**Lab 2**

**Create a new REST service with Spring Boot**

In lab 1 you made your first REST service in Java with the Springboot framework (if not you can use the completed services that is included with the first lab).

In this lab you are creating your second REST service, named product service, and make some changes to the shopping service so that it calls the product service for its list of drinks.

**Create your second project**

In the first lab, you were introduced to the web-based Spring Initializr, which generates an ‘out of the box’ project structure for you. For the creation of your second REST service you can make use of it again or use an embedded/plugin version in the IDE of your choice.

* Name the Artifact ‘productservice’
* Fill in ‘demo project for Spring Boot’ for the description
* Change package name to: nl.groothandel.service
* Set the packaging option to jar
* Choose java version 8 (or higher, depending on your installed JDK version)
* Choose WEB as a dependency
* If not already so, open the project in your favorite IDE

**Add a JSON Controller**

* Add a new folder to the package ‘nl.groothandel.service’ and name it ‘**web**’
* Add a new Java class to the web folder and name it ‘**ProductsController.java**’
* Annotate the class definition as a REST controller and give it a request mapping with the value ‘**products**’ (see lab 1 for more details, if you are not sure how to do this). By this request mapping annotation, the products controller is reacheable via the URL <http://[servername]:[port]/products>.

**Add a domain with products**

In the shopping service (lab 1), drinks were retrieved from a hard-coded list of String values. The productservice however, will be serving drinks as a list of Products. For now, these products will still be hard coded, but later in the labs (in the 2nd SIG) these products will be retrieved from a database.

For now, you are going to add 2 domain classes to the productservice.

* Add a new folder to the package ‘nl.groothandel.service’ and name it ’**domain**’
* Add a new Java class to the domain folder and name it **Product.java**
* Add another Java class to the domain folder and name it **ProductRepositoryImpl.java**
* Open the **Product.java class** and add the following properties to the class definition:

private String productId;  
private String name;  
private String type;  
private String brand;  
private String bottleSize;  
private double abv; //eg. 20 pct alcohol  
private double price;

* Also add the following 2 constructor methods to the Product.java class. A constructor method is called upon automatically at runtime during instantiation.

public Product() {}  
  
public Product(String productId, String name, String type, String brand, String bottleSize, double abv, double price) {  
 super();  
 this.productId = productId;  
 this.name = name;  
 this.type = type;  
 this.brand = brand;  
 this.bottleSize = bottleSize;  
 this.abv = abv;  
 this.price = price;  
}

* Generate or make getter & setter methods for each property

(Go to: Code -> Generate… -> Getter & Setter)

public String getProductId() {  
 return productId;  
}  
  
public void setProductId(String productId) {  
 this.productId = productId;  
}

//...repeat for other properties

* Open the **ProductRepositoryImpl.java** **class** and add a collection (**java.util.Map**) of drinks to it (just below line with the class definition):

private Map<String, Product> products;  
{  
 Map<String, Product> map = new HashMap<>();  
 map.put("GLNF", new Product("GLNF","Glenfiddich 18 Years", "Whisky", "Glenfiddich", "70cl", 42, 39.95));  
 map.put("PULT", new Product("PULT"," Old Pulteney 17 years Single Malt", "Whisky", "Old Pulteney", "70cl", 41, 59.95));  
 this.products = map;  
}

In lab 1 you added a hard-coded list of drinks to the **ShoppingService**. By the following instructions in this lab, the **ShoppingService** will retrieve its list of drinks from the **ProductService** and so, no so longer make use of the embedded hardcoded list. Therefor it will be removed from the shopping service later.

For now, add a getter and setter method for the map to the **ProductRepositoryImpl.java class**

public Map<String, Product> getProducts() {  
 return products;  
}  
  
public void setProducts(Map<String, Product> products) {  
 this.products = products;  
}

For now, this completes your domain definition.

* Open the file **ProductsController.java**

Below the line with the class definition add the following:

ProductRepositoryImpl productRepository = new ProductRepositoryImpl();

As you probably know, this is a so called ‘hard wired dependency’ also known as ‘tight coupling’ and can have unwanted implications during the classes life cycle. This line is coded as is for learning purposes. You are going to make changes to it later.

* Add the following method to the file **ProductsController.java** for retrieving a list of products. This list contains the products that you added earlier to the map in the ProductRepositoryImpl.java class.

public List<Product> retrieveProducts() {  
 return new ArrayList<>(productRepository.getProducts().values());  
}

* The **retrieveProducts()** method should be invokeable via http **GET** and the URL <http://[servername]:[port]/products/>, which you already set for the class level. Add an appropriate annotation to the method. If you are not sure about the annotation, have a look at the finished code which comes with this lab.
* Add a second method to the controller class for getting a specific product from the list via the url: [http://[localhost]:[port]/products/{productId}](http://[localhost]:[port]/products/%7bproductId%7d). Again, can you figure out the annotation?

public Product retrieveProduct (@PathVariable("productId") String productId) {  
 return productRepository.getProducts().get(productId);  
}

**Change the portnumber for the web server**

* Open the file **application.properties**, which already exists in your project folder, and add the following line:

server.port=8081

Since the shopping service already runs on port 8080, another port is needed for the product service

**Test the Product Service**

For testing purposes, you can use Postman again.

* Choose GET
* Type the URL: <http://[server]:[port]/products> with the placeholders [server] and [port] replaced with your actual values: likely localhost and 8081.
* Press send.
* If all goes well, then the list with drinks is returned.

**Adjust the Shopping Service**

Now you have the product service returning a list of products in JSON format, it is time to adjust the shopping service for using this list, (instead of the hard-coded list in the shopping service).

* Reopen the shopping service in case you closed this.
* In the file **ShoppingController.java** adjust the method **retrieveDrinks()**:
  + (Temporarily) adjust the method line to:

public static List retrieveDrinks()

Since the list from the product service contains products, and no longer Strings, the generic String must be removed from List<String>. The change to just List allows the method to return any object type. Further on you are going to restrict the list to return only products.

* + Replace the line with the statement ‘return drinks;’ with the following:

RestTemplate restTemplate = new RestTemplate();  
return restTemplate.getForObject("http://localhost:8081/products", List.class);

* Test the shopping service: <http://[server]:[port]/shopping/drinks> (GET). A json list with the drinks retrieved from the product service should be in the result.
* Add a new ‘**domain’** folder to the package nl.sjop.service and create a new class **Product.java** into it. The contents of the **Product.java** class is identical to the one in the product service (except for the package name).
* In the ShoppingController class now change List to List<Product>:

public static List<Product> retrieveDrinks() {

* Check everything still works by testing it again.

The method retrieveDrink still retrieves its data from within, so let’s change that as well.

* Change the line with the method declaration retrieveDrink into:

public static Product retrieveDrink(@PathVariable("id") String productId) {

Note the changed return type, which is now Product.

* Replace the content of the method with the following code:

final String url = "http://localhost:8081/products/{productId}";  
Map<String, String> uriParams = new HashMap<>();  
uriParams.put("productId", productId);  
UriComponentsBuilder builder = UriComponentsBuilder.*fromUriString*(url);  
URI uri = builder.buildAndExpand(uriParams).toUri();  
  
RestTemplate restTemplate = new RestTemplate();  
return restTemplate.getForObject(uri, Product.class);

The builder in this code creates an URI with the productId replaced with the value the method receives in the parameter productId. Again, this value is passed to the method via the ShoppingController when it receives a request via the url: [http://[server]:[port]/shopping/drink/{id}](http://[server]:[port]/shopping/drink/%7bid%7d), with server, port and id replaced with actual values. The created uri is passed to the method getForObject of the RestTemplate class. In turn it receives an instance of Product class, which can be used for further processing.

Note that this rest call invokes the method retrieveProduct in the product service over http.

* Remove the hard-coded list named drinks from the **ShoppingController.java** class.

**Test the Shopping Service**

**Test1**: retrieve the list with drinks by invoking: <http://[server]:[port]/shopping/drinks>

**Test2**: retrieve the list with drinks by invoking: [http://[server]:[port]/shopping/drink/{id}](http://[server]:[port]/shopping/drink/%7bid%7d)

Eg. <http://localhost:8080/shopping/drink/PULT> or <http://localhost:8080/shopping/drink/GLNF>

**Rest Template exchange method**

In the above example both methods in the shopping service make use of the getForObject method, included in the RestTemplate class.

Sometimes you want more control over the response handling concerned with the RestTemplate call. Therefor you can make use of the exchange method that comes with the RestTemplate class. The exchange method returns its result into a ResponseEntity instance. Let’s implement this now in the retrieveDrink method for the ShoppingController.java class, to see how it works.

* Add a new class to nl.sjop.service and name it **ProductNotFoundException.java**. You are going to invoke this class when no product is returned from the product service.
* Add the following to **this ProductNotFoundException.java** class:

@ResponseStatus(*NOT\_FOUND*)  
public class ProductNotFoundException extends RuntimeException {  
 public ProductNotFoundException(String message) {  
 super(message);  
 }  
}

* (re)Open the **ShoppingController.java** class
* Comment out (or remove) the return line from **retrieveDrink()**:

//return restTemplate.getForObject(uri, Product.class);

* Add the following lines after the RestTemplate instantiation line:

HttpHeaders headers = new HttpHeaders();  
HttpEntity<String> entity = new HttpEntity("parameters", headers);  
ResponseEntity<Product> result =  
 restTemplate.exchange(uri, HttpMethod.*GET*, entity, Product.class);  
if (result.getStatusCode()== HttpStatus.*OK* && result.getBody() != null) {  
 return result.getBody();  
} else {  
 throw new ProductNotFoundException("id:" + productId);  
}

* Perform a test for retrieving an existing product and see if this still works as before.
* Also perform a test for a non-existing product. Notice the http status code and message.

**External API**

The shop also wants to show the price in USD. This can be hardcoded for each product, but it is better to call another API to retrieve the exchange rate between EUR and USD and use that rate to calculate the price in USD. For this purpose, we are gonna use the API exposed at <https://api.exchangeratesapi.io/>. This API will return exchange rates from a currency to other currencies.

* Open the **ShoppingService** and add an extra instance field to the **Product.java** class:

private double priceUSD;

* And add the getter/setter:

public double getPriceUSD () {  
 return priceUSD;  
}  
  
public void setPriceUSD(double priceUSD) {  
 this.priceUSD = priceUSD;  
}

* Look at the response from <https://api.exchangeratesapi.io/latest?base=EUR>. The JSON response contains the base name, date of the exchange rate and a list of exchange rates.
* Create a Java class with the name **Currency** in the domain folder and add an instance field for each property in the JSON response. Tip: use **Map<String, Double>** as type for the rates.
* Next, create/generate getters and setters for these fields.
* Inside the **retrieveDrink** method of the **ShoppingController** class, add a call to <https://api.exchangeratesapi.io/latest?base=EUR> using the RestTemplate class. Mind the use of the request parameter (everything behind the ? in an url is request parameters). These need to be set in a HttpEntity which is used as input for the RestTemplate.
* Calculate the price in USD using the exchange rate and store it in the priceUSD variable of the Product object. Use the following piece of code to get the exchange rate in USD from the response:

double usd = currency.getRates().get("USD");

* Test the **ShoppingService** again and see if you get a price in USD for a product.

**Appendix**

package nl.sjop.service.web;  
  
import nl.sjop.service.domain.Currency;  
import nl.sjop.service.domain.Product;  
import nl.sjop.service.exception.ProductNotFoundException;  
import org.springframework.http.\*;  
import org.springframework.web.bind.annotation.PathVariable;  
import org.springframework.web.bind.annotation.RequestMapping;  
import org.springframework.web.bind.annotation.RequestMethod;  
import org.springframework.web.bind.annotation.RestController;  
import org.springframework.web.client.RestTemplate;  
import org.springframework.web.util.UriComponentsBuilder;  
  
import java.net.URI;  
import java.util.HashMap;  
import java.util.List;  
import java.util.Map;  
  
@RestController  
@RequestMapping(value="shopping")  
public class ShoppingController {  
  
 private static final String *urlProductService* = "http://localhost:8081/products";  
  
 @RequestMapping(value="drinks", method=RequestMethod.*GET*)  
 public static List<Product> retrieveDrinks() {  
 RestTemplate restTemplate = new RestTemplate();  
 return restTemplate.getForObject(*urlProductService*, List.class );  
 }  
  
 @RequestMapping(value="drink/{id}", method=RequestMethod.*GET*, produces = "application/json")  
 public static Product retrieveDrink(@PathVariable("id") String productId) {  
  
 final String url = "http://localhost:8081/products/{productId}";  
  
 Map<String, String> uriParams = new HashMap<>();  
 uriParams.put("productId", productId);  
 UriComponentsBuilder builder = UriComponentsBuilder.*fromUriString*(url);  
 URI uri = builder.buildAndExpand(uriParams).toUri();  
 //  
 RestTemplate restTemplate = new RestTemplate();  
 //return restTemplate.getForObject(uri, Product.class);  
 HttpHeaders headers = new HttpHeaders();  
 //headers.setAccept(Arrays.asList(MediaType.APPLICATION\_JSON));  
 HttpEntity<String> entity = new HttpEntity<>("parameters", headers);  
 ResponseEntity<Product> result = restTemplate.exchange(uri, HttpMethod.*GET*, entity, Product.class);  
 Product product = result.getBody();  
 if (!(result.getStatusCode() == HttpStatus.*OK* && result.getBody() != null)) {  
 throw new ProductNotFoundException("id:"+productId);  
 }  
  
 final String currencyUrl = "https://api.exchangeratesapi.io/latest";  
 restTemplate = new RestTemplate();  
 HttpHeaders currencyHeaders = new HttpHeaders();  
 headers.add("base", "EUR");  
 HttpEntity<String> currencyEntity = new HttpEntity<>("parameters", currencyHeaders);  
 ResponseEntity<Currency> currencyResult = restTemplate.exchange(currencyUrl, HttpMethod.*GET*, currencyEntity, Currency.class);  
 Currency currency = currencyResult.getBody();  
 product.setPriceUSD(product.getPrice() \* currency.getRates().get("USD"));  
 return product;  
 }  
}

package nl.sjop.service.domain;  
  
public class Product {  
  
 //private static final Long serialVersionID = 1L;  
 private String productId;  
 private String name;  
 private String type;  
 private String brand;  
 private String bottleSize;  
 private double abv;  
 private double price;  
 private double priceUSD;  
  
 public Product()  
 {  
 super();  
 }  
  
 public Product(String productId, String name, String type, String brand, String bottleSize, double abv, double price) {  
 this.productId = productId;  
 this.name = name;  
 this.type = type;  
 this.brand = brand;  
 this.bottleSize = bottleSize;  
 this.abv = abv;  
 this.price = price;  
 }  
  
 public String getProductId() {  
 return productId;  
 }  
  
 public void setProductId(String productId) {  
 this.productId = productId;  
 }  
  
 public String getName() {  
 return name;  
 }  
  
 public void setName(String name) {  
 this.name = name;  
 }  
  
 public String getType() {  
 return type;  
 }  
  
 public void setType(String type) {  
 this.type = type;  
 }  
  
 public String getBrand() {  
 return brand;  
 }  
  
 public void setBrand(String brand) {  
 this.brand = brand;  
 }  
  
 public String getBottleSize() {  
 return bottleSize;  
 }  
  
 public void setBottleSize(String bottleSize) {  
 this.bottleSize = bottleSize;  
 }  
  
 public double getAbv() {  
 return abv;  
 }  
  
 public void setAbv(double abv) {  
 this.abv = abv;  
 }  
  
 public double getPrice() {  
 return price;  
 }  
  
 public void setPrice(double price) {  
 this.price = price;  
 }  
  
 public double getPriceUSD() {  
 return priceUSD;  
 }  
  
 public void setPriceUSD(double priceUSD) {  
 this.priceUSD = priceUSD;  
 }  
}

package nl.sjop.service.domain;  
  
import java.util.Map;  
  
public class Currency {  
  
 private String base;  
 private String date;  
 private Map<String, Double> rates;  
  
 public String getBase() {  
 return base;  
 }  
  
 public void setBase(String base) {  
 this.base = base;  
 }  
  
 public String getDate() {  
 return date;  
 }  
  
 public void setDate(String date) {  
 this.date = date;  
 }  
  
 public Map<String, Double> getRates() {  
 return rates;  
 }  
  
 public void setRates(Map<String, Double> rates) {  
 this.rates = rates;  
 }  
}

package nl.sjop.service.exception;  
  
import org.springframework.web.bind.annotation.ResponseStatus;  
  
import static org.springframework.http.HttpStatus.*NOT\_FOUND*;  
  
@ResponseStatus(*NOT\_FOUND*)  
public class ProductNotFoundException extends RuntimeException {  
  
 public ProductNotFoundException(String message) {  
 super(message);  
 }  
}

package nl.groothandel.service.web;  
  
import nl.groothandel.service.domain.Product;  
import nl.groothandel.service.domain.ProductRepositoryImpl;  
import org.springframework.web.bind.annotation.\*;  
  
import java.util.ArrayList;  
import java.util.Arrays;  
import java.util.List;  
  
@RestController  
@RequestMapping(value="products")  
public class ProductsController {  
  
 ProductRepositoryImpl productRepository = new ProductRepositoryImpl();  
  
 @GetMapping  
 public List<Product> retrieveProducts() {  
 return new ArrayList<>(productRepository.getProducts().values());  
 }  
  
 @RequestMapping(value="/{productId}", method=RequestMethod.*GET*)  
 public Product retrieveProduct (@PathVariable("productId") String productId) {  
 return productRepository.getProducts().get(productId);  
 }  
}

package nl.groothandel.service.domain;  
  
import java.util.HashMap;  
import java.util.Map;  
  
public class ProductRepositoryImpl {  
  
 private Map<String, Product> products;  
 {  
 Map<String, Product> map = new HashMap<>();  
 map.put("GLNF", new Product("GLNF", "Glenfiddich 18 Years", "Whisky", "Glenfiddich", "70cl", 42, 39.95));  
 map.put("PULT", new Product("PULT", "Old Pulteney 17 years Single Malt", "Whisky", "Old Pulteney", "70cl", 41, 59.95));  
 this.products = map;  
 }  
  
 public void setProducts(Map<String, Product> products) {  
 this.products = products;  
 }  
  
 public Map<String, Product> getProducts() {  
 return products;  
 }  
}