Software

- Computers are general purpose machines
- Computers can be made to perform different types of word
- The computer itself – the hardware cannot do any of those things.
- The ingredient that enables a computer to perform a specific task is software, which consists of electronic instruction
- Software → brings life to the machine.
- It is an abstract part of the computer system.
- It acts as a interface between human and computer hardware
- The software is made up of series of instructions, commands and data that are used to process to get the required information.
- Software can be compared with our soul and hardware as our body part.
- In computer system also the hardware and software are inseparable parts.
- Computer programs that make hardware work.
- Computer program instructions used to tell a computer what to do.
- Computer program, instructions by which the machine operates which includes both system oriented programs and application programs.

Types of Software:

- Application Software
    - Is a packaged software specially designed for a specific task like word processing, spread sheet, data base etc
    - Are written by programmers using computer language or the programs which we buy from the market as a ready- made package
    - A program running on a top f the O.S that has been created to perform a specific task for a user.
    - We can make our own custom programs to computerize the billing system, accounting system, for record keeping system, result processing etc. using any computer language.
- System Software
    - Is a program or a complicated set of programs that act together to allow other programs to function
    - Programs that controls and support operation of a computer system.
    - Program which gives instructions to the computer in terms of electronic signals to work with the different parts of the computer in the response of the instruction provided by other programs or commands from input units.
    - Set of programs necessary to run the computer.
    - It actually assists for the computer operations residing inside the memory.
    - This type of software controls the hardware part of the system for different operations.
    - Is developed by the manufacture of the computer and all the routines of the system software are hardware related.

- Application Software

- Those softwares which are required to make the computer useful for people.
- Programs that help people accomplish specific tasks are referred to as application software.
- Thousands of applications are available for many purposes and for people of all age groups
- Major categories of these applications
    - Word processing Software → creating text – based documents such as newsletters or brochures
    - Spreadsheets → for creating numeric – based documents such as budgets or balance sheets.
    - Database Management Software → for building and manipulating large sets of data.
    - Presentation programs → for designing illustrations or manipulating photographs, movies or animations
    - Multimedia applications → for building digital movies that incorporate sound, video, animations and interactive features
    - Entertainment and education software
    - Web design tools, web browsers and other internet applications such as email programs.
    - Games, which can be played by several player over a network or the internet
    - Programming language, such as c, c++, visual basic and java which allow the programmer to create new applications.
    - Networking and communication software that let computers connect to one another and exchange data.

    E.g.:

    Office Automation Systems
    Transaction Processing Systems
    Decision Support Systems
    Management Information System
    Expert Systems

Software Developing Life Cycle

- Creating an information system or software can be a complex task.
- It involves several distinct phases, each of which often must be completed before a subsequent task can begin.
- Software development life cycle consists of a series of 5 different phases
    - Problem Definition
    - System Analysis
    - System Design
    - System Implementation
    - System Testing / Verification
    - System Maintenance
- Problem Definition

- Includes the identification of the actual requirement that needed to be fulfilled by the proposed system
- Also known as *requirement analysis*
- Includes the thorough interaction with the client for the details analysis of the system input and system output.
- Also determines which part of the system is to be computerized and which one not.
- The output of this step is an unambiguous explanation of the problem.

- System Analysis
  - The phase elaborates *" What the system will do" but not "How"*
  - Developers use various tools like " Data Flow Diagram" and Entity Relationship Diagram" to depict the internals of the proposed system
  - The entire system is modularized into a small chunks (divide and conquer strategy) and data used by the systems are analyzed

- System Design
  - Elaborates *" How the system works"*
  - Each modules are further broken down into smaller pieces and elaborated minutely with the help of the flow-chart or pseudo code
  - The design process may follow Top-Down Approach or Bottom Up Approach
  - In Top-Down Design, team members start with the large picture and move to the details
  - They look at major functions that the system must provide and break these down into smaller and smaller activities.
  - In Bottom-Up Design, the team starts with the details and then moves to big pictures (the major functions or processes)

- System Implementation
  - After detail design of system, system is implemented using suitable programming language
  - The coding process starts where each pseudo codes are converted into programming language constructs.

- System Testing / Verification
  - Includes the detail testing of the implemented program
  - The testing can be categorized into 2 types
    - Black Box Testing – where known input is provided and checked whether system generates expected output or not
    - White Box Testing – where every possible course of action inside the code is checked thoroughly.

- System Maintenance
  - Is a continuous process and is done until the life – time of software.

- A software system never becomes 100% correct and it needs continuous maintenance.

- Documentation also plays vital role in software development; Documentation may or may not be a different stage.
- It is important for the simple reason that it helps in system maintenance and understanding the functionality of the system
- User documentation is for those who use the system and technical documentation is for the maintenance of the system
- It helps to those who use and maintain software so that the software becomes easy to extend, redesign and debug.

System Software

Operating System

- Is the system program that controls all the in and out flow of the data in the computer system
- It controls the flow of disk data to the memory and vice versa
- It is the powerful software without which hardware becomes ineffective
- It provide a software platform on the top of which other programs can run.
- Modern computer system consists of one or more processors, some main memory, disk, printers, a keyboard, display, network interfaces and other input/output devices.
- All in all, a complex system writing programs that keep track of all these components and use them correctly is an extremely difficult job.
- For this reason, computers are equipped with a layer of software called the operating system whose job is to manage all these devices and provide user programs with a simple interface to the hardware.
- There are different types of O.S and most of them are built by the industry itself in order to maintain the standard. E.g.: MS-DOS, OS/2, Windows, Linux, UNIX, Macintosh etc.

Utility Program

- It is the program written by manufacturers that helps to check hardware part, disk utility, virus scanner etc.
- These programs provide facilities for carrying out the basic and most necessary functions like checking faulty disk, recovering disk errors, preparing disk for storing information, setting the screen resolution, enabling or disabling the computer peripherals etc.
- E.g. Norton Utility, hard drive utility drive, PC- tools etc.
- Is a program that performs a very specific tasks usually related to managing system resources.
- It makes operation of a PC more convenient, including programs to move disk file more easily, diagnostic programs etc.

Language Processor:

- It is used to translate the program written in a computer programming language into the machine readable code.
- It converts the English like language into the machine readable form.
- Classified into three types
    - Assembler
    - Complier
    - Interpreter.

- Assembler
    - Translates program written in an assembly language into machine readable code
    - The source code for this type of language is written in mnemonic instruction and assembler translate these mnemonic into the binary codes so machine would understand it.
    - After assembling the program it can be run easily it takes short time to execute the program.

- Complier
    - A compiler is a program that translates a source program written in some high- level programming language (like java, c) into machine code.
    - The act of running the complier program is called compiling.
    - The compiler reads the instructions and outputs a file of 1's and 0's which cause the computer to perform the programmer's original instructions
    - The computer only runs the file of 1's and 0's.
    - Since different computer has a different meaning for the 1's and 0's the programmer must compile the program using a different compiler for each computer the program should run on.
    - Program compiled for a IBM compatible PC will not run on a Macintosh or other (sun workstation)
    - For every different processor type, there must be corresponding compilers.
    - It takes the complete high level program (source code) as input and translates it in terms of machine level instructions (object code)
    - E.g. to translate the whole article written in English to French.

- Interpreter
    - Is also a translator which translates high level language to a machine level language
    - The working principle is different from that of compiler.
    - It reads each line of the programmer's instructions, determines what they mean and sends the appropriate 1's and 0's to the computer.
    - Since the interpreter needs to evaluate the program letter by letter, then word by word, then line by line , its an incredibly slow process, if there is comments, it's even slower

- E.g. If we have to speak in French but we don't know how to. Then we can hire a French speaker who can understand both Nepali and French. The translator will translate that sentence to French sentence.
- In compiler, the syntax errors are found only after the compilation of complete program where as in interpreter, errors can be trapped after translation of every line.

Device Driver:

- Is program that controls a device
- Any input/output devices generally consist of two parts: a controller and the device itself.
- Controller is a chip or set of chips on a plug in board that physically controls the device
- It accepts commands from the operating system for example to read data from the device and carries them out.
- Because each type of controller is different, different software is needed to control each one.
- The software that talks to a controller giving it commands and accepting responses is called a device driver.
- Each controller manufacturer has to supply a driver for each operating system it supports.
- Every device, whether it is a printer, disk drive or keyboard must have a driver program.
- Many drivers, such as the keyboard driver, come with the operating system.
- For other devices, you may need to load a new driver when you connect the device to your computer.
- In DOS system drivers are files with a .sys extension.
- In Windows environments, drivers have .drv extensions
- Driver acts like translators between device and programs that use the device.
- The driver accepts generic commands from a program and then translates them into specialized commands for the device.

Operating System

- Manage the operation of computer as whole.
- Is system software that acts as an intermediate between the user and computer hardware.
- Is the first software we see when we turn on the computer and again the last software we see when the computer is turned off
- It's very difficult for users of computer to understand how to operate those hardware directly. So the OS becomes the interpreter between the computer hardware and the user.

Functions of Operating System

- Job Scheduling / interrupt handling in the processor
- Input / Output (I/0) Control.

- Managing / Controlling Resources (Resource Allocation)
- Memory Management
- Paging
- Security
- File Management
- Event Logging
- Sharing Resources

Types of Operating System

- A single Program System
  - A single program is run at the particular time
  - The problem is that the single program is not enough to use the full capacity of the processor.

- Stacked Job Batch System
  - A batch system is one in which jobs are bundled together with the instructions necessary to allow them to be processed without intervention
  - Often magnetic tapes and drums were used to store intermediate data and compiled programs.

- Spooling Batch System
  - In this computer can perform IO in parallel with computation, became possible to have the computer read a deck of cards to a tape, a drum or disk and to out to a tape printer while it was computing
  - This processing is called SPOOLING: Simultaneous Peripheral Operation Online
  - Advantage of Spooling batch systems was that the output from jobs was available as soon as the job completed, rather than only after all jobs in the current cycle were finished.

- Multiprogramming Systems
  - The concept of multiprogramming is to create systems that would load several jobs into memory at once and cycle through them in some order, working on each one for a specified period of time
  - Responsible for : starting user jobs, spooling operations, IO for user jobs, switching between user jobs, ensuring proper protection while doing the above.
  - Multiprogramming was introduced in System 360

- Time Sharing Systems
  - Multiple terminals are connected to the computer, with each "in-use" terminal being associated with one or more jobs on the computer.

- The OS is responsible for switching between the jobs in such a way that every terminal feels that it is occupying the entire computer resources.

- Real Time Operating System
  - Are dedicated to some well- defined jobs which require very fast response time.
  - Must be fault- tolerant i.e. must handle the error without going to unstable stage.
  - Execution time is the most critical issue in real time OS and they must finish the execution of job within predefined time boundary.
  - Eg. Missile guiding system, medical monitoring system, flight simulation system etc.

- Multiprocessing Operating System
  - Is one which runs on the computer having more than one CPU. Such OS simultaneously executer two or more jobs at a single time.
  - The controlling mechanism, in multiprocessing OS becomes a bit complex.
  - Depending upon the main memory, this type of OS can be categorized into two subtypes
    - Share memory: OS have only one set of main-memory which are shared among the processors. Manage the efficient sharing of memory and synchronization among the processors.
    - Distributed Memory – CPU has got own memory set.

- Network Operating System
  - Works under the principle of client- server mechanism
  - Client server is a mechanism in which co-operation and interconnection and intercommunication between various elements of network takes place and one machine “serves” others for various functions.

- Distributed Operating System
  - Is one that appears to its user as a traditionally uniprocessor system, even though it is actually composed of multiple processors computers
  - The user mustn’t aware of where their application/program is running or where their file is located
  - The user feels like he is working in the terminal in front of him, but actually the work may take place in any machine in the network. It is the job of operating system to create such transparency.
  - Distributed system is one more enhancement in Network operating System adding transparency.

Choosing an Operating System

- First application programs are coded to run under a particular operating system, so the choice of an operating system determines the selection of programs available.
- Second features vary among operating systems, so the types and uses of hardware devices in the computer system may be limited by the choice of the operating system.
- Third, the computer uses the particular format of the operating system when writing data onto a disk. One operating system may not be able to read the disks written by another operating system.

Example of Operating Systems

- UNIX
- DOS
- Macintosh Operating System
- Window 3x
- OS/2 Wrap
- Windows NT
- Windows 95 and 98
- LINUX
- Windows 2000 and XP