JavaOne℠

OSGi on the Web: Here's How

Don Brown

Atlassian


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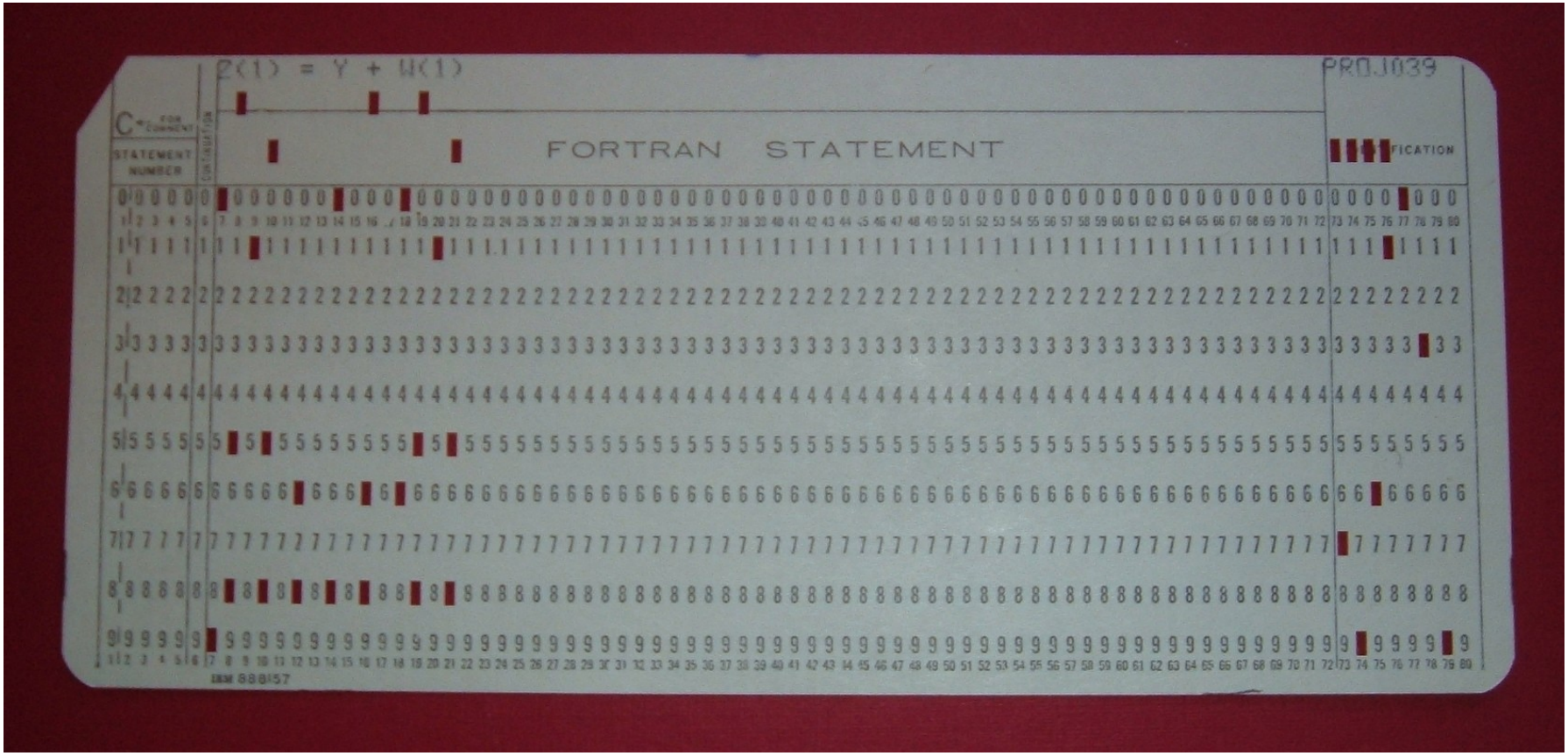
TIMEX sinclair 1000
TIMEX® Module 16K RAM Module
TIMEX sinclair 1016
TIMEX User Manual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PROJ039
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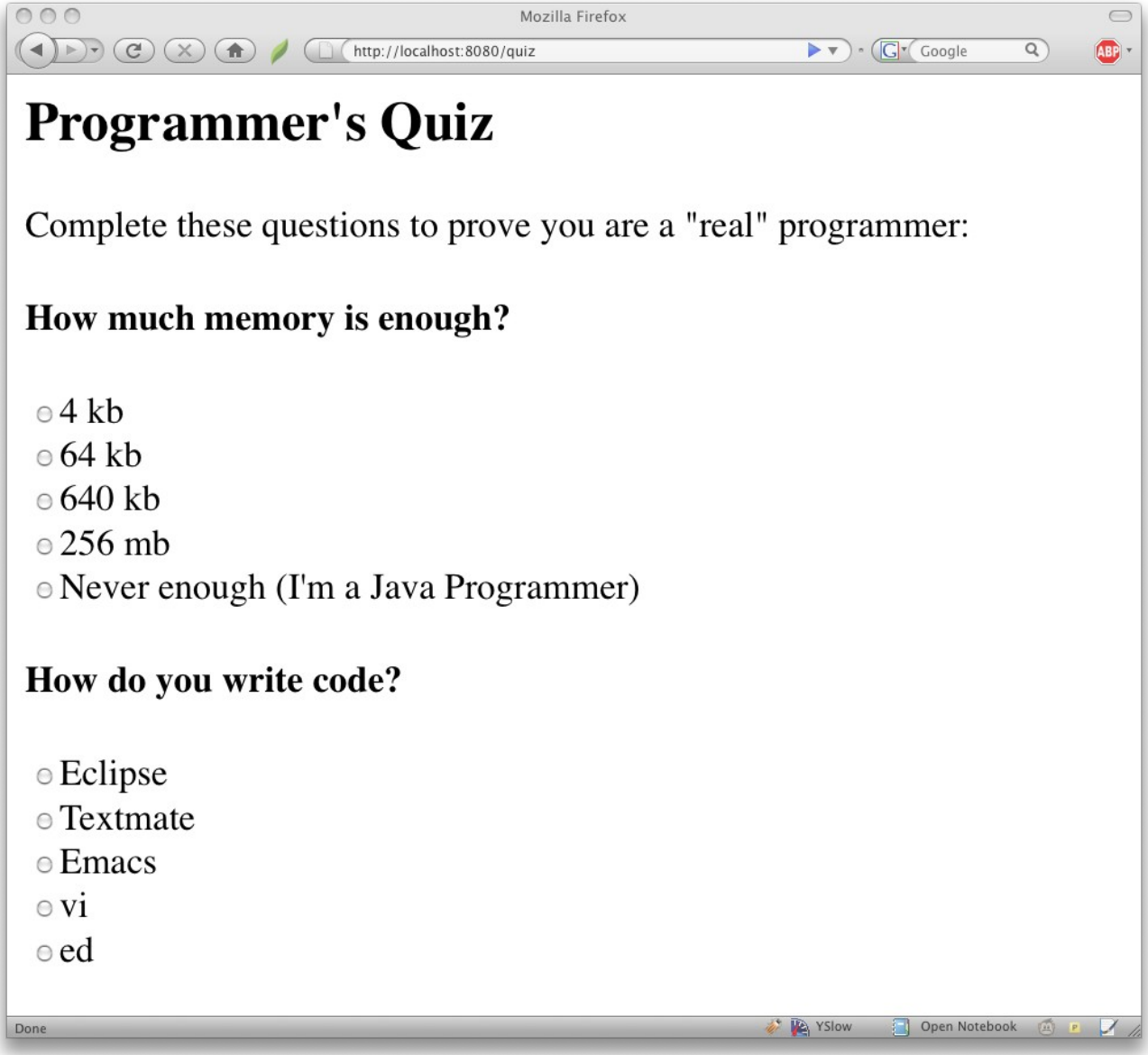
Mozilla Firefox
http://localhost:8080/quiz
Google
Programmer's Quiz
Complete these questions to prove you are a "real" programmer:
How much memory is enough?
4 kb
64 kb
640 kb
256 mb
Never enough (I'm a Java Programmer)
How do you write code?
Eclipse
Textmate
Emacs
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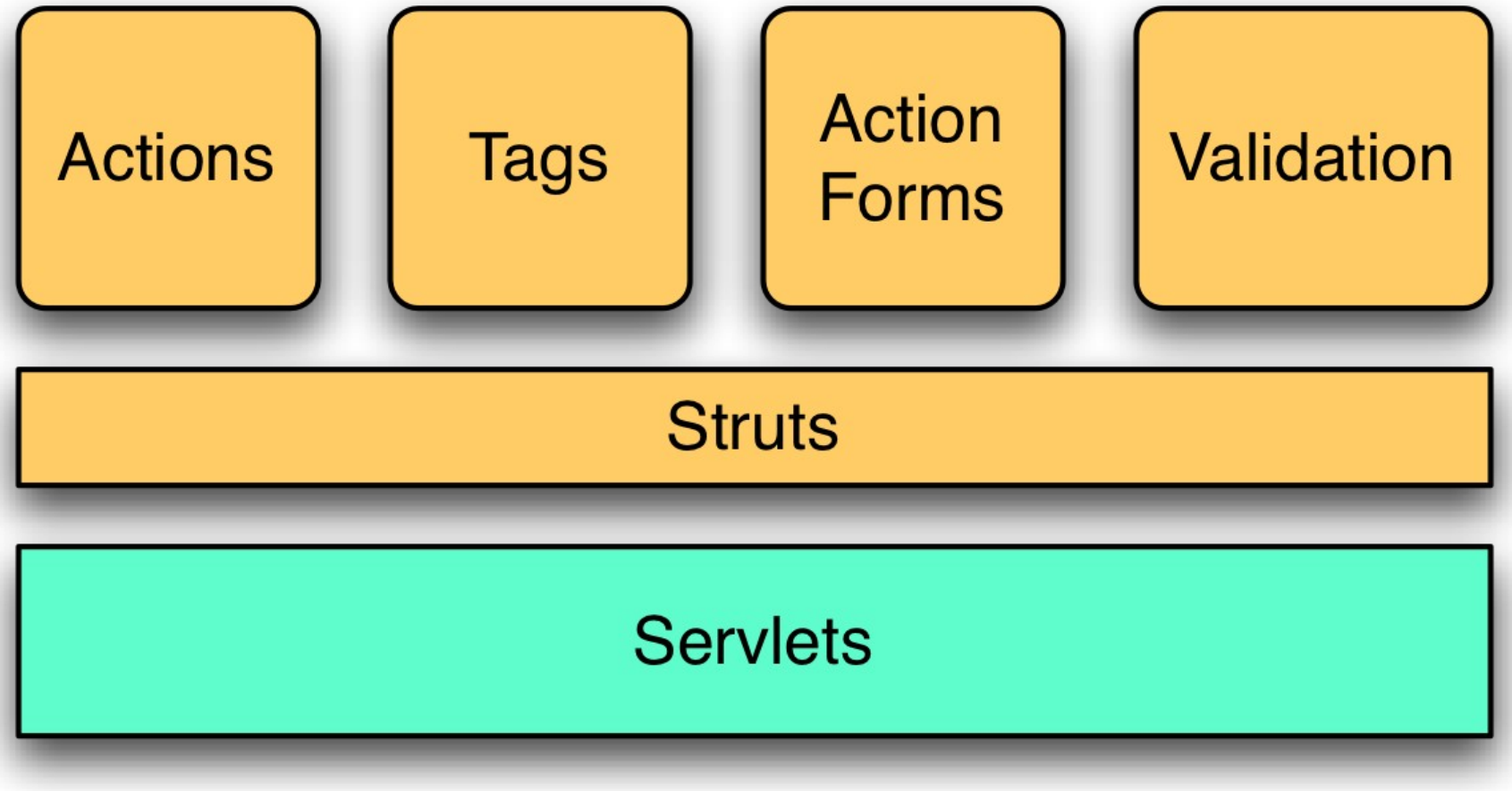
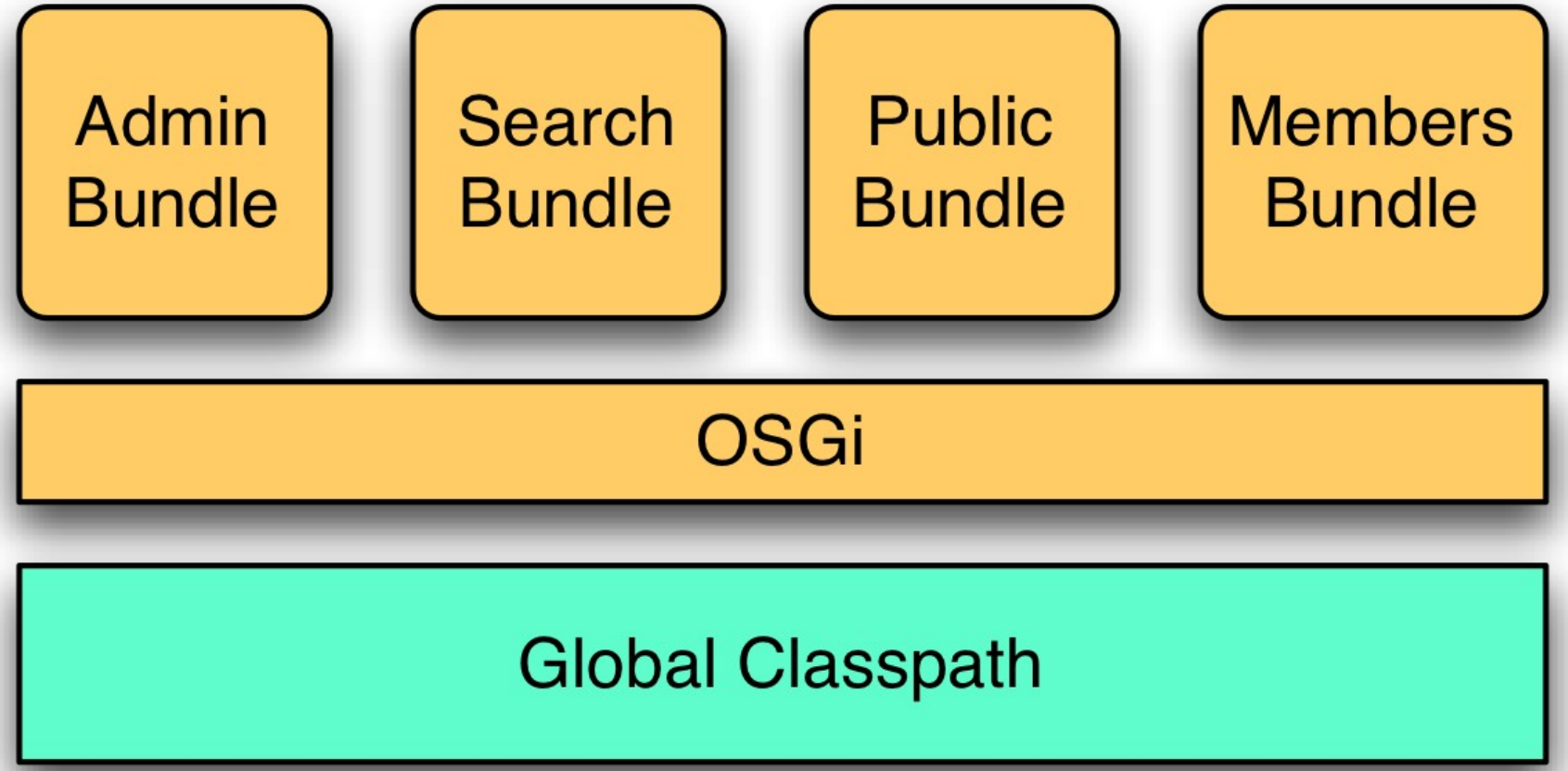
Open Notebook

Raising the abstraction with Struts



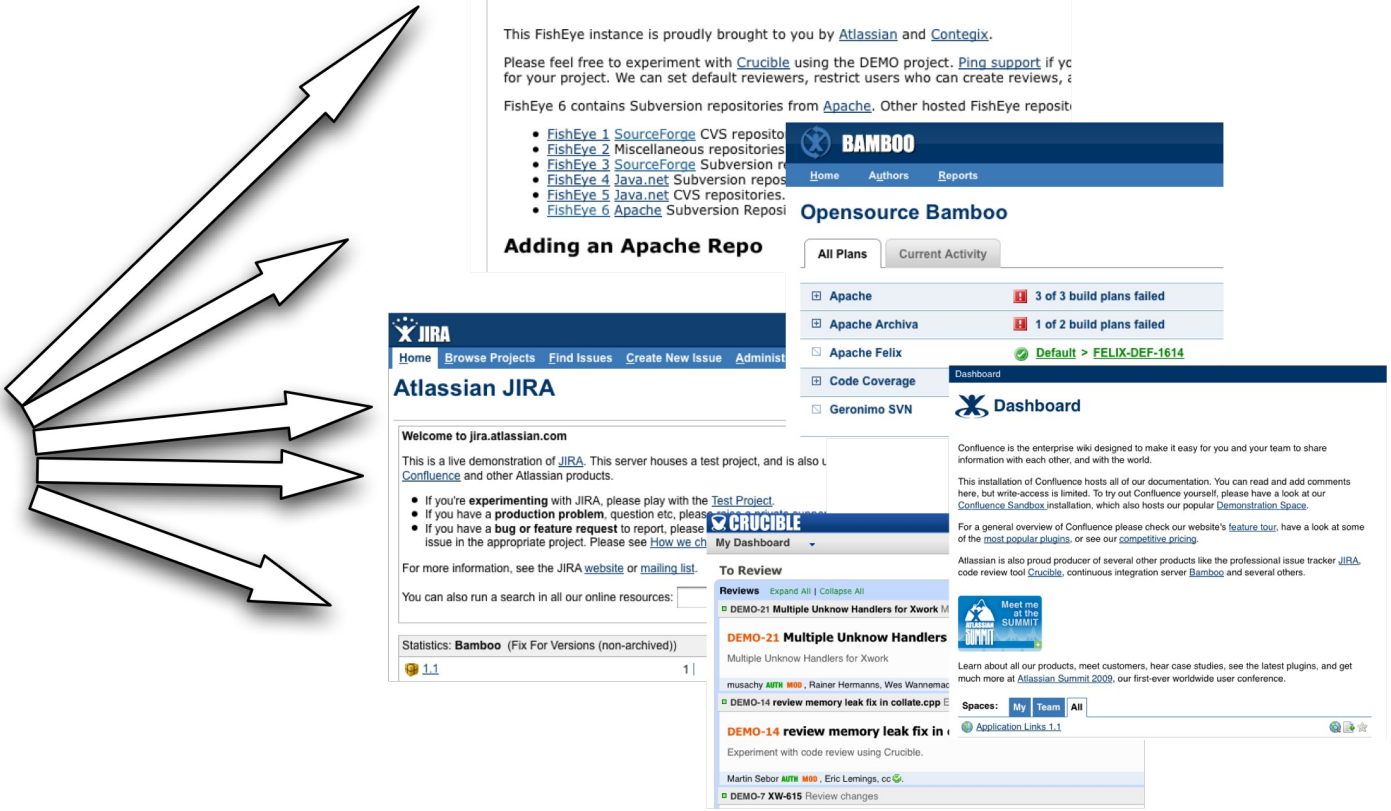
Raising the abstraction with OSGi



Why we needed OSGi

One feature * five products =

Dashboard



Multiple teams across the globe

Gdańsk, Poland

San Francisco, USA

Kuala Lumpur, Malaysia

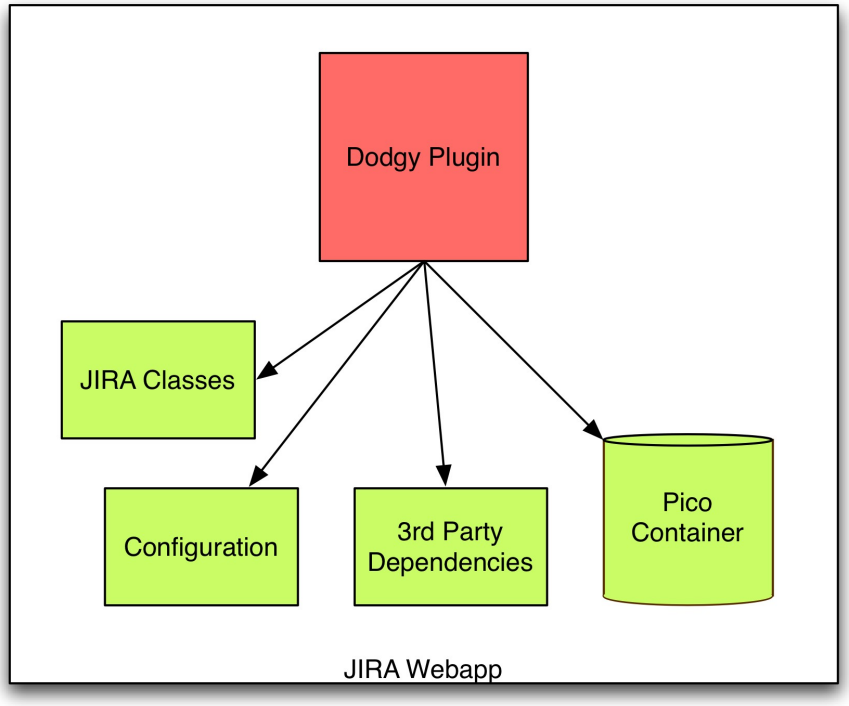
Sydney, Australia

Plugin development slow

- Write plugin code
- Build plugin
- Copy plugin to WEB-INF/lib
- Start app
- Discover bug
- Wash, rinse, repeat

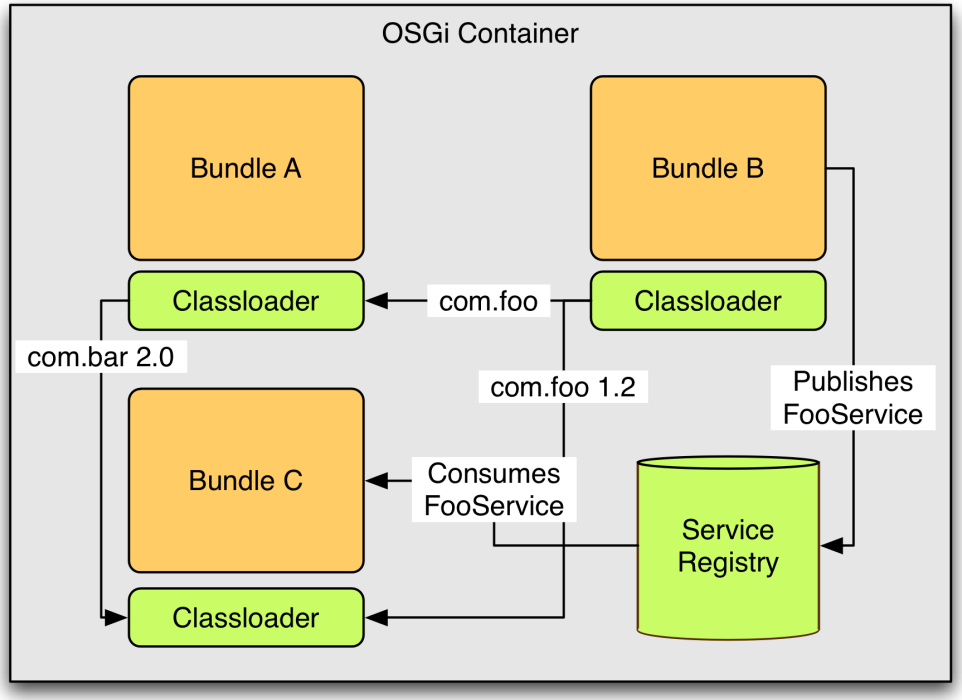
Plugins break on product upgrade

- Plugins have unrestricted access to application classes, objects, and configuration
- Broken plugins after a product upgrade make us look bad



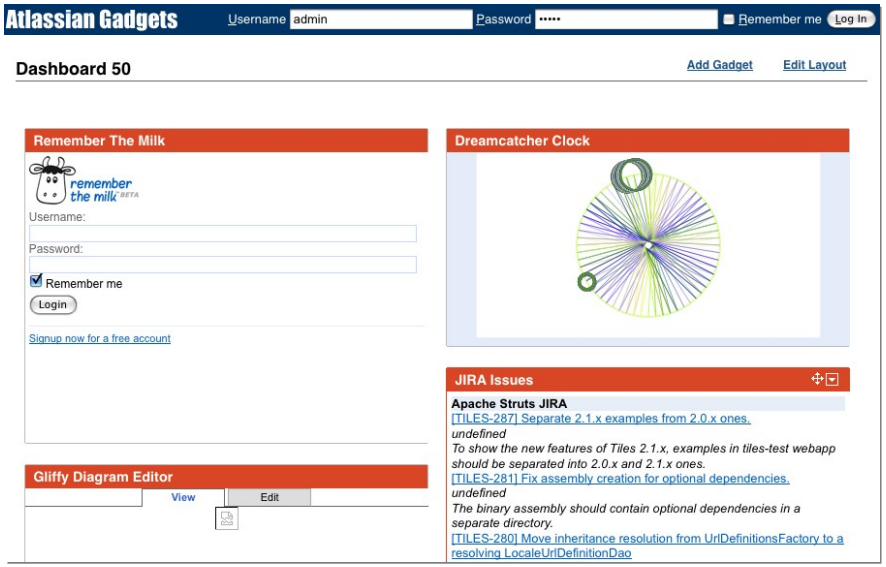
OSGi in one slide

- Bundles contain code, configuration, manifest metadata
- Runtime dependencies at Java package, service, and bundle levels
- Supports multiple versions of code
- Can share dynamic service objects
- Lifecycle: install, resolve, active, uninstall



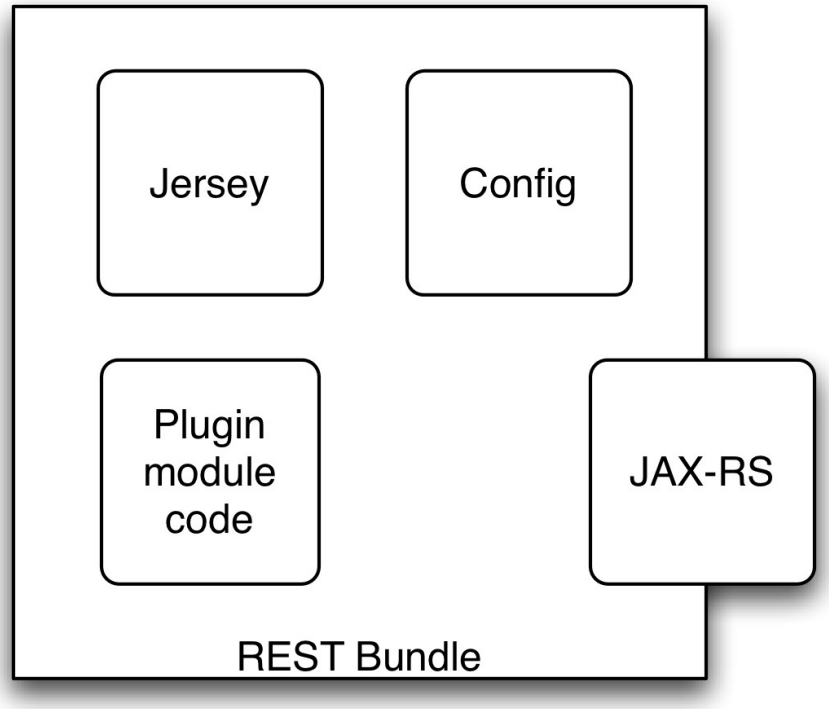
Features written once

- Example: OpenSocial-based dashboard as an OSGi plugin
- Written and owned by San Francisco team
- Contains UI, Shindig, internal services, SPI, and API



Each team can “own” a bundle

- Only JAX-RS exposed
- Complete freedom to switch to another JAX-RS implementation
- Can run multiple versions of the bundle side-by-side

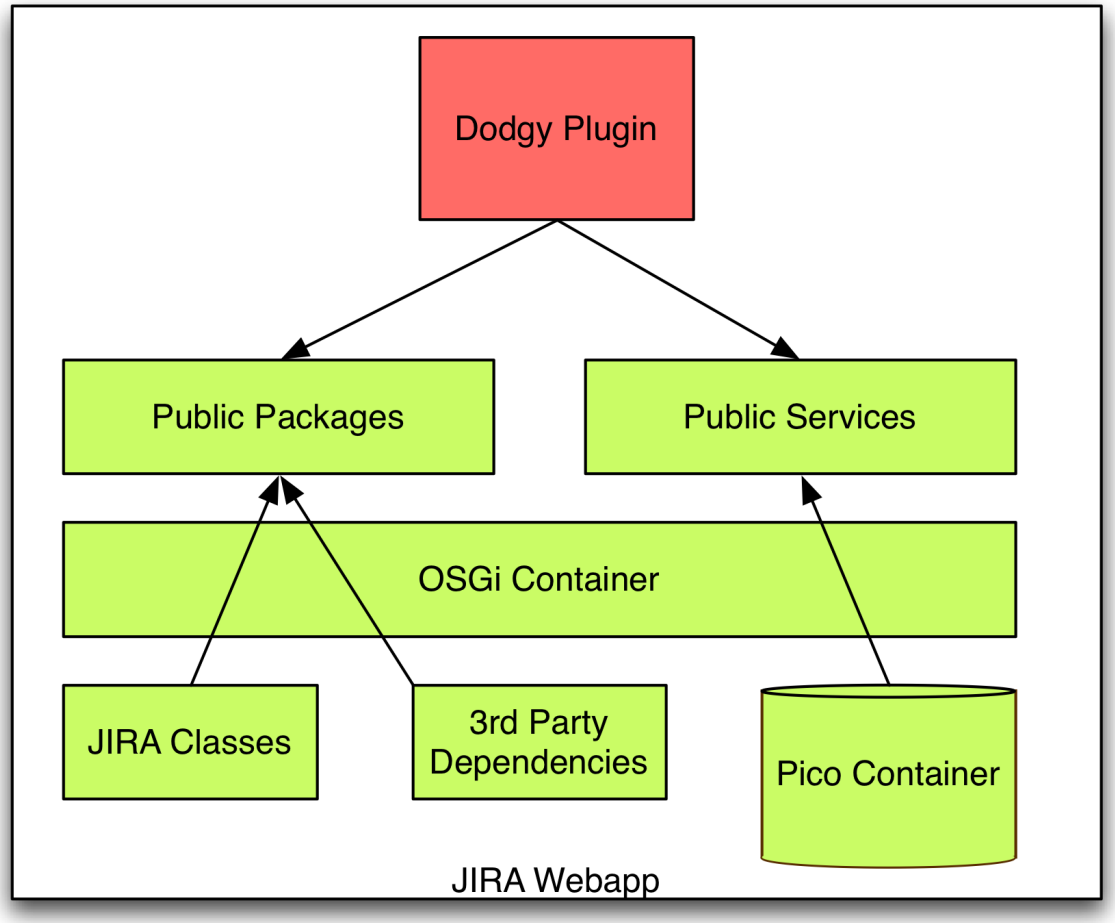


Dynamic deployment = faster dev cycle

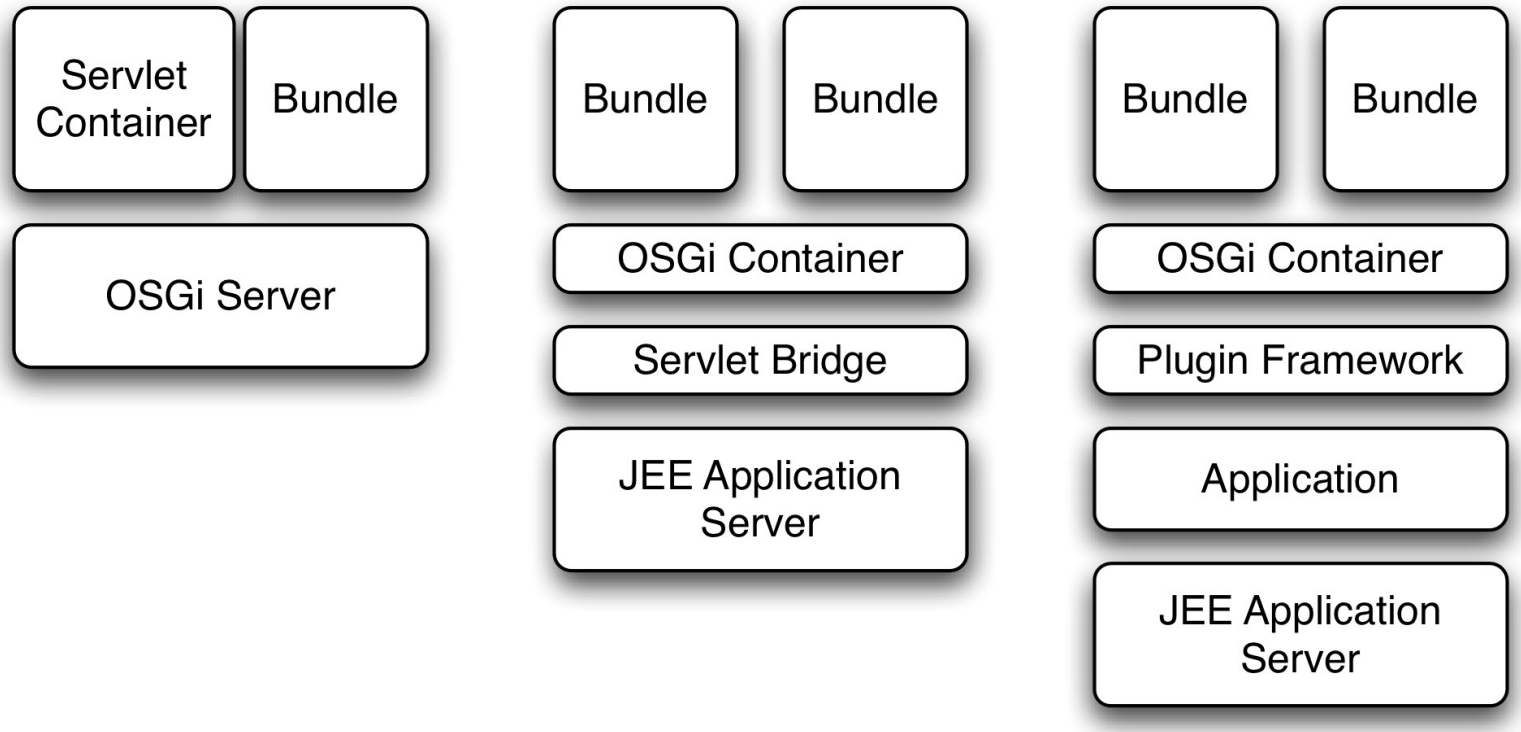
- Without OSGi
  1. Code
  2. Compile
  3. Copy to WEB-INF/lib
  4. Restart application
  5. Test in browser
- With OSGi
  1. Code
  2. Build and push to running web application
  3. Test in browser

. . . from code to browser in one or two seconds

Sandboxed plugins



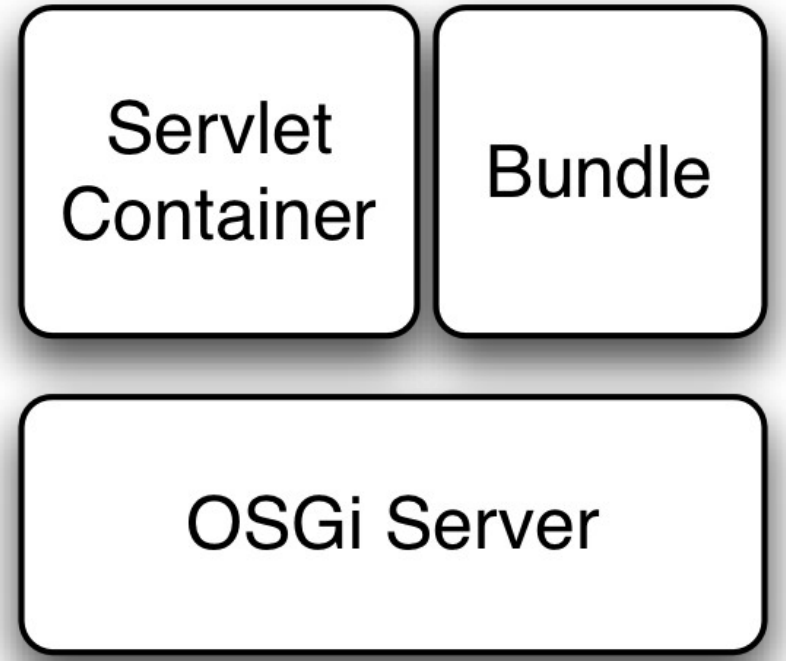
Architecture options



Server **Embedded** **Plugin**

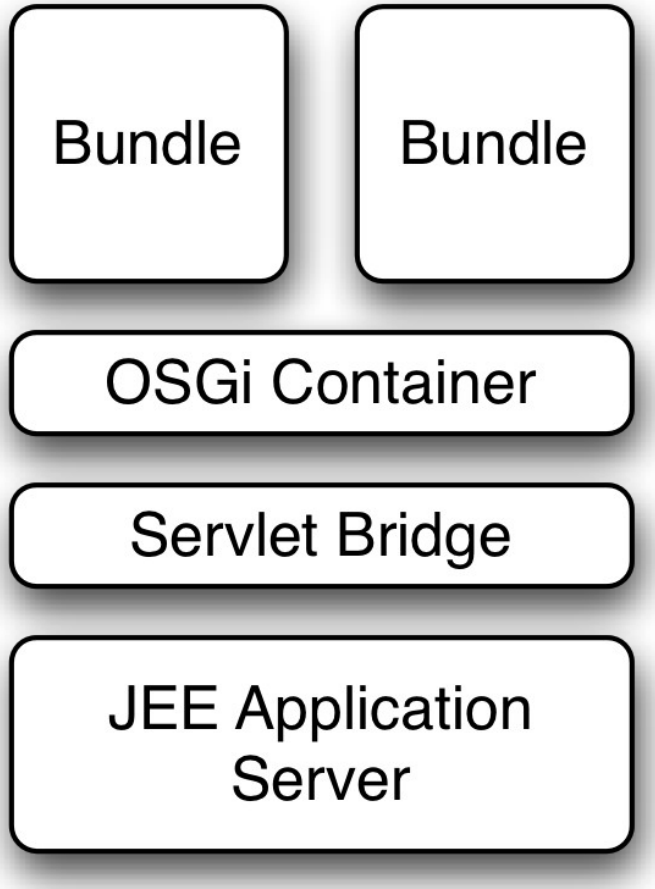
Architecture: OSGi server

- Options
  - Spring DM Server
  - Roll your own with Apache Felix, Equinox, etc.
- Advantages
  - Few deployment hassles
  - Consistent OSGi environment
- Disadvantages
  - Cannot use existing JEE infrastructure



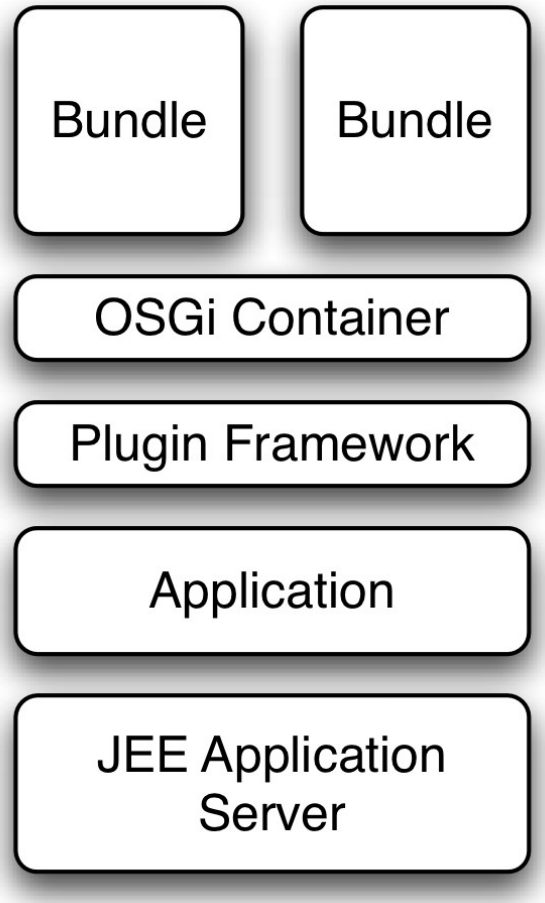
Architecture: Embed OSGi via bridge

- Options
  - Equinox Servlet bridge
- Advantages
  - Can reuse JEE servers
  - Application still pure OSGi
- Disadvantages
  - Susceptible to deployment issues
  - Poor framework support



Architecture: Embed OSGi via plugins

- Options
  - Atlassian Plugins
- Advantages
  - Can reuse JEE servers
  - Easier migration
  - Fewer library hassles
- Disadvantages
  - More complicated
  - Susceptible to deployment issues



Development experience

- How to share and consume services?
- What if bundles I depend on go down?
- How do I configure my manifest?
- What tools are available?

Services: What the tutorials show

- Registering a service:

```
MovieFinder finder = new BasicMovieFinderImpl();
registration = context.registerService(
                MovieFinder.class.getName(),
                finder, null);
```

- Consuming a service

```
ServiceReference ref = bundleContext.getServiceReference(
                         MovieFinder.class.getName());
MovieFinder finder = (MovieFinder)
                     bundleContext.getService(ref);
```

Services: The old school reality

```
public class MovieFinderTracker extends ServiceTracker {

        private final MovieListerImpl lister = new MovieListerImpl();
        private int finderCount = 0;
        private ServiceRegistration registration = null;

        public MovieFinderTracker(BundleContext context) {
                super(context, MovieFinder.class.getName(), null);
        }

        private boolean registering = false;
        public Object addingService(ServiceReference reference) {
                MovieFinder finder = (MovieFinder) context.getService(reference);
                lister.bindFinder(finder);

                synchronized(this) {
                        finderCount ++;
                        if (registering)
                                return finder;
                        registering = (finderCount == 1);
                        if (!registering)
                                return finder;
                }

                ServiceRegistration reg = context.registerService(
                MovieLister.class.getName(), lister, null);

                synchronized(this) {
                        registering = false;
                        registration = reg;
                }

                return finder;
        }

        public void removedService(ServiceReference reference, Object service) {
                MovieFinder finder = (MovieFinder) service;
                lister.unbindFinder(finder);
                context.ungetService(reference);

                ServiceRegistration needsUnregistration = null;
                synchronized(this) {
                        finderCount --;
                        if (finderCount == 0) {
                                needsUnregistration = registration;
                                registration = null;
                        }
                }

                if(needsUnregistration != null) {
                        needsUnregistration.unregister();
                }
        }
}
```

Spring Dynamic Modules

- **Great if:** You are already using Spring and like it
- **Sucks if:** You deploy 50+ and need high performance
- **Example:**

```
<service ref="beanToBeExported" interface="com.xyz.MyServiceInterface">
  <service-properties>
    <beans:entry key="myOtherKey" value="aStringValue"/>
    <beans:entry key="aThirdKey" value-ref="beanToExposeAsProperty"/>
  </service-properties>
</service>
```

```
<reference id="asyncMessageService" interface="com.xyz.MessageService"
  filter="(asynchronous-delivery=true)"/>
```

Peaberry using Guice

- **Great if:** You need speed and like Guice
- **Sucks if:** You need full lifecycle support (doesn't use the extender pattern)
- **Example:**

```
bind(export(StockQuote.class)).toProvider(
service(myQuoteImpl).attributes(names("Currency=GBP")).export());
```

```
bind(StockQuote.class).toProvider(
service(StockQuote.class).filter(ldap("(Currency=GBP)")).single());
```

Declarative Services

- **Great if:** You want to use the built-in OSGi standard
- **Sucks if:** You don't like XML and want to use constructor injection or construct your own services
- **Example:**

```
<component name="stockQuote">
  <implementation class="com.xyz.internal.MyStockQuote"/>
  <service>
    <provide interface="com.xyz.StockQuote"/>
  </service>
  <reference name="RUNNABLE"
             interface="java.lang.Runnable"
             bind="setRunnable"
             unbind="unsetRunnable"
             cardinality="0..1"
             policy="dynamic"/>
</component>
```

Bundle packaging

This is what you are up against in MANIFEST.MF:

```
APSHOT",com.atlassian.sal.api.scheduling;version="2.0.1.SNAPSHOT",com
 .atlassian.sal.api.search;version="2.0.1.SNAPSHOT",com.atlassian.sal.
 api.search.parameter;version="2.0.1.SNAPSHOT",com.atlassian.sal.api.s
 earch.query;version="2.0.1.SNAPSHOT",com.atlassian.sal.api.transactio
 n;version="2.0.1.SNAPSHOT",com.atlassian.sal.api.upgrade;version="2.0
 .1.SNAPSHOT",com.atlassian.sal.api.user;version="2.0.1.SNAPSHOT",com.
 atlassian.sal.jira.scheduling,com.atlassian.sal.spi,com.atlassian.sec
 urity.auth.trustedapps,com.atlassian.seraph.auth,com.atlassian.seraph
 .config,com.opensymphony.module.propertyset,com.opensymphony.user,jav
 ax.servlet.http,org.apache.commons.httpclient,org.apache.commons.http
 client.auth,org.apache.commons.httpclient.methods,org.apache.commons.
 httpclient.params,org.apache.commons.httpclient.util,org.apache.commo
 ns.lang,org.apache.log4j
Spring-Context: *;timeout:=60
Embed-Transitive: false
Bnd-LastModified: 1239159384564
Export-Package: com.atlassian.sal.jira.scheduling;uses:="org.apache.lo
 g4j,com.atlassian.sal.api.scheduling,com.opensymphony.module.property
 set,com.atlassian.configurable,com.atlassian.sal.api.component,com.at
 lassian.jira.service"
Bundle-Version: 2.0.1.SNAPSHOT
Bundle-Name: Shared Application Access Layer JIRA Plugin
Bundle-Description: Shared Application Access Layer JIRA 4.0 Plugin
Bundle-ClassPath: .,META-INF/lib/sal-core-2.0.1-SNAPSHOT.jar
Build-Jdk: 1.5.0_16
Private-Package: com.atlassian.sal.core.auth,com.atlassian.sal.core.co
 mponent,com.atlassian.sal.core.executor,com.atlassian.sal.core.lifecy
 cle,com.atlassian.sal.core.message,com.atlassian.sal.core.net,com.atl
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 assian.sal.core.upgrade,com.atlassian.sal.core.util,com.atlassian.sal
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 com.atlassian.sal.jira.lifecycle,com.atlassian.sal.jira.message,com.a
 tlassian.sal.jira.pluginsettings,com.atlassian.sal.jira.project,com.a
 tlassian.sal.jira.search,com.atlassian.sal.jira.trusted,com.atlassian
 .sal.jira.upgrade,com.atlassian.sal.jira.user
Bundle-DocURL: http://www.atlassian.com/
Embed-Directory: META-INF/lib
Bundle-ManifestVersion: 2
Bundle-Vendor: Atlassian Pty Ltd
Bundle-SymbolicName: com.atlassian.sal.jira
Tool: Bnd-0.0.255
Require-Bundle: system.bundle
Embed-Dependency: *;scope=compile|runtime;inline=false
```

Using the bundle tool BND

- Maven and Ant support
- Maven 2 plugin also does packaging

```
<plugin>
  <groupId>org.apache.felix</groupId>
  <artifactId>maven-bundle-plugin</artifactId>
  <extensions>true</extensions>
  <configuration>
    <instructions>
      <Export-Package>org.foo.myproject.api</Export-Package>
      <Private-Package>org.foo.myproject.*</Private-Package>
      <Bundle-Activator>org.foo.myproject.impl1.Activator
      </Bundle-Activator>
    </instructions>
  </configuration>
</plugin>
```

SpringSource's Bundlor

- Maven 2 and Ant support
- Handles manifest generation only

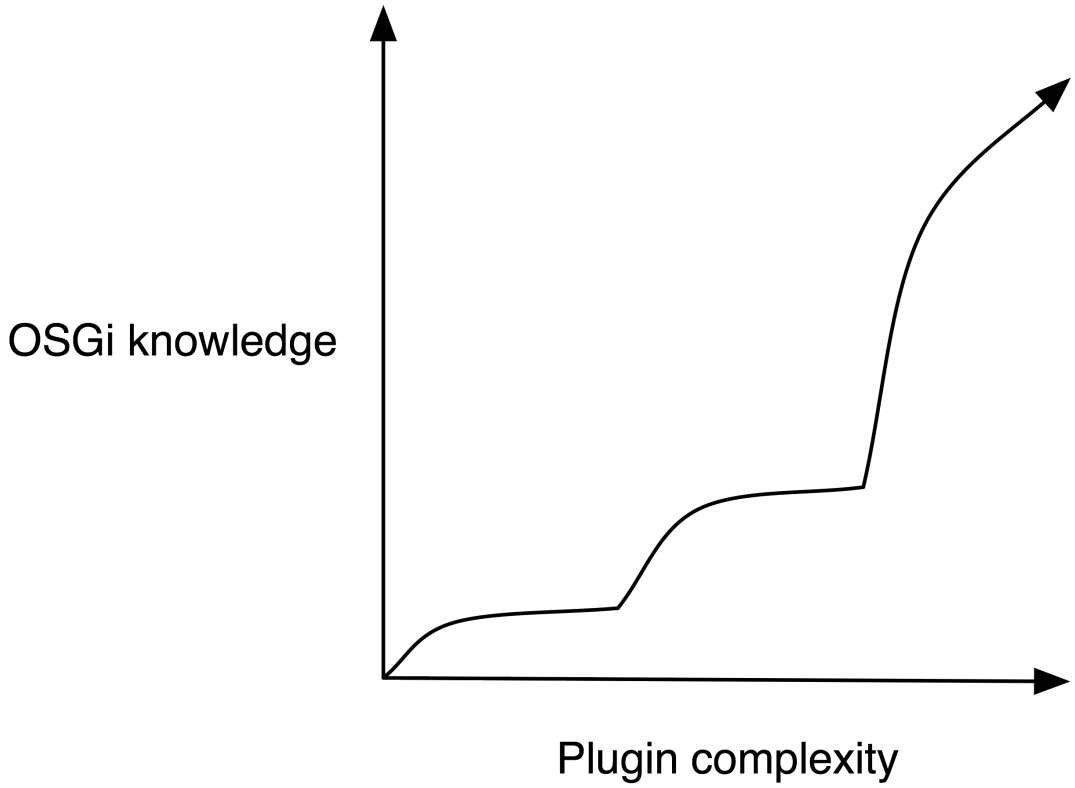
```
Bundle-ManifestVersion: 2
Bundle-SymbolicName: org.springframework.binding
Bundle-Name: Spring Binding
Bundle-Vendor: SpringSource
Import-Package:
ognl;version="[2.6.9, 3.0.0)";resolution:=optional,
org.jboss.el;version="[2.0.0, 3.0.0)";resolution:=optional
Import-Template:
org.springframework.*;version="[2.5.4.A, 3.0.0)",
org.apache.commons.logging;version="[1.1.1, 2.0.0)",
javax.el;version="[2.1.0, 3.0.0)";resolution:=optional
```

How we did it - Atlassian Plugins

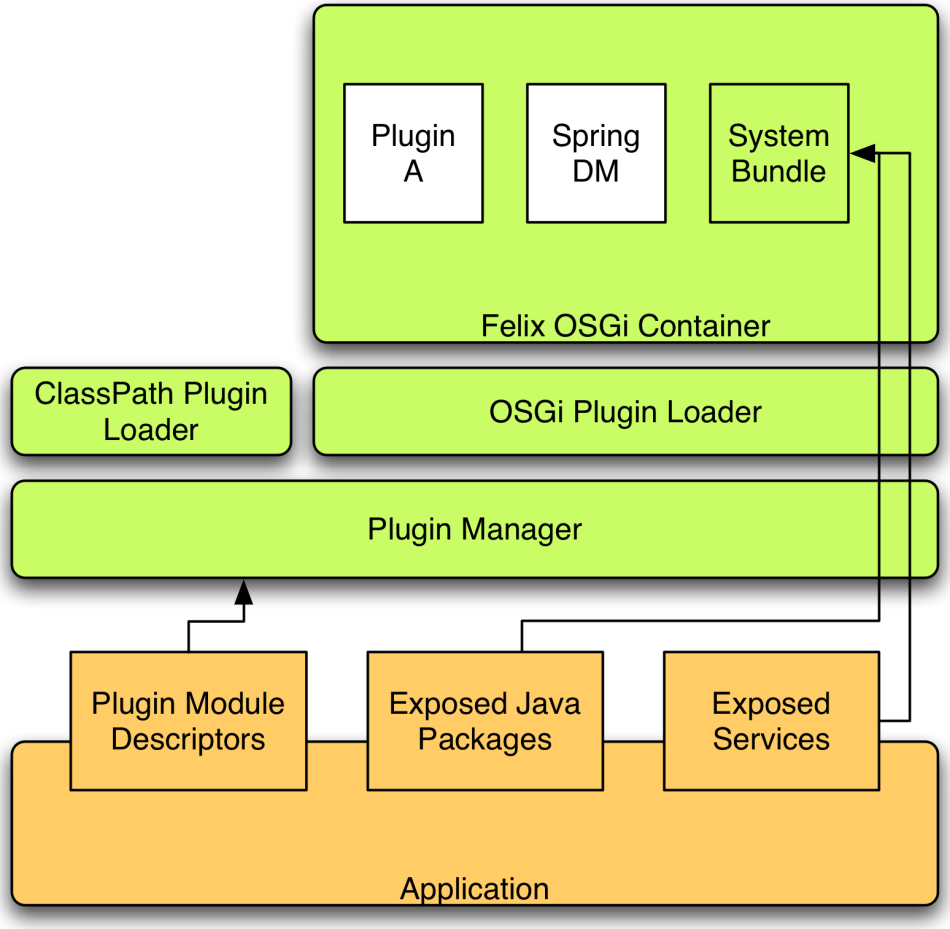
- Constraints
  - Must run on any JEE server
  - Must co-exist with millions of lines of legacy code
  - Must not require developers to be OSGi experts
- Selections
  - Felix OSGi embedded as part of our existing plugin framework
  - Spring DM to manage services
  - Automatic bundle transformation for simple plugins

One more thing - Minimal OSGi required

- Can we scale the learning curve to keep the easy plugins easy?



Plugins architecture



Plugin descriptor

- atlassian-plugin.xml

```
<atlassian-plugin key="com.xyz.example"
                  name="Example Plugin"
                  plugins-version="2">
  <plugin-info>
    <description>A sample plugin</description>
    <version>1.0</version>
    <vendor name="Atlassian"
            url="http://www.atlassian.com/"/>
  </plugin-info>
  <servlet key="test" name="Test Servlet"
           class="com.xyz.TestServlet">
    <description>An example servlet</description>
  </servlet>
</atlassian-plugin>
```

Available modules

General	Confluence	JIRA
Servlet	Job	Search
Servlet filter	Macro	Custom field
Link	Theme	Issue tab
Link section	Workflow	Portlet
REST (JAX-RS)	Language pack	RPC
Component	Editor	Workflow
Component import	Event listener	User format
Module type	RPC	Report

Plugin descriptor - Hidden OSGi

- atlassian-plugin.xml

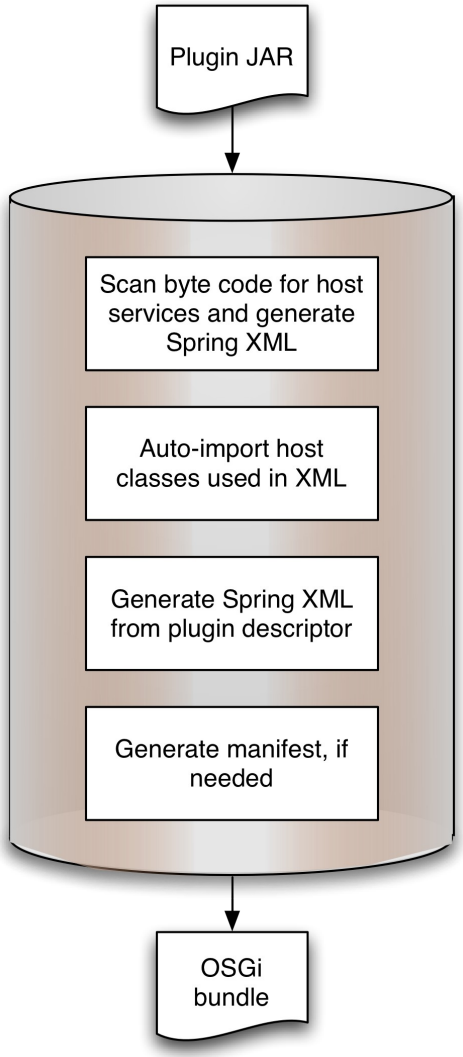
```
<atlassian-plugin key="com.xyz.example"
                  name="Example Plugin"
                  plugins-version="2">
  …
  <component key="myComponent" class="com.xyz.MyComponent"
             public="true">
    <interface>com.xyz.Component</interface>
  </component>

  <component-import key="otherComponent"
                    interface="com.abc.OtherComponent" />

</atlassian-plugin>
```

Plugin descriptor - Hidden OSGi

- Generates atlassian-plugin-spring.xml

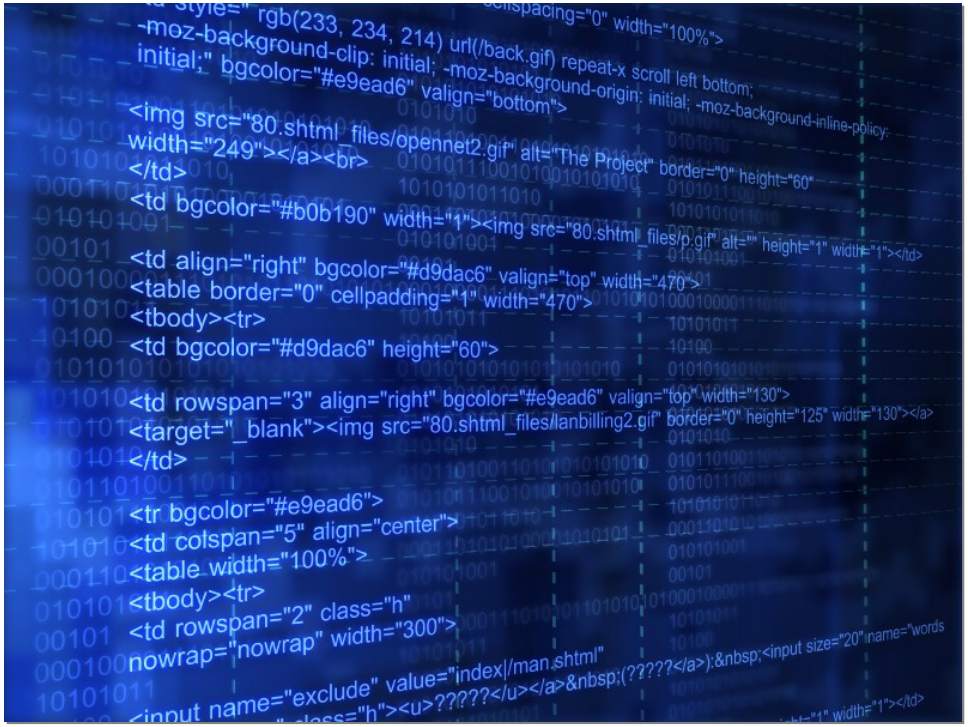
```
<beans …>
  <bean id=“myComponent class=“com.xyz.MyComponent” />

  <osgi:service id=“myComponent_service” ref=“myComponent”
                interface=“com.xyz.Component” />

  <osgi:reference id=“otherComponent"
                  interface="com.abc.OtherComponent” />
</beans>
```

Plugin to bundle process



- Goal: Allow simple plugins with no OSGi knowledge
- Three types of plugins:
  - **Simple** - no OSGi
  - **Moderate** - OSGi via plugin descriptor
  - **Complex** - OSGi via Spring XML directly

DEMO: Using Atlassian Plugins



http://atlassian.com/opensource

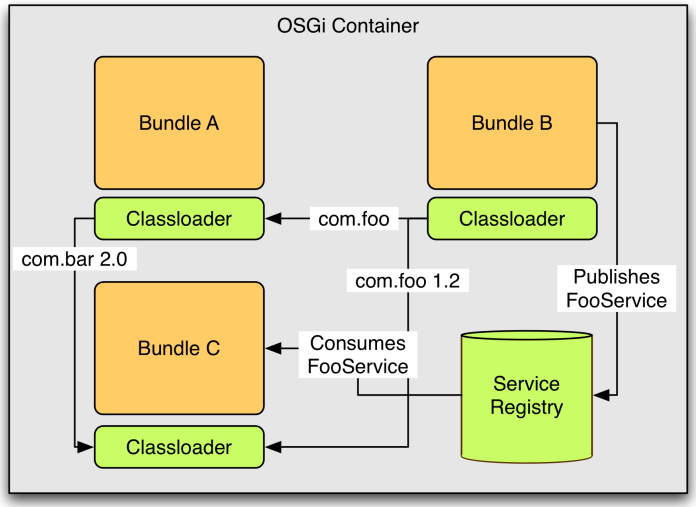
Lessons learned

Training key

- Critical topics
  - How classloaders work
  - OSGi (obviously)
  - How to develop quickly
  - Debugging

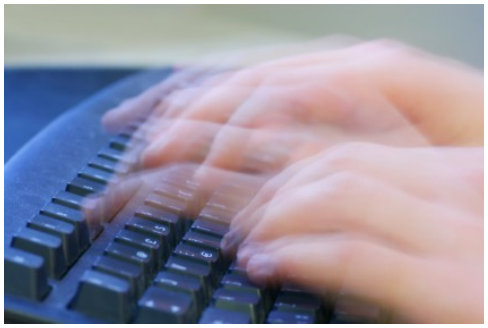
Be prepared for classloader hell

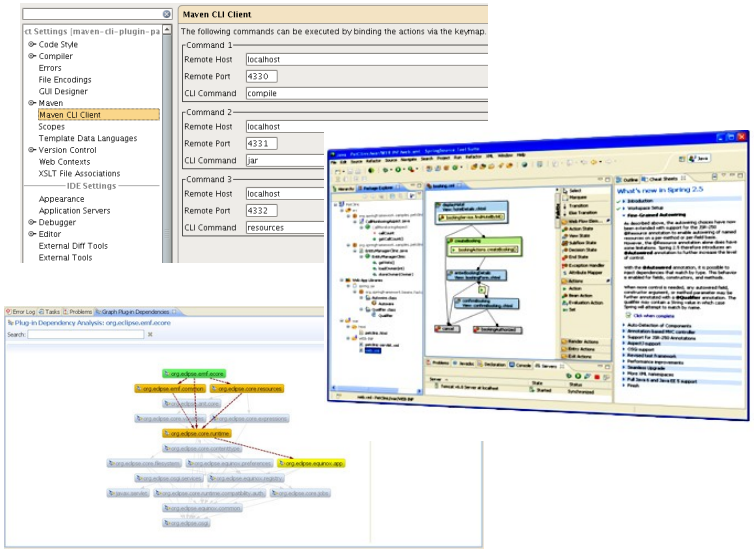
- Your new playmates
  - ClassNotFoundException
  - NoClassDefFoundError
  - ClassCastException
- Know what the thread context classloader is and how/where it is used
- Avoid Class.forName()
- Know your wires




```
- Installed bundle com.atlassian.plugin.osgi.logging (2)
- Installed bundle org.springframework.bundle.osgi.extender (3)
- Installed bundle com.springsource.org.aopalliance (4)
- Installed bundle org.springframework.bundle.spring (5)
- Installed bundle org.springframework.bundle.osgi.extensions.annotations (6)
- Installed bundle org.springframework.bundle.osgi.core (7)
- Installed bundle org.springframework.bundle.osgi.io (8)
- WIRE: 6.0 -> org.osgi.framework -> 0
- WIRE: 6.0 -> org.apache.commons.logging -> 2.0
- WIRE: 6.0 -> org.springframework.osgi.service.importer -> 7.0
- WIRE: 6.0 -> org.springframework.osgi.util -> 7.0
- WIRE: 6.0 -> org.springframework.osgi.extender -> 3.0
- WIRE: 6.0 -> org.springframework.core.annotation -> 5.0
```

Focus on development experience early





- Evaluate tools like Eclipse, the Intellij IDEA plugin Osmorc, and SpringSource Tool Suite
- Be prepared to be under-whelmed - tool support lacking in general
- Look at building custom Ant/Maven/Buildr plugins to optimize build/deploy/test cycle
- If using Maven 2 to deploy bundles, consider the Maven CLI Plugin

Deployment environments matter

- WebSphere
  - Uses OSGi but R4.0. Ensure child-first classloading
  - Classloader scanning for packages to expose to OSGi may not work. Be prepared to scan WEB-INF/lib contents directly.
- WebLogic
  - Uses own XML parser, so ensure weblogic.* is available via boot classpath delegation for JAXP
- Profiling
  - Add com.yourkit.* and com.jprofiler.* to boot delegation

Takeaway:

- Web on OSGi can rock, but beware the cliffs

Questions

Thank You

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