Spring

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Contents

Introduction

Seminar Topic

In this seminar we will learn to use Spring's:

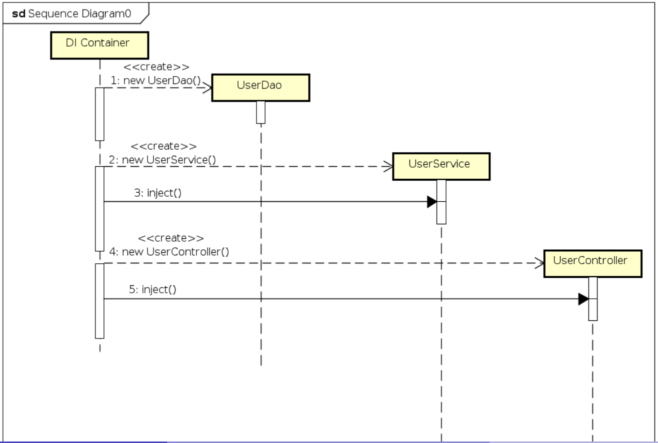
- Dependency Injection (DI) functionality,
- Transactional management

Dependency Injection - Revisited

Definition and Sequence Example

Dependency Injection

Component lifecycle is controlled by the *container* which is responsible for delivering correct implementation of the given bean.



Plain Java code vs DI

```
package cz.cvut.kbss.ear.spring_example;
import ...

public class SchoolInformationSystem {

 private CourseRepository repository
   = new InMemoryCourseRepository();

 public static void main(String[] args) {
   SchoolInformationSystem main = new SchoolInformationSystem();
   System.out.println(main.repository.getName());
 }
}
```

The client code (`SchoolInformationSystem`) itself decides which repository implementation to use

- change in **implementation** requires *client code* change.
- change in **configuration** requires *client code* change.

DI using Annotations

SchoolInformationSystem.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Component
public class SchoolInformationSystem {
  @Autowired
  private CourseRepository repository;
}
```

CourseRepository.java

```
package cz.cvut.kbss.ear.spring_example;
public interface CourseRepository {
  public String getName() { return name; }
}
```

InMemoryCourseRepository.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Component
public class InMemoryCourseRepository
  implements CourseRepository {
  public String getName() { return
    "In-memory course repository"; }
}
```

Proxy Design Pattern

Question Is the class of `SchoolInformationSystem.repository` InMemoryCourseRepository?

Proxy Design Pattern

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Answer No, it is not. It is a subclass of InMemoryCourseRepository.

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Answer No, it is not. It is a subclass of InMemoryCourseRepository.

Proxy Design Pattern

Spring implements Dependency Injection using the Proxy Design Pattern on Beans. The InMemoryCourseRepository is inherited in the background to enable DI.

Proxy Design Pattern - Java code Example

Calculator.java

```java
public class Calculator{
 public int add(int a, int b){
   return a + b;
 }

 public int subtract(int a, int b){
   return a - b;
 }
}
```

CalculatorLoggerProxy.java

```java
public class CalculatorLoggerProxy extends
  Calculator{
 private static final Logger LOG ...
 @Override
 public int add(int a, int b){
   int ret = super.add(a,b);
   LOG.debug("{} + {} = {}", a, b, ret);
   return ret;
 }

 @Override
 public int subtract(int a, int b){
   int ret = super.subtract(a,b);
   LOG.debug("{} - {} = {}", a, b, ret);
   return ret;
 }
}
```

Some observations:

- CalculatorLoggerProxy is also a Calculator
- extends execution by adding pre- and post-processing code

Spring beans

Bean Declaration

Bean declaration tells Spring how to create a bean. We will learn about two ways of bean creation:

- Bean creation trough class constructor
- Bean creation with a factory method

Bean Declaration - Class Constructor

A bean can be declared using annotation on a class. Annotations used for declaration of beans in this way are:

- `@Component`
- `@Configuration`
- `@Repository`
- `@Service`

Code example:

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Component
public class InMemoryCourseRepository implements CourseRepository {
 public String getName() { return "In-memory course repository"; }
}
```

Bean Declaration - Factory method

A bean factory method should be implemented in a configuration bean. The method should be annotated with the `@Bean` annotation and it should return the bean. The methods input parameters will be injected if possible. Code example:

```
@Configuration // is this a bean? Yes it is.
public class RepositoryConfiguration{
  @Bean
  public InMemoryCourseRepository createInMemoryRepository() {
       return new InMemoryCourseRepository();
  }
}
```

Bean Injection

During creation beans are injected with declared dependencies. To declare a dependency in Spring use the annotation:

- @Autowired

Code example:

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Component
public class SchoolInformationSystem {
  @Autowired
  private CourseRepository repository;
}
```

Spring Bean Scopes

Scopes define the life cycle of a bean

singleton	a single bean instance per Spring IoC container (the default scope)
prototype	a new bean instance each time when requested (e.g. injected during creation of another bean)
request	a single bean instance per HTTP request
session	a single bean instance per HTTP session
globalSession	a single bean instance per global HTTP session

Code example specifying the scope of a bean:

```
@Component
@Scope("singleton")
public class SchoolInformationSystem {
  @Autowired
  private CourseRepository repository;
}
```

Spring allows custom scope definition (e.g. JSF 2 Flash scope)

Bean Disambiguation

To resolve a bean dependency spring looks for beans in the application context which will satisfy that dependency.

SchoolInformationSystem.java

```java
package cz.cvut.kbss.ear.spring_example;
import ...

@Component
public class SchoolInformationSystem {
  @Autowired
  private CourseRepository repository;
}
```

InMemoryCourseRepository.java

```java
package cz.cvut.kbss.ear.spring_example;
import ...

@Component
public class InMemoryCourseRepository
  implements CourseRepository {
  public String getName() { return
    "In-memory course repository"; }
}
```

Spring Transactional Management

Transaction Management Annotations

The following annotations work with conjunction with JPA.

- `@Transactional` - on methods and classes, wraps a method in a transaction
- `@EnableTransactionManagement` - enabling transactional support, not needed in Sring Boot

Code example:

```
@Service
public class CartService {
  @Transactional
  public void addItem(Cart cart, CartItem toAdd) {
    ...
  }
}
```

Injecting Entity Manager

The following annotations work with conjunction with JPA.

- `@Transactional` - on methods and classes, wraps a method in a transaction
- `@EnableTransactionManagement` - enabling transactional support, not needed in Sring Boot

Code example:

```
@Repository
public class CartDao {
  @PersistenceContext
  protected EntityManager em;
  ...
}
```

Other Commonly Used Spring Features

Annotation based Spring Configuration

- `@ComponentScan` searching for spring beans among classes in a given package
- `@Import` composing spring configuration

Code example searching for beans:

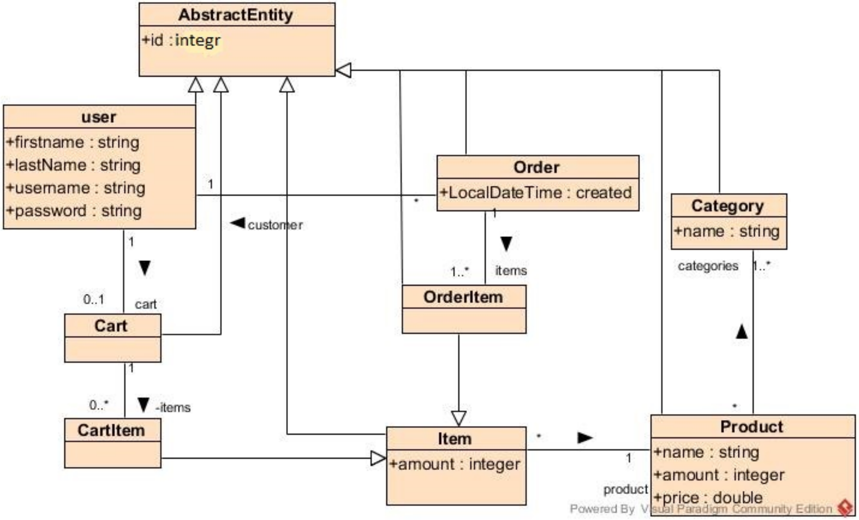
```
@Configuration
@ComponentScan(basePackages = "cz.cvut.kbss.ear.eshop.dao")
public class PersistenceConfig {
...
}
```

Code example importing configuration.

```
@Configuration
@Import( {PersistenceConfig.class})
public class AppConfig {
...
}
```

Demo E-Shop Application

JPA Model


AbstractEntity
+id :integr
user
+firstname : string
+lastName : string
+username : string
+password : string
1
customer
*
Order
+LocalDateTime : created
1
items
1..*
Category
+name : string
categories
1..*
1
cart
0..1
Cart
OrderItem
1
-items
0..*
CartItem
Item
+amount : integer
*
1
product
*
Product
+name : string
+amount : integer
+price : double
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Tasks

Syncing Your Fork

1. Make sure your local copy git repository is configured correctly[1] and all changes are committed (git status - your branch is up to date, nothing to commit).
2. Fetch branches and commits from the upstream repository (EAR/B191-eshop)
   - `git fetch upstream`
3. Check out local branch corresponding to the task branch
   - `git checkout -b b191-seminar-04-task`
4. Merge changes from the corresponding upstream branch
   - `git merge upstream/b191-seminar-04-task`
5. Do your task
6. Push the solution to your fork
   - `git push origin b191-seminar-04-task`

[1] see seminar page 18 (Task for 1 point) and page 19 (Syncing Your Fork)

Task 1 – Configuration of Persistence Layer (1 point)

1. Declare missing bean declarations and injections.
    - Some of the classes in the dao package should be declared as beans but they are not. Declared them properly.
    - In the dao package there is also one dependency injection which not is declared properly. Fix it.
    - **Hint:** `@Repository`, `@PersistenceContext`
2. Create a prototype bean with class java.util.Date.
    - **Hint:** `@Configurable`, `@Bean`

- **Hint:** Use tests to help you debug the issues.
- **Acceptance criteria:** All enabled tests are passing.

Task 2 – Implementation of a Service (1 point)

1. Remove `@Ignore` annotation from `CartServiceTest` and verify that tests are now failing
2. Implement `CartService` that allows to
    - add specific items to a cart
    - remove specific items from a cart
    - amount of products available in stock should be correctly adjusted during each add/remove operation
3. Make sure that service methods are transactional
4. **Acceptance criteria:** Transactional processing is configured properly and all tests are passing.

The End