CS520 Web Programming

Spring – MVC Framework

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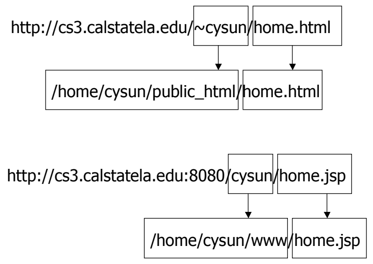
Roadmap

- Request Processing
- Transactions and hibernate support (Model)
- Controllers and validation (Controller)
- Data input and display (View)

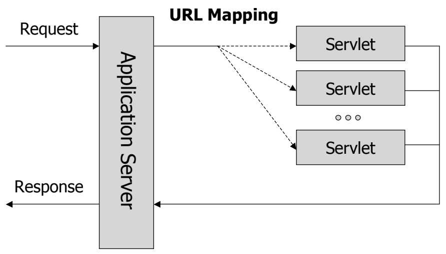
Understand Request Processing

- What happens when the server received a request like `http://sun.calstatela.edu/csns/instructor/viewSubmissions.html?assignmentId=50001`

Direct Resource Mapping


http://cs3.calstatela.edu/~cysun/home.html
/home/cysun/public_html/home.html
http://cs3.calstatela.edu:8080/cysun/home.jsp
/home/cysun/www/home.jsp

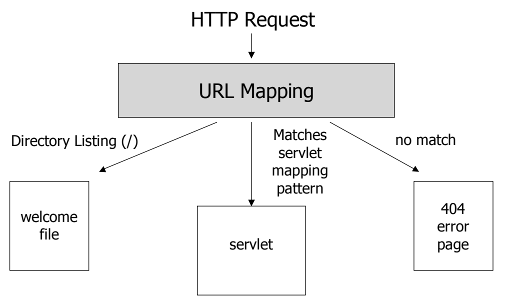
URL Mapping in a Java EE Application



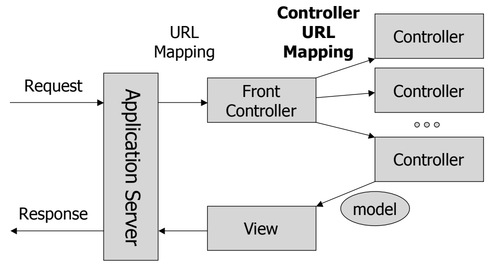
URL Mapping …

- Configured in web.xml
  - <servlet> and <servlet-mapping>
  - <welcome-file-list>
  - <error-page>
- Specified in the Servlet Specification

... URL Mapping



Request Processing in an MVC Framework



Spring Configuration File(s)

- <name>-servlet.xml
  - <name> must be the same as the <servlet-name> of the DispatcherServlet specified in web.xml
- Can have additional bean configurations files
  - E.g. applicationContext.xml, csns-data.xml, csns-email.xml, csns-acegi.xml ...

More About Configuration Files (Welcome to Metadata Hell!)

- Under classpath (/WEB-INF/classes)
  - hibernate.cfg.xml
  - ehcache.xml
  - *.properties
- Under /WEB-INF
  - web.xml
  - Spring configuration files
  - server-config.wsdd
- Under /META-INF
  - context.xml

Configuration Files in CSNS ...

- All configuration files are under `/conf`
- `init` target in build.xml
  - Copy configuration files to the right places
  - Rename `spring-*.xml` to `${app.name}-*.xml`
  - Insert some parameter values into the configuration files

... Configuration Files in CSNS

- Advantages
  - One folder (i.e. `/conf`) for all metadata files
  - One file (i.e. `build.properties`) for all configurable parameters
  - Reusable for other applications
- Disadvantages
  - Non-standard
  - "Resource out of sync" error in Eclipse

Controller URL Mapping …

◈ Maps a URL pattern to a controller that will handle the request

BeanNameUrlHandlerMapping (default)

```
<bean name="/instructor/home.html"
      class="csns.spring.controller.instructor.ViewSectionsController">
```

… Controller URL Mapping …

SimpleUrlHandlerMapping

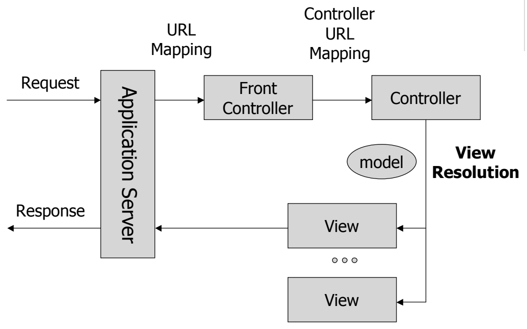
```
<bean id="home" class="csns.spring.controller.HomeController" />

<bean id="urlMapping"
  class="org.springframework.web.servlet.handler.SimpleUrlHandlerMapping">
   <property name="mappings">
      <props>
         <prop key="/home.html">home</prop>
      </props>
   </property>
</bean>
```

… Controller URL Mapping

◈ More than one URL handler
- <property name="order" value="0"/>

◈ No mapping found
- 404 error

Request Processing in an MVC Framework



Model and View Examples

◈ AddInstructorController

◈ ViewSubmissionsController

◈ TakeSurveyController

ModelAndView

$$\begin{tikzcd}
\text{String viewName,} \arrow[r] & \text{Resolve to a view} \\
\text{String modelName,} \arrow[r] & \text{Attribute in Request scope} \\
\text{Object modelObject} \arrow[ur] &
\end{tikzcd}$$

```
ModelAndView (
        String viewName,
        String modelName,
        Object modelObject
)
```

```
ModelAndView( String viewName )
   .addObject( String modelName, String modelObject )
   .addObject( String modelName, String modelObject )
   …
```

View Resolvers ...

- http://static.springframework.org/spring/docs/2.0.x/api/org/springframework/web/servlet/ViewResolver.html

... View Resolvers

- `InternalResourceViewResolver` for JSP
- Support for non-JSP view technologies
  - Velocity, FreeMarker, JsperReports, XSLT
- Views generated by Java classes
  - `BeanNameViewResolver`
  - `XmlViewResolver`
  - `ResourceBundleViewResolve`
- Multiple view resolvers
  - <property name="order" value="0"/>

InternalResourceViewResolver Example

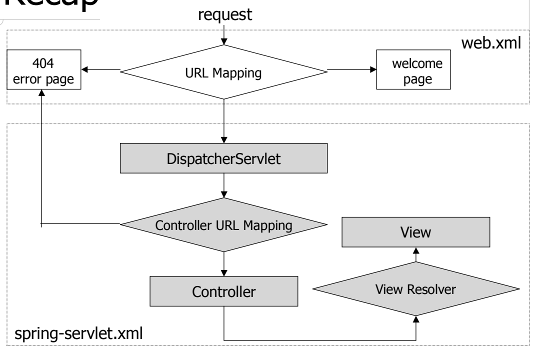
```
<bean id="viewResolver"
   class="org.springframework.web.servlet.view.InternalResourceViewResolver">
      <property name="prefix" value="/WEB-INF/jsp/" />
      <property name="suffix" value=".jsp" />
</bean>
```

Prefix + ViewName + Suffix = JSP File

Special Views

- Redirect
  - new ModelAndView("**redirect:**" + url)
  - E.g. LogoutController
- Forward
  - new ModelAndView("**forward:**" + url)
- null
  - E.g. DownloadController

Recap



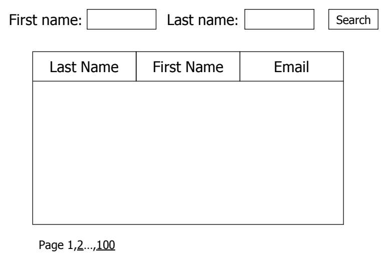
Example 1: List All Users

- Add a new menu item `Users` to the top menu `Resources`
- Display user information in a table that supports paging

Last Name	First Name	Email

Page 1,2,...,100

Example 2: Find Users by First Name or Last Name


First name: Last name: Search

Last Name	First Name	Email

Page 1,2,...,100

Database Access

- DAO interfaces
  - E.g. `csns.model.dao`
- DAO implementations
  - E.g. `csns.model.dao.hibernate`
  - Hibernate DAO implementation classes inherit from HibernateDaoSupport
- HibernateTemplate
  - http://static.springframework.org/spring/docs/2.0.x/api/org/springframework/orm/hibernate3/HibernateTemplate.html

Programmatic vs. Declarative Transaction Management

Programmatic:

```
void saveUser( User u )
{
  transaction.start();
  …
  transaction.end();
}
```

Declarative:

```
<transaction>
   <method>
      saveUser
   </method>
</transaction>
```

Hibernate Support in Spring

Without Spring

```
Transaction tx = null;
try
{
   tx = s.beginTransaction();
   s.saveOrUpdate( e );
   tx.commit();
}
catch( Exception e )
{
   if( tx != null ) tx.rollback();
   e.printStackTrace();
}
```

With Spring

```
getHibernateTemplate()
.saveOrUpdate( user );
```

Spring Transaction Managers

- JDBC
- Hibernate
  - V3
  - Before V3
- JTA
- Object-Relational Bridge (ORB)

Configure Hibernate Transaction Manager

- `dataSource`
  - Database connection information
  - DBCP - http://jakarta.apache.org/commons/dbcp/
- `sessionFactory`
  - Hibernate information
- `transactionManager`
- `transactionAttributeSource`

See `/conf/spring-data.xml`

Transaction Attributes

- Isolation levels
- Read-only hints
- Transaction timeout period
- Method name patterns
- *Propagation behaviors*

Propagation Behaviors

- Determines whether the method should be run in a transaction, and if so, whether it should run within an existing transaction, a new transaction, or a nested transaction within an existing transaction.

The Need for Propagation Behaviors

```
Class FoobarDao {

   void saveFoo( Foo foo )  { save(foo); }

    void saveBar( Bar bar )  { save(bar); }

    void saveFoobar( Foobar foobar )
    {
       saveFoo( foobar.getFoo() );
       saveBar( foobar.getBar() );
     }

}
```

Propagation Behaviors in Spring

Propagation Behaviors	Run in …
PROPAGATION_MANDATORY	Existing transaction
PROPAGATION_NESTED	Nested transaction
PROPAGATION_NEVER	No existing transaction
PROPAGATION_NOT_SUPPORTED	Suspended during existing transaction
PROPAGATION_REQUIRED	Existing or new transaction
PROPAGATION_REQUIRES_NEW	New transaction
PROPAGATION_SUPPORTS	May run in existing transaction

Add Transaction Support for DAO Classes

- TransactionProxyFactoryBean
- Bean definition *inheritance*

```
class FooDao {

  void saveFoo( Foo foo )
  {
     save(foo);
   }
}
```

⇨

```
class FooDaoProxy {

  void saveFoo( Foo foo )
  {
     transaction.begin();
     save(foo);
     transaction.end();
   }
}
```

Controller Interface

- org.springframework.web.servlet.mvc.Controller - http://static.springframework.org/spring/docs/2.0.x/api/org/springframework/web/servlet/mvc/Controller.html

```
ModelAndView handleRequest (
     HttpServletRequest request,
     HttpServletResponse response )
```

Select A Controller

ParameterizableViewController	Simply display a view, i.e. the request does not need to be processed
Controller (interface) **AbstractController**	do not use request parameters or use only simple parameters
BaseCommandController AbstractCommandController	request parameters can be mapped to an object; can use *validators* to validate request parameters
AbstractFormController **SimpleFormController**	Handles form input
AbstractWizardFormController	Handles multi-page form input

ParameterizableViewController

- CSNS Examples
  - index

AbstractController

- CSNS Examples
  - CourseController
  - DeleteAssignmentController
- Example 1: list all users

Displaytag

- http://displaytag.sourceforge.net/
- Sortable columns and result paging
- Use displaytag, *not* displaytag-el

Displaytag Examples

- CSNS Examples
  - courses.jsp
  - instructor/viewSubmissions.jsp
  - forum/viewTopic.jsp
- Example 1: list all users

<display:table>

- name
  - Name of the collection to be displayed
  - Like `items` in `<c:forEach>`
- uid
  - Name of the object in each iteration
  - Like `var` in `<c:forEach>`
- requestURI
  - The URL used to request the page
  - E.g. `viewSubmission.html`, not `instructor/viewSubmission.jsp`

<display:column>

- property
- sortable
- title
- sortProperty

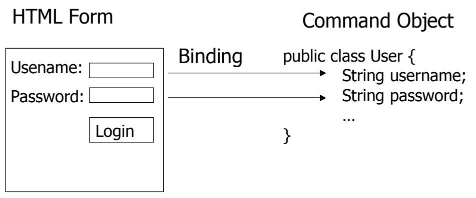
Customize Displaytag Tables

- Using CSS
  - `class` and `style` attributes for <display:table> and <display:column>
- Using properties
  - displaytag.properties for the whole application
  - <display:setProperty> for a particular table
  - http://displaytag.sourceforge.net/11/configuration.html

SimpleFormController

- CSNS Examples
  - EditAssignmentController
  - CreateTopicController
- Example 2: find users by name

Command Object

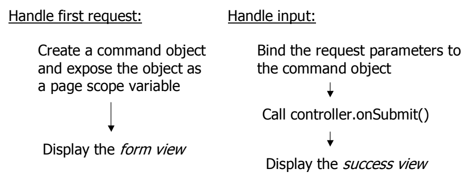


```
public class User {
    String username;
    String password;
    …
}
```

- Any class can be used as a command class in Spring
  - vs. ActionForm in Struts

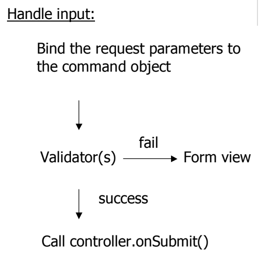
Simple Form Handling

- The controller needs to handle two cases:
  - Display form
  - Process input data


Handle first request:
Create a command object and expose the object as a page scope variable
Display the *form view*
Handle input:
Bind the request parameters to the command object
Call controller.onSubmit()
Display the *success view*

Validation

- org.springframework.validation
  - Validator
  - Errors


Handle input:
Bind the request parameters to the command object
Validator(s)
fail
Form view
success
Call controller.onSubmit()

messages.properties

- <name,value> pairs
- A single place for output messages
  - Easy to change
  - I18N
- Need to declare a `messageSource` bean in Spring configuration file
- Can be used by <fmt> tags in JSTL

Spring's `form` Tag Library

- Documentation - http://static.springframework.org/spring/docs/2.5.x/reference/view.html#view-jsp-formtaglib
- Tag reference – http://static.springframework.org/spring/docs/2.0.x/reference/spring-form.tld.html
- Example
  - admin/survey/addQuestion.jsp

Other Validation Options

- JavaScript validation
- Commons-validator
  - http://commons.apache.org/validator/
  - Provide both *declarative* and *programmatic* validation

Commons-Validator Declarative Validation Example

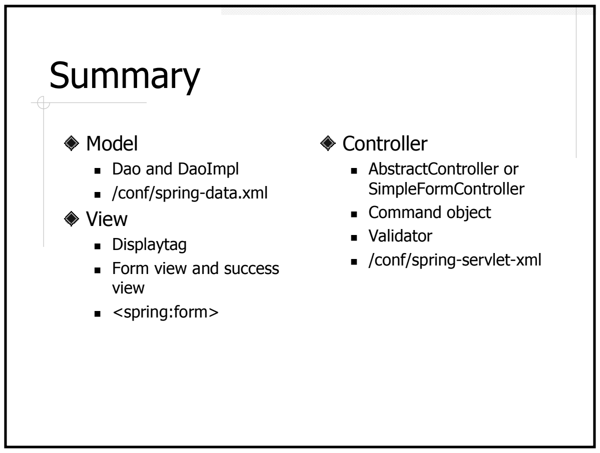
```
<form name="fooForm">

    <field property="name" depends="required">
        <arg0 key="fooForm.definition"/>
    </field>

    <field property="difficultyLevel"
           depends="required, integer">
        <arg0 key="fooForm.difficultyLevel"/>
    </field>

</form>
```

Commons-Validator Routines

- http://commons.apache.org/validator/api-1.3.1/org/apache/commons/validator/routines/package-summary.html
- Independent of the declarative validation framework
- A set of methods to validate
  - Date and time
  - Numeric values
  - Currency
  - ...

AbstractWizardFormController

- CSNS Examples
  - TakeSurveyController



Summary

- Model
  - Dao and DaoImpl
  - /conf/spring-data.xml
- View
  - Displaytag
  - Form view and success view
  - <spring:form>
- Controller
  - AbstractController or SimpleFormController
  - Command object
  - Validator
  - /conf/spring-servlet-xml