Employee Shift Scheduler

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Course: Internet Software Architectures

**1.Introduction**

This software is a simulation of business software, concretly for management. It’s purpose is to manipulate with data for employees and shifts, and most important purpose is to make schedule for those shifts with employees. In this app is a very simple example of the algorithm that is used for scheduling shifts, which I have constructed, only already existable part is sorting with Insertion Sort algorithm.

This application architecture is based on 2 REST Spring Boot microservices, and one client app made in Spring which is tinny connected to those REST web services.

I have used REST web services because REST is much flexible than SOAP, mainly because it supports more standards such as JSON, YAML, XML etc. In this app, I am using JSON format for transfering the data, and it is much faster than XML format, which is better for modeling data, as we can see in configuration files for Spring and Spring Boot, or Maven, Android, Java FX etc.

This project is 2 layer architecture, because there is no database, inspite of that we have simulated database with Array Lists in Java.

Client App is CLI, without GUI, but user is driven with clear sentences and menus throw the application.

There is 10 mapping methods which are mapping to REST resources (URI-s), such as GET, POST, PUT, DELETE requests.

Also in both services we have Controller and Model. Model is implemented as DAO (Data Access Object) service which is Autowired into the controller for using DAO methods in mapping methods.

With this app, managers of employees won’t waste so much time by scheduling employees.

**2.Review of Used Technologies**

First for both web services we have used Spring Boot preconfigured framework with REST, Hibernate and Maven frameworks also, but Hibernate is not used because we don’t have real database where we can use Hibernate. Maven is great for managing whole project structure, for example in downloading external libraries.

Spring Boot is great preconfigured framework and more easier to work than casual Spring framework. Spring Boot is based on MVC (Model View Controller) application architecture but we will Model use as DAO (Data Access Object) layer. In this case Controller is implemented as Rest Controller and DAO class as Spring Boot Component so it can be Autowired.

In both web services (Employee Service and Shift Service) there is one of the most important xml files which is named **pom.xml**.

That file is used for injecting all dependencies into the project, storing information about SDK, project description, repositories etc.

Because those two web services are targeted on the same IP address (localhost -> 127.0.0.1), their socket (IP address + port) needs to be different, but because they are localy developed, they have only 2 different ports

Default port is 8080, and it is however used for **Employee Service** because there is not app that taked this port, so file **application.properties** in this web service is empty.

In other web service **Shift Service** we put into **application.properties** file server.port=1313, so this service will communicate throw port 1313 with client application.

Client application is developed with Spring framework so it has spring.xml file as configuration file but it is empty because there is no need for creating concrete objects in this app, because its main perpose is exchanging data with those 2 web services.

Also in this Client Application I have used apache http client external libraries for connecting application with web services.

There is special class with static methods for sending requests and receiving responses from the web services.

In one we can use either GET or DELETE method, depending on that what is sent by argument that is used as type of method, while in other static method we have same situation with POST or PUT HTTP methods for requests.

**3.Implementation**

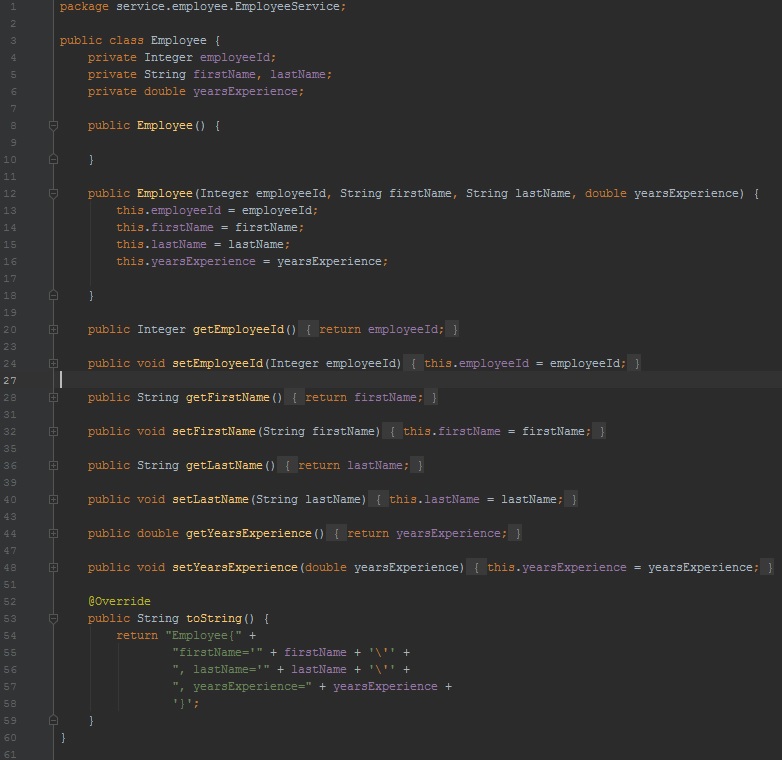
Now we will show implementation for Employee Service, then Shift Service and at the end Manager Client application.

**3.1 EmployeeService**

Service has internal Spring Boot environment and its own web server that uses port 8080 as default port

**3.1.1 Employee.java**

This class just shows basic informations about one employee that needs to be inserted in required shift. Class have private attributes, default and constructor with arguments, getters and setters and **toString()** overridden method.

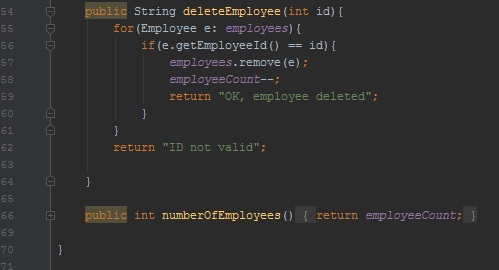
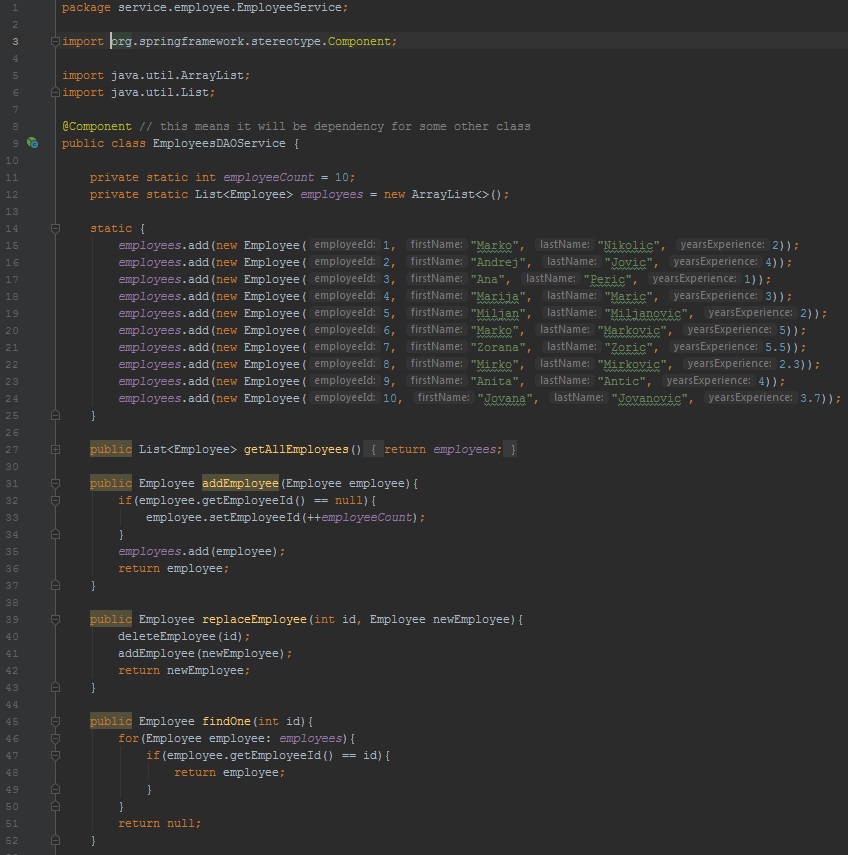


**3.1.2 EmployeesDAOService.java**

Class is Annotated as Spring Boot Component that will be automatically injected into Controller.

This class have 2 static fields. One is data about number of employees, other is simulation of database table as Array List of employees.

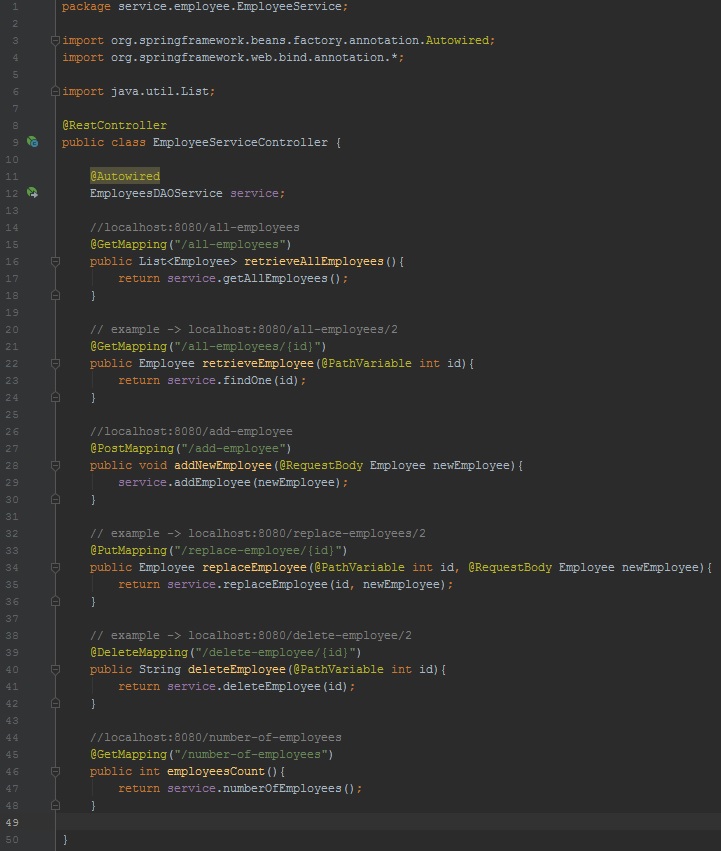
Also it has static block for adding initial employees into the list. There are also methods that will be called into Controller mapping methods which are displaying all employees, only one specified employee, deleting employee, replacing one employee with another, showing total number of employees, and for adding one employee into the list.



**3.1.3 EmployeeServiceController.java**

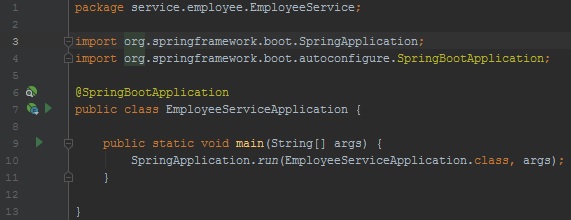
This class is implemented as Rest Controller and in this class Spring Boot automatically inject DAO service object with **Autowired** annotation.

Methods in this class are all annotated with HTTP methods which will be used for those resources mapped on specific URI. This annotations have URI routes on which we are calling this method defined below annotation. **@PathVariable** is here an integer that is taken from the address path and used in the method and **@RequestBody** is data taken from body of the client request which data will be used for creating object in services as new Employee.



**3.1.4 EmployeeServiceApplication.java**

This class is the main class which is calling file for this class in Java bytecode via run method of Spring Boot internal environment, so by that our service will be up if there is no errors.

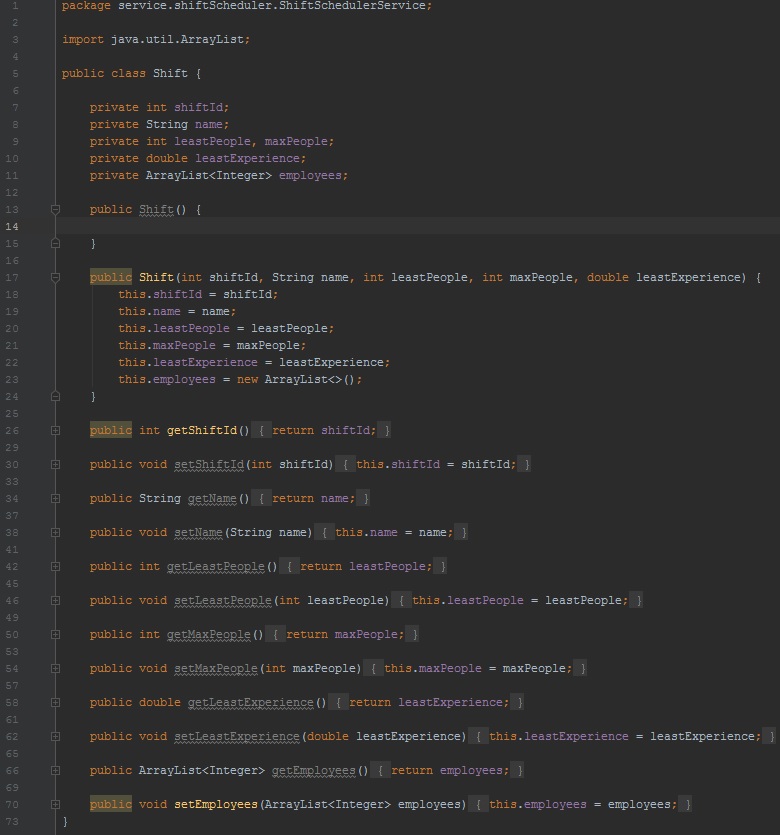


**3.2 ShiftService**

This service uses port 1313 which is added in application.properties file in resurces folder.C:\Users\Korisnik\Desktop\Zavrsni projekat\docs\Untitled.jpg . This service is used for manipulating with data for shifts and scheduling employees into shifts by special algorithm in the client application.

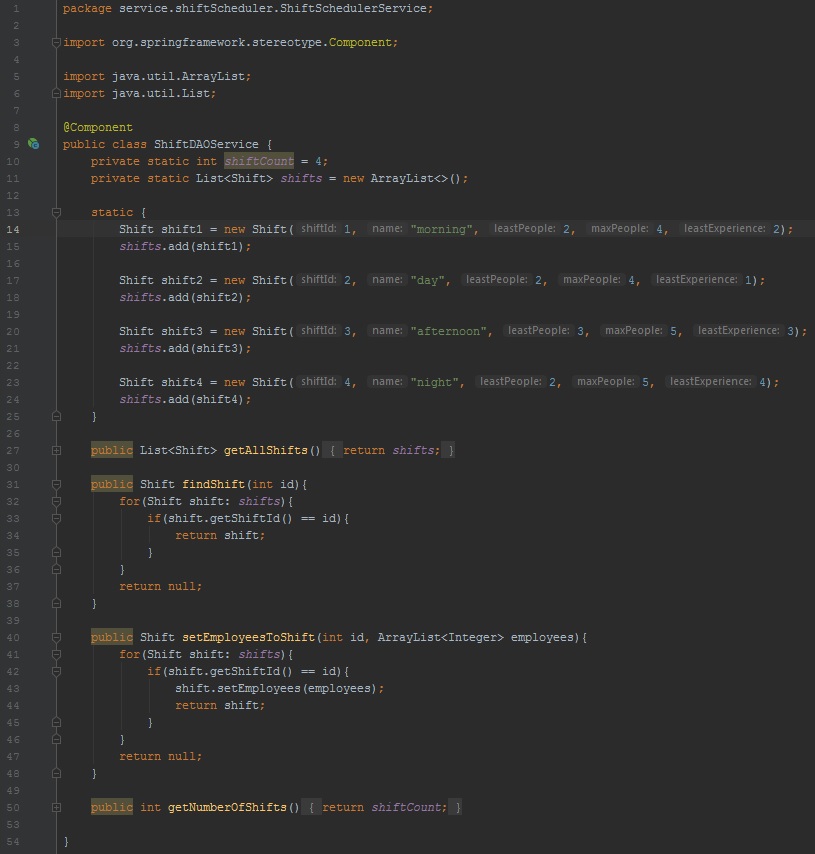
**3.2.1 Shift.java**

This class is used for creating shift objects and it has all necessary data and **constraints about it as leastPeople, maxPeople and leastExperience**. Everyting else is just constructors, getters and setters that are easy to understand. List of employees is empty at the beginning but letter the algorithm will insert employees in it. This class is simulated as template for one record in the database table which is not created here.

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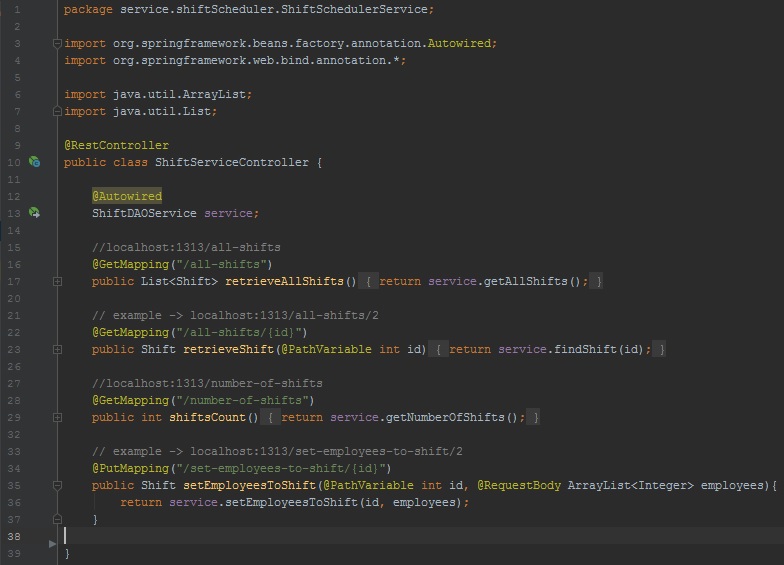
**3.2.2 ShiftDAOService.java**

This class is implemented as Spring Boot component with **@Component** annotation for it at the beginning for Autowiring as Spring Bean in Controller class. It has static fields for number of shifts and static List of shifts defined and added in static block. Also there are 4 methods which are called for sending requests on specific URIs defined in controller. Those methods are used for modifying data in shifts or showing shifts. One important method is **setEmployeesToShift()** which will add employees ordered by algorithm on the client for concrete shift.

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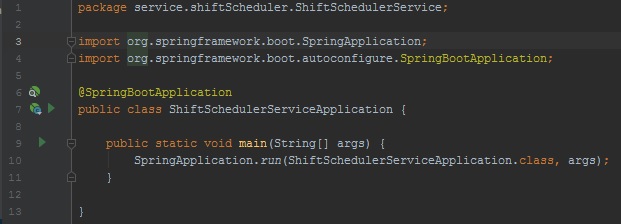
**3.2.3 ShiftServiceController.java**

This is REST Controller so we assigned annotation for that so Spring Boot will recognize it. DAO service is automatically injected by **@Autowired** annotation. We have 4 mapping methods with HTTP methods annotations and paths to specifis resources which are readed or posted. There are 3 **GET** methods which are triggered and which are showing data for all shifts, specific shift by id, number of shifts and one the most important method which uses **HTTP PUT** method for setting list of employees given by algorithm for specifis shift.



**3.2.4 ShiftSchedulerServiceApplication.java**

This is main class for Shift Service, as previous Employee Service, same procedure is for this compiling. Run method from Spring Boot will compile main class which will start service on port 1313 if every other component is started and all dependencies are injected without errors.

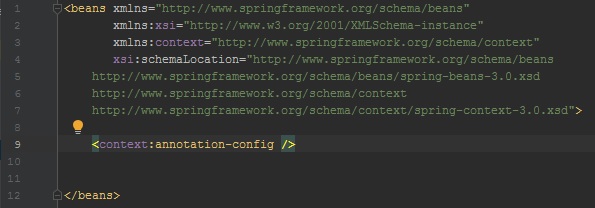
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**3.3 ManagerClientApp**

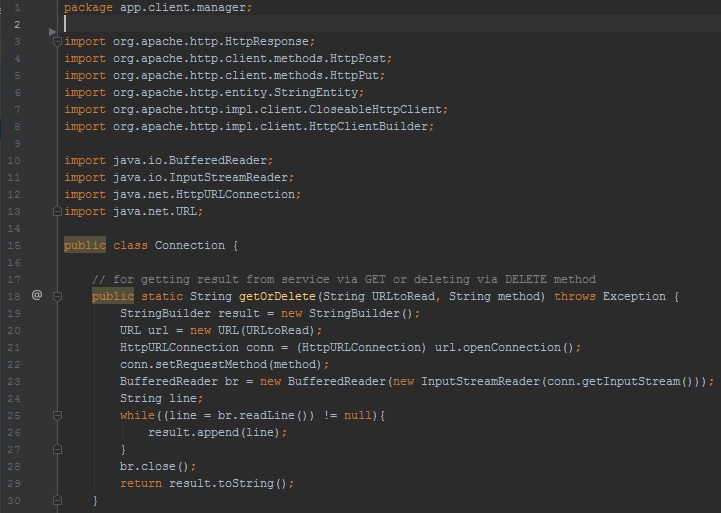
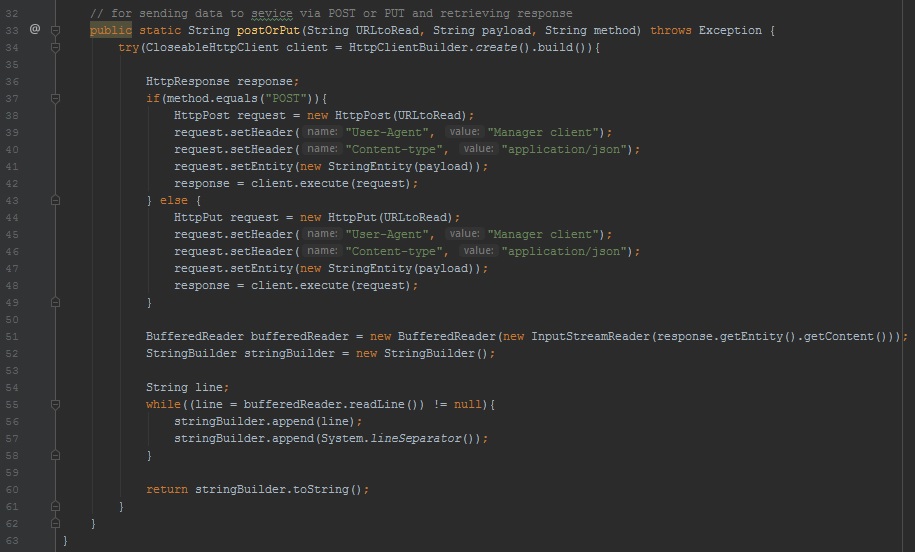
This Spring client application that communicates with 2 web services above via web and transfer data. It also includes class Conncetion for connecting to those services and important algorithm for scheduling employees which is the key part of this software.

**3.3.1 spring.xml**

This is empty Spring xml configuration file, because at the end there wasn’t need for additional beans because everything is in transferring data between services and app, so we only have application context and links for Spring.



**3.3.2 Connection.java**

This class as mentiones is used for connecting to web services with 4 HTTP methods. In first static method we are using either GET or DELETE and by that we will send request to given URL with given method, and after we get response, we will just read it and return it. Similar is done in 2nd method except we are setting header in request and in body we set our payload data for sending to server. Important is that we use external org.apache.htttp libraries for connection.

**3.3.3 ManagerClientApp**