Spring MVC

Trainer: Ly Quy Duong

Introduction

- Your role
- Your background and experience in the subject
- What do you want from this course

Course Objectives

- At the end of the course, you will have acquired sufficient knowledge to:
  - perform objective 1
  - perform objective 2

Agenda

- Section One
- Section Two
- Section Three
- Section Four
- Section Five
- Section Six
- Section Seven

Course Audience and Prerequisite

- The course is for <whom>
- The following are prerequisites to <course>:
  - <knowledge>
  - <experiences>
  - <course>
  - …

Assessment Disciplines

- Class Participation: <%>
- Assignment: <%>
- Final Exam: <%>
- Passing Scores: <%>

Duration and Course Timetable

- Course Duration: <hrs>
- Course Timetable:
  - From <time> to <time>
  - Break <x> minutes from <time> to <time>

Further References

- <Source 1>
- <Source 2>
- …

Set Up Environment

- To complete the course, your PC must install:
  - Software 1
  - Software 2
  - …

Course Administration

- In order to complete the course you must:
  - Sign in the Class Attendance List
  - Participate in the course
  - Provide your feedback in the End of Course Evaluation

August 16, 2017

Spring MVC

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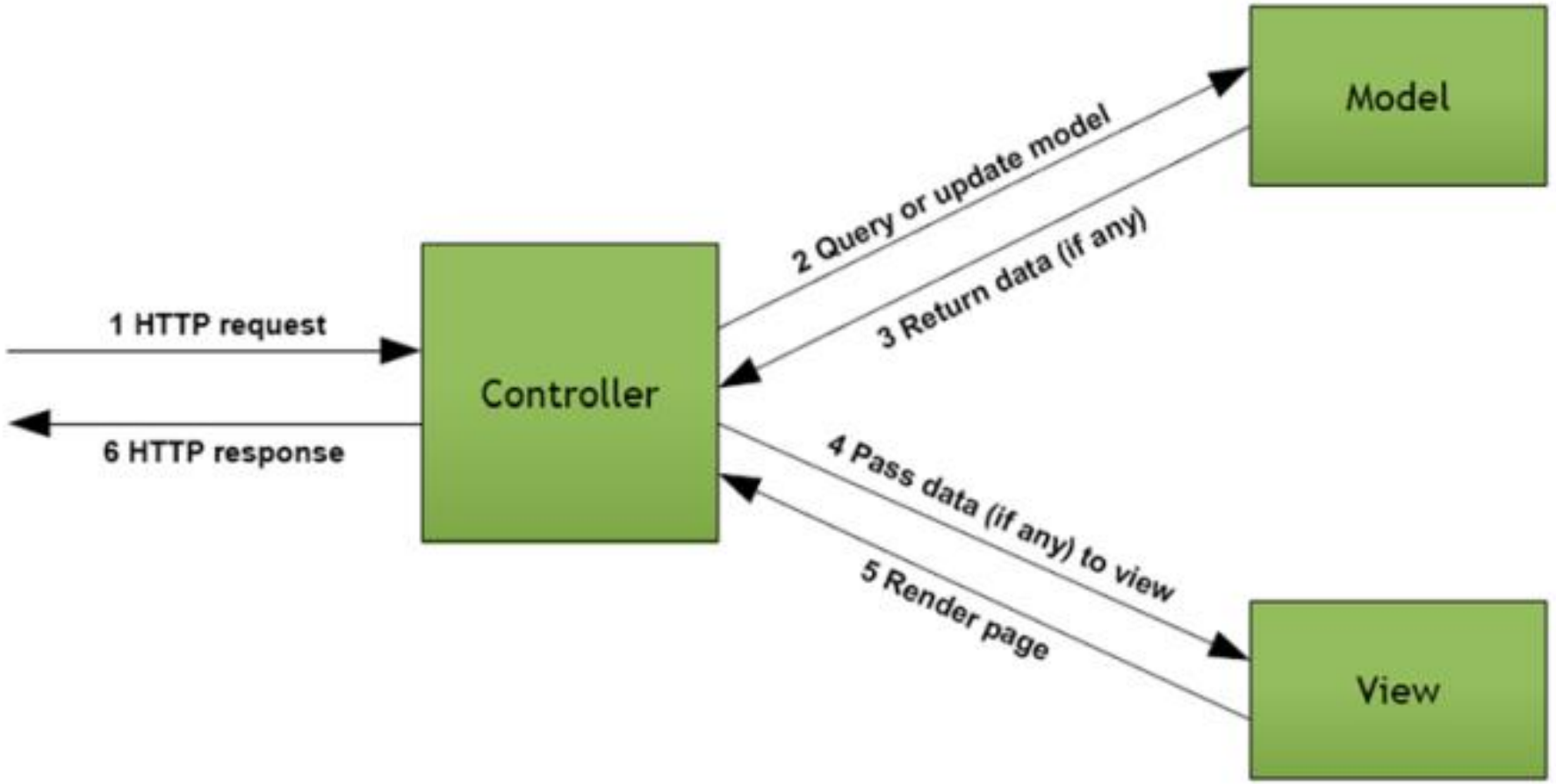
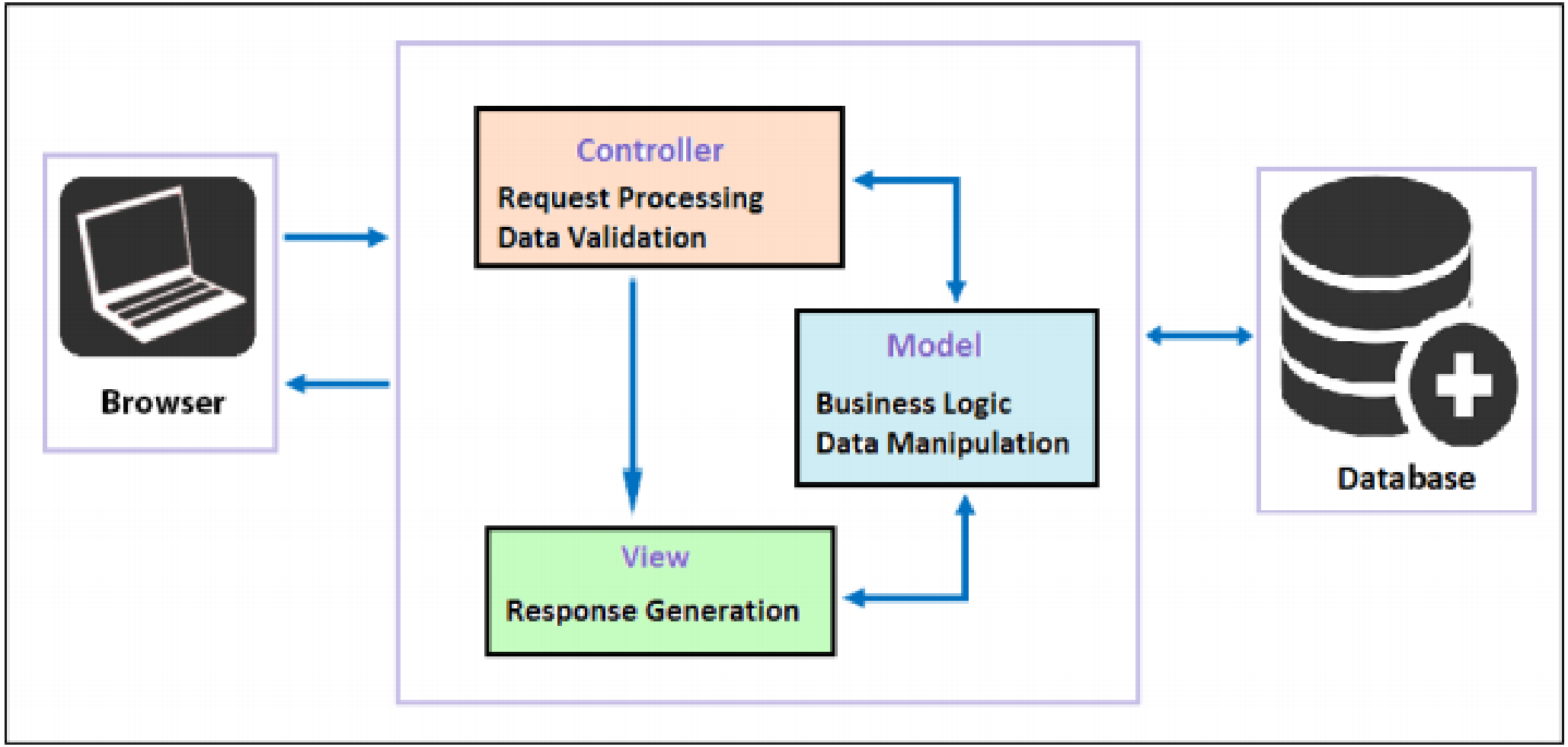
Model-View-Controller (MVC) Design Pattern

- MVC is an architectural pattern used in the development of web applications
- Separate your business services and domain objects (the model) from the UI (the view) and mediate their interaction through one or more controllers.
- To be able to modify your UI without having to change your business logic and domain objects

Model-View-Controller (MVC) Design Pattern



Model-View-Controller (MVC) Design Pattern



Model

- The Model represents the business entity on which the application's data is stored
- It is the conceptualization of the objects that the user works with and the mapping of those concepts into data structures: the user model and data model.

View

- The View is responsible for preparing the presentation for the client based on the outcome of the request processing, without including any business logic
- It renders the model data into the client's user interface type

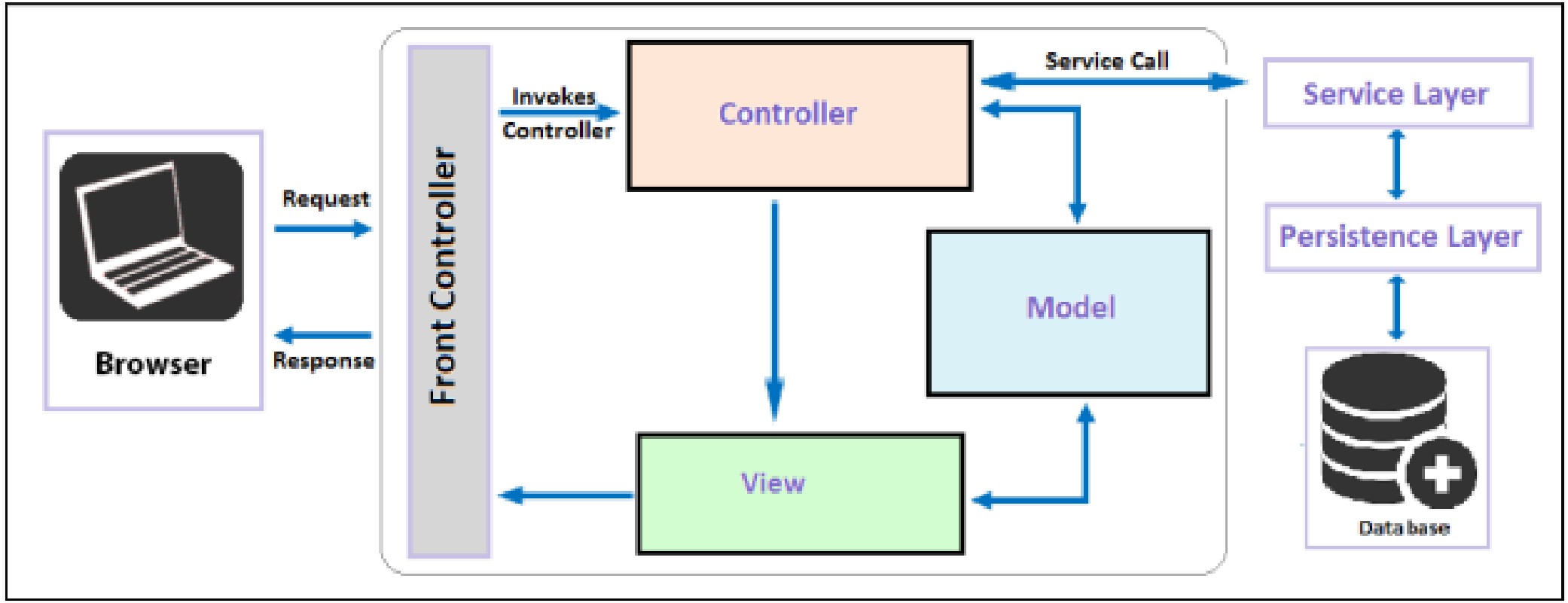
Controller

- The Controller is responsible for controlling the flow request to response flow in the middleware
- It invokes backend services for businesses after receiving a request from the user, and updates the model
- It prepares models for the View to present.
- It is also responsible for determining which view should be rendered.

Front Controller Design Pattern

- The Front Controller is used at the initial point of contact to handle all Hyper Text Transfer Protocol (HTTP) requests
- It enables us to centralize logic to avoid duplicate code, and manages the key HTTP request-handling activities
- The Front Controller design pattern enables centralizing the handling of all HTTP requests without limiting the number of handlers in the system.

Front Controller Design Pattern



Spring MVC

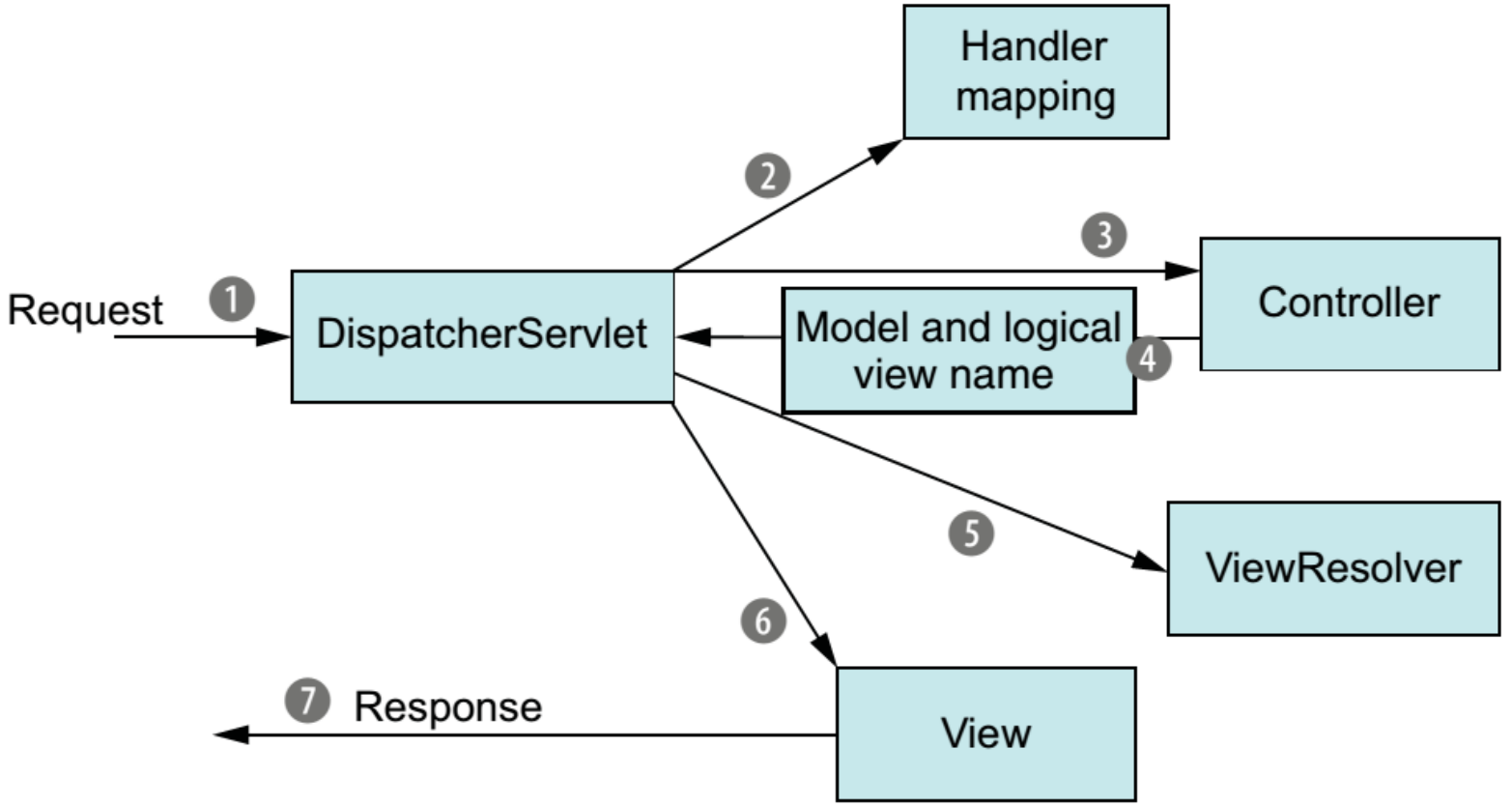
- A web framework built on the principles of the Spring Framework
- Spring’s web framework is designed to address these concerns (state management, workflow, and validation)
- The Spring MVC framework is implemented using standard Java technologies such as Java, Servlet, and JSP

Features of the Spring MVC framework

- Powerful configuration of framework and application classes
- It allows easier testing
- It allows separation of roles. Each component of a Spring MVC framework performs a different role during request handling (Controller, Validator, Model Object, View Resolver, and HandlerMapping interfaces)
- No need for the duplication of code
- It allows specific validation and binding

Flow of request handling in Spring MVC

- Spring moves requests between a dispatcher servlet, handler mappings, controllers, and view resolvers.



DispatcherServlet

- A single front controller servlet.
- The Servlet intercepts and analyzes the incoming HTTP request and dispatches them to the appropriate controller to be processed.
- It is configured in the web.xml file of any web application

Handler mapping

- This maps the HTTP request to the handler, that is, a method within a Spring MVC controller class, based on the HTTP paths expressed through the @RequestMapping annotation at the method or type level within the controller class

Controller

- A **controller** is a Spring component that processes the request
- The Controller in Spring MVC receives requests from the DispatcherServlet class and performs some business logic in accordance with the client.
- Package up the model data and identify the name of a view that should render the output

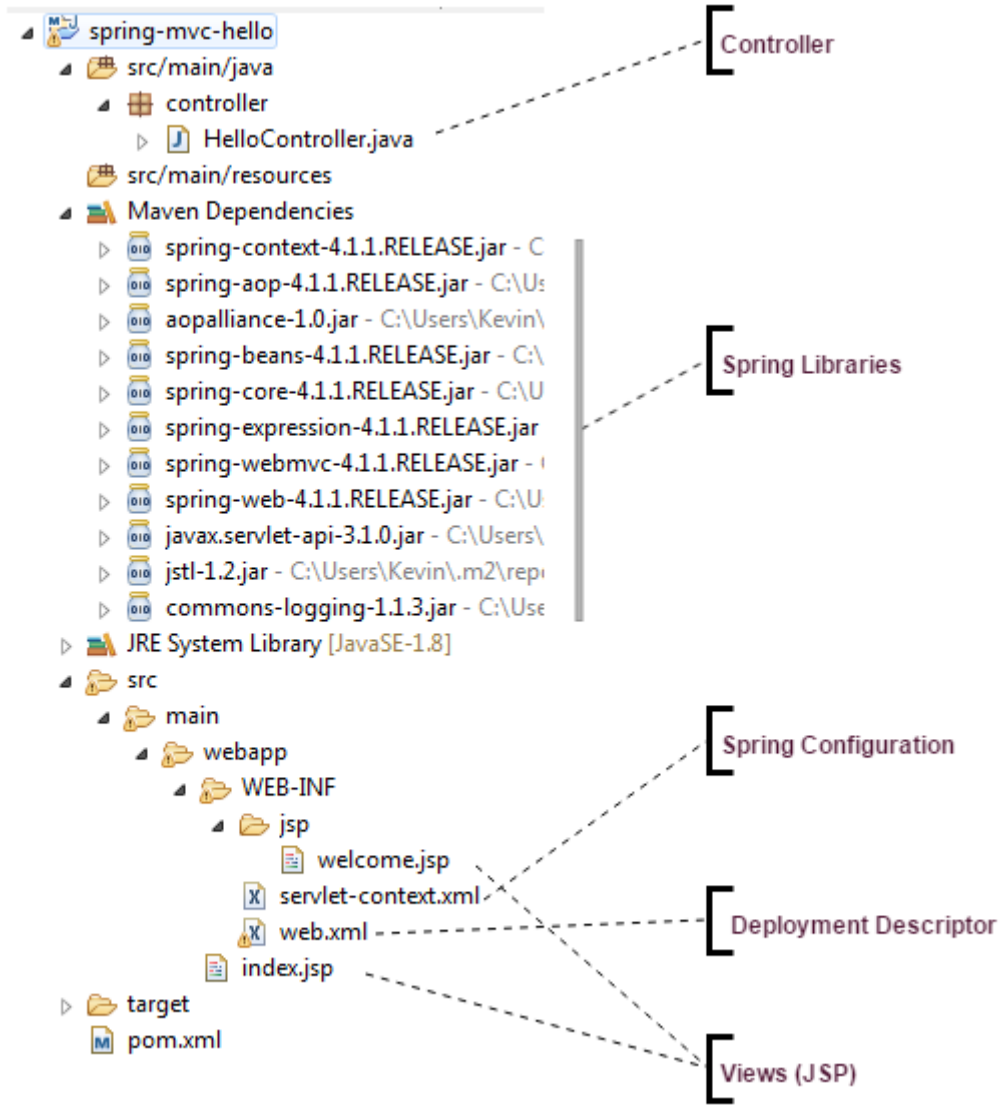
ViewResolver

- The ViewResolver interface of Spring MVC supports view resolution based on the view name returned by controller
  - The URLBasedViewResolver class supports the direct resolution of view name to URLs.
  - The ContentNegotiatingViewResolver class supports the dynamic resolution of views based on the media type supported by the client, such as PDF, XML, JSON , and so on

View

- The View components are user-interface elements which are responsible for displaying the output of a Spring MVC application.

Spring MVC Sample



Controller

```java
@Controller
public class HelloController {

    @RequestMapping("/welcome")
    public String sayHello(ModelMap model){
        String message = "Welcome to Spring MVC.!";

        model.addAttribute("message", message);

        return "welcome";
    }
}
```

Spring Configuration

```
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:mvc="http://www.springframework.org/schema/mvc"
    xmlns:context="http://www.springframework.org/schema/context"
    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
        http://www.springframework.org/schema/mvc
        http://www.springframework.org/schema/mvc/spring-mvc.xsd
        http://www.springframework.org/schema/context
        http://www.springframework.org/schema/context/spring-context.xsd">

    <context:component-scan base-package="controller" />

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

</beans>
```

Deployment Descriptor

```
<servlet>
    <servlet-name>appServlet</servlet-name>
    <servlet-class>org.springframework.web.servlet.DispatcherServlet
    </servlet-class>
    <init-param>
        <param-name>contextConfigLocation</param-name>
        <param-value>/WEB-INF/servlet-context.xml</param-value>
    </init-param>
    <load-on-startup>1</load-on-startup>
</servlet>

<servlet-mapping>
    <servlet-name>appServlet</servlet-name>
    <url-pattern>/welcome.jsp</url-pattern>
    <url-pattern>/welcome.html</url-pattern>
    <url-pattern>*.html</url-pattern>
</servlet-mapping>
```

@Controller annotation

- The @Controller annotation is used to define a class as a controller class without inheriting any interface or class

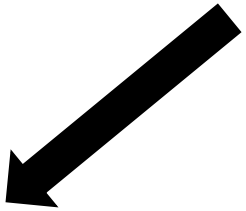
```
@Controller
public class HelloController {

    //....
```

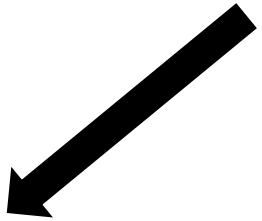
```
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:mvc="http://www.springframework.org/schema/mvc"
    xmlns:context="http://www.springframework.org/schema/context"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="
        http://www.springframework.org/schema/beans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

    <context:component-scan base-package="controller" />
```

@RequestMapping annotation

- The web request in Spring MVC is mapped to handlers by one or more @RequestMapping annotations declared in the controller class

http://localhost:8080/spring-mvc-hello/welcome.html





/spring-mvc-hello

/welcome.html

```
@RequestMapping("/welcome")
public String sayHello(ModelMap model){
```

@RequestMapping - Mapping requests at the class level

```
@Controller
@RequestMapping(value = "/employee")
public class EmployeeController {

    @RequestMapping("/add")
    public String addEmployee (Model model) {
       model.addAttribute("employee", new Employee());
       model.addAttribute("empList", employeeService.list());

       return "employeeList";
    }
...
}
```

http://localhost:8080/spring-mvc/employee/add

@RequestMapping - Mapping requests at the class level

```
@Controller
@RequestMapping(value = "/employee")
public class EmployeeController {

    @RequestMapping(value = {"/remove", "/delete"}",
                            method = RequestMethod.GET)
     public String removeEmployee (
                (@RequestParam("employeeId") int employeeId){

        employeeService.removeEmployee(employeeId);
        return "redirect:";
     }
...
}
```

http://localhost:8080/spring-mvc/employee/remove

http://localhost:8080/spring-mvc/employee/delete

@RequestMapping - Mapping requests at the class level

```
@Controller
@RequestMapping(value = "/employee")
public class EmployeeController {

    @RequestMapping(value = "/{employeeId}",
                                    method = RequestMethod.GET)
    public String getEmployee (
                @PathVariable("employeeId")Integer employeeId,
                Model model){
        //...
        return "employeeList";
    }

...
}
```

http://localhost:8080/spring-mvc/employee/10121

@RequestParam

- It can be used to bind the HTTP request parameter to the argument of the controller method
- Its functionality is similar to ServletRequest.getParameter(java.lang.String)

```
@RequestMapping(value = {"/remove", "/delete"}",
                                method = RequestMethod.GET)
 public String removeEmployee (
                (@RequestParam("employeeId") int employeeId){

    employeeService.removeEmployee(employeeId);
    return "redirect:";
 }
```

Return values in @RequestMapping annotated methods

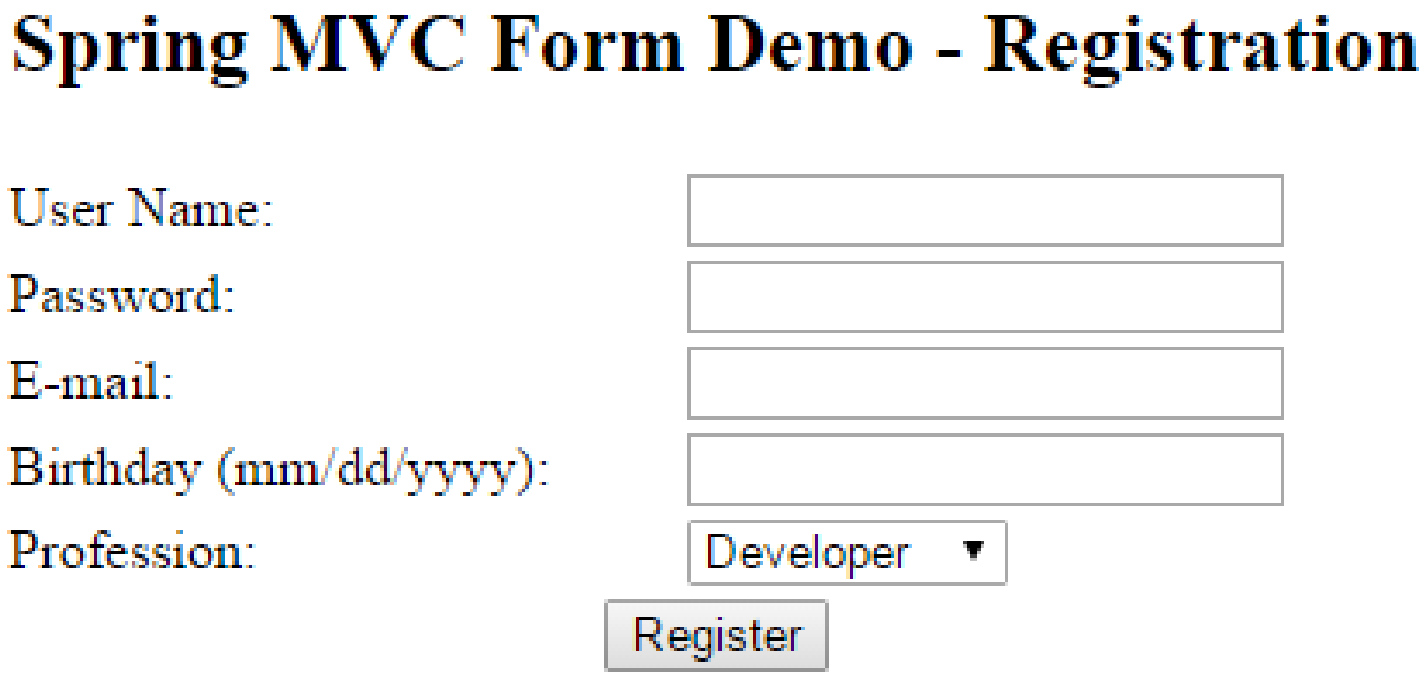
Return type	Description
`ModelAndView`	This holds Model and View information
`String`	This represents the View name
`View`	This represents the View object
`Model/Map`	This contains data exposed by a view; view is determined implicitly by the `RequestToViewNameTranslator` class
`Void`	This specifies that a view can be handled by the invoked method internally or can be determined implicitly by the `RequestToViewNameTranslator` class

ViewResolver in Spring MVC

- Spring provides a number of ViewResolver classes that are configured in the XML files

ViewResolver	Description
`org.springframework.web.servlet.view.ResourceBundleViewResolver`	This configures view names in property files; the default resource bundle is properties
`org.springframework.web.servlet.view.InternalResourceViewResolver`	This refers to a convenient `ViewResolver` class that uses suffix and prefix properties for the view name and `RequestDispatcher` to transfer the control
`org.springframework.web.servlet.view.Freemarker.FreeMarkerViewResolver`	This maps the view name with the `FreemarkerView` class, which is used for the FreeMarker template engine
`org.springframework.web.servlet.view.velocity.VelocityViewResolver`	This maps the view name with the `VelocityView` class, which is used for the Velocity template engine

Spring MVC Form



Spring MVC Form

```
<%@ taglib prefix="form" uri="http://www.springframework.org/tags/form"%>


<form:form action="register" method="post" commandName="userForm">
    <table border="0">
        <tr>..
        <tr>
            <td>User Name:</td>
            <td><form:input path="username" /></td>
        </tr>
        <tr>
            <td>Password:</td>
            <td><form:password path="password" /></td>
        </tr>
        <tr>..
        <tr>
            <td>Birthday (mm/dd/yyyy):</td>
            <td><form:input path="birthDate" /></td>
        </tr>
        <tr>
            <td>Profession:</td>
            <td><form:select path="profession" items="${professionList}" /></td>
        </tr>
        <tr>
            <td colspan="2" align="center"><input type="submit" value="Register" /></td>
        </tr>
    </table>
</form:form>
```

Spring MVC Form

```java
@Controller
@RequestMapping(value = "/register")
public class RegisterController {

    @RequestMapping(method = RequestMethod.GET)
    public String viewRegistration(Map<String, Object> model) {
        User userForm = new User();
        model.put("userForm", userForm);

        List<String> professionList = new ArrayList<>();
        professionList.add("Developer");
        professionList.add("Designer");
        professionList.add("IT Manager");
        model.put("professionList", professionList);

        return "Registration";
    }

    @RequestMapping(method = RequestMethod.POST)
    public String processRegistration(@ModelAttribute("userForm") User user, Map<String, Object> model) {

        System.out.println(user.toString());

        return "RegistrationSuccess";
    }
}
```

@ModelAttribute in the controller class

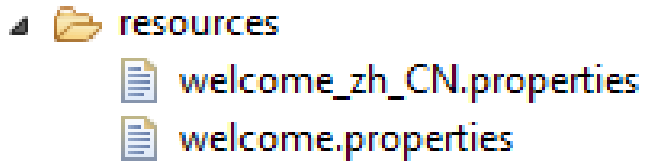
- The org.springframework.web.bind.annotation.ModelAttribute in Spring MVC is used to an annotation for the handler method or method arguments in the controller class
- The @ModelAttribute annotation binds a named model attribute to any arguments in a method or to the method itself

Spring MVC internationalization (i18n)

- Spring Configuration

```
<bean id="messageSource"
    class="org.springframework.context.support.ResourceBundleMessageSource">
    <property name="basename" value="welcome" />
</bean>
```

- Resource Bundle Files



- Using on JSP

```
<spring:message code="welcome.springmvc" text="default text" />
```

Spring MVC internationalization (i18n)

- ReloadableResourceBundleMessageSource
  - Reloading properties file without restarting the JVM

```
<bean id="messageSource"
    class="org.springframework.context.support.ReloadableResourceBundleMessageSource">
    <property name="basename" value="welcome" />
    <property name="defaultEncoding" value="UTF-8" />
</bean>
```

Spring MVC internationalization (i18n)

- SessionLocaleResolver
  - SessionLocaleResolver resolves locales by inspecting a predefined attribute in a user's session.
  - If the session attribute doesn't exist, this locale resolver determines the default locale from the accept-language HTTP header

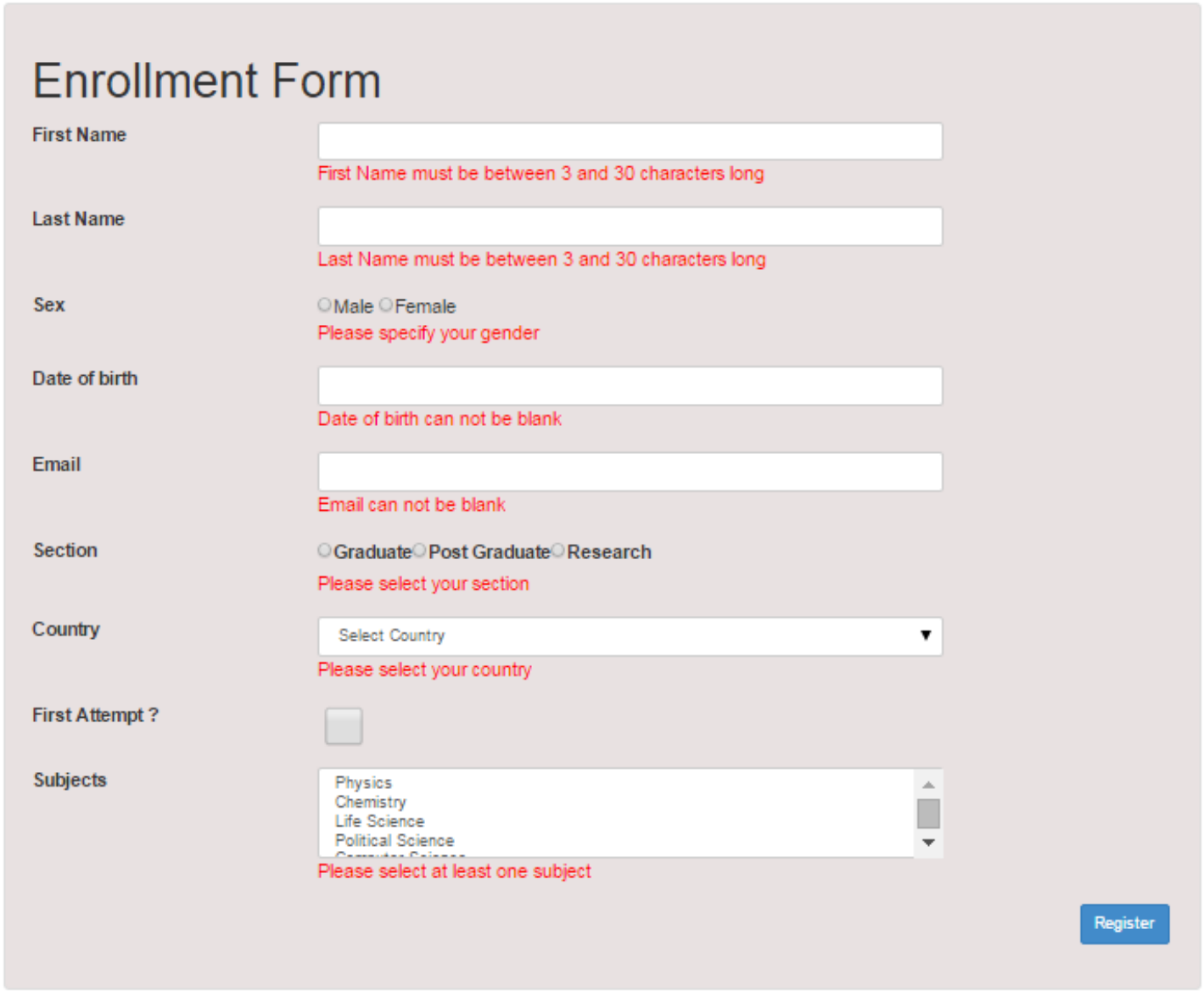
```
<bean id="localeResolver" class="org.springframework.web.servlet.i18n.SessionLocaleResolver">
    <property name="defaultLocale" value="en" />
</bean>
```

Spring MVC internationalization (i18n)

- LocaleChangeInterceptor
  - LocaleChangeInterceptor interceptor detects if a special parameter is present in the current HTTP request.
  - The parameter name can be customized with the paramName property of this interceptor.
  - If such a parameter is present in the current request, this interceptor changes the user's locale according to the parameter value.

```
<bean id="localeChangeInterceptor" class="org.springframework.web.servlet.i18n.LocaleChangeInterceptor">
    <property name="paramName" value="lang" />
</bean>

<bean class="org.springframework.web.servlet.mvc.annotation.DefaultAnnotationHandlerMapping">
    <property name="interceptors">
        <list>
            <ref bean="localeChangeInterceptor" />
        </list>
    </property>
</bean>
```

Spring MVC Form Validation Using Hibernate Validators



Spring MVC Form Validation Using Hibernate Validators

```
public class Student implements Serializable {

    @Size(min=3, max=30)
    private String firstName;

    @Size(min=3, max=30)
    private String lastName;

    @NotEmpty
    private String sex;

    @DateTimeFormat(pattern="dd/MM/yyyy")
    @Past @NotNull
    private Date dob;

    @Email @NotEmpty
    private String email;

    @NotEmpty
    private String section;

    @NotEmpty
    private String country;

    private boolean firstAttempt;

    @NotEmpty
    private List<String> subjects = new ArrayList<String>();
```

Spring MVC Form Validation Using Hibernate Validators

- Controller

```
/*
 * This method will be called on form submission, handling POST request It
 * also validates the user input
 */
@RequestMapping(method = RequestMethod.POST)
public String saveRegistration(@Valid Student student, BindingResult result, ModelMap model) {

    if (result.hasErrors()) {
        return "enroll";
    }
```

Spring MVC Form Validation Using Hibernate Validators

```
Size.student.firstName=First Name must be between {2} and {1} characters long
Size.student.lastName=Last Name must be between {2} and {1} characters long
NotEmpty.student.sex=Please specify your gender
NotNull.student.dob=Date of birth can not be blank
Past.student.dob=Date of birth must be in the past
Email.student.email=Please provide a valid Email address
NotEmpty.student.email=Email can not be blank
NotEmpty.student.country=Please select your country
NotEmpty.student.section=Please select your section
NotEmpty.student.subjects=Please select at least one subject
```

@SessionAttributes

- It’s a way to add objects to Session
- @SessionAttributes is used in conjunction with @ModelAttribute

```
@Controller
@RequestMapping("/")
@SessionAttributes({"cart"})
public class ProductController {

    @RequestMapping(method = RequestMethod.GET)
    public String get(Model model) {
        if (!model.containsAttribute("cart")) {
            model.addAttribute("cart", new ArrayList<Product>());
        }
```

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RESTful Web Service - Spring

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RESTful Web Service - Spring

- What is REST?
- REST Concepts
- RESTful Architecture Design
- Spring @MVC
- Implement REST api using Spring @MVC

What is REST?

- Representational State Transfer
- Term coined up by Roy Fielding
  - Author of HTTP spec
- Architectural style
- Architectural basis for HTTP
  - Defined a posteriori

Core REST Concepts

- Identifiable Resources
- Uniform interface
- Stateless conversation
- Resource representations
- Hypermedia

Identifiable Resources

- Everything is a resource
  - Customer
  - Order
  - Catalog Item
- Resources are accessed by URIs

Uniform interface

- Interact with Resource using single, fixed
- interface
- **GET /orders** - fetch list of orders
- **GET /orders/1** - fetch order with id 1
- **POST /orders** – create new order
- **PUT /orders/1** – update order with id 1
- **DELETE /orders/1** – delete order with id 1
- **GET /customers/1/order** – all orders for customer with id 1

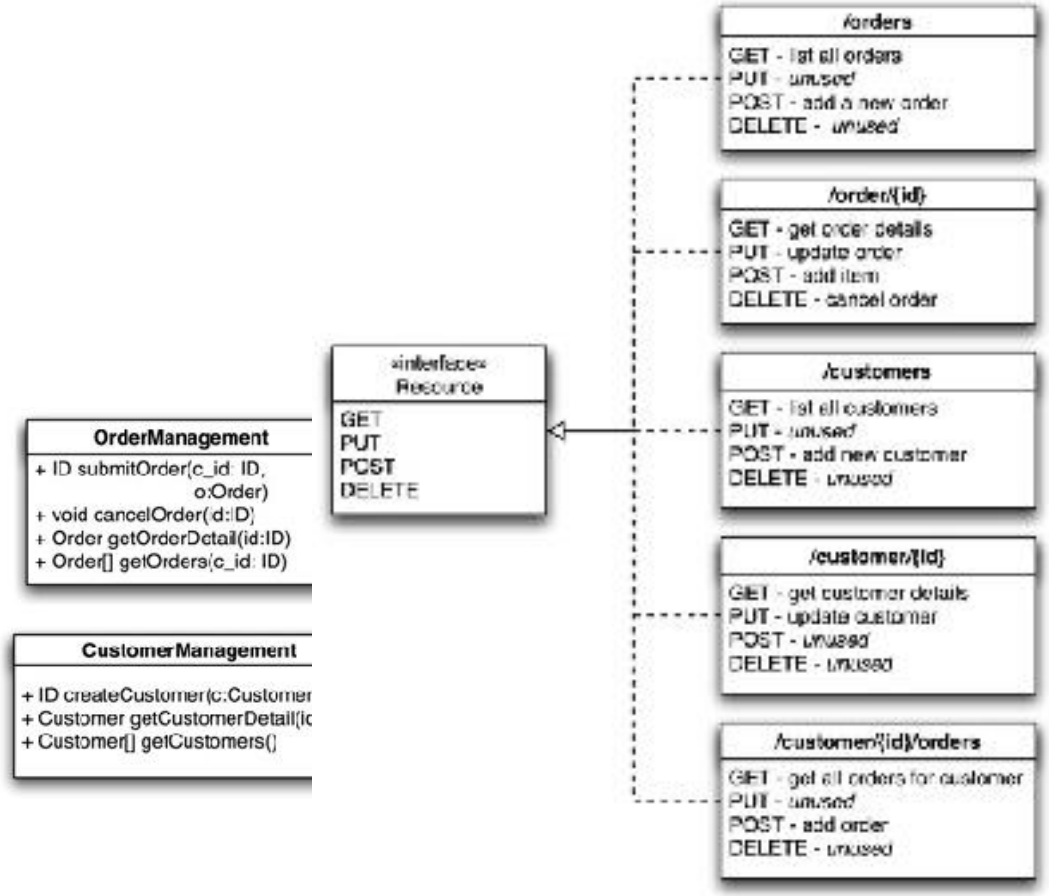
Resource representations

- More that one representation possible
  - text/html, image/gif, application/pdf
- Desired representation set in Accept HTTP header
  - Or file extension
- Delivered representation show in Content-Type
- Access resources through representation
- Prefer well-known media types

Stateless conversation

- Server does not maintain state
  - Don’t use the Session!
- Client maintains state through links
- Very scalable
- Enforces loose coupling (no shared session knowledge)

RESTful Architecture



RESTful application design

- Identify resources
  - Design URIs
- Select representations
  - Or create new ones
- Identify method semantics
- Select response codes

Spring @MVC

```
@Controller
public class AccountController {
        @Autowired AccountService accountService;

        @RequestMapping("/details")
        public String details(@RequestParam("id")Long id,
                              Model model) {
                Account account = accountService.findAccount(id);
                model.addAttribute(account);
                return "account/details";
        }
}

account/details.jsp
        <h1>Account Details</h1>
        <p>Name :  ${account.name}</p>
        <p>Balance :  ${account.balance}</p>

../details?id=1
```

RESTful support in Spring 3.0

- Extends Spring @MVC to handle URL templates - @PathVariable
- Leverages Spring OXM module to provide marshalling / unmarshalling (castor, xstream, jaxb etc)
- @RequestBody – extract request body to method parameter
- @ResponseBody – render return value to response body using converter – no views required

REST controller

```
@Controller public class AccountController {

        @RequestMapping(value="/accounts",method=RequestMethod.GET)
        @ResponseBody  public AccountList getAllAcccount() {
        }

        @RequestMapping(value="/accounts/${id}",method=RequestMethod.GET)
        @ResponseBody public Account getAcccount(@PathVariable("id")Long id) {
        }

        @RequestMapping(value="/accounts/",method=RequestMethod.POST)
        @ResponseBody public Long createAcccount(@RequestBody Account account) {
        }

        @RequestMapping(value="/accounts/${id}",method=RequestMethod.PUT)
        @ResponseBody public Account updateAcccount(@PathVariable("id")Long id, @RequestBody Account account) {
        }

        @RequestMapping(value="/accounts/${id}",method=RequestMethod.DELETE)
        @ResponseBody public void deleteAcccount(@PathVariable("id")Long id) {
        }
}
```

Invoke REST services

- The new RestTemplate class provides clientside invocation of a RESTful web-service

HTTP Method	RestTemplate Method
DELETE	delete(String url, String... urlVariables)
GET	getForObject(String url, Class<t> responseType, String … urlVariables)
HEAD	headForHeaders(String url, String… urlVariables)
OPTIONS	optionsForAllow(String url, String… urlVariables)
POST	postForLocation(String url, Object request, String… urlVariables)
PUT	put(String url, Object request, String…urlVariables)

Points to Remember

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Questions & Answer

Thank You !

Revision History

Date	Version	Description	Updated by	Reviewed and Approved By
12/13/2015	1.0	Initial Document • Front Controller Design Pattern • Spring MVC • Spring MVC Form	Kien Tran	
Dec 2016	1.1	Add • RESTful Web Service - Spring	Duong Ly	
Aug 2017	2.0	Retheme with DXC template		Quang Tran