Unit – 2 System Development Life Cycle (SDLC) and Structured System Analysis and Design Method (SSADM)

- **Introduction to SDLC:**
  - **System Analysis: Problem Identification, Feasibility Study, System Requirement Analysis**
  - **System Design: System Design Specification and Programming, System Implementation, follow up and maintenance, System Evaluation**
- **Introduction of SSADM**
- **SSADM Methodology: System Survey, Structured Analysis, Structured Design, Hardware Study, System Implementation and Maintenance**
- **Advantages of SSADM**

What is System Development Life Cycle (SDLC)?

The basic idea of SDLC is that there is a well defined process by which a system is conceived, developed and implemented.

SDLC which is performed in two steps:

1. System analysis
2. System design

System analysis and system design together involves six stages. Systems analysis involves:

1. Problem identification
2. Feasibility study and cost benefit analysis
3. System requirement analysis

System design involves:

4. System design specification and programming
5. System implementation, follow up and maintenance
6. Evaluation of the system

Problem Identification:

One of the most difficult tasks of system analysis is identifying the real problem of the existing system. Experienced analysts spend considerable time in this task. Without clear understanding of the problem in the system, any further work done will lead to wastage of time and energy at a later stage. Several questions must be posed before identifying the correct problem at this stage itself.

1. What is the actual problem?
2. What are the causes for this problem?
3. Is it important to solve this problem?
4. How complex it is?
5. What are the likely solutions to this problem?
6. What type of benefits can be expected once the problem is solved?

The problem may come to the notice of the systems analyst from any one or more sources listed below.

INTERNAL ENVIRONMENT	EXTERNAL ENVIRONMENT
Company management	Customers
Employees of different departments	Management consultants
Internal auditors	Outside auditors
Data processing department	Government policies
Financial records	Competitions

Further the types of problems which arise may be different.

Problem of Reliability	The system may not work properly all the time or for the same procedure the system may give different results.
Problem of validity	Reports contain misleading information.
Problem of Accuracy	Reports have many errors.
Problem of economy	The system is costly to maintain.
Problem of Timeliness	Reports are often late; queries are not answered in time.
Problem of Capacity	Inadequate processing capacity, transmission capacity and storing capacity. This is evident in rapidly growing organizations.
Problem of Throughput	This is exactly the reverse of problem of capacity. Here more capacity may be available but less work is being done. For example, five programmers doing the work which two programmers can accomplish. Hence this deals with the problem of efficiency of the system.

The advantages of problem identification in SDLC are:
It helps in pinpointing the problems, setting proper system goals, determining the boundaries of the project by taking into consideration the limitations of the available resources.

Feasibility Study and Cost Benefit Analysis:

Feasibility study is carried out whenever there is a complex problem or opportunity. A feasibility study is undertaken to determine the possibility or possibility of either improving the existing system or the developing a completely new system. It helps to obtain an overview of the problem and to get rough assessment of whether feasible solutions exist.

NEEDS FOR FEASIBILITY STUDY:

a) Answer the question whether a new system is to be installed or not?
b) Determine the potential of the existing system.
c) Improve the existing system.
d) Know what should be embedded in the new system.
e) Define the problems and objectives involved in a project.
f) Avoid costly repairs at a later when the system is implemented.
g) Avoid crash implementation of a new system.
h) Avoid the 'Hardware approach' i.e. getting a computer first and then deciding how to use it.

To conduct a detailed feasibility study, firstly an expert committee called "Steering Committee" is appointed. This committee generally consists of system analyst , representatives from the departments which are likely to benefit from the project and a chairman who is generally a key person in the organization.

The committee will look into

- Technical Feasibility
- Economic Feasibility and
- Operation Feasibility of the project

Technical Feasibility:

The technical feasibility should ask questions related to:

- Adequacy of available technology
- Adequacy of hardware
- Availability of computer
- Operating time and support facilities

Economic Feasibility:

1. Firstly identify the alternatives.
2. Determined costs and expected savings of each of the alternatives.

The costs must include both onetime costs and recurring costs. Onetime costs may include:

1. Feasibility study cost.
2. The costs for converting from present system to new system.
3. Construction or remodeling of computer room/facilities.
4. Cost involved in software packages.

Recurring costs may include:

1. Rental or purchase of equipments.
2. Salaries of personnel.
3. Supplies.
4. Equipment maintenance

Operational Feasibility:

Operational feasibility is the measure of how well a proposed system solves the problems, and takes advantage of the opportunities identified during scope definition and how it satisfies the requirements identified in the requirements analysis phase of system development.

RETURN ON INVESTMENT (ROI) ANALYSIS :

Profitability and Return on Investment are the two yardsticks of measuring business performances.

ROI = Net Earning / Total Investment

ROI clearly indicates whether you are working on a right problem or not.

System Requirement Analysis:

Requirements analysis is the determination of the requirements for a new system. Once the systems analyst has determined that a problem exists and has obtained permission to do something about it, then the requirements analysis can begin.

Requirements analysis for the new system should identify the user requirements first. This will enable the system to be more user friendly rather than designer friendly.

1. What output are needed?
2. What inputs are needed to obtain these outputs?
3. What operations it must perform to obtain these outputs?
4. What resources must be used?
5. What operational and accounting controls are needed?

Different ways to assess the user requirements includes:

1. Asking users directly.
2. Interviews
3. Questionnaires
4. Counting transactions and documents often by sampling.
5. Developing various flowcharts.

System Design Specifications and Programming:

As we move from systems analysis to system design we are in fact moving from the conceptual to the physical aspects of the life cycle i.e. we are moving from “What” part to “How” part in system development. Now the stage is set for the system to be defined in terms of its specifications. These specifications are:

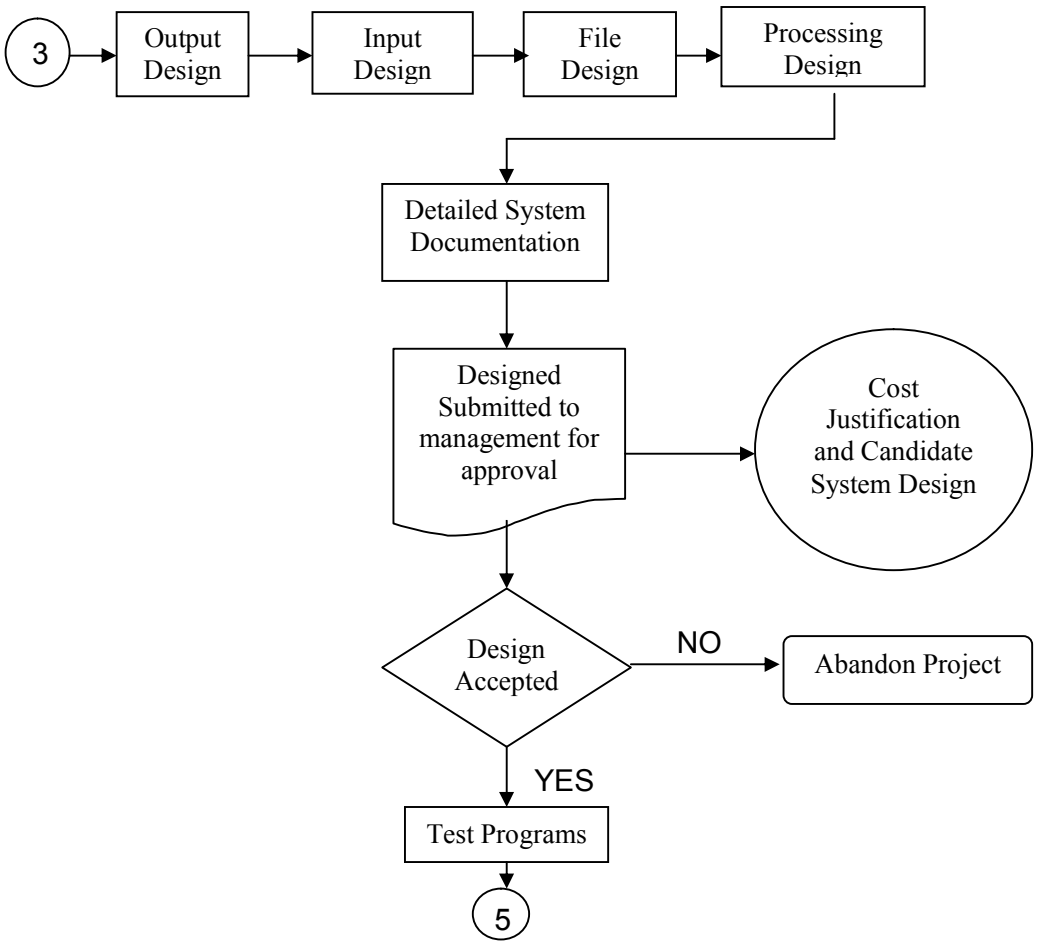
1. Output design
2. Input design
3. Procedures
4. Information flow
5. Files and database
6. Volumes
7. Manually used forms
8. Program specification

The designer used certain standard tools and techniques to organize and work through the system specifications like output design, input design etc. These traditional tools are:

1. System flowcharts, computer run chart, clerical procedure chart, computer procedure chart
2. IPO (input processing and output) and HIPO (Hierarchy of IPO) charts.
3. Decision tables.

A system analyst begins the design process by identifying reports and other outputs of the system. The formats of the reports are decided at this stage and the specific data to be included are pin-pointed.

Now the detailed processing design evolves. This design information is passed on to the programming staff. Designers must take care to provide complete and clearly outlined software specifications. Depending on the need, cost of software, availability of programmers etc., the decisions are made whether to make or buy the software for different application. Finally documentation is essential to test the programs and carry on maintenance. Before presenting for implementation, testing the program with some assistance from users is a must. Testing should be through and critical and include ‘trouble shooting’ data rather than routine once.



When system design is completed, full details of developed system will be available.

Implementation, Follow Up and Maintenance:

Implementation may not be a creative process but certainly is a difficult task. This is because users have to accept the system. Users' training and availability of users' reference manuals with procedures to tackle "trouble shooting" are a must.

Implementation includes:

1. Site preparation
2. Installation of new equipment
3. Users' training, seminars meetings to gain user support.
4. Use of new inputs and procedures
5. Trial and parallel runs systems on the computer
6. Gradual phasing out of the old systems.

Maintenance is the 'tall end' of the life cycle but it is most expensive and consumes energy, cost and time in the long run.

After a new system has been implemented, problem and errors and discrepancies appear and must be fixed. This requires 'system maintenances' as an ongoing

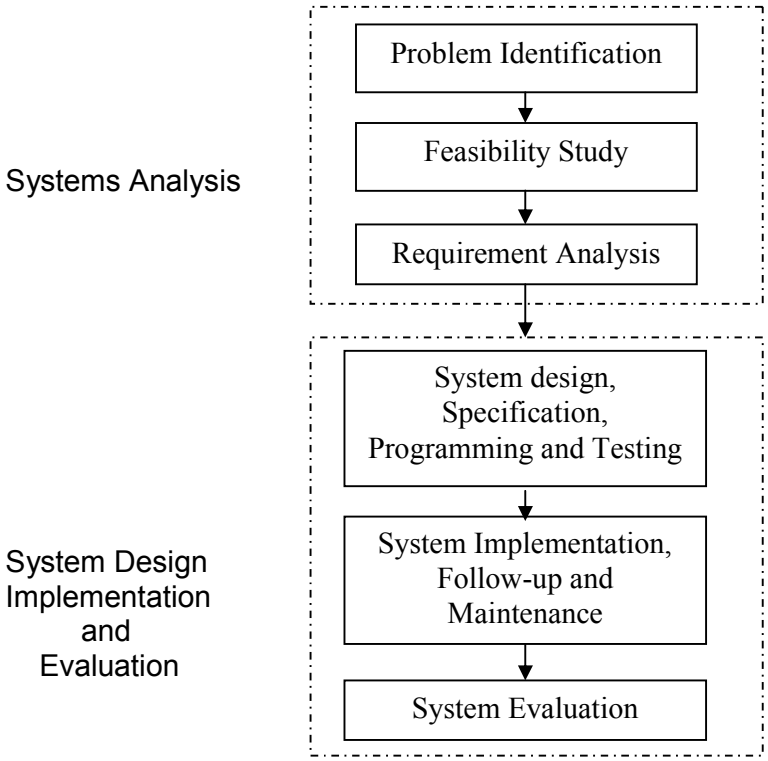
process. Generally hardware venders take the burden of hardware maintenance. In case of software, vendors provide newer versions which help system enhancements thereby increasing processing capacities. Hence the systems analyst needs to concentrate more on “documents maintenance” and system efficiency. When the system maintenance becomes more costly and time demanding, new system will have to be thought of, thereby completing the full system life cycle.

Evaluation of the System:

Evaluation is nothing but feedback for the system. This is the third and final checkpoint of SDLC.

1. **Developmental evaluation :**
   This decides whether the system is developed on time and within the budget.
2. **Operational evaluation:**
   - Response time
   - Ease of use
   - Reliability of computation
   - Adequacy of storage capacity
3. **User Management Assessment Evaluation:**
   If the management is satisfied then generally the organization also is satisfied. The use of questionnaires and interview method will be helpful in this respect.

System Development Life Cycle Diagram



System development is a birth-death process. A systems project begins with a decision to analyze user processing requirements. The project ends once a usable software product is produced, implemented and released. Thus the system

development life cycle consists of System Analysis, System design and system implementation.

Structured Systems Analysis and Design Method (SSADM)

Need for structured Analysis and Design:

Conventional system development method (SDLC) has some limitations. These limitations are:

1. Interaction with the user is limited. The user interacts with the systems analyst at the problem identifications and feasibility study stages. After that they are expected to use the system when it is implemented. Hence for the user, the new system is a black box. Further in SDLC, there is no proper mode for the user to express his requirements clearly to the analyst at different stages.

2. The systems analyst is constantly overwhelmed with the business and technical details of the system.

3. The analytical tools of SDLC like system flowchart, program flowchart etc. are concerned more with physical aspect of the system rather than the logical once.

4. The system specifications of SDLC are difficult to maintain or modified. Even a small change in the user's requirements necessitates several changes in different system documents.

5. Software development is bottom-up. Hence the package can be viewed only after it is fully complete by which time it becomes difficult to make any correction.

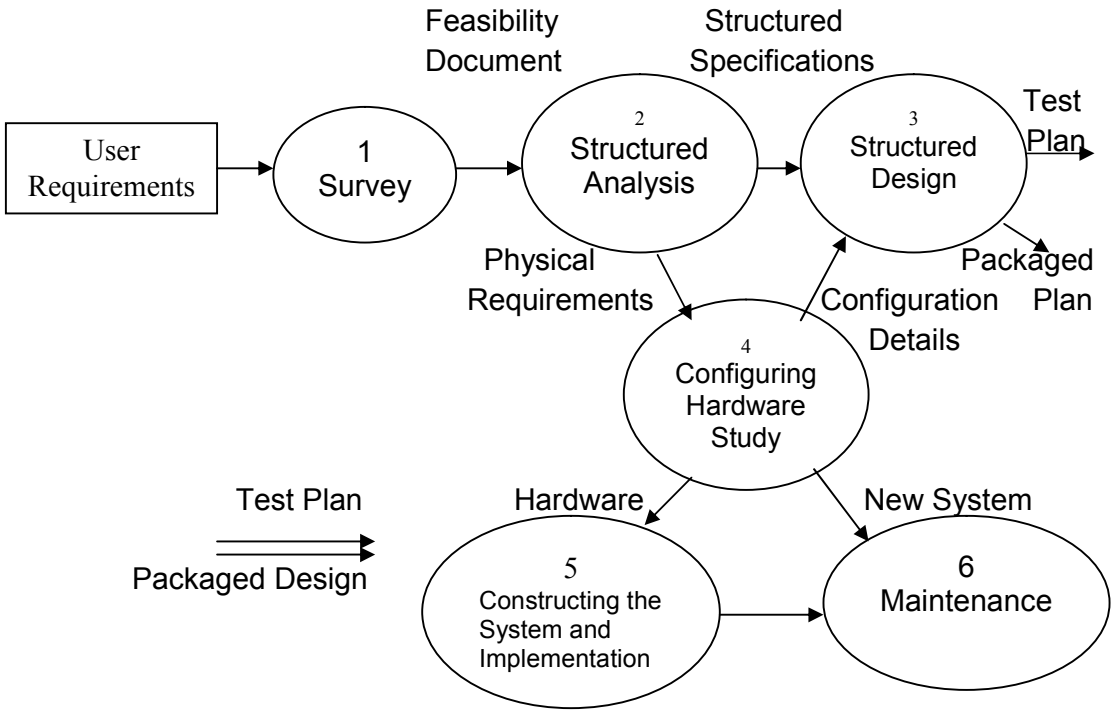
6. All system documentation is prepared at the end of the project.

WHAT IS SSADM?

Structure systems analysis and design is a well defined approach in the form of methodology.

SSDAM consists of:

1. System Survey
2. Structured Analysis
3. Structured Design
4. Hardware Study
5. Implementation
6. Maintenance



The SSADM involves data flow diagram (DFD) method of showing the movements of data though a system. The DFD's are free of unnecessary details and are therefore very useful in providing an overview of the system. The structured analysis uses other tools like:

1. Data Dictionary
2. Structured English
3. Decision Trees
4. Decision Tables

SSDAM METHODOLOGY

1) SYSTEM SURVEY:

The first step in SSADM is system survey. The sub activities in survey are

a) Identify the scope of the current system.
b) Identify and list the deficiencies in the current system by taking into consideration the user requirement.
c) Establish new system goals and identify the constraints.
d) Prepare a document consisting of
   I. Goals and objectives
   II. Customized project life cycle.
   III. Constraints regarding technical and procedural aspect
   IV. Cost benefit analysis

2) STRUCTURED ANALYSIS:

The second stage in SSDAM is structured Analysis which is the most important part. Structured Analysis is a set of techniques and graphical tools. They allow the analyst to develop a new kind of system specifications that are easily understandable to the user. Here the analyst uses graphic symbols, data flow diagram and data dictionaries to represent the system.

Subprocess 2.1: To Study Current System:

The analyst identifies

1. The external entities.
2. The list of process performed in the current system.
3. Sequence of these processes
4. Data used for the processes
5. How the processes are performed etc.

Subprocess 2.2: To Derive logical equivalent DFD:

A physical model is a pictorial representation showing how the job is performed physically. This requires a pictorial representation of the system that shows what processes must be performed, the flow of the data through the system and the data stores that are required. That is a logical DFD of the working of the current system is needed.

Subprocess 2.3: Develop logical model of new system:

The output of this sub process is new logical DFD of the proposed system. The output will also include data elements, files, outputs, inputs etc. i.e. a new data dictionary.

Subprocess 2.4: Establish man-machine interface:

The output of 2.3 is the logical DFD and DDs for the proposed system. But to bring this conceptual idea to the real life world, we need DFDs relating physical things like people, forms, computers, and their relationships.

Subprocess 2.5: Quantify Costs and Benefits:

Here, the various options are identified in terms of costs and benefits.

Costs		Benefits	
One time cost	**Recurring Cost**	**Tangible Benefits**	**Intangible Benefits**
* Cost of converting from present system to proposed system * Construction or remodeling of existing facilities. * Hardware Cost	* Salary of personal * Supplies * Equipment maintenance	* Reduction in cost of operation * Increased value in sales and net income * Reduced time in completing the tasks	* Customer satisfaction * Better employee morale due to better facilitites. * Better company image * Satisfaction to management about entering into newer Information Technologies.

The life span of the new system has to be decided by taking into consideration net present value and internal rate of return of the future cost benefits.

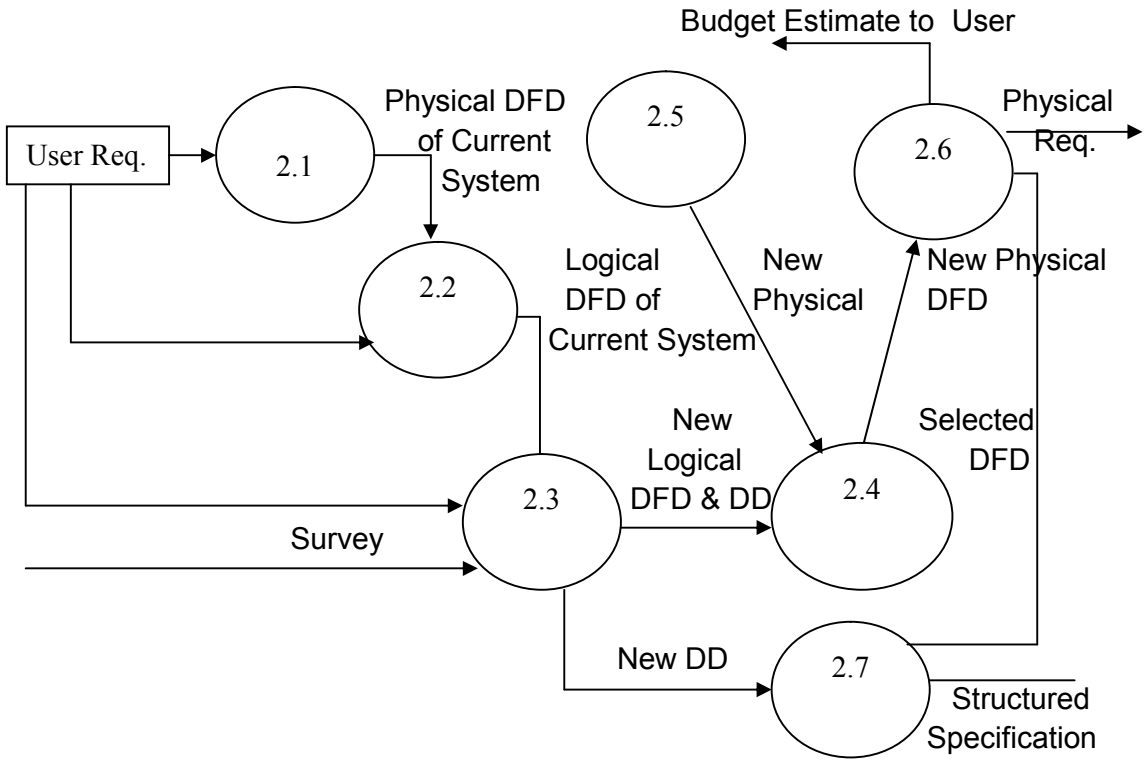
Subprocess 2.6: Select the Best Option:

The inputs for this sub process are cost benefit analysis report and physical DFD proposed system. In this sub process, the most important activity of taking the decision of selecting the best option is carried out. This selection outlines the hardware and software requirements. The estimated budget for the proposed system is worked out. The outputs of this subprocess are

i. Estimated budget
ii. Physical requirements and
iii. DFDs for the selected option

Subprocess 2.7: Package Specifications

Now that all the conceptual thinking of the analysis phase is over, the only remaining task is to collect the products of analysis and organize them into finished structured specifications. This process is called “Packaging”.



2.1: Study Current System
2.2: Derive Logical Equivalent DFD
2.3: Develop Logical Model of New System
2.4: Establish Man-Machine Interface
2.5: Quantify cost and Benefit
2.6: Select the Best Option
2.7: Package Specification

3) STRUCTURED DESIGN:

Structured design is a data-flow based methodology. The input for structured design is structured specifications which is the output of structured analysis. It also receives input from the hardware study. The important activity is “Software Packaging”. The software packaging includes

i. Input-output design
ii. Files and Database design
iii. Program design
iv. Control Design

Activities that run parallel to this detailed design steps of software packaging are

I. Equipment specifications
II. Test specifications
III. User interface specifications

The main input, structured specifications is used to derive structure charts. The most difficult step in SSADM is that of converting DFDs of structured specifications into software package. To do this, we need to construct what is called structured charts. A structured chart is a documentation technique. It shows the hierarchy of modules and their interrelationships in a program or a system.

While a DFD consider a sequence order of processes the structured chart begins with the most important process and then goes on to its subordinate process. The top level of structured chart shows the most important division of work, the lowest level at the bottom shows the details.

To maintain a dialogue with users during the process of system design is often difficult. Wise designers make it a point to involve users at several stages in the design and more particularly in the earlier stages of the design itself. For this, they use a technique called Structured Walk through. A structured Walk through is an organized step by step tracing through of a design by a group of people. The group may be peer group or users. The purpose of Walk through is to find where improvement can be made in the system or in the development process. There are two types of Structured Walk throughs

1. A Preliminary Design Walk through
2. A Detailed Design Walk through

Walkthroughs are conducted

1. To catch design errors in advance
2. To improve communication and
3. To fine tune a design

4) CONFIGURING HARDWARE STUDY:

This step considers the physical requirements of the proposed system.

5) CONSTRUCTING THE SYSTEM AND IMPLEMENTATION:

The implementation process begins after the management has accepted the new system. System implementation consists of five components

A. System Acquisition
B. Programming
C. Testing
D. Conversion
E. Documentation

A. System Acquisition:

It involves the purchase of hardware, packaged software and software services. Here the systems analyst and designer work together to determine the best place to make these outside purchases. Another important part of system acquisition is the actual purchase of goods and services.

B. Programming:

It is the writing of instructions to be read and executed by a computer. Programming is performed by computer programmer or programmer/analyst rather than by systems analyst or designers. Normally a team of programmers work under the direction of lead programmer- typically a system designer. Tasks in programming include writing the coded instructions, testing each segment of the code and testing the entire computer programme once it is completed.

C. Testing:

It consists of putting together the various coded pieces of a design, testing them and correcting the parts of the code or the design that are not correct. At this stage some errors are introduced purposely to test whether they will be spotted by the program.

D. Conversion:

Once the system has been tested successfully then the part which remains is that of putting them into the operation. The conversion team must manage the smooth changeover from the old system to the new system. This requires

- Training of personnel
- Modifying prts of the old system
- Running parallel system or dual system until everything goes as planned.

E. Documentation:

Documentation means putting it in the written from about how a system is designed or functions.

a) Design Documentation
b) Program Documentation
c) Training Documentation
d) Operations Documentation
e) User reference Documentation

a) Design Documentation: It describes the overall system design and includes system flowcharts, all input/output formats, file description, control requirements and report specifications.

b) Program Documentation: It consists of rogramming specifications like program logic, graphic aids, input-output formats etc.

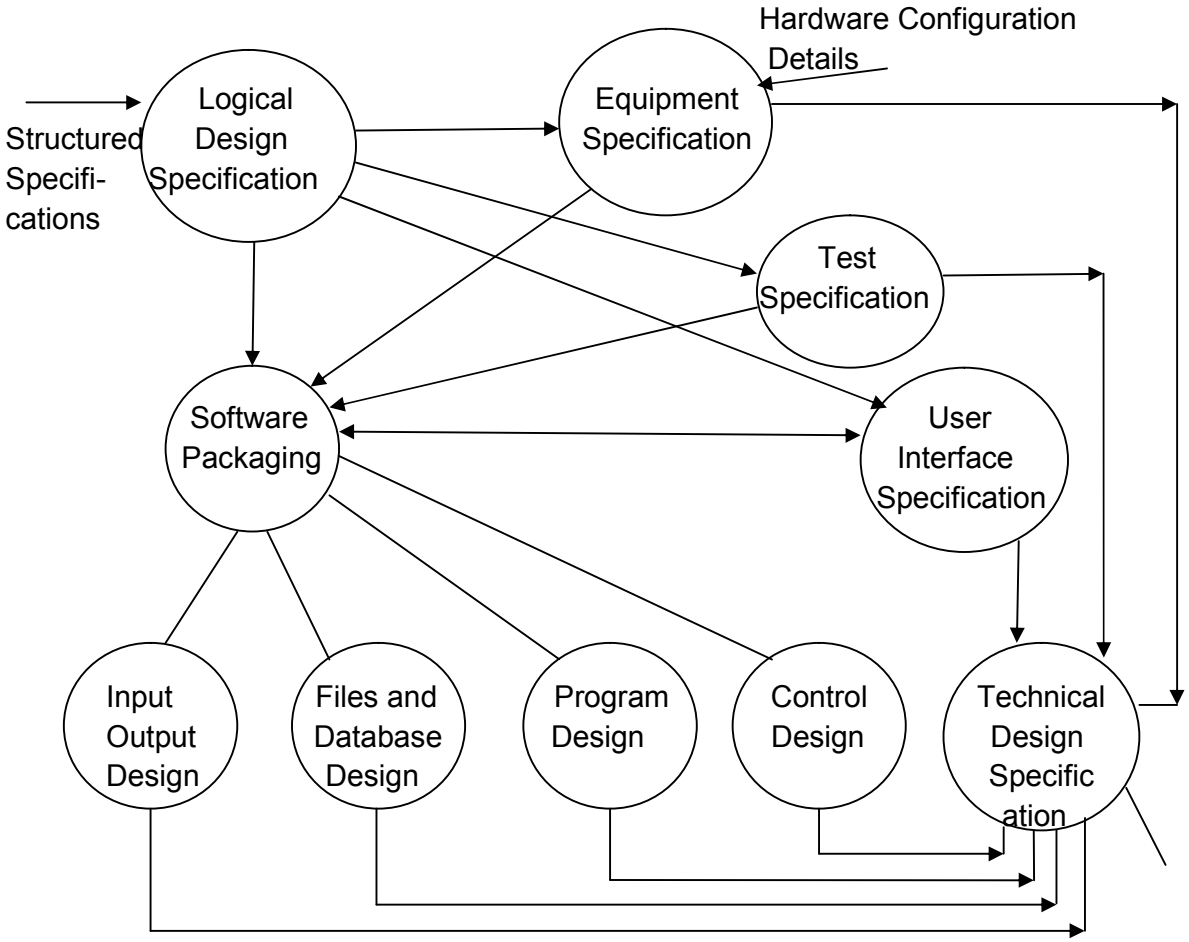
c) Training Documentation: It includes user training manuals and materials to be used in the conversion and the installation of new system.

d) Operation Documentation: It contains instructions for normal operations as well as directions for handling problems and breakdowns.

e) User reference Documentation: It carries on after training is over and the system is installed. It should provide quick, clear answers like a dictionary.

6) MAINTENANCE:

This is the last step in the system life cycle. However it takes the lowest duration. Maintenance may be corrective, adaptive or perfective. In corrective maintenance errors or bugs are rectified. In adaptive maintenance the user requirements if any are still considered and the necessary changes are made. In perfective maintenance efforts will be constantly going on to perfect the system in terms of response time and resource requirements.



The System Design Process

ADVANTAGES OF SSDAM

- **Good Documentation:** In the structured methodology well defined documentation takes place.
- **Better Communication:** Since structured methodology is graphic it provides easy to understand presentation of the application.
- **Standardization:** Before the emergence of the structured methods, the systems analyst used to have their own methods of designing computerized system.
- **Modularization:** The process is partitioned so that we have clear picture of the smaller modules which is essential to understand the system thoroughly.
- **Logical Design:** The SSADM is more logical than physical. The elements of the system do not depend on vendor or hardware.
- **User Oriented:** The SSADM consults user at every stage of development thereby leaving no scope for rejection after the system is implemented.
- **Maintainability:** The need for maintenance arises due to errors, modified user requirements and enhancements.