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Software Requirement Engineering

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# Waterfall Model:-

It is the basic software development life cycle model. It is an idealistic model. The model considers that one process can be started after completion of the previous process. The output of one process becomes the input of the next process.

The process include in the waterfall model are:

* Feasibility study
* Requirement Analysis and Specification
* Design
* Coding & Unit Testing
* Integration & System Testing
* Maintenance

Advantages:-

The advantages of using Waterfall Model for software development are:

* It is simple and easy to understand.
* Each stage in the model is clearly defined.
* This model works well for smaller projects and projects where requirements are well understood.

Disadvantages:-

The disadvantages of using Waterfall Model for software development are:

* Difficult to accommodate change request.
* No error correction and feedback path.
* No overlapping of the process due to this efficiency can’t increase and cost can’t reduce.

# V-Model:-

It is a type of SDLC model where process executes in a sequential manner in V-shape. It is also known as Verification and Validation model. It is based on the association of a testing phase for each corresponding development stage. Development of each step directly associated with the testing phase. The next phase starts only after completion of the previous phase.

Verification: It involves static analysis technique (review) done without executing code.

Validation: It involves dynamic analysis technique (functional, non-functional), testing done by executing code.

The process include in V-model are:-

* Requirement Analysis
* System Design
* Architectural Design
* Module Design
* Coding
* Unit testing
* Integration testing
* System testing
* User Acceptance testing

Advantages:-

The advantages of using V-model are:

* This model focuses on verification and validation activities early in the life cycle of software development.
* V-Model is used for small projects where project requirements are clear.
* It enables project management to track progress accurately.

Disadvantages:-

The disadvantages of using V-model are:

* Uncertainty and high risk.
* Not good for complex projects.
* It does not support iteration process.

# Incremental Model:-

It is the software development model in which the software product are developed and delivered incrementally. Software requirements are broken down into several modules that can be incrementally developed and delivered. The development team then undertakes to develop fundamental feature of the software. Once it is constructed and fully developed, it is then delivered and then feedback of customer is to be undertaken, after that these are incorporated in the next version. It goes on-and-on until the final product is obtained.

Advantages:-

The advantages of using Incremental model are:

* Incremental Deployment of the system.
* Minimization of error.
* Uses divide and conquer strategy for breakdown tasks.

Disadvantages:-

The disadvantages of using Incremental model are:

* It requires good planning and design
* Well defined module interfaces are required.
* Total cost is not lower.

# Prototyping Model:-

Prototyping is defined as the process of developing a working replication of a product or system that has to be engineered. This model is used when the customers do not know the exact project requirements beforehand. In this model, a prototype of the end product is first developed, tested and refined as per customer feedback repeatedly till a final acceptable prototype is achieved.

In this process model, the system is partially implemented before or during the analysis phase thereby giving the customers an opportunity to see the product early in the life cycle. Once the customer figures out the problems, the prototype is further refined to eliminate them. The process continues till the user approves the prototype and finds the working model to be satisfactory. Stages included are:

* Customer Feedback
* Develop prototype
* Testing of prototype by customer

Advantages:-

The advantages of using Prototyping model are:

* Flexibility in design.
* Customer can see the early product of software life cycle.
* New requirement can be accommodate easily.

Disadvantages:-

* It is Costly with respect to time.
* Very poor documentation due to changing in customer requirements.
* Uncertainty in determining the number of iterations that would be required before the prototype is finally accepted by the customer.

# Rapid Application Development Model (RAD):-

It is the model in which software project can be broken down into many small modules where each module can be assigned independently to separate teams. At the end, all modules are combined to form the final product. This model is the short time span model i.e. 60-90 days. The phases included in this model are:

* Requirement Planning
* User Description
* Construction
* Testing

Advantages:-

The advantages of using RAD model are:

* It is easier to accommodate changing requirements.
* Reduced costs as fewer developers are required.
* The progress of the project can be measured through the various stages.

Disadvantages:-

The disadvantages of using RAD model are:

* Customer involvement is required throughout the life cycle.
* The absence of reusable components can lead to failure of the project.
* The team leader must work closely with the developers and customers to close the project in time.

# Spiral Model:-

Spiral Model is the most important SDLC model, which provides support for risk handling. It has spiral with many loops where each loop is called a phase in software development process. The exact numbers of phases to develop are unknown as it is depending upon the project risk. The phases of spiral model include:

* Objective determination & identify alternative solution
* Identify & resolve risks
* Develop next version of product
* Review & plan for next phase

Advantages:-

The advantages of using spiral model are:

* Risk Handling.
* Flexibility in requirements.
* Good for large projects.

Disadvantages:-

The disadvantages of using spiral model are:

* Complex.
* Expensive.
* Difficulty in time management.

# Agile Model:-

The Agile model was developed to help the projects to adapt the changes quickly. In this model, the requirements are divided in smaller parts which are developed incrementally. Each incremental part is developed over iteration. Thus, each iteration is intended to be small and easily manageable and that can be completed within a couple of weeks only. At a time one iteration is planned, developed and deployed to the customers. The phases included in the agile model are:

* Requirement Gathering
* Requirement Analysis
* Design
* Code
* Testing
* User Acceptance

Advantages:-

The advantages of using Agile Model are:-

* Pair Programming.
* Customer Satisfaction.
* Reduce total development time of the project development.

Disadvantages**:-**

The disadvantages of using Agile Model are:-

* Due to lack of formal documents, it creates confusion in the development phase.
* Lack of proper documentation.
* Problems in the maintenance of the whole project.

# Extreme Programming (XP):-

Extreme Programming is the important framework of the Agile Model. XP is based on the frequent iteration through which the developers implement User Stories. User stories are simple and informal statements of the customer about the functionalities needed. For that, a prototype is being developed to get the overview of the project. The phases include in the Extreme Programming are:

* Requirement gather
* Coding
* Testing
* Designing
* Feedback

Advantages:-

The advantages of using Extreme Programming Model are:-

* Better for small projects.
* Good for the projects with rapidly changing requirements.
* It minimizes time and save cost.

Disadvantages:-

The disadvantages of using Extreme Programming Model are:-

* Lack of proper documentation.
* It does not measure the code quality assurance.
* It focuses more on the code rather than design.

# Feature Driven Design (FDD):-

It is an agile iterative and incremental model that focuses on progressing the features of the developing software. The main motive is FDD Model is to provide timely updated and working software to the client. In FDD, reporting and progress tracking is necessary at all levels. The phases included in the Feature Driven Design Model are:-

* Build overall model
* Build feature list
* Plan by feature
* Design by feature
* Build by feature

Advantages:-

The advantages of using FDD Model are:-

* It is short iterative which helps to finish the project quickly.
* Reduction in risks is observed as whole model and design is built in smaller segments.
* Reporting at all levels leads to easier progress tracking.

Disadvantages:-

The disadvantages of using FDD Model are:-

* This agile practice is not good for smaller projects.
* There is high dependency on lead programmers, designers and mentors.
* There is lack of documentation which can create an issue afterwards.

# Dynamic System Development Method (DSDM):-

The Dynamic System Development Method is the agile development approach that provides a framework for building and maintaining systems. DSDM is an iterative code method within which every iteration follows the 80% rule that simply enough work is needed for every increment to facilitate movement to the following increment. The remaining detail is often completed later. The phases included in DSDM Model are:-

* Feasibility Study
* Business Study
* Functional Model Iteration
* Design & Build Iteration
* Implementation

Advantages:-

The advantages of using DSDM Model are:-

* Users are highly involved in the development of the system, so it provides good knowledge to the user.
* Basic functionality is developed quickly, with more functionality added at frequently.
* The projects are delivered on time and within a specific budget.

Disadvantages:-

The disadvantages using DSDM Model are:-

* It is not effective for small scale projects.
* It is costly to implement as it require both customer and developer to be trained effectively.
* It is not very common and easy to understand.

# Adaptive SDLC Model:-

Adaptive SDLC approaches have a mix of incremental and iterative development. It involves adding features incrementally and making changes and refinements according to feedback. In other words, the work can easily adapt to the changing requirements based on new feedback received from the client. The phases included in Adaptive SDLC Model are:-

* Speculate
* Collaborate
* Learn

Advantages:-

The advantages of using Adaptive SDLC Model are:-

* It focuses on delivering high quality applications while maintaining technical excellence.
* Short feedback loops lead to quick adaptation to changing requirements.
* It is mainly used to build complex software projects.

Disadvantages:-

The disadvantages of using Adaptive SDLC Model are:-

* It demands customer involvement throughout SDLC.
* It creates lack of detail and proper documentation due to adaptive in nature.
* Since adaptive SDLC requires close collaboration between organizations and their clients, lack of commitment from either of the sides could impact software quality.