Making Agile Real

Automated deployment with Maven and friends

Going the whole nine yards

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Presentation Goals

Learn about how build automation techniques can also be used to deploy your application

Speaker's qualifications

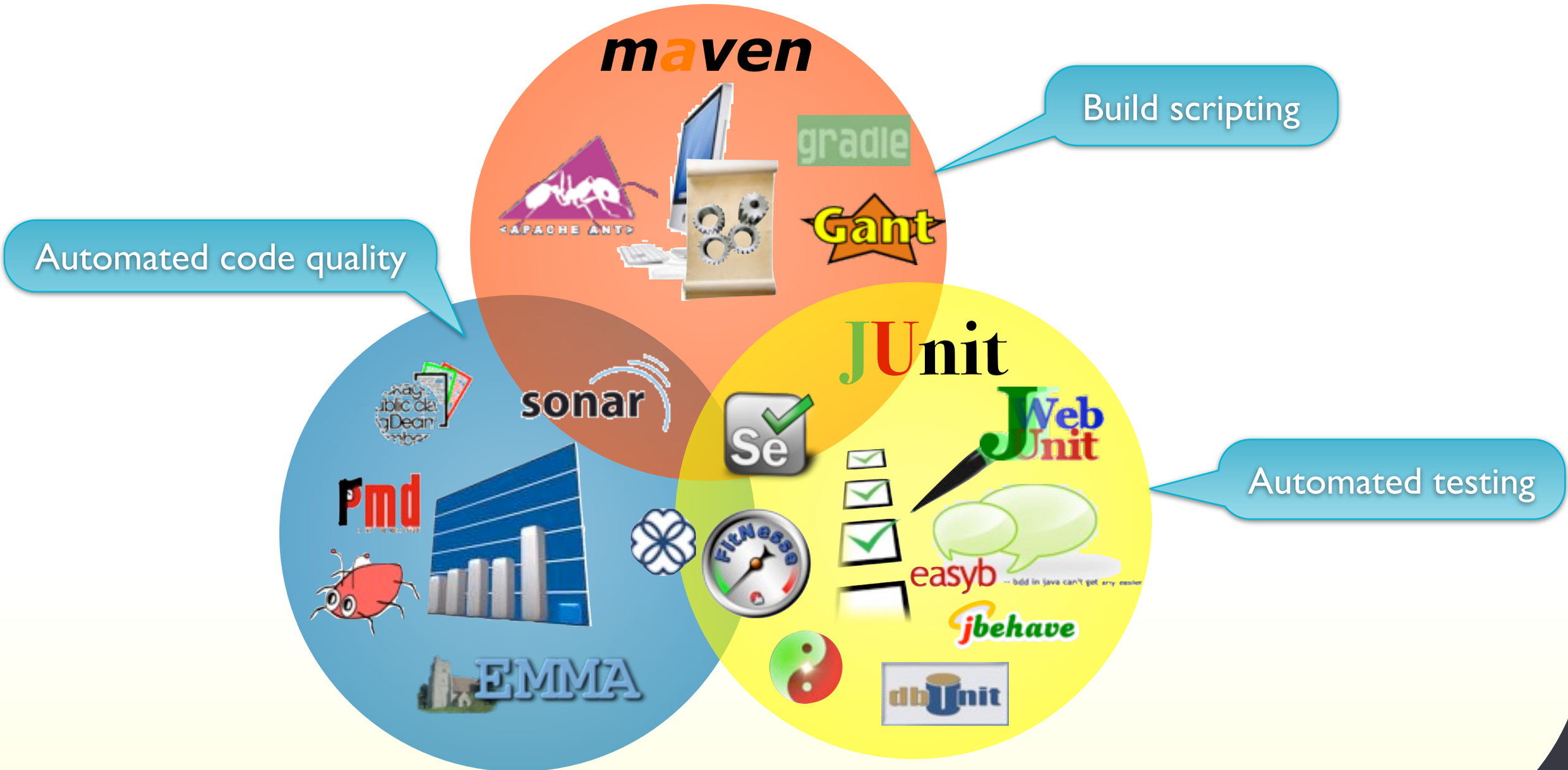
- John Ferguson Smart
  - Consultant, Trainer, Mentor, Author,...
  - Works with Enterprise Java, Web Development, and Open Source technologies
  - Author of 'Java Power Tools' (O'Reilly)
  - Writes articles for sites like JavaWorld, DevX and Java.net, and blogs on Java.net
  - Frequent speaker at conferences and Java User Groups
  - Likes to write about himself in the third person

Agenda

- What will we cover today
  - Build automation fundamentals
  - The Maven Release Cycle
  - The role of the Maven Enterprise Repository
  - Automating Deployment
  - Automating Web Testing
  - Automating Web Deployment
  - Deploying Database Updates
  - Scripting the Deployment Process
  - A real-world example

Build automation

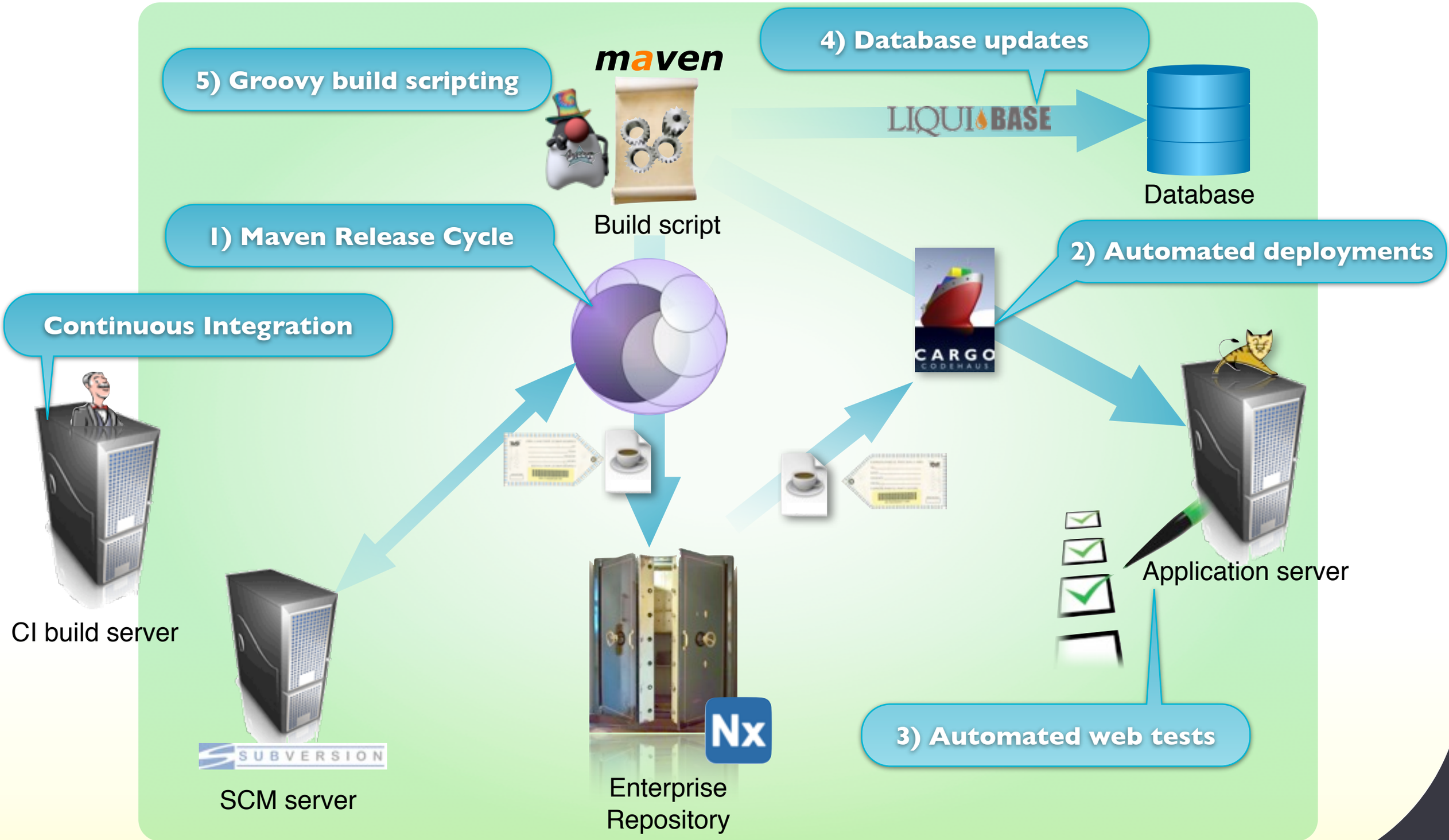
- Build automation - the Big Three



Build automation

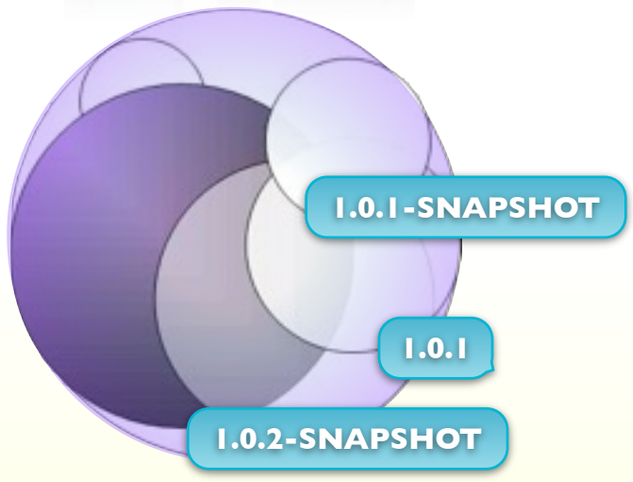
- Step 4 - Automate your deployment process!

Release automation - an overview



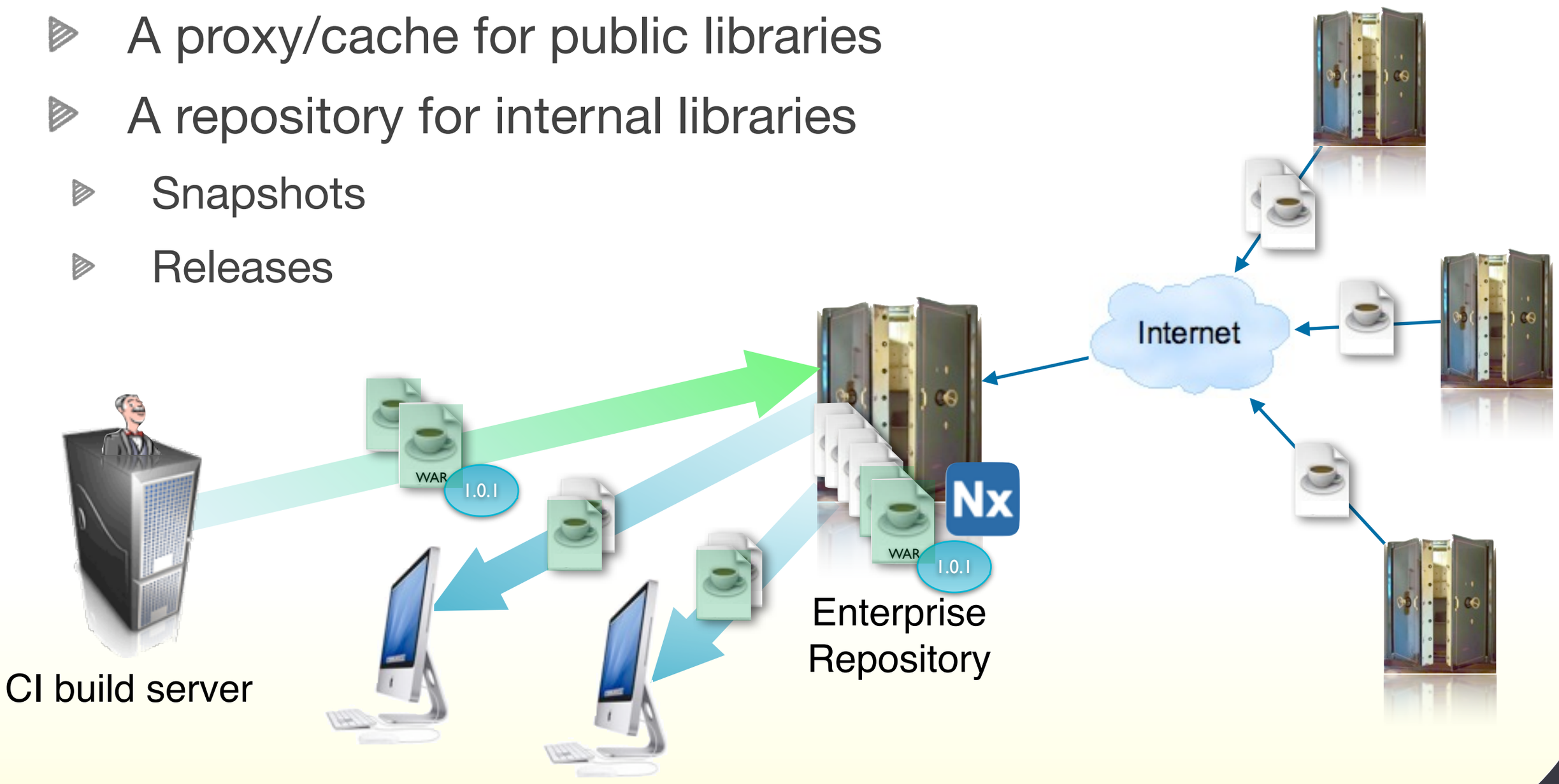
Release Foundations

- Building your release process on solid building blocks:
  - The Maven Enterprise Repository
  - The Maven Release Cycle



The Maven Enterprise Repository

- The Maven Enterprise Repository
  - A proxy/cache for public libraries
  - A repository for internal libraries
    - Snapshots
    - Releases

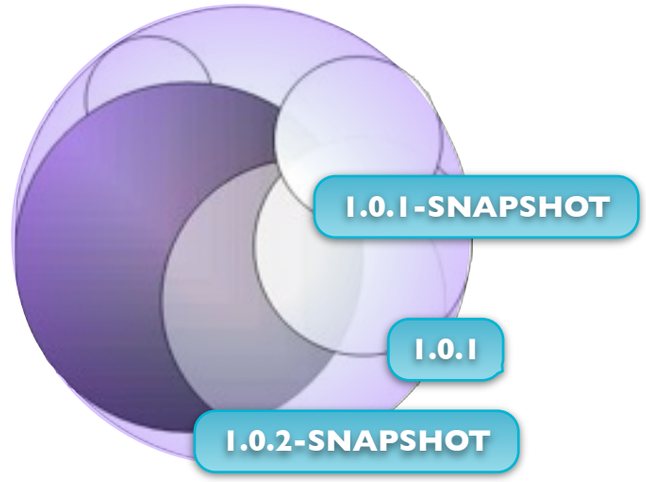


The Maven Enterprise Repository

- The Maven Enterprise Repository
  - Several options available
    - Nexus
    - Artifactory
    - Archiva
    - File server...

The Maven Release Cycle

- The Maven Release Cycle
  - Develop against snapshot versions
    - Each release produces a new time-stamped artifact
    - Snapshot versions are identified by the SNAPSHOT keyword
  - Release stable versions
    - Stable, tested release
    - Each artifact is unique




```
<groupId>myorg.myapp</groupId>
<artifactId>myapp-web</artifactId>
<version>1.0.0-SNAPSHOT</version>
```

```
<groupId>myorg.myapp</groupId>
<artifactId>myapp-web</artifactId>
<version>1.0.0</version>
```

The Maven Release Cycle

- Deploying a release involves many tasks
  - Commit all current changes to version control
  - Upgrade the version number(s) and commit the changes
  - Tag the release version
  - Build and deploy this version
  - Update the version number and commit the changes

The Maven Release Cycle

- The Maven Release Plugin automates this process
  - Automates the release process
  - Updates version numbers
  - Commits changes and creates new SCM tags
  - Builds, tests and deploys to the Enterprise Repository

The Maven Release Cycle

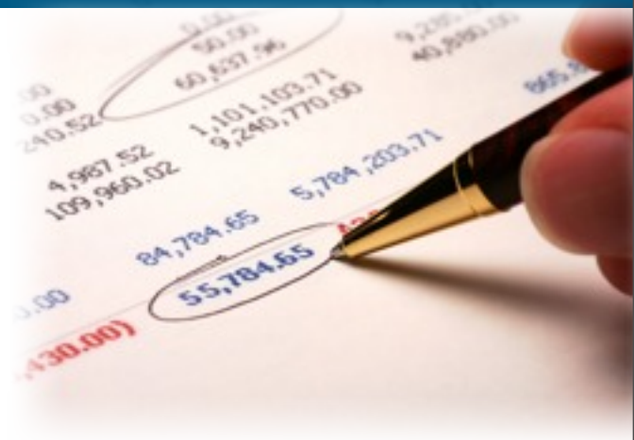
- Try this at home!
  - You will need:
    - A valid SCM configuration
    - The maven-release-plugin

```
<scm>
  <connection>scm:git:git://github.com/wakaleo/babble.git</connection>
  <developerConnection>scm:git:git://github.com/wakaleo/babble.git
  </developerConnection>
</scm>
```

```
<plugin>
  <groupId>org.apache.maven.plugins</groupId>
  <artifactId>maven-release-plugin</artifactId>
  <configuration>
    <preparationGoals>clean verify install</preparationGoals>
  </configuration>
</plugin>
```

Need this for multi-module projects

The Maven Release Cycle

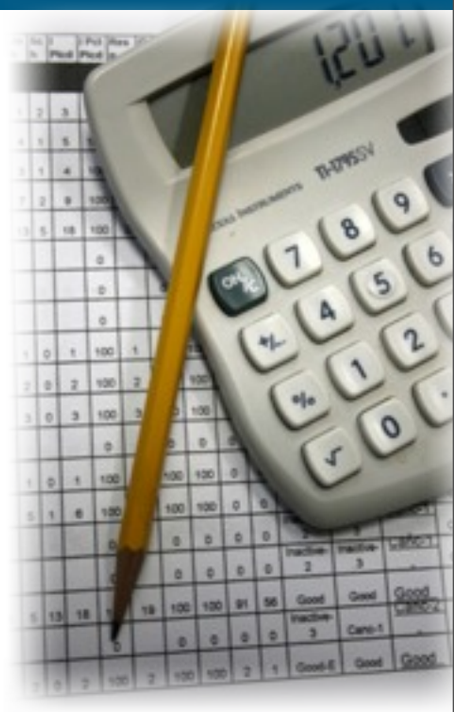


- Using the Maven Release Plugin

```
$ mvn release:prepare
```

  - Audits your code...
    - Check that there is no uncommitted code
    - Check that there are no snapshot dependencies
    - Prompts for release tag, branch and new version numbers

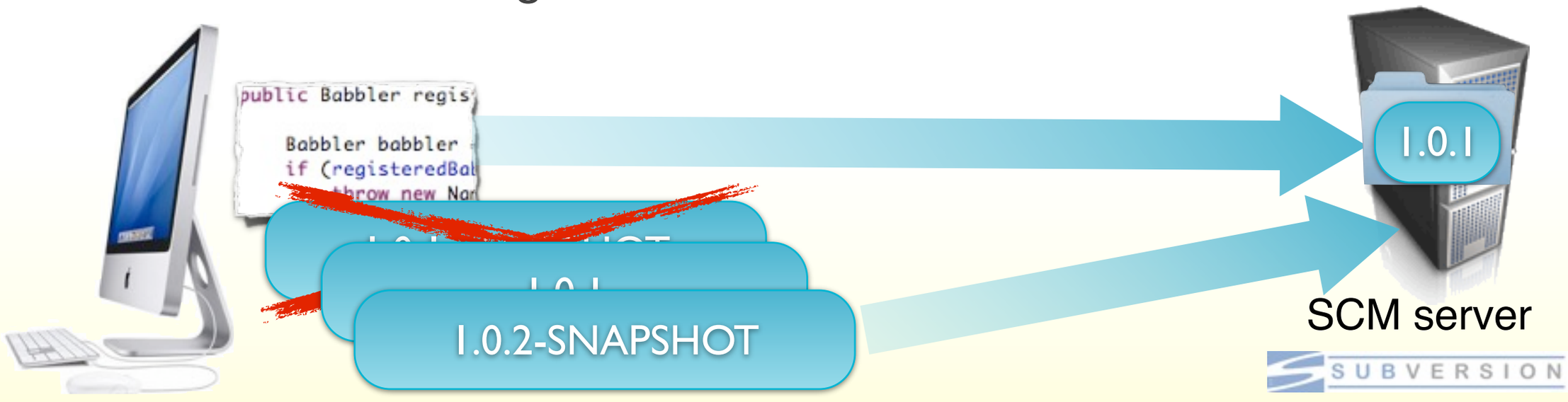
The Maven Release Cycle



- Using the Maven Release Plugin

```
$ mvn release:prepare
```

  - ...then does the bookkeeping
    - Updates version numbers to release versions
    - Creates a new release tag in SCM
    - Updates version numbers to next SNAPSHOT versions
    - Commit these changes to SCM



The Maven Release Cycle

- The Maven Release Plugin - interactive or automated?

```
$ mvn release:prepare
```

  - By default, Maven will prompt you for:
    - ☑ Release version number
    - ☑ Release tag
    - ☑ Next snapshot version number

- This is not appropriate for automated builds

```
$ mvn release:prepare -B
```

No questions asked

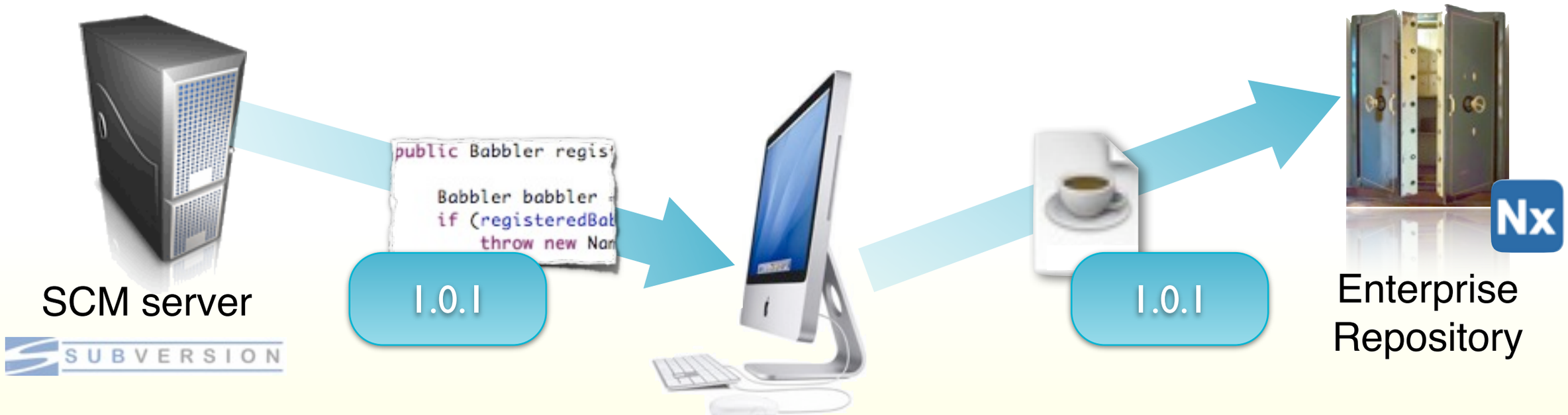
  - Use batch mode to use sensible default values

The Maven Release Cycle

- Using the Maven Release Plugin

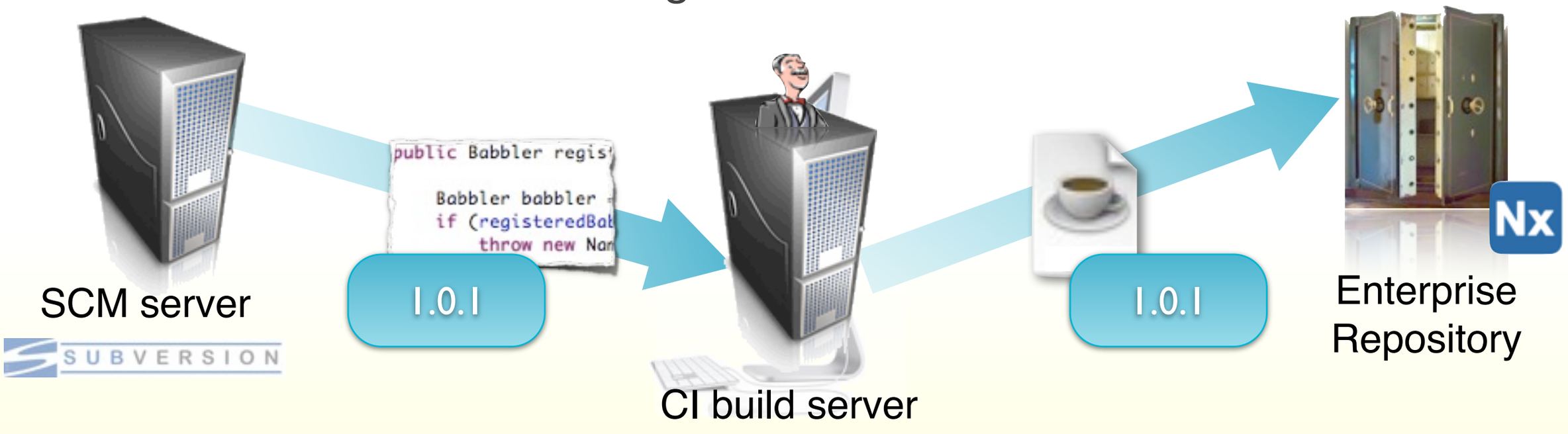
```
$ mvn release:perform
```

  - Do the real work
    - ☑ Checkout a release version
    - ☑ Build, test and deploy to the Enterprise repository



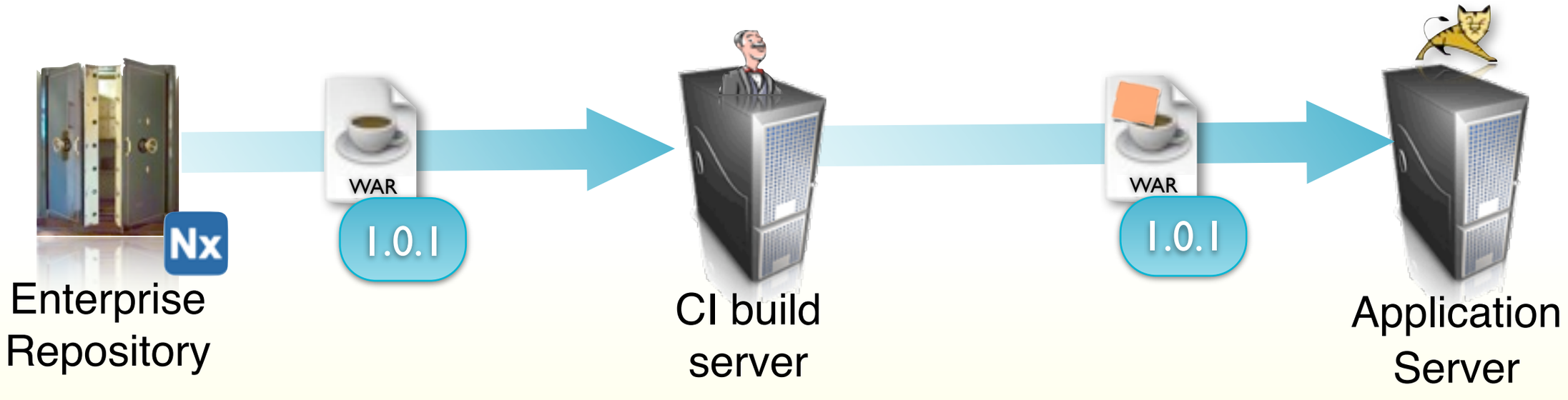
The Maven Release Cycle

- Automating the Maven Release Plugin
  - Don't use the maven-release-plugin on your own machine
  - Run it on a build server instead
    - ☑ Accessible to all
    - ☑ Reference environment
    - ☑ No risk of local code changes



Automated deployment

- Automating the deployment process
  - Don’t rebuild, reuse!
    - Download application binaries from the Enterprise repository
    - Externalize configuration as much as possible
    - Patch if necessary with target environment configuration
    - Deploy to target environment



Automated deployment

- Deployment strategies - direct reuse
  - Reuse from the repository without modification
  - Externalized environment-specific configuration
    - JNDI
    - Local environment-specific properties files
    - ...

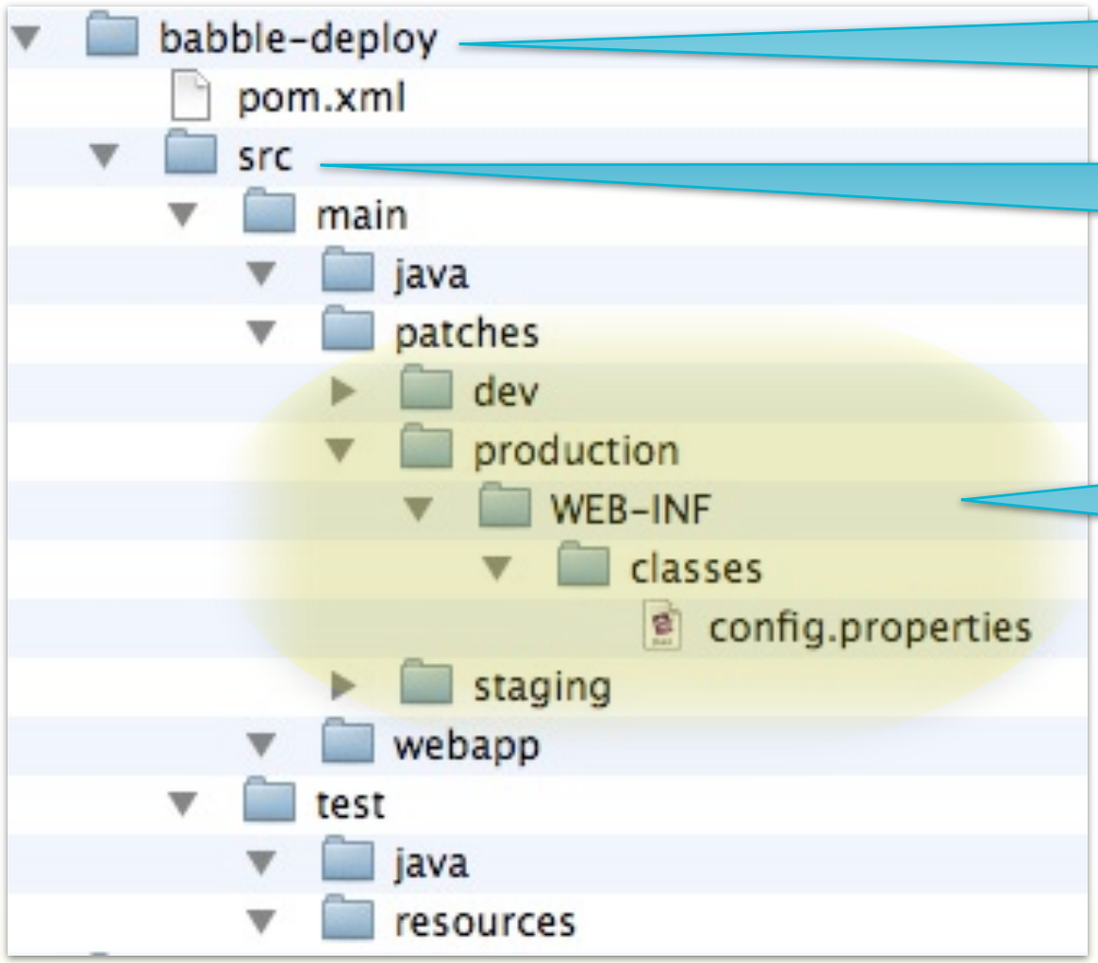
Automated deployment

- Deployment strategies - patching
  - Reuse binaries from the repository
  - Modify internal configuration files for the target environment
  - Can use overlays in Maven

NOTE: Use patching only if you can't deploy your binaries directly!

Automated deployment

- Patching - Deploying a web application in 5 easy steps!



Create a deployment project

Most of the directories are empty

These are the files that will patch the web application for different environments

Automated deployment

- Patching - Deploying a web application in 5 easy steps!

```
<dependency>
  <groupId>myorg.myapp</groupId>
  <artifactId>myapp-web</artifactId>
  <version>${webapp.version}</version>
  <type>war</type>
</dependency>
...
<properties>
  <webapp.version>${project.version}</webapp.version>
</properties>
```

Add a parameterized dependency to your WAR

Provide a sensible default target version

Automated deployment

- Patching - Deploying a web application in 5 easy steps!

```
<plugin>
  <artifactId>maven-war-plugin</artifactId>
  <configuration>
        <warName>myapp-web</warName>
    <overlays>
      <overlay>
        <groupId>myorg.myapp</groupId>
        <artifactId>myapp-web</artifactId>
        <excludes>
          <exclude>WEB-INF/classes/config.properties</exclude>
        </excludes>
      </overlay>
      ...
```

Incorporate the web application, but exclude the files to be patched

Automated deployment

- Patching - Deploying a web application in 5 easy steps!

```
<plugin>
  <artifactId>maven-war-plugin</artifactId>
  <configuration>
    ...
    <webResources>
      <resource>
        <directory>${patch.path}</directory>
      </resource>
    </webResources>
  </configuration>
</plugin>
...
```

Include patched files in the final bundle

Automated deployment

- Patching - Deploying a web application in 5 easy steps!

```
<profile>
  <id>dev</id>
  <properties>
    <patch.path>src/main/patches/dev</patch.path>
  </properties>
</profile>
```

The exact patch files is defined in profiles

```
<profile>
  <id>staging</id>
  <properties>
    <patch.path>src/main/patches/staging</patch.path>
    <webapp.version>${target.version}</webapp.version>
  </properties>
</profile>
```

For staging and production, you can also override the version being deployed

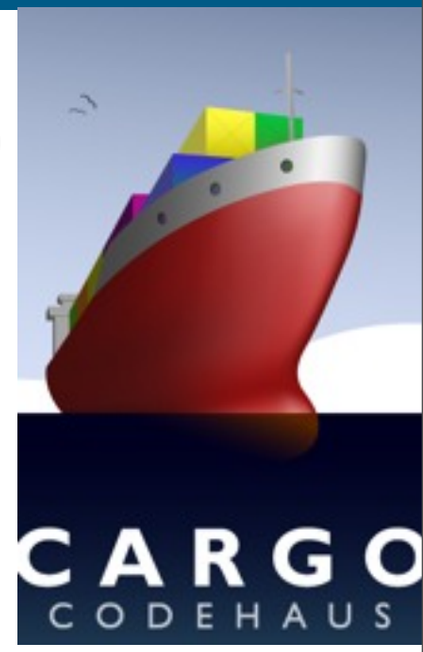
Provide the version to be deployed as a parameter

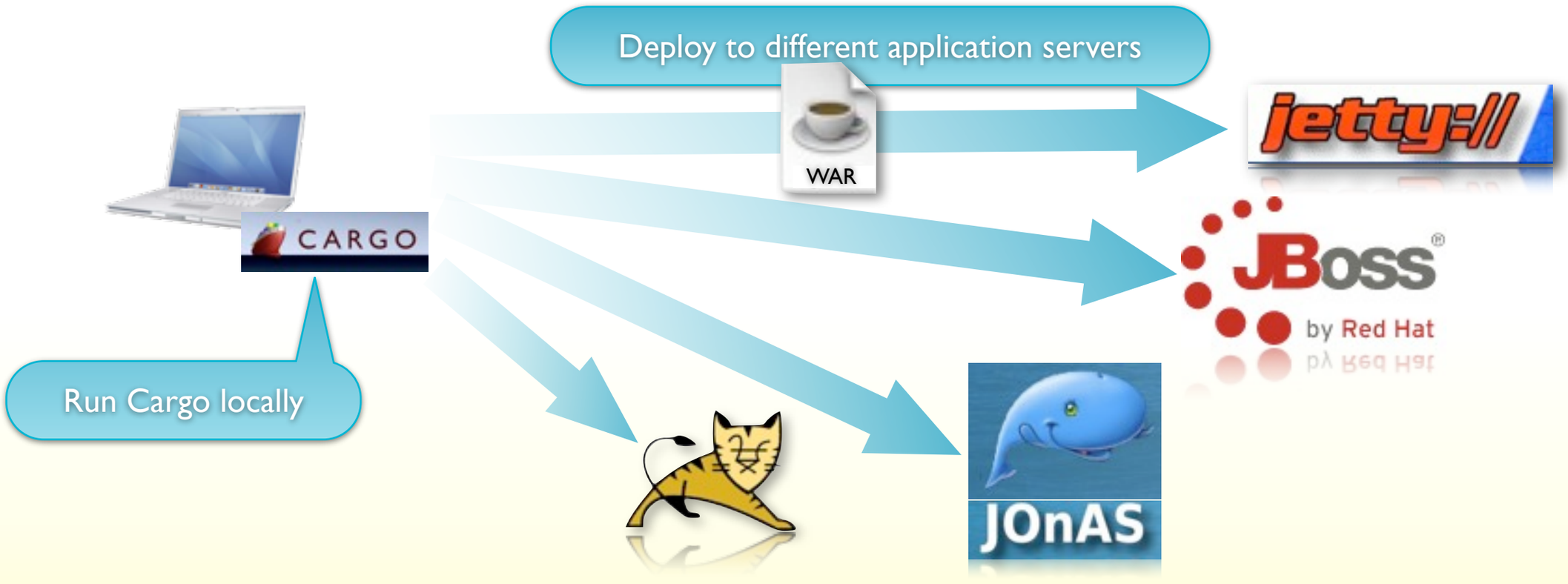
```
$ mvn package -Dtarget.version=1.0.5 -Pstaging
```

The profile indicates the target environment

Automated web deployment

- Automating the deployment process with Cargo
  - Start, stop and install application servers
  - Deploy to different application servers
  - Run a stand-alone instance
  - Or deploy to an existing server





Automated web deployment

- Deploying to an embedded Jetty instance

  - The simplest way to use Cargo with Maven

```
<project>
    <build>
        ...
        <plugins>
          <plugin>
            <groupId>org.codehaus.cargo</groupId>
            <artifactId>cargo-maven2-plugin</artifactId>
            <version>1.0</version>
          </plugin>
        </plugins>
    </build>
```

Use the Cargo Maven plugin

```
$ mvn cargo:start
...
[INFO] [cargo:start]
[INFO] No container defined, using a default [jetty6x, embedded] container
[INFO] [beddedLocalContainer] Jetty 6.x Embedded starting...
...
2009-07-21 16:47:36.470::INFO:  Started SelectChannelConnector @ 0.0.0.0:8080
[INFO] [beddedLocalContainer] Jetty 6.x Embedded started on port [8080]
[INFO] Press Ctrl-C to stop the container...
```

Start embedded Jetty instance

Jetty is now running

Automated web deployment

- Deploying to a “real” application server
  - Deploy to a locally installed instance
  - Download and install a server as required
  - Deploy to a running server
  - Start and stop a server
  - ...

Automated web deployment

Deploying to a local Tomcat server

```
<project>
  <build>
    ...
    <plugins>
      <plugin>
        <groupId>org.codehaus.cargo</groupId>
        <artifactId>cargo-maven2-plugin</artifactId>
        <version>1.0</version>
        <configuration>
          <container>
            <containerId>tomcat6x</containerId>
            <home>/usr/local/tomcat</home>
          </container>
          <configuration>
            <type>standalone</type>
            <home>target/tomcat6x</home>
          </configuration>
        </configuration>
      </plugin>
    </plugins>
  </build>
```

Use a locally-installed Tomcat installation

Tomcat home directory goes here

Automated web deployment

Deploying to a local Tomcat server

```
<project>
  <build>
    ...
    <plugins>
      <plugin>
        <groupId>org.codehaus.cargo</groupId>
        <artifactId>cargo-maven2-plugin</artifactId>
        <version>1.0</version>
        <configuration>
          <container>
            <containerId>tomcat6x</containerId>
            <zipUrlInstaller>
              <url>http://www.ibiblio.org/.../tomcat-6.0.20.zip</url>
              <installDir>${user.home}/tools/tomcat</installDir>
            </zipUrlInstaller>
          </container>
          <configuration>
            <type>standalone</type>
            <home>target/tomcat6x</home>
          </configuration>
        </configuration>
      </plugin>
    </plugins>
  </build>
```

Or download a copy of Tomcat...

...and install it here

Automated web deployment

Deploying to a remote server

```
<project>
  <build>
    ...
    <plugins>
      <plugin>
        <groupId>org.codehaus.cargo</groupId>
        <artifactId>cargo-maven2-plugin</artifactId>
        <version>1.0</version>
        <configuration>
          <container>
            <containerId>tomcat6x</containerId>
            <type>remote</type>
          </container>
          <configuration>
            <type>runtime</type>
            <properties>
              <cargo.remote.username>admin</cargo.remote.username>
              <cargo.remote.password></cargo.remote.password>
              <cargo.tomcat.manager.url>
              http://appserver.acme.com:8888/manager
              </cargo.tomcat.manager.url>
            </properties>
          </configuration>
        </configuration>
      </plugin>
    </plugins>
  </build>
```

Deploy to a remote server

Use these properties to connect to the server

Automated web deployment

Deploying a separate WAR file

```
<plugin>
  <groupId>org.codehaus.cargo</groupId>
  <artifactId>cargo-maven2-plugin</artifactId>
  <version>1.0</version>
  <configuration>
    <container>...</container>
    <configuration>...</configuration>
    <deployer>
     <deployables>
       <deployable>
         <artifactId>ebank-web</artifactId>
         <groupId>org.ebank</groupId>
         <type>war</type>
       </deployable>
     </deployables>
   </deployer>
  </configuration>
</plugin>
...
```

Deploy a WAR file defined in the dependency list

The exact version of the WAR is defined here

```
<dependencies>
  <dependency>
    <groupId>org.ebank</groupId>
    <artifactId>ebank-web</artifactId>
    <type>war</type>
    <version>${target.version}</version>
 </dependency>
</dependencies>

<properties>
  <target.version>${project.version}</target.version>
</properties>
```

Automated web deployment

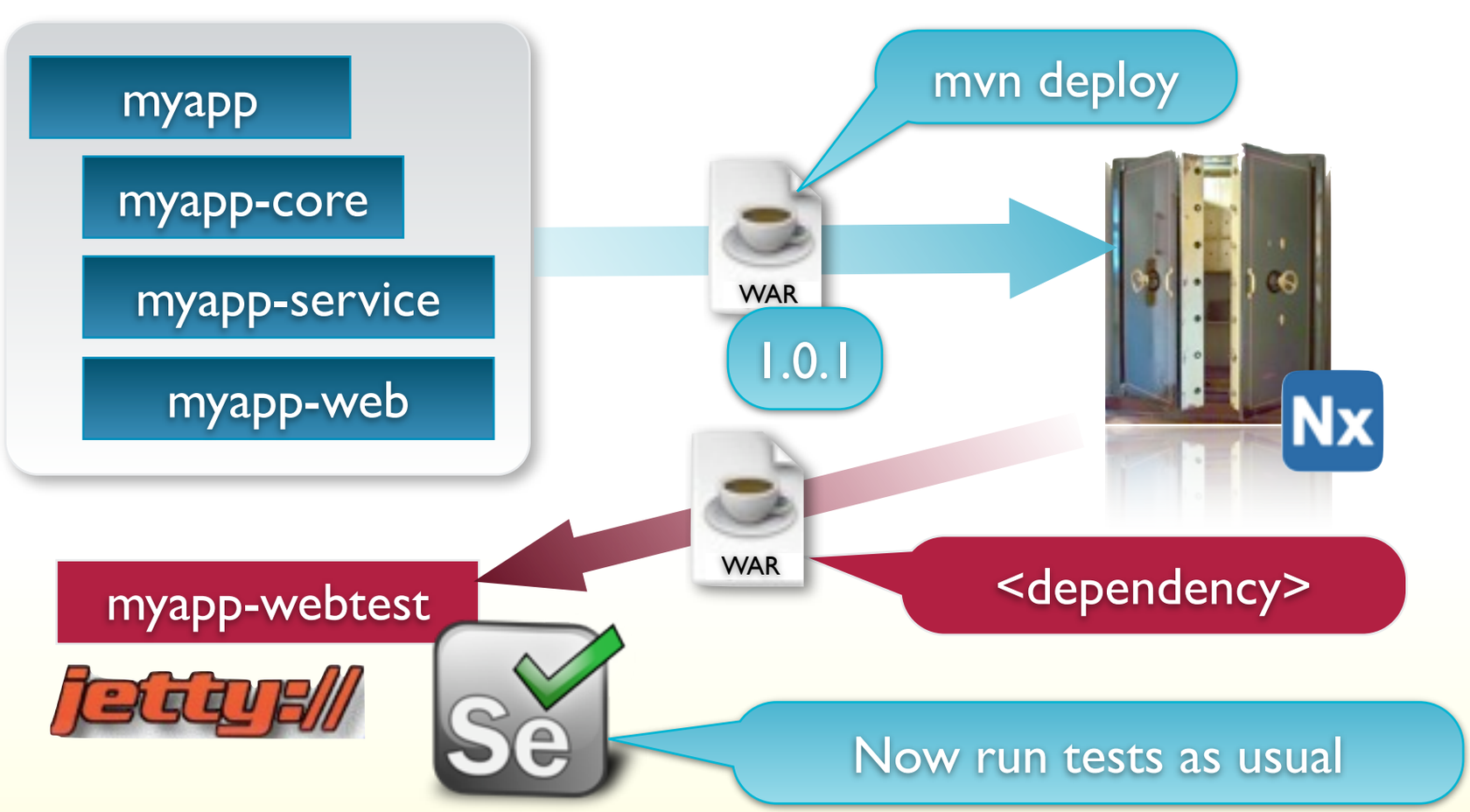
- Deploying a separate WAR file

Automated web testing

- Automated functional/web tests
  - Many tools available:
    - Selenium
    - HTMLUnit
    - JWebUnit
    - Canoo Webtest
    - ...
  - And many strategies:
    - Run tests before deployment
    - Run tests against the deployed application

Automated web testing

- Basic principle - don't rebuild, deploy!
  - Create a special Maven project to run your web tests



Automated web testing

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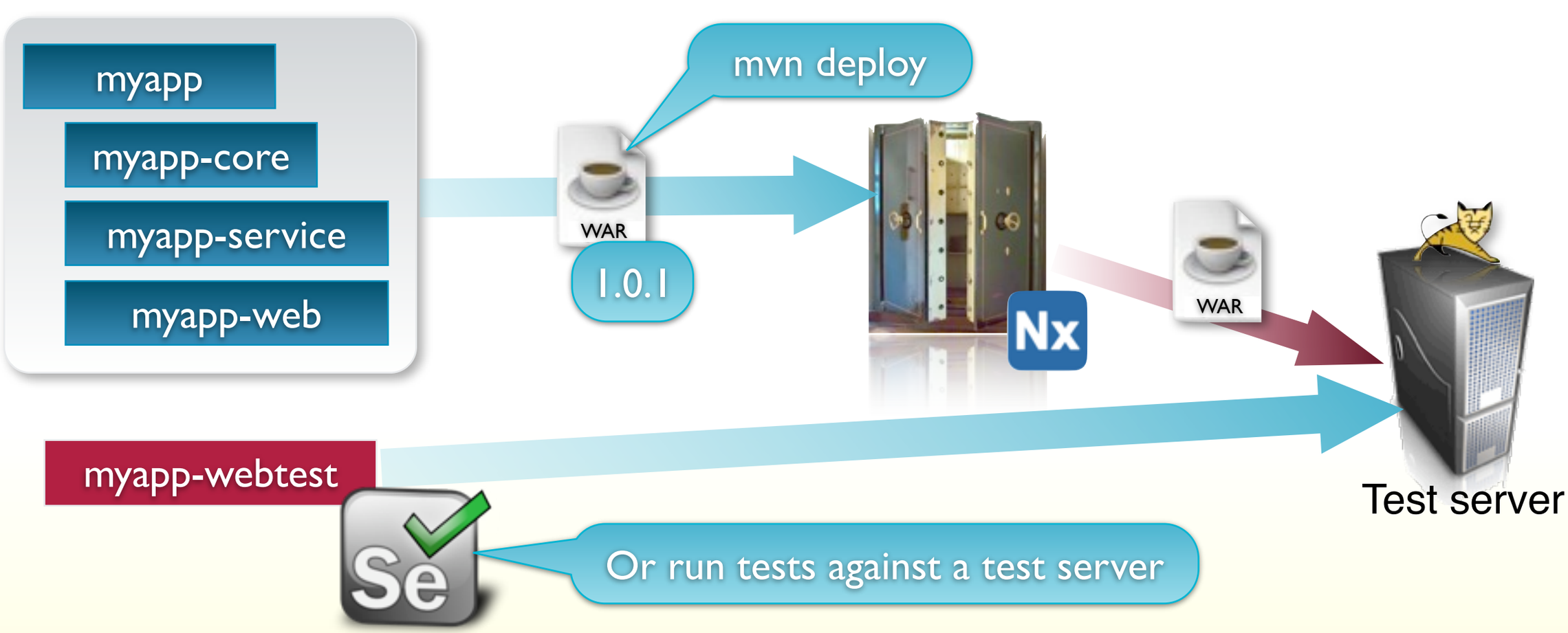
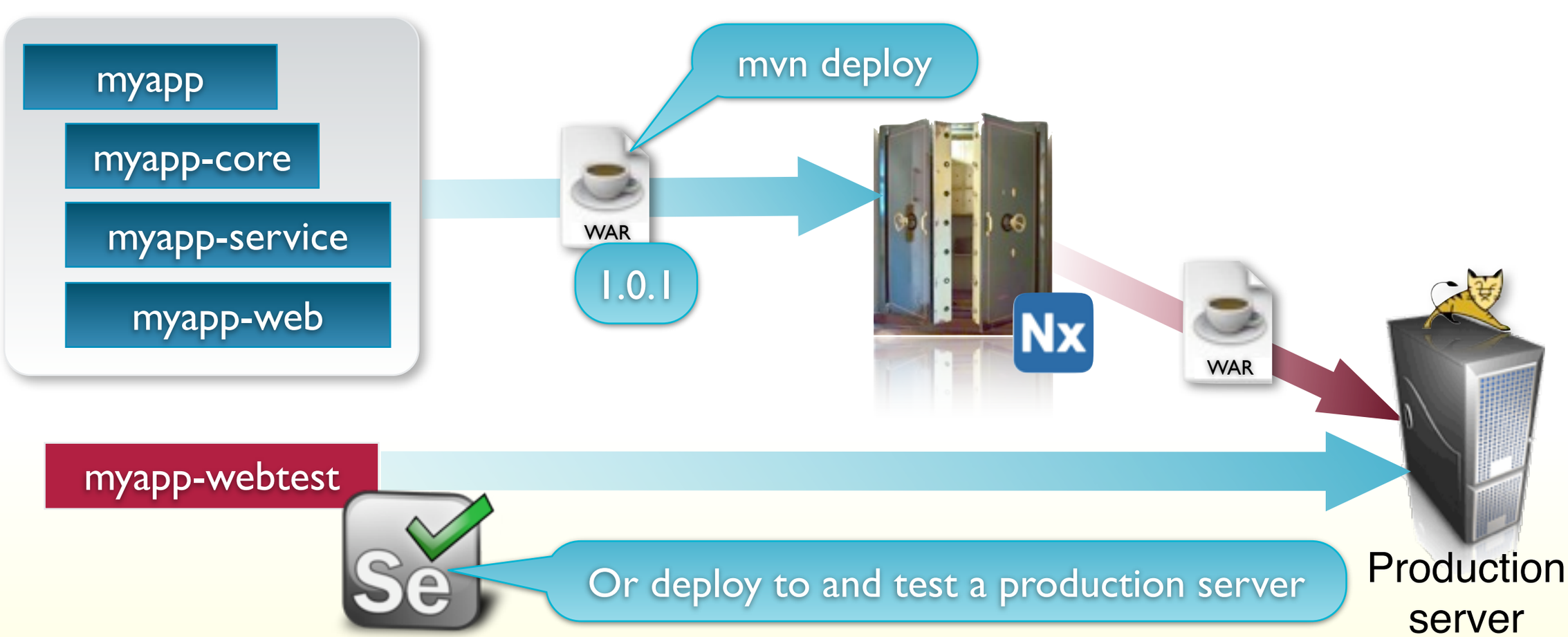


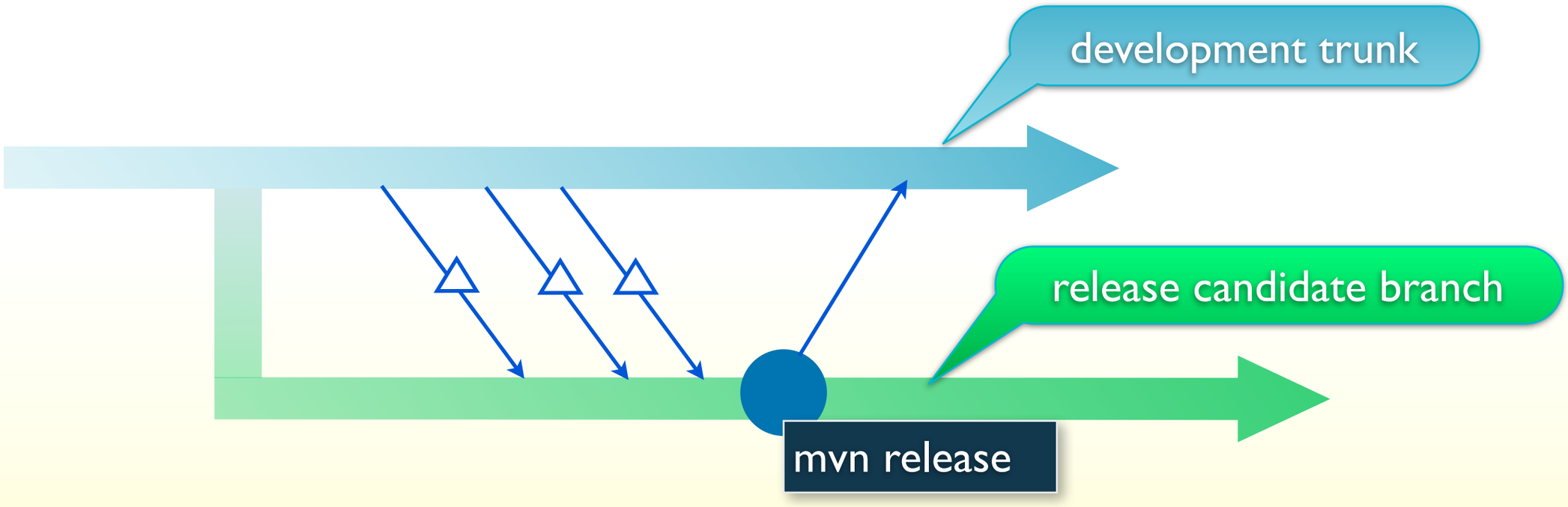
Automated web testing

- Basic principle - don't rebuild, deploy!
  - Create a special Maven project to run your web tests



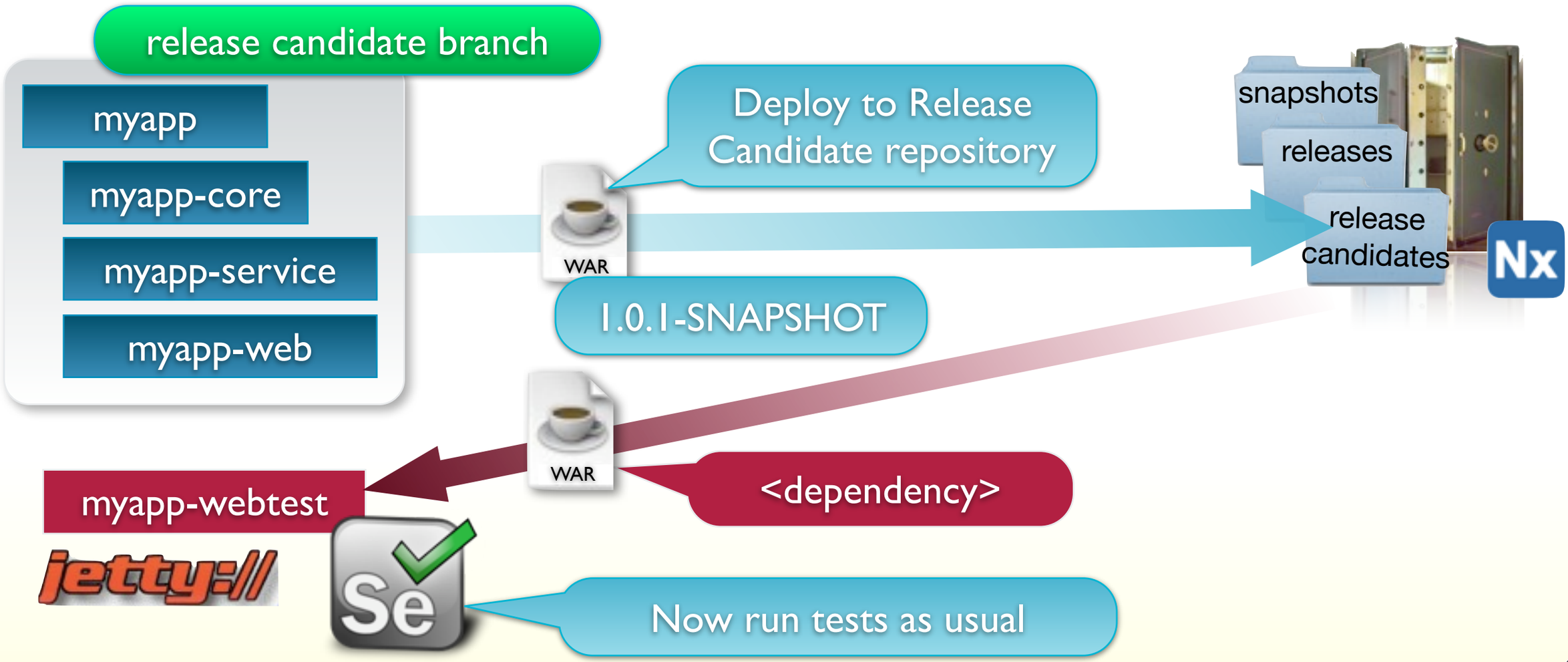
Automated web testing

- Testing Snapshots or Release Candidates - an approach
  - Use a dedicated release candidate branch
    - Changes are merged into the release candidate branches when ready
    - Automated tests are (also) run against the release candidate branch
    - Releases are run against the release candidate branch
    - Updated version numbers need to be merged back to the trunk



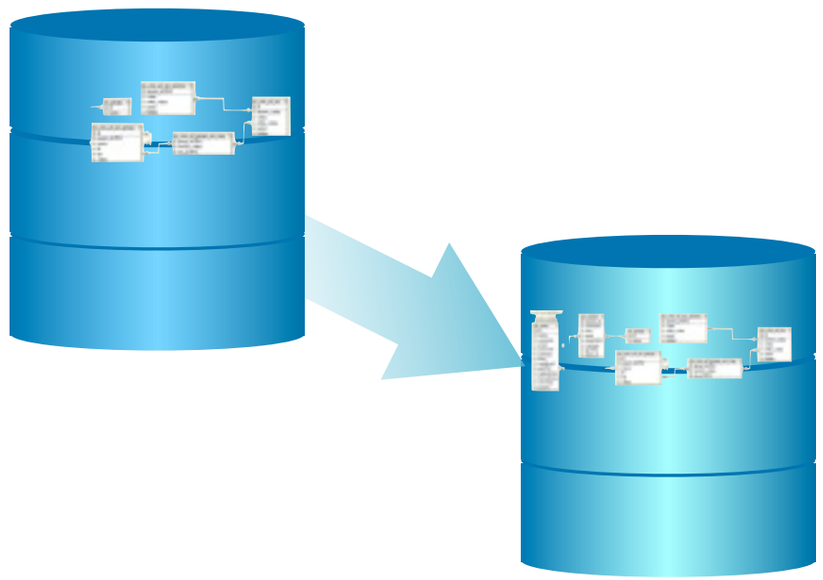
Automated web testing

- Testing Snapshots or Release Candidates - an approach
  - Use multiple repositories on your Enterprise server



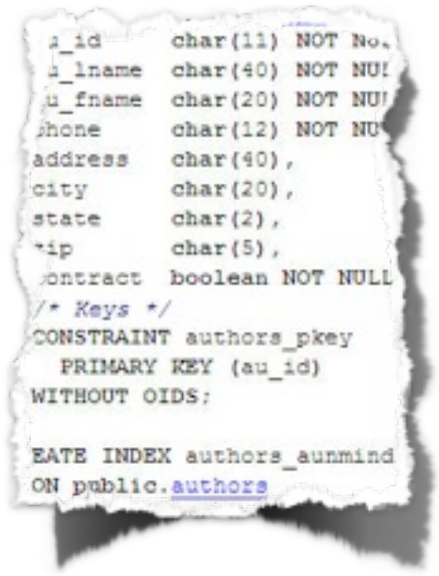
Deploying Database Updates

- But what about database updates?
  - Schema updates
  - Data updates
  - Data migration
  - Database backups and updates
  - Rollbacks



Deploying Database Updates

- Several approaches and tools exist, e.g.
  - Manual SQL scripts
  - Hibernate
  - Liquibase
  - ...



HIBERNATE

LIQUIBASE

Deploying Database Updates

- Liquibase - smart database updates

  - Open source tool for managing database changes
  - Database changes are stored in XML form in the SCM
  - Database neutral
  - Many powerful features
    - Roll back changes
    - Merge changes from several developers
    - Generate a SQL update script that a DBA can apply
    - ...

Deploying Database Updates

- Liquibase change sets
  - Database changes recorded manually in XML
  - More work, but allows more intelligent rollbacks

```
<databaseChangeLog
  xmlns="http://www.liquibase.org/xml/ns/dbchangelog/1.6"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.liquibase.org/xml/ns/dbchangelog/1.6
        http://www.liquibase.org/xml/ns/dbchangelog/dbchangelog-1.6

    <changeSet id="1" author="john">
        <createTable tableName="department">
            <column name="id" type="int">
                <constraints primaryKey="true" nullable="false"/>
            </column>
            <column name="name" type="varchar(50)">
                <constraints nullable="false"/>
            </column>
            <column name="active" type="boolean" defaultValue="1"/>
        </createTable>
    </changeSet>
</databaseChangeLog>
```

Each changeset is unique

Create a new table

Deploying Database Updates

- Liquibase change sets
  - Lots of types of changes are supported
    - DDL updates (add, modify or drop tables, columns or indexes...)

```
<databaseChangeLog...>
    <changeSet id="2" author="simon">
        <addColumn tableName="department">
            <column name="description" type="varchar(50)"/>
        </addColumn>
        <dropColumn tableName="department" columnName="telex" >
    </changeSet>
</databaseChangeLog>
```

Add a new column

Drop a column

Deploying Database Updates

- Liquibase change sets
  - Lots of types of changes are supported
    - DDL updates (add, modify or drop tables, columns or indexes...)
    - Insert data...

```
<databaseChangeLog...>
    <changeSet id="4" author="john">
        <insert tableName="country">
            <column name="id" valueNumeric="1"/>
            <column name="code" value="AL"/>
            <column name="name" value="Albania"/>
        </addColumn>
    </changeSet>
```

Insert a row of data

```
<databaseChangeLog...>
    <changeSet id="3" author="simon">
        <loadData tableName="countries" file="countries.csv">
            <column name="id" type="NUMERIC"/>
            <column name="code" type="STRING"/>
            <column name="name" type="STRING"/>
        </loadData>
    </changeSet>
</databaseChangeLog>
```

Upload data from a file

Deploying Database Updates

Integration with Maven

LIQUIBASE

```
<project>
  <build>
    <plugins>
      <plugin>
        <groupId>org.liquibase</groupId>
        <artifactId>liquibase-plugin</artifactId>
        <version>1.9.3.0</version>
        <configuration>
           <propertyFileWillOverride>true</propertyFileWillOverride>
           <propertyFile>src/main/resources/liquibase.properties</propertyFile>
        </configuration>
      </plugin>
    </plugins>
  </build>
  ...
</project>
```

Use the Maven Liquibase plugin

And a configuration file

```
changeLogFile = changelog.xml
driver = com.mysql.jdbc.Driver
url = jdbc:mysql://localhost/ebank
username = scott
password = tiger
verbose = true
dropFirst = false
```

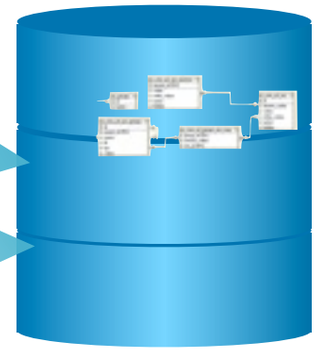
liquibase.properties

Deploying Database Updates

- Integration with Maven
  - Commands can be run directly or as part of the lifecycle, e.g.

```
$ mvn liquibase:update
```

Update any unimplemented changes

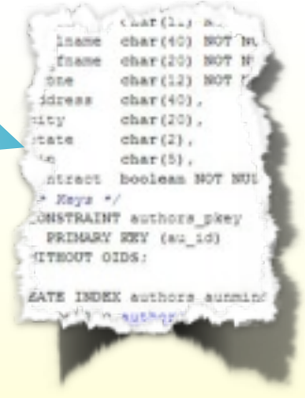


```
$ mvn liquibase:rollback -Dliquibase.rollbackCount=1
```

Rollback latest changes

```
mvn liquibase:updateSQL
```

Generate SQL update script



Scripting the deployment process

- Real-world deployments are complex
  - Deployments to application servers
  - Database backups and updates
  - Web service deployments
  - ...
- Some tasks need to be manual...
- ...but many don’t

Scripting the deployment process

- Deployment scripting - Groovy is your friend!
  - Close to Java
  - Concise and readable
  - Great for file manipulation

- How can you use Groovy?
  - Use a dedicated Maven project to fetch and/or prepare the artifact
  - Call the Groovy script from your Maven deployment project
  - Or wrap the Maven script in Groovy and add the more specific tasks

Scripting the deployment process

- Using Groovy Scripting in Maven

  - Just use the GMaven plugin
    - Embed Groovy script in your `pom.xml` file
    - Run an external Groovy script
    - Use elements of your `pom.xml` or `settings.xml` in your script

Scripting the deployment process

- Using Groovy Scripting in Maven
  - Just use the GMaven plugin


```
<build>
   <plugins>
    <plugin>
      <groupId>org.codehaus.groovy.maven</groupId>
      <artifactId>gmaven-plugin</artifactId>
      <version>1.0-rc-5</version>
      <configuration>
        <source>
        println "Hi there, I'm ${user.name}. My project is ${project.name}"
        </source>
      </configuration>
    </plugin>
  </plugins>
</build>
```

Run some Groovy code

You can use objects from your pom.xml file

Scripting the deployment process

Using Groovy Scripting in Maven

- Another example - invoking another Groovy script

```
<build>
   <plugins>
    <plugin>
      <groupId>org.codehaus.groovy.maven</groupId>
      <artifactId>gmaven-plugin</artifactId>
      <version>1.0-rc-5</version>
      <configuration>
        <source>
        def server = settings.servers.find{ it.id.equals('dbserver') }
        """groovy update-scripts.groovy -Ddb.username=${server.username}
           -Ddb.password=${server.password}""".execute()
        </source>
      </configuration>
    </plugin>
  </plugins>
</build>
```

```
<settings...>
  <servers>
    <server>
      <id>dbserver</id>
      <username>scott</username>
      <password>tiger</password>
    </server>
  </servers>
  ...
</settings>
```

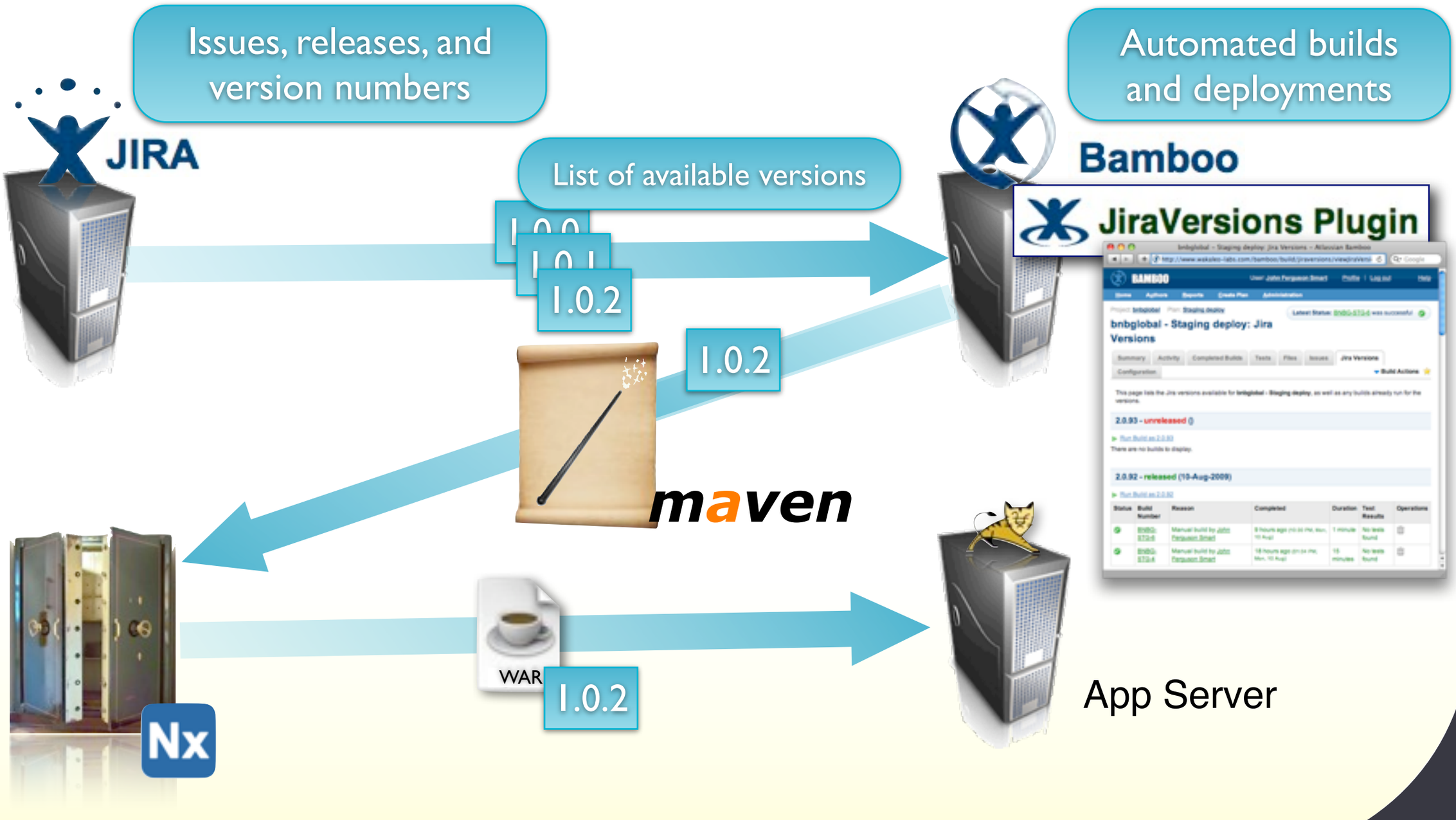
settings.xml

Fetch username and password details from the settings.xml file

Invoke an external Groovy script and provide the username and password as parameters

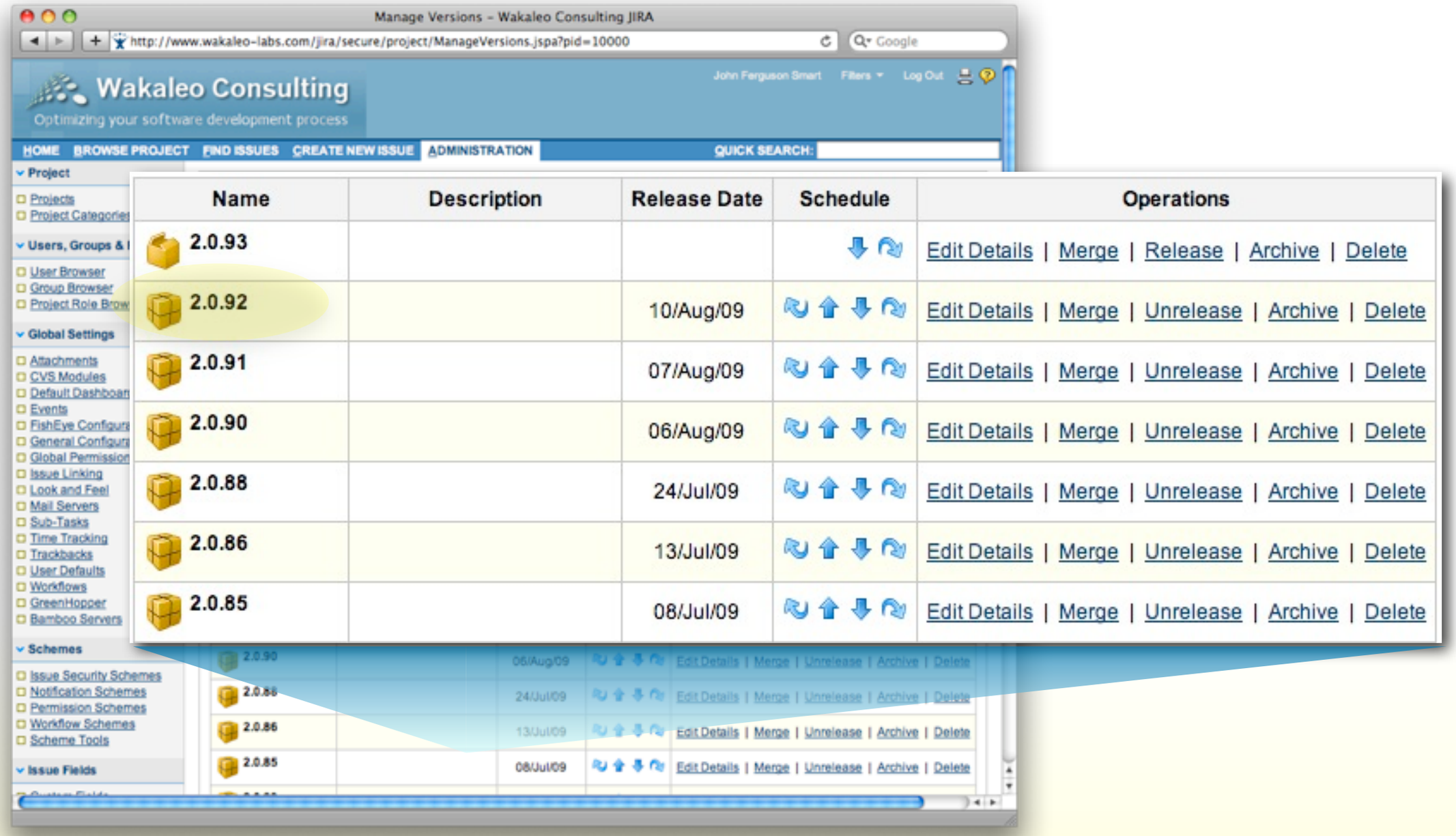
An example: JIRA and Bamboo

- Automating the release process with JIRA and Bamboo



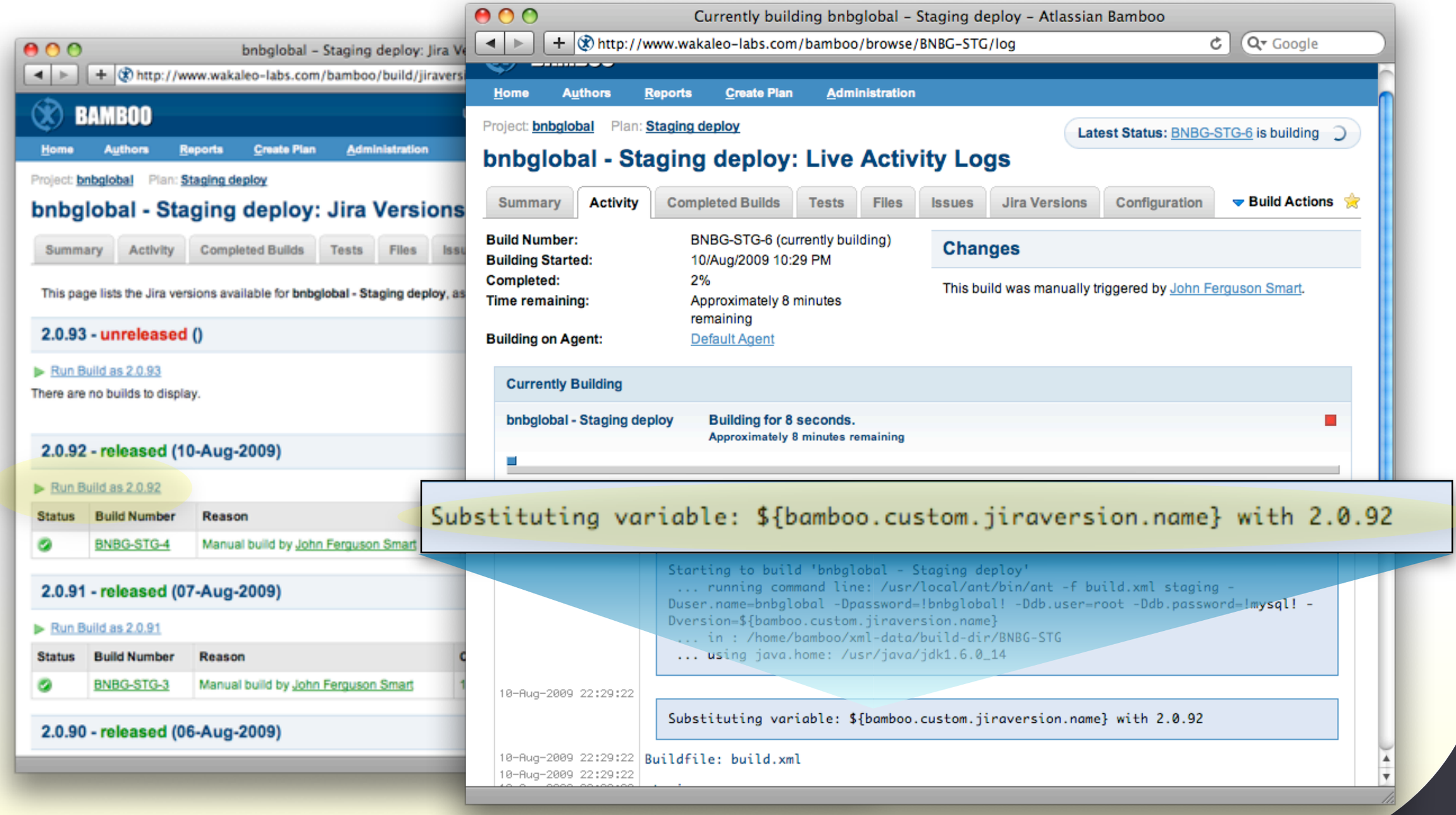
Example: JIRA and Bamboo

- Automating the release process with JIRA and Bamboo



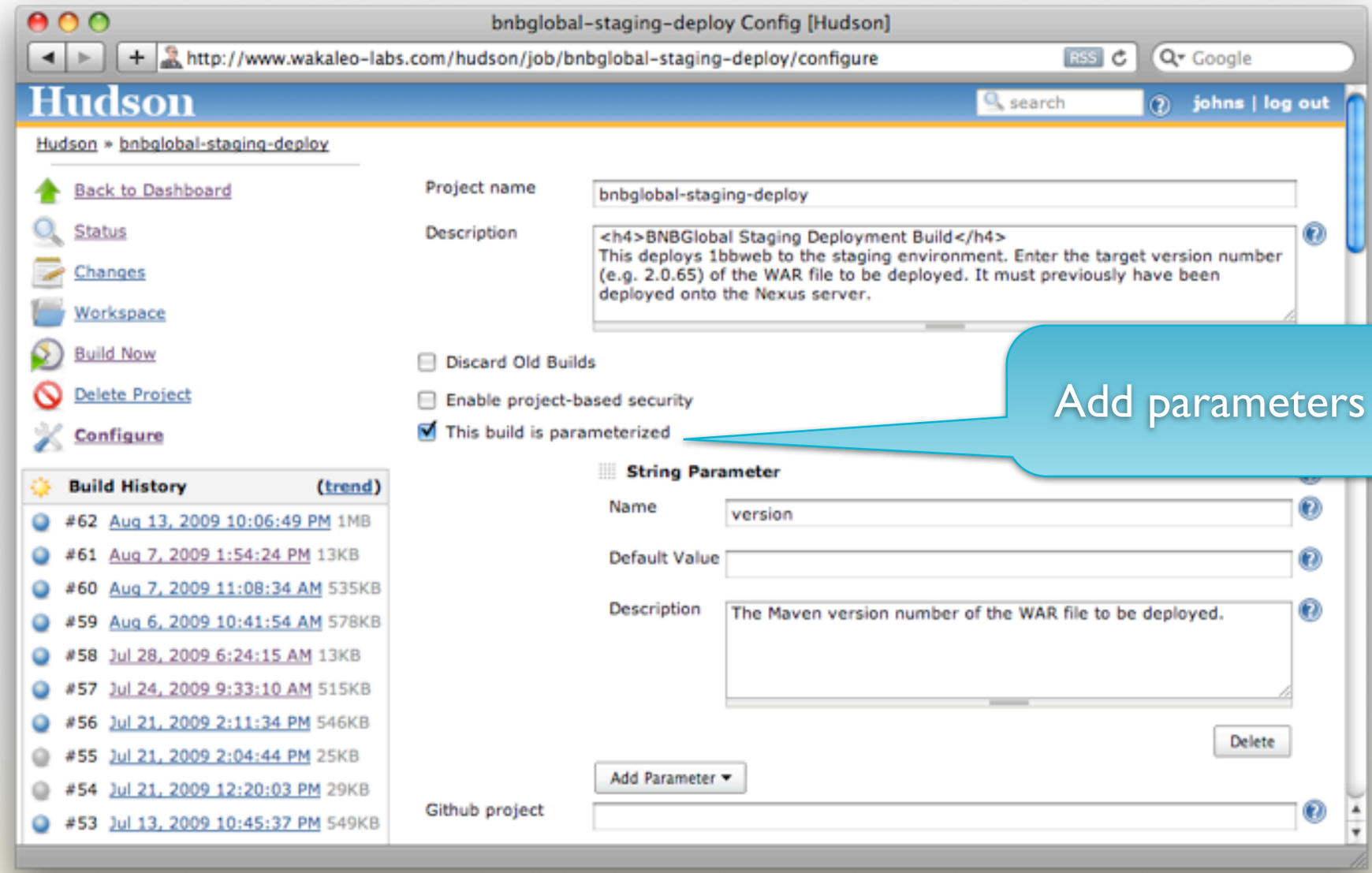
Example: JIRA and Bamboo

- Automating the release process with JIRA and Bamboo



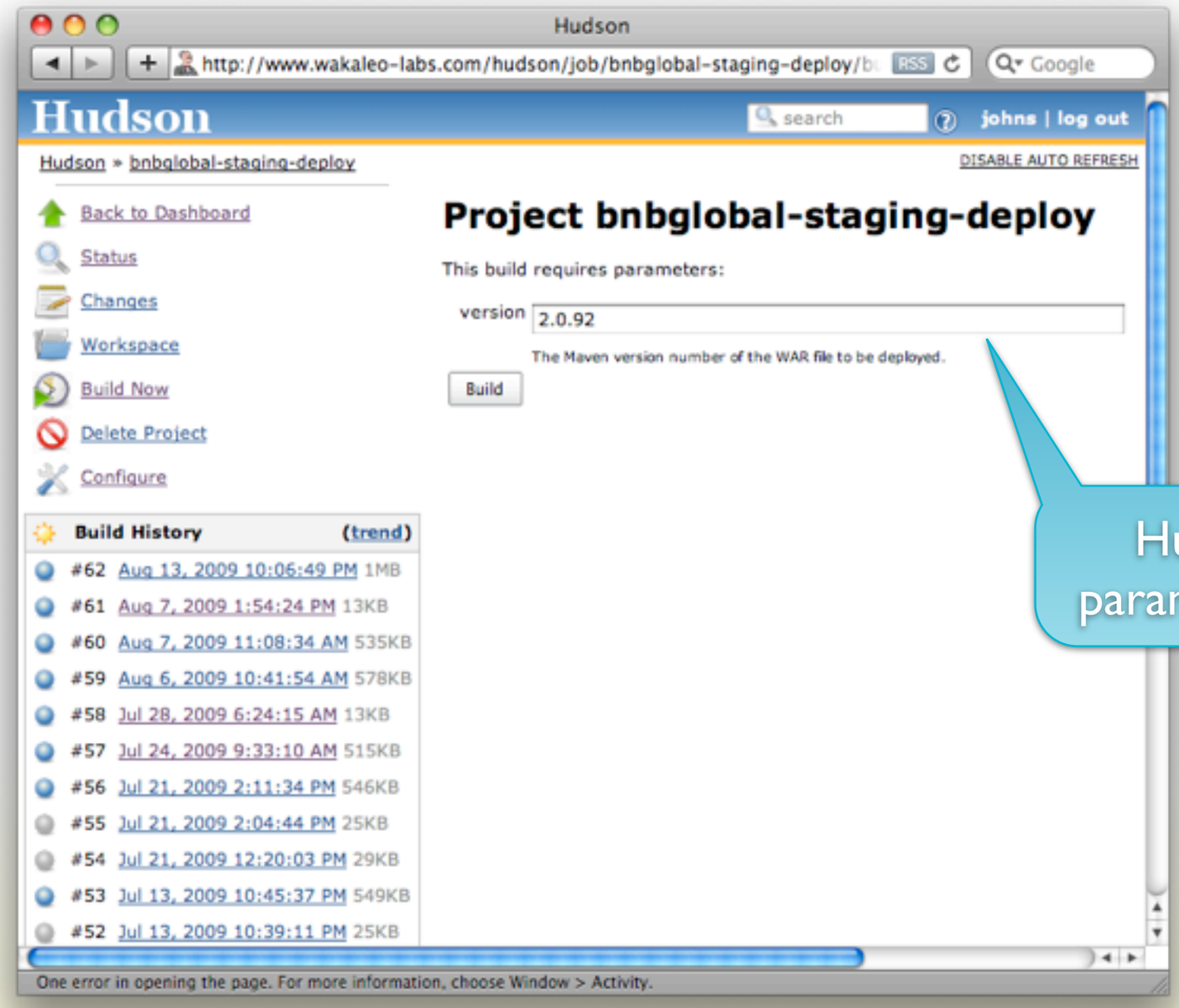
And in Hudson?

- Use the “parameterized build” plugin



And in Hudson?

- Use the “parameterized build” plugin



Hudson prompts you for the parameter when you run the build

In conclusion

- What have we covered?
  - Using the Maven Release Cycle
  - Nexus as a cornerstone of the deployment process
  - Cargo to automate your application deployment
  - Liquibase to manage your database updates
  - Using Groovy in your Maven builds

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Thanks for your attention