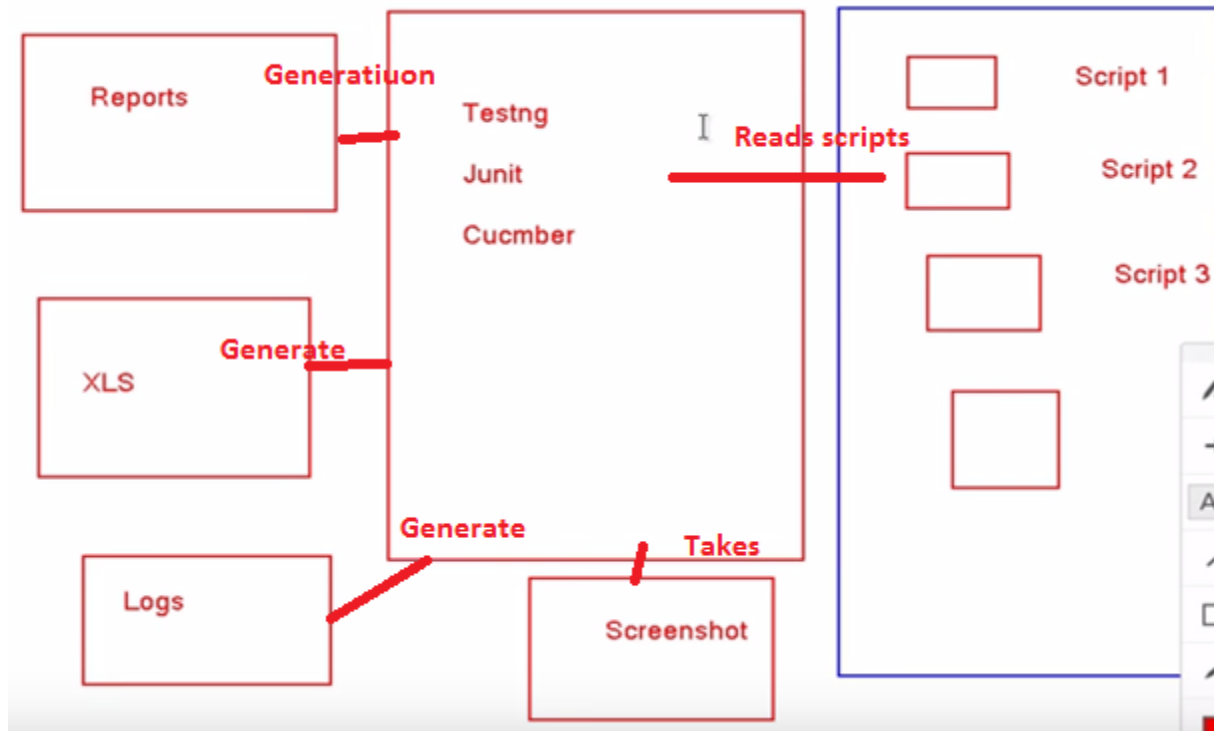


# TestNG - Testing framework

- TestNG/JUnit/Cucumber reads the scripts and generates Reports, xls, logs and also takes screenshots.

## Overall Picture



## Features of TestNG

- Support for **annotations**
- Support for **parameterization**
- Advance execution methodology that do not require test suites to be created
- Support for Data Driven Testing using **Data providers**
- Enables user to **set execution priorities** for the test methods
- Supports thread safe environment when executing multiple threads
- Readily supports integration with various tools and plug-ins like build tools (**Ant**, **Maven** etc.), Integrated Development Environment (Eclipse).
- Facilitates user with effective means of Report Generation using **ReportNG**.

# TestNG - Testing framework

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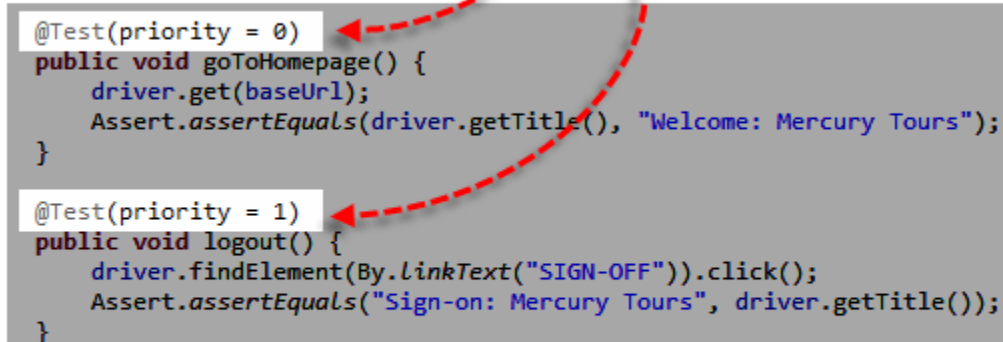
## Advantages of TestNG over JUnit

1. Annotations are easier to understand
2. Test cases can be grouped more easily
3. Parallel testing is possible
4. TestNG has built in HTML report and XML report generation facility. It has also built in logging facility

- **Annotations in TestNG are lines of code that can control how the method below them will be executed.**

They are always preceded by the @ symbol.

*These are 2 examples of annotations*



```
@Test(priority = 0)
public void goToHomepage() {
    driver.get(baseUrl);
    Assert.assertEquals(driver.getTitle(), "Welcome: Mercury Tours");
}

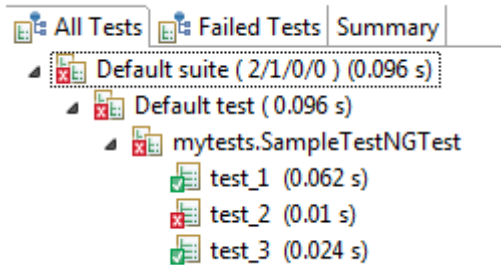
@Test(priority = 1)
public void logout() {
    driver.findElement(By.LinkText("SIGN-OFF")).click();
    Assert.assertEquals("Sign-on: Mercury Tours", driver.getTitle());
}
```

*The example above simply says that the method goToHomepage() should be executed first before logout() because it has a lower priority number*

# TestNG - Testing framework

## Why do we need TestNG in Selenium

1. Web Driver has no native mechanism for **generating reports**. Hence TestNG can generate reports based on our Selenium test results.



2. There is no more need for a **static main method** in our tests.

Usual structure  
(somewhat difficult to read)

```
public class myclass {  
  
    public static String baseUrl = "http://newtours.demoaut.com/";  
    public static WebDriver driver = new FirefoxDriver();  
  
    public static void main(String[] args) {  
        driver.get(baseUrl);  
        verifyHomepageTitle();  
        driver.quit();  
    }  
  
    public static void verifyHomepageTitle() {  
        String expectedTitle = "Welcome: Mercury Tours";  
        String actualTitle = driver.getTitle();  
        try {  
            Assert.assertEquals(actualTitle, expectedTitle);  
            System.out.println("Test Passed");  
        } catch (Throwable e) {  
            System.out.println("Test Failed");  
        }  
    }  
}
```

# TestNG - Testing framework

---

TestNG structure  
(easier to understand)

```
public class SampleTestNGTest {  
    public String baseUrl = "http://newtours.demoaut.com/";  
    public WebDriver driver;  
  
    @BeforeTest  
    public void setBaseUrl() {  
        driver = new FirefoxDriver();  
        driver.get(baseUrl);  
    }  
  
    @Test  
    public void verifyHomepageTitle() {  
        String expectedTitle = "Welcome: Mercury Tours";  
        String actualTitle = driver.getTitle();  
        Assert.assertEquals(actualTitle, expectedTitle);  
    }  
  
    @AfterTest  
    public void endSession() {  
        driver.quit();  
    }  
}
```

3. Uncaught exceptions are automatically handled by TestNG without terminating the test prematurely. These exceptions are reported as failed steps in the report.

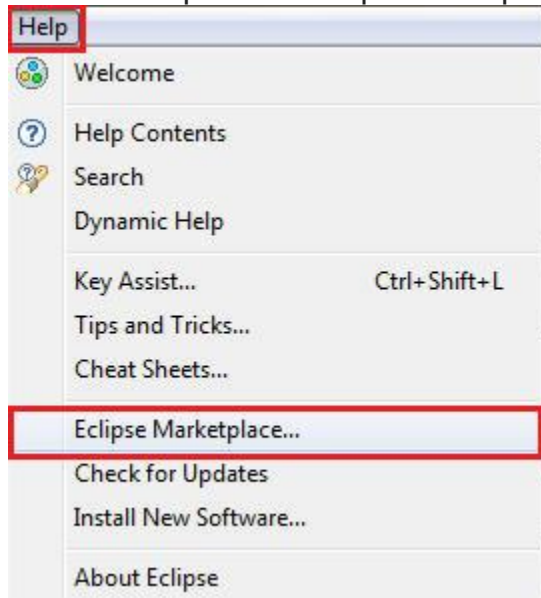
# TestNG - Testing framework

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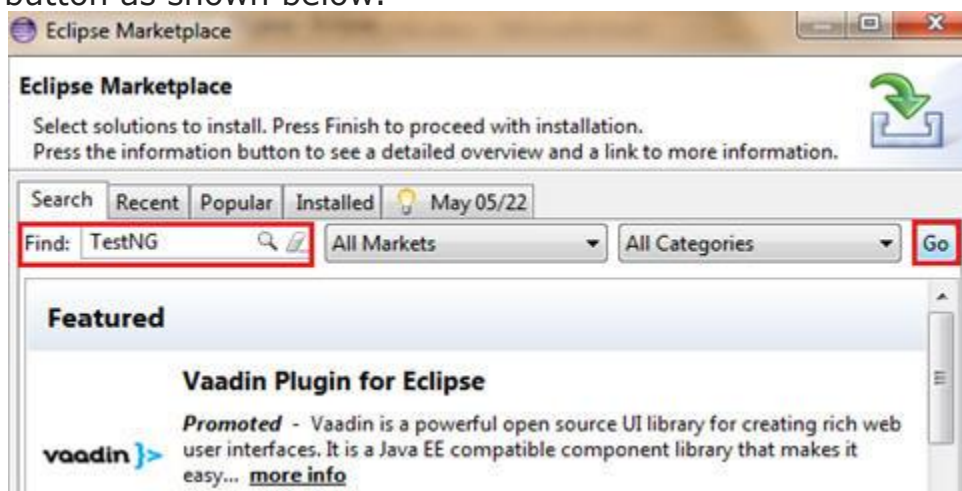
## TestNG Installation in Eclipse

**Follow the below steps to TestNG Download and installation on eclipse:**

**Step 1:** Launch eclipse IDE -> Click on the Help option within the menu -> Select "Eclipse Marketplace." option within the dropdown.

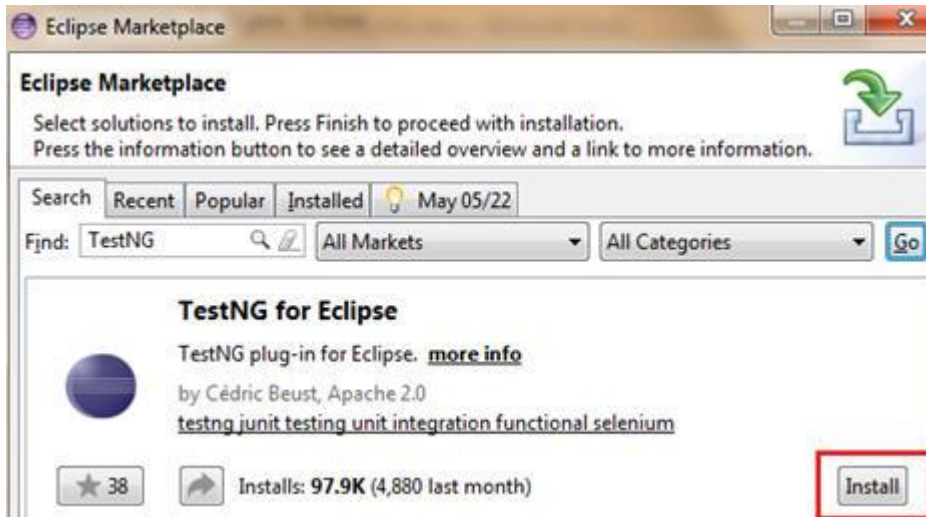


**Step 2:** Enter the keyword "TestNG" in the search textbox and click on "Go" button as shown below.

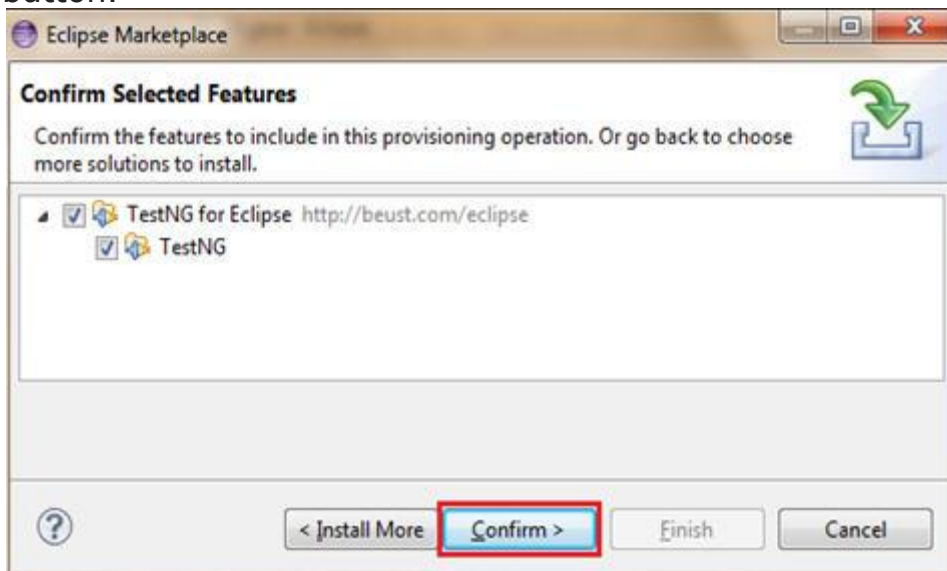


# TestNG - Testing framework

**Step 3:** As soon as the user clicks on the “Go” button, the results matching to the search string would be displayed. Now user can click on the Install button to install TestNG.



**Step 4:** As soon as the user clicks on the Install button, the user is prompted with a window to confirm the installation. Click on “Confirm” button.

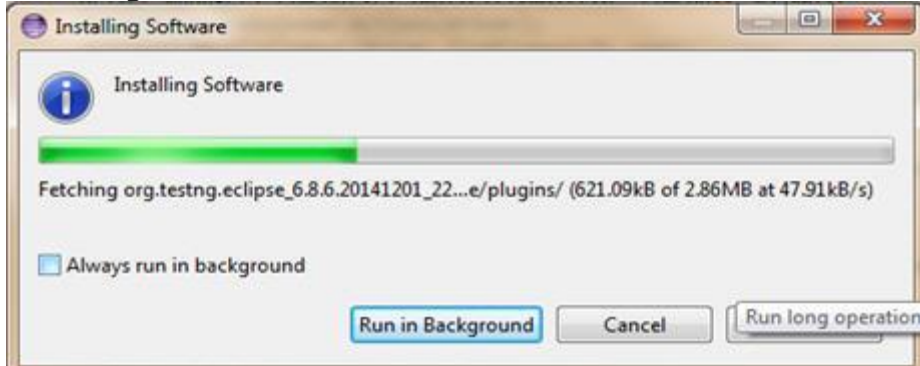


# TestNG - Testing framework

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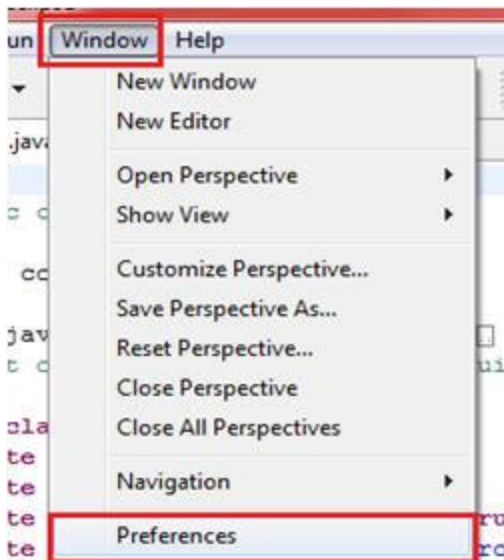
**Step 5:** In the next step, the application would prompt you to accept the license and then click on the "Finish" button.

**Step 6:** The installation is initiated now and the progress can be seen as following:



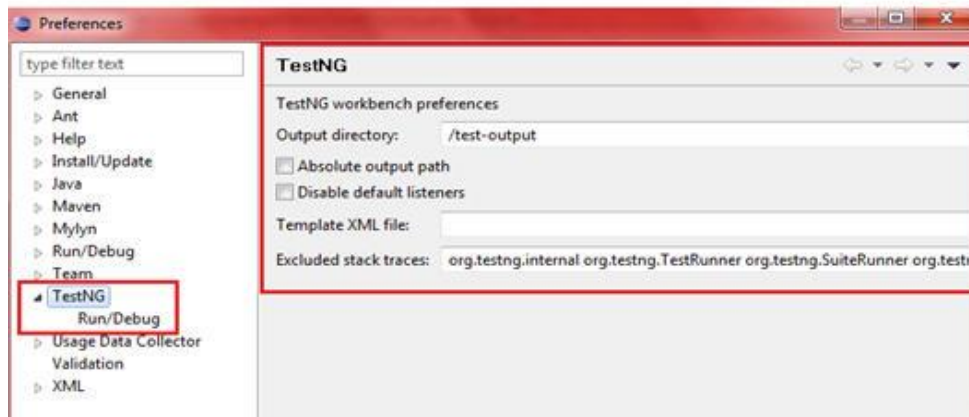
We are advised to restart our eclipse so as to reflect the changes made.

Upon restart, user can verify the TestNG installation by navigating to "Preferences" from "Window" option in the menu bar. Refer the following figure for the same.



*(Click on image to view enlarged)*

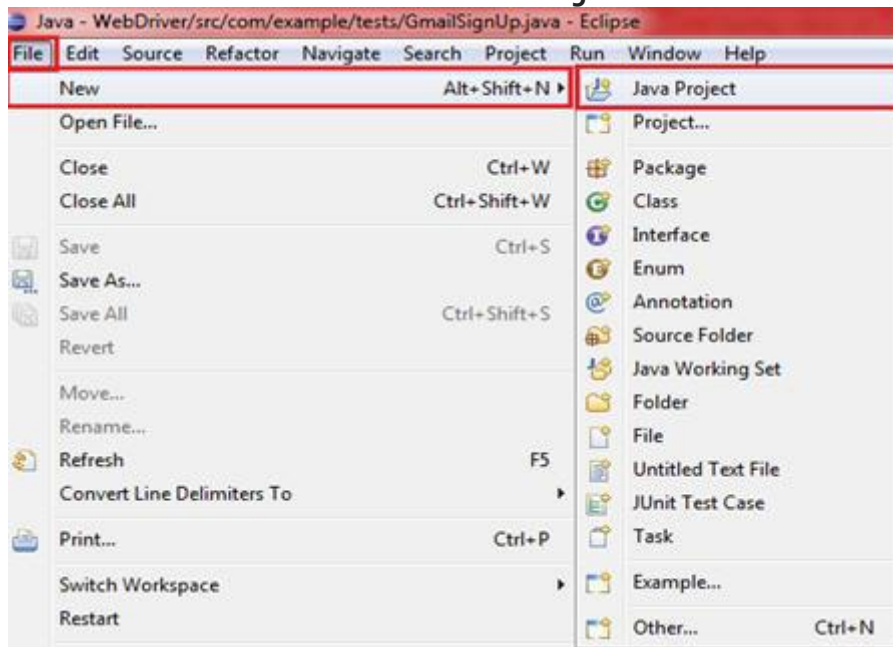
# TestNG - Testing framework



Creation of Sample TestNG project

Let us begin with the creation of TestNG project in eclipse IDE.

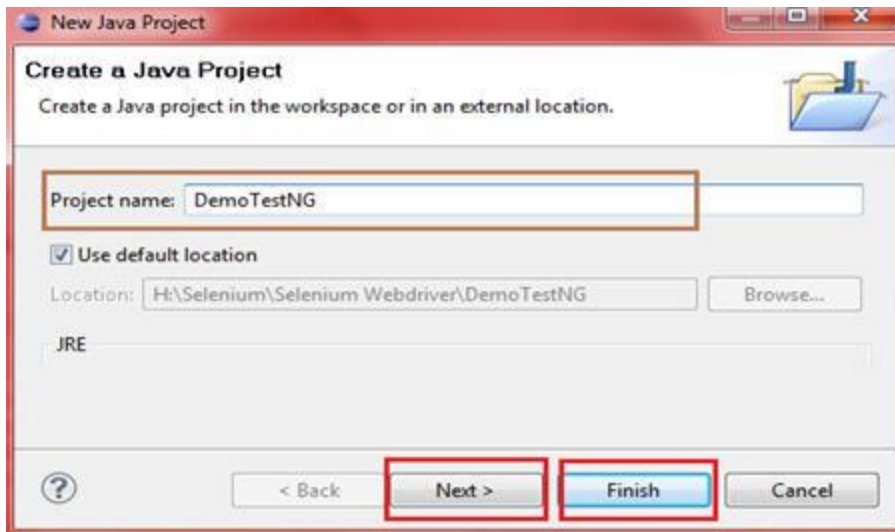
**Step 1:** Click on the File option within the menu -> Click on New -> Select Java Project.



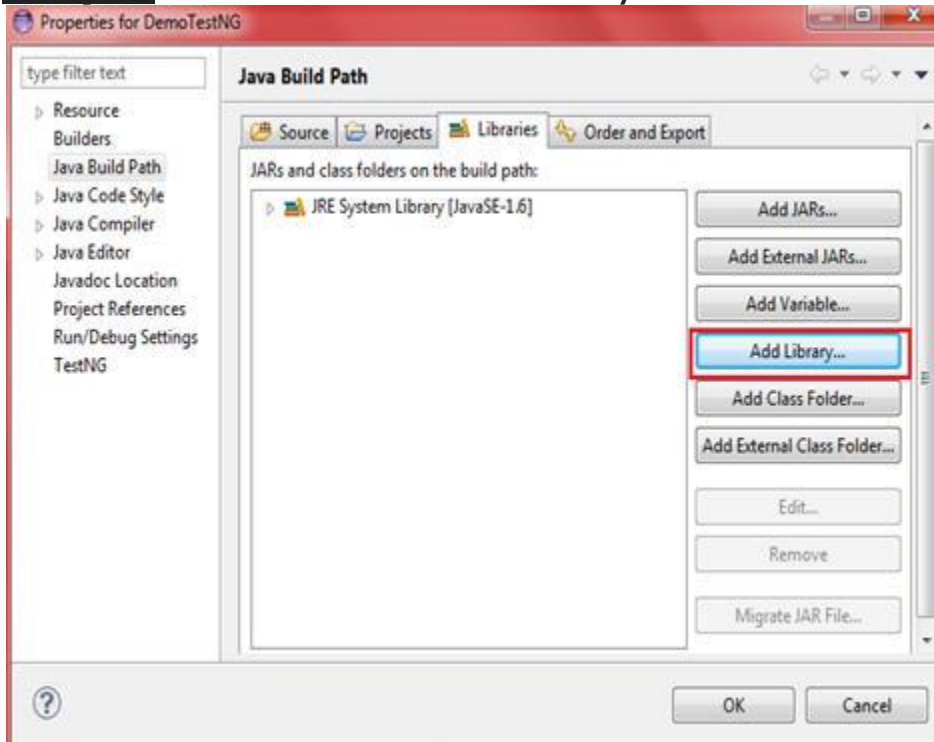


# TestNG - Testing framework

**Step 2:** Enter the project name as "**DemoTestNG**" and click on "Next" button and Click Finish.



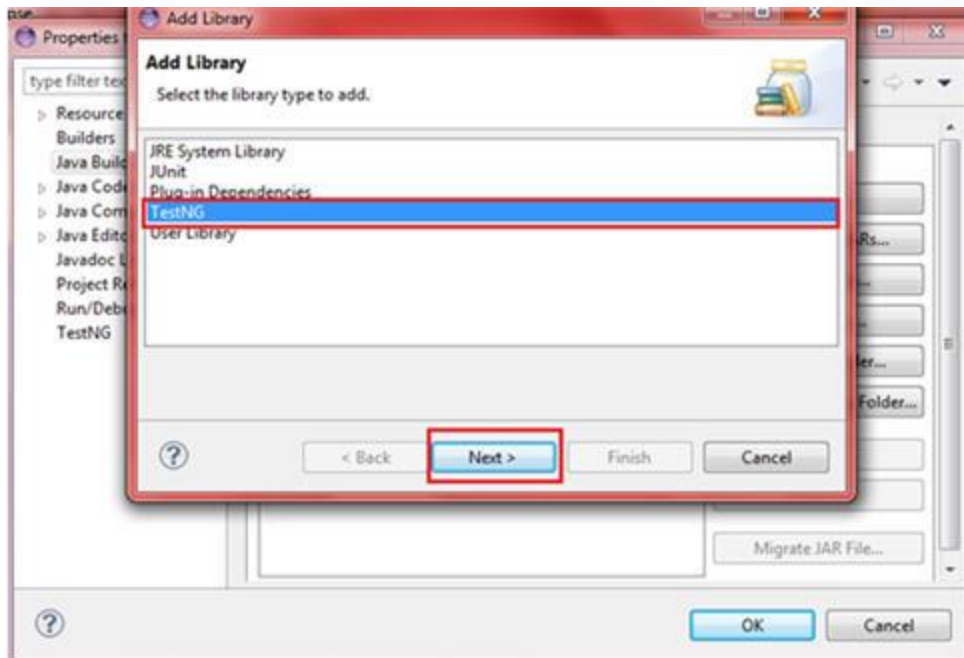
**Step 3:** Click on "Add library" as shown below.



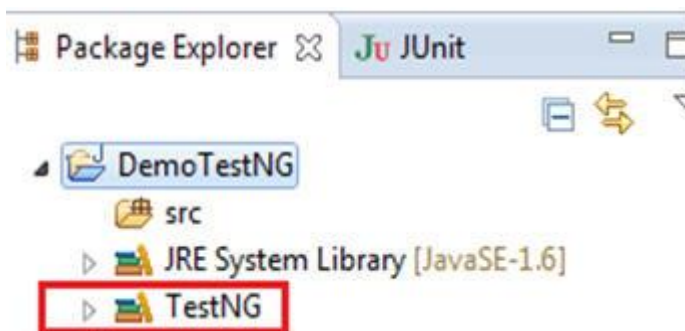
# TestNG - Testing framework

---

## **Step 4:** Select TestNG.



The TestNG is now added to the Java project and the required libraries can be seen in the package explorer upon expanding the project.



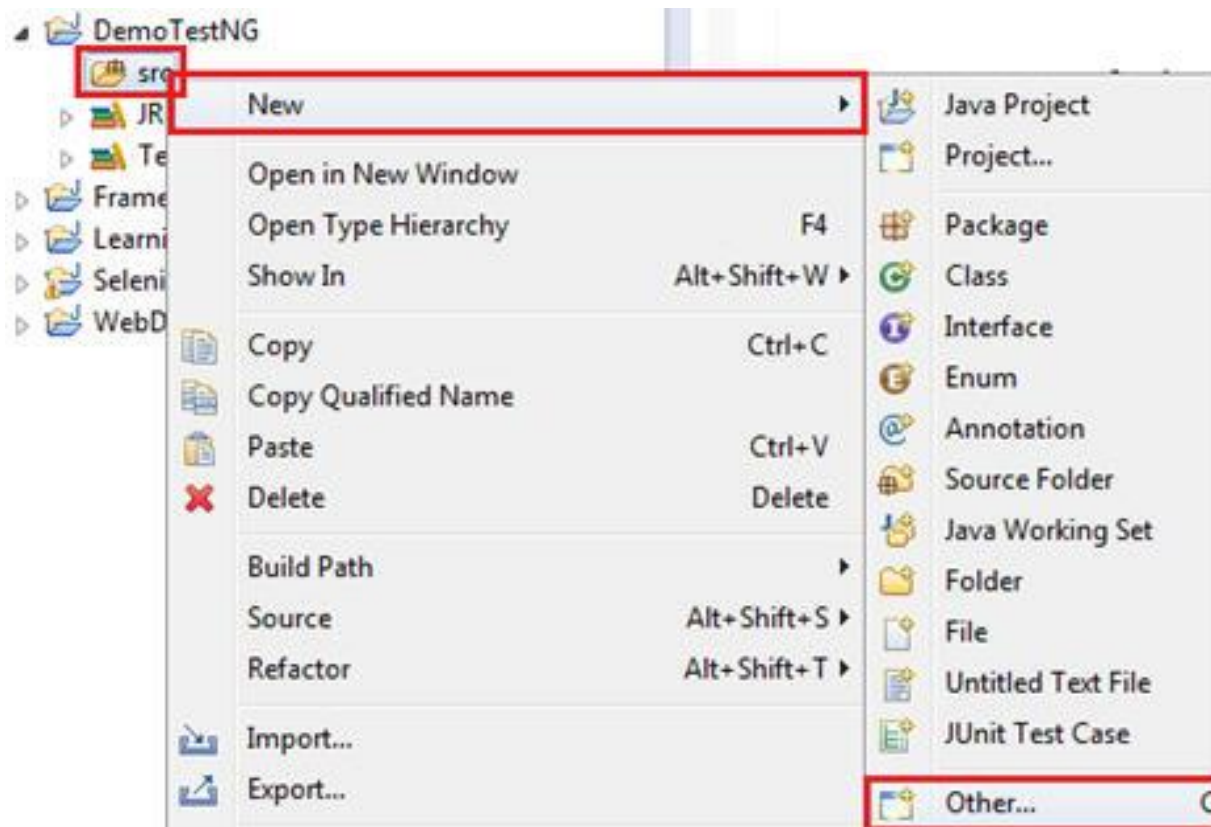
Add all the downloaded Selenium libraries and jars.

# TestNG - Testing framework

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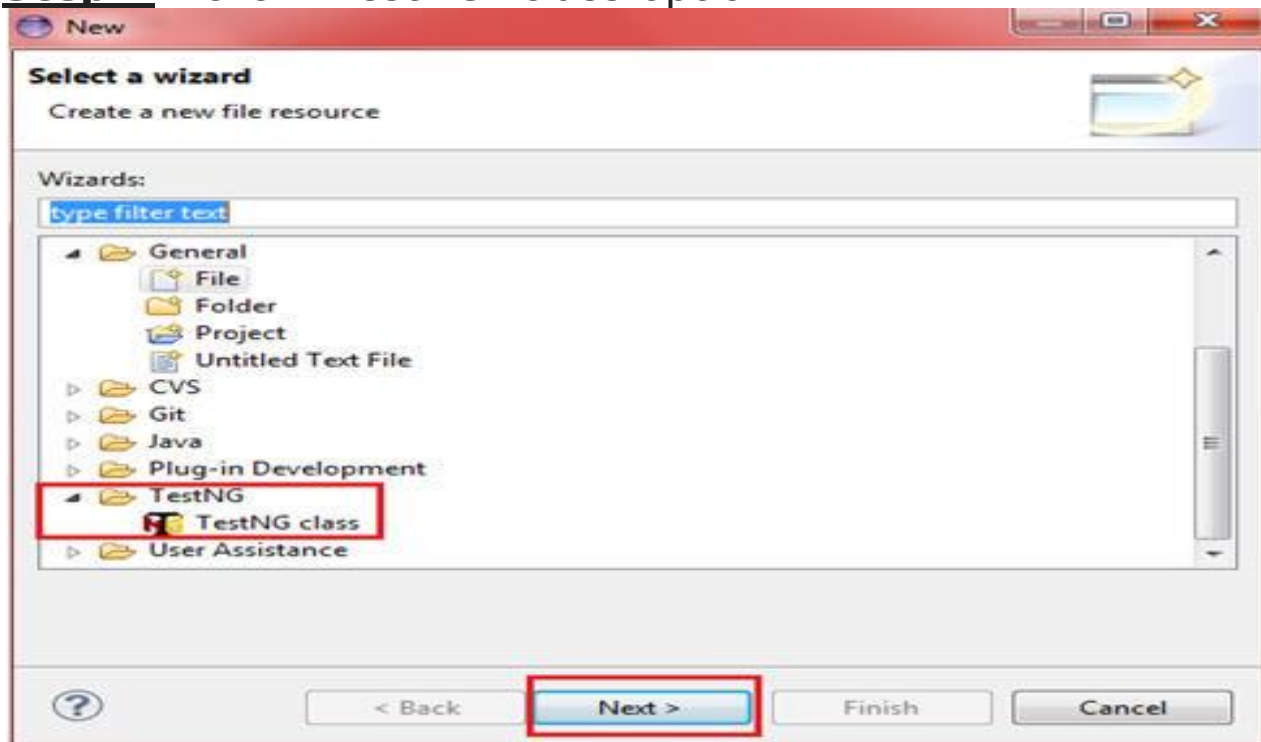
## Creating TestNG class

**Step 1:** Expand the “DemoTestNG” project and go to “src” folder. Right click on the “src” package and navigate to New -> Other.

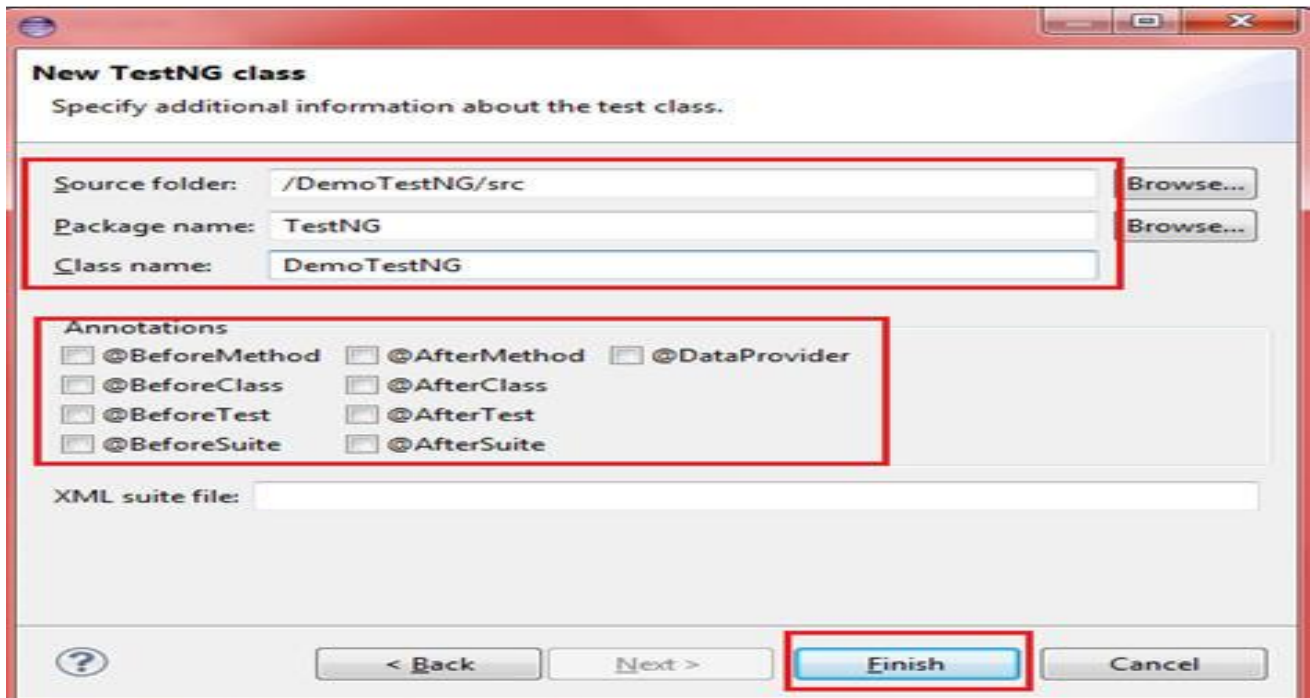


# TestNG - Testing framework

**Step 2:** click "TestNG" class option

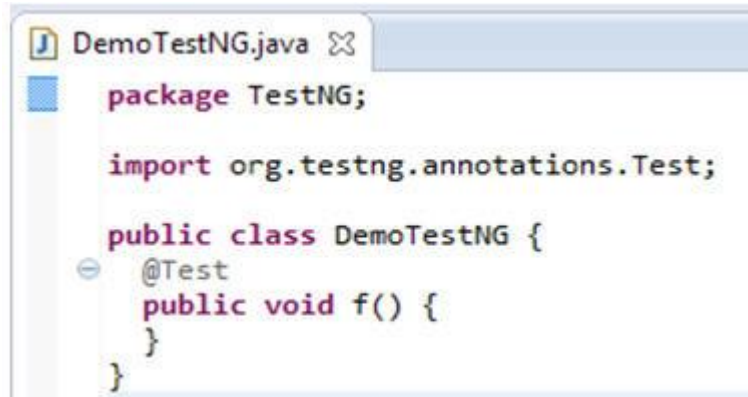


**Step 3:** Specify the Source folder, package name and the TestNG class name and click on the Finish button.



# TestNG - Testing framework

---

A screenshot of a Java IDE window titled 'DemoTestNG.java'. The code is as follows:

```
package TestNG;

import org.testng.annotations.Test;

public class DemoTestNG {
    @Test
    public void f() {
    }
}
```

Now that we have created the basic foundation for the TestNG test script, let us now inject the actual test code. We are using the same code we used in the previous session.

## **Scenario:**

- Launch the browser and open "gmail.com".
- Verify the title of the page and print the verification result.
- Enter the username and Password.
- Click on the Sign in button.
- Close the web browser.

# TestNG - Testing framework

---

## Code:

```
package TestNG;
import org.openqa.selenium.By;
import org.openqa.selenium.WebDriver;
import org.openqa.selenium.WebElement;
import org.openqa.selenium.firefox.FirefoxDriver;
import org.testng.Assert;
import org.testng.annotations.Test;

public class DemoTestNG {
    public WebDriver driver = new FirefoxDriver();
    String appUrl =
    "https://accounts.google.com";

    @Test
    public void gmailLogin() {
        // launch the firefox browser and open the
        application url
        driver.get("https://gmail.com");

        // maximize the browser window
        driver.manage().window().maximize();

        // declare and initialize the variable to store the
        expected title of the webpage.
        String expectedTitle = "Sign in -
        Google Accounts ";

        // fetch the title of the web page and save it into a
        string variable
        String actualTitle = driver.getTitle();
        Assert.assertEquals(expectedTitle,actualTitle);

        // enter a valid username in the email textbox
        WebElement username =
        driver.findElement(By.id("Email"));
        username.clear();
        username.sendKeys("TestSelenium");

        // enter a valid password in the password textbox
        WebElement password =
        driver.findElement(By.id("Passwd"));
        password.clear();
        password.sendKeys("password123");

        // click on the Sign in button
        WebElement SignInButton =
        driver.findElement(By.id("signIn"));
        SignInButton.click();

        // close the web browser
        driver.close();
    }
}
```

# TestNG - Testing framework

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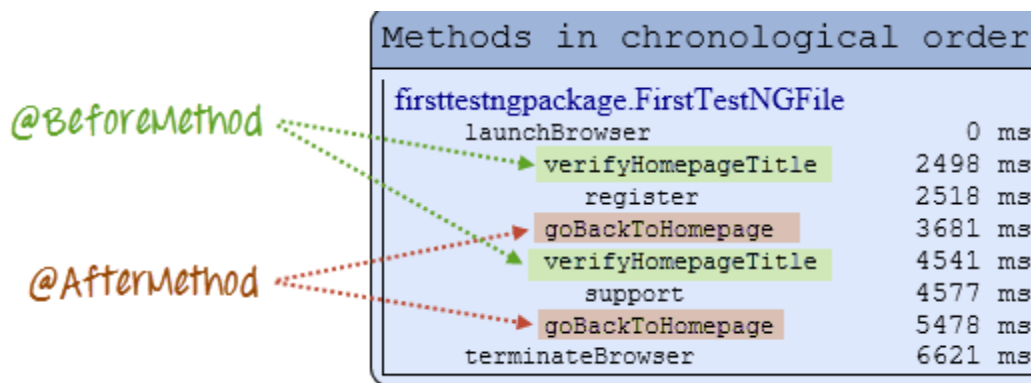
## **Summary of TestNG Annotations**

- **@BeforeSuite:** The annotated method will be run before all tests in this suite have run.
- **@AfterSuite:** This method will be run after all tests in this suite have run.
- **@BeforeTest:** This method will be run before any test method belonging to the classes inside the tag is run i.e prior to the first test case in the TestNG file.
- **@AfterTest:** This method will be run after all the test methods belonging to the classes inside the tag have run i.e after all test cases in the TestNG file are executed.
- **@BeforeGroups:** The list of groups that this configuration method will run before. This method is guaranteed to run shortly before the first test method that belongs to any of these groups is invoked.
- **@AfterGroups:** The list of groups that this configuration method will run after. This method is guaranteed to run shortly after the last test method that belongs to any of these groups is invoked.
- **@BeforeClass:** This method will be run before the first test method in the current class is invoked.



# TestNG - Testing framework

- **@AfterClass:** This method will be run after all the test methods in the current class have been run.
- **@BeforeMethod:** This method will be run before each test method.
- **@AfterMethod:** This method will be run after each test method.
- **@Test:** This method is a part of a test case.



## Multiple Test Cases

- We can use multiple @Test annotations in a single TestNG file. By default, methods annotated by @Test are executed alphabetically. See the code below. Though the methods **c\_test**, **a\_test**, and **b\_test** are not arranged alphabetically in the code, they will be executed as such.



# TestNG - Testing framework

```
public class FirstTestNGFile {  
  
    @Test  
    public void c_test() {  
        Assert.fail();  
    }  
  
    @Test  
    public void a_test() {  
        Assert.assertTrue(true);  
    }  
  
    @Test  
    public void b_test() {  
        throw new SkipException("Skipping b_test...");  
    }  
}
```

- Run this code and on the generated index.html page, click "Chronological view".

The screenshot shows a TestNG report. The top section, 'Default suite', has a yellow background and lists information about the test run. The 'Chronological view' option is highlighted in orange. A red arrow points from this option to a table titled 'Methods in chronological order'. The table has a blue header and lists three methods: 'a\_test' (0 ms), 'b\_test' (17 ms), and 'c\_test' (20 ms). The 'c\_test' method is marked with a red 'X' and is enclosed in a red box. A red arrow points from this box to the handwritten text 'tests were executed alphabetically' at the bottom.

**Default suite**

**Info**

- C:\Users\... \AppData\Local\Temp\testng-eclipse-127915423\testng-customsuite.xml
- 1 test
- 0 groups
- Times
- Reporter output
- Ignored methods
- **Chronological view**

**Methods in chronological order**

firsttestngpackage.FirstTestNGFile	
a_test	0 ms
b_test	17 ms
<input checked="" type="checkbox"/> c_test	20 ms

tests were executed alphabetically

# TestNG - Testing framework

## Parameters

- If you want the methods to be executed in a different order, use the parameter "priority".

`@Test(priority = 0)`

parameter      value of the  
                 parameter

```
public class FirstTestNGFile {
```

```
    @Test(priority = 3) {  
        public void c_test() {  
            Assert.fail();  
        }  
    }
```

the 2nd least priority value so  
this will be executed 2nd

```
    @Test(priority = 0) {  
        public void a_test() {  
            Assert.assertTrue(true);  
        }  
    }
```

this has the lowest priority value  
so this will be executed first

```
    @Test(priority = 7) {  
        public void b_test() {  
            throw new SkipException("Skipping b_test...");  
        }  
    }  
}
```

largest priority value so this will  
be executed last

- The TestNG HTML report will confirm that the methods were executed based on the ascending value of priority.

Methods in chronological order		
firsttestngpackage.FirstTestNGFile		
a_test		0 ms
❌ c_test		18 ms
b_test		23 ms

# TestNG - Testing framework

---

## Assertion

- An assertion is a Boolean expression at a specific point in a program which will be **true** unless there is a bug in the program.
- Asserts helps us to verify the conditions of the test and decide whether test has failed or passed. A test is considered successful ONLY if it is completed without throwing any exception.

## Benefits of Assertions:

- It is used to detect subtle errors which might go unnoticed.
- It is used to detect errors sooner after they occur.
- Make a statement about the effects of the code that is guaranteed to be true.

## Limitations of Assertion

- Reporting an error when it does not exist.
- Can take time to execute if it contains errors and occupies memory as well.

## Type of Assert statements

- **assertEqual(String actual,String expected) :-** It takes two string arguments and checks whether both are equal, if not it will fail the test.
- **assertEqual(String actual,String expected, String message) :-** It takes three string arguments and checks whether both are equal, if not it will fail the test and throws the message which we provide.

# TestNG - Testing framework

---

- **assertEquals(boolean actual,boolean expected) :-** It takes two boolean arguments and checks whether both are equal, if not it will fail the test.
- **assertEquals(java.util.Collection actual, java.util.Collection expected, java.lang.String message) :-** Takes two collection objects and verifies both collections contain the same elements and with the same order. if not it will fail the test with the given message.
- **Assert.assertTrue(condition) :-** It takes one boolean arguments and checks that a condition is true, If it isn't, an AssertionError is thrown.
- **Assert.assertTrue(condition, message) :-** It takes one boolean argument and String message. It Asserts that a condition is true. If it isn't, an AssertionError, with the given message, is thrown.
- **Assert.assertFalse(condition) :-** It takes one boolean arguments and checks that a condition is false, If it isn't, an AssertionError is thrown.
- **Assert.assertFalse(condition, message) :-** It takes one boolean argument and String message. It Asserts that a condition is false. If it isn't, an AssertionError, with the given message, is thrown.

# TestNG - Testing framework

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## DataProvider in TestNG

- The annotated method must return an `Object[][]` where each `Object[]` can be assigned the parameter list of the test method.
- The `@Test` method that wants to receive data from this `DataProvider` needs to use a `dataProvider` name equals to the name of this annotation.
- The name of this data provider. If it's not supplied, the name of this data provider will automatically be set to the name of the method.
- Example: passing three different usernames and passwords

# TestNG - Testing framework

---

```
package Dataprovider;

import org.testng.annotations.DataProvider;
import org.testng.annotations.Test;
import org.testng.annotations.BeforeTest;
import org.testng.annotations.AfterTest;

public class DataExample {
    @Test
    public void Test() {
        System.out.println("Test");
    }

    //This test method declares that its data should be supplied by the Data Provider
    // "getdata" is the function name which is passing the data
    // Number of columns should match the number of input parameters
    @Test(dataProvider="getData")
    public void setData(String username, String password)
    {
        System.out.println("you have provided username as::"+username);
        System.out.println("you have provided password as::"+password);
    }

    @DataProvider
    public Object[][] getData()
    {
        //Rows - Number of times your test has to be repeated.
        //Columns - Number of parameters in test data.
        Object[][] data = new Object[3][2];

        // 1st row
        data[0][0] = "sampleuser1";
        data[0][1] = "abcdef";

        // 2nd row
        data[1][0] = "testuser2";
        data[1][1] = "zxcvb";

        // 3rd row
        data[2][0] = "guestuser3";
        data[2][1] = "pass123";

        return data;
    }

    @BeforeTest
    public void beforeTest() {
        System.out.println("BeforeTest");
    }

    @AfterTest
    public void afterTest() {
        System.out.println("AfterTest");
    }
}
```

# TestNG - Testing framework

## Output:

```
Problems @ Javadoc Console Progress Results of running class DataExample
<terminated> DataExample [TestNG] C:\Program Files\Java\jre1.8.0_111\bin\javaw.exe (Dec 8, 2016, 7:01:48 PM)
[TestNG] Running:
  C:\Users\skahar\AppData\Local\Temp\testng-eclipse--974334325\testng-customsuite.xml

BeforeTest
Test
you have provided username as::sampleuser1
you have provided password as::abcdef
you have provided username as::testuser2
you have provided password as::zxcvb
you have provided username as::guestuser3
you have provided password as::pass123
AfterTest
PASSED: Test
PASSED: setData("sampleuser1", "abcdef")
PASSED: setData("testuser2", "zxcvb")
PASSED: setData("guestuser3", "pass123")

=====
      Default test
      Tests run: 4, Failures: 0, Skips: 0
=====

=====
Default suite
Total tests run: 4, Failures: 0, Skips: 0
=====
```

Problems @ Javadoc Console Progress Results of running class DataExample Tests: 1/1 Methods: 4 (191 ms)

Search:  Passed: 4 Failed: 0 Skipped: 0

All Tests	Failed Tests	Summary
Default suite (4/0/0) (0.009 s)		
Default test (0.009 s)		
Dataprovider.DataExample		
Test (0.006 s)		
setData (0.003 s)		
"sampleuser1","abcdef" (0.001 s)		
"testuser2","zxcvb" (0.001 s)		
"guestuser3","pass123" (0.001 s)		

# TestNG - Testing framework

---

## Difference between @Factory and @DataProvider

- **DataProvider:** A test method that uses DataProvider will be executed a multiple number of times based on the data provided by the DataProvider. The test method will be executed using the same instance of the test class to which the test method belongs.
- dataProvider is used to provide parameters to a test. If you provide dataProvider to a test, the test will be run taking different sets of value each time. This is useful for a scenario like where you want to login into a site with different sets of username and password each time.
- **Factory:** A factory will execute all the test methods present inside a test class using a separate instance of the respective class.
- TestNG factory is used to create instances of test classes dynamically. This is useful if you want to run the test class any number of times. For example, if you have a test to login into a site and you want to run this test multiple times, then its easy to use TestNG factory where you create multiple instances of test class and run the tests (may be to test any memory leak issues).



# TestNG - Testing framework

---

## @DataProvider Example

- The below class contains the testMethod and beforeClass methods. testMethod takes a String argument and the value of the argument is provided by the DataProvider method, dataMethod. The beforeClass method prints a message onto the console when executed, and the same is the case with testMethod. testMethod prints the argument passed onto it to the console when executed.

```
public class DataProviderClass
{
    @BeforeClass
    public void beforeClass() {
        System.out.println("Before class executed");
    }

    @Test(dataProvider = "dataMethod")
    public void testMethod(String param) {
        System.out.println("The parameter value is: " + param);
    }

    @DataProvider
    public Object[][] dataMethod() {
        return new Object[][] { { "one" }, { "two" } };
    }
}
```

```
Before class executed
The parameter value is: one
The parameter value is: two
PASSED: testMethod("one")
PASSED: testMethod("two")
```

# TestNG - Testing framework

---

## @Factory Example

- The below class contains the testMethod and beforeClass methods. The constructor of the test class takes a String argument value. Both beforeClass and testMethod print a message onto console.

```
public class SimpleTest
{
    private String param = "";

    public SimpleTest(String param) {
        this.param = param;
    }

    @BeforeClass
    public void beforeClass() {
        System.out.println("Before SimpleTest class executed.");
    }

    @Test
    public void testMethod() {
        System.out.println("testMethod parameter value is: " + param);
    }
}

public class SimpleTestFactory
{
    @Factory
    public Object[] factoryMethod() {
        return new Object[] {
            new SimpleTest("one"),
            new SimpleTest("two")
        };
    }
}
```

```
Before SimpleTest class executed.
testMethod parameter value is: two
Before SimpleTest class executed.
testMethod parameter value is: one
PASSED: testMethod
PASSED: testMethod
```

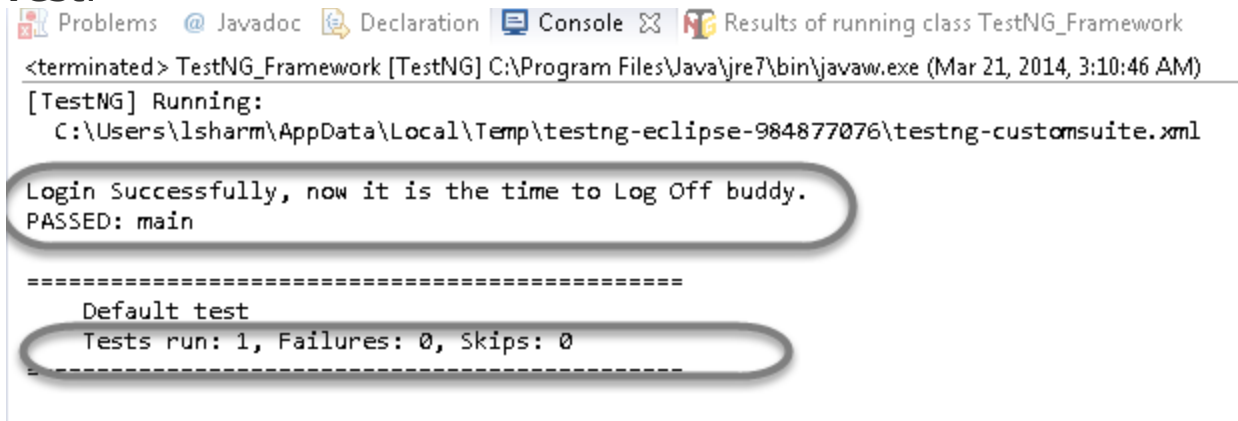
# TestNG - Testing framework

## TestNG Reporting

### Report type 1- Console output.

Run the test by right click on the test case script and select **Run As > TestNG**

#### Test.



The screenshot shows the Eclipse IDE's Console window. The title bar indicates the output is for 'Results of running class TestNG\_Framework'. The output text is as follows:

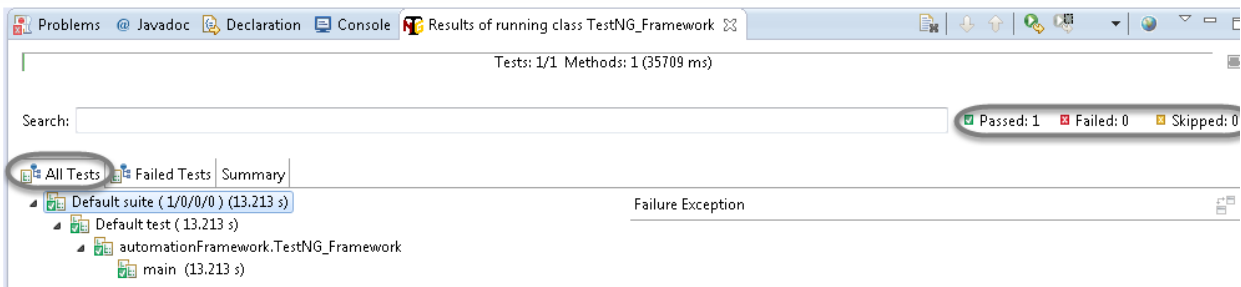
```
<terminated> TestNG_Framework [TestNG] C:\Program Files\Java\jre7\bin\javaw.exe (Mar 21, 2014, 3:10:46 AM)
[TestNG] Running:
  C:\Users\lsharm\AppData\Local\Temp\testng-eclipse-984877076\testng-customsuite.xml

Login Successfully, now it is the time to Log Off buddy.
PASSED: main

=====
      Default test
Tests run: 1, Failures: 0, Skips: 0
=====
```

Two specific lines of output are highlighted with rounded rectangular callouts: 'Login Successfully, now it is the time to Log Off buddy. PASSED: main' and 'Tests run: 1, Failures: 0, Skips: 0'.

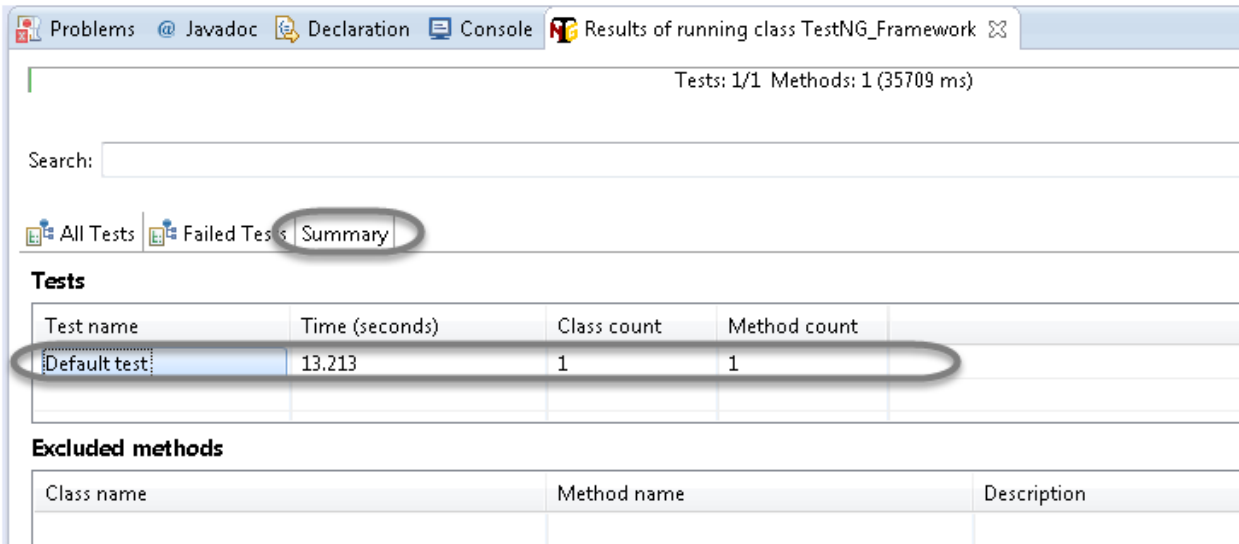
5) Click on the **Results of TestNG** tab. It will display the total passed, failed and skipped test with time taken during the execution.



# TestNG - Testing framework

It displayed 'passed : 1'. This means test is successful and Passed.

There are 3 sub tabs. "All Tests", "Failed Tests" and "Summary". Just click "All Tests" to see what is there.



Tests: 1/1 Methods: 1 (35709 ms)

Search:

[All Tests](#) [Failed Tests](#) [Summary](#)

**Tests**

Test name	Time (seconds)	Class count	Method count
Default test	13.213	1	1

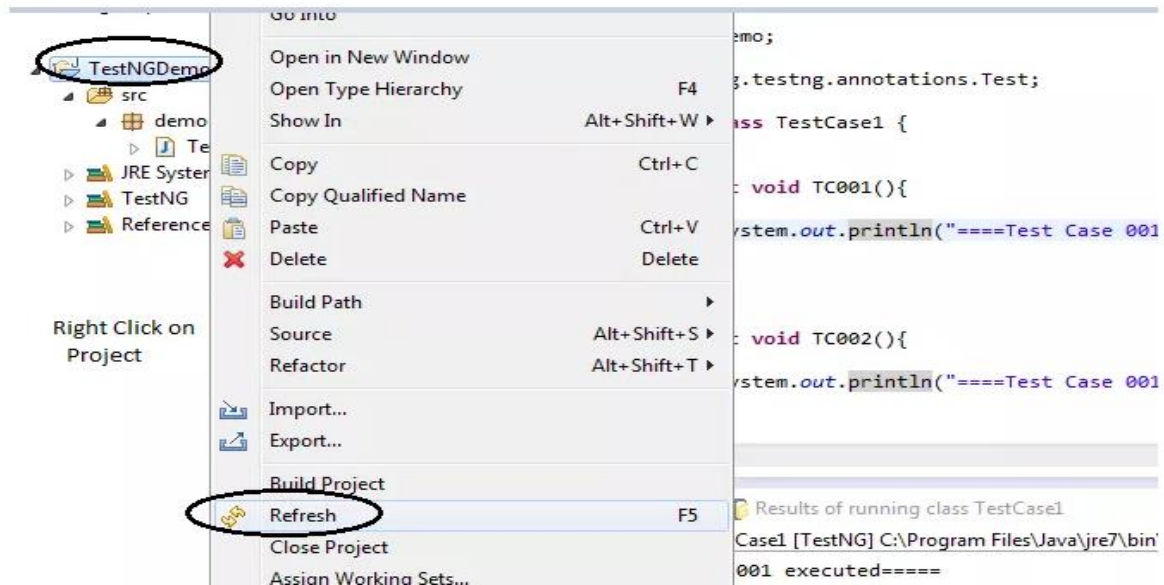
**Excluded methods**

Class name	Method name	Description
------------	-------------	-------------

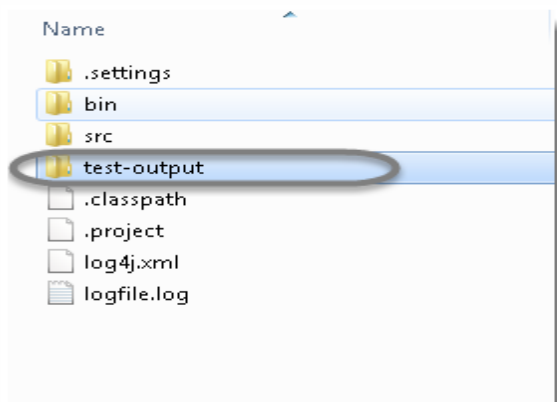
# TestNG - Testing framework

## Report type 2- HTML report

We have to refresh your project and reports folder will come automatically.

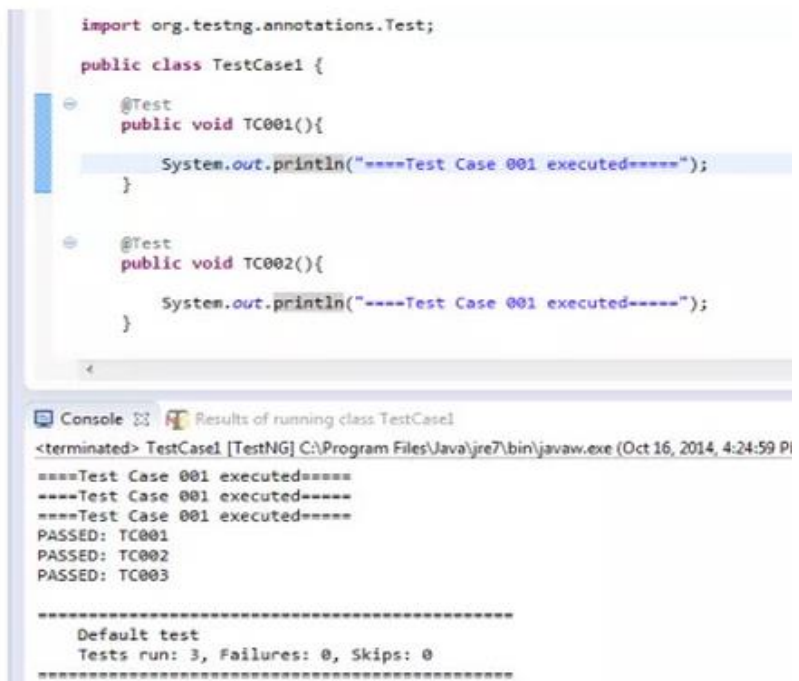
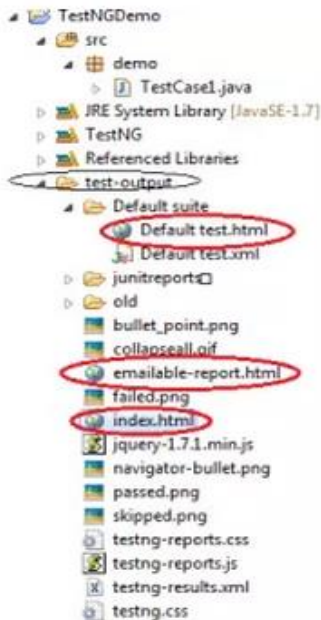


6) TestNG also produce HTML reports. To access those reports go to your **Project** folder and open **test-output** folder.



# TestNG - Testing framework

After refreshing, you will get below folder ready 😊



First open Default test.html

## Default test

Tests passed/Failed/Skipped:	3/0/0
Started on:	Thu Oct 16 16:25:29 IST 2014
Total time:	0 seconds (167 ms)
Included groups:	
Excluded groups:	

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

PASSED TESTS			
Test method	Exception	Time (seconds)	Instance
TC001 Test class: demo.TestCase1		0	demo.TestCase1@199dc59
TC002 Test class: demo.TestCase1		0	demo.TestCase1@199dc59
TC003 Test class: demo.TestCase1		0	demo.TestCase1@199dc59

# TestNG - Testing framework

7) Open '**emailable-report.html**', as this is a html report open it with browser.

Test	# Passed	# Skipped	# Failed	Time (ms)	Included Groups	Excluded Groups
Default suite						
<a href="#">Default test</a>	1	0	0	35,599		

Class	Method	Start	Time (ms)
Default suite			
Default test — passed			
automationFramework.TestNG_Framework	<a href="#">main</a>	1395351668683	13213

## Default test

**automationFramework.TestNG\_Framework#main**

8) TestNG also produce '**index.html**' report and it resides in the same **test-output** folder. This reports gives the link to all the different component of the TestNG reports like **Groups & Reporter Output**. On clicking these will display detailed descriptions of execution. In the advance chapter of TestNG we will go though each of the TestNG topics.

## Test results

1 suite

### All suites

#### Default suite

##### Info

- C:\Users\lsharm\AppData\Local\Temp\testng-eclipse-984877076\testng-customsuite.xml
- 1 test
- 0 groups
- Times
- Reporter output
- Ignored methods
- Chronological view

##### Results

- 1 method, 1 passed
- Passed methods ([show](#))