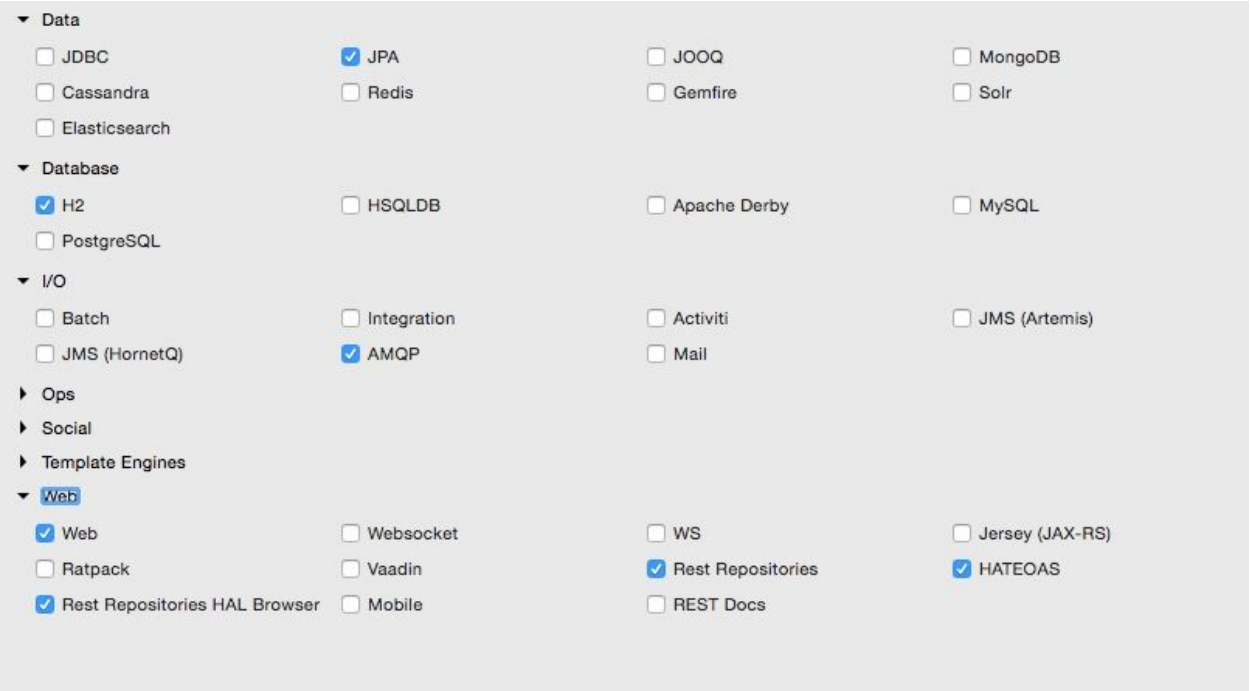
Lab 9: Developing a comprehensive microservices example

Create a new Spring Boot project and call it `chapter2.bootcustomer`, the same way as earlier. Select the options as in the following screenshot in the starter module selection screen:



This will create a web project with JPA, the REST repository, and H2 as a database. H2 is a tiny in-memory embedded database with which it is easy to demonstrate database features. In the real world, it is recommended to use an appropriate enterprise-grade database. This example uses JPA to define persistence entities and the REST repository to expose REST-based repository services.

The project structure will be similar to the following screenshot:

Start building the application by adding an Entity class named `Customer`. For simplicity, there are only three fields added to the `Customer` Entity class: the autogenerated `id` field, `name`, and `email`. Take a look at the following code:

```
@Entity
class Customer {
  @Id
  @GeneratedValue(strategy = GenerationType.AUTO)
  private Long id;
  private String name;
  private String email;
```

Add a repository class to handle the persistence handling of Customer. `CustomerRepository` extends the standard JPA repository. This means that all CRUD methods and default finder methods are automatically implemented by the Spring Data JPA repository, as follows:

```
@RepositoryRestResource
interface CustomerRespository extends JpaRepository <Customer,Long>{
  Optional<Customer> findByName(@Param("name") String name);
}
```

In this example, we added a new method to the repository class, `findByName`, which essentially searches the customer based on the customer name and returns a `Customer` object if there is a matching name.

The `@RepositoryRestResource` annotation enables the repository access through RESTful services. This will also enable HATEOAS and HAL by default. As for CRUD methods there is no additional business logic required, we will leave it as it is without controller or component classes. Using HATEOAS will help us navigate through Customer Repository methods effortlessly.

Note that there is no configuration added anywhere to point to any database. As H2 libraries are in the class path, all the configuration is done by default by Spring Boot based on the H2 autoconfiguration.

Update the `Application.java` file by adding `CommandLineRunner` to initialize the repository with some customer records, as follows:

```
@SpringBootApplication
public class Application {
    public static void main(String[] args) {
        SpringApplication.run(Application.class, args);
    }

    @Bean
  CommandLineRunner init(CustomerRespository repo) {
  return (evt) ->  {
    repo.save(new Customer("Adam","adam@boot.com"));
    repo.save(new Customer("John","john@boot.com"));
  repo.save(new Customer("Smith","smith@boot.com"));
    repo.save(new Customer("Edgar","edgar@boot.com"));
    repo.save(new Customer("Martin","martin@boot.com"));
    repo.save(new Customer("Tom","tom@boot.com"));
    repo.save(new Customer("Sean","sean@boot.com"));
  };
  }
}
```

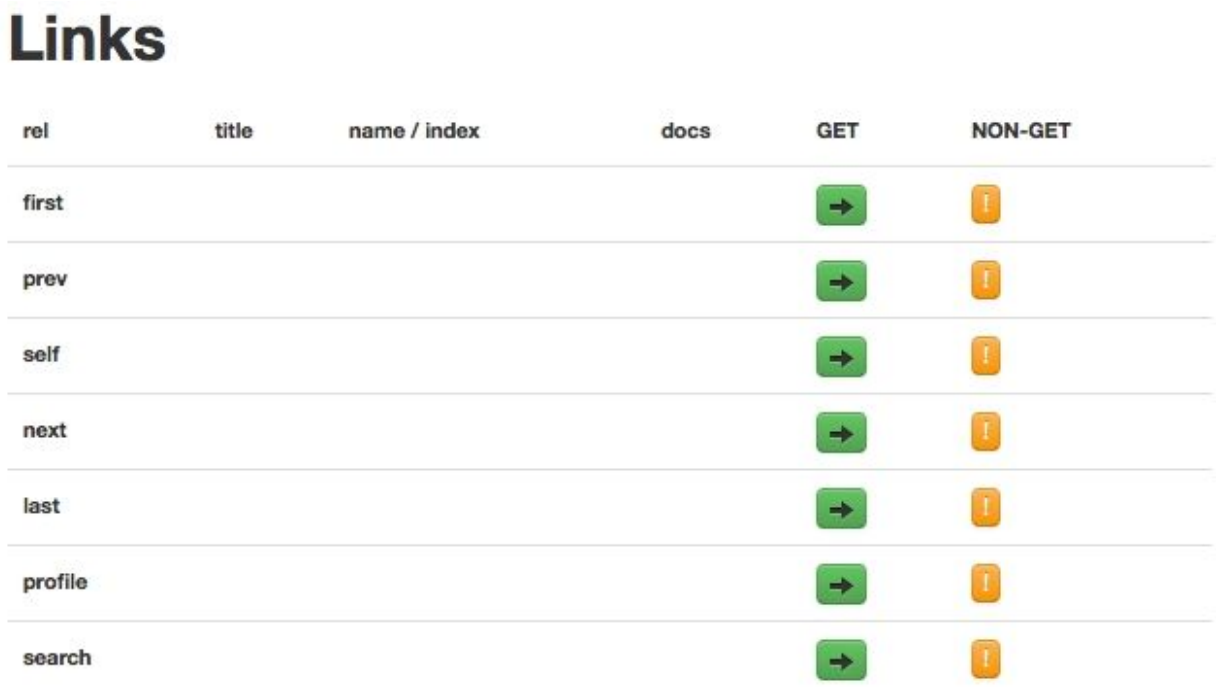
`CommandLineRunner`, defined as a bean, indicates that it should run when it is contained in `SpringApplication`. This will insert six sample customer records into the database at startup.

At this point, run the application as Spring Boot App. Open the HAL browser and point the browser to `http://localhost:8080`.

In the **Explorer** section, point to `http://localhost:8080/customers` and click on **Go**. This will list all the customers in the **Response Body** section of the HAL browser.

In the **Explorer** section, enter `http://localhost:8080/customers?size=2&page=1&sort=name` and click on **Go**. This will automatically execute paging and sorting on the repository and return the result. As the page size is set to `2` and the first page is requested, it will come back with two records in a sorted order.

Review the **Links** section. As shown in the following screenshot, it will facilitate navigating **first**, **next**, **prev**, and **last**. These are done using the HATEOAS links automatically generated by the repository browser:



Also, one can explore the details of a customer by selecting the appropriate link, such as `http://localhost:8080/customers/2`.

As the next step, add a controller class, `CustomerController`, to handle service endpoints. There is only one endpoint in this class, `/register`, which is used to register a customer. If successful, it returns the `Customer` object as the response, as follows:

```
@RestController
class CustomerController{

  @Autowired
  CustomerRegistrar customerRegistrar;

  @RequestMapping( path="/register", method = RequestMethod.POST)
  Customer register(@RequestBody Customer customer){
    return customerRegistrar.register(customer);
  }
}
```

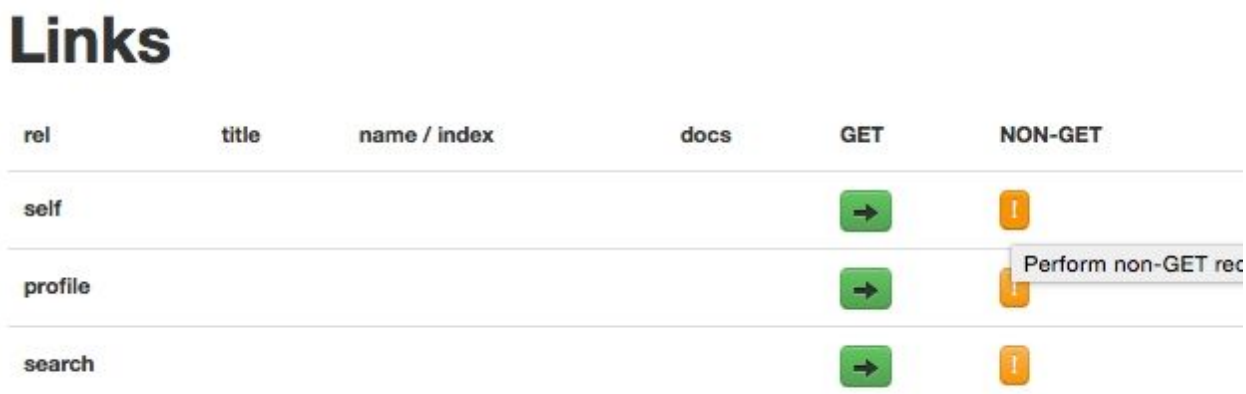
A `CustomerRegistrar` component is added to handle the business logic. In this case, there is only minimal business logic added to the component. In this component class, while registering a customer, we will just check whether the customer name already exists in the database or not. If it does not exist, then we will insert a new record, and otherwise, we will send an error message back, as follows:

```
@Component
class CustomerRegistrar {

  CustomerRespository customerRespository;

  @Autowired
  CustomerRegistrar(CustomerRespository customerRespository){
    this.customerRespository = customerRespository;
  }

  Customer register(Customer customer){
    Optional<Customer> existingCustomer =
customerRespository.findByName(customer.getName());
    if (existingCustomer.isPresent()){
      throw new RuntimeException("is already exists");
```

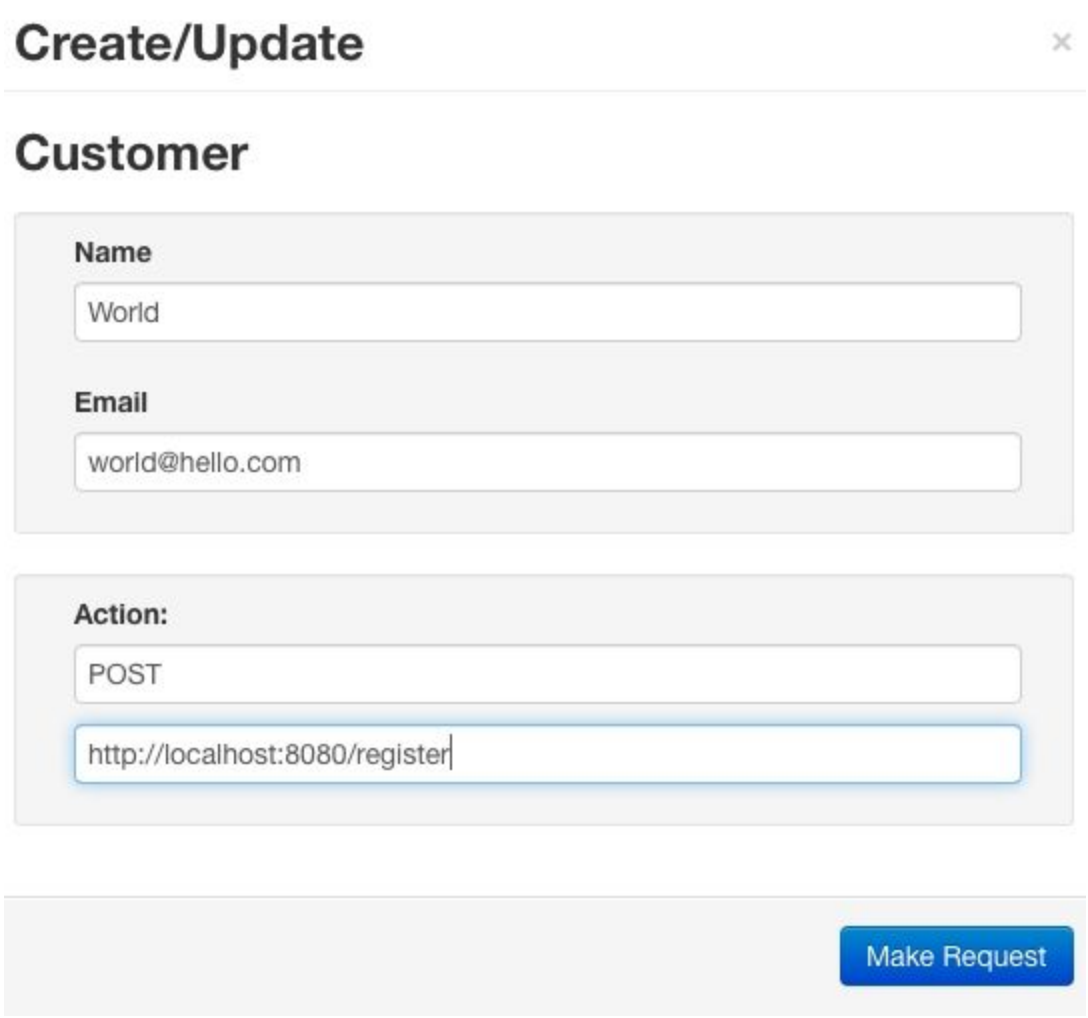
```
    } else {
      customerRespository.save(customer);
    }
    return customer;
  }
}
```

Restart the Boot application and test using the HAL browser via the URL `http://localhost:8080`.

Point the **Explorer** field to `http://localhost:8080/customers`. Review the results in the **Links** section:



Click on the **NON-GET** option against **self**. This will open a form to create a new customer:



Fill the form and change the **Action** as shown in the diagram. Click on the **Make Request** button. This will call the register service and register the customer. Try giving a duplicate name to test the negative case.

Let's complete the last part in the example by integrating the Customer Notification service to notify the customer. When registration is successful, send an e-mail to the customer by asynchronously calling the Customer Notification microservice.

First update `CustomerRegistrar` to call the second service. This is done through messaging. In this case, we injected a `Sender` component to send a notification to the customer by passing the customer's e-mail address to the sender, as follows:

```
@Component
@Lazy
```

```
class CustomerRegistrar {

  CustomerRespository customerRespository;
  Sender sender;

  @Autowired
  CustomerRegistrar(CustomerRespository customerRespository, Sender sender){
    this.customerRespository = customerRespository;
    this.sender = sender;
  }

  Customer register(Customer customer){
    Optional<Customer> existingCustomer =
customerRespository.findByName(customer.getName());
    if (existingCustomer.isPresent()){
      throw new RuntimeException("is already exists");
    } else {
      customerRespository.save(customer);
      sender.send(customer.getEmail());
    }
    return customer;
  }
}
```

The sender component will be based on RabbitMQ and AMQP. In this example, `RabbitMessagingTemplate` is used as explored in the last messaging example; take a look at the following:

```
@Component
@Lazy
class Sender {

  @Autowired
  RabbitMessagingTemplate template;

  @Bean
  Queue queue() {
    return new Queue("CustomerQ", false);
  }
```

```
  public void send(String message){
    template.convertAndSend("CustomerQ", message);
  }
}
```

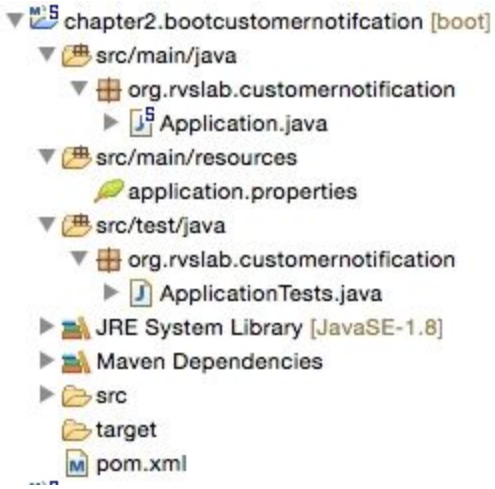
The `@Lazy` annotation is a useful one and it helps to increase the boot startup time. These beans will be initialized only when the need arises.

We will also update the `application.property` file to include Rabbit MQ-related properties, as follows:

```
spring.rabbitmq.host=localhost
spring.rabbitmq.port=5672
spring.rabbitmq.username=guest
spring.rabbitmq.password=guest
```

We are ready to send the message. To consume the message and send e-mails, we will create a notification service. For this, let's create another Spring Boot service, `chapter2.bootcustomernotification`. Make sure that the **AMQP** and **Mail** starter libraries are selected when creating the Spring Boot service. Both **AMQP** and **Mail** are under **I/O**.

The package structure of the `chapter2.bootcustomernotification` project is as shown here:



Add a `Receiver` class. The `Receiver` class waits for a message on customer. This will receive a message sent by the Customer Profile service. On the arrival of a message, it sends an e-mail, as follows:

```
@Component
class Receiver {
  @Autowired
  Mailer mailer;

  @Bean
  Queue queue() {
    return new Queue("CustomerQ", false);
  }

  @RabbitListener(queues = "CustomerQ")
    public void processMessage(String email) {
        System.out.println(email);
        mailer.sendMail(email);
    }
}
```

Add another component to send an e-mail to the customer. We will use `JavaMailSender` to send an e-mail via the following code:

```
@Component
class Mailer {
  @Autowired
  private  JavaMailSender  javaMailService;
    public void sendMail(String email){
      SimpleMailMessage mailMessage=new SimpleMailMessage();
      mailMessage.setTo(email);
      mailMessage.setSubject("Registration");
      mailMessage.setText("Successfully Registered");
      javaMailService.send(mailMessage);
    }
}
```

Behind the scenes, Spring Boot automatically configures all the parameters required by `JavaMailSender`.

To test SMTP, a test setup for SMTP is required to ensure that the mails are going out. In this example, FakeSMTP will be used. You can download FakeSMTP from http://nilhcem.github.io/FakeSMTP.

Once you download `fakeSMTP-2.0.jar`, run the SMTP server by executing the following command:

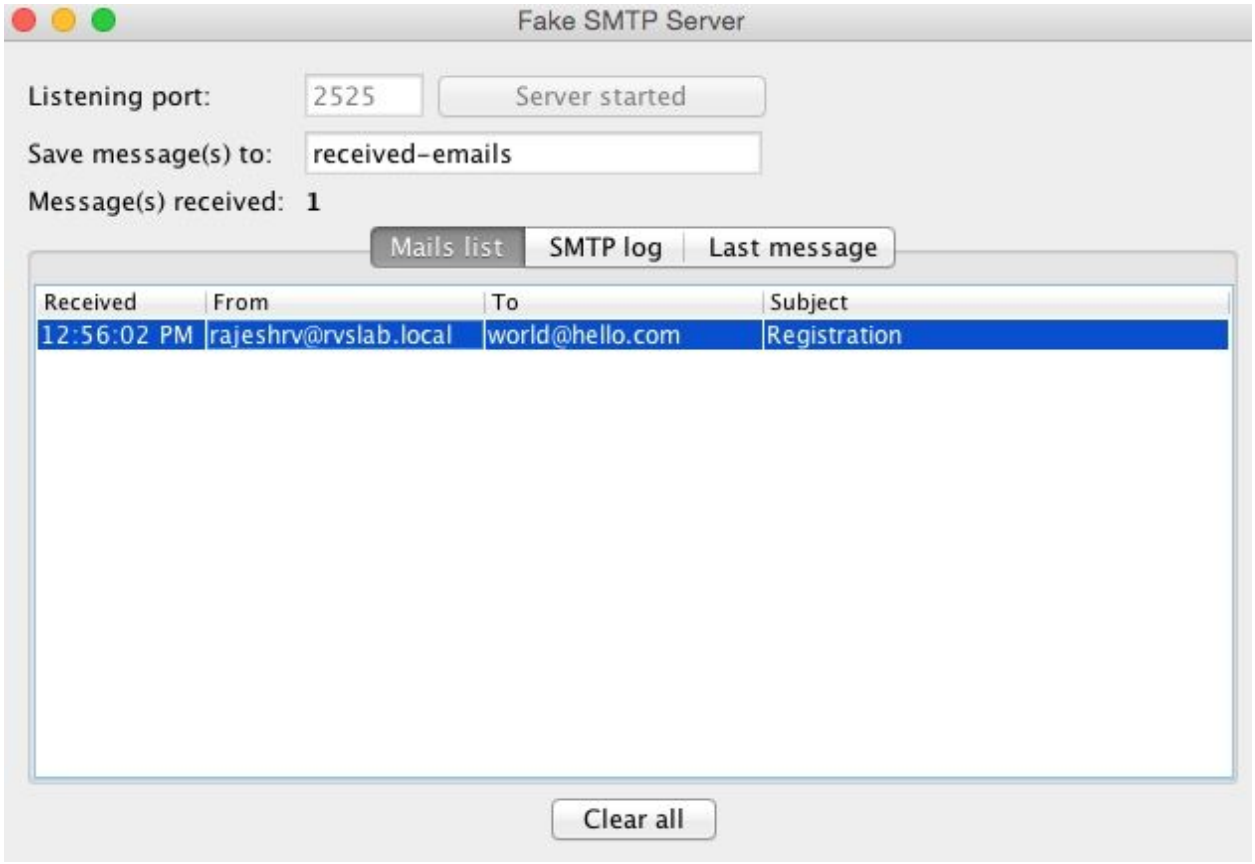
```
$ java -jar fakeSMTP-2.0.jar
```

This will open a GUI to monitor e-mail messages. Click on the **Start Server** button next to the listening port textbox.

Update `application.properties` with the following configuration parameters to connect to RabbitMQ as well as to the mail server:

```
spring.rabbitmq.host=localhost
spring.rabbitmq.port=5672
spring.rabbitmq.username=guest
spring.rabbitmq.password=guest

spring.mail.host=localhost
spring.mail.port=2525
```

We are ready to test our microservices end to end. Start both the Spring Boot apps. Open the browser and repeat the customer creation steps through the HAL browser. In this case, immediately after submitting the request, we will be able to see the e-mail in the SMTP GUI. Internally, the Customer Profile service asynchronously calls the Customer Notification service, which, in turn, sends the e-mail message to the SMTP server:


Fake SMTP Server
Listening port:
2525
Server started
Save message(s) to:
received-emails
Message(s) received:
1
Mails list
SMTP log
Last message
Received
From
To
Subject
12:56:02 PM
rajeshrv@rvslab.local
world@hello.com
Registration
Clear all