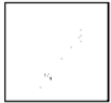


SYSTEM DEVELOPMENT LIFE CYCLE



- Define a system.
- Explain System Development Life Cycle and its importance.
- Describe objectives of SDLC.
- Describe stakeholder of SDLC and their roles.
- Explain the following phases of SDLC:
 - Planning
 - Feasibility
 - Analysis
 - Requirement engineering
 - Requirement gathering
 - ❖ Functional requirements
 - ❖ Non-functional requirements
 - Requirement validation
 - Requirement management
 - Design (algorithm, flowchart and pseudo code)
 - Coding
 - Testing/verification
 - Deployment/implementation
 - Maintenance/support
- Explain the role of the following in SDLC:
 - Management in SDLC
 - Project manager
 - System analyst
 - Programmer
 - Software tester
 - Customer



The **Systems Development Life Cycle (SDLC)**, in Software Engineering, is the process of creating or altering information systems. In other words these are the models and methodologies that experts use to develop these systems. Software engineering is an engineering approach for software development. In software engineering the SDLC concept reinforces many kinds of software development techniques. These techniques form the framework for planning and controlling the creation of an information system.

A system is a set of components (hardware and software) for collecting, creating, storing, processing, and distributing information.

A system can be developed by applying a set of methods, procedures and routines in a proper sequence to carry out some specific task.

System developing life cycle (SDLC) is a problem-solving process through which a series of steps or phases helps to produce a new information processing system or software.

The basic purpose of System development life cycle is to develop a system in a systematic way in the perfect manner.

- It delivers quality software which meet the system requirements.
- It ensures that the requirements for the development of the software/system are well defined and subsequently satisfied.
- It delivers cost-effective system.
- It maximizes the productivity.

A systems development lifecycle (SDLC) has three primary objectives:

- Ensure that high quality systems are delivered
- Provide strong management controls over the projects
- Maximize the productivity

These objectives are summarized as follows:



Before starting the chapter, the students could be asked few questions about the term “System” to explain what they understand about it.

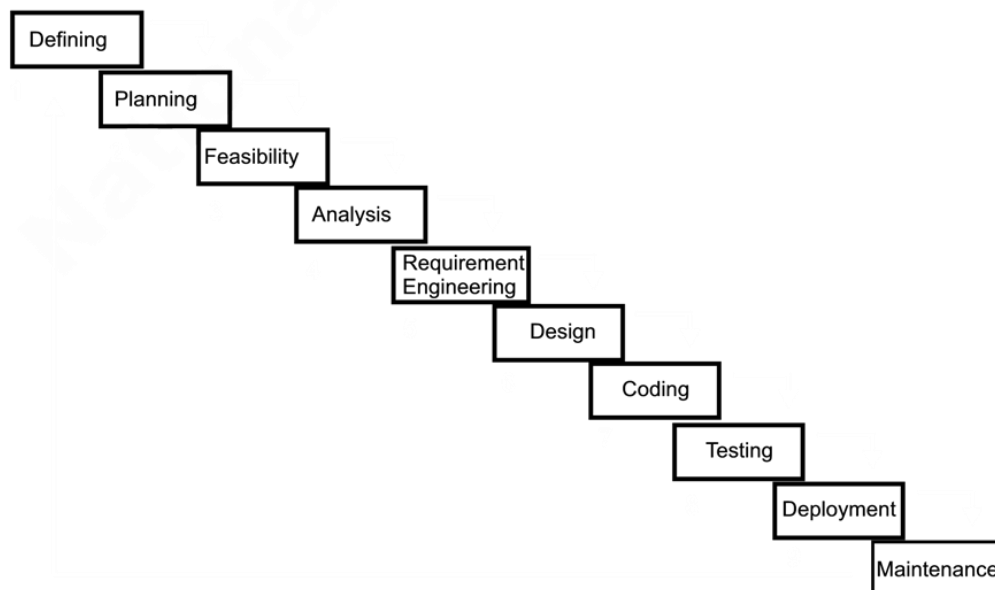


- One of the major objectives of SDLC is to establish an appropriate level of management authority to direct, coordinate, control, review, and approve the software development project.
- SDLC should identify the potential project risks in advance so that proper planning should be done in early.

Stakeholders of SDLC are those entities or groups which are either within the organization or outside of the organization that sponsor, plan, develop or use a project. Stakeholders may be users, managers and developers. It is the duty of the project management team to identify the stakeholders, determine their requirements, expectations and manage their influence in relation to the requirements to ensure a successful project.

The following are phases/steps in SDLC. These phases are shown in Figure 2.1.

- Defining Problem
- Planning
- Feasibility Study
- Analysis
- Requirement Engineering
- Design
- Coding
- Testing / Verification
- Deployment / Implementation
- Maintenance / Support





In this phase the problem to be solved or system to be developed is clearly defined. All the requirements are documented and approved from the customer or the company which consists of all the product requirements to be designed and developed during the development life cycle.

Example: Students' Examination System Development

Defining the problem: A Students' Examination System is needed to be developed that covers all the aspects from Examination taking to the Students' results generations.

During the planning phase, the objective of the project is determined and the requirements to produce the product are considered. An estimate of resources, such as personnel and costs, is prepared, along with a concept for the new product. All of the information is analyzed to see if there is an alternative solution to creating a new product. If there is no other viable alternative, the information is assembled into a project plan and presented to management for approval.

Example: In the **Students' Examination System Development** project planning will be made to set the ultimate goals and an estimate of resources, such as personnel and costs, is prepared.

Feasibility study is used to assess the strengths and weaknesses of a proposed software/system and present directions of activities which will improve a project and achieve desired results. The nature and components of feasibility studies depend primarily on the areas in which analyzed projects are implemented.

Feasibility study is the analysis and evaluation of a proposed project/system, to determine, whether it is technically, financially/economically, legally and operationally feasible within the estimated cost and time. Feasibility study is one of the important steps in SDLC. It is divided into the following types/forms.

- Technical feasibility
- Economic feasibility
- Operational feasibility
- Legal feasibility
- Schedule feasibility

Example: The **Students' Examination System Development** project is assessed for all types of feasibilities and presented to management for final approval.



During the analysis phase the project team determines the end-user requirements. Often this is done with the assistance of client focus groups, which provide an explanation of their needs and what their expectations are for the new system and how it will perform.

In this phase, the in-charge of the project team must decide whether the project should go ahead with the available resources or not. Analysis is also looking at the existing system to see what and how it is doing its job. The project team asks the following questions during the analysis.

- Can the proposed software or system be developed with the available resources and budget?
- Will this system significantly improve the organization?
- Does the existing system even need to be replaced etc.?

Example: The **Students' Examination System Development** project is analysed for development. The project team will visit the School/College to study the existing system and will suggest the possible improvements.

It is the process of determining user expectations for a new or modified system/software. Requirements engineering is a set of activities used to identify and communicate the purpose of a software system, and the framework in which it will be used. Requirement engineering consists of the following steps.

- Requirement gathering
- Requirement validation
- Requirements management

i. Requirement Gathering

Requirement gathering is usually the first part of any software/system development process. In this, meetings with the customers are arranged, the market requirements and features that are in demand are analyzed.

These requirements are of two types:

- Functional requirements
- Non-Functional Requirements

Functional requirements: Functional requirements specify the software functionality that the developers must build into the product to enable users to accomplish their tasks.

Non-functional requirements: Non-functional requirements specify criteria for the judgment of the operations of a system. It describes that how well the system performs its duties.

ii. Requirements Validation

Requirement validation is concerned with examining the requirements to certify that they meet the intentions of the stakeholders. The validation differs from verification in the sense that



verification occurs after requirements have been accepted. In requirements validation, the requirements elicited are reviewed to check that requirements are complete and accurate.

iii. Requirements Management

Requirements management is performed to ensure that the software continues to meet the expectations of the acquirer and users. Requirements management needs to gather new requirements that arise from changing expectations, new regulations, or other sources of change.

Example: In the **Students' Examination System Development** project, the development team will gather the necessary information by 'Interviewing the users', 'Giving questionnaire' or 'by reading existing documents'.

The design phase is the "architectural" phase of system design. The flow of data processing is developed into charts, and the project team determines the most logical design and structure for data flow and storage. For the user interface, the project team designs mock-up screen layouts that the developers use to write the code for the actual interface.

The design phase normally consists of two different structures. These are:

- Algorithms
- Flow chart

i. Algorithms

An algorithm is a specific step by step procedure for carrying out the solution of a problem.

Example: In the **Students' Examination System Development** project the following algorithm will find the result of a student on percentage marks.

1. **Start**
2. **Read Marks**
3. **If Marks ≥ 40 Then Print " Pass" Else Print "Fail"**
4. **End**

ii. Flowcharts

A flowchart is a type of diagram that represents an algorithm or a process. It shows the steps of the algorithms with the help of symbols and their order by arrows connecting the symbols. This diagrammatic representation of the algorithm gives a step-by-step solution to a given problem. The operations are represented in these symbols, and the flow of control on the arrows. These flowcharts are used for analyzing, designing, documenting or managing a process or program in various fields.



Some most commonly used flowchart symbols are shown in Figure 2.2.

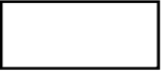
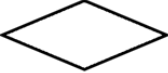
Symbol	Name	Function
	Start / Stop	An oval represents Start / Stop of flowchart
	Arrows	A line with arrow head connects the symbols and shows the direction of flow
	Input / Output	A parallelogram represents input or output
	Process	A rectangle represents a process
	Decision	A diamond indicates a decision

Figure 2.2 Flowchart Symbols

Example: In the **Students' Examination System Development** project, the Flowchart for the above algorithm will be as follows.

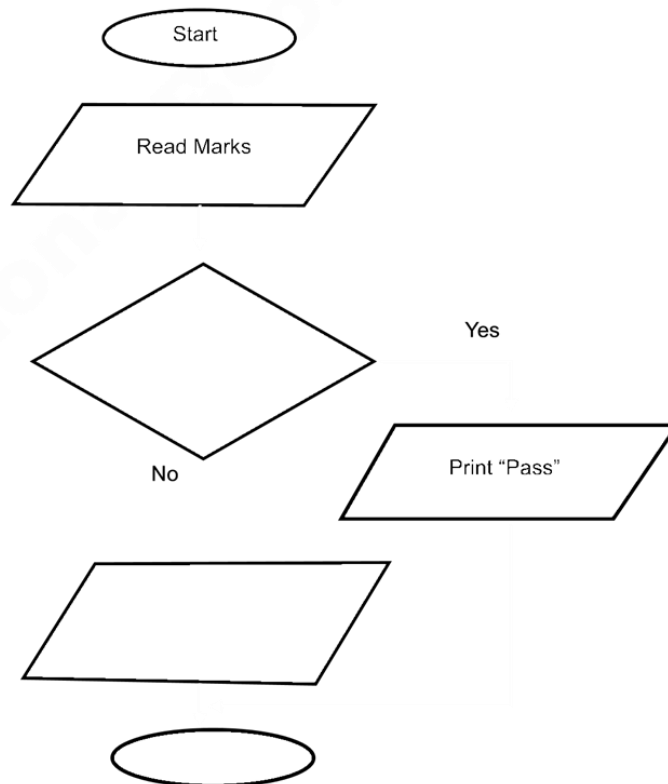


Figure 2.3 Flowchart



During the construction phase developers execute the plans laid out in the design phase. The developers design the database, generate the code for the data flow process and design the actual user interface screens. During the construction phase, test data is prepared and processed as many times as necessary to refine the code. This code is written in programming languages. Coding is also called computer programming.

Example: In the **Students' Examination System Development** project, the coding style of the C++ programming language is shown as follows.

```
#include <iostream.h>
#include <conio.h>
main ()
{
    Percentage;
    cout<< "Enter Percentage of the student"<<endl;
    cin>> Percentage;
    Percentage
        "Pass";
    else
        "Fail";
    getch();
    0;
}
```

During the test phase all aspects of the system are tested for functionality and performance. The execution of a programming modules to find errors is called testing. Here, the bugs are identified in the programmed modules. The process of removing bugs/errors from the program is called debugging.

The main purpose of testing/verification of the system is to determine that whether it meets its required results or not. Testing/verification the software is actually operating the software under controlled conditions. It is the process of checking the items for consistency by evaluating the results against pre-specified requirements.



Example: In the **Students' Examination System Development** project the above programming module is tested for errors. The result of the program module is given as follows.

Test 1:

Enter Percentage of the student

70.0

Pass

Test 2:

Enter Percentage of the student

20.0

Fail

Software deployment is a set of activities that are used to make the software/system available for use. The deployment is also called implementation.

The main activities that are involved during deployment/implementation phase are:

- Installation and activation of the hardware and software.
- In some cases the users and the computer operation personals are trained on the developed software system.
- Conversion: The process of changing from the old system to the new one is called conversion.

The following four methods/techniques are used for system deployment/implementation. (Figure 2.4)

- Direct Implementation:** This method involves the old system being completely dropped and the new system being completely implemented at the same time. The old system is no longer available.
- Parallel:** The parallel method of implementation involves operating both systems together for a period. This allows any major problems with the new system to be encountered and corrected without the loss of data.
- Phased:** The phased method of implementing from an old system to a new system involves a gradual introduction of the new system. The old system is progressively discarded.



- iv. Pilot:** With the Pilot method of implementation, the new system is installed for a small number of users. These users learn, use and evaluate the new system. Once the new system is deemed to be performing satisfactorily then the system is installed and used by all.

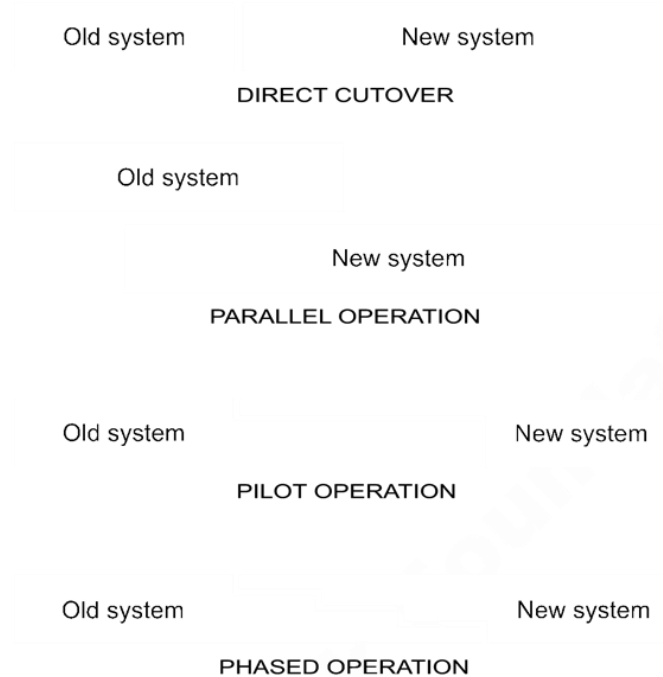


Figure 2.4 Deployment/Implementation

In SDLC, the system maintenance is an ongoing process. The system is monitored continually for performance in accordance with user requirements and needed system modifications are incorporated. When modifications are identified, the system may reenter the planning phase. This process continues until a complete solution is provided to the customer. Maintenance can be either be repairing or modification or some enhancement in the existing system.

SDLC activities are performed by different groups of people and individuals called personnel. These personnel are professionals in performing their particular jobs. These include:

- Management Personnel
- Project Manager



Take one system, (other than the computer system), and explain how all the steps of SDLC could be applied to develop this system.



- System Analyst
- Programmer
- Software Tester
- Customer or End user

a. Management Personnel/Team

A strong management team has the ability to satisfy the customers and acquirers of the software system. Also, a proposed project or a product will only meet its objectives if managed properly, otherwise, will result in failure.

The roles of a good management team is to:

- i. provide consistency of success of the software with regard to Time, Cost, and Quality objectives.
- ii. ensure that customer expectations are met.
- iii. collect historical information and data for future use.
- iv. provide a method of thought for ensuring all requirements are addressed through a comprehensive work definition process.
- v. reduce risks associated with the project.

b. Project Manager

A project manager is a professional responsible for planning, execution, and closing of any project. Apart from management skills, a software project manager will typically have an extensive background in software development. He/She is also expected to be familiar with the whole software development life cycle process. The key roles of a project manager are:

- i. Developing the project plan
- ii. Managing the project budget
- iii. Managing the project stakeholders
- iv. Managing the project team
- v. Managing the project risk
- vi. Managing the project schedule
- vii. Managing the project conflicts



Teacher may also use presentations or animations or videos to explain the steps of SDLC. Take any computer system as example.



c. System Analyst

A systems analyst is a professional in the field of software development that studies the problems, plans solutions for them, recommends software systems, and coordinates development to meet business or other requirements. System analyst has expertise in a variety of programming languages, operating systems, and computer hardware platforms. The general roles and responsibilities of an analyst are defined below.

- i. Plan a system flow.
- ii. Interact with customers to learn and document requirements that are then used to produce business requirements documents.
- iii. Define technical requirements.
- iv. Interact with designers to understand software limitations.
- v. Help programmers during system development phase.
- vi. Manage system testing.
- vii. Document requirements and contribute to user manuals.

d. Programmer

A programmer is a technical person that writes computer programs in computer programming languages to develop software. A programmer writes, tests, debugs, and maintains the detailed instructions that are executed by the computer to perform their functions. The responsibilities of a programmer includes:

- i. Writing, testing, and maintaining the instructions of computer programs.
- ii. Updating, modifying and expanding existing programs.
- iii. Testing the code by running to ensure its correctness.
- iv. Preparing graphs, tables and analytical data displays which show the progress of a computer program.

e. Software Tester

A software tester is a computer programmer having specialty in testing the computer programs using different testing techniques. Software tester is responsible for understanding requirements, creating test scenarios, test scripts, preparing test data, executing test scripts and reporting defects and reporting results.



Teacher should give some home assignments to the students at the end of the chapter.



f. Customer or End user

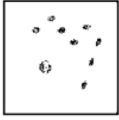
A Customer is an individual or a company which buys and uses the system. Customers usually purchase software from software manufacturer companies (software houses), users groups and individuals. Customers are also called clients but the only difference between the two is that the customers purchase the software products and the clients purchase services. Customers are the real evaluators of a software product by using it and identifying its merits and demerits.



- The Systems Development Life Cycle (**SDLC**), is the process of creating or altering information systems, and the models and methodologies that experts use to develop these systems.
- The term '**System**' is a Greek word meaning to "place together." It can be defined as a set of interrelated components having a clearly defined boundary that work together to achieve a common set of objectives.
- The basic purpose of System development life cycle is to develop a system in a systematic way in the perfect manner.
- A systems development life cycle (SDLC) has three primary objectives: ensure that high quality systems are delivered, provide strong management controls over the projects, and maximize the productivity.
- **Stakeholders** of SDLC are those entities or groups which are either within the organization or outside of the organization that sponsor, plan, develop or use a project.
- The **planning phase** of SDLC determines the objective of the project and considers the requirements to produce the product.
- **Feasibility study**, in SDLC, is used to assess the strengths and weaknesses of a proposed project and present directions of activities which will improve a project and achieve desired results.
- During the **analysis phase** of SDLC the project team determines the end-user requirements.
- In SDLC, **requirements engineering**, also called requirements analysis is the process of determining user expectations for a new or modified system/software.
- The **design phase**, in SDLC, is the "architectural" phase of system design. The flow of data processing is developed into charts, and the project team determines the most logical design and structure for data flow and storage.



- An **algorithm** is a specific set of instructions for carrying out a procedure or solving a problem.
- A **flowchart** is a type of diagram that represents an algorithm or a process.
- During the **construction phase** of SDLC, developers execute the plans laid out in the design phase.
- The **test phase** of SDLC is used to test the functionality and performance of the system/program.
- **Software deployment**, in SDLC, is a set of activities that are used to make the software system available for use.
- In SDLC, keeping a system in its proper working condition is called **maintenance**.
- '**Management**' is the organization, coordination and controlling the activities of a software development by the managers and executives in accordance with certain standard procedures.
- A **project manager** is a professional responsible for planning, execution, and closing of any project.
- A **systems analyst** is a professional in the field of software development that studies the problems, plans solutions for them, recommends software systems, and coordinates development to meet business or other requirements.
- A **programmer** is a technical person that writes computer programs in computer programming languages to develop software.
- A **software tester** is a computer programmer having specialty in testing the computer programs using different testing techniques.
- A **customer** is an individual or an organization that is a current or potential buyer or user of the software product.



- i. The first step in the system development life cycle is:
 - a) Analysis
 - b) Design
 - c) Problem Identification
 - d) Development and Documentation
 - ii. The organized process or set of steps that needs to be followed to develop an information system is known as:
 - a) Analytical cycle
 - b) Design cycle
 - c) Program specifications
 - d) System development life cycle
 - iii. Enhancements, upgradation and bugs fixation are done during the _____ step in the SDLC.
 - a) Maintenance and Evaluation
 - b) Problem Identification
 - c) Design
 - d) Development and Documentation
 - iv. The _____ determines whether the project should go forward.
 - a) Feasibility
 - b) Problem identification
 - c) System evaluation
 - d) Program specification
 - v. _____ spend most of their time in the beginning stages of the SDLC, talking with end-users, gathering requirements, documenting systems and proposing solutions.
 - a) Project managers
 - b) System analysts
 - c) Network engineers
 - d) Database administrators
 - vi. The entities having a positive or negative influence in the project completion are known as _____.
 - a) Stakeholders
 - b) Stake supervisors
 - c) Stake owners
 - d) None of the above
 - vii. System maintenance is performed in response to _____.
 - a) Business changes
 - b) Hardware and software changes
 - c) All of the above
 - d) User's requests for additional features
- i. What is a system?
 - ii. Name different phases of SDLC.
 - iii. What are the objectives of SDLC?
 - iv. Give some activities of planning phase.
 - v. Differentiate between functional and non-functional requirements.



- vi. Design phase is considered as the “architectural” phase of SDLC. Give reasons.
 - vii. Explain flowchart symbols.
 - viii. What is the purpose of Testing/verification phase of SDLC?
 - ix. Give main activities of the Implementation phase.
-
- i. Define software development life cycle (SDLC). What are its objectives?
 - ii. What is system? Where exactly the Testing activities begin in SDLC?
 - iii. Why software development life cycle is important for the development of software?
 - iv. Who are stakeholders of SDLC? Describe their responsibilities.
 - v. What is feasibility study? Explain its different types.
 - vi. What is the purpose of Requirement Engineering phase? Explain its various steps in detail.
 - vii. Which personnel are involved in SDLC? Explain their role briefly.



Prepare a chart to show all the phases of SDLC.