# Comparison and Contrast between Black Box Testing & White Box Testing

Software testing is a process to evaluate the functionality of software. A good testing guarantees that software is meeting the standard which was promised at the time of requirement gathering.

A good testing comprise of the test cases which fulfils each aspect of requirement gathering. It involves considering all scenarios where software can fail or behaves unexpected.

Software testing can be described as two-step process

1. Verification
2. Validation

Verification – Verification process involves finding the bugs or unexpected behaviour in the software system. For example software was made for “Vending Machine” to deliver a can of soft-drink. It accepts certain denomination of coins. If vending machine doesn’t accept certain denomination which was agreed on or start accepting non-agreed denomination then picking this unexpected behaviour would be part of verification process. Verification process would contain all of the test cases where the software might fail. Usually test case writer would supply unexpected value or do negative testing to check software against unexpected values.

Validation – Validation process determines if the software made for a purpose, is fulfilling the requirement. For example if the take above case of “Vending Machine”, the main purpose of the software would be to accept denomination and deliver soft drink. But instead of that if programmer implements a system that accepts a denomination, plays music (let say to make software look more advanced) and then delivers the soft drink. The implementation is fascinating however it is defeating the purpose of implementing an original software requirement.

Based on above discussion the testing of the software can be divided into two categories

1. Black box testing
2. White box testing
3. Black box testing

Black box testing is also known as functional testing. During black box testing the tester/QC guy focuses on the functionality of the system. That means he/she will only concentrating of the input given to the system and corresponding output. The input and output pattern will be compared against the test cases (written prior to start test) and would decide if the functionality of the system is as it was agreed on. During blank box testing the tester doesn’t care about the internal architecture and how components are working.

As the name suggests the Black box is the type of testing where the testing is done on Black box i.e. a box which is not transparent and tester can’t see inside. If we consider Black Box as a software system, the system would have many components inside like classes, modules, libraries and other stuff. During Black Box testing these underlying components are not visible to tester. They only concentrate on the functionality of the software.

A typical diagram of Black box testing is something like this…

Software System

Output

Input

(Black box testing structure diagram)

Following are some of the criteria to create test cases for Black Box testing…

1. The test cases are designed by examining the software specification document. Software specification document specifies the modules involved in the software, their input and possible outcome. It also describes the behaviour of system at a given time by given input. Tester writes statement to test like the input values given and output from system.
2. Some of the tools used by the tester during Black box testing are…
   1. Decision Table: A typical decision table has the state of the system with input data and possible outcome.
   2. State Transition Table: State transition table contains the change of the state of the system during a given time, by given set of input data. For example “Button Presses” event in the computer system starts the “Computer” and changes the state of the computer system from “Stop” to “Started” state.

The black box testing is often referred to as validation testing because tester validates the input and out of the software system.

Following are some types of testing which are considered as part of Black Box testing…

1. User Acceptance Testing – User acceptance testing is the part of system acceptance testing. It is a type of testing usually customer performs on the given system. They input some data according to their requirement and validates if the output from system is matching their possible outcome. Most of the time user has a series of input and output in a sheet of paper or excel and validates the new system. Sometimes they validate the new system parallel to the old system.
2. Beta Testing – Most of the software development organisation develops the software as a package and distributes it among users. Users are generally end user who downloads the software packages on their system and reports possible bugs or unexpected behaviour. The advantage of this testing is the number of users who trying the new system are more and their experience. It gives advantage over dedicated software tester as sometimes they miss test cases due to time constraint or because they get used to the system. There are other advantages of using Beta Testings are…
   1. The volumes of the users are more. So more head counts ensures the good testing of the system especially if it is related to the load testing.
   2. Most of the users do negative testing. It ensures the system is capable of handling unexpected behaviour.
   3. The cost factor is another advantage of using beta testing. Beta testing users use the software free so the development organisation doesn’t have to pay for using the system.
3. System Testing – The system testing is another kind of black box testing where the system is tested as a whole. For example in user acceptance testing user might be concentrated on a particular module of the system, however system testing ensures that all other modules and components are working to-gather and functioning as expected. Output from one module could be input to other, so it is necessary to determine if the system is working as expected. Most of the time system testing is performed by group of special users with the help of system testers to determine the outcome by integrating system components to-gather and evaluate their outcomes.

Some of the advantages and disadvantages of the black box testing…

**Advantages:**

1. The test cases are independent of the actual software system. So as soon as the software requirement specification is development the test cases to test the functionality can be built. Apart from that usually test cases are developed by independent testers so it is ideal to test system against independently written test cases
2. Writing test cases doesn’t need software knowledge. So it is often easy to hire people for functional testing
3. The black box testing can identify the hidden gaps in software specification requirement. In software engineering sometimes minute details are ignored but if proper test cases are written these gaps can be exposed early and implemented during development phase.

**Disadvantages:**

1. Test cases in black box testing are often based on software specification document. So success of test cases depends on the clarity of the document. So sometimes it is very hard to determine of the test cases written are truly evaluating the system
2. Black box test cases are often written by non-technical testers. Sometime these test cases ignore internal functionality which is often critical.

2- White Box Testing – White box testing as the name suggested is type of testing where the components of the systems are visible to the tester i.e. at the time of testing the tester knows the internal architecture of the system, its classes, modules and code base. The main reason to test white box testing is to verify the internal mechanism of the system.

White box testing is also attributed as verification of the system. During verification the tester verifies if the system is meeting the requirement of the end user i.e. the system is performing exactly as it was specified in the system specification document.

The disadvantage of white box testing is dependency on the programmer/developer to test the system. It ignores some test cases which can be carried out at the time of development. However adding black box testing on top of white Box testing completes the requirement for proper test cases and execution. Also unit tests are often technically written in programming language. Something this complexity hides validity from independent testers hence bug persist in the system till it goes into Black box testing.

The tools used for white box testing are…

1. Debugging tools – Every programming language development environment contains some debugging tool where programmer can execute different test cases and find out possible outcome.
2. Baseline method – Baseline method determines the path to be used for traversing each branch.
3. Control Flow testing – The control flow testing determines the program executing path from one statement to another. It determines the outcome of the every possible conditional statement such as IF ELSE, FOR LOOP etc.

White Box Testing is often comprises of following components

1. Path Test – Path test determines the programming path or software executing path
2. Structure Test – Structure of the program determines the building blocks and components of the system and how they are interconnected.
3. Logic Test – Logic test determines if the outcome of the system during debugging is providing proper output.

Following are types of testing which are considered as white box testing…

Unit Test – Unit tests are testing of the software module developed by the original developer. Developer ensures that the given set of code or module functioning the way it should be. In a true scenario a developer gets the test cases from tester and writes unit tests for software system. A unit test can be a separate project which determines the validity of the software or it can be few methods written in the same module.

Unit tests are often contains IF-ELSE statement which checks and verifies all business cases of the software.

Advantages and disadvantages of White Box testing…

**Advantage**

The main advantage of the white box testing is that code is visible to the developer/programmer so it is obvious for the developer to write test cases to test all control and program structure

**Disadvantage**

1. Most of the times at the time of development test cases are ignored due to complex nature of development. When the test cases are development it is too late which results buggy code for client or testing team (which might have been tackled at the time of development)
2. Writing test cases for White Box testing requires knowledge of the software specification. Sometimes development team ignores sticking with requirement and results produces buggy code.

Following are some of the tests which are categorised as both Black Box and White Box testing…

Regression Test – Regression test determines the testing of the system after changes are introduced in the system. Changes in the system influence, Black Box testing i.e. functional testing, load testing etc. as well as unit testing from the developer.

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