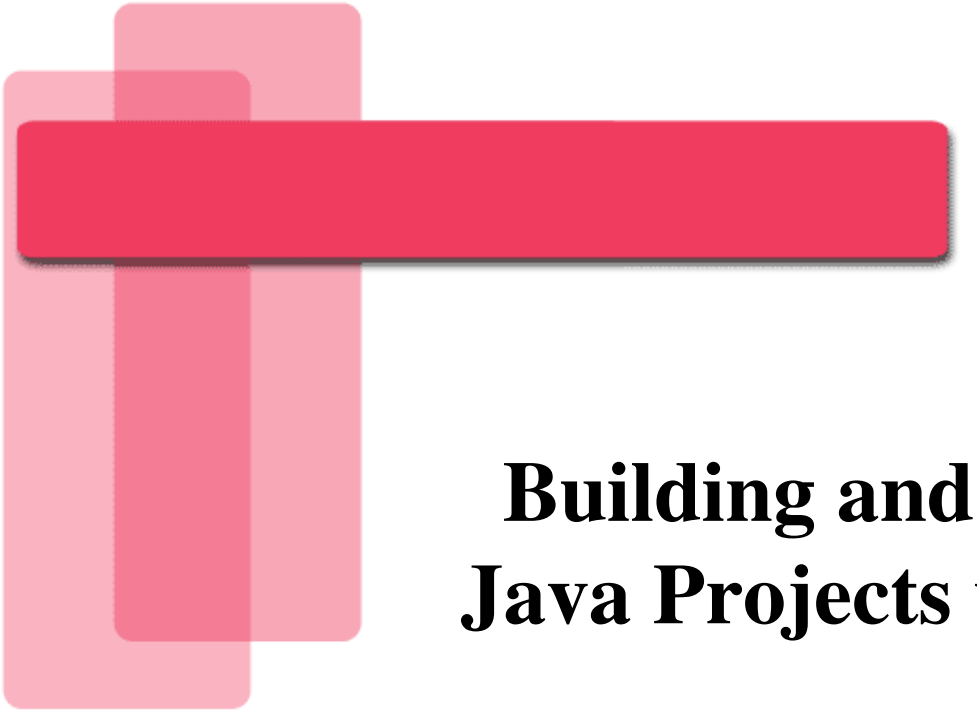


Building and Managing Java Projects with Maven

Alan Wang

Connectria

Agenda

- What is Maven?
- A J2EE example
- Customizing and extending Maven
- Tips and discussions

What is Maven?

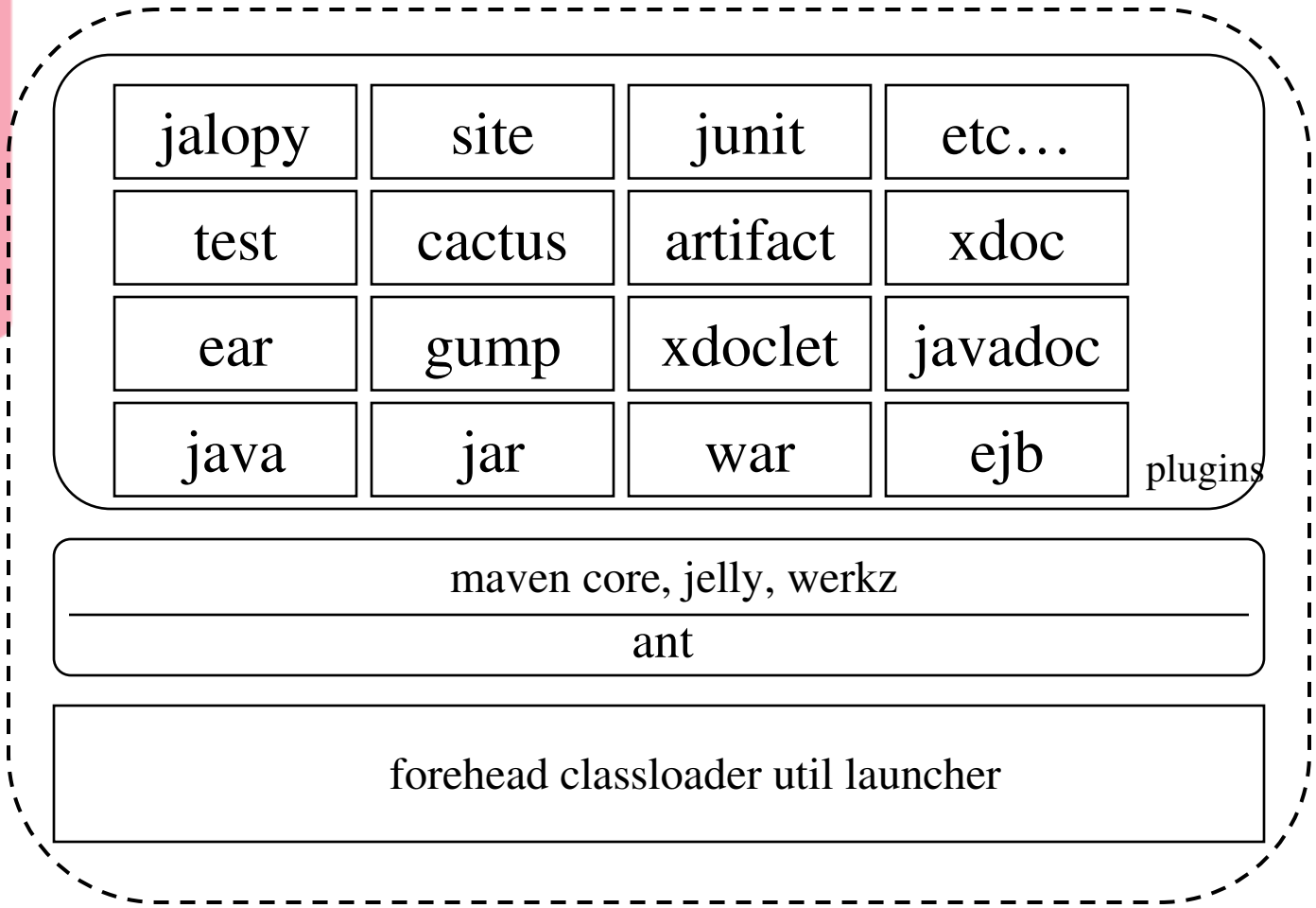
- A Java project management and integration build tool.
- Based on the concept of XML Project Object Model (POM).
- Originally developed for building Turbine.
- A small core with numerous plugins (in Jelly).

Build Tools Retrospective

- One level above ant.
- Make → ant → Maven
- (Assembly → C → C++)

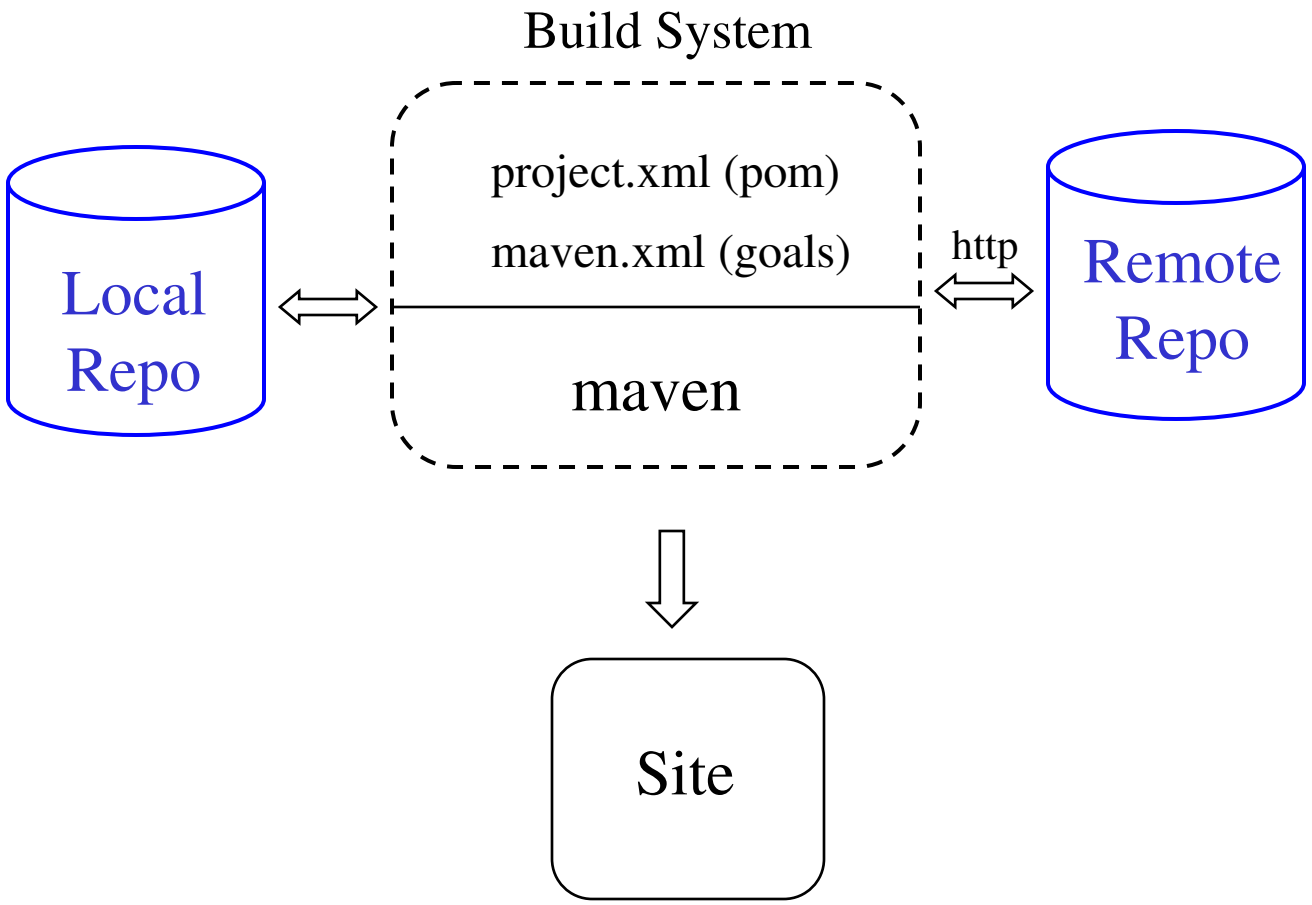
Make	makefile	target
Ant	build.xml	target
Maven	project.xml maven.xml	goals

Under the Hood



Maven

Architecture Overview



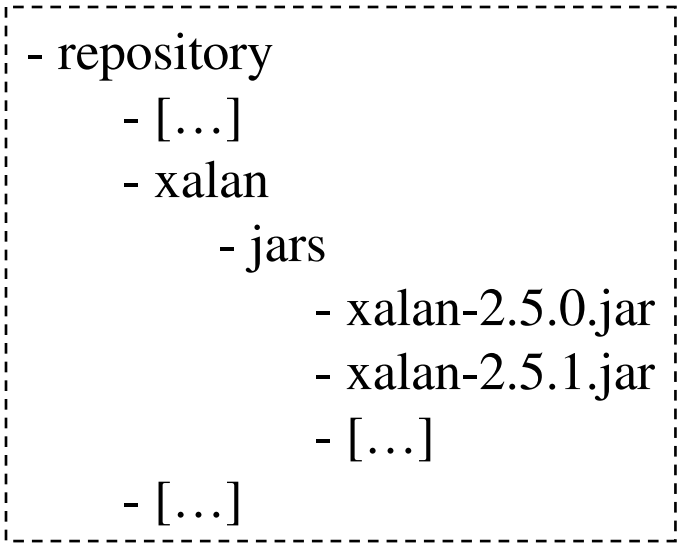
Artifact Repository

The Most Important Feature

- Remote Repository

${mave.repo.remote}/**<groupId>**/**<type>**s/**<artifactId>**-**<version>**.**<type>**

```
…
<dependencies>
  <dependency>
    <groupId>xalan</groupId>
    <artifactId>xalan</artifactId>
    <version>2.5.1</version>
    <type>jar</type>
  </dependency>
  …
</dependencies>
…
```



Artifact Repository

- Local Repository
  - A local mirror/cache of downloaded artifacts from remote repositories.
  - Located at ${user.home}/.maven/repository

${mave.repo.local}/**<groupId>**/**<type>**s/**<artifactId>**-**<version>**.**<type>**

Implementing an Example

- Get Started
  - Download from
    - http://maven.apache.org/start/download.html
  - Current version: 1.0rc1
  - Environment setup
    - export MAVEN_HOME=c:/maven-1.0rc1
    - export PATH="$MAVEN_HOME/bin;$PATH"

      (or set MAVEN_HOME = c:\maven-1.0rc1

      set PATH = %MAVEN_HOME%\bin;%PATH%)
  - run *install_repo.sh* to populate the local repository

Create a New Project

Type:

maven genapp

It will prompt for

- project id
- project name
- project package name

A Sample Service J2EE Project

- EJB (stateless session beans exposed as web services)
- Data components
- Web application

Directory Layout

Project Directory Layout

sampleservice

- project.xml - Master POM of the project
- maven.xml - Reactor definition
- project.properties - Properties related to the project
- application/ - Application component
- service-data/ - Common data component
- service-ejb/ - EJB/WS component
- service-web/ - Web Application component
- target/ - Generated artifact directory
- xdocs/ - Various documents in xml format
- …

Directory Layout

A Component Directory Layout

…

service-data - Data component subproject

- project.xml - POM of the data project
- maven.xml - Goals definition
- project.properties - Properties related to the project
- src/ - Source directory
  - conf/ - Configuration and resource files
  - java/ - Java source files
  - test/ - Test source files
- target/ - Generated artifact directory
- xdocs/ - Various documents in xml format

…

Project Object Model (POM)

Projects are described as Project Object Model.

- Project Management
  - Detailed description of the project.
  - Company information.
  - Developer roles and information.
  - Mailing list and source control modules configuration.
- Project Build
  - Source code and test code location.
  - Resources location

Project Object Model (POM)

- Project Dependency
  - Libraries needed for build and runtime.
- Project Reports
  - Junit reports
  - Javadoc reports
  - Checkstyle reports, ….etc

Project Management Section

```
<project>
  <pomVersion>3</pomVersion>
  <groupId>sampleservice</groupId>
  <name>Sample Service</name>  <!-- Used in Javadoc -->
  <id>sampleservice</id>
  <currentVersion>1.0</currentVersion>

  <!-- Used for document creation -->
 <organization>
  <name>My, Inc.</name>
  <url>http://www.myinc.com</url>
  <logo>/images/logo.gif</logo>
 </organization>
 …
```

(elements in bold are required)

Project Management Section

```
<project>
    […]
    <inceptionYear>2003</inceptionYear> <!-- Used in JavaDoc –
    <package>com.myinc.sampleservice</package> <!-- Used in JavaDoc -->
    <shortDescription>Demo to use maven</shortDescription>  <!-- one liner -->

    <!-- Used in front page-->
    <description>
        A detailed description about this demo
    </description>
    <url>http://www.myinc.com/sampleservice/</url>
    <issueTrackingUrl/>
    <siteAddress>dev.myinc.com</siteAddress> <!-- Used in deployment -->
    <siteDirectory>/www/sampleservice/</siteDirectory>  <!-- Used in deployment -->
    <!-- Used in deployment. If defined, it overrides ${maven.repo.central} -->
    <distributionSite>/www/dist/sampleservice</distributionSite>
    <!-- Used in deployment, final distribution directory -->
    <distributionDirectory>/www/www.myinc.com/somedir</distributionDirectory>
```

Project Management Section

```
<project>
    […]
     <repository>
          <connection>scm:cvs:pserver:anoncvs@cvs.myinc.com:/cvsroot:samples
              ervice</connection>
          <developerConnection>scm:cvs:pserver:${maven.username}@cvs.myinc
              .com:/cvsroot:sampleservice</developerConnection>
          <url>http://cvs.myinc.org/viewcvs/sampleservice/</url>
    </repository>
    <!-- Used in maven:dist -->
    <versions>
          <version>
                <id>1.0-beta-1</id>
                <name>1.0-beta-1</name>
                <tag>1.0-beta-1</tag>
          </version>
    </versions>
    <branches/>
    […]
```

```
…
<mailingLists/>
<contributors/>
<developers/>
…
```

Project Dependency Section

```
<project>
    […]
    <dependencies>
      <dependency>
        <groupId>log4j</groupId>
        <artifactId>log4j</artifactId>
        <version>1.2.8</version>
        <properties>
          <ear.bundle>true</ear.bundle>
          <ejb.manifest.classpath>true</ejb.manifest.classpath
            >
        </properties>
      </dependency>
    </dependencies>
    […]
```

Special Dependency:
SNAPSHOT

Project Dependency Section

Dependency Classloader

```
[…]
<dependency>
    <groupId>bcel</groupId>
    <artifactId>bcel</artifactId>
    <version>5.1</version>
    <properties>
        <classloader>root</classloader>
    </properties>
</dependency>
[…]
```

Maven has three classloaders:

- root -- ant classloader
- root.maven – maven core classloader
- default – plugin classloader

Project Dependency Section

Dependency Override

project.xml

```
…
<dependency>
        <groupId>weblogic</groupId>
        <artifactId>weblogic</artifactId>
        <version>8.1.1</version>
        <properties>
                <classloader>root</classloader>
        </properties>
</dependency>
```

project.properties

```
…
## Dependency override
maven.jar.override = on
maven.jar.weblogic = ${weblogic.home}/lib/weblogic.jar
maven.jar.webservices = ${weblogic.home}/lib/webservices.jar
```

Project Build Section

Defines the location of source, test and resource files.

```
[…]
 <build>
      <nagEmailAddress>buildmaster@myinc.com</nagEmailAddress>
      <sourceDirectory>${src.java.dir}</sourceDirectory>
      <unitTestSourceDirectory>${src.test.dir}</unitTestSourceDirectory>
      <aspectSourceDirectory/>

[…]
```

src/java

src/aspect

src/test

Project Build Section

```
<unitTest>
        <includes>
                <include>**/*Test.java</include>
        </includes>
        <resources/>
</unitTest>

<resources>
        <resource>
                <directory>${src.conf.dir}</directory>
                <targetPath/>
                <includes>
                    <include>**/*.properties</include>
                </includes>
        </resource>
</resources>
```

src/conf

prefix package name, e.g. com.myinc. sampleservice

Project Report Section

Defines various reports to be generated

```
<reports>
    <report>maven-jdepend-plugin</report>
    <report>maven-checkstyle-plugin</report>
    <report>maven-changelog-plugin</report>
    <report>maven-developer-activity-plugin</report>
    <report>maven-file-activity-plugin</report>
    <report>maven-javadoc-plugin</report>
    <report>maven-jxr-plugin</report>
    <report>maven-junit-report-plugin</report>
    <report>maven-linkcheck-plugin</report>
    <report>maven-tasklist-plugin</report>
</reports>
```

Project Report - Example

Jakarta Turbine

Last published: 03 March 2004 | Doc for 2.3

Turbine Home | Fulcrum | TDK | JCS

General Information
- Overview
- **Features**
- Specification
- Getting Started

Documentation
- Changes
- Core DB Schema
- Services
- How-To's
- JavaDocs

Development
- Proposals
- How To Help
- Todo

Project Documentation
- About jakarta-turbine-2
- ⊞Project Info
- ⊞Project Reports
- Development Process

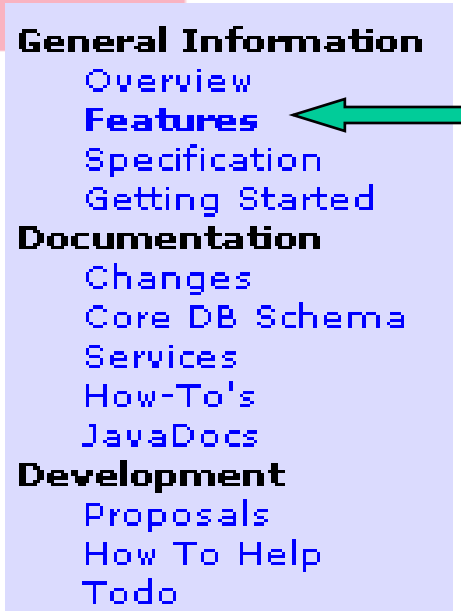
Features

This document is for bragging about all of Turbine's features and inherent coolness. Turbine is well over 200 classes and contains a boat load of features and API's. Many of these can also be used indepently of Turbine. Almost all of the default implementations can be easily overridden with your own implementations. Turbine also has extensive Javadoc documentation for nearly all of the classes as well as in-code comments. At the risk of sounding snooty < smile>, Turbine is by far the leader of complex web application development tools. No other systems come close to being as cleanly implemented and executed. It clearly has been developed by the people who do web applications on a daily basis and have to constantly solve the same problems over and over again.

All of these features have been made possible thanks to the over 30 developers (and growing all the time!) who have contributed to Turbine over the last 2+ years.

- Integration with template systems: Velocity, JSP
- Utility code for working with Velocity, such as a SelectorBox class for building `select` boxes

Project Report - XDoc



xdocs/**navigation.xml**

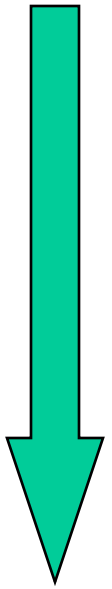
```
…
<menu name="General Information">
   <item name="Overview"            href="/index.html"/>
   <item name="Features"            href="/features.html"/>
   <item name="Specification"       href="/fsd.html"/>
   <item name="Getting Started"     href="/getting-started.html"/>
</menu>
```

xdocs/**features.xml**

```
<document>
      <properties>
         <title>Turbine Features</title>
         <author email="">Jon S. Stevens</author>
      </properties>
      <body>
       <section name="Features">
       <p>This document is for bragging about all of Turbine's ….
       …
</document>
```

Property Processing

${project.home}/project.properties	Project scope properties
${project.home}/build.properties	Properties specific to each build
${user.home}/build.properties	Properties specific to each user
CLI –Dfoo=bar	



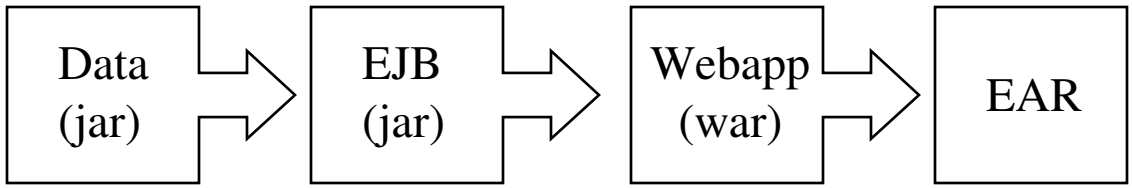
Sample build.properties:
…
bea.home=c:/bea81sp1
oracle.home=c:/oracle/ora9i

The ***last*** definition wins

Build Process Design

Sample Service project components

- Common data module
- EJBs
- Web Application



Subproject: service-data

project.xml (POM)

```
<project>
    <extend>../project.xml</extend>
    <name>Sample Service Data
      Module</name>
    <id>sampleservice-data</id>
</project>
```

Note: POM can be inherited.

Subproject: service-data

maven.xml (Goals)

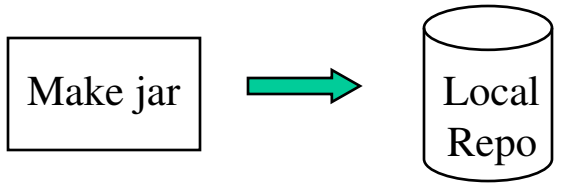
```
<project default="build"
   xmlns:j="jelly:core"
   xmlns:maven="jelly:maven"
   xmlns:ant="jelly:ant">

   <goal name="build"
            prereqs="jar:install"/>

</project>
```

Note: Goals can also be inherited

```
sampleservice
        –project.xml
        –maven.xml
        –application/
        –service-data/
                –project.xml
                –maven.xml
                –src/
        –service-ejb/
        –service-web/
        –xdocs/
```



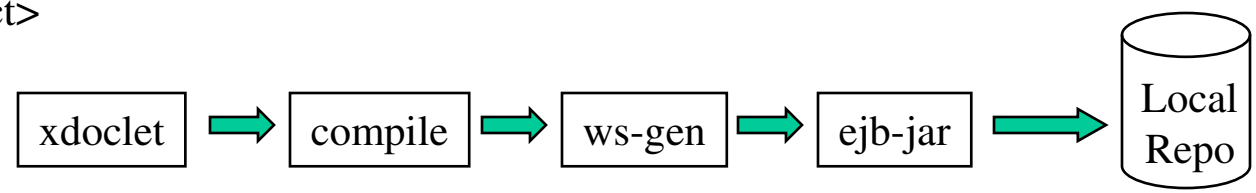
Subproject: service-ejb

project.xml (POM)

```
<project>
        <extend>../project.xml</extend>
        <name>Sample Service EJB</name>
        <id>sampleservice-ejb</id>

        <dependency>
                <groupId>${pom.groupId}</groupId>
                <artifactId>sampleservice-data</artifactId>
                <version>${pom.currentVersion}</version>
                <properties>
                    <ejb.manifest.classpath>true</ejb.manifest
                    .classpath>
                </properties>
        </dependency>
</project>
```

```
sampleservice
        –project.xml
        –maven.xml
        –application/
        –service-data/
        –service-ejb/
                –project.xml
                –maven.xml
                –src/
        –service-web/
        –xdocs/
```



Subproject: service-ejb

Maven XDoclet Plugin

- Support all standard tags
- Automatically includes generated src dir in compilation src set
- Support util class generation
- Dependencies
  - xdoclet-ejb-module-1.2
  - xdoclet-web-module-1.2
  - xdoclet-bea-module-1.2
    (for WebLogic Server Deployment)

Note: Current version 1.2 does not work out-of-box (needed to fix the project.xml)

Subproject: service-ejb

Maven XDoclet Plugin - Properties

```
## EJBDoclet
maven.xdoclet.ejbdoclet.fileset.0.include=**/ejb/**/*Bean.java
maven.xdoclet.ejbdoclet.ejbSpec=2.0
maven.xdoclet.ejbdoclet.verbose=true
maven.xdoclet.ejbdoclet.session.0=false
maven.xdoclet.ejbdoclet.localhomeinterface.0=true
maven.xdoclet.ejbdoclet.localinterface.0=true
maven.xdoclet.ejbdoclet.utilobject.0=true

## EJBDoclet WebLogic Nested Element
maven.xdoclet.ejbdoclet.weblogic.0=true
maven.xdoclet.ejbdoclet.weblogic.0.mergeDir=${src.dir}/ejbdoclet
maven.xdoclet.ejbdoclet.weblogic.0.destDir=${maven.xdoclet.ejbdoclet.deploym
    entdescriptor.0.destDir}
```

Subproject: service-ejb

Web Services

– Currently Maven has no container specific plugins

```
<goal name="wsgen" prereqs="wsgen.autotype, wsgen.source2wsdd"/>

 <goal name="wsgen.autotype">
   <taskdef name="autotype"
                classname="weblogic.ant.taskdefs.webservices.javaschema.JavaSchema"/>
   ….
  </goal>

<goal name=“wsgen.source2wsdd”>
   …
</goal>
```

project.properties

```
## Web Services
maven.webservice.javaComponents=\
    com.myinc.sampleservice.ejb.BasicAccountInquiry,\
    com.myinc.sampleservice.ejb.ExpandedAccountInquiry,\
    com.myinc.sampleservice.ejb.DetailedAccountInquiry
maven.webservice.autotype.package=com.myinc.sampleservice.autotype
maven.webservice.autotype.keepgenerated=false
```

Use tag: @wlws

Subproject: service-ejb

Maven EJB Plugin

– Currently no container specific ejb-jar

```
<goal name="ejbjar" prereqs="java:compile">
  <path id="ejb.classpath">
    <pathelement location="${maven.build.dest}"/>
    <path refid="maven.dependency.classpath"/>
  </path>
  <j:set var="maven.ejb.descriptordir"
      value="${pom.getPluginContext('maven-xdoclet-plugin')…./>
  <ejbjar srcdir="${maven.build.dest}"
     descriptordir="${maven.ejb.descriptordir}"
     flatdestdir="true"
     basejarname="${pom.artifactId}-${pom.currentVersion}">
     <classpath refid="ejb.classpath"/>
    <weblogic destdir="${maven.build.dir}“newCMP="true"
          outputdir="${maven.build.dir}/ejb" rebuild="false"
          ejbcclass="weblogic.ejbc"
    </weblogic>
    …
```

sampleservice

- –project.xml
- –maven.xml
- –application/
- –service-data/
- **–service-ejb/**
  - –project.xml
  - **–maven.xml**
  - –src/
- –service-web/
- –xdocs/

Subproject: service-ejb

Making the Final EJB Jar

```
<project default="build“>
 <goal name="build" prereqs="ejb:install"/>

 <preGoal name="java:compile">
    <attainGoal name="xdoclet:ejbdoclet"/>
 </preGoal>

 <postGoal name="java:compile">
    <attainGoal name="wsgen"/>
    <attainGoal name="java:jar-resources"/>
 </postGoal>

 <preGoal name="ejb:ejb">
   <attainGoal name="ejbjar"/>
 </preGoal>

 <postGoal name="ejb:install">
   <artifact:install
      artifact="${maven.build.dir}/${pom.artifactId}-${pom.currentVersion}.xml"
      type="xml“   project="${pom}"/>
 </postGoal>
```

sampleservice

- –project.xml
- –maven.xml
- –application/
- –service-data/
- **–service-ejb/**
  - –project.xml
  - **–maven.xml**
  - –src/
- –service-web/
- –xdocs/

Subproject: service-web

project.xml (POM)

```
<project>
    <extend>../project.xml</extend>
    <name>Sample Service Web Application</name>
    <id>sampleservice-web</id>
    …
    <dependency>
        <groupId>${pom.groupId}</groupId>
        <artifactId>sampleservice-data</artifactId>
        <version>${pom.currentVersion}</version>
    </dependency>
    <dependency>
        <groupId>${pom.groupId}</groupId>
        <artifactId>sampleservice-ejb</artifactId>
        <version>${pom.currentVersion}</version>
        <type>ejb</type>
        <properties>
            <web-service>true</web-service>
        </properties>
    </dependency>
```

custom property

```
sampleservice
    –project.xml
    –maven.xml
    –application/
    –service-data/
    –service-ejb/
    –service-web/
        –project.xml
        –maven.xml
        –src/
    –xdocs/
```

Subproject: service-web

maven.xml (goals)

```
<project default="build">
    <goal name="build" prereqs="war:install"/>
    <preGoal name="war:war">
      <j:forEach var="dep" items="${pom.dependencies}">
        <j:if test="${dep.getProperty('web-service')=='true'}">
          <util:file var="xmlFile"
            name="${maven.repo.local}/${dep.groupId}/xmls/${dep.artifactId}-
                  ${dep.version}.xml"/>
          <j:if test="${xmlFile.exists()}">
            <x:parse var="xml" xml="${xmlFile}"/>
            <x:forEach var="node" select="$xml/*/*">
              <j:set var="temp" value="${root.add(node.detach())}"/>
            </x:forEach>
          </j:if>
        </j:if>
      </j:forEach>
      <j:if test="${!root.elements().isEmpty()}">
       <!– output the "web-services.xml" -->
      </j:if>
    </preGoal>
```

preGoal is used to generate web services DD file if defined

Subproject: application

sampleservice
- –project.xml
- –maven.xml
- –application/
  - **–project.xml**
  - –maven.xml
  - –src/
- –service-data/
- **–service-ej**b/
- –service-web/
- –xdocs/

EAR Packaging

```
<project>
  <extend>../project.xml</extend>
  <name>Sample Service Application</name>
  <id>sampleservice</id>
```

```
<!-- Data Component -->
<dependency>
  <groupId>${pom.groupId}</groupId>
  <artifactId>sampleservice-data</artifactId>
  <version>${pom.currentVersion}</version>
  <type>jar</type>
  <properties>
    <ear.bundle>true</ear.bundle>
  </properties>
</dependency>
```

```
<!-- EJB Component -->
<dependency>
  <groupId>${pom.groupId}</groupId>
  <artifactId>sampleservice-ejb</artifactId>
  <version>${pom.currentVersion}</version>
  <type>ejb</type>
  <properties>
    <ear.bundle>true</ear.bundle>
  </properties>
</dependency>
```

```
<!-- WAR Component -->
<dependency>
  <groupId>${pom.groupId}</groupId>
  <artifactId>sampleservice-web</artifactId>
  <version>${pom.currentVersion}</version>
  <type>war</type>
  <properties>
    <ear.bundle>true</ear.bundle>
    <ear.appxml.war.context-root>
      /${pom.artifactId}
    </ear.appxml.war.context-root>
  </properties>
</dependency>
```

Subproject: application

sampleservice
- –project.xml
- –maven.xml
- **–application/**
  - –project.xml
  - **–maven.xml**
  - –src/
- –service-data/
- –service-ejb/
- –service-web/
- –xdocs/

EAR Packaging

```
<project default="build">

  <goal name="build" prereqs="ear"/>

  <preGoal name="ear:generate-ear-descriptor">
    <mkdir dir="${maven.ear.appxml.dir}"/>
  </preGoal>
</project>
```

project.properties

```
…
## Ear related
maven.ear.appxml.dir = ${maven.build.dir}/application/META-INF
maven.ear.appxml = ${maven.ear.appxml.dir}/application.xml
maven.ear.appxml.generate = true
```

Tip: container specific DD files can be stored at src/application/META-INF

Putting It Together: Reactor

```
<project default="build"
    xmlns:j="jelly:core"
    xmlns:maven="jelly:maven"
    xmlns:ant="jelly:ant">
   ....

        <goal name="build">
          <maven:reactor
            basedir="${basedir}"
            postProcessing="true"
            includes="*/project.xml"
            excludes=""
            goals="build"
            banner="Building"
            ignoreFailures="false"/>
         </goal>
       ...
```

```
sampleservice
        –project.xml
        –maven.xml
        –application/
        –service-data/
        –service-ejb/
        –service-web/
        –xdocs/
```

Putting It Together: Reactor

```
/c/dev/sampleservice/>maven

 __  __
|  \/  |__ _Apache__ ___
| |\/| / _` \ V / -_) ' \  ~ intelligent projects ~
|_|  |_\__,_|\_/\___|_||_|  v. 1.0-rc1-SNAPSHOT

Starting the reactor...
Our processing order:
Sample Service Data Module
Sample Service EJB
Sample Service Web Application
Sample Service Application
+---------------------------------------
| Building Sample Service Data Module
| Memory: 3M/4M
+---------------------------------------
build:

java:prepare-filesystem:
    [mkdir] Created dir: C:\dev\sampleservice\service-data\target\classes

java:compile:
….
```

Customizing Maven

- Override plugin properties in
  - project.properties
  - build.properties
- Use maven.xml
  - Override plugin goals
  - Intercept plugin goals with <preGoal/> and <postGoal/>
- Write you own plugin
  - In Java, Jelly, or other scripting language.

Real Life Maven

- Single artifact per project
  - Can be tweaked to deliver multiple artifacts as long as no type conflicts
  - Fine-grained design
- Project Migration/Mavenizing
  - Can co-exist with ant
  - May require different directory structure
- Too Slow?
  - Use console plugin
- Are you ready for maven?
  - Culture change

Summary

- Pros
  - Work out-of-box for standard projects
  - Build assets highly reusable, thanks to core/plugin architecture
  - Build rules are more dynamic
  - Best suited for project integration
  - IDE friendly
- Cons
  - Incomplete documentation
  - Missing convenience details
  - Not yet mature. Still waiting for the R1.

Get More

- http://maven.apache.org
- http://www.onjava.com/pub/a/onjava/2003/10/22/maven.html
- http://www-106.ibm.com/developerworks/java/library/j-maven
- http://www.javausergroup.at/events/maven.pdf
- http://www.theserverside.com/articles/article.jsp?l=MavenMagic
- http://blogs.codehaus.org/people/vmassol/archives/000080.html
- http://www.javaworld.com/javaworld/jw-10-2002/jw-1011-maven.html

Questions