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## UNIT I

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About two hundred years before, the word "computer" started to appear in the dictionary. Some people even didn't know what is a computer? However, most of the people today not just knowing what is a computer, but understand how to use a computer. Therefore, computer becomes more and more popular and important to our society. We can use computer everywhere and they are very useful and helpful to our life.

Computers have brought about a tremendous revolution in every walk of life and are expected to open more vast fields due to the dexterity of those who design software and those who develop application programs. In a very short period, scientists have been able to extirpate all the defects, the limitations and the shortcoming of computer and much is expected from their ingenuity, acumen and acquisitiveness. The fields of application of computers are various and new applications are being searched out. The scientists applied it to prediction of weather earthquakes, and storms, controlling of satellites and controlling of atomic reactions in reactors and elsewhere. Engineers have not lagged behind. They use computers in designing cars, aeroplanes, ships, buildings, bridges and tools etc. In the business world, computers are playing great parts. They are used to word processing, record keeping, inventory controlling, patrol processing, account keeping and auditing, stock marketing and ticket reservations. They are now used to keep personal telephone and address directory. Business concerns use computers in forecasting demands and planning to meet them. Manufacturing concerns use them in forecasting material requirements, inventory management, production scheduling, control and other purposes. Bank now use them to keep records of day to day transactions, keeping accounts and managing overall investment. Computers have been placed at the hands of bank customers. This provides facility of making withdrawals at odd hours. Financial houses take the help of the computers to make their credit cards a medium of exchange. For entertainment purposes, computers are now used to play complex games, I.Q games and stimulation game. Computers have also played a vital role in communication field. It has become so

advantageous that the 21st century is being called “information century” because information can easily be transferred from one place to another within seconds by using internet. But computers don't have only merits. As all manomade things have their limitations, weaknesses and shortcoming, so are the computers wrought with them. Firstly they have inflexibility. They understand only symbols. Secondly they need detailed instructions to work. Thirdly they are costly and their peripheral devices are far most costly than the equipment themselves. Fourthly the cost of maintenance is also high. Fifthly the cost of operation in terms of staff and material is expensive. Sixthly in particular circumstances stored data may be completely lost, seventhly they are susceptible to destructive programs called virus and eighthly they need extra care in handling and maintenance. Despite the aforesaid frailties, foibles and faults they are tempted with, computers are widely acclaimed, intensively used and blindly relied upon. Their applications are increasing in various fields and they are expected to do services so far not imagined by man.

### CHARACTERISTICS OF COMPUTER

- 1. Speed:** - As you know computer can work very fast. It takes only few seconds for calculations that we take hours to complete. You will be surprised to know that computer can perform millions (1,000,000) of instructions and even more per second. Therefore, we determine the speed of computer in terms of microsecond (10<sup>-6</sup> part of a second) or nanosecond (10 to the power -9 part of a second). From this you can imagine how fast your computer performs work.
- 2. Accuracy:** - The degree of accuracy of computer is very high and every calculation is performed with the same accuracy. The accuracy level is determined on the basis of design of computer. The errors in computer are due to human and inaccurate data.
- 3. Diligence:** - A computer is free from tiredness, lack of concentration, fatigue, etc. It can work for hours without creating any error. If millions of calculations are to be performed, a computer will perform every calculation with the same accuracy. Due to this capability it overpowers human being in routine type of work.

**4. Versatility:** - It means the capacity to perform completely different type of work. You may use your computer to prepare payroll slips. Next moment you may use it for inventory management or to prepare electric bills.

**5. Power of Remembering:** - Computer has the power of storing any amount of information or data. Any information can be stored and recalled as long as you require it, for any numbers of years. It depends entirely upon you how much data you want to store in a computer and when to lose or retrieve these data.

**6. No IQ:** - Computer is a dumb machine and it cannot do any work without instruction from the user. It performs the instructions at tremendous speed and with accuracy. It is you to decide what you want to do and in what sequence. So a computer cannot take its own decision as you can.

**7. No Feeling:** - It does not have feelings or emotion, taste, knowledge and experience. Thus it does not get tired even after long hours of work. It does not distinguish between users.

**8. Storage:** - The Computer has an in-built memory where it can store a large amount of data. You can also store data in secondary storage devices such as floppies, which can be kept outside your computer and can be carried to other computers.

### EVOLUTION OF COMPUTERS

Each generation of computer is characterized by a major technological development that fundamentally changed the way computers operate, resulting in increasingly smaller, cheaper, more powerful and more efficient and reliable devices.

The various generations of computers are listed below:

**First Generation (1946-1959):** During the period of 1940 to 1956 first generation of computers were developed. The first generation computers used vacuum tubes for circuitry and magnetic drums for memory, and were often enormous, taking up entire rooms. The vacuum tube was developed by Lee DeForest. A vacuum tube is a device generally used to amplify a signal by controlling the movement of electrons in an evacuated space. First generation computers were very expensive to operate and in addition to using a great deal of electricity, generated a lot of heat, which was often the cause of malfunctions. Some of the computers of this generation were: **Mark I, ENIAC (Electronic Numerical Integrator and Calculator), EDVAC (Electronic Discrete Variable**

**Automatic Computer), EDSAC (Electronic Delay Storage Automatic Computer), UNIVAC-1 (Universal Accounting Computer).**

### **Features:**

1. First generation computers were based on vacuum tubes.
2. Machine language was used for programming.

### **Limitations:**

Followings are the major drawbacks of First generation computers.

1. They were large in size, slow in processing and had less storage capacity.
2. They consumed lots of electricity and produced lots of heat.
3. Their computing capabilities were limited.
4. They were not so reliable.
5. They were very expensive.

**Second Generation (1959-1964) :** The second-generation computer used transistors for CPU components & ferrite cores for main memory & magnetic disks for secondary memory. They used high-level languages such as FORTRAN (1956), ALGOL (1960) & COBOL (1960 - 1961). I/O processor was included to control I/O operations.

Around 1955 a device called Transistor replaced the bulky Vacuum tubes in the first generation computer. Transistors are smaller than Vacuum tubes and have higher operating speed. They have no filament and require no heating. Manufacturing cost was also very low. Thus the size of the computer got reduced considerably.

It is in the second generation that the concept of Central Processing Unit (CPU), memory, programming language and input and output units were developed. The programming languages such as COBOL, FORTRAN were developed during this period. Some of the computers of the Second Generation were: **IBM 1620, IBM 1401, CDC 3600.**

### **Features:**

1. Transistors were used instead of Vacuum Tube.
2. Processing speed is faster than First Generation Computers (Micro Second)
3. Smaller in Size (51 square feet)

4. The input and output devices were faster.

**Limitations:**

1. Cooling system was required.
2. Constant maintenance was require.
3. Commercial production was difficult.
4. Only used for specific purposes.
5. Costly and not versatile.
6. Punch cards were used for input.

**Third Generation (1965-1971)** : By the development of IC's (Integetherated Circuits) a small chip consisting of the capacity of the **300 transistors**. These ICs are popularly known as *Chips*. A single IC has many transistors, registers and capacitors built on a single thin slice of **silicon**. So it is quite obvious that the size of the computer got further reduced. Some of the computers developed during this period were **IBM-360, ICL-1900, IBM-370, and VAX-750**. Higher level language such as **BASIC (Beginners All purpose Symbolic Instruction Code)** was developed during this period. Computers of this generation were small in size, low cost, large memory and processing speed was very high. Very soon ICs were replaced by **LSI (Large Scale Integration)** circuits, which consisted about 100 components.

**Features:**

1. They used Integrated Circuit (IC) chips in place of the transistors.
2. Semi-conductor memory devices were used.
3. The size was greatly reduced, the speed of processing was high, and they were more accurate and reliable.
4. Large Scale Integration (LSI) was also developed.
5. The mini computers were introduced in this generation.
6. They used high level language for programming.

**Limitations:**

1. Air conditioning was required.

2. Highly sophisticated technology required for the manufacturing of IC chips.

**Fourth Generation (1971-1980):** This generation is based on VLSI (Very Large Scale Integration) circuit technology. An IC containing about 100 components is called LSI (Large Scale Integration) circuit and the one which has more than 1000 such components, is called as **VLSI (Very Large Scale Integration)** circuit. It uses *very large scale Integrated Circuits* (VLSIC) built on a single silicon chip called microprocessors. Due to the development of microprocessor it is possible to place computer's *central processing unit* (CPU) on single chip. Thus the computer which was occupying a very large room in earlier days can now be placed on a table. The personal computer (PC) that you see in your school is a Fourth Generation Computer. Main memory used fast semiconductor chips up to 4 M bits size. Hard disks were used as secondary memory. Keyboards, dot matrix printers etc. were developed. OS-such as **MS-DOS, UNIX, Apple's Macintosh** were available. Object oriented language, **C++ etc** were developed.

**Features:**

1. They used Microprocessor (VLSI) as their main switching element.
2. They are also called as micro computers or personal computers.
3. Portable and cheap; their size varies from desktop to laptop or palmtop.
4. They have very high speed of processing; they are 100% accurate, reliable, diligent and versatile.
5. They have very large storage capacity.

**Limitations:**

1. Very advanced technology was required to fabricate to the ICs.
2. Very advance technology was required to make the ICs.
3. Air conditioning was required in many cases due to ICs.

**Fifth Generation (1980-onwards):** 5th generation computers use ULSI (Ultra-Large Scale Integration) chips. Millions of transistors are placed in a single IC in ULSI chips. 64 bit microprocessors have been developed during this period. Memory chips and flash memory up to 16 GB, hard disks in Tera Bytes & optical disks up to 50 GB have been developed. Various Fifth generation digital computer will be having **Artificial intelligence**.

**Features:**

1. It is more reliable and works faster.
2. Available in different sizes with unique features.

**Limitations:**

The disadvantages of fifth generation computers have yet to be agreed upon, but many feel that they are two of its advantages: AI (Artificial Intelligence) and the overall advanced technology. The addition of AI worries many due to the computers possibly becoming smart enough to replace humans altogether, and many people are becoming reliant on the advanced technology for tasks that they can do without computers.

## TYPES OF COMPUTERS

Since the advent of the first computer different types and sizes of computers are offering different services. Computers can be as big as occupying a large building and as small as a laptop or a microcontroller in mobile & embedded systems.

The four basic types of computers are as under:

Supercomputer

Mainframe Computer

Minicomputer

Microcomputer

### **Supercomputer**

The most powerful computers in terms of performance and data processing are the Supercomputers. These are specialized and task specific computers used by large

organizations. These computers are used for space research and exploration purposes, like NASA uses supercomputers for launching space shuttles, controlling them and for space exploration purpose, earthquake studies, weather forecasting, nuclear weapons testing etc. The supercomputers are very expensive and very large in size. It can be accommodated in large air-conditioned rooms; some super computers can span an entire building.

*Seymour Cray designed the first Supercomputer "CDC 6600" in 1964. CDC 6600 is known as the first ever Supercomputer.*

### **Exascale Supercomputer**

On 29th July, 2015, President of the United States, Barack Obama, approved the development of an Exascale Super Computer. The Exascale Super computer will be 30 times faster and more powerful than today's fastest Super Computers. The need to develop such a high performance Supercomputer comes after China's surge in high performance computing. However, the US still tops the list of Supercomputers with 233 high performance machines. China has 37 Supercomputers but they lead the list of the most powerful and high performance supercomputers since June 2013.

Presently, China's "**Tianhe – 2**" is the world's faster Supercomputer.

Popular Supercomputers:

IBM's Sequoia, in United States

Fujitsu's K Computer in Japan

IBM's Mira in United States

IBM's Super MUC in Germany

NUDT Tianhe-1A in China

### **Mainframe computer**

Although Mainframes are not as powerful as supercomputers, but certainly they are quite expensive nonetheless, and many large firms & government organizations uses Mainframes to run their business operations. The Mainframe computers can be accommodated in large air-conditioned rooms because of its size. Super-computers are

the fastest computers with large data storage capacity, Mainframes can also process & store large amount of data. Banks, educational institutions & insurance companies use mainframe computers to store data about their customers, students & insurance policy holders.

Popular Mainframe computers:

Fujitsu's ICL VME

Hitachi's Z800

### **Minicomputer**

Minicomputers are used by small businesses & firms. Minicomputers are also called as "Midrange Computers". These are small machines and can be accommodated on a disk with not as processing and data storage capabilities as super-computers & Mainframes. These computers are not designed for a single user. Individual departments of a large company or organizations use Mini-computers for specific purposes. For example, a production department can use Mini-computers for monitoring certain production process.

Popular Minicomputers:

K-202

Texas Instrument TI-990

SDS-92

IBM Midrange computers

### **Microcomputer**

Desktop computers, laptops, personal digital assistant (PDA), tablets & smartphones are all types of microcomputers. The micro-computers are widely used & the fastest growing computers. These computers are the cheapest among the other three types of computers. The Micro-computers are specially designed for general usage like entertainment, education and work purposes. Well known manufacturers of Micro-computer are Dell, Apple, Samsung, Sony & Toshiba.

Desktop computers, Gaming consoles, Sound & Navigation system of a car, Netbooks, PDA's, Tablet PC's, Smartphones, Calculators are all type of Microcomputers.

### **Workstations**

*A terminal or desktop computer in a network. In this context, workstation is just a generic term for a user's machine (client machine) in contrast to a "server" or "mainframe."*

## **CLASSIFICATION OF COMPUTERS**

Computers differ based on their data processing abilities. They are classified according to purpose, data handling and functionality. According to purpose, computers are either general purpose or specific purpose. General purpose computers are designed to perform a range of tasks. They have the ability to store numerous programs, but lack in speed and efficiency. Specific purpose computers are designed to handle a specific problem or to perform a specific task. A set of instructions is built into the machine. According to data handling, computers are analog, digital or hybrid. Analog computers work on the principle of measuring, in which the measurements obtained are translated into data. Modern analog computers usually employ electrical parameters, such as voltages, resistances or currents, to represent the quantities being manipulated. Such computers do not deal directly with the numbers. They measure continuous physical magnitudes. Digital computers are those that operate with information, numerical or otherwise, represented in a digital form. Such computers process data into a digital value (in 0s and 1s). They give the results with more accuracy and at a faster rate. Hybrid computers incorporate the measuring feature of an analog computer and counting feature of a digital computer. For computational purposes, these computers use analog components and for storage, digital memories are used.

According to functionality, computers are classified as:

### **Analog Computer**

An analog computer is a form of computer that uses *continuous* physical phenomena such as electrical, mechanical, or hydraulic quantities to model the problem being solved.

### **Digital Computer**

A computer that performs calculations and logical operations with quantities represented as digits, usually in the binary number system.

### **Hybrid Computer (Analog + Digital)**

A combination of computers those are capable of inputting and outputting in both digital and analog signals. A hybrid computer system setup offers a cost effective method of performing complex simulations.

## **APPLICATIONS OF COMPUTERS**

Computers were originally invented to do fast and accurate computations -- hence the name "computers." Now they are mostly used for different purposes. Most people -- especially young people -- use them almost exclusively for social networking. Writers use computers for the same purpose that writers once used typewriters. Businesses use computers to replace work staff that once did the most-boring jobs. Following list demonstrates various applications of computers in today's arena.

### **Business**

A computer has high speed of calculation, diligence, accuracy, reliability, or versatility which made it an integrated part in all business organizations.

Computer is used in business organizations for:

- Payroll calculations
- Budgeting
- Sales analysis
- Financial forecasting
- Managing employees database
- Maintenance of stocks etc.

### **Banking**

Today banking is almost totally dependent on computer.

Banks provide following facilities:

- Banks provide online accounting facility, which includes current balances, deposits, overdrafts, interest charges, shares, and trustee records.
- ATM machines are making it even easier for customers to deal with banks.

### **Insurance**

Insurance companies are keeping all records up-to-date with the help of computers. The insurance companies, finance houses and stock broking firms are widely using computers for their concerns.

Insurance companies are maintaining a database of all clients with information showing

- procedure to continue with policies
- starting date of the policies
- next due installment of a policy
- maturity date
- interests due
- survival benefits
- bonus

### **Education**

The computer has provided a lot of facilities in the education system. The computer provides a tool in the education system known as CBE (Computer Based Education). CBE involves control, delivery, and evaluation of learning.

- The computer education is rapidly increasing the graph of number of computer students.
- On-line education using internet.
- There are number of methods in which educational institutions can use computer to educate the students.
- It is used to prepare a database about performance of a student and analysis is carried out on this basis.

### **Marketing**

In marketing, uses of computer are following:

- 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.
- At 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.

### **Health Care**

Computers have become important part in hospitals, labs, and dispensaries. The computers are being used in hospitals to keep the record of patients and medicines. It is also used in scanning and diagnosing different diseases. ECG, EEG, Ultrasounds and CT Scans etc., are also done by computerized machines.

Some major fields of health care in which computers are used are:

- Diagnostic System: Computers are used to collect data and identify cause of illness.
- Lab-diagnostic System: All tests can be done and reports are prepared by computer.
- Patient Monitoring System: These are used to check patient's signs for abnormality such as in Cardiac Arrest, ECG etc.
- Pharma Information System: Computer checks Drug-Labels, Expiry dates, harmful drug's side effects etc.
- Surgery: Nowadays, computers are also used in performing surgeries.

### **Engineering Design**

Computers are widely used in engineering purpose.

One of major areas is CAD (Computer aided design). That provides creation and modification of images. Some fields 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.

### **Military**

Computers are largely used in defence. Modern tanks, missiles, weapons etc. Military also employs computerised control systems. Some military areas where a computer has been used are:

- Missile Control
- Military Communication
- Military Operation and Planning
- Smart Weapons

### **Communication**

Communication means to convey a message, an idea, a picture or speech that is received and understood clearly and correctly by the person for whom it is meant. Some main areas in this category are:

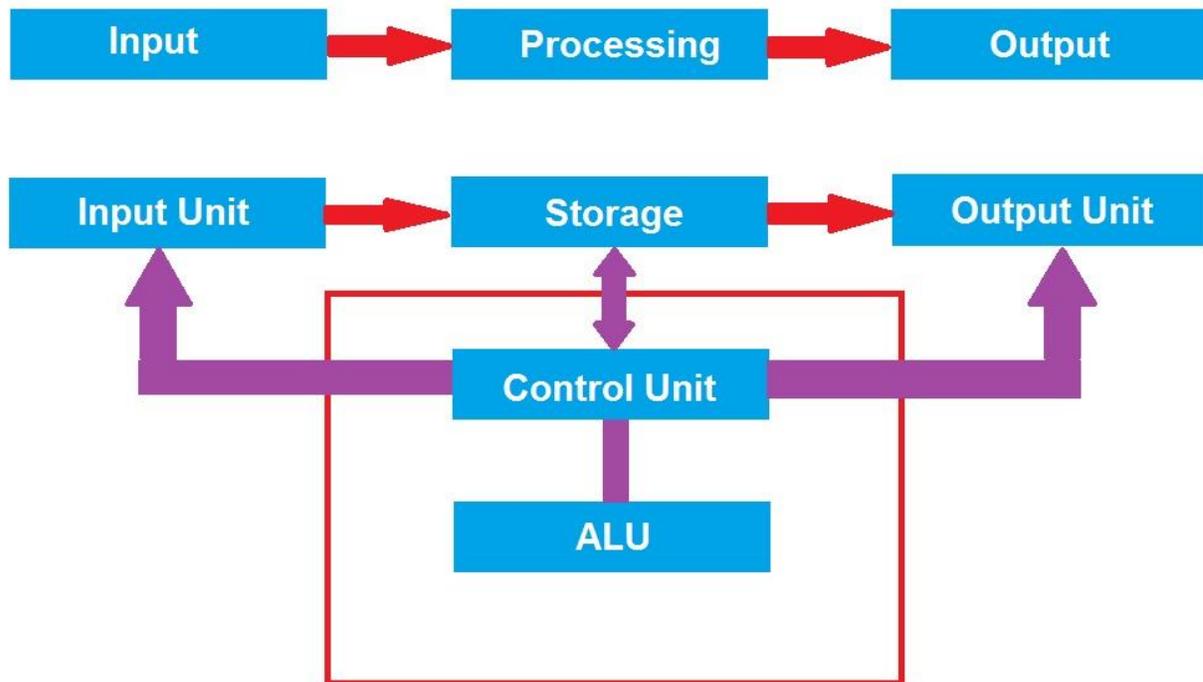
- E-mail
- Chatting
- Usenet
- FTP
- Telnet
- Video-conferencing

### **Government**

Computers play an important role in government. 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

### **BLOCK DIAGRAM OF A COMPUTER**



A computer can process data, pictures, sound and graphics. They can solve highly complicated problems quickly and accurately. A computer performs basically five major computer operations or functions irrespective of their size and make. These are:

- 1) it accepts data or instructions by way of input,
- 2) it stores data,
- 3) it can process data as required by the user,
- 4) it gives results in the form of output, and
- 5) it controls all operations inside a computer.

## INPUT UNIT

Input is the process of entering data and programs into the computer system. You should know that computer is an electronic machine like any other machine which takes as inputs raw data and performs some processing giving out processed data. Therefore, the input unit takes data from us to the computer in an organized manner for processing.

In computing, an input unit (device) is a peripheral (piece of computer hardware equipment) used to provide data and control signals to a computer or information appliance. Examples of input devices include keyboards, scanners, digital cameras and joysticks.

### OUTPUT UNIT

Output is the process of producing results from the data for getting useful information. Similarly the output produced by the computer after processing must also be kept somewhere inside the computer before being given to you in human readable form. Again the output is also stored inside the computer for further processing.

An output unit (device) is any device used to send data from a computer to another device or user. Most computer data output, that is meant for humans is in the form of pictures, audio or video. Thus, most output devices used by humans are in these categories. Examples include monitors, projectors, speakers, headphones and printers.

### STORAGE UNIT

The process of saving data and instructions permanently is known as storage. Data has to be fed into the system before the actual processing starts. It is because the processing speed of Central Processing Unit (CPU) is so fast that the data has to be provided to CPU with the same speed. Therefore the data is first stored in the storage unit for faster access and processing. This storage unit or the primary storage of the computer system is designed to do the above functionality. It provides space for storing data and instructions.

The storage unit performs the following major functions:

- All data and instructions are stored here before and after processing.
- Intermediate results of processing are also stored here.

### CENTRAL PROCESSING UNIT

**CPU** (*pronounced as separate letters*) is the abbreviation for Central Processing Unit, sometimes referred to simply as the Processor, the CPU is the brain of the computer. CPU is the electronic circuitry within a computer that carries out the instructions of a computer program by performing the basic arithmetic, logical, control and input/output (I/O) operations specified by the instructions. In terms of computing

power, the CPU is the most important element of a computer system. CPU is the central component of the computer. It is the CPU that runs the whole computer inside. All work that is done on a computer is performed directly or indirectly by the CPU. Obviously, it is one of the most important components of the computer, it is also, scientifically, not only one of the most amazing parts of the Computer, but one of the most amazing devices in the world of technology. As the CPU performs many different functions, it is actually divided up into different components like ALU (Arithmetic Logic Unit), CU (Control Unit), Registers (CPU Memory).

### ARITHMETIC LOGIC UNIT

The Arithmetic Logic Unit is that part of the CPU that does all the calculations. It has electronic circuits that can manipulate data in various ways. It has three main functions.

1. It can perform arithmetic calculations on data. For example, it can add and subtract two numbers together or multiply and divide numbers.
2. It can perform logical operations on data. These are computations that involve, for example, the use of AND, OR and NOT.
3. The third job of the ALU is to hold data it has already worked on, ready to be sent out, and to hold data that has been fetched, ready to be processed. All data that goes into and out of the CPU goes via the ALU. The ALU acts like a 'revolving door' for data, letting data pass in as well as out of the CPU.

Summarizing this we can say, the ALU:

performs arithmetic calculations,

performs logical operations on data,

acts as a 'revolving door' for data going into and out of the CPU.

### CONTROL UNIT

The CU is responsible for controlling all the peripherals connected to a computer. It is the CU that manages the whole computer. CU is responsible for managing how instructions are executed. It has some very important jobs to do! It is in charge of fetching instructions and data from wherever they are stored in the memory unit. It does this by sending control signals at the right time to various parts of the computer that then access the correct memory unit location and retrieve the contents of that location. Its next very important job is to interpret, or 'decode', an instruction so that it knows

what has to be done. It has a special piece of equipment called an 'instruction decoder' to do this. Once it has done this, it can then execute the instruction. It can send signals to all the different parts of the CPU telling them what to do and when.

Any program you write or application you run is made up of a sequence of instructions. When you 'run' a program, it is the control unit that is fetching, then decoding and finally executing every instruction, one after another. Unsurprisingly, this is known as the 'fetch-decode-execute cycle' and is dealt with in another section.

## REGISTERS

No discussion about a CPU would be complete without mentioning the role of 'registers'. The registers are an integral part of the CPU. They are a type of memory that can be accessed very quickly compared to other types of memory. The pieces of information they hold are needed very often, such as an intermediate result, a constant etc. They can be used to store data and control information during a fetch-decode-execute cycle or they can be used to hold values that are generated as part of the ALU working on data. There are a number of very special registers that do very specific jobs.

## UNIT II

### SOFTWARE

Computer software, or simply 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. Software is that part of a computer system that consists of encoded information or computer instructions, in contrast to the physical hardware from which the system is built. Software is used to manage and control various physical parts (peripherals) of a computer or any other device.

The term "software" was first proposed by Alan Turing and used in this sense by John W. Tukey in 1957. In computer science and software engineering, computer software is all information processed by computer systems, programs and data.

## RELATIONSHIP BETWEEN HARDWARE AND SOFTWARE

Hardware refers to the basic components of a computer. These may include things like the keyboard, mouse, motherboard, monitor and hard drives. For these things to function, they require instructions (programs) that are installed in the form of software.

The software thus helps the hardware to operate. Both hardware and software are interdependent, none can operate without the other. Where hardware includes all the physical entities, software is virtual (can't be touched or felt).

## TYPES OF SOFTWARES

There are two types of software:

System Software

Application Software

### SYSTEM SOFTWARE

System software is software that directly operates the computer hardware, to provide basic functionality needed by users and other software, and to provide a platform for running application software. The system software is collection of programs designed to operate, control, and extend the processing capabilities of the computer itself. System software are generally prepared by computer manufactures. 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 hardware and application softwares or end users.

Some examples of system software are **Operating System** (*which are essential collections of software that manage resources and provides common services for other software that runs "on top" of them.* Supervisory programs, boot

*loaders, shells and window systems are core parts of operating systems. In practice, an operating system comes bundled with additional software (including application software) so that a user can potentially do some work with a computer that only has an operating system.)* **Device drivers** (which operate or control a particular type of device that is attached to a computer. Each device needs at least one corresponding device driver; because a computer typically has at minimum at least one input device and at least one output device, a computer typically needs more than one device driver), **Utilities** (which are computer programs designed to assist users in the maintenance and care of their computers), **Compilers** (which transforms source code written in a programming language (the source language) into another computer language (the target language), with the latter often having a binary form known as object code), **Interpreters** (which can analyse and execute a program line by line), **Assemblers** (which converts instructions written in low-level symbolic code into machine code) etc.

Thus system software are:

- Close to system
- Fast in speed
- Difficult to design
- Difficult to understand
- Less interactive
- Smaller in size
- Difficult to manipulate
- Generally written in low-level language

### **Functions of system software**

The three major functions of system software are allocating system resources, monitoring system activities, and disk and file management.

- 1. Allocating system resources:** The system resources are time, memory, input, and output. The time in the CPU is divided into time slices. The time slices are

measured in terms of milliseconds. Based on the priority of tasks the time slices are assigned. Memory is also managed by system software. Disk space is the part of main memory. The data flow is controlled by system software.

- 2. Monitoring system activities:** The system security and system performance is monitored by system software. System performance includes response time and CPU utilization. System security is a part of operating system. Multiple users can't access without the security code or password.
- 3. File and disk management:** The user needs to save, copy, delete, move and rename the files. The system software will handle those functions. Disk and file management is the technical task.

## APPLICATION SOFTWARE

Application software is software that uses the computer system to perform special functions beyond the basic operation of the computer itself. Application software products are designed to satisfy a particular need of a particular environment. All software applications prepared in the computer lab can come under the category of Application software.

Application software may consist of a single program, such as a Microsoft's notepad for writing and editing simple text. It may also consist of a collection of programs, often called a software package, which work together to accomplish a task, such as a spreadsheet package.

Some examples of Application software are as: Inventory Management Software, Income Tax Software, Railways Reservation Software, Microsoft Office Suite Software, Microsoft Word, Microsoft Excel, Microsoft Powerpoint, VLC media player, Adobe Photoshop etc.

Thus application software are:

- Close to user
- Easy to design

- More interactive
- Slow in speed
- Generally written in high-level language
- Easy to understand
- Easy to manipulate and use
- Bigger in size and require large storage space

### *MALICIOUS SOFTWARE*

*Malicious software or malware, which is software that is developed to harm and disrupt computers. As such, malware is undesirable. Malware is closely associated with computer-related crimes.*

### FIRMWARE

Firmware is a software program or set of instructions programmed on a hardware device. It provides the necessary instructions for how the device communicates with the other computer hardware. Firmware is a combination of software and hardware. ROMs, PROMs and EPROMs that have data or programs recorded on them are firmware. Firmware is typically stored in the flash ROM of a hardware device. While ROM is "read-only memory," flash ROM can be erased and rewritten because it is actually a type of flash memory. Firmware can be thought of as "semi-permanent" since it remains the same unless it is updated by a firmware updater.

### TYPES OF SYSTEM SOFTWARE

System software is software that helps a computer to run. There are different types of system software as:

- Operating system software
- Utility programs
- Library programs
- Translator software

## **Operating system**

An operating system (OS) is a set of programs that manage computer hardware resources and provide common services for application software. The operating system is the most important type of system software in a computer system. Without an operating system, a user cannot run an application program on their computer (unless the application program is self-booting). For hardware functions such as input/output and main memory management, the operating system acts as a middleman between application programs and the computer hardware, although the application code is usually executed directly by the hardware it will frequently call the OS or be interrupted by it. Operating systems can be found on almost any device that contains a computer, from mobile phones and video game consoles to supercomputers and web servers.

## **Utility programs**

Utility software is a type of system software which has a very specific task to perform related to the working of the computer, for example anti-virus software, disk defragment etc.

Utility software should not be confused with application software, which allows users to do things like creating text documents, playing games, listening to music or surfing the web. Rather than providing these kinds of user-oriented or output-oriented functionality, utility software usually focuses on how the computer infrastructure (including the computer hardware, operating system, application software and data storage) operates. Due to this focus, utilities are often rather technical and targeted at people with an advanced level of computer knowledge.

## **Library programs**

Library programs are collections of compiled routines which are shared by multiple programs, such as the printing function. Library programs contain code and data that provide services to other programs such as interface (look and feel), printing, network code and even the graphic engines of computer games. If you have ever wondered why all Microsoft Office programs have the same look and feel, that is because they are using

the same graphical user interface libraries. For computer games a developer might not have the time and budget to write a new graphics engine so they often buy graphical libraries to speed up development, this will allow them to quickly develop a good looking game that runs on the desired hardware. For example Battlefield 3 and Need for Speed both use the same Frostbite engine. Most programming languages have a standard set of libraries that can be used, offering code to handle input/output, graphics and specialist maths functions.

### **Translator software**

The final type of system software is translator software. This is software that allows new programs to be written and run on computers, by converting source code into machine code.

*Assembler* - converts assembly code into machine code

*Interpreter* - converts 3rd generation languages such as javascript into machine code one line at a time

*Compiler* - converts 3rd generation languages such as C++ into machine code all at once

## **COMMONLY USED APPLICATION SOFTWARE**

### **WORD PROCESSING**

Word processing software is used to manipulate text and apply a basic design to pages. Users typically enter text by typing, and the software provides tools for copying, deleting and various types of formatting. Some of the functions of word processing software include:

- Creating, editing, saving and printing documents.
- Copying, pasting, moving and deleting text within a document.
- Formatting text, such as font type, bolding, underlining or italicizing.
- Creating and editing tables.

- Inserting elements from other software, such as illustrations or photographs.
- Correcting spelling and grammar.

Word processing includes a number of tools to format pages. For example, it can organize text into columns, add page numbers, insert illustrations, etc. However, word processing does not give complete control over the look and feel of document. Word processing software typically also contains features to make it easier to perform repetitive tasks. For example, let's say a business firm needs to send a letter to all its customers regarding a new policy. The letter is the same for all customers except for the name and address at the top of the letter. A mail merge function allows it to produce all the letters using one template document and a table with customer names and addresses in the database. Text editors shouldn't be confused with word processing software. While they do also allow you to create, edit and save text documents, they only work on plain text. Text editors don't use any formatting, such as underlined text or different fonts. Text editors serve a very different purpose from word processing software. They are used to work with files in plain text format, such as source code of computer programs or configuration files of an operating system. An example of a text editor would be Notepad. There are a number of different word processing applications. One of the most widely used ones is Word, which is part of Microsoft Office. Another widely used one is WordPerfect by the Corel Corporation. A third one is Writer, which is part of OpenOffice by Apache. While the first two are commercial software, OpenOffice is open source and can be downloaded and used free of charge. Finally, there is Pages, which is part of iWork by Apple.

## SPREADSHEET

A spreadsheet is a sheet of paper that shows accounting or other data in rows and columns; a spreadsheet is also a computer application program that simulates a physical spreadsheet by capturing, displaying, and manipulating data arranged in rows and columns. The spreadsheet is one of the most popular uses of the personal computer.

In a spreadsheet, spaces that hold items of data are called cells. Each cell is labeled according to its placement (for example, A1, A2, A3...) and may have an absolute or relative reference to the cells around it. A spreadsheet is generally designed to hold numerical data and short text strings. Spreadsheets usually provide the ability to portray data relationships graphically.

Spreadsheet users may adjust any stored value and observe the effects on calculated values. This makes the spreadsheet useful for "what-if" analysis since many cases can be rapidly investigated without manual recalculation. Modern spreadsheet software can have multiple interacting sheets, and can display data either as text and numerals, or in graphical form.

Besides performing basic arithmetic and mathematical functions, modern spreadsheets provide built-in functions for common financial and statistical operations. Such calculations as net present value or standard deviation can be applied to tabular data with a pre-programmed function in a formula. Spreadsheet programs also provide conditional expressions, functions to convert between text and numbers, and functions that operate on strings of text.

Spreadsheets have replaced paper-based systems throughout the business world. Although they were first developed for accounting or bookkeeping tasks, they now are used extensively in any context where tabular lists are built, sorted, and shared.

Spreadsheets generally do not offer the ability to structure and label data items as fully as a database and usually do not offer the ability to query the database. In general, a spreadsheet is a much simpler program than a database program.

LANPAR, available in 1969, was the first electronic spreadsheet on mainframe and time sharing computers. LANPAR was an acronym: LANguage for Programming Arrays at Random. VisiCalc was the first electronic spreadsheet on a microcomputer and it helped turn the Apple II computer into a popular and widely used system. Lotus 1-2-3 was the leading spreadsheet when DOS was the dominant operating system. Excel now has the largest market share on the Windows and Macintosh platforms.

## DATABASE

Often abbreviated *DB*, a database is a collection of information that is organized so that it can easily be accessed, managed, and updated. Computer databases typically contain aggregations of data records or files, such as sales transactions, product catalogs and inventories, and customer profiles. Database is basically a collection of information organized in such a way that a computer program can quickly select desired pieces of data.

Traditional databases are organized by *fields*, *records*, and *files*. A field is a single piece of information; a record is one complete set of fields; and a file is a collection of records. For example, a telephone book is analogous to a file. It contains a list of records, each of which consists of three fields: name, address, and telephone number.

To access information from a database, we need a *database management system (DBMS)*. This is a collection of programs that enables us to enter, organize, and select data in a database. Increasingly, the term *database* is used as shorthand for *database management system*. There are many different types of DBMSs, ranging from small systems that run on personal computers to huge systems that run on mainframes.

DBMSs provide various functions for management of a database and its data which can be classified into four main functional groups:

*Data definition* – Creation, modification and removal of definitions that define the organization of the data.

*Update* – Insertion, modification, and deletion of the actual data.

*Retrieval* – Providing information in a form directly usable or for further processing by other applications. The retrieved data may be made available in a form basically the same as it is stored in the database or in a new form obtained by altering or combining existing data from the database.

*Administration* – Registering and monitoring users, enforcing data security, monitoring performance, maintaining data integrity, dealing with concurrency control, and

recovering information that has been corrupted by some event such as an unexpected system failure.

Database are classified according to their organisational approach.

*Relational database*:- A tabular database in which data is defined so that it can be reorganized and accessed in a number of different ways. It stores data in tables with relationships to other tables.

*Distributed database*:- A distributed database is one that can be dispersed or replicated among different point in a network.

*Object oriented programming database*:- In this database, the data is defined in object classes and sub classes.

Some examples of database software are Oracle, FileMaker Pro, Microsoft Access, Microsoft SQL Server, SAP and MySQL.

## GRAPHICS PERSONAL ASSISTANCE

Graphics personal assistance is related to an intelligent personal assistant which is actually a software that can perform tasks or services for an individual. These tasks or services are based on user input, location awareness, and the ability to access information from a variety of online sources (such as weather or traffic conditions, news, stock prices, user schedules, retail prices, etc.). One of the key aspects of a graphics personal assistant is its ability to organize and maintain information. This includes the management of emails, calendar events, files, to-do lists, etc. Examples of such an agent are Apple's Siri, Google's Google Now (and later Google Assistant). Amazon Alexa, Amazon's Evi (branded as Evi), Microsoft's Cortana, Braina (application developed by Brainasoft for Microsoft Windows), Samsung's S Voice, LG G3's Voice Mate, BlackBerry's Assistant, SILVIA, HTC's Hidi, IBM's Watson (computer), Facebook's M (app) and One Voice Technologies (IVAN). Various other tasks that may be performed by a smart graphics personal assistant include schedule management (e.g., sending an alert to a dinner date that a user is running late due to traffic conditions, update schedules for both parties, and change the restaurant

reservation time) and personal health management (e.g., monitoring caloric intake, heart rate and exercise regimen, then making recommendations for healthy choices).

***Personal digital assistant (PDA)***, also known as a handheld PC, or personal data assistant, is a mobile device that functions as a personal information manager. The term evolved from Personal Desktop Assistant, a software term for an application that prompts or prods the user of a computer with suggestions or provides quick reference to contacts and other lists. PDAs were largely discontinued in the early 2010s after the widespread adoption of highly capable smartphones, in particular those based on iOS and Android.

Nearly all PDAs have the ability to connect to the Internet. A PDA has an electronic visual display, enabling it to include a web browser, all models also have audio capabilities enabling use as a portable media player, and also enabling most of them to be used as mobile phones. Most PDAs can access the Internet, intranets or extranets via Wi-Fi or Wireless Wide Area Networks. Most PDAs employ touchscreen technology.

The first PDA was released in 1984 by Psion, the Organizer. Followed by Psion's Series 3, in 1991, which began to resemble the more familiar PDA style. It also had a full keyboard. The term PDA was first used on January 7, 1992 by Apple Computer CEO John Sculley at. In 1994, IBM introduced the first PDA with full mobile phone functionality, the IBM Simon, which can also be considered the first smartphone. Then in 1996, Nokia introduced a PDA with full mobile phone functionality, the 9000 Communicator, which became the world's best-selling PDA. The Communicator spawned a new category of PDAs: the "PDA phone", now called "smartphone". Another early entrant in this market was Palm, with a line of PDA products which began in March 1996. The terms "personal digital assistant" and "PDA" apply to smartphones but are not used in marketing, media, or general conversation to refer to devices such as the BlackBerry, iPad, iPhone or Android devices.

## SOFTWARE APPLICATIONS IN EDUCATION

Computers have changed the way we work, be it any profession. Therefore, it is only natural that the role of computers in education has been given a lot of importance in recent years. Computers play a vital role in every field. They aid industrial processes, they find application in medicine; they are the reason why software industries developed and flourished and they play an important role in education. This is also why the education system has made computer education a part of school curriculum. Considering the use of computer technology in almost every sphere of life, it is important for everyone to have at least the basic knowledge of using computers.

### Access To The Internet

Internet can play an important role in education. As it is an enormous information base, it can be harnessed for retrieval of information on a variety of subjects. The Internet can be used to refer to information on different subjects. Both teachers and students benefit from the Internet. Teachers can refer to it for additional information and references on the topics to be taught. Students can refer to web sources for additional information on subjects of their interest. The Internet helps teachers set test papers, frame questions for home assignments and decide project topics. And not just academics, teachers can use web sources for ideas on sports competitions, extracurricular activities, picnics, parties and more. Students can search for the concepts or things which they wish to know, by referring to relevant websites. The Internet is an ocean of information and surfing daily will increase the knowledge of these students greatly.

### Better Presentation Of Information

Computers facilitate effective presentation of information. Presentation software like PowerPoint and animation software like Flash among others can be of great help to teachers while delivering lectures. Teachers hardly use chalk and board today. They bring presentations on a flash drive, plug it in to a computer in the classroom, and the teaching begins.

### Audio-Visual Aids In Teaching

Computers facilitate audio-visual representation of information, thus making the process of learning interactive and interesting. Computer-aided teaching adds a fun

element to education. There's color, there's sound, there's movement - the same old information comes forth in a different way and learning becomes fun. The otherwise not-so- interesting lessons become interesting due to audio-visual effects. Due to the visual aid, difficult subjects can be explained in better ways.

### Distance Education - On-line Education

Many times, it happens that students are not able to enroll for degree courses which they are interested in due to lack of money or because the institute is far away from their residence. The introduction of distance/on-line learning has solved all these problems. The distance learning programs or online degree programs provides education at much affordable costs than the costs incurred on full- time training. Also, students living far off, in remote areas, need not travel several kilometers and come to the city as they can now learn from the comforts of their home provided they own a computer with an Internet connection.

### Storage Of Information

Computers enable storage of data in the electronic format, thereby saving paper. Memory capacities of computer storage devices are in gigabytes. This enables students to store huge chunks of data. Moreover, these devices are compact. They occupy very less space, yet store large amounts of data. Both teachers and students benefit from the use of computer technology. Presentations, notes, e-books, e-lectures and test papers can be stored and transferred easily over computer storage devices. Similarly, students can submit homework and assignments as soft copies.

### ENTERTAINMENT SOFTWARES

Entertainment software is any software that supports a hobby or provides a form of amusement. Entertainment software includes video games, videos and any other software that a user feels is enjoyable. Entertainment software has come a long way in the last couple of decades--from simple games like "Space Invaders" with straightforward graphics and limited complexity, to 3-D thrillers like the "Tomb Raider" series *with a* seemingly unending amount of variety and complexity. Many Web sites serve as entertainment software portals, typically providing resources for all types of games. The sites *gamespot.com/gamespot* and *zone.msn.com* are just a small sample of online game portal sites. *PCgameworld.com* has hundreds of games listed at this site.

Entertainment software might not be able to calculate your taxes or schedule important meetings, but these programs can make life more interesting. Thanks to an array of unique developers, many different types of entertainment software exist. Leaving games aside there exist many entertainment softwares that help you enjoy life a lot. e.g.

### *Liquid Dream*

Dreams are mysterious, but your dreams can become a lot more real with Liquid Dream. This program actually tracks your dreams while you sleep. Chart your dreams, what you dream about, and how long your sleep cycles last. Liquid Dream also comes with detailed instructions, so you can track and trace your dreams simply.

### *Crystal Ball*

Reminiscent of a Magic Eight ball, Crystal Ball features a virtual, well, crystal ball. You can ask this ball all kinds of questions, and await clever and funny responses. Place Crystal Ball on your desktop for a bit of distracting fun. Not essential by any stretch of the imagination, but imaginative and entertaining all the same.

### *Strobe Light*

Strobe Light is a program developed by SLSoft that creates a strobe light effect on your desktop. Simply download this program, and watch as your computer turns into a mini disco. Strobe Light can be a lot of fun when used in a dark room.

### *BooMonsters*

If you don't have a real pet, you can download BooMonsters. This program will place a virtual pet on your desktop. Name your pet, take care of it, and learn how to become a loving master with BooMonsters -- a fun way to pass the time.

Thus the purpose of entertainment softwares is to let the user enjoy and have fun. There are too many examples of such softwares which could not be covered here. Along with the off-line softwares that could be installed on your PC's and used, there exist many websites that come under the category of entertainment.

## COMPUTER LANGUAGES

Computer languages are designed to communicate instructions to a computer. Computer languages can be used to create programs to control the behavior of a

computer system. A computer language is a language used to write computer programs, which involve a computer performing some kind of computation or algorithm and possibly control external devices such as printers, disk drives, robots and so on. Programming languages differ from natural languages in that natural languages are only used for interaction between people, while computer languages allow humans to communicate instructions to machines.

The earliest computers were often programmed without the help of a computer language, by writing programs in absolute *machine language*. The programs, in binary form (0,1), were read in from punched cards or magnetic tape, or toggled in on switches on the front panel of the computer. Absolute machine languages were later termed first-generation programming languages (1GL).

The next step was development of so-called second-generation programming language (2GL) or *assembly language*, which was still closely tied to the instruction set architecture of the specific computer. This served to make the program much more human-readable, and relieved the programmer of tedious and error-prone address calculations.

The first *high-level programming language*, or third generation programming language (3GL), was written in the 1950s.

### *Machine Level Language*

Machine language, also known as machine code, is the elemental language of computers, comprising a long sequence of binary digital zeros and ones (0,1).

Ultimately, the output of any programming language emerges in the form of machine code (0's and 1's). After you write a program, your source language statements are compiled and translated into machine code that is stored as an executable file until someone tells the computer's OS (operating system) to run it. In personal computer OSs, these files typically have the suffix ".exe."

Each processor has its own specific machine language, and it reads and handles a certain number of bits at a time. Because it is designed to know how many bits (and

which bits) tell it what operation to do, the processor can look at the correct sequence of bits and perform the next operation. Then it reads the next instruction, and so on. Each machine-language instruction causes the CPU (central processing unit) to perform a simple operation such as an arithmetic calculation or storing data in RAM (random access memory). Human programmers rarely, write or read in machine code because it is essentially impossible to translate it. Humans write in so-called high-level languages that are far more comprehensible than machine languages, and that require far fewer characters to represent the task at hand.

Machine languages are also referred to as 1st generation programming languages.

### *Assembly Language*

Assembly language is a low-level programming language for a computer or other programmable device specific to a particular computer architecture in contrast to most high-level programming languages, which are generally portable across multiple systems. Assembly language is converted into executable machine code (0,1) by a utility program referred to as an assembler.

Each personal computer has a microprocessor that manages the computer's arithmetical, logical, and control activities. Each family of processors has its own set of instructions for handling various operations such as getting input from keyboard, displaying information on screen and performing various other jobs. These set of instructions are called 'machine language instructions'.

A processor understands only machine language instructions, which are strings of 1's and 0's. However, machine language is too obscure and complex for using in software development. So, the low-level assembly language is designed for a specific family of processors that represents various instructions in symbolic code and a more understandable form.

### *High Level Language*

High-level language is any programming language that enables development of a program in much simpler programming context and is generally independent of the computer's hardware architecture. High-level language has a higher level of abstraction

from the computer, and focuses more on the programming logic rather than the underlying hardware components such as memory addressing and register utilization.

High level languages are designed to be used by the human operator or the programmer. They are referred to as "closer to humans." In other words, their programming style and context is easier to learn and implement, and the entire code generally focuses on the specific program to be created.

High-level language doesn't require addressing hardware constraints to a greater extent when developing a program. However, every single program written in a high level language must be interpreted into machine language before being executed by the computer.

BASIC, C/C++ and Java are popular examples of high-level languages.

### UNIT III

#### POSITIONAL NUMBER SYSTEM

A positional number system is a system for representation of numbers by an ordered set of numeral symbols (called digits) in which the value of a numeral symbol depends on its position. For each position a unique symbol or a limited set of symbols is used. The standard decimal system uses ten symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. Contemporary computers use binary, octal, and hexadecimal number systems. In the binary number system we need 2 symbols 0 and 1; for octal number system we need 8 symbols 0, 1, 2, 3, 4, 5, 6, 7; and for hexadecimal number system we need 16 symbols for representation in each position, the decimal numerals 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 plus first six capital letters A, B, C, D, E, F are used.

#### DECIMAL NUMBER SYSTEM

Decimal number system, also called Hindu-Arabic, or Arabic, number system, is a positional number system employing 10 as the base and requiring 10 different numerals, the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. It also requires a dot (decimal point) to represent decimal fractions. In this scheme, the numerals used in denoting a number take different place values depending upon position.

Eg. In a base-10 (decimal) system the number  $(543)_{10}$  represents the sum:

$$\Rightarrow (5 \times 10^2) + (4 \times 10^1) + (3 \times 10^0)$$

$$\Rightarrow (5 \times 100) + (4 \times 10) + (3 \times 1)$$

$$\Rightarrow 500 + 40 + 3$$

$$\Rightarrow 543$$

*(You will better understand this when we move on with other number systems)*

#### BINARY NUMBER SYSTEM

A binary number system or base-2 numeral system is one which represents numeric values using two different symbols: 0 (zero) and 1 (one). The base-2 system is a positional notation with a base of 2. Because of its straightforward implementation in digital electronic circuitry using logic gates, the binary system is used internally by

almost all modern computers and computer-based devices. Each digit is referred to as a bit.

The numbers of decimal number system 0 to 9 are represented in binary number system as:

Decimal Number	Binary Equivalent
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001

Now the same decimal number  $(543)_{10}$  can be represented in binary as:

By dividing the decimal number with base 2, and getting the remainder at each step (0 or 1) and dividing the quotient again and repeating the same till we get 1 as quotient (which is not further divisible by 2). Then getting all the remainders from bottom upwards shows the binary equivalent.

Thus:

$$(543)_{10} = (1000011111)_2$$

Now you can understand that in decimal number

system the number  $(543)_{10} = 543$ ; but the same number in binary number system is equal to 1000011111.

As we have already shown the binary equivalent of decimal number 9 is 1001;

Let us make it clear how it is. Let us take the number 9 and divide it with 2(binary base).

2	543	1
2	271	1
2	135	1
2	67	1
2	33	1
2	16	0
2	8	0
2	4	0
2	2	0
	1	



2	9	1
2	4	0
2	2	0
	1	

Here we get  $(9)_{10} = (1001)_2$

### OCTAL NUMBER SYSTEM

The octal numeral system, or oct for short, is the base-8 number system, and uses the 8 digits 0, 1, 2, 3, 4, 5, 6, 7. Thus any number (of other number systems) can be represented using these 8 symbols in octal number system.

Now let us again take the example of decimal number 543 and see what will be its octal equivalent. Here we need to divide the number by 8 (octal base).

8	543	7
8	67	3
8	8	0
	1	

Thus:

$$(543)_{10} = (1037)_8$$

### HEXADECIMAL NUMBER SYSTEM

Hexadecimal number system (or hex) is a positional numeral system with a base of 16. Here we need 16 symbols for representation in each position, so the decimal numerals 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 plus first six capital letters A, B, C, D, E, F are used. Hexadecimal numerals are widely used by computer system designers and programmers. As each hexadecimal digit represents four binary digits (bits), it allows a human-friendly representation of binary-coded values. One hexadecimal digit represents a nibble (4 bits), which is half of an octet or byte (8 bits). Eg. a single byte can have values ranging from 00000000 to 11111111, in binary, but this is more conveniently represented as 00 to FF in hexadecimal.

Now once again let us take the example of the decimal number 543 and convert it into hexadecimal equivalent. Here we have to divide the number by 16 (hexadecimal base) to get its hexadecimal equivalent.

16	543	15
16	33	1
	2	

Thus:

$$(543)_{10} = (21F)_{16} \quad [as\ 15\ is\ equal\ to\ F]$$

## CONVERSION FROM ONE NUMBER SYSTEM TO ANOTHER

### CONVERSION FROM DECIMAL NUMBER SYSTEM TO OTHER NUMBER SYSTEMS

As we have already seen how a decimal number is converted into different other number systems. Whenever we need to convert a decimal number into binary, octal or hexadecimal number we simply have to divide the decimal number by the base of the number system in which we want to convert it.

*Steps To Be Followed:*

**Step 1** – Divide the decimal number to be converted by the value of the new base.

**Step 2** – Get the remainder from Step 1 as the rightmost digit (least significant digit) of new base number.

**Step 3** – Divide the quotient of the previous divide by the new base.

**Step 4** – Record the remainder from Step 3 as the next digit (to the left) of the new base number.

Repeat Steps 3 and 4, getting remainders from right to left, until the quotient becomes zero in Step 3.

The last remainder thus obtained will be the Most Significant Digit (MSD) of the new base number.

Eg. If we want to convert a number say 28 into binary then we have to divide it by 2 (binary base), if we need to convert it into octal then we have to divide by 8 (octal base) and for hexadecimal by 16 (hexadecimal base).

Now let us take the decimal number 28 and convert it first into binary:

## DECIMAL TO BINARY

$$(28)_{10} = (\dots\dots\dots)_2$$

Step 1:

$$\begin{array}{r|l|r} 2 & 28 & 0 \\ \hline & 14 & \end{array}$$

Here we got 0 (zero) as remainder and will keep it as the rightmost digit.

$$(\dots\dots\dots 0)_2$$

Step 2:

Now the quotient of last step is 14 and dividing it further by base 2 we will get.

$$\begin{array}{r|l|r} 2 & 14 & 0 \\ \hline & 7 & \end{array}$$

Here we have 0 (zero) as remainder and we have to keep it on the left side of the previous remainder.

$$(\dots\dots 00)_2$$

Step 3:

The remainder of previous step is 7 and we have to keep on dividing till the quotient becomes zero.

$$\begin{array}{r|l|r} 2 & 7 & 1 \\ \hline & 3 & \end{array}$$

Now we have 1 (one) as remainder and by keeping it on left side of the previous remainders we get;

$$(\dots 100)_2$$

Step 4:

Still the quotient from last step is not zero, so we need to continue with dividing.

$$\begin{array}{r|l|r} 2 & 3 & 1 \\ \hline & 1 & \end{array}$$

Here the remainder is 1 (one) and by keeping it on left side of previous remainders we have:

$$(\dots 1100)_2$$

Step 5:

The quotient of previous step is 1 so further we have to divide it by 2.

2	1	1
	0	

The remainder here is 1 and by putting it on the left side of previous remainders we have:

$$(11100)_2$$

Now as the quotient is zero, so we have to stop and the number that is the remainders **11100** is the binary equivalent of decimal number 28 or we can write:

$$(28)_{10} = (11100)_2$$

But doing same separately step by step is time consuming, so it is better to do the same in one go.

2	28	0
2	14	0
2	7	1
2	3	1
2	1	1
	0	

In this way we have the remainders on the right side and when the quotient becomes zero, we have to stop and write the remainders as bottom upwards from left to right(as per arrow direction).

So this is how a decimal number is converted into binary, but what about a fractional part.

Eg. 5.25

Same procedure is to be followed for converting the digit 5, but for the fractional part there is a bit different way; see

We need to multiply the fractional part with base of the number system in which we want to convert it (2 in case of binary). The procedure is to be continued till we get o(s) zeros in the fractional part. The digits that we get to the left of the fractional part (real numbers) must be written from left to right. (*o (zero) must be considered wherever we don't get a real number*).

The real number 5 will be simply converted as:

2	5	1
2	2	0
2	1	1
	0	

So the result we have is 101.\_\_\_\_

Now to get the fractional part we will multiply the fractional part(.25) with base (2)

$$\Rightarrow \underline{.25 \times 2}$$

$$\Rightarrow .50 \quad (\text{here we didn't get a real number, so we will consider a 0(zero) for this step})$$

$$\Rightarrow 0.50$$

The result of above step is 0. Thus the binary equivalent we got till now is 101.0\_\_

The fractional part is still greater than 0 (.50), so we will further multiply this fractional part .50 with 2(base).

$$\Rightarrow \underline{.50 \times 2}$$

$$\Rightarrow 1.00 \quad (\text{here we got 1 on the real part})$$

The binary equivalent now is 101.01

As the fractional part has become zero we have to stop.

Now you have learnt how to convert the fractional part step by step you can do the same as:

$$\begin{array}{r} \underline{.25 \times 2} \\ \underline{0.50 \times 2} \\ 1.00 \end{array}$$

$$\text{So } (5.25)_{10} = (101.01)_2$$

Similarly you can practice the fraction conversion for other number systems, using different bases.

## DECIMAL TO OCTAL

Here the decimal number is to be divided by 8 (Octal base).

Let us take the same decimal number 28 and convert it into octal.

8	28	4
8	3	3
	0	

Thus:

$$(28)_{10} = (34)_8$$

You can practice by converting different numbers.

## DECIMAL TO HEXADECIMAL

Here the decimal number is to be divided by 16(Hexadecimal base).

Let us take the same example.

16	28	12
16	1	1
	0	

Here one thing we have to remember that in hexadecimal number system we have the symbols 0 to 9 and English letters A to E, so here 10 is represented by A, 11 by B, 12 by C, 13 by D, 14 by E and 15 by F.

Thus the remainders that we got here are 1 and 12 and we can write:

$(28)_{10} = (112)_{16}$  but it is not correct as 12 does not belong to hexadecimal number system, it must be replaced by C.

So we have to write:

$$(28)_{10} = (1C)_{16}.$$

So whenever we get a remainder greater than 9, then we have to replace it by the Hexadecimal symbols A(10), B(11),C(12), D(13), E(14), F(15).

As we have learned how to convert decimal numbers into different number systems. Now we will see how to convert numbers from other number systems to Decimal number system.

## CONVERSION FROM OTHER NUMBER SYSTEMS TO DECIMAL NUMBER SYSTEM

*Steps To Be Followed:*

**Step 1:** Begin with the rightmost digit of the number which is to be converted and multiply it with the base (with a power of 0) of the number system to which it belongs.

**Step 2:** Move to the next digit towards left and multiply it with the base but increase the power of the base by 1.

**Step 3:** Add the product result of previous step and step 2.

**Step 4:** Repeat step 2 and 3 till all the digits of the number get multiplied with the base.

## BINARY TO DECIMAL

Let us take the previous example of decimal number 28 whose binary equivalent we got as: 11100, now we will convert the same and see whether it gets converted into 28.

Step 1:

The binary number that we have to convert is 11100.

Starting with the rightmost digit that is 0 (11100), we will multiply it with base that is 2 in case of binary with a power of 0( $2^0$ ).

$$\Rightarrow \underline{0 \times 2^0}$$

$$\Rightarrow \underline{0 \times 1} \quad (\text{Any digit having power of zero is equal to one})$$

$$\Rightarrow \underline{0}$$

Thus the product of first step is 0.

Step 2:

Moving to the next digit to the left that is 0 (11100), we have to multiply it with base (2) with power incremented by 1( $2^1$ ).

$$\Rightarrow \underline{0 \times 2^1}$$

$$\Rightarrow \underline{0 \times 2}$$

$$\Rightarrow \underline{0}$$

Thus the product of this step is 0.

Step 3:

Adding the results of first two steps we will get.

$$\Rightarrow 0 + 0$$

$$\Rightarrow 0$$

Step 4:

Moving to the next digit to the left that is 1 (11100), we have to multiply it with base (2) with power incremented by 1( $2^2$ ).

$$\Rightarrow \underline{1 \times 2^2}$$

$$\Rightarrow \underline{1 \times 4}$$

$$\Rightarrow \underline{4}$$

Step 5:

Adding the result of step 4 to the result of step 3, we will get;

$$\Rightarrow 4 + 0$$

$$\Rightarrow 4$$

Step 6:

As there are still 2 digits remaining, so let us move to the next digit to the left that is 1 (11100) and multiply it with base (2) with power incremented by 1( $2^3$ ).

$$\Rightarrow \underline{1 \times 2^3}$$

$$\Rightarrow \underline{1 \times 8}$$

$$\Rightarrow \underline{8}$$

Step 7:

Adding the result of step 6 with previous total that is result of step 5;

$$\Rightarrow 4 + 8$$

$$\Rightarrow 12$$

Step 8:

Now we have the last digit pending which is 1 (11100), so let us multiply it with base (2) with power incremented by 1( $2^4$ ).

$$\Rightarrow \underline{1 \times 2^4}$$

$$\Rightarrow \underline{1 \times 16}$$

$$\Rightarrow \underline{16}$$

Step 9:

So finally adding the result of step 8 with previous total of step 7 we have;

$$\Rightarrow 12 + 16$$

$$\Rightarrow 28$$

Thus we got 28 which is the decimal equivalent of binary 11100.

Doing all this in a step by step manner was to teach you in a feasible manner but you can save time by doing the same in just one go;

11100 (*Binary number to be converted into decimal number*)

Have a look at the following step from right to left.

$$\Rightarrow \underline{1 \times 2^4} + \underline{1 \times 2^3} + \underline{1 \times 2^2} + \underline{0 \times 2^1} + \underline{0 \times 2^0}$$

$$\Rightarrow \underline{1 \times 16} + \underline{1 \times 8} + \underline{1 \times 4} + \underline{0 \times 2} + \underline{0 \times 1}$$

$$\Rightarrow \underline{16} + \underline{8} + \underline{4} + \underline{0} + \underline{0}$$

$$\Rightarrow \underline{28}$$

This is the time saving method.

But a question arising here is what about a number with a fractional part.

In that case for the fractional part we have to follow the same process of getting the sum by multiplying the numbers with the base but from left to right and beginning with a power of -1 and decrementing it by 1 with every next digit.

Eg. Convert binary number 101.01 into its decimal equivalent.

$$\Rightarrow \underline{1 \times 2^2} + \underline{0 \times 2^1} + \underline{1 \times 2^0} . \underline{0 \times 2^{-1}} + \underline{1 \times 2^{-2}}$$

$$\Rightarrow \underline{1 \times 4} + \underline{0 \times 2} + \underline{1 \times 1} . \underline{0 \times 1/2} + \underline{1 \times 1/4}$$

$$\Rightarrow 4 + 0 + 1 . 0 + 0.25$$

$$\Rightarrow 5.25$$

Thus the decimal equivalent of binary 101.01 is 5.25

### OCTAL TO DECIMAL

Here the octal number which is to be converted is to be multiplied by 8 (Octal base).

Let us take the same previous example in which we converted the decimal number 28 into octal equivalent 34.

So here we will convert the octal 34 and see its decimal equivalent.

$$\Rightarrow \underline{3 \times 8^1} + \underline{4 \times 8^0}$$

$$\Rightarrow \underline{3 \times 8} + \underline{4 \times 1}$$

$$\Rightarrow \underline{24} + \underline{4}$$

$$\Rightarrow \underline{28}$$

Thus  $(34)_8 = (28)_{10}$

### HEXADECIMAL TO DECIMAL

Here the hexadecimal number which is to be converted is to be multiplied by 16 (hexadecimal base).

Let us take the same previous example in which we converted the decimal number 28 into hexadecimal equivalent 1C.

So here we will convert the hexadecimal 1C and see its decimal equivalent.

$$\Rightarrow \underline{1 \times 16^1} + \underline{C \times 16^0}$$

$$\Rightarrow \underline{1 \times 16} + \underline{12 \times 1} \quad (\text{As the hexadecimal C means 12})$$

$$\Rightarrow \underline{16} + \underline{12}$$

$$\Rightarrow \underline{28}$$

Thus  $(1C)_{16} = (28)_{10}$

Now you can practice and convert any number.

## COMPUTER CODES

### BCD

The binary coded decimal (BCD) is a type of binary code used to represent a given decimal number in an equivalent binary form. Its main advantage is that it allows easy conversion to decimal digits for printing or display and faster calculations. In this code each decimal digit is represented by a 4-bit binary number. BCD is a way to express each of the decimal digits separately with a binary code. In the BCD, with four bits we can represent sixteen numbers (0000 to 1111). But in BCD code only first ten of these are used (0000 to 1001). The remaining six code combinations i.e. 1010 to 1111 are invalid in BCD. The most common BCD code is the 8421 BCD code. In this, the BCD equivalent of a decimal number is written by replacing each decimal digit in integer and fractional parts with its four-bit binary equivalent '(or nibble). Here 8, 4, 2 and 1 represent the weights of different bits in the four-bit groups, starting from the most significant bit (to extreme left) and proceeding towards the least significant bit.

Decimal	0	1	2	3	4	5	6	7	8	9
BCD	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001

So here if we want to convert a decimal number say 32 into BCD equivalent, we have to convert both the digits separately.

$$\begin{array}{cc} \underline{3} & \underline{2} \\ \underline{0011} & \underline{0010} \end{array}$$

Thus, the BCD equivalent of (32) is 0011 0010.

### EBCDIC

**EBCDIC** is short for **Extended Binary Coded Decimal Interchange Code** is eight bits, or one *byte*, wide. This is a coding system used to represent characters-letters, numerals,

punctuation marks, and other symbols in computerized text. A character is represented in EBCDIC by eight bits. EBCDIC mainly used on IBM mainframe and IBM midrange computer operating systems. Each byte consists of two *nibbles*, each four bits wide. The first four bits define the class of character, while the second nibble defines the specific character inside that class.

EBCDIC is different from, and incompatible with, the ASCII character set used by all other computers. The EBCDIC code allows for 256 different characters. EBCDIC was adapted from the character codes used in IBM's pre electronic PUNCHED CARD machines, which made it less than ideal for modern computers. Among its many inconveniences were the use of non-contiguous codes for the alphabetic characters, and the absence of several punctuation characters such as the square brackets [] used by much modern software.

For example, setting the first nibble to all-ones, (1111) defines the character as a number, and the second nibble defines which number is encoded. EBCDIC can code up to 256 different characters. There have been six or more incompatible versions of EBCDIC, the latest of which do include all the ASCII characters, but also contain characters that are not supported in ASCII.

## ASCII

The name ASCII is an acronym for: American Standard Code for Information Interchange. It is a character encoding standard developed several decades ago to provide a standard way for digital machines to encode characters. The ASCII code provides a mechanism for encoding alphabetic characters, numeric digits, and punctuation marks for use in representing text and numbers written using the Roman alphabet.

As originally designed, it was a seven bit code. The seven bits allow the representation of 128 unique characters. All of the alphabet, numeric digits and standard English punctuation marks are encoded. The ASCII standard was later extended to an eight bit code (which allows 256 unique code patterns) and various additional symbols were added, including characters with diacritical marks (such as accents) used in European languages, which don't appear in English.

There are also numerous non-standard extensions to ASCII giving different encoding for the upper 128 character codes than the standard. For example, the character set encoded into the display card for the original IBM PC had a non-standard encoding for the upper character set. This is a non-standard extension that is in very wide spread use, and could be considered a standard in itself.

## UNICODE

Unicode is an entirely new idea in setting up binary codes for text or script characters. Officially called the Unicode Worldwide Character Standard, it is a system for "the interchange, processing, and display of the written texts of the diverse languages of the modern world." It also supports many classical and historical texts in a number of languages.

Currently, the Unicode standard contains 34,168 distinct coded characters derived from 24 supported language scripts. These characters cover the principal written languages of the world. The Unicode Standard, the latest version of Unicode contains a repertoire of more than 128,000 characters covering 135 modern and historic scripts, as well as multiple symbol sets. Additional work is underway to add the few modern languages not yet included.

Unicode's success at unifying character sets has led to its widespread and predominant use in the internationalization and localization of computer software. The standard has been implemented in many recent technologies, including modern operating systems, XML, Java (and other programming languages), and the .NET Framework.

Unicode can be implemented by different character encodings. The most commonly used encodings are UTF-8, UTF-16 and the now-obsolete UCS-2. UTF-8 uses one byte for any ASCII character, all of which have the same code values in both UTF-8 and ASCII encoding, and up to four bytes for other characters. UCS-2 uses a 16-bit code unit (two 8-bit bytes) for each character but cannot encode every character in the current Unicode standard. UTF-16 extends UCS-2, using one 16-bit unit for the characters that were representable in UCS-2 and two 16-bit units ( $4 \times 8$  bits) to handle each of the additional characters.

## GRAY CODE

Gray code after Frank Gray, also known as reflected binary code (RBC), is a binary numeral system where two successive values differ in only one bit(binary digit). The reflected binary code was originally designed to prevent spurious output from electromechanical switches. Today, Gray codes are widely used to facilitate error correction in digital communications such as digital terrestrial television and some cable TV systems.

Many devices indicate position by closing and opening switches. If that device uses natural binary codes, positions 3 and 4 are next to each other but all three bits of the binary representation differ:

Decimal	Binary
...	...
3	011
4	100
...	...

The problem with natural binary codes is that physical switches are not ideal: it is very unlikely that physical switches will change states exactly in synchrony. In the transition between the two states shown above, all three switches change state. In the brief period while all are changing, the switches will read some spurious position. Even without keybounce, the transition might look like 011 — 001 — 101 — 100. When the switches appear to be in position 001, the observer cannot tell if that is the "real" position 001, or a transitional state between two other positions. If the output feeds into a sequential system, possibly via combinational logic, then the sequential system may store a false value.

The reflected binary code solves this problem by changing only one switch at a time, so there is never any ambiguity of position,

Decimal	Binary	Gray	Gray as decimal
0	000	000	0
1	001	001	1
2	010	011	3
3	011	010	2
4	100	110	6
5	101	111	7

6	110	101	5
7	111	100	4

Notice that the Gray code for decimal 7 rolls over to decimal 0 with only one switch change. This is called the "cyclic" property of a Gray code. In the standard Gray coding the least significant bit follows a repetitive pattern of 2 on, 2 off ( ... 11001100 ... ); the next digit a pattern of 4 on, 4 off; and so forth.

More formally, a Gray code is a code assigning to each of a contiguous set of integers, or to each member of a circular list, a word of symbols such that each two adjacent code words differ by one symbol. These codes are also known as single-distance codes, reflecting the Hamming distance of 1 between adjacent codes. There can be more than one Gray code for a given word length, but the term was first applied to a particular binary code for the non-negative integers, the binary-reflected Gray code, or BRGC, the three-bit version of which is shown above.

## DATA AND INFORMATION CONCEPTS

### DATA

Information in raw or unorganized form (such as alphabets, numbers, or symbols) that refer to, or represent, conditions, ideas, or objects. Data is limitless and present everywhere in the universe.

In computers it means the quantities, characters, or symbols on which operations are performed by a computer, which may be stored and transmitted in the form of electrical signals and recorded on magnetic, optical, or mechanical recording media.

### INFORMATION

Data that is accurate and timely, specific and organized for a purpose, presented within a context that gives it meaning and relevance, and can lead to an increase in understanding and decrease in uncertainty. We can even say that the processed data is known as information.

Information is valuable because it can affect behavior, a decision, or an outcome. For example, if a manager is told his/her company's net profit decreased in the past month, he/she may use this information as a reason to cut financial spending for the next month. A piece of information is considered valueless if, after receiving it, things remain unchanged.

### INFORMATION PROCESSING

Information processing is the change (processing) of information in any manner detectable by an observer. As such, it is a process that describes everything that happens (changes) in the universe, from the falling of a rock (a change in position) to the printing of a text file from a digital computer system. In the latter case, an information processor is changing the form of presentation of that text file.

So far as our subject is concerned information processing means the manipulation of digitized information by computers and other digital electronic equipment. Information processing systems include business software, operating systems, computers, networks and mainframes. Whenever data needs to be transferred or operated upon in some way, this is referred to as information processing.

A computer information processor processes information to produce understandable results. The processing may include the acquisition, recording, assembly, retrieval or dissemination of information. For example, in printing a text file, an information processor works to translate and format the digital information for printed form.

Information processing began decades ago as businesses and governments sought to be able to process large amounts of data, often statistical or calculated from gathered data. The desire to travel into space further fueled the need to process large amounts of data and the information processing revolution gained more momentum. The 21st century has seen an explosion of data and the amount of information processed every day has reached gigantic proportions. Information is processed by billions of devices, hundreds of satellites and millions of software applications. Trillions of bytes are processed every minute.

Information processing is still in a growth phase; larger systems and more prolific ownership has created a steady increase in the amount of information processed globally.

### NEED FOR INFORMATION

We need information because it empowers us. It allows intellectual development which leads to academic credibility. It allows the development of subject knowledge leading to an ability to

discuss our subject with authority. It brings an ability to meet the research requirements of our course.

Successful management of any large organization requires extensive and effective use of information. Information about education ranges from staff and student information to extensive financial information, which may also encompass school facility and program-level information. The information is needed by almost every organization.

- Using information helps to influence decision-making. Good decisions are based on inquiry and analysis. Information technologies are available to make good decision-making possible for managers.
- Information is needed to target specific areas for improvement. Timely and accurate data can help decision-makers at all levels focus on improvement strategies.
- Information is needed in rapid program evaluation. To have an impact, program evaluation must be timely as well as complete. When program and other data are compiled and linked in an accurate and well-designed retrieval system, the goals of system can be more effectively and efficiently met.
- Information is needed for budgetary control. Greater control and more informed decision-making are possible when all costs of system operations are available.
- Information is needed to examine relationships between cost and effectiveness. Information technologies allow graphic representations of these data.
- Information helps to improve administrative time management and mandated reporting. When core databases are built around the NCES Common Core of Data Elements, improvements in administrative efficiency and time management can be significant.

## CHARACTERISTICS OF INFORMATION

Good information is that which is used and which creates value. Experience and research shows that good information has numerous qualities.

Good information is relevant for its purpose, sufficiently accurate for its purpose, complete enough for the problem, reliable and targeted to the right person. It is also communicated in time for its purpose, contains the right level of detail and is communicated by an appropriate channel, i.e. one that is understandable to the user.

Further details of these characteristics related to organizational information for decision-making follows.

### Availability/accessibility

Information should be easy to obtain or access. Information kept in a book of some kind is only available and easy to access if you have the book to hand. A good example of availability is a telephone directory, as every home has one for its local area. It is probably the first place you look for a local number.

Businesses used to keep customer details on a card-index system at the customer's branch. If the customer visited a different branch a telephone call would be needed to check details. Now, with centralized computer systems, businesses like banks and building societies can access any customer's data from any branch.

### Accuracy

Information needs to be accurate enough for the use to which it is going to be put. To obtain information that is 100% accurate is usually unrealistic as it is likely to be too expensive to produce on time. The degree of accuracy depends upon the circumstances. At operational levels information may need to be accurate to the nearest penny – on a supermarket till receipt, for example. At tactical level department heads may see weekly summaries correct to the nearest 100 Rs., whereas at strategic level directors may look at comparing stores' performances over several months to the nearest 100,000 Rs. per month.

Accuracy is important. As an example, if government statistics based on the last census wrongly show an increase in births within an area, plans may be made to build schools and construction companies may invest in new housing developments. In these cases any investment may not be recouped.

### Reliability or objectivity

Reliability deals with the truth of information or the objectivity with which it is presented. You can only really use information confidently if you are sure of its reliability and objectivity. When researching for an essay in any subject, we might make straight for the library to find a

suitable book. We are reasonably confident that the information found in a book, especially one that the library has purchased, is reliable and (in the case of factual information) objective. The book has been written and the author's name is usually printed for all to see. The publisher should have employed an editor and an expert in the field to edit the book and question any factual doubts they may have. In short, much time and energy goes into publishing a book and for that reason we can be reasonably confident that the information is reliable and objective.

Compare that to finding information on the Internet where anybody can write unedited and unverified material and 'publish' it on the web. Unless you know who the author is, or a reputable university or government agency backs up the research, then you can be sure that the information is reliable. Some Internet websites are like vanity publishing, where anyone can write a book and pay certain (vanity) publishers to publish it.

#### Relevance/appropriateness

Information should be relevant to the purpose for which it is required. It must be suitable. What is relevant for one manager may not be relevant for another. The user will become frustrated if information contains data irrelevant to the task in hand.

For example, a market research company may give information on users' perceptions of the quality of a product. This is not relevant for the manager who wants to know opinions on relative prices of the product and its rivals. The information gained would not be relevant to the purpose.

#### Completeness

Information should contain all the details required by the user. Otherwise, it may not be useful as the basis for making a decision. For example, if an organization is supplied with information regarding the costs of supplying a fleet of cars for the sales force, and servicing and maintenance costs are not included, then a costing based on the information supplied will be considerably underestimated.

#### Level of detail/conciseness

Information should be in a form that is short enough to allow for its examination and use. There should be no extraneous information. For example, it is very common practice to summarize

financial data and present this information, both in the form of figures and by using a chart or graph. We would say that the graph is more concise than the tables of figures as there is little or no extraneous information in the graph or chart. Clearly there is a trade-off between level of detail and conciseness.

### Presentation

The presentation of information is important to the user. Information can be more easily assimilated if it is aesthetically pleasing. For example, a marketing report that includes graphs of statistics will be more concise as well as more aesthetically pleasing to the users within the organization. Many organizations use presentation software and show summary information via a data projector. These presentations have usually been well thought out to be visually attractive and to convey the correct amount of detail.

### Timing

Information must be on time for the purpose for which it is required. Information received too late will be irrelevant. For example, if you receive a brochure from a theatre and notice there was a concert by your favorite band yesterday, then the information is too late to be of use.

## CATEGORIES OF INFORMATION

First category is the Strategic information, it is the information needed by top most management for decision making. For example the trends in revenues earned by the organization are required by the top management for setting the policies of the organization. This information is not required by the lower levels in the organization.

The second category of information required by the middle management is known as managerial information. The information required at this level is used for making short term decisions and plans for the organization. Information like sales analysis for the past quarter or yearly production details etc. fall under this category.

The third category of information is relating to the daily or short term information needs of the organization such as attendance records of the employees. This kind of information is required at the operational level for carrying out the day-to-day operational activities. Some examples of information of this category are processing of orders, posting of entries in bank, evaluating overdue purchaser orders etc.

## INFORMATION SYSTEMS

There are some general types of information systems. For example, a database management system (DBMS) is a combination of software and data that makes it possible to organize and analyze data. DBMS software is typically not designed to work with a specific organization or a specific type of analysis. Rather, it is a general-purpose information system. Another example is an electronic spreadsheet. This is a tool for basic data analysis based on formulas that define relationships among the data. For example, you can use a spreadsheet to calculate averages for a set of values or to plot the trend of a value over time.

In contrast, there are a number of specialized information systems that have been specifically designed to support a particular process within an organization or to carry out very specific analysis tasks. For example, enterprise resource planning (ERP) is an information system used to integrate the management of all internal and external information across an entire organization. Another example is a geographic information system (GIS), which is used to manage and analyze all types of geographical data. Expert systems are another example of information systems. An experts system is designed to solve complex problems by following the reasoning of an expert.

## TYPES OF INFORMATION SYSTEMS

Information systems differ in their business needs. Also depending upon different levels in organization information systems differ. Three major information systems are

- Transaction processing systems
- Management information systems
- Decision support systems

### Transaction Processing Systems

TPS processes business transaction of the organization. Transaction can be any activity of the organization. Transactions differ from organization to organization. For example, take a railway reservation system. Booking, canceling, etc are all transactions. Any query made to it is a transaction. However, there are some transactions, which are common to almost all organizations. Like employee new employee, maintaining their leave status, maintaining employee's accounts, etc.

This provides high speed and accurate processing of record keeping of basic operational processes. These include calculation, storage and retrieval. Transaction processing systems provide speed and accuracy, and can be programmed to follow routines functions of the organization.

### Management Information Systems

These systems assist lower management in problem solving and making decisions. They use the results of transaction processing and some other information also. It is a set of information processing functions. It should handle queries as quickly as they arrive. An important element of MIS is database.

A database is a non-redundant collection of interrelated data items that can be processed through application programs and available to many users.

### Decision Support Systems

These systems assist higher management to make long term decisions. These type of systems handle unstructured or semi structured decisions. A decision is considered unstructured if there are no clear procedures for making the decision and if not all the factors to be considered in the decision can be readily identified in advance.

These are not of recurring nature. Some recur infrequently or occur only once. A decision support system must very flexible. The user should be able to produce customized reports by giving particular data and format specific to particular situations.

## UNIT IV

### MOBILE INTERNET

The terms 'mobile internet' or 'mobile broadband', '3G' and '4G' refer to the provision of internet connections using mobile phone networks. Generally, the only other types of broadband widely available are ADSL (phone line) or cable (fiber-optic) broadband. Mobile internet uses mobile

phone networks as opposed to copper phone or fiber-optic cable lines, and for the most part can be accessed by any mobile device or any computer with a USB port. No routers, cables or telephone lines are needed.

The mobile internet thus refers to the use of browser-based Internet services over handheld mobile devices, such as smartphones or feature phones, through a mobile or other wireless network. 'Mobile Internet' means the access to the Internet via a cellular telephone service provider. It is wireless access that can handoff to another radio tower while it is moving across the service area.

In many ways, mobile internet is taking over from home broadband in much the same way as mobile phones took over from home phones in the 1990s. Greater flexibility and mobility are the key factors fuelling the growth of mobile internet. And with increasingly sophisticated technology, mobile internet is on course to replace traditional, phone-line based mediums.

## GPS

The Global Positioning System (GPS) is a space age navigational system that can pinpoint your position anywhere on the globe, usually within a few yards or meters. This amazing technology is available to everyone, everywhere, day and night, and best of all, at no cost for use of the navigational data. GPS uses a constellation of 24 satellites in precise orbits approximately 11,000 miles above the earth. The satellites transmit data via high frequency radio waves back to Earth and, by locking onto these signals, a GPS receiver can process this data to triangulate its precise location on the globe.

The GPS project was launched in the United States in 1973 to overcome the limitations of previous navigation systems. The U.S. Department of Defense (DoD) developed the system, which originally used 24 satellites. It became fully operational in 1995. The US government, maintains the GPS system, and makes it freely accessible to anyone with a GPS receiver. However, the US government can selectively deny access to the system.

GPS operates 24 hours a day, in all weather conditions, and can be used worldwide for precise navigation on land, on water and even in the air. Some of its many current applications include: boating, fishing, hunting, scouting on land or from the air, hiking, camping, biking, rafting, pack trips by horseback, hot air ballooning, general aviation, snowmobiling and skiing, search and rescue, emergency vehicle tracking, 4 wheeling, highway driving and a host of other outdoor activities where accurate positioning is required.

### 3G

3G stands for Third Generation (of mobile phones) and it enables increased data-handling rates and high speed bandwidth. 3G is a network protocol which refers to the generations of mobile phones and telecommunication equipment which are compatible with the International Mobile Telecommunications-2000 (IMT-2000) standards stated by International Telecommunication Union (ITU). Because of this technology users can use many advanced features like video conference calling, video Streaming, video calls and enhanced web browsing capabilities. The older versions of this technology were also able to carry voice but they were unable to transfer data over this network.

NTT DoCoMo launched the first 3G network in Japan, in the year 2001. It was branded as FOMA (Freedom of Mobile Multimedia Access) and was based on W-CDMA technology.

One of its key visions is to provide seamless global roaming, enabling users to move across borders while using the same number and handset. Our mobile phones run on spectrums which is difference between higher & lower frequencies. To use 3G technology on the cell phone huge bandwidth is needed, this bandwidth can be calculated from the difference of high and low frequencies. The most expected range of bandwidth to work with 3G technology could be as much as 15-20 Mhz. UMTS (Universal Mobile Telecommunications System) is now a day's most famous part of 3G cell phone technologies. The highlight of 3G technology is its video telephony technology. Today this wireless technology has also enabled video broadcast and data-intensive services such as stock transactions, e-learning and telemedicine.

### 4G

4G is the short name for fourth-generation wireless communication, a descendant to 2G and 3G technology aiming to provide very high data transfer rates. 4G technology provides very speedy wireless internet access to not only stationary users but also to the mobile users. This technology has trounce the deficiencies of 3G technology in terms of speed and quality. 4G denotes a fastest internet access available to mobile phone users in the world. More over the distinguishing feature of high multimedia streaming and end to end IP configuration is judged to be its best enchantment. 3G utilized WiMax (Worldwide Interoperability for Microwave Access) and Wi-Fi (Wireless Fidelity) as separate wireless technologies, whereas 4G Technology coalesce these

two technologies. 4G can greatly anticipate in evolving and advancing the pervasive computing. The aim of pervasive computing is to attach itself to every living space possible, so that human beings remain intact with the wireless technology intentionally and unintentionally. 4G technology enables to connect various high speed networks together, which would enable each one of us to carry digital devices even in dispersed locations. The network operators worldwide would be able to deploy wireless mesh networks and make use of cognitive radio technology for widespread coverage and access.

4g technology keeps full potential to make us forget the way we use internet before, on our laptops and on moving devices such as mobile phones and tablet devices. It has removed all the barriers of speed & bandwidth which reward every user with high stream data. It is because of fast internet HD content is streamed with ease. These days, websites are designed keeping internet speeds of users in mind. Ever since 4G technology has been deployed, web is full of High Definition (HD) content and downloading or high quality streaming is consider no issue at all.

4G is a multi-purpose and versatile technology hence it can utilize almost all of the packet switched technologies. It can use both orthogonal frequency division multiplexing (OFDM) and orthogonal frequency division multiple access (OFDMA). OFDM is a type of digital modulation in which a signal is split into several narrowband channels at different frequencies. This is more efficient than TDMA, which divides channels into time slots and has multiple users take turns transmitting bursts or CDMA, which simultaneously transmits multiple signals on the same channel. The reason why 4G makes use of this technology lies in its ability to minimize the intervention among symbols and channels associated to data streaming. 4G is also capable of using multiple input / multiple output technology (MIMO). This antenna technology is used to optimize the data speed and reduce the errors in the networks. Universal Mobile Telecommunication Service (UMTS) which is basically a broadband 3G technology, is also a part of 4G. This broadband technology transfers data in the form of frames or packets. Hence it is capable of carrying voice, video, text and other types of multimedia datagram with the speed of 2Mb. UMTS is part of 4G because it can enables 4G to make use of international mobile phone roaming via using GSM (Global system for Mobile Communications). Another wireless telecommunication technology known as time division synchronous code division multiple access (TD-SCDMA) provides support to 4G to transfer both circuit switched data like video and voice and packet switched data.

It is 2016 now, almost every country has deployed 4G networks either in their national cellular companies or internet service providers. It is an amazing technology that has revolutionized the communication through-out the world.

### Wi-Fi

Wi-Fi also known as "wireless fidelity", developed on IEEE 802.11 standards. It is widely used technology advancement in wireless communication for over a decade now. As the name indicates, wi-fi provides wireless access to applications and data across using radio waves. It sets up numerous ways to build up a connection between the transmitter and the receiver. Transmitter is normally a wireless router / HotSpot and receiver is normal Wi-fi enabled device such as Laptop, Mobile, Tablet etc.

The development on this technology began in 1997, when the Institute of *Electrical and Electronic Engineers (IEEE)* introduced the standard 802.11 technology that carried higher capacities of data across the network. It greatly interested some of major brands across the globe such as the world famous networking giant 'Cisco Systems' or '3COM' . Initially, the price of implementing Wi-Fi technology was very high but around in 2002, the IT market witnessed the arrival of a breakthrough product that worked under the new 802.11 g standards. In year 2003, IEEE sanctioned the standard and the world saw the creation of affordable Wi-Fi enabled device in masses.

Wi-Fi technology provides its users with the liberty of connecting to the Internet from any place such as their home, office or a public place without the hassles of plugging in the wires, by now you should be quite aware of that at least. It is quicker than the conventional modem for accessing information over a large network. With the help of different amplifiers, the users can easily change their location without disruption in their network access. Wi-Fi enabled devices are compliant with each other to grant efficient access of information to the user. Wi-Fi location where the users can connect to the wireless network is called a Wi-Fi hotspot. Through the Wi-Fi hotspot, the users can even enhance their home business, as accessing information through Wi-Fi is simple. Accessing a wireless network (wi-fi) through a hotspot in some cases is cost-free while in some it may carry additional charges. Many standard Wi-Fi chips such as PCI, mini PCI, USB, Card-bus and PC card, ExpressCard make the Wi-Fi experience convenient and pleasurable for the users. These small devices are normal plug and play and can be easily used if your device does not provide in build Wi-fi. But now every single thing comes with Wi-fi including lowest end mobile phones, tablets.

Even watches comes with wi-fi technology known as smart watches, wi-fi TV or smart enables you to connect to internet using wi-fi technology and enables users to browse internet and use different software.



## BLUETOOTH

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz. Bluetooth is one of the major wireless technologies developed to achieve WPAN (Wireless Personal Area Network). Bluetooth is a wireless LAN technology used to connect devices of different functions such as telephones, computers (laptop or desktop), notebooks, cameras, printers and so on. Invented by telecom vendor Ericsson in 1994, it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization. It was named Bluetooth after the name of Denmark king – Harald Blatand who unified Denmark and Norway in 10th century.

Nowadays, Bluetooth technology is used for several computer and non computer application:

- It is used for providing communication between peripheral devices like wireless mouse or keyboard with the computer.
- It is used by modern healthcare devices to send signals to monitors.
- It is used by modern communicating devices like mobile phone, PDAs, palmtops etc. to transfer data rapidly.

- It is used for dial up networking. Thus allowing a notebook computer to call via a mobile phone.
- It is used for cordless telephoning to connect a handset and its local base station.
- It also allows hands-free voice communication with headset.
- It also enables a mobile computer to connect to a fixed LAN.
- It can also be used for file transfer operations from one mobile phone to another.

Bluetooth uses omnidirectional radio waves that can pass through walls or other non-metal barriers. Bluetooth devices have a built-in short range radio transmitter. The rate provided is 1Mbps and uses 2.4 GHz bandwidth. Bluetooth is that when the device is within the scope of another device and automatically starts the transfer of information without the user noticing the small network created between the devices and the user feels as if there were cables used to transfer data.

## SOCIAL NETWORKING

Social Networking refers to grouping of individuals and organizations together via some medium, in order to share thoughts, interests, and activities.

There are several web based social network services are available such as Facebook, Twitter, LinkedIn, Google+ etc. which offer easy to use and interactive interface to connect with people with in the country an overseas as well. There are also several mobile based social networking services in for of apps such as WhatsApp, Hike, Line etc.

The following table describes some of the famous social networking services provided over web and mobile:

S.N.	Service Description
1.	<b>Facebook</b> Allows to share text, photos, video etc. It also offers interesting online games.
2.	<b>Google+</b> It is pronounced as Google Plus. It is owned and operated by Google.
3.	<b>Twitter</b> Twitter allows the user to send and reply messages in form of tweets. These tweets are the small messages, generally include 140+ characters.
4.	<b>Faceparty</b> Faceparty is a UK based social networking site. It allows the users to create profiles and interact with each other using forums messages.
5.	<b>LinkedIn</b>

	LinkedIn is a business and professional networking site.
6.	<b>Flickr</b> Flickr offers image hosting and video hosting.
7.	<b>Ibibo</b> Ibibo is a talent based social networking site. It allows the users to promote one's self and also discover new talent.
8.	<b>WhatsApp</b> It is a mobile based messaging app. It allows to send text, video, and audio messages.
9.	<b>Line</b> It is same as WhatsApp. Allows to make free calls and messages.
10.	<b>Hike</b> It is also mobile based messenger and allows to send messages and exciting emotions.

Following are the areas where social networking is helpful:

#### Online Marketing

Social networking sites like Facebook allow us to create a page for specific product, community or firm and promoting over the web.

#### Online Jobs

Social networking sites like LinkedIn allow us to create connection with professionals and helps to find the suitable job based on one's specific skills set.

#### Online News

On social networking sites, people also post daily news which helps us to keep updated.

#### Chatting

Social networking allows us to keep in contact with friends and family. We can communicate with them via messages.

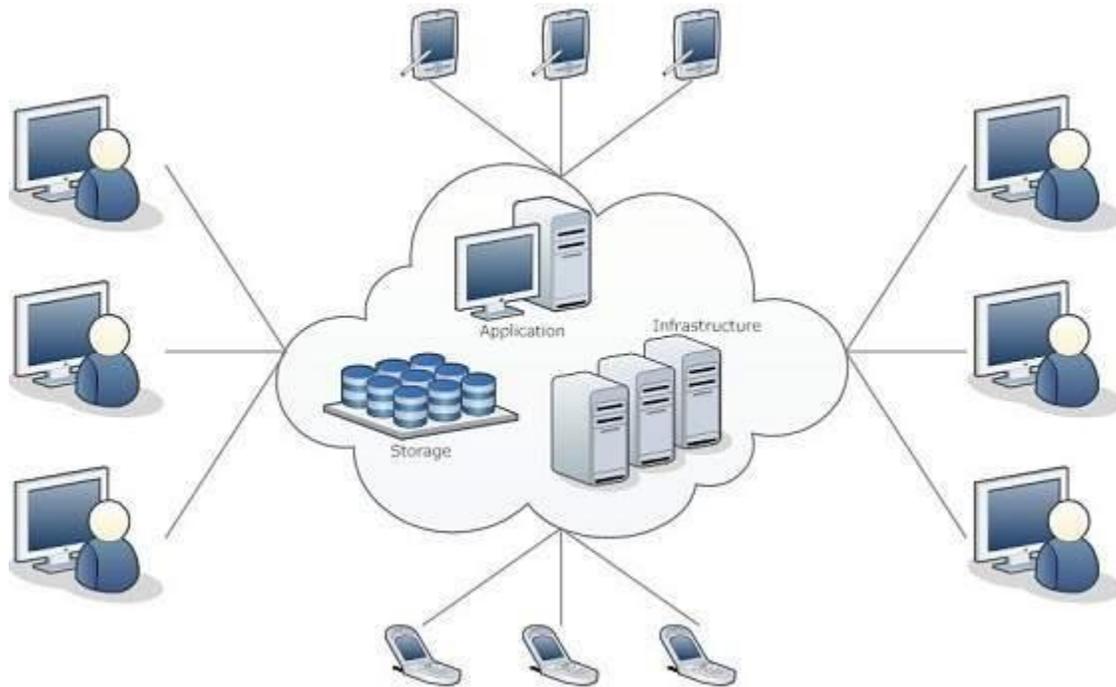
#### Share Picture, Audio and video

One can share pictures, audio and video messages using social networking sites.

### CLOUD TECHNOLOGY

Cloud Technology or Cloud Computing provides a means of accessing the applications as utilities over the Internet. It allows to create, configure, and customize the applications online. The term Cloud refers to a Network or Internet. In other words, we can say that Cloud is something, which is present at remote location. Cloud can provide services over public and private networks, i.e., WAN, LAN or VPN. Applications such as e-mail, web conferencing, customer relationship management (CRM) execute on cloud.

Cloud Computing refers to manipulating, configuring, and accessing the hardware and software resources remotely. It offers online data storage, infrastructure, and application. Cloud computing offers platform independency, as the software is not required to be installed locally on the PC. Hence, the Cloud Computing is making our business applications mobile and collaborative.

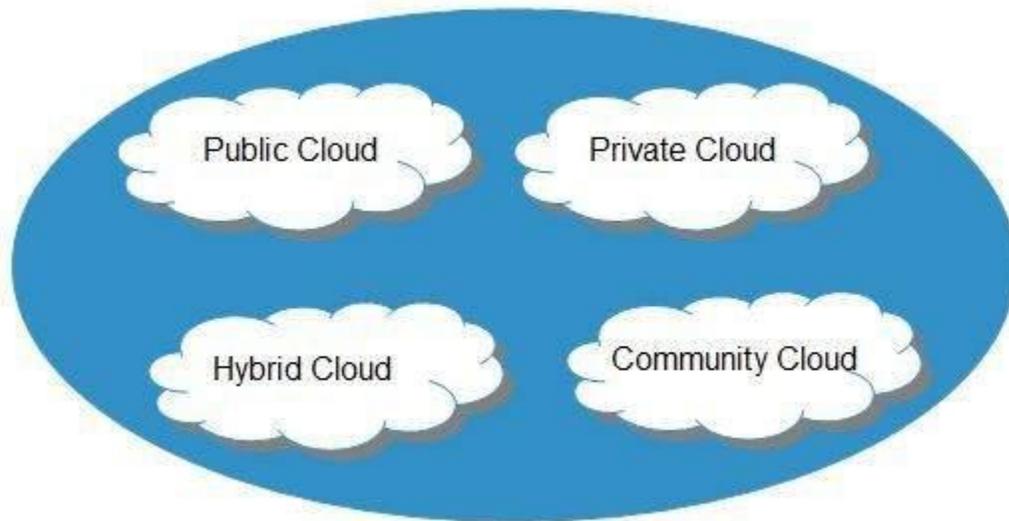


There are certain services and models working behind the scene making the cloud computing feasible and accessible to end users. Following are the working models for cloud computing:

- Deployment Models
- Service Models

### DEPLOYMENT MODELS

Deployment models define the type of access to the cloud, i.e., how the cloud is located? Cloud can have any of the four types of access: Public, Private, Hybrid, and Community.



#### Public Cloud:

The public cloud allows systems and services to be easily accessible to the general public. Public cloud may be less secure because of its openness.

#### Private Cloud:

The private cloud allows systems and services to be accessible within an organization. It is more secured because of its private nature.

#### Community Cloud:

The community cloud allows systems and services to be accessible by a group of organizations.

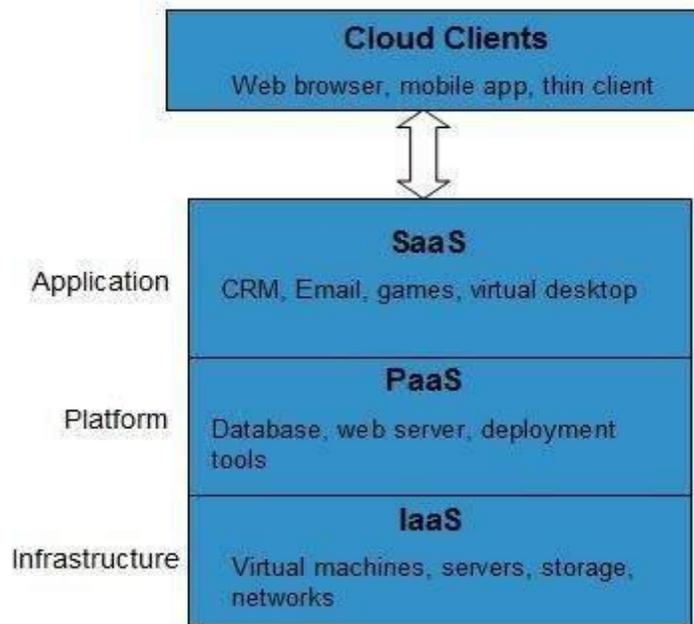
#### Hybrid Cloud:

The hybrid cloud is a mixture of public and private cloud, in which the critical activities are performed using private cloud while the non-critical activities are performed using public cloud.

### SERVICE MODELS

Cloud computing is based on service models. These are categorized into three basic service models which are -

- Infrastructure-as-a-Service (IaaS)
- Platform-as-a-Service (PaaS)
- Software-as-a-Service (SaaS)



#### Infrastructure-as-a-Service (IaaS):

The Infrastructure-as-a-Service (IaaS) is the most basic level of service. Each of the service models inherit the security and management mechanism from the underlying model, as shown in the above diagram. IaaS provides access to fundamental resources such as physical machines, virtual machines, virtual storage, etc.

#### Platform-as-a-Service (PaaS):

PaaS provides the runtime environment for applications, development and deployment tools, etc.

#### Software-as-a-Service (SaaS)

SaaS model allows to use software applications as a service to end-users.

Cloud Computing has numerous advantages. Some of them are as-

- One can access applications as utilities, over the Internet.
- One can manipulate and configure the applications online at any time.

- It does not require to install a software to access or manipulate cloud application.
- Cloud Computing offers online development and deployment tools, programming runtime environment through PaaS model.
- Cloud resources are available over the network in a manner that provide platform independent access to any type of clients.
- Cloud Computing offers on-demand self-service. The resources can be used without interaction with cloud service provider.
- Cloud Computing is highly cost effective because it operates at high efficiency with optimum utilization. It just requires an Internet connection
- Cloud Computing offers load balancing that makes it more reliable.

### VIRTUAL LAN TECHNOLOGY

A virtual local area network (VLAN) is a logical group of workstations, servers and network devices that appear to be on the same LAN despite their geographical distribution. A VLAN allows a network of computers and users to communicate in a simulated environment as if they exist in a single LAN and are sharing a single broadcast and multicast domain. VLANs are implemented to achieve scalability, security and ease of network management and can quickly adapt to change in network requirements and relocation of workstations and server nodes.

Higher-end switches allow the functionality and implementation of VLANs. The purpose of implementing a VLAN is to improve the performance of a network or apply appropriate security features.

A VLAN allows several networks to work virtually as an LAN. One of the most beneficial elements of a VLAN is that it removes latency in the network, which saves network resources and increases network efficiency. In addition, VLANs are created to provide segmentation and assist in issues like security, network management and scalability. Traffic patterns can also easily be controlled by using VLANs.

Implementing VLANs has following benefits:

- Allowing network administrators to apply additional security to network communication

- Making expansion and relocation of a network or a network device easier
- Providing flexibility because administrators are able to configure in a centralized environment while the devices might be located in different geographical locations
- Decreasing the latency and traffic load on the network and the network devices, offering increased performance

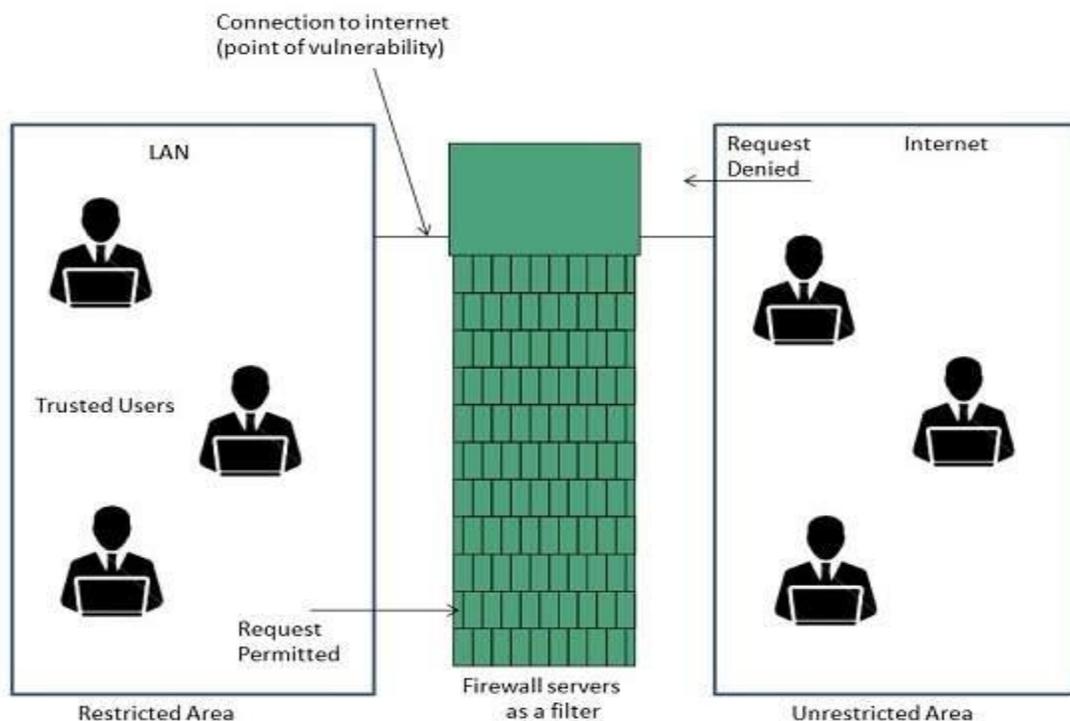
VLANs also have some disadvantages and limitations as:

- High risk of virus issues because one infected system may spread a virus through the whole logical network
- Equipment limitations in very large networks because additional routers might be needed to control the workload
- More effective at controlling latency than a WAN but less efficient than a LAN.

## FIREWALL

Firewall is a barrier between Local Area Network (LAN) and the Internet. It allows keeping private resources confidential and minimizes the security risks. It controls network traffic, in both directions.

The following diagram depicts a sample firewall between LAN and the internet. The connection between the two is the point of vulnerability. Both hardware and the software can be used at this point to filter network traffic.



There are two types of Firewall system: One works by using filters at the network layer and the other works by using proxy servers at the user, application, or network layer. Firewall management must be addressed by both system managers and the network managers. The amount of filtering a firewall varies. For the same firewall, the amount of filtering may be different in different directions.

### M-COMMERCE

The phrase mobile commerce was originally coined in 1997 by Kevin Duffey. Mobile commerce, also referred as m-commerce, is the use of wireless handheld devices such as cellular phones and laptops to conduct commercial transactions online. Mobile commerce means engaging users in a buy or sell process via a mobile device. For instance, when someone buys an Android app or an iPhone app, that person is engaged in m-commerce. There are a number of content assets that can be bought and sold via a mobile device such as games, applications, ringtones, subscriptions etc. Mobile commerce transactions continue to grow, and the term includes the purchase and sale of a wide range of products and services, such as paying for travel or events, online banking, bill payment and information delivery. Mobile-commerce is just one of the many subsets of electronic commerce.

The increasing adoption of electronic commerce has provided a strong foundation for mobile commerce. The rapid growth of mobile commerce is being driven by a number of positive factors, including the demand for applications from an increasingly mobile consumer base; the rapid adoption of online commerce, thanks to the resolution of security issues; and technological advances that have given wireless handheld devices advanced capabilities and substantial computing power.

### NANOTECHNOLOGY

Nanotechnology is science, engineering, and technology conducted at the nanoscale, which is about 1 to 100 nanometers. Nanotechnology has enabled scientists to work in a field so small that even cannot be identified with the help of microscopes. It is also known as nanotech and deals in developing small sized devices or materials. Nanotechnology is the study and application of extremely small things and can be used across all the other science fields, such as chemistry, biology, physics, materials science, and engineering.

It's hard to imagine just how small nanotechnology is. One nanometer is a billionth of a meter, or  $10^{-9}$  of a meter. Here are a few illustrative examples:

- There are 25,400,000 nanometers in an inch
- A sheet of newspaper is about 100,000 nanometers thick
- On a comparative scale, if a marble were a nanometer, then one meter would be the size of the Earth

Today's scientists and engineers are finding a wide variety of ways to deliberately make materials at the nanoscale to take advantage of their enhanced properties such as higher strength, lighter weight, increased control of light spectrum, and greater chemical reactivity than their larger-scale counterparts.

Undoubtedly, nanotechnology is going to be the future, as studies are going on in diversifying the technology from materials with dimensions in nano scale to materials in dimensions of atomic scale. Some new methods like molecular self-assembly have been developed to make this possible. There may be a future when all the common basic needs like food, shelter and even costly diamonds will be made by nanorobots.

## NANOTECHNOLOGY AND COMPUTERS

Nanotechnology in computers provides the need for faster running computer processes at cooler temperatures than traditional, transistor-based computer components. In traditional computing, transistors have used silicon components as an affordable and easily manufactured method to provide smaller and faster computers and electronic gadgets, such as netbooks, smartphones and personal assistant devices. Such powerful gadgets at so small a size produce too much heat, however, reducing the effectiveness, performance and longevity of the silicon components. Nanotechnology in computing solves the heat dilemma by providing improved processor power at cooler temperatures and lighter weights.

Nanotechnology in computers makes use of nanomaterials, tiny molecule-sized machines that process information similarly to the intricate and complex cells in a living organism. Similar to cells, nanomaterials exist on a microscopic level, one nanometer measuring one billionth of a meter, or  $1/50,000$  the thickness of a human hair. Nanotechnology in computing therefore operates on a minuscule level. Computer manufacturers create long, microscopic strands of carbon atoms, called carbon nanotubes, into tiny transistors that provide twice the processing

power of silicon chips, while generating much less heat and lighter components. Additionally, nanotechnology applications offer more efficient performance, thus conserving power and increasing battery life for smaller, portable electronic devices.

The drive for more powerful computers with larger memory at lighter weights and cooler temperatures is responsible for the development of nanotechnology in computers. Besides greater processing power, nanotechnology in computers is providing advanced means of memory storage. The "nanodot," with its ability to condense vast amounts of data in a closely-packed compartment, may eventually replace the hard drive disk. Nanomaterials are generally more expensive than silicon materials, but the rise in demand outweighs the economic concern. With the development of the transistor after World War II, consumer electronics exploded in popularity. Within four decades, the personal computer was born. As a bulky desktop appliance, there was no immediate need for portability in computers. Fans inside the computer housing, a necessary ingredient to keep transistors and other computer parts cool, gobbled up precious space. Yet since these first computers were stationary, manufacturers saw no real need to shrink the size of the machines.

The development of the cell phone and small computer devices created a need for smarter, more efficient means for carrying out computing processes. The silicon chip answered the call for faster computing. As devices became smaller and consumers requested more powerful technology, the heat produced from silicon components overwhelmed the electronic devices. Computer science developed nanotechnology, or nanotech, to accommodate the need for smaller devices operating at cooler temperatures and faster speeds.

## VIRTUAL REALITY

Virtual reality is the term used to describe a three-dimensional, computer generated environment which can be explored and interacted with by a person. That person becomes part of this virtual world or is immersed within this environment and whilst there, is able to manipulate objects or perform a series of actions.

Virtual reality (VR) typically refers to computer technologies that use software to generate realistic images, sounds and other sensations that replicate a real environment (or create an imaginary setting), and simulate a user's physical presence in this environment, by enabling the user to interact with this space and any objects depicted therein using specialized display screens or projectors and other devices. VR has been defined as "a realistic and immersive simulation of a three-dimensional environment, created using interactive software and

hardware, and experienced or controlled by movement of the body" or as an "immersive, interactive experience generated by a computer".

A person using virtual reality equipment is typically able to "look around" the artificial world, move about in it and interact with features or items that are depicted on a screen or in goggles. Virtual realities artificially create sensory experiences, which can include sight, touch, hearing, and, less commonly, smell. Today most virtual realities are displayed either on a computer monitor, a projector screen, or with a virtual reality headset (also called head-mounted display or HMD).

Immersive films and video games are good examples for virtual reality. The entertainment industry is after all a multi-billion dollar one and consumers are always keen on novelty. Virtual reality has many other, more serious, applications as well.

There are a wide variety of applications for virtual reality which include:

- Architecture
- Sport
- Medicine
- The Arts
- Entertainment

Virtual reality can lead to new and exciting discoveries in these areas which impact upon our day to day lives.

Wherever it is too dangerous, expensive or impractical to do something in reality, virtual reality is the answer. From trainee fighter pilots to medical applications trainee surgeons, virtual reality allows us to take virtual risks in order to gain real world experience. As the cost of virtual reality goes down and it becomes more mainstream you can expect more serious uses, such as education or productivity applications, to come to the fore. Virtual reality and its cousin augmented reality could substantively change the way we interface with our digital technologies.

So finally it can be summarized as, Virtual reality is the creation of a virtual environment presented to our senses in such a way that we experience it as if we were really there. It uses a host of technologies to achieve this goal and is a technically complex feat that has to account for our perception and cognition. It has both entertainment and serious uses. The technology is becoming cheaper and more widespread. We can expect to see many more innovative uses for

the technology in the future and perhaps a fundamental way in which we communicate and work thanks to the possibilities of virtual reality.

## BPO and KPO

### BPO

Business process outsourcing (BPO) is the contracting of a specific business task, such as payroll, human resources (HR) or accounting, to a third-party service provider. Usually, BPO is implemented as a cost-saving measure for tasks that a company requires but does not depend upon to maintain their position in the marketplace.

Two categories BPO is often divided into are back office outsourcing, which includes internal business functions such as billing or purchasing, and front office outsourcing, which includes customer-related services such as marketing or tech support.

Back office outsourcing offers organizations services to help manage tasks like data entry, data management, surveys, payment processing, quality assurance and accounting support. Back office tasks are integral to a company's core business process and help keep business running smoothly.

Front office outsourcing services deal with customer interactions. Examples of front office tasks include phone conversations, email, fax and other forms of communication with customers. Front office outsourcing providers' service lists include:

- Telemarketing
- Customer service/support
- Technical support/help desk
- Appointment scheduling
- Inbound/outbound sales
- Market research

BPO that is contracted outside a company's own country is sometimes called *offshore* outsourcing. BPO that is contracted to a company's neighboring country is sometimes called *nearshore* outsourcing, and BPO that is contracted with the company's own country is sometimes called *onshore* outsourcing.

Some benefits of BPO are:

- Speed and efficiencies of outsourced business processes are enhanced
- Organizations using BPO get access to the latest technology
- Freedom and flexibility to choose the most relevant services for the company's operations
- Quick and accurate reporting
- Save on resources related to staffing and training.

Disadvantages of BPO are:

- Data privacy breaches
- Underestimating running costs of services
- Overdependence on service providers
- Communication issues that delay project completion.

## KPO

Knowledge process outsourcing (KPO) is a form of outsourcing in which knowledge- and information-related work is carried out by workers in a different company or by a subsidiary of the same organization. This subsidiary may be in the same country or in an offshore location to save costs or other resources. Companies resort to knowledge process outsourcing when they have a shortage of skilled professionals and have the opportunity to hire skilled workers earning lower wages in another location for a lower overall cost.

Knowledge process outsourcing (KPO) is the allocation of relatively high-level tasks to an outside organization or a different group in a different geographic location. Examples of KPO include long-term jobs for intellectual, analytical and knowledgeable people within industries such as research and development, financial consultancy and services, business and technical analysis and many others. KPO services include all kinds of research and information gathering, e.g. intellectual property research for patent applications; equity research, business and market

research, legal and medical services; training, consultancy, and research and development in fields such as pharmaceuticals and biotechnology; and animation and design, etc.

Some benefits of KPO are:

- Cost reduction
- Shortage of skilled employees
- Provides many graduates at very low cost
- High end services are provided at a lower cost to decrease unemployment and benefit their economy
- Provide flexibility in terms of HRM & time management

Some drawbacks of KPO are:

- Security- Classified information about the company can be lost
- Key talent retention
- The character of the employee and the quality of the work cannot be assured
- KPO is time consuming and cannot provide a quick fix to the company seeking immediate results.
- Lack of communication between partners due to legal, language and cultural barriers can lead to complications.

## MORAL, SOCIAL AND ETHICAL ISSUES OF INTERNET

The World Wide Web, for example, makes it possible for people to access a wealth of information from the comfort of their own homes. E-mail capabilities enable individuals to communicate information from one country to another at a fraction of what it would cost to do so by making an international telephone call. Bulletin boards and discussion lists provide large groups of like-minded persons with a forum in which they can exchange ideas. All of these media are fully available to the user at any time of the day.

The unique capabilities of these new technologies, however, have also given rise to novel legal, social, and ethical problems. The unprecedented development of Internet raises a series of questions regarding the users' ethical behavior.

Moral issues:

- Pages may be set up containing the wrong information.
- Bullying may occur in online chat rooms and social media networks.
- Explicit content can be viewed online.
- Easy to spread rumors online.

#### Social Issues:

- Privacy issues as social networking sites, email etc invade the users privacy.
- Online betting and gambling sites further promote gambling addiction.
- Use of the internet for prolonged periods of time is not healthy.
- Addiction to social media and online gaming for children is a cause for concern.

#### Ethical Issues:

- Plagiarism occurs, users take information from the internet and do not reference the original source.
- Spam, Companies monitor staff email and their internet use.
- Using somebody wireless signal without their consent.

Three issues that need to be taken much care are: privacy, anonymity and trust. Privacy is analyzed from the point of view of philosophy of rights and from the point of view of the ethical responsibility of the site owners to protect internet user personal data. Anonymity and trust are treated together, trust can be built between online anonyms as a duty regarding respect and moral behavior between two human beings, even if they don't know each other.

There is a link between privacy, anonymity and trust. Anonymity can protect privacy because the social network user is not forced to provide his/her personal data. Also, in this situation the site administrator doesn't have any moral issues regarding the users' personal data. Anonymity can also be seen as fleeing from moral responsibility, from our actions in the social networking virtual world. Also, anonymity doesn't suppose lack of trust between users. Trust can be created as a game of chance, or as moral duty between different human beings. The relation between privacy and trust is a difficult one at the user's level because the user most of the time is unconscious about the dangers of posting personal information about him/herself. The same relation raises difficult issues on the duty of online social networks administrators about how they can use the data provided by the online users in commercial or third parties interests.

## YOUTUBE

YouTube is a video sharing service that allows users to watch videos posted by other users and upload videos of their own. The service was started as an independent website in 2005 and was acquired by Google in 2006. Videos that have been uploaded to YouTube may appear on the YouTube website and can also be posted on other websites, though the files are hosted on the YouTube server.

The slogan of the YouTube website is "Broadcast Yourself." This implies the YouTube service is designed primarily for ordinary people who want to publish videos they have created. While several companies and organizations also use YouTube to promote their business, the vast majority of YouTube videos are created and uploaded by amateurs.

YouTube videos are posted by people from all over the world, from all types of backgrounds. Therefore, there is a wide range of videos available on YouTube. Some examples include amateur films, homemade music videos, sports bloopers, and other funny events caught on video. People also use YouTube to post instructional videos, such as step-by-step computer help, do-it-yourself guides, and other how-to videos. Since Google offers revenue sharing for advertisement clicks generated on video pages, some users have been able to turn YouTube into a profitable enterprise.

While YouTube can serve a business platform, most people simply visit YouTube for fun. Since so many people carry digital cameras or cell phones with video recording capability, more events are now captured on video than ever before.

## FACEBOOK

Facebook is a social networking website that was originally designed for college students, but is now open to anyone 13 years of age or older. Facebook users can create and customize their own profiles with photos, videos, and information about themselves. Friends can browse the profiles of other friends and write messages on their pages.

Each Facebook profile has a "wall," where friends can post comments. Since the wall is viewable by all the user's friends, wall postings are basically a public conversation. Therefore, it is usually best not to write personal messages on your friends' walls. Instead, you can send a person a private message, which will show up in his or her private Inbox, similar to an e-mail message.

Facebook allows each user to set privacy settings, which by default are pretty strict. For example, if you have not added a certain person as a friend, that person will not be able to view your profile. However, you can adjust the privacy settings to allow users within your network (such as your college or the area you live) to view part or all of your profile. You can also create a "limited profile," which allows you to hide certain parts of your profile from a list of users that you select. If you don't want certain friends to be able to view your full profile, you can add them to your "limited profile" list.

Another feature of Facebook, which makes it different from MySpace, is the ability to add applications to your profile. Facebook applications are small programs developed specifically for Facebook profiles. Some examples include SuperPoke (which extends Facebook's "poke" function) and FunWall (which builds on the basic "wall" feature). Other applications are informational, such as news feeds and weather forecasts. There are also hundreds of video game applications that allow users to play small video games, such as Jetman or Tetris within their profiles. Since most game applications save high scores, friends can compete against each other or against millions of other Facebook users.

Facebook provides an easy way for friends to keep in touch and for individuals to have a presence on the Web without needing to build a website. Since Facebook makes it easy to upload pictures and videos, nearly anyone can publish a multimedia profile. Of course, if you are a Facebook member or decide to sign up one day, remember to use discretion in what you publish or what you post on other user's pages. After all, your information is only as public as you choose to make it!

## LINKEDIN

LinkedIn is a social networking site designed specifically for the business community. The goal of the site is to allow registered members to establish and document networks of people they know and trust professionally.

A LinkedIn member's profile page, which emphasizes skills, employment history and education, has professional network news feeds and a limited number of customizable modules. Basic membership for LinkedIn is free. Network members are called "connections." Unlike other free

social networking sites like Facebook or Twitter, LinkedIn requires connections to have a pre-existing relationship.

With basic membership, a member can only establish connections with someone he has worked with, knows professionally (online or offline) or has gone to school with. Connections up to three degrees away (see six degrees of separation) are seen as part of the member's network, but the member is not allowed to contact them through LinkedIn without an introduction. Premium subscriptions can be purchased to provide members with better access to contacts in the LinkedIn database.

LinkedIn was co-founded by Reid Hoffman, a former Executive Vice President in charge of business and corporate development for PayPal. The site, which was launched in May 2003, currently has over 300 million members from 200 countries, representing 170 industries. According to Reid Hoffman, 27 percent of LinkedIn subscribers are recruiters. Microsoft acquired LinkedIn in June of 2016 for \$26.2 billion.

### ORKUT

A social networking site sponsored by Google and named after Google developer Orkut Buyukkokten. Launched in early 2004, Orkut was originally an invitation-only site, but was later opened to the general public. Membership exceeded 40 million users within two years. The majority of Orkut users are from Brazil, India and Japan, and the service is hosted in Google's Brazilian facilities.

Like other social networks, orkut facilitates communication and interaction between friends, colleagues and family. Orkut users may upload videos and pictures and utilize a "like" feature to share interesting Web pages and content.

Despite its popularity, orkut is plagued with user security issues, including hacking and spam. Google has initiated strides toward preventing and eliminating security issues and has made some headway against them.

## INTERNET TECHNOLOGY AND WORLD WIDE WEB

### WORLD WIDE WEB

The World Wide Web (WWW) most often referred to simply as "the Web" is a network of online content that is formatted in HTML and accessed via HTTP. The term refers to all the interlinked

HTML pages that can be accessed over the Internet. The World Wide Web was originally designed in 1991 by Tim Berners-Lee while he was a contractor at CERN.

The World Wide Web is what most people think of as the Internet. It is a collection of web pages. It is all the Web pages, pictures, videos and other online content that can be accessed via a Web browser. The Internet, in contrast, is the underlying network connection that allows us to send email and access the World Wide Web. The early Web was a collection of text-based sites hosted by organizations that were technically gifted enough to set up a Web server and learn HTML. It has continued to evolve since the original design, and it now includes interactive (social) media and user-generated content that requires little to no technical skills.

### WEB BROWSERS

A web browser (commonly referred to as a browser) is a software application for retrieving, presenting, and traversing information resources on the World Wide Web. An information resource is identified by a Uniform Resource Identifier/Locator (URI/URL) and may be a web page, image, video or other piece of content. Although browsers are primarily intended to use the World Wide Web, they can also be used to access information provided by web servers in private networks or files in file systems.

Technically, a Web browser is a client program that uses HTTP (Hypertext Transfer Protocol) to make requests of Web servers throughout the Internet on behalf of the browser user. Most browsers support e-mail and the File Transfer Protocol (FTP) but a Web browser is not required for those Internet protocols and more specialized client programs are more popular. The first Web browser with a graphical user interface was Mosaic, which appeared in 1993. Many of the user interface features in Mosaic went into Netscape Navigator. Microsoft followed with its Internet Explorer (IE).

The major web browsers are Firefox, Google Chrome, Internet Explorer/Microsoft Edge, Opera, and Safari.

### INTERNET ADDRESS

An Internet address uniquely identifies a node on the Internet. Internet address may also refer to the name or IP of a Web site (URL). The term Internet address can also represent someone's e-mail address. An Internet Protocol address (IP address) is a numerical label assigned to each device (e.g., computer, printer) participating in a computer network that uses the Internet

Protocol for communication. An internet address serves two principal functions: host or network interface identification and location addressing. Its role has been characterized as follows: "A name indicates what we seek. An address indicates where it is. A route indicates how to get there."

The designers of the Internet Protocol defined an Internet address as a 32-bit number and this system, known as Internet Protocol Version 4 (IPv4), is still in use today. However, because of the growth of the Internet and the predicted depletion of available addresses, a new version of IP (IPv6), using 128 bits for the address, was developed in 1995.

## DOMAIN NAME

A domain name locates an organization or other entity on the Internet. For example, the domain name `www.google.com` locates an Internet address for "google.com" at Internet address and a particular host server named "www."

The "com" part of the domain name reflects the purpose of the organization or entity (in this example, "commercial") and is called the top-level domain name. The "google" part of the domain name defines the organization or entity and together with the top-level is called the second-level domain name. The second-level domain name maps to and can be thought of as the "readable" version of the Internet address. A third level can be defined to identify a particular host server at the Internet address. In our example, "www" is the name of the server that handles Internet requests. A third level of domain name is not required. For example, the fully-qualified domain name could have been "totalbaseball.com" and the server assumed.

Second-level domain names must be unique on the Internet and registered with one of the ICANN-accredited registrars for the COM, NET, and ORG top-level domains. Where appropriate, a top-level domain name can be geographic.

On the Web, the domain name is that part of the Uniform Resource Locator(URL) that tells a domain name server using the domain name system (DNS) whether and where to forward a request for a Web page. The domain name is mapped to an IP address (which represents a physical point on the Internet).

More than one domain name can be mapped to the same Internet address. This allows multiple individuals, businesses, and organizations to have separate Internet identities while sharing the same Internet server.

### E- MAIL

Short for electronic mail, e-mail or email is information stored on a computer that is exchanged between two users over telecommunications. More plainly, e-mail is a message that may contain text, files, images, or other attachments sent through a network to a specified individual or group of individuals. The first e-mail was sent by Ray Tomlinson in 1971. By 1996, more electronic mail was being sent than postal mail. E-mail, a mail you can send or receive directly on your computer. People can actually write you letters and send them to your computer, and you can turn on your computer and go pick up your mail whenever it's convenient. But now a days e-mail is used to electronically send and receive small files, music and videos almost instantly. Although basically a method of passing messages from one computer to another email is becoming increasingly popular, in part because those computers sending messages to each other could be in adjacent offices or on opposite sides of the world. In fact the ability to send a letter or memo halfway across the world at the speed of electricity instead of the more traditional postal services is one of the strengths of the Internet. Because of email even the remotest office can maintain practically instant communication with headquarters, or even another remote office. E-mail may not be as personal as a handwritten note, but it's the quickest and most convenient way yet to communicate written information. If something absolutely positively has to be there in ten minutes, e-mail can get it there on time. To send or receive e-mail, you must have a modem or your computer has to be on a network (Internet).

Anyone who wants to make use of e-mail, needs to have a valid e-mail ID. An e-mail ID has four parts, the user name, @ sign, domain name and a domain suffix

Eg. [shakeelmasoodi5@gmail.com](mailto:shakeelmasoodi5@gmail.com) (shakeelmasoodi5, @, gmail, .com)

- valid e-mail address
- There are several rules that an e-mail address must follow to be valid:
- As mentioned earlier, an e-mail must have a username followed by an @ (at sign) which is followed by the domain name with a domain suffix.

- The username cannot be longer than 64 characters long and the domain name cannot be longer than 254 characters.
- There should be only one @ sign in an e-mail address.
- The space and special characters: ( ) , : ; < > \ [ ] are allowed. Occasionally, aspace, backslash, and quotation mark work but must be preceded with a forward slash. Although valid, some e-mail providers do not allow these characters.
- The username and e-mail addresses as a whole cannot begin or end with a period.
- The e-mail must not have two or more consecutive periods.

So following points must be remembered:

- The first part of all e-mail addresses, the part before the @ symbol, contains the alias, user, group, or department of a company. In the above example shakeelmasoodi5 is the user at gmail.
- Next, the @ (at sign) is used as a divider in the e-mail address; it is required for all SMTP e-mail addresses since the first message was sent by Ray Tomlinson.
- Finally, gmail.com is the domain name to which the user belongs.

### How To Send And Receive E-Mail

#### E-mail Program:

To send and receive e-mail messages, you can use an e-mail program, also known as an e-mail client, such as Microsoft Outlook or Mozilla Thunderbird. When using an e-mail client, you must have a server that stores and delivers your messages, which is provided by your ISP or in some cases, another company. An e-mail client needs to connect to a server to download new e-mail, whereas email stored online updates automatically when you visit the site.

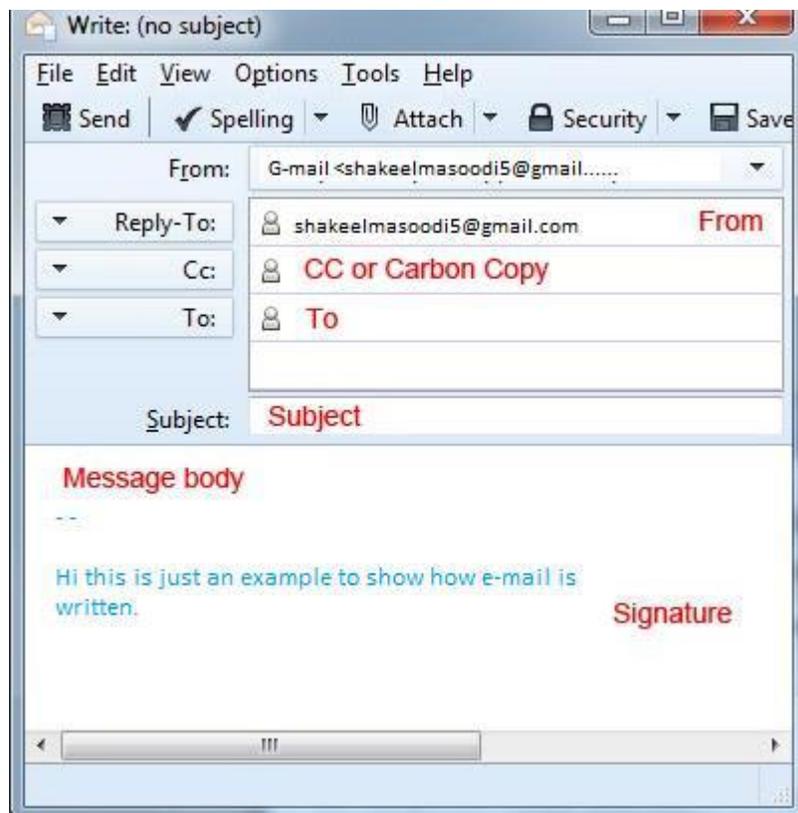
#### E-mail Online:

An alternative way of sending and receiving e-mail (and the more popular solution for most people) is an online e-mail service or webmail. Examples include Hotmail (now Outlook.com), Gmail, and Yahoo Mail. Many of the online e-mail services, including the ones we just mentioned, are free or have a free account option.

## Writing An E-Mail

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

- The *To* field is where you type the e-mail address of the person who is the recipient of your message.
- The *From* field should contain your e-mail address.
- If you are replying to a message, the *To* and *From* fields are automatically filled out; if it's a new message, you'll need to enter them manually.
- The *CC* or Carbon Copy field allows you to send a copy of the message to another e-mail address, but is not mandatory.
- The *Subject* Line, although not required, should consist of a few words describing the e-mail's contents.
- Finally, the *Message Body* is the location you type your main message. It often contains your signature at the bottom; similar to a hand-written letter.



## VOICE MAIL

Voicemail is a method of storing voice messages electronically for later retrieval by intended recipients. Callers leave short messages that are stored on digital media (or, in some older systems, on analog recording tape).

Originally, voicemail was developed for telephony as a means to prevent missed calls, and also to facilitate call screening. In recent years, voicemail has become integrated with the Internet, allowing users to receive incoming messages on traditional computers as well as on tablets and mobile phones.

Microsoft Exchange is a popular platform for voicemail with desktop and notebook computers. Users can play their voicemail messages either as audio (MP3) or as text. In order to play a voicemail or read it as text, the user simply clicks on an inbox item, just as would be done with an ordinary e-mail message.

One particularly interesting development is the integration of voicemail with e-mail. Google Voice, for example, can translate voice messages into text for viewing on mobile and tablet devices. Google Voice also allows free or low-cost worldwide texting. Users can set up custom greetings for various callers. Address books can be shared across multiple platforms such as e-mail, a landline phone, and a mobile phone. Google Voice and similar applications work in effect like voice-enabled e-mail in reverse.

Proponents of voicemail-to-text, voice-enabled e-mail, and unified messaging assert that these applications have largely dissolved the barriers between data networks and traditional voice networks.