

## Software Testing and Quality Assurance

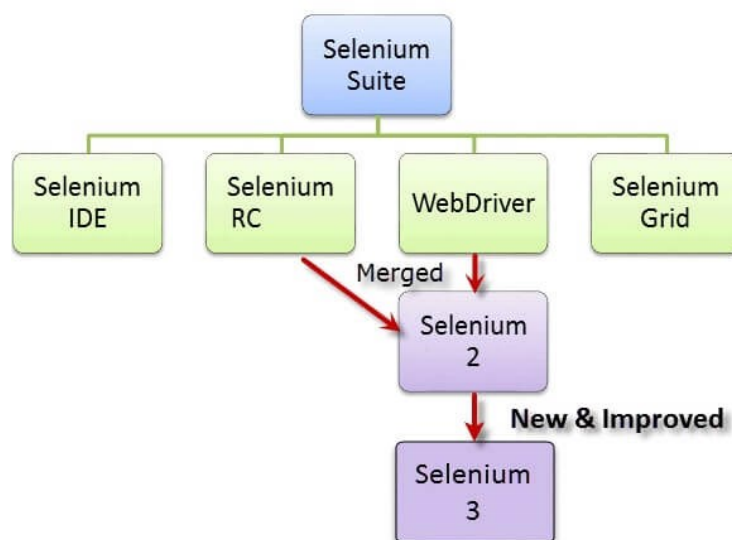
### Assignment 4

#### Unit 4: Selenium Tool

1. With the help of neat diagram Describe a brief history of the selenium tool. Explain in details selenium tool suite, what are the different Selenium components.

##### History of Selenium

- Currently, Selenium 3.0 Web is in use comprising of Selenium IDE, Selenium WebDriver, and Selenium Grid.
- Selenium 3.0 Web is a suite of tools. Selenium was created by Jason Huggins in 2004 as an internal tool of Thoughtworks.
- Later, Paul Hammant joined the team at ThoughtWorks and started the second mode of development i.e. Selenium RC.
- Later in 2008 Philippe Hanrigou developed Selenium Grid, which provides a hub allowing the running of multiple Selenium tests parallelly thus reducing the execution time of test scripts.
- The first version of Selenium which was launched in the market was Selenium 1.0. It was a suite of tools comprising of Selenium IDE, Selenium RC, and Selenium Grid.



##### Selenium Grid

Selenium Grid is a tool used for parallel execution of selenium scripts. For example, if we have a single machine and to this single machine, we can connect multiple machines with

multiple operating systems so that we can run our test cases parallel across different machines which saves our time.

### ***Selenium IDE***

Selenium IDE is a tool which basically runs only on Chrome and Firefox browsers. It generates no reports and cannot execute multiple test cases. For example, if we have 5000 test cases then IDE cannot work, it is not a robust tool to execute multiple test cases. It cannot generate logs.

### ***Selenium RC***

Selenium RC, which is deprecated now in present market can write dynamic scripts which could work on multiple browsers. In Selenium RC, we had to learn a programming language like Python, C#, Ruby, Java to execute Selenium RC. It can generate Reports and logs.

### ***Selenium WebDriver***

As time progressed the selenium guys came up with WebDriver 2.0 in 2011. It is not a migration from RC to WebDriver, it was an entirely different tool than RC, where each has its own commands.

The entire Selenium Tool Suite is comprised of four components:

- Selenium IDE, a Firefox add-on that you can only use in creating relatively simple test cases and test suites.
- Selenium Remote Control, also known as Selenium 1, which is the first Selenium tool that allowed users to use programming languages in creating complex tests.
- WebDriver, the newer breakthrough that allows your test scripts to communicate directly to the browser, thereby controlling it from the OS level.
- Selenium Grid is also a tool that is used with Selenium RC to execute parallel tests across different browsers and operating systems.

Selenium RC and WebDriver was merged to form Selenium 2.

Selenium is more advantageous than QTP in terms of costs and flexibility. It also allows you to run tests in parallel, unlike in QTP where you are only allowed to run tests sequentially.

## ***2. What is Selenium? List features provided by a Selenium IDE.***

Selenium is a free (open source) automated testing framework used to validate web applications across different browsers and platforms. You can use multiple programming languages like Java, C#, Python etc to create Selenium Test Scripts. Testing done using the Selenium tool is usually referred to as Selenium Testing.

Selenium Software is not just a single tool but a suite of software, each piece catering to different testing needs of an organization.

Selenium Integrated Development Environment (IDE) is the simplest framework in the Selenium suite. It is a browser plugin to record and playback the operations performed on the browser. Selenium IDE plugins are available for Chrome and Firefox browsers. It does not support the programming features. Selenese is the language which is used to write test scripts in Selenium IDE.

### **Features of Selenium IDE**

- Very use to use and install
- Has built-in test results reporting module
- No programming experience is required
- It is used to create and execute Test cases using Firefox or Chrome browsers
- The user can easily record the Test scripts
- The user can edit the Test scripts
- The user can create Test Suites.

## ***3. Describe selenium Web Driver architecture with the help of neat diagram.***

Selenium WebDriver is a browser automation framework that accepts commands and sends them to a browser. It is implemented through a browser-specific driver. It controls the browser by directly communicating with it. Also, Selenium Webdriver API helps in communication between languages and browsers. Selenium WebDriver and API supports Java, C#, PHP, Python, Perl, Ruby.

There are four components of Selenium Architecture:

1. Selenium Client Library
2. JSON Wire Protocol over HTTP
3. Browser Drivers
4. Browsers

**Selenium Client Libraries/Language Bindings:**

Selenium supports multiple libraries such as Java, Ruby, Python, etc., Selenium Developers have developed language bindings to allow Selenium to support multiple languages. Check out Selenium Libraries in the official site.

**JSON WIRE PROTOCOL Over HTTP Client:**

JSON stands for JavaScript Object Notation. It is used to transfer data between a server and a client on the web. JSON Wire Protocol is a REST API that transfers the information between HTTP servers. Each WebDriver (such as FirefoxDriver, ChromeDriver etc.,) has its own HTTP server.

**Browser Drivers:**

Each browser contains separate browser driver. Browser drivers communicate with respective browser without revealing the internal logic of browser's functionality. When a browser driver is received any command then that command will be executed on the respective browser and the response will go back in the form of HTTP response.

**Browsers:**

Selenium supports multiple browsers such as Firefox, Chrome, IE, Safari etc.

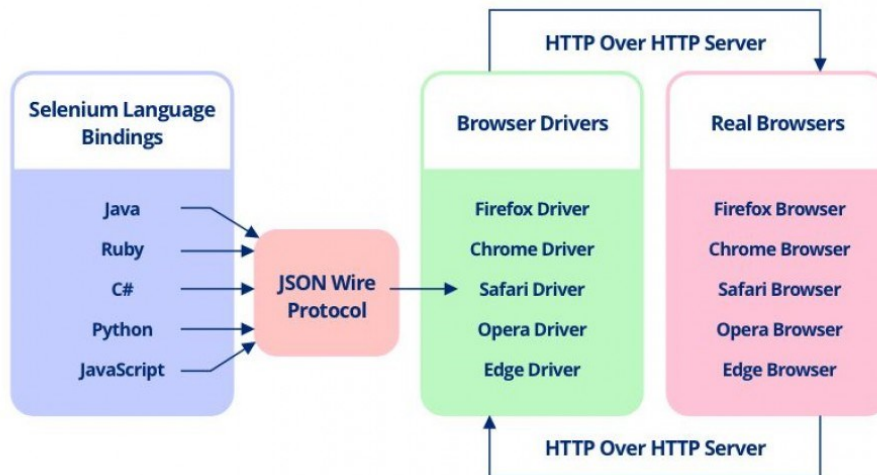
Once the script is executed, every statement in your script will be converted as a URL with the help of JSON Wire Protocol over HTTP. The URL's will be passed to the Browser Drivers. (In the above code, we took FirefoxDriver). Here in our case the client library (java) will convert the statements of the script to JSON format and communicates with the FirefoxDriver.

Every Browser Driver uses a HTTP server to receive HTTP requests. Once the URL reaches the Browser Driver, then the Browser Driver will pass that request to the real browser over HTTP. Then the commands in your selenium script will be executed on the browser.

If the request is POST request, then there will be an action on browser

If the request is a GET request then the corresponding response will be generated at the browser end and it will be sent over HTTP to the browser driver and the Browser Driver over JSON Wire Protocol and sends it to the UI (Eclipse IDE).

## Selenium WebDriver Architecture



### 4. What is selenium Grid? What is the purpose of selenium Grid?

The Selenium Grid is a testing tool which allows us to run our tests on different machines against different browsers. It is a part of the Selenium Suite which specialise in running multiple tests across different browsers, operating system, and machines.

There are two main elements to Selenium Grid — a hub, and nodes.

#### Hub

The hub is a computer which is the central point where we can load our tests into. Hub also acts as a server because of which it acts as a central point to control the network of Test machines. The Selenium Grid has only one hub and it is the master of the network. When a test with given Desired Capabilities is given to Hub, the Hub searches for the node which matches the given configuration. There should be only one hub in a Grid.

#### Node

A node is referred to a Test Machine which opts to connect with the Hub. This test machine will be used by Hub to run tests on. A Grid network can have multiple nodes. A node is supposed to have different platforms i.e. different operating system and browsers. The node does not need the same platform for running as that of hub.

#### How it Works

First you need to create a hub. Then you can connect (or “register”) nodes to that hub. Nodes are where your tests will run, and the hub is responsible for making sure your tests

end up on the right one (e.g., the machine with the operating system and browser you specified in your test).

With Selenium Grid you can create a simple infrastructure of various browsers on different operating systems to not only distribute test load, but also give you a diversity of browsers to work with. The Selenium Grid is used because of many reasons:

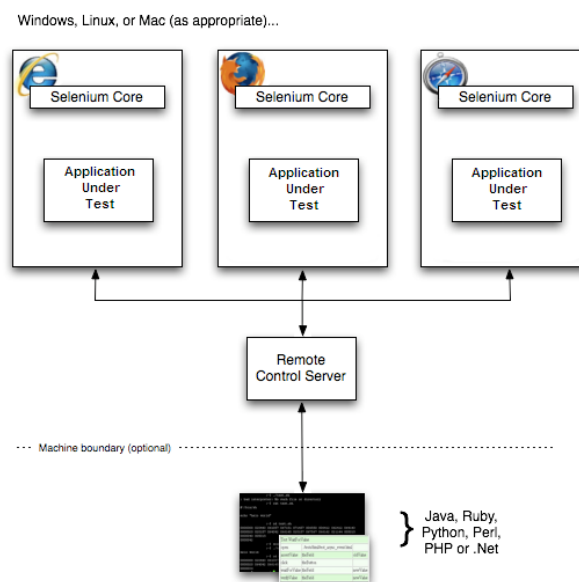
- When we want to run our tests against multiple browsers, the multiple versions of browsers and the browsers running on different operating system.
- It is also used to reduce the time taken by the test suite to complete a test pass by running tests in parallel.

## 5. What is Selenium RC? Explain its features.

Selenium RC is an important component in the Selenium test suite. It is a testing framework that enables a QA or a developer to write test cases in any programming language to automate UI tests for web applications against any HTTP website.

Selenium RC comprises of two parts:

- Client libraries for the preferred computer language
- A server that launches and kills browsers automatically



**Selenium RC architecture**

The following operations are performed behind the scenes when a test script is executed in Selenium RC:

- The RC server injects a JavaScript program known as Selenium Core into the browser

- Once the Selenium Core program is injected, it starts receiving instructions from the RC server based on test scripts
- Selenium Core executes all these instructions as JavaScript commands
- The web browser executes all the commands given by Selenium Core and returns the test summary back to the server

## 6. *What are the limitations of Selenium?*

- Selenium cannot extend support to the Windows applications; it only works on the web-based applications.
- Selenium is not capable of performing mobile automation on its own.
- Selenium does not have any inbuilt reporting feature.
- Selenium is not accurate while dealing with handling dynamic web elements.
- Selenium has challenges handling frames and pop ups.
- Selenium has enormous timeout, sync, and page load issues.
- Selenium does not automate captcha.
- Selenium does not automate barcodes.
- Selenium depends on third party frameworks like TestNG, Cucumber for the reporting.
- Selenium is open source, so in case of issues there is no prompt vendor assistance.
- Selenium users need to be aware of some programming languages.
- Selenium users do not find it easy to set up a test environment compared to the licensed tools like UFT.
- Selenium does not provide support for test management tasks like the tool like HP ALM.
- Selenium cannot perform testing for the images.
- Selenium users need a subsequent amount of time for test case authoring.
- The new features introduced in Selenium may not work as expected as always.
- Selenium does not support automation testing of video and audio.
- Selenium does not give provision of running parallel tests from one computer.
- Selenium does not automate test cases on fingerprints.

## 7. *List automation tools for software testing. Describe QTP in detail.*

The following are the Automation Testing tools

1. LambdaTest
2. TestComplete
3. QMetry Automation Studio

4. TestProject
5. Katalon Studio
6. Testsigma
7. Qualibrate
8. Worksoft
9. ZeuZ Test Automation Framework
10. 21 – Connecting Testing and Production Autonomously
11. Testimony
12. Selenium
13. Subject7
14. Appium
15. Micro Focus UFT
16. Test Studio
17. Ranorex
18. IBM Rational Functional Tester

### **HP QTP**

HP **QuickTest Professional (QTP)**, an automated functional testing tool that helps testers to perform automated regression testing to identify any gaps, errors/defects in contrary to the actual/desired results of the application under test. It was designed by Mercury Interactive and later acquired by HP and now MicroFocus.

- It is an icon-based tool that automates the regression and Functional Testing of an application
- Both technical, as well as a non-technical tester, can use Micro Focus QTP
- It provides both features- Record as well as Playback
- We can test Desktop as well as the Web-based applications
- It allows Business Process Testing (BPT)
- QTP Testing is based on scripting language VB script
- Micro Focus's UFT uses VBScript to automate applications
- It supports the largest pool of software development environments like SAP, Oracle etc...
- QTP tool helps the testers to perform an automated functional testing uninterrupted.

### **8. What are selenium test design considerations?**

1. Flexibility in testing  
Manual testing comes with the inherent benefit of offering testers full control and flexibility of how to execute single tests. Testing manually allows fast, ad hoc testing and is crucial for signing off new features during a sprint.
2. Regression testing  
Manual regression testing is incredibly time-consuming and comes with a range of issues
3. Scalability  
Manual testing can only be scaled with more people and hours being allocated to the given



project. More test cases require more hands, which does not scale well.

4. The human touch in DevOps  
DevOps is all about streamlining the release pipeline, and automation plays a key role in this. Test automation, specifically, is completely in line with DevOps principles.
5. Processes and ownership  
When you apply automation to the DevOps pipeline, make sure that testers still have – and feel they have – a say in how the pipeline is defined. Testers are accountable for product quality and they should decide how often builds are pushed to test environments, when automated test should run, and how test results are distributed and formatted.
6. Tooling  
Introducing an automation tool comes with the risk that a long learning curve or technical challenges take up too much time and require a lot of support between team members. This takes away time and focus from testers' primary tasks (building test cases, analyzing requirements, reporting, etc.).
7. Change management  
Introducing agile processes and DevOps is a big change for organizations, and management must equip their teams to being able to handle this transformation.
8. Skills  
The essence of testing is to guard and improve the quality of an application through a series of tasks: Test case definition, requirement analysis, test execution, regression testing, result reporting etc. All these disciplines are still relevant and required when test automation is introduced.
9. Domain knowledge  
A deep understanding of an application never goes out of fashion! As mentioned above, the concept of knowing a software well is often confused with having to know the code the software is made of.