

A better Java project

Best practices for an efficient Java/Maven project

Version 1.18-SNAPSHOT

2018-08-17

Table of Contents

1. Eclipse plugins	1
2. Useful Java libraries	1
2.1. Mockito / PowerMockito	1
2.2. OpenPojo : Auto test Pojo classes for coverage	1
2.3. SLF4J : Abstract logging	2
2.4. Aspect4log : Logging functions starts/stops with inputs/outputs	3
2.5. Log methods duration	5
2.5.1. using JCabi @Loggable	5
3. Best practices	6
3.1. Java	6
3.1.1. Java packages & classes naming	6
3.1.2. Java 7 try with closable objects	6
3.1.3. Static Java Maps	7
3.1.4. Init on demand	7
3.1.5. Enum and String	7
3.1.6. MyEnum.toEnum(String)	8
3.2. Maven	9
3.2.1. Config files location	9
3.2.2. Checkstyle : check javadoc	9
3.2.3. Add version and date to AsciiDoc PDFs	10
3.2.4. Javadoc generation with UML diagrams	11
3.2.5. Install provided dependencies in local repository	12
3.2.6. To generate AsciiDoc PDF files	12
3.2.7. SonarQube with Jacoco for coverage	13

Table 1. History

Date	Author	Detail Unresolved directive in subdocs/_init.adoc - include::/builds/TheNeVraX/cg-wm/target/generated-docs/history/better-java-project.adoc.psv[]
------	--------	---

1. Eclipse plugins

Developer Guide



TODO : put the generic content inline here

2. Useful Java libraries

2.1. Mockito / PowerMockito

Usage for static classes

```
@RunWith(PowerMockRunner.class)
@PrepareForTest({ TypeUtils.class })
@PowerMockIgnore("javax.management.*")
public class OpenPojoWebTest {

    @Before
    public void before() throws Exception {
        PowerMockito.mockStatic(TypeUtils.class);
        PowerMockito.when(TypeUtils.setterDate((Date) Mockito.any(), (Date) Mockito.any()))
            .thenAnswer(invocation -> invocation.getArgumentAt(1, Date.class));
    }

}
```

2.2. OpenPojo : Auto test Pojo classes for coverage



<https://github.com/OpenPojo/openpojo>

OpenPojo au tests Pojo classes, especially getters and setters. Very handy for large beans / auto generated classes for whom testing is boring.

```

import com.openpojo.reflection.filters.FilterNonConcrete;
import com.openpojo.validation.Validator;
import com.openpojo.validation.ValidatorBuilder;
import com.openpojo.validation.test.impl.GetterTester;
import com.openpojo.validation.test.impl.SetterTester;

public class OpenPojoTest {

    public static void validateBeans(String javaPackage) {
        Validator validator = ValidatorBuilder.create().with(new SetterTester()).with(new GetterTester()).build();
        //exclude enums, abstracts, interfaces
        validator.validateRecursively(javaPackage, new FilterNonConcrete());
    }

    @Test ①
    public void testPojoRecursiv() {
        // recursive
        validateBeans("my.full.java.package.with.sub.packages");
    }

    @Test ②
    public void testExcludingSomeClasses() {
        List<PojoClass> listOfPojoClassInDto = PojoClassFactory.getPojoClasses("my.full.java.package.with.sub.packages",
null);
        listOfPojoClassInDto.remove(PojoClassFactory.getPojoClass(SomeSpecialClassNotToTest.class));
        validator.validate(listOfPojoClassInDto);
    }
}

```

① Fully recursive example

② Excluding some classes

Maven dependency

```

<dependency>
  <groupId>com.openpojo</groupId>
  <artifactId>openpojo</artifactId>
  <version>0.8.6</version>
  <scope>test</scope>
</dependency>

```

2.3. SLF4J : Abstract logging

```
<dependency>
  <groupId>org.slf4j</groupId>
  <artifactId>slf4j-api</artifactId>
  <version>1.7.21</version>
</dependency>
<dependency>
  <groupId>org.slf4j</groupId>
  <artifactId>jcl-over-slf4j</artifactId>
  <version>1.7.21</version>
</dependency>
<dependency>
  <groupId>org.apache.logging.log4j</groupId>
  <artifactId>log4j-api</artifactId>
  <version>2.7</version>
</dependency>
<dependency>
  <groupId>org.apache.logging.log4j</groupId>
  <artifactId>log4j-core</artifactId>
  <version>2.7</version>
</dependency>
<dependency>
  <groupId>org.apache.logging.log4j</groupId>
  <artifactId>log4j-slf4j-impl</artifactId>
  <version>2.7</version>
</dependency>
```

2.4. Aspect4log : Logging functions starts/stops with inputs/outputs



<http://aspect4log.sourceforge.net>

Use Aspect4Log, which logs functions start/stop with inputs/outputs using AOP.

Result log example

```
07-31_14:13:48.491 DEBUG org.a.utils.ConfigUtils - > getParameter(test)
07-31_14:13:48.491 DEBUG org.a.utils.wmcall.WmHelper - > getPackageName(true)
07-31_14:13:48.492 DEBUG g.a.utils.wmcall.WmCallEclipse - > getPackageName(true)
07-31_14:13:48.492 DEBUG g.a.utils.wmcall.WmCallEclipse - . getPackageName(true) -> DEFAULT
07-31_14:13:48.492 DEBUG org.a.utils.wmcall.WmHelper - . getPackageName(true) -> DEFAULT
07-31_14:13:48.492 DEBUG org.a.utils.ConfigUtils - > getParameter(DEFAULT, test)
07-31_14:13:48.494 DEBUG persistence.PersistenceManager - > findParameterValue(test, MONO_IS)
07-31_14:13:48.500 DEBUG persistence.PersistenceManager - . findParameterValue(test, MONO_IS) -> (null)
07-31_14:13:48.501 DEBUG org.a.utils.file.ConfigReader - > getValueFromConfigFile(DEFAULT, test)
07-31_14:13:48.501 DEBUG org.a.utils.file.ConfigReader - > getValueFromConfigFile(DEFAULT, config.properties, test)
07-31_14:13:48.501 DEBUG org.a.utils.file.ConfigReader - > getConfigFileKeyValues(DEFAULT, config.properties)
07-31_14:13:48.501 DEBUG org.a.utils.file.ConfigReader - > getConfigPath(DEFAULT)
07-31_14:13:48.502 DEBUG org.a.utils.wmcall.WmHelper - > getServerConfigFolder()
07-31_14:13:48.502 DEBUG g.a.utils.wmcall.WmCallEclipse - > getServerConfigFolder()
07-31_14:13:48.502 DEBUG g.a.utils.wmcall.WmCallEclipse - . getServerConfigFolder() -> src/test/resources/config
07-31_14:13:48.502 DEBUG org.a.utils.wmcall.WmHelper - . getServerConfigFolder() -> src/test/resources/config
07-31_14:13:48.503 DEBUG org.a.utils.file.ConfigReader - . getConfigPath(DEFAULT) -> src/test/resources/config/packages/DEFAULT
07-31_14:13:48.503 DEBUG org.a.utils.file.ConfigReader - . getConfigFileKeyValues(DEFAULT, config.properties) -> {unitTest=OK, MaxAnomaliesSelectedForResubmission=100, useDbParameters=false}
07-31_14:13:48.504 DEBUG org.a.utils.file.ConfigReader - . getValueFromConfigFile(DEFAULT, config.properties, test) -> (null)
07-31_14:13:48.504 DEBUG org.a.utils.file.ConfigReader - . getValueFromConfigFile(DEFAULT, test) -> (null)
07-31_14:13:48.505 DEBUG org.a.utils.ConfigUtils - . getParameter(DEFAULT, test) -> (null)
07-31_14:13:48.506 DEBUG org.a.utils.ConfigUtils - . getParameter(test) -> (null)
```

LOGGER declaration

```
import net.sf.aspect4log.Log;
import static net.sf.aspect4log.Log.Level.TRACE;

@Log ①
public class FooDao {

    public void tooLowLevelFunction(){ ②
        //[...]
    }

    @Log(enterLevel = Level.TRACE, exitLevel = Level.TRACE) ③
    public void delete(String foo) {
        //[...]
    }

    @Log(argumentsTemplate = "[...skipped...]", resultTemplate = "[...skipped...]") ④
    public void find(String bigXML) {
        //[...]
    }

    @Log(on = { @Exceptions(exceptions = { CgException.class }, level = Level.INFO) }) ⑤
    public void saveOrUpdate(String foo) {
        //[...]
    }
}
```

- ① @Log on a class will affect every methods not annotated
- ② So this method will be logged, in DEBUG by default
- ③ Lower the level to TRACE if some methods pollute the logs
- ④ You can skip only the arguments/results if they are too verbose

- ⑤ Some advanced functionality are available, see the website

For runtime, have log4j & aspect4log configuration files in the classpath, examples : [link:log4j2.xml](#) & [link:aspect4log.xml](#).

Dependencies

```
<dependencies>
  <!-- for @Log -->
  <dependency>
    <groupId>net.sf.aspect4log</groupId>
    <artifactId>aspect4log</artifactId>
    <version>1.0.7</version>
  </dependency>
  <!-- AspectJ for instrumentation -->
  <dependency>
    <groupId>org.aspectj</groupId>
    <artifactId>aspectjrt</artifactId>
    <version>1.8.9</version>
  </dependency>
  <dependency>
    <groupId>org.aspectj</groupId>
    <artifactId>aspectjtools</artifactId>
    <version>1.8.9</version>
  </dependency>
</dependencies>

<plugins>
  <plugin>
    <groupId>org.codehaus.mojo</groupId>
    <artifactId>aspectj-maven-plugin</artifactId>
    <version>1.7</version>
    <executions>
      <execution>
        <goals>
          <goal>compile</goal>
        </goals>
      </execution>
    </executions>
    <configuration>
      <showWeaveInfo>>false</showWeaveInfo>
      <Xlint>adviceDidNotMatch=ignore,noGuardForLazyTjp=ignore</Xlint>
      <aspectLibraries>
        <aspectLibrary>
          <groupId>net.sf.aspect4log</groupId>
          <artifactId>aspect4log</artifactId>
        </aspectLibrary>
      </aspectLibraries>
    </configuration>
    <dependencies>
      <dependency>
        <groupId>org.aspectj</groupId>
        <artifactId>aspectjtools</artifactId>
        <version>1.8.9</version>
      </dependency>
    </dependencies>
  </plugin>
</plugins>
```

2.5. Log methods duration

2.5.1. using JCabi @Loggable



With AOP, get selected methods duration :

```
2016-10-11 14:22:52.716 [main] INFO  PERFORMANCES - #setTestMode(...): in 30,51ms
2016-10-11 14:22:52.857 [main] INFO  PERFORMANCES - #setTestMode(...): in 1,20ms
```

Loggable example

```
@Loggable(skipArgs = true, skipResult = true, name = "PERFORMANCES")
public static void topLevelJarFunction(IData pipeline) throws ServiceException {
    //[...]
}
```

3. Best practices

3.1. Java

3.1.1. Java packages & classes naming

- Best package organization is by fonctionnality first, and then technically when many classes of the same type
- Always put classes in subpackage of the project
 - If a java project is **bar-a-b**, all packages are **mycorp.bar.a.b.***
- Don't use different packages for a few classes, regroup them (if below or equal 3 classes by package)
- Don't put in the class name what is already in the package name, except for too generic file name

Some naming conventions

<http://stackoverflow.com/questions/3226282/are-there-best-practices-for-java-package-organisation>
<http://www.javapractices.com/topic/TopicAction.do?Id=205>

Some widely used examples

<http://commons.apache.org/proper/commons-lang/javadocs/api-2.6/overview-tree.html>
<https://commons.apache.org/proper/commons-lang/apidocs/overview-tree.html>

3.1.2. Java 7 try with closable objects

Before Java 7, you had to close() streams and other closable objects in a try/catch/finally. Now Java handles everything if you use the right pattern :

try-with-resource

```
try (
    ZipOutputStream zos = new ZipOutputStream(new FileOutputStream(dstDirectory + "/" + fileName + ".zip"));
    FileInputStream in = new FileInputStream(foundFile.getAbsolutePath())
) {
    ZipEntry ze = new ZipEntry(fileName);
    zos.putNextEntry(ze);

    int len;
    while ((len = in.read(buffer)) > 0) {
        zos.write(buffer, 0, len);
    }

    if (delete)
        foundFile.delete();
} catch (IOException e) {
    LOGGER.error("Unable to zip or delete the file=" + srcDirectory + "/" + fileName + ", dest=" + dstDirectory, e);
    throw e;
}
```

3.1.3. Static Java Maps

When a **Map** is static (and then accessed by multiple threads), declare it `Map` and instantiate it `ConcurrentHashMap` :

Thread-safe Map

```
Map<a,b> myMap == new ConcurrentHashMap<>();
```

Idem for a **Set** but this is a bit tricky :

Thread-safe Set

```
Set<String>
mySet = Collections.newSetFromMap(new ConcurrentHashMap<String,Boolean>());
```

3.1.4. Init on demand

For objects used by static functions, try to initialize them only once and do it in thread safe mode.

Init on demand pattern

```
public class Something {
    private Something() {}

    private static class LazyHolder {
        private static final Something INSTANCE = new Something();
    }

    public static Something getInstance() {
        return LazyHolder.INSTANCE;
    }
}
```

3.1.5. Enum and String

A String from an Enum must be used with a custom `toString()`, never with `getName()` or default

toString().

Enum.toString() pattern

```
// Natures d echange
public enum EsbNatureType {
    DIFFUSION_FICHER("DiffusionFichier"), DIFFUSION_MESSAGES("DiffusionMessages");

    private String name = null;

    EsbNatureType(String nameString) {
        this.name = nameString;
    }

    @Override
    public String toString() {
        return this.name;
    }
};
```

If you don't do this way, we loose the flexibility to rename either the Enum or the String.

3.1.6. MyEnum.toEnum(String)

Comment déclarer l'Enum :

toEnum pattern

```
public enum ServiceOption {
    COMPLEMENTS,
    RESTRICTIONS,
    RISQUES,
    SNGI_EM_DECEDE,
    SNGI_EM_NON_IDENT,
    SNGI_ID_OBLIGATOIRE,
    DCR,
    DCR_STATUT,
    DCR_DELAI,
    LISTE_PSORTANTS,
    ID_TIERS,
    NOM_FLUX_SORTIE,
    ABO_ACTIF,
    DENOM_METIER,
    REF_ABO,
    UNKNOWN;

    public static ServiceOption toEnum(String optionName) {
        switch (optionName) {
            case "priseEnCptLstRisque":
                return RISQUES;
            case "priseEnCptLstCompl":
                return COMPLEMENTS;
            default:
                return UNKNOWN;
        }
    }
}
```

Puis ton Builder tu fais un **ServiceOption.toEnum(tonOption)** et le tour est joué.



Never write files outside of target/

3.2. Maven

3.2.1. Config files location

Config files have to be put in the right folder in Eclipse.

- **src/main/resources/**
 - Only files that will is not likely to be modified, because it will be in the jar
- **config/**
 - Files that is likely to be modified on IS
 - Don't forget to put them manually on IS
- **src/test/resources/**
 - File used in JUnit tests only for this sub-module
- **../src/test/shared-resources**
 - Files used in JUnit tests accross multiple modules
 - requires some maven configuration



TODO give Maven details for shared-resources

3.2.2. Checkstyle : check javadoc

With Checkstyle, you can enforce continuous javadoc check

pom.xml plugin

```
<!-- checkstyle to fail the build on javadoc warnings -->
<!-- to skip : mvn install -Dcheckstyle.skip=true -->
<plugin>
  <groupId>org.apache.maven.plugins</groupId>
  <artifactId>maven-checkstyle-plugin</artifactId>
  <version>2.17</version>
  <executions>
    <execution>
      <id>validate</id>
      <phase>validate</phase>
      <configuration>
        <configLocation>checkstyle-javadoc.xml</configLocation>
        <encoding>UTF-8</encoding>
        <consoleOutput>true</consoleOutput>
        <failsOnError>true</failsOnError>
        <linkXRef>false</linkXRef>
      </configuration>
      <goals>
        <goal>check</goal>
      </goals>
    </execution>
  </executions>
</plugin>
```

checkstyle-javadoc.xml to be created in the root project

```
<?xml version="1.0"?>
<!DOCTYPE module PUBLIC
    "-//Puppy Crawl//DTD Check Configuration 1.2//EN"
    "http://www.puppycrawl.com/dtds/configuration_1_2.dtd">
<module name="Checker">
    <module name="TreeWalker">
        <module name="JavadocMethod"/>
        <module name="JavadocType"/>
        <module name="JavadocVariable"/>
        <module name="JavadocStyle"/>
    </module>
</module>
```

3.2.3. Add version and date to AsciiDoc PDFs

```

<plugins>

  <plugin>
    <groupId>org.codehaus.mojo</groupId>
    <artifactId>buildnumber-maven-plugin</artifactId>
    <version>1.2</version>
    <executions>
      <execution>
        <phase>validate</phase>
        <goals>
          <goal>create-timestamp</goal>
        </goals>
      </execution>
    </executions>
    <configuration>
      <timestampFormat>yyyy-MM-dd</timestampFormat>
      <timestampPropertyName>build.date</timestampPropertyName>
    </configuration>
  </plugin>

  <!-- Ant tasks plugin -->
  <!-- single usage : mvn antrun:run -->
  <plugin>
    <groupId>org.apache.maven.plugins</groupId>
    <artifactId>maven-antrun-plugin</artifactId>
    <version>1.7</version>
    <inherited>true</inherited>
    <executions>
      <execution>
        <!-- add version to generated pdf filenames -->
        <id>pdfsAddVersion</id>
        <configuration>
          <failOnError>false</failOnError>
          <target name="add version and date to all generated pdf filenames">
            <move todir="${project.build.directory}/generated-docs" includeemptydirs="false">
              <fileset dir="${project.build.directory}/generated-docs" />
              <mapper type="glob" from="*.pdf" to="*_V${project.version}_${build.date}.pdf" />
            </move>
          </target>
        </configuration>
        <goals>
          <goal>run</goal>
        </goals>
      </execution>
    </executions>
  </plugin>

</plugins>

```

3.2.4. Javadoc generation with UML diagrams

```

<!-- javadoc html, fix or generate -->
<plugin>
  <groupId>org.apache.maven.plugins</groupId>
  <artifactId>maven-javadoc-plugin</artifactId>
  <version>2.10.4</version>
  <configuration>
    <!-- usage : javadoc:javadoc or javadoc:jar -->
    <show>public</show>
    <reportOutputDirectory>${project.reporting.outputDirectory}</reportOutputDirectory>
    <destDir>javadoc</destDir>
    <!-- for UML diagram in javadoc:javadoc -->
    <!-- Locally : need http://www.graphviz.org/Download_windows.php to work -->
    <!-- and add "C:\Program Files (x86)\Graphviz\bin" to windows path -->
    <doclet>org.umlgraph.doclet.UmlGraphDoc</doclet>
    <docletArtifact>
      <groupId>org.umlgraph</groupId>
      <artifactId>umlgraph</artifactId>
      <version>5.6.6</version>
    </docletArtifact>
    <additionalparam>-views -attributes -visibility -types -enumerations -enumconstants</additionalparam>
    <useStandardDocletOptions>true</useStandardDocletOptions>
  </configuration>
</plugin>

```

3.2.5. Install provided dependencies in local repository

```

<plugins>
  <!-- install WM jars in local repository -->
  <!-- part of mvn clean because maven check them early in the process -->
  <plugin>
    <groupId>org.apache.maven.plugins</groupId>
    <artifactId>maven-install-plugin</artifactId>
    <version>2.5.2</version>
    <!-- We do not want children attempting to install these jars to the repository -->
    <inherited>>false</inherited>
    <executions>
      <execution>
        <id>wm-isclient95</id>
        <phase>clean</phase>
        <goals>
          <goal>install-file</goal>
        </goals>
        <configuration>
          <file>lib/wm9.5/wm-isclient-9.5.jar</file>
          <groupId>webmethods</groupId>
          <artifactId>wm-isclient</artifactId>
          <version>9.5</version>
          <packaging>jar</packaging>
        </configuration>
      </execution>
    </executions>
  </plugin>
</plugins>

```

3.2.6. To generate AsciiDoc PDF files

```

<plugins>
  <!-- to generate asciidoc pdf documents -->
  <!-- part of mvn install -->
  <!-- single usage : mvn asciidoctor:process-asciidoc -->
  <!-- We don't bind it to the official phase to choose the moment in Jenkins pipeline -->
  <plugin>
    <groupId>org.asciidoctor</groupId>
    <artifactId>asciidoctor-maven-plugin</artifactId>
    <version>1.5.5</version>
    <dependencies>
      <dependency>
        <groupId>org.asciidoctor</groupId>
        <artifactId>asciidoctorj-pdf</artifactId>
        <version>1.5.0-alpha.14</version>
      </dependency>
      <dependency>
        <groupId>org.asciidoctor</groupId>
        <artifactId>asciidoctorj-diagram</artifactId>
        <version>1.5.4</version>
      </dependency>
    </dependencies>
    <configuration>
      <backend>pdf</backend>
      <sourceDirectory>src/docs/asciidoc</sourceDirectory>
      <sourceHighlighter>rouge</sourceHighlighter>
      <requires>
        <require>asciidoctor-diagram</require>
      </requires>
      <!-- Attributes common to all output formats -->
      <attributes>
        <imagesdir>${project.build.directory}/generated-docs/images</imagesdir>
        <pdf-style>${user.dir}/src/docs/asciidoc/themes/cg-theme.yml</pdf-style>
        <icons>font</icons>
        <pagenums />
        <toc />
        <idprefix />
        <idseparator>-</idseparator>
        <!-- custom -->
        <source-dir>../../main/java</source-dir>
        <test-dir>../../test/java</test-dir>
        <project-version>${project.version}</project-version>
        <root-project-dir>${user.dir}</root-project-dir>
        <history-dir>${project.build.directory}/generated-docs/history</history-dir>
        <project-images-dir>${project.basedir}/src/main/resources/images</project-images-dir>
      </attributes>
    </configuration>
  </plugin>
</plugins>

```

3.2.7. SonarQube with Jacoco for coverage



<https://www.sonarqube.org>

SonarQube ensures code quality with static analysis and Jacoco checks code coverage.

pom.xml properties

```
<properties>
  <custom.ut.skip>${skipTests}</custom.ut.skip>
  <sonar.java.coveragePlugin>jacoco</sonar.java.coveragePlugin>
  <jacoco.reportPath>../target/jacoco.exec</jacoco.reportPath>
  <jacoco.itReportPath>../target/jacoco-it.exec</jacoco.itReportPath>
  <sonar.jacoco.reportPaths>${jacoco.reportPath}, ${jacoco.itReportPath}</sonar.jacoco.reportPaths>

  <sonar.coverage.exclusions>**/WmCall.*,**/Broker.*,**/UniversalMessaging.*,**/MsgServerBroker.*,**/UmListener.*,**/PerfLogger.*,**/elastic/*DataSender.*</sonar.coverage.exclusions>
  <sonar.host.url>http://localhost:9000</sonar.host.url>
  <sonar.scm.disabled>true</sonar.scm.disabled>
  <sonar.scm.provider>git</sonar.scm.provider>
</properties>
```

pom.xml without powermock static

```
<dependencies>

  <!-- For unit tests coverage in Sonar -->
  <dependency>
    <groupId>org.sonarsource.java</groupId>
    <artifactId>sonar-jacoco-listeners</artifactId>
    <version>4.9.0.9858</version>
    <scope>test</scope>
  </dependency>

</dependencies>

<plugins>

  <!-- SonarQube -->
  <plugin>
    <groupId>org.codehaus.mojo</groupId>
    <artifactId>sonar-maven-plugin</artifactId>
    <version>3.2</version>
  </plugin>

  <!-- handling unit tests coverage with Jacco -->
  <plugin>
    <groupId>org.jacoco</groupId>
    <artifactId>jacoco-maven-plugin</artifactId>
    <version>0.8.0</version>
    <executions>
      <execution>
        <id>pre-unit-test</id>
        <phase>test-compile</phase>
        <goals>
          <goal>prepare-agent</goal>
        </goals>
        <configuration>
          <destFile>${sonar.jacoco.reportPath}</destFile>
          <dataFile>${sonar.jacoco.reportPath}</dataFile>
          <append>true</append>
        </configuration>
      </execution>
      <execution>
        <id>prepare-jacoco-agent-it</id>
        <phase>pre-integration-test</phase>
        <goals>
          <goal>prepare-agent-integration</goal>
        </goals>
        <configuration>
          <destFile>${sonar.jacoco.itReportPath}</destFile>
          <dataFile>${sonar.jacoco.itReportPath}</dataFile>
          <append>true</append>
        </configuration>
      </execution>
    </executions>
  </plugin>

</plugins>
```



```

        </execution>
      </executions>
    </plugin>

    <!-- Unit Tests -->
    <plugin>
      <groupId>org.apache.maven.plugins</groupId>
      <artifactId>maven-surefire-plugin</artifactId>
      <!-- version 2.19.1 is broken on jenkins -->
      <version>2.18.1</version>
      <configuration>
        <testFailureIgnore>>false</testFailureIgnore>
        <runOrder>alphabetical</runOrder>
        <skipTests>${custom.ut.skip}</skipTests>
        <properties>
          <property>
            <name>listener</name>
            <value>org.sonar.java.jacoco.JUnitListener</value>
          </property>
        </properties>
      </configuration>
    </plugin>

    <!-- Integration Tests -->
    <plugin>
      <groupId>org.apache.maven.plugins</groupId>
      <artifactId>maven-failsafe-plugin</artifactId>
      <!-- version 2.19.1 is broken on jenkins -->
      <version>2.18.1</version>
      <configuration>
        <runOrder>alphabetical</runOrder>
        <properties>
          <property>
            <name>listener</name>
            <value>org.sonar.java.jacoco.JUnitListener</value>
          </property>
        </properties>
      </configuration>
      <executions>
        <execution>
          <id>integration-tests</id>
          <phase>integration-test</phase>
          <goals>
            <goal>integration-test</goal>
          </goals>
        </execution>
        <!-- to exit in error on test fail -->
        <execution>
          <id>verify</id>
          <phase>verify</phase>
          <goals>
            <goal>verify</goal>
          </goals>
        </execution>
      </executions>
    </plugin>
  </plugins>

```

pom.xml with powermock : instrumentation in conflict, offline jacoco instrumentation is needed

```

<dependencies>

  <!-- For unit tests coverage in Sonar -->
  <dependency>
    <groupId>org.jacoco</groupId>
    <artifactId>org.jacoco.agent</artifactId>
    <classifier>runtime</classifier>
    <version>0.8.0</version>
  </dependency>

```

```

        <scope>test</scope>
      </dependency>
    </dependencies>

    <plugins>

      <!-- SonarQube -->
      <plugin>
        <groupId>org.codehaus.mojo</groupId>
        <artifactId>sonar-maven-plugin</artifactId>
        <version>3.2</version>
      </plugin>

      <!-- handling unit tests coverage with Jacco -->
      <!-- offline instrumentation is mandatory when using other instrumentation framework such as PowerMock -->
      <!-- https://github.com/powermock/powermock/wiki/Code-coverage-with-JaCoCo -->
      <!-- to separate UT and IT : -->
      <!-- (1) mvn test jacoco:restore-instrumented-classes -->
      <!-- (2) mvn install -Dcustom.ut.skip=true -Dcheckstyle.skip=true -->
      <plugin>
        <groupId>org.jacoco</groupId>
        <artifactId>jacoco-maven-plugin</artifactId>
        <version>0.8.0</version>
        <executions>
          <execution>
            <id>jacoco-instrument</id>
            <phase>test-compile</phase>
            <goals>
              <goal>instrument</goal>
            </goals>
            <configuration>
              <skip>${skipTests}</skip>
            </configuration>
          </execution>
          <execution>
            <id>jacoco-restore-instrumented-classes</id>
            <phase>post-integration-test</phase>
            <goals>
              <goal>restore-instrumented-classes</goal>
            </goals>
            <configuration>
              <skip>${skipTests}</skip>
            </configuration>
          </execution>
        </executions>
      </plugin>

      <!-- Unit Tests -->
      <plugin>
        <groupId>org.apache.maven.plugins</groupId>
        <artifactId>maven-surefire-plugin</artifactId>
        <!-- version 2.19.1 is broken on jenkins -->
        <version>2.18.1</version>
        <configuration>
          <testFailureIgnore>>false</testFailureIgnore>
          <runOrder>alphabetical</runOrder>
          <skipTests>${custom.ut.skip}</skipTests>
          <systemPropertyVariables>
            <jacoco-agent.destfile>${jacoco.reportPath}</jacoco-agent.destfile>
          </systemPropertyVariables>
        </configuration>
      </plugin>

      <!-- Integration Tests -->
      <!-- usage full test : mvn integration-test -->
      <!-- usage only IT (but does not fill jacoco-it) : mvn test-compile failsafe:integration-test -->
      <plugin>
        <groupId>org.apache.maven.plugins</groupId>

```

```

<artifactId>maven-failsafe-plugin</artifactId>
<!-- version 2.19.1 is broken on jenkins -->
<version>2.18.1</version>
<configuration>
  <runOrder>alphabetical</runOrder>
  <systemPropertyVariables>
    <jacoco-agent.destfile>${jacoco.itReportPath}</jacoco-agent.destfile>
  </systemPropertyVariables>
</configuration>
<executions>
  <execution>
    <id>integration-tests</id>
    <phase>integration-test</phase>
    <goals>
      <goal>integration-test</goal>
    </goals>
  </execution>
  <execution>
    <id>verify</id>
    <phase>verify</phase>
    <goals>
      <goal>verify</goal>
    </goals>
  </execution>
</executions>
</plugin>

```