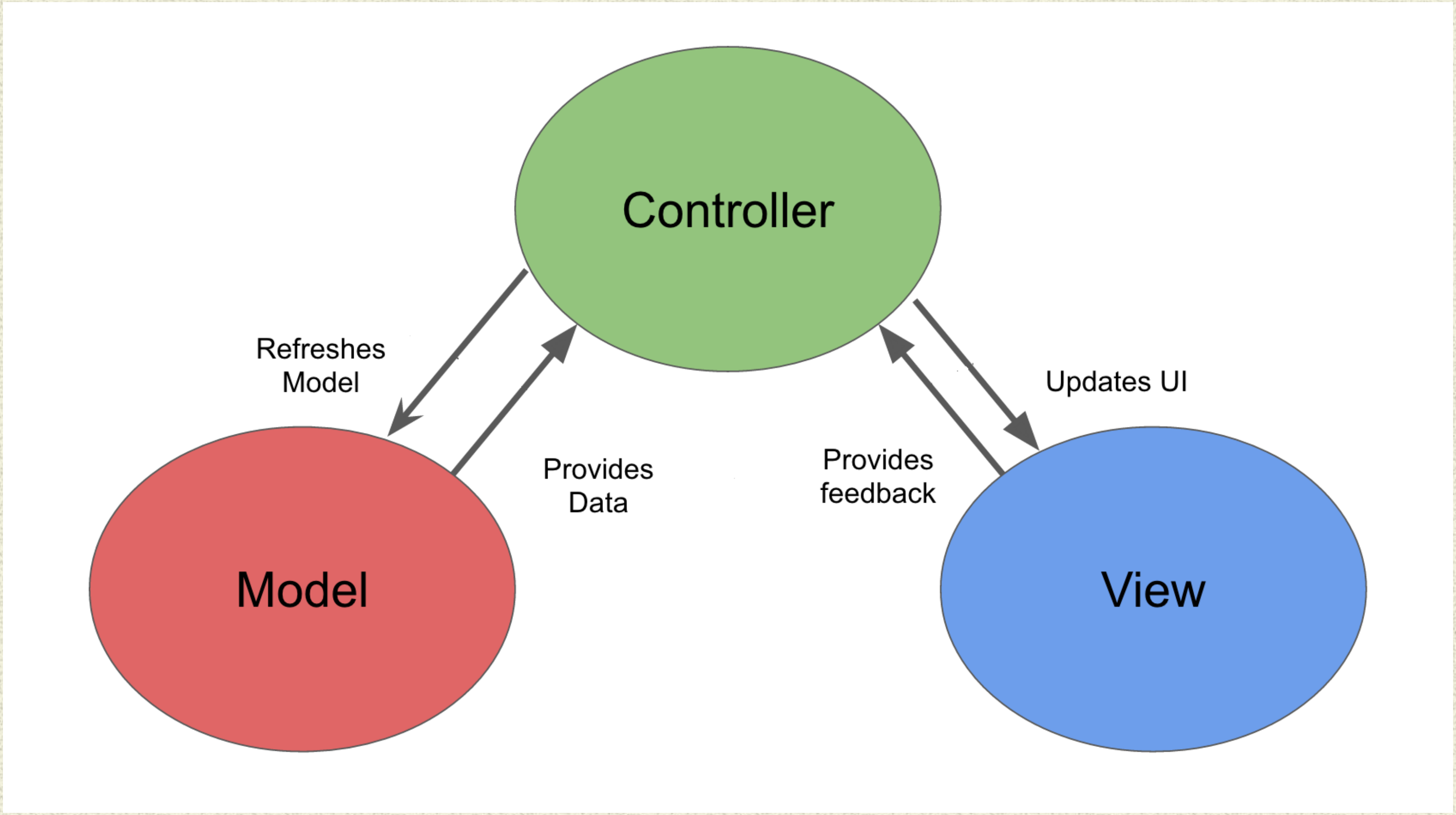
Lesson 11
Spring MVC Framework
Infinite Diversity Arising from Unity

MVC Pattern



[MVC Solo]()

See "Spring-less MVC" DEMO -- Product4aJSP

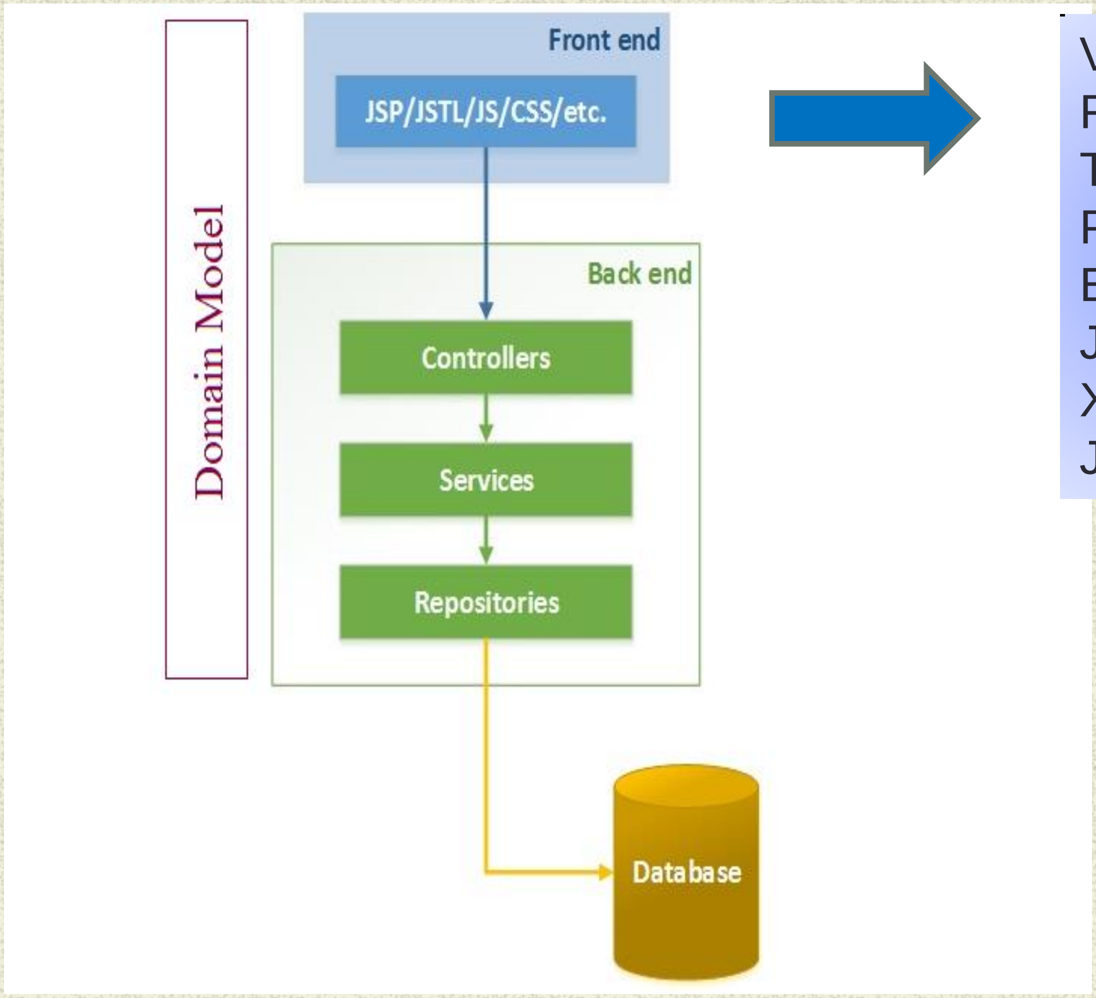
Spring MVC

Distinct Separation of Concerns

Clearly defined interfaces for role/responsibilities "beyond"
Model-View-Controller

- Single Central Servlet
  - Manages HTTP level request/response
  - delegates to defined interfaces
- Models integrate/communicate with views
  - No need for separate form objects
- Views are plug and play
- Controllers allowed to be HTTP agnostic

Spring N-Tier With Spring MVC Presentation Tier



Velocity
FileMarker
ThymeLeaf
PDF
Excel
JSF
XML
JSON

Spring MVC DispatcherServlet Front Controller

- DispatcherServlet - "Front Controller" design pattern

  Common pattern used by MVC frameworks

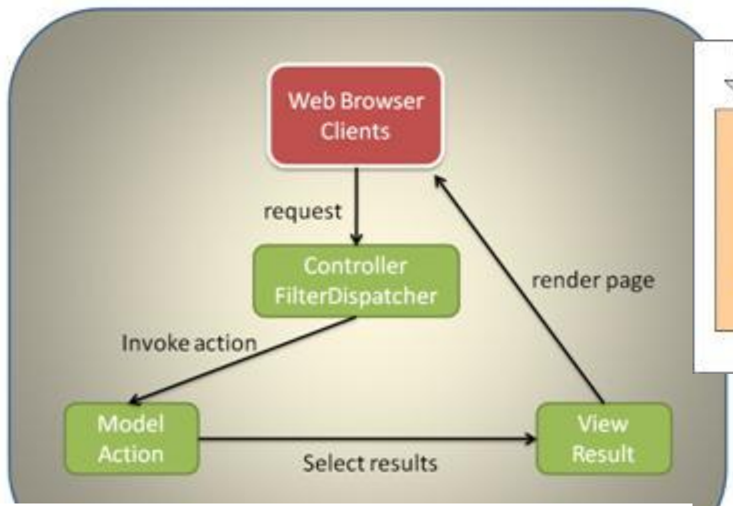
- Single Central Servlet that dispatches requests to controllers and offers other functionality that facilitates the development of web applications.

- Completely integrated with the Spring container

  Able to “exploit” Spring framework features

- Has a WebApplicationContext, which inherits all the beans already defined in the root WebApplicationContext.

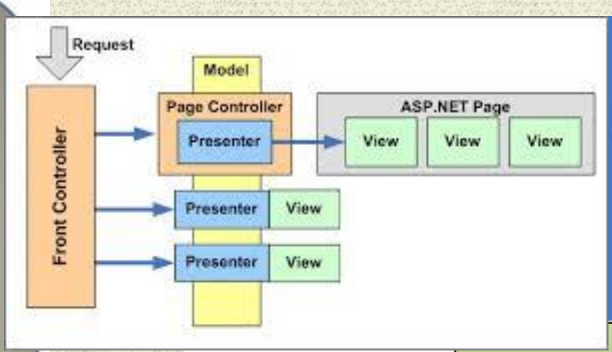
FRONT CONTROLLER

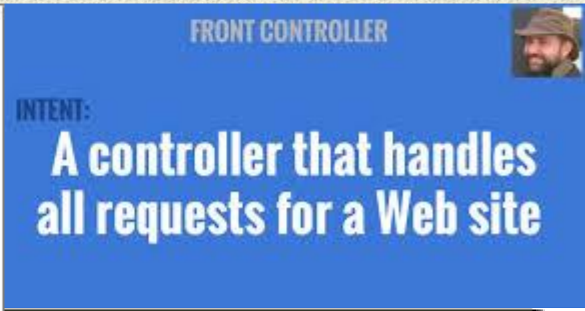


Front Controller

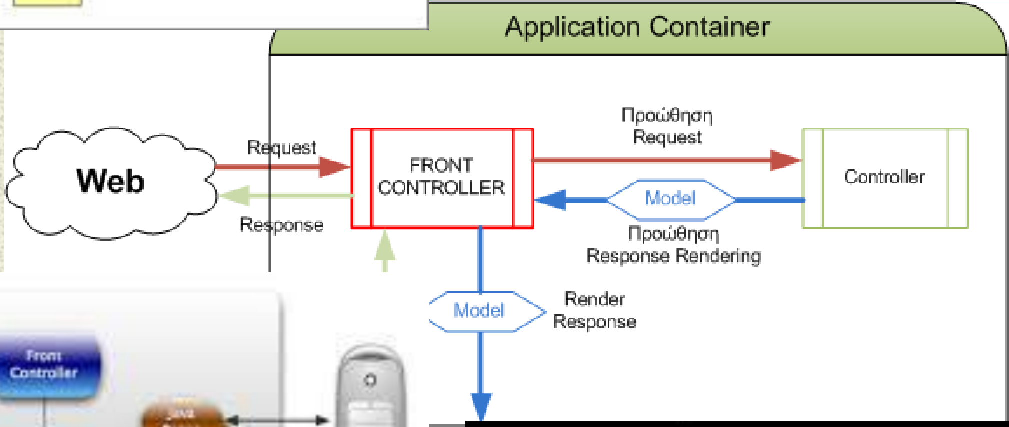
Problema

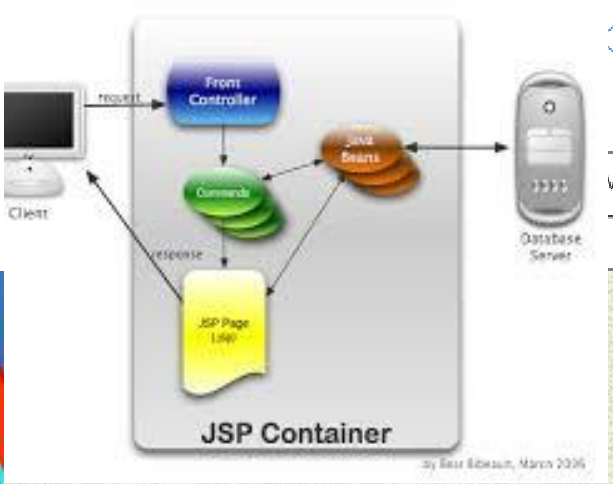
- Si vuole fornire un punto di accesso centralizzato per la gestione delle richieste al livello dello strato di presentazione, in modo da sparare la logica di presentazione da quella di *processamento* delle richieste stesse.
- Inoltre si vuole evitare di avere del codice duplicato e si vuole applicare una logica comune a più richieste.

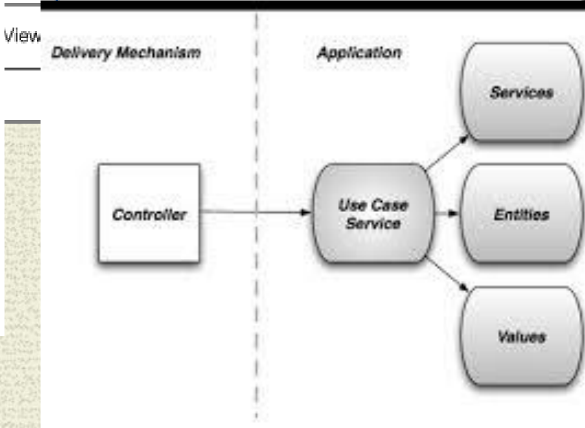


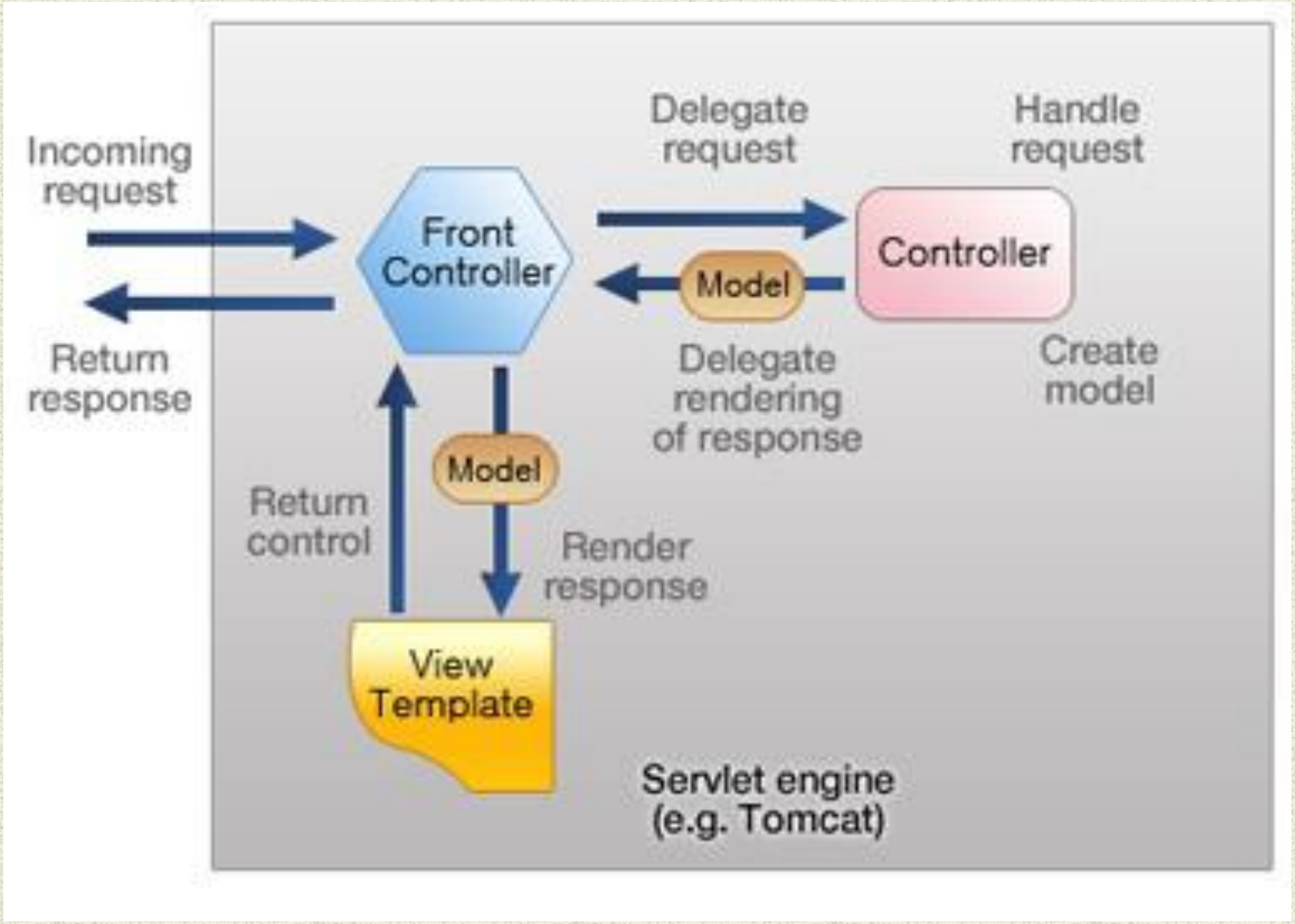

FRONT CONTROLLER

INTENT:
A controller that handles all requests for a Web site

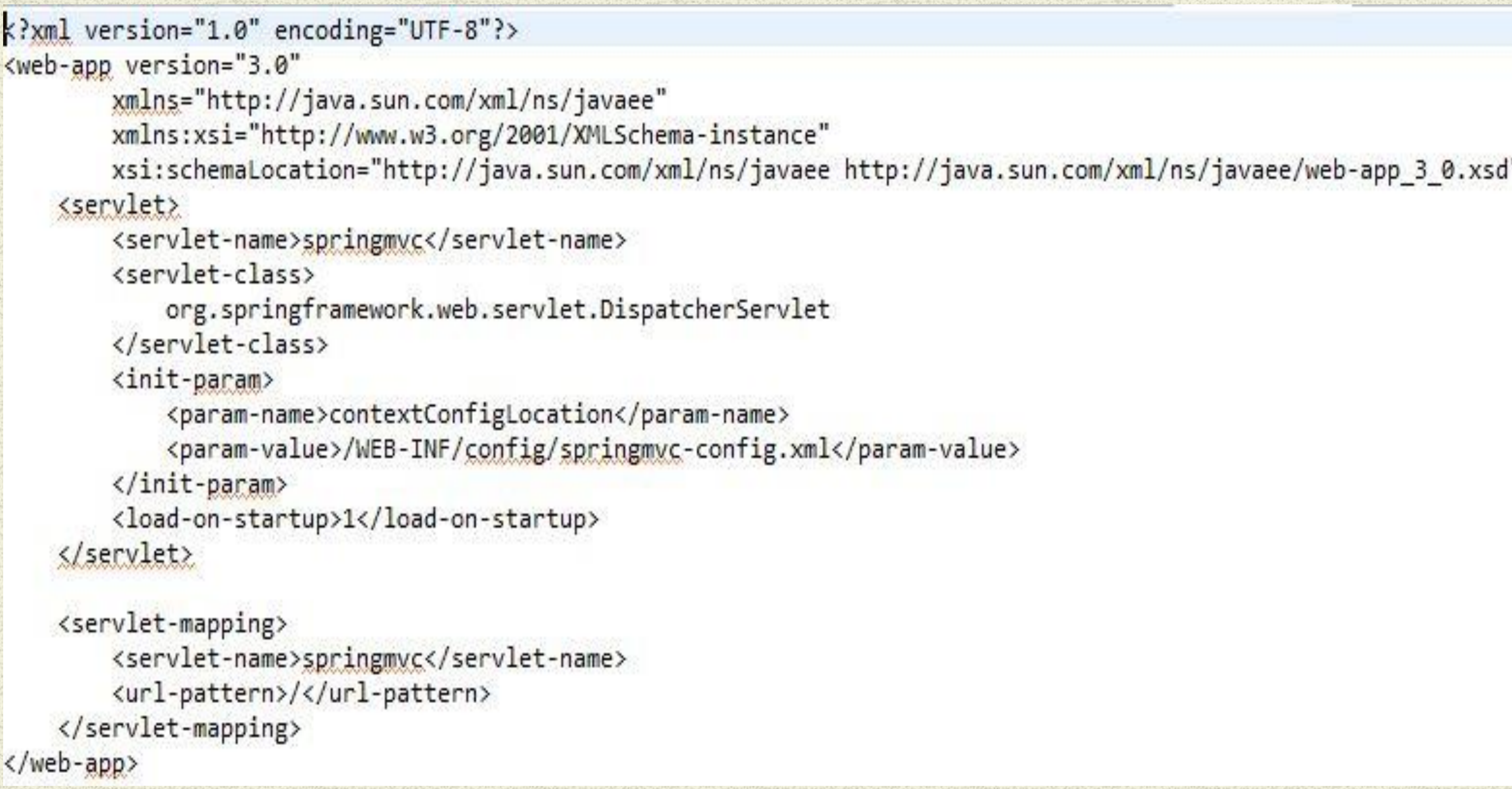






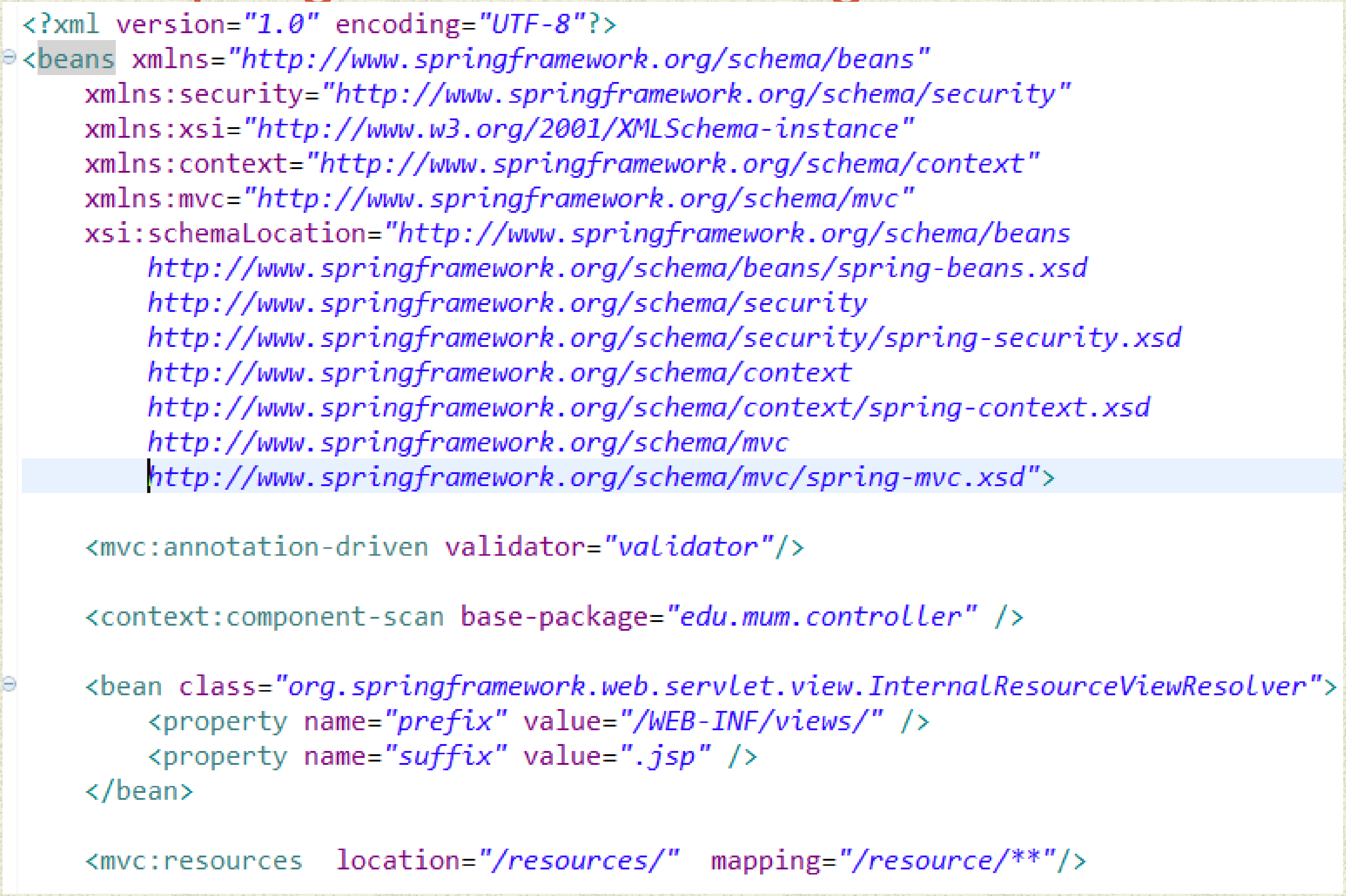

Incoming request
Return response
Front Controller
Delegate request
Handle request
Controller
Model
Create model
Delegate rendering of response
Return control
Model
Render response
View Template
Servlet engine (e.g. Tomcat)

Spring MVC Front Controller Configuration



```
<?xml version="1.0" encoding="UTF-8"?>
<web-app version="3.0"
        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 http://java.sun.com/xml/ns/javaee/web-app_3_0.xsd
    <servlet>
        <servlet-name>springmvc</servlet-name>
        <servlet-class>
            org.springframework.web.servlet.DispatcherServlet
        </servlet-class>
        <init-param>
            <param-name>contextConfigLocation</param-name>
            <param-value>/WEB-INF/config/springmvc-config.xml</param-value>
        </init-param>
        <load-on-startup>1</load-on-startup>
    </servlet>

    <servlet-mapping>
        <servlet-name>springmvc</servlet-name>
        <url-pattern>/</url-pattern>
    </servlet-mapping>
</web-app>
```

Spring MVC XML Configuration File



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

    <mvc:annotation-driven validator="validator"/>

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

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

    <mvc:resources  location="/resources/"  mapping="/resource/**"/>
```

XML Configuration file – enable annotations

<context:component-scan base-package= “pkg,pkg…" **>**

Scans defined packages to find and register @Component-annotated classes and activate basic annotations[e.g. @Autowired] - within the current application context

See Product4a DEMO

<mvc:annotation-driven/>

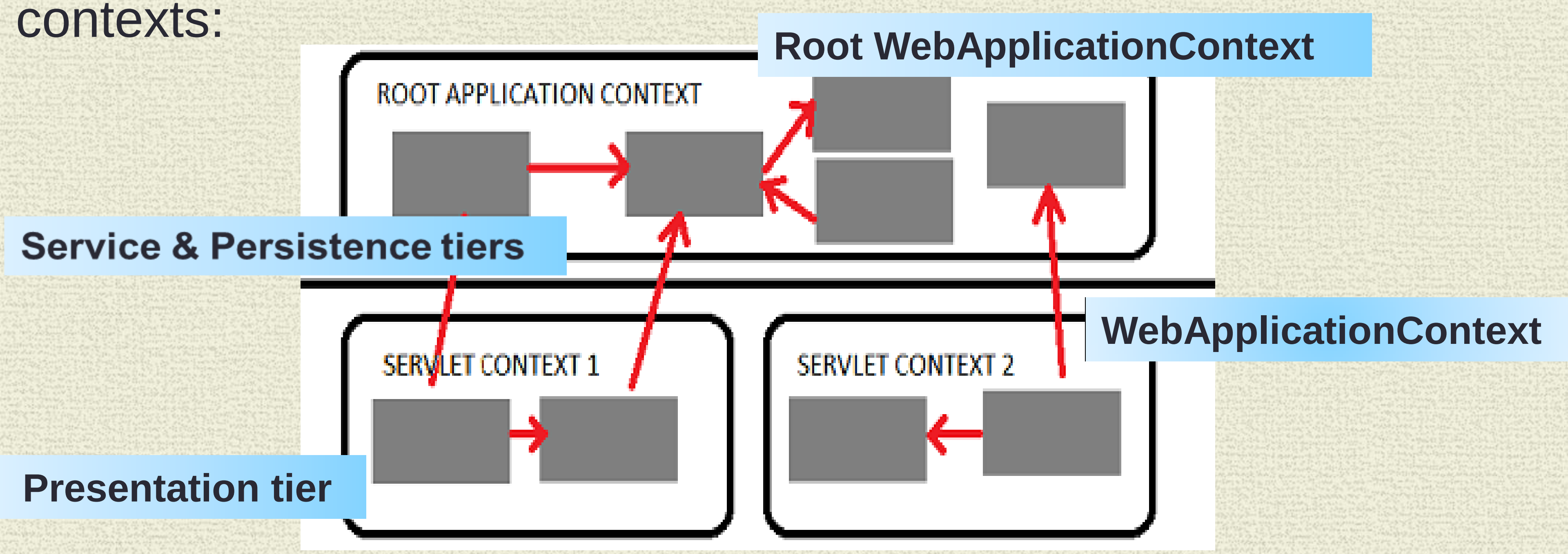
Enables support for specific annotations [e.g. @RequestMapping, etc.] that are required for Spring MVC to dispatch requests to @Controllers. It is based on MVC XML namespace

<tx:annotation-driven />

Enables support for specific annotations that are required for Spring Transactions @Transaction

Web Application Context

- Spring has multilevel application context hierarchies.
- Web apps by default have two hierarchy levels, root and servlet contexts:

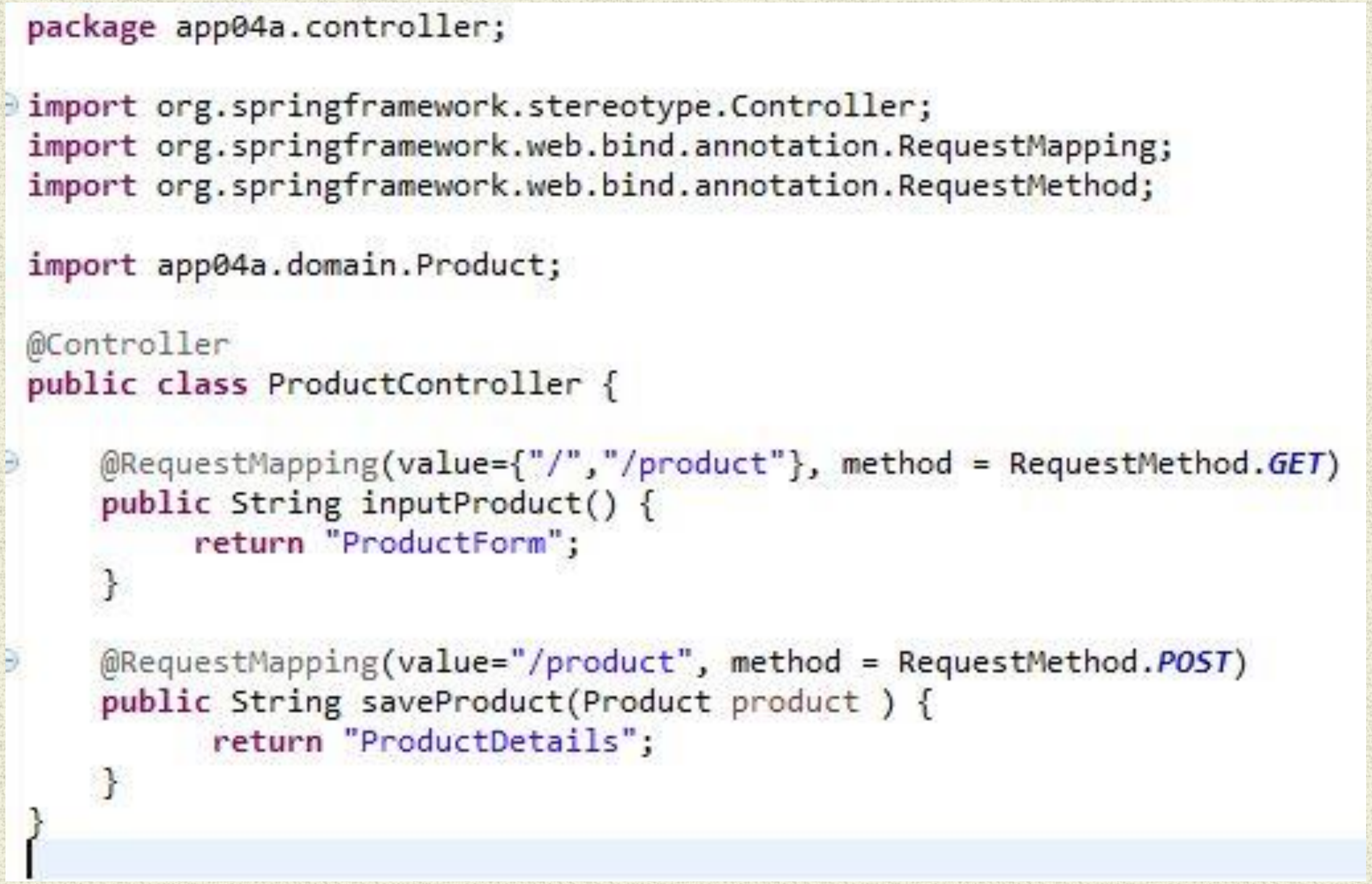


- **Presentation tier has a WebApplicationContext [Servlet Context] which inherits all the resources already defined in the root WebApplicationContext [Services, Persistence]**

Data Binding

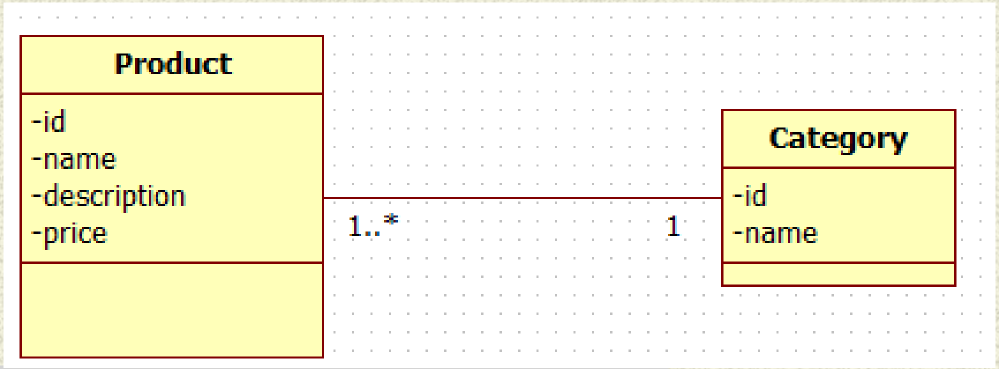
- Automatically maps request parameters domain objects
- Simplifies code by removing repetitive tasks
- Built-in Data Binding handles simple String to data type conversions
- HTTP request parameters [String types] are converted to model object properties of varying data types.
- Does NOT handle COMPLEX data types; that requires custom formatters
- Does handle complex nested relationships

Data Binding example



```
package app04a.controller;

import org.springframework.stereotype.Controller;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RequestMethod;

import app04a.domain.Product;

@Controller
public class ProductController {

    @RequestMapping(value={"/","/product"}, method = RequestMethod.GET)
    public String inputProduct() {
        return "ProductForm";
    }

    @RequestMapping(value="/product", method = RequestMethod.POST)
    public String saveProduct(Product product ) {
         return "ProductDetails";
    }
}
```

Data Binding - Relationships



```
<form action="product" method="post">
     <legend>Add a product</legend>
        <p>
     <label for="category">Category </label>
       <select name="category.id">
              <option value="-">--Select Category--</option>
           <c:forEach var="category" items="${categories}">
              <option value="${category.id}" > ${category.name}</option
           </c:forEach>
        </select>
```

See SimpleMVC Demo

```
      <label for="name">Product Name: </label>
         <input type="text" id="name" name="name" >
```

Main Point

- The basic ingredients of a Spring MVC application include web pages for the view (the known), the back end domain logic and data (knower or underlying intelligence), and the Spring framework and Dispatcher Servlet and managed beans as the controller to connect the view and model. *Knowledge is the wholeness of knower, known, and process of knowing.*

Spring MVC Annotations

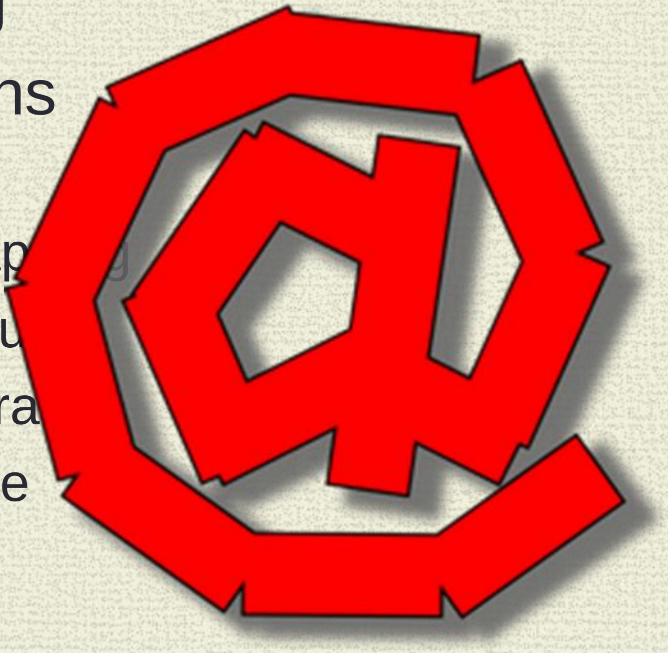
- Handler Mapping
- Spring Annotations
  - @Controller

    @RequestMap

    @ModelAttribu

    @RequestPara

    @PathVariable



Spring MVC @Controller

- Spring implements a controller in a very abstract way, which enables you to create a wide variety of controllers.
- Spring Controllers do not extend specific base classes or implement specific interfaces
- They do not have direct dependencies on Servlet APIs, although you can easily configure access to Servlet facilities. [actual request, response objects, etc.]
-

Mapping Example

```
@Controller
@RequestMapping({"/members"})
public class MemberController {

@Autowired
private MemberService  memberService;

@RequestMapping(value={"","/all"}, method = RequestMethod.GET)
public String listMembers(Model model) {
        model.addAttribute("members", memberService.findAll());
        return "members";
}

@RequestMapping(value="/{id}", method = RequestMethod.GET)
public String getMemberById(@PathVariable("id") Long id,Model model) {
        Member member = memberService.findOne(id);
        model.addAttribute("member", member);

         return "member";
}
```

See MemberSpringMVC

Mapping Example [Cont.] & Validation

```
@RequestMapping(value = "/add", method = RequestMethod.GET)
public String getAddNewMemberForm(@ModelAttribute("newMember") Member newMember)
{
    return "addMember";
}

@RequestMapping(value = "/add", method = RequestMethod.POST)
public String processAddNewMemberForm( @Valid @ModelAttribute("newMember")
                              Member memberToBeAdded, BindingResult result) {

if(result.hasErrors()) {
return "addMember";
}

    memberService.saveFull(memberToBeAdded);

    return "redirect:/members";
```

See Member in MemberSpringMVC for Validation

@RequestParam

- Placed on Method argument

- http://localhost:8080/MemberSpringMVC/products/product?id=1

```
 @RequestMapping("/product")
public String getProductById(Model model, @RequestParam("id") Long id)
{
        Product product = productService.findOne(id);
```

- **Handling multiple values [e.g., multiple selection list]**

http://localhost:8091/store/sizechoices?sizes=small&sizes=medium&sizes=large

```
  public String getSizes(@RequestParam(“sizes")String sizeArray[]
```

@RequestMapping Template with @PathVariable

- Facility to pass resource request as part of URL INSTEAD of as a @RequestParam
  - Conforms to RESTful service syntax

- http://localhost:8080/MemberSpringMVC/members/1

```
 @RequestMapping("/{id}")
public String getMemberById(@PathVariable("id") Long id,Model model) {
    Member member = memberService.findOne(id);
```

@PathVariable is used in conjunction with @RequestMapping URL template.
In this case it is a means to get the category string passed in the method signature.

The @PathVariable param needs to be the same as the param in the @RequestMapping

See Member in MemberSpringMVC

Main Point

- Annotations are metadata that allow the knowledge about the creation of an object to reside with the object itself
- *The self-referral nature of Transcendental Consciousness makes all our actions clearer and more powerful*

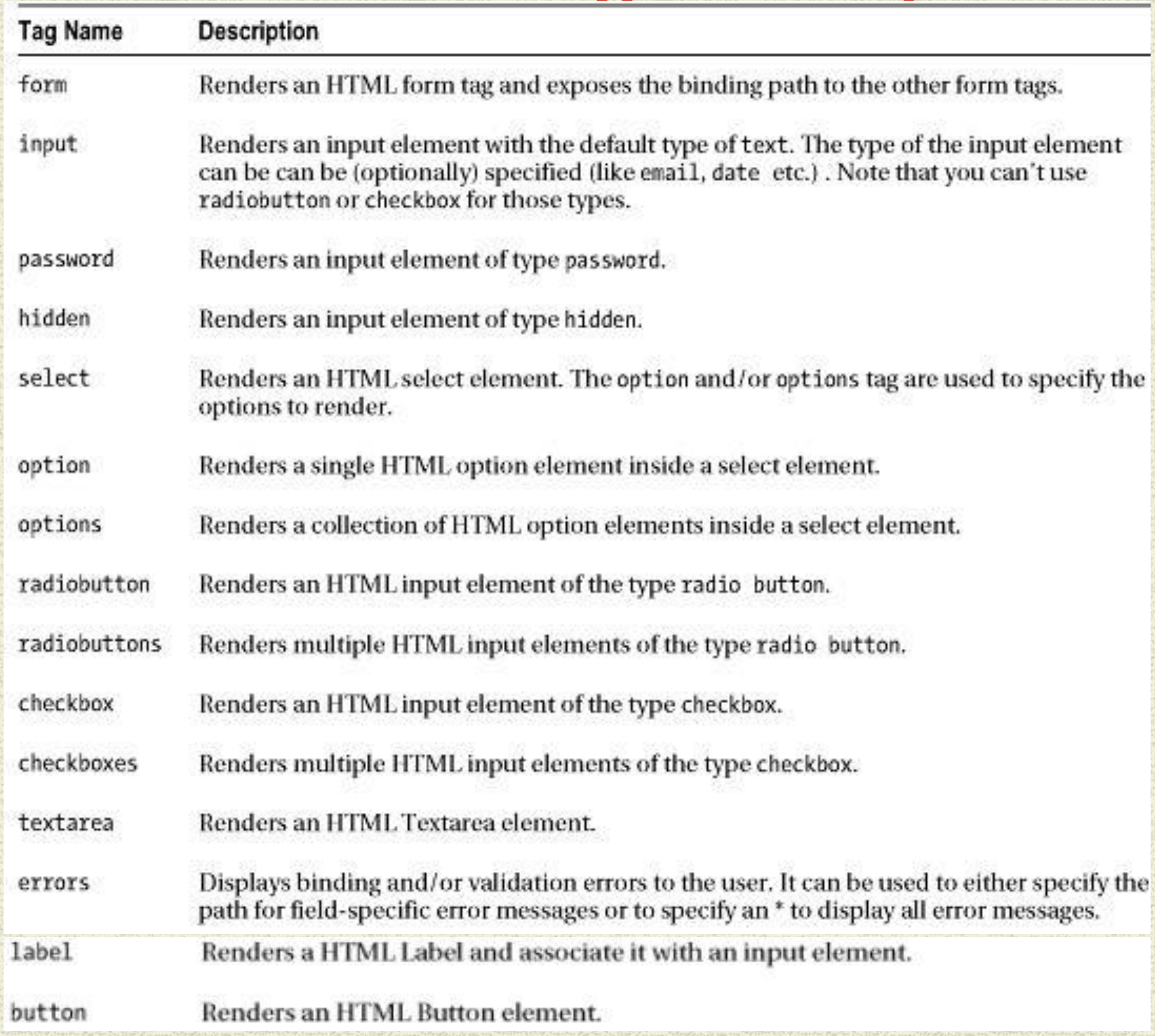
Spring MVC Form Tag Library

- Facilitates the development of JSP pages
- Integrated with Spring MVC data binding features
- Each tag provides support for the set of attributes of its corresponding HTML tag counterpart, making the tags familiar and intuitive to use.
- Access Form Tag Library:

See MemberSpringMVC

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

Form Tag Library



Tag Name	Description
form	Renders an HTML form tag and exposes the binding path to the other form tags.
input	Renders an input element with the default type of text. The type of the input element can be can be (optionally) specified (like email, date etc.) . Note that you can't use radiobutton or checkbox for those types.
password	Renders an input element of type password.
hidden	Renders an input element of type hidden.
select	Renders an HTML select element. The option and/or options tag are used to specify the options to render.
option	Renders a single HTML option element inside a select element.
options	Renders a collection of HTML option elements inside a select element.
radiobutton	Renders an HTML input element of the type radio button.
radiobuttons	Renders multiple HTML input elements of the type radio button.
checkbox	Renders an HTML input element of the type checkbox.
checkboxes	Renders multiple HTML input elements of the type checkbox.
textarea	Renders an HTML Textarea element.
errors	Displays binding and/or validation errors to the user. It can be used to either specify the path for field-specific error messages or to specify an * to display all error messages.
label	Renders a HTML Label and associate it with an input element.
button	Renders an HTML Button element.

Form Tag

- This tag renders an HTML 'form' tag and exposes a **binding path** to inner tags for binding. *All the other tags in this library are nested tags of the form tag*.

```
• @RequestMapping(value = "/add", method = RequestMethod.GET)
• public String AddProduct(@ModelAttribute("newProduct")
             Product newProduct) {
```

```
<form:form  modelAttribute="newProduct" action="add" method="post >
```

```
• @RequestMapping(value = "/add", method = RequestMethod.POST)
• public String saveProduct(@Valid @ModelAttribute("newProduct")
  Product productToBeAdded, BindingResult result) {
```

Form examples with HTML output

```
<form:input id=“name" path=“name"/>
```

Generated HTML:

```
<input id=“name" name=“name" type="text" value=""/>
```

- **When categories is a LIST**

```
<form:select id="category" path="category.id"
items="${categories}" itemValue="id" itemLabel="name" />
```

Generated HTML:

```
        <select id="category" name="category.id">
                <option value="1">Computing</option>
                <option value="2">Travel</option >
                <option value="3">Health</option >
        </select>
```

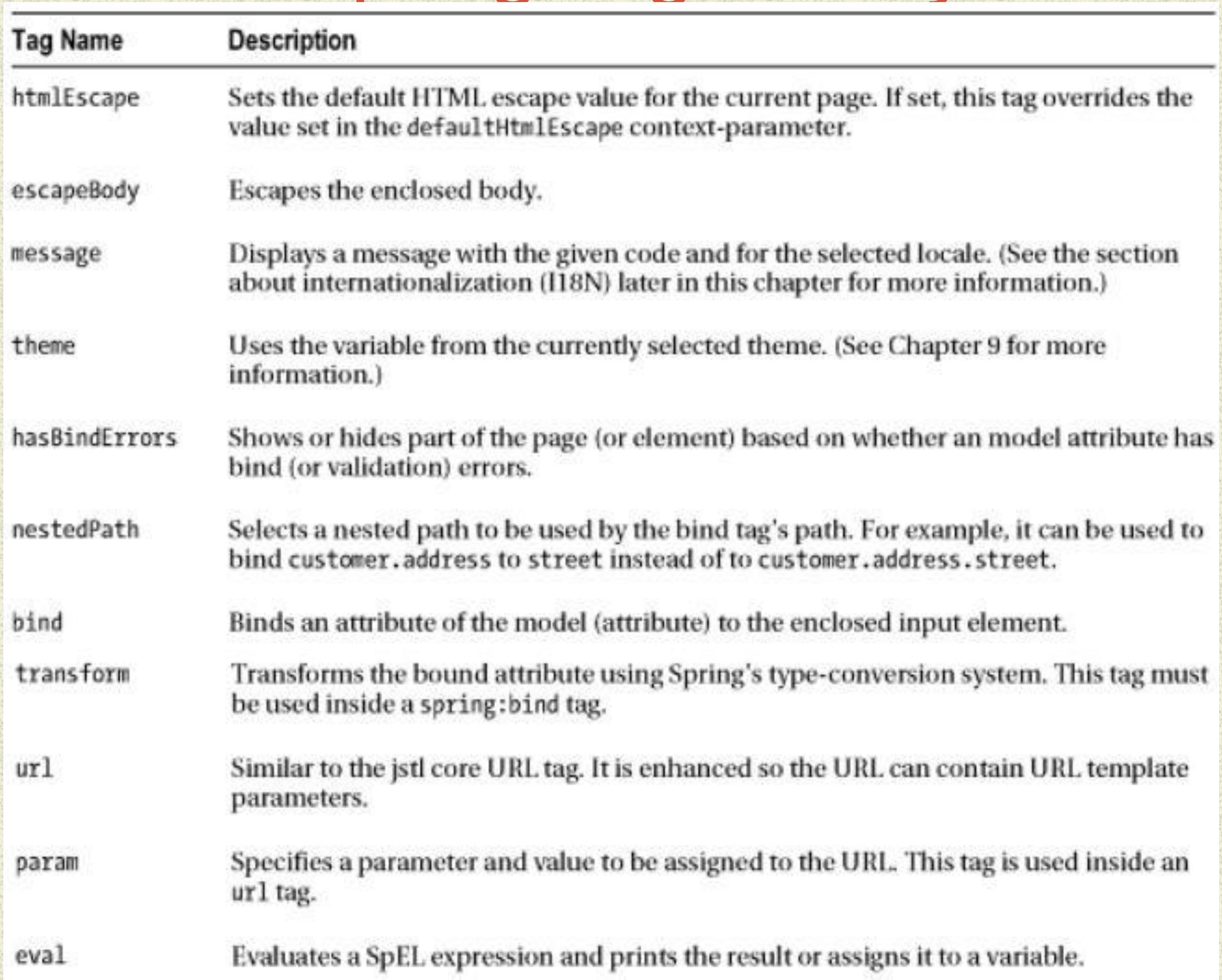
NOTE: *path is the “binding Path” defined previously*

General Purpose Spring Tag Library

- Not Spring MVC specific
- Available to any Java Server Page used in the Spring Framework
- Tags for evaluating errors, setting themes and outputting internationalized messages.

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

Spring Tag Library



Tag Name	Description
htmlEscape	Sets the default HTML escape value for the current page. If set, this tag overrides the value set in the defaultHtmlEscape context-parameter.
escapeBody	Escapes the enclosed body.
message	Displays a message with the given code and for the selected locale. (See the section about internationalization (I18N) later in this chapter for more information.)
theme	Uses the variable from the currently selected theme. (See Chapter 9 for more information.)
hasBindErrors	Shows or hides part of the page (or element) based on whether an model attribute has bind (or validation) errors.
nestedPath	Selects a nested path to be used by the bind tag's path. For example, it can be used to bind customer.address to street instead of to customer.address.street.
bind	Binds an attribute of the model (attribute) to the enclosed input element.
transform	Transforms the bound attribute using Spring's type-conversion system. This tag must be used inside a spring:bind tag.
url	Similar to the jstl core URL tag. It is enhanced so the URL can contain URL template parameters.
param	Specifies a parameter and value to be assigned to the URL. This tag is used inside an url tag.
eval	Evaluates a SpEL expression and prints the result or assigns it to a variable.

Message Tag

- Message tag

  Internationalization support through externalization of messages

  Text from MessageSource configured in DispatcherServlet

```
<spring:message code="greeting" text =“Hi" />
```

“code” isn’t set or cannot be resolved, “text” will be used as default message.

Also, the spring:message- tag, works with the locale support that comes with Spring. [Internationalization]

Controller return “view”

- View Resolver[s] can simplify view declaration
- For example with the view resolver:

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

```
 return "ProductForm";
resolves to:
            /WEB-INF/jsp/ProductForm.jsp
```

The subsequent RequestDispatcher forward is done by the framework

Main Point

The Spring MVC tag library facilitates JSP development with specialized Form tags.*The practice of the TM technique, by structuring the laws of nature in one's life makes everything go more smoothly.*

Spring Web Security

Infinite Diversity Arising from Unity

Cross-cutting Technologies

Servlet Filter

- Generic Servlet/web based filter

Interceptor

- Spring MVC Handler specific Interceptor

Spring AOP

- Simplified AOP implementation- Method level granularity
- Only Spring recognized Beans
- Employs a run time integration [AKA weaving] process

AspectJ

- Fine grained supports method & field level AOP
- Employs a specialized compilation weaving process
- Works with non-Spring components

FILTER SERVLET

Based on Servlet Specification

Coupled with the Servlet API.

Access to HttpServletRequest and HttpServletResponse objects

Intended for operating on request and response object parameters like HTTP headers, URIs and/or HTTP methods,

Generically applied - regardless of how the servlet is implemented.

EXAMPLES: Authentication , Logging, auditing, UTF-8 encoding

USED in Both Spring Web Security

&& Spring OAuth2

Spring Web Application Security Servlet Filter based

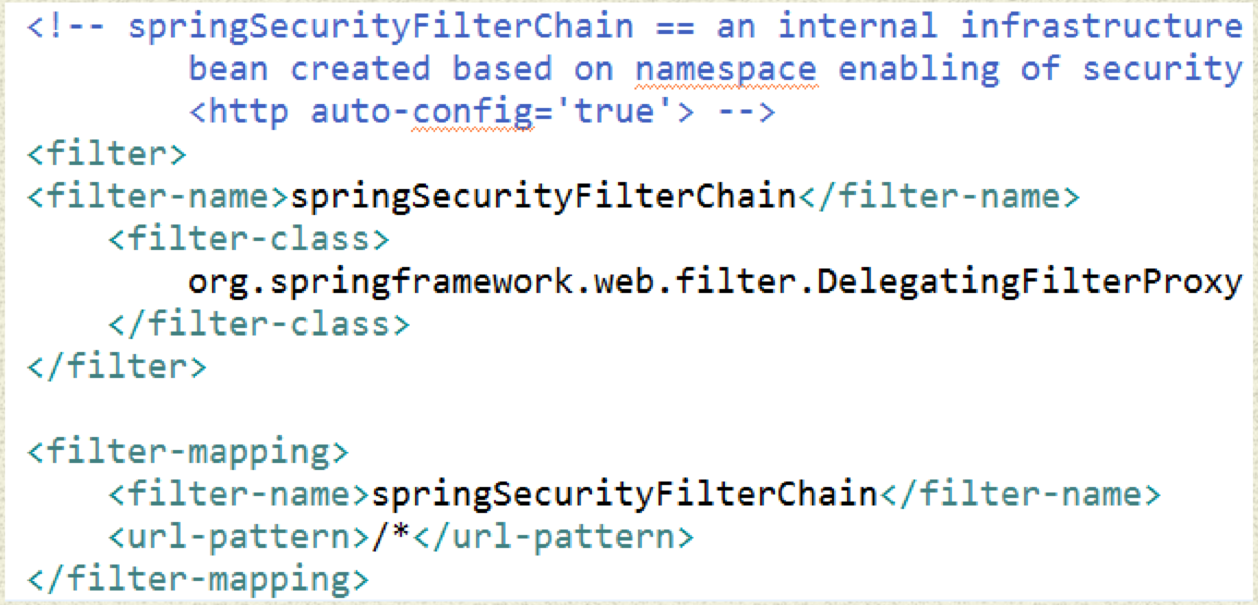
Spring Security's web infrastructure is based entirely on standard servlet filters.

Agnostic to specific web technology.

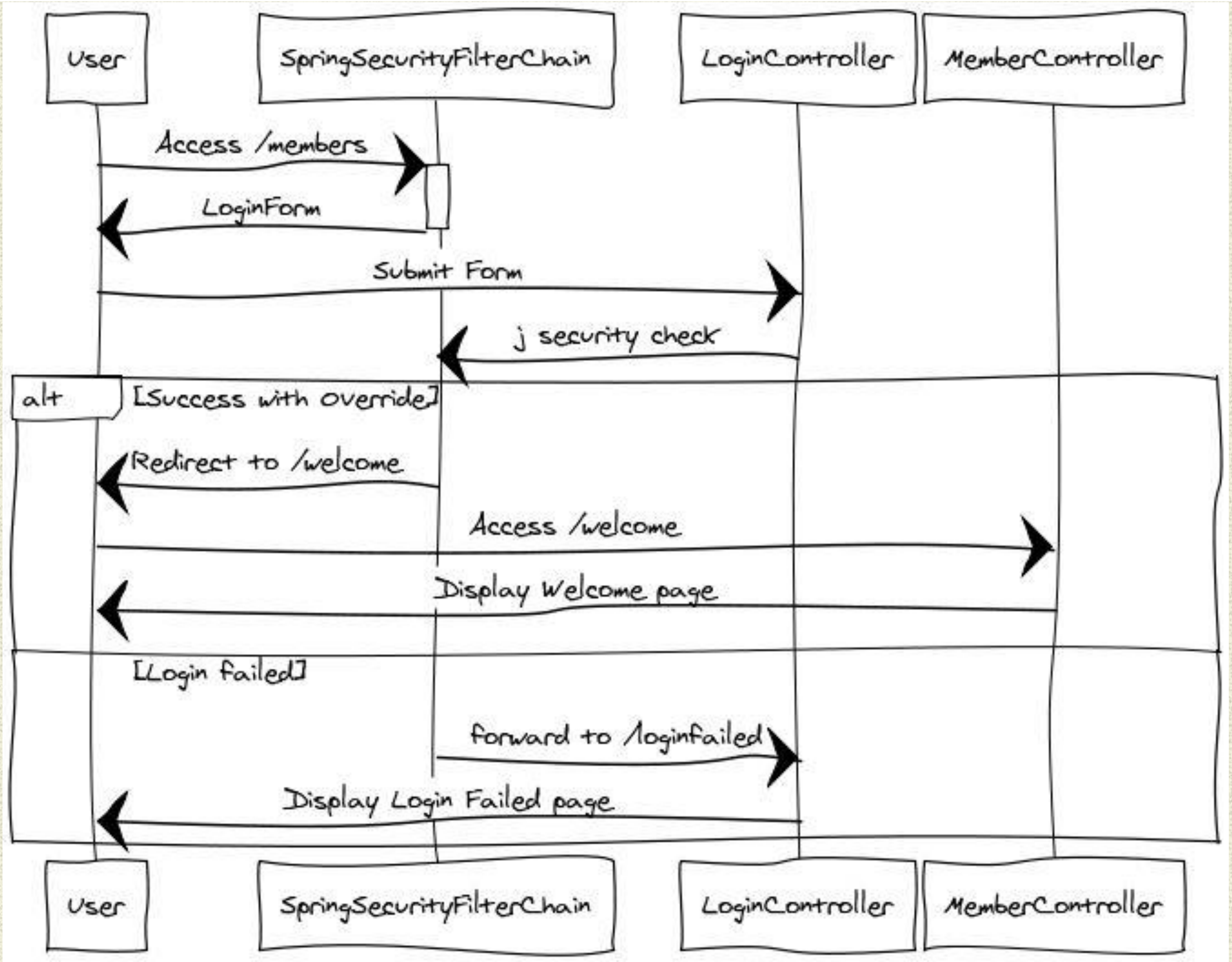
Based on HttpServletRequests and HttpServletResponses

Usage:

- Browser
- Web service client
- AJAX application.



```
<!-- springSecurityFilterChain == an internal infrastructure
        bean created based on namespace enabling of security
        <http auto-config='true'> -->
<filter>
<filter-name>springSecurityFilterChain</filter-name>
    <filter-class>
        org.springframework.web.filter.DelegatingFilterProxy
    </filter-class>
</filter>

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


User
SpringSecurityFilterChain
LoginController
MemberController
Access /members
LoginForm
Submit Form
j security check
alt
[Success with override]
Redirect to /welcome
Access /welcome
Display Welcome page
[Login failed]
forward to /loginfailed
Display Login Failed page
User
SpringSecurityFilterChain
LoginController
MemberController

Minimal [XML] configuration

Requires all users to be authenticated

Allows users to authenticate with form based login

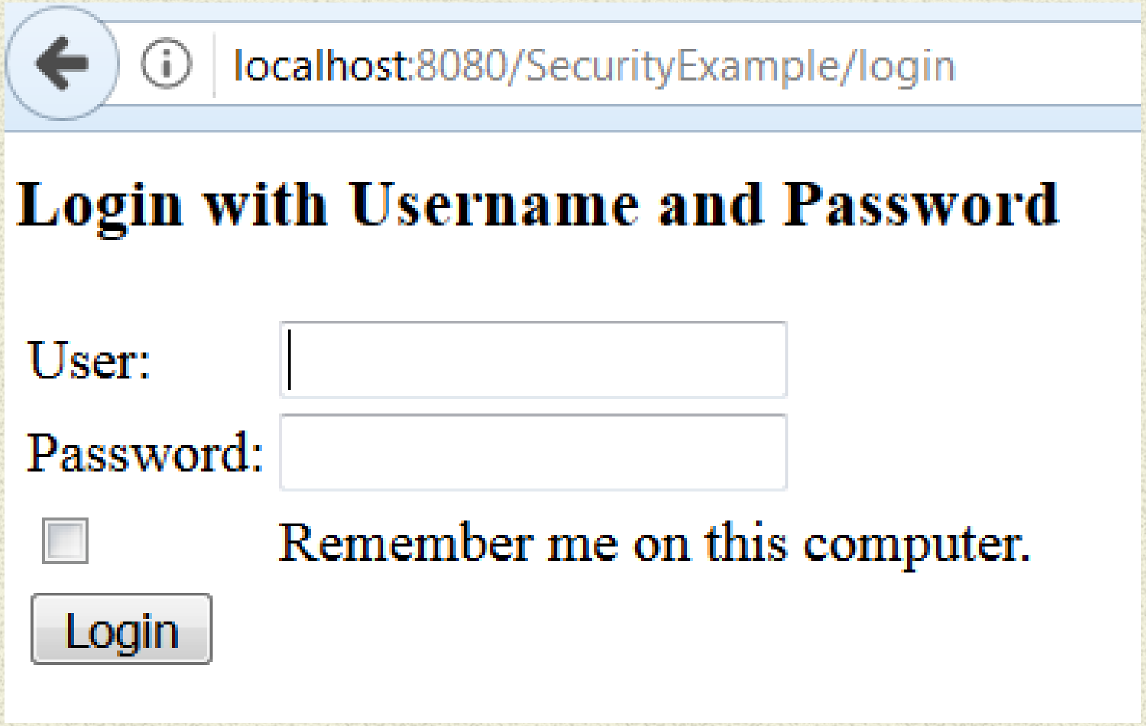
Allows users to authenticate with HTTP Basic authentication

```
<security:http use-expressions= "true“ >
    <intercept-url pattern="/**" access= “isFullyAuthenticated()“ />
    <form-login />
</security:http>
```

Default Form Based Login

<form-login /> generates a default login form

Available at URL: login



localhost:8080/SecurityExample/login

Login with Username and Password

User:	
Password:	
☐	Remember me on this computer.

Login

Overridden if attributes are set on <form-login />

Custom Login Configuration

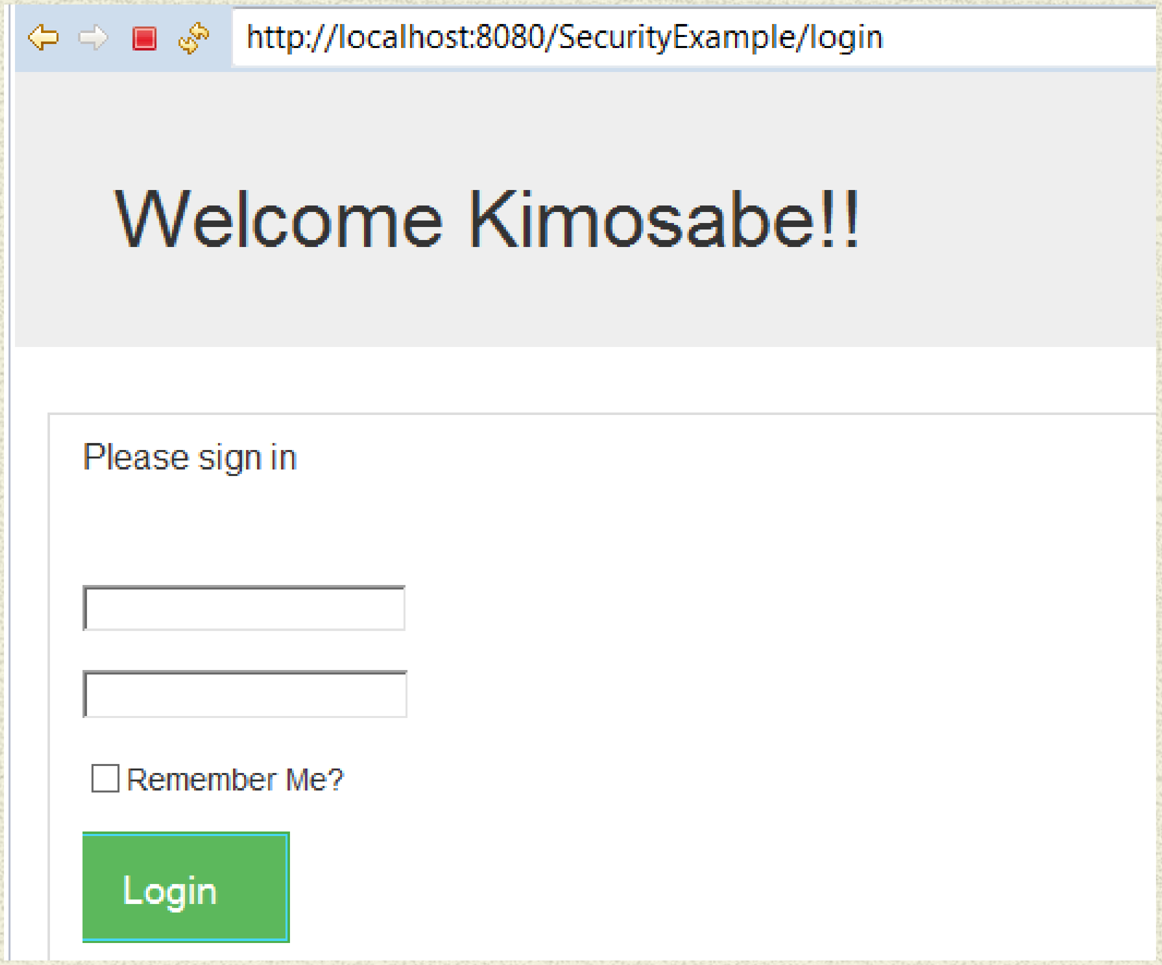
Security Version 4

```
<security:form-login
 login-page="/login"
   default-target-url="/welcome"
                always-use-default-target="true"
                authentication-failure-url="/loginfailed"/>

        <security:logout logout-success-url="/logout"
                                         delete-cookies="JSESSIONID" />
```

```
<security:form-login login-page="/login"
        login-processing-url="/postLogin“
        username-parameter="username"
        password-parameter="password"
        default-target-url="/welcome"
       always-use-default-target="true"
       authentication-failure-url="/loginfailed"/>
     <security:logout logout-success-url="/logout"  logout-url= "/doLogout"/>
</security:http>
```

Default values in Version 4

Customized Login



http://localhost:8080/SecurityExample/login

Welcome Kimosabe!!

Please sign in

☐ Remember Me?

security-context.xml Authorization

Enable Method level authorization. If here -APPLICATION Level scanned components. For WEB level - need to place in Dispatcher-servlet

```
<security:global-method-security pre-post-annotations="enabled"/>
```

security:http enables security filter mechanism.

name space configuration is activated

use-expressions enables SPEL syntax for URL level authorization

```
<security:http use-expressions="true">
    <security:intercept-url pattern="/members"
                           access="hasAnyRole('ROLE_ADMIN','ROLE_USER')" />
    <security:intercept-url pattern="/**"
                           access="permitAll" requires-channel="https"/>
```

Authorization

Web request authorization using interceptors.

Method authorization using AspectJ or Spring AOP

Common usage pattern

is to perform **some** web request authorization
coupled with Spring AOP method authorization on the
services layer [**more secure**].

URL based Authorization

Patterns are always evaluated in the order they are defined

Configuration:

```
<security:intercept-url pattern="/members/add"
                 access= "hasRole('ROLE_ADMIN')" />
```

Method level Authorization

Configuration:

```
<security:global-method-security
                 pre-post-annotations="enabled"/>
```

MemberServiceImpl.java

```
 @PreAuthorize("hasRole('ROLE_ADMIN')")
  public void save( Member member) {
      memberRepository.save(member);
```

Main Point

- Authentication & Authorization underlie the entire web application. They provide a shield that makes the application invulnerable.
- *Transcendental consciousness is characterized by the quality of invincibility, which means one cannot be overcome or overpowered*

Main Point

- The different technologies [Filter, Interceptor, AOP] available in Spring, together provide a thorough solution to cross cutting concerns.
- *Creative intelligence enhances and strengthens uniquely differing values in life in a comprehensive way.*
-