Software concept

Software is the set of the programs concerned with the operation of a data processing system. Software is broadly grouped into two categories namely

a) **System software** : It is a collection of systems program to perform common task. System software is hardware dependent and not portable . System software is of three types

i) Operating system

ii) Language translators

iii) Utilities

b)**Application software** : It consists of user application packages such as payroll , financial accounting packages. Application software is generally written in high level language

Example: Microsoft office ,Oracle

Computer Languages

Programming language: A programming language is a set of rules which the user has to follow to instruct the computer what operations are to be performed.

All the computer languages are classified as Low level languages and High level languages.

1. **Low level languages.**
   i. Machine level languages
   ii. Assembly languages
2. **High level languages**
   i. Specific purpose languages
   ii. General purpose languages

Machine language: The basic language of the computer representing data as 0's and 1's is known as machine language or machine code. The instructions provided in machine language are immediately understood and converted into electrical signals to run the computer. A machine code instruction has two parts namely, OPCODE (Operation code) and OPERAND (Address / Location). The OPCODE denotes the operation which is to be performed. The OPERAND gives the address of the data to which the operation code is to be applied.

Advantages:

1. It makes efficient use of the storage.
2. Since machine language instructions don't need compilation or translation, the machine language instructions are immediately executed.
3. Machine language instructions can be used to manipulate the individual bits in a byte of computer storage.

Disadvantages:

1. The machine languages are machine dependent.
2. It is difficult to correct machine language programs.
3. Since it is difficult to memorize the dozens of operations in the machine language, the programming is very difficult.

Assembly Language: It is a low level programming language that allows a user to write programs using letters and symbols which are more easily remembered. It is a symbolic language and the

symbols used to write the program are called mnemonics. The translator program that translates an assembly code in to machine code is called an assembler.

Advantages:

1. Compared to machine language, writing programs in assembly language is easier.
2. Requires few instructions to accomplish the same result.
3. Since mnemonics are used, assembly language is easier to understand.
4. Identifying and correcting the errors is easier.

Disadvantages:

1. Since the programs are machine dependent, the programs cannot be executed on small sized computers.
2. Lack of portability of programs between computers of different make.
3. Since the programs are written using symbols, the programs will become lengthier.

High level languages:

They are the languages where the instructions in a program are expressed in English statements. These languages are machine independent.

They are classified in to two types. Namely,

1. **General purpose languages** like, BASIC, Pascal and C. They can be used to solve a wide variety of problems like business, scientific, graphical etc.,

Specific purpose languages like, COBOL, FORTRAN. They can be used to solve specific types of problems.

Advantages of high level language:

1. They are machine independent.
2. Errors are less.
3. Easy to learn and to use
4. Fewer errors and easier modification
5. Better documentation

Disadvantages of high level language:

1. They require translation program.
2. The translation programs are expensive and require more memory.
3. The programs written in high level languages require more main memory.
4. They are less flexible.
5. They are less efficient.
6. Slower in execution.

Language translators: It is software is used to convert the program written in other than machine language to the equivalent machine language. There are three types of translator programs.

1. **Assembler**: It is system software which translates an assembly language program into its machine language equivalent only if the entire program is free from error

2. **Compiler**: It is a system software that translates entire source code (program written by user) to object code(machine language program) only if the program is free from the error. The process of translation is called as compilation.
The compiler can identify the following errors
a) illegal characters
b) illegal combination of character
c) improper sequence of instruction.
The various tasks that the compiler has to accomplish during compilation are as follows
a) Read each line of source program and convert into equivalent machine language
b) Allocate the space in memory for storage
c) Combine the machine code with appropriate subroutine
d) Identify the proper order of processing
3. **Interpreters**: A translator that translates a statement of a high level language and immediately executes it before translating next source language statement.

Differences between the interpreter and compiler

	Interpreter	compiler
1	Translates the program line by line	Translates the entire program
2	Requires less main memory	Requires more main memory
3	No security of source code	Security of source code
4	Execution time is more	Execution time is less
5	Faster debugging and testing	Slower testing and debugging
6	Source program and interpreter are required for execution	Neither source nor the compiler are required for execution
7	Each time program is executed every line is checked for syntax and then convert to object code	Converts entire program to machine code when the syntax error are removed

Linker: It is a system software that loads all the library segment to the modules and links the modules, so that the modules executes properly.
Loader: It is a system software that loads the program into the main memory of computer so that it can be executed.

Operating system

An operating system is a computer program that acts as an intermediary (interface) between the user of the computer and the computer hardware. It provides a proper environment in which the

user can use the computer in an efficient manner.
Example: MS-DOS , windows 7, Unix, Sun Solaris ,windows 8.1, windows10, etc.

Main features or functions of an operating system are

1. It loads and calls application programs utilities and translators.
2. It controls the flow of jobs by loading and unloading the programs.
3. It communicates control and error massages to operator.
4. It allocates peripherals to programs and checks their availability.
5. Wide range of computer configurations can be used with one operating system.
6. File storage can be controlled.
7. Supervise the overall operation of the computer
8. Performs the function of spooling, virtual memory etc.

Views of the operating system

The different views of the operating system are,

1. The operating system as an extended machine.

The user need not know how the files are being stored, the internal structure of the processor. The operating system hides the internal details of the processor and thus helps the user to get his work dine in an easier manner. The operating system hides the user from a number of unpleasant tasks concerning interrupts, timers, memory management and other important functions at the lower level.

2. The operating system as a resource manager:

The modern computer consists of various components such as processors, memory devices, printers and so on. Operating system allocates the available sources equally to all the programs that are trying to capture the available sources. It acts as a manager, which sees that all the processes get equal time and equal resources to execute.

3. The operating system as a guardian and accountant:

The present day computers can perform special tasks in a predefined order. Thus they work as a guardian. The operating system keeps track of information such as disk storage used, the connect time, the logout time. This service allows the service provider a proper means for billing for the service.

The different types of operating systems: The different types of OS are

Single user operating systems: They are standalone systems. The user is the person having control over the entire system at hand. First the user inputs a boot program to initialize the system, once the boot program is in the memory; the user can then setup the input and output devices necessary for running his applications. When the application is completed the user is required to bring back the system to its initial idle state.

Time sharing or Multiuser systems: It allows a number of users to work on the same computer at the same time. IT uses CPU scheduling and multi programming to provide each user with a small portion of a time shared system. Each user has at least one program running in the memory. This program is referred to as a process. When a process is executed for a short duration of time, if the job finishes or needs to perform an input output operation, rather than the CPU waiting idle the operating system will rapidly switch to the program of the other user.
The time sharing systems were developed to provide interactive use of the system at a reasonable cost. It uses CPU scheduling and multi programming to provide each user with a small portion of time shared system

Batch processing systems: To speed up the processing, similar jobs are grouped together in the form of batches and the operator would run each batch. Then the output of each batch will be sent back to the programmer.
The users of such systems will prepare a job consisting of program and data required for the program and enter it to the system with the help of punched cards, later in the day the output would be generated. The output will include valid result junk values in the case of errors in running the program

Real time systems: These systems are used in dedicated applications. Sensors bring the input data to the computer. These systems are used in medical imaging systems, industrial control systems. The main feature is that the processing should de done within the definite time period otherwise the system will fail.
Multiprogramming operating system: It is the capability of the CPU to execute two or more programs concurrently. Easily two or more programs are stored concurrently in primary storage and the CPU moves from one program to another partially executing each in turn.
Multitasking operating system: Multi-tasking OS is distinguished by its ability to support concurrent execution of two or more process. Multitasking is also called context switching. Multitasking usually refers to single user.
Distributed operating system: It is a collection of autonomous computer system capable of communication and cooperation via their software and hardware interconnections. This operating system helps us in balancing the load by sharing process etc.
Network operating system: It is a collection of software and associated protocols that allows a set of autonomous computer which are inter connected by a computer network. It can be used in a convenient and cost effective manner.
Multi thread operating system: A thread is a sequence of the instructions with in a program. A program may have many thread which share the same code section and other OS resources

Functional features of commonly used operating system : There are two types of user interface
1) Command line user interface(CUI) and 2) Graphical user interface (GUI)

Comparison of CUI and GUI

CUI	GUI
Mouse operation is not available	Mouse operation required to select
User must remember the commands and their parameter	The user need not remember any commands
User must type the command	User must click on the icons
CUI stands for command user interface	GUI stands for Graphical user interface
Example: DOS	Example: Windows 7

Disk operating system(DOS): It is single user operating system developed by Bill gates and Paul Allen in 1980 for IBM with following features

1. File management
2. Directory management
3. Memory management
4. Command interpreter

Unix OS: Unix was developed by Dennis Ritchie and ken Thompson in 1985 by sun micro system with following features (feature of Linux is also same)

1.Hierarchical file organization
2. Portability
3.Multi user and Multi tasking support
4. Machine independent
5. Excellent tools and tool building utilities

Solaris OS: This operating system is a free unix based operating system produced by sun micro system in 1992 with following features

1) Advanced networking capabilities with high throughput
2)Facilitates zoning security
3)Managing hardware interface of a particular application

Windows 7: This operating system will following features

1) It is designed for64 bit and 32 bit system
2) Better search facility for file
3) Better security support
4) Support for multi core processor
50 Redesigned task bar