Viva Questions

Introduction To Software Engineering and Process Models

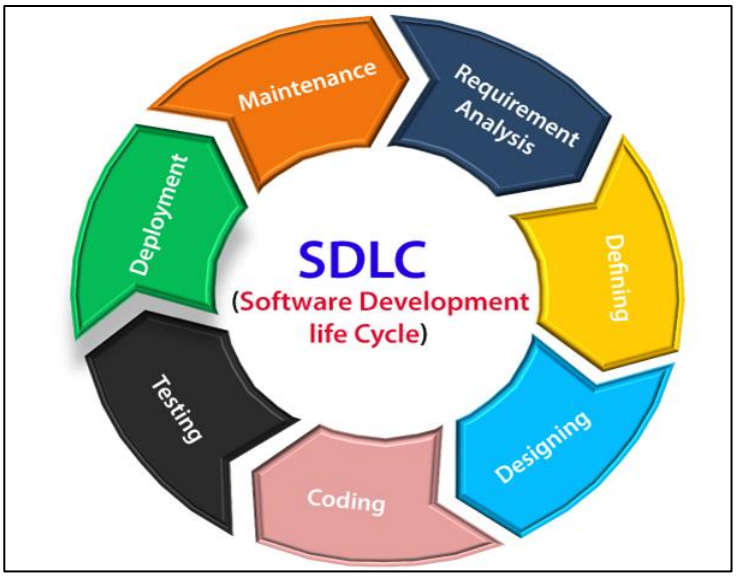
Software Engineering is an engineering branch related to the evolution of software product using well-defined scientific principles, techniques, and procedures. The result of software engineering is an effective and reliable software product.

Need of Software Engineering

- Huge Programming
- Quality Management
- Adaptability
- Cost
- Dynamic Nature

software life cycle model

A software life cycle model (also termed process model) is a pictorial and diagrammatic representation of the software life cycle. A life cycle model represents all the methods required to make a software product transit through its life cycle stages. It also captures the structure in which these methods are to be undertaken.



Software Process Framework is an abstraction of the software development process. It details the steps and chronological order of a process. Since it serves as a foundation for them, it is utilized in most applications. Task sets, umbrella activities, and process framework activities all define the characteristics of the software development process.

Software process includes:

Tasks – focus on a small, specific objective.

Action – set of tasks that produce a major work product.

Activities – group of related tasks and actions for a major objective.

What is Capability Maturity Model (CMM) Levels?

The Software Engineering Institute (SEI) Capability Maturity Model (CMM) specifies an increasing series of levels of a software development organization. The higher the level, the better the software development process, hence reaching each level is an expensive and time-consuming process.

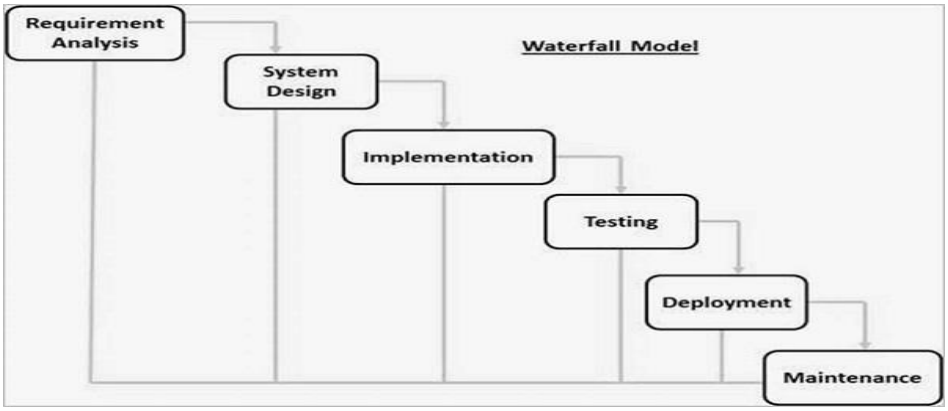
1. Initial
2. Repeatable/Managed
3. Defined
4. Quantitatively Managed
5. Optimizing

Prescriptive Process Models: The Waterfall, Incremental Process Models,

Evolutionary Process Models: RAD & Spiral

Waterfall Model

- The Waterfall Model was the first Process Model to be introduced.
- It is also referred to as a linear-sequential life cycle model.
- It is very simple to understand and use.
- In a waterfall model, each phase must be completed before the next phase can begin and there is no overlapping in the phases.



Some of the major advantages of the Waterfall Model are as follows –

- Simple and easy to understand and use
- Easy to manage due to the rigidity of the model. Each phase has specific deliverables and a review process.
- Phases are processed and completed one at a time.
- Works well for smaller projects where requirements are very well understood.
- Clearly defined stages.
- Well understood milestones.
- Easy to arrange tasks.

The major disadvantages of the Waterfall Model are as follows –

- No working software is produced until late during the life cycle.

- High amounts of risk and uncertainty.
- Not a good model for complex and object-oriented projects.
- Poor model for long and ongoing projects.
- Not suitable for the projects where requirements are at a moderate to high risk of changing. So, risk and uncertainty is high with this process model.
- It is difficult to measure progress within stages.
- Cannot accommodate changing requirements.

RAD

RAD is a linear sequential software development process model that emphasizes a concise development cycle using an element-based construction approach. If the requirements are well understood and described, and the project scope is a constraint, the RAD process enables a development team to create a fully functional system within a concise time period.

WE USE IN:

- When the system should need to create the project that modularizes in a short span time (2-3 months).
- When the requirements are well-known.
- When the technical risk is limited.
- When there's a necessity to make a system, which modularized in 2-3 months of period.
- It should be used only if the budget allows the use of automatic code generating tools.

Advantage of RAD Model

- This model is flexible for change.
- In this model, changes are adoptable.
- Each phase in RAD brings highest priority functionality to the customer.
- It reduced development time.

Disadvantage of RAD Model

- It required highly skilled designers.
- All application is not compatible with RAD.
- For smaller projects, we cannot use the RAD model.
- On the high technical risk, it's not suitable

Incremental Model:

- **Incremental Model** is a process of software development where requirements divided into multiple standalone modules of the software development cycle.
- In this model, each module goes through the requirements, design, implementation and testing phases.
- Every subsequent release of the module adds function to the previous release. The process continues until the complete system achieved.
- When the requirements are superior.
- A project has a lengthy development schedule.
- When Software team are not very well skilled or trained.
- When the customer demands a quick release of the product.
- You can develop prioritized requirements first.

Advantage of Incremental Model

- Errors are easy to be recognized.
- Easier to test and debug
- More flexible.
- Simple to manage risk because it handled during its iteration.
- The Client gets important functionality early.

Disadvantage of Incremental Model

- Need for good planning
- Total Cost is high.
- Well defined module interfaces are needed.

The spiral model

- **The spiral model**, initially proposed by Boehm, is an evolutionary software process model that couples the iterative feature of prototyping with the controlled and systematic aspects of the linear sequential model.
- It implements the potential for rapid development of new versions of the software.
- Using the spiral model, the software is developed in a series of incremental releases. During the early iterations, the additional release may be a paper model or prototype.
- During later iterations, more and more complete versions of the engineered system are produced.

When to use Spiral Model?

- When deliverance is required to be frequent.
- When the project is large
- When requirements are unclear and complex
- When changes may require at any time
- Large and high budget projects

Advantages

- High amount of risk analysis
- Useful for large and mission-critical projects.

Disadvantages

- Can be a costly model to use.
- Risk analysis needed highly particular expertise
- Doesn't work well for smaller projects.

Agile methods

Agile methods break tasks into smaller iterations, or parts do not directly involve long term planning

The project scope and requirements are laid down at the beginning of the development process. Plans regarding the number of iterations, the duration and the scope of each iteration are clearly defined in advance. WHEN USE:

- When frequent changes are required.
- When a highly qualified and experienced team is available.
- When a customer is ready to have a meeting with a software team all the time.
- When project size is small.

Phases of Agile Model:

Following are the phases in the Agile model are as follows:

- Requirements gathering
- Design the requirements
- Construction/ iteration
- Testing/ Quality assurance
- Deployment
- Feedback

Agile Testing Methods:

- Scrum
- Crystal
- Dynamic Software Development Method(DSDM)
- Feature Driven Development(FDD)
- Lean Software Development
- eXtreme Programming(XP)

Advantage(Pros) of Agile Method:

- Frequent Delivery
- Face-to-Face Communication with clients.
- Efficient design and fulfils the business requirement.
- Anytime changes are acceptable.
- It reduces total development time.

The disadvantages of the Agile Model are as follows –

- Not suitable for handling complex dependencies.
- More risk of sustainability, maintainability and extensibility.
- An overall plan, an agile leader and agile PM practice is a must without which it will not work.
- Strict delivery management dictates the scope, functionality to be delivered, and adjustments to meet the deadlines.

Software Requirements Analysis and Modeling

Analysis Model is a technical representation of the system. It acts as a link between system description and design model.

In Analysis Modelling, information, behaviour, and functions of the system are defined and translated into the architecture, component, and interface level design in the design modeling**.**

Data Dictionary:

It is a repository that consists of a description of all data objects used or produced by the software. It stores the collection of data present in the software. It is a very crucial element of the analysis model.

Entity Relationship Diagram (ERD):

It depicts the relationship between data objects and is used in conducting data modeling activities. The attributes of each object in the Entity-Relationship Diagram can be described using Data object description. It provides the basis for activity related to data design.

Data Flow Diagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It can be manual, automated, or a combination of both.

Level 0,1,2

Scenario-based elements :

Using a scenario-based approach, system is described from user's point of view. For example, basic use cases and their corresponding use-case diagrams evolve into more elaborate template-based use cases. Figure 1(a) depicts a UML activity diagram for eliciting requirements and representing them using use cases. There are three levels of elaboration.

Software Requirement Specification (SRS):

Software Requirement Specification (SRS) Format as name suggests, is complete specification and description of requirements of software that needs to be fulfilled for successful development of software system. These requirements can be functional as well as non-functional depending upon type of requirement. The interaction between different customers and contractor is done because its necessary to fully understand needs of customers.

1. Introduction

- Purpose of this document
- Scope of this document
- Overview

2. General description
3. Functional Requirements
4. Interface Requirements
5. Performance Requirements
6. Design Constraints
7. Non-Functional Attributes
8. Preliminary Schedule and Budget
9. Appendices

Software Estimation Metrics

A software metric

A software metric is a measure of software characteristics which are measurable or countable. Software metrics are valuable for many reasons, including measuring software performance, planning work items, measuring productivity, and many other uses.

Classification of Software Metrics:

There are 3 types of software metrics:

Product Metrics: Product metrics are used to evaluate the state of the product, tracing risks and undercover prospective problem areas. The ability of the team to control quality is evaluated.

Process Metrics: Process metrics pay particular attention to enhancing the long-term process of the team or organization.

Project Metrics: The project matrix describes the project characteristic and execution process.

- Number of software developer
- Staffing patterns over the life cycle of software
- Cost and schedule
- Productivity

Advantages of Software Metrics :

- Reduction in cost or budget.
- It helps to identify the particular area for improvising.
- It helps to increase the product quality.
- Managing the workloads and teams.
- Reduction in overall time to produce the product,.
- It helps to determine the complexity of the code and to test the code with resources.
- It helps in providing effective planning, controlling and managing of the entire product.

Disadvantages of Software Metrics :

- It is expensive and difficult to implement the metrics in some cases.
- Performance of the entire team or an individual from the team can't be determined. Only the performance of the product is determined.
- Sometimes the quality of the product is not met with the expectation.
- It leads to measure the unwanted data which is wastage of time.
- Measuring the incorrect data leads to make wrong decision making.

Estimation project management:

Estimation of the size of the software is an essential part of Software Project Management. It helps the project manager to further predict the effort and time which will be needed to build the project.

Lines of Code (LOC): As the name suggests, LOC count the total number of lines of source code in a project. The units of LOC are:

- KLOC- Thousand lines of code
- NLOC- Non-comment lines of code
- KDSI- Thousands of delivered source instruction.

Advantages:

- Universally accepted and is used in many models like COCOMO.
- Estimation is closer to the developer's perspective.
- Simple to use.

Disadvantages:

- Different programming languages contain a different number of lines.
- No proper industry standard exists for this technique.
- It is difficult to estimate the size using this technique in the early stages of the project.

Cocomo model

Project Scheduling

Project-task scheduling is a significant project planning activity. It comprises deciding which functions would be taken up when. To schedule the project plan, a software project manager wants to do the following:

- Identify all the functions required to complete the project.
- Break down large functions into small activities.
- Determine the dependency among various activities.
- Establish the most likely size for the time duration required to complete the activities.
- Allocate resources to activities.
- Plan the beginning and ending dates for different activities.
- Determine the critical path. A critical way is the group of activities that decide the duration of the project.

Advantages of Project Scheduling:

There are several advantages provided by project schedule in our project management:

- It simply ensures that everyone remains on same page as far as tasks get completed, dependencies, and deadlines.
- It helps in identifying issues early and concerns such as lack or unavailability of resources.
- It also helps to identify relationships and to monitor process.
- It provides effective budget management and risk mitigation.

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TRACK:

- Gannt chart
- PERT chart

S. No.	Black Box Testing	White Box Testing
1.	It is a way of software testing in which the internal structure or the program or the code is hidden and nothing is known about it.	It is a way of testing the software in which the tester has knowledge about the internal structure or the code or the program of the software.
2.	Implementation of code is not needed for black box testing.	Code implementation is necessary for white box testing.
3.	It is mostly done by software testers.	It is mostly done by software developers.
4.	No knowledge of implementation is needed.	Knowledge of implementation is required.
5.	It can be referred to as outer or external software testing.	It is the inner or the internal software testing.
6.	It is a functional test of the software.	It is a structural test of the software.
7.	This testing can be initiated based on the requirement specifications document.	This type of testing of software is started after a detail design document.
8.	No knowledge of programming is required.	It is mandatory to have knowledge of programming.
9.	It is the behaviour testing of the software.	It is the logic testing of the software.
10.	It is applicable to the higher levels of testing of software.	It is generally applicable to the lower levels of software testing.
11.	It is also called closed testing.	It is also called as clear box testing.
12.	It is least time consuming.	It is most time consuming.

S. No.	Black Box Testing	White Box Testing
13.	It is not suitable or preferred for algorithm testing.	It is suitable for algorithm testing.
14.	Can be done by trial and error ways and methods.	Data domains along with inner or internal boundaries can be better tested.
15.	**Example:** Search something on google by using keywords	**Example:** By input to check and verify loops
16.	**Black-box test design techniques-** • Decision table testing • All-pairs testing • Equivalence partitioning • Error guessing	**White-box test design techniques-** • Control flow testing • Data flow testing • Branch testing
17.	**Types of Black Box Testing:** • Functional Testing • Non-functional testing • Regression Testing	**Types of White Box Testing:** • Path Testing • Loop Testing • Condition testing
18.	It is less exhaustive as compared to white box testing.	It is comparatively more exhaustive than black box testing.

What is a "version control system"?

Version control systems are a category of software tools that helps in recording changes made to files by keeping a track of modifications done in the code.

Benefits of the version control system:

- Enhances the project development speed by providing efficient collaboration,
- Leverages the productivity, expedites product delivery, and skills of the employees through better communication and assistance,
- Reduce possibilities of errors and conflicts meanwhile project development through traceability to every small change,
- Employees or contributors of the project can contribute from anywhere irrespective of the different geographical locations through this VCS,
- For each different contributor to the project, a different working copy is maintained and not merged to the main file unless the working copy is validated. The most popular example is Git, Helix core, Microsoft TFS,

Helps in recovery in case of any disaster or contingent situation,

- Informs us about Who, What, When, Why changes have been made.

Types of Version Control Systems:

- Local Version Control Systems
- Centralized Version Control Systems
- Distributed Version Control Systems

Purpose of Version Control:

- Multiple people can work simultaneously on a single project. Everyone works on and edits their own copy of the files and it is up to them when they wish to share the changes made by them with the rest of the team.
- It also enables one person to use multiple computers to work on a project, so it is valuable even if you are working by yourself.
- It integrates the work that is done simultaneously by different members of the team. In some rare cases, when conflicting edits are made by two people to the same line of a file, then human assistance is requested by the version control system in deciding what should be done.

RMMM Plan :

A risk management technique is usually seen in the software Project plan. This can be divided into Risk Mitigation, Monitoring, and Management Plan (RMMM). In this plan, all works are done as part of risk analysis. As part of the overall project plan project manager generally uses this RMMM plan.

Risk Mitigation :

It is an activity used to avoid problems (Risk Avoidance).

Steps for mitigating the risks as follows.

- Finding out the risk.
- Removing causes that are the reason for risk creation.
- Controlling the corresponding documents from time to time.
- Conducting timely reviews to speed up the work.

Risk Monitoring:

It is an activity used for project tracking.

It has the following primary objectives as follows.

To check if predicted risks occur or not.

- To ensure proper application of risk aversion steps defined for risk.
- To collect data for future risk analysis.
- To allocate what problems are caused by which risks throughout the project.

Risk Management and planning :

It assumes that the mitigation activity failed and the risk is a reality. This task is done by Project manager when risk becomes reality and causes severe problems. If the project manager effectively uses project mitigation to remove risks successfully then it is easier to manage the risks. This shows that the response that will be taken for each risk by a manager. The main objective of the risk management plan is the risk register. This risk register describes and focuses on the predicted threats to a software project.

Example:

Let us understand RMMM with the help of an example of high staff turnover.

Risk Mitigation:

- To mitigate this risk, project management must develop a strategy for reducing turnover. The possible steps to be taken are:
- Meet the current staff to determine causes for turnover (e.g., poor working conditions, low pay, competitive job market).
- Mitigate those causes that are under our control before the project starts.
- Once the project commences, assume turnover will occur and develop techniques to ensure continuity when people leave.
- Organize project teams so that information about each development activity is widely dispersed.
- Define documentation standards and establish mechanisms to ensure that documents are developed in a timely manner.
- Assign a backup staff member for every critical technologist.

Risk Monitoring:

As the project proceeds, risk monitoring activities commence. The project manager monitors factors that may provide an indication of whether the risk is becoming more or less likely. In the case of high staff turnover, the following factors can be monitored:

- General attitude of team members based on project pressures.
- Interpersonal relationships among team members.
- Potential problems with compensation and benefits.
- The availability of jobs within the company and outside it.

Risk Management:

Risk management and contingency planning assumes that mitigation efforts have failed and that the risk has become a reality. Continuing the example, the project is well underway, and a number of people announce that they will be leaving. If the mitigation strategy has been followed, backup is available, information is documented, and knowledge has been dispersed across the team. In addition, the project manager may temporarily refocus resources (and readjust the project schedule) to those functions that are fully staffed, enabling newcomers who must be added to the team to "get up to the speed".

Drawbacks of RMMM:

- It incurs additional project costs.
- It takes additional time.
- For larger projects, implementing an RMMM may itself turn out to be another tedious project.
- RMMM does not guarantee a risk-free project, in fact, risks may also come up after the project is delivered.