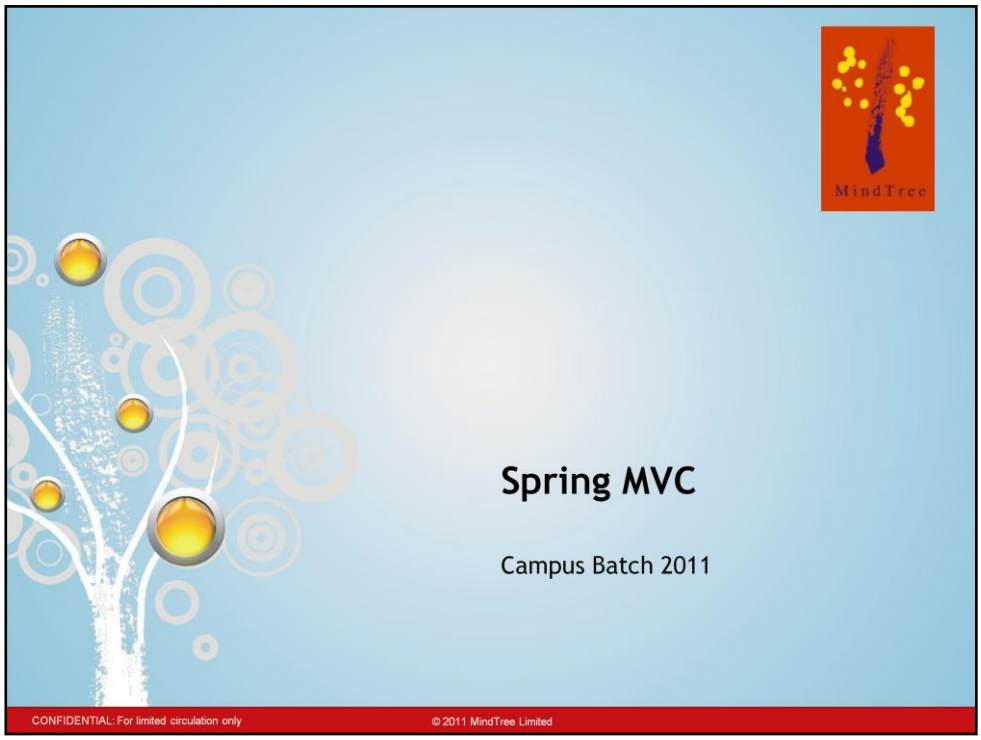
MindTree
Spring MVC
Campus Batch 2011
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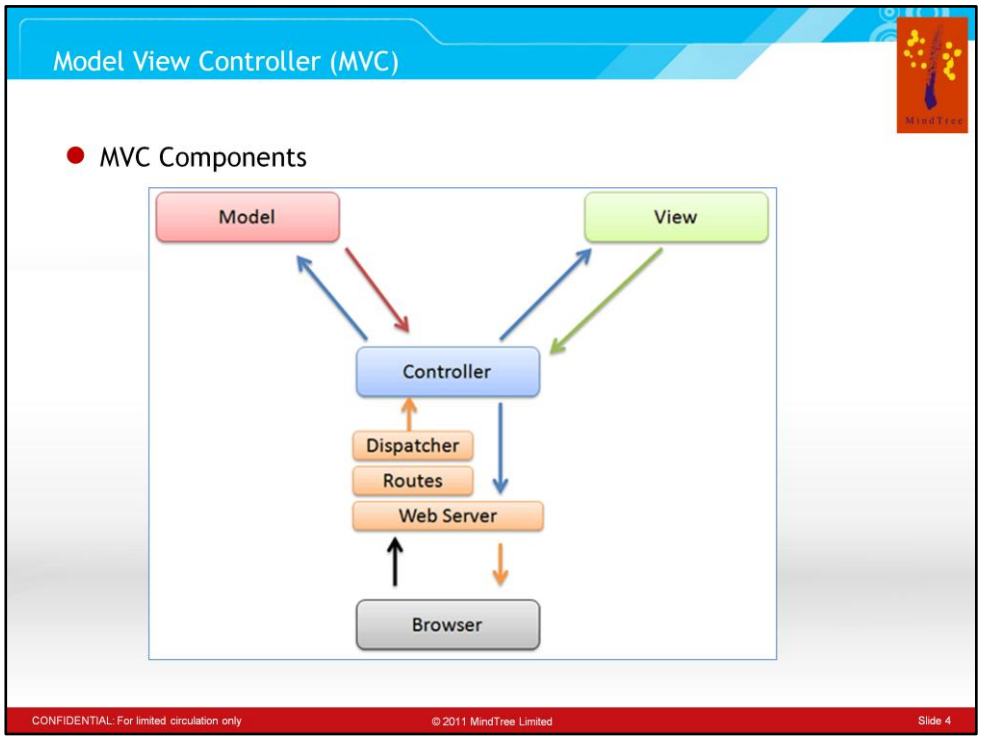
Objectives

- Overview of MVC Paradigm
- Understand the components of Spring MVC
- Implementing a basic controller
- Creating a Simple view
- Configuring a Spring MVC application
- Understand Spring 3 MVC
- Annotating Controller's and RequestMapping
- Spring MVC Hibernate Integration
- Model driven attribute using @ModelAttribute
- Using Spring Validation for validating form fields
- Understand PropertyEditors for converting string type to custom data type.
- Understand how to pre populate form fields

Model View Controller (MVC)

- MVC = Model-View-Controller
  - Clearly separates business, navigation and presentation logic
  - Proven mechanism for building a thin and clean web-tier.
- Three core collaborating components
  - Controller
    - Handles navigation logic and interacts with the service tier for business logic
  - Model
    - The contract between the Controller and the View
    - Contains the data needed to render the View
    - Populated by the Controller
  - View
    - Renders the response to the request
    - Pulls data from the model



The **browser** makes a request, such as https://konnect.mindtree.com/communities/j2ee/Pages/

The **web server** (Apache, WebSphere, etc.) receives the request. It uses **routes** to find out which controller to use.

The web server then uses the **dispatcher** to create a new controller, call the action and pass the parameters.

Controllers do the work of parsing user requests, data submissions, cookies, sessions and the "browser stuff". They act as locus for transfering data between Model and View.

Models are Java classes. They talk to the database, store and validate data, perform the business logic and otherwise do the heavy lifting.

Views are what the user sees: HTML, CSS, XML, Javascript, JSON. **Views are merely puppets** reading what the controller gives them. They don't know what happens in the back room.

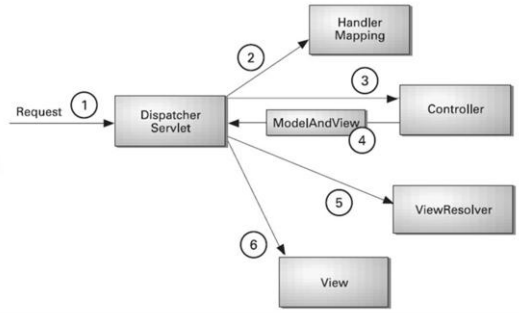
Model View Controller (MVC)

- Motivation
  - Eases maintenance burden
    - Changes to business logic are less likely to break the presentation logic
    - Changes to presentation logic also does not break business logic.
  - Facilitates multi-disciplined team development
    - Developers can focus on creating robust business code without having to worry about breaking the UI
    - Designers can focus on building usable and engaging UIs without worrying about Java
  - Use the best tool for the job
    - Java is especially suited to creating business logic code
    - Markup or template languages are more suited to creating HTML layouts.
  - Ease testability
    - Business and navigation logic are separated from presentation logic meaning they can be tested separately
    - Practically: you can test more code outside the Servlet container

Spring MVC

- Core Components of Spring MVC
  - DispatcherServlet
    - Spring's Front Controller implementation. Request routing is completely controlled by the Front Controller. As an application developer, you will have to just configure the DispatcherServlet in web.xml
  - Controller
    - An application developer created component for handling requests.
    - Controllers are POJOs which are managed by Spring ApplicationContext just like any other bean
    - Controllers encapsulates navigation logic.
  - View
    - An application developer created pages responsible for rendering output.

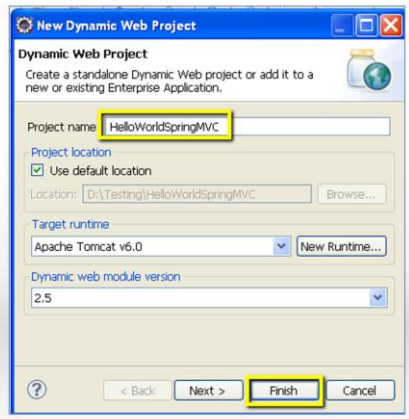
Spring MVC

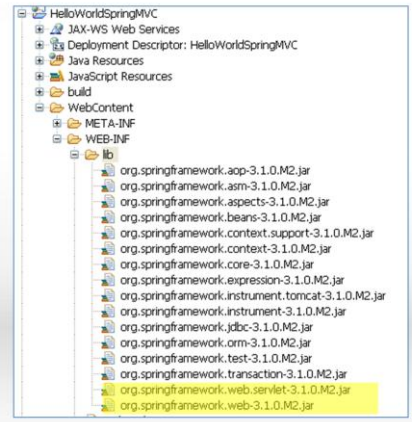


1. The DispatcherServlet first receives the request
2. The DispatcherServlet consults the HandlerMapping and invokes the Controller associated with the request
3. The Controller process the request by calling the appropriate service methods
4. The Controller returns a ModeAndView object to the DispatcherServlet. The ModeAndView object contains the model data and the view name.
5. The DispatcherServlet sends the view name to a ViewResolver to find the actual View to invoke.
6. Now the DispatcherServlet will pass the model object to the View to render the result.The View with the help of the model data will render the result back to the user

Writing your first Spring MVC Web application

- Step 1.
  - Create a Dynamic Web Project
  - Copy Spring jar files to WEB-INF\lib folder

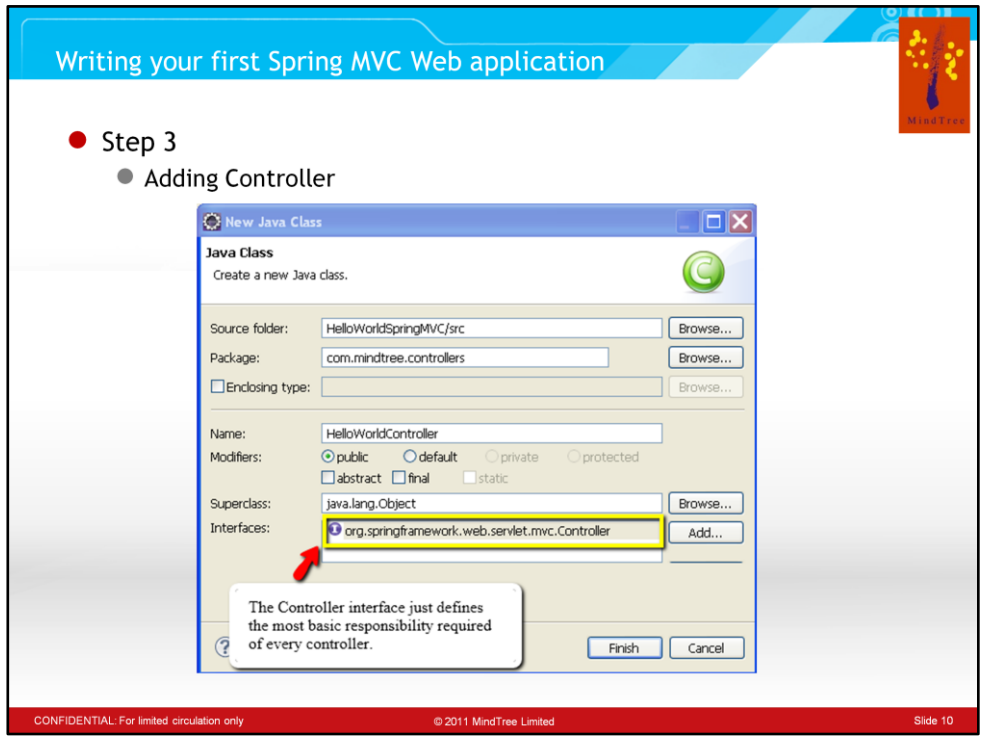




Writing your first Spring MVC Web application

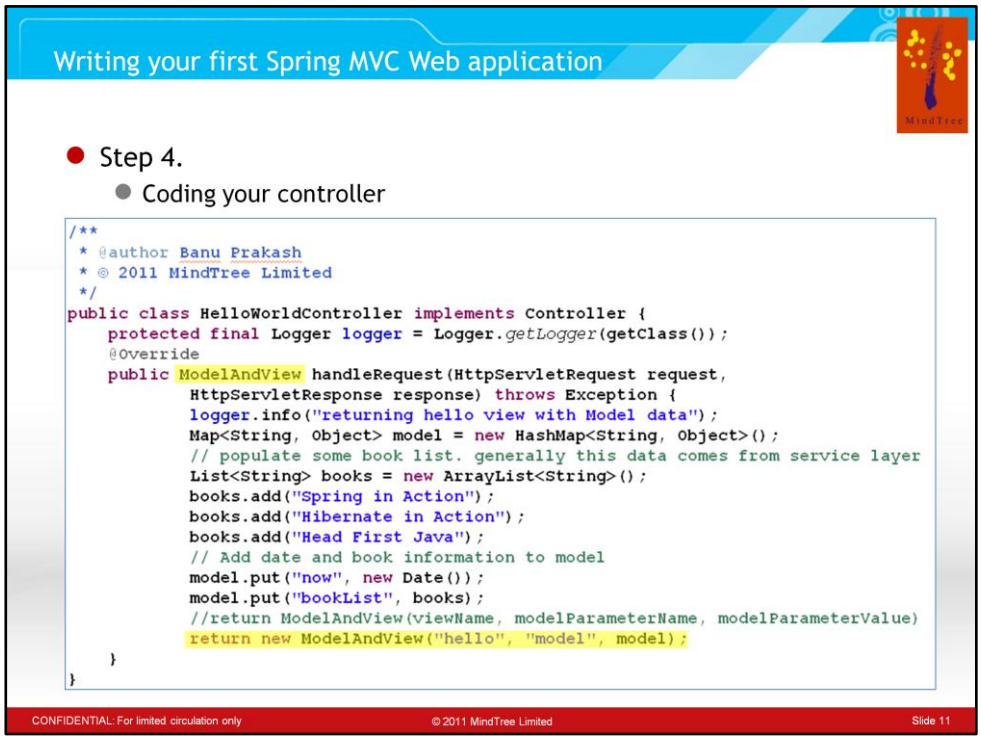
- Step 2
  - Configure DispatcherServlet (FrontController).
    - Requests that you want the DispatcherServlet to handle will have to be mapped using a URL mapping in the same web.xml file.
    - We have configured all requests ending with ".view" will be handled by the 'dispatcher' DispatcherServlet.

```
<servlet>
      <servlet-name>dispatcher</servlet-name>
      <servlet-class>org.springframework.web.servlet.DispatcherServlet</servlet-class>
      <load-on-startup>1</load-on-startup>
  </servlet>

  <servlet-mapping>
      <servlet-name>dispatcher</servlet-name>
      <url-pattern>*.view</url-pattern>
  </servlet-mapping>
```

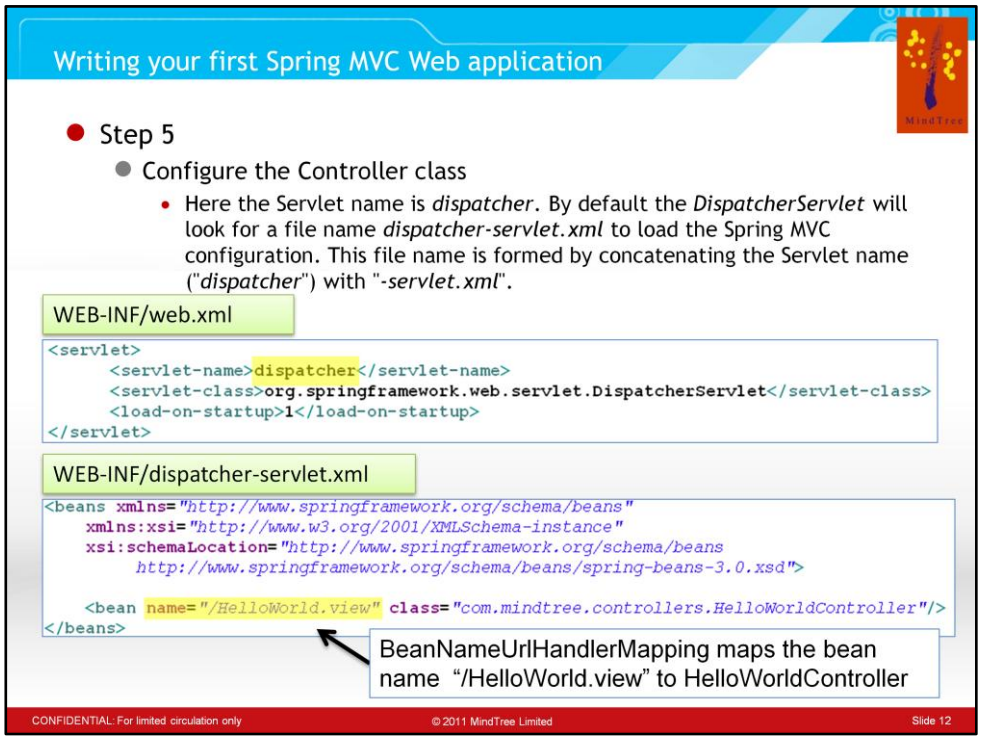


Spring's basis for the controller architecture is the org.springframework.web.servlet.mvc.Controller interface:

```
public interface Controller {
        /** * Process the request and return a ModelAndView object which the DispatcherServlet
         * will render.
        */
        ModelAndView handleRequest( HttpServletRequest request, HttpServletResponse response) throws Exception;
}
```



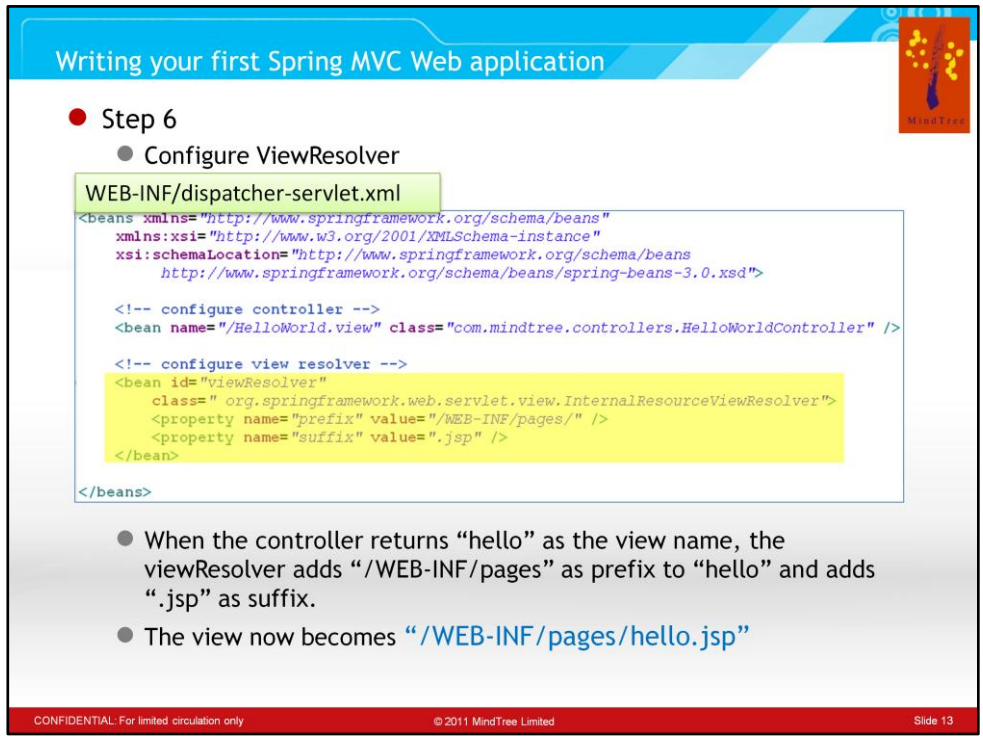
The HelloWorldController stores model data in a Map as “now” and “bookList” keys and returns ModelAndView object which contains “hello” as the name of view and “model” as model parameter name. The ViewResolver uses the view name to forward to appropriate view.



By default the DispatcherServlet uses the BeanNameUrlHandlerMapping to map the incoming request.

The BeanNameUrlHandlerMapping uses the bean name as the URL pattern. Since BeanNameUrlHandlerMapping is used by default, you need not do any seperate configuration for this.

Also in our web.xml we have configured that any url ending with "*.view" will be handled by the DispatcherServlet.



Views are represented using logical view names which are returned by the Controller

Without using ViewResolver, Controllers can return an actual View class if needed.

Writing your first Spring MVC Web application

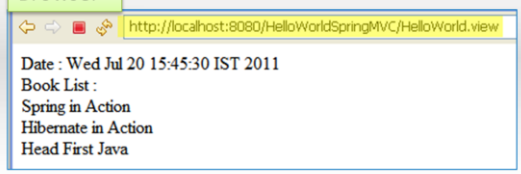
- Step 7
  - Writing view

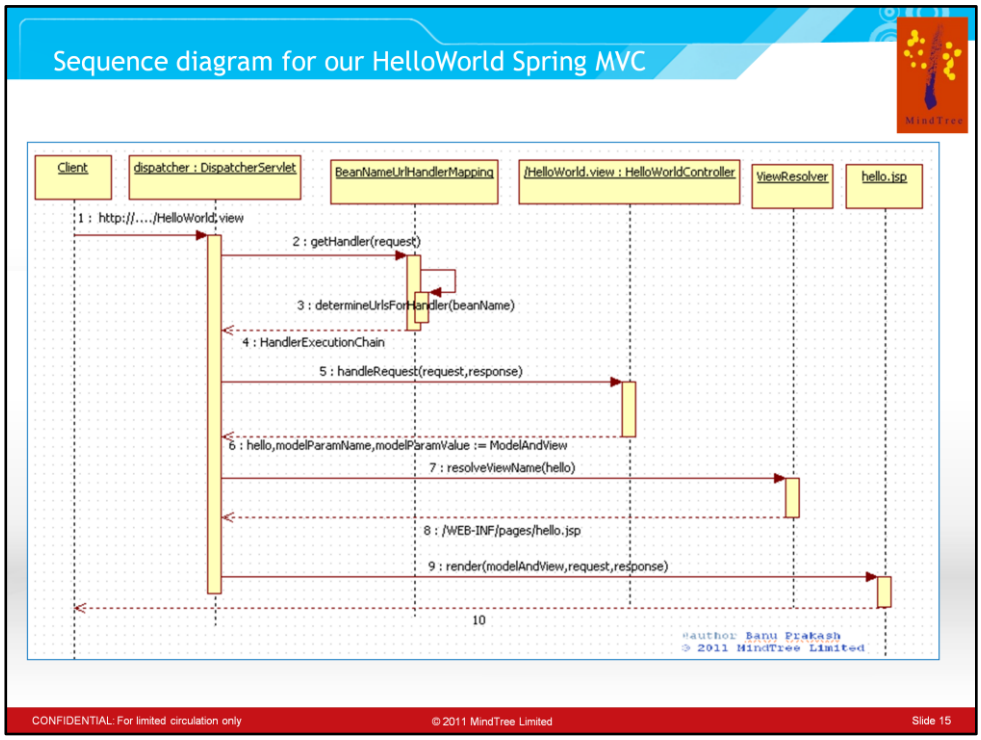
WEB-INF/pages/hello.jsp

```
<body>
    Date : ${requestScope.model.now}<br />
    Book List : <br />
    <c:forEach items="${requestScope.model.bookList}" var="book">
        <c:out value="${book}" /> <br />
    </c:forEach>
</body>
```

  - The HelloWorldController returns
    - ModelAndView("hello", "model", model); where “hello” was the view name, “model” was the attribute name stored in request scope.

Browser





Refer:

a) http://static.springsource.org/spring/docs/2.0.x/reference/mvc.html

b) http://static.springsource.org/spring/docs/1.1.5/api/org/springframework/web/servlet/DispatcherServlet.html

c) http://static.springsource.org/spring/docs/2.5.x/api/org/springframework/web/servlet/HandlerMapping.html

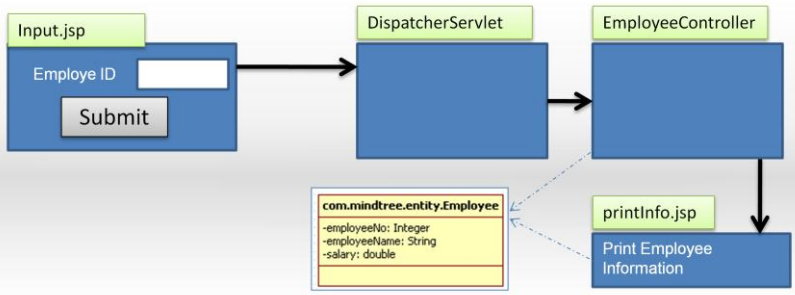
Example

- Code Example
  - HelloWorldSpringMVC.zip
    - Example used for the presentation.
    - Illustrates creating a bare minimum Spring MVC application

Annotation support for Spring started from 2.x, but the Presentation uses 3.x style of Spring MVC

Activity

- Spring MVC Activity 1
- Write a Spring MVC application to perform the following:
  - The EmployeeController should have a map having employeeId as key and Employee instance as value
  - User should input employeeID from form field.
  - The EmployeeController should return an ModelAndView containing the Employee instance for the specified employeeID and "printInfo" as the view name.
  - The "printInfo.jsp" should print the employee information.



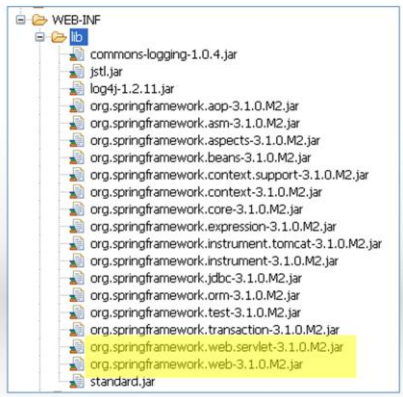
Annotation support for Spring started from 2.x, but the Presentation uses 3.x style of Spring MVC

Spring 3 MVC

- Why Spring 3 MVC?
  - Spring 3 introduces a mvc namespace that greatly simplifies Spring MVC setup.
    - Using mvc namespace Controllers, ViewResoulvers, interceptors and resources configuration becomes that much easier.
  - No changes to the DispatcherServlet configuration in web.xml
  - Many other enhancements makes it easier to get Spring 3.x web applications up and running.

Spring 3 MVC

- Step 1
  - Create a Dynamic Web Project
  - Add Spring 3 Libraries to WEB-INF/lib folder

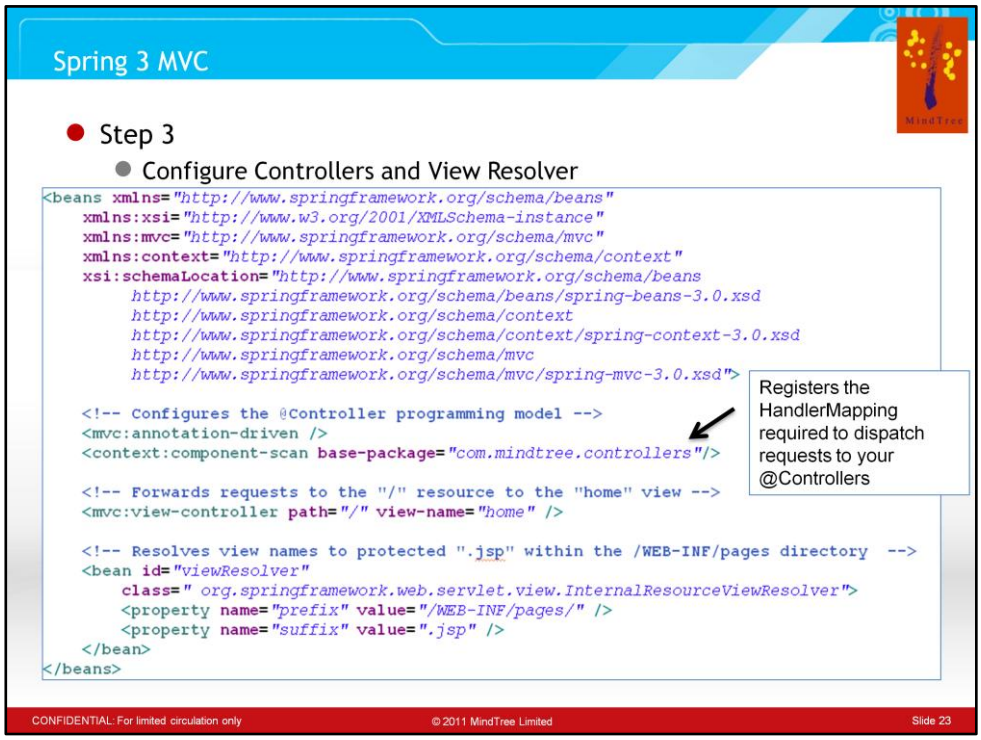


Spring libraries required for building Spring MVC application

- Step 2
  - Configure DispatcherServlet in web.xml [this remains the same for every version of spring MVC application]

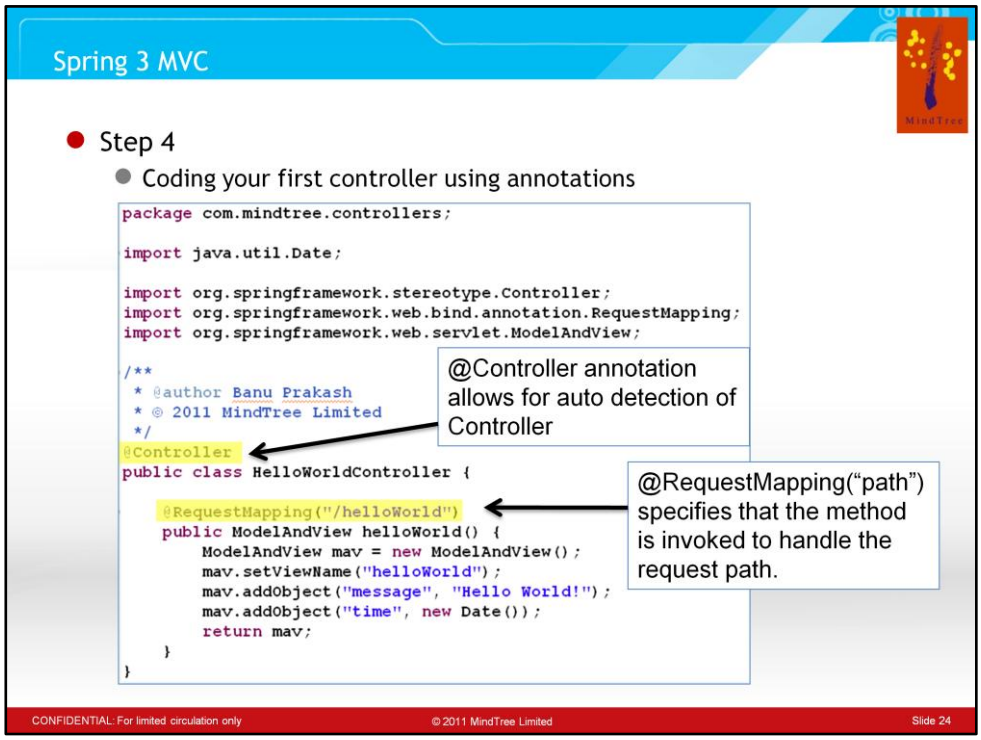
```
<servlet>
    <servlet-name>dispatcher</servlet-name>
    <servlet-class>org.springframework.web.servlet.DispatcherServlet</servlet-class>
    <load-on-startup>1</load-on-startup>
</servlet>

<servlet-mapping>
    <servlet-name>dispatcher</servlet-name>
    <url-pattern>/</url-pattern>
</servlet-mapping>
```

  - The DispatcherServlet is configured as the default Servlet for the application (mapped to "/")



<context:component-scan /> tag searches for Controllers which are annotated with @Controller present in the classpath. With annotation based now the Controllers need not implement “Controller” interface and the application developer is free to write any method to handle request, it need not be only handleRequest(request,response).

<mvc:view-controller path="/" view-name=“home" /> : Behind the scenes, mvc:view-controller registers a ParameterizableViewController that selects a view for rendering. In this case, when "/" is requested, the “home” view is rendered. The actual view template is a .jsp resolved inside the /WEB-INF/pages directory.

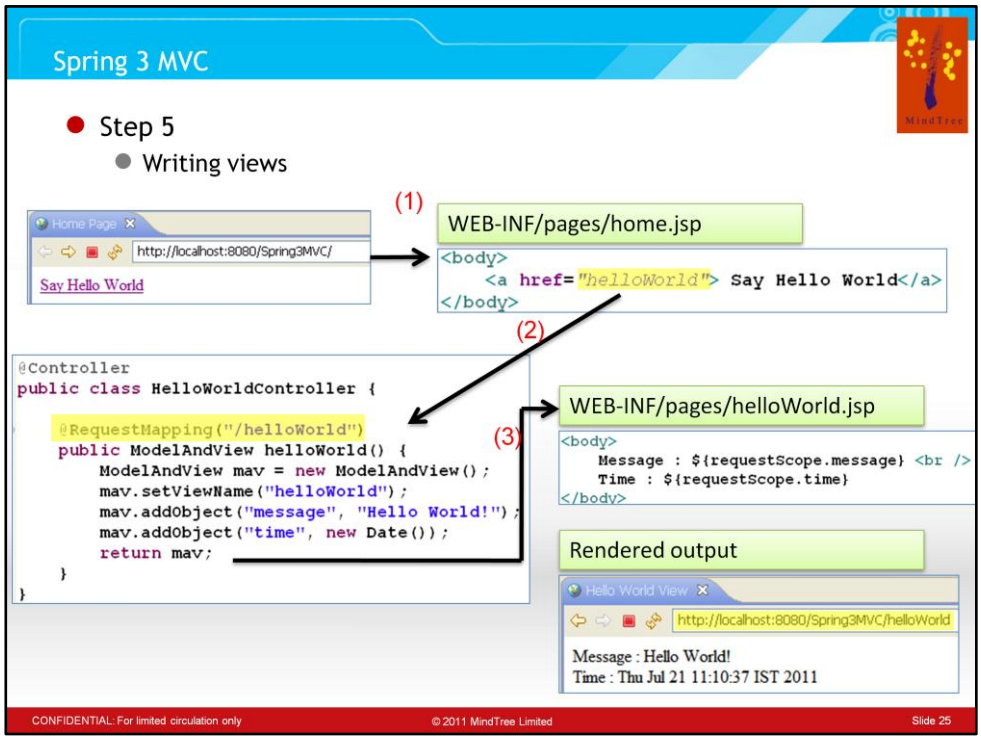


Controllers implemented in this style do not have to extend specific base classes or implement specific interfaces.

Furthermore, they do not usually have direct dependencies on Servlet APIs, although you can easily configure access to Servlet facilities.

The @Controller and @RequestMapping annotations allow flexible method names and signatures.

In this particular example the method has no parameters and returns a ModelAndView, but various other (and better) strategies exist, as explained later.



1. Client makes a request from browser : “http://localhost:8080/Spring3MVC/”, this URL is mapped to <mvc:view-controller path="/" view-name="home" /> in dispather-servlet.xml. Using InternalResourceViewResolver renders WEB-INF/pages/home.jsp page
2. On clicking “Say Hello World” hyperlink, the helloWorld()

Example

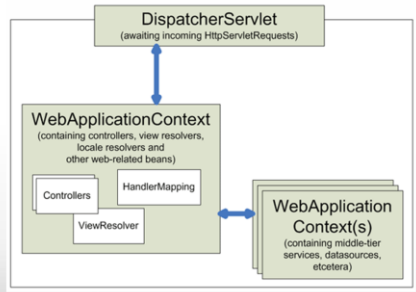
- Code Example
  - Spring3MVC.zip
    - Example code used for the presentation slides.
- Reference:
  - http://www.roseindia.net/tutorial/spring/spring3/web/spring-3-mvc-hello-world.html
    - Illustrates step by step creation of Spring MVC application

Activity

- Spring MVC Activity 2
  - Repeat the Spring MVC Activity 1using Spring 3 MVC

Spring MVC - Business Layer integration

- The WebApplicationContext is an extension of the plain ApplicationContext that has some extra features necessary for web applications



Spring MVC - Business Layer integration

- **ContextLoaderListener a servlet listener which is responsible for loading additional WebApplicationContext mostly consisting of beans for service layer and dao layer.**

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

<context-param>
    <param-name>contextConfigLocation</param-name>
    <param-value>/WEB-INF/beans.xml</param-value>
</context-param>
```

beans.xml file consists of all the Dao/Service Layer configurations as discussed in Hibernate Spring integration

- The ContextLoaderListener looks for /WEB-INF/applicationContext.xml by default, but you can override it using the context parameter contextConfigLocation as shown.

Spring MVC - Business Layer integration

- Coding the Controller to interact with service layer

```
/**
 * @author Banu Prakash
 * © 2011 MindTree Limited
 */
@Controller
public class BankController {

    @Autowired
    private BankService bankService;

    @RequestMapping("/getAccounts")
    public String getAccounts(Model model) {
        String target = "printAccounts";
        try {
            model.addAttribute("accountList",
                    bankService.getAllAccounts());
        } catch (ServiceException e) {
            model.addAttribute("errorMessage", e.getMessage());
            target = "home";
        }
        return target;
    }
}
```

Example

- Code Example:
  - Spring3MVC_Hibernate.zip
    - Illustrates integrating Spring MVC with Hibernate
    - Illustrates configuring ContextLoaderListener to create a WebApplicationContext using “beans.xml” configuration file.
    - Code fetches all accounts present in database using Hibernate API.

Mapping requests

- **Request Mapping**
  - Method Level mapping
  - **By HTTP method**
    - @RequestMapping("path", method=RequestMethod.GET)
    - POST, PUT, DELETE, OPTIONS, and TRACE are are also supported
  - **By presence of query parameter**
    - @RequestMapping("path", method=RequestMethod.GET, params="foo")
    - Negation also supported: params={ "foo", "!bar" })
  - Class Level Mapping is also supported

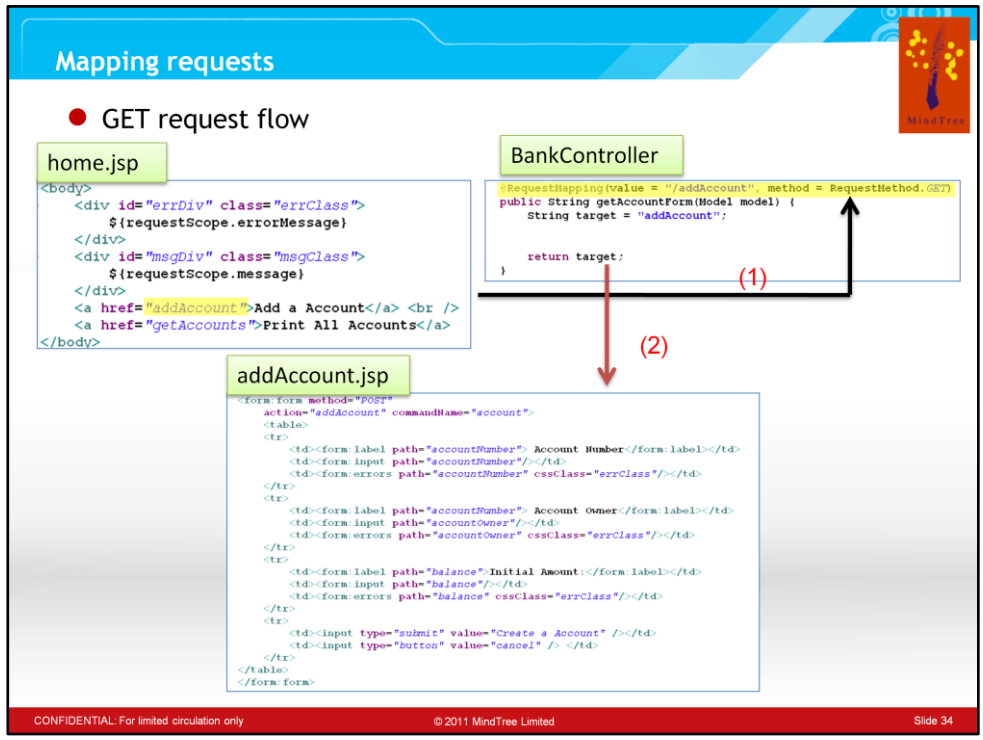
Mapping requests

- Configuring MultiAction Controllers
  - A Single controller can handle requests for different URL's

```
@RequestMapping(value = "/addAccount", method = RequestMethod.GET)
public String getAccountForm(Model model) {
    String target = "addAccount";
    Remaining code removed for clarity
    return target;
}

@RequestMapping(value = "/addAccount", method = RequestMethod.POST)
public String addAccount(@ModelAttribute("account") Account account,
        BindingResult errorResults, Model model) {
    String target = "printAccounts";
    Remaining code removed for clarity
    return target;
}
```

For request URI of "/addAccount "and GET request, getAccountForm method is called

For request URI of "/addAccount "and POST request, addAccount method is called



1) Clicking on the hyperlink “Add a Account” GET request is made to the controller and invokes a handler which is configured to handle request mapping “/addAccount” and method=RequestMethod.GET.
2) From the getAccountForm() method when “addAccount” view name is returned, ViewResolver will render addAccount.jsp.

Mapping requests

- POST request flow

addAccount.jsp

```
<form:form method="POST"
    action="addAccount" commandName="account">
    <table>
    <tr>
        <td><form:label path="accountNumber"> Account Number</form:label></td>
        <td><form:input path="accountNumber"/></td>
        <td><form:errors path="accountNumber" cssClass="errClass"/></td>
    </tr>
    <tr>
        <td><form:label path="accountNumber"> Account Owner</form:label></td>
        <td><form:input path="accountOwner"/></td>
        <td><form:errors path="accountOwner" cssClass="errClass"/></td>
    </tr>
    <tr>
        <td><form:label path="balance">Initial Amount:</form:label></td>
        <td><form:input path="balance"/></td>
        <td><form:errors path="balance" cssClass="errClass"/></td>
    </tr>
    <tr>
        <td><input type="submit" value="Create a Account" /></td>
        <td><input type="button" value="cancel" /> </td>
    </tr>
</table>
</form:form>
```

```
@RequestMapping(value = "/addAccount", method = RequestMethod.POST)
public String addAccount(@ModelAttribute("account") Account account,
        BindingResult errorResults, Model model) {
    String target = "printAccounts";


    return target;
}
```

When the form is submitted, since the method of request is “POST” addAccount() is called and not getAccountForm().

Remember both addAccount() and getAccountForm() are mapped to same URI.

@ModelAttribute

- @ModelAttribute maps a model attribute to the specific, annotated method parameter.
  - This is how the controller gets a reference to the object holding the data auto-populated from request parameters entered in the form.

```
<form:form method="POST"
    action="addAccount" commandName="account">
     Account Number<form:input path="accountNumber"/> <br/>
     Account Owner<form:input path="accountOwner"/> <br />
     Initial Amount:<form:input path="balance"/> <br />
     <input type="submit" value="Create a Account" />
    <input type="button" value="cancel" />
</form:form>
```

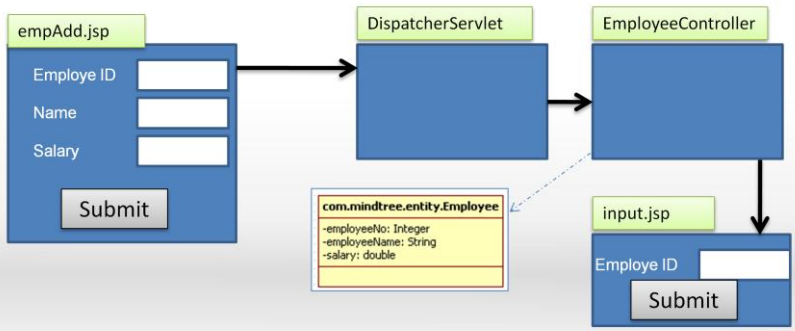
```
@RequestMapping(value = "/addAccount", method = RequestMethod.POST)
public String addAccount(@ModelAttribute("account") Account account,Model model) {
    String target = "printAccounts";
    try {
        bankService.addAccount(account);
    } catch (ServiceException e) {
        model.addAttribute("errorMessage", e.getMessage());
        target = "home";
    }
    return target;
}
```

Example

- Code Example:
  - Refer: Spring3MVC_Hibernate_CRUD.zip
    - Illustrates using @RequestMapping annotation to map a URI to a controller method
    - Illustrates using @ModelAttribute annotation to map form field data to entity class

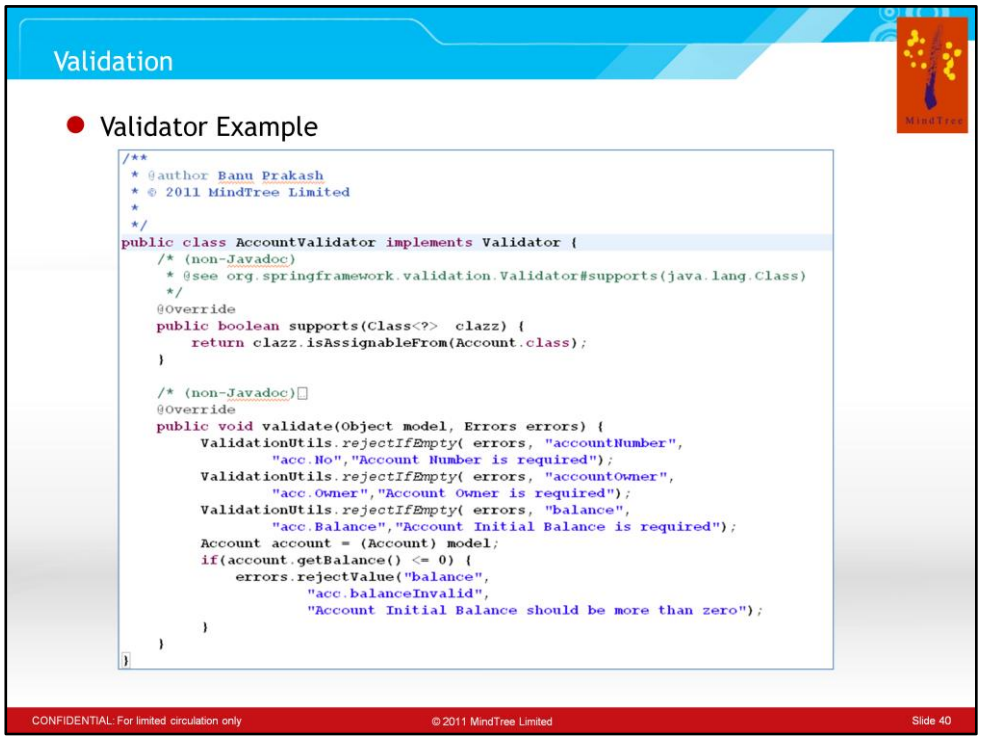
Activity

- Activity 3
  - Modify the Activity 2 to add Employee entity to store in a map using @ModelAttribute



Validation

- **Validator interface**
  - Spring's features a Validator interface that you can use to validate objects.
  - The Validator interface works using an Errors object so that while validating, validators can report validation failures to the Errors object.
  - Methods of org.springframework.validation.Validator interface:
    - boolean supports(Class)
      - Can this Validator validate instances of the supplied Class?
    - void validate(Object, org.springframework.validation.Errors)
      - validates the given object and in case of validation errors, registers those with the given Errors object



ValidationUtils class is used to reject the properties are null or the empty string.

public static void **rejectIfEmpty**(Errors errors, String field, String errorCode, String defaultMessage)

Reject the given field with the given error code and message if the value is empty. The object to validate does not have to be passed in, as the Errors instance allows to check field values (it will usually hold an internal reference to the target object).

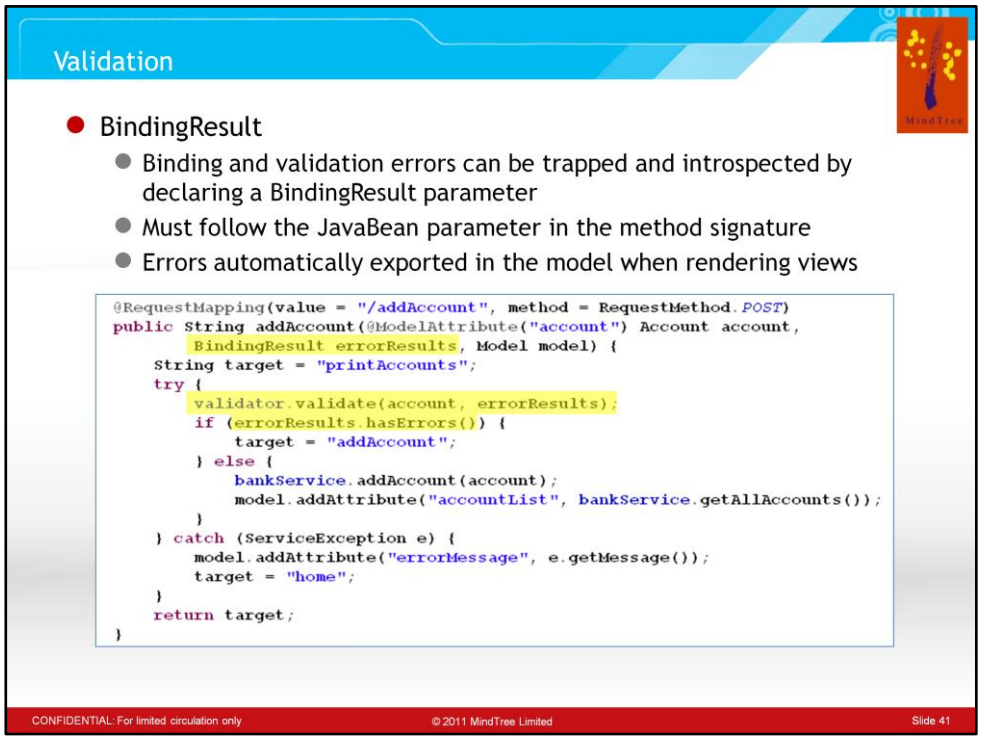
Parameters: errors Errors instance to register errors on

field - the field name to check

errorCode - error code, interpretable as message key

defaultMessage - fallback default message

Refer:
http://static.springsource.org/spring/docs/1.1.5/api/org/springframework/validation/ValidationUtils.html



All the validation errors for the model “account” will be stored in errorResults [BindingResults].

If errorResults contains any validation errors the user is redirect to the input page “addAccount.jsp”.

In “addAccount.jsp” errors are displayed using <form:errors path=*“propertyName" cssClass="errClass"/> example* <form:errors path=*"accountNumber" cssClass="errClass"/>.*

Note: It is important to note that the Errors or BindingResult parameters have to follow the model object that is being bound immediately as the method signature.

Example

- Code Example:
  - Refer: Spring3MVC_Hibernate_CRUD.zip
    - Illustrates integrating with Hibernate API
    - Illustrates using @ModelAttribute to map form request parameters to entity class
    - Illustrates using Spring validation framework: Validator interface, BindingResult interface to validate form data

Activity

- Activity 4
  - Modify Activity 3 to validate employee
    - Employee should be stored in the map data of EmployeeController only if valid data is entered.
    - Validation Rules:
      - Employee ID is required and should be numeric
      - Employee Name is required and minimum 3 digits
      - Salary is required and should be greater than zero.

Type Conversion

- **PropertyEditors**
  - The java.beans.PropertyEditor interface provides a means to customize how String values are mapped to non-String types.
  - java.beans.PropertyEditorSupport is a support class to help build property editors.
  - Some important methods which has to be overridden in our PropertyEditor class are listed below:

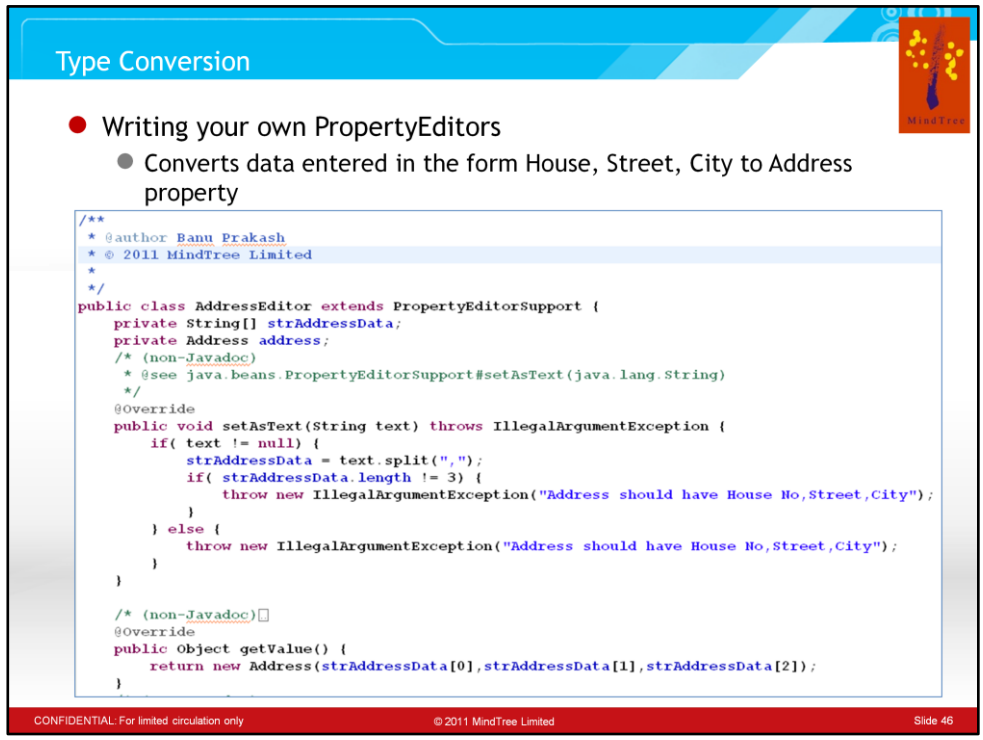
Method	Description
void setAsText(String text)	Sets the property value by parsing a given String
String getAsText()	Gets the property value as a string suitable for presentation to a human to edit
Object getAsValue()	Gets the value of the property.

Refer :http://download.oracle.com/javase/1.5.0/docs/api/java/beans/PropertyEditorSupport.html

Type Conversion

- Spring Framework comes with several custom editors based on PropertyEditorSupport.
  - For Example “CustomDateEditor” is used to set a java.util.Date property from a String using a custom java.text.DateFormat object.
- **In a web application data entered from form fields are of type String, If type conversion has to happen between the entered date in the String format to a java.util.Date, you need to register explicitly using WebDataBinder.**
- Annotating controller methods with @InitBinder allows you to configure web data binding directly within your controller class

```
@InitBinder
public void initBinder(WebDataBinder binder) {
    SimpleDateFormat dateFormat = new SimpleDateFormat("dd-MM-yyyy");
    binder.registerCustomEditor(Date.class, new CustomDateEditor(
            dateFormat, true));
}
```



Data entered as “house,street,city” will be passed as argument to setAsText(String text). The value returned from getValue() will be assigned to property of type Address

.

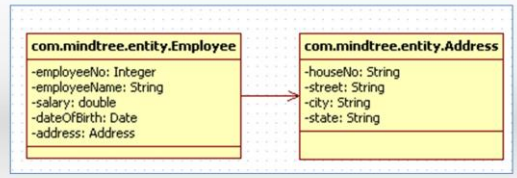
Example

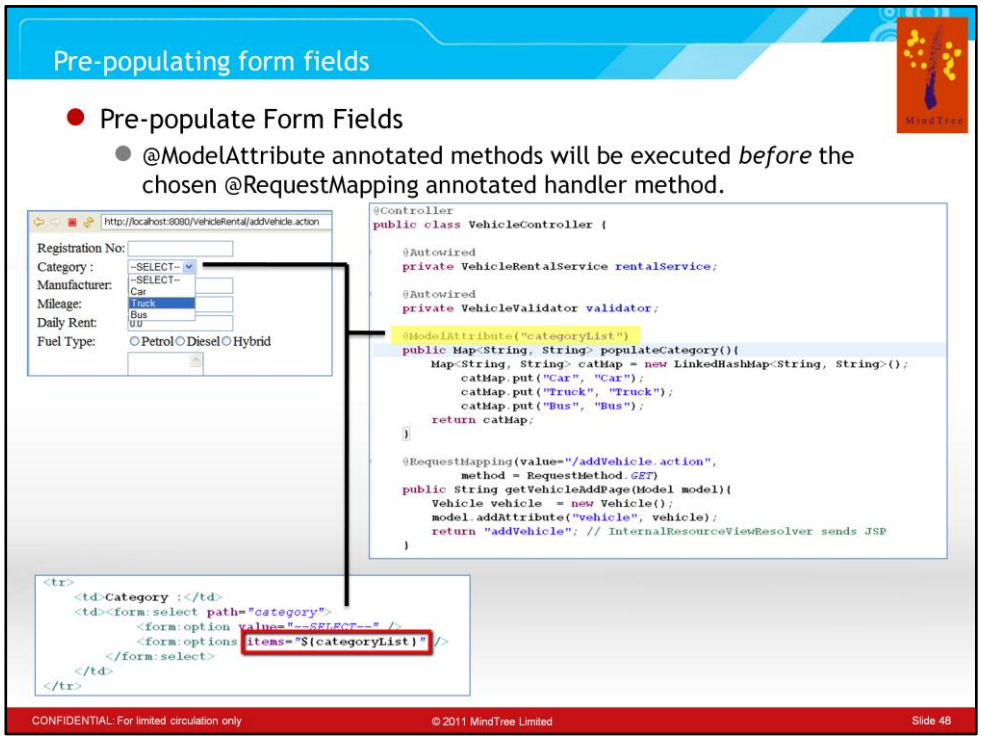
```
public class Customer {
        private String name;
        private Address address;
}
```

```
<bean id="customer" class="com.mindtree.entity.Customer">
        <property name="name" value="Banu Prakash" />
        <property name="address" value="No 5,Yelahanka new Town, Bangalore" />
</bean>
```

Activity

- Activity 5
  - Modify Activity 4.
    - The user interface should accept dateOfBirth and address. These data entered in form field are in the form of String data type.
    - Using WebDataBinder convert the data entered in form field for Date Of Birth to Date and data entered in address field to Address respectively.
    - Date is entered as dd-MMM-yyyy
      - Example: 10-JAN-1987
    - Address is entered in the form houseNo, street, city, state
      - Example: No: 5, I A Main Road, Yelahanka New town, Bangalore, Karnataka.





For the following Request “http://localhost:8080/VehicleRental/addVehicle.action” VehicleController’s GET @RequestMapping(value=“/addVehicle.action”, method=RequestMethod.GET) will be mapped. But before this method is invoked, it invokes all the methods annotated with @ModelAttribute for pre-populating the form fields.

Example

- Code Example:
  - Spring3MVC_Vehicle_Rental_App.zip
    - A Spring MVC web application which illustrates integration with Hibernate
    - Illustrates using Validators, ResourceMapping and populating form fields
    - Illustrates implementing Open Session In View Filter design pattern.

- Add a view to display all Categories and vehicles belonging to that category
  - Note: Do not use lazy loading, absorb the difference with and without OpenSesssionInViewFilter configuration.
- Add the following Validation
  - While renting a vehicle “Returned Date” should not be before the “Booked Date”.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References
Contains the reference that will supplement the self learning and will be needed for completing the assignments & practice questions
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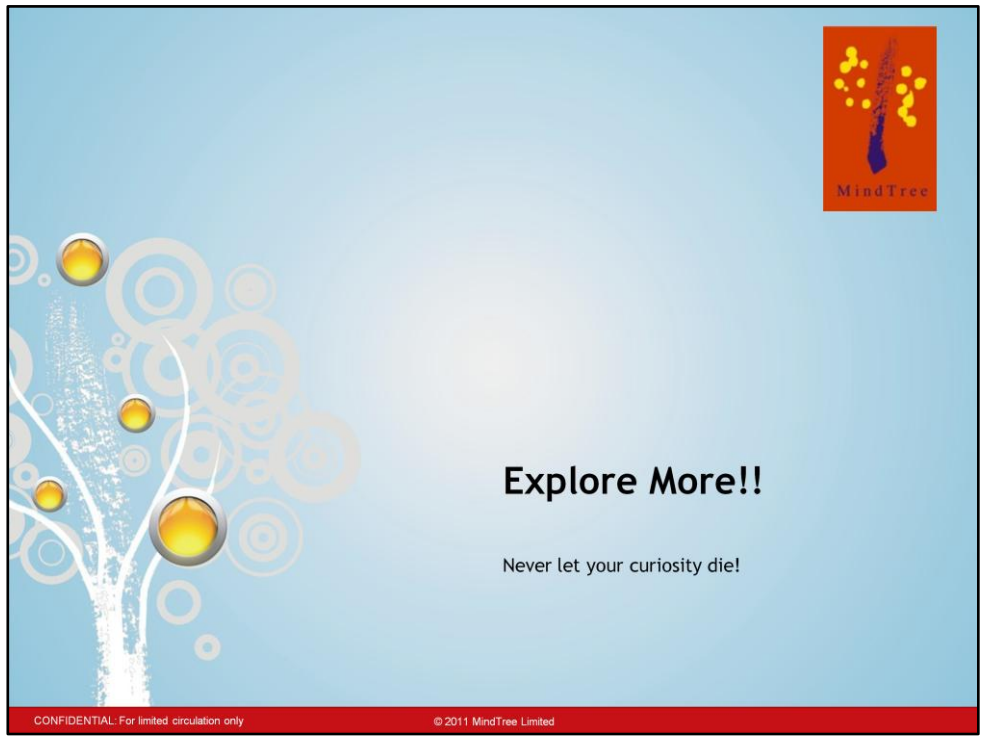
References

- Spring MVC Documentation:
  - http://static.springsource.org/spring/docs/3.0.x/spring-framework-reference/html/mvc.html
  - http://static.springsource.org/spring/docs/2.5.x/api/org/springframework/orm/hibernate3/support/OpenSessionInViewFilter.html
- Spring MVC Tutorial
  - http://www.mkyong.com/tutorials/spring-mvc-tutorials/
- Spring Form tags
  - http://static.springsource.org/spring/docs/2.0.x/reference/spring-form.tld.html
  - http://static.springsource.org/spring/docs/3.0.x/spring-framework-reference/html/view.html
  - http://www.vaannila.com/spring/spring-form-tags-1.html
- Spring Samples:
  - https://src.springframework.org/svn/spring-samples/
  - Refer: mvc-basic/ mvc-showcase/ petcare/ jpetstore/ mvc-ajax/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Explore more

- Session handling
  - http://static.springsource.org/spring/docs/2.5.x/api/org/springframework/web/bind/annotation/SessionAttributes.html
  - http://www.infoq.com/articles/spring-2.5-ii-spring-mvc
  - http://static.springsource.org/spring/docs/2.5.x/reference/mvc.html
- **Spring's multipart (file upload) support**
  - http://static.springsource.org/spring/docs/2.5.x/reference/mvc.html
- Internationalization
  - http://www.mkyong.com/spring-mvc/spring-mvc-internationalization-example/


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