ALAGAPPA UNIVERSITY

[Accredited with 'A+' Grade by NAAC (CGPA:3.64) in the Third Cycle and Graded as Category–I University by MHRD-UGC]

KARAIKUDI – 630 003

DIRECTORATE OF DISTANCE EDUCATION

Diploma in Computer Applications

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PRINCIPLES OF INFORMATION TECHNOLOGY

I - Semester

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(A State University Established by the Government of Tamil Nadu)

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PRINCIPLES OF INFORMATION TECHNOLOGY

SYLLABI
PRINCIPLES OF INFORMATION TECHNOLOGY

<div align="center">**UNIT I**</div>

<div align="center">**INTRODUCTION TO INFORMATION TECHNOLOGY**</div>

Structure

1. INFORMATION TECHNOLOGY

1.1 INTRODUCTION:

Information technology (IT) is the use of computers to store, retrieve, transmit, and manipulate data or information. IT is typically used within the context of business operations as opposed to personal or entertainment technologies. IT is considered to be a subset of information and communications technology (ICT).

1.2 Information System

An information system is a set of interrelated components that collect, manipulate, store data and disseminate information and provide a feedback mechanism to monitor performance. An Information system (IS) is a formal, sociotechnical, organizational system designed to collect, process, store, and distribute information.

In a sociotechnical perspective, information systems are composed by four components: task, people, structure (or roles), and technology.

1.3 Computer and System

A computer system is a set of integrated devices that input, output, process, and store data and information. Computer systems are currently built around at least one digital processing device. There are five main hardware components in a computer system: Input, Processing, Storage, Output and Communication devices.
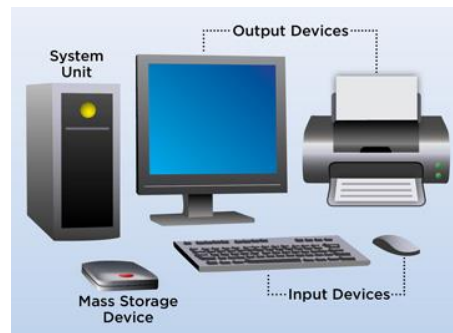
1.4 Software and Data

Software

Software is a set of instructions, data or programs used to operate computers and execute specific tasks. Opposite of hardware, which describes the physical aspects of a computer, software is a generic term used to refer to applications, scripts and programs that run on a device.

Data

Data is a set of values of subjects with respect to qualitative or quantitative variables. Data is raw, unorganized facts that need to be processed. When data is processed, organized, structured or presented in a given context so as to make it useful, it is called information.

1.5 IT IN BUSINESS & INDUSTRY

Information technology fosters innovation in business. Innovation results in smarter apps, improved data storage, faster processing, and wider information distribution. Innovation makes businesses run more efficiently. And innovation increases value, enhances quality, and boosts productivity.

IT in banking

Information technology in banking sector refers to the use of sophisticated information and communication technologies together with computer science to enable banks to offer better services to its customers in a secure, reliable and affordable manner and sustain competitive advantage over other banks.

Banking without computers can't be imagined. A lot of work is done in the computers from transactions to maintaining records. Recurring deposits (e-RD), Fixed deposits (e-FD), money transfer from one account to another (NEFT, RTGS), online transactions are done using the Internet.

IT in insurance

Insurance companies use a computer to store data of their clients. It manages their data and gives them timely notifications for their premium. It allows the user to get a good knowledge over their policy.

IT in marketing

The computer is very much needed in marketing. The computer is used to create sell advertisements. It is used to monitor the performance of the product in the market. different illustrations can be made to present the product in an effective and decorative way.

- ➢ Advertising - With computers, advertising professionals create art and graphics, write and revise copy, and print and disseminate ads with the goal of selling more products.
- ➢ Home Shopping - Home shopping has been made possible through use of computerized catalogues that provide access to product information and permit direct entry of orders to be filled by the customers.

IT in BPO services

Business Process Outsourcing (BPO) services mean those business operations which are performed by an outside service provider. In other words, you can say that some industries take help from other service providers to facilitate their work. They heir some outsourcing companies for that work and those outsourcing companies is called BPO (Business Process Outsourcing).

Some of the BPO services are as follows:

(a) Financial and Accounting Services

(b) Taxation and Insurance Services

(c) E-Publishing and Web Promotion

(d) Legal Services and Content Writing

(e) Multimedia and Design Services

(f) Document Management Services

(g) Software Testing Services

(h) Health Care Services

1.6 IT IN HOME & AT PLAY:

Information technologies aid us in doing chores at home in three principal ways: (1) by controlling the appliances we use for housework, (2) by establishing local networks for home communications and control, and (3) by directly providing electronic information and transaction services from the home.

Using the right kind of technology/games/activities can support the development of your child's learning and skills, including fine motor skills, letter/ number/ shape/ colour recognition, eye-hand co-ordination, reading, writing, planning, problem solving etc.

IT in home computing:

We use a PC (personal computer) at our home. The computer is used in our homes for surfing the internet, making presentations, video, games, etc.

IT in everyday life:

In our daily life, most of the equipment we are using is embedded with software. Microwave has its own software to maintain the temperature and also washing machines, the set-top box has software to interact with us and give us a good experience.

1.7 IT IN EDUCATION, WORKPLACE AND TRAINING:

Using information technology in education has made it possible for students to keep on learning, irrespective of where they are. Teachers and professors can send assignments to students and they can complete and submit them even without physically stepping into the classrooms and so learning never has to stop.

IT in library

Nowadays managing books in the library is not such tough work. Libraries are now computerised. To manage a lot of books barcodes can be associated with books which make the process easy to keep track of the list of available books and many more.

IT in education

Information technology IT is very much used in education for teaching-learning processes. The software and Hardware made

the process of learning very easy. We can see a lot of animations in educational videos which made studying very interesting. Various methods of illustrations are now brought to visualize what we are reading in the real world.

a) IT in the classroom

IT can be used in various ways in schools to handle online classes.

• e-learning classrooms;
• smart-board presentations;
• videos on experiments;
• creation of images and video;
• desktop publishing of magazines, letters and documents;

Google Classroom

(b) Education — anywhere anytime

A lot of books and educational content are now digitalized. We can get the content whenever we want. Our government is also providing websites to access NCERT books online.

(c) Teaching aids and media

IT is used mostly as a teaching aid in schools to use pictures, animations and audio-visuals to explain subjects that are difficult to explain, make the lessons interesting using presentations and organize lessons using the computer.

(d) Learning Management System (LMS)

A Learning Management System (LMS) is being used by many schools to manage their school system. This system is very useful for managing attendance and result. Is well designed to record students' data in an effective way.

IT at workplace

All the offices are equipped with computers for office automation using various softwares like Microsoft word, Excel and Powerpoint. Most of the work is now done on computers. in offices computers and software makes their work very easy and fast. IT play an important role in e-governance. Some major fields in this category are:

> Budgets
> Sales tax department
> Income tax department Male/Female ratio
> Computerization of voters lists
> Computerization of driving licensing system
> Computerization of PAN card
> Weather forecasting

1.8 IT IN ENTERTAINMENT & ARTS:

Entertainment technology helps us relax and enjoy some free time. The latest technology has been revolutionized daily entertainment. Old ways such as recording on records, tapes, and

CDs, have made music across the world. Movies are brought into living rooms through photography, film, and video.

IT has substantially changed the field of Graphics Arts. IT provides a variety of new media for many different artists. Digital still photography and video are now becoming commonplace. Computers provide powerful tools for editing such photographs and video.

IT in Entertainment

One can now download movies, play games, chat, video calls using mobiles and computers. Digital broadcasting has opened a door to the world. It changed the television experience. digital programs are now more interactive and use very much graphics designing.

IT in Communication

In communication, IT has a significant role. One can easily chat through various platforms. Video calling has now become easier. IT has really changed the way of communication.

1.9 IT IN SCIENCE, ENGINEERING AND MATHEMATICS

To use the technology correlatively, for example, data processing, simulation techniques, mathematical model and database etc. Through the process of establishing the mechanism model, using a computer data analysis process in materials science, the model predicts the optimal design to achieve. One of major areas is CAD Computer aided design. That provides creation and modification of images

To do complex scientific calculations, Computer-Aided Design (CAD) or Computer-Aided Manufacturing (CAM) Scientists and engineers use software applications. It made their work easy. drawing and calculation became very easy. Some fields of engineering and mathematics are:

- Structural Engineering - Requires stress and strain analysis for design of Ships, Buildings, Budgets, Airplanes etc.
- Industrial Engineering - Computers deal with design, implementation and improvement of integrated systems of people, materials and equipment.
- Architectural Engineering - Computers help in planning towns, designing buildings, determining a range of buildings on a site using both 2D and 3D drawings
- Discrete mathematics provides an important foundation for all areas of computer science. Discrete math is used in various areas including computer architecture, algorithms, computer systems, databases, functional programming, distributed systems, machine learning, operating systems, computer security, and networks. There are also many mathematical and statistical software are used to solve the problems.

IT in health care

Our hospitals are now computerised a lot of healthcare activities are now monitored by computers. Some of the high-level gadgets are made to serve in hospitals.

(i) Computerised Axial Tomography Machine (CAT):

Using this machine three-dimensional (3D) images of different parts of the body can be made. These images are helpful in the diagnosis of diseases.

(ii) MRI (Magnetic Resonance Imaging Machine):

MRI machines are used to provide an image of the internal organs of the body by using strong magnetic fields and radio waves. The digital images are very helpful in the detection of the disease.

(iii) Electrocardiogram (ECG) Machine:

This machine is used to monitor the heartbeat of a person. This machine records the electrical impulse.

(iv) Cardiac Screening Machine:

This machine is used to detect the problems related to the heart. It monitors the internal working of the heart.

(v) EEG (Electro encephalography) Machine:

The Electro encephalography machine is used to record the activities of the brain. This machine works both in the patient is sleeping of awake.

Blood Sugar Testing Machine is used to check the sugar level in blood and Blood Pressure can be checked digitally by the blood pressure measuring machine.

1.10 GLOBAL POSITIONING SYSTEM:

1.10.1 Introduction to Global Positioning Systems

The Global Positioning System (GPS) is a worldwide radio-navigation system formed from a constellation of 24 satellites and their ground stations. Global Positioning System (GPS) is a navigation system using satellites, a receiver and algorithms to synchronize location, velocity and time data for air, sea and land travel.

A GPS system consists of a network of 24 orbiting satellites, called NAVSTAR (Navigation System with Time and Ranging), and placed in space in six different orbital paths with four satellites in each orbital plane and covering the entire earth under their signal beams.
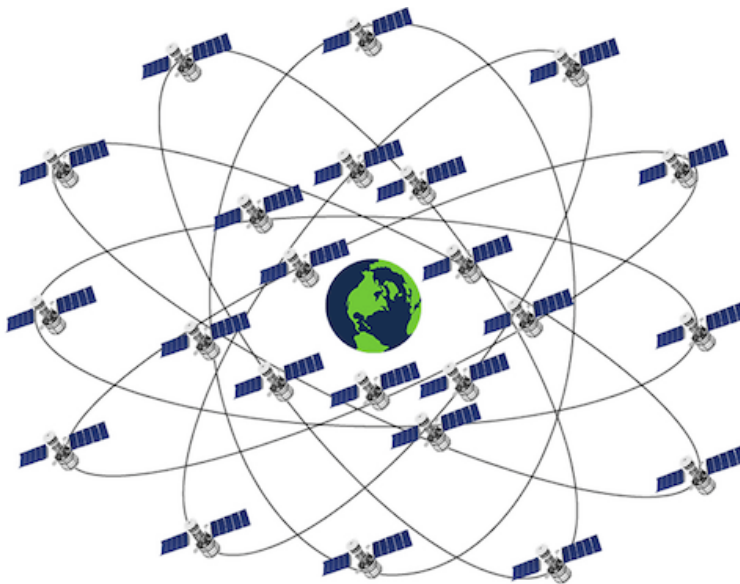

Fig Global positioning system

1. The orbital period of these satellites is twelve hours.
2. The satellite signals can be received anywhere and at any time in the world.
3. The spacing of the satellites is arranged such that a minimum of five satellites are in view from every point on the globe.

4. The first GPS satellite was launched in February 1978.
5. Each satellite is expected to last approx 7.5 years, and replacements are constantly being built and launched into orbit.
6. Each satellite is placed at an altitude of about 10,900 nautical miles and weights about 862 kg.
7. The satellites extend to about 5.2m (17ft) in space including the solar panels. Each satellite transmits on three frequencies.
8. The GPS is based on well known concept called the triangulation technique.

History of the Global Positioning System (GPS)

- 1957 - Soviet Union launched Sputnik I satellite.
- 1960s - U.S. Navy tracked U.S. submarines with satellite navigation.
- 1978 - NAVSTAR Block I GPS satellite was launched.
- 1983 - U.S. announced that it will make GPS available for civilian use after Korean Air flight 007 shot down.
- 1989 - Magellan introduced NAV 1000, the first hand-held GPS device. First Block II satellite is launched.
- 1993 - Constellation of 24 satellite system became operational.
- 1995 - Full Operational Capability (FOC) declared.
- 2000 - Selective Availability discontinued by the U.S. Government.
- 2004 - Qualcomm successfully completed test of live assisted GPS on a mobile phone.
- 2008 - Block II satellite launched.
- 2016 - GPS IIF satellite launched.

Beneficiaries of GPS

At the start, more than 1000 portable commercial GPS receivers were purchased for military use. They were carried by soldiers and attached to vehicles, helicopters, and aircraft instrument panels.

GPS receivers were used in several aircrafts, including B-2 bombers and F-16 fighters etc. Navy ships used them for rendezvous, minesweeping, and aircraft operations.

GPS has become important for all military operations and weapons systems. In additions, GPS benefits non-military operations. GPS is used on satellites to obtain highly accurate orbit data and to control spacecraft orientation.

What is WASS?

Wide Area Augmentation System (WAAS) is a system of satellites and ground stations that provide GPS signal corrections, giving you even better position accuracy. How much better? Try an average of up to five times better. A WAAS-capable receiver can give you a position accuracy of better than three meters, 95 percent of the time. As long as your GPS system is WAAS enabled you do not need any additional equipment or pay any service fees.
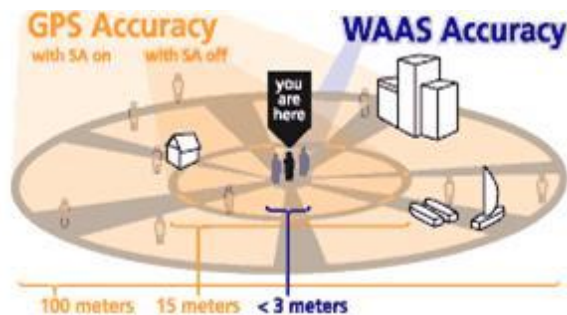
Three Components to GPS

1. Space Segment –the satellites orbiting the earth and transmitting timing and ranging messages.
2. User Segment - the handheld or other receivers used to interpret the messages broadcast from the Satellites
3. Control Segment - monitors the health and position of the satellites in the space segment and transmits correction information back up to the satellite.

Books for Reference:

1. Dennis P.Curtin, Kim dolwy, KunL AWN, Xrhleen morin, Information Technology, the breaking wave, TMH 2000.
2. Stacey C Sawyer, Brain K Williams, Sarah E Hutchinson Using Information Technology – Brief Version A Practical Introduction to Computer and Communications Third Edition, McGraw Hill Companies 2011.
3. James O'Brien – Introduction to Information systems. 16th edition, 2005.

FUNDAMENTALS OF COMPUTERS

Structure

2.1 INTRODUCTION TO COMPUTERS:

A computer is an electronic device, operating under the control of instructions stored in its own memory that can accept data (input), process the data according to specified rules, produce information (output), and store the information for future use1. Any kind of computers consists of Hardware and Software.

What is a computer?

A computer is an electronic device that manipulates information, or data. It has the ability to store, retrieve, and process data. You may already know that you can use a computer to type documents, send email, play games, and browse the Web. You can also use it to edit or create spreadsheets, presentations, and even videos.

A computer is designed to execute applications and provides a variety of solutions through integrated hardware and software components. It works with the help of programs and represents the decimal numbers through a string of binary digits. It also has a

memory that stores the data, programs, and result of processing. The components of a computer such as machinery that includes wires, transistors, circuits, hard disk are called hardware. Whereas, the programs and data are called software.

It is believed that the Analytical Engine was the first computer which was invented by Charles Babbage in 1837. It used punch cards as read-only memory. Charles Babbage is also known as the father of the computer.

The basic parts without which a computer cannot work are as follows:

1. Processor: It executes instructions from software and hardware.
2. Memory: It is the primary memory for data transfer between the CPU and storage.
3. Motherboard: It is the part that connects all other parts or components of a computer.
4. Storage Device: It permanently stores the data, e.g., hard drive.
5. Input Device: It allows you to communicate with the computer or to input data, e.g., a keyboard.
6. Output Device: It enables you to see the output, e.g., monitor.
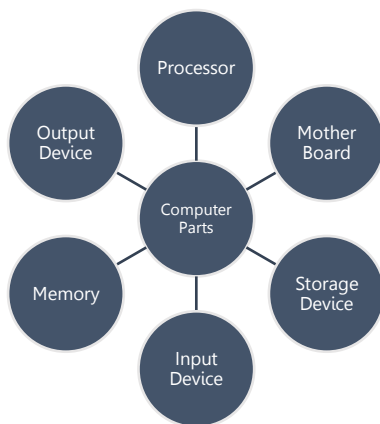
2.2 History of Computers:

Charles Babbage, an English mechanical engineer and polymath, originated the concept of a programmable computer. Considered the "father of the computer", he conceptualized and invented the first mechanical computer in the early 19th century. ... The machine was about a century ahead of its time.

Abacus

The history of computer begins with the birth of abacus which is believed to be the first computer. It is said that Chinese invented Abacus around 4,000 years ago. It was a wooden rack which has metal rods with beads mounted on them. The beads were moved by the abacus operator according to some rules to perform arithmetic calculations.

Fig 2.1 Abacus

Napier's bones

It was a manually-operated calculating device which was invented by John Napier (1550-1617) of Merchiston. In this calculating tool, he used 9 different ivory strips or bones marked

with numbers to multiply and divide. So, the tool became known as "Napier's Bones. It was also the first machine to use the decimal point.

Difference Engine

In the early 1820s, it was designed by Charles Babbage who is known as "Father of Modern Computer". It was a mechanical computer which could perform simple calculations. It was a steam driven calculating machine designed to solve tables of numbers like logarithm tables.

Fig 2.2 Difference Engine

2.2.1 GENERATIONS OF COMPUTERS

A generation of computers refers to the specific improvements in computer technology with time. In 1946, electronic pathways called circuits were developed to perform the counting. It replaced the gears and other mechanical parts used for counting in previous computing machines.

In each new generation, the circuits became smaller and more advanced than the previous generation circuits. The

miniaturization helped increase the speed, memory and power of computers. There are five generations of computers which are described below;

First Generation Computers

The first generation (1946-1959) computers were slow, huge and expensive. In these computers, vacuum tubes were used as the basic components of CPU and memory. These computers were mainly depended on batch operating system and punch cards. Magnetic tape and paper tape were used as output and input devices in this generation.Some of the popular first generation computers are;

- ➢ ENIAC (Electronic Numerical Integrator and Computer)
- ➢ EDVAC (Electronic Discrete Variable Automatic Computer)
- ➢ UNIVACI (Universal Automatic Computer)
- ➢ IBM-701
- ➢ IBM-650

Second Generation Computers

The second generation (1959-1965) was the era of the transistor computers. These computers used transistors which were cheap, compact and consuming less power; it made transistor computers faster than the first generation computers.

In this generation, magnetic cores were used as the primary memory and magnetic disc and tapes were used as the secondary storage. Assembly language and programming languages like COBOL and FORTRAN, and Batch processing and multiprogramming operating systems were used in these computers. **Some of the popular second generation computers are;**

- ➢ IBM 1620

- IBM 7094
- CDC 1604
- CDC 3600
- UNIVAC 1108

Third Generation Computers

The third generation computers used integrated circuits (ICs) instead of transistors. A single IC can pack huge number of transistors which increased the power of a computer and reduced the cost. The computers also became more reliable, efficient and smaller in size. These generation computers used remote processing, time-sharing, multi programming as operating system. Also, the high-level programming languages like FORTRON-II TO IV, COBOL, PASCAL PL/1, ALGOL-68 were used in this generation.

Some of the popular third generation computers are;
- IBM-360 series
- Honeywell-6000 series
- PDP(Personal Data Processor)
- IBM-370/168
- TDC-316

Fourth Generation Computers

The fourth generation (1971-1980) computers used very large scale integrated (VLSI) circuits; a chip containing millions of transistors and other circuit elements. These chips made this generation computers more compact, powerful, fast and affordable. These generation computers used real time, time sharing and distributed operating system. The programming languages like C, C++, and DBASE were also used in this generation.

Some of the popular fourth generation computers are;
- ➢ DEC 10
- ➢ STAR 1000
- ➢ PDP 11
- ➢ CRAY-1(Super Computer)
- ➢ CRAY-X-MP(Super Computer)

Fifth Generation Computers

In fifth generation (1980-till date) computers, the VLSI technology was replaced with ULSI (Ultra Large Scale Integration). It made possible the production of microprocessor chips with ten million electronic components. This generation computers used parallel processing hardware and AI (Artificial Intelligence) software. The programming languages used in this generation were C, C++, Java, .Net, etc.

Some of the popular fifth generation computers are;
- ➢ Desktop
- ➢ Laptop
- ➢ Notebook
- ➢ Ultra Book
- ➢ Chrome Book

2.3 Types of Computers:

Computers are divided into different types based on different criteria. Based on the size, a computer can be divided into five types:

1. Micro Computer
2. Mini Computer
3. Mainframe Computer

4. Super Computer
5. Workstations

1. Micro Computer:

It is a single-user computer which has less speed and storage capacity than the other types. It uses a microprocessor as a CPU. The first microcomputer was built with 8-bit microprocessor chips. The common examples of microcomputers include laptops, desktop computers, personal digital assistant (PDA), tablets, and Smartphone. Microcomputers are generally designed and developed for general usage like browsing, searching for information, internet, MS Office, social media, etc.

2. Mini Computer

Mini-computers are also known as "Midrange Computers." They are not designed for a single. They are multi-user computers designed to support multiple users simultaneously. So, they are generally used by small businesses and firms. Individual departments of a company use these computers for specific purposes. For example, the admission department of a University can use a Mini-computer for monitoring the admission process.

3. Mainframe Computer:

It is also a multi-user computer capable of supporting thousands of users simultaneously. They are used by large firms and government organizations to run their business operations as they can store and process large amounts of data. For example, Banks, universities, and insurance companies use mainframe computers to store the data of their customers, students, and policyholders, respectively.
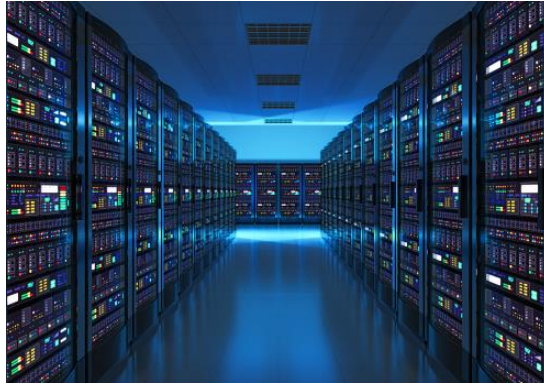
Fig . Main Frame computer

4. Super Computer:

Super-computers are the fastest and most expensive computers among all types of computers. They have huge storage capacities and computing speeds and thus can perform millions of instructions per second. The super-computers are task-specific and thus used for specialized applications such as large-scale numerical problems in scientific and engineering disciplines including applications in electronics, petroleum engineering, weather forecasting, medicine, space research and more. For example, NASA uses supercomputers for launching space satellites and monitoring and controlling them for space exploration.

5. Work stations:

It is a single-user computer. Although it is like a personal computer, it has a more powerful microprocessor and a higher-quality monitor than a microcomputer. In terms of storage capacity and speed, it comes between a personal computer and minicomputer. Work stations are generally used for specialized applications such as desktop publishing, software development, and engineering designs.

2.4 Characteristics of computers

The characteristics of computers include the following;

- ➢ Speed.
- ➢ Accuracy.
- ➢ Diligence
- ➢ Versatility
- ➢ Reliability
- ➢ Automation
- ➢ Memory
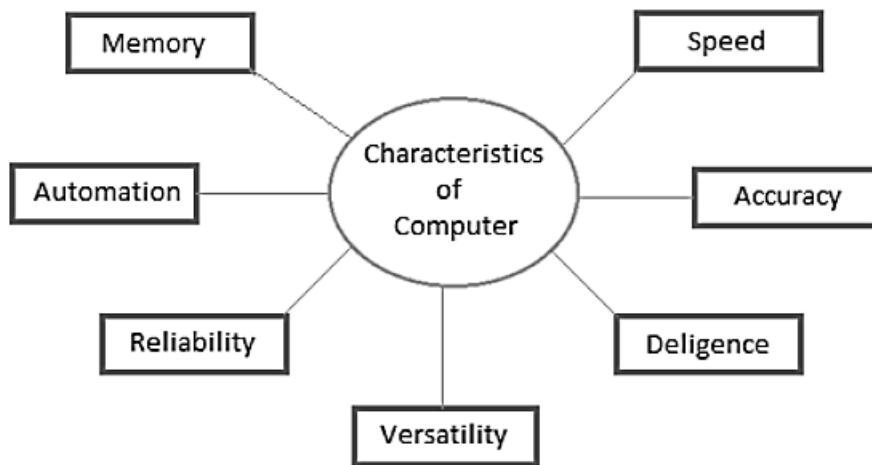
Speed

A computer works with much higher speed and accuracy compared to humans while performing mathematical calculations. Computers can process millions (1,000,000) of instructions per second. The time taken by computers for their operations is microseconds and nanoseconds.

Accuracy

Computers perform calculations with 100% accuracy. Errors may occur due to data inconsistency or inaccuracy.

Diligence

A computer can perform millions of tasks or calculations with the same consistency and accuracy. It doesn't feel any fatigue or lack of concentration. Its memory also makes it superior to that of human beings.

Versatility

Versatility refers to the capability of a computer to perform different kinds of works with same accuracy and efficiency.

Reliability

A computer is reliable as it gives consistent result for similar set of data i.e., if we give same set of input any number of times, we will get the same result.

Automation

Computer performs all the tasks automatically i.e. it performs tasks without manual intervention.

Memory

A computer has built-in memory called primary memory where it stores data. Secondary storage are removable devices such as CDs, pen drives, etc., which are also used to store data.

2.5 Basic Anatomy of Computer:

Anatomy of digital computer is basically related to the fundamental functioning of the digital computer system. ... A digital computer is a combination of certain vital components like hardware, software Central processing unit, Arithmetic, and logic unit, Memory, Registers, Microprocessor, and some addresses.
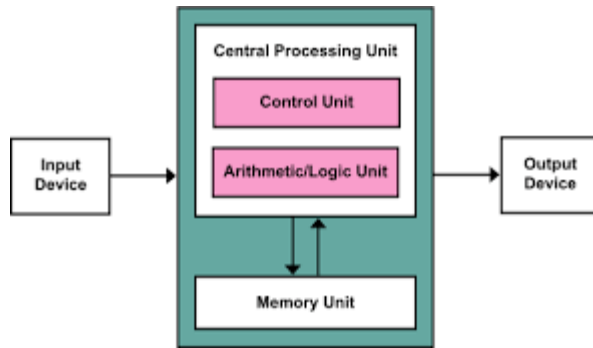
Fig. Anatomy of Computer

2.6 Applications of Computer

Computers play a role in every field of life. They are used in homes, business, educational institutions, research organizations, medical field, government offices, entertainment, etc.

➢ Education

Computers are used in education sector through online classes, online examinations, referring e-books, online tutoring, etc. They help in increased use of audio-visual aids in the education field.

➢ At Home.

Computers are used at homes for several purposes like online bill payment, watching movies or shows at home, home tutoring, social media access, playing games, internet access, etc. They provide communication through electronic mail. They help to avail work from home facility for corporate employees. Computers help the student community to avail online educational support.

➢ Business and Marketing

Nowadays, computers are totally integrated into business. The main objective of business is transaction

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processing, which involves transactions with suppliers, employees or customers. Computers can make these transactions easy and accurate. People can analyze investments, sales, expenses, markets and other aspects of business using computers.

➢ Banking Sector

In the banking sector, computers are used to store details of customers and conduct transactions, such as withdrawal and deposit of money through ATMs. Banks have reduced manual errors and expenses to a great extent through extensive use of computers.

➢ Entertainment

Computers help to watch movies online, play games online; act as a virtual entertainer in playing games, listening to music, etc. MIDI instruments greatly help people in the entertainment industry in recording music with artificial instruments. Videos can be fed from computers to full screen televisions. Photo editors are available with fabulous features.

➢ Medical Hospital

Computers are used in hospitals to maintain a database of patients' history, diagnosis, X-rays, live monitoring of patients, etc. Surgeons nowadays use robotic surgical devices to perform delicate operations, and conduct surgeries remotely. Virtual reality technologies are also used for training purposes. It also helps to monitor the fetus inside the mother's womb.

➢ Science and Research and Government

Computers with high performance are used to stimulate dynamic process in Science and Engineering. Supercomputers have numerous applications in area of

Research and Development (R&D). Topographic images can be created through computers. Scientists use computers to plot and analyze data to have a better understanding of earthquakes.

In government sectors, computers are used in data processing, maintaining a database of citizens and supporting a paperless environment. The country's defense organizations have greatly benefitted from computers in their use for missile development, satellites, rocket launches, etc.,

2.7 COMPUTER MEMORY AND ITS TYPES

The computer memory holds the data and instructions needed to process raw data and produce output. The computer memory is divided into large number of small parts known as cells. Each cell has a unique address which varies from 0 to memory size minus one. Computer memory is of two types: Volatile (RAM) and Non-volatile (ROM). The secondary memory (hard disk) is referred as storage not memory.
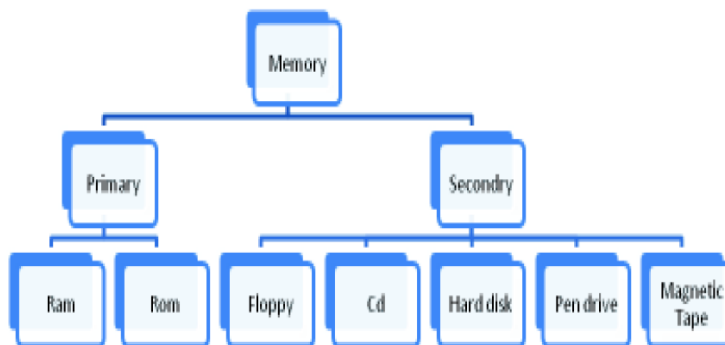

Fig. Memory types

But, if we categorize memory on behalf of space or location, it is of four types:

➤ Primary memory

- Secondary memory
- Register memory
- Cache memory

Primary Memory

Primary memory, often called main memory, constitutes that device, or group of devices, that holds instructions and data for rapid and direct access by the computer's central processing unit (CPU). Primary memory is synonymous with random-access memory (RAM). Primary Memory is of two types: RAM and ROM.

Random Access Memory RAM (Volatile Memory)

It is a volatile memory. It means it does not store data or instructions permanently. When you switch on the computer the data and instructions from the hard disk are stored in RAM. CPU utilizes this data to perform the required tasks. As soon as you shut down the computer the RAM loses all the data.

Read Only Memory ROM (Non-volatile Memory)

It is a non-volatile memory. It means it does not lose its data or programs that are written on it at the time of manufacture. So it is a permanent memory that contains all important data and instructions needed to perform important tasks like the boot process.

SECONDARY MEMORY

Secondary memory storage is generally a storage medium for noncritical data that does not need to be frequently accessed. It is initially referred to the class of media that is used to store the data. While secondary storage on the one hand does not need to be accessed as frequently as primary data, but its recovery of can prove crucial while replacing the information and applications that a

business need. With the increase in corporate data growth, storage managers are also adopting more secondary storage in order to reclaim capacity on primary storage arrays. The ability to maintain older data copies in an easily accessible form that satisfies business and also meets all regulatory compliance requirements. Secondary storage devices are rated on the basis of:

- Performance
- Data migration
- Speed
- Cloud service provider
- Volume manager

The secondary storage devices which are built into the computer or connected to the computer are known as a secondary memory of the computer. It is also known as external memory or auxiliary storage.

It is accessed indirectly via input/output operations. It is non-volatile, so permanently stores the data even when the computer is turned off or until this data is overwritten or deleted. The CPU can't directly access the secondary memory. First, the secondary memory data is transferred to primary memory then the CPU can access it.

It is also called auxiliary memory or mass storage, consists of devices not directly accessible by the CPU. Hard drives, floppy disks, tapes, and optical disks are widely used for secondary storage. First, most secondary storage devices are capable of containing much more information than is feasible for primary memory (hence the use of the term "mass storage" as a synonym for secondary memory). A second, and essential, feature of secondary memory is that it is non-volatile. This means that data is stored with or without electrical power being supplied to the device, as opposed to RAM, which can retain its data only so long as electrical power is present.

Like primary memory, many secondary memory devices are capable of storing information, as well as retrieving it. Magnetic technology devices (such as hard drives, floppy disks, and tape) have this read-write capability, as do magnetooptical drives. However, some mass storage devices can only read data, as in the case of CD-ROM (Compact Disk-Read Only Memory) drives. CD-ROMs utilize optical technology; however, newer optical technologies, such as CD-RW (compact disk-rewriteable), can both read and write information like magnetic storage devices.

The hard disk is the main, and usually largest, data storage device in a computer. The operating system, software titles and most other files are stored in the hard disk.

MAGNETIC DISK

Magnetic disks are circular metal plates coated with a magnetized material on both sides. Several disks are stacked on a spindle one below the other with read/ write heads to make a disk pack. The disk drive consists of a motor and all the disks rotate together at very high speed. Information is stored on the surface of a disk along a concentric set of rings called tracks. These tracks are divided into sections called sectors. A cylinder is a pair of corresponding tracks in every surface of a disk pack. Disk drives are connected to a disk controller.

Thus, if a disk pack has n plates, there will be 2n surfaces; hence, the number of tracks per cylinder is 2n. The minimum quantity of information which can be stored, is a sector. If the number of bytes to be stored in a sector is less than the capacity of the sector, the rest of the sector is padded with the last type recorded. The following figure shows a magnetic disk memory.
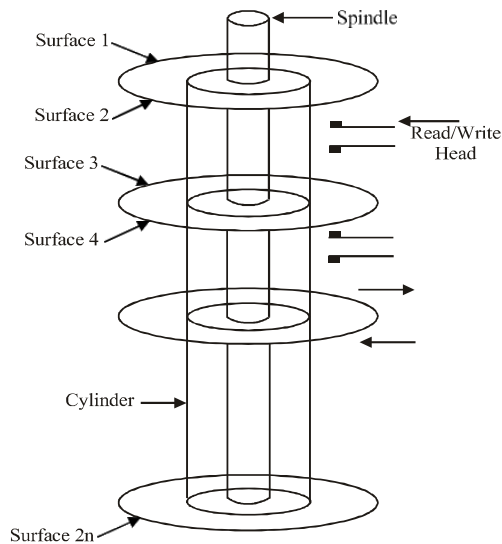
Fig. Magnetic Disk Memory

FLOPPY DISK

A floppy disk, also known as a diskette, is a very convenient bulk storage device and can be taken out of the computer. It is of 5.25" or 3.5" size, the latter size being more common. It is contained in a rigid plastic case. The read/write hea ds of the disk drive can write or read information from both sides of the disk. The storage of data is in magnetic form, similar to that of the hard disk. The 3.5" floppy disk has a capacity of storage up to 1.44 Mbytes. It has a hole in the centre for mounting it on the drive. Data on the floppy disk is organized during the formatting process. The disk is also organized into sectors and tracks. The 3.5" high density disk has 80 concentric circles called tracks and each track is divided into 18 sectors. Tracks and circles exist on both sides of the disk. Each sector can hold 512 bytes of data plus other information like address, etc. It is a cheap read/write bulk storage device.

Fig. Floppy Disk

MAGNETIC TAPE

A magnetic disk is used by almost all computer systems as a permanent storage device. It is still the accepted low-cost magnetic storage medium, and is primarily used for backup storage purposes. The digital audio tape (DAT) is the normal backup magnetic tape tool used these days. A standard cartridge-size cassette tape offers about 1.2 GB of storage. These magnetic tape memories are similar to that of audio tape recorders.

Fig. Magnetic Tape

A magnetic tape drive consists of two spools on which the tape is wound. Between the two spools, there is a set of nine magnetic heads to write and read information on the tape. The nine

heads operate independently and record information on nine parallel tracks, all parallel to the edge of the tape. Eight tracks are used to record a byte of data and the ninth track is used to record a parity bit for each byte. The standard width of the tape is half an inch. The number of bits per inch (bpi) is known as recording density.

Normally, when data is recorded on to a tape, a block of data is recorded and then a gap is left and then another block is recorded, and so on. This gap is known as Inter-Block Gap (IBG). The blocks are normally 10 times as long as IBG. The Beginning Of the Tape (BOT) is indicated through a metal foil known as marker, and the end of the tape (EOT) is also indicated through a metal foil known as end of tape marker.

The data on the tape is arranged as blocks and cannot be addressed. It can only be retrieved sequentially in the same order in which it is written. Thus, if a desired record is at the end of the tape, earlier records have to be read before it is reached and hence the access time is very high as compared to magnetic disks.

Optical Disk

This (optical disk) storage technology has the benefit of high-volume economical storage coupled with slower times than magnetic disk storage.

Compact Disk-Read Only Memory (CD-ROM)

The CD-ROM optical drives are employed for storage of data that is circulated for read-only use. A single CD-ROM has the capacity to hold around 800 MB of data. This media can be used when software and huge reports are to be circulated to a large number of users. As compared to floppy disks or tapes, CD-ROM is more dependable for circulation. Nowadays, almost all software and documentations are circulated only on CD-ROM.

In a CD-ROM, data is stored uniformly across the disk in parts made of equal size. So, as you go towards the outer surface of the disk, the data stored on a track increases. Thus, CD-ROMs are rotated at changing speeds for reading.

Fig. CD-ROM

Information in a CD-ROM is written by creating pits on the disk surface by shining a laser beam. As the disk rotates, the laser beam traces out a continuous spiral. When 1 is to be written on the disk, a circular pit of around 0.8-micrometer diameter is created by the sharply focussed beam and no pit is created if a zero is to be written. The pre-recorded information on a CD-ROM is read with the help of a CD-ROM reader, which uses a laser beam for reading. For this, the CD- ROM disk is inserted into a slot of CD drive. Then, a motor rotates the disk. A laser head moves in and out of the specified position. As the disk rotates, the head senses pits and converted to 1s and 0s by the electronic interface and sent to the computer. The following figure depicts a CD-ROM.

CD-ROM disk

Spiral tracks   Laser beam
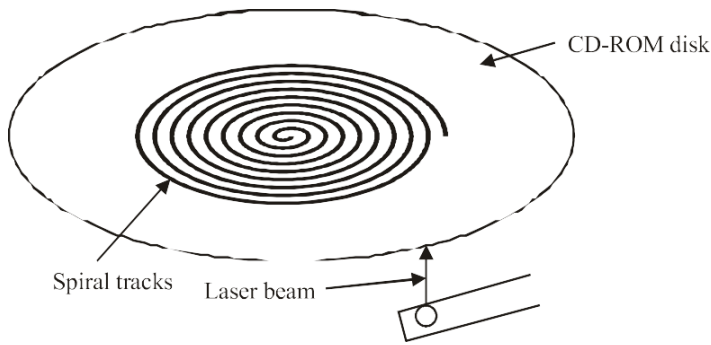
The speed of the disk is indicated by nx, where n is an integer indicating the factor by which the original nominal speed of 150 KB/S is multiplied. Thus, a 52X CD-ROM disk speed will be $52 \times 150 = 7800$ KB/S. The CD-ROM has a buffer size of 256 Kilobytes to keep data temporarily. A Small Computer System Interface (SCSI) adapter connects it to the computer system.

The following are the major benefits of CD-ROM:

*   It has the capacity to store large amounts of data/information.

*   Its mass replication is fast and inexpensive.

*   It has removable disks.

The following are the demerits of CD-ROM:

*   It is read-only and hence cannot be updated.

*   Access time is longer than that of a magnetic disk.

Erasable Optical Disk

A recent development in optical disk technology is the erasable optical disk. The erasable optical disk can be a substitute for the standard magnetic disk, subject to the condition that the speed of access is not essential and the quantity of data stored is large. The optical disk is used for multimedia, image and high-volume, low-activity backup storage. Data in these disks can be changed repeatedly as in a magnetic disk. The erasable optical disk is portable,

highly reliable and has a longer life. It uses a format that makes semi-random access feasible.

Digital Versatile Disc (DVDs):

A DVD is a type of optical media used for storing digital data. It is the same size as a CD, but has a larger storage capacity. Some DVDs are formatted specifically for video playback, while others may contain different types of data, such as software programs and computer files. DVDs can be divided into three main categories which are as follows:

DVD-ROM (Read-Only):

These types of DVDs come with media already recorded on them, such as movie dvds. As the name suggests, data on these discs cannot be erased or added, so these discs are known as a read-only or non-writable DVD.

DVD-R (Writable):

It allows you to record or write information to the DVD. However, you can write information only once as it becomes a read-only DVD once it is full.

DVD-RW (Rewritable or Erasable):

This type of discs can be erased, written, or recorded multiple times.

Register Memory

Register memory is the smallest and fastest memory in a computer. It is not a part of the main memory and is located in the CPU in the form of registers, which are the smallest data holding

elements. A register temporarily holds frequently used data, instructions, and memory address that are to be used by CPU. They hold instructions that are currently processed by the CPU. All data is required to pass through registers before it can be processed. So, they are used by CPU to process the data entered by the users.

Registers hold a small amount of data around 32 bits to 64 bits. The speed of a CPU depends on the number and size (no. of bits) of registers that are built into the CPU. Registers can be of different types based on their uses. Some of the widely used Registers include Accumulator or AC, Data Register or DR, the Address Register or AR, Program Counter (PC), I/O Address Register, and more.

Computer Registers:

Data Register:

It is a 16-bit register, which is used to store operands (variables) to be operated by the processor. It temporarily stores data, which is being transmitted to or received from a peripheral device.

Program Counter (PC):

It holds the address of the memory location of the next instruction, which is to be fetched after the current instruction is completed. So, it is used to maintain the path of execution of the different programs and thus executes the programs one by one, when the previous instruction gets completed.

Instructor Register:

It is a 16-bit register. It stores the instruction which is fetched from the main memory. So, it is used to hold instruction codes,

which are to be executed. The Control Unit takes instruction from Instructor Register, then decodes and executes it.

Accumulator Register:

It is a 16-bit register, which is used to store the results produced by the system. For example, the results generated by CPU after the processing are stored in the AC register.

Address Register:

It is a 12-bit register that stores the address of a memory location where instructions or data is stored in the memory.

I/O Address Register: Its job is to specify the address of a particular I/O device.

I/O Buffer Register: Its job is to exchange the data between an I/O module and the CPU.

Cache Memory:

Cache memory is a high-speed memory, which is small in size but faster than the main memory (RAM). The CPU can access it more quickly than the primary memory. So, it is used to synchronize with high-speed CPU and to improve its performance.

Cache memory can only be accessed by CPU. It can be a reserved part of the main memory or a storage device outside the CPU. It holds the data and programs which are frequently used by the CPU. So, it makes sure that the data is instantly available for CPU whenever the CPU needs this data. In other words, if the CPU

finds the required data or instructions in the cache memory, it doesn't need to access the primary memory (RAM). Thus, by acting as a buffer between RAM and CPU, it speeds up the system performance.

Types of Cache Memory:

L1: It is the first level of cache memory, which is called Level 1 cache or L1 cache. In this type of cache memory, a small amount of memory is present inside the CPU itself. If a CPU has four cores (quad core cpu), then each core will have its own level 1 cache. As this memory is present in the CPU, it can work at the same speed as of the CPU. The size of this memory ranges from 2KB to 64 KB. The L1 cache further has two types of caches: Instruction cache, which stores instructions required by the CPU, and the data cache that stores the data required by the CPU.

L2: This cache is known as Level 2 cache or L2 cache. This level 2 cache may be inside the CPU or outside the CPU. All the cores of a CPU can have their own separate level 2 cache, or they can share one L2 cache among themselves. In case it is outside the CPU, it is connected with the CPU with a very high-speed bus. The memory size of this cache is in the range of 256 KB to the 512 KB. In terms of speed, they are slower than the L1 cache.

L3: It is known as Level 3 cache or L3 cache. This cache is not present in all the processors; some high-end processors may have this type of cache. This cache is used to enhance the performance of Level 1 and Level 2 cache. It is located outside the CPU and is shared by all the cores of a CPU. Its memory size ranges from 1 MB to 8 MB. Although it is slower than L1 and L2 cache, it is faster than Random Access Memory (RAM).

Memory Units

Memory units are used to measure and represent data. Some of the commonly used memory units are:

1) Bit:

The computer memory units start from bit. A bit is the smallest memory unit to measure data stored in main memory and storage devices? A bit can have only one binary value out of 0 and 1.

2) Byte:

It is the fundamental unit to measure data. It contains 8 bits or is equal to 8 bits. Thus a byte can represent 2*8 or 256 values.

3) Kilobyte: A kilobyte contains 1024 bytes.

4) Megabyte: A megabyte contains 1024 kilobytes.

5) Gigabyte: A gigabyte contains 1024 megabyte.

6) Terabyte: A terabyte contains 1024 gigabytes.

Books for Reference:

1. Dennis P.Curtin, Kim dolwy, KunL AWN, Xrhleen morin, Information Technology, the breaking wave, TMH 2000.
2. Stacey C Sawyer, Brain K Williams, Sarah E Hutchinson Using Information Technology – Brief Version A Practical Introduction to Computer and Communications Third Edition, McGraw Hill Companies 2011.
3. James O'Brien – Introduction to Information systems. 16th edition, 2005.

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UNIT – III
SOFTWARE FUNDAMENTALS

Structure

3.1 SOFTWARE

A computer cannot operate without any instructions and is based on a logical sequence of instructions in order to perform a function. These instructions are known as a 'computer program', and constitute the computer software. The sequences of instructions are based on algorithms that provide the computer with instructions on how to perform a function. Thus, it is impossible for a computer to process without software, a term attributed to John W. Tukey in 1958.

Different kinds of software designs have been developed for particular functions. Popular computer software include interpreter, assembler, compiler, operating systems, networking, word processing, accounting, presentation, graphics, computer games, etc. The computer software is responsible for converting the instructions in a program into a machine language facilitating their execution.

Software is a set of programs, which is designed to perform a well-defined function. A program is a sequence of instructions written to solve a particular problem.

3.2 KINDS OF SOFTWARE:

Today, software is a significant aspect of almost all fields including business, education, medicine, etc. The basic requirement for software is a distinct set of procedures. Thus, software can be used in any domain that can be described in logical and related steps and every software is developed with the aim of catering to a particular objective, such as data processing, information sharing, communication, etc. Software is based on the type of applications that are as follows:

System Software:

This type of software is involved managing and controlling the operations of a computer system. System software is a group of programs rather than one program and is responsible for using computer resources efficiently and effectively. Operating system, for example, is system software, which controls the hardware, manages memory and multitasking functions and acts as an interface between applications programs and the computer.

Real-Time Software:

This is based on observing, analysing and controlling real life events as they occur. Manually, a real-time system guarantees a response to an external event within a specified period of time. The real- time software, for instance, is used for navigation in which the computer must react to a steady flow of new information without interruption. Most defence organizations all over the world use real time software to control their military hardware.

Business Software:

This kind of software is functional in the domain of management and finance. The basic aspect of a business system comprises payroll, inventory, accounting and software that permits users to access relevant data from the database. These activities are usually performed with the help of specialized business software that facilitates efficient framework in the business operation and in management decisions.

Engineering and Scientific Software:

This software has developed as a significant tool used in the research and development of next generation technology. Applications, such as study of celestial bodies, study of under surface activities and programming of orbital path for space shuttle, are heavily dependent on engineering and scientific software. This software is designed to perform precise calculations on complex numerical data that are obtained during real-time environment.

Artificial Intelligence (AI) Software:

Certain problem solving techniques are non-algorithmic in nature and primarily require this type of software. The solutions to such problems normally cannot be arrived at using computation or straightforward analysis. Such problems need particular problem solving techniques including expert system, pattern recognition and game playing. Also, it constitutes various kinds of searching techniques, such as the application of heuristics. The function of AI is to add certain degree of intelligence into the mechanical hardware to have the desired work done in an agile manner.

Web Based Software:

This category of software performs the function of an interface between the user and the Internet. There are various forms in which data is available online, such as text, audio or video format, linked with hyperlinks. For the retrieval of Web pages from the Internet a Web browser is used, which is a Web based software. The software incorporates executable instructions written in special scripting languages, such as Common Gateway Interface (CGI) or Active Server Page (ASP). Apart from providing navigation on the Web, this software also supports additional features that are useful while surfing the Internet.

Personal Computer (PC) Software:

This software is primarily designed for personal use on a daily basis. The past few years have seen a marked increase in the personal computer software market from normal text editor to word processor and from simple paintbrush to advance image editing software. This software is used mostly in almost every field, whether it is database management system, financial accounting package or a multimedia based software. It has emerged as a versatile tool for daily life applications.

Software can also be classified in terms of the relationship between software users or software purchasers and software development.

Commercial Off-The-Shelf (COTS):

This comprises the software without any committed user before it is put up for sale. The software users have less or no contact with the vendor during development. It is sold through retail stores or distributed electronically. This software includes commonly used programs, such as word processors, spreadsheets, games, income tax

programs, as well as software development tools, such as software testing tools and object modelling tools.

Customized or Bespoke:

This software is designed for a specific user, who is bound by some kind of formal contract. Software developed for an aircraft, for example, is usually done for a particular aircraft making company. They are not purchased 'off-the-shelf' like any word processing software.

Customized COTS:

In this classification, a user can enter into a contract with the software vendor to develop a COTS product for a special purpose, that is, software can be customized according to the needs of the user. Another growing trend is the development of COTS software components—the components that are purchased and used to develop new applications. The COTS software component vendors are essentially parts stores which are classified according to their application types. These types are listed as follows:

- Stand-Alone Software: A software that resides on a single computer and does not interact with any other software installed in a different computer.
- Embedded Software: A software that pertains to the part of unique application involving hardware like automobile controller.
- Real-Time Software: In this type of software the Operations are executed within very short time limits, often microseconds, e.g., radar software in air traffic control system.

- Network Software: In this type of software, software and its components interact across a network.

On the functional basis, software is categorized as follows:

3.2.1 Application Software:

o It helps the end users to complete one or more specific tasks. The specific applications include industrial automation, business software, computer games, telecommunications, databases, educational software, medical software and military software.

3.2.2 System Software:

o It helps in the proper functioning of computer hardware. It includes device drivers, operating systems, servers and utilities.

3.3 APPLICATION SOFTWARE AND ITS TYPES

Application software is a set of programs designed to perform a specific task. It does not control the working of a computer as it is designed for end-users. A computer can run without application software. Application software can be easily installed or uninstalled as required. It can be a single program or a collection of small programs.

Users install specific software programs based on their requirements; for instance, accounting software (like Tally) used in business organizations and designing software used by architects. All programs, languages and utility programs constitute software. With the help of these programs, users can design their own software based on individual preferences. Software programs aid in achieving efficient application of computer hardware and other resources.

Licensed Software

Although there is a large availability of open source or free software online, not all software available in the market is free for use. Some software falls under the category of Commercial Off-The-Shelf (COTS). COTS is a term used for software and hardware technology which is available to the general public for sale, license or lease. In other words, to use COTS software, you must pay its developer in one way or another.

Most of the application software available in the market need a software license for use.

Software is licensed in different categories. Some of these licenses are based on the number of unique users of the software while other licenses are based on the number of computers on which the software can be installed. A specific distinction between licenses would be an Organizational Software License, which grants an organization the right to distribute the software or application to a certain number of users or computers within the organization, and a Personal Software License which allows the purchaser of the application to use the software on his or her computer only.

Free Domain Software

To understand this, let us distinguish between the commonly used terms Freeware and Free Domain software. The term 'freeware' has no clear accepted definition, but is commonly used for packages that permit redistribution but not modification. This means that their source code is not available. Free domain software is software that comes with permission for anyone to use, copy, and distribute, either verbatim or with modifications, either gratis or for a fee. In particular, this means that the source code must be available. Free domain software can be freely used, modified, and redistributed but with one restriction: the redistributed software must be distributed with the original terms of free use, modification and distribution. This is

known as 'copyleft'. Free software is a matter of freedom, not price. Free software may be packaged and distributed for a fee. The 'Free' here refers to the ability of reusing it — modified or unmodified, as a part of another software package. The concept of free software is the brainchild of Richard Stallman, head of the GNU project. The best known example of free software is Linux, an operating system that is proposed as an alternative to Windows or other proprietary operating systems.

Types of Application Software
- ➢ Word Processing
- ➢ Spread Sheet
- ➢ Presentation
- ➢ Database
- ➢ Multimedia

3.3.1 WORD PROCESSING

Microsoft Word is a word processing computer application program written by Microsoft. It is mainly used to design text for presentation. It helps in arranging written text in a proper format and giving it a systematic look. This formatted look facilitates easier reading.

It is an application program used for the production of any type of printable text document including composition, editing, formatting and printing. It takes the advantage of a Graphical User Interface (GUI) to present data in a required format. It can produce any arbitrary combination of images, graphics and text. Microsoft Word is the most widely used word processing system.

It can be used for the simplest to the most complex word processing applications. Using Word, you can write letters and reports, prepare bills and invoices, prepare office stationery, such as

letterheads, envelopes and forms, design brochures, pamphlets, newsletters and magazines, etc

This software allows users to create, edit, format, and manipulate the text and more. It offers lots of options for writing documents, creating images, and more. For example, MS Word, WordPad, Notepad, etc.

It includes all topics of MS Word such as save the document, correct error, word count, font size, font style, apply a style, customize a style, page size, page margin, insert header and footer and more. It provides spell-check options, formatting functions like cut-copy-paste, and spots grammatical errors on a real-time basis. It also helps in saving and storing documents.
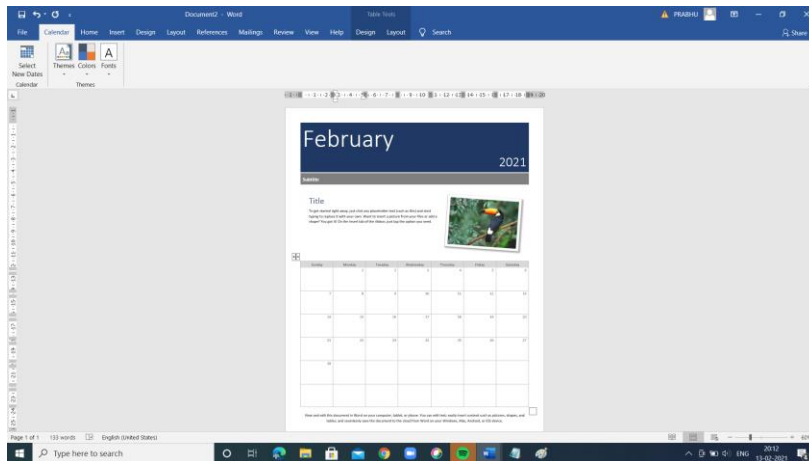
Fig. Microsoft Word Document

It's also used to add images, preview the complete text before printing it; organize the data into lists and then summarize, compare and present the data graphically. It allows the header and footer to display descriptive information, and to produce personalized letters through mail. This software is used to create, format and edit any document. It allows us to share the resources such as clip arts, drawing tools, etc. available to all office programs.

3.3.2 SPREAD SHEET: MS EXCEL

Excel is and spread Sheet application ideal for a task that needs a number of lists, tables, financial calculations, analysis and graphs. Excel is good for organizing different kinds of data, however it is numerical data that is best suited. Thus, Excel can be used when you not only need a tool for storing and managing data, but also analysing and querying it. In addition to providing simple database capabilities, Excel also allows you to create documents for the World Wide Web (WWW).

The menus, toolbars and icons of MS Excel are very similar (though not the same) to MS Word. This is in keeping with Microsoft's much hyped philosophy and strategy of offering users a totally integrated office suite pack. From the user's point of view, this means less time spent in learning the second package once you know the first, and almost effortless and seamless exchange of data between various components.
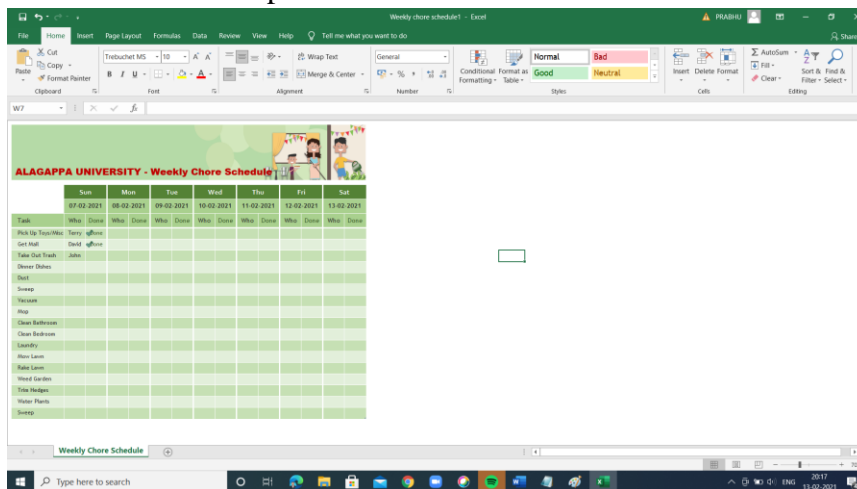

Fig. Microsoft Excel Worksheet

Spreadsheet software is used to perform calculations. In this software, data is stored in a table format. The intersecting area, called cells, are separated to define fields such as text, date, time,

and number. It allows users to provide formulas and functions to perform calculations. Microsoft Excel is one good example of spreadsheet software.

It is one of the most suitable spreadsheet functions that help us manage data, create optically logical charts, and thought-provoking graphs. Microsoft Excel is supported by both Mac and PC platforms. Microsoft Excel can also be used to balance a check book, create an expense document, build formulas, and edit them.

It mainly comprises tabs, groups of commands, and worksheets. The worksheet is made of rows and columns that intersect each other to form cells where data is entered. It is capable of performing multiple tasks like calculations, data analysis, and integrating data.

Microsoft Office button, ribbon, and quick access toolbar are the three main features of excel that you need to focus on while learning excel.

Microsoft Excel Features

There are several features that are available in Excel to make our task more manageable. Some of the main features are;
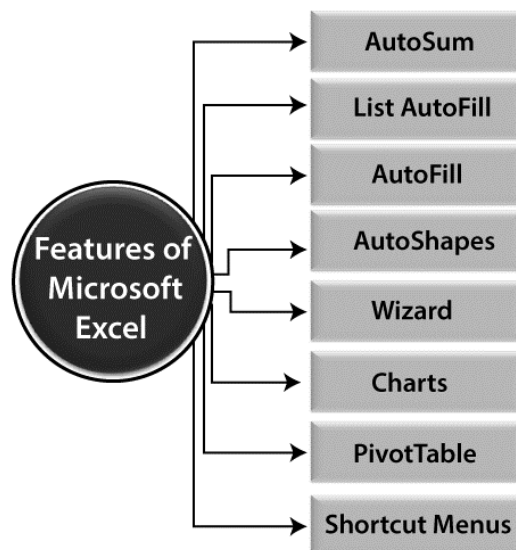
Excel Interface

After starting Excel, we will see two windows - one within the other. The outer window is the Application Window, and the inner window is a Workbook Window. When maximized, the Excel Workbook Window composite in with the Application Window. After completing this module, we should be able to:

Identify the components of the Application Window.

Identify the components of the Workbook Window.
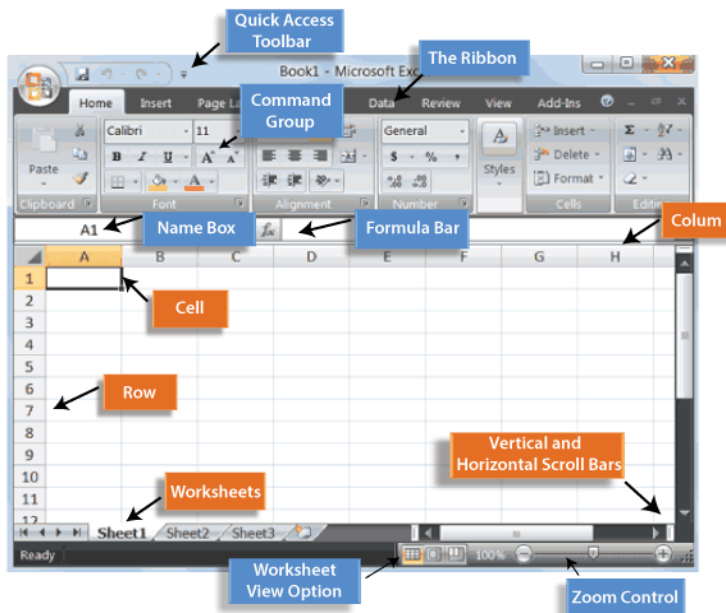
3.3.3 PRESENTATION GRAPHIC SOFTWARE

MSPOWER POINT

Some very popular presentation software, such as Microsoft's Power point and Lotus's Freelance Graphics, are sold stand-alone or can come as part of office-oriented suites or packages of software. Other popular products include Adobe Persuasion, Astound, Asymetrix Compel, Corel Presentations, and Harvard Graphics. Among the most popular multimedia authoring tools are Macromedia Director and Asymetrix's Multimedia Toolbook. These authoring tools also

include presentation capability as well. Most if not all of these products come in both PC and Mac versions.

Fig. Microsoft Power Point

Recently, a new presentation tool has arrived: your Web browser and the tools for creating Web pages, such as Microsoft's FrontPage and Adobe's PageMill. The ubiquity of these tools and the browser as a playback device make this a popular approach, especially when a presentation can combine HTML pages on the hard disk with links to outside sites (if you have a live Internet connection).

Fig. Windows Media Player

Multimedia software are developed to perform editing of video, audio, and text. It allows you to combine texts, videos, audio, and images. Thus, you can improve a tex t document by adding photos, animations, graphics, and charts through multimedia software. For example, VLC player, Window Media Player, etc.

3.3.4 DATABASE SOFTWARE: MS ACCESS

Database software is used to create and manage a database. Also known as a DBMS (Database Management System), it helps you organize your data. So, when you run an application, data is fetched from the database, modified, and is stored back in the database. Oracle, MySQL, Microsoft SQL Server, PostgreSQL, MongoDB, and IBM Db2 are some popular databases.

3.3.5 COMMUNICATION SOFTWARE

Communication software is an application or program designed to pass information from one system to another. Such software provides remote access to systems and transmits files in a multitude of formats between computers. Communication software forms a part of communication systems with software components classified according to functions within the Open Systems Interconnection Model (OSI Model). The best-defined examples of communication software are file transfer protocol (FTP), messaging software and email.

3.4 SYSTEM SOFTWARE

System software is software designed to provide a platform for other software. Examples of system software include operating systems like macOS, GNU/Linux , Android and Microsoft Windows,

computational science software, game engines, industrial automation, and software as a service applications.

System software constitutes all the programs, languages and documentation provided by the manufacturer in the computer. These programs provide the user with an access to the system so that he can communicate with the computer and write or develop his own programs. The software makes the machine user-friendly and makes an efficient use of the resources of the hardware. Systems software are permanent programs on a system and reduce the burden of the programmer as well as aid in maximum resource utilization. MS DOS (Microsoft Disk Operating System) was one of the most widely used systems software for IBM compatible microcomputers. Windows and its different versions are popular examples of systems software. Systems software are installed permanently on a computer system used on a daily basis.

The system software is a collection of programs designed to operate, control, and extend the processing capabilities of the computer itself. System software is generally prepared by the computer manufacturers. These software products comprise of programs written in low-level languages, which interact with the hardware at a very basic level. System software serves as the interface between the hardware and the end users.

Some examples of system software are Operating System, Compilers, Interpreter, Assemblers, etc. Some other examples of system software include:

BIOS:

It stands for basic input output system. It is a type of system software, which is stored in Read Only Memory (ROM) located on the motherboard. However, in advanced computer systems, it is stored in flash memory. BIOS is the first software that gets activated

when you turn on your computer system. It loads the drivers of the hard disk into memory as well as assists the operating system to load itself into the memory.

Boot Program:

Boot refers to starting up a computer. When you switch on the computer, the commands in the ROM are executed automatically to load the boot program into memory and execute its instructions. The BIOS program has a basic set of commands that enables the computer to perform the basic input/output instructions to start the computer.

An assembler:

It plays the role of a converter as it receives basic computer instructions and converts them into a pattern of bits. The processor uses these bits to perform basic operations.

A device driver:

This system software controls hardware devices connected to a computer. It enables the computer to use the hardware by providing an appropriate interface. The kernel of a Computer's CPU communicates with different hardware through this software. Operating systems generally come with most of the device drivers. If the operating system does not have a device driver for hardware, you have to install the device driver before using that hardware device.

3.4.1 Operating systems

The computer's OS is a well-known example of system software. Widely used operating systems include Microsoft Windows, macOS and Linux. Unlike other system software types, the average computer user regularly interacts with the computer OS

through its graphical UI (GUI) and, with some operating systems, a less complex command-line interface (CLI).Because a GUI is a program that sits on top of the OS, it may be referred to as *application software*, not system software. In other words, the GUI is application software that makes it possible for the user to manipulate parts of the OS.

3.4.1.1 Functions of an operating System

1. **Security** –

   The operating system uses password protection to protect user data and similar other techniques. it also prevents unauthorized access to programs and user data.

2. **Control over system performance**

   Monitors overall system health to help improve performance. records the response time between service requests and system response to have a complete view of the system health. This can help improve performance by providing important information needed to troubleshoot problems.

3. **Job accounting**

   Operating system Keeps track of time and resources used by various tasks and users, this information can be used to track resource usage for a particular user or group of user.

4. **Error detecting aids**

   Operating system constantly monitors the system to detect errors and avoid the malfunctioning of computer system.

5. **Coordination between other software and users**

   Operating systems also coordinate and assign interpreters, compilers, assemblers and other software to the various users of the computer systems.

6. **Memory Management**

The operating system manages the Primary Memory or Main Memory. Main memory is made up of a large array of bytes or words where each byte or word is assigned a certain address. Main memory is a fast storage and it can be accessed directly by the CPU. For a program to be executed, it should be first loaded in the main memory. An Operating System performs the following activities for memory management:

It keeps tracks of primary memory, i.e., which bytes of memory are used by which user program. The memory addresses that have already been allocated and the memory addresses of the memory that has not yet been used. In multi programming, the OS decides the order in which process are granted access to memory, and for how long.

It Allocates the memory to a process when the process requests it and deallocates the memory when the process has terminated or is performing an I/O operation.

7. **Processor Management**

In a multi programming environment, the OS decides the order in which processes have access to the processor, and how much processing time each process has. This function of OS is called process scheduling. An Operating System performs the following activities for processor management.

Keeps tracks of the status of processes. The program which perform this task is known as traffic controller. Allocates the CPU that is processor to a process. De-allocates processor when a process is no more required.

8. **Device Management**

An OS manages device communication via their respective drivers. It performs the following activities for device management. Keeps tracks of all devices connected to system. designates a program responsible for every device known as the

Input/Output controller. Decides which process gets access to a certain device and for how long. Allocates devices in an effective and efficient way. Deallocates devices when they are no longer required.

9. **File Management**

A file system is organized into directories for efficient or easy navigation and usage. These directories may contain other directories and other files. An Operating System carries out the following file management activities. It keeps track of where information is stored, user access settings and status of every file and more… These facilities are collectively known as the file system.

Summary

• A computer cannot operate without any instructions and is based on a logical sequence of instructions in order to perform a function.

• Different kinds of software designs have been developed for particular functions. Popular computer software include interpreter, assembler, compiler, operating systems, networking, word processing, accounting, presentation, graphics, computer games, etc.

• Today, software is a significant aspect of almost all fields including business, education, medicine, etc.

• Web based software performs the function of an interface between the user and the Internet.

• Engineering and scientific software has developed as a significant tool used in the research and development of next generation technology.

- System software constitutes all the programs, languages and documentation provided by the manufacturer in the computer.

- The software makes the machine user-friendly and makes an efficient use of the resources of the hardware.

- Windows and its different versions are popular examples of systems software.

- An Operating System (OS) is the main control program for handling all other programs in a computer.

- The role of an OS in a computer is similar to the role of the manager in an office for the overall management of the college.

- A linkage editor is an editor program that establishes a single module from many modules by resolving cross references among the modules.

- Users install specific software programs based on their requirements; for instance, accounting software (like Tally) used in business organizations and designing software used by architects.

- A word processor is an application program used for the production of any type of printable text document including composition, editing, formatting and printing.

- Excel is ideal for a task that needs a number of lists, tables, financial calculations, analysis and graphs.

Books for Reference:

1. Dennis P.Curtin, Kim dolwy, KunL AWN, Xrhleen morin, Information Technology, the breaking wave, TMH 2000.

2. Stacey C Sawyer, Brain K Williams, Sarah E Hutchinson Using Information Technology – Brief Version A Practical Introduction to Computer and Communications Third Edition, McGraw Hill Companies 2011.

COMPUTER NETWORKS

Structure

4.1 Introduction

Network is used to share information and resources. Group of computer and their peripheral are connected with each other to share information and resources is called networking. Computers are connected to communicate.

4.2 Definition of Computer Networks

A computer network is a system in which multiple computers are connected to each other to share information and resources.

There are some major types of network i.e. LAN (Local Area Network), MAN (Metropolitan Area Network) and WAN

(Wide Area Network). Some other networks are also there which can be implemented like PAN (Personal Area Network), SAN (Storage Area Network), EPN (Enterprise Private Network), VPN (Virtual Private Network).

These networks have some similarities and some dissimilarities. Major difference among these networks is their geographical area they cover. LAN is implemented in a small geographical area like within a building, office etc. MAN is spread within a city or town. WAN covers the largest area like Internet which is spread all over the world. These networks can be wired (with cables) or wireless (without cables). If we talk about the similarity then all the networks are used to share information and resources. This unit will deal with communication channels

Advantages of a Computer Network:

- Share resources from one computer to another.

- Create files and store them in one computer, access those files from the other computer(s) connected over the network.

- Connect a printer, scanner, or a fax machine to one computer within the network and let other computers of the network use the machines available over the network.

Following is the list of hardware's required to set up a computer network.

- Network Cables
- Distributors
- Routers
- Internal Network Cards
- External Network Cards

4.3 Computer Network Types

A computer network is a group of computers linked to each other that enables the computer to communicate with another computer and share their resources, data, and applications. A computer network can be categorized by their size. Network is of different types:

> - LAN (Local Area Network)
> - MAN (Metropolitan Area Network)
> - WAN (Wide Area Network)
> - PAN (Personal Area Network)
> - SAN (Storage Area Network)
> - EPN (Enterprise Private Network)
> - VPN (Virtual Private Network)

LAN: is used in small areas like office, building or an organisation. It is network which is spread in local area. The main purpose of LAN is to share information and resources.

MAN: is used to share information within a city or town to share information. MAN is commonly used for TV cable network.

WAN: is used to share information with world. It is spread all over the world. Example of WAN are Internet, Intranet, Bank ATM etc.

PAN: Personal Area Network is a network which enables communication between computer devices near a person.

SAN: It is a block-based storage. It is a technology by which high-speed architecture connects with servers to their logical disk units (LUNs). ALUN is a range of blocks provisioned from a pool of shared storage and presented to the server as a logical disk.

EPN: It is used by a business enterprise to connect its various company sites (such as production sites, offices and shops) in order to share computer resources.

VPN: It is a network technology that is used to create a safe and encrypted connection over a less secure network, such as the internet.

4.3.1 Local Area Network (LAN)

LAN or Local Area Network connects network devices in such a way that personal computer and workstations can share data, tools and programs. The group of computers and devices are connected together by a switch, or hub. It has its own addressing scheme as defined by the TCP/IP protocol. Each node is having different address. This address is obtained by PC automatically while network configuration or can be given manually to each PC. These addresses are unique in relation to other computers on the local network. Routers are placed at LAN for connecting with larger WAN.

Data transmission rate very fast as the number of computers linked are limited. LAN uses be high speed and relatively inexpensive hardware (Such as hubs, network adapters and Ethernet cables). LANs cover smaller geographical area (Size is limited to a few meters) and are privately owned. One can use it for an office building, home, hospital, schools, etc. LAN is easy to design and maintain. A Communication medium used for LAN has twisted pair cables and coaxial cables. It covers a short distance, and so the error and noise are minimized.

The speed of LAN is normally 100 or 1000 Mbps. Propagation delay is very short in a LAN. LAN can comprise of two to many computers connected with each other. Generally wired LAN is setup with twisted pair cable of cat 3 or cat 6 .Wired LAN is sued for increased speed and security, but wireless connections can also implemented known as WLAN. LAN has less network congestion and fault tolerance is more.

LAN requirement are:

•   LAN card or Ethernet card or NIC (Network Interface Card)
•   Networking cable (twisted pair cat 3 or cat 6)
•   Hub and Switch
•   RJ 45 connector
•   WAP (Wireless Access Point) for wireless LAN

Advantages of Networking

1. Efficient use of storage media: Data storage can be done at central location for east sharing and reducing duplicate data.

2. Quickest Document delivery: Document can be transferred quickly in local area network.

3. Sharing of hardware resources: Network hardware can be shared to work cost efficiently. Network hardware like printer, scanner can be shared.

4. Reduce redundancy: Repetition of data is reduced in networking. Information can be accessed in networking from any node.

5. Promote Multiuser environment: LAN support multiuser environment like many user can work on same workbook in Excel which is shared. It allows the editing done by multiuser.

6. Network security in LAN can be achieved by user authentication by password and by giving right access like read only, read and write access.

Points to Remember:

o Local Area Network is a group of computers connected to each other in a small area such as building, office.

o LAN is used for connecting two or more personal computers through a communication medium such as twisted pair, coaxial cable, etc.

o It is less costly as it is built with inexpensive hardware such as hubs, network adapters, and ethernet cables.

o The data is transferred at an extremely faster rate in Local Area Network.

o Local Area Network provides higher security.

4.3.2 Metropolitan Area Networks (MAN)

A Metropolitan Area Network (MAN) is a network that covers a larger geographic area by interconnecting a different LAN to form a larger network. Government agencies use MAN to connect to the

citizens and private industries. In MAN, various LANs are connected to each other through a telephone exchange line. The most widely used protocols in MAN are RS-232, Frame Relay, ATM, ISDN, OC-3, ADSL, etc. It has a higher range than Local Area Network (LAN).
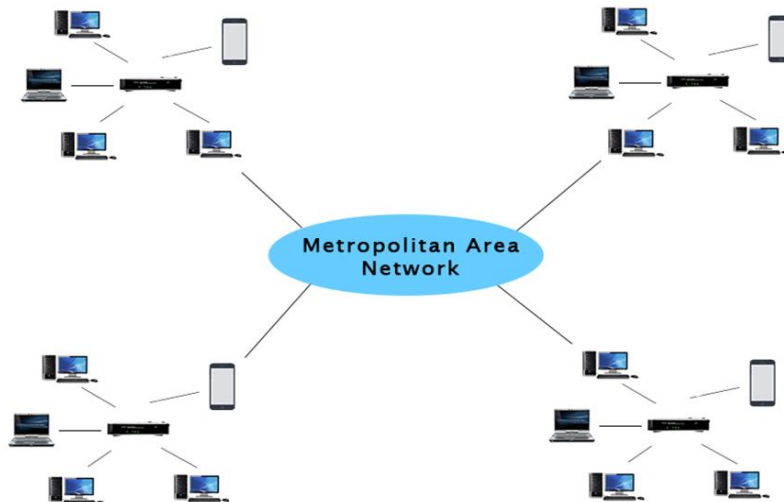
Uses of Metropolitan Area Network:

- o MAN is used in communication between the banks in a city.
- o It can be used in an Airline Reservation.
- o It can be used in a college within a city.
- o It can also be used for communication in the military.

4.3.3 Wide Area Network (WAN)

A Wide Area Network is a network that extends over a large geographical area such as states or countries. A Wide Area Network is quite bigger network than the LAN. A Wide Area Network is not limited to a single location, but it spans over a large geographical area through a telephone line, fiber optic cable or satellite links. The internet is one of the biggest WAN in the world. A Wide Area

Network is widely used in the field of Business, government, and education.
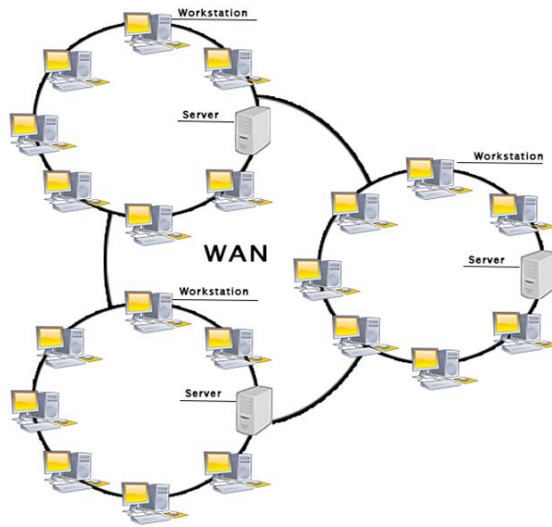
Examples of Wide Area Network:

- o **Mobile Broadband:** A 4G network is widely used across a region or country.

- o **Last mile:** A telecom company is used to provide the internet services to the customers in hundreds of cities by connecting their home with fiber.

- o **Private network:** A bank provides a private network that connects the 44 offices. This network is made by using the telephone leased line provided by the telecom company.

Advantages of Wide Area Network:

- o **Geographical area:** A Wide Area Network provides a large geographical area. Suppose if the branch of our office is in a different city then we can connect with them through WAN. The internet provides a leased line through which we can connect with another branch.

- **Centralized data:** In case of WAN network, data is centralized. Therefore, we do not need to buy the emails, files or back up servers.

- **Get updated files:** Software companies work on the live server. Therefore, the programmers get the updated files within seconds.

- **Exchange messages:** In a WAN network, messages are transmitted fast. The web application like Facebook, Whatsapp, Skype allows you to communicate with friends.

- **Sharing of software and resources:** In WAN network, we can share the software and other resources like a hard drive, RAM.

- **Global business:** We can do the business over the internet globally.

- **High bandwidth:** If we use the leased lines for our company then this gives the high bandwidth. The high bandwidth increases the data transfer rate which in turn increases the productivity of our company.

Disadvantages of Wide Area Network:

- **Security issue:** A WAN network has more security issues as compared to LAN and MAN network as all the technologies are combined together that creates the security problem.

- **Needs Firewall & antivirus software:** The data is transferred on the internet which can be changed or hacked by the hackers, so the firewall needs to be used. Some people can inject the virus in our system so antivirus is needed to protect from such a virus.

- **High Setup cost:** An installation cost of the WAN network is high as it involves the purchasing of routers, switches.

- **Troubleshooting problems:** It covers a large area so fixing the problem is difficult.

4.3.4 Personal Area Networks (PAN)

Thomas Zimmerman was the first research scientist to bring the idea of the Personal Area Network. Personal Area Network is a network arranged within an individual person, typically within a range of 10 meters. It is used for connecting the computer devices of personal use is known as Personal Area Network. It covers an area of 30 feet**.** Personal computer devices that are used to develop the personal area network are the laptop, mobile phones, media player and play stations. There are two types of Personal Area Network namely

- Wired Personal Area Network
- Wireless Personal Area Network

Wireless Personal Area Network:

Wireless Personal Area Network is developed by simply using wireless technologies such as WiFi, Bluetooth. It is a low range network.

Wired Personal Area Network:

Wired Personal Area Network is created by using the USB. Examples of Personal Area Network;

- **Body Area Network:** Body Area Network is a network that moves with a person. **For example**, a mobile network moves with a person. Suppose a person establishes a network connection and then creates a connection with another device to share the information.

- o **Offline Network:** An offline network can be created inside the home, so it is also known as a **home network**. A home network is designed to integrate the devices such as printers, computer, television but they are not connected to the internet.

- o **Small Home Office:** It is used to connect a variety of devices to the internet and to a corporate network using a VPN

4.4 Internet

Internet is a global communication system that links together thousands of individual networks. It allows exchange of information between two or more computers on a network. Thus, internet helps in transfer of messages through mail, chat, video & audio conference.

4.5 Intranet

Intranets increase communication within an organization by allowing employees to easily access important information, links, applications and forms as well as databases that can provide company records. Security can also be increased within the intranet by establishing a database that maintains all of the usernames of people who are allowed access to the network.

Uses of the intranet

Potential uses of an intranet include:

- Streamlining everyday activities by making repeated tasks more feasible.

- Centralizing and managing important information and company data in a single database.

- Making collaboration easier since information can be shared across the entire network.

- Providing personalized content to employees based on their role within the company.

- Improving internal communication by making employee directories, company news and organization charts readily available.

- Providing fast and easy access to information about company policies, benefits and updates.

4.6 Firewall

A firewall is a network security device that monitors incoming and outgoing network traffic and permits or blocks data packets based on a set of security rules. Its purpose is to establish a barrier between your internal network and incoming traffic from external sources (such as the internet) in order to block malicious traffic like viruses and hackers.

4.7 Network Topology

The configuration, or topology, of a network is key to determining its performance. Network topology is the way a network is arranged, including the physical or logical description of how links and nodes are set up to relate to each other.

There are numerous ways a network can be arranged, all with different pros and cons, and some are more useful in certain circumstances than others. Admins have a range of options when it comes to choosing a network topology, and this decision must account for the size and scale of their business, its goals, and budget. Several tasks go into effective network topology management,

including configuration management, visual mapping, and general performance monitoring. The key is to understand your objectives and requirements to create and manage the network topology in the right way for your business.

Network topology refers to how various nodes, devices, and connections on your network are physically or logically arranged in relation to each other. Think of your network as a city, and the topology as the road map. Just as there are many ways to arrange and maintain a city—such as making sure the avenues and boulevards can facilitate passage between the parts of town getting the most traffic—there are several ways to arrange a network. Each has advantages and disadvantages and depending on the needs of your company, certain arrangements can give you a greater degree of connectivity and security.

There are two approaches to network topology: physical and logical. Physical network topology, as the name suggests, refers to the physical connections and interconnections between nodes and the network—the wires, cables, and so forth. Logical network topology is a little more abstract and strategic, referring to the conceptual understanding of how and why the network is arranged the way it is, and how data moves through it.

Why Is Network Topology Important?

The layout of your network is important for several reasons. Above all, it plays an essential role in how and how well your network functions. Choosing the right topology for your company's operational model can increase performance while making it easier to locate faults, troubleshoot errors, and more effectively allocate resources across the network to ensure optimal network health. A streamlined and properly managed network topology can increase

energy and data efficiency, which can in turn help to reduce operational and maintenance costs.

The design and structure of a network are usually shown and manipulated in a software-created network topology diagram. These diagrams are essential for a few reasons, but especially for how they can provide visual representations of both physical and logical layouts, allowing administrators to see the connections between devices when troubleshooting.

The way a network is arranged can make or break network functionality, connectivity, and protection from downtime. The question of, "What is network topology?" can be answered with an explanation of the two categories in the network topology.

1. **Physical** – The physical network topology refers to the actual connections (wires, cables, etc.) of how the network is arranged. Setup, maintenance, and provisioning tasks require insight into the physical network.

2. **Logical** – The logical network topology is a higher-level *idea* of how the network is set up, including which nodes connect to each other and in which ways, as well as how data is transmitted through the network. Logical network topology includes any virtual and cloud resources.

Effective network management and monitoring require a strong grasp of both the physical and logical topology of a network to ensure your network is efficient and healthy.

**What's the Most Common Type of Network Topology?**

Building a local area network (LAN) topology can be make-or-break for your business, as you want to set up a resilient, secure, and easy-to-maintain topology. There are several different types of

network topology and all are suitable for different purposes, depending on the overall network size and your objectives.

Network Topology Types
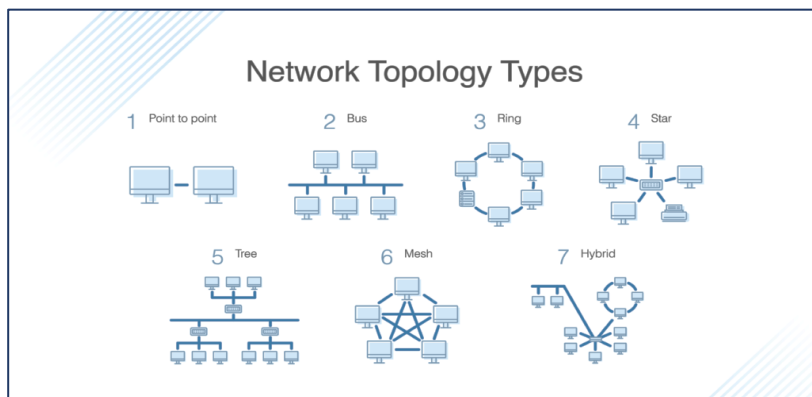
4.7.1 Bus Topology

A bus topology orients all the devices on a network along a single cable running in a single direction from one end of the network to the other—which is why it's sometimes called a "line topology" or "backbone topology." Data flow on the network also follows the route of the cable, moving in one direction.
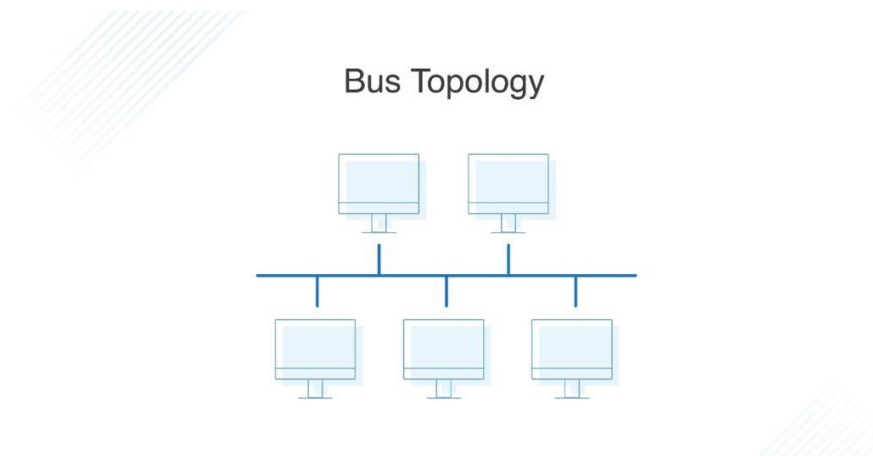
Bus Topology

Advantages of Bus Topology

- Bus topologies are a good, cost-effective choice for smaller networks because the layout is simple, allowing all devices to be connected via a single coaxial or RJ45 cable.

- If needed, more nodes can be easily added to the network by joining additional cables.

Disadvantages of Bus Topology

However, because bus topologies use a single cable to transmit data, they're somewhat vulnerable. If the cable experiences a failure, the whole network goes down, which can be time-consuming and expensive to restore, which can be less of an issue with smaller networks.

Bus topologies are best suited for small networks because there's only so much bandwidth, and every additional node will slow transmission speeds. Furthermore, data is "half-duplex," which means it can't be sent in two opposite directions at the same time, so this layout is not the ideal choice for networks with huge amounts of traffic.

4.7.2 Ring Topology

Ring topology is where nodes are arranged in a circle (or ring). The data can travel through the ring network in either one direction or both directions, with each device having exactly two neighbors.
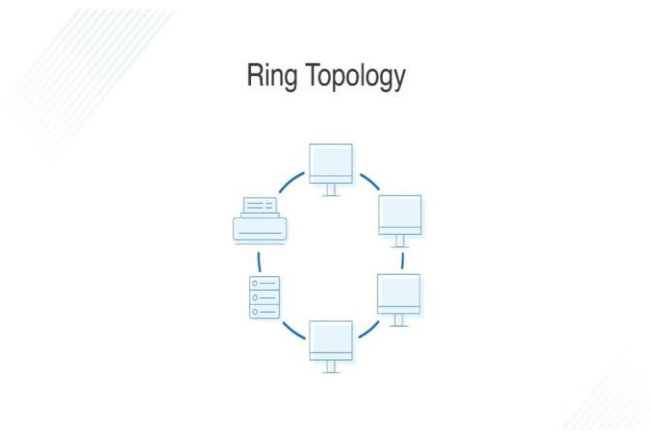
Ring Topology

Advantage of Ring Topology

Since each device is only connected to the ones on either side, when data is transmitted, the packets also travel along the

circle, moving through each of the intermediate nodes until they arrive at their destination. If a large network is arranged in a ring topology, repeaters can be used to ensure packets arrive correctly and without data loss.

Only one station on the network is permitted to send data at a time, which greatly reduces the risk of packet collisions, making ring topologies efficient at transmitting data without errors. By and large, ring topologies are cost-effective and inexpensive to install, and the intricate point-to-point connectivity of the nodes makes it relatively easy to identify issues or misconfigurations on the network.

Disadvantages of Ring Topology

Even though it's popular, a ring topology is still vulnerable to failure without proper network management. Since the flow of data transmission moves unidirectionally between nodes along each ring, if one node goes down, it can take the entire network with it. That's why it's imperative for each of the nodes to be monitored and kept in good health. Nevertheless, even if you're vigilant and attentive to node performance, your network can still be taken down by a transmission line failure.

The question of scalability should also be taken into consideration. In a ring topology, all the devices on the network share bandwidth, so the addition of more devices can contribute to overall communication delays. Network administrators need to be mindful of the devices added to the topology to avoid overburdening the network's resources and capacity.

Additionally, the entire network must be taken offline to reconfigure, add, or remove nodes. And while that's not the end of

the world, scheduling downtime for the network can be inconvenient and costly

4.7.3 Hybrid Topology

Hybrid topologies combine two or more different topology structures—the tree topology is a good example, integrating the bus and star layouts. Hybrid structures are most commonly found in larger companies where individual departments have personalized network topologies adapted to suit their needs and network usage.
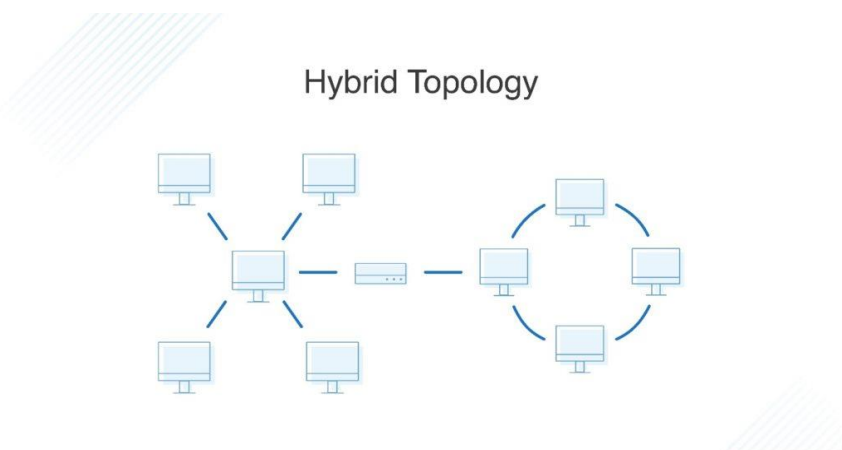
Hybrid Topology

Advantages of Hybrid Topology

The main advantage of hybrid structures is the degree of flexibility they provide, as there are few limitations on the network structure itself that a hybrid setup can't accommodate.

Disadvantages of Hybrid Topology

However, each type of network topology comes with its own disadvantages, and as a network grows in complexity, so too does the experience and know-how required on the part of the admins to keep everything functioning optimally. There's also the monetary cost to consider when creating a hybrid network topology.

4.7.4 Star Topology

A star topology, the most common network topology, is laid out so every node in the network is directly connected to one central hub via coaxial, twisted-pair, or fiber-optic cable. Acting as a server, this central node manages data transmission—as information sent from any node on the network has to pass through the central one to reach its destination—and functions as a repeater, which helps prevent data loss.

Star Topology
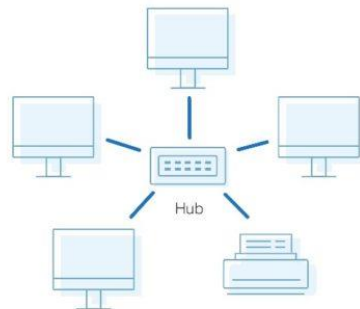
Advantages of Star Topology

Star topologies are common since they allow you to conveniently manage your entire network from a single location. Because each of the nodes is independently connected to the central hub, should one go down, the rest of the network will continue functioning unaffected, making the star topology a stable and secure network layout. Additionally, devices can be added, removed, and modified without taking the entire network offline.

On the physical side of things, the structure of the star topology uses relatively little cabling to fully connect the network, which allows for both straightforward setup and management over time as the network expands or contracts. The simplicity of the

network design makes life easier for administrators, too, because it's easy to identify where errors or performance issues are occurring.

Disadvantages of Star Topology

On the flipside, if the central hub goes down, the rest of the network can't function. But if the central hub is properly managed and kept in good health, administrators shouldn't have too many issues.

The overall bandwidth and performance of the network are also limited by the central node's configurations and technical specifications, making star topologies expensive to set up and operate.

Books for Reference:

1. Dennis P.Curtin, Kim dolwy, KunL AWN, Xrhleen morin, Information Technology, the breaking wave, TMH 2000.
2. Stacey C Sawyer, Brain K Williams, Sarah E Hutchinson Using Information Technology – Brief Version A Practical Introduction to Computer and Communications Third Edition, McGraw Hill Companies 2011.
3. James O'Brien – Introduction to Information systems. 16th edition, 2005.

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UNIT V

BASIC INTERNET CONCEPTS

</div>

Structure

5.1 Introduction

Internet is a global network of billions of computers and other electronic devices. With the Internet, it's possible to access almost any information, communicate with anyone else in the world, and do much more. We can do all of this by connecting a computer to the Internet, which is also called going online. When someone says a computer is online, it's just another way of saying it's connected to the Internet.

5.2 Analog and Digital Signals

An analog signal is a continuous signal that represents physical measurements. Digital signals are time

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separated signals which are generated using digital modulation. It uses a continuous range of values that help you to represent information. Digital signal uses discrete 0 and 1 to represent information.

Digital Communication - Analog to Digital

The conventional methods of communication used analog signals for long distance communications, which suffer from many losses such as distortion, interference, and other losses including security breach.

In order to overcome these problems, the signals are digitized using different techniques. The digitized signals allow the communication to be clearer and more accurate without losses.

The following figure indicates the difference between analog and digital signals. The digital signals consist of **1s** and **0s** which indicate High and Low values respectively.

Analog Signal   Digital Signal
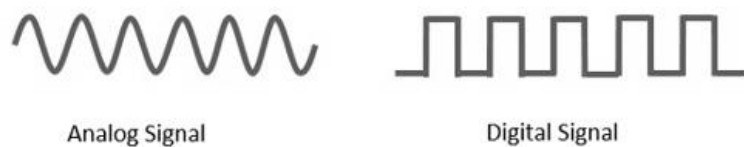
Representation of Signals

## Advantages of Digital Communication

As the signals are digitized, there are many advantages of digital communication over analog communication, such as −

- The effect of distortion, noise, and interference is much less in digital signals as they are less affected.

- Digital circuits are more reliable.

- Digital circuits are easy to design and cheaper than analog circuits.

- The hardware implementation in digital circuits, is more flexible than analog.

- The occurrence of cross-talk is very rare in digital communication.

- The signal is un-altered as the pulse needs a high disturbance to alter its properties, which is very difficult.

- Signal processing functions such as encryption and compression are employed in digital circuits to maintain the secrecy of the information.

- The probability of error occurrence is reduced by employing error detecting and error correcting codes.

- Spread spectrum technique is used to avoid signal jamming.

- Combining digital signals using Time Division Multiplexing TDMTDM is easier than combining analog signals using Frequency Division Multiplexing FDMFDM.

- The configuring process of digital signals is easier than analog signals.

- Digital signals can be saved and retrieved more conveniently than analog signals.

- Many of the digital circuits have almost common encoding techniques and hence similar devices can be used for a number of purposes.

- The capacity of the channel is effectively utilized by digital signals.

Elements of Digital Communication

   The elements which form a digital communication system is represented by the following block diagram for the ease of understanding.

Basic Elements of a Digital Communication System
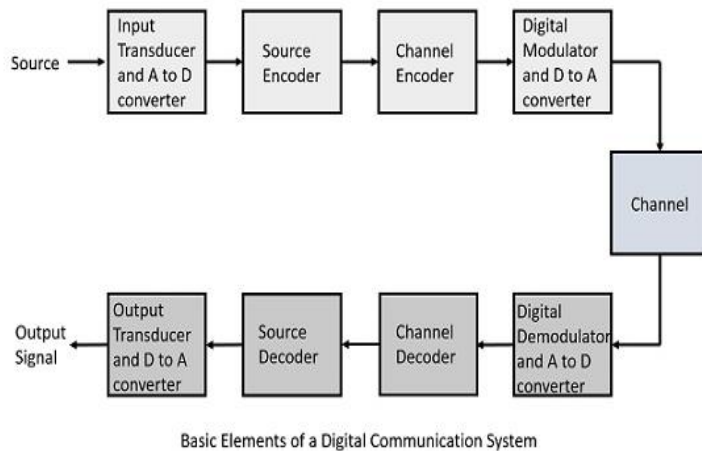
Following are the sections of the digital communication system.

Source

The source can be an **analog** signal. **Example**: A Sound signal

Input Transducer

   This is a transducer which takes a physical input and converts it to an electrical signal (**Example**: microphone). This block also consists of an **analog to digital** converter where a digital signal is needed for further processes.

A digital signal is generally represented by a binary sequence.

Source Encoder

   The source encoder compresses the data into minimum number of bits. This process helps in effective utilization of the bandwidth.

Channel Encoder

The channel encoder, does the coding for error correction. During the transmission of the signal, due to the noise in the channel, the signal may get altered and hence to avoid this, the channel encoder adds some redundant bits to the transmitted data. These are the error correcting bits.

Digital Modulator

The signal to be transmitted is modulated here by a carrier. The signal is also converted to analog from the digital sequence, in order to make it travel through the channel or medium.

Channel

The channel or a medium, allows the analog signal to transmit from the transmitter end to the receiver end.

Digital Demodulator

This is the first step at the receiver end. The received signal is demodulated as well as converted again from analog to digital. The signal gets reconstructed here.

Channel Decoder

The channel decoder, after detecting the sequence, does some error corrections. The distortions which might occur during the transmission, are corrected by adding some redundant bits. This addition of bits helps in the complete recovery of the original signal.

Source Decoder

The resultant signal is once again digitized by sampling and quantizing so that the pure digital output is obtained without the loss of information. The source decoder recreates the source output.

Output Transducer

This is the last block which converts the signal into the original physical form, which was at the input of the transmitter. It converts the electrical signal into physical output (**Example**: loud speaker).

Output Signal

This is the output which is produced after the whole process. **Example** − The sound signal received.

5.2 Modem

A modem (modulator-demodulator) is a device that modulates an analog signal to digital information. It also decodes carrier signals to demodulates the transmitted information. The main aim of the modem is to produce a signal that can be transmitted easily and decoded to reproduce the digital data in its original form. Modems are also used for transmitting analog signals, from Light Emitting Diodes (LED) to radio.

5.2.1 Types of Modems

Dial-up Modem:

This type of modem is using the analog telephone line to connect two end devices like two personal computers. It offers an interface between the digital system and an analog system. It modulates the binary data into the carrier signal on the telephone line.

DSL Modem:

DSL model uses twisted pair cable for transmission of signals. It will radiate at higher frequencies and covered more

distance than the dial-up modems. It offers to speed up to 2 Mbps and even more, which depends upon the type and configuration.

Cable Modem:

This type of modem is designed in a way to carry radio and television signals. It can be configured internally/ externally with the television line to convert the signals into the compatible mode.

Mobile broadband Modems:

This type of modem makes use of mobile telephone lines such as GRPS, Wi-Max, UMTS,etc. It is also called wireless modems. They are built-in in a PC or a laptop. They can also be inserted inside the USB port for internet access.

Half Duplex Modem:

This type of modem allows you to transmit a signal in one direction at one time. So, if the modem is receiving the incoming signal, then it displays indication light to the sending point to stop transmitting data till the time it completes the process of receiving signals.

Full Duplex Modem:

This type of modem permits transmission in both directions at the same interval of time. These types of modems have two carriers on the line.

Four Wire Modem:

It is a separate pair of wires that is used for the incoming and outgoing carrier. Therefore, the same frequency can be used for transmission at both ends.

Two-Wire Modem:

This type of modem uses a pair of wires for both incoming and outgoing carriers. However, if we are using the half-duplex mode, then the same frequency can be used for transmission as data flows in the same direction only at a time.

Functions of Modem

Function to be performed at the transmitting end:

- Convert the data (0s and 1 s) into an appropriate analog signal.
- Perform the line control and signaling to other ends of a phone line.
- Send the dialing signal if the modem is designed to dial without the presence of a user.
- Offer protection against line overload and other problems.

Function to be performed at the receiving end:

- Receiving the analog signal and demodulate them
- Put the demodulate into RS-232 format connect to RS-232 interface.
- Perform line signaling and control.
- Have protection against the overload problem.

Advantages of Modem

- More useful in connecting LAN with the Internet
- Speed depends on the cost
- The modem is the most widely used data communication roadway.

Disadvantages of Modem

- Slow speed when compared to the hub.

- Acts as an interface between LAN and Internet. It does not offer any traffic maintenance.

- Main drawback of a modem is speed. If you spend more money, you get more speed.

Communication Software:

Communications software is the loose category of systems and apps that allows users to exchange files and text, audio, and video messages via the cloud or local network from various devices. The most common tools are email, chat, and messaging apps.

Benefits of Communications Software

Why use communication software when you already have email? Well, email is just one tool in a suite of communication apps. There is more to this software that will allow you to do or achieve the following.

1.   Work remotely. Teams are increasingly distributed not just within the country but globally. Businesses today need communication tools to keep everyone on the same page in real-time to conduct daily operations, work collaboratively, or address urgent situations. With a suite of communication software tools leveraging cloud and mobile, teams today can delegate tasks, coordinate activities, and communicate instructions wherever and whenever they have an internet connection.

2.   Boost productivity. Communicate with clarity with teams and avoid costly errors like missed deadlines, wrong outputs, and mismatched expectations. You have plenty of tools to ensure you get the message across. Likewise, the best communications apps-including live chat, email, and top VoIP tools-have a recording

feature that keeps employees accountable for their tasks. Remote teams are also always connected through mobile devices, so the office and field can quickly coordinate daily on urgent tasks. Overall, the company boosts productivity when everyone is on the same page.

3.   Easy to integrate. Most live chat, email and other messaging apps are so ubiquitous that they work smoothly with bigger systems like CRM software, project management systems, help desk software tools, ecommerce platforms, and other SaaS solutions. That means you can share data seamlessly, for instance: funnel live chat messages into CRM for leads, convert emails into tasks or tickets, or upload recorded webinars or training in your knowledge base.

4.   Capture important information. One of the major advantages of communications software is it acts as a repository of data. Many apps can record or archive message exchanges and audio and video calls, meaning you can capture important details such as customer queries, discussion points, and meeting minutes. The benefits from this are plenty, including sorting promising customer inquiries for leads, referencing discussion points as proof of agreement, and preparing minutes.

5.   Minimize costs. Many of the best communications software solutions can be accessed using your employees' smartphone or tablet. This significantly lowers hardware costs. Similarly, many free communication tools are good enough to exchange messages, audio/video calls, and files. You can also replace expensive PBX and landline licenses and hardware with cloud-based communications software at affordable monthly fees.

5.4 Integrated Services Digital Network (ISDN) LINES
5.4.1 ISDN

ISDN or Integrated Services Digital Network is a circuit-switched telephone network system that transmits both data and voice over a digital **line**. You can also think of it as a set of communication standards to transmit data, voice, and signaling. These digital **lines** could be copper **lines**.

These are a set of communication standards for simultaneous digital transmission of voice, video, data, and other network services over the traditional circuits of the public switched telephone network. Before *Integrated Services Digital Network (ISDN)*, the telephone system was seen as a way to transmit voice, with some special services available for data. The main feature of ISDN is that it can integrate speech and data on the same lines, which were not available in the classic telephone system.

ISDN is a circuit-switched telephone network system, but it also provides access to packet switched networks that allows digital transmission of voice and data. This results in potentially better voice or data quality than an analog phone can provide. It provides a packet-switched connection for data in increments of 64 kilobit/s. It provided a maximum of 128 kbit/s bandwidth in both upstream and downstream directions. A greater data rate was achieved through channel bonding. Generally ISDN B-channels of three or four BRIs (six to eight 64 kbit/s channels) are bonded.

In the context of the OSI model, ISDN is employed as the network in data-link and physical layers but commonly ISDN is often limited to usage to Q.931 and related protocols. These protocols introduced in 1986 are a set of signaling protocols establishing and breaking circuit-switched connections, and for advanced calling features for the user. ISDN provides simultaneous voice, video, and text transmission between individual desktop videoconferencing systems and group videoconferencing systems.

ISDN Interfaces:

Basic Rate Interface (BRI)

There are two data-bearing channels ('B' channels) and one signaling channel ('D' channel) in BRI to initiate connections. The B channels operate at a maximum of 64 Kbps while the D channel operates at a maximum of 16 Kbps. The two channels are independent of each other. For example, one channel is used as a TCP/IP connection to a location while the other channel is used to send a fax to a remote location. In iSeries ISDN supports basic rate interface (BRl). The basic rate interface (BRl) specifies a digital pipe consisting two B channels of 64 Kbps each and one D channel of 16 Kbps. This equals a speed of 144 Kbps. In addition, the BRl service itself requires an operating overhead of 48 Kbps. Therefore a digital pipe of 192 Kbps is required.

Primary Rate Interface (PRI)

Primary Rate Interface service consists of a D channel and either 23 or 30 B channels depending on the country you are in. PRI is not supported on the iSeries. A digital pipe with 23 B channels and one 64 Kbps D channel is present in the usual Primary Rate Interface (PRI). Twenty-three B channels of 64 Kbps each and one D channel of 64 Kbps equals 1.536 Mbps. The PRI service uses 8 Kbps of overhead also. Therefore PRI requires a digital pipe of 1.544 Mbps.

Broadband-ISDN (B-ISDN)

Narrowband ISDN has been designed to operate over the current communications infrastructure, which is heavily dependent on the copper cable however B-ISDN relies mainly on the evolution of fiber optics. According to CCITT B-ISDN is best

described as 'a service requiring transmission channels capable of supporting rates greater than the primary rate.

ISDN Services:

ISDN provides a fully integrated digital service to users. These services fall into 3 categories- bearer services, teleservices and supplementary services.

1. **Bearer Services**

    Transfer of information (voice, data and video) between users without the network manipulating the content of that information is provided by the bearer network. There is no need for the network to process the information and therefore does not change the content. Bearer services belong to the first three layers of the OSI model. They are well defined in the ISDN standard. They can be provided using circuit-switched, packet-switched, frame-switched, or cell-switched networks.

2. **Teleservices**

    In this the network may change or process the contents of the data. These services correspond to layers 4-7 of the OSI model. Teleservices relay on the facilities of the bearer services and are designed to accommodate complex user needs. The user need not to be aware of the details of the process. Teleservices include telephony, teletex, telefax, videotex, telex and teleconferencing. Though the ISDN defines these services by name yet they have not yet become standards.

3. **Supplementary Service**

    Additional functionality to the bearer services and teleservices are provided by supplementary services. Reverse charging, call waiting, and message handling are examples of supplementary

services which are all familiar with today's telephone company services.

Principle of ISDN:

The ISDN works based on the standards defined by ITU-T (formerly CCITT). The Telecommunication Standardization Sector (ITU-T) coordinates standards for telecommunications on behalf of the International Telecommunication Union (ITU) and is based in Geneva, Switzerland. The various principles of ISDN as per ITU-T recommendation are:

- To support switched and non-switched applications
- To support voice and non-voice applications
- Reliance on 64-kbps connections
- Intelligence in the network
- Layered protocol architecture

5.4.2 CABLE MODEMS

Cable modems are a prevalent type of hardware that connects computer devices with your Internet service provider (ISP). Differing from other types of modems, a cable modem uses coax cable, the same infrastructure that brings television programing to our business or homes, to proxy that connection, rather than a telephone or DSL line.

How Does a Modem Work?

Essentially, cable modems work as digital translators. They receive data signals from your ISP's network, then immediately translate them into a digital "language" for your routers to distribute across your local network via wired ethernet or Wi-Fi connection.

Cable modems perform that all-important conversion via coaxial cables and an ethernet cord that connects directly into computer devices or a network router. Some modern cable modem devices, though, come with an integrated router, meaning you do not need two separate devices connected via ethernet cords and ports to access the internet. The single machine performs both functions simultaneously. In either case — a separate cable modem and router or a dual unit — your modem relies on the same kinds of cables relaying TV signals to access the Internet.

This delivery ecosystem requires national cable providers or operators to set up regional and even neighborhood hubs to transfer cable-line based data. Within those hubs, people evenly split bandwidth, with those cable operators imposing data limits to ensure no single user (including businesses) siphons too much bandwidth. With the wide adoption growth of the technology, cable providers have elected to segment their residential and business customers, so while the platform is still shared, business traffic is isolated from the residental neighbors. Business services will also include a higher tier SLA (service level agreement) that assures an accelerated response and priority to disruptions or service outages.

Higher-priced tiers open your organization's access to greater bandwidth. Many people assume adding more bandwidth

means you're increasing your Internet speeds. However, this is a misunderstanding, since bandwidth is actually the amount of data that can be sent to you in megabits per second (Mbps). Increasing bandwidth simply means you can receive more information — i.e., more megabits. This creates the impression of data-speed improvements but is actually a data-quantity improvement.

In fact, only cable modems and other network infrastructure can increase what we perceive as internet speed. How does a modem work and what are the affects on your internet speed? These speeds are relayed in a transmission measurement known as the Data Over Cable Service Interface Specification standard, or DOCSIS for short. Every cable modem comes with a DOCSIS speed, and these speeds vary widely across modem models. Typical download speeds for older DOCSIS modem models (e.g., DOCSIS 1, 1.1 and 2) average 30-100 Mbps, while the most advanced models transmit between 1 to 10 gigabit per second (Gbps) uploads.

What is a Cable Modem Used For?

Business cable modems are an essential piece of hardware for functioning Internet and data communications systems. Finding a unit with the right capabilities is crucial to unlocking full communication capabilities, including:

1. Accessing the ISP: The most basic function of a cable modem is to communicate with your Internet service provider's network. A cable modem is one of the most popular and reliable modes of ISP connectivity since it operates on an already well-established ecosystem of physical cables stretching across the country.

2. Using and bundling services: Voice services, Internet and television can all be bundled under one contract using cable modem-based delivery networks. In many cases, bundling services from one provider cuts your provider bills, saving your business money. When bundled, each service is delivered via separate physical cable lines, minimizing service disruptions and lag times. Bundling mirrors unified communications as a service (UCaaS)best practices, which often combine telecommunications technology and related infrastructure under one umbrella platform.

3. Upgrading internet speeds: ISPs and cable companies offer a range of internet download servicing speeds, from less than 100 Mbps to up to a gigabit. Your cable modem significantly impacts the internet speeds to which you have access. Without a DOCSIS model with a corresponding speed standard, your organization may

Choosing the Right Cable Modem for a Business

Keep in mind these cable modem tips when upgrading or selecting your internet service provider or communication hardware.

1. ISP Compatibility

Modems must be compatible with your internet service provider. Carriers typically give you a matching unit if you sign up to rent modems and routers directly from them. However, when purchasing your own modems, you must ensure it's compatible with both your service carrier itself and your internet bandwidth tier. Both can be done by checking the DOCSIS standard release number as well as calling your provider to hear their definitive modem list.

2. High-Speed Internet Access

Upgraded internet tiers — including packages delivering bandwidth above 100 Mbps — requires new generations of DOCSIS modems, typically a DOCSIS 3 or 3.1. Older units simply won't have the capacity to support these service speeds, meaning when you upgrade your overall internet package, you'll likely need to purchase a new cable modem as well to utilize the connection you're paying for.

3. Upload and Download Speeds

Many internet providers advertise packages according to their max download speeds (in Mbps). Typical download speeds depend on your service provider, geographic location, hardware condition, package tier type and other variables.

When selecting your cable modem internet package, though, it's equally as important to consider the max upload speeds. Cable modems operate under an asynchronous delivery, meaning those upload speeds will be a fraction of the stated download speeds. Yet the nature of business operations is synchronous and relies on the constant flow of sent and received documents, data, Internet communications, cloud access and more. Each of these activities requires quick upload speeds just as much as fast retrievals and downloads. For that reason, organizational leaders must pay just as much attention to upload speed as advertised downloading ones.

- Insider trick: A good rule of thumb is that most package upload speeds will be around 15% of its stated download speed. For example, if your internet package's max

download advertises 200 Mbps, it's likely the uploading rate will be around 30 Mbps.

4. Actual Employee Usage

Higher Mbps is not always better. Business owners should consider the actual internet usage of its employee user group before selecting a premium bandwidth package, categorizing the actual applications its staff uses the internet for.

- Moderate and high usage: Employees requiring frequent access to cloud-hosted applications, continual data exchange or high amounts of VoIP or videoconferencing fall into the moderate to high usage category. At these usage levels, experts recommend a 2:1 bandwidth ratio, or 1 Mbps of bandwidth per two employees.

- Low or casual usage: Employees utilizing the internet namely for basic internet searches and email usage fall into the low or casual usage catego For this tier, experts suggest a ratio of 3:1, or 1 Mbps of package bandwidth for every three employees.

5. Firewall Throughput

Upgrading your modems or internet packages is an excellent time to review your firewall throughput, or the volume of traffic that can pass through your firewall (also measured in Mbps or Gbps).

Like older DOCSIS modems, older firewall technology might not keep up with your upgraded cable speeds, lacking the RAM, CPU and other features required to do so. Make the most of

your new coax service by considering upgrades to your firewalls and other similar network defenses alongside your selection of your Internet service plan to realize the most capability from your new Internet service.

5.5 INTERNET

The origins of the Internet can be found in the early sixties, when the U.S. Department of Defense sponsored a project to develop a telecommunications network that would survive a nuclear attack. It had to link together a diverse set of computers and work in a decentralized manner so that, if any part of the network were not functioning, network traffic would automatically be re-routed via other network nodes. This project quickly grew into a popular academic network linking virtually all major research institutions and U.S. universities. Soon other countries jumped onto the bandwagon, thus linking academics and researchers across the globe. True to the academic ethos, it quickly became a means for global information sharing. By now, businesses also got a piece of the action. This was spurred on by the trend to network the personal computers in home and business environments and the development of more user-friendly, graphical interfaces: the web-browser and the Windows operating system.

The Internet (or, more colloquially, the Net) consists of a huge and fast-growing number (hundreds of thousands) of interconnected networks linked together. Currently more than 100 million users are connected to the Internet. The popularity of the Internet can be explained by the amount of information it makes available: the equivalent of many libraries of information is stored on millions of computers (Internet hosts), much of it free of charge

to all Internet users. This information is provided by educational institutions, governmental agencies and organizations, individuals, and increasingly by businesses. Hence, the Internet is frequently referred to as the Information Highway or the Infobahn.

But the Internet is more than just a huge information resource. Its initial purpose was to act as a communications network and it fulfills that role well. It is the transport mechanism for electronic mail, the transfer of computer files, remote computer access and even allows for voice calls. Businesses quickly realized the potential of the multimedia-enabled Internet for marketing purposes. Of late, more and more business transactions are being conducted via the Internet: electronic commerce (e-commerce) is the latest revolution to be embraced by the Internet community.

5.6 THE WORLD WIDE WEB (WWW)

The Internet service that has received the most attention from the public media is the World Wide Web or the Web for short (sometimes also called WWW or W3). The Web is a vast collection of multimedia information located on Web servers attached to the Internet. Its popularity is due to a number of reasons.

- Information links are transparent. Links to any other piece of information located anywhere on the Internet can be inserted in a web document. A simple click of the mouse takes the reader completely automatically from one Web server to another, quite possibly in another country.

- Information can be presented in a hypertext link format whereby one can jump immediately from one concept to a related concept or explanation. No need to read text in the traditional top-to-bottom sequential way.

- It allows for multimedia information. A Web document can incorporate rich and colourful graphics, animation, video clips, sound etc. Just think of the marketing opportunities!

- The Web supports interactive applications. Web applications can request information from visiting users and documents can include programming instructions. Users can even download small programs (often written in Java) that could perform some processing on the user's computer or display special visual effects.

- WWW stands for **W**orld **W**ide **W**eb. A technical definition of the World Wide Web is − All the resources and users on the Internet that are using the Hypertext Transfer Protocol (HTTP).

- A broader definition comes from the organization that Web inventor Tim Berners-Lee helped found, the World Wide Web Consortium (W3C): The World Wide Web is the universe of network-accessible information, an embodiment of human knowledge.

- In simple terms, The World Wide Web is a way of exchanging information between computers on the Internet, tying them together into a vast collection of interactive multimedia resources.

- W3C stands for **W**orld **W**ide **W**eb Consortium which is an international consortium of companies involved with the Internet and the Web.

- The W3C was founded in 1994 by Tim Berners-Lee, the original architect of the World Wide Web. The organization's purpose is to develop open standards so that the Web evolves in a single direction rather than being

splintered among competing factions. The W3C is the chief standards body for HTTP and HTML.

Clients and Servers

Internet resources -- information and services -- are provided through host computers, known as servers. The **server** is the computer system that contains information such as electronic mail, database information, or text files. As a customer, or **client**, you access those resources via client programs (applications) which use TCP/IP to deliver the information to your screen in the appropriate format for your computer.

One important kind of client program is called a **browser**, which is used to search through information provided by a specific type of server. A browser helps you view and navigate through information on the Internet. Today's most popular browsers, including Mosaic(R), Netscape(TM) Navigator, and the Microsoft Internet Explorer offer a graphical interface to the World Wide Web.

Client/Server Operation

A client/server system works something like this:

- A big hunk of computer (called a server) sits in some office somewhere with a bunch of files that people might want access to. This computer runs a software package (uh...also called a server unfortunately) that listens all day long to requests over the wires.

- Typically, these requests will be in some language and some format that the computer understands, but in English sound something like, "hello software package running on a big

hunk of computer, please give me the file called "mydocument.txt" that is located in the directory "/usr/people/myname".

- The "server software" will then access the server hardware, find the requested file, send it back over the wires to the "client" who requested it, and then wait for another request from the same or another client.

- Usually, the "client" is actually a software program, like Netscape Navigator, that is being operated by a person who is the one who really wants to see the file. The client software however, deals with all the underlying client/server protocol stuff and then displays the document (that usually means interpreting HTML, but we'll get there in just a bit) to the human user.

- The whole process looks something like the figure below:
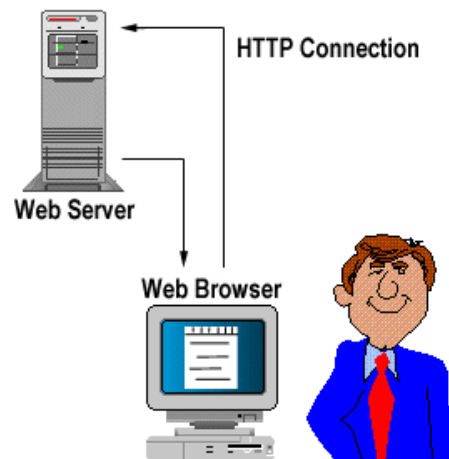
5.7 CONNECTING TO THE INTERNET:

Some of the basic services available to Internet users are −

- **Email** − A fast, easy, and inexpensive way to communicate with other Internet users around the world.

- **Telnet** − Allows a user to log into a remote computer as though it were a local system.

- **FTP** − Allows a user to transfer virtually every kind of file that can be stored on a computer from one Internet-connected computer to another.

- **UseNet news** − A distributed bulletin board that offers a combination news and discussion service on thousands of topics.

- **World Wide Web (WWW)** − A hypertext interface to Internet information resources.

5.8 BROWSING THE WEB

Web browsers are programs that allow you to access web pages on the Internet, read HTML (hypertext markup language) documents on your computer, or view your local intranet site. These browsers don't just display information. They also help you find information using search engines, purchase products online using various online shopping sites, interact with other people using social media services, use web-based editing applications to create documents, and much more.

JAWS works best with the latest versions of Google Chrome™, Microsoft® Edge® Chromium (released in early 2020), Mozilla® Firefox®, and Internet Explorer 11®. JAWS provides the same powerful features for each supported browser, allowing you to choose the one that best suits your needs.

When browsing the web, JAWS gives you quick access to the information you need, and provides detailed information about the structure and organization of web pages. Tables, lists, headings, and alternate text for images are all announced. The information comes right from the HTML used to create the page. HTML is designed with accessibility in mind, and JAWS supports more of the built-in HTML accessibility features than any other screen reader.

JAWS uses the Virtual Cursor on web pages, letting you read as you would in a word processing document. The Virtual Cursor is also available in other applications, such as HTML based help systems, HTML based e-mails in Outlook, and in PDF (Portable Document Format) files. Many of the features discussed within these topics are also available wherever the Virtual Cursor is used.

When you open the browser, your home page opens. If you don't have a home page specified, you can select a web page from your Favorites menu, or press ALT+D to move to the Address Bar and type in the address of a page. Once a page is selected, it is loaded and JAWS announces the page title along with the number of links, headings, and regions. Then, JAWS begins reading the text on the screen from top to bottom. To move through the page, use UP and DOWN ARROW, PAGE UP, and PAGE DOWN as you would in a word processing document. The JAWS commands to Read By Word, Line, Sentence, and Paragraph work normally.

If you are using Fusion, JAWS will not automatically begin reading the page after announcing the title followed by the number of elements. This prevents focus from being bumped back up to the top of the page if you are a low vision user attempting to navigate with the mouse. To change this setting, open JAWS Settings Center and select "Document and Web Pages Automatically Read."

As you navigate a page, JAWS says, "link," when it encounters a link to another document or portion of the page. To follow a link, press ENTER while positioned on the link.

To go back to the previous page, press ALT+LEFT ARROW or BACKSPACE. To move forward one page after you have moved back, press ALT+RIGHT ARROW.

Web browsers can be used to view pages on the Internet when you have an Internet connection.

To start browsing the web:

1. When you start up Web, your cursor should be in the text entry field at the top of the window. Type in the URL of the webpage that you want to visit or your search term.

2. Press return to go to the web page or to search.

Tabs are used to view more than one web page in one window. When you first start up *Web*, you will not be shown any tabs. To *open a new tab*, press the menu button at the top-right of the screen, then New Tab. Once the new tab is open, you can use it as you would normally use a new window.

We can also use the Ctrl+T keyboard shortcut to open a new tab or the new tab button in the top-left of the window. To *open a link in a new tab*, right click on the link, then select Open Link in New Tab or use the middle mouse button to click on the link.

5.9 WEB BROWSER

Web Browsers are software installed on your PC. A web browser, or simply "browser," is an application used to access and view websites. Common web browsers include Microsoft Internet Explorer, Google Chrome, Mozilla Firefox, and Apple Safari.

The primary function of a web browser is to render HTML, the code used to design or "mark up" webpages. Each time a browser loads a web page, it processes the HTML, which may include text, links, and references to images and other items, such as cascading style sheets and JavaScript functions. The browser processes these items, then renders them in the browser window.

Early web browsers, such as Mosaic and Netscape Navigator, were simple applications that rendered HTML, processed form input, and supported bookmarks. As websites have evolved, so have web browser requirements. Today's browsers are far more advanced, supporting multiple types of HTML (such as XHTML and HTML 5), dynamic JavaScript, and encryption used by secure websites.

The capabilities of modern web browsers allow web developers to create highly interactive websites. For example, Ajax enables a browser to dynamically update information on a webpage without the need to reload the page. Advances in CSS allow browsers to display a responsive website layouts and a wide array of visual effects. Cookies allow browsers to remember your settings for specific websites.

While web browser technology has come a long way since Netscape, browser compatibility issues remain a problem. Since browsers use different rendering engines, websites may not appear the same across multiple browsers. In some cases, a website may work fine in one browser, but not function properly in another. Therefore, it is smart to install multiple browsers on your computer so you can use an alternate browser if necessary.

A web browser takes you anywhere on the internet. It retrieves information from other parts of the web and displays it on your desktop or mobile device. The information is transferred using the Hypertext Transfer Protocol, which defines how text, images and video are transmitted on the web. This information needs to be shared and displayed in a consistent format so that people using any browser, anywhere in the world can see the information.

Sadly, not all browser makers choose to interpret the format in the same way. For users, this means that a website can look and function differently. Creating consistency between browsers, so that

any user can enjoy the internet, regardless of the browser they choose, is called web standards.

When the web browser fetches data from an internet connected server, it uses a piece of software called a rendering engine to translate that data into text and images. This data is written in Hypertext Markup Language (HTML) and web browsers read this code to create what we see, hear and experience on the internet.

Hyperlinks allow users to follow a path to other pages or sites on the web. Every webpage, image and video have its own unique Uniform Resource Locator (URL), which is also known as a web address. When a browser visits a server for data, the web address tells the browser where to look for each item that is described in the html, which then tells the browser where it goes on the web page.

5.10 Uniform Resource Locator (URL)

URL stands for **U**niform **R**esource **L**ocator, and is used to specify addresses on the World Wide Web. A URL is the fundamental network identification for any resource connected to the web (e.g., hypertext pages, images, and sound files).

A URL will have the following format −
protocol://hostname/other_information

The protocol specifies how information is transferred from a link. The protocol used for web resources is Hyper Text Transfer Protocol (HTTP). Other protocols compatible with most web browsers include FTP, telnet, newsgroups, and Gopher. The protocol is followed by a colon, two slashes, and then the domain name. The domain name is the computer on which the resource is located. Links to particular files or subdirectories may be further

specified after the domain name. The directory names are separated by single forward slashes.

A Uniform Resource Locator (URL), colloquially termed a web address, is a reference to a web resource that specifies its location on a computer network and a mechanism for retrieving it. A URL is a specific type of Uniform Resource Identifier (URI), although many people use the two terms interchangeably. URLs occur most commonly to reference web pages (http), but are also used for file transfer (ftp), email (mailto), database access (JDBC), and many other applications.

The URL interface is used to parse, construct, normalize, and encode URLs. It works by providing properties which allow you to easily read and modify the components of a URL. You normally create a new URL object by specifying the URL as a string when calling its constructor, or by providing a relative URL and a base URL. You can then easily read the parsed components of the URL or make changes to the URL.

If a browser doesn't yet support the URL() constructor, you can access a URL object using the Window interface's Window.URL property. Be sure to check to see if any of your target browsers require this to be prefixed.

5.11 ELECTRONIC MAIL (E-mail)

Electronic mail is a method of exchanging messages ("mail") between people using electronic devices. Email was developed by Ray Tomlinson. When email was started the use is limited but now used almost everyone for exchange of mail. Email is operated using Internet. Some early email systems required the author and the recipient to both be online at the same time, in common with instant messaging. Today's email systems are based on a store-and-forward model. Email servers accept, forward, deliver, and store messages. Neither the users nor their computers are required to be online simultaneously; they need to connect only briefly, typically to a mail server or a webmail interface, for as long as it takes to send or receive messages.
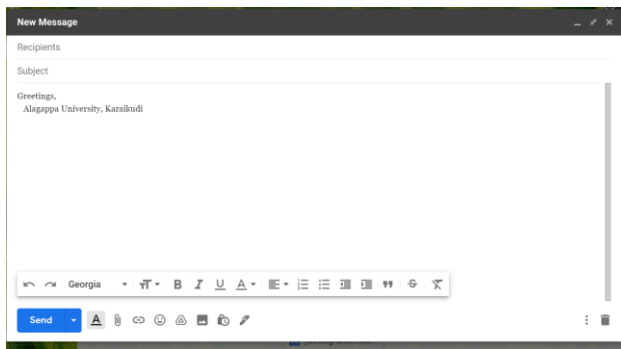
We all use emails because it is fast and makes our lives easier. In the conventional mailing system, the processing time was indefinite. When comparing both systems, there is a drastic difference.

The following are just some of the advantages of e-mail. ·

- Reliability: although there is no guarantee, you will normally receive quick feedback if the address does not exist or there is a similar delivery problem. ·

- Efficiency: many short-cut tools exist to increase your efficiency when composing messages. You can use your computer's cut-and-paste function, you can have managed address books and lists, when replying to another message you can automatically incorporate any part of the message to which you are, etc. And it is just as easy to send a message to one as to a whole list of addressees. (Admittedly, this results in a lot of abuse and information overload on the recipient's side.)

- Digital: e-mail is composed on a computer and remains in computer-readable format all the way to its destination. Thus one can also easily incorporate other computer data such as graphics or document files.

- Cheap: because the capacity of the Internet and disk storage is increasing all the time, the cost of a sending and storing a one-page e-mail message is negligible.

- Speed: messages are generally delivered across the world in a matter of seconds.

The email communication is done via three protocols.

- IMAP (Internet Mail Access Protocol)
- POP (Post Office Protocol)
- SMTP (Simple Mail Transfer Protocol)

IMAP

The IMAP stands for Internet Mail Access Protocol. This protocol is used while receiving an email. When one uses IMAP, the emails will be present in the server and not get downloaded to the

user's mail box and deleted from the server. This helps to have less memory used in the local computer and server memory is increased.

POP

The POP stands for Post Office Protocol. This protocol is also used for incoming emails. The main difference with the both protocols is that POP downloads the entire email into the local computer and deletes the data on the server once it is downloaded. This is helpful in a server with less free memory. Current version of POP is POP3.

SMTP

The SMTP stands for Simple Mail Transfer Protocol. Email is sent using this protocol.

How email works:

1. A user sends an email message and connects to an SMTP server as configured in her email client or Mail User Agent (MUA).
2. On the SMTP server, a Mail Transfer Agent (MTA) looks at the recipient address and looks up the domain part of the address to determine its destination.
3. After querying a Domain Name System (DNS) server for the name of the Mail EXchanger (MX) for the recipient's domain name.
4. SMTP server will send the message to that server via the SMTP protocol.
5. The receiving server will store the message and make it available to the recipient, who can access it via web, POP, or IMAP.

Books for Reference:

1. Dennis P.Curtin, Kim dolwy, KunL AWN, Xrhleen morin, Information Technology, the breaking wave, TMH 2000.

2. Stacey C Sawyer, Brain K Williams, Sarah E Hutchinson Using Information Technology – Brief Version A Practical Introduction to Computer and Communications Third Edition, McGraw Hill Companies 2011.

3. James O'Brien – Introduction to Information systems. 16th edition, 2005.

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UNIT VI

Structure

6.1 Internet Address:

Network computer users generally prefer to use domain names instead of dotted decimal addresses. Internet programs need to use 32 bit IP addresses. As such to ensure successful internetwork communications between the programs and users we need fast, reliable method of translating between address schemes. For this reason, network engineers developed name-server software. A name server is a program that translates domain name into IP addresses.

6.2 Domain Name System (DNS)

Domain Name System DNS is a client/ server based distributed database system. The DNs distributes specific address details among various name servers. The internet Domain Name system uses names like ftp.microsoft.com to identify specific computer. Each element is referred as a label. For example ftp.microsoft.com consists of three label namely ftp, Microsoft and com. Your separate internet name labels with a period that you read as a word dot. In other words, you would say the name ftp.microsoft.com as ftp dot Microsoft dot com. Domain is defined as a sphere of activity, concern or function. The label Microsoft describes the organisation or entity the owns the compute Microsoft corporation. The label com represents organisation uses the computer for commercial enterprises.

The following figure shows the hierarch of Domain name system. It can be viewed as organization chart. The top of the chart is an unnamed starting point called root. The DNS root is like directory on the disk – neither root has a name. However, like directories on the computer, each domain has the name. Just each directory is divided into sub-directories; the Internet Domain further divides each domain into sub-domains.
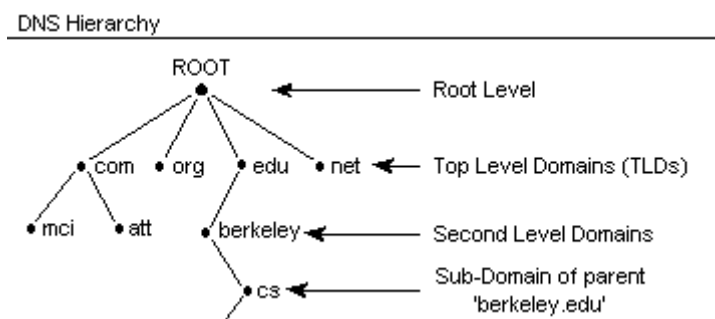

Fig. The hierarchical structure of Internet DNS

The level immediately below the root of the Internet DNS consists of three top domains. The internet usually divides this group of domains into seven basic categories. The given table identifies the seven basic classifications of the organizational domains.

Domain	Description
Com	Commercial organizations such as business
Edu	Educational organizations such as universities
Gov	US government organizations etc
Int	International organizations
Mil	US military organization
Net	A network that doesn't fit into one of the other organizational domain categories
Org	An organization that doesn't fit into one of the other organizational domain categories

6.3 Locating Information on the net

Most information is found on the Internet by utilizing search engines. A search engine is a web service that uses web robots to query millions of pages on the Internet and creates an index of those web pages. Internet users can then use these services to find information on the Internet. When searching for information on the Internet, keep the below things in mind.

If you are searching for a specific phrase, such as computer help, place quotes around the phrase to get results for that exact combination of words. For example, type "computer help" as your search criteria to match pages where those two words appear together.

This trick can also be used in parts of your search query. For example, Microsoft "computer help" would search for anything

containing Microsoft and that also has computer help together.

You can include multiple quoted phrases in your search. For example, searching for "Microsoft Windows" "computer help" would give results for pages that contain both of those exact phrases.

6.4 Internet Search Engine

Search engine is a service that allows Internet users to search for content via the World Wide Web (WWW). A user enters keywords or key phrases into a search engine and receives a list of Web content results in the form of websites, images, videos or other online data. The list of content returned via a search engine to a user is known as a search engine results page (SERP).(Source ;Tecopedia).

Fig. Search Engines

For example

- Google.
- Bing.
- Yahoo.
- Ask.com.
- AOL.com.

- Baidu.
- Wolframalpha.
- DuckDuckGo.

6.5 Chatting and Conferencing on the Internet

Internet is used in many areas; some of the areas where the internet is used is as follows;

- ➢ Website
- ➢ E-Commerce
- ➢ Social Media
- ➢ Resource Sharing
- ➢ Conferencing and Email
- ➢ Chatting
- ➢ Online Courses

Chatting

Chatting is almost as good as speaking to the other person over the phone. Online chatting is a online conversation between users or group of users. There are many free chat sites on the web through which you can communicate with one or many people from different locations. After you log on to free chat site, go to the specific chat room where you have agreed to meet other person.

For example:

1. Type the site address www.yahoo.com
2. Click on chat option
3. Click on sign up for yahoo chat to create a new account
4. If you already have an account with yahoo you can enter Yahoo Id and Password and click on Sign In button.

5. Click on Start Chatting button.

Video Conferencing

Conferencing comprises the technologies for transmission of audio/video signals by users from different places for communication between users on the network. Video conferencing is also called as video collaboration is a type of network groupware. Video conferencing systems during 1990's are expensive communication systems with network and software requirements. Video conferencing using two protocols such as Session Initialization Protocol (SIP) and H3.xxx.

A video conference is a live, visual connection between two or more people residing in separate locations for the purpose of communication. At its simplest, video conferencing provides transmission of static images and text between two locations. At its most sophisticated, it provides transmission of full-motion video images and high-quality audio between multiple locations.

The components necessary to make videoconference include:
• A microphone, webcam and speakers
• A display
• A software program that captures the voice stream from the microphone, encodes it, transmits to the other participant, and simultaneously decodes the digital voice stream being received from the remote participant in the video conference (most commonly referred to as a "Codec").

- A software program that bridges both parties together across a digital connection, managing the exchange of voice and video between participants. At either end of the connection, the video and voice traffic is combined and delivered to each participant in the form of a real-time video image and audio stream.

- An optional management tool for the scheduling of video conferencing sessions

There are two types of videoconference.

1. Point to Point video conference (one person or group is connected to another)

2. Multipoint video conference (three or more locations are connected together)

As video conferencing technology has evolved, two main protocols have emerged to provide the signaling control for the establishment, control and termination of video conferencing calls:

- SIP (Session Initiation Protocol)

- H.320

SIP is a protocol for creating, modifying and terminating sessions with one or more users. The architecture of SIP is similar to Hyper Text Markup Protocol(HTTP). The client request services to the server for processing the tasks. The server receives the request and processes it and responds back to the client. This protocol itself provides reliability, which is not depending on TCP/IP.

The SIP system has two components; user agents and network servers. A user agent is an end system acting on behalf the user. It has two parts namely client and server. There are three types of network servers namely proxy server, registration server and redirect server. A registration server receives updates about the user

location. A proxy servers receives the message and forwards to next-hop server. A redirect server receives the message, and determine the next-hop server to the client.

H.3XX are ITU-T study group XVI umbrella recommendations for video conferencing. These recommendations refer other recommendations that include multiplexing, control and signaling.

Audio Conferencing

Audio Conferencing is a telephone meeting conducted between multiple separate callers (three callers define a "conference"). The type of telephone used can vary but typically an audio conference includes attendees that use handheld wired telephones (such as those at a person's business office or home), conference room speakerphones that can be shared by several people, or individual cellular or mobile telephones.

Audio conferencing is sometimes called "teleconferencing" and traditionally means using a telephone instrument to conduct a business meeting. Telephones are widely accessible and generally provide an easy method for meeting attendees to join into a conference session. With some exceptions, users of telephones can easily operate their telephones and connect to locations both within and outside of their home and office. This makes teleconferences, as they are sometimes called, quick, easy and generally widely accessible for participants.

6.6 MESSAGING

An Internet messaging platform is any system on the Internet that exchanges messages for the purpose of human communications.

6.6.1 Internet Relay Chat (IRC)

Internet Relay Chat (IRC) is an application layer protocol which is used to communicate in the form of text. It was developed in August 1988, by Jarkko Oikarinel. IRC is used to enable the users to request to a server using server side programming software and communicate with each other online

The IRC client software is used to connect to the IRC server. There are some small IRC servers available for Internet Relay chat. The small IRC servers are namely OperaNet which has less number of users. The medium IRC servers are freenode and Dalnet which may have 40,000 users. The big IRC servers may consist of over 100,000 users; for example, EFNet and UnderNet. The example IRC is shown in figure.
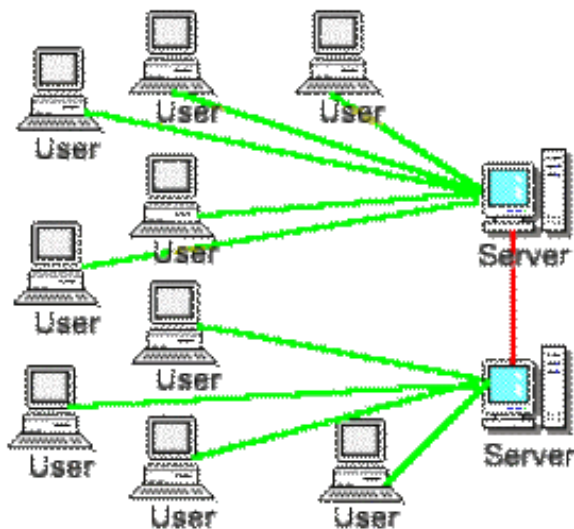

Fig. Internet Relay Chat System

IRC is a messaging application for chatting which consists of set of rules and software for client/server technology. One can start a chat room(Called a channel) or join an existing chat room. Protocols are used to identify existing chat groups. The nick names can be used to identify particular user or group of users. Some of chat applications provide users registration and profile manipulation.

6.6.2 Social Networking

Social networking is the use of internet-based programs to make connections with friends, family, classmates, customers and clients. Social networking is used for social purposes, business purposes or both through sites such as Facebook, Twitter, LinkedIn, Classmates.com and Yelp. Social networking is also a significant target area for marketers seeking to engage users. Social networking services vary in format and the number of features. They can incorporate a range of new information and communication tools. Social networking sites allow users to share ideas, digital photos and videos, posts, and to inform others about online or real-world activities and events with people in their network. Professional use of social networking services refers to the employment of a network site to connect with other professionals within a given field of interest. Every coin is having two sides, same with the social networking sites.

Advantages
- Worldwide Connectivity
- Commonality of Interest
- Real-Time Information Sharing
- Targeted Advertising
- Increased News Cycle Speed

Disadvantages.

- Cyber bullying and crime against children
- Risks of Fraud or Identity Theft
- Time consumer
- Corporate Invasion of Privacy
- Backlash

6.6.3 Micro Blogging

Micro blogging is a type small text message published by user on micro blogging site like twitter, Pownce, Jaiku, Tumblr etc. Bloggers can usually use a number of service for the updates including instant messaging, e-mail, or twitter. The posts are called microposts, while the act of using these services to update your blog is called microblogging.

Microblogging has also become an important source of real-time news updates during socio-political revolutions and crisis situations. It has empowered citizens themselves to act as sensors or sources of information that could lead to consequences and influence, or even cause, media coverage. People share what they observe in their surroundings, information about events, and their opinions about topics from a wide range of fields. Tweets/comments are publicly visible by default, but senders can restrict message delivery to just their followers.

6.6.4 Forums

An Internet forum, or message board, is an online discussion site where people can hold conversations in the form of posted messages. They differ from chat room in that messages are often longer than one line of text, and are at least temporarily archived.

Also, depending on the access level of a user or the forum set-up, a posted message might need to be approved by a moderator before it becomes visible.

The Internet is a great place to find new information. One of the most common places for people to have conversations, ask questions, and provide answers is Internet forums. Also known as discussion boards, discussion groups, discussion forums and message boards, Internet forums are the original "social media" sites.

In a standard Internet forum, a user creates a post. That post can be accessed by other users at any time. Posts can contain questions, opinions, images, videos, links, and more. Users can respond to the post, which creates a dialogue other user can participate in, also called a thread. They can start a new thread of conversation by creating a post on a different topic. All of these threads combine to make what's called a message board. We should follow Proper Netiquette while posting the message on forums.

6.6.5 Blogs

The blog word comes from the combination of two words (Web, log). It is similar to diary entry. The entries in blog are known as post. Posts are typically displayed in reverse chronological order, so that the most recent post appears first, at the top of the web page.
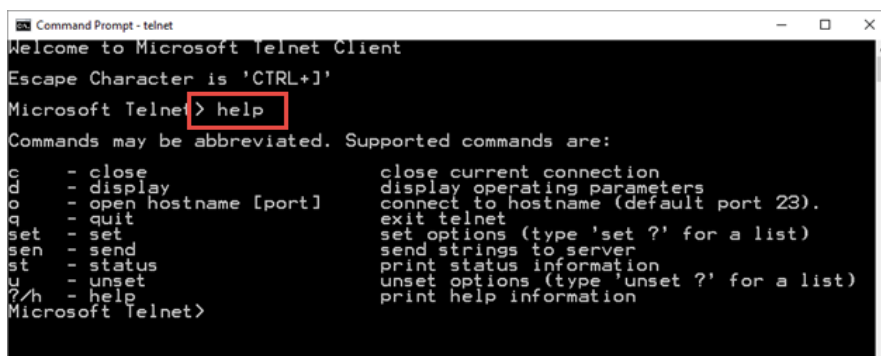
The appearance and growth of blogs in the late 1990s coincided with the advent of web publishing tools that facilitated the posting of content bynon-technical users who did not have much experience with HTML. Blogging can be seen as a form of social networking site. Indeed, bloggers do not only produce content to post on their blogs, but also often build social relations with their readers and other bloggers. However, there are high-readership blogs which do not allow comments. Different sites where we can

post blog are blogspot.com, blogger.com, wordpress.com, web.com etc.

6.6.6 Telnet

The Telnet (Telecommunication network) program is intended to provide a remote login or virtual terminal capability across a network. In other words, a user on machine A should be able to log into machine B anywhere on the network, and as far as user is concerned, it appears that the user is seated in front of the machine B. The telnet service is provided through TCPs port number 3. The term Telnet is used to refer to both the program and the protocol that provide these services. When two machines communicate using Telnet, Tenet itself can determine and set the communications and terminal parameters for the session during connection phase.

The Telnet protocol includes the capability not to support a service that one end of the connection cannot handle. When a connection has been established by Telnet, both ends have agreed upon a method for the two machines to exchange information, taking the load off the server CPU for a sizable amount of this work. The figure shows the Microsoft telnet client window.

Fig. Microsoft Telnet Client Window

Telnet involves a process on the server that accepts incoming request for a Telnet Session. On UNIX systems, this process is called tented. On Windows NT and other PC based operating systems, a Telnet Server program is usually involved. The client runs a program, usually called telnet that attempts the connection to the server.

6.6.7 Usenet Newsgroup

Usenet Newsgroup is storage with in the usenet system where the users from different geographical locations post their messages over internet. The usenet files uploaded by the users are stored in the servers distributed over the various geographical locations and connected through the internet. The sending and receiving of files is performed by the Network News Transfer Protocol (NNTP) which allows connection to Usenet servers and data transfer over the internet. The communication is established between server-server and client-server. Newsgroups are divided into two ways; text and binary which depend on bandwidth.

Books for Reference:

1. Dennis P.Curtin, Kim dolwy, KunL AWN, Xrhleen morin, Information Technology, the breaking wave, TMH 2000.
2. Stacey C Sawyer, Brain K Williams, Sarah E Hutchinson Using Information Technology – Brief Version A Practical Introduction to Computer and Communications Third Edition, McGraw Hill Companies 2011.
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