Software Testing Techniques and Open Source Automation Testing Tools

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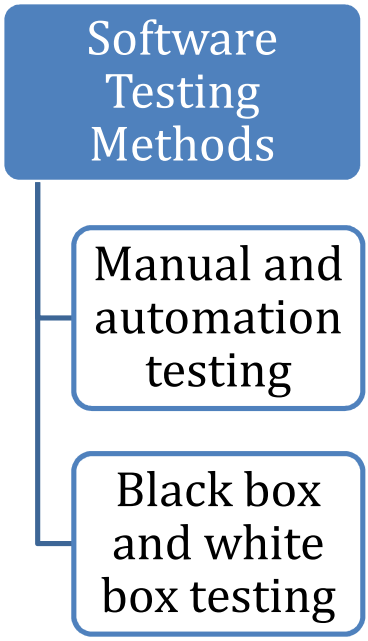
I. Introduction

In the past few years, software testing has been tested as one of the most well-known parts in software development fields. Software testing is defined as an action to check the actual result that matches the expected result and to confirm that the software system is error free. Software testing is also used to test software for other software positioning factors such as reliability, usability, efficiency, flexibility, integrity, security, capability, maintenance, compatibility, and more. Software testing is the process of finding errors and correcting these errors using software testing techniques. The software uses important features such as test validation and validation. Software testing method can be useful for software testing. Methods are: manual testing, automation testing, black box testing and white box testing.

II. Methods of software testing :

Software testing is quite large topic that has many types, levels and techniques of testing software. Some methods are :

a) Manual and automation testing
b) Black box and white box testing



a) Manual and Automation Testing:

- **Manual Testing:** Manual testing is that the procedure of testing the software system by hand i.e. except victimization any software system tool.
- **Automation Testing**: It's additionally known as check automation. During this procedure the tester produce a script and uses different software system tools to testing the software system.

The distinction of manual and automation testing are often given within the following table I :

Table : I

Sr No.	**Manual Testing**	**Automation Testing**
1)	Manual testing is that the procedure that is finished by hand or human.	Automation testing may be a procedure that is finished by tools.
2)	The manual testing may be a state testing unless this testing we tend to can't begin automation testing.	Automation testing may be a continuous a part of manual testing.
3)	In manual testing the tester are allowable to try to do random testing to search out errors.	In automation checking we tend to invariably test through running scripts.

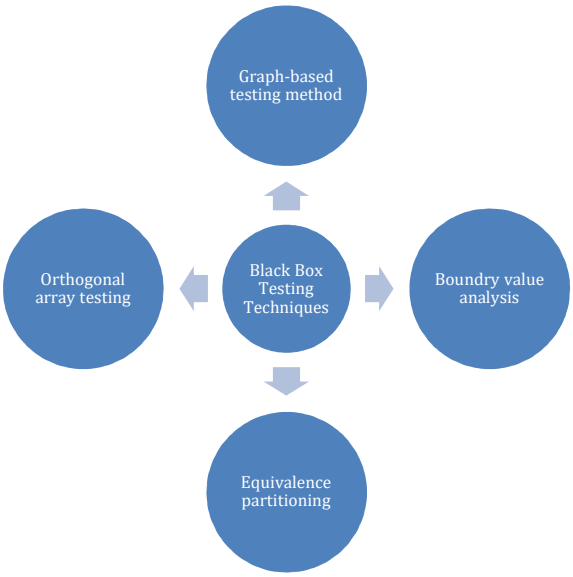
4)	Manual testing would be run one by one.	Automation testing is finished on completely different machines at a similar time.
5)	It is not costly or pricey.	It is more costlier or pricey.

b) Black box and white box testing :

Depending on the sources of information collected for the testing, there are two large methods of testing:

- **Black box testing:** Black box testing also known as Behavioral testing, functional testing. In black box testing procedure of software is tested for its functionality and not for the knowledge of internal structure of software. It focuses on functional requirements of the software.
  It is focuses on **"what system do?"** .
  Following are the objectives of black box testing:
  1) Find out incorrect or missing functions.
  2) To locate interface errors (I/O screens).
  3) To identify errors in DS and eternal databases.
  4) To identify behaviour or performance error.
  5) To find out initialization and termination errors.

Black box testing uses different techniques:



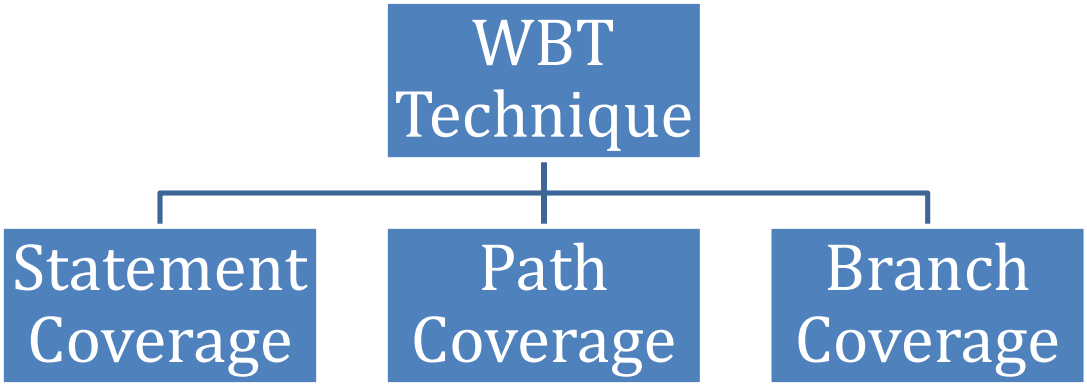
- **White box testing :** White box testing is known as structural testing, testing in small. It is also known as glass box testing because it requires knowledge of internal details of software.
  White box testing requires :
  i) CFG : It stands for Control Flow Graph. It will explain the order of execution and identify in how many ways execution goes on.

ii) DFG : It stands for Data Flow Graph. It focuses on the flow of input and output data between various process modules of software.

Objectives of white box testing :

1. To increase security.
2. To increase performance and reliability of software.
3. Test the flow of input/output over the application.
4. Better design and reduce of use.

Types of white box testing techniques are shown in fig. :



III. A strategic approach to software testing :

A strategy is the planning of a given model and the series of steps that result in successfully building of software. It also check quality and approaches for the further process. A testing also gives a new approach for the building of software and which is the successful approach towards all the testing processes.

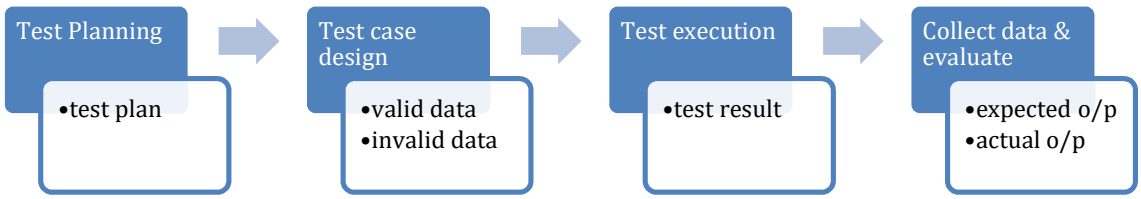
The testing strategy integrates :

i) Test planning

ii) Test case design

iii) Test execution

iv) Data collection and evaluation



- **Characteristics of testing strategy :**

1. Perform quick technical reviews at the end of every action and remove errors at first stage.
2. Start testing at component level i.e. unit testing and then forward for system testing.
3. Perform different types of testing techniques at different points of SDLC.
4. Testing is conducted by developer in case of small project but in case of large project , testing team must be invited.
5. Testing and debugging are two different activities i.e.
    a. Testing - find out errors
    b. Debugging - remove errors
    But these two activities are closely interrelated so debugging must be included in the plan.

The testing strategy mainly contain :

a. **Verification :** Verification refers to the set of activities to ensure that software implements correct function.
b. **Validation :** Validation refers to the set of activities to ensure that the software is working according to customers requirement.
The given table can be shows the difference between verification and validation :

Sr no.	**Verification**	**Validation**
1)	Verification is done from developers point of view.	Validation is done for customers points of view.
2)	Verification is focus on “What is the problem?”.	Validation is focuses on “How to resolve the problem? ”.
3)	Verification is performed on	Validation is performed on final

	project documents like SRS, project plan, software design, source code, user manual.	product i.e. to be installed at customers site.
4)	Verification focus on quality attributes of software.	Validation simply focus on customer requirements.

IV. Automation testing tools :

We have a combined variety of testing tools are provided in the market. These testing tools support in parts of testing like automation and manual testing, regression, load, functional, performance, stress and unit testing, web mobile and desktop testing.

Some software testing tools are licensed based and some are open-source. We are focus on open source testing tools which are freely available to testing the software.

Top open source automation testing tools are :

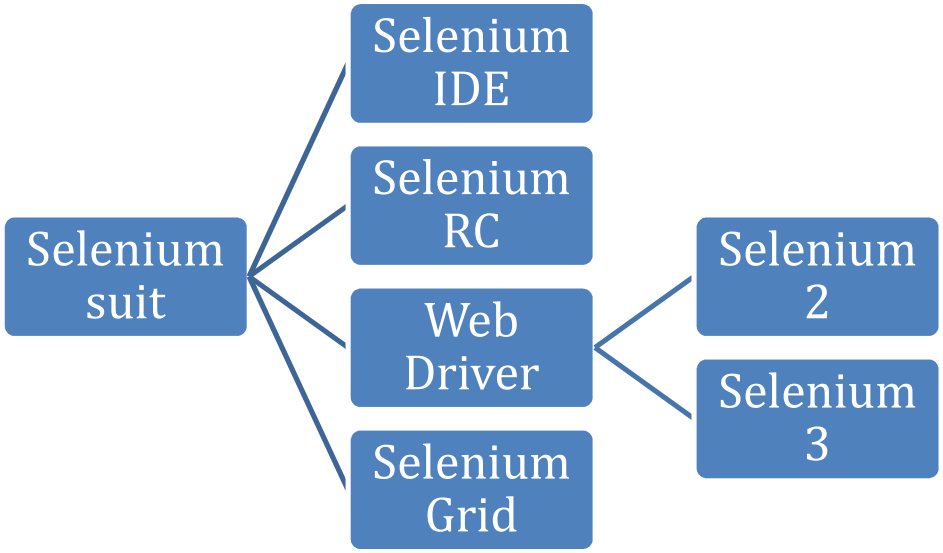
- Selenium
- Cucumber
- Watir
- Appium
- Apache JMeter
- SoapUI
- TestNG
- Robotium

1) **Selenium :** Selenium is a free or open source automation testing tool used for web automation beyond multiple browsers and platforms. Selenium was developed by Jason Huggins in 2004. Selenium is very close to HP Quick Test Pro(QTP currently UTF) one that selenium are focuses on automation web based applications. Selenium is not only single tool but it suite of software, each tool provide to various testing needs. Selenium tool is flexible and maintainable.

   It has four components:

   a. Selenium Integrated Development Environment (IDE)
   b. Selenium Remote Control (RC)
   c. WebDriver
   d. Selenium Grid

This fig shown the selenium RC and WebDriver can merged and create a selenium2.



2) Cucumber : Cucumber is an open source tool which is based on using Behavioural Driven Development. Cucumber was developed by Aslak Hellesoy, Joseph Wilk, Matt Wynne, Gregory Hnatiuk, Mike Sassak in 25July,2009. Cucumber software was originally written in the Ruby programming language. Cucumber supports run automated acceptance tests.

- It is useful to include business stakeholders who can't read code easily.
- It focuses on end-user experience.
- Fast and easy set up and execution.
- Effective tool for testing.
- Code can be reused in the tests.

3) Watir : Watir is standard form for **W**eb **A**pplication **T**esting **I**n **R**uby. Watir is a powerful open source tool for web automation testing founded on a family of Ruby libraries. Watir is also said as WATER. Watir was developed by Bret Pettichard and Paul Rogers in September 30,2012.

- Watir can support data-driven testing.
- Tests are easy to read and maintained.
- Watir software is an extremely lightweight.
- Watir software can support cross browser testing.
- Scalable over a group of various API's.

4) Appium : Appium is an open source tool to test a mobile applications. Appium was developed by Dan Cuellar in 2011 within the name "iOSAuto", written in C# programming language. The application we are building it should not be recompiling

or modifying as it is in any way or it can ordered to test that application. This software doesn't allow to lock your application in specific language or the framework to run the test.

- Appium set up process is easy.
- Appium software is on the basis of client and server architecture.
- Appium is prompt simulators(iOS) and emulators(Android).
- It is maintain native, hybrid and mobile web applications and desktop apps.

5) Apache JMeter : Apache JMeter is an open source java desktop application which was first developed by Stefano Mazzocchi in December 1998, designed to load test, functional, behaviour and measure performance. Apache JMeter initially is utilise for web application testing or FTP application. Currently it is utilised for a functional test, database server test etc.

- It has a capacity to load and performance test several different applications/ severs /protocol types: web, SOAP, FTP, LDAP, TCP, mail protocols, shell scripts, java objects.
- Apache JMeter is across-platform operating system.
- Combination over libraries for Maven, Graddle, and Jenkins.
- Functions might be applied to supply dynamic input to a test or supply data manipulation.

6) SoapUI : SoapUI is an open source cross-platform API testing tool released in October 2005. SoapUI is doesn't used for user interface testing. It is just apply for WebAPI or WebService testing. SoapUI provide/enables testers to perform automated functional, regression, compliance, and load tests on various WebAPI. SoapUI helps all the standard protocols and technologies to test all kind of API's. SoapUI interface is easy that allows both technical and non-technical users to use seamlessly.

- It helps drag-drop feature which speeds up the script development.
- It helps to debugging of tests and enables testers to develop data driven test.
- Provides end-to-end system performance monitoring.

7) TestNG : TestNG stands for Test Next Generation. TestNG is an open source testing framework that approved by Junit and Nunit with several new features along with create a more powerful tool?. It helps mostly all kind of testing like unit testing, functional testing, integration testing, data driven testing, end-to-end testing etc. Some of its features like:

- Annotations
- Big thread pool
- Flexible test configuration
- Support for parameters
- Different tools
- Plug-ins.

8) Robotium : Robotium is open source test automation framework made to facilitate the task of writing powerful and solid automatic black-box UI tests for Android. The Robotium was developed by Renas Reda in January 5,2014. In

Robotium, developers are allowed to write function, system and user acceptance testing scenarios wrapping several android activities.

- It allowed to tests both native and hybrid android apps.
- It can be faster test case execution.
- Runs several android activities automatically.
- Minimum time needed to write solid test cases.

Conclusion:

- **Comparative table of open source automation testing tools :**

Sr no	Tools	Java	Groovy	PHP	Python	Ruby	C#	Android	Launch	Use of testing	O.S.	License
1)	Selenium	yes	no	yes	yes	yes	yes	no	2004	load	cross-platform	Apache license 2.0
2)	cucumber	no	yes	yes	yes	yes	no	no	25 july, 2009	acceptance	cross-platform	MIT license
3)	watir	no	no	no	no	yes	no	no	Sep 30, 2019	functional	cross-platform	MIT license
4)	Appium	yes	no	yes	yes	yes	yes	yes	2012	Mobile application	cross-platform	Apache2 license

5)	Apache JMeter	yes	no	yes	no	no	no	no	Dec, 1998	Load, functional, regression	Windows, linux, MAC	Apache license 2.0
6)	SoapUI	yes	yes	no	no	no	no	no	Oct 2005	Functional, regression	Windows, linux, MAC	EUPL
7)	TestNG	yes	no	no	no	no	no	no	April27, 2004	Framework	Windows, linux, MAC	Apache 2.0
8)	Robotium	yes	no	no	no	no	no	yes	Jan5, 2014	UI & system	Android	Apache license 2.0

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