Build Automation
- A Brief Introduction to Maven

CS480 Software Engineering

Yu Sun, Ph.D.
http://yusun.io
yusun@cpp.edu

CAL POLY POMONA

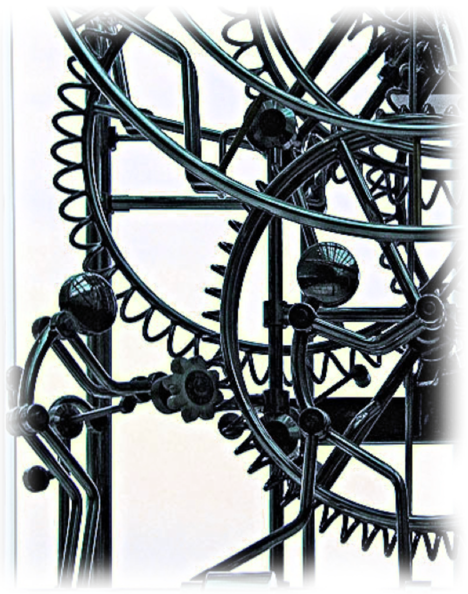
Very Important in Practice

- Gateway to participate in real software development

- You cannot start coding without knowing how to use the build automation tools in the industry

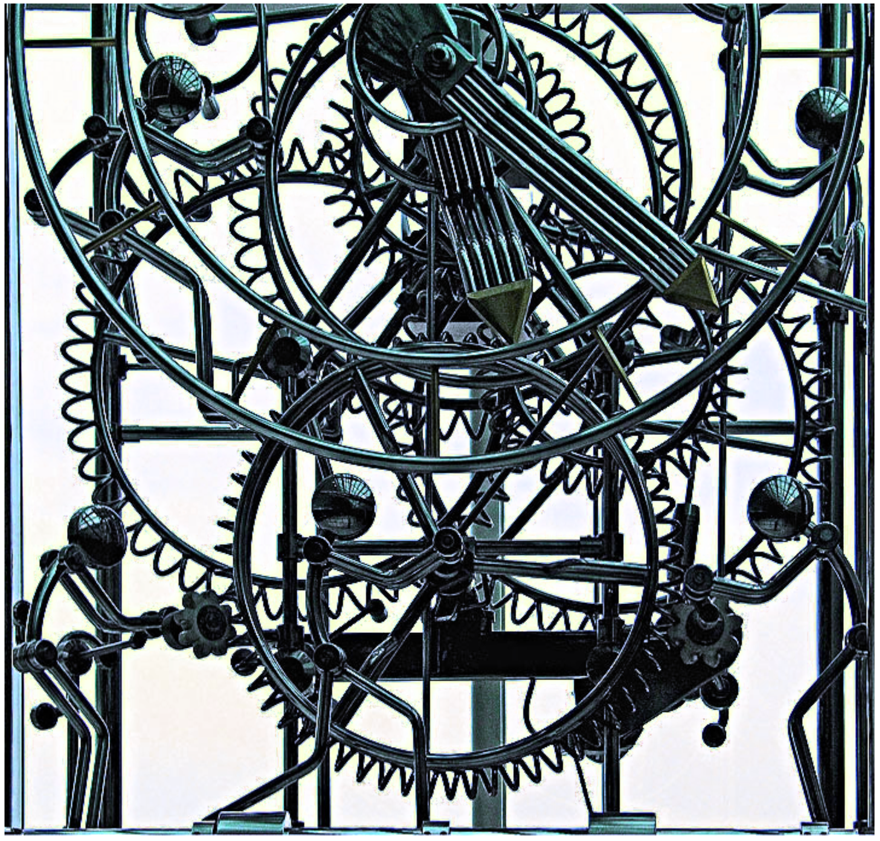
What is Build Automation (Maven)?

- Build lifecycle
- Dependency management tool
- Artefact repository
- Collection of plugins
- Project reporting tool
- Set of conventions
- Distilled experience



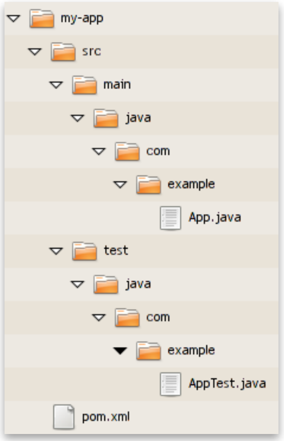
What Else is Build Automation(Maven)?

- Succinct command line tool
- Designed for Java/Java EE/other
- Holder/publisher of project documentation
- Generator of project metrics
- Customisable: environment, lifecycle, etc.
- Inheritable
- Declarative
- Encourager of modularity and reuse
- Integrated with SCM tools
- Integrated with IDEs
- Integrated with Ant
- System of repositories
- Project kick starter
- Release manager
- Deployer
- Enabler of portable build knowledge
- Encourager of best practice
- Community
- Not perfect

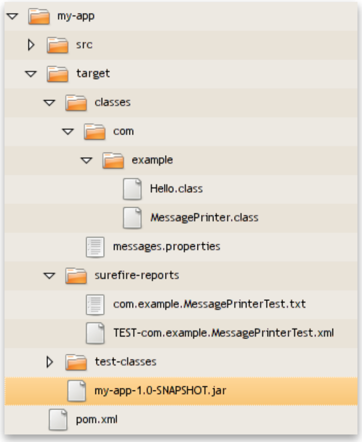


We Focus on the Important

- Project Structure Management

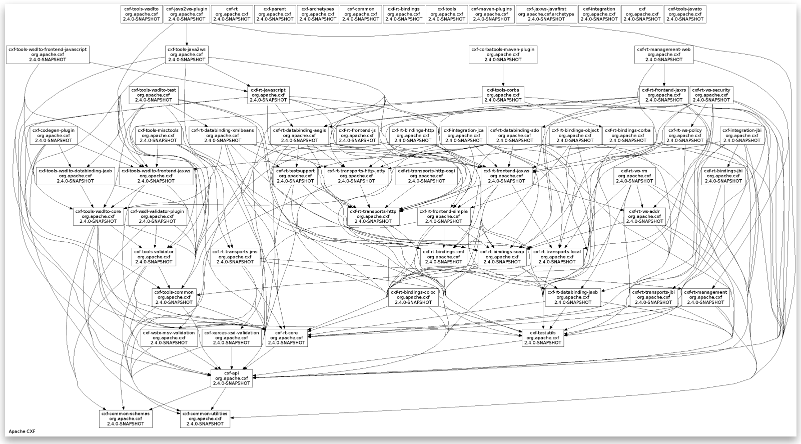


```
my-app
  src
    main
      java
        com
          example
            App.java
    test
      java
        com
          example
            AppTest.java
  pom.xml
```



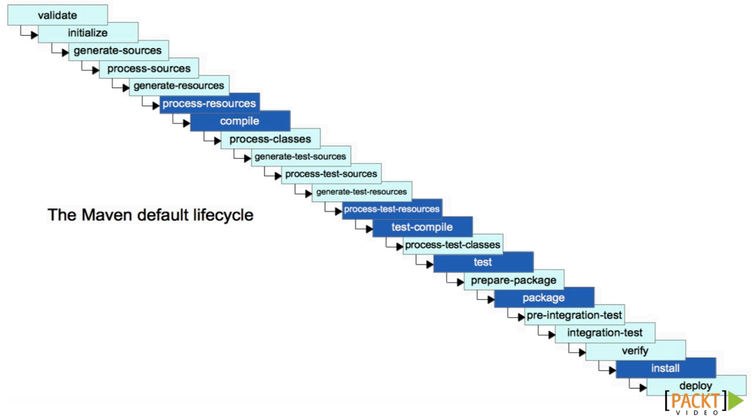
```
my-app
  src
  target
    classes
      com
        example
          Hello.class
          MessagePrinter.class
      messages.properties
    surefire-reports
      com.example.MessagePrinterTest.txt
      TEST-com.example.MessagePrinterTest.xml
    test-classes
    my-app-1.0-SNAPSHOT.jar
  pom.xml
```

- Dependency Management



- Software Artifact Packing

- Build Lifecycle Management



The Maven default lifecycle

Why Project Structure Management

- When software grows, project files and artifacts have to be well organized

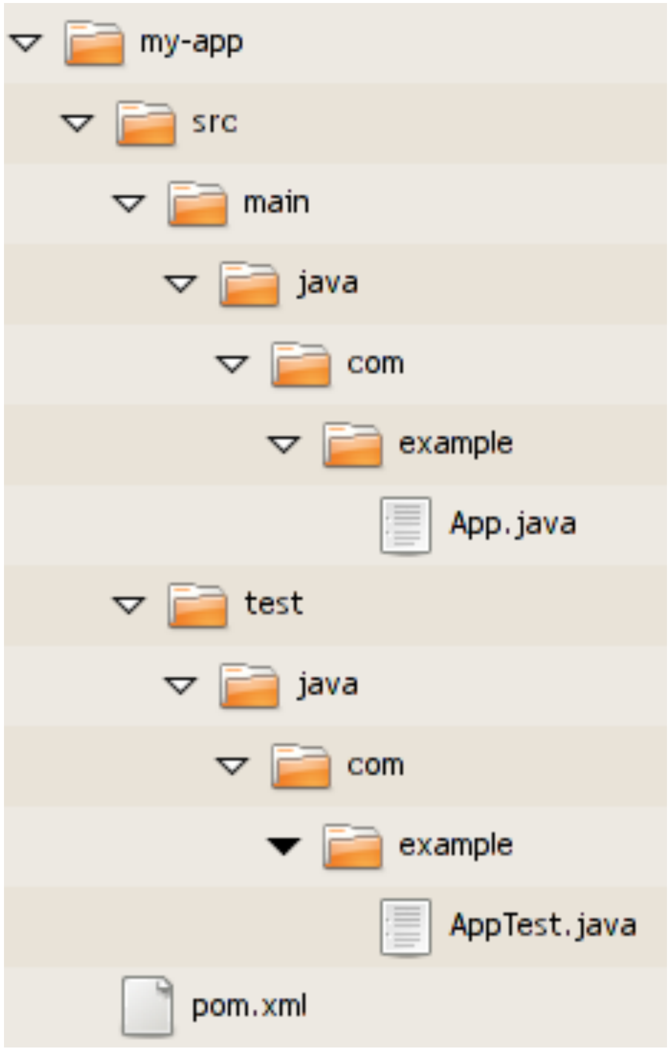
Why Project Structure Management

- The project structure should be standardized
- Anyone can quickly build others' projects and collaborate

Create Maven Project

- Use Eclipse Maven plugin
- mvn archetype:generate

Directory Structure Convention



```
my-app
  src
    main
      java
        com
          example
            App.java
    test
      java
        com
          example
            AppTest.java
  pom.xml
```

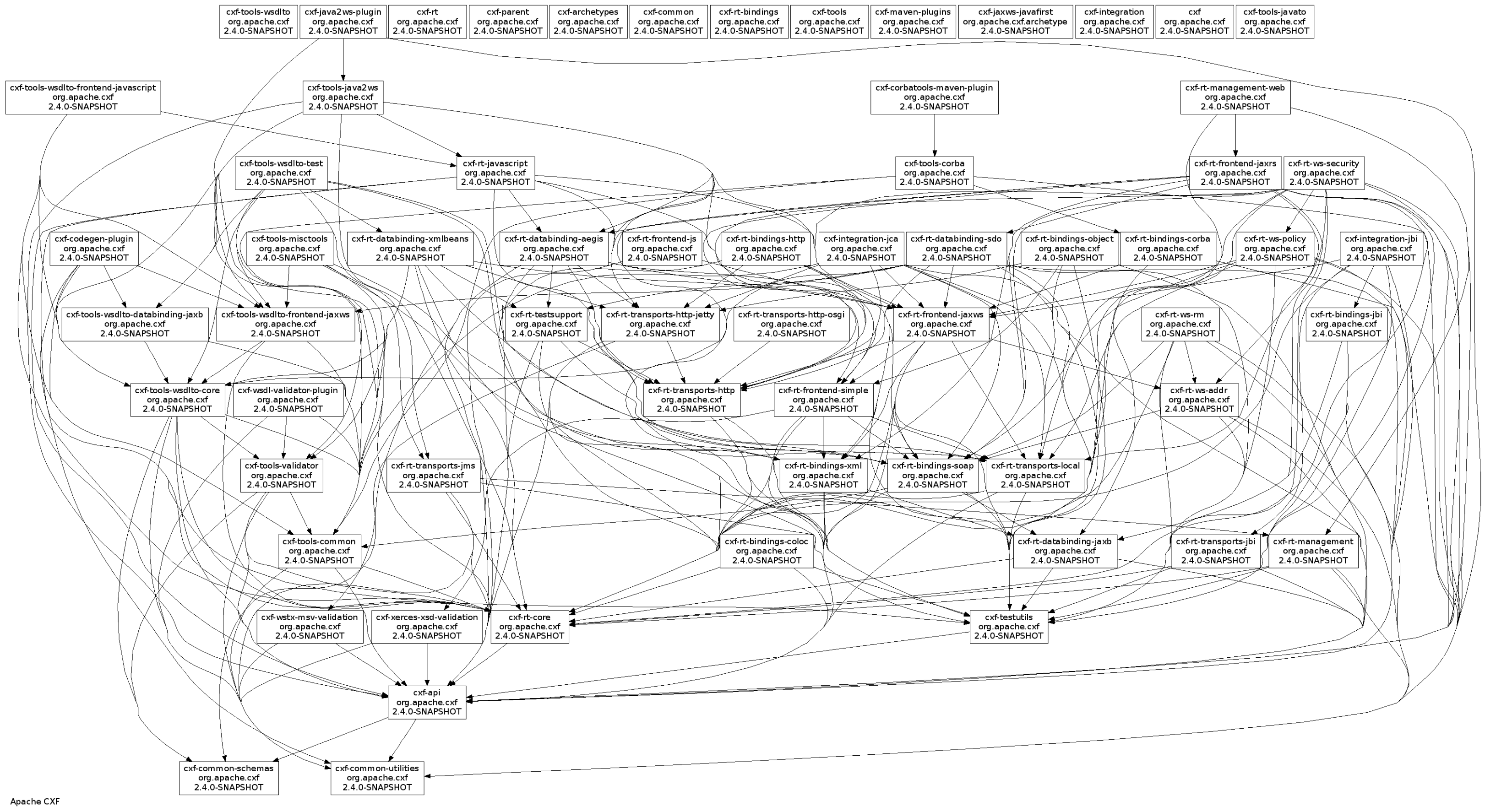
- Java sources: src/main/java
- Unit tests: src/test/java
- pom.xml

Maven POM

- Stands for Project Object Model
- Describes a project
  - Name and Version
  - Artifact Type
  - Source Code Locations
  - Dependencies
  - Plugins
  - Profiles (Alternate build configurations)
- Uses XML by Default

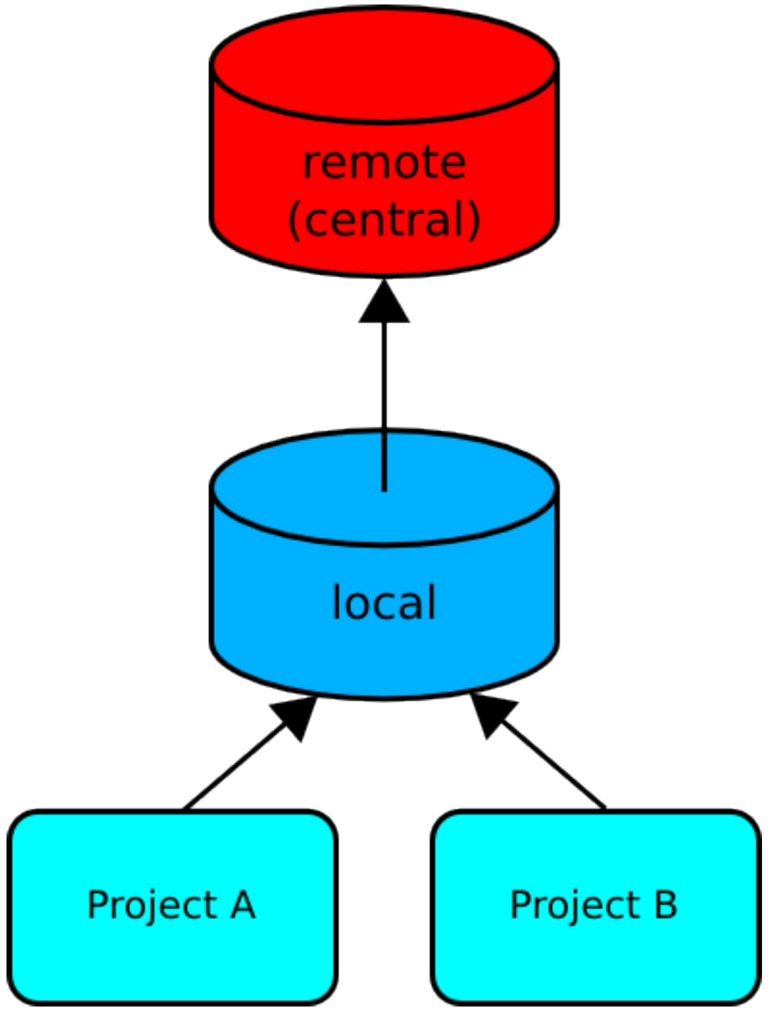
Dependency Management

- Maven revolutionized Java dependency management
  - No more checking libraries into version control



cxf-tools-wsdlto org.apache.cxf 2.4.0-SNAPSHOT
cxf-java2ws-plugin org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt org.apache.cxf 2.4.0-SNAPSHOT
cxf-parent org.apache.cxf 2.4.0-SNAPSHOT
cxf-archetypes org.apache.cxf 2.4.0-SNAPSHOT
cxf-common org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-bindings org.apache.cxf 2.4.0-SNAPSHOT
cxf-tools org.apache.cxf 2.4.0-SNAPSHOT
cxf-maven-plugins org.apache.cxf 2.4.0-SNAPSHOT
cxf-jaxws-javafirst org.apache.cxf.archetype 2.4.0-SNAPSHOT
cxf-integration org.apache.cxf 2.4.0-SNAPSHOT
cxf org.apache.cxf 2.4.0-SNAPSHOT
cxf-tools-javato org.apache.cxf 2.4.0-SNAPSHOT
cxf-tools-wsdlto-frontend-javascript org.apache.cxf 2.4.0-SNAPSHOT
cxf-tools-java2ws org.apache.cxf 2.4.0-SNAPSHOT
cxf-corbatools-maven-plugin org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-management-web org.apache.cxf 2.4.0-SNAPSHOT
cxf-tools-wsdlto-test org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-javascript org.apache.cxf 2.4.0-SNAPSHOT
cxf-tools-corba org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-frontend-jaxrs org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-ws-security org.apache.cxf 2.4.0-SNAPSHOT
cxf-codegen-plugin org.apache.cxf 2.4.0-SNAPSHOT
cxf-tools-misctools org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-databinding-xmlbeans org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-databinding-aegis org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-frontend-js org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-bindings-http org.apache.cxf 2.4.0-SNAPSHOT
cxf-integration-jca org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-databinding-sdo org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-bindings-object org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-bindings-corba org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-ws-policy org.apache.cxf 2.4.0-SNAPSHOT
cxf-integration-jbi org.apache.cxf 2.4.0-SNAPSHOT
cxf-tools-wsdlto-databinding-jaxb org.apache.cxf 2.4.0-SNAPSHOT
cxf-tools-wsdlto-frontend-jaxws org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-testsupport org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-transports-http-jetty org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-transports-http-osgi org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-frontend-jaxws org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-ws-rm org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-bindings-jbi org.apache.cxf 2.4.0-SNAPSHOT
cxf-tools-wsdlto-core org.apache.cxf 2.4.0-SNAPSHOT
cxf-wsdl-validator-plugin org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-transports-http org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-frontend-simple org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-ws-addr org.apache.cxf 2.4.0-SNAPSHOT
cxf-tools-validator org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-transports-jms org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-bindings-xml org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-bindings-soap org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-transports-local org.apache.cxf 2.4.0-SNAPSHOT
cxf-tools-common org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-bindings-coloc org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-databinding-jaxb org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-transports-jbi org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-management org.apache.cxf 2.4.0-SNAPSHOT
cxf-wstx-msv-validation org.apache.cxf 2.4.0-SNAPSHOT
cxf-xerces-xsd-validation org.apache.cxf 2.4.0-SNAPSHOT
cxf-rt-core org.apache.cxf 2.4.0-SNAPSHOT
cxf-testutils org.apache.cxf 2.4.0-SNAPSHOT
cxf-api org.apache.cxf 2.4.0-SNAPSHOT
cxf-common-schemas org.apache.cxf 2.4.0-SNAPSHOT
cxf-common-utilities org.apache.cxf 2.4.0-SNAPSHOT
Apache CXF

Maven Repositories



- Repositories store artifacts:
  - plugins
  - project dependencies
- Central:
  http://repo1.maven.org/maven2
  (or mirror)
- Local: ~/.m2/repository
- The first execution of a plugin, or requirement for a dependency pulls the artifact from central and caches it locally

Adding a Dependency

- Dependencies consist of:
  - GAV
  - Scope: compile, test, provided (default=compile)
  - Type: jar, pom, war, ear, zip (default=jar)

```
<project>
    ...
    <dependencies>
        <dependency>
            <groupId>javax.servlet</groupId>
            <artifactId>servlet-api</artifactId>
            <version>2.5</version>
            <scope>provided</scope>
        </dependency>
    </dependencies>
</project>
```

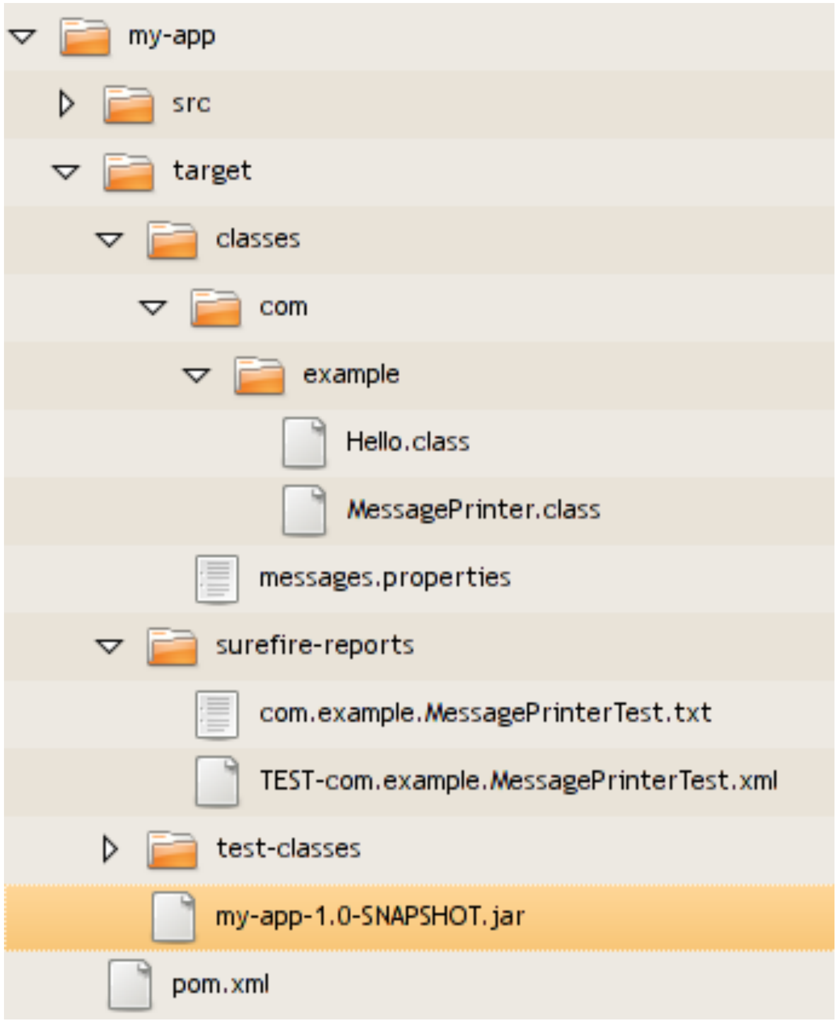
Software Artifact Packing

- Make your software deliverable

Ready for Take Off

```
mvn package
```

The Finished Product

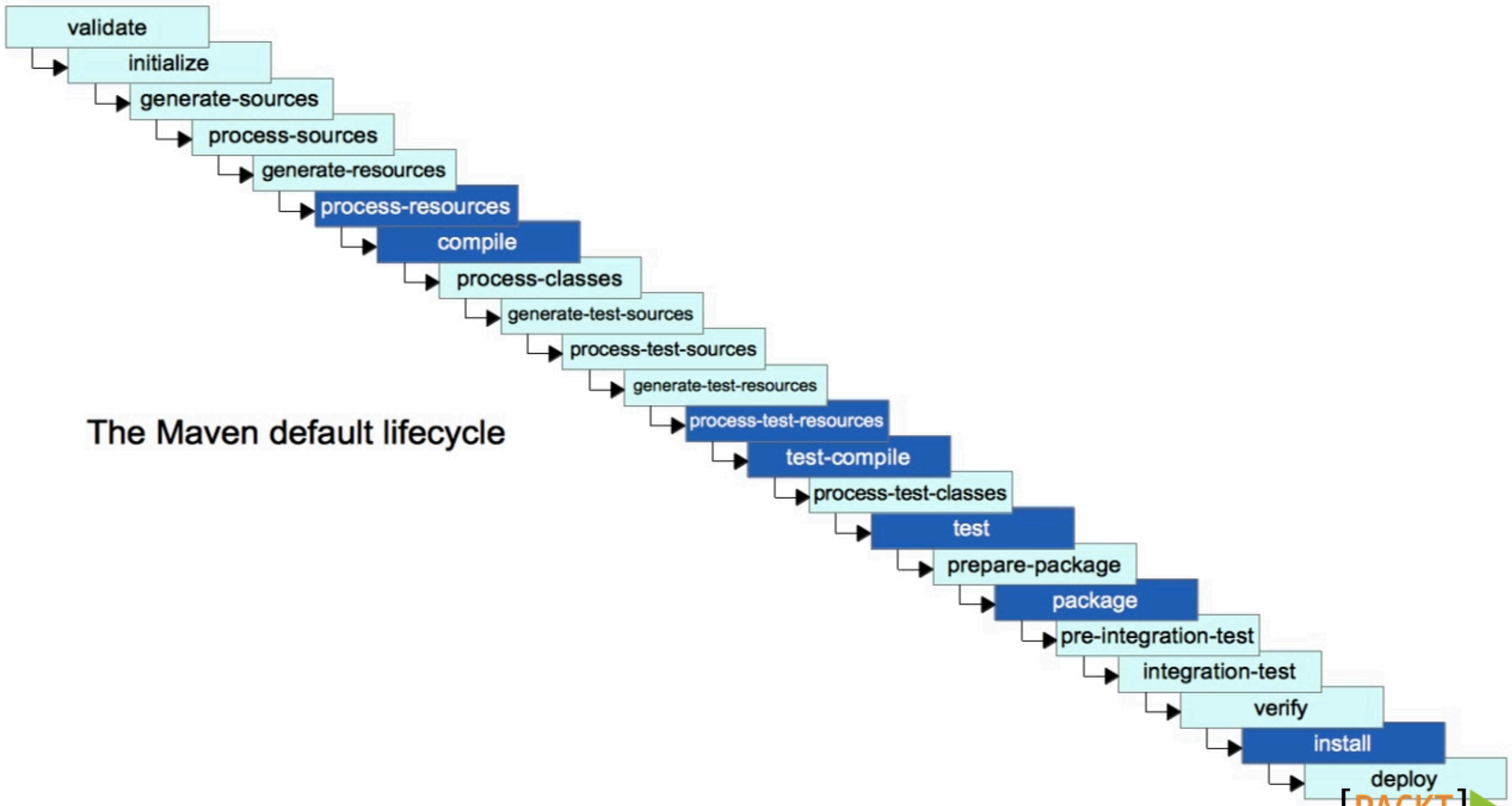


```
my-app
  src
  target
    classes
      com
        example
          Hello.class
          MessagePrinter.class
      messages.properties
    surefire-reports
      com.example.MessagePrinterTest.txt
      TEST-com.example.MessagePrinterTest.xml
    test-classes
    my-app-1.0-SNAPSHOT.jar
  pom.xml
```

- Classes and test classes compiled
- Resources copied to classes directory
- Test reports created
- Jar file created

```
$ java -jar my-app-1.0-SNAPSHOT.jar
Hello World!
```

Build Lifecycle Management



The Maven default lifecycle

Maven Build Lifecycle

- A Maven build follow a lifecycle
- Default lifecycle
  - generate-sources/generate-resources
  - compile
  - test
  - package
  - integration-test (pre and post)
  - Install
  - deploy
- There is also a Clean lifecycle

Example Maven Goals

- To invoke a Maven build you set a lifecycle “goal”

- mvn install
  - Invokes generate* and compile, test, package, integration-test, install
- mvn clean
  - Invokes just clean
- mvn clean compile
  - Clean old builds and execute generate*, compile
- mvn compile install
  - Invokes generate*, compile, test, integration-test, package, install
- mvn test clean
  - Invokes generate*, compile, test then cleans