



What is **maven**



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Introduction to Maven



► Introduction to Maven

- First, it was used at **Apache's Jakarta Alexandria Project** in 2001
- What Maven did was to **simplify the build processes**



► Introduction to Maven

- ▶ As a project management tool, Maven :
 - ▷ builds **multiple projects** easily,
 - ▷ **publishes documentation** for the projects,
 - ▷ accomplishes an **easy deployment**,
 - ▷ **helps in collaboration** with development teams.



► Introduction to Maven

- ▶ Maven can :
 - ▷ **manage the versions** of consecutive builds,
 - ▷ **compile** source code into binary,
 - ▷ **download dependencies**,
 - ▷ **run tests**,
 - ▷ **package** compiled code
 - ▷ **deploy** artifacts



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Features of Maven



Features of Maven

- ▶ **Easy to start** with Maven
- ▶ Variety of **options**
- ▶ **Same structure** across different projects
- ▶ **Easy to integrate** into a developing team
- ▶ It has a **powerful dependency management tool**
- ▶ **Large repository** of libraries



► Features of Maven

- **Extra features** with plugins
- **Different outputs** like a **jar**, **ear** or **war**
- Maven can **generate a website**
- Maven can **support the older versions**



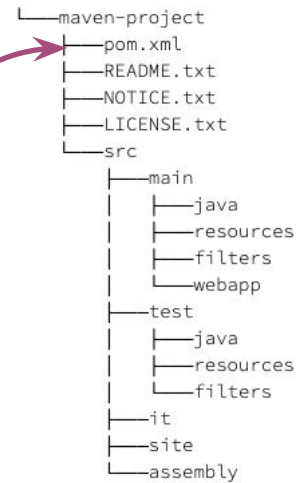
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► Directory Structure



Directory Structure

- ▶ Project structure **should conform** to →
- ▶ The most important file is the **pom file** →
 - ▶ defines project's **config details**



POM File



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- ▶ **Introduction to POM File**
- ▶ **Super POM**
- ▶ **Project Inheritance**



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Introduction to POM File



► Introduction to POM File

- ▶ It is an XML file
- ▶ **Project Object Model** is the **starting point** for a Maven project
- ▶ It contains **configurations** about the project
- ▶ When a task or goal is executed, **Maven searches for the POM file**



► Introduction to POM File

- ▶ POM defines
 - ▷ Project **dependencies**
 - ▷ Plugins and **goals** to be executed
 - ▷ **Build profiles**
 - ▷ Other information like the **project version, description, developers, mailing lists**, and more...



► Introduction to POM File

- There **must** be a POM file in every Maven project
- **All POMs need** at least
 - Project tag
 - modelVersion tag
 - **groupId** tag
 - **artifactId** tag
 - **version** (Last three called as **gav** in short)

```
1- <project xmlns = "http://maven.apache.org/POM/4.0.0"
2  xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance"
3  xsi:schemaLocation = "http://maven.apache.org/POM/4.0.0
4  http://maven.apache.org/xsd/maven-4.0.0.xsd">
5    <modelVersion>4.0.0</modelVersion>
6
7    <groupId>com.companyname.project-group</groupId>
8    <artifactId>project</artifactId>
9    <version>1.0</version>
10  </project>
11
```



► Introduction to POM File

- **Project tag** is the **root** of the file
- It should reference a basic schema settings such as **apache schema** and **w3.org** specification
- **Model version** describes the **version of Maven**
- **Group Id** is the id of the project's group (Simply it shows the **company** or the **organization** or the **owner of the project**)

```
1- <project xmlns = "http://maven.apache.org/POM/4.0.0"
2  xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance"
3  xsi:schemaLocation = "http://maven.apache.org/POM/4.0.0
4  http://maven.apache.org/xsd/maven-4.0.0.xsd">
5    <modelVersion>4.0.0</modelVersion>
6
7    <groupId>com.companyname.project-group</groupId>
8    <artifactId>project</artifactId>
9    <version>1.0</version>
10  </project>
11
```



► Introduction to POM File

- **Group Id** should be long enough to give **uniqueness** to the project
- **Artifact id** is the id for specifying the project under the group
- It shows the **name of the project** like pet-clinic-server
- **Version** defines the version number of the project

```
1 <project xmlns = "http://maven.apache.org/POM/4.0.0"
2 xmlns:xsi = "http://www.w3.org/2001/XMLSchema-instance"
3 xsi:schemaLocation = "http://maven.apache.org/POM/4.0.0
4 http://maven.apache.org/xsd/maven-4.0.0.xsd">
5   <modelVersion>4.0.0</modelVersion>
6
7   <groupId>com.companyname.project-group</groupId>
8   <artifactId>project</artifactId>
9   <version>1.0</version>
10 </project>
11
```



2 ► Super POM



Super POM

- ▶ [Super POM](#) is Maven's **default POM**
- ▶ **All POMs extend** the Super POM **unless explicitly set**
- ▶ Super POM and project POM creates the **Effective POM**
- ▶ Which is the **overall configuration** file
- ▶ Effective POM can be examined by running
“**mvn help:effective-pom**”

- Effective POM -

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>
  <groupId>com.companyname.project-group</groupId>
  <artifactId>project</artifactId>
  <version>1.0</version>
  <build>
    <sourceDirectory>C:\MVN\project\src\main\java</sourceDirectory>
    <scriptSourceDirectory>src/main/scripts</scriptSourceDirectory>
    <testSourceDirectory>C:\MVN\project\src\test\java</testSourceDirectory>
    <outputDirectory>C:\MVN\project\target\classes</outputDirectory>
    <testOutputDirectory>C:\MVN\project\target\test-classes</testOutputDirectory>
    <resources>
      <resource>
        <mergeId>resource-0</mergeId>
        <directory>C:\MVN\project\src\main\resources</directory>
      </resource>
      <resources>
        <testResource>
          <mergeId>resource-1</mergeId>
          <directory>C:\MVN\project\src\test\resources</directory>
        </testResource>
      </testResources>
      <directory>C:\MVN\project\target</directory>
      <finalName>project-1.0</finalName>
    </build>
  </project>
```

1

```
<pluginManagement>
  <plugins>
    <plugin>
      <artifactId>maven-antrun-plugin</artifactId>
      <version>1.3</version>
    </plugin>
    <plugin>
      <artifactId>maven-assembly-plugin</artifactId>
      <version>2.2-beta-2</version>
    </plugin>
    <plugin>
      <artifactId>maven-clean-plugin</artifactId>
      <version>2.2</version>
    </plugin>
    <plugin>
      <artifactId>maven-compiler-plugin</artifactId>
      <version>2.0.2</version>
    </plugin>
    <plugin>
      <artifactId>maven-dependency-plugin</artifactId>
      <version>2.0</version>
    </plugin>
    <plugin>
      <artifactId>maven-deploy-plugin</artifactId>
      <version>2.4</version>
    </plugin>
    <plugin>
      <artifactId>maven-ear-plugin</artifactId>
      <version>2.3.1</version>
    </plugin>
    <plugin>
      <artifactId>maven-ejb-plugin</artifactId>
      <version>2.1</version>
    </plugin>
  </plugins>
</pluginManagement>
```

2

```
<plugins>
  <plugin>
    <artifactId>maven-install-plugin</artifactId>
    <version>2.2</version>
  </plugin>
  <plugin>
    <artifactId>maven-jar-plugin</artifactId>
    <version>2.2</version>
  </plugin>
  <plugin>
    <artifactId>maven-javadoc-plugin</artifactId>
    <version>2.5</version>
  </plugin>
  <plugin>
    <artifactId>maven-plugin-plugin</artifactId>
    <version>2.4.3</version>
  </plugin>
  <plugin>
    <artifactId>maven-rar-plugin</artifactId>
    <version>2.2</version>
  </plugin>
  <plugin>
    <artifactId>maven-release-plugin</artifactId>
    <version>2.0-beta-8</version>
  </plugin>
  <plugin>
    <artifactId>maven-resources-plugin</artifactId>
    <version>2.3</version>
  </plugin>
  <plugin>
    <artifactId>maven-site-plugin</artifactId>
    <version>2.0-beta-7</version>
  </plugin>
</plugins>
```

3



- Effective POM -

```
<plugin>
  <artifactId>maven-source-plugin</artifactId>
  <version>2.0.4</version>
</plugin>
<plugin>
  <artifactId>maven-surefire-plugin</artifactId>
  <version>2.4.3</version>
</plugin>
<plugin>
  <artifactId>maven-war-plugin</artifactId>
  <version>2.1-alpha-2</version>
</plugin>
</plugins>
</pluginManagement>

<plugins>
  <plugin>
    <artifactId>maven-help-plugin</artifactId>
    <version>2.1.1</version>
  </plugin>
</plugins>
</build>

<repositories>
  <repository>
    <snapshots>
      <enabled>false</enabled>
    </snapshots>
    <id>central</id>
    <name>Maven Repository Switchboard</name>
    <url>http://repo1.maven.org/maven2</url>
  </repository>
</repositories>
```

```
<pluginRepositories>
  <pluginRepository>
    <releases>
      <updatePolicy>never</updatePolicy>
    </releases>
    <snapshots>
      <enabled>false</enabled>
    </snapshots>
    <id>central</id>
    <name>Maven Plugin Repository</name>
    <url>http://repo1.maven.org/maven2</url>
  </pluginRepository>
</pluginRepositories>
<reporting>
  <outputDirectory>C:\MVN\project\target\site</outputDirectory>
</reporting>
</project>
```

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Project Inheritance



► Project Inheritance

- ▶ As in the object-oriented programming, POM files **can also be inherited** by other POM files
- ▶ Child POM can either **inherit** or **override**
- ▶ Parent POM is a **general template**
- ▶ **Not every item** in the parent is inherited
- ▶ Some elements should be declared specifically
- ▶ Like **artifactId**, **name**, and **prerequisites**



► Project Inheritance

- ▶ Parent POM's **packaging** tag should have the value "**pom**"

Parent

```
<project xmlns="http://maven.apache.org/POM/4.0.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
    https://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>

  <groupId>com.clarusway.mojo</groupId>
  <artifactId>my-parent</artifactId>
  <version>2.0</version>
  <packaging>pom</packaging>
</project>
```

<!-- NOTICE THE PACKAGING TYPE -->



Project Inheritance

- ▶ Child is related to parent **by specifying the parent element**
- ▶ If you want to inherit an element you should remove it

Parent

```
<project xmlns="http://maven.apache.org/POM/4.0.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
    https://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>
  <groupId>com.clarusway.mojo</groupId>
  <artifactId>my-parent</artifactId>
  <version>2.0</version>
  <packaging>pom</packaging> <!-- NOTICE THE PACKAGING TYPE -->
</project>
```

Child

```
<project xmlns="http://maven.apache.org/POM/4.0.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
    https://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>
  <parent>
    <groupId>com.clarusway.mojo</groupId>
    <artifactId>my-parent</artifactId>
    <version>2.0</version>
    <relativePath>../my-parent/pom.xml</relativePath>
  </parent>
  <artifactId>my-project</artifactId>
</project>
```

Inherited



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Project Aggregation



▶ Project Aggregation

- ▶ A project **with modules** (children) is called a **multi-module**, or aggregator project
- ▶ Modules are projects that a **parent POM file specifies**
- ▶ These modules are **built together as a group**
- ▶ Aggregator POM should have
 - ▶ **packaging tag** with "pom"
 - ▶ **modules tag** with relative paths to the directories or the POM files of modules



▶ Project Aggregation

- ▶ **As in the example :**

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <project xmlns="http://maven.apache.org/POM/4.0.0"
3         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
4         xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
5                             https://maven.apache.org/xsd/maven-4.0.0.xsd">
6
7     <modelVersion>4.0.0</modelVersion>
8
9     <groupId>com.clarusway.mojo</groupId>
10    <artifactId>my-parent</artifactId>
11    <version>2.0</version>
12    <packaging>pom</packaging>
13
14    <modules>
15        <module>my-project</module>
16        <module>another-project</module>
17        <module>third-project/pom-example.xml</module>
18    </modules>
19 </project>
```



Build Lifecycles



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- ▶ Introduction to Build Lifecycles
- ▶ Clean Lifecycle
- ▶ Default Lifecycle
- ▶ Site Lifecycle



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Introduction to Build Lifecycles



▶ Introduction to Build Lifecycles

- ▶ A Build Lifecycle is **a track** that is comprised of **different number of phases**
- ▶ A phase is a **job unit** or a **specific stage** in a lifecycle

► Introduction to Build Lifecycles

- ▶ There are **three built-in lifecycles** :
 - ▷ **default, clean,** and **site**
 - ▷ Default is the **main lifecycle**
 - ▷ Clean is used for **cleaning the project**
 - ▷ Site lifecycle is used for building the **project's website**

► Introduction to Build Lifecycles

- ▶ Each life cycle has a different number of phases
 - ▷ Default build lifecycle has **23**
 - ▷ Clean lifecycle has **3**
 - ▷ Site lifecycle has **4 phases**



Introduction to Build Lifecycles

► Using Command-Line :

- ▷ Maven CLI commands generates your outputs
- ▷ For example,
 - ▷ “**mvn package**” gives you a “**jar, war or ear ...**”
 - ▷ “**mvn test**” gives your test code’s results
 - ▷ “**mvn clean**” cleans the artifacts of a previous command



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Clean Lifecycle



Clean Lifecycle

- ▶ Clean Lifecycle has **three phases**
 - ▶ **pre-clean, clean, and post-clean**
- ▶ These phases are **in sequence**
- ▶ When a phase is called (for example "mvn post-clean"), **phases prior to that phase** are also **run**



Clean Lifecycle

- ▶ It cleans the project's target directory
- ▶ **Pre-clean** phase is used for **any task prior to** the cleanup
- ▶ **Post-clean** phase is used for **any task following** the cleanup



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Default Lifecycle



▶ Default Lifecycle

- ▶ Default lifecycle is used **for application build**
- ▶ There are **23 phases** in Default Lifecycle
- ▶ The most important phases are :
 - ▶ **validate:** validates if the project has necessary information
 - ▶ **compile:** compiles the source code
 - ▶ **test-compile:** compiles the test source code



► Default Lifecycle

- ▶ The most important phases are :
 - ▷ **test:** runs unit tests
 - ▷ **package:** packages compiled source code
 - ▷ **packaging tag** in POM.xml changes the output



► Default Lifecycle

- ▶ The most important phases are :
 - ▷ **integration-test:** processes and deploys the package if needed to run integration test
 - ▷ **install:** installs the package to local repository
 - ▷ **deploy:** copies the package to a remote repository



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Site Lifecycle



Site Lifecycle

- ▶ Site lifecycle has **four phases**
 - ▶ **pre-site, site, post-site, site-deploy**
- ▶ For Site Lifecycle, the **Site Plugin** is used
- ▶ The plugin's **main duty** is to **generate a website**



THANKS!

Any questions?



► phase-goal-plugin



**Maven Build
Lifecycle**

Phases

Goals

Plugin

pre-clean

clean

clean

clean

Clean

post-clean



► phase-goal-plugin

Phase	plugin:goal
<code>process-resources</code>	<code>resources:resources</code>
<code>compile</code>	<code>compiler:compile</code>
<code>process-test-resources</code>	<code>resources:testResources</code>
<code>test-compile</code>	<code>compiler:testCompile</code>
<code>test</code>	<code>surefire:test</code>
<code>package</code>	<code>jar:jar</code>
<code>install</code>	<code>install:install</code>
<code>deploy</code>	<code>deploy:deploy</code>