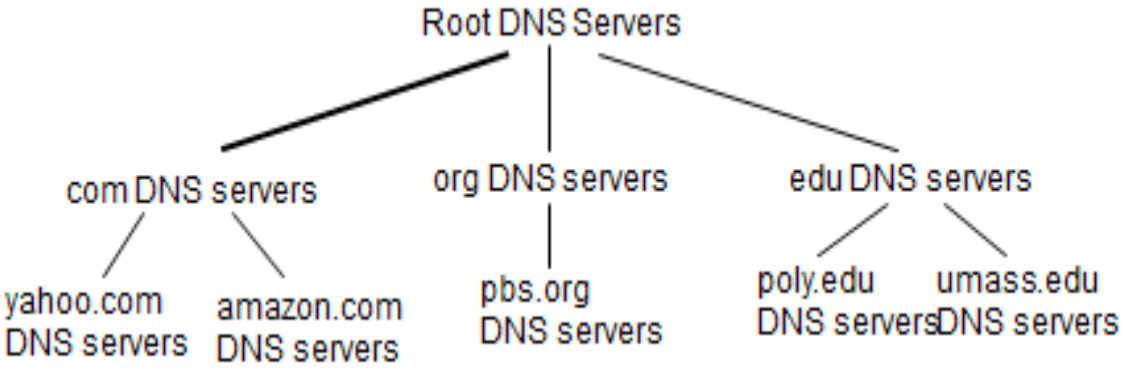


Fig: Domain Name and Labels

Distributed, Hierarchical Database



Client wants IP for www.amazon.com; 1st approx:

- client queries a root server to find com DNS server
- client queries com DNS server to get amazon.com DNS server
- client queries amazon.com DNS server to get IP address for www.amazon.com

CLIENT SERVER NETWORKS

In the client/ server architecture, certain computers acts as server and other acts as clients.

A server is simply a computer that manages the network resource, provides service to other computers when they request

server computer functions as the "brain" of the organization, and a group of client computers which are commonly called *workstations*

A client computer requests a service from a server

One can construct client server network by using one or more powerful networked computers and rest as clients

CLIENT SERVER NETWORKS CONTD…

Here, all the available network resources such as files, directories, applications & shared devices are centrally managed & hosted & then are accessed by client.

Security of the clients are provided by the server.

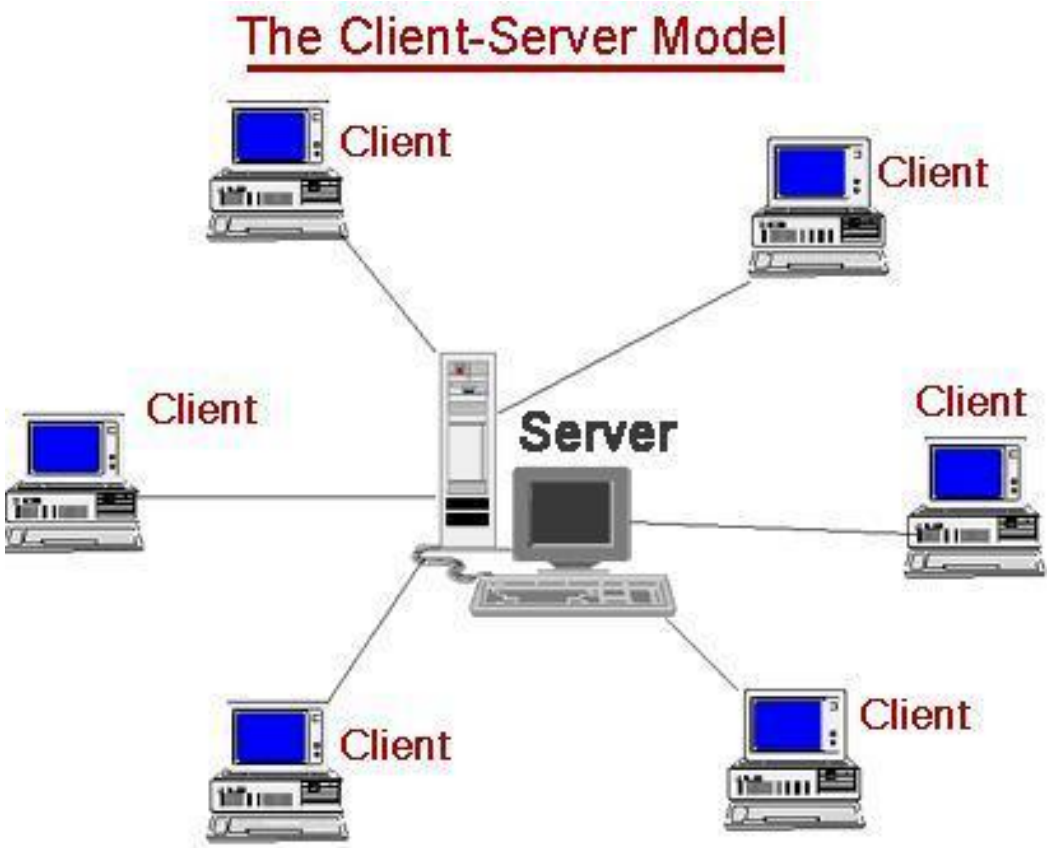
Communication between the client & the server

- The client places the request on the server machine when it wants to access the centralized resources.
- The server responds to the request sends the reply.

TYPES OF SERVERS

- Application Servers
- Audio/Video Servers
- Chat Servers
- Fax Servers
- FTP Servers
- Mail Servers
- News Servers
- Proxy Servers
- Telnet Servers
- Web Servers

CLIENT/SERVER ARCHITECTURE



ADVANTAGES - CLIENT/SERVER

1) **Centralization :** Unlike P2P, in this architecture there is a centralized control.
   Servers help in administering the whole set-up. Access rights and resource allocation is done by Servers.
2) **Proper Management:** All the files are stored at the same place. In this way, management of files becomes easy. Also it becomes easier to find files.
3) **Back-up and Recovery possible :** As all the data is stored on server its easy to make a back-up of it. Also, in case of some break-down if data is lost, it can be recovered easily and efficiently.
4) **Upgradation and Scalability in Client-server set-up :** Changes can be made easily by just upgrading the server. Also new resources and systems can be added by making necessary changes in server.

ADVANTAGES - CLIENT/SERVER CONTD...

5) **Accessibility :** From various platforms in the network, server can be accessed remotely.
6) As new information is uploaded in database , each workstation need not have its own storage capacities increased (as may be the case in peer-to-peer systems). All the changes are made only in central computer on which server database exists.
7) **Security :** Rules defining security and access rights can be defined at the time of set-up of server.
8) Servers can play different roles for different clients.

DISADVANTAGES: CLIENT/SERVER

1) **Congestion in Network :** Too many requests from the clients may lead to congestion, which rarely takes place in P2P network. Overload can lead to breaking-down of servers. In peer-to-peer, the total bandwidth of the network increases as the number of peers increase.

2) Client-Server architecture is **not as robust** as a P2P and if the server fails, the whole network goes down. Also, if you are downloading a file from server and it gets abandoned due to some error, download stops altogether. However, if there would have been peers, they would have provided the broken parts of file.

3) **Cost :** It is very expensive to install and manage this type of computing.

4) You **need professional IT people** to maintain the servers and other technical details of network.

SEARCH ENGINES

DEFINITION OF SEARCH ENGINE

Search Engines are web sites that allow users to search information based on keywords or combination of key words. Web search engines are actually databases that contain references to thousand of resources.

It response to specific item, or query, of interest with a list of pages that match query, by virtue containing the keywords that were included in the query. It allows the user to access various level of information. There are many search engines available on the web. Some of them are:

http:// www. google.com
http:// www. altavista.com
http:// www. yahoo.com
http:// www. bing.com

Information on the internet can be located through the use of search engine. Search engines are accessed through a web page that provides a text box for the user to type in key words which may be expected to be found in the document.

It is the only method available for internet searches so it is useful to learn to optimize the search techniques.

Search engines function by collecting a database of keywords which are indexes to records. Each record contains an array of URL (Uniform Resource Locator) addresses for all web documents that contain the specific key word(s), plus associated ranking information of the keyword for each document. Search engine databases are continuously updated.

HYPER TEXT TRANSFER PROTOCOL (HTTP)

A standard Internet protocol that specifies the client/server (request-response) interaction processes between Web browsers such as Mozilla Firefox and Web servers such as Apache. Its the network protocol used to deliver virtually all files and other data(collectively called resources) on the World-Wide-Web, whether they are HTML files, image files, query results or anything else. Usually HTTP takes place though TCP/IP Sockets.

A Browser is an HTTP client because it sends requests to an HTTP server (Web Sever), which then sends response back to the client. The standard and default port for the HTTP servers to listen is 80, though they can use any port.

The original Hypertext Transfer Protocol (HTTP) 1.0 protocol is a stateless protocol whereby a Web browser forms a connection with a Web server, downloads the appropriate file, and then terminates the connection. The browser usually requests a file using an HTTP GET method request on TCP port 80, which consists of a series of HTTP request headers that define the transaction method (GET, POST, HEAD, and so on) and indicates to the server the capabilities of the client. The server responds with a series of HTTP response headers that indicate whether the transaction is successful, the type of data being sent, the type of server, and finally the requested data.

Hypertext is structured text that uses logical links (hyperlinks) between nodes containing text. HTTP is the protocol to exchange or transfer hypertext.

HTTPS VS HTTP.

As opposed to HTTP URLs that begin with "http://" and use port 80 by default, HTTPS URLs begin with "https://" and use port 443 by default. HTTP is unsecured and is subject to man-in-the-middle and eavesdropping attacks, which can let attackers gain access to website accounts and sensitive information. HTTPS is designed to withstand such attacks and is considered secure against such attacks . HTTP operates at the highest layer of the OSI Model, the Application layer; but the security protocol operates at a lower sublayer, encrypting an HTTP message prior to transmission and decrypting a message upon arrival. Strictly speaking, HTTPS is not a separate protocol, but refers to use of ordinary HTTP over an encrypted Secure Sockets Layer (SSL) or Transport Layer Security (TLS) connection. Everything in the HTTP message is encrypted, including the headers, and the request/response load.

FILE TRANSFER PROTOCOL (FTP)

- FTP is reliable, connection-oriented service that uses TCP to transfer files between systems that support FTP.
- The main purpose of FTP is to transfer files form one computer to another by copying and moving files from servers to clients, and from clients to servers.
- When files are copied from a server, FTP first establishes a Control Connection between the client and the server.
- Then, a second connection is established, which is a link between the computers through which data is transferred.
- Data transfer can occur in ASCII mode or in binary mode. These modes determine the encoding used for data file, which in the OSI model is a presentation layer task.

- After the file transfer has ended, the data connection terminates automatically when the entire session of copying and moving files is complete, the command link is closed when the user logs off and ends the session.
- FTP uses Transmission Control Protocol (TCP) for reliable network communication by establishing a session before initiating data transfer. TCP port number 21 on the FTP server listens for connection attempts from an FTP client and is used as a control port for establishing a connection between the client and server, for allowing the client to send an FTP command to the server, and for returning the server's response to the command. Once a control connection has been established, the server opens port number 20 to form a new connection with the client for transferring the actual data during uploads and downloads.

Requirements for using FTP

1. An FTP client like Auto FTP Manager installed on your computer
2. Certain information about the FTP server you want to connect to:

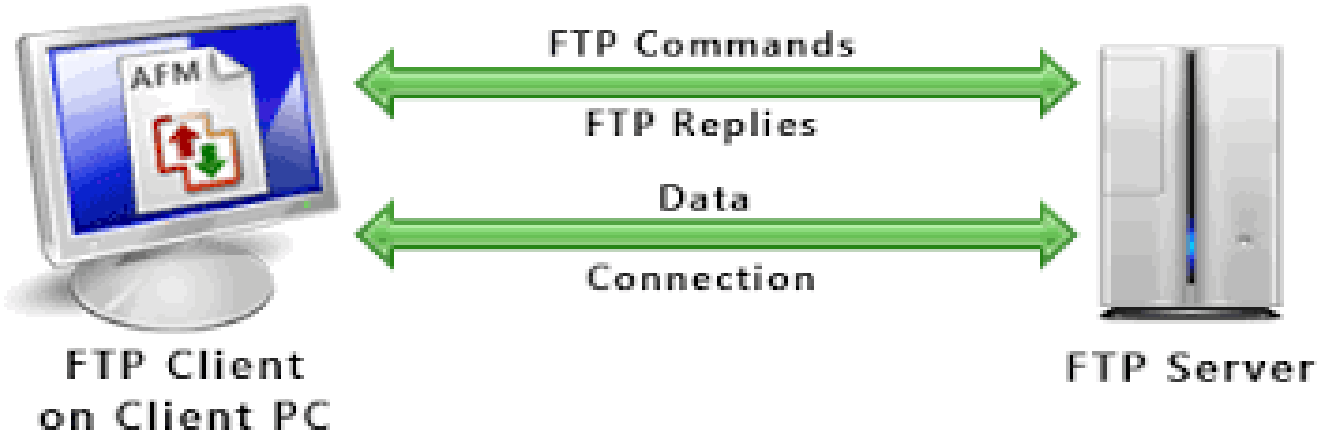
a. The **FTP server address.** This looks a lot like the addresses you type to browse web sites.

Example : Server address is "ftp.videodesk.net".

Sometimes the server address will be given as a numeric address, like "64.185.225.87".

b. A user name and password. Some FTP servers let you connect to them anonymously.

For anonymous connections, you do not need a user name and password.



WORLD WIDE WEB (WWW)

- The world wide web is an architectural framework for accessing linked documents spread out over millions of machines all over the internet. The www is a repository (source) of information spread all over the world and linked together.
- The WWW project was initiated by CREN (European Laboratory for Particle Physics) to create a system to handle distributed resources necessary for scientific research.
- The World Wide Web (WWW) is combination of all resources and users on the Internet that are using the Hypertext Transfer Protocol (HTTP) that supports links to other documents, as well as graphics, audio, and video files.

- There are several applications called Web browsers that make it easy to access the World Wide Web; Two of the most popular being Firefox and Microsoft's Internet Explorer.
- The Web gives users access to a vast array of documents that are connected to each other by means of hypertext or hypermedia links—i.e., hyperlinks, electronic connections that link related pieces of information in order to allow a user easy access to them.
- Hypertext allows the user to select a word from text and and thereby access other documents that contain additional information pertaining to that word; hypermedia documents feature links to images, sounds, animations, and movies.

- The Web operates within the Internet's basic client-server format; servers are computer programs that store and transmit documents to other computers on the network when asked to, while clients are programs that request documents from a server as the user asks for them.
- A hypertext document with its corresponding text and hyperlinks is written in HyperText Markup Language (HTML) and is assigned an online address called a Uniform Resource Locator (URL).
- Users are attached to WWW because it is interactive, easy to use and combines graphics, text, sound and animation into a rich communication medium.

A broader definition comes from the World Wide Web Consortium (W3C):

"The World Wide Web is the universe of network-accessible information, an embodiment of human knowledge."

The Web, as it's commonly known, is often confused with the internet. Although the two are connected, they are different things. The internet is, as its name implies, a network -- a vast, global network that incorporates a multitude of lesser networks. As such, the internet consists of supporting infrastructure and other technologies. In contrast, the Web is a communications model that, through HTTP, enables the exchange of information over the internet.

TELNET

- Telnet is a protocol, or set of rules, that enables one computer to connect to another computer. This process is also referred to as a remote login.
- It permits a user to connect to an account on a remote machine.
- A client program running on the user's machine communicates using Telnet protocol with a server program running on the remote machine.
- The remote computer can be physically located in the next room, the next town, or in another country.
- Telnet allows you to connect to remote computers (called hosts) over a TCP/IP network (such as the Internet).

- It allows the user to access Internet resources on other computers around the world.
- telnet are used to access a variety of resources such as databases, other internet tools such as FTP, WWW.

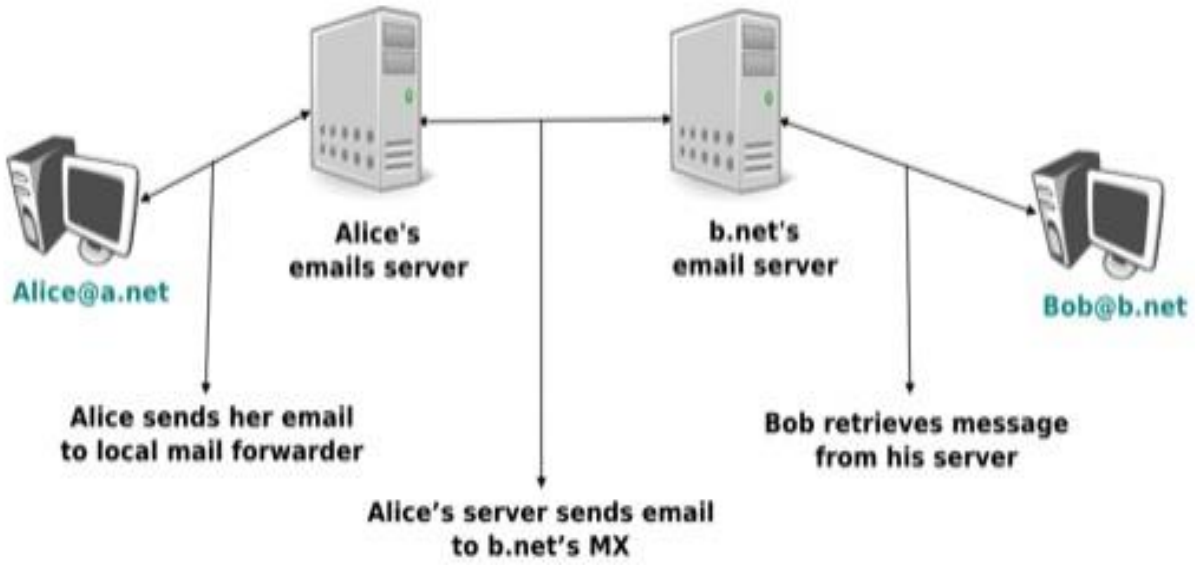
HOW TELNET WORKS?

- Telnet also operates on the client/server principle. The local computer uses a telnet client program and the remote, or host, computer uses a telnet server program.
- Telnet uses software installed on your computer, to create a connection with the remote host.
- The telnet client (local computer), at your command, will send a request to the telnet server (remote host).
- The server will reply asking for a user name and password. If accepted, the Telnet client will establish a connection to the host, thus making your computer a virtual terminal and allowing you complete access to the host's computer.
- Telnet requires the use of a user name and password, which means you need to have previously set up an account on the remote computer.
- In some cases, however, computers with telnet will allow guests to log on with restricted access.

ELECTRONIC MAIL (E-MAIL)

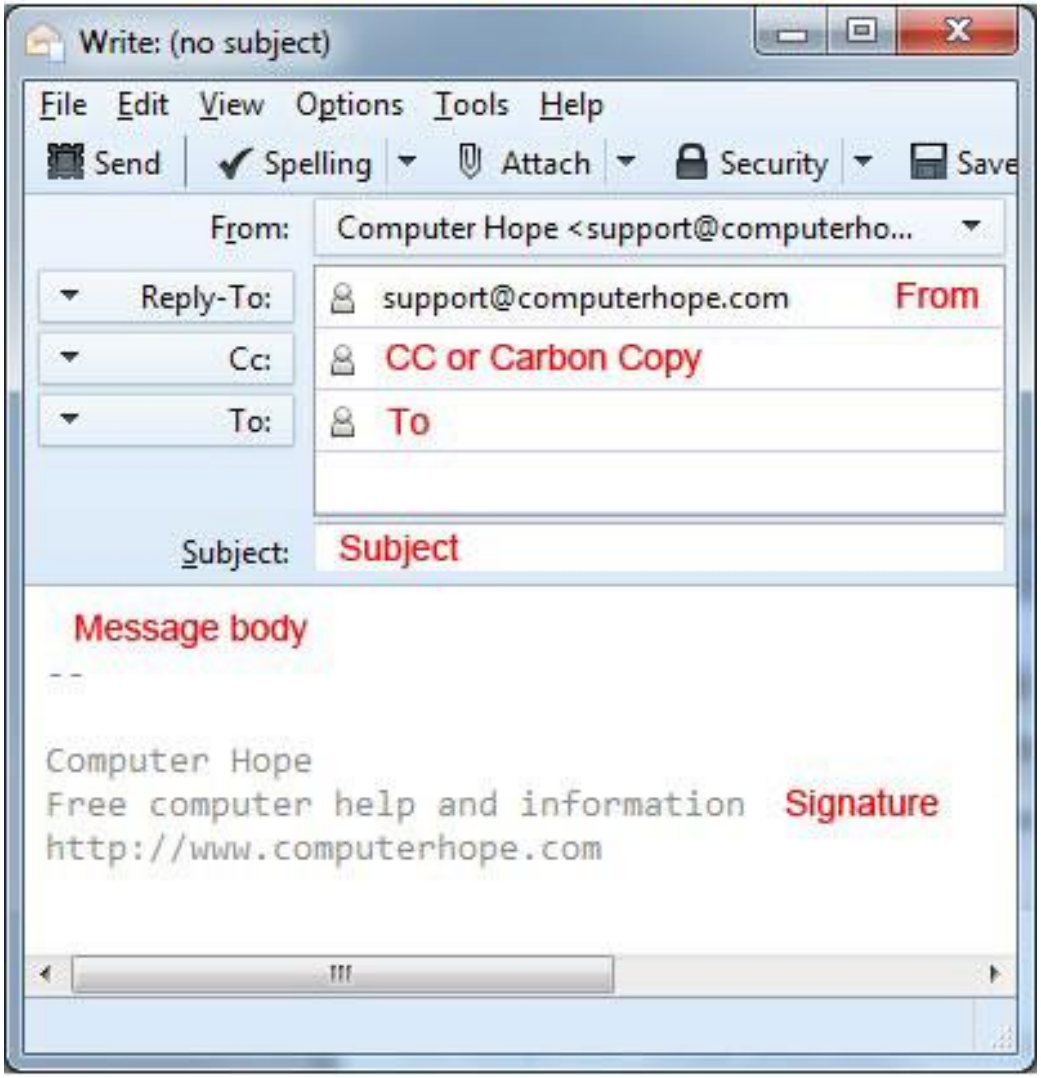
- E-mail is a method of exchanging digital messages which includes text, voice, videos, graphics, etc form one address to another.
- E-mail is the exchange of computer-stored messages by telecommunication.
- The most widely used protocol for the transmission of electronic mail is SMTP (Simple Mail Transfer Protocol) and POP3 (Post Office Protocol version 3) in the internet.
- E-mail can be send and received through an email program such as Microsoft Outlook or via web page belonging to a web mail provider such as gmail, yahoo, etc.

- The email system are based on store and forward mechanism, in which email server computer system accept, forward, deliver, manage and store messages on the name of user accounts in an email server.



- Let us consider a simple scenario illustrated in the figure below, where Alice sends an email to Bob. Alice prepares her email by using an email clients and sends it to her email server. Alice's email server extracts Bob's address from the email and delivers the message to Bob's server. Bob retrieves Alice's message on his server and reads it by using his favourite email client or through his webmail interface.
- Email consists of two parts: the message header part and the body part.
- The header contains the information such as one or more receiver, email address, etc.
- The body part of the email contains the actual message the sender is sending to receiver.

Basics of an e-mail message



When writing an e-mail message, it should look something like the example window below. As you can see, several fields are required when sending an e-mail:

The **To** field is where you type the e-mail address of the person who is the recipient of your message.

The **From** field should contain your e-mail address.

If you are replying to a message, the To and From fields are automatically filled out; if it's a new message, you'll need to enter them manually.

The **CC or Carbon Copy** field allows you to send a copy of the message to another e-mail address, but is not mandatory.

The **Subject Line**, although not required, should consist of a few words describing the e-mail's contents.

The **Message Body** is the location you type your main message. It often contains your signature at the bottom; similar to a hand-written letter.

EMAIL ADDRESS BREAKDOWN

support@ncc.edu.np

- The first portion all e-mail addresses, the part before the @ symbol, contains the user, group, or department of a company. In our above example support is the Technical Support department at Nepal Commerce Campus.
- Next, the @ (at sign) is used as a divider in the e-mail address; it is required for all SMTP e-mail addresses
- Finally, ncc.edu.np is the domain name to which the user belongs.

TYPES OF EMAIL ACCOUNT

Basically there are two types of email account.

- POP (Post Office Protocol) email account
- Web email account

POP EMAIL ACCOUNT

- POP email is accessed using client application in the user computer.
- The user has to get the service from the email service provider for free or by paying some amount.
- The user has to configure the email client application with their user id and password.
- Popular email clients a re Microsoft Outlook, Mozilla thunderbird, Opera mail, etc.
- The POP mail client connects the email server and downloads the new email from server to user computer so that it can be seen later at nay time.

- POP email basically works by downloading email data to the first client that connects to it. This means if you open up Outlook on your laptop and download new emails from the server using POP, your laptop is the only place those emails now live. If you try to access them using POP on your phone or other computer, they won’t show up.

ADVANTAGES AND DISADVANTAGES

Advantages:

1. No need to connect to read old emails and to compose new one.
2. It secures emails as they are stored in the local computer.
3. Advertisement and spam mails are automatically blocked by software.

Disadvantages:

1. It is not convenient for users who have to access emails from different places.
2. Need third party software to access email from server.
3. If the local computer is shared, the email can be viewed by other people.

WEB EMAIL ACCOUNT

- The web based email service provides a web page through which the user access the email server.
- The web page access the email server on behalf of the user and stores the email on database.
- The user can access the mail by logging into web page by providing the username and password.
- Through the web page the user can view, send and store and manages the emails.
- Email server can be accessed from any part of the world using web page.
- To get web email services, user has to subscribe service by paying or free of cost depending upon service. Some of the free web based services are yahoo, hotmail, Gmail, etc.

- In this type, access to email is without downloading any email to local computer.
- If you read a message on your iPad it will show as read on your laptop too. Moving emails from one folder to another is also synced.
- **Advantages:**

1. No need of third party software to view it, simply web browser can access it.
2. Email account can be accessed from any part of the world (from any computer).
3. No need to manage emails by user themselves

Disadvantages:

1. Need to be online every time to view and compose mails.
2. Slow to access email, since every emails should be accessed and download from the server to view it.
3. Size on email server for one user is limited.
4. Web mails consists of large number of advertisement and spam mails.

STATIC AND DYNAMIC WEB PAGE

- Web page is a document available on world wide web. Web Pages are stored on web server and can be viewed using a web browser.
- A web page contains huge information including text, graphics, audio, video and hyper links. These hyper links are the link to other web pages.
- Web pages can be either static or dynamic. "Static" means unchanged or constant, while "dynamic" means changing or lively. Therefore, static Web pages contain the same prebuilt content each time the page is loaded, while the content of dynamic Web pages can be generated on-the-fly.

STATIC WEB SITES

- For a static content web site, all content appearing on the web pages is place manually by professional web developers. This is also called “design time page construction” because the pages are fully built while the site is being developed.
- Static content web site is developed and then maintained by experienced professionals. Such web site usually cost less when initially developed., but then all future changes still have to be done by web professionals.
- Therefore, a static web site can be more expensive to maintain, especially when you want to make frequent changes to your site.

- Standard HTML pages are static Web pages. They contain HTML code, which defines the structure and content of the Web page. Each time an HTML page is loaded, it looks the same. The only way the content of an HTML page will change is if the Web developer updates and publishes the file.
- Example an organization site, institute site etc.

DYNAMIC WEB PAGE

- Pages in a dynamic web content web site are constructed “on the fly” when a page is requested from a web browser.
- Dynamic content web site, is developed by the professionals and can be maintained directly by the customer as well.
- Such web site initially costs more to develop but then you don’t have to pay web professionals every time you need to change something on the site.
- Dynamic Web pages are capable of producing different content for different visitors from the same source code file. The website can display different content based on what operating system or browser the visitor is using.

- Other types of Web pages, such as PHP, ASP, and JSP pages are dynamic Web pages. These pages contain "server-side" code, which allows the server to generate unique content each time the page is loaded.
- For example, the server may display the current time and date on the Web page. It may also output a unique response based on a Web form the user filled out.
- Many dynamic pages use server-side code to access database information, which enables the page's content to be generated from information stored in the database. Websites that generate Web pages from database information are often called database-driven websites.

- Dynamic websites use client side scripting for prepare dynamic design and server- side code to handle event, manage session and cookies, and storing and retrieving data from database. Example E-commerce sites, online form application, E-governance site, social networking sites etc.
- You can often tell if a page is static or dynamic simply by looking at the page's file extension in the URL, located in the address field of the Web browser. If it is ".htm" or ".html," the page is probably static. If the extension is ".php," ".asp," or ".jsp," the page is most likely dynamic. While not all dynamic Web pages contain dynamic content, most have at least some content that is generated on-the-fly.

WEB BROWSERS

- is an application software that acts as an interface between the user and the inner-workings of the WWW
- is a software application which enables a user to display and interact with text, images, videos, music, games and other information typically located on a Web page at a Web site on the World Wide Web or a local area network.
- Web browsers format HTML information for display, so the appearance of a Web page may differ between browsers.
- Web browsers are the most-commonly-used type of HTTP user agent. Although browsers are typically used to access the World Wide Web, they can also be used to access information provided by Web servers in private networks or content in file systems.
- E.g. Microsoft Internet Explorer, Mozilla Firefox, Netspace Navigator, Opera, Maxthon etc.

UNIFORM RESOURCE LOCATOR(URL)

- A Uniform Resource Locator specifies where an identified resource is available and the mechanism for retrieving it. In popular language, a URL is also referred to as a Web address.
- URL represents a standardized addressing scheme for Internet resources and helps the users to locate these resources by indicating exactly where they are.
- Example: https://themeisle.com/

E-COMMERCE

- E-commerce (Electronic Commerce) is the buying and selling of goods and services, or the transmitting of funds or data, over the internet.
- E-commerce is a methodology of modern business which addresses the need of business organizations, vendors and customers to reduce cost and improve the quality of goods and services while increasing the speed of delivery.
- E-commerce refers to paperless exchange of business information using E-mail, electronic fund transfer etc.
- E-commerce web sites are like on-line market places where you can sell and buy items, and facilitate it by advertising your product, establishing newsgroups and blogs, posting job-oriented resumes etc.

TYPES OF E-COMMERCE MODELS:

There are four main types of ecommerce models that can describe almost every transaction that takes place between consumers and businesses.

1. Business-to-Consumer (B2C)

The B2C model involves transaction between business organization and customer. The business organization sells its products directly to a consumer. Customer can view the products shown on the website. The customer can choose a product and order the same. The website will then send a notification to the business organization via email and the organization will dispatch the product/goods to the customer.

2. Business-to-Business (B2B)

The B2B model involves the transaction between companies/businesses, such as between a manufactures and a wholesaler or between wholesaler and a retailer. The business/company sells its products to an intermediate buyer who then sells the product to the final customer.

3. Consumer-to-Business (C2B)

The C2B model involves a transaction between a consumer and business organization. It is similar to B2C model, however the difference is that in this case the consumer is the seller and business organization is the buyer. In this kind of transaction, the consumer decide the price of a particular product, which business accept or decline.

4. Consumer-to-Consumer (C2C)

The C2C model involves transaction between consumers. Here, a consumer sells directly to another consumer. A well-known example is eBay.

E-GOVERNANCE

- E-governance expands to electronic governance, is the integration of Information and Communication Technology (ICT) in all the processes, with the aim of enhancing government ability to address the needs of the general public.
- The basic purpose of e-governance is to simplify processes for all, ie. government, citizens, businesses, etc at National, State and local levels.
- In short, it is the use of electronic means, to promote good governance. It means the implementation of information technology in the government processes and functions so as to cause simple, moral, accountable and transparent governance. It entails the access and delivery of government services, dissemination of information, communication in a quick and efficient manner.
- Through e-governance, the government plans to raise the coverage and quality of information and services provided to the general public, by the use of ICT in an easy, economical and effective manner. The process is extremely complicated which requires, the proper arrangement of hardware, software, networking and indeed re-engineering of all the processes to facilitate better delivery of services.

Benefits of E-governance

- Reduced corruption
- High transparency
- Increased convenience
- Direct participation of constituents
- Reduction in overall cost
- Expanded reach of government

Types of Interactions in E-Governance

1. G2G (Government to Government): When the exchange of information and services is within the periphery of the government, is termed as G2G interaction. This can be both horizontal, i.e. among various government entities and vertical, i.e. between national, state and local government entities and within different levels of the entity.

2. G2C (Government to Citizen): The interaction amidst the government and general public is G2C interaction. Here an interface is set up between government and citizens, which enables citizens to get access to wide variety of public services. The citizens has the freedom to share their views and grievances on government policies anytime, anywhere.

3. G2B (Government to Business): In this case, the e-governance helps the business class to interact with the government seamlessly. It aims at eliminating saving time, cost and establish transparency in the business environment, while interacting with government.

4. G2E (Government to Employees): The government of any country is the biggest employer and so it also deals with employees on a regular basis, as other employers do. ICT helps in making the interaction between government and employees fast and efficient, along with raising their level of satisfaction by providing perquisites and add-on benefits.

SMART CITY

- A smart city is a designation given to a city that incorporates information and communication technologies (ICT) to enhance the quality and performance of urban services such as energy, transportation and utilities in order to reduce resource consumption, wastage and overall costs.
- The aim of a smart city is to enhance the quality of living for its citizens through smart technology.
- Some major characteristics used to determine a city's smartness include:

- a technology-based infrastructure;
- environmental initiatives;
- a high functioning public transportation system;
- a confident sense of urban planning and
- humans to live and work within the city and utilize its resources.

How a smart city works ?

Smart cities utilize their web of connected IoT devices and other technologies to achieve their goals of improving the quality of life and achieving economic growth. Successful smart cities follow four steps:

- **Collection** - Smart sensors throughout the city gather data in real time.
- **Analysis** - Data collected by the smart sensors is assessed in order to draw meaningful insights.
- **Communication** - The insights that have been found in the analysis phase are communicated with decision makers through strong communication networks.
- **Action** - Cities use the insights pulled from the data to create solutions, optimize operations and asset management and improve the quality of life for residents.


Smart government
Smart health
Mobility/ Wi-Fi
Open data
Smart farming/ agriculture
Smart grid/ energy/ utilities
Smart manufacturing
Smart/ digital citizens
Smart buildings
Smart transportation
H
SMART CITY COMPONENTS

Smart cities are designed to use technology and data to improve the quality of life for residents and optimize the use of resources. Some of the advantages of smart cities include:

Improved efficiency: Smart cities use technology and data to optimize the use of resources such as energy, water, and transportation, resulting in cost savings and reduced waste.

Enhanced safety and security: Smart cities can use advanced technologies such as video surveillance, sensors, and data analytics to monitor and respond to potential safety and security threats in real-time.

Better transportation: Smart transportation systems can help reduce traffic congestion, improve public transportation services, and reduce air pollution, making commuting easier and more convenient for residents.

Improved environmental sustainability: Smart cities use technology to monitor and manage energy usage, waste management, and water consumption, which can help reduce the environmental impact of urban areas.

Enhanced quality of life: Smart cities can improve the quality of life for residents by providing better access to healthcare, education, and social services, as well as creating more opportunities for employment and economic growth.

Increased citizen participation: Smart cities can enable citizens to participate more actively in decision-making processes through digital platforms and tools, leading to more transparent and democratic governance.

Overall, smart cities have the potential to make urban areas more livable, sustainable, and efficient, while also enhancing the safety, security, and well-being of residents.

CENSORSHIP AND PRIVACY ISSUES

- **Internet censorship is the control or suppression** of what can be accessed, published, or viewed online. It happens when governments, organizations, or individuals restrict or block access to web content.
- Internet censorship refers to the practice of controlling, suppressing, or regulating access to information or expression on the internet. This can take many forms, including government restrictions, content filtering, website blocking, and surveillance.
- Governments may censor the internet for a variety of reasons, such as national security, protecting public morals, or preventing the spread of false information. However, censorship can also be used to silence dissenting voices and restrict free expression.
- Content filtering and website blocking are common forms of internet censorship. Governments may block websites or social media platforms that they deem to be a threat to national security or public order, or that contain content that is deemed illegal or offensive. In some cases, internet service providers may also be required to filter out certain types of content.

Surveillance is another form of internet censorship, as it involves monitoring and collecting information about internet users. Governments may use surveillance to monitor individuals who they perceive to be a threat to national security, or to track online activity that they deem to be illegal.

WHY INTERNET CENSORSHIP IS GOOD?

Prudence

Internet censorship offers a means of limiting the number of harmful videos or other forms of offensive content your children have access to. In simple terms, internet censorship provides a tool to limit access or even block access to content that can cause irreparable harm to young people. Proponents of internet censorship argue that censorship works to protect people with a common sense approach to the information that appears on the web.

In the past, users have expressed discomfort knowing that their children have easy access to pornography. Internet censorship methods are implemented to make accessing these sites more difficult. These measures included a question prompt when entering websites “Are you 18 years or older?”

This is a great start but that child can click yes and gain access anyway. Internet censorship has its pros and cons but as long as violent acts are kept offline the internet is already home to endless privacy options.

Helps Protect National Security

Government agencies know that information sharing on the web can threaten national security. Sensitive content, including numerous videos of military movements and tactics, posts about proprietary economic information, or other compromising details can put our country at risk. Although the United States is often thought to be the home of absolute freedom, internet censorship takes on a very real purpose when it used to protect the national economy or other factors that can influence our position on the global market.

Limits Child Pornography and Other Harmful Information

The internet today is nothing like it was years ago, when most users exhibited some form of self censorship. Now, everything goes, and local communities are feeling the pressure to protect free speech while creating internet limits that halt dangerous or harmful content.

Sites like Craigslist and Facebook give individuals access to buy and sell drugs, partake in human trafficking, and even engage in the distribution of child pornography.

Harmful information goes beyond access to child porn or similar online content. It may also include:

•Hate speech about gender identity or targeting a specific group for threats

•False news

•Details about illegal activities

•Information on how to commit identity theft

Proponents of censorship also argue that with the use of internet censorship, it restricts the chances for predators to find targets easily. While internet censorship regulations have lofty goals, online communities have found ways to defeat even the most well-meaning laws.

Minimizes Risk of Identity Theft and Other Cyber Threats

Cybercrimes are a rising concern in this digital era. People store a lot of their personal and private information on their computers. Without the proper knowledge of passwords and privacy policies, users can leave themselves very vulnerable online. Limiting the amount of information put online can certainly assist in minimizing the threat of these cyber attacks. If internet censorship is designed to prevent access to the tools and strategies used to commit cyber crimes, communities must weigh the advantages and disadvantages of such regulation.

Eliminates Misleading/Fake News

With news media sites springing up all over the web, it can be hard to know what is real and what is fake news. Established news outlets like CNN, Fox, and CNBC are not the only players on the web anymore. With the end-goal of profiting only, there are many sites in existence that cash in on providing false, misleading articles online. By enacting a strong program of internet censorship, this censorship could most likely reduce the amount of fake news.