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Preface

Susan Kerschbaumer
2009

Winter slumbering in the open air,
Wears on his smiling face a dream of Spring!

—Samuel Taylor Coleridge

The Spring framework is aptly named – in many ways Spring ushers in a new season for Java programming, and brings a sense of renewal to Java's roots in portability and object oriented concepts. Spring evolved from the needs of the J2EE community at a particular moment in time. In the process it has become a much broader tool in the drive toward more modular, portable, and now, aspect oriented, programming. If you are a Java programmer and have access to a JVM, you can leverage any part of Spring to begin to build applications that are easier to code, easier to test, and easier to manage. This book will show you how.

1 Spring: Evolution Over Intelligent Design

One of the reasons that Spring has become so popular and so usable is the simple fact that it is evolving. Yes, there was some intelligent design involved at its inception (thanks to Spring's creator Rod Johnson). But what started out as a good idea to help address some very specific problems for J2EE developers became a conversation, a dialog with the developer community. This conversation has helped to shape the direction of this thing we call Spring.

Programmers are linguists. We make up words, assemble grammars, and use them to express concepts both abstract and concrete. The evolution of programming languages and technologies, Spring included, has been inspired and conducted by the people that use them. And just as in every language, usage dictates meaning.

From procedural, to object oriented, and to the newer linguistics of aspect oriented programming, the way we think about coding is eternally evolving alongside the languages and technologies we use. Spring evolved from within a context of needed change in Java programming environments. Not only has Spring popularized some core best practices in Java development, it is now influencing the evolution of Java itself.

2 A Little History

The Spring framework began as one programmer's need to solve a set of problems that Sun had tried to solve through edict in the Enterprise JavaBeans (EJB) Specification. At the time, companies were putting a lot of money and effort into developing web applications. The lack of established industry standards made management nervous, and development, haphazard. The J2EE specification promised scalability, security, high availability. Enterprise JavaBeans (EJB), as part of the J2EE suite of specifications from Sun, were intended to be as reusable and portable as their non-enterprise counterparts, plain JavaBeans.

When the final draft of the first EJB specification was released in 1998, Java web programmers looked to it as the golden child of enterprise web development.

But what they found was that the many interfaces and configuration files required to create an EJB were awkward, tedious, and prone to error. The EJBs' marriage to the container made unit testing close to impossible. And applications became heavy in the bulk of extra container features.
Since then, certain IDEs and EJB 3.0 have addressed some of these issues, but to many application developers, it's too little, too late.

The reality is that while Java and your business needs are here to stay, everything in between is likely to change, and change often. This takes us back to Java's early notion of portability (“compile once, run everywhere”) - portability is important because in today's programming environment, hardware, operating systems, IDEs, and containers, rapidly change.

Spring provides a POJO (Plain Old Java Object) based configuration environment, a container to manage the instantiation and lifecycle of your POJO components, and a framework to help you put into place some established best practices for your applications. The idea behind Spring is that your code should be well-factored, and components, kept pristine. Your components should run with or without a container, and be testable with minimal to no intrusion from outside classes. In essence, your components should have a life outside of the framework.

And as complete entities unto the themselves, these truly modular components should have a loose affiliation with other components but should not be bogged down in these dependencies. Component factoring in this way has become central to object oriented programming.

While helping you make your code more truly object oriented, Spring introduces you to two new grammars in the world of application development – the Inversion of Control (IoC) container and Aspect Oriented Programming (AOP). Both of these concepts arose naturally from the needs of developers to improve maintainability, productivity, portability, and design.

Spring also provides practical and modular solutions to JDBC connectivity and transaction management. These solutions offer a superset of the traditional JDBC and JTA offered in J2EE containers. The modular design of these aspects of Spring also allow you to leverage these pieces outside of the context of Spring's container.

And this is the beauty of Spring. Spring provides all of these features and tools, and more, in a non-intrusive framework. Spring is a container, but it is also a set of utilities which can be used outside of the container. And in keeping with the idea of portability, the authors of Spring have taken into account where your applications might be today (tangled up in EJB interfaces, or RMI services, for example), and have provided means to port your existing code as simply as possible.

### 3 Goals of This Book

Spring was not developed in a boardroom and as a result it has a vibrant and sometimes confusing context. This book will first introduce you to the core concepts behind Spring and how Spring will make your life easier (and more interesting!). Spring is built around a few key patterns and some relatively new concepts in Java programming. In this book after the introduction, each article will be based on a working example available from the Spring by Example Subversion repository [http://svn.springbyexample.org/].

While Spring evolved out of the J2EE realm, in keeping with the idea that Java components should not be tied to a particular architecture, we only require that you have some knowledge of Java and XML in order to understand and make use of most of this book. Although more advanced examples may require some additional knowledge to understand the example fully, but there are references at the end of each example to read more about the subject covered.

### 4 A Note about Format
New terms appear in **bold italics** the first time they are defined or described. **Buzzwords**, or keywords that have already been defined but that are important to a concept being explained may then appear in *italics*. Direct references to coding examples in the text of the book (methods, classnames, etc), and the coding examples themselves, are displayed in **courier font**, otherwise known as That Typewriter Typeface (TTT). Incidentally, there are a lot of acronyms in this book and some of them may be new to you. Generally if the acronym is the most common way to refer to a particular term, we will use the term, followed by the acronym, the first time it is mentioned in a section. The acronym will be used for the remainder of the section.
Part I. Spring Introduction

Basic introduction to Inversion of Control (IoC), Dependency Injection (DI), and the Spring Framework.
Spring In Context: Core Concepts

Susan Kerschbaumer
David Winterfeldt
2009

...The architecture that actually predominates in practice has yet to be discussed: the BIG BALL OF MUD...A BIG BALL OF MUD is haphazardly structured, sprawling, sloppy, duct-tape and bailingwire, spaghetti code jungle...Why is this architecture so popular?...Can we avoid this? Should we? How can we make such systems better?

— Big Ball of Mud, by Brian Foote and Joseph Yoder

Everyone knows the Big Ball of Mud. You've either written it (accidentally of course), you've had to read it, or you've had to refactor it. The Big Ball of Mud is disorganized, unwieldy code -- it blossomed in the late 1990's when the dotcom boom was in full force and there was great demand for fast application development, technology personnel was constantly in flux, and core technologies were changing regularly in order to accommodate issues of scalability.

Today the Big Ball of Mud behaves more like The Blob\textsuperscript{1}, growing larger as it consumes more application functionality, and threatening to swallow up good coding practices everywhere. Disorganized and poorly factored applications can be disastrous -- wasteful, expensive, and miserable to work with. Sometimes The Big Ball of Mud is so unwieldy it can't be worked with at all.

Fortunately, as web applications began to standardize on J2EE platforms (now known, and from here on referred to, as Java EE), design patterns for Java EE began to take shape (http://java.sun.com/blueprints/patterns). Frameworks such as Struts and Avalon gave more formal structure to web applications, and best practices began to emerge from, and inform, these frameworks. Spring's framework expanded on the concepts introduced in Struts and Avalon, adding its own twist in the form of its extremely lightweight Inversion of Control (IoC) container. Spring is different from other frameworks in that it can be used with virtually any Java component, including POJOs (Plain Old Java Objects), and can be leveraged in small pieces.

This chapter is about the Big Picture. We will explore the core concepts behind Spring and what it brings to Java EE Object Oriented methodologies. We'll also briefly summarize some of the other features of Spring that exist outside of the IoC container and illustrate how these features fit together, and tease apart.

What makes a framework, work?

A framework is essentially a skeleton, a structure around which the fleshing out of your application occurs. Frameworks tend to be built around a design pattern and consist of frozen spots -- structural components which are unmodified by the developer -- and hot spots, the pieces that an application developer contributes\textsuperscript{2}. In Spring, the

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\textsuperscript{1} A 1950's horror film featuring the big screen debut of Steve McQueen. The film stars an ever-growing, all-consuming amoeba-like monster that terrorizes a small Pennsylvania town.

---
hot spots are developer-contributed POJOs which are configured to run within the framework.

In this chapter we'll explore the context of Spring's most important component – the IoC container – and how Spring can lead you to better Object Oriented programming and eventually to new possibilities with Aspect Oriented Programming. The Spring framework can't make bad code good, but it can enforce good coding practices that make it easier for you and your fellow developers to cooperate in writing well-factored, reusable, readable, and manageable application components.

1. **Spring and Inversion of Control**

There is a lot of confusion about the definition of the IoC container – some equate it with a design pattern called Dependency Injection – but in reality IoC is much larger than dependency injection. The Spring IoC container enforces dependency injection in its various forms and employs a number of established design patterns to achieve this.

The main idea behind Inversion of Control as a concept is that component dependencies, lifecycle events, and configuration reside outside of the components themselves, and in the case of Spring, in the framework. This may sound a bit like giving up too much control, but in fact it can make your code more manageable, more testable, and more portable.

Before we discuss the Spring IoC container in detail, it's important to understand on the most basic level what the dependency injection pattern is and how it emerged in object oriented programming methodology. Spring's Inversion of Control framework is based on some best practice patterns – aspects of Spring IoC resemble and include the Factory and Observer patterns, and its most prominent feature is its implementation of a framework which enforces use of the dependency injection pattern.

**Dependency Inversion: Precursor to Dependency Injection**

The first reference to what would eventually become Dependency Injection appeared in 1994 in a paper by Robert C. Martin called “The Dependency Inversion Principle”.

In “The Dependency Inversion Principle” (or DIP), the author states the three defining factors of “bad code”:

1. It is hard to change because every change affects too many other parts of the system (Rigidity)
2. When you make a change, unexpected parts of the system break (Fragility)
3. It is hard to reuse in another application because it cannot be disentangled from the current application (Immobility)  

According to Martin, interdependency causes these coding problems (we'll call them RFI for Rigidity, Fragility, and Immobility). To fix RFI issues in your OO code, DIP has two basic rules:

1. **High level modules should not depend upon low level modules, both should depend upon abstractions.**

In other words, high level modules – which contain your business logic and all of the important meat of your

---

3 *The Dependency Inversion Principle*, Martin, Robert C., © 1994
application – should not depend on lower level components. The reason for this is if these lower level components were to change, the changes might affect the higher level components as well. This is the defining concept behind dependency inversion, that the prevailing wisdom of having higher-level modules dependent on lower-level modules is in fact a bad idea.

2. Abstractions should not depend upon details, details should depend upon abstractions.

This is another way to say that before you begin coding to the abstraction – the interface or abstract class -- you should find the common behaviors in the code and work backwards. Your interface /abstraction should cater to the intersection between the needs of your business logic and the common behaviors of the lower level modules. You should also leave the details of how these behaviors are implemented to the implementation classes.

This simple example of a voting booth program shows a non-DIP compliant program.

```java
package org.springbyexample.vote;

public class VotingBooth {
    VoteRecorder voteRecorder = new VoteRecorder();

    public void vote(Candidate candidate) {
        voteRecorder.record(candidate);
    }

    class VoteRecorder {
        Map hVotes = new HashMap();

        public void record(Candidate candidate) {
            int count = 0;
            if (!hVotes.containsKey(candidate)) {
                hVotes.put(candidate, count);
            } else {
                count = hVotes.get(candidate);
            }

            count++;
            hVotes.put(candidate, count);
        }
    }
}
```

1. This increments the `count` variable.
2. Add candidate and votes to `Map`.

In this example, the `VotingBooth` class is directly dependent on `VoteRecorder`, which has no abstractions and is the implementing class.

A dependency “inverted” version of this code might look a little different. First, we would define our `VoteRecorder` interface.
package org.springbyexample.vote;
public interface VoteRecorder {
    public void record(Candidate candidate);
}

And our implementing classes.

The `LocalVoteRecorder`, which implements the `VoteRecorder` interface:

```java
package org.springbyexample.vote;
public class LocalVoteRecorder implements VoteRecorder {
    Map<String, Integer> votes = new HashMap<>();
    public void record(Candidate candidate) {
        int count = votes.containsKey(candidate) ? votes.get(candidate) : 0;
        if (count == 0) {
            votes.put(candidate, count);
        } else {
            count = votes.get(candidate) + 1;
            votes.put(candidate, count);
        }
    }
}
```

And the `VotingBooth` class:

```java
package org.springbyexample.vote;
public class VotingBooth {
    VoteRecorder recorder = null;
    public void setVoteRecorder(VoteRecorder recorder) {
        this.recorder = recorder;
    }
    public void vote(Candidate candidate) {
        recorder.record(candidate);
    }
}
```
Now the LocalVoteRecorder class – the implementing class of the VoteRecorder interface -- is completely decoupled from the VotingBooth class. We have removed all hard-coded references to lower level classes. According to the rules of DIP, this is all we need to do in order to rid our code of RFI.

However, there is one problem with this implementation. We don’t have a main method. We definitely need one in order to run our application, and somewhere in this main method we will need to instantiate the LocalVoteRecorder.

By instantiating the LocalVoteRecorder in our main method, we would break Rule #1 of Dependency Inversion. We have coded to the abstraction, we have integrated our changes, but our application would still have a dependency on a lower level class.

2. Dependency Injection To The Rescue

Dependency Injection takes the level of decoupling that began with the Dependency Inversion Principle one step further. Dependency injection has the concept of an assembler – or what in Java is commonly referred to as a Factory -- that instantiates the objects required by an application and “injects” them into their dependent objects.

In the case of a dependency injection-informed framework such as Spring, components are coded to interfaces, just as in the DIP example above. But now the IoC container manages the instantiation, management, and class casting of the implemented objects so that the application doesn't have to. This removes any true dependencies on low-level implemented classes.

There are three types of Dependency Injection employed by IoC container providers.

<table>
<thead>
<tr>
<th>DI Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructor Injection</td>
<td>The constructor arguments are injected during instance instantiation.</td>
</tr>
<tr>
<td>Setter Injection</td>
<td>This is the most favored method of dependency injection in Spring. Dependencies are “set” in the objects through setter methods defined in a Spring configuration file.</td>
</tr>
<tr>
<td>Interface Injection</td>
<td>This is not implemented in Spring currently, but by Avalon. It’s a different type of DI that involves mapping items to inject to specific interfaces.</td>
</tr>
</tbody>
</table>

Spring uses the concept of a BeanFactory as its assembler, and it is the BeanFactory that manages the JavaBeans you have configured to run within it. In the next section we will discuss Spring's IoC container and how it makes use of dependency injection patterns to make your code, well, RFI-free, and just better.

---

4 Martin Fowler, Inversion of Control Containers and The Dependency Injection Pattern
3. Bean management through IoC

Through its factory, Spring's IoC container manages the objects that it is configured to instantiate. Spring's management of the container objects adds flexibility and control to your application, and provides a central place of configuration management for your Plain Old Java Objects.

For example, through Spring IoC you can configure the number of instances of the component – whether the component is a singleton or not – and at what point the component is created and destroyed in memory. In Spring, the initialization of a bean by the framework is exactly equivalent to using the `new` keyword to instantiate an object in Java code. Once the framework has instantiated the object, it manages the scope of the bean, based on its configuration.

Because the IoC container is managing the beans, JNDI lookups that are typical in Java EE containers are no longer required, leaving your code container-agnostic and easier to unit test both inside and outside of the framework. And while you are coding to interfaces as part of good OO practice, Spring allows you to manage what implementations are used by leveraging dependency injection, resulting in cleaner, decoupled components.

The IoC container can also be configured to receive instantiation and destruction callback events for a particular bean. Certain components such as a database connection pool obviously need to be initialized and destroyed when the application is shutdown. Instead of using your custom code, Spring can manage these lifecycle events.

4. Our Example In Spring IoC

So how would we configure our simple voting counter example for the Spring IoC container?

We can use our code exactly as is. All we need to do is inform Spring through an XML configuration file that the `recorder` bean is implemented by the `LocalVoteRecorder` class. We do this with the following line:

```xml
<bean id="recorder" class="com.springindepth.LocalVoteRecorder" />
```

Then we simply map the `recorder` bean to the `VotingBooth` bean by setter injection in that bean's definition.

```xml
<bean id="votingBooth" class="com.springindepth.VotingBooth">
  <property name="voteRecorder" ref="recorder"/>
</bean>
```

Spring works its magic to handle class instantiation for you, so your application code never becomes aware of the implementing classes. Now with this configuration and the Spring framework, and through dependency injection, we have finally removed the low-level component dependencies and have achieved true dependency inversion!
As we may have mentioned, the core of the Spring Framework is its Inversion of Control (Ioc) container. The IoC container manages Java objects – from instantiation to destruction – through its BeanFactory. Java components that are instantiated by the IoC container are called beans, and the IoC container manages a bean’s scope, lifecycle events, and any AOP features for which it has been configured and coded.

The IoC container enforces the dependency injection pattern for your components, leaving them loosely coupled and allowing you to code to abstractions. This chapter is a tutorial – in it we will go through the basic steps of creating a bean, configuring it for deployment in Spring, and then unit testing it.

1. Basic Bean Creation

A Spring bean in the IoC container can typically be any POJO (plain old Java object). POJOs in this context are defined simply as reusable modular components – they are complete entities unto themselves and the IoC container will resolve any dependencies they may need. Creating a Spring bean is as simple as coding your POJO and adding a bean configuration element to the Spring XML configuration file or annotating the POJO, although XML based configuration will be covered first.

To start our tutorial, we’ll use a simple POJO, a class called Message which does not have an explicit constructor, just a getMessage() and setMessage(String message) method. Message has a zero argument constructor and a default message value.

```java
public class DefaultMessage {
    private String message = "Spring is fun.";
    /**
    * Gets message.
    */
    public String getMessage() {
        return message;
    }
    /**
    * Sets message.
    */
    public void setMessage(String message) {
        this.message = message;
    }
}
```
Example 1 DefaultMessage

The bean element below indicates a bean of type Message – defined by the class attribute – with an id of 'message'. The instance of this bean will be registered in the container with this id.

An end tag for the beans element closes the document (we said it was simple!).

DefaultMessageTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                        http://www.springframework.org/schema/beans/spring-beans.xsd">
  <bean id="message" class="org.springbyexample.di.xml.DefaultMessage"/>
</beans>
```

When the container instantiates the message bean, it is equivalent to initializing an object in your code with 'new DefaultMessage()'.

2. Basic Constructor Injection

Now that we have our POJO and a basic configuration for the message bean, we can introduce our first dependency injection example. Through the Spring beans XML file you can configure your bean to initialize with an argument for the constructor, and then assign the arguments. Spring essentially “injects” the argument into your bean. This is referred to as constructor injection.

The following example passes in the String message using a constructor. The class is the same as the one in Basic Bean Creation except the default message on the message variable has been cleared and is now set to null. A single parameter constructor has been added to set a message.

```java
public class ConstructorMessage {
    private String message = null;
    /**
     * Constructor
     */
    public ConstructorMessage(String message) {
        this.message = message;
    }
    /**
     * Gets message.
     */
    public String getMessage() {
        return message;
    }
}
```
Example 2 ConstructorMessage

The configuration for this bean is exactly the same as in the previous example, but now we have a new element, the `constructor-arg`. The `constructor-arg` element injects a message into the bean using the `constructor-arg` element's value attribute.

ConstructorMessageTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
     xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd">
  <bean id="message"
       class="org.springbyexample.di.xml.ConstructorMessage">
    <constructor-arg value="Spring is fun." />
  </bean>
</beans>
```

3. Basic Setter Injection

The Spring IoC container also supports **setter injection**, which is the preferred method of dependency injection in Spring. Setter injection uses the `set*` methods in a class file to garner property names that are configurable in the `spring XML config`.

From a configuration standpoint, setter injection is easier to read because the property name being set is assigned as an attribute to the bean, along with the value being injected.

To determine the property names, Spring follows the JavaBeans Specification (http://java.sun.com/products/javabeans/docs/spec.html).

In most cases Spring will lowercase the first letter after "set" in the method name and use the rest of the method name as-is for deducing the property name. So for example if there is a `setMessage()` method in your class, the property name you would use when setting that property on a bean in the XML config is 'message'. If there is a `setFirstName()` method in your class, the property name you would use when setting the value is 'firstName'.

In cases where the letters after "set" are all uppercase, Spring will leave the property name as uppercase. So if you have `setXML()` on a class, the property name would be 'XML'.

* Sets message.
*/
public void setMessage(String message) {
    this.message = message;
}
}

Example 2 ConstructorMessage

The configuration for this bean is exactly the same as in the previous example, but now we have a new element, the `constructor-arg`. The `constructor-arg` element injects a message into the bean using the `constructor-arg` element's value attribute.

ConstructorMessageTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
     xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd">
  <bean id="message"
       class="org.springbyexample.di.xml.ConstructorMessage">
    <constructor-arg value="Spring is fun." />
  </bean>
</beans>
```

3. Basic Setter Injection

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In cases where the letters after “set” are all uppercase, Spring will leave the property name as uppercase. So if you have `setXML()` on a class, the property name would be 'XML'.

* Sets message.
*/
public void setMessage(String message) {
    this.message = message;
}
}
Because Spring uses the set method names to infer the property name, the naming of your set methods should follow the JavaBeans Spec, or at least be consistent within the confines of your application. See the example below for basic setter injection on our Message class.

```java
public class SetterMessage {
    private String message = null;

    /**
     * Gets message.
     */
    public String getMessage() {
        return message;
    }

    /**
     * Sets message.
     */
    public void setMessage(String message) {
        this.message = message;
    }
}
```

**Example 3 SetterMessage**

The `property` element is used to define the setter injection:

*SetterMessageTest-context.xml*

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd">

    <bean id="message" class="org.springbyexample.di.xml.SetterMessage">
        <property name="message" value="Spring is fun." />
    </bean>
</beans>
```

4. Reference Injection

So far we have only injected constructor and property values with static values, which is useful if you want to eliminate configuration files. Values can also be injected by reference -- one bean definition can be injected into another. To do this, you use the `constructor-arg` or `property`'s `ref` attribute instead of the `value` attribute. The `ref` attribute then refers to another bean definition's id.

In the following example, the first bean definition is a `java.lang.String` with the id `springMessage`. It is
Instantiating Spring in your application does not violate rule #1 of dependency inversion (see Spring In Context: Core Concepts) because Spring would be a higher level dependency.

ReferenceSetterMessageTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd">
    <bean id="springMessage"
        class="java.lang.String">
        <constructor-arg value="Spring is fun." />
    </bean>
    <bean id="message"
        class="org.springbyexample.di.xml.SetterMessage">
        <property name="message" ref="springMessage" />
    </bean>
</beans>
```

5. Creating a Spring Application

Spring can be used in standard applications, web applications, full Java EE applications, and other containers, the only requirement is that you run a standard JVM. Spring's resource abstraction allows you to load configuration files from wherever you'd like -- the classpath, the file system, FTP, and HTTP locations. You can also use Spring's resource abstraction for loading other files required for your application.

Once the IoC container is initialized, you can retrieve your Spring beans. By delegating as much bean creation as possible to Spring, there should only be a few key points where the application code needs to directly access the IoC container, and this is true even for legacy applications. If you're developing a web application, you may not need to directly access the IoC container at all since it will automatically handle instantiation of your controller and any beans it requires.

The lowest level implementation of the IoC container is the BeanFactory, but it is recommended to use an ApplicationContext for your application. The ApplicationContext is a subclass of the BeanFactory interface so it has all the functionality a BeanFactory has and more. Unless you are writing an application that needs an extremely small memory footprint, BeanFactory shouldn't be used directly.

There are a few different ApplicationContext implementations that can be used, which can be learned about by reading the Spring Framework's documentation and source code. For the purposes of this example, we'll use a very popular one -- ClassPathXmlApplicationContext, which defaults to reading resources from the classpath. If you need to use a different location for your classes, you can append prefixes before the configuration file's path such as 'file', 'http', etc. This will force the ApplicationContext to read from somewhere other than the default location.

The following class is a standard Java application with a main method. The first line of the main method creates a

---

1 Instantiating Spring in your application does not violate rule #1 of dependency inversion (see Spring In Context: Core Concepts) because Spring would be a higher level dependency.
ClassPathXmlApplicationContext passing in '/application-context.xml' to its constructor which is assigned to the ApplicationContext interface. In this case the configuration file is in the root of the classpath. The ApplicationContext's getBean(String beanName) method is used on the next line to retrieve the message bean from the IoC container.

```java
public class MessageRunner {
    final static Logger logger = LoggerFactory.getLogger(MessageRunner.class);

    /**
     * Main method.
     *
     * @param args
     *
     * @throws Exception
     */
    public static void main(String[] args) {
        logger.info("Initializing Spring context.");
        ApplicationContext applicationContext = new ClassPathXmlApplicationContext("/application-context.xml");
        logger.info("Spring context initialized.");
        Message message = (Message) applicationContext.getBean("message");
        logger.debug("message='" + message.getMessage() + "'");
    }
}
```

Example 4 MessageRunner

application-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
        http://www.springframework.org/schema/beans/spring-beans.xsd">
    <bean id="message" class="org.springbyexample.di.app.Message">
        <property name="message" value="Spring is fun." />
    </bean>
</beans>
```

6. Unit Test Beans from Application Context

There are two types of testing that developers typically perform before they release code into production. Functional testing is the testing you do when your application is mostly built and you want to make sure that everything works according to the functional requirements you were given.

**Unit testing** is the process by which you test each component of your application in isolation. Unit testing can be done far in advance of functional testing and code release. EJBs are difficult to unit test because it is cumbersome to
tease them apart from the container for testing. Spring makes unit testing easy because each component is intended to be an entity unto itself – callable from anywhere.

Unit testing is an important part of the development process, so important in fact that some methodologies, including Agile \(^2\), require that the unit test be written before the class that it will be testing. Certainly writing the unit test first will give you a very clear idea of the use case for your class file. But the real value in unit testing is in giving you the ability to isolate where the problems may lie in your code. This will shorten the amount of time you would need to debug your code and ultimately lead to faster time to production.

As you create your unit tests, you may organize them into test suites. There are several third party and open source products that can help you set up and conduct your unit tests. JUnit (http://www.junit.org) is the most popular unit testing framework and can be integrated with Ant, Maven, the Eclipse IDE, and others. Maven (http://maven.apache.org) is a build framework used for compiling, assembling jars, and running unit tests. All of the examples that accompany this book can be built and tested using Maven, and Eclipse plugins for Junit allow you to run your unit tests from within the IDE.

Spring also has unit testing support and it can reduce the size of your test classes if you can use them. Most unit tests are annotated with @RunWith(SpringJUnit4ClassRunner.class) and @ContextConfiguration. The @ContextConfiguration default to loading an XML configuration file from the package and name of the test plus `-context.xml`. For org.springbyexample.di.xml.SetterMessageTest, the default XML file is org/springbyexample/di/xml.SetterMessageTest-context.xml. Specific XML configuration files can be set on the annotation if the default isn’t acceptable.

The SetterMessageTest will use the Spring XML configuration file org/springbyexample/di/xml/SetterMessageTest-context.xml. The testMessage() method uses the SetterMessage injected by the test framework into the message field. The bean from the XML configuration will be injected into this field because of the @Autowired annotation which indicates the field should be autowired by type. Finally, the testMessage() method uses JUnit’s assertNotNull and assertEquals methods to check if the SetterMessage instance isn’t null, the message isn’t null, and the message is the expected value. For assertEquals the first parameter is the error message that will be shown if the test fails. The second parameter is the expected value and third parameter is the value from the message bean.

---

\(^2\) A conceptual framework that promotes development iterations throughout the lifecycle of a project.
assertEquals("Message should be \"\" + expectedMessage + ",\"", expectedMessage, msg);
logger.info("message='{}'\n
\nExample 5 SetterMessageTest

SetterMessageTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.springframework.org/schema/beans
  http://www.springframework.org/schema/beans/spring-beans.xsd">
  <bean id="message"
    class="org.springbyexample.di.xml.SetterMessage">
    <property name="message" value="Spring is fun." />
  </bean>
</beans>
```

7. Getting Started

Now that we've walked you through the creation and testing of your first Spring application, it's time to dig a little deeper into Spring. Articles and examples will cover different areas of the Spring Framework and other Spring projects. Before we do, use the following instructions to set up your Spring environment, and check out these basic DI examples.

Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```
$ svn co http://svn.springbyexample.org/core/basic-dependency-injection/tags/1.0/
basic-dependency-injection
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup
8. Reference

Related Links

- Spring 2.5.x 'The IoC Container' Documentation [http://static.springframework.org/spring/docs/2.5.x/reference/beans.html]

Project Information

- Spring Framework 2.5.x
Part II. Core

Core Spring examples.
AspectJ Load-time Weaving in Spring

David Winterfeldt

2008

This example shows using Spring with AspectJ's Load-time Weaving (LTW) to gather statistics. Spring 2.5 added support to make it easier to use AspectJ's LTW. It's also finer grained because you can activate it in specific classloaders using the new context namespace by adding this, `<context:load-time-weaver/>`, to your XML configuration. Besides adding a JVM argument and the custom namespace, the rest is standard AspectJ LTW and how to configure the AspectJ configuration file can be found on AspectJ's site.

Note

This example must be run with Java 5 or higher since support for the -javaagent JVM argument was added in Java 5. Also, Maven and Eclipse are currently configured to look for the spring-agent.jar at c:/spring-framework-2.5/dist/weaving/spring-agent.jar so you will need to edit this to match where it is actually located. This can be changed at the bottom of the Maven pom.xml or in the Eclipse Run Dialog's argument tab.

1. JVM Argument

This JVM argument needs to be set in order for Spring's context:load-time-weaver to work, although with certain classloaders this isn't necessary.

- javaagent:/path/to/jar/spring-agent.jar

2. Spring Configuration

The context:load-time-weaver registers AspectJ's Load-time Weaver to the current classloader. So, not only Spring beans will be targeted, but any class loaded in the classloader that match the defined pointcuts.

applicationContext.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xmlns:context="http://www.springframework.org/schema/context"
 xsi:schemaLocation="http://www.springframework.org/schema/beans
 http://www.springframework.org/schema/beans/spring-beans.xsd
 http://www.springframework.org/schema/context
 http://www.springframework.org/schema/context/spring-context.xsd">
  <context:load-time-weaver />
</beans>
```
3. AspectJ Configuration

For AspectJ LTW a configuration file will automatically be loaded from META-INF/aop.xml. Multiple includes or excludes can be used to target weaving, and if you wanted to include all subpackages and not just a specific package the package name could be specified as org.springframework.aspectjLoadTimeWeaving..* (notice the double periods before the asterisk). In this example, the aspect specified contains the pointcut and advice being applied.

/META-INF/aop.xml

```xml
<!DOCTYPE aspectj PUBLIC
<aspectj>
  <weaver>
    <!-- only weave classes in this package -->
    <include within="org.springframework.aspectjLoadTimeWeaving.*" />
  </weaver>
  <aspects>
    <!-- use only this aspect for weaving -->
    <aspect name="org.springframework.aspectjLoadTimeWeaving.PerformanceAdvice" />
  </aspects>
</aspectj>
```

4. Code Example

```java
@Aspect
public class PerformanceAdvice {

    @Pointcut("execution(public * org.springframework.aspectjLoadTimeWeaving..*.*(..))")
    public void aspectjLoadTimeWeavingExamples() { }

    @Around("aspectjLoadTimeWeavingExamples()")
    public Object profile(ProceedingJoinPoint pjp) throws Throwable {
        final Logger logger = LoggerFactory.getLogger(pjp.getSignature().getDeclaringType());
        StopWatch sw = new StopWatch(getClass().getSimpleName());
        try {
            sw.start(pjp.getSignature().getName());
            return pjp.proceed();
        } finally {
            sw.stop();
        }
    }
}
```
5. Reference

Related Links

- AspectJ Load-time Weaving Spring Documentation [http://static.springframework.org/spring/docs/2.5.x/reference/aop.html#aop-aj-ltw]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```
$ svn co http://svn.springbyexample.org/core/aspectj-load-time-weaving/tags/1.0/
aspectj-load-time-weaving
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
- AspectJ 1.5.x
Part III. Persistence

Persistence examples.
Simple Spring JDBC Template

David Winterfeldt

2008

A simple example using SimpleJdbcTemplate.

1. Spring Configuration

The Spring JDBC Template just needs a DataSource. This DataSource automatically initializes an HSQL DB with the schema.sql script.

```xml
<bean id="dataSource"
     class="org.springframework.jdbc.datasource.HsqldbInitializingDriverManagerDataSource">
     <property name="sqlScriptProcessor">
         <bean class="org.springframework.jdbc.core.SqlScriptProcessor">
             <property name="sqlScripts">
                 <list>
                     <value>classpath:/schema.sql</value>
                 </list>
             </property>
         </bean>
     </property>
</bean>
```

2. Code Example

Inject the DataSource into a bean and in the setter for the DataSource create a SimpleJdbcTemplate. Then the template has many methods for doing updates, queries, and deletes. The example below shows getting a List of Maps from the template.

```java
protected SimpleJdbcTemplate simpleJdbcTemplate = null;

@Autowired
public void setDataSource(final DataSource dataSource) {
    this.simpleJdbcTemplate = new SimpleJdbcTemplate(dataSource);
}

List<Map<String, Object>> lPersonMaps = simpleJdbcTemplate.queryForList("SELECT * FROM PERSON");
Map<String, Object> hPerson = lPersonMaps.get(0);
Integer id = (Integer)hPerson.get("ID");
String firstName = (String)hPerson.get("FIRST_NAME");
String lastName = (String)hPerson.get("LAST_NAME");
```
3. Reference

Related Links

- SimpleJdbcTemplate [Spring Documentation](http://static.springframework.org/spring/docs/2.5.x/reference/jdbc.html#jdbc-SimpleJdbcTemplate)

- Spring by Example JDBC HsqldbInitializingDriverManagerDataSource
Simple Hibernate XML Configuration

David Winterfeldt
2008

A simple example using Hibernate with an XML configuration to find, save, and update a record.

1. Spring Configuration

The HsqlDbInitializingDriverManagerDataSource is used to initialize the test HSQLDB database and the LocalSessionFactoryBean is using to configure Hibernate. The mappingLocations property is used to set a list of Hibernate XML mapping files. The Person DAO is configured using Hibernate's session factory.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xsi:schemaLocation="http://www.springframework.org/schema/beans
                           http://www.springframework.org/schema/beans/spring-beans.xsd">

    <bean id="dataSource" 
          class="org.springbyexample.jdbc.datasource.HsqlDbInitializingDriverManagerDataSource">
        <property name="sqlScriptProcessor">
            <bean class="org.springbyexample.jdbc.core.SqlScriptProcessor">
                <property name="sqlScripts">
                    <list>
                        <value>classpath:/schema.sql</value>
                    </list>
                </property>
            </bean>
        </property>
    </bean>

    <bean id="sessionFactory" class="org.springframework.orm.hibernate3.LocalSessionFactoryBean">
        <property name="dataSource" ref="dataSource" />
        <property name="mappingLocations">
            <list>
                <value>classpath:org/springbyexample/orm/hibernate3/bean/Person.hbm.xml</value>
            </list>
        </property>
        <property name="hibernateProperties">
            <value>
                hibernate.format_sql=true
                hibernate.dialect=org.hibernate.dialect.HSQLDialect
            </value>
        </property>
    </bean>

    <bean id="personDao" class="org.springbyexample.orm.hibernate3.dao.PersonDaoImpl">
        <property name="sessionFactory" ref="sessionFactory" />
    </bean>

</beans>
```
2. Hibernate Configuration

A very simple Hibernate configuration mapping the PERSON table to the Person class.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE hibernate-mapping PUBLIC
"-//Hibernate/Hibernate Mapping DTD 3.0//EN"
"http://hibernate.sourceforge.net/hibernate-mapping-3.0.dtd">
<hibernate-mapping package="org.springbyexample.orm.hibernate3.bean" default-access="field">
  <class name="Person" table="PERSON">
    <id name="id" column="ID">
      <generator class="native"/>
    </id>
    <property name="firstName" column="FIRST_NAME"/>
    <property name="lastName" column="LAST_NAME"/>
  </class>
</hibernate-mapping>
```

3. SQL Script

```sql
CREATE TABLE PERSON (
    ID integer identity primary key,
    FIRST_NAME varchar(50) not null,
    LAST_NAME varchar(50) not null
);
```

4. Code Example

The Hibernate SessionFactory is used to create a HibernateTemplate as it's set. The template is then used for any Hibernate database operations. Spring's HibernateTemplate converts all exceptions to runtime exceptions so it isn't necessary to handle any exceptions.

```java
@Repository
public class PersonDaoImpl implements PersonDao {

    protected HibernateTemplate template = null;

    /**
     * Sets Hibernate session factory and creates a
     * <code>HibernateTemplate</code> from it.
     */
```
public void setSessionFactory(SessionFactory sessionFactory) {
    template = new HibernateTemplate(sessionFactory);
}

/**
 * Find all persons.
 */
@SuppressWarnings("unchecked")
public Collection<Person> findPersons() throws DataAccessException {
    return template.find("from Person");
}

/**
 * Find persons by last name.
 */
@SuppressWarnings("unchecked")
public Collection<Person> findPersonsByLastName(String lastName) throws DataAccessException {
    return template.find("from Person p where p.lastName = ?", lastName);
}

/**
 * Saves person.
 */
public void save(Person person) {
    template.saveOrUpdate(person);
}

5. Reference

Related Links

- Hibernate [http://static.springframework.org/spring/docs/2.5.x/reference/orm.html#orm-hibernate]
- Spring by Example JDBC HsqldbInitializingDriverManagerDataSource
- Hibernate [http://www.hibernate.org/]
- Apache Commons DBCP [http://commons.apache.org/dbcp]
One to Many Hibernate XML Configuration

David Winterfeldt
2008

A simple example using a one-to-many relationship in Hibernate with an XML configuration to find, save, and update a record. A Person has a one-to-many relationship with Address.

1. Spring Configuration

The HsqldbInitializingDriverManagerDataSource is used to initialize the test HSQLDB database and the LocalSessionFactoryBean is using to configure Hibernate. The mappingLocations property is used to set a list of Hibernate XML mapping files. The Person DAO is configured using Hibernate’s session factory.

shared-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
                        http://www.springframework.org/schema/beans/spring-beans.xsd">
    <bean id="dataSource"
        class="org.springbyexample.jdbc.datasource.HsqldbInitializingDriverManagerDataSource">
        <property name="sqlScriptProcessor">
            <bean class="org.springbyexample.jdbc.core.SqlScriptProcessor">
                <property name="sqlScripts">
                    <list>
                        <value>classpath:/schema.sql</value>
                    </list>
                </property>
            </bean>
        </property>
    </bean>
    <bean id="sessionFactory" class="org.springframework.orm.hibernate3.LocalSessionFactoryBean">
        <property name="dataSource" ref="dataSource"/>
        <property name="mappingLocations">
            <list>
                <value>classpath:/org/springbyexample/orm/hibernate3/bean/Address.hbm.xml</value>
                <value>classpath:/org/springbyexample/orm/hibernate3/bean/Person.hbm.xml</value>
            </list>
        </property>
        <property name="hibernateProperties">
            <value>
                hibernate.format_sql=true
                hibernate.dialect=org.hibernate.dialect.HSQLDialect
            </value>
        </property>
    </bean>
</beans>
```
PersonDaoTest-context.xml

2. Hibernate Configuration

A very simple Hibernate configuration mapping the PERSON table to the Person class and the ADDRESS table to the Address class. There is a one-to-many relationship between the PERSON and ADDRESS table. The set element in the Person mapping creates the relationship from the PERSON to the ADDRESS table and stores the Address instances in a java.util.Set. The key element inside the set element indicates ADDRESS.PERSON_ID is the column to match against PERSON.ID to retrieve addresses associated with a person.

Person.hbm.xml

Address.hbm.xml
3. SQL Script

Excerpt from schema.sql

```sql
CREATE TABLE PERSON (
    ID integer identity primary key,
    FIRST_NAME varchar(50) not null,
    LAST_NAME varchar(50) not null,
    CREATED timestamp,
    CONSTRAINT IDX_PERSON_ID PRIMARY KEY (ID)
);)
CREATE TABLE ADDRESS (
    ID integer identity primary key,
    PERSON_ID integer,
    ADDRESS varchar(255),
    CITY varchar(50) not null,
    STATE varchar(50) not null,
    ZIP_POSTAL varchar(30) not null,
    CREATED timestamp,
    CONSTRAINT IDX_ADDRESS_ID PRIMARY KEY (ID),
    CONSTRAINT FK_ADDRESS_PERSON_ID FOREIGN KEY (PERSON_ID) REFERENCES PERSON(ID) on delete cascade
);)
```

4. Code Example

The Hibernate SessionFactory is used to create a HibernateTemplate as it's set. The template is then used for any Hibernate database operations. Spring's HibernateTemplate converts all exceptions to runtime exceptions so it isn't necessary to handle any exceptions.
The `@Transactional` annotation isn't used in this example because there isn't anything configuring transactions in the Spring configuration.

```java
@Repository
@Transactional(readOnly = true)
public class PersonDaoImpl implements PersonDao {
    protected HibernateTemplate template = null;
    /**
     * Sets Hibernate session factory.
     */
    public void setSessionFactory(SessionFactory sessionFactory) {
        template = new HibernateTemplate(sessionFactory);
    }
    /**
     * Find persons.
     */
    @SuppressWarnings("unchecked")
    public Collection<Person> findPersons() throws DataAccessException {
        return template.find("from Person");
    }
    /**
     * Find persons by last name.
     */
    @SuppressWarnings("unchecked")
    public Collection<Person> findPersonsByLastName(String lastName) throws DataAccessException {
        return template.find("from Person p where p.lastName = ", lastName);
    }
    /**
     * Saves person.
     */
    @Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
    public void save(Person person) {
        template.saveOrUpdate(person);
    }
}
```

**Example 1 PersonDaoImpl**

## 5. Reference

### Related Links

- Hibernate [Spring Documentation](http://static.springframework.org/spring/docs/2.5.x/reference/orm.html#orm-hibernate)
- Spring by Example JDBC [HsqldbInitializingDriverManagerDataSource](http://www.hibernate.org/)
- Apache Commons DBCP [http://commons.apache.org/dbcp]
Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```
$ svn co http://svn.springbyexample.org/persistence/simple-hibernate/tags/1.0/ simple-hibernate
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
- Hibernate 3.2.6.ga
One to Many Hibernate Annotation Configuration

David Winterfeldt
2008

A simple example using a one-to-many relationship in Hibernate with an Annotation configuration to find, save, and update a record. A Person has a one-to-many relationship with Address.

1. Spring Configuration

The HsqldbInitializingDriverManagerDataSource is used to initialize the test HSQLDB database and the LocalSessionFactoryBean is using to configure Hibernate.

Excerpt from shared-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
                         http://www.springframework.org/schema/beans/spring-beans.xsd">
  <bean id="dataSource"
      class="org.springbyexample.jdbc.datasource.HsqldbInitializingDriverManagerDataSource">
    <property name="sqlScriptProcessor">
      <bean class="org.springbyexample.jdbc.core.SqlScriptProcessor">
        <property name="sqlScripts">
          <list>
            <value>classpath:/schema.sql</value>
          </list>
        </property>
      </bean>
    </property>
  </bean>
  ...
</beans>
```

The annotatedClasses property is used to set a list of Hibernate annotated classes. The Person DAO is configured using Hibernate's session factory.

PersonAnnotationDaoTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
                         http://www.springframework.org/schema/beans/spring-beans.xsd">
  ...
</beans>
```
<import resource="classpath:org/springbyexample/orm/hibernate3/shared-context.xml"/>

<!-- Override xml session factory imported from shared-context.xml -->
<bean id="sessionFactory" class="org.springframework.orm.hibernate3.annotation.AnnotationSessionFactoryBean">
  <property name="dataSource" ref="dataSource" />
  <property name="annotatedClasses">
    <list>
      <value>org.springbyexample.orm.hibernate3.annotation.bean.Person</value>
      <value>org.springbyexample.orm.hibernate3.annotation.bean.Address</value>
    </list>
  </property>
  <property name="hibernateProperties">
    <value>
      hibernate.format_sql=true
      hibernate.dialect=org.hibernate.dialect.HSQLDialect
    </value>
  </property>
</bean>

<bean id="personDao" class="org.springbyexample.orm.hibernate3.annotation.dao.PersonDaoImpl">
  <property name="sessionFactory" ref="sessionFactory" />
</bean>

</beans>

2. Hibernate Configuration

The @Entity annotation indicates that the JavaBean is a persistent entity. By default the class name will be used for the Hibernate entity name as this class is registered with Hibernate. A different entity name could be specified by using the annotations name attribute (ex: @Entity(name="Employee")). The @Table annotation indicates the table the class should be mapped to. If the property name matches the field name, a specific mapping doesn't need to be set. Like for the id column. The first name column needs to be explicitly set using the @Column annotation (ex: @Column(name="FIRST_NAME")).

The one-to-many relationship from Person to Address is configured on public Set<Address> getAddresses(). The @OneToMany(fetch=FetchType.EAGER) annotation indicates a one-to-many relationship and that any associated addresses should be eagerly fetched. The @JoinColumn(name="PERSON_ID", nullable=false) annotation indicates ADDRESS.PERSON_ID is the column to match against PERSON.ID to retrieve addresses associated with a person.

@Entity
@Table(name="PERSON")
public class Person {

  private Integer id = null;
  private String firstName = null;
  private String lastName = null;
  private Set<Address> addresses = null;
  private Date created = null;

  /**
   * Gets id (primary key).
   */
  @Id
  @GeneratedValue(strategy=GenerationType.AUTO)
public Integer getId() {
    return id;
}

/**
 * Sets id (primary key).
 */
public void setId(Integer id) {
    this.id = id;
}

/**
 * Gets first name.
 */
@Column(name="FIRST_NAME")
public String getFirstName() {
    return firstName;
}

/**
 * Sets first name.
 */
public void setFirstName(String firstName) {
    this.firstName = firstName;
}

/**
 * Gets last name.
 */
@Column(name="LAST_NAME")
public String getLastName() {
    return lastName;
}

/**
 * Sets last name.
 */
public void setLastName(String lastName) {
    this.lastName = lastName;
}

/**
 * Gets list of <code>Address</code>es.
 */
@OneToMany(fetch=FetchType.EAGER)
@JoinColumn(name="PERSON_ID", nullable=false)
public Set<Address> getAddresses() {
    return addresses;
}

/**
 * Sets list of <code>Address</code>es.
 */
public void setAddresses(Set<Address> addresses) {
    this.addresses = addresses;
}

/**
 * Gets date created.
 */
public Date getCreated() {
    return created;
}

/**
 * Sets date created.
 */
public void setCreated(Date created) {
    this.created = created;
}
Example 1 Excerpt from Person

```java
@Entity
@Table(name="ADDRESS")
public class Address {

    private Integer id = null;
    private String address = null;
    private String city = null;
    private String state = null;
    private String zipPostal = null;
    private Date created = null;

    /**
     * Gets id (primary key).
     */
    @Id
    @GeneratedValue(strategy=GenerationType.AUTO)
    public Integer getId() {
        return id;
    }

    /**
     * Sets id (primary key).
     */
    public void setId(Integer id) {
        this.id = id;
    }

    /**
     * Gets address.
     */
    public String getAddress() {
        return address;
    }

    /**
     * Sets address.
     */
    public void setAddress(String address) {
        this.address = address;
    }

    /**
     * Gets city.
     */
    public String getCity() {
        return city;
    }

    /**
     * Sets city.
     */
    public void setCity(String city) {
        this.city = city;
    }
}
```
* Gets state.
 */
public String getState() {
    return state;
}
/**
 * Sets state.
 */
public void setState(String state) {
    this.state = state;
}
/**
 * Gets zip or postal code.
 */
@Column(name="ZIP_POSTAL")
public String getZipPostal() {
    return zipPostal;
}
/**
 * Sets zip or postal code.
 */
public void setZipPostal(String zipPostal) {
    this.zipPostal = zipPostal;
}
/**
 * Gets date created.
 */
public Date getCreated() {
    return created;
}
/**
 * Sets date created.
 */
public void setCreated(Date created) {
    this.created = created;
}
...
4. Code Example

The Hibernate SessionFactory is used to create a HibernateTemplate as it's set. The template is then used for any Hibernate database operations. Spring's HibernateTemplate converts all exceptions to runtime exceptions so it isn't necessary to handle any exceptions.

The @Transactional annotation isn't used in this example because there isn't anything configuring transactions in the Spring configuration.
Example 3 PersonDaoImpl

5. Reference

Related Links

- Hibernate [http://static.springframework.org/spring/docs/2.5.x/reference/orm.html#orm-hibernate]
- Spring by Example JDBC HsqldbInitializingDriverManagerDataSource
- Hibernate [http://www.hibernate.org/]
- Apache Commons DBCP [http://commons.apache.org/dbcp]
- One to Many Hibernate XML Configuration

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```
$ svn co http://svn.springbyexample.org/persistence/simple-hibernate/tags/1.0/ simple-hibernate
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
- Hibernate 3.2.6.ga
One to Many JpaTemplate Hibernate Configuration

David Winterfeldt
2009

This is a one-to-many JpaTemplate example using Hibernate that can to find, save, and update a record. There is a Person that has a one-to-many relationship to Address. This example is very similar to One to Many Hibernate Annotation Configuration example since that example was already using javax.persistence annotations to configure the Person and Address beans. Using JpaTemplate can make an easier upgrade path to JPA from an application already using Spring's HibernateTemplate.

Note

This example has the DAO class extend JpaDaoSupport and uses the JpaTemplate, but Spring recommends the native JPA style of coding.

JpaTemplate mainly exists as a sibling of JdoTemplate and HibernateTemplate, offering the same style for people used to it or newly started projects, consider adopting the native JPA style of coding data access objects instead, based on a "shared EntityManager" reference obtained through the JPA @PersistenceContext annotation.

— Spring 2.5.x JPA Documentation
[http://static.springframework.org/spring/docs/2.5.x/reference/orm.html#orm-jpa]

1. Spring Configuration

The Person DAO is configured using context:component-scan. Then tx:annotation-driven will configure transactions on any beans with @Transactional, and just after it the JPA transaction manager is setup. The HsqldbInitializingDriverManagerDataSource is used to initialize the test HSQLDB database. The LocalContainerEntityManagerFactoryBean is configured with the DataSource and for use with Hibernate as the JPA adapter. It also sets the persistenceUnitName attribute to specify which persistence unit to use for this entity manager (multiple examples use this persistence.xml).

PersonTemplateDaoTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:context="http://www.springframework.org/schema/context"
    xmlns:tx="http://www.springframework.org/schema/tx"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context.xsd
    http://www.springframework.org/schema/tx
    http://www.springframework.org/schema/tx/spring-tx.xsd"/>
```

Spring by Example Version 1.03 Spring by Example 52
2. JPA Entity Configuration

The @Entity annotation indicates that the JavaBean is a persistent entity. JPA would automatically pick up this class except the JPA configuration explicitly registers the classes each persistence unit should handle. The @Table annotation indicates the table the class should be mapped to. If the property name matches the field name, a specific mapping doesn't need to be set (like for the id column). The first name column needs to be explicitly set using the @Column annotation (ex: @Column(name="FIRST_NAME")) so it maps to the database field FIRST_NAME.

The one-to-many relationship from Person to Address is configured on public Set<Address> getAddresses(). The @OneToMany(fetch=FetchType.EAGER) annotation indicates a one-to-many relationship and that any associated addresses should be eagerly fetched. The @JoinColumn(name="PERSON_ID", nullable=false) annotation indicates ADDRESS.PERSON_ID is the column to match against PERSON.ID to retrieve addresses associated with a person.

```java
@Entity
@Table(name = "PERSON")
public class Person implements Serializable {
```
private static final long serialVersionUID = -8712872385957386182L;

private Integer id = null;
private String firstName = null;
private String lastName = null;
private Set<Address> addresses = null;
private Date created = null;

/**
 * Gets id (primary key).
 */
@Id
@GeneratedValue(strategy = GenerationType.AUTO)
public Integer getId() {
    return id;
}

/**
 * Sets id (primary key).
 */
public void setId(Integer id) {
    this.id = id;
}

/**
 * Gets first name.
 */
@Column(name = "FIRST_NAME")
public String getFirstName() {
    return firstName;
}

/**
 * Sets first name.
 */
public void setFirstName(String firstName) {
    this.firstName = firstName;
}

/**
 * Gets last name.
 */
@Column(name = "LAST_NAME")
public String getLastName() {
    return lastName;
}

/**
 * Sets last name.
 */
public void setLastName(String lastName) {
    this.lastName = lastName;
}

/**
 * Gets list of <code>Address</code>es.
 */
@OneToMany(fetch = FetchType.EAGER, cascade = CascadeType.ALL)
@JoinColumn(name = "PERSON_ID", nullable = false)
public Set<Address> getAddresses() {
    return addresses;
}

/**
 * Sets list of <code>Address</code>es.
 */
public void setAddresses(Set<Address> addresses) {
    this.addresses = addresses;
}

/**
 * Gets date created.
 */
Example 1 Excerpt from Person

```java
@javax.persistence.Entity
@javax.persistence.Table(name = "ADDRESS")
public class Address implements Serializable {
    private static final long serialVersionUID = 7851794269407495684L;
    private Integer id = null;
    private String address = null;
    private String city = null;
    private String state = null;
    private String zipPostal = null;
    private String country = null;
    private Date created = null;

    /**
     * Gets id (primary key).
     * @return id
     */
    @javax.persistence.Id
    @javax.persistenceGeneratedValue(strategy = GenerationType.AUTO)
    public Integer getId() {
        return id;
    }

    /**
     * Sets id (primary key).
     * @param id id
     */
    public void setId(Integer id) {
        this.id = id;
    }

    /**
     * Gets address.
     * @return address
     */
    public String getAddress() {
        return address;
    }

    /**
     * Sets address.
     * @param address address
     */
    public void setAddress(String address) {
        this.address = address;
    }

    /**
     * Gets city.
     * @return city
     */
    public String getCity() {
        return city;
    }

    /**
     * Sets city.
     * @param city city
     */
    public void setCity(String city) {
        this.city = city;
    }

    /**
     * Gets state.
     * @return state
     */
    public String getState() {
        return state;
    }

    /**
     * Sets state.
     * @param state state
     */
    public void setState(String state) {
        this.state = state;
    }

    /**
     * Gets zipPostal.
     * @return zipPostal
     */
    public String getZipPostal() {
        return zipPostal;
    }

    /**
     * Sets zipPostal.
     * @param zipPostal zipPostal
     */
    public void setZipPostal(String zipPostal) {
        this.zipPostal = zipPostal;
    }

    /**
     * Gets country.
     * @return country
     */
    public String getCountry() {
        return country;
    }

    /**
     * Sets country.
     * @param country country
     */
    public void setCountry(String country) {
        this.country = country;
    }

    /**
     * Gets created.
     * @return created
     */
    public Date getCreated() {
        return created;
    }

    /**
     * Sets date created.
     * @param created created
     */
    public void setCreated(Date created) {
        this.created = created;
    }

    ...
public String getCity() {
    return city;
}
/**
 * Sets city.
 */
public void setCity(String city) {
    this.city = city;
}
/**
 * Gets state.
 */
public String getState() {
    return state;
}
/**
 * Sets state.
 */
public void setState(String state) {
    this.state = state;
}
/**
 * Gets zip or postal code.
 */
@Column(name = "ZIP_POSTAL")
public String getZipPostal() {
    return zipPostal;
}
/**
 * Sets zip or postal code.
 */
public void setZipPostal(String zipPostal) {
    this.zipPostal = zipPostal;
}
/**
 * Gets country.
 */
public String getCountry() {
    return country;
}
/**
 * Sets country.
 */
public void setCountry(String country) {
    this.country = country;
}
/**
 * Gets date created.
 */
public Date getCreated() {
    return created;
}
/**
 * Sets date created.
 */
public void setCreated(Date created) {
    this.created = created;
}...
3. JPA Configuration

Excerpt from META-INF/persistence.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<persistence xmlns="http://java.sun.com/xml/ns/persistence"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://java.sun.com/xml/ns/persistence http://java.sun.com/xml/ns/persistence/persistence_1_0.xsd"
version="1.0">
  <persistence-unit name="simple-jpa-template" transaction-type="RESOURCE_LOCAL">
    <class>org.springbyexample.orm.jpa.bean.Person</class>
    <class>org.springbyexample.orm.jpa.bean.Address</class>
    <exclude-unlisted-classes/>
  </persistence-unit>
  ...
</persistence>
```

4. Code Example

```java
@Repository
@.Transactional(readOnly = true)
public class PersonTemplateDaoImpl extends JpaDaoSupport implements PersonTemplateDao {

/**
 * Constructor
 */
@Autowired
public PersonTemplateDaoImpl(EntityManagerFactory entityManagerFactory) {
    super.setEntityManagerFactory(entityManagerFactory);
}

/**
 * Find persons.
 */
@SuppressWarnings("unchecked")
public Collection<Person> findPersons() {
    return getJpaTemplate().find("from Person");
}

/**
 * Find persons by last name.
 */
@SuppressWarnings("unchecked")
public Collection<Person> findPersonsByLastName(String lastName) {
```
Example 3 PersonTemplateDaoImpl

5. Reference

Related Links

- JPA Spring Documentation [http://static.springframework.org/spring/docs/2.5.x/reference/orm.html#orm-jpa]
- Hibernate [http://www.hibernate.org/]
- Spring by Example JDBC HsqldbInitializingDriverManagerDataSource
- Apache Commons DBCP [http://commons.apache.org/dbcp]
- One to Many Hibernate Annotation Configuration

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```
$ svn co http://svn.springbyexample.org/persistence/simple-jpa/tags/1.1.1/ simple-jpa
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
- Java Persistence API 1.0
One to Many JPA Hibernate Configuration

David Winterfeldt

2009

This is a one-to-many JPA configuration that can find, save, and update a record. Hibernate is used as the JPA provider. There is a Person that has a one-to-many relationship to Address. This example is very similar to One to Many JpaTemplate Hibernate Configuration and even uses the same javax.persistence annotated beans, but uses the native JPA style for accessing data objects.

1. Spring Configuration

The Person DAO is configured using context:component-scan. Then tx:annotation-driven will configure transactions on any beans with @Transactional, and just after it the JPA transaction manager is setup. The HsqldbInitializingDriverManagerDataSource is used to initialize the test HSQLDB database. The LocalContainerEntityManagerFactoryBean is configured with the DataSource and for use with Hibernate as the JPA adapter. It also sets the persistenceUnitName attribute to specify which persistence unit to use for this entity manager (multiple examples use the persistence.xml).

PersonDaoTest-context.xml

```xml
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:context="http://www.springframework.org/schema/context"
      xmlns:tx="http://www.springframework.org/schema/tx"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                         http://www.springframework.org/schema/beans/spring-beans.xsd
                         http://www.springframework.org/schema/context
                         http://www.springframework.org/schema/context/spring-context.xsd
                         http://www.springframework.org/schema/tx
                         http://www.springframework.org/schema/tx/spring-tx.xsd">

  <context:component-scan base-package="org.springbyexample.orm.jpa.dao" />
  <tx:annotation-driven />

  <bean id="transactionManager"
        class="org.springframework.orm.jpa.JpaTransactionManager">
    <property name="entityManagerFactory" ref="entityManagerFactory" />
  </bean>

  <bean id="dataSource"
        class="org.springbyexample.jdbc.datasource.HsqldbInitializingDriverManagerDataSource">
    <property name="sqlScriptProcessor">
      <bean class="org.springbyexample.jdbc.core.SqlScriptProcessor">
        <property name="charset" value="UTF-8" />
        <property name="sqlScripts">
          <list>
            <value>classpath:/schema.sql</value>
          </list>
        </property>
      </bean>
    </property>
  </bean>
</beans>
```
### 2. JPA Entity Configuration

The `@Entity` annotation indicates that the JavaBean is a persistent entity. JPA would automatically pick up this class except the JPA configuration explicitly registers the classes each persistence unit should handle. The `@Table` annotation indicates the table the class should be mapped to. If the property name matches the field name, a specific mapping doesn't need to be set (like for the id column). The first name column needs to be explicitly set using the `@Column` annotation (ex: `@Column(name="FIRST_NAME")`) so it maps to the database field `FIRST_NAME`.

The one-to-many relationship from `Person` to `Address` is configured on `public Set<Address> getAddresses()`. The `@OneToMany(fetch=FetchType.EAGER)` annotation indicates a one-to-many relationship and that any associated addresses should be eagerly fetched. The `@JoinColumn(name="PERSON_ID", nullable=false)` annotation indicates `ADDRESS.PERSON_ID` is the column to match against `PERSON.ID` to retrieve addresses associated with a person.

```java
@Entity
@Table(name = "PERSON")
public class Person implements Serializable {
    private static final long serialVersionUID = -8712872385957386182L;

    private Integer id = null;
    private String firstName = null;
    private String lastName = null;
    private Set<Address> addresses = null;
    private Date created = null;

    /**
     * Gets id (primary key).
     */
    @Id
    @GeneratedValue(strategy = GenerationType.AUTO)
    public Integer getId() {
        return id;
    }

    /**
     * Sets id (primary key).
     */
    public void setId(Integer id) {
        this.id = id;
    }
}
```
* Gets first name.
 */
@Column(name = "FIRST_NAME")
public String getFirstName() {
    return firstName;
}
/**
 * Sets first name.
 */
public void setFirstName(String firstName) {
    this.firstName = firstName;
}
/**
 * Gets last name.
 */
@Column(name = "LAST_NAME")
public String getLastName() {
    return lastName;
}
/**
 * Sets last name.
 */
public void setLastName(String lastName) {
    this.lastName = lastName;
}
/**
 * Gets list of <code>Address</code>es.
 */
@OneToMany(fetch = FetchType.EAGER, cascade = CascadeType.ALL)
@JoinColumn(name = "PERSON_ID", nullable = false)
public Set<Address> getAddresses() {
    return addresses;
}
/**
 * Sets list of <code>Address</code>es.
 */
public void setAddresses(Set<Address> addresses) {
    this.addresses = addresses;
}
/**
 * Gets date created.
 */
public Date getCreated() {
    return created;
}
/**
 * Sets date created.
 */
public void setCreated(Date created) {
    this.created = created;
}
...
@Entity
@Table(name = "ADDRESS")
public class Address implements Serializable {

    private static final long serialVersionUID = 7851794269407495684L;

    private Integer id = null;
    private String address = null;
    private String city = null;
    private String state = null;
    private String zipPostal = null;
    private String country = null;
    private Date created = null;

    /**
     * Gets id (primary key).
     */
    @Id
    @GeneratedValue(strategy = GenerationType.AUTO)
    public Integer getId() {
        return id;
    }

    /**
     * Sets id (primary key).
     */
    public void setId(Integer id) {
        this.id = id;
    }

    /**
     * Gets address.
     */
    public String getAddress() {
        return address;
    }

    /**
     * Sets address.
     */
    public void setAddress(String address) {
        this.address = address;
    }

    /**
     * Gets city.
     */
    public String getCity() {
        return city;
    }

    /**
     * Sets city.
     */
    public void setCity(String city) {
        this.city = city;
    }

    /**
     * Gets state.
     */
    public String getState() {
        return state;
    }

    /**
     * Sets state.
     */
    public void setState(String state) {
        this.state = state;
    }

    /**
     * Gets zipPostal.
     */
    public String getZipPostal() {
        return zipPostal;
    }

    /**
     * Sets zipPostal.
     */
    public void setZipPostal(String zipPostal) {
        this.zipPostal = zipPostal;
    }

    /**
     * Gets country.
     */
    public String getCountry() {
        return country;
    }

    /**
     * Sets country.
     */
    public void setCountry(String country) {
        this.country = country;
    }

    /**
     * Gets created.
     */
    public Date getCreated() {
        return created;
    }

    /**
     * Sets created.
     */
    public void setCreated(Date created) {
        this.created = created;
    }

    public Address() {
        super();
    }
}
3. JPA Configuration

Hibernate is setup as the JPA provider. Another JPA provider, like EclipseLink [http://www.eclipse.org/eclipselink/], could be specified and if all your code just uses JPA nothing else would need to be changed. The Person & Address classes are explicitly configured, and JPA’s scanning for entity beans is turned off by specifying the exclude-unlisted-classes element. Some Hibernate specific configuration items are set within the properties element.

Excerpt from META-INF/persistence.xml

Example 2 Excerpt from Address
4. Code Example

```java
@Repository
@Transactional(readOnly = true)
public class PersonDaoImpl implements PersonDao {

    private EntityManager em = null;

    /**
     * Sets the entity manager.
     */
    @PersistenceContext
    public void setEntityManager(EntityManager em) {
        this.em = em;
    }

    /**
     * Find persons.
     */
    public Person findPersonById(Integer id) {
        return em.find(Person.class, id);
    }

    /**
     * Find persons using a start index and max number of results.
     */
    @SuppressWarnings("unchecked")
    public Collection<Person> findPersons(final int startIndex, final int maxResults) {
        return em.createQuery("select p from Person p order by p.lastName, p.firstName"
                .setFirstResult(startIndex).setMaxResults(maxResults).getResultList();
    }
}
```
/**
 * Find persons.
 */
@SuppressWarnings("unchecked")
public Collection<Person> findPersons() {
    return em.createQuery("select p from Person p order by p.lastName, p.firstName").getResultList();
}

/**
 * Find persons by last name.
 */
@SuppressWarnings("unchecked")
public Collection<Person> findPersonsByLastName(String lastName) {
    return em.createQuery("select p from Person p where p.lastName = :lastName order by p.lastName, p.firstName")
        .setParameter("lastName", lastName).getResultList();
}

/**
 * Saves person.
 */
@Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
public Person save(Person person) {
    return em.merge(person);
}

/**
 * Deletes person.
 */
@Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
public void delete(Person person) {
    em.remove(em.merge(person));
}

/**
 * Saves address to person.
 */
@Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
public Person saveAddress(Integer id, Address address) {
    Person person = findPersonById(id);
    if (!person.getAddresses().contains(address)) {
        person.getAddresses().remove(address);
    }
    person.getAddresses().add(address);
    return save(person);
}

/**
 * Deletes address from person.
 */
@Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
public Person deleteAddress(Integer id, Integer addressId) {
    Person person = findPersonById(id);
    Address address = new Address();
    address.setId(addressId);
    if (!person.getAddresses().contains(address)) {
        person.getAddresses().remove(address);
    }
    return save(person);
}
Example 3 PersonDaoImpl

5. Reference

Related Links

• JPA Spring Documentation [http://static.springframework.org/spring/docs/2.5.x/reference/orm.html#orm-jpa]
• Hibernate [http://www.hibernate.org/]
• Spring by Example JDBC HsqldbInitializingDriverManagerDataSource
• Apache Commons DBCP [http://commons.apache.org/dbcp]
• One to Many JpaTemplate Hibernate Configuration

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

$ svn co http://svn.springbyexample.org/persistence/simple-jpa/tags/1.1.1/ simple-jpa

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

• Spring Framework 2.5.x
• Java Persistence API 1.0
This shows a JPA configuration for inheritance. There are three different types, which are single table, joined, and table per class. This example uses joined inheritance. Joined inheritance involves a base table for shared fields and a table for each subclass. There is a `Person` class that is the parent for `Student` and `Professional`. This example is based on One to Many JPA Hibernate Configuration, but has been modified enough to add inheritance.

### 1. Spring Configuration

The Person DAO is configured using `context:component-scan`. Then `tx:annotation-driven` will configure transactions on any beans with `@Transactional`, and just after it the JPA transaction manager is setup. The `HsqldbInitializingDriverManagerDataSource` is used to initialize the test HSQLDB database. The `LocalContainerEntityManagerFactoryBean` is configured with the `DataSource` and for use with Hibernate as the JPA adapter. The `persistenceUnitName` attribute is set to specify which persistence unit to use (multiple examples use the `persistence.xml`).

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:context="http://www.springframework.org/schema/context"
      xmlns:tx="http://www.springframework.org/schema/tx"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                         http://www.springframework.org/schema/beans/spring-beans.xsd
                         http://www.springframework.org/schema/context
                         http://www.springframework.org/schema/context/spring-context.xsd
                         http://www.springframework.org/schema/tx
                         http://www.springframework.org/schema/tx/spring-tx.xsd">
  <context:component-scan base-package="org.springbyexample.orm.jpa.inheritance.dao" />
  <tx:annotation-driven />
  <bean id="transactionManager" class="org.springframework.orm.jpa.JpaTransactionManager">
    <property name="entityManagerFactory" ref="entityManagerFactory"/>
  </bean>
  <bean id="dataSource" class="org.springbyexample.jdbc.datasource.HsqldbInitializingDriverManagerDataSource">
    <property name="sqlScriptProcessor">
      <bean class="org.springbyexample.jdbc.core.SqlScriptProcessor">
        <property name="charset" value="UTF-8" />
        <property name="sqlScripts">
          <list>
            <value>classpath:/schema_inheritance.sql</value>
          </list>
        </property>
      </bean>
    </property>
  </bean>
  <bean id="entityManagerFactory" class="org.springframework.orm.jpa.EntityManagerFactory">
    <property name="jpaVendorAdapter" ref="jpaVendorAdapter"/>
    <property name="jpaTransactionManager" ref="transactionManager"/>
    <property name="persistenceUnitName" value="PersonInheritance"/>
  </bean>
</beans>
```
2. JPA Entity Configuration

The `javax.persistence` annotation `@Entity` indicates this is a persistent entity bean, and JPA would pick it up during classpath scanning. Although in this configuration, JPA scanning for entity beans is turned off. The `@Table` annotation explicitly configures which table the entity is mapped to, although in this case it isn't necessary since it would default to the name of the class which matches the table name.

Inheritance is configured using the `@Inheritance` and `@DiscriminatorColumn` annotations. The `@Inheritance` configures the inheritance type to joined. The `@DiscriminatorColumn` annotation sets the field used to determine the subclass to the `TYPE` field and the field type to integer.

```java
@Entity
@Table(name="PERSON")
@Inheritance(strategy = InheritanceType.JOINED)
@DiscriminatorColumn(name="TYPE", discriminatorType=DiscriminatorType.INTEGER)
public class Person implements Serializable {
    private static final long serialVersionUID = -2175150694352541150L;

    private Integer id = null;
    private String firstName = null;
    private String lastName = null;
    private Set<Address> addresses = null;
    private Date created = null;

    /**
     * Gets id (primary key).
     */
    @Id
    @GeneratedValue(strategy=GenerationType.AUTO)
    public Integer getId() {
        return id;
    }

    /**
     * Sets id (primary key).
     */
    public void setId(Integer id) {
        this.id = id;
    }

    /**
     * Gets first name.
     */
    @Column(name="FIRST_NAME")
    public String getFirstName() {
        return firstName;
    }
```
/**
 * Sets first name.
 */
public void setFirstName(String firstName) {
    this.firstName = firstName;
}

/**
 * Gets last name.
 */
@Column(name = "LAST_NAME")
public String getLastName() {
    return lastName;
}

/**
 * Sets last name.
 */
public void setLastName(String lastName) {
    this.lastName = lastName;
}

/**
 * Gets list of <code>Address</code>es.
 */
@OneToMany(fetch=FetchType.EAGER, cascade=CascadeType.ALL)
@JoinColumn(name="PERSON_ID", nullable=false)
public Set<Address> getAddresses() {
    return addresses;
}

/**
 * Sets list of <code>Address</code>es.
 */
public void setAddresses(Set<Address> addresses) {
    this.addresses = addresses;
}

/**
 * Gets date created.
 */
public Date getCreated() {
    return created;
}

/**
 * Sets date created.
 */
public void setCreated(Date created) {
    this.created = created;
}

public Address findAddressById(Integer id) {
    Address result = null;
    if (addresses != null) {
        for (Address address : addresses) {
            if (address.getId().equals(id)) {
                result = address;
                break;
            }
        }
    }
    return result;
}

...
Example 1 Excerpt from Person

The Student class extends Person. The @DiscriminatorValue indicates the value to be used for the discriminator column in the parent class when storing and retrieving this subclass. The PERSON_STUDENT table stores all the extra values unique to this subclass, which in this case is just the school name of the student.

```java
@Entity
@Table(name="PERSON_STUDENT")
@DiscriminatorValue("1")
public class Student extends Person {
    private static final long serialVersionUID = -8933409594928827120L;
    private String schoolName = null;
    /**
     * Gets school name.
     */
    @Column(name="SCHOOL_NAME")
    public String getSchoolName() {
        return schoolName;
    }
    /**
     * Sets school name.
     */
    public void setSchoolName(String schoolName) {
        this.schoolName = schoolName;
    }
}
```

Example 2 Student

The Professional class is very similar to the Student class except it has a different table, discriminator value, and it's unique field is the professional's company name.

```java
@Entity
@Table(name="PERSON_PROFESSIONAL")
@DiscriminatorValue("2")
public class Professional extends Person {
    private static final long serialVersionUID = 8199967229715812072L;
    private String companyName = null;
    /**
     * Gets company name.
     */
    @Column(name="COMPANY_NAME")
    public String getCompanyName() {
        return companyName;
    }
    /**
     * Sets company name.
     */
    public void setCompanyName(String companyName) {
        this.companyName = companyName;
    }
    /**
     * Sets company name.
     */
```
Example 3 Professional

3. JPA Configuration

Hibernate is setup as the JPA provider. Another JPA provider, like EclipseLink [http://www.eclipse.org/eclipselink/], could be specified and if all your code just uses JPA nothing else would need to be changed. The `Person` & `Address` classes are explicitly configured, and JPA’s scanning for entity beans is turned off by specifying the `exclude-unlisted-classes` element. Some Hibernate specific configuration items are set within the `properties` element.

Excerpt from `META-INF/persistence.xml`

```xml
<?xml version="1.0" encoding="UTF-8"?>
<persistence xmlns="http://java.sun.com/xml/ns/persistence"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="http://java.sun.com/xml/ns/persistence
   http://java.sun.com/xml/ns/persistence/persistence_1_0.xsd"
   version="1.0">
   ...
   <persistence-unit name="inheritance-jpa">
      <provider>org.hibernate.ejb.HibernatePersistence</provider>
      <class>org.springbyexample.orm.jpa.inheritance.bean.Student</class>
      <class>org.springbyexample.orm.jpa.inheritance.bean.Professional</class>
      <class>org.springbyexample.orm.jpa.inheritance.bean.Address</class>
      <exclude-unlisted-classes/>
      <properties>
         <property name="hibernate.dialect" value="org.hibernate.dialect.HSQLDialect" />
         <property name="hibernate.show_sql" value="true" />
         <property name="hibernate.cache.provider_class" value="org.hibernate.cache.HashtableCacheProvider" />
      </properties>
   </persistence-unit>
</persistence>
```

4. Code Example

```java
@Repository
*/
public void setCompanyName(String companyName) {
    this.companyName = companyName;
}
```
@Transactional(readOnly = true)
public class PersonInheritanceImpl implements PersonInheritanceDao {
    private EntityManager em = null;
    /**
     * Sets the entity manager.
     */
    @PersistenceContext
    public void setEntityManager(EntityManager em) {
        this.em = em;
    }
    /**
     * Find persons.
     */
    public Person findById(Integer id) {
        return em.find(Person.class, id);
    }
    /**
     * Find persons using a start index and max number of results.
     */
    @SuppressWarnings("unchecked")
    public Collection<Person> findPersons(int startIndex, int maxResults) {
        return em.createQuery("select p from Person p order by p.lastName, p.firstName")
            .setFirstResult(startIndex).setMaxResults(maxResults).getResultList();
    }
    /**
     * Find persons by last name.
     */
    @SuppressWarnings("unchecked")
    public Collection<Person> findPersonsByLastName(String lastName) {
        return em.createQuery("select p from Person p where p.lastName = :lastName order by p.lastName, p.firstName")
            .setParameter("lastName", lastName).getResultList();
    }
    /**
     * Saves person.
     */
    @Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
    public Person save(Person person) {
        return em.merge(person);
    }
    /**
     * Deletes person.
     */
    @Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
    public void delete(Person person) {
        em.remove(em.merge(person));
    }
    /**
     * Saves address to person.
     */
    @Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
    public Person setAddressByPersonId(Integer id, Address address) {
        Person person = findPersonById(id);
    }
}
if (person.getAddresses().contains(address)) {
    person.getAddresses().remove(address);
}

person.getAddresses().add(address);
return save(person);
}

/**
 * Deletes address from person.
 */
@Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
public Person deleteAddress(Integer id, Integer addressId) {
    Person person = findPersonById(id);
    Address address = new Address();
    address.setId(addressId);
    if (person.getAddresses().contains(address)) {
        person.getAddresses().remove(address);
    }
    return save(person);
}

Example 4 PersonInheritanceImpl

5. SQL Script

Excerpt from schema_inheritance.sql

... 
CREATE TABLE PERSON_TYPE ( 
    ID integer identity primary key, 
    NAME varchar(50) not null, 
    CREATED timestamp, 
    CONSTRAINT IDX_PERSON_TYPE_ID PRIMARY KEY (ID) 
);

CREATE TABLE PERSON ( 
    ID integer identity primary key, 
    FIRST_NAME varchar(50) not null, 
    LAST_NAME varchar(50) not null, 
    TYPE integer not null, 
    CREATED timestamp, 
    CONSTRAINT IDX_PERSON_ID PRIMARY KEY (ID), 
    CONSTRAINT FK_PERSON_TYPE FOREIGN KEY (TYPE) REFERENCES PERSON_TYPE(ID) 
);

CREATE TABLE PERSON_STUDENT ( 
    ID integer not null, 
    SCHOOL_NAME varchar(50) not null, 
    CREATED timestamp, 
    CONSTRAINT FK_PERSON_STUDENT_ID FOREIGN KEY (ID) REFERENCES PERSON(ID) on delete cascade 
);

CREATE TABLE PERSON_PROFESSIONAL {
6. Reference

Related Links

- JPA Spring Documentation [http://static.springframework.org/spring/docs/2.5.x/reference/orm.html#orm-jpa]
- Hibernate [http://www.hibernate.org/]
- Spring by Example JDBC HsqldbInitializingDriverManagerDataSource
- Apache Commons DBCP [http://commons.apache.org/dbcp]
- One to Many JPA Hibernate Configuration

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```bash
$ svn co http://svn.springbyexample.org/persistence/simple-jpa/tags/1.1.1/ simple-jpa
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information
• Spring Framework 2.5.x

• Java Persistence API 1.0
Hibernate Transaction Annotation Configuration

David Winterfeldt
2008

Creating basic transaction using annotations with Spring for Hibernate.

1. Spring Configuration

To process annotation-based transaction configuration a transactionManager bean needs to be created and this will be used by <tx:annotation-driven/> for managing transactions.

PersonDaoTransactionTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:tx="http://www.springframework.org/schema/tx"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                         http://www.springframework.org/schema/beans/spring-beans.xsd
                         http://www.springframework.org/schema/tx
                         http://www.springframework.org/schema/tx/spring-tx.xsd">
  <import resource="classpath:org/springbyexample/orm/hibernate3/shared-context.xml"/>
  
  <bean id="transactionManager" class="org.springframework.orm.hibernate3.HibernateTransactionManager">
    <property name="sessionFactory" ref="sessionFactory" />
  </bean>
  
  <tx:annotation-driven/>
  
  <bean id="personDao" class="org.springbyexample.orm.hibernate3.dao.PersonDaoImpl">
    <property name="sessionFactory" ref="sessionFactory" />
  </bean>
</beans>
```

2. Code Example

The Hibernate SessionFactory is used to create a HibernateTemplate as it's set. The template is then used for any Hibernate database operations. Spring's HibernateTemplate converts all exceptions to runtime exceptions so it isn't necessary to handle any exceptions.

The @Transactional annotation configures the class and all it's methods for read only access, but the save method overrides this by specifying it's own annotation of @Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW).
@Repository
@Transactional(readOnly = true)
public class PersonDaoImpl implements PersonDao {

    protected HibernateTemplate template = null;

    /**
     * Sets Hibernate session factory.
     */
    public void setSessionFactory(SessionFactory sessionFactory) {
        template = new HibernateTemplate(sessionFactory);
    }

    /**
     * Find persons.
     */
    @SuppressWarnings("unchecked")
    public Collection<Person> findPersons() throws DataAccessException {
        return template.find("from Person");
    }

    /**
     * Find persons by last name.
     */
    @SuppressWarnings("unchecked")
    public Collection<Person> findPersonsByLastName(String lastName) throws DataAccessException {
        return template.find("from Person p where p.lastName = ?", lastName);
    }

    /**
     * Saves person.
     */
    @Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
    public void save(Person person) {
        template.saveOrUpdate(person);
    }
}

Example 1 PersonDaoImpl

3. Reference

Related Links

- Hibernate [http://static.springframework.org/spring/docs/2.5.x/reference/orm.html#orm-plain]
- Spring [http://static.springframework.org/spring/docs/2.5.x/reference/orm.html#orm-plain]
- Spring by Example JDBC HsqldbInitializingDriverManagerDataSource
- Hibernate [http://www.hibernate.org/]
- Apache Commons DBCP [http://commons.apache.org/dbcp]
- One to Many Hibernate XML Configuration
- One to Many Hibernate XML Configuration
Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```
$ svn co http://svn.springbyexample.org/persistence/simple-hibernate/tags/1.0/ simple-hibernate
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
- Hibernate 3.2.6.ga
Simple Spring Transactional JUnit 4 Test

David Winterfeldt
2008

Simple Spring Transactional JUnit 4 Test of a Hibernate transaction.

1. Spring Configuration

A transactionManager bean is setup for the transactional annotations to use and the DataSource from the shared context (not shown) is used by AbstractTransactionalJUnit4SpringContextTests to make a SimpleJdbcTemplate available.

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:tx="http://www.springframework.org/schema/tx"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                         http://www.springframework.org/schema/beans/spring-beans.xsd
                         http://www.springframework.org/schema/tx
                         http://www.springframework.org/schema/tx/spring-tx.xsd">

  <import resource="classpath:org/springbyexample/orm/hibernate3/shared-context.xml"/>

  <bean id="transactionManager"
        class="org.springframework.orm.hibernate3.HibernateTransactionManager">
    <property name="sessionFactory" ref="sessionFactory"/>
  </bean>

  <bean id="personDao" class="org.springbyexample.orm.hibernate3.dao.PersonDaoImpl">
    <property name="sessionFactory" ref="sessionFactory"/>
  </bean>

</beans>
```

2. Code Example

The @RunWith annotation is part of JUnit 4 and is set to use SpringJUnit4ClassRunner to run the unit test. The other annotations, except for @Test, are Spring annotations. @ContextConfiguration initializes the Spring context and by default looks for a Spring XML file in the same package as the unit test with the file name the same as the class with '-context.xml' as a suffix (ex: PersonDaoTransactionUnitTest-context.xml.). @TransactionConfiguration and @Transactional configure transactions for the tests.

The method with @Test is the main test method which saves a person in a transaction. The method with
@BeforeTransaction is run before the transaction starts and the method with @AfterTransaction is run after the transaction ends. They both use SimpleJdbcTemplate to directly check the database and avoid any caching Hibernate might be performing.

```java
import org.springframework.stereotype.Service;
import org.springframework.transaction.annotation.Transactional;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.test.context.ContextConfiguration;
import org.springframework.test.context.junit4.SpringJUnit4ClassRunner;
import org.springframework.test.context.TestContextFactory;
import org.springframework.test.context.transaction;q

public class PersonDaoTransactionUnitTest extends AbstractTransactionalJUnit4SpringContextTests {
    final Logger logger = LoggerFactory.getLogger(PersonDaoTransactionUnitTest.class);

    protected static int SIZE = 2;
    protected static Integer ID = new Integer(1);
    protected static String FIRST_NAME = "Joe";
    protected static String LAST_NAME = "Smith";
    protected static String CHANGED_LAST_NAME = "Jackson";

    @Autowired
    protected PersonDao personDao = null;

    @RunWith(SpringJUnit4ClassRunner.class)
    @ContextConfiguration
    @TransactionConfiguration
    @Transactional
    public class PersonDaoTransactionUnitTest extends AbstractTransactionalJUnit4SpringContextTests {
        final Logger logger = LoggerFactory.getLogger(PersonDaoTransactionUnitTest.class);

        protected static int SIZE = 2;
        protected static Integer ID = new Integer(1);
        protected static String FIRST_NAME = "Joe";
        protected static String LAST_NAME = "Smith";
        protected static String CHANGED_LAST_NAME = "Jackson";

        @Autowired
        protected PersonDao personDao = null;

        /**
         * Tests that the size and first record match what is expected
         * before the transaction.
         */
        @BeforeTransaction
        public void beforeTransaction() {
            testPerson(true, LAST_NAME);
        }

        /**
         * Tests person table and changes the first records last name.
         */
        @Test
        public void testHibernateTemplate() throws SQLException {
            assertNotNull("Person DAO is null.", personDao);
            Collection<Person> lPersons = personDao.findPersons();
            assertNotNull("Person list is null.", lPersons);
            assertNotEquals("Number of persons should be " + SIZE + ".", SIZE, lPersons.size());

            for (Person person : lPersons) {
                assertNotEquals("Person is null.", person);
                if (ID.equals(person.getId())) {
                    assertEquals("Person first name should be " + FIRST_NAME + ".", FIRST_NAME,
                                person.getFirstName());
                    assertEquals("Person last name should be " + LAST_NAME + ".", LAST_NAME,
                                person.getLastName());
                    person.setLastName(CHANGED_LAST_NAME);
                    personDao.save(person);
                }
            }

            /**
             * Tests that the size and first record match what is expected
             * after the transaction.
             */
            @AfterTransaction
            public void afterTransaction() {
                testPerson(false, LAST_NAME);
            }

            /**
             * Tests person table.
             */
        }
    }
```
protected void testPerson(boolean beforeTransaction, String matchLastName) {
    List<Map<String, Object>> lPersonMaps = simpleJdbcTemplate.queryForList("SELECT * FROM PERSON");
    assertNotNull("Person list is null.", lPersonMaps);
    assertEquals("Number of persons should be " + SIZE + ".", SIZE, lPersonMaps.size());
    Map<String, Object> hPerson = lPersonMaps.get(0);
    logger.debug((beforeTransaction ? "Before" : "After") + " transaction. " + hPerson.toString());
    Integer id = (Integer)hPerson.get("ID");
    String firstName = (String)hPerson.get("FIRST_NAME");
    String lastName = (String)hPerson.get("LAST_NAME");
    if (ID.equals(id)) {
        assertEquals("Person first name should be " + FIRST_NAME + ".", FIRST_NAME, firstName);
        assertEquals("Person last name should be " + matchLastName + ".", matchLastName,
                     lastName);
    }
}

Example 1 PersonDaoTransactionUnitTest

3. Reference

Related Links

- JUnit [http://www.junit.org/]
- Hibernate Spring Documentation [http://static.springframework.org/spring/docs/2.5.x/reference/orm.html#orm-hibernate]
- Spring by Example JDBC HsqlDbInitializingDriverManagerDataSource
- Hibernate [http://www.hibernate.org/]
- Apache Commons DBCP [http://commons.apache.org/dbcp]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

$ svn co http://svn.springbyexample.org/persistence/simple-hibernate/tags/1.0/ simple-hibernate

General Setup Instructions
General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

**Project Information**

- Spring Framework 2.5.x
- Hibernate 3.2.6.ga
Part IV. Web

Web application examples.
This is a simple example showing how to setup Spring MVC to use Tiles 2. Any request coming in mapped for Tiles processing will attempt to find a Tiles definition that matches the request and then render it.

### 1. Spring Configuration

The `tilesConfigurer` bean initializes tiles with all the tiles configuration files (more than one can be specified). The `tilesViewResolver` bean defines using Spring's `TilesView` which uses the url to lookup the Tiles definition and render it.

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.springframework.org/schema/beans 
  http://www.springframework.org/schema/beans/spring-beans.xsd">
  <bean id="tilesConfigurer" 
    class="org.springframework.web.servlet.view.tiles2.TilesConfigurer">
    <property name="definitions">
      <list>
        <value>/WEB-INF/tiles-defs/templates.xml</value>
      </list>
    </property>
  </bean>
  <bean id="tilesViewResolver" 
    class="org.springframework.web.servlet.view.UrlBasedViewResolver">
    <property name="viewClass" value="org.springframework.web.servlet.view.tiles2.TilesView" />
  </bean>
  <bean id="urlMapping" class="org.springframework.web.servlet.handler.SimpleUrlHandlerMapping">
    <property name="mappings">
      <props>
        <prop key="/**/*.html">viewController</prop>
      </props>
    </property>
  </bean>
  <bean id="viewController" 
    class="org.springframework.web.servlet.mvc.UrlFilenameViewController"/>
</beans>
```

### 2. Tiles XML Configuration

The Tiles '.mainTemplate' sets up the default layout and the other two definitions extend the main template and just
set their body.

/WEB-INF/tiles-defs/templates.xml

```xml
<?xml version="1.0" encoding="ISO-8859-1" ?>
<!DOCTYPE tiles-definitions PUBLIC
-//Apache Software Foundation//DTD Tiles Configuration 2.0//EN
"http://tiles.apache.org/dtds/tiles-config_2_0.dtd">
<tiles-definitions>
  <!-- Default Main Template -->
  <definition name=".mainTemplate" template="/WEB-INF/templates/main.jsp">
    <put-attribute name="title" value="Simple Tiles 2 Example" type="string" />
    <put-attribute name="header" value="/WEB-INF/templates/header.jsp" />
    <put-attribute name="footer" value="/WEB-INF/templates/footer.jsp" />
    <put-attribute name="menu" value="/WEB-INF/templates/menu.jsp" />
    <put-attribute name="body" value="/WEB-INF/templates/blank.jsp" />
  </definition>
  <definition name="index" extends=".mainTemplate">
    <put-attribute name="body" value="/WEB-INF/jsp/index.jsp" />
  </definition>
  <definition name="info/about" extends=".mainTemplate">
    <put-attribute name="body" value="/WEB-INF/jsp/info/about.jsp" />
  </definition>
</tiles-definitions>
```

3. JSP Example

This JSP has the main layout for where the header, footer, menu, and body are located. They are inserted using Tiles custom JSP tags.

/WEB-INF/templates/menu.jsp

```xml
<%@ taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core" %>
<%@ taglib uri="http://tiles.apache.org/tags-tiles" prefix="tiles" %>

<html>
<head>
  <title><tiles:getAsString name="title" /></title>
  <link rel="stylesheet" type="text/css" href="<c:url value="/css/main.css"/>" />
</head>

<body>
  <div id="header">
    <div id="headerTitle"><tiles:insertAttribute name="header" /></div>
  </div>
  <div id="menu">
    <tiles:insertAttribute name="menu" />
  </div>
  <div id="content">
    <td><tiles:insertAttribute name="body" /></td>
  </div>
  <div id="footer">
    <tiles:insertAttribute name="footer" />
  </div>
</body>
```

Simple Tiles 2 Spring MVC Webapp
4. Reference

Related Links

- Spring 2.5.x Tiles Documentation [http://static.springframework.org/spring/docs/2.5.x/reference/view.html#view-tiles]
- Tiles 2 [http://tiles.apache.org/]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

$ svn co http://svn.springbyexample.org/web/simple-tiles2-webapp/tags/1.0/ simple-tiles2

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
- Spring Security 2.0.x
- Spring Web Flow 2.0.x
Basic Webapp Internationalization

David Winterfeldt

2008

Creating a basic webapp that will handle UTF-8 characters from form input and also have internationalized messages.

View a working demo of the application at http://www.springbyexample.org/simple-form/.

1. Web Configuration

The character encoding type for the request can be set using the CharacterEncodingFilter [http://static.springframework.org/spring/docs/2.5.x/api/org/springframework/web/filter/CharacterEncodingFilter.html].

By setting this, when a form values are retrieved from the request the encoding type will be UTF-8.

WEB-INF/web.xml

```
<filter>
    <filter-name>encoding-filter</filter-name>
    <filter-class>
        org.springframework.web.filter.CharacterEncodingFilter
    </filter-class>
    <init-param>
        <param-name>encoding</param-name>
        <param-value>UTF-8</param-value>
    </init-param>
</filter>

<filter-mapping>
    <filter-name>encoding-filter</filter-name>
    <url-pattern>/*</url-pattern>
</filter-mapping>
```

2. Spring Configuration

This configures the web application for internationalized messages that can then be displayed in a JSP page using the JSTL message format tag. The basenames property of ResourceBundleMessageSource is set to 'messages' which will then look for the default message resource of messages.properties. Based on different locales, other property files can be defined like messages_es.properties for Spanish.

The LocaleChangeInterceptor is configured to look for the parameter name 'locale' to indicate a change of the user's locale. For example, adding 'locale=es' to a URL would change the locale to Spanish. The SessionLocaleResolver keeps the user's currently configured locale in session scope.

Excerpt from WEB-INF/simple-form-servlet.xml

```
```
3. JSP Example

To make sure pages display UTF-8 characters properly, it's important to set the page encoding and content type at the very top of the JSP page. Since this example webapp is using Tiles, it's only necessary to set it at the top of the main template.

Excerpt from /WEB-INF/templates/main.jsp

```jsp
<%@ page pageEncoding="UTF-8" contentType="text/html; charset=UTF-8" %>
```

The footer of the Tiles template shows how to display something from the message resource files and also how to create a link to change locales. The `fmt:message` retrieves 'button.locale' from the property file that matches the current locale, or if that key isn't in the current locale's file it will use the default locale's message.

The URL to change the locale uses the `c:url` JSTL tag and redirects to the home page. It sets the parameter to match what was configured on the `LocaleChangeInterceptor` bean's `paramName` property. Which in this case is 'locale'. Passing in no locale switches to the default locale and for Spanish the parameter 'es' is used.

/WEB-INF/templates/footer.jsp

```jsp
<%@ taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core" %>
<%@ taglib prefix="fmt" uri="http://java.sun.com/jsp/jstl/fmt" %>
<div align="right">
  <fmt:message key="button.locale"/>
  <c:url var="englishLocaleUrl" value="/index.html">
    <c:param name="locale" value=""/>
  </c:url>
  <c:url var="spanishLocaleUrl" value="/index.html">
    <c:param name="locale" value="es"/>
  </c:url>
  <a href='<c:out value="${englishLocaleUrl}" />'><fmt:message key="locale.english"/></a>
```
4. Message Resource Property Files

Excerpt from messages.properties

button.cancel=Cancel
button.create=Create
button.edit=Edit
button.delete=Delete
button.reset=Reset
button.save=Save
button.search=Search

button.locale=Language
locale.english=English
locale.spanish=Español

site.title=Simple Spring MVC Form Annotation-based Configuration

Excerpt from messages_es.properties

button.cancel=Cancelar
button.create=Crear
button.edit=Corregir
button.delete=Borrar
button.reset=Restaurar
button.save=Guardar
button.search=Buscar

button.locale=Lenguaje

site.title=Simple Configuración Spring MVC usando Anotaciones

5. Reference

Related Links

• Internationalization using MessageSources Spring Documentation
http://static.springframework.org/spring/docs/2.5.x/reference/beans.html#context-functionality-messagesource

- Spring Web MVC Locale Change

[http://www.springbyexample.org/twiki/bin/view/Example/SpringWebMVCLocaleChangeExample]

### Project Setup

The project is available to checkout from an anonymous Subversion checkout.

### Command Line Example

```bash
$ svn co http://svn.springbyexample.org/web/simple-form-annotation-config-webapp/tags/1.0.1/simple-form-annotation-config-webapp
```

### General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

### Project Information

- Spring Framework 2.5.x
Simple Spring MVC Form Annotation Configuration Webapp

David Winterfeldt

2008

Simple Spring MVC form using annotation-based configuration. The webapp has basic create, update, delete, and search functionality for a person form. The form basically just has a hidden id (primary key), first name, and last name fields. Tiles is implemented with Spring by Example's Dynamic Tiles Spring MVC Module, Hibernate, and internationalized messages are configured, but this example will focus on explaining the MVC configuration.

View a working demo of the application at http://www.springbyexample.org/simple-form/.

1. Web Configuration

Below is the basic web.xml configuration. The main Spring context is configured to be /WEB-INF/web-application-context.xml as a context param, and the default context file specific to the simple-form servlet is overridden to not load anything (/WEB-INF/simple-form-servlet.xml would have been loaded otherwise, the name of of the DispatcherServlet plus '-servlet.xml'). The servlet-mapping for 'simple-form' is configured to handle all requests ending in '.html'. The 'encoding-filter' sets all requests to the encoding type of UTF-8.

/WEB-INF/web.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<web-app id="WebApp_ID" version="2.4"
 xmlns="http://java.sun.com/xml/ns/j2ee"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee
 http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd">
  <display-name>simple-form</display-name>
  <listener>
    <listener-class>
      org.springframework.web.context.ContextLoaderListener
    </listener-class>
  </listener>
  <context-param>
    <param-name>contextConfigLocation</param-name>
    <param-value>
      /WEB-INF/web-application-context.xml
    </param-value>
  </context-param>
  <filter>
    <filter-name>encoding-filter</filter-name>
    <filter-class>
      org.springframework.web.filter.CharacterEncodingFilter
    </filter-class>
    <init-param>
      <param-name>encoding</param-name>
      <param-value>UTF-8</param-value>
    </init-param>
  </filter>
</web-app>
```
2. Spring Configuration

The `<context:component-scan>` registers the `PersonController`, which is defined in the `org.springbyexample.web.servlet.mvc` package. The first import configures the JPA configuration for managing a person and the second configures Spring MVC.

```
<filter-mapping>
    <filter-name>encoding-filter</filter-name>
    <url-pattern>/*</url-pattern>
</filter-mapping>

<servlet>
    <servlet-name>simple-form</servlet-name>
    <servlet-class>org.springframework.web.servlet.DispatcherServlet</servlet-class>
    <init-param>
        <param-name>contextConfigLocation</param-name>
        <param-value></param-value>
    </init-param>
</servlet>

<servlet-mapping>
    <servlet-name>simple-form</servlet-name>
    <url-pattern>*.html</url-pattern>
</servlet-mapping>

<welcome-file-list>
    <welcome-file>index.jsp</welcome-file>
</welcome-file-list>
</web-app>

This standard Spring MVC configuration file creates handlers, configures Tiles, and also internationalization. The `classnameControllerMappings` bean enables convention based mappings for reduced configuration. It is configured to be case sensitive, so a controller called `StudentPersonController` would map to the URL...
Simple Spring MVC Form Annotation Configuration Webapp

'/studentPerson'. Although it defaults to case insensitive and would then map to the URL '/studentperson'. The
default handler is set with the UrlFilenameViewController, which will handle any requests not handled by
a convention based controller. The tilesConfigurer bean configures tiles and dynamicTilesViewResolver takes the url
of a request and uses it for the body in a Tiles template. The last three beans configure locale and messsage resource
handling.
/WEB-INF/simple-form-servlet.xml

<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:p="http://www.springframework.org/schema/p"
xmlns:context="http://www.springframework.org/schema/context"
xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd
http://www.springframework.org/schema/context
http://www.springframework.org/schema/context/spring-context.xsd">
<!-- Enables /[resource]/[action] to [Resource]Controller class mapping -->
<bean id="classnameControllerMappings"
class="org.springframework.web.servlet.mvc.support.ControllerClassNameHandlerMapping"
p:interceptors-ref="localeChangeInterceptor"
p:caseSensitive="true">
<property name="defaultHandler">
<bean class="org.springframework.web.servlet.mvc.UrlFilenameViewController" />
</property>
</bean>
<!-- Enables annotated POJO @Controllers -->
<bean class="org.springframework.web.servlet.mvc.annotation.AnnotationMethodHandlerAdapter" />
<!-- Enables plain Controllers -->
<bean class="org.springframework.web.servlet.mvc.SimpleControllerHandlerAdapter" />
<bean id="tilesConfigurer"
class="org.springframework.web.servlet.view.tiles2.TilesConfigurer">
<property name="definitions">
<list>
<value>/WEB-INF/tiles-defs/templates.xml</value>
</list>
</property>
</bean>
<bean id="tilesViewResolver"
class="org.springframework.web.servlet.view.UrlBasedViewResolver">
<property name="viewClass"
value="org.springbyexample.web.servlet.view.tiles2.DynamicTilesView" />
<property name="prefix" value="/WEB-INF/jsp/" />
<property name="suffix" value=".jsp" />
</bean>
<bean id="messageSource"
class="org.springframework.context.support.ResourceBundleMessageSource">
<property name="basenames">
<value>messages</value>
</property>
</bean>
<!-- Declare the Interceptor -->
<bean id="localeChangeInterceptor"
class="org.springframework.web.servlet.i18n.LocaleChangeInterceptor">
<property name="paramName" value="locale"/>
</bean>
<!-- Declare the Resolver -->
<bean id="localeResolver" class="org.springframework.web.servlet.i18n.SessionLocaleResolver" />
</beans>

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3. JSP Example

The `form:form` custom JSP tag is configured to post to the URL '/person/form.html', which based on the ControllerClassNameHandlerMapping would map to the `form` method on the PersonController configured to receive a post request. The form is bound to the 'person' model, which is the default for the PersonController. The `form:hidden` custom JSP tag binds to the Person's id and `form:input` is used to bind 'firstName' and 'lastName'.

/WEB-INF/jsp/form/person.jsp

```jsp
<h1><fmt:message key="person.form.title"/></h1>
<c:if test="${not empty statusMessageKey}">
    <p><fmt:message key="${statusMessageKey}" /></p>
</c:if>
<c:url var="url" value="/person/form.html" />
<form:form action="${url}" commandName="person">
    <form:hidden path="id" />
    <fieldset>
        <div class="form-row">
            <label for="firstName"><fmt:message key="person.form.firstName"/>:</label>
            <span class="input"><form:input path="firstName" /></span>
        </div>
        <div class="form-row">
            <label for="lastName"><fmt:message key="person.form.lastName"/>:</label>
            <span class="input"><form:input path="lastName" /></span>
        </div>
        <div class="form-buttons">
            <div class="button"><input name="submit" type="submit" value="<fmt:message key="button.save"/>"></div>
        </div>
    </fieldset>
</form:form>
```

The search displays all records in the person table and generates links to edit and delete a record. The `fmt:message` tag retrieves the local sensitive message based on the message resource key passed in.

/WEB-INF/jsp/person/search.jsp

```jsp
<h1><fmt:message key="person.search.title"/></h1>
```
4. Code Example

The `@Controller` indicates the class is a Spring MVC controller stereotype which is automatically registered by `context:component-scan` in the `web-application-context.xml`. Because the convention based handler `ControllerClassNameHandlerMapping` was used to configure this controller, requests will map to the class name (up unto the 'Controller' suffix) and method names. While using the method signatures and `@RequestMapping` annotations to help target if a method is specifically for a certain type of HTTP request. More sophisticated targeting based on available parameters can also be done, but is not needed in this example.

The first method, `newRequest`, is annotated with `@ModelAttribute`. This indicates that the method will be called before every request. In this case it takes the request parameter 'id', but doesn't require the parameter. By default specifying `@RequestParameter` would cause an error if it wasn't available and no other method was available for processing the request. The `newRequest` method looks up the person from the database and returns it or if the 'id' param is null it returns a new instance for the form to bind to. Without specifying a specific name for the model to be bound to, it will be bound to the class name. So `Person` will be bound to 'person'.

The first `form` method handles a create and edit for an HTTP GET request since it's annotated with `@RequestMapping(method=RequestMethod.GET)`. It's just a place holder since the `newRequest` method has already created or retrieved the appropriate bean from the db. By default, Spring will continue forwarding the request where it was headed before it was intercepted by the controller. This could be changed by returning a `String` with the new path or by returning a view instance (like `ModelAndView`).

The second `form` method handles a save from the person form. It will only accept a request that is an HTTP POST and it has the method signature `form(Person person, Model model)`. By specifying the `person` variable, Spring will automatically retrieve or create (depending on it's scope) an instance of `Person` and bind any
available request parameters to it. Since it is also the default model object, any values set on it will be available on the page the request forwards to. The Model is made available just by specifying it. This can also be done for the HttpServletRequest and HttpServletResponse. The method sets a create date if one isn't already set, saves the person bean, then if it is create the new id is set on the person instance. After this a success message is set on the model for display on form.

The last two method are delete and search. The delete method is very straight forward. It just deletes person, and then redirects to the search page. The search method retrieves all persons and returns them in a Collection. It doesn't explicitly set the return value to be bound to the scope 'persons' using the @ModelAttribute(SEARCH_MODEL_KEY).

```java
@Controller
public class PersonController {

    private static final String SEARCH_VIEW_KEY = "redirect:search.html";
    private static final String SEARCH_MODEL_KEY = "persons";

    @Autowired
    protected PersonDao personDao = null;

    /**
     * For every request for this controller, this will
     * create a person instance for the form.
     */
    @ModelAttribute
    public Person newRequest(@RequestParam(required=false) Integer id) {
        return (id != null ? personDao.findPersonById(id) : new Person());
    }

    /**
     * <p>Person form request.</p>
     * <p>Expected HTTP GET and request '/person/form'.</p>
     */
    @RequestMapping(method=RequestMethod.GET)
    public void form() {};

    /**
     * <p>Saves a person.</p>
     * <p>Expected HTTP POST and request '/person/form'.</p>
     */
    @RequestMapping(method=RequestMethod.POST)
    public void form(Person person, Model model) {
        if (person.getCreated() == null) {
            person.setCreated(new Date());
        }
        Person result = personDao.save(person);
        // set id from create
        if (person.getId() == null) {
            person.setId(result.getId());
        }
        model.addAttribute("statusMessageKey", "person.form.msg.success");
    }

    /**
     * <p>Deletes a person.</p>
     * <p>Expected HTTP POST and request '/person/delete'.</p>
     */
    @RequestMapping(method=RequestMethod.POST)
    public String delete(Person person) {
        personDao.delete(person);
    }

    private static final String SEARCH_VIEW_KEY = "redirect:search.html";
    private static final String SEARCH_MODEL_KEY = "persons";

    @Autowired
    protected PersonDao personDao = null;

    /**
     * For every request for this controller, this will
     * create a person instance for the form.
     */
    @ModelAttribute
    public Person newRequest(@RequestParam(required=false) Integer id) {
        return (id != null ? personDao.findPersonById(id) : new Person());
    }

    /**
     * <p>Person form request.</p>
     * <p>Expected HTTP GET and request '/person/form'.</p>
     */
    @RequestMapping(method=RequestMethod.GET)
    public void form() {};

    /**
     * <p>Saves a person.</p>
     * <p>Expected HTTP POST and request '/person/form'.</p>
     */
    @RequestMapping(method=RequestMethod.POST)
    public void form(Person person, Model model) {
        if (person.getCreated() == null) {
            person.setCreated(new Date());
        }
        Person result = personDao.save(person);
        // set id from create
        if (person.getId() == null) {
            person.setId(result.getId());
        }
        model.addAttribute("statusMessageKey", "person.form.msg.success");
    }

    /**
     * <p>Deletes a person.</p>
     * <p>Expected HTTP POST and request '/person/delete'.</p>
     */
    @RequestMapping(method=RequestMethod.POST)
    public String delete(Person person) {
        personDao.delete(person);
    }

    private static final String SEARCH_VIEW_KEY = "redirect:search.html";
    private static final String SEARCH_MODEL_KEY = "persons";

    @Autowired
    protected PersonDao personDao = null;

    /**
     * For every request for this controller, this will
     * create a person instance for the form.
     */
    @ModelAttribute
    public Person newRequest(@RequestParam(required=false) Integer id) {
        return (id != null ? personDao.findPersonById(id) : new Person());
    }

    /**
     * <p>Person form request.</p>
     * <p>Expected HTTP GET and request '/person/form'.</p>
     */
    @RequestMapping(method=RequestMethod.GET)
    public void form() {};

    /**
     * <p>Saves a person.</p>
     * <p>Expected HTTP POST and request '/person/form'.</p>
     */
    @RequestMapping(method=RequestMethod.POST)
    public void form(Person person, Model model) {
        if (person.getCreated() == null) {
            person.setCreated(new Date());
        }
        Person result = personDao.save(person);
        // set id from create
        if (person.getId() == null) {
            person.setId(result.getId());
        }
        model.addAttribute("statusMessageKey", "person.form.msg.success");
    }

    /**
     * <p>Deletes a person.</p>
     * <p>Expected HTTP POST and request '/person/delete'.</p>
     */
    @RequestMapping(method=RequestMethod.POST)
    public String delete(Person person) {
        personDao.delete(person);
    }

    private static final String SEARCH_VIEW_KEY = "redirect:search.html";
    private static final String SEARCH_MODEL_KEY = "persons";

    @Autowired
    protected PersonDao personDao = null;

    /**
     * For every request for this controller, this will
     * create a person instance for the form.
     */
    @ModelAttribute
    public Person newRequest(@RequestParam(required=false) Integer id) {
        return (id != null ? personDao.findPersonById(id) : new Person());
    }

    /**
     * <p>Person form request.</p>
     * <p>Expected HTTP GET and request '/person/form'.</p>
     */
    @RequestMapping(method=RequestMethod.GET)
    public void form() {};

    /**
     * <p>Saves a person.</p>
     * <p>Expected HTTP POST and request '/person/form'.</p>
     */
    @RequestMapping(method=RequestMethod.POST)
    public void form(Person person, Model model) {
        if (person.getCreated() == null) {
            person.setCreated(new Date());
        }
        Person result = personDao.save(person);
        // set id from create
        if (person.getId() == null) {
            person.setId(result.getId());
        }
        model.addAttribute("statusMessageKey", "person.form.msg.success");
    }

    /**
     * <p>Deletes a person.</p>
     * <p>Expected HTTP POST and request '/person/delete'.</p>
     */
    @RequestMapping(method=RequestMethod.POST)
    public String delete(Person person) {
        personDao.delete(person);
    }
```
return SEARCH_VIEW_KEY;
}

/**
 * Searches for all persons and returns them in a 
 * Collection.</p>
 * 
 * Expected HTTP GET and request '/person/search'.
 */

@RequestMapping(method=RequestMethod.GET)
public @ModelAttribute(SEARCH_MODEL_KEY) Collection<Person> search() {
    return personDao.findPersons();
}

Example 1 PersonController

5. Reference

Related Links

- Annotation-based Controller Configuration Spring Documentation
  [http://static.springframework.org/spring/docs/2.5.x/reference/mvc.html#mvc-annotation]

- Juergen Hoeller's Blog 'Annotated Web MVC Controllers in Spring 2.5'

- Spring by Example's Dynamic Tiles 2 Spring MVC Module

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

$ svn co http://svn.springbyexample.org/web/simple-form-annotation-config-webapp/tags/1.0.2/
  simple-form-annotation-config-webapp

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
Simple Spring Security Webapp

David Winterfeldt

2008

Simple Spring Security 2.0 example securing a webapp based on the Simple Spring MVC Form Annotation Configuration Webapp. All URLs are restricted to valid users except the login, logoff, and style sheet. Only admins have the ability to delete a record. A non-admin doesn't see the link on the search page to delete a record and also calling the delete method on the DAO is restricted to admins.

View a working demo of the application at http://www.springbyexample.org/simple-security/.

1. Web Configuration

The 'springSecurityFilterChain' filter needs to be configured to intercept all URLs so Spring Security can control access to them. The filter must be named this to match the default bean it retrieves from the Spring context.

/WEB-INF/web.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<web-app id="WebApp_ID" version="2.4"
 xmlns="http://java.sun.com/xml/ns/j2ee"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee
 http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd">
  <display-name>simple-security</display-name>
  <listener>
    <listener-class>
      org.springframework.web.context.ContextLoaderListener
    </listener-class>
  </listener>
  <context-param>
    <param-name>contextConfigLocation</param-name>
    <param-value>
      /WEB-INF/security-applicationContext.xml,
      /WEB-INF/applicationContext.xml
    </param-value>
  </context-param>
  <filter>
    <filter-name>springSecurityFilterChain</filter-name>
    <filter-class>
      org.springframework.web.filter.DelegatingFilterProxy
    </filter-class>
  </filter>
  <filter>
    <filter-name>encoding-filter</filter-name>
    <filter-class>
      org.springframework.web.filter.CharacterEncodingFilter
    </filter-class>
    <init-param>
      <param-name>encoding</param-name>
      <param-value>UTF-8</param-value>
    </init-param>
  </filter>
</web-app>
```
2. Spring Configuration

The `security:global-method-security` element configures annotation based security so `@Secured` can be used to restrict access to methods.

The `security:http` is set to auto-configure basic HTTP security. Inside the the login, logout, and main style sheet are set to the anonymous role (unrestricted access). The rest of the site is restricted to an authenticated user in the user role. The default login and logout configuration is also customized to use custom pages to maintain the sites look & feel.

The authentication is set to use jdbc based user authentication. Only the `DataSource` needs to be set on the `security:jdbc-user-service` element if the default tables are used. Although other tables can be used by setting custom queries on the element. If you look below the `security:jdbc-user-service` element, you will see a static configuration of users which might be more convenient for a small application or during testing.

/WEB-INF/security-applicationContext.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:security="http://www.springframework.org/schema/security"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
      http://www.springframework.org/schema/beans/spring-beans-2.5.xsd
      http://www.springframework.org/schema/security
      http://www.springframework.org/schema/security/spring-security-2.0.xsd">
  <security:global-method-security secured-annotations="enabled" />
</beans>
```
3. JSP Example

The security tag is defined at the top of the page with a prefix of 'sec'. Then around delete link the sec:authorize tag is configured to only show the link if the user is in the role 'ROLE_ADMIN'. Now, this doesn't actually stop someone from executing a delete query if they know the URL. Below, in the PersonDao, the @Secured tag is configured to enforce the rule that only an admin can delete a record.

/web-inf/jsp/search/person.jsp

```jsp
<%@ taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core" %>
<%@ taglib prefix="fmt" uri="http://java.sun.com/jsp/jstl/fmt" %>
<%@ taglib prefix="form" uri="http://www.springframework.org/tags/form" %>
<%@ taglib prefix="sec" uri="http://www.springframework.org/security/tags" %>

<h1><fmt:message key="person.search.title"/></h1>
<table class="search">
  <tr>
    <th><fmt:message key="person.form.firstName" /></th>
    <th><fmt:message key="person.form.lastName" /></th>
  </tr>
  <!-- Table content goes here -->
</table>
```
4. Code Example

The delete method has access restricted to users in the admin role by putting the `@Secured` annotation above it and setting the allowed roles. Which in this case is only the 'ROLE_ADMIN' role. By securing the actual DAO interface, even if a non-admin user tries to execute the delete URL they will not be able to delete a record. Try to delete a user as a non-admin user to see the request being stopped by Spring Security (ex: http://www.springbyexample.org/simple-security/delete/person.html?id=1).

```java
public interface PersonDao {
    /**
     * Find person by id.
     */
    public Person findPersonById(Integer id) throws DataAccessException;

    /**
     * Find persons.
     */
    public Collection<Person> findPersons() throws DataAccessException;

    /**
     * Find persons by last name.
     */
    public Collection<Person> findPersonsByLastName(String lastName) throws DataAccessException;

    /**
     * Saves person.
     */
    public void save(Person person);

    /**
     * Deletes person.
     */
    @Secured ("ROLE_ADMIN")
    public void delete(Person person);
}
```
**Example 1 PersonDao**

You may wonder why the '/delete/person*' URL wasn’t restricted. For the current application, this would have been sufficient. But we don’t really want to restrict the URL, we want to restrict the actual delete action. Spring Security makes it very easy to restrict access to actual methods. If at some point in the future the another URL is made to also delete a record, our rule will still be enforced. Also, if at some point someone creates a method that calls delete that is accessed by a completely different URL, only admins will be able to execute this new part of the application successfully. A new implementation of the interface will also have the same rule applied to since the security annotation was placed on the interface and not the implementation itself.

5. SQL Script

`security_schema.sql`

```sql
SET IGNORECASE TRUE;

CREATE TABLE users (  
    username VARCHAR(50) NOT NULL PRIMARY KEY,  
    password VARCHAR(50) NOT NULL,  
    enabled BIT NOT NULL
);

CREATE TABLE authorities (  
    username VARCHAR(50) NOT NULL,  
    authority VARCHAR(50) NOT NULL
);

CREATE UNIQUE INDEX ix_auth_username ON authorities (username, authority);

ALTER TABLE authorities ADD CONSTRAINT fk_authorities_users foreign key (username) REFERENCES users(username);

INSERT INTO users VALUES ('david', 'newyork', true);
INSERT INTO users VALUES ('alex', 'newjersey', true);
INSERT INTO users VALUES ('tim', 'illinois', true);

INSERT INTO authorities VALUES ('david', 'ROLE_USER');
INSERT INTO authorities VALUES ('david', 'ROLE_ADMIN');
INSERT INTO authorities VALUES ('alex', 'ROLE_USER');
INSERT INTO authorities VALUES ('tim', 'ROLE_USER');
```

6. Reference

**Related Links**

- Spring Security Site [http://static.springframework.org/spring-security/site/]
• Simple Spring MVC Form Annotation Configuration Webapp

**Project Setup**

The project is available to checkout from an anonymous Subversion checkout.

**Command Line Example**

```
$ svn co http://svn.springbyexample.org/web/simple-spring-security-webapp/tags/1.0.1/
simple-spring-security-webapp
```

**General Setup Instructions**

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

**Project Information**

• Spring Framework 2.5.x
• Spring Security 2.0.x
A very simple Spring Web Flow 2.0 example using a flow to create and edit a Person. A Spring MVC annotation-based controller still handles search and deleting records. The example is built on Simple Spring MVC Form Annotation Configuration Webapp and Simple Spring Security Webapp which can be referred to for better explanations of Spring MVC Annotations and Spring Security.

View a working demo of the application at http://www.springbyexample.org/simple-webflow/.

1. **Web Configuration**

This would be optional, but to use any of the Spring JavaScript the ResourceServlet needs to be configured. You can see some basic resources loaded in the excerpt from the master Tiles template.

*Excerpt from /WEB-INF/web.xml*

```xml
<!-- Serves static resource content from .jar files such as spring-faces.jar -->
<servlet>
  <servlet-name>resources</servlet-name>
  <servlet-class>org.springframework.js.resource.ResourceServlet</servlet-class>
  <load-on-startup>0</load-on-startup>
</servlet>

<servlet>
  <servlet-name>simple-form</servlet-name>
  <servlet-class>org.springframework.web.servlet.DispatcherServlet</servlet-class>
  <init-param>
    <param-name>contextConfigLocation</param-name>
    <param-value></param-value>
  </init-param>
  <load-on-startup>1</load-on-startup>
</servlet>

<!-- Map all /resources requests to the Resource Servlet for handling -->
<servlet-mapping>
  <servlet-name>resources</servlet-name>
  <url-pattern>/resources/*</url-pattern>
</servlet-mapping>

<servlet-mapping>
  <servlet-name>simple-form</servlet-name>
  <url-pattern>*.html</url-pattern>
</servlet-mapping>
```

2. **Spring Configuration**

Basic Spring Web Flow configuration with Tiles as the view resolver and the security flow execution listener. The
The handlers are configured so flows and annotation-based controllers can be used together. The url '/person.html' is mapped to the person flow in the flowMappings bean and assigned a custom flow handler, which redirects to the search page at the end of the flow and if an exception not handled by the flow occurs.

The tilesViewResolver in the Spring Web Flow examples is normally AjaxUrlBasedViewResolver with the viewClass property set to use FlowAjaxTilesView. This example isn't using AJAX to dynamically populate anything, so Dynamic Tiles Spring MVC Module is used to reduce the Tiles configuration.
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                          http://www.springframework.org/schema/beans/spring-beans.xsd">
  <bean class="org.springframework.web.servlet.mvc.annotation.DefaultAnnotationHandlerMapping">
    <property name="interceptors" ref="localeChangeInterceptor" />
  </bean>

  <!-- Enables annotated POJO @Controllers -->
  <bean class="org.springframework.web.servlet.mvc.annotation.AnnotationMethodHandlerAdapter" />

  <!-- Enables plain Controllers -->
  <bean class="org.springframework.web.servlet.mvc.SimpleControllerHandlerAdapter" />

  <!-- URL to flow mapping rules -->
  <bean id="flowMappings" class="org.springframework.web.servlet.handler.SimpleUrlHandlerMapping">
    <property name="mappings">
      <value>/person.html=personFlowHandler</value>
    </property>
    <property name="order" value="0" />
  </bean>

  <!-- Enables convention-based request URL mapping to @Controllers (ex: /person/* maps to PersonController) -->
  <bean class="org.springframework.web.servlet.mvc.support.ControllerClassNameHandlerMapping">
    <property name="order" value="1" />
  </bean>

  <bean id="tilesConfigurer" class="org.springframework.web.servlet.view.tiles2.TilesConfigurer">
    <property name="definitions">
      <list>
        <value>/WEB-INF/tiles-defs/templates.xml</value>
      </list>
    </property>
  </bean>

  <bean id="tilesViewResolver" class="org.springframework.web.servlet.view.UrlBasedViewResolver">
    <property name="viewClass" value="org.springbyexample.web.servlet.view.tiles2.DynamicTilesView" />
    <property name="prefix" value="/WEB-INF/jsp/" />
    <property name="suffix" value=".jsp" />
  </bean>

  <bean id="messageSource" class="org.springframework.context.support.ResourceBundleMessageSource">
    <property name="basenames">
      <value>messages</value>
    </property>
  </bean>

  <!-- Declare the Interceptor -->
  <bean id="localeChangeInterceptor" class="org.springframework.web.servlet.i18n.LocaleChangeInterceptor">
    <property name="paramName" value="locale" />
  </bean>

  <!-- Declare the Resolver -->
  <bean id="localeResolver" class="org.springframework.web.servlet.i18n.SessionLocaleResolver" />
</beans>
Custom flow for person handling create and edit. The decision-state checks if the id is null and if it is it goes to the 'createPerson' action-state, otherwise it goes to the 'editPerson' action-state. In 'createPerson' the personController's bean's newPerson() method is called and the value is put into 'flowScope' under 'person'. The evaluation is performed using EL. Spring Web Flow supports OGNL and JBoss EL. The example uses JBoss EL. The 'editPerson' action-state uses the Hibernate person DAO to look the person record based on the id in the edit URL.

Note

It would be better to have a prototype bean configured to get a new Person instance, but this was done to show some of the flexibility you get from Spring Web Flow's EL support. See Spring Web Flow Subflow Webapp for an example using prototype beans to put a new Person instance in the flow scope.

Both create and edit forward to the 'personForm' view where the user has a save and cancel button. Both of these buttons are handled using the transition element. The 'save' transition saves the person using the person DAO. Then both save and cancel populate the latest search results and forward to end-state elements that have their view set to the person search page.

The flow is secured to the Spring Security role of 'ROLE_USER'. Which in this case is redundant since the entire webapp is secured to this role, but finer grained rules can make use of this and also it's good to secure the flow since they are reusable components (as subflows).

Person Flow (/WEB-INF/jsp/person/person.xml)

```xml
<?xml version="1.0" encoding="UTF-8"?>
<flow xmlns="http://www.springframework.org/schema/webflow"
     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
     <secured attributes="ROLE_USER" />
     <input name="id" />
     <decision-state id="createOrEdit">
         <if test="id == null" then="createPerson" else="editPerson" />
     </decision-state>
     <action-state id="createPerson">
         <evaluate expression="personController.newPerson()"
                   result="flowScope.person" />
         <transition to="personForm" />
     </action-state>
     <action-state id="editPerson">
         <evaluate expression="personDao.findPersonById(id)"
                   result="flowScope.person" />
         <transition to="personForm" />
     </action-state>
     <view-state id="personForm" model="person" view="/person/form">
         <transition on="save" to="savePerson">
             <evaluate expression="personDao.save(person)" />
         </transition>
         <transition on="cancel" to="cancelPerson" bind="false">
             <evaluate expression="personDao.findPersons()" result="flowScope.persons" />
         </transition>
     </view-state>
</flow>
```
3. JSP Example

All '/resources' URLs are resolved by Spring JavaScript's the ResourceServlet configured in the web.xml.

Excerpt from /WEB-INF/templates/main.jsp

```html
<link type="text/css" rel="stylesheet" href="<c:url value="/resources/dijit/themes/tundra/tundra.css"/>" />
<script type="text/javascript" src="<c:url value="/resources/dojo/dojo.js"/>"></script>
<script type="text/javascript" src="<c:url value="/resources/spring/Spring.js"/>"></script>
```

The create link goes to '/person.html' which is mapped to the person flow. The search link still goes through the PersonController.

/WEB-INF/templates/menu.jsp

```html
<%@ taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core" %>
<%@ taglib prefix="fmt" uri="http://java.sun.com/jsp/jstl/fmt" %>

<div id="side-bar">
  <a href="<c:url value="/"/>">Home</a>
  <p><fmt:message key="person.form.title"/></p>
  <a href="<c:url value="/person.html"/>">Create</a>
  <a href="<c:url value="/person/search.html"/>">Search</a>
</div>
```

The edit link goes to the person flow (ex: '/person.html?id=1'). The flow will look up the person record based on the id request parameter.

/WEB-INF/jsp/person/search.jsp

```html
<%@ taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core" %>
<%@ taglib prefix="fmt" uri="http://java.sun.com/jsp/jstl/fmt" %>
```
The `form:form` element just needs to have it's `modelAttribute` set to correspond to where the flow put the Person instance. The save and cancel buttons specify which event id they are associated with for this step in the flow. This value should match the flow's transition element's `on` attribute. Just for an example, Spring JavaScript is being used to submit the save button. It isn't really necessary for the example, but it could specify to have just a div on the page update. Like if there was a messages div, this JavaScript, `Spring.remoting.submitForm('save', 'person', {fragments:'messages'}); return false;` could be used to display success or failure messages without updating the entire page.

/WEB-INF/jsp/person/form.jsp
4. Code Example

The person controller still handles delete and search. It also has a new `Person()` method used by the 'create' action-state in the person flow to put a new person in scope for the form.

```java
@Controller
class PersonController {

    final Logger logger = LoggerFactory.getLogger(PersonController.class);

    static final String SEARCH_VIEW_KEY = "/person/search";
    static final String SEARCH_MODEL_KEY = "persons";

    @Autowired
    protected PersonDao personDao = null;

    /**
     * Deletes a person.
     * @param id
     * @return
     */
    @RequestMapping(value="/person/delete.html")
    public ModelAndView delete(@RequestParam("id") Integer id) {
        Person person = new Person();
        person.setId(id);
        personDao.delete(person);
        return new ModelAndView(SEARCH_VIEW_KEY, SEARCH_MODEL_KEY, search());
    }

    /**
     * Searches for all persons and returns them in a Collection as 'persons' in the ModelMap.
     * @return
     */
    @RequestMapping(value="/person/search.html")
    @ModelAttribute(SEARCH_MODEL_KEY)
    public Collection<Person> search() {
        Collection<Person> lResults = personDao.findPersons();
        return lResults;
    }

    /**
     * Creates new instance of Person.
     */
    public Person newPerson() {
        return new Person();
    }
}
```
### Example 1 PersonController

At the end of the flow and when exception occurs that the flow doesn't handle, the `PersonFlowHandler` redirects to the search page.

```java
@Component
public class PersonFlowHandler extends AbstractFlowHandler {

    /**
     * Where the flow should go when it ends.
     */
    @Override
    public String handleExecutionOutcome(FlowExecutionOutcome outcome, HttpServletRequest request, HttpServletResponse response) {
        return getContextRelativeUrl(PersonController.SEARCH_VIEW_KEY);
    }

    /**
     * Where to redirect if there is an exception not handled by the flow.
     */
    @Override
    public String handleException(FlowException e, HttpServletRequest request, HttpServletResponse response) {
        if (e instanceof NoSuchFlowExecutionException) {
            return getContextRelativeUrl(PersonController.SEARCH_VIEW_KEY);
        } else {
            throw e;
        }
    }

    /**
     * Gets context relative url with an '.html' extension.
     */
    private String getContextRelativeUrl(String view) {
        return "contextRelative:" + view + ".html";
    }
}
```

### Example 2 PersonFlowHandler

5. Reference

#### Related Links

- Spring Web Flow Site [http://code.google.com/webtoolkit/]
- Simple Spring MVC Form Annotation Configuration Webapp
- Simple Spring Security Webapp

#### Project Setup
The project is available to checkout from an anonymous Subversion checkout.

**Command Line Example**

```
$ svn co http://svn.springbyexample.org/web/simple-spring-webflow-webapp/tags/1.0.1/
simple-spring-webflow-webapp
```

**General Setup Instructions**

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

**Project Information**

- Spring Framework 2.5.x
- Spring Security 2.0.x
- Spring Web Flow 2.0.x
Spring Web Flow Subflow Webapp

David Winterfeldt

2008

A Spring Web Flow 2.0 example using a flow to create and edit a Person and a subflow to create and edit a Person's Addresses. A Spring MVC annotation-based controller still handles search and deleting Person records. The example is built on Simple Spring Web Flow Webapp which can be referred to if necessary.

View a working demo of the application at http://www.springbyexample.org/swf-subflow/.

1. Spring Configuration

This is a basic Spring Web Flow configuration with Tiles as the view resolver and with a Spring Security flow execution listener configured. The webflow:flow-registry element registers the person flow and address subflow. The person flow XML file is stored with the person form and search page, and the address flow is stored with the address form page. A flow specific message resources file (messages.properties) could also be put in these locations.

/WEB-INF/webflow-config.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:webflow="http://www.springframework.org/schema/webflow-config"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                         http://www.springframework.org/schema/beans/spring-beans.xsd
                         http://www.springframework.org/schema/webflow-config
                         http://www.springframework.org/schema/webflow-config/spring-webflow-config-2.0.xsd">
  <!-- Enables FlowHandlers -->
  <bean class="org.springframework.webflow.mvc.servlet.FlowHandlerAdapter">
    <property name="flowExecutor" ref="flowExecutor" />
  </bean>

  <!-- Executes flows: the entry point into the Spring Web Flow system -->
  <webflow:flow-executor id="flowExecutor">
    <webflow:flow-execution-listeners>
      <webflow:listener ref="securityFlowExecutionListener" />
    </webflow:flow-execution-listeners>
  </webflow:flow-executor>

  <!-- The registry of executable flow definitions -->
  <webflow:flow-registry id="flowRegistry" flow-builder-services="flowBuilderServices">
    <webflow:flow-location path="/WEB-INF/jsp/person/person.xml" />
    <webflow:flow-location path="/WEB-INF/jsp/address/address.xml" />
  </webflow:flow-registry>

  <!-- Plugs in a custom creator for Web Flow views -->
  <webflow:flow-builder-services id="flowBuilderServices" view-factory-creator="mvcViewFactoryCreator" />

  <!-- Configures Web Flow to use Tiles to create views for rendering; Tiles allows for applying consistent layouts to your views -->
  <bean id="mvcViewFactoryCreator" class="org.springframework.webflow.mvc.builder.MvcViewFactoryCreator">
    <property name="viewResolvers" ref="tilesViewResolver" />
  </bean>
</beans>
```
The handlers are configured so flows and annotation-based controllers can be used together. The url '/person.html' is mapped to the person flow in the flowMappings bean and assigned a custom flow handler, which redirects to the search page at the end of the flow and if an exception not handled by the flow occurs.

The tilesViewResolver in the Spring Web Flow examples is normally AjaxUrlBasedViewResolver with the viewClass property set to use FlowAjaxTilesView. This example isn't using AJAX to dynamically populate anything, so Dynamic Tiles Spring MVC Module is used to reduce the Tiles configuration.

/web-inf/webmvc-config.xml
Custom flow for person handling create and edit. The decision-state checks if the id is null and if it is it goes to the 'createPerson' action-state, otherwise it goes to the 'editPerson' action-state. In 'createPerson' the prototype scoped personBean bean is put into 'flowScope' under 'person'. The evaluation is performed using EL. Spring Web Flow supports OGNL and JBoss EL, but the example uses JBoss EL. The 'editPerson' action-state uses the Hibernate person DAO to look the person record based on the id in the edit URL.

Both create and edit forward to the 'personForm' view where the user has a save and cancel button. Both of these buttons are handled using the transition element. The 'save' transition saves the person using the person DAO, and puts the result of the save into 'flowScope.person' along with the person id (in case of a create). The success message key is put into 'flashScope' (scope available until next view render), and then goes back to the person form. The cancel populates the latest search results and forward to end-state elements that have their view set to the person search page.

The 'personForm' view also has transitions for handling adding, editing, and deleting addresses. Adding and editing are passed to the 'address' subflow-state. The delete is handled by an evaluate element calling person DAO. Both the address id and the person instance are passed into the address subflow. The person instance is used by an edit to retrieve the address to edit instead of looking it up from that database since it's already in scope. At the end of the address flow the address instance is output from the subflow and saved by the person flow's 'address' subflow-state.

Both flows are secured to the Spring Security role of 'ROLE_USER'. Which in this case is redundant since the entire webapp is secured to this role, but finer grained rules can make use of this and also it's good to secure the flow since they are reusable components (as subflows). The subflow could have only allowed only admins to access the address subflow.
Person Flow (/WEB-INF/jsp/person/person.xml)

```xml
<?xml version="1.0" encoding="UTF-8"?>
<flow xmlns="http://www.springframework.org/schema/webflow"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:schemaLocation="http://www.springframework.org/schema/webflow
                        http://www.springframework.org/schema/webflow/spring-webflow-2.0.xsd">
  <secured attributes="ROLE_USER" />
  <input name="id" />
  <decision-state id="createOrEdit">
    <if test="id == null" then="create" else="edit" />
  </decision-state>
  <action-state id="create">
    <evaluate expression="personBean" result="flowScope.person" />
    <transition to="personForm" />
  </action-state>
  <action-state id="edit">
    <evaluate expression="personDao.findPersonById(id)" result="flowScope.person" />
    <transition to="personForm" />
  </action-state>
  <view-state id="personForm" model="person" view="/person/form">
    <transition on="addAddress" to="address" bind="false">
      <set name="flashScope.addressId" value="''" />
    </transition>
    <transition on="editAddress" to="address">
      <set name="flashScope.addressId" value="requestParameters.addressId" />
    </transition>
    <transition on="deleteAddress" to="personForm">
      <evaluate expression="personDao.deleteAddress(id, requestParameters.addressId)"
                 result="flowScope.person" />
    </transition>
    <transition on="save" to="personForm">
      <evaluate expression="personDao.save(person)" result="flowScope.person" />
      <set name="flowScope.id" value="person.id" />
      <set name="flashScope.statusMessageKey" value="person.form.msg.success" />
    </transition>
    <transition on="cancel" to="cancel" bind="false">
      <evaluate expression="personDao.findPersons()" result="flowScope.persons" />
    </transition>
  </view-state>
  <subflow-state id="address" subflow="address">
    <input name="id" value="addressId" />
    <input name="person" value="person" />
    <output name="address" />
    <transition on="saveAddress" to="personForm">
      <evaluate expression="personDao.saveAddress(id, address)" result="flowScope.person" />
      <set name="flashScope.statusMessageKey" value="address.form.msg.success" />
    </transition>
    <transition on="cancelAddress" to="personForm" />
  </subflow-state>
  <end-state id="personConfirmed" />
  <end-state id="cancel" />
</flow>
```
The flow is very similar to the person flow. The decision-state handles a create or an edit based on whether or not an id is passed into the flow. Then the action-state for the create put a new Address instance into scope and the edit gets it from the person instance. The save outputs the address instance and let’s the parent flow handle saves.

**Address Flow (/WEB-INF/jsp/address/address.xml)**

```xml
<?xml version="1.0" encoding="UTF-8"?>
<flow xmlns="http://www.springframework.org/schema/webflow"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="http://www.springframework.org/schema/webflow
   http://www.springframework.org/schema/webflow/spring-webflow-2.0.xsd">
   <secured attributes="ROLE_USER" />
   <input name="id" />
   <input name="person" />
   <decision-state id="createOrEdit">
     <if test="id == ''" then="createAddress" else="editAddress" />
   </decision-state>
   <action-state id="createAddress">
     <evaluate expression="addressBean" result="flowScope.address" />
     <transition to="addressForm" />
   </action-state>
   <action-state id="editAddress">
     <evaluate expression="person.findAddressById(id)" result="flowScope.address" />
     <transition to="addressForm" />
   </action-state>
   <view-state id="addressForm" model="address" view="/address/form">
     <transition on="save" to="saveAddress" />
     <transition on="cancel" to="cancelAddress" bind="false" />
   </view-state>
   <end-state id="saveAddress">
     <output name="address" value="address" />
   </end-state>
   <end-state id="cancelAddress" />
</flow>
```

### 2. JSP Example

The create link goes to 'person.html' which is mapped to the person flow. The search link still goes through the PersonController.

/Web-INF/templates/menu.jsp
The edit link goes to the person flow (ex: '/person.html?id=1'). The flow will look up the person record based on the id request parameter.

/WEB-INF/jsp/person/search.jsp

The form:form element just needs to have its modelAttribute set to correspond to where the flow put the Person instance. The save and cancel buttons specify which event id they are associated with for this step in the flow. This value should match the flow's transition element's on attribute.

The link to add an address goes to the address subflow. If there are any addresses, they are displayed in a table with an edit next to each record. There is also a delete link if the user is an admin.
The top of the page has a 'messages' div which can display a status message key or any Spring bind errors. This is where Spring Web Flow will store any errors for automatic validation performed based on a method on the model instance or a bean. In this case, there is a `personValidator` bean that validates if the first and last name are not blank.

/WEB-INF/jsp/person/form.jsp

```html
<%@ taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core" %>
<%@ taglib prefix="fmt" uri="http://java.sun.com/jsp/jstl/fmt" %>
<%@ taglib prefix="spring" uri="http://www.springframework.org/tags" %>
<%@ taglib prefix="form" uri="http://www.springframework.org/tags/form" %>
<%@ taglib prefix="sec" uri="http://www.springframework.org/security/tags" %>

<h1><fmt:message key="person.form.title"/></h1>

<div id="messages">
<c:if test="${not empty statusMessageKey}">
<p><fmt:message key="${statusMessageKey}"/></p>
</c:if>

<spring:hasBindErrors name="person">
<h2>Errors</h2>
<div class="formerror">
<ul>
<c:forEach var="error" items="${errors.allErrors}">
<li>${error.defaultMessage}</li>
</c:forEach>
</ul>
</div>
</spring:hasBindErrors>
</div>

<form:form modelAttribute="person">
<form:hidden path="id" />
<fieldset>
<div class="form-row">
<label for="firstName"><fmt:message key="person.form.firstName"/></label>
<span class="input"><form:input path="firstName" /></span>
</div>
<div class="form-row">
<label for="lastName"><fmt:message key="person.form.lastName"/></label>
<span class="input"><form:input path="lastName" /></span>
</div>
<div class="form-buttons">
<div class="button">
<input type="submit" id="save" name="_eventId_save" value="<fmt:message key="button.save"/>
onclick="Spring.remoting.submitForm('save', 'person')="/ninput type="submit" name="_eventId_cancel" value="Cancel"/>
</div>
</div>
</fieldset>
</form>

<c:if test="${not empty person.id}">
<div style="clear: both;float:left;">
<div>
<a href="${flowExecutionUrl}&_eventId=addAddress" ><fmt:message key="address.form.button.add"/></a>
</div>
</c:if>
<c:if test="${empty person.addresses}"/>
Pnbsp;/p
</c:if>
<c:if test="${not empty person.addresses}"
<table class="search">
```

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The 'messages' div at the top of the page can display a status message or any Spring bind errors. The validation for address is in a method in the Address class. The method in this case is validateAddressForm(MessageContext context). It is for the 'addressForm' view-state so the method name should be 'validate' + ${viewStateId} and take a MessageContext as a parameter.
3. Code Example

The person controller still handles delete and search. It also has a newPerson() and newAddress() method used by the 'create' action-state in the person and address flows to put a new instance in scope for the form to bind to. This method could be called on any bean though. It doesn't need to be on the person controller.

```java
@Controller
public class PersonController {
    final Logger logger = LoggerFactory.getLogger(PersonController.class);

    static final String SEARCH_VIEW_KEY = "/person/search";
    static final String SEARCH_MODEL_KEY = "persons";

    @Autowired
    protected PersonDao personDao = null;

    /**
     * Deletes a person.
     */
    @RequestMapping(value="/person/delete.html")
    public ModelAndView delete(@RequestParam("id") Integer id) {
        Person person = new Person();
        person.setId(id);
        personDao.delete(person);
        return new ModelAndView(SEARCH_VIEW_KEY, SEARCH_MODEL_KEY, search());
    }
}
```
Example 1 PersonController

At the end of the flow and when exception occurs that the flow doesn't handle, the PersonFlowHandler redirects to the search page.

Example 2 PersonFlowHandler

Person Validator that is automatically called by Spring Web Flow based on bean name ($model' + 'Validator') and
the method based binding in a *view-state*.

```java
@Component
public class PersonValidator {
    /**
     * Spring Web Flow activated validation (validate + ${state}).
     * Validates 'personForm' view state after binding to person.
     */
    public void validatePersonForm(Person person, MessageContext context) {
        if (!StringUtils.hasText(person.getFirstName())) {
            context.addMessage(new
                MessageBuilder().error().source("firstName").code("person.form.firstName.error").build());
        }
        if (!StringUtils.hasText(person.getLastName())) {
            context.addMessage(new
                MessageBuilder().error().source("lastName").code("person.form.lastName.error").build());
        }
    }
}

Example 3 PersonValidator

```java
/**
 * Validates 'addressForm' view state after binding to address.
 * Spring Web Flow activated validation ('validate' + ${state}).
 */
public void validateAddressForm(MessageContext context) {
    if (!StringUtils.hasText(address)) {
        context.addMessage(new
            MessageBuilder().error().source("address").code("address.form.address.error").build());
    }
    if (!StringUtils.hasText(city)) {
        context.addMessage(new
            MessageBuilder().error().source("city").code("address.form.city.error").build());
    }
    if (!StringUtils.hasText(state)) {
        context.addMessage(new
            MessageBuilder().error().source("state").code("address.form.state.error").build());
    }
    if (!StringUtils.hasText(zipPostal)) {
        context.addMessage(new
            MessageBuilder().error().source("zipPostal").code("address.form.zipPostal.error").build());
    }
    if (!StringUtils.hasText(country)) {
        context.addMessage(new
            MessageBuilder().error().source("country").code("address.form.country.error").build());
    }
}

Example 4 Excerpt from Address

```java
```
4. Reference

Related Links

• Spring Web Flow Site [http://code.google.com/webtoolkit/]

• Simple Spring Web Flow Webapp

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```
$ svn co http://svn.springbyexample.org/web/spring-webflow-subflow-webapp/tags/1.0.1/spring-webflow-subflow-webapp
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

• Spring Framework 2.5.x

• Spring Security 2.0.x

• Spring Web Flow 2.0.x
Simple GWT Spring Webapp

David Winterfeldt

2008

This enhances the Spring Web Flow Subflow Webapp by using GWT (Google Web Toolkit) version 1.5-RC1 for a GWT table widget on the search page. The example also uses Spring JS to submit the person form by using Spring.remoting.submitForm to only update the content div. Tiles Spring MVC Module (version 1.1) has been updated to support rendering Tiles fragments like AjaxTilesView and FlowAjaxTilesView in Spring JS and Spring Web Flow.

View a working demo of the application at http://www.springbyexample.org/simple-gwt/.

1. Web Configuration

All JSP requests are routed to '*.htm' and all '*.do' requests are requests to a GWT Controller. Previous examples mapped requests to '*.html', but this caused a problem serving the autogenerated GWT HTML pages. It might be better to have the controller map requests to specific areas like '/person/*.html' and then this would avoid the conflict between serving dynamic and static content.

Excerpt from /WEB-INF/web.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<servlet>
    <servlet-name>simple-form</servlet-name>
    <servlet-class>org.springframework.web.servlet.DispatcherServlet</servlet-class>
    <init-param>
        <param-name>contextConfigLocation</param-name>
        <param-value></param-value>
    </init-param>
    <load-on-startup>1</load-on-startup>
</servlet>

<servlet>
    <servlet-name>gwt-controller</servlet-name>
    <servlet-class>org.springframework.web.servlet.DispatcherServlet</servlet-class>
    <load-on-startup>2</load-on-startup>
</servlet>

<!-- Map all /resources requests to the Resource Servlet for handling -->
<servlet-mapping>
    <servlet-name>resources</servlet-name>
    <url-pattern>/resources/*</url-pattern>
</servlet-mapping>

<servlet-mapping>
    <servlet-name>simple-form</servlet-name>
    <url-pattern>*.htm</url-pattern>
</servlet-mapping>

<servlet-mapping>
    <servlet-name>gwt-controller</servlet-name>
    <url-pattern>*.do</url-pattern>
</servlet-mapping>
```
2. GWT

For GWT integration a Maven plugin that generates the GWT static HTML and JavaScript files as part of the compilation step is being used. The `GWTApplication.launch` can be used to launch GWT inside Eclipse either in standard or debug mode. Unfortunately GWT was made to extend it's RemoteServiceServlet class. It was simplest to have a mock/test implementation to return some static data to use with GWT debugging and a Spring controller for development within Spring. In order to develop in Spring, there is a small manual step in the current project setup. Which is running Maven's compile and then copying the generated files into 'src/main/webapp' after removing the existing files. GWT generates unique file names each time for most files, so old ones will build up if they aren't removed.

```bash
mvn compile
# remove old static files from src/main/webapp
cp -R target/simple-gwt-1.0/org.springbyexample.web.gwt.App src/main/webapp/
```

The Spring controller extends GwtController within the project and is very simple. It extends RemoteServiceServlet and also implements the Spring Controller interface, which then just calls doPost in the handleRequest method. The doPost method will deserialize any incoming IsSerializable JavaBeans sent by the client request, call the method specified in the RPC request, and serialize any results returned to the client. Also see the GWTSpringController GWT Widget Library to not have to maintain your own controller class.

**GWT Configuration**

This is used during the compilation process and when running GWT with `GWTApplication.launch` in Eclipse. There is a static HTML page in a directory called 'public' just under the XML file's directory.

All normal projects inherit `com.google.gwt.user.User`, but this example also uses `com.google.gwt.i18n.I18N` for internationalization and `com.google.gwt.http.HTTP` for getting the edit/delete links from a JSP fragment for each table row. The `entry-point` element is the class that initializes the GWT application. Typically client code is under a client package and server is under a server package.

**Note**

All client classes must be under the same package root. With `org.springbyexample.web.gwt.client.App`, `org.springbyexample.web.gwt.client.bean.Person` is ok, but `org.springbyexample.web.bean.Person` would not be.

**App.gwt.xml**

```xml
<main>
  <!-- Inherit the core Web Toolkit stuff. -->
  <inherits name='com.google.gwt.user.User'/>
  <inherits name='com.google.gwt.i18n.I18N'/>
  <inherits name='com.google.gwt.http.HTTP'/>

  <!-- Specify the app entry point class. -->
  <inherits name='org.springbyexample.web.gwt.App'/>
</main>
```
Spring Configuration

The ServiceController is loaded by the context:component-scan and configured on the SimpleUrlHandlerMapping bean to map to /person/service.do to handle calls from the GWT client.

/WEB-INF/gwt-controller-servlet.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans" 
xmni:context="http://www.springframework.org/schema/context" 
  <context:component-scan base-package="org.springbyexample.web.gwt.server" />
  <bean class="org.springframework.web.servlet.mvc.annotation.DefaultAnnotationHandlerMapping">
    <!-- <property name="interceptors" ref="localeChangeInterceptor"/> -->
  </bean>
  <!-- Enables annotated POJO @Controllers -->
  <bean class="org.springframework.web.servlet.mvc.annotation.AnnotationMethodHandlerAdapter" />
  <!-- Enables plain Controllers -->
  <bean class="org.springframework.web.servlet.mvc.SimpleControllerHandlerAdapter" />
  <bean class="org.springframework.web.servlet.handler.SimpleUrlHandlerMapping">
    <property name="order" value="0" />
    <property name="mappings">
      <value>
        /person/service.do=serviceController
      </value>
    </property>
  </bean>
</beans>
```

JSP Example

The script element references the generated script entry point and the 'search-table' div is where the script will insert the table widget.

GWT has built in internationalization (i18n) support, but to integrate it in with the web application’s i18n support a JavaScript object must be created on the page that GWT will read from by calling Dictionary.messageResource = Dictionary.getDictionary("MessageResource"). Then they can be
retrieved by calling `messageResource.get("person.form.firstName")` with the message key.

/WEB-INF/jsp/search/person.jsp

```html
<div id="search-table"></div>
```

## Code Example

GWT requires an interface and a matching asynchronous interface for clients to use. Whatever the main interface name is, the asynchronous name should match with a suffix of 'Async' ('Service' --> 'ServiceAsync').

**Server interface** that must extend GWT's `RemoteService` interface.

```java
public interface Service extends RemoteService {
    /**
     * Finds person within a range.
     */
    public Person[] findPersons(int startIndex, int maxResults);
}
```

**Example 1 Service**

Client asynchronous interface that matches the `Service` interface, but returns `void` and has `AsyncCallback<Person[]>` added as a final parameter.

---

**Note**
The value returned from the Service interface is now the generic value passed into the AsyncCallback.

```java
public interface ServiceAsync {
    /**
     * Finds person within a range.
     */
    public void findPersons(int startIndex, int maxResults, AsyncCallback<Person[]> callback);
}
```

**Example 2 ServiceAsync**

This class extends GwtController and implements the Service interface. The person DAO is used to get the current page of results and copies them into another Person instance that implements IsSerializable (which indicates that this is serializable by GWT RPC requests). The instance returned by the DAO can’t be used because it has annotations that the GWT compiler can’t convert to JavaScript.

```java
@Controller
public class ServiceController extends GwtController implements Service {
    final Logger logger = LoggerFactory.getLogger(ServiceController.class);
    private static final long serialVersionUID = -2103209407529882816L;
    @Autowired
    private PersonDao personDao = null;
    /**
     * Finds person within a range.
     */
    public Person[] findPersons(int startIndex, int maxResults) {
        Person[] results = null;
        List<Person> lResults = new ArrayList<Person>();
        Collection<org.springbyexample.orm.hibernate3.annotation.bean.Person> lPersons =
                personDao.findPersons(startIndex, maxResults);
        for (org.springbyexample.orm.hibernate3.annotation.bean.Person person : lPersons) {
            Person result = new Person();
            result.setId(person.getId());
            result.setFirstName(person.getFirstName());
            result.setLastName(person.getLastName());
            lResults.add(result);
        }
        return lResults.toArray(new Person[]{})
    }
}
```

**Example 3 ServiceController**
The constructor sets up the asynchronous service. The URL base is set by using `GWT.getHostPageBaseURL()` so the generated JavaScript can be hosted in other pages as shown in the `search.jsp` above. The callback is used to process the results or a failure if there is a problem with the request.

The `processLinkRequest` method is used to populate the table cell with the edit/delete link by making an HTTP GET request to a JSP fragment with the links in the pages. This isn't the best for performance, but seemed the easiest way to leverage Spring Security's JSP tags for evaluating whether or not someone has permission to delete a record.

```java
private class PersonProvider implements SearchTableDataProvider {

    private final ServiceAsync service;
    private int lastMaxRows = -1;
    private Person[] lastPeople;
    private int lastStartRow = -1;

    /**
     * Constructor
     */
    public PersonProvider() {
        service = (ServiceAsync) GWT.create(Service.class);
        ServiceDefTarget target = (ServiceDefTarget) service;
        String moduleRelativeURL = GWT.getHostPageBaseURL() + "service.do";
        target.setServiceEntryPoint(moduleRelativeURL);
    }

    public void updateRowData(final int startRow, final int maxRows,
                               final RowDataAcceptor acceptor) {
        final StringBuffer sb = new StringBuffer();
        // Check the simple cache first.
        if (startRow == lastStartRow) {
            if (maxRows == lastMaxRows) {
                // Use the cached batch.
                pushResults(acceptor, startRow, lastPeople);
            }
        }
        // Fetch the data remotely.
        service.findPersons(startRow, maxRows, new AsyncCallback<Person[]>() {
            public void onFailure(Throwable caught) {
                acceptor.failed(caught);
            }

            public void onSuccess(Person[] result) {
                lastStartRow = startRow;
                lastMaxRows = maxRows;
                lastPeople = result;
                pushResults(acceptor, startRow, result);
            }
        });
    }

    private void pushResults(RowDataAcceptor acceptor, int startRow, Person[] people) {
        String[][] rows = new String[people.length][];
        for (int i = 0, n = rows.length; i < n; i++) {
            Person person = people[i];
            rows[i] = new String[3];
            rows[i][0] = person.getFirstName();
            rows[i][1] = person.getLastName();
            rows[i][2] = "";
        }
        // increment by one because of table header
        int row = i + 1;
    }
}
```
processLinkRequest(person.getId(), acceptor, row);
}

String message = acceptor.accept(startRow, rows);
dynamicTable.setStatusText(message);

private void processLinkRequest(Integer personId,
final RowDataAcceptor acceptor, final int row) {
    String url = GWT.getHostPageBaseURL() + "fragment/search_link.htm" +
                "?ajaxSource=true&fragments=content&" + "id=" + personId;
    url = URL.encode(url);
    RequestBuilder rb = new RequestBuilder(RequestBuilder.GET, url);
    try {
        Request response = rb.sendRequest(null, new RequestCallback() {
            public void onError(Request request, Throwable exception) {

            }
            public void onResponseReceived(Request request, Response response) {
                dynamicTable.setCell(row, 2, response.getText());
            }
        });
    } catch (RequestException e) {
        Window.alert("Failed to send the request: " + e.getMessage());
    }
}

Example 4 SearchTableWidget.PersonProvider

3. Spring JS Configuration

The person form on a save uses AJAX to render just the content part of the page.

Spring Configuration

For the AJAX requests to work correctly an AjaxUrlBasedViewResolver must be configured and FlowAjaxDynamicTilesView as the view class. If the dynamic tiles module isn't being used, an AjaxTilesView can be set for use outside of Web Flow or FlowAjaxTilesView for flow based AJAX requests.

Excerpt from /WEB-INF/webmvc-context.xml

```xml
<bean id="tilesViewResolver"
    class="org.springframework.js.ajax.AjaxUrlBasedViewResolver">
    <property name="viewClass"
        value="org.springbyexample.web.servlet.view.tiles2.FlowAjaxDynamicTilesView" />
    <property name="prefix" value="/WEB-INF/jsp/" />
    <property name="suffix" value=".jsp" />
</bean>
```

Simple GWT Spring Webapp
At the end of the save transition, the 'content' Tiles attribute is the fragment specified to be rendered.

Spring Web Flow Configuration (Excerpt from /WEB-INF/jsp/person/person.xml)

```xml
<view-state id="personForm" model="person" view="/person/form">
    <transition on="addAddress" to="address" bind="false">
        <set name="flashScope.addressId" value="''" />
    </transition>
    <transition on="editAddress" to="address">
        <set name="flashScope.addressId" value="requestParameters.addressId" />
    </transition>
    <transition on="deleteAddress" to="personForm">
        <evaluate expression="personDao.deleteAddress(id, requestParameters.addressId)"
            result="flowScope.person" />
    </transition>
    <transition on="save">
        <evaluate expression="personDao.save(person)" result="flowScope.person" />
        <set name="flowScope.id" value="person.id" />
        <set name="flashScope.statusMessageKey" value="'person.form.msg.success'" />
        <render fragments="content" />
    </transition>
    <transition on="cancel" to="cancel" bind="false">
        <evaluate expression="personDao.findPersons()" result="flowScope.persons" />
    </transition>
</view-state>
```

JSP Example

The submit button has its `onclick` attribute set to use Spring JS to submit the form using AJAX. The `Spring.remoting.submitForm('save', 'person', {fragments:'content'})` request specifies the id of the button, the name of the form, and the Tiles fragments to re-render (can be a comma delimited list). The returned fragments are matched to existing divs on the page (‘message’ div in returned result to ‘message’, ‘personForm’ div to ‘personForm’, etc.).

Excerpt from /WEB-INF/jsp/person/form.jsp

```html
<div id="personForm">
    <form:form modelAttribute="person">
        <form:hidden path="id" />
        <fieldset>
            <div class="form-row">
                <label for="firstName"><fmt:message key="person.form.firstName"/></label>
                <span class="input"><form:input path="firstName" /></span>
            </div>
            <div class="form-row">
                <label for="lastName"><fmt:message key="person.form.lastName"/></label>
                <span class="input"><form:input path="lastName" /></span>
            </div>
            <div class="form-buttons">
                <div class="button">
                    <input type="submit" id="save" name="_eventId_save" value="<fmt:message key="button.save"/>
```

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4. Reference

Related Links

- Google Web Toolkit [http://code.google.com/webtoolkit/]
- Spring Web Flow [http://www.springframework.org/webflow]
- Spring by Example's Dynamic Tiles 2 Spring MVC Module
- GWT Widget Library [http://gwt-widget.sourceforge.net/](see GWTSpringController)

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```
$ svn co http://svn.springbyexample.org/web/simple-gwt-webapp/tags/1.0/ simple-gwt-webapp
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

**Project Information**

- Spring Framework 2.5.x
- Spring Security 2.0.x
- Spring Web Flow 2.0.x
- GWT 1.5-RC1
Spring Bayeux GWT Chat Webapp

David Winterfeldt

2008

The chat example allows a client to send and receive messages published to a chat channel and also to see a list of the other chat clients. The example has GWT & Dojo Cometd [http://cometdproject.dojotoolkit.org/ ] integration on the client and Spring Bayeux integration on the server. The GWT part of the client handles display and client interaction, but calls out to external JavaScript to let Dojo Cometd [http://cometdproject.dojotoolkit.org/ ] handle Bayeux publish/subscribe on the client. The Spring by Example Web Module is used for it's Bayeux support to configure the Bayeux Chat Service.

To briefly explain Comet & Bayeux, Comet is server side push basically. Instead of a standard HTTP request that makes a request and immediately receives a response, Comet either has an open connection to stream data to the client or long polling is used. Long polling, which is what the current Bayeux implementation uses, makes a request and the server doesn't respond until an event occurs on the server. Bayeux is a protocol that clearly defines a number of things, but one of it's primary goals is providing low latency over HTTP. It provides a publish/subscribe API for handling events. Bayeux also has implementation in more than just Java and JavaScript.

The chat example is based on the Dojo Cometd [http://cometdproject.dojotoolkit.org/ ] chat example and a slightly modified version of the example is also available for comparison in the web application. The only changes made to the Dojo Cometd [http://cometdproject.dojotoolkit.org/ ] example was just enough to get it integrated into the Tiles page and changing the JavaScript since the URL for subscribing to the chat service is slightly different. The actual Bayeux Chat Service, which will be shown further in the example, has only minor changes compared to the original to integrate it with Spring.

The project uses Spring by Example Web Module's Spring Bayeux Integration for Comet on Jetty. This has support for creating and initializing the main Bayeux instance in Spring and then the Spring Bayeux servlet will retrieve it from the Spring context. Also, Bayeux Services can then have the Bayeux instance injected along with Hibernate, Web Services, etc. A message driven POJO could even then publish a message event to Bayeux clients.

Note

Currently this example only runs on Jetty since it uses the Bayeux implementation provided by Jetty. Tomcat also has Comet support and it should be easy to port a Bayeux implementation to it if one doesn't already exist. There isn't currently a standard API to suspend and resume HTTP requests, but the Servlet 3.0 Draft Specification is standardizing this. Hopefully it will be finalized relatively soon and most major servlet engines will have a Servlet 3.0 implementation. Jetty already has a pre-release 7.0 version implementing the Servlet 3.0 specification as it currently is.

1. Server Configuration

Web Configuration

This is basically the same as a standard Spring MVC web configuration, but two things to note are the Spring JS ResourceServlet and the SpringContinuationCometdServlet handles Bayeux requests. The
ResourceServlet is used for serving static files from jars. The Spring JS libraries contain Dojo, and are actually served from there. The Dojox JavaScript libraries are in the dojox-resources.jar. The SpringContinuationCometdServlet handles all Bayeux publish and subscribe requests and is mapped to '/cometd/*'.

/WEB-INF/web.xml

```xml
  <display-name>chat</display-name>
  <listener>
    <listener-class>org.springframework.web.context.ContextLoaderListener</listener-class>
  </listener>
  <context-param>
    <param-name>contextConfigLocation</param-name>
    <param-value>/WEB-INF/web-application-context.xml</param-value>
  </context-param>
  <filter>
    <filter-name>encoding-filter</filter-name>
    <filter-class>org.springframework.web.filter.CharacterEncodingFilter</filter-class>
    <init-param>
      <param-name>encoding</param-name>
      <param-value>UTF-8</param-value>
    </init-param>
  </filter>
  <filter-mapping>
    <filter-name>encoding-filter</filter-name>
    <url-pattern>/*</url-pattern>
  </filter-mapping>
  <!-- Serves static resource content from .jar files such as spring-faces.jar -->
  <servlet>
    <servlet-name>resources</servlet-name>
    <servlet-class>org.springframework.js.resource.ResourceServlet</servlet-class>
    <load-on-startup>0</load-on-startup>
  </servlet>
  <servlet>
    <servlet-name>cometd</servlet-name>
    <servlet-class>org.springbyexample.cometd.continuation.SpringContinuationCometdServlet</servlet-class>
    <init-param>
      <param-name>asyncDeliver</param-name>
      <param-value>false</param-value>
    </init-param>
    <load-on-startup>1</load-on-startup>
  </servlet>
  <servlet>
    <servlet-name>chat</servlet-name>
    <servlet-class>org.springframework.web.servlet.DispatcherServlet</servlet-class>
    <init-param>
      <param-name>contextConfigLocation</param-name>
      <param-value></param-value>
    </init-param>
  </servlet>
</web-app>
```
Spring Configuration

The \texttt{context:component-scan} will register the Bayeux Chat Service. The \texttt{bayeux} bean class is \texttt{SpringContinuationBayeux}. This is the main instance that will control of Bayeux's publish and subscribe on the server. It will be used by all Bayeux services and by the Bayeux servlet. Basic values like timeout can be set (\texttt{p}-namespace is being used for setter injection, shortcut for using \texttt{property} element). The Bayeux implementation also supports filtering of any messages. This example has a filter defined to not allow any markup to be sent and also has two basic regular expression filters. One matches 'Spring by Example' (either a capital or lower case 's' for 'spring', 'b' for 'by', and 'e' for 'example') or 'sbe' (upper or lower case) and changes it to 'Spring by Example'. The other corrects typos for 'the' and 'spring'.

\texttt{/WEB-INF/bayeux-context.xml}

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd"
xmlns:p="http://www.springframework.org/schema/p"
xmlns:context="http://www.springframework.org/schema/context"
xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd
http://www.springframework.org/schema/context
http://www.springframework.org/schema/context/spring-context.xsd">

<context:component-scan base-package="org.springbyexample.web.cometd" />

<bean id="bayeux"
class="org.springbyexample.web.cometd.continuation.SpringContinuationBayeux"
p:timeout="300000"
p:interval="0"
p:maxInterval="10000"
p:multiFrameInterval="2000"
p:logLevel="0"
p:directDeliver="true">
    <property name="filters">
        </property>
    </bean>
</beans>
```
Code Example

The `ChatService` is basically the same as the one from the Dojo Cometd example. The key differences are that the class is annotated with `@Component` and the constructor is annotated with `@Autowired`. So the service is picked up by the `context:component-scan` because of the `@Component` annotation and the `Bayeux` instance configured in the XML configuration is injected into the constructor because of the `@Autowired` annotation. At this point the class just calls `super` in its constructor to give the `Bayeux` instance to its parent and working on the service is the same. So it is very easy to modify any Bayeux service example to be Spring configured and gain the full advantage of IoC and DI.

`src/main/java/org/springbyexample/web/cometd/chat/ChatService.java`

```java
@Component
public class ChatService extends BayeuxService {

    final Logger logger = LoggerFactory.getLogger(ChatService.class);

    final ConcurrentHashMap<String, Set<String>> _members = new ConcurrentHashMap<String, Set<String>>();

    /**
     * Constructor
     */
    @Autowired
```
public ChatService(Bayeux bayeux) {
    super(bayeux, "chat");
    subscribe("/chat/**", "trackMembers");
}
/**
 * Tracks chat clients.
 */
public void trackMembers(Client joiner, String channel,
    Map<String, Object> data, String id) {
    if (Boolean.TRUE.equals(data.get("join"))) {
        Set<String> m = _members.get(channel);
        if (m == null) {
            Set<String> new_list = new CopyOnWriteArraySet<String>();
            m = _members.putIfAbsent(channel, new_list);
            if (m == null) {
                m = new_list;
            }
        }
        final Set<String> members = m;
        final String username = (String) data.get("user");
        members.add(username);
        joiner.addListener(new RemoveListener() {
            public void removed(String clientId, boolean timeout) {
                members.remove(username);
                logger.info("members: " + members);
            }
        });
        logger.info("Members: " + members);
        send(joiner, channel, members, id);
    }
}

Example 1 ChatService

2. Client Configuration

Join Code Example

The AppBase is the parent of App. AppBase is used as a class without an Dojo Cometd dependencies so it can be launched in GWT hosted mode for basic debugging and looking at the GUI layout.

This excerpt from AppBase.onModuleLoad() adds a ClickListener to the join button. When the button is clicked, the user name is set from the text field, the join method is called, the join panel's visibility is set to false, and the main chat panel is added. The join method in AppBase doesn't do anything, but the child class, App, overrides the join method and calls out to a native JavaScript method which calls Dojo Cometd to subscribe to chat.

Excerpt from web/chat-webapp/src/main/java/org/springbyexample/web/gwt/chat/client/AppBase.java
Example 2 Join Code Example (excerpt from AppBase.java)

The join method is native and has special comments before and after the body so the GWT compiler can process the method into JavaScript. The app variable makes a reference to this for use in the anonymous inner function. The call to external JavaScript starts with $wnd which indicates to the GWT compiler that what follows $wnd is a native JavaScript call that is calling room.join. The room.join takes the user's name and three callbacks to GWT. The first one is for displaying messages, the second is for displaying a user joining, and the last is to clear the user table.

Inside the first anonymous function, it is configured to take from and text values for displaying a chat message. The app variable created about is used to reference the App class. This is the special syntax the GWT compiler uses to make a reference from JavaScript to GWT generated JavaScript. You'll notice that an @ symbol is put before the full class name, which is then followed by '::' and the name of the method along with it's signature. Right after that the variables passed into the function are passed into App.display(String from, String text) (method actually located in AppBase).

Excerpt from web/chat-webapp/src/main/java/org/springbyexample/web/gwt/chat/client/App.java

protected native void join(String userName) /*-{  
    // Keep reference to self for use inside closure  
    var app = this;  
    $wnd.room.join(userName,  
        function(from, text) {  
            app.@org.springbyexample.web.gwt.chat.client.App::display(Ljava/lang/String;Ljava/lang/String;)(from,  
                text);  
        },  
        function(user) {  
            app.@org.springbyexample.web.gwt.chat.client.App::addUser(Ljava/lang/String;)(user);  
        },  
        function() {  
            app.@org.springbyexample.web.gwt.chat.client.App::clearUserTable();  
        }  
    );  
}*/;  

Example 3 Join Code Example (excerpt from App.java)

This shows the JavaScript function being called from GWT to join the chat room ($wnd.room.join).

Excerpt from src/main/webapp/js/gwt-chat.js
join: function(userName, displayCallback, addUserCallback, clearUserTableCallback) {
    if (userName == null || userName.length == 0) {
        alert('Please enter a username!');
        return;
    }

    var hostName = window.location.hostname;
    var port = window.location.port;
    var contextPath = "/chat";
    var host = "http:\/\/" + hostName;
    if (port) {
        host += ":" + port;
    }
    host += contextPath;
    dojox.cometd.init(host + "/cometd/chat/"); ❶

    room.connected = true;
    room.userName = userName;
    room.displayCallback = displayCallback; ❷
    room.addUserCallback = addUserCallback;
    room.clearUserTableCallback = clearUserTableCallback;

    // subscribe and join
    dojox.cometd.startBatch(); ❸
    dojox.cometd.subscribe("/chat/demo", room, "processMessageEvent"); ❹
    dojox.cometd.publish("/chat/demo", { ❺
        user: room.userName,
        join: true,
        chat: room.userName + " has joined"
    });
    dojox.cometd.endBatch(); ❻

    ...
},

❶ This makes the main connection to Bayeux using Dojo Cometd’s init function.
❷ This sets the GWT callback for displaying a chat message when this code receives a message.
❸ Dojo Cometd’s startBatch() is called to batch together subscribing to the chat room and publishing the current user has joined the room.
❹ This method subscribes to /chat/demo and configures the callback to be the room variable’s processMessageEvent function.
❺ Dojo Cometd’s publish function publishes that the current user has just joined the room so other chat users are notified.
❻ This line ends the current batch so it can be processed.

Example 4 Join Code Example (excerpt from gwt-chat.js)

Send Code Example

This excerpt from AppBase.onModuleLoad() adds a KeyboardListener to the text box that listens for the enter key being pressed to send a message, and a ClickListener to the the send button.
chatTextBox.addKeyboardListener(new KeyboardListener() {
    public void onKeyDown(Widget sender, char keyCode, int modifiers) {
    }
    public void onKeyPress(Widget sender, char keyCode, int modifiers) {
        if (keyCode == KEY_ENTER) {
            send(chatTextBox.getText());
            chatTextBox.setText("");  
        }
    }
    public void onKeyUp(Widget sender, char keyCode, int modifiers) {
    }};
Button sendButton = new Button();
sendButton.setText(sendLabel);
sendButton.addClickListener(new ClickListener() {
    public void onClick(Widget sender) {
        send(chatTextBox.getText());
        chatTextBox.setText("");
    }
});

Example 5 Send Code Example (excerpt from AppBase.java)

This is the send method being called by the KeyboardListener and ClickListener defined for send that calls the native JavaScript method $wnd.room.chat.

Excerpt from web/chat-webapp/src/main/java/org/springbyexample/web/gwt/chat/client/App.java

protected native void send(String message) /*-{ $wnd.room.chat(message); }-*/;

Example 6 Send Code Example (excerpt from App.java)

Below is the JavaScript function being called from GWT to send a chat message ($wnd.room.chat).

Excerpt from src/main/webapp/js/gwt-chat.js

chat: function(text) {
    if (!text || !text.length) {
        return false;
    }
    dojox.cometd.publish("/chat/demo", { user: room.userName, chat: text });
}
Dojo Cometd's `publish` function to the `/chat/demo` channel sending user and chat message.

*Example 7 Send Code Example (excerpt from gwt-chat.js)*

**Leave Code Example**

The leave button has a `ClickListener` that leaves the chat room, clears the screen and chat panel, then shows the join panel so the user can rejoin the chat.

Excerpt from `web/chat-webapp/src/main/java/org/springbyexample/web/gwt/chat/client/AppBase.java`

```java
leaveButton.addClickListener(new ClickListener() {
    public void onClick(Widget sender) {
        leave(userName);
        chatTextBox.setText("*");
        chatPanel.remove(sendChatPanel);
        clearUserTable();
        clearChatTable();
        joinChatPanel.setVisible(true);
    }
});
```

*Example 8 Leave Code Example (excerpt from AppBase.java)*

The `leave` method calls the native JavaScript room's `leave` function.

Excerpt from `web/chat-webapp/src/main/java/org/springbyexample/web/gwt/chat/client/App.java`

```java
protected native void leave(String userName) /*-{
    $wnd.room.leave();
}*/;
```

*Example 9 Leave Code Example (excerpt from App.java)*

The `leave` function doesn't do anything if the user name is `null`. If the Dojo Cometd meta subscription isn't `null`, it unsubscribes from the meta channel. Then it begins a batch that unsubscribes from the chat channel and publishes that the user has left the room before ending the batch. At the end it disconnects from Bayeux on the server.

Excerpt from `src/main/webapp/js/gwt-chat.js`
leave: function(){
    if (!room.userName) {
        return;
    }

    if (room.meta) {
        dojo.unsubscribe(room.meta);
    }

    room.meta = null;

dojo.cometd.startBatch(); ❶
dojo.cometd.unsubscribe("/chat/demo", room, "processMessageEvent"); ❷
dojo.cometd.publish("/chat/demo", { ❸
        user: room.userName,
        leave: true,
        chat: room.userName + " has left"
    });
dojo.cometd.endBatch(); ❹

    room.userName = null;
    dojo.cometd.disconnect(); ❺
},

Dojo Cometd's `startBatch()` is called to batch together unsubscribing to the chat room and publishing the current user has left the room.

This method unsubscribes from `/chat/demo` and configures the callback to be the `room` variable's `processMessageEvent` function.

Dojo Cometd's `publish` function publishes that the current user has just left the room.

This line ends the current batch so it can be processed.

Dojo Cometd's `disconnect` function is called to disconnect from Bayeux.

*Example 10 Leave Code Example (excerpt from gwt-chat.js)*

### 3. Reference

#### Related Links

- Dojo Cometd [http://cometdproject.dojotoolkit.org/]
- Spring by Example Web Module
- Google Web Toolkit [http://code.google.com/webtoolkit/]
- Simple GWT Spring Webapp
- Spring by Example's Dynamic Tiles 2 Spring MVC Module

#### Project Setup

The project is available to checkout from an anonymous Subversion checkout.
Note

Maven [http://maven.apache.org/] 2.0.9 or higher needs to be used for the build process.

Command Line Example

```
$ svn co http://svn.springbyexample.org/web/spring-bayeux-gwt-chat-webapp/tags/1.0/
  spring-bayeux-gwt-chat-webapp
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

**Project Information**

- Spring Framework 2.5.x
- GWT 1.5.3
- Cometd API 1.0.beta1
The Trade Monitor has a client that allows dynamic subscriptions to trade summary information for a stock symbol. The data is random buys and sells generated on the server by a timer. The example has GWT & Dojo Cometd [http://cometdproject.dojotoolkit.org/ ] integration on the client and Spring Bayeux integration on the server. The GWT part of the client handles display and client interaction, but calls out to external JavaScript to let Dojo Cometd [http://cometdproject.dojotoolkit.org/ ] handle Bayeux publish/subscribe on the client. The Spring by Example Web Module is used for it's Bayeux support to configure the Bayeux Trade Monitor Service.

Please see the Spring Bayeux GWT Chat Webapp example for a brief explanation of Comet and Bayeux, and also to see a simpler Bayeux service example.

Note

Currently this example only runs on Jetty since it uses the Bayeux implementation provided by Jetty. Tomcat also has Comet support and it should be easy to port a Bayeux implementation to it if one doesn't already exist. There isn't currently a standard API to suspend and resume HTTP requests, but the Servlet 3.0 Draft Specification is standardizing this. Hopefully it will be finalized relatively soon and most major servlet engines will have a Servlet 3.0 implementation. Jetty already has a pre-release 7.0 version implementing the Servlet 3.0 specification as it currently is.

1. Server Configuration

Web Configuration

This is basically identical to the Spring Bayeux GWT Chat Webapp's web.xml. The Spring JS ResourceServlet is defined to serve JavaScript files like Dojo and the Dojox library. The SpringContinuationCometdServlet handles Bayeux publish and subscribe requests and is mapped to '/cometd/*'.

/web-inf/web.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<web-app id="WebApp_ID" version="2.4"
xmlns="http://java.sun.com/xml/ns/j2ee"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  <display-name>monitor</display-name>
  <listener>
    <listener-class>
```
org.springframework.web.context.ContextLoaderListener
</listener-class>
</listener>
<context-param>
  <param-name>contextConfigLocation</param-name>
  <param-value>/WEB-INF/web-application-context.xml</param-value>
</context-param>
<filter>
  <filter-name>encoding-filter</filter-name>
  <filter-class>org.springframework.web.filter.CharacterEncodingFilter</filter-class>
  <init-param>
    <param-name>encoding</param-name>
    <param-value>UTF-8</param-value>
  </init-param>
</filter>
<filter-mapping>
  <filter-name>encoding-filter</filter-name>
  <url-pattern>/*</url-pattern>
</filter-mapping>
<!-- Serves static resource content from .jar files such as spring-faces.jar -->
<servlet>
  <servlet-name>resources</servlet-name>
  <servlet-class>org.springframework.js.resource.ResourceServlet</servlet-class>
  <load-on-startup>0</load-on-startup>
</servlet>
<servlet>
  <servlet-name>cometd</servlet-name>
  <servlet-class>org.springbyexample.cometd.continuation.SpringContinuationCometdServlet</servlet-class>
  <init-param>
    <param-name>asyncDeliver</param-name>
    <param-value>false</param-value>
  </init-param>
  <load-on-startup>1</load-on-startup>
</servlet>
<servlet>
  <servlet-name>trade-monitor</servlet-name>
  <servlet-class>org.springframework.web.servlet.DispatcherServlet</servlet-class>
  <init-param>
    <param-name>contextConfigLocation</param-name>
    <param-value></param-value>
  </init-param>
  <load-on-startup>2</load-on-startup>
</servlet>
<!-- Map all /resources requests to the Resource Servlet for handling -->
<servlet-mapping>
  <servlet-name>resources</servlet-name>
  <url-pattern>/resources/*</url-pattern>
</servlet-mapping>
<servlet-mapping>
  <servlet-name>cometd</servlet-name>
  <url-pattern>/cometd/*</url-pattern>
</servlet-mapping>
<servlet-mapping>
  <servlet-name>trade-monitor</servlet-name>
  <url-pattern>*.htm</url-pattern>
</servlet-mapping>
<welcome-file-list>
  <welcome-file>index.jsp</welcome-file>
</welcome-file-list>
Spring Configuration

The context:component-scan registers the bayeux server TradeMonitorService and the bayeux bean configures the Bayeux instance used by the Bayeux services and servlet.

/WEB-INF/bayeux-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:p="http://www.springframework.org/schema/p"
    xmlns:context="http://www.springframework.org/schema/context"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context.xsd">
    <context:component-scan base-package="org.springbyexample.web.cometd"/>
    <bean id="bayeux" class="org.springbyexample.cometd.continuation.SpringContinuationBayeux"
        p:timeout="300000"
        p:interval="0"
        p:maxInterval="10000"
        p:multiFrameInterval="2000"
        p:logLevel="0"
        p:directDeliver="true">
    </bean>
</beans>
```

Code Example

The Trade Monitor Bayeux Service is just a test class that randomly generates different buys and sells for any registered symbols, keeps track of the summary information for each symbol, and publishes the summary information to anyone subscribed to the symbols channel.

The TradeMonitorService is annotated with @Component so it is registered as a bean by the context:component-scan in the bayeux-context.xml. Its constructor is marked with @Autowired the Bayeux created in the XML configuration file will be injected into the constructor. There is also an initialization method with @PostConstruct on it that means it should be called during Spring’s initialization lifecycle. The init() adds the starting prices and ranges for symbols. It also initializes the timer to broadcast the server list used for the menu and also to publish the randomly generated trades.

Excerpt from src/main/java/org/springbyexample/web/cometd/monitor/TradeMonitorService.java
@Component
public class TradeMonitorService extends BayeuxService {


/**
 * Constructor
 */
@Autowired
public TradeMonitorService(Bayeux bayeux) {
    super(bayeux, "monitor");
}

/**
 * Init sending monitor test messages.
 */
@PostConstruct
protected void init() {
    Bayeux bayeux = getBayeux();
    final Channel serversChannel = bayeux.getChannel("/monitor/servers", true);
    final Client client = getClient();

    addChannel(NYSE_GATEWAY, ATT_SYMBOL, "AT&T", 24, 20, 25);
    addChannel(NYSE_GATEWAY, GM_SYMBOL, "General Motors", 5, 5, 9);
    addChannel(NYSE_GATEWAY, IBM_SYMBOL, IBM_SYMBOL, 80, 80, 100);
    addChannel(NYSE_GATEWAY, MS_SYMBOL, "Morgan Stanley", 17, 10, 26);
    addChannel(NYSE_GATEWAY, NYX_SYMBOL, "NYSE Euronext", 27, 23, 32);
    addChannel(NYSE_GATEWAY, PG_SYMBOL, "Proctor & Gamble", 63, 57, 64);
    addChannel(NASDAQ_GATEWAY, JAVA_SYMBOL, "Sun Microsystems, Inc.", 4, 4, 12);
    addChannel(NASDAQ_GATEWAY, ORCL_SYMBOL, "Oracle Corporation", 17, 16, 23);
    addChannel(NASDAQ_GATEWAY, GOOG_SYMBOL, "Google Inc.", 331, 330, 510);
    addChannel(NASDAQ_GATEWAY, MSFT_SYMBOL, "Microsoft Corporation", 21, 21, 28);
    addChannel(NASDAQ_GATEWAY, YHOO_SYMBOL, "Yahoo! Inc.", 12, 12, 20);

    // start now, publish every 10 seconds
    timer.schedule(new TimerTask() {
        @Override
        public void run() {
            publishServerList(serversChannel, client); ❶
        }
    }, 0, 5000);

    // start now, publish every second
    timer.schedule(new TimerTask() {
        @Override
        public void run() {
            publishTrades(client); ❷
        }
    }, 0, 200);
}

...

❶ The server list is published every 5 seconds.
❷ The different trades are generated every 200 milliseconds.

Example 1 TradeMonitorService Initialization

Trades are randomly generated, occasionally skipping some symbols, with a volume of 500-1000 and a price movement of up to a dollar. The trade also randomly generates whether or not it is a buy or a sell.
SummaryInfo will change the buy to a sell or a sell to a buy if the symbol has passed it's range set during initialization.

Excerpt from src/main/java/org/springbyexample/web/cometd/monitor/TradeMonitorService.java

```java
protected void publishTrades(Client client) {
    Random random = new Random();
    for (Channel channel : hTrades.keySet()) {
        SummaryInfo summary = hTrades.get(channel);
        // randomly skip a symbols trade if it's not IBM, P&G, or Google
        if (IBM_SYMBOL.equals(summary.getSymbol()) ||
            PG_SYMBOL.equals(summary.getSymbol()) ||
            GOOG_SYMBOL.equals(summary.getSymbol()) ||
            random.nextInt(5) < 4) {
            int volume = 500 + random.nextInt(500);
            double price = random.nextDouble();
            boolean buy = random.nextBoolean();
            summary.increment(volume, price, buy); ❶
            channel.publish(client, summary.getTradeSummaryMap(), null); ❷
        }
    }
}
```

❶ Increments the summary information for a symbol by passing in this trades volume, movement in price, and whether or not it is a buy or a sell.

❷ Publishes the summary info to the symbol's channel.

Example 2 TradeMonitorService Publish Trades

2. Client Configuration

The GWT Client uses Dojo Cometd to subscribe to the list of servers and symbols they have. These are displayed in the left hand menu. When a symbol is clicked on, this subscribes to the symbol's Bayeux channel and adds a summary widget to the screen. Whenever updates are received for any Bayeux message the JavaScript uses a GWT callback to display the information.

Subscribe Code Example

This adds a summary widget for the symbol that was clicked to the screen and also subscribes to it's channel. The DeferredCommand frees up the event processing thread in the browser and queues the processing to be done later. This can create a more responsive environment for the user by letting the browser handle events in a more timely manner.

There is a unique key for each symbol based on the server name and symbol name. This is used to check in a Map if there is already a widget on the screen for this symbol or not. If there isn't, A new SummaryWidget is created. This is the custom GWT component used to display summary information. Besides passing in the server and symbol name, it also creates a SummaryCloseListener which handles removing the widget and unsubscribing from the symbol's Bayeux channel if the summary window is closed. The widget is added to the Map of widgets. This Map is
used to manage the active summary widgets. Then the method subscribes to the symbol's Bayeux channel for updates.

Excerpt from web/trade-monitor-webapp/src/main/java/org/springbyexample/web/gwt/monitor/client/AppBase.java

```
protected void addSummaryWidget(final String serverName, final String symbol) {
  DeferredCommand.addCommand(new Command() {
    public void execute() {
      // server name and symbol
      String key = getTradeKey(serverName, symbol);
      if (!hSummaryWidgets.containsKey(key)) {
        SummaryWidget summary = new SummaryWidget(serverName, symbol, key, new SummaryCloseListener(key));
        centerTable.add(summary);
        hSummaryWidgets.put(key, summary);
        // subscribe this summary to it's feed
        subscribe(getChannel(serverName, symbol));
      }
    }
  });
}
```

**Example 3 Subscribe Code Example (excerpt from AppBase.java)**

The `subscribe` method passes in two callbacks to the native JavaScript's `monitor.subscribe` function. The `$wnd` indicates to the GWT compiler that this is a call to native JavaScript. The first callback is to display the list of servers and their symbols and the second is to display any incoming trade summary information.

Excerpt from web/trade-monitor-webapp/src/main/java/org/springbyexample/web/gwt/monitor/client/App.java

```
protected native void subscribe() /*-{
  // Keep reference to self for use inside closure
  var app = this;

  $wnd.monitor.subscribe(
    function(servers) {
      app.@org.springbyexample.web.gwt.monitor.client.App::displayServers(Lcom/google/gwt/core/client/JsArray;)(servers); ①
    },
    function(trade) {
      app.@org.springbyexample.web.gwt.monitor.client.App::displayTrade(Lorg/springbyexample/web/gwt/monitor/client/bean/TradeSummaryInfo;)(trade); ②
    }
  );
}-*/;
```

① GWT callback to display the list of servers and symbols in the menu.
② GWT callback to display a symbol's trade summary update in its SummaryWidget.

**Example 4 Subscribe Code Example (excerpt from App.java)**
The `subscribe` function just sets the two callbacks passed from GWT to local variables and subscribes to any existing subscriptions. The default one configured is the one with the list of available servers and symbols for display in the menu. Each subscription is given the callback of the `monitor` variable and `processMessageEvent` function.

Excerpt from `src/main/webapp/js/monitor.js`

```javascript
subscribe: function(displayCallback, tradeDisplayCallback) {
    monitor.displayCallback = displayCallback;
    monitor.tradeDisplayCallback = tradeDisplayCallback;

    for (var i = 0; i < monitor.subscriptions.length; i++) {
        dojox.cometd.subscribe(monitor.subscriptions[i], monitor, "processMessageEvent");
    }
},
```

Processes all the existing subscriptions using Dojo Cometd's `subscribe` function.

*Example 5 Subscribe Code Example (excerpt from monitor.js)*

### Display Trade Summary Code Example

When a trade summary event comes in from the server, the `processMessageEvent` function in `monitor.js` will be called since it was registered as the callback for all Bayeux subscriptions. It will then process the appropriate GWT callback to display the information.

If there isn't any message data, the function returns. If there is and it is the subscription to `/monitor/servers` (the main server list channel), it calls the `monitor.displayCallback` callback. Otherwise the `monitor.tradeDisplayCallback` is called to display the trade summary update for a symbol.

Excerpt from `src/main/webapp/js/monitor.js`

```javascript
processMessageEvent: function(message) {
    if (!message.data) {
        return;
    }

    if (message.channel == "/monitor/servers") {
        monitor.displayCallback(message.data);
    } else {
        monitor.tradeDisplayCallback(message.data);
    }
}
```

*Example 6 Display Trade Summary Code Example (excerpt from monitor.js)*

The `monitor.tradeDisplayCallback` callback from `monitor.js` is a reference to `AppBase.displayTrade(final TradeSummaryInfo trade)`. It gets the key for the trade, looks up the summary widget, and call update on it. The JavaScript data passed into GWT is mapped into
TradeSummaryInfo which extends TradeInfo, but TradeInfo extends JavaScriptObject. Mapping JavaScript data to a GWT class is just creating native methods that return the correct value from the JavaScript data instance (ex: public final native String getSymbol() /*-{ return this.symbol; }-*/).

Excerpt from web/trade-monitor-webapp/src/main/java/org/springbyexample/web/gwt/monitor/client/AppBase.java

```java
public void displayTrade(final TradeSummaryInfo trade) {
  String key = getTradeKey(trade.getServerName(), trade.getSymbol());
  SummaryWidget summary = hSummaryWidgets.get(key);
  summary.update(trade);
}
```

Example 7 Display Trade Summary Code Example (excerpt from AppBase.java)

3. Reference

Related Links

- Dojo Cometd [http://cometdproject.dojotoolkit.org/]
- Spring by Example Web Module
- Google Web Toolkit [http://code.google.com/webtoolkit/]
- Spring Bayeux GWT Chat Webapp
- Spring by Example's Dynamic Tiles 2 Spring MVC Module

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Note

Maven [http://maven.apache.org/] 2.0.9 or higher needs to be used for the build process.

Command Line Example

```
$ svn co http://svn.springbyexample.org/web/spring-bayeux-gwt-monitor-webapp/tags/1.0/
    spring-bayeux-gwt-monitor-webapp
```

General Setup Instructions
General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

**Project Information**

- Spring Framework 2.5.x
- GWT 1.5.3
- Cometd API 1.0.beta1
Simple Flex Webapp

David Winterfeldt

2009

The simple Flex [http://www.adobe.com/products/flex/] webapp is based on the Simple Spring MVC Form Annotation Configuration Webapp. It’s the same except the HTML results on the search page have been replaced with a Flex [http://www.adobe.com/products/flex/] application and services for Flex [http://www.adobe.com/products/flex/] were configured on the server using Spring BlazeDS Integration [http://www.springsource.org/spring-flex] and Adobe BlazeDS.


Note

The build using Flex Builder (Eclipse plugin) works fine, but the Maven Flex build needs more work even though it is generating a swf.

1. Web Configuration

This is a standard Spring web application configuration except a DispatcherServlet specifically for handling Flex [http://www.adobe.com/products/flex/] remoting requests has been added and the Spring config specified will configure Spring BlazeDS Integration [http://www.springsource.org/spring-flex].

/WEB-INF/web.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<web-app id="WebApp_ID" version="2.4"
xmlns="http://java.sun.com/xml/ns/j2ee"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee
http://java.sun.com/xml/ns/j2ee/web-app_2_4.xsd">
<display-name>simple-form</display-name>

<listener>
  <listener-class>
    org.springframework.web.context.ContextLoaderListener
  </listener-class>
</listener>

<context-param>
  <param-name>contextConfigLocation</param-name>
  <param-value>
    /WEB-INF/web-application-context.xml
  </param-value>
</context-param>

<filter>
  <filter-name>
```
2. Spring Configuration

The Spring BlazeDS Integration [http://www.springsource.org/spring-flex] is very simple. The `flex:message-broker` initializes BlazeDS and it's configuration files, which by default are expected in '/WEB-INF/flex' and for the main configuration to be called 'services-config.xml'. Two services are loaded, 'personDao' and 'personService'. It's not best practice to expose the DAO directly as a service, but for this example it was done to illustrate exposing a remoting service using annotations and the custom namespace. One from the `context:component-scan` and the other

---

1. Spring BlazeDS Integration servlet.
2. Mapping Spring BlazeDS Integration servlet to handle all requests to '/spring/*'.

---

### 2. Spring Configuration

The Spring BlazeDS Integration [http://www.springsource.org/spring-flex] is very simple. The `flex:message-broker` initializes BlazeDS and it’s configuration files, which by default are expected in '/WEB-INF/flex' and for the main configuration to be called 'services-config.xml'. Two services are loaded, 'personDao' and 'personService'. It’s not best practice to expose the DAO directly as a service, but for this example it was done to illustrate exposing a remoting service using annotations and the custom namespace. One from the `context:component-scan` and the other
is exposed using the Spring BlazeDS Integration [http://www.springsource.org/spring-flex] custom namespace. The PersonService exposed through scanning will be shown later in the Code Example section, and the JPA Person DAO is exposed using flex:remoting-destination. It's created just by referencing the Person DAO. To have a remoting destination name other than the bean name the destination-id could specify something different.

/WEB-INF/flex-servlet-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:p="http://www.springframework.org/schema/p"
    xmlns:context="http://www.springframework.org/schema/context"
    xmlns:flex="http://www.springframework.org/schema/flex"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context.xsd
    http://www.springframework.org/schema/flex
    http://www.springframework.org/schema/flex/spring-flex-1.0.xsd">
    <context:component-scan base-package="org.springbyexample.web.service" />
    <flex:message-broker/> §
    <flex:remoting-destination ref="personDao" /> §
</beans>
```

1. Spring BlazeDS Integration configuration of the BlazeDS message broker, which handles remoting and messaging requests.
2. Exposes the personDao bean as a BlazeDS remoting destination.

### 3. Adobe BlazeDS Configuration

The BlazeDS configuration first imports the 'remoting-config.xml' and sets up a default channel called 'person-amf'. Then in the channels section, it's URL and the class that will handle requests to the URL is configured. The parameters in the URL 'server.name' and 'server.port' are supplied by the Flex runtime. The 'context.root' parameter needs to be supplied during compilation using the 'context-root' compiler option.

/WEB-INF/flex/services-config.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<services-config>
    <services>
        <service-include file-path="remoting-config.xml" />
        <default-channels>
            <channel ref="person-amf"/>
        </default-channels>
    </services>
    <channels>
        <channel-definition id="person-amf" class="mx.messaging.channels.AMFChannel">
            <endpoint
```
A JavaAdapter is configured to handle remoting requests. The 'person-amf' channel configured in the main config is set as the default channel. If Spring weren't used, remote services would be configured here.

/WEB-INF/flex/remoting-config.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<service id="remoting-service"
   class="flex.messaging.services.RemotingService">
    <adapters>
        <adapter-definition id="java-object"
            class="flex.messaging.services.remoting.adapters.JavaAdapter"
            default="true"/>
    </adapters>
    <default-channels>
        <channel ref="person-amf"/>
    </default-channels>
</service>
```

4. Code Example

This is the other remoting service previously mentioned. It's picked up by the `context:component-scan` because of the `Service` annotation and exposed as a Flex [http://www.adobe.com/products/flex/] remoting service because of
the `RemotingDestination` annotation. The service exposed is 'personService' based on the class name, but if a value could be passed into the `Service` annotation to expose it under a different name (ex: `@Service("otherService")`). To explicitly expose or hide methods the annotations `RemotingInclude` and `RemotingExclude` can be used.

**Note**

Trying to pass the `Person` instance returned from a remote request directly into the `Person` DAO's `delete` method would cause an error since it's missing information woven into the class by the JPA implementation for the one to many relationship with `Address`.

```java
@Service
@RemotingDestination
public class PersonService {

    private final PersonDao personDao;

    /**
     * Constructor
     */
    @Autowired
    public PersonService(PersonDao personDao) {
        this.personDao = personDao;
    }

    /**
     * <p>Deletes person.</p>
     * <p><strong>Note</strong>: Passing back the person from the Flex client causes a problem with Hibernate.</p>
     */
    public void remove(int id) {
        Person person = personDao.findPersonById(id);
        personDao.delete(person);
    }
}
```

*Example 1 PersonService*

### 5. Flex Code Example

This section will go over the code for the Flex [http://www.adobe.com/products/flex/] search page. It will cover remoting, the UI, internationalization (i18n), and logging. Parts of the application use the Flex [http://www.adobe.com/products/flex/] MVC framework from Adobe called Cairngorm [http://opensource.adobe.com/wiki/display/cairngorm/]. The model, view, and controller are all in the ActionScript code and helps separate business logic from the UI components.

**Note**

```bash
-locale=en_US,es_ES -source-path=../locales/{locale} -context-root simple-flex
-compiler.services ${user.dir}/../webapp/WEB-INF/flex/services-config.xml
```
These additional compiler arguments are necessary when building the Flex [http://www.adobe.com/products/flex/] part of the example. The 'locale' option specifies that both the 'en_US' and 'es_ES' locales should be compiled into the binary. The 'source-path' option indicates where the different locales properties files should be found. To use locales other than English (en_US) a command must be run for the Flex SDK to copy the default locale of 'en_US' to create the new locale.

```bash
$ /Applications/Adobe\ Flex\ Builder\ 3\ Plug-in/sdks/3.2.0/bin/copylocale en_US es_ES
```

The 'context-root' is the web applications context path and is used as a variable in the 'services-config.xml' when defining the remoting channel's URL. The 'compiler.services' option points to the location of the BlazeDS configuration. The different channels defined are compiled into the binary, so when a RemoteObject is defined in the code below it isn't necessary to specify it's endpoint.

The 'search.mxml' is the entry point for the Flex [http://www.adobe.com/products/flex/] application. So it's main enclosing element is mx:Application. In Flex [http://www.adobe.com/products/flex/] components can either be made in mxml files or ActionScript files. It configures the mx namespace (Flex [http://www.adobe.com/products/flex/] components) and controller namespace (applicaton specific classes). The layout is set to 'horizontal', but isn't important since there is just one component displayed. There are multiple events during the components initialization that can have callbacks registered with them. The 'initialize' and 'addedToStage' events are used here.

The mx:Metadata element loads the 'messages' resource bundles. The controller namespace is used to instantiate the application's two Cairngorm [http://opensource.adobe.com/wiki/display/cairngorm/] controllers.

The mx:Script element contains ActionScript. At the beginning of it are imports just like in Java. Below that fields for the logging are defined. Underneath are the two methods for handling initialization events and a key down handler for the logging window. During initialization logging is setup with the application's log target and the logging window is initialized. The Cairngorm [http://opensource.adobe.com/wiki/display/cairngorm/] events for initializing the locale from the server and the initial data for search are dispatched as well as setting the model for the search results to the DataGrid. The added to stage event sets up a key down handler to hide and show the logging window when 'ctrl + shift + up' is pressed.

The mx:DataGrid is the display component for search. If columns weren't explicitly defined, the data would still be shown but the property name would be used for the header. By using the mx:DataGridColumn element the columns being shown and the i18n column name is used. Also the third column is a custom renderer that creates an edit and delete button for each row. The edit button redirects to the edit page using the navigateToURL method, and delete sends a request to the person service.

```xml
<?xml version="1.0" encoding="utf-8"?>
   xmlns:controller="org.springbyexample.web.flex.controller."
   layout="horizontal"
   initialize="initializeHandler()"
   addedToStage="addedToStageHandler()">

<!-- To use other locales besides en_US, the en_US locale must be copied in the sdk. 

ex: /Applications/Adobe\ Flex\ Builder\ 3\ Plug-in/sdks/3.2.0/bin/copylocale en_US es_ES -->
```
<mx:Script><![CDATA[
import org.springbyexample.web.flex.log.LogWindow;
import mx.logging.Log;
import mx.logging.ILogger;
import org.springbyexample.web.flex.event.LocaleChangeEvent;
import org.springbyexample.web.flex.event.PersonSearchEvent;
import org.springbyexample.web.flex.log.StringBufferTarget;
import org.springbyexample.web.flex.model.PersonSearchModelLocator;

private const logger:ILogger = Log.getLogger("search.mxml");
private var logTarget:StringBufferTarget = new StringBufferTarget();
private var logWindow:LogWindow;

/**
 * Initialize component.
 */
private function initializeHandler():void {
    Log.addTarget(logTarget);

    logWindow = new LogWindow()
    logWindow.logTarget = logTarget;

    var lce:LocaleChangeEvent = new LocaleChangeEvent(resourceManager);
    lce.dispatch();

    var psml:PersonSearchModelLocator = PersonSearchModelLocator.getInstance();
    searchDataGrid.dataProvider = psml.personData;

    var pse:PersonSearchEvent = new PersonSearchEvent();
    pse.dispatch();
}

/**
 * Handles the 'addedToStage' event.
 */
private function addedToStageHandler():void {
    stage.addEventListener(KeyboardEvent.KEY_DOWN, keydownHandler);
}

/**
 * Handles key down event. Toggles showing the log text area
 * if 'ctrl + shift + up' is pressed.
 */
private function keydownHandler(event:KeyboardEvent):void {
    if (event.ctrlKey && event.shiftKey && event.keyCode == Keyboard.UP) {
        if (logWindow.active) {
            logWindow.hide();
        } else {
            logWindow.open(this);
        }
    }
}
]]></mx:Script>
Example 2 search.mxml

1. Loads all locale resource bundles that start with 'messages' (all 'messages.properties' resource bundles).
2. Configures a logger.
3. Initialization callback handler that configures logging with the application's log target, initializes the log window, dispatch the LocaleChangeEvent to get the locale from the server and set the matching one in the client, sets the Person model to the search DataGrid and dispatch the PersonSearchEvent to get the search data from the server and initialize the search DataGrid.
4. The search DataGrid that displays the search results.
5. Defines the column for the 'firstName' field and retrieves the header from the resource manager's 'messages' bundle using the 'person.form.firstName' key.
6. Defines the column for the 'lastName' field and retrieves the header from the resource manager's 'messages' bundle using the 'person.form.lastName' key.
7. Creates a custom renderer for the third column that has an edit and delete button for the current row. The edit button redirects to the HTML edit page. The delete button sends a request to the server and removes the row from the UI.

The Person ActionScript class is very similar to a Java class. A package is defined, imports, and a class that can contain variables and functions. The class has RemoteClass metadata set on it indicating that if the org.springbyexample.web.jpa.bean.Person Java class is serialized by either a remoting or a messaging request, Flex [http://www.adobe.com/products/flex/] will bind the incoming data to the matching ActionScript class. More can be read about the mapping between ActionScript and Java at Explicitly mapping ActionScript and Java objects [http://livedocs.adobe.com/blazeds/1/blazeds_devguide/help.html?content=serialize_data_3.html].

```actionscript
package org.springbyexample.web.jpa.bean {

    import mx.collections:ArrayCollection;

}```
/**
 * <p>Person information which binds to the Java remote class <code>org.springbyexample.web.jpa.bean.Person</code>.</p>
 * @author David Winterfeldt
 */
[RemoteClass(alias="org.springbyexample.web.jpa.bean.Person")] public class Person {
    public var id:int;
    public var firstName:String;
    public var lastName:String;
    public var addresses:ArrayCollection;
    public var created:Date;
}

Example 3 Person

This is the Cairngorm [http://opensource.adobe.com/wiki/display/cairngorm/] model. The PersonSearchModelLocator has the metadata value [Bindable] set on it. This indicates that any changes to values in this class will fire events to anything a value is bound to. In this case the search DataGrid is bound to the personData ArrayCollection so when the controller updates the data, the DataGrid is automatically updated.

The PersonSearchModelLocator is using the standard singleton pattern, but ideally a Dependency Injection (DI) framework would be used instead to inject the model where it's needed. This wasn't done to keep this example simpler, and this is actually the suggested way to create a model in Cairngorm [http://opensource.adobe.com/wiki/display/cairngorm/]. There are multiple DI frameworks available. Two are Parsley [http://www.spicefactory.org/parsley/] and Spring ActionScript [http://www.springactionscript.org/]. Spring ActionScript [http://www.springactionscript.org/] is a SpringSource sponsored project.

[Bindable]
public class PersonSearchModelLocator implements ModelLocator {
    public var personData:ArrayCollection = new ArrayCollection();
    private static var _instance:PersonSearchModelLocator = null;
    /**
     * Implementation of <code>ModelLocator</code>.
     */
    public static function getInstance():PersonSearchModelLocator {
        if (_instance == null) {
            _instance = new PersonSearchModelLocator();
        }
        return _instance;
    }
}

Example 3 Person
Example 4 PersonSearchModelLocator

This is the custom Cairngorm [http://opensource.adobe.com/wiki/display/cairngorm/] event for retrieving person search data. As was seen in 'search.mxml' an instance of the event can be created and dispatch can then be called on it.

```java
public class PersonSearchEvent extends CairngormEvent {
    public static var EVENT_ID:String = "org.springframework.web.flex.event.PersonSearchEvent";
    /**
     * Constructor
     */
    public function PersonSearchEvent() {
        super(EVENT_ID);
    }
}
```

Example 5 PersonSearchEvent

The PersonController is a front controller and allows mapping of custom events to command implementations for the events.

```java
public class PersonController extends FrontController {
    /**
     * Constructor
     */
    public function PersonController() {
        super();
        addCommand(PersonSearchEvent.EVENT_ID, PersonSearchCommand);
        addCommand(PersonDeleteEvent.EVENT_ID, PersonDeleteCommand);
    }
}
```

Example 6 PersonController

The PersonSearchCommand was associated with the PersonSearchEvent in the PersonController. In execute(event:CairngormEvent), which is the implementation of ICommand, a remoting request to the 'personDao' service is made. A RemoteObject is created passing in the name of the service, and the method matching the Java class on the server is called. It's very simple and straightforward. An event listener is attached to the RemoteObject to listen for a result. An event listener could also be registered to listen for a failure. Flex [http://www.adobe.com/products/flex/] has an excellent event model that is easy to leverage for custom events.

```java
public class PersonSearchCommand implements ICommand {
    /**
     */
}
```
Example 7 PersonSearchCommand

The PersonDeleteCommand was associated with the PersonDeleteEvent in the PersonController. It retrieves the person id from the event and makes a delete request to the server. Upon success a PersonSearchEvent is fired to display the latest data in the search results. It would be more efficient to just remove the row from the ArrayCollection, but this was done to illustrate how easy it is to perform different tasks in the application once everything is cleanly decoupled using MVC.

Example 8 PersonDeleteCommand
6. Reference

Related Links

- Adobe Flex [http://www.adobe.com/products/flex/]
- Spring BlazeDS Integration [http://www.springsource.org/spring-flex]
- Adobe BlazeDS
- Adobe Cairngorm [http://opensource.adobe.com/wiki/display/cairngorm/]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

\$ svn co http://svn.springbyexample.org/flex/simple-flex-webapp/tags/1.0/ simple-flex-webapp

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
- Spring BlazeDS Integration 1.0.0.RC2
Part V. Enterprise

Enterprise examples.
This is a very simple example using a Spring JMS Template to send messages and also having a JMS listener process the messages sent. An embedded ActiveMQ instance is used as the broker.

### 1. Producer Configuration

#### Spring Configuration

The Spring configuration shows a `context:component-scan` that picks up the JMS producer and listener. Following this the Spring custom namespace for Apache's ActiveMQ is used to create an embedded JMS broker. A queue is configured for 'org.springbyexample.jms.test'. Then a JMS connection factory is made for the JmsTemplate to use. The template will be used by the producer to send messages.

Excerpt from `JmsMessageListenerTest-context.xml`

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:p="http://www.springframework.org/schema/p"
      xmlns:context="http://www.springframework.org/schema/context"
      xmlns:jms="http://www.springframework.org/schema/jms"
      xmlns:amq="http://activemq.apache.org/schema/core"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                       http://www.springframework.org/schema/beans/spring-beans.xsd
                       http://www.springframework.org/schema/context
                       http://www.springframework.org/schema/context/spring-context.xsd
                       http://www.springframework.org/schema/jms
                       http://www.springframework.org/schema/jms/spring-jms.xsd
                       http://activemq.apache.org/schema/core
                       http://activemq.apache.org/schema/core/activemq-core.xsd">
    <context:component-scan base-package="org.springbyexample.jms" />
    <!-- Embedded ActiveMQ Broker -->
    <amq:broker id="broker" useJmx="false" persistent="false">
        <amq:transportConnectors>
            <amq:transportConnector uri="tcp://localhost:0" />
        </amq:transportConnectors>
    </amq:broker>
    <!-- ActiveMQ Destination -->
    <amq:queue id="destination" physicalName="org.springbyexample.jms.test" />
    <!-- JMS ConnectionFactory to use, configuring the embedded broker using XML -->
    <amq:ConnectionFactory id="jmsFactory" brokerURL="vm://localhost"/>
    <!-- JMS Producer Configuration -->
    <bean id="jmsProducerConnectionFactory"
          class="org.springframework.jms.connection.SingleConnectionFactory"
          depends-on="broker"
          p:targetConnectionFactory-ref="jmsFactory"/>
</beans>
```
Code Example

The producer uses @PostConstruct to indicate that generateMessages() is an initialization method. It uses the JmsTemplate to send text messages and also sets an int property for the message count.

src/main/java/org/springbyexample/jms/JmsMessageProducer.java

```java
@Component
public class JmsMessageProducer {

  private static final Logger logger = LoggerFactory.getLogger(JmsMessageProducer.class);

  protected static final String MESSAGE_COUNT = "messageCount";

  @Autowired
  private JmsTemplate template = null;

  private int messageCount = 100;

  /**
   * Generates JMS messages
   */
  @PostConstruct
  public void generateMessages() throws JMSException {
    for (int i = 0; i < messageCount; i++) {
      final int index = i;
      final String text = "Message number is " + i + ".";

      template.send(new MessageCreator() {
        public Message createMessage(Session session) throws JMSException {
          TextMessage message = session.createTextMessage(text);
          message.setIntProperty(MESSAGE_COUNT, index);

          logger.info("Sending message: " + text);
          return message;
        }
      });
    }
  }
}
```

Example 1 JmsMessageProducer

2. Client Configuration
Spring Configuration

This shows configuring the JMS listener using Spring's jms custom namespace. The jmsMessageListener bean was loaded by the context:component-scan and implements MessageListener. If it didn't the jms:listener element could specify which method should process a message from the queue. The jms:listener specifies the destination attribute to be 'org.springbyexample.jms.test', which matches the queue defined by the amq:queue element in the embedded ActiveMQ configuration.

The AtomicInteger is used by the listener to increment how many messages it processes, and is also used by the unit test to confirm is received all the messages from the producer.

Excerpt from JmsMessageListenerTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:p="http://www.springframework.org/schema/p"
    xmlns:context="http://www.springframework.org/schema/context"
    xmlns:jms="http://www.springframework.org/schema/jms"
    xmlns:amq="http://activemq.apache.org/schema/core"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context.xsd
    http://www.springframework.org/schema/jms
    http://www.springframework.org/schema/jms
    http://activemq.apache.org/schema/core
    http://activemq.apache.org/schema/core/activemq-core.xsd">
    <context:component-scan base-package="org.springbyexample.jms" />
    ...
    <!-- JMS Consumer Configuration -->
    <bean id="jmsConsumerConnectionFactory"
        class="org.springframework.jms.connection.SingleConnectionFactory"
        depends-on="broker"
        p:targetConnectionFactory-ref="jmsFactory" />
    <jms:listener-container container-type="default"
        connection-factory="jmsConsumerConnectionFactory"
        acknowledge="auto">
        <jms:listener destination="org.springbyexample.jms.test" ref="jmsMessageListener" />
    </jms:listener-container>
    <!-- Counter for consumer to increment and test to verify count -->
    <bean id="counter" class="java.util.concurrent.atomic.AtomicInteger" />
</beans>
```

Code Example

The JmsMessageListener implements the JMS interface MessageListener. The int property for the message count can be retrieved before casting the message to TextMessage. Then the message and message count are both logged.
src/main/java/org/springbyexample/jms/JmsMessageListener.java

@Component
public class JmsMessageListener implements MessageListener {

    private static final Logger logger = LoggerFactory.getLogger(JmsMessageListener.class);

    @Autowired
    private AtomicInteger counter = null;

    /**
     * Implementation of <code>MessageListener</code>.
     */
    public void onMessage(Message message) {
        try {
            int messageCount = message.getIntProperty(JmsMessageProducer.MESSAGE_COUNT);
            if (message instanceof TextMessage) {
                TextMessage tm = (TextMessage)message;
                String msg = tm.getText();
                logger.info("Processed message '{}'. value={}", msg, messageCount);
                counter.incrementAndGet();
            }
        } catch (JMSException e) {
            logger.error(e.getMessage(), e);
        }
    }
}

Example 2 JmsMessageListener

3. Reference

Related Links

- JMS Spring Documentation [http://static.springframework.org/spring/docs/2.5.x/reference/jms.html]
- Java Message Service (JMS) [http://java.sun.com/products/jms/]
- Apache ActiveMQ [http://activemq.apache.org/]
- Apache ActiveMQ Spring Support Documentation [http://activemq.apache.org/spring-support.html]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

dsc co http://svn.springbyexample.org/enterprise/simple-spring-jms/tags/1.0/ simple-spring-jms
General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
Simple Spring Web Services using JAXB for Marshalling

David Winterfeldt

2008

A very simple example of using Spring Web Services 1.5.x with JAXB for marshalling and unmarshalling requests. A JAXB plugin for Maven is used to generate the JAXB beans from and XSD and the XSD is reused to generate a WSDL. The response from the server sends a person list, but could easily be modified to retrieve person based on an ID.

1. Server Configuration

Web Configuration

The MessageDispatcherServlet needs to be defined and the URL patterns it will handle. The contextConfigLocation is specified instead of allowing the default (/WEB-INF/spring-ws-servlet.xml) because this location makes the configuration easier to share with the unit test.

/WEB-INF/web.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<web-app xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns="http://java.sun.com/xml/ns/javaee"
    xmlns:web="http://java.sun.com/xml/ns/javaee/web-app_2_5.xsd"
    xsi:schemaLocation="http://java.sun.com/xml/ns/javaee
    http://java.sun.com/xml/ns/javaee/web-app_2_5.xsd"
    id="WebApp_ID" version="2.5">
    <servlet>
        <servlet-name>spring-ws</servlet-name>
        <servlet-class>org.springframework.ws.transport.http.MessageDispatcherServlet</servlet-class>
        <init-param>
            <param-name>contextConfigLocation</param-name>
            <param-value>classpath:/spring-ws-context.xml</param-value>
        </init-param>
    </servlet>
    <servlet-mapping>
        <servlet-name>spring-ws</servlet-name>
        <url-pattern>/*</url-pattern>
    </servlet-mapping>
</web-app>
```

Spring Configuration
The **PersonEndpoint** is defined as a bean and will automatically be registered with Spring Web Services since the class is identified as an endpoint by the `@Endpoint` annotation. This configuration uses the `person.xsd` that was used to generated the JAXB beans to generate the WSDL. The `locationUri` matches the URL pattern specified in the `web.xml`.

The JAXB marshaller/unmarshaller is configured using Spring OXM and also set on the `MarshallingMethodEndpointAdapter` bean.

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xmlns:p="http://www.springframework.org/schema/p"
   xmlns:context="http://www.springframework.org/schema/context"
   xsi:schemaLocation="http://www.springframework.org/schema/beans
   http://www.springframework.org/schema/beans/spring-beans.xsd
   http://www.springframework.org/schema/context
   http://www.springframework.org/schema/context/spring-context.xsd">
   <context:component-scan base-package="org.springbyexample.ws.service" />
   <bean id="person" class="org.springframework.ws.wsdl.wsdl11.DefaultWsdl11Definition"
         p:portTypeName="Person"
         p:locationUri="/personService/"
         p:targetNamespace="http://www.springbyexample.org/person/schema/beans">
       <property name="schema">
         <bean class="org.springframework.xml.xsd.SimpleXsdSchema">
           <property name="xsd" value="classpath:/person.xsd"/>
         </bean>
       </property>
   </bean>
   <bean class="org.springframework.ws.server.endpoint.mapping.PayloadRootAnnotationMethodEndpointMapping">
     <description>An endpoint mapping strategy that looks for @Endpoint and @PayloadRoot annotations.</description>
   </bean>
   <bean class="org.springframework.ws.server.endpoint.adapter.MarshallingMethodEndpointAdapter">
     <description>Enables the MessageDispatchServlet to invoke methods requiring OXM marshalling.</description>
     <constructor-arg ref="marshaller" />
   </bean>
   <bean id="marshaller" class="org.springframework.oxm.jaxb.Jaxb2Marshaller"
         p:contextPath="org.springbyexample.person.schema.beans" />
</beans>
```

### XML Schema Descriptor

A very simple XSD defining an element to indicate an incoming request to get all persons (name element isn't used) and a person response element that contains a list of person elements.

**person.xsd**

```xml

```

---

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Code Example

Interface for getting persons using the JAXB generated beans ('get-persons-request' element --> GetPersonsRequest?, 'person-response' element --> PersonResponse?). It also has constants for the namespace (matches XSD) and a request constant.

```java
public interface MarshallingPersonService {
    public final static String NAMESPACE = "http://www.springbyexample.org/person/schema/beans";
    public final static String GET_PERSONS_REQUEST = "get-persons-request";

    /**
     * Gets person list.
     */
    public PersonResponse getPersons(GetPersonsRequest request);
}
```

Example 1 MarshallingPersonService

It is indicated as an endpoint by the @Endpoint annotation and implements MarshallingPersonService. The getPersons method is indicated to handle a specific namespace and incoming request element.
The endpoint just prepares a static response, but this could very easily have a DAO injected into it and information retrieved from a database that is then mapped into the JAXB beans. The PersonResponse is created using the JAXB Fluent API which is less verbose than the standard JAXB API.

```java
@Endpoint
public class PersonEndpoint implements MarshallingPersonService {
    /**
     * Gets person list.
     */
    @PayloadRoot(localPart=GET_PERSONS_REQUEST, namespace=NAMESPACE)
    public PersonResponse getPersons(GetPersonsRequest request) {
        return new PersonResponse().withPerson(
            new Person().withId(1).withFirstName("Joe").withLastName("Smith"),
            new Person().withId(2).withFirstName("John").withLastName("Jackson"));
    }
}
```

### Example 2 PersonEndpoint

#### 2. Client Configuration

##### Spring Configuration

The org.springbyexample.ws.service package is scanned for beans and will find the PersonServiceClient and inject the WebServiceTemplate into it. The JAXB marshaller/unmarshaller is defined and set on the template.

The import of the jetty-context.xml isn't relevant to creating a client, but it creates an embedded jetty instance that loads the spring-ws-context.xml and it's services. Then client in the unit test is able to run in isolation.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:p="http://www.springframework.org/schema/p"
    xmlns:context="http://www.springframework.org/schema/context"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context.xsd">
    <import resource="jetty-context.xml"/>
    <context:component-scan base-package="org.springbyexample.ws.client"/>
    <context:property-placeholder location="org/springbyexample/ws/client/ws.properties"/>
    <bean id="personWsTemplate" class="org.springframework.ws.client.core.WebServiceTemplate"
        p:defaultUri="http://${ws.host}:${ws.port}/${ws.context.path}/personService/
        p:marshaller-ref="marshaller"
        p:unmarshaller-ref="marshaller" />
</beans>
```
Code Example

At this point Spring Web Services handle almost everything. The template just needs to be called and it will return the PersonResponse from the service endpoint. The client can be used like this:

```java
PersonResponse response = client.getPersons(new GetPersonsRequest());
```

```java
public class PersonServiceClient implements MarshallingPersonService {
    @Autowired
    private WebServiceTemplate wsTemplate;

    /**
     * Gets person list.
     * *
     * @param request
     * @return
     */
    public PersonResponse getPersons(GetPersonsRequest request) {
        PersonResponse response = (PersonResponse) wsTemplate.marshalSendAndReceive(request);

        return response;
    }
}
```

Example 3 PersonServiceClient

3. Unit Test

Spring Configuration

The unit test’s main XML configuration was shown in the Client Spring Configuration section, but this is the configuration that it imported. It creates an embedded Jetty instance and registers the Spring Web Service MessageDispatcherServlet. The spring-ws-context.xml configuration is passed into the servlet.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:p="http://www.springframework.org/schema/p"
    xmlns:context="http://www.springframework.org/schema/context"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
        http://www.springframework.org/schema/beans/spring-beans.xsd
        http://www.springframework.org/schema/context
        http://www.springframework.org/schema/context/spring-context.xsd">
</beans>
```
http://www.springframework.org/schema/context/spring-context.xsd">

  <context:property-placeholder location="org/springbyexample/ws/client/ws.properties"/>

  <bean id="jettyServer"
  class="org.mortbay.jetty.Server"
  init-method="start" destroy-method="stop">
    <property name="threadPool">
      <bean id="ThreadPool"
        class="org.mortbay.thread.concurrent.ThreadPool">
        <constructor-arg value="0" />
      </bean>
    </property>
    <property name="connectors">
      <list>
        <bean id="Connector"
          class="org.mortbay.jetty.nio.SelectChannelConnector"
          p:port="${ws.port}"
          p:maxIdleTime="30000"
          p:acceptors="2"
          p:confidentialPort="8443" />
      </list>
    </property>
    <property name="handlers">
      <list>
        <bean class="org.mortbay.jetty.servlet.Context"
          p:contextPath="/${ws.context.path}"
          <property name="sessionHandler">
            <bean class="org.mortbay.jetty.servlet.SessionHandler" />
          </property>
          <property name="servletHandler">
            <bean class="org.mortbay.jetty.servlet.ServletHandler">
              <property name="servlets">
                <list>
                  <bean class="org.mortbay.jetty.servlet.ServletHolder"
                    p:name="spring-ws">
                    <property name="servlet">
                      <bean class="org.springframework.ws.transport.http.MessageDispatcherServlet" />
                      <property name="initParameters">
                        <map>
                          <entry key="contextConfigLocation" value="classpath:/spring-ws-context.xml" />
                        </map>
                      </property>
                    </bean>
                  </bean>
                </list>
              </property>
              <property name="servletMappings">
                <list>
                  <bean class="org.mortbay.jetty.servlet.ServletMapping"
                    p:servletName="spring-ws"
                    p:pathSpec="/" />
                </list>
              </property>
            </bean>
          </property>
        </bean>
      </list>
    </property>
  </bean>
</beans>
4. Reference

Related Links

- Spring Web Services Site [http://www.springframework.org/spring-ws]
- JAXB Reference Implementation Project [https://jaxb.dev.java.net/]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```
svn co http://svn.springbyexample.org/enterprise/simple-spring-web-services/tags/1.2/
simple-spring-web-services
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
- Spring Web Services 1.5.x
Embedded Spring Web Services

David Winterfeldt

2009

When running a standalone application, there might be a need to have it controlled by web services. This example shows how to configure an embedded Jetty instance to run your Spring Web Services and still allow the embedded Spring Web Services context reference the main application context as a parent.

This example will primarily focus on embedding the Web Services, but it's based on Simple Spring Web Services. Anything not covered here should be explained in the other example.

1. Spring Configuration

The Jetty configuration configures what would be considered the server context even though there isn’t anything there except a Person bean to be shared with the web application context. The Spring Web Services web application is created by adding a Context to Jetty that has the MessageDispatcherServlet and the Spring configuration file spring-ws-embedded-context.xml in it.

Note

There isn’t a need for a web.xml. The configuration is completely handled by configuring Jetty in Spring.

embedded-jetty-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:p="http://www.springframework.org/schema/p"
      xmlns:context="http://www.springframework.org/schema/context"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                        http://www.springframework.org/schema/beans/spring-beans.xsd
                        http://www.springframework.org/schema/context
                        http://www.springframework.org/schema/context/spring-context.xsd">
</beans>
```

Note

This bean will be available for injection in the child context that the Web Service is in.

```xml
<bean class="org.springbyexample.person.schema.beans.Person"
      p:id="1" p:firstName="Joe" p:lastName="Smith" />
```

```xml
<context:property-placeholder location="org/springbyexample/ws/embedded/ws.properties"/>
```

```xml
<bean id="jettyServer" class="org.mortbay.jetty.Server"
      destroy-method="stop">
  <property name="threadPool">
    <bean id="ThreadPool"
         class="org.mortbay.thread.concurrent.ThreadPool">
      <constructor-arg value="0"/>
    </bean>
  </property>
</bean>
```
Bean from the main application context that will be wired into the embedded Spring Web Services context.

Jetty Server bean. Note that it's init method is not configured since this will be done programatically so the parent context is available when the Web Services application starts.

This bean removes the need for having a web.xml by creating a web context for the Spring Web Services. The context path for the webapp is set on this bean.

The MessageDispatcherServlet is configured as a servlet for the webapp. This is the main servlet that handles Spring Web Services.

The Spring configuration file, spring-ws-embedded-context.xml, is configured for the
MessageDispatcherServlet as a servlet parameter. This overrides the servlet's default configuration file, which would be `/WEB-INF/spring-ws-servlet.xml` (/WEB-INF/${servlet.name}-servlet.xml).

This configures the MessageDispatcherServlet to handle any incoming request.

This configuration file is the same as any that would be used to configure a Spring Web Services web application. If this file wasn't explicitly specified in the MessageDispatcherServlet, the servlet would look for the default file `/WEB-INF/spring-ws-servlet.xml` (/WEB-INF/${servlet.name}-servlet.xml).

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:p="http://www.springframework.org/schema/p"
xmlns:context="http://www.springframework.org/schema/context"
xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd
http://www.springframework.org/schema/context
http://www.springframework.org/schema/context/spring-context.xsd">
  <context:component-scan base-package="org.springbyexample.ws.embedded.service" />
  <bean id="person" class="org.springframework.ws.wsdl.wsdl11.DefaultWsdl11Definition"
p:portTypeName="Person"
p:locationUri="/personService/
p:targetNamespace="http://www.springbyexample.org/person/schema/beans">
    <property name="schema">
      <bean class="org.springframework.xml.xsd.SimpleXsdSchema">
        <property name="xsd" value="classpath:/person.xsd"/>
      </bean>
    </property>
  </bean>
  <bean
class="org.springframework.ws.server.endpoint.mapping.PayloadRootAnnotationMethodEndpointMapping">
    <description>An endpoint mapping strategy that looks for @Endpoint and @PayloadRoot annotations.</description>
  </bean>
  <bean
class="org.springframework.ws.server.endpoint.adapter.MarshallingMethodEndpointAdapter">
    <description>Enables the MessageDispatchServlet to invoke methods requiring OXM marshalling.</description>
    <constructor-arg ref="marshaller"/>
  </bean>
  <bean id="marshaller" class="org.springframework.oxm.jaxb.Jaxb2Marshaller"
p:contextPath="org.springbyexample.person.schema.beans" />
</beans>
```

### 2. Code Example

The code excerpt below is from `EmbeddedPersonServiceClientTest`, and is run before any of the tests are run to initialize Jetty. Even though this is a unit test, this would be the same code that would be used to start a standalone Spring application. It could contain an executor pool, db connection pool, timer processes, etc.

The main application context is initialized, and then the Jetty Server bean is retrieved from it. Then the ServletContext from the Spring Web Services webapp is retrieved. An intermediary web application context is
created between the main application context and the Spring Web Services context. The intermediary web context is then set as an attribute on the ServletContext under the constant WebApplicationContext.ROOT_WEB_APPLICATION_CONTEXT_ATTRIBUTE, which indicates it should be used as the parent context for the web application. Then the Jetty server is ready to be started.

Example 1 EmbeddedPersonServiceClientTest

1. Create the main application context which has Jetty configured in it.
2. Retrieve the Jetty server bean.
3. Retrieve the ServletContext from the Spring Web Services webapp. The context path of the Context doesn't need to be checked because it's the only Context configured.
4. Create a web application context as an intermediary between the main application context and the webapp's context.
5. Set created web application context as the parent context of the web application by setting it on the ServletContext under the WebApplicationContext.ROOT_WEB_APPLICATION_CONTEXT_ATTRIBUTE constant.

3. Reference

Related Links

- Spring Web Services Site [http://www.springframework.org/spring-ws]
- JAXB Reference Implementation Project [https://jaxb.dev.java.net/]
- Jetty [http://www.mortbay.org/jetty/]
• Simple Spring Web Services

**Project Setup**

The project is available to checkout from an anonymous Subversion checkout.

**Command Line Example**

```plaintext
svn co http://svn.springbyexample.org/enterprise/simple-spring-web-services/tags/1.2/
   simple-spring-web-services
```

**General Setup Instructions**

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

**Project Information**

• Spring Framework 2.5.x

• Spring Web Services 1.5.x
This example uses Spring Integration [http://www.springframework.org/spring-integration] to process a book order and appropriately route the message depending on if it's a pickup from the store or it should be delivered. Spring Integration [http://www.springframework.org/spring-integration] is an implementation of Enterprise Integration Patterns [http://eaipatterns.com/].

From the Order gateway, the BookOrder is sent to the 'processOrder' channel. An OrderRouter routes the order either to the 'pickup' or 'delivery' channels based on the order's OrderType annotation. If the order is a pickup, the 'pickup' channel is bridged to the 'store' channel which is configured to have the StoreEndpoint do the final processing for this part of the flow. If the order is a delivery, the DeliveryTransformer converts the BookOrder into an OnlineBookOrder that contains the delivery address. The address is just hard coded in the example, but could have looked up an address in a real application. The online order is sent to the 'post' channel, which is configured to have the PostEndpoint handle the end of this part of the flow.

Order Message Flow

1. Spring Configuration

This configuration uses a combination of XML and classes with annotations to configure the message flow. The annotation-config element enables annotation-based configuration for Spring Integration [http://www.springframework.org/spring-integration]. The context:component-scan loads the annotated part of the configuration. The gateway element creates the Order gateway, which is the beginning of the flow. Different channels are created, a bridge between two channels using the bridge element, and the outbound-channel-adapter is used to configure an endpoint for the 'store' and 'post' channels.

OrderTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans:beans xmlns="http://www.springframework.org/schema/integration"
            xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
            xmlns:beans="http://www.springframework.org/schema/beans"
            xmlns:context="http://www.springframework.org/schema/context"/>
```
2. Code Example

The gateway, or main entry point to the order flow, is the `Order` interface. It was defined in the Spring configuration and the `@Gateway` annotation indicates what channel any items passed to `process(BookOrder order)` will be sent to.

```java
public interface Order {

    /**
     * Process a book order.
     */
    @Gateway(requestChannel="processOrder")
    public void process(BookOrder order);
}
```
Example 1 Order

The OrderRouter indicates it is a message endpoint by using the @MessageEndpoint on the class. The @Router annotation on processOrder(BookOrder order) configures the incoming channel by setting the inputChannel attribute. The method should return a String that matches one of the configured channels. In this case the incoming channel is set to 'processOrder' and depending on the order type either 'delivery' or 'pickup' will be returned.

```java
@MessageEndpoint
public class OrderRouter {

    private final Logger logger = LoggerFactory.getLogger(OrderRouter.class);

    /**
     * Process order. Routes based on whether or not the order is a delivery or pickup.
     */
    @Router(inputChannel="processOrder")
    public String processOrder(BookOrder order) {
        String result = null;
        logger.debug("In OrderRouter. title='{}' quantity={} orderType={}",
                        new Object[] { order.getTitle(), order.getQuantity(), order.getOrderType() });
        switch (order.getOrderType()) {
            case DELIVERY:
                result = "delivery";
                break;
            case PICKUP:
                result = "pickup";
                break;
        }
        return result;
    }
}
```

Example 2 OrderRouter

The StoreEndpoint is the end of the store pickup flow. It just retrieves the message payload and logs it's output. In a real application the order could be electronically sent or printed at the appropriate store so the order could be prepared for pickup.

```java
@MessageEndpoint
public class StoreEndpoint {

    private final Logger logger = LoggerFactory.getLogger(StoreEndpoint.class);

    /**
     * Process an order for a pickup from the store.
     */
    public void processMessage(Message<BookOrder> message) {
        BookOrder order = message.getPayload();
        logger.debug("In StoreEndpoint. title='{}' quantity={} orderType={}",
                        new Object[] { order.getTitle(), order.getQuantity(), order.getOrderType() });
    }
}
```
Example 3 StoreEndpoint

The DeliveryTransformer indicates processMessage(BookOrder order) is a transformer by using the @Transformer annotation. It converts a BookOrder from the 'delivery' channel to an OnlineBookOrder which will be sent to the 'post' channel. The address for the online order is hard coded, but in a real application the transformer could look up an address.

Example 4 DeliveryTransformer

The PostEndpoint is the end of the delivery flow. It just retrieves the message payload for the online order and logs its output. In a real application the order could be electronically sent or printed at the appropriate warehouse so the order could be prepared for shipping to the address added by the DeliveryTransformer.
Example 5 PostEndpoint

3. Reference

Related Links

- Spring Integration [http://www.springframework.org/spring-integration]
- Enterprise Integration Patterns [http://eaipatterns.com/]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```
$ svn co http://svn.springbyexample.org/enterprise/spring-integration/tags/1.0/ spring-integration
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
- Spring Integration 1.0.x
Spring JMX

David Winterfeldt
2009

JMX is a good way to expose parts of your application for monitoring and management. Spring also provides support for exposing JMX for remote management (JSR-160 [http://jcp.org/en/jsr/detail?id=160]) and creating a client to manage it. This example registers a Spring bean as a JMX MBean, exposes the JMX server over RMI, and creates a client to access it.

To connect to the example using a JMX Management tool, JConsole can be used and comes with the JDK installation. In the IDE a break point could be set in the unit test or Thread.sleep could be added to pause the application from shutting down. To activate local JMX access, the Java argument -Dcom.sun.management.jmxremote must be used when starting the test.

```
$ jconsole
```

1. Spring Configuration

The `<context:component-scan>` creates a Spring bean from the `ServerManagerImpl`. The `<context:mbean-export>` element will register any annotation beans as JMX MBeans.

The `<registry>` bean creates an RMI registry on the specified port. The `<serverConnector>` bean will expose JMX for remote management over RMI using the RMI registry just created.

The `<clientConnector>` creates a remote reference as an `MBeanServerConnection`. From this `MBeanInfo` can be retrieved for different JMX MBeans. But even more convenient is to create a proxy of the MBean using the `MBeanProxyFactoryBean`. This creates a remote proxy to the MBean specified by the `p:objectName` attribute, and uses the `p:proxyInterface` attribute to set what interface should be used for the proxy.

```
jmxBTest-context.xml
```

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xmlns:p="http://www.springframework.org/schema/p"
 xmlns:context="http://www.springframework.org/schema/context"
 xsi:schemaLocation="http://www.springframework.org/schema/beans
 http://www.springframework.org/schema/beans/spring-beans.xsd
 http://www.springframework.org/schema/context
 http://www.springframework.org/schema/context/spring-context.xsd">

   <context:component-scan base-package="org.springbyexample.jmx" />

   <context:mbean-export />

   <bean id="registry" class="org.springframework.remoting.rmi.RmiRegistryFactoryBean"
        p:port="1099" />

   <!-- Expose JMX over RMI -->
   <bean id="serverConnector" class="org.springframework.jmx.support.ConnectorServerFactoryBean"
        p:objectName="connector:name=rmi"/>

   <bean id="localConnector" class="org.springframework.jmx.support.ConnectorServerFactoryBean"
        p:objectName="connector:name=local"/>

   <!-- Expose MBeans as JMX MBeans -->
   <context:mbean-export />```
2. Code Example

The **ServerManagerImpl** is registered as a Spring bean, and then exposed as a JMX MBean.

The `@Component` annotation indicates that this class is eligible to be a Spring bean when `context:component-scan` runs. The `@ManagedResource` annotation indicates that the bean can be exported as a JMX MBean. Its `objectName` attribute is optional, but can be used to specify a specific name for the MBean. In this case it will be exposed under the 'org.springbyexample.jmx' directory with the name 'ServerManager'. By default it would have been exposed under the directory 'org.springbyexample.jmx' and subdirectory 'serverManagerImpl' with the name 'ServerManagerImpl'.

The `@ManagedAttribute` can expose a getter or setter by annotating the method. A method that takes multiple values can be exposed using `@ManagedOperation` along with `@ManagedOperationParameters` and `@ManagedOperationParameter` to parameters the operation can take.
/**
 * Sets whether or not the server is running.
 */
@ManagedAttribute(description="Whether or not the server is running.
, currencyTimeLimit=20,
, persistPolicy="OnUpdate"
)
public void setServerRunning(boolean serverRunning) {
    this.serverRunning = serverRunning;
}

/**
 * Change db connection pool size.
 *
 * @param min Minimum pool size.
 * @param max Maximum pool size.
 *
 * @return int Current pool size.
 */
@ManagedOperation(description="Change db connection pool size.
)
@ManagedOperationParameters({
    @ManagedOperationParameter(name="min", description= "Minimum pool size."),
    @ManagedOperationParameter(name="max", description= "Maximum pool size.")
})
public int changeConnectionPoolSize(int minPoolSize, int maxPoolSize) {
    Assert.isTrue((minPoolSize > 0),
        "Minimum connection pool size must be larger than zero. min=" + minPoolSize);
    Assert.isTrue((minPoolSize < maxPoolSize),
        "Minimum connection pool size must be smaller than the maximum. " +
        " min=" + minPoolSize + ", max=" + maxPoolSize);

    this.minPoolSize = minPoolSize;
    this.maxPoolSize = maxPoolSize;

    int diff = (maxPoolSize - minPoolSize);
    // randomly generate current pool size between new min and max
    Random rnd = new Random();
    int currentSize = (minPoolSize + rnd.nextInt(diff));

    logger.info("Changed connection pool size. min={}, max={}, current={}",
        new Object[]{ this.minPoolSize, this.maxPoolSize, currentSize});

    return currentSize;
}

Example 1 ServerManagerImpl

@Autowired
private MBeanServerConnection clientConnector = null;

@Autowired
@Qualifier("serverManagerProxy")
private ServerManager serverManager = null;

public void testMBeanServerConnection() {
    MBeanInfo beanInfo = null;

    try {
        beanInfo = clientConnector.getMBeanInfo(new
            ObjectName("org.springbyexample.jmx:name=ServerManager"));
    } ...
Example 2 Excerpt from JmxTest

3. Reference

Related Links

• Spring 2.5.x JMX Documentation [http://static.springframework.org/spring/docs/2.5.x/reference/jmx.html]

• Java Management Extensions (JMX) [http://java.sun.com/javase/technologies/core/mntr-mgmt/javamanagement/]

• Monitoring and Management Using JMX [http://java.sun.com/j2se/1.5.0/docs/guide/management/agent.html]


Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```
$ svn co http://svn.springbyexample.org/enterprise/spring-jmx/tags/1.0/ spring-jmx
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

• Spring Framework 2.5.x
Spring Modules JCR Node Creation & Retrieval

David Winterfeldt

2008

This example shows how to create and retrieve nodes and files (content nodes) using Spring Modules JCR (Java Content Repository (JSR-170)) module. This example uses Apache Jackrabbit for the Java Content Repository which is the reference implementation for JSR-170.

1. Spring Configuration

The first bean definition defines defines the Jackrabbit repository by specifying the configuration file to use and the location of the repository. If the repository doesn't already exist, it will be created on startup. The next bean creates a session factory based on the repository and the next one creates a JcrTemplate using the session factory.

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:context="http://www.springframework.org/schema/context"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context.xsd">

    <!-- Register Annotation-based Post Processing Beans -->
    <context:annotation-config />

    <!-- normal repository -->
    <bean id="repository"
        class="org.springmodules.jcr.jackrabbit.RepositoryFactoryBean">
        <!-- normal factory beans params -->
        <property name="configuration" value="classpath:/jackrabbit-repository.xml" />
        <property name="homeDir" value="file:./target/repo" />
    </bean>

    <bean id="sessionFactory"
        class="org.springmodules.jcr.jackrabbit.JackrabbitSessionFactory">
        <property name="repository" ref="repository" />
    </bean>

    <bean id="jcrTemplate" class="org.springmodules.jcr.JcrTemplate">
        <property name="sessionFactory" ref="sessionFactory" />
        <property name="allowCreate" value="true" />
    </bean>

</beans>
```
2. Code Example

This code using JcrTemplate creates a node if one doesn't already exist in the repository.

```java
private String nodeName = "fileFolder";
...
public void testAddNodeIfDoesntExist() {
    assertNotNull("JCR Template is null.", template);
    template.execute(new JcrCallback() {
        public Object doInJcr(Session session) throws RepositoryException {
            Node root = session.getRootNode();
            logger.debug("Starting from root node. node={}", root);
            Node node = null;
            if (root.hasNode(nodeName)) {
                node = root.getNode(nodeName);
                logger.debug("Node exists. node={}", node);
            } else {
                node = root.addNode(nodeName);
                session.save();
                logger.info("Saved node. node={}", node);
            }
            assertNotNull("Node is null.", node);
            return node;
        }
    });
}
```

**Example 1 Node Creation (Excerpt from JcrNodeCreationTest)**

This code using JcrTemplate creates a file node by attaching one if one doesn't already exist in the repository.

If the file node doesn't exist, it is created from the log4j.xml file in the classpath by passing in an InputStream of the file. After this you will see the part of the unit test that retrieves the file node and checks if the first and last line are correct.

The first thing that is done is to retrieve the root node from the JCR Session by calling `session.getRootNode()`. Then the expected folder node that should contain the file is located just under the root node, so `root.getNode(nodeName)` is called to retrieve the folder node. Then if the file node doesn't exist under the folder node, it's created. First a node named based on the file name is created under the folder node, then a JCR content node is created under the file node and a data property is where the actual file (as an InputStream) is set.

```java
private String nodeName = "fileFolder";
...
```
public void testAddFileIfDoesntExist() {
    Node node = (Node) template.execute(new JcrCallback() {
        @SuppressWarnings("unchecked")
        public Object doInJcr(Session session) throws RepositoryException, IOException {
            Node resultNode = null;

            Node root = session.getRootNode();
            logger.info("starting from root node. node={}", root);

            // should have been created in previous test
            Node folderNode = root.getNode(nodeName);

            String fileName = "log4j.xml";
            if (folderNode.hasNode(fileName)) {
                logger.debug("File already exists. file={}", fileName);
            } else {
                InputStream in = this.getClass().getResourceAsStream("/" + fileName);
                Node fileNode = folderNode.addNode(fileName, JcrConstants.NT_FILE);

                // create the mandatory child node - jcr:content
                resultNode = fileNode.addNode(JcrConstants.JCR_CONTENT, JcrConstants.NT_RESOURCE);

                resultNode.setProperty(JcrConstants.JCR_MIMETYPE, "text/xml");
                resultNode.setProperty(JcrConstants.JCR_ENCODING, "UTF-8");
                resultNode.setProperty(JcrConstants.JCR_DATA, in);
                Calendar lastModified = Calendar.getInstance();
                lastModified.setTimeInMillis(System.currentTimeMillis());
                resultNode.setProperty(JcrConstants.JCR_LASTMODIFIED, lastModified);

                session.save();
            }

            IOUtils.closeQuietly(in);
            logger.debug("Created '{}' file in folder.", fileName);
        }
    });
}

Example 2 File Node Creation (Excerpt from JcrNodeCreationTest)

This code using JcrTemplate to retrieve the content of a file node from the repository.
Node folderNode = root.getNode(nodeName);
String fileName = "log4j.xml";
...
Node contentNode = folderNode.getNode(fileName).getNode(JcrConstants.JCR_CONTENT);
Property dataProperty = contentNode.getProperty(JcrConstants.JCR_DATA);
List<String> list = (List<String>) IOUtils.readLines(dataProperty.getStream());
...
});
};

Example 3 File Node Retrieval (Excerpt from JcrNodeCreationTest)

3. Reference

Related Links

• Spring by Example JCR Site [http://www.springbyexample.org/maven/site/spring-by-example-jcr/1.0/index.html]

• Spring Modules [https://springmodules.dev.java.net/]

• Apache Jackrabbit [http://jackrabbit.apache.org/]

• Integrating Java Content Repository and Spring [http://www.infoq.com/articles/spring-modules-jcr]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

$ svn co http://svn.springbyexample.org/enterprise/spring-modules-jcr/tags/1.0/ spring-modules-jcr

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

• Spring Framework 2.5.x

• Spring Security 2.0.x
• Spring Web Flow 2.0.x
Velocity E-mail Template

David Winterfeldt

2009

A Velocity template is used to generate the body of an e-mail and then is sent using Spring mail sender.

Note

When running the example, the mailSender bean in the Spring configuration needs to be edited to a valid host, and the 'mail.properties' file also needs to have valid user and password for this host entered along with setting the test e-mail recipient.

1. Spring Configuration

The context:component-scan loads the VelocityEmailSender bean, and the context:property-placeholder loads the mail properties which have the mail user, password, and e-mail recipient.

The velocityEngine bean is created by Spring's VelocityEngineFactoryBean. It sets the resourceLoaderPath property to 'classpath:/org/springbyexample/email', so the Velocity engine will use this as the root of any template references. By setting preferFileSystemAccess property to 'false', a Spring resource loader will be used for loading template resources instead of the default Velocity file resource loader.

The mailSender bean is configured to send to Gmail. It can be customized to match another host and many will probably not need any extra Java Mail properties defined. The templateMessage bean at the end of the configuration is just used to pass in the from address, recipient address, and the subject to use when constructing MimeMessageHelper in the VelocityEmailSender (which is below in the Code Example).

VelocityEmailSenderTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:p="http://www.springframework.org/schema/p"
    xmlns:context="http://www.springframework.org/schema/context"
    xmlns:util="http://www.springframework.org/schema/util"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
        http://www.springframework.org/schema/beans/spring-beans.xsd
        http://www.springframework.org/schema/context
        http://www.springframework.org/schema/context/spring-context.xsd">
    <context:component-scan base-package="org.springbyexample.email" />
    <!-- Edit 'mail.properties' to set a valid user and password for the mail sender. -->
    <context:property-placeholder location="classpath:/mail.properties" />

    <bean id="velocityEngine" class="org.springframework.ui.velocity.VelocityEngineFactoryBean"
        p:resourceLoaderPath="classpath:/org/springbyexample/email"
        p:preferFileSystemAccess="false"/>

    <!-- Mail sender configured for using Gmail -->
    <bean id="mailSender" class="org.springframework.mail.javamail.JavaMailSenderImpl"
        p:host="smtp.gmail.com" />
</beans>
```
2. Code Example

The send(SimpleMailMessage, Map<Object, Object>) method uses a MimeMessagePreparator to create an e-mail with an HTML body. The recipient address, from address, and subject are set on the message. Then Spring's VelocityEngineUtils is used to generate the message body. It uses the Velocity engine, the location of the template (which is in the '/org/springbyexample/email' package), and the variables for Velocity to use during template generation. After the mime message is created is is send using the JavaMailSender.

If a plain text body was being used the MailSender interface could be used to send a SimpleMailMessage.

```java
@Component
public class VelocityEmailSender implements Sender {

    private static final Logger logger = LoggerFactory.getLogger(VelocityEmailSender.class);

    private final VelocityEngine velocityEngine;
    private final JavaMailSender mailSender;

    /**
     * Constructor
     */
    @Autowired
    public VelocityEmailSender(VelocityEngine velocityEngine,
                                JavaMailSender mailSender) {
        this.velocityEngine = velocityEngine;
        this.mailSender = mailSender;
    }

    /**
     * Sends e-mail using Velocity template for the body and
     * the properties passed in as Velocity variables.
     *
     * @param msg The e-mail message to be sent, except for the body.
     * @param hTemplateVariables Variables to use when processing the template.
     */
    public void send(final SimpleMailMessage msg,
                     final Map<Object, Object> hTemplateVariables) {
        MimeMessagePreparator preparator = new MimeMessagePreparator() {
            public void prepare(MimeMessage mimeMessage) throws Exception {
                MimeMessageHelper message = new MimeMessageHelper(mimeMessage);
                message.setTo(msg.getTo());
                message.setSubject(
```

Velocity E-mail Template

Spring by Example Version 1.03

Spring by Example
message.setFrom(msg.getFrom());
message.setSubject(msg.getSubject());

String body = VelocityEngineUtils.mergeTemplateIntoString(velocityEngine, "/emailBody.vm", hTemplateVariables);
logger.info("body={}", body);
message.setText(body, true);
}
}
mailSender.send(preparator);
logger.info("Sent e-mail to '{:}', msg.getTo());

Example 1 VelocityEmailSender

3. Reference

Related Links

• Spring 2.5.x E-mail Documentation [http://static.springframework.org/spring/docs/2.5.x/reference/mail.html]

• Spring 2.5.x E-mail Template Documentation [http://static.springframework.org/spring/docs/2.5.x/reference/mail.html#mail-templates]

• Velocity Engine [http://velocity.apache.org/engine/]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

$ svn co http://svn.springbyexample.org/enterprise/velocity-email-template/tags/1.0/velocity-email-template

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

• Spring Framework 2.5.x
Solr Client

David Winterfeldt

2009


Note

The Solr [http://lucene.apache.org/solr/] server needs to be started before running the unit tests. After downloading Solr [http://lucene.apache.org/solr/] and changing to it’s directory, the example server can be run and in another console window the sample data can be loaded into the server using the commands below.

```bash
$ cd example
$ java -jar start.jar
$ cd example/exampledocs
$ java -jar post.jar *.xml
```

1. Connecting to Solr using SolrOxmClient

Spring Configuration

The context:component-scan loads the CatalogItemMarshaller which marshalls an update request and unmarshalls a search request. The context:property-placeholder loads values for the Solr [http://lucene.apache.org/solr/] host and port. The selectUrl bean sets up the URL for a select, which is used by an HttpClientTemplate, but just for debugging the XML of the search result. The solrOxmClient bean just needs the base url for Solr [http://lucene.apache.org/solr/] and a marshaler and unmarshaler.

SolrOxmClientTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:p="http://www.springframework.org/schema/p"
    xmlns:context="http://www.springframework.org/schema/context"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context.xsd">
  <!-- Loads CatalogItemMarshaller -->
  <context:component-scan base-package="org.springbyexample.enterprise.solr"/>
</beans>
```
<context:property-placeholder location="org/springbyexample/enterprise/solr/solr.properties"/>

<!-- Just used for debugging -->
<branch id="selectUrl" class="java.lang.String">
  <constructor-arg value="http://{solr.host}:{solr.port}/solr/select" />
</branch>

<bean id="solrOxmClient" class="org.springbyexample.httpclient.solr.SolrOxmClient">
  <p:baseUrl="http://{solr.host}:{solr.port}/solr">
    <p:marshaller-ref="catalogItemMarshaller" />
    <p:unmarshaller-ref="catalogItemMarshaller" />
  </p:baseUrl>
</bean>
</beans>

## Code Example

The SolrOxmClient supports marshalling searches and unmarshalling updates. Updates and deletes autocommit, but their methods are overridden so a boolean can be passed in to control commits. It also allows for direct calls to commit, rollback, and optimize. Commit and optimize both support creating requests with max segments, wait flush, and wait searcher by using SolrRequestAttributes.

**Note**

The statistics for searches, updates, commits, etc. can be checked using Solr Stats [http://localhost:8983/solr/admin/stats.jsp].

### Search

Simple search passing in a query. It could be any valid Solr [http://lucene.apache.org/solr/] query.

```java
List<CatalogItem> lCatalogItems = client.search(SEARCH_QUERY_PARAM);
```

*Example 1 Excerpt from SolrOxmClientTest.testSearch()*

### Paginated Search

The 'start' & 'rows' indicate what range of the results to return in the Map. The search query is 'electronics' and is passed into the search along with the Map.

The 'indent' value isn't used by the unmarshaller, and shouldn't be set since it will introduce whitespace in the XML results. In this case it is set so a debug request request that logs the unprocessed XML results is easier to read.

```java
Map<String, String> hParams = new HashMap<String, String>();
hParams.put("start", "5");
hParams.put("rows", "5");
hParams.put("indent", "on");
```
List<CatalogItem> lCatalogItems = client.search("electronics", hParams);

**Example 2 Excerpt from SolrOxmClientTest.testPaginatedSearch()**

**Update**

Adds or updates any records in the list based on their id. A commit request is sent immediately after the update.

```java
List<CatalogItem> lCatalogItems = new ArrayList<CatalogItem>();
CatalogItem item = new CatalogItem();
item.setId(CATALOG_ITEM_ID);
item.setManufacturer(CATALOG_ITEM_MANUFACTURER);
item.setName(CATALOG_ITEM_NAME);
item.setPrice(CATALOG_ITEM_PRICE);
item.setInStock(CATALOG_ITEM_IN_STOCK);
item.setPopularity(expectedPopularity);
lCatalogItems.add(item);
client.update(lCatalogItems);
```

**Example 3 Excerpt from SolrOxmClientTest.testUpdate()**

**Rollback**

Update is called passing in the list and a boolean value of false indicating not to commit the update. Then commit or rollback can be called manually. In this example rollback is called.

```java
List<CatalogItem> lCatalogItems = new ArrayList<CatalogItem>();
CatalogItem item = new CatalogItem();
item.setId(CATALOG_ITEM_ID);
item.setManufacturer(CATALOG_ITEM_MANUFACTURER);
item.setName(CATALOG_ITEM_NAME);
item.setPrice(CATALOG_ITEM_PRICE);
item.setInStock(CATALOG_ITEM_IN_STOCK);
item.setPopularity(popularity);
lCatalogItems.add(item);
// update without commit
client.update(lCatalogItems, false);
...
client.rollback();
```
Example 4 Excerpt from SolrOxmClientTest.testRollback()

Delete

This deletes by using a query matching all 'manu' fields with 'Belkin'. A commit is immediately sent after the delete request. There is also a deleteById(String) for deleting specific records based on their id.

```java
client.deleteByQuery("manu:Belkin");
```

Example 5 Excerpt from SolrOxmClientTest.testDelete()

Optimize

Sends a request to optimize the search engine.

```java
client.optimize();
```

Example 6 Excerpt from SolrOxmClientTest.testOptimize()

Creating a marshaller/unmarshaller is the most work setting up the SolrOxmClient since it handles the custom marshalling and unmarshalling between the custom JavaBean and the search fields configured in Solr [http://lucene.apache.org/solr/].

Implementation of Spring OXM Marshaller and Unmarshaller using dom4j [http://www.dom4j.org/].

```java
@Component
public class CatalogItemMarshaller implements Marshaller, Unmarshaller {
    final Logger logger = LoggerFactory.getLogger(CatalogItemMarshaller.class);
    private static final String ADD_ELEMENT_NAME = "add";
    private static final String DOC_ELEMENT_NAME = "doc";
    private static final String FIELD_ELEMENT_NAME = "field";
    private static final String FIELD_ELEMENT_NAME_ATTRIBUTE = "name";

    /**
     * Implementation of <code>Marshaller</code>.
     */
    @SuppressWarnings("unchecked")
    public void marshal(Object bean, Result result) throws XmlMappingException, IOException {
        List<CatalogItem> lCatalogItems = (List<CatalogItem>) bean;
        OutputStream out = null;
        XMLWriter writer = null;
        if (result instanceof StreamResult) {
            try {
                out = ((StreamResult) result).getOutputStream();
                XMLWriter writer = null;
            } finally {
            }
        } else {
            out = result.getOutputStream();
            XMLWriter writer = null;
        }
        for (CatalogItem catalogItem : lCatalogItems) {
            if (catalogItem.getAdd() == null) {
                continue;
            }
            XMLWriter writer = null;
            try {
                writer = new XMLWriter(out);
                writer.attribute(ADD_ELEMENT_NAME, catalogItem.getAdd());
                writer.startElement(ADD_ELEMENT_NAME);
                writer.startElement(DOC_ELEMENT_NAME);
                for (CatalogItemField field : catalogItem.getFields()) {
                    writer.attribute(FIELD_ELEMENT_NAME, field.getName());
                    writer.startElement(FIELD_ELEMENT_NAME);
                    writer.setAttribute(FIELD_ELEMENT_NAME_ATTRIBUTE, field.getValue());
                    writer.endElement();
                    writer.endElement();
                }
                writer.close();
            } finally {
                try {
                    out.close();
                } finally {
                    XMLWriter writer = null;
                    writer.close();
                }
            }
        }
    }

    /**
     * Implementation of <code>Unmarshaller</code>.
     */
    public Object unmarshal(Result result) throws XmlMappingException, IOException {
        InputStream inputStream = null;
        try {
            inputStream = result.getInputStream();
            XMLReader reader = null;
            reader = new XMLReader(inputStream);
            return reader.toJava();
        } finally {
            XMLReader reader = null;
            reader.close();
            inputStream.close();
        }
    }
}
```
Document document = DocumentHelper.createDocument();
Element root = document.addElement(ADD_ELEMENT_NAME);
for (CatalogItem item : lCatalogItems) {
    Element doc = root.addElement(DOC_ELEMENT_NAME);
    doc.addElement(FIELD_ELEMENT_NAME).addAttribute(FIELD_ELEMENT_NAME_ATTRIBUTE, "id")
        .addText(item.getId());
    doc.addElement(FIELD_ELEMENT_NAME).addAttribute(FIELD_ELEMENT_NAME_ATTRIBUTE, "manu")
        .addText(item.getManufacturer());
    doc.addElement(FIELD_ELEMENT_NAME).addAttribute(FIELD_ELEMENT_NAME_ATTRIBUTE, FIELD_ELEMENT_NAME_ATTRIBUTE)
        .addText(item.getName());
    doc.addElement(FIELD_ELEMENT_NAME).addAttribute(FIELD_ELEMENT_NAME_ATTRIBUTE, "price")
        .addText(new Float(item.getPrice()).toString());
    doc.addElement(FIELD_ELEMENT_NAME).addAttribute(FIELD_ELEMENT_NAME_ATTRIBUTE, "inStock")
        .addText(BooleanUtils.toStringTrueFalse(item.isInStock()));
    doc.addElement(FIELD_ELEMENT_NAME).addAttribute(FIELD_ELEMENT_NAME_ATTRIBUTE, "popularity")
        .addText(new Integer(item.getPopularity()).toString());
}
writer = new XMLWriter(out);
writer.write(document);
}
finally {
    try { writer.close(); } catch (Exception e) {} 
    IOUtils.closeQuietly(out);
}
logger.debug("Marshalled bean of size {}.", lCatalogItems.size());

/**
 * Implementation of <code>Unmarshaller</code>
 */
@SuppressWarnings("unchecked")
public Object unmarshal(Source source) throws XmlMappingException, IOException {
    List<CatalogItem> lResults = new ArrayList<CatalogItem>();
    if (source instanceof StreamSource) {
        InputStream in = null;
        try {
            in = ((StreamSource) source).getInputStream();
            SAXReader reader = new SAXReader();
            Document document = reader.read(in);
            List<Node> lNodes =
                document.selectNodes("//response/result[@name='response']/doc/*");
            CatalogItem item = null;
            // loop over all matching nodes in order, so can create a new bean
            // instance on the first match and add it to the results on the last
            for (Node node : lNodes) {
                if (BooleanUtils.toBoolean(node.valueOf("./@name='id'"))){
                    item = new CatalogItem();
                    item.setId(node.getText());
                } else if (BooleanUtils.toBoolean(node.valueOf("./@name='inStock'"))) {
                    item.setInStock(BooleanUtils.toBoolean(node.getText()));
                } else if (BooleanUtils.toBoolean(node.valueOf("./@name='manu'"))) {
                    item.setManufacturer(node.getText());
                }
            }
        } finally {
            try { writer.close(); } catch (Exception e) {} 
            IOUtils.closeQuietly(out);
        }
    }
    logger.debug("Marshalled bean of size {}.", lCatalogItems.size());
}

// loop over all matching nodes in order, so can create a new bean
// instance on the first match and add it to the results on the last
for (Node node : lNodes) {
    if (BooleanUtils.toBoolean(node.valueOf("./@name='id'"))){
        item = new CatalogItem();
        item.setId(node.getText());
    } else if (BooleanUtils.toBoolean(node.valueOf("./@name='inStock'"))) {
        item.setInStock(BooleanUtils.toBoolean(node.getText()));
    } else if (BooleanUtils.toBoolean(node.valueOf("./@name='manu'"))) {
        item.setManufacturer(node.getText());
    }
}
Example 7 CatalogItemMarshaller

2. Connecting to Solr using HttpClientTemplate & HttpClientOxmTemplate

Spring Configuration

An HttpClientTemplate and HttpClientOxmTemplate are configured. The former is used for non-marshalling requests and the latter is for marshalling requests.

SolrHttpClientTemplateTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:p="http://www.springframework.org/schema/p"
    xmlns:context="http://www.springframework.org/schema/context"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context.xsd">
    <!-- Loads CatalogItemMarshaller -->
</beans>
```
<context:component-scan base-package="org.springbyexample.enterprise.solr" />
<context:property-placeholder location="org/springbyexample/enterprise/solr/solr.properties"/>

<bean id="selectUrl" class="java.lang.String">
  <constructor-arg value="http://${solr.host}:${solr.port}/solr/select" />
</bean>

<bean id="updateUrl" class="java.lang.String">
  <constructor-arg value="http://${solr.host}:${solr.port}/solr/update" />
</bean>

<bean id="selectTemplate" class="org.springbyexample.httpclient.HttpClientTemplate">
  <p:defaultUri-ref="selectUrl" />
</bean>

<bean id="updateTemplate" class="org.springbyexample.httpclient.HttpClientTemplate">
  <p:defaultUri-ref="updateUrl" />
</bean>

<bean id="marshallingSelectTemplate" class="org.springbyexample.httpclient.HttpClientOxmTemplate">
  <p:defaultUri-ref="selectUrl" />
  <p:marshaller-ref="catalogItemMarshaller" />
  <p:unmarshaller-ref="catalogItemMarshaller" />
</bean>

<bean id="marshallingUpdateTemplate" parent="marshallingSelectTemplate">
  <p:defaultUri-ref="updateUrl" />
</bean>

</beans>

Code Example

A basic search, paginated search, and update will be shown using marshalling and unmarshalling with HttpClientOxmTemplate. Also HttpClientTemplate is used to make search requests and log the results for debugging.

Search

A simple search is made by passing in the search query as the key of 'q'. The selectTemplate is the HttpClientTemplate and performs a search based Map and logs the results. The same Map is then used by the marshallingSelectTemplate to make a request that is unmarshalled into a list of CatalogItem.

```java
public void testSearch() {
    assertNotNull("HttpClientOxmTemplate is null.", marshallingSelectTemplate);

    Map<String, String> hParams = new HashMap<String, String>();
    hParams.put("q", SEARCH_QUERY_PARAM);
    hParams.put("indent", "on");

    // just for debugging
    selectTemplate.executeGetMethod(hParams, new ResponseStringCallback() {
        public void doWithResponse(String response) throws IOException {
            logger.debug(response);
        }
    });

    marshallingSelectTemplate.executeGetMethod(hParams,
        new ResponseCallback<List<CatalogItem>>() {
            public void doWithResponse(List<CatalogItem> lCatalogItems) throws IOException {
                assertNotNull("Catalog item list is null.", lCatalogItems);
            }
        });
}
```
Example 8 Excerpt from SolrHttpClientTemplateTest.testSearch()

Paginated Search

This search is paginated since it defines what range of results to return, which are defined by the 'start' key and the 'rows' key. The search parameter is defined by the 'q' key, and searches for any record that has 'electronics' in it. The 'indent' key is useful for having formatted results logged by selectTemplate for debugging.

```java
Example 8 Excerpt from SolrHttpClientTemplateTest.testSearch()

Paginated Search

This search is paginated since it defines what range of results to return, which are defined by the 'start' key and the 'rows' key. The search parameter is defined by the 'q' key, and searches for any record that has 'electronics' in it. The 'indent' key is useful for having formatted results logged by selectTemplate for debugging.

```
Example 9 Excerpt from SolrHttpClientTemplateTest.testPaginatedSearch()

Update

Adds or updates a list of JavaBeans and then calls commit. The add or update isn't committed until a commit is sent.

```java
public void testUpdate() {
    ...
    List<CatalogItem> lCatalogItems = new ArrayList<CatalogItem>();
    CatalogItem item = new CatalogItem();
    item.setId(CATALOG_ITEM_ID);
    item.setManufacturer(CATALOG_ITEM_MANUFACTURER);
    item.setName(CATALOG_ITEM_NAME);
    item.setPrice(CATALOG_ITEM_PRICE);
    item.setInStock(CATALOG_ITEM_IN_STOCK);
    item.setPopularity(expectedPopularity);
    lCatalogItems.add(item);
    marshallingUpdateTemplate.executePostMethod(lCatalogItems);
    // have to commit the updates
    updateTemplate.executePostMethod(COMMIT);
    ...
}
```

Example 10 Excerpt from SolrHttpClientTemplateTest.testUpdate()

3. Reference

Related Links

- Apache Solr [http://lucene.apache.org/solr/]
- Spring by Example Utils Module

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

```
$ svn co http://svn.springbyexample.org/enterprise/solr-client/tags/1.0/ solr-client
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.
Example Project Setup

**Project Information**

- Spring Framework 2.5.x
- Spring by Example Utils 1.2.1
- Apache Solr 1.3.0
Part VI. Spring dm Server

This section is on developing with the Spring dm Server and OSGi based development.

OSGi (Open Services Gateway interface) is a specification maintained by the OSGi Alliance [http://www.osgi.org/]. It was founded in March 1999. One of the goals of OSGi is to reduce complexity by having much better modularity and deployment of libraries and services. The increased modularity primarily comes from a much more fine grained classloading mechanism compared to a standard JVM or Java EE container. Libraries and packages needed at runtime must be explicitly defined and even the version or version ranges required can be specified. Also, what interfaces or classes your library exports are also clearly defined. A library (JAR archive) in OSGi terminology is referred to as a bundle.


The Spring dm Server [http://www.springsource.com/products/suite/dmserver] is also an OSGi server and is actually built on top of Equinox [http://www.eclipse.org/equinox/]. Although many customizations and enhancements have been done to make it easier to manage and deploy bundles. Some of the enhancements are customizations to make it easier to deploy Spring bundles and also for deploying web bundles. In fact, standard WARs can be deployed as they are to any web container. Web modules can also be deployed as a thin WAR that uses OSGi imports to resolve any JARs instead of having them embedded in /WEB-INF/lib and also a more OSGi like web solution which will be shown in the next basic example.

SpringSource [http://www.springsource.com/] has made a very nice plugin for developing OSGi bundles and working with the Spring dm Server [http://www.springsource.com/products/suite/dmserver] on the Eclipse IDE [http://www.eclipse.org/]. The plugin provides project templates for a basic bundle and also a type called PAR. A PAR is a way to group together related bundles and deploy them together. The plugin also has Server support in the IDE that allows deploying projects to the server. As changes are made to your project, it will automatically keep deploying any changes to the bundle to the server. Also, when managing the project any OSGi bundle from the SpringSource [http://www.springsource.com/] can be downloaded directly into the Spring dm Server [http://www.springsource.com/products/suite/dmserver].

If you haven't already installed the IDE support for this and would like to run the examples, please refer to the Setup Appendix.
Simple Message Service

David Winterfeldt
2008

There are three OSGi bundles in this example. Two are different versions of a bundle that exposes a message interface as an OSGi service. Each bundle depends on a different version of Commons Lang to demonstrate the side-by-side versioning capabilities of OSGi. The third bundle is a web module that displays the result from calling the OSGi message service. The example was made to be deployed on the Spring dm Server [http://www.springsource.com/products/suite/dmserver].

Note

Currently the examples are setup to only run from the Eclipse environment and to be deployed using the Spring dm Server [http://www.springsource.com/products/suite/dmserver]'s IDE integration. A Maven build will eventually be added.

1. Message Service Bundle 1.0

Manifest Configuration

The manifest defines the services name, description, it's symbolic name (will deployed under this name), version, and whatever libraries, bundles, and/or packages it imports. Also, whatever packages are exported are also defined.

Note

If when opening the manifest and viewing the Dependencies tab in the Eclipse IDE, there isn't an 'Import Bundle' section on the right and an 'Import Library' section underneath it the default Eclipse manifest editor may have been opened. To open the Spring manifest editor, right click, 'Open with/Other...', and then choose the 'Bundle Manifest Editor'.

```
src/main/resources/META-INF/MANIFEST.MF
```

```manifest
Manifest-Version: 1.0
Bundle-Name: Simple Service Bundle
Bundle-Description: Simple Service
Bundle-ManifestVersion: 2
Bundle-SymbolicName: org.springbyexample.sdms.message.messageService
Bundle-Version: 1.0.0
Import-Library: org.aspectj,
org.springframework
Import-Bundle: com.springsource.org.apache.commons.lang;version="[2.1.0,2.1.0]"
Export-Package: org.springbyexample.sdms.message.service;version="1.0.0"
```
The symbolic name the bundle is deployed under and another bundle could use to reference it.

The version the bundle is deployed under.

The *Import-Bundle* property imports the package `com.springsource.org.apache.commons.lang`, version 2.1.0.

The *Export-Package* property exposes any packages for external use by other bundles. This exposes the package `org.springbyexample.sdms.message.service` which has the `MessageService` interface as version 1.0.0.

**Spring Configuration**

By default any spring configuration files in the `META-INF/spring` will be processed (this is configurable). Following the naming conventions setup by Spring Dynamic Modules for OSGi(tm) Service Platforms [http://www.springsource.org/osgi] there are two Spring configuration files. One is called `bundle-context.xml` and the other is called `bundle-context-osgi.xml`. The first one is for standard Spring configuration and the latter is meant for Spring Dynamic Modules [http://www.springsource.org/osgi] specific configuration. Like exposing OSGi services or defining services as bean references.

The `MessageServiceImpl` is defined as a `messageService` bean which will be exposed as a service in the `bundle-context-osgi.xml` configuration file. Spring's `context:component-scan` could have also been used, but wasn't just to keep the example a little more clear.

```
src/main/resources/META-INF/spring/bundle-context.xml

<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:p="http://www.springframework.org/schema/p"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd">
    <bean id="messageService"
        class="org.springbyexample.sdms.message.service.impl.MessageServiceImpl"
        p:message="Greetings!/"/>
</beans>
```

The Spring Dynamic Modules [http://www.springsource.org/osgi]' namespace is setup as the default namespace for the configuration file. The `service` element exposes the `messageService` bean as an OSGi service under the interface `org.springbyexample.sdms.message.service.MessageService`.

```
src/main/resources/META-INF/spring/bundle-context-osgi.xml

<?xml version="1.0" encoding="UTF-8"?>
<beans:beans xmlns="http://www.springframework.org/schema/osgi"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:beans="http://www.springframework.org/schema/beans"
    xsi:schemaLocation="http://www.springframework.org/schema/osgi
http://www.springframework.org/schema/osgi/spring-osgi.xsd">
    <service ref="messageService"/>
</beans:beans>
```
Code Example

The code consists of the `MessageService` interface and the implementation `MessageServiceImpl`. It's just an interface to get a message and the implementation uses Commons Lang.

```
public interface MessageService {
    /**
     * Gets message.
     * /
    public String getMessage();
}
```

**Example 1 Message Service MessageService (version 1.0)**

This implementation uses `FastDateFormat` from Commons Lang 2.1.0 to display a formatted date after the message that will be injected from the Spring configuration.

```
public class MessageServiceImpl implements MessageService {
    private String message = null;
    /**
     * Gets message.
     * /
    public String getMessage() {
        StringBuffer sb = new StringBuffer();
        sb.append(message);
        sb.append("[");
        sb.append(FastDateFormat.getInstance("MM/dd/yy").format(new Date()));
        sb.append("]");
        return sb.toString();
    }
    /**
     * Sets message.
     * /
    public void setMessage(String message) {
        this.message = message;
    }
}
```
Example 2 Message Service MessageServiceImpl (version 1.0)

2. Message Service Bundle 1.1

Manifest Configuration

This is the same as the 1.0 version of the Message Service bundle, but it has it’s version set to 1.1.0 on the Bundle-Version property and also depends on Commons Lang 2.4.0.

src/main/resources/META-INF/MANIFEST.MF

Manifest-Version: 1.0
Bundle-Name: Simple Service Bundle
Bundle-Description: Simple Service
Bundle-ManifestVersion: 2
Bundle-SymbolicName: org.springbyexample.sdms.message.messageService
Bundle-Version: 1.1.0
Import-Library: org.aspectj, org.springframework.spring
Import-Bundle: com.springsource.org.apache.commons.lang;version="[2.4.0,2.4.0]"
Export-Package: org.springbyexample.sdms.message.service;version="1.1.0"

1. The symbolic name the bundle is deployed under and another bundle could use to reference it.
2. The version the bundle is deployed under.
3. The Import-Bundle property imports the package com.springsource.org.apache.commons.lang, version 2.4.0.
4. The Export-Package property exposes any packages for external use by other bundles. This exposes the package org.springbyexample.sdms.message.service which has the MessageService interface as version 1.1.0.

Spring Configuration

The version 1.1 of MessageServiceImpl has a different message than version 1.0. Also the implementation uses a Commons Lang 2.4.0 specific method call that is appended to the message.

src/main/resources/META-INF/spring/bundle-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:p="http://www.springframework.org/schema/p"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                         http://www.springframework.org/schema/beans/spring-beans.xsd">
  <bean id="messageService"
        class="org.springbyexample.sdms.message.service.impl.MessageServiceImpl"
        p:message="Greetings from Spring by Example!"/>
</beans>
```
The `messageService` bean is exposed as a service under the interface `org.springbyexample.sdms.message.service.MessageService`.

gsrc/main/resources/META-INF/spring/bundle-context-osgi.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans:beans xmlns="http://www.springframework.org/schema/osgi"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:beans="http://www.springframework.org/schema/beans"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
        http://www.springframework.org/schema/beans/spring-beans.xsd
        http://www.springframework.org/schema/osgi
        http://www.springframework.org/schema/osgi/spring-osgi.xsd">
    <service ref="messageService"
        interface="org.springbyexample.sdms.message.service.MessageService"/>
</beans:beans>
```

**Code Example**

The `MessageService` interface is identical to the one in the Message Service Bundle 1.0 class. So the Message Service Web Module can dynamically use either implementation's service.

`sdms/message-service/service-version1_1/src/main/java/org/springbyexample/sdms/message/service/MessageService.java`

```java
public interface MessageService {
    /**
     * Gets message.
     * @return message
     */
    public String getMessage();
}
```

*Example 3 Message Service MessageService (version 1.1)*

This implementation uses `FastDateFormat` from Commons Lang 2.4.0 to display a formatted date after the message that will be injected from the Spring configuration. It also uses `StringUtils.length(String)` to add the message length at the end of the message. This method was adding Commons Lang 2.4.0. If you try to use this method in the Message Service Bundle 1.0 implementation, you will see that it won't be able to find that method on `StringUtils`.

`sdms/message-service/service-version1_1/src/main/java/org/springbyexample/sdms/message/service/impl/MessageServiceImpl.java`
public class MessageServiceImpl implements MessageService {

    private String message = null;

    /**
     * Gets message.
     */
    public String getMessage() {
        StringBuffer sb = new StringBuffer();
        sb.append(message);
        sb.append("[");
        sb.append(FastDateFormat.getInstance("MM/dd/yyyy").format(new Date()));
        sb.append("]");

        // add Commons Lang StringUtils.length(String) which was specifically added in Commons Lang 2.4.0
        sb.append(" (message length=");
        sb.append(StringUtils.length(message));
        sb.append(" )");

        return sb.toString();
    }

    /**
     * Sets message.
     */
    public void setMessage(String message) {
        this.message = message;
    }
}

Example 4 Message Service MessageServiceImpl (version 1.1)

3. Message Service Web Module

Manifest Configuration

The web module's manifest is very similar to the other bundles, but it imports the taglib and servlet bundles. Also instead of exporting a package, it imports the Message Service package exported by the Message Service bundles and specifies that is can use version 1.0.0 through 1.1.0.

src/main/resources/META-INF/MANIFEST.MF

```
Manifest-Version: 1.0
Bundle-Name: Simple Service Web Module
Bundle-SymbolicName: org.springbyexample.sdms.message.webModule
Bundle-Version: 1.0.0
Bundle-Vendor: Spring by Example
Bundle-ManifestVersion: 2
Import-Bundle: com.springsource.org.apache.taglibs.standard, com.springsource.javax.servlet
Import-Library: org.aspectj;version="[1.6.0,1.7.0)", org.springframework.spring;version="[2.5.5,3.0.0)"
Module-Type: Web
Web-ContextPath: message
Web-DispatcherServletUrlPatterns: *.html
```
The symbolic name the bundle is deployed under and another bundle could use to reference it.

The version the bundle is deployed under.

Declares the module type indicating this is a web module. This is used by the Spring dm Server [http://www.springsource.com/products/suite/dmserver].

The Web-ContextPath property configures the web application's context path.

The Web-DispatcherServletUrlPatterns property configures the dispatch servlet to route any matches for the pattern '*.html' to controllers.

The Import-Package property imports the package org.springbyexample.sdms.message.service which was exported by the message service bundle.

Spring Configuration

The bundle-context.xml isn't used in this example, but bundle-context-osgi.xml makes a reference to the message bundle service and exposes it as a bean. The Spring web configuration is in webmvc-context.xml.

The reference to the OSGi service MessageService is exposed as a bean named messageService.

```
src/main/resources/META-INF/spring/bundle-context-osgi.xml

<?xml version="1.0" encoding="UTF-8"?>
<beans:beans xmlns="http://www.springframework.org/schema/osgi"
     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
     xmlns:beans="http://www.springframework.org/schema/beans"
     xsi:schemaLocation="http://www.springframework.org/schema/osgi
http://www.springframework.org/schema/beans
http://www.springframework.org/schema/osgi/spring-osgi.xsd">
    <reference id="messageService"
           interface="org.springbyexample.sdms.message.service.MessageService"/>
</beans:beans>
```

This is just a standard Spring MVC configuration and the controller is register using context:component-scan.

```
src/main/resources/META-INF/spring/webmvc-context.xml

<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
     xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
     xmlns:p="http://www.springframework.org/schema/p"
     xmlns:context="http://www.springframework.org/schema/context"
     xsi:schemaLocation="http://www.springframework.org/schema/beans
http://www.springframework.org/schema/beans/spring-beans.xsd
http://www.springframework.org/schema/context
http://www.springframework.org/schema/context/spring-context.xsd">
    <context:component-scan base-package="org.springbyexample.sdms.web.message.mvc"/>
</beans>
```
Simple Message Service

```xml
<bean class="org.springframework.web.servlet.mvc.annotation.DefaultAnnotationHandlerMapping">
    <property name="interceptors" ref="localeChangeInterceptor"/>
</bean>

<!-- Enables annotated POJO @Controllers -->
<bean class="org.springframework.web.servlet.mvc.annotation.AnnotationMethodHandlerAdapter"/>

<!-- Enables plain Controllers -->
<bean class="org.springframework.web.servlet.mvc.SimpleControllerHandlerAdapter"/>

<bean class="org.springframework.web.servlet.view.InternalResourceViewResolver">
    <property name="prefix="/WEB-INF/jsp/"
    <property name="suffix='.jsp'/">
</bean>

<bean id="messageSource" class="org.springframework.context.support.ResourceBundleMessageSource">
    <property name="basenames">
        <value>messages</value>
    </property>
</bean>

<!-- Declare the Interceptor -->
<bean id="localeChangeInterceptor" class="org.springframework.web.servlet.i18n.LocaleChangeInterceptor">
    <property name="paramName" value="locale"/>
</bean>

<!-- Declare the Resolver -->
<bean id="localeResolver" class="org.springframework.web.servlet.i18n.SessionLocaleResolver" />
</beans>
```

JSP Example

To reduce the complexity of the example the controller just puts the message into the Model and is rendered on the page using JSTL.

`src/main/resources/MODULE-INF/WEB-INF/jsp/display/index.jsp`

```html
<html>
<head>
<title>Message</title>
</head>
<body>
<h1>Message</h1>
<p>${message}</p>
</body>
</html>
```

Code Example

The controller has the message service defined in `bundle-context-osgi.xml` injected using `@Autowired`. The
display method maps to /display/index.html and puts the results of the message service into the Model under the key 'message'.

sdms/message-service/service-web-module/src/main/java/org/springbyexample.sdms/web/message/mvc/MessageController.java

```java
@Controller
public class MessageController {

    @Autowired
    protected MessageService messageService = null;

    /**
     * Displays RMI info.
     */
    @RequestMapping(value="/display/index.html")
    public void display(Model model) {
        model.addAttribute("message", messageService.getMessage());
    }
}
```

Example 5 Message Service MessageController

4. Reference

Related Links

- OSGi Alliance [http://www.osgi.org/]
- Equinox [http://www.eclipse.org/equinox/]
- Adrian Colyer's blog 'Why should I care about OSGi anyway?' [http://blog.springsource.com/2008/05/15/why-should-i-care-about-osgi-anyway/]
- Rob Harrop's blog 'Getting started with SpringSource dm Server' [http://blog.springsource.com/2008/10/22/getting-started-with-springsource-dm-server/]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

This will checkout all three projects, but each one could be checked out individually too.

```
$ svn co http://svn.springbyexample.org/sdms/simple-message-service/tags/1.0/ simple-message-service
```

General Setup Instructions
General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

**Project Information**

- Spring Framework 2.5.x
- Spring dm Server 1.0
Simple Spring MVC

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2008

There are three OSGi bundles in this example that can either be deployed individually or as part of a PAR bundle. A PAR bundle groups together your other bundles and deploys them so they aren't visible outside the PAR. In this example since a javax.sql.DataSource is exposed as an OSGi service, this feature is very useful since it's quite likely at some point to want to deploy multiple services of a similar type, but each one may be specific to an application.

This example has a DataSource bundle that exposes a DataSource OSGi service for an in memory HSQL DB. There is a JPA Bundle that exposes a Person service and uses the DataSource service. The final bundle is a web application using Spring MVC to create, edit, update, delete, and search using the Person service. The example was made to be deployed on the Spring dm Server [http://www.springsource.com/products/suite/dmserver].

Note

Currently the examples are setup to only run from the Eclipse environment and to be deployed using the Spring dm Server [http://www.springsource.com/products/suite/dmserver]’s IDE integration. A full Maven build will eventually be added.

The simple-spring-mvc-par project has a Maven build that will download and install all the libraries and bundles needed for this example. It will install in them in '${sdms.home}/repository/libraries/usr' and '${sdms.home}/repository/bundles/usr'. Just change the property ‘sdms.path’ in the pom.xml to the Spring dm Server [http://www.springsource.com/products/suite/dmserver] location used by Eclipse and run 'mvn package'.

1. Simple Spring MVC PAR

Manifest Configuration

There basically isn't very much to the PAR bundle since it's just a way to group together other bundles. If you telnet into the server you'll be able to see the synthetic context the bundles were deployed under based on the PAR's bundle name. Below is a partial display of the results from running the ss.

```bash
$ telnet localhost 2401

osgi> ss
...
91 ACTIVE
org.springbyexample.sdms.simpleForm-1-org.springbyexample.sdms.simpleForm-synthetic.context_1.0.0
92 ACTIVE
org.springbyexample.sdms.simpleForm-1-org.springbyexample.sdms.simpleForm.datasource_1.0.0
93 ACTIVE
org.springbyexample.sdms.simpleForm-1-org.springbyexample.sdms.simpleForm.person_1.0.0
94 ACTIVE
org.springbyexample.sdms.simpleForm-1-org.springbyexample.sdms.simpleForm.webModule_1.0.0
```
Note

If when opening the manifest and viewing the Dependencies tab in the Eclipse IDE, it doesn't say 'PAR Editor' at the top, the default Eclipse manifest editor may have been opened. To open the Spring manifest editor, right click, 'Open with'/Other...', and then choose the 'PAR Manifest Editor'.

src/main/resources/META-INF/MANIFEST.MF

Manifest-Version: 1.0
Application-SymbolicName: org.springbyexample.sdms.simpleForm
Application-Version: 1.0.0
Application-Name: Simple Spring MVC PAR
Bundle-Vendor: Spring by Example

The symbolic name the PAR bundle is deployed under.

2. Simple Spring MVC DataSource Bundle

The DataSource bundle creates an in memory HSQL database and creates a connection pool that is exposed as an OSGi DataSource service.

Manifest Configuration

The manifest defines the bundles symbolic name, and imports javax.sql, Spring, HSQL DB, and Commons DBCP.

Note

If when opening the manifest and viewing the Dependencies tab in the Eclipse IDE, there isn't an 'Import Bundle' section on the right and an 'Import Library' section underneath it the default Eclipse manifest editor may have been opened. To open the Spring manifest editor, right click, 'Open with'/Other...', and then choose the 'Bundle Manifest Editor'.

src/main/resources/META-INF/MANIFEST.MF

Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: Simple Spring MVC Form DataSource Bundle
Bundle-Description: Simple Spring MVC Form DataSource
Bundle-SymbolicName: org.springbyexample.sdms.simpleForm.datasource
Bundle-Version: 1.0.0
Bundle-Vendor: Spring by Example
Import-Package: javax.sql
The symbolic name the bundle is deployed under and another bundle could use to reference it.

The version the bundle is deployed under.

Imports the package javax.sql.

The Import-Library property imports all the related Spring bundles for the latest version of the library that can be resolved based on the version range.

Imports the HSQL DB and Commons DBCP bundles, retrieving the newest version possible based on the version ranges specified.

Spring Configuration

By default any spring configuration files in the META-INF/spring will be processed (this is configurable). A connection pool is created using Commons DBCP to an HSQL DB and then the pool is exposed as an OSGi service.

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="http://www.springframework.org/schema/beans
   http://www.springframework.org/schema/beans/spring-beans.xsd">
   <bean id="dataSource" class="org.apache.commons.dbcp.BasicDataSource"
   destroy-method="close">
       <property name="driverClassName" value="org.hsqldb.jdbcDriver" />
       <property name="url" value="jdbc:hsqldb:mem:person" />
       <property name="username" value="sa" />
       <property name="password" value="" />
   </bean>
</beans>
```

The Spring Dynamic Modules [http://www.springsource.org/osgi] namespace is setup as the default namespace for the configuration file. The service element exposes the dataSource bean as an OSGi service under the interface javax.sql.DataSource.

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/osgi"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xmlns:beans="http://www.springframework.org/schema/beans"
   xsi:schemaLocation="http://www.springframework.org/schema/osgi
   http://www.springframework.org/schema/osgi/spring-osgi-1.0.xsd
   http://www.springframework.org/schema/beans
   http://www.springframework.org/schema/beans/spring-beans-2.5.xsd">
</beans>
```
3. Simple Spring MVC Person DAO Bundle

The bundle uses JPA to create a Person service. The Person has a one to many relationship to Address, but to keep the example simple only the Person is used by the web module. JPA is using Hibernate for persistence.

**Manifest Configuration**

The bundle imports javax.sql, HSQL DB, Spring, and Hibernate. It also exports the package containing the Hibernate persistence beans and the Person DAO interface.

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: Simple Spring MVC Person Bundle
Bundle-Description: Simple Spring MVC Person
Bundle-SymbolicName: org.springbyexample.sdms.simpleForm.person
Bundle-Version: 1.0.0
Bundle-Vendor: Spring by Example
Import-Package: javax.sql
Import-Bundle: com.springsource.org.hsqldb;version="[1.8.0,2.0.0)"
Import-Library: org.springframework.spring;version="[2.5.5,3.0.0)",
                org.hibernate.ejb;version="[3.3.2.GA,3.3.2.GA]"
Export-Package: org.springbyexample.sdms.simpleForm.orm.bean;version="1.0.0",
                org.springbyexample.sdms.simpleForm.orm.dao;version="1.0.0"
```

1. The symbolic name the bundle is deployed under.
2. The version the bundle is deployed under.
3. Imports the package javax.sql.
4. Imports the HSQL DB bundle.
5. The two libraries for Spring and Hibernate are resolved based on their version ranges.
6. The package containing the persistence beans and the one with the Person DAO interface are both exported under the version 1.0.0.

**JPA Configuration**

The JPA configuration sets up Hibernate as the persistence provider and registers the two entity classes Person and Address.

```
<service ref="dataSource" interface="javax.sql.DataSource"/>
</beans:beans>
```
Spring Configuration

The `<context:component-scan>` is used to Person DAO implementation, and `<tx:annotation-driven>` configures Spring to process transaction annotations. A JPA transaction manager is created and JPA with i and also with the `DataSource` from the OSGi service.

`src/main/resources/META-INF/spring/bundle-context.xml`

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xmlns:context="http://www.springframework.org/schema/context"
   xmlns:tx="http://www.springframework.org/schema/tx"
   xsi:schemaLocation="http://www.springframework.org/schema/beans
   http://www.springframework.org/schema/beans/spring-beans.xsd
   http://www.springframework.org/schema/context
   http://www.springframework.org/schema/context/spring-context.xsd
   http://www.springframework.org/schema/tx
   http://www.springframework.org/schema/tx/spring-tx.xsd">
  <context:component-scan base-package="org.springbyexample.sdms.simpleForm.orm.impl"/>
  <tx:annotation-driven />

  <bean id="transactionManager" class="org.springframework.orm.jpa.JpaTransactionManager">
    <property name="entityManagerFactory" ref="entityManagerFactory"/>
  </bean>

  <bean id="entityManagerFactory" class="org.springframework.orm.jpa.LocalContainerEntityManagerFactoryBean">
    <property name="dataSource" ref="dataSource"/>
    <property name="jpaVendorAdapter">
      <bean class="org.springframework.orm.jpa.vendor.HibernateJpaVendorAdapter"/>
    </property>
  </bean>
</beans>
```
The `javax.sql.DataSource` exposed by the previous bundle is referenced, and the Person DAO implementation is registered as an OSGi service.

```
<beans:

    <reference id="dataSource" interface="javax.sql.DataSource" />
    <service ref="personDao" interface="org.springbyexample.sdms.simpleForm.orm.dao.PersonDao" />
</beans>
```

### Code Example

The Person entity uses `javax.persistence` annotation for configuration.

Excerpt from `sdms/simple-spring-mvc/simple-spring-mvc-person/src/main/java/org/springbyexample/sdms/simpleForm/orm/bean/Person.java`

```java
@Entity
@Table(name="PERSON")
public class Person implements Comparable<Person>, Serializable {

    ... 
    private Integer id = null;
    private String firstName = null;
    private String lastName = null;
    private Set<Address> addresses = null;
    private Date created = null;

    /**
     * Gets id (primary key).
     * 
     * @Id
     * @GeneratedValue(strategy=GenerationType.AUTO)
     * public Integer getId() {
     *     return id;
     * }
    /**
```
* Sets id (primary key).
 */
 public void setId(Integer id) {
    this.id = id;
 }

/**
 * Gets first name.
 */
@Column(name="FIRST_NAME")
public String getFirstName() {
    return firstName;
}

/**
 * Sets first name.
 */
public void setFirstName(String firstName) {
    this.firstName = firstName;
}

/**
 * Gets last name.
 */
@Column(name="LAST_NAME")
public String getLastName() {
    return lastName;
}

/**
 * Sets last name.
 */
public void setLastName(String lastName) {
    this.lastName = lastName;
}

/**
 * Gets list of <code>Address</code>s.
 */
@OneToMany(fetch=FetchType.EAGER, cascade=CascadeType.ALL)
@JoinColumn(name="PERSON_ID", nullable=false)
public Set<Address> getAddresses() {
    return addresses;
}

/**
 * Sets list of <code>Address</code>s.
 */
public void setAddresses(Set<Address> addresses) {
    this.addresses = addresses;
}

/**
 * Gets date created.
 */
public Date getCreated() {
    return created;
}

/**
 * Sets date created.
 */
public void setCreated(Date created) {
    this.created = created;
}

public Address findAddressById(Integer id) {
    Address result = null;
    if (addresses != null) {
        for (Address address: addresses) {
            if (address.getId().equals(id)) {
                result = address;
                break;
            }
        }
    }
    return result;
}
Example 1 Person Entity

The Person DAO implementation uses the JPA EntityManager for managing a Person.

```java
@Repository("personDao")
@Repository(extend = true)
public class PersonDaoImpl implements PersonDao {
    private EntityManager em;
    @PersistenceContext
    public void setEntityManager(EntityManager em) {
        this.em = em;
    }
    /**
     * Find persons.
     */
    @SuppressWarnings("unchecked")
    public Person findPersonById(Integer id) {
        return em.find(Person.class, id);
    }
    /**
     * Find persons using a start index and max number of results.
     */
    @SuppressWarnings("unchecked")
    public Collection<Person> findPersonsByLastName(String lastName) {
        return em.createQuery("select p from Person p where p.lastName = :lastName order by p.lastName, p.firstName")
        .setParameter("lastName", lastName).getResultList();
    }
    /**
     * Find persons by last name.
     */
    @SuppressWarnings("unchecked")
    public Collection<Person> findPersonsByLastName(String lastName) {
        return em.createQuery("select p from Person p where p.lastName = :lastName order by p.lastName, p.firstName")
        .setParameter("lastName", lastName).getResultList();
    }
    /**
     * Find persons.
     */
    @SuppressWarnings("unchecked")
    public Collection<Person> findPersons() {
        return em.createQuery("select p from Person p order by p.lastName, p.firstName")
        .getResultList();
    }
    /**
     * Find persons.
     */
    @SuppressWarnings("unchecked")
    public Collection<Person> findPersons(final int startIndex, final int maxResults) {
        return em.createQuery("select p from Person p order by p.lastName, p.firstName")
        .setFirstResult(startIndex).setMaxResults(maxResults).getResultList();
    }
    /**
     * Find persons using a start index and max number of results.
     */
    @SuppressWarnings("unchecked")
    public Collection<Person> findPersons() {
        return em.createQuery("select p from Person p order by p.lastName, p.firstName")
        .getResultList();
    }
    /**
     * Find persons.
     */
    @SuppressWarnings("unchecked")
    public void setEntityManager(EntityManager em) {
        this.em = em;
    }
}
```

sdms/simple-spring-mvc/simple-spring-mvc-person/src/main/java/org/springbyexample/sdms/simpleForm/orm/impl/PersonDaoImpl.java
/**
 * Saves person.
 */
@Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
public Person save(Person person) {
    return em.merge(person);
}

/**
 * Deletes person.
 */
@Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
public void delete(Person person) {
    em.remove(em.merge(person));
}

/**
 * Saves address to person.
 */
@Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
public Person saveAddress(Integer id, Address address) {
    Person person = findPersonById(id);
    if (person.getAddresses().contains(address)) {
        person.getAddresses().remove(address);
    }
    person.getAddresses().add(address);
    return save(person);
}

/**
 * Deletes address from person.
 */
@Transactional(readOnly = false, propagation = Propagation.REQUIRES_NEW)
public Person deleteAddress(Integer id, Integer addressId) {
    Person person = findPersonById(id);
    Address address = new Address();
    address.setId(addressId);
    if (person.getAddresses().contains(address)) {
        person.getAddresses().remove(address);
    }
    return save(person);
}

Example 2 Person DAO Implementation

4. Simple Spring MVC Web Module

The web module has a simple form for creating and editing a Person, and also has a basic search page. The application also has internationalization and uses Tiles for templating.

Manifest Configuration
The symbolic name the bundle is deployed under.

The version the bundle is deployed under.

Declares the module type indicating this is a web module. This is used by the Spring dm Server [http://www.springsource.com/products/suite/dmserver].

The Web-ContextPath property configures the web application's context path.

The Web-DispatcherServletUrlPatterns property configures the dispatch servlet to route any matches for the pattern ".html" to controllers.

The Import-Package property imports the the persistence beans and the Person DAO interface from the Person DAO bundle.

Spring Configuration

The bundle-context.xml isn't used in this example, but bundle-context-osgi.xml makes a reference to the Person service and exposes it as a bean. The Spring web configuration is in webmvc-context.xml.

The reference to the OSGi service PersonDao is exposed as a bean named personDao.
This standard Spring MVC configuration file scans for controller classes, creates handlers, configures Tiles, and also internationalization. The `classnameControllerMappings` bean enables convention based mappings for reduced configuration. It is configured to be case sensitive, so a controller called `StudentPersonController` would map to the URL '/studentPerson'. Although it defaults to case insensitive and would then map to the URL '/studentperson'. The default handler is set with the `UrlFilenameViewController`, which will handle any requests not handled by a convention based controller.

```
src/main/resources/META-INF/spring/webmvc-context.xml
```

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:p="http://www.springframework.org/schema/p"
      xmlns:context="http://www.springframework.org/schema/context"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                          http://www.springframework.org/schema/beans/spring-beans.xsd
                          http://www.springframework.org/schema/context
                          http://www.springframework.org/schema/context/spring-context.xsd">
  <context:component-scan base-package="org.springbyexample.sdms.simpleForm.web.mvc" />
  <!-- Enables /[resource]/[action] to [Resource]Controller class mapping -->
  <bean id="classnameControllerMappings"
        class="org.springframework.web.servlet.mvc.support.ControllerClassNameHandlerMapping"
        p:order="1"
        p:interceptors-ref="localeChangeInterceptor"
        p:caseSensitive="true">
    <property name="defaultHandler">
      <bean class="org.springframework.web.servlet.mvc.UrlFilenameViewController" />
    </property>
  </bean>
  <!-- Enables annotated POJO @Controllers -->
  <bean class="org.springframework.web.servlet.mvc.annotation.AnnotationMethodHandlerAdapter" />
  <!-- Enables plain Controllers -->
  <bean class="org.springframework.web.servlet.mvc.SimpleControllerHandlerAdapter" />
  <bean id="tilesConfigurer"
        class="org.springframework.web.servlet.view.tiles2.TilesConfigurer">
    <property name="definitions">
      <list>
        <value>/WEB-INF/tiles-defs/templates.xml</value>
      </list>
    </property>
  </bean>
  <bean id="tilesViewResolver"
        class="org.springframework.web.servlet.view.UrlBasedViewResolver"
        p:order="2"
        p:viewClass="org.springframework.web.servlet.view.tiles2.TilesView" />
  <bean id="messageSource"
        class="org.springframework.context.support.ResourceBundleMessageSource"
        p:basenames="messages" />
  <!-- Declare the Interceptor -->
  <bean id="localeChangeInterceptor"
        class="org.springframework.web.servlet.i18n.LocaleChangeInterceptor"
        p: paramName="locale" />
  <!-- Declare the Resolver -->
```

Simple Spring MVC
JSP Example

A simple person form using Spring's custom JSP tags.

src/main/resources/MODULE-INF/WEB-INF/jsp/person/form.jsp

```jsp
<%@ taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core"%>
<%@ taglib prefix="fmt" uri="http://java.sun.com/jsp/jstl/fmt"%>
<%@ taglib prefix="form" uri="http://www.springframework.org/tags/form"%>

<h1><fmt:message key="person.form.title"/></h1>

<c:if test="${not empty statusMessageKey}">
  <p><fmt:message key="${statusMessageKey}"/></p>
</c:if>

<c:url var="url" value="/person/form.html" />
<form:form action="${url}" commandName="person">
  <form:hidden path="id" />
  <fieldset>
    <div class="form-row">
      <label for="firstName"><fmt:message key="person.form.firstName"/>:</label>
      <span class="input"><form:input path="firstName" /></span>
    </div>
    <div class="form-row">
      <label for="lastName"><fmt:message key="person.form.lastName"/>:</label>
      <span class="input"><form:input path="lastName" /></span>
    </div>
    <div class="form-buttons">
      <div class="button"><input name="submit" type="submit" value="<fmt:message key="button.save"/>"></div>
    </div>
  </fieldset>
</form:form>
```

This is the search page and next to each record displayed is an 'edit' and 'delete' link.

src/main/resources/MODULE-INF/WEB-INF/jsp/person/search.jsp

```jsp
<%@ taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core"%>
<%@ taglib prefix="fmt" uri="http://java.sun.com/jsp/jstl/fmt"%>
<%@ taglib prefix="form" uri="http://www.springframework.org/tags/form"%>

<h1><fmt:message key="person.search.title"/></h1>
<table class="search">
  <tr>
    <th><fmt:message key="person.form.firstName"/></th>
    <th><fmt:message key="person.form.lastName"/></th>
  </tr>
</table>
```

Spring by Example Version 1.03
Below is an example of an alternative way to handle a delete following a REST style approach, although the following JavaScript won't work in IE. A library like Dojo should be used for the AJAX call to make the JavaScript browser independent.

The delete method in the controller would be made to only accept an HTTP DELETE. A standard HTML form can't submit this type of request, but JavaScript's XMLHttpRequest can. Ideally in a more complex example, Spring JS would be used to decorate the link with JavaScript and there would be a URL that would still function with a standard GET or POST in case the user has JavaScript disabled in their browser.

The delete link calls the JavaScript function deletePerson passing in the URL that should be called by XMLHttpRequest using an HTTP DELETE (instead of the usual GET or POST). Before the delete is processed it is confirmed by a JavaScript popup.

**Alternative search JSP**

```html
<%@ taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core"%
<%@ taglib prefix="fmt" uri="http://java.sun.com/jsp/jstl/fmt" %
<%@ taglib prefix="form" uri="http://www.springframework.org/tags/form"%

<script language="javascript">
//<!--
function deletePerson(url){
    var confirmed = confirm('<fmt:message key="person.form.confirmDelete"/>');
    if (confirmed) {
        var request = new XMLHttpRequest();
        request.open('DELETE', url, true);
        request.onreadystatechange = function () { window.location.reload(true); };
        request.send(null);
    }
    // -->
</script>

<h1><fmt:message key="person.search.title"/></h1>
```
Code Example

Because of the `classnameControllerMappings` bean, the controller is automatically mapped to handle '/person/*' based on it's name (ex: [Path]Controller). Then the method names are used to match the rest of the path. So, '/person/form' will match the form method. The `ModelAttribute` will be called before each path mapped to the controller. For example, when '/person/form' is called, the `newRequest` method will be called first so an instance of `Person` is available to bind to the form.

The search method doesn't currently use the person model attribute from the `newRequest` method, but in a more advanced example it likely would. For example using the first and last name fields to perform a like search in the database.

```
@ModelAttribute
public Person newRequest(@RequestParam(required=false) Integer id) {
  return (id != null ? personDao.findPersonById(id) : new Person());
}
```
Person form request.

* Expected HTTP GET and request '/person/form'.

```java
@RequestMapping(method=RequestMethod.GET)
public void form() {} 
```

Saves a person.

* Expected HTTP POST and request '/person/form'.

```java
@RequestMapping(method=RequestMethod.POST)
public void form(Person person, Model model) {
  if (person.getCreated() == null) {
    person.setCreated(new Date());
  }
  Person result = personDao.save(person);
  // set id from create
  if (person.getId() == null) {
    person.setId(result.getId());
  }
  model.addAttribute("statusMessageKey", "person.form.msg.success");
}
```

Deletes a person.

* Expected HTTP POST and request '/person/delete'.

```java
@RequestMapping(method=RequestMethod.POST)
public String delete(Person person) {
  personDao.delete(person);
  return SEARCH_VIEW_KEY;
}
```

Searches for all persons and returns them in a Collection.

* Expected HTTP GET and request '/person/search'.

```java
@RequestMapping(method=RequestMethod.GET)
public @ModelAttribute(SEARCH_MODEL_KEY) Collection<Person> search() {
  return personDao.findPersons();
}
```

Example 3 Simple Spring MVC PersonController

5. Reference

Related Links

- OSGi Alliance [http://www.osgi.org/]
Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Command Line Example

This will checkout all four projects, but each one could be checked out individually too.

```
$ svn co http://svn.springbyexample.org/sdms/simple-spring-mvc/tags/1.0.3/ simple-spring-mvc
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
- Spring dm Server 1.0
Part VII. Modules

Reusable libraries/modules released under the Apache License, Version 2.0 [http://www.apache.org/licenses/LICENSE-2.0.txt] and developed with Java 5.
Module Summary

David Winterfeldt

2008

Reusable libraries/modules released under the Apache License, Version 2.0 [http://www.apache.org/licenses/LICENSE-2.0.txt] and developed with Java 5.

See Where is the Maven Repository for Spring by Example? [http://www.springbyexample.org/twiki/bin/view/Main/FAQ#Where_is_the_Maven_Repository_for_Spring_by_Example?] for how to download or register the Maven repository for a Maven build or go to the download section of the related module.

1. Downloads

Custom ServletContext Scope Module

The Spring by Example Custom ServletContext Scope module is a custom scope implementation for providing ServletContext (web application) scoped beans.

- Custom ServletContext Scope Module
- Custom ServletContext Scope Module Site [http://www.springbyexample.org/maven/site/custom-servlet-context-scope/1.0/index.html]
- Download
  - Maven Dependency Instructions or Custom ServletContext Scope Module 1.0 JAR [http://www.springbyexample.org/maven/repo/org/springbyexample/custom-servlet-context-scope/1.0/custom-servlet-context-scope-1.0.jar]

Custom Thread Scope Module

The Spring by Example Custom Thread Scope module is a custom scope implementation for providing thread scoped beans.

- Custom Thread Scope Module
- Custom Thread Scope Module Site [http://www.springbyexample.org/maven/site/custom-thread-scope/1.0/index.html]
- Download
  - Maven Dependency Instructions or Custom Thread Scope Module 1.0 JAR [http://www.springbyexample.org/maven/repo/org/springbyexample/custom-thread-scope/1.0/custom-thread-scope-1.0.jar]

Dynamic Tiles Module

The Dynamic Tiles 2 module dynamically renders a Tiles 2 template with Spring MVC. Any request coming in
mapped for Tiles processing will use the default template and dynamically insert the body based on the URL. There is support for AJAX and Spring Web Flow requests to render a fragment of a URL (based on AjaxTilesView from Spring JS and FlowAjaxTilesView from Spring Web Flow).

- Dynamic Tiles Spring MVC Module

- Dynamic Tiles Spring MVC Module Site
  [http://www.springbyexample.org/maven/site/dynamic-tiles2/1.1/index.html]

- Download

  - Maven Dependency Instructions or Dynamic Tiles Module 1.1 JAR
    [http://www.springbyexample.org/maven/repo/org/springbyexample/dynamic-tiles2/1.1/dynamic-tiles2-1.1.jar]

### Spring by Example JCR Module

The Spring by Example JCR module uses Spring Modules JCR (Java Content Repository) module. Currently the utilities provide a way to recurse through the repositories nodes using JcrTemplate and a custom node callback for each matching node found while recursing the repository. This example uses Apache Jackrabbit for the Java Content Repository which is the reference implementation for JSR-170.

- Spring by Example JCR Module

- Spring by Example JCR Module Site
  [http://www.springbyexample.org/maven/site/spring-by-example-jcr/1.0/index.html]

- Download

  - Maven Dependency Instructions or Spring by Example JCR Module 1.0 JAR
    [http://www.springbyexample.org/maven/repo/org/springbyexample/spring-by-example-jcr/1.0/spring-by-example-jcr-1.0.jar]

### Spring by Example JDBC Module

The Spring by Example JDBC module has some utilities to help create and initialize a database. There is an extension of SimpleDriverDataSource from Spring, which doesn't pool connections (primarily for testing), that can be configured to run scripts once the class is initialized and another one based on Commons DBCP BasicDataSource. The script processor that they use can also be used separately.

**Note**

SimpleDriverDataSource was added to the Spring Framework in version 2.5.5, so 2.5.5 or higher is needed to use InitializingDriverManagerDataSource and HsqldbInitializingDriverManagerDataSource in Spring by Example JDBC version 1.0.3.

- Spring by Example JDBC Module

- Spring by Example JDBC Module Site
  [http://www.springbyexample.org/maven/site/spring-by-example-jdbc/1.0.3/index.html]
Spring by Example Utils Module

The Spring by Example Utils module currently has the HttpClientTemplate and HttpClientOxmTemplate which are light wrappers on top of Apache's HttpClient providing Spring style code based templating. The latter template provides marshaling and unmarshaling of XML based requests.

Built on top of the HttpClientTemplate and HttpClientOxmTemplate, the SolrOxmClient provides for easier client communication with Apache Solr [http://lucene.apache.org/solr/]. Solr [http://lucene.apache.org/solr/] provides an XML based API over HTTP to the Apache Lucene [http://lucene.apache.org/] search engine. SolrOxmClient marshalls/unmarshalls searches and updates to and from a JavaBean. It also allows calls to commit, rollback, and optimize.

The Logger BeanPostProcessor provides logger creation and injection based on reflection, interfaces, or annotations.

The ImageProcessor [http://www.springbyexample.org/maven/site/spring-by-example-util/1.2.1/apidocs/org/springbyexample/util/image/ImageProcessor.html] is a utility to process images and currently can help scale and image from one size to another either using a java.io.File or a java.io.InputStream to a java.io.OutputStream.

Spring by Example Web Module

There is a Spring GWT Controller for standard GWT usage and also Spring Bayeux integration for using Comet on Jetty.

There is an ImageInterceptor that intercepts a request and looks in a directory that matches the requests relative path. Currently it only matches one image extension type which defaults to '.jpg'. It generates a thumbnail if one doesn't exist and also makes a list of available thumbnails and images. Also, GenericHtmlController is a generic annotation-based controller to handle html requests ('/**/*.html') is available. It's useful with Dynamic Tiles Spring MVC Module to allow rendering of static pages or dynamic ones that don't necessarily need to go through a controller to render.

Spring by Example Version 1.03 Spring by Example 241
http://www.springbyexample.org/maven/site/spring-by-example-web/1.1.1/index.html]

• Download

• Maven Dependency Instructions or Spring by Example Web Module 1.1.1 JAR
  [http://www.springbyexample.org/maven/repo/org/springbyexample/spring-by-example-web/1.1.1/spring-by-example-web-1.1.1.jar]
The Spring by Example Custom ServletContext Scope module is a custom scope implementation for providing ServletContext (web application) scoped beans.

It can be useful for sharing a Spring bean between web applications if your servlet container has cross context support. Tomcat has cross context support that can be turned on by setting crossContext="true" on the Context. See Tomcat's context documentation for more details.

**Note**

Even though a bean can be shared between web contexts, only classes loaded by a parent classloader can be shared. The easiest thing to do is either share data as XML or in a Map or String (something JVM's core). Then there won't be any ClassCastException. Or the server can be configured to have the shared class in the parent classloader. For example, in Tomcat the jar with the shared class could be put in Tomcat's lib directory, but this should be avoided as much as possible since it will cause your web applications to be tightly coupled together.

1. Spring Configuration

The custom ServletContextScope is registered with the CustomScopeConfigurer under the key 'servletContext'. The key can be used to specify the scope on a bean just like the default scopes 'singleton' or 'prototype'.

```xml
<bean class="org.springframework.beans.factory.config.CustomScopeConfigurer">
  <property name="scopes">
    <map>
      <entry key="servletContext">
        <bean class="org.springbyexample.web.context.ServletContextScope"/>
      </entry>
    </map>
  </property>
</bean>
```

This is the same, but it specifies a specific context to use for storing and retrieving values.

```xml
<bean class="org.springframework.beans.factory.config.CustomScopeConfigurer">
  <property name="scopes">
    <map>
      <entry key="servletContext">
        <bean class="org.springbyexample.web.context.ServletContextScope"/>
      </entry>
    </map>
  </property>
</bean>
```
2. Download

If you are using Maven, you can use the Maven dependency below and add a repository definition for the Spring by Example Maven repository. Otherwise you can download the jar directly from the Spring by Example Maven repository (http://www.springbyexample.org/maven/repo/).

```xml
<dependency>
  <groupId>org.springbyexample</groupId>
  <artifactId>custom-servlet-context-scope</artifactId>
  <version>1.0</version>
</dependency>
<repositories>
  <repository>
    <id>springbyexample.org</id>
    <name>Spring by Example</name>
    <url>http://www.springbyexample.org/maven/repo</url>
  </repository>
</repositories>
```

3. Reference

Related Links

- Custom ServletContext Scope Site
  [http://www.springbyexample.org/maven/site/custom-servlet-context-scope/1.0/index.html]

- Spring 2.5.x Custom Scope Documentation
  [http://static.springframework.org/spring/docs/2.5.x/reference/beans.html#beans-factory-scopes-custom-creating]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.
Checkout instructions for the project are available at Source Repository Instructions [http://www.springbyexample.org/maven/site/custom-servlet-context-scope/1.0/source-repository.html].

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

• Spring Framework 2.5.x
Spring by Example Custom Thread Scope Module

David Winterfeldt
2008

The Custom Thread Scope module is a custom scope implementation for providing thread scoped beans. Every request for a bean will return the same instance for the same thread. A Runnable must be wrapped in a ThreadScopeRunnable if destruction callbacks should occur on a thread scoped bean.

1. Spring Configuration

The threadCounter bean is set to use the custom ThreadScope and the CustomScopeConfigurer registers the custom scope.

```
<bean id="threadCounter"
     class="org.springbyexample.bean.scope.thread.Counter"
     scope="thread" />

<bean class="org.springframework.beans.factory.config.CustomScopeConfigurer">
    <property name="scopes">
        <map>
            <entry key="thread">
                <bean class="org.springbyexample.bean.scope.thread.ThreadScope"/>
            </entry>
        </map>
    </property>
</bean>
```

2. Code Example

Below is the code for the ThreadScopeRunnable class. It can be used to wrap another Runnable so when it's finished running it clears the current thread scoped variables in order for destruction callbacks to run. If you have your own custom Thread implementations, they can call ThreadScopeContextHolder.currentThreadScopeAttributes().clear() directly.

```java
public class ThreadScopeRunnable implements Runnable {
    protected Runnable target = null;

    /**
     * Constructor
     */
    public ThreadScopeRunnable(Runnable target) {
```
3. Download

If you are using Maven, you can use the Maven dependency below and add a repository definition for the Spring by Example Maven repository. Otherwise you can download the jar directly from the Spring by Example Maven repository (http://www.springbyexample.org/maven/repo/).

```
<dependency>
  <groupId>org.springbyexample</groupId>
  <artifactId>custom-thread-scope</artifactId>
  <version>1.0</version>
</dependency>
<repositories>
  <repository>
    <id>springbyexample.org</id>
    <name>Spring by Example</name>
    <url>http://www.springbyexample.org/maven/repo</url>
  </repository>
</repositories>
```

4. Reference

Related Links

- Custom Thread Scope Site [http://www.springbyexample.org/maven/site/custom-thread-scope/1.0/index.html]
- Spring 2.5.x Custom Scope Documentation [http://static.springframework.org/spring/docs/2.5.x/reference/beans.html#beans-factory-scopes-custom-creating]
- Spring JIRA 2581 - Provide out of the box implementation of the thread scope
Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Checkout instructions for the project are available at Source Repository Instructions [http://www.springbyexample.org/maven/site/custom-thread-scope/1.0/source-repository.html].

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

• Spring Framework 2.5.x
Spring by Example's Dynamic Tiles 2
Spring MVC Module

David Winterfeldt
2008

The Dynamic Tiles 2 Spring MVC Module [http://www.springbyexample.org/maven/site/dynamic-tiles2/1.1/index.html], version 1.1, dynamically renders a Tiles 2 [http://tiles.apache.org/] template with Spring MVC. Any request coming in mapped for Tiles processing will use the default template and dynamically insert the body based on the URL.

Besides basic support for rendering dynamically rendering Tiles templates, there is also support for rendering Tiles fragments like AjaxTilesView and FlowAjaxTilesView in Spring JS and Spring Web Flow

1. Spring Configuration

The tilesConfigurer bean initializes tiles with all the tiles configuration files (more than one can be specified). The tilesViewResolver bean defines using DynamicTilesView which uses the url to lookup the Tiles definition, dynamically insert the body into the definition, and render it.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                        http://www.springframework.org/schema/beans/spring-beans.xsd">

  <bean id="tilesConfigurer"
       class="org.springframework.web.servlet.view.tiles2.TilesConfigurer">
    <property name="definitions">
      <list>
        <value>/WEB-INF/tiles-defs/templates.xml</value>
      </list>
    </property>
  </bean>

  <bean id="tilesViewResolver" class="org.springframework.web.servlet.view.UrlBasedViewResolver">
    <property name="viewClass" value="org.springbyexample.web.servlet.view.tiles2.DynamicTilesView" />
    <property name="prefix" value="/WEB-INF/jsp/" />
    <property name="suffix" value=".jsp" />
  </bean>

  <bean id="urlMapping" class="org.springframework.web.servlet.handler.SimpleUrlHandlerMapping">
    <property name="mappings">
      <props>
        <prop key="/**/*.html">viewController</prop>
      </props>
    </property>
  </bean>

  <bean id="viewController" class="org.springframework.web.servlet.mvc.UrlFilenameViewController"/>
</beans>
```
For the AJAX requests to work correctly an AjaxUrlBasedViewResolver must be configured and FlowAjaxDynamicTilesView as the view class.

```xml
<beans>

<bean id="tilesViewResolver"
     class="org.springframework.js.ajax.AjaxUrlBasedViewResolver">
  <property name="viewClass" value="org.springbyexample.web.servlet.view.tiles2.FlowAjaxDynamicTilesView"/>
  <property name="prefix" value="/WEB-INF/jsp/"/>
  <property name="suffix" value=".jsp"/>
</bean>
</beans>
```

2. Tiles XML Configuration

The Tiles '.mainTemplate' sets up the default layout. Each page is dynamically rendered by dynamically setting the body on the derived Tiles definition. Which in this case is '.mainTemplate'.

```xml
<?xml version="1.0" encoding="ISO-8859-1" ?>
<!DOCTYPE tiles-definitions PUBLIC
   "-//Apache Software Foundation//DTD Tiles Configuration 2.0//EN"
   "http://tiles.apache.org/dtds/tiles-config_2_0.dtd">

<tiles-definitions>

   <!-- Default Main Template -->
   <definition name=".mainTemplate" template="/WEB-INF/templates/main.jsp">
      <put-attribute name="title" value="Simple Tiles 2 Example" type="string"/>
      <put-attribute name="header" value="/WEB-INF/templates/header.jsp"/>
      <put-attribute name="footer" value="/WEB-INF/templates/footer.jsp"/>
      <put-attribute name="menu" value="/WEB-INF/templates/menu.jsp"/>
      <put-attribute name="content" value="/WEB-INF/templates/blank.jsp"/>
   </definition>

</tiles-definitions>
```

3. Tiles JSP Example

This JSP has the main layout for where the header, footer, menu, and body are located. They are inserted using Tiles custom JSP tags.
4. DynamicTilesView

Processing Order

If a request is made for '/info/index.html', Spring will pass 'info/index' into the view. The first thing will be to look for 'info/index' as a Tiles definition. Then a template definition of '.info.mainTemplate', which if found will dynamically have a body set on this definition. If the previous aren't found, it is assumed a root definition exists. This would be '.mainTemplate'. If none of these exist, a TilesException will be thrown.

1. Check if a Tiles definition based on the URL matches.

2. Checks if a definition derived from the URL and default template name exists and then dynamically insert the body based on the URL.

3. Check if there is a root template definition and then dynamically insert the body based on the URL.

4. If no match is found from any process above a TilesException is thrown.

The following are the default values for determining a Tiles definition for a request. If these aren't acceptable, they can be changed using TilesUrlBasedViewResolver which is a subclass of UrlBasedViewResolver. Or for AJAX support TilesAjaxUrlBasedViewResolver, which is a subclass of AjaxUrlBasedViewResolver, can be used.

Table 1. DynamicTilesView Defaults

<table>
<thead>
<tr>
<th>Property</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tilesDefinitionName</td>
<td>mainTemplate</td>
</tr>
</tbody>
</table>

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5. Download

If you are using Maven, you can use the Maven dependency below and add a repository definition for the Spring by Example Maven repository. Otherwise you can download the jar directly from the Spring by Example Maven repository (http://www.springbyexample.org/maven/repo/).

```xml
<dependency>
    <groupId>org.springbyexample</groupId>
    <artifactId>dynamic-tiles2</artifactId>
    <version>1.1</version>
</dependency>
<repositories>
    <repository>
        <id>springbyexample.org</id>
        <name>Spring by Example</name>
        <url>http://www.springbyexample.org/maven/repo</url>
    </repository>
</repositories>
```

6. Reference

Related Links

- Dynamic Tiles 2 Site [http://www.springbyexample.org/maven/site/dynamic-tiles2/1.0/index.html]
- Spring 2.5.x Tiles Documentation
Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Checkout instructions for the project are available at Source Repository Instructions [http://www.springbyexample.org/maven/site/dynamic-tiles2/1.1/source-repository.html].

Dynamic Tiles 2 Webapp Example

```
$ svn co http://svn.springbyexample.org/web/dynamic-tiles2-webapp/tags/1.1/ dynamic-tiles2-webapp
```

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
- Tiles 2
The Spring by Example JCR module uses Spring Modules JCR (Java Content Repository) module. Currently the utilities provide a way to recurse through the repositories nodes using JcrTemplate and a custom node callback for each matching node found while recursing the repository. This example uses Apache Jackrabbit for the Java Content Repository which is the reference implementation for JSR-170.

1. Spring Configuration

The first bean definition defines the Jackrabbit repository by specifying the configuration file to use and the location of the repository. If the repository doesn't already exist, it will be created on startup. The next bean creates a session factory based on the repository and the next one creates a JcrTemplate using the session factory.

```xml
<beans xmlns="http://www.springframework.org/schema/beans" 
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" 
   xmlns:context="http://www.springframework.org/schema/context" 
   xsi:schemaLocation="http://www.springframework.org/schema/beans 
   http://www.springframework.org/schema/beans/spring-beans.xsd 
   http://www.springframework.org/schema/context 
   http://www.springframework.org/schema/context/spring-context.xsd">
   <!-- Register Annotation-based Post Processing Beans -->
   <context:annotation-config />
   <!-- Scan context package for any eligible annotation configured beans. -->
   <context:component-scan base-package="org.springbyexample.jcr" />

   <!-- normal repository -->
   <bean id="repository" 
     class="org.springmodules.jcr.jackrabbit.RepositoryFactoryBean">
     <!-- normal factory beans params -->
     <property name="configuration" value="classpath:/jackrabbit-repository.xml" />
     <property name="homeDir" value="file:./target/repo" />
   </bean>

   <bean id="sessionFactory" 
     class="org.springmodules.jcr.jackrabbit.JackrabbitSessionFactory">
     <property name="repository" ref="repository" />
   </bean>

   <bean id="jcrTemplate" class="org.springmodules.jcr.JcrTemplate">
     <property name="sessionFactory" ref="sessionFactory" />
     <property name="allowCreate" value="true" />
   </bean>

   <bean id="processor" class="org.springbyexample.jcr.JcrContentExporter">
     <property name="contentRecurser" ref="jcrContentRecurser" />
     <property name="rootFolder" value="./target/repo_export" />
   </bean>

</beans>
```
2. Code Example

The example shows calling `JcrContentExporter` which is defined in the Spring configuration. It just needs a reference to the `JcrContentRecurser`, which is automatically loaded by the `context:component-scan` since it has an `@Component` annotation, and also a file path where to export all content nodes in the repository.

This is an excerpt from `JcrContentExporterTest`.

```java
@Autowired
private JcrContentExporter processor = null;
...

public void testJcrContentProcessor() {
...
    List<String> lResults = processor.process();
...
}
```

**Example 1 Content Exporter**

This example is from `JcrContentExporter`. It processes each content node and writes the content to an export directory, but obviously any type of processing can be done on the content node inside the callback.

For every content node found while recursing the repository `JcrNodeCallback.doInJcrNode(Session session, Node node)` is called. The file name and relative path from the root node is derived and then the content is retrieved and written to the export directory.

```java
public List<String> process() {
    final List<String> lResults = new ArrayList<String>();
    contentRecurser.recurse(new JcrNodeCallback() {
        public void doInJcrNode(Session session, Node node) throws IOException, RepositoryException {
            // file name node is above content
            String fileName = node.getParent().getName();
            // file path is two above content
            String path = node.getParent().getParent().getPath();

            logger.debug("In content recurser callback." +
                        " fileName='{}' path='{}'", fileName, path);

            File fileDir = new File(rootFolder + path);
            File file = new File(fileDir, fileName);

            Property dataProperty = node.getProperty(JcrConstants.JCR_DATA);
            InputStream in = null;
            OutputStream out = null;

            try {
                FileUtil.forceMkdir(fileDir);
                in = dataProperty.getStream();
                out = new FileOutputStream(file);
```
Example 2 Using JcrContentRecurser

The previous example of JcrContentRecurser is a very simple subclass of JcrRecurser. If it no specific node matching is set on it, its callback will be called for every node in the repository. But a Set of specific node names to match can be passed in either through the constructor or methods.

Below is JcrContentRecurser which just sets the content node as the only node to have callbacks performed.

```java
public class JcrContentRecurser extends JcrRecurser {
    final Logger logger = LoggerFactory.getLogger(JcrContentRecurser.class);

    /**
     * Constructor
     */
    public JcrContentRecurser() {
        super(JcrConstants.JCR_CONTENT);
    }
}
```

Example 3 Using JcrRecurser

3. Download

If you are using Maven, you can use the Maven dependency below and add a repository definition for the Spring by Example Maven repository. Otherwise you can download the jar directly from the Spring by Example Maven repository (http://www.springbyexample.org/maven/repo/).

```xml
<dependency>
    <groupId>org.springbyexample</groupId>
    <artifactId>spring-by-example-jcr</artifactId>
    <version>1.0</version>
</dependency>
<repositories>
    <repository>
        <id>springbyexample.org</id>
    </repository>
</repositories>
```
4. Reference

Related Links

- Spring by Example JCR Site [http://www.springbyexample.org/maven/site/spring-by-example-jcr/1.0/index.html]
- Spring Modules [https://springmodules.dev.java.net/]
- Apache Jackrabbit [http://jackrabbit.apache.org/]
- Integrating Java Content Repository and Spring [http://www.infoq.com/articles/spring-modules-jcr]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Checkout instructions for the project are available at Source Repository Instructions [http://www.springbyexample.org/maven/site/spring-by-example-jcr/1.0/source-repository.html].

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
The Spring by Example JDBC module has some utilities to help creating and initializing a database. There is an extension of SimpleDriverDataSource from Spring, which doesn't pool connections, that can be configured to run scripts once the class is initialized and another one based on Commons DBCP BasicDataSource. The script processor that they use can also be used separately.

**Note**

SimpleDriverDataSource was added to the Spring Framework in version 2.5.5, so 2.5.5 or higher is needed to use InitializingDriverManagerDataSource and HsqldbInitializingDriverManagerDataSource in Spring by Example JDBC version 1.0.3.

1. Spring Configuration

The InitializingBasicDataSource is an extension of Commons DBCP BasicDataSource. The key difference is that an initialization callback is used to process SQL scripts on startup. The list of scripts can either be a SQL script or a Spring resource (classpath, file, http, etc.). Also, the destruction method does not have to be defined in the XML because this class has a destruction callback.

```xml
<bean id="dataSource" class="org.springbyexample.jdbc.datasource.InitializingBasicDataSource">
   <property name="driverClassName" value="org.hsqldb.jdbcDriver"/>
   <property name="url" value="jdbc:hsqldb:mem:Test"/>
   <property name="username" value="sa"/>
   <property name="password" value=""/>
   <property name="sqlScriptProcessor">
      <bean class="org.springbyexample.jdbc.core.SqlScriptProcessor">
         <property name="sqlScripts">
            <list>
               <value>classpath:/schema.sql</value>
            </list>
         </property>
      </bean>
   </property>
</bean>
```

The InitializingDriverManagerDataSource is an extension of Spring’s SimpleDriverDataSource, so Spring 2.5.5 or higher is needed to use it. The key difference is that an initialization callback is used to process SQL scripts on startup. The list of scripts can either be a SQL script or a...
Spring resource (classpath, file, http, etc.).

**Note**

This creates a new connection each time one is requested so this is primarily useful for testing. Use `InitializingBasicDataSource` for pooling.

### InitializingDriverManagerDataSource

```xml
<bean id="dataSource" class="org.springbyexample.jdbc.datasource.InitializingDriverManagerDataSource">
  <property name="driverClassName" value="org.hsqldb.jdbcDriver"/>
  <property name="url" value="jdbc:hsqldb:mem:Test"/>
  <property name="username" value="sa"/>
  <property name="password" value=""/>
  <property name="sqlScriptProcessor">
    <bean class="org.springbyexample.jdbc.core.SqlScriptProcessor">
      <property name="sqlScripts">
        <list>
          <value>classpath:/schema.sql</value>
        </list>
      </property>
    </bean>
  </property>
</bean>
```

The `HsqldbInitializingDriverManagerDataSource` is an extension of `InitializingDriverManagerDataSource` specifically to use with HSQLDB. The key difference is that an initialization callback is used to process SQL scripts on startup. The list of scripts can either be a SQL script or a Spring resource (classpath, file, http, etc.). It defaults to creating an in memory database called Test with a username of sa and a blank password.

### HsqldbInitializingDriverManagerDataSource

```xml
<bean id="dataSource" class="org.springbyexample.jdbc.datasource.HsqldbInitializingDriverManagerDataSource">
  <property name="sqlScriptProcessor">
    <bean class="org.springbyexample.jdbc.core.SqlScriptProcessor">
      <property name="sqlScripts">
        <list>
          <value>classpath:/security_schema.sql</value>
          <value>classpath:/schema.sql</value>
        </list>
      </property>
    </bean>
  </property>
</bean>
```

The `SqlScriptProcessor` is used to process SQL scripts which can either be a SQL script or a Spring resource...
(classpath, file, http, etc.). The property `initOnStartup` defaults to `false`, but can be set to `true` if the scripts should be run on startup.

**SqlScriptProcessor**

```xml
<bean id="sqlScriptProcessor" class="org.springbyexample.jdbc.core.SqlScriptProcessor">
    <property name="dataSource" ref="dataSource" />
    <property name="initOnStartup" value="true" />
    <property name="sqlScripts">
        <list>
            <value>
                DROP TABLE COMPANY IF EXISTS;
                CREATE TABLE COMPANY (  
                    ID integer identity primary key,  
                    NAME varchar(50) not null,  
                    DESCRIPTION varchar(255) not null,  
                    ADDRESS varchar(255),  
                    CITY varchar(50) not null,  
                    STATE varchar(50) not null,  
                    ZIP_POSTAL varchar(30) not null  
                );
            </value>
            <value>classpath:/schema.sql</value>
        </list>
    </property>
</bean>
```

### 2. Code Example

`InitializingBasicDataSource`, `InitializingDriverManagerDataSource`, and `HsqlDbInitializingDriverManagerDataSource` are all standard DataSources and be used anywhere one is needed. It can be passed into a `JdbcTemplate`, a Hibernate session factory, etc.

```java
@Autowired
private DataSource ds = null;

public void process() {
    JdbcTemplate template = new JdbcTemplate(ds);
    ...
}
```

### 3. Download

If you are using Maven, you can use the Maven dependency below and add a repository definition for the Spring by Example Maven repository. Otherwise you can download the jar directly from the Spring by Example Maven repository (http://www.springbyexample.org/maven/repo/).
4. Reference

Related Links

- Spring by Example JDBC Site [http://www.springbyexample.org/maven/site/spring-by-example-jdbc/1.0.3/index.html]
- DriverManagerDataSource [http://static.springframework.org/spring/docs/2.5.x/reference/jdbc.html#jdbc-DriverManagerDataSource]
- Apache Commons DBCP [http://commons.apache.org/dbcp]

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Checkout instructions for the project are available at Source Repository Instructions [http://www.springbyexample.org/maven/site/spring-by-example-jdbc/1.0.3/source-repository.html].

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
Spring by Example Utils Module

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2008

The Spring by Example Utils module currently has the HttpClientTemplate and HttpClientOxmTemplate which are light wrappers on top of Apache's HttpClient providing Spring style code based templating. The latter template provides marshaling and unmarshalling of XML based requests.

The Logger BeanPostProcessor provides logger creation and injection based on reflection, interfaces, or annotations.

The ImageProcessor [http://www.springbyexample.org/maven/site/spring-by-example-util/1.2.1/apidocs/org/springbyexample/util/image/ImageProcessor.html] is a utility to process images and currently can help scale and image from one size to another either using a java.io.File or a java.io.InputStream to a java.io.OutputStream.

1. HttpClientTemplate

HttpClientTemplate which uses Apache's HttpClient to process HTTP requests and receive the data as a String, InputStream, or byte[].

Spring Configuration

Basic Configuration

Set a default URI for the HttpClientTemplate.

HttpclientTemplateTest-context.xml

```xml
<beans xmlns="http://www.springframework.org/schema/beans"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="http://www.springframework.org/schema/beans
   http://www.springframework.org/schema/beans/spring-beans.xsd">

  <bean id="httpClient" class="org.springbyexample.httpclient.HttpClientTemplate">
     <property name="defaultUri">
        <value><![CDATA[http://localhost:8093/test]]></value>
     </property>
  </bean>

</beans>
```

HTTP Authorization Configuration
The HttpClient instance used by HttpClientTemplate could be set during configuration with authorization, but all of the default authorization classes must be set using constructors. The Spring by Example authorization beans allow the use of setters so are a little more Spring friendly. The example below will use the userName and password when challenged for authentication by a request to localhost:8093.

When accessing a site that will challenge any request, authenticationPreemptive can be set to true. Then the credentials will be sent along with every request instead of a challenging needed to be issues before the credentials are sent.

**HttpClientTemplateAuthTest-context.xml**

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                          http://www.springframework.org/schema/beans/spring-beans.xsd">

  <bean id="httpClient" class="org.springbyexample.httpclient.HttpClientTemplate">
    <property name="defaultUri">
      <value><![CDATA[http://localhost:8093/admin/test]]></value>
    </property>
    <property name="credentials">
      <list>
        <bean class="org.springbyexample.httpclient.auth.Credentials">
          <property name="authScopeHost" value="localhost" />
          <property name="authScopePort" value="8093" />
          <property name="userName" value="jsmith" />
          <property name="password" value="password" />
        </bean>
      </list>
    </property>
  </bean>
</beans>
```

**Code Example**

Excerpts from HttpClientTemplateTest.

```java
public void doWithResponse(String response) throws IOException {
    ...
    logger.debug("HTTP Get string response. '{}'", response);
}
```

**Example 1 HTTP Get Response with a String**

```java
template.executeGetMethod(new ResponseStreamCallback() {
    ...
    logger.debug("HTTP Get string response. '{}'", response);

Example 1 HTTP Get Response with a String
```
public void doWithResponse(InputStream in) throws IOException {
    String response = IOUtils.toString(in);
    ...
    logger.debug("HTTP Get stream response. '{}'", response);
}
}

Example 2 HTTP Get Response with an InputStream

template.executeGetMethod(new ResponseByteCallback() {
    public void doWithResponse(byte[] byteResponse) throws IOException {
        String response = new String(byteResponse);
        ...
        logger.debug("HTTP Get byte response. '{}'", response);
    }
});

Example 3 HTTP Get Response with a Byte Array

Map<String, String> hParams = new HashMap<String, String>();
hParams.put(GET_PARAM_INPUT_KEY, GET_PARAM_INPUT_VALUE);

template.executeGetMethod(hParams,
    new ResponseStringCallback() {
        public void doWithResponse(String response) throws IOException {
            ...
            logger.debug("HTTP Get with params string response. '{}'", response);
        }
    });

Example 4 HTTP Get with Parameters & Response with a String

Map<String, String> hParams = new HashMap<String, String>();
hParams.put(LOWER_PARAM, POST_NAME);

template.executePostMethod(hParams,
    new ResponseStringCallback() {
        public void doWithResponse(String response) throws IOException {
            ...
            logger.debug("HTTP Post string response. '{}'", response);
        }
    });
Example 5 HTTP Post with Parameters & Response with a String

```java
Map<String, String> hParams = new HashMap<String, String>();
hParams.put(LOWER_PARAM, POST_NAME);

template.executePostMethod(hParams,
    new ResponseStreamCallback() {
        public void doWithResponse(InputStream in) throws IOException {
            String response = IOUtils.toString(in);
            ...
            logger.debug("HTTP Post stream response. '{}", response);
        }
    });
```

Example 6 HTTP Post with Parameters & Response with an InputStream

```java
Map<String, String> hParams = new HashMap<String, String>();
hParams.put(LOWER_PARAM, POST_NAME);

template.executePostMethod(hParams,
    new ResponseByteCallback() {
        public void doWithResponse(byte[] byteResponse) throws IOException {
            String response = new String(byteResponse);
            ...
            logger.debug("HTTP Post byte response. '{}", response);
        }
    });
```

Example 7 HTTP Post with Parameters & Response with a Byte Array

A post sending data, like XML, in the request for the server to process and return results.

```java
protected final static String POST_DATA_INPUT = "<message>Greetings</message>";
...

template.executePostMethod(POST_DATA_INPUT,
    new ResponseStringCallback() {
        public void doWithResponse(String response) throws IOException {
            ...
            logger.debug("HTTP string data post string response. '{}", response);
        }
    });
```

Example 8 HTTP Post with Data & Response with a String
2. HttpClientOxmTemplate

HttpClientOxmTemplate which uses Apache's HttpClient [http://hc.apache.org/] to process HTTP requests and Spring Web Service's OXM [http://static.springframework.org/spring-ws/site] to marshall and unmarshall the requests.

Spring Configuration

Define a marshaller/unmarshaller and set it on HttpClientOxmTemplate along with it's default URI.

HttpClientOxmTemplateTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans" 
xsi:schemaLocation="http://www.springframework.org/schema/beans 
http://www.springframework.org/schema/beans/spring-beans.xsd">
  <bean id="jaxbMarshaller" class="org.springframework.oxm.jaxb.Jaxb2Marshaller">
    <property name="contextPath" value="org.springbyexample.schema.beans"/>
  </bean>
  <bean id="httpClient" class="org.springbyexample.httpclient.HttpClientOxmTemplate">
    <property name="defaultUri">
      <value>http://localhost:8093/test</value>
    </property>
    <property name="marshaller" ref="jaxbMarshaller" />
    <property name="unmarshaller" ref="jaxbMarshaller" />
  </bean>
</beans>
```

Code Example

The instance of Persons is marshalled and the XML is posted to the default uri and the callback has the XML result unmarshalled back to an instance of Persons. The class passed in and returned in this example match, but they don't need to since a different marshaller and unmarshaller can be used.

```java
template.executePostMethod(persons, new ResponseCallback<Persons>() {
    public void doWithResponse(Persons persons) throws IOException {
        ... 
        Person result = persons.getPerson().get(0);
        ...
        logger.debug("id={} firstName={} lastName={}",
                    new Object[] { result.getId(),
                                  result.getFirstName(),
                                  result.getLastName()});
    }
});
```
3. SolrOxmClient

The SolrOxmClient provides for easier client communication with Apache Solr [http://lucene.apache.org/solr/]. It marshalls/unmarshalls searches and updates to and from a JavaBean. It also allows calls to commit, rollback, and optimize. It is built on top of HttpClientTemplate and HttpClientOxmTemplate.

**Note**

The Spring configuration and code are from the Solr Client example and are not part of this module.

**Spring Configuration**

A base URL to Solr [http://lucene.apache.org/solr/] and a marshaller and unmarshaller must be defined to use it. To read more about the test look at the Solr Client example.

**HttpClientOxmTemplateTest-context.xml**

```xml
<bean id="solrOxmClient" class="org.springbyexample.httpclient.solr.SolrOxmClient"
    p:baseUrl="http://${solr.host}:${solr.port}/solr"
    p:marshaller-ref="catalogItemMarshaller"
    p:unmarshaller-ref="catalogItemMarshaller" />
```

**Code Example**

Any Solr [http://lucene.apache.org/solr/] search parameter can be passed in and the results are unmarshalled into a specific JavaBean.

```java
List<CatalogItem> lCatalogItems = client.search(SEARCH_QUERY_PARAM);
```

**Example 10 Excerpt from SolrOxmClientTest.testSearch()**

To pass in other parameters to the search, a Map can be passed in. The query is specified by the 'q' key, and the 'start' & 'rows' indicate what range of the results to return.

```java
Map<String, String> hParams = new HashMap<String, String>();
hParams.put("q", "electronics");
hParams.put("start", "5");
hParams.put("rows", "5");
```
List<CatalogItem> lCatalogItems = client.search(hParams);

Example 11 Excerpt from SolrOxmClientTest.testPaginatedSearch()

Updates a list of CatalogItem instances.

client.update(lCatalogItems);

Example 12 Excerpt from SolrOxmClientTest.testUpdate()

4. LoggerBeanPostProcessor

There are different logger BeanPostProcessors to dynamically inject a logger based on reflection, interfaces, or annotations. Many loggers are defined with a static reference to the a class for each class and a developer cuts & pastes each logger definition. This can be error prone and the LoggerBeanPostProcessors help deal with this problem.

Tim Voet [http://www.springbyexample.org/twiki/bin/view/Main/TimVoet] developed this idea and posted the initial code on the site.

Spring Configuration

All of the logger BeanPostProcessors will ignore any logger that isn't defined in the Map of logger factories. The defaults defined are SLF4J, Apache Commons Logging, Log4J, and JDK Logging. A custom list can be set using the loggerFactoryMap property.

<table>
<thead>
<tr>
<th>Logger</th>
<th>Logger Factory Static Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>org.slf4j.Logger</td>
<td>org.slf4j.LoggerFactory.getLogger</td>
</tr>
<tr>
<td>org.apache.commons.logging.Log</td>
<td>org.apache.commons.logging.LogFactory.getLog</td>
</tr>
<tr>
<td>org.apache.log4j.Logger</td>
<td>org.apache.log4j.Logger.getLogger</td>
</tr>
<tr>
<td>java.util.logging.Logger</td>
<td>java.util.logging.Logger.getLogger</td>
</tr>
</tbody>
</table>

Table 1. Default Loggers

The LoggerBeanPostProcessor uses reflection to set a logger on any method that matches the specified method and the logger being set on it matches the defined loggers and logger factories.

Reflection
The `LoggerAwareBeanPostProcessor` only sets subclasses of the `LoggerAware` interface. The current interfaces are `Slf4JLoggerAware`, `CommonsLoggerAware`, `Log4JLoggerAware`, and `JdkLoggerAware`.

**Interfaces**

The `AnnotationLoggerBeanPostProcessor` can be used to inject loggers into fields and methods that have the `AutowiredLogger` annotation.

**Annotations**
Code Example

Examples of the beans having loggers inject by the BeanPostProcessors defined in the Spring configurations above.

```java
public class LoggerBean {
    Logger logger = null;

    /**
     * Gets SLF4J logger.
     */
    public Logger getCustomLogger() {
        return logger;
    }

    /**
     * Sets SLF4J logger.
     */
    public void setCustomLogger(Logger logger) {
        this.logger = logger;
    }
}
```

Example 13 Reflection

```java
public class Slf4JLoggerBean implements Slf4JLoggerAware {
    Logger logger = null;

    /**
     * Gets SLF4J logger.
     */
    public Logger getLogger() {
        return logger;
    }

    /**
     * Sets SLF4J logger.
     */
    public void setLogger(Logger logger) {
        this.logger = logger;
    }
}
```

Example 14 Interfaces
Example 15 Annotations

5. Download

If you are using Maven, you can use the Maven dependency below and add a repository definition for the Spring by Example Maven repository. Otherwise you can download the jar directly from the Spring by Example Maven repository (http://www.springbyexample.org/maven/repo/).

```xml
<dependency>
    <groupId>org.springbyexample</groupId>
    <artifactId>spring-by-example-util</artifactId>
    <version>1.2.1</version>
</dependency>

<repositories>
    <repository>
        <id>springbyexample.org</id>
        <name>Spring by Example</name>
        <url>http://www.springbyexample.org/maven/repo</url>
    </repository>
</repositories>
```

6. Reference

Related Links

- Spring by Example Site [http://www.springbyexample.org/maven/site/spring-by-example-util/1.2.1/index.html]
- Apache's HttpClient [http://hc.apache.org/]
- Solr Client
Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Checkout instructions for the project are available at Source Repository Instructions [http://www.springbyexample.org/maven/site/spring-by-example-util/1.2.1/source-repository.html].

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
- Apache Commons HttpClient 3.1
There is a Spring GWT Controller for standard GWT usage and also Spring Bayeux integration for using Comet on Jetty.

There is an ImageInterceptor that intercepts a request and looks in a directory that matches the requests relative path. Currently it only matches one image extension type which defaults to '.jpg'. It generates a thumbnail if one doesn't exist and also makes a list of available thumbnails and images. Also, GenericHtmlController is a generic annotation-based controller to handle html requests ('/**/*.html') is available. It’s useful with Dynamic Tiles Spring MVC Module to allow rendering of static pages or dynamic ones that don’t necessarily need to go through a controller to render.

1. Spring GWT Controller

Spring Configuration

Even though the service controller is annotation-based, since GWT calls RPC methods using reflection, the mapping has to be manually set using the SimpleUrlHandlerMapping.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:context="http://www.springframework.org/schema/context"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
                        http://www.springframework.org/schema/beans/spring-beans.xsd
                        http://www.springframework.org/schema/context
                        http://www.springframework.org/schema/context/spring-context.xsd">

  <context:component-scan base-package="org.springbyexample.web.gwt.server" />

  <bean class="org.springframework.web.servlet.mvc.annotation.DefaultAnnotationHandlerMapping" />  
  <bean class="org.springframework.web.servlet.mvc.annotation.AnnotationMethodHandlerAdapter" />  
  <bean class="org.springframework.web.servlet.handler.SimpleUrlHandlerMapping">
    <property name="order" value="0" />
    <property name="mappings">
      <value>
        /person/service.do=serviceController
      </value>
    </property>
  </bean>

</beans>
```
Code Example

```java
@Controller
public class ServiceController extends GwtController implements Service {
    final Logger logger = LoggerFactory.getLogger(ServiceController.class);

    private static final long serialVersionUID = -2103209407529882816L;

    @Autowired
    private PersonDao personDao = null;

    /**
     * Finds person within a range.
     */
    public Person[] findPersons(int startIndex, int maxResults) {
        Person[] results = null;
        List<Person> lResults = new ArrayList<Person>();
        Collection<org.springbyexample.orm.hibernate3.annotation.bean.Person> lPersons = 
            personDao.findPersons(startIndex, maxResults);
        for (org.springbyexample.orm.hibernate3.annotation.bean.Person person : lPersons) {
            Person result = new Person();
            result.setId(person.getId());
            result.setFirstName(person.getFirstName());
            result.setLastName(person.getLastName());
            lResults.add(result);
        }
        return lResults.toArray(new Person[]{})
    }
}
```

2. Spring Bayeux Integration for Comet on Jetty

Web Configuration

The SpringContinuationCometdServlet is configured to handle all Comet requests. It only needs the asyncDeliver value set on it and the other values you would normally set on ContinuationCometdServlet are all set on SpringContinuationBayeux in the Spring configuration.

```xml
<?xml version="1.0" encoding="ISO-8859-1"?>
<web-app xmlns="http://java.sun.com/xml/ns/javaee"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://java.sun.com/xml/ns/javaee"/>
```
Spring by Example Web Module

```
http://java.sun.com/ns/javaee/web-app_2_5.xsd
<display-name>Spring Cometd Test WebApp</display-name>
<context-param>
  <param-name>contextConfigLocation</param-name>
  <param-value>/WEB-INF/web-application-context.xml</param-value>
</context-param>
<listener>
  <listener-class>org.springframework.web.context.ContextLoaderListener</listener-class>
</listener>
<servlet>
  <servlet-name>cometd</servlet-name>
  <servlet-class>org.springbyexample.cometd.continuation.SpringContinuationCometdServlet</servlet-class>
  <init-param>
    <param-name>asyncDeliver</param-name>
    <param-value>false</param-value>
  </init-param>
  <load-on-startup>1</load-on-startup>
</servlet>
<servlet-mapping>
  <servlet-name>cometd</servlet-name>
  <url-pattern>/cometd/*</url-pattern>
</servlet-mapping>
</web-app>
```

Spring Configuration

```
[{
  "channels": "/**",
  "filter" : "org.mortbay.cometd.filter.NoMarkupFilter",
  "init" : {} },
{
  "channels": "/chat/**",
  "filter" : "org.mortbay.cometd.filter.RegexFilter",
  "init" : [
    [ "[Ss]pring [Bb]y [Ee]ample","Spring by Example" ],
    [ "[Ss][Bb][Ee]","Spring by Example*" ]
  ] }
],
{
  "channels": "/chat/***",
  "filter" : "org.mortbay.cometd.filter.RegexFilter",
  "init" : [
    [ "teh ","the "],
    [ "sring ","spring "]
  ] }
]
```

Spring by Example Version 1.03  Spring by Example
The only difference in this compared to a standard BayeuxService is that this Bayeux implementation is instantiated by Spring and the Bayeux instance is injected into it’s constructor.

```java
@Component
public class ChatService extends BayeuxService {

    final Logger logger = LoggerFactory.getLogger(ChatService.class);
    final ConcurrentMap<String, Set<String>> _members = new ConcurrentHashMap<String, Set<String>>() {
        /**
         * Constructor
         */
        @Autowired
        public ChatService(Bayeux bayeux) {
            super(bayeux, "chat");
            subscribe("/chat/**", "trackMembers");
        }

        /**
         * Tracks chat clients.
         */
        public void trackMembers(Client joiner, String channel, Map<String, Object> data, String id) {
            if (Boolean.TRUE.equals(data.get("join"))) {
                Set<String> m = _members.get(channel);
                if (m == null) {
                    Set<String> new_list = new CopyOnWriteArraySet<String>();
                    m = _members.putIfAbsent(channel, new_list);
                    if (m == null) {
                        m = new_list;
                    }
                }

                final Set<String> members = m;
                final String username = (String) data.get("user");
                members.add(username);

                joiner.addListener(new RemoveListener() {
                    public void removed(String clientId, boolean timeout) {
                        members.remove(username);
                        logger.info("members: " + members);
                    }
                });

                logger.info("Members: " + members);
                send(joiner, channel, members, id);
            }
        }
    }
}
```
3. Image Interceptor

Used for generic thumbnail processing. If a request for '/pics/newyork.html' is received, the image interceptor will look for a directory at '/var/www/html/images/newyork'. If the directory exists generate any missing thumbnails and have the view rendered by the `imageViewName` property.

Spring Configuration

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:context="http://www.springframework.org/schema/context"
      xsi:schemaLocation="http://www.springframework.org/schema/beans
      http://www.springframework.org/schema/beans/spring-beans.xsd
      http://www.springframework.org/schema/context
      http://www.springframework.org/schema/context/spring-context.xsd">
  <!-- Setup interceptor for annotation-based controllers -->
  <bean class="org.springframework.web.servlet.mvc.annotation.DefaultAnnotationHandlerMapping">
    <property name="interceptors">
      <list>
        <ref bean="localeChangeInterceptor"/>
        <ref bean="imageInterceptor"/>
      </list>
    </property>
  </bean>
  <bean class="org.springframework.web.servlet.mvc.annotation.AnnotationMethodHandlerAdapter"/>
  <context:annotation-config/>
  <bean id="tilesConfigurer"
    class="org.springframework.web.servlet.view.tiles2.TilesConfigurer">
    <property name="definitions">
      <list>
        <value>/WEB-INF/tiles-defs/templates.xml</value>
      </list>
    </property>
  </bean>
  <bean id="dynamicTilesViewResolver"
    class="org.springframework.web.servlet.view.UrlBasedViewResolver">
    <property name="viewClass" value="org.springbyexample.web.servlet.view.tiles2.DynamicTilesView"/>
    <property name="prefix" value="/WEB-INF/jsp/"/>
    <property name="suffix" value=".jsp"/>
  </bean>
  <bean id="messageSource"
    class="org.springframework.context.support.ResourceBundleMessageSource">
    <property name="basenames" value="messages"/>
  </bean>
</beans>
<!-- Declare the Interceptor -->
```
<bean id="localeChangeInterceptor" class="org.springframework.web.servlet.i18n.LocaleChangeInterceptor">
  <property name="paramName" value="locale"/>
</bean>

<!-- Declare the Resolver -->
<bean id="localeResolver" class="org.springframework.web.servlet.i18n.SessionLocaleResolver"/>

<bean name="imageInterceptor" class="org.springframework.web.servlet.i18n.ImageInterceptor">
  <property name="imageProcessor">
    <bean class="org.springbyexample.util.image.ImageProcessorImpl" />  
  </property>
  <property name="rootImagePath" value="/var/www/html"/>
  <property name="imageViewName" value="/pics/generic_display"/>
</bean>

<bean class="org.springbyexample.web.servlet.mvc.GenericHtmlController" />
</beans>

JSP Example

JSP referenced by the imageViewName property defined in the imageInterceptor bean.

<%@taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core"%>
<table>
<c:forEach var="item" items="${imageList}" varStatus="status">
  <c:if test="${(status.index % rowWidth) == 0}">
    <tr>
  </c:if>
  <td>
    <a href="${item.imagePath}"
       <img src="${item.thumbnailPath}"/>
  </td>
  <c:if test="${(status.index % 3) == (rowWidth -1)}">
    </tr>
  </c:if>
</c:forEach>
</table>

4. Download

If you are using Maven, you can use the Maven dependency below and add a repository definition for the Spring by Example Maven repository. Otherwise you can download the jar directly from the Spring by Example Maven repository (http://www.springbyexample.org/maven/repo/).

<dependency>
5. Reference

Related Links

• Spring by Example Web Module Site [http://www.springbyexample.org/maven/site/spring-by-example-web/1.1.1/]

• GWT (Google Web Toolkit) [http://code.google.com/webtoolkit/]

• GWT Widget Library [http://gwt-widget.sourceforge.net/] (see GWTSpringController)

• Jetty Continuations [http://docs.codehaus.org/display/JETTY/Continuations]

• Simple GWT Spring Webapp

Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Checkout instructions for the project are available at Source Repository Instructions [http://www.springbyexample.org/maven/site/spring-by-example-web/1.1.1/source-repository.html].

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

• Spring Framework 2.5.x
Spring Modules Validation

David Winterfeldt

2009

The Spring Modules [https://springmodules.dev.java.net/] project has a number of subprojects, including validation. This module is based on Spring Modules Validation Version 0.9 [https://springmodules.dev.java.net/docs/reference/0.9/html/validation.html] and has a number of enhancements to the Valang part of the project. Please refer to the original documentation [https://springmodules.dev.java.net/docs/reference/0.9/html/validation.html] for additional information since this section will primarily focus on explaining Valang and the enhancements.

Thanks to everyone that has worked on this project previously and currently.

1. Valang

Valang is short for Validation Language. It provides a very readable language for expressing validation rules, as well as providing the ability to add custom functions to the language. Once the ValangValidator is configured, using it isn't different than any other Spring Validator since it implements org.springframework.validation.Validator.

Below is a list of current enhancements.

Version 0.91

- Bytecode generation added to DefaultVisitor as a replacement for reflection accessing simple properties (BeanPropertyFunction) for a significant performance improvement.

- Basic enum comparison support. In the expression below the personType is an enum and the value STUDENT will be converted to an enum for comparison. The value must match an enum value on the type being compared or an exception will be thrown.

  personType EQUALS ['STUDENT']

  For better performance the full class name can be specified so the enum can be retrieved during parsing. The first example is for standard enum and the second one is for an inner enum class.

  personType
  ['org.springmodules.validation.example.PersonType.STUDENT']

  personType
  ['org.springmodules.validation.example.Person$PersonType.STUDENT']

- Where clause support. In the expression below, the part of the expression price < 100 will only be evaluated if the personType is 'STUDENT'. Otherwise the validation will be skipped.

  price < 100 WHERE personType EQUALS ['STUDENT']
- Improved performance of 'IN'/'NOT IN' if comparing a value to a java.util.Set it will use Set.contains(value). Static lists of Strings (ex: 'A', 'B', 'C') are now stored in a Set instead of an ArrayList.

- Functions can be configured in Spring, but need to have their scope set as prototype and use a FunctionWrapper that is also a prototype bean with `<aop:scoped-proxy>` set on it.

- Removed servlet dependency from Valang project except for the custom JSP tag ValangValidateTag needing it, but running Valang no longer requires it. This involved removing ServletContextAware from it's custom dependency injection. If someone was using this in a custom function, the function can now be configured directly in Spring and Spring can inject any "aware" values.

- Changed logging to use SLF4J api.

Version 0.92

- Removed custom dependency injection since functions can be configured in Spring.

- Added auto-discovery of FunctionWrapper beans from the Spring context to go with existing auto-discovery of FunctionDefinition beans.

Version 0.93

- Made specific comparison classes for each operator for a performance improvement.

- Changed IS WORD and IS BLANK to use Commons Lang StringUtils, which will change the behavior slightly but should be more accurate to the description of the validation.

- Change Operator from interfaces to an enum and removed OperatorConstants.

- Fixed bytecode generation to handle a Map, a List, and an Array.

**Note**

Support for the where clause has not been added to the JavaScript custom tag currently.

## Rule Syntax

The basic construction of a Valang rule is to have it begin and end with a brace. Within the braces, the default property name for the rule is specified first. Then the Valang expression, followed by the default error message. These are all the required values for a Valang rule. The other optional values for a rule are the error message key and arguments for it. Each of the values of the rule are delimited by a colon.

```
{ <property-name> : <expression> : <default-error-message> : <error-message-key> : <error-message-args> }
```

<table>
<thead>
<tr>
<th>Rule Value</th>
<th>Description</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>property-name</td>
<td>This is the default property of the bean being targeted for validation,</td>
<td>true</td>
</tr>
</tbody>
</table>
and can be referred to with the shortcut ? in an expression.

expression | The Valang expression. | true |
default-error-message | The default error message. If this isn't needed, it can be left blank even though it's required. | true |
error-message-key | The message resource key for the i18n error message. | false |
error-message-arg | If the error-message-key is specified, arguments for the error message can also be set as the final value of the rule. This accepts a comma delimited list of values. | false |

Expression Syntax

The expression language provides an English like syntax for expressing validation rules. There are a number of operators for comparing a value to another. Logical expressions, resulting in true or false, can be grouped together with parentheses to form more complex expressions.

Just to give some context to the explanation of all the rules, below is a simple example. The bean being validated has the properties getFirstName(), getLastName(), and getAge(). The first two return a String and the last returns an int. The default property is 'firstName', which is referred to by the question mark. The first part of the rule enclosed in parentheses checks if the first name is either 'Joe' or it's length is greater than 5. The next part checks if the last name is one of the values in the list, and the final part checks if the age is over 18.

(? EQUALS 'Joe' OR length(?) > 5) AND lastName IN 'Johnson', 'Jones', 'Smith' AND age > 18

Operator Syntax

The parser is not case sensitive when processing the operators.

Table 2. Expression Operators

<table>
<thead>
<tr>
<th>Comparison Operator</th>
<th>Description</th>
<th>Supports</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>=</td>
<td>==</td>
<td>IS</td>
<td>EQUALS</td>
</tr>
<tr>
<td>!=</td>
<td>&lt;&gt;</td>
<td>&gt;&lt;</td>
<td>IS NOT</td>
</tr>
<tr>
<td>Comparison Operator</td>
<td>Description</td>
<td>Supports</td>
<td>Example</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>&gt;</td>
<td>GREATER THAN</td>
<td>IS GREATER THAN</td>
<td>Checks if a value is greater than another.</td>
</tr>
<tr>
<td>&lt;</td>
<td>LESS THAN</td>
<td>IS LESS THAN</td>
<td>Checks if a value is less than another.</td>
</tr>
<tr>
<td>&gt;=</td>
<td></td>
<td>GREATER THAN OR EQUALS</td>
<td>IS GREATER THAN OR EQUALS</td>
</tr>
<tr>
<td>&lt;=</td>
<td></td>
<td>LESS THAN OR EQUALS</td>
<td>IS LESS THAN OR EQUALS</td>
</tr>
<tr>
<td>NULL</td>
<td></td>
<td>IS NULL</td>
<td>Checks if a value is null.</td>
</tr>
<tr>
<td>NOT NULL</td>
<td></td>
<td>IS NOT NULL</td>
<td>Checks if a value is not null.</td>
</tr>
<tr>
<td>HAS TEXT</td>
<td></td>
<td></td>
<td>Checks if the value has at least one non-whitespace character.</td>
</tr>
<tr>
<td>HAS NO TEXT</td>
<td></td>
<td></td>
<td>Checks if the value doesn't have a non-whitespace character.</td>
</tr>
<tr>
<td>HAS LENGTH</td>
<td></td>
<td></td>
<td>Checks if the value's length is greater than zero.</td>
</tr>
<tr>
<td>HAS NO LENGTH</td>
<td></td>
<td></td>
<td>Checks if the value's length is zero.</td>
</tr>
<tr>
<td>IS BLANK</td>
<td></td>
<td></td>
<td>Checks if the value is blank (null or zero length).</td>
</tr>
<tr>
<td>IS NOT BLANK</td>
<td></td>
<td></td>
<td>Checks if the value isn't blank (not null, length greater than zero).</td>
</tr>
<tr>
<td>IS UPPERCASE</td>
<td></td>
<td></td>
<td>Checks if the value is uppercase.</td>
</tr>
<tr>
<td>IS NOT UPPERCASE</td>
<td></td>
<td></td>
<td>Checks if the value isn't uppercase.</td>
</tr>
<tr>
<td>IS LOWERCASE</td>
<td></td>
<td></td>
<td>Checks if the value is lowercase.</td>
</tr>
<tr>
<td>IS NOT LOWERCASE</td>
<td></td>
<td></td>
<td>Checks if the value isn't lowercase.</td>
</tr>
<tr>
<td>Comparison Operator</td>
<td>Description</td>
<td>Supports</td>
<td>Example</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>IS NOT LOWER CASE</td>
<td>lowercase.</td>
<td>Strings.</td>
<td>LOWERCASE</td>
</tr>
<tr>
<td>IS NOT LOWER</td>
<td>Checks if the value has one or more letters or numbers (no spaces or special characters).</td>
<td>Strings.</td>
<td>firstName IS NOT LOWER</td>
</tr>
<tr>
<td>IS WORD</td>
<td>Checks if the value has one or more letters or numbers (no spaces or special characters).</td>
<td>Strings.</td>
<td>firstName IS WORD</td>
</tr>
<tr>
<td>NOT BETWEEN</td>
<td>Checks if a value isn't between two other values.</td>
<td>Numbers and dates.</td>
<td>age NOT BETWEEN 18 AND 65</td>
</tr>
<tr>
<td>BETWEEN</td>
<td>Checks if a value is between two other values.</td>
<td>Numbers and dates.</td>
<td>age BETWEEN 18 AND 65</td>
</tr>
<tr>
<td>IN</td>
<td>Checks if a value is in a list.</td>
<td>Strings, booleans, numbers, dates, and enums.</td>
<td>firstName IN 'Joe', 'Jack', 'Jane', 'Jill'</td>
</tr>
<tr>
<td>NOT IN</td>
<td>Checks if a value isn't in a list.</td>
<td>Strings, booleans, numbers, dates, and enums.</td>
<td>firstName NOT IN 'Joe', 'Jack', 'Jane', 'Jill'</td>
</tr>
<tr>
<td>NOT</td>
<td>Checks for the opposite of the following expression.</td>
<td>Any expression.</td>
<td>NOT firstName EQUALS 'Joe'</td>
</tr>
<tr>
<td>!</td>
<td>Changes a boolean expression to it's opposite.</td>
<td>Booleans</td>
<td>matches('\s+', firstName) IS !(TRUE)</td>
</tr>
<tr>
<td>AND</td>
<td>Used to join together the logical comparisons on either side of the operator. Both must evaluate to true.</td>
<td>Any expression.</td>
<td>firstName EQUALS 'Joe' AND age &gt; 21</td>
</tr>
<tr>
<td>OR</td>
<td>Used to join together the logical comparisons on either side of the operator. Only one must evaluate to true.</td>
<td>Any expression.</td>
<td>firstName EQUALS 'Joe' OR age &gt; 21</td>
</tr>
<tr>
<td>WHERE</td>
<td>If the where expression is true, then the main expression for validation is performed. Otherwise it isn't evaluated and no errors are generated.</td>
<td>Any expression.</td>
<td>firstName EQUALS 'Joe' WHERE age &gt; 21</td>
</tr>
</tbody>
</table>
### Comparison Operator

<table>
<thead>
<tr>
<th>Comparison Operator</th>
<th>Description</th>
<th>Supports</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>this</td>
<td>A reference to the bean passed in for validation, which could be passed into a custom function for example.</td>
<td>Any expression.</td>
<td>isValid(this) IS TRUE</td>
</tr>
</tbody>
</table>

### Literal Syntax

**Table 3. Literals**

<table>
<thead>
<tr>
<th>Literal Type</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>String</td>
<td>String literals are surrounded by single quotes.</td>
<td>'Joe'</td>
</tr>
<tr>
<td>Numbers</td>
<td>Numbers can be expressed without any special syntax. Numbers are all parsed using BigDecimal.</td>
<td>1, 100, 0.73, -2.48</td>
</tr>
<tr>
<td>Dates</td>
<td>Date literals are surrounded by brackets. These are the supported formats supported by the DefaultDateParser. yyyyMMdd, yyyy-MM-dd, yyyy-MM-dd HH:mm:ss, yyyyMMdd HH:mm:ss, yyyy-MM-dd HHmmss:</td>
<td>[20081230], [2008-12-30], [2008-12-30 12:20:31]</td>
</tr>
<tr>
<td>Booleans</td>
<td>There are four different constants for boolean values. The values 'TRUE' and 'YES' represent true, and the values 'FALSE' and 'NO' represent false.</td>
<td>TRUE, YES, FALSE, NO</td>
</tr>
<tr>
<td>Enums</td>
<td>Enums are surrounded by bracket and single quotes. If the full path to the enum isn't specified, it will be resolved when the expression is evaluated by looking up the enum value from enum on the opposite side of the expression. ['FAIL'], ['org.springmodules.validation.valang.CreditStatus.FAIL'], ['org.springmodules.validation.valang.CreditStatus.EXCELLENT'], Person$CreditRating.EXCELLENT</td>
<td></td>
</tr>
</tbody>
</table>
Valang supports basic mathematical formulas based on numeric literals and property values.

Table 4. Mathematical Expression Operators

<table>
<thead>
<tr>
<th>Mathematical Operator</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>Addition operator.</td>
<td>price + 12</td>
</tr>
<tr>
<td>-</td>
<td>Subtraction operator.</td>
<td>price - 12</td>
</tr>
<tr>
<td>*</td>
<td>Multiplication operator.</td>
<td>price * 1.2</td>
</tr>
<tr>
<td>/</td>
<td>DIV</td>
<td>Division operator.</td>
</tr>
<tr>
<td>%</td>
<td>MOD</td>
<td>Modulo operator.</td>
</tr>
</tbody>
</table>

Property Syntax

Valang supports standard property and nested property access to the bean passed in for validation.

Table 5. Property Syntax

<table>
<thead>
<tr>
<th>Property Type</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Using standard JavaBean property notation, a value from the bean being validated may be retrieved. The address represents getAddress() on the bean.</td>
<td>address IS NOT NULL</td>
</tr>
<tr>
<td>Nested</td>
<td>Using standard JavaBean property notation, a nested value from the bean being validated may be retrieved. The address.city represents getAddress().getCity() on the bean.</td>
<td>address.city IS NOT BLANK</td>
</tr>
<tr>
<td>List</td>
<td>From an array, List, or Set, a value from it can be returned by specifying it's index. Only arrays and lists are supported by bytecode generation.</td>
<td>addresses[1] IS NOT NULL</td>
</tr>
<tr>
<td>Map</td>
<td>From a Map, the value based on the key specified is retrieved.</td>
<td>addresses[home] IS NOT NULL</td>
</tr>
</tbody>
</table>

Functions

These are built in functions that come with Valang. The function framework is pluggable, so it's easy to add custom
functions. Adding custom functions will be covered in the next section.

Table 6. Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>length</td>
<td>Returns the size of a collection or an array, and otherwise returns the length of string by called toString() on the object.</td>
<td>length(firstName) &lt; 20</td>
</tr>
<tr>
<td>match</td>
<td>Performs a match on a regular expression. The first argument is the regular expression and the second is the value match on.</td>
<td>matches('\w+', firstName) IS TRUE</td>
</tr>
<tr>
<td>email</td>
<td>Checks if the value is a valid e-mail address.</td>
<td>email(email) IS TRUE</td>
</tr>
<tr>
<td>upper</td>
<td>Converts the value to uppercase.</td>
<td>upper(firstName) EQUALS 'JOE'</td>
</tr>
<tr>
<td>lower</td>
<td>Converts the value to lowercase.</td>
<td>lower(firstName) EQUALS 'joe'</td>
</tr>
<tr>
<td>resolve</td>
<td>Wraps a string in DefaultMessageSourceResolvable.</td>
<td>resolve('personForm.firstName') EQUALS 'First Name'</td>
</tr>
</tbody>
</table>

Custom Functions

Custom functions can either be explicitly registered or instances of FunctionDefinition and FunctionWrapper are automatically registered with a ValangValidator. If just specifying a class name, it must have a constructor with the signature Function[] arguments, int line, int column. The FunctionWrapper is specifically for Spring configured functions. If the Function in a FunctionWrapper takes any arguments, it must implement ConfigurableFunction which allows the parser to configure the arguments, line number, and column number. Otherwise the line & column number will not be set on a Spring configured function.

Note

It's important for a FunctionWrapper around a custom Function to be of the scope prototype as well as the FunctionWrapper. Also the FunctionWrapper must have <aop:scoped-proxy/> defined so each call to it will get a new instance of the function. This is because as the validation language is parsed a new instance of a function is made each time and has the arguments specific to that function set on it.
Spring Configuration

The example below shows how to explicitly register a custom function directly with a validator. The custom functions 'validLastName' and 'creditApproval' are registered on the customFunctions property as a Map. The key is the name of the function to be used in the validation language and the value if the function being registered, which can either be the fully qualified name of the class or an instance of FunctionWrapper.

ValangValidatorCustomFunctionTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:aop="http://www.springframework.org/schema/aop"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd
    http://www.springframework.org/schema/aop
    http://www.springframework.org/schema/aop/spring-aop.xsd">

    <bean id="creditApprovalFunction"
        class="org.springmodules.validation.valang.CreditApprovalFunction"
        scope="prototype">
        <property name="creditRatingList">
            <list>
                <value>GOOD</value>
                <value>EXCELLENT</value>
            </list>
        </property>
    </bean>

    <bean id="personValidator" class="org.springmodules.validation.valang.ValangValidator">
        <property name="className" value="org.springmodules.validation.valang.Person"/>
        <property name="customFunctions">
            <map>
                <entry key="validLastName">
                    <value>org.springmodules.validation.valang.ValidLastNameFunction</value>
                </entry>
                <entry key="creditApproval">
                    <bean class="org.springmodules.validation.valang.functions.FunctionWrapper"
                        scope="prototype">
                        <aop:scoped-proxy/>
                    </bean>
                </entry>
            </map>
        
    </bean>    

    <bean id="personValidator" class="org.springmodules.validation.valang.ValangValidator">
        <property name="className" value="org.springmodules.validation.valang.Person"/>
        <property name="customFunctions">
            <map>
                <entry key="validLastName">
                    <value>org.springmodules.validation.valang.ValidLastNameFunction</value>
                </entry>
                <entry key="creditApproval">
                    <bean class="org.springmodules.validation.valang.functions.FunctionWrapper"
                        scope="prototype">
                        <aop:scoped-proxy/>
                    </bean>
                </entry>
            </map>
        
    </bean>    

    <property name="valang">
        <value><![CDATA[
            { lastName : validLastName(?) is true : '' }
            { lastName : creditApproval(age, creditRating) is true : '' }
            { lastName : validLastName(?) is true AND creditApproval(age, creditRating) is true :
              '' }
            { lastName : validLastName(?) is true AND (creditApproval(age, creditRating) is true OR creditApproval(age,
              ['org.springmodules.validation.valang.Person$CreditRating.FAIR']) is true) : '' }
        ]]]</value>
    </property>
</beans>
```
Instances of `FunctionDefinition` and `FunctionWrapper` are automatically registered with a `ValangValidator`. The custom functions 'validLastName' and 'creditApproval' are registered. If a `FunctionWrapper` doesn't have a function name specified, the name of the bean will be used for the function name.

`ValangValidatorCustomFunctionDiscoveryTest-context.xml`

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xmlns:aop="http://www.springframework.org/schema/aop"
   xmlns:p="http://www.springframework.org/schema/p"
   xsi:schemaLocation="http://www.springframework.org/schema/beans
   http://www.springframework.org/schema/beans/spring-beans.xsd
   http://www.springframework.org/schema/aop
   http://www.springframework.org/schema/aop/spring-aop.xsd">
   <bean class="org.springmodules.validation.valang.functions.FunctionDefinition"
      p:name="validLastName"
      p:className="org.springmodules.validation.valang.ValidLastNameFunction"/>

   <!-- Uses bean name for function name if not explicitly set on the wrapper -->
   <bean id="creditApproval"
      class="org.springmodules.validation.valang.functions.FunctionWrapper"
      scope="prototype">
      <aop:scoped-proxy/>
      <property name="function">
         <bean id="creditApprovalFunction"
            class="org.springmodules.validation.valang.CreditApprovalFunction"
            scope="prototype">
            <property name="creditRatingList">
               <list>
                  <value>GOOD</value>
                  <value>EXCELLENT</value>
               </list>
            </property>
         </bean>
      </property>
   </bean>
   <bean id="personValidator" class="org.springmodules.validation.valang.ValangValidator">
      <property name="className" value="org.springmodules.validation.valang.Person"/>
      <property name="valang">
         <!-- Final validation tests that the aop:scoped-proxy is working since if the same instance
         of CreditApprovalFunction is used it will be set to a failing value for both sides of
         the or. While if two instances are made the first condition should pass while the second will
         fail. -->
         <value><![CDATA[
            { lastName : validLastName(?) is true : '' } 
            { lastName : creditApproval(age, creditRating) is true : '' } 
            { lastName : validLastName(?) is true AND creditApproval(age, creditRating) is true : '' } 
            { lastName : validLastName(?) is true AND creditApproval(age, creditRating) is true OR 
              creditApproval(age, 
        ]]></value>
   </bean>
</beans>
```
Code Example

Checks if the last name is in a list, and if it isn’t false is returned.

```java
public class ValidLastNameFunction extends AbstractFunction {
    final Logger logger = LoggerFactory.getLogger(ValidLastNameFunction.class);
    final Set<String> lValidLastNames = new HashSet<String>();

    /**
     * Constructor
     */
    public ValidLastNameFunction(Function[] arguments, int line, int column) {
        super(arguments, line, column);
        definedExactNumberOfArguments(1);
        lValidLastNames.add("Anderson");
        lValidLastNames.add("Jackson");
        lValidLastNames.add("Johnson");
        lValidLastNames.add("Jones");
        lValidLastNames.add("Smith");
    }

    /**
     * Checks if the last name is blocked.
     * @return Object Returns a <code>boolean</code> for whether or not the last name is blocked.
     */
    @Override
    protected Object doGetResult(Object target) {
        boolean result = true;
        String symbol = getArguments()[0].getResult(target).toString();
        if (!lValidLastNames.contains(symbol)) {
            result = false;
        }
        return result;
    }
}

Example 1 ValidLastNameFunction

The function checks if a person can get credit approval. Their credit rating is checked against a list only if they are over 18 years old.
public class CreditApprovalFunction extends AbstractFunction
    implements ConfigurableFunction {
    final Logger logger = LoggerFactory.getLogger(CreditApprovalFunction.class);
    Set<Person.CreditRating> lCreditRatings = new HashSet<Person.CreditRating>();

    /**
     * Constructor
     */
    public CreditApprovalFunction() {
    }

    /**
     * Constructor
     * @param arguments the arguments
     * @param line the line number
     * @param column the column number
     */
    public CreditApprovalFunction(Function[] arguments, int line, int column) {
        super(arguments, line, column);
        definedExactNumberOfArguments(2);
        lCreditRatings.add(Person.CreditRating.FAIR);
        lCreditRatings.add(Person.CreditRating.GOOD);
        lCreditRatings.add(Person.CreditRating.EXCELLENT);
    }

    /**
     * Gets number of expected arguments.
     * Implementation of ConfigurableFunction.
     */
    public int getExpectedNumberOfArguments() {
        return 2;
    }

    /**
     * Sets arguments, line number, and column number.
     * Implementation of ConfigurableFunction.
     * @param expectedNumberOfArguments the expected number of arguments
     * @param arguments the arguments
     * @param line the line number
     * @param column the column number
     */
    public void setArguments(int expectedNumberOfArguments, Function[] arguments, int line, int column) {
        super.setTemplate(line, column);
        super.setArguments(arguments);
        super.definedExactNumberOfArguments(expectedNumberOfArguments);
    }

    /**
     * Sets valid credit rating approval list.
     */
    public void setCreditRatingList(Set<Person.CreditRating> lCreditRatings) {
        this.lCreditRatings = lCreditRatings;
    }

    /**
     * If age is over 18, check if the person has good credit,
     * and otherwise reject.
     * @return boolean Returns a boolean for whether or not the person has good enough
     * credit to get approval.
     */
    @Override
    protected Object doGetResult(Object target) {
        boolean result = true;
        int age = (Integer) getArguments()[0].getResult(target);
        Person.CreditRating creditRating = (Person.CreditRating)getArguments()[1].getResult(target);
        // must be over 18 to get credit approval
        if (age < 18) {
            result = false;
        }
        return result;
    }
}
if (age > 18) {
    if (!lCreditRatings.contains(creditRating)) {
        result = false;
    }
}

return result;

Example 2 ConfigurableFunction

Bytecode Generation

If the validator will only be used to validate a specific class, the property 'className' can be specified to avoid reflection. If it's set, a custom Function will be generated that directly retrieves a property to avoid reflection. This provides a significant performance improvement if that is a concern, which typically isn't if the validation is being used to validate a web page since the delay is so small either way.

Note

Only a Map, a List, or an Array is supported by bytecode generation, not a Set. Primitive arrays currently aren't supported, but any object one is. Also, nested properties are currently not supported.

This is a small excerpt from the logging of the performance unit test. As you can see from the logging, as the validator is initialized it generates bytecode and shows for which class and method, as well as what the generated class name is. The package and name of the original class is used and then has what property is being retrieved appended along with 'BeanPropertyFunction$$Valang' to make a unique class name to try to avoid any collisions.

Results from ValangValidatorPerformanceTest which was run on a Macbook Pro (2.5GHz Intel Dual Core 2 Duo with 4 GB RAM with OS X 10.5.6) with Java 5. All the expressions are identical, but adjusted to either retrieve the values being compared from a JavaBean, Map, List, or an array.

Table 7. Bytecode Generation Performance Comparison
<table>
<thead>
<tr>
<th>Expression</th>
<th>Reflection</th>
<th>Bycode Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>{ lastName : validLastName(?) is true AND creditApproval(age, creditRating) is true WHERE firstName IN 'Joe', 'Jack', 'Jill', 'Jane' AND creditStatus IN ['org.springmodules.validation.valang.CreditStatus.PENDING'], ['org.springmodules.validation.valang.CreditStatus.FAIL'] AND creditRating EQUALS ['org.springmodules.validation.valang.Person$CreditRating.EXCELLENT'] AND age &gt; 18 : '' }</td>
<td>7098ns</td>
<td>2124ns</td>
</tr>
<tr>
<td>{ mapVars[lastName] : validLastName(?) is true AND creditApproval(mapVars[age], mapVars[creditRating]) is true WHERE mapVars[firstName] IN 'Joe', 'Jack', 'Jill', 'Jane' AND mapVars[creditStatus] IN ['org.springmodules.validation.valang.CreditStatus.PENDING'], ['org.springmodules.validation.valang.CreditStatus.FAIL'] AND mapVars[creditRating] EQUALS ['org.springmodules.validation.valang.Person$CreditRating.EXCELLENT'] AND mapVars[age] &gt; 18 : '' }</td>
<td>4902ns</td>
<td>237ns</td>
</tr>
</tbody>
</table>
Spring Configuration

By specifying the 'className' property, bytecode will be generated for each method being called to avoid reflection. This gives a significant performance improvement.

Excerpt from ValangValidatorCustomFunctionTest-context.xml

```xml
<!--
Only perform validation if valid first name, credit status is failed or pending,
and the credit rating is excellent where the person's age is over 18.
-->
<bean id="expression" class="java.lang.String">
    <constructor-arg>
        <value><![CDATA[
            { lastName : validLastName(?) is true AND creditApproval(age, creditRating) is true
                WHERE firstName IN 'Joe', 'Jack', 'Jill', 'Jane' AND
                creditStatus IN
                ['org.springmodules.validation.valang.CreditStatus.PENDING'],
                ['org.springmodules.validation.valang.CreditStatus.FAIL'] AND
                creditRating EQUALS
                ['org.springmodules.validation.valang.Person$CreditRating.EXCELLENT'] AND
                age > 18 : '' }
        ]]]></value>
    </constructor-arg>
</bean>

...<bean id="bytecodePersonValidator" class="org.springmodules.validation.valang.ValangValidator">
    <property name="className" value="org.springmodules.validation.valang.Person"/>
    <property name="valang" ref="expression"/>
</bean>
```

Date Examples

The default date parser provides support for a number of different date literals, and also has support for shifting and manipulating dates. Below are a few examples, but see the DefaultDateParser for more detailed information.

Spring Configuration

ValangValidatorDateTest-context.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:aop="http://www.springframework.org/schema/aop"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans.xsd
    http://www.springframework.org/schema/aop
    http://www.springframework.org/schema/aop/spring-aop.xsd">
    <bean id="personValidator" class="org.springmodules.validation.valang.ValangValidator">
        <property name="className" value="org.springmodules.validation.valang.Person"/>
    </bean>
</beans>
```
2. Download

If you are using Maven, you can use the Maven dependency below and add a repository definition for the Spring by Example Maven repository. Otherwise you can download the jar directly from the Spring by Example Maven repository (http://www.springbyexample.org/maven/repo/).

```
<dependency>
  <groupId>org.springbyexample.validation</groupId>
  <artifactId>sbe-validation</artifactId>
  <version>0.93</version>
</dependency>

<repositories>
  <repository>
    <id>springbyexample.org</id>
    <name>Spring by Example</name>
    <url>http://www.springbyexample.org/maven/repo</url>
  </repository>
</repositories>
```

3. Reference

Related Links

- Spring Modules Validation Version 0.9 Documentation
Project Setup

The project is available to checkout from an anonymous Subversion checkout.

Checkout instructions for the project are available at Source Repository Instructions [http://www.springbyexample.org/maven/site/sbe-validation/0.93/source-repository.html].

General Setup Instructions

General instructions for checking out the project with Eclipse and building with Maven.

Example Project Setup

Project Information

- Spring Framework 2.5.x
Appendix A. Setup

A.1. Project Setup

Projects can be checked out directly from the Subversion repository located at http://svn.springbyexample.org/springindepth/ or using an IDE.

The projects were setup to checkout directly into Eclipse, but Maven can also be used to generate IntelliJ project files (`mvn idea:idea`). The project is also setup to use the Spring IDE [http://springide.org/].

Basic Setup

1. Java 5 or higher installed with JAVA_HOME set.

2. Download and install to use Maven from the command line. Maven [http://maven.apache.org/] (version 2.x or higher).

Example Environment Settings

Optionally you can set MAVEN_OPTS to increase it's memory settings.

```bash
JAVA_HOME=/usr/local/java
M2_HOME=/usr/local/maven
MAVEN_OPTS="-Xms128m -Xmx512m"

PATH=$JAVA_HOME/bin:$M2_HOME/bin:$PATH

export JAVA_HOME M2_HOME MAVEN_OPTS
```

SpringSource Tool Suite Setup


- SpringSource Tool Suite Download [http://www.springsource.com/products/sts]

Plugin Setup

1. Install the Subversive [http://eclipse.org/subversive/downloads.php] (Subversion plugin) so projects can be checked out from the repository.
• In the Available Software tab under 'Help/Software Updates...', add the following sites by clicking on the 'Add Site...' button.
  
  • http://download.eclipse.org/technology/subversive/0.7/update-site/
  
  • http://www.polarion.org/projects/subversive/download/eclipse/2.0/update-site/
  
  • Select all items from each update site except the JavaHL Win32 items if you're not on Windows from the Polarion site. For more information see Subversive Installation Instructions [http://www.eclipse.org/subversive/documentation/gettingStarted/aboutSubversive/install.php] and Polarion's Subversive Download Info [http://community.polarion.com/index.php?page=download&project=subversive].

  • Click on the Install button, click on Next, accept the license, and then click on Finish.

2. Optional: SpringSource dm Server

To work with the SpringSource dm Server [http://www.springsource.com/products/dmserver] and the examples using it, you will need to install the SpringSource dm Server [http://www.springsource.com/products/dmserver].


**Eclipse IDE 3.4 Setup**

Download and install Eclipse 3.4, preferably the Java EE release.

• Eclipse Downloads [http://www.eclipse.org/downloads/]

**Plugin Setup**

1. Install the Subversive [http://www.eclipse.org/subversive/downloads.php] Subversion Eclipse plugin (replacement for Subclipse for Eclipse 3.4) so the project can be checked out from the repository.

  • In the Available Software tab under 'Help/Software Updates...', add the following sites by clicking on the 'Add Site...' button.

  • http://download.eclipse.org/technology/subversive/0.7/update-site/

  • http://www.polarion.org/projects/subversive/download/eclipse/2.0/update-site/

  • Select all items from each update site except the JavaHL Win32 items if you're not on Windows from the Polarion site. For more information see Subversive Installation Instructions [http://www.eclipse.org/subversive/documentation/gettingStarted/aboutSubversive/install.php] and Polarion's Subversive Download Info [http://community.polarion.com/index.php?page=download&project=subversive].

  • Click on the Install button, click on Next, accept the license, and then click on Finish.

2. Install the Spring IDE [http://springide.org/] .

  • Installation Instructions [http://springide.org/project/wiki/SpringideInstall]
1. Adding the Spring IDE update site to Eclipse will also add the AspectJ AJDT update site. Select all of the Spring IDE items except the Dependency one (not for use with Eclipse 3.4) and all of the AJDT items.

2. Click on the Install button, click on Next, accept the license, and then click on Finish.

3. Install the M2Eclipse plugin [http://m2eclipse.codehaus.org/] developed by Sonatype for Maven support. It will allow easier management of Maven project files and also allow multi-module project support in the Eclipse IDE.

   In the Available Software updates, add the update site from the bottom of http://m2eclipse.codehaus.org/.

4. Optional: SpringSource dm Server


### General Eclipse IDE Setup

#### Subversion Setup


#### Project Checkout

1. Navigate to the projects trunk using the Subversion repository browser.

2. Right click on 'trunk', select 'Checkout...', click on the 'Finish' button.

#### Web Setup


2. Show Server View
   
   - Window/Show View/Others...
   
   - Server/Servers

3. Right click in the Server View and select 'New/Server'.
• Choose the installed server (for example Tomcat [http://tomcat.apache.org/] if that is the server you chose to install).

4. Right click on project and select 'Run As'/'Run on Server'.

• Choose the server to run the project on.

• Click on Next.

• Click on Finish.

• This should launch the application and also open up a browser window in Eclipse pointing to the webapps home page.

**SpringSource dm Server Setup**


Follow the instructions for installation after downloading either the binary release or the source and build the server yourself. If you're using the server plugin in the Eclipse IDE, you'll be able to start and stop the server inside Eclipse. Otherwise there are startup and shutdown scripts in the bin directory.

**Maven Setup**

**Note**

This setup is unnecessary when using M2Eclipse Plugin in the Eclipse IDE. The M2Eclipse plugin will handle downloading any jars and Maven builds can be run inside the Eclipse IDE. Also the plugin can download source and javadoc jars as well as the plugin automatically handling the projects classpath using the dependencies from the pom.xml.

1. From the command line (or the Maven Eclipse Plugin can be used) run 'mvn package' from the project directory at least once. This will download all the required jars.
Appendix B. Author Bios

B.1. David Winterfeldt

Introduction

David has been using Java since 1998 and involved in using Open Source almost as long. David is a committer on Struts [http://struts.apache.org/] and Commons Validator [http://commons.apache.org/validator/], but is no longer active on either. He was also the creator of Commons Validator [http://commons.apache.org/validator/]. He has focused on Web and Java EE development and always tries to leverage Open Source projects whenever possible. David started working with Spring 2.0 towards the end of 2006 and really enjoy working with the Spring Framework. He really enjoys it because it not only saves time, but encourages better design and code reuse through loosely coupled components.

David started Spring by Example [http://www.springbyexample.org/] to post different examples he had been doing at home and also to become involved again with Open Source projects. He opened up the TWiki to the public so people could more easily share different examples they have done. Hopefully Spring by Example [http://www.springbyexample.org/] will be a general resource for Spring Examples and ultimately save people time.

Currently David works for a financial firm in New York City.

Technical Expertise

• Publications

• Co-author of Spring In-depth, In Context [http://www.springindepth.com/], which is a free, in progress, online

• Co-author of the validation chapter in Struts in Action: Building Web Applications with the Leading Java Framework, Manning Publications (November 2002) [http://www.manning.com/husted/].

• Conference Speaker

• Speaker at SpringOne Americas 2008 [http://americas.springone.com/] presenting Case Study: GWT & Comet Integration with the Spring Framework at NYSE [http://americas.springone.com/show_session_view.jsp?presentationId=12842&showId=172].

• Open Source Contributions

• Original developer of Commons Validator and its integration into Struts.

• Committer on Struts (http://struts.apache.org) and the Commons Validator (http://jakarta.apache.org/commons).

• Webmaster of Spring by Example (http://www.springbyexample.org [http://jakarta.apache.org/commons]).

• Architecture & Design

• Struts Validator & Commons Validator with matching client side JavaScript validation

• Scalable E-mail Framework with scheduling, retry process, template processing, and dynamic population processing

• Keyword based E-mail Alert System for online articles

• Scalable Publishing System with configurable publishing processes

• Multi-threaded, multi-tier servers with custom thread pools and tcp/ip socket connections for a client entry prototype system.

• Programming Languages

• Java 1.0/1.1.x/1.2.x/1.3.x/1.4.x/1.5/1.6, Perl, JavaScript, SQL, PL/SQL

• Java EE

• JDBC, RMI, JavaMail, JMS, EJBs (Stateless, Session, Message Driven, Entity), RMI, JSPs, Servlets, Web Services, XML, JTA

• Application Servers

• Jetty 6.x, Tomcat 3.x/4.x/5.0/5.5/6.0, Spring dm Server, JBoss, BEA Weblogic Application Server 4.0/4.5/5.1/7.0

• Databases

• Oracle 8i/9i, DB2, MS SQL*Server 6.0/6.5/7.0, MySQL, PostgreSQL, MS Access, FoxPro

• Open Source Frameworks
• Spring Framework, Spring Security, Spring Web Flow, Spring Web Services, Struts, GWT, Hibernate, Velocity Template Engine, Axis, OSGi

• Open Source Projects

• Ant, Maven, AspectJ, Jakarta Commons BeanUtils, Jakarta Commons Betwixt, Jakarta Commons Collections, Jakarta Commons Digester, Jakarta Commons IO, Jakarta Commons Lang, Jakarta Commons Validator, Jakarta ORO, Jakarta POI, Jakarta Regexp, Tiles, Log4J, LOGBack, Xalan, Xerces, JUnit, HttpUnit, Cactus, XDoclet

• Miscellaneous

• Windows 2000 Server, Windows XP, Mac OS X, Solaris, Linux, Eclipse IDE

Experience

• Lead Architect: Designing systems/frameworks, preparing projects and frameworks for developers on new projects, providing instruction and assistance to developers.

• Ability to interact with Business Analysts, and Clients to gather requirements and implement.

• Performance Enhancements: database performance, adding multi-threading, optimizing code.

• Interaction with clients to define specifications, gather requirements, and communicate & resolve issues.

• Documentation: Javadocs, Wiki based documentation for developers, technical specifications.

• Interpreting specifications and requirement documents into working systems.

• Ability to learn new technologies, investigate issues, resolve development issues.

• Working with distributed team environments.

Sites & Blogs

• Spring by Example - http://www.springbyexample.org/

• Blog - http://davidwinterfeldt.blogspot.com/

• Spring by Example Blog - http://springbyexample.blogspot.com/

• Twitter - http://twitter.com/dwinterfeldt

Contact Info

E-mail: <dwinterfeldt@springbyexample.org>