Unit 6: The Internet and Internet Services

Introduction:

The computers interconnected by LAN, MAN, and WAN are able to exchange information, within their networks, i.e. a computer connected to one network is able to exchange information with another computer connected to the same network. However, a computer connected to a particular network may need to interact with a computer connected to a different network.

Internet is defined as an interconnection of networks. Internet allows computers on different kinds of networks to interact with each other. Any two computers, often having different software and hardware, can exchange information over the Internet, as long as they obey the technical rules of Internet communication. The exchange of information may be among connected computers located anywhere, like military and research institutions, different kinds of organizations, banks, educational institutions (elementary schools, high schools, colleges), public libraries, commercial sectors etc.

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) 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. For this, 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) 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.

The computers connected to Internet may be personal computers or mainframes; the computers could have a slow or fast CPU, small or large memory, connected to different networks having slow or fast speed. TCP/IP protocol makes it possible for any pair of computers connected to Internet to communicate, despite their hardware differences.
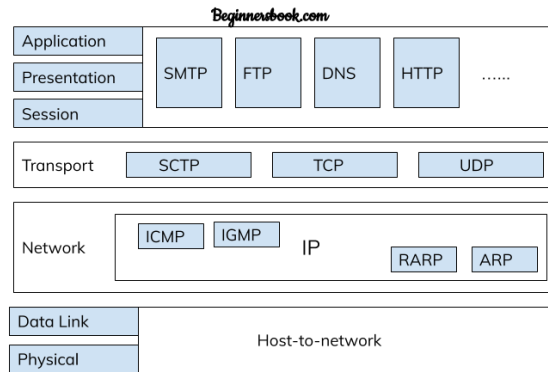
Fig: TCP/IP Model

The Internet Architecture

Internet is a network of interconnected networks and is designed to operate without a central control. If a portion of the network fails, connection is made through alternative paths available. The architecture of Internet is hierarchical in nature. A brief description of the architecture of Internet is as follows:

- Client (user of computer) at home or in a LAN network is at the lowest level in hierarchy.
- 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.
  - ➢ Examples of local ISP in Nepal are Nepal Telecommunication (NTC), Worldlink Communications etc.
  - ➢ The client calls local ISP using a modem or Network Interface Card.
- 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 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.
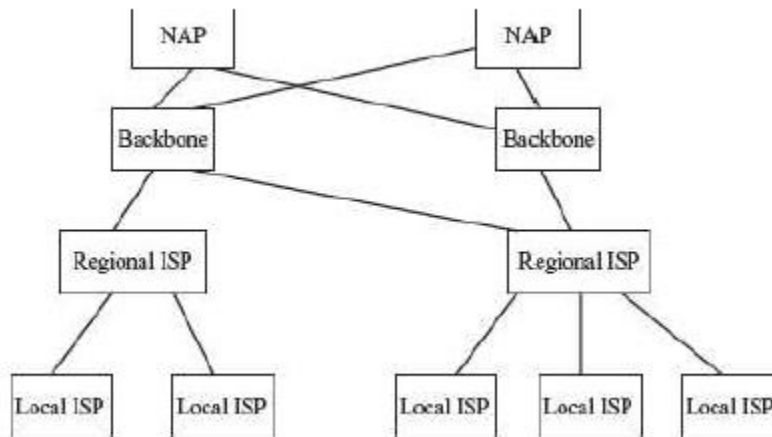- The Internet hierarchy is shown below:

Fig: The Internet Hierarchy

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 shown in Table 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

Table: Internet Organizations

Connecting to Internet:

To be able to connect your computer to the Internet, you require:

(1) a TCP/IP enabled computer,

(2) web browser software,

(3) an account with an ISP,

(4) a telephone line, and

(5) a modem or Network Interface Card (NIC) to connect the telephone line to the computer.

A modem is a device that connects a computer to Internet. A Network Interface Card or NIC is a device that is required to connect a computer to Internet via a LAN or high-speed Internet connection like cable modem or Digital Subscriber Line (DSL). A web browser is a software that allows the user to view information on WWW. WWW is a large-scale, on-line repository of information that the users search using the web browser. Internet Explorer and Google Chrome are examples of web browser.
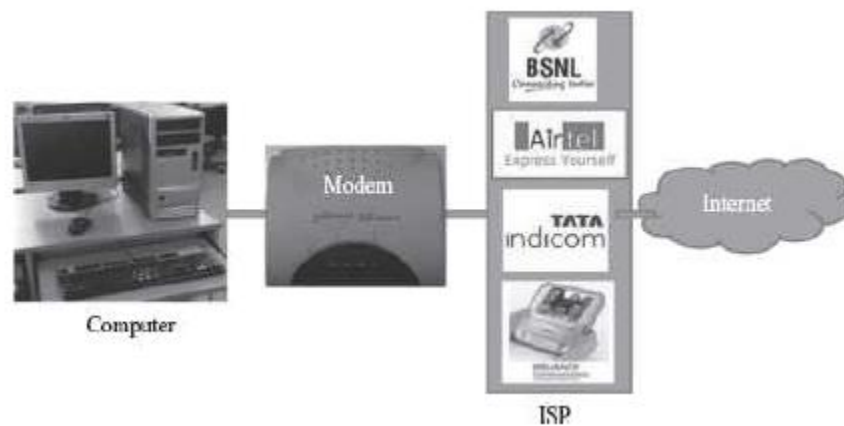

Fig: Connecting to Internet

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.
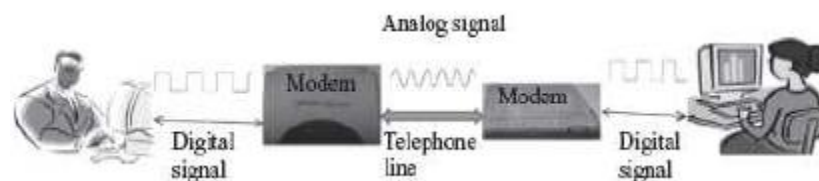

Fig: Communication via telephone line

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— (1) 0–25kHz for regular telephone, (2) 25kHz–200kHz for user to Internet (upload), and (3) 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.

Internet Address:

A computer connected to the Internet must have a unique address in order to communicate across the Internet. Internet Protocol (IP) address is assigned uniquely to every computer connected to the Internet. IP address is provided by the ISP whose services you use to connect your computer to the Internet. IP address is a string of numbers consisting of four parts, where each part is a number between 0 and 255. An IP address looks like 201.54.122.107. Since IP addresses are numeric, it is difficult to remember everyone's IP address. So, instead of numeric IP address, domain name is used.

Domain name is a text name (string of words) corresponding to the numeric IP address of a computer on the Internet. Domain names are used for the convenience of the user. A domain name combines a group of hosts on the Internet (e.g. Facebook, Google etc.), and a top-level domain.

Some examples of top-level domain are as follows:

com—for commercial organizations,

edu—for educational institutions,

net—for gateways and administrative hosts,

org—for non-profit organizations,

co—for companies, and

ac—for academics

Some examples of domain name are google.com, wikipedia.org, tuexam.edu.np and ntc.net.np Additionally, top-level domain is also provided based on the two-letter Internet country code. For example, np for Nepal, uk for United Kingdom, au for Australia etc.

In order to translate numeric IP address that identifies a computer on the Internet to a domain name that is convenient for the user to remember, a mapping is needed between the IP addresses and domain names. Domain Name System (DNS) server is a computer having a database that stores the IP addresses and their domain names. Whenever a user uses the domain name, DNS translates it into its corresponding IP address, to access the computer on Internet.

For example, DNS translates google.com to the IP address of the computer that houses Google.

Internet Services:

Internet is a huge de-centralized network that connects computers. Every computer connected to the Internet has a unique address, which helps to identify the computer on the Internet uniquely. Over the years, Internet has grown as the biggest network for communication and provides several services to its users. Each service has its own features and uses. Some of the important services provided by Internet are—World Wide Web, electronic mail, news, chat, and discussion groups.

World Wide Web (WWW)

- WWW (also called as Web) is a large scale, online store of information. It is a system of creating, organizing, and linking of documents.
- Information is stored on WWW as a collection of documents that are interconnected with each other via links. The interconnected documents may be located on one or more than one computer, worldwide, thus, the name world wide web. The features of WWW and terms linked to WWW are given below—
- The documents on web are created in hypertext format. Hypertext facilitates linking of documents.
- The language used to create a hypertext format document is HyperText Markup Language (HTML). HTML allows the designer of the document to include text, pictures, video, images, sound, graphics, movies etc., and also to link contents on the same document or different documents using a hyperlink.
- The hypertext format document is transferred on the Web using HyperText Transfer Protocol (HTTP).
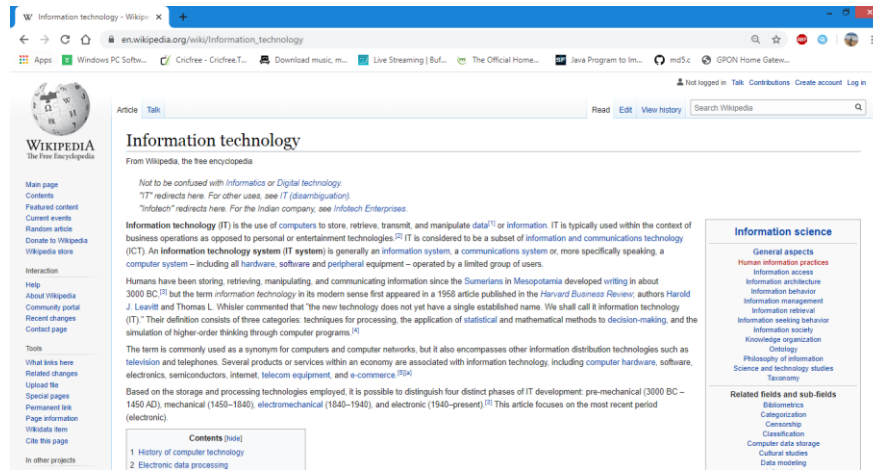- A single hypertext document is called a Web page.

Fig: A web page

- A group of related web pages is called a Web site. A web site displays related information on a specific topic.
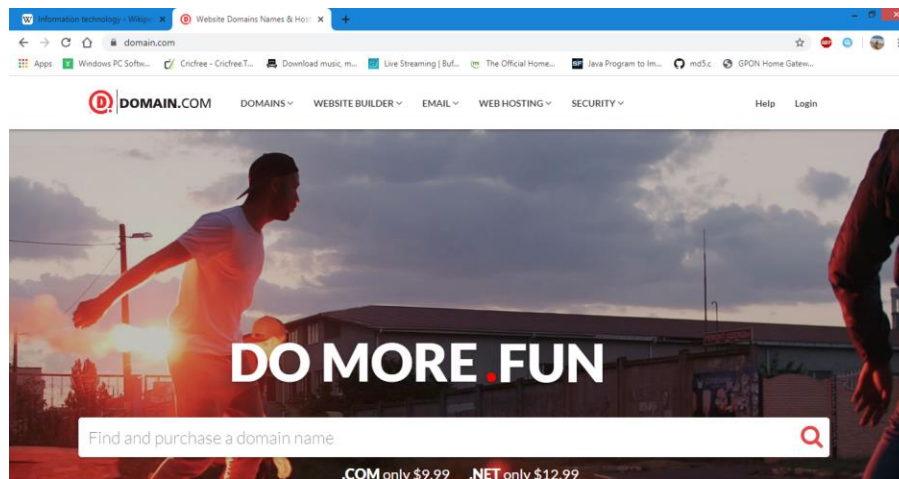

Fig: A web site

- The first web page or main page of a website is called Homepage.
- The web pages are stored on the Internet on the Web Server. Web servers are host computers that can store thousands of web pages.
- The process of storing a web page on a web server is called uploading.
- The process of retrieving a web page from a web server onto the user's computer is downloading.
- The web pages stored on web server on the Internet, can be viewed from the user's computer using a tool called Web browser.
- Every web page is identified on Internet by its address, also called Uniform Resource Locator (URL).
- A web portal is a web site that presents information from different sources and makes them available in a unified way. A web portal enables the user to search for any type of information from a single location, i.e. the home page of the web portal. A web portal generally consists of a search engine, e-mail service, news, advertisements, and an extensive list of links to other sites etc. www.msn.com and www.google.com are popular web portals.
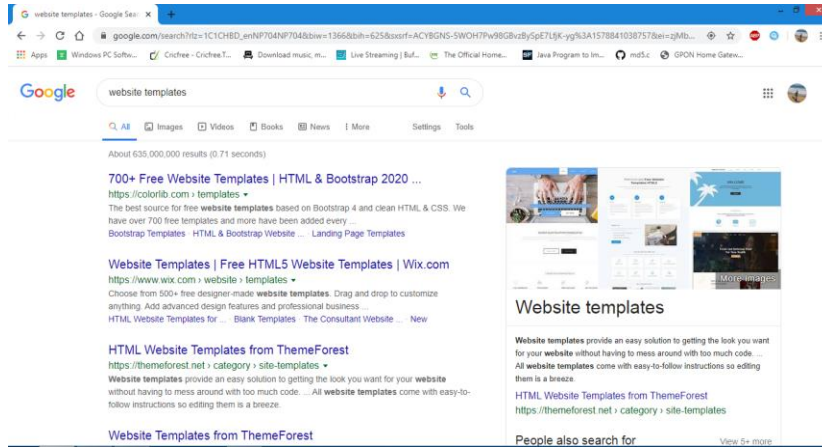
Fig: Web portal

Web Browser:

Web Browser (or browser) is a software program that extracts information on user request from the Internet and presents it as a web page to the user. It is also referred to as the user interface of the web. Some of the popular web browsers are—Internet Explorer from Microsoft, Mosaic browser, Google's chrome, and Netscape Navigator from Netscape Inc.

Browsers are of two types—graphical browser and text-based browser.

Graphical browsers provide a graphical user interface where the user can jump from one web page to the other by clicking on the hyperlink (displayed in blue color with underline) on a web page. Internet Explorer, Chrome are examples of graphical browsers.

Text browsers are used on computers that do not support graphics. Lynx is a text browser.

The process of using browser to view information on the Internet is known as Browsing or Surfing. During browsing, the user can navigate from one web page to another using URLs, hyperlinks, browser navigation tools like forward and back button, bookmarks etc.

Uniform Resource Locator (URL):

A web page on the Internet is uniquely identified by its address, called URL. URL is the address on the Internet at which the web page resides (Figure 10.10). The user uses this address to get a web page from the Internet.

The general form of URL is protocol://address/path

where,

- protocol defines the method used to access the web page, e.g., http, ftp, news etc.
- address is the Internet address of the server where the web page resides. It contains the service (e.g. www) and the domain name (e.g. google.com), and
- path is the location of web page on the server.

To access documents on WWW, the HTTP protocol is used. An example of a URL is, http://www.dsc.com/mainpage where, http is the protocol, www.dsc.com is the address, and mainpage is the path.

Electronic Mail

- Electronic mail (E-mail) is an electronic message transmitted over a network from one user to another. E-mail is a text-based mail consisting of lines of text, and can include attachments such as audio messages, pictures and documents.
- The features of e-mail are as follows:
    - E-mail can be sent to one person or more than one person at the same time.
    - Communicating via e-mail does not require physical presence of the recipient. The recipient can open the e-mail at his/her convenience.
    - Since messages are transmitted electronically, e-mail is a fast way to communicate with the people in your office or to people located in a distant country, as compared to postal system.
    - E-mail messages can be sent at any time of the day.
    - A copy of e-mail message that the sender has sent is available on the sender's computer for later reference.
    - In addition to sending messages, e-mail is an ideal method for sending documents already on the computer, as attachments.
    - E-mail has features of the regular postal service. The sender of e-mail gets the e-mail address of the recipient, composes the message and sends it. The recipient of e-mail can read the mail, forward it or reply back. The recipient can also store the e-mail or delete it.

E-mail Address

To use e-mail, a user must have an e-mail address. The e-mail address contains all information required to send or receive a message from anywhere in the world. An e-mail address consists of two parts separated by @ symbol (spelled as at)—the first part is user_name and the second part is host computer name.

The e-mail address may look like abcdgoel@gmail.com

where, abcdgoel is the user_name, gmail.com is the host computer name (domain name) i.e. the mailbox where finally the mail will be delivered. gmail is the mail server where the mailbox "abcdgoel" exists.

E-mail Message Format

The e-mail message consists of two parts-header and body. The header contains information about the message, such as:

- From—Sender's e-mail address.
- To—Recipient's e-mail address.
- Date—When the e-mail was sent.
- Subject—The topic of the message.
- Cc—Addresses where carbon copies of the same e-mail will be sent. The recipients of e-mail can see all e-mail addresses to which the copies have been sent.

- Bcc—Addresses where Blind carbon copies (Bcc) of the same e-mail will be sent. The recipients of e-mail do not know that the same e-mail has been sent to other e-mail addresses.
- The size of e-mail.

The body contains the text of the message and any attachments to be sent. Figure below shows the "compose mail" on outlook.com to create a new e-mail message.
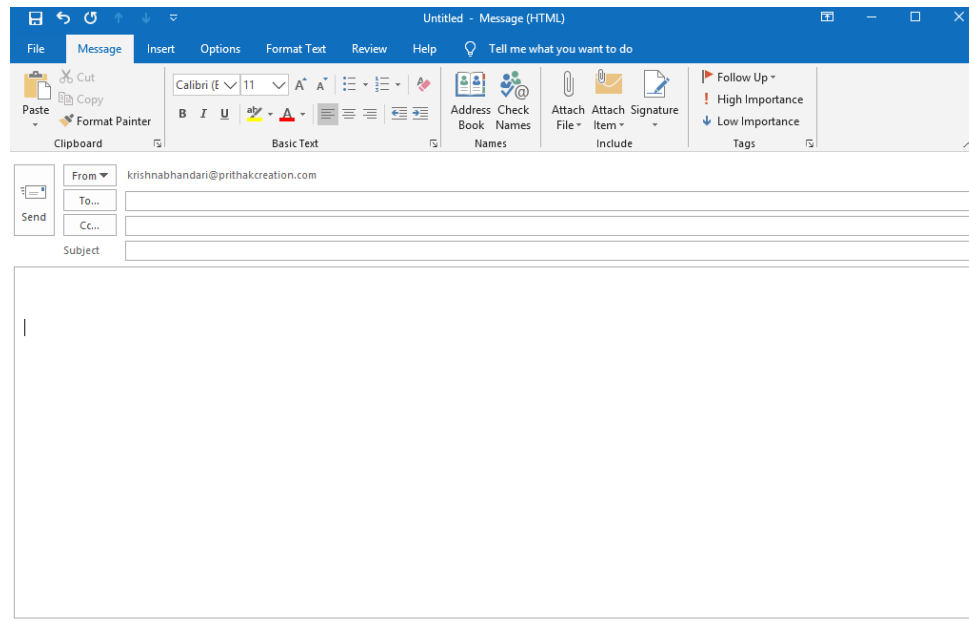
File Transfer Protocol (FTP)

FTP is an Internet tool used for copying files from one computer to another. It gives access to directories or folders on remote computers, and allows software, data and text files to be transferred between different kinds of computers. Using an FTP program or a web browser, the user can log onto an FTP host computer over Internet and copy files onto their own computer.

The goals of FTP are as follows:

- FTP promotes sharing of files, articles, and other types of data.
- FTP encourages indirect use of remote computers.
- Heterogeneous systems use different operating systems, character sets, directory structures, file structures, and formats. FTP shields users from these variations and transfers data reliably and efficiently.
- Universities and software companies use FTP host computers to provide visitors with access to data.

Terminal Network (Telnet)

- Telnet uses the telecommunication network facility that allows a computer to access the contents of another computer (also called host computer).
- A telnet program allows the user to access or edit files, or, issue or execute commands on the host computer. Telnet is different from FTP.

- While FTP allows transfer of files from the host computer, Telnet allows access to the computing facility of the host computer but does not allow transfer of files.
- Telnet is widely used by libraries, to allow visitors to look up information, find articles, to access the computer of your office from home, etc. To start telnet, the user gives a command to log to the host computer.

News

- News includes tens of thousands of newsgroups. Each newsgroup is focused to a specific topic for discussion.
- People who are interested in the topic, post their articles or views on it for others to read. People can read articles and also respond to articles.
- The name of the newsgroup suggests the specific topic handled by it. For example, prefix of comp indicates that the newsgroup is about computers, and soc indicates a newsgroup about social issues and socializing.
- To participate in a newsgroup, newsreader software like Microsoft Outlook Express is needed. Newsreader software allows the user to read articles that have been posted on a newsgroup.

Internet Relay Chat (IRC)

- IRC allows users to communicate in real time by typing text in a special window.
- This means that other users with whom you chat are present online on their computers. It is an instant sending and receiving of message, unlike e-mail where the receiver may not be on-line when the e-mail message is sent.
- There are several IRC channels, where each is a discussion room for a user group or for discussion on a subject.
- A message sent by a user to IRC channel is received by all the users who have joined the channel.
- Many chat rooms are set up in Web sites, enabling visitors to chat directly in their browser window, without running special chat software. This is also called web-based chat.

Uses of Internet:

Internet is used for different purposes by different people. Some uses of the Internet are listed below:

- E-Commerce (auction, buying, selling products etc.)
- Research (on-line journals, magazines, information etc.)
- Education (e-learning courses, virtual classroom, distance learning)
- E-Governance (online filing of application (Income Tax), on-line application forms etc.)
- On-line ticket booking (airplane tickets, rail tickets, cinema hall tickets etc.)
- On-line payments (credit card payments etc.)
- Video conferencing
- Exchange of views, music, files, mails, folders, data, information etc.
- Outsourcing jobs (work flow software)
- Social networking (sites like facebook, linkedin, twitter)
- E-Telephony (sites like skype)

Introduction to Internet of Things (IoT):

- Internet of Things (IoT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment.
- In the upcoming years, IoT-based technology will offer advanced levels of services and practically change the way people lead their daily lives.
- Advancements in medicine, power, gene therapies, agriculture, smart cities, and smart homes are just a very few of the categorical examples where IoT is strongly established.
- Over 9 billion 'Things' (physical objects) are currently connected to the Internet, as of now. In the near future, this number is expected to rise to a whopping 20 billion.

- There are two ways of building IoT:
  - Form a separate internetwork including only physical objects.
  - Make the Internet ever more expansive, but this requires hard-core technologies such as rigorous cloud computing and rapid big data storage (expensive).

Some common applications for IoT devices are:

- Smart Home (eg. smart lamps)
- Wearables (eg. smart-watches)
- Autonomous vehicles
- Smart cities
- Smart Retail

How do IoT devices work?

An IoT system is comprised of four main components:

- Sensors: enables the devices to collect data from the environment surrounding the device (eg. velocity, GPS coordinates, temperature, etc...).
- Connectivity: successively the data collected is sent to the cloud (through either WiFi or Bluetooth connection).
- Data Processing: once the data is received by the cloud infrastructure, it can then be processed (eg. check if the data received adhere to the requirements and if it's not alert the user).

- User Interface: Once the data is processed, the results are then given to the end user.

| Sensors	Connectivity	Data Processing	User Interface
Collecting data	Sending data to cloud	Making data useful	Delivering information to user

Fig: Main Components of an IoT System

Introduction to Wearable Computing:

- Wearable computing is the study or practice of inventing, designing, building, or using miniature body-borne computational and sensory devices.
- It refers to computer-powered devices or equipment that can be worn by a user, including clothing, watches, glasses, shoes and similar items. Wearables are typically worn on the wrist (e.g. fitness trackers), hung from the neck (like a necklace), strapped to the arm or leg (smartphones when exercising), or on the head (as glasses or a helmet), though some have been located elsewhere (e.g. on a finger or in a shoe).
- Wearable computing devices can range from providing very specific, limited features like heart rate monitoring to advanced "smart" functions and features similar to those a smartphone or smartwatch offers.
- These more advanced wearable computing devices can typically enable the wearer to take and view pictures or video, read text messages and emails, respond to voice commands, browse the web and more.
- Wearable computers have various technical issues such as batteries, heat dissipation, software architectures, wireless and personal area networks, and data management. Many wearable computers are active all the time, e.g. processing or recording data continuously.

Wearable Technology Is The New Businesses
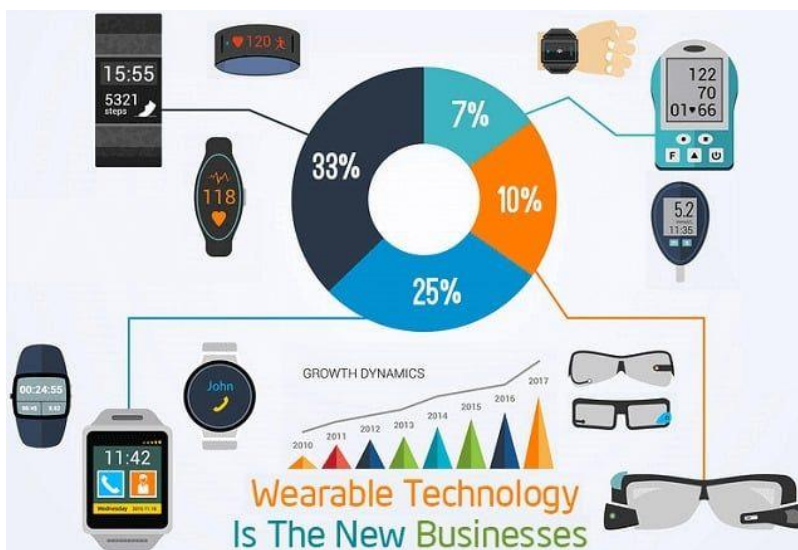
Introduction to Cloud Computing:

- Cloud computing is the on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user.
- The term is generally used to describe data centers available to many users over the Internet. Large clouds, predominant today, often have functions distributed over multiple locations from central servers.
- Rather than owning their own computing infrastructure or data centers, companies can rent access to anything from applications to storage from a cloud service provider.
- One benefit of using cloud computing services is that firms can avoid the upfront cost and complexity of owning and maintaining their own IT infrastructure, and instead simply pay for what they use, when they use it.
- In turn, providers of cloud computing services can benefit from significant economies of scale by delivering the same services to a wide range of customers.
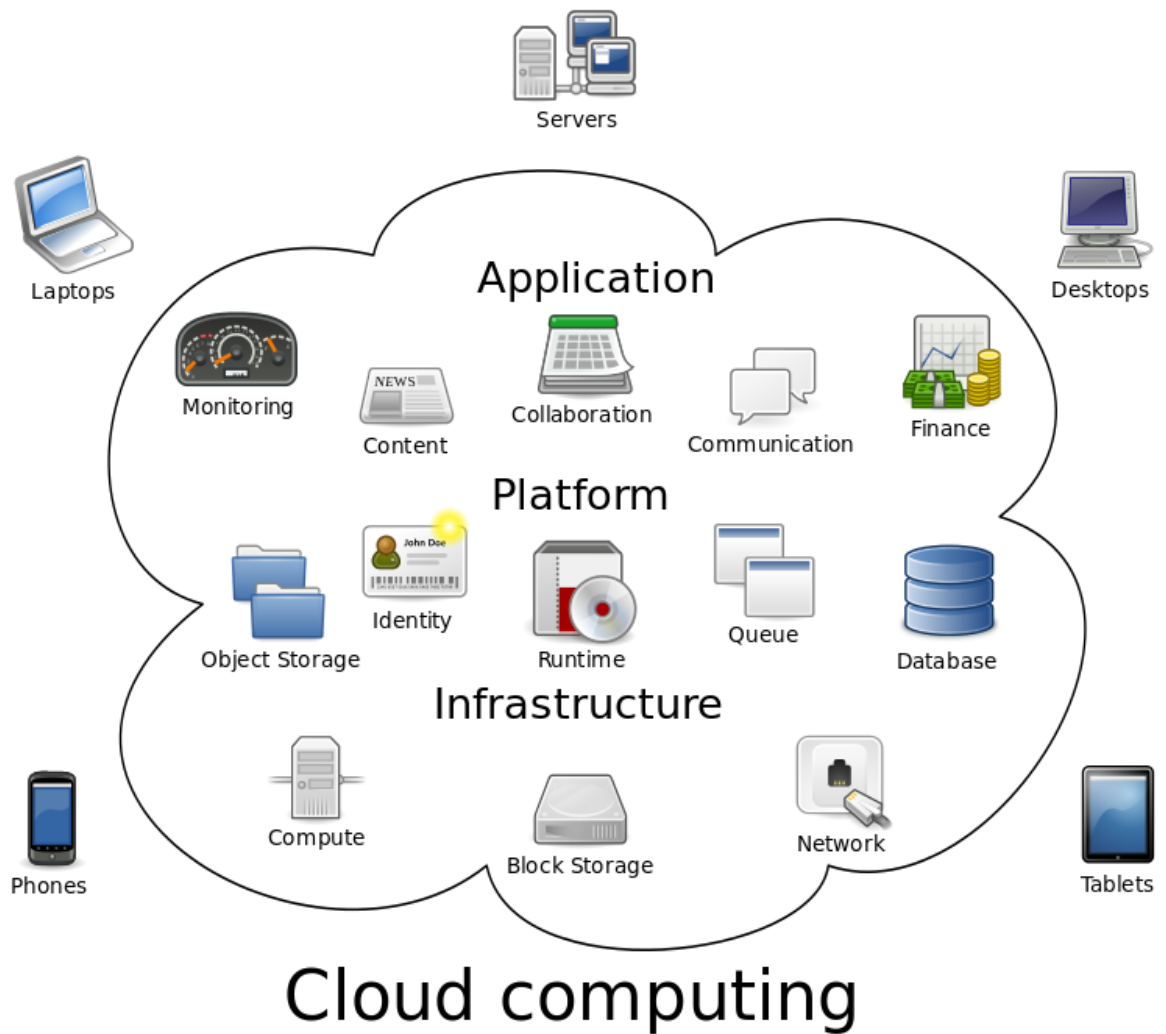
Introduction to E-Commerce:

- Ecommerce, also known as electronic commerce or internet commerce, refers to the buying and selling of goods or services using the internet, and the transfer of money and data to execute these transactions.
- Ecommerce is often used to refer to the sale of physical products online, but it can also describe any kind of commercial transaction that is facilitated through the internet.
- Whereas e-business refers to all aspects of operating an online business, ecommerce refers specifically to the transaction of goods and services.

Types of Ecommerce Models

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

- Business to Consumer (B2C): When a business sells a good or service to an individual consumer (e.g. You buy a pair of shoes from an online retailer).
- Business to Business (B2B): When a business sells a good or service to another business (e.g. A business sells software-as-a-service for other businesses to use).
- Consumer to Consumer (C2C): When a consumer sells a good or service to another consumer (e.g. You sell your old furniture on HamroBazaar to another consumer).
- Consumer to Business (C2B): When a consumer sells their own products or services to a business or organization (e.g. a photographer licenses their photo for a business to use).

Examples of Ecommerce

Ecommerce can take on a variety of forms involving different transactional relationships between businesses and consumers, as well as different objects being exchanged as part of these transactions.

1. Retail: The sale of a product by a business directly to a customer without any intermediary.

2. Wholesale: The sale of products in bulk, often to a retailer that then sells them directly to consumers.

3. Drop shipping: The sale of a product, which is manufactured and shipped to the consumer by a third party.

4. Crowdfunding: The collection of money from consumers in advance of a product being available in order to raise the startup capital necessary to bring it to market.

5. Subscription: The automatic recurring purchase of a product or service on a regular basis until the subscriber chooses to cancel.

6. Physical products: Any tangible good that requires inventory to be replenished and orders to be physically shipped to customers as sales are made.

7. Digital products: Downloadable digital goods, templates, and courses, or media that must be purchased for consumption or licensed for use.

8. Services: A skill or set of skills provided in exchange for compensation. The service provider's time can be purchased for a fee.

Introduction to E-Governance:

- Electronic governance or e-governance is the application of information and communication technology (ICT) for delivering government services, exchange of information, communication transactions, integration of various stand-alone systems between government to citizen (G2C), government-to-business (G2B), government-to-government (G2G), government-to-employees (G2E) as well as back-office processes and interactions within the entire government framework.
- Through e-governance, government services are made available to citizens in a convenient, efficient, and transparent manner.
- The three main target groups that can be distinguished in governance concepts are government, citizens, and businesses/interest groups.

Benefits of E-Governance:

- Better access to information and quality services for citizens
- Simplicity, efficiency and accountability in the government
- Expanded reach of government

Introduction to 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.

Introduction to GIS:

- A Geographic Information System (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present geographic data.
- The 4 main ideas of Geographic Information Systems (GIS) are:

- o   Create geographic data.
- o   Manage it in a database.
- o   Analyze and find patterns.
- o   Visualize it on a map
- GIS integrates many types of data. It analyzes geographic location and organizes layers of information into visualizations using maps and 3D scenes.
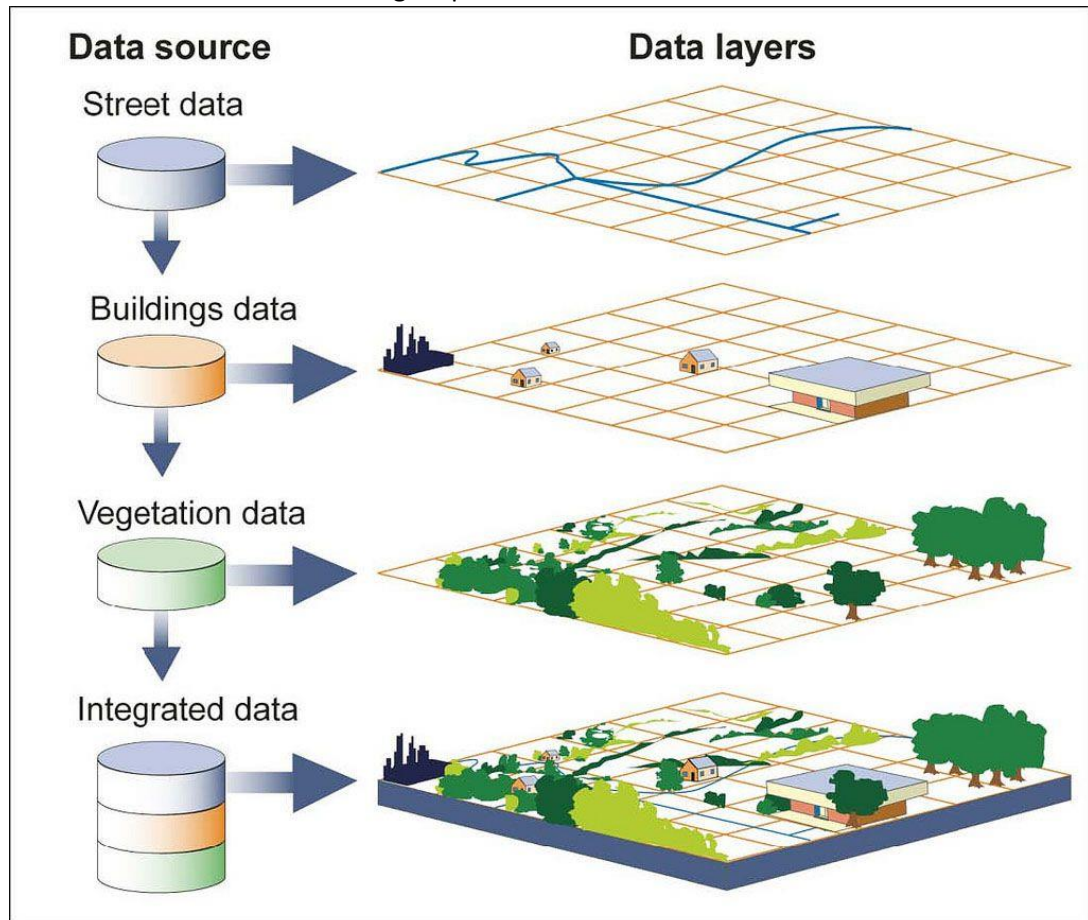
Source: GAO.

- Geographic Information Systems (GIS) have various industrial applications, and technological advancements have significantly enhanced GIS data, specifically how it can be used and what can be achieved as a result.
- Geographic Information Systems are powerful decision-making tools for any business or industry since it allows the analyzation of environmental, demographic, and topographic data.
- Data intelligence compiled from GIS applications help companies and various industries, and consumers, make informed decisions.

Applications of GIS

- Mapping
- Telecom and Network Services
- Accident analysis, improvement of road safety measures and better traffic management
- Urban planning

- Transportation planning
- Environment Impact Analysis
- Agricultural applications
- Disaster management and estimation
- Natural Resources Management