Unit-I Introduction to Computer-Classification of Digital Computer System-Computer Architecture-Memory Storage-Auxiliary Storage Device-Input and Output Devices.

INTRODUCTION TO COMPUTER

A **computer** is an electronic device that receives input, stores or processes the input as per user instructions and provides output in desired format.

GENERATION OF COMPUTER

The history of the computer dates back to several years. There are five prominent generations of computers. Each generation has witnessed several technological advances which change the functionality of the computers. This results in more compact, powerful, robust systems which are less expensive. The brief history of computers is discussed below −

FIRST GENERATION (1940-1956)

The first-generation computers had the following features and components −

Hardware

The hardware used in the first generation of computers was: **Vacuum Tubes** and **Punch Cards**.

Features

Following are the features of first-generation computers −

- It supported machine language.
- It had slow performance
- It occupied large size due to the use of vacuum tubes.
- It had a poor storage capacity.
- It consumed a lot of electricity and generated a lot of heat.

Memory

The memory was of 4000 bits.

Data Input

The input was only provided through hard-wired programs in the computer, mostly through punched cards and paper tapes.

Examples

The examples of first generation computers are −

- ENIAC
- UNIVACTBM 701

SECOND GENERATION (1956-1963)

Several advancements in the first-gen computers led to the development of second-generation computers. Following are various changes in features and components of second-generation computers −

Hardware

The hardware used in the second generation of computers were −

- Transistors
- Magnetic Tapes

Features

It had features like −

- Batch operating system
- Faster and smaller in size
- Reliable and energy efficient than the previous generation
- Less costly than the previous generation

Memory

The capacity of the memory was 32,000 bits.

Data Input

The input was provided through punched cards.

Examples

The examples of second-generation computers are −

- Honeywell 400
- CDC 1604
- IBM 7030

THIRD GENERATION (1964-1971)

Following are the various components and features of the third-generation computers −

Hardware

The hardware used in the third generation of computers were −

- Integrated Circuits made from semi-conductor materials
- Large capacity disks and magnetic tapes

Features

The features of the third-generation computers are −

- Supports time-sharing OS
- Faster, smaller, more reliable and cheaper than the previous generations
- Easy to access

Memory

The capacity of the memory was 128,000 bits.

Data Input

The input was provided through keyboards and monitors.

Examples

The examples of third generation computers are −

- IBM 360/370
- CDC 6600
- PDP 8/11

Fourth Generation (1972-2010)

Fourth generation computers have the following components and features −

Hardware

The Hardware used in the fourth generation of computers were −

- ICs with Very Large-Scale Integration (VLSI) technology
- Semiconductor memory
- Magnetic tapes and Floppy

Features

It supports features like −

- Multiprocessing & distributed OS
- Object-oriented high-level programs supported
- Small & easy to use; hand-held computers have evolved
- No external cooling required & affordable
- This generation saw the development of networks and the internet
- It saw the development of new trends in GUIs and mouse

Memory

The capacity of the memory was 100 million bits.

Data Input

The input was provided through improved hand held devices, keyboard and mouse.

Examples

The examples of fourth generation computers are −

- Apple II
- VAX 9000
- CRAY 1 (super computers)

Fifth Generation (2010-Present)

These are the modern and advanced computers. Significant changes in the components and operations have made fifth generation computers handy and more reliable than the previous generations.

APPLICATION OF COMPUTER

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

Home

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

Medical Field

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

Entertainment

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

Industry

Computers are used to perform several tasks in industries like managing inventory, designing purpose, creating virtual sample products, interior designing, video conferencing, etc. Online marketing has seen a great revolution in its ability to sell various products to inaccessible corners like interior or rural areas. Stock markets have seen phenomenal participation from different levels of people through the use of computers.

Education

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

Government

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

Banking

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

Business

Nowadays, computers are totally integrated into business. The main objective of business is transaction processing, which involves transactions with suppliers, employees or customers. Computers can make these transactions easy and accurate. People can analyze investments, sales, expenses, markets and other aspects of business using computers.

Training

Many organizations use computer-based training to train their employees, to save money and improve performance. Video conferencing through computers allows saving of time and travelling costs by being able to connect people in various locations.

Arts

Computers are extensively used in dance, photography, arts and culture. The fluid movement of dance can be shown live via animation. Photos can be digitized using computers.

Science and Engineering

Computers with high performance are used to stimulate dynamic process in Science and Engineering. Supercomputers have numerous applications in area of Research and Development (R&D). Topographic images can be created through computers. Scientists use computers to plot and analyze data to have a better understanding of earthquakes.

CHARACTERISTICS OF COMPUTER
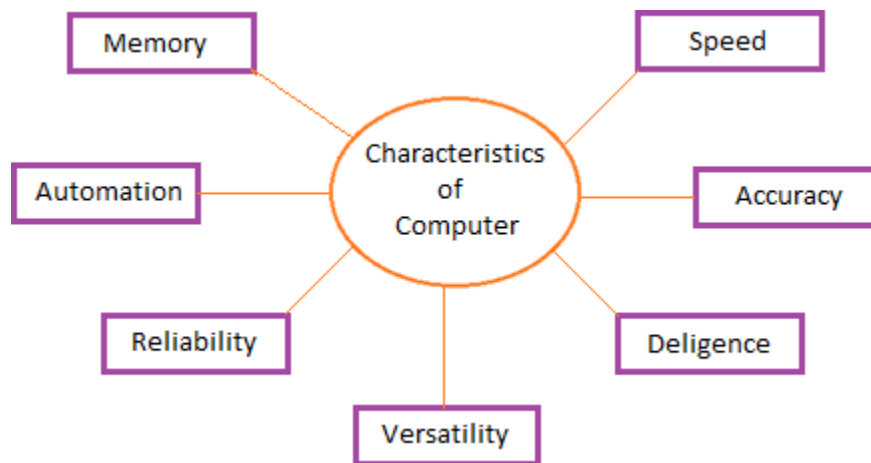
Speed

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

Accuracy

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

Diligence

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

Versatility

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

Reliability

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

Automation

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

Memory

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

COMPONENTS OF COMPUTER

Computer consist of Hardware and Software.

Hardware

The term hardware refers to mechanical device that makes up computer. Computer hardware consists of interconnected electronic devices that we can use to control computer's operation, input and output. Examples of hardware are CPU, keyboard, mouse, hard disk, etc.

Software

A set of instructions that drives computer to do stipulated tasks is called a program. Software instructions are programmed in a computer language, translated into machine language, and executed by computer. Software can be categorized into two types −

- System software
- Application software

System Software

System software operates directly on hardware devices of computer. It provides a platform to run an application. It provides and supports user functionality. Examples of system software include operating systems such as Windows, Linux, Unix, etc.

Application Software

An application software is designed for benefit of users to perform one or more tasks. Examples of application software include Microsoft Word, Excel, PowerPoint, Oracle, etc.

CLASSIFICATION OF DIGITAL COMPUTERS

The digital computers that are available now a days vary in their sizes and types. These digital computers are broadly classified into four categories based on their size and type.

- Micro Computer
- Mini Computer
- Mainframe Computer
- Super Computer

MICRO COMPUTER:

- ☐ Micro Computer are small low cast and single user digital computers.
- ☐ It is a device with microprocessor, Input unit, storage unit and CPU (Central Processing Unit).
- ☐ Microcomputer Computer formerly a commonly used term for Personal Computers particularly any of class of any small digital computers. Its CPU contained on a single integrated semi-conductor chip.
- ☐ IBM PC based on Pentium microprocessor and Apple Macintosh are some Examples of microcomputers.
- ☐ Microcomputers include desktop computers, notebook computers or laptop, tablet compute, handheld computer, smartphones and notebook.

Types of Micro Computers:

A) Desktop Computer or Personal Computer(PC):
- It is the most type of microcomputer. A desktop computer is a personal computer designed for regular use at a single location on or near a desk or table due to its size and power requirements.
- It is not very expensive and is suited t the needs of a single user at home, small business units, and organization.
  Examples: Apple, Microsoft, Dell and Lenovo, Sony, HP etc., are some of the PC manufactures.

B) Notebook Computers or Laptop:
- A laptop is a small, portable computer and have all the features of a desktop computer.
- The advantage of the laptop is that it is small in size, so it can be carried anywhere. Notebook computers use a variety of techniques, known as flat-panel technologies, to produce a lightweight and non-bulky display screen.
- Laptops Computers are costlier than the desktop computers.

C) Netbook:

- These are smaller notebooks optimized for low weight and low cost, and are designed for accessing web-based applications.
- Netbooks deliver the performance needed to enjoy popular activities like streaming videos ort music, e-mailing, web surfing or instant messaging.

D) Tablet:

- A tablet is a wireless, portable personal computer with a touchscreen interface.
- The tablet form factor is typically smaller than a notebook computer, but larger than a smartphone.

E) Handheld Computer or Personal Digital Assistant(PDA):
- It is a small computer that can be held on the top of the palm.
- It is small in size. PDA uses a pen or a stylus for input, instead of the keyboard. They have a limited memory and are less pitiful.
- PDAs can be connected to the internet via wireless connection.

F) Smart Phones:
- A smartphone is a mobile phone with highly advanced features.
- A typical smartphone has a high-resolution touch screen display, Wi-Fi connectivity, Web browsing capabilities, and the ability to accept sophisticated applications.
- The majority of these devices run on any of these popular mobile operating systems: Android, Symbian, iOS, BlackBerry OS and Windows Mobile.

MINI COMPUTER

- These perform multi-tasking and allow terminals to be connected to their services. The ability to connect minicomputers to each other and mainframes has popularized them among larger businesses.
- This use is being challenged by the development in the microcomputer range and the practice of starting resources of microcomputer under a network.
- Minicomputer are still recognized as being able to process large amounts of data.

Types of minicomputer

The types of minicomputer are- tablet PC, Desktop minicomputers, cell phones, notebooks, high-end mP3 players, etc.

Examples:- IBM'sAS/400e

MAINFRAME COMPUTER

Main frame computers generally require special attention and are kept in a controlled atmosphere. They are multi-tasking and generally used in areas where large database is maintained example as government agency or airline industry.

Examples: - IBM Linux ONE

SUPER COMPUTER

- Super Computers operate very fast and have multiple processors. There are very few of these machines in existence due to their cost.
- This type of computer has been developed for scientific applications usually involving complex arithmetic and mathematical operations. One such use is in weather forecasting.
- A super computer is a type of computer that has the architecture, resources and components to achieve massive computing power. Although advances like multi-core processors and GPGPUs (general-purpose graphics processing units) have enabled powerful machines for personal use (see: desktop supercomputer, GPU supercomputer), by definition, a supercomputer is exceptional in terms of performance.

China has owned the fastest supercomputer in the world. "Fast" is defined by the number of petaflops the computer system can perform. A petaflop is one thousand teraflops, or one quadrillion floating-point operations per second.

| Year	Supercomputer	Peak speed	Location
2016	Sunway TaihuLight	93.01 PFLOPS	Wuxi, China
2013	NUDT Tianhe-2	33.86 PFLOPS	Guangzhou, China
2012	Cray Titan	17.59 PFLOPS	Oak Ridge, U.S.
2012	IBM Sequoia	17.17 PFLOPS	Livermore, U.S.
2011	Fujitsu K computer	10.51 PFLOPS	Kobe, Japan

COMPUTER ARCHITECTURE

Computer systems consist of three components. **Central Processing Unit, Input devices and Output devices**. Input devices provide data input to processor, which processes data and generates useful information that's displayed to the user through output devices. This is stored in computer's memory.
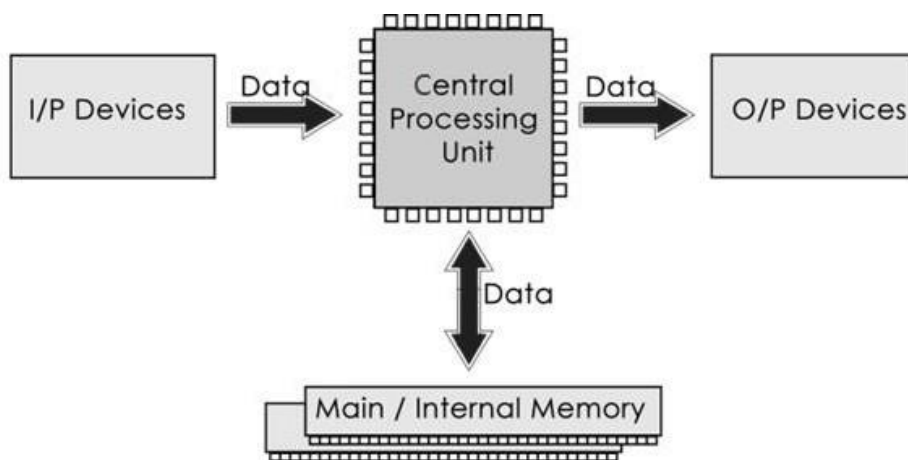
Central Processing Unit

The Central Processing Unit (CPU) is called "the brain of computer" as it controls operation of all parts of computer. It consists of two components: Arithmetic Logic Unit (ALU), and Control Unit.
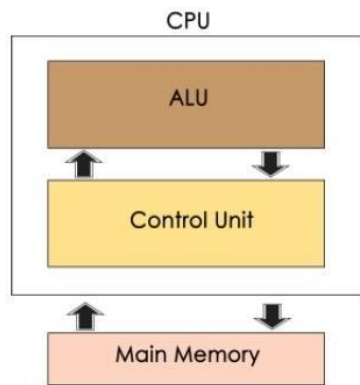
Arithmetic Logic Unit (ALU)

Data entered into computer is sent to RAM, from where it is then sent to ALU, where rest of data processing takes place. All types of processing, such as comparisons, decision-making and processing of non-numeric information takes place here and once again data is moved to RAM.

Control Unit

As name indicates, this part of CPU extracts instructions, performs execution, maintains and directs operations of entire system.

Functions of Control Unit

Control unit performs following functions −

- It controls all activities of computer
- Supervises flow of data within CPU
- Directs flow of data within CPU
- Transfers data to Arithmetic and Logic Unit
- Transfers results to memory
- Fetches results from memory to output devices

Memory Unit

This is unit in which data and instructions given to computer as well as results given by computer are stored. Unit of memory is "Byte".
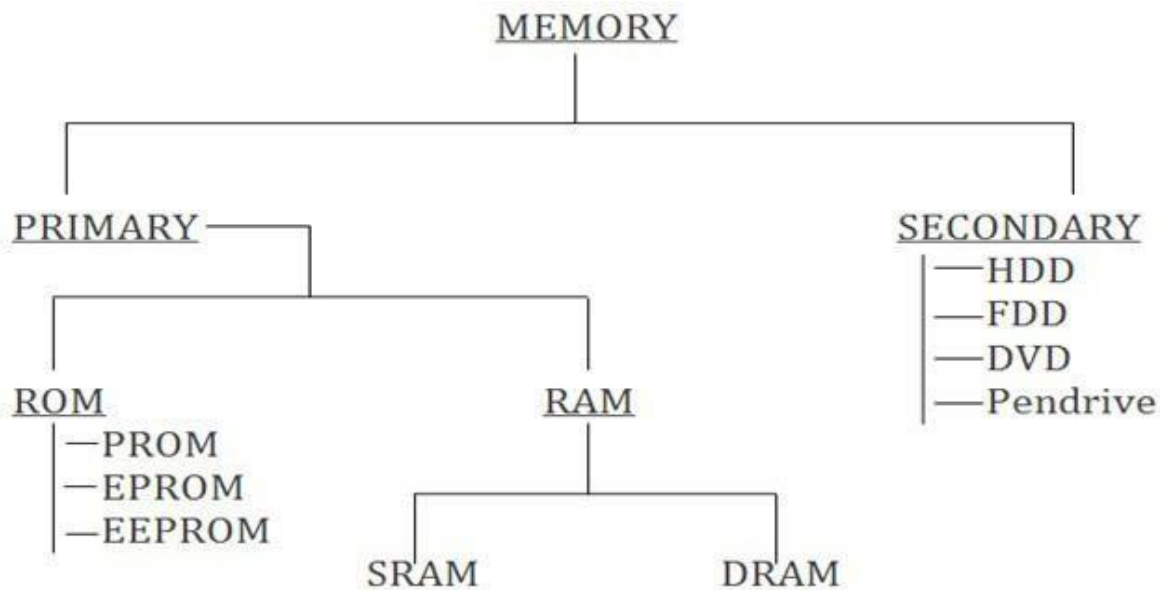
1 Byte = 8 Bits

Memory

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells. Each location or cell has a unique address, which varies from zero to memory size minus one. For example, if the computer has 64k words, then this memory unit has 64 * 1024 = 65536 memory locations. The address of these locations varies from 0 to 65535.

Memory is primarily of two types:

- Primary Memory/Main Memory
- Secondary Memory

```
                          MEMORY
                             |
        +--------------------+--------------------+
        |                                         |
   PRIMARY----------+                        SECONDARY
        |           |                          |—HDD
        |           |                          |—FDD
        |           |                          |—DVD
      ROM          RAM                         |—Pendrive
      |—PROM        |
      |—EPROM    +--+--+
      |—EEPROM   |     |
               SRAM  DRAM
```

Primary and Secondary Memory in Computer

RAM - ROM

HDD

VidyaGyaan.com

Cache Memory

Cache memory is a very high-speed semiconductor memory which can speed up the CPU. It acts as a buffer between the CPU and the main memory. It is used to hold those parts of data and program which are most frequently used by the CPU. The parts of data and programs are transferred from the disk to cache memory by the operating system, from where the CPU can access them.

Advantages

The advantages of cache memory are as follows −

- Cache memory is faster than main memory.
- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.

Disadvantages

The disadvantages of cache memory are as follows −

- Cache memory has limited capacity.
- It is very expensive.

Primary Memory (Main Memory)

Primary memory holds only those data and instructions on which the computer is currently working. It has a limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. These memories are not as fast as registers. The data and instruction required to be processed resides in the main memory. It is divided into two subcategories RAM and ROM.

a) **Random Access Memory (RAM):** The primary storage is referred to as Random Access Memory (RAM) because it is possible to randomly select and use any location of the memory directly to store and retrieve data. It takes same time to any address of the memory as the first address. It is also called read/write memory. The storage of data and instructions inside the primary storage is temporary. It disappears from RAM as soon as the power to the computer is switched off. The memories, which lose their content on failure of power supply, are known as volatile memories. So now we can say that RAM is volatile memory

b) **Read Only Memory (ROM):** There is another memory in computer, which is called Read Only Memory (ROM). it is the ICs inside the PC that form the ROM. The storage of program and data in the ROM is permanent. The ROM stores some standard processing programs supplied by the manufacturers to operate the personal computer. The ROM can only be read by the CPU but it cannot be changed. The basic input/output program is stored in the ROM that examines and initializes various equipment attached to the PC when the switch is turned ON. The memories, which do not lose their content on failure of power supply, are known as non-volatile memories. ROM is non-volatile memory.

c) **PROM:** There is another type of primary memory in computer, which is called Programmable Read Only Memory (PROM). You know that it is not possible to modify or erase programs stored in ROM, but it is possible for you to store your program in PROM chip. Once the programs are written it cannot be changed and remain intact even if power is switched off. Therefore, programs or instructions written in PROM or ROM cannot be erased or changed.

d) **EPROM:** This stands for Erasable Programmable Read Only Memory, which overcome the problem of PROM and ROM. EPROM chip can be programmed time and again by erasing the information stored earlier in it. Information stored in EPROM can be erased by exposing it to ultraviolet light. This memory can be reprogrammed using a special programming facility. When the EPROM is in use, information can only be read.

e) EAPROM: This stands for Electrically Alterable Programmable Read Only Memory. This concept is same as that of EPROM. The only difference is that the memory can be altered using electrical signals. The whole of the memory need not be erased.

f) Cache Memory: The speed of CPU is extremely high compared to the access time of main memory. Therefore, the performance of CPU decreases due to the slow speed of main memory. The decreases the mismatch in operating speed, a small memory chip is attached between CPU and Main memory whose access time is very close to the processing speed of CPU. It is called CACHE memory. CACHE memories are accessed much faster than conventional RAM. It is used to store programs or data currently being executed or temporary data frequently used by the CPU. It is also very expensive to have bigger size of cache memory. Its size is therefore, normally kept small.

g) Registers: The CPU processes data and instruction with high speed. There is also movement of data between various units of the computer. It is necessary to transfer the processed data with high speed. So, the computer uses a number of special memory units called registers. They are not part of the main memory but they store data or information temporarily and pass it on as directed by the control unit.

Secondary Storage You are now clear that the operating speed of primary memory or main memory should be as fast as possible to cope up with the CPU speed. These high-speed storage devices are very expensive and hence the cost per bit of storage is also very high. Again, the storage capacity of the main memory is also very limited. Often it is necessary to store hundreds of millions of bytes of data for the CPU to process. Therefore, additional memory is required in all the computer systems. This memory is called auxiliary memory or secondary storage.

In this type of memory, the cost per bit of storage is low. However, the operating speed is slower than that of the primary memory. Huge volume of data is stored here on permanent basis and transferred to the primary storage as and when required. Most widely used secondary storage devices are magnetic tapes, magnetic disks and floppy disks.

Magnetic Tape: Magnetic tapes are used for large computers like mainframe computers where large volume of data is stored for a longer time. In PCs also you can use tapes in the form of cassettes. The cost of storing data in tapes is inexpensive. Tapes consist of magnetic materials that store data permanently. It can be 12.5 mm to 25 mm wide plastic film-type and 500 meters to 1200 meters long which is coated with magnetic material. The deck is connected to the central

processor and information is fed into or read from the tape through the processor. It is similar to cassette tape recorder.

Advantages of Magnetic Tape l Compact: A 10-inch diameter reel of tape is 2400 feet long and is able to hold 800, 1600 or 6250 characters in each inch of its length. The maximum capacity of such type is 180 million characters. Thus, data are stored much more compact on tape

Economical: The cost of storing characters on tape is very less as compared to other storage devices. l Fast: Copying of data is easier and fast. l Long term Storage and Re-usability: Magnetic tapes can be used for long term storage and a tape can be used repeatedly without loss of data.

Magnetic Disk You might have seen the gramophone record, which is circular like a disk and coated with magnetic material. Magnetic disks used in computer are made on the same principle. It rotates with very high speed inside the disk drive. Data are stored on both the surface of the disk. Magnetic disks are most popular for direct access storage. Each disk consists of a number of invisible concentric circles called tracks. Information is recorded on tracks of a disk surface in the form of tiny magnetic sports. The presence of a magnetic sport represents one bit (1) and its absence represents zero bit (0). The information stored in a disk can be read many times without affecting the stored data. So, the reading operation is non-destructive. But if you want to write a new data, then the existing data is erased from the disk and new data is recorded.

Floppy Disk It is similar to magnetic disk discussed above. It is 3.5 inch in diameter. The capacity of a 3.5-inch floppy is 1.44 megabytes. It is cheaper than any other storage devices and is portable. The floppy is a low-cost device particularly suitable for personal computer system.

Optical Disk With every application and software there is greater demand for memory capacity. It is the necessity to store large volume of data that has led to the development of optical disk storage medium. Optical disks can be divided into the following categories. (i) Compact Disk/Read Only Memory (CD-ROM): CD-ROM disks are made of reflective metals. CD-ROM is written during the process of manufacturing by high power laser beam. Here the storage density is very high, storage cost is very low and access time is relatively fast. Each disk is approximately 4 1/2 inches in diameter and can hold over 600 MB of data. As the CD-ROM can be read only, we cannot write or make changes into the data contained in it. (ii) Write Once Read Many (WORM): The inconvenience that we cannot write anything in to a CD-ROM is avoided in WORM. A WORM allows the user to write data permanently on the disk. Once the data is written it can never be erased without physically damaging the disk. Here data can be recorded from

keyboard, video scanner, OCR equipment and other devices. The advantage of WORM is that it can store vast amount of data amounting to gigabytes. Any document in a WORM can be accessed very fast.

Erasable Optical Disk: These are optical disks where data can be written, erased and re-written. This also applies a laser beam to write and re-write the data. These disks may be used as alternatives to traditional disks. Erasable optical disks are based on a technology known as magnetic optical (MO). To write a data bit on the erasable optical disk the MO drive's laser beam heats a tiny, precisely defined point on the disk's surface and magnesites it.

INPUT DEVICE

An input device presents data to the processing unit in a machine-readable form. Although the keyboard is a common input device for a small computer, a system may also support various other input devices such as Optical Character Recognition (OCR), Magnetic Ink Character Recognition (MICR), mark sense reader, etc.

1.4.1 Key board: The keyboard is very much like a standard typewriter keyboard with a few additional keys. The basic QWERTY layout of characters is maintained to make it easy for the trained typist to use the system. The additional keys are included to perform certain special functions such as loading a program, edition a text, etc. These are known as function keys that vary in number from system to system.

1.4.2 Optical Character Recognition Often abbreviated: as OCR, optical character recognition involves reading text from paper and translating the images into a form that the computer can manipulate. An OCR system enables you to take a book or a magazine article and feed it directly into an electronic computer file.

1.4.3 Magnetic Ink Character Recognition (MICR): An MICR can identify characters printed with a special ink that contain particles of magnetic material. This device particularly finds applications in banking industry. Since the MICR system can recognize only certain character styles, the characters have to be accurately formed.

1.4.4 Optical Mark Recognition (OMR): Optical mark recognition, also called mark sense reader, is a technology where an OMR device senses the presence or absence of a mark, such as pencil mark. OMR is widely used in tests such as aptitude tests.

Bar Code Reader These devices are generally available in super markets, bookshops, etc. Bar-code readers are photoelectric scanners that read the bar codes or vertical zebra striped marks, printed on product containers. Supermarkets use a

bar code system called the Universal Product Code (UPC). The bar code identifies the product to the supermarket's computer which has a description and the latest price of the product. The computer automatically tells the Point of Sales (POS) terminal what the price is. 1.4.6 Digitating Tablet This is an input device that enables you to enter drawings and sketches into a computer. A digitating tablet consists of an electronic tablet and a cursor or pen. A cursor (also called a puck) is similar to a mouse, except that it has a window with cross hairs for pinpoint placement, and it can have as many as 16 buttons. A pen (also called a stylus) looks like a simple ballpoint pen but uses an electronic head instead of ink. The tablet contains electronic field that enables it to detect movement of the cursor or pen and translate the movements into digital signals that it sends to the computer. Digitating tables are also called digitizers, graphics tables, touch tables or simply tables.

Scanner

Scanner is an input device that can read text or illustrations printed on paper and translate the information into a form that the computer can use. A scanner works by digitizing an image - dividing it into a grid of boxes and representing each box with either a zero or a one, depending on whether the box is filled in. The resulting matrix of bits, called a bit map, can then be stored in a file, displayed on a screen and manipulated by programs. Optical scanners do not distinguish text from illustrations, they represent all images as bit maps. Therefore, you cannot directly edit text that has been scanned. To edit text read by an optical scanner, you need an optical character recognition (OCR) system to translate the image into ASCII characters. Most optical scanners sold today come with OCR packages.

Mouse

Mouse is a device that controls the movement of the cursor or pointer on a display screen. It is a small object you can roll along a hard and flat surface. As you move the mouse, the pointer on the display screen moves in the same direction. Mouse contains at least one button and sometimes as many as three, which have different functions depending on what program is running.

Light Pen

Light pen is an input device that utilizes a light-sensitive detector to select objects on a display screen.

Speech input devices

Speech or voice input devices convert a person's speech into digital form. These input devices, when combined with appropriate software, form voice recognition

systems. These systems enable users to operate microcomputers using voice commands.

OUTPUT DEVICE:

Output devices receive information from the CPU and present it to the user in the desired form. Output devices include display screen, loudspeakers, printers, plotters, etc.

Display Screen When a program is keyed in, the screen (which is similar to a television screen) displays the characters. The user can read the program line by line and make corrections before it is stored or printed on a printer. It is also possible to bring to the screen a portion of the program stored in the external storage for editing. Screen sizes differ from system to system. The standard size is 24 lines by 80 characters. Most systems have provision for scrolling. This facilitates the user to move the text vertically or horizontally on the screens thus bringing to the screen the hidden text. Thus, the user can scan through the entire file either to review or to select a particular portion. The cursor on the screen is controlled by the cursor keys on the keyboard.

Printer

Printer is a device that prints text or illustrations on paper and in many cases on transparencies and other media. There are many different types of printers. In terms of the technology utilised, printer fall into the following categories.

i.Ink-jet Printer Ink-jet printers work by spraying ionized ink on a sheet of paper. Magnetized plates in the ink's path direct the ink onto the paper in the desired shapes. Inkjet printers are capable of producing high quality print approaching to that produced by laser printers. A typical ink-jet printer provides a resolution of 300 dots per inch, although some newer models offer higher resolutions. In general, the price of ink-jet printers is lower than that of laser printers. However, they are also considerably slower. Another drawback of ink-jet printers is that they require a special type of ink that is apt to smudge on inexpensive copier paper. Because ink-jet printers require smaller mechanical parts than laser printers, they are especially popular as portable printers. In addition, color ink-jet printers provide an inexpensive way to print full-color documents.

ii. Laser Printer Laser Printer utilizes a laser beam to produce an image on a drum. The light of the laser alters the electrical charge on the drum wherever it hits. The drum is then rolled through a reservoir of toner, which is picked up by the charged

portions of the drum. Finally, the toner is transferred to the paper through a combination of heat and pressure. This is also the way copy machines work.

Because an entire page is transmitted to a drum before the toner is applied, laser printers are sometimes called page printers. There are two other types of page printers that fall under the category of laser printers even though they do not use lasers at all. One uses an array of LEDs to expose the drum, and the other uses LCDs. Once the drum is charged, however, they both operate like a real laser printer. One of the chief characteristics of laser printers is their resolution - how many dots per inch (dpi) they lay down. The available resolutions range from 300 dpi at the low end to 1,200 dpi at the high end. By comparison, offset printing usually prints at 1,200 or 2,400 dpi. Some laser printers achieve higher resolutions with special techniques known generally as resolution enhancement. In addition to text, laser printers are very adept at printing graphics. However, you need significant amounts of memory in the printer to print high-resolution graphics. To print a full-page graphic at 300 dpi, for example, you need at least 1 MB (megabyte) of printer RAM. For a 600-dpi graphic, you need at least 4 MB RAM.

The speed of laser printers ranges from about 4 to 20 pages of text per minute (ppm). A typical rate of 6 ppm is equivalent to about 40 characters per second (cps).

iii) Line Printer Line printers are high-speed printers capable of printing an entire line at one time. A fast line printer can print as many as 3,000 lines per minute. The disadvantages of line printers are that they can print only one font, they cannot print graphics, the print quality is low, and they are very noisy.

iv) Thermal printer Thermal printers are printers that produce images by pushing electrically heated pins against special heat-sensitive paper. Thermal printers are inexpensive and are used in most calculators and many fax machines. They produce low-quality print, and the paper tends to curl and fade after a few weeks or months.

v) Plotter is a device that draws pictures on paper based on commands from a computer. Plotters differ from printers in that they draw lines using a pen. As a result, they can produce continuous lines, whereas printers can only simulate lines by printing a closely spaced series of dots. Multicolor plotters use different-colored pens to draw different colors. In general, plotters are considerably more expensive than printers. They are used in engineering applications where precision is mandatory.

vi) Sound Cards & Speakers

An expansion board that enables a computer to manipulate and output sounds. Sound cards are necessary for nearly all CD-ROMs and have become commonplace on modern personal computers. Sound cards enable the computer to output sound through speakers connected to the board, to record sound input from a microphone connected to the computer, and manipulate sound stored on a disk. Nearly all sound cards support MIDI, a standard for representing music electronically. In addition, most sound cards are Sound Blaster-compatible, which means that they can process commands written for a Sound Blaster card, the de facto standard for PC sound.

vii) 3D-Audio

3D audio is a technique for giving more depth to traditional stereo sound. Typically, 3D sound, or 3D audio, is produced by placing a device in a room with stereo speakers. The device dynamically analyses the sound coming from the speakers and sends feedback to the sound system so that it can readjust the sound to give the impression that the speakers are further apart. 3D audio devices are particularly popular for improving computer audio where the speakers tend to be small and close together. There are a number of 3D audio devices that can be attached to a computer's sound card.

AUXILIARY STORAGE DEVICE

Introduction
- Historically, the most common forms of auxiliary storage have been magnetic tapes or rotating magnetic drums and disks.
- Other technologies, such as the magnetic bubble, have been tested but have achieved only limited success.
- One promising new technology is the optical disk. Another level of storage is provided by mass storage units, which permit access to a large number of disks or tapes, but the rapidly improving disk technology has led to limited use.
- As was mentioned before, auxiliary storage has many attributes similar to other I/0 units. For this reason, many of the same ideas, such as buffering, apply to auxiliary storage units.
- This lesson will consider the auxiliary storage devices used with today's computing systems.

Auxiliary storage

- Auxiliary storage units behave in a manner similar to other I/O devices, but users do not interact directly with them.
- If you were to place yourself inside the computer, in many ways you would not be able to distinguish among the various kinds of I/O equipment.
- Auxiliary storage equipment has data transmission rates that may be significantly higher than other I/O devices but are still much slower than the internal speeds of the processor; hence, many of the techniques already discussed, such as buffering, are used.
- Auxiliary storage serves two main purposes: it serves as an extension of the main memory or as a medium to permanently archive information.
- The computer can use it as a memory extension for its own purposes outside the control of the user.
- Called virtual memory, this concept will be discussed later. On the other hand, the user can employ the extra storage to maintain almost limitless information.

Type of Access

- Data are stored in memory in three different ways.
- In the first method, random access memory (RAM), any element may be accessed in equal time. This is most commonly associated with the processor's primary or main memory.
- The second technique, direct access memory (DAM), behaves in a way analogous to RAM. Through an addressing scheme, it permits direct access to each storage location; however, the access time depends on the location of the data. Direct access is generally associated with magnetic and optical disks.
- The third method, the one most often associated with magnetic tape, stores each data element sequentially.
- It is known as sequential access memory (SAM). This means that to access the last data element, one must first scan through all the preceding items.
- The terminology that has been used with personal computers confuses random access and direct access. Floppy disk and hard disk drives are often called random access devices.
- To better understand the differences between the last two techniques, let's consider a hypothetical situation in which we have a cassette tape with

four songs and a phonograph record with the same four songs. Suppose you wish to play the third song.

- With the tape, you must sequentially move the first two songs past the reading head of the recorder.
- With the phonograph record, if you have been told where the third song is located, you may move the record arm directly over that position and begin to play the music.

Auxiliary Storage Devices

Sequential Access – Magnetic Tape
- Magnetic tape has traditionally been one of the most important means of supplying auxiliary storage for information processing systems.
- A reel of tape or cassette is mounted on a tape drive and can be moved at relatively high speed under the read/ write head. Reading and recording take place much like the familiar voice tape recorder.
- Large computing systems have reels of tape one-half-inch wide and up to twenty-four hundred feet in length.
- Newer magnetic tape technologies use smaller tape cassettes that reduce storage difficulties and facilitate access. Personal computers typically used standard cassette recorders.
- The most common method of storing information records the data on nine separate tracks.
- Recall that a single character may be represented with eight bits. If characters are stored across the width of the tape, a single character can be placed at each position along the length of the tape. The extra track is used to store a parity bit.
- The capacity of the tape depends not only on the tape's length, but also on how many bits can be stored per inch, or the density.
- Common densities for the half-inch tapes are 1,600 and 6,250 bits per inch (bpi). This is actually the density per track; thus, bpi may also mean bytes per inch or characters per inch (cpi).
- New tape drives have been introduced with eighteen tracks and a density of approximately 32,000 bpi and are stored in enclosed cartridges.
- Speeds of several hundred inches per second mean that several million characters per second move past the read/write heads (6,250 bytes/inch x 200 inches/second = 1.25 megabytes/second). This is known as the

transmission rate. High-density tapes can store several hundred million characters of information.

- Reading from or writing to the tape takes place in units called physical records.
- The size of the records must be consistent with the physical parameters of the tape drive and computer system, such as the transmission rate and the amount of main memory available to store the data before it is processed.
- Special characters may be used to show the boundaries of the record.
- Usually, for transmission purposes, records are grouped together in blocks.
- The number of records in a single block is known as the blocking factor. An inter block gap, usually on the order of 0.5 inch in length, separates the blocks.
- This is necessary to allow for the starting and stopping of the tape. Blocking the records decreases the number of starts and stops and, therefore, improves efficiency and eliminates tape space.
- Two special records, the header label and trailer label, are used to mark the beginning and end of the data on the tape.
- The header label usually contains the name of the data file and the date it was created. It may also contain access and security information. The trailer label usually contains the number of records in the data file.

Direct Access Storage Devices

- The direct access storage device (DASD) permits the on-line storage of vast amounts of data, making possible many of our familiar applications today.
- Magnetic drums and disks have been the mainstay for DASD systems for the past several decades.
- In the late it was thought that a magnetic bubble device would replace drum and disk devices, but manufacturing problems have dimmed its future.
- Optical disks, which use laser technology to store and retrieve information, offer greater promise.
- Although DASD systems offer direct access, they can also be used to store sequential data.
- In the following two subsections, we will consider the most common forms of DASD, the magnetic disk and the laser disk.

- The laser disk still seems to hold great promise for increasing storage capacity in the future.

Disk

- Disk storage devices are by far the most popular of the DASD systems.
- Magnetic disk, like magnetic drum storage, provides the computing system with the ability to read or retrieve data sequentially or directly.
- The magnetic disk is a flat platter with magnetic oxide coated on the surface.
- Since the disk is solid in the direction perpendicular to the direction of rotation, it does not suffer from the distortion problems associated with the magnetic drum.
- The recording surface of each disk is divided into concentric tracks. Data are stored serially bit by bit along a track as magnetic spots.
- Read/write heads are positioned above the track to record or read the data.
- There are fixed head disks with one head for each track and movable head disks with an arm to position the head over a particular track.
- At present, the technology is sufficient to move the arms so rapidly that the moving head disks are more cost-effective.
- Some disk systems have several movable heads.
- The capacity or density of the disk is determined by how closely the tracks are placed together and how closely the bits are packed.
- The data transmission speed depends on the density and how fast the disk is spinning under the read/write head.
- Recording may be on a single surface or on both surfaces of the disk. Larger disk systems stack several disks in a single pack (disk pack). Access to the different surfaces is accomplished.
- There is a separate read/write head for each surface.
- These arms move as a unit and access the tracks on different surfaces at the same time.
- The set of tracks at the same radius on different surfaces is referred to as a cylinder. Very large disk systems will have several packs mounted on different spindles.
- Disk packs may be movable or fixed, although the newer high-capacity disk systems tend to be fixed for reliability considerations.
- The read/write heads move so close to the surface of the disk that a collision with a smoke particle would cause a serious problem.

- In the 1970s a new disk technology called floppy diskettes became very popular.
- Floppy disks are now still used extensively with personal computers. The basic ideas are the same, except the recording surface is a flexible mylar disk.
- There are several standard sizes including 5 1 /4", 8", and 3 1 /2". The first two are usually housed in a cardboard envelope, while the 3 1 /2" is housed in a sealed hard plastic container.
- The trend is to the 3 1 /2" diskette. Capacities vary from less than 100 kbytes to more than 1 mbyte.

There is a series of terms used to describe the way the data are recorded on the diskette:

· single density-lowest recording density

· double density-next highest density

· quad density-highest density

· single sided-recording on a single side of the diskette

· double sided-recording on both sides of the diskette.

Another disk technology that is very popular with personal computers is called the Winchester drive.

- This drive is sometimes referred to as a hard disk.
- During the read/write operation, the Winchester head "flies" above the surface of the disk on an air-bearing supported by carefully balanced aerodynamic forces.
- Winchester drives can store GB bytes of data. The large storage capacities on these relatively small and inexpensive disk drives have opened up a large number of applications for microcomputers that previously could only be accomplished with more expensive mini and mainframe computers.
- Winchester drives are also used on mainframes.

One of the major considerations in designing any information processing system is the time needed to access the information (access time). Before we stated that access time to the primary memory was on the order of microseconds or even nanoseconds. Access time to data on a disk consists of three components:

(1) seek time-the time it takes to position the read/write head over the correct cylinder or track;

(2) rotational delay time-the time it takes to rotate the data under the read/write head; and

(3) transmission time-the time it takes to transmit data to the CPU.

- The seek time is much longer than the other two time components. Most attempts to improve performance utilize both hardware and software techniques to decrease the seek time.
- Access times are in the range of ten milliseconds, or thousands to millions of times slower than primary memory.
- Disks are organized in a manner analogous to blocked records on tape. Each disk is divided into sectors.
- The size of the sector depends on how much data can be read into the buffer in main memory.
- Although any sector on the disk can be arbitrarily accessed, the access time is dependent on the sector location and the present position of the read/write head.
- This type of access has traditionally been called direct access to distinguish it from access to main memory.
- Main memory access is called random since the access time does not depend on the location.
- More recently, particularly in the personal computer environment, the terms have become confused, and disk access is often called random access.
- There are several software techniques used to access information on a disk drive when there are many concurrent requests for data.
- One simple idea is to use a first-came first-served approach.
- This tends to be inefficient, since the read/write head has to be moved on the average halfway across the disk.
- Another scheme serves the request that is closest to the present position of the head. This is efficient but is very unfair to requests for data near the outer extremes of the disk.
- One technique that is both efficient and fair is to move the head from the outer edge of the disk to the innermost track, serving all requests as encountered.
- Disks generally store the magnetic information horizontally on the surface of the platter. A newer technique to increase the density is to store the magnetic information vertically, standing the magnets on end in a crystal structure of cobalt and chrome. Using this method permits 5 1/4" floppy diskettes to store as much information as the Winchester drives.

Optical Disks

- In the rapidly changing world of computing, it is hard to predict what new technologies will be developed and what their impact will be.
- Just as magnetic bubble memory seemed to be the answer for the next generation of auxiliary storage devices in the 1970s, optical disk units seem to hold great promise in the 1980s and is still widely used.
- The optical disk can store incredible amounts of data. An entire encyclopedia can be recorded on a single disk. Bits are stored by a finely focused laser beam burning microscopic dots on the surface.
- These are then read by scanning with a laser of much lower intensity. Addressing particular items of data can be accomplished using a microcomputer.
- The major restriction with the early optical disk systems is that they are read-only devices; that is, once the data images are recorded, they may not be changed. Newer systems are being developed that permit both the reading and recording of information similar to the magnetic storage devices.
- Just as with any new technology, it is hard to predict how video disks will be used in the future; however, video disks offer an excellent medium for electronic printing and publishing due to their low reproduction costs and their text and graphics capabilities.
- The ability to store visual images also gives them the potential of being a versatile way to deliver computer assisted instruction.

UNIT-II

Introduction to computer software-operating system-programming language-general software features and trends.

INTRODUCTION OF COMPUTER SOFTWARE

- 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.

There are two types of software −

- System Software
- Application Software

System Software

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

Examples of system software are Operating System, Compilers, Interpreter, Assemblers, etc.

Features of a system software −

- Close to the system
- Fast in speed
- Difficult to design
- Difficult to understand

- Less interactive
- Smaller in size
- Difficult to manipulate
- Generally written in low-level language

Application Software

- 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 Microsoft's notepad for writing and editing a 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.

Examples of Application software are the following −

- Payroll Software
- Student Record Software
- Inventory Management Software
- Income Tax Software
- Railways Reservation Software
- Microsoft Office Suite Software
- Microsoft Word
- Microsoft Excel
- Microsoft PowerPoint

Features of application software are as follows −

- Close to the 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 requires large storage space

OPERATING SYSTEM

- An Operating system (OS) is a software which acts as an interface between the end user and computer hardware.
- Every computer must have at least one OS to run other programs. An application like Chrome, MS Word, Games, etc needs some environment in which it will run and perform its task.
- The OS helps you to communicate with the computer without knowing how to speak the computer's language.
- It is not possible for the user to use any computer or mobile device without having an operating system.

HARDWARE
•CPU, Memory, Hard Drive

OPERATING SYSTEM
•Windows, Apple OS X, Linux

END USER
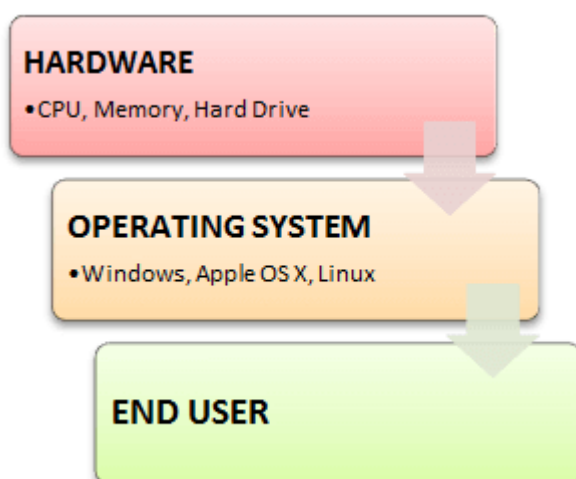
History Of OS

- Operating systems were first developed in the late 1950s to manage tape storage
- The General Motors Research Lab implemented the first OS in the early 1950s for their IBM 701
- In the mid-1960s, operating systems started to use disks
- In the late 1960s, the first version of the Unix OS was developed
- The first OS built by Microsoft was DOS. It was built in 1981 by purchasing the 86-DOS software from a Seattle company
- The present-day popular OS Windows first came to existence in 1985 when a GUI was created and paired with MS-DOS.

Features of Operating System

- Protected and supervisor mode
- Allows disk access and file systems Device drivers Networking Security
- Program Execution
- Memory management Virtual Memory Multitasking
- Handling I/O operations
- Manipulation of the file system
- Error Detection and handling
- Resource allocation
- Information and Resource Protection
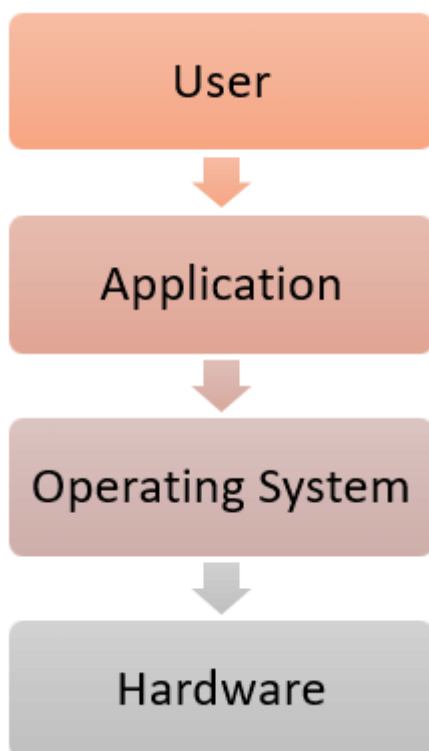
What is a Kernel?

The kernel is the central component of a computer operating systems. The only job performed by the kernel is to the manage the communication between the software and the hardware. A Kernel is at the nucleus of a computer. It makes the communication between the hardware and software possible. While the Kernel is the innermost part of an operating system, a shell is the outermost one.
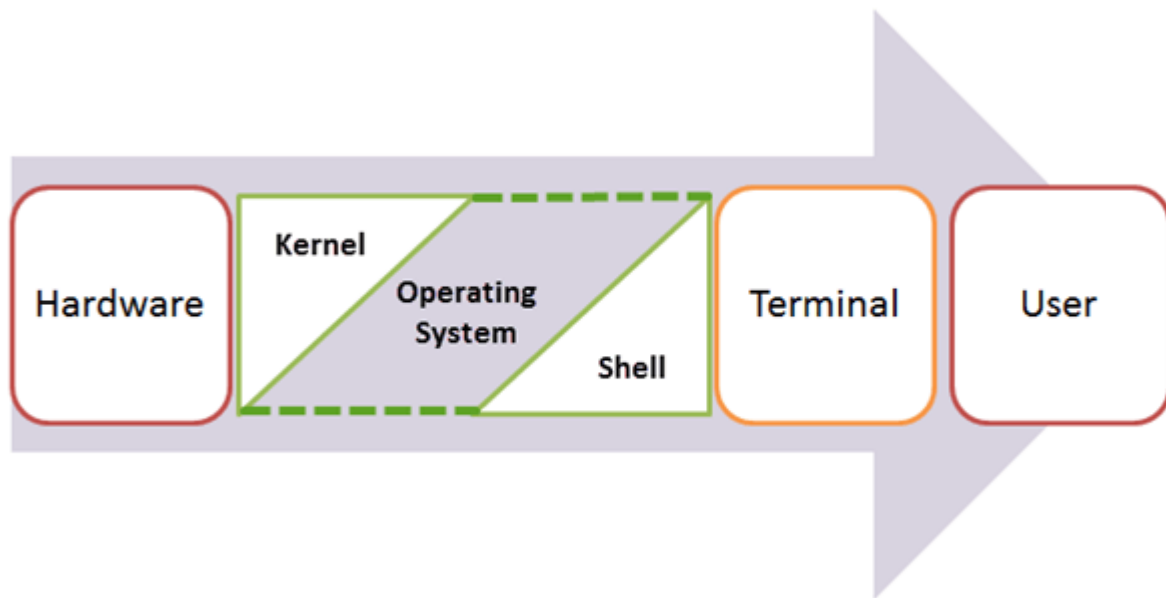
Features of Kennel

- Low-level scheduling of processes
- Inter-process communication
- Process synchronization
- Context switching

Types of Kernels

There are many types of kernels that exists, but among them, the two most popular kernels are:

1.**Monolithic**

- A monolithic kernel is a single code or block of the program. It provides all the required services offered by the operating system.
- It is a simplistic design which creates a distinct communication layer between the hardware and software.

2. Microkernels

- Microkernel manages all system resources.
- In this type of kernel, services are implemented in different address space.
- The user services are stored in user address space, and kernel services are stored under kernel address space.
- So, it helps to reduce the size of both the kernel and operating system.

Functions of an Operating System
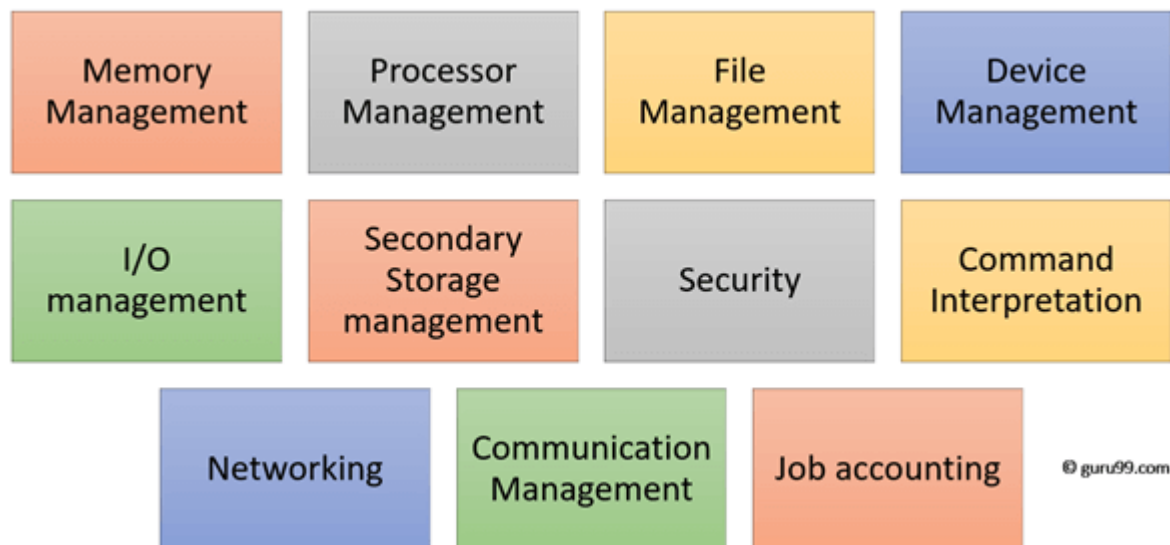
Function of an Operating System

1. **Process management** - Process management helps OS to create and delete processes. It also provides mechanisms for synchronization and communication among processes.

2. **Memory management -** Memory management module performs the task of allocation and de-allocation of memory space to programs in need of this resources.

3. **File management** - It manages all the file-related activities such as organization storage, retrieval, naming, sharing, and protection of files.

4. **Device Management** - Device management keeps tracks of all devices. This module also responsible for this task is known as the I/O controller. It also performs the task of allocation and de-allocation of the devices.

5. **I/O System Management -** One of the main objects of any OS is to hide the peculiarities of that hardware devices from the user.

6. **Secondary-Storage Management** - Systems have several levels of storage which includes primary storage, secondary storage, and cache storage. Instructions and data must be stored in primary storage or cache so that a running program can reference it.

7. **Security** - Security module protects the data and information of a computer system against malware threat and authorized access.

8. **Command interpretation** - This module is interpreting commands given by the and acting system resources to process that commands.

9. **Networking** - A distributed system is a group of processors which do not share memory, hardware devices, or a clock. The processors communicate with one another through the network.

10. **Job accounting -** Keeping track of time & resource used by various job and users.

11. **Communication management** - Coordination and assignment of compilers, interpreters, and another software resource of the various users of the computer systems.

Types of Operating system

- Batch Operating System
- Multitasking/Time Sharing OS
- Multiprocessing OS
- Real Time OS
- Distributed OS
- Network OS
- Mobile OS

Batch Operating System

- Some computer processes are very lengthy and time-consuming.
- To speed the same process, a job with a similar type of needs are batched together and run as a group.
- The user of a batch operating system never directly interacts with the computer.

- In this type of OS, every user prepares his or her job on an offline device like a punch card and submit it to the computer operator.

Multi-Tasking/Time-sharing Operating systems

- Time-sharing operating system enables people located at a different terminal(shell) to use a single computer system at the same time.
- The processor time (CPU) which is shared among multiple users is termed as time sharing.

Real time OS

- A real time operating system time interval to process and respond to inputs is very small.
- **Examples:** Military Software Systems, Space Software Systems.

Distributed Operating System

- Distributed systems use many processors located in different machines to provide very fast computation to its users.

Network Operating System

- Network Operating System runs on a server.
- It provides the capability to serve to manage data, user, groups, security, application, and other networking functions.

Mobile OS

- Mobile operating systems are those OS which is especially that are designed to power smartphones, tablets, and wearables devices.
- Some most famous mobile operating systems are Android and iOS, but others include BlackBerry, Web, and watchOS.

The advantage of using Operating System

- Allows you to hide details of hardware by creating an abstraction
- Easy to use with a GUI
- Offers an environment in which a user may execute programs/applications
- The operating system must make sure that the computer system convenient to use
- Operating System acts as an intermediary among applications and the hardware components
- It provides the computer system resources with easy to use format

- Acts as an intermediator between all hardware's and software's of the system

Disadvantages of using Operating System

- If any issue occurs in OS, you may lose all the contents which have been stored in your system
- Operating system's software is quite expensive for small size organization which adds burden on them. Example Windows
- It is never entirely secure as a threat can occur at any time.

PROGRAMMING LANGUAGES

- A computer program (also commonly called an application) is a set of instructions that the computer can perform in order to perform some task.

- The process of creating a program is called programming. Programmers typically create programs by producing source code (commonly shortened to code), which is a list of commands typed into one or more text files.

- The collection of physical computer parts that make up a computer and execute programs is called the **hardware**.

- When a computer program is loaded into memory and the hardware sequentially executes each instruction, this is called **running** or **executing** the program.

Types of Programming Languages

1. **Low level language**
   a) Machine language (1Genegration Language)
   b) Assembly language (2Genegration Language)
2. **High level language**
   a) Procedural-Oriented language (3Generation Language)
   b) Problem-Oriented language (4Generation Language)
   c) Natural language (5Generation Language)

1. Low level language

This language is the most understandable language used by computer to perform its operations. It can be further categorized into:

a) Machine Language (1GL)

- Machine language consists of strings of binary numbers (i.e. 0s and 1s) and it is the only one language, the processor directly understands.
- Machine language has an Merits of very fast execution speed and efficient use of primary memory.

Merits:

- It is directly understood by the processor so has faster execution time since the programs written in this language need not to be translated.
- It doesn't need larger memory.

Demerits:

- It is very difficult to program using 1GL since all the instructions are to be represented by 0s and 1s.
- Use of this language makes programming time consuming.
- It is difficult to find error and to debug.
- It can be used by experts only.

b) Assembly Language

- Assembly language is also known as low-level language because to design a program programmer requires detailed knowledge of hardware specification.
- This language uses mnemonics code (symbolic operation code like 'ADD' for addition) in place of 0s and 1s.
- The program is converted into machine code by assembler. The resulting program is referred to as an object code.

Merits:

- It is makes programming easier than 1GL since it uses mnemonics code for programming. Eg: ADD for addition, SUB for subtraction, DIV for division, etc.
- It makes programming process faster.
- Error can be identified much easily compared to 1GL.
- It is easier to debug than machine language.

Demerits:

- Programs written in this language is not directly understandable by computer so translators should be used.

- It is hardware dependent language so programmers are forced to think in terms of computer's architecture rather than to the problem being solved.
- Being machine dependent language, programs written in this language are very less or not portable.
- Programmers must know its mnemonics codes to perform any task.

2. High level language

- Instructions of this language closely resembles to human language or English like words. It uses mathematical notations to perform the task.
- The high-level language is easier to learn.
- It requires less time to write and is easier to maintain the errors.
- The high-level language is converted into machine language by one of the two different languages translator programs; **interpreter or compiler.**

High level language can be further categorized as:

a) Procedural-Oriented language (3GL)

- Procedural Programming is a methodology for modelling the problem being solved, by determining the steps and the order of those steps that must be followed in order to reach a desired outcome or specific program state.
- These languages are designed to express the logic and the procedure of a problem to be solved.
- It includes languages such as Pascal, COBOL, C, FORTAN, etc.

Merits:
- Because of their flexibility, procedural languages are able to solve a variety of problems.
- Programmer does not need to think in term of computer architecture which makes them focused on the problem.
- Programs written in this language are portable.

Demerits:
- It is easier but needs higher processor and larger memory.
- It needs to be translated therefore its execution time is more.

b) Problem-Oriented language (4GL)
- It allows the users to specify what the output should be, without describing all the details of how the data should be manipulated to produce the result.

- This is one step ahead from 3GL. These are result oriented and include database query language.

Eg: Visual Basic, C#, PHP, etc.

The objectives of 4GL are to

- Increase the speed of developing programs.
- Minimize user's effort to obtain information from computer.
- Reduce errors while writing programs.

Merits:

- Programmer need not to think about the procedure of the program. So, programming is much easier.

Demerits:

- It is easier but needs higher processor and larger memory.
- It needs to be translated therefore its execution time is more.

c) Natural language (5GL)

Natural language is still in developing stage where we could write statements that would look like normal sentences.

Merits:

- Easy to program.
- Since, the program uses normal sentences, they are easy to understand.
- The programs designed using 5GL will have artificial intelligence (AI).
- The programs would be much more interactive and interesting.

Demerits:

- It is slower than previous generation language as it should be completely translated into binary code which is a tedious task.
- Highly advanced and expensive electronic devices are required to run programs developed in 5GL. Therefore, it is an expensive approach.

GENERAL SOFTWARE FEATURES AND TRENDS

- Now a day's software projects are becoming more and more complex — in size, sophistication, and technologies used.
- Most software products are used by huge number of people, not only that, these software support different national languages and come in different sizes and shapes — desktop, standard, professional, Enterprise Resource Planning (ERP) packages and so on.

- Almost all application software products (like word processors, ERP packages) support more than on hardware and/or software platform.
- For example, we have web browsers for the PC and Mac; we have database management systems that run on MVS, UNIX, Windows NT, and Linux and so on.
- The competition and the advancements in technology are driving software vendors to include additional functionality and new features to their products— just to stay in business.
- The Information Technology is revolutionizing the way we live and work.
- The digital technology has given mankind the ability to treat information with mathematical precision, to transmit it at very high accuracy and to manipulate it at will.

Features of Software

Ease of use

- The software systems are applications are becoming more and more easy to use. Software developers and system analysts are concerned for ensuring that the software they develop are user-friendly than their competitor's products.
- The user interfaces are more intuitive, the error messages are more descriptive, there is context sensitive help, and there are wizards and templates to help the user when one encounters a problem.

Graphical User Interface (GUI)

- Today's software applications and products provide users with intuitive, graphical and easy- to-use interfaces.
- Now the users do not have to remember the cryptic system commands or shortcut keys that were a must in the character based era.
- Now almost any tasks can be accomplished by a mouse click.

   For example, in a DOS environment, to copy a file one needs to know the command for copying files, its exact syntax and so on, whereas in the Windows environment, you just have to drag the files you want to copy from the source to destination.

Requirement of more powerful hardware

- Because software vendors are incorporating more and more features into their products this software need more and powerful machines to run.
- They need more main memory, more secondary storage, and faster and powerful processors.
- It is also not very difficult to go for new powerful computers as the price of computers are decreasing day by day.

Multi-platform capability

- Today's software applications are not developed for just one platform. Most of the software applications supports multiple platforms— both hardware and software platforms.
- There are software applications that support hardware platforms ranging from mainframes to PCs and different software platforms like MVS, Solaris, AIX, UNIX, Windows and so on.
- Database like IBM's DB2 Universal is available for a variety of hardware and software platforms.
- Another important feature of today's software application is that they support multiple languages and multiple currencies.
- Many vendors are providing their application in many languages like English, Arabic, Japanese and Chinese and so on.

Network Capabilities

- Network computers are becoming popular as they can work with minimal memory, disk storage and processor power.
- These computers are connected to a network especially the Internet. The idea behind network computers is that many users who are connected to a network don't need all the computer power they get from a typical personal computer.
- Instead, they can rely on the power of the network servers.
- As the popularity of network computers increase, the demand for software that can run these computers are increasing and the software applications of today and tomorrow will have that capability.

Compatibility with other software

- Now a day's most of the software products are compatible with each other. For example, we can import HTML documents and other text documents into a Microsoft Word document.
- Also as newer versions of software are released, most vendors maintain backward
  compatibility i.e. compatibility with earlier versions.
- These two features— backward compatibility and compatibility with other products make it easier for the users, as they can choose the application they want and still use the old files they created using other applications or using older versions of the same application.

Object Linking and Embedding

- We have mechanism to interact with other software systems.
- One of the methods to integrate external tolls into an application is using the Object Linking and Embedding (OLE) architecture to link or embed a component from another application running on the computer.
- OLE is a compound document standard developed by Microsoft Corporation.
- It enables us to create objects with one application and then link or embed them into a second application.
- This embedding and linking of components enables applications to share components.

Group work capabilities

- Technologies, which support collaboration, are in greater demand today than ever before.
- Therefore, vendors are integrating collaborating technologies into their products. Distributed work forces, information overload, and getting products to market as quickly as possible are just a few of the motivational aspects pushing collaboration technology development.

Mail Enabling

- The mail enabling of an application is the process through which email is gradually replacing many of the single purpose applications now used on personal computers.
- In its simplest form, a mail-enabled application is a Windows program that has a 'Send' command in its 'File' menu.
- **For example**, the Microsoft Word 2000 has a 'Send To' menu item in the 'File' menu where we can choose to send the document to a mail recipient, fax recipient and so on.

Web Enabling

- With the ever-increasing popularity of Internet and the amount of information that is available on the net, most software application is now web-enabled.
- Web enabling helps the user in many different ways.
- During installation, most of the applications will automatically connect the Internet and to the vendor's web site and will register their products (earlier one had to fill in a paper form and mail or fax it to the vendor).

Unit-III

Database Management System-Data Processing-Introduction to Database Management System-database design.

DATA PROCESSING

- Data processing refers to the process of performing specific operations on a set of data or a database.
- A database is an organized collection of facts and information, such as records on employees, inventory, customers, and potential customers.
- As these examples suggest, numerous forms of data processing exist and serve diverse applications in the business setting.
- Data processing primarily is performed on information systems, a broad concept that encompasses computer systems and related devices.
- At its core, an information system consists of input, processing, and output. In addition, an information system provides for feedback from output to input. The input mechanism (such as a keyboard, scanner, microphone, or camera) gathers and captures raw data and can be either manual or automated. Processing, which also can be accomplished manually or automatically, involves transforming the data into useful outputs.
- This can involve making comparisons, taking alternative actions, and storing data for future use. Output typically takes the form of reports and documents that are used by managers.
- Feedback is utilized to make necessary adjustments to the input and processing stages of the information system.
- The processing stage is where management typically exerts the greatest control over data.
- It also is the point at which management can derive the most value from data, assuming that powerful processing tools are available to obtain the intended results.
- The most frequent processing procedures available to management are basic activities such as segregating numbers into relevant groups, aggregating them, taking ratios, plotting, and making tables.

- The goal of these processing activities is to turn a vast collection of facts into meaningful nuggets of information that can then be used for informed decision making, corporate strategy, and other managerial functions.

DATA AND INFORMATION

- Data consist of raw facts, such as customer names and addresses. Information is a collection of facts organized in such a way that it has more value beyond the facts themselves.
- **For example**, a database of customer names and purchases might provide information on a company's market demographics, sales trends, and customer loyalty/turnover.
- Turning data into information is a process or a set of logically related tasks performed to achieve a defined outcome.
- This process of defining relationships between various data requires knowledge. Knowledge is the body or rules, guidelines, and procedures used to select, organize, and manipulate data to make it suitable for specific tasks.
- Consequently, information can be considered data made more useful through the application of knowledge.
- The collection of data, rules, procedures, and relationships that must be followed are contained in the knowledge base.

CHARACTERISTICS OF VALUABLE INFORMATION

1. Accurate. Accurate information is free from error.
2. Complete. Complete information contains all of the important facts.
3. Economical. Information should be relatively inexpensive to produce.
4. Flexible. Flexible information can be used for a variety of purposes, not just one.
5. Reliable. Reliable information is dependable information.
6. Relevant. Relevant information is important to the decision-maker.
7. Simple. Information should be simple to find and understand.
8. Timely. Timely information is readily available when needed.
9. Verifiable. Verifiable information can be checked to make sure it is accurate.

SIX STAGES OF DATA PROCESSING

1. Data collection

- Collecting data is the first step in data processing. Data is pulled from available sources, including <u>data lakes and data warehouses</u>.
- It is important that the data sources available are trustworthy and well-built so the data collected (and later used as information) is of the highest possible quality.

2. Data preparation

- Once the data is collected, it then enters the <u>data preparation</u> stage.
- Data preparation, often referred to as "pre-processing" is the stage at which raw data is cleaned up and organized for the following stage of data processing.
- During preparation, raw data is diligently checked for any errors. The purpose of this step is to eliminate bad data (<u>redundant</u>, incomplete, or incorrect data) and begin to create high-quality data for the best <u>business intelligence</u>.

3. Data input

- The clean data is then entered into its destination (perhaps a CRM like <u>Salesforce</u> or a data warehouse like <u>Redshift</u>), and translated into a language that it can understand.
- Data input is the first stage in which raw data begins to take the form of usable information.

4. Processing

- During this stage, the data inputted to the computer in the previous stage is actually processed for interpretation.
- Processing is done using <u>machine learning</u> algorithms, though the process itself may vary slightly depending on the source of data being processed (data lakes, social networks, connected devices etc.) and its intended use (examining advertising patterns, medical diagnosis from connected devices, determining customer needs, etc.).

5. Data output/interpretation

- The output/interpretation stage is the stage at which data is finally usable to non-data scientists.
- It is translated, readable, and often in the form of graphs, videos, images, plain text, etc.). Members of the company or institution can now begin to self-serve the data for their own data analytics projects.

6. Data storage

- The final stage of data processing is storage.
- After all of the data is processed, it is then stored for future use. While some information may be put to use immediately, much of it will serve a purpose later on.
- Plus, properly stored data is a necessity for compliance with data protection legislation like GDPR.
- When data is properly stored, it can be quickly and easily accessed by members of the organization when needed.

DATA MANAGEMENT

- Data are organized in a hierarchy that begins with the smallest piece of data used by a computer—for purposes of this discussion, a single character such as a letter or number.
- Characters form fields such as names, telephone numbers, addresses, and purchases. A collection of fields makes up a record.
- A collection of records is referred to as a file. Integrated and related files make up a database.
- An entity is a class of people, objects, or places for which data are stored or collected. Examples include employees and customers.
- Consequently, data are stored as entities, such as an employee database and a customer database. An attribute is a characteristic of an entity.
- **For example**, the name of a customer is an attribute of a customer.
- A specific value of an attribute is referred to as a data item. That is, data items are found in fields.
- The traditional approach to data management consists of maintaining separate data files for each application.

- **For example,** an employee file would be maintained for payroll purposes, while an additional employee file might be maintained for newsletter purposes.
- One or more data files are created for each application. However, duplicated file results in data redundancy.
- The problem with data redundancy is the possibility that updates are accomplished in one file but not in another, resulting in a lack of data integrity.
- Likewise, maintaining separate files is generally inefficient because the work of updating and managing the files is duplicated for each separate file that exists.
- To overcome potential problems with traditional data management, the database approach was developed.
- The database approach is such that multiple business applications access the same database.
- Consequently, file updates are not required of multiple files. Updates can be accomplished in the common database, thus improving data integrity and eliminating redundancy.
- The database approach provides the opportunity to share data, as well as information sources.
- Additional software is required to implement the database approach to data management.
- A database management system (DBMS) is needed.
- A DBMS consists of a group of programs that are used in an interface between a database and the user, or between the database and the application program.

DATABASE MODELS

- The structure of the relationships in most databases follows one of three logical database models: hierarchical, network, and relational.
- A hierarchical database model is one in which the data are organized in a top-down or inverted tree-like structure.
- This type of model is best suited for situations where the logical relationships between data can be properly represented with the one-parent-many-children approach.
- A network model is an extension of the hierarchical database model.

- The network model has an owner-member relationship in which a member may have many owners, in contrast to a one-to-many-relationship.
- A relational model describes data using a standard tabular format.
- All data elements are placed in two-dimensional tables called relations, which are the equivalent of files.
- Data inquiries and manipulations can be made via columns or rows given specific criteria.
- Network database models tend to offer more flexibility than hierarchical models.
- However, they are more difficult to develop and use because of relationship complexity.
- The relational database model offers the most flexibility, and was very popular during the early 2000s.

DATABASE MANAGEMENT SYSTEMS

Database: Database is a collection of inter-related data which helps in efficient retrieval, insertion and deletion of data from database and organizes the data in the form of tables, views, schemas, reports etc.

For Example, university database organizes the data about students, faculty, and admin staff etc. which helps in efficient retrieval, insertion and deletion of data from it.

DDL is short name of Data Definition Language, which deals with database schemas and descriptions, of how the data should reside in the database.

CREATE: to create a database and its objects like (table, index, views, store procedure, function, and triggers)

ALTER: alters the structure of the existing database

DROP: delete objects from the database

TRUNCATE: remove all records from a table, including all spaces allocated for the records are removed

COMMENT: add comments to the data dictionary

RENAME: rename an object

DML is short name of Data Manipulation Language which deals with data manipulation and includes most common SQL statements such SELECT, INSERT, UPDATE, DELETE, etc., and it is used to store, modify, retrieve, delete and update data in a database.

SELECT: retrieve data from a database
INSERT: insert data into a table
UPDATE: updates existing data within a table
DELETE: Delete all records from a database table
MERGE: UPSERT operation (insert or update)
CALL: call a PL/SQL or Java subprogram
EXPLAIN PLAN: interpretation of the data access path
LOCK TABLE: concurrency Control

PARADIGM SHIFT FROM FILE SYSTEM TO DBMS

- File System manages data using files in hard disk. Users are allowed to create, delete, and update the files according to their requirement.
- Let us consider the example of file-based University Management System. Data of students is available to their respective Departments, Academics Section, Result Section, Accounts Section, Hostel Office etc.
- Some of the data is common for all sections like Roll No, Name, Father Name, Address and Phone number of students but some data is available to a particular section only like Hostel allotment number which is a part of hostel office.
- **Redundancy of data:** Data is said to be redundant if same data is copied at many places. If a student wants to change Phone number, he has to get it updated at various sections. Similarly, old records must be deleted from all sections representing that student.
- **Inconsistency of Data:** Data is said to be inconsistent if multiple copies of same data do not match with each other. If Phone number is different in Accounts Section and Academics Section, it will be inconsistent. Inconsistency may be because of typing errors or not updating all copies of same data.
- **Difficult Data Access:** A user should know the exact location of file to access data, so the process is very cumbersome and tedious. If user wants to search student hostel allotment number of a student from 10000 unsorted students' records, how difficult it can be.
- **Unauthorized Access:** File System may lead to unauthorized access to data. If a student gets access to file having his marks, he can change it in unauthorized way.

- **No Concurrent Access:** The access of same data by multiple users at same time is known as concurrency. File system does not allow concurrency as data can be accessed by only one user at a time.
- **No Backup and Recovery:** File system does not incorporate any backup and recovery of data if a file is lost or corrupted.

KEYS IN DBMS

- Key plays an important role in relational database; it is used for identifying unique rows from table. It also establishes relationship among tables.

Types of keys in DBMS

Primary Key – A primary is a column or set of columns in a table that uniquely identifies tuples (rows) in that table.

Super Key – A super key is a set of one of more columns (attributes) to uniquely identify rows in a table.

Candidate Key – A super key with no redundant attribute is known as candidate key

Alternate Key – Out of all candidate keys, only one gets selected as primary key, remaining keys are known as alternate or secondary keys.

Composite Key – A key that consists of more than one attribute to uniquely identify rows (also known as records & tuples) in a table is called composite key.

Foreign Key – Foreign keys are the columns of a table that points to the primary key of another table. They act as a cross-reference between tables.

TYPES OF DBMS

Four Types of DBMS systems are:

- Hierarchical
- Network
- Relational
- Object-Oriented DBMS

Hierarchical DBMS

- In a Hierarchical database, model data is organized in a tree-like structure. Data is Stored Hierarchically (top down or bottom up) format.
- Data is represented using a parent-child relationship. In Hierarchical DBMS parent may have many children, but children have only one parent.

Network Model

- The network database model allows each child to have multiple parents.
- It helps you to address the need to model more complex relationships like as the orders/parts many-to-many relationship.
- In this model, entities are organized in a graph which can be accessed through several paths.

Relational model

- Relational DBMS is the most widely used DBMS model because it is one of the easiest.
- This model is based on normalizing data in the rows and columns of the tables.
- Relational model stored in fixed structures and manipulated using SQL.

Object-Oriented Model

- In Object-oriented Model data stored in the form of objects. The structure which is called classes which display data within it.
- It defines a database as a collection of objects which stores both data members values and operations.

Advantages of DBMS

- DBMS offers a variety of techniques to store & retrieve data

- DBMS serves as an efficient handler to balance the needs of multiple applications using the same data
- Uniform administration procedures for data
- Application programmers never exposed to details of data representation and storage.
- A DBMS uses various powerful functions to store and retrieve data efficiently.
- Offers Data Integrity and Security
- The DBMS implies integrity constraints to get a high level of protection against prohibited access to data.
- A DBMS schedules concurrent access to the data in such a manner that only one user can access the same data at a time
- Reduced Application Development Time

Disadvantage of DBMS

DBMS may offer plenty of advantages but, it has certain flaws-

- Cost of Hardware and Software of a DBMS is quite high which increases the budget of your organization.
- Most database management systems are often complex systems, so the training for users to use the DBMS is required.
- In some organizations, all data is integrated into a single database which can be damaged because of electric failure or database is corrupted on the storage media
- Use of the same program at a time by many users sometimes lead to the loss of some data.
- DBMS can't perform sophisticated calculations

When not to use a DBMS system

- Although, DBMS system is useful. It is still not suited for specific task mentioned below:
- Not recommended when you do not have the budget or the expertise to operate a DBMS. In such cases, Excel/CSV/Flat Files could do just fine.

DATABASE DESIGN

- Database design is a collection of processes that facilitate the designing, development, implementation and maintenance of enterprise data management systems.
- Properly designed database is easy to maintain, improves data consistency and are cost effective in terms of disk storage space.
- The database designer decides how the data elements correlate and what data must be stored.
- The main objectives of database designing are to produce logical and physical designs models of the proposed database system.
- The logical model concentrates on the data requirements and the data to be stored independent of physical considerations.
- It does not concern itself with how the data will be stored or where it will be stored physically.
- The physical data design model involves translating the logical design of the database onto physical media using hardware resources and software systems such as database management systems (DBMS).
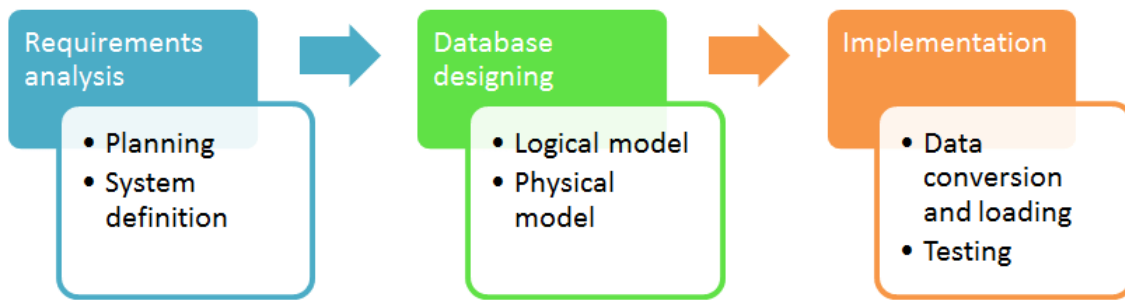
Importance of Database Design

It helps produce database systems

1. That meet the requirements of the users
2. Have high performance.

- Database designing is crucial to **high performance** database system.

Note, the genius of a database is in its design. Data operations using SQL is relatively simple

DATABASE DEVELOPMENT LIFE CYCLE

- The database development life cycle has a number of stages that are followed when developing database systems.
- The steps in the development life cycle do not necessary have to be followed religiously in a sequential manner.
- On small database systems, the database system development life cycle is usually very simple and does not involve a lot of steps.
- In order to fully appreciate the above diagram, let's look at the individual components listed in each step.

Requirements analysis

- **Planning** - This stage concerns with planning of entire Database Development Life Cycle. It takes into consideration the Information Systems strategy of the organization.
- **System definition** - This stage defines the scope and boundaries of the proposed database system.

Database designing

- **Logical model** - This stage is concerned with developing a database model based on requirements. The entire design is on paper without any physical implementations or specific DBMS considerations.
- **Physical model** - This stage implements the logical model of the database taking into account the DBMS and physical implementation factors.

Implementation

- **Data conversion and loading** - this stage is concerned with importing and converting data from the old system into the new database.

- **Testing** - this stage is concerned with the identification of errors in the newly implemented system .It checks the database against requirement specifications.

Unit-IV

Introduction to Telecommunication-Networking-Communication System-Distributed System-Internet-Intranet

NETWORKS

- Networking, also known as computer networking, is the practice of transporting and exchanging data between <u>nodes</u> over a shared medium in an information system.
- Networking comprises not only the design, construction and use of a network, but also the management, maintenance and operation of the network infrastructure, software and policies.
- Computer networking enables devices and endpoints to be connected to each other on a local area network (<u>LAN</u>) or to a larger network, such as the internet or a private wide area network (<u>WAN</u>).
- This is an essential function for service providers, businesses and consumers worldwide to share resources, use or offer services, and communicate.
- Networking facilitates everything from telephone calls to text messaging to streaming video to the internet of things (<u>IoT</u>).
- The level of skill required to operate a network directly correlates to the complexity of a given network.
- **For example,** a large enterprise may have thousands of nodes and rigorous security requirements, such as <u>end-to-end encryption</u>, requiring specialized network administrators to oversee the network.
- At the other end of the spectrum, a layperson may set up and perform basic troubleshooting for a home Wi-Fi network with a short instruction manual. Both examples constitute computer networking.

TYPES OF NETWORKING

- There are two primary types of computer networking: wired networking and wireless networking.
- Wired networking requires the use of a physical medium for transport between nodes.
- Copper-based Ethernet cabling, popular due to its low cost and durability, is commonly used for digital communications in businesses and homes.

- Alternatively, optical fibre is used to transport data over greater distances and at faster speeds, but it has several trade-offs, including higher costs and more fragile components.
- Wireless networking uses radio waves to transport data over the air, enabling devices to be connected to a network without any cabling. Wireless LANs are the most well-known and widely deployed form of wireless networking.
- Alternatives include microwave, satellite, cellular and Bluetooth, among others.
- As a general rule, wired networking offers greater speed, reliability and security compared to wireless networks; wireless networking tends to provide more flexibility, mobility and scalability.
- It should be noted that these types of networking concern the physical layer of the network. Networking can also be classified according to how it's built and designed, encompassing approaches that include software-defined networking (SDN) or overlay networks.
- Networking can also be categorized by environment and scale, such as LAN, campus, WAN, data center networks or storage area networks.

COMPONENTS OF NETWORKING

- Computer networking requires the use of physical network infrastructure -- including switches, routers and wireless access points -- and the underlying firmware that operates such equipment.
- Other components include the software necessary to monitor, manage and secure the network.
- Additionally, networks rely on the use of standard protocols to uniformly perform discrete functions or communicate different types of data, regardless of the underlying hardware.
- **For example,** voice over IP (VoIP) can transport IP telephony traffic to any endpoint that supports the protocol.
- HTTP provides a common way for browsers to display webpages.
- The internet protocol suite, also known as TCP/IP, is a family of protocols responsible for transporting data and services over an IP-based network.

Servers - Servers are computers that hold shared files, programs, and the network operating system.

- Servers provide access to network resources to all the users of the network.

- There are many different kinds of servers, and one server can provide several functions.

- **For example,** there are file servers, print servers, mail servers, communication servers, database servers, fax servers and web servers, to name a few.

- Sometimes it is also called host computer, servers are powerful computer that store data or application and connect to resources that are shared by the user of a network.

Clients - Clients are computers that access and use the network and shared network resources.

- Client computers are basically the customers(users) of the network, as they request and receive services from the servers.

- These days, it is typical for a client to be a personal computer that the users also use for their own non-network applications.

Transmission Media - Transmission media are the facilities used to interconnect computers in a network, such as twisted-pair wire, coaxial cable, and optical fibre cable.

- Transmission media are sometimes called transmission medium channels, links or lines.

Shared data - Shared data are data that file servers provide to clients such as data files, printer access programs and e-mail.

Shared printers and other peripherals - Shared printers and peripherals are hardware resources provided to the users of the network by servers.

- Resources provided include data files, printers, software, or any other items used by clients on the network.

Network Interface Card - Each computer in a network has a special expansion card called a network interface card (NIC).

- The NIC prepares(formats) and sends data, receives data, and controls data flow between the computer and the network. On the transmit side, the NIC

passes frames of data on to the physical layer, which transmits the data to the physical link.

- On the receiver's side, the NIC processes bits received from the physical layer and processes the message based on its contents.

Local Operating System - A local operating system allows personal computers to access files, print to a local printer, and have and use one or more disk and CD drives that are located on the computer.

- **Examples** are MS-DOS, Unix, Linux, Windows 2000, Windows 98, Windows XP etc. The network operating system is the software of the network. It serves a similar purpose that the OS serves in a stand-alone computer

Network Operating System - The network operating system is a program that runs on computers and servers that allows the computers to communicate over the network.

Hub - Hub is a device that splits a network connection into multiple computers. It is like a distribution center.

- When a computer requests information from a network or a specific computer, it sends the request to the hub through a cable.

- The hub will receive the request and transmit it to the entire network.

- Each computer in the network should then figure out whether the broadcast data is for them or not.

Switch - Switch is a telecommunication device grouped as one of computer network components. Switch is like a Hub but built in with advanced features.

- It uses physical device addresses in each incoming message so that it can deliver the message to the right destination or port.

- Unlike a hub, switch doesn't broadcast the received message to entire network, rather before sending it checks to which system or port should the message be sent.

- In other words, switch connects the source and destination directly which increases the speed of the network.

- Both switch and hub have common features: Multiple RJ-45 ports, power supply and connection lights.

Router - When we talk about computer network components, the other device that used to connect a LAN with an internet connection is called Router.

- When you have two distinct networks (LANs) or want to share a single internet connection to multiple computers, we use a Router.

- In most cases, recent routers also include a switch which in other words can be used as a switch.

- You don't need to buy both switch and router, particularly if you are installing small business and home networks.

- There are two types of Router: wired and wireless. The choice depends on your physical office/home setting, speed and cost.

LAN Cable A local area Network cable is also known as data cable or Ethernet cable which is a wired cable used to connect a device to the internet or to other devices like computer, printers, etc.

COMMUNICATION SYSTEM

- A "hello how are you" from one person, from one location, needs to be conveyed effectively and, clearly without noise to another person in another location.
- A picture sent to someone far away should be received without any distortion. A file transferred from one location to another location should be received without errors.
- Communication engineering is a process by which, connection (link) is established between two points, for information exchange maximizing customer delight.
- The main examples of the communication system include telephone, telegraph, mobile, Edison telegraph, computer and TV cable.
- The sources of this system can be divided into electric otherwise non-electric.
- These are the sources of an input or message signal. The sources include audio files like mp3, mp4, MKV, and GIFs (graphic image files), human voice, e-mail messages, TV picture, and electromagnetic radiation.

Definition Communication

• Communication is the imparting, conveying or exchange of thoughts, messages, ideas, knowledge or information by sign and sounds like speech, signals, writing or behaviour.

Telecommunication System

- Telecommunication implies communication between two points, separated by a distance. "Tele" means "at a distance".

- It considers that something may be and will be lost in the process; hence the term 'telecommunication' includes all kinds of distances and all kinds of techniques such as radio, telegraphy, television, telephony, data communication, and computer networking.

Telecommunication System

- We can define telecommunication as, communicating information such as data, text, pictures, voice, audio, video, feelings, thoughts over a long distance.

- The medium for such signal transmission can be thro electrical wire or cable (also known as "copper"), optical fibre or ether etc.

- If the communication is through the free-space by means of electromagnetic waves, then it is called wireless.

- The Internet is the largest example of a typical data communication network.

- Few other forms of Telecom networks can be Corporate and academic wide-area networks (WANs).

- Different technologies have evolved, to bring out newer applications. Broadband and mobile Communications have instantly become popular. Some of the technologies in vogue are

- Digital Telephone networks
- WiMAX, WIFI, BLUETOOTH
- Police wireless (Walkie talkie)
- GSM / CDMA / UMTS / LTE / Wireless LAN
- Facebook, Twitter, Linked In, WhatsApp

Distance does not matter anymore. Communication has to happen anytime, anywhere, at any place, through any medium, at any speed, through any device.

BASIC ELEMENTS OF COMMUNICATION SYSTEM

- The basic elements of a communication system are shown in the elementary block diagram.
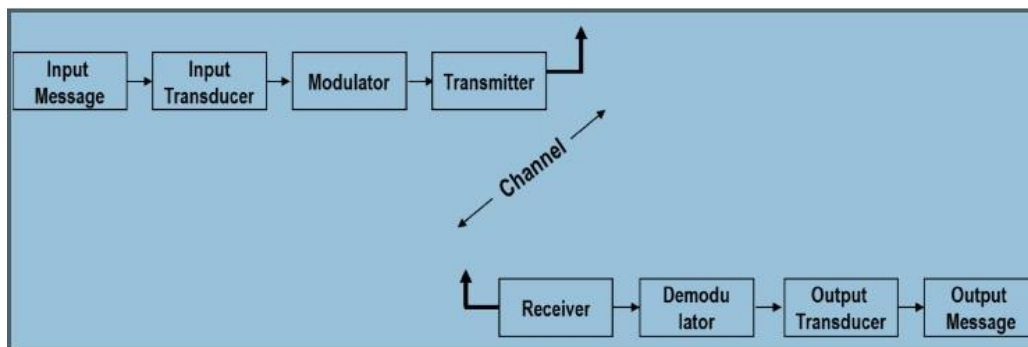
Basic Elements of Communication System

Objectives

- The objectives of a communication system include Minimum bandwidth, Maximum quality (Signal to Ratio), Minimum Bit Error Rate (BER), Maximum speed, Economy, Reliability, Mobility.

Messages

- The message can be voice, music, Data, Video, Temperature, Light, Pressure etc

Input Transducer

- The input can be in <u>any energy form</u> (temperature, pressure, light) but for transmission purposes, this needs to be converted to <u>electrical energy</u>. Transducer does this.

Modulator
- Translates the input signal to a higher frequency spectrum and also modulates (camouflages) the signal to combat noise (Amplitude Modulation, Freq Modulation, Phase Modulation, PCM, Delta Modulation, ASK, FSK, PSK, QPSK, QAM, GMSK, etc). The output can be analog or digital (thro <u>A/D converters</u>).

Transmitter
- It converts information into a signal that is suitable for transmission over a medium.
- Transmitter increases the power of the signal thro power amplifiers and also provides interfaces to match the transmission medium, such as <u>an antenna</u> interface, fiber interface and so on.

Antenna
- If it is <u>wireless communication,</u> antenna propagates (radiates) the signal through the air (atmosphere)

Channel
- A channel in a communication system just refers to the medium through which an electrical signal travel.
- These media are classified into two types such as guided as well as unguided. Guided media can be directed from a source in the direction of the receiver by using connecting cables.
- In <u>OFC-optical fibre communication</u>, an optical fibre is a medium.
- Additional guided media may comprise telephone wire, coaxial cable, and twisted pairs, etc.
- The **second type** of media namely unguided media that refers to a communication channel which forms space among the source as well as the receiver.
- In <u>RF communication</u>, the medium is space which is called air.
- It is the only thing among the source & receiver whereas in further cases such as sonar, the medium is generally water since sound waves tour powerfully through assured liquid media.
- The two types of Medias are measured unguided for the reason that there are no connecting wires between the source as well as the receiver.

Noise

- Noise is the challenge for communication engineers.

- It is random and unpredictable in nature. Noise is the undesirable electric energy that enters the communication system and interferes with the desired signal.

- Noise is produced at the transmitter, channel and also at the receiver. Everywhere.
- It can be man-made and natural.
- Natural noise: Lightning, Solar radiation, Thermal
- Man-made: Welding, Sparking, Motors, Car ignition, Tube lights, Electronic fan regulators etc

Receiver
- Receives the signal (desired) with noise (undesired).
- Recovers the original signal in spite of the noise.
- Consists of amplifiers, filters, mixers, oscillators, demodulators, transducers.
- The receiver consists of a similar sequence of block diagrams.
- Whatever was done in the transmitter will be undone in the receiver.
- For example, modulation in TX will be matched by Demodulation in RX, A to D in TX will be undone by D to A in the receiver and so on.

APPLICATION AREAS OF COMMUNICATION SYSTEM

- There are several types of communications which are used in different fields. The application areas of communication system mainly include the following.
- A strategic communications system is applicable for straight support of strategic forces. It is designed to meet up the necessities of changing strategic conditions as well as environmental conditions.

- It gives protectable communications like data, voice, video, between the mobile users to make possible. Generally, requires very short fitting times, typically on the hours of order, in order to gather the necessities of common replacement.

- An Emergency communication system is normally based on the computer that is mainly used for the two-way communication of urgent situation of sending messages between two persons & groups of persons.

- The main intention of these systems to combine the cross-communication of messages among is different communication technologies.

- An ACD or Automatic call distributor is one kind of <u>communication system</u> that routinely assigns, queues, as well as unites callers in the direction of handlers.
- Main applications of this system involved in customer service, placing an order by telephone, otherwise management services.
- A VCCS or Voice Communication Control System is basically an automatic call distributor with characteristics that make to utilize in dangerous situations.

<u>TYPES OF COMMUNICATION SYSTEM</u>

1. Optical Communication System

    - The word "Optical" stands for light. As the name itself suggests, optical communication system depends on light as the medium for communication.

    - In an optical communication system, the transmitter converts the information into an optical signal (signal in the form of light) and finally the signal then reaches the recipient.

    - The recipient then decodes the signal and responds accordingly. In optical communication system, light helps in the transmission of information.

    - The safe landing of helicopters and aeroplanes work on the above principle. The pilots receive light signals from the base and decide their next movements.

    - On the roads, red light communicates the individual to immediately stop while the individual moves on seeing the green light.

    - In this mode of communication light travels through the optical fibre.

2. Radio Communication System

- In the radio communication system, the information flows with the help of a radio.

- Radio communication system works with the aid of a transmitter and a receiver both equipped with an antenna.

- The transmitter with the help of an antenna produces signals which are carried through radio carrier wave.

- The receiver also with the help of an antenna receives the signal.

- Some information is unwanted and must be discarded and hence the electronic filters help in the separation of radio signals from other unwanted signals which are further amplified to an optimum level

- Finally the signals are decoded in an information which can be easily understood by the individuals for them to respond accordingly.

3. Duplex communications system

- In Duplex communications system two equipment's can communicate with each other in both the directions simultaneously and hence the name Duplex.

- When you interact with your friend over the telephone, both of you can listen to each other at the same time.

- The sender sends the signals to the receiver who receives it then and there and also give his valuable feedback to the speaker for him to respond.

- Hence the communication actually takes place between the speaker and the receiver simultaneously.

- In the Duplex communication system, two devices can communicate with each other at the same time.

- A type of communication system involves the sender and the receiver where the sender is in charge of sending signals and the recipients only listen to it and respond accordingly.

- Such communication is also called Simplex communication system.

4. Half Duplex Communication System

- In half Duplex communication system, both the two parties can't communicate simultaneously.

- The sender has to stop sending the signals to the recipient and then only the recipient can respond.

- A walkie talkie works on the half duplex communication system. The military personnel while interacting has to say "Over" for the other person to respond.

- He needs to speak the security code correctly for the other person to speak.

- The other party will never communicate unless and until the code is correct and complete.

5. Tactical Communication System

- Another mode of communication is the tactical mode of communication. In this mode of communication, communication varies according to the changes in the environmental conditions and other situations.

DISTRIBUTED SYSTEMS

- **A distributed system, also known as distributed computing, is a system with multiple components located on different machines that communicate and coordinate actions in order to appear as a single coherent system to the end-user.**
- The machines that are a part of a distributed system may be computers, physical servers, virtual machines, containers, or any other node that can connect to the network, have local memory, and communicate by passing messages.

There are two general ways that distributed systems function:

1. Each machine works toward a common goal and the end-user views results as one cohesive unit.

2. Each machine has its own end-user and the distributed system facilitates sharing resources or communication services.

- Although distributed systems can sometimes be obscure, they usually have three primary characteristics: all components run concurrently, there is no global clock, and all components fail independently of each other.

BENEFITS AND CHALLENGES OF DISTRIBUTED SYSTEMS

- There are three reasons that teams generally decide to <u>implement distributed systems</u>:

- **Horizontal Scalability**—Since computing happens independently on each node, it is easy and generally inexpensive to add additional nodes and functionality as necessary.
- **Reliability**—Most distributed systems are fault-tolerant as they can be made up of hundreds of nodes that work together. The system generally doesn't experience any disruptions if a single machine fails.
- **Performance**—Distributed systems are extremely efficient because work loads can be broken up and sent to multiple machines.

However, distributed systems are not without challenges. Complex architectural design, construction, and debugging processes that are required to create an effective distributed system can be overwhelming.

Three more challenges you may encounter include:

- **Scheduling**—A distributed system has to decide which jobs need to run, when they should run, and where they should run. Schedulers ultimately have limitations, leading to underutilized hardware and unpredictable <u>runtimes</u>.
- **Latency**—The more widely your system is distributed, the more latency you can experience with communications. This often leads to teams making trade-offs between availability, consistency, and latency.
- **Observability**—Gathering, processing, presenting, and <u>monitoring hardware usage metrics</u> for large clusters is a significant challenge.

WORKING PRINCIPLE OF DISTRIBUTED SYSTEMS

- Hardware and software architectures are used to maintain a distributed system.
- Everything must be interconnected—CPUs via the network and processes via the communication system.

TYPES OF DISTRIBUTED SYSTEMS

Distributed systems generally fall into one of four different basic architecture models:

1. **Client-server**—Clients contact the server for data, then format it and display it to the end-user. The end-user can also make a change from the client-side and commit it back to the server to make it permanent.
2. **Three-tier**—Information about the client is stored in a middle tier rather than on the client to simplify application deployment. This architecture model is most common for web applications.
3. ***n*-tier**—Generally used when an application or server needs to forward requests to additional enterprise services on the network.
4. **Peer-to-peer**—There are no additional machines used to provide services or manage resources. Responsibilities are uniformly distributed among machines in the system, known as peers, which can serve as either client or server.

INTERNET
- The Internet, sometimes called simply "the Net," is a worldwide system of computer networks -- a network of networks in which users at any one computer can, if they have permission, get information from any other computer (and sometimes talk directly to users at other computers).

- It was conceived by the Advanced Research Projects Agency (ARPA) of the U.S. government in 1969 and was first known as the ARPANet.

- The original aim was to create a network that would allow users of a research computer at one university to "talk to" research computers at other universities.

- A side benefit of ARPANet's design was that, because messages could be routed or rerouted in more than one direction, the network could continue

to function even if parts of it were destroyed in the event of a military attack or other disaster.

- Today, the Internet is a public, cooperative and self-sustaining facility accessible to hundreds of millions of people worldwide.

HOW THE INTERNET WORKS

- Physically, the Internet uses a portion of the total resources of the currently existing public telecommunication networks.

- Technically, what distinguishes the Internet is its use of a set of protocols called Transmission Control Protocol/Internet Protocol (TCP/IP).

- Two recent adaptations of Internet technology, the intranet and the extranet, also make use of the TCP/IP protocol.

- The Internet can be seen as having two major components: network protocols and hardware.

- The protocols, such as the TCP/IP suite, present sets of rules that devices must follow in order to complete tasks.

- Without this common collection of rules, machines would not be able to communicate.

- The protocols are also responsible for translating the alphabetic text of a message into electronic signals that can be transmitted over the Internet, and then back again into legible, alphabetic text.

- Hardware, the second major component of the Internet, includes everything from the computer or smartphone that is used to access the Internet to the cables that carry information from one device to another.

- Additional types of hardware include satellites, radios, cell phone towers, routers and servers.

- These various types of hardware are the connections within the network. Devices such as computers, smartphones and laptops are end points, or clients, while the machines that store the information are the servers.

- The transmission lines that exchange the data can either be wireless signals from satellites or 4G and cell phone towers, or physical lines, such as cables and fibre optics.

- The process of transferring information from once device to another relies on packet switching.

- Each computer connected to the Internet is assigned a unique IP address that allows the device to be recognized.

- When one device attempts to send a message to another device, the data is sent over the Internet in the form of manageable packets.

- Each packet is assigned a port number that will connect it to its endpoint.

- A packet that has both a unique IP address and port number can be translated from alphabetic text into electronic signals by travelling through the layers of the OSI model from the top application layer to the bottom physical layer.

- The message will then be sent over the Internet where it is received by the Internet service provider's (ISP) router.

- The router will examine the destination address assigned to each packet and determine where to send it.

- Eventually, the packet reaches the client and travels in reverse from the bottom physical layer of the OSI model to the top application layer.

- During this process, the routing data -- the port number and IP address -- is stripped from the packet, thus allowing the data to be translated back into alphabetic text and completing the transmission process.

<u>USES OF THE INTERNET</u>

- In general, the Internet can be used to communicate across large or small distances, share information from any place in the world and access information or answers to almost any question in moments.

Some specific examples of how the Internet is used include:

- <u>E-mail</u> and other forms of communication, such Internet Relay Chat (<u>IRC</u>), <u>Internet telephony</u>, <u>instant messaging</u>, <u>video conferencing</u> and <u>social media</u>;
- education and self-improvement through access to online degree programs, courses and workshops and
- searching for jobs -- both the employer and applicant use the Internet to post open positions, apply for jobs and recruit individuals found on social networking sites like <u>LinkedIn</u>.

Other examples include:

- <u>Online discussion groups and forums</u>
- Online dating
- Online gaming
- Research
- Reading electronic newspapers and magazines
- Online shopping

<u>DIFFERENCE BETWEEN THE WORLD WIDE WEB AND THE INTERNET</u>

- The key difference between the Internet and the World Wide Web (<u>WWW or the Web</u>) is that the Internet is a global connection of networks while the Web is a collection of information that can be accessed using the Internet. In other words, the Internet is the <u>infrastructure</u> and the Web is a service on top.

- The Web is the most widely used part of the Internet. Its outstanding feature is <u>hypertext</u>, a method of instant cross-referencing.

- In most Web sites, certain words or phrases appear in text of a different color than the rest; often this text is also underlined.

- When a user selects one of these words or phrases, they will be transferred to the related site or page. Buttons, images, or portions of images are also used as <u>hyperlinks</u>.

- The Web provides access to billions of pages of information. Web browsing is done through a Web <u>browser</u>, the most popular of which are <u>Google Chrome</u>, <u>Firefox</u> and <u>Internet Explorer</u>.

- The appearance of a particular <u>Web site</u> may vary slightly depending on the browser used.

- Later or more updated versions of a particular browser are able to render more complex features, such as animation, <u>virtual reality</u>, sound and music files.

<u>SECURITY AND THE INTERNET</u>

- Large amounts of information, both public and private, is collected across the Internet, opening users up to the risk of <u>data breaches</u> and other <u>security</u> threats.

- <u>Hackers</u> and <u>crackers</u> can break into networks and systems and steal information such as login information or bank and credit card account records.

Some steps that can be taken to protect online privacy include:

- Installing <u>antivirus</u> and <u>antimalware</u>
- Creating difficult, varied <u>passwords</u> that are impossible to guess.

- Using a virtual private network (VPN) or, at least, a private browsing mode, such as Google Chrome's Incognito window.

- Only using HTTPS

- Making all social media accounts private.

- Deactivating autofill.

- Turning off the device's GPS.

- Updating cookies so an alert is sent anytime a cookie is installed.

- Logging out of accounts instead of just closing the tab or window.

- Using caution with spam emails and never opening or downloading content from unknown sources.

- Using caution when accessing public Wi-Fi or hotspots.

Additionally, there is an element of the Internet called the dark web.

- The dark web is hidden and inaccessible through standard browsers. Instead, it uses the Tor and I2P browsers which allow users to remain entirely anonymous.

- While this anonymity can be a great way to protect an online user's security and free speech or for the government to keep classified data hidden, the dark web also creates an environment that facilitates cybercrime, the transfer of illegal goods and terrorism.

Social impact of the Internet

- The social impact of the Internet can be seen as both positive and negative.

- On one side, people argue that the Internet has increased the risk of isolation, alienation and withdrawal from society, pointing to increases in an emotional response called FOMO, or the fear of missing out.

- On the other side, people believe the Internet to have had the opposite effect on society, arguing that the Internet increases civic engagement, sociability and the intensity of relationships.

- Whether the impacts are good or bad, the Internet has changed the way society interacts and connects.

- One example of change is the increased focus on personal growth and a decline in a community that is determined by work, family and space.

- People are now constructing social relationships based on individual interests, projects and values. Communities are being formed by like-minded individuals not only offline and in person, but through the Internet and the multitude of online environments which it creates and offers.

- Social networking sites -- like Facebook and LinkedIn -- have become the preferred platforms for both businesses and individuals looking to perform all kinds of tasks and communicate with others.

BENEFITS OF THE INTERNET

- Access to endless information, knowledge and education.

- An increased ability to communicate, connect and share.

- The ability to work from home, collaborate and access a global workforce.

- The chance to sell and make money as a business or individual.

- Access to an unlimited supply of entertainment sources, such as movies, music, videos and games.

- The ability to amplify the impact of a message, allowing charities and other organizations to reach a wider audience and increase the total amount of donations.

- Access to the internet of things (IoT), which allows home appliances and devices to connect and be controlled from a computer or smartphone.

- The ability to save data and easily share files with cloud storage.

- The ability to monitor and control personal accounts instantly, such as bank accounts or credit card bills.

HISTORY OF THE INTERNET

- The ARPANet, the predecessor of the Internet, was first deployed in 1969. In 1983, the ARPANet transitioned into using the TCP/IP open networking protocol suite and in 1985, the National Science Foundation Network (NSFN) designed the network to connect university computer science departments around the country.

- Communications over the Internet greatly improved in 1989 when the hypertext transfer protocol (HTTP) was created, giving different computer platforms the ability to connect to the same Internet sites. In 1993, the Mosaic Web browser was created.

- The Internet has continued to grow and evolve over the years of its existence. IPv6, for example, was designed to anticipate enormous future expansion in the number of available IP addresses.

- In a related development, the IoT is the burgeoning environment in which almost any entity or object can be provided with a unique identified (UID) and the ability to transfer data automatically over the Internet.

INTRANET

Intranet is defined as private network of computers within an organization with its own server and firewall. Moreover we can define Intranet as:

- Intranet is system in which multiple PCs are networked to be connected to each other. PCs in intranet are not available to the world outside of the intranet.

- Usually each company or organization has their own Intranet network and members/employees of that company can access the computers in their intranet.

- Every computer in internet is identified by a unique IP address.

- Each computer in Intranet is also identified by a IP Address, which is unique among the computers in that Intranet.
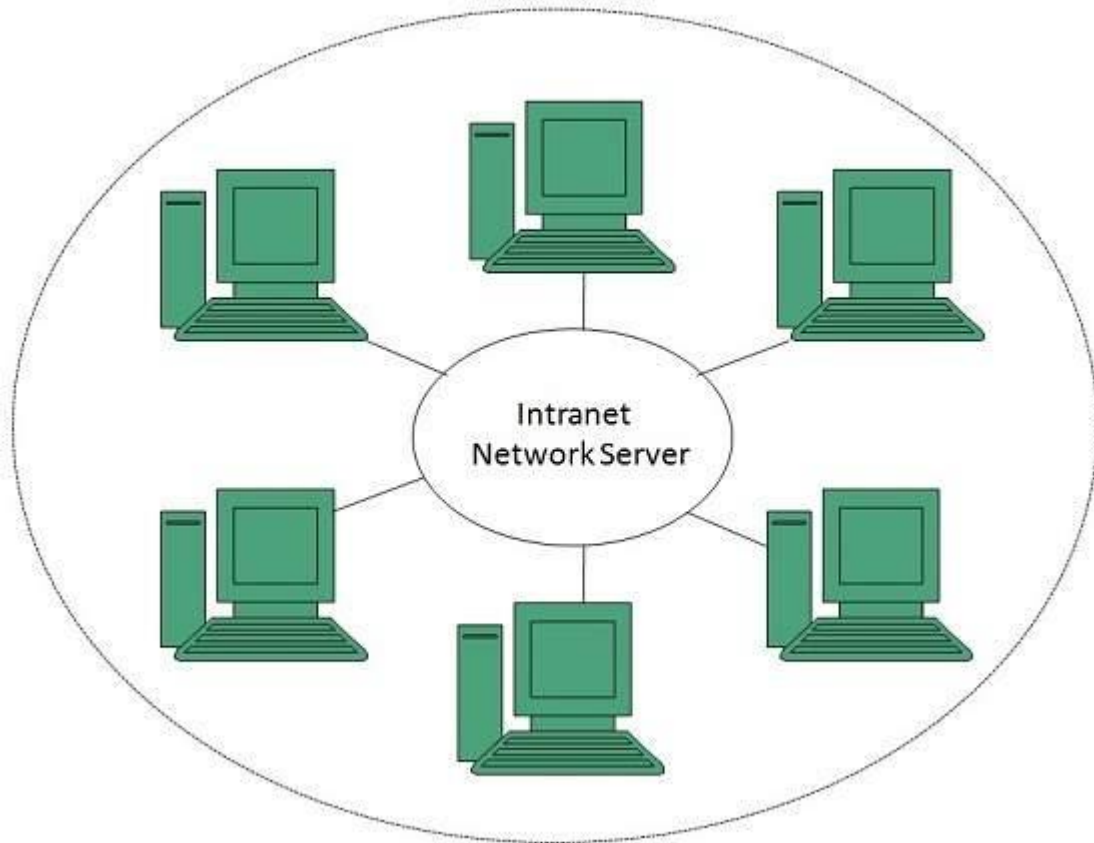
BENEFITS

- Intranet is very efficient and reliable network system for any organization. It is beneficial in every aspect such as collaboration, cost-effectiveness, security, productivity and much more.

Intranet Advantages
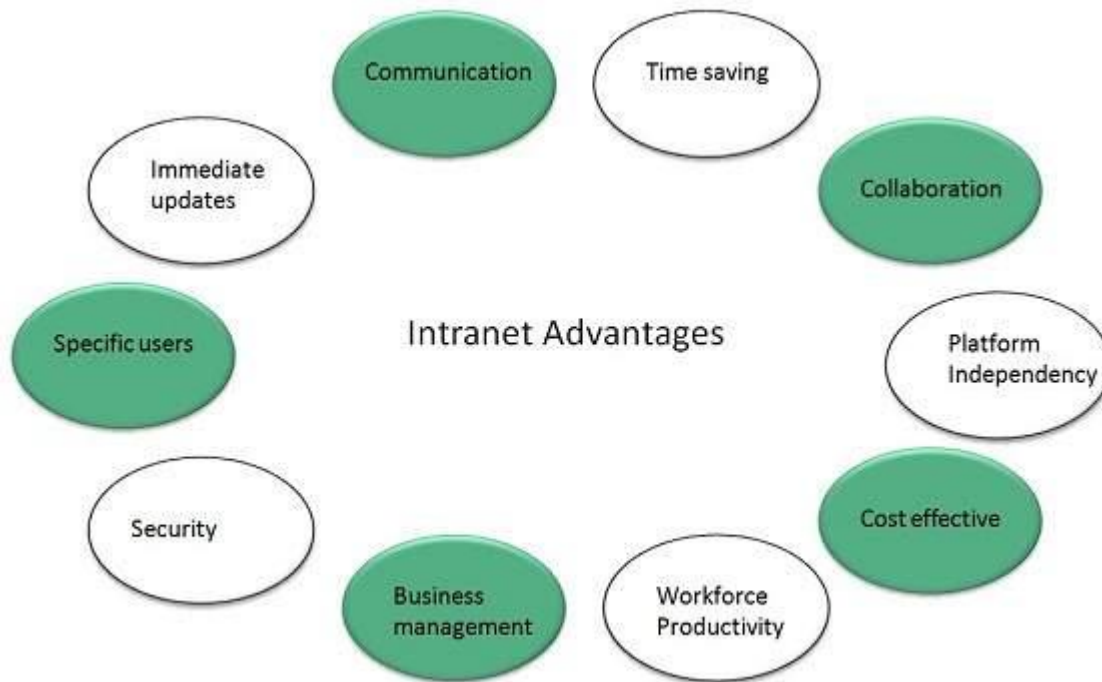
COMMUNICATION

Intranet offers easy and cheap communication within an organization. Employees can communicate using chat, e-mail or blogs.

Time Saving

- Information on Intranet is shared in real time.

Collaboration

- Information is distributed among the employees as according to requirement and it can be accessed by the authorized users, resulting in enhanced teamwork.

Platform Independency

- Intranet can connect computers and other devices with different architecture.

Cost Effective

- Employees can see the data and other documents using browser rather than printing them and distributing duplicate copies among the employees, which certainly decreases the cost.

Workforce Productivity

- Data is available at every time and can be accessed using company workstation. This helps the employees work faster.

Business Management

- It is also possible to deploy applications that support business operations.

Security

- Since information shared on intranet can only be accessed within an organization, therefore there is almost no chance of being theft.

Specific Users
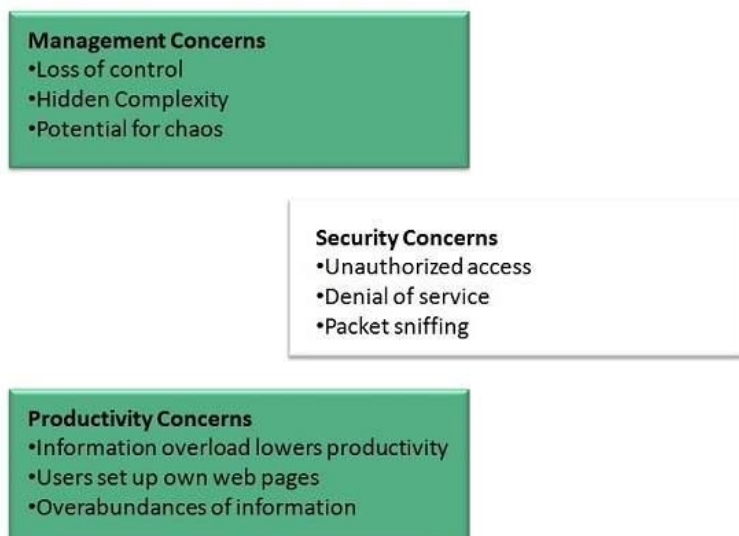
- Intranet targets only specific users within an organization therefore, once can exactly know whom he is interacting.

Immediate Updates

- Any changes made to information are reflected immediately to all the users.

Issues

- Apart from several benefits of Intranet, there also exist some issues.. These issues are shown in the following diagram:

Management Concerns
- Loss of control
- Hidden Complexity
- Potential for chaos

Security Concerns
- Unauthorized access
- Denial of service
- Packet sniffing

Productivity Concerns
- Information overload lowers productivity
- Users set up own web pages
- Overabundances of information

APPLICATIONS

- Intranet applications are same as that of Internet applications. Intranet applications are also accessed through a web browser.

- The only difference is that, Intranet applications reside on local server while Internet applications reside on remote server.
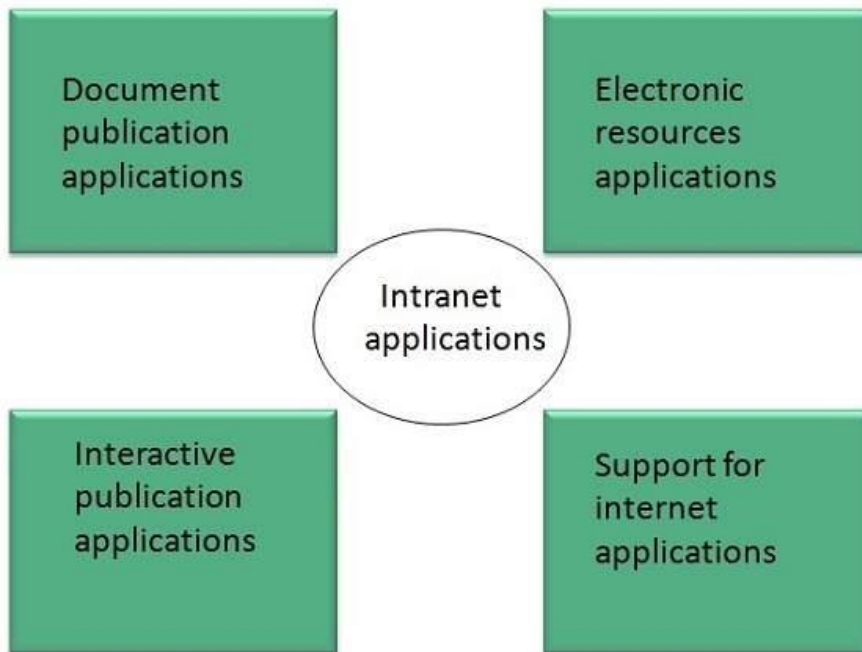
Document publication applications

- Document publication applications allow publishing documents such as manuals, software guide, employee profits etc without use of paper.

Electronic resources applications

- It offers electronic resources such as software applications, templates and tools, to be shared across the network.

Interactive Communication applications

- Like on internet, we have e-mail and chat like applications for Intranet, hence offering an interactive communication among employees.

Support for Internet Applications

- Intranet offers an environment to deploy and test applications before placing them on Internet.

INTERNET VS. INTRANET

- Apart from similarities there are some differences between the two. Following are the differences between Internet and Intranet:

Intranet	Internet
Localized Network.	Worldwide Network
Doesn't have access to Intranet	Have access to Internet.
More Expensive	Less Expensive
More Safe	Less Safe
More Reliability	Less Reliability

Unit-V

Multimedia tools- Virtual Reality- E-Commerce- Data Warehousing-Data Mining-Application; Geographical Information System -computer in business, Industry, Home, Education and Training

VIRTUAL REALITY

- Virtual reality is an artificial environment that is created with software and presented to the user in such a way that the user suspends belief and accepts it as a real environment. On a computer, virtual reality is primarily experienced through two of the five senses: sight and sound.

- The simplest form of virtual reality is a 3-D image that can be explored interactively at a personal computer, usually by manipulating keys or the mouse so that the content of the image moves in some direction or zooms in or out.

- More sophisticated efforts involve such approaches as wrap-around display screens, actual rooms augmented with wearable computers, and haptics devices that let you feel the display images.

Virtual reality can be divided into:

- The simulation of a real environment for training and education.
- The development of an imagined environment for a game or interactive story.

The Virtual Reality Modelling Language (VRML) allows the creator to specify images and the rules for their display and interaction using textual language statements.

Ecommerce

- Ecommerce, also known as electronic commerce or internet commerce, refers to the buying and selling of goods or services using the internet, and the transfer of money and data to execute these transactions.

- Ecommerce is often used to refer to the sale of physical products online, but it can also describe any kind of commercial transaction that is facilitated through the internet.

- Whereas e-business refers to all aspects of operating an online business, ecommerce refers specifically to the transaction of goods and services.

- The <u>history of ecommerce</u> begins with the first ever online sale: on the August 11, 1994 a man sold a CD by the band Sting to his friend through his website Net Market, an American retail platform.

- This is the first example of a consumer purchasing a product from a business through the World Wide Web—or "ecommerce" as we commonly know it today.

- Since then, ecommerce has evolved to make products easier to discover and purchase through online retailers and marketplaces.

- Independent freelancers, small businesses, and large corporations have all benefited from ecommerce, which enables them to sell their goods and services at a scale that was not possible with traditional offline retail.

- Global retail ecommerce sales are projected to reach <u>$27 trillion</u> by 2020.

Types of Ecommerce Models

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

1. Business to Consumer (B2C):
When a business sells a good or service to an individual consumer (e.g. You buy a pair of shoes from an online retailer).

2. Business to Business (B2B):

When a business sells a good or service to another business (e.g. A business sells software-as-a-service for other businesses to use)

3. Consumer to Consumer (C2C):

When a consumer sells a good or service to another consumer (e.g. You sell your old furniture on eBay to another consumer).

4. Consumer to Business (C2B):

When a consumer sells their own products or services to a business or organization (e.g. An influencer offers exposure to their online audience in exchange for a fee, or a photographer licenses their photo for a business to use).

Examples of Ecommerce

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

1. Retail:

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

2. Wholesale:

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

3. Drop shipping:

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

4. Crowdfunding:

The collection of money from consumers in advance of a product being available in order to raise the start-up capital necessary to bring it to market.

5. Subscription:

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

6. Physical products:

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

7. Digital products:

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

8. Services:

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

What is Data Warehousing?

- A **Data Warehousing** (DW) is process for collecting and managing data from varied sources to provide meaningful business insights.
- A Data warehouse is typically used to connect and analyze business data from heterogeneous sources. The data warehouse is the core of the BI system which is built for data analysis and reporting.
- It is a blend of technologies and components which aids the strategic use of data.
- It is electronic storage of a large amount of information by a business which is designed for query and analysis instead of transaction processing.
- It is a process of transforming data into information and making it available to users in a timely manner to make a difference.
- The decision support database (Data Warehouse) is maintained separately from the organization's operational database. However, the data warehouse is not a product but an environment.
- It is an architectural construct of an information system which provides users with current and historical decision support information which is difficult to access or present in the traditional operational data store.
- You many know that a 3NF-designed database for an inventory system many have tables related to each other.

- For example, a report on current inventory information can include more than 12 joined conditions. This can quickly slow down the response time of the query and report. A data warehouse provides a new design which can help to reduce the response time and helps to enhance the performance of queries for reports and analytics.

Data warehouse system is also known by the following name:

- Decision Support System (DSS)
- Executive Information System
- Management Information System
- Business Intelligence Solution
- Analytic Application
- Data Warehouse

History of Datawarehouse

The Datawarehouse benefits users to understand and enhance their organization's performance. The need to warehouse data evolved as computer

systems became more complex and needed to handle increasing amounts of Information. However, Data Warehousing is a not a new thing.

Here are some key events in evolution of Data Warehouse-

- 1960- Dartmouth and General Mills in a joint research project, develop the terms dimensions and facts.

- 1970- A Nielsen and IRI introduces dimensional data marts for retail sales.
- 1983- Tera Data Corporation introduces a database management system which is specifically designed for decision support

- Data warehousing started in the late 1980s when IBM worker Paul Murphy and Barry Devlin developed the Business Data Warehouse.

- However, the real concept was given by Inmon Bill. He was considered as a father of data warehouse. He had written about a variety of topics for building, usage, and maintenance of the warehouse & the Corporate Information Factory.

How Datawarehouse works?

- A Data Warehouse works as a central repository where information arrives from one or more data sources.
- Data flows into a data warehouse from the transactional system and other relational databases.

Data may be:

1. Structured
2. Semi-structured
3. Unstructured data

- The data is processed, transformed, and ingested so that users can access the processed data in the Data Warehouse through Business Intelligence tools, SQL clients, and spreadsheets.
- A data warehouse merges information coming from different sources into one comprehensive database.

- By merging all of this information in one place, an organization can analyze its customers more holistically. This helps to ensure that it has considered all the information available. Data warehousing makes data mining possible. Data mining is looking for patterns in the data that may lead to higher sales and profits.

Types of Data Warehouse

1. Enterprise Data Warehouse:

Enterprise Data Warehouse is a centralized warehouse. It provides decision support service across the enterprise. It offers a unified approach for organizing and representing data. It also provide the ability to classify data according to the subject and give access according to those divisions.

2. Operational Data Store:

Operational Data Store, which is also called ODS, are nothing but data store required when neither Data warehouse nor OLTP systems support organizations reporting needs. In ODS, Data warehouse is refreshed in real time. Hence, it is widely preferred for routine activities like storing records of the Employees.

3. Data Mart:

A data mart is a subset of the data warehouse. It specially designed for a particular line of business, such as sales, finance, sales or finance. In an independent data mart, data can collect directly from sources.

General stages of Data Warehouse

Earlier, organizations started relatively simple use of data warehousing. However, over time, more sophisticated use of data warehousing begun.

The following are general stages of use of the data warehouse:

Offline Operational Database:

In this stage, data is just copied from an operational system to another server. In this way, loading, processing, and reporting of the copied data do not impact the operational system's performance.

Offline Data Warehouse:

Data in the Datawarehouse is regularly updated from the Operational Database. The data in Datawarehouse is mapped and transformed to meet the Datawarehouse objectives.

Real time Data Warehouse:

In this stage, Data warehouses are updated whenever any transaction takes place in operational database. For example, Airline or railway booking system.

Integrated Data Warehouse:

In this stage, Data Warehouses are updated continuously when the operational system performs a transaction. The Datawarehouse then generates transactions which are passed back to the operational system.

Components of Data warehouse

Four components of Data Warehouses are:

Load manager: Load manager is also called the front component. It performs with all the operations associated with the extraction and load of data into the warehouse. These operations include transformations to prepare the data for entering into the Data warehouse.

Warehouse Manager: Warehouse manager performs operations associated with the management of the data in the warehouse. It performs operations like analysis of data to ensure consistency, creation of indexes and views, generation of denormalization and aggregations, transformation and merging of source data and archiving and baking-up data.

Query Manager: Query manager is also known as backend component. It performs all the operation operations related to the management of user queries. The operations of this Data warehouse components are direct queries to the appropriate tables for scheduling the execution of queries.

End-user access tools:

This is categorized into five different groups like 1. Data Reporting 2. Query Tools 3. Application development tools 4. EIS tools, 5. OLAP tools and data mining tools.

Who needs Data warehouse?

Data warehouse is needed for all types of users like:

- Decision makers who rely on mass amount of data
- Users who use customized, complex processes to obtain information from multiple data sources.
- It is also used by the people who want simple technology to access the data
- It also essential for those people who want a systematic approach for making decisions.
- If the user wants fast performance on a huge amount of data which is a necessity for reports, grids or charts, then Data warehouse proves useful.
- Data warehouse is a first step If you want to discover 'hidden patterns' of data-flows and groupings.

What Is a Data Warehouse Used For?

Here, are most common sectors where Data warehouse is used:

Airline:

In the Airline system, it is used for operation purpose like crew assignment, analyses of route profitability, frequent flyer program promotions, etc.

Banking:

It is widely used in the banking sector to manage the resources available on desk effectively. Few banks also used for the market research, performance analysis of the product and operations.

Healthcare:

Healthcare sector also used Data warehouse to strategize and predict outcomes, generate patient's treatment reports, share data with tie-in insurance companies, medical aid services, etc.

Public sector:

In the public sector, data warehouse is used for intelligence gathering. It helps government agencies to maintain and analyze tax records, health policy records, for every individual.

Investment and Insurance sector:

In this sector, the warehouses are primarily used to analyze data patterns, customer trends, and to track market movements.

Retain chain:

In retail chains, Data warehouse is widely used for distribution and marketing. It also helps to track items, customer buying pattern, promotions and also used for determining pricing policy.

Telecommunication:

A data warehouse is used in this sector for product promotions, sales decisions and to make distribution decisions.

Hospitality Industry:

This Industry utilizes warehouse services to design as well as estimate their advertising and promotion campaigns where they want to target clients based on their feedback and travel patterns.

Steps to Implement Data Warehouse

The best way to address the business risk associated with a Datawarehouse implementation is to employ a three-prong strategy as below

1. **Enterprise strategy**: Here we identify technical including current architecture and tools. We also identify facts, dimensions, and attributes. Data mapping and transformation is also passed.
2. **Phased delivery**: Datawarehouse implementation should be phased based on subject areas. Related business entities like booking and billing should be first implemented and then integrated with each other.
3. **Iterative Prototyping**: Rather than a big bang approach to implementation, the Datawarehouse should be developed and tested iteratively.

Here, are key steps in Datawarehouse implementation along with its deliverables.

Step	Tasks	Deliverables
1	Need to define project scope	Scope Definition
2	Need to determine business needs	Logical Data Model
3	Define Operational Datastore requirements	Operational Data Store Model
4	Acquire or develop Extraction tools	Extract tools and Software
5	Define Data Warehouse Data requirements	Transition Data Model
6	Document missing data	To Do Project List
7	Maps Operational Data Store to Data Warehouse	D/W Data Integration Map

8	Develop Data Warehouse Database design	D/W Database Design
9	Extract Data from Operational Data Store	Integrated D/W Data Extracts
10	Load Data Warehouse	Initial Data Load
11	Maintain Data Warehouse	On-going Data Access and Subsequent Loads

Best practices to implement a Data Warehouse

- Decide a plan to test the consistency, accuracy, and integrity of the data.
- The data warehouse must be well integrated, well defined and time stamped.
- While designing Datawarehouse make sure you use right tool, stick to life cycle, take care about data conflicts and ready to learn you're your mistakes.
- Never replace operational systems and reports
- Don't spend too much time on extracting, cleaning and loading data.
- Ensure to involve all stakeholders including business personnel in Datawarehouse implementation process. Establish that Data warehousing is a joint/ team project. You don't want to create Data warehouse that is not useful to the end users.
- Prepare a training plan for the end users.

Advantages of Data Warehouse:

- Data warehouse allows business users to quickly access critical data from some sources all in one place.
- Data warehouse provides consistent information on various cross-functional activities. It is also supporting ad-hoc reporting and query.
- Data Warehouse helps to integrate many sources of data to reduce stress on the production system.
- Data warehouse helps to reduce total turnaround time for analysis and reporting.

- Restructuring and Integration make it easier for the user to use for reporting and analysis.
- Data warehouse allows users to access critical data from the number of sources in a single place. Therefore, it saves user's time of retrieving data from multiple sources.
- Data warehouse stores a large amount of historical data. This helps users to analyze different time periods and trends to make future predictions.

Disadvantages of Data Warehouse:

- Not an ideal option for unstructured data.
- Creation and Implementation of Data Warehouse is surely time confusing affair.
- Data Warehouse can be outdated relatively quickly
- Difficult to make changes in data types and ranges, data source schema, indexes, and queries.
- The data warehouse may seem easy, but actually, it is too complex for the average users.
- Despite best efforts at project management, data warehousing project scope will always increase.
- Sometime warehouse users will develop different business rules.
- Organisations need to spend lots of their resources for training and Implementation purpose.

The Future of Data Warehousing

- Change in **Regulatory constrains** may limit the ability to combine source of disparate data. These disparate sources may include unstructured data which is difficult to store.
- As the **size** of the databases grows, the estimates of what constitutes a very large database continue to grow. It is complex to build and run data warehouse systems which are always increasing in size. The hardware and software resources are available today do not allow to keep a large amount of data online.
- **Multimedia data** cannot be easily manipulated as text data, whereas textual information can be retrieved by the relational software available today. This could be a research subject.

Data Warehouse Tools

There are many Data Warehousing tools are available in the market. Here, are some most prominent one:

1. MarkLogic:

MarkLogic is useful data warehousing solution that makes data integration easier and faster using an array of enterprise features. This tool helps to perform very complex search operations. It can query different types of data like documents, relationships, and metadata.

http://developer.marklogic.com/products

2. Oracle:

Oracle is the industry-leading database. It offers a wide range of choice of data warehouse solutions for both on-premises and in the cloud. It helps to optimize customer experiences by increasing operational efficiency.

https://www.oracle.com/index.html

3. Amazon RedShift:

Amazon Redshift is Data warehouse tool. It is a simple and cost-effective tool to analyze all types of data using standard SQL and existing BI tools. It also allows running complex queries against petabytes of structured data, using the technique of query optimization.

https://aws.amazon.com/redshift/?nc2=h_m1

Here is a complete list of useful Datawarehouse Tools.

DATA MINING

- Data mining is widely used in diverse areas. There are a number of commercial data mining system available today and yet there are many challenges in this field. In this tutorial, we will discuss the applications and the trend of data mining.

Data Mining Applications

Here is the list of areas where data mining is widely used −

- Financial Data Analysis
- Retail Industry
- Telecommunication Industry
- Biological Data Analysis
- Other Scientific Applications
- Intrusion Detection

Financial Data Analysis

The financial data in banking and financial industry is generally reliable and of high quality which facilitates systematic data analysis and data mining. Some of the typical cases are as follows −

- Design and construction of data warehouses for multidimensional data analysis and data mining.
- Loan payment prediction and customer credit policy analysis.
- Classification and clustering of customers for targeted marketing.
- Detection of money laundering and other financial crimes.

Retail Industry

- Data Mining has its great application in Retail Industry because it collects large amount of data from on sales, customer purchasing history, goods transportation, consumption and services.
- It is natural that the quantity of data collected will continue to expand rapidly because of the increasing ease, availability and popularity of the web.

- Data mining in retail industry helps in identifying customer buying patterns and trends that lead to improved quality of customer service and good customer retention and satisfaction.

Here is the list of examples of data mining in the retail industry −

- Design and Construction of data warehouses based on the benefits of data mining.

- Multidimensional analysis of sales, customers, products, time and region.

- Analysis of effectiveness of sales campaigns.

- Customer Retention.

- Product recommendation and cross-referencing of items.

Telecommunication Industry

- Today the telecommunication industry is one of the most emerging industries providing various services such as fax, pager, cellular phone, internet messenger, images, e-mail, web data transmission, etc.
- Due to the development of new computer and communication technologies, the telecommunication industry is rapidly expanding. This is the reason why data mining is become very important to help and understand the business.
- Data mining in telecommunication industry helps in identifying the telecommunication patterns, catch fraudulent activities, make better use of resource, and improve quality of service.

Here is the list of examples for which data mining improves telecommunication services −

- Multidimensional Analysis of Telecommunication data.

- Fraudulent pattern analysis.

- Identification of unusual patterns.

- Multidimensional association and sequential patterns analysis.

- Mobile Telecommunication services.

- Use of visualization tools in telecommunication data analysis.

Biological Data Analysis

In recent times, we have seen a tremendous growth in the field of biology such as genomics, proteomics, functional Genomics and biomedical research.

Biological data mining is a very important part of Bioinformatics. Following are the aspects in which data mining contributes for biological data analysis −

- Semantic integration of heterogeneous, distributed genomic and proteomic databases.

- Alignment, indexing, similarity search and comparative analysis multiple nucleotide sequences.

- Discovery of structural patterns and analysis of genetic networks and protein pathways.

- Association and path analysis.

- Visualization tools in genetic data analysis.

Scientific Applications

The applications discussed above tend to handle relatively small and homogeneous data sets for which the statistical techniques are appropriate. Huge amount of data have been collected from scientific domains such as geosciences, astronomy, etc. A large amount of data sets is being generated because of the fast numerical simulations in various fields such as climate and ecosystem modeling, chemical engineering, fluid dynamics, etc. Following are the applications of data mining in the field of Scientific Applications −

- Data Warehouses and data preprocessing.
- Graph-based mining.
- Visualization and domain specific knowledge.

Intrusion Detection

Intrusion refers to any kind of action that threatens integrity, confidentiality, or the availability of network resources. In this world of connectivity, security has become the major issue. With increased usage of internet and availability of the tools and tricks for intruding and attacking network prompted intrusion detection to become a critical component of network administration. Here is the list of areas in which data mining technology may be applied for intrusion detection −

- Development of data mining algorithm for intrusion detection.

- Association and correlation analysis, aggregation to help select and build discriminating attributes.

- Analysis of Stream data.

- Distributed data mining.

- Visualization and query tools.

Data Mining System Products

There are many data mining system products and domain specific data mining applications. The new data mining systems and applications are being added to the previous systems. Also, efforts are being made to standardize data mining languages.

Choosing a Data Mining System

The selection of a data mining system depends on the following features −

- **Data Types** − The data mining system may handle formatted text, record-based data, and relational data. The data could also be in ASCII text, relational database data or data warehouse data. Therefore, we should check what exact format the data mining system can handle.

- **System Issues** − We must consider the compatibility of a data mining system with different operating systems. One data mining system may run on only one operating system or on several. There are also data mining systems that provide web-based user interfaces and allow XML data as input.

- **Data Sources** − Data sources refer to the data formats in which data mining system will operate. Some data mining system may work only on ASCII text files while others on multiple relational sources. Data mining system should also support ODBC connections or OLE DB for ODBC connections.

- **Data Mining functions and methodologies** − There are some data mining systems that provide only one data mining function such as classification while some provides multiple data mining functions such as concept description, discovery-driven OLAP analysis, association mining, linkage analysis, statistical analysis, classification, prediction, clustering, outlier analysis, similarity search, etc.

- **Coupling data mining with databases or data warehouse systems** − Data mining systems need to be coupled with a database or a data warehouse system. The coupled components are integrated into a uniform information processing environment. Here are the types of coupling listed below −

    - No coupling
    - Loose Coupling
    - Semi tight Coupling
    - Tight Coupling

- **Scalability** − There are two scalability issues in data mining −

  - o **Row (Database size) Scalability** − A data mining system is considered as row scalable when the number or rows are enlarged 10 times. It takes no more than 10 times to execute a query.

  - o **Column (Dimension) Salability** − A data mining system is considered as column scalable if the mining query execution time increases linearly with the number of columns.

- **Visualization Tools** − Visualization in data mining can be categorized as follows −

  - o Data Visualization
  - o Mining Results Visualization
  - o Mining process visualization
  - o Visual data mining

- **Data Mining query language and graphical user interface** − An easy-to-use graphical user interface is important to promote user-guided, interactive data mining. Unlike relational database systems, data mining systems do not share underlying data mining query language.

Trends in Data Mining

Data mining concepts are still evolving and here are the latest trends that we get to see in this field −

- Application Exploration.

- Scalable and interactive data mining methods.

- Integration of data mining with database systems, data warehouse systems and web database systems.

- SStandardization of data mining query language.

- Visual data mining.

- New methods for mining complex types of data.

- Biological data mining.

- Data mining and software engineering.

- Web mining.

- Distributed data mining.

- Real time data mining.

- Multi database data mining.

- Privacy protection and information security in data mining.

GEOGRAPHIC INFORMATION SYSTEM (GIS)

A geographic information system (GIS) is a system designed to capture, store, manipulate, analyze, manage, and present all types of geographical data. The key word to this technology is **Geography** – this means that some portion of the data is spatial. In other words, data that is in some way referenced to locations on the earth.

Coupled with this data is usually tabular data known as attribute data. Attribute data can be generally defined as additional information about each of the spatial features. An example of this would be schools. The actual location of the schools is the spatial data. Additional data such as the school name, level of education taught, student capacity would make up the attribute data.

It is the partnership of these two data types that enables GIS to be such an effective problem solving tool through spatial analysis.

GIS is more than just software. People and methods are combined with geospatial software and tools, to enable spatial analysis, manage large datasets, and display information in a map/graphical form.

What can we do with GIS?

GIS can be used as tool in both problem solving and decision making processes, as well as for visualization of data in a spatial environment. Geospatial data can be analyzed to determine (1) the location of features and relationships to other features, (2) where the most and/or least of some feature exists, (3) the density of features in a given space, (4) what is happening inside an area of interest (AOI), (5) what is happening nearby some feature or phenomenon, and (6) and how a specific area has changed over time (and in what way).

1. **Mapping where things are.** We can map the spatial location of real-world features and visualize the spatial relationships among them. Example: below we see a map of frac sand mine locations and sandstone areas in Wisconsin. We can see visual patterns in the data by determining that frac sand mining activity occurs in a region with a specific type of geology.

Frac sand: Wisconsin sites
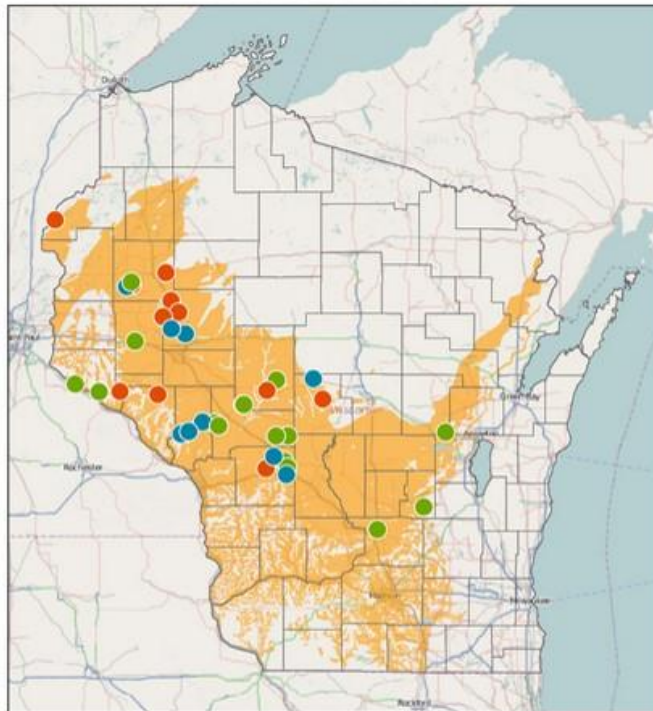
● Active (16)
● In development (11)
● Proposed (14)

◻ Sandstone areas of possible interest to frac sand miners

Mine and processing plant sites compiled in July 2011 from interviews with county and company officials; company websites; and Department of Natural Resources permit records. Sandstone identified with assistance from the Wisconsin Geological Survey.

Map: Kate Golden, Wisconsin Center for Investigative Journalism. Research: Jason Smathers and Julie Strupp, WCIJ.

2. **Mapping quantities.** People map quantities, such as where the most and least are, to find places that meet their criteria or to see the relationships between places.

Example: below is a map of cemetery locations in Wisconsin. The map shows the cemetery locations as dots (dot density) and each county is color coded to

show where the most and least are (lighter blue means fewer cemeteries).
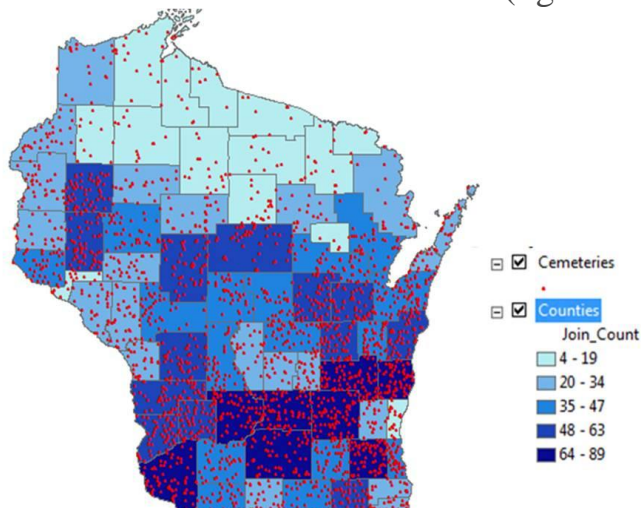
3. **Mapping densities.** Sometimes it is more important to map concentrations, or a quantity normalized by area or total number. Example: Below we have mapped the population density of Manhattan (total population counts normalized by the area in sq. miles of census tracts.)


4. **Finding what is inside.** We can use GIS to determine what is happening or what features are located inside a specific area/region. We can determine the characteristics of "inside" by creating specific criteria to define an area of interest (AOI). Example: below is a map showing a flood event and the tax parcels and buildings in the floodway. We can use tools like CLIP to determine which parcels fall inside the flood event. Further, we can use attributes of the parcels to determine potential costs of property damage.

5. **Finding what is nearby.** We can find out what is happening within a set distance of a feature or event by mapping what is nearby using geoprocessing tools like BUFFER. Example: below we see a map of drive times from a central location in the City of Madison, WI. We can use streets as a network and add specific criteria like speed limit and intersection controls to determine how far a driver can typically get in 5, 10, or 15 minutes. (Map courtesy of UW Extension)
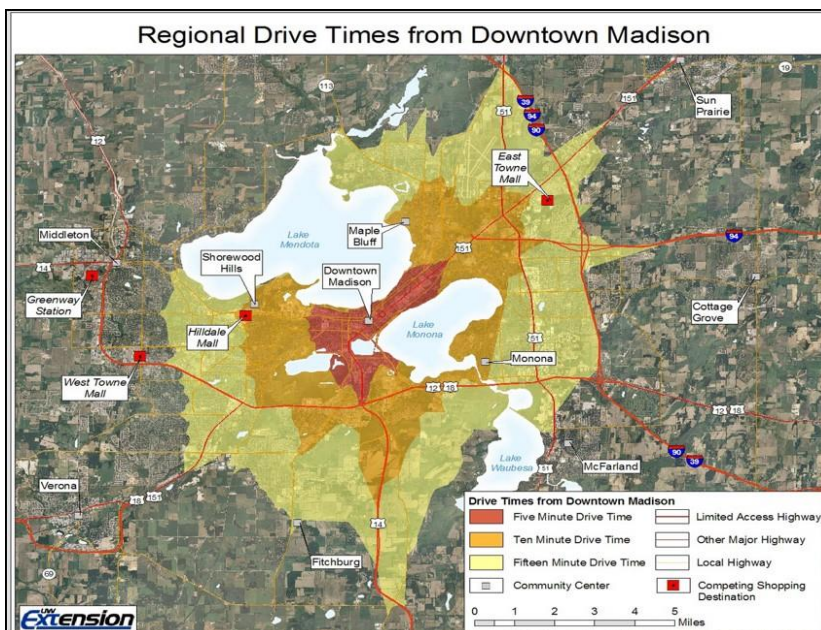
6. **Mapping change.** We can map the change in a specific geographic area to anticipate future conditions, decide on a course of action, or to evaluate the

results of an action or policy. Example: below we see land use maps of Barnstable, MA showing changes in residential development from 1951 to 1999. The dark green shows forest, while bright yellow shows residential development. Applications like this can help inform community planning processes and policies.

1951 Barnstable Land Cover

1999 Barnstable Land Cover
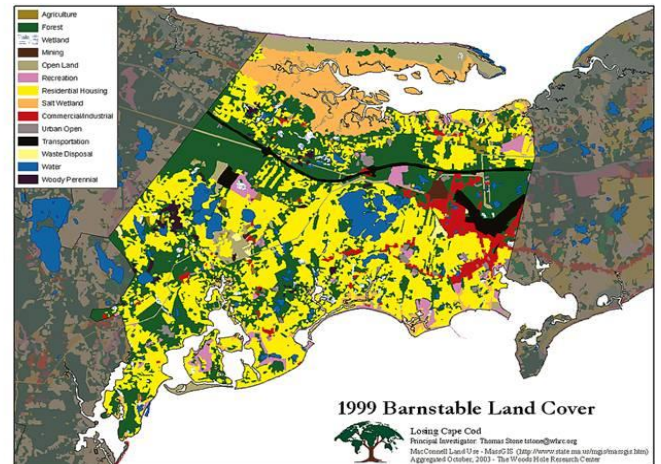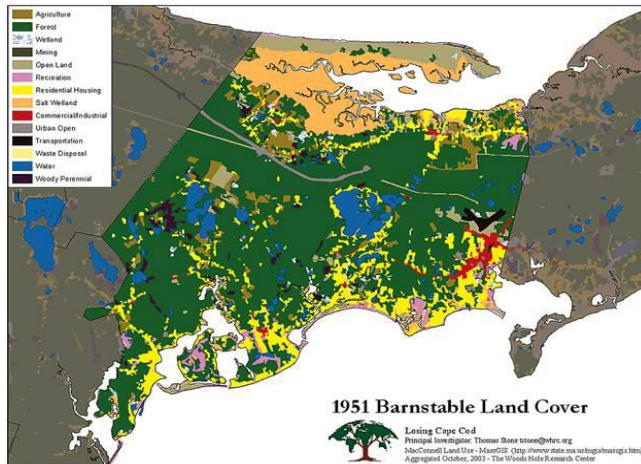
APPLICATIONS OF COMPUTER

Home

- Computer can also be used for personal purposes.
- One can use computer system to keep all the day-to-day details that are essential to keep anywhere.
- You can use it for personal things such as investments, incomes, expenditures, savings etc.

Education

The computer helps in providing 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.

- Computer education is rapidly increasing the graph of number of computer students.

- There are a number of methods in which educational institutions can use a 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.

Entertainment

Most of the persons are using computer for entertainment purposes such as:

- watching movies
- watching videos
- listening songs
- photos
- animations etc.

Computer can be used to create these things in an attractive manner so that user loves to enjoy the things.

Science

- Scientific research was the first application of computer as computer was first used to perform this job that is scientific research.
- At that time to now, the speed and accuracy of computer enabled scientific analysis carried out too fast.
- Computer controlled robots must be used in all those areas where there is danger to human being such as in nuclear research and deep sea investigation etc.

Medicine

- Computers have become an important part in hospitals, labs, and dispensaries.
- They 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.

Following are some major fields of health care in which computers are used.

- **Diagnostic System** − Computers are used to collect data and identify the cause of illness.

- **Lab-diagnostic System** − All tests can be done and the reports are prepared by computer.

- **Patient Monitoring System** − These are used to check the patient's signs for abnormality such as in Cardiac Arrest, ECG, etc.

- **Pharma Information System** − Computer is used to check drug labels, expiry dates, harmful side effects, etc.

- **Surgery** − Nowadays, computers are also used in performing surgery.

Engineering

- Computers are widely used for Engineering purpose.
- One of the major areas is CAD (Computer Aided Design) that provides creation and modification of images. Some of the 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.

- Computer is a device through which you can perform a variety of jobs.
- You can use your computer system for different applications by changing the software packages

Business

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

Computer is used in business organizations for −

- Payroll calculations

- Budgeting
- Sales analysis
- Financial forecasting
- Managing employee database
- Maintenance of stocks, etc.

Banking

- Today, banking is almost totally dependent on computers.

Banks provide the following facilities −

- Online accounting facility, which includes checking current balance, making deposits and overdrafts, checking interest charges, shares, and trustee records.

- ATM machines which are completely automated are making it even easier for customers to deal with banks.

Military

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

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

Communication

- Communication is a way 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 services. Some major fields in this category are −

- Budgets
- Sales tax department
- Income tax department
- Computation of male/female ratio
- Computerization of voters lists
- Computerization of PAN card
- Weather forecasting

Now-a-days, peoples are using computers most of the time to play games.For online games to play, you must have the internet connectivity whereas for offline games, you can start without any internet connectivity.

There are a variety of games available in computer world. Here are some of the category available in the game field:

- action
- racing
- adventurous
- puzzle
- simulations
- combat etc.

Peoples are playing (mostly today's or new generation childs) games on computer for few to many hours.