

Selenium

27654-54919-02

Testing automation – environment preparation



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Agenda

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- Test automation preparations
- Tests and tests data preparations
- Environment preparations
- Selenium settings
- omation project



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Test Automation Work Flow

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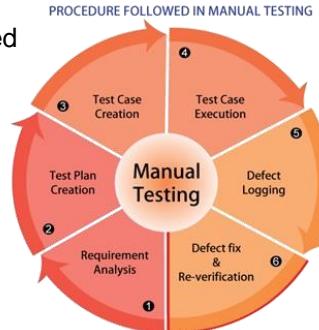
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Understand Manual Test Steps

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- Create a new user in salesforce.com
- Verify the “Congratulations” message appear, make sure the new account was created
- Verify you can move forward with the new account
- Verify multiple new accounts can be created



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Environment Requirement

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Verify that Environment ready for testing:

- Check for stability in the application under test.
- Ensure that the test and tester have permissions to access the database, host systems and input/output data.
- Execute the test case steps manually to determine the expected results.

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Input Data To Be Used

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Determine the input data for testing the application:

- Knowledge transfer with tester in order to get valid\invalid data for your test.
- Decide what is the scenario if invalid data is given as input to the application.



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Test Automation Preparation

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Before start recording the test:

- Identify the start\end conditions for each test case.
- Establish standards for name conventions.



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Planning Initial And End Conditions

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You'll receive your first email that will guide you through your free trial so you experience everything Salesforce offers.

For documentation, free training, and getting started tips, go to [help.salesforce.com](#). You'll need your Salesforce username and password to access some of these materials (check the email from us for details).



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If you're already registered for a free trial and need help, please contact us at 1-800-NO-SOFTWARE between 6:00 a.m. and 6:00 p.m. (PT), Monday through Friday.

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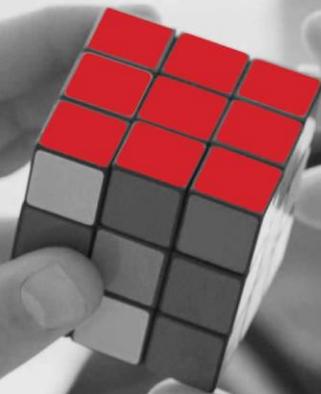


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Selenium Modules



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Agenda

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- Selenium modules
 - Selenium - IDE
 - selenium – RC
 - Selenium – WebDriver
 - Selenium - Grid



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Selenium History

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Selenium the beginning
At the year 2004

Jason Huggins



Who worked at **ThoughtWorks** as a consultant
Agile development and Experience design company
Developed JavaScriptTestRunner and called it
Selenium
He got assistance from

Paul Gross



and Jie Tina Wang



* Selenium is being used at Google and FaceBook and more...

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The Modules

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- Selenium IDE - The tool you use to develop your Selenium test cases
- RC – Remote Control – The Selenium server
- Web Driver – The new Selenium version (2.0)
- Selenium Grid – Extend Selenium execution capabilities



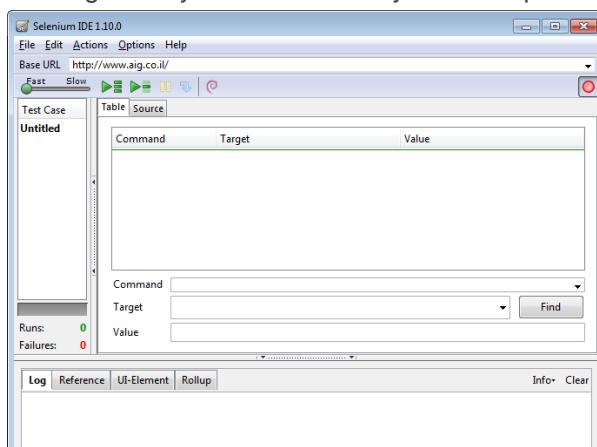
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Selenium - IDE

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The tool you use to develop your Selenium test cases. It's an easy-to-use Firefox plug-in and is generally the most fast way to develop test cases.



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Selenium - IDE

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Can be use also for:

- Execute user action
- Synchronize your script following your AUT
- Verify page elements
- Additional JS components
- Running a test suite

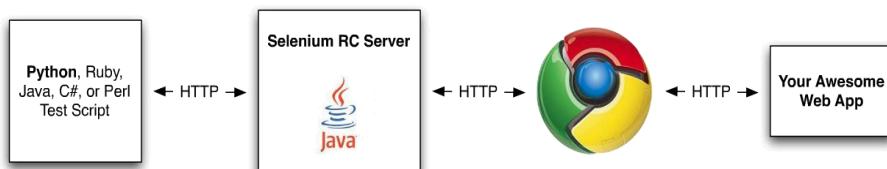
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Selenium – RC (Ver 1)

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Selenium 1.0



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Selenium – WebDriver (Ver 2)

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- Selenium-WebDriver makes direct calls to the browser using each browser's native support for automation.
- WebDriver is designed to provide a 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.

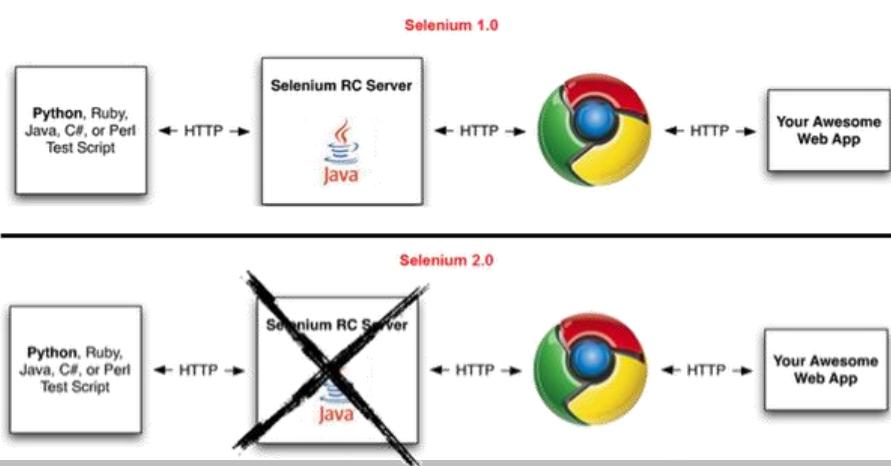
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Selenium – WebDriver (con't)

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Selenium RC vs Selenium Web Driver



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Selenium - Grid

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Grid allows you to :

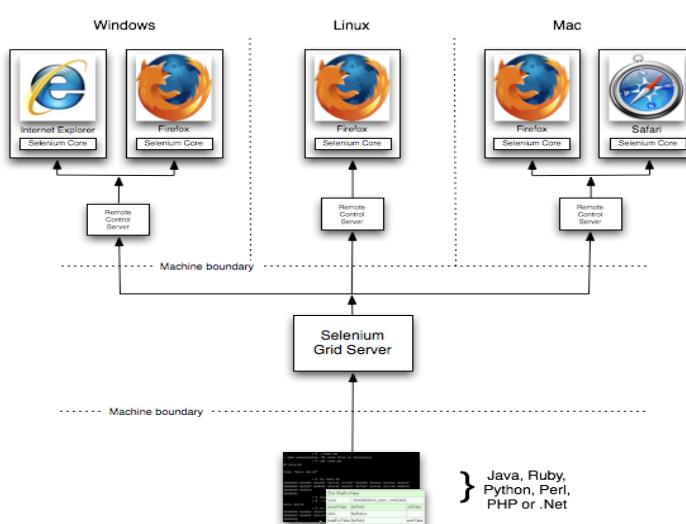
- scale by distributing tests on several machines, parallel execution.
- manage multiple environments from a central point, making it easy to run the tests against a vast combination of browsers / OS.

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Selenium – Grid (Con't)

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Installation and a basic script



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Agenda

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- How and from where to install the Selenium IDE
- Selenium IDE main features
- For what do I need the IDE features
- Record a basic test
- Run test
- Save test
- View test results



- 1.
- 2.
- 3.

The Selenium IDE - Installing

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- Download the selenium IDE file from:

seleniumhq.org

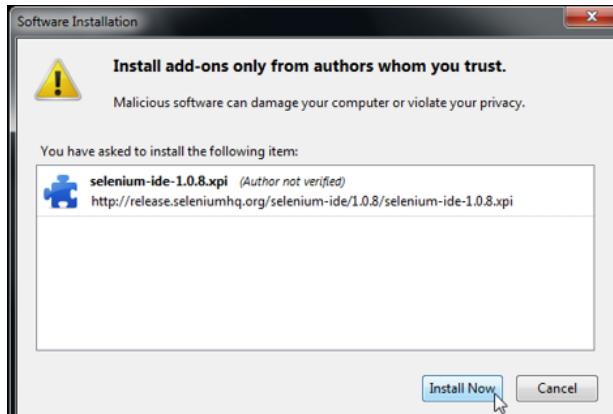
The screenshot shows a Mozilla Firefox browser window with the URL <http://seleniumhq.org/download/>. The page is titled "SeleniumHQ" and displays a "Downloads" section. On the left, there's a sidebar with links for "Selenium Downloads", "Previous Releases", "Nightly Releases", "Source Code", and "Maven Repository Info". The main content area shows a table of Selenium projects with their release dates and versions. At the bottom, there's a section for "Plugins for Selenium IDE" with a status bar indicating "Stopped".

Project	Release Date	Version	Action
Selenium Core	June 10, 2009	1.0.1	Download Changelog
Selenium IDE	Nov 5, 2010	1.0.8	Download Release Notes
Selenium RC	February 23, 2010	1.0.3	Download
Selenium Grid	April 8, 2010	1.0.6	Download (zip) Changelog
CubicTest	Nov 10, 2008	1.8.11	Download Changelog
Bromine	July 25, 2010	3.0 RC 2	Download
Selenium 2	April 22, 2010	2.0 alpha 5	Download

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



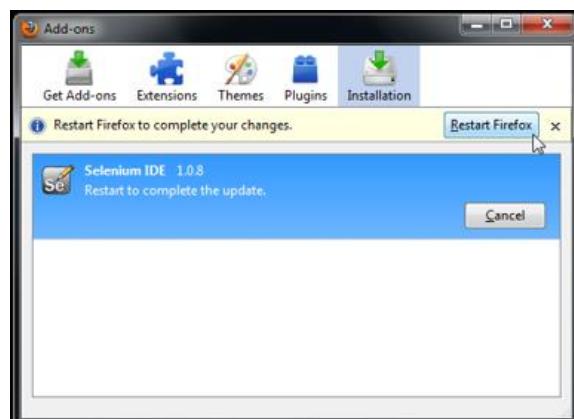
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Select Install Now. The Firefox Add-ons window pops up, first showing a progress bar, and when the download is complete, displays the following.



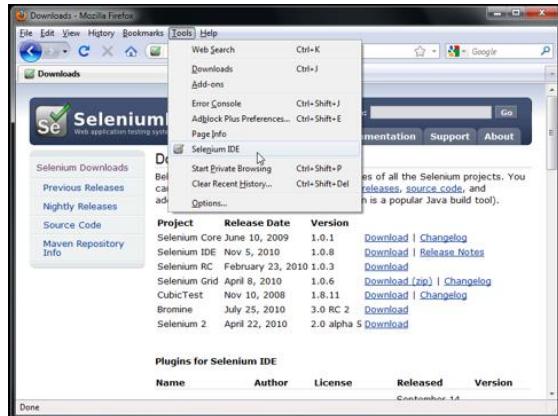
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The Selenium IDE - Installing

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



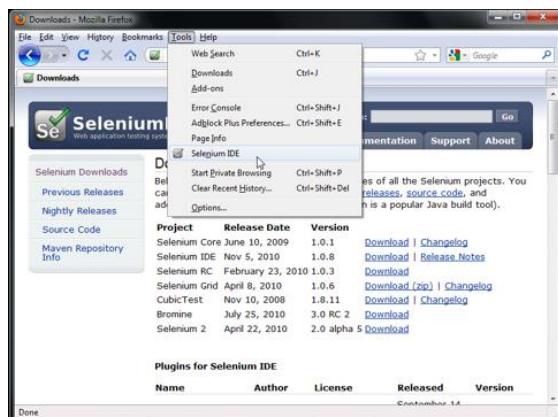
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IDE Features – the icons

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



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IDE Features – Icons

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The screenshot shows the Selenium IDE interface with several red callout bubbles pointing to specific elements:

- Speed Control:** controls how fast your test case run. (points to the speed slider at the top left)
- Run All** (points to the green arrow icon in the toolbar)
- Run** (points to the play/pause button in the toolbar)
- Apply Rollup Rules** (points to the rollup icon in the toolbar)
- Record** (points to the record icon in the toolbar)

Below the toolbar, there's a table view of test cases, a command input field, and a log pane.

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IDE Features – Interface

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The screenshot shows the Selenium IDE interface with several red callout bubbles pointing to specific elements:

- The selected URL** (points to the base URL field: "Base URL: http://www.aig.co.il")
- Test Case name** (points to the test case name: "Untitled")
- Test Case pane** (points to the main table view showing a list of commands)
- The currently selected command along with its parameters** (points to the command and target fields in the center pane: "Command: clickAndWait Target: link=היררכיה ביטוח נסיעות")
- The button pane** (points to the bottom right pane showing generated code and arguments)

Below the interface, there's a code preview area:

```
clickAndWait(locator)
Generated from click(locator)
Arguments:
  • locator: an element locator
```

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IDE Features – Interface (source)

Display the TC in a native format, can be change to programing language.

The screenshot shows the Selenium IDE interface. The title bar says "Selenium IDE 1.10.0". The menu bar includes File, Edit, Actions, Options, and Help. The base URL is set to "http://www.aig.co.il/". The left sidebar shows a "Test Case" section with an "Untitled" entry. Below it, "Runs: 0" and "Failures: 0" are displayed. The main pane shows the XML source code for a new test case:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" "http://www.w3.org/1999/xhtml">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en">
<head profile="http://selenium-ide.openqa.org/profiles/test-case">
<meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />
<link rel="selenium:base" href="http://www.aig.co.il/" />
<title>New Test</title>
</head>
<body>
<table cellpadding="1" cellspacing="1" border="1">
<thead>
<tr>
<td rowspan="3" colspan="3">New Test</td>
</tr>
<tr>
<td><td><td>


At the bottom, there are tabs for Log, Reference, UI-Element, and Rollup. The UI-Element tab is selected, showing the command "clickAndWait(locator)" generated from "click(locator)". Arguments are listed as "Locator: in element locator".



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```

IDE Features – Test Case Pane

Entry fields display the currently selected command along with its parameters,

Fields can be used for changing the values, events, or object identification

The screenshot shows the Test Case pane with three input fields:

- Command:** A dropdown menu currently showing "type".
- Target:** A dropdown menu currently showing "id=p_ctl02_lgnPersonal_UserName".
- Value:** An input field containing the value "Moshe".

Below these fields is a "Find" button.

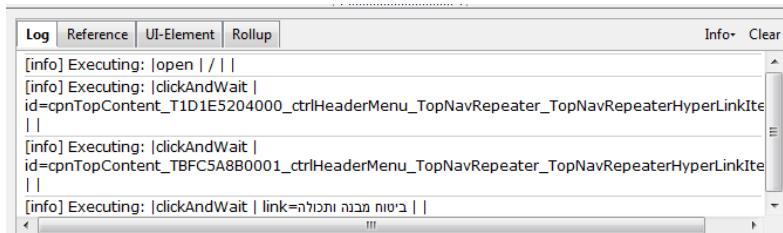
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IDE Features – Test Log

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Progress errors and information messages showing in this pane



The screenshot shows a window titled "Log" with several log entries. The entries are:

- [info] Executing: |open| // |
- [info] Executing: |clickAndWait|
id=cpnTopContent_T1D1E5204000_ctrlHeaderMenu_TopNavRepeater_TopNavRepeaterHyperLinkItem_1 |
- [info] Executing: |clickAndWait|
id=cpnTopContent_TBFC5A8B0001_ctrlHeaderMenu_TopNavRepeater_TopNavRepeaterHyperLinkItem_1 |
- [info] Executing: |clickAndWait| link= ביטוח מבנה ותוכלה |

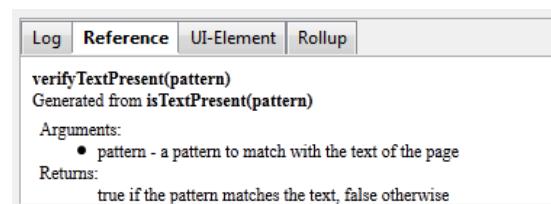
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IDE Features – Test Reference

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Whenever you are entering or modifying Selence commands and parameters in Table mode



The screenshot shows a window titled "Reference" with the command `verifyTextPresent(pattern)`. It states that it is generated from `isTextPresent(pattern)`. The arguments are listed as:

- pattern - a pattern to match with the text of the page

The returns are listed as:

- true if the pattern matches the text, false otherwise

Selence Commands - Selenium commands, often called selene, are the set of commands that run your tests

e.g.	clickAndWait	id=p_ctl02_lgnPersonal_Login	ביטוח מבנה ותוכלה
	verifyText	link= ביטוח מבנה ותוכלה	פוליסות ביטוח דירה
	clickAndWait	link= Lior	Lior

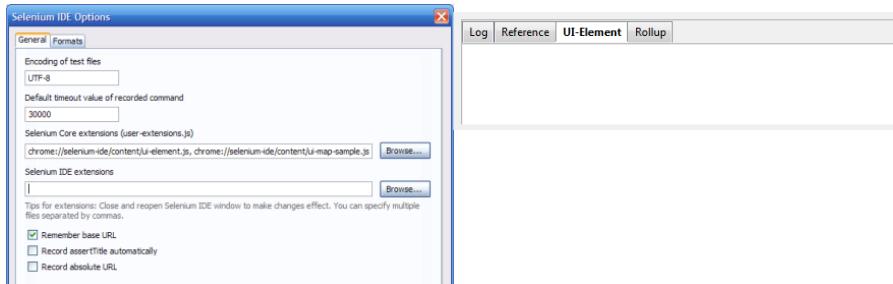
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IDE Features – UI Element

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A storage and a simple way to understand your script recording, can be found under:



* Will explain deeply in the object identification session

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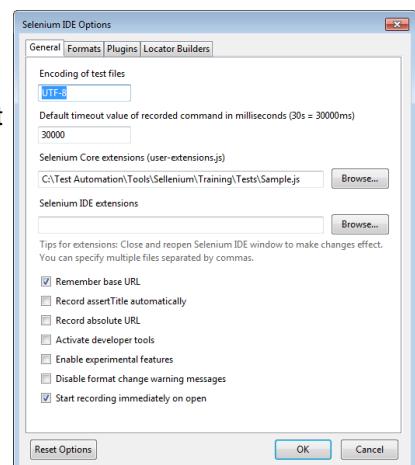
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IDE Features – RollUp

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Rollup rule is a set of Selenium commands that are grouped into one single command

- Rollups are expanded at runtime but a set of commands can be reduced into a rollup using the `commandMatcher` property or the `getRollup` method.
- Rollup rules are defined in the `user-extension.js` file and are usable by both IDE and RC via the `rollup` command



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Start Recording

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After recording Table Vs. Source

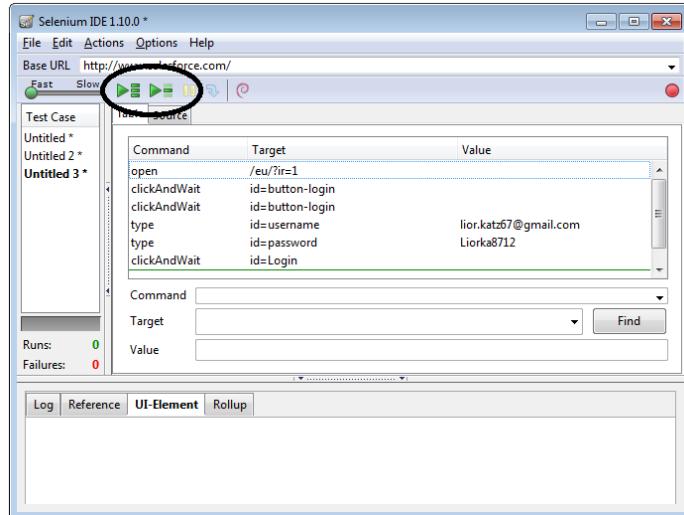
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Execute a Test

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Viewing a Test Run

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The screenshot shows the Selenium IDE interface with a failed test run. On the left, a screenshot of the Salesforce login page shows a red 'X' icon over the 'Remember User Name' checkbox, indicating a failure.

The 'Test Case' panel shows the same test cases as the previous screenshot. The 'Untitled 3 *' test case is selected, and its source code is displayed in the 'Table' tab, identical to the previous screenshot.

The 'Log' tab at the bottom shows the execution log with an error message:

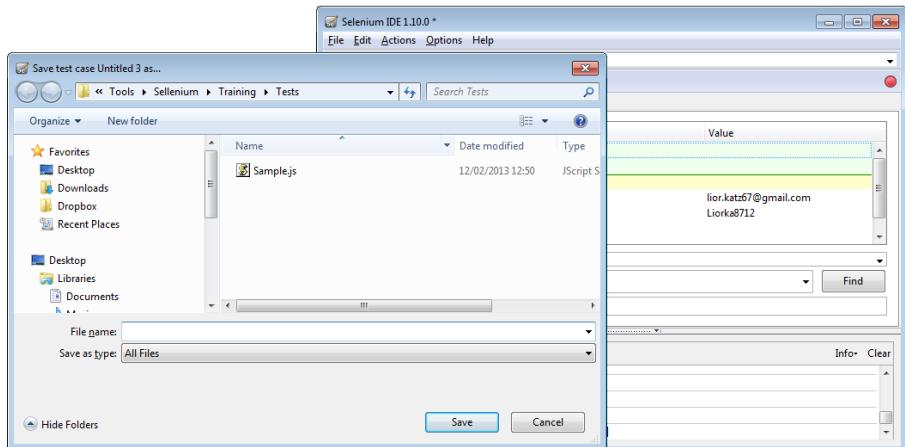
```
[info] Executing: [clickAndWait | id=button-login | ]  
[error] Element id=vpa1 not found  
[info] Changed test case  
[info] Executing: [open | /eu/?ir=1 | ]  
[info] Executing: [clickAndWait | id=button-login | ]
```

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Saving a Test Under File System

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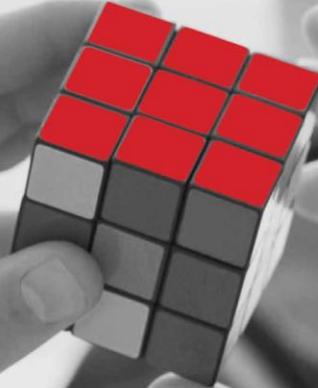
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Introduction to web page objects



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- DOM
 - HTML
- Classes And Objects
- Methods (Actions)
 - Java Script
- Properties
 - Get Values
 - Verify Values
 - CSS



- DOM – Document Object Model
 - Describes the web page objects hierarchy, methods and properties
 - Allows programmers to access all the above information
- HTML – Hyper Text Markup Language
 - Tags language that is rendered by the browser to a visual web page
 - For example: text box <INPUT Type=text>, table <TABLE> and many more
- How to access?
 - Manually
 - Browsers tools (E.g. Fire Bug, F12)
 - “View Source” menu option
 - Programmatically
 - Perform actions on objects
 - Get and verify object's properties

DOM – Basic Page Structure

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```
<html>
  <head>
    <style>
    </style>
    <script>
    </script>
  </head>
  <body>
    <div id="div1">
      <div id="div2">
        <input id="username" type="text"/>
        <input name="password" type="password"/>
        <input name="OK" type="button" value="OK"/>
        <a href="http://www.yahoo.com">Go to Yahoo</a>
      </div>
    </div>
  </body>
</html>
```

DOM – Automation Perspective

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- Automation Perspective
 - Allows us to interact with web pages



- Definition:
 - In object-oriented programming, a class is an extensible program-code-template for creating objects, providing initial values for state and implementations of behaviour (member functions or methods)
- And now, in terms we can also understand ☺:
 - Class is a code structure that gathers together:
 - Properties: values that describes the class (E.g. Color, Position, Label and many more)
 - Methods: operation the class can perform
- Examples:
 - Class: Button
 - Properties: X, Y, Label, Width, Height
 - Methods: Click, Double Click
 - Class: Person
 - Properties: Height, Hair Colour, Gender
 - Methods: Walk, Eat



- Definition:
 - An object is an instance of a class
- Objects inherits the class's properties and methods and initializes the properties with values
- Examples:
 - Object: OK Button (an instance of the Button class)
 - Properties: X = 10, Y = 10, Label = "OK", Width = 100, Height = 20
 - Object: Cancel Button (an instance of the Button class)
 - Properties: X = 120, Y = 10, Label = "Cancel", Width = 100, Height = 20
 - Object: Sitvanit Har Dagan (an instance of the Person class)
 - Properties: Height = 160, Hair Colour = "Brown", Gender = "Female"
 - Object: Nachshon Ben Haaminadav (an instance of the Person class)
 - Properties: Height = 180, Hair Colour = "Black", Gender = "Male"



Objects– Automation Perspective

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- **Automation Perspective**

- Selenium identifies all HTML objects as WebElement



Methods

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- Web page is event-driven

- An action performed on an object (E.g. mouse\keyboard) invokes a method (AKA action, function and more...) associated with this object's event. For example the Click event can invoke the default method OnClick or any other method associated by the programmer (E.g. verifyMandatoryFields)
 - There are methods that are common to all objects types and methods that are specific to specific objects types
 - The most common scripting language in web pages is Java Script
 - HTML tag: <script>

- **Automation Perspective**

- Allows us to perform actions on HTML objects

Properties

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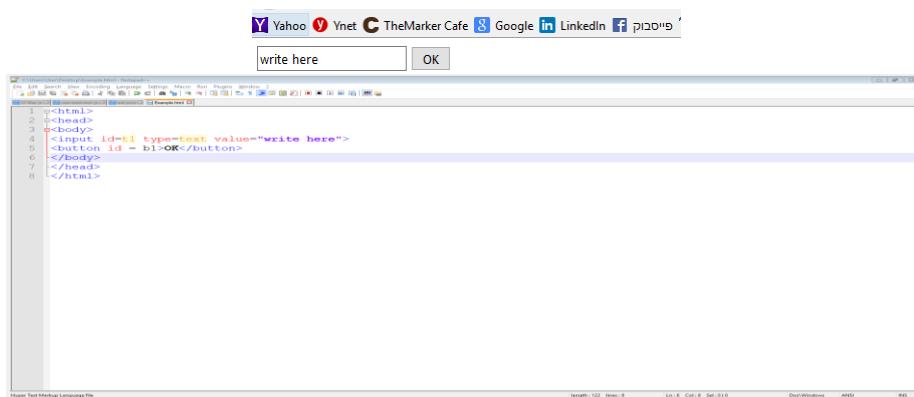
- Properties
 - Properties describes objects by their values. E.g. Color, Position, Text, Value and many more
 - Properties may affect objects behavior and available actions. E.g. Enabled, Focused, ReadOnly
- CSS – Cascading Style Sheets
 - A language that is used to apply set of properties values on several objects or object types in a web page
 - Can be a section on a web page code or an external file
 - HTML tag: <style>
- Automation Perspective
 - Allows us to identify objects uniquely
 - Allows us to get and verify object's properties

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A (Very) Simple Example...

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The screenshot shows a Microsoft Notepad window displaying the following HTML code:

```
<!DOCTYPE html>
<html>
<head>
</head>
<body>
<input id="t1" type="text" value="write here">
<button id = b1>OK</button>
</body>
</html>
```

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Xpath toturial



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- Relationships
- Node Selection
- Axes
- Operations
- Functions
- Practice



- 1.
- 2.
- 3.



- Tags – all <> elements in the page. Each elements should have an opening and closing element. For example: <head></head>
- Attributes – additional information about the element. Embedded into the tag element. For example <table cellspacing="0" name='myTable'>
- Value – the actual value of a specific tag.
For example: <td>Data</td>

```
<head>
</head>
<body>
  <table border="1" cellspacing="0" name="myTable">
    <tr>
      <th>Header 1</th>
      <th>Header 2</th>
    </tr>
    <tr>
      <td>row 1, cell 1</td>
      <td>row 1, cell 2</td>
    </tr>
  </table>
</body>
```

Relationships

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- Parent – each element and attribute has one parent
- Children – element nodes may have zero, one or more children
- Sibling – nodes that have the same parent
- Ancestors – a node's parent, parent's parent, etc
- Descendants – a node's children, children's children, etc

Examples

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- /bookstore
- //title
- //@lang
- //book[2]
- //*[@lang='fre']/..
- //title[@lang='fre'] | //title[@lang='eng']

```
④ <bookstore index='1'>
  ⑤   <book>
    ⑥     <title lang="fre">Harry Potter</title>
    ⑥     <price>29.99</price>
  ⑤   </book>
  ⑤   <book>
    ⑥     <title lang="eng">Learning XML</title>
    ⑥     <price>39.95</price>
  ⑤   </book>
</bookstore>
```



Node Selection

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- Path expressions
 - nodename
 - // -selects from the root node in any place of the document
 - / -selects from the root node
 - . - current node
 - .. - parent of the current node
 - @ - attributes
- Predicates
 - [] - zero based (IE) or [] - one based (other)
 - [@attribute]



Node Selection

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- Unknown nodes
 - * - any element node
 - @* - any attribute
 - node() - any node
- Combining paths
 - "|" - and element allows combining of several path queries

Operators

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- | - combine two node sets
- +,-,* ,div,mod - mathematical operations
- <,<=,>,>= -numerical comparison
- =, != - equal and not equal
- or, and - logical operations

Examples

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```
④ <bookstore index='1'>
  <book>
    <title lang="fre">Harry Potter</title>
    <price>29.99</price>
  </book>
  <book>
    <title lang="eng">Learning XML</title>
    <price>39.95</price>
  </book>
</bookstore>
```

- //book[price>30]
- //price[text()='29.99'] | //title[@lang='fre']
- //title[@lang='eng' and text()='Learning XML']
- //book[price div 2=19.975]

Functions

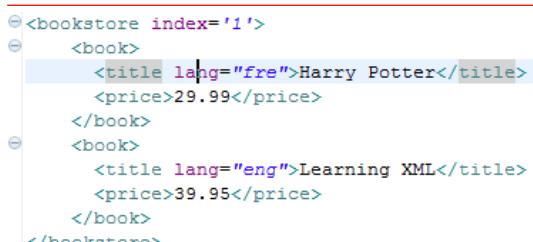
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- String
 - contains(s1, s2) - returns true if s1 contains s2
 - starts-with(s1, s2) - returns true if s1 starts with s2
 - ends-with(s1, s2) - returns true if s1 ends with s2
 - matches(s1,p) - returns true if s1 matches p pattern
 - substring(s1,i1,i2) - returns a new string from i1 to i2
- Context
 - position() -index of the current node
 - last() -number of items in the processed list
- Other (XQuery)
 - text() - return the text value of the match

Examples

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- //book[contains(title,"XML")]
- //title[starts-with(.,'L')]
- //book[position()=1]
- //book[last()]
- count(/book)
- //title[@lang='eng']/text()



```
<bookstore index='1'>
  <book>
    <title lang="fre">Harry Potter</title>
    <price>29.99</price>
  </book>
  <book>
    <title lang="eng">Learning XML</title>
    <price>39.95</price>
  </book>
</bookstore>
```



- ancestor - Selects all ancestors
- ancestor-or-self - Selects all ancestors and current node
- attribute - Selects all attributes of current node
- descendant - Selects all descendants of current node
- descendant-or-self - Selects all descendants and current node
- child - Selects all children of current node
- following - Selects everything after current node
- following-sibling - Selects all siblings after current node
- parent - Selects the parent of current node
- preceding - Selects everything before current node
- preceding-sibling - Selects all siblings before current node
- self - Selects current node



- A step consists of:
 - an axis (defines the tree-relationship between the selected nodes and the current node)
 - a node-test (identifies a node within an axis)
 - zero or more predicates (to further refine the selected node-set)
- **Syntax**
axisname::nodetest[predicate]

Examples

```
① <bookstore index='1'>
②   <book>
③     <title lang="fre">Harry Potter</title>
④     <price>29.99</price>
⑤   </book>
⑥   <book>
⑦     <title lang="eng">Learning XML</title>
⑧     <price>39.95</price>
⑨   </book>
⑩ </bookstore>
```

- /bookstore/child::book - All book nodes that are children of bookstore
- //title/attribute::lang - Selects the lang attribute of the current node
- /bookstore/child::* - Selects all children of the current node
- //title/child::text() - Selects all text child nodes of the current node
- //book/ancestor-or-self::book
- /bookstore/descendant::title



TestNG



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Agenda

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- JUnit Evolution
- Basic Usage
- Features
- Testng.xml
- Reports
- Eclipse Integration
- Training



- 1.
- 2.
- 3.



First There Was JUnit

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- Does it need any introduction?
- Simple Java testing framework based on introspection, test methods, test classes and test suites
- First Java testing framework created and now de facto standard in the Java world

JUnit Example

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```
package com;
import org.junit.Assert;
import org.junit.Before;
import org.junit.Test;
public class JUnitExample {
    private Calculator calc;
    @Before
    public void setUp(){
        calc = new Calculator();
    }
    @Test
    public void testAdd(){
        int result = calc.add(5,5);
        Assert.assertEquals(10, result);
    }
    @Test
    public void testSubstract(){
        int result = calc.sub(10,5);
        Assert.assertEquals(5, result);
    }
}
```

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“Rhythm” of an Automated Test

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- **Fixture** (most of it in a separate method)
- **Exercise** (call) production class(es)
- **Assertion(s)**; true => silence; false => fail
- **Teardown** (if needed, in a separate method)

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JUnit Behaviour

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```
package com;

import org.junit.Assert;
import org.junit.Test;

public class JUnitExample2 {

    private String str;

    @Test
    public void setTest() {
        str = "some value";
    }

    @Test
    public void getTest() {
        Assert.assertEquals("some value", str);
    }
}
```

JUnit Problems

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- Victim of its own success. Initially designed to enable unit testing only, now used for all kinds of testing
- ... but very limited for anything but unit testing e.g. no dependent test methods
- Poor configuration control (setUp/tearDown)
- Adding test listeners can be cumbersome
- Reports are poor
- Tests are completely independent

What is TestNG?

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- Automated testing framework
- NG = Next Generation
- Similar to JUnit (especially JUnit 4)
- Not a JUnit extension (but inspired by JUnit)
- Designed to be better than JUnit, especially when testing integrated classes
- Created by Dr. Cédric Beust (of Google)
- Open source (<http://testng.org>)

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TestNG Philosophy

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- Feature-rich (JUnit: simplicity is valued)
- Support testing integrated classes (e.g., by default, don't create a new test class instance for every test method).
- Separate compile-time test code from run-time configuration/data info.

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TestNG Example

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```
package com;
import org.testng.Assert;
import org.testng.annotations.BeforeMethod;
import org.testng.annotations.Test;
public class TestNGExample {
    private Calculator calc;
    @BeforeMethod
    public void setUp() {
        calc = new Calculator();
    }
    @Test
    public void testAdd() {
        int result = calc.add(5, 5);
        Assert.assertEquals(result, 10);
    }
    @Test
    public void testSubtract() {
        int result = calc.sub(10, 5);
        Assert.assertEquals(result, 5);
    }
}
```

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@Test

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- Test methods can be organized in groups

```
@Test(groups = {"sanity", "smoke"})
```

- We can add description to test methods

```
@Test(description = "This is my awesome test!")
```

- We can add a timeout to our test methods

```
@Test(timeOut = 1500)
```

- We can disable our test

```
@Test(enabled = true)
```

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Fixtures

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Annotation	Description
@BeforeSuite	Before all tests in this suite have run.
@AfterSuite	After all tests in this suite have run.
@BeforeTest	Before any test method belonging to the classes inside the <test> tag is run.
@AfterTest	After all the test methods belonging to the classes inside the <test> tag have run.
@BeforeGroups	Before the first test method that belongs to any of the groups is invoked.
@AfterGroups	After the last test method that belongs to any of these groups is invoked.
@BeforeClass	Before the first test method in the current class is invoked.
@AfterClass	After all the test methods in the current class have been run.
@BeforeMethod	Before each test method.
@AfterMethod	After each test method.

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Data Providers

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```
public class DataProviderExample {  
  
    private LoginPage loginPage = new LoginPage();  
  
    @DataProvider(name = "credentials")  
    public Object[][] createData() {  
        return new Object[][] {  
            { "user1", "password1" },  
            { "user2", "password2" } };  
    }  
  
    @Test(dataProvider = "credentials")  
    public void testLogin(String user, String password) {  
        boolean result = loginPage.login(user, password);  
        Assert.assertTrue(result);  
    }  
}
```

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Data Providers

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- Data providers can lay in other classes

```
@Test(dataProvider = "create", dataProviderClass = StaticProvider.class)
```

- Iterator can be used instead of array of arrays

```
@DataProvider(name = "test1")
public Iterator<Object[]> createDataWithIterator() {
    return new MyIterator(DATA);
}
```

- The provider have access to the calling method

```
@DataProvider(name = "credentials")
public Object[][] createData(Method m) {
    System.out.println(m.getName());
    return new Object[][] { { "user1", "password1" },
        { "user2", "password2" } };
}
```

Dependencies

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- Test methods can be dependent on each other

```
public class DependenciesExample {

    @Test
    public void startServer() {
        System.out.println("Starting server");
    }

    @Test(dependsOnMethods = "startServer")
    public void testDeployApp() {
        System.out.println("Deploying app");
    }
}
```

- There are soft and hard dependencies
- Test method can also be dependent on groups



- TestNG can run tests in separated threads
- You can also define a thread pool

```
@Test(threadPoolSize = 10, invocationCount = 30)
public void parallelTest() {
    System.out.println("Crunching...");
```

- Parallel execution can be applied to
 - Methods
 - Tests
 - Classes
 - Suites



- Controls test runs
- Optional
- File can have any name (.xml suffix advised)
 - TestNG creates “testng-failed.xml”, for easy re-run
- Root: <suite> (then <test>/<classes>/<method>)
- Suite can also point to a list of additional xml suite files
- Some of the available specifications are described next



testng.xml Example

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- Selecting by class name

```
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >

<suite name="Suitel">
    <test name="Smoke" >
        <classes>
            <class name="SmokeTests" />
        </classes>
    </test>

    <test name="Regression1">
        <classes>
            <class name="test.sample.ParameterSample"/>
            <class name="test.sample.ParameterTest"/>
        </classes>
    </test>
</suite>
```

testng.xml Example

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- Selecting by package

```
<suite name="Suitel" verbose="1" >
    <test name="Regression1" >
        <packages>
            <package name="test.sample" />
        </packages>
    </test>
</suite>
```

- Selecting by groups

```
<test name="Regression1">
    <groups>
        <run>
            <exclude name="brokenTests" />
            <include name="checkinTests" />
        </run>
    </groups>
</test>
```

testng.xml Example

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- Selecting by method

```
<test name="Regression1">
    <classes>
        <class name="test.IndividualMethodsTest">
            <methods>
                <include name="testMethod" />
            </methods>
        </class>
    </classes>
</test>
```

Parameters

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```
@Test
@Parameters({ "user-name", "password" })
public void login(String userName, String password) {
    Reporter.log("About to login with user " + userName + " and
    password " + password);
}
```

```
<parameter name="user-name" value="someUser"/>
<parameter name="password" value="s3cret"/>
<test name="Login With Parameters">
    <classes>
        <class name="com.ParametersExample"></class>
    </classes>
</test>
```

Passed Tests

com.ParametersExample

login	0.001s	Method arguments: "someUser", "s3cret" About to login with user someUser and password s3cret
-------	--------	--

Reports Location

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```

    sandbox
      src/main/java
      src/main/resources
      src/test/java
      src/test/resources
      JRE System Library [J2SE-1.5]
      Maven Dependencies
      src
      target
        surefire
        surefire-reports
      test-output
        Default suite
        junitreports
      old
        bullet_point.png
        collapsesall.gif
        emailable-report.html
        failed.png
        index.html
        jquery-1.7.1.min.js
        navigator-bullet.png
        passed.png
        skipped.png
        testng-failed.xml
        testng-reports.css
        testng-reports.js
        testng-results.xml
        testng.css
      pom.xml
      testng.xml
  
```

Maven Execution Reports

Eclipse Execution Reports

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Default Reports

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Test results					
1 suite, 1 failed test					
All suites	<input type="button" value="New"/>				
Command line suite <table border="1"> <tr> <td>Info</td> <td> <input checked="" type="checkbox"/> com.TestNGExample testSubtract java.lang.AssertionError: expected [5] but found [0] at com.TestNGExample.testSubtract(TestNGExample.java:24) ... Removed 39 stack frames </td> </tr> <tr> <td>Results</td> <td> 2 methods, 1 failed, 1 passed Failed methods (hide) <input checked="" type="checkbox"/> testSubtract Passed methods (hide) <input checked="" type="checkbox"/> testAdd </td> </tr> </table>		Info	<input checked="" type="checkbox"/> com.TestNGExample testSubtract java.lang.AssertionError: expected [5] but found [0] at com.TestNGExample.testSubtract(TestNGExample.java:24) ... Removed 39 stack frames	Results	2 methods, 1 failed, 1 passed Failed methods (hide) <input checked="" type="checkbox"/> testSubtract Passed methods (hide) <input checked="" type="checkbox"/> testAdd
Info	<input checked="" type="checkbox"/> com.TestNGExample testSubtract java.lang.AssertionError: expected [5] but found [0] at com.TestNGExample.testSubtract(TestNGExample.java:24) ... Removed 39 stack frames				
Results	2 methods, 1 failed, 1 passed Failed methods (hide) <input checked="" type="checkbox"/> testSubtract Passed methods (hide) <input checked="" type="checkbox"/> testAdd				

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Default Reports

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Command line test

Tests passed/Failed/Skipped:	1/1/0
Started on:	Sun Jul 14 17:29:01 IDT 2013
Total time:	0 seconds (29 ms)
Included groups:	
Excluded groups:	

(Hover the method name to see the test class name)

FAILED TESTS			
Test method	Exception	Time (seconds)	Instance
testSubtract Test class: com.TestNGExample	java.lang.AssertionError: expected [5] but found [0] at com.TestNGExample.testSubtract(TestNGExample.java:24) ... Removed 39 stack frames	0	com.TestNGExample@85ed60
Click to show all stack frames			

PASSED TESTS			
Test method	Exception	Time (seconds)	Instance
testAdd Test class: com.TestNGExample		0	com.TestNGExample@85ed60

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Adding Messages

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- All you need to do is to call static methods of the Reporter class

```

public class TestNGExample {
    private Calculator calc;

    @BeforeMethod
    public void setUp() {
        calc = new Calculator();
    }

    @Test
    public void testAdd() {
        Reporter.log("About to test the add function");
        int result = calc.add(5, 5);
        Assert.assertEquals(result, 10);
    }

    @Test
    public void testSubtract() {
        Reporter.log("About to test the subtract function");
        int result = calc.sub(10, 5);
        Assert.assertEquals(result, 5);
    }
}
```

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ReportNG

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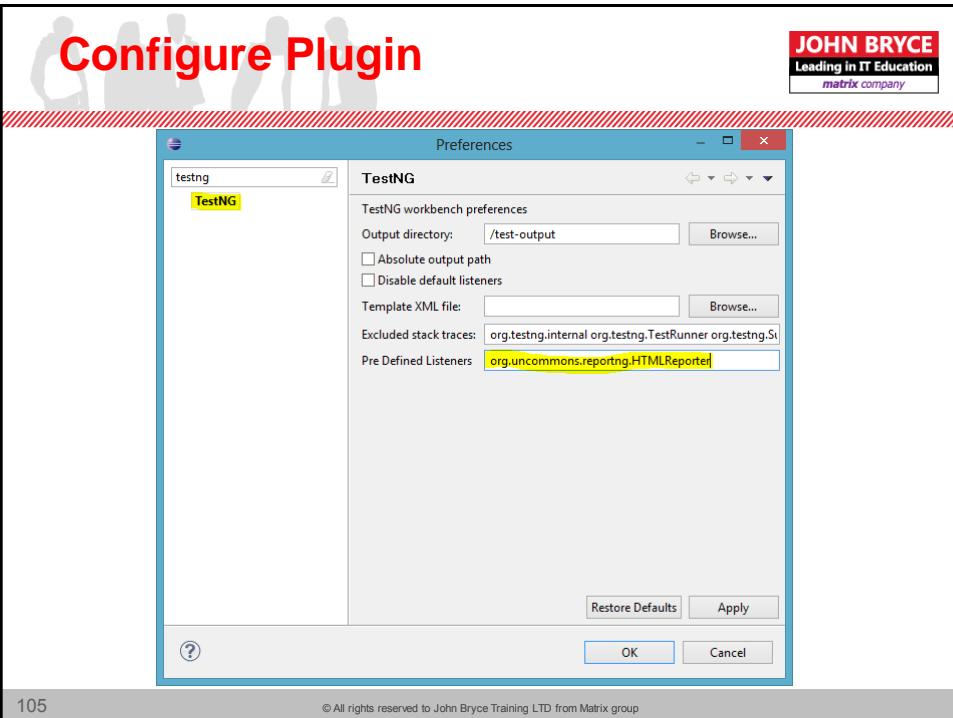
- Plugin for TestNG
- Replacement for the default TestNG HTML report
- Produces a color coded view of the results
- Includes also a better JUnit report
- Open source
- See [example](#)

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Install from Eclipse Marketplace

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Logging Infrastructure

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1. Log4j 2.x version

Log4j API that can be used to create logging infra structure in your tests.

Why logging is important in any application?

Logging is very important to any application. It helps us in quick debugging, easy maintenance by collecting information about the execution.

1.1. Advantages of Log4j

- Log4j allows you to have a very good logging infrastructure with minimal efforts.
- Allows categorizing logs at different logging levels (Trace, Debug, Info, Warn, Error and Fatal).
- Provides control to format the output of the logs.
- It has multiple Appenders styles, which allows to direct logs to different outputs styles like a file, console or a database.
- Logging can be set at runtime using configuration files.

1.2. Log4j consists of three main components

- **Logger:** This is a class, which helps you log information at different logging levels.
- **Appenders:** Appenders are objects, which help Logger objects write logs to different outputs. Appenders can specify a file, console or a database as the output location.
- **Layouts:** Layout class helps us define how the log information should appear in the outputs.



2. System property

Log4j will check the system property “**log4j.configurationFile**” for the configuration file path.

In case no system property is defined the configuration order takes below precedence:

- Property **ConfigurationFactory** will look for log4j2-test.properties in the classpath.
- YAML ConfigurationFactory will look for log4j2-test.yaml or log4j2-test.yml in the classpath.
- JSON ConfigurationFactory will look for log4j2-test.json or log4j2-test.json in the classpath.
- XML ConfigurationFactory will look for log4j2-test.xml in the classpath.
- Property ConfigurationFactory will look for log4j2.properties on the classpath.
- YAML ConfigurationFactory will look for log4j2.yml or log4j2.yaml in the classpath.
- JSON ConfigurationFactory will look for log4j2.json or log4j2.json in the classpath.
- XML ConfigurationFactory will look for log4j2.xml in the classpath.
- If no configuration file was provided, the DefaultConfiguration takes place and that would lead you for set of default behaviors:
 - Root logger will be used.
 - Root logger level will be set to ERROR.
 - Root logger will propagate logging messages into console.
 - PatternLayout is set to be %d{HH:mm:ss.SSS}[%t] %-5level%logger{36}-%msg%n.

1.1. Log levels

Log Level	When It Should Be Used
OFF	When no events will be logged
FATAL	When a severe error will prevent the application from continuing
ERROR	When an error in the application, possibly recoverable
WARN	When an event that might possible lead to an error
INFO	When an event for informational purposes
DEBUG	When a general debugging event required
TRACE	When a fine grained debug message, typically capturing the flow through the application.
ALL	When all events should be logged



3. Adding Log4j Jar to Library

3.1. Download sites

- <https://logging.apache.org/log4j/2.0/download.html>

Download Apache Log4j 2

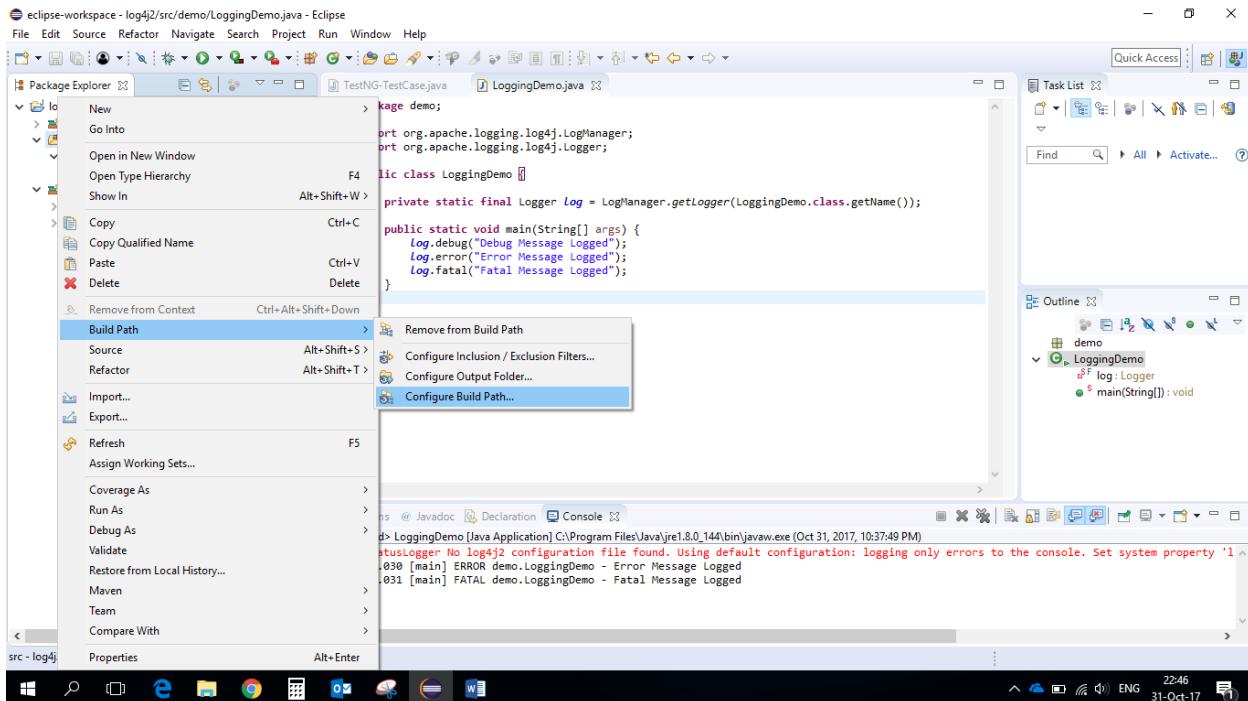
Apache Log4j 2 is distributed under the [Apache License, version 2.0](#).

The link in the Mirrors column should display a list of available mirrors with a default selection based on your inferred location. If you do not see that page, try a different browser. The checksum and signature are links to the originals on the main distribution server.

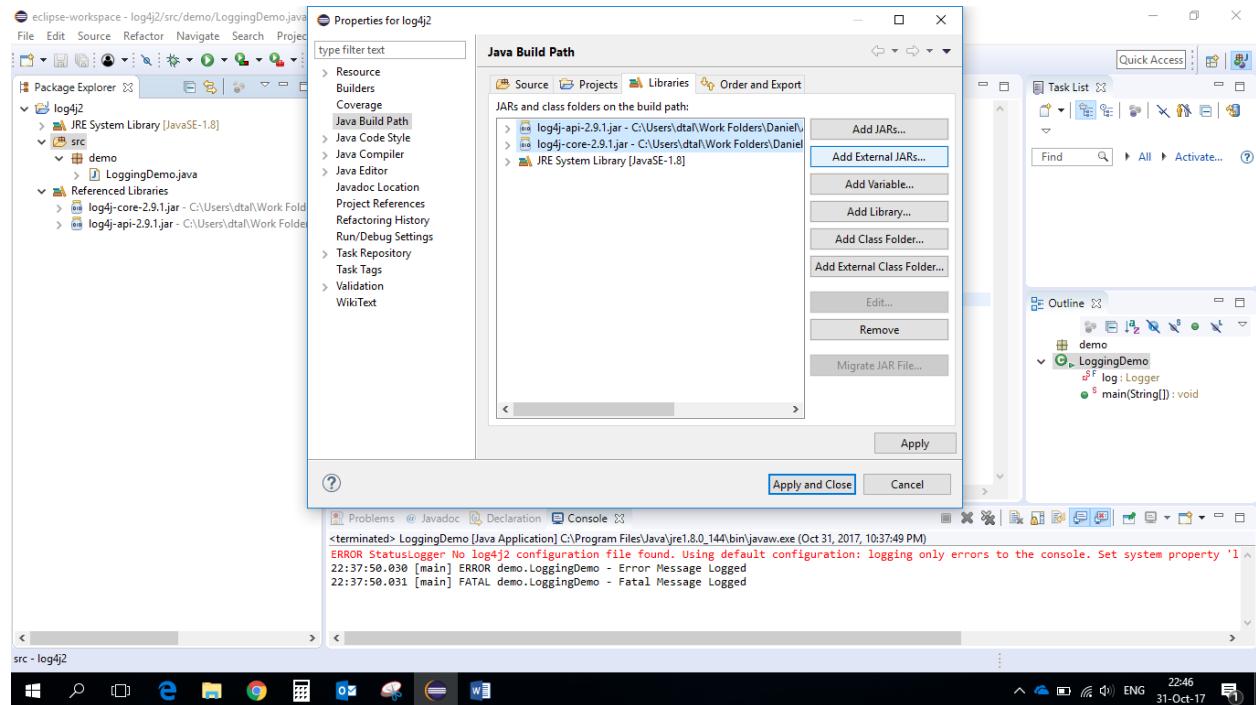
Distribution	Mirrors	Checksum	Signature
Apache Log4j 2 binary (tar.gz)	apache-log4j-2.9.1-bin.tar.gz	apache-log4j-2.9.1-bin.tar.gz.md5	apache-log4j-2.9.1-bin.tar.gz.asc
Apache Log4j 2 binary (zip)	apache-log4j-2.9.1-bin.zip	apache-log4j-2.9.1-bin.zip.md5	apache-log4j-2.9.1-bin.zip.asc
Apache Log4j 2 source (tar.gz)	apache-log4j-2.9.1-src.tar.gz	apache-log4j-2.9.1-src.tar.gz.md5	apache-log4j-2.9.1-src.tar.gz.asc
Apache Log4j 2 source (zip)	apache-log4j-2.9.1-src.zip	apache-log4j-2.9.1-src.zip.md5	apache-log4j-2.9.1-src.zip.asc

3.2. Steps to follow:

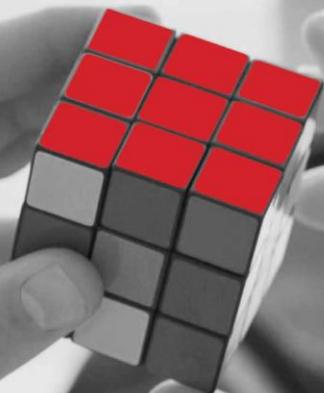
Right click the project name and navigate to Build Path and select “Configure Build Path”.



Click on Add External JARs and navigate to the folder where you have kept the Log4j jar files.



Web Driver



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Agenda

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- WebDriver
- WebDriver Advanced
- Training



Implementation

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- WebDriver makes direct calls to the browser using each browser's native support for automation
- The features supported are depended on the browser that is used
- Some of the drivers available:
 - Firefox driver
 - Internet Explorer driver
 - Chrome driver
 - Safari driver
 - Opera driver
 - iPhone driver
 - Android driver

Supported Browsers

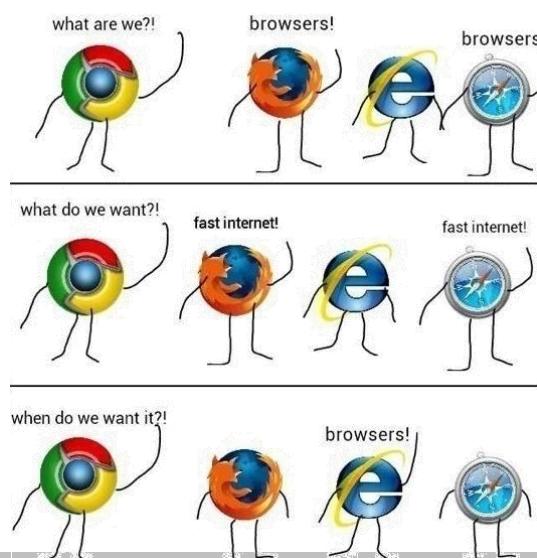
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- Version 2.40.0

Browser	Version
Firefox	27, 26, 24, 17
Internet Explorer	6, 7, 8, 9 and 10 are supported. 11 is currently awaiting a fix
Safari	5.1+ (Only Mac?)
Opera	12.x and older
Chrome	Google Chrome 12.0.7+
HtmlUnit	2.9
Android	2.3+
iOS	3+ for phones (devices & emulators) and 3.2+ for tablets (devices & emulators)

Supported Browsers

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Supported Programming Languages

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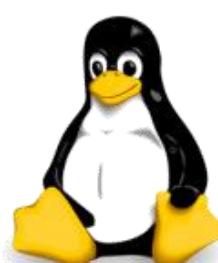
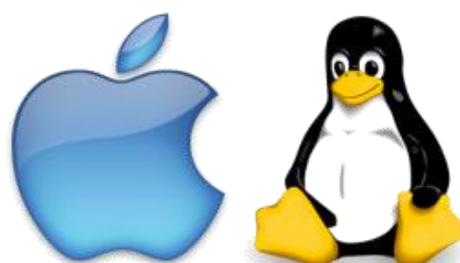


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Supported Operating Systems

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Setting Up in Java

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- In Maven we add the selenium-java artifact to our project
- All the Selenium bindings and dependencies would be downloaded

```
<project>
    <groupId>il.co.topq</groupId>
    <artifactId>sugarcrm-tests</artifactId>
    <version>0.0.1-SNAPSHOT</version>
    <dependencies>
        <dependency>
            <groupId>org.testng</groupId>
            <artifactId>testng</artifactId>
            <version>6.1.1</version>
            <scope>test</scope>
        </dependency>
        <dependency>
            <groupId>org.seleniumhq.selenium</groupId>
            <artifactId>selenium-java</artifactId>
            <version>2.42.0</version>
        </dependency>
    </dependencies>
</project>
```

115 > mvn clean install

WebDriver API

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- WebDriver API is object oriented – Unlike Selenium 1
- First we locate the web element using one of the selectors
- Then we can perform operation on the element
- Web element represents an HTML element.

```
<!DOCTYPE html>
<html>
    <body>
        <div id="div1">
            <p id="p1">This is my paragraph</p>
            <button id="btn1"/>
        </div>
    </body>
</html>
```

```
WebElement divElement = driver.findElement(By.id("div1"));
WebElement btnElement = divElement.findElement(By.id("btn1"));
btnElement.click();
```

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WebDriver API

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WebDriver API

- **WebDriver**
 - `get(String) : void`
 - `getCurrentUrl() : String`
 - `getTitle() : String`
 - `findElements(By) : List<WebElement>`
 - `findElement(By) : WebElement`
 - `getPageSource() : String`
 - `close() : void`
 - `quit() : void`
 - `getWindowHandles() : Set<String>`
 - `getWindowHandle() : String`
 - `switchTo() : TargetLocator`
 - `navigate() : Navigation`
 - `manage() : Options`

WebElement API

- **WebElement**
 - `click() : void`
 - `submit() : void`
 - `sendKeys(CharSequence...) : void`
 - `clear() : void`
 - `getTagName() : String`
 - `getAttribute(String) : String`
 - `isSelected() : boolean`
 - `isEnabled() : boolean`
 - `getText() : String`
 - `findElements(By) : List<WebElement>`
 - `findElement(By) : WebElement`
 - `isDisplayed() : boolean`
 - `getLocation() : Point`
 - `getSize() : Dimension`
 - `getCssValue(String) : String`

Selectors

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- Selectors are used to identify web elements

```
WebElement divElement = driver.findElement(By.id("div1"));
```

- Available selectors
 - ID
 - NAME
 - CLASS
 - CSS
 - XPATH
 - PARTIAL LINK
 - LINK
 - TAG NAME

NOTE: We will learn more on selectors later on

Moving between iframes and Windows

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- Some web applications have many frames or multiple windows
- WebDriver supports moving between named windows using the “switchTo” method
- We can select windows by the window name or handle

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

- To get all window handles
- We can select frame name, id, index or web element

```
driver.getWindowHandles();
```

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

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Training Login Tests with WebDriver

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- **Testing environment**
 - Sugarcrm-test project
- **Target**
 - Simple WebDriver Usage
- **Exercise**
 - Import the sugarcrm-test project from the exe2 folder
 - Open the LoginTests class
 - Complete the required operations in the testLogin method in order for the test to perform login to the application
 - User: admin, password: admin

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Explicit and Implicit Waits

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- **Explicit Waits** - wait for a certain condition to occur before proceeding further in the code
- Use WebDriver wait

```
wait = new WebDriverWait(driver, 60);
wait.until(ExpectedConditions.visibilityOfElementLocated(By.id("myId")));
wait.until(ExpectedConditions.elementToBeClickable(By.id("myId")));
wait.until(ExpectedConditions.titleContains("my title"));
wait.until(ExpectedConditions.not(ExpectedConditions.titleContains("my title")));
wait.until(ExpectedConditions.alertIsPresent());
```

DISCUSSION: Why not to use Thread.sleep ?

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Explicit and Implicit Waits

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- **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
- To configure implicit waits:

```
WebDriver driver = new FirefoxDriver();
driver.manage().timeouts().implicitlyWait(30, TimeUnit.SECONDS);
driver.get("http://www.google.com");
```

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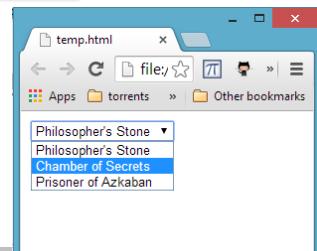
Drop Down Lists

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- WebDriver has a special class for drop down lists

```
<select name="HarryPotter" id="HarryPotter">
    <option label="Philosopher's Stone" value="Stone">Philosopher's Stone</option>
    <option label="Chamber of Secrets" value="Secrets">Chamber of Secrets</option>
    <option label="Prisoner of Azkaban" value="Azkaban">Prisoner of Azkaban</option>
</select>

WebElement ddbox = driver.findElement(By.id("HarryPotter"));
Select harrySelect = new Select(ddbox);
harrySelect.selectByValue("Secrets");
```



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Advanced User Interactions

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- Advanced User Interactions API
- The Actions class allows you to build a chain of actions and perform them.
- Supports native and synthetic events

```
Actions builder = new Actions(driver);
builder.keyDown(Keys.CONTROL)
.click(someElement)
.click(someOtherElement)
.keyUp(Keys.CONTROL);
builder.perform();3
```

NOTE: Can you figure what this code do?

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Advanced User Interactions

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- keyDown(Keys) : Actions
- keyDown(WebElement, Keys) : Actions
- keyUp(Keys) : Actions
- keyUp(WebElement, Keys) : Actions
- sendKeys(CharSequence...) : Actions
- sendKeys(WebElement, CharSequence...) : Actions
- clickAndHold(WebElement) : Actions
- clickAndHold() : Actions
- release(WebElement) : Actions
- release() : Actions
- click(WebElement) : Actions
- click() : Actions
- doubleClick(WebElement) : Actions
- doubleClick() : Actions
- moveToElement(WebElement) : Actions
- moveToElement(WebElement, int, int) : Actions
- moveByOffset(int, int) : Actions
- contextClick(WebElement) : Actions
- contextClick() : Actions
- dragAndDrop(WebElement, WebElement) : Actions
- dragAndDropBy(WebElement, int, int) : Actions
- ✓ pause(long) : Actions
- build() : Action
- perform() : void

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Advanced User Interactions

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- Advanced user interactions requires native events support

platform	IE6	IE7	IE8	IE9	FF3.6	FF10+	Chrome stable	Chrome beta	Chrome dev	Opera	Android	iOS
Windows XP	Y	Y	Y	n/a	Y	Y	Y	Y	Y	?	Y [1]	n/a
Windows 7	n/a	n/a	Y	Y	Y	Y	Y	Y	Y	?	Y [1]	n/a
Linux (Ubuntu)	n/a	n/a	n/a	n/a	Y [2]	Y [2]	Y	Y	Y	?	Y [1]	n/a
Mac OSX	n/a	n/a	n/a	n/a	N	N	Y	Y	Y	?	Y [1]	N
Mobile Device	n/a	n/a	n/a	n/a	n/a	?	n/a	n/a	n/a	?	Y	N

[1] (1, 2, 3, 4) Using the emulator

[2] (1, 2) With explicitly enabling native events

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Stale Element Reference Exception

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▪ What is WebElement?

- A WebElement is a reference to an element in the DOM. A StaleElementException is thrown when the element you were interacting with is destroyed and then recreated
- Common in one of the following cases:
 - The element has been deleted entirely. Maybe by some JS library
 - The page was refreshed
 - The user navigated away from the page
 - Common when using PageFactory

▪ What to do?

- In most cases you would just need to search for it again.

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Adding Screenshots

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- The **TakesScreenshot** interface captures the screenshot of the entire page, current window, visible portion of the page, or of the complete desktop window in their respective order as supported by the browser.

It does not provide a way to capture an image of the specific element.

```
WebDriver driver = new FirefoxDriver(); driver.get("http://www.google.com/");  
File scrFile = ((TakesScreenshot)driver).getScreenshotAs(OutputType.FILE);  
FileUtils.copyFile(scrFile, new File("c:\\tmp\\screenshot.png"));
```

QUESTION: Can you think on a way to capture the image of an element?

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Training Test Create Lead

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- **Testing environment**
 - sugarcrm-test project from the exe3 folder
- **Target**
 - Advanced WebDriver Usage
- **Exercise**
 - Import the sugarcrm-test project from the exe3 folder
 - Open the LeadsTests class
 - Complete the required operations in the testCreateLead method
 - Update the String URL class member
 - The test should:

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Training Test Create Lead

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- Perform login (Already implemented)
- Click on the **Sales** menu item
- Click on the **Leads** sub menu item
- Click on the **Create Lead** action
- Enter text to the **first** and **last name** text boxes (Can you make it unique?)
- Select **Salutation** (Mr. Ms. Etc.)
- Click on the **Copy address from left** check box
- Enter the last name you have entered to the basic search text box (At the top right)
- Assert that your lead is found in the leads view table

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CSS Selector



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Agenda

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- CSS Introduction
- CSS Selectors
- Training



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What is CSS?

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- **CSS** stands for Cascading Style Sheets
- Styles define how to display HTML elements
- Styles were added to HTML 4.0 to solve a problem
- External Style Sheets can save a lot of work
- External Style Sheets are stored in **CSS** files

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CSS Example

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```
<html>
  <head>
    <style>
      .center
      {
        text-align:center;color:red
      }
    </style>
  </head>

  <body>
    <h1 class="center">Center-aligned
    heading</h1>
    <p class="center">Center-aligned
    paragraph.</p>
  </body>
</html>
```

Center-aligned heading
Center-aligned paragraph.

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CSS Selectors

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- **What are CSS selectors?**

- In CSS, selectors are patterns used to select the element(s) you want to style

locator:	IE6		IE7		IE8		IE
	CSS	XPT	CSS	XPT	CSS	XPT	CSS
Relative ID	0.09	17	0.08	15	0.10	17	0.09
Relative Class	12	16	13	15	13	17	22
Relative Content	13	17	14	17	16	18	27
Relative Name	0.1	16	0.11	15	0.11	17	0.09

- **Why use CSS ?**

- They're faster
 - They're more readable
 - 3. CSS is jQuery's locating strategy
 - 4. No one else uses XPATH anyways

- **Things that XPATH can do and CSS can't**

- Get an element's parent, eg: //div[@class='bob']/..
 - Refer to element value

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CSS Selectors

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CSS	EXPLANATION
div	Find elements of a particular type
#bob	Find elements with a specific ID
div#bob	Find an elements of a particular type with a specific ID
.bob	Find elements with a specific class
div.bob	Find elements of a particular type with a specific class
div a	Find descendant elements of a particular type
div > a	Find direct child elements of a particular type
a[title]	Find elements of a particular type that have a specific attribute
a[title="bob"]	Find elements of a particular type that have an attribute of a specific value
a[title*="bob"]	Find elements of a particular type that have an attribute that contains a specific value
a[title^="bob"]	Find elements of a particular type that have an attribute that starts with a specific value

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Examples

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- book
 - #author1
 - author#author1
 - .weak
 - book.weak
 - bookstore comment
 - book > comment
-
- ```
<bookstore>
 <book class='strong' category="CHILDREN">
 <title lang="en">Harry Potter</title>
 <author id="author1">J. K. Rowling</author>
 <year>2005</year>
 <price>29.99</price>
 </book>
 <book class='weak' category="WEB">
 <title lang="en">Learning XML</title>
 <author id="author2">Erik T. Ray</author>
 <year>2003</year>
 <comment>Great Book!</comment>
 <price>39.95</price>
 </book>
</bookstore>
```

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## Examples

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- book[category\*="HILD"]
- title[lang]
- title[lang="en"]
- book[category^="W"]

```
<bookstore>
 <book class='strong' category="CHILDREN">
 <title lang="en">Harry Potter</title>
 <author id="author1">J. K. Rowling</author>
 <year>2005</year>
 <price>29.99</price>
 </book>
 <book class='weak' category="WEB">
 <title lang="fre">Learning XML</title>
 <author id="author2">Erik T. Ray</author>
 <year>2003</year>
 <comment>Great Book!</comment>
 <price>39.95</price>
 </book>
</bookstore>
```

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## Page Objects



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- Motivation
- Page object to the rescue
- Page Factory
- Training



## First Approach

```
@Test
public void CreateTodoItems() {
 driver.findElement(By.id("username")).sendKeys("itai.agmon@top-q.co.il");
 driver.findElement(By.id("password")).sendKeys("s3cret!");
 driver.findElement(By.cssSelector("div#signin_button > input")).click();

 wait.until(ExpectedConditions.visibilityOfElementLocated(By.cssSelector("a[data-behavior='new_project_bounce']")));
 driver.findElement(By.cssSelector("a[data-behavior='new_project_bounce']")).click();
 wait.until(ExpectedConditions.visibilityOfElementLocated(By.id("project_name")));
 driver.findElement(By.id("project_name")).sendKeys("My Project " + System.currentTimeMillis());
 driver.findElement(By.id("project_description")).sendKeys("project_description");
 driver.findElement(By.name("commit")).click();

 wait.until(ExpectedConditions.visibilityOfElementLocated(By.xpath("//a[@data-tool-name='todolists']")));
 driver.findElement(By.cssSelector("a[data-tool-name='todolists']")).click();
 driver.findElement(By.id("todolist_name")).sendKeys("My TODO List");
 driver.findElement(By.cssSelector("input[value='Save and start adding todos']")).click();
}
```

**DISCUSSION:** What are the problems with this approach?

## Second Approach – Separate to Methods

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```
@Test
public void CreateTodoItems(){
 login("some.user@gmail.com", "s3cret");
 createNewProject("My Project Name", "My project description");
 createNewTodoList("TODO list name");
 addItem("My item title");
 assertItem("My item title");
}

private void login(String email, String password) {
 driver.findElement(By.id("username")).sendKeys(email);
 driver.findElement(By.id("password")).sendKeys(password);
 driver.findElement(By.cssSelector("div#signin_button > input")).click();
}
```

- Ok.. That looks a lot better.
- But where do I put all this methods? I want to use them in many test cases.
- The locators are exposed to the test layer ☺
- Hmm... How about the abstraction level? Is it good enough for negative tests?

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## Page Object Design Pattern

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- Each page or part of the page in the AUT is modeled as a class.
- Page objects are facing in two directions simultaneously
  - Toward the developer – They represent services offered by the page
  - Facing away from the developer – Deep knowledge of the HTML structure
- Each page class exposes three kind of services:
  - Functional services (click, type text)
  - Assertion services
  - Navigation services

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# Page Object - Example

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```
public class LoginPage extends AbstractPageObject {

 public LoginPage(WebDriver driver) {
 super(driver);
 }

 public void typeToEmailTb(String email) {
 driver.findElement(By.id("username")).sendKeys(email);
 }

 public void typeToPasswordTb(String password) {
 driver.findElement(By.id("password")).sendKeys(password);
 }

 public ProjectsHomePage clickOnSigninBtn() {
 driver.findElement(By.cssSelector("div#signin_button > input")).click();
 return new ProjectsHomePage(driver);
 }

 public void assertErrorMessage(String messageText) {
 driver.findElement(By.xpath("//h2[contains(.,'" + messageText +
 "')]]"));
 }
}
```

Functional

Functional

Navigation

Assertion

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# Page Object - Example

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```
@Test
public void testLogin() {
 LoginPage.loginPage.typeToEmailTb("my.user@top-q.co.il");
 LoginPage.loginPage.typeToPasswordTb("s3cret");
 ProjectsHomePage projectHomePage = LoginPage.loginPage.clickOnSigninBtn();
 projectHomePage.clickOnNewProjectBtn();
}
```

**DISCUSSION:** What are the page object approach benefits?

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## Page Object Principles

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- The public methods represent the services that the page offers.
- Try not to expose the internals of the page
- Generally don't make assertions
- Methods return other [PageObjects](#)
- Need not represent an entire page
- Be consistent!

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## Page Object Benefits

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- Easy navigation – Always in sync with the actual application
- Code completion allows fast test implementation.
- Tests visibility is great.
- Easy to know where to add or consume services
- Tests are robust – Less prone to application changes.

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- **Testing environment**
  - basecamp-auto-exe2 project
- **Target**
  - Exercise the page object pattern
- **Exercise**
  - Import the project to Eclipse
  - Set the user and password
  - Open the **TestBasecampWithPageObjects** class
  - Make the test work by implementing the following:
    - ProjectsHomePage
    - ProjectPage
  - For advanced users, also implement the  
TodoListModule



- In order to support the PageObject pattern, WebDriver's support library contains a factory class
- Static init of the Page and init of all of the page elements

## Page Factory- Usage

- Each element of the page that is taking part in the test should be modeled as a member in the page object class
- The type of the member is WebElement
- We use the @FindBy annotation to describe the element selector

```
@FindBy(id = "username")
private WebElement user;
```

- We use the PageFactory class to create an instance of the element.

```
PageFactory.initElements(driver, LoginPage.class);
```

## Page Factory- Example

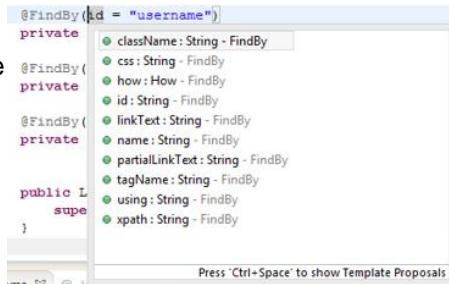
```
public class LoginPage extends AbstractPageObject{
 @FindBy(id = "username")
 private WebElement emailTb;
 @FindBy(id = "password")
 private WebElement passwordTb;
 @FindBy(css = "div#signin_button > input")
 private WebElement signinBtn;

 public LoginPage(WebDriver driver){
 super(driver);
 }
 public void typeToEmailTb(String email){
 emailTb.sendKeys(email);
 }
 public void typeToPasswordTb(String password){
 passwordTb.sendKeys(password);
 }
 public ProjectsHomePage clickOnSigninBtn(){
 signinBtn.click();
 return PageFactory.initElements(driver, ProjectsHomePage.class);
 }
}
```

## @FindBy Annotation

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- As previously described, the **FindBy** is used for specifying the element selector.
- We can use the same selectors that were used in the dynamic approach



```
@FindBy(how = How.ID ,using = "username")
private WebElement user;
```

- The annotation supports an alternative syntax

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## @FindBy Annotation

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- If the element locator is the element id or name, we don't even have to use the annotation.  
The member name should be element id or name

```
private WebElement username;
```

**NOTE:** This is not yet working in C#

- To find element within element, we can use the `@FindBys` annotation.

```
@FindBys({@FindBy(tagName = "div"),@FindBy(tagName = "button") })
private WebElement buttonInDiv;
```

- To cache the element use the `@CacheLookup` annotation

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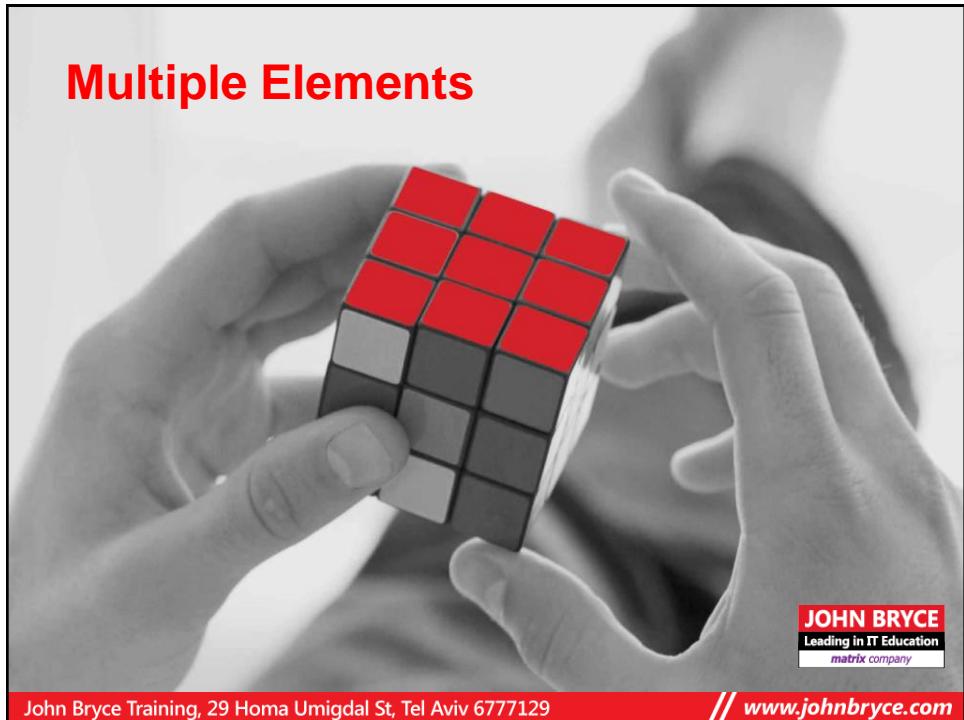
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## Multiple Elements

A black and white photograph showing a person's hands holding a Rubik's cube. The cube has red faces on top and bottom, and grey faces on the sides. The hands are positioned as if solving the puzzle.

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## Agenda

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- When To Use
- Retrieving a List of Elements
- Iterating List Of Elements
- Handling Few Elements as an Object
  - The “TABLE” Element
  - The “SELECT” Element
  - And More...



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## When To Use

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- We may want to retrieve a group of element to perform a task
  - Verify a property of all elements (E.g. Buttons font, Text fields size etc.)
  - Perform an action or get data from an “object” which is built from few elements
    - List
    - Table

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## Retrieving a List of Elements

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- Import

```
import java.util.List;
```

- Get elements

```
List<WebElement> allLinks = driver.findElements(By.tagName("a"));
```

- Accessing a list item

```
String firstLink = allLinks.get(0).getText();
```

- Getting the size of a Java list

```
int numOfLinks = allLinks.size();
```



## Iterating a Java List

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- Iterating through Java list

```
for(int i = 0; i <= numOfLinks; i++){
 System.out.println(allLinks.get(i).getText());
}
```

# Handling Few Elements as an Object

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- Sometimes we would like to treat few elements as one objects, in order to perform the required action
  - Get data from a TABLE
  - Build a flexible function to handle a custom menu
  - Verify items in a combo box
  - And more...

# TABLE Element

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- TABLE consists mainly of 3 tags
  - TABLE
  - TR (row)
  - TD (cell)

```
<table style="width:100%">
 <tr>
 <td>Jill</td>
 <td>Smith</td>
 <td>50</td>
 </tr>
 <tr>
 <td>Eve</td>
 <td>Jackson</td>
 <td>94</td>
 </tr>
</table>
```

# TABLE Element

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- Get number of rows

```
WebElement table = driver.findElement(By.id("myTable"));
List<WebElement> allRows = table.findElements(By.tagName("tr"));
int rowsNum = allRows.size();
```

- Iterating rows and cells

```
for(int i = 0; i < rowsNum; i++){
 List<WebElement> allCells = table.findElements(By.tagName("td"));
 int cellsNum = allCells.size();
 for(int j = 0; j < cellsNum; j++){
 System.out.println(allCells.get(j).getText());
 }
}
```

# SELECT Element

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- SELECT consists mainly of 2 tags
  - SELECT
  - OPTION

```
<select>
 <option value="volvo">Volvo</option>
 <option value="saab">Saab</option>
 <option value="mercedes">Mercedes</option>
 <option value="audi">Audi</option>
</select>
```

# SELECT Element

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- For SELECT there is already a solution

- Import

```
import org.openqa.selenium.support.ui.Select;
```

- Initiate object

```
Select carSelect = new Select(driver.findElement(By.xpath("//select")));
```

- Select list item

```
carSelect.selectByValue("opel");
carSelect.selectByVisibleText("Opel");
carSelect.selectByIndex(0);
```

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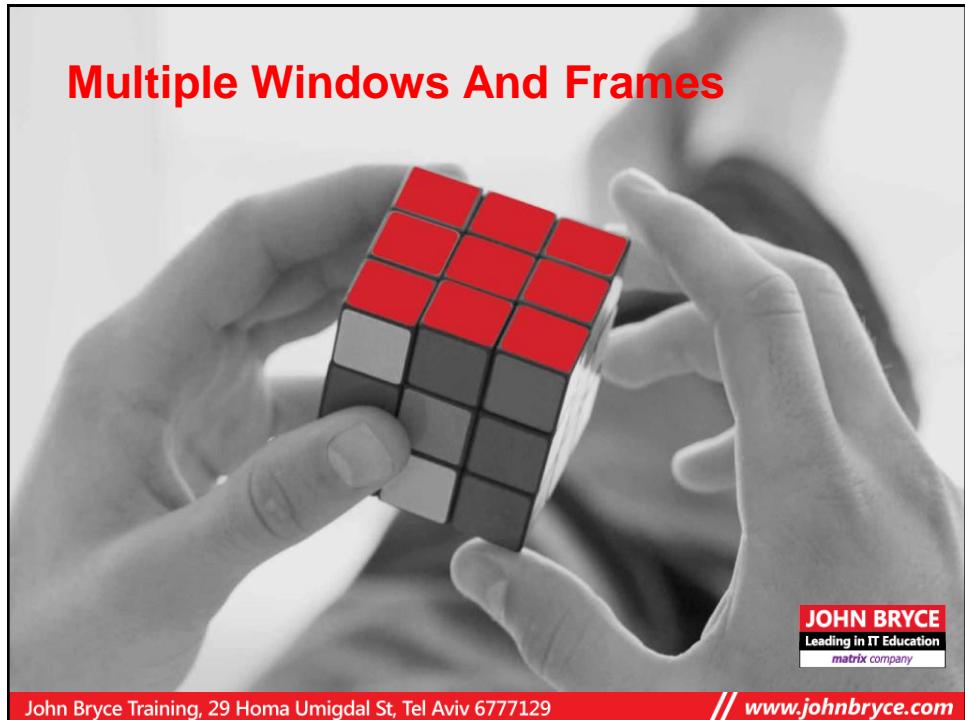
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## Multiple Windows And Frames



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- Multiple Windows
- Multiple Frames



## Multiple Windows

- Selenium WebDriver can connect to a single window at a given moment, so when an action in a page opens an additional page, we need to explicitly move between the windows in order to perform actions on its elements
- Import

```
import java.util.Iterator;
import java.util.Set;
```

- Switch to new window

```
// Get all windows handles
Set<String> windowsIds = driver.getWindowHandles();
// Get number of windows
int numOfWindows = windowsIds.size();
Iterator<String> iter = windowsIds.iterator();
// Get main window handle
String goToWindowId = iter.next();
// Move to new window
goToWindowId = iter.next();
driver.switchTo().window(goToWindowId);
```



## Multiple Windows

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- Switch back to main window
  - In order to switch back to main window you need to get the windows handles again and use only one “Iter.next(“;

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## Multiple Frames

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- When we want to access elements in a frame in a page, we must first move the driver control to the frame
- We can switch to frame by 3 ways
  - By index

```
driver.switchTo().frame(1);
```

  - By name

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

  - By WebElement

```
WebElement frameElement = driver.findElement(By.cssSelector("frameLocator"));
driver.switchTo().frame(frameElement);
```

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## Multiple Frames

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- Switch back to main window

```
driver.switchTo().defaultContent();
```

- Or

```
driver.switchTo().parentFrame();
```

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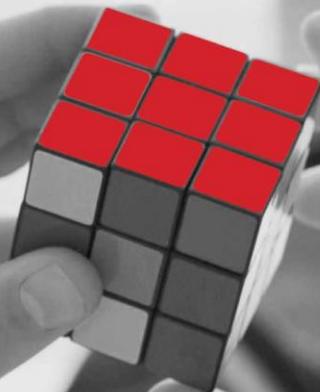
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## Selenium grid



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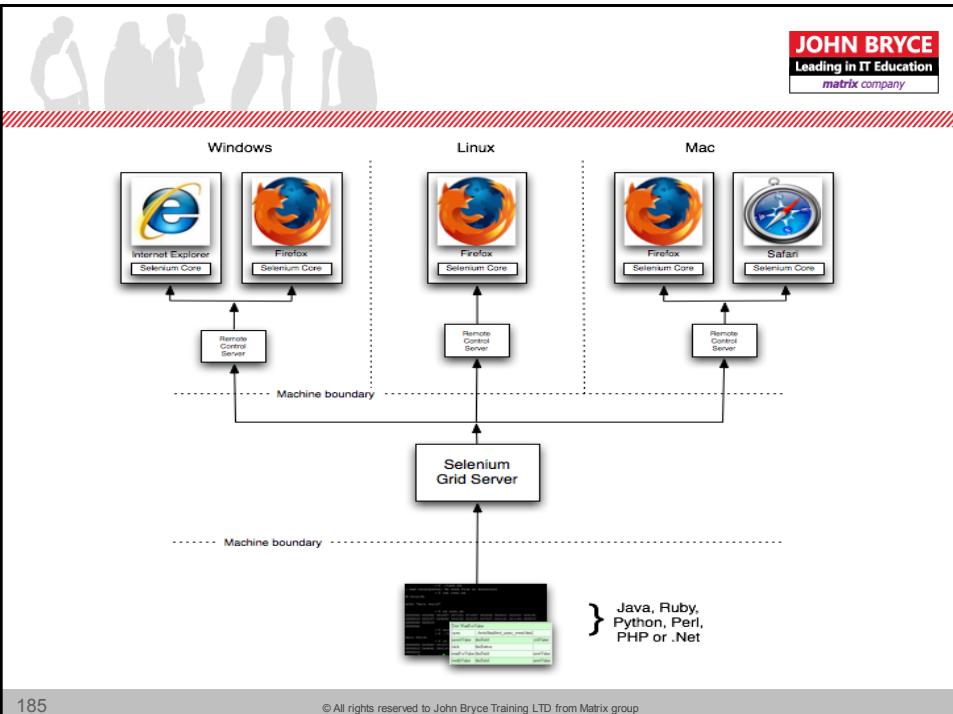


- What is Selenium Grid?
- When to use it?
- How to use?
- Optional Training



**Selenium-Grid** allows you run your tests on **different machines** against **different browsers** in **parallel**.

- Scale by distributing tests on several machines
- Manage multiple environments from a central point, making it easy to run the tests against a vast combination of browsers / OS.
- Minimize the maintenance time for the grid by allowing you to implement custom hooks to leverage virtual infrastructure for instance.



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## When to Use It?

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- To support complex test environment matrix

	Windows	Linux	Mac
Safari	Yes	No	Yes
Explorer 8	Yes	No	No
Explorer 9	Yes	No	No
Firefox 34	Yes	Yes	Yes
Firefox 35	Yes	Yes	Yes
Chrome 40	Yes	Yes	Yes

- To reduce execution time

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## Running the Hub

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- Download the server from:  
<http://selenium-release.storage.googleapis.com/index.html>
- Execute the hub (you will need Java)  

```
> java -jar selenium-server-standalone-2.44.0.jar -role hub
```
- The hub will automatically start-up using port **4444** by default. To change the default port, you can add the optional parameter **-port** when you run the command

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## Running the Node

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- The Grid node is actually in the same Jar as the server.  

```
> java -jar selenium-server-standalone-2.44.0.jar -role node -hub
http://localhost:4444/grid/register
```
- By default, this starts 11 browsers : **5 Firefox, 5 Chrome, 1 Internet Explorer**. The maximum number of **concurrent tests is set to 5** by default.

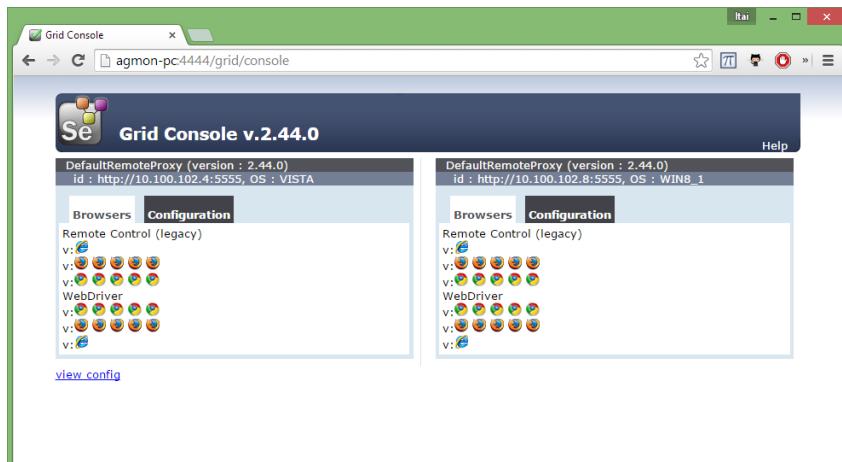
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## Monitoring the Hub

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- <http://localhost:4444/grid/console>



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## Using Grid in Our Tests

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```
private WebDriver driver;

@BeforeMethod
public void setUp() throws MalformedURLException{
 DesiredCapabilities capability = DesiredCapabilities.firefox();
 capability.setPlatform(Platform.WINDOWS);
 capability.setVersion("7");
 driver = new RemoteWebDriver(new URL("http://localhost:4444/wd/hub"),
 capability);
 driver.get("http://www.google.com");
}

@Test
public void testGoogle(){
 driver.findElement(By.name("q")).sendKeys("Cheese");
 driver.findElement(By.name("btnK")).click();
}

@AfterMethod
public void tearDown() {
 if (driver != null){
 driver.quit();
 }
}
```

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# Configuring the Node – Command Line

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- The node can be configured in 2 different ways; one is by specifying command line parameters, the other is by specifying a json file.
- Configuring max instances
  - > -browser browserName=firefox,version=3.6,maxInstances=5,platform=LINUX
- Configuring browsers binaries
  - > -browser browserName=firefox,version=3.6,firefox\_binary=/home/myhomedir/firefox36/firefox,maxInstances=3, platform=LINUX
- **-timeout** : Idle timeout in seconds (default 300)
- **-registerCycle** : how often in ms the node will try to register itself again

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# Configuring the Node - JSON

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```
> java -jar selenium-server-standalone.jar -role node -nodeConfig nodeconfig.json
```

```
{
 "capabilities": [
 {
 "browserName": "*firefox",
 "maxInstances": 5,
 "seleniumProtocol": "Selenium"
 },
 {
 "browserName": "*googlechrome",
 "maxInstances": 5,
 "seleniumProtocol": "Selenium"
 },
 {
 "browserName": "*iexplore",
 "maxInstances": 1,
 "seleniumProtocol": "Selenium"
 },
 {
 "browserName": "firefox",
 "maxInstances": 5,
 "seleniumProtocol": "WebDriver"
 }
]
}
```



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## Configuring the Node – Json (Con't)

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```
> java -jar selenium-server-standalone.jar -role node -nodeConfig nodeconfig.json
```

```
{
 "browserName": "chrome",
 "maxInstances": 5,
 "seleniumProtocol": "WebDriver"
},
{
 "browserName": "internet explorer",
 "maxInstances": 1,
 "seleniumProtocol": "WebDriver"
}
],
"configuration": {
 "proxy": "org.openqa.grid.selenium.proxy.DefaultRemoteProxy",
 "maxSession": 5,
 "port": 5555,
 "host": "",
 "register": true,
 "registerCycle": 5000,
 "hubPort": 4444,
 "hubHost": ""
}
```

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## Configuring Timeouts in the Hub

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- Timeouts should normally be handled through **webDriver.manage().timeouts()**.
- There are two other timeout values that can be set on the hub:
- **-timeout**: Will ensure all resources are reclaimed X seconds after a client crashes.
- **-browserTimeout**: Maximum time a node is willing to hang inside the browser.
- All the nodes use these two values from the hub if they are set
- it is generally recommended not to set these timeouts on the node.
- The browserTimeout **should** be: Generally higher than values used in webDriver.manage().timeouts(), since this mechanism is a "last line of defense".

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## Parallel Tips

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- Each new instance of WebDriver is a session
- Make sure you close the driver instance after each test

```
@AfterMethod
public void tearDown() {
 if (driver != null){
 driver.quit();
 }
}
```

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