

### 7.3 Explores different information system development models and methods

Time: 8 periods

#### **Learning Outcomes**

- Lists and briefly describes system development models
- Investigates the applicability of each model
- Lists and describes the stages of System Development Life Cycle (SDLC) in Waterfall model
- Lists and describes phases of the SDLC in Spiral model
- Lists and briefly describes system development methodologies

#### **What is Software Engineering?**

Software engineering is a branch of computer science, defined as a process of analyzing user requirements and then designing, building, and testing software application which will satisfy those requirements.

#### **Who is Computer Software Engineer?**

**Software engineers are also called software developers** and they **design and develop software applications or computer systems**. Some develop the applications that allow people to do specific tasks on a computer or another device. Others develop the underlying systems that run the devices or that control networks.

There are **two functions of a software engineer**:

1. Development of new applications
2. Maintenance.

#### **Career Requirements**

- Bachelor's degree in Computer science, software engineering or related field.
- Some employers may prefer a master's degree

**Key Skills** - Analytical, problem-solving, teamwork and communication skills as well as creativity and attention to detail; familiarity with database management, development environment, program testing and other related software

## **Where to get an IT degree in Sri Lanka**

### **Degree from a National University**

- Computer Science and Engineering Degree at University of Moratuwa
- Computer Software Engineering courses at University of Sri Jayewardenepura or other Engineering Faculties
- Bachelor Of Computer Science Degree Programme at University of Colombo School of Computing (UCSC)
- Computer Science at University of Sri Jayewardenepura
- Computer Science at University of Kelaniya
- Other Government Universities that offer Computer science and Software engineering degrees eg. Peradeniya, Ruhuna, Uva-Wellassa.

However to enter most of these courses you need pass and have a good Z-score at GCE A/L examination in Mathematics stream (by following combined mathematics as a subject).

However you may enter into some of the IT courses by following IT as a subject or with science subjects.

### **External BIT Degrees and Open University**

- Bachelor of Information Technology BIT External degree from UCSC
- BIT External Degree from University of Moratuwa
- Bachelor of Software Engineering Honors at Open University

### **Private IT degrees**

- Computing and information Technology courses offered by SLIIT, NIBM, NSBM Green Campus, APIIT, Informatics, IDM, ESOFIT and many other Private Institutes.

### Software companies in Colombo, Sri Lanka



Millennium  
IT



### Success of a Software Project

- Project Management Institute (PMI) has defined success as **onTime, onBudget, and onTarget** also known as the **Triple Constraints**
- Six factors now being included in the overall measure of success **on Time, OnBudget, on Target, on Goal, Value and Satisfaction**

### Bad Software Engineering Practices Create

- Failed projects
- Lost money
- Stressed employees
- Poor customer value

### Good Software Engineering Practices Create

- Successful projects
- Business value
- Lower stress levels for developers
- Happy customers



### Stakeholder

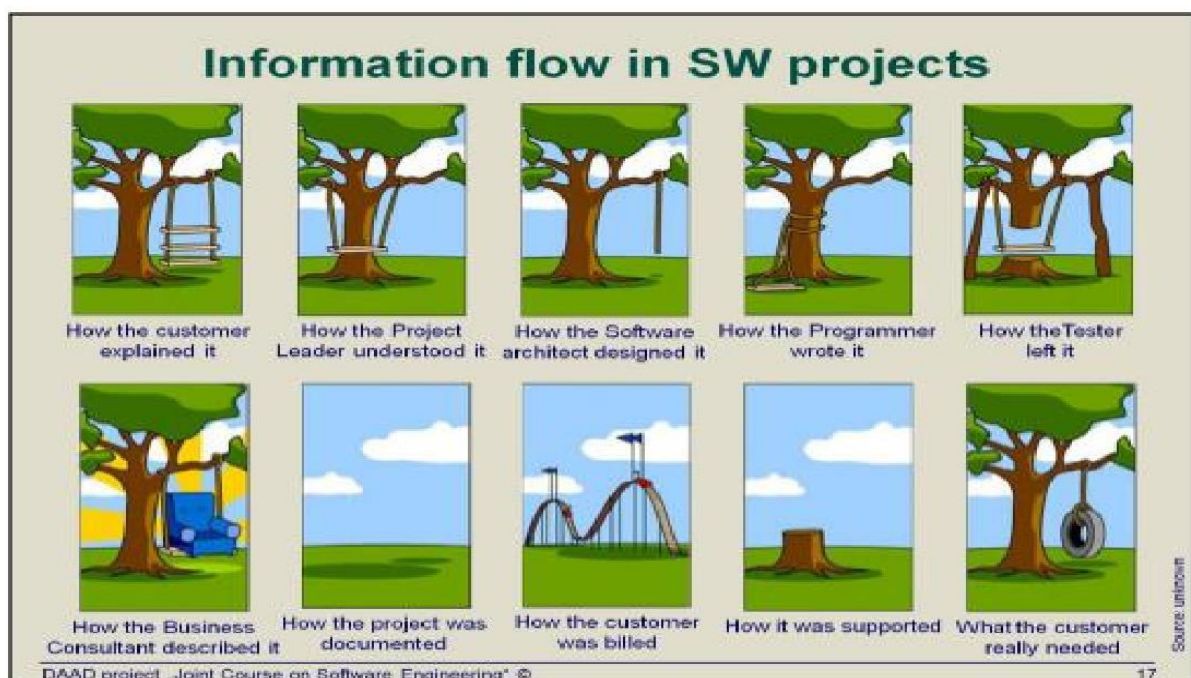
A typical information systems development usually has three (3) stakeholders namely;

1. **Users** – Users are the ones who use the system after it has been developed to perform their day to day tasks.
2. **Project sponsors** - this category of the stakeholders is responsible for the financial aspect of the project and ensuring that the project is completed.
3. **Developers** – this category is usually made up of systems analysts and programmers. The system analysts are responsible for collecting the user requirements and writing system requirements.

The programmers develop the required system based on the system requirements that is developed by the system analysts.

The most important stakeholders in a project are users. For a project to be accepted as being completed, the users must accept it and use it. If the users do not accept the system, then the project is a failure.

## Information flow in Software



## Systems Development Life Cycle (SDLC)

The system development life cycle refers to the processing of **Strategy Planning, Feasibility Study, System Analysis, System Design, Implementation and Maintenance** an information system.

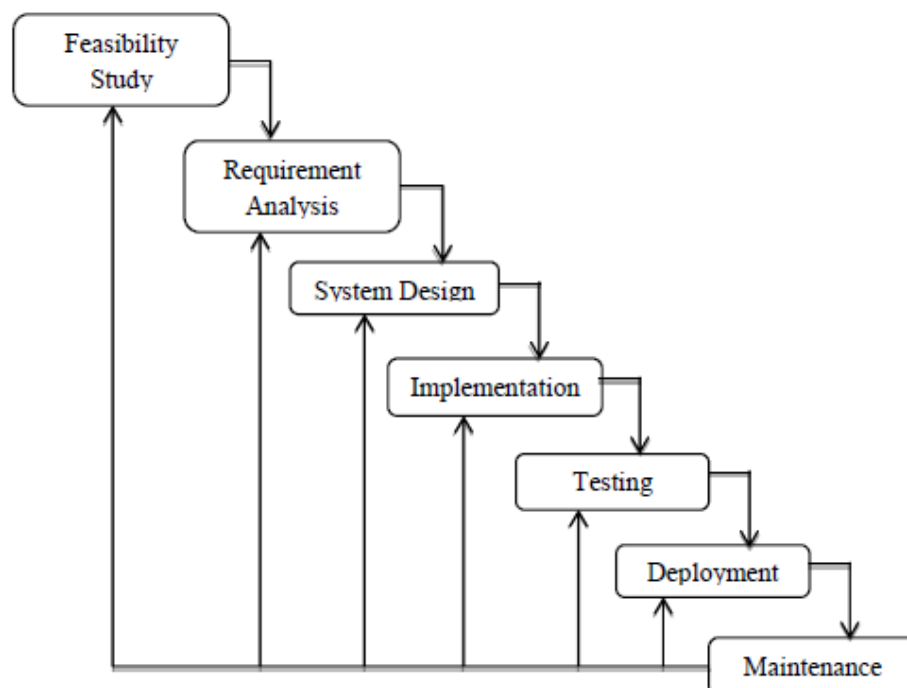
The main objective of system development life cycle is to produce high-quality information systems that meet or exceed the expectations of the users within the agreed budget and time frame.

SDLC uses a number of development models to achieve this objective.

- Waterfall Modal
- Spiral Modal
- Agile Modal
- Prototyping Modal
- Rapid Application Development (RAD) Modal

### Waterfall Modal

The waterfall model uses a sequential design model. The next stage starts only after the completion of the previous stage. The first stage is usually drawn on the top and the subsequent stages below and to the left bottom. This forms a waterfall like structure, and it's where the name came from.



**Feasibility Study** - a feasibility study is performed, which determines whether the solution considered to accomplish the requirements is practical and workable in the software. Information such as resource availability, cost estimation for software development, benefits of the software to the organization after it is developed and cost to be incurred on its maintenance are considered during the feasibility study.

**Requirement Gathering and analysis** - All possible requirements of the system to be developed are captured in this phase and documented in a requirement specification document.

**System Design** - the requirement specifications from first phase are studied in this phase and the system design is prepared. This system design helps in specifying hardware and system requirements and helps in defining the overall system architecture.

**Implementation** - with inputs from the system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality, which is referred to as Unit Testing.

**Integration and Testing** - All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.

**Deployment of system** - Once the functional and non-functional testing is done; the product is deployed in the customer environment or released into the market.

**Maintenance** - There are some issues which come up in the client environment. To fix those issues, patches are released. Also to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

The **biggest challenge** of the waterfall model is adoption to change. It is not easy to incorporate new user requirements.

**Advantages and Disadvantages of Waterfall Model****• Advantages:**

- Simple, easy to understand and use
- Easy to manage
- Works well for projects where requirements are very well understood and fixed
- Clear documentation

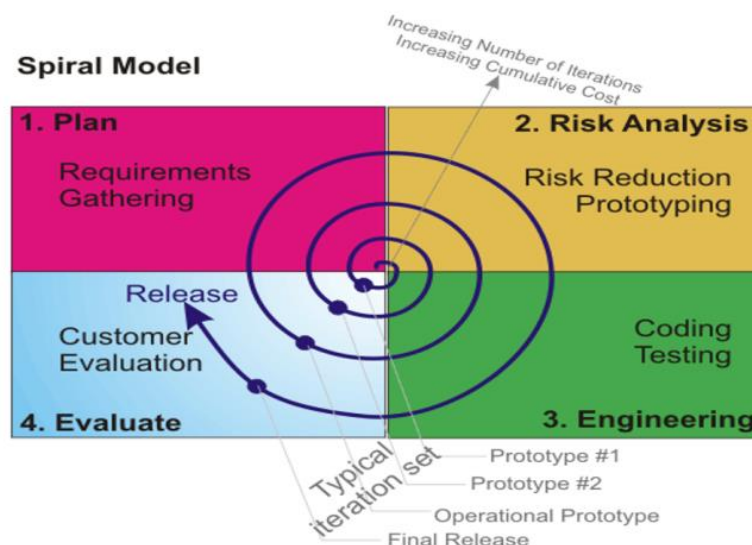
**• Disadvantages:**

- Difficulty of accommodating change after the process is underway
- High amount of risk and uncertainty
- No working products till the end of SDLC
- Not a good model for complex projects

**Spiral Model**

Spiral Model is a combination of a waterfall model and iterative model. Each phase in spiral model begins with a design goal and ends with the client reviewing the progress. The spiral model was first mentioned by Barry Boehm in his 1986 paper.

The development team in Spiral-SDLC model starts with a small set of requirements and goes through each development phase for those set of requirements. The software engineering team adds functionality for the additional requirement in every-increasing spirals until the application is ready for the production phase.





### **Advantages and Disadvantage of Spiral model**

- **Advantages:**

- High amount of risk analysis
- Additional functionality can be added at a later date

- **Disadvantages:**

- Can be a costly model
- Risk analysis requires highly specific expertise

### **When to use Spiral Methodology?**

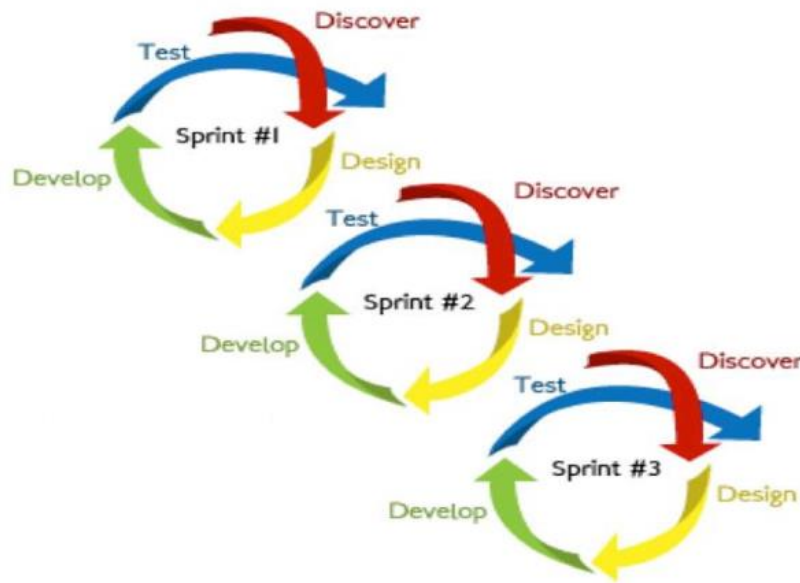
- When project is large
- When releases are required to be frequent
- When creation of a prototype is applicable
- When risk and costs evaluation is important
- For medium to high-risk projects
- When requirements are unclear and complex
- When changes may require at any time
- When long term project commitment is not feasible due to changes in economic priorities

### **Agile Development Model**

Agile development is an alternative methodology to traditional project management which promotes adaptive planning, evolutionary development, early delivery, continuous improvement, and encourages rapid and flexible response to change.

A sprint in agile terms is a well-defined task to be accomplished within a given time. Sprint goals and durations are set by the customers and development team. All stakeholders must meet in person to get the feedback on the sprint before they can move on to the next sprint if any.





### **Advantages and Disadvantages of Agile model**

- **Advantages:**

- Customer satisfaction by rapid continuous delivery
- Continuous attention to technical excellence and good design
- Evolutionary development and delivery,
- Rapid and flexible response to change.

- **Disadvantages:**

- Lack of emphasis on designing and documentation
- The project can easily get taken off the track if the customer is not clear what the final outcome they want
- Difficult to assess the effort required at the beginning for some large project

## **Prototyping Modal**

A prototype is a semi-functional simulation model of the actual system to be developed. Prototyping development methodologies make use of prototypes. Prototypes allow both developers and users to get feedback early.

Prototyping makes it easy for users to specify their requirements and developers understanding the requirements of the users because of the prototypes. A prototyping methodology stands with identifying the basics system requirements especially the input and output from the system. These requirements are then used to create a simulation model that users can interact with and provide feedback. The user feedback is used to enhance the prototype and make other important decisions such as project costing and feasible time schedules.

- **Evolutionary Prototyping**

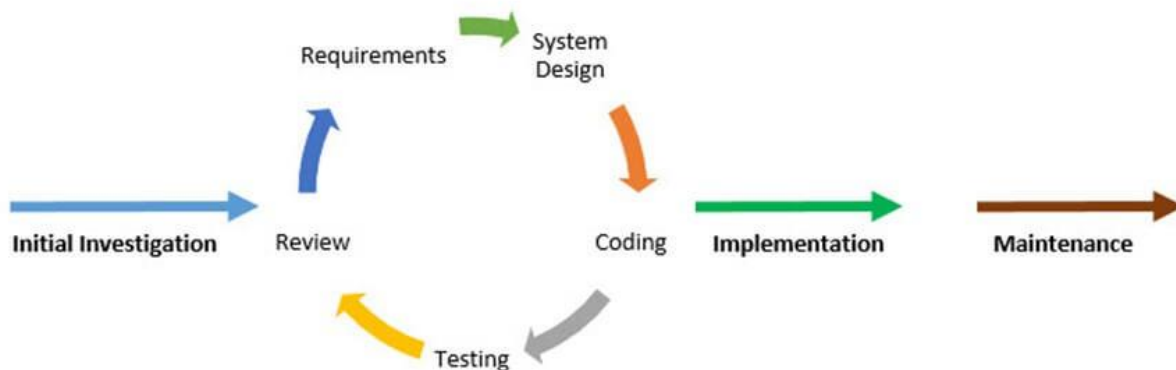
- Objective is to work with customers and to evolve a final system from an initial outline specification.
- Should start with well-understood requirements.
- The system evolves by adding new features as they are proposed by customer.

- **Throw-away Prototyping**

- Objective is to understand the system requirements.  
Should start with poorly understood requirements
  - Develop “quick and dirty” system quickly;
  - Expose to user comments and refine

## Rapid Application Development (RAD) Model

### Prototyping



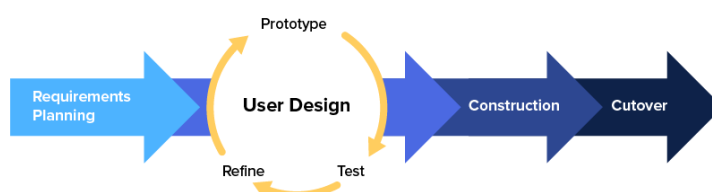
RAD or Rapid Application Development process is an adoption of the waterfall model; it targets at developing software in a short span of time. RAD follows the iterative.

It focuses on input-output source and destination of the information. It emphasizes on delivering projects in small pieces; the larger projects are divided into a series of smaller projects. The main features of RAD model are that it focuses on the reuse of templates, tools, processes, and code.

### When to use RAD Methodology?

- When a system needs to be produced in a short span of time (2-3 months)
- When the requirements are known
- When the user will be involved all through the life cycle
- When technical risk is less
- When there is a necessity to create a system that can be modularized in 2-3 months of time
- When a budget is high enough to afford designers for modeling along with the cost of automated tools for code generation

Rapid Application Development (RAD)

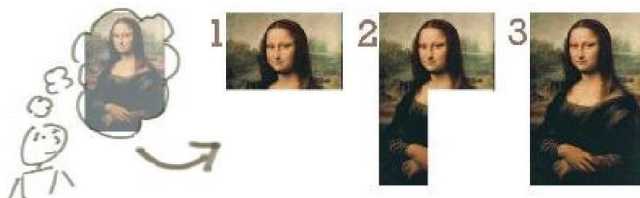
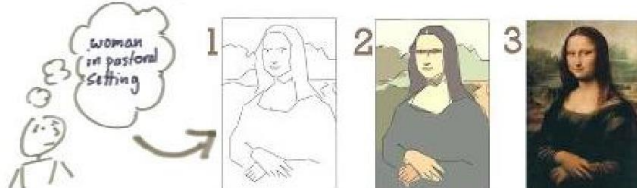


**Advantages and Disadvantages of RAD****RAD****• Advantages:**

- Minimal planning and fast prototyping.
- Developing instead of planning
- The lack of pre-planning generally allows software to be written much faster, and makes it easier to change requirements
- Quick initial reviews
- Encourage customer feedback

**• Disadvantages:**

- High dependency on modeling skills
- Requires skilled developers/designers

**Incremental vs. Iterative****Incremental****Iterative****References**

Teachers' Guide -2017

<https://www.guru99.com/mis-development-process.html>

[https://www.tutorialspoint.com/sdlc/sdlc\\_spiral\\_model.htm](https://www.tutorialspoint.com/sdlc/sdlc_spiral_model.htm)