

# Study and Analysis of different Testing Techniques for Web Application

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## ABSTRACT

Web applications are now become indistinguishable parts of the global information infrastructure in context of real life application. In this view web application testing requires more attention to discover requirement specification, design, and coding related bugs and errors in their programs. It is used to make sure the application correctness, completeness, browser compatibility, usability, performance, security and quality of web application against a given software specification. It shows all mistakes, errors and flaws in the application under development or developed applications. There are many techniques for application testing, but effective testing of complex web based product is essentially a process of investigation, not just a matter of creating test cases and test application against them. It is herculean task to find out all the flaws or errors in the program. This basic problem in application testing thus throws an open question, as to what would be the approaches should apply for testing. Further work introduces about the web application and its nature and types, testing techniques for web based applications and their effectiveness and comparative study.

## Keywords

Web Applications, White Box, Black Box, Gray Box

## 1. INTRODUCTION

Web Applications are continuously becoming more interactive, important and also popular for developing electronic transaction oriented system. Most organization goes for developing web based software wherever possible in their business process, because the accessibility of these applications are worldwide and helps in catering to huge number of target users. In current scenario the web applications are very powerful and having capability to provide information to large number of users across the globe by using less expensive infrastructure. So it is very challenging and tactful task to test web application's functionality with more and more features.

Web Application testing is analysis carried out to collect information about the quality of the product or application under test [1]. Any activity, which estimates the functionality, capability and correctness of outcome of any program, application or system to fulfill the pre-specified requirements, belongs to testing process of application. The purpose of testing not only for finding the defects or bugs in an application but also to fix it for ensuring the quality of product and the mission of testing is to minimize the risk of application's faults and failures. It access, track and report product quality parameters of current product and get it record for future purpose. Testing is a trade-off among total cost of development, quality of product and total time, for delivery of the product. It's not only covers error detection but it also

covers verification and validation, functionality testing, load and performance testing [2] etc.

## 2. TESTING TECHNIQUES FOR WEB APPLICATIONS

Some Traditional testing techniques as given below are used for software testing, can also apply for web application testing.

### 2.1 White Box Testing

White-box testing [3] is testing that takes into account the internal mechanism of a system or component. It also known as glass box, structural, clear box and open box testing, static analysis. This testing approach needs explicit knowledge of the internal working of the application modules being tested for the selection of test data. It require specific knowledge of programming code to examine output of web application and the test is accurate only if the tester knows what the application is supposed to do. In that view, tester can see deviations of program towards its intended goal. White box testing which is also known as glass box, because it pinpoints the exact line (or lines) of code, which may cause of weakness or flaw might be rectified, and it can be use for data flow testing ,control flow testing, path testing and branch testing [5].

### 2.2 Black Box Testing

The black-box [3] approach is a testing method in which test data are derived from the specified functional requirements without regard to the final program structure. [6] It also known as dynamic analysis of software. In case of Web application, black box testing analyzes code as it is running to identify vulnerabilities that an attacker could find when the application is running on real world data. Because such kinds of tools take an external view of application, they are able to test whether the weakness can be exploited or identify, the types of weakness therefore tester can validate exploitability manually.

### 2.3 Gray Box Testing

Gray Box testing [5] is a combination of White and Black box testing to uncover the flaws that not discoverable by using either one. It is a hybrid testing approach that could provide better views of application testing than black box testing. Gray box tester has awareness of design document and medium level of software granularity, so they can prepare and form better test cases and test plans. Nevertheless, this testing approach provides testers with only partial knowledge of different application functionalities. In this kind of testing the tester must have good understanding of internal data structures and major algorithm of application under test, for the purpose of designing test cases.

### 3. NATURE OF WEB APPLICATIONS AND TESTING APPROACHES

Web application is an application that hosts over web server and can access over the network such as internet or intranet with the help of web browsers. There are major two types of web applications. First one is Presentation-Oriented web application [7] that produces interactive web pages containing various types of Markup and Scripting languages (HTML, XML, java script, DHTML, VBScript and so on) and Dynamic contents in response of any requests. Second one is Service-Oriented web application [7] implements the functionality of a web based services in the form of RMI [8] and Web services [8] etc. Presentation-oriented applications are often access the functionalities of Service-Oriented web applications.

In today's scenario web applications become indistinguishable parts of the global information infrastructure and provides authenticated information with high degree of reliability. Testing process of application needs more than 50% efforts and cost of application development [9]. Usually Following tests might be conducted on web application with specified reasons [10].

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**Functionality Testing [10]:** It checks the links in web pages, database connection, working of web forms for posting the data or gathering information from the user, and Cookies testing.

**Usability testing [10]:** It tests the Navigations (How easily the user surf the websites), content relevancy, other information related to user help (like Site Map, Help file, search option) etc.

**Interface testing [10]:** It tests all interaction between web server and application server and web server to database server for proper response.

**Compatibility testing [10]:** It basically focuses on browser compatibility, Operating system compatibility, mobile & tablet browsing and Printing options.

**Performance testing [9]:** It basically focuses on Web Load Testing with variable number of users and Web Stress Testing and the system recovery from any failure.

**Security testing [9]:** It basically focuses on observing the system behavior on suspicious inputs (To restricts SQL injections), accessing internal pages without login, CAPTCHA for automates scripts logins, SSL for security majors etc.

First four testing (mentioned above) refer black box testing approach and rest two refer Gray box testing approach. Apart from traditional approach, some other approaches of testing are available which basically apply for testing of web applications as mentioned below.

**Ricca and Tonella's approach:-** Ricca and Tonella's approach[11][12] generates a directed graph of web application in which vertices represent web objects like web

pages, forms, frame ,edges represent navigations and interactions between vertices and flow of control represent the direction of edges . It is a white box testing which use a path expression to generate test requirement and test cases The limitation of this system is the cost of find the inputs which used for system testing and finding input data is manual.

**Session based Testing techniques:-**User Session Based[12] [13] Technique record the user request as requested URL (Uniform Recourse Locator) by the end user and active session objects. Then it retrieves the session values corresponding to each live session variables and applies some heuristic and conventional methodology to generate test cases and apply these test cases to the application to find out discrepancy between expected and actual results. This testing is a Gray box testing which has medium software granularity.

**Multi-Approach Testing Methodology [14]:-**Generally the web application follows multilayer and n-tier architecture to increase the performance of the system. An application can have an user interface tier/ layer that provides interaction between web browser (client) to web server and also use for presentation of information responded by the user . Another layer /tier can hold the Business logic of the application; third can hold the data access layer/tier which provides the service for storing and retrieving the data form database server and forth layer/tier that can use to contain web services or Remote methods invocation interfaces or LINQ proxy classes etc. In such kind of application a tester can use multiple approaches for different tiers as per example Data access layer use for handles the stored procedures, function, triggers, cursors etc. and it is very crucial for any web application so here use can use white box testing for unit level and Gray box testing for integration level.

### 4. EFFECTIVENESS OF TESTING TECHNIQUES

White box tester needs to write test cases that ensure the complete coverage of the program logic. For this tester should know the complete application data structure, web navigation map and complete knowledge of program logic, i.e. he should know the specification and the code to be tested, good Knowledge of programming languages and logic.

Black Box Tester can be non-technical and used to verify contradictions in actual system and the specifications and he design test cases as soon as the functional specifications are complete. Black box testing tools are primarily record and playback tools. These tools are used for regression testing that to ensure whether new version of application has created any bug in earlier working application functionality. These tools records test cases in the form of some scripts such as TSL, Visual Basic Script, Java Script, and Perl.

Gray Box Testers are not required to know programming languages or methods for well testing of large code segment web application or software, which makes this testing mostly fair and non- intrusive. In this technique access to program code is not necessary which provides clearly defined roles for users and developers during testing. Table-1 has the comparative analysis of testing techniques mostly used by the testers.

**Table 1: Comparison among three forms of Testing Techniques [15] [16]**

S. No.	Black Box Testing	Gray Box Testing	White Box Testing
1.	Analyses primary aspects only i.e. not any idea of internal working of application.	Partial knowledge of internal working of application.	Complete knowledge of internal working application.
2.	Software granularity is low	Software granularity is medium	Software granularity is high
3.	Performed by end users and also by tester and developers	Performed by end users and also by tester and developers	It is performed by developers and testers
4.	Testing is based on external exceptions and internal behaviour of the program is ignored	Test design is based on high level database design, dataflow diagrams, internal states of objects or variables, more knowledge of algorithm and software architecture	Internal logics are fully known
5.	It is least exhaustive and time consuming	Its exhaustiveness and time consumption is somewhere in between of black box testing and white box testing	Potentially most exhaustive and time consuming
6.	It can test only by hit and trail method	Data domains and boundary value analysis can be tested and over flow, if known	Test better: data domains and flow of control and data form one module to another.
7.	Not suited for internal logic testing.	Not suited for internal logic testing.	Suited for internal logic testing.

Above mention techniques have their own disadvantage or shortfalls which make the technique less effective for web applications testing like; it is not possible for white box testing to cover each and every path of the loops in program. This means exhaustive testing is impossible for large system by using white box testing. In black box testing, writing of all possible test cases is difficult and slow, due to difficulty of identify all possible inputs in limited testing time, In this case there may a possibility of having unidentified or untested paths remain during this testing technique. In Gray box testing, testers have limited knowledge of the internal logic, so it has limited involved path coverage of application and also designing of test cases are very difficult. That is why; it is not considered an efficient testing method. In the near future new inventions will take place and use of new techniques, for more effective automated testing tools and frameworks to test more sophisticated web based applications.

## 5. CONCLUSION

Software testing defines as a process to ensure the quality, component design, correctness and capability of an application to determine, that it meet its required specification. There are so many approaches available for application testing, but more effective testing of complex n-layer/tier web based product is not done by using a single technique that is why, software testing professionals should make a combination of more than one or two techniques to uncover all possible bugs or errors. To carry out web application testing in efficient and effective manner, this paper talks about testing approaches, describe some major web application testing techniques and compared three main traditional application testing techniques.

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