Annotation-based Configuration

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“Code with Passion!”

Disclaimer

- Many slides of this presentation are based on the Spring Framework Reference Documentation
  - http://docs.spring.io/spring/docs/current/spring-framework-reference/html/index.html

Topics (page 1)

- Annotation-based Dependency Injection
  - *@Autowired, @Required*
- Qualifier
  - @Qualifier, Custom qualifier
- JSR 330 (Dependency Injection for Java)
  - @Inject
- JSR 250 (Common Annotations)
  - *@PostConstruct & @PreDestroy, @Resource*
- *@Component and further stereotyped annotations*
  - *@Service, @Repository, @Controller*
- Auto scanning
  - *@ComponentScan*

Topics (page 2)

- Java-based Spring configuration (instead of XML configuration file)
  - *@Configuration, @Bean*
- Profile
  - *@Profile*
- Spring Boot
  - *@SpringBootApplication*
  - *@EnableAutoConfiguration*

Annotation-based Dependency Injection (DI)

Annotation-based DI specification

- An alternative to XML based DI specification
  - Bean definitions and wiring are specified in the Java source code
- You can use both XML and annotation-based DI specifications
  - Annotation-based injection is performed before XML-based injection
  - XML-based injection will override Annotation-based injection
- Annotation-based DI specification is usually preferred over XML-based DI specification
  - Typing checking is possible at compile time
  - No need to have separate XML-file

DI related Annotations Introduced in Spring

- Spring 2.0
  - *@Required*
- Spring 2.5
  - *@Autowired*
  - JSR-250 (Common Annotation for Java Platform 1.0) annotations: *@Resource, @PostConstruct, @PreDestroy*
- Spring 3.0
  - JSR 330 (Dependency Injection for Java) annotations: *@Inject, @Qualifier, @Named, and @Provider*
  - *@Configuration, @Bean, @Value*
- Spring 3.1
  - *@ComponentScan, @Profile*

DI related Annotations Introduced in Spring

- Spring 4
  - *@SpringBootApplication*
  - *@EnableAutoConfiguration*
  - *@Conditional*

@Autowired

@Autowired

- Can be used in the Java source code for specifying DI requirement (instead of in XML file)
- Places where *@Autowired* can be used
  - Fields
  - Setter methods (setter injection)
  - Constructor methods (constructor injection)
  - Arbitrary methods

@Autowired at Field

```
public class MovieRecommender {

  // @Autowired at the field
  @Autowired
  private MovieCatalog movieCatalog;



  // ...
}
```

@Autowired at Setter method

```
public class SimpleMovieLister {

  private MovieFinder movieFinder;

  // MovieFinder object gets created and injected by Spring DI container
  @Autowired
  public void setMovieFinder(MovieFinder movieFinder) {
      this.movieFinder = movieFinder;
  }

  // ...
}
```

@Autowired at Constructor method

```
public class MovieRecommender {

  private CustomerPreferenceDao customerPreferenceDao;

  // @Autowired at the constructor
  @Autowired
  public MovieRecommender(
      CustomerPreferenceDao customerPreferenceDao) {
      this.customerPreferenceDao = customerPreferenceDao;
  }

  // ...
}
```

@Autowired at arbitrary methods

- You can also apply @Autowired annotation to methods with arbitrary names and/or multiple arguments:

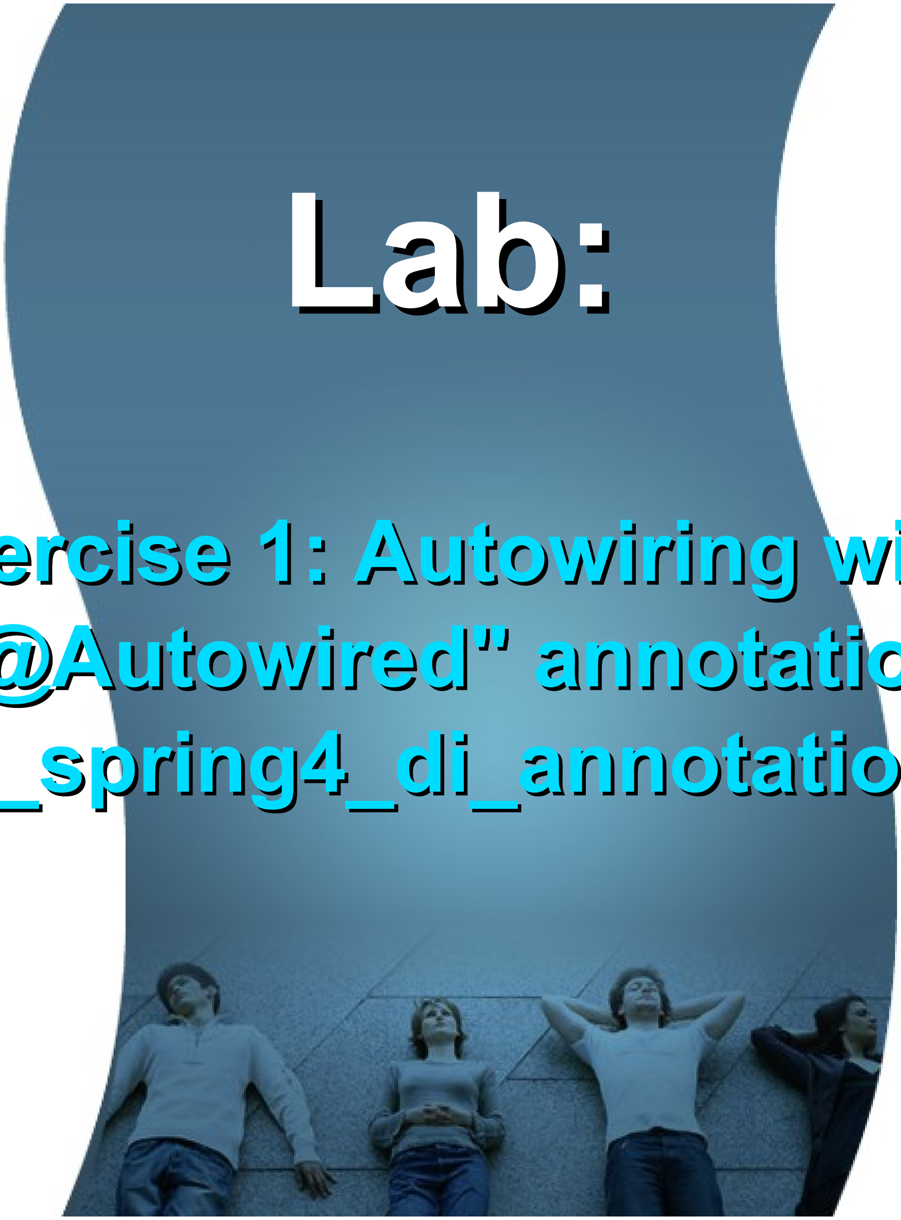
```
public class MovieRecommender {

  private MovieCatalog movieCatalog;
  private CustomerPreferenceDao customerPreferenceDao;

  // MovieCatalog and CustomerPreferenceDao objects are
  // injected automatically
  @Autowired
  public void prepare(MovieCatalog movieCatalog,
                      CustomerPreferenceDao customerPreferenceDao) {
      this.movieCatalog = movieCatalog;
      this.customerPreferenceDao = customerPreferenceDao;
  }

  // ...
}
```

@Required

- The *@Required* annotation applies to bean property setter methods
- It throws an exception if the bean property has not been set in the configuration

```
public class Person {
    private String name;
    private int age;

    public String getName() {
        return name;
    }

    @Required
    public void setName(String name) {
        this.name = name;
    }

    public int getAge() {
        return age;
    }

    @Required
    public void setAge(int age) {
         this.age = age;
     }
}
```

the value of name field has to be set in the configuration



Lab:

Exercise 1: Autowiring with "@Autowired" annotation
4939_spring4_di_annotation.zip

@Qualifier

Fine-tuning @Autowired with Qualifiers

- Because autowiring by type may lead to multiple candidates, it is often necessary to have more control over the selection process
- One way to accomplish this is with Spring's @*Qualifier* annotation

```
public class MovieRecommender {

  // Among the multiple candidates of MovieCatalog type, select
  // the one that has the bean name “main”.
  @Autowired
  @Qualifier("main")
  private MovieCatalog movieCatalog;

  // ...
}
```

Fine-tuning @Autowired with @Qualifier

- The @Qualifier annotation can also be specified on individual constructor arguments or method arguments

```
public class MovieRecommender {

  private MovieCatalog movieCatalog;
  private CustomerPreferenceDao customerPreferenceDao;

  @Autowired
  public void prepare(
                    @Qualifier("main") MovieCatalog movieCatalog,
                    CustomerPreferenceDao customerPreferenceDao) {
      this.movieCatalog = movieCatalog;
      this.customerPreferenceDao = customerPreferenceDao;
  }

  // ...
}
```

Qualifier name is usually bean name

```
@Configuration
public class BeanConfiguration {

    @Bean(name = "myaddress")
    public AddressInterface getMyAddress() {
        AddressInterface address = new MyAddress();
        return address;
    }

    @Bean(name = "youraddress")
    public AddressInterface getYourAddress() {
        AddressInterface address = new YourAddress();
        return address;
    }

    @Bean
    public Person getPerson() {
        Person person = new Person();
        return person;
    }

}
```

There are two candidates
to AddressInterface type:
MyAddress and YourAddress.

Give name to these candidates
so that they can be specified
in the selection process

Custom Qualifier

Creating Custom Qualifier Annotation

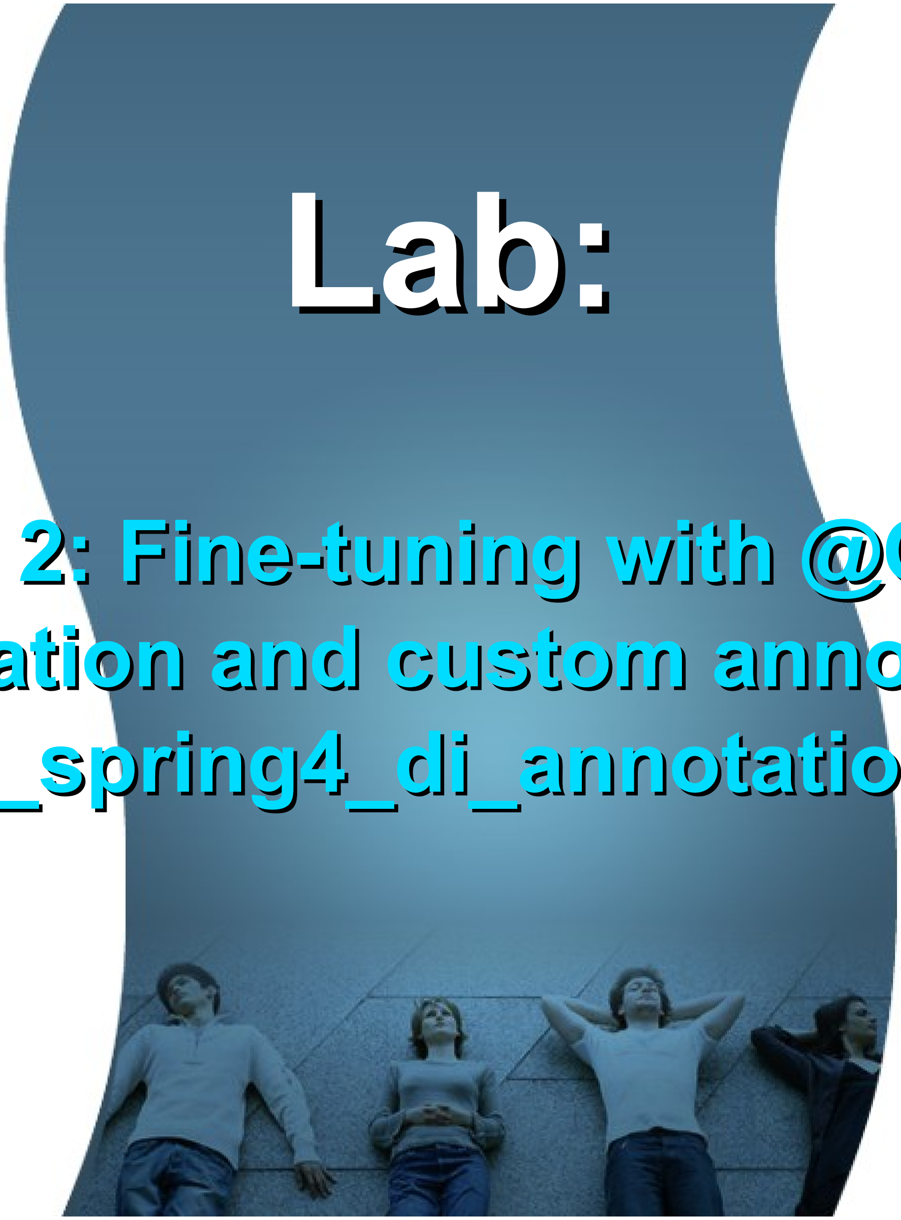
- You can create your own custom qualifier annotations.

```
// Create custom qualifier annotation called "Genre"
@Target({ElementType.FIELD, ElementType.PARAMETER})
@Retention(RetentionPolicy.RUNTIME)
@Qualifier
public @interface Genre {

  String value();
}
```

@Autowired with Custom Qualifier

- Then you can provide the custom qualifier annotation on autowired fields and parameters:

```
public class MovieRecommender {

  @Autowired
  @Genre("Action")
  private MovieCatalog actionCatalog;

  private MovieCatalog comedyCatalog;

  @Autowired
  public void setComedyCatalog(
     @Genre("Comedy" ) MovieCatalog comedyCatalog) {
     this.comedyCatalog = comedyCatalog;
  }

  // ...
}
```



Lab:

Exercise 2: Fine-tuning with @Qualifier annotation and custom annotation
4939_spring4_di_annotation.zip

@Inject Annotation from JSR 330 (Dependency Injection for Java)

JSR 330's @Inject

- JSR 330 – Dependency Injection for Java
- JSR 330's @Inject annotation can be used in place of Spring's @Autowired annotation

@JSR 330 Maven Dependency

```
<!-- JSR 330 Dependency Injection for Java -->
<dependency>
         <groupId>javax.enterprise</groupId>
        <artifactId>cdi-api</artifactId>
        <version>1.2</version>
</dependency>
```

Lab:

Exercise 3: JSR 330 Annotations - @Inject
4939_spring4_di_annotation.zip

@PostConstruct & @PreDestroy & @Resource from JSR 250 (Common Annotations for Java)

@PostConstruct and @PreDestroy

- Offers an post-initialization callback and an pre-destruction callback

```
public class CachingMovieLister {

  @PostConstruct
  public void populateMovieCache() {
      // populates the movie cache upon initialization...
  }

  @PreDestroy
  public void clearMovieCache() {
      // clears the movie cache upon destruction...
  }
}
```

Invoked after object creation

Invoked before object destruction

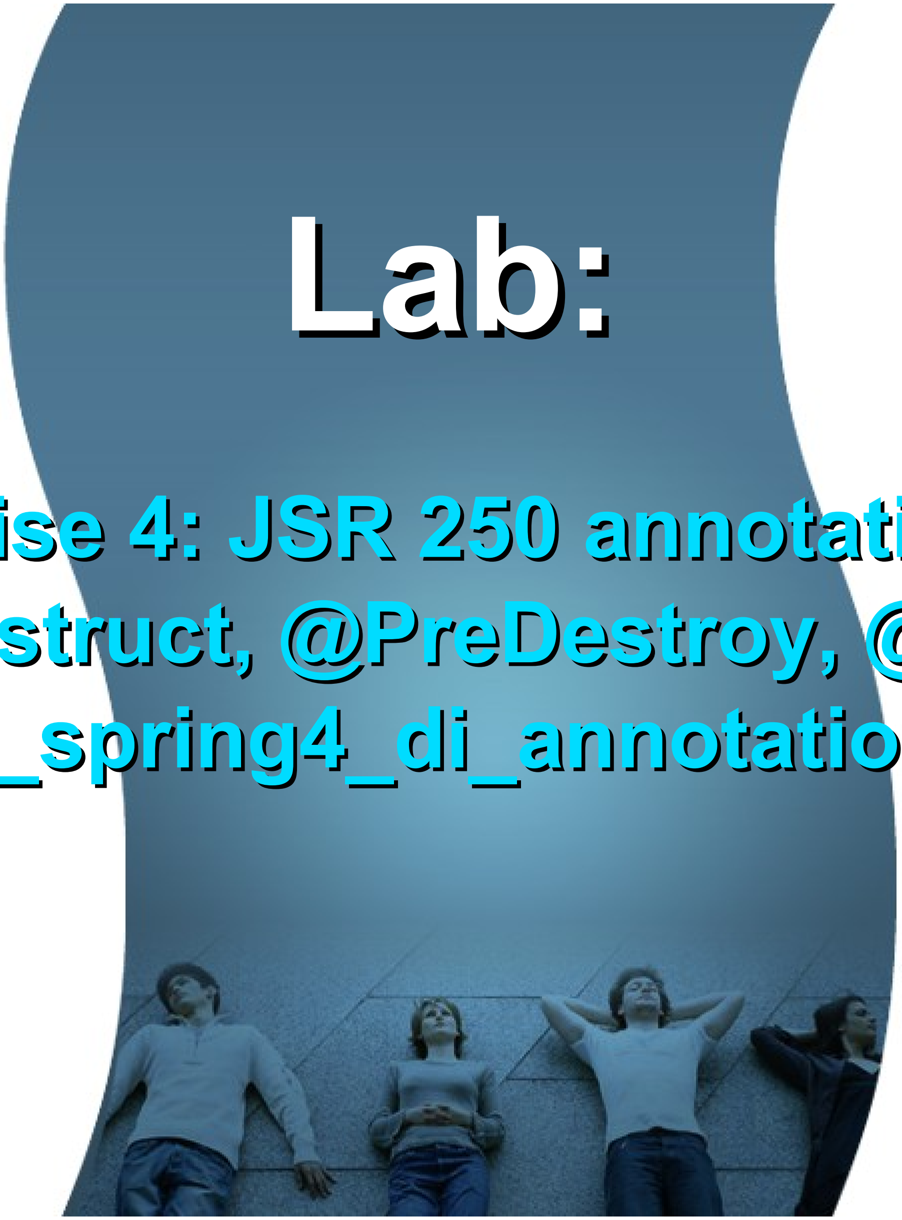
@Resource

- Spring also supports injection using the JSR-250 *@Resource* annotation on fields or bean property setter methods
  - > This is a common pattern found in Java EE 5 and Java 6, which Spring supports for Spring-managed objects as well
- *@Resource* takes a 'name' attribute, and by default Spring will interpret that value as the bean name to be injected. In other words, it follows by-name semantics as demonstrated in this example:

```
public class SimpleMovieLister {

    private MovieFinder movieFinder;

    @Resource(name="myMovieFinder")
    public void setMovieFinder(MovieFinder movieFinder) {
        this.movieFinder = movieFinder;
    }
}
```

Lab:

Exercise 4: JSR 250 annotations - @PostConstruct, @PreDestroy, @Resource 4939_spring4_di_annotation.zip



Java-based Container Configuration

@Configuration and @Bean

- Annotating a class with the *@Configuration* indicates that the class can be used by the Spring DI container as a source of bean definitions (as opposed to from XML file)

```
import com.acme.services.MyServiceImpl;

@Configuration
public class AppConfig {
    // @Bean annotation plays the same role as the
    // <bean/> element in XML configuration
    @Bean
    public MyService myService() {
        return new MyServiceImpl();
    }
}
```

The above is the same as

```
<beans>
  <bean id="myService" class="com.acme.services.MyServiceImpl"/>
</beans>
```

AnnotationConfigApplicationContext

- Like Spring XML files are used as input when instantiating a *ClassPathXmlApplicationContext*, *@Configuration* classes may be used as input when instantiating an *AnnotationConfigApplicationContext*.

```
public static void main(String[] args) {

    // Read bean configuration defined in the AppConfig.clas
    // and perform bean instantiation, configuration, wiring, and assembly
    ApplicationContext ctx =
                    new AnnotationConfigApplicationContext(AppConfig.class);

    // Retrieve MyClass object
    MyService myService = ctx.getBean(MyService.class);
    myService.doStuff();
}
```

@Configuration and @Bean

- A case where a bean has a dependency bean

```
@Configuration
public class AppConfig {
   @Bean
   public TransferService transferService() {
      return new TransferServiceImpl(accountRepository());
   }
   @Bean
   public AccountRepository accountRepository() {
      return new InMemoryAccountRepository();
   }
}
```

The above is the same as

```
<bean id = "transferService"
          class = "com.javapassion.examples.account.service.TransferServiceImpl">
        <property name="accountRepository" ref="accountRepository"/>
</bean>
<bean id = "accountRepository"
           class = "com.javapassion.examples.account.repository.InMemoryAccountRepository">
</bean
```

Lab:

Exercise 5: Java based configuration
4939_spring4_di_annotation.zip

@Component & Further Stereotype Annotations (@Repository, @Service, @Controller)

@Component, @Repository, @Service, @Controller

- @Component is a generic stereotype for any Spring-managed component
- @Repository, @Service, and @Controller are specializations of @Component for more specific use cases (We are going to cover these in detail in Spring MVC topics)
  - @Repository – for persistence
  - @Service – for service
  - @Controller – for controller

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@Repository, @Service, @Controller

- @Repository
  - A class that is annotated with "@Repository" is eligible for Spring org.springframework.dao.DataAccessException translation.
- @Service
  - A class that is annotated with "@Service" plays a role of business service
- @Controller
  - A class that is annotated with "@Controller" plays a role of controller in the Spring MVC application

Lab:

Exercise 6: @Service and @Repository Annotations

4939_spring4_di_annotation.zip

Component Scanning (@ComponentScan)

@ComponentScan

- Configures component scanning
  - Same as XML's <context:component-scan> element
- No need to declare beans with @Bean annotations
- One of basePackageClasses(), basePackages() or its alias value() may be specified to define specific packages to scan
  - If specific packages are not defined scanning will occur from the package of the class with this annotation

Component Scan

- The specified package via base-package attribute – *com.jpassion.examples* package in the example below - will be scanned, looking for any *@Component*-annotated (and its stereo-typed annotations - *@Service, @Repository, @Controller*) classes, and those classes will be registered

```
@Configuration
@ComponentScan("com.jpassion.examples")
public class BeanConfiguration {

//   @Bean
//   public CustomerService getCustomerService() {
//       CustomerService customerService = new CustomerServiceImpl();
//       return customerService;
//   }
//
//   @Bean
//   public CustomerDao getCustomerDao() {
//       CustomerDao customerDao = new CustomerDaoImpl();
//       return customerDao;
//   }
}
```

No need to manually configure beans

@Profile

@Profile

- Spring Profiles provide a way to segregate parts of your application configuration and make it only available in certain environments
- Any @Component or @Configuration can be marked with @Profile to limit when it is loaded

```
@Configuration
@Profile("production")
public class ProductionConfiguration {

    // ...

}
```

- In the normal Spring way, you can use a spring.profiles.active Environment property to specify which profiles are active
- You can also specify the property in application.properties file

```
spring.profiles.active=dev,hsqldb
```

Lab:

Exercise 7: @Profile

4939_spring4_di_annotation.zip

@SpringBootApplication
@EnableAutoConfiguration

@SpringBootApplication

- Composite annotation (Stereo annotation)
- Introduced as part of Spring Boot

```
@Target(ElementType.TYPE)
@Retention(RetentionPolicy.RUNTIME)
@Documented
@Inherited
@Configuration
@EnableAutoConfiguration
@ComponentScan
public @interface SpringBootApplication {

/**
 * Exclude specific auto-configuration classes such that they will never be applied.
 * @return the classes to exclude
 */
Class<?>[] exclude() default {};

}
```

@EnableAutoConfiguration

- Enable auto-configuration of the Spring Application Context, attempting to guess and configure beans that you are likely to need
- Auto-configuration classes are usually applied based on your classpath and what beans you have defined
  - If you have tomcat-embedded.jar on your classpath you are likely to want a TomcatEmbeddedServletContainerFactory (unless you have defined your own EmbeddedServletContainerFactory bean)
- Auto-configuration tries to be as intelligent as possible and will back-away as you define more of your own configuration
  - You can always manually exclude() any configuration that you never want to apply
  - Auto-configuration is always applied after user-defined beans have been registered.

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