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Selenium Tool: A Web based Automation Testing Framework

Ms. Rigzin Angmo, Mrs. Monika Sharma

Department of Information technology

University Institute of Engineering Technology, Panjab University,

Chandigarh (U.T.)

INDIA

Abstract: The commercialization of I.T. sector and opportunity of new technologies, in web based system undergo frequent and rapid changes. The classical way of testing web application was based on protocol level, in which the tester created an HTTP request and then send it to the web site which was under test, further response was analyzed. So to do manually testing in most of the cases was time consuming, expensive as well as hectic job. To save time, money and also for the better business purpose an auto testing is required. But sometime there may be a problem arising to do automation testing due to improper use of testing framework. So a proper testing framework is to be chosen for a better result. In this paper we will discuss about selenium. Selenium is an open source automation testing tool and is a type of software testing framework for web application. It is one of the best tools for automation testing and provides testers with different framework for different test cases. It also uses different platform and framework according to the programming language used by the developers

Keywords: software testing, testing framework, Selenium, selenium RC, Selenium IDE, grid, WebDriver.

I. Introduction

Framework in general means something real or based on a conceptual structure that is used to provide a support or guide line for the building of something that expands the structure into something useful^[12]. In computer language, a framework is a layered structure indicating what kind of programs can or should be built and how they would interrelate to one another. A framework may be for a set of functions within a system that interrelate the layers of an operating system and the layers of an application subsystem as well as how communication should be standardized at some level of a network. Some frameworks in computer system also include programming interfaces ,programs, or can also offer programming tools for using the frameworks. A framework is more comprehensive than a protocol and more prescriptive than a structure.

Today everything is web based thus it is becoming more and more complex. For this huge information platform and quick release cycle as well as quick regeneration is required. This requires the web application to be comprehensive, expansibility and efficiency. For this some framework also includes automation tools. In this paper we will discuss about the Selenium automation testing tool that is used in framework for better results. As we know sometimes there may be a problem arising to choose proper framework for automation testing. Selenium is a set of tools working with many Operating Systems, browsers, programming languages and different testing frameworks, each with different approach in support of automation test for testing web based application.

II. Basics of Selenium

Selenium Framework provides a standardized way of writing Selenium tests. Selenium Automation Framework increases automation efficiency by reducing initial coding effort. It is a scriptless framework used for automation testing of web applications that is developed in many programming languages like java, .NET, Php etc. The framework provides a platform to execute data driven framework by spreadsheet template. It can be used in the current automation project. Whenever needed Selenium framework helps enterprises speed up testing at the test design layer using accelerators while keeping the automation suite flexible to in

Table 1.1: Illustrate Features of selenium Automation framework^[15]

Features of selenium Automation framework	
1.	It is a user-friendly interface for creating and executing test suites
2.	It is robust, flexible and extensible framework
3.	It supports test automation on diverse sets of web applications across domains
4.	Programmatic generation o functional test cases and test suites
5.	Integration for dynamic and flexible grouping of test suites
6.	Schedulers for test execution and test report mailing

7.	The framework permits users to perform acceptance, compatibility and functional testing for most web applications
8.	Automated HTML report generation and emailing of the same to all stake holders
9.	Detailed test execution results with consolidated summary and error snapshots
10.	Supports concurrent-related bugs detection

III. Evolution of web automation testing framework

The test automation is not at all new but the automation testing has been around the day one of the computing industry. In 40's Programmers used to test the software was not the testers and testing was often not distinguished from debugging as well^[10]. Throughout the sixties; papers regarding testing, such as the proceedings of the IFIPS conferences^[11], almost assumed that programmers tested the software they built. As larger and more complex systems arose, the idea of software testers came into trend. The first conference on testing software was organized in 1972 at Chapel Hill where the proceedings of the conference presented that the discipline of testing is distinct from programming. The automation of technology allows us to share information limitlessly. Several researchers used the web automation testing framework in their research work. The researchers also enhanced some of tool for better performance and results. These tools are applied independently as well as combined to solve the challenges in software testing. Here, we discuss work done on web automation testing with the use of automation testing framework.

Wang et al. [1] introduced a new automation framework integrated by selenium and Jmeter. This automation framework shares the test steps and test data which is convenient to switching in various types of testing for web application. With use of this software framework one can efficiently improve the extensibility and reusability of automation test as well as product quality. The paper also describes how to design web based test automation in details. The design of new framework supports multiple browser and operating System.

Wong et al. [2] presents an approach to mining an executable specification from given Selenium IDE test suite. There approach evaluate by number of test suits for real world system. There work also demonstrates integration of the two opposite processes of model mining and model based test generation in one framework.

Wang et al. [3] presents a useful auto testing framework based on Selenium and FitNesse. This testing Framework contains strength of both Selenium and FitNesse. In this paper framework uses selenium API to get page value, Dbfit to get database and FitNesse to manage the test fixture. By doing this it will reduce the number of lines of code to test and error rate as well as save money. So the framework improves coding productivity and quality of final product.

Bruns et al. [4] describes an automation regression testing for web applications that uses the selenium testing framework. The author and his colleague also provide many useful testing hints for practioners. In this paper author describes selenium tools by which developers can easily run acceptance test in their browsers.

Razak et al. [5] presents how selenium tool will accelerate the test execution process and cut the cost of the whole test execution process. In this paper, author emphasize that the test as earlier as possible which leads to cut the cost and focus on integration. From the evolution of automation testing tools from code based to data driven framework understood that the less development cost and effective maintains of test automation becomes.

Wang et al. [6] proposed a usage model and workload to simulate user's behaviors and help to generate realistic load for load testing of web application respectively. They implement an eclipsed based tool known as "Load testing Automation Framework" for load testing of web applications. The tool is based on the above two models. There is some limitation also in their models.

Castro et al. [7] presents an extension of selenium RC tool which checks data in database by testing web applications. A new function is implemented in selenium framework core for verification process. The proposed tool was evaluated applying on Nokia Institute of Technology. The obtained result is then compared.

IV. Types of SeleniumTools

Selenium is not a single tool but it is a suite to automate web browsers across many platforms that comprise of 4 tools: selenium IDE, selenium RC, selenium WebDriver, selenium grid^[15]. Selenium is a portable an open source automated testing suite for web applications supporting different browser and application. Selenium runs in many browsers and operating systems and it can be controlled by many programming languages and testing frameworks. Further in this paper we will discuss about these suites of selenium framework.

Selenium IDE

Selenium is an integrated development environment to develop Selenium test cases. It is a Firefox Plug-in that allow you to record, edit, and debug the selenium test cases. Selenium IDE includes the entire Selenium Core and allowing you to easily and quickly record and play back tests in the actual environment that they will run in. In figure 1.1 we can see the selenium IDE.

Selenium IDE is not only a recording tool but it is a complete IDE. Selenium has the feature like recording capability, or can edit scripts by hand. Selenium IDE is the ideal environment for creating Selenium tests with auto complete support and the ability to move commands around quickly, no matter what style of tests you prefer.

Table 1.2: Features of selenium IDE

S.No.	Features of selenium IDE
1.	Easy record and playback
2.	Intelligent field selection will use names, IDs, XPath as needed
3.	all common Selenium commands auto completed
4.	Walk through tests is there
5.	Can Debug and also we can set breakpoints
6.	It saves tests as HTML, Ruby scripts, JavaScript etc format
7.	It supports .js user-extensions file
8.	It has option to automatically assert the title of every page
9.	Through plug-in selenium IDE is easy customizable

Selenium RC

Selenium Remote Control is a test tool that allows you to write automated web application. Selenium RC is also known as Selenium 1.0. Selenium RC is part of a suite of selenium tools. Before the WebDriver, Selenium RC was the main Selenium project which is brought up by merging selenium1.0 with WeDdriver. The selenium WebDriver is also called as selenium 2.0. Selenium 2.0 is the newest and more powerful tool. But Selenium 1 is still actively supported and provides some features that may not be available in Selenium 2 for a while. It support for several languages like Java, JavaScript, Ruby, PHP, Python, Perl and C# and also support for almost every browser.

Selenium RC has two parts:

1. It has a server that automatically launches and executes browsers. Selenium RC acts as a HTTP proxy for web requests.
2. It has client libraries for several computer language that user want to use.

Table1.3: Illustrate the Features of Selenium RC

S.No.	Features of Selenium RC
1	It was a flagship testing framework of the whole selenium project.
2.	It allowed the user to use programming language they prefer.
3.	Can support data driven testing
4.	can run tests automatically as many times as you want
5.	Can readily support new browsers.
6.	Have matured and complete API
7.	Faster execution speed than IDE.
8.	Cross browser and cross platform

Table1.4: illustrates Limitations of selenium RC

S.No.	Limitations of selenium RC
1.	Switching between the multiple instances of the same browser is not possible
2.	Switching between the multiple instances of the different browsers is not possible
3.	Browser navigation, like back and forward button emulations is not possible
4.	Limited features in terms of drag and drop of objects
5.	To work with Ajax based UI elements there are very limited features are there with Selenium RC

Selenium webdriver is used to overcome above limitation of selenium RC.

C . Selenium Webdriver

Selenium WebDriver is also known as selenium 2.0. Selenium 2.0 is a new feature which builds by integration of selenium1.0 and WebDriver API. WebDriver is designed to remove some the limitations in the Selenium RC API. WebDriver provide a simpler, more concise programming interface. Selenium-WebDriver better support dynamic web pages where elements of a page may vary without the page itself being reloaded. WebDriver's purpose is to deliver a well-designed object-oriented API that provides enhanced support for modern advanced

web-app testing problems. Selenium-WebDriver direct speaks to the browser by using each browser's native support for automation.

Selenium 1.0 + WebDriver = Selenium 2.0

Table1.5: illustrate Features of Selenium WebDriver

S.No.	Feature
1.	Selenium WebDriver is a web based automation framework that allows you to execute your tests against different browsers.
2.	It also allow you to use a programming language of your choice for creating test scripts
3.	Selenium WebDriver's architecture is more simpler than Selenium RC's architecture.
4.	It is faster than Selenium RC as it directly calls the browser by using the browser's own engine to control it.
5.	Selenium WebDriver's API is simpler than Selenium RC's. It doesn't include unnecessary and puzzling commands.
6.	It can support the headless HtmlUnit browser.

Table1.6: Illustrates Limitations of selenium webdriver

S.No.	Limitations of selenium webdriver
1.	Selenium WebDriver Cannot Readily Support New Browsers because it operates on the OS level and also we know that different browsers communicate differently with the Operating System.
2.	Selenium WebDriver has no built-in command that automatically generates a Test Results File.

D. Selenium Grid

Selenium grid uses hub and node concept to execute selenium test in parallel that saves the time required. Selenium-Grid enables you run your tests on different machines against different browsers in parallel at same time. That means it runs multiple tests at the same time against different machines running different browsers and operating systems. Basically, Selenium-Grid support distributed test execution. It allows you to run your tests in a *distributed test execution* environment. There are two versions in selenium grid. The older version is selenium grid 1.0 and newest version is selenium grid 2.0.

Table1.7: Grid 1.0 vs. Grid 2.0

S.No.	Grid 1.0	Grid 2.0
1.	Selenium Grid 1.0 has its own remote control that is different from the Selenium RC server. They are two different programs.	Selenium Grid 2.0 is collection of Selenium Server jar file.
2.	It needs to install and configure Apache Ant first before using Grid.	No need to install Apache Ant in Grid 2.
3.	It Can only support Selenium RC commands and scripts.	It Can support both Selenium RC and WebDriver scripts.
4.	It can only automate one browser per remote control.	In this one remote control can automate up to 5 browsers.

Table 1.8: Illustrates Features of selenium Grid

S.No.	Features of selenium Grid
1.	It can be extended by distributing tests on several machines i.e. parallel execution can be done.
2.	It manages multiple environments from a central point and make test to run easily against a huge combination of browsers as well as Operating System.
3.	It reduces the maintenance time for the grid by allowing you to implement regular hooks to influence virtual infrastructure for instance.

Table1.9: Illustrates limitations of Selenium Grid

S.No.	Limitations of selenium grid
1.	It has selenium at its core. So all limitations which applies for Selenium is also applies for grid too.
2.	Selenium grid by itself cannot run multiple tests in parallel, the framework like TestNG or JUnit are used to provide multiple tests to the grid

VI.Conclusion

In this paper we have discuss about selenium framework. Selenium is a web based automation framework which uses different platform and framework according to the programming language that is used by programmer. Selenium is a set of different tools and all have different features which are useful for developer. Selenium IDE

is use for record and playback as well as for those developers who are new in developing side can also use easily for their work. For developers who are good in programming language can use selenium RC or WebDriver. To run selenium tests parallel one can use selenium grid. Therefore for overall review it is clear that whether in automatic or manual testing choosing a proper framework is very important. By choosing proper framework one can save time as well as money and can improve software quality.

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