



# **Selenium Documentation**

*Release 1.0*

**Selenium Project**

August 26, 2012



# CONTENTS

<b>1</b>	<b>Note to the Reader—Docs Being Revised for Selenium 2.0!</b>	<b>3</b>
<b>2</b>	<b>Introduction</b>	<b>5</b>
2.1	Test Automation for Web Applications . . . . .	5
2.2	To Automate or Not to Automate? . . . . .	5
2.3	Introducing Selenium . . . . .	6
2.4	Brief History of The Selenium Project . . . . .	6
2.5	Selenium’s Tool Suite . . . . .	7
2.6	Choosing Your Selenium Tool . . . . .	8
2.7	Supported Browsers and Platforms . . . . .	8
2.8	Flexibility and Extensibility . . . . .	9
2.9	What’s in this Book? . . . . .	9
2.10	The Documentation Team—Authors Past and Present . . . . .	10
<b>3</b>	<b>Selenium-IDE</b>	<b>13</b>
3.1	Introduction . . . . .	13
3.2	Installing the IDE . . . . .	13
3.3	Opening the IDE . . . . .	16
3.4	IDE Features . . . . .	17
3.5	Building Test Cases . . . . .	20
3.6	Running Test Cases . . . . .	22
3.7	Using Base URL to Run Test Cases in Different Domains . . . . .	22
3.8	Selenium Commands – “Selenese” . . . . .	23
3.9	Script Syntax . . . . .	24
3.10	Test Suites . . . . .	25
3.11	Commonly Used Selenium Commands . . . . .	25
3.12	Verifying Page Elements . . . . .	26
3.13	Assertion or Verification? . . . . .	26
3.14	Locating Elements . . . . .	28
3.15	Matching Text Patterns . . . . .	33
3.16	The “AndWait” Commands . . . . .	35
3.17	The waitFor Commands in AJAX applications . . . . .	35
3.18	Sequence of Evaluation and Flow Control . . . . .	35
3.19	Store Commands and Selenium Variables . . . . .	36
3.20	JavaScript and Selenese Parameters . . . . .	37
3.21	echo - The Selenese Print Command . . . . .	38
3.22	Alerts, Popups, and Multiple Windows . . . . .	38
3.23	Debugging . . . . .	40

3.24	Writing a Test Suite . . . . .	42
3.25	User Extensions . . . . .	43
3.26	Format . . . . .	44
3.27	Executing Selenium-IDE Tests on Different Browsers . . . . .	44
3.28	Troubleshooting . . . . .	44
<b>4</b>	<b>Selenium WebDriver</b>	<b>47</b>
4.1	Introducing WebDriver . . . . .	47
4.2	How Does WebDriver ‘Drive’ the Browser Compared to Selenium-RC? . . . . .	47
4.3	WebDriver and the Selenium-Server . . . . .	47
4.4	Setting Up a Selenium-WebDriver Project . . . . .	48
4.5	Migrating from Selenium 1.0 . . . . .	50
4.6	Introducing the Selenium-WebDriver API by Example . . . . .	50
4.7	Selenium-WebDriver API Commands and Operations . . . . .	54
4.8	Driver Specifics and Tradeoffs . . . . .	65
4.9	Selenium-WebDriver’s Drivers . . . . .	65
4.10	Alternative Back-Ends: Mixing WebDriver and RC Technologies . . . . .	70
4.11	Running Standalone Selenium Server for use with RemoteDrivers . . . . .	72
4.12	Additional Resources . . . . .	72
4.13	Next Steps . . . . .	72
<b>5</b>	<b>WebDriver: Advanced Usage</b>	<b>73</b>
5.1	Explicit and Implicit Waits . . . . .	73
5.2	RemoteWebDriver . . . . .	75
5.3	AdvancedUserInteractions . . . . .	77
5.4	Browser Startup Manipulation . . . . .	78
5.5	HTML5 . . . . .	80
5.6	Parallelizing Your Test Runs . . . . .	81
<b>6</b>	<b>Selenium 1 (Selenium RC)</b>	<b>83</b>
6.1	Introduction . . . . .	83
6.2	How Selenium RC Works . . . . .	83
6.3	Installation . . . . .	85
6.4	From Selenese to a Program . . . . .	87
6.5	Programming Your Test . . . . .	91
6.6	Learning the API . . . . .	97
6.7	Reporting Results . . . . .	98
6.8	Adding Some Spice to Your Tests . . . . .	100
6.9	Server Options . . . . .	102
6.10	Specifying the Path to a Specific Browser . . . . .	106
6.11	Selenium RC Architecture . . . . .	106
6.12	Handling HTTPS and Security Popups . . . . .	110
6.13	Supporting Additional Browsers and Browser Configurations . . . . .	111
6.14	Troubleshooting Common Problems . . . . .	111
<b>7</b>	<b>Test Design Considerations</b>	<b>117</b>
7.1	Introducing Test Design . . . . .	117
7.2	Types of Tests . . . . .	117
7.3	Validating Results . . . . .	119
7.4	Location Strategies . . . . .	120
7.5	Wrapping Selenium Calls . . . . .	122
7.6	UI Mapping . . . . .	124

7.7	Page Object Design Pattern . . . . .	125
7.8	Data Driven Testing . . . . .	128
7.9	Database Validation . . . . .	129
<b>8</b>	<b>Selenium-Grid</b>	<b>131</b>
8.1	Quick Start . . . . .	131
8.2	What is Selenium-Grid? . . . . .	131
8.3	When to Use It . . . . .	131
8.4	Selenium-Grid 2.0 . . . . .	132
8.5	Selenium-Grid 1.0 . . . . .	132
8.6	How Selenium-Grid Works—With a Hub and Nodes . . . . .	132
8.7	Installation . . . . .	133
8.8	Starting Selenium-Grid . . . . .	133
8.9	Configuring Selenium-Grid . . . . .	134
8.10	Hub Configuration . . . . .	134
8.11	Node Configuration . . . . .	135
8.12	Timing Parameters . . . . .	135
8.13	Getting Command-Line Help . . . . .	135
8.14	Common Errors . . . . .	136
8.15	Troubleshooting . . . . .	136
<b>9</b>	<b>User-Extensions</b>	<b>137</b>
9.1	Introduction . . . . .	137
9.2	Actions . . . . .	137
9.3	Accessors/Assertions . . . . .	137
9.4	Locator Strategies . . . . .	138
9.5	Using User-Extensions With Selenium-IDE . . . . .	139
9.6	Using User-Extensions With Selenium RC . . . . .	139
<b>10</b>	<b>Selenium WebDriver Cheat Sheet</b>	<b>143</b>
10.1	Role Based Interfaces in Selenium WebDriver . . . . .	143
<b>11</b>	<b>How to Install the Android Driver</b>	<b>145</b>
<b>12</b>	<b>.NET client driver configuration</b>	<b>147</b>
<b>13</b>	<b>Importing Sel2.0 Project into Eclipse using Maven</b>	<b>151</b>
<b>14</b>	<b>Importing Sel2.0 Project into IntelliJ Using Maven</b>	<b>153</b>
<b>15</b>	<b>Selenium 1.0 Java Client Driver Configuration</b>	<b>167</b>
15.1	Configuring Selenium-RC With Eclipse . . . . .	167
15.2	Configuring Selenium-RC With IntelliJ . . . . .	183
<b>16</b>	<b>Python Client Driver Configuration</b>	<b>185</b>
<b>17</b>	<b>Locating Techniques</b>	<b>189</b>
17.1	Useful XPATH patterns . . . . .	189
17.2	Starting to use CSS instead of XPATH . . . . .	189
<b>18</b>	<b>Migrating From Selenium RC to Selenium WebDriver</b>	<b>191</b>
18.1	How to Migrate to Selenium WebDriver . . . . .	191
18.2	Why Migrate to WebDriver . . . . .	191

18.3	Before Starting . . . . .	192
18.4	Getting Started . . . . .	192
18.5	Next Steps . . . . .	192
18.6	Common Problems . . . . .	192

Contents:





## **NOTE TO THE READER—*DOCS BEING REVISED FOR SELENIUM 2.0!***

Hello, and welcome! The Documentation Team would like to welcome you, and to thank you for being interested in Selenium.

*We are currently updating this document for the Selenium 2.0 release.* This means we are currently writing and editing new material, and revising old material. While reading, you may experience typos or other minor errors. If so, please be patient with us. Rather than withholding information until it's finally complete, we are frequently checking-in new writing and revisions as we go. Still, we do check our facts first and are confident the info we've submitted is accurate and useful. Still, if you find an error, particularly in one of our code examples, please let us know. You can create a new issue (<http://code.google.com/p/selenium/issues/entry>) with "Docs Error" in the subject line.

We have worked very, very hard on this document. And, as just mentioned, we are once again working hard, on the new revision. Why? We absolutely believe this is the best tool for web-application testing. We feel its extensibility and flexibility, along with its tight integration with the browser, is unmatched by available proprietary tools. We are very excited to promote Selenium and, hopefully, to expand its user community. In short, we really want to "get the word out" about Selenium.

We believe you will be similarly excited once you understand how Selenium approaches test automation. It's quite different from other automation tools. Whether you are brand-new to Selenium, or have been using it for awhile, we believe this documentation will truly help to spread the knowledge around. We have aimed our writing so that those completely new to test automation can use this document as a stepping stone. However, at the same time we have included a number of advanced, test design topics that should be interesting to the experienced software engineer. In both cases we have written the "Sel-Docs" to help test engineers of all abilities to quickly become productive writing your own Selenium tests. Experienced users and "newbies" alike will benefit from our Selenium User's Guide.

Thanks very much for reading.

– the Selenium Documentation Team



# INTRODUCTION

## 2.1 Test Automation for Web Applications

Many, perhaps most, software applications today are written as web-based applications to be run in an Internet browser. The effectiveness of testing these applications varies widely among companies and organizations. In an era of highly interactive and responsive software processes where many organizations are using some form of Agile methodology, test automation is frequently becoming a requirement for software projects. Test automation is often the answer. Test automation means using a software tool to run repeatable tests against the application to be tested. For regression testing this provides that responsiveness.

There are many advantages to test automation. Most are related to the repeatability of the tests and the speed at which the tests can be executed. There are a number of commercial and open source tools available for assisting with the development of test automation. Selenium is possibly the most widely-used open source solution. This user's guide will assist both new and experienced Selenium users in learning effective techniques in building test automation for web applications.

This user's guide introduces Selenium, teaches its features, and presents commonly used best practices accumulated from the Selenium community. Many examples are provided. Also, technical information on the internal structure of Selenium and recommended uses of Selenium are provided.

Test automation has specific advantages for improving the long-term efficiency of a software team's testing processes. Test automation supports:

- Frequent regression testing
- Rapid feedback to developers
- Virtually unlimited iterations of test case execution
- Support for Agile and extreme development methodologies
- Disciplined documentation of test cases
- Customized defect reporting
- Finding defects missed by manual testing

## 2.2 To Automate or Not to Automate?

Is automation always advantageous? When should one decide to automate test cases?

It is **not** always advantageous to automate test cases. There are times when manual testing may be more appropriate. For instance, if the application's user interface will change considerably in the near future, then any automation might need to be rewritten anyway. Also, sometimes there simply is not enough time to build test automation. For the short term, manual testing may be more effective. If an application has a very tight deadline, there is currently no test automation available, and it's imperative that the testing get done within that time frame, then manual testing is the best solution.

## 2.3 Introducing Selenium

Selenium is a set of different software tools each with a different approach to supporting test automation. Most Selenium QA Engineers focus on the one or two tools that most meet the needs of their project, however learning all the tools will give you many different options for approaching different test automation problems. The entire suite of tools results in a rich set of testing functions specifically geared to the needs of testing of web applications of all types. These operations are highly flexible, allowing many options for locating UI elements and comparing expected test results against actual application behavior. One of Selenium's key features is the support for executing one's tests on multiple browser platforms.

## 2.4 Brief History of The Selenium Project

Selenium first came to life in 2004 when Jason Huggins was testing an internal application at ThoughtWorks. Being a smart guy, he realized there were better uses of his time than manually stepping through the same tests with every change he made. He developed a Javascript library that could drive interactions with the page, allowing him to automatically rerun tests against multiple browsers. That library eventually became Selenium Core, which underlies all the functionality of Selenium Remote Control (RC) and Selenium IDE. Selenium RC was ground-breaking because no other product allowed you to control a browser from a language of your choice.

While Selenium was a tremendous tool, it wasn't without its drawbacks. Because of its Javascript based automation engine and the security limitations browsers apply to Javascript, different things became impossible to do. To make things "worst", webapps became more and more powerful over time, using all sorts of special features new browsers provide and making this restrictions more and more painful.

In 2006 a plucky engineer at Google named Simon Stewart started work on a project he called WebDriver. Google had long been a heavy user of Selenium, but testers had to work around the limitations of the product. Simon wanted a testing tool that spoke directly to the browser using the 'native' method for the browser and operating system, thus avoiding the restrictions of a sandboxed Javascript environment. The WebDriver project began with the aim to solve the Selenium' pain-points.

Jump to 2008. The Beijing Olympics mark China's arrival as a global power, massive mortgage default in the United States triggers the worst international recession since the Great Depression, The Dark Knight is viewed by every human (twice), still reeling from the untimely loss of Heath Ledger. But the most important story of that year was the merging of Selenium and WebDriver. Selenium had massive community and commercial support, but WebDriver was clearly the tool of the future. The joining of the two tools provided a common set of features for all users and brought some of the brightest minds in test automation under one roof. Perhaps the best explanation for why WebDriver and Selenium are merging was detailed by Simon Stewart, the creator of WebDriver, in a joint email to the WebDriver and Selenium community on August 6, 2009.

"Why are the projects merging? Partly because webdriver addresses some shortcomings in selenium (by being able to bypass the JS sandbox, for example. And we've got a gorgeous

API), partly because selenium addresses some shortcomings in webdriver (such as supporting a broader range of browsers) and partly because the main selenium contributors and I felt that it was the best way to offer users the best possible framework.”

## 2.5 Selenium’s Tool Suite

Selenium is composed of multiple software tools. Each has a specific role.

### 2.5.1 Selenium 2 (aka. Selenium Webdriver)

Selenium 2 is the future direction of the project and the newest addition to the Selenium toolkit. This brand new automation tool provides all sorts of awesome features, including a more cohesive and object oriented API as well as an answer to the limitations of the old implementation.

As you can read in Brief History of The Selenium Project, both the Selenium and WebDriver developers agreed that both tools have advantages and that merging the two projects would make a much more robust automation tool.

Selenium 2.0 is the product of that effort. It supports the WebDriver API and underlying technology, along with the Selenium 1 technology underneath the WebDriver API for maximum flexibility in porting your tests. In addition, Selenium 2 still runs Selenium 1’s Selenium RC interface for backwards compatibility.

### 2.5.2 Selenium 1 (aka. Selenium RC or Remote Control)

As you can read in Brief History of The Selenium Project, Selenium RC was the main Selenium project for a long time, before the WebDriver/Selenium merge brought up Selenium 2, the newest and more powerful tool.

Selenium 1 is still actively supported (mostly in maintenance mode) and provides some features that may not be available in Selenium 2 for a while, including support for several languages (Java, Javascript, Ruby, PHP, Python, Perl and C#) and support for almost every browser out there.

### 2.5.3 Selenium IDE

Selenium IDE (Integrated Development Environment) is a prototyping tool for building test scripts. It is a Firefox plugin and provides an easy-to-use interface for developing automated tests. Selenium IDE has a recording feature, which records user actions as they are performed and then exports them as a reusable script in one of many programming languages that can be later executed.

**Note:** Even though Selenium IDE has a “Save” feature that allows users to keep the tests in a table-based format for later import and execution, *it is not designed to run your test passes nor is it designed to build all the automated tests you will need.* Specifically, Selenium IDE doesn’t provide iteration or conditional statements for test scripts. At the time of writing there is no plan to add such thing. The reasons are partly technical and partly based on the Selenium developers encouraging best practices in test automation which always requires some amount of programming. **Selenium IDE is simply intended as a rapid prototyping tool.** The Selenium developers recommend for serious, robust test automation either Selenium 2 or Selenium 1 to be used with one of the many supported programming languages.

## 2.5.4 Selenium-Grid

Selenium-Grid allows the Selenium RC solution to scale for large test suites and for test suites that must be run in multiple environments. Selenium Grid allows you to run your tests in parallel, that is, different tests can be run at the same time on different remote machines. This has two advantages. First, if you have a large test suite, or a slow-running test suite, you can boost its performance substantially by using Selenium Grid to divide your test suite to run different tests at the same time using those different machines. Also, if you must run your test suite on multiple environments you can have different remote machines supporting and running your tests in them at the same time. In each case Selenium Grid greatly improves the time it takes to run your suite by making use of parallel processing.

## 2.6 Choosing Your Selenium Tool

Many people get started with Selenium IDE. If you are not already experienced with a programming or scripting language you can use Selenium IDE to get familiar with Selenium commands. Using the IDE you can create simple tests quickly, sometimes within seconds.

We don't, however, recommend you do all your test automation using Selenium IDE. To effectively use Selenium you will need to build and run your tests using either Selenium 2 or Selenium 1 in conjunction with one of the supported programming languages. Which one you choose depends on you.

At the time of writing the Selenium developers are planning on the Selenium-WebDriver API being the future direction for Selenium. Selenium 1 is provided for backwards compatibility. Still, both have strengths and weaknesses which are discussed in the corresponding chapters of this document.

We recommend those who are completely new to Selenium to read through these sections. However, for those who are adopting Selenium for the first time, and therefore building a new test suite from scratch, you will probably want to go with Selenium 2 since this is the portion of Selenium that will continue to be supported in the future.

## 2.7 Supported Browsers and Platforms

In Selenium 2.0, the supported browsers vary depending on whether you are using Selenium-WebDriver or Selenium-RC.

### 2.7.1 Selenium-WebDriver

Selenium-WebDriver supports the following browsers along with the operating systems these browsers are compatible with.

- Google Chrome 12.0.712.0+
- Internet Explorer 6, 7, 8, 9 - 32 and 64-bit where applicable
- Firefox 3.0, 3.5, 3.6, 4.0, 5.0, 6, 7
- Opera 11.5+
- HtmlUnit 2.9
- Android – 2.3+ for phones and tablets (devices & emulators)
- iOS 3+ for phones (devices & emulators) and 3.2+ for tablets (devices & emulators)

*Note: At the time of writing there is an emulator bug with Android 2.3 that prevents the driver from working properly on device emulators. However, it works fine on tablet emulators and real devices.*

## 2.7.2 Selenium 1.0 and Selenium-RC.

This is the old, support platform for Selenium 1.0. It should still apply to the Selenium 2.0 release of Selenium-RC.

Browser	Selenium IDE	Selenium 1 (RC)	Operating Systems
Firefox 3.x	Record and playback tests	Start browser, run tests	Windows, Linux, Mac
Firefox 3	Record and playback tests	Start browser, run tests	Windows, Linux, Mac
Firefox 2	Record and playback tests	Start browser, run tests	Windows, Linux, Mac
IE 8	Test execution only via Selenium RC*	Start browser, run tests	Windows
IE 7	Test execution only via Selenium RC*	Start browser, run tests	Windows
IE 6	Test execution only via Selenium RC*	Start browser, run tests	Windows
Safari 4	Test execution only via Selenium RC	Start browser, run tests	Windows, Mac
Safari 3	Test execution only via Selenium RC	Start browser, run tests	Windows, Mac
Safari 2	Test execution only via Selenium RC	Start browser, run tests	Windows, Mac
Opera 10	Test execution only via Selenium RC	Start browser, run tests	Windows, Linux, Mac
Opera 9	Test execution only via Selenium RC	Start browser, run tests	Windows, Linux, Mac
Opera 8	Test execution only via Selenium RC	Start browser, run tests	Windows, Linux, Mac
Google Chrome	Test execution only via Selenium RC	Start browser, run tests	Windows, Linux, Mac
Others	Test execution only via Selenium RC	Partial support possible**	As applicable

\* Tests developed on Firefox via Selenium IDE can be executed on any other supported browser via a simple Selenium RC command line.

\*\* Selenium RC server can start any executable, but depending on browser security settings there may be technical limitations that would limit certain features.

## 2.8 Flexibility and Extensibility

You'll find that Selenium is highly flexible. There are many ways you can add functionality to both Selenium test scripts and Selenium's framework to customize your test automation. This is perhaps Selenium's greatest strength when compared with other automation tools. These customizations are described in various places throughout this document. In addition, since Selenium is Open Source, the sourcecode can always be downloaded and modified.

## 2.9 What's in this Book?

This user's guide targets both new users and those who have already used Selenium but are seeking additional knowledge. We introduce Selenium to new users and we do not assume prior Selenium experience. We do assume, however, that the user has at least a basic understanding of test automation. For the more experienced user, this guide can act as a reference. For the more experienced, we recommend browsing the chapter and subheadings. We've provided information on the Selenium architecture, examples of common usage, and a chapter on test design techniques.

The remaining chapters of the reference present:

**Selenium IDE** Introduces Selenium IDE and describes how to use it to build test scripts. using the Selenium Integrated Development Environment. If you are not experienced in programming, but

still hoping to learn test automation this is where you should start and you'll find you can create quite a few automated tests with Selenium IDE. Also, if you are experienced in programming, this chapter may still interest you in that you can use Selenium IDE to do rapid prototyping of your tests. This section also demonstrates how your test script can be "exported" to a programming language for adding more advanced capabilities not supported by Selenium IDE.

**Selenium 2** Explains how to develop an automated test program using Selenium 2.

**Selenium 1** Explains how to develop an automated test program using the Selenium RC API. Many examples are presented in both programming languages and scripting languages. Also, the installation and setup of Selenium RC is covered here. The various modes, or configurations, that Selenium RC supports are described, along with their trade-offs and limitations. An architecture diagram is provided to help illustrate these points. Solutions to common problems frequently difficult for new Sel-R users are described here, for instance, handling Security Certificates, https requests, pop-ups, and the opening of new windows.

**Test Design Considerations** This chapter presents programming techniques for use with Selenium-WebDriver and Selenium RC. We also demonstrate techniques commonly asked about in the user forum such as how to design setup and teardown functions, how to implement data-driven tests (tests where one can vary the data between test passes) and other methods of programming common test automation tasks.

**Selenium-Grid** *This chapter is not yet developed.*

**User extensions** Describes ways that Selenium can be modified, extended and customized.

## 2.10 The Documentation Team—Authors Past and Present

In alphabetical order, the following people have made significant contributions to the authoring of this user's guide, its publishing infrastructure, or both. We are very grateful to all of them.

- Dave Hunt
- Luke Inman-Semerau
- Mary Ann May-Pumphrey
- Noah Sussman
- Paul Grandjean
- Peter Newhook
- Santiago Suarez-Ordonez
- Simon Stewart
- Tarun Kumar

### 2.10.1 Acknowledgements

A special thanks goes to Patrick Lightbody. As an administrator of the SeleniumHQ website, major contributor to Selenium RC, his support was invaluable when writing the first release of the user's guide. Patrick helped us understand our audience. He also set us up with everything we needed on the



seleniumhq.org website for publishing the documents. Also a thanks goes to Andras Hatvani for his advice on publishing solutions, and to Amit Kumar for participating in our discussions and for assisting with reviewing the document.

And of course, we must *recognize the Selenium Developers*. They have truly designed an amazing tool. Without the vision of the original designers, and the continued efforts of the current developers, we would not have such a great tool to pass on to you.



# SELENIUM-IDE

## 3.1 Introduction

The Selenium-IDE (Integrated Development Environment) is the tool you use to develop your Selenium test cases. It's an easy-to-use Firefox plug-in and is generally the most efficient way to develop test cases. It also contains a context menu that allows you to first select a UI element from the browser's currently displayed page and then select from a list of Selenium commands with parameters pre-defined according to the context of the selected UI element. This is not only a time-saver, but also an excellent way of learning Selenium script syntax.

This chapter is all about the Selenium IDE and how to use it effectively.

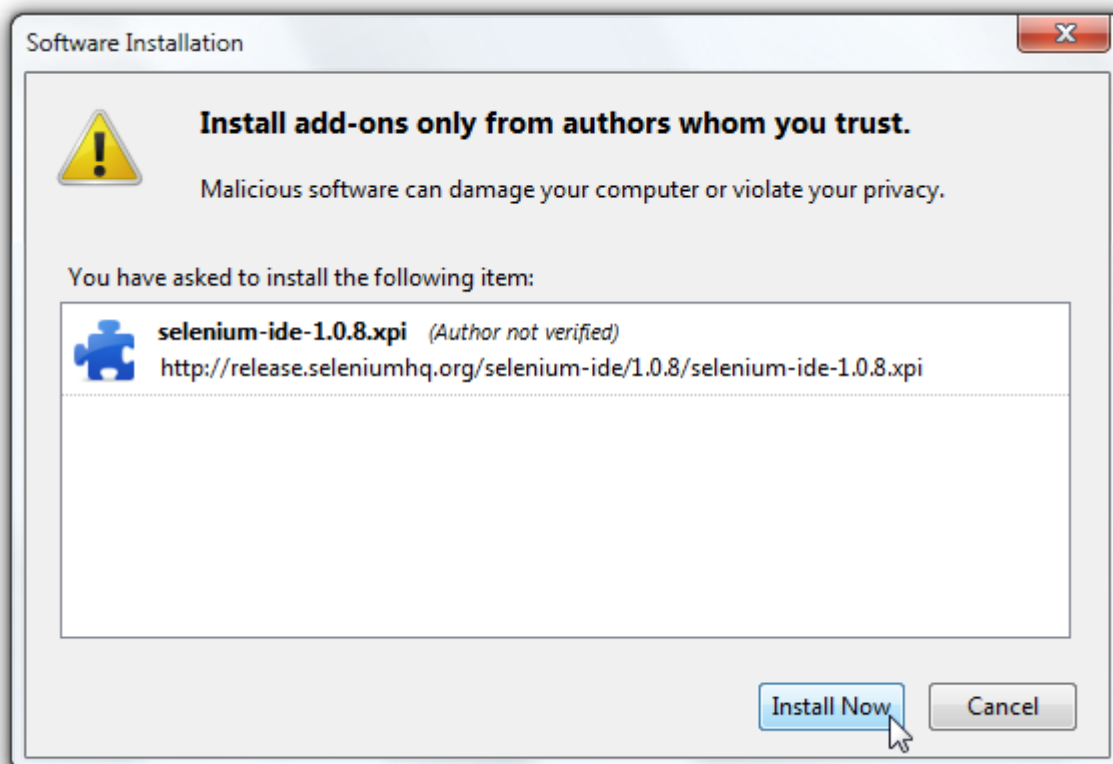
## 3.2 Installing the IDE

Using Firefox, first, download the IDE from the SeleniumHQ [downloads page](#)

Firefox will protect you from installing addons from unfamiliar locations, so you will need to click 'Allow' to proceed with the installation, as shown in the following screenshot.

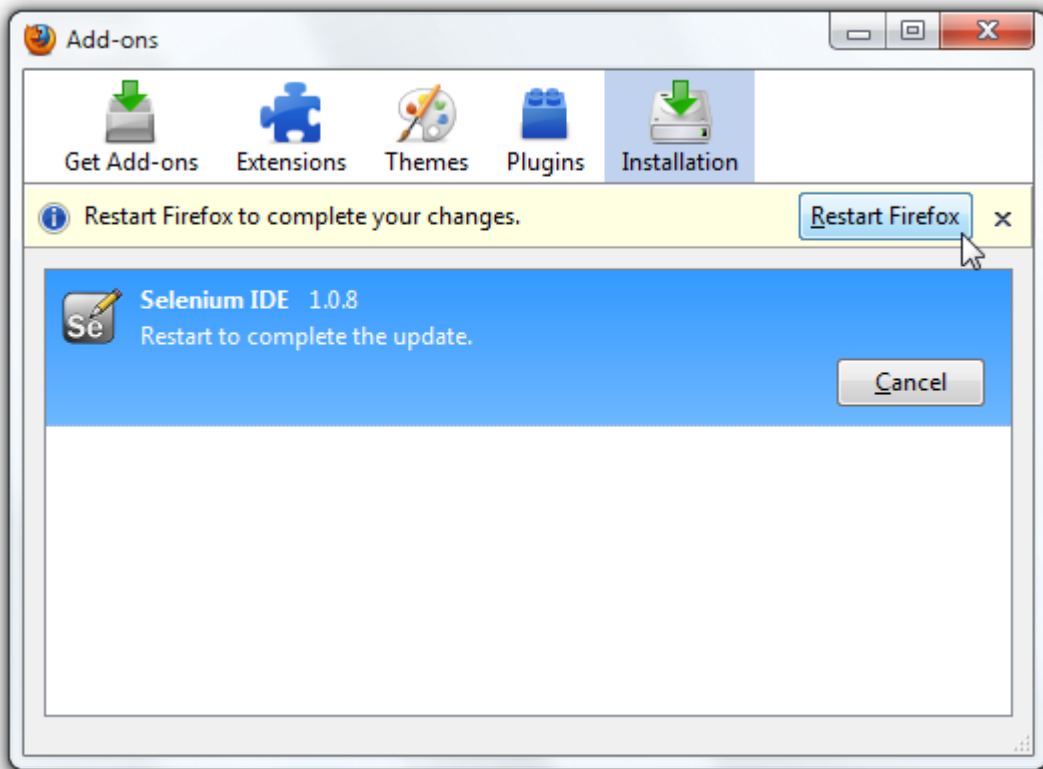


When downloading from Firefox, you'll be presented with the following window.

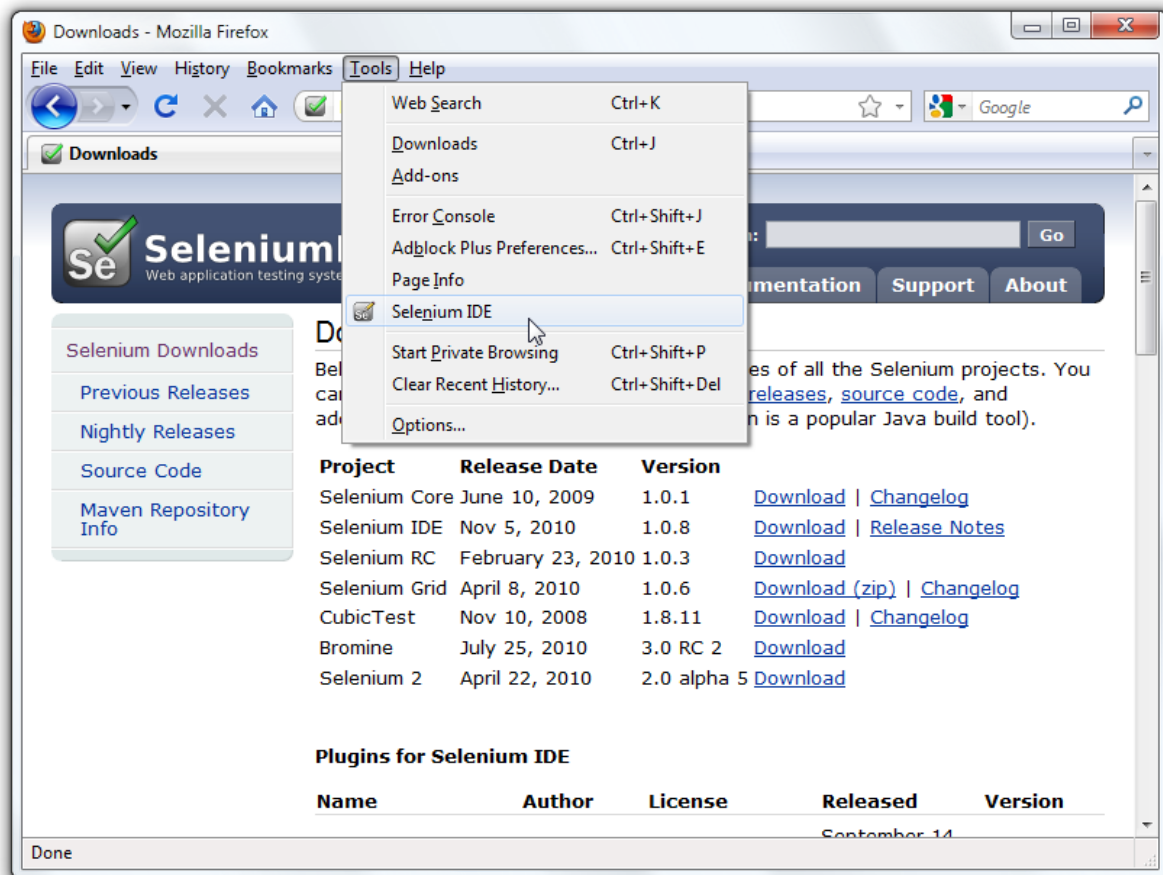


Select Install Now. The Firefox Add-ons window pops up, first showing a progress bar, and when the

download is complete, displays the following.

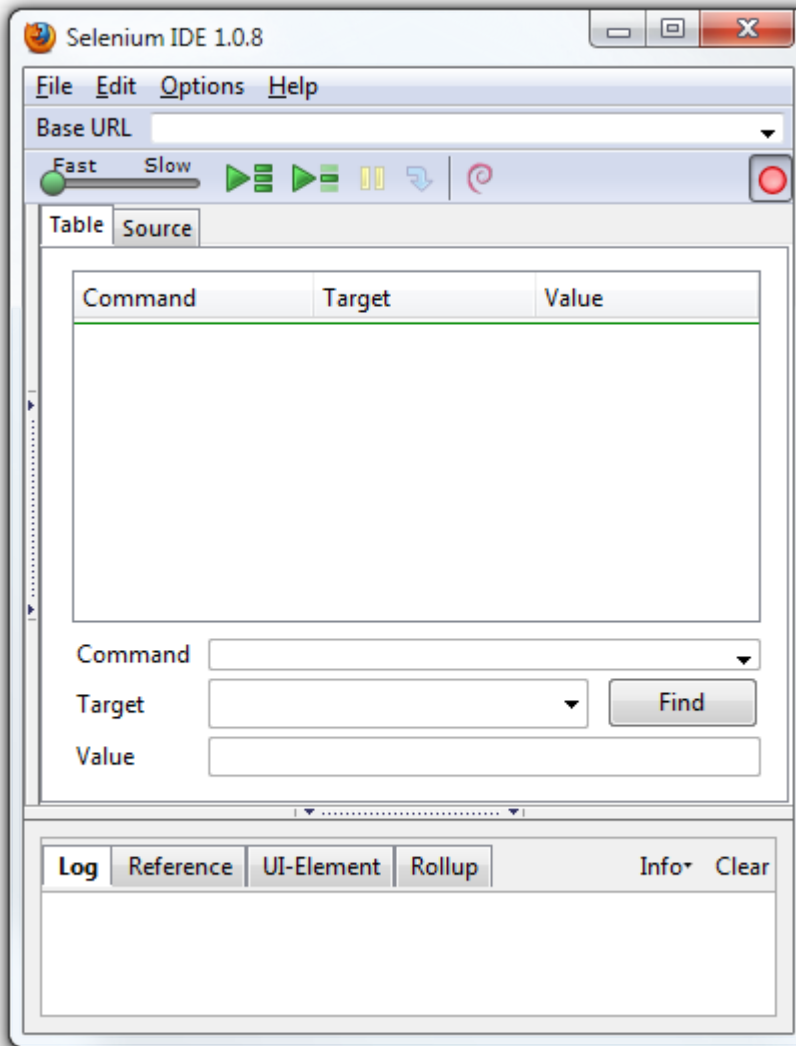


Restart Firefox. After Firefox reboots you will find the Selenium-IDE listed under the Firefox Tools menu.



### 3.3 Opening the IDE

To run the Selenium-IDE, simply select it from the Firefox Tools menu. It opens as follows with an empty script-editing window and a menu for loading, or creating new test cases.



## 3.4 IDE Features

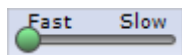
### 3.4.1 Menu Bar

The File menu has options for Test Case and Test Suite (suite of Test Cases). Using these you can add a new Test Case, open a Test Case, save a Test Case, export Test Case in a language of your choice. You can also open the recent Test Case. All these options are also available for Test Suite.

The Edit menu allows copy, paste, delete, undo, and select all operations for editing the commands in your test case. The Options menu allows the changing of settings. You can set the timeout value for certain commands, add user-defined user extensions to the base set of Selenium commands, and specify the format (language) used when saving your test cases. The Help menu is the standard Firefox Help menu; only one item on this menu—UI-Element Documentation—pertains to Selenium-IDE.

### 3.4.2 Toolbar

The toolbar contains buttons for controlling the execution of your test cases, including a step feature for debugging your test cases. The right-most button, the one with the red-dot, is the record button.



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.



Step: Allows you to “step” through a test case by running it one command at a time. Use for debugging test cases.



TestRunner Mode: Allows you to run the test case in a browser loaded with the Selenium-Core TestRunner. The TestRunner is not commonly used now and is likely to be deprecated. This button is for evaluating test cases for backwards compatibility with the TestRunner. Most users will probably not need this button.



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.

### 3.4.3 Test Case Pane

Your script is displayed in the test case pane. It has two tabs, one for displaying the command and their parameters in a readable “table” format.

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

The other tab - 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. See the Options menu for details. The Source view also allows one to edit the test case in its raw form, including copy, cut and paste operations.

The Command, Target, and Value entry fields display the currently selected command along with its parameters. These are entry fields where you can modify the currently selected command. The first



parameter specified for a command in the Reference tab of the bottom pane always goes in the Target field. If a second parameter is specified by the Reference tab, it always goes in the Value field.

Command	clickAndWait	
Target	xpath=id('menu_download')/a	Find
Value		

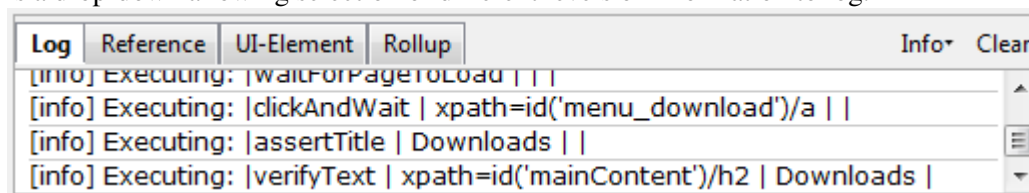
If you start typing in the Command field, a drop-down list will be populated based on the first characters you type; you can then select your desired command from the drop-down.

### 3.4.4 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.

## 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.

## 3.5 Building Test Cases

There are three primary methods for developing test cases. Frequently, a test developer will require all three techniques.

### 3.5.1 Recording

Many first-time users begin by recording a test case from their interactions with a website. When Selenium-IDE is first opened, the record button is ON by default. If you do not want Selenium-IDE to begin recording automatically you can turn this off by going under Options > Options... and deselecting “Start recording immediately on open.”

During recording, Selenium-IDE will automatically insert commands into your test case based on your actions. Typically, this will include:

- clicking a link - *click* or *clickAndWait* commands
- entering values - *type* command
- selecting options from a drop-down listbox - *select* command
- clicking checkboxes or radio buttons - *click* command

Here are some “gotchas” to be aware of:

- The *type* command may require clicking on some other area of the web page for it to record.
- Following a link usually records a *click* command. You will often need to change this to *clickAndWait* to ensure your test case pauses until the new page is completely loaded. Otherwise, your test case will continue running commands before the page has loaded all its UI elements. This will cause unexpected test case failures.

### 3.5.2 Adding Verifications and Asserts With the Context Menu

Your test cases will also need to check the properties of a web-page. This requires *assert* and *verify* commands. We won’t describe the specifics of these commands here; that is in the chapter on Selenium Commands – “Selenese”. Here we’ll simply describe how to add them to your test case.

With Selenium-IDE recording, go to the browser displaying your test application and right click anywhere on the page. You will see a context menu showing *verify* and/or *assert* commands.

The first time you use Selenium, there may only be one Selenium command listed. As you use the IDE however, you will find additional commands will quickly be added to this menu. Selenium-IDE will attempt to predict what command, along with the parameters, you will need for a selected UI element on the current web-page.

Let’s see how this works. Open a web-page of your choosing and select a block of text on the page. A paragraph or a heading will work fine. Now, right-click the selected text. The context menu should give you a *verifyTextPresent* command and the suggested parameter should be the text itself.

Also, notice the Show All Available Commands menu option. This shows many, many more commands, again, along with suggested parameters, for testing your currently selected UI element.

Try a few more UI elements. Try right-clicking an image, or a user control like a button or a checkbox. You may need to use Show All Available Commands to see options other than *verifyTextPresent*. Once you select these other options, the more commonly used ones will show up on the primary context menu. For example, selecting *verifyElementPresent* for an image should later cause that command to be available on the primary context menu the next time you select an image and right-click.

Again, these commands will be explained in detail in the chapter on Selenium commands. For now though, feel free to use the IDE to record and select commands into a test case and then run it. You can learn a lot about the Selenium commands simply by experimenting with the IDE.

### 3.5.3 Editing

#### Insert Command

##### Table View

Select the point in your test case where you want to insert the command. To do this, in the Test Case Pane, left-click on the line where you want to insert a new command. Right-click and select Insert Command; the IDE will add a blank line just ahead of the line you selected. Now use the command editing text fields to enter your new command and its parameters.

##### Source View

Select the point in your test case where you want to insert the command. To do this, in the Test Case Pane, left-click between the commands where you want to insert a new command, and enter the HTML tags needed to create a 3-column row containing the Command, first parameter (if one is required by the Command), and second parameter (again, if one is required). Be sure to save your test before switching back to Table view.

#### Insert Comment

Comments may be added to make your test case more readable. These comments are ignored when the test case is run.

Comments may also be used to add vertical white space (one or more blank lines) in your tests; just create empty comments. An empty command will cause an error during execution; an empty comment won't.

##### Table View

Select the line in your test case where you want to insert the comment. Right-click and select Insert Comment. Now use the Command field to enter the comment. Your comment will appear in purple text.

##### Source View

Select the point in your test case where you want to insert the comment. Add an HTML-style comment, i.e., `<!-- your comment here -->`.

## Edit a Command or Comment

### Table View

Simply select the line to be changed and edit it using the Command, Target, and Value fields.

### Source View

Since Source view provides the equivalent of a WYSIWYG (What You See is What You Get) editor, simply modify which line you wish—command, parameter, or comment.

## 3.5.4 Opening and Saving a Test Case

Like most programs, there are Save and Open commands under the File menu. However, Selenium distinguishes between test cases and test suites. To save your Selenium-IDE tests for later use you can either save the individual test cases, or save the test suite. If the test cases of your test suite have not been saved, you'll be prompted to save them before saving the test suite.

When you open an existing test case or suite, Selenium-IDE displays its Selenium commands in the Test Case Pane.

## 3.6 Running Test Cases

The IDE allows many options for running your test case. You can run a test case all at once, stop and start it, run it one line at a time, run a single command you are currently developing, and you can do a batch run of an entire test suite. Execution of test cases is very flexible in the IDE.

**Run a Test Case** Click the Run button to run the currently displayed test case.

**Run a Test Suite** Click the Run All button to run all the test cases in the currently loaded test suite.

**Stop and Start** The Pause button can be used to stop the test case while it is running. The icon of this button then changes to indicate the Resume button. To continue click Resume.

**Stop in the Middle** You can set a breakpoint in the test case to cause it to stop on a particular command. This is useful for debugging your test case. To set a breakpoint, select a command, right-click, and from the context menu select Toggle Breakpoint.

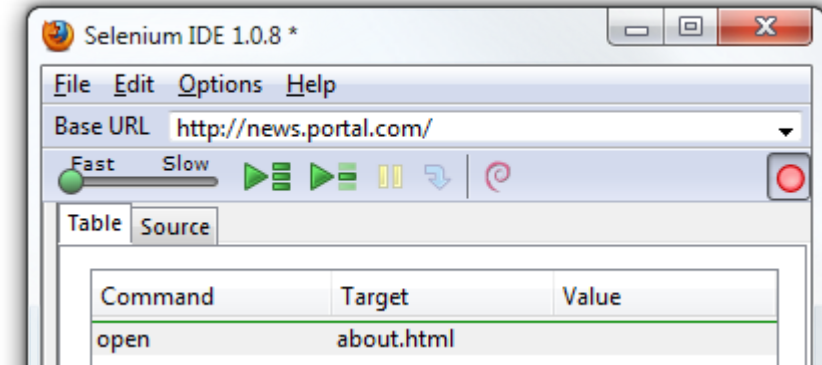
**Start from the Middle** You can tell the IDE to begin running from a specific command in the middle of the test case. This also is used for debugging. To set a startpoint, select a command, right-click, and from the context menu select Set/Clear Start Point.

**Run Any Single Command** Double-click any single command to run it by itself. This is useful when writing a single command. It lets you immediately test a command you are constructing, when you are not sure if it is correct. You can double-click it to see if it runs correctly. This is also available from the context menu.

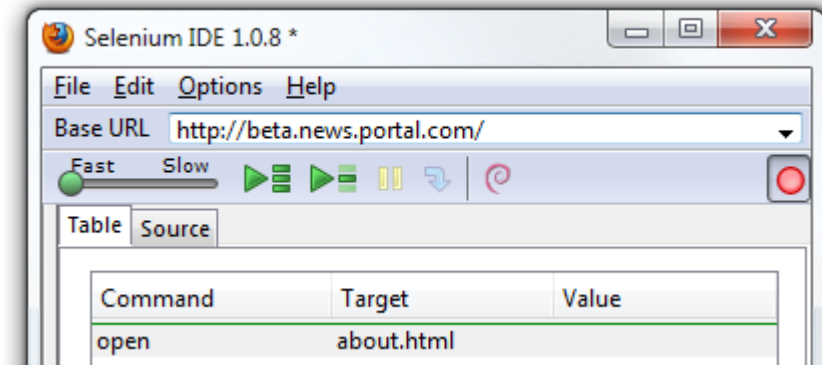
## 3.7 Using Base URL to Run Test Cases in Different Domains

The *Base URL* field at the top of the Selenium-IDE window is very useful for allowing test cases to be run across different domains. Suppose that a site named `http://news.portal.com` had an in-house beta

site named `http://beta.news.portal.com`. Any test cases for these sites that begin with an *open* statement should specify a *relative URL* as the argument to *open* rather than an *absolute URL* (one starting with a protocol such as `http:` or `https:`). Selenium-IDE will then create an absolute URL by appending the *open* command's argument onto the end of the value of Base URL. For example, the test case below would be run against `http://news.portal.com/about.html`:



This same test case with a modified Base URL setting would be run against `http://beta.news.portal.com/about.html`:



### 3.8 Selenium Commands – “Selenese”

Selenium commands, often called *selenese*, are the set of commands that run your tests. A sequence of these commands is a *test script*. Here we explain those commands in detail, and we present the many choices you have in testing your web application when using Selenium.

Selenium provides a rich set of commands for fully testing your web-app in virtually any way you can imagine. The command set is often called *selenese*. These commands essentially create a testing language.

In selenese, one can test the existence of UI elements based on their HTML tags, test for specific content, test for broken links, input fields, selection list options, submitting forms, and table data among other things. In addition Selenium commands support testing of window size, mouse position, alerts, Ajax functionality, pop up windows, event handling, and many other web-application features. The [Command Reference](#) lists all the available commands.

A *command* is what tells Selenium what to do. Selenium commands come in three “flavors”: **Actions**, **Accessors**, and **Assertions**.

- **Actions** are commands that generally manipulate the state of the application. They do things like “click this link” and “select that option”. If an Action fails, or has an error, the execution of the current test is stopped.

Many Actions can be called with the “AndWait” suffix, e.g. “clickAndWait”. This suffix tells Selenium that the action will cause the browser to make a call to the server, and that Selenium should wait for a new page to load.

- **Accessors** examine the state of the application and store the results in variables, e.g. “storeTitle”. They are also used to automatically generate Assertions.
- **Assertions** are like Accessors, but they verify that the state of the application conforms to what is expected. Examples include “make sure the page title is X” and “verify that this checkbox is checked”.

All Selenium Assertions can be used in 3 modes: “assert”, “verify”, and “waitFor”. For example, you can “assertText”, “verifyText” and “waitForText”. When an “assert” fails, the test is aborted. When a “verify” fails, the test will continue execution, logging the failure. This allows a single “assert” to ensure that the application is on the correct page, followed by a bunch of “verify” assertions to test form field values, labels, etc.

“waitFor” commands wait for some condition to become true (which can be useful for testing Ajax applications). They will succeed immediately if the condition is already true. However, they will fail and halt the test if the condition does not become true within the current timeout setting (see the `setTimeout` action below).

## 3.9 Script Syntax

Selenium commands are simple, they consist of the command and two parameters. For example:

verifyText	//div//a[2]	Login
------------	-------------	-------

The parameters are not always required; it depends on the command. In some cases both are required, in others one parameter is required, and in still others the command may take no parameters at all. Here are a couple more examples:

goBackAndWait		
verifyTextPresent		Welcome to My Home Page
type	id=phone	(555) 666-7066
type	id=address1	\${myVariableAddress}

The command reference describes the parameter requirements for each command.

Parameters vary, however they are typically:

- a *locator* for identifying a UI element within a page.
- a *text pattern* for verifying or asserting expected page content
- a *text pattern* or a selenium variable for entering text in an input field or for selecting an option from an option list.

Locators, text patterns, selenium variables, and the commands themselves are described in considerable detail in the section on Selenium Commands.

Selenium scripts that will be run from Selenium-IDE will be stored in an HTML text file format. This consists of an HTML table with three columns. The first column identifies the Selenium command, the second is a target, and the final column contains a value. The second and third columns may not require values depending on the chosen Selenium command, but they should be present. Each table row represents a new Selenium command. Here is an example of a test that opens a page, asserts the page title and then verifies some content on the page:

```
<table>
  <tr><td>open</td><td>/download/</td><td></td></tr>
  <tr><td>assertTitle</td><td></td><td>Downloads</td></tr>
  <tr><td>verifyText</td><td>//h2</td><td>Downloads</td></tr>
</table>
```

Rendered as a table in a browser this would look like the following:

open	/download/	
assertTitle		Downloads
verifyText	//h2	Downloads

The Selenese HTML syntax can be used to write and run tests without requiring knowledge of a programming language. With a basic knowledge of selenese and Selenium-IDE you can quickly produce and run testcases.

## 3.10 Test Suites

A test suite is a collection of tests. Often one will run all the tests in a test suite as one continuous batch-job.

When using Selenium-IDE, test suites also can be defined using a simple HTML file. The syntax again is simple. An HTML table defines a list of tests where each row defines the filesystem path to each test. An example tells it all.

```
<html>
<head>
<title>Test Suite Function Tests - Priority 1</title>
</head>
<body>
<table>
  <tr><td><b>Suite Of Tests</b></td></tr>
  <tr><td><a href= "./Login.html" >Login</a></td></tr>
  <tr><td><a href= "./SearchValues.html" >Test Searching for Values</a></td></tr>
  <tr><td><a href= "./SaveValues.html" >Test Save</a></td></tr>
</table>
</body>
</html>
```

A file similar to this would allow running the tests all at once, one after another, from the Selenium-IDE.

Test suites can also be maintained when using Selenium-RC. This is done via programming and can be done a number of ways. Commonly Junit is used to maintain a test suite if one is using Selenium-RC with Java. Additionally, if C# is the chosen language, NUnit could be employed. If using an interpreted language like Python with Selenium-RC then some simple programming would be involved in setting up a test suite. Since the whole reason for using Selenium-RC is to make use of programming logic for your testing this usually isn't a problem.

## 3.11 Commonly Used Selenium Commands

To conclude our introduction of Selenium, we'll show you a few typical Selenium commands. These are probably the most commonly used commands for building tests.



**open** opens a page using a URL.

**click/clickAndWait** performs a click operation, and optionally waits for a new page to load.

**verifyTitle/assertTitle** verifies an expected page title.

**verifyTextPresent** verifies expected text is somewhere on the page.

**verifyElementPresent** verifies an expected UI element, as defined by its HTML tag, is present on the page.

**verifyText** verifies expected text and its corresponding HTML tag are present on the page.

**verifyTable** verifies a table's expected contents.

**waitForPageToLoad** pauses execution until an expected new page loads. Called automatically when `clickAndWait` is used.

**waitForElementPresent** pauses execution until an expected UI element, as defined by its HTML tag, is present on the page.

### 3.12 Verifying Page Elements

Verifying UI elements on a web page is probably the most common feature of your automated tests. Selenese allows multiple ways of checking for UI elements. It is important that you understand these different methods because these methods define what you are actually testing.

For example, will you test that...

1. an element is present somewhere on the page?
2. specific text is somewhere on the page?
3. specific text is at a specific location on the page?

For example, if you are testing a text heading, the text and its position at the top of the page are probably relevant for your test. If, however, you are testing for the existence of an image on the home page, and the web designers frequently change the specific image file along with its position on the page, then you only want to test that *an image* (as opposed to the specific image file) exists *somewhere on the page*.

### 3.13 Assertion or Verification?

Choosing between “assert” and “verify” comes down to convenience and management of failures. There's very little point checking that the first paragraph on the page is the correct one if your test has already failed when checking that the browser is displaying the expected page. If you're not on the correct page, you'll probably want to abort your test case so that you can investigate the cause and fix the issue(s) promptly. On the other hand, you may want to check many attributes of a page without aborting the test case on the first failure as this will allow you to review all failures on the page and take the appropriate action. Effectively an “assert” will fail the test and abort the current test case, whereas a “verify” will fail the test and continue to run the test case.

The best use of this feature is to logically group your test commands, and start each group with an “assert” followed by one or more “verify” test commands. An example follows:



Command	Target	Value
open	/download/	
assertTitle	Downloads	
verifyText	//h2	Downloads
assertTable	1.2.1	Selenium IDE
verifyTable	1.2.2	June 3, 2008
verifyTable	1.2.3	1.0 beta 2

The above example first opens a page and then “asserts” that the correct page is loaded by comparing the title with the expected value. Only if this passes will the following command run and “verify” that the text is present in the expected location. The test case then “asserts” the first column in the second row of the first table contains the expected value, and only if this passed will the remaining cells in that row be “verified”.

### 3.13.1 verifyTextPresent

The command `verifyTextPresent` is used to verify *specific text exists somewhere on the page*. It takes a single argument—the text pattern to be verified. For example:

Command	Target	Value
verifyTextPresent	Marketing Analysis	

This would cause Selenium to search for, and verify, that the text string “Marketing Analysis” appears somewhere on the page currently being tested. Use `verifyTextPresent` when you are interested in only the text itself being present on the page. Do not use this when you also need to test where the text occurs on the page.

### 3.13.2 verifyElementPresent

Use this command when you must test for the presence of a specific UI element, rather than its content. This verification does not check the text, only the HTML tag. One common use is to check for the presence of an image.

Command	Target	Value
verifyElementPresent	//div/p/img	

This command verifies that an image, specified by the existence of an `<img>` HTML tag, is present on the page, and that it follows a `<div>` tag and a `<p>` tag. The first (and only) parameter is a *locator* for telling the Selenese command how to find the element. Locators are explained in the next section.

`verifyElementPresent` can be used to check the existence of any HTML tag within the page. You can check the existence of links, paragraphs, divisions `<div>`, etc. Here are a few more examples.

Command	Target	Value
verifyElementPresent	//div/p	
verifyElementPresent	//div/a	
verifyElementPresent	id=Login	
verifyElementPresent	link=Go to Marketing Research	
verifyElementPresent	//a[2]	
verifyElementPresent	//head/title	

These examples illustrate the variety of ways a UI element may be tested. Again, locators are explained in the next section.

### 3.13.3 verifyText

Use `verifyText` when both the text and its UI element must be tested. `verifyText` must use a locator. If you choose an *XPath* or *DOM* locator, you can verify that specific text appears at a specific location on the page relative to other UI components on the page.

Command	Target	Value
<code>verifyText</code>	<code>//table/tr/td/div/p</code>	This is my text and it occurs right after the div inside the table.

## 3.14 Locating Elements

For many Selenium commands, a target is required. This target identifies an element in the content of the web application, and consists of the location strategy followed by the location in the format `locatorType=location`. The locator type can be omitted in many cases. The various locator types are explained below with examples for each.

### 3.14.1 Locating by Identifier

This is probably the most common method of locating elements and is the catch-all default when no recognized locator type is used. With this strategy, the first element with the `id` attribute value matching the location will be used. If no element has a matching `id` attribute, then the first element with a `name` attribute matching the location will be used.

For instance, your page source could have `id` and `name` attributes as follows:

```
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   </form>
8 </body>
9 </html>
```

The following locator strategies would return the elements from the HTML snippet above indicated by line number:

- `identifier=loginForm(3)`
- `identifier=password(5)`
- `identifier=continue(6)`
- `continue(6)`

Since the `identifier` type of locator is the default, the `identifier=` in the first three examples above is not necessary.

### Locating by Id

This type of locator is more limited than the `identifier` locator type, but also more explicit. Use this when you know an element's `id` attribute.

```

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>

```

- id=loginForm (3)

## Locating by Name

The name locator type will locate the first element with a matching name attribute. If multiple elements have the same value for a name attribute, then you can use filters to further refine your location strategy. The default filter type is value (matching the value attribute).

```

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>

```

- name=username (4)
- name=continue value=Clear (7)
- name=continue Clear (7)
- name=continue type=button (7)

**Note:** Unlike some types of XPath and DOM locators, the three types of locators above allow Selenium to test a UI element independent of its location on the page. So if the page structure and organization is altered, the test will still pass. You may or may not want to also test whether the page structure changes. In the case where web designers frequently alter the page, but its functionality must be regression tested, testing via id and name attributes, or really via any HTML property, becomes very important.

## Locating by XPath

XPath is the language used for locating nodes in an XML document. As HTML can be an implementation of XML (XHTML), Selenium users can leverage this powerful language to target elements in their web applications. XPath extends beyond (as well as supporting) the simple methods of locating by id

or name attributes, and opens up all sorts of new possibilities such as locating the third checkbox on the page.

One of the main reasons for using XPath is when you don't have a suitable id or name attribute for the element you wish to locate. You can use XPath to either locate the element in absolute terms (not advised), or relative to an element that does have an id or name attribute. XPath locators can also be used to specify elements via attributes other than id and name.

Absolute XPaths contain the location of all elements from the root (html) and as a result are likely to fail with only the slightest adjustment to the application. By finding a nearby element with an id or name attribute (ideally a parent element) you can locate your target element based on the relationship. This is much less likely to change and can make your tests more robust.

Since only xpath locators start with “/”, it is not necessary to include the xpath= label when specifying an XPath locator.

```
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>
```

- xpath=/html/body/form[1] (3) - *Absolute path (would break if the HTML was changed only slightly)*
- //form[1] (3) - *First form element in the HTML*
- xpath=//form[@id='loginForm'] (3) - *The form element with attribute named 'id' and the value 'loginForm'*
- xpath=//form[input/@name='username'] (3) - *First form element with an input child element with attribute named 'name' and the value 'username'*
- //input[@name='username'] (4) - *First input element with attribute named 'name' and the value 'username'*
- //form[@id='loginForm']/input[1] (4) - *First input child element of the form element with attribute named 'id' and the value 'loginForm'*
- //input[@name='continue'][@type='button'] (7) - *Input with attribute named 'name' and the value 'continue' and attribute named 'type' and the value 'button'*
- //form[@id='loginForm']/input[4] (7) - *Fourth input child element of the form element with attribute named 'id' and value 'loginForm'*

These examples cover some basics, but in order to learn more, the following references are recommended:

- [W3Schools XPath Tutorial](#)
- [W3C XPath Recommendation](#)

There are also a couple of very useful Firefox Add-ons that can assist in discovering the XPath of an element:

- [XPath Checker](#) - suggests XPath and can be used to test XPath results.
- [Firebug](#) - XPath suggestions are just one of the many powerful features of this very useful add-on.

## Locating Hyperlinks by Link Text

This is a simple method of locating a hyperlink in your web page by using the text of the link. If two links with the same text are present, then the first match will be used.

```

1 <html>
2 <body>
3   <p>Are you sure you want to do this?</p>
4   <a href= "continue.html" >Continue</a>
5   <a href= "cancel.html" >Cancel</a>
6 </body>
7 </html>

```

- link=Continue (4)
- link=Cancel (5)

## Locating by DOM

The Document Object Model represents an HTML document and can be accessed using JavaScript. This location strategy takes JavaScript that evaluates to an element on the page, which can be simply the element's location using the hierarchical dotted notation.

Since only dom locators start with “document”, it is not necessary to include the dom= label when specifying a DOM locator.

```

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>

```

- dom=document.getElementById('loginForm') (3)
- dom=document.forms['loginForm'] (3)
- dom=document.forms[0] (3)
- document.forms[0].username (4)
- document.forms[0].elements['username'] (4)

- `document.forms[0].elements[0]` (4)
- `document.forms[0].elements[3]` (7)

You can use Selenium itself as well as other sites and extensions to explore the DOM of your web application. A good reference exists on [W3Schools](#).

### Locating by CSS

CSS (Cascading Style Sheets) is a language for describing the rendering of HTML and XML documents. CSS uses Selectors for binding style properties to elements in the document. These Selectors can be used by Selenium as another locating strategy.

```
1 <html>
2 <body>
3   <form id= "loginForm" >
4     <input class= "required" name= "username" type= "text" />
5     <input class= "required passfield" 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>
```

- `css=form#loginForm` (3)
- `css=input[name="username"]` (4)
- `css=input.required[type="text"]` (4)
- `css=input.passfield` (5)
- `css=#loginForm input[type="button"]` (4)
- `css=#loginForm input:nth-child(2)` (5)

For more information about CSS Selectors, the best place to go is [the W3C publication](#). You'll find additional references there.

**Note:** Most experienced Selenium users recommend CSS as their locating strategy of choice as it's considerably faster than XPath and can find the most complicated objects in an intrinsic HTML document.

### Implicit Locators

You can choose to omit the locator type in the following situations:

- Locators without an explicitly defined locator strategy will default to using the identifier locator strategy. See [Locating by Identifier](#).
- Locators starting with `“/”` will use the XPath locator strategy. See [Locating by XPath](#).
- Locators starting with `“document”` will use the DOM locator strategy. See [Locating by DOM](#).

## 3.15 Matching Text Patterns

Like locators, *patterns* are a type of parameter frequently required by Selenese commands. Examples of commands which require patterns are **verifyTextPresent**, **verifyTitle**, **verifyAlert**, **assertConfirmation**, **verifyText**, and **verifyPrompt**. And as has been mentioned above, link locators can utilize a pattern. Patterns allow you to *describe*, via the use of special characters, what text is expected rather than having to specify that text exactly.

There are three types of patterns: *globbing*, *regular expressions*, and *exact*.

### 3.15.1 Globbing Patterns

Most people are familiar with globbing as it is utilized in filename expansion at a DOS or Unix/Linux command line such as `ls *.c`. In this case, globbing is used to display all the files ending with a `.c` extension that exist in the current directory. Globbing is fairly limited. Only two special characters are supported in the Selenium implementation:

- \* which translates to “match anything,” i.e., nothing, a single character, or many characters.

- [ ] (*character class*) which translates to “match any single character found inside the square brackets.” A dash (hyphen) can be used as a shorthand to specify a range of characters (which are contiguous in the ASCII character set). A few examples will make the functionality of a character class clear:

- [aeiou] matches any lowercase vowel

- [0-9] matches any digit

- [a-zA-Z0-9] matches any alphanumeric character

In most other contexts, globbing includes a third special character, the `?`. However, Selenium globbing patterns only support the asterisk and character class.

To specify a globbing pattern parameter for a Selenese command, you can prefix the pattern with a **glob:** label. However, because globbing patterns are the default, you can also omit the label and specify just the pattern itself.

Below is an example of two commands that use globbing patterns. The actual link text on the page being tested was “Film/Television Department”; by using a pattern rather than the exact text, the **click** command will work even if the link text is changed to “Film & Television Department” or “Film and Television Department”. The glob pattern’s asterisk will match “anything or nothing” between the word “Film” and the word “Television”.

Command	Target	Value
click	link=glob:Film*Television Department	
verifyTitle	glob:*Film*Television*	

The actual title of the page reached by clicking on the link was “De Anza Film And Television Department - Menu”. By using a pattern rather than the exact text, the `verifyTitle` will pass as long as the two words “Film” and “Television” appear (in that order) anywhere in the page’s title. For example, if the page’s owner should shorten the title to just “Film & Television Department,” the test would still pass. Using a pattern for both a link and a simple test that the link worked (such as the `verifyTitle` above does) can greatly reduce the maintenance for such test cases.

## Regular Expression Patterns

*Regular expression* patterns are the most powerful of the three types of patterns that Selenese supports. Regular expressions are also supported by most high-level programming languages, many text editors, and a host of tools, including the Linux/Unix command-line utilities **grep**, **sed**, and **awk**. In Selenese, regular expression patterns allow a user to perform many tasks that would be very difficult otherwise. For example, suppose your test needed to ensure that a particular table cell contained nothing but a number. `regexp: [0-9]+` is a simple pattern that will match a decimal number of any length.

Whereas Selenese globbing patterns support only the `*` and `[ ]` (character class) features, Selenese regular expression patterns offer the same wide array of special characters that exist in JavaScript. Below are a subset of those special characters:

PATTERN	MATCH
.	any single character
[ ]	character class: any single character that appears inside the brackets
*	quantifier: 0 or more of the preceding character (or group)
+	quantifier: 1 or more of the preceding character (or group)
?	quantifier: 0 or 1 of the preceding character (or group)
{1,5}	quantifier: 1 through 5 of the preceding character (or group)
	alternation: the character/group on the left or the character/group on the right
()	grouping: often used with alternation and/or quantifier

Regular expression patterns in Selenese need to be prefixed with either `regexp:` or `regexpi:`. The former is case-sensitive; the latter is case-insensitive.

A few examples will help clarify how regular expression patterns can be used with Selenese commands. The first one uses what is probably the most commonly used regular expression pattern—`.*` (“dot star”). This two-character sequence can be translated as “0 or more occurrences of any character” or more simply, “anything or nothing.” It is the equivalent of the one-character globbing pattern `*` (a single asterisk).

Command	Target	Value
click	link=regexp:Film.*Television Department	
verifyTitle	regexp:.*Film.*Television.*	

The example above is functionally equivalent to the earlier example that used globbing patterns for this same test. The only differences are the prefix (**regexp:** instead of **glob:**) and the “anything or nothing” pattern (`.*` instead of just `*`).

The more complex example below tests that the Yahoo! Weather page for Anchorage, Alaska contains info on the sunrise time:

Command	Target	Value
open	<a href="http://weather.yahoo.com/forecast/USAK0012.html">http://weather.yahoo.com/forecast/USAK0012.html</a>	
verifyTextPresent	regexp:Sunrise: *[0-9]{1,2}:[0-9]{2} [ap]m	

Let’s examine the regular expression above one part at a time:

Sunrise: *	The string <b>Sunrise:</b> followed by 0 or more spaces
[0-9]{1,2}	1 or 2 digits (for the hour of the day)
:	The character <b>:</b> (no special characters involved)
[0-9]{2}	2 digits (for the minutes) followed by a space
[ap]m	“a” or “p” followed by “m” (am or pm)



## Exact Patterns

The **exact** type of Selenium pattern is of marginal usefulness. It uses no special characters at all. So, if you needed to look for an actual asterisk character (which is special for both globbing and regular expression patterns), the **exact** pattern would be one way to do that. For example, if you wanted to select an item labeled “Real \*” from a dropdown, the following code might work or it might not. The asterisk in the `glob:Real *` pattern will match anything or nothing. So, if there was an earlier select option labeled “Real Numbers,” it would be the option selected rather than the “Real \*” option.

select	//select	glob:Real *
--------	----------	-------------

In order to ensure that the “Real \*” item would be selected, the `exact :` prefix could be used to create an **exact** pattern as shown below:

select	//select	exact:Real *
--------	----------	--------------

But the same effect could be achieved via escaping the asterisk in a regular expression pattern:

select	//select	regexp:Real \*
--------	----------	----------------

It’s rather unlikely that most testers will ever need to look for an asterisk or a set of square brackets with characters inside them (the character class for globbing patterns). Thus, globbing patterns and regular expression patterns are sufficient for the vast majority of us.

## 3.16 The “AndWait” Commands

The difference between a command and its *AndWait* alternative is that the regular command (e.g. *click*) will do the action and continue with the following command as fast as it can, while the *AndWait* alternative (e.g. *clickAndWait*) tells Selenium to **wait** for the page to load after the action has been done.

The *AndWait* alternative is always used when the action causes the browser to navigate to another page or reload the present one.

Be aware, if you use an *AndWait* command for an action that does not trigger a navigation/refresh, your test will fail. This happens because Selenium will reach the *AndWait*’s timeout without seeing any navigation or refresh being made, causing Selenium to raise a timeout exception.

## 3.17 The *waitFor* Commands in AJAX applications

In AJAX driven web applications, data is retrieved from server without refreshing the page. Using *andWait* commands will not work as the page is not actually refreshed. Pausing the test execution for a certain period of time is also not a good approach as web element might appear later or earlier than the stipulated period depending on the system’s responsiveness, load or other uncontrolled factors of the moment, leading to test failures. The best approach would be to wait for the needed element in a dynamic period and then continue the execution as soon as the element is found.

This is done using *waitFor* commands, as *waitForElementPresent* or *waitForVisible*, which wait dynamically, checking for the desired condition every second and continuing to the next command in the script as soon as the condition is met.

## 3.18 Sequence of Evaluation and Flow Control

When a script runs, it simply runs in sequence, one command after another.

Selenese, by itself, does not support condition statements (if-else, etc.) or iteration (for, while, etc.). Many useful tests can be conducted without flow control. However, for a functional test of dynamic content, possibly involving multiple pages, programming logic is often needed.

When flow control is needed, there are three options:

1. Run the script using Selenium-RC and a client library such as Java or PHP to utilize the programming language's flow control features.
2. Run a small JavaScript snippet from within the script using the `storeEval` command.
3. Install the `goto_sel_ide.js` extension.

Most testers will export the test script into a programming language file that uses the Selenium-RC API (see the Selenium-IDE chapter). However, some organizations prefer to run their scripts from Selenium-IDE whenever possible (for instance, when they have many junior-level people running tests for them, or when programming skills are lacking). If this is your case, consider a JavaScript snippet or the `goto_sel_ide.js` extension.

## 3.19 Store Commands and Selenium Variables

You can use Selenium variables to store constants at the beginning of a script. Also, when combined with a data-driven test design (discussed in a later section), Selenium variables can be used to store values passed to your test program from the command-line, from another program, or from a file.

The plain `store` command is the most basic of the many store commands and can be used to simply store a constant value in a selenium variable. It takes two parameters, the text value to be stored and a selenium variable. Use the standard variable naming conventions of only alphanumeric characters when choosing a name for your variable.

Command	Target	Value
store	<a href="mailto:paul@mysite.org">paul@mysite.org</a>	userName

Later in your script, you'll want to use the stored value of your variable. To access the value of a variable, enclose the variable in curly brackets (`{ }`) and precede it with a dollar sign like this.

Command	Target	Value
verifyText	//div/p	<code>\${userName}</code>

A common use of variables is for storing input for an input field.

Command	Target	Value
type	id=login	<code>\${userName}</code>

Selenium variables can be used in either the first or second parameter and are interpreted by Selenium prior to any other operations performed by the command. A Selenium variable may also be used within a locator expression.

An equivalent store command exists for each verify and assert command. Here are a couple more commonly used store commands.

### 3.19.1 `storeElementPresent`

This corresponds to `verifyElementPresent`. It simply stores a boolean value—"true" or "false"—depending on whether the UI element is found.

### 3.19.2 storeText

StoreText corresponds to verifyText. It uses a locator to identify specific page text. The text, if found, is stored in the variable. StoreText can be used to extract text from the page being tested.

### 3.19.3 storeEval

This command takes a script as its first parameter. Embedding JavaScript within Selenese is covered in the next section. StoreEval allows the test to store the result of running the script in a variable.

## 3.20 JavaScript and Selenese Parameters

JavaScript can be used with two types of Selenese parameters: script and non-script (usually expressions). In most cases, you'll want to access and/or manipulate a test case variable inside the JavaScript snippet used as a Selenese parameter. All variables created in your test case are stored in a JavaScript *associative array*. An associative array has string indexes rather than sequential numeric indexes. The associative array containing your test case's variables is named **storedVars**. Whenever you wish to access or manipulate a variable within a JavaScript snippet, you must refer to it as **storedVars['yourVariableName']**.

### 3.20.1 JavaScript Usage with Script Parameters

Several Selenese commands specify a **script** parameter including **assertEval**, **verifyEval**, **storeEval**, and **waitForEval**. These parameters require no special syntax. A Selenium-IDE user would simply place a snippet of JavaScript code into the appropriate field, normally the **Target** field (because a **script** parameter is normally the first or only parameter).

The example below illustrates how a JavaScript snippet can be used to perform a simple numerical calculation:

Command	Target	Value
store	10	hits
storeXPathCount	//blockquote	blockquotes
storeEval	storedVars['hits']-storedVars['blockquotes']	paragraphs

This next example illustrates how a JavaScript snippet can include calls to methods, in this case the JavaScript String object's `toUpperCase` method and `toLowerCase` method.

Command	Target	Value
store	Edith Wharton	name
storeEval	storedVars['name'].toUpperCase()	uc
storeEval	storedVars['name'].toLowerCase()	lc

### JavaScript Usage with Non-Script Parameters

JavaScript can also be used to help generate values for parameters, even when the parameter is not specified to be of type **script**. However, in this case, special syntax is required—the JavaScript snippet must be enclosed inside curly braces and preceded by the label `javascript`, as in `javascript {*yourCodeHere*}`. Below is an example in which the `type` command's second parameter `value` is generated via JavaScript code using this special syntax:

Command	Target	Value
store	league of nations	searchString
type	q	javascript{storedVars['searchString'].toUpperCase()}

## 3.21 *echo* - The Selenese Print Command

Selenese has a simple command that allows you to print text to your test's output. This is useful for providing informational progress notes in your test which display on the console as your test is running. These notes also can be used to provide context within your test result reports, which can be useful for finding where a defect exists on a page in the event your test finds a problem. Finally, echo statements can be used to print the contents of Selenium variables.

Command	Target	Value
echo	Testing page footer now.	
echo	Username is \${userName}	

## 3.22 Alerts, Popups, and Multiple Windows

Suppose that you are testing a page that looks like this.

```
1  <!DOCTYPE HTML>
2  <html>
3  <head>
4    <script type="text/javascript">
5      function output(resultText) {
6        document.getElementById('output').childNodes[0].nodeValue=resultText;
7      }
8
9      function show_confirm() {
10         var confirmation=confirm("Chose an option.");
11         if (confirmation==true) {
12           output("Confirmed.");
13         }
14         else{
15           output("Rejected!");
16         }
17       }
18
19       function show_alert() {
20         alert("I'm blocking!");
21         output("Alert is gone.");
22       }
23       function show_prompt() {
24         var response = prompt("What's the best web QA tool?", "Selenium");
25         output(response);
26       }
27       function open_window(windowName) {
28         window.open("newWindow.html", windowName);
29       }
30     </script>
31 </head>
32 <body>
33
```

```

34 <input type= "button" id= "btnConfirm" onclick= "show_confirm()" value= "Show confirm
35 <input type= "button" id= "btnAlert" onclick= "show_alert()" value= "Show alert" />
36 <input type= "button" id= "btnPrompt" onclick= "show_prompt()" value= "Show prompt" />
37 <a href= "newWindow.html" id= "lnkNewWindow" target= "_blank" >New Window Link</a>
38 <input type= "button" id= "btnNewNamelessWindow" onclick= "open_window()" value= "Open
39 <input type= "button" id= "btnNewNamedWindow" onclick= "open_window('Mike')" value= "O
40
41 <br />
42 <span id= "output" >
43 </span>
44 </body>
45 </html>

```

The user must respond to alert/confirm boxes, as well as moving focus to newly opened popup windows. Fortunately, Selenium can cover JavaScript pop-ups.

But before we begin covering alerts/confirm/prompts in individual detail, it is helpful to understand the commonality between them. Alerts, confirmation boxes and prompts all have variations of the following

Command	Description
<code>assertFoo(pattern)</code>	throws error if <i>pattern</i> doesn't match the text of the pop-up
<code>assertFooPresent</code>	throws error if pop-up is not available
<code>assertFooNotPresent</code>	throws error if any pop-up is present
<code>storeFoo(variable)</code>	stores the text of the pop-up in a variable
<code>storeFooPresent(variable)</code>	stores the text of the pop-up in a variable and returns true or false

When running under Selenium, JavaScript pop-ups will not appear. This is because the function calls are actually being overridden at runtime by Selenium's own JavaScript. However, just because you cannot see the pop-up doesn't mean you don't have to deal with it. To handle a pop-up, you must call its `assertFoo(pattern)` function. If you fail to assert the presence of a pop-up your next command will be blocked and you will get an error similar to the following [error] Error: There was an unexpected Confirmation! [Chose an option.]

### 3.22.1 Alerts

Let's start with alerts because they are the simplest pop-up to handle. To begin, open the HTML sample above in a browser and click on the "Show alert" button. You'll notice that after you close the alert the text "Alert is gone." is displayed on the page. Now run through the same steps with Selenium IDE recording, and verify the text is added after you close the alert. Your test will look something like this:

Command	Target	Value
open	/	
click	btnAlert	
assertAlert	I'm blocking!	
verifyTextPresent	Alert is gone.	

You may be thinking "That's odd, I never tried to assert that alert." But this is Selenium-IDE handling and closing the alert for you. If you remove that step and replay the test you will get the following error [error] Error: There was an unexpected Alert! [I'm blocking!]. You must include an assertion of the alert to acknowledge its presence.

If you just want to assert that an alert is present but either don't know or don't care what text it contains, you can use `assertAlertPresent`. This will return true or false, with false halting the test.

## Confirmations

Confirmations behave in much the same way as alerts, with `assertConfirmation` and `assertConfirmationPresent` offering the same characteristics as their alert counterparts. However, by default Selenium will select OK when a confirmation pops up. Try recording clicking on the “Show confirm box” button in the sample page, but click on the “Cancel” button in the popup, then assert the output text. Your test may look something like this:

Command	Target	Value
open	/	
click	btnConfirm	
chooseCancelOnNextConfirmation		
assertConfirmation	Choose an option.	
verifyTextPresent	Rejected	

The `chooseCancelOnNextConfirmation` function tells Selenium that all following confirmation should return false. It can be reset by calling `chooseOkOnNextConfirmation`.

You may notice that you cannot replay this test, because Selenium complains that there is an unhandled confirmation. This is because the order of events Selenium-IDE records causes the click and `chooseCancelOnNextConfirmation` to be put in the wrong order (it makes sense if you think about it, Selenium can’t know that you’re cancelling before you open a confirmation) Simply switch these two commands and your test will run fine.

## 3.23 Debugging

Debugging means finding and fixing errors in your test case. This is a normal part of test case development.

We won’t teach debugging here as most new users to Selenium will already have some basic experience with debugging. If this is new to you, we recommend you ask one of the developers in your organization.

### 3.23.1 Breakpoints and Startpoints

The Sel-IDE supports the setting of breakpoints and the ability to start and stop the running of a test case, from any point within the test case. That is, one can run up to a specific command in the middle of the test case and inspect how the test case behaves at that point. To do this, set a breakpoint on the command just before the one to be examined.

To set a breakpoint, select a command, right-click, and from the context menu select *Toggle Breakpoint*. Then click the Run button to run your test case from the beginning up to the breakpoint.

It is also sometimes useful to run a test case from somewhere in the middle to the end of the test case or up to a breakpoint that follows the starting point. For example, suppose your test case first logs into the website and then performs a series of tests and you are trying to debug one of those tests. However, you only need to login once, but you need to keep rerunning your tests as you are developing them. You can login once, then run your test case from a startpoint placed after the login portion of your test case. That will prevent you from having to manually logout each time you rerun your test case.

To set a startpoint, select a command, right-click, and from the context menu select *Set/Clear Start Point*. Then click the Run button to execute the test case beginning at that startpoint.

### 3.23.2 Stepping Through a Testcase

To execute a test case one command at a time (“step through” it), follow these steps:

1. Start the test case running with the Run button from the toolbar.



1. Immediately pause the executing test case with the Pause button.



1. Repeatedly select the Step button.



### 3.23.3 Find Button

The Find button is used to see which UI element on the currently displayed webpage (in the browser) is used in the currently selected Selenium command. This is useful when building a locator for a command’s first parameter (see the section on *locators* in the Selenium Commands chapter). It can be used with any command that identifies a UI element on a webpage, i.e. *click*, *clickAndWait*, *type*, and certain *assert* and *verify* commands, among others.

From Table view, select any command that has a locator parameter. Click the Find button. Now look on the webpage: There should be a bright green rectangle enclosing the element specified by the locator parameter.

### 3.23.4 Page Source for Debugging

Often, when debugging a test case, you simply must look at the page source (the HTML for the webpage you’re trying to test) to determine a problem. Firefox makes this easy. Simply right-click the webpage and select ‘View->Page Source. The HTML opens in a separate window. Use its Search feature (Edit=>Find) to search for a keyword to find the HTML for the UI element you’re trying to test.

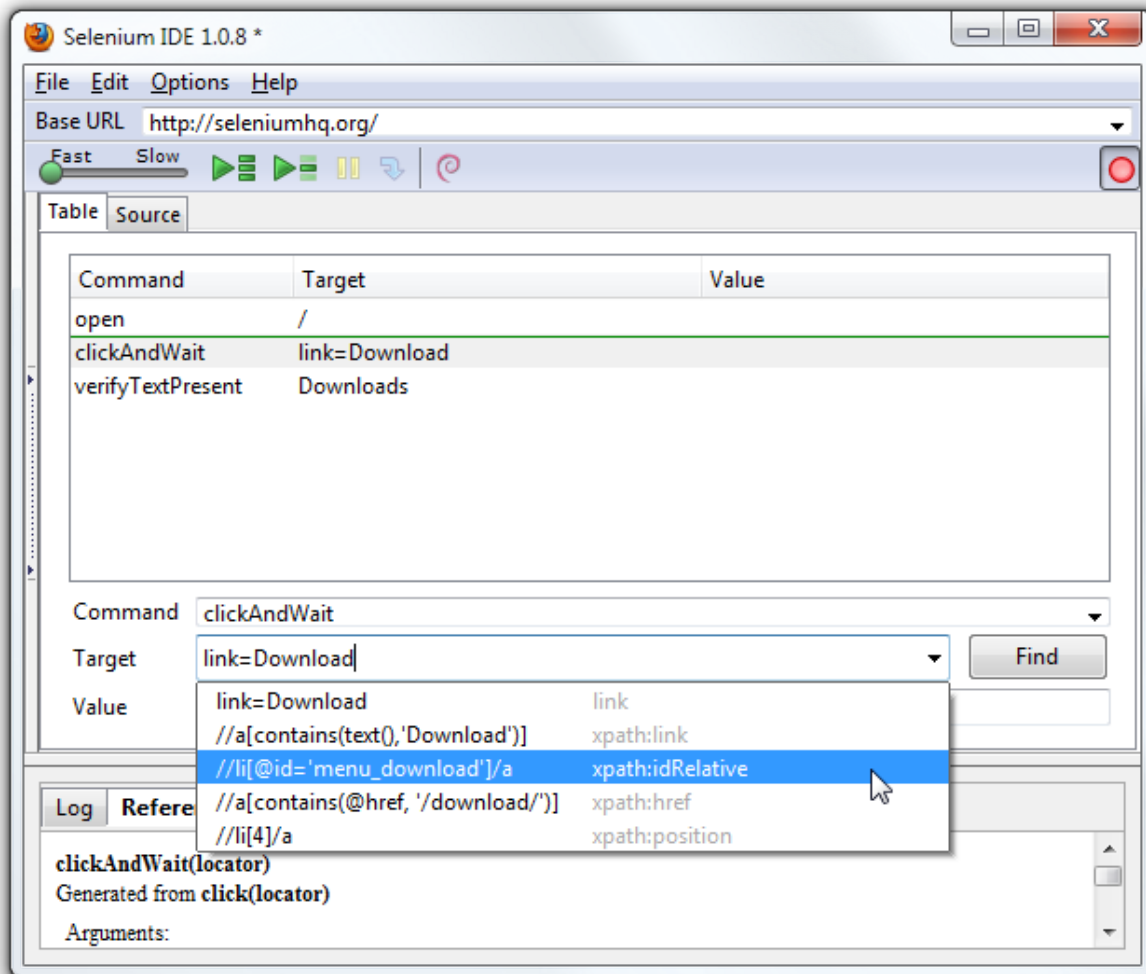
Alternatively, select just that portion of the webpage for which you want to see the source. Then right-click the webpage and select View Selection Source. In this case, the separate HTML window will contain just a small amount of source, with highlighting on the portion representing your selection.

### 3.23.5 Locator Assistance

Whenever Selenium-IDE records a locator-type argument, it stores additional information which allows the user to view other possible locator-type arguments that could be used instead. This feature can be very useful for learning more about locators, and is often needed to help one build a different type of locator than the type that was recorded.

This locator assistance is presented on the Selenium-IDE window as a drop-down list accessible at the right end of the Target field (only when the Target field contains a recorded locator-type argument). Below is a snapshot showing the contents of this drop-down for one command. Note that the first

column of the drop-down provides alternative locators, whereas the second column indicates the type of each alternative.



## 3.24 Writing a Test Suite

A test suite is a collection of test cases which is displayed in the leftmost pane in the IDE. The test suite pane can be manually opened or closed via selecting a small dot halfway down the right edge of the pane (which is the left edge of the entire Selenium-IDE window if the pane is closed).

The test suite pane will be automatically opened when an existing test suite is opened *or* when the user selects the New Test Case item from the File menu. In the latter case, the new test case will appear immediately below the previous test case.

Selenium-IDE also supports loading pre-existing test cases by using the File -> Add Test Case menu option. This allows you to add existing test cases to a new test suite.

A test suite file is an HTML file containing a one-column table. Each cell of each row in the `<tbody>` section contains a link to a test case. The example below is of a test suite containing four test cases:

```
<html>
<head>
  <meta http-equiv="Content-Type" content="text/html; charset=UTF-8" >
  <title>Sample Selenium Test Suite</title>
</head>
```



```

<body>
  <table cellpadding="1" cellspacing="1" border="1" >
    <thead>
      <tr><td>Test Cases for De Anza A-Z Directory Links</td></tr>
    </thead>
    <tbody>
      <tr><td><a href= ". /a.html " >A Links</a></td></tr>
      <tr><td><a href= ". /b.html " >B Links</a></td></tr>
      <tr><td><a href= ". /c.html " >C Links</a></td></tr>
      <tr><td><a href= ". /d.html " >D Links</a></td></tr>
    </tbody>
  </table>
</body>
</html>

```

**Note:** Test case files should not have to be co-located with the test suite file that invokes them. And on Mac OS and Linux systems, that is indeed the case. However, at the time of this writing, a bug prevents Windows users from being able to place the test cases elsewhere than with the test suite that invokes them.

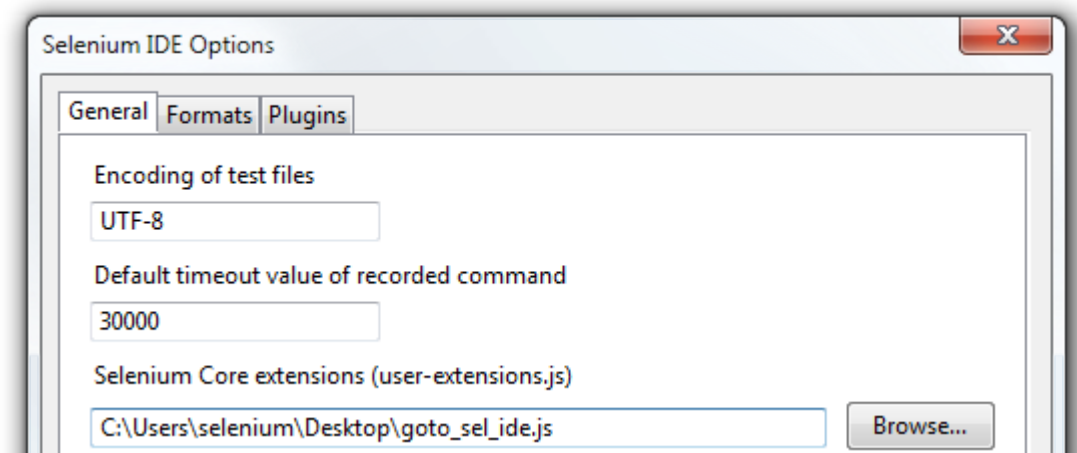
## 3.25 User Extensions

User extensions are JavaScript files that allow one to create his or her own customizations and features to add additional functionality. Often this is in the form of customized commands although this extensibility is not limited to additional commands.

There are a number of useful [extensions](#) created by users.

**IMPORTANT: THIS SECTION IS OUT OF DATE—WE WILL BE REVISING THIS SOON.** Perhaps the most popular of all Selenium-IDE extensions is one which provides flow control in the form of while loops and primitive conditionals. This extension is the [goto\\_sel\\_ide.js](#). For an example of how to use the functionality provided by this extension, look at the [page](#) created by its author.

To install this extension, put the pathname to its location on your computer in the **Selenium Core extensions** field of Selenium-IDE's Options=>Options=>General tab.



After selecting the **OK** button, you must close and reopen Selenium-IDE in order for the extensions file to be read. Any change you make to an extension will also require you to close and reopen Selenium-IDE.

Information on writing your own extensions can be found near the bottom of the Selenium [Reference](#) document.

### 3.26 Format

Format, under the Options menu, allows you to select a language for saving and displaying the test case. The default is HTML.

If you will be using Selenium-RC to run your test cases, this feature is used to translate your test case into a programming language. Select the language, e.g. Java, PHP, you will be using with Selenium-RC for developing your test programs. Then simply save the test case using File=>Export Test Case As. Your test case will be translated into a series of functions in the language you choose. Essentially, program code supporting your test is generated for you by Selenium-IDE.

Also, note that if the generated code does not suit your needs, you can alter it by editing a configuration file which defines the generation process. Each supported language has configuration settings which are editable. This is under the Options=>Options=>Formats tab.

**Note:** At the time of this writing, this feature is not yet supported by the Selenium developers. However the author has altered the C# format in a limited manner and it has worked well.

### 3.27 Executing Selenium-IDE Tests on Different Browsers

While Selenium-IDE can only run tests against Firefox, tests developed with Selenium-IDE can be run against other browsers, using a simple command-line interface that invokes the Selenium-RC server. This topic is covered in the [Run Selenese tests](#) section on Selenium-RC chapter. The `-htmlSuite` command-line option is the particular feature of interest.

### 3.28 Troubleshooting

Below is a list of image/explanation pairs which describe frequent sources of problems with Selenium-IDE:

*Table view is not available with this format.*

This message can be occasionally displayed in the Table tab when Selenium IDE is launched. The workaround is to close and reopen Selenium IDE. See [issue 1008](#). for more information. If you are able to reproduce this reliably then please provide details so that we can work on a fix.

---

*error loading test case: no command found*

You've used **File=>Open** to try to open a test suite file. Use **File=>Open Test Suite** instead.

An enhancement request has been raised to improve this error message. See [issue 1010](#).

---

Log	Reference	UI-Element	Rollup	Info*	Clear
[info]	Executing:	open   /			
[info]	Executing:	waitForPageToLoad			
[info]	Executing:	click   xpath=id('menu_download')/a			
[info]	Executing:	assertTitle   Downloads			
[info]	Executing:	verifyText   xpath=id('mainContent')/h2   Downloads			
[error]	Element xpath=id('mainContent')/h2 not found				

This type of **error** may indicate a timing problem, i.e., the element specified by a locator in your command wasn't fully loaded when the command was executed. Try putting a **pause 5000** before the command to determine whether the problem is indeed related to timing. If so, investigate using an appropriate **waitFor\*** or **\*AndWait** command before the failing command.

Log	Reference	UI-Element	Rollup	Info*	Clear
[info]	Executing:	store   URL   http://seleniumhq.org/			
[info]	Executing:	open   \${URL}			

Whenever your attempt to use variable substitution fails as is the case for the **open** command above, it indicates that you haven't actually created the variable whose value you're trying to access. This is sometimes due to putting the variable in the **Value** field when it should be in the **Target** field or vice versa. In the example above, the two parameters for the **store** command have been erroneously placed in the reverse order of what is required. For any Selenese command, the first required parameter must go in the **Target** field, and the second required parameter (if one exists) must go in the **Value** field.

*error loading test case: [Exception... "Component returned failure code: 0x80520012 (NS\_ERROR\_FILE\_NOT\_FOUND) [nsIFileInputStream.init]" nresult: "0x80520012 (NS\_ERROR\_FILE\_NOT\_FOUND)" location: "JS frame :: chrome://selenium-ide/content/file-utils.js :: anonymous :: line 48" data: no]*

One of the test cases in your test suite cannot be found. Make sure that the test case is indeed located where the test suite indicates it is located. Also, make sure that your actual test case files have the .html extension both in their filenames, and in the test suite file where they are referenced.

An enhancement request has been raised to improve this error message. See [issue 1011](#).

Log	Reference	UI-Element	Rollup	Info*	Clear
[info]	Executing:	open   /			
[info]	Executing:	storeEval   3   numLinks			
[info]	Executing:	storeExpression   0   index			
[info]	Executing:	while   (\${index} < \${numLinks})			
[error]	Unknown command: 'while'				

Your extension file's contents have not been read by Selenium-IDE. Be sure you have specified the proper pathname to the extensions file via **Options=>Options=>General** in the **Selenium Core extensions**

field. Also, Selenium-IDE must be restarted after any change to either an extensions file *or* to the contents of the **Selenium Core extensions** field.

# SELENIUM WEBDRIVER

*NOTE: We're currently working on documenting these sections. We believe the information here is accurate, however be aware we are also still working on this chapter. Additional information will be provided as we go which should make this chapter more solid.*

## 4.1 Introducing WebDriver

The primary new feature in Selenium 2.0 is the integration of the WebDriver API. WebDriver is designed to providing an simpler, more concise programming interface along with addressing some limitations in the Selenium-RC API. Selenium-WebDriver was developed to better support dynamic web pages where elements of a page may change without the page itself being reloaded. WebDriver's goal is to supply a well-designed object-oriented API that provides improved support for modern advanced web-app testing problems.

## 4.2 How Does WebDriver 'Drive' the Browser Compared to Selenium-RC?

Selenium-WebDriver makes direct calls to the browser using each browser's native support for automation. How these direct calls are made, and the features they support depends on the browser you are using. Information on each 'browser driver' is provided later in this chapter.

For those familiar with Selenium-RC, this is quite different from what you are used to. Selenium-RC worked the same way for each supported browser. It 'injected' javascript functions into the browser when the browser was loaded and then used its javascript to drive the AUT within the browser. WebDriver does not use this technique. Again, it drives the browser directly using the browser's built in support for automation.

## 4.3 WebDriver and the Selenium-Server

You may, or may not, need the Selenium Server, depending on how you intend to use Selenium-WebDriver. If you will be only using the WebDriver API you do not need the Selenium-Server. If your browser and tests will all run on the same machine, and your tests only use the WebDriver API, then you do not need to run the Selenium-Server; WebDriver will run the browser directly.

There are some reasons though to use the Selenium-Server with Selenium-WebDriver.

- You are using Selenium-Grid to distribute your tests over multiple machines or virtual machines (VMs).

- You want to connect to a remote machine that has a particular browser version that is not on your current machine.
- You are not using the Java bindings (i.e. Python, C#, or Ruby) and would like to use HtmlUnit Driver

## 4.4 Setting Up a Selenium-WebDriver Project

To install Selenium means to set up a project in a development so you can write a program using Selenium. How you do this depends on your programming language and your development environment.

### 4.4.1 Java

The easiest way to set up a Selenium 2.0 Java project is to use Maven. Maven will download the java bindings (the Selenium 2.0 java client library) and all its dependencies, and will create the project for you, using a maven pom.xml (project configuration) file. Once you've done this, you can import the maven project into your preferred IDE, IntelliJ IDEA or Eclipse.

First, create a folder to contain your Selenium project files. Then, to use Maven, you need a pom.xml file. This can be created with a text editor. We won't teach the details of pom.xml files or for using Maven since there are already excellent references on this. Your pom.xml file will look something like this. Create this file in the folder you created for your project.

```
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0"
          xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
          xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apa
<modelVersion>4.0.0</modelVersion>
<groupId>MySel20Proj</groupId>
<artifactId>MySel20Proj</artifactId>
<version>1.0</version>
<dependencies>
  <dependency>
    <groupId>org.seleniumhq.selenium</groupId>
    <artifactId>selenium-java</artifactId>
    <version>2.25.0</version>
  </dependency>
  <dependency>
    <groupId>com.opera</groupId>
    <artifactId>operadriver</artifactId>
  </dependency>
</dependencies>
<dependencyManagement>
  <dependencies>
    <dependency>
      <groupId>com.opera</groupId>
      <artifactId>operadriver</artifactId>
      <version>0.16</version>
      <exclusions>
        <exclusion>
          <groupId>org.seleniumhq.selenium</groupId>
          <artifactId>selenium-remote-driver</artifactId>
        </exclusion>
      </exclusions>
    </dependency>
  </dependencies>
</dependencyManagement>
```

```
        </dependency>
      </dependencies>
    </dependencyManagement>
  </project>
```

Be sure you specify the most current version. At the time of writing, the version listed above was the most current, however there were frequent releases immediately after the release of Selenium 2.0. Check the [Maven download page](#) for the current release and edit the above dependency accordingly.

Now, from a command-line, CD into the project directory and run maven as follows.

```
mvn clean install
```

This will download Selenium and all its dependencies and will add them to the project.

Finally, import the project into your preferred development environment. For those not familiar with this, we've provided an appendix which shows this.

*Importing a maven project into IntelliJ IDEA. Importing a maven project into Eclipse.*

#### 4.4.2 C#

As of Selenium 2.2.0, the C# bindings are distributed as a set of signed dlls along with other dependency dlls. Prior to 2.2.0, all Selenium dll's were unsigned. To include Selenium in your project, simply download the latest selenium-dotnet zip file from <https://code.google.com/p/selenium/downloads/list>. If you are using Windows Vista or above, you should unblock the zip file before unzipping it: Right click on the zip file, click "Properties", click "Unblock" and click "OK".

Unzip the contents of the zip file, and add a reference to each of the unzipped dlls to your project in Visual Studio (or your IDE of choice).

Official NuGet Packages: [RC WebDriver](#) [WebDriverBackedSelenium Support](#)

#### 4.4.3 Python

If you are using Python for test automation then you probably are already familiar with developing in Python. To add Selenium to your Python environment run the following command from a command-line.

```
pip install selenium
```

Pip requires [pip](#) to be installed, pip also has a dependency on [setuptools](#).

Teaching Python development itself is beyond the scope of this document, however there are many resources on Python and likely developers in your organization can help you get up to speed.

#### 4.4.4 Ruby

If you are using Ruby for test automation then you probably are already familiar with developing in Ruby. To add Selenium to your Ruby environment run the following command from a command-line.

```
gem install selenium-webdriver
```

Teaching Ruby development itself is beyond the scope of this document, however there are many resources on Ruby and likely developers in your organization can help you get up to speed.

### 4.4.5 Perl

Perl bindings are provided by a third party, please refer to any of their documentation on how to install / get started. There is one known [Perl binding](#) as of this writing.

### 4.4.6 PHP

PHP bindings are provided by a third party, please refer to any of their documentation on how to install / get started. There are three known bindings at this time: [By Chibimagic](#) [By Lukasz Kolczynski](#) and [By the Facebook](#)

## 4.5 Migrating from Selenium 1.0

For those who already have test suites written using Selenium 1.0, we have provided tips on how to migrate your existing code to Selenium 2.0. Simon Stewart, the lead developer for Selenium 2.0, has written an article on migrating from Selenium 1.0. We've included this as an appendix.

*[Migrating From Selenium RC to Selenium WebDriver](#)*

## 4.6 Introducing the Selenium-WebDriver API by Example

WebDriver is a tool for automating web application testing, and in particular to verify that they work as expected. It aims to provide a friendly API that's easy to explore and understand, easier to use than the Selenium-RC (1.0) API, which will help to make your tests easier to read and maintain. It's not tied to any particular test framework, so it can be used equally well in a unit testing or from a plain old "main" method. This section introduces WebDriver's API and helps get you started becoming familiar with it. Start by setting up a WebDriver project if you haven't already. This was described in the previous section, *[Setting Up a Selenium-WebDriver Project](#)*.

Once your project is set up, you can see that WebDriver acts just as any normal library: it is entirely self-contained, and you usually don't need to remember to start any additional processes or run any installers before using it, as opposed to the proxy server with Selenium-RC.

Note: additional steps are required to use Chrome Driver, Opera Driver, Android Driver and iPhone Driver

You're now ready to write some code. An easy way to get started is this example, which searches for the term "Cheese" on Google and then outputs the result page's title to the console.

```
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;
import org.openqa.selenium.support.ui.ExpectedCondition;
import org.openqa.selenium.support.ui.WebDriverWait;
```



```

public class Selenium2Example {
    public static void main(String[] args) {
        // Create a new instance of the Firefox driver
        // Notice that the remainder of the code relies on the interface,
        // not the implementation.
        WebDriver driver = new FirefoxDriver();

        // And now use this to visit Google
        driver.get("http://www.google.com");
        // Alternatively the same thing can be done like this
        // driver.navigate().to("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());

        // Google's search is rendered dynamically with JavaScript.
        // Wait for the page to load, timeout after 10 seconds
        (new WebDriverWait(driver, 10)).until(new ExpectedCondition<Boolean>() {
            public Boolean apply(WebDriver d) {
                return d.getTitle().toLowerCase().startsWith("cheese!");
            }
        });

        // Should see: "cheese! - Google Search"
        System.out.println("Page title is: " + driver.getTitle());

        //Close the browser
        driver.quit();
    }
}

```

```

using OpenQA.Selenium;
using OpenQA.Selenium.Firefox;

// Requires reference to WebDriver.Support.dll
using OpenQA.Selenium.Support.UI;

class GoogleSuggest
{
    static void Main(string[] args)
    {
        // Create a new instance of the Firefox driver.

        // Notice that the remainder of the code relies on the interface,
        // not the implementation.

        // Further note that other drivers (InternetExplorerDriver,

```

```
// ChromeDriver, etc.) will require further configuration
// before this example will work. See the wiki pages for the
// individual drivers at http://code.google.com/p/selenium/wiki
// for further information.
IWebDriver driver = new FirefoxDriver();

//Notice navigation is slightly different than the Java version
//This is because 'get' is a keyword in C#
driver.Navigate().GoToUrl("http://www.google.com/");

// Find the text input element by its name
IWebElement query = driver.FindElement(By.Name("q"));

// Enter something to search for
query.SendKeys("Cheese");

// Now submit the form. WebDriver will find the form for us from the element
query.Submit();

// Google's search is rendered dynamically with JavaScript.
// Wait for the page to load, timeout after 10 seconds
WebDriverWait wait = new WebDriverWait(driver, TimeSpan.FromSeconds(10));
wait.Until((d) => { return d.Title.ToLower().StartsWith("cheese"); });

// Should see: "Cheese - Google Search"
System.Console.WriteLine("Page title is: " + driver.Title);

//Close the browser
driver.Quit();
}
}

from selenium import webdriver
from selenium.common.exceptions import TimeoutException
from selenium.webdriver.support.ui import WebDriverWait # available since 2.4.0
import time

# Create a new instance of the Firefox driver
driver = webdriver.Firefox()

# go to the google home page
driver.get("http://www.google.com")

# find the element that's name attribute is q (the google search box)
inputElement = driver.find_element_by_name("q")

# type in the search
inputElement.send_keys("Cheese!")

# submit the form (although google automatically searches now without submitting)
inputElement.submit()

# the page is ajaxy so the title is originally this:
print driver.title

try:
```

```
# we have to wait for the page to refresh, the last thing that seems to be updated is
WebDriverWait(driver, 10).until(lambda driver : driver.title.lower().startswith("c"))

# You should see "cheese! - Google Search"
print driver.title

finally:
    driver.quit()

require 'rubygems'
require 'selenium-webdriver'

driver = Selenium::WebDriver.for :firefox
driver.get "http://google.com"

element = driver.find_element :name => "q"
element.send_keys "Cheese!"
element.submit

puts "Page title is #{driver.title}"

wait = Selenium::WebDriver::Wait.new(:timeout => 10)
wait.until { driver.title.downcase.start_with? "cheese!" }

puts "Page title is #{driver.title}"
driver.quit

var driver = new webdriver.Builder().build();
driver.get('http://www.google.com').then(function() {
    return driver.findElement(webdriver.By.name('q')).then(function(searchBox) {
        return searchBox.sendKeys('webdriver').then(function() {
            return driver.findElement(webdriver.By.name('btnG')).then(function(submitButton) {
                return submitButton.click().then(function() {
                    var newTitle;
                    driver.wait(function() {
                        driver.getTitle().then(function(title) {
                            newTitle = title;
                        });
                    }, 3000).then(function() {
                        require('assert').equal('webdriver - Google Search', newTitle);
                    });
                });
            });
        });
    });
});
```

In upcoming sections, you will learn more about how to use WebDriver for things such as navigating forward and backward in your browser's history, and how to test web sites that use frames and windows. We also provide a more thorough discussions and examples.

## 4.7 Selenium-WebDriver API Commands and Operations

### 4.7.1 Fetching a Page

The first thing you're likely to want to do with WebDriver is navigate to a page. The normal way to do this is by calling "get":

```
driver.get( "http://www.google.com" );

driver.Url = "http://www.google.com" ;

driver.get " http://www.google.com "

driver.get( " http://www.google.com " )
```

Dependent on several factors, including the OS/Browser combination, WebDriver may or may not wait for the page to load. In some circumstances, WebDriver may return control before the page has finished, or even started, loading. To ensure robustness, you need to wait for the element(s) to exist in the page using *Explicit and Implicit Waits*.

### 4.7.2 Locating UI Elements (WebElements)

Locating elements in WebDriver can be done on the WebDriver instance itself or on a WebElement. Each of the language bindings expose a "Find Element" and "Find Elements" method. The first returns a WebElement object otherwise it throws an exception. The latter returns a list of WebElements, it can return an empty list if no DOM elements match the query.

The "Find" methods take a locator or query object called "By". "By" strategies are listed below.

#### By ID

This is the most efficient and preferred way to locate an element. Common pitfalls that UI developers make is having non-unique id's on a page or auto-generating the id, both should be avoided. A class on an html element is more appropriate than an auto-generated id.

Example of how to find an element that looks like this:

```
<div id= "coolestWidgetEvah" >...</div>

WebElement element = driver.findElement(By.id( "coolestWidgetEvah" ));

IWebElement element = driver.FindElement(By.Id( "coolestWidgetEvah" ));

element = driver.find_element(:id, " coolestWidgetEvah " )
```

```
element = driver.find_element_by_id("coolestWidgetEvah")

or

from selenium.webdriver.common.by import By
element = driver.find_element(by=By.ID, value="coolestWidgetEvah")
```

## By Class Name

“Class” in this case refers to the attribute on the DOM element. Often in practical use there are many DOM elements with the same class name, thus finding multiple elements becomes the more practical option over finding the first element.

Example of how to find an element that looks like this:

```
<div class="cheese"><span>Cheddar</span></div><div class="cheese"><span>Gouda</span></div>
```

```
List<WebElement> cheeses = driver.findElements(By.className("cheese"));
```

```
IList<IWebElement> cheeses = driver.FindElements(By.ClassName("cheese"));
```

```
cheeses = driver.find_elements(:class_name, "cheese")
```

**or**

```
cheeses = driver.find_elements(:class, "cheese")
```

```
cheeses = driver.find_elements_by_class_name("cheese")
```

or

```
from selenium.webdriver.common.by import By
cheeses = driver.find_elements(By.CLASS_NAME, "cheese")
```

## By Tag Name

The DOM Tag Name of the element.

Example of how to find an element that looks like this:

```
<iframe src="..."></iframe>
```

```
WebElement frame = driver.findElement(By.tagName("iframe"));
```

```
IWebElement frame = driver.FindElement(By.TagName("iframe"));
```

```
frame = driver.find_element(:tag_name, "iframe")

frame = driver.find_element_by_tag_name("iframe")

or

from selenium.webdriver.common.by import By
frame = driver.find_element(By.TAG_NAME, "iframe")
```

### By Name

Find the input element with matching name attribute.

Example of how to find an element that looks like this:

```
<input name="cheese" type="text" />
```

```
WebElement cheese = driver.findElement(By.name("cheese"));

IWebElement cheese = driver.FindElement(By.Name("cheese"));

cheese = driver.find_element(:name, "cheese")

cheese = driver.find_element_by_name("cheese")

or

from selenium.webdriver.common.by import By
cheese = driver.find_element(By.NAME, "cheese")
```

### By Link Text

Find the link element with matching visible text.

Example of how to find an element that looks like this:

```
<a href="http://www.google.com/search?q=cheese">cheese</a>>
```

```
WebElement cheese = driver.findElement(By.linkText("cheese"));

IWebElement cheese = driver.FindElement(By.LinkText("cheese"));
```

```
cheese = driver.find_element(:link_text, " cheese ")
```

or

```
cheese = driver.find_element(:link, " cheese ")
```

```
cheese = driver.find_element_by_link_text("cheese")
```

or

```
from selenium.webdriver.common.by import By
cheese = driver.find_element(By.LINK_TEXT, "cheese")
```

## By Partial Link Text

Find the link element with partial matching visible text.

Example of how to find an element that looks like this:

```
<a href= "http://www.google.com/search?q=cheese" >search for cheese</a>>
```

```
WebElement cheese = driver.findElement(By.partialLinkText("cheese"));
```

```
IWebElement cheese = driver.FindElement(By.PartialLinkText("cheese"));
```

```
cheese = driver.find_element(:partial_link_text, " cheese ")
```

```
cheese = driver.find_element_by_partial_link_text("cheese")
```

or

```
from selenium.webdriver.common.by import By
cheese = driver.find_element(By.PARTIAL_LINK_TEXT, "cheese")
```

## By CSS

Like the name implies it is a locator strategy by css. Native browser support is used by default, so please refer to *w3c css selectors* <<http://www.w3.org/TR/CSS/#selectors>> for a list of generally available css selectors. If a browser does not have native support for css queries, then [Sizzle](#) is used. IE 6,7 and FF3.0 currently use Sizzle as the css query engine.

Beware that not all browsers were created equal, some css that might work in one version may not work in another.

Example of to find the cheese below:

```
<div id= "food" ><span class= "dairy" >milk</span><span class= "dairy aged" >cheese</span></div>
```

```
WebElement cheese = driver.findElement(By.cssSelector("#food span.dairy.aged"));

IWebElement cheese = driver.FindElement(By.CssSelector("#food span.dairy.aged"));

cheese = driver.find_element(:css, "# food span.dairy.aged ")

cheese = driver.find_element_by_css_selector("#food span.dairy.aged")

or

from selenium.webdriver.common.by import By
cheese = driver.find_element(By.CSS_SELECTOR, "#food span.dairy.aged")
```

## By XPATH

At a high level, WebDriver uses a browser's native XPath capabilities wherever possible. On those browsers that don't have native XPath support, we have provided our own implementation. This can lead to some unexpected behaviour unless you are aware of the differences in the various xpath engines.

Driver	Tag and Attribute Name	Attribute Values	Native XPath Support
HtmlUnit Driver	Lower-cased	As they appear in the HTML	Yes
Internet Explorer Driver	Lower-cased	As they appear in the HTML	No
Firefox Driver	Case insensitive	As they appear in the HTML	Yes

This is a little abstract, so for the following piece of HTML:

```
<input type="text" name="example" />
<INPUT type="text" name="other" />
```

```
List<WebElement> inputs = driver.findElements(By.xpath("//input"));

IList<IWebElement> inputs = driver.FindElements(By.XPath("//input"));

inputs = driver.find_elements(:xpath, "//input ")

inputs = driver.find_elements_by_xpath("//input")

or

from selenium.webdriver.common.by import By
inputs = driver.find_elements(By.XPATH, "//input")
```



The following number of matches will be found

XPath expression	HtmlUnit Driver	Firefox Driver	Internet Explorer Driver
//input	1 ("example")	2	2
//INPUT	0	2	0

Sometimes HTML elements do not need attributes to be explicitly declared because they will default to known values. For example, the “input” tag does not require the “type” attribute because it defaults to “text”. The rule of thumb when using xpath in WebDriver is that you **should not** expect to be able to match against these implicit attributes.

## Using JavaScript

You can execute arbitrary javascript to find an element and as long as you return a DOM Element, it will be automatically converted to a WebElement object.

Simple example on a page that has jQuery loaded:

```
WebElement element = (WebElement) ((JavascriptExecutor)driver).executeScript("return $("
```

```
IWebElement element = (IWebElement) ((IJavaScriptExecutor)driver).ExecuteScript("return
```

```
element = driver.execute_script(" return $(' .cheese' )[0] ")
```

```
element = driver.execute_script(" return $( ' .cheese ' )[0] ")
```

Finding all the input elements to the every label on a page:

```
List<WebElement> labels = driver.findElement(By.tagName("label"));
List<WebElement> inputs = (List<WebElement>) ((JavascriptExecutor)driver).executeScript(
    "var labels = arguments[0], inputs = []; for (var i=0; i < labels.length; i++){ " +
    "inputs.push(document.getElementById(labels[i].getAttribute('for'))); } return input
```

```
IList<IWebElement> labels = driver.FindElements(By.TagName("label"));
IList<IWebElement> inputs = (IList<IWebElement>) ((IJavaScriptExecutor)driver).ExecuteScript(
    "var labels = arguments[0], inputs = []; for (var i=0; i < labels.length; i++){ " +
    "inputs.push(document.getElementById(labels[i].getAttribute('for'))); } return input
```

```
labels = driver.find_elements(:tag_name, " label ")
inputs = driver.execute_script(
    " var labels = arguments[0], inputs = []; for (var i=0; i < labels.length; i++){ "
    " inputs.push(document.getElementById(labels[i].getAttribute('for'))); } return input
```

```
labels = driver.find_elements_by_tag_name( " label " )
inputs = driver.execute_script(
    " var labels = arguments[0], inputs = []; for (var i=0; i < labels.length; i++){ "
    " inputs.push(document.getElementById(labels[i].getAttribute( ' for ' ))); } return "
```

### 4.7.3 User Input - Filling In Forms

We’ve already seen how to enter text into a textarea or text field, but what about the other elements? You can “toggle” the state of checkboxes, and you can use “click” to set something like an OPTION tag selected. Dealing with SELECT tags isn’t too bad:

```
WebElement select = driver.findElement(By.tagName( "select" ));
List<WebElement> allOptions = select.findElements(By.tagName( "option" ));
for (WebElement option : allOptions) {
    System.out.println(String.format( "Value is: %s", option.getAttribute( "value" )));
    option.click();
}
```

```
IWebElement select = driver.FindElement(By.TagName( "select" ));
IList<IWebElement> allOptions = select.FindElements(By.TagName( "option" ));
foreach (IWebElement option in allOptions)
{
    System.Console.WriteLine( "Value is: " + option.GetAttribute( "value" ));
    option.Click();
}
```

```
select = driver.find_element(:tag_name, " select ")
all_options = select.find_elements(:tag_name, " option ")
all_options.each do |option|
    puts " Value is: " + option.attribute( " value ")
    option.click
end
```

```
select = driver.find_element_by_tag_name( " select ")
allOptions = select.find_elements_by_tag_name( " option ")
for option in allOptions:
    print " Value is: " + option.get_attribute( " value ")
    option.click()
```

This will find the first “SELECT” element on the page, and cycle through each of its OPTIONS in turn, printing out their values, and selecting each in turn. As you will notice, this isn’t the most efficient way of dealing with SELECT elements. WebDriver’s support classes include one called “Select”, which provides useful methods for interacting with these.

```
Select select = new Select(driver.findElement(By.tagName( "select" )));
select.deselectAll();
select.selectByVisibleText( "Edam" );
```

```
SelectElement select = new SelectElement(driver.FindElement(By.TagName("select")));
select.DeselectAll();
select.SelectByText("Edam");

# available since 2.14
select = Selenium.WebDriver.Support.Select.new(driver.find_element(:tag_name, "
select.deselect_all()
select.select_by(:text, " Edam ")

# available since 2.12
from selenium.webdriver.support.ui import Select
select = Select(driver.find_element_by_tag_name(" select "))
select.deselect_all()
select.select_by_visible_text(" Edam ")
```

This will deselect all `OPTIONS` from the first `SELECT` on the page, and then select the `OPTION` with the displayed text of “Edam”.

Once you’ve finished filling out the form, you probably want to submit it. One way to do this would be to find the “submit” button and click it:

```
driver.findElement(By.id("submit")).click();

driver.find_element(:id, " submit ").click

driver.find_element_by_id(" submit ").click()
```

Alternatively, `WebDriver` has the convenience method “submit” on every element. If you call this on an element within a form, `WebDriver` will walk up the DOM until it finds the enclosing form and then calls submit on that. If the element isn’t in a form, then the `NoSuchElementException` will be thrown:

```
element.submit();

element.submit

element.submit()
```

## 4.7.4 Moving Between Windows and Frames

Some web applications have many frames or multiple windows. `WebDriver` supports moving between named windows using the “switchTo” method:

```
driver.switchTo().window("windowName");

driver.switch_to_window(" windowName ")
```

All calls to `driver` will now be interpreted as being directed to the particular window. But how do you know the window's name? Take a look at the javascript or link that opened it:

```
<a href="somewhere.html" target="windowName">Click here to open a new window</a>
```

Alternatively, you can pass a “window handle” to the “`switchTo().window()`” method. Knowing this, it's possible to iterate over every open window like so:

```
for (String handle : driver.getWindowHandles()) {  
    driver.switchTo().window(handle);  
}
```

```
driver.window_handles.each do |handle|  
    driver.switch_to.window handle  
end
```

```
for handle in driver.window_handles:  
    driver.switch_to_window(handle)
```

You can also switch from frame to frame (or into iframes):

```
driver.switchTo().frame("frameName");
```

```
driver.switch_to_frame(" frameName ")
```

It's possible to access subframes by separating the path with a dot, and you can specify the frame by its index too. That is:

```
driver.switchTo().frame("frameName.0.child");
```

```
driver.switch_to_frame(" frameName.0.child ")
```

would go to the frame named “child” of the first subframe of the frame called “frameName”. **All frames are evaluated as if from `*top*`.**

### 4.7.5 Popup Dialogs

Starting with Selenium 2.0 beta 1, there is built in support for handling popup dialog boxes. After you've triggered an action that opens a popup, you can access the alert with the following:

```
Alert alert = driver.switchTo().alert();
```

```
alert = driver.switch_to.alert
```

```
alert = driver.switch_to_alert()  
# usage: alert.dismiss(), etc.
```

This will return the currently open alert object. With this object you can now accept, dismiss, read its contents or even type into a prompt. This interface works equally well on alerts, confirms, and prompts. Refer to the [JavaDocs](#) or [RubyDocs](#) for more information.

#### 4.7.6 Navigation: History and Location

Earlier, we covered navigating to a page using the “get” command (`driver.get("http://www.example.com")`). As you’ve seen, WebDriver has a number of smaller, task-focused interfaces, and navigation is a useful task. Because loading a page is such a fundamental requirement, the method to do this lives on the main WebDriver interface, but it’s simply a synonym to:

```
driver.navigate().to("http://www.example.com");

driver.navigate.to "http://www.example.com"

driver.get("http://www.example.com") # python doesn't have driver.navigate
```

To reiterate: “`navigate().to()`” and “`get()`” do exactly the same thing. One’s just a lot easier to type than the other!

The “navigate” interface also exposes the ability to move backwards and forwards in your browser’s history:

```
driver.navigate().forward();
driver.navigate().back();

driver.navigate.forward
driver.navigate.back

driver.forward()
driver.back()
```

Please be aware that this functionality depends entirely on the underlying browser. It’s just possible that something unexpected may happen when you call these methods if you’re used to the behaviour of one browser over another.

#### 4.7.7 Cookies

Before we leave these next steps, you may be interested in understanding how to use cookies. First of all, you need to be on the domain that the cookie will be valid for. If you are trying to preset cookies before you start interacting with a site and your homepage is large / takes a while to load an alternative is to find a smaller page on the site, typically the 404 page is small (<http://example.com/some404page>)

```
// Go to the correct domain
driver.get("http://www.example.com");

// Now set the cookie. This one's valid for the entire domain
```

```
Cookie cookie = new Cookie("key", "value");
driver.manage().addCookie(cookie);

// And now output all the available cookies for the current URL
Set<Cookie> allCookies = driver.manage().getCookies();
for (Cookie loadedCookie : allCookies) {
    System.out.println(String.format("%s -> %s", loadedCookie.getName(), loadedCookie.getValue()));
}

// You can delete cookies in 3 ways
// By name
driver.manage().deleteCookieNamed("CookieName");
// By Cookie
driver.manage().deleteCookie(loadedCookie);
// Or all of them
driver.manage().deleteAllCookies();

# Go to the correct domain
driver.get("http://www.example.com")

# Now set the cookie. Here's one for the entire domain
# the cookie name here is 'key' and it's value is 'value'
driver.add_cookie({'name': 'key', 'value': 'value', 'path': '/'})
# additional keys that can be passed in are:
# 'domain' -> String,
# 'secure' -> Boolean,
# 'expiry' -> Milliseconds since the Epoch it should expire.

# And now output all the available cookies for the current URL
for cookie in driver.get_cookies():
    print "%s -> %s" % (cookie['name'], cookie['value'])

# You can delete cookies in 2 ways
# By name
driver.delete_cookie("CookieName")
# Or all of them
driver.delete_all_cookies()

# Go to the correct domain
driver.get("http://www.example.com")

# Now set the cookie. Here's one for the entire domain
# the cookie name here is 'key' and it's value is 'value'
driver.manage.add_cookie(:name => 'key', :value => 'value')
# additional keys that can be passed in are:
# :path => String, :secure -> Boolean, :expires -> Time, DateTime, or seconds since epoch

# And now output all the available cookies for the current URL
driver.manage.all_cookies.each { |cookie|
    puts "#{cookie[:name]} => #{cookie[:value]}"
}

# You can delete cookies in 2 ways
# By name
driver.manage.delete_cookie("CookieName")
```

```
# Or all of them
driver.manage.delete_all_cookies
```

### 4.7.8 Changing the User Agent

This is easy with the Firefox Driver:

```
FirefoxProfile profile = new FirefoxProfile();
profile.addAdditionalPreference( "general.useragent.override", "some UA string" );
WebDriver driver = new FirefoxDriver(profile);
```

```
profile = Selenium.WebDriver.Firefox.Profile.new
profile[ 'general.useragent.override' ] = " some UA string "
driver = Selenium.WebDriver.for :firefox, :profile => profile
```

### 4.7.9 Drag And Drop

Here's an example of using the Actions class to perform a drag and drop. Native events are required to be enabled.

```
WebElement element = driver.findElement(By.name( "source" ));
WebElement target = driver.findElement(By.name( "target" ));

(new Actions(driver)).dragAndDrop(element, target).perform();
```

```
element = driver.find_element(:name => 'source' )
target = driver.find_element(:name => 'target' )

driver.action.drag_and_drop(element, target).perform
```

```
from selenium.webdriver.common.action_chains import ActionChains
element = driver.find_element_by_name( " source " )
target = driver.find_element_by_name( " target " )

ActionChains(driver).drag_and_drop(element, target).perform()
```

## 4.8 Driver Specifics and Tradeoffs

## 4.9 Selenium-WebDriver's Drivers

WebDriver is the name of the key interface against which tests should be written, but there are several implementations. These include:

### 4.9.1 HtmlUnit Driver

This is currently the fastest and most lightweight implementation of WebDriver. As the name suggests, this is based on HtmlUnit. HtmlUnit is a java based implementation of a WebBrowser without a GUI. For any language binding (other than java) the Selenium Server is required to use this driver.

#### Usage

```
WebDriver driver = new HtmlUnitDriver();
```

```
IWebDriver driver = new RemoteWebDriver(new Uri("http://127.0.0.1:4444/wd/hub"),  
                                         DesiredCapabilities.HtmlUnit());
```

```
driver = webdriver.Remote(" http://localhost:4444/wd/hub ", webdriver.DesiredCapabilities)
```

```
driver = Selenium.WebDriver.for :remote, :url => " http://localhost:4444/wd/hub ", :de
```

#### Pros

- Fastest implementation of WebDriver
- A pure Java solution and so it is platform independent.
- Supports JavaScript

#### Cons

- Emulates other browsers' JavaScript behaviour (see below)

#### JavaScript in the HtmlUnit Driver

None of the popular browsers uses the JavaScript engine used by HtmlUnit (Rhino). If you test JavaScript using HtmlUnit the results may differ significantly from those browsers.

When we say “JavaScript” we actually mean “JavaScript and the DOM”. Although the DOM is defined by the W3C each browser has its own quirks and differences in their implementation of the DOM and in how JavaScript interacts with it. HtmlUnit has an impressively complete implementation of the DOM and has good support for using JavaScript, but it is no different from any other browser: it has its own quirks and differences from both the W3C standard and the DOM implementations of the major browsers, despite its ability to mimic other browsers.

With WebDriver, we had to make a choice; do we enable HtmlUnit's JavaScript capabilities and run the risk of teams running into problems that only manifest themselves there, or do we leave JavaScript disabled, knowing that there are more and more sites that rely on JavaScript? We took the conservative approach, and by default have disabled support when we use HtmlUnit. With each release of both WebDriver and HtmlUnit, we reassess this decision: we hope to enable JavaScript by default on the HtmlUnit at some point.



## Enabling JavaScript

If you can't wait, enabling JavaScript support is very easy:

```
HtmlUnitDriver driver = new HtmlUnitDriver(true);

WebDriver driver = new RemoteWebDriver(new Uri("http://127.0.0.1:4444/wd/hub"),
    DesiredCapabilities.HtmlUnitWithJavaScript());

caps = Selenium::WebDriver::Remote::Capabilities.htmlunit(:javascript_enabled => true)
driver = Selenium::WebDriver.for :remote, :url => "http://localhost:4444/wd/hub", :desired_capabilities => caps

driver = webdriver.Remote("http://localhost:4444/wd/hub", webdriver.DesiredCapabilities.HTMLUNIT_WITH_JAVASCRIPT)
```

This will cause the HtmlUnit Driver to emulate Firefox 3.6's JavaScript handling by default.

### 4.9.2 Firefox Driver

Controls the [Firefox](#) browser using a Firefox plugin. The Firefox Profile that is used is stripped down from what is installed on the machine to only include the Selenium WebDriver.xpi (plugin). A few settings are also changed by default ([see the source to see which ones](#)) Firefox Driver is capable of being run and is tested on Windows, Mac, Linux. Currently on versions 3.6, 10, latest - 1, latest

#### Usage

```
WebDriver driver = new FirefoxDriver();

IWebDriver driver = new FirefoxDriver();

driver = webdriver.Firefox()

driver = Selenium::WebDriver.for :firefox
```

#### Pros

- Runs in a real browser and supports JavaScript
- Faster than the Internet Explorer Driver

#### Cons

- Slower than the HtmlUnit Driver

## Modifying the Firefox Profile

Suppose that you wanted to modify the user agent string (as above), but you've got a tricked out Firefox profile that contains dozens of useful extensions. There are two ways to obtain this profile. Assuming that the profile has been created using Firefox's profile manager (`firefox -ProfileManager`):

```
ProfileIni allProfiles = new ProfilesIni();
FirefoxProfile profile = allProfiles.getProfile("WebDriver");
profile.setPreferences("foo.bar", 23);
WebDriver driver = new FirefoxDriver(profile);
```

Alternatively, if the profile isn't already registered with Firefox:

```
File profileDir = new File("path/to/top/level/of/profile");
FirefoxProfile profile = new FirefoxProfile(profileDir);
profile.addAdditionalPreferences(extraPrefs);
WebDriver driver = new FirefoxDriver(profile);
```

As we develop features in the Firefox Driver, we expose the ability to use them. For example, until we feel native events are stable on Firefox for Linux, they are disabled by default. To enable them:

```
FirefoxProfile profile = new FirefoxProfile();
profile.setEnableNativeEvents(true);
WebDriver driver = new FirefoxDriver(profile);
```

```
profile = webdriver.FirefoxProfile()
profile.native_events_enabled = True
driver = webdriver.Firefox(profile)
```

```
profile = Selenium::WebDriver::Firefox::Profile.new
profile.native_events = true
driver = Selenium::WebDriver.for :firefox, :profile => profile
```

## Info

See the [Firefox section in the wiki page](#) for the most up to date info.

## 4.9.3 Internet Explorer Driver

This driver is controlled by a .dll and is thus only available on Windows OS. Each Selenium release has it's core functionality tested against versions 6, 7 and 8 on XP, and 9 on Windows7.

## Usage

```
WebDriver driver = new InternetExplorerDriver();
```

```
IWebDriver driver = new InternetExplorerDriver();
```

```
driver = webdriver.Ie()
```

```
driver = Selenium.WebDriver.for :ie
```

## Pros

- Runs in a real browser and supports JavaScript with all the quirks your end users see.

## Cons

- Obviously the Internet Explorer Driver will only work on Windows!
- Comparatively slow (though still pretty snappy :)
- XPath is not natively supported in most versions. Sizzle is injected automatically which is significantly slower than other browsers and slower when comparing to CSS selectors in the same browser.
- CSS is not natively supported in versions 6 and 7. Sizzle is injected instead.
- CSS selectors in IE 8 and 9 are native, but those browsers don't fully support CSS3

## Info

See the [Internet Explorer section of the wiki page](#) for the most up to date info. Please take special note of the Required Configuration section.

### 4.9.4 Chrome Driver

Chrome Driver is maintained / supported by the [Chromium](#) project itself. WebDriver works with Chrome through the chromedriver binary (found on the chromium project's download page). You need to have both chromedriver and a version of chrome browser installed. chromedriver needs to be placed somewhere on your system's path in order for WebDriver to automatically discover it. The Chrome browser itself is discovered by chromedriver in the default installation path. These both can be overridden by environment variables. Please refer to [the wiki](#) for more information.

## Usage

```
WebDriver driver = new ChromeDriver();
```

```
IWebDriver driver = new ChromeDriver();
```

```
driver = webdriver.Chrome()
```

```
driver = Selenium.WebDriver.for :chrome
```

## Pros

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

## Cons

- Slower than the HtmlUnit Driver

## Info

See our [wiki](#) for the most up to date info. More info can also be found on the [downloads page](#)

## Getting running with Chrome Driver

Download the [Chrome Driver executable](#) and follow the other instructions on the [wiki page](#)

### 4.9.5 Opera Driver

See the [Opera Driver wiki article](#) in the Selenium Wiki for information on using the Opera Driver.

### 4.9.6 iPhone Driver

See the [iPhone Driver wiki article](#) in the Selenium Wiki for information on using the Mac iOS Driver.

### 4.9.7 Android Driver

See the [Android Driver wiki article](#) in the Selenium Wiki for information on using the Android Driver.

## 4.10 Alternative Back-Ends: Mixing WebDriver and RC Technologies

### 4.10.1 WebDriver-Backed Selenium-RC

The Java version of WebDriver provides an implementation of the Selenium-RC API. These means that you can use the underlying WebDriver technology using the Selenium-RC API. This is primarily provided for backwards compatibility. It allows those who have existing test suites using the Selenium-RC API to use WebDriver under the covers. It's provided to help ease the migration path to Selenium-WebDriver. Also, this allows one to use both APIs, side-by-side, in the same test code.

Selenium-WebDriver is used like this:

```
// You may use any WebDriver implementation. Firefox is used here as an example
WebDriver driver = new FirefoxDriver();
```

```
// A "base url", used by selenium to resolve relative URLs
String baseUrl = "http://www.google.com" ;

// Create the Selenium implementation
Selenium selenium = new WebDriverBackedSelenium(driver, baseUrl);

// Perform actions with selenium

selenium.open( "http://www.google.com" );
selenium.type( "name=q" , "cheese" );
selenium.click( "name=btnG" );

// Get the underlying WebDriver implementation back. This will refer to the
// same WebDriver instance as the "driver" variable above.
WebDriver driverInstance = ((WebDriverBackedSelenium) selenium).getWrappedDriver();

//Finally, close the browser. Call stop on the WebDriverBackedSelenium instance
//instead of calling driver.quit(). Otherwise, the JVM will continue running after
//the browser has been closed.
selenium.stop();
```

## Pros

- Allows for the WebDriver and Selenium APIs to live side-by-side
- Provides a simple mechanism for a managed migration from the Selenium RC API to WebDriver's
- Does not require the standalone Selenium RC server to be run

## Cons

- Does not implement every method
- More advanced Selenium usage (using “browserbot” or other built-in JavaScript methods from Selenium Core) may not work
- Some methods may be slower due to underlying implementation differences

### 4.10.2 Backing WebDriver with Selenium

WebDriver doesn't support as many browsers as Selenium RC does, so in order to provide that support while still using the WebDriver API, you can make use of the `SeleneseCommandExecutor`

Safari is supported in this way with the following code (be sure to disable pop-up blocking):

```
DesiredCapabilities capabilities = new DesiredCapabilities();
capabilities.setBrowserName( "safari" );
CommandExecutor executor = new SeleneseCommandExecutor( new URL( "http://localhost:4444/" )
WebDriver driver = new RemoteWebDriver( executor, capabilities );
```

There are currently some major limitations with this approach, notably that `findElements` doesn't work as expected. Also, because we're using Selenium Core for the heavy lifting of driving the browser, you are limited by the JavaScript sandbox.

## 4.11 Running Standalone Selenium Server for use with RemoteDrivers

From [Selenium's Download page](#) download `selenium-server-standalone-<version>.jar` and optionally `IEDriverServer`. If you plan to work with Chrome, download it from [Google Code](#).

Unpack `IEDriverServer` and/or `chromedriver` and put them in a directory which is on the `$PATH` / `%PATH%` - the Selenium Server should then be able to handle requests for IE / Chrome without additional modifications.

Start the server on the command line with

```
java -jar <path_to>/selenium-server-standalone-<version>.jar
```

If you want to use native events functionality, indicate this on the command line with the option

```
-Dwebdriver.enable.native.events=1
```

For other command line options, execute

```
java -jar <path_to>/selenium-server-standalone-<version>.jar -help
```

In order to function properly, the following ports should be allowed incoming TCP connections: 4444, 7054-5 (or twice as many ports as the number of concurrent instances you plan to run). Under Windows, you may need to unblock the applications as well.

## 4.12 Additional Resources

You can find further resources for WebDriver in [WebDriver's wiki](#)

Of course, don't hesitate to do an internet search on any Selenium topic, including Selenium-WebDriver's drivers. There are quite a few blogs on Selenium along with numerous posts on various user forums. Additionally the Selenium User's Group is a great resource. <http://groups.google.com/group/selenium-users>

## 4.13 Next Steps

This chapter has simply been a high level walkthrough of WebDriver and some of its key capabilities. Once getting familiar with the Selenium-WebDriver API you will then want to learn how to build test suites for maintainability, extensibility, and reduced fragility when features of the AUT frequently change. The approach most Selenium experts are now recommending is to design your test code using the Page Object Design Pattern along with possibly a Page Factory. Selenium-WebDriver provides support for this by supplying a `PageFactory` class in Java and C#. This is presented, along with other advanced topics, in the [next chapter](#). Also, for high-level description of this technique, you may want to look at the [Test Design Considerations chapter](#). Both of these chapters present techniques for writing more maintainable tests by making your test code more modular.

# WEBDRIVER: ADVANCED USAGE

## 5.1 Explicit and Implicit Waits

Waiting is having the automated task execution elapse a certain amount of time before continuing with the next step.

### 5.1.1 Explicit Waits

An explicit wait is code you define to wait for a certain condition to occur before proceeding further in the code. The worst case of this is `Thread.sleep()`, which sets the condition to an exact time period to wait. There are some convenience methods provided that help you write code that will wait only as long as required. `WebDriverWait` in combination with `ExpectedCondition` is one way this can be accomplished.

```
WebDriver driver = new FirefoxDriver();
driver.get( "http://somedomain/url_that_delays_loading" );
WebElement myDynamicElement = (new WebDriverWait(driver, 10))
    .until(new ExpectedCondition<WebElement>() {
        @Override
        public WebElement apply(WebDriver d) {
            return d.findElement(By.id( "myDynamicElement" ));
        }
    });
```

```
IWebDriver driver = new FirefoxDriver();
driver.Url = "http://somedomain/url_that_delays_loading" ;
WebDriverWait wait = new WebDriverWait(driver, TimeSpan.FromSeconds(10));
IWebElement myDynamicElement = wait.Until<IWebElement>((d) =>
{
    return d.FindElement(By.Id( "someDynamicElement" ));
});
```

```
from selenium import webdriver
from selenium.webdriver.support.ui import WebDriverWait # available since 2.4.0
```

```
ff = webdriver.Firefox()
ff.get( " http://somedomain/url_that_delays_loading " )
try:
    element = WebDriverWait(ff, 10).until(lambda driver : driver.find_element_by_id( " m
finally:
    ff.quit()
```

```
require 'rubygems' # not required for ruby 1.9 or if you installed without gem
require 'selenium-webdriver'

driver = Selenium::WebDriver.for :firefox
driver.get "http://somedomain/url_that_delays_loading"

wait = Selenium::WebDriver::Wait.new(:timeout => 10) # seconds
begin
  element = wait.until { driver.find_element(:id => "some-dynamic-element" ) }
ensure
  driver.quit
end
```

This waits up to 10 seconds before throwing a `TimeoutException` or if it finds the element will return it in 0 - 10 seconds. `WebDriverWait` by default calls the `ExpectedCondition` every 500 milliseconds until it returns successfully. A successful return is for `ExpectedCondition` type is `Boolean` return `true` or not null return value for all other `ExpectedCondition` types.

This example is also functionally equivalent to the first `Implicit Waits` example.

## Expected Conditions

There are some common conditions that are frequently come across when automating web browsers. Listed below are Implementations of each. Java happens to have convenience methods so you don't have to code an `ExpectedCondition` class yourself or create your own utility package for them.

- Element is Clickable - it is Displayed and Enabled.

```
WebDriverWait wait = new WebDriverWait(driver, 10);
WebElement element = wait.until(ExpectedConditions.elementToBeClickable(By.id("someid")))

wait = WebDriverWait(driver, 10)
def clickable(element):
  if element.is_clickable():
    return element
  return null
element = wait.until(lambda d: clickable(d.find_element_by_id('someid')))
```

The `ExpectedConditions` class in contains a set of predefined conditions to use with `WebDriverWait` in Java.

### 5.1.2 Implicit Waits

An implicit wait is to tell `WebDriver` to poll the DOM for a certain amount of time when trying to find an element or elements if they are not immediately available. The default setting is 0. Once set, the implicit wait is set for the life of the `WebDriver` object instance.

```
WebDriver driver = new FirefoxDriver();
driver.manage().timeouts().implicitlyWait(10, TimeUnit.SECONDS);
driver.get("http://somedomain/url_that_delays_loading");
WebElement myDynamicElement = driver.findElement(By.id("myDynamicElement"));
```



```
WebDriver driver = new FirefoxDriver();
driver.Manage().Timeouts().ImplicitlyWait(TimeSpan.FromSeconds(10));
driver.Url = "http://somedomain/url_that_delays_loading";
IWebElement myDynamicElement = driver.FindElement(By.Id("someDynamicElement"));
```

```
from selenium import webdriver
```

```
ff = webdriver.Firefox()
ff.implicitly_wait(10) # seconds
ff.get("http://somedomain/url_that_delays_loading")
myDynamicElement = ff.find_element_by_id("myDynamicElement")
```

```
require 'rubygems' # not required for ruby 1.9 or if you installed without gem
require 'selenium-webdriver'
```

```
driver = Selenium::WebDriver.for :firefox
driver.manage.timeouts.implicit_wait = 10 # seconds

driver.get "http://somedomain/url_that_delays_loading"
element = driver.find_element(:id => "some-dynamic-element")
```

## 5.2 RemoteWebDriver

### 5.2.1 Taking a Screenshot

```
import java.io.File;
import java.net.URL;

import org.openqa.selenium.OutputType;
import org.openqa.selenium.TakesScreenshot;
import org.openqa.selenium.WebDriver;
import org.openqa.selenium.remoteAugmenter;
import org.openqa.selenium.remote.DesiredCapabilities;
import org.openqa.selenium.remote.RemoteWebDriver;

public class Testing {

    public void myTest() throws Exception {
        WebDriver driver = new RemoteWebDriver(
            new URL("http://localhost:4444/wd/hub"),
            DesiredCapabilities.firefox());

        driver.get("http://www.google.com");

        // RemoteWebDriver does not implement the TakesScreenshot class
        // if the driver does have the Capabilities to take a screenshot
        // then Augmenter will add the TakesScreenshot methods to the instance
        WebDriver augmentedDriver = new Augmenter().augment(driver);
        File screenshot = ((TakesScreenshot) augmentedDriver).
            getScreenshotAs(OutputType.FILE);
    }
}
```

```
}  
}
```

```
// Add this class to your code and use this instead of RemoteWebDriver  
// You will then be able to cast it to ITakesScreenshot and call GetScreenshot
```

```
public class ScreenshotRemoteWebDriver : RemoteWebDriver, ITakesScreenshot  
{  
    public ScreenshotRemoteWebDriver(Uri RemoteAddress, ICapabilities capabilities)  
        : base(RemoteAddress, capabilities)  
    {  
    }  
  
    /// <summary>  
    /// Gets a <see cref="Screenshot"/> object representing the image of the page on  
    /// </summary>  
    /// <returns>A <see cref="Screenshot"/> object containing the image.</returns>  
    public Screenshot GetScreenshot()  
    {  
        // Get the screenshot as base64.  
        Response screenshotResponse = this.Execute(DriverCommand.Screenshot, null);  
        string base64 = screenshotResponse.Value.ToString();  
  
        // ... and convert it.  
        return new Screenshot(base64);  
    }  
}
```

```
// And then the usage would be:
```

```
ScreenshotRemoteWebDriver webDriver = new ScreenshotRemoteWebDriver(new Uri("http://127.0.0.1:4444/wd/hub"),  
// ... do stuff with webDriver  
Screenshot ss = ((ITakesScreenshot)webDriver).GetScreenshot();  
string screenshot = ss.AsBase64EncodedString;  
byte[] screenshotAsByteArray = ss.AsByteArray;  
ss.SaveAsFile(activeDir + TestSuiteName + "/" + FileNanme + imageFormat, ImageFormat.Jpeg);
```

```
from selenium import webdriver
```

```
driver = webdriver.Remote("http://localhost:4444/wd/hub", webdriver.DesiredCapabilities.CHROME)  
driver.get("http://www.google.com")  
driver.get_screenshot_as_file('/Screenshots/google.png')
```

```
require 'rubygems'
```

```
require 'selenium-webdriver'
```

```
begin
```

```
    driver = Selenium::WebDriver.for :remote, :url => "http://localhost:4444/wd/hub", :capabilities => { :browser => :chrome }  
    driver.get "http://www.google.com"  
    driver.save_screenshot "/Screenshots/google.png"
```

```
ensure
```

```
driver.quit  
end
```

### 5.2.2 Using a FirefoxProfile

```
FirefoxProfile fp = new FirefoxProfile();  
// set something on the profile...  
DesiredCapabilities dc = DesiredCapabilities.firefox();  
dc.setCapability(FirefoxDriver.PROFILE, fp);  
WebDriver driver = new RemoteWebDriver(dc);
```

```
from selenium import webdriver  
fp = webdriver.FirefoxProfile()  
# set something on the profile...  
driver = webdriver.Remote(desired_capabilities=webdriver.DesiredCapabilities.FIREFOX, br
```

### 5.2.3 Using ChromeOptions

```
ChromeOptions options = new ChromeOptions();  
// set some options  
DesiredCapabilities dc = DesiredCapabilities.chrome();  
dc.setCapability(ChromeOptions.CAPABILITY, options);  
WebDriver driver = new RemoteWebDriver(dc);
```

```
from selenium import webdriver  
options = webdriver.ChromeOptions()  
# set some options  
driver = webdriver.Remote(desired_capabilities=options.to_capabilities())
```

## 5.3 AdvancedUserInteractions

The Actions class(es) allow you to build a Chain of Actions and perform them. There are too many possible combinations to count. Below are a few of the common interactions that you may want to use. For a full list of actions please refer to the API docs [Java C# Ruby Python](#)

The Advanced User Interactions require native events to be enabled. Here's a table of the current support Matrix for native events:

plat- form	IE6	IE7	IE8	IE9	FF3.6	FF10	Chrome stable	Chrome beta	Chrome dev	Opera	An- droid	iOS
Win- dows XP	Y	Y	Y	n/a	Y	Y	Y	Y	Y	?	Y <sup>1</sup>	n/a
Win- dows 7	n/a	n/a	Y	Y	Y	Y	Y	Y	Y	?	Y <sup>1</sup>	n/a
Linux (Ubuntu)	n/a	n/a	n/a	n/a	Y <sup>2</sup>	Y <sup>2</sup>	Y	Y	Y	?	Y <sup>1</sup>	n/a
Mac OSX	n/a	n/a	n/a	n/a	N	N	Y	Y	Y	?	Y <sup>1</sup>	N
Mo- bile De- vice	n/a	n/a	n/a	n/a	n/a	?	n/a	n/a	n/a	?	Y	N

## 5.4 Browser Startup Manipulation

Todo

Topics to be included:

- restoring cookies
- changing firefox profile
- running browsers with plugins

### 5.4.1 Using a Proxy

#### Internet Explorer

The easiest and recommended way is to manually set the proxy on the machine that will be running the test. If that is not possible or you want your test to run with a different configuration or proxy, then you can use the following technique that uses a Capabilities object. This temporarily changes the system's proxy settings and changes them back to the original state when done.

```
String PROXY = "localhost:8080";

org.openqa.selenium.Proxy proxy = new org.openqa.selenium.Proxy();
proxy.setHttpProxy(PROXY)
    .setFtpProxy(PROXY)
    .setSslProxy(PROXY);
DesiredCapabilities cap = new DesiredCapabilities();
cap.setPreference(CapabilityType.PROXY, proxy);

WebDriver driver = new InternetExplorerDriver(cap);
```

---

<sup>1</sup>Using the emulator

<sup>2</sup>With explicitly enabling native events

```

from selenium import webdriver

PROXY = " localhost:8080 "

webdriver.DesiredCapabilities.INTERNETEXPLORER[ ' proxy ' ] = {
    " httpProxy " :PROXY,
    " ftpProxy " :PROXY,
    " sslProxy " :PROXY,
    " noProxy " :None,
    " proxyType " : " MANUAL " ,
    " class " : " org.openqa.selenium.Proxy " ,
    " autodetect " :False
}

# you have to use remote, otherwise you'll have to code it yourself in python to
# dynamically changing the system proxy preferences
driver = webdriver.Remote( " http://localhost:4444/wd/hub " , webdriver.DesiredCapabilities)

require 'rubygems'
require 'selenium-webdriver'

PROXY = " localhost:8080 "

proxy = Selenium::WebDriver::Proxy.new(
  :http => PROXY,
  :ftp => PROXY,
  :ssl => PROXY
)

caps = Selenium::WebDriver::Remote::Capabilities.ie(:proxy => proxy)

# you have to use remote, otherwise you'll have to code it yourself in ruby to
# dynamically changing the system proxy preferences
driver = Selenium::WebDriver.for :remote, :url => " http://localhost:4444/wd/hub " , :desired_capabilities => caps

```

## Chrome

Is basically the same as internet explorer. It uses the same configuration on the machine as IE does (on windows). On Mac it uses the System Preference -> Network settings. On Linux it uses (on Ubuntu) System > Preferences > Network Proxy Preferences (Alternatively in “/etc/environment” set http\_proxy). As of this writing it is unknown how to set the proxy programmatically.

## Firefox

Firefox maintains it's proxy configuration in a profile. You can preset the proxy in a profile and use that Firefox Profile or you can set it on profile that is created on the fly as is shown in the following example.

```

String PROXY = "localhost:8080";

org.openqa.selenium.Proxy proxy = new org.openqa.selenium.Proxy();

```

```
proxy.setHttpProxy (PROXY)
    .setFtpProxy (PROXY)
    .setSslProxy (PROXY);
DesiredCapabilities cap = new DesiredCapabilities();
cap.setPreference (CapabilityType.PROXY, proxy);
WebDriver driver = new FirefoxDriver (cap);

from selenium import webdriver

PROXY_HOST = " host "
PROXY_PORT = 8080

fp = webdriver.FirefoxProfile()

# Direct = 0, Manual = 1, PAC = 2, AUTODETECT = 4, SYSTEM = 5
fp.set_preference (" network.proxy.type ", 1)

fp.set_preference (" network.proxy.http ", PROXY_HOST)
fp.set_preference (" network.proxy.http_port ", PROXY_PORT)
fp.set_preference (" network.proxy.ftp ", PROXY_HOST)
fp.set_preference (" network.proxy.ftp_port ", PROXY_PORT)
fp.set_preference (" network.proxy.ssl ", PROXY_HOST)
fp.set_preference (" network.proxy.ssl_port ", PROXY_PORT)

fp.set_preference (" network.proxy.no_proxies_on ", " ") # set this value as desired

driver = webdriver.Firefox (firefox_profile=fp)

require 'rubygems'
require 'selenium-webdriver'

PROXY = 'localhost:8087'

profile = Selenium::WebDriver::Firefox::Profile.new
profile.proxy = Selenium::WebDriver::Proxy.new (
  :http => PROXY,
  :ftp => PROXY,
  :ssl => PROXY
)

driver = Selenium::WebDriver.for :firefox, :profile => profile
```

## Opera

Todo

## 5.5 HTML5

Todo

## 5.6 Parallelizing Your Test Runs

Todo





# SELENIUM 1 (SELENIUM RC)

## 6.1 Introduction

As you can read in *Brief History of The Selenium Project*, Selenium RC was the main Selenium project for a long time, before the WebDriver/Selenium merge brought up Selenium 2, the newest and more powerful tool.

Selenium 1 is still actively supported (mostly in maintenance mode) and provides some features that may not be available in Selenium 2 for a while, including support for several languages (Java, Javascript, Ruby, PHP, Python, Perl and C#) and support for almost every browser out there.

## 6.2 How Selenium RC Works

First, we will describe how the components of Selenium RC operate and the role each plays in running your test scripts.

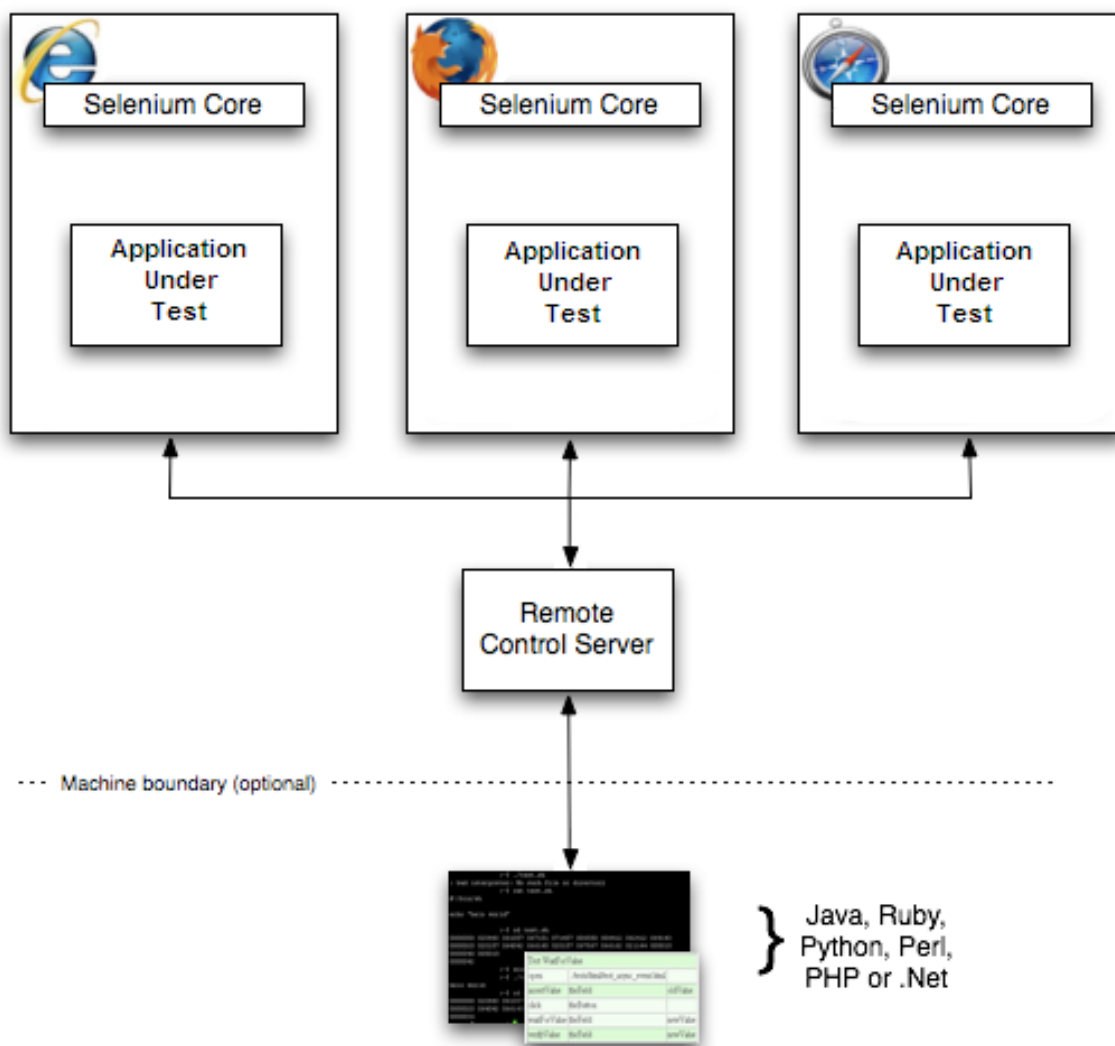
### 6.2.1 RC Components

Selenium RC components are:

- The Selenium Server which launches and kills browsers, interprets and runs the Selenese commands passed from the test program, and acts as an *HTTP proxy*, intercepting and verifying HTTP messages passed between the browser and the AUT.
- Client libraries which provide the interface between each programming language and the Selenium RC Server.

Here is a simplified architecture diagram....

Windows, Linux, or Mac (as appropriate)...



The diagram shows the client libraries communicate with the Server passing each Selenium command for execution. Then the server passes the Selenium command to the browser using Selenium-Core JavaScript commands. The browser, using its JavaScript interpreter, executes the Selenium command. This runs the Selenese action or verification you specified in your test script.

## 6.2.2 Selenium Server

Selenium Server receives Selenium commands from your test program, interprets them, and reports back to your program the results of running those tests.

The RC server bundles Selenium Core and automatically injects it into the browser. This occurs when your test program opens the browser (using a client library API function). Selenium-Core is a JavaScript program, actually a set of JavaScript functions which interprets and executes Selenese commands using the browser's built-in JavaScript interpreter.

The Server receives the Selenese commands from your test program using simple HTTP GET/POST requests. This means you can use any programming language that can send HTTP requests to automate Selenium tests on the browser.

### 6.2.3 Client Libraries

The client libraries provide the programming support that allows you to run Selenium commands from a program of your own design. There is a different client library for each supported language. A Selenium client library provides a programming interface (API), i.e., a set of functions, which run Selenium commands from your own program. Within each interface, there is a programming function that supports each Selenese command.

The client library takes a Selenese command and passes it to the Selenium Server for processing a specific action or test against the application under test (AUT). The client library also receives the result of that command and passes it back to your program. Your program can receive the result and store it into a program variable and report it as a success or failure, or possibly take corrective action if it was an unexpected error.

So to create a test program, you simply write a program that runs a set of Selenium commands using a client library API. And, optionally, if you already have a Selenese test script created in the Selenium-IDE, you can *generate the Selenium RC code*. The Selenium-IDE can translate (using its Export menu item) its Selenium commands into a client-driver's API function calls. See the Selenium-IDE chapter for specifics on exporting RC code from Selenium-IDE.

## 6.3 Installation

Installation is rather a misnomer for Selenium. Selenium has set of libraries available in the programming language of your choice. You could download them from [downloads page](#)

Once you've chosen a language to work with, you simply need to:

- Install the Selenium RC Server.
- Set up a programming project using a language specific client driver.

### 6.3.1 Installing Selenium Server

The Selenium RC server is simply a Java *jar* file (*selenium-server-standalone-<version-number>.jar*), which doesn't require any special installation. Just downloading the zip file and extracting the server in the desired directory is sufficient.

### 6.3.2 Running Selenium Server

Before starting any tests you must start the server. Go to the directory where Selenium RC's server is located and run the following from a command-line console.

```
java -jar selenium-server-standalone-<version-number>.jar
```

This can be simplified by creating a batch or shell executable file (.bat on Windows and .sh on Linux) containing the command above. Then make a shortcut to that executable on your desktop and simply double-click the icon to start the server.

For the server to run you'll need Java installed and the PATH environment variable correctly configured to run it from the console. You can check that you have Java correctly installed by running the following on a console.

```
java -version
```

If you get a version number (which needs to be 1.5 or later), you're ready to start using Selenium RC.

### 6.3.3 Using the Java Client Driver

- Download Selenium java client driver zip from the SeleniumHQ [downloads page](#).
- Extract selenium-java-<version-number>.jar file
- Open your desired Java IDE (Eclipse, NetBeans, IntelliJ, Netweaver, etc.)
- Create a java project.
- Add the selenium-java-<version-number>.jar files to your project as references.
- Add to your project classpath the file selenium-java-<version-number>.jar.
- From Selenium-IDE, export a script to a Java file and include it in your Java project, or write your Selenium test in Java using the selenium-java-client API. The API is presented later in this chapter. You can either use JUnit, or TestNG to run your test, or you can write your own simple main() program. These concepts are explained later in this section.
- Run Selenium server from the console.
- Execute your test from the Java IDE or from the command-line.

For details on Java test project configuration, see the Appendix sections *Configuring Selenium RC With Eclipse* and *Configuring Selenium RC With IntelliJ*.

### 6.3.4 Using the Python Client Driver

- Install Selenium via PIP, instructions linked at SeleniumHQ [downloads page](#)
- Either write your Selenium test in Python or export a script from Selenium-IDE to a python file.
- Run Selenium server from the console
- Execute your test from a console or your Python IDE

For details on Python client driver configuration, see the appendix *Python Client Driver Configuration*.

### 6.3.5 Using the .NET Client Driver

- Download Selenium RC from the SeleniumHQ [downloads page](#)
- Extract the folder
- Download and install [NUnit](#) ( Note: You can use NUnit as your test engine. If you're not familiar yet with NUnit, you can also write a simple main() function to run your tests; however NUnit is very useful as a test engine.)
- Open your desired .Net IDE (Visual Studio, SharpDevelop, MonoDevelop)
- Create a class library (.dll)

- Add references to the following DLLs: nmock.dll, nunit.core.dll, nunit.framework.dll, ThoughtWorks.Selenium.Core.dll, ThoughtWorks.Selenium.IntegrationTests.dll and ThoughtWorks.Selenium.UnitTests.dll
- Write your Selenium test in a .Net language (C#, VB.Net), or export a script from Selenium-IDE to a C# file and copy this code into the class file you just created.
- Write your own simple main() program or you can include NUnit in your project for running your test. These concepts are explained later in this chapter.
- Run Selenium server from console
- Run your test either from the IDE, from the NUnit GUI or from the command line

For specific details on .NET client driver configuration with Visual Studio, see the appendix *.NET client driver configuration*.

### 6.3.6 Using the Ruby Client Driver

- If you do not already have RubyGems, install it from [RubyForge](#)
- Run `gem install selenium-client`
- At the top of your test script, add `require "selenium/client"`
- Write your test script using any Ruby test harness (eg Test::Unit, Mini::Test or RSpec).
- Run Selenium RC server from the console.
- Execute your test in the same way you would run any other Ruby script.

For details on Ruby client driver configuration, see the [Selenium-Client documentation](#)

## 6.4 From Selenese to a Program

The primary task for using Selenium RC is to convert your Selenese into a programming language. In this section, we provide several different language-specific examples.

### 6.4.1 Sample Test Script

Let's start with an example Selenese test script. Imagine recording the following test with Selenium-

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

Note: This example would work with the Google search page <http://www.google.com>

## 6.4.2 Selenese as Programming Code

Here is the test script exported (via Selenium-IDE) to each of the supported programming languages. If you have at least basic knowledge of an object- oriented programming language, you will understand how Selenium runs Selenese commands by reading one of these examples. To see an example in a specific language, select one of these buttons.

```
using System;
using System.Text;
using System.Text.RegularExpressions;
using System.Threading;
using NUnit.Framework;
using Selenium;

namespace SeleniumTests
{
    [TestFixture]
    public class NewTest
    {
        private ISelenium selenium;
        private StringBuilder verificationErrors;

        [SetUp]
        public void SetupTest ()
        {
            selenium = new DefaultSelenium("localhost", 4444, "*firefox", "http://www
            selenium.Start();
            verificationErrors = new StringBuilder();
        }

        [TearDown]
        public void TeardownTest ()
        {
            try
            {
                selenium.Stop();
            }
            catch (Exception)
            {
                // Ignore errors if unable to close the browser
            }
            Assert.AreEqual("", verificationErrors.ToString());
        }

        [Test]
        public void TheNewTest ()
        {
            selenium.Open("/");
            selenium.Type("q", "selenium rc");
            selenium.Click("btnG");
            selenium.WaitForPageToLoad("30000");
            Assert.AreEqual("selenium rc - Google Search", selenium.GetTitle());
        }
    }
}
```

```

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

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

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

use strict;
use warnings;
use Time::HiRes qw( sleep );
use Test::WWW::Selenium;
use Test::More "no_plan";
use Test::Exception;

my $sel = Test::WWW::Selenium->new( host => "localhost",
    port => 4444,
    browser => "*firefox",
    browser_url => "http://www.google.com/" );

$sel->open_ok( "/" );
$sel->is_element_present_ok( "q" );
$sel->type_ok( "q", "selenium rc" );
$sel->value_is( "q", "selenium rc" );
$sel->is_element_present_ok( "btnG" );
$sel->click_ok( "btnG" );
$sel->wait_for_text_present( "results", 30000 );
$sel->is_element_present_ok( "resultStats" );

<?php

require_once 'PHPUnit/Extensions/SeleniumTestCase.php';

class Example extends PHPUnit_Extensions_SeleniumTestCase
{
    function setUp()
    {
        $this->setBrowser( " *firefox " );
        $this->setBrowserUrl( " http://www.google.com/ " );
    }
}

```

```
function testMyTestCase()
{
  $this->open( " / " );
  $this->type( " q ", " selenium rc " );
  $this->click( " btnG " );
  $this->waitForPageToLoad( " 30000 " );
  $this->assertTrue( $this->isTextPresent( " Results * for selenium rc " ));
}
}
?>
```

```
from selenium import selenium
import unittest, time, re
```

```
class NewTest(unittest.TestCase):
    def setUp(self):
        self.verficationErrors = []
        self.selenium = selenium( " localhost ", 4444, " *firefox ",
                                   " http://www.google.com/" )
        self.selenium.start()

    def test_new(self):
        sel = self.selenium
        sel.open( " / " )
        sel.type( " q ", " selenium rc " )
        sel.click( " btnG " )
        sel.wait_for_page_to_load( " 30000 " )
        self.failUnless(sel.is_text_present( " Results * for selenium rc " ))

    def tearDown(self):
        self.selenium.stop()
        self.assertEqual([], self.verficationErrors)
```

```
require " selenium "
require " test/unit "
```

```
class NewTest < Test::Unit::TestCase
  def setup
    @verification_errors = []
    if $selenium
      @selenium = $selenium
    else
      @selenium = Selenium::SeleniumDriver.new( " localhost ", 4444, " *firefox ", " h
      @selenium.start
    end
    @selenium.set_context( " test_new " )
  end

  def teardown
    @selenium.stop unless $selenium
    assert_equal [], @verification_errors
  end
end
```



```
def test_new
  @selenium.open " / "
  @selenium.type " q ", " selenium rc "
  @selenium.click " btnG "
  @selenium.wait_for_page_to_load " 30000 "
  assert @selenium.is_text_present( " Results * for selenium rc " )
end
end
```

In the next section we'll explain how to build a test program using the generated code.

## 6.5 Programming Your Test

Now we'll illustrate how to program your own tests using examples in each of the supported programming languages. There are essentially two tasks:

- Generate your script into a programming language from Selenium-IDE, optionally modifying the result.
- Write a very simple main program that executes the generated code.

Optionally, you can adopt a test engine platform like JUnit or TestNG for Java, or NUnit for .NET if you are using one of those languages.

Here, we show language-specific examples. The language-specific APIs tend to differ from one to another, so you'll find a separate explanation for each.

- Java
- C#
- Python
- Ruby
- Perl, PHP

### 6.5.1 Java

For Java, people use either JUnit or TestNG as the test engine. Some development environments like Eclipse have direct support for these via plug-ins. This makes it even easier. Teaching JUnit or TestNG is beyond the scope of this document however materials may be found online and there are publications available. If you are already a “java-shop” chances are your developers will already have some experience with one of these test frameworks.

You will probably want to rename the test class from “NewTest” to something of your own choosing. Also, you will need to change the browser-open parameters in the statement:

```
selenium = new DefaultSelenium( "localhost", 4444, "*iehta", "http://www.google.com/" )
```

The Selenium-IDE generated code will look like this. This example has comments added manually for additional clarity.

```
package com.example.tests;
// We specify the package of our tests

import com.thoughtworks.selenium.*;
// This is the driver's import. You'll use this for instantiating a
// browser and making it do what you need.

import java.util.regex.Pattern;
// Selenium-IDE add the Pattern module because it's sometimes used for
// regex validations. You can remove the module if it's not used in your
// script.

public class NewTest extends SeleneseTestCase {
// We create our Selenium test case

    public void setUp() throws Exception {
        setUp( "http://www.google.com/", "*firefox" );
        // We instantiate and start the browser
    }

    public void testNew() throws Exception {
        selenium.open( "/" );
        selenium.type( "q", "selenium rc" );
        selenium.click( "btnG" );
        selenium.waitForPageToLoad( "30000" );
        assertTrue( selenium.isTextPresent( "Results * for selenium rc" ) );
        // These are the real test steps
    }
}
```

### 6.5.2 C#

The .NET Client Driver works with Microsoft.NET. It can be used with any .NET testing framework like NUnit or the Visual Studio 2005 Team System.

Selenium-IDE assumes you will use NUnit as your testing framework. You can see this in the generated code below. It includes the *using* statement for NUnit along with corresponding NUnit attributes identifying the role for each member function of the test class.

You will probably have to rename the test class from “NewTest” to something of your own choosing. Also, you will need to change the browser-open parameters in the statement:

```
selenium = new DefaultSelenium( "localhost", 4444, "*iehta", "http://www.google.com/" )
```

The generated code will look similar to this.

```
using System;
using System.Text;
using System.Text.RegularExpressions;
using System.Threading;
using NUnit.Framework;
using Selenium;
```

```
namespace SeleniumTests
```

```
{  
    [TestFixture]  
  
    public class NewTest  
    {  
        private ISelenium selenium;  
  
        private StringBuilder verificationErrors;  
  
        [SetUp]  
  
        public void SetupTest()  
        {  
            selenium = new DefaultSelenium("localhost", 4444, "*iehta",  
                "http://www.google.com/");  
  
            selenium.Start();  
  
            verificationErrors = new StringBuilder();  
        }  
  
        [TearDown]  
  
        public void TeardownTest()  
        {  
            try  
            {  
                selenium.Stop();  
            }  
  
            catch (Exception)  
            {  
                // Ignore errors if unable to close the browser  
            }  
  
            Assert.AreEqual("", verificationErrors.ToString());  
        }  
    }  
    [Test]  
  
    public void TheNewTest()  
    {  
        // Open Google search engine.  
        selenium.Open("http://www.google.com/");  
  
        // Assert Title of page.  
        Assert.AreEqual("Google", selenium.GetTitle());  
  
        // Provide search term as "Selenium OpenQA"  
        selenium.Type("q", "Selenium OpenQA");  
  
        // Read the keyed search term and assert it.  
        Assert.AreEqual("Selenium OpenQA", selenium.GetValue("q"));  
    }  
}
```

```
// Click on Search button.
selenium.Click( "btnG" );

// Wait for page to load.
selenium.WaitForPageToLoad( "5000" );

// Assert that "www.openqa.org" is available in search results.
Assert.IsTrue(selenium.IsTextPresent( "www.openqa.org" ));

// Assert that page title is - "Selenium OpenQA - Google Search"
Assert.AreEqual( "Selenium OpenQA - Google Search",
                 selenium.GetTitle());
    }
}
}
```

You can allow NUnit to manage the execution of your tests. Or alternatively, you can write a simple `main()` program that instantiates the test object and runs each of the three methods, `SetupTest()`, `NewTest()`, and `TeardownTest()` in turn.

### 6.5.3 Python

Pyunit is the test framework to use for Python. To learn Pyunit refer to its *official documentation* <<http://docs.python.org/library/unittest.html>>\_.

The basic test structure is:

```
from selenium import selenium
# This is the driver's import. You'll use this class for instantiating a
# browser and making it do what you need.

import unittest, time, re
# This are the basic imports added by Selenium-IDE by default.
# You can remove the modules if they are not used in your script.

class NewTest(unittest.TestCase):
# We create our unittest test case

    def setUp(self):
        self.errors = []
        # This is an empty array where we will store any verification errors
        # we find in our tests

        self.selenium = selenium( "localhost", 4444, "*firefox",
                                   "http://www.google.com/" )
        self.selenium.start()
        # We instantiate and start the browser

    def test_new(self):
        # This is the test code. Here you should put the actions you need
        # the browser to do during your test.

        sel = self.selenium
        # We assign the browser to the variable "sel" (just to save us from
        # typing "self.selenium" each time we want to call the browser).
```

```

sel.open( " / " )
sel.type( " q ", " selenium rc " )
sel.click( " btnG " )
sel.wait_for_page_to_load( " 30000 " )
self.failUnless(sel.is_text_present( " Results * for selenium rc " ))
# These are the real test steps

def tearDown(self):
    self.selenium.stop()
    # we close the browser (I'd recommend you to comment this line while
    # you are creating and debugging your tests)

    self.assertEqual([], self.errors)
    # And make the test fail if we found that any verification errors
    # were found

```

### 6.5.4 Ruby

Selenium-IDE generates reasonable Ruby, but requires the old Selenium gem. This is a problem because the official Ruby driver for Selenium is the Selenium-Client gem, not the old Selenium gem. In fact, the Selenium gem is no longer even under active development.

Therefore, it is advisable to update any Ruby scripts generated by the IDE as follows:

1. On line 1, change `require "selenium"` to `require "selenium/client"`
2. On line 11, change `Selenium::SeleniumDriver.new` to `Selenium::Client::Driver.new`

You probably also want to change the class name to something more informative than “Untitled,” and change the test method’s name to something other than “testUntitled.”

Here is a simple example created by modifying the Ruby code generated by Selenium IDE, as described above.

```

# load the Selenium-Client gem
require "selenium/client"

# Load Test::Unit, Ruby 1.8's default test framework.
# If you prefer RSpec, see the examples in the Selenium-Client
# documentation.
require "test/unit"

class Untitled < Test::Unit::TestCase

  # The setup method is called before each test.
  def setup

    # This array is used to capture errors and display them at the
    # end of the test run.
    @verification_errors = []

    # Create a new instance of the Selenium-Client driver.
    @selenium = Selenium::Client::Driver.new \
      :host => "localhost",
      :port => 4444,

```

```
:browser => " *chrome ",
:url => " http://www.google.com/ ",
:timeout_in_second => 60

# Start the browser session
@selenium.start

# Print a message in the browser-side log and status bar
# (optional).
@selenium.set_context( " test_untitled " )

end

# The teardown method is called after each test.
def teardown

  # Stop the browser session.
  @selenium.stop

  # Print the array of error messages, if any.
  assert_equal [], @verification_errors
end

# This is the main body of your test.
def test_untitled

  # Open the root of the site we specified when we created the
  # new driver instance, above.
  @selenium.open " / "

  # Type 'selenium rc' into the field named 'q'
  @selenium.type " q ", " selenium rc "

  # Click the button named "btnG"
  @selenium.click " btnG "

  # Wait for the search results page to load.
  # Note that we don't need to set a timeout here, because that
  # was specified when we created the new driver instance, above.
  @selenium.wait_for_page_to_load

begin

  # Test whether the search results contain the expected text.
  # Notice that the star (*) is a wildcard that matches any
  # number of characters.
  assert @selenium.is_text_present( " Results * for selenium rc " )

rescue Test::Unit::AssertionFailedError

  # If the assertion fails, push it onto the array of errors.
  @verification_errors << $!

end
end
end
```

### 6.5.5 Perl, PHP

The members of the documentation team have not used Selenium RC with Perl or PHP. If you are using Selenium RC with either of these two languages please contact the Documentation Team (see the chapter on contributing). We would love to include some examples from you and your experiences, to support Perl and PHP users.

## 6.6 Learning the API

The Selenium RC API uses naming conventions that, assuming you understand Selenese, much of the interface will be self-explanatory. Here, however, we explain the most critical and possibly less obvious aspects.

### 6.6.1 Starting the Browser

```
selenium = new DefaultSelenium( "localhost", 4444, "*firefox", "http://www.google.com/"
selenium.Start();
```

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

```
my $sel = Test::WWW::Selenium->new( host => "localhost",
                                   port => 4444,
                                   browser => "*firefox",
                                   browser_url => "http://www.google.com/" );
```

```
$this->setBrowser("*firefox");
$this->setBrowserUrl("http://www.google.com/");
```

```
self.selenium = selenium( "localhost", 4444, "*firefox",
                          "http://www.google.com/" )
self.selenium.start()
```

```
@selenium = Selenium::ClientDriver.new( "localhost", 4444, "*firefox", "http://www"
@selenium.start
```

Each of these examples opens the browser and represents that browser by assigning a “browser instance” to a program variable. This program variable is then used to call methods from the browser. These methods execute the Selenium commands, i.e. like *open* or *type* or the *verify* commands.

The parameters required when creating the browser instance are:

**host** Specifies the IP address of the computer where the server is located. Usually, this is the same machine as where the client is running, so in this case *localhost* is passed. In some clients this is an optional parameter.

**port** Specifies the TCP/IP socket where the server is listening waiting for the client to establish a connection. This also is optional in some client drivers.

**browser** The browser in which you want to run the tests. This is a required parameter.

**url** The base url of the application under test. This is required by all the client libs and is integral information for starting up the browser-proxy-AUT communication.

Note that some of the client libraries require the browser to be started explicitly by calling its *start()* method.

### 6.6.2 Running Commands

Once you have the browser initialized and assigned to a variable (generally named “selenium”) you can make it run Selenese commands by calling the respective methods from the browser variable. For example, to call the *type* method of the selenium object:

```
selenium.type(“field-id”, “string to type”)
```

In the background the browser will actually perform a *type* operation, essentially identical to a user typing input into the browser, by using the locator and the string you specified during the method call.

## 6.7 Reporting Results

Selenium RC does not have its own mechanism for reporting results. Rather, it allows you to build your reporting customized to your needs using features of your chosen programming language. That’s great, but what if you simply want something quick that’s already done for you? Often an existing library or test framework can meet your needs faster than developing your own test reporting code.

### 6.7.1 Test Framework Reporting Tools

Test frameworks are available for many programming languages. These, along with their primary function of providing a flexible test engine for executing your tests, include library code for reporting results. For example, Java has two commonly used test frameworks, JUnit and TestNG. .NET also has its own, NUnit.

We won’t teach the frameworks themselves here; that’s beyond the scope of this user guide. We will simply introduce the framework features that relate to Selenium along with some techniques you can apply. There are good books available on these test frameworks however along with information on the internet.

### 6.7.2 Test Report Libraries

Also available are third-party libraries specifically created for reporting test results in your chosen programming language. These often support a variety of formats such as HTML or PDF.

### 6.7.3 What’s The Best Approach?

Most people new to the testing frameworks will begin with the framework’s built-in reporting features. From there most will examine any available libraries as that’s less time consuming than developing your own. As you begin to use Selenium no doubt you will start putting in your own “print statements” for reporting progress. That may gradually lead to you developing your own reporting, possibly in parallel



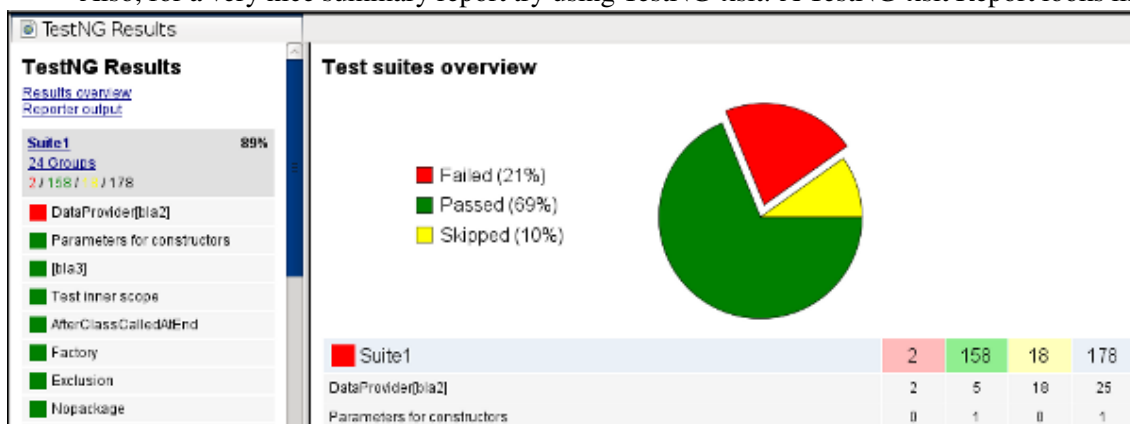
to using a library or test framework. Regardless, after the initial, but short, learning curve you will naturally develop what works best for your own situation.

## 6.7.4 Test Reporting Examples

To illustrate, we'll direct you to some specific tools in some of the other languages supported by Selenium. The ones listed here are commonly used and have been used extensively (and therefore recommended) by the authors of this guide.

### Test Reports in Java

- If Selenium Test cases are developed using JUnit then JUnit Report can be used to generate test reports. Refer to [JUnit Report](#) for specifics.
- If Selenium Test cases are developed using TestNG then no external task is required to generate test reports. The TestNG framework generates an HTML report which list details of tests. See [TestNG Report](#) for more.
- ReportNG is a HTML reporting plug-in for the TestNG framework. It is intended as a replacement for the default TestNG HTML report. ReportNG provides a simple, colour-coded view of the test results. See [ReportNG](#) for more.
- Also, for a very nice summary report try using TestNG-xslt. A TestNG-xslt Report looks like this.



See [TestNG-xslt](#) for more.

### Logging the Selenese Commands

- Logging Selenium can be used to generate a report of all the Selenese commands in your test along with the success or failure of each. Logging Selenium extends the Java client driver to add this Selenese logging ability. Please refer to [Logging Selenium](#).

### Test Reports for Python

- When using Python Client Driver then HTMLTestRunner can be used to generate a Test Report. See [HTMLTestRunner](#).

## Test Reports for Ruby

- If RSpec framework is used for writing Selenium Test Cases in Ruby then its HTML report can be used to generate a test report. Refer to [RSpec Report](#) for more.

**Note:** If you are interested in a language independent log of what's going on, take a look at Selenium Server Logging

## 6.8 Adding Some Spice to Your Tests

Now we'll get to the whole reason for using Selenium RC, adding programming logic to your tests. It's the same as for any program. Program flow is controlled using condition statements and iteration. In addition you can report progress information using I/O. In this section we'll show some examples of how programming language constructs can be combined with Selenium to solve common testing problems.

You will find as you transition from the simple tests of the existence of page elements to tests of dynamic functionality involving multiple web-pages and varying data that you will require programming logic for verifying expected results. Basically, the Selenium-IDE does not support iteration and standard condition statements. You can do some conditions by embedding javascript in Selenese parameters, however iteration is impossible, and most conditions will be much easier in a programming language. In addition, you may need exception handling for error recovery. For these reasons and others, we have written this section to illustrate the use of common programming techniques to give you greater 'verification power' in your automated testing.

The examples in this section are written in C# and Java, although the code is simple and can be easily adapted to the other supported languages. If you have some basic knowledge of an object-oriented programming language you shouldn't have difficulty understanding this section.

### 6.8.1 Iteration

Iteration is one of the most common things people need to do in their tests. For example, you may want to execute a search multiple times. Or, perhaps for verifying your test results you need to process a "result set" returned from a database.

Using the same Google search example we used earlier, let's check the Selenium search results. This test could use the Selenese:

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

The code has been repeated to run the same steps 3 times. But multiple copies of the same code is not good program practice because it's more work to maintain. By using a programming language, we can iterate over the search results for a more flexible and maintainable solution.

**In C#:**

```
// Collection of String values.
String[] arr = { "ide", "rc", "grid" };

// Execute loop for each String in array 'arr'.
foreach (String s in arr) {
    sel.open( "/" );
    sel.type( "q", "selenium " +s);
    sel.click( "btnG" );
    sel.waitForPageToLoad( "30000" );
    assertTrue( "Expected text: " +s+ " is missing on page."
        , sel.isTextPresent( "Results * for selenium " + s));
}
```

## 6.8.2 Condition Statements

To illustrate using conditions in tests we'll start with an example. A common problem encountered while running Selenium tests occurs when an expected element is not available on page. For example, when running the following line:

```
selenium.type( "q", "selenium " +s);
```

If element 'q' is not on the page then an exception is thrown:

```
com.thoughtworks.selenium.SeleniumException: ERROR: Element q not found
```

This can cause your test to abort. For some tests that's what you want. But often that is not desirable as your test script has many other subsequent tests to perform.

A better approach is to first validate whether the element is really present and then take alternatives when it is not. Let's look at this using Java.

```
// If element is available on page then perform type operation.
if(selenium.isElementPresent( "q" )) {
    selenium.type( "q", "Selenium rc" );
} else {
    System.out.printf( "Element: " +q+ " is not available on page." )
}
```

The advantage of this approach is to continue with test execution even if some UI elements are not available on page.

## 6.8.3 Executing JavaScript from Your Test

JavaScript comes very handy in exercising an application which is not directly supported by selenium. The **getEval** method of selenium API can be used to execute JavaScript from selenium RC.

Consider an application having check boxes with no static identifiers. In this case one could evaluate JavaScript from selenium RC to get ids of all check boxes and then exercise them.

```
public static String[] getAllCheckboxIds () {
    String script = "var inputId = new Array();" ;// Create array in java scrip
    script += "var cnt = 0;" ; // Counter for check box ids.
    script += "var inputFields = new Array();" ; // Create array in java scrip
    script += "inputFields = window.document.getElementsByTagName('input');" ;
    script += "for(var i=0; i<inputFields.length; i++) {" ; // Loop through the
    script += "if(inputFields[i].id !=null " +
        "&& inputFields[i].id !='undefined' " +
        "&& inputFields[i].getAttribute('type') == 'checkbox') {" ; // If input fie
    script += "inputId[cnt]=inputFields[i].id ;" + // Save check box id to inp
        "cnt++;" + // increment the counter.
        "}" + // end of if.
        "}" ; // end of for.
    script += "inputId.toString();" ;// Convert array in to string.
    String[] checkboxIds = selenium.getEval(script).split(","); // Split the s
    return checkboxIds;
}
```

To count number of images on a page:

```
selenium.getEval( "window.document.images.length;" );
```

Remember to use window object in case of DOM expressions as by default selenium window is referred to, not the test window.

## 6.9 Server Options

When the server is launched, command line options can be used to change the default server behaviour.

Recall, the server is started by running the following.

```
$ java -jar selenium-server-standalone-<version-number>.jar
```

To see the list of options, run the server with the `-h` option.

```
$ java -jar selenium-server-standalone-<version-number>.jar -h
```

You'll see a list of all the options you can use with the server and a brief description of each. The provided descriptions will not always be enough, so we've provided explanations for some of the more important options.

### 6.9.1 Proxy Configuration

If your AUT is behind an HTTP proxy which requires authentication then you should configure `http.proxyHost`, `http.proxyPort`, `http.proxyUser` and `http.proxyPassword` using the following command.

```
$ java -jar selenium-server-standalone-<version-number>.jar -Dhttp.proxyHost=proxy.com -
```

## 6.9.2 Multi-Window Mode

If you are using Selenium 1.0 you can probably skip this section, since multiwindow mode is the default behavior. However, prior to version 1.0, Selenium by default ran the application under test in a sub frame as shown here.



Some applications didn't run correctly in a sub frame, and needed to be loaded into the top frame of the window. The multi-window mode option allowed the AUT to run in a separate window rather than in the default frame where it could then have the top frame it required.



For older versions of Selenium you must specify multiwindow mode explicitly with the following option:

```
-multiwindow
```

As of Selenium RC 1.0, if you want to run your test within a single frame (i.e. using the standard for earlier Selenium versions) you can state this to the Selenium Server using the option

```
-singlewindow
```

### 6.9.3 Specifying the Firefox Profile

Firefox will not run two instances simultaneously unless you specify a separate profile for each instance. Selenium RC 1.0 and later runs in a separate profile automatically, so if you are using Selenium 1.0, you can probably skip this section. However, if you're using an older version of Selenium or if you need to use a specific profile for your tests (such as adding an https certificate or having some addons installed), you will need to explicitly specify the profile.

First, to create a separate Firefox profile, follow this procedure. Open the Windows Start menu, select "Run", then type and enter one of the following:

```
firefox.exe -profilemanager
```

```
firefox.exe -P
```

Create the new profile using the dialog. Then when you run Selenium Server, tell it to use this new Firefox profile with the server command-line option `-firefoxProfileTemplate` and specify the path to the profile using its filename and directory path.

```
-firefoxProfileTemplate "path to the profile"
```

**Warning:** Be sure to put your profile in a new folder separate from the default!!! The Firefox profile manager tool will delete all files in a folder if you delete a profile, regardless of whether they are profile files or not.

More information about Firefox profiles can be found in [Mozilla's Knowledge Base](#)

## 6.9.4 Run Selenese Directly Within the Server Using `-htmlSuite`

You can run Selenese html files directly within the Selenium Server by passing the html file to the server's command line. For instance:

```
java -jar selenium-server-standalone-<version-number>.jar -htmlSuite "*firefox"
"http://www.google.com" "c:\absolute\path\to\my\HTMLSuite.html"
"c:\absolute\path\to\my\results.html"
```

This will automatically launch your HTML suite, run all the tests and save a nice HTML report with the results.

**Note:** When using this option, the server will start the tests and wait for a specified number of seconds for the test to complete; if the test doesn't complete within that amount of time, the command will exit with a non-zero exit code and no results file will be generated.

This command line is very long so be careful when you type it. Note this requires you to pass in an HTML Selenese suite, not a single test. Also be aware the `-htmlSuite` option is incompatible with `-interactive`. You cannot run both at the same time.

## 6.9.5 Selenium Server Logging

### Server-Side Logs

When launching selenium server the **-log** option can be used to record valuable debugging information reported by the Selenium Server to a text file.

```
java -jar selenium-server-standalone-<version-number>.jar -log selenium.log
```

This log file is more verbose than the standard console logs (it includes DEBUG level logging messages). The log file also includes the logger name, and the ID number of the thread that logged the message. For example:

```
20:44:25 DEBUG [12] org.openqa.selenium.server.SeleniumDriverResourceHandler -
Browser 465828/:top frame1 posted START NEW
```

The message format is

```
TIMESTAMP (HH:mm:ss) LEVEL [THREAD] LOGGER - MESSAGE
```

This message may be multiline.

### Browser-Side Logs

JavaScript on the browser side (Selenium Core) also logs important messages; in many cases, these can be more useful to the end-user than the regular Selenium Server logs. To access browser-side logs, pass the **-browserSideLog** argument to the Selenium Server.

```
java -jar selenium-server-standalone-<version-number>.jar -browserSideLog
```

**-browserSideLog** must be combined with the **-log** argument, to log browserSideLogs (as well as all other DEBUG level logging messages) to a file.

## 6.10 Specifying the Path to a Specific Browser

You can specify to Selenium RC a path to a specific browser. This is useful if you have different versions of the same browser and you wish to use a specific one. Also, this is used to allow your tests to run against a browser not directly supported by Selenium RC. When specifying the run mode, use the **\*custom** specifier followed by the full path to the browser's executable:

```
*custom <path to browser>
```

## 6.11 Selenium RC Architecture

**Note:** This topic tries to explain the technical implementation behind Selenium RC. It's not fundamental for a Selenium user to know this, but could be useful for understanding some of the problems you might find in the future.

To understand in detail how Selenium RC Server works and why it uses proxy injection and heightened privilege modes you must first understand the same origin policy.

### 6.11.1 The Same Origin Policy

The main restriction that Selenium faces is the Same Origin Policy. This security restriction is applied by every browser in the market and its objective is to ensure that a site's content will never be accessible by a script from another site. The Same Origin Policy dictates that any code loaded within the browser can only operate within that website's domain. It cannot perform functions on another website. So for example, if the browser loads JavaScript code when it loads `www.mysite.com`, it cannot run that loaded code against `www.mysite2.com`—even if that's another of your sites. If this were possible, a script placed on any website you open would be able to read information on your bank account if you had the account page opened on other tab. This is called XSS (Cross-site Scripting).

To work within this policy, Selenium-Core (and its JavaScript commands that make all the magic happen) must be placed in the same origin as the Application Under Test (same URL).



Historically, Selenium-Core was limited by this problem since it was implemented in JavaScript. Selenium RC is not, however, restricted by the Same Origin Policy. Its use of the Selenium Server as a proxy avoids this problem. It, essentially, tells the browser that the browser is working on a single “spoofed” website that the Server provides.

**Note:** You can find additional information about this topic on Wikipedia pages about [Same Origin Policy](#) and [XSS](#).

### 6.11.2 Proxy Injection

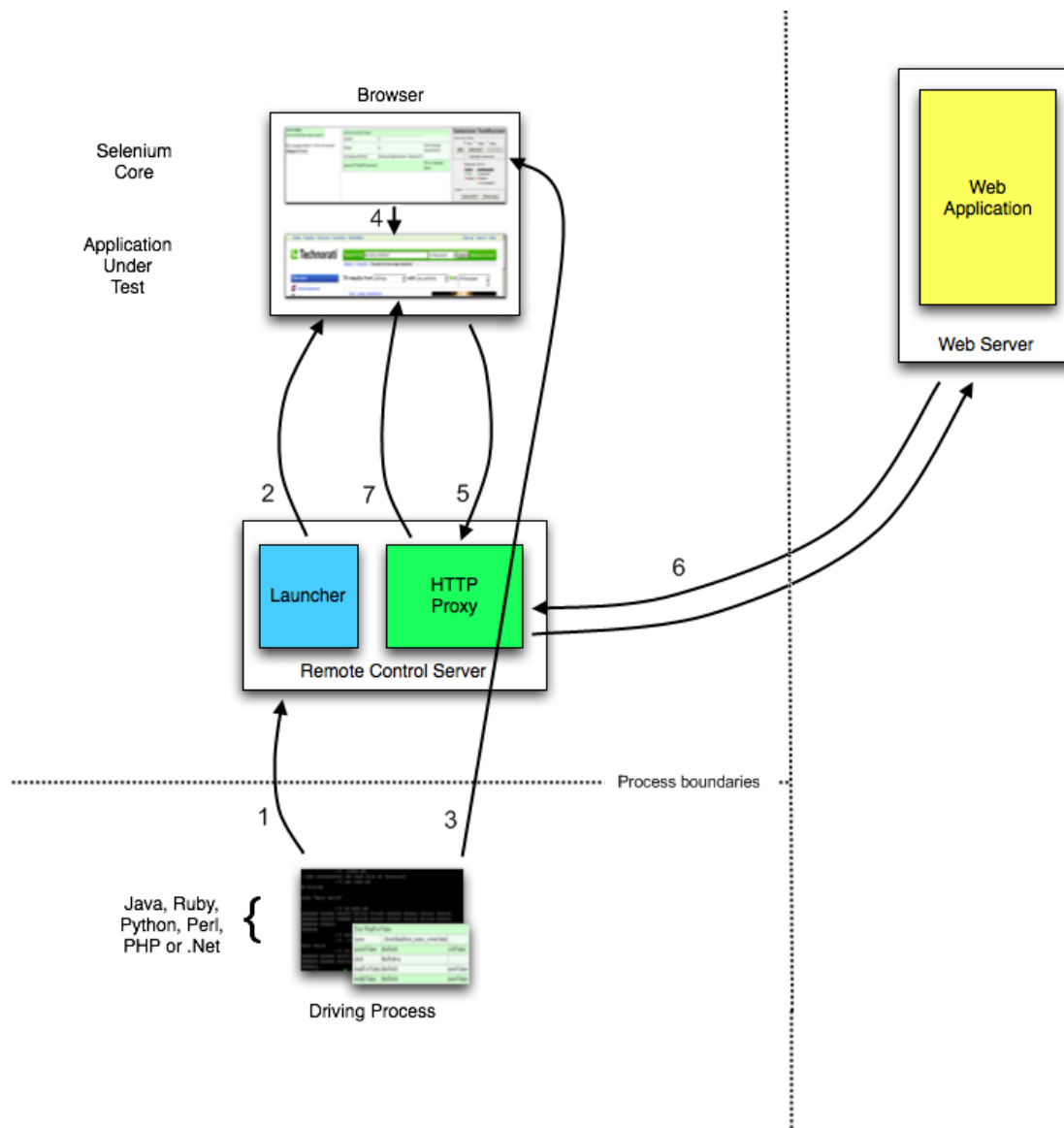
The first method Selenium used to avoid the The Same Origin Policy was Proxy Injection. In Proxy Injection Mode, the Selenium Server acts as a client-configured <sup>1</sup> **HTTP proxy** <sup>2</sup>, that sits between the browser and the Application Under Test. It then masks the AUT under a fictional URL (embedding Selenium-Core and the set of tests and delivering them as if they were coming from the same origin).

Here is an architectural diagram.

---

<sup>1</sup> The proxy is a third person in the middle that passes the ball between the two parts. It acts as a “web server” that delivers the AUT to the browser. Being a proxy gives Selenium Server the capability of “lying” about the AUT’s real URL.

<sup>2</sup> The browser is launched with a configuration profile that has set localhost:4444 as the HTTP proxy, this is why any HTTP request that the browser does will pass through Selenium server and the response will pass through it and not from the real server.



As a test suite starts in your favorite language, the following happens:

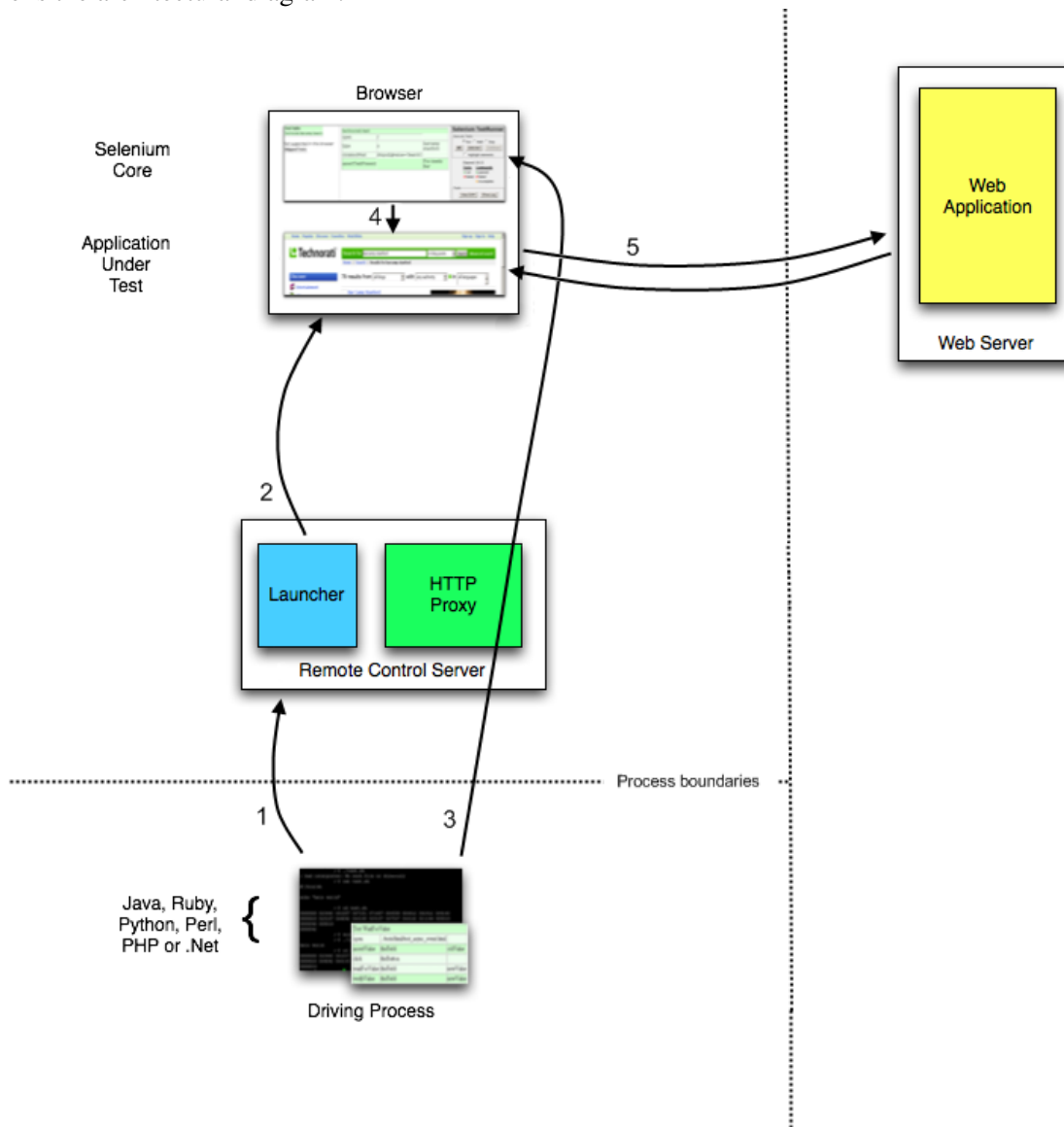
1. The client/driver establishes a connection with the selenium-RC server.
2. Selenium RC server launches a browser (or reuses an old one) with a URL that injects Selenium-Core's JavaScript into the browser-loaded web page.
3. The client-driver passes a Selenese command to the server.
4. The Server interprets the command and then triggers the corresponding JavaScript execution to execute that command within the browser.
5. Selenium-Core instructs the browser to act on that first instruction, typically opening a page of the AUT.
6. The browser receives the open request and asks for the website's content from the Selenium RC server (set as the HTTP proxy for the browser to use).
7. Selenium RC server communicates with the Web server asking for the page and once it receives it, it sends the page to the browser masking the origin to look like the page comes from the same server as Selenium-Core (this allows Selenium-Core to comply with the Same Origin Policy).

8. The browser receives the web page and renders it in the frame/window reserved for it.

### 6.11.3 Heightened Privileges Browsers

This workflow in this method is very similar to Proxy Injection but the main difference is that the browsers are launched in a special mode called *Heightened Privileges*, which allows websites to do things that are not commonly permitted (as doing [XSS](#), or filling file upload inputs and pretty useful stuff for Selenium). By using these browser modes, Selenium Core is able to directly open the AUT and read/interact with its content without having to pass the whole AUT through the Selenium RC server.

Here is the architectural diagram.



As a test suite starts in your favorite language, the following happens:

1. The client/driver establishes a connection with the selenium-RC server.
2. Selenium RC server launches a browser (or reuses an old one) with a URL that will load Selenium-Core in the web page.
3. Selenium-Core gets the first instruction from the client/driver (via another HTTP request made to the Selenium RC Server).

4. Selenium-Core acts on that first instruction, typically opening a page of the AUT.
5. The browser receives the open request and asks the Web Server for the page. Once the browser receives the web page, renders it in the frame/window reserved for it.

## 6.12 Handling HTTPS and Security Popups

Many applications switch from using HTTP to HTTPS when they need to send encrypted information such as passwords or credit card information. This is common with many of today's web applications. Selenium RC supports this.

To ensure the HTTPS site is genuine, the browser will need a security certificate. Otherwise, when the browser accesses the AUT using HTTPS, it will assume that application is not 'trusted'. When this occurs the browser displays security popups, and these popups cannot be closed using Selenium RC.

When dealing with HTTPS in a Selenium RC test, you must use a run mode that supports this and handles the security certificate for you. You specify the run mode when your test program initializes Selenium.

In Selenium RC 1.0 beta 2 and later use `*firefox` or `*iexplore` for the run mode. In earlier versions, including Selenium RC 1.0 beta 1, use `*chrome` or `*iehta`, for the run mode. Using these run modes, you will not need to install any special security certificates; Selenium RC will handle it for you.

In version 1.0 the run modes `*firefox` or `*iexplore` are recommended. However, there are additional run modes of `*iexploreproxy` and `*firefoxproxy`. These are provided for backwards compatibility only, and should not be used unless required by legacy test programs. Their use will present limitations with security certificate handling and with the running of multiple windows if your application opens additional browser windows.

In earlier versions of Selenium RC, `*chrome` or `*iehta` were the run modes that supported HTTPS and the handling of security popups. These were considered 'experimental modes although they became quite stable and many people used them. If you are using Selenium 1.0 you do not need, and should not use, these older run modes.

### 6.12.1 Security Certificates Explained

Normally, your browser will trust the application you are testing by installing a security certificate which you already own. You can check this in your browser's options or Internet properties (if you don't know your AUT's security certificate ask your system administrator). When Selenium loads your browser it injects code to intercept messages between the browser and the server. The browser now thinks untrusted software is trying to look like your application. It responds by alerting you with popup messages.

To get around this, Selenium RC, (again when using a run mode that support this) will install its own security certificate, temporarily, to your client machine in a place where the browser can access it. This tricks the browser into thinking it's accessing a site different from your AUT and effectively suppresses the popups.

Another method used with earlier versions of Selenium was to install the Cybervillians security certificate provided with your Selenium installation. Most users should no longer need to do this however; if you are running Selenium RC in proxy injection mode, you may need to explicitly install this security certificate.

## 6.13 Supporting Additional Browsers and Browser Configurations

The Selenium API supports running against multiple browsers in addition to Internet Explorer and Mozilla Firefox. See the SeleniumHQ.org website for supported browsers. In addition, when a browser is not directly supported, you may still run your Selenium tests against a browser of your choosing by using the “\*custom” run-mode (i.e. in place of \*firefox or \*iexplore) when your test application starts the browser. With this, you pass in the path to the browsers executable within the API call. This can also be done from the Server in interactive mode.

```
cmd=getNewBrowserSession&l=*custom c:\Program Files\Mozilla Firefox\MyBrowser.exe&2=ht
```

### 6.13.1 Running Tests with Different Browser Configurations

Normally Selenium RC automatically configures the browser, but if you launch the browser using the “\*custom” run mode, you can force Selenium RC to launch the browser as-is, without using an automatic configuration.

For example, you can launch Firefox with a custom configuration like this:

```
cmd=getNewBrowserSession&l=*custom c:\Program Files\Mozilla Firefox\firefox.exe&2=htt
```

Note that when launching the browser this way, you must manually configure the browser to use the Selenium Server as a proxy. Normally this just means opening your browser preferences and specifying “localhost:4444” as an HTTP proxy, but instructions for this can differ radically from browser to browser. Consult your browser’s documentation for details.

Be aware that Mozilla browsers can vary in how they start and stop. One may need to set the MOZ\_NO\_REMOTE environment variable to make Mozilla browsers behave a little more predictably. Unix users should avoid launching the browser using a shell script; it’s generally better to use the binary executable (e.g. firefox-bin) directly.

## 6.14 Troubleshooting Common Problems

When getting started with Selenium RC there’s a few potential problems that are commonly encountered. We present them along with their solutions here.

### 6.14.1 Unable to Connect to Server

When your test program cannot connect to the Selenium Server, Selenium throws an exception in your test program. It should display this message or a similar one:

```
"Unable to connect to remote server (Inner Exception Message:  
  No connection could be made because the target machine actively  
  refused it )"
```

```
(using .NET and XP Service Pack 2)
```

If you see a message like this, be sure you started the Selenium Server. If so, then there is a problem with the connectivity between the Selenium Client Library and the Selenium Server.

When starting with Selenium RC, most people begin by running their test program (with a Selenium Client Library) and the Selenium Server on the same machine. To do this use “localhost” as your connection parameter. We recommend beginning this way since it reduces the influence of potential networking problems which you’re getting started. Assuming your operating system has typical networking and TCP/IP settings you should have little difficulty. In truth, many people choose to run the tests this way.

If, however, you do want to run Selenium Server on a remote machine, the connectivity should be fine assuming you have valid TCP/IP connectivity between the two machines.

If you have difficulty connecting, you can use common networking tools like *ping*, *telnet*, *ifconfig(Unix)/ipconfig* (Windows), etc to ensure you have a valid network connection. If unfamiliar with these, your system administrator can assist you.

### 6.14.2 Unable to Load the Browser

Ok, not a friendly error message, sorry, but if the Selenium Server cannot load the browser you will likely see this error.

```
(500) Internal Server Error
```

This could be caused by

- Firefox (prior to Selenium 1.0) cannot start because the browser is already open and you did not specify a separate profile. See the section on Firefox profiles under Server Options.
- The run mode you’re using doesn’t match any browser on your machine. Check the parameters you passed to Selenium when you program opens the browser.
- You specified the path to the browser explicitly (using “\*custom”—see above) but the path is incorrect. Check to be sure the path is correct. Also check the user group to be sure there are no known issues with your browser and the “\*custom” parameters.

### 6.14.3 Selenium Cannot Find the AUT

If your test program starts the browser successfully, but the browser doesn’t display the website you’re testing, the most likely cause is your test program is not using the correct URL.

This can easily happen. When you use Selenium-IDE to export your script, it inserts a dummy URL. You must manually change the URL to the correct one for your application to be tested.

### 6.14.4 Firefox Refused Shutdown While Preparing a Profile

This most often occurs when you run your Selenium RC test program against Firefox, but you already have a Firefox browser session running and, you didn’t specify a separate profile when you started the Selenium Server. The error from the test program looks like this:

```
Error: java.lang.RuntimeException: Firefox refused shutdown while  
preparing a profile
```

Here's the complete error message from the server:

```
16:20:03.919 INFO - Preparing Firefox profile...
16:20:27.822 WARN - GET /selenium-server/driver/?cmd=getNewBrowserSession&l=*firefox&2=http%3a%2f%2fsage-webappl.qa.idc.com HTTP/1.1
java.lang.RuntimeException: Firefox refused shutdown while preparing a profile
    at org.openqa.selenium.server.browserlaunchers.FirefoxCustomProfileLauncher.waitForFullProfileToBeCreated(FirefoxCustomProfileLauncher.java:277)
    ...
Caused by: org.openqa.selenium.server.browserlaunchers.FirefoxCustomProfileLauncher$FileLockRemainedException: Lock file still present! C:\DOCUME~1\jsvec\LOCALS~1\Temp\customProfileDir203138\parent.lock
```

To resolve this, see the section on Specifying a Separate Firefox Profile

### 6.14.5 Versioning Problems

Make sure your version of Selenium supports the version of your browser. For example, Selenium RC 0.92 does not support Firefox 3. At times you may be lucky (I was). But don't forget to check which browser versions are supported by the version of Selenium you are using. When in doubt, use the latest release version of Selenium with the most widely used version of your browser.

### 6.14.6 Error message: “(Unsupported major.minor version 49.0)” while starting server

This error says you're not using a correct version of Java. The Selenium Server requires Java 1.5 or higher.

To check double-check your java version, run this from the command line.

```
java -version
```

You should see a message showing the Java version.

```
java version "1.5.0_07"
Java(TM) 2 Runtime Environment, Standard Edition (build 1.5.0_07-b03)
Java HotSpot(TM) Client VM (build 1.5.0_07-b03, mixed mode)
```

If you see a lower version number, you may need to update the JRE, or you may simply need to add it to your PATH environment variable.

### 6.14.7 404 error when running the getNewBrowserSession command

If you're getting a 404 error while attempting to open a page on “<http://www.google.com/selenium-server/>”, then it must be because the Selenium Server was not correctly configured as a proxy. The “selenium-server” directory doesn't exist on google.com; it only appears to exist when the proxy is properly configured. Proxy Configuration highly depends on how the browser is launched with \*firefox, \*iexplore, \*opera, or \*custom.

- \*iexplore: If the browser is launched using \*iexplore, you could be having a problem with Internet Explorer's proxy settings. Selenium Server attempts To configure the

global proxy settings in the Internet Options Control Panel. You must make sure that those are correctly configured when Selenium Server launches the browser. Try looking at your Internet Options control panel. Click on the “Connections” tab and click on “LAN Settings”.

- If you need to use a proxy to access the application you want to test, you’ll need to start Selenium Server with “-Dhttp.proxyHost”; see the Proxy Configuration for more details.
- You may also try configuring your proxy manually and then launching the browser with `*custom`, or with `*iehta` browser launcher.
- **\*custom: When using \*custom you must configure the proxy correctly(manually),** otherwise you’ll get a 404 error. Double-check that you’ve configured your proxy settings correctly. To check whether you’ve configured the proxy correctly is to attempt to intentionally configure the browser incorrectly. Try configuring the browser to use the wrong proxy server hostname, or the wrong port. If you had successfully configured the browser’s proxy settings incorrectly, then the browser will be unable to connect to the Internet, which is one way to make sure that one is adjusting the relevant settings.
- For other browsers (`*firefox`, `*opera`) we automatically hard-code the proxy for you, and so there are no known issues with this functionality. If you’re encountering 404 errors and have followed this user guide carefully post your results to user group for some help from the user community.

### 6.14.8 Permission Denied Error

The most common reason for this error is that your session is attempting to violate the same-origin policy by crossing domain boundaries (e.g., accesses a page from <http://domain1> and then accesses a page from <http://domain2>) or switching protocols (moving from <http://domainX> to <https://domainX>).

This error can also occur when JavaScript attempts to find UI objects which are not yet available (before the page has completely loaded), or are no longer available (after the page has started to be unloaded). This is most typically encountered with AJAX pages which are working with sections of a page or subframes that load and/or reload independently of the larger page.

This error can be intermittent. Often it is impossible to reproduce the problem with a debugger because the trouble stems from race conditions which are not reproducible when the debugger’s overhead is added to the system. Permission issues are covered in some detail in the tutorial. Read the section about the The Same Origin Policy, Proxy Injection carefully.

### 6.14.9 Handling Browser Popup Windows

There are several kinds of “Popups” that you can get during a Selenium test. You may not be able to close these popups by running selenium commands if they are initiated by the browser and not your AUT. You may need to know how to manage these. Each type of popup needs to be addressed differently.

- HTTP basic authentication dialogs: These dialogs prompt for a username/password to login to the site. To login to a site that requires HTTP basic authentication, use a username and password in the URL, as described in [RFC 1738](#), like this: `open(“http://myusername:myuserpassword@myexample.com/blah/blah/blah“).`
- SSL certificate warnings: Selenium RC automatically attempts to spoof SSL certificates when it is enabled as a proxy; see more on this in the section on HTTPS. If your browser is configured



correctly, you should never see SSL certificate warnings, but you may need to configure your browser to trust our dangerous “CyberVillains” SSL certificate authority. Again, refer to the HTTPS section for how to do this.

- modal JavaScript alert/confirmation/prompt dialogs: Selenium tries to conceal those dialogs from you (by replacing `window.alert`, `window.confirm` and `window.prompt`) so they won’t stop the execution of your page. If you’re seeing an alert pop-up, it’s probably because it fired during the page load process, which is usually too early for us to protect the page. Selenese contains commands for asserting or verifying alert and confirmation popups. See the sections on these topics in Chapter 4.

#### 6.14.10 On Linux, why isn’t my Firefox browser session closing?

On Unix/Linux you must invoke “firefox-bin” directly, so make sure that executable is on the path. If executing Firefox through a shell script, when it comes time to kill the browser Selenium RC will kill the shell script, leaving the browser running. You can specify the path to firefox-bin directly, like this.

```
cmd=getNewBrowserSession&l=*firefox /usr/local/firefox/firefox-bin&2=http://www.google.c
```

#### 6.14.11 Firefox \*chrome doesn’t work with custom profile

Check Firefox profile folder -> `prefs.js` -> `user_pref(“browser.startup.page”, 0);` Comment this line like this: `“//user_pref(“browser.startup.page”, 0);”` and try again.

#### 6.14.12 Is it ok to load a custom pop-up as the parent page is loading (i.e., before the parent page’s javascript `window.onload()` function runs)?

No. Selenium relies on interceptors to determine window names as they are being loaded. These interceptors work best in catching new windows if the windows are loaded AFTER the `onload()` function. Selenium may not recognize windows loaded before the `onload` function.

#### 6.14.13 Problems With Verify Commands

If you export your tests from Selenium-IDE, you may find yourself getting empty verify strings from your tests (depending on the programming language used).

*Note: This section is not yet developed.*

#### 6.14.14 Safari and MultiWindow Mode

*Note: This section is not yet developed.*

#### 6.14.15 Firefox on Linux

On Unix/Linux, versions of Selenium before 1.0 needed to invoke “firefox-bin” directly, so if you are using a previous version, make sure that the real executable is on the path.

On most Linux distributions, the real *firefox-bin* is located on:

```
/usr/lib/firefox-x.x.x/
```

Where the x.x.x is the version number you currently have. So, to add that path to the user's path. you will have to add the following to your .bashrc file:

```
export PATH= "$PATH:/usr/lib/firefox-x.x.x/"
```

If necessary, you can specify the path to firefox-bin directly in your test, like this:

```
"*firefox /usr/lib/firefox-x.x.x/firefox-bin"
```

### 6.14.16 IE and Style Attributes

If you are running your tests on Internet Explorer and you cannot locate elements using their *style* attribute. For example:

```
//td[@style= "background-color:yellow" ]
```

This would work perfectly in Firefox, Opera or Safari but not with IE. IE interprets the keys in *@style* as uppercase. So, even if the source code is in lowercase, you should use:

```
//td[@style= "BACKGROUND-COLOR:yellow" ]
```

This is a problem if your test is intended to work on multiple browsers, but you can easily code your test to detect the situation and try the alternative locator that only works in IE.

### 6.14.17 Error encountered - “Cannot convert object to primitive value” with shut down of \*googlechrome browser

To avoid this error you have to start browser with an option that disables same origin policy checks:

```
selenium.start( "commandLineFlags=--disable-web-security" );
```

### 6.14.18 Where can I Ask Questions that Aren't Answered Here?

Try our [user group](#)

# TEST DESIGN CONSIDERATIONS

## 7.1 Introducing Test Design

We've provided in this chapter information that will be useful to both those new to test automation and for the experienced QA professional. Here we describe the most common types of automated tests. We also describe 'design patterns' commonly used in test automation for improving the maintenance and extensibility of your automation suite. The more experienced reader will find these interesting if not already using these techniques.

## 7.2 Types of Tests

What parts of your application should you test? That depends on aspects of your project: user expectations, time allowed for the project, priorities set by the project manager and so on. Once the project boundaries are defined though, you, the tester, will certainly make many decisions on what to test.

We've created a few terms here for the purpose of categorizing the types of test you may perform on your web application. These terms are by no means standard, although the concepts we present here are typical for web-application testing.

### 7.2.1 Testing Static Content

The simplest type of test, a *content test*, is a simple test for the existence of a static, non-changing, UI element. For instance

- Does each page have its expected page title? This can be used to verify your test found an expected page after following a link.
- Does the application's home page contain an image expected to be at the top of the page?
- Does each page of the website contain a footer area with links to the company contact page, privacy policy, and trademarks information?
- Does each page begin with heading text using the `<h1>` tag? And, does each page have the correct text within that header?

You may or may not need content tests. If your page content is not likely to be affected then it may be more efficient to test page content manually. If, for example, your application involves files being moved to different locations, content tests may prove valuable.

### 7.2.2 Testing Links

A frequent source of errors for web-sites is broken links or missing pages behind links. Testing involves clicking each link and verifying the expected page. If static links are infrequently changed then manual testing may be sufficient. However if your web designers frequently alter links, or if files are occasionally relocated, link tests should be automated.

### 7.2.3 Function Tests

These would be tests of a specific function within your application, requiring some type of user input, and returning some type of results. Often a function test will involve multiple pages with a form-based input page containing a collection of input fields, Submit and Cancel operations, and one or more response pages. User input can be via text-input fields, check boxes, drop-down lists, or any other browser-supported input.

Function tests are often the most complex tests you'll automate, but are usually the most important. Typical tests can be for login, registration to the site, user account operations, account settings changes, complex data retrieval operations, among others. Function tests typically mirror the user-scenarios used to specify the features and design of your application.

### 7.2.4 Testing Dynamic Elements

Often a web page element has a unique identifier used to uniquely locate that element within the page. Usually these are implemented using the html tag's 'id' attribute or its 'name' attribute. These names can be a static, i.e unchanging, string constant. They can also be dynamically generated values that vary each instance of the page. For example, some web servers might name a displayed document doc3861 one instance of a page, and 'doc6148' on a different instance of the page depending on what 'document' the user was retrieving. A test script verifying that a document exists may not have a consistent identifier to use for locating that document. Often, dynamic elements with varying identifiers are on some type of result page based on a user action. This though certainly depends on the function of the web application.

Here's an example.

```
<input type= "checkbox" value= "true" id= "addForm:_ID74:_ID75:0:_ID79:0:
checkbox" />
```

This shows an HTML tag for a check box. Its ID (addForm:\_ID74:\_ID75:0:\_ID79:0:checkbox) is a dynamically generated value. The next time the same page is opened it will likely be a different value.

### 7.2.5 Ajax Tests

Ajax is a technology which supports dynamically changing user interface elements which can dynamically change without the browser having to reload the page, such as animation, RSS feeds, and real-time data updates among others. There's a countless ways Ajax can be used to update elements on a web page. But, the easy way to think of this is that in Ajax-driven applications, data can be retrieved from the application server and then displayed on the page without reloading the entire page. Only a portion of the page, or strictly the element itself is reloaded.

## 7.3 Validating Results

### 7.3.1 Assert vs. Verify

When should you use an assert command and when should you use a verify command? This is up to you. The difference is in what you want to happen when the check fails. Do you want your test to terminate, or to continue and simply record that the check failed?

Here's the trade-off. If you use an assert, the test will stop at that point and not run any subsequent checks. Sometimes, perhaps often, that is what you want. If the test fails you will immediately know the test did not pass. Test engines such as TestNG and JUnit have plugins for commonly used development environments (Chap 5) which conveniently flag these tests as failed tests. The advantage: you have an immediate visual of whether the checks passed. The disadvantage: when a check does fail, there are other checks which were never performed, so you have no information on their status.

In contrast, verify commands will not terminate the test. If your test uses only verify commands you are guaranteed (assuming no unexpected exceptions) the test will run to completion whether the checks find defects or not. The disadvantage: you have to do more work to examine your test results. That is, you won't get feedback from TestNG or JUnit. You will need to look at the results of a console printout or a log output. And you will need to take the time to look through this output every time you run your test. If you are running hundreds of tests, each with its own log, this will be time-consuming, and the immediate feedback of asserts will be more appropriate. Asserts are more commonly used than verifies due to their immediate feedback.

### 7.3.2 Trade-offs: *assertTextPresent*, *assertElementPresent*, *assertText*

You should now be familiar with these commands, and the mechanics of using them. If not, please refer to Chapter 3 first. When constructing your tests, you will need to decide

- Do I only check that the text exists on the page? (*verify/assertTextPresent*)
- Do I only check that the HTML element exists on the page? That is, the text, image, or other content is not to be checked, only the HTML tag is what is relevant. (*verify/assertElementPresent*)
- Must I test both, the element and its text content? (*verify/assertText*)

There is no right answer. It depends on the requirements for your test. Which, of course, depend on the requirements for the application you're testing. If in doubt, use *assertText* since this is the strictest type of checkpoint. You can always change it later but at least you won't be missing any potential failures.

*Verify/assertText* is the *most specific test* type. This can fail if either the HTML element (tag) OR the text is not what your test is expecting. Perhaps your web-designers are frequently changing the page and you don't want your test to fail every time they do this because the changes themselves are expected periodically. However, assume you still need to check that *something* is on the page, say a paragraph, or heading text, or an image. In this case you can use *verify/assertElementPresent*. It will ensure that a particular type of element exists (and if using XPath can ensure it exists relative to other objects within the page). But you don't care what the content is. You only care that a specific element, say, an image, is at a specific location.

Getting a feel for these types of decisions will come with time and a little experience. They are easy concepts, and easy to change in your test.

## 7.4 Location Strategies

### 7.4.1 Choosing a Location Strategy

There are multiple ways of selecting an object on a page. But what are the trade offs of each of these locator types? Recall we can locate an object using

- the element's ID
- the element's name attribute
- an XPath statement
- by a links text
- document object model (DOM)

Using an element ID or name locator is the most efficient in terms of test performance, and also makes your test code more readable, assuming the ID or name within the page source is well-named. XPath statements take longer to process since the browser must run its XPath processor. XPath has been known to be especially slow in Internet Explorer version 7. Locating via a link's text is often convenient and performs well. This technique is specific to links though. Also, if the link text is likely to change frequently, locating by the <a> element would be the better choice.

Sometimes though, you must use an XPath locator. If the page source does not have an ID or name attribute you may have no choice but to use an XPath locator. (DOM locators are no longer commonly used since XPath can do everything they can and more. DOM locators are available simply to support legacy tests.)

There is an advantage to using XPath that locating via ID or name attributes do not have. With XPath (and DOM) you can locate an object with respect to another object on the page. For example, if there is a link that must occur within the second paragraph within a <div> section, you can use XPath to specify this. With ID and name locators, you can only specify that they occur on the page that is, somewhere on the page. If you must test that an image displaying the company logo appears at the top of the page within a header section XPath may be the better locator.

### 7.4.2 Locating Dynamic Elements

As was described earlier in the section on types of tests, a dynamic element is a page element whose identifier varies with each instance of the page. For example,

```
<a class="button" id="adminHomeForm" onclick="return oamSubmitForm('adminHomeForm',  
'adminHomeForm:_ID38');" href="#">View Archived Allocation Events</a>
```

This HTML anchor tag defines a button with an ID attribute of “adminHomeForm”. It's a fairly complex anchor tag when compared to most HTML tags, but it is still a static tag. The HTML will be the same each time this page is loaded in the browser. Its ID remains constant with all instances of this page. That is, when this page is displayed, this UI element will always have this Identifier. So, for your test script to click this button you simply need to use the following selenium command.

```
click            adminHomeForm
```

Or, in Selenium 1.0

```
selenium.click( "adminHomeForm" );
```

Your application, however, may generate HTML dynamically where the identifier varies on different instances of the webpage. For instance, HTML for a dynamic page element might look like this.

```
<input type= "checkbox" value= "true" id= "addForm:_ID74:_ID75:0:_ID79:0:checkBox"
      name= "addForm:_ID74:_ID75:0:_ID79:0:checkBox" />
```

This defines a checkbox. Its ID and name attributes (both `addForm:_ID74:_ID75:0:_ID79:0:checkBox`) are dynamically generated values. In this case, using a standard locator would look something like the following.

```
click          addForm:_ID74:_ID75:0:_ID79:0:checkBox
```

Or, again in Selenium-RC

```
selenium.click( "addForm:_ID74:_ID75:0:_ID79:0:checkBox" );
```

Given the dynamically generated Identifier, this approach would not work. The next time this page is loaded the Identifier will be a different value from the one used in the Selenium command and therefore, will not be found. The click operation will fail with an “element not found” error.

To correct this, a simple solution would be to just use an XPath locator rather than trying to use an ID locator. So, for the checkbox you can simply use

```
click          //input
```

Or, if it is not the first input element on the page (which it likely is not) try a more detailed XPath statement.

```
click          //input[3]
```

Or

```
click          //div/p[2]/input[3]
```

If however, you do need to use the ID to locate the element, a different solution is needed. You can capture this ID from the website before you use it in a Selenium command. It can be done like this.

```
String[] checkboxids = selenium.getAllFields(); // Collect all input IDs on page.
for (String checkboxid:checkboxoids) {
    if (checkboxid.contains( "addForm" )) {
        selenium.click( expectedText );
    }
}
```

This approach will work if there is only one check box whose ID has the text ‘expectedText’ appended to it.

### 7.4.3 Locating Ajax Elements

As was presented in the Test Types subsection above, a page element implemented with Ajax is an element that can be dynamically refreshed without having to refresh the entire page. The best way to locate and verify an Ajax element is to use the Selenium 2.0 WebDriver API. It was specifically designed to address testing of Ajax elements where Selenium 1 has some limitations.

In Selenium 2.0 you use the `waitFor()` method to wait for a page element to become available. The parameter is a `By` object which is how WebDriver implements locators. This is explained in detail in the WebDriver chapters.

To do this with Selenium 1.0 (Selenium-RC) a bit more coding is involved, but it isn't difficult. The approach is to check for the element, if it's not available wait for a predefined period and then again recheck it. This is then executed with a loop with a predetermined time-out terminating the loop if the element isn't found.

Let's consider a page which brings a link (`link=ajaxLink`) on click of a button on page (without refreshing the page) This could be handled by Selenium using a *for* loop.

```
// Loop initialization.
for (int second = 0;; second++) {

    // If loop is reached 60 seconds then break the loop.
    if (second >= 60) break;

    // Search for element "link=ajaxLink" and if available then break loop.
    try { if (selenium.isElementPresent("link=ajaxLink")) break; } catch (Exception e) {

    // Pause for 1 second.
    Thread.sleep(1000);

    }
}
```

This certainly isn't the only solution. Ajax is a common topic in the user forum and we recommend searching previous discussions to see what others have done.

## 7.5 Wrapping Selenium Calls

As with any programming, you will want to use utility functions to handle code that would otherwise be duplicated throughout your tests. One way to prevent this is to wrap frequently used selenium calls with functions or class methods of your own design. For example, many tests will frequently click on a page element and wait for page to load multiple times within a test.

```
selenium.click(elementLocator);
selenium.waitForPageToLoad(waitPeriod);
```

Instead of duplicating this code you could write a wrapper method that performs both functions.

```
/**
 * Clicks and Waits for page to load.
 *
 * param elementLocator
 * param waitPeriod
 */
```



```
public void clickAndWait(String elementLocator, String waitPeriod) {
    selenium.click(elementLocator);
    selenium.waitForPageToLoad(waitPeriod);
}
```

### 7.5.1 ‘Safe Operations’ for Element Presence

Another common usage of wrapping Selenium methods is to check for presence of an element on page before carrying out some operation. This is sometimes called a ‘safe operation’. For instance, the following method could be used to implement a safe operation that depends on an expected element being present.

```
/**
 * Selenium-RC -- Clicks on element only if it is available on page.
 *
 * param elementLocator
 */
public void safeClick(String elementLocator) {
    if(selenium.isElementPresent(elementLocator)) {
        selenium.click(elementLocator);
    } else {
        // Using the TestNG API for logging
        Reporter.log("Element: " +elementLocator+ ", is not available on page"
            +selenium.getLocation());
    }
}
```

This example uses the Selenium 1 API but Selenium 2 also supports this.

```
/**
 * Selenium-WebDriver -- Clicks on element only if it is available on page.
 *
 * param elementLocator
 */
public void safeClick(String elementLocator) {
    WebElement webElement = getDriver().findElement(By.XXXX(elementLocator));
    if(webElement != null) {
        selenium.click(elementLocator);
    } else {
        // Using the TestNG API for logging
        Reporter.log("Element: " +elementLocator+ ", is not available on page"
            + getDriver().getUrl());
    }
}
```

In this second example ‘XXXX’ is simply a placeholder for one of the multiple location methods that can be called here.

Using safe methods is up to the test developer’s discretion. Hence, if test execution is to be continued, even in the wake of missing elements on the page, then safe methods could be used, while posting a message to a log about the missing element. This, essentially, implements a ‘verify’ with a reporting mechanism as opposed to an abortive assert. But if element must be available on page in order to be able to carry out further operations (i.e. login button on home page of a portal) then this safe method technique should not be used.

## 7.6 UI Mapping

A UI map is a mechanism that stores all the locators for a test suite in one place for easy modification when identifiers or paths to UI elements change in the AUT. The test script then uses the UI Map for locating the elements to be tested. Basically, a UI map is a repository of test script objects that correspond to UI elements of the application being tested.

What makes a UI map helpful? Its primary purpose is making test script management much easier. When a locator needs to be edited, there is a central location for easily finding that object, rather than having to search through test script code. Also, it allows changing the Identifier in a single place, rather than having to make the change in multiple places within a test script, or for that matter, in multiple test scripts.

To summarize, a UI map has two significant advantages.

- Using a centralized location for UI objects instead of having them scattered throughout the script. This makes script maintenance more efficient.
- Cryptic HTML Identifiers and names can be given more human-readable names improving the readability of test scripts.

Consider the following, difficult to understand, example (in java).

```
public void testNew() throws Exception {
    selenium.open( "http://www.test.com" );
    selenium.type( "loginForm:tbUsername", "xxxxxxx" );
    selenium.click( "loginForm:btnLogin" );
    selenium.click( "adminHomeForm:_activitynew" );
    selenium.waitForPageToLoad( "30000" );
    selenium.click( "addEditEventForm:_IDcancel" );
    selenium.waitForPageToLoad( "30000" );
    selenium.click( "adminHomeForm:_activityold" );
    selenium.waitForPageToLoad( "30000" );
}
```

This script would be hard to follow for anyone not familiar with the AUT's page source. Even regular users of the application might have difficulty understanding what this script does. A better script could be:

```
public void testNew() throws Exception {
    selenium.open( "http://www.test.com" );
    selenium.type( admin.username, "xxxxxxx" );
    selenium.click( admin.loginbutton );
    selenium.click( admin.events.createnewevent );
    selenium.waitForPageToLoad( "30000" );
    selenium.click( admin.events.cancel );
    selenium.waitForPageToLoad( "30000" );
    selenium.click( admin.events.viewoldevents );
    selenium.waitForPageToLoad( "30000" );
}
```

Now, using some comments and whitespace along with the UI Map identifiers makes a very readable script.

```

public void testNew() throws Exception {

    // Open app url.
    selenium.open( "http://www.test.com" );

    // Provide admin username.
    selenium.type(admin.username, "xxxxxxxx" );

    // Click on Login button.
    selenium.click(admin.loginbutton);

    // Click on Create New Event button.
    selenium.click(admin.events.createnewevent);
    selenium.waitForPageToLoad( "30000" );

    // Click on Cancel button.
    selenium.click(admin.events.cancel);
    selenium.waitForPageToLoad( "30000" );

    // Click on View Old Events button.
    selenium.click(admin.events.viewoldevents);
    selenium.waitForPageToLoad( "30000" );

}

```

There are various ways a UI Map can be implemented. One could create a class or struct which only stores public String variables each storing a locator. Alternatively, a text file storing key value pairs could be used. In Java, a properties file containing key/value pairs is probably best method.

Consider a property file *prop.properties* which assigns as ‘aliases’ reader-friendly identifiers for UI elements from the previous example.

```

admin.username = loginForm:tbUsername
admin.loginbutton = loginForm:btnLogin
admin.events.createnewevent = adminHomeForm:_activitynew
admin.events.cancel = addEditEventForm:_IDcancel
admin.events.viewoldevents = adminHomeForm:_activityold

```

The locators will still refer to html objects, but we have introduced a layer of abstraction between the test script and the UI elements. Values are read from the properties file and used in the Test Class to implement the UI Map. For more on Java properties files refer to the following [link](#).

## 7.7 Page Object Design Pattern

Page Object is a Design Pattern which has become popular in test automation for enhancing test maintenance and reducing code duplication. A page object is an object-oriented class that serves as an interface to a page of your AUT. The tests then use the methods of this page object class whenever they need to interact with that page of the UI. The benefit is that if the UI changes for the page, the tests themselves don’t need to change, only the code within the page object needs to change. Subsequently all changes to support that new UI are located in one place.

The Page Object Design Pattern provides the following advantages.

1. There is clean separation between test code and page specific code such as locators (or their use if you’re using a UI map) and layout.

2. There is single repository for the services or operations offered by the page rather than having these services scattered through out the tests.

In both cases this allows any modifications required due to UI changes to all be made in one place. Useful information on this technique can be found on numerous blogs as this ‘test design pattern’ is becoming widely used. *We encourage the reader who wishes to know more to search the internet for blogs on this subject.* Many have written on this design pattern and can provide useful tips beyond the scope of this user guide. To get you started, though, we’ll illustrate page objects with a simple example.

First, consider an example, typical of test automation, that does not use a page object.

```
/**
 * Tests login feature
 */
public class Login {

    public void testLogin() {
        selenium.type( "inputBox" , "testUser" );
        selenium.type( "password" , "my supersecret password" );
        selenium.click( "sign-in" );
        selenium.waitForPageToLoad( "PageWaitPeriod" );
        Assert.assertTrue( selenium.isElementPresent( "compose button" ),
                           "Login was unsuccessful" );
    }
}
```

There are two problems with this approach.

1. There is no separation between the test method and the AUTs locators (IDs in this example); both are intertwined in a single method. If the AUT’s UI changes its identifiers, layout, or how a login is input and processed, the test itself must change.
2. The id-locators would be spread in multiple tests, all tests that had to use this login page.

Applying the page object techniques this example could be rewritten like this in the following example of a page object for a Sign-in page.

```
/**
 * Page Object encapsulates the Sign-in page.
 */
public class SignInPage {

    private Selenium selenium;

    public SignInPage(Selenium selenium) {
        this.selenium = selenium;
        if(!selenium.getTitle().equals( "Sign in page" )) {
            throw new IllegalStateException( "This is not sign in page, current page is "
            +selenium.getLocation() );
        }
    }

    /**
     * Login as valid user
     */
}
```

```
* @param userName
* @param password
* @return HomePage object
*/
public HomePage loginValidUser(String userName, String password) {
    selenium.type("usernamefield", userName);
    selenium.type("passwordfield", password);
    selenium.click("sign-in");
    selenium.waitForPageToLoad("waitPeriod");

    return new HomePage(selenium);
}
```

and page object for a Home page could look like this.

```
/**
 * Page Object encapsulates the Home Page
 */
public class HomePage {

    private Selenium selenium;

    public HomePage(Selenium selenium) {
        if (!selenium.getTitle().equals("Home Page of logged in user")) {
            throw new IllegalStateException("This is not Home Page of logged in user"
                + "is: " + selenium.getLocation());
        }
    }

    public HomePage manageProfile() {
        // Page encapsulation to manage profile functionality
        return new HomePage(selenium);
    }

    /*More methods offering the services represented by Home Page
    of Logged User. These methods in turn might return more Page Objects
    for example click on Compose mail button could return ComposeMail class object*/
}
```

So now, the login test would use these two page objects as follows.

```
/**
 * Tests login feature
 */
public class TestLogin {

    public void testLogin() {
        SignInPage signInPage = new SignInPage(selenium);
        HomePage homePage = signInPage.loginValidUser("userName", "password");
        Assert.assertTrue(selenium.isElementPresent("compose button"),
            "Login was unsuccessful");
    }
}
```

There is a lot of flexibility in how the page objects may be designed, but there are a few basic rules for getting the desired maintainability of your test code. Page objects themselves should never be make verifications or assertions. This is part of your test and should always be within the test's code, never in an page object. The page object will contain the representation of the page, and the services the page provides via methods but no code related to what is being tested should be within the page object.

There is one, single, verification which can, and should, be within the page object and that is to verify that the page, and possibly critical elements on the page, were loaded correctly. This verification should be done while instantiating the page object. In the examples above, both the `SignInPage` and `HomePage` constructors check that the expected page is available and ready for requests from the test.

A page object does not necessarily need to represent an entire page. The Page Object design pattern could be used to represent components on a page. If a page in the AUT has multiple components, it may improved maintainability if there was a separate page object for each component.

There are other design patterns that also may be used in testing. Some use a Page Factory for instantiating their page objects. Discussing all of these is beyond the scope of this user guide. Here, we merely want to introduce the concepts to make the reader aware of some of the things that can be done. As was mentioned earlier, many have blogged on this topic and we encourage the reader to search for blogs on these topics.

## 7.8 Data Driven Testing

Data Driven Testing refers to using the same test (or tests) multiple times with varying data. These data sets are often from external files i.e. .csv file, text file, or perhaps loaded from a database. Data driven testing is a commonly used test automation technique used to validate an application against many varying input. When the test is designed for varying data, the input data can expand, essentially creating additional tests, without requiring changes to the test code.

### In Python:

```
# Collection of String values
source = open("input_file.txt", "r")
values = source.readlines()
source.close()
# Execute For loop for each String in the values array
for search in values:
    sel.open("/")
    sel.type("q", search)
    sel.click("btnG")
    sel.waitForPageToLoad("30000")
    self.failUnless(sel.is_text_present("Results * for " + search))
```

The Python script above opens a text file. This file contains a different search string on each line. The code then saves this in an array of strings, and iterates over the array doing a search and assert on each string.

This is a very basic example, but the idea is to show that running a test with varying data can be done easily with a programming or scripting language. For more examples, refer to the [Selenium RC wiki](#) for examples of reading data from a spreadsheet or for using the data provider capabilities of TestNG. Additionally, this is a well-known topic among test automation professionals including those who don't use Selenium so searching the internet on "data-driven testing" should reveal many blogs on this topic.

## 7.9 Database Validation

Another common type of testing is to compare data in the UI against the data actually stored in the AUT's database. Since you can also do database queries from a programming language, assuming you have database support functions, you can use them to retrieve data and then use the data to verify what's displayed by the AUT is correct.

Consider the example of a registered email address to be retrieved from a database and then later compared against the UI. An example of establishing a DB connection and retrieving data from the DB could look like this.

### In Java:

```
// Load Microsoft SQL Server JDBC driver.
Class.forName( "com.microsoft.sqlserver.jdbc.SQLServerDriver" );

// Prepare connection url.
String url = "jdbc:sqlserver://192.168.1.180:1433;DatabaseName=TEST_DB";

// Get connection to DB.
public static Connection con =
DriverManager.getConnection(url, "username", "password");

// Create statement object which would be used in writing DDL and DML
// SQL statement.
public static Statement stmt = con.createStatement();

// Send SQL SELECT statements to the database via the Statement.executeQuery
// method which returns the requested information as rows of data in a
// ResultSet object.

ResultSet result = stmt.executeQuery
( "select top 1 email_address from user_register_table" );

// Fetch value of "email_address" from "result" object.
String emailaddress = result.getString( "email_address" );

// Use the emailAddress value to login to application.
selenium.type( "userID", emailaddress);
selenium.type( "password", secretPassword);
selenium.click( "loginButton" );
selenium.waitForPageToLoad( timeout );
Assert.assertTrue( selenium.isTextPresent( "Welcome back" + emailaddress ), "Unable to log
```

This is a simple Java example of data retrieval from a database.





# SELENIUM-GRID

*Note: We are currently working on this chapter. Presently we have introductory info here for people completely new to Selenium-Grid. Over the next few months we hope to provide useful examples and illustrations to thoroughly explain how to use Selenium-Grid.*

## 8.1 Quick Start

If you're already experienced in Selenium test automation you may simply need a quick-start to get up and running. This chapter has much information geared to many skill levels, but may be too much if you're looking for just a quick reference to quickly try things out. For a quick-start, refer to the Selenium-Grid articles in the [Selenium Wiki](#).

## 8.2 What is Selenium-Grid?

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.

## 8.3 When to Use It

Generally speaking, there's 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.

Selenium-Grid is used to speed up the execution of a test pass by using multiple machines to run tests in parallel. For example, if you have a suite of 100 tests, but you set up Selenium-Grid to support 4 different machines (VMs or separate physical machines) to run those tests, your test suite will complete in (roughly) one-fourth the time as it would if you ran your tests sequentially on a single machine. For large test suites, and long-running test suite such as those performing large amounts of data-validation, this can be a significant time-saver. Some test suites can take hours to run. Another reason to boost the time spent running the suite is to shorten the turnaround time for test results after developers check-in code for the AUT. Increasingly software teams practicing Agile software development want test feedback as immediately as possible as opposed to wait overnight for an overnight test pass.

Selenium-Grid is also used to support running tests against multiple runtime environments, specifically, against different browsers at the same time. For example, a ‘grid’ of virtual machines can be setup with each supporting a different browser that the application to be tested must support. So, machine 1 has Internet Explorer 8, machine 2, Internet Explorer 9, machine 3 the latest Chrome, and machine 4 the latest Firefox. When the test suite is run, Selenium-Grid receives each test-browser combination and assigns each test to run against it’s required browser.

In addition, one can have a grid of all the same browser, type and version. For instance, one could have a grid of 4 machines each running 3 instances of Firefox 12, allowing for a ‘server-farm’ (in a sense) of available Firefox instances. When the suite runs, each test is passed to Selenium-Grid which assigns the test to the next available Firefox instance. In this manner one gets test pass where conceivably 12 tests are all running at the same time in parallel, significantly reducing the time required to complete a test pass.

Selenium-Grid is very flexible. These two examples can be combined to allow multiple instances of each browser type and version. A configuration such as this would provide both, parallel execution for fast test pass completion and support for multiple browser types and versions simultaneously.

## 8.4 Selenium-Grid 2.0

Selenium-Grid 2.0 is the latest release as of the writing of this document (5/26/2012). It is quite different from version 1 of Selenium-Grid. In 2.0 Selenium-Grid was merged with the Selenium-RC server. Now, you only need to download a single .jar file to get the remote Selenium-RC-Server and Selenium-Grid all in one package.

## 8.5 Selenium-Grid 1.0

Version 1 was the first general release of Selenium-Grid. If you are new to Selenium-Grid you should use version 2. It’s been updated and has new features, and supports Selenium-WebDriver. Legacy test systems may still be using version 1 however. Information on Selenium-Grid version 1 may be found at the [Selenium-Grid website](#).

## 8.6 How Selenium-Grid Works—With a Hub and Nodes

A grid consists of a single hub, and one or more nodes. Both are started using the selenium-server.jar executable. We’ve listed some examples in the following sections of this chapter.

The hub receives a test to be executed along with information on which browser and ‘platform’ (i.e. WINDOWS, LINUX, etc) where the test should be run. It ‘knows’ the configuration of each node that has been ‘registered’ to the hub. Using this information it selects an available node that has the requested browser-platform combination. Once a node has been selected, Selenium commands initiated by the test are send the the hub, which passes them to the node assigned to that test. The node runs the browser, and executes the Selenium commands within that browser against the application under test.

A [diagram](#) illustrates this. Refer to the second diagram on this page (the first one is illustrating Selenium-RC). The second diagram was for Selenium-Grid 1, however it still applies and is a good illustration of what we’re describing here. The only difference is one of terminology. Replace the term ‘Selenium Remote Control’ with ‘Selenium-Grid node’ the diagram will match our description for Selenium-Grid 2.

## 8.7 Installation

Installation is simple. Download the Selenium-Server jar file from the [SeleniumHq website's download page](#). You want the link under the section “Selenium-Server (formerly Selenium-RC)”.

Install it in a folder of your choice. You'll need to be sure the java executable is on your execution path so you can run it from the command-line. If it does not run correctly, verify your system's path variable includes the path to the java.exe.

## 8.8 Starting Selenium-Grid

Generally you would start a hub first since nodes depend on a hub. This is not absolutely necessary however, since nodes can recognize when a hub has been started and vice-versa. For learning purposes though, it would easier to start the hub first, otherwise you'll see error messages that may not want to start off with your first time using Selenium-Grid.

### 8.8.1 Starting a Hub

To start a hub with default parameters, run the following command from a command-line shell. This will work on all the supported platforms, Windows Linux, or MacOS.

```
java -jar selenium-server-standalone-2.21.0.jar -hub
```

This starts a hub using default parameter values. We'll explain these parameters in following subsections. Note that you will likely have to change the version number in the jar filename depending on which version of the selenium-server you're using.

### 8.8.2 Starting a Node

To start a node using default parameters, run the following command from a command-line.

```
java -jar selenium-server-standalone-2.21.0.jar -role node -hub http://localhost:4444/g
```

This assumes the hub has been started above using default parameters. The default port the hub uses to listen for new requests is port 4444. This is why port 4444 was used in the URL for locating the hub. Also the use of 'localhost' assumes your node is running on the same machine as your hub. For getting started this is probably easiest. If running the hub and node on separate machines, simply replace 'localhost' with the hostname of the remote machine running the hub.

**WARNING:** Be sure to turn off the firewalls on the machine running your hub and nodes. Otherwise you may get connection errors.

## 8.9 Configuring Selenium-Grid

### 8.9.1 Default Configuration

### 8.9.2 JSON Configuration File

### 8.9.3 Configuring Via the Command-Line Options

## 8.10 Hub Configuration

To run the hub using the default options simply specify `-role hub` to the Selenium-Server

```
java -jar selenium-server-standalone-2.21.0.jar -hub
```

You should see the following logging output.

```
Jul 19, 2012 10:46:21 AM org.openqa.grid.selenium.GridLauncher main
INFO: Launching a selenium grid server
2012-07-19 10:46:25.082:INFO:osjs.Server:jetty-7.x.y-SNAPSHOT
2012-07-19 10:46:25.151:INFO:osjsh.ContextHandler:started o.s.j.s.ServletContextHandler
2012-07-19 10:46:25.185:INFO:osjs.AbstractConnector:Started SocketConnector@0.0.0.0:4444
```

### 8.10.1 Specifying the Port

The default port used by the hub is 4444. The port being referred to here, is the TCP/IP port used when the 'client', that is, the automated tests connect to the Selenium-Grid hub. If another application on your computer is already using this port, or if, you already have a Selenium-Server started, you'll see the following message in the log output.

```
10:56:35.490 WARN - Failed to start: SocketListener0@0.0.0.0:4444
Exception in thread "main" java.net.BindException: Selenium is already running on port
```

If this occurs you can either shutdown the other process that is using port 4444, or you can tell Selenium-Grid to use a different port for its hub. Use the `-port` option for changing the port used by the hub.

```
java -jar selenium-server-standalone-2.21.0.jar -hub -port 4441
```

This will work even if another hub is already running on the same machine, that is, as long as they're both not using port 4441.

You may, however, want to see what process is using port 4444 so you can allow the hub to use the default. To see the ports used by all running programs on your machine use the command.

```
netstat -a
```

This should work on all supported systems, Unix/Linux, MacOS, and Windows although additional options beyond `-a` may be required. Basically you need to display the process ID along with the port. In Unix you may 'grep' the output (use a pipe) from the port number to only display those records you're concerned with.

## 8.11 Node Configuration

## 8.12 Timing Parameters

## 8.13 Getting Command-Line Help

The Selenium-Server provides listings of available options with a brief description of each. Currently (summer 2012), the command-line help has some oddities, but it can be helpful if you know where to look and how to interpret the information.

The Selenium-Server provides two distinct functions, that of the Selenium-RC server and that of Selenium-Grid. These were likely written by different Selenium teams, and therefore the command-line help for each function has ended up in two different places. And, for the new user, it may not be apparent at first which of these two you are viewing.

If you simply pass a `-h` option as you might first assume, you get the Selenium-RC Server options but not those for Selenium-Grid.

```
java -jar selenium-server-standalone-2.21.0.jar -h
```

This would give you Selenium-RC's server options. If you want the command-line help for Selenium-Grid, you first use the `-hub` or `-node` options to tell Selenium-Server you're interested in Selenium-Grid, and then follow with a `-h`.

```
java -jar selenium-server-standalone-2.21.0.jar -role node -h
```

Or, for that matter, just pass a garbage argument to the `-role node` as follows.

```
java -jar selenium-server-standalone-2.21.0.jar -role node xx
```

You will first see "INFO..." and an "ERROR" but below that you'll get the command-line options for Selenium-Grid. We won't list the whole output here since it's rather long, but the first few lines look like this.

```
Jul 19, 2012 10:10:39 AM org.openqa.grid.selenium.GridLauncher main
INFO: Launching a selenium grid node
org.openqa.grid.common.exception.GridConfigurationException: You need to specify a hub t
    at org.openqa.grid.common.RegistrationRequest.validate(RegistrationRequest.java:
    at org.openqa.grid.internal.utils.SelfRegisteringRemote.startRemoteServer(SelfRe
    at org.openqa.grid.selenium.GridLauncher.main(GridLauncher.java:72)
Error building the config :You need to specify a hub to register to using -hubHost X -hu
Usage :
    -hubConfig:
        (hub) a JSON file following grid2 format.

    -nodeTimeout:
        (node) <XXXX> the timeout in seconds before the hub
            automatically ends a test that hasn't had any activity than XX
            sec.The browser will be released for another test to use.This
            typically takes care of the client crashes.
```

## 8.14 Common Errors

### 8.14.1 Unable to access the jarfile

```
Unable to access jarfile selenium-server-standalone-2.21.0.jar
```

This error can occur when starting up either a hub or node. This means Java cannot find the selenium-server jar file. Either run the command from the directory where the selenium-server-XXXX.jar file is stored, or specify an explicit path to the jar.

## 8.15 Troubleshooting

# USER-EXTENSIONS

*NOTE: This section is close to completion, but it has not been reviewed and edited.*

## 9.1 Introduction

Extending Selenium by adding your own actions, assertions and locator-strategies can be quite simple. Add JavaScript methods to the Selenium object prototype and the PageBot object prototype. On startup, Selenium will automatically look through methods on these prototypes, using name patterns to recognize which ones are actions, assertions and locators. The following examples give an indication of how Selenium can be extended with JavaScript.

## 9.2 Actions

All methods on the Selenium prototype beginning with “do” are added as actions. For each action foo there is also an action fooAndWait registered. An action method can take up to two parameters, which will be passed the second and third column values in the test. Example: Add a “typeRepeated” action to Selenium, which types the text twice into a text box.

```
Selenium.prototype.doTypeRepeated = function(locator, text) {  
    // All locator-strategies are automatically handled by "findElement"  
    var element = this.page().findElement(locator);  
  
    // Create the text to type  
    var valueToType = text + text;  
  
    // Replace the element text with the new text  
    this.page().replaceText(element, valueToType);  
};
```

## 9.3 Accessors/Assertions

All *getFoo* and *isFoo* methods on the Selenium prototype are added as accessors (*storeFoo*). For each accessor there is an *assertFoo*, *verifyFoo* and *waitForFoo* registered. An assert method can take up to 2 parameters, which will be passed the second and third column values in the test. You can also define your own assertions literally as simple “assert” methods, which will also auto-generate “verify” and “waitFor” commands. Example: Add a *valueRepeated* assertion, that makes sure that the element

value consists of the supplied text repeated. The 2 commands that would be available in tests would be `assertValueRepeated` and `verifyValueRepeated`.

```
Selenium.prototype.assertValueRepeated = function(locator, text) {  
    // All locator-strategies are automatically handled by "findElement"  
    var element = this.page().findElement(locator);  
  
    // Create the text to verify  
    var expectedValue = text + text;  
  
    // Get the actual element value  
    var actualValue = element.value;  
  
    // Make sure the actual value matches the expected  
    Assert.matches(expectedValue, actualValue);  
};
```

### 9.3.1 Prototype generates additional commands

All `getFoo` and `isFoo` methods on the Selenium prototype automatically result in the availability of `storeFoo`, `assertFoo`, `assertNotFoo`, `verifyFoo`, `verifyNotFoo`, `waitForFoo`, and `waitForNotFoo` commands. Example, if you add a `getTextLength()` method, the following commands will automatically be available: `storeTextLength`, `assertTextLength`, `assertNotTextLength`, `verifyTextLength`, `verifyNotTextLength`, `waitForTextLength`, and `waitForNotTextLength` commands.

```
Selenium.prototype.getTextLength = function(locator, text) {  
    return this.getText(locator).length;  
};
```

Also note that the `assertValueRepeated` method described above could have been implemented using `isValueRepeated`, with the added benefit of also automatically getting `assertNotValueRepeated`, `storeValueRepeated`, `waitForValueRepeated` and `waitForNotValueRepeated`.

## 9.4 Locator Strategies

All `locateElementByFoo` methods on the PageBot prototype are added as locator-strategies. A locator strategy takes 2 parameters, the first being the locator string (minus the prefix), and the second being the document in which to search. Example: Add a “valuerepeated=” locator, that finds the first element a value attribute equal to the the supplied value repeated.

```
// The "inDocument" is a the document you are searching.  
PageBot.prototype.locateElementByValueRepeated = function(text, inDocument) {  
    // Create the text to search for  
    var expectedValue = text + text;  
  
    // Loop through all elements, looking for ones that have  
    // a value === our expected value  
    var allElements = inDocument.getElementsByTagName("*");  
    for (var i = 0; i < allElements.length; i++) {  
        var testElement = allElements[i];  
        if (testElement.value && testElement.value === expectedValue) {
```



```
        return testElement;
    }
}
return null;
};
```

## 9.5 Using User-Extensions With Selenium-IDE

User-extensions are very easy to use with the selenium IDE.

1. Create your user extension and save it as user-extensions.js. While this name isn't technically necessary, it's good practice to keep things consistent.
2. Open Firefox and open Selenium-IDE.
3. Click on Tools, Options
4. In Selenium Core Extensions click on Browse and find the user-extensions. js file. Click on OK.
5. Your user-extension will not yet be loaded, you must close and restart Selenium-IDE.
6. In your empty test, create a new command, your user-extension should now be an options in the Commands dropdown.

## 9.6 Using User-Extensions With Selenium RC

If you Google “Selenium RC user-extension” ten times you will find ten different approaches to using this feature. Below, is the official Selenium suggested approach.

### 9.6.1 Example

C#

1. Place your user extension in the same directory as your Selenium Server.
2. If you are using client code generated by the Selenium-IDE you will need to make a couple of small edits. First, you will need to create an `HttpCommandProcessor` object with class scope (outside the `SetupTest` method, just below `private StringBuilder verificationErrors;`)

```
HttpCommandProcessor proc;
```

1. Next, instantiate that `HttpCommandProcessor` object as you would the `DefaultSelenium` object. This can be done in the test setup.

```
proc = new HttpCommandProcessor("localhost", 4444, "*iexplore", "http://google.ca/");
```

1. Instantiate the `DefaultSelenium` object using the `HttpCommandProcessor` object you created.

```
selenium = new DefaultSelenium(proc);
```

1. Within your test code, execute your user-extension by calling it with the `DoCommand()` method of `HttpCommandProcessor`. This method takes two arguments: a string to identify the user-extension method you want to use and string array to pass arguments. Notice that the first letter of your function is lower case, regardless of the capitalization in your user-extension. Selenium automatically does this to keep common JavaScript naming conventions. Because JavaScript is case sensitive, your test will fail if you begin this command with a capital. `inputParams` is the array of arguments you want to pass to the JavaScript user-extension. In this case there is only one string in the array because there is only one parameter for our user extension, but a longer array will map each index to the corresponding user-extension parameter. Remember that user extensions designed for Selenium-IDE will only take two arguments.

```
string[] inputParams = { "Hello World" };  
proc.DoCommand( "alertWrapper" , inputParams);
```

1. Start the test server using the `-userExtensions` argument and pass in your `user-extensions.js` file.

```
java -jar selenium-server.jar -userExtensions user-extensions.js
```

```
using System;  
using System.Text;  
using System.Text.RegularExpressions;  
using System.Threading;  
using NUnit.Framework;  
using Selenium;  
  
namespace SeleniumTests  
{  
    [TestFixture]  
    public class NewTest  
    {  
  
        private ISelenium selenium;  
        private StringBuilder verificationErrors;  
        private HttpCommandProcessor proc;  
  
        [SetUp]  
        public void SetupTest()  
        {  
            proc = new HttpCommandProcessor( "localhost" , 4444, "*iexplore"  
            selenium = new DefaultSelenium(proc);  
            //selenium = new DefaultSelenium("localhost", 4444, "*iexplore",  
            selenium.Start();  
            verificationErrors = new StringBuilder();  
  
        }  
  
        [TearDown]
```

```
public void TeardownTest ()
{
    try
    {
        selenium.Stop();
    }
    catch (Exception)
    {
        // Ignore errors if unable to close the browser
    }
    Assert.AreEqual("", verificationErrors.ToString());
}

[Test]
public void TheNewTest ()
{
    selenium.Open("/");
    string[] inputParams = { "Hello World", };
    proc.DoCommand("alertWrapper", inputParams);
}
}
```

Appendixes:



# SELENIUM WEBDRIVER CHEAT SHEET

## 10.1 Role Based Interfaces in Selenium WebDriver

One of the differences between Selenium RC and Selenium WebDriver is that the WebDriver APIs make extensive use of “role-based interfaces” to allow users to determine whether a particular driver supports a feature. This can make it hard to know what features are available without first knowing which interface to try and use. The key interfaces are listed below.

Interface	Role	Documentation
HasCapabilities	Provides access to the capabilities supported by this driver.	<a href="#">Java HasCapabilities.java</a>
JavascriptExecutor	Allows the execution of arbitrary JS commands.	<a href="#">Java JavascriptExecutor.java</a>
Rotatable	Indicates whether the driver supports rotating the display (mostly just mobile drivers).	<a href="#">Java Rotatable.java</a>
TakesScreenshot	Provides a mechanism for taking screenshots.	<a href="#">Java TakesScreenshot.java</a>



# HOW TO INSTALL THE ANDROID DRIVER

This is a placeholder.

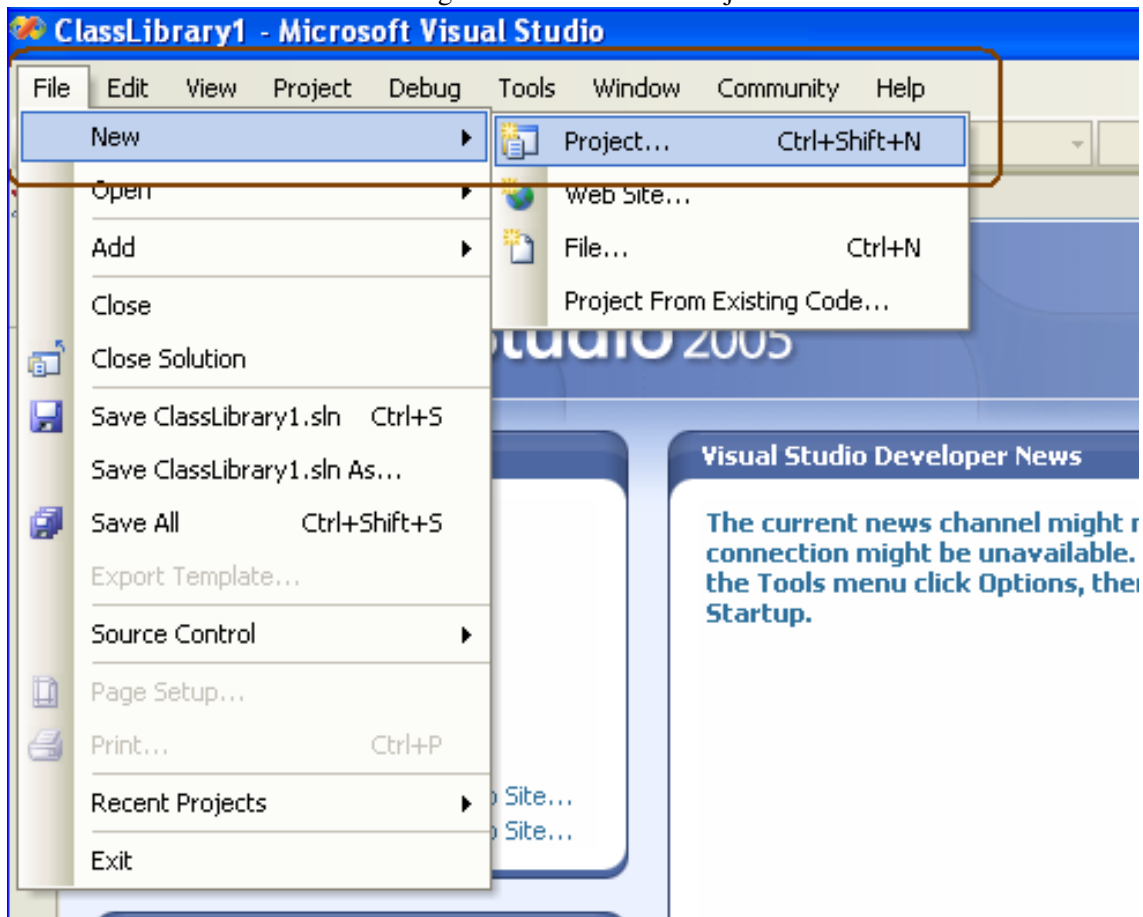




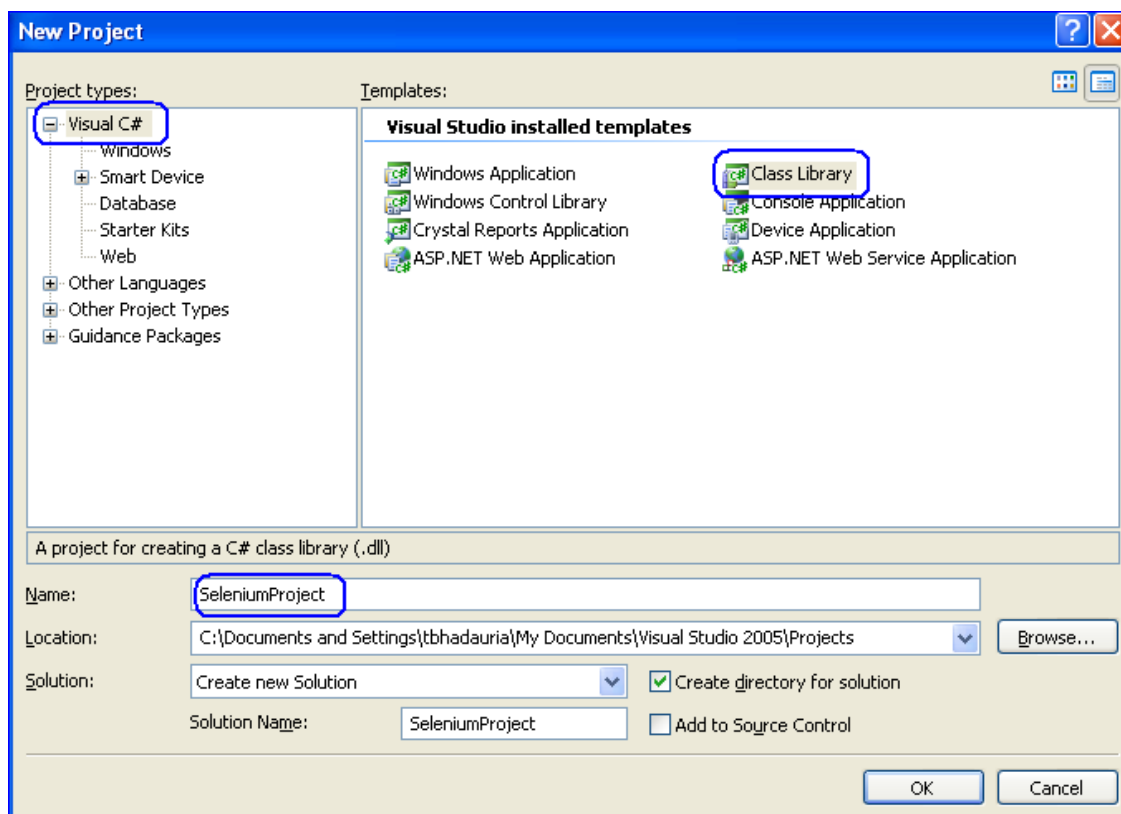
# .NET CLIENT DRIVER CONFIGURATION

.NET client Driver can be used with Microsoft Visual Studio. To Configure it with Visual Studio do as Following.

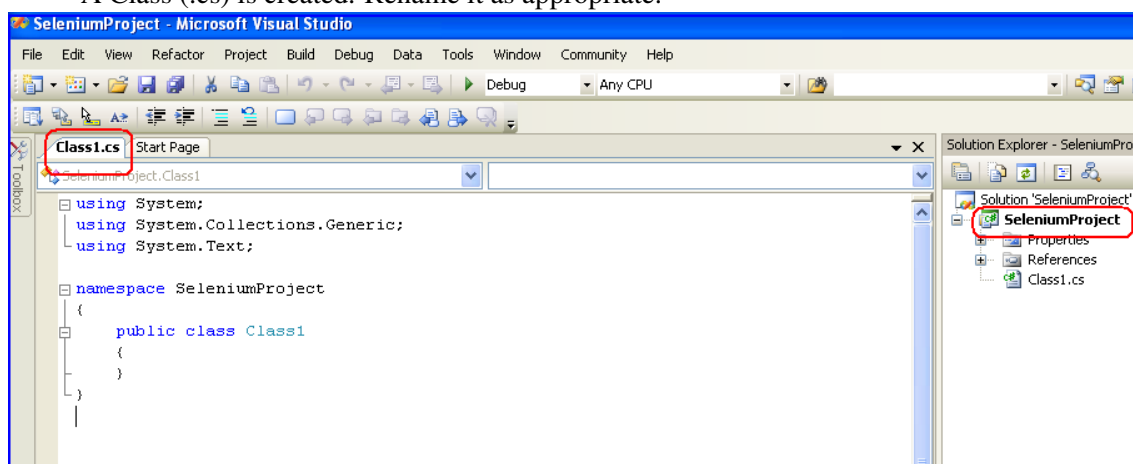
- Launch Visual Studio and navigate to File > New > Project.



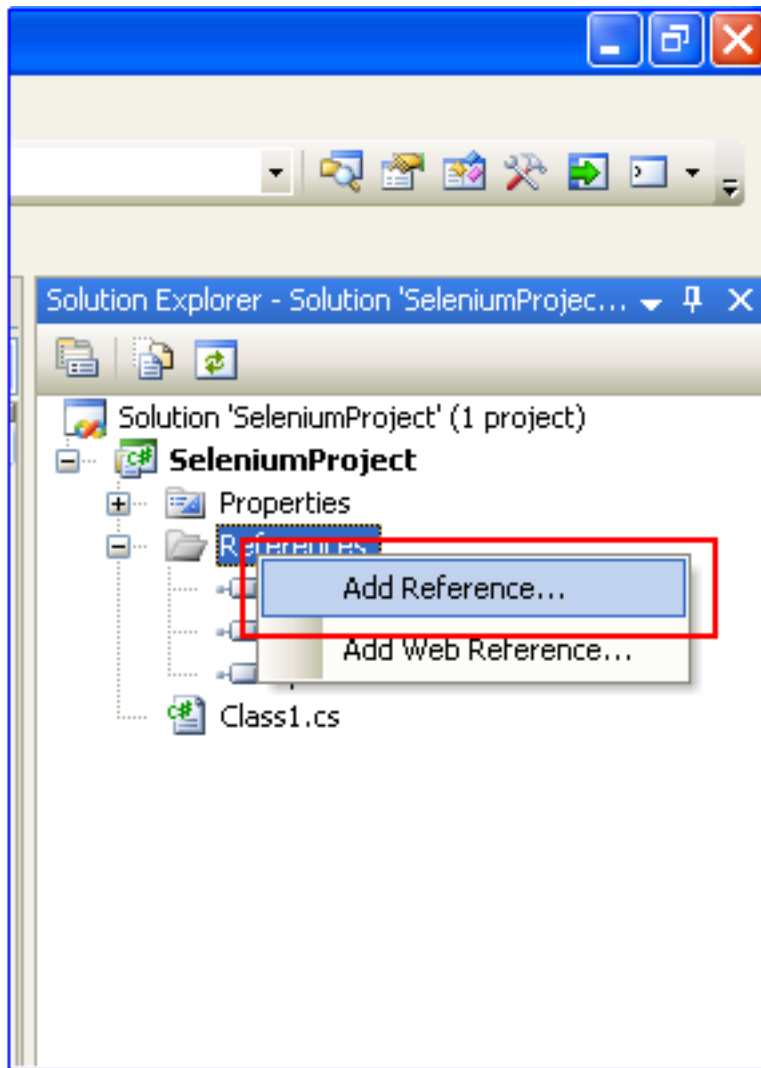
- Select Visual C# > Class Library > Name your project > Click on OK button.



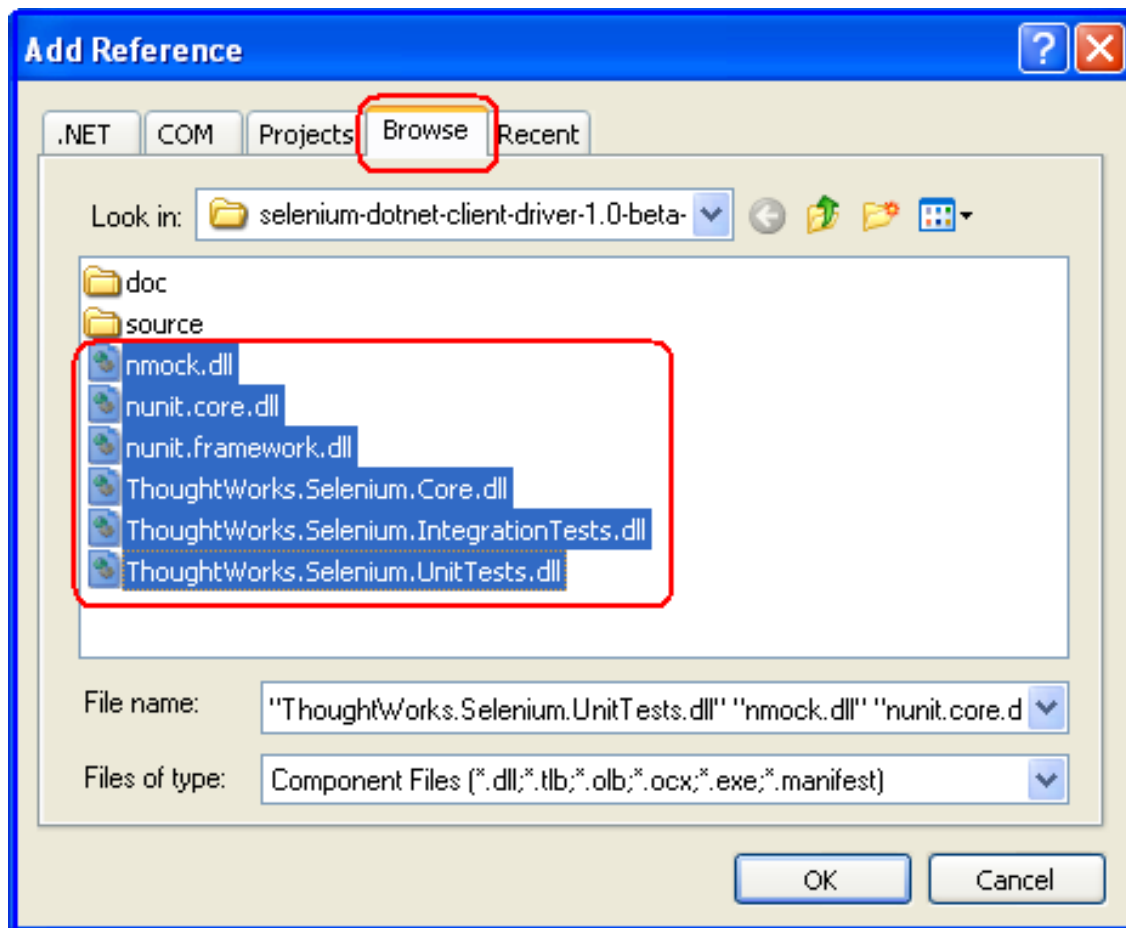
- A Class (.cs) is created. Rename it as appropriate.



- Under right hand pane of Solution Explorer right click on References > Add References.



- Select following dll files - nmock.dll, nunit.core.dll, nunit.framework.dll, ThoughtWorks.Selenium.Core.dll, ThoughtWorks.Selenium.IntegrationTests.dll, ThoughtWorks.Selenium.UnitTests.dll and click on Ok button



With This Visual Studio is ready for Selenium Test Cases.

# IMPORTING SEL2.0 PROJECT INTO ECLIPSE USING MAVEN

Once you have created your pom.xml file in your project, you can have maven autogenerate the project files necessary for eclipse with a simple command:

```
mvn eclipse:eclipse
```

Then open eclipse. Choose your workspace or create a new one. Once the Eclipse IDE loads, do the following:

# File -> Import... # General -> Existing Projects into Workspace # Click next # Next to "Select root Directory:" click "Browse" button # locate the project folder containing your pom.xml and click ok. # Your project should appear in the "Projects" box already # click finish

If you haven't already, install the [m2eclipse plugin](#) then right click on your project and select Maven -> Enable Dependency Management.

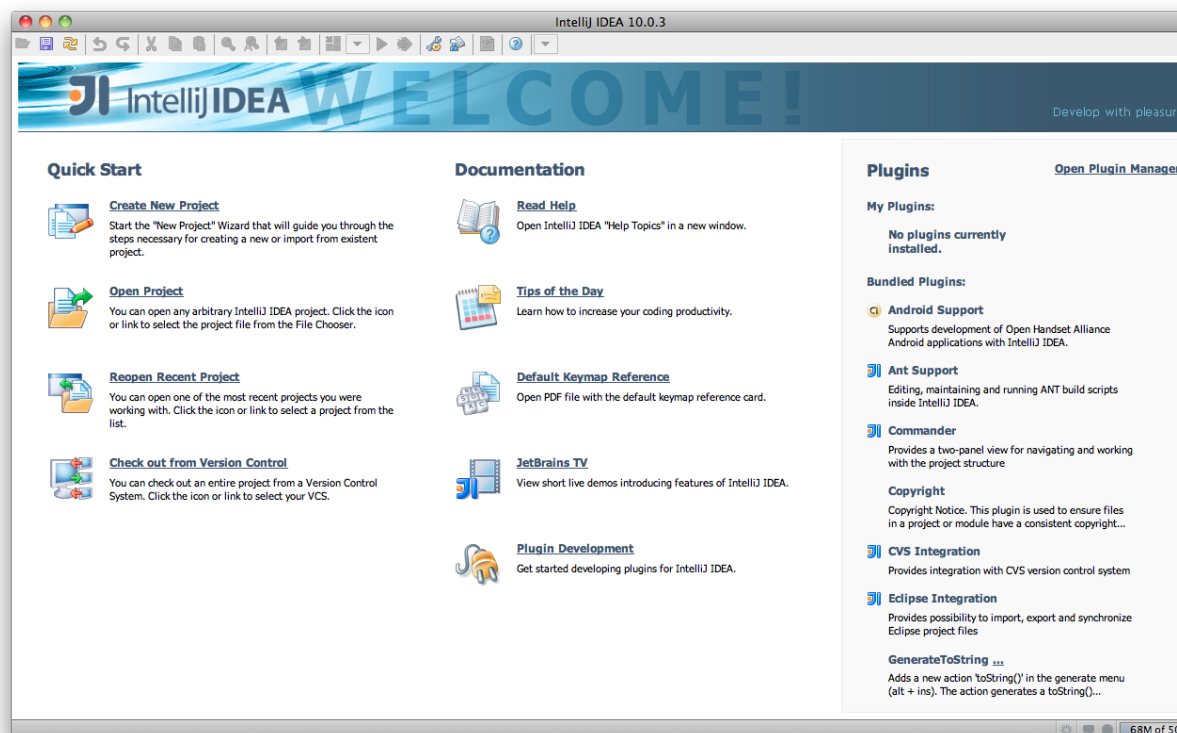


# IMPORTING SEL2.0 PROJECT INTO INTELLIJ USING MAVEN

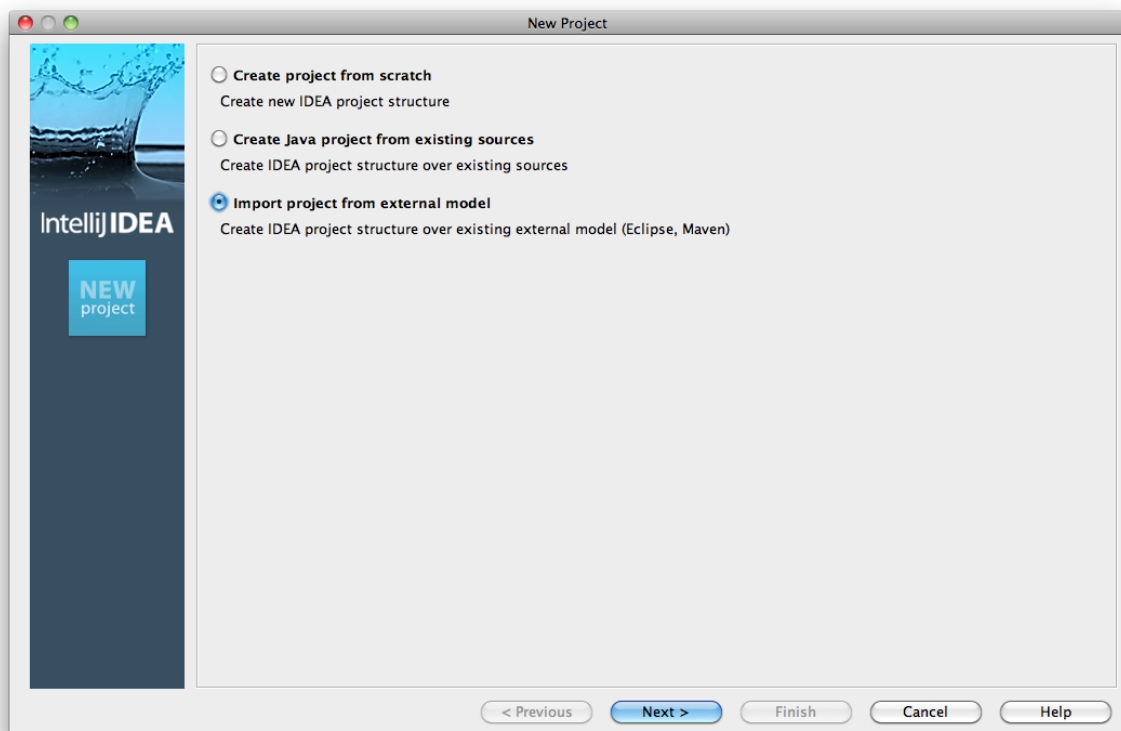
*We are currently working on this appendix. The information provided here is accurate, although it may not be finished.*

In this appendix we provide the steps, including screen captures, showing how to create a Selenium 2.0 java client-driver project in IntelliJ IDEA. These steps assume you have already used maven with a pom.xml file to set up the project. This process is described in the Selenium 2.0 chapter. You must have followed that process before you can perform these steps. This appendix then shows you how to import the maven-created Selenium 2.0 java project into IntelliJ.

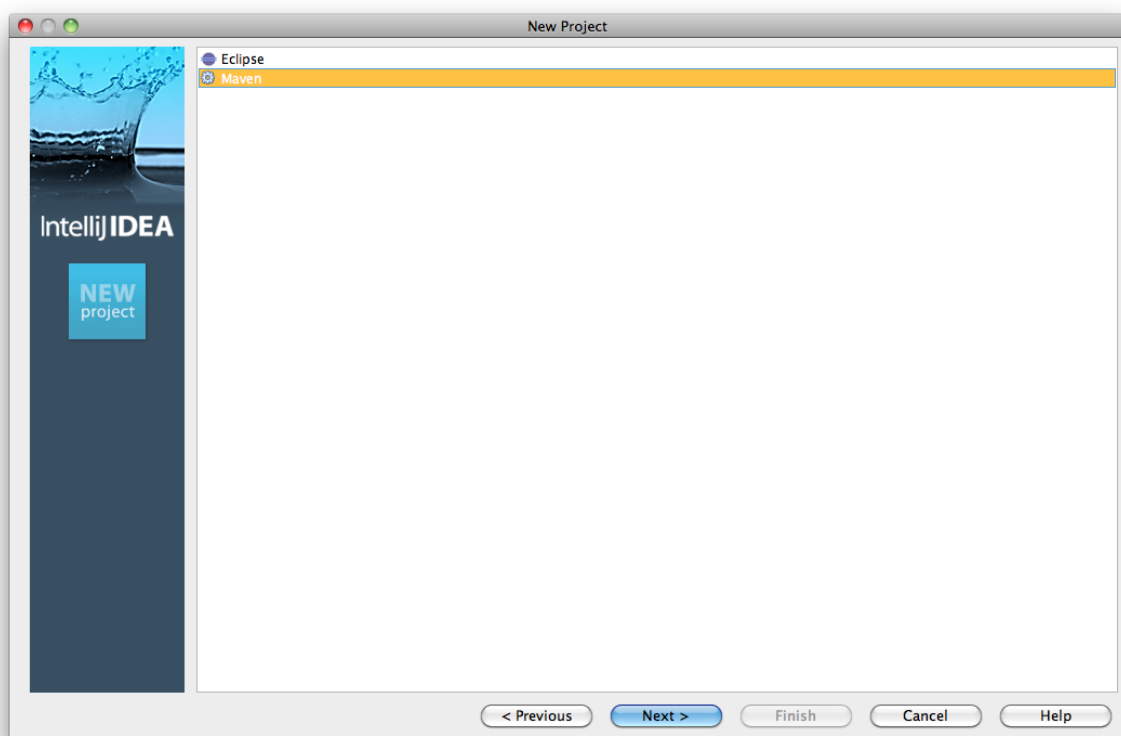
First, open IntelliJ and from the entry page, click Create New Project.



From the New Project dialog select Import Project from External Model.

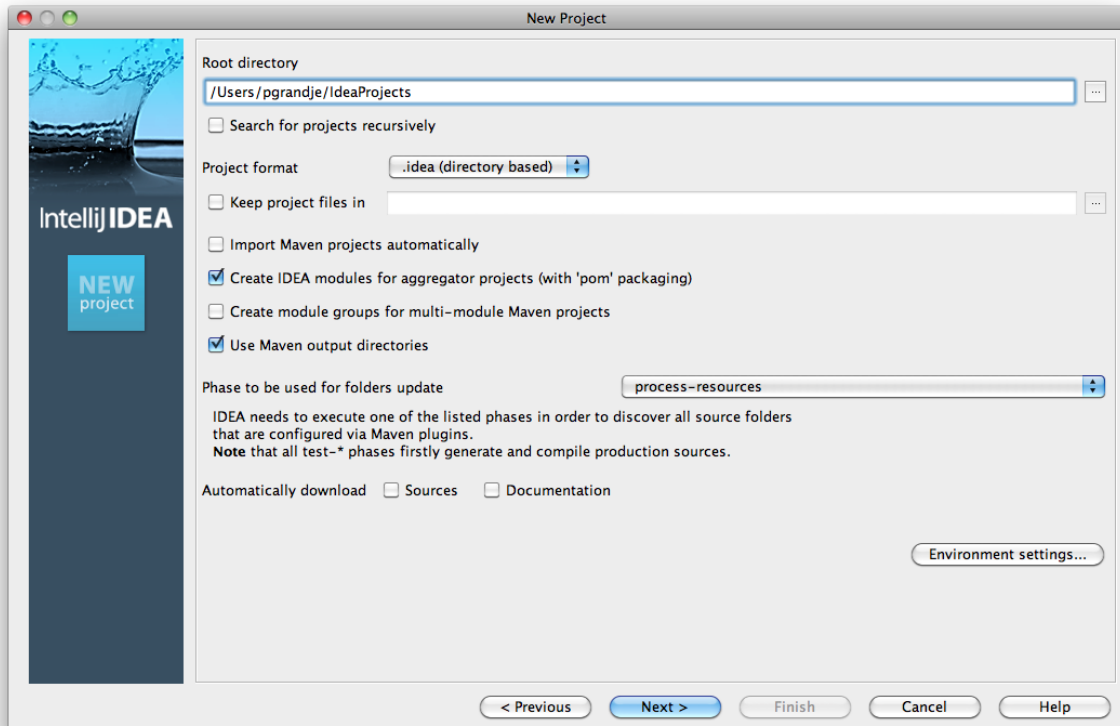


From the list of project types, select maven.

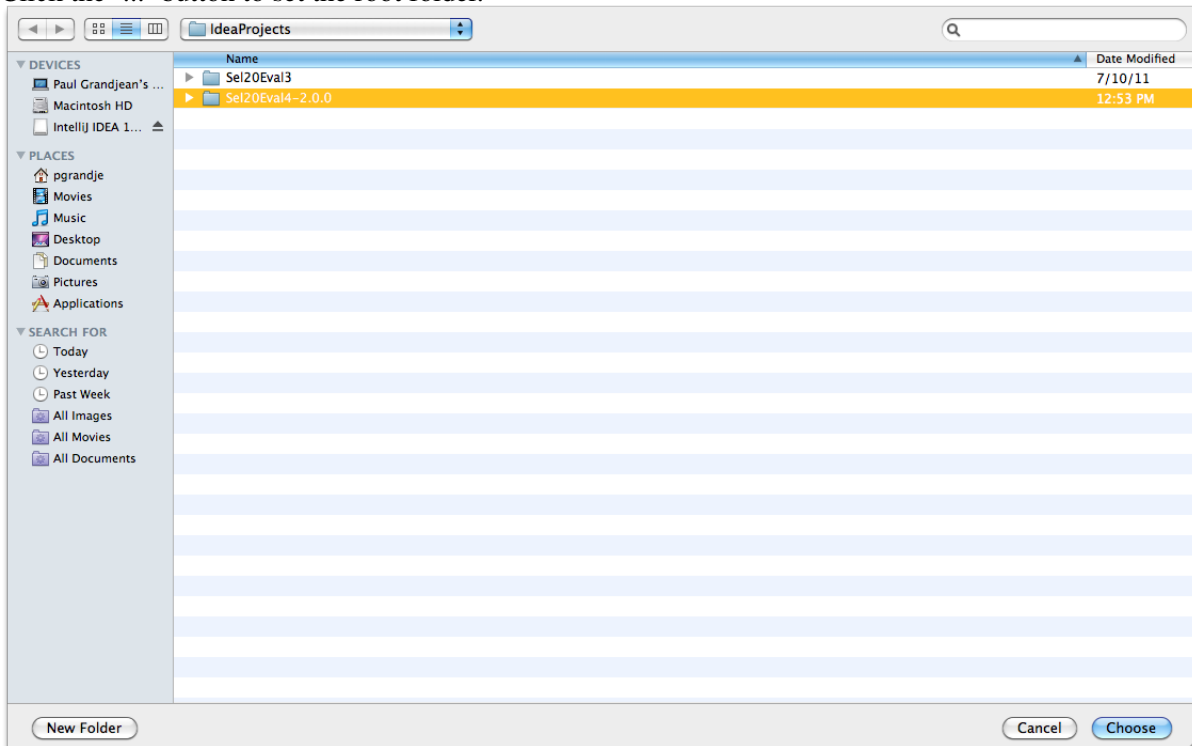


Now you will see a dialog allowing you to set project options including the project's root directory.

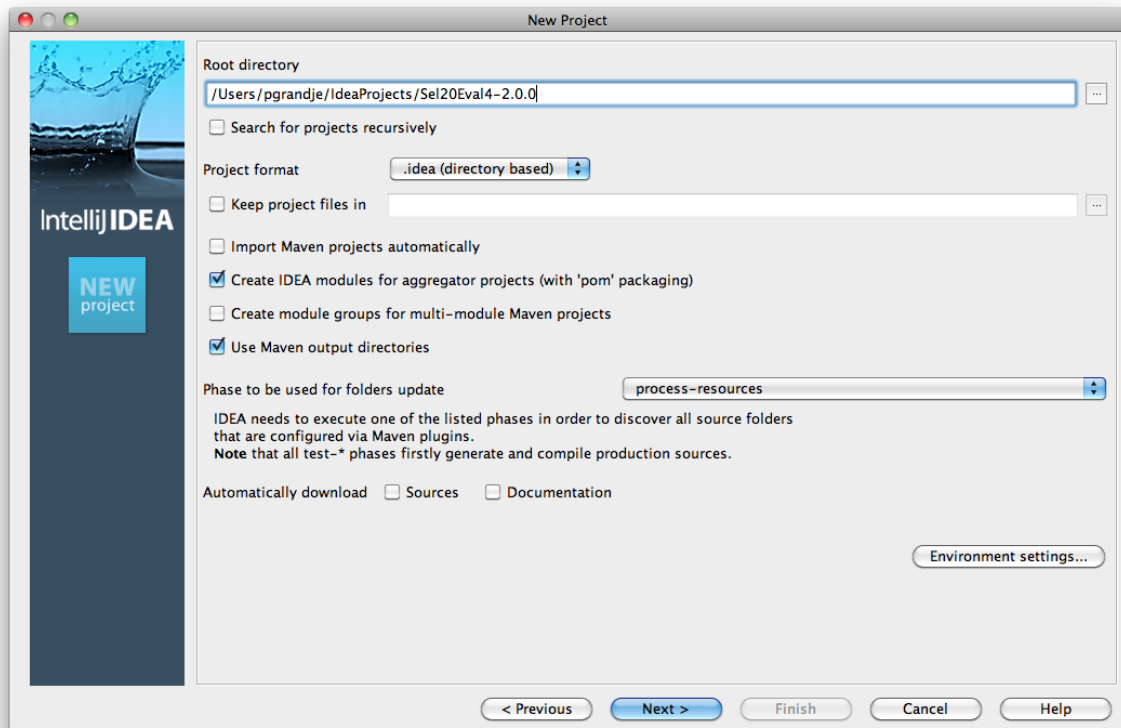




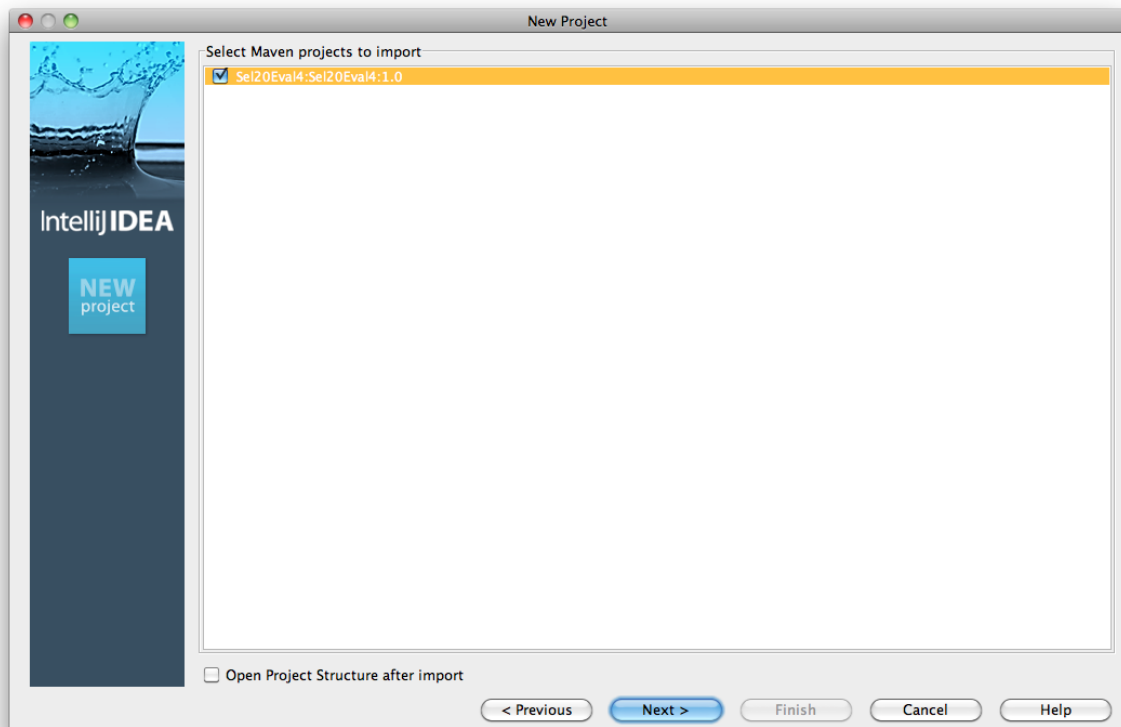
Click the ‘...’ button to set the root folder.



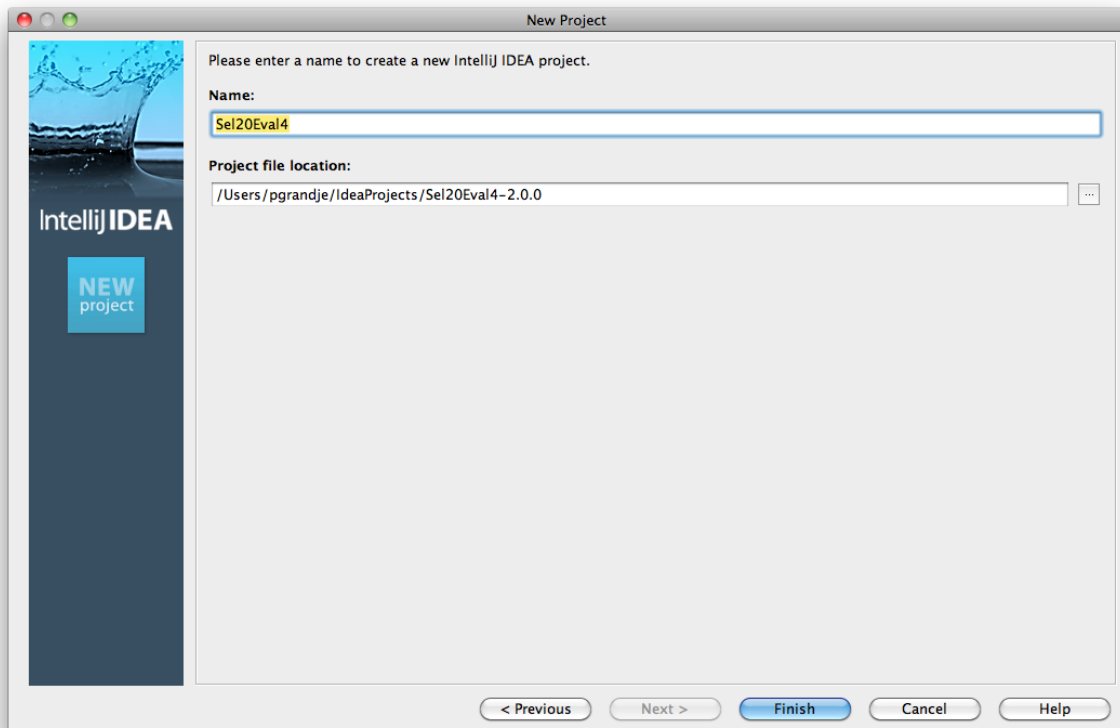
Now the settings dialog will show the directory you just selected.



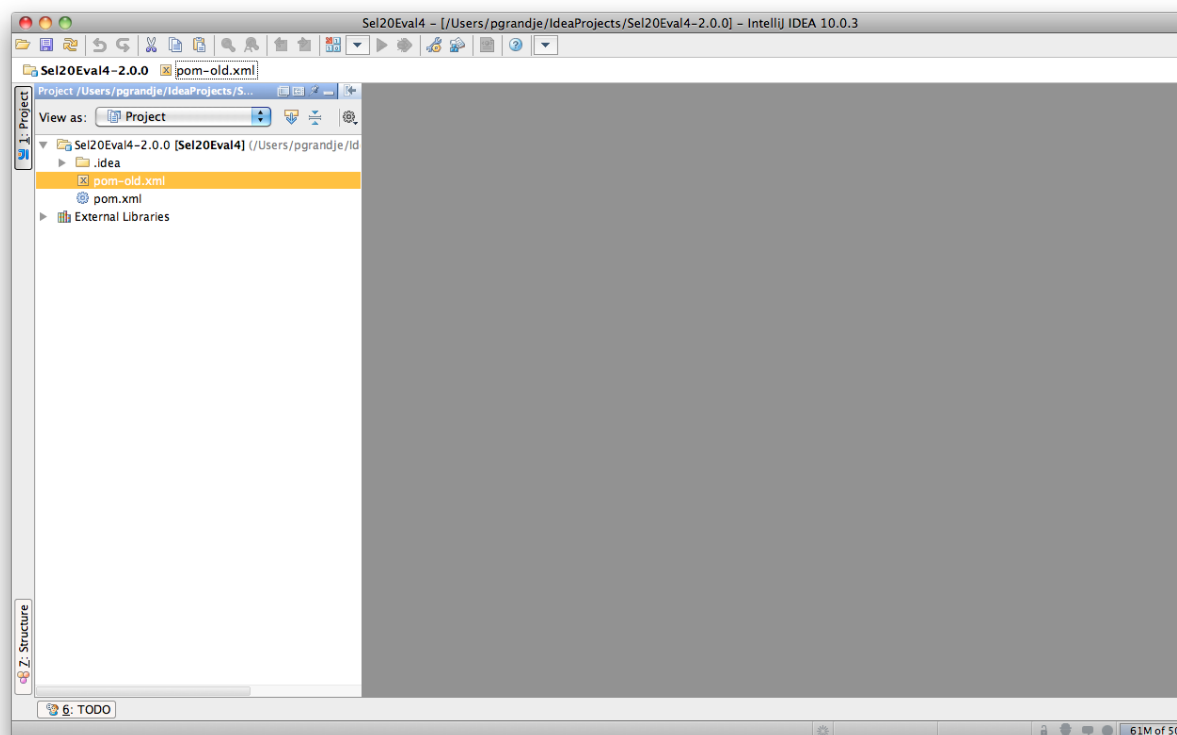
This next dialog shows the name of your maven project as specified in the pom.xml file. Select your maven project and continue.



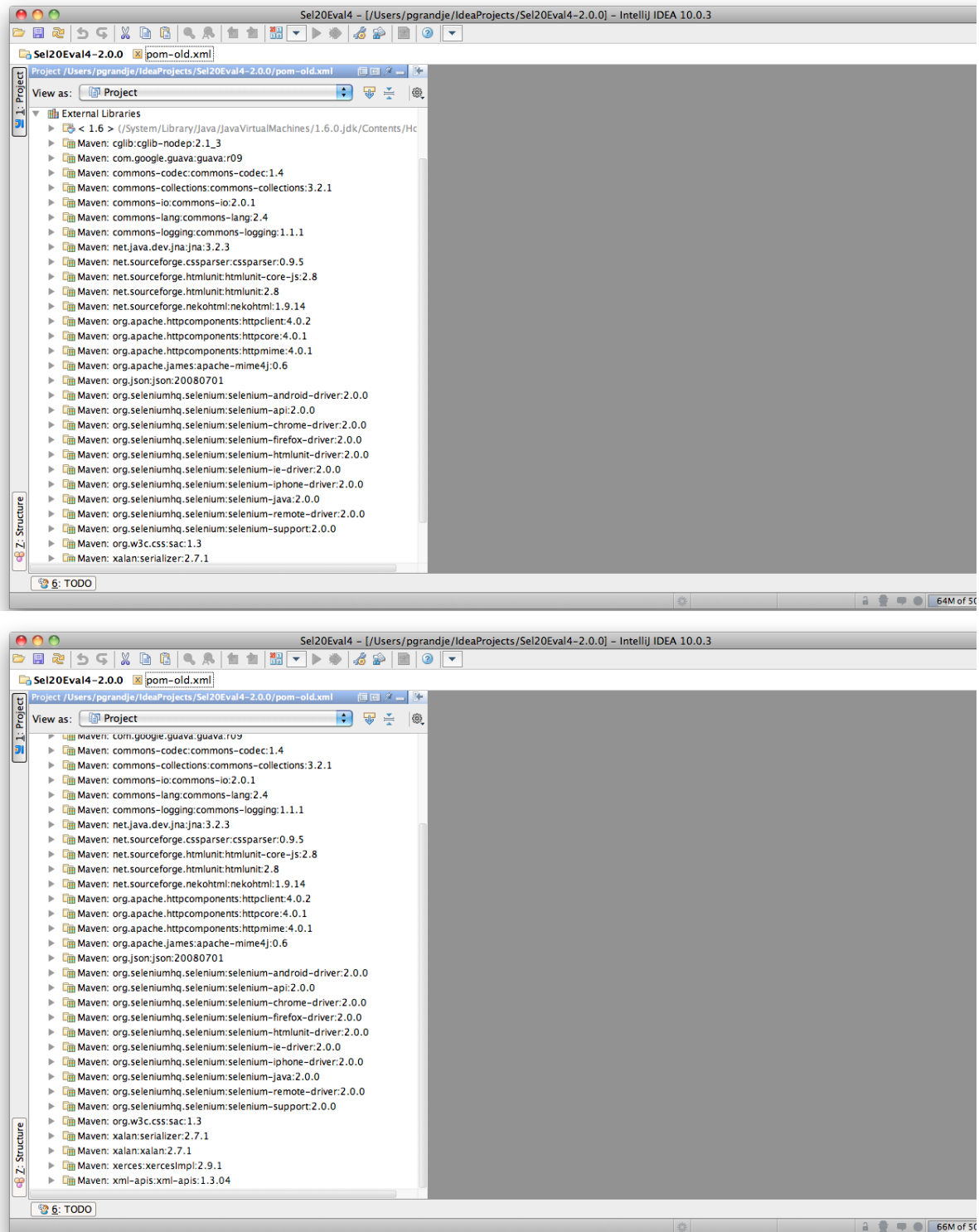
Enter a name for your project.



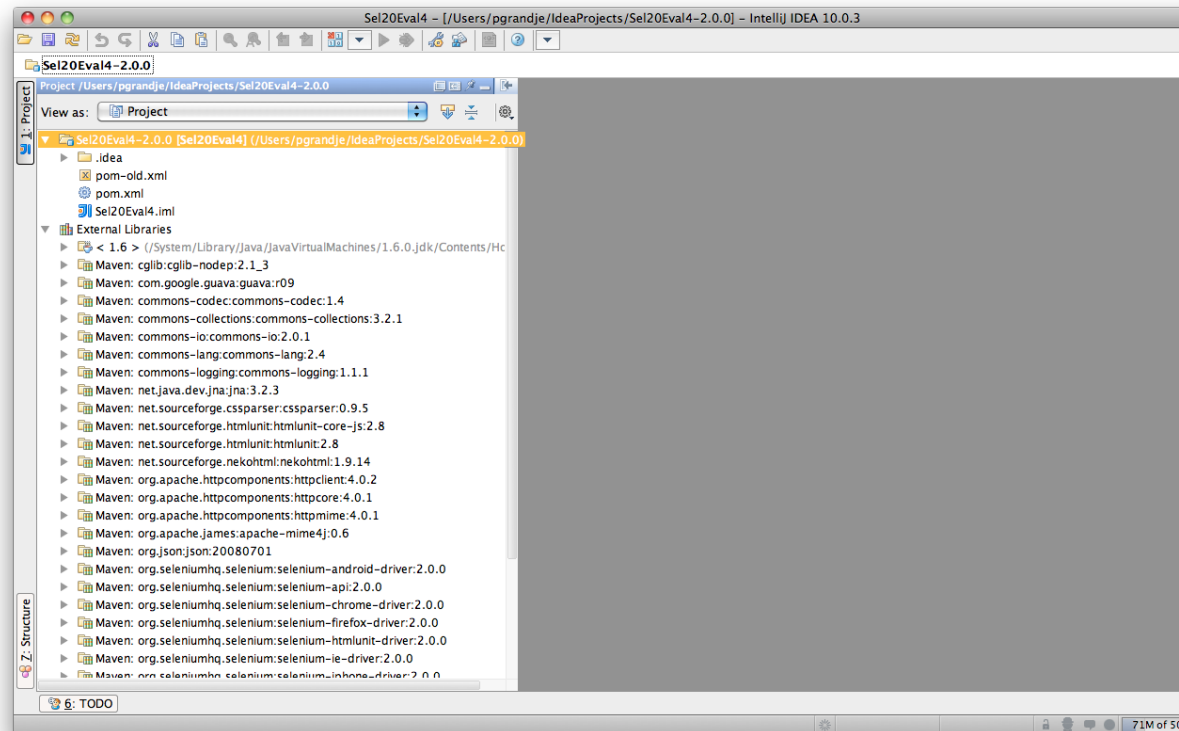
Once your project has been imported it should look like this in IntelliJ.



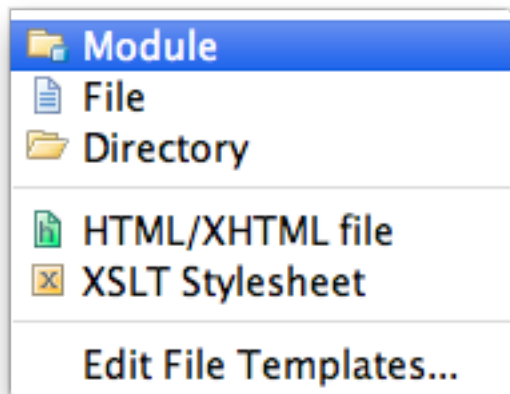
The maven project download many dependencies (libraries) when you originally ran 'mvn install'. Now in IntelliJ you can see all these libraries. These next two screen captures shows the libraries you should now have in your project.



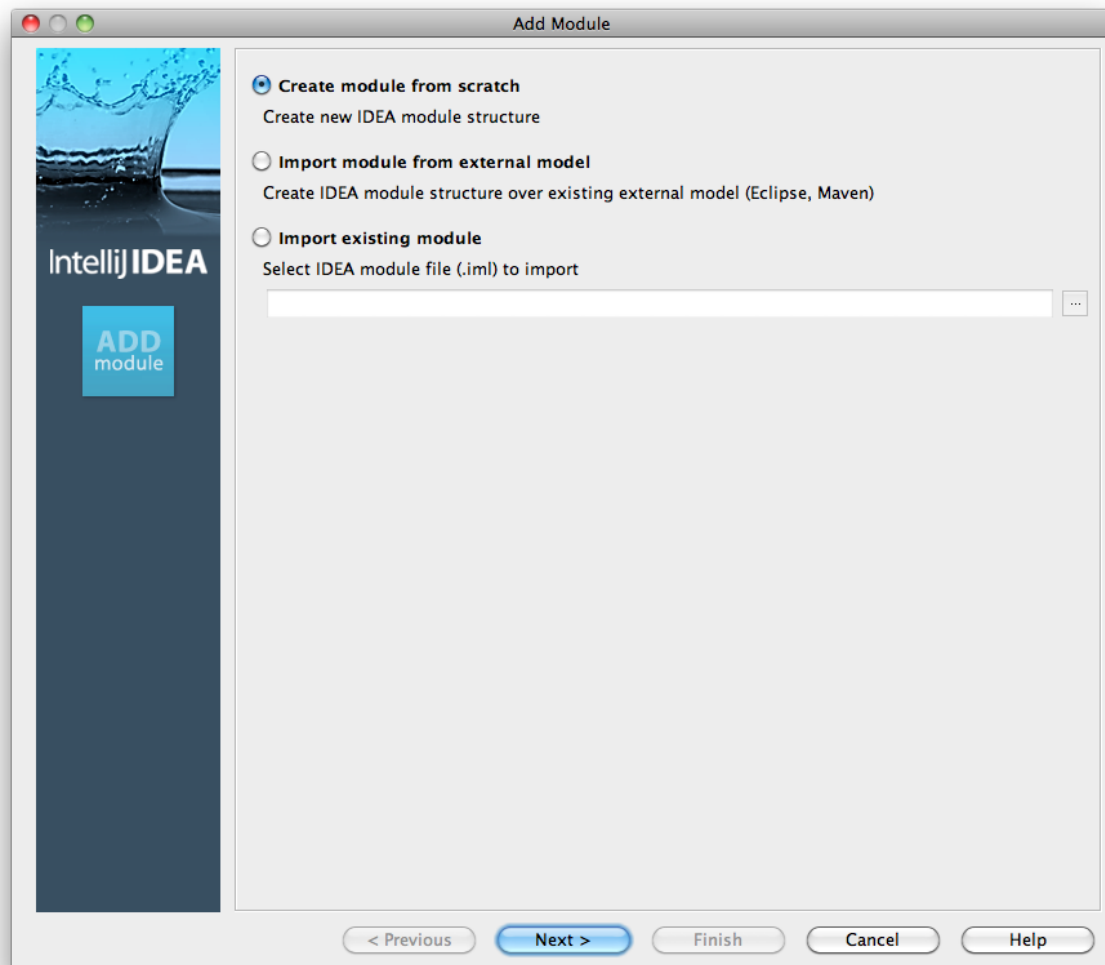
Before you can start writing Selenium code, you still need to create a module and at least one Java class (a .java file). First select the Project's root in IntelliJ and right click.



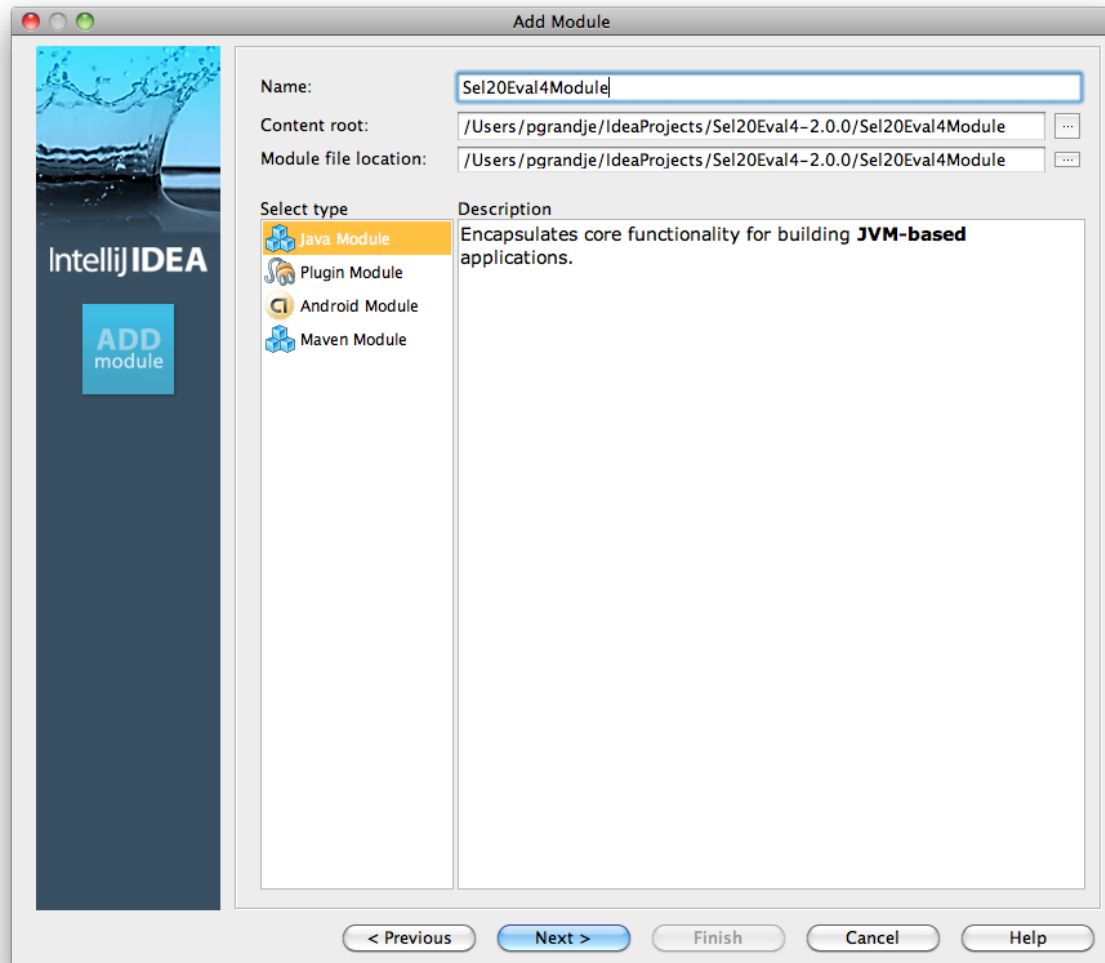
And select Create Module.



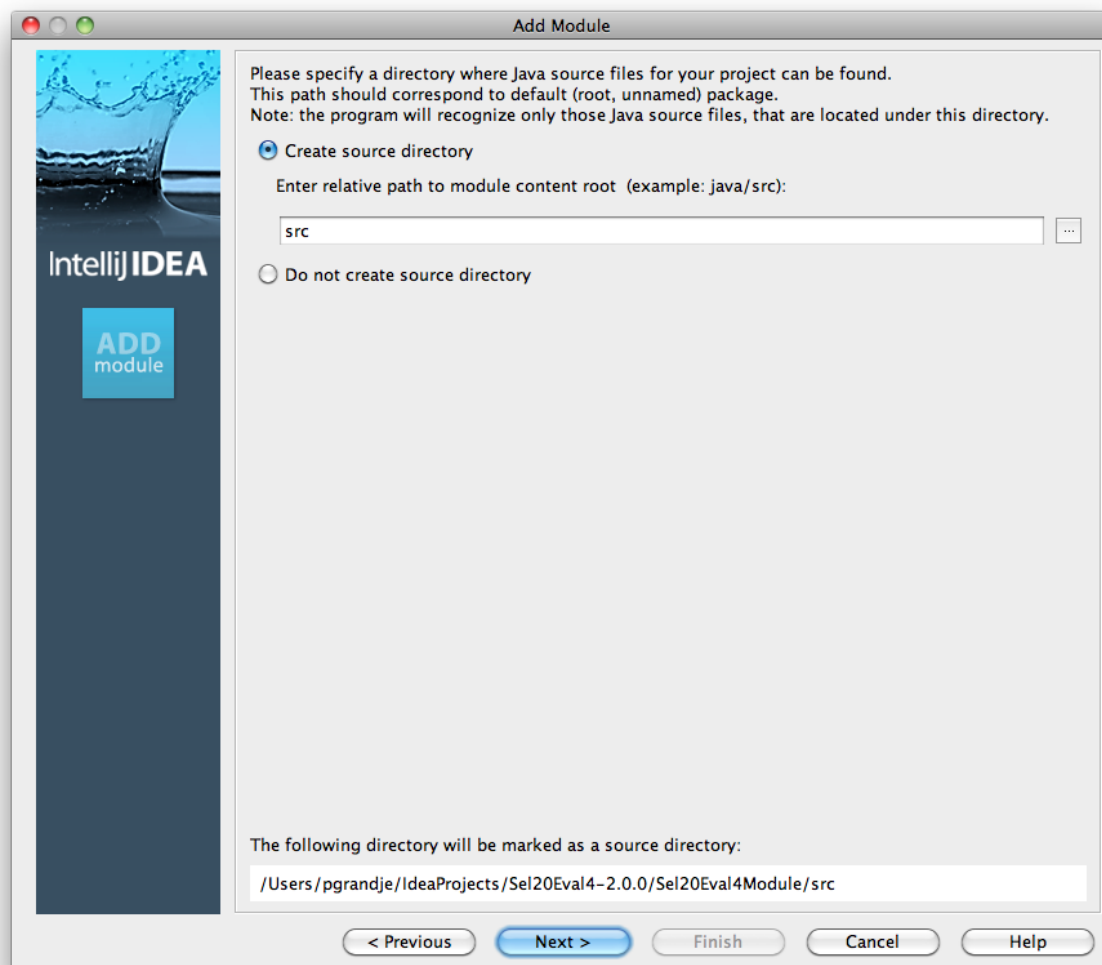
In the dialog select the radio button Create Module From Scratch.



Select Java Module and enter a name for the new module.

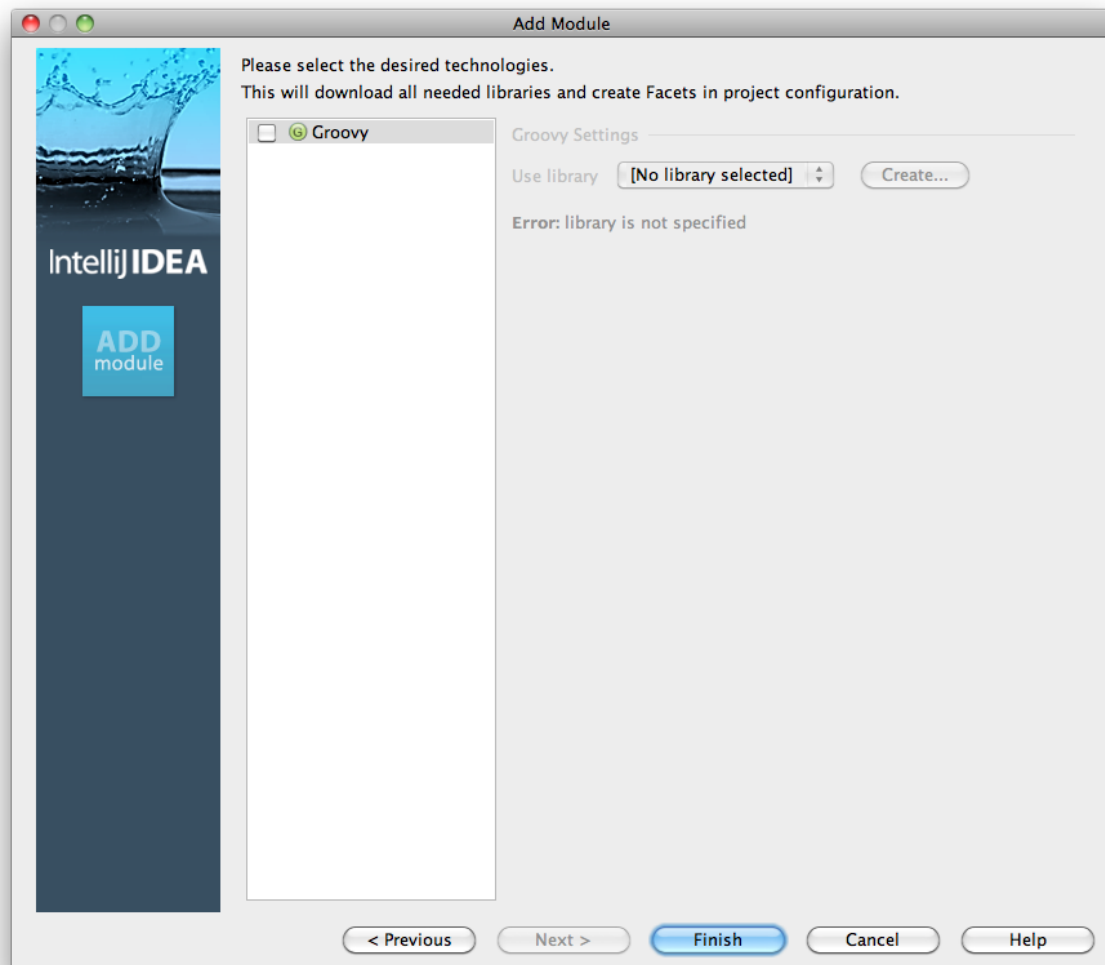


And next, you must create a folder for the source code. By convention this is almost always named 'src'.

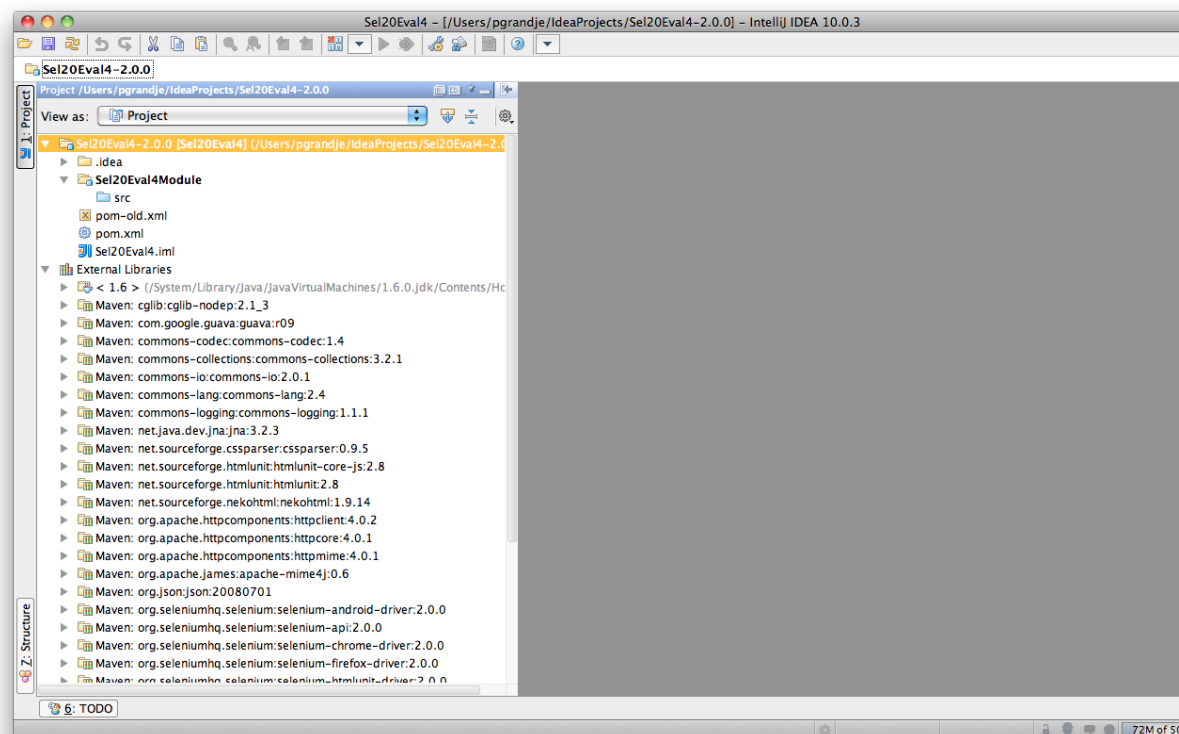


Now we're on the last dialog. Typically you don't need to select any 'technologies' here. Unless you know for a fact you will be using Groovy or some other technology.

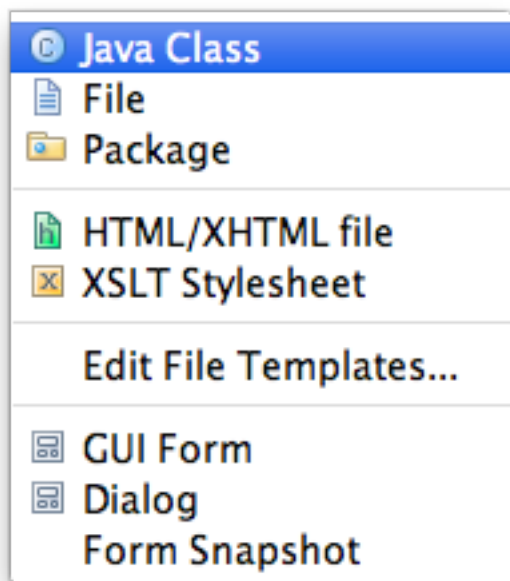




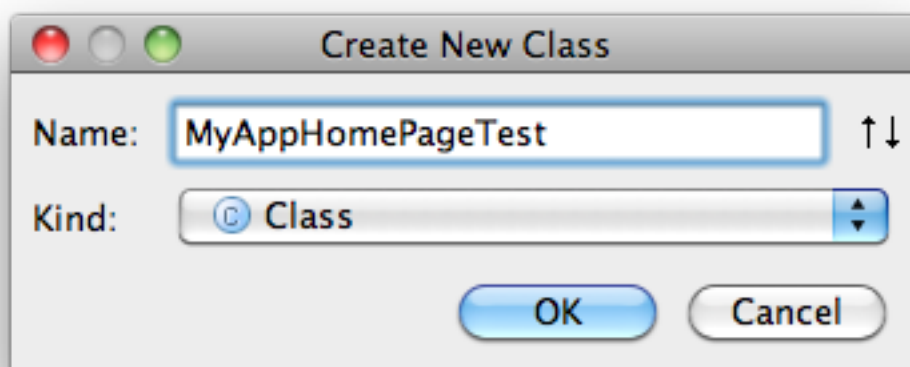
Now that the module is created, your project should show the following structure.



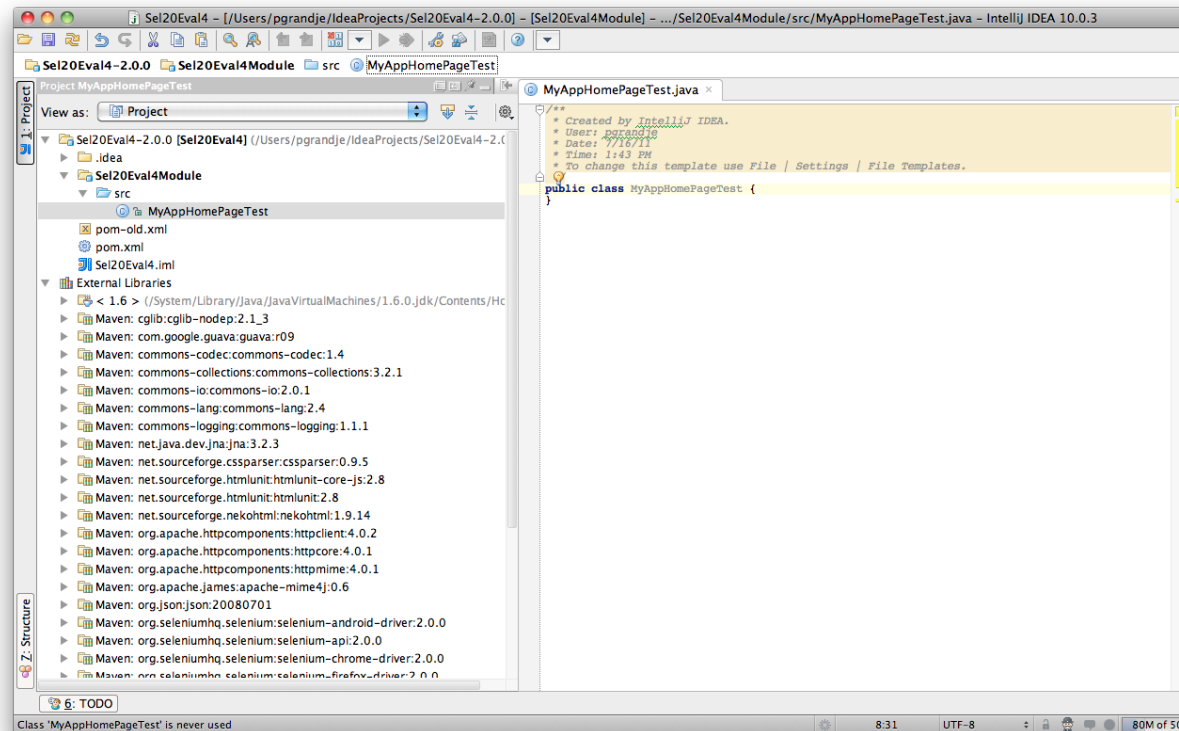
Finally, you need to create a .java file with a corresponding java class.



Enter the class name.



The .java file should now be created. It should look like this in your project.



If your project now looks like the one displayed above, you're done, congrats! And hope you enjoy coding your first Selenium automation!



# SELENIUM 1.0 JAVA CLIENT DRIVER CONFIGURATION

In General configuration of Selenium-RC with any java IDE would have following steps:

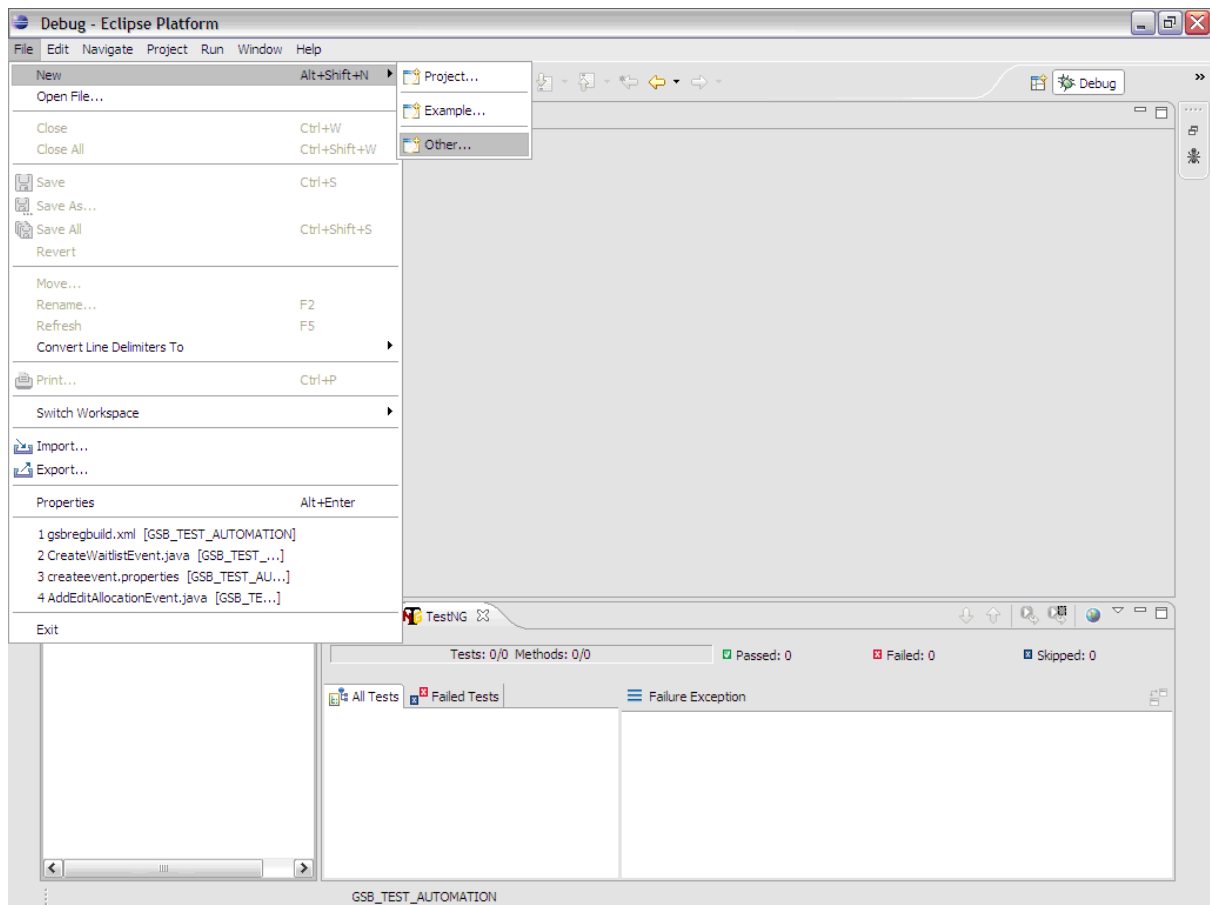
- Download Selenium-RC from the SeleniumHQ [downloads page](#)
- Start any java IDE
- Create new project
- Add “selenium-java-<version-number>.jar” to your project classpath
- Record your test from Selenium-IDE and translate it to java code (Selenium IDE has automatic translation feature to generate tests in variety of languages)
- Run selenium server from console
- Run your test in the IDE

These points have been delineated below with reference to Eclipse and IntelliJ:

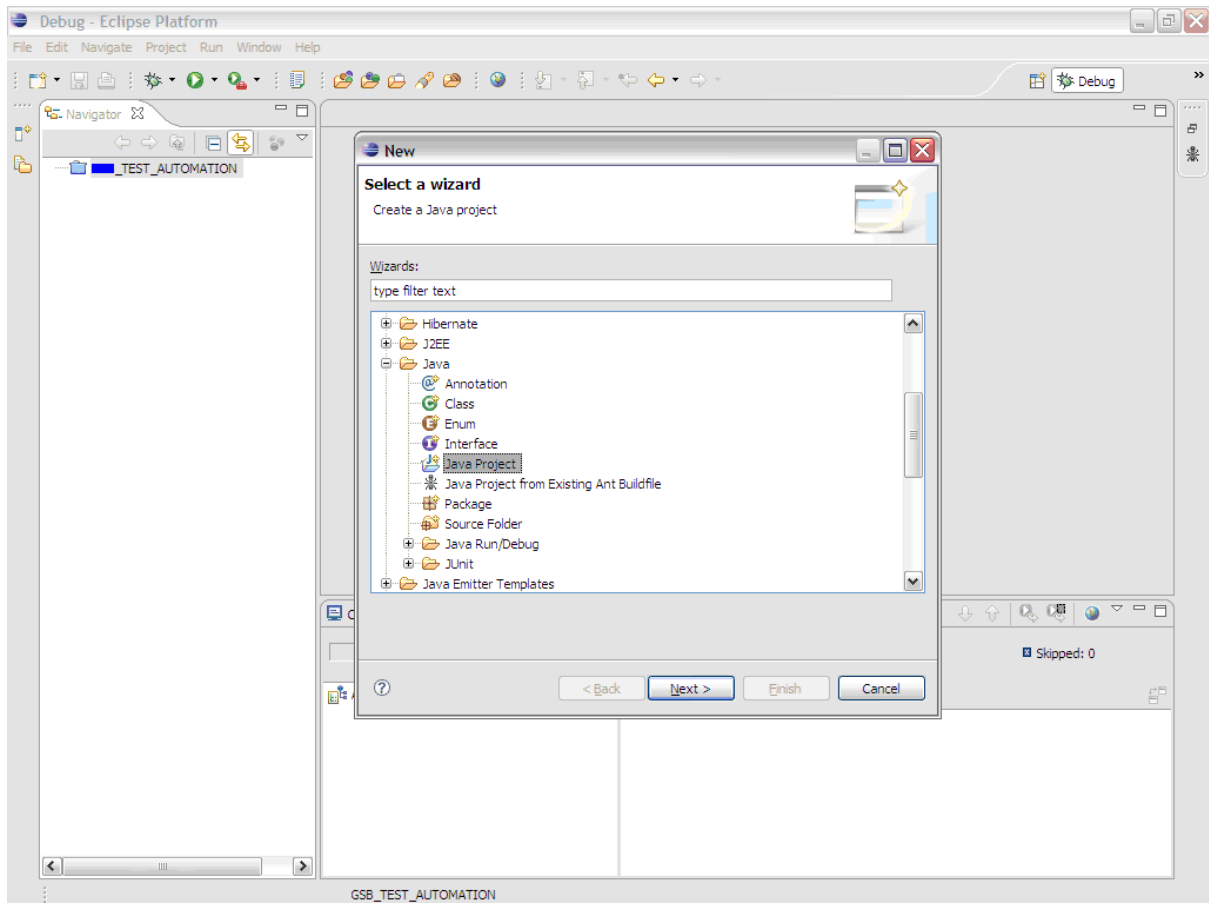
## 15.1 Configuring Selenium-RC With Eclipse

**Eclipse** is a multi-language software development platform comprising an IDE and a plug-in system to extend it. It is written primarily in Java and is used to develop applications in this language and, by means of the various plug-ins, in other languages as well as C/C++, Cobol, Python, Perl, PHP and more. Following lines describes configuration of Selenium-RC with Eclipse - Version: 3.3.0. (Europa Release). It should not be too different for higher versions of Eclipse

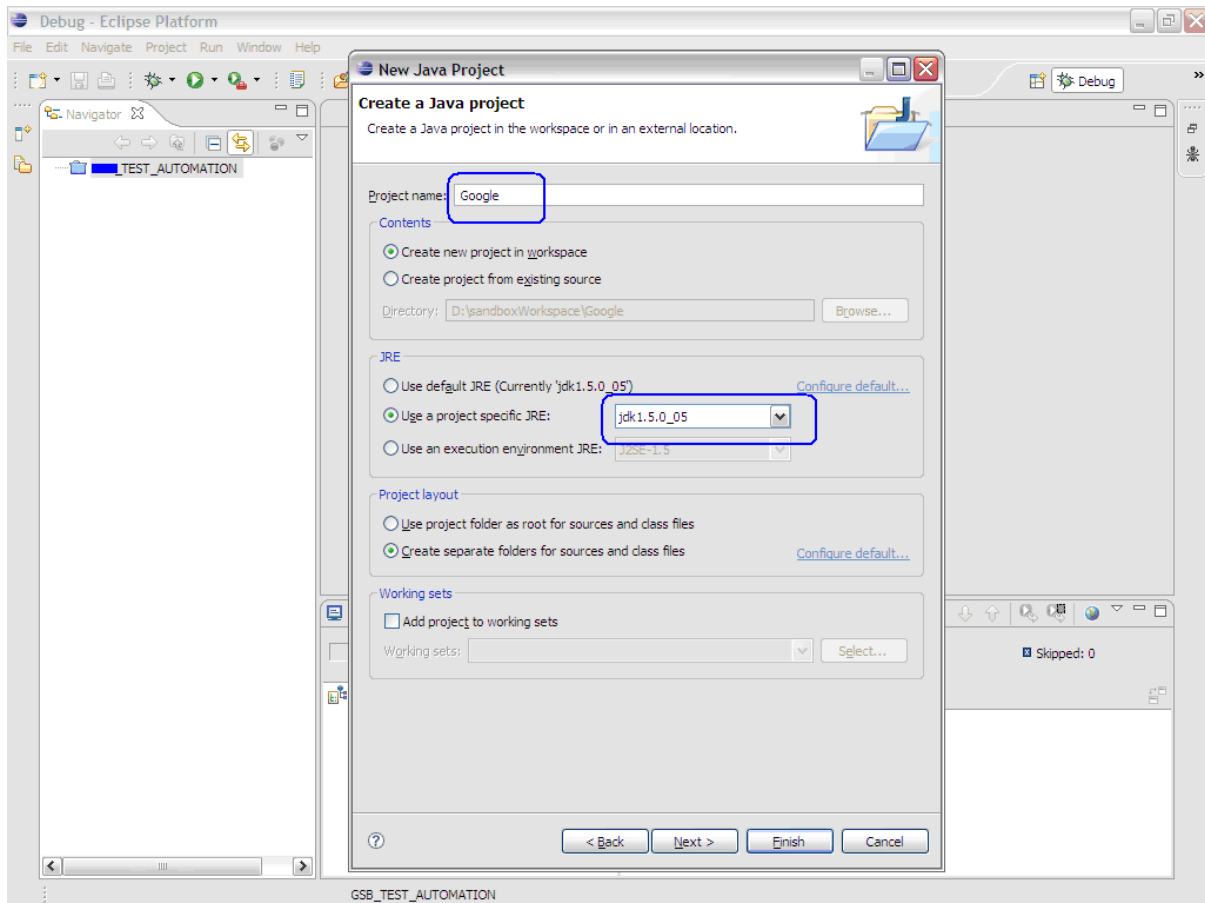
- Launch Eclipse.
- Select File > New > Other.



- Java > Java Project > Next

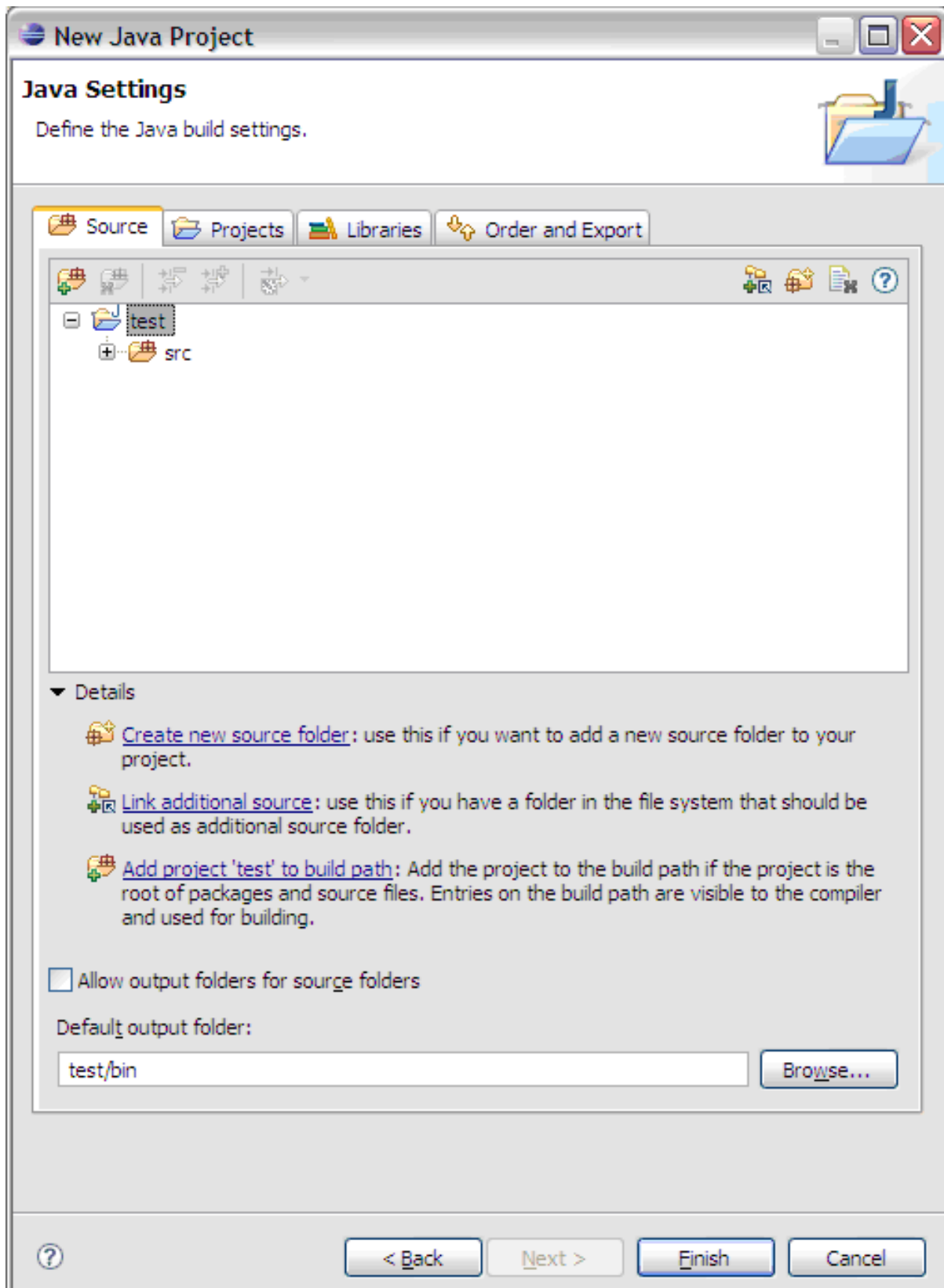


- Provide Name to your project, Select JDK in 'Use a project Specific JRE' option (JDK 1.5 selected in this example) > click Next

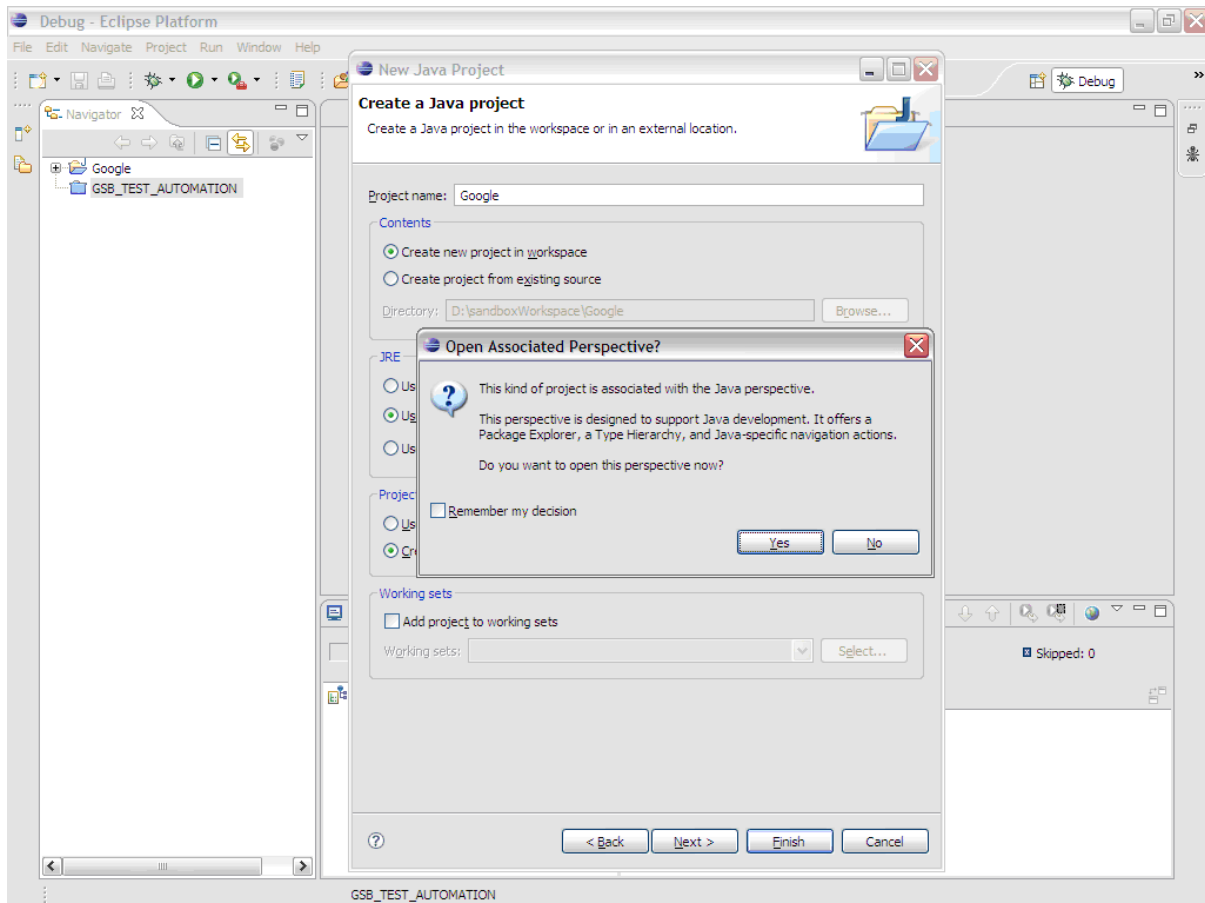


- Keep 'JAVA Settings' intact in next window. Project specific libraries can be added here. (This described in detail in later part of document.)

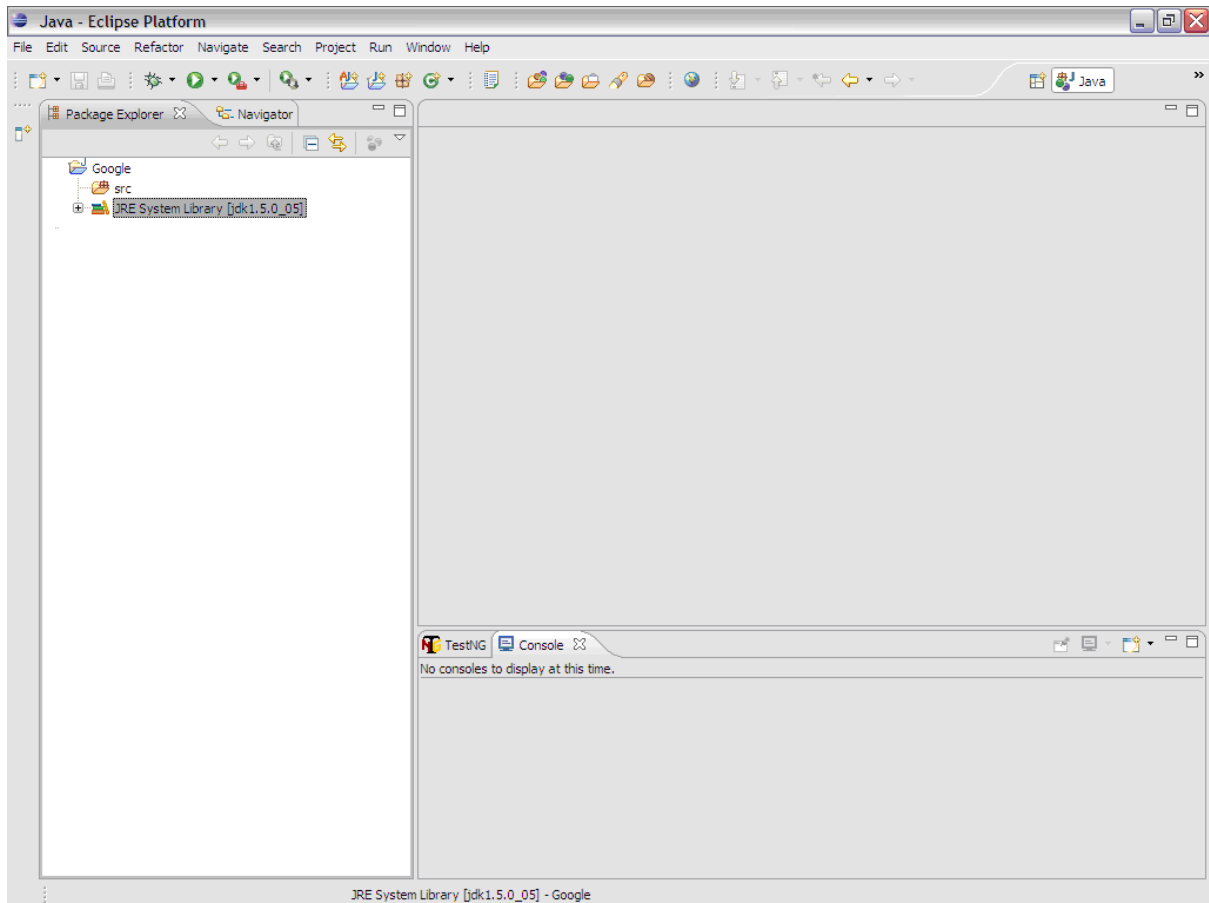




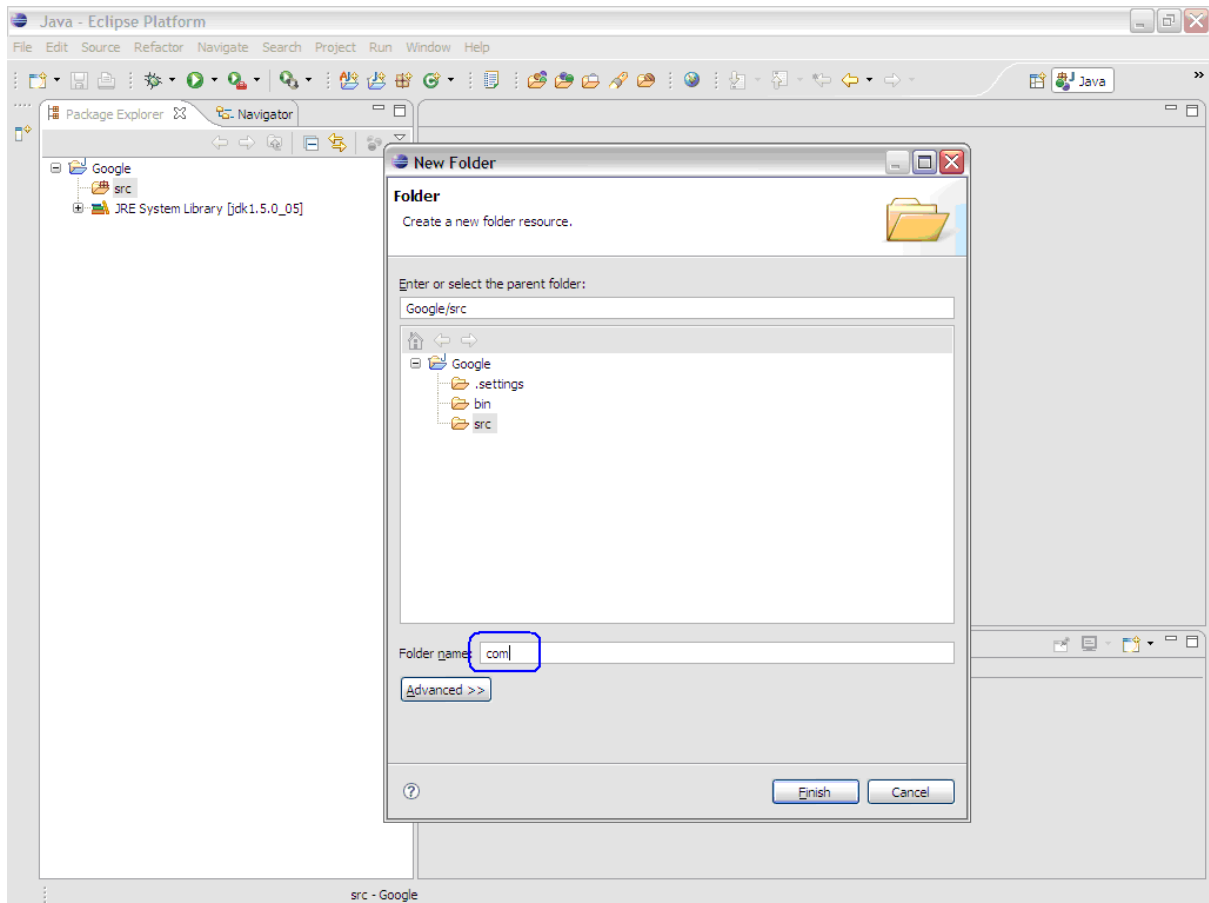
- Click Finish > Click on Yes in Open Associated Perspective pop up window.



This would create Project Google in Package Explorer/Navigator pane.

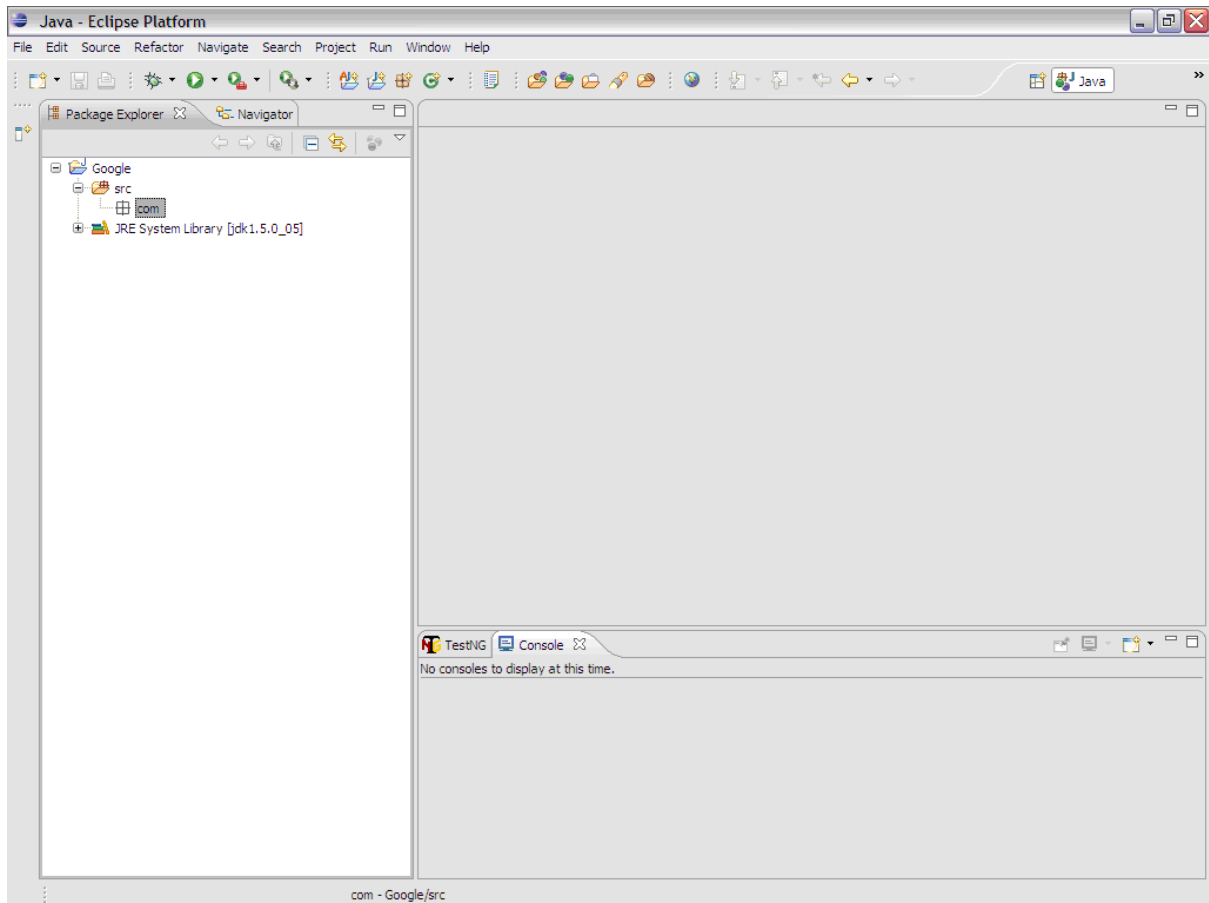


- Right click on src folder and click on New > Folder

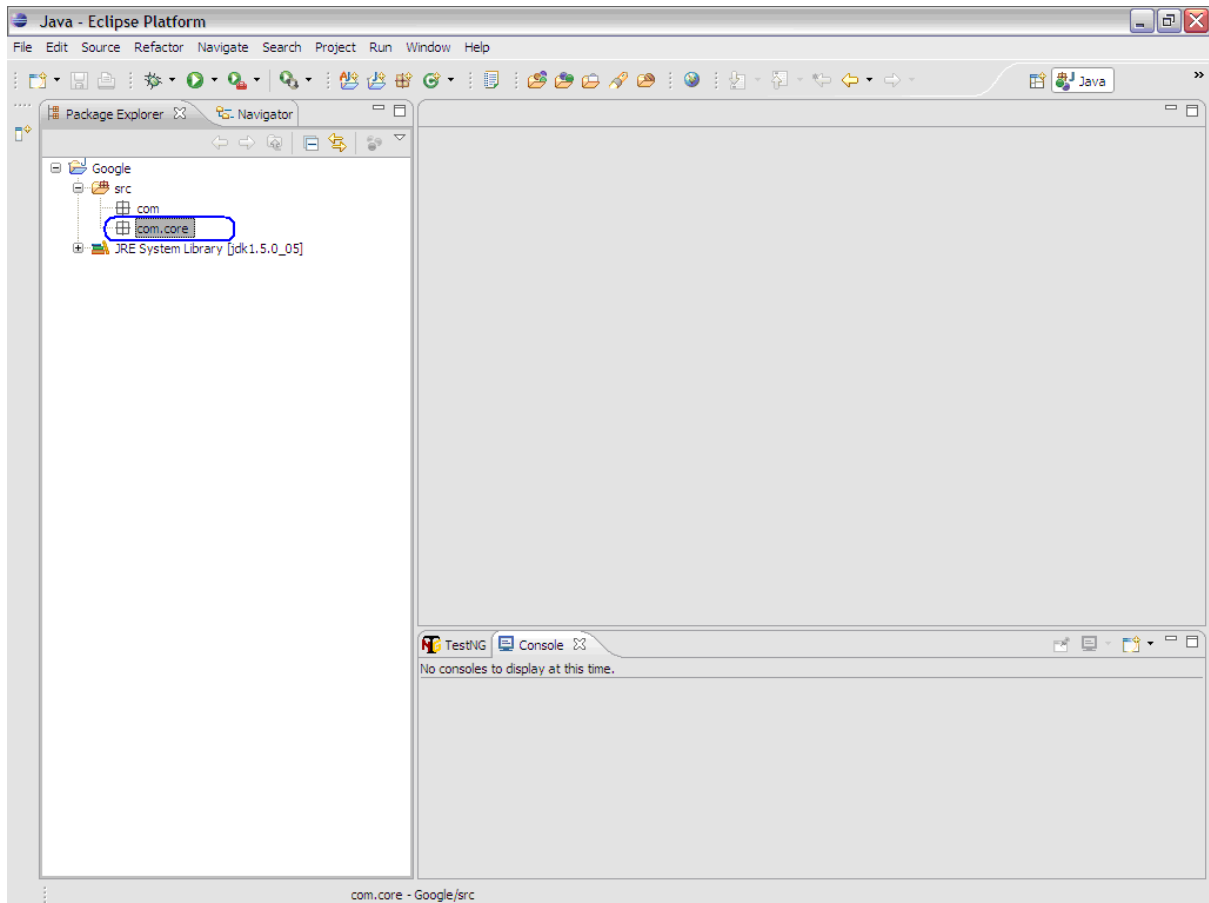


Name this folder as com and click on Finish button.

- This should get com package insider src folder.



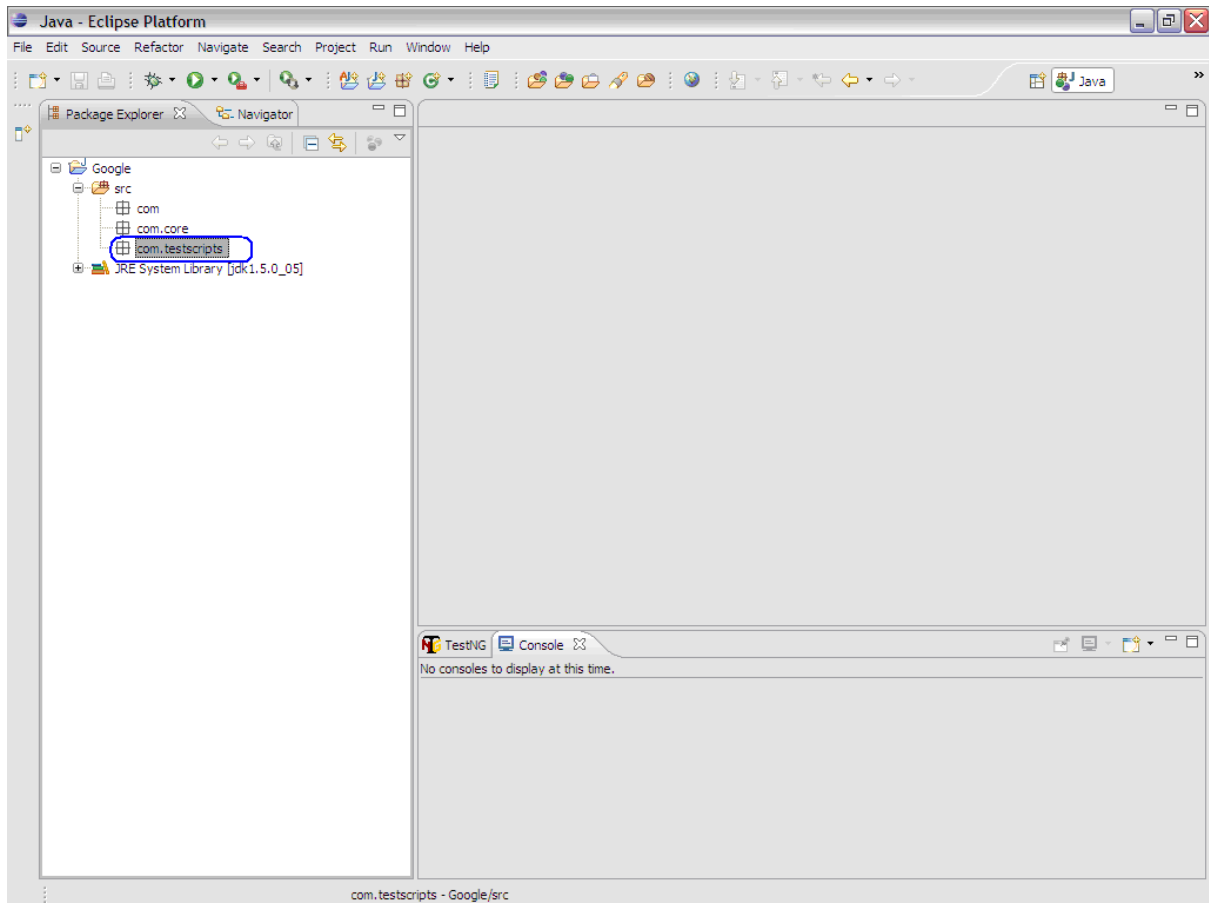
- Following the same steps create *core* folder inside *com*



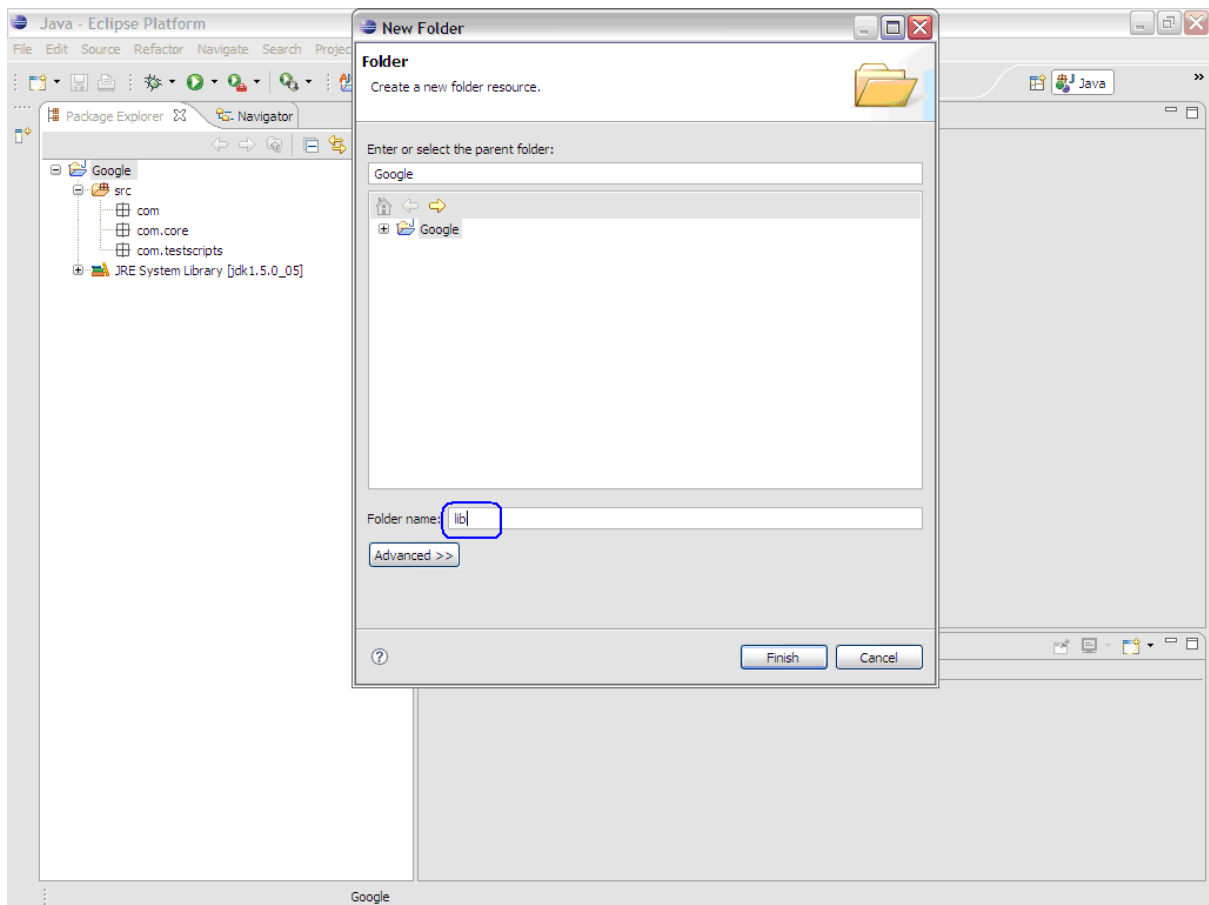
`SetTestCase` class can be kept inside `core` package.

Create one more package inside `src` folder named `testscripts`. This is a place holder for test scripts.

*Please notice this is about the organization of project and it entirely depends on individual's choice / organization's standards. Test scripts package can further be segregated depending upon the project requirements.*

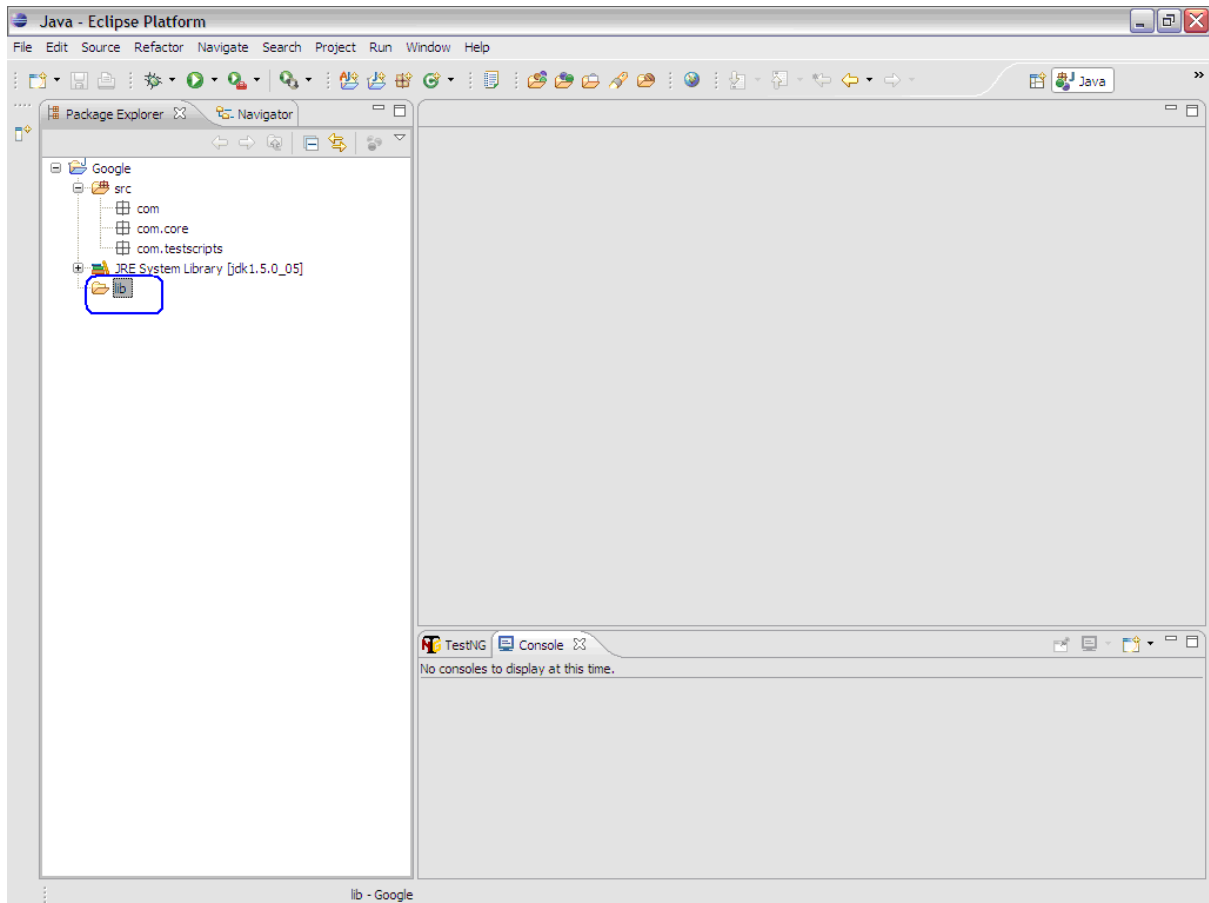


- Create a folder called lib inside project Google. Right click on Project name > New > Folder. This is a place holder for jar files to project (i.e. Selenium client driver, selenium server etc)

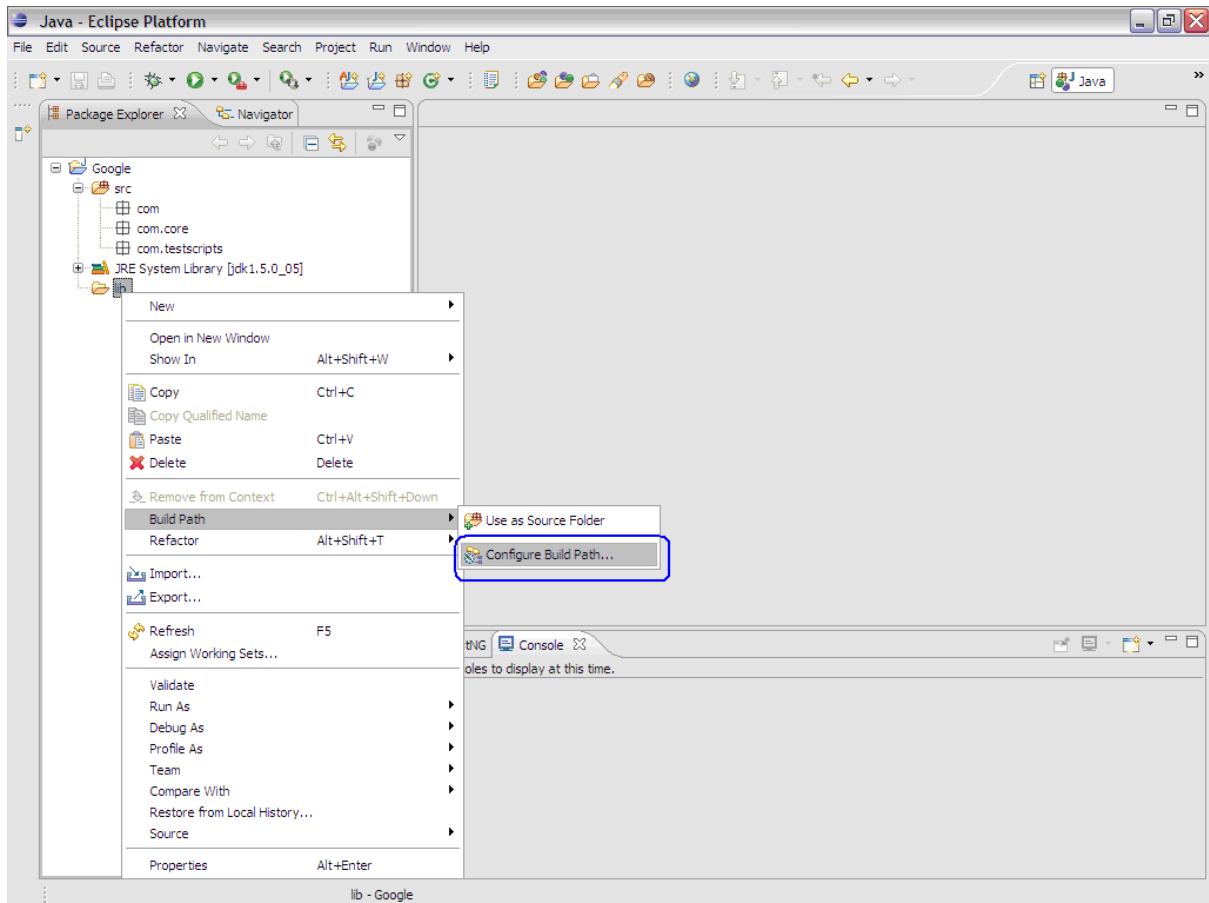


This would create lib folder in Project directory.

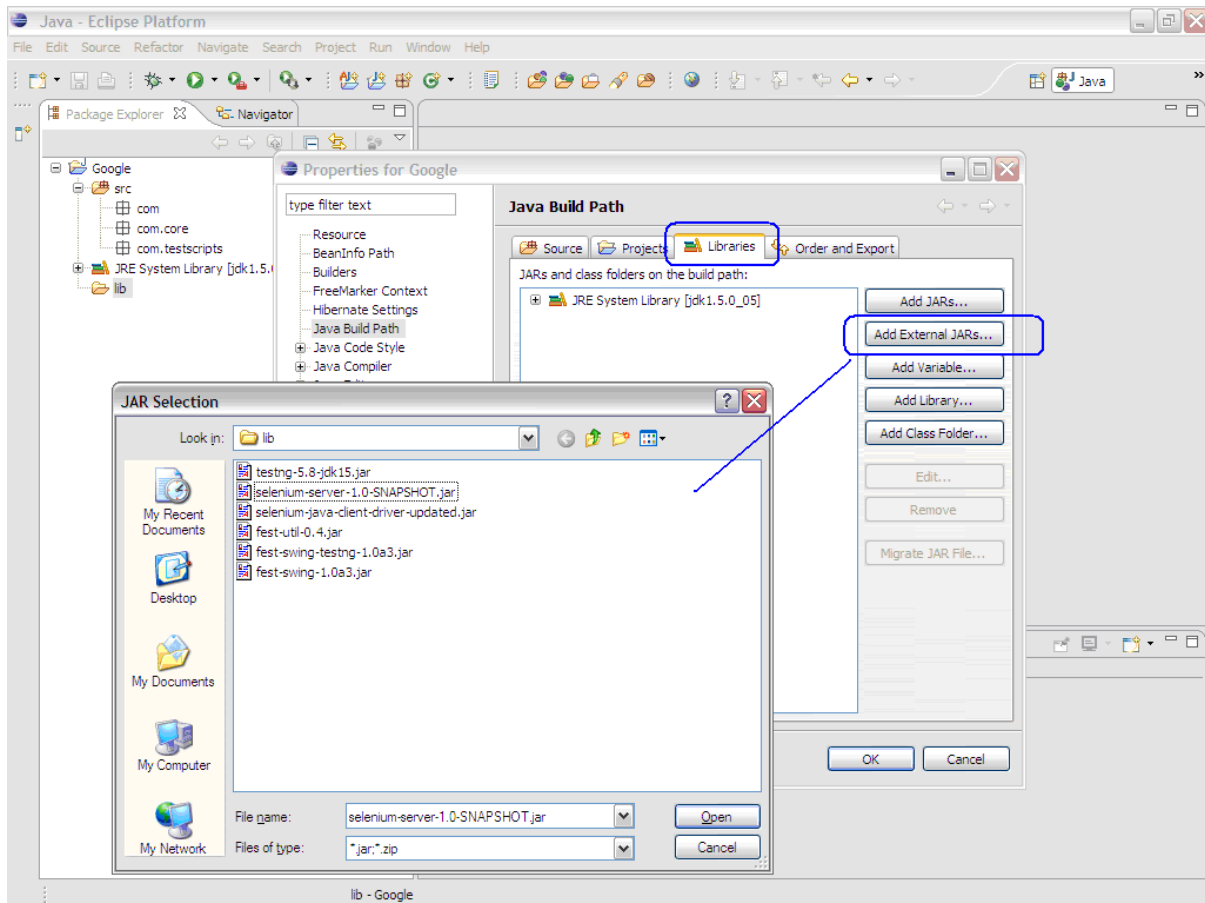




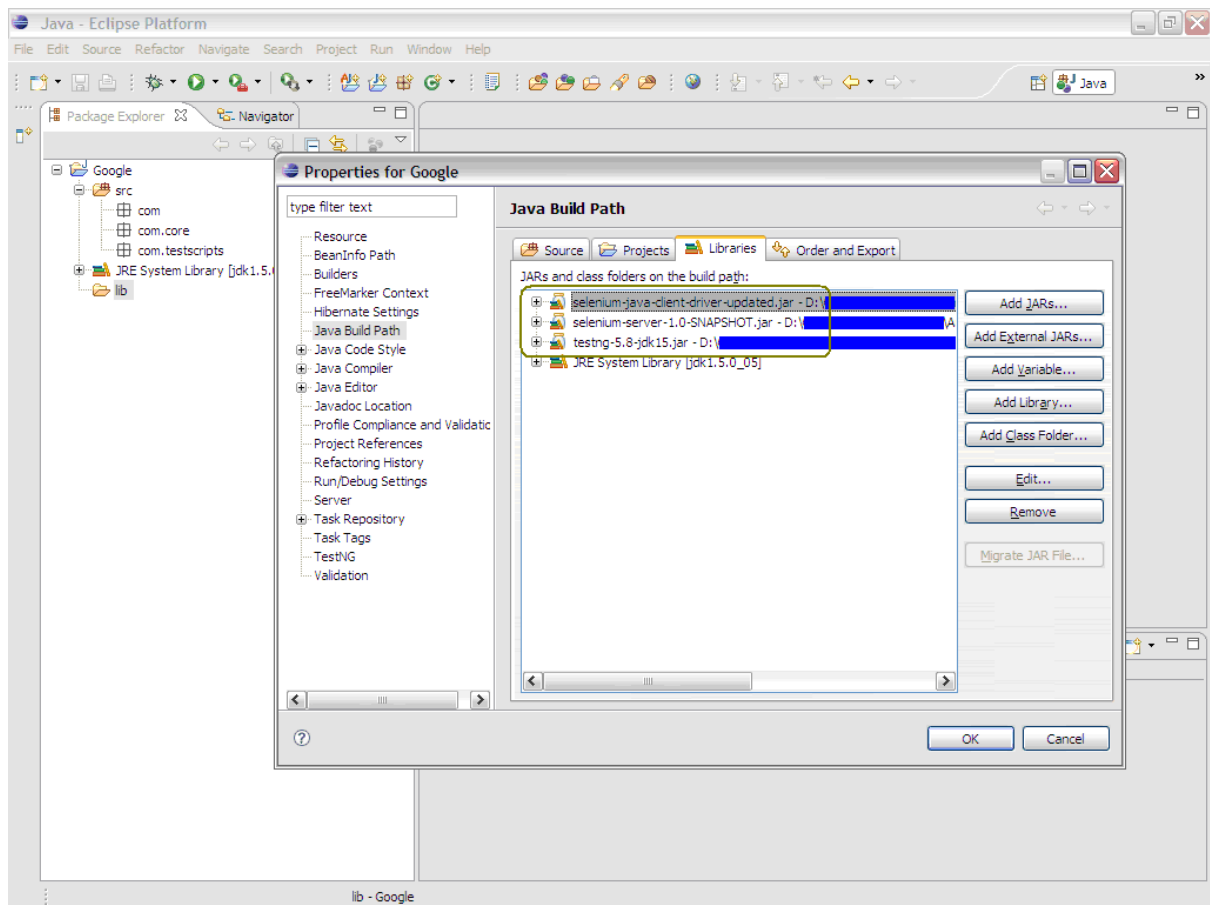
- Right click on *lib* folder > Build Path > Configure build Path



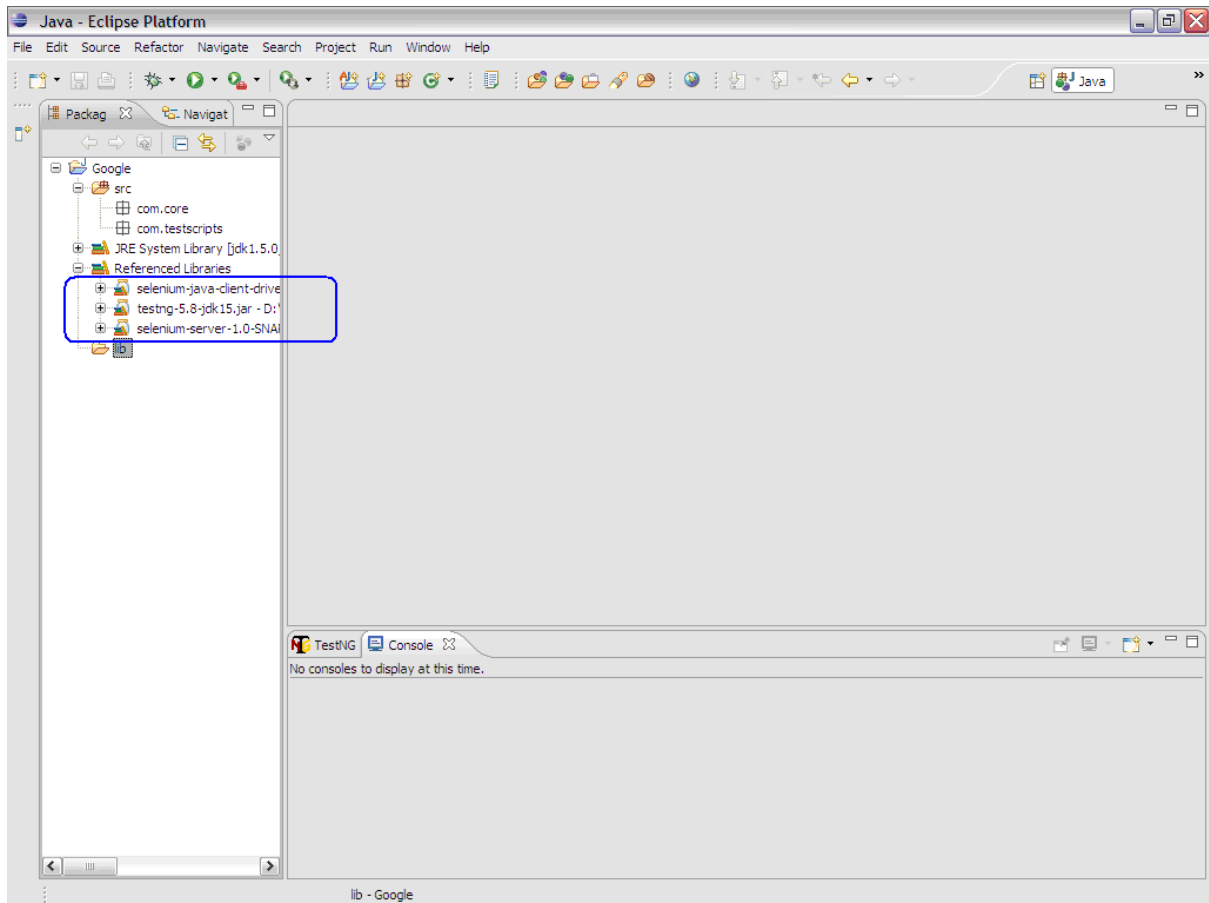
- Under Library tab click on Add External Jars to navigate to directory where jar files are saved. Select the jar files which are to be added and click on Open button.



After having added jar files click on OK button.



Added libraries would appear in Package Explorer as following:



## 15.2 Configuring Selenium-RC With IntelliJ

- Watch [this excellent tutorial](#) by Simon Stewart on starting a Selenium project with IntelliJ



# PYTHON CLIENT DRIVER CONFIGURATION

- Download Selenium-RC from the SeleniumHQ [downloads page](#)
- Extract the file *selenium.py*
- Either write your Selenium test in Python or export a script from Selenium-IDE to a python file.
- Add to your test's path the file *selenium.py*
- Run Selenium server from the console
- Execute your test from a console or your Python IDE

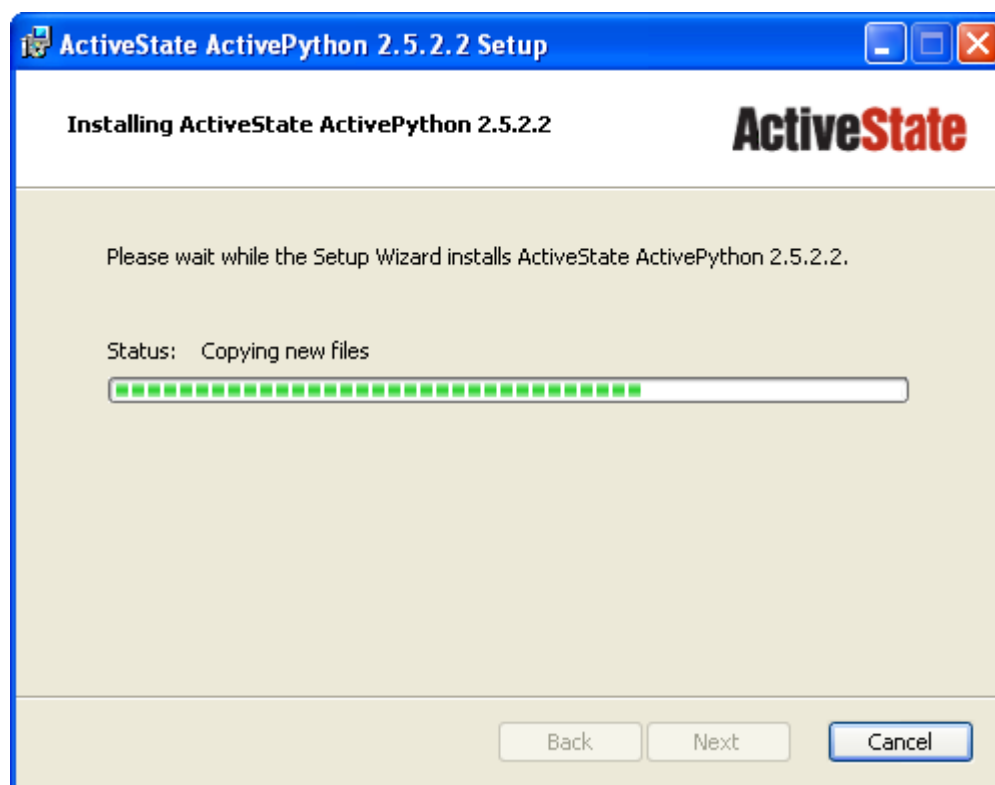
The following steps describe the basic installation procedure. After following this, the user can start using the desired IDE, (even write tests in a text processor and run them from command line!) without any extra work (at least on the Selenium side).

- Installing Python

**Note:** This will cover python installation on Windows and Mac only, as in most linux distributions python is already pre-installed by default.

- Windows

1. Download Active python's installer from ActiveState's official site:  
<http://activestate.com/Products/activepython/index.mhtml>
2. Run the installer downloaded (ActivePython-x.x.x.x-win32-x86.msi)



- Mac

The latest Mac OS X version (Leopard at this time) comes with Python pre-installed. To install an extra Python, get a universal binary at <http://www.pythonmac.org/> (packages for Python 2.5.x).

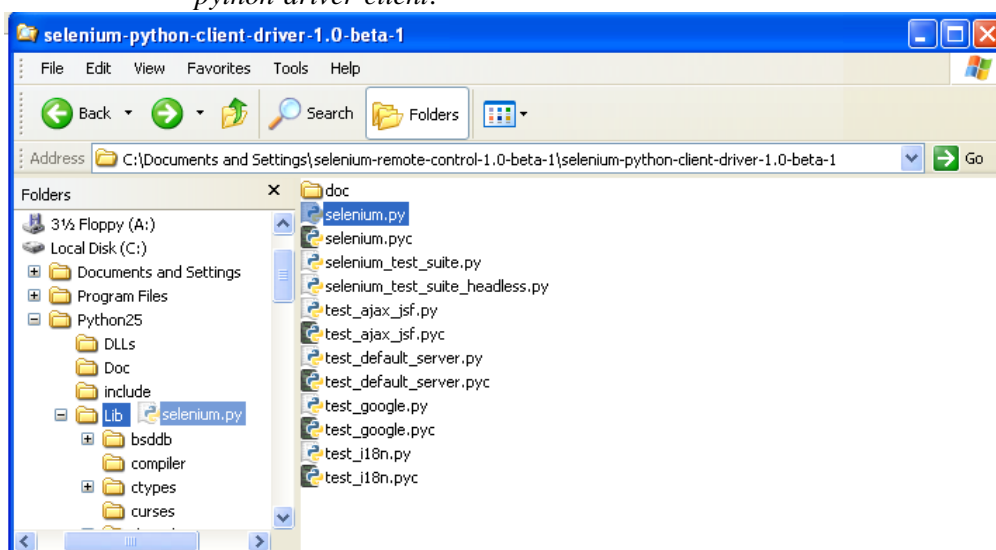


You will get a .dmg file that you can mount. It contains a .pkg file that you can launch.



- Installing the Selenium driver client for python

1. Download the last version of Selenium Remote Control from the [downloads page](#)
2. Extract the content of the downloaded zip file
3. Copy the module with the Selenium's driver for Python (selenium.py) in the folder `C:/Python25/Lib` (this will allow you to import it directly in any script you write). You will find the module in the extracted folder, it's located inside *selenium-python-driver-client*.



Congratulations, you're done! Now any python script that you create can import selenium and start interacting with the browsers.



# LOCATING TECHNIQUES

## 17.1 Useful XPATH patterns

### 17.1.1 text

Not yet written - locate elements based on the text content of the node.

### 17.1.2 starts-with

Many sites use dynamic values for element's id attributes, which can make them difficult to locate. One simple solution is to use XPath functions and base the location on what you do know about the element. For example, if your dynamic ids have the format `<input id="text-12345" />` where 12345 is a dynamic number you could use the following XPath: `//input[starts-with(@id, 'text-')]`

### 17.1.3 contains

If an element can be located by a value that could be surrounded by other text, the contains function can be used. To demonstrate, the element `<span class="top heading bold">` can be located based on the 'heading' class without having to couple it with the 'top' and 'bold' classes using the following XPath: `//span[contains(@class, 'heading')]`. Incidentally, this would be much neater (and probably faster) using the CSS locator strategy `css=span.heading`

### 17.1.4 siblings

Not yet written - locate elements based on their siblings. Useful for forms and tables.

## 17.2 Starting to use CSS instead of XPATH

### 17.2.1 Locating elements based on class

In order to locate an element based on associated class in XPath you must consider that the element could have multiple classes and defined in any order. However with CSS locators this is much simpler (and faster).

- XPath: `//div[contains(@class, 'article-heading')]`

- CSS: `css=div.article-heading`

# MIGRATING FROM SELENIUM RC TO SELENIUM WEBDRIVER

## 18.1 How to Migrate to Selenium WebDriver

A common question when adopting Selenium 2 is what's the correct thing to do when adding new tests to an existing set of tests? Users who are new to the framework can begin by using the new WebDriver APIs for writing their tests. But what of users who already have suites of existing tests? This guide is designed to demonstrate how to migrate your existing tests to the new APIs, allowing all new tests to be written using the new features offered by WebDriver.

The method presented here describes a piecemeal migration to the WebDriver APIs without needing to rework everything in one massive push. This means that you can allow more time for migrating your existing tests, which may make it easier for you to decide where to spend your effort.

This guide is written using Java, because this has the best support for making the migration. As we provide better tools for other languages, this guide shall be expanded to include those languages.

## 18.2 Why Migrate to WebDriver

Moving a suite of tests from one API to another API requires an enormous amount of effort. Why would you and your team consider making this move? Here are some reasons why you should consider migrating your Selenium Tests to use WebDriver.

- Smaller, compact API. WebDriver's API is more Object Oriented than the original Selenium RC API. This can make it easier to work with.
- Better emulation of user interactions. Where possible, WebDriver makes use of native events in order to interact with a web page. This more closely mimics the way that your users work with your site and apps. In addition, WebDriver offers the advanced user interactions APIs which allow you to model complex interactions with your site.
- Support by browser vendors. Opera, Mozilla and Google are all active participants in WebDriver's development, and each have engineers working to improve the framework. Often, this means that support for WebDriver is baked into the browser itself: your tests run as fast and as stably as possible.

## 18.3 Before Starting

In order to make the process of migrating as painless as possible, make sure that all your tests run properly with the latest Selenium release. This may sound obvious, but it's best to have it said!

## 18.4 Getting Started

The first step when starting the migration is to change how you obtain your instance of Selenium. When using Selenium RC, this is done like so:

```
Selenium selenium = new DefaultSelenium(
    "localhost", 4444, "*firefox", "http://www.yoursite.com");
selenium.start();
```

This should be replaced like so:

```
WebDriver driver = new FirefoxDriver();
Selenium selenium = new WebDriverBackedSelenium(driver, "http://www.yoursite.com");
```

Once you've done this, run your existing tests. This will give you a fair idea of how much work needs to be done. The Selenium emulation is good, but it's not completely perfect, so it's completely normal for there to be some bumps and hiccups.

## 18.5 Next Steps

Once your tests execute without errors, the next stage is to migrate the actual test code to use the WebDriver APIs. Depending on how well abstracted your code is, this might be a short process or a long one. In either case, the approach is the same and can be summed up simply: modify code to use the new API when you come to edit it.

If you need to extract the underlying WebDriver implementation from the Selenium instance, you can simply cast it to WrapsDriver:

```
WebDriver driver = ((WrapsDriver) selenium).getWrappedDriver();
```

This allows you to continue passing the Selenium instance around as normal, but to unwrap the WebDriver instance as required.

At some point, your codebase will mostly be using the newer APIs. At this point, you can flip the relationship, using WebDriver throughout and instantiating a Selenium instance on demand:

```
Selenium selenium = new WebDriverBackedSelenium(driver, baseUrl);
```

## 18.6 Common Problems

Fortunately, you're not the first person to go through this migration, so here are some common problems that others have seen, and how to solve them.

### 18.6.1 Clicking and Typing is More Complete

A common pattern in a Selenium RC test is to see something like:

```
selenium.type( "name" , "exciting tex" );
selenium.keyDown( "name" , "t" );
selenium.keyPress( "name" , "t" );
selenium.keyUp( "name" , "t" );
```

This relies on the fact that “type” simply replaces the content of the identified element without also firing all the events that would normally be fired if a user interacts with the page. The final direct invocations of “key\*” cause the JS handlers to fire as expected.

When using the WebDriverBackedSelenium, the result of filling in the form field would be “exciting texttt”: not what you’d expect! The reason for this is that WebDriver more accurately emulates user behavior, and so will have been firing events all along.

This same fact may sometimes cause a page load to fire earlier than it would do in a Selenium 1 test. You can tell that this has happened if a “StaleElementException” is thrown by WebDriver.

### 18.6.2 WaitForPageToLoad Returns Too Soon

Discovering when a page load is complete is a tricky business. Do we mean “when the load event fires”, “when all AJAX requests are complete”, “when there’s no network traffic”, “when document.readyState has changed” or something else entirely?

WebDriver attempts to simulate the original Selenium behavior, but this doesn’t always work perfectly for various reasons. The most common reason is that it’s hard to tell the difference between a page load not having started yet, and a page load having completed between method calls. This sometimes means that control is returned to your test before the page has finished (or even started!) loading.

The solution to this is to wait on something specific. Commonly, this might be for the element you want to interact with next, or for some Javascript variable to be set to a specific value. An example would be:

```
Wait<WebDriver> wait = new WebDriverWait(driver, 30);
WebElement element= wait.until(visibilityOfElementLocated(By.id( "some_id" )));
```

Where “visibilityOfElementLocated” is implemented as:

```
public ExpectedCondition<WebElement> visibilityOfElementLocated(final By locator) {
    return new ExpectedCondition<WebElement>() {
        public WebElement apply(WebDriver driver) {
            WebElement toReturn = driver.findElement(locator);
            if (toReturn.isDisplayed()) {
                return toReturn;
            }
            return null;
        }
    };
}
```

This may look complex, but it’s almost all boiler-plate code. The only interesting bit is that the “ExpectedCondition” will be evaluated repeatedly until the “apply” method returns something that is neither “null” nor Boolean.FALSE.

Of course, adding all these “wait” calls may clutter up your code. If that’s the case, and your needs are simple, consider using the implicit waits:

```
driver.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
```

By doing this, every time an element is located, if the element is not present, the location is retried until either it is present, or until 30 seconds have passed.

### 18.6.3 Finding By XPath or CSS Selectors Doesn’t Always Work, But It Does In Selenium 1

In Selenium 1, it was common for xpath to use a bundled library rather than the capabilities of the browser itself. WebDriver will always use the native browser methods unless there’s no alternative. That means that complex xpath expressions may break on some browsers.

CSS Selectors in Selenium 1 were implemented using the Sizzle library. This implements a superset of the CSS Selector spec, and it’s not always clear where you’ve crossed the line. If you’re using the WebDriverBackedSelenium and use a Sizzle locator instead of a CSS Selector for finding elements, a warning will be logged to the console. It’s worth taking the time to look for these, particularly if tests are failing because of not being able to find elements.

### 18.6.4 There is No Browserbot

Selenium RC was based on Selenium Core, and therefore when you executed Javascript, you could access bits of Selenium Core to make things easier. As WebDriver is not based on Selenium Core, this is no longer possible. How can you tell if you’re using Selenium Core? Simple! Just look to see if your “getEval” or similar calls are using “selenium” or “browserbot” in the evaluated Javascript.

You might be using the browserbot to obtain a handle to the current window or document of the test. Fortunately, WebDriver always evaluates JS in the context of the current window, so you can use “window” or “document” directly.

Alternatively, you might be using the browserbot to locate elements. In WebDriver, the idiom for doing this is to first locate the element, and then pass that as an argument to the Javascript. Thus:

```
String name = selenium.getEval(
    "selenium.browserbot.findElement('id=foo', browserbot.getCurrentWindow()).tagName")
```

becomes:

```
WebElement element = driver.findElement(By.id("foo"));
String name = (String) ((JavascriptExecutor) driver).executeScript(
    "return arguments[0].tagName", element);
```

Notice how the passed in “element” variable appears as the first item in the JS standard “arguments” array.

### 18.6.5 Executing Javascript Doesn’t Return Anything

WebDriver’s JavascriptExecutor will wrap all JS and evaluate it as an anonymous expression. This means that you need to use the “return” keyword:



```
String title = selenium.getEval( "browserbot.getCurrentWindow().document.title" );
```

becomes:

```
((JavascriptExecutor) driver).executeScript( "return document.title;" );
```