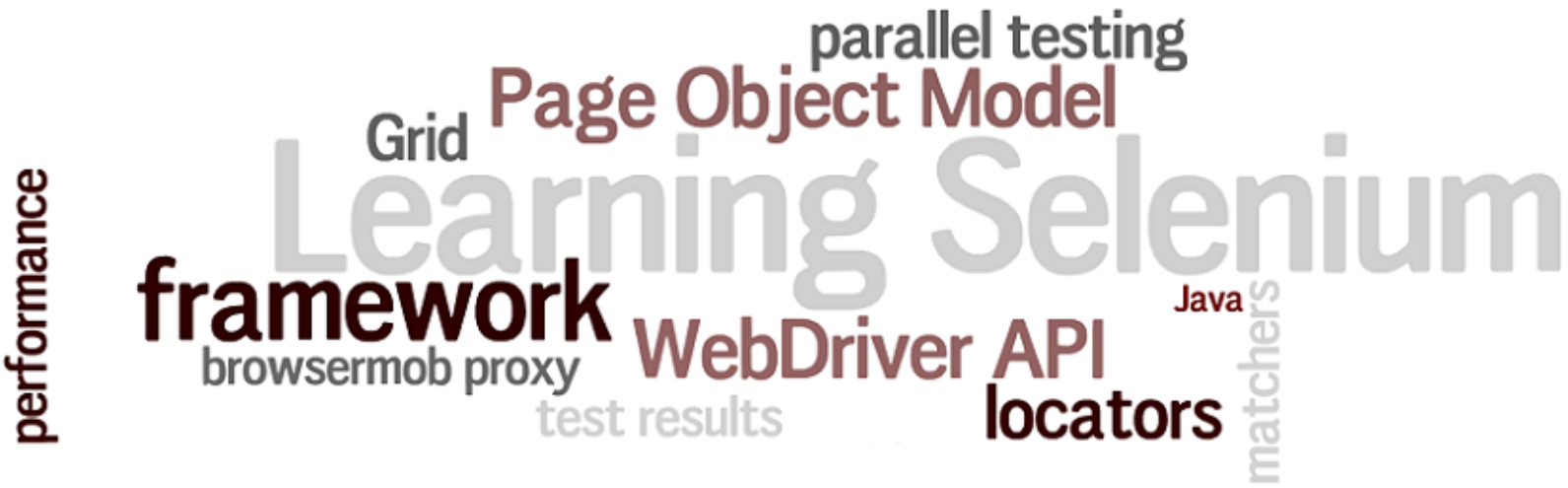

Learning Selenium

by Roy de Kleijn

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Learning Selenium

Hands-on tutorials to create a robust and maintainable test automation framework.

Roy de Kleijn

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Preface

Today's companies have started to realize the advantages of test automation. Test automation will reduce regression testing time, limit repetitive work and it gives testers the opportunity to do some real thinking about more complex test scenarios.

Selenium is a tool that interacts with browsers. We can divide Selenium in two parts.

- **Selenium IDE** comes as a FireFox add-on and can be used to get familiar with test automation and furthermore to create quick bug reproduction scripts. (IDE stands for Integrated Development Environment)
- **Selenium WebDriver** is a collection of language specific bindings to drive a browser and can be used to create robust/maintainable browser-based automation scripts.

As a Technical Test Consultant I visit many companies to support them with test automation. More frequently Test Engineers working in those companies are starting to automate repetitive tasks. Nevertheless, they find it hard to start and structure their Selenium test automation project.

Therefore, I wrote this book to give some guidance in test automation. This book does not provide the silver bullet for writing automated tests, but it gives some hands-on tutorials on writing automated tests.

In this book

Chapter 1, Selenium IDE: Selenium IDE is a great tool to get familiar with test automation. This chapter describes how you can start implementing recorded scripts.

Chapter 2, Selenium IDE extensions & plugins: Selenium IDE has some shortcomings. Some of them can be easily resolved by installing plugins or applying extensions, these are discussed in this chapter.

Chapter 3, Locators: Selenium is using a locator mechanism to identify elements of a web application. This chapter demonstrates some useful locator strategies.

Chapter 4, Implementing a Testing Framework: In order to execute testscripts we have to implement a testing framework. This chapter describes the basic usage of a testing framework.

Chapter 5, Interact with the Browser: Selenium can simulate all kinds of user actions. This chapter demonstrates the most frequently used Selenium WebDriver API calls to interact with the browser.

Chapter 6, Advanced browser interaction: This chapter will describe more advanced browser interactions, such as drag and drop and synchronization solutions.

Chapter 7, Improved assertions: In chapter 4 we implemented a testing framework. This framework will provide some ways of making assertions, although they may not be sufficient. This chapter will introduce a more flexible way of making assertions.

Chapter 8, Advanced Testing Framework Usage: In chapter 4 we implemented a basic testing framework. This framework can be enriched with data providers, grouping tests and listeners, these topics will be covered in this chapter.

Chapter 9, Make your Test Maintainable: Maintainability challenges will increase with the number of tests implemented. This chapter will introduce some design patterns to make your tests more maintainable and easier to read.

Chapter 10, Test Results: This section will be filled in shortly.

Chapter 11, Selenium Grid: Functional testing is slow! So ideally we would like to execute multiple tests all at once. This chapter introduces Selenium Grid which allows you to run multiple tests all at once and execute those tests against different browsers.

Chapter 12, Measuring Client-Side Performance: Web applications are becoming more complex these days, mostly because of A-synchronous communication. This chapter describes some ways of measuring client-side performance.

Chapter 13, Testing over a proxy: This section will be filled in shortly.

Book structure

We will use a demo website to explain the examples. The website can be found on http://selenium.polteq.com/testshop/, it represents an E-commerce website.

Each chapter includes tutorials about the chapters topic. Most tutorials have an **In Practice** section demonstrating a working example.

Every chapter ends with a **Further references** section pointing you to other references.

Source code

All the source code will be available on GitHub in the following repository:
https://github.com/roydekleijn/testshop

About the author

Roy de Kleijn is a Technical Test Consultant at Polteq where he works with clients on test process and automation, mainly in agile teams, and develops and presents training in Selenium/WebDriver. He is especially interested in web technology, new programming languages and knowledge transfer methods. He publishes Selenium-related tutorials at http://selenium.polteq.com and test-related articles at http://rdekleijn.nl.

Do not hesitate to contact Roy in case you have questions, suggestions or improvements related to this book.

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About Polteq

Polteq, quality in testing services. This describes the services and courses of Polteq best. Polteq is an independent provider of (inter)national testing services and market leader in the Netherlands. Our professionals can fulfil the role of test engineer or test manager within your organization. Furthermore Polteq is specialized in supporting organizations to improve their testing processes, test automation, managing test outsourcing and providing training sessions (including certification).

By flexible and self-reliant anticipation of the developments within the IT industry and by offering our professionals room for personal development, Polteq is capable of continuously innovating the testing profession, of operating on national and international markets as a trend setter, and, consequently, of consolidating its role as a top-class expert, pioneer and market leader.

All employees chose Polteq to fully focus themselves on the testing craft in a small (100+ professionals), flexible and informal company with an open working culture, where everyone is appreciated and respected. All colleagues know each other and this forms a unique bond of professionals.

To ensure the high quality of service, Polteq finds that continuous education for all its employees and the sharing of knowledge and experience are a must. Not only the development of testing methods and techniques are of importance but also the development of personal and communication skills.

1 Selenium IDE

Selenium IDE (Integrated Development Environment) is a tool that we can use to develop automated test scripts. It has record-and-playback functionality, but we can also write the test scripts ourselves by manually entering the commands. It comes with a browser context menu with the most frequently used Selenium commands. It saves test execution time and is a good way to get familiar with test automation.

This chapter will explain the main functionality of Selenium IDE.

1.1 Using Selenium IDE for the first time

Selenium IDE comes as a Firefox plug-in and has an easy-to-use user interface. Although the interface is very intuitive the most frequently used parts are explained in this section.

Prerequisites

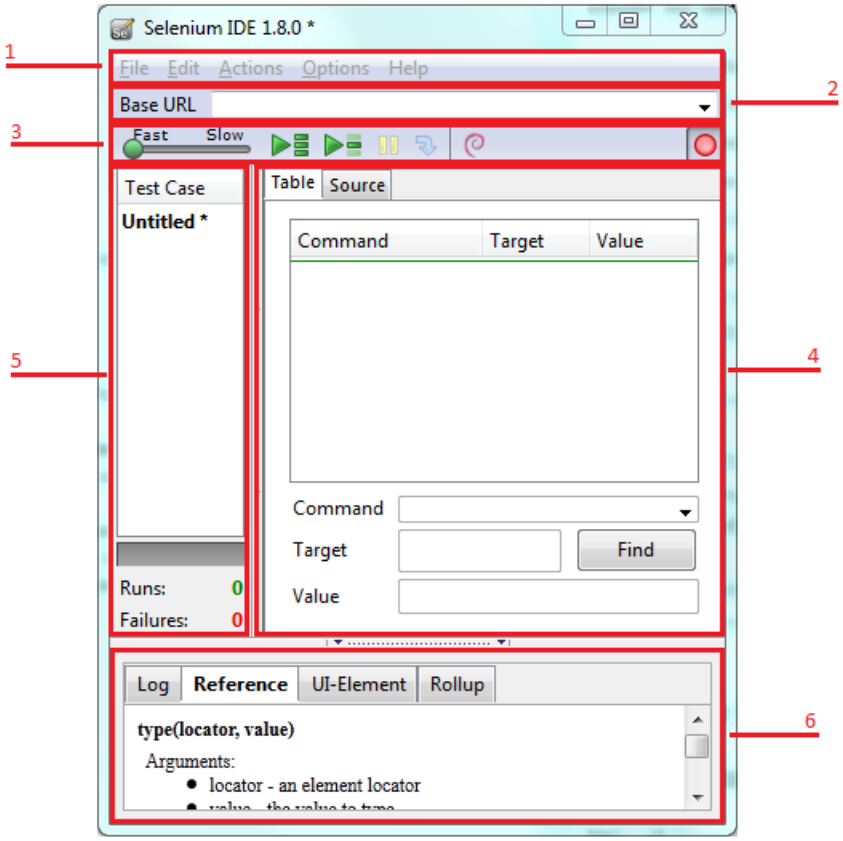
As we are going to use Selenium IDE for the first time, the first thing we have to do is to make sure that Firefox and Selenium IDE are installed properly.

1. Go to http://getfirefox.com and install Firefox.
2. Go to http://seleniumhq.org/download/ in the Firefox browser and install Selenium IDE.
3. Restart Firefox if requested.

In practice

We can now open Selenium IDE by using the following actions:

1. Open Firefox
2. Open Selenium IDE, via the `Tools` menu.



Selenium IDE

We just opened Selenium IDE and we can start recording test scripts by default.

There is more...

Selenium IDE is divided into sections which are numbered in the previous screenshot. Each section is explained below:

1. Menubar

   The menubar has options to `add`, `open` and `save` test scripts and test suites. It also has some general edit options and it is even possible to specify a preferred programming language.
2. Base URL

   Allows test scripts to be run across different domains.
3. Toolbar

   The buttons in the toolbar are used to control the test scripts. Each button is explained below (starting from the left):
   - Speed Control: Controls how fast your test script runs.
   - Run All: Run all test scripts in Selenium IDE.

- Run: Run a single test script in Selenium IDE.
- Pause/Resume: Pause a running test script.
- Step: Step through the test script once it has been paused.
- Apply Rollup Rules: This allows us to group a sequence of actions into a single action.
- Record: The record button. It will be enabled when Selenium IDE is recording.

4. test script pane

   The test script commands are displayed in the test script pane. There is one tab which shows us the script in the three-column table format. The other tab shows us the script in a preferred language.

   The Command, Target and value textfields are corresponding to the three-column table structure. It is possible to edit the values by clicking on a specific row. Those three fields are explained below:
   - Command: This select box has a list of all the Selenium commands. It is possible to type into it to use the auto complete functionality or use it as a dropdown. Some reference information is shown in the reference pane at the bottom once a specific action is selected.
   - Action: The first parameter specified for a command in the Reference tab of the bottom pane always goes in the Target field.
   - Value: If a second parameter is specified by the Reference tab, it always goes in the Value field.

5. Test suite pane

   Shows the test scripts in the current test-suite along with the results.

6. Log/Reference pane

   The bottom pane is used for four different functions divided in separate tabs, like: `Log`, `Reference`, `UI-Element`, and `Rollup` information. Each function is explained below:
   - Log: Error messages and information messages are shown while the test is running.
   - Reference: Displays the documentation of the command actually selected.
   - UI-Element: Displays the UI-element mappings actually in use.
   - Rollup: Shows rollup rules.

1.2 Record a test script

In this tutorial we are going to record a test script with Selenium IDE.

Prerequisites

Ensure that the record button is enabled. Selenium IDE automatically opens in record mode, otherwise you need to click on the (red) record button in the right top corner.

In practice

1. Open the website under test in the Firefox browser. In this case we will use: http://selenium.polteq.com/testshop/.
2. Open Selenium IDE, via the `Tools` menu.
3. Start recording by pressing the `record` button in the right top corner, if needed.
4. Search for 'iPod' and click on the search button.
5. Validate that the text 'iPod shuffle' is present in the search results list. We can do that by selecting the text and opening the context menu (right-click) and select `assertText`.

The test script will end up like this:

Command	Target	Value
open	/testshop/index.php	
type	id=search_query_top	iPod
clickAndWait	name=submit_search	
assertText	css=li > div > h3	iPod shuffle

Selenese test cases are HTML based, so do not forget to add the HTML extension once you save the test case.

We can change the Locator Builder settings in Options -> Options… -> Locator Builders tab. It's a good practice to put CSS on top.

1.3 Modify a test script

In this tutorial we will modify a test script by adding some commands manually.

Prerequisites

We can use the test script created in the previous tutorial, but now we want to change the language without recording the test again.

In practice

1. Open the previous recorded test script.
2. Select the row where we want to put an extra command.
3. Ensure that record mode is enabled.
4. Click on a specific language.
5. Disable record mode.

The test script will end up like this:

Command	Target	Value
open	/testshop/	
click	css=img[alt=”en”]	
type	id=search_query_top	iPod
clickAndWait	name=submit_search	
assertText	css=li > div > h3	iPod shuffle

We just added an extra command to our previous recorded test script.

1.4 Store information from the page

With Selenium IDE we can store data and use it later. There are a couple of actions to store data, like:
`store`,
`storeValue`,
`storeText`.

In practice

We like to store the text from a specific link and print it to the log panel. Obviously you can also use the text (which is stored in a variable) in the next test step.

1. Open the previously recorded test script.
2. Select the last row.
3. Insert two new rows by opening the context menu (right-click) and select `Insert New Command`
4. Add a `storeText` command to store the text of a given element.
5. Add a `echo` command to display the content of the variable in the log panel.

The test script will end up like this:

Command	Target	Value
open	/testshop/	
type	id=search_query_top	iPod
clickAndWait	name=submit_search	
storeText	css=li > div > h3	test
echo	${test}	
assertText	css=li > div > h3	iPod shuffle

The output of the script above is: `[info] echo: iPod shuffle`

Selenium uses a JavaScript map called `storedVars` to store the data.

1.5 Dealing with AJAX functionality

Some websites are using AJAX to modify the graphical user interface (GUI) without being reloaded. In this tutorial we are going to record website functionality which is using AJAX. We can use `waitFor` commands, like:
`waitForAlertNotPresent`,
`waitForAlertPresent`,
`waitForElementPresent`,
`waitForElementNotPresent`,
`waitForTextPresent`,
etc.

In practice

1. Open the website under test in the Firefox browser. In this case we will use: http://selenium.polteq.com/testshop/.
2. Open Selenium IDE, via the `Tools` menu.
3. Start recording by pressing the `record` button in the right top corner, if needed.
4. Add a product to the cart by performing the following actions: navigate to the 'laptop' category, view an item and click on the 'add to cart' button.
5. Verify that the product is added to the cart, by right clicking on the items name in the cart and select `waitForText`.
6. Delete the item from the cart, by clicking on the remove icon next to the item name.
7. Verify that the text 'no product' is present in the cart, we can do that by selecting the text and opening the context menu (right-click) and select `waitForElementPresent`.
8. Stop recording by clicking on the record button and try to execute the recorded test script by clicking on the play button.

The test script will end up like this:

Command	Target	Value
open	/testshop/	
clickAndWait	link=Laptops	
clickAndWait	css=h3 > a[title=”MacBook”]	
click	name=Submit	
waitForText	css=dt[id*=cart_block_product] > a	MacBook
click	css=a.ajax_cart_block_remove_link	
waitForElementPresent	css=span.ajax_cart_no_product	

Selenese test cases are HTML based, so do not forget to add the HTML extension once you save the test case.

1.6 Create test suites

A test suite is a collection of test scripts. In this tutorial we are going to take a closer look on how to create a test suite.

In practice

1. Create a test script as described in the previous tutorials.
2. Select `File -> New Test Case` to create a new test script. (or open the context menu from the left panel and select `New Test Case`)
3. Repeat step 1 and 2 as many times you want.
4. Select `File -> Save Test Suite` to save all test scripts.

Selenese test suites are HTML based, so do not forget to add the HTML extension once you save the test case.

1.7 Exexute test scripts in different browsers

In this tutorial we are going to execute test scripts in different browsers.

Prerequisites

It is necessary to download the `Selenium standalone server`, `IEDriverServer` and `chromedriver`. (http://code.google.com/p/selenium/downloads/list)

In practice

1. We need to start Selenium standalone server by entering the following command in the commandline:

```
1   java -jar selenium-server-standalone-2.39.0.jar -Dwebdriver.ie.driver=IEDriverSe\
2  rver.exe -Dwebdriver.chrome.driver=chromedriver.exe`
```

2. We need to enable `WebDriver Playback` in Selenium IDE. `Options -> Options... -> WebDriver` tab and check `Enable WebDriver Playback`
3. Specify in which browser we like to run our test scripts `Options -> Options... -> WebDriver` tab and specify the browser in the textfield. (chrome, firefox, internet explorer and so on)

Now you can run your test script with WebDriver in the specified browser.

1.8 Further references

All the Selenium IDE commands are explained on the following location:
http://release.seleniumhq.org/selenium-core/1.0.1/reference.html

2 Selenium IDE extensions & plugins

Selenium IDE (Integrated Development Environment) can be enriched with user-extensions, such as: logical statements and data driven testing. It also allows us to create our own actions, assertions and even your own locator strategies. Those extensions are written in JavaScript and will be loaded on IDE's start up.

As of Selenium IDE version 1.0.4 Selenium can also be extended through its own plugin system. They will mainly add new functionality to Selenium IDE, such as: extra buttons in the toolbar.

2.1 Using the UI-map user-extension

We want to make maintainable and readable test scripts by extracting the locators to an external file.

In practice

First we have to make an external file, called `UI-map.js`. This can be done with notepad. (or a more sophisticated editor)

We have to initialize a new UIMap object, using the following code:

First line of UImap.js

```
1 var myMap = new UIMap();
```

Now we can add pagesets, which can define a set of pages that share a set of common page elements. A pageset can have the following attributes:

Attribute	Mandatory	Description
name	Yes	The name of the pageset, This should be unique within the UIMap.
description	Yes	Description of the pageset. It could give you an idea of what UI-elements the pageset will have.
pagePrefix	No	The path of the URL which indicates the prefix for a certain page.
paths pathRegexp	Yes	A string or array with regular expressions.
paramRegexps	No	A mapping from URL parameter names to regular expression strings which must match their values.
pageContent	Conditional	A function that tests whether a page, represented by its document object, is contained in the pageset, and returns true if this is the case.

Finally we can add UI-elements. They can exist of multiple attributes, the most common attributes are listed in the table below.

Attribute	Mandatory	Description
name	Yes	Name of the element
description	Yes	Description of the element. This is used for documentation purposes.
args	No	A list of arguments that will modify the getLocator() method.
locator		
getLocator	Yes	Either a fixed locator string, or a function that returns a locator string given a set of arguments.

The external maintainable locator file will look like this:

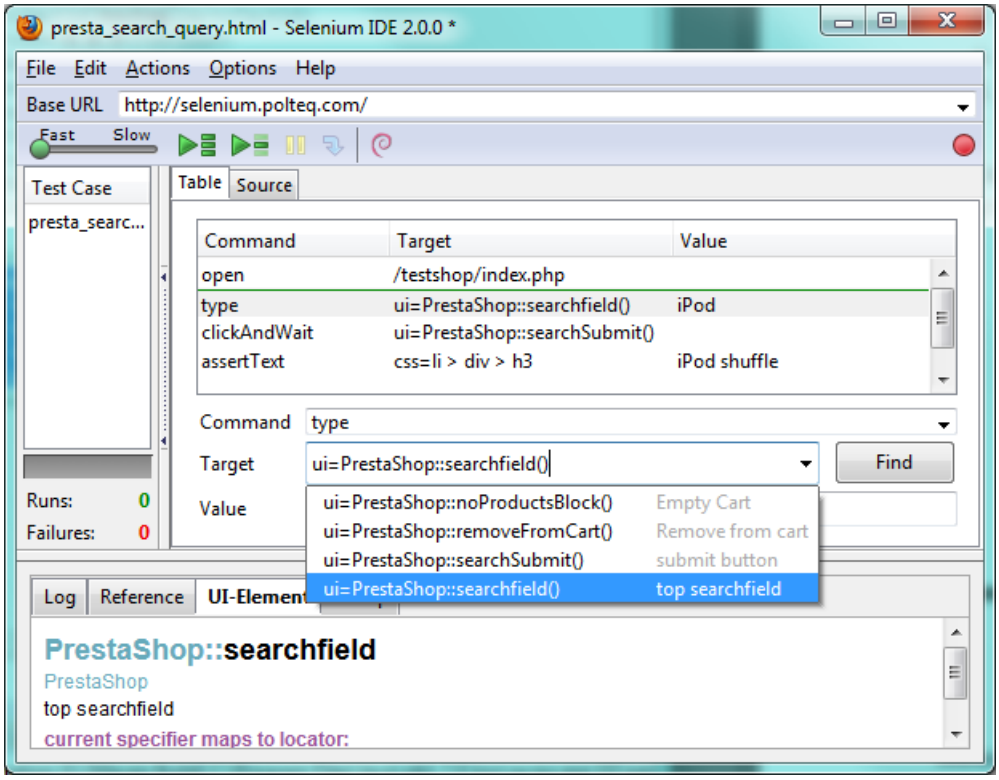
UImap.js

```
1  var myMap = new UIMap();
2  myMap.addPageset( {
3    name : 'PrestaShop',
4    description : 'PrestaShop',
5    pathRegexp : '.*'
6  });
7  myMap.addElement('PrestaShop', {
8    name : 'searchfield',
9    description : 'top searchfield',
10   locator : "css=#search_query_top"
11 });
12 myMap.addElement('PrestaShop', {
13   name : 'searchSubmit',
14   description : 'submit button',
15   locator : "css=input[name='submit_search']"
16 });
17 myMap.addElement('PrestaShop', {
18   name : 'removeFromCart',
19   description : 'Remove from cart',
20   locator : "css=a.ajax_cart_block_remove_link"
21 });
22 myMap.addElement('PrestaShop', {
23   name : 'noProductsBlock',
24   description : 'Empty Cart',
25   locator : "css=#cart_block_no_products"
26 });
```

Pay attention to the syntax, otherwise the Javascript file doesn't load properly.

After creating the external file we can embed it in Selenium IDE.

1. Open Selenium IDE by selecting Selenium IDE from the Tools menu in Firefox.
2. Open the Options window by clicking `Options -> Options...`
3. Set the location of the UI-map, using the `Browse...` button.
4. Click on OK to confirm the modifications and reopen Selenium IDE to make changes effect.
5. The target textfield has been changed to a selectbox with the locators from the UI-map.



Selenium IDE - changed Target field

We made the locators known in Selenium IDE following the previous steps. We are now able to select locators by their meaningful name.

2.2 Using the flow control user-extension

We want to add conditional statements to our tests. This tutorial will show different ways of using conditional statements.

Prerequisites

We have to make the `flow-control` user-extension available in Selenium IDE by loading the file into the IDE. The flow-control user-extension can be downloaded from the following location: http://wiki.openqa.org/display/SEL/flowControl

In practice

This user-extension provides a couple of logical functions, like: label, goto, gotoIf and while loops. We can define points in our tests to navigate to. We can place the label command in front of a selection of code.

Command	Target	Value
label	name_of_label	

There are two ways to navigate to the labelled selection of code. We can make a conditional statement or we can just jump to that selection. The first table shows the goto command and the second table shows a conditional statement.

Command	Target	Value
gotolabel	name_of_label	

Command	Target	Value
gotoIf	Conditional statement	name_of_label

We have also the ability to make a conditional loop, a while-loop.

Command	Target	Value

while
//Script within the while-loop
endWhile
	Conditional statement	

2.3 Using the data driven user-extension

There are several reasons for implementing data driven testing. Imagine we have to test a Telecom application, where we need unique phone numbers for every test. Or we have to test an insurance application, where we need unique policy numbers for every test. Or we have to test a banking application, where we need unique account numbers for every test cycle. For those reasons it could be extremely useful to populate the test with test data from an external file. This can be done with the data driven user-extension.

Prerequisites

We have to make the `flow-control`, `include` and `datadriven` user-extension available in Selenium IDE by loading the file into the IDE. The user-extensions can be downloaded from the following location: http://wiki.openqa.org/display/SEL/datadriven

In practice

The first thing we need to do is creating an XML file with test data, which can be used in the tests. The test data in the XML file is written as a key/value structure and will look like this:

datadriven.xml

```
1 <testdata>
2   <vars key1="value1" key2="value2"/>
3 </testdata>
```

Once we have the XML with test data, we can build or modify our tests. We have to load the XML file and walk through the test data rows. For each row we have to execute the test. The script will look like this:

Command	Target	Value
loadTestData	`pathToXmlFile`	
While	!testdata.EOF()	
NextTestData		
//Script within the while-loop		
endWhile		

`pathToXmlFile` must start with `file://<drive>:/<path>` on Windows computers.

`pathToXmlFile` must start with `file:///<drive>:/<path>` on Mac computers.

The user-extensions are loaded into the core of Selenium. The script will load an XML file from a preferred location and execute the script for every single line of test data in the XML. We can call the keys from the test script itself, like this `${key1}` and `${key2}`

It's currently not supported to run tests which are using extensions in other browsers. Make sure that you disabled WebDriver Playback: `Options` -> `Options...` -> `WebDriver` tab and uncheck `Enable WebDriver Playback`

2.4 Using the highlight elements plugin

Sometimes it is hard to see what is going on in the browser window. With the highlight elements plugin we can make the elements we use while testing more visible.

Prerequisites

The `highlight elements` plugin can be downloaded from the Firefox add-on manager, using the following URL: https://addons.mozilla.org/.

In practice

There is an extra button visible in the toolbar of Selenium IDE after installing the plugin. We can see the button in the following screenshot:

Selenium IDE - highlight elements plugin

The plugin makes it possible to highlight every element which we use in tests by enabling this button.

2.5 Using the power debugger plugin

This plugin is very powerful in debugging test scripts. It will pause the execution rather than fail the test. We can simple hit the resume button, once we resolved the issue.

Prerequisites

The `power debugger plugin` can be downloaded from the Firefox add-on manager, using the following URL: https://addons.mozilla.org/.

In practice

There is an extra button visible in the toolbar of Selenium IDE after installing the plugin. We can see the button in the following screenshot:

Selenium IDE - power debugger plugin

We can press the red pause button any time and the test will pause on a failure. We can continue the test by pressing the resume button.

2.6 Using the stored variables viewer plugin

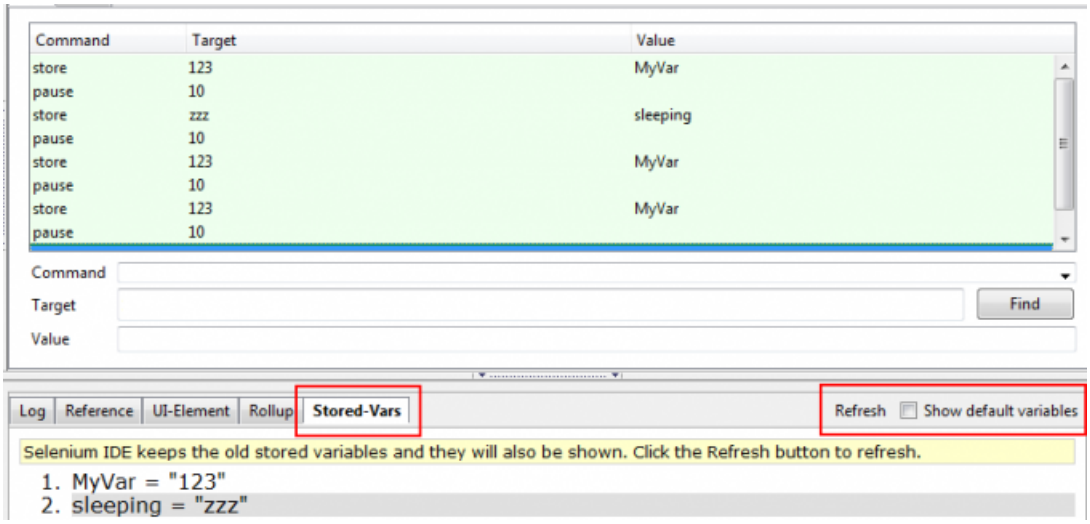
Selenium IDE provides the capability to store values in variables while running the test. The store variables viewer plugin makes it possible to display the values in the logging panel.

Prerequisites

The `stored variables viewer plugin` can be downloaded from the Firefox add-on manager, using the following URL: https://addons.mozilla.org/.

In practice

There will be an extra tab in the logging panel at the bottom of Selenium IDE. The extra tab is displayed in the following screenshot:



Selenium IDE - stored variables viewer plugin

2.7 Using the favorites plugin

We may have generated a lot of test suites for a single or multiple projects. It could be helpful to have quick access to frequently used test suites. In this case the favorites plugin can be of great help.

Prerequisites

The `favorites` plugin can be downloaded from the Firefox add-on manager, using the following URL: https://addons.mozilla.org/.

In practice

This plugin creates one extra button in the toolbar of Selenium IDE. We can compare this function to the favorites function in the browser. We can see the extra button in the screenshot below:

Selenium IDE - favorites plugin

2.8 Further references

More plugins are listed on the following location: http://docs.seleniumhq.org/download/

More extentions are listed on the following location:
http://wiki.openqa.org/display/SEL/Contributed+User-Extensions