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Understanding the Different Models used for Software Testing

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Abstract: - The process of software testing has few guidelines and rules and policies and certain number of stages which the testers are supposed to follow in order to do efficient testing of the product or system software or application. There are number of software testing models which can be used to test the system or product based on the type of system to be tested. There are few stages in each model which on should follow to do testing of the application. This paper will explain each model in detail with the help of diagrams. This will also explain the challenges and advantages of each model in detail.

Keywords: - Software Testing, Software testing, Advantages, challenges, Software testing models.

Introduction: - In an organisation during the development of software certain process is followed which is known as software development life cycle. Once the software is developed, it is necessary to test it which comes under software testing life cycle. For testing the software there are different models in the market which has its own advantages and disadvantages. The selection of the models depends upon the complexity of the project and the type of project to be tested. Following are the types of models available in the market: -

1. Waterfall model
2. Spiral Model
3. Incremental model
4. V-Model
5. Agile Model
6. Prototype Model
7. RAD Model

1. Waterfall Model: - This is the oldest model. There are certain stages in this model. Each stage should be finished first only then the other stage can be started as the outputs of first stage are the inputs for the other stage. It is also known as sequential model. Following are the stages of waterfall model: -

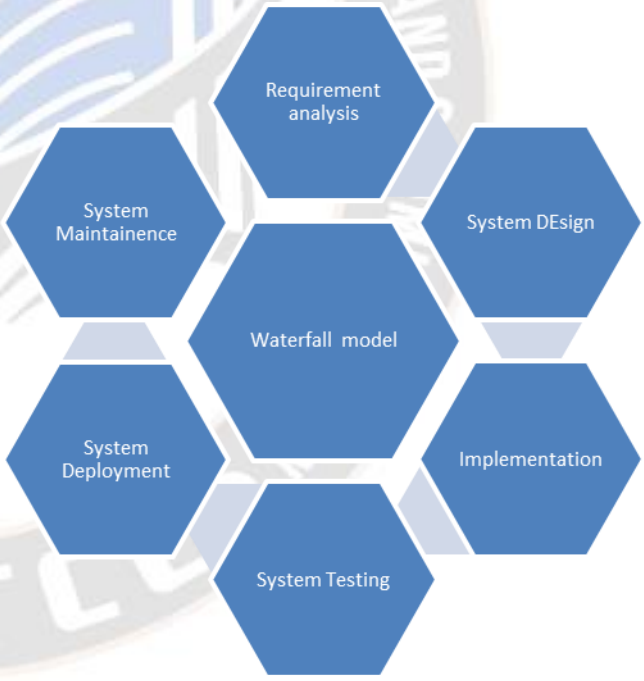

Figure1. Waterfall model

1. Requirement analysis: - In this stage the designers sit with the client and understand their requirements. They make proper document stating all the specifications and requirements by the end user.
2. Design: - In this stage the actual designing of the product takes place. It is decided which language will be used for coding, what all platforms it will

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support based upon the requirement specification from stage first.

3. Implementation process: - In this phase based upon the design document the implementation phase will start. In this stage the developers will start writing the code based upon the design document. All the coding part is done in this phase.
4. System Testing: -In this stage the testing of the software build is done. It is tested whether the system is giving expected results or not based on the user requirements.
5. Deployment: - In this stage the product is deployed on the actual platform after making sure that it is meeting all the requirements and working properly.
6. Maintenance: - This stage is to provide support to the customer if he faces any issues or any errors arrives. IF the customer changes his specifications or wants some modifications then all those can be done in this phase.

Advantages of Waterfall-Model: -

- These models are very easy to follow as all the stages of this model are easy and can be done in less time.
- These models are best for the projects whose complexity is less and are small projects.
- The model is linear model and hence the phases never overlaps with each other.
- The model can be managed easily and hence the maintenance of the model is less and easy.

Disadvantages of Waterfall Model: -

- The risk factor is high in this model.
- This can be used for only small products where the complexity if less.
- It is very difficult to make changes in the middle of the ongoing project.
- It is time consuming as the stages cannot be executed at the same time.
- It is not suitable for long projects.

2. Spiral Model: This model is used for the projects which are complex in nature and also which has high risk factors. This model has four stages. [1]

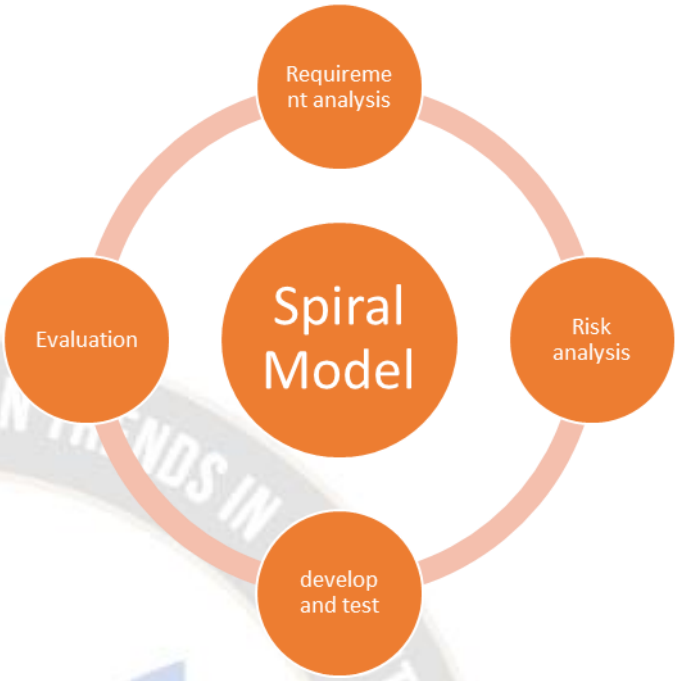

Figure2 Different stages of spiral model

- Requirement Analysis: - In this stage the information gathering is done to know the needs of the user. After that it is analysed and then designing of the product is being done in this stage.
- Risk Analysis: - In this stage based on the specifications given by the end user, the risks involved in development of the product is done. Each and all the factors which might are risky for the development of the software is determined and hence the risks involved can be avoided as they are predicted well in advance.
- Develop and Testing of the code: - In this stage based on the design document the development phase starts. The document is converted into coding using the language decided by the developers. Once the coding is done, the testers test the product for any errors. If yes then they will rectify it or send it to the developers to check the error and rectify them.
- Evaluation: - In this stage the end product is given to the client and it is evaluated that the client has further changes or modifications which he wants to make.

Advantages of Spiral Model: -

- This model is efficient as it helps to do risk analysis as a result of which future error can be avoided.
- It can be used for projects which are for longer duration.
- The development is very fast in this type of model.

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- The stages can be executed simultaneously as one need not wait till the previous phase finishes.
- Customer modifications can be done at early stage as well.

Disadvantages of Spiral Model: -

- The risk analysis should be done properly and hence needs such a analyst which has sound knowledge of the project.
- Sometimes the deadlines are hard to meet.
- It cannot be implemented in small business as the cost factor is high.

3. Incremental Model: - [2] In this model the requirement document is broken into many small cycles. Each cycle will pass through same four stages of the software development life cycle. Each stage iteration is independent from each other. In each increment stage the product is given to the end user using only few specifications. If there are any modifications then those are added in next increment cycle. This way the product is made in small incremental steps. Following are the stages of this model: -

1. Analysis: - Same as other models, the analysis of the requirements is done in this stage and it is broken into small increments.
2. Design: - In this stage the designing of the first increment is done based on few functionalities of the product.
3. Code: - The actual coding of the product is done in this stage.
4. Test: - The first increment when ready is tested and then given to the end user to check whether it is meeting his requirements or not.

Advantages of Incremental Model: -

- One of the main advantage of this model is that, it is easy to make changes at any point of time in this model.
- The development of the product is done in small stages and hence the risk factor involved is less.
- The cost factor involved in this model is also less.
- It is very easy to identify the errors in this model and hence easy to fix them at an early stage.

Disadvantages of Incremental Model: -

- The main disadvantage of this model is that the stages of the model does not overlap with each other.
- It is time consuming process as the specifications are turn in to reality step by step which takes a lot of time.
- If the planning is not done properly then it is difficult to identify which requirements to include in first increment.

4.V-Model: - This model is also known as verification or validation model. In this model the stages involved are similar to waterfall model but the testing is done in all the phases simultaneously.

a. Requirement analysis stage: - In this stage after gathering requirement from the user, the acceptance testing is done parallelly.

b. System Design: - In this stage based on the requirement document in first stage, the system design will take place and at the same time system testing is done.

c. Architecture design: - In this stage the whole designing of the product is being done and at the same time integration testing will be done at this stage. This is to make sure how the system behaves when all the components of the system are integrated with each other.

d. Module Design: - In this stage the small modules of the product are designed. At the same time testing of each module will be done which is known as unit testing.

Advantages of V-Model: -

- It is time saving model and saves a lot of time and energy as the testing is conducted parallelly.
- Can be used for small projects.
- Modifications can be done during the ongoing development phase.

Disadvantages: -

- The risk factor involved is more in this type of model.
- This type of model is not flexible as in this also like waterfall model each phase should be completed before the other stage is started.
- Documentation is more in this model. If any small changes is being made then the requirement document should also be updated.
- This model cannot be used for the project which will have longer duration of cycle and also whose complexity is high.

5.Agile Model: - This model is combination of iterative model and incremental model. Each iteration will be executed for one increment and so

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on. This gives combined advantage of incremental model as well as iterative model. Following are the various stages of the agile model: -[3]

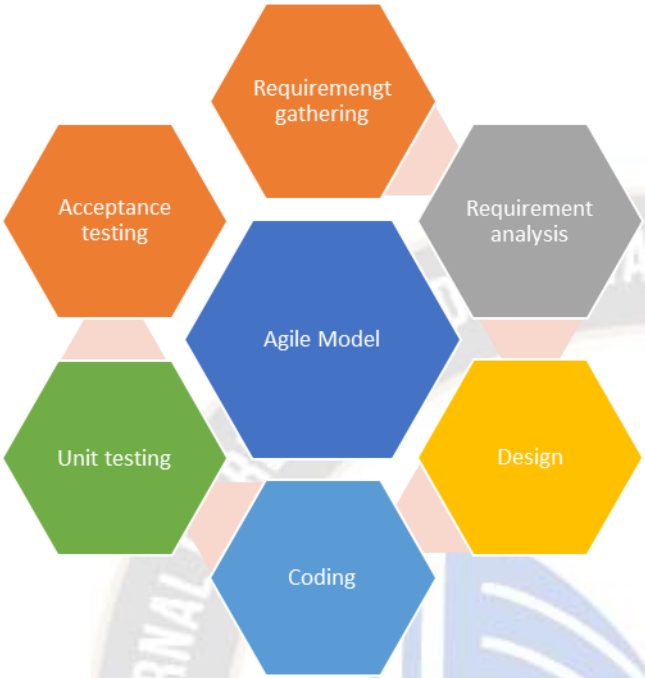

Figure3 Agile Model stages

- In this model, the requirements are divided in to small parts and then the coding starts. There will be more communication between the end user and the developing team so as to understand whether the developed small part of product is as per user's needs or not. In this model there is more focus on the development as compared to documentation and hence it saves time and energy.
- The communication among the other team members is also more in this model so the overall process of developing the software increases.
- There are usually two teams of small number of team members due to which one team is responsible for coding and the other for reviewing it. This process also saves a lot of time and efforts.

Advantages of Agile Model: -

- This model helps to decrease the time taken to develop the software.
- The customer will always be updated about what is going on in the project.
- It is easy to make modifications if the end user changes any requirements.
- The risk factor can be analysed thoroughly in this model.

Disadvantages of Agile Model: -

- As there is no proper documentation in this model, so sometimes it is difficult to know the facts about the ongoing project.
- AS the absence of documentation, if there is new team member in the team, then it will take a lot of time to make him understand about the project which will waste a lot of time and energy.

5. Prototype Model: - In this type of model since the requirements are not known properly, a small prototype is made and given to the end user. This process is a continued process and various number of prototypes is made until final product is developed. Following are the stages of the prototype model: -

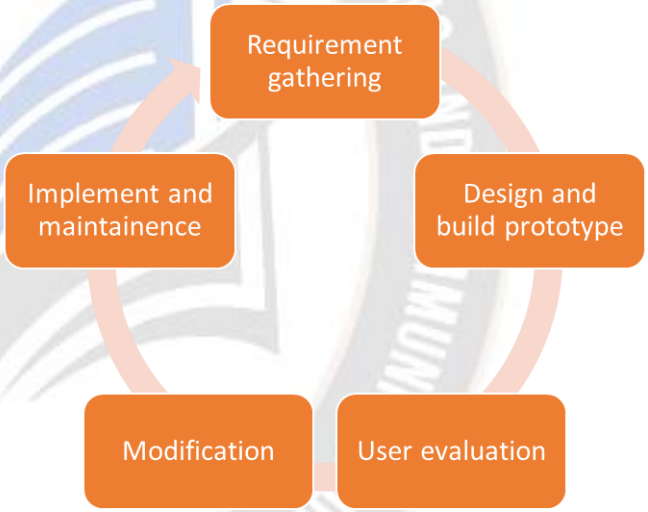

Figure 4 Prototype Model

- First of all, the developers sit with the client and understand the requirements. Then based on that requirements a design is made and then prototype of the model is made. In this stage coding is done and then it is given to the end user to do evaluation. Then if the end user wants to make any modifications then again designing is done and again a small build prototype is made and tested and then given to the end user to evaluate it again. This whole process is repeated until final product is developed and then if the end user is satisfied then it is deployed and implemented. Then comes the maintenance phase in which support is provided to the customer to install the developed software in his environment.

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Advantages of Prototype Model: -

- It is very simple model and hence easy to understand.
- If any new team member joined the team then it will take little time to explain him the project.
- If the customer is not satisfied then again from scratch the prototype can be made.

Disadvantages of Prototype Model: -

- The prototype made is discarded due to which cost factor may increase.
- Sometimes the user keeps on making unrealistic demands and keep on modifying his requirements.

6. RAD Model: - In this type of model, like incremental model, the small prototypes are made based on small functions and components of the software. This model is also known as rapid application development model. They are considered as small projects. Following are the stages of RAD model: -

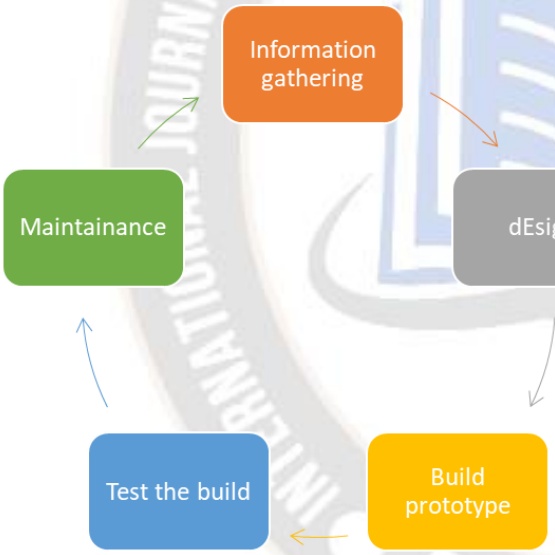

Figure 5 RAD Model

Advantage of RAD Model: -

- The development time of the project is decreased.
- Gives the facility to customer to give feedback and option to make modifications.
- Reusability concept.

Disadvantages of RAD Model: -

- The development team of the project should be well knowledgeable and highly skilled.
- There should be proper communication between all the teams.
- The cost of implementing the model is high as compared to other models.

Conclusion: - With the help of this paper, various models of software development have been discussed. There are advantages as well as disadvantages of each model. One needs to be very efficient to select the type of model which depends on the type of project and many other factors. Hence, the development team should first communicate with the end user in order to understand the requirements of the end user and then should decide the budget and select the model.

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