

CHAPTER 02

SYSTEM DEVELOPMENT LIFE CYCLE METHODOLOGY STAGES IN SDLC

PRELIMINARY INVESTIGATION
SYSTEM ANALYSIS
SYSTEM DESIGN
SYSTEM CONSTRUCTION
SYSTEM TESTING
SYSTEM IMPLEMENTATION

1. **SYSTEM DEVELOPMENT PROCESS** is that process which takes place in an organization whenever that organization wants to convert an old system into a new system or wants to upgrade or change the existing system.

2. REASONS FOR FAILURE OF SYSTEM DEVELOPMENT IN ORGANIZATIONS

Changing requirements or needs of users and lack of clarity in this regard
Lack of support from management, users
Resistance to change
Rapid change in technologies
Lack of technical know-how among developers and users

3. APPROACHES TO SYSTEM DEVELOPMENT

Traditional approach
Prototype approach
End user approach
Top Down & Bottom Up approach
SD approach in small organizations

4. TRADITIONAL APPROACH

Popular and usable approach. Used primarily to develop large & complex IS.
All steps of SDLC are followed as it is
Initial traditional approach was based on principle that there will be no error in previous step of SDLC
Later, the old approach was modified to include feedback to rectify errors in previous phases
Latest traditional approach has been further modified to simultaneously starting 2 or more phases to cut time
Also known as **WATER FALL APPROACH**

5. PROTOTYPE APPROACH is used in developing non recurring systems. Following steps are used to determine exact requirements of system:

User specifies the requirements from the system

Construct a design of the system based on the requirements specified above

Build a prototype. PROTOTYPE is a system with basic functionality, primarily presenting inputs and outputs.

Evaluation of prototype by the users to determine correct requirements

Implement suggestions of the users in the prototype.

These steps continue till the time the user provides his consent for the prototype.

Once the user is satisfied with the prototype system, the remaining system is developed using normal traditional approach.

Prototype approach has the following advantages

Helps to determine exact requirement

Helps to provide input & output formats in advance

Helps to ensure success of system

Helps in sorting technical issues of System Development

Prototype approach has the following disadvantages

Time consuming

Causes inefficient System Development

Disappointment to user

6. END USER APPROACH

User specifies requirements from system and accordingly, user procures or develops system

Low cost & easy to use

Disadvantages

User cannot specify all requirements

Lack of integration among all systems in organization

Lack of complete use of new system

7. TOP DOWN & BOTTOM UP APPROACH

TOP DOWN APPROACH	BOTTOM UP APPROACH
Those systems, which satisfy organization objectives or which help top management in working, are procured first	Those systems, which help operational executives in day to day operations, are procured first
Top management is involved in System Development	Operational executives help in System Development
Once system is developed for top management, the system is extended to satisfy requirements of operational executives	Once system is developed, it is extended to satisfy requirements of top management

8. SD APPROACH IN SMALL ORGANIZATIONS is an easy to use and low cost approach.

Following are the steps to be used:

- Organization determines its requirements for a system
- Organization evaluates various software available in market, which can satisfy its requirements
- Organization selects the software and procures the required hardware accordingly
- Organization implements the software & hardware for system use.

9. RAPID APPLICATION DEVELOPMENT

- A. RAD is the latest system development approach, to develop complex systems rapidly or in lesser time
- B. This approach is an extension of the traditional system development approach. Here, instead of developing software by analysts & developers on a standalone basis, a joint application process / approach is followed by involving user as a part of development.
- C. In this approach, system development work are organized with following components as
 - a. part of that workshops:
 - Users
 - Analysts
 - Developers
 - Computer Aided Software Engineering (CASE) tools
 - Previously developed applications

D. These components help to develop applications rapidly by using the following process

- Document the requirements of the user
- Design the system
- Develop the system
- Test the system
- Jointly develop the application
- Satisfy the requirements of the user

All the above processes are iterative process & are continued till the final product is out for use.

10. SYSTEM DEVELOPMENT METHODOLOGY

- Divide entire project into manageable tasks
- Every task or activity has to be properly documented
- Ensure involvement of users
- Thorough testing of system before its implementation
- Ensure proper training of user for system
- Perform post-implementation review of the system to find out the various problems encountered in system development & outputs.

11. SYSTEM DEVELOPMENT TOOLS

These are software & methods used for efficient system development. They help to document the specification of the system to be built. They are of the following types:

- A. System component & flow tools
- B. User interface tools
- C. Data attribute & relationship tools
- D. Detailed logics tools

12. DATA FLOW DIAGRAM

It is a graphical representation of the logical flow of data from origin to destination with an intermediate process and storage. It helps in expressing the system requirement in simple and understandable form. It helps programmers & users in understanding the working of a particular process with required entities.

13. SYSTEM FLOWCHART

It is used to present a system and its component along with its interaction with other systems.

It provides a higher level view of system to be developed.

It represents a graphical model of physical information system, whether present or proposed.

14. SYSTEM COMPONENT MATRIX

This tool is used to represent the system components in a tabular form. It is primarily used to provide information about system components to end users in an easy to understand form.

15. DATA DICTIONARY

It is used to maintain data about data and also known as metadata.

It maintains structural information, which helps in efficient operation of database. It does all valuations for database operations. & provides information on database structure.

16. CASE TOOLS

COMPUTER AIDED SOFTWARE ENGINEERING tools

Used for efficient software development

Helps in increasing the productivity of the software developers

Increases the quality of the developed software

17. DIFFERENT CODING SYSTEM

- A. Classification Codes: This scheme is used to classify objects or entities by using 1 or 2 digit codes.
- B. Functional Codes: This coding scheme is used to different functions or activities.
- C. Subset of Digits Code: This coding scheme is used to provide data code to large volume of data by dividing data into certain sets or parts, which help in efficient input & processing.
- D. Mnemonics Code: Here, abbreviations or short forms are created for frequently used data values.
- E. Hierarchical Codes (Work Breakdown Structure Code): This is similar to subset of digits coding scheme. This is used for providing data codes to projects / activities, in an hierarchical manner.

18. DATA STORAGE DESIGN

Here, analyst and database administrator design the data management system of the IS to be developed and the structure of the database to be used. There are 2 methods of data management:

- A. File System is a conventional or old method of data management and in this, data is managed using flat files.
- B. DBMS is the most popular method of data management and it provides various advantages over the file system such as data integrity, concurrent data access and reduced redundancy.

19. SOFTWARE DEVELOPMENT

Software development involves development of programs. Program development includes various steps or phases known as program development life cycle. They are:

- A. Program Analysis: In this step, programmer analyses the program to be developed in terms of given inputs, required outputs and processes or logics to be used to convert given inputs into required outputs.
- B. Program Design: In this step, programmer develops or designs the program to be developed normally with help of flowcharts. Program design helps in efficient coding of program.
- C. Program Coding: In this step, programmer writes a program by using some high level language. This program developed in high level language is known as source program. To execute a program on computer, the source program is converted into an object program with help of compiler.
- D. Program Debugging: To execute a program on a computer, it is required that the program is correctly compiled. A program may have many types of errors or bugs which should be removed for correct execution of program. This removal of errors or bugs from a program is known as program debugging.
- E. Program Documentation: here, documents are prepared for development of program. Various types of documents are prepared for a program.
- F. Program Maintenance: Here, developed program is maintained for various upgradations. A program maintenance normally includes up gradation or changes to following:
 - Change of input formats & new input processing
 - Change of logics and implementation of new logics
 - Change of output formats and implementation of new outputs

20. PHASE 1 OF SDLC - PRELIMINARY INVESTIGATION

This is the first stage of SDLC and in this phase, the user's requests for new system or change in the existing system are validated through various analysis. The purpose is to collect information and apprise the feasibility of the project.

Following steps are part of this phase:

- A. Defining problem – User request for new system or change in existing system is properly defined by analysts.
- B. Conducting preliminary investigation
 - Conducting interviews with users for determining requirements
 - Review of documents to determine the workings & the problems of the existing system and the requirements from the new system
- C. Exploring viable options – Analyst explores various viable options which can be used to satisfy user requirements from system
- D. Conducting feasibilities – various feasibilities are tested for the selected viable options. They include:
 - Technical feasibility
 - Operational feasibility
 - Economic feasibility
 - Legal feasibility
 - Schedule feasibility
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- E. Submission of reports – After analysis, complete analysis is documented as a report for submission to management. This report also includes the recommendations for options to be used in a new system.

21. PHASE 2 OF SDLC - SYSTEM ANALYSIS

In this phase, exact requirements of the user from the new system are specified. Here, following steps are performed to determine and specify the exact requirements from the proposed system:

- A. Collect information – Detailed investigations are performed to determine user requirements and also to determine the data being used in the existing system for various business operations.

Analysts use various methods to collect information and these methods are known as fact finding techniques. Following are some popular fact finding techniques:

- Structured interview
- Questionnaires
- Collect documents
- Observation

B. Analysis of existing system – Detailed analysis of existing system is performed by the analyst in terms of the following:

- Inputs
- Outputs
- Methods, procedures & data communication
- Data files
- Internal controls
- History

After all the above analysis, analyst prepares 2 more things:

FLOW DIAGRAM of existing system's working, which includes all details of the existing system in terms of input, process & output

Analysis of the flow diagram, prepared above, is performed in terms of:

- Excess workload
- Inefficient and non required operation
- Efficient operation

C. Analysis of proposed system – Requirements from proposed system are then specified in a document known as requirement specification document. Detailed analysis of proposed system is performed by the analyst in terms of the following:

- Inputs
- Outputs
- Methods, procedures & data communication
- Data files
- Internal controls

Database is analyzed in terms of types of DBMS to be used to provide the required system.

D. Preparing requirement specification document – All requirements from proposed system are specified in a document known as REQUIREMENT SPECIFICATION DOCUMENT. This acts as a base for further development of system. This document is submitted to management for further process.

22. PHASE 3 OF SDLC - SYSTEM DESIGN

In this phase, system is designed for its component as per the specifications given in the Requirement Specification Document.

A. Characteristics of a Good Design

- It should be easy to understand
- It should be comprehensive & efficient
- It should be easily expandable
- It should be flexible to implement changes

B. Components to be designed

Output Design – This provides the design of reports and message boxes. Output design should be in such a way that it provides output / reports in appropriate form.

Factors to be considered for output design: content, volume, format, mode, timeliness & media
Presentation of information :

Format: tabular & graphical
Mode: Printed & Display

Input Design – Purpose is fast, error free entry of voluminous data

Factors to be considered for input design: content, volume, format, mode, timeliness & media

Design of Input forms: A good Data entry form helps in efficient data entry. It should be easy to fill, should ensure accurate completion, should be attractive and should meet intended purpose.

Design of Input Codes: Codes help in efficient data entry. They are, usually, the primary key. They should be unique, of appropriate size, easy to use, suggestive, expandable and permanent.

C. System Manual – It is a document which contains all the design specification of, both, the existing as well as the proposed system. Design specifications are used to construct the proposed system and is included as part of the system manual.

23. PHASE 4 OF SDLC - SYSTEM ACQUISITION AND SOFTWARE DEVELOPMENT

A. Various factors to be considered for hardware procurement

- Hardware should be procured to meet design specifications for data processing of proposed system
- Hardware should be of latest technology

It should support the required types and a number of input and output devices
There should be support services from hardware supplier for both maintenance and operation of hardware
There should be a consideration to various software provided by hardware suppliers for providing optimum performance of their hardware

B. Make or Buy Software – Factors

If required software is readily available in market
Organization does not have the required skill to develop the software
Organization does not want to spend time and money required for software Development

C. Advantages of packaged software

Rapid installation and use
Cost efficient
High quality
Low risk of failure

D. Limitations of packaged software

Partial usefulness – not all features are used
Inflexibility
Low quality of documents
Lack of continuity or support from seller

E. Steps used for vendor system verification

Prepare design specification
Prepare request for proposal document (RFP) based on design specifications
Provide RFP document to reputed vendors and ask them to submit proposal
Evaluate submitted proposals and remove inferior proposals
Ask remaining vendors to provide presentation on system
Provide suggestions to vendors to improve system and to resubmit the proposal
Evaluate resubmitted proposals
Contact existing users of their systems to determine system performance
Conduct benchmark tests of vendor systems
Select best system

F. Criteria for vendor system verification

Check list method
Support, training & maintenance
Cost v/s. Benefit

Adaptability, flexibility, upgradability
Compatibility with existing systems

G. Methods to evaluate vendor's systems

Check list method
Point scoring analysis method
Bench mark test
Evaluation from published reports

H. Sources of packaged software

Software development organization
Channel partners or distributors
Hardware manufacturers or suppliers

24. PHASE 5 OF SDLC – SYSTEM TESTING

In this phase, system is traditionally tested before its implementation or use. Normally, following procedures are used for system testing:

- A. Prepare realistic test data. Realistic in terms of values and volumes
- B. Execute test data on developed system
- C. Review the outputs in terms of errors, response time, formats and required content etc.
- D. Then, appropriate action should be taken for correction of errors and outputs
- E. Review the outputs with users for any correction

System is, normally, put into testing even after implementation under parallel testing procedures, in which the newly developed system is used in parallel with the existing system. System, also goes through various types of testing, like:

- A. Alpha Testing: This is performed by expert developers;
- B. Beta Testing: This is performed by expert users of similar system; and
- C. Gamma Testing: his testing is performed by expert system analyst and designers.

There is one more popular type of system testing, which is conducted for multi user systems, known as STRESS TEST. In this test, system performance is evaluated for number of users and volume of data which, systems can handle without degrading its performance.

25. PHASE 6 OF SDLC – SYSTEM IMPLEMENTATION

System implementation is a process, which ensures that information system is properly operational and allows its users to take over its operation for use & evaluation. It includes activities for conversion of an old system to a new system. The system implemented can be a totally new system or a major modification to the existing system. In either case, a proper implementation is necessary to provide a reliable system to meet user's requirements.

System implementation consists of following activities:

- A. Equipment installation – In this, procured hardware is installed in the organization for using the developed or acquired software. Steps involved are:
 - Site Preparation: Here, a layout is prepared regarding where the equipments will be installed in terms of their place, user locations etc.
 - Install Equipments: Once a site is prepared, the equipments are installed physically and connected to power line and communication lines etc.
 - Check equipments: Installed equipments are checked for proper utilization and various routine tests.
- B. Training personnel – It is an important aspect for effective utilization of the installed system. Whenever a new system is installed in the organization, a need of training arises for both general users and computer professional as the new system often contains some new types of software and hardware. Normally, 2 types of training are provided, namely:
 - Training to system operators
 - Training to end users
- C. Conversion procedures – This involves the activities carried out for successful conversion from old system to new system. Following activities are carried out:
 - Procedures Conversion: For implementing the new system, the procedure & methods for working on the new system must be clearly defined and converted from old procedures and methods.
 - File Conversion: Old data files should be converted to as per the requirements of the new system and these conversions must be done before the new system is Implemented.
 - System (Processing) Conversion
 - Scheduling of personnel and equipment:
 - Preparation of alternative plan in case of equipment failure:

Conversion Strategies

- Direct conversion: On a given date, old system is totally discontinued and new system is started from next date.
- Parallel conversion: Both old & new system are used together for some time and after that, the old system is discontinued.
- Gradual conversion: Here, the volume of transactions is gradually reduced in the old system and subsequently increased in the new system.
- Modular prototype conversion: Here, each part of the system is developed, redefined, implemented and then, the next one and so on and so forth until the whole system is converted.
- Distributed conversion: This system is used when the same system is to be installed in several places at the same time.

D. Post implementation evaluation

Evaluation provides the feedback necessary to assess the value of information and performance of the system. It provides information about how successful is the system in satisfying the user's requirements and where it has drawbacks. Evaluation covers the following:

Development Evaluation: Checks whether the system is developed on schedule & within the budget.

Operation Evaluation: includes the operational aspects of the developed system. It is very essential that the developed system should be easy to operate and should work as per the user requirements.

Information Evaluation: This evaluation is related to finding out the value of information that the developed system is providing to the user and how it is affecting the quality of decision making.

- E. System Maintenance: Organizations have changing information requirements from time to time. Hence, the system requires to be modified to adapt to these changing requirements. Maintenance can be of 2 types:

Schedule Maintenance (planned maintenance), includes antivirus run, updating run etc.

Rescue maintenance, includes tackling situations which are not expected but have arisen etc.

A proper system operation requires the proper maintenance of system and the system staff should continuously plan and implement the required changes to provide the system utility in an optimum manner