SELENIUM

Automated Testing Tool

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HISTORY

- Developed in 2004 by Jason Huggins as a JavaScript library used to automate his manual testing routines
- Selenium Core is born whose functionality underlies the Selenium RC (Remote Control) and Selenium IDE tools
- The Limitation of having a JavaScript based automation engine and browser security restricted Selenium to specific functionality
- Google, who has been a long time user of Selenium, had a developer named Simon Stewart who developed WebDriver. This tool circumvented Selenium's JavaScript sandbox to allow it to communicate with the Browser and Operating System directly using native methods
- In 2008, Selenium and WebDriver merged technologies and intellectual intelligence to provide the best possible test automation framework

INTRODUCTION

- Selenium is a suite of testing automation tools used for Web-Base applications: Selenium IDE, Selenium RC, Selenium WebDriver and Selenium Grid
- These tools provide a rich set of testing functions specifically geared to varied testing scenarios of all types of Web applications
- The operations provided by these tools are highly flexible and afford many options for comparing UI elements to expected application behavior
- Selenium tests can be executed on multiple browser platforms

WHY USE/LEARN SELENIUM

Increases you marketability

Has a lot of Java planks

Growing Industry standard

Assist with the deployment of defective-free code

Open source, web-based testing automation tool and cross-browser compliant

Muti-language backend support (Java, Ruby, Python, C#, PHP, ect…)

SELENIUM TOOLS

- Selenium IDE
  - Rapid prototyping tool for building test scripts
  - Firefox plugin
  - Can be used by developers with little to no programming experience to write simple tests quickly and gain familiarity with the Selenese commands
  - Has a recording feature that records a user's live actions that can be exported in one of many programming languages
  - Does not provide iteration or conditional statements for test scripts
  - Can only run tests against FireFox
  - Developed tests can be run against other browsers, using a simple command-line interface that invokes the Selenium RC server
  - Can export WebDriver or Remote Control scripts (these scripts should be in PageObject structure)
  - Allows you the option to select a language for saving and displaying test cases

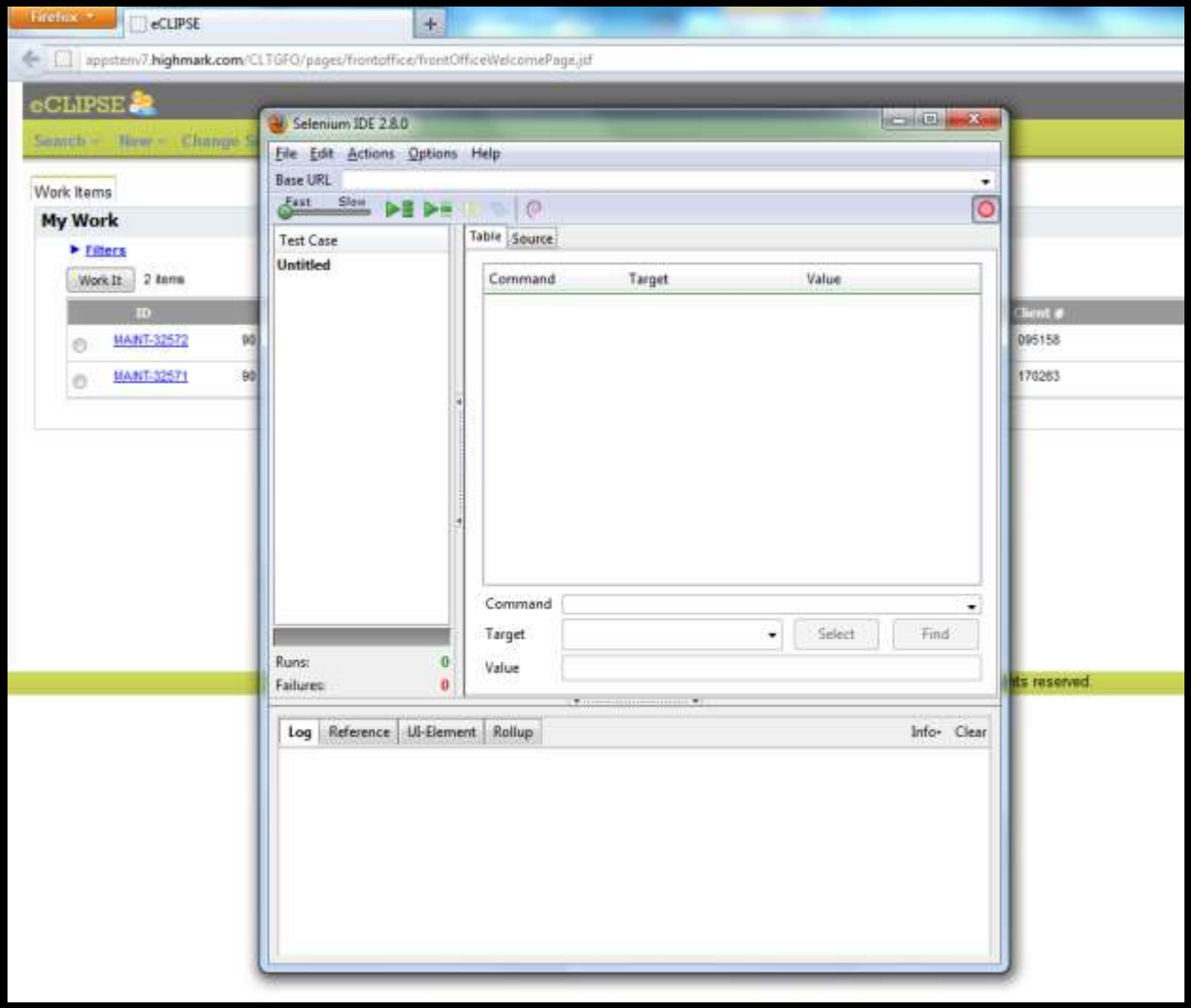
SELENIUM TOOLS

- Selenium RC aka Selenium 1
  - It 'inject' JavaScript functions into the browser when the browser is loaded and then uses its JavaScript to drive the AUT within the browser
  - Mainly supported in maintenance mode
  - Provides support for several programming languages
- Selenium WebDriver
  - Designed to provide a simpler, more concise programming interface in addition to addressing some limitations in the Selenium-RC API
  - Developed to better support dynamic web pages where elements of a page may change without the page itself being reloaded
  - Makes direct calls to the browser using each browser's native support for automation.
  - Has the Selenium 1 (aka Selenium RC) underlying technology for flexibility and Portability
  - *Migrating From Selenium RC to Selenium WebDriver*
  - Not tied to any particular test framework, so it can be used equally well in unit testing or from a plain old "main" method.

SELENIUM TOOLS

- Selenium Grid
  - Scales the Selenium RC solution for large test suites and test that must be run in multiple environments
  - Tests can be run in parallel with simultaneous execution (different tests on different remote machines)
  - It allows for running your tests in a *distributed test execution* environment
  - Used to run your tests against multiple browsers, multiple versions of browser, and browsers running on different operating systems
  - It reduces the time it takes for the test suite to complete a test pass

SELENIUM IDE



SELENIUM IDE

Selenese Commands

Action

Manipulate the state of the application

Used with "AndWait" (clickAndWait)

Accessors

Examines the application state and stores the results in variables

Used to auto generate Assertions

Assertions

Similar to Accessors but verifies the state of the application to what is expected

Modes: assert, verify and waitFor

SELENIUM IDE

Syntax

Has two parameters (both are not required)

Can view command requirements from the command reference tab

Parameters

Locators identify a UI Element on a page

Test Patterns are used for asserting or verifying

Selenium variable or Text Patterns that can be entered in input fields or drop down selections

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Selenese Command (continued)

AndWait

Tells Selenium to wait for the page to load after an action has been performed

Used when triggering navigation/page refresh (test will fail otherwise)

Command: clickAndWait

WaitFor

No set time period

Dynamically waits for the desired condition, checking every second

Commands: waitForElementPresent, waitForVisible, etc…

Echo

Used to display information progress notes that is displayed to the console during test execution

Informational notes can be used to provide context within your test results report

Used to print the contents of Selenium variables

SELENIUM IDE

Store Commands and Selenium Variables

Selenium variables can be used to store constants at the beginning of scripts and values passed to a test script from the command-line, another program or file

Store Command

Two parameters (text value and Selenium variable)

Uses ${} to access the value of a variable

Can be used in the first or second parameter or within a locator expression

Other Store Commands: storeElementPresent, storeText, storeEval, ect…

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JavaScript and Selenese Parameters

JavaScript uses script and non-script Selenese parameters

Parameters can be accessed via a JavaScript associative array "storedVars[]"

Script Parameters

Specified by assertEval, verifyEval, storeEval and waitForEval

A snippet of JavaScript code is placed into the appropriate field, normally the Target field (script parameters are usually the first or only parameter)

Non-Script Parameters

Uses JavaScript to generate values for elements with non-script parameters

JavaScript must be enclosed in curly braces and proceeded by the label "javascript"

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Commonly Used Selenium Commands

open

click/clickAndWait

verifyTitle/assertTitle

verifyTextPresent

verifyElementPresent

verifyText

verifyTable

waitForPageToLoad

waitForElementPresent

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Locators

By Identifier

Used by default

Locator type is "identifier"

First element with id attribute value matching the location will be used

First element with a name attribute matching the location will be used if there are no id matches

By ID

More limited than the "identifier" type

Locator type is "id"

Use this type when you know the element's id

By Name

Locates an element with a matching name attribute

Filters can be applied for elements with the same name attribute

Locator type is "name"

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X-Path

Used for locating nodes in an XML document

Elements can be located in regards to absolute terms or a relative position to an element that has a specified id or name attribute

Can locate elements via attributes other than id or name

Starts with "//"

By DOM

Can be accessed using Javascript

Locator type is "document"

By CSS

Uses the style binding of selectors to elements in a document as a locating strategy

Faster than X-Path and can find the most complicated objects in an intrinsic HTML document

Locator type is "css"

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Matching Patterns

Text Patterns

A parameter required by following Selenese commands: verifyText, verifyText, verifyTitle, verifyAlert, assertConfirmation, verifyPrompt, ect…

Globbing Patterns

Pattern matching based on wild card characters (*, [], -)

Uses the "glob:" label

Default pattern matching scheme

Regular Expressions

The most powerful pattern matching scheme

Prefixed with "regexp:" label

Exact Patterns

Uses no special characters, no need to escape characters

Prefixed with "exact:" label

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- Alerts, Pop-ups and Multiple Windows
- In Selenium, JavaScript alert and confirmation pop-ups will not appear, they are overridden at runtime by Selenium's own JavaScript
- Alert pop-ups, however, still have a presence and would need to be asserted with one of the various assertFoo functions (assertFoo(pattern), assertFooPresent(), assertFooNotPresent(), storeFoo(variable), storeFooPresent(variable), ect…
- Confirmation pop-ups select "Ok" by default and use assertConfirmation, assertConfirmationPresent, ect.. functions

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- Debugging and Start Points
- Set a debug start point by right-clicking a command and toggle “break point/start point”
- The Find button highlights the currently selected UI element on the displayed page. From the Table view, select any command that has a locator parameter and click the Find button
- To view portions of the Page Source, select the respective portion of the web page, right-click, select view selection source
- In recording a locator-type argument, Selenium IDE stores additional information that presents the user with alternative locator-type arguments

SELENIUM IDE

- User Extensions
- JavaScript files created for customizations and features to add additional functionality to Selenium IDE
- For Flow Control, install the goto_sel_ide.js extension

SELENIUM IDE

Java Test Script Example

```
public void testGoogleTestSearch() throws Exception
{
    selenium.open("http://www.google.com/webhp");
    assertEquals("Google", selenium.getTitle());
    selenium.type("q", "Selenium OpenQA");
    selenium.click("btnG");
    selenium.waitForPageToLoad("5000");
    assertEquals("Selenium OpenQA - Google Search",
    selenium.getTitle());
}
```

SELENIUM WEBDRIVER

Project Setup

Java

The easiest way is use Maven. Maven will download the java bindings (the Selenium 2.0 java client library) and all its dependencies, and will create the project for you, using a maven pom.xml (project configuration) file

You can then import the maven project into your preferred IDE, IntelliJ IDEA or Eclipse.

From a command-line, CD into the project directory and run maven as follows: mvn clean install

SELENIUM WEBDRIVER

- Commands and Operations
- **To fetch a page you would use the "get" command**
  - driver.get("http://www.google.com");
- **Locating UI Elements**
- Language bindings expose a "findElement" and "Find Elements" method
- The "Find" methods take a locator or query object called "By"
- WebElement element= driver.findElement(By.id("coolestWidgetEvah"));
- List<WebElement>cheeses = driver.findElements(By.className("cheese"));
- WebElement frame = driver.findElement(By.tagName("iframe"));
- WebElement cheese = driver.findElement(By.name("cheese"));
- WebElement cheese = driver.findElement(By.linkText("cheese"));
- WebElement cheese = driver.findElement(By.partialLinkText("cheese"));
- Web Element cheese = driver.findElement(By.cssSelector("#food.span.dairy.aged")) List<WebElement> inputs = driver.findElements(By.xpath("//input"));
- WebElement element = (WebElement) ((JavascriptExecutor)driver).executeScript("return $('.cheese')[0]");

- Input and Navigation
- Select select = new Select(driver.findElement(By.tagName("select"))); select.deselectAll(); select.selectByVisibleText("Edam");
- driver.findElement(By.id("submit")).click();
- driver.switchTo().window("windowName");
- for (String handle : driver.getWindowHandles()) { driver.switchTo().window(handle); }
- driver.switchTo().frame("frameName");
- Alert alert = driver.switchTo().alert();
- driver.navigate().to("http://www.example.com");
- driver.navigate().forward(); driver.navigate().back();

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Page Objects

OO Library that separates test code into a MVC pattern bringing OOP to test scripts

Language neutral pattern for representing a complete page or position of a page in an OO manner

Requires Language specific coding

Used for maintenance, script cascading, enhanced script readability/functionality

SELENIUM WEBDRIVER

Scripts and Page Objects

Scripts are more procedural while Page Objects are detail oriented

Locators appear once in all Page Objects of a page and do not cross Page Object boundaries

Uses Elements, Actions and Synchronization

Order of Operation

Locator

Element Implementation

Add Elements to Page Objects

Actions

SELENIUM WEBDRIVER

Do not create the Page Object all at once, build test incrementally

Scripts Should

Not contain any synchronization code

Not contain any Driver API calls (promotes changes to Selenium or other technology without changing the scripts)

Has asserts (determination of results)

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Driver Implementations

HtmlUnitDriver

The fastest and most lightweight implementation of WebDriver

HtmlUnit is a java based implementation of a WebBrowser without a GUI

For any language binding (other than java) the Selenium Server is required to use this driver

A pure Java solution and so it is platform independent

Supports JavaScript but emulates other browsers' JavaScript behaviour

FireFox Driver

Controls the Firefox browser using a Firefox plugin

Runs in a real browser and supports JavaScript

Faster than the Internet Explorer Driver but slower than HtmlUnitDriver

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Internet Explorer Driver

This driver is controlled by a .dll files and is thus only available on Windows OS

Each Selenium release has its core functionality tested against versions 6, 7 and 8 on XP, and 9 on Windows7

Runs in a real browser and supports JavaScript

XPath is not natively supported in most versions

CSS is not natively supported in versions 6 and 7

CSS selectors in IE 8 and 9 are native, but those browsers don't fully support CSS3

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Driver Implementation

Chrome Driver

Chrome Driver is maintained / supported by the Chromium Project

WebDriver works with Chrome through the chromedriver binary (found on the chromium project's download page)

Runs in a real browser and supports JavaScript

Because Chrome is a Webkit-based browser, the Chrome Driver may allow you to verify that your site works in Safari. Note that since Chrome uses its own V8 JavaScript engine rather than Safari's Nitro engine, JavaScript execution may differ

Slower than the HtmlUnit Driver

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Opera Driver

See the Opera Driver wiki article in the Selenium Wiki for information on using the Opera Driver

iOS Driver

See either the ios-driver or appium projects

Android Driver

See the Selendroid project

SELENIUM WEBDRIVER

Example Java Implementation

LoginPage.java

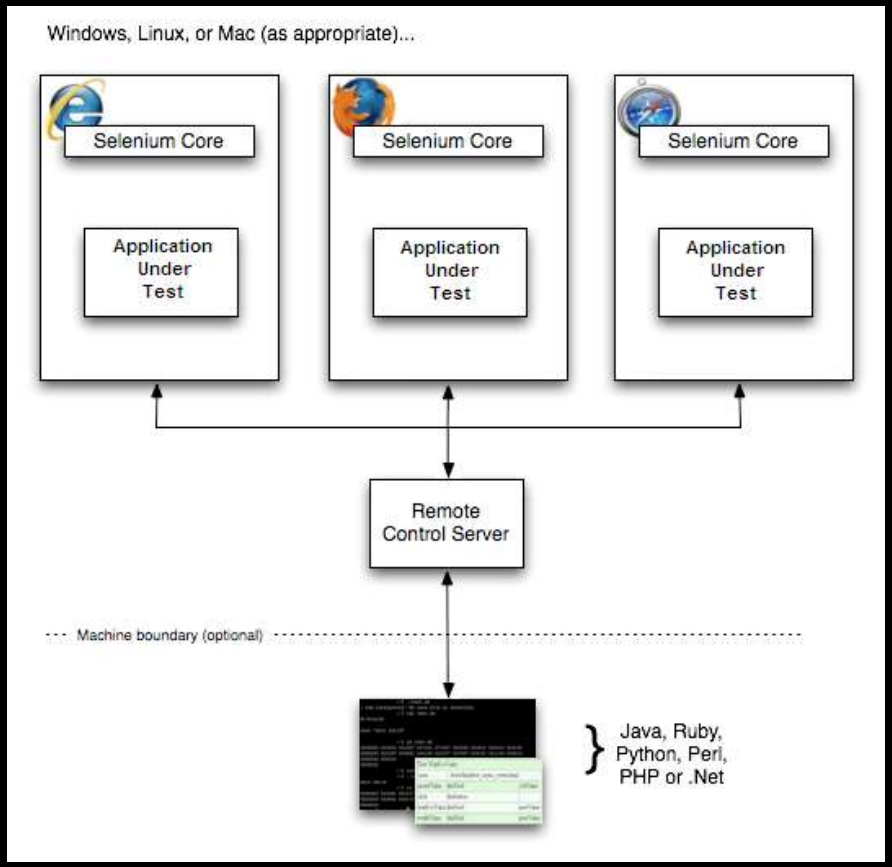
HomePage.java

LoginTest.java

SELENIUM RC

- In Selenium RC, the Selenium Server launches and kills browsers, interprets and runs the Selenese commands passed from the test program, and acts as an *HTTP proxy*, intercepting and verifying HTTP messages passed between the browser and the AUT
- Client libraries which provide the interface between each programming language and the Selenium RC Server.
- The primary task for using Selenium RC is to convert your Selenese into a programming language

SELENIUM RC


Windows, Linux, or Mac (as appropriate)...
Selenium Core
Application Under Test
Selenium Core
Application Under Test
Selenium Core
Application Under Test
Remote Control Server
Machine boundary (optional)
Java, Ruby, Python, Perl, PHP or .Net

SELENIUM RC

Sample Test Script

open	/	
type	q	selenium rc
clickAndWait	btnG	
assertTextPresent	Results * for selenium rc	

SELENIUM RC

```
/** Add JUnit framework to your classpath if not already there
    *  for this example to work
   */
package com.example.tests;

import com.thoughtworks.selenium.*;
import java.util.regex.Pattern;

public class NewTest extends SeleneseTestCase {
   public void setUp() throws Exception {
      setUp("http://www.google.com/", "*firefox");
   }
     public void testNew() throws Exception {
        selenium.open("/");
        selenium.type("q", "selenium rc");
        selenium.click("btnG");
        selenium.waitForPageToLoad("30000");
        assertTrue(selenium.isTextPresent("Results * for selenium rc"));
   }
}
```

SELENIUM RC

Learning the API

setUp("http://www.google.com/", "*firefox");

The Browser is manipulated by a Browser Instance that is assigned to a program variable

This program variable is then used to call methods from the browser

Selenese commands are then ran by calling the respective methods from the browser variable - selenium.type("field-id","string to type")

To utilize iteration and conditional logic, Selenium RC uses program language specific methods in conjunction with Selenese commands

Use the **getEval** method of selenium API to execute JavaScript from selenium RC

SELENIUM RC

- Server, Security and Browers Configurations
- Command line options can be used to change the default server behaviour.
- If your AUT is behind an HTTP proxy which requires authentication then you should configure http.proxyHost, http.proxyPort, http.proxyUser and http.proxyPassword
- You can run Selenese html files directly within the Selenium Server by passing the html file to the server's command line
- When launching selenium server the **-log** option can be used to record valuable debugging information reported by the Selenium Server to a text file
- When dealing with HTTPS in a Selenium RC test, there is a run mode that supports handling security pop-ups and processes the security certificate for you
- When a browser is not directly supported, you may still run your Selenium tests against a browser of your choice by using the "*custom" run-mode (i.e. in place of *firefox or *iexplore) when your test application starts the browser.

SELENIUM GRID

- A Grid consists of a single Hub, and one or more Nodes. Both are started using a selenium-server.jar executable.
- The Hub receives a test to be executed along with information on which browser and 'platform' (i.e. WINDOWS, LINUX, etc) where the test should be run.
- Since the Hub knows the configuration for each registered Node, it selects an available Node that has the requested browser-platform combination
- Selenium commands initiated by the test are sent to the Hub, which passes them to the Node assigned to that test
- The Node runs the browser, and executes the Selenium commands within that browser against the application under test

SELENIUM REFERENCES

PushToTest.com

SelenuiumHQ