

## CS520 Web Programming

### Introduction to Maven

Chengyu Sun  
California State University, Los Angeles

## Build

- ◆ Preprocessing
- ◆ Compilation
- ◆ Postprocessing
- ◆ Distribution
- ◆ Deployment

## What is Maven?

- ◆ Mostly used as a build tool for Java projects
- ◆ It is more than a build tool
  - Project Object Model (POM)
  - Project lifecycles
  - Dependency management
  - Plugin framework
- ◆ It is a project management tool

## A Simple Maven Example

### pom.xml

```
<project>
  <modelVersion>4.0.0</modelVersion>
  <groupId>edu.calstatela.cs520</groupId>
  <artifactId>maven-exmaple</artifactId>
  <version>1.0</version>
</project>
```

Run:

```
mvn compile
mvn package
```

## pom.xml and modelVersion

- ◆ `pom.xml` is a description of the project
- ◆ `modelVersion` is the version of the "grammar" of the description

## Maven Coordinates

- ◆ `groupId`
  - Name of the company, organization, team etc., usually using the reverse URL naming convention
- ◆ `artifactId`
  - A unique name for the project under `groupId`
- ◆ `version`
- ◆ `packaging`, default: `jar`
- ◆ `classifier`

*Maven coordinates uniquely identifies a project.*

## Convention Over Configuration

- ◆ Systems, libraries, and frameworks should assume *reasonable defaults*.

*See the Effect POM tab of pom.xml in Eclipse for all the "defaults".*

## Default Directory Structure

- ◆ `src/main/java`
- ◆ `src/main/resources` for files that should be placed under classpath
- ◆ `src/main/webapp` for web applications
- ◆ `src/test/java`
- ◆ `target`

## How Does Maven Work?

- ◆ Q: what happens when you run `mvn compile`?
- ◆ A: Maven will go through each phase of the build lifecycle up to the `compile` phase, and run the operations associated with each phase

## Build Lifecycle

- ◆ The process for building and distributing a project
- ◆ A build lifecycle consists of a number of steps called phases.

## Some Lifecycle Phases

- ◆ `validate`
- ◆ `compile`
- ◆ `test`
- ◆ `package`
- ◆ `deploy`

[http://maven.apache.org/guides/introduction/introduction-to-the-lifecycle.html#Lifecycle\\_Reference](http://maven.apache.org/guides/introduction/introduction-to-the-lifecycle.html#Lifecycle_Reference)

## About Lifecycle Phases

- ◆ Not all projects utilize all phases
- ◆ Not all phases have operations associated with them

## Goals and Plugins

- ◆ Goals, a.k.a. Mojos, are *operations* provided by Maven plugins

## Some Maven Plugins

- ◆ resources
- ◆ compiler
- ◆ surefire
- ◆ jar, war

<http://maven.apache.org/plugins/index.html>

## Example of Using a Plugin

```
<build><plugins><plugin>
  <groupId>org.apache.maven.plugins</groupId>
  <artifactId>maven-compiler-plugin</artifactId>
  <version>2.3.2</version>
  <executions><execution>
    <id>default-compile</id>
    <phase>compile</phase>
    <goals>
      <goal>compile</goal>
    </goals>
    <configuration>
      <target>1.6</target>
    </configuration>
  </execution></executions>
</plugin></plugins></build>
```

## About The Plugin Example

- ◆ A plugin is uniquely identified by its coordinates just like any other project
- ◆ Goals are associated (i.e. *bound*) to a build lifecycle phase
- ◆ The behavior of a goal can be customized with additional parameters in the `<configuration>` section

## Run a Maven Build

```
mvn <phase>
```

- ◆ Maven will go through each build lifecycle phase up to the specified phase
- ◆ In each phase, execute the goals bound to that phase

## Run a Maven Build in Eclipse

- ◆ Need the `m2e` Eclipse plugin
- ◆ Right click on the project then select Run As → Maven Build ...
- ◆ Give the build a name
- ◆ Enter the phase name for Goals
- ◆ Click Run

## Why Not Just Use an IDE

- ◆ Can your IDE do *everything* you want?
  - Deploy a web application to a remote server
  - Generate source code from some metadata files
  - Create a zip package of selected files for homework submission
  - ...

## Why Use Maven

- ◆ Everybody uses it!
- ◆ Common framework for project build and management
  - Project Object Model
  - Build lifecycles
- ◆ Archetype
- ◆ Dependency management
- ◆ Resource filtering

## Archetype

- ◆ An archetype is a *template* for a Maven project which can be used to create new projects quickly
- ◆ Example: creating a project from archetype
  - `maven-archetype-quickstart`
  - `maven-archetype-webapp`
- ◆ Users can create new archetypes and publish them through catalogs
  - Main Maven archetype catalog:  
<http://repo.maven.apache.org/maven2/archetype-catalog.xml>

## Dependency Management

- ◆ A dependency of a project is a library that the project depends on
- ◆ Adding a dependency to a project is as simple as adding the coordinates of the library to `pom.xml`
- ◆ Maven *automatically downloads the library from an online repository* and store it locally for future use

## Dependency Example

```
<dependencies>
  <dependency>
    <groupId>javax.servlet</groupId>
    <artifactId>javax.servlet-api</artifactId>
    <version>3.0.1</version>
  </dependency>
</dependencies>
```

- ◆ Add a dependency to `pom.xml`
- ◆ Add a dependency in Eclipse

## Dependencies and Repositories

- ◆ Search for dependency coordinates at <http://mvnrepository.com/>
- ◆ Maven Central Repository - <http://repo.maven.apache.org/maven2/>
- ◆ Additional libraries and repositories - <https://maven.nuxeo.org/>

## More About Dependency Management

- ◆ Dependencies of a dependency are automatically included
- ◆ Dependency conflicts are automatically resolved
- ◆ See CSNS2 for example

## Resource Filtering

- ◆ Use placeholders in resource files and replace them with actual value during the build process

```
<param name="File" value="${app.dir.log}/csns2.log" />
```



```
<param name="File" value="F:/TEMP/csns2/csns2.log" />
```

## Resource Filtering Example

```
<build>  
  <filters>  
    <filter>build.properties</filter>  
  </filters>  
  <resources>  
    <resource>  
      <directory>src/main/resources</directory>  
      <filtering>true</filtering>  
    </resource>  
  </resources>  
</build>
```

## Summary

- ◆ Project Object Model (POM)
- ◆ Coordinates
- ◆ Lifecycles and phases
- ◆ Plugins and goals
- ◆ Archetype
- ◆ Dependency management
- ◆ Resource filtering

## Further Readings

- ◆ Free online Maven books - <http://www.sonatype.com/resources/books>