Introduction to Spring MVC Framework

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What is MVC?

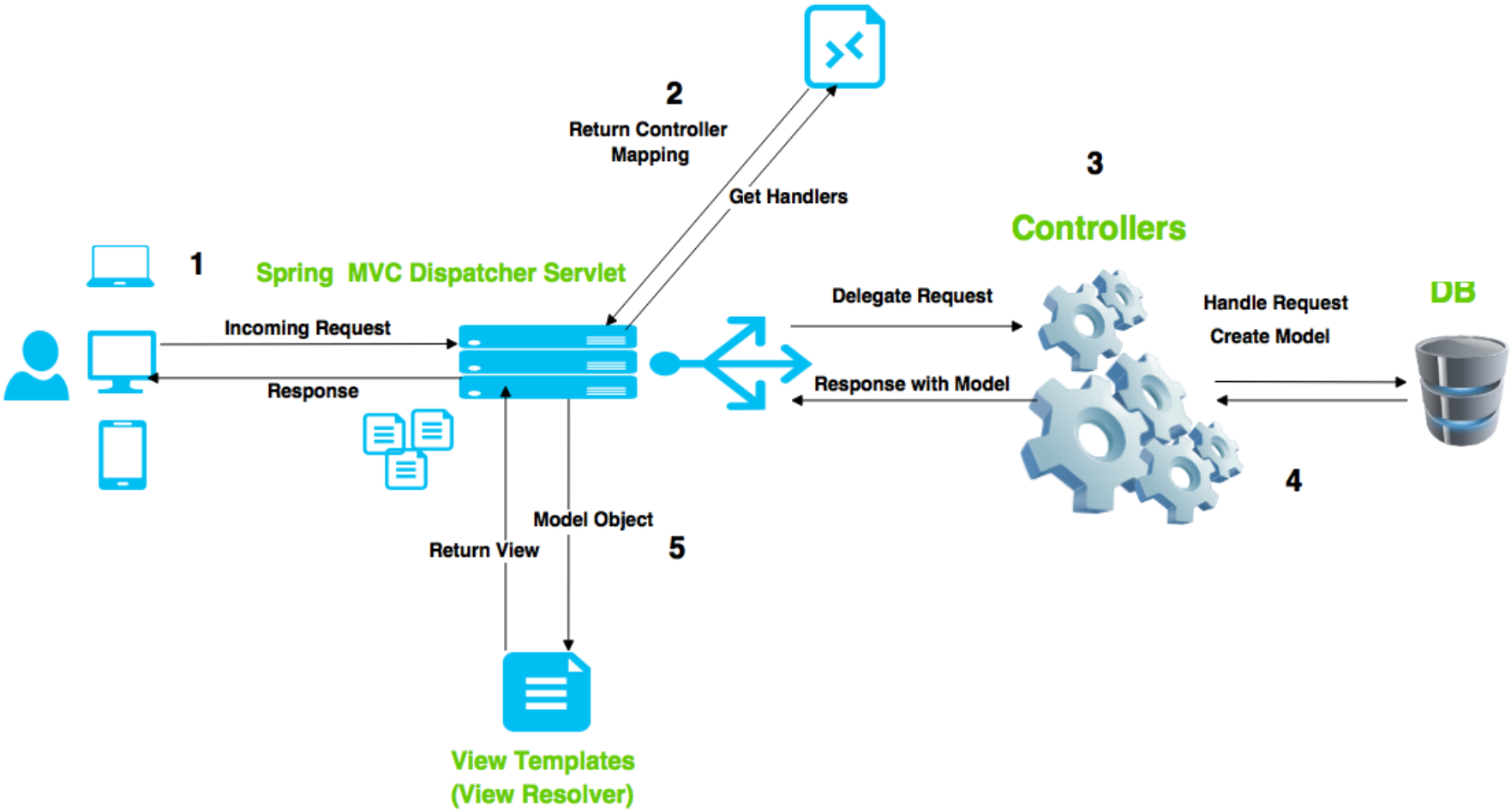
- **MVC** stands for **Model View Controller (architecture)**
  MCV đại diện cho ... (kiến trúc)
- It is a design pattern used in WEB based **JAVA Enterprise Applications** nó là một design pattern sử dụng trong ứng dụng web java enterprise
- **MVC pattern** is also implemented in other WEB frameworks as well for separating the model layer from view layer. By doing that UI programmers and back end developers can work together.
- **Model Layer** includes business specific logic
- **View Layer** is responsible for rendering(displaying) model objects inside the user interface using different view technogies (JSP, Facelets or Velocity) (browser)
- **Controller** receives user inputs and calls model objects based on handler mappings and pass model objects to views in order to display output inside the view layer.

What is Dependency Injection?

https://toidicodedao.com/2015/11/03/dependency-injection-va-inversion-of-control-phan-1-dinh-nghia/

- This is also called as **IOC (Inversion of Control Principle)**
- It is a **software design pattern** which is really useful for designing loosely coupled software components
  là một dspartern mà hữu ích cho việc thiết kế phần mềm, giảm sự kết dính giữa các module
- You will have more **plug-gable** and testable code and objects
  tính dễ chỉnh sửa, test code và các đối tượng
- It is easy to **reuse** your code in other applications
  dễ dàng tái sử dụng trong ứng dụng khác
- The dependencies won't be hard coded inside all java objects/ classes instead they will be defined in **XML configuration files** or configuration classes (**Java Config**)
  giảm bớt sự phụ thuộc vào java code, thay vào đó là định nghĩa trong file cấu hình xml hoặc những class cấu hình java config
- Spring Container is responsible for injecting dependencies of objects
  chịu trách nhiệm cho các đối tượng phụ tuộc injecting
- There are two types of **Dependency injection** in Spring Framework Setter Injection and Constructor Injection

Request Processing Workflow in Spring MVC

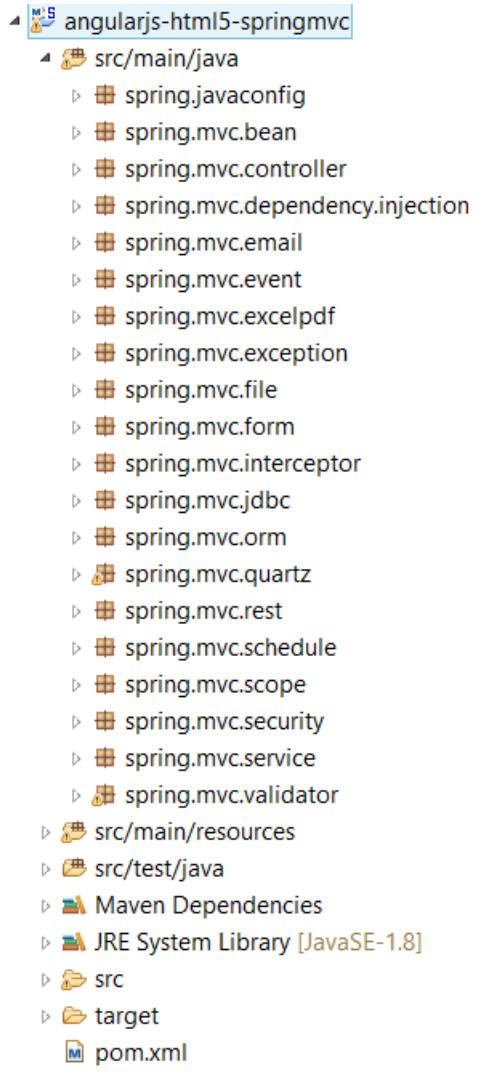


The general information about web.xml and Java EE

- The **WEB-INF/web.xml** is the Web Application Deployment Descriptor of Java Enterprise Web applications/
- Inside **web.xml**, developers can define

  Servlets,
  Welcome File List
  Filters,
  Context parameters,
  Error pages
  Security rights and etc.

The general information about the sample web application



- **Apache Maven Project**
- **Pivotal tc server**
- **Java Spring MVC 4.x version**

What is the concept of DispatcherServlet and how do you configure it?

được cấu hình để gửi htp request đi và nhận về kết quả từ trình duyệt

- **DispatcherServlet** is configured in order to dispatch in-coming HTTP request to handlers and returns response to browsers
- **Spring MVC** is designed around **DispatcherServlet**
- **DispatcherServlet** is configured in web.xml file

```
<servlet>
     <servlet-name>dispatcherServlet</servlet-name>
     <servlet-class>org.springframework.web.servlet.DispatcherServlet</servlet-
class>
     <init-param>
          <param-name>contextConfigLocation</param-name>
          <param-value>/WEB-INF/classes/mvc-config.xml</param-value>
     </init-param>
     <load-on-startup>1</load-on-startup>
</servlet>
<servlet-mapping>
     <servlet-name>dispatcherServlet</servlet-name>
     <url-pattern>/</url-pattern>
</servlet-mapping>
```

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What is ContextLoaderListener and how do you configure it in Spring MVC?

- **ContextLoaderListener** is responsible for creating a root application context in Java Enterprise Web application inside **ServletContext**
- Developers can use different controller and view layers (For example Struts, JSF or Spring MVC can be used) however **Spring Framework** will be responsible for managing services layer or components defined ContextLoaderListener configuration files
- You can set different configuration XML files in web.xml

  http://docs.spring.io/spring/docs/2.5.x/reference/mvc.html#mvc-servlet

How do you configure controllers in Spring MVC?

- By extending **AbstractController** class and implementing **handleRequestInternal** method
- By using **@Controller** or **@RestController** annotation on class level
- Controller with bean name **URL mapping**
- Controller with **class name** mapping
- Controller with **XML config with mappings**

How is an incoming request mapped to a mapped to a method in Spring MVC?

- **@RequestMapping** is used in order to map incoming request to a controller using URL matching
- **@RequestParam** and **@PathVariable** is used to get parameters or variable from HTTP request

```
@RequestMapping(value = "/jdbcDelete/user/{iduser}",
method=RequestMethod.GET)
public ModelAndView jdbcDelete(@PathVariable(value="iduser")
int iduser) {
```

```
@RequestMapping(value="/register", method=RequestMethod.POST)
public ModelAndView register(@RequestParam(required=true)
String email,@RequestParam(required=true) String password)
```

What is a View in Spring MVC? How is the InternalResourceViewResolver configured?

- **Java Spring MVC** can be configured with different view technologies such as Java Server Faces, JSP, Velocity etc.
- **Views** are responsible for displaying the content of Model objects on browsers as response output
- **InternalResourceViewResolver** is used to resolve the correct view based on suffix and prefixes so the correct output (view) is resolved based on strings

Return types from Controllers

You can return the followings from Controllers

- **ModelAndView**
- **Model**
- **Map**
- **View**
- **String**
- **void**
- **HttpHeaders and others**

Scopes in Spring MVC

- Default Scope in Spring MVC is **request**
- **Session scope** can be used in order to save the state of beans in web based applications
- Each time a request send through HTTP a new bean will be created with request scope

Application Event Handling

- **Developers can handle application events by implementing**

  `ApplicationListener<ApplicationEvent>`

- **Customs events can be published by using application context and extending**

  `ApplicationEvent class`

Spring MVC File Upload

- In order to upload a file with **Java Spring MVC**

```
<!-- File Upload bean config-->
<bean id="multipartResolver"
class="org.springframework.web.multipart.commons.CommonsMultipartRe
solver">
<!-- set the maximum file size in bytes -->
<property name="maxUploadSize" value="1000000"/>
</bean>
```

```
@Controller
public class FileUploadController {
@RequestMapping(value="/uploadFile", method=RequestMethod.POST)
public @ResponseBody String
handleFileUpload(@RequestParam("file") MultipartFile file){
```

Quartz Scheduling Framework and Spring Schedules

- **Quartz** is an alternative to **Spring Schedules** and has more functionality
- In order to use Quartz; **Triggers, Jobs, Tasks and Scheduler** have to defined in XML configuration
- Spring Schedules can be configured using **@Scheduled** annotation
- **@Scheduled(cron="0/30 * * * * ?")** or **@Scheduled(fixedDelay = 10000)** can be applied to schedules

Logging in Spring MVC

- **LOGBack** framework will be used in order to log outputs
- LOGBack is a significantly improved version of log4j logging framework
- Both log4j and logback were founded with the same developer
- It is easy to switch logging technologies by using LOGBack
- The configuration is done through **logback.xml**
- **By default Spring Framework use commons-logging so dependencies should be excluded in pom.xml**

Apache Maven

- **Apache Maven** is a build automation and dependency management tool
- Apache Maven is configured using **pom.xml** file
- Maven is integrated into **Eclipse or STS**

JPA and Hibernate ORM

- **JPA** stands for Java Persistence API
- **Hibernate ORM** is an implementation of JPA
- ORM stands for **Object Relational Mapping**
- Hibernate ORM uses **@Entity** annotation to manage classes in ORM framework
- **@Table**(name="USER") is used to map Java Objects to Database Tables
- **@Id and @Column**(name="USERNAME") annotations can be used on field levels.
- **@PersistenceContext** has to be used on EntityManager

JDBC and JDBCTemplate

- **JDBC** stands for Java Database Connectivity
- It is an application programming interface API for connecting different databases
- Spring MVC uses **jdbcTemplate** in order to run queries on databases
- **JdbcTemplate** simplifies database access code
- **JdbcTemplate** handles database related exceptions and throws **DataAccessException**

PDF and Excel Documents

- In order to return **PDF and Excel Documents** org.springframework.web.servlet.view.**XmlViewResolver** has to be configured in Spring MVC Framework
- Documents have to extend related classes named as AbstractExcelView and **AbstractPdfView**
- **Apache POI is used to generate PDFs inside sample applicaions**
- **Itext library is used to generate Excel documents**

Spring MVC Java Config

- In order to configure **Spring MVC** with JavaConfig;

```
@Configuration
@EnableWebMvc
@ComponentScan(basePackages = {"spring.javaconfig"})
public class JavaConfig extends WebMvcConfigurerAdapter {
```

- You don't need **web.xml** file with the new specification Servlet API 3.0+

```
public class WebInitializer implements
WebApplicationInitializer {
@Override
public void onStartup(ServletContext servletContext)
throws ServletException {
```

Spring MVC Email

- **Spring MVC** can send emails to users using Java Mail API
- Inside the sample application **Velocity Email Template** is used in order to send customized emails
- Velocity is configured in configuration files and template locations should be set

```
    <!-- Velocity Email Template Config Bean -->
    <bean id="velocityEngine"
class="org.springframework.ui.velocity.VelocityEngineFactoryBean">
  <property name="resourceLoaderPath" value="/WEB-INF/email-templates/"/>
    </bean>
```

Spring Security

- In order to activate Spring Security in Spring MVC applications, springSecurityFilterChain has to be configured in web.xml file with **Delegating-FilterProxy**
- **Spring Security** annotations and custom tags can be used in order to define java method level security

```
    <filter>
        <filter-name>springSecurityFilterChain</filter-name>
        <filter-class>org.springframework.web.filter.DelegatingFilterProxy</filter-
class>
     </filter>
```

Spring Exception Handling

- Inside **Spring MVC**, users can define a exception handling class by implementing

```
@Component
public class ExceptionHandler implements HandlerExceptionResolver{

private static final Logger logger =
LoggerFactory.getLogger(ExceptionHandler.class);

@Override
public ModelAndView resolveException(HttpServletRequest
request,HttpServletResponse response, Object object, Exception
exception) {

logger.error("Error: ", exception);
return new
ModelAndView("error/exception","exception","ExceptionHandler
message: " + exception.toString());
}
```

Spring REST with RestTemplate

- **@RestController** will add **@ResponseBody** annotations to all methods inside a class
- **RestTemplate** is used to access Rest Based Web Services
- **@PathVariable** is used in order to get variables from URL
- **ResponseEntity** class is used to map response to Java Objects