# Tutorial: Spring Dynamic Modules

Adrian Colyer, CTO, SpringSource
Martin Lippert, aquinet agile GmbH
BJ Hargrave, IBM & CTO, OSGi Alliance

## Agenda

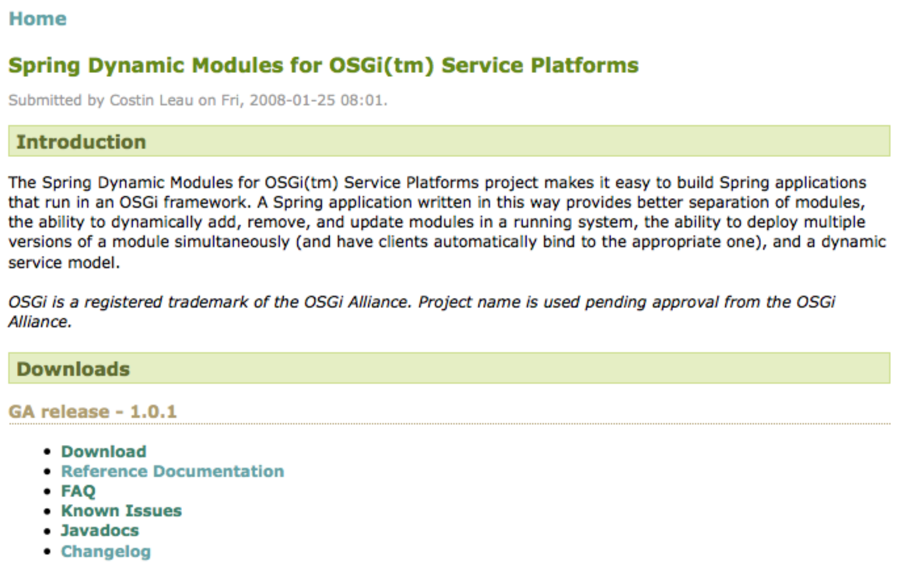
- What is Spring Dynamic Modules?
- Spring Dynamic Modules in Action
- Server-side Applications
- RCP Applications
- Summary

## What is Spring Dynamic Modules?

- Project Objectives
- Introduction to key Spring concepts
- Bundles and module contexts
- Application design
- The extender pattern
- Who's using it?

## Spring Dynamic Modules is...

- A open source project in the Spring portfolio
  - led by SpringSource
  - committers from BEA and Oracle
  - many non-code contributions from the community and from the OSGi EEG and CPEG



Home

**Spring Dynamic Modules for OSGi(tm) Service Platforms**

Submitted by Costin Leau on Fri, 2008-01-25 08:01.

**Introduction**

The Spring Dynamic Modules for OSGi(tm) Service Platforms project makes it easy to build Spring applications that run in an OSGi framework. A Spring application written in this way provides better separation of modules, the ability to dynamically add, remove, and update modules in a running system, the ability to deploy multiple versions of a module simultaneously (and have clients automatically bind to the appropriate one), and a dynamic service model.

*OSGi is a registered trademark of the OSGi Alliance. Project name is used pending approval from the OSGi Alliance.*

**Downloads**

GA release - 1.0.1

- Download
- Reference Documentation
- FAQ
- Known Issues
- Javadocs
- Changelog

http://www.springframework.org/osgi

## Project Objectives

- Bring the benefits of OSGi:
  - modularity
  - versioning
  - lifecycle support

- To enterprise application development

## Design considerations (raw OSGi)

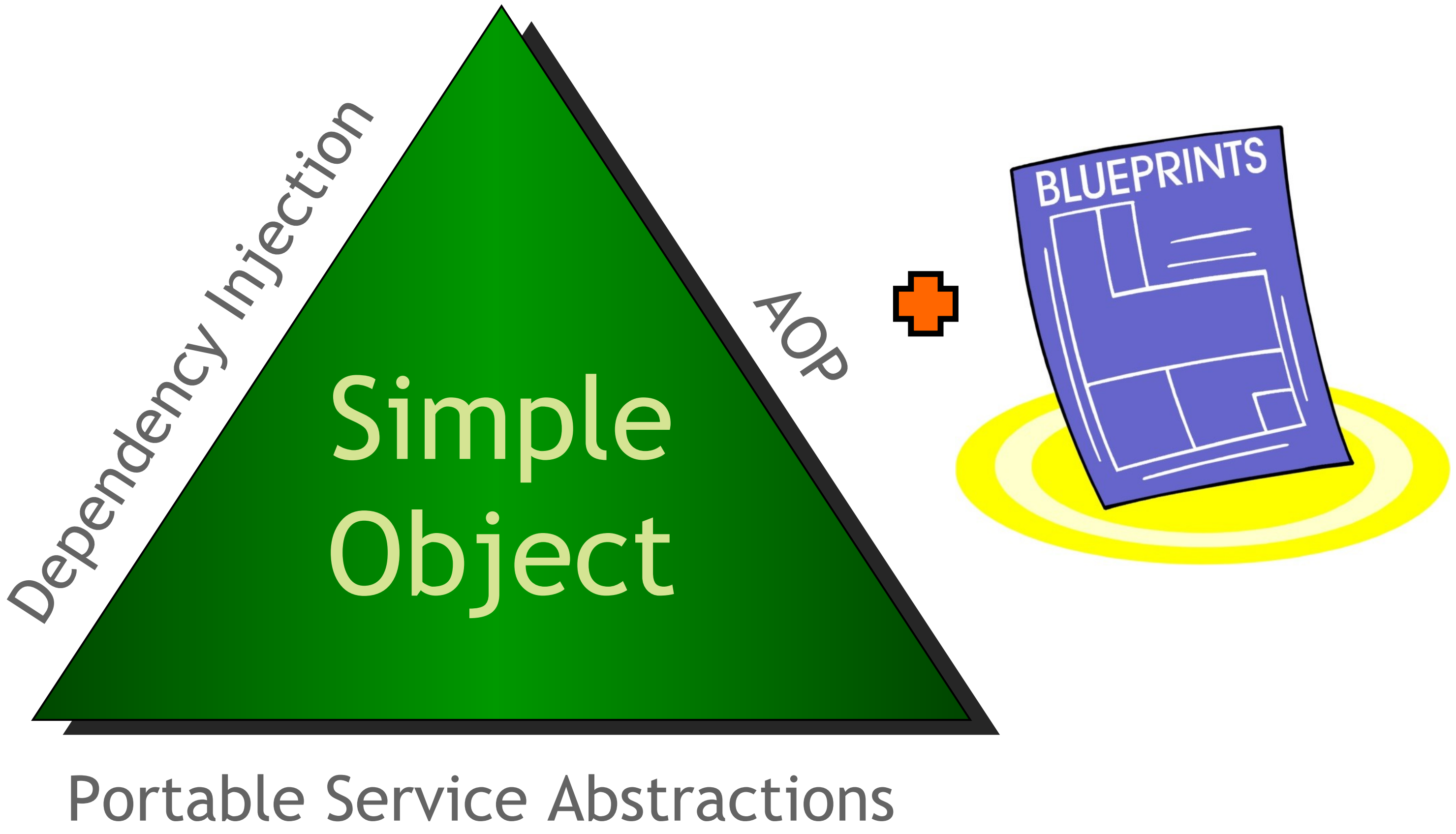
- Platform dynamics
  - services may come and go at any time
  - ServiceTracker
- Asynchronous activation
  - service dependency management
- Testing
- Concurrency and thread management

## Project Objectives

- The simplicity and power of Spring...
  - with the dynamic module system of OSGi
- Modules need instantiating, configuring, decorating, assembling, ...
- Need an easy way to manage service references between modules
- Easy unit and integration testing

*Bring the benefits of OSGi to enterprise applications*

## Key Spring Concepts



## The Heart of Spring

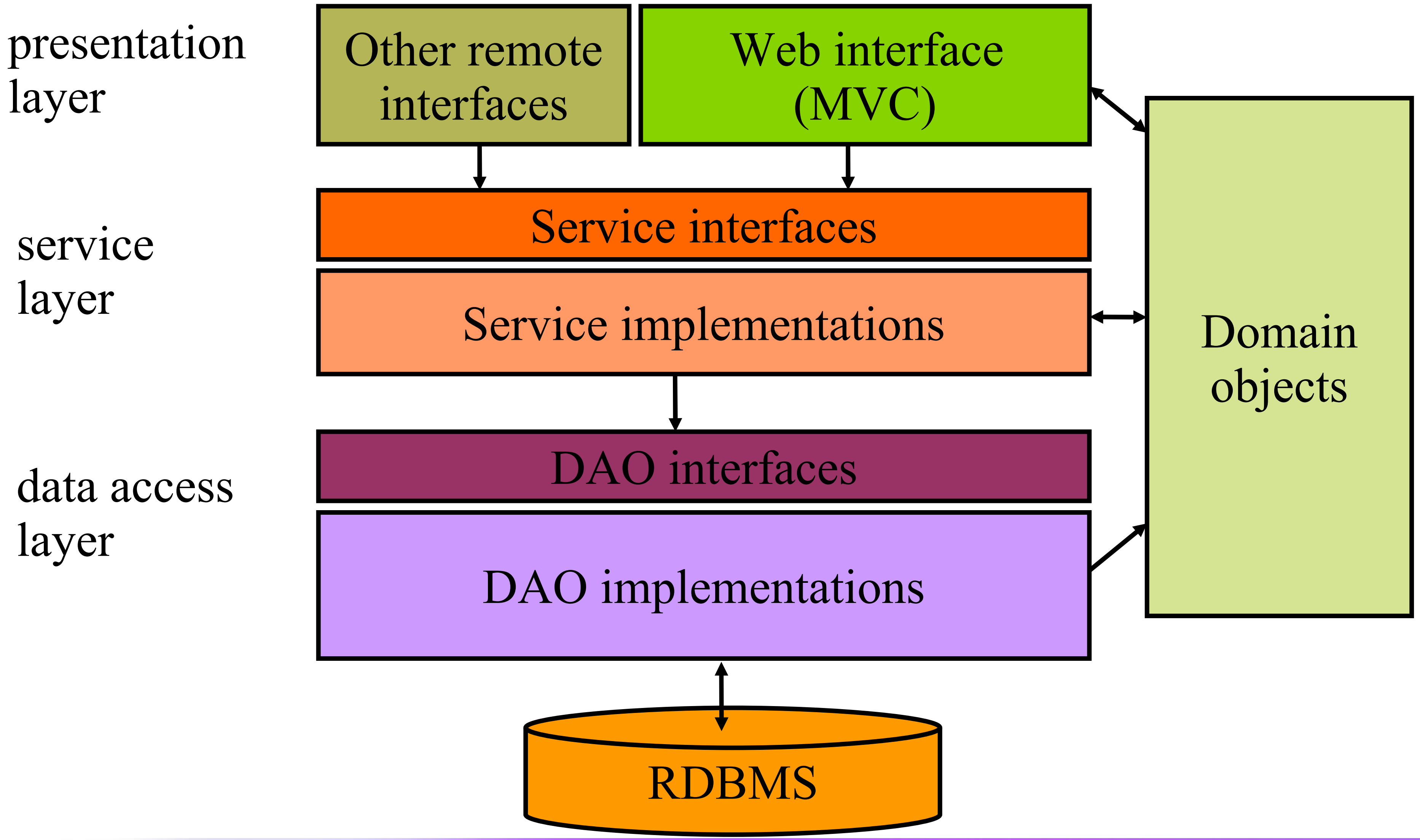
- Lightweight container
  - Full stack, simple object based application development
- Works in any environment
  - web-app, ejb, integration test, standalone
- Provides…
  - a powerful object factory that manages the instantiation, configuration, decoration and assembly of business objects

## Spring-based development

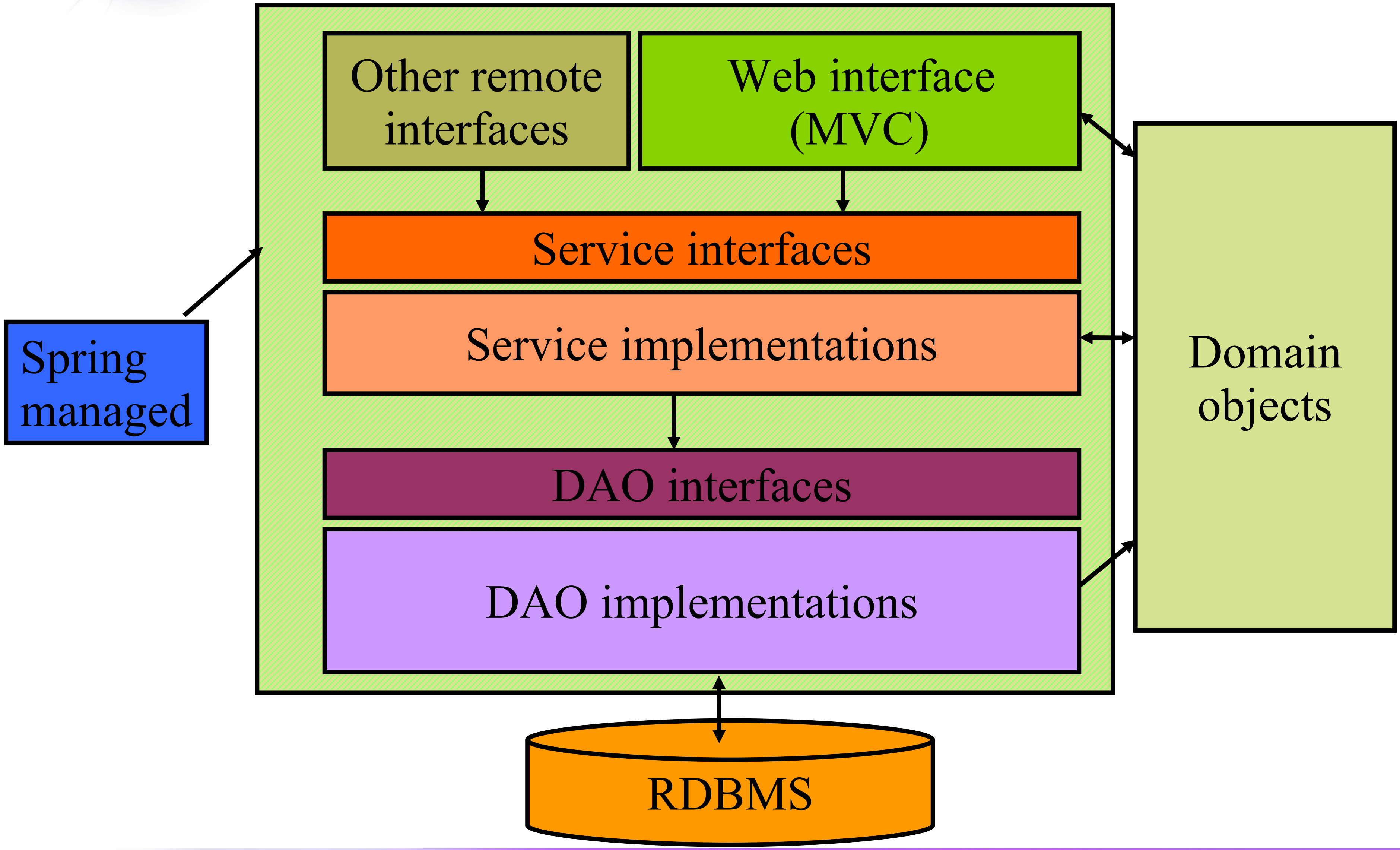
- View application as a set of components
  - with clear layering
- Each component is a simple object
  - Testable in isolation

- Container manages component configuration and assembly
- Container decorates your components at runtime

# Typical application layering



# Typical application layering



## Spring Framework

- Dependency injection
- Integration with persistence technologies (JDBC, Hibernate)
- Web application support Spring MVC, JSF and Struts
- Enterprise service abstractions
  - Transactions
  - Messaging
- Aspect Oriented Programming support

## Without dependency injection

```
public class TransferServiceImpl implements TransferService {
    private AccountRepository accountRepository;

    public TransferServiceImpl() {
        DataSource ds = (DataSource)
            ctx.lookup(“myAppserverDS”);
        accountRepository = new JdbcAccountRepository(ds);
    }
    …
}
```

Tied to Jdbc implementation
Tied to application server JNDI
Hard to test.  Hard to reuse

## Dependency Injection

```
public class JdbcAccountRepository implements
    AccountRepository {
    …
}
```

Implements a service interface

```
public class TransferServiceImpl implements TransferService {
    private final  AccountRepository accountRepository;

    public TransferServiceImpl(AccountRepository ar) {
        this.accountRepository = ar;
    }
    …
}
```

Depends on service interface;
conceals complexity of implementation;
allows for swapping out implementation

## Spring Blueprint

```
<beans>

   <bean id=“transferService” class=“app.impl.TransferServiceImpl”>
      <constructor-arg ref=“accountRepository” />
   </bean>

   <bean id=“accountRepository” class=“app.impl.JdbcAccountRepository”>
      <constructor-arg ref=“dataSource” />
   </bean>

   <bean id=“dataSource” class=“com.oracle.jdbc.pool.OracleDataSource”>
      <property name=“URL” value=“jdbc:oracle:thin:@localhost:1521:BANK” />
      <property name=“user” value=“moneytransfer-app” />
   </bean>

</beans>
```

## Bundles and Module Contexts

- OSGi bundle <==> Spring Application Context
  - we call it a *module context*
- Module context created when bundle is started
- destroyed when bundle is stopped

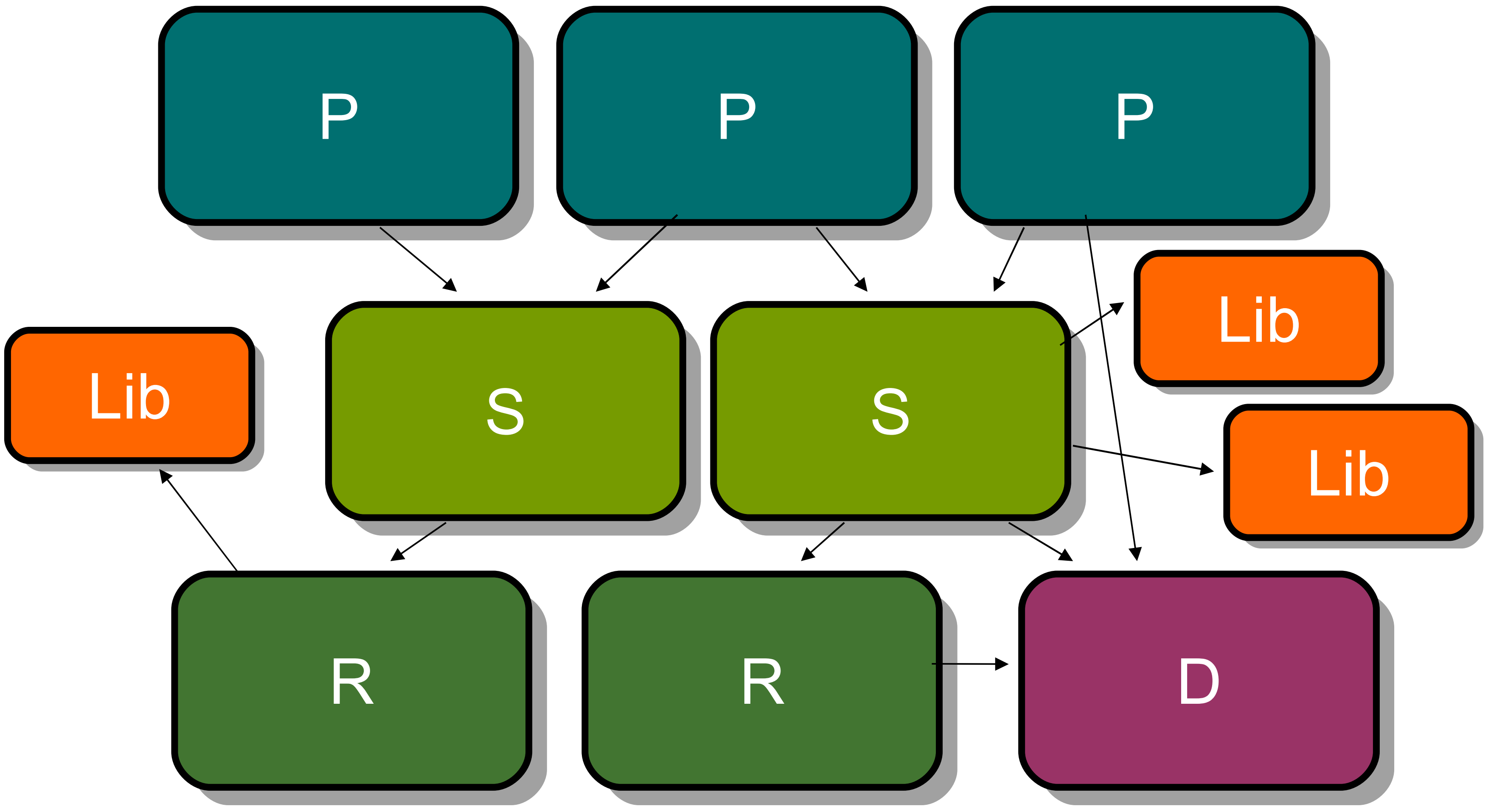
- Module components <==> Spring beans
  - instantiated, configured, decorated, assembled by Spring

- Components can be imported / exported from OSGi service registry

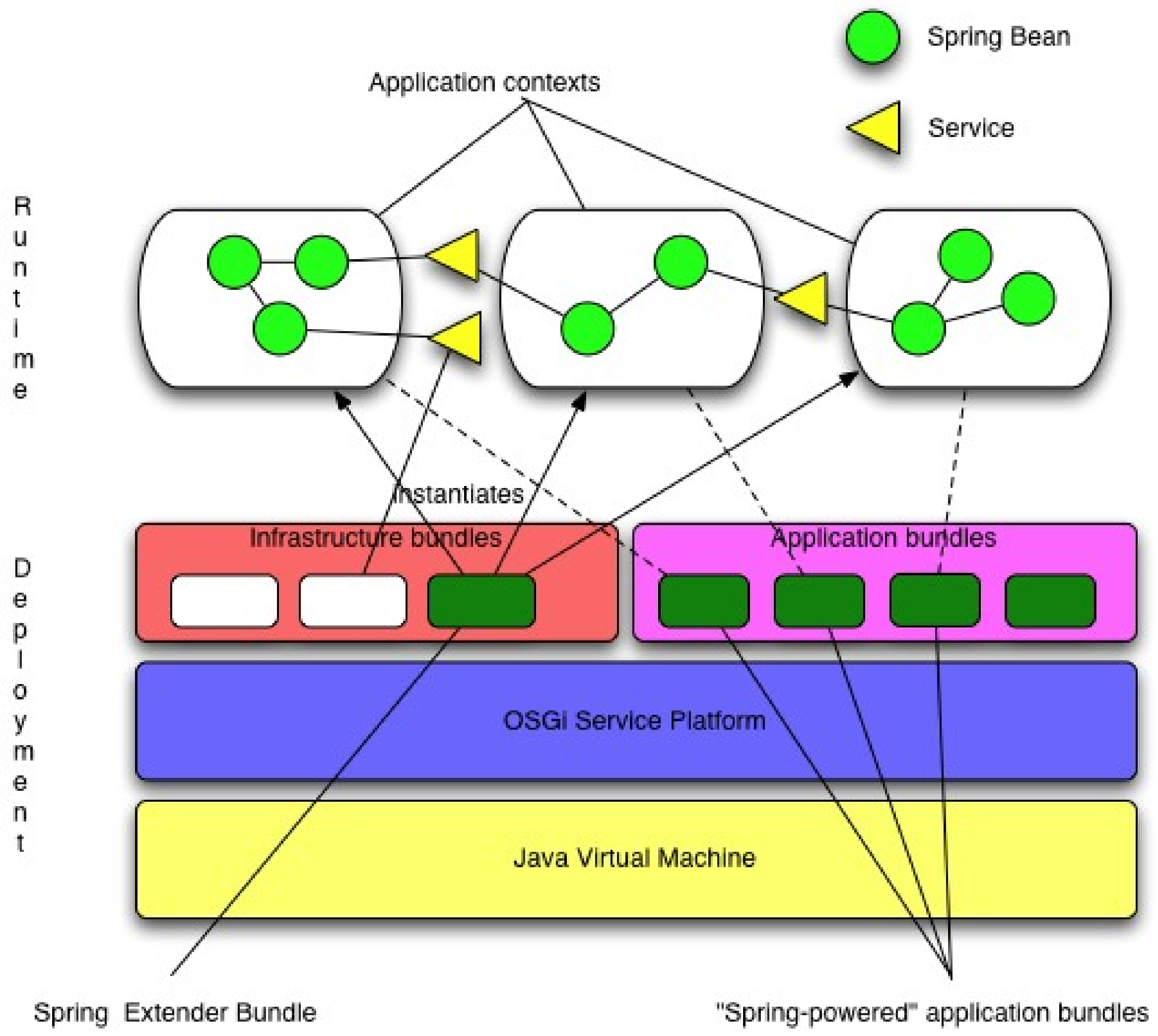
## Application Design

- Application becomes a set of co-operating bundles
  - vertical decomposition first
  - then horizontal
- Communication via service registry

## Application wiring



## Spring Dynamic Modules



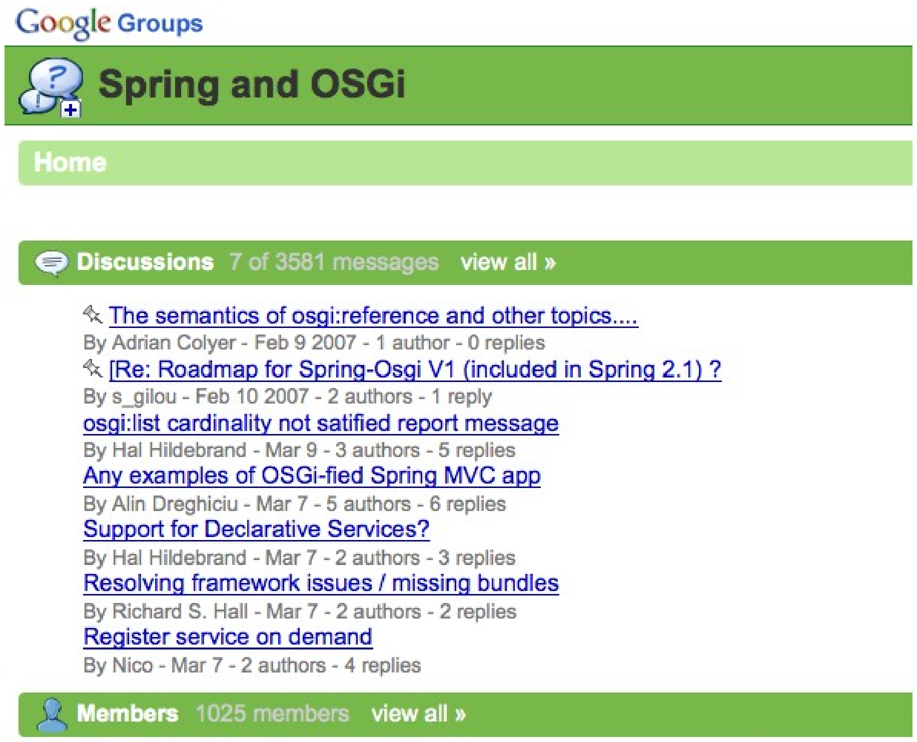
## The Extender pattern

- "The OSGi Extender Model"
  - Peter Kriens, Feb. 2007
  - http://www.osgi.org/blog/2007/02/osgi-extender-model.html
- [A]synchronous bundle listener
  - listen to install, update, uninstall events
  - inspect bundle content
  - Take appropriate action on behalf of the bundle

- Spring Dynamic Modules extender bundle:
  - org.springframework.osgi.bundles.extender
  - must be installed and active for module contexts to be created

## Spring Dynamic Modules Users

- Oracle
  - building next generation middleware platform on OSGi and Spring DM
- BEA
  - WebLogic Event Server 2.0 built on Spring Dynamic Modules
- Over 1000 subscribers on mailing list



Discussions 7 of 3581 messages view all »

The semantics of osgi:reference and other topics....
By Adrian Colyer - Feb 9 2007 - 1 author - 0 replies
[Re: Roadmap for Spring-Osgi V1 (included in Spring 2.1) ?
By s_gilou - Feb 10 2007 - 2 authors - 1 reply
osgi:list cardinality not satified report message
By Hal Hildebrand - Mar 9 - 3 authors - 5 replies
Any examples of OSGi-fied Spring MVC app
By Alin Dreghiciu - Mar 7 - 5 authors - 6 replies
Support for Declarative Services?
By Hal Hildebrand - Mar 7 - 2 authors - 3 replies
Resolving framework issues / missing bundles
By Richard S. Hall - Mar 7 - 2 authors - 2 replies
Register service on demand
By Nico - Mar 7 - 2 authors - 4 replies

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http://groups.google.com/group/spring-osgi

## Agenda

- What is Spring Dynamic Modules?
- **Spring Dynamic Modules in Action**
- Server-side Applications
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## Spring Dynamic Modules in Action

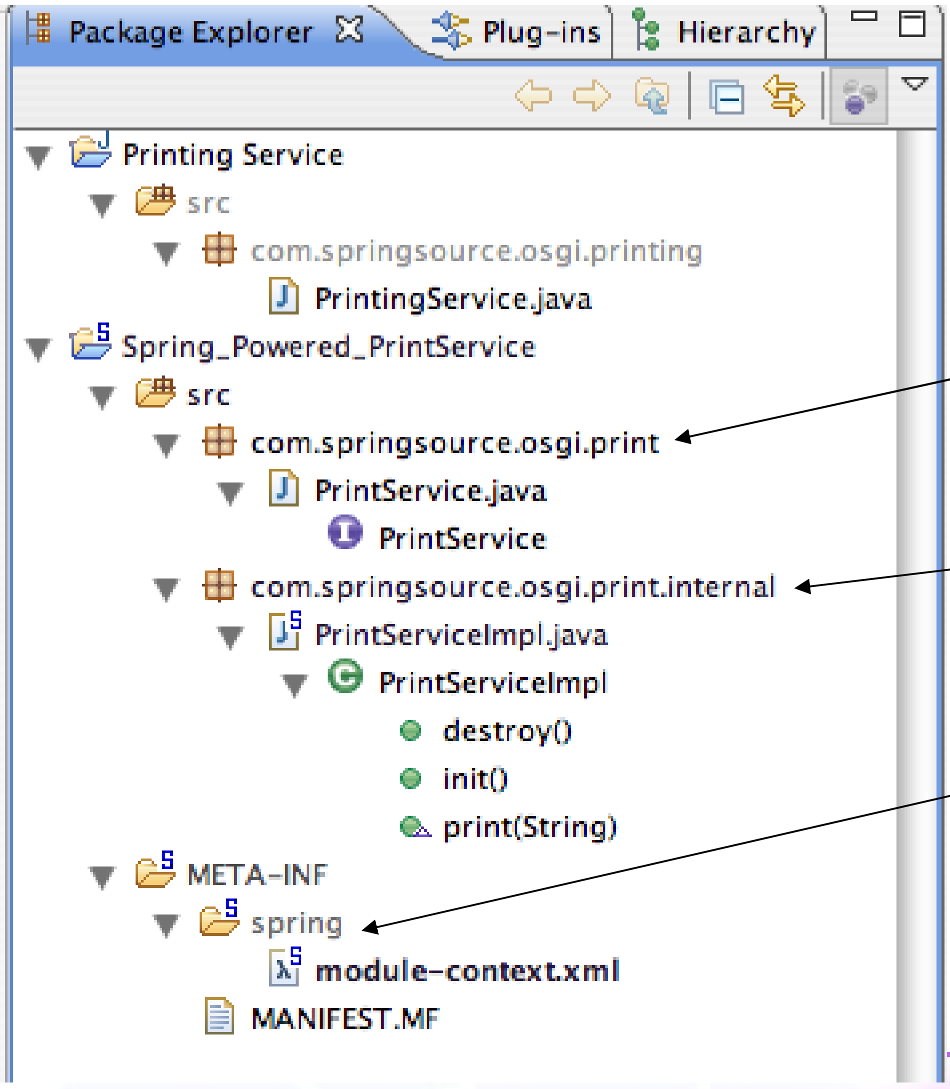
- Creating a Spring-powered bundle
- Importing and exporting services
- The whiteboard pattern
- Dynamics
- Startup and shutdown

## Spring-powered bundles

- Spring module context (app context) per bundle (module)
  - created automatically for you by Spring extender bundle
  - no need to depend on any OSGi APIs

- META-INF/spring/*.xml
- or Spring-Context header in MANIFEST.MF

# Demo: Spring-powered bundle



```
▼ Printing Service
    ▼ src
        ▼ com.springsource.osgi.printing
              PrintingService.java
▼ Spring_Powered_PrintService
    ▼ src
        ▼ com.springsource.osgi.print
            ▼ PrintService.java
                  PrintService
        ▼ com.springsource.osgi.print.internal
            ▼ PrintServiceImpl.java
                ▼ PrintServiceImpl
                      destroy()
                      init()
                      print(String)
    ▼ META-INF
        ▼ spring
              module-context.xml
          MANIFEST.MF
```

Published interfaces

Protected implementations

Spring configuration files

## Getting log output

- Spring uses Jakarta Commons Logging
- Commons logging doesn't behave well under OSGi
  - Use SLF4J binding instead
    - Simple Logging Facade for Java (http://www.slf4j.org/)
- Bundles:
  - jcl104.over.slf4j (static binding of jcl to slf4j)
  - slf4j.api (the slf4j API)
  - slf4j.log4j12 (implementation of slf4j over log4j)

## Getting log output

```
osgi> log4j:WARN No appenders could be found for logger
  (org.springframework.util.ClassUtils).
log4j:WARN Please initialize the log4j system properly.
```

- Where to put log4j.properties?
  - which bundle is it that looks for this file?
  - how do we make it visible to that bundle?

## Getting log output

- Use a *Fragment Bundle*
  - *"Fragments are bundles that are attached to a host bundle by the Framework."* - OSGi Core Specification, 3.14

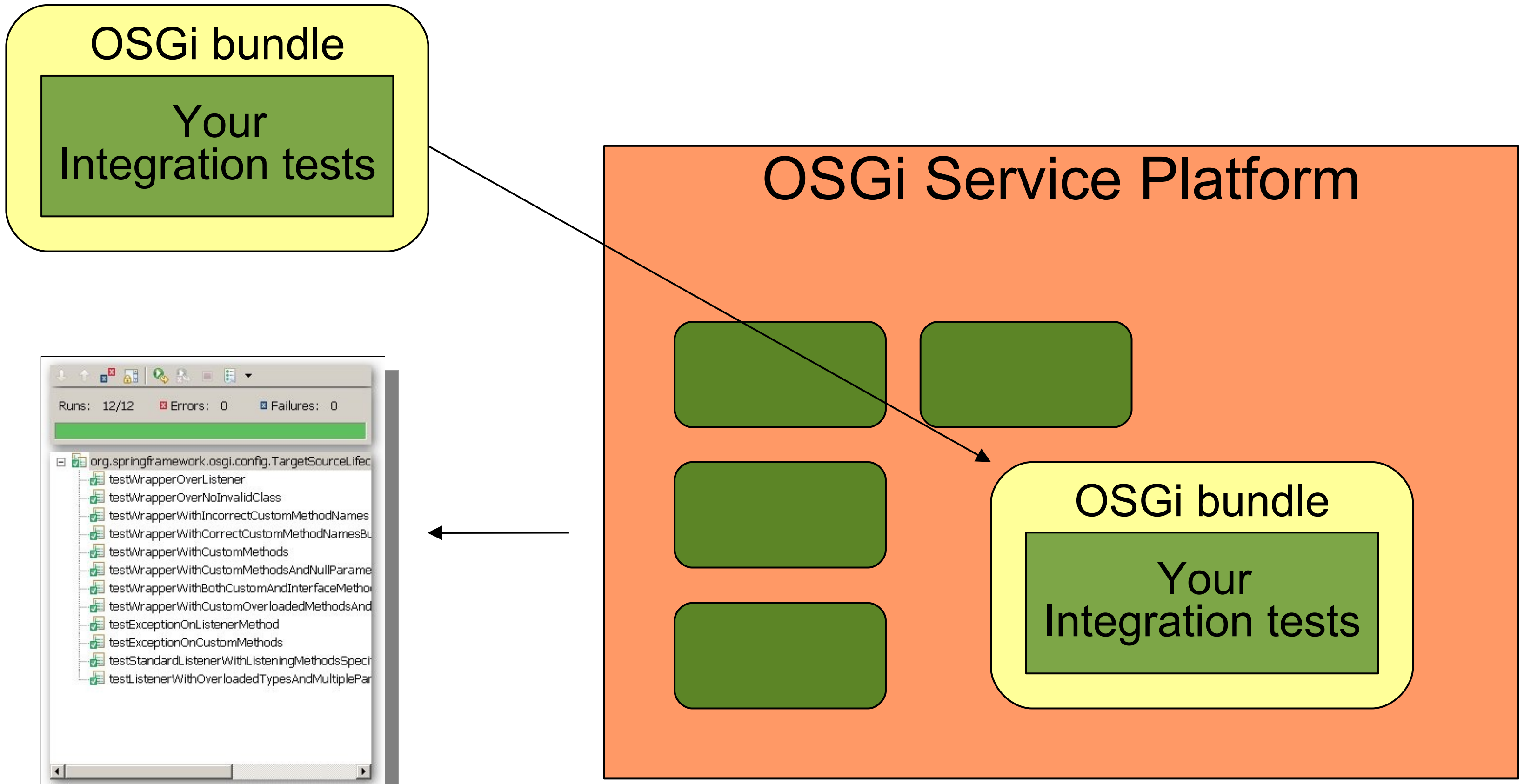
```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: Logging Configuration Fragment
Bundle-SymbolicName: com.springsource.logging.config
Bundle-Version: 1.0.0
Bundle-Vendor: SpringSource
Fragment-Host:  org.springframework.osgi.log4j.osgi;
  bundle-version="1.2.15.SNAPSHOT"
Bundle-RequiredExecutionEnvironment: J2SE-1.5
```

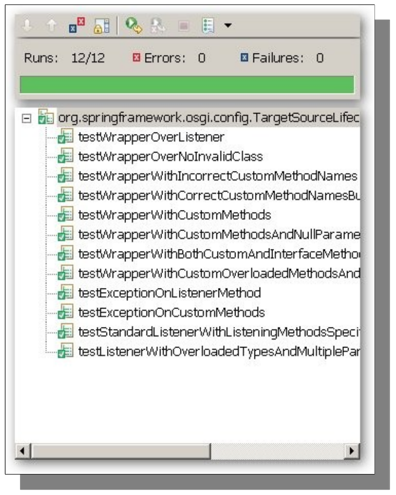
## Testing

- Unit testing is easy...
- Integration testing
  - verify module behaves as expected
  - running *inside* OSGi Service Platform
  - kick-off tests in standard fashion
    - JUnit: IDE, ant, maven, ...

- Spring Dynamic Modules integration test support...

## Integration test support





```
Runs:  12/12    Errors:  0    Failures:  0

org.springframework.osgi.config.TargetSourceLifec
    testWrapperOverListener
    testWrapperOverNoInvalidClass
    testWrapperWithIncorrectCustomMethodNames
    testWrapperWithCorrectCustomMethodNamesBu
    testWrapperWithCustomMethods
    testWrapperWithCustomMethodsAndNullParame
    testWrapperWithBothCustomAndInterfaceMetho
    testWrapperWithCustomOverloadedMethodsAnd
    testExceptionOnListenerMethod
    testExceptionOnCustomMethods
    testStandardListenerWithListeningMethodsSpeci
    testListenerWithOverloadedTypesAndMultiplePar
```

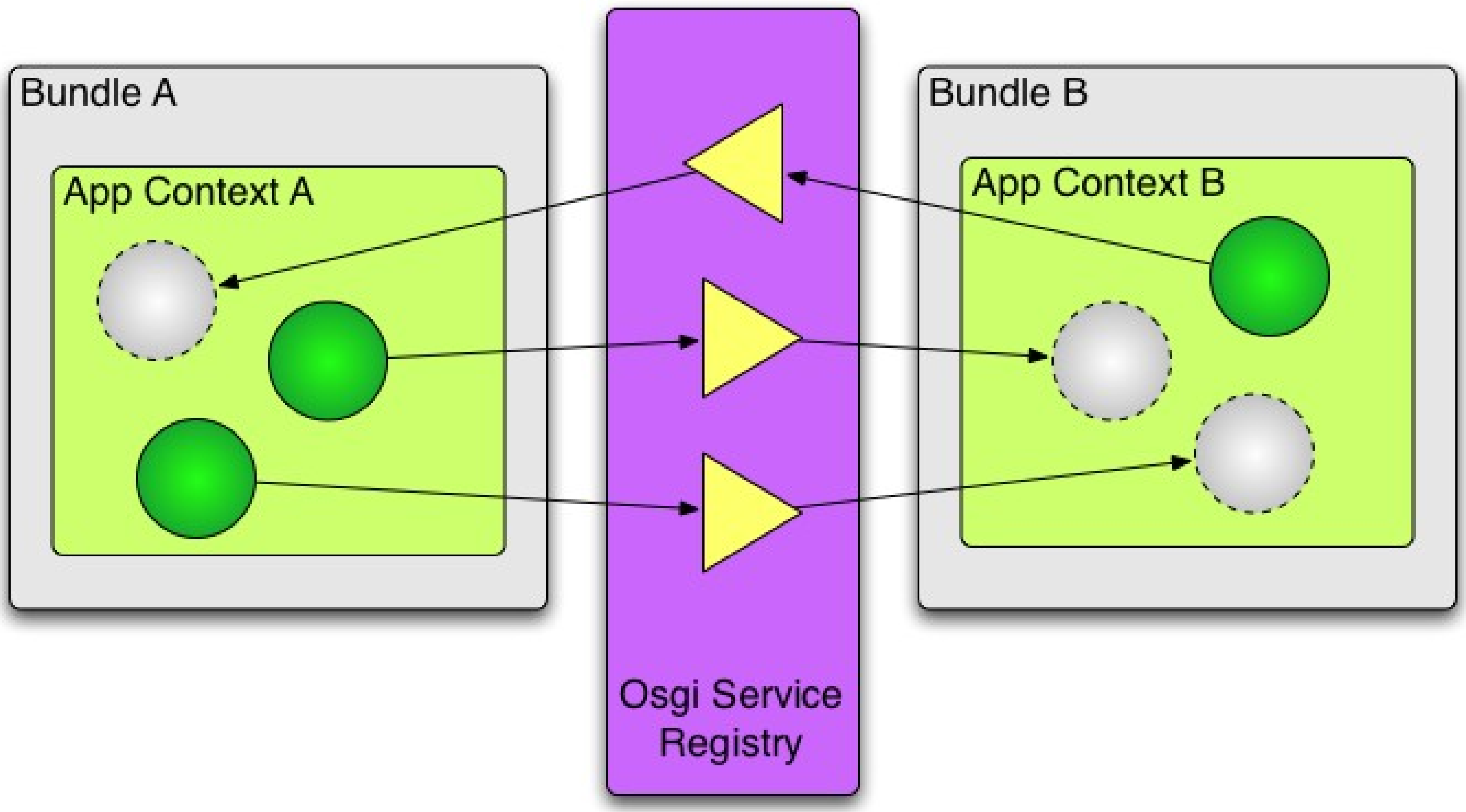
## Spring Dynamic Modules in Action

- Creating a Spring-powered bundle
- **Importing and exporting services**
- The whiteboard pattern
- Dynamics
- Startup and shutdown

## Services

- Your application is constructed as a set of bundles, each with their own module context
- How do we reference beans in other modules?
  - use the OSGi Service Registry
    - advertise public services
    - import references to external services

## Beans and services



## Demo: service import/export

Exporting context:

```
<bean id="printService"
   class="com.springsource.osgi.print.internal.PrintServiceImpl"
   init-method="init"
   destroy-method="destroy"/>

<osgi:service ref="printService"
        interface="com.springsource.osgi.print.PrintService"/>
```

Importing context:

```
<bean id="printClient"
   class="com.springsource.osgi.print.client.Client"
   init-method="init">
   <property name="printService" ref="printService"/>
</bean>

<osgi:reference id="printService"
        interface="com.springsource.osgi.print.PrintService"/>
```

## Exporting a service

```
<bean id="printService"
   class="com.springsource.osgi.print.internal.PrintServiceImpl"
   init-method="init"
   destroy-method="destroy"/>

<osgi:service ref="printService"
        interface="com.springsource.osgi.print.PrintService"/>
```

- *any* Spring bean can be exported as OSGi service
- offers access to the ServiceRegistration object

## Importing a service

```
<bean id="printClient"
   class="com.springsource.osgi.print.client.Client"
   init-method="init">
   <property name="printService" ref="printService"/>
</bean>

<osgi:reference id="printService"
        interface="com.springsource.osgi.print.PrintService"/>
```

- locates the best OSGi service that matches the description
- handles the service dynamics internally

## Controlling Service Exporting

- Which interface(s) should the service be registered under?
  - a single interface, use the interface attribute
  - multiple interfaces, use the nested interfaces element
  - Or... have Spring Dynamic Modules calculated the exported interface set for you automatically.

```
<osgi:reference id="printService" auto-export="interfaces"/>
```

- auto-export values are interfaces, class-hierarchy, or all-classes.

## Controlling Service Exporting

- Service always has service property
  - org.springframework.osgi.bean.name
  - (set to bean name)
- Specify additional service properties explicitly if needed

```
<osgi:service ref="printService"
        interface="com.springsource.osgi.print.PrintService">
  <osgi:service-properties>
    <entry key="aKey" value="someValue"/>
    <entry key="aKey" value-ref="someBeanName"/>
  </osgi:service-properties>
</osgi:service>
```

## Controlling Service Importing

- Use filter expressions
  - RFC 1960: A String representation of LDAP Search Filters

```
<osgi:reference id="printService"
    interface="com.springsource.osgi.print.PrintService"
    filter="(colour=true)"/>
```

- Special attribute bean-name matches on org.springframework.osgi.bean.name property
  - condition anded with filter expression if present
- Can specify multiple interfaces using nested interfaces element.

## Spring Dynamic Modules in Action

- Creating a Spring-powered bundle
- Importing and exporting services
- **The whiteboard pattern**
- Dynamics
- Startup and shutdown

## The Whiteboard Pattern

- "Listeners Considered Harmful: The Whiteboard Pattern"
  - OSGi Alliance Technical Whitepaper, 2004
  - http://www.osgi.org/wiki/uploads/Links/whiteboard.pdf

- Lifecycle issues around listener registration
- Solution: whiteboard
  - event source is not registered as a service
  - listeners register as services using well-known interface
  - event source uses a tracker to track listener services

## Importing a set of services

```
<bean id="printClient"
   class="com.springsource.osgi.print.client.Client"
   init-method="init">
   <property name="printService" ref="printService"/>
</bean>

<osgi:set id="printService"
        interface="com.springsource.osgi.print.PrintService"/>
```

- locates *all* OSGi services that match the description
- handles the service dynamics internally
- See also: <osgi:list... />

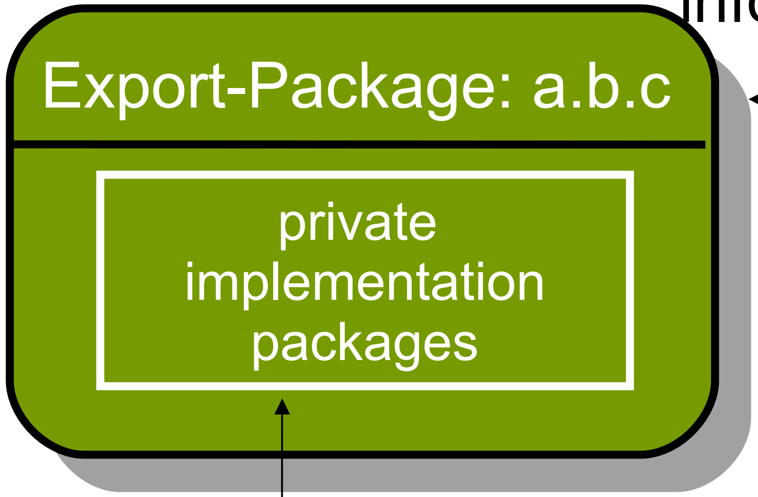
## Spring Dynamic Modules in Action

- Creating a Spring-powered bundle
- Importing and exporting services
- The whiteboard pattern
- **Dynamics**
- Startup and shutdown

## Dealing with dynamics

A service bundle…

Service interface types exported [with version information]



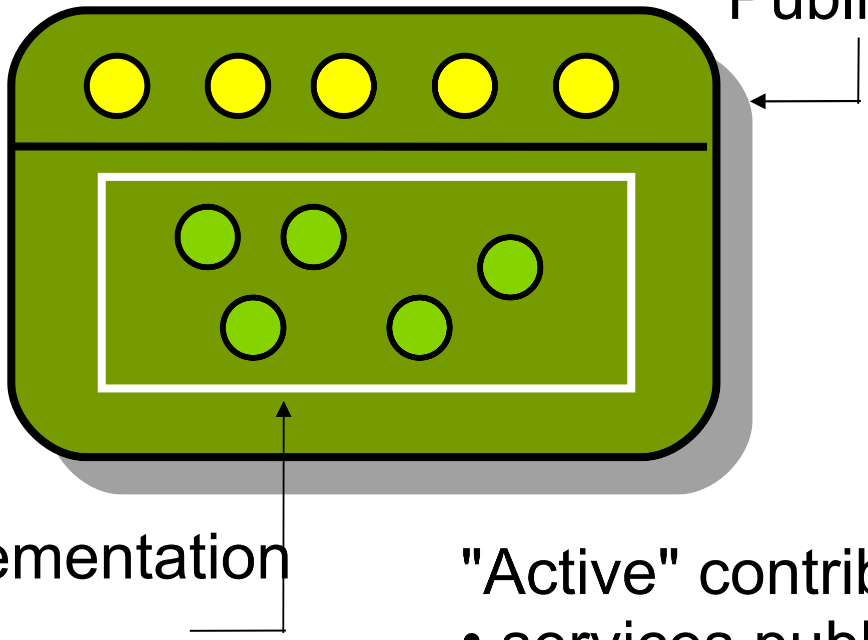
Service implementation locked away

"Passive" contribution
- types added to type space
- bundles see new version on resolution after install/refresh

## Demo: update vs. refresh

## Dealing with dynamics

A service bundle…



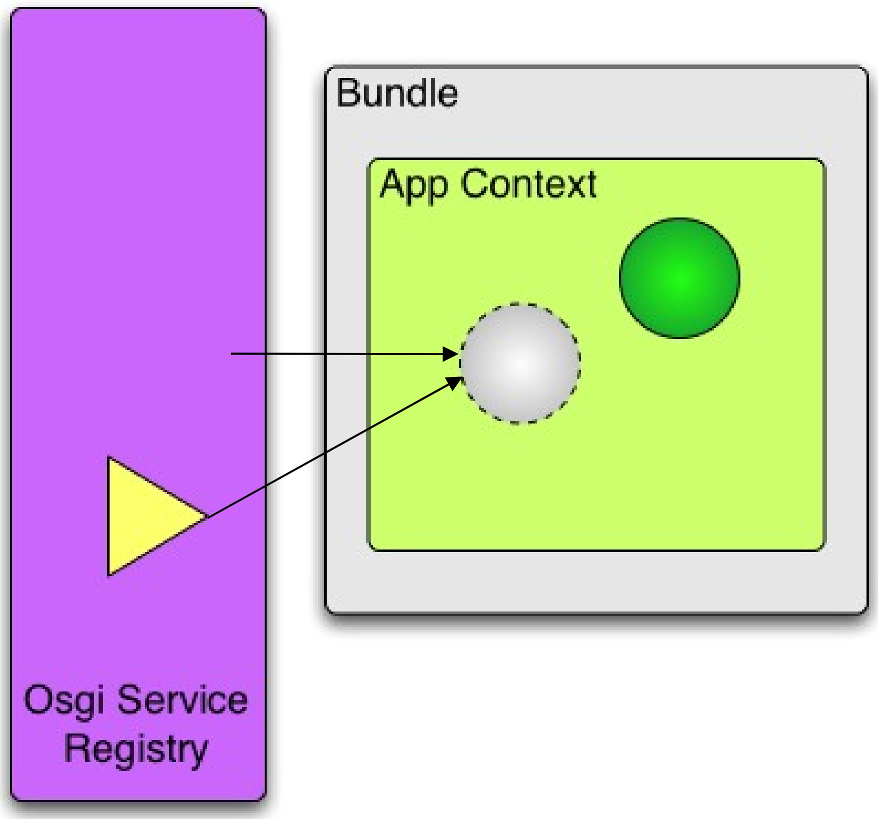
"Active" contribution

- services published in registry
- bundles see service changes immediately

## Service Dynamics

- What happens when a service goes away?
  - osgi:reference cardinality=”0..1”
    - track replacement and retarget proxy when suitable target found
    - ServiceUnavailableException after timeout if invoked
  - osgi:reference cardinality=”1..1”
    - as above, plus
    - unregister any exported services that depend on the unsatisfied reference

## Cardinality (single reference)



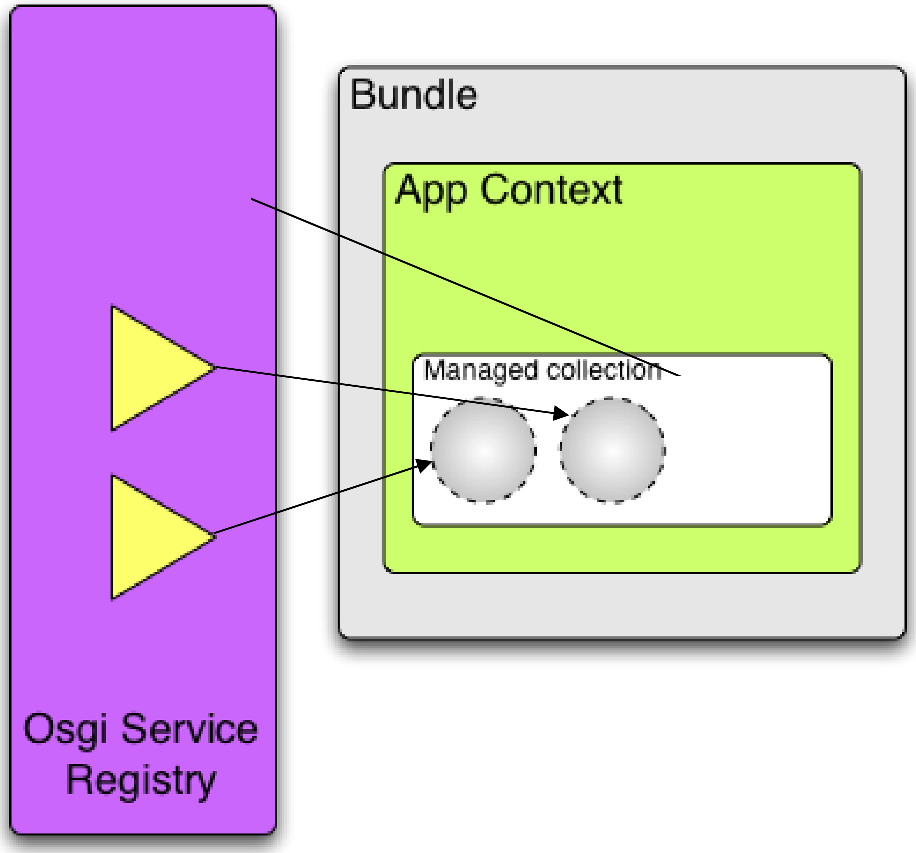
## Registration management

```
<osgi:service id="myService" ref="exposedBean"/>

<bean id="exposedBean" class="...">
   <property name="myHelper" ref="helperBean"/>
</bean>

<bean id="helperBean" class="...">
   <property name="fooService" ref="fooService"/>
</bean>

<osgi:reference id="fooService" interface="..."/>
```

## Service Dynamics

- What happens when a service goes away?
  - osgi:set/list cardinality=”0..n”
    - service is removed from the set
    - Iterator contract is honored
  - osgi:set/list cardinality=”1..n”
    - as above, plus
    - unregister any exported services that depend on the unsatisfied service reference

## Cardinality - many



## Listening

- You work with a constant reference
  - Proxy / Set / List
- Spring Dynamic Modules manages the target backing service(s) for you
- You can optionally listen to bind / unbind events
- You can optionally listen to register / unregister events

## Reference listeners

```
<osgi:reference id="printService"
        interface="com.springsource.osgi.print.PrintService">

  <osgi:listener bind-method="onBind"
                 unbind-method="onUnbind">
    <beans:bean class="MyCustomListener"/>
  </osgi:listener>

</osgi:reference>
```

```
class MyCustomListener {

  public void onBind(PrintService service, Map serviceProperties) {...}

  public void onBind(FastPrintService service, Map serviceProps) {...}

  public void onUnbind(ColorPrintService service, Map props) {...}

}
```

## Registration listeners

```
<osgi:service id="printService"
        interface="com.springsource.osgi.print.PrintService">

  <osgi:registration-listener
      registration-method="registered"
      unregistration-method="unregistered"
      ref="printServiceListener"/>

</osgi:service>
```

```
class MyCustomListener {

  public void registered(PrintService service, Map serviceProps) {...}

  public void unregistered(PrintService service, Map serviceProps) {...}

}
```

## Spring Dynamic Modules in Action

- Creating a Spring-powered bundle
- Importing and exporting services
- The whiteboard pattern
- Dynamics
- **Startup and shutdown**

## Startup

- Context creation
  - blocks until all mandatory service references are satisfied
  - simply start your bundles and let Spring Dynamic Modules figure it out
- Control via Spring-Context manifest header directives
  - wait-for-dependencies:=[true|false]
  - timeout:=[seconds]
- E.g.
  - Spring-Context: *;wait-for-dependencies:=false

## Shutdown

- Module contexts disposed when bundle is stopped
- Stopping the extender bundle disposes of all module contexts created by it
  - First those bundles that do not export any referenced services (in reverse bundle id order)
  - Cycles broken first by ranking, then by service id

## Agenda

- What is Spring Dynamic Modules?
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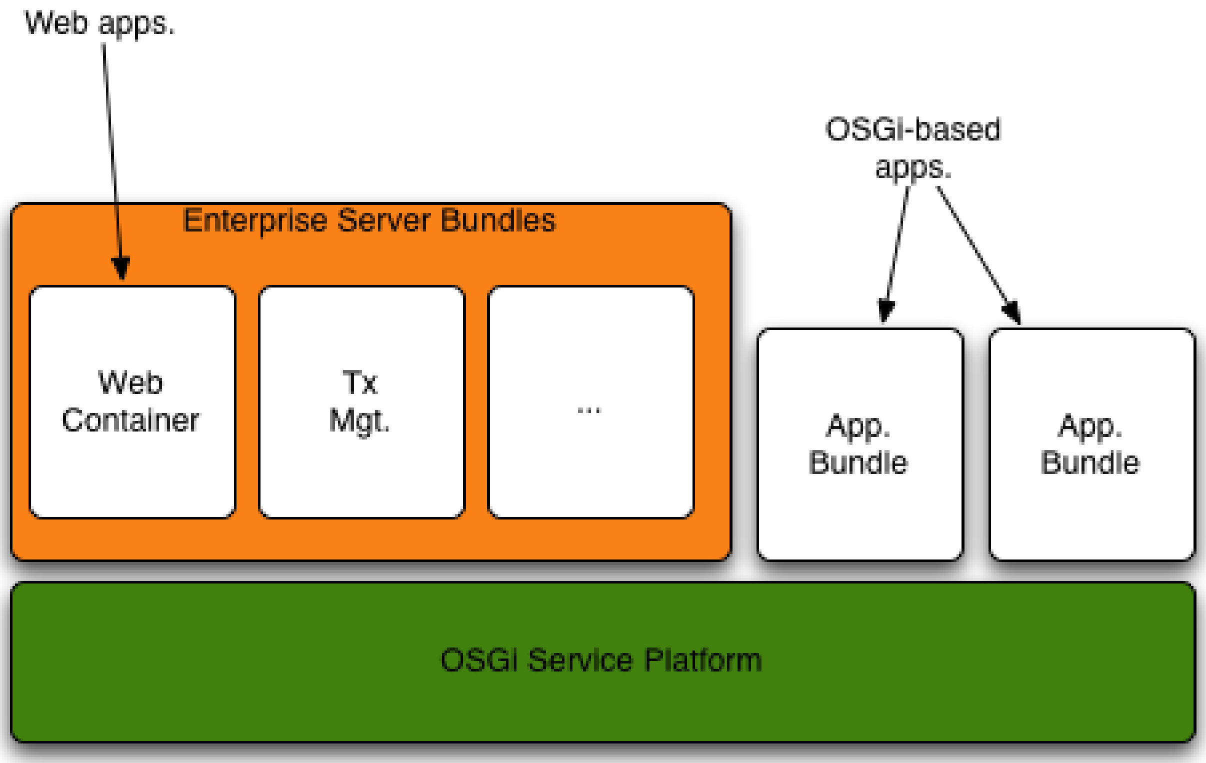
- **Server-side Applications**
- RCP Applications
- Summary

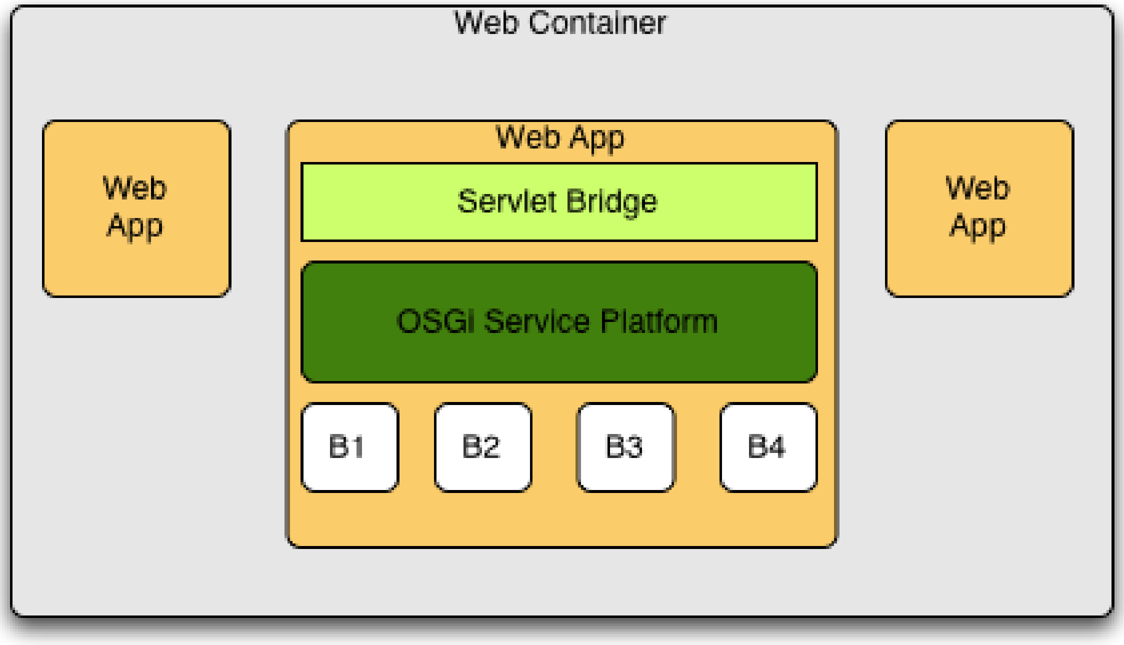
## Server-side Applications

- Options for using OSGi on the server-side
- Enterprise library "gotchas"
- Context class loader management
- Petclinic application

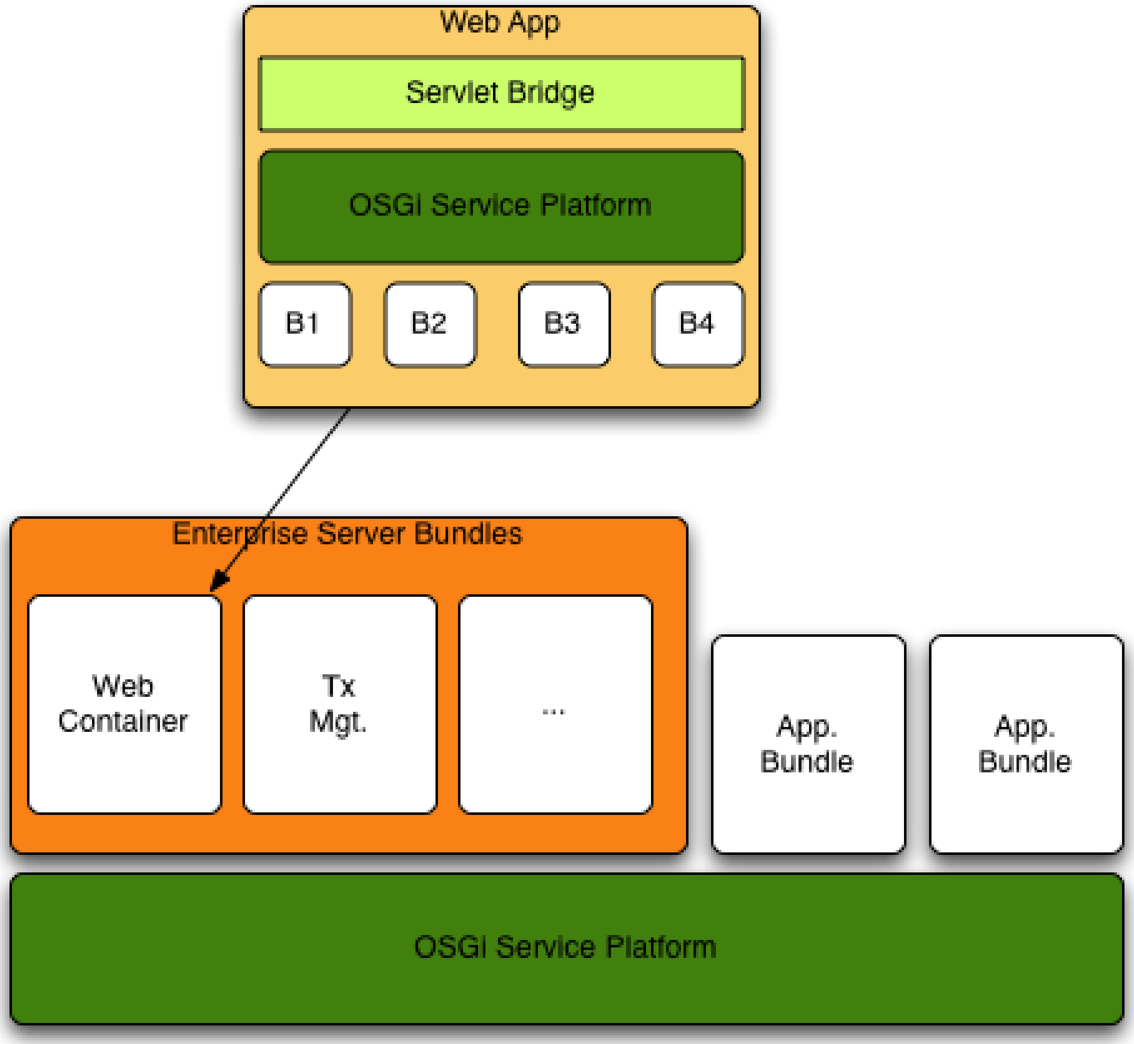
## OSGi as a server platform



# Embedded OSGi



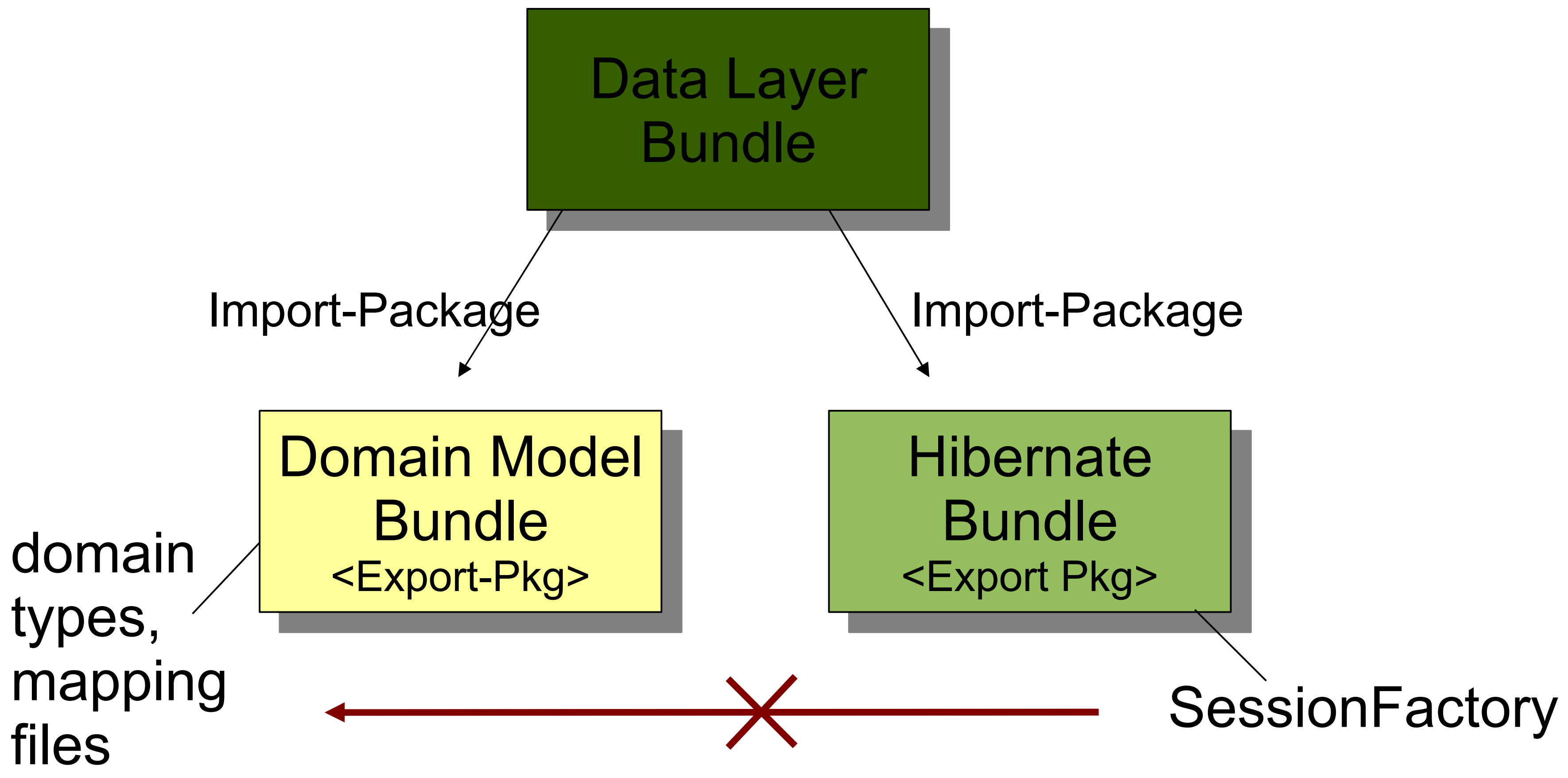
## Nested OSGi


Web App
Servlet Bridge
OSGi Service Platform
B1
B2
B3
B4
Enterprise Server Bundles
Web Container
Tx Mgt.
...
App. Bundle
App. Bundle
OSGi Service Platform

## Enterprise Libraries under OSGi

- class and resource-loading problems
  - class visibility
  - Class.forName
  - context class loader
- Good news: Spring 2.5 is OSGi-ready
  - modules shipped as bundles
  - all class loading behaves correctly under OSGi

## Example: Class visibility

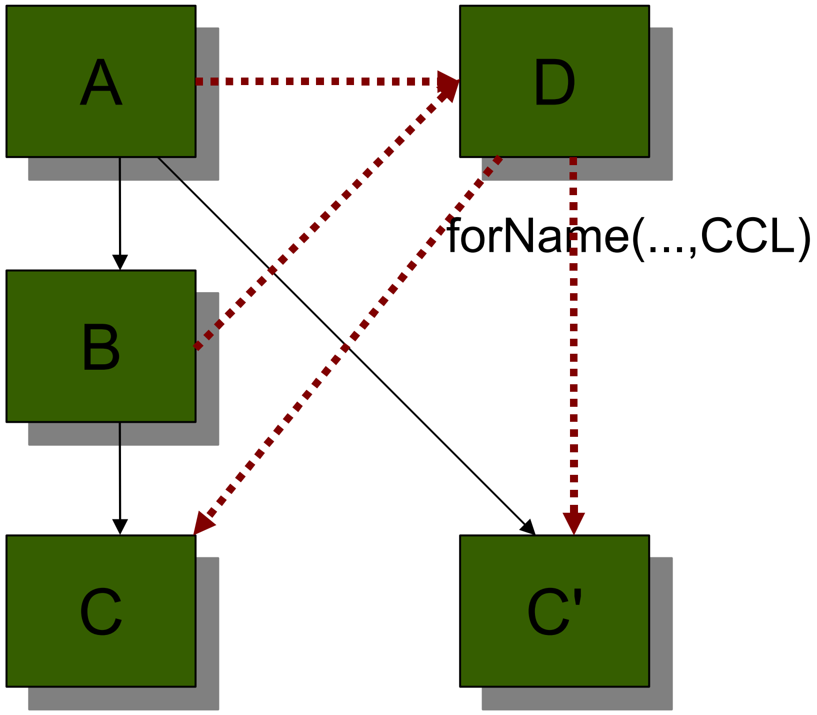

Data Layer Bundle
Import-Package
Import-Package
Domain Model Bundle <Export-Pkg>
Hibernate Bundle <Export Pkg>
domain types, mapping files
SessionFactory

## Class visibility solutions

- Dynamic-ImportPackage
  - a last resort, too broad a scope
  - does not affect module resolution
- Equinox Buddy Policy
  - In Hibernate bundle manifest:
    - Eclipse-BuddyPolicy : registered
  - In domain model bundle manifest:
    - Eclipse-RegisterBuddy : org.hibernate
    - Import-Package: org.hibernate
- Attach a Fragment Bundle
  - ◆ With required Import-Package headers

## Class.forName

- Caches the returned class in the initiating class loader
  - native, vm-level cache
- Can cause class loading errors
- Prefer ClassLoader.loadClass



## Context Class Loader

- Heavily used in enterprise Java
- Expected to have visibility of application types + classpath
- ContextClassLoader is undefined in OSGi!
  - No notion of “context”; No notion of “application”
- Solutions:
  - Eclipse Equinox: Context Finder
  - Spring Dynamic Modules : CCL management

## Context ClassLoader Management

- Context ClassLoader guaranteed to have visibility of bundle classpath when the module context for a bundle is created
- Control CCL on service invocation:
  - client-side (attribute of reference element)
    - context-class-loader=”client|service-provider|**unmanaged**”
  - service-side (attribute of service element)
    - context-class-loader=”service-provider|**unmanaged**”

## Web Applications

- OSGi HttpService (Servlet 2.1 - 1998)
  - registerServlets and resources under aliases
  - programmatic configuration
- Equinox Http Registry bundle
  - register servlets and resources using eclipse extension registry
- OPS4J
  - (http://wiki.ops4j.org/confluence/display/ops4j/Pax)
  - Pax Web (Servlet 2.5, based on Jetty)
  - Pax Web Extender – War
- Focus of Spring Dynamic Modules v1.1

## Extension Registry

```xml
<plugin>

  <extension point="org.eclipse.equinox.http.registry.resources">
    <resource
      alias="/files"
      base-name="/web_files"/>
  </extension>

  <extension point="org.eclipse.equinox.http.registry.servlets">
    <servlet
      alias="/test"
      class="com.example.servlet.MyServlet"/>
  </extension>

</plugin>
```

## Case Study: Petclinic

## Petclinic under OSGi

- Spring Framework 2.5 petclinic sample
- Database: hsqldb
- Persistence: JPA (Toplink Essentials)
- Middle-tier
  - context:load-time weaving
- Web-tier: JSP, Spring-MVC
  - annotation-driven approach
- Web container: Jetty

## Bundles

- database bundle
  - starts hsqldb
  - exports DataSource
- application bundle
  - exports Clinic
  - uses JPA, load-time weaving
- web bundle
  - registers DispatcherServlet

## Demo: db layer

```
<bean id="dataSource" class=
   "org.springframework.jdbc.datasource.DriverManagerDataSource"
   depends-on="hsqldb">
  <property name="driverClassName" value="org.hsqldb.jdbcDriver"/>
  <property name="url" value="jdbc:hsqldb:hsql://localhost:9001"/>
  <property name="username" value="sa"/>
  <property name="password" value=""/>
</bean>

<!--  expose the data source for other modules to use -->
<osgi:service ref="dataSource" interface="javax.sql.DataSource"/>
```

## Demo: middle-tier

```
<!--  pull in dataSource from db bundle -->
<osgi:reference id="dataSource" interface="javax.sql.DataSource"/>

<!-- JPA EntityManagerFactory -->
<bean id="entityManagerFactory" class=
      "org.springframework.orm.jpa.LocalContainerEntityManagerFactoryBean"
      p:dataSource-ref="dataSource">
  <property name="jpaVendorAdapter">
    <bean class="org.springframework.orm.jpa.vendor.TopLinkJpaVendorAdapter"
       p:databasePlatform="${jpa.databasePlatform}"
       p:showSql="${jpa.showSql}"/>
  </property>
  <property name="persistenceXmlLocation"
           value="classpath:org/springframework/.../jpa/persistence.xml"/>
</bean>

...
```

## JPA class-visibility

- TopLink entity manager bundle can't see the Petclinic types

- In petclinic bundle:
  - `Eclipse-RegisterBuddy: oracle.toplink.essentials`
- In TopLink Essentials bundle:
  - `Eclipse-BuddyPolicy: registered`

## Import what you Export

- IncompatibleClassChangeError
  - TopLink Essentials bundles javax.persistence inside its jar
- Version seen by TopLink classes different to version used by Petclinic bundle

- Solution: (in TopLink Bundle)
  - `Import-Package: javax.persistence, javax.persistence.spi`

## Load-time weaving agent

- TopLink needs instrumentation agent

```
<!--
Activates a load-time weaver for the context. Any bean within the context that
implements LoadTimeWeaverAware (such as LocalContainerEntityManagerFactoryBean)
will receive a reference to the autodetected load-time weaver.
-->
<context:load-time-weaver/>
```

- -javaagent:spring-agent.jar
- Must configure Eclipse to delegate to application classpath first

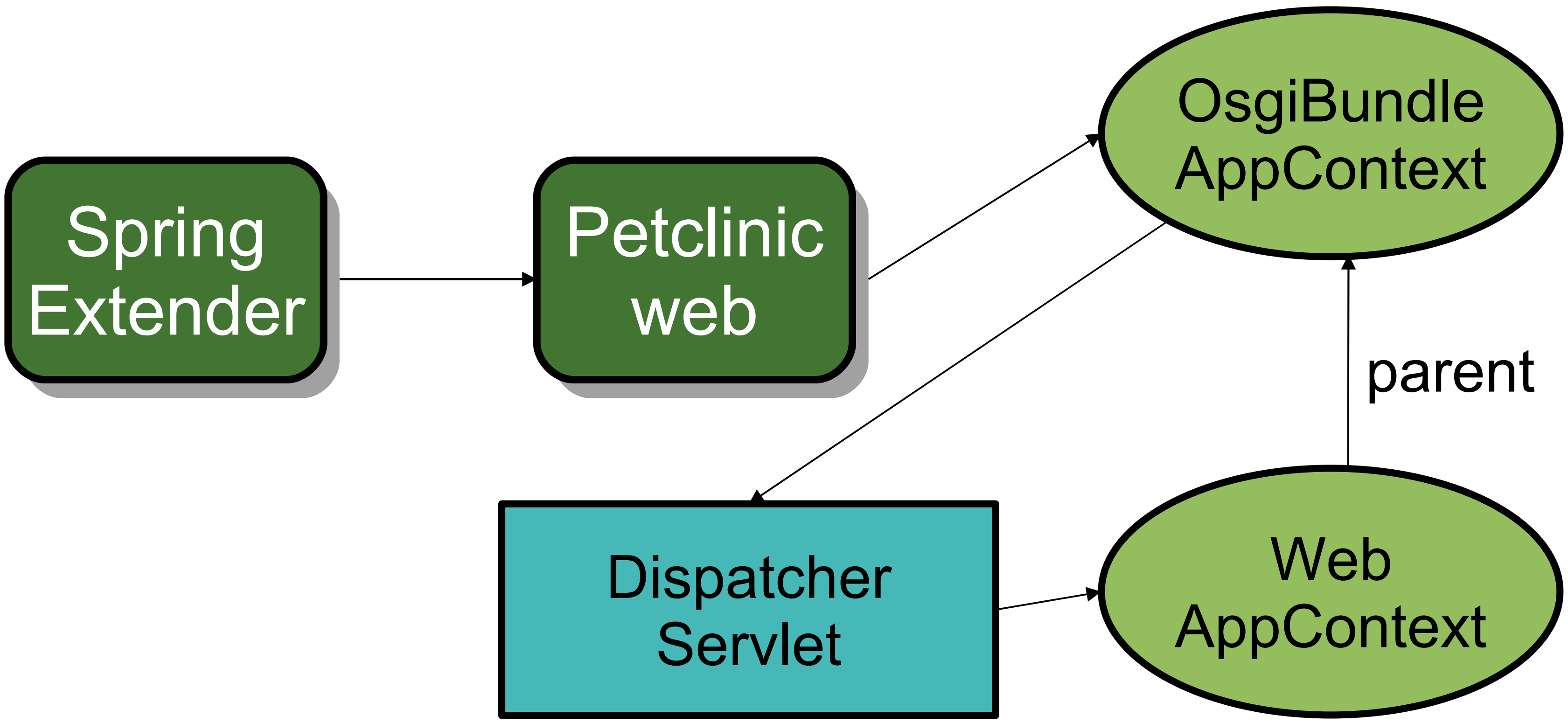
## Demo: web-tier

```
<osgi:reference id="clinic"
  interface="org.springframework.samples.petclinic.Clinic"/>

<osgi:reference id="httpService" interface="org.osgi.service.http.HttpService"/>

<bean id="servletRegistration"
   class="org.springframework...registration.ServletRegistration"
   init-method="register" destroy-method="unregister">
  <property name="httpService" ref="httpService"/>
  <property name="alias" value="petclinic"/>
  <property name="jspLocation" value="/WEB-INF/jsp"/>
  <property name="resourceAliases">
    <map>
      <entry key="images" value="/WEB-INF/images"/>
      <entry key="styles" value="/WEB-INF/styles"/>
      <entry key="html" value="/WEB-INF/html"/>
      <entry key="docs" value="/WEB-INF/docs"/>
    </map>
  </property>
</bean>
```

## Web application context



## Supporting JSPs

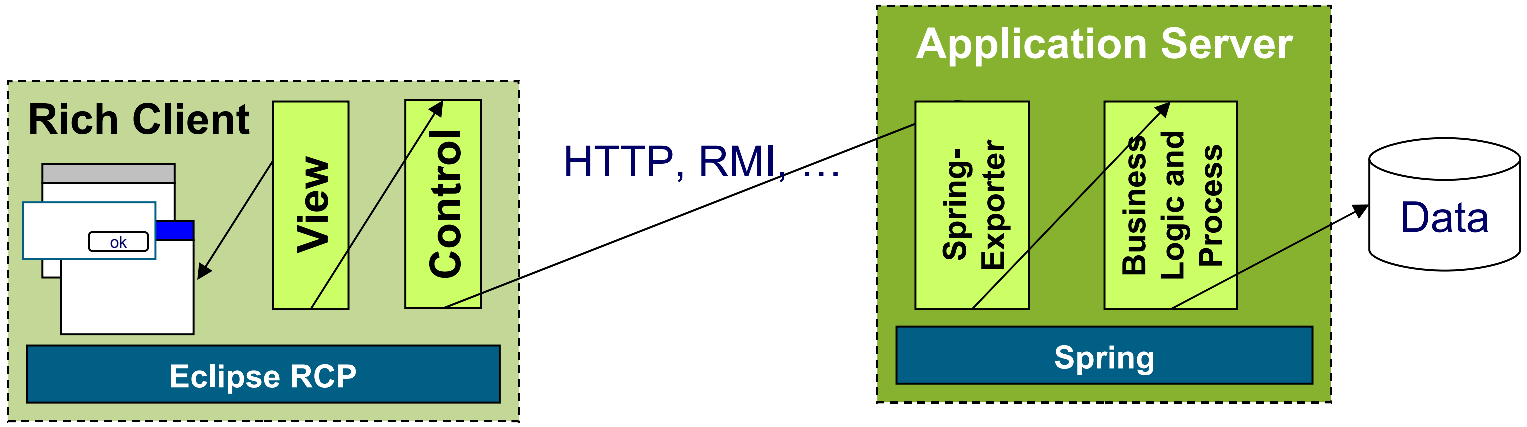
- Register JasperServlet with HttpService
- Bundles:
  - org.eclipse.equinox.jsp.jasper
  - org.apache.jasper
  - org.apache.commons.el
  - java.servlet.jsp

## Agenda

- What is Spring Dynamic Modules?
- Spring Dynamic Modules in Action
- Server-side Applications
- **RCP Applications**
- Summary

## Pure RCP Client for a Spring Backend

- Server provides REST/SOAP services, client consumes via HTTP
- Server provides services via RMI, client consumes via RMI



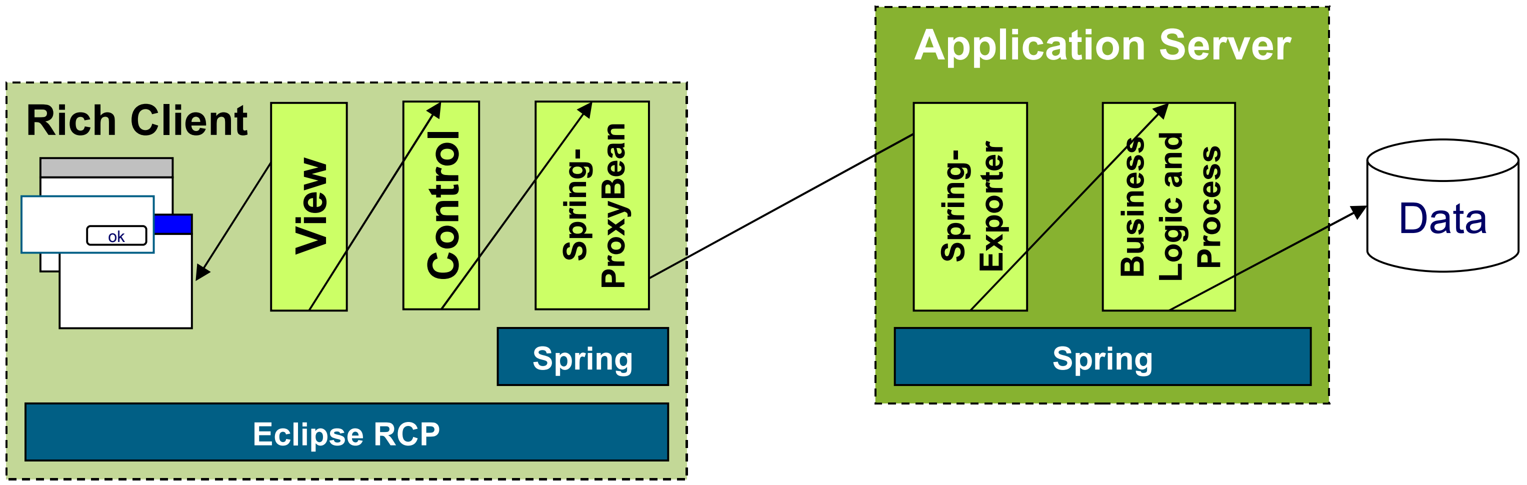
## Evaluation

+ Unrestricted usage of Spring on the server
+ Unrestricted usage of RCP on the client

– Different deployment and programming models (OSGi bundles on the client, typical WAR/EAR files on the server)
    - Good for highly decoupled systems
    - Difficult for more integrated systems

## RCP & Spring on the Client, Spring Backend

- Uses Spring/Remoting for remote communication
- With all the possible variations (RMI, HTTPInvoker, Hessian, Burlap, etc.)



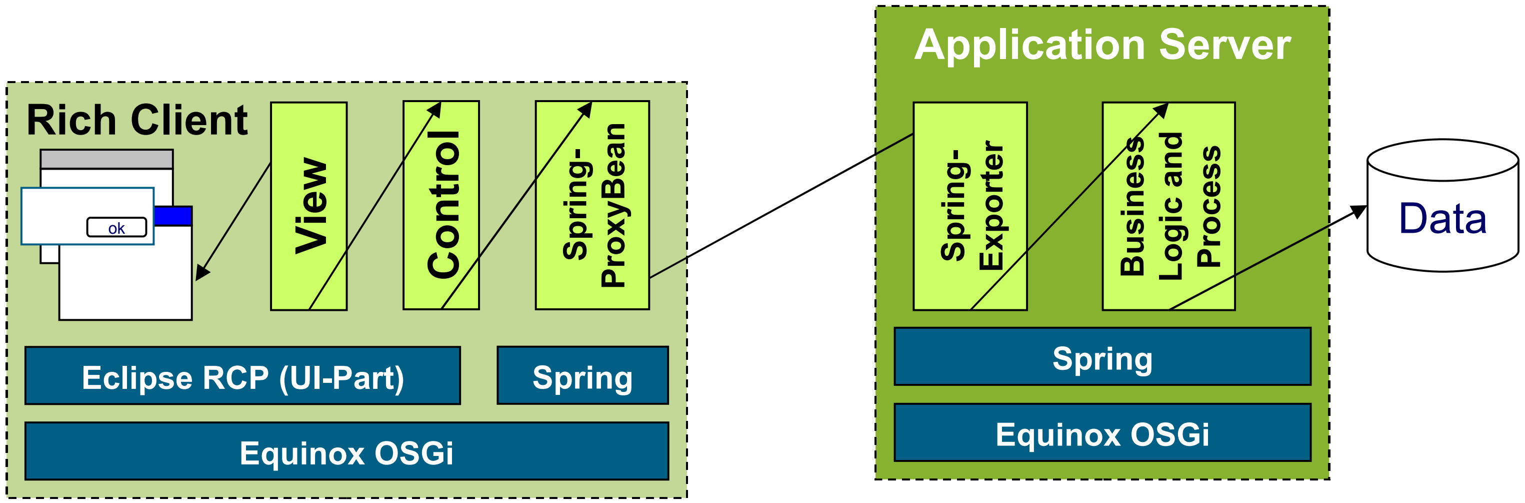
## Evaluation

+ Unrestricted usage of Spring on the client **and** the server
+ Unrestricted usage of RCP on the client
+ Easy remote communication via Spring/Remoting

– Still different deployment and programming models (OSGi bundles on the client, typical WAR/EAR files on the server)
  - Although most likely classes are shared between client and server

## Spring & OSGi everywhere

- Equinox/OSGi can be used to implement middle-tiers
  - Same component model on both sides
  - Same extensibility for both sides
- Client and server shares components



## Evaluation

- ✚ Full OSGi power on client and server
- ✚ Full Spring power on client and server
- ✚ Homogeneous programming model for client and server

## More Spring on the Rich Client

- Dependency injection and all other technology abstractions usable as well
  - Just straight forward using Spring Dynamic Modules
- How to incorporate this with the Extension-Registry?
  - For example, inject dependencies into views and editors?

## Alternative 1: Views with dependencies

- Define the View in the Spring context
  - Using Spring for dependency injection
- Define the Extension using an extension factory
  - Which delegates the creation to the Spring context

+ Dependency injection for general extensions

– Cumbersome manual programming for each extension

## Alternative 2: Auto wiring

- Define the View in the Spring context
  - Using Spring for dependency injection
- Add a call to the auto wiring factory from the views constructor

+ Dependency injection for general extensions

– Still some manual extra code for each extension

## Alternative 3: @Configurable

- Define the View in the Spring context
  - Using Spring for dependency injection
- Add the @Configurable annotation to the view implementation

+ Dependency injection for general extensions
+ No additional code necessary
– Does not work out of the box
– Adds load-time weaving overhead

## Summary

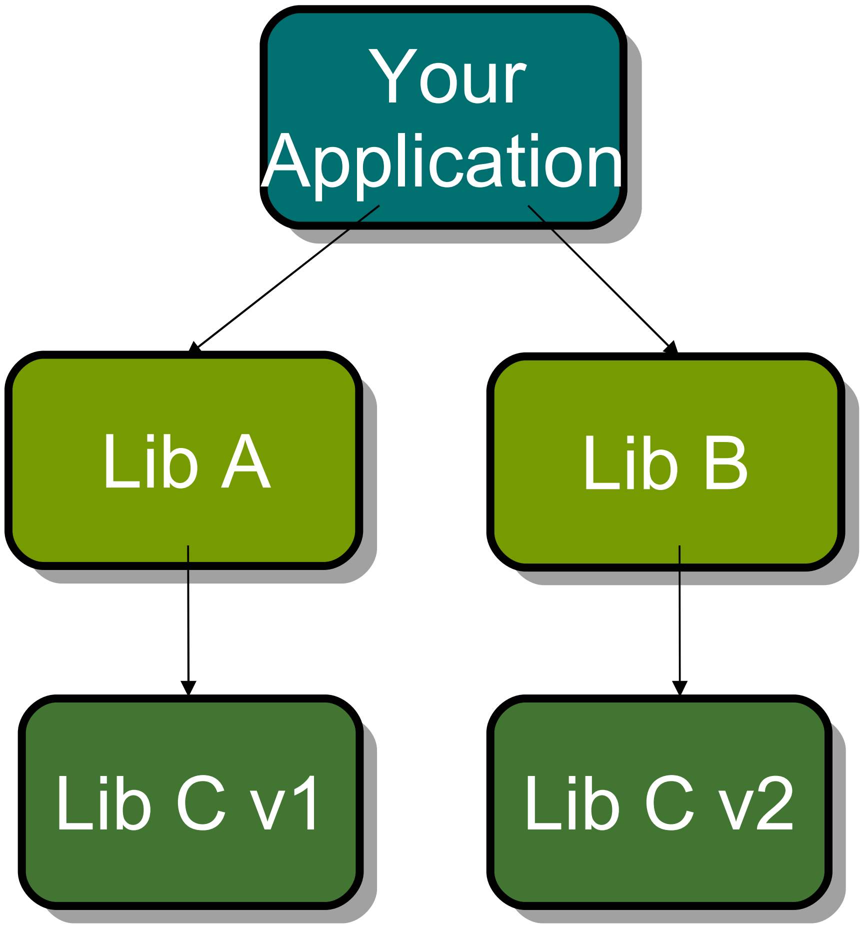
## Summary

- Spring Dynamic Modules brings the familiar Spring model to the OSGi platform
- Associates module context with a bundle
- Import and export of services with management of dynamics
- A new approach for constructing enterprise applications
- ... and Rich Client Platform applications

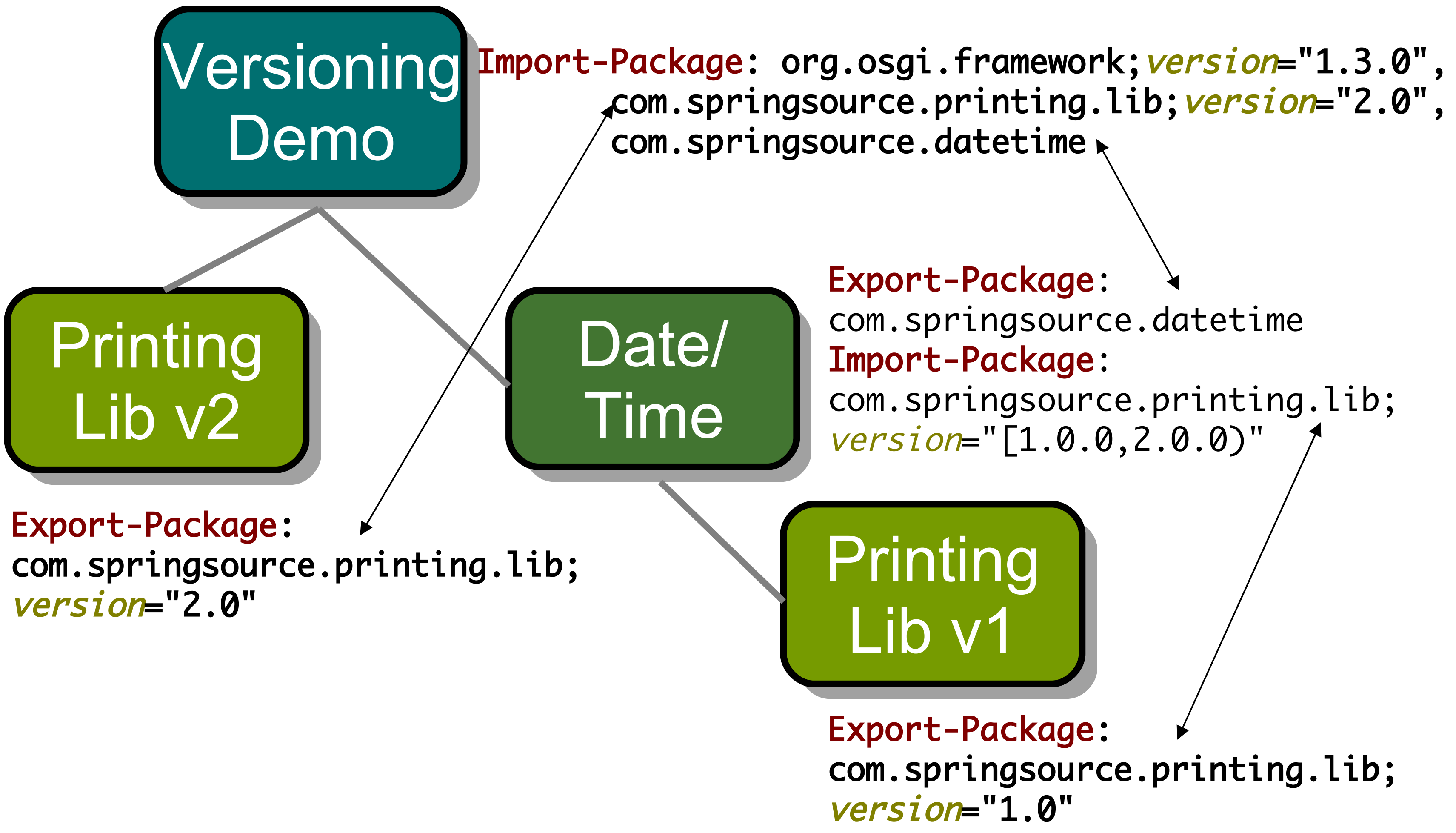
## Backup Materials

## Versioning

- Packages are imported
  - optionally with version information
- Can have multiple versions of same package concurrently



# Try it: versioning



```
Import-Package: org.osgi.framework;version="1.3.0",
         com.springsource.printing.lib;version="2.0",
         com.springsource.datetime
```

```
Export-Package:
com.springsource.datetime
Import-Package:
com.springsource.printing.lib;
version="[1.0.0,2.0.0)"
```

```
Export-Package:
com.springsource.printing.lib;
version="2.0"
```

```
Export-Package:
com.springsource.printing.lib;
version="1.0"
```

## Compendium Services

- supported by the “osgix” namespace
- currently only Configuration Admin service

```
<osgix:property-placeholder id="osgi-props"
        persistent-id="com.springsource.osgi.print"/>

<bean id="printService" ... >
  <property name="queueSize" value="${queue.size}"/>
</bean>
```

- Support will be extended in future releases