



## A Scenario of Different Types of Testing Techniques in Software Engineering

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**Abstract--** *Software testing is a Critical elements in the software quality assurance which are used to uncover the errors basically related to design and coding .The main purpose of testing is to detect the failures of the software and so that defects are discovered and then corrected. Testing is used to identify the variety of things but most importantly it measures the quality of the developed software. Testing is generally performed to find out the errors but its intent is to find that whether it satisfies the customer requirement or fulfill the expectation of customer or not.*

*Testing is a method to detect and discovered the software failure and ensures about the quality of the software. While performing testing what strategy is adopted is very important. Which technique are taken and perform for which type of software application is always a question for tester. In this paper, I have described the three most commonly used techniques of testing and also compared it. The techniques which are often used for detect the errors are described in this paper.*

**Keywords -** *White Box , Black Box, Gray Box*

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### I. INTRODUCTION

Software testing is a process of analyzing the software and identifies the differences between the required and existing conditions. Software testing not only accessing the functionality of the software through analysis but also correctness of software as well. The main purpose or objective of testing is to not to find every software defects or bugs that exists but also uncover the situations which could negatively impact on customer requirement, usability and maintainability. Testing can be done for assuring the quality of the software and allows the developers to builds the software that meets and fulfills the customer expectation and requirement. (Testing will prove the developers failure.). The purpose of testing is quality assurance, reliability estimation and validation and verification. Correctness and reliability are two major areas of testing.

There are several techniques but three more important techniques that are used for detecting errors are

**A. *White Box Testing Technique :***

It is a technique of testing having the full knowledge of internal logic and structure of the software. This testing tested the application at level of Source code.

**B. *Black Box Testing Technique:***

It is a technique of testing which examines the functionality of the application and not have the knowledge of internal structure of system.

**C. *Grey Box Testing Technique:***

This technique of testing is the combination of both black box and white box testing. i.e. this technique have the partial knowledge of internal working of application as well its functionality of the system.

### II. WHITE BOX TESTING

White Box testing is a method of testing which can be used to examine that the code works as expected or not. White box testing test the application at the levels of source code. This method of testing can uncover implementation errors by analyzing the part of software, but not detect or uncover unimplemented parts or missing requirements of the specification. In white box testing the Tester must have the full knowledge of internal structure of the software not the functionality of the software.

White box testing is suitable at the three levels (Unit, Integration and Regression) of the software testing process. In this method tester run the code with predetermined set of inputs and determine that the code produces the expected (appropriate) or predetermined outputs or not.

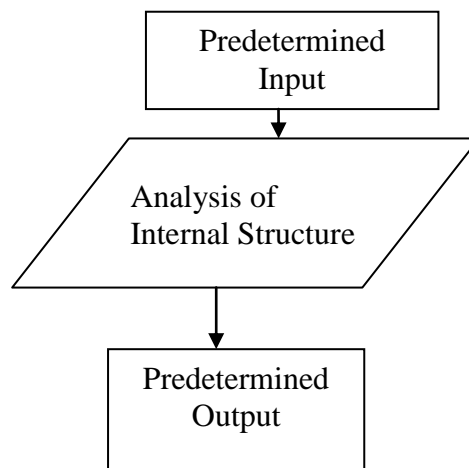


Figure 1. White box testing technique

The White Box Testing have some advantages and disadvantages which are described below

Advantages of White box testing

- In White Box testing Tester guess easily the type of input data.
- Used in Optimization of the code.
- This method helps to detect the possible errors early.
- Removing the errors occurred in hidden code by eliminating the extra lines of code.

Disadvantages of White box testing

- It's not possible every time to look into every bit of the code to find out hidden errors that's why many paths will remain untested.
- In White box testing full knowledge of internal structure is necessary so it required skilled tester.
- The cost are increased due to highly skilled tester needed to perform testing.
- Difficult to maintain the use of specialized tools like debugging and code analyzers tools.

There are some types of white box testing which are listed below

White Box Testing

- Control Flow Testing.
- Data Flow Testing.
- Basis Path Testing.
- Loop Testing.

#### **A. Control Flow Testing**

It is a structural testing strategy which uses the program control flow as a model control flow but favors simpler paths rather than complicated but fewer path. It is more suitable for unstructured code and catches 50% of all bugs during unit testing.

#### **B. Data Flow Testing**

Data Flow testing is a diagrammatic representation of Program and their execution. This type of testing look at how the program variables are defined and used while annotating the control flow graph with information.

#### **C. Basis Path Testing**

It is technique which is used to test the code which are based on control flow. This method uses bot control flow and control flow chart to convert the code into a model for deriving the independent paths from it.

#### **D. Loop Testing**

It is a technique of White box testing which are mainly focused on validity of the loops . There are some Synonyms for White box testing are listed below

- Structural Testing
- Transparent Testing.
- Glass Box Testing.
- Clear Box Testing.

### **III. BLACK BOX TESTING**

The Black Box testing is opposed to the White box testing method , in which tester does not have the knowledge of the internal logic and structure of the system. In this technique tester examines the functionality of the software only not the internal working of it. Black box testing is a testing method that ignores the internal logic of system and focuses on the generated outputs based on inputs and execution conditions.

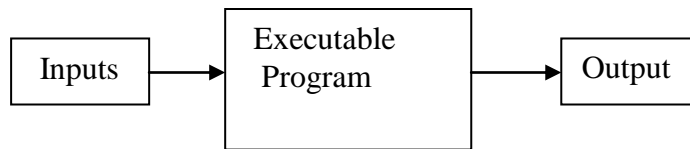


Figure 2. Black box testing technique

The Black Box Testing have some advantages and disadvantages which are described below

Advantages of Black box testing

- This technique is more efficient for larger systems.
- No needs of highly skilled tester, it may be either technical or non-technical tester.
- No needs to access the code.
- The environment of the program is also tested by this technique.
- No need to have the full knowledge of internal structure of the system.

Disadvantages of Black box testing

- Testing is insufficient because tester have limited knowledge of application.
- All the properties of software are not tested.
- The reason of failure of software is not founded by this method.
- It is difficult to design such type of test cases.

There are some types of Black box testing which are listed below:

- Equivalence partitioning.
- Boundary Value Analysis.
- Cause Effect Graph.
- Orthogonal Array Testing.
- All Pair testing.
- State Transition Testing.

#### **A. Equivalence Partitioning**

It is a software testing technique that partitions the software unit input data into some set of equivalence data from which test cases can be derived. This technique is applied to any level of testing and need to test only one condition from each partition.

#### **B. Boundary Value Analysis**

In this technique test cases are designed by taking the values of boundaries. The mainly focus of testing at boundaries rather than the centers values. In this technique errors are observed at the extreme values.

#### **C. Cause effect Graph**

It is a black box testing technique that graphically describes the relationship between the given outputs and all the factors that effect this outcomes.

#### **D. Orthogonal Array Testing**

OAT method is applied when the input domain is very small, but too Complex or large to accommodate exhaustive testing.

#### **E. All Pair Testing**

In this technique, test are conducted to execute all possible discrete combinations of each pair of input parameters.

#### **F. State Transition Testing**

This technique is used to design test cases which are used to execute valid and invalid state transitions. This technique is most suitable for Real time systems.

There are some of the synonyms of black box testing technique which are

- Opaque testing.
- Functional testing.
- Close box testing.
- Behavioral testing.

### **IV. GREY BOX TESTING**

The Gray Box testing is used for testing of software application using the combination of both Black Box and White Box testing. It is a method of testing whose working are partially knows by the tester. This method is suitable for all the domain (business as well as functional domain) and also more appropriate for algorithm testing.

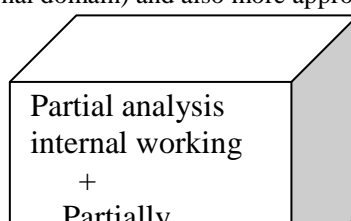




Figure 3. Gray box testing technique

The Gray Box Testing have some advantages and disadvantages which are described below:

Advantages of Gray Box Testing are

- It offers the combined benefits of both testing (black box and White Box testing).
- Gray Box Testing maintains the boundary between the developers and tester.
- The tester handles excellent test scenarios.
- Gray Box Testing is Non-intrusive.
- It offers the unbiased testing.

Disadvantages of grey box testing technique are

- Limited access to internal structure of the applications so that limited access to code coverage.
- It is difficult to identify the defect in the distributed application using this method.
- Most of the paths remain untested.

The synonym of gray box testing is translucent testing.

There are some type of Grey Box Testing which are listed below

- Orthogonal Array Testing.
- Matrix Testing.
- Regression Testing.
- Pattern Testing.

**A. Orthogonal Array Testing**

This technique uses as the subset of all the possible combinations

**B. Matrix Testing**

This method of testing used for the status report of the project stated. Data for this matrix will collected from performed actions.

**C. Regression Testing**

This technique is implies when any new changes are made in software or application.

**D. Pattern Testing**

This type of testing ensures that development pattern and architecture design are implemented correctly or not.

TABLE – I: COMPARISON BETWEEN THREE FORMS OF TESTING TECHNIQUES

S.no.	Key Points	White Box Testing	Black Box Testing	Gray Box Testing
1.	knowledge of internal structure	Fully Known	Not Known	Partial Known
2.	Granularity	High	Low	Medium
3.	Performed by	Tester and developer	End user ,Tester and Developer	End user ,Tester and Developer
4.	Exhaustive	Most Exhaustive	Least exhaustive	Between these two
5.	Algorithm Testing	Suited	Not suited	Not suited
6.	Domain testing	It is suited for all domain	It is suited for functional /business domain	It is suited for functional/business domain bit in depth
7.	Synonyms	It is also called as Glass Box, Clear Box, Transparent and Structural testing	It is also called as Opaque Box, Closed box, input output, Behavioral testing	It is also called as Translucent box testing

8.	Testing method	Where internals are fully known	Where internals behavior is ignored and system viewed as black box.	Where internals are partly known , not fully known
9.	Application	It is suited for applications where internal structure are known	It is well suited for rapid test scenario and quick web service prototyping..	It is well suited for web applications.

#### V. CONCLUSION

In the software development Life cycle Software testing plays a major role and it is a critical element of software development. Software testing saves both time and money by detecting the errors early and correcting them. Software Testing ensures that product is error free and delivers the defect free product to the customer. Testing is an art which requires tester creativity, experiences, attitude together with proper technique. Testing is not just only to detect the errors and improved them but also used in validation, verification and reliability. The main focus of good testing is to produce the error free product which meets the customer expectation and requirements. So testing is the process of quality assurance by which software engineers saved his time as well as money for producing quality product.

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