System testing types in software engineering

A good system design is to organize the program modules in such a way that are easy to develop and change. Structured design techniques help developers to deal with the size and complexity of programs. Analysts create instructions for the developers about how code should be written and how pieces of code should fit together to form a program.Importance :If any pre-existing code needs to be understood, organized, and pieced together.It is common for the project team to have to write some code and produce original programs that support the application logic of the system.There are many strategies or techniques for performing system design. They are:Bottom-up approach:The design starts with the lowest level components and subsystems. By using these components, the next immediate higher-level components and subsystems are created or composed. The process is continued till all the components and subsystems are composed into a single component, which is considered as the complete system. The amount of abstraction grows high as the design moves to more high levels. By using the basic information existing system, when a new system needs to be created, the bottom-up strategy suits the purpose.Advantages:The economics can result when general solutions can be reused.It can be used to hide the low-level details of implementation and be merged with the top-down technique.Disadvantages:It is not so closely related to the structure of the problem.High-quality bottom-up solutions are very hard to construct.It leads to the proliferation of ‘potentially useful’ functions rather than the most appropriate ones.Top-down approach:Each system is divided into several subsystems and components. Each of the subsystems is further divided into a set of subsystems and components. This process of division facilitates in forming a system hierarchy structure. The complete software system is considered as a single entity and in relation to the characteristics, the system is split into sub-system and component. The same is done with each of the sub-systems. This process is continued until the lowest level of the system is reached. The design is started initially by defining the system as a whole and then keeps on adding definitions of the subsystems and components. When all the definitions are combined together, it turns out to be a complete system. For the solutions of the software that need to be developed from the ground level, top-down design best suits the purpose.Advantages:The main advantage of the top-down approach is that its strong focus on requirements helps to make a design responsive according to its requirements.Disadvantages:Project and system boundaries tend to be application specification-oriented. Thus it is more likely that advantages of component reuse will be missed.The system is likely to miss, the benefits of a well-structured, simple architecture.Hybrid Design:It is a combination of both the top-down and bottom-up design strategies. In this, we can reuse the modules. Prerequisite – Software Testing | BasicsBlack box testing is a type of software testing in which the functionality of the software is not known. The testing is done without the internal knowledge of the products.Black box testing can be done in following ways:1. Syntax Driven Testing – This type of testing is applied to systems that can be syntactically represented by some language. For example- compilers,language that can be represented by context free grammar. In this, the test cases are generated so that each grammar rule is used at least once.2. Equivalence partitioning – It is often seen that many type of inputs work similarly so instead of giving all of them separately we can group them together and test only one input of each group. The idea is to partition the input domain of the system into a number of equivalence classes such that each member of class works in a similar way, i.e., if a test case in one class results in some error, other members of class would also result into same error.The technique involves two steps:Identification of equivalence class – Partition any input domain into minimum two sets: valid values and invalid values. For example, if the valid range is 0 to 100 then select one valid input like 49 and one invalid like 104.Generating test cases –(i) To each valid and invalid class of input assign unique identification number.(ii) Write test case covering all valid and invalid test case considering that no two invalid inputs mask each other.To calculate the square root of a number, the equivalence classes will be:(a) Valid inputs:Whole number which is a perfect square- output will be an integer.Whole number which is not a perfect square- output will be decimal number.Positive decimals(b) Invalid inputs:Negative numbers(integer or decimal).Characters other that numbers like “a”,”!”,”;”,etc.3. Boundary value analysis – Boundaries are very good places for errors to occur. Hence if test cases are designed for boundary values of input domain then the efficiency of testing improves and probability of finding errors also increase. For example – If valid range is 10 to 100 then test for 10,100 also apart from valid and invalid inputs.4. Cause effect Graphing – This technique establishes relationship between logical input called causes with corresponding actions called effect. The causes and effects are represented using Boolean graphs. The following steps are followed:Identify inputs (causes) and outputs (effect).Develop cause effect graph.Transform the graph into decision table.Convert decision table rules to test cases.For example, in the following cause effect graph:It can be converted into decision table like:Each column corresponds to a rule which will become a test case for testing. So there will be 4 test cases.5. Requirement based testing – It includes validating the requirements given in SRS of software system.6. Compatibility testing – The test case result not only depend on product but also infrastructure for delivering functionality. When the infrastructure parameters are changed it is still expected to work properly. Some parameters that generally affect compatibility of software are:Processor (Pentium 3,Pentium 4) and number of processors.Architecture and characteristic of machine (32 bit or 64 bit).Back-end components such as database servers.Operating System (Windows, Linux, etc). Testing is an integral part of software development life cycle. Various models or approaches are used in the software development process where each model has its own advantages and disadvantages. Choosing a particular model depends on the project deliverables and complexity of the project. Now Let us go through the various software testing models and their benefits: 1. Waterfall Model This is the most basic software development life cycle process which is followed broadly in the industry. Here the developers follow a sequence of processes where the processes flow progressively downwards towards the ultimate goal. It is like a waterfall where there are a number of phases. These phases have their own unique functions and goals. There are, in fact, four phases – requirement gathering and analysis phase, software design, programmed implementation and testing, maintenance. All these four phases come one after another in the given order. In the first phase all the possible system requirements for developing a particular software are noted and analyzed. This in turn depends on the software requirement specifications which includes detailed information about expectations of the end user. Based on this a Requirement Specification. Document is created which acts an input to the next phase, i.e. software design phase. What needs to be emphasized here is that once you move into the next phase it won’t be possible to update the requirements. So you must be very thorough and careful about the end-user requirements. Advantages Easy to implement and maintain. The initial phase of rigorous scrutiny of requirements and systems helps in saving time later in the developmental phase The requirement of resources is minimal and testing is done after completion of each phase. Disadvantages It is not possible to alter or update requirements You cannot make changes once you are into the next phase. Cannot start the next phase until the previous phase is completed 2. V Model This model is widely recognized as superior to waterfall model. Here the development and test execution activities are carried on side by side in the downhill and uphill shape. In this model, testing starts at the unit level and spreads towards integration of the entire system. So, SDLC is divided into five phases – unit testing, integration testing, regression testing, system testing and acceptance testing. Advantages Easy to use the model since testing activities like planning and test designing are done before coding Saves time and enhances chances of success. Defects are mostly found at an early stage and downward flow of defects is generally avoided Disadvantages It is a rigid model Early prototypes of the product are not available since the software is developed during the implementation phase If there are changes in the midway, then the test document needs to be updated 3. Agile model In this SDLC model requirements and solutions evolve through collaboration between various cross functional teams. This is known as an iterative and incremental model. Also Read: Selenium Tutorial For Beginners- An Overall View into this Tool. Advantages Ensure customer satisfaction with rapid and continuous development of deliverables. It is a flexible model as customers, developers and testers continuously interact with each other Working software can be developed quickly and product can be adapted to changing requirements regularly Disadvantages In large and complex software development cases it becomes difficult to assess the effort required at the beginning of the cycle Due to continuous interaction with the customer, the project can go off track if the customer is not clear about the goals 4. Spiral model It is more like the Agile model, but with more emphasis on risk analysis. It has four phases – planning, risk analysis, engineering and evaluation. Here gathering of requirements and risk assessment is done at the base level and every upper spiral builds on it. Advantages Risk avoidance chance is enhanced due to the importance on risk analysis. Its a good model for complex and large systems. Depending on the changed circumstances additional functionalities can be added later on Software is produced early in the cycle Disadvantages Its a costly model and requires highly specialized expertise in risk analysis It does not work well in simpler projects 5. Rational Unified Process This model also consists of four phases, each of which is organized into a number of separate iterations. The difference with other models is that each of these iterations must separately satisfy defined criteria before the next phase is undertaken. Advantages With an emphasis on accurate documentation this model is able to resolve risks associated with changing requirements of the client Integration takes less time as the process goes on throughout the SDLC. Disadvantages 6. Rapid application development This is another incremental model like the Agile model. Here the components are developed parallelly to each other. The developments are then assembled into a product. Advantages The development time is reduced due to simultaneous development of components and the components can be reused A lot of integration issues are resolved due to integration from the initial stage Disadvantages It requires a strong team of highly capable developers with individual efficacy in identifying business requirements It is a module based model, so systems that can be modularized can only be developed in this model As the cost is high, the model is not suitable for cheaper projects Conclusion The above mentioned software testing models are a part of the SDLC process. With the ever increasing awareness and need for information technology, has given rise to more than 100+ testing types that are used today in many big companies. These processes keep changing as per the requirements, projects and preferences. Click to rate this post!

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