Chapter 01 : Basics of Information Technology

1.0 Overview

Q : 01-00-01 : What is a Global Village ? Define or Describe Global Village ?
Q : 01-00-01 : How the World has become a Global Village today ?

Answer :

Information is the key factor in this era and is the most precious commodity today. Everything evolves around information and communication which play key role in the functionality and existence of each system. Information Technology (IT) has virtually made one-community area "**Global Village**". The computer users are almost always sharing and exchanging their information in such a manner as if they are sitting in a drawing room **face to face**.

Q : 01-00-02 : What is Data ? Define or Describe Data ?

Answer :

The raw facts and figures, that are, not meaningful. These are used in processing to produce meaningful information.

Q : 01-00-03 : What is Information ? Define or Describe Information ?

Answer :

The facts and figures about anything i.e. The know-how about any object that exists and plays its role in any system. This must be meaningful.

Q : 01-00-04 : What is System ? Define or Describe System ?

Answer :

The system is any identified and known work that accepts data / information into itself, manipulates in the shape of certain output(s) and delivers so that it becomes useful and meaningful.

Q : 01-00-05 : What is Information Technology ? Define or Describe IT ?

Answer :

Information Technology or IT" merges computing with high speed communication links carrying data in the form of text, sound, images, video etc, from place to place over the World. The computer systems are networked in such a way that the data / information stored / processed on them is always available from anywhere, at any place, at any moment.

Q : 01-00-06 : What is Digital Convergence ? Define or Describe Digital Convergence ?

Answer :

The "**Digital Convergence**" is the technological merger of various industries / enterprises through some electronic gadgets that exchange information between them. It means that from a common electronic base, information can be communicated to any shape that the users are accustomed to see i.e. photographs, movies, audio, graphical shapes, text form, analog diagrams etc.

Q : 01-00-07 : What is The **Modern Scenario** of **IT** ? Define, Describe or Discuss Briefly The **Modern Scenario** of **IT** ?

Answer :
The impact of IT has broadened the base of computing and communication through satellite, fiber-optic, mobile phone, fax machine, multi- media / hyper-media, e-commerce, m-commerce etc. etc. Fantastic scenario of computer utilization is in the fields like :

a. Artificial Intelligence
b. Web-based Applications
c. E-commerce, M-commerce (Mobile Commerce)
d. Computer Animation
e. Multi-media, Hyper-media
f. Distributed Computing

1.01 Hardware and Software

Q : 01-01-01 : What is Hardware ? Define or Describe Hardware ?

Answer :
The physical parts of a machine or computer which we can see, touch or have weight. Input and output devices are part of the machine hardware.

Q : 01-01-02 : What is Machine ? Define or Describe Machine ?

Answer :
A "**MACHINE**" is hardware. It is an artifact (man made) used to accomplish a well defined task.

Q : 01-01-03 : What is Software ? Define or Describe Software ?

Answer :
A program is called software, it is not hardware, it has the instructions and data for processing in the computer.

Q : 01-01-04 : What is Computer System ? Define or Describe Computer System ?

Answer :
[A "COMPUTER" is a machine that can be programmed to accept data (input), process it into useful information (output), and store it away (in a secondary storage device) for safekeeping or later reuse]. Input and output devices are part of the machine that can be called "Complete Computer System".

The related important definitions are :

Input Devices : Accept data in a form that the computer can use, and then sends it to the processing unit.
CPU : The central processing Unit (CPU) or processor, has the electronic circuitry that manipulates (as ordered in program or instructions) input data into the form of useful information. The processor executes the instructions (Programs) in a logical sequence.
Output Devices : Show us the processed data i.e. information, in the shape we want it.
Primary Storage, Main Memory or Random Access Memory (RAM) : It can hold data and programs only temporarily. Data on RAM is lost when we shut down the computer.
Secondary Storage : Usually called storage, which consists of secondary storage devices, such as hard disk, floppy diskettes, CDs, DVDs etc which can store data and programs outside the computer

itself. This data persists between two sessions of computer (when we use computer after first shutting it down, the programs and data remain intact). These devices actually supplement main memory or RAM.

Q : 01-01-05 : Briefly Describe Software and give its classification ?

Answer :

Software : A program or instructions, it is not hardware, it has the instructions and data for processing in the computer.

System Software : Controls the usage and allocation of different hardware components / devices and enables the other (user) application programs to execute. Operating Systems, Utility Programs (Backup/Restore) or Drivers etc.

Application Software : A software that has been developed to solve a specific (user) problem.

Custom-Built Software : This software is designed and developed for a particular customer.

Packaged software : Off-the-shelf programs or components, developed for sale to the potential users for examples MS-Word, MS-Excel, Oracle etc.

1.02 Input and Output Devices

Q : 01-02-01 : What is Keyboard ? Define or Describe Keyboard ?

Answer :

The keyboard may look like a typewriter keypad to which some special keys have been added. The keys normally available on the keyboards are Numeric, Alphabetic, Function and additional Special-purpose keys.

Q : 01-02-02 : Briefly Describe Pointing Devices used for input ?

Answer :

[**Pointing devices control the position of the cursor or pointer on the screen**].

Mouse : It is an input device that looks a little bit like a mouse. It has a ball on its underside (now we have optical mouse which has optical censor underside) that is rolled on a flat surface or mouse-pad. The rolling movement causes a corresponding cursor movement on the screen. It also has buttons often used to click on icons to invoke the command.

Trackball : The trackball is a movable ball, on top of a stationary device (laptop), that is rotated with fingers or palm of the hand. It looks like the mouse turned upside down and has additional buttons for various functions.

Pointing Stick : It looks like a pencil eraser protruding from the keyboard between the G, H, and B keys. We move the pointing stick with our forefinger while using the thumb to press buttons located in front of the space bar.

Joystick : It consists of a vertical handle like a gearshift lever mounted on a base with one or two buttons. It is used in video games.

Touch Pad : It is a small, flat surface over which we slide our finger, using the same movements as we would with a mouse. As we move the finger, the cursor follows the movement. We “click” by tapping the finger on the pad’s surface or by pressing button positioned close by the pad.

Touch Screen : A touch screen is a video display screen that is sensitized to receive input from simply touching our fingers onto it. It is covered with a plastic layer, behind which are invisible beams of infrared light. We simply touch the provided buttons or menus and get the information on

the display screen.
Light Pen : A light-sensitive Stylus, or pen-like device, connected by a wire to the computer terminal. The user brings the pen to a desired point on the display screen and presses the pen button, which identifies that screen location to the computer. Engineers, graphic designers, and illustrators use light pens.
Digitizing / Graphic Tablet : A tablet connected by a wire to a stylus or puck. A stylus is a pen-like device with which the user "sketches" an image. A puck is a copying device with which the user copies an image, such as an architectural drawing or a civil engineering map. A puck looks a bit like a mouse but has different types of buttons and a clear plastic section extending from one end with crosshairs printed on it. The intersection of the crosshairs points to a location on the graphics tablet, which in turn is mapped to a specific location on the screen.
Pen-Based Systems : These computers use a pen-like stylus to allow people to enter handwriting and marks onto a computer screen rather than typing on a keyboard. This system connects an instructor's electronic "whiteboard" on the classroom wall with student's pen computers, so that the students could receive notes directly, without having to write.

Q : 01-02-03 : Briefly Describe Scanning Devices ?
Answer :
[**Source Data-Entry Devices or Scanning Devices are used for direct data entry to the computer systems**]. Scanners use laser beams and reflected light to translate images of text, drawings, photos, and the like into digital form.

Bar-Code Reader : Bar-Codes are the vertical zebra-stripped marks on the manufactured products in the market. Bar-code system is also called "Universal Product Code". Bar-code readers (photoelectric scanners) read and translate the bar-code symbols into digital code, which is then fed to the computers for further processing.
Magnetic-Ink Character Recognition (MICR) : A method of machine-reading characters made of magnetized particles. MICR characters, which are printed with magnetized ink, are read by MICR equipment, producing a digitized signal, which goes to the computer as data for further processing.
Optical Mark-Recognition (OMR) : Optical recognition systems use a light beam to scan input data to convert it into electrical / digital signals, which are then sent to the computer for processing. SAT and GRE test marking (multiple choice questions).
Optical Character-Recognition (OCR) : It reads preprinted characters in a particular font and converts them to digital code. The common examples are some utility bills, and price tags in the departmental stores.
Magnetic-Strip Cards : It is a strip of magnetically encoded data on the back of card. These are used for personal identification during driving, in the stores, at public places etc.
Smart-Cards : It looks like a credit card but a microprocessor and memory chip have been added additionally. When inserted into a reader, it exchanges data with the corresponding information on a central computer. It can store some basic information. A Mobile-SIM card and an ATM card are good examples.
Fax Machine : The fax or facsimile transmission machine scans an image and sends it as electrical signals over telephone lines to a receiving fax machine, which re-creates the image on paper. Dedicated fax machines and fax modem cards.
Imaging System : Image scanner (graphic scanner) converts text, drawings, and photographs into digital form and stores it to the computer system for further processing. The system scans each image

with light and breaks the image into light and dark dots or color dots, which are then converted to digital form. Its called **raster graphics**.

Q : 01-02-04 : Briefly Describe Audio / Video Input Devices ?

Answer :

Audio-Input Device : It records analog sound and translates it for digital storage and processing. Sound (analog form) goes through a special circuit board (audio board), which converts analog sound to digital form and stores it for further processing. Microphone is an audio-input device.

Video-Input Device : Films and video images from VCR or camcorder are converted to digital form with the help of a special digitizing card (video-capture card).

Frame-Grabber Video Card : It can capture and digitize only a single frame at a time.

Full-Motion Video card : It can capture / convert analog to digital signals at the rate of 30 frames per second, like motion picture.

Digital Camera : A digital camera uses a light-sensitive processor chip to capture photographic images in digital form on a disk or flash-memory chips. The digital form is then uploaded to the computer for manipulation and printing.

Q : 01-02-05 : Briefly Describe Output Devices ?

Answer :

Output Device : The information processed by the computer is translated into a form that we understand, and displayed by these machines. The examples are printouts (text or graphics), sound, video etc.

Display Screens : CRTs (Cathode Ray Tube), Monitors, or simply screens, differ in size, color, resolution, and video display adapter card.

Size : Monitors come in different sizes, from small screen built into palmtops and laptop to extra large monitors used for special purposes.

Color : Many monitors display color. These Red, Green, and Blue (RGB) displays can create *256* colors and several thousand variations on them by blending shades of RGB. Monochrome displays show information using a single foreground color on a contrasting background color.

Resolution : All the characters and images on a monitor are made up of dot patterns (pixels); the number of pixels per inch determines resolution, or the sharpness of the image. A higher number of pixels means a shaper and better image.

Video Display Adapters : Video display adapter or card is a circuit board that determines the resolution, number of colors, and speed with which images appear on the display screen.

VGA (Video Graphics Array) : Supports 16-256 colors, depending on screen resolution. 16 colors at 320 x 200 pixels, and 256 colors at 640 x 480 pixels. It is called 4-bit color.

SVGA (Super Video Graphics Array) : Supports 256 colors at higher resolution than VGA. It has two graphics modes : 800 x 600 pixels and 1024 x 768 pixels. It is called 8-bit color.

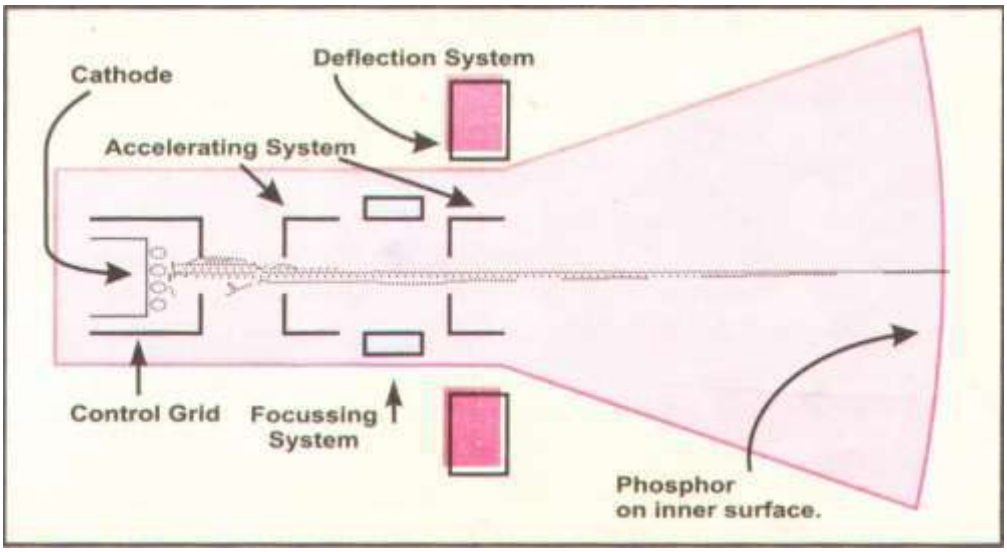
XGA (Extended Graphics Array) : Supports up to 16.7 million colors at a resolution of 1024 x 768 pixels. It can support 256, 65536, or 16,777,216 colors. It is called 24-bit color or True color. Now it is available in 32-bits or higher colors also.

Q : 01-02-06 : Briefly Describe Types of Screens ?

Answer :

CRT (Cathode-Ray Tubes) : [**A Cathode-Ray tube is a vacuum tube used as a display screen in a computer or video display terminal. A stream of bits defining the image is sent from the**

computer (CPU) to the CRT's electron gun, where the bits are converted to electrons. The inside of the front of the CRT screen is coated with phosphor. When a beam of electrons from the electron gun (deflected through a yoke) hits the phosphor, it lights up selected pixels to generate an image on the screen].
It is found in computer screens, television sets and flight information monitors on airport.



Flat-Panel Displays : The flat-panel displays are thinner, lighter, and consume less power than CRT, and hence better for portable computers. [Flat-panel displays are made up of two plates of glass with a substance in between them, which is activated in different ways.]

LCD (Liquid-Crystal Display) has liquid crystal, the molecules line up in a way that lighting behind the screen is blocked or allowed through to create an image.

EL (Electro- Luminescent Display) contains a substance that glows when it is charged by an electric current.

Gas-Plasma display is like a neon bulb, in which the display uses a gas that emits light in the presence of an electric current.

Q : 01-02-07 : Briefly Describe Various Types of Printers and Plotters ?

Answer :

Printers : Printers are used to print characters, symbols, and graphics on paper.

Impact Printers : An impact printer forms characters or images by striking a hammer or wheel against an inked ribbon.

Dot-Matrix Printer : It contains a print head of small pins, which strike inked ribbon against paper, forming characters or images. Print heads are available with 9, 18, or 24 pins.

Daisy-Wheel Printer : A series of petals arranged on a petal wheel; having a character at the end of each petal. A character comes into a print position by wheel rotation and an image is formed by the hammer strike on the desired character. It is slower than dot-matrix printer but better in quality of print.

Line Printer : It prints a whole line of characters at once rather than a single character at a time. Some of these can print up to 3000 lines per minute.

Non-Impact Printers : Print characters or images without making direct physical contact between printing mechanism and paper.

Laser Printer : The images are created on a drum, treated with a magnetically charged ink-like toner (powder), and then transferred from drum to paper. The laser printer can produce high quality images of both text and graphics (ranging from 300 dpi to 1200 dpi – dpi means dots per inch).

Ink-Jet Printer : Ink-Jet printer sprays small, electrically charged droplets of ink from four nozzles through holes in a matrix at high speed on to paper. It is cheaper compared to laser printer but lower in resolution (300- 720 dpi) and is slower also (1-6) text-only pages per minute. It has another type of printer i.e. Bubble-Jet Printer, which uses miniature heating elements to force specially formulated inks through print heads with 128 tiny nozzles.

Thermal Printer : Thermal printer uses colored waxes and heat to produce images by burning dots on to special paper. It produces a high quality printout but is quite expensive.

Plotters : A plotter is used to produce high-quality graphics in many colors and used for specialized applications i.e. architectural drawings, maps, graphs, and charts. Plotters are of two basic kinds.

Flatbed Plotter : A flatbed plotter is the one, which has a paper lying flat on a table-like surface. One to four color pens move across the paper and the images are printed by the computer.

Drum Plotter : Paper is mounted over a drum, enabling a continuous output. A typical usage is to track earthquake readings.

Q : 01-02-08 : Briefly Describe Sound Output ?

Answer :

Speakers are used to get audio output as microphone is used to input audio data to the computer.

1.03 System Software vs Application Software

Q : 01-03-01 : Describe or Differentiate between System and Application Software?

Answer :

System Software vs Application Software

The System Software : It manages hardware and software resources of the whole computer system i.e. Operating system, Backup and Restore utility program, drivers etc.

Application Software (Computer Programs) : Programs used to accomplish a given task (of a user). It is designed and implemented by the computer professionals. It has many forms / categories i.e. Commercial software, Scientific software, Financial packages, Games etc.

1.04 Basic Units Of Data Storage

Q : 01-04-01 : What is Computer Memory ? How various types of data are represented in the memory ?

Answer :

[The memory (main or primary) is composed of an electronic circuitry, which is a combination of "ON" and "OFF" switches. This On / Off state has been conceived by the computer's manufacturers as the numbers "1" and "0", as the circuit can show 1 (ON state) or 0 (OFF state) at a given time.] Based on these binary numbers, the computer can construct sophisticated ways of representing data

in the memory. [Converting the numbers, alphabets, and characters (and their combinations) into binary digits enable us to represent them in the computer memory.]

Binary Digit (BIT) : The binary number 1 or 0 is called a **BIT** (binary digit), which is the basic unit for storing data in the computer memory.

BYTE : A byte is a combination of 8-bits, that can store a single character of data (a letter, numeral or special character). The capacity of the memory or the storage is expressed in terms of number of bytes it can hold or store.

Unit	Bytes		Bits		Pronounced
BIT			2^0	1	Bit
Byte	2^0	1	2^3	8	Byte
Kilobyte-KB	2^{10}	1024	2^{13}	8096	Thousand Bytes
Megabyte-MB	2^{20}	1048576	2^{23}	8388608	Million Bytes
Gigabyte–GB	2^{30}	1073741824	2^{33}	8589934592	Billion Bytes
Terabyte–GB	2^{40}	1099511627776	2^{43}	8796093022208	Trillion Bytes
Petabyte-PB	2^{50}	1125899906842624	2^{53}	9007199254740992	Quadrillion Bytes
Exabyte-EB	2^{60}	1152921504606846976	2^{63}	9223372036854775808	Quintillion Bytes
Zettabyte-ZB	2^{70}	1180591620717411303424	2^{73}	94447329657392904273 92	Sextillion Bytes
Yottabyte–YB	2^{80}	1208925819614629174706176	2^{83}	96714065569170333976 49408	Septillion Bytes

Reference Table for Calculations

Prefix	Symbol(s)	Power of 10	Power of 2
yocto-	Y	10^{-24}	--
zepto-	Z	10^{-21}	--
atto-	A	10^{-18}	--
femto-	F	10^{-15}	--
pico-	P	10^{-12}	--
nano-	N	10^{-9}	--
micro-	μ	10^{-6}	--
milli-	M	10^{-3}	--
centi-	C	10^{-2}	--
deci-	D	10^{-1}	--
(none)	--	10^0	2^0
deka-	D	10^1	--
hecto-	H	10^2	--
kilo-	k or K *	10^3	2^{10}
mega-	M	10^6	2^{20}
giga-	G	10^9	2^{30}
tera-	T	10^{12}	2^{40}
peta-	P	10^{15}	2^{50}
exa-	E	10^{18}	2^{60}
zetta-	Z	10^{21}	2^{70}
yotta-	Y	10^{24}	2^{80}
* k = 10^3 Communication and K = 2^{10} used in Data Storage			

Example : Convert 133 TB of memory in Gigabytes, Megabytes, Kilobytes, Bytes and Bits ?

133 TB = 133 X 2^{10} GB = 133 X 2^{20} MB = 133 X 2^{30} KB = 133 X 2^{40} Bytes = 133 X 8 X 2^{43} Bits.

Q : 01-04-02 : What is Computer Word ? Explain word sizes ?

Answer :

Computer Word : The size of a CPU register, is defined as number of bits that constitute a common unit of data, as defined by the computer system. The larger the word, the more powerful is the computer.

Bytes Per Word	Bits	Era Of Computer
One Byte	8	Early Computer
Two Byte	16	Micro Computer
Single Word	32	Mainframe and some Mini-Computer
Double Word (DW)	64	Super Computing

Note : **An 8-bit machine could handle only one-byte (a character) at a time, whereas a 64-bit machine handles two words or 8 bytes at a time, making its processing speed eight times faster (in the same interval of time)**.

Q : 01-04-03 : What is System ? What does it comprise of ?

Answer :

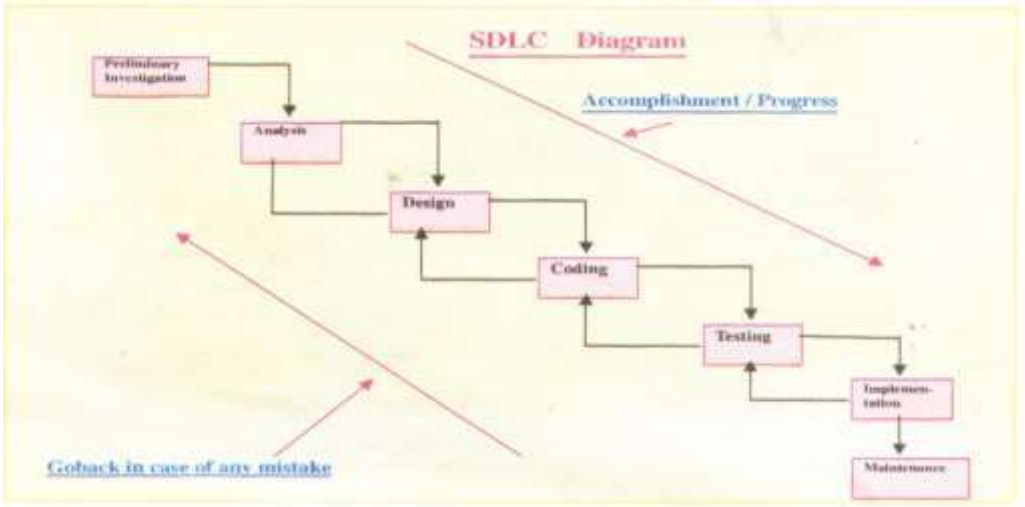
System : [**A combination of some related components that interact with each other to perform some specific tasks**]. It comprises of Hardware, Software, People / Users, Data / Information and Communication Setup.

1.05 System (Software) Development Life Cycle - SDLC

Q : 01-05-01 : Define SDLC ? Give SDLC Diagram including various phases ?

Answer :

SDLC : [**SDLC (System / Software Development Life Cycle) is an organized way to develop a successful system**]. It involved seven phases.



Preliminary Investigation

System Identification
System Scope
Alternate Solutions

- Feasibility Study
- Preliminary Plan

System Analysis

- Needs Analysis
- Data Gathering
  - Written Documents
  - Interviews
  - Questionnaires
  - Observations
  - Sampling
- Data Analysis
- Analysis Report

Design

- Logical Design
- Physical Design
- Report

Coding

Testing

- Unit-Testing
- System-Testing

Implementation

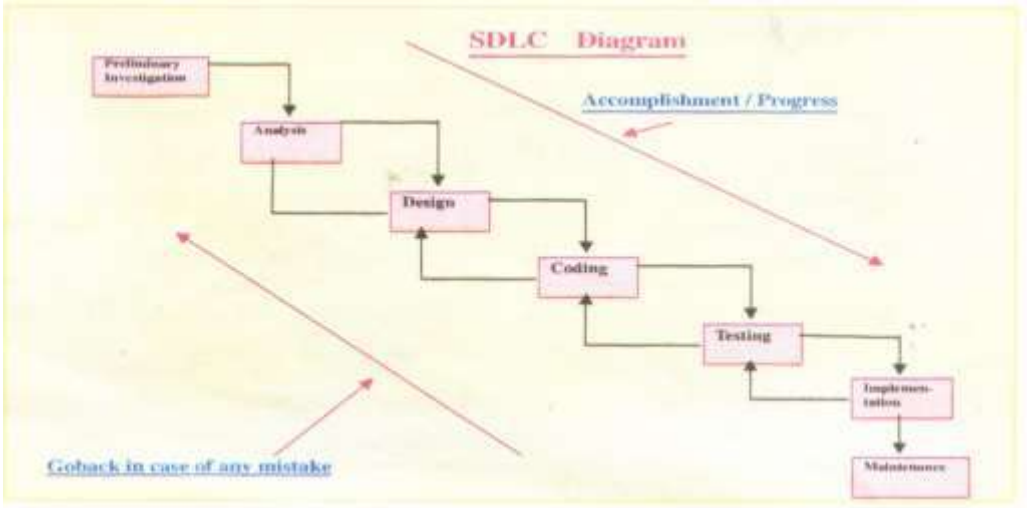
- Direct Implementation
- Parallel Implementation
- Phased Implementation
- Pilot Implementation
- User Training

Maintenance

Q : 01-05-02 : Define SDLC ? Explain SDLC with Diagram of various phases ?

Answer :

SDLC : [SDLC (System / Software Development Life Cycle) is an organized way to develop a successful system]. It involved seven phases.



The detailed breakdown of these phases :

Preliminary Investigation : The objective is to conduct an initial analysis and findings of the system.

System Identification : The system is to be identified at this stage. Everything done in future will depend on the basis of this definition.

System Scope : The scope of the system is established at this stage. Sometimes, it becomes necessary to curtail the projects to certain limits due to financial, political, or time constraints.

Alternate Solutions : There may be alternate solutions to develop the system. Identify all those and choose the best one. The best strategy in this regard would be to interview the concerned people inside the organization, clients or customers of the system, suppliers and consultants. What the competitors are doing for the same type of systems ?

Feasibility Study : We have to see the financial, political, and time-frame viabilities to go ahead for the system. There may be some social and technical constraints to be considered.

Preliminary Plan : Wind up all findings and submit as a written document for approval. The readers of this document (also known as feasibility report) are top managers who will then decide about the future actions to be taken, based on this report. They might like to make few amendments in the project or shelve it.

System Analysis : Analyst will conduct following activities :

Needs Analysis : It is also called Requirements Analysis. Analyst would sum up the requirements of the system from the users and the managers. The developed system should satisfy these requirements during testing phase.

Data Gathering : Systems analyst uses different tools and methods for data gathering.

Written Documents : Handful information can be obtained from documents. These are reports, forms, memos, business plans, policy statements, organizational charts etc.

Interviews : Interviewing the managers, users. clients, suppliers, competitors will help the analysts / designers to gain more knowledge about the system. The precise and relevant questions should be asked.

Questionnaires : It may be **difficult to** interview many people, so it is **better to** design some questionnaires to collect the information *from* as **many** people as we like. This is very convenient and inexpensive method to collect data.

Observations : The analyst or his team may go and watch the working, behavior, and similar things to know more about the similar systems around. He may be a participant or non-participant observer.

Sampling : If there were a large number of people or events involved in the system, it would be better to work on a portion of all of them to save time.

Data Analysis : Data must be accurate, complete, and readily available in the systems we design. We have many tools available. For example: DFDs (Data Flow Diagrams), System Flowcharts, Connectivity Diagrams, Grid Charts, and Decision Tables etc.

Analysis Report : We document analysis work in a presentable form to the higher management for their review and approval of the project. This report should have three parts : First, it should explain how the current system (manual or automated if exists) works. Second, it should explain the problems in the existing system, and finally it should describe the requirements for the new system and make recommendations for future.

Design : Analyst works on the preliminary (Logical) design, detail (Physical) design, and then writes a detailed report.

Logical Design : It describes the general functional capabilities of a proposed system. It reviews the system requirements and considers the major system components. MS-Project, Gantt chart, PERT chart etc may be used to accomplish this.

Physical Design : It describes how a proposed system will deliver the general capabilities described in the Logical design. It will address output requirements, input requirements, storage requirements, processing requirements, and system control and backup / recovery.

Report : A detailed report on logical and physical design is to be submitted to the higher management along with some sort of presentation, explaining the proposed system.

Coding : Writing the segments and programs, which will be coupled together in the shape of a complete system. It needs a lot of time, effort and budget to acquire a workable system. The program specifications, algorithms, flowcharts are given to the programmers / software engineers to code the required programs. Off-the-Shelf-Components (already written programs) can also be used.

Testing : Having proper hardware acquired, the programs can be tested :

Unit-Testing : It is also called modular testing where individual modules, programs can be tested using test (sample) data.

System-Testing : Parts or modules are linked together to test their workability as a one system. Actual data may be used to do the system testing and erroneous data can be used to check whether the system fails or not.

Note : If the system passes all the tests, we can implement the servers, so that the organization and other clients can use it.

Implementation : This activity consists of transferring the hardware, software and data (files, database etc) to the new working environment (server). Users of the system are also trained in this phase. It includes:

Direct Implementation : Users start using the new system and stop working on the old one.

Parallel Implementation : New and old systems are used side by side until satisfied.

Phased Implementation : Parts of the system are implemented from time to time, until the whole system is implemented.

Pilot Implementation : Implement the complete system but to a selected group of users or selected department(s).

User Training : Involve the users in the SDLC process from the beginning and ensure their proper training is essential throughout the system design activity. A variety of methods / tools are used to do so i.e. Instruction Manual, Videotapes/CDs, and Lectures etc.

Comment : In general, the pilot and phased implementation are the most favored and popular approaches to implement the systems. Phased approach is preferable for organizations where different types of functions are carried out whereas Pilot approach is preferred where almost same type of work is going on in the organization.

Maintenance : The last phase adjusts and improves the system by considering the users evaluation, feedback, and enhancements based on their due recommendations. In this phase, due maintenance and help is also provided to the users against their queries, problems, and ambiguities.