Computer Fundamental (CACS 101)

Unit-1 Introduction to computer

Introduction

A computer is an electronic machine that takes input from a user, processes the given input and generates output in the form of useful information.

A computer accepts inputs in many forms such as data, programs and user reply.

DATA -> raw details that require processing for generating useful information

PROGRAM -> set of instructions that can be executed by computer in sequential or non-sequential order

USER REPLY -> input provided by the user in response to query asked by computer

Characteristics

1. Speed

A computer can do any tasks in fractions of a second. The speed of the computer is based on its hardware configuration.

2. Storage Capacity

A computer can store a huge amount of data in many different formats.

3. Accuracy

A computer carries out any calculation with a 100% accuracy. However, this depends on the configuration of the system and instruction from the user.

4. Reliability

A computer process results with 0 error. Mostly the error generated in the computer is due to the user's fault.

5. Diligence

A computer can be set to perform repetitive tasks for numerous times and the result will always be displayed with the same accuracy and efficiency. Computers aren't affected by human traits like dizziness, fatigue, distraction, tiredness, etc.

6. Versatility

The same computer can be used for many different tasks for many different purposes.

Evolution of Computer

1. Mechanical Era

2. First Generation Computer

Employed: 1940 – 1956

Technology used: Vacuum Tube

Tasks done: Mathematical Calculation

Advantages: fast computing in their time, executed complex mathematical problems in an efficient manner

Disadvantages: Operated on machine language (0s and 1s), not flexible for running different applications, large and bulky in size and consumed high power

3. Second Generation Computer

Employed: 1956 – 1963

Technology Used: Transistors

Improvements: development of printer, secondary storage, operating system technology, replacement of

machine language with assembly language
Tasks done: Mathematical Calculation
Advantages: fast computing in their time, easy to program (assembly language), smaller in size and consumed less power
Disadvantages: I/O devices not improved to a considerable extent, generated a huge amount of heat, beyond the access of households
4. Third Generation Computer
Employed: 1964 – 1975
Technology Used: Integrated Circuits (I.C.)
Improvements: I.C.s made the size of computer smaller, performance efficient and faster and reliable
Advantages: computational time reduced to nano-seconds, use of high-level language
Disadvantages: low storage, costly
5. Fourth Generation Computer
Employed: 1975 – 1989
Technology Used: LSI, VLSI
Improvements: GUI, new Operating System, development of LAN
Advantages: Size and cost minimized, accessible by home users
Disadvantages: complex microprocessor design and fabrication,
6. Fifth Generation Computer
Employed: 1989 onwards
Technology used: ULSI
Improvements: portable computers – laptop, pocket computer, PDA, etc. developed, developed parallel processing, invention of optical disk technology, Internet invented
Advantages: True AI, advanced parallel processing, portability, superconductor technology
Disadvantages: sophisticated and complex tools

Classification of Computer

S.No.	Basis of Classification	Types
1	Operating Principle	Analog, Digital, Hybrid
2	Application	General Purpose, Special Purpose
3	Size and Capacity	Micro, Mini, Mainframe, Super Computer

Anatomy of digital computer

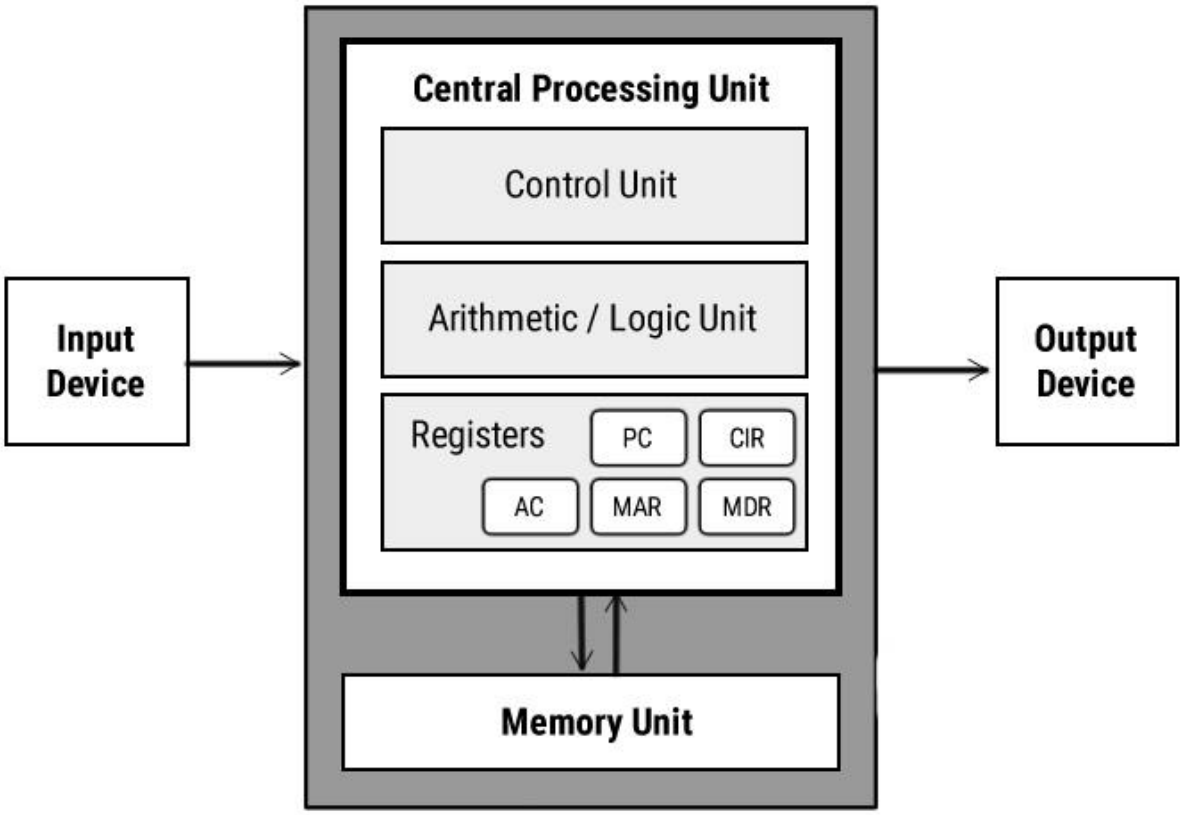


Figure: Vonn-Neuman Architecture/ Block Diagram of Computer**1. Central Processing Unit**

It is responsible for processing the data inside the computer system. It is also responsible for controlling all other components of the system.

The main operation of the CPU includes four phases

– Fetching instruction from memory

– Decoding the instruction to decide what operation are to be performed

– Executing Instructions

– Storing the result back into memory

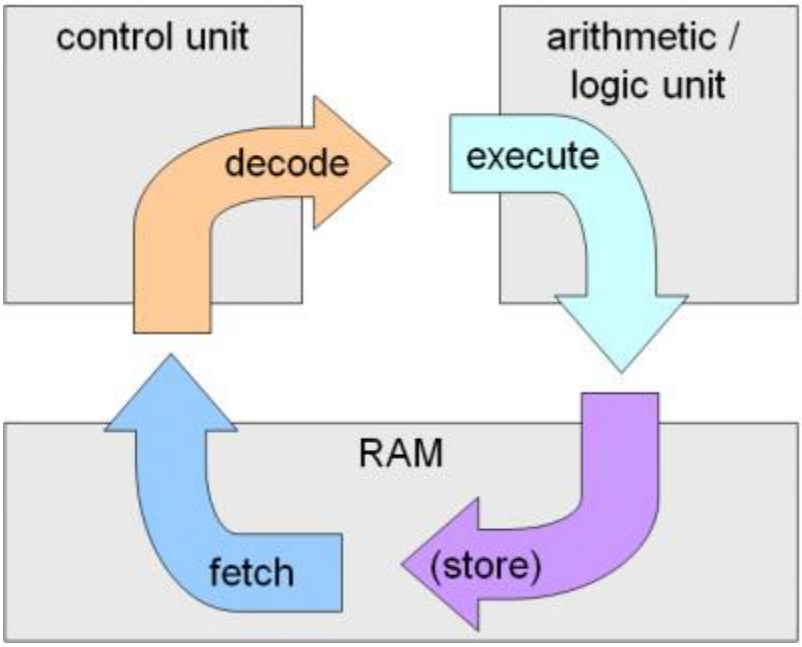


Figure: CPU Cycle**Components of CPU**

1. Arithmetic/ Logical Unit

ALU does arithmetic and logical operations. Arithmetic operations include addition, subtraction, multiplication and division. The arithmetic unit takes input instruction in the following form:

opcode + operand + format code

opcode – operation

operand – data

format code – format of the operand, e.g. fixed-point or floating-point

The logical unit operates the data logically. Logical operations include greater than (>), less than (<), equals to (=), not equal to (! =), shift left, shift right, etc. This unit makes use of logical gates (AND, OR, NAND, NOR, etc.) to perform logical operations.

2. Control Unit

This unit of CPU controls the flow of data and information. It maintains the sequence of operation being performed by the CPU. The control unit fetched instruction from storage area, decode the instructions and transmit the corresponding signal to ALU and the storage registers.

3. Main Memory

(discussed below)

2. Memory

1. Main Memory

RAM is the primary or main memory. It is volatile in nature and holds the data for a short period of time only, that is only until the system is running. Files and instructions are saved in different secondary storage systems and they are fetched to the RAM before the execution. This technique is known as swapping. Memory space available in the main memory directly affects the speed of the computer.

2. Cache Memory

It is the smallest and fastest form of memory. The contents that require to be fetched frequently are stored in the cache memory. Therefore, the processor before looking for the content in RAM checks here and goes to RAM only if the content isn't available here.

Cache memory is always placed between RAM and the processor.

3. Register

There are special-purpose temporary storage units which are called registers. They are the form of memory with the highest transfer speed. These registers are used for holding instructions, data and intermediate results that are currently being processed.

Examples: Program Counter (PC), Instruction Register, Memory Address Register, Memory Buffer Register, Memory Data Register, Accumulator, etc.

3. Input Device

They are the computer peripherals that are used to send input signals to the computer for processing. The basic input device is keyboard.

Example: mouse, scanner, digital camera, etc.

4. Output Device

They are the computer peripherals that are used to display the results of the processed data. The basic output device is monitor.

Example: speaker, printer, etc.

5. Mass Storage Device

They are the peripherals that are used to store the processed data for future references.

Example: Hard Drive, Solid State Drive, flash drive, etc.

Memory and Storage System

Besides processing data and getting the results for immediate use computer is used for storing data as well. Therefore, there are two types of memory in a computer system, one for storing data that are currently being handled by the CPU and another for storing data and results for future reference.

The storage system used for handling the running process is called primary memory. They are temporary in nature. And the storage which is used to store data and information for longer-term is called secondary memory.

The data and information held by the primary memory can be directly accessed by the CPU using data and address buses. However, the data stored in the secondary memory is to be fetched to the primary memory through I/O channel first and the CPU reads the data from the secondary memory via the primary.

There is a third type of memory as well which is known as internal process memory. These are placed either near to the CPU or inside the CPU itself.

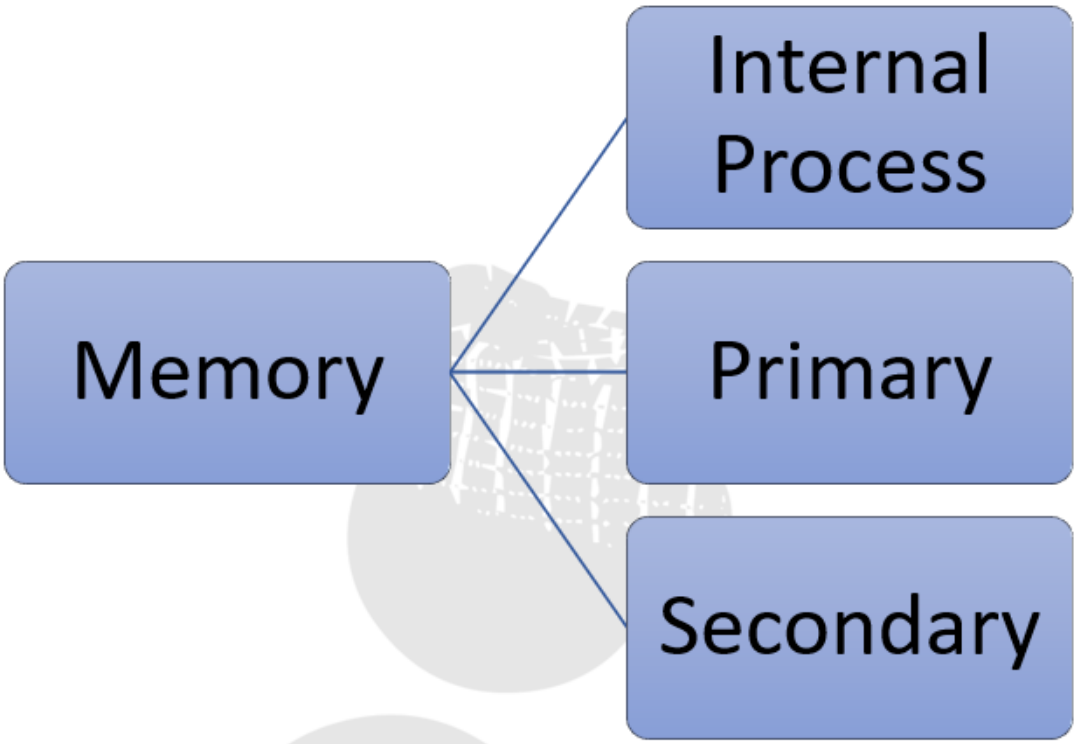


Figure: Types of Memory**Memory Representation**

1 Byte = 8 Bits

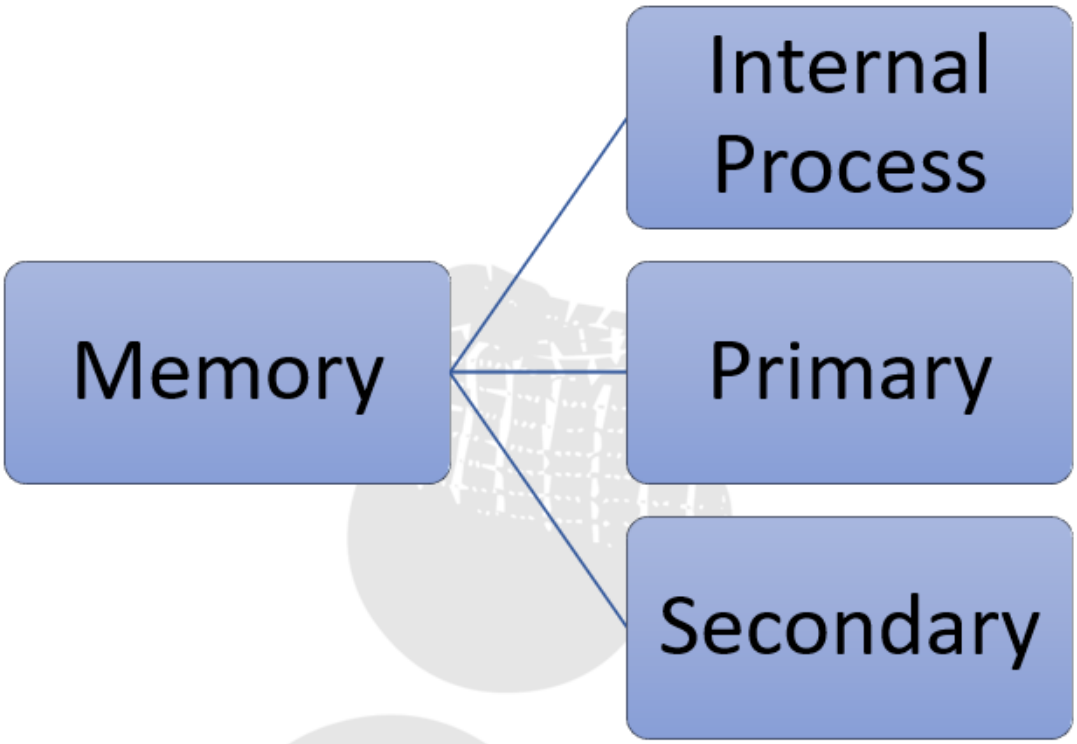
1 KB = 1024 Bytes

1 MB = 1024 KB = 1048576 Bytes

1 GB = 1024 MB = 1073741824 Bytes

1 TB = 1024 GB = 1099511627776 Bytes

Primary Memory



Types of Memory**1. RAM**

It is volatile in nature and loses all its content once the power of the computer is turned off. Hence RAM is used for storing the data and instructions only during the processing. Unlike Secondary form of memory, it is faster in data transfer. It is the internal memory. It is also called Read/ Write memory as it can perform both read and write operations.

Ram can be further categorized into two types.

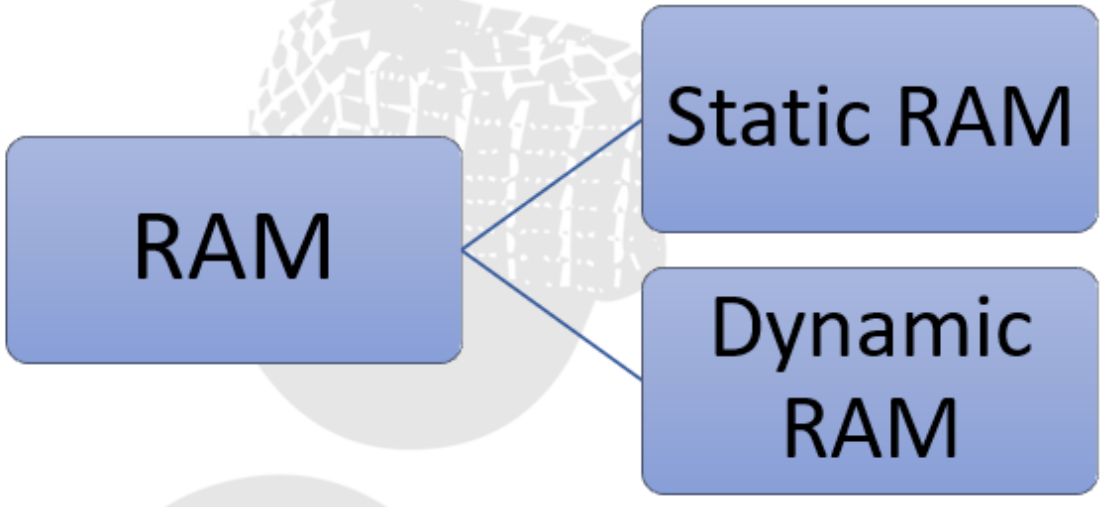


Figure: Types of RAM**i. SRAM**

In this type of RAM data is stored only until the power of the computer is on. It uses numbers of transistors to store a single bit of data. Based on the functioning nature it can be further classified as

a. Asynchronous SRAM

It performs operations without the use of a system clock. It makes use of three signals for working, i.e. chip select (CS), write enable (WE) and output-enable (OE).

b. Burst SRAM

It works in association with the system clock. Therefore, it is also known as synchronous SRAM. It is used with high-speed applications as the read and writes cycles are synchronized with the clock cycle of the processor. The access waiting time gets reduced after the read and write cycle are synchronized.

c. Pipeline Burst SRAM

It uses the pipeline technology in which a large amount of data is broken up into different packets containing data. These packets are arranged in a sequential manner in a pipeline form and are sent to the processor simultaneously. It can handle a large amount of data at a very high speed. In fact, it is the fastest form of SRAM.

ii. Dynamic SRAM

In this type of RAM, data is stored in a storage cell consisting of transistors and capacitors. Unlike SRAM, DRAM needs to be refreshed continuously with the power supply because the capacitor has the tendency to get discharged. The DRAM is of four types.

i. Synchronous DRAM

It performs operations in association with the system clock cycle. It is used with the processor for storing data continuous manner. The continuous form of data storage helps in processing a greater number of instructions per unit time which ultimately increases the speed of data transfer.

ii. Rombus DRAM

It contains multiple addresses and data line that helps in increasing the data access speed. It is faster than Synchronous DRAM.

iii. Extended Data Out DRAM

It can access more than a bit of data at a time which helps in increasing data access rate. It allows to perform various tasks at a time such as read and write.

iv. Fast Page Mode DRAM

It makes use of paging in which read and write operation is performed by selecting the address of data from rows and columns of the matrix. Use of paging doesn't allow the use of bus at the memory of 66 MHz because of which reading and writing data from matrix consumes a lot of time.

2. ROM

ROM stores data permanently. This means unlike RAM; it can retain data even after the computer is turned off. Generally, contents of ROM cannot be erased, modified or changed. Devices such as calculator, laser printer, etc. use ROM. It allows sequential access to data. It is divided into four types.

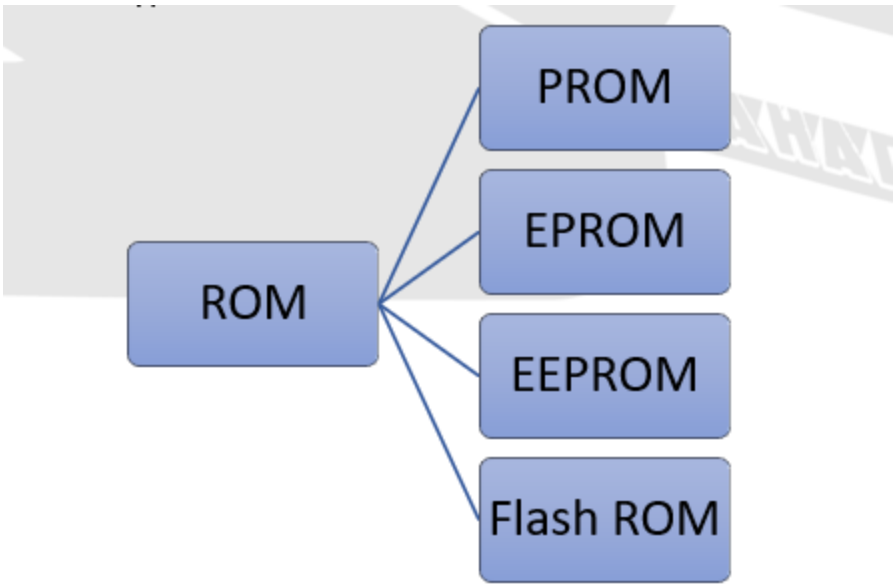


Figure: Types of ROM**i.**

Programmable ROM (PROM)

It is a memory chip on which write operation can be performed only once. The data on this ROM is written permanently and cannot be erased afterwards. The writing process on such ROM is called 'Burning ROM'. It is mostly used in video games and electronic dictionaries.

ii. Erasable Programmable ROM (EPROM)

In such type of ROM, data can be erased or destroyed using Ultra-Violet (UV) rays. In such, the facility of changing the content is available. It facilitates the storage of data for longer terms.

iii. Electrically Erasable Programmable ROM (EEPROM)

It is the type of ROM in which data can be erased or destroyed electrically with the means of electric charge. Here, data can be written or read at the rate of one bit per unit time which makes it slow.

iv. Flash ROM (FROM)

It is a variation of EEPROM that uses floating gate transistors which can store data for a longer period of time. It is mainly used in mobile phones, digital cameras, etc. It is the fastest form of ROM. It uses continuous memory cells for storing data. It is of two types.

a. NAND Flash ROM

b. NOR Flash ROM

Secondary Memory/ Storage System

1. Magnetic Storage System

i. Magnetic Tapes

They are plastic tapes with a magnetic coating that are used for data storage. They are similar to normal recording tapes which can be used for storing audio and video. Data can be accessed sequentially.

Advantages:

– low cost and high storage

– easily transportable

– easy to handle and store

Disadvantages:

– low data transmission due to a sequential transmission

– low life duration
– required protected environment for storage

ii. Magnetic Disks

It is a flat disk covered with magnetic coating for holding information. It is used to store digital information in the form of small and magnetized needles. It is large in storage size and cheaper than RAM. It allows random access to data and provides the facility of erasing and recording data as many times as required.

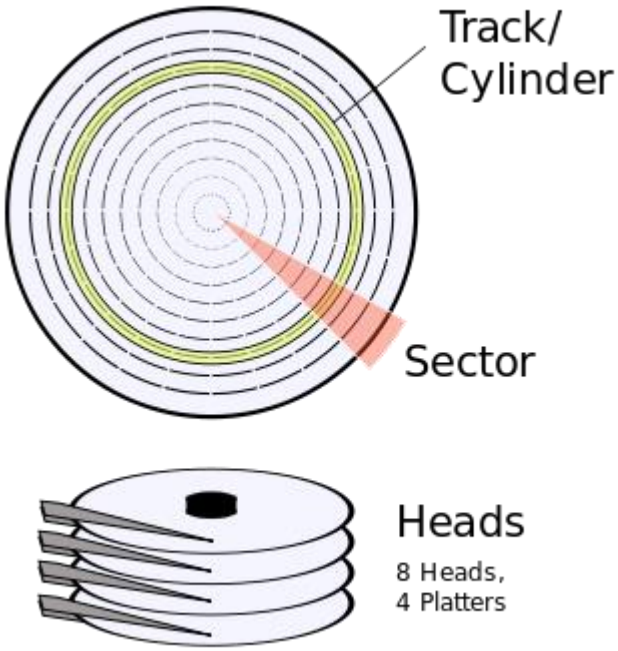


Figure: Structure of Magnetic Disk

Advantages:

– High storage capacity and low cost
– Easy and direct access to data
– Less prone to corruption of data compared to magnetic tapes

Disadvantages:

– Prone to physical damage since it has a physical moving part
– Slower than SSDs

2. Optical Storage System

This storage system uses the laser light as the optical medium to retrieve as well as record data.
Example: CD-ROM, DVD, CR-R, CD-RW, DVD-R, DVD-RW
They are non-volatile and reliable compare to magnetic tapes.

Advantages:

– Large storage capacity
– Longer life-span than magnetic tapes
– Low 'cost-per-bit' for storage
– Portable

Disadvantages:

– Prone to scratches which could disturb or totally prevent the driver to perform R/W operations

3. Magneto-Optical System

It includes the features of both optical and magnetic disks. Its main objective is to store the data on personal computers for a longer period of time. It performs R/W operation by making use of laser and optical technology. It has ferromagnetic particles enclosed in a plastic coating. The laser beam used for R/W operation gets reflected due to magnetic surface of the disk.

It is slower in speed but its manufacturing cost is high.

4. Solid State Drive (SSD)

It is the device that contains all the properties of a hard drive to store the data and uses the solid-state memory which has no moving part. It uses semiconductors to store data. Its main principle is to process data electronically. Since it has no mechanical moving part, the data access time is faster than that in HDD.

Advantages:

– Better performance – high access speed, random access of data, faster R/W operation
– Low power consumption
– Highly reliable
– Small dimension/ compact size

Disadvantages:

– High cost
– Lower capacity
– Low storage density
– Vulnerable – data loss, affected by power loss, electrostatic discharges and magnetic fields

Interface

A system of interaction or communication between a computer and another entity such as printer, another computer network or a human user. Devices such as cable, network card, monitor or keyboard that enables interaction or communication between computer and other entity.

Interface is of three types.

1. Hardware Interface

Hardware interface exists in many of the components such as buses, storage devices, other I/O devices, etc. A hardware interface is described by mechanical, electrical and logical signal at the interface and protocols for sequencing them. Hardware interfaces can be parallel with several electrical connections carrying parts of data simultaneously or serially where data can be sent one bit at a time.

Serial -> 1 bit at a time

Parallel -> 1 word at a time

2. Software Interface

A software interface may refer to a wide range of different types of interface at different types of interfaces at different levels – an operating system may interface with a piece of hardware; application or program running on the operating system may need to interact via data streams, filters and pipelines. In Object oriented program, object within an application may need to interact via methods.

3. User Interface

A user interface consisting of a set of dials, knobs, operating system commands, graphical display formats and other devices provided by a computer or a program to allow the users to communicate or use the computer or program. The popular means of user interface is Graphical User Interface (GUI) which provides pictorial (picture-oriented) way to interact with the system. GUI is easier to use and user-

friendly interface.

Mobile Computing

Mobile computing is human-interaction by which a computer is expected to be transported during normal usage which allows transmission of data and information in different available forms. This involves mobile communication, mobile hardware and mobile software.

• Mobile communication issues include ad-hoc networks and infrastructure networks as well as communication properties, protocols, data formats and concrete technologies.

• Mobile software deals with the characteristics and requirements of a mobile application.

Example: smartphone, smart card, laptop, wearable computer, etc.

Principles of Mobile Computing

1. Portability – facilitate movement of device within the mobile computing environment
2. Connectivity – availability to continuous connection w/ minimal lag & no interruption while movement
3. Social Interactivity – maintaining the connectivity to collaborate w/ other users
4. Individuality – adapting technology to meet individual needs

Unit-2 Computer Software

Contents: Introduction to Software, Types of Software, Program vs Software, Computer Virus and Antivirus

Introduction to Software

Among the two major components of a computer system, Software is one while Hardware being the other. Software refers to a set of computer programs and related data that provide the instructions for telling a computer what to do and how to do. It is a set of instructions that guides the hardware and tells it how to accomplish each task.

Hardware refers to the physical equipment that is necessary for performing various operations such as storing results and providing output to users in the desired form.

Types of Software

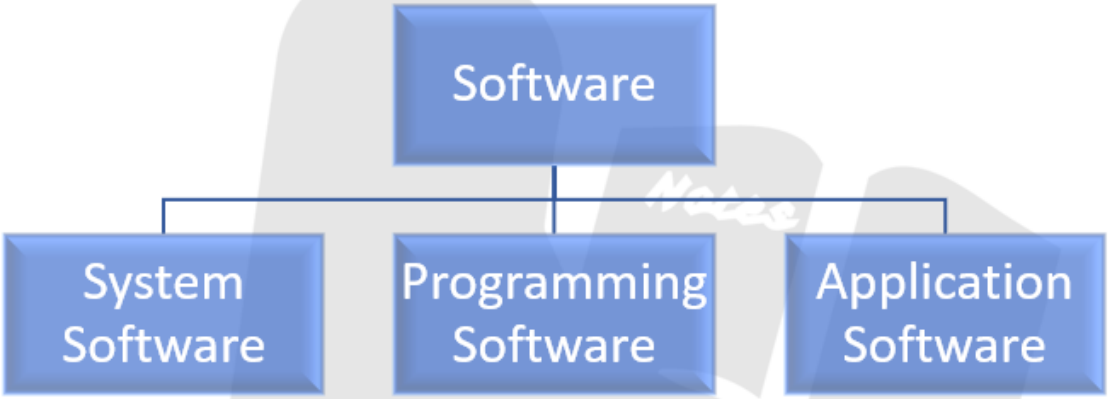


Fig: Types of Software

System Software

It is a type of computer software that is designed to operate the computer hardware so that the basic functionality and a platform for running application software are provided. Operating System and all other utility programs that manage computer resources at low level are system software.
Example: BIOS (Basic Input/ Output System) gets the computer system started after you turn it on, and it manages that data flow between the operating system and other attached devices such as hard disk, video adapter, etc. System utilities such as the disk defragmenter and system restore are also system software.

Programming Software

It includes tools in the form of programs or applications that software developers take in use to create, debug, maintain and support other programs and applications. Compiler, debugger, interpreter, linker and text editor are the parts programming software.

1. Compiler

They convert a high level language program into a low-level language program.

2. Assembler

They convert an assembly language program into low-level language programs.

3. Interpreter

It processes high-level language line by line and simultaneously produces low-level programs.

4. Linker

Most low-level languages allow the developer to develop a large program containing multiple modules. Linker arranges the object code of all the modules that have been generated by the language translator into a single program.

5. Debugger
It is a software that is used to detect the errors and bugs in programs. It locates the position of errors in the program codes.

6. Text editor
It is a program that allows the user to work with texts in a computer system. It is used for documentation purpose and enables us to edit information present in an existing document or file.
Example: C, C++, C#, BASIC, Java, Python, etc.

Application Software
It is a program of a group of programs designed for individual users. It allows end-users to accomplish one or more specific non-computer related task.
Example: Word processor, presentation software, data management system, desktop publisher, web browsers, etc.

Program vs Software

Software is the superset of programs in which one or many programs are executed sequentially or simultaneously to perform a particular job. It is the end product of a set of programs.
Example: MS-Excel

A program is a combination of lines of codes which takes input works on instruction on a computer to generate output. A program is the group of instructions which when performed will generate a logical output.
Example: addition or subtraction operation in MS-Excel

Summarizing, the program is a set of instructions that are executed by a computer, whereas software is a set of programs.
Example: the calculator is a software whereas addition, subtraction, etc. are set of programs that exist in the calculator

Computer Virus ad Antivirus

Computer Virus
A computer virus is a set of malicious code or program written to alter the way a computer operates. It is usually designed to spread from computer to computer. A virus operates by inserting or attaching itself to a legitimate program or document support macros in order to execute the codes.
A virus has the potential to cause unexpected or damaging effects such as harming system software by corrupting or damaging data. Once a virus successfully attaches itself to a program, file or document, the virus will remain dormant until circumstances cause a computer to execute its code. In order for a virus to infect any computer, the infected program has to be run in order for the code to be executed.

Signs of Computer Virus
1. Frequent pop-up windows
2. Changes your homepage
3. Mass email being sent from your email account
4. Frequent crashes
5. Slow computer performance

Different types of Virus

1. Boot sector virus
This type of virus can take control when you start or boot your computer. It spreads by plugging Flash drives.

2. Web scripting virus
This type of virus exploits the code of web browsers and webpages. It spreads through infected webpages.

3. Browser hijacker
This type of virus hijacks certain web browser functions and might automatically be directed to unintended sites.

4. Resident virus
This is the general type of virus that inserts itself in a computer system memory. A resident virus can execute at any time when the operating system loads.

5. Direct-action virus
This type of function comes into action when you execute a file containing a virus otherwise it remains dormant.

6. Polymorphic virus
A polymorphic virus changes its code each time the infected file is executed. It does this to invade antivirus.

7. File infector virus
This common virus inserts malicious code into executable files. i.e. files used to perform certain functions or operations on a system.

8. Macros virus
Macros virus are written in some macro language used for a software application. Such virus spread when you open an infected document often through an email attachment.

Antivirus
Antivirus is a type of program designed and developed to protect a computer from malware like computer virus, worm, spyware, botnets, boot-kits, keylogger, etc. Antivirus function to scan, detect and remove such viruses from the computer. Most antivirus incorporates both automated and manual filtering abilities. Instant scanning option may check files downloaded from the internet, disks that are embedded into PCs and files that are made by software installers.

Features of Antivirus

1. Default deny protection
It is implemented to prevent the entry of suspicious files by default.

2. Auto sand-box technology
A virtual environment where suspicious and unknown files are secluded and run to check for any malicious activity without interfering the normal operations.

3. Containment technology
It validates and authorizes the programs that are executable and ensure that processes are running without affecting the regular operation of the system.

4. Host intrusion protection system (HIPS)
It terminates any malicious activity once found. This prevents malware from infecting the operating system, registry keys, personal data or the system memory.

Unit-3 Operating System

Contents: Introduction, Functions and Types of Operating System and Open Source Operating System

Introduction

An operating system is a software that makes the computer hardware to work while the computer hardware providers 'raw computer power', the operating system is responsible for making a computer more useful for users. The operating system provides an interface for users to communicate with the computer. It also manages the use of hardware, resources and enables proper implementation of application programs. In short, the operating system is the master of the control program of a computer.

The main function of the operating system includes:

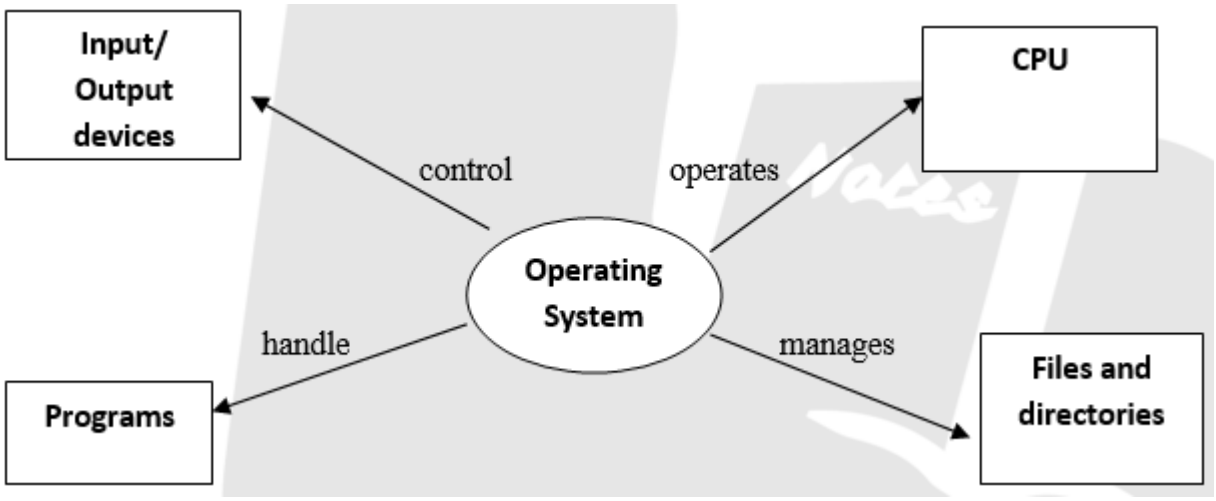


Figure: Functions of Operating System

1. Operating CPU of the computer.
2. Controlling Input/ Output devices that provide an interface between the user and the computer.
3. Handling the working of application programs with the hardware and other software systems.
4. Managing the storage and retrieval of information using storage devices such as disks.

Functions of Operating System

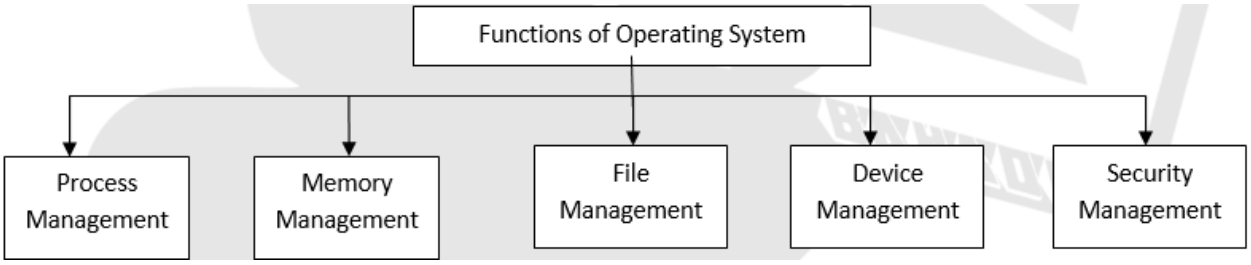


Figure: Functions of Operating System

The main function of an operating system is t manage the resources such as memory and files of the computer system. The operating system also resolved the conflicts that arise when two users or programs request the same resources at the same time. Therefore it is also called resource manager of a computer. Some of the important functions of an operating system are:

1. Process management
It manages the processes running in the computer system process. A process is basically a program that is being currently run by a user or a computer.
Example: A word processor application program such as MS Word runs processes in a computer system.

2. Memory Management.
It manages the memory resources of a computer system. There are various resources of computer including primary memory or Random-Access Memory (RAM) and secondary memory like CDs and HDs. All the programs are loaded in the main memory before their execution. It is the function of the operating system to determine how much memory should we provide at each process.

3. File Management
It manages the files and directories of a computer system. A file can be defined as a collection of information or data that is stored in the memory of a computer system. Every file has a unique mane associated with it. The organization of files and directories in a computer system is referred to as a file system. An operating system allows users to create, modify, save or delete files in a computer system.

4. Device Management
The operating system deals with the management of peripheral devices such as printer, mouse and keyboard attached to a computer system. An operating system interacts with the hardware devices through a specific device driver. The primary task of the operating system is to manage the input/ output operation performed by end-users.

5. Security Management.

It ensures security for a computer system from various threats such as virus attack and unauthorized access. An operating system uses various technologies such as authentication, authorization, cryptography, etc. for ensuring the security of a computer system.

Types of Operating System

Based on the capabilities and the types of application supported, the operating system can be divided into six major categories viz.

1. Batch Processing Operating System

They are capable of executing only one job at a time. The jobs a program submitted by different users are grouped into batches and one batch of the job is to provide as input to the computer system at a time. The jobs in the batch are processed on a first come first serve basis. After execution of one job is completed the operating system automatically fetches the next job from the batch without any human intervention.

Advantages:

a) They were very efficient in their time as idle time for these computers is very less.
b) The OS facilitates execution of jobs in an organized manner.

Disadvantages:

a) Jobs are processed only in the order they are places and not per user's priority.
b) Debugging of a program at execution is not possible.
c) The executing jobs may enter an infinite loop as each job is not associated with proper times.

2. Multi-user Operating System

The multi-user operating system enables multiple users to use the resource of a computer system at the same time. It allows a number of users to work simultaneously on the same computer. It is usually implemented by following multiterminal configuration. In the configuration, a single powerful computer is connected to multiple terminals through serial ports. The computer system is responsible for processing different requests generated by various terminals at a time. The control computer is equipped with a fast processor and a memory of large capacity for catering to multiple requests of end-users. Example: Linux, Unix, VM-386, etc.

Advantages

a) Allows resources of a computer to be utilized an inefficient manner.
b) It enhances the overall productivity of various users by providing simultaneous access to various computer resources.

Disadvantages

a) It is complex and hence difficult to handle and maintain.
b) It may result in inconsistent data if activities of a user aren't protected from other users.
c) It is required to have a robust security mechanism.

3. Multitasking Operating System

The multitasking operating system allows users to carry out multiple tasks at the same time on a single computer system. The multitasking OS are also known as several other names such as multi-processing, multi-programming, concurrent, or process scheduling operating system. In this type of operating system, different processes are executed simultaneously by implementing the concept of time slicing. According to this concept, a regular slice of CPU time is provided to each of the processes running in the computer system. It can be of two types, viz.

a) Preemptive Multitasking Operating System

In this OS, a slice of CPU time is allocated on some priority basis.

b) Co-operative Multitasking Operating System
In this OS, time slices of CPU are assigned to the process depending on whether or not to give up CPU control for other running processes.
Example: UNIX, Windows 2000, Linux, Windows XP.

Advantages:
a) It helps in increasing the overall performance of the system.
b) It helps in increasing the overall productivity of the user by performing a number of tasks at the same time.

Disadvantages:
a) A large amount of memory is required to execute several programs at a time.
b) Some mechanisms need to be implemented to ensure that the activity of one process does not interfere with the activities of other processes.

4. Rest- time Operating System
The real-time operating system is similar to the multi-tasking operating system in its functionality. However, these OS are specially designed and developed for handling real-time applications or embedded applications. The real-time applications are those critical applications that are required to be executed within a specific period of time.
Example of real-time applications is; industrial robots, space-crafts, industrial control applications.

It is of two types, viz.
a) Head Real-time OS
It is a type of OS where it is necessary to perform a task in a specified amount of time.

b) Soft Real-time OS
In Soft Real-time OS, a task can be performed even after its allocated time has elapsed.
Example: M tox, Lynx, RTX

Advantages:
a) It is easy to design, develop and execute the real-time application under the real-time OS.
b) It is usually more compact as compared to other operating systems hence requires less memory.

Disadvantages:
a) It is primarily focused on optimizing the execution time of an application and thus it sometimes overlooks some of the other critical factor related to the overall efficiency of the computer system.
b) It is used only for providing some dedicated functionality and cannot be used as a general-purpose OS.

5. Multiprocessor Operating System
Multiprocessor OS allows the use of multiple CPUs in a computer system for execution of multiple processes at the same time. The processes are executed faster compared to a single processor.
Example: Linux, UNIX, Windows 2000, etc.

Advantages
a) It helps in improving the overall efficiency and throughput of a computer system.

b) It helps in increasing the reliability of a computer. If one CPU fails, the other CPU takes control and execute the currently running processes.

Disadvantages:
a) Cost is very high.
b) A large amount of memory is required for running and executing several users program.

6. Embedded Operating System
It is somewhat similar to the real-time OS. The embedded OS is installed on an embedded computer system which is used for performing a computational task in electronic devices. This OS provides limited functionality that is required for the corresponding embedded computer system.
Example: Palm OS, Window CE.

Advantages:
a) It allows the implementation of an embedded system in an efficient manner.
b) A system with an embedded OS is easy to use and maintain.

Disadvantages:
a) It is possible to perform some specific operation with those OS.
b) This OS cannot be used in a frequently changing environment.

Open Source Operating System

Open Source is a methodology or approach towards the design and development of software with the intention of giving the user the access to the code. If we use open source software, not only we will be able to use it but also be able to see how it works, debug it, modify it and redistribute it. Open source software is licensed in a way that marked it legal to use as many copies as user wants. There's a core difference between open source and free software, both represent the same core idea but the open resource allows the commercial utilization of code with the motive of profit.
Example: Red hat gains significant revenue from sales, distribution, maintenance and consulting service provided by Open Source Software.

Being an open source program, program code of an open source operating system are available. The user can modify these codes and develop a new application according to their requirement. Example: Linux

Linux
It is an open-source powerful UNIX based OS which runs on varieties of platforms including Intel, SPARCE and Power PC. It is a multi-user, multi-tasking, multi-programming operating system mainly popular for server OS. It is distributed through different distributors such as Red Hat, Mandrate, Open Suse, Ubuntu, Slackware, Sobayon, Debian, Mandriva, Fedora, Genten, Granular Linux.

Unit-4 Database Management System

Contents: Introduction to Database Management System, DBMS Models, SQL, Database Design and Data Security, Data Warehouse, Data Mining, Database Administrator

What is Database?

A database is a collection of related data and data is a collection of facts and figures that can be processed to produce information.

Mostly data represents recordable facts. Data aids in producing information, which is based on facts. For example, if we have data about marks obtained by all students, we can then conclude about toppers and average marks.
A database management system stores data in such a way that it becomes easier to retrieve, manipulate, and produce information.

Characteristics of DBMS

Real-world entity:

A modern DBMS is more realistic and uses real-world entities to design its architecture. It uses the behavior and attributes too. For example, a school database may use students as an entity and their age as an attribute.
Relation-based tables:

DBMS allows entities and relations among them to form tables. A user can understand the architecture of a database just by looking at the table names.
Isolation of data and application: A database system is entirely different than its data. A database is an active entity, whereas data is said to be passive, on which the database works and organizes. DBMS also stores metadata, which is data about data, to ease its own process.
Less redundancy:

DBMS follows the rules of normalization, which splits a relation when any of its attributes is having redundancy in values. Normalization is a mathematically rich and scientific process that reduces data redundancy.

Consistency:

Consistency is a state where every relation in a database remains consistent. There exist methods and techniques, which can detect attempt of leaving database in inconsistent state. A DBMS can provide greater consistency as compared to earlier forms of data storing applications like file-processing systems.

Query Language:

DBMS is equipped with query language, which makes it more efficient to retrieve and manipulate data. A user can apply as many and as different filtering options as required to retrieve a set of data.
Traditionally it was not possible where file-processing system was used

ACID Properties:

DBMS follows the concepts of Atomicity, Consistency, Isolation, and Durability (normally shortened as ACID). These concepts are applied on transactions, which manipulate data in a database. ACID properties help the database stay healthy in multi-transactional environments and in case of failure.
Multiuser and Concurrent Access:

DBMS supports multi-user environment and allows them to access and manipulate data in parallel. Though there are restrictions on transactions when users attempt to handle the same data item, but

users are always unaware of them.

Multiple views:

DBMS offers multiple views for different users. A user who is in the Sales department will have a different view of database than a person working in the Production department. This feature enables the users to have a concentrate view of the database according to their requirements.

Security:

Features like multiple views offer security to some extent where users are unable to access data of other users and departments. DBMS offers methods to impose constraints while entering data into the database and retrieving the same at a later stage. DBMS offers many different levels of security features, which enables multiple users to have different views with different features.

Database Models

Data models define how the logical structure of a database is modelled. Data Models are fundamental entities to introduce abstraction in a DBMS. Data models define how data is connected to each other and how they are processed and stored inside the system.

Two types

Entity-Relationship Model

Figure: ER Model

Entity-Relationship (ER) Model is based on the notion of real-world entities and relationships among them. While formulating real-world scenario into the database model, the ER Model creates entity set, relationship set, general attributes, and constraints.

ER Model is best used for the conceptual design of a database.

ER Model is based on:

- Entities and their attributes.
- An entity in an ER Model is a real-world entity having properties called attributes. Every attribute is

defined by its set of values called domain.
For example, in a school database, a student is considered as an entity. Student has various attributes like name, age, class, etc.

Relationships among entities

The logical association among entities is called relationship. Relationships are mapped with entities in various ways. Mapping cardinalities define the number of associations between two entities.

Relational Model

Figure: Relational Model

The most popular data model in DBMS is the Relational Model. It is a more scientific model than others. This model is based on first-order predicate logic and defines a table as an n-ary relation.

The main highlights of this model are:

1. Data is stored in tables called relations.
2. Relations can be normalized.
3. In normalized relations, values saved are atomic values.
4. Each row in a relation contains a unique value
5. Each column in a relation contains values from the same domain.

SQL (Structured Query Language)

What is SQL?

SQL is Structured Query Language, which is a computer language for storing, manipulating and retrieving data stored in relational database. SQL is the standard language for Relation Database System. All relational database management systems like MySQL, MS Access, Oracle, Sybase, Informix, postgres and SQL Server use SQL as standard database language.

Why SQL?

Allows users to access data in relational database management systems.
Allows users to describe the data.
Allows users to define the data in database and manipulate that data.
Allows embedding within other languages using SQL modules, libraries & pre-compilers.
Allows users to create and drop databases and tables

SQL Process

When you are executing an SQL command for any RDBMS, the system determines the best way to carry out your request and SQL engine figures out how to interpret the task.
There are various components included in the process. These components are Query Dispatcher, Optimization Engines, Classic Query Engine and SQL Query Engine, etc. Classic query engine handles all non-SQL queries, but SQL query engine won't handle logical files

SQL Commands

The standard SQL commands to interact with relational databases are CREATE, SELECT, INSERT, UPDATE, DELETE and DROP. These commands can be classified into groups based on their nature.

DDL	Data Definition Language:
CREATE	Creates a new table, a view of a table, or another object in the database
ALTER	Modifies an existing database object, such as a table.
DROP	Deletes an entire table, a view of a table or other object in the database.
DML	Data Manipulation Language:
INSERT	Creates a record
UPDATE	Modifies records
DELETE	Deletes records
DCL	Data Control Language:
GRANT	Gives a privilege to the user
REVOKE	Takes back privileges granted from user
DQL	Data Query Language:
SELECT	Retrieves certain records from one or more tables

Unit-5 Data Communications and Computer Network

Contents: Introduction to Communication system, Modes of Communication, Introduction to Computer

Network, LAN Topologies, Transmission Media, Network Devices, OSI Reference Model, Communication

Protocols, Centralized vs Distributed System

Introduction to Data Communication

Data communications are the exchange of data between two devices via some form of transmission medium such as a wire cable.

For data communications to occur, the communicating devices must be part of a communication system

made up of a combination of hardware (physical equipment) and software (programs).

Fundamental Characteristics

The effectiveness of a data communications system depends on four fundamental characteristics: delivery, accuracy, timeliness, and jitter.

1. Delivery

The system must deliver data to the correct destination. Data must be received by the intended device or user and only by that device or user.

2. Accuracy.

The system must deliver the data accurately. Data that have been altered in transmission and left uncorrected are unusable

3. Timeliness.

The system must deliver data in a timely manner. Data delivered late are useless. In the case of video and audio, timely delivery means delivering data as they are produced, in the same order that they are produced, and without significant delay. This kind of delivery is called real-time transmission.

4. Jitter

Jitter refers to the variation in the packet arrival time. It is the uneven delay in the delivery of audio or video packets

Components of Data Communication

A data communications system has five components

Fig: Components of Data Communication

1. Message

The message is the information (data) to be communicated. Popular forms of information include text, numbers, pictures, audio, and video.

2. Sender

The sender is the device that sends the data message. It can be a computer, workstation, telephone handset, video camera, and so on.

3. Receiver

The receiver is the device that receives the message. It can be a computer, workstation, telephone handset, television, and so on.

4. Transmission medium

The transmission medium is the physical path by which a message travels from sender to receiver. Some examples of transmission media include twisted-pair wire, coaxial cable, fiber-optic cable, and radio waves.

5. Protocol

A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices.

Mode of Data Communication

Communication between two devices can be simplex, half-duplex, or full-duplex

Simplex:

In simplex mode, the communication is unidirectional, as on a one-way street. Only one of the two devices on a link can transmit; the other can only receive. Keyboards and traditional monitors are examples of simplex devices. The keyboard can only introduce input; the monitor can only accept output. The simplex mode can use the entire capacity of the channel to send data in one direction.

Half-Duplex:

In half-duplex mode, each station can both transmit and receive, but not at the same time. When one device is sending, the other can only receive, and vice versa. In a half-duplex transmission, the entire capacity of a channel is taken over by whichever of the two devices is transmitting at the time. Walkie-

talkies and CB (citizens band) radios are both half-duplex systems. The half-duplex mode is used in cases

where there is no need for communication in both directions at the same time; the entire capacity of the channel can be utilized for each direction

Full-Duplex:

In full-duplex both stations can transmit and receive simultaneously. The full-duplex mode is like a two way street with traffic flowing in both directions at the same time. In full-duplex mode, signals going in one direction share the capacity of the link: with signals going in the other direction. One common example of full-duplex communication is the telephone network. When two people are communicating

by a telephone line, both can talk and listen at the same time. The full-duplex mode is used when communication in both directions is required all the time. The capacity of the channel, however, must be divided between the two directions.

Data Flow in different modes

Computer Network

A computer network is a group of computer systems and other computing hardware devices that are linked together through communication channels to facilitate communication and resource-sharing among a wide range of users.

Network Criteria

A network must be able to meet a certain number of criteria. The most important of these are performance, reliability, and security

1. Performance:

Performance can be measured in many ways, including transit time and response time. Transit time is the amount of time required for a message to travel from one device to another. Response time is the elapsed time between an inquiry and a response. The performance of a network depends on a number of factors, including the number of users, the type of transmission medium, the capabilities of the connected hardware, and the efficiency of the software.

2. Reliability:

Network reliability is measured by the frequency of failure, the time it takes a link to recover from a failure, and the network's robustness in a catastrophe.

3. Security:

Network security issues include protecting data from unauthorized access, protecting data from damage and development, and implementing policies and procedures for recovery from breaches and data losses.

Types of Connections

There are two types of connections.

1. Point-to-Point

A point-to-point connection provides a dedicated link between two devices. The entire capacity of the link is reserved for transmission between those two devices.

2. Multipoint

A multipoint (also called multidrop) connection is one in which more than two specific devices share a single link.

In a multipoint environment, the capacity of the channel is shared, either spatially or temporally. If several devices can use the link simultaneously, it is a spatially shared connection. If users must take turns, it is a timeshared connection.

Types of Computer Network

Networks may be divided into different types and categories according to four different criteria

1. Geographic spread of nodes and hosts

When the physical distance between the hosts is within a few kilometers, the network is said to be a Local area Network (LAN). LANs are typically used to connect a set of hosts within the same building (e.g., an office environment) or a set of closely-located buildings (e.g., a university campus)

For larger distances, the network is said to be a Metropolitan Area Network (MAN) or a Wide Area Network (WAN). MANs cover distances of up to a few hundred kilometers and are used for interconnecting hosts spread across a city.

WANs are used to connect hosts spread across a country, a continent, or the globe

2. Access restrictions

Most networks are for the private use of the organizations to which they belong; these are called private networks. Networks maintained by banks, insurance companies, airlines, hospitals, and most other businesses are of this nature

Public networks, on the other hand, are generally accessible to the average user, but may require registration and payment of connection fees. Internet is the most-widely known example of a public network.

3. Communication model employed by the nodes

The communication between the nodes is either based on a point-to-point model or a broadcast model.

4. Switching model employed by the nodes

In the point-to-point model, nodes either employ circuit switching or packet switching. In circuit switching, a dedicated communication path is allocated between A and B, via a set of intermediate nodes. In packet switching, data is divided into packets (chunks of specific length and characteristics) which are sent from A to B via intermediate nodes. Each intermediate node temporarily stores the packet and waits for the receiving node to become available to receive it

LAN Topologies

Various topologies are possible for the broadcast LAN such as bus, ring or mesh topology.

1. BUS Topology

A bus topology is multipoint. One long cable act as a backbone to link all the devices in a network. Nodes are connected to the bus cable by drop lines and taps.

As a signal travels along the backbone, some of its energy is transformed into heat. Therefore, it becomes weaker and weaker as it travels farther and farther. For this reason, there is a limit on the number of taps a bus can support and on the distance between those taps.

Fig: Bus Topology

2. Ring Topology

In a ring topology, each device has a dedicated point-to-point connection with only the two devices on either side of it. A signal is passed along the ring in one direction, from device to device, until it reaches its destination. Each device in the ring incorporates a repeater. When a device receives a signal intended for another device, its repeater regenerates the bits and

passes them along.

Fig: Ring Topology

3. Star Topology:

In a star topology, each device has a dedicated point-to-point link only to a central controller, usually called a hub. The devices are not directly linked to one another. Unlike a mesh topology, a star topology does not allow direct traffic between devices. The controller acts as an exchange: If one device wants to send data to another, it sends the data to the controller, which then relays the data to the other connected device.

Fig: Star Topology

4. Mesh Topology

In a mesh topology, every device has a dedicated point-to-point link to every other device. The term dedicated means that the link carries traffic only between the two devices it connects.

Fig: Mess Topology

Transmission Media

A transmission medium can be broadly defined as anything that can carry information from a source to a destination. The transmission medium is usually free space, metallic cable, or fiber-optic cable. The information is usually a signal that is the result of a conversion of data from another form.

Guided Media

A signal traveling along any of these media is directed and contained by the physical limits of the medium. Twisted-pair and coaxial cable use metallic (copper) conductors that accept and transport signals in the form of electric current. Optical fiber is a cable that accepts and transports signals in the form of light.

1. Twisted-Pair Cable

A twisted pair consists of two conductors (normally copper), each with its own plastic insulation, twisted together. One of the wires is used to carry signals to the receiver, and the other is used only as a ground reference. The signal sent by the sender on one of the wires causes interference (noise) and crosstalk creating unwanted signals. Twisting the pair of cable reduces interference and cross talk between signals. For example, Twisted-pair cables are used in telephone lines to provide voice and data channels.

2. Coaxial Cable

Coaxial cable (or coax) carries signals of higher frequency ranges than those in twisted pair cable. Instead of having two wires, coax has a central core conductor of solid or stranded wire (usually copper) enclosed in an insulating sheath, which is, in turn, encased in an outer conductor of metal foil, braid, or a combination of the two.

3. Fiber Optic Cable:

A fiber-optic cable is made of glass or plastic and transmits signals in the form of light. To understand optical fiber, we first need to explore several aspects of the nature of light. Optical fibers use reflection to guide light through a channel. A glass or plastic core is surrounded by a cladding of less dense glass or plastic. The difference in density of the two materials must be such that a beam of light moving through the core is reflected off the cladding instead of being refracted into it.

Advantages

• Higher bandwidth. Fiber-optic cable can support dramatically higher bandwidths

• Less signal attenuation. Fiber-optic transmission distance is significantly greater than that of other guided media. A signal can run for 50 km without requiring regeneration.

• Immunity to electromagnetic interference. Electromagnetic noise cannot affect fiber-optic cables.

• Resistance to corrosive materials. Glass is more resistant to corrosive materials than copper.

• Light weight. Fiber-optic cables are much lighter than copper cables.

• Greater immunity to tapping. Fiber-optic cables are more immune to tapping than copper cables. Copper cables create antenna effects that can easily be tapped.

Disadvantages

• Installation and maintenance is difficult

• Unidirectional light propagation. Propagation of light is unidirectional. If we need bidirectional communication, two fibers are needed.

UNGUIDED MEDIA: WIRELESS

Unguided media transport electromagnetic waves without using a physical conductor. This type of

communication is often referred to as wireless communication. Signals are normally broadcast through free space and thus are available to anyone who has a device capable of receiving them.

Unguided signals can travel from the source to destination in several ways: ground propagation, sky propagation, and line-of-sight propagation

Network device

1. Repeaters

A repeater is a device that operates only in the physical layer. Signals that carry information within a network can travel a fixed distance before attenuation endangers the integrity of the data. A repeater receives a signal and, before it becomes too weak or corrupted, regenerates the original bit pattern. A repeater does not actually connect two LANs; it connects two segments of the same LAN.

2. Bridges or Link Layer Switches

A bridge or Link layer switch (or simply Switch) operates in both the physical and the data link layer. As a physical layer device, it regenerates the signal it receives. As a data link layer device, the bridge can check the physical (MAC) addresses (source and destination) contained in the frame. A bridge has filtering capability. A bridge has a table that maps addresses to ports.

3. Hubs

A Hub is a device that operates only in the physical layer. It is basically used for connecting stations in a physical star topology. The main disadvantage of Hub is that it broadcast data to all the devices connected to it. So, chances of collision and data corruption is high in hubs.

4. Routers

A router is a three-layer device that routes packets based on their logical addresses (host-to-host addressing). A router normally connects LANs and WANs in the Internet and has a routing table that is used for making decisions about the route. The routing tables are normally dynamic and are updated using routing protocols.

There are three major differences between a router and a repeater or switch.

• A router has a physical and logical address for each of its interfaces.

• A router acts only on those packets in which the link layer destination address matches the address of the interface at which the packet arrives.

• A router changes the link layer address of the packet when it forwards the packet

5. Gateway

A gateway is normally a computer that operates in all five layers of the Internet or seven layers of OSI model. A gateway takes an application message, reads it, and interprets it. This means that it can be used as a connecting device between two internetworks that use different models

OSI Reference Model

The model is called the ISO-OSI (Open Systems Interconnection) Reference Model because it deals with connecting open systems—that is, systems that are open for communication with other systems.

The OSI model is a layered framework for the design of network systems that allows communication between all types of computer systems. It consists of seven separate but related layers, each of which defines a part of the process of moving information across a network.

The OSI model is composed of seven ordered layers: physical (layer 1), data link (layer 2), network (layer 3), transport (layer 4), session (layer 5), presentation (layer 6), and application (layer 7).

As the message travels from A to B, it may pass through many intermediate nodes. These intermediate nodes usually involve only the first three layers of the OSI model

Fig: OSI-ISO Reference Model

Physical Layer

The physical layer coordinates the functions required to carry a bit stream over a physical medium. It deals with the mechanical and electrical specifications of the interface and transmission medium. It also defines the procedures and functions that physical devices and interfaces have to perform for transmission to occur.

Data Link Layer

The data link layer transforms the physical layer, a raw transmission facility, to a reliable link. It makes the physical layer appear error-free to the upper layer (network layer).

Other responsibilities of the data link layer include the following

• Framing – The data link layer divides the stream of bits received from the network layer into manageable data units called frames

• Physical addressing

• Flow control – If the rate at which the data are absorbed by the receiver is less than the rate at

which data are produced in the sender, the data link layer imposes a flow control mechanism to avoid overwhelming the receiver

• Error control – The data link layer adds reliability to the physical layer by adding mechanisms to detect and retransmit damaged or lost frames. It also uses a mechanism to recognize duplicate frames. Error control is normally achieved through a trailer added to the end of the frame

• Access control – When two or more devices are connected to the same link, data link layer protocols are necessary to determine which device has control over the link at any given time

Network Layer

The network layer is responsible for the source-to-destination delivery of a packet, possibly across multiple networks (links). Whereas the data link layer oversees the delivery of the packet between two systems on the same network (links), the network layer ensures that each packet gets from its point of origin to its final destination.

Other responsibilities of the network layer include the following:

• Logical addressing – The physical addressing implemented by the data link layer handles the addressing problem locally. If a packet passes the network boundary, we need another addressing system to help distinguish the source and destination systems. The network layer adds a header to the packet coming from the upper layer that, among other things, includes the logical addresses of the sender and receiver.

• Routing – When independent networks or links are connected to create internetworks (network of networks) or a large network, the connecting devices (called routers or switches) route or switch the packets to their final destination. One of the functions of the network layer is to provide this mechanism.

Transport Layer

The transport layer is responsible for process-to-process delivery of the entire message. A process is an application program running on a host. Whereas the network layer oversees source-to-destination delivery of individual packets, it does not recognize any relationship between those packets. It treats each one independently, as though each piece belonged to a separate message, whether or not it does. The transport layer, on the other hand, ensures that the whole message arrives intact and in order, overseeing both error control and flow control at the source-to-destination level.

Other function includes

• **Connection control –** The transport layer can be either connectionless or connection oriented.

• Flow control – Like the data link layer, the transport layer is responsible for flow control. However, flow control at this layer is performed end to end rather than across a single link.

• Error control Like the data link layer, the transport layer is responsible for error control. However, error control at this layer is performed process-to-process rather than across a single link. The sending transport layer makes sure that the entire message arrives at the receiving transport layer without error (damage, loss, or duplication). Error correction is usually achieved through retransmission.

Session Layer

The services provided by the first three layers (physical, data link, and network) are not sufficient for some processes. The session layer is the network dialog controller. It establishes, maintains, and synchronizes the interaction among communicating systems.

Specific responsibilities of the session layer include the following:

• Dialog control – The session layer allows two systems to enter into a dialog. It allows the communication between two processes to take place in either half duplex (one way at a time) or full-duplex (two ways at a time) mode.

• Synchronization – The session layer allows a process to add checkpoints, or synchronization points, to a stream of data

Presentation Layer

The presentation layer is concerned with the syntax and semantics of the information exchanged between two systems

• Translation – Different computers use different encoding systems, the presentation layer is responsible for interoperability between these different encoding methods. The presentation layer at the sender changes the information from its sender-dependent format into a common format. The presentation layer at the receiving machine changes the common format into its receiver-dependent format

• Encryption – To carry sensitive information, a system must be able to ensure privacy. Encryption means that the sender transforms the original information to another form and sends the

resulting message out over the network. Decryption reverses the original process to transform the message back to its original form.

• Compression – Data compression reduces the number of bits contained in the information. Data compression becomes particularly important in the transmission of multimedia such as text, audio, and video.

Application Layer

The application layer enables the user, whether human or software, to access the network. It provides user interfaces and support for services such as electronic mail, remote file access and transfer, shared database management, and other types of distributed information services.

Specific services provided by the application layer include the following:

• Network virtual terminal – A network virtual terminal is a software version of a physical terminal, and it allows a user to log on to a remote host.

• File transfer, access, and management – This application allows a user to access files in a remote host (to make changes or read data), to retrieve files from a remote computer for use in the local computer, and to manage or control files in a remote computer locally.

• Mail services – This application provides the basis for e-mail forwarding and storage.

• Directory services – This application provides distributed database sources and access for global information about various objects and services.

Fig: OSI Layers as Software tasks

Communication Protocols

All communications between devices require that the devices agree on the format of the data. The set of rules defining a format is called a protocol. At the very least, a communications protocol must define the following:

• rate of transmission (in baud or bps)

• whether transmission is to be synchronous or asynchronous

• whether data is to be transmitted in half-duplex or full-duplex mode

In addition, protocols can include sophisticated techniques for detecting and recovering from transmission errors and for encoding and decoding data.

Centralized vs Decentralized System

Distributed System

A distributed system is a collection of independent computers that appear to the users of the system as a single system. A Distributed system consists of multiple autonomous computers, each having its own private memory, communicating through a computer network. Information exchange in a distributed system is accomplished through message passing.

Examples

• World Wide Web (WWW) is the biggest example of distributed system.

• The internet

• An intranet which is a portion of the internet managed by an organization

• Network of branch office computers

Advantages of Distributed Systems over Centralized Systems

• Economics – A collection of microprocessors offers a better price/performance than mainframes. Low price/performance ratio: cost effective way to increase computing power.

• Speed – A distributed system may have more total computing power than a mainframe. Ex. 10,000 CPU chips, each running at 50 MIPS. Not possible to build 500,000 MIPS single processor since it would require 0.002 sec instruction cycle. Enhanced performance through load distributing.

• Inherent distribution – Some applications are inherently distributed. Ex. a supermarket chain.

• Reliability – If one machine crashes, the system as a whole can still survive. Higher availability and improved reliability.

• Incremental growth – Computing power can be added in small increments. Modular expand-ability

• Another deriving force – The existence of large number of personal computers, the need for people to collaborate and share information.

• Open system – This is the most important point and the most characteristic point of a distributed system. Since it is an open system it is always ready to communicate with other systems. An open system that scales has an advantage over a perfectly closed and self-contained system.

Unit -6 Internet and WWW

Contents:

- **Internet**
    - Introduction to Internet and its Applications
    - Connecting to the Internet
    - Client/Server Technology
    - Internet as a Client/Server Technology
    - Email
    - Video-Conferencing
    - Internet Service Providers
    - Domain Name Server
    - Internet Address
    - Internet Protocols (IP, TCP, HTTP, FTP, SMTP, POP, Telnet, Gopher, WAIS)
    - Introduction to Intranet, Internet vs. Intranet vs. Extranet
    - Advantages & Disadvantages of Intranet
- **World Wide Web (WWW)**
    - World Wide Web and Its Evolution
    - Architecture of Web
    - Uniform Resource Locator (URL)
    - Browsers
    - Search Engine
    - Web Servers: Apache, IIS, Proxy Server
    - HTTP Protocol, FTP Protocol

Introduction to Internet

The Internet is a global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP) to serve billions of users worldwide. It is a network of networks that consists of millions of private, public, academic, business, and government networks, of local to global scope that are linked by a broad array of electronic, wireless, and optical networking technologies.

The Internet carries a vast range of information resources and services, such as the interlinked hypertext documents of the World Wide Web (WWW) and the infrastructure to support electronic mail.

Application of Internet

1. **E-mail** – Email is now an essential communication tool in business. With email, you can send and receive instant electronic messages.
2. **24/7 Availability** – Internet is available 24 hours a day, 7 days a week, for usage.
3. **Information** – Information is probably the biggest advantage the Internet offers. There is a huge amount of information available on the Internet for just about every subject, ranging from government law and services, trade fairs and conferences, market information, new ideas, and technical support.
4. **Services** – Net banking, job searching, purchasing tickets, hotel reservations, guidance services, etc.
5. **E-commerce, Entertainment, Software downloads, etc.**

Limitations of Internet

1. **Theft of Personal Information** – Risk of personal data being stolen.
2. **Negative Effects on Family Communication** – Overuse of the Internet affects interpersonal relationships.
3. **Internet Addiction** – Excessive use can lead to addiction.
4. **Children Using the Internet** – Exposure to inappropriate content.
5. **Virus Threats and Spamming** – Risks include malicious software and unsolicited emails.

Connecting to the Internet

Many home and small business users connect to the Internet via high-speed broadband Internet service. With broadband Internet service, your computer or mobile device is usually connected to the Internet the entire time it is powered on. Examples of broadband Internet services include cable, DSL, fiber, radio signals, and satellite.

1. **Cable Internet Service** – Provides high-speed Internet access through the cable television network via a cable modem.
2. **DSL (Digital Subscriber Line)** – Provides high-speed Internet connections using regular copper telephone lines.
3. **Fiber to the Premises (FTTP)** – Uses fiber-optic cable to provide high-speed Internet access to home and business users.
4. **Fixed Wireless** – Provides high-speed Internet connections using a dish-shaped antenna on your house or business to communicate with a tower location via radio signals.
5. **Cellular Radio Network** – Offers high-speed Internet connections to devices with built-in compatibility.
6. **Wi-Fi (Wireless Fidelity) Network** – Uses radio signals to provide high-speed Internet connections to compatible or properly equipped wireless computers and devices.
7. **Satellite Internet Service** – Provides high-speed Internet connections via satellite to a satellite dish that communicates with a satellite modem.