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INTRODUCTION TO SYSTEM ANALYSIS AND DESIGN

1.1 INTRODUCTION

Systems are created to solve problems. One can think of the systems approach as an organized way of dealing with a problem. In this dynamic world, the subject System Analysis and Design (SAD), mainly deals with the software development activities.

1.2 OBJECTIVES

After going through this lesson, you should be able to

- define a system
- explain the different phases of system development life cycle
- enumerate the components of system analysis
- explain the components of system designing

1.3 DEFINING A SYSTEM

A collection of components that work together to realize some objectives forms a system. Basically there are three major components in every system, namely input, processing and output.

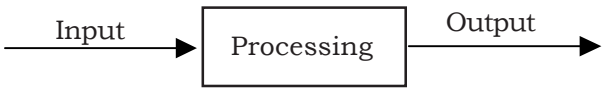

Fig. 1.1: Basic System Components

In a system the different components are connected with each other and they are interdependent. For example, human body represents a complete natural system. We are also bound by many national systems such as political system, economic system, educational system and so forth. The objective of the system demands that some output is produced as a result of processing the suitable inputs. A well-designed system also includes an additional element referred to as 'control' that provides a feedback to achieve desired objectives of the system.

1.4 SYSTEM LIFE CYCLE

System life cycle is an organizational process of developing and maintaining systems. It helps in establishing a system project plan, because it gives overall list of processes and sub-processes required for developing a system.

System development life cycle means combination of various activities. In other words we can say that various activities put together are referred as system development life cycle. In the System Analysis and Design terminology, the system development life cycle also means software development life cycle.

Following are the different phases of system development life cycle:

- Preliminary study
- Feasibility study
- Detailed system study
- System analysis
- System design
- Coding
- Testing
- Implementation
- Maintenance

The different phases of system development life cycle is shown in Fig. 1.2 below.

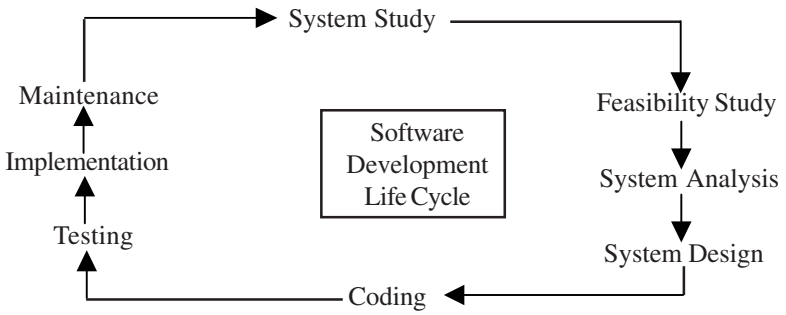

Fig. 1.2: Phases of System Development Life Cycle

INTEXT QUESTIONS

1. Write True or False for the following statements.

   (a) A collection of components that work together to realize some objectives forms a system.

   (b) System life cycle is not an organizational process of developing and maintaining a system.

   (c) In the system analysis and design terminology the system development life cycle means software development life cycle.

   (d) Coding is not a step in system development life cycle.

   (e) System analysis and system design are the same phase of system development life cycle.

1.5 PHASES OF SYSTEM DEVELOPMENT LIFE CYCLE

Let us now describe the different phases and related activities of system development life cycle.

(a) Preliminary System Study

Preliminary system study is the first stage of system development life cycle. This is a brief investigation of the system under consideration and gives a clear picture of what actually the physical system is? In practice, the initial system study involves the preparation of a 'System Proposal' which lists the Problem Definition, Objectives of the Study, Terms of reference for Study, Constraints, Expected benefits of the new system, etc. in the light of the user requirements. The system proposal is prepared by the System Analyst (who studies the system) and places it before the user management. The management may accept the proposal and the cycle proceeds to the next stage. The management may also reject the proposal or request some modifications in the proposal. In summary, we would say that system study phase passes through the following steps:

- problem identification and project initiation
- background analysis
- inference or findings (system proposal)

(b) Feasibility Study

In case the system proposal is acceptable to the management, the

next phase is to examine the feasibility of the system. The feasibility study is basically the test of the proposed system in the light of its workability, meeting user's requirements, effective use of resources and of course, the cost effectiveness. These are categorized as technical, operational, economic and schedule feasibility. The main goal of feasibility study is not to solve the problem but to achieve the scope. In the process of feasibility study, the cost and benefits are estimated with greater accuracy to find the Return on Investment (ROI). This also defines the resources needed to complete the detailed investigation. The result is a feasibility report submitted to the management. This may be accepted or accepted with modifications or rejected. The system cycle proceeds only if the management accepts it.

(c) Detailed System Study

The detailed investigation of the system is carried out in accordance with the objectives of the proposed system. This involves detailed study of various operations performed by a system and their relationships within and outside the system. During this process, data are collected on the available files, decision points and transactions handled by the present system. Interviews, on-site observation and questionnaire are the tools used for detailed system study. Using the following steps it becomes easy to draw the exact boundary of the new system under consideration:

- Keeping in view the problems and new requirements
- Workout the pros and cons including new areas of the system

All the data and the findings must be documented in the form of detailed data flow diagrams (DFDs), data dictionary, logical data structures and miniature specification. The main points to be discussed in this stage are:

- Specification of what the new system is to accomplish based on the user requirements.
- Functional hierarchy showing the functions to be performed by the new system and their relationship with each other.
- Functional network, which are similar to function hierarchy but they highlight the functions which are common to more than one procedure.
- List of attributes of the entities – these are the data items which need to be held about each entity (record)

(d) System Analysis

Systems analysis is a process of collecting factual data, understand the processes involved, identifying problems and recommending feasible suggestions for improving the system functioning. This involves studying the business processes, gathering operational data, understand the information flow, finding out bottlenecks and evolving solutions for overcoming the weaknesses of the system so as to achieve the organizational goals. System Analysis also includes subdividing of complex process involving the entire system, identification of data store and manual processes.

The major objectives of systems analysis are to find answers for each business process: What is being done, How is it being done, Who is doing it, When is he doing it, Why is it being done and How can it be improved? It is more of a thinking process and involves the creative skills of the System Analyst. It attempts to give birth to a new efficient system that satisfies the current needs of the user and has scope for future growth within the organizational constraints. The result of this process is a logical system design. Systems analysis is an iterative process that continues until a preferred and acceptable solution emerges.

(e) System Design

Based on the user requirements and the detailed analysis of the existing system, the new system must be designed. This is the phase of system designing. It is the most crucial phase in the developments of a system. The logical system design arrived at as a result of systems analysis is converted into physical system design. Normally, the design proceeds in two stages:

- Preliminary or General Design
- Structured or Detailed Design

Preliminary or General Design: In the preliminary or general design, the features of the new system are specified. The costs of implementing these features and the benefits to be derived are estimated. If the project is still considered to be feasible, we move to the detailed design stage.

Structured or Detailed Design: In the detailed design stage, computer oriented work begins in earnest. At this stage, the design of the system becomes more structured. Structure design is a blue print of a computer system solution to a given problem having the

same components and inter-relationships among the same components as the original problem. Input, output, databases, forms, codification schemes and processing specifications are drawn up in detail. In the design stage, the programming language and the hardware and software platform in which the new system will run are also decided.

There are several tools and techniques used for describing the system design of the system. These tools and techniques are:

- Flowchart
- Data flow diagram (DFD)
- Data dictionary
- Structured English
- Decision table
- Decision tree

Each of the above tools for designing will be discussed in detailed in the next lesson.

The system design involves:

i. Defining precisely the required system output

ii. Determining the data requirement for producing the output

iii. Determining the medium and format of files and databases

iv. Devising processing methods and use of software to produce output

v. Determine the methods of data capture and data input

vi. Designing Input forms

vii. Designing Codification Schemes

viii. Detailed manual procedures

ix. Documenting the Design

(f) Coding

The system design needs to be implemented to make it a workable system. This demands the coding of design into computer understandable language, i.e., programming language. This is also called the programming phase in which the programmer converts the pro-

gram specifications into computer instructions, which we refer to as programs. It is an important stage where the defined procedures are transformed into control specifications by the help of a computer language. The programs coordinate the data movements and control the entire process in a system.

It is generally felt that the programs must be modular in nature. This helps in fast development, maintenance and future changes, if required.

(g) Testing

Before actually implementing the new system into operation, a test run of the system is done for removing the bugs, if any. It is an important phase of a successful system. After codifying the whole programs of the system, a test plan should be developed and run on a given set of test data. The output of the test run should match the expected results. Sometimes, system testing is considered a part of implementation process.

Using the test data following test run are carried out:

- Program test
- System test

Program test: When the programs have been coded, compiled and brought to working conditions, they must be individually tested with the prepared test data. Any undesirable happening must be noted and debugged (error corrections)

System Test: After carrying out the program test for each of the programs of the system and errors removed, then system test is done. At this stage the test is done on actual data. The complete system is executed on the actual data. At each stage of the execution, the results or output of the system is analysed. During the result analysis, it may be found that the outputs are not matching the expected output of the system. In such case, the errors in the particular programs are identified and are fixed and further tested for the expected output.

When it is ensured that the system is running error-free, the users are called with their own actual data so that the system could be shown running as per their requirements.

(h) Implementation

After having the user acceptance of the new system developed, the

implementation phase begins. Implementation is the stage of a project during which theory is turned into practice. The major steps involved in this phase are:

- Acquisition and Installation of Hardware and Software
- Conversion
- User Training
- Documentation

The hardware and the relevant software required for running the system must be made fully operational before implementation. The conversion is also one of the most critical and expensive activities in the system development life cycle. The data from the old system needs to be converted to operate in the new format of the new system. The database needs to be setup with security and recovery procedures fully defined.

During this phase, all the programs of the system are loaded onto the user's computer. After loading the system, training of the user starts. Main topics of such type of training are:

- How to execute the package
- How to enter the data
- How to process the data (processing details)
- How to take out the reports

After the users are trained about the computerized system, working has to shift from manual to computerized working. The process is called 'Changeover'. The following strategies are followed for changeover of the system.

(i) **Direct Changeover:** This is the complete replacement of the old system by the new system. It is a risky approach and requires comprehensive system testing and training.

(ii) **Parallel run:** In parallel run both the systems, i.e., computerized and manual, are executed simultaneously for certain defined period. The same data is processed by both the systems. This strategy is less risky but more expensive because of the following:

- Manual results can be compared with the results of the computerized system.

- The operational work is doubled.
- Failure of the computerized system at the early stage does not affect the working of the organization, because the manual system continues to work, as it used to do.

(iii) **Pilot run:** In this type of run, the new system is run with the data from one or more of the previous periods for the whole or part of the system. The results are compared with the old system results. It is less expensive and risky than parallel run approach. This strategy builds the confidence and the errors are traced easily without affecting the operations.

The documentation of the system is also one of the most important activity in the system development life cycle. This ensures the continuity of the system. There are generally two types of documentation prepared for any system. These are:

- User or Operator Documentation
- System Documentation

The user documentation is a complete description of the system from the users point of view detailing how to use or operate the system. It also includes the major error messages likely to be encountered by the users. The system documentation contains the details of system design, programs, their coding, system flow, data dictionary, process description, etc. This helps to understand the system and permit changes to be made in the existing system to satisfy new user needs.

(i) Maintenance

Maintenance is necessary to eliminate errors in the system during its working life and to tune the system to any variations in its working environments. It has been seen that there are always some errors found in the systems that must be noted and corrected. It also means the review of the system from time to time. The review of the system is done for:

- knowing the full capabilities of the system
- knowing the required changes or the additional requirements
- studying the performance.

If a major change to a system is needed, a new project may have to be set up to carry out the change. The new project will then proceed through all the above life cycle phases.

INTEXT QUESTIONS

2. Fill in the blanks.

   (a) System study is the _____ stage of system development life cycle.

   (b) Analysis involves a _____ study of the current system.

   (c) All procedures requirements must be analysed and documented in the form of data flow diagrams, data dictionary, _____ and miniature specifications.

   (d) _____ is a blue print of a computer system.

   (e) In _____ run the new system installed in parts.

   (f) In parallel run computerized and _____ systems are executed in parallel.

1.6 WHAT YOU HAVE LEARNT

In this lesson a systematic approach to solve any given problem is explained. Phases of system such as preliminary system study, detailed system study, system analysis, design, coding, testing, implementation and maintenance are explained. Computer based systems are defined. System development life cycle is discussed in detail. The different phases of the development of system are explained in detail.

1.7 TERMINAL QUESTIONS

1. Define a system. Explain the components of a system.

2. How do you explain system development life cycle?

3. Discuss the importance of system analysis and design in the development of a system.

1.8 KEY TO INTEXT QUESTIONS

1. (A) True (b) False (c) True (d) False (e) False

2. (a) first (b) detailed (c) logical data structure

   (d) structure design (e) pilot (f) manual