TESTNG - QUICK GUIDE

Testing is the process of checking the functionality of the application whether it is working as per requirements and to ensure that at developer level, unit testing comes into picture. Unit testing is the testing of single entity *classormethod*. Unit testing is very essential to every software company to give a quality product to their customers.

JUnit has driven developers to understand the usefulness of tests, especially of unit tests when compared to any other testing framework. Leveraging a rather simple, pragmatic, and strict architecture, JUnit has been able to "infect" great number of developers. Features of JUnit can be seen in Junit Features.

Some of the short comings of JUnit are:

- Initially designed to enable unit testing only, now used for all kinds of testing.
- Cannot do dependency testing.
- Poor configuration control *setUp/tearDown*.
- Intrusive *forcesyoutoextendclassesandnameyourmethodsacertainway*.
- Static programming model *forcesyoutorecompileunnecessarily*.
- The management of different suites of tests in complex projects can be very tricky..

What is TestNG?

Definition of TestNG as per its documentation is:

TestNG is a testing framework inspired from JUnit and NUnit but introducing some new functionalities that make it more powerful and easier to use.

TestNG is an open source automated testing framework; where **NG** of Test**NG** means **N**ext **G**eneration. TestNG is similar to JUnit *especiallyJUnit*4, but its not a JUnit extension. Its inspired by JUnit. It is designed to be better than JUnit, especially when testing integrated classes. The creator of TestNG is *Cedric Beust*.

TestNG eliminates most of the limitations of the older framework and gives the developer the ability to write more flexible and powerful tests. As it heavily borrows from Java Annotations *introducedwithJDK*5.0 to define tests, it can also show you how to use this new feature of the Java language in a real production environment.

TestNG Features

- Annotations.
- TestNG uses more Java and OO features.
- Supports testing integrated classes *e. g.* , *bydefault*, *noneedtocreateanewtestclassinstanceforeverytestmethod*.
- Separate compile-time test code from run-time configuration/data info.
- Flexible runtime configuration.
- Introduces ‘test groups’. Once you have compiled your tests, you can just ask TestNG to run all the "front-end" tests, or "fast", "slow", "database", etc...
- Supports Dependent test methods, parallel testing, load testing, partial failure.
- Flexible plug-in API.
- Support for multi threaded testing.

ENVIRONMENT SET-UP

TestNG is a framework for Java, so the very first requirement is to have JDK installed in your machine.

System Requirement

JDK	1.5 or above.
Memory	no minimum requirement.
Disk Space	no minimum requirement.
Operating System	no minimum requirement.

Step 1 - verify Java installation in your machine

Now, open console and execute the following **java** command.

OS	Task	Command
Windows	Open Command Console	c:\> java -version
Linux	Open Command Terminal	$ java -version
Mac	Open Terminal	machine:~ joseph$ java -version

Let's verify the output for all the operating systems:

OS	Output
Windows	java version "1.7.0_25" Java*TM* SE Runtime Environment *build*$1.7.0_25 - b15$ Java HotSpot*TM* 64-Bit Server VM *build*$23.25 - b01$, *mixedmode*
Linux	java version "1.7.0_25" Java*TM* SE Runtime Environment *build*$1.7.0_25 - b15$ Java HotSpot*TM* 64-Bit Server VM *build*$23.25 - b01$, *mixedmode*
Mac	java version "1.7.0_25" Java*TM* SE Runtime Environment *build*$1.7.0_25 - b15$ Java HotSpot*TM* 64-Bit Server VM *build*$23.25 - b01$, *mixedmode*

If you do not have Java installed, install the Java Software Development Kit *SDK* from http://www.oracle.com/technetwork/java/javase/downloads/index.html. We are assuming Java 1.7.0_25 as installed version for this tutorial.

Step 2: Set JAVA environment

Set the **JAVA_HOME** environment variable to point to the base directory location, where Java is installed on your machine. For example;

OS	Output
Windows	Set the environment variable JAVA_HOME to C:\Program Files\Java\jdk1.7.0_25

Linux	export JAVA_HOME=/usr/local/java-current
Mac	export JAVA_HOME=/Library/Java/Home

Append Java compiler location to System Path.

OS	Output
Windows	Append the string ;C:\Program Files\Java\jdk1.7.0_25\bin to the end of the system variable, Path.
Linux	export PATH=$PATH$:JAVA_HOME/bin/
Mac	not required

Verify Java Installation using **java -version** command explained above.

Step 3: Download TestNG archive

Download latest version of TestNG jar file from http://www.testng.org. At the time of writing this tutorial, I downloaded *testng-6.8.jar* and copied it into C:\>TestNG folder.

OS	Archive name
Windows	testng-6.8.jar
Linux	testng-6.8.jar
Mac	testng-6.8.jar

Step 4: Set TestNG environment

Set the **TESTNG_HOME** environment variable to point to the base directory location, where TestNG jar is stored on your machine. Assuming, we've stored testng-6.8.jar in TestNG folder on various Operating Systems as follows.

OS	Output
Windows	Set the environment variable TESTNG_HOME to C:\TESTNG
Linux	export TESTNG_HOME=/usr/local/TESTNG
Mac	export TESTNG_HOME=/Library/TESTNG

Step 5: Set CLASSPATH variable

Set the **CLASSPATH** environment variable to point to the TestNG jar location. Assuming, we've stored testng-6.8.jar in TestNG folder on various Operating Systems as follows.

OS	Output
Windows	Set the environment variable CLASSPATH to %CLASSPATH%;%TESTNG_HOME%\testng-6.8.jar;
Linux	export CLASSPATH=$CLASSPATH$:TESTNG_HOME/testng-6.8.jar:

Mac	export CLASSPATH=*CLASSPATH*:TESTNG_HOME/testng-6.8.jar:

Step 6: Test TestNG Setup

Create a java class file name TestNGSimpleTest in **C:\ > TestNG_WORKSPACE**

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

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

TestNG can be invoked in several different ways:

- With a testng.xml file
- With ant
- From the command line

Let us invoke using the testng.xml file. Create an xml file with name testng.xml in **C:\ > TestNG_WORKSPACE** to execute Test case*s*.

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
<suite name="Suite1">
  <test name="test1">
    <classes>
       <class name="TestNGSimpleTest"/>
    </classes>
  </test>
</suite>
```

Step 7: Verify the Result

Compile the class using **javac** compiler as follows:

```
C:\TestNG_WORKSPACE>javac TestNGSimpleTest.java
```

Now, invoke the testng.xml to see the result.

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE" org.testng.TestNG testng.xml
```

Verify the output.

```
===============================================
Suite1
Total tests run: 1, Failures: 0, Skips: 0
===============================================
```

WRITING TESTS

Writing a test in TestNG basically involves following steps:

- Write the business logic of your test and insert TestNG annotations in your code.
- Add the information about your test *e. g. theclassname, thegroupsyouwishtorun, etc. . .* in a testng.xml

file or in build.xml..

- Run TestNG.

Here, we will see one complete example of TestNG testing using POJO class, Business logic class and a test xml, which will be run by TestNG.

Create **EmployeeDetails.java** in **C:\ > TestNG_WORKSPACE** which is a POJO class.

```
public class EmployeeDetails {

   private String name;
   private double monthlySalary;
   private int age;

   /**
   * @return the name
   */
   public String getName() {
      return name;
   }
   /**
   * @param name the name to set
   */
   public void setName(String name) {
      this.name = name;
   }
   /**
   * @return the monthlySalary
   */
   public double getMonthlySalary() {
      return monthlySalary;
   }
   /**
   * @param monthlySalary the monthlySalary to set
   */
   public void setMonthlySalary(double monthlySalary) {
      this.monthlySalary = monthlySalary;
   }
   /**
   * @return the age
   */
   public int getAge() {
      return age;
   }
   /**
   * @param age the age to set
   */
   public void setAge(int age) {
   this.age = age;
   }
}
```

EmployeeDetails class is used to:

- get/set the value of employee's name.
- get/set the value of employee's monthly salary.
- get/set the value of employee's age.

Create a **EmpBusinessLogic.java** in **C:\ > TestNG_WORKSPACE** which contains business logic.

```
public class EmpBusinessLogic {
   // Calculate the yearly salary of employee
   public double calculateYearlySalary(EmployeeDetails employeeDetails){
      double yearlySalary=0;
      yearlySalary = employeeDetails.getMonthlySalary() * 12;
```

```
      return yearlySalary;
   }

   // Calculate the appraisal amount of employee
   public double calculateAppraisal(EmployeeDetails employeeDetails){
      double appraisal=0;
      if(employeeDetails.getMonthlySalary() < 10000){
         appraisal = 500;
      }else{
         appraisal = 1000;
      }
      return appraisal;
   }
}
```

EmpBusinessLogic class is used for calculating.

- the yearly salary of employee.
- the appraisal amount of employee.

Now, let's create a TestNG class called **TestEmployeeDetails.java** in **C:\ > TestNG_WORKSPACE**.A TestNG class is a Java class that contains at least one TestNG annotation. This class contains test cases to be tested. A TestNG test can be configured by @BeforeXXX and @AfterXXX annotations (we will see this in the chapter TestNG - Execution Procedure) which allows to perform some Java logic before and after a certain point.

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

public class TestEmployeeDetails {
 EmpBusinessLogic empBusinessLogic = new EmpBusinessLogic();
 EmployeeDetails employee = new EmployeeDetails();

 @Test
 public void testCalculateAppriasal() {
  employee.setName("Rajeev");
  employee.setAge(25);
  employee.setMonthlySalary(8000);
  double appraisal = empBusinessLogic
   .calculateAppraisal(employee);
  Assert.assertEquals(500, appraisal, 0.0, "500");
 }

 // test to check yearly salary
 @Test
 public void testCalculateYearlySalary() {
  employee.setName("Rajeev");
  employee.setAge(25);
  employee.setMonthlySalary(8000);
  double salary = empBusinessLogic
   .calculateYearlySalary(employee);
  Assert.assertEquals(96000, salary, 0.0, "8000");
 }
}
```

TestEmployeeDetails class is used for testing the methods of **EmpBusinessLogic** class. It

- tests the yearly salary of the employee.
- tests the appraisal amount of the employee.

Before you can run the tests, however, you must configure TestNG using a special XML file, conventionally named testng.xml. The syntax for this file is very simple, and its contents as below. Create this file in **C:\ > TestNG_WORKSPACE**:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
```

```
<suite name="Suite1">
  <test name="test1">
    <classes>
       <class name="TestEmployeeDetails"/>
    </classes>
  </test>
</suite>
```

Details of the above file are as below:

- A suite is represented by one XML file. It can contain one or more tests and is defined by the <suite> tag.
- Tag <test> represents one test and can contain one or more TestNG classes.
- <class> tag represents a TestNG class is a Java class that contains at least one TestNG annotation. It can contain one or more test methods.

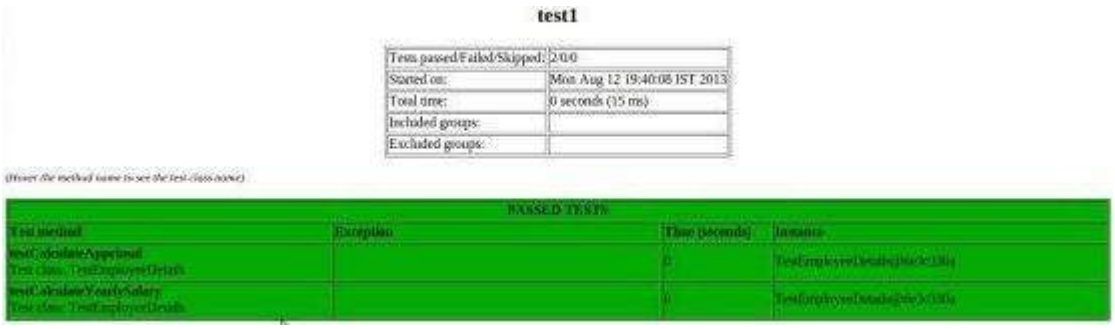
Compile the Test case classes using javac.

```
C:\TestNG_WORKSPACE>javac EmployeeDetails.java EmpBusinessLogic.java
TestEmployeeDetails.java
```

Now TestNG with the following command:

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE" org.testng.TestNG testng.xml
```

If all has been done correctly, you should see the results of your tests in the console. Furthermore, TestNG creates a very nice HTML report in a folder called **test-output** that is automatically created in the current directory. If you open it and load index.html, you will see a page similar to the one in the image below:



BASIC ANNOTATIONS

The traditional way to indicate test methods in JUnit 3 is by prefixing their name with test. This is a very effective method for tagging certain methods in a class as having a special meaning, but the naming doesn't scale very well *whatifwewanttoaddmoretagsfordifferentframeworks*? and is rather inflexible *whatifwewanttopassadditionalparameterstothetestingframework*?.

Annotations were formally added to the Java language in JDK 5 and TestNG made the choice to use annotations to annotate test classes.

Here is the list of annotations that TestNG supports:

Annotation	Description
@BeforeSuite	The annotated method will be run only once before all tests in this suite have run.
@AfterSuite	The annotated method will be run only once after all tests in this suite have run.
@BeforeClass	The annotated method will be run only once before the first test method in the current class is invoked.

@AfterClass	The annotated method will be run only once after all the test methods in the current class have been run.
@BeforeTest	The annotated method will be run before any test method belonging to the classes inside the <test> tag is run.
@AfterTest	The annotated method will be run after all the test methods belonging to the classes inside the <test> tag have run.
@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.
@BeforeMethod	The annotated method will be run before each test method.
@AfterMethod	The annotated method will be run after each test method.
@DataProvider	Marks a method as supplying data for a test method. 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.
@Factory	Marks a method as a factory that returns objects that will be used by TestNG as Test classes. The method must return Object[].
@Listeners	Defines listeners on a test class.
@Parameters	Describes how to pass parameters to a @Test method.
@Test	Marks a class or a method as part of the test.

Benefits of using annotations

Following are some of the benefits of using annotations:

- TestNG identifies the methods it is interested in by looking up annotations. Hence method names are not restricted to any pattern or format.
- We can pass additional parameters to annotations.
- Annotations are strongly typed, so the compiler will flag any mistakes right away.
- Test classes no longer need to extend anything *suchasTestCase*, *forJUnit3*.

EXCECUTION PROCEDURE

This tutorial explains the execution procedure of methods in TestNG which means that which method is called first and which one after that. Here is the execution procedure of the TestNG test API methods with the example.

Create a java class file name TestngAnnotation.java in **C:\ > TestNG_WORKSPACE** to test annotation.

```
import org.testng.annotations.Test;
import org.testng.annotations.BeforeMethod;
import org.testng.annotations.AfterMethod;
import org.testng.annotations.BeforeClass;
import org.testng.annotations.AfterClass;
import org.testng.annotations.BeforeTest;
```

```
import org.testng.annotations.AfterTest;
import org.testng.annotations.BeforeSuite;
import org.testng.annotations.AfterSuite;

public class TestngAnnotation {
 // test case 1
 @Test
 public void testCase1() {
  System.out.println("in test case 1");
 }

 // test case 2
 @Test
 public void testCase2() {
  System.out.println("in test case 2");
 }

 @BeforeMethod
 public void beforeMethod() {
  System.out.println("in beforeMethod");
 }

 @AfterMethod
 public void afterMethod() {
  System.out.println("in afterMethod");
 }

 @BeforeClass
 public void beforeClass() {
  System.out.println("in beforeClass");
 }

 @AfterClass
 public void afterClass() {
  System.out.println("in afterClass");
 }

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

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

 @BeforeSuite
 public void beforeSuite() {
  System.out.println("in beforeSuite");
 }

 @AfterSuite
 public void afterSuite() {
  System.out.println("in afterSuite");
 }

}
```

Next, let's create the file **testng.xml** in **C:\ > TestNG_WORKSPACE** to execute annotations.

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
<suite name="Suite1">
  <test name="test1">
    <classes>
       <class name="TestngAnnotation"/>
    </classes>
  </test>
```

```
</suite>
```

Compile the Test case class using javac.

```
C:\TestNG_WORKSPACE>javac TestngAnnotation.java
```

Now, run the testng.xml, which will run test case defined in provided Test Case class.

```
C:\TestNG_WORKSPACE>java org.testng.TestNG testng.xml
```

Verify the output.

```
in beforeSuite
in beforeTest
in beforeClass
in beforeMethod
in test case 1
in afterMethod
in beforeMethod
in test case 2
in afterMethod
in afterClass
in afterTest
in afterSuite

===============================================
Suite
Total tests run: 2, Failures: 0, Skips: 0
===============================================
```

See the above output and this is how the TestNG execution procedure is:

- First of all beforeSuite method is executed only once.
- Lastly, the afterSuite method executes only once.
- Even the methods beforeTest, beforeClass, afterClass and afterTest methods are executed only once.
- beforeMethod method executes for each test case but before executing the test case.
- afterMethod method executes for each test case but after the execution of test case.
- In between beforeMethod and afterMethod each test case executes.

EXECUTING TESTS

The test cases are executed using **TestNG** class. This class is the main entry point for running tests in the TestNG framework. Users can create their own TestNG object and invoke it in many different ways:

- On an existing testng.xml
- On a synthetic testng.xml, created entirely from Java
- By directly setting the test classes.

You can also define which groups to include or exclude, assign parameters, etc. The command line parameters are:

- -d outputdir: specify the output directory
- -testclass class_name: specifies one or several class names
- -testjar jar_name: specifies the jar containing the tests

- -sourcedir src1;src2: ; separated list of source directories *usedonlywhenjavadocannotationsareused*
- -target
- -groups
- -testrunfactory
- -listener

We will create the TestNG object an existing testng.xml in our example below.

Create a Class

- Create a java class to be tested say MessageUtil.java in **C:\ > TestNG_WORKSPACE**

```
/*
* This class prints the given message on console.
*/
public class MessageUtil {

   private String message;

   //Constructor
   //@param message to be printed
   public MessageUtil(String message){
      this.message = message;
   }

   // prints the message
   public String printMessage(){
      System.out.println(message);
      return message;
   }
}
```

Create Test Case Class

- Create a java test class say SampleTest.java.
- Add a test method testPrintMessage to your test class.
- Add an Annotation @Test to method testPrintMessage.
- Implement the test condition and check the condition using assertEquals API of TestNG.

Create a java class file name SampleTest.java in **C:\ > TestNG_WORKSPACE**

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

public class SampleTest {

   String message = "Hello World";
   MessageUtil messageUtil = new MessageUtil(message);

   @Test
   public void testPrintMessage() {
        Assert.assertEquals(message, messageUtil.printMessage());
   }
}
```

Create testng.xml

Next, let's create testng.xml file in **C:\ > TestNG_WORKSPACE** to execute Test case*s*. This file captures your entire testing in XML. This file makes it easy to describe all your test suites and their parameters in one file, which you can check in your code repository or email to coworkers. It also

makes it easy to extract subsets of your tests or split several runtime configurations *e. g. , testng − database. xmlwouldrunonlyteststhatexerciseyourdatabase*.

```
<?xml version="1.0" encoding="UTF-8"?>
<suite name="Sample test Suite">
   <test name="Sample test">
    <classes>
      <class name="SampleTest" />
    </classes>
  </test>
</suite>
```

Compile the Test case using javac.

```
C:\TestNG_WORKSPACE>javac MessageUtil.java SampleTest.java
```

Now, run the testng.xml, which will run test case defined in <test> tag.

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE" org.testng.TestNG testng.xml
```

Verify the output.

```
Hello World

===============================================
Sample test Suite
Total tests run: 1, Failures: 0, Skips: 0
===============================================
```

SUITE TESTS

A **Test suite** is a collection of test cases that are intended to test a behavior or set of behaviors of software program. In TestNG, we cannot define a suite in testing source code, but it is represented by one XML file as suite is the feature of execution. This also allows flexible configuration of the *tests* to be run. A suite can contain one or more tests and is defined by the <suite> tag.

<suite> is a root tag of your testng.xml. It describes a test suite, which in turn is made of several <test> sections.

Table below lists all the legal attributes <suite> accepts.

Attribute	Description
name	The name of this suite. It is a **mandatory** attribute.
verbose	The level or verbosity for this run.
parallel	Whether TestNG should run different threads to run this suite.
thread-count	The number of threads to use,if parallel mode is enabled *ignoredother − wise*.
annotations	The type of annotations you are using in your tests.
time-out	The default timeout that will be used on all the test methods found in this test.

In this chapter we will show you an example having two Test1 & Test2 test classes to run together using Test Suite.

Create a Class

Create a java class to be tested say MessageUtil.java in **C:\ > JUNIT_WORKSPACE**

```
/*
* This class prints the given message on console.
*/
public class MessageUtil {
    private String message;

    // Constructor
    // @param message to be printed
    public MessageUtil(String message) {
     this.message = message;
    }

    // prints the message
    public String printMessage() {
     System.out.println(message);
     return message;
    }

    // add "Hi!" to the message
    public String salutationMessage() {
     message = "Hi!" + message;
     System.out.println(message);
     return message;
    }
}
```

Create Test Case Classes

Create a java class file name Test1.java in **C:\ > TestNG_WORKSPACE**

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

public class Test1 {
    String message = "Manisha";
    MessageUtil messageUtil = new MessageUtil(message);

    @Test
    public void testPrintMessage() {
        System.out.println("Inside testPrintMessage()");
 Assert.assertEquals(message, messageUtil.printMessage());
    }
}
```

Create a java class file name Test2.java in **C:\ > TestNG_WORKSPACE**

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

public class Test2 {
    String message = "Manisha";
    MessageUtil messageUtil = new MessageUtil(message);

    @Test
    public void testSalutationMessage() {
        System.out.println("Inside testSalutationMessage()");
        message = "Hi!" + "Manisha";
        Assert.assertEquals(message,messageUtil.salutationMessage());
    }
}
```

Now, let's write the testng.xml in **C:\ > TestNG_WORKSPACE** which would contain the <suite> tag as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
<suite name="Suite1">
```

```
  <test name="exampletest1">
    <classes>
       <class name="Test1" />
    </classes>
  </test>
  <test name="exampletest2">
    <classes>
       <class name="Test2" />
    </classes>
  </test>
</suite>
```

Suite1 includes *exampletest1* and *exampletest2*.

Compile all java classes using javac.

```
C:\TestNG_WORKSPACE>javac MessageUtil.java Test1.java Test2.java
```

Now, run the testng.xml, which will run test case defined in provided Test Case class.

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE" org.testng.TestNG testng.xml
```

Verify the output.

```
Inside testPrintMessage()
Manisha
Inside testSalutationMessage()
Hi!Manisha

===============================================
Suite1
Total tests run: 2, Failures: 0, Skips: 0
===============================================
```

IGNORE TESTS

Sometimes, it happens that our code is not ready and test case written to test that method/code will fail if run. In such cases annotation *@Testenabled = false* helps to disable this test case.

A test method annotated with *@Testenabled = false*, then the test case that is not ready to test is bypassed.

Now, let's see @Test*enabled = false* in action.

Create a Class

- Create a java class to be tested say MessageUtil.java in **C:\ > TestNG_WORKSPACE**

```
/*
* This class prints the given message on console.
*/
public class MessageUtil {

   private String message;

   //Constructor
   //@param message to be printed
   public MessageUtil(String message){
      this.message = message;
   }

   // prints the message
   public String printMessage(){
      System.out.println(message);
      return message;
```

```
   }

   // add "Hi!" to the message
   public String salutationMessage(){
      message = "Hi!" + message;
      System.out.println(message);
      return message;
   }
}
```

Create Test Case Class

- Create a java test class say IgnoreTest.java.
- Add test methods testPrintMessage, testSalutationMessage to your test class.
- Add an Annotation @Test*enabled = false* to method testPrintMessage.

Create a java class file name IgnoreTest.java in **C:\ > TestNG_WORKSPACE**

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

public class IgnoreTest {
    String message = "Manisha";
    MessageUtil messageUtil = new MessageUtil(message);

    @Test(enabled = false)
    public void testPrintMessage() {
        System.out.println("Inside testPrintMessage()");
        message = "Manisha";
 Assert.assertEquals(message, messageUtil.printMessage());
    }

    @Test
    public void testSalutationMessage() {
        System.out.println("Inside testSalutationMessage()");
 message = "Hi!" + "Manisha";
 Assert.assertEquals(message, messageUtil.salutationMessage());
    }
}
```

Create testng.xml

Create a testng.xml **C:\ > TestNG_WORKSPACE** to execute Test cases

```
<?xml version="1.0" encoding="UTF-8"?><!DOCTYPE suite SYSTEM "http://testng.org/testng-
1.0.dtd" >
<suite name="Suite1">
  <test name="test1">
    <classes>
       <class name="IgnoreTest" />
    </classes>
  </test>
 </suite>
```

Compile the MessageUtil, Test case classes using javac.

```
C:\TestNG_WORKSPACE>javac MessageUtil.java IgnoreTest.java
```

Now, run the testng.xml, which will not run testPrintMessage test case defined in provided Test Case class.

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE" org.testng.TestNG testng.xml
```

Verify the output. testPrintMessage test case is not tested.

```
Inside testSalutationMessage()
Hi!Manisha

===============================================
Suite1
Total tests run: 1, Failures: 0, Skips: 0
===============================================
```

GROUP TEST

The group test is a new innovative feature in TestNG, it doesn’t exist in JUnit framework, it permits you dispatch methods into proper portions and preform sophisticated groupings of test methods. Not only can you declare those methods that belong to groups, but you can also specify groups that contain other groups. Then, TestNG can be invoked and asked to include a certain set of groups *orregularexpressions* while excluding another set. This gives you maximum flexibility in how you partition your tests and doesn't require you to recompile anything if you want to run two different sets of tests back to back.

Groups are specified in your testng.xml file using the <groups> tag. It can be found either under the <test> or <suite> tag. Groups specified in the <suite> tag apply to all the <test> tags underneath.

Now, let's see an example of how to group test.

Create a Class

- Create a java class to be tested say MessageUtil.java in **C:\ > TestNG_WORKSPACE**

```
/*
* This class prints the given message on console.
*/
public class MessageUtil {
    private String message;

    // Constructor
    // @param message to be printed
    public MessageUtil(String message) {
        this.message = message;
    }

    // prints the message
    public String printMessage() {
        System.out.println(message);
 return message;
    }

    // add "tutorialspoint" to the message
    public String salutationMessage() {
        message = "tutorialspoint" + message;
 System.out.println(message);
 return message;
    }

    // add "www." to the message
    public String exitMessage() {
 message = "www." + message;
 System.out.println(message);
 return message;
    }
}
```

Create Test Case Class

- Create a java test class say GroupTestExample.java.

- Add test methods testPrintMessage, testSalutationMessage to your test class.
- Group the test method in two categories say:
    - Check-in tests *checkintest*: These tests should be run before you submit new code. They should typically be fast and just make sure no basic functionality is broken.
    - Functional tests *functest*: These tests should cover all the functionalities of your software and be run at least once a day, although ideally you would want to run them continuously.

Create the java class file name GroupTestExample.java in **C:\ > TestNG_WORKSPACE**

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

public class GroupTestExample {
    String message = ".com";
    MessageUtil messageUtil = new MessageUtil(message);

    @Test(groups = { "functest", "checkintest" })
    public void testPrintMessage() {
        System.out.println("Inside testPrintMessage()");
 message = ".com";
 Assert.assertEquals(message, messageUtil.printMessage());
    }

    @Test(groups = { "checkintest" })
    public void testSalutationMessage() {
        System.out.println("Inside testSalutationMessage()");
 message = "tutorialspoint" + ".com";
 Assert.assertEquals(message, messageUtil.salutationMessage());
    }

    @Test(groups = { "functest" })
    public void testingExitMessage() {
        System.out.println("Inside testExitMessage()");
        message = "www." + "tutorialspoint"+".com";
 Assert.assertEquals(message, messageUtil.exitMessage());
    }
}
```

Create testng.xml

Create a testng.xml **C:\ > TestNG_WORKSPACE** to execute Test case*s*. Here, we would be executing only those tests which belong to the group *functest*.

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
<suite name="Suite1">
    <test name="test1">
        <groups>
     <run>
  <include name="functest" />
     </run>
 </groups>
 <classes>
     <class name="GroupTestExample" />
 </classes>
    </test>
</suite>
```

Compile the MessageUtil, Test case classes using javac.

```
C:\TestNG_WORKSPACE>javac MessageUtil.java GroupTestExample.java
```

Now, run the testng.xml, which will run only the method testPrintMessage as it belongs to the group

functest.

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE" org.testng.TestNG testng.xml
```

Verify the output. Only the method testPrintMessage is executed.

```
Inside testPrintMessage()
.com
Inside testExitMessage()
www..com

===============================================
Suite1
Total tests run: 2, Failures: 1, Skips: 0
===============================================
```

Groups of groups

Groups can also include other groups. These groups are called *MetaGroups*. For example, you might want to define a group *all* that includes *checkintest* and *functest*. Let's modify our testng.xml file as below:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
<suite name="Suite1">
   <test name="test1">
      <groups>
         <define name="all">
     <include name="functest"/>
     <include name="checkintest"/>
  </define>
  <run>
     <include name="all"/>
  </run>
     </groups>
  <classes>
       <class name="GroupTestExample" />
 </classes>
   </test>
</suite>
```

Executing the above testng.xml will execute all the three tests and will give you the below result:

```
Inside testPrintMessage()
.com
Inside testSalutationMessage()
tutorialspoint.com
Inside testExitMessage()
www.tutorialspoint.com

===============================================
Suite1
Total tests run: 3, Failures: 0, Skips: 0
===============================================
```

Exclusion groups

You can ignore a group by using the <exclude> tag as shown below:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
<suite name="Suite1">
   <test name="test1">
      <groups>
         <define name="all">
     <exclude name="functest"/>
```

```
      <include name="checkintest"/>
  </define>
  <run>
      <include name="all"/>
  </run>
     </groups>
  <classes>
       <class name="GroupTestExample" />
 </classes>
   </test>
</suite>
```

EXCEPTION TEST

TestNG provides a option of tracing the Exception handling of code. You can test whether a code throws desired exception or not. The **expectedExceptions** parameter is used along with @Test annotation. Now let's see *@TestexpectedExceptions* in action.

Create a Class

- Create a java class to be tested say MessageUtil.java in **C:\ > TestNG_WORKSPACE**.
- Add a error condition inside printMessage method.

```
/*
* This class prints the given message on console.
*/
public class MessageUtil {

   private String message;

   //Constructor
   //@param message to be printed
   public MessageUtil(String message){
      this.message = message;
   }

   // prints the message
   public void printMessage(){
      System.out.println(message);
      int a =0;
      int b = 1/a;
   }

   // add "Hi!" to the message
   public String salutationMessage(){
      message = "Hi!" + message;
      System.out.println(message);
      return message;
   }
}
```

Create Test Case Class

- Create a java test class say ExpectedExceptionTest.java.
- Add expected exception ArithmeticException to testPrintMessage test case.

Create a java class file name ExpectedExceptionTest.java in **C:\ > TestNG_WORKSPACE**

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

public class ExpectedExceptionTest {
    String message = "Manisha";
    MessageUtil messageUtil = new MessageUtil(message);
```

```
    @Test(expectedExceptions = ArithmeticException.class)
    public void testPrintMessage() {
        System.out.println("Inside testPrintMessage()");
        messageUtil.printMessage();
   }
   @Test
   public void testSalutationMessage() {
      System.out.println("Inside testSalutationMessage()");
      message = "Hi!" + "Manisha";
      Assert.assertEquals(message,messageUtil.salutationMessage());
   }
}
```

Create Test Runner

Create a testng.xml in **C:\ > TestNG_WORKSPACE** to execute Test case*s*.

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
<suite name="Suite1">
   <test name="test1">
        <classes>
       <class name="ExpectedExceptionTest" />
 </classes>
   </test>
</suite>
```

Compile the MessageUtil, Test case classes using javac

```
C:\TestNG_WORKSPACE>javac MessageUtil.java TestJunit.java
```

Now, run the Test Runner which will run test cases defined in provided Test Case class.

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE" org.testng.TestNG testng.xml
```

Verify the output. testPrintMessage test case will be passed.

```
Inside testPrintMessage()
Manisha
Inside testSalutationMessage()
Hi!Manisha

===============================================
Suite1
Total tests run: 2, Failures: 0, Skips: 0
===============================================
```

DEPENDENCY TEST

Sometimes, you may need to invoke methods in a Test case in a particular order or you want to share some data and state between methods. This kind of dependency is supported by TestNG as it supports the declaration of explicit dependencies between test methods.

TestNG allows you to specify dependencies either with:

- Using attributes *dependsOnMethods* in @Test annotations OR
- Using attributes *dependsOnGroups* in @Test annotations.

Example using attribute *dependsOnMethods*

Create a Class

Create a java class to be tested say MessageUtil.java in **C:\ > TestNG_WORKSPACE**

```
public class MessageUtil {
    private String message;

    // Constructor
    // @param message to be printed
    public MessageUtil(String message) {
        this.message = message;
    }

    // prints the message
    public String printMessage() {
        System.out.println(message);
 return message;
    }

    // add "Hi!" to the message
    public String salutationMessage() {
 message = "Hi!" + message;
 System.out.println(message);
 return message;
    }
}
```

Create Test Case Class

- Create a java test class say DependencyTestUsingAnnotation.java.
- Add test methods testPrintMessage,testSalutationMessage and initEnvironmentTest to your test class.
- Add attribute *dependsOnMethods = { "initEnvironmentTest" }* to the @Test annotation of *testSalutationMessage* method.

Create the java class file name DependencyTestUsingAnnotation.java in **C:\ > TestNG_WORKSPACE**

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

public class DependencyTestUsingAnnotation {
    String message = "Manisha";
    MessageUtil messageUtil = new MessageUtil(message);

    @Test
    public void testPrintMessage() {
 System.out.println("Inside testPrintMessage()");
 message = "Manisha";
 Assert.assertEquals(message, messageUtil.printMessage());
    }

    @Test(dependsOnMethods = { "initEnvironmentTest" })
    public void testSalutationMessage() {
        System.out.println("Inside testSalutationMessage()");
 message = "Hi!" + "Manisha";
 Assert.assertEquals(message, messageUtil.salutationMessage());
    }

    @Test
    public void initEnvironmentTest() {
 System.out.println("This is initEnvironmentTest");
    }
}
```

Create testng.xml

Create a testng.xml **C:\ > TestNG_WORKSPACE** to execute Test cases.

```
<?xml version="1.0" encoding="UTF-8"?><!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
<suite name="Suite1">
    <test name="test1">
 <classes>
     <class name="DependencyTestUsingAnnotation" />
 </classes>
    </test>
</suite>
```

Compile the MessageUtil, Test case classes using javac.

```
C:\TestNG_WORKSPACE>javac MessageUtil.java DependencyTestUsingAnnotation.java
```

Now, run the testng.xml, which will run the *testSalutationMessage* method only after the execution of *initEnvironmentTest* method.

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE" org.testng.TestNG testng.xml
```

Verify the output.

```
This is initEnvironmentTest
Inside testPrintMessage()
Manisha
Inside testSalutationMessage()
Hi!Manisha

===============================================
Suite1
Total tests run: 3, Failures: 0, Skips: 0
===============================================
```

Example using attribute *dependsOnGroups*

You can also have methods that depend on entire groups. Let's see an example below:

Create a Class

Create a java class to be tested say MessageUtil.java in **C:\ > TestNG_WORKSPACE**

```
public class MessageUtil {
    private String message;

    // Constructor
    // @param message to be printed
    public MessageUtil(String message) {
        this.message = message;
    }

    // prints the message
    public String printMessage() {
        System.out.println(message);
 return message;
    }

    // add "Hi!" to the message
    public String salutationMessage() {
 message = "Hi!" + message;
 System.out.println(message);
 return message;
    }
}
```

Create Test Case Class

- Create a java test class say DependencyTestUsingAnnotation.java.
- Add test methods testPrintMessage,testSalutationMessage and initEnvironmentTest to your test class and them to the group "init".
- Add attribute *dependsOnMethods = { "init.*" }* to the @Test annotation of *testSalutationMessage* method.

Create the java class file name DependencyTestUsingAnnotation.java in **C:\ > TestNG_WORKSPACE**

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

public class DependencyTestUsingAnnotation {
    String message = "Manisha";
    MessageUtil messageUtil = new MessageUtil(message);

    @Test(groups = { "init" })
    public void testPrintMessage() {
 System.out.println("Inside testPrintMessage()");
 message = "Manisha";
 Assert.assertEquals(message, messageUtil.printMessage());
    }

    @Test(dependsOnGroups = { "init.*" })
    public void testSalutationMessage() {
 System.out.println("Inside testSalutationMessage()");
 message = "Hi!" + "Manisha";
 Assert.assertEquals(message, messageUtil.salutationMessage());
    }

    @Test(groups = { "init" })
    public void initEnvironmentTest() {
 System.out.println("This is initEnvironmentTest");
    }
}
```

In this example, testSalutationMessage is declared as depending on any group matching the regular expression "init.*", which guarantees that the methods testPrintMessage and initEnvironmentTest will always be invoked before testSalutationMessage.

> *If a method depended upon fails and you have a hard dependency on it alwaysRun = false, whichisthedefault, the methods that depend on it are not marked as FAIL but as SKIP. Skipped methods will be reported as such in the final report inacolorthatisneitherrednorgreeninHTML, which is important since skipped methods are not necessarily failures.*

Create testng.xml

Create a testng.xml **C:\ > TestNG_WORKSPACE** to execute Test case*s*.

```
<?xml version="1.0" encoding="UTF-8"?><!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
<suite name="Suite1">
    <test name="test1">
 <classes>
     <class name="DependencyTestUsingAnnotation" />
 </classes>
    </test>
</suite>
```

Compile the MessageUtil, Test case classes using javac.

```
C:\TestNG_WORKSPACE>javac MessageUtil.java DependencyTestUsingAnnotation.java
```

Now, run the testng.xml, which will run the *testSalutationMessage* method only after the execution of *initEnvironmentTest* method.

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE" org.testng.TestNG testng.xml
```

Verify the output.

```
This is initEnvironmentTest
Inside testPrintMessage()
Manisha
Inside testSalutationMessage()
Hi!Manisha

===============================================
Suite1
Total tests run: 3, Failures: 0, Skips: 0
===============================================
```

dependsOnGroups Vs *dependsOnMethods*

- On using groups, we are no longer exposed to refactoring problems. as long as we don’t modify the dependsOnGroups or groups attributes, our tests will keep running with the proper dependencies set up.
- Whenever a new method needs to be added in the dependency graph, all we need to do is put it in the right group and make sure it depends on the correct group. We don’t need to modify any other method.

PARAMETERIZED TEST

Another interesting feature available in TestNG is *parametric testing*. In most cases, you'll come across a scenario where the business logic requires a hugely varying number of tests. *Parameterized tests* allow developer to run the same test over and over again using different values.

TestNG lets you pass parameters directly to your test methods in two different ways:

- With testng.xml
- With Data Providers

Passing Parameters with *testng.xml*

With this technique you define the simple parameters in the *testng.xml* file and then reference those parameters in source files. Let us see an example below on how to use this technique to pass parameters.

Create Test Case Class

- Create a java test class say ParameterizedTest1.java.
- Add test method parameterTest to your test class. This method takes a String as input parameter.
- Add the annotation *@Parameters*"*myName*" to this method. The parameter would be passed values from testng.xml which we will see in the next step.

Create the java class file name ParameterizedTest1.java in **C:\ > TestNG_WORKSPACE**

```
import org.testng.annotations.Parameters;
import org.testng.annotations.Test;
```

```
public class ParameterizedTest1 {
    @Test
    @Parameters("myName")
    public void parameterTest(String myName) {
        System.out.println("Parameterized value is : " + myName);
    }
}
```

Create testng.xml

Create a testng.xml **C:\ > TestNG_WORKSPACE** to execute Test cases.

```
<?xml version="1.0" encoding="UTF-8"?><!DOCTYPE suite SYSTEM "http://testng.org/testng-
1.0.dtd" >
<suite name="Suite1">
    <test name="test1">
 <parameter name="myName" value="manisha"/>
 <classes>
     <class name="ParameterizedTest1" />
     </classes>
    </test>
</suite>
```

> *We can also define the parameters at the <suite> level. Suppose we have defined myName at both <suite> and <test>, levels then, in such cases regular scoping rules apply. This means that any class inside <test> tag will see the value of parameter defined in <test>, while the classes in the rest of the testng.xml file will see the value defined in <suite>.*

Compile the Test case class using javac.

```
C:\TestNG_WORKSPACE>javac ParameterizedTest1.java
```

Now, run the testng.xml, which will run the *parameterTest* method. TestNG will try to find a parameter named *myName* first in the <test> tag , and then, if it can't find it, it searches in the <suit> tag that encloses it.

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE" org.testng.TestNG testng.xml
```

Verify the output.

```
Parameterized value is : manisha

===============================================
Suite1
Total tests run: 1, Failures: 0, Skips: 0
===============================================
```

TestNG will automatically try to convert the value specified in testng.xml to the type of your parameter. Here are the types supported:

- String
- int/Integer
- boolean/Boolean
- byte/Byte
- char/Character
- double/Double

- float/Float
- long/Long
- short/Short

Passing Parameters with *Dataproviders*

When you need to pass complex parameters or parameters that need to be created from Java complex objects, objects read from a property file or a database, etc..., in such cases parameters can be passed using Dataproviders. A Data Provider is a method annotated with *@DataProvider*. This annotation has only one string attribute: its name. If the name is not supplied, the Data Provider's name automatically defaults to the method's name. A Data Provider returns an array of objects.

Let us check out examples below of using Dataproviders. The first example is about @DataProvider using Vector, String or Integer as parameter and the second example is about @DataProvider using object as parameter

Example 1

Here, the @DataProvider passes Integer and Boolean as parameter.

Create Java class

Create a java class PrimeNumberChecker.java. This class checks if the number is prime. Create this class in **C:\ > TestNG_WORKSPACE**

```
public class PrimeNumberChecker {
    public Boolean validate(final Integer primeNumber) {
        for (int i = 2; i < (primeNumber / 2); i++) {
            if (primeNumber % i == 0) {
                return false;
             }
        }
        return true;
    }
}
```

Create Test Case Class

- Create a java test class say ParamTestWithDataProvider1.java.
- Define the method primeNumbers which is defined as a Dataprovider using the annotation. This method returns array of object array.
- Add test method testPrimeNumberChecker to your test class. This method takes a Integer and Boolean as input parameters. This method validates if the parameter passed is a prime number.
- Add the annotation *@Test*dataProvider = "test1" to this method. The attribute dataProvider is mapped to "test1".

Create the java class file name ParamTestWithDataProvider1.java in **C:\ > TestNG_WORKSPACE**

```
import org.testng.Assert;
import org.testng.annotations.BeforeMethod;
import org.testng.annotations.DataProvider;
import org.testng.annotations.Test;

public class ParamTestWithDataProvider1 {
    private PrimeNumberChecker primeNumberChecker;

    @BeforeMethod
    public void initialize() {
```

```
        primeNumberChecker = new PrimeNumberChecker();
    }

    @DataProvider(name = "test1")
    public static Object[][] primeNumbers() {
        return new Object[][] { { 2, true }, { 6, false }, { 19, true },
         { 22, false }, { 23, true } };
    }

    // This test will run 4 times since we have 5 parameters defined
    @Test(dataProvider = "test1")
    public void testPrimeNumberChecker(Integer inputNumber,
        Boolean expectedResult) {
 System.out.println(inputNumber + " " + expectedResult);
 Assert.assertEquals(expectedResult,
         primeNumberChecker.validate(inputNumber));
    }
}
```

Create testng.xml

Create a testng.xml **C:\ > TestNG_WORKSPACE** to execute Test cases.

```
<?xml version="1.0" encoding="UTF-8"?><!DOCTYPE suite SYSTEM "http://testng.org/testng-
1.0.dtd" >
<suite name="Suite1">
    <test name="test1">
 <classes>
     <class name="ParamTestWithDataProvider1" />
     </classes>
    </test>
</suite>
```

Compile the Test case class using javac.

```
C:\TestNG_WORKSPACE>.javac ParamTestWithDataProvider1.java PrimeNumberChecker.java
```

Now, run the testng.xml.

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE" org.testng.TestNG testng.xml
```

Verify the output.

```
2 true
6 false
19 true
22 false
23 true

===============================================
Suite1
Total tests run: 5, Failures: 0, Skips: 0
===============================================
```

Example 2

Here, the @DataProvider passes Object as parameter.

Create Java class

Create a java class Bean.java, which is simple object with get/set methods, in **C:\ > TestNG_WORKSPACE**.

```
public class Bean {
```

```
    private String val;
    private int i;
    public Bean(String val, int i){
        this.val=val;
        this.i=i;
    }
    public String getVal() {
 return val;
    }
    public void setVal(String val) {
 this.val = val;
    }
    public int getI() {
 return i;
    }
    public void setI(int i) {
 this.i = i;
    }
}
```

Create Test Case Class

- Create a java test class say ParamTestWithDataProvider2.java.
- Define the method primeNumbers which is defined as a Dataprovider using the annotation. This method returns array of object array.
- Add test method testMethod to your test class. This method takes object bean as parameter.
- Add the annotation *@Testdataprovider = "test1"* to this method. The attribute dataProvider is mapped to "test1".

Create the java class file name ParamTestWithDataProvider2.java in **C:\ > TestNG_WORKSPACE**

```
import org.testng.annotations.DataProvider;
import org.testng.annotations.Test;

public class ParamTestWithDataProvider2 {
    @DataProvider(name = "test1")
    public static Object[][] primeNumbers() {
        return new Object[][] { { new Bean("hi I am the bean", 111) } };
    }

    @Test(dataProvider = "test1")
    public void testMethod(Bean myBean) {
        System.out.println(myBean.getVal() + " " + myBean.getI());
    }
}
```

Create testng.xml

Create a testng.xml **C:\ > TestNG_WORKSPACE** to execute Test cases.

```
<?xml version="1.0" encoding="UTF-8"?><!DOCTYPE suite SYSTEM "http://testng.org/testng-
1.0.dtd" >
<suite name="Suite1">
    <test name="test1">
 <classes>
     <class name="ParamTestWithDataProvider2" />
     </classes>
    </test>
</suite>
```

Compile the Test case class using javac.

```
C:\TestNG_WORKSPACE>javac ParamTestWithDataProvider2.java Bean.java
```

Now, run the testng.xml.

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE" org.testng.TestNG testng.xml
```

Verify the output.

```
hi I am the bean 111

===============================================
Suite1
Total tests run: 1, Failures: 0, Skips: 0
===============================================
```

RUN JUNIT TESTS

Now that you have understood TestNG and its various tests, you must be worried by now as to how to refactor your existing Junit code. There's no need to worry as TestNG provides a way to shift from Junit to TestNG at your own pace. You can execute your existing Junit test cases using TestNG.

TestNG can automatically recognize and run JUnit tests, so you can use TestNG as a runner for all your existing tests and write new tests using TestNG. All you have to do is to put JUnit library on the TestNG classpath, so it can find and use JUnit classes, change your test runner from JUnit to TestNG in Ant and then run TestNG in "mixed" mode. This way you can have all your tests in the same project, even in the same package, and start using TestNG. This approach also allows you to convert your existing JUnit tests to TestNG incrementally.

Let us see an example below and try out the above feature:

Create Junit Test case Class

Create a java class which is a Junit test class, TestJunit.java in **C:\ > TestNG_WORKSPACE**

```
import org.junit.Test;
import static org.testng.AssertJUnit.assertEquals;


public class TestJunit {
    @Test
    public void testAdd() {
        String str= "Junit testing using TestNG";
        assertEquals("Junit testing using TestNG",str);
    }
}
```

Now, let's write the testng.xml in **C:\ > TestNG_WORKSPACE** which would contain the <suite> tag as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd">
<suite name="Converted JUnit suite" >
    <test name="JUnitTests" junit="true">
        <classes>
            <class name="TestJunit" />
        </classes>
    </test>
</suite>
```

To execute the Junit test cases define property *junit*="*true*" as in the xml above. The Junit test case class TestJunit is defined in class name.

For Junit 4, TestNG will use the *org.junit.runner.JUnitCore* runner to run your tests.

Compile all java classes using javac.

```
C:\TestNG_WORKSPACE>javac TestJunit.java
```

Now, run the testng.xml, which will run Junit test case as TestNG.

```
C:\TestNG_WORKSPACE>java -cp "C:\TestNG_WORKSPACE:C:\TestNG_WORKSPACE\lib\junit-
4.11.jar" org.testng.TestNG testng.xml
```

Here I've placed the junit-4.11.jar under C:\TestNG_WORKSPACE\lib\junit-4.11.jar.

Verify the output.

```
===============================================
Converted JUnit suite

Total tests run: 1, Failures: 0, Skips: 0
===============================================
```

TEST RESULTS

Reporting is the most important part of any test execution, reason being it helps the user to understand the result of the test execution, point of failure, and reasons for the failure. Logging, on the other hand, is important to keep an eye on the execution flow or for debugging in case of any failures.

TestNG by default generates a different type of report for its test execution. This includes an HTML and an XML report output. TestNG also allows its users to write their own reporter and use it with TestNG. There is also an option to write your own loggers, which are notified at runtime by TestNG.

There are two main ways to generate a report with TestNG:

- **Listeners :** For implementing a listener class, the class has to implement the *org.testng.ITestListener* interface. These classes are notified at runtime by TestNG when the test starts, finishes, fails, skips, or passes.
- **Reporters :** For implementing a reporting class, the class has to implement an *org.testng.IReporter* interface. These classes are called when the whole suite run ends. The object containing the information of the whole test run is passed to this class when called.

The table below lists examples for different cases of reporting and logging:

Custom Logging	This example illustrates how to write your own logger.
Custom Reporter	This example illustrates how to write your own reporter.
HTML and XML report	This example illustrates the default HTML and XML report generated by TestNG.
JUnit Reports	This example illustrates the about generating Junit reports from TestNG reports.

PLUG WITH ANT

In this example, we will demonstrate how to run TestNG using ANT. Let's follow the given steps:

Step 1: Download Apache Ant

Download Apache Ant

OS	Archive name

Windows	apache-ant-1.8.4-bin.zip
Linux	apache-ant-1.8.4-bin.tar.gz
Mac	apache-ant-1.8.4-bin.tar.gz

Step 2: Set Ant Environment

Set the **ANT_HOME** environment variable to point to the base directory location where ANT libraries is stored on your machine. For example, We've stored Ant libraries in apache-ant-1.8.4 folder on various Operating Systems as follows.

OS	Output
Windows	Set the environment variable ANT_HOME to C:\Program Files\Apache Software Foundation\apache-ant-1.8.4
Linux	export ANT_HOME=/usr/local/\apache-ant-1.8.4
Mac	export ANT_HOME=/Library/\apache-ant-1.8.4

Append Ant compiler location to System Path is as follows for different OS:

OS	Output
Windows	Append the string ;%ANT_HOME\bin to the end of the system variable, Path.
Linux	export PATH=PATH:ANT_HOME/bin/
Mac	not required

Step 3: Download TestNG Archive

Download http://www.testng.org.

OS	Archive name
Windows	testng-6.8.jar
Linux	testng-6.8.jar
Mac	testng-6.8.jar

Step 4: Create Project Structure

- Create folder **TestNGWithAnt** in **C:\ > TestNG_WORKSPACE**
- Create folder **src** in **C:\ > TestNG_WORKSPACE > TestNGWithAnt**
- Create folder **test** in **C:\ > TestNG_WORKSPACE > TestNGWithAnt**
- Create folder **lib** in **C:\ > TestNG_WORKSPACE > TestNGWithAnt**
- Create MessageUtil class in **C:\ > TestNG_WORKSPACE > TestNGWithAnt > src** folder

```
/*
* This class prints the given message on console.
*/
```

```
public class MessageUtil {

   private String message;

   //Constructor
   //@param message to be printed
   public MessageUtil(String message){
      this.message = message;
   }

   // prints the message
   public void printMessage(){
      System.out.println(message);
      return message;
   }

   // add "Hi!" to the message
   public String salutationMessage(){
      message = "Hi!" + message;
      System.out.println(message);
      return message;
   }
}
```

- Create TestMessageUtil class in **C:\ > TestNG_WORKSPACE > TestNGWithAnt > src** folder

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


public class TestMessageUtil {
    String message = "Manisha";
    MessageUtil messageUtil = new MessageUtil(message);

    @Test
    public void testPrintMessage() {
        System.out.println("Inside testPrintMessage()");
        Assert.assertEquals(message,messageUtil.printMessage());
    }

    @Test
    public void testSalutationMessage() {
        System.out.println("Inside testSalutationMessage()");
        message = "Hi!" + "Manisha";
        Assert.assertEquals(message,messageUtil.salutationMessage());
    }
}
```

- Copy testng-6.8.jar in **C:\ > TestNG_WORKSPACE > TestNGWithAnt > lib** folder

Create ANT build.xml

First we need define the TestNG ant task as follows:

```
<taskdef name="testng" classname="org.testng.TestNGAntTask">
    <classpath>
      <pathelement location="lib/testng-6.8.jar"/>
    </classpath>
  </taskdef>
```

Then, we'll be using **<testng>** task in Ant to execute our TestNG test cases.

The **C:\ > TestNG_WORKSPACE > TestNGWithAnt >\ build.xml** is as follows:

```
<project name="TestNGTest" default="test" basedir=".">
<!-- Define <testng> task -->
```

```
  <taskdef name="testng" classname="org.testng.TestNGAntTask">
    <classpath>
      <pathelement location="lib/testng-6.8.jar"/>
    </classpath>
  </taskdef>
   <property name="testdir" location="test" />
   <property name="srcdir" location="src" />
   <property name="libdir" location="lib" />
   <property name="full-compile" value="true" />
   <path />
   <path >
       <fileset dir="${libdir}">
         <include name="**/*.jar" />
       </fileset>
       <pathelement location="${testdir}" />
       <pathelement location="${srcdir}" />
       <path ref />
   </path>
   <target name="clean" >
       <delete verbose="${full-compile}">
          <fileset dir="${testdir}" includes="**/*.class" />
       </delete>
   </target>
   <target name="compile" depends="clean">
       <javac srcdir="${srcdir}" destdir="${testdir}"
          verbose="${full-compile}">
          <classpath ref/>
       </javac>
   </target>
   <target name="test" depends="compile">
 <testng outputdir="${testdir}" classpathref="classpath.test">
       <xmlfileset dir="${srcdir}" includes="testng.xml"/>
    </testng>
   </target>
</project>
```

Run the following ant command.

```
C:\TestNG_WORKSPACE\TestNGWithAnt>ant
```

Verify the output.

```
test:
   [testng] [TestNG] Running:
   [testng]   C:\TestNG_WORKSPACE\TestNGWithAnt\src\testng.xml
   [testng]
   [testng] Inside testPrintMessage()
   [testng] Manisha
   [testng] Inside testSalutationMessage()
   [testng] Hi!Manisha
   [testng]
   [testng] ===============================================
   [testng] Plug ANT test Suite
   [testng] Total tests run: 2, Failures: 0, Skips: 0
   [testng] ===============================================
   [testng]

BUILD SUCCESSFUL
Total time: 1 second
```

PLUG WITH ECLIPSE

To set up TestNG with eclipse, the following steps need to be followed.

Step 1: Download TestNG archive

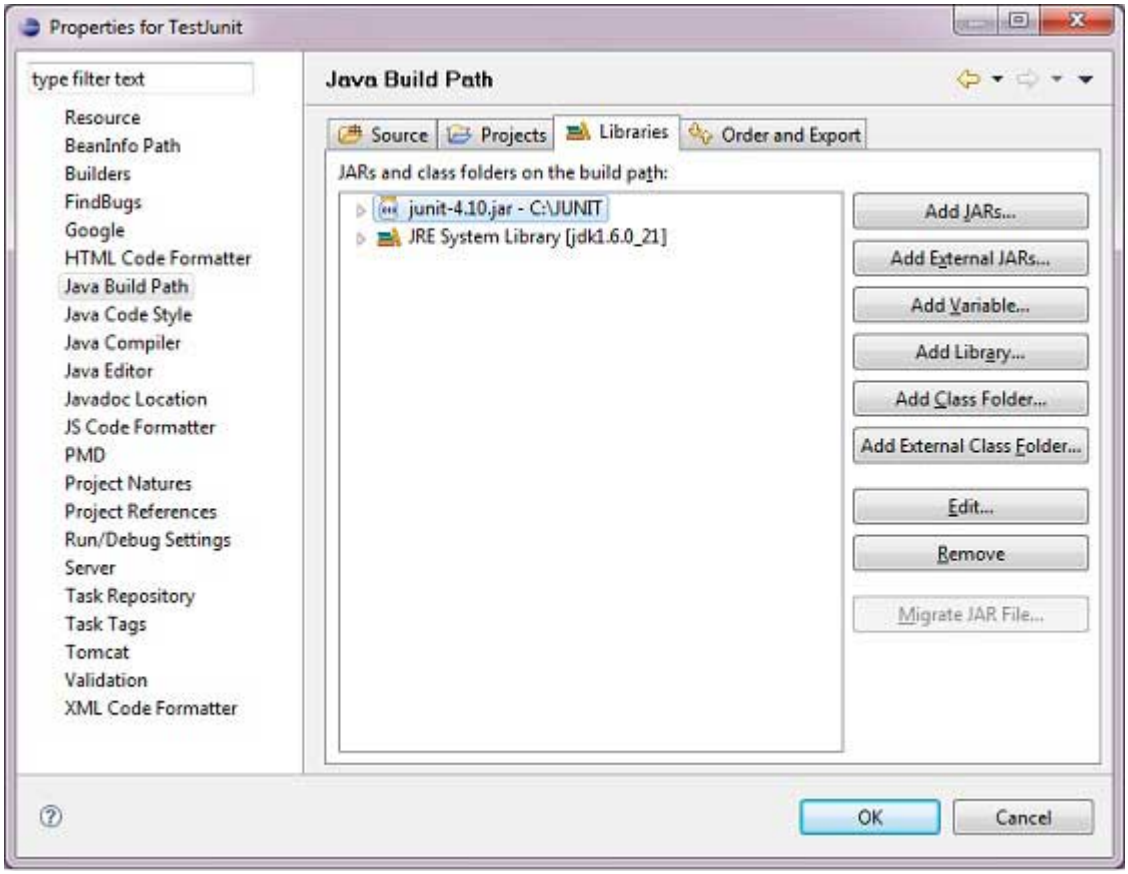
Download http://www.testng.org

OS	Archive name
Windows	testng-6.8.jar
Linux	testng-6.8.jar
Mac	testng-6.8.jar

Assume you copied above JAR file in C:\>TestNG folder.

Step 2: Set Eclipse environment

- Open eclipse -> right click on project and click on property > Build Path > Configure Build Path and add the testng-6.8.jar in the libraries using *Add External Jar* button.



- We assume that your eclipse has inbuilt TestNG plugin if it is not available then please get the latest version using the update site:
    - In your eclipse IDE select *Help / Software updates / Find and Install*.
    - *Search for new features to install.*
    - *New remote site.*
    - For Eclipse 3.4 and above, enter http://beust.com/eclipse.
    - For Eclipse 3.3 and below, enter http://beust.com/eclipse1.
    - Make sure the check box next to URL is checked and click *Next*.
    - Eclipse will then guide you through the process.

Now, your eclipse is ready for the development of TestNG test cases.

Step 3: Verify TestNG installation in Eclipse

- Create a project TestNGProject in eclipse at any location.
- Create a class MessageUtil to test in the project.

```
/*
* This class prints the given message on console.
*/
public class MessageUtil {

   private String message;

   //Constructor
   //@param message to be printed
   public MessageUtil(String message){
      this.message = message;
   }

   // prints the message
   public String printMessage(){
      System.out.println(message);
      return message;
   }
}
```

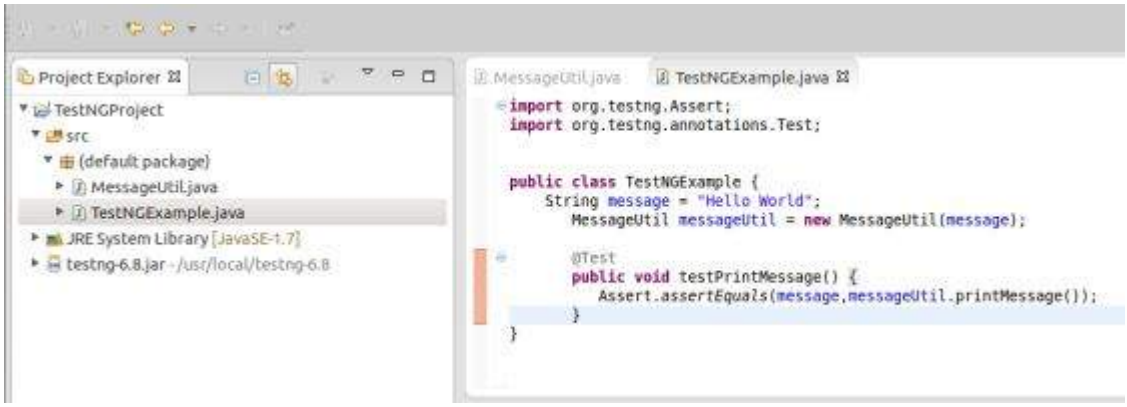
- Create a test class TestNGExample in the project.

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

public class TestNGExample {
    String message = "Hello World";
    MessageUtil messageUtil = new MessageUtil(message);

    @Test
    public void testPrintMessage() {
       Assert.assertEquals(message,messageUtil.printMessage());
   }
}
```

Following should be the project structure:



Finally, verify the output of the program by right click on program and run as TestNG.

Verify the result.