

# Labs : Spring and SpringBoot

## Requirements

- JDK 11+
- IDE (IntelliJIDEA, Eclipse, STS, VSCode)
- Librairie lombok : <https://projectlombok.org/downloads/lombok.jar>
- Docker
- Git

## Lab1 : Spring, First configuration

The first practical lab uses the example presented in the slides.

We want to develop a business service able to list all the films of a specific director. The films being stored in a repository (A simple text file for the moment).

Therefore, the service will expose the following method:

```
public List<Movie> moviesDirectedBy(String director)
```

It can rely on a repository interface which allow to retrieve all the movies store in a particular repository.

```
public interface MovieDAO {  
    public List<Movie> findAll();  
}
```

An implementation of this interface for a csv file (*org.formation.dao.FileDAO*).

Finally, a provided test class is used to test the implementation of your business object.

### ***1.1 XML Configuration***

#### 1. Set up the project

Import the provided Maven project.

#### 2. Implement *org.formation.service.MovieLister*

Implement the business method and either the constructor or the setters allowing dependency injection.

#### 3. Configure Spring

In *src/test/resources/test.xml*, declare the necessary beans and set their attributes.

#### 4. Execute the test

Execute the test *org.formation.service.MovieListerTest* to validate your implementation

## Lab2. Configuration via annotations

### 2.1 Configuration via annotations

Start from the previous lab

Add the dependency ***javax.annotation :javax.annotation-api :1.3.2*** to use *@PostConstruct* and *@PreDestroy* annotations

Perform a configuration equivalent to the previous lab only via annotations.

In particular, you will use:

- *@Configuration* and stereotype annotations
- The location of the file containing the movies will be externalized in a *application.properties* file

### 2.2 Profiles

We want to run the test in 2 separate profiles "*csv*" and "*jdbc*"

Add the following dependencies :

```
<dependency>
  <groupId>org.springframework</groupId>
  <artifactId>spring-jdbc</artifactId>
  <version>5.3.13</version>
</dependency>
<dependency>
  <groupId>org.postgresql</groupId>
  <artifactId>postgresql</artifactId>
  <version>42.3.1</version>
</dependency>
```

Start a DB server and a pgAdmin instance via docker-compose :  
*docker-compose -f postgres-docker-compose.yml up -d*

Connect to *pgAdmin* (localhost:81) with ***admin@admin.com/admin***

Declarer the DB server with the following connection properties :

***movies-postgresql postgres/postgres***

Create a database named ***movies*** and execute the provided initialisation script.

Retrieve the provided JDBC classes and annotate them correctly.

Rewrite the test class by defining 2 methods:

- 1 performing the test in the *csv* profile
- the other in the *jdbc* profile

## Lab3 : Getting started with SpringBoot

- Create a Spring project (*New* → *SpringStarter Project*)
  - Add the starter web
  - Execute the application, (*Run As* → *Spring Boot App*)
  - Access to ***http://localhost:8080***
  - In *Run* → *Configurations*, override the properties *server.port*
    - Access to the new URL
- Create a class with the following code :

```
@Component
@ConfigurationProperties("hello")
public class HelloProperties {

    /**
     * Greeting message returned by the Hello Rest service.
     */
    private String greeting = "Welcome ";

    public String getGreeting() {
        return greeting;
    }

    public void setGreeting(String greeting) {
        this.greeting = greeting;
    }
}
```

- Another class implementing a REST endpoint:

```
@RestController
public class HelloController {

    @Autowired
    HelloProperties props;

    @RequestMapping("/hello")
    public String hello(@RequestParam String name) {
        return props.getGreeting()+name;
    }
}
```

Add a dependency in the pom.xml to process the *@ConfigurationProperties* annotation during the build phase and create the necessary files so that Spring Tool takes into account the new properties:

```
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-configuration-
processor</artifactId>
</dependency>
```

- Then test the completion in the property editor

- Test the application

### **Auto configuration**

In the Main class, use the return value of `SpringApplication.run(Application.class, args);` to print auto-configured Spring beans.

### **Plug-in Maven**

Start the application from the command line after performing a build (*mvn package* or *gradlew bootJar*)

### **Development starters**

Add the dependency *spring-boot-configuration-processor*

Activate *devtools*

Observe the consequences of devtools: Automatic restart when changing Java code

### **Properties via le format .yml**

Rename *application.properties* to *application.yml*

Set the following application properties, these properties are encapsulated in the configuration properties class *HelloProperties* :

- *hello.greeting* (not empty without default value) : The way to say *hello*
- *hello.styleCase* (Upper, Lower or Camel) : The way to write the name
- *hello.position* (0 ou 1) : The name or the greeting in first position

Add validation constraints in *HelloProperties*

### **Profiles**

Define a different port for the prod profile

Activate Profile:

- Via the IDE
- Via the CLI, after having generated the *fat jar*

### **DEBUG mode and trace configuration**

Enable the *-debug* option on boot

Modify the configuration in order to generate a server log file

Modify the trace level of the logger *org.springframework.boot* to DEBUG without the option *-debug*

## Lab4 : SpringData

### 4.1 Spring Data JPA

#### *Default configuration of Spring JPA*

Create a project with

- a dependency on the starter **Spring JPA**
- a dependency on **H2**

Retrieve the provided model classes.

The Member and Document classes are used for the JPA part, the Customer class for the NoSQL part

If necessary add Maven or Gradle dependency

Configure Hibernate to show SQL statements

Retrieve the supplied **import.sql** script and place it correctly in the project arborescence so that it inserts test data into the database

Start the application and verify that the insertions take place

#### *Interfaces JpaRepository*

Define Repository interfaces that implement the following functionalities:

- CRUD on Member and Documents
- Search all documents
- Find members with a particular email
- Find the member for a given email and password
- All members whose first or last name contains a particular string
- Search all documents of a member from its name (Remember to use the `@Query` annotation)
- Count members
- Count documents
- Find a member from their ID with all associated documents pre-loaded

## **Tests**

Use the provided test class to validate queries for the *Member* entity.

Write on the same model a test class validating queries on Document

## Optional:

Inject an *EntityManager* or a Datasource to work directly at the JPA or JDBC level

## ***Datasource configuration and connexion pool***

Add a dependency on the PostgreSQL driver

Define a postgres database using a pool of connections (maximum 10 connections) in a production profile.

Create a runtime configuration that enables this profil.

## ***Service implementation***

Implement a business method that allows you to add a document to all users of the database

Test the method

## Lab4B (Optional) : MongoDB

Add dependency on MongoDB and on Mongo embeddeed server

Declare a model class as follows:

```
public class Customer {

    @Id
    public String id;

    public String firstName;
    public String lastName;

    public Customer() {}

    public Customer(String firstName, String lastName) {
        this.firstName = firstName;
        this.lastName = lastName;
    }

    @Override
    public String toString() {
        return String.format(
            "Customer[id=%s, firstName='%s', lastName='%s']",
            id, firstName, lastName);
    }
}
```

Define a MongoRepository interface that allows searching for *Customer* by **firstName** or **lastName** attributes

Write a test class which will contain the following code:

```
private void _playWithMongo() {
    customerRepository.deleteAll();

    // save a couple of customers
    customerRepository.save(new Customer("Alice", "Smith"));
    customerRepository.save(new Customer("Bob", "Smith"));

    // fetch all customers
    System.out.println("Customers found with findAll():");
    System.out.println("-----");
    for (Customer customer : customerRepository.findAll()) {
        System.out.println(customer);
    }
    System.out.println();

    // fetch an individual customer
    System.out.println("Customer found with
findByFirstName('Alice'):");
    System.out.println("-----");

    System.out.println(customerRepository.findByFirstName("Alice"));
```

```
        System.out.println("Customers found with  
findByLastName('Smith'):");  
        System.out.println("-----");  
        for (Customer customer :  
customerRepository.findByLastName("Smith")) {  
            System.out.println(customer);  
        }  
    }
```



# Lab5 : Restful with SpringBoot and SpringMVC

## 5.1 Controllers

Create a Rest controller, *MemberRestController*, to:

- Display all members
- To display members whose full name (first name + last name) containing a particular string
- Perform all CRUD methods on a member
- Retrieve all documents of a given member
- To add a document to a member

When returning a list of members the returned json will only contain simple Member's attributes

When returning a single member, the json will also contain the associated documents.

Some methods may throw "MemberNotFoundException" business exceptions

Disable "Open Session in View" Pattern

Test GET URLs

## 5.2 CORS and Exceptions handling

Configure the cors, to allow requests from all origins

Add a *ControllerAdvice* which centralize exception handling *MemberNotFoundException*

## 5.3 OpenAPI and Swagger

Add following dependency to get OpenApi 3.0 documentation

```
<dependency>
  <groupId>org.springdoc</groupId>
  <artifactId>springdoc-openapi-ui</artifactId>
  <version><last-version></version>
</dependency>
```

Access the description of our REST API (<http://server:port/swagger-ui.html>)

Add OpenAPI annotations to perfect documentation

## Lab6 : RESTful call

Create another project that implements a service implementing 3 methods performing REST calls to the previous application:

- Load 1 member
- Load all members
- Create a member

### Steps :

Create a project with the reactive-web starter

Disable tomcat startup with property:

*spring.main.web-application-type=none*

Implement a Service bean using **WebClient.Builder** and **WebClient**

Write the tests to make the calls

## Lab7 : Messaging

We set up a Publish/Subscribe type communication

*ProductService* publishes the TICKET\_READY event to a topic

*DeliveryService* reacts by creating a delivery in its own database

### 7.1 Starting the message broker

Retrieve the **docker-compose.yml** file to start the Kafka message broker and the necessary ZooKeeper process

*docker-compose up -d*

Declare kafka in the local host file (/etc/hosts)

127.0.0.1 kafka

### 7.2 Producer

Add **spring-kafka** starters on *ProductService*

Implement a service which :

- Creates a ticket
- Publishes an event *READY\_TO\_PICK* on the kafka topic ***tickets-status***, the key of the message is the Ticket id and the body an instance of *ChangeStatusEvent*

Publish some messages by creating ticket

### 7.3 Consumer

Add **spring-kafka** starters on *DeliveryService*

Implement a Service which

- Listens to the topic ***ticket-status***
- If the event is *READY\_TO\_PICK*, create a Livraison entity

You can test everything with the provided JMeter script

## Lab8 : *SpringSecurity*

### 8.1 Configuration

Add Spring Security in dependencies of previous web project

Test application access

Enable debug traces for security

View the *springSecurityFilterChain* filter, perform the authentication sequence and observe messages on the console

Add a configuration class of *WebSecurityConfigurerAdapter* which :

- Allow access to swagger documentation
- Requires authentication for API GET methods
- Requires ADMIN role for all other methods

### 8.2 Memory realm

Define in-memory users to verify previous ACL rules

What filters are enabled in the filter chain?

Enable debugging and make requestss

### 8.3 Custom authentication

Set up a class implementing *UserDetailsService*, configure authentication to use this class.

The class will be based on the *MemberRepository* bean developed in the previous lab

Also ensure that passwords are encrypted in the database.

### 8.4 (Optional) Authentication via OpenId/oAuth2

- Apply <https://www.baeldung.com/spring-security-5-oauth2-login> to our project
- Set up a specific page

In addition to the login proposal, add an authentication form, allowing authentication with the DB

## 8.5 (Optional) KeyCloak integration

### 1. Set up the token provider : KeyCloak

Start a KeyCloak server via Docker:

```
docker run -e KEYCLOAK_USER=admin -e KEYCLOAK_PASSWORD=admin -p 8089:8080 --name keycloak jboss/keycloak
```

- Connect to its administration console with admin/admin
- Create a Realm **MemberRealm**
- Under this realm, create one client : member-app
- Set access-type to confidential and Valid Redirect Uri to \*
- Then create a user with credentials user/secret

Obtaining tokens:

#### Grant type password for the client store-app

```
curl -XPOST http://localhost:8089/auth/realms/MemberRealm/protocol/openid-connect/token -d grant_type=password -d client_id=member-app -d client_secret=<client_secret> -d username=user -d password=secret
```

Get a refresh token using a POST request with:

client\_id:member-app

client\_secret:<client\_secret>

'refresh\_token': refresh\_token\_requete\_précédente,

grant\_type:refresh\_token

### 2. OAuth2 login et sécurité stateful

Ajouter les starters **security et oauth2-client** au projet Members

Configurer la sécurité en indiquant le oAuth2Login()

Exemple code Spring WebFlux :

```
@Bean
public SecurityWebFilterChain securityWebFilterChain(
    ServerHttpSecurity http) {
    return http.authorizeExchange()
        .pathMatchers("/actuator/**").permitAll()
        .pathMatchers("/auth/**").permitAll()
```

```

        .anyExchange().authenticated()
        .and().
        oauth2Login().csrf().disable().build();
    }
}

```

Configure Keycloak's oauth2 client as follows:

```

spring :
  security:
    oauth2:
      client:
        provider:
          keycloak:
            token-uri: http://localhost:8089/auth/realms/StoreRealm/protocol/openid-
connect/token
            authorization-uri:
http://localhost:8089/auth/realms/StoreRealm/protocol/openid-connect/auth
            user-info-uri:
http://localhost:8089/auth/realms/StoreRealm/protocol/openid-connect/userinfo
            user-name-attribute: preferred_username
            registration:
            store-app:
              provider: keycloak
              client-id: store-app
              client-secret: 57abb4f6-5130-4c73-9545-6d377dd947cf
              authorization-grant-type: authorization_code
              redirect-uri: "{baseUrl}/login/oauth2/code/keycloak"

```

Then access the API via a browser

To better understand, you can see the filter configured in the console and also augment the traces via:

```

logging:
  level:
    org.springframework.security: debug

```

### 3. ACL and resource server

Add the starter **oauth2-resource-server**

Specify **spring.security.oauth2.resourceserver.jwt.issuer-uri**

Modifier la configuration de la sécurité pour mettre des ACL sur le scope du client

```

@Bean
public SecurityWebFilterChain securityWebFilterChain(
    ServerHttpSecurity http) {
    return http.authorizeExchange()
        .pathMatchers("/actuator/**").permitAll()
        .pathMatchers("/auth/**").permitAll()
        .anyExchange().authenticated()
        .and().
        oauth2ResourceServer(v -> v.jwt()).csrf().disable().build();
}

```

## Lab 9 : SpringBootTest and auto-configured tests

For each test, it is recommended to print the Spring application context (ApplicationContext) in order to inspect the auto-configured beans.

### **@DataJpaTest**

Write a test class which tests the *findByOwner* method

### **@JsonTest**

Write a test class which tests the serialization/deserialization of the Member class

### **@WebMvcTest**

Use **@WebMvcTest** to test MemberRestController using a mockMVC

## Lab10: Toward Production

### **10.1 Actuator**

Add a dependency to *Actuator*,

View default endpoints

Configure the application so that all endpoints are activated and accessible

View endpoints

### **10.2 Production profile**

Set up a production profile:

- Using Postgres database
- Choice for the security profile
- Disabling swagger-ui

### **10.3 Artefact for production**

Modify the build so that build information is added

Configure the build so that the generated artifact is executable and has the project name

Start the app and access actuator endpoints

Optionally build a Docker image and boot it from Docker