2 System Development Life Cycle

The chapter concerns the following;

- What is a system?
- Interactions among components in a system
- Manual information systems vs computer based information systems
- The ability to determine why a system is necessary
- Steps in the development process of an information system
- The use of life cycle models to develop information systems

2.1 Describes the concept for Information Systems

What is a system?

A system is a collection of components that interact to achieve a specific task.

According to figure 2.1 below, the elements that form the road construction machine are not interconnected. Therefore, the machine does not function properly and road construction is not possible. Figure 2.2 highlights an interconnected road construction machine. It is possible to use this machine for construction work in order to achieve the goals. Figure 2.2 shows a machine working as a system.

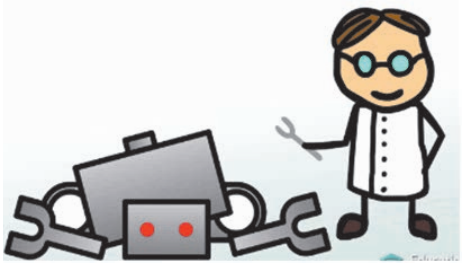
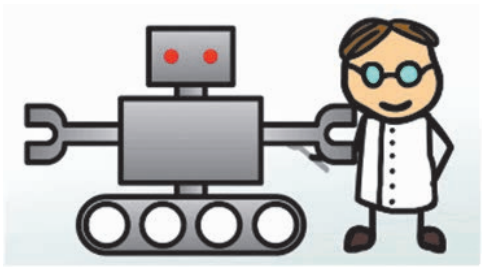


Figure 2.1



The road construction machine Figure 2.2

Basic Elements of a System

A system consists of three basic components.

1. Input
2. process
3. output

Input received by a system is converted to output by processing.

Figure 2.3 - Basic components of a system

Example 1 - Consider the school as a system.

System	-	School
Objective	-	To produce a responsible, worthwhile, just citizen to society
Input	-	Children
Process	-	The child is subjected to the teaching/learning process through interactions of teachers and other resources
Output	-	Providing good citizens to the country

Example 2

Output tomorrow's weather by a weather forecasting system taking atmospheric pressure, temperature, wind direction, humidity as input

Information Systems

A system which converts data into Information is known as information system.

Figure 2.4

Information systems can be classified as: Manual Information Systems and Computer Based Information Systems.

Manual System

In this type of a system all processes are done manually.

Example - Let us consider a manual student information system

A child admitted to a school receives a registered number. A file is prepared which contains personal information about the child. This file also contains information about special abilities displayed while in school and achievements recorded.

Assume that the principal requires a progress report on the student of the previous year. The input, process and output here are as follows;

Input

Name of student and relevant year

Process

1. Find the index number of the student
2. Find the personal file according to the index number
3. Extract the required information for the relevant year from the file
4. Prepare a report using this information

Output

Progress report on the student for the relevant year

Activity

Assume that the above school has a computer based information system instead of the manual system. Compare and contrast the advantages and disadvantages when the above information is obtained from the manual system and the computer based information system.

Computer Based Information Systems

A system which converts data into Information using a computer is known as a computer based information system.

Consider a computer based library information system. Some of the benefits to a librarian in using a computer based library system are as follows.

- Ability to detect whether a particular book is available in the library and if available, the location of the book.
- Ability to use a bar code to maintain issues and receipts
- Ability to automatically calculate fines for late returns
- Ability to search for books efficiently

- Ability to maintain records of those who have borrowed books
- Possibility to list those who have failed to return books on due dates
- Establishes an online system for remote reservation and searching for books
- Ability to provide e-books to members
- A computer based library system can be networked with the main office of the school providing facility to confirm the return of library books by the students when issuing leaving certificates.

Activity

List benefits of a computer based library information system.

Main differences between manual systems and computer based information systems

Computer based information systems	Manual systems
Errors are minimal with data processed by a computer program	Since the data is manually processed, there is more room for error.
Data can be processed more efficiently	Processing of data is less efficient
Large amounts of data can be stored in a small physical surface. Database software can be used for the purpose.	Requires a large space for data storage. Filing cabinets are required to store files
Security can be ensured with backups and the use of passwords	Data is open to a lot of threats. Is not as safe as a computer based system.

2.2 System Development Processes

To develop an information system, there are different methodologies. The System Development Life Cycle is one aspect of the process.

2.2.1 System Development Life Cycle

This has the following steps.

1. Identification of requirements
2. Designing the solution
3. Coding of the solution
4. Testing and debugging
5. Deployment of the system
6. Maintenance of the system

This process can be iterated to go back to the first step when new requirements arise.

Phases of System Development Life Cycle

1. Identification of requirements

A complete investigation on the existing manual system or the computer based system to be delivered is carried out in this phase. Aspects such as objectives, benefits, efficiency etc are constructed. This is carried out in collaboration with the staff of the organization and the development team.

At this stage the system analyst will study the existing system extensively and identify new requirements. The developer also collects information to fulfill the needs of the user.

There are several methods of gathering information. Some of them are as follows;

1. Observation
2. Interviews
3. Questionnaires
4. Document sample collection
5. Prototyping

1. Observation

At the initial stages of developing a computer based system, the existing system is observed as it is, to gather information. This is important towards making assumptions.

E.g. - Observation of issuing of books in a library

2. Interviews

Since the interview provides an opportunity to discuss matters related to personal attitudes openly, it is useful to identify personal requirements.

E.g. - Meeting the librarian for a discussion.

3. Questionnaires

A questionnaire is used in user requirement gathering. Answers collected are analyzed for understanding the needs.

E.g. - Handing over a questionnaire to the librarian for his/her responses

4. Document sample collection

Reports or files maintained in an organization under study are examined for information.

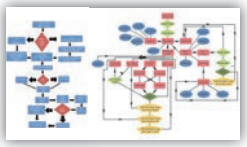
E.g. - Reports, library cards available in a library

5. Prototyping

A model or a prototype of the proposed system to be implemented is developed and demonstrated to the staff and the users for feedback and comments.

E.g. - A display of screenshots, records, samples

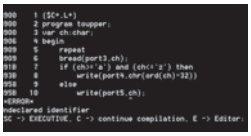
2. Designing the solution



At this stage, actual design of the proposed system takes place. Some activities related to the design process are as follows:

1. Identification of software and software architecture
2. User interface - what the user sees on the screen and preparation for data storage
3. Identification of main hardware systems and its components
4. Identification of dependency of each sub-system
5. Deciding on the required hardware and software to run the system
6. Designing infrastructure for software, databases, user interfaces
7. Planning of tests

3. Coding of the solution



The main objective of this stage is coding of the proposed system, using a suitable computer language. Making the code simple and efficient enables one to develop and understand easily. A well-written code makes it easy to read and understand and reduces maintenance cost.

4. Testing and debugging

The main objective of this phase is to resolve errors. Errors in cording, planning and requirements are corrected.

There are several methods to test a system. Some of them are as follows:

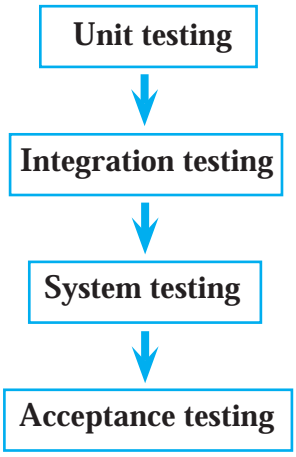


Figure 2.5 - System Testing

1) Unit Testing

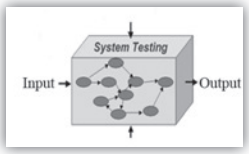
Each unit in the system is tested. Outputs are tested against the given output.

E.g. - Testing the units related to the Accounts branch and Establishment branch independently.

2) Integration Testing

Units already tested and debugged are integrated to form the complete system and the integrated system is tested at this stage.

3) System Testing



The complete system is tested for its outputs for the given inputs.

4) Acceptance Testing

Acceptance or user acceptance testing is carried out at the late stages of testing. This testing is carried out at with the users of the system and the user is allowed to use the system. Either the user approves or request for more improvments.

5. Deployment of the system

Deployment (ie install and use) of the system which has been tested and debugged is carried out at this stage.

There are different deployment approaches to deploy a system. They are as follows:

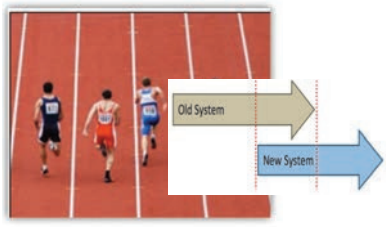
1. Direct deployment
2. Parallel deployment
3. Pilot deployment
4. Phased deployment

Direct deployment

The existing system is totally terminated and the new system is installed. If the new system proves successful, the old system can be abandoned.

E.g. - The manual system in the library can be totally abandoned using and new library management software can be installed.

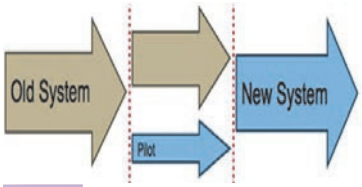
Parallel deployment



The existing and the new systems are used parallel for a certain period. If the new system proves successful, the old system can be terminated and the new system continues.

E.g. - Using the newly deployed system in the library together with the existing manual system.

Pilot deployment



Pilot deployment is about using the newly developed system in a selected area.

E.g. - A system for the whole country can first be installed in a selected district.

E.g. - A system for revenue collection from vehicles can first be installed in one province of the country and if, successful, can be deployed in all provinces of the country.

Phased deployment

Here, the new system is deployed in stages. Success with each stage leads to the next and in completing the new system, the old system is completely replaced by the new.

E.g. - Types of books in school library, i.e. Dictionaries first, course books second and fiction last, to be deployed in stages.

6. Maintenance of the system

A system once installed and in the use for a certain period, needs to be maintained well. The computers, software and computer networks are all maintained in this manner.

With system maintenance, the following may be required.

- Developing systems to suit new user requirements
- Issues that surfaced with the use of the system which were not identified during system development.
- Adopting new, technology into the new system to improve efficiency

2.2.2 System Development Life cycle Models

There are several models of Systems Development Life Cycle. Each model facilitates the system development in different ways. Some example models are:

1. Waterfall Model
2. Iterative Incremental Model
3. Prototyping Model
4. Spiral Model

Waterfall Model

The Waterfall Model consists of several stages in system development. It shows linear development with the life cycle. To develop a system using the Waterfall Model, the following need consideration.

- First identify requirements
- Complete one stage before going to the next phase
- The result of the developed system is found at the final stage. This model has a limitation of developing a system that is different to what the user wants as the user sees the system at the end of the Life Cycle.

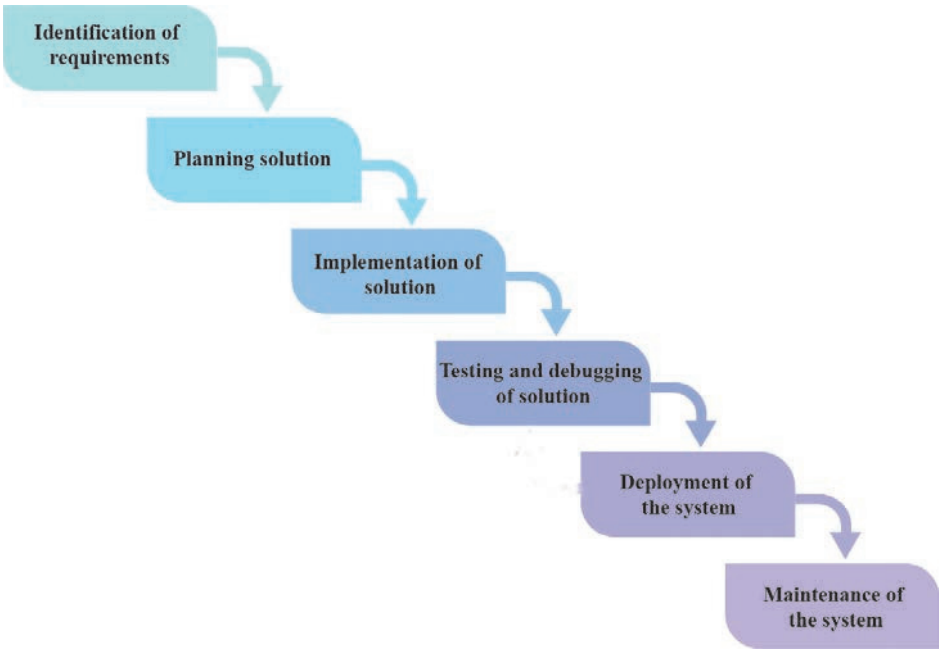


Figure 2.6 - Phased System development model - Waterfall model

Iterative Incremental Model

Iterative Incremental Model is also used as a system development model.

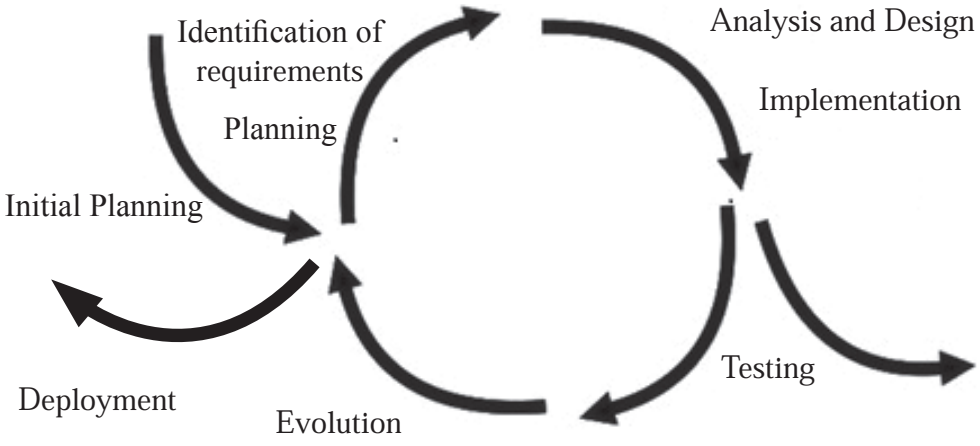


Figure 2.7 - Iterative Incremental Life Cycle

Some features of the iterative incremental model are as follows,

- The main objective of this model is to develop one small componant at a time in an iterative fashion. Each iteration develops more componants of the system.
- System developers have the advantage of using the knowledge gained in the earlier iterations.
- The first step begins with the rough idea of the system requirement
- The system gets developed more and more, incrementally until the last stage.
- At each incremental stage, the system becomes larger with more and more componants being completed/developed.

Activity

Compere and contrust Waterfall Life Cycle model with iterative incremental life cyle model.

Summary

- A system is the collection of different components that usually interconnected towards a common objective.
- Any system consists of three basic components namely input, process and output.
- Information systems transform data into information.
- Information systems can be divided into Manual Information Systems and Computer based Information Systems.
- Manual Information Systems does not use computers and performs tasks using human.
- Computer based Information Systems use a computer to transform data into information.
- A system can be developed or an existing system can be made more efficient by using the system development life cycle.
- The system development life cycle consists of the following:
  1. Identification of Requirements
  2. Designing Solution
  3. Coding of Solution
  4. Testing and Debugging
  5. Deployment of System
  6. Maintenance of System
- The waterfall life cycle model and iterative incremental models are examples for system development life cycles.