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

```xml
<pom.xml
  <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

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

```xml
<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:

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

```xml
<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/](http://mvnrepository.com/)
- Additional libraries and repositories - [https://maven.nuxeo.org/](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

```xml
<param name="File" value="$(app.dir.log)/csns2.log" />
<param name="File" value="F:/TEMP/csns2/csns2.log" />
```

Resource Filtering Example

```xml
<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