

Test Automation & Advanced Selenium

Lesson 00:

People matter, results count.



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Document History

Date	Course Version No.	Software Version No.	Developer / SME	Change Record Remarks
27 Jan, 2016	1.0	NA	Ritika Verma – V&V Automation CoE	New contents created



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Course Goals and Non Goals

- Course Goals

- At the end of this program, participants gain an understanding of how to automate test cases using Selenium testing API of a web application.

- Course Non Goals

- This course does not cover the topics other than mentioned in course goals



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Pre-requisites

- Web Designing & Development Technologies like HTML5, CSS 3, JavaScript & XML
- Testing concepts
- Requirement Validation & Functional Decomposition
- Use case
- Defect Reporting
- Java 8 with JAXB
- Development Tools



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Intended Audience

- Test Engineers, Software Engineers and Senior Software Engineers.



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Day Wise Schedule

- Day 1 (Half Day)
 - Lesson 1: Introduction to Automation
 - Lesson 2: Introduction to Selenium
- Day 2
 - Lesson 3: Working With Selenium IDE
- Day 3
 - Lesson 3 (Contd.): Working With Selenium IDE
 - Lesson 4: Selenium 2.0 – Web Driver
- Day 4
 - Lesson 5: Testing Web Applications Using Web Driver API
- Day 5
 - Lesson 5 (Contd.): Testing Web Applications Using Web Driver API



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Day Wise Schedule

- Day 6
 - Lesson 5 (Contd.): Testing Web Applications Using Web Driver API
- Day 7
 - Lesson 5(Contd.): Testing Web Applications Using Web Driver API
- Day 8
 - Lesson 6 Web Driver Test with Xunit
- Day 9
 - Lesson 7 (Contd.): Selenium Web Driver – Advance
- Day 10
 - Lesson 7 (Contd.): Selenium Web Driver – Advance
- Day 11
 - Lesson 8: Selenium Frameworks



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 - 1.2. What is automation
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 - 2.2. What it is and what it is not
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 - 8.9. CI Tools (Jenkins etc)



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Next Step Courses (if applicable)

- NA



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Other Parallel Technology Areas

- NA



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Test Automation & Advanced Selenium

Lesson 1: Introduction to
Automation

Lesson Objectives

- Automation vs. Manual
- What is Automation
- What is Test Automation
- Why And When
- Example Of Test Automation



1.1: Introduction to Automation

Automation vs. Manual

MANUAL TESTING

AUTOMATED TESTING

- Testing is time consuming and tedious
- Delay the ability in thoroughly testing an application
- Critical bugs escape undetected
- What happens when multiple platforms involved

- Higher efficiency
- Higher product quality
- Easy to focus on all possible workflows
- Delivers: Reusability, Consistency and Productivity

Manual vs. Automated Testing

The graph shows two lines starting at approximately (1, 100) and (1, 250) respectively. The blue line (Manual Testing) rises steeply, reaching about 900 hours at release 13. The red line (Automated Testing) rises more gradually, reaching about 450 hours at release 13.

Release #	Manual Testing (Hours)	Automated Testing (Hours)
1	100	250
4	400	300
7	650	350
10	850	400
13	900	450

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1.1: Introduction To Automation

What is Automation

■ “The first rule of any technology used in a business is that automation applied to an efficient operation will magnify the efficiency. The second is automation applied to an inefficient operation will magnify the inefficiency.”

-Bill Gates

The diagram illustrates the core benefits of automation. At the center is a large circle labeled "Automation". Surrounding it are six smaller circles, each representing a benefit: "Speed" (top), "Reliability" (top-right), "Repeatability" (right), "Visibility" (bottom-right), "Metrics" (left), and "Roll-backs" (bottom-left). All components are interconnected by lines.

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Automation is the linking of disparate systems and software in such a way that they become self-acting or self-regulating.

1.1: Introduction To Automation

What is Test Automation

- The method which/that takes automation tool's support to execute the test cases is known as Automation Testing.
- It is a method which
 - uses automation tools to run tests that repeat predefined actions
 - matches the developed program's probable and real results
- If the project prospects and results align, your project is behaving as it should, and you are likely bug free. If the two don't align, still, there is a problem that requires to be addressed. You'll have to take a look at your code, alter it, and continue to run tests until the actual and expected outcomes align.

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Test Automation and its Benefits:

Why automate Testing?

In today's fast moving world, it is a challenge for any company to continuously maintain and improve the quality and efficiency of software systems development. In many software projects, testing is neglected because of time or cost constraints. This leads to a lack of product quality, followed by customer dissatisfaction and ultimately to increased overall quality costs.

The main reasons for these added costs are primarily:

- 1.poor test strategy
- 2.underestimated effort of test case generation
- 3.delay in testing
- 4.subsequent test maintenance

Test automation can improve the development process of a software product in many cases. The automation of tests is initially associated with increased effort, but the related benefits will quickly pay off.

Automated tests can run fast and frequently, which is cost-effective for software products with a long maintenance life. When testing in an agile environment, the ability to quickly react to ever-changing software systems and requirements is necessary. New test cases are generated continuously and can be added to existing automation in parallel to the development of the software itself. In both manual and automated testing environments test cases need to be modified for extended periods of time as the software project progresses. It is important to be aware that complete coverage of all tests using test automation is unrealistic. When deciding what tests to automate first, their value vs. the effort to create them needs to be considered. Test cases with high value and low effort should be automated first. Subsequently test cases with frequent use, changes, and past errors; as well as test cases with low to moderate effort in setting up the test environment and developing the automation project are best suited for automation.

Optimization of Speed, Efficiency, Quality and the Decrease of Costs:

The main goal in software development processes is a timely release. Automated tests run fast and frequently, due to reused modules within different tests. Automated regression tests which ensure the continuous system stability and functionality after changes to the software were made lead to shorter development cycles combined with better quality software and thus the benefits of automated testing quickly outgain the initial costs.

Advance a Tester's Motivation and Efficiency:

Manual testing can be mundane, error-prone and therefore become exasperating. Test automation alleviates testers' frustrations and allows the test execution without user interaction while guaranteeing repeatability and accuracy. Instead testers can now concentrate on more difficult test scenarios.

Increase of Test Coverage:

Sufficient test coverage of software projects is often achieved only with great effort. Frequent repetition of the same or similar test cases is laborious and time consuming to perform manually.

Some examples are:

Regression test after debugging or further development of software

Testing of software on different platforms or with different configurations

Data-driven testing (creation of tests using the same actions but with many different inputs)

Test automation allows performing different types of testing efficiently and effectively.

1.1: Introduction To Automation

Why & When

- Tests can run fast and frequently
 - Cost-effective for software products with a long maintenance life
- Useful in agile environment
 - Robust Test Automation Projects balanced for Value and Effort
- Optimization of Efficiency & Quality
 - Quick Return on investment (ROI) of Test Automation
- Advance a Tester's Motivation and Efficiency
 - More efficient Assignments of QA Tasks
- Increase of Test Coverage
 - Different types of testing to increase test coverage

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Add the notes here.

1.1: Introduction To Automation

Example of Test Automation

■ Test Sample for Invalid Data:

```
@Test
public void Add_User_With_Invalid_Data()
{
    /*Pre Conditions
     * 1. Check login
     * 2. Check logged in user has access to manage users
     * */

    /* Adding a user
     * 1. Navigate to Manage Users Grid
     * 2. Check for "Add Users" button, if exists,
     * 2.1 Click on Add user button in Manage users Grid
     * 3. Check for the Fields and Enter required fields if exists
     * 3. Click on Submit button
     * 4. Error message should be displayed.
     * 5. Compare for the Error message based on the input provided
     * */
}
```



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In Above example “Add Users With Valid Data”

To execute the test case, we need to login to the application. We also need to check if the user is already logged in or not. And the other we need to check is if the logged in person is having access to “Add Users” or Not. If the above Two Conditions are passed then we should execute the rest Else we should return the test as failed.

Summary

- In this lesson, you have learnt
 - Testing is an extremely creative & intellectually challenging task
 - Manual testing is performed by a human sitting in front of a computer carefully executing the test steps
 - Automation Testing means using an automation tool to execute your test case suite
 - Goal of Automation is to reduce number of test cases to be run manually and not eliminate manual testing all together.



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Review Question

Question 1

Why would you want to automate a test? Is it to:

- Increase test coverage?
- Improve quality?
- Save time for exploratory testing?
- Find more bugs?
- Replace manual testers?



Question 2: True/False

- Automation Testing uses automation tools to run tests that repeat predefined actions.

Question 3: Fill in the Blanks

- Automation Testing delivers _____, consistency and productivity.



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Test Automation & Advanced Selenium

Lesson 2: Introduction to
Selenium

Lesson Objectives

- Introduction to Selenium
- What it is and what it is not
- Landscape and Usage
 - Selenium IDE
 - Selenium Remote Control (Selenium 1.0)
 - Selenium Web Driver (Selenium 2.0)
 - Selenium Grid



2.1: Introduction to Selenium

Introduction to Selenium

- Invented by Jason R. Huggins
- Free (open source) automated testing suite for web applications across different browsers and platforms
- Selenium has a suite of tools which consists of the following:
 - Selenium IDE
 - Selenium Core
 - Selenium RC (Remote Control), Also known as Selenium 1
 - Selenium Web driver or Selenium 2
 - Selenium Grid
- Test cases in selenium can be written in many popular programming languages supported by selenium like Java, C#, Ruby, Python etc.

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2.1: Introduction To Selenium

Selenium: What it is?

- Selenium automates browsers. That's it!
- Selenium is a portable testing API for web applications.
- Web Application: Pure HTML & JavaScript (No Flash, ActiveX, Silverlight etc.)
- Primarily, it is for automating web applications for testing purposes, but is certainly not limited to just that.
- It is Open Source and Freeware.
- Supports multiple browsers & OS.
 - Browsers: Firefox, Chrome, IE, Safari, Opera, PhantomJS
 - OS: Windows, MAC, Linux, Android, iOS
- In process Headless execution.



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2.1: Introduction To Selenium

Selenium: What it is NOT?

- Selenium is NOT a Test Tool.
- It is NOT a Framework.
- It is NOT a installable software.
- It is NOT a Programming Language.



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2.1: Introduction To Selenium

Landscape and Usage

- Selenium is not just a single tool but a suite of software's, each catering to different testing needs of an organization. *It has four components:*

```
graph TD; SeleniumSuite[Selenium Suite] --> IDE[Selenium IDE]; SeleniumSuite --> RC[Selenium RC]; SeleniumSuite --> WebDriver[WebDriver]; SeleniumSuite --> Grid[Selenium Grid]; WebDriver -- Merged --> Selenium2[Selenium 2]; Grid -- Merged --> Selenium2;
```

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Add the notes here.

2.1: Introduction To Selenium

Overview of Selenium IDE

- Firefox plug in, allows you to record, play back, edit, and debug tests in browser.
- Allows you to record user actions on browser window.
- Generate scripts from recorded user actions in most of the popular languages like Java, C#, Perl, Ruby etc. However to run them in an automated testing fashion you need to use Selenium Web Driver.
- Selenium default scripts are html (added JavaScript) and that is the script we are going to use it in selenium IDE
- The reason for availability of other language is, user can get the scripts for Selenium WebDriver/RC.
- It also has a context menu (right-click) integrated with the Firefox browser, which allows the user to pick from a list of assertions and verifications for the selected location



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2.1: Introduction To Selenium

Selenium Remote Control (Selenium 1.0)

- Selenium Remote Control (RC) is a test tool that allows you to write automated web application UI tests in any programming language against any HTTP website using any mainstream JavaScript-enabled browser.
- Selenium RC comes in two parts:
 - A server which automatically launches and kills browsers, and acts as a HTTP proxy for web requests from them.
 - Client libraries for your favorite computer language.

```
graph TD; Client[Java, Ruby, Python, Perl, PHP or .Net] --> RCServer[Remote Control Server]; RCServer --> InternetExplorer[Internet Explorer Selenium Core]; RCServer --> Firefox[Firefox Selenium Core]; RCServer --> Safari[Safari Selenium Core];
```

The diagram illustrates the Selenium Remote Control architecture. At the bottom, a box labeled 'Java, Ruby, Python, Perl, PHP or .Net' contains a code editor icon, representing various programming languages. An arrow points from this box up to a 'Remote Control Server' box. From the 'Remote Control Server' box, three arrows point upwards to three separate boxes, each representing a different browser: 'Internet Explorer Selenium Core', 'Firefox Selenium Core', and 'Safari Selenium Core'. Each of these browser boxes contains its respective browser logo and the text 'Selenium Core' below it. A dashed line labeled 'Machine boundary (optional)' separates the client languages from the server and browser components.

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2.1: Introduction To Selenium

Selenium Web Driver (Selenium 2.0)

- Selenium WebDriver proves itself to be better than both Selenium IDE and Selenium RC in many aspects.
- It implements a more modern and stable approach in automating the browser's actions.
- WebDriver, unlike Selenium RC, does not rely on JavaScript for automation.
- It controls the browser by directly communicating to it.



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2.1: Introduction To Selenium Selenium Grid

- Runs multiple tests on different machines against different browsers and operating systems in parallel
- Supports distributed test execution.
- Run tests in a distributed test execution environment

The diagram illustrates the Selenium Grid architecture. At the bottom is a terminal window showing command-line interface. An arrow points upwards to a box labeled "Selenium Grid Server". From the "Selenium Grid Server" box, arrows point to three separate "Remote Control Server" boxes, each located between a "Machine boundary" line. The first "Remote Control Server" is connected to two browser instances on a "Windows" machine (Internet Explorer and Firefox). The second "Remote Control Server" is connected to a browser instance on a "Linux" machine (Firefox). The third "Remote Control Server" is connected to two browser instances on a "Mac" machine (Firefox and Safari). Each browser instance has a "Selenium Grid" label below it.

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Summary

- In this lesson, you have learnt
- Selenium is a free (open source) automated testing suite for web applications across different browsers and platforms
- **Selenium** is a collection of different tools
- **Selenium IDE**, a Firefox add-on that you can only use in creating relatively simple test cases and test suites
- **Selenium RC** allows users to use programming languages in creating complex tests
- **WebDriver**, allows test scripts to communicate directly to the browser, thereby controlling it from the OS level.
- **Selenium Grid** is used with Selenium RC to execute parallel tests across different browsers and operating systems.



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Add the notes here.

Review Question

Question 1

- Select the component which is NOT part of Selenium suite
 - Selenium IDE
 - Selenium RC
 - Selenium Grid
 - Selenium Web



Question 2: True/False

- Selenium is a set of tools that supports rapid development of test automation scripts for web based applications.

Question 3: Fill in the Blanks

- WebDriver, unlike Selenium RC, does not rely on _____ for automation.

Test Automation & Advanced Selenium

Lesson 3: Working With
Selenium IDE

Lesson Objectives

- Selenium IDE – An Introduction
- Installation of Selenium IDE
- Components of Selenium IDE
- Introduction to Selenium Commands – “Selenese”
- Understanding Element Locators in Selenium IDE
 - ID
 - Name
 - Link Text
 - CSS Selector
 - Tag and ID
 - Tag and class
 - Tag and attribute
 - Tag, class, and attribute
 - Inner text
 - DOM (Document Object Model)
 - getElementById
 - getElementsByName
 - dom:name
 - dom:index
 - Working with Alerts
 - Creating Test Script using Selenium IDE
 - Creating & Executing Test Suits
 - Exporting scripts to multiple languages and Formats



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3.1: Working With Selenium IDE

Selenium IDE – An Introduction

- Selenium provides a record/playback tool for authoring tests without learning a test scripting language (Selenium IDE).
- Selenium IDE, fully-featured Integrated Development Environment (IDE)
- Installs as a plugin in Mozilla Firefox
- Enables developers to test their web applications through Selenium
- Records user interactions with the web browser and play back to test for errors
- Effortless to install and easy to learn

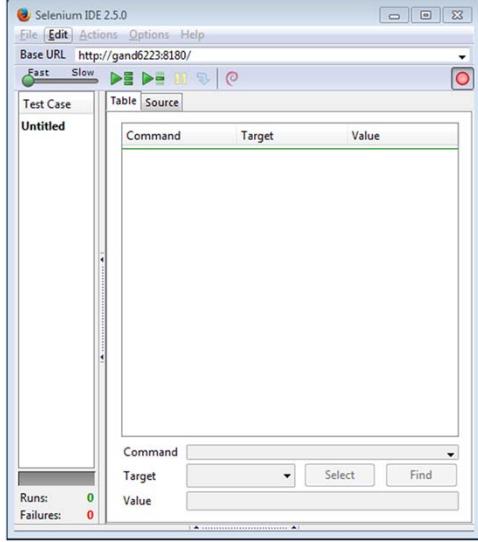


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3.1: Working With Selenium IDE

Installation of Selenium IDE

- Download Selenium IDE
- Copy Selenium IDE file to extensions folder of Mozilla Firefox.
- To facilitate opening of .xpi file for selenium you can drag and drop the .xpi file on the Mozilla browser to install it and get it in the add-ons of the browser



The screenshot shows the Selenium IDE 2.5.0 interface. The title bar says "Selenium IDE 2.5.0". The menu bar includes "File", "Edit", "Actions", "Options", and "Help". The base URL is set to "http://gand6223:8180/". The interface has two main panels: "Test Case" on the left and "Table" on the right. The "Test Case" panel shows an "Untitled" test case. The "Table" panel has columns for "Command", "Target", and "Value". At the bottom, there are fields for "Command", "Target", and "Value", along with buttons for "Select" and "Find". Statistics at the bottom show "Runs: 0" and "Failures: 0".

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3.1: Working With Selenium IDE

Components of Selenium IDE

The screenshot shows the Selenium IDE interface with several annotations:

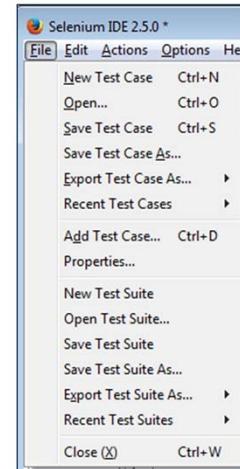
- Execution Commands**: Points to the toolbar buttons at the top of the main window.
- Record Test Actions**: Points to the red circular button in the toolbar.
- Try the test in the Web Based TestRunner**: Points to the "Find" button in the command input area.
- Specify commands, including Asserts**: Points to the "Value" input field and the generated Java code in the Log pane.
- Reference of currently selected command**: Points to the "Command" dropdown menu.

Below the interface, the Capgemini logo is visible, along with copyright information: Copyright © Capgemini 2015. All Rights Reserved. 5

3.1: Working With Selenium IDE Continued.

■ Menu Bar

- Positioned at the upper most of the Selenium IDE window
- File Menu
- Allows user to:
 - Create new test case, open existing test case, save the current test case
 - Export Test Case As option exports and converts only the currently opened Selenium IDE test case
 - Export Test Case As and Export Test Suite As in any of the associated programming language compatible with Selenium RC and WebDriver
 - Export Test Suite As option exports and converts all the test cases associated with the currently opened IDE test suite
 - Close the test case



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1.File Menu

It is very much analogous to the file menu belonging to any other application. Export Test Case As and Export Test Suite give the liberty to the user to prefer amid the available unit testing frameworks like jUnit, TestNG etc. Thus an IDE test case can be exported for a chosen union of programming language, unit testing framework and tool from the selenium package.

3.1: Working With Selenium IDE
Continued.

Tool Bar

- Contains buttons for controlling the execution of your test cases
- Step feature for debugging your test cases
- Speed Control: Controls how fast your test case runs
- Run All: Runs the entire test suite when a test suite with multiple test cases is loaded
- Run: Runs the currently selected test. When only a single test is loaded this button and the Run All button have the same effect
- Pause/Resume: Allows stopping and re-starting of a running test case

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The Selenium IDE test cases can be saved into following format:

HTML format

The Selenium IDE test cases can be exported into following formats/programming languages.

java (IDE exported in Java)

rb (IDE exported in Ruby)

py (IDE exported in Python)

cs (IDE exported in C#)

3.1: Working With Selenium IDE Continued.

Tool Bar

-  Step: Allows you to “step” through a test case by running it one command at a time. Use for debugging test cases
-  Apply Rollup Rules: This advanced feature allows repetitive sequences of Selenium commands to be grouped into a single action. Detailed documentation on rollup rules can be found in the UI-Element Documentation on the Help menu
-  Record: Records the user’s browser actions.



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The Selenium IDE test cases can be saved into following format:

HTML format

The Selenium IDE test cases can be exported into following formats/programming languages.

java (IDE exported in Java)

rb (IDE exported in Ruby)

py (IDE exported in Python)

cs (IDE exported in C#)

3.1: Working With Selenium IDE Continued.

- Test Case Pane
- Script is displayed in the test case pane
- It has two tabs:
 - Displays the command and their parameters in a readable “Table” format
 - “Source” displays the test case in the native format in which the file will be stored
 - By default, this is HTML although it can be changed to a programming language such as Java or C#, or a scripting language like Python

Command	Target	Value
open	/	
waitForPageToLoad		
clickAndWait	xpath=id('menu_download')/a	
assertTitle	Downloads	
verifyText	xpath=id('mainContent')/h2	Downloads



3.1: Working With Selenium IDE Continued.

Command, Target and Value

- Command displays the currently selected command along with its parameters
- Target displays unique tag value for the selected field
- Value contains the data in case of text box fields

Command	<input type="text" value="clickAndWait"/>
Target	<input type="text" value="xpath=id('menu_download')/a"/> <input type="button" value="Find"/>
Value	<input type="text"/>



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**3.1: Working With Selenium IDE
Continued.**

Log/Reference/UI-Element/Rollup Pane

- Bottom pane is used
- Log: Error messages and information messages showing the progress are displayed automatically
- Reference : Displays documentation on the current command in table mode
- UI-Element and Rollup: Detailed information on these two panes (which cover advanced features) can be found in the UI-Element Documentation on the Help menu of Selenium-IDE

The screenshot shows the Selenium IDE interface with four tabs at the top: Log, Reference, UI-Element, and Rollup. The Log tab is selected, showing a list of log entries:

- [INFO] Executing: |waitForPageToLoad|
- [info] Executing: |clickAndWait | xpath=id('menu_download')/a | |
- [info] Executing: |assertTitle | Downloads | |
- [info] Executing: |verifyText | xpath=id('mainContent')/h2 | Downloads |

The Reference pane below it displays the documentation for the clickAndWait command:

clickAndWait(locator)
Generated from click(locator)
Arguments:

- locator - an element locator

Clicks on a link, button, checkbox or radio button. If the click action causes a new page to load (like a link usually does), call waitForPageToLoad.

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Log/Reference/UI-Element/Rollup Pane

The bottom pane is used for four different functions—Log, Reference, UI-Element, and Rollup—depending on which tab is selected.

Log

When you run your test case, error messages and information messages showing the progress are displayed in this pane automatically, even if you do not first select the Log tab. These messages are often useful for test case debugging. Notice the Clear button for clearing the Log. Also notice the Info button is a drop-down allowing selection of different levels of information to log.

Reference

The Reference tab is the default selection whenever you are entering or modifying [Selenese](#) commands and parameters in Table mode. In Table mode, the Reference pane will display documentation on the current command. When entering or modifying commands, whether from Table or Source mode, it is critically important to ensure that the parameters specified in the Target and Value fields match those specified in the parameter list in the Reference pane. The number of parameters provided must match the number specified, the order of parameters provided must match the order specified, and the type of parameters provided must match the type specified. If there is a mismatch in any of these three areas, the command will not run correctly.

While the Reference tab is invaluable as a quick reference, it is still often necessary to consult the Selenium [Reference](#) document.

3.1: Working With Selenium IDE

Introduction to Selenium Commands – “Selenese”

- Set of commands used by selenium to automate the web application testing
- Combination of Selenese commands creates test script

3A's
Selenese is a combination of as 3A's:

- Action: Used to change the state of the AUT(Application under Test)
E.g.: Click , close , doubleclick
- Accessor: Check the state of application & save state in some variable
E.g.: storeTitle , storeElementPresent
- Assertions: Verifies the state of the application matches it with the expected state and generates the True/False result
E.g. : verifyText, assertText

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Action:

Used to change the state of the AUT(Application under Test)like click on some link, type a value in edit box, select some options on the page, select a value from drop down etc.

When action is performed on AUT the test will fail if the action is not achieved.

Accessor:

This command check the state of the application and save the application state in some variable. It can be used for automatic generation of assertions.

Assertions:

Are very similar to checkpoint in UFT/QTP. Assertion verifies the state of the application matches it with the expected state and generates the True/False result.

3.1: Working With Selenium IDE

Understanding Element Locators in Selenium IDE

- Types of Element Locators
- ID
- Name
- Link Text
- CSS Selector
 - Tag and ID
 - Tag and class
 - Tag and attribute
 - Tag, class, and attribute
 - Inner text
- DOM (Document Object Model)
 - getElementById
 - getElementsByName
 - dom:name
 - dom: index
- XPath

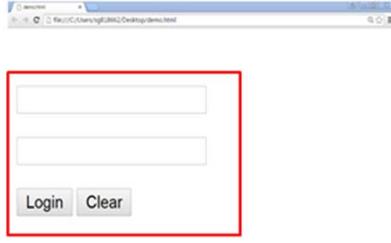
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3.1: Working With Selenium IDE Locating by ID

```
<html>
<body>
    <form id="loginForm" >
        <input name= "username" type= "text" />
        <input name= "password" type= "password" />
        <input name= "continue" type= "submit" value= "Login" />
        <input name= "continue" type= "button" value= "Clear" />
    </form>
</body>
<html>
```

Id = loginForm



The screenshot shows a simple login interface. It consists of a single `form` element with the `id` attribute set to `loginForm`. Inside this form, there are two `input` elements: one for the username and one for the password. Below these is a `submit` button with the value `Login`, and at the bottom right is a `button` with the value `Clear`. A red rectangular box surrounds the entire `form` element.

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3.1: Working With Selenium IDE Locating by NAME

name=username
name=continue value=Clear
name=continue Clear
name=continue type=button



```
1 <html>
2 <body>
3 <form id="loginForm" >
4 <input name="username" type="text" />
5 <input name="password" type="password" />
6 <input name="continue" type="submit" value="Login" />
7 <input name="continue" type="button" value="Clear" />
8 </form>
9 </body>
10 </html>
```

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3.1: Working With Selenium IDE

Locating by Link Text

link=Link1

link=Link3

```
1 <html>
2 <body>
3 <a href="#">Link1</a>
4 <a href="#">Link2</a>
5 <a href="#">Link3</a>
6 <form id="loginForm" >
7   <input name="username" type="text" />
8   <input name="password" type="password" />
9   <input name="continue" type="submit" value="Login" />
10  <input name="continue" type="button" value="Clear" />
11 </form>
12 </body>
13 </html>
```

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3.1: Working With Selenium IDE

Locating by CSS Selector - Tag and ID

```
<html>
<body>
    <form id="loginForm" >
        <input name= "username" type= "text" />
        <input name= "password" type= "password" />
        <input name= "continue" type= "submit" value= "Login" />
        <input name= "continue" type= "button" value= "Clear" />
    </form>
</body>
<html>
```

css = form# loginForm

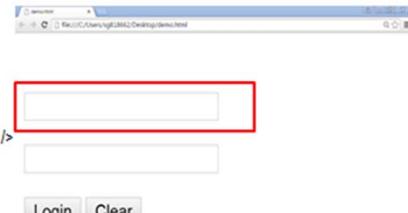
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3.1: Working With Selenium IDE Locating by CSS Selector - Tag and Class

```
<html>
<body>
<form id="loginForm" >
→ <input name="username" type="text" class="inputtext" />
<input name="password" type="password" class="inputtext" />
<input name="continue" type="submit" value="Login" />
<input name="continue" type="button" value="Clear" />
</form>
</body>
<html>
```

css = input.inputtext



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3.1: Working With Selenium IDE

Locating by CSS Selector - Tag and Attribute

```
<html>
<body>
<form id="loginForm" >
  <input name= "username" type= "text" class="inputtext" /> 
  <input name= "password" type= "password" class="inputtext" /> 
  <input name= "continue" type= "submit" value= "Login" />
  <input name= "continue" type= "button" value= "Clear" />
</form>
</body>
<html>
```

css = input[name=username]



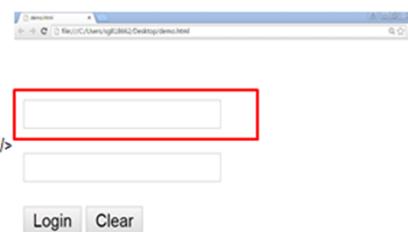
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3.1: Working With Selenium IDE

Locating by CSS Selector – Tag, Class and Attribute

```
<html>
<body>
<form id= "loginForm" >
    <input name= "username" type= "text" class= "inputtext" /> 
    <input name= "password" type= "password" class= "inputtext" /> 
    <input name= "continue" type= "submit" value= "Login" />
    <input name= "continue" type= "button" value= "Clear" /> Login Clear
</form>
</body>
<html>
```

css = input.inputtext[name=username]



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3.1: Working With Selenium IDE

Locating by CSS Selector – Inner text

`css=a:contains("Link1")`

`css=a:contains("Link3")`

```
1 <html>
2 <body>
3 <a href="#">Link1</a>
4 <a href="#">Link2</a>
5 <a href="#">Link3</a>
6 <form id="loginForm" >
7 <input name="username" type="text" />
8 <input name="password" type="password" />
9 <input name="continue" type="submit" value="Login" />
10 <input name="continue" type="button" value="Clear" />
11 </form>
12 </body>
13 </html>
```

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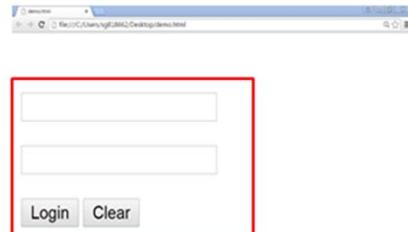
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3.1: Working With Selenium IDE

Locating by DOM – getElementsById

```
<html>
<body>
    <form id="loginForm" >
        <input name="username" type="text" class="inputtext" />
        <input name="password" type="password" class="inputtext" />
        <input name="continue" type="submit" value="Login" />
        <input name="continue" type="button" value="Clear" />
    </form>
</body>
<html>
```

document.getElementById("loginForm")



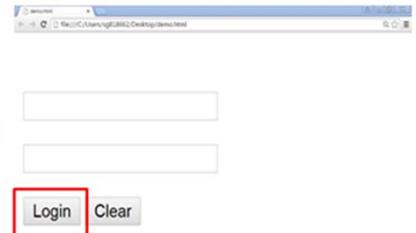
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3.1: Working With Selenium IDE

Locating by DOM – getElementsByName

```
<html>
<body>
<form id="loginForm" >
<input name="username" type="text" class="inputtext" />
<input name="password" type="password" class="inputtext" />
→ <input name="continue" type="submit" value="Login" />
<input name="continue" type="button" value="Clear" />
</form>
</body>
<html>
```

document.getElementsByName(" continue ")[1]



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3.1: Working With Selenium IDE

Locating by DOM – DOM:Name

```
<html>
<body>
<form name= "loginForm" >
→ <input name= "username" type= "text" class="inputtext" />
<input name= "password" type= "password" class="inputtext" />
<input name= "continue" type= "submit" value= "Login" />
<input name= "continue" type= "button" value= "Clear" />
</form>
</body>
<html>
```

document.forms[" loginForm "].elements[" username "]



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3.1: Working With Selenium IDE

Locating by DOM – DOM:Index

```
<html>
<body>
<form name= "loginForm" >
<input name= "username" type= "text" class="inputtext" />
→ <input name= "password" type= "password" class="inputtext" />
<input name= "continue" type= "submit" value= "Login" />
<input name= "continue" type= "button" value= "Clear" />
</form>
</body>
<html>
```

document.forms[1].elements[2]

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3.1: Working With Selenium IDE Locating by XPath

```
<html>
<body>
<form name= "loginForm" >
<input name= "username" type= "text" class= "inputtext" />
→ <input name= "password" type= "password" class= "inputtext" />
<input name= "continue" type= "submit" value= "Login" />
<input name= "continue" type= "button" value= "Clear" />
</form>
</body>
<html>
//*[@id="loginForm"]/input[2]
//html/body/form/input[2]
```

The screenshot shows a web browser window with a login form. The password input field is highlighted with a red box. On the left, two XPath expressions are displayed in red boxes: `//*[@id="loginForm"]/input[2]` and `//html/body/form/input[2]`. These expressions identify the second input element within the form.

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3.1: Working With Selenium IDE

Working With Alerts

- Simplest form of pop-up windows
- Most common Selenium IDE commands used in handling alerts are the following :

assertAlert	retrieves the message of the alert and asserts it to a string value that you specified
assertNotAlert	
assertAlertPresent	asserts if an Alert is present or not
assertAlertNotPresent	
storeAlert	retrieves the alert message and stores it in a variable that you will specify
storeAlertPresent	returns TRUE if an alert is present; FALSE if otherwise
verifyAlert	
verifyNotAlert	retrieves the message of the alert and verifies if it is equal to the string value that you specified
verifyAlertPresent	verifies if an Alert is present or not
verifyAlertNotPresent	

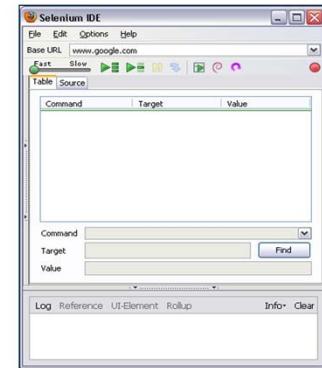
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3.1: Working With Selenium IDE

Creating Test Scripts using Selenium IDE

- Go to the Web Page for which you want to carry out the test
- Hit the record button on IDE



3.1: Working With Selenium IDE

Creating Test Scripts using Selenium IDE(Contd.)

- Enter the text on Web Page and submit
- IDE should be updated, stop the recorder and add the assertions

The screenshot shows two windows side-by-side. On the left is a web browser window displaying the Google India homepage. A search term 'Testing Methods' has been entered into the search bar, and the 'Google Search' button is highlighted. On the right is the Selenium IDE interface, showing a table of recorded test steps. The first step is 'open http://www.google.com' and the second step is 'type q Testing Methods'. The Selenium IDE window also includes tabs for 'Table', 'Source', and 'Log'.

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3.1: Working With Selenium IDE

Creating Test Scripts using Selenium IDE(Contd.)

Play Button

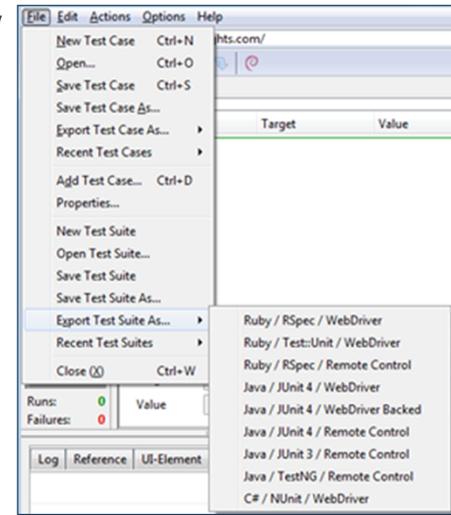
Hit the play button to play the recorded scripts

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3.1: Working With Selenium IDE Exporting scripts to multiple languages and Formats

- Test cases can be exported only to the following formats:
 - .cs (C# source code)
 - .java (Java source code)
 - .py (Python source code)
 - .rb (Ruby source code)



Summary

- In this lesson, you have learnt
 - Selenium IDE (Integrated Development Environment) is the simplest tool in the Selenium Suite.
 - Menu bar is used in creating, modifying, and exporting test cases into formats useable by Selenium RC and WebDriver
 - The default format for Selenese commands is HTML.
 - The Test Case Pane shows the list of currently opened test cases and a concise summary of test runs
 - Locators tell Selenium IDE which GUI elements (say Text Box, Buttons, Check Boxes etc.) its needs to operate on
 - The choice of locator depends largely on your Application Under Test



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Add the notes here.

Review Question

■ Question 1

- Select the Locator which is NOT part of Selenium IDE
- CSS Selector
- XPath
- getElementsById
- getElementsByXpath

■ Question 2: True/False

- The choice of locator depends largely on your Application Under Test.

■ Question 3: Fill in the Blanks

- Error messages and information messages showing the progress are displayed automatically in _____ pane.



Test Automation & Advanced Selenium

Lesson 4: Selenium 2.0 – Web
Driver

Lesson Objectives

- Introduction To Web Driver
- Web Driver Vs Selenium RC Vs Selenium IDE
- Benefits of Web Driver over Selenium IDE and RC
- Limitations of Web Driver



4.1: Selenium 2.0 – Web Driver

Introduction To Web Driver

- Web automation framework that allows you to execute your tests against different browsers, not just Firefox (unlike Selenium IDE).
- Provides a simpler, more concise programming interface
- Selenium-WebDriver was developed to better support dynamic web pages where elements of a page may change without the page itself being reloaded
- Supply a well-designed object-oriented API that provides improved support for modern advanced web-app testing problems.

```
graph TD; WebDriver --> MozillaFireFox; WebDriver --> InternetExplorer; WebDriver --> Safari; WebDriver --> GoogleChrome; WebDriver --> OperaBrowser; WebDriver --> GhostDriver;
```

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4.1: Selenium 2.0 – Web Driver

Web Driver Vs Selenium RC Vs Selenium IDE

WebDriver	Selenium RC	Selenium IDE
<ul style="list-style-type: none">■ Supports all browsers like Firefox, IE, Chrome, Safari, Opera etc.■ Supports Record and playback■ Doesn't required to start server before executing the test script■ Interacts natively with browser application■ As compared to RC, it is bit complex and large API.	<ul style="list-style-type: none">■ Supports all browsers like Firefox, IE, Chrome, Safari, Opera etc.■ Doesn't supports Record and playback■ Required to start server before executing the test script.■ Core engine is JavaScript based■ It is easy and small API	<ul style="list-style-type: none">■ Only works in Mozilla browser■ Doesn't supports Record and playback■ Doesn't required to start server before executing the test script.■ Core engine is JavaScript based■ Very simple to use

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4.1: Selenium 2.0 – Web Driver

Benefits of Web Driver over Selenium IDE and RC

- Architecture is simpler than Selenium RC's
- Faster than Selenium RC
- Interacts with page elements in a more realistic way
- API is simpler than Selenium RC's
- Support the headless HtmlUnit browser

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1. Architecture

WebDriver's architecture is simpler than Selenium RC's.

- It controls the browser from the OS level
- All you need are your programming language's IDE (which contains your Selenium commands) and a browser.
- You first need to launch a separate application called Selenium Remote Control (RC) Server before you can start testing
- The Selenium RC Server acts as a "middleman" between your Selenium commands and your browser
- When you begin testing, Selenium RC Server "injects" a Javascript program called Selenium Core into the browser.
- Once injected, Selenium Core will start receiving instructions relayed by the RC Server from your test program.
- When the instructions are received, Selenium Core will execute them as Javascript commands.
- The browser will obey the instructions of Selenium Core, and will relay its response to the RC Server.
- The RC Server will receive the response of the browser and then display the results to you.
- RC Server will fetch the next instruction from your test script to repeat the whole cycle.

2. Speed

WebDriver is faster than Selenium RC since it speaks directly to the browser uses the browser's own engine to control it.

- Selenium RC is slower since it uses a Javascript program called Selenium Core. This Selenium Core is the one that directly controls the browser, not you.

3. Real-life Interaction

WebDriver interacts with page elements in a more realistic way. For example, if you have a disabled text box on a page you were testing, WebDriver really cannot enter any value in it just as how a real person cannot.

- Selenium Core, just like other Javascript codes, can access disabled elements. In the past, Selenium testers complain that Selenium Core was able to enter values to a disabled text box in their tests. Differences in API

4. API

Selenium RC's API is more matured but contains redundancies and often confusing commands.

- For example, most of the time, testers are confused whether to use type or typeKeys; or whether to use click, mouseDown, or mouseDownAt. Worse, different browsers interpret each of these commands in different ways tool
- WebDriver's API is simpler than Selenium RC's. It does not contain redundant and confusing commands.

5. Browser Support

WebDriver can support the headless HtmlUnit browser

- HtmlUnit is termed as "headless" because it is an invisible browser - it is GUI-less.
- It is a very fast browser because no time is spent in waiting for page elements to load. This accelerates your test execution cycles.
- Since it is invisible to the user, it can only be controlled through automated means.
- Selenium RC cannot support the headless HtmlUnit browser. It needs a real, visible browser to operate on.

4.1: Selenium 2.0 – Web Driver

Limitations of Web Driver

- Cannot Readily Support New Browsers
 - Since, WebDriver operates on the OS level
 - Different browsers communicate with the OS in different ways.
 - If a new browser comes out, it may have a different process of communicating with the OS as compared to other browsers
- Has no built-in command that automatically generates a Test Results File
 - Have to rely on your IDE's output window, or design the report yourself using the capabilities of your programming language and store it as text, html, etc.
 - Selenium RC automatically generates an HTML file of test results



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Summary

- In this lesson, you have learnt
 - WebDriver is a tool for testing web applications across different browsers using different programming languages.
 - You are now able to make powerful tests because WebDriver allows you to use a programming language of your choice in designing your tests.
 - WebDriver is faster than Selenium RC because of its simpler architecture.
 - WebDriver directly talks to the browser while Selenium RC needs the help of the RC Server in order to do so.
 - WebDriver's API is more concise than Selenium RC's.
 - WebDriver can support HtmlUnit while Selenium RC cannot.
 - The only drawbacks of WebDriver are:
 - It cannot readily support new browsers, but Selenium RC can.
 - It does not have a built-in command for automatic generation of test results.



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Add the notes here.

Review Question

■ Question 1

- Select which is NOT a feature of Web Driver
- Architecture is simpler
- Faster
- API is complex
- Supports all the browsers



■ Question 2: True/False

- WebDriver can Readily Support New Browsers.

■ Question 3: Fill in the Blanks

- WebDriver can support _____ while Selenium RC cannot.

Test Automation & Advanced Selenium

Lesson 5: Testing Web
Applications Using Web Driver
API

Lesson Objectives

- Writing first Web Driver Test
- Locating UI Elements-Developers Tools
- Navigation API
 - get
 - navigate
- Interrogation API
 - getTitle
 - getCurrentUrl
 - getPageSource
- WebElement API
 - findElement & findElements
 - By
 - id
 - xpath
 - cssSelector
 - className
 - linkText
 - name
 - tagName
 - partialLinkText



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Lesson Objectives (Contd.)

■ WebElement API

- click
- clear
- sendKeys
- submit
- Select – selectByVisibleText etc.
- getText
- getAttribute

■ Handling Popup Dialogs and Alerts

■ Windows

- getWindowHandle and getWindowHandles
- switchTo
- manage

■ Alerts

- switchTo
- dismiss
- accept

■ Why synchronization is important



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Lesson Objectives (Contd.)

- Using Explicit & Implicit Wait
 - Expected Condition & Expected Conditions
 - WebDriverWait
 - ImplicitlyWait
 - pageLoadTimeout



5.1: Testing Web Applications Using Web Driver API

Writing first Web Driver Test(Java)

```
package org.openqa.selenium.example;

import org.openqa.selenium.By;
import org.openqa.selenium.WebDriver;
import org.openqa.selenium.WebElement;
import org.openqa.selenium.firefox.FirefoxDriver;

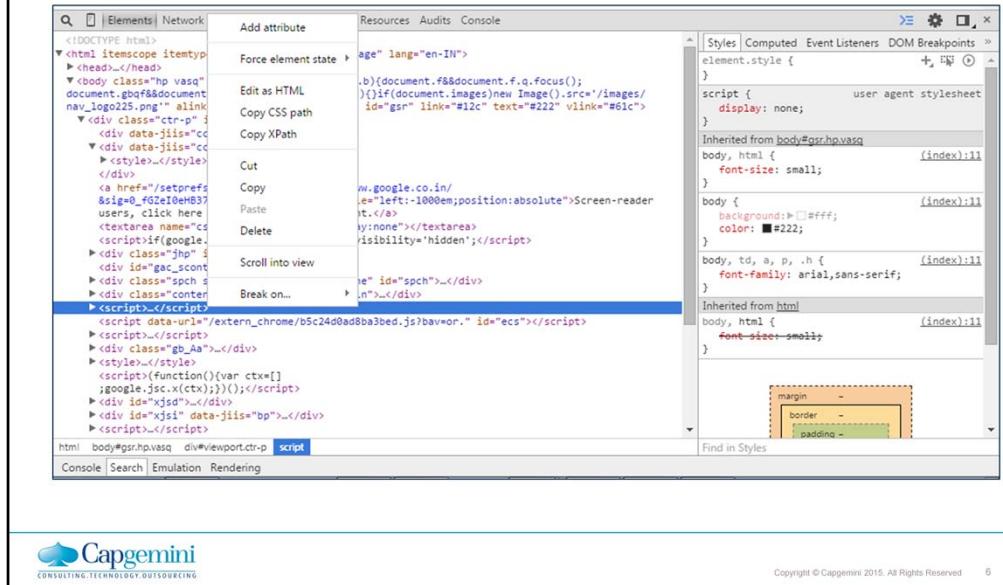
public class Selenium2Example {
    public static void main(String[] args) {
        // Create a new instance of the Firefox driver
        WebDriver driver = new FirefoxDriver();
        // And now use this to visit Google
        driver.get("http://www.google.com");
        // Find the text input element by its name
        WebElement element = driver.findElement(By.name("q"));
        // Enter something to search for
        element.sendKeys("Cheese!");
        // Now submit the form. WebDriver will find the form for us from the element
        element.submit();
        // Check the title of the page
        System.out.println("Page title is: " + driver.getTitle());
        //Close the browser
        driver.quit();
    }
}
```



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5.1: Testing Web Applications Using Web Driver API

Locating UI Elements-Developers Tools



5.1: Testing Web Applications Using Web Driver API

Navigation API

- `driver.get("URL")`
 - Required to navigate to a page
 - E.g.: `driver.get("http://www.google.com");`
 - WebDriver will wait until the page has fully loaded before returning control to your test or script
 - to ensure page is fully loaded then wait commands can be used
- `driver.navigate().to("URL")`
 - E.g.: `driver.navigate().to("http://www.google.com");`
 - Other Navigate commands
 - `driver.navigate().refresh();`
 - `driver.navigate().forward();`
 - `driver.navigate().back();`

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Single-Page Applications are an exception to this.

The difference between these two methods comes not from their behavior, but from the behavior in the way the application works and how browser deal with it.
`navigate().to()` navigates to the page by changing the URL like doing forward/backward navigation.

Whereas, `get()` refreshes the page to changing the URL.

So, in cases where application domain changes, both the method behaves similarly. That is, page is refreshed in both the cases. But, in single-page applications, while `navigate().to()` do not refreshes the page, `get()` do.

Moreover, this is the reason browser history is getting lost when `get()` is used due to application being refreshed.

5.1: Testing Web Applications Using Web Driver API

Interrogation API

- `driver.getTitle()`
 - Get the title of the current page
- `driver.getCurrentUrl()`
 - Get the current URL of the browser
- `driver.getPageSource()`
 - Get the source code of the page

▪ Syntax:

```
public void testTitleReliability() {  
    driver.get("https://www.google.com");  
    boolean title = driver.getTitle().contains("Google");  
    if(title)  
        String currentURL = driver.getCurrentUrl();  
        (If you want to verify a particular text is present or not on the page, do as below)  
        boolean b = driver.getPageSource().contains("your text");  
        System.out.println("Expected title is present ");  
    else if(!title)  
        System.out.println(" Expected title is not present");  
}
```

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5.1: Testing Web Applications Using Web Driver API

WebElement API

- **findElement:**
 - Used to locate single element and return WebElement object of first occurrences element on web page
 - If element not found, throw s exception NoSuchElementException
 - Syntax: findElement(By by)
- **Example:**

```
WebElement element = driver.findElement(By.id("Home"));
element.click();
```
- **findElements:**
 - Used to find multiple element on webpage, e.g.: count total number of row in table
 - Returns List of WebElement object of all occurrences of element
 - If element not found, returns empty List of WebElement object
 - Syntax: List element = findElements(By by)
- **Example:**

```
List {WebElement} element = driver.findElement(By.xpath("//table/tr"));
int size = element.size();
```



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5.1: Testing Web Applications Using Web Driver API

WebElement API (Cont..)

By:

- A collection of factory functions for creating webdriver.Locator instances

```
graph TD; By[By] --> xpath[xpath]; By --> name[name]; By --> id[id]; By --> className[className]; name --> linkText[linkText]; name --> partialLinkText[partialLinkText]; className --> tagName[tagName]; className --> cssSelector[cssSelector]
```

- By id: Locates an element by its ID
 - Syntax: driver.findElement(By.id("element id"))
- By className: Locates elements that have a specific class name
 - Syntax : driver.findElement(By.className("element class"))
- By name: Locates elements whose name attribute has the given value
 - Syntax : driver.findElement(By.name("element name"))

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5.1: Testing Web Applications Using Web Driver API

WebElement API (Cont..)

- By XPath: Locates elements matching a XPath selector.
 - For example, given the selector "//div", WebDriver will search from the document root regardless of whether the locator was used with a WebElement
 - Syntax: driver.findElement(By.xpath("xpath expression"))
- By linkText :Locates link elements whose visible text matches the given string
 - Syntax : driver.findElement(By.link("link text"))
- By partialLinkText: Locates link elements whose visible text contains the given substring
 - Syntax : driver.findElement(By.partialLinkText("link text"))
- By tagName: Locates elements with a given tag name.
 - The returned locator is equivalent to using the getElementsByTagName DOM function
 - Syntax : driver.findElement(By.tagName("element html tag name"))
- By CSS Selector: Locates elements with a given tag name.
 - Syntax : driver.findElement(By.cssSelector("css selector"))

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CSS selectors for Selenium with example

When we don't have an option to choose Id or Name, we should prefer using CSS locators as the best alternative.

CSS is "Cascading Style Sheets" and it is defined to display HTML in structured and colorful styles are applied to webpage.

Selectors are patterns that match against elements in a tree, and as such form one of several technologies that can be used to select nodes in an XML document. Visit to know more [W3.Org Css selectors](#)

CSS has more Advantage than Xpath

CSS is much more faster and simpler than the Xpath.

In IE Xpath works very slow, where as Css works faster when compared to Xpath.

5.1: Testing Web Applications Using Web Driver API

WebElement API (Cont..)

- Click():
 - For Example: Login button is available on login screen
 - Syntax:
`WebElement click = driver.findElement(By.xpath("//[@id='btnLogOn']"));
click.click();`
- Scenarios where Click() is used:
 - “Check / Uncheck” a checkbox
 - Select a radio button
- Clear():
 - Function sets the value property of the element to an empty string (“”)
 - Syntax:
`driver.findElement(By.xpath("//*[@id='textBox']")).clear();`
- SendKeys():
 - Method is used to simulate typing into an element, which may set its value
 - Syntax:
`driver.findElement(By.id("NameTextBox")).sendKeys("Rahul");`

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Click():**Click a link / button:**

To click on an object through webdriver first we need to find out which locator we are going to use. Is it ID, name, xpath, or css? For this purpose we can utilize firebug / xpath checker to find out if there any id / name exists for the object we are going to perform action upon. Then write the code as below:

```
driver.findElement(By.xpath("//a[@href='CustomerInfo.htm']")).click();
```

In the above line of code “driver” could be FirefoxDriver, InternetExplorerDriver, ChromeDriver, HtmlUnitDriver, etc. On one of these browsers we are going to find an element and then click as per the code.

`findElement` is an API provided by the webdriver which requires argument “`By.xpath`”. The “`xpath`” can be replaced by one of the below methods if we need to identify the element with any other attributes such as `css`, `name`, `classname`, etc.

“Check / Uncheck” a checkbox

To “Check / Uncheck” a checkbox, the object needs to be identified using `findElement` method and then just click. To find out whether the checkbox is checked or not utilize the method – `element.isSelected()`

```
WebElement kancheck = driver.findElement(By.name("kannada"));
kancheck.click();
System.out.println(kancheck.isSelected());
```

Above code snippet will first click the checkbox named `kannada` and then verifies whether it is clicked or not.



Select a radio button

Follow the same steps which are used in Checkbox to select a radio button and then verify the status using isSelected() method.

```
WebElement gender =  
driver.findElement(By.xpath("//input[@name='male']"));  
gender.click();  
System.out.println(gender.isSelected());
```

Clear();

- The clear() method executes an "Automation Atom", which is a JavaScript function intended to provide the smallest basic unit of automation functionality for a browser. In the case of clear(), that function sets the value property of the element to an empty string (""), then fires the onchange event on the element. The atoms function you're interested in is bot.action.clear()
- click
- clear
- sendKeys
- submit
- Select – selectByVisibleText etc.
- getText
- getAttribute

5.1: Testing Web Applications Using Web Driver API

WebElement API (Cont..)

- **SendKeys():**
 - Scenarios where sendKeys() is used:
 - Sending special characters (Enter , F5, Ctrl, Alt etc..)
 - Key events to WebDriver
 - Uploading a file
- **Syntax:**

```
//Sending Ctrl+A  
driver.findElement(By.xpath("//body")).sendKeys(Keys.chord(Keys.CONTROL, "a"));  
  
//Sending pagedown key from keyboard  
driver.findElement(By.id("name")).sendKeys(Keys.PAGE_DOWN);  
  
//Sending space key  
driver.findElement(By.id("name")).sendKeys(Keys.SPACE);
```
- **Submit():**
 - If form has submit button which has type = "submit" instead of type = "button" then .submit() method will work `<input type="submit" value="Submit">`
 - If button Is not Inside <form> tag then .submit() method will not work.
- **Syntax:**

```
driver.findElement(By.xpath("//input[@name='Company']")).submit();
```

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When to use .click() method

You can use .click() method to click on any button of software web application. Means element's type = "button" or type = "submit", .click() method will works for both.

When to use .submit() method

If you will look at firebug view for any form's submit button then always It's type will be "submit". In this case, .submit() method Is very good alternative of .click() method.

5.1: Testing Web Applications Using Web Driver API

WebElement API (Cont..)

- Select:
 - WebDriver's support classes
 - Used to work with Dropdowns
 - Method Name: selectByIndex
 - Syntax: select.selectByIndex(Index);
 - Method Name: selectByValue
 - Syntax: select.selectByValue(Value);
 - Method Name: selectByVisibleText
 - Syntax: select.selectByVisibleText(Text);

```
<html>
<head>
<title>Select Example by Index value</title>
</head>
<body>
<select name="Mobiles"><option value="0" selected> Please select</option>
<option value="1">iPhone</option>
<option value="2">Nokia</option>
<option value="3">Samsung</option>
<option value="4">HTC</option>
<option value="5">BlackBerry</option>
</select>
</body>
</html>
```

```
<html>
<head>
<title>Select Example by Value</title>
</head>
<body>
<p>Which mobile device do you like most?</p>
<select name="Mobiles"><option selected> Please select</option>
<option value="iphone">iPhone</option>
<option value="nokia">Nokia</option>
<option value="samsung">Samsung</option>
<option value="htc">HTC</option>
<option value="blackberry">BlackBerry</option>
</select>
</body>
</html>
```

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Method Name: selectByIndex

Purpose: To Select the option based on the index given by the user.
 There is an attribute called "values" which will have the index values.
 Example:

```
WebElement element=driver.findElement(By.name("Mobiles"));
Select se=new Select(element);
se.selectByIndex(1);
```

Method Name: selectByValue

Purpose: To Select the options that have a value matching with the given argument by the user.

Example:

```
WebElement element=driver.findElement(By.name("Mobiles"));
Select se=new Select(element);
se.selectByValue("nokia");
```

Method Name: selectByVisibleText

Purpose: To Select all options that display text matching the given argument. It will not look for any index or value, it will try to match the VisibleText (which will display in dropdown)

Example:

```
WebElement element=driver.findElement(By.name("Mobiles"));
Select se=new Select(element);
se.selectByVisibleText("HTC");
```



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Method Name: deselectByIndex

Purpose: To Deselect the option at the given index. The user has to provide the value of index.

Example:

```
se.deselectByIndex(1);
```

Method Name: deselectByValue

Purpose: To Deselect all options that have a value matching the given argument.

Example:

```
se.deselectByValue("nokia");
```

Method Name: deselectByVisibleText

Purpose: To Deselect all options that display text matching the given argument.

Example:

```
se.deselectByVisibleText("HTC");
```

Method Name: deselectAll

Purpose: To Clear all selected entries. This works only when the SELECT supports multiple selections. It throws NotImplemented eError if the "SELECT" does not support multiple selections. In select it mandatory to have an attribute `multiple="multiple"`

Example:

```
se.deselectAll();
```

5.1: Testing Web Applications Using Web Driver API

WebElement API (Cont..)

- **getText():**
 - Get the text content from a DOM-element found by given selector
 - Make sure the element you want to request the text from is interact able otherwise empty string is returned

Syntax:

```
WebElement TxtBoxContent = driver.findElement(By.id("WebelementID"));
TxtBoxContent.getText();
```

- **getAttribute():**
 - getText() will only get the inner text of an element
 - To get the value, you need to use getAttribute("attribute name")
 - Attribute name can be class, id, name, status etc

<button name="bttnK" id="gbqfba" aria-label="Google Search" class="gbqfba">Google Search</button>

Syntax:

```
WebElement TxtBoxContent = driver.findElement(By.id(WebelementID));
System.out.println("Printing " + TxtBoxContent.getAttribute("class"));
```

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When to use .click() method

You can use .click() method to click on any button of software web application. Means element's type = "button" or type = "submit", .click() method will works for both.

When to use .submit() method

If you will look at firebug view for any form's submit button then always It's type will be "submit". In this case, .submit() method Is very good alternative of .click() method.

5.1: Testing Web Applications Using Web Driver API

Handling Popup Dialogs and Alerts

Two types of alerts:

- Windows based alert pop ups
 - Selenium will not be able to recognize it, since it is an OS-level dialog
- Web based alert pop ups
 - Can be Alert box/ Pop up box/ confirmation Box/ Prompt/ Authentication Box
 - Alert interface gives us following methods to deal with the alert
 - `accept()` : To accept the alert
 - `dismiss()` : To dismiss the alert
 - `getText()` : To get the text of the alert
 - `sendKeys()` : To write some text to the alert



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Simple alert

Simple alerts just have a **OK** button on them. They are mainly used to display some information to the user.

Confirmation Alert

This alert comes with an option to accept or dismiss the alert. To accept the alert you can use **Alert.accept()** and to dismiss you can use the **Alert.dismiss()**.

Prompt Alerts

In prompt alerts you get an option to add text to the alert box. This is specifically used when some input is required from the user. We will use the **sendKeys()** method to type something in the Prompt alert box.

5.1: Testing Web Applications Using Web Driver API

Windows

- Multiple windows are handled by switching the focus from one window to another
- **Syntax:**

```
// Opening site
driver.findElement(By.xpath("//img[@alt='SeleniumMasterLogo']")).click();

// Storing parent window reference into a String Variable
String Parent_Window = driver.getWindowHandle();

// Switching from parent window to child window
for (String Child_Window : driver.getWindowHandles())
{
    driver.switchTo().window(Child_Window);

    // Performing actions on child window
    driver.findElement(By.id("dropdown_txt")).click();
    driver.findElement(By.xpath("//*[@id='anotherItemDiv']")).click();
}

//Switching back to Parent Window
driver.switchTo().window(Parent_Window);

//Performing some actions on Parent Window
driver.findElement(By.className("btn_style")).click();
```

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Steps for understanding window handling:

Window A has a link "Link1" and we need to click on the link (click event).
 Window B displays and we perform some actions.

The entire process can be fundamentally segregated into following steps:

Step 1 : Clicking on Link1 on Window A

A new Window B is opened.

Step 2 : Save reference for Window A

Step 3 : Create reference for Window B

Step 4 : Move Focus from Window A to Window B

Window B is active now

Step 5 : Perform Actions on Window B

Complete the entire set of Actions

Step 6 : Move Focus from Window B to Window A

Window A is active now

5.1: Testing Web Applications Using Web Driver API

Alerts

- Present in the **org.openqa.selenium.Alert** package
- Syntax:

```
Alert simpleAlert = driver.switchTo().alert(); //switch from main window to an alert
String alertText = simpleAlert.getText(); //To get the text present on alert
System.out.println("Alert text is " + alertText);
//Simple alert
simpleAlert.accept(); //To click on 'Ok'/'Yes' on Alert
```

OR

- Confirmation Alert

```
simpleAlert.dismiss(); //To click on 'Cancel'/'No' on Alert
```

OR

- Prompt Alerts

```
simpleAlert.sendKeys("Accepting the alert"); //Send some text to the alert
```

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Alerts are different from regular windows. The main difference is that alerts are blocking in nature. They will not allow any action on the underlying webpage if they are present. So if an alert is present on the webpage and you try to access any of the element in the underlying page you will get following exception:

UnhandledAlertException: Modal dialog present

5.1: Testing Web Applications Using Web Driver API

Why synchronization is important

- “Mechanism which involves more than one components to work parallel with each other”
- Every time user performs an operation on the browser, one of the following happens:
 - The request goes all the way to server and entire DOM is refreshed when response comes back
 - The request hits the server and only partial DOM gets refreshed (Ajax requests or asynchronous JavaScript calls)
 - The request is processed on the client side itself by JavaScript functions
- So if we think about the overall workflow, there is a need of certain synchronization that happens between the client(aka. browser) and the server (the url)



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5.1: Testing Web Applications Using Web Driver API

Using Explicit & Implicit Wait

- Implicit Wait
- Element Synchronization
 - Default element existence timeout can be set
 - Below statement will set the default object synchronization timeout as 20
 - Means that selenium script will wait for maximum 20 seconds for element to exist
 - If Web element does not exist within 20 seconds, it will throw an exception
- `driver.manage().timeouts().implicitlyWait(20, TimeUnit.SECONDS);`

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Synchronization can be classified into two categories:

1. Unconditional
2. Conditional Synchronization

Unconditional :

In this we just specify timeout value only. We will make the tool to wait until certain amount of time and then proceed further.

Examples: Wait() and Thread.Sleep();

The main **disadvantage** for the above statements are, there is a chance of unnecessary waiting time even though the application is ready.

The **advantages** are like in a situation where we interact for third party systems like interfaces, it is not possible to write a condition or check for a condition. Here in this situations, we have to make the application to wait for certain amount of time by specifying the timeout value.

Conditional Synchronization:

We specify a condition along with timeout value, so that tool waits to check for the condition and then come out if nothing happens.

It is very important to set the timeout value in conditional synchronization, because the tool should proceed further instead of making the tool to wait for a particular condition to satisfy.

In Selenium we have **implicit Wait and Explicit Wait conditional statements**

5.1: Testing Web Applications Using Web Driver API

Using Explicit & Implicit Wait

- Explicit Wait
 - Specific condition synchronization
 - Instruct selenium to wait until element is in expected condition
 - Syntax:

```
WebDriverWait w = new WebDriverWait(driver,20);
w.ignoring(NoSuchElementException.class);
WebElement P = null;
//below statement will wait until element becomes visible
P=w.until(ExpectedConditions.visibilityOfElementLocated(By.id("x")));
//below statement will wait until element becomes clickable.
P= w.until(ExpectedConditions.elementToBeClickable(By.id("ss")));
```

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Page Load Synchronization:

- Default page navigation timeout can be set.
- Below statement will set the navigation timeout as 50
- Means that selenium script will wait for maximum 50 seconds for page to load
- If page does not load within 50 seconds, it will throw an exception

Syntax

```
driver.manage().timeouts().pageLoadTimeout(50, TimeUnit.SECONDS)
;
```

Summary

- In this lesson, you have learnt
 - Multiple windows are handled by switching the focus from one window to another.
 - By is a collection of factory functions for creating webdriver.Locator instances.
 - Alert contains methods for dismissing, accepting, inputting, and getting text from alert prompts.
 - Explicit synchronization points are inserted in the script using WebDriverWait class.
 - Each and every time when there is need to match speed of the application and speed of test execution we have to use thread.sleep().
 - The implicit wait will not wait for the entire time that is specified, rather it will only wait, until the entire page is loaded.



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Add the notes here.

Review Question

■ Question 1

- Select which is NOT an Explicit Wait
 - VisibilityOfElementLocated
 - ElementToBeClickable
 - PageLoadTimeout
 - None of the above



■ Question 2: True/False

- The syntax is correct:
- Syntax : driver.findElement(By. PartialLinkText("link text"));

■ Question 3: Fill in the Blanks

- findElements is used to find _____ element on webpage

Test Automation & Advanced Selenium

Lesson 6: Web Driver Test with
Xunit

Lesson Objectives

- Introduction to Xunit and Junit
- Junit Annotations
- Assertions/Verifications with Junit or TestNG
- Web Driver Test cases with Junit or TestNG
- Test Suite



6.1: Selenium 2.0 – Web Driver Test with Xunit

Web Driver Test with Xunit

- Is something not missing? We do Testing, where are Test Cases , Test Suite, Verifications, Results , Reports....
- Because, Selenium web driver is automation API not testing API
- So, combine Selenium automation with testing frameworks, like Xunit



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6.1: Selenium 2.0 – Web Driver Test with Xunit

Introduction To XUNIT

- Xunit is the collective name for several unit testing frameworks that derive their structure and functionality from Smalltalk's SUnit.
- The names of many of these frameworks are a variation on "SUnit", usually substituting the "S" for the first letter (or letters) in the name of their intended language ("JUnit" for Java, "RUnit" for R etc.).
- These frameworks and their common architecture are collectively known as "Xunit".
- All Xunit frameworks share the following basic component architecture:

```
graph TD; TR[TestRunner] -- runs --> T[Test]; TR -- collects results --> T; TS[TestSuite] -- inherits from --> T; TC[TestCase] -- inherits from --> T; T --> TF[TestFixture]
```

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6.1: Selenium 2.0 – Web Driver Test with Xunit

Introduction to JUnit

- JUnit is a unit testing framework for the Java programming language.
- Important in the development of test-driven development, and is one of a family of unit testing frameworks which is collectively known as Xunit .
- JUnit is linked as a JAR at compile-time. The framework resides under package "junit.framework " for JUnit 3.8 and earlier, and under package "org.junit" for JUnit 4 and later.

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A research survey performed in 2013 across 10,000 Java projects hosted on GitHub found that JUnit, (in a tie with [slf4j-api](#)), was the most commonly included external library. Each library was used by 30.7% of projects.

6.1: Selenium 2.0 – Web Driver Test with Xunit

Junit – Annotations

@Test:

- The Test annotation tells JUnit that the public void method to which it is attached can be run as a test case. To run the method, JUnit first constructs a fresh instance of the class then invokes the annotated method. Any exceptions thrown by the test will be reported by JUnit as a failure. If no exceptions are thrown, the test is assumed to have succeeded.

```
1  public class MyTestClass {  
2      @Test  
3      public void myTestMethod() {  
4          /**  
5             * Use Assert methods to call your methods to be tested.  
6             * A simple test to check whether the given list is empty or not.  
7             */  
8          org.junit.Assert.assertTrue( new ArrayList().isEmpty() );  
9      }  
10 }
```



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6.1: Selenium 2.0 – Web Driver Test with Xunit
Continued.

@Before:

- When writing tests, it is common to find that several tests need similar objects created before they can run. Annotating a public void method with @Before causes that method to be run before the Test method. The @Before methods of super classes will be run before those of the current class.

```
1  public class MyTestClass {
2      List<String> testList;
3
4      @Before
5      public void initialize() {
6          testList = new ArrayList<String>();
7      }
8      @Test
9      public void myTestMethod() {
10         /**
11          * Use Assert methods to call your methods to be tested.
12          * A simple test to check whether the given list is empty or not.
13          */
14         org.junit.Assert.assertTrue( testList.isEmpty() );
15     }
}
```



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6.1: Selenium 2.0 – Web Driver Test with Xunit

Continued.

@After:

- If you allocate external resources in a Before method you need to release them after the test runs. Annotating a public void method with @After causes that method to be run after the Test method. All @After methods are guaranteed to run even if a Before or Test method throws an exception. The @After methods declared in super classes will be run after those of the current class.

```
1  public class MyTestClass {
2      OutputStream stream;
3      @Before
4      public void initialize() {
5          /**
6             * Open OutputStream, and use this stream for tests.
7             */
8          stream = new FileOutputStream(...);
9      }
10     @Test
11     public void myTestMethod() {
12         /**
13             * Now use OutputStream object to perform tests
14             */
15         ...
16     }
17     @After
18     public void closeOutputStream() {
19         /**
20             * Close output stream here
21             */
22         try{
23             if(stream != null) stream.close();
24         } catch(Exception ex){
25         }
26     }
27 }
28 }
```



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6.1: Selenium 2.0 – Web Driver Test with Xunit

Continued.

@BeforeClass:

- Annotating a public static void no-arg method with @BeforeClass causes it to be run once before any of the test methods in the class. The @BeforeClass methods of superclasses will be run before those of the current class.
- The annotations @BeforeClass and @Before are same in functionality. The only difference is the method annotated with @BeforeClass will be called once per test class based, and the method annotated with @Before will be called once per test based.

```
1  public class MyTestClass {
2      @BeforeClass
3      public void initGlobalResources() {
4          /**
5             * This method will be called only once per test class.
6             */
7      }
8      @Before
9      public void initializeResources() {
10         /**
11             * This method will be called before calling every test.
12             */
13     }
14     @Test
15     public void myTestMethod1() {
16         /**
17             * initializeResources() method will be called before calling this method
18             */
19     }
20     @Test
21     public void myTestMethod2() {
22         /**
23             * initializeResources() method will be called before calling this method
24             */
25     }
26 }
```



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6.1: Selenium 2.0 – Web Driver Test with Xunit

Continued.

@AfterClass:

- If you allocate expensive external resources in a BeforeClass method you need to release them after all the tests in the class have run. Annotating a public static void method with @AfterClass causes that method to be run after all the tests in the class have been run. All @AfterClass methods are guaranteed to run even if a BeforeClass method throws an exception. The @AfterClass methods declared in superclasses will be run after those of the current class.

```
1  public class MyTestClass {
2      @BeforeClass
3      public void initGlobalResources() {
4          /**
5             * This method will be called only once per test class. It will be called
6             * before executing test.
7         */
8     }
9
10    @Test
11    public void myTestMethod1() {
12        // write your test code here...
13        ...
14    }
15
16    @AfterClass
17    public void closeGlobalResources() {
18        /**
19             * This method will be called only once per test class. It will be called
20             * after executing test.
21         */
22     }
}
```



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6.1: Selenium 2.0 – Web Driver Test with Xunit

Continued.

@Ignore:

- Sometimes you want to temporarily disable a test or a group of tests. Methods annotated with `@Test` that are also annotated with `@Ignore` will not be executed as tests. Also, you can annotate a class containing test methods with `@Ignore` and none of the containing tests will be executed. Native JUnit 4 test runners should report the number of ignored tests along with the number of tests that ran and the number of tests that failed.

```
1  public class MyTestClass {
2      @Ignore
3      @Test
4      public void myTestMethod() {
5          /**
6          * This test will be ignored.
7          */
8          org.junit.Assert.assertTrue( new ArrayList().isEmpty() );
9      }
10 }
```



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11

6.1: Selenium 2.0 – Web Driver Test with Xunit

Junit - Assertion

- JUnit provides overloaded assertion methods for all primitive types and Objects and arrays.
- The parameter order is expected value followed by actual value
- Some of the important methods of Assert class are:
 - void assertEquals(boolean expected, boolean actual)
Check that two primitives/Objects are equal
 - void assertTrue(boolean expected, boolean actual)
Check that a condition is true
 - void assertFalse(boolean condition)
Check that a condition is false
 - void assertNotNull(Object object)
Check that an object isn't null
 - void assertNull(Object object)
Check that an object is null



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6.1: Selenium 2.0 – Web Driver Test with Xunit

Continued.

- `void assertEquals(boolean condition)`
The assertEquals() methods tests if two object references point to the same object
- `void assertNotSame(boolean condition)`
The assertNotSame() methods tests if two object references not point to the same object
- `void assertArrayEquals(expectedArray, resultArray);`
The assertEquals() method will test whether two arrays are equal to each other



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6.1: Selenium 2.0 – Web Driver Test with Xunit Junit – Assertion Example

```
1  public class TestAssertions {
2      @Test
3      public void testAssertions() {
4          //test data
5          String str1 = new String ("abc");
6          String str2 = new String ("abc");
7          String str3 = null;
8          String str4 = "abc";
9          String str5 = "abc";
10         int val1 = 5;
11         int val2 = 6;
12         String[] expectedArray = {"one", "two", "three"};
13         String[] resultArray = {"one", "two", "three"};
14         //Check that two objects are equal
15         assertEquals(str1, str2);
16         //Check that a condition is true
17         assertTrue (val1 < val2);
18         //Check that a condition is false
19         assertFalse(val1 > val2);
20         //Check that an object isn't null
21         assertNotNull(str1);
22         //Check that an object is null
23         assertNull(str3);
24         //Check if two object references point to the same object
25         assertSame(str4,str5);
26         //Check if two object references not point to the same object
27         assertNotSame(str1,str3);
28         //Check whether two arrays are equal to each other.
29         assertEquals(expectedArray, resultArray);
30     }
31 }
```

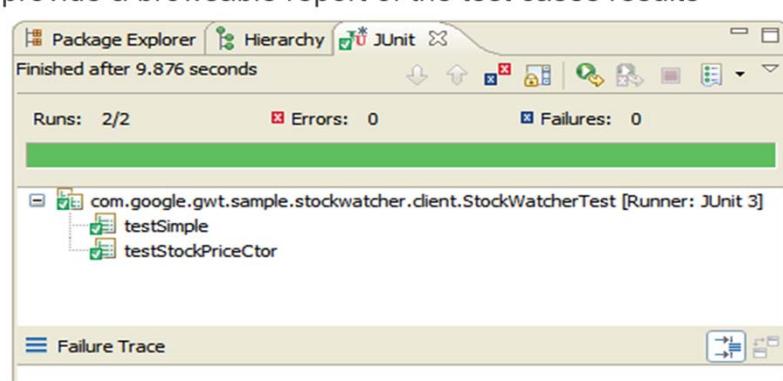


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6.1: Selenium 2.0 – Web Driver Test with Xunit

Junit – Reports

- Junit report collects individual XML files
- Merge the individual XML files generated by the JUnit task and eventually apply a stylesheet on the resulting merged document to provide a browsable report of the test cases results



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6.1: Selenium 2.0 – Web Driver Test with Xunit

Web Driver Test cases with TestNG

- Open source Java testing framework, not limited to unit tests
- Designed to be better than JUnit, especially when testing integrated classes
- Supports parameterized tests out-of-the-box (in much more convenient way than JUnit does)
- Facilitates running multi-threaded tests
- Allows to express dependencies between test methods
- Integrates very well with the build tools: Ant, Maven and Gradle
- Supported by all major IDEs
- Can be used with different JVM languages (e.g. Java, Groovy, Scala) and cooperates with many quality and testing tools (e.g. code coverage tools, mocking libraries, matchers libraries)
- Some popular solutions - e.g. Spring Framework - provide means to facilitate testing with TestNG



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6.1: Selenium 2.0 – Web Driver Test with Xunit
Continued.

Writing a test is typically a three-step process:

- Write the business logic of your test and insert TestNG annotations in your code.
- Add the information about your test (e.g. the class name, the groups you wish to run, etc...) in a testng.xml file or in build.xml.
- Run TestNG

```
import org.testng.annotations.Test;
import static org.testng.Assert.assertEquals;

public class TestNGSimpleTest {
    @Test
    public void testAdd() {
        String str = "TestNG is working fine";
        assertEquals("TestNG is working fine", str);
    }
}
```

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
<suite name="Suitel">
    <test name="test1">
        <classes>
            <class name="TestNGSimpleTest"/>
        </classes>
    </test>
</suite>
```

Test Case Example

testng.xml File



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6.1: Selenium 2.0 – Web Driver Test with Xunit

TestNG Annotations

Annotation	Description
@Test	The annotation notifies the system that the method annotated as @Test is a test method
@BeforeSuite	The annotation notifies the system that the method annotated as @BeforeSuite must be executed before executing the tests in the entire suite
@AfterSuite	The annotation notifies the system that the method annotated as @AfterSuite must be executed after executing the tests in the entire suite
@BeforeTest	The annotation notifies the system that the method annotated as @BeforeTest must be executed before executing any test method within the same test class

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6.1: Selenium 2.0 – Web Driver Test with Xunit

Continued.

@AfterTest	The annotation notifies the system that the method annotated as @AfterTest must be executed after executing any test method within the same test class
@BeforeClass	The annotation notifies the system that the method annotated as @BeforeClass must be executed before executing the first test method within the same test class
@AfterClass	The annotation notifies the system that the method annotated as @AfterClass must be executed after executing the last test method within the same test class
@BeforeMethod	The annotation notifies the system that the method annotated as @BeforeMethod must be executed before executing any and every test method within the same test class



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6.1: Selenium 2.0 – Web Driver Test with Xunit

Continued.

@AfterMethod	The annotation notifies the system that the method annotated as @AfterMethod must be executed after executing any and every test method within the same test class
@BeforeGroups	The annotation notifies the system that the method annotated as @BeforeGroups is a configuration method that enlists a group and that must be executed before executing the first test method of the group
@AfterGroups	The annotation notifies the system that the method annotated as @AfterGroups is a configuration method that enlists a group and that must be executed after executing the last test method of the group



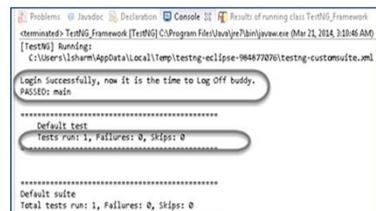
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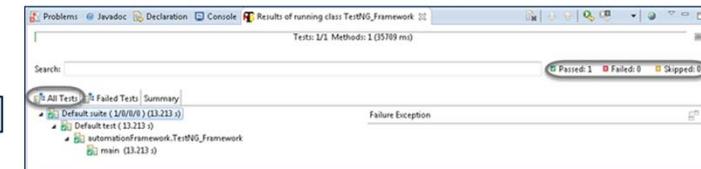
6.1: Selenium 2.0 – Web Driver Test with Xunit

TestNG Result

■ TestNG result is displayed into two windows as shown below:

- Console Window
- Testing Result Window

a 

b 

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6.1: Selenium 2.0 – Web Driver Test with Xunit

TestNG Reports

- Generates a different type of report for test execution
- Whenever TestNG is run, HTML and XML reports are generated by default in the directory
- For implementing a reporting class, the class has to implement an org.testng.IReporter interface
- Has its own reporter objects which are called when whole suite run ends
- Object containing the information of the whole test run is passed on to the report implementations
- Default implementations are:
 - Main
 - Failed Reporter
 - XML Reporter
 - EmailableReporter2
 - JUnitReport Reporter
 - SuiteHTML Reporter

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6.1: Selenium 2.0 – Web Driver Test with Xunit

TestNG Reports

- In Main report layout ,test-output directory contains HTML reports like an index.html file, that is the entry point to the TestNG HTML report.
- The top-level report gives us a list of all the suites that were just run, along with an individual and compound total for each passed, failed, and skipped test.

The screenshot shows two windows side-by-side. On the left is a file explorer window titled 'testingReports > test-output >'. It lists several files and folders: junitreports, main-suite, old, suite1, suite2, bullet_point.png, collapseall.gif, custom-report.html, emailable-report.html, failed.png, index.html (which is highlighted with a red circle), jquery-1.7.1.min.js, and navigator-bullet.png. An arrow points from this window to the right one. The right window is titled 'Test results' and shows '1 suite'. Under 'All suites', it lists 'Default suite'. Below that, under 'Info', is a list of test details: C:\Users\lsham\AppData\Local\Temp\testng-eclipse-984877076\testng-customsuite.xml, 1 test, 0 groups, 0 times, Reporter output, Ignored methods, and Chronological view. Under 'Results', it shows 1 method, 1 passed, and Passed methods (show).

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6.1: Selenium 2.0 – Web Driver Test with Xunit

Test Suite(JUnit)

- Test suite means bundle a few unit test cases and run it together.
- In JUnit, both `@RunWith` and `@Suite` annotation are used to run the suite test.

Example of Test Suite in JUnit:

```
import org.junit.runner.RunWith;
import org.junit.runners.Suite;

@RunWith(Suite.class)
@Suite.SuiteClasses({
    TestFeatureLogin.class,
    TestFeatureLogout.class,
    TestFeatureNavigate.class,
    TestFeatureUpdate.class
})

public class FeatureTestSuite {
    // the class remains empty,
    // used only as a holder for the above annotations
}
```



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Aggregating tests in suites:

Using Suite as a runner allows you to manually build a suite containing tests from many classes. It is the JUnit 4 equivalent of the JUnit 3.8.x static `Test suite()` method. To use it, annotate a class with `@RunWith(Suite.class)` and `@SuiteClasses(TestClass1.class, ...)`. When you run this class, it will run all the tests in all the suite classes.

Example:

The class above is a placeholder for the suite annotations, no other implementation is required.

Note : `@RunWith` annotation, which specifies that the JUnit 4 test runner to use is `org.junit.runners.Suite` for running this particular test class. This works in conjunction with the `@Suite` annotation, which tells the Suite runner which test classes to include in this suite and in which order.

6.1: Selenium 2.0 – Web Driver Test with Xunit Test Suite(TestNG)

Example:

```
<?xml version="1.0" encoding="UTF-8"?>
<suite name="example suite 1" verbose="1" >
  <test name="Regression suite 1" >
    <classes>
      <class name="com.first.example.demoOne"/>
      <class name="com.first.example.demoTwo"/>
      <class name="com.second.example.demoThree"/>
    </classes>
  </test>
</suite>
```

In the above xml

class name has been specified as “com.first.example.demoOne” and “com.first.example.demoOne” which are in “com.first.example” package

Class name demoThree is in package “com.second.example.”



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We need to specify the class names along with packages in between the classes tags.

All the classes specified in the xml will get executes which have TestNG annotations.

Summary

- In this lesson, you have learnt
 - In this lesson, you have understood that Xunit is the latest technology for unit testing.
 - JUnit is an open source framework which is used for writing & running tests.
 - Junit Provides Annotation to identify the test methods, Assertions for testing expected results and also provides Test runners for running tests.
 - You have also understood how to execute Web Driver with Junit ,Testing and Test Suite.
 - Test suite enables you to execute the bundle of unit test cases at a time .
 - The only drawback of Xunit is:
 - Lack of documentation- Compared to MSTest and NUnit, xUnit.NET lacks documentation



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Add the notes here.

Review Question

■ Question 1

- Select the Annotation which is NOT part of JUnit Annotations
- @After
- @After or Before
- @Before
- @AfterClass



■ Question 2: True/False

- The Selenium web driver is automation API not testing AP

■ Question 3: Fill in the Blanks

- The assertEquals() methods tests if two object references point to the _____ .

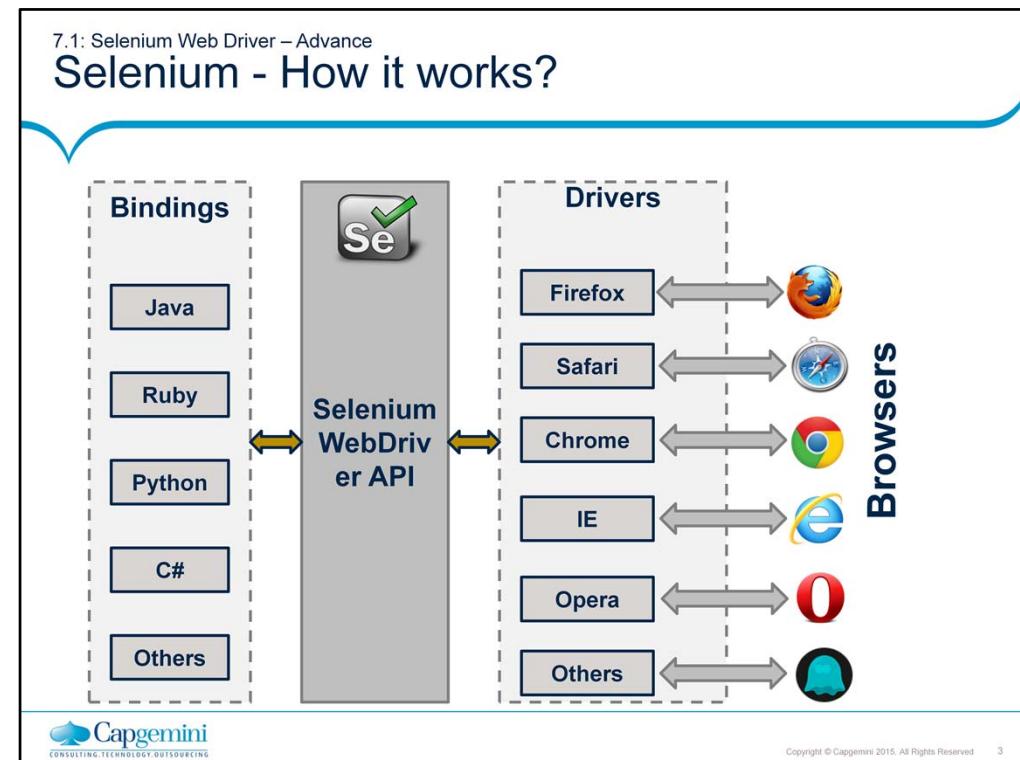
Test Automation & Advanced Selenium

Lesson 7: Selenium Web
Driver – Advance

Lesson Objectives

- Selenium: How it works
- Different drivers
 - Chrome
 - Firefox
 - Internet Explorer
 - Headless Browser
 - Ghost Driver and Phantom JS
 - Mobile Browsers
 - Selendriod & Appium
 - Remote Web Driver
 - Capabilities
 - Profile setting
 - Selenium Grid





7.1: Selenium Web Driver – Advance

Different Drivers

Firefox:
WebDriver driver = new FirefoxDriver();

IE:
WebDriver driver = new InternetExplorerDriver();

Chrome:
WebDriver driver = new ChromeDriver();

Safari:
WebDriver driver = new SafariDriver();

Opera:
WebDriver driver = new OperaDriver()

GhostDriver and PhantomJs:
WebDriver driver = new PhantomJS();

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1. Architecture

WebDriver's architecture is simpler than Selenium RC's.

- It controls the browser from the OS level
- All you need are your programming language's IDE (which contains your Selenium commands) and a browser.
- You first need to launch a separate application called Selenium Remote Control (RC) Server before you can start testing
- The Selenium RC Server acts as a "middleman" between your Selenium commands and your browser
- When you begin testing, Selenium RC Server "injects" a Javascript program called Selenium Core into the browser.
- Once injected, Selenium Core will start receiving instructions relayed by the RC Server from your test program.
- When the instructions are received, Selenium Core will execute them as Javascript commands.
- The browser will obey the instructions of Selenium Core, and will relay its response to the RC Server.
- The RC Server will receive the response of the browser and then display the results to you.
- RC Server will fetch the next instruction from your test script to repeat the whole cycle.

2. Speed

WebDriver is faster than Selenium RC since it speaks directly to the browser uses the browser's own engine to control it.

- Selenium RC is slower since it uses a Javascript program called Selenium Core. This Selenium Core is the one that directly controls the browser, not you.

3. Real-life Interaction

WebDriver interacts with page elements in a more realistic way. For example, if you have a disabled text box on a page you were testing, WebDriver really cannot enter any value in it just as how a real person cannot.

- Selenium Core, just like other Javascript codes, can access disabled elements. In the past, Selenium testers complain that Selenium Core was able to enter values to a disabled text box in their tests. Differences in API

4. API

Selenium RC's API is more matured but contains redundancies and often confusing commands.

- For example, most of the time, testers are confused whether to use type or typeKeys; or whether to use click, mouseDown, or mouseDownAt. Worse, different browsers interpret each of these commands in different ways tool
- WebDriver's API is simpler than Selenium RC's. It does not contain redundant and confusing commands.

5. Browser Support

WebDriver can support the headless HtmlUnit browser

- HtmlUnit is termed as "headless" because it is an invisible browser - it is GUI-less.
- It is a very fast browser because no time is spent in waiting for page elements to load. This accelerates your test execution cycles.
- Since it is invisible to the user, it can only be controlled through automated means.
- Selenium RC cannot support the headless HtmlUnit browser. It needs a real, visible browser to operate on.

7.1: Selenium Web Driver – Advance

Different Drivers (Contd.)

- Firefox Driver:

```

1 // Create a new instance of the Firefox driver
2 WebDriver driver=new FirefoxDriver();
3 // opening Google
4 driver.get("https://www.google.com/");
5 // Closing driver
6 driver.close();

```

- IE Driver:

```

1 //Setting system property for IE driver
2 System.setProperty("webdriver.ie.driver", "/path/to/IEDriver");
3 // Create a new instance of the IE driver
4 WebDriver driver=new InternetExplorerDriver();
5 // opening Google
6 driver.get("https://www.google.com/");
7 // Closing driver
8 driver.close();

```

- Chrome Driver:

```

1 //Setting system property for Chrome driver
2 System.setProperty("webdriver.chrome.driver", "/path/to/chromedriver");
3 // Create a new instance of the Chrome driver
4 WebDriver driver=new ChromeDriver();
5 // opening Google
6 driver.get("https://www.google.com/");
7 // Closing driver
8 driver.close();

```

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1. Architecture

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- Selenium RC cannot support the headless HtmlUnit browser. It needs a real, visible browser to operate on.

7.1: Selenium Web Driver – Advance

Different Drivers (Contd.)

- Headless Browser

- Web browser without a graphical user interface
- Normally, interaction with a website are done with mouse and keyboard using a browser with a GUI
- While most headless browser provides an API to manipulate the page/DOM, download resources etc.
- So instead of, for example, actually clicking an element with the mouse, a headless browser allows you to click an element by code
- Headers, Local storage and Cookies work the same way
- List of Headless Browsers
 - PhantomJS
 - HtmlUnit
 - TrifleJS
 - Splash



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Headless browsers are typically used in following situations:

1. You have a central build tool which does not have any browser installed on it. So to do the basic level of sanity tests after every build you may use the headless browser to run your tests.
2. You want to write a crawler program that goes through different pages and collects data, headless browser will be your choice. Because you really don't care about opening a browser. All you need is to access the webpages.
3. You would like to simulate multiple browser versions on the same machine. In that case you would want to use a headless browser, because most of them support simulation of different versions of browsers. We will come to this point soon.

Things to pay attention to before using headless browser

Headless browsers are simulation programs, they are not your real browsers. Most of these headless browsers have evolved enough to simulate, to a pretty close approximation, like a real browser. Still you would not want to run all your tests in a headless browser. JavaScript is one area where you would want to be really careful before using a Headless browser. JavaScript are implemented differently by different browsers. Although JavaScript is a standard but each browser has its own little differences in the way that they have implemented JavaScript. This is also true in case of headless browsers also. For example HtmlUnit headless browser uses the Rhino JavaScript engine which not being used by any other browser.

Selenium support for headless browser

Selenium supports headless testing using its class called **HtmlUnitDriver**. This class internally uses HtmlUnit headless browser. HtmlUnit is a pure Java implementation. HtmlUnitWebDriver can be created as mentioned below:

```
HtmlUnitDriver unitDriver = new HtmlUnitDriver();
```

7.1: Selenium Web Driver – Advance

Different Drivers (Contd.)

▪ PhantomJS (Headless Browser)

- HEADLESS WEBSITE TESTING
 - Headless Web Kit with JavaScript API
- SCREEN CAPTURE
 - Programmatically capture web contents, including SVG and Canvas
- PAGE AUTOMATION
 - Access and manipulate webpages with the standard DOM API, or with usual libraries like jQuery
- Example of interacting with a page using PhantomJS:

```
page.evaluate(function() {  
    //Fill in form on page  
    document.getElementById('Name').value = 'John Doe';  
    document.getElementById('Email').value =  
    'john.doe@john.doe';  
    //Submit  
    $('#SubmitButton').click();  
});
```



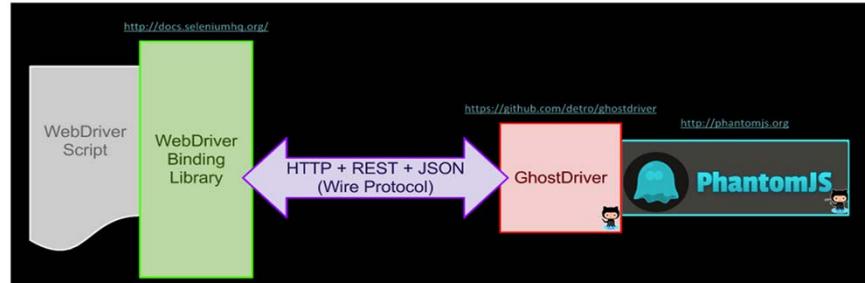
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7.1: Selenium Web Driver – Advance

Different Drivers (Contd.)

▪ GhostDriver(Headless Browser)

- Pure JavaScript implementation of the WebDriver Wire Protocol for PhantomJS Remote
- WebDriver that uses PhantomJS as back-end



GhostDriver is the project that provides the code that exposes the WebDriver API for use within PhantomJS.

PhantomJS bakes the GhostDriver code into itself, and ships it as part of its downloadable executable.

Thus, to use "GhostDriver" with PhantomJS, only PhantomJS is needed.

7.1: Selenium Web Driver – Advance

Different Drivers (Contd.)

- Mobile Browsers

- Mobile web browsers differ greatly in terms of features offered an operating systems supported
- Best can display most websites and offer page zoom and keyboard shortcuts, while others can only display websites optimizes for mobile devices
- Appium and Selendroid are the two cross browser mobile automation tool

- Appium(Mobile Browser)

- Open-source tool for automating native, mobile web, and hybrid applications on iOS and Android platforms, which is handled by a Appium node.js server.
- Cross-platform which allows to write tests against multiple platforms (iOS, Android), using the same API
- Enables code reuse between iOS and Android test suites



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Native apps are those written using the iOS or Android SDKs.

Mobile web apps are web apps accessed using a mobile browser (Appium supports Safari on iOS and Chrome or the built-in 'Browser' app on Android).

Hybrid apps have a wrapper around a "webview" -- a native control that enables interaction with web content. Projects like Phonegap, make it easy to build apps using web technologies that are then bundled into a native wrapper, creating a hybrid app.

Appium was designed to meet mobile automation needs according to a philosophy outlined by the following four tenets:

- You shouldn't have to recompile your app or modify it in any way in order to automate it.
- You shouldn't be locked into a specific language or framework to write and run your tests.
- A mobile automation framework shouldn't reinvent the wheel when it comes to automation APIs.
- A mobile automation framework should be open source, in spirit and practice as well as in name.

7.1: Selenium Web Driver – Advance

Different Drivers (Contd.)

Selendroid

Test automation framework which is used Android native & hybrid applications (apps) and mobile web

- Full compatibility with the JSON Wire Protocol
- No modification of app under test required in order to automate it
- Testing the mobile web using built in Android driver webview app
- UI elements can be found by different locator types
- Selendroid can interact with multiple Android devices (emulators or hardware devices) at the same time
- Existing emulators are started automatically
- Supports hot plugging of hardware devices
- **Full integration as a node into Selenium Grid for scaling and parallel testing**



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7.1: Selenium Web Driver – Advance

Remote Web Driver

- Implementation class of the WebDriver interface that a test script developer can use to execute their test scripts via the Remote WebDriver server on a remote machine
- Needs to be configured so that it can run your tests on a separate machine
- If **driver is not Remote WebDriver**, communication to the web browser is local. So driver will be used as below:

```
Webdriver driver = new FirefoxDriver();
```

using driver will access Firefox on the local machine, directly
- If **Remote WebDriver**, needs location Selenium Server (Grid) web browser
- For example,

```
WebDriver driver = new RemoteWebDriver(new
URL("http://localhost:4444/wd/hub"),
DesiredCapabilities.firefox());
```



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This example assumes that Selenium Server is running on localhost with the default port of 4444. The nice thing about this is you can run Selenium Server on any machine, change the URL to point to the new machine and run the tests. For example, I run the test code from my Mac OS X computer but I run Selenium Server on a Window XP machine. This way I can launch Internet Explorer tests from my Mac OS X computer.

7.1: Selenium Web Driver – Advance

Capabilities and Profile Setting

- Capabilities describes a series of key/value pairs that encapsulate aspects of a browser
- DesiredCapabilities set properties for the WebDriver
- Profile used to create custom Firefox profile and use it with desired capabilities

- Example to use Firefox profile with desired capabilities:

```
DesiredCapabilities dc=DesiredCapabilities.firefox();
FirefoxProfile profile = new FirefoxProfile();
dc.setCapability(FirefoxDriver.PROFILE, profile);
Webdriver driver = new FirefoxDriver(dc);
```

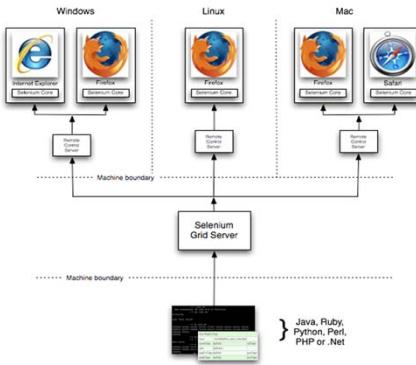


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7.1: Selenium Web Driver – Advance

Selenium Grid

Allows you run your tests on different machines against different browsers in parallel. That is, running multiple tests at the same time against different machines running different browsers and operating systems. Essentially, Selenium-Grid support distributed test execution. It allows for running your tests in a distributed test execution environment.



Summary

- In this lesson, you have learnt
- In this lesson, you have understood that how the selenium works and interacts with client server.
- Different drivers that are available for selenium-Chrome , IE ,Firefox ,headless browsers and mobile browsers.
- In remote webdriver the server will always run on the machine with the browser you want to test. And ,there are two ways to user the server: command line or configured in code.
- Capabilities gives facility to set the properties of browser. Such as to set BrowserName, Platform, Version of Browser.
- There are two reasons why you might want to use Selenium-Grid.
 - To run your tests against multiple browsers, multiple versions of browser, and browsers running on different operating systems.
 - To reduce the time it takes for the test suite to complete a test pass.



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Add the notes here.

Review Question

■ Question 1:

- PhantomJS is
- Chrome Driver
- Mobile Browser
- Headless Browser
- Firefox Driver

■ Question 2: True/False

- Firefox saves your information such as cookies and browser history in a file called your profile.

■ Question 3: Fill in the Blanks

- Client driver will send the program that is written in eclipse IDE as _____ and send it to Selenium server



Test Automation & Advanced Selenium

Lesson 8 : Selenium
Frameworks

Lesson Objectives

- Framework Overview
- Data Driven (Excel, Databases)
- Keyword Driven
- Component based (Sprintest®/CBF)
- Reports (Excel, PDF)
- TDD (JUnit, TestNG)
- BDD (Cucumber, SpecFlow)
- ATDD (Fitnesse)
- CI Tools (Jenkins etc)



8.1: Selenium Frameworks

Framework Overview

- Automation testing requires a well-defined approach, based on a comprehensive framework, in order to reap maximum benefits.
- A framework is a hierarchical directory that encapsulates shared resources, such as a dynamic shared library, image files, localized strings, header files, and reference documentation, in a single package. There are various frameworks available for automation, such as:
 - Data-Driven Automation Framework.
 - Keyword-Driven Automation Framework.
 - Hybrid Automation Framework.
- Component based framework(CBF) is an hybrid Automation framework.



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8.1: Selenium Frameworks

Data Driven

- Data driven is the design of possible inputs what may given by the end user. This would cover maximum probabilities of an input data.
- It can be Spread sheet or sql. We have to connect and pass the values to the respective field or element.
- In this type of framework Data is not hardcoded with script ,but data is provided from external source.
- When some test needs to repeat for different data set , Data driven framework gets used. In this framework, Parameters in the test case gets linked to database, excel, csv, text files from there test case run for all defined parameter in the file.
- Below figure shows example of the data driven, test case stored in excel

	A	B	C	D	E	F
1	TestCase ID	URL	UserName	Password	EmailSubject	FBSearch
2	TC_Gmail	www.gmail.com	abcd	password		
3	TC_YahooMail	www.yahooemail.com	abc@yahoo.com	password	Good Morning	
4	TC_Facebook	www.facebook.com	abc@somemail.com	password		abc def
5						
6						
7						
8						
9	All the test cases are saved in a single excel sheet.					
10						

All the test cases are saved in a single excel sheet.

Few cells would be blank as they are not used by all the test cases.

TestData

www.automationrepository.com

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8.1: Selenium Frameworks

Keyword-Driven

- As Name suggest, Keyword nothing but a code which represent some action, say "login". in this framework, we map the set of code which perform certain action with a keyword and then we use that keyword across the framework.
- The Keyword-Driven or Table-Driven framework requires the development of data tables and keywords, independent of the test automation tool used to execute them. Keyword-driven tests look very similar to manual test cases.
- The driver code "drives" the application-under-test, keyword driven test and the data. In a keyword-driven test, the functionality of the application-under-test is documented in a table like structure for e.g. Excel Sheet
- Below figure shows example of the keyword-driven, test case stored in excel

A	B	C	D	E	F	G	H
1 Test Case Name	Mapped Function	Description					
2 TC_Login	Login	User Login to Application					
3 TC_Book Flight	FlightBook	User Book a Flight					
4 TC_Logout	Logout	User Logout from Application					
5							
6							
7							
8							

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1. Architecture

WebDriver's architecture is simpler than Selenium RC's.

- It controls the browser from the OS level
- All you need are your programming language's IDE (which contains your Selenium commands) and a browser.
- You first need to launch a separate application called Selenium Remote Control (RC) Server before you can start testing
- The Selenium RC Server acts as a "middleman" between your Selenium commands and your browser
- When you begin testing, Selenium RC Server "injects" a Javascript program called Selenium Core into the browser.
- Once injected, Selenium Core will start receiving instructions relayed by the RC Server from your test program.
- When the instructions are received, Selenium Core will execute them as Javascript commands.
- The browser will obey the instructions of Selenium Core, and will relay its response to the RC Server.
- The RC Server will receive the response of the browser and then display the results to you.
- RC Server will fetch the next instruction from your test script to repeat the whole cycle.



2. Speed

WebDriver is faster than Selenium RC since it speaks directly to the browser uses the browser's own engine to control it.

- Selenium RC is slower since it uses a Javascript program called Selenium Core. This Selenium Core is the one that directly controls the browser, not you.

3. Real-life Interaction

WebDriver interacts with page elements in a more realistic way. For example, if you have a disabled text box on a page you were testing, WebDriver really cannot enter any value in it just as how a real person cannot.

- Selenium Core, just like other Javascript codes, can access disabled elements. In the past, Selenium testers complain that Selenium Core was able to enter values to a disabled text box in their tests. Differences in API

4. API

Selenium RC's API is more matured but contains redundancies and often confusing commands.

- For example, most of the time, testers are confused whether to use type or typeKeys; or whether to use click, mouseDown, or mouseDownAt. Worse, different browsers interpret each of these commands in different ways too!
- WebDriver's API is simpler than Selenium RC's. It does not contain redundant and confusing commands.

5. Browser Support

WebDriver can support the headless HtmlUnit browser

- HtmlUnit is termed as "headless" because it is an invisible browser - it is GUI-less.
- It is a very fast browser because no time is spent in waiting for page elements to load. This accelerates your test execution cycles.
- Since it is invisible to the user, it can only be controlled through automated means.
- Selenium RC cannot support the headless HtmlUnit browser. It needs a real, visible browser to operate on.

9.1: Selenium Frameworks

Component Based (Sprintest®/CBF)

- Component Based is an automatic test which is made up of components.
- It allows you to create automatic tests.
- IGATE's Test Automation Framework (CBF) is IGATE's Component Based Test Automation solution, aimed at optimizing test automation for business critical applications.
- CBF is designed to help test analysts and engineers build and automate tests using such abstraction, thus fine-tuning the test engineering process to the application under test (AUT) and minimizing the tedium of detailing each test step in each test one by one.

Framework Architecture

In consideration to the richness and diversity of UI of the applications and nature of test cases in scope, we are using a Modular Based Hybrid Automation Framework for the Automation project.

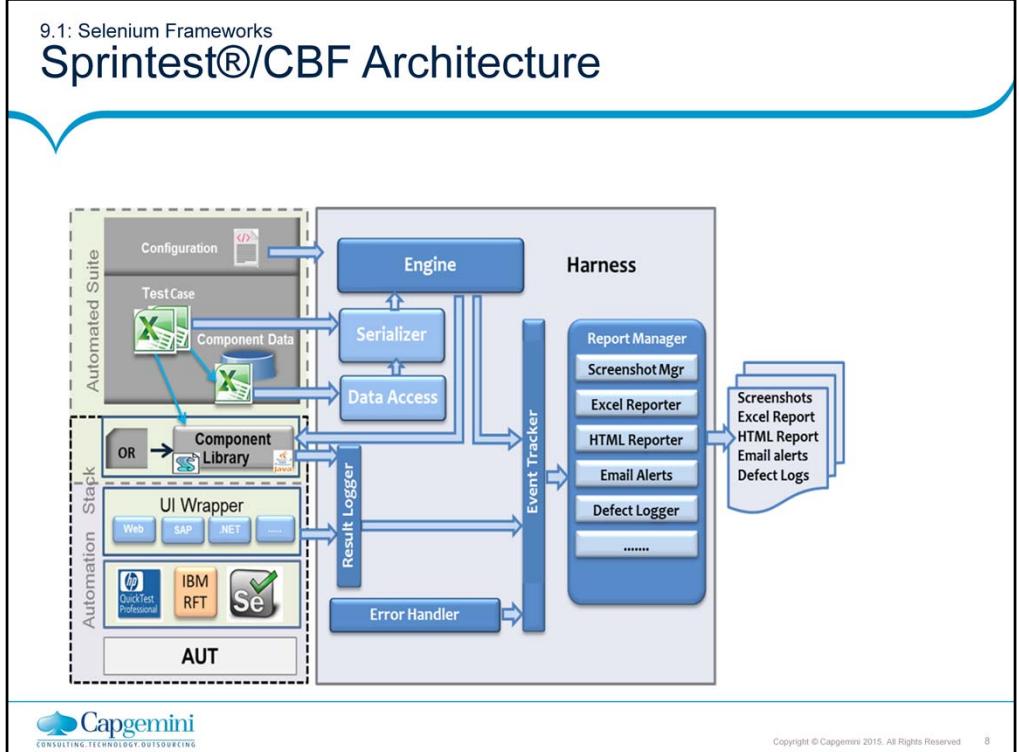


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1.File Menu

It is very much analogous to the file menu belonging to any other application. Export Test Case As and Export Test Suite give the liberty to the user to prefer amid the available unit testing frameworks like jUnit, TestNG etc.

Thus an IDE test case can be exported for a chosen union of programming language, unit testing framework and tool from the selenium package.



The Selenium IDE test cases can be saved into following format:

HTML format

The Selenium IDE test cases can be exported into following formats/programming languages.

java (IDE exported in Java)

rb (IDE exported in Ruby)

py (IDE exported in Python)

cs (IDE exported in C#)

8.1: Selenium Frameworks Continued.

- Harness: Execution gets triggered from here. Initializes the result logs, reports and initiates execution.
- Engine: General purpose runner for executing component based test cases. It supports a robust event model for reporting. Also Encapsulates runtime exception handling, test failures and recovery.
- Serializer: Deserializes the Auto_TC.xls file, resolves the references with the help of Data Access and creates a testcase object for execution.
- Data Access: Reads data from centrally maintained data files at the module level, thus helps in resolving data refs.
- Error Handler: Logs errors in a csv file, thus helps in tracking error.
- Result Logger: Exposes set of methods like Passed, Failed, Error, Done etc, which will be used to log results in the component libraries on verification. The logged results are made available in the selected reports.
- Report Manager: Manages different report types on user selection like ScreenshotMgr, Excel reporter, HTML Reporter, Email Alerts etc..
- Component Libraries:Collection of automation driver scripts for each action. Provision to organize functions into a small number of module driver files for maintainability. Simplifies test layer to a series of calls to this layer.
- OR:Used to store the Object Repository map file.
- Configuration: Refers to either hardware or software, or the combination of both
- Component Data: Data maintained for components in the module excel workbooks.
- TestCase: Assembly of different combinations of components.
- Application Under Test: Application considered for automation.
- Automated testing tools: Execute tests, report outcomes and compare results with earlier test runs.
- UI Wrapper: Generic methods like SetValue(), Click(), GetCtrlProperty() etc.. which will be used in scripting the components.



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8.1: Selenium Frameworks

Sprintest®/Quadrant

- A Solution built over Protractor with options for Excel based test data and HTML & Excel based reports primarily for test automation of AngularJS based applications.

Highlights

- Uses Grunt for easy integration with CI tools and Command Line invocation as well
- Provides Test Data in Excel
- Provides facility to select Browser and Test Suite to execute
- Provides HTML report with Screenshots of failed steps

Architecture

```

graph LR
    AS[Automated Specs] --> JASDD
    JASDD --> G[Grunt]
    G --> P[Protractor]
    P --> BA[Browser Application]
    Jenkins --> G
  
```

Benefits

- Easy management of executions and results from a Jenkins central console
- Easily integrates with Jenkins .
- Provides to create Data Driven Test cases

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The Selenium IDE test cases can be saved into following format:

HTML format

The Selenium IDE test cases can be exported into following formats/programming languages.

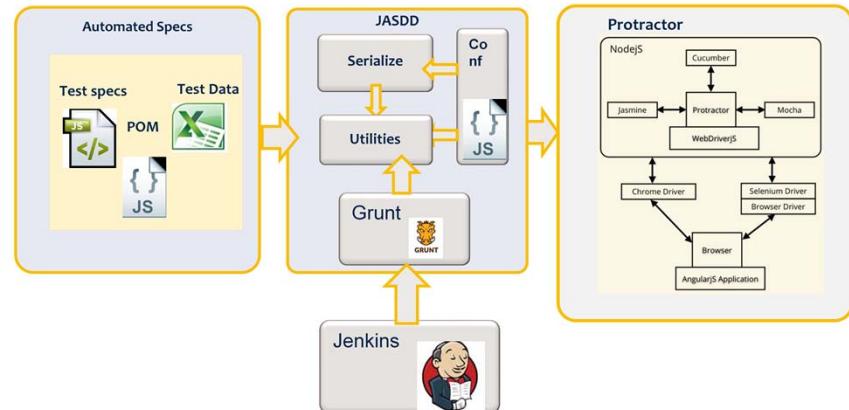
java (IDE exported in Java)

rb (IDE exported in Ruby)

py (IDE exported in Python)

cs (IDE exported in C#)

8.1: Selenium Web Driver – Advance
Sprintest®/Quadrant Architecture



8.1: Selenium Frameworks Reports

- Different applications have different reporting needs. Some require combined results for a test batch and some require individual level test report for each test case in test batch. Thus, framework should be flexible enough to generate required reports.
- Reports output in many formats such as Html/Excel/PDF Format.
- We can also capture and store all the screen shots for failed and passed scenarios
- It also stores the executed data sheets with Pass/Fail status.
- It provides two types of reports
 - summary report and
 - detailed report
- The summary report provides details of execution duration, test start time and end time
- The detailed reports describe exceptional cases handled, steps passed, and steps failed.



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8.1: Selenium Web Driver – Advance Continued.

- The below(fig:a) is the sample html format summary report generated by TestNG.
- The below(fig:b) is the example report to see failed test cases report in detail

Screenshot (a): Sample HTML Format Summary Report

Test results
1 suite, 1 failed test

All suites

ApplicationName Test Suite

Info

- 0 STUDY Selenium App Project testing and
- 1 test
- 3 groups
- 1 time
- Report output
- Failed methods
- Chronological view

Results

- 13 methods, 1 failed, 12 passed
- Failed methods (show)
- Passed methods (show)

Methods in chronological order

Method	Time
com.app.systemadmin.ManageUsers	0 ms
Add User With Invalid Data	20 ms
Edit User With Invalid Data	22 ms
Edit User With Valid Data	24 ms
com.app.systemadmin.ManageDepartments	29 ms
Add Department With Invalid Data	30 ms
Edit Department With Invalid Data	31 ms
Edit Department With Valid Data	33 ms
com.app.systemadmin.ManageLocations	37 ms
Add Location With Invalid Data	40 ms
Edit Location With Invalid Data	41 ms
Edit User With Valid Data	42 ms
com.app.systemadmin.AssignUserToDepartments	165 ms
Assign Users To Department	

Screenshot (b): Failed Test Case Report

Test results
1 suite, 1 failed test

All suites

ApplicationName Test Suite

Info

- 0 STUDY Selenium App Project testing and
- 1 test
- 0 groups
- 1 time
- Report output
- Failed methods
- Chronological view

Results

- 1 methods, 1 failed, 0 passed
- Failed methods (show)
- Edit User With Valid Data**
- Passed methods (show)

Exception stack trace:

```

Edit User With Valid Data
org.testng.internal.thread.Thread�权限异常: Method.org.testng.internal.TestNG
at java.lang.Thread.printStackTrace(Thread.java:482)
at com.app.systemadmin.ManageLocations.Edit User With Valid Data(ManageLocati
at java.util.concurrent.Executors$RunnableAdapter.call(Executors.java:502)
at java.util.concurrent.FutureTask.run(FutureTask.java:266)
at java.util.concurrent.ThreadPoolExecutor.runWorker(ThreadPoolExecutor.java:1142)
at java.util.concurrent.ThreadPoolExecutor$Worker.run(ThreadPoolExecutor.java:617)
at java.lang.Thread.run(Thread.java:748)
... Removed 7 stack frames

```

Log/Reference/UI-Element/Rollup Pane

The bottom pane is used for four different functions—Log, Reference, UI-Element, and Rollup—depending on which tab is selected.

Log

When you run your test case, error messages and information messages showing the progress are displayed in this pane automatically, even if you do not first select the Log tab. These messages are often useful for test case debugging. Notice the Clear button for clearing the Log. Also notice the Info button is a drop-down allowing selection of different levels of information to log.

Reference

The Reference tab is the default selection whenever you are entering or modifying [Selenese](#) commands and parameters in Table mode. In Table mode, the Reference pane will display documentation on the current command. When entering or modifying commands, whether from Table or Source mode, it is critically important to ensure that the parameters specified in the Target and Value fields match those specified in the parameter list in the Reference pane. The number of parameters provided must match the number specified, the order of parameters provided must match the order specified, and the type of parameters provided must match the type specified. If there is a mismatch in any of these three areas, the command will not run correctly.

While the Reference tab is invaluable as a quick reference, it is still often necessary to consult the Selenium [Reference](#) document.

8.1: Selenium Frameworks

TDD

- Test-driven development (TDD) is a software development process that relies on the repetition of a very short development cycle: first the developer writes an (initially failing) automated test case that defines a desired improvement or new function, then produces the minimum amount of code to pass that test, and finally refactors the new code to acceptable standards.

RED – The developer writes a failing test essentially capturing the requirements in a test.
GREEN – The developer implements the business functionality, writing just enough code to pass the test
REFACTOR – The developer refines and improves the code without adding new functionality.

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Action: Used to change the state of the AUT(Application under Test) like click on some link, type a value in edit box, select some options on the page, select a value from drop down etc.

When action is performed on AUT the test will fail if the action is not achieved.

Accessor:-

This command check the state of the application and save the application state in some variable. It can be used for automatic generation of assertions.

Assertions:

Are very similar to checkpoint in UFT/QTP. Assertion verifies the state of the application matches it with the expected state and generates the True/False result.

8.1: Selenium Frameworks

Acceptance TDD

There are two levels of TDD:

- **Acceptance TDD (ATDD):**It is a development methodology based on communication between the business customers, the developers, and the testers
- **With ATDD** you write a single acceptance test, or behavioral specification depending on your preferred terminology, and then just enough production functionality/code to fulfill that test.
- The goal of ATDD is to specify detailed, executable requirements for your solution on a just in time (JIT) basis. Since, ATDD encompasses many of the same practices it is also called Behavior Driven Development (BDD)
- **Behavior Driven(BDD) :**Behavior-driven development combines practices from TDD and from ATDD.
- It includes the practice of writing tests first, but focuses on tests which describe behavior, rather than tests which test a unit of implementation. Tools such as Mspe and Specflow provide a syntax which allow non-programmers to define the behaviors which developers can then translate into automated tests.



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8.1: Selenium Frameworks

ATDD FrameWork

FitNesse

- FitNesse is one of the Acceptance TDD framework.
- It is a web server, a wiki and an automated testing tool for software.
- It allows users of a developed system to enter specially formatted input (its format is accessible to non-programmers).
- The input is interpreted and tests are created automatically. These tests are then executed by the system and output is returned to the user.
- The advantage of this approach is very fast feedback from users. The developer of the system to be tested needs to provide some support
- It is written in Java. The program first supported only Java, but versions for several other languages have been added over time likeC++, Python, Ruby, Delphi, C#, etc.
- Different Principles of fitNesse is described in the next page.

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8.1: Selenium Frameworks

Continued.

- **FitNesse as a testing method**

It was originally designed as a highly usable interface around the Fit framework. As such its intention is to support an agile style of black-box testing acceptance and regression testing. In this style of testing the functional testers in a software development project collaborate with the software developers to develop a testing suite.

- **FitNesse as a testing tool**

Tests are described in FitNesse as some sort of coupling of inputs and expected output. These couplings are expressed as some sort of variation of a decision table. The FitNesse tool supports several of these variations, ranging from literal decision tables to tables that execute queries to tables that express testing scripts (i.e. a literal ordering of steps that must be followed to reach a result).

- **FitNesse as a software tool**

It is a tool developed in Java and shipped as a single, executable jar file. The executable includes a wiki engine, an embedded web server, a testing engine and all the resources (images, stylesheets and so on) required to create a web site in FitNesse's own style.



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8.1: Selenium Frameworks

Behavior TDD

- In software engineering, behavior-driven development is a software development process that emerged from test-driven development (TDD).
- Behavior-driven development combines the general techniques and principles of TDD with ideas from domain-driven design and object-oriented analysis and design to provide software development and management teams with shared tools and a shared process to collaborate on software development.
- Although BDD is principally an idea about how software development should be managed by both business interests and technical insight, the practice of BDD does assume the use of specialized software tools to support the development process.
- BDD is an agile software development technique that encourages collaboration between developers, QA, and non-technical or business participants in a software project. It's more about business specifications than about tests. You write a specification for a story and verify whether the specs work as expected.
- Some of BTDD Frameworks are:
 - Cucumber
 - Spec Flow



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8.1: Selenium Frameworks

BTDD Frameworks

Cucumber

- Cucumber is a software tool that computer programmers use for testing other software. It runs automated acceptance tests written in a behavior-driven development (BDD) style.
- Cucumber is written in the Ruby programming language.
- Cucumber allows the execution of feature documentation written in business-facing text.
 - Example:
 - A feature definition, with a single scenario:
- Feature:
 - Division In order to avoid silly mistakes Cashiers must be able to calculate a fraction
- Scenario:
 - Regular numbers * I have entered 3 into the calculator * I press divide * I have entered 2 into the calculator * I press equal * The result should be 1.5 on the screen.

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8.1: Selenium Frameworks Continued.

The execution of the test implicit in the feature definition above requires the definition, using the Ruby language, of a few "steps"

```
Before do @calc = Calculator.new
end
After do
End
Given /I have entered (\d+)/ into the calculator/ do |n|
@calc.push n.to_i
end
When /I press (\w+)/ do |op|
@result = @calc.send op
end
Then /the result should be (.*) on the screen/ do |result|
@result.should == result.to_f
end
```



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8.1: Selenium Frameworks

Continued.

Specflow

- SpecFlow is a BDD library/framework for .NET that adds capabilities that are similar to Cucumber. It allows to write specification in human readable Gherkin format
- Gherkin is the language that Cucumber understands. It is a Business Readable, Domain Specific Language that lets you describe software behavior without detailing with how that behavior is implemented. It's simply a DSL for describing the required functionality for a given system. This functionality is broken down by feature, and each feature has a number of scenarios.
- It is open source and provided under a BSD license . As a part of the Cucumber family, it uses the official Gherkin parser and provides integration to the .NET framework, Silverlight, Windows Phone and Mono.
- It bridges the communication gap between domain experts and developers by binding business readable behavior specifications and examples to the underlying source code.
- It also supports the concepts of Acceptance Test Driven Development (ATDD) and Behavior Driven Development (BDD).



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8.1: Selenium Frameworks Continued.

Example:

- THE ESSENCE IN two EASY STEPS

Specify!

Describe behavior and evolve a business readable testing and specification DSL.

The screenshot shows a terminal window with the following content:

```
Answers.feature ✘ X
Feature: Ordering answers

Scenario: The answer with the highest vote gets to the top
  Given there is a question "What's your favorite colour?" with the answers
    | Answer      | Vote |
    | Red         | 1   |
    | Cucumber green | 1   |
  When you upvote answer "Cucumber green"
  Then the answer "Cucumber green" should be on top
```



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8.1: Selenium Frameworks
Continued.

Automate!

- Automate scenarios to establish a continuously validated living documentation.

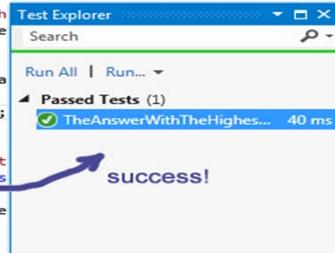
```
[Binding]
public class OrderingAnswersSteps
{
    private readonly QuestionPage questionPage;

    public OrderingAnswersSteps(QuestionPage questionPage) {...}

    [Given(@"there is a question '(.*)' with")
    public void GivenThereIsAQuestionWithThe
    {
        questionPage.VoteUpQuestion(answer);
    }

    [When(@"you upvote answer '(.*)'")
    public void WhenYouUpvoteAnswer(string a
    {
        questionPage.VoteUpQuestion(answer);
    }

    [Then(@"the answer '(.*)' should be on t")
    public void ThenTheAnswerShouldBeOnTop(s
    {
        Assert.AreEqual(answer, questionPage
    }
}
```



The screenshot shows the Microsoft Test Explorer window with a single passed test named "TheAnswerWithTheHighe...". An annotation with a blue arrow points to the test result, labeled "SUCCESS!".

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8.1: Selenium Frameworks

Continuous Integration.

- Continuous integration (CI) is the practice, in software engineering, of merging all developer working copies to a shared mainline several times a day.
- The main aim of CI is to prevent integration problems, referred to as "integration hell" in early descriptions of XP. CI isn't universally accepted as an improvement over frequent integration, so it is important to distinguish between the two as there is disagreement about the virtues of each.
- In addition to automated unit tests, organizations using CI typically use a build server to implement continuous processes of applying quality control in general — small pieces of effort, applied frequently.
- Continuous integration involves integrating early and often, so as to avoid the pitfalls of "integration hell". The practice aims to reduce rework and thus reduce cost and time.
- A complementary practice to CI is that before submitting work, each programmer must do a complete build and run (and pass) all unit tests. Integration tests are usually run automatically on a CI server when it detects a new commit.



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8.1: Selenium Frameworks

CI Tools

Jenkins

- Jenkins provides continuous integration services for software development. It is a server-based system running in a servlet container such as Apache Tomcat .
- Plugins have been released for Jenkins that extend its use to projects written in languages other than Java. Plugins are available for integrating Jenkins with most version control systems and big databases. Many build tools are supported via their respective plugins. Plugins can also change the way Jenkins looks or add new functionality.
- Builds can generate test reports in various formats supported by plugins (JUnit support is currently bundled) and Jenkins can display the reports and generate trends and render them in the GUI.



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Summary

- In this lesson, you have learnt
 - In this lesson, you have understood the different ways in the data is driven from the framework.
 - In the Data Driven Automation Framework, the Input Data/Input Parameters are not hard-coded in the test scripts. Instead, these are stored and passed from external files/resources such as Microsoft Excel Spreadsheets, Microsoft Access Tables, SQL Tables and XML files etc.
 - In the Keyword Driven Automation Framework, we can create multiple keywords that allow testers to associate a unique action or function for each of these keywords
 - After execution of the test script, it is necessary to get the results of the execution. The reports are customized in the framework such that the summary report and the detailed report are stored in html format.
 - Test-driven development does not perform sufficient testing in situations where full functional tests are required to determine success or failure, due to extensive use of unit tests.



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Add the notes here.

Review Question

- Question 1:
 - CBF is
 - Data Driven Framework
 - Key word Driven Framework
 - Hybrid Framework
 - None of the above

- Question 2: True/False
 - The summary report provides details of execution duration, test start time and end time

- Question 3: Fill in the Blanks
 - Cucumber is written in the _____ language.



Test Automation & Advanced Selenium

Lab Book Version 1.0

Document Revision History

Date	Revision No.	Author	Summary of Changes
Jan 2016	1.1	Ritika Verma	Material Revamp

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Getting Started

Overview

This lab book is a guided tour for learning Test Automation & Advanced Selenium. It comprises solved examples and 'To Do' assignments. Follow the steps provided in the solved examples and work out the 'To Do' assignments given.

Setup Checklist for Selenium

Here is what is expected on your machine in order for the lab to work.

Minimum System Requirements

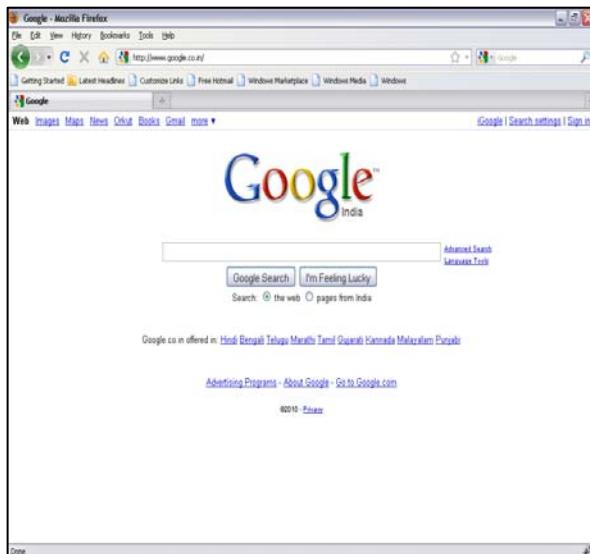
- Intel Pentium 90 or higher (P166 recommended)
- Microsoft Windows 95, 98, or NT 4.0, 2k, XP.
- Memory: 512MB of RAM
- Internet Explorer 6.0 or higher
- Mozilla Firefox(Add-ons: Firebug, Firepath, Selenium IDE)

Instructions

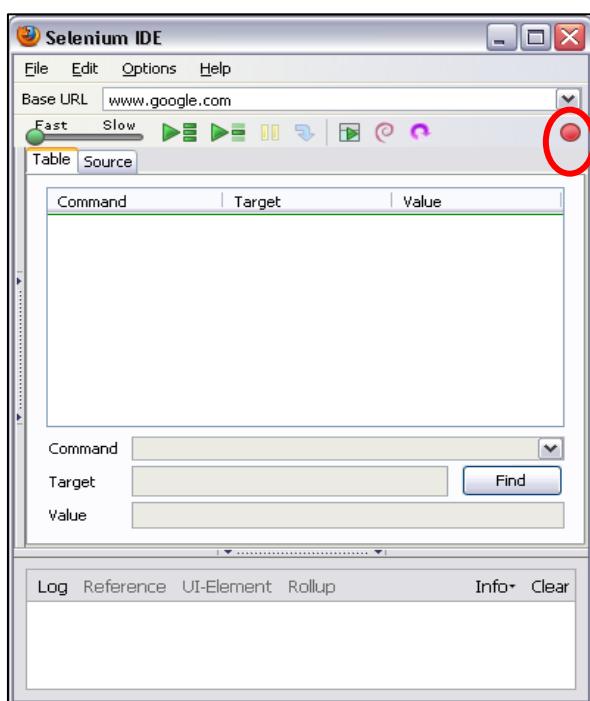
- For all coding standards refer Appendix A. All lab assignments should refer coding standards.
- Create a directory by your name in drive <drive>. In this directory, create a subdirectory Selenium_Assign. For each lab exercise create a directory as lab <lab number>.

Lab Demo 1: Example (Basic Selenium IDE Flow)

Goals	<ul style="list-style-type: none"> Understand the process of automation testing of a web application on Selenium IDE Learn to manage document spacing
Time	60 minutes



Go to the Web Page for which you want to carry out the test

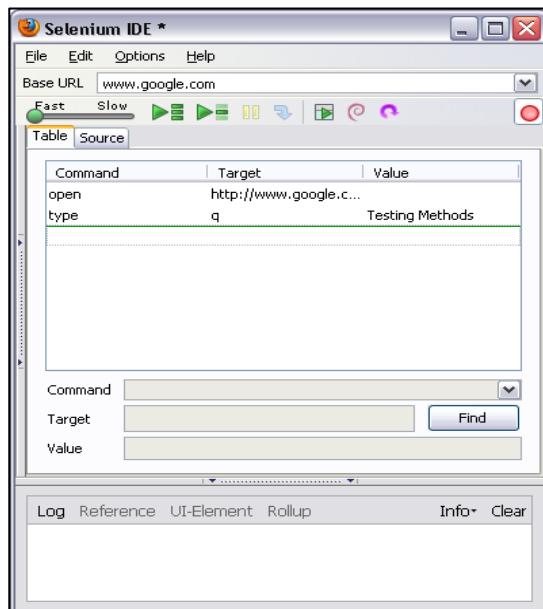


Hit the record button on IDE

Lab Demo: Example (Selenium IDE) (Cont....)

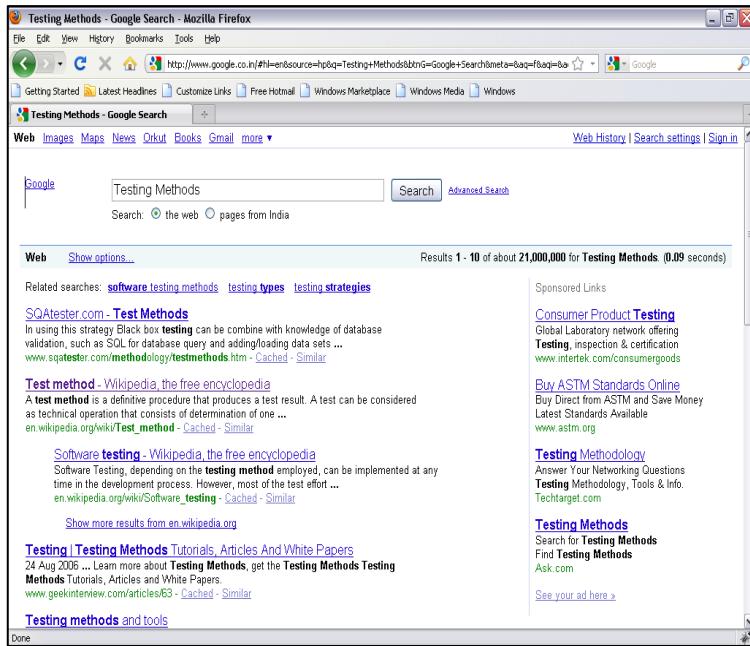


Enter the text on Web
Page and submit

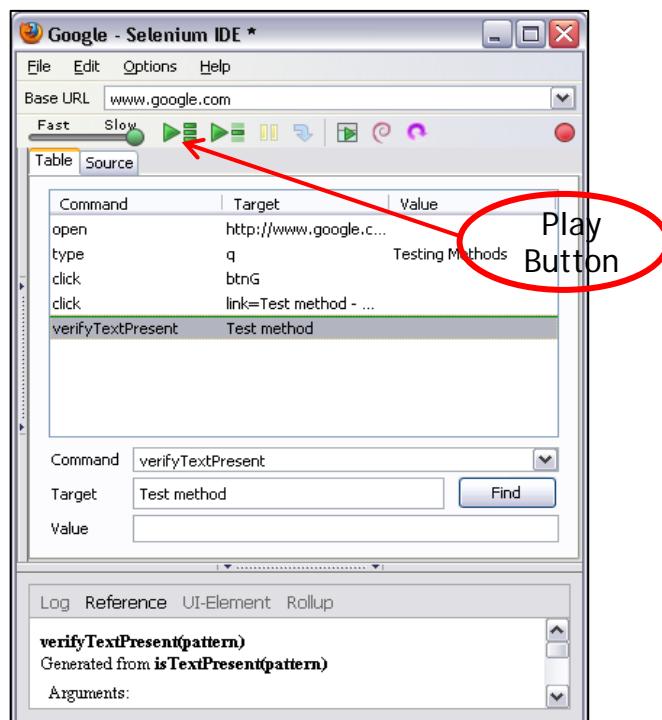


IDE should be updated, stop the
recorder and add the assertions

Lab Demo: Example (Selenium IDE) (Cont....)



Perform operations on the web page



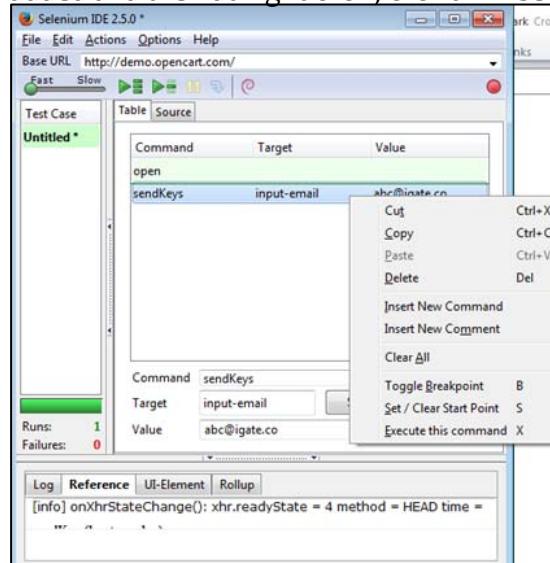
Hit the play button to play the recorded scripts

Lab Demo 2: Learning Selenium IDE (Modifications)

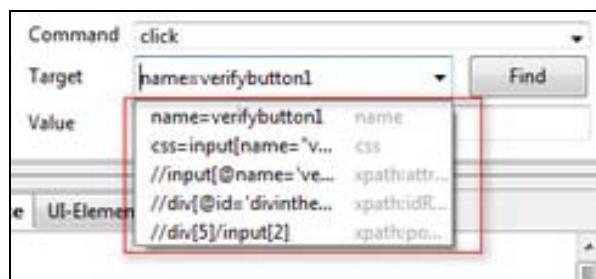
Goals	<ul style="list-style-type: none"> Understand the process of further modifications and validations in automation testing of a web application on Selenium IDE Learn to manage document spacing
Time	60 minutes

Basic URL: <http://demo.opencart.com/>

- Follow the steps from Lab Demo 1
- In order to add new command, go to the command where the new command needs to be added and then do right click , click on ‘Insert New Command’



- ‘Command’ dropdown provides options/ keywords to perform the operation

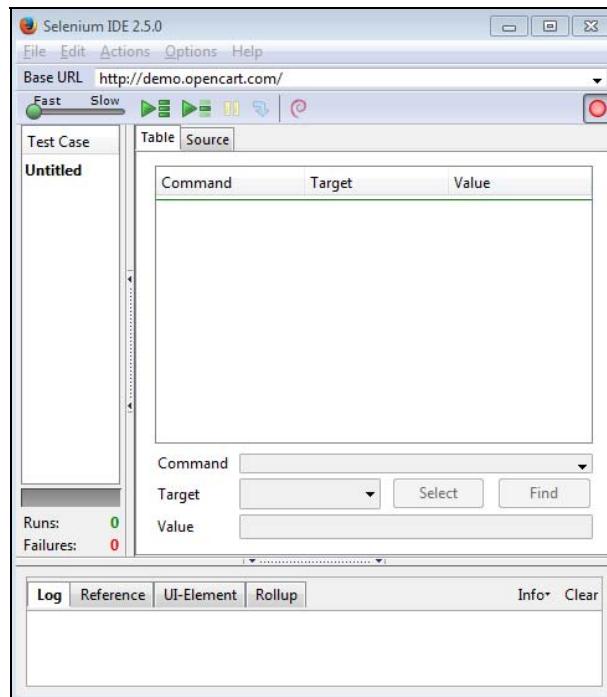


Lab 1. Learning Selenium IDE(Basic Flow)

Goals	<ul style="list-style-type: none"> Understand the basic process of automation testing of a web application in Selenium IDE Learn to manage document spacing
Time	60 minutes

Basic URL: <http://demo.opencart.com/>

1. Open the URL on Firefox
2. Start recording on Selenium IDE
3. Go to 'Desktops' tab
4. Click on 'Mac'
5. Select 'Name(A-Z)' from the 'Sort By' dropdown
6. Click on 'Add to Cart' button
7. Stop the recording on Selenium IDE
8. Playback the whole test case



Lab 2. Learning Selenium IDE(Performing Validations)

Goals	<ul style="list-style-type: none">• Understand the process of automation testing of a web application• Learn to manage document spacing
Time	60 minutes

Basic URL: <http://demo.opencart.com/>

1. Open the URL on Firefox
2. Start recording on Selenium IDE
3. Verify title of the page
4. Go to 'Desktops' tab
5. Click on 'Mac'
6. Select 'Name(A-Z)' from the 'Sort By' dropdown
7. Click on 'Add to Cart' button
8. Enter 'Mobile' in 'Search' text box and click on 'Search' button
9. Wait for page to load
10. Clear the text from 'Search Criteria' text box
11. Click on 'Search in product descriptions' check box and click on 'Search' button
12. Stop the recording on Selenium IDE
13. Add the step after Step 5 where verify the 'Mac' heading
14. Change the value from 'Mobile' to 'Monitors'
15. Save the test case
16. Playback the whole test case.
17. Playback set by step
18. Add the step after Click on 'Mac' where verify the 'Mac' heading
19. Save the test case
20. Export the test case as 'Java/JUnit/webDriver'
21. Run the whole Test case and check the 'Pass' Status
22. Create another test case with the same flow
23. Create the test suite for the above test cases

Lab 3. Create a new account (using Selenium Webdriver)

Goals	<ul style="list-style-type: none"> • Understanding the scenario from end to end and automating the same • Analyze the requirement and perform validations accordingly
Time	120 minutes

Basic URL: <http://demo.opencart.com/>

Please ensure that the variables have to be defined before it is being used.

Part 1: Launch Application

1. Launch the URL on Firefox
2. Verify 'Title' of the page
3. Click on 'My Account' dropdown
4. Select 'Register' from dropdown
5. 'Register Account' page will open up, verify the heading 'Register Account'
6. Click on 'Continue' button at the bottom of the page
7. Verify warning message 'Warning: You must agree to the Privacy Policy!'

Automate and validate the different sections of 'Register Account' page:

Part 2: For 'Your Personal Details'

1. Enter data in 'First Name' text box
2. Verify if 33 characters can be entered in 'First Name' text box by clicking on 'Continue' button.
3. If not, verify error message.
4. Enter data in 'Last Name' text box
5. Verify if 33 characters can be entered in 'First Name' text box by clicking on 'Continue' button.
6. If not, verify error message.
7. Enter valid 'E-mail'.
8. Enter 'Telephone' which must be between 3 and 32 characters.

Part 3: For 'Your Address'

1. Enter 'Address 1' which should contain characters between 3 and 128
2. Enter 'City' which should contain characters between 2 and 128
3. Enter 'Post Code' which should contain characters between 2 and 10

4. Select 'India' from 'Country' Dropdown
5. Select 'Region/State' from dropdown

Part 4: For 'Password'

1. Enter 'Password' which must be between 4 and 20 characters.
2. Enter 'Password Confirm'.

Part 4: For 'Newsletter'

1. Click on 'Yes' Radio button
2. Click on checkbox for 'I have read and agree to the Privacy Policy'.
3. Click on 'Continue' button
4. Verify message 'Your Account Has Been Created!'
5. Click on 'Continue'
6. Click on link 'View your order history' under 'My Orders'

Lab 4. Validations in Selenium (using Selenium Webdriver)

Goals	<ul style="list-style-type: none">• Understanding the scenario from end to end and automating the same
Time	120 minutes

Basic URL: <http://demo.opencart.com/>

After login on the 'Open Cart', create a test script following the below mentioned steps:

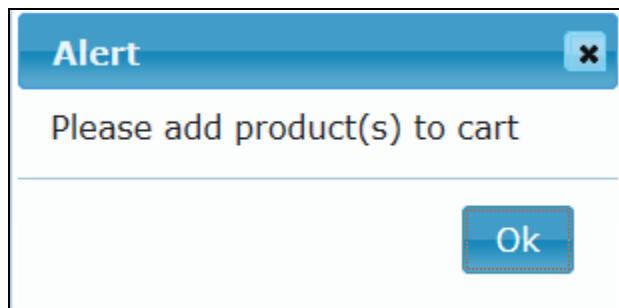
1. Login with credentials created in Lab 1
2. Go to 'Components' tab and click
3. Select 'Monitors'
4. Select 25 from 'Show' dropdown
5. Click on 'Add to cart' for the first item
6. Click on 'Specification' tab
7. Verify details present on the page
8. Click on 'Add to Wish list' button.
9. Verify message 'Success: You have added Apple Cinema 30" to your wish list!'
10. Enter 'Mobile' in 'Search' text box.
11. Click on 'Search' button
12. Click on 'Search in product descriptions' check box
13. Click on link 'HTC Touch HD' for the mobile 'HTC Touch HD'
14. Clear '1' from 'Qty' and enter '3'
15. Click on 'Add to Cart' button
16. Verify success message 'Success: You have added HTC Touch HD to your shopping cart!'
17. Click on 'View cart' button adjacent to search button
18. Verify Mobile name added to the cart
19. Click on 'Checkout' button
20. Click on 'My Account' dropdown
21. Select 'Logout' from dropdown
22. Verify 'Account Logout' heading
23. Click on 'Continue'

Lab 5. Alert and window handling (using Selenium Webdriver)

Goals	Learning alert handling and window handling basics in selenium webdriver
Time	120 minutes

Base URL: <https://ispace.iq.capgemini.com/sitepages/index.aspx>

1. Launch the URL
2. Go to 'Application' tab
3. Click on checkbox 'Stationery Request'
4. Verify the new title 'Stationary'
5. On 'Stationery' tab, click on 'Submit to collect your Stationery >>>' link
6. Switch to alert as shown below.
7. Verify text on the alert 'Please add product(s) to cart'
8. Verify if 'Ok' button is present on the alert
9. Click on 'Ok' button
10. Click on 'Photocopy' tab, click on 'Save Request' button
11. Switch to alert and verify text 'No changes made'
12. Verify if 'Ok' button is present
13. Click on 'Ok' button present on alert
14. Click on 'Logout' button
15. Close the 'Stationery' window



Appendices

Appendix A: Selenium Standards

Key points to keep in mind:

Selenium standards help you reach the widest possible audience.
There are many technologies that are associated with HTML because they are used on web pages or in conjunction with HTML.

For each of the above, please follow coding conventions specified by that technology.

Sometimes you are going to have to break rules and use non-standard syntax for good reason. Try to keep this to the minimum.

How to follow Selenium standards:

See the W3C site for more information on locator types and keyword statements.

The important thing to remember is that proper keywords are essential to assist validation software in checking your document.

Use Selenium IDE to find the locators for the elements.

Refer to W3C for technical and syntax information.

Always use the comments with the codes for proper understanding.

Some simple Selenium standards:

Names of Selenium files should always end with the extension .java.

Correct: foo.java

Incorrect: foo.bar