Spring Boot Microservices - Spring Cloud API Gateway

author: Ramesh Fadatare

MICROSERVICES SPRING BOOT SPRING CLOUD

In a previous couple of tutorials, we have seen:

Spring Boot Microservices Communication Example using RestTemplate

Spring Boot Microservices Communication Example using WebClient

Spring Boot Microservices Communication Example using Spring Cloud Open Feign

Spring Boot Microservices - Spring Cloud Config Server

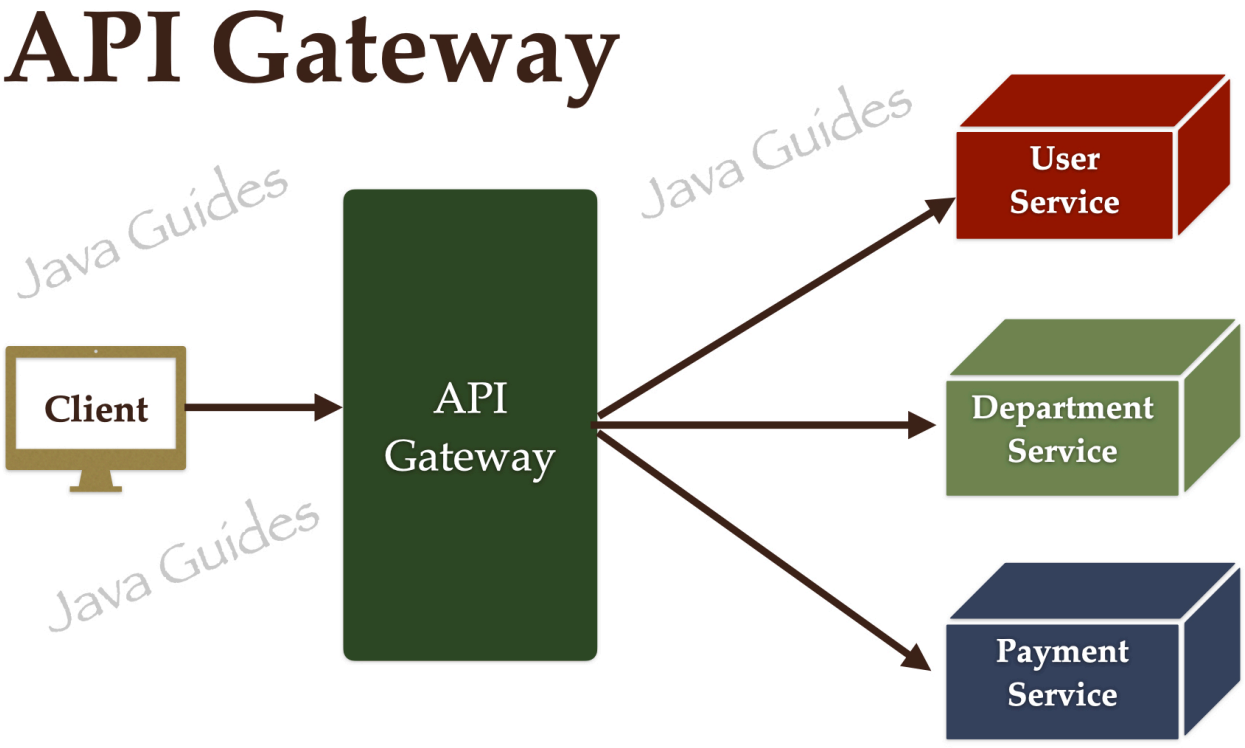
Spring Boot Microservices - Spring Cloud Netflix Eureka-based Service Registry

In this tutorial, we will learn how to set up an API gateway into our microservices project using the Spring Cloud Gateway library.

YouTube Video

Spring Cloud Gateway Overview

Spring Cloud Gateway provides a library for building an API Gateway on top of Spring WebFlux. Spring Cloud Gateway aims to provide a simple, yet effective way to route to APIs and provide cross-cutting concerns to them such as security, monitoring/metrics, and resiliency.



The Spring Cloud Gateway has three important parts to it:

Route – These are the building blocks of the gateway which contain the URL to which the request is to be forwarded to and the predicates and filters that are applied to the incoming requests.

Predicate – These are the set of criteria that should match for the incoming requests to be forwarded to internal microservices. For example, a path predicate will forward the request only if the incoming URL contains that path.

Filters – These act as the place where you can modify the incoming requests before sending the requests to the internal microservices or before responding back to the client.

To know more read **Spring Cloud Gateway documentation**.

Prerequisites

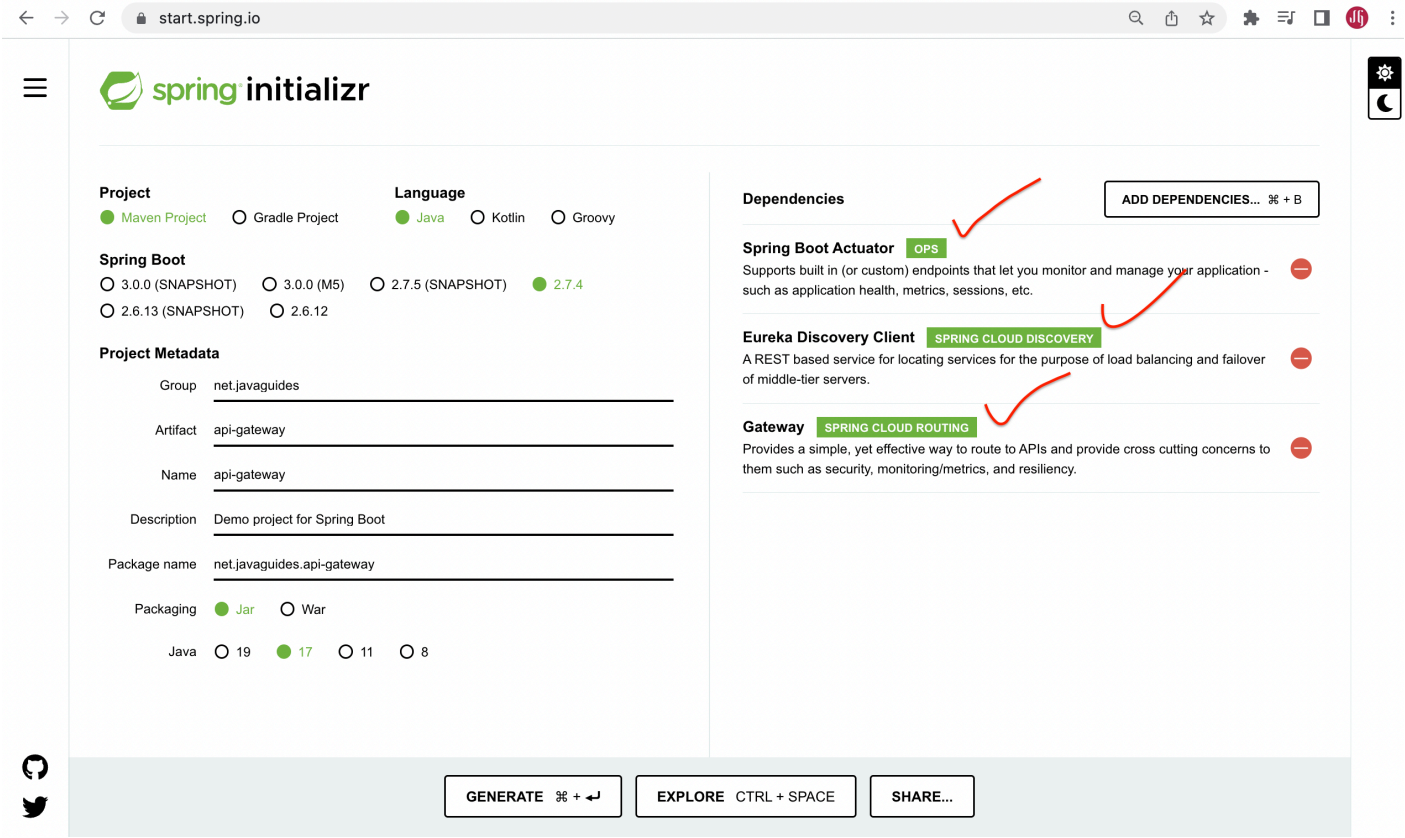
Refer to the below tutorial to create `department-service` and `user-service` microservices and configure Netflix Eureka Service Registry:

Spring Boot Microservices - Spring Cloud Netflix Eureka-based Service Registry

1. Create and Setup Spring Boot Project in IntelliJ IDEA

Let's create a Spring boot project using the **spring initializr**.

Refer to the below screenshot to enter details while creating the spring boot application using the **spring initializr**:



Click on Generate button to download the Spring boot project as a zip file. Unzip the zip file and import the Spring boot project in IntelliJ IDEA.

Here is the `pom.xml` file for your reference:

```
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
	xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 https://maven.apache.org/xsd/maven-4.0.0.xsd">
	<modelVersion>4.0.0</modelVersion>
	<parent>
		<groupId>org.springframework.boot</groupId>
		<artifactId>spring-boot-starter-parent</artifactId>
		<version>2.7.4</version>
		<relativePath/> <!-- lookup parent from repository -->
	</parent>
	<groupId>nt.javaguides</groupId>
	<artifactId>api-gateway</artifactId>
	<version>0.0.1-SNAPSHOT</version>
	<name>api-gateway</name>
	<description>api-gateway</description>
	<properties>
		<java.version>17</java.version>
		<spring-cloud.version>2021.0.4</spring-cloud.version>
	</properties>
	<dependencies>
		<dependency>
			<groupId>org.springframework.boot</groupId>
			<artifactId>spring-boot-starter-actuator</artifactId>
		</dependency>
		<dependency>
			<groupId>org.springframework.cloud</groupId>
			<artifactId>spring-cloud-starter-gateway</artifactId>
		</dependency>
		<dependency>
			<groupId>org.springframework.cloud</groupId>
			<artifactId>spring-cloud-starter-netflix-eureka-client</artifactId>
		</dependency>

		<dependency>
			<groupId>org.springframework.boot</groupId>
			<artifactId>spring-boot-starter-test</artifactId>
			<scope>test</scope>
		</dependency>
	</dependencies>
	<dependencyManagement>
		<dependencies>
			<dependency>
				<groupId>org.springframework.cloud</groupId>
				<artifactId>spring-cloud-dependencies</artifactId>
				<version>${spring-cloud.version}</version>
				<type>pom</type>
				<scope>import</scope>
			</dependency>
		</dependencies>
	</dependencyManagement>

	<build>
		<plugins>
			<plugin>
				<groupId>org.springframework.boot</groupId>
				<artifactId>spring-boot-maven-plugin</artifactId>
			</plugin>
		</plugins>
	</build>

</project>
```

Now we have all the dependencies that we need to have in our API gateway application. So now let's configure the Routes and other API gateway-specific configurations to use in our project.

2. Enable Eureka Client using @EnableEurekaClient

The `@EnableEurekaClient` annotation makes your Spring Boot application act as a Eureka client.

```
package nt.javaguides.apigateway;

import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.cloud.netflix.eureka.EnableEurekaClient;

@SpringBootApplication
@EnableEurekaClient
public class ApiGatewayApplication {

	public static void main(String[] args) {
		SpringApplication.run(ApiGatewayApplication.class, args);
	}

}
```

Don't miss this step, you have to configure the API gateway as a Eureka Client for this project. Otherwise, you couldn't use discovery functions to identify the correct API from the service registry.

3. Configure Eureka Server URL

To register the Spring Boot application into Eureka Server we need to add the following configuration in our `application.properties` file and specify the Eureka Server URL in our configuration.

```
spring.application.name=API-GATEWAY
server.port=9191
eureka.instance.client.serviceUrl.defaultZone=http://localhost:8761/eureka/
management.endpoints.web.exposure.include=*
```

4. Configuring API Gateway Routes With Spring Cloud Gateway

Now, you might be wondering how API Gateway knows the hostname or IP and port of microservices right.

When a client sends a request to the API gateway, It will discover the correct service IP and PORT using the service registry to communicate and route the request.

Let's configure Routes using properties:

```
spring.application.name=API-GATEWAY
server.port=9191
eureka.instance.client.serviceUrl.defaultZone=http://localhost:8761/eureka/
management.endpoints.web.exposure.include=*

spring.cloud.gateway.routes[0].id=USER-SERVICE
spring.cloud.gateway.routes[0].uri=lb://USER-SERVICE
spring.cloud.gateway.routes[0].predicates[0]=Path=/api/users/**

spring.cloud.gateway.routes[1].id=DEPARTMENT-SERVICE
spring.cloud.gateway.routes[1].uri=lb://DEPARTMENT-SERVICE
spring.cloud.gateway.routes[1].predicates[0]=Path=/api/departments/**

spring.cloud.gateway.routes[2].id=DEPARTMENT-SERVICE
spring.cloud.gateway.routes[2].uri=lb://DEPARTMENT-SERVICE
spring.cloud.gateway.routes[2].predicates[0]=Path=/message/**
```

What are the properties that we set for API gateway routes?

- id – This is just an identification of the routes.
- URI – Here we can use either URL **http://localhost:8080** or lb://DEPARTMENT-SERVICE. But if we need to use the inbuilt load balancer on the Netflix Eureka server, we should use lb://DEPARTMENT-SERVICE, then the API registry will take over the request and show a load-balanced request destination to the API gateway.
- predicates – In here we can set multiple paths to identify a correct routing destination. Eg:- If the API gateway gets and request like **http://localhost:9191/api/users/1** then it will be routed into **http://localhost:8081/api/users/1**.

5. Run All the Microservices

Department Service running on port: **http://localhost:8080**

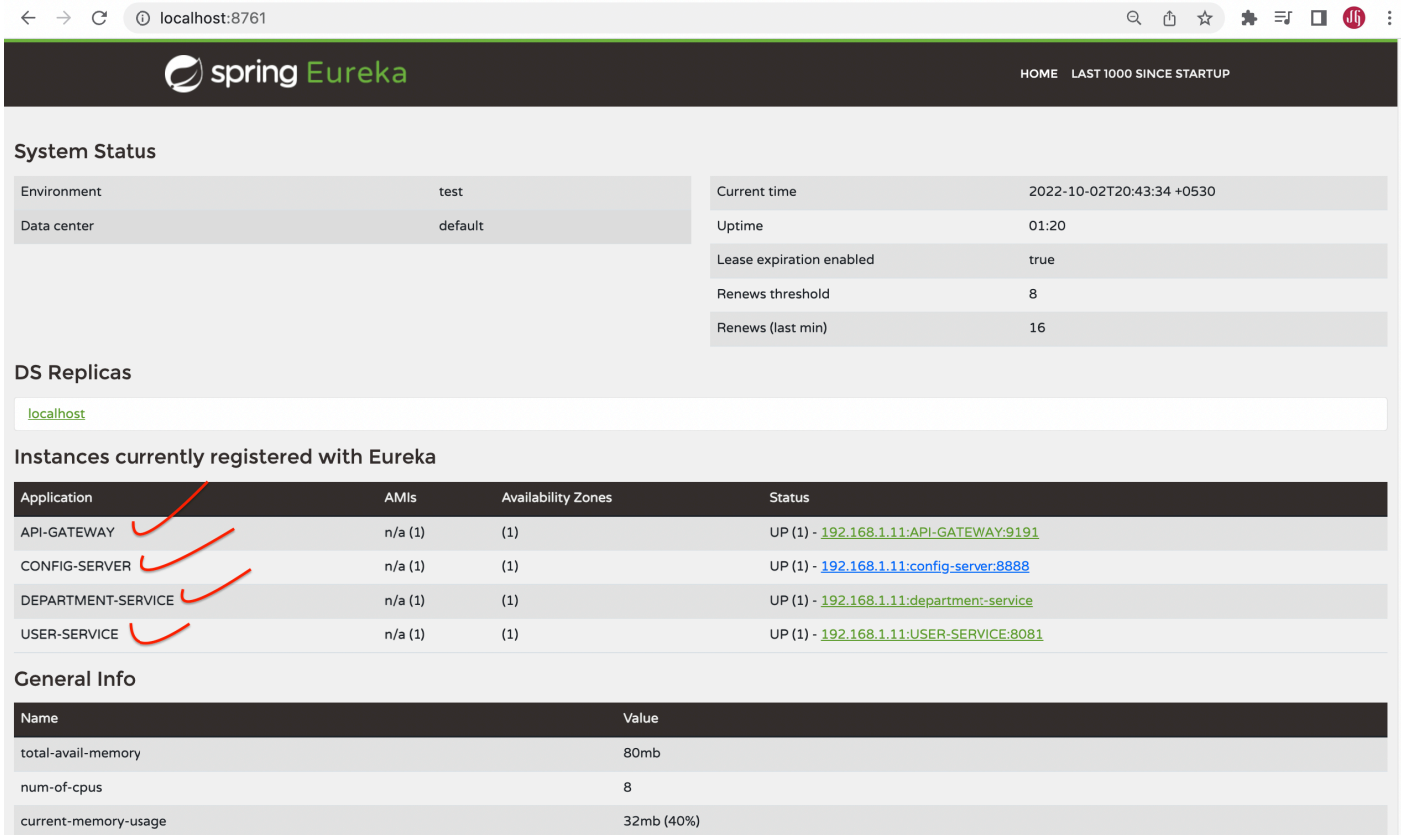
User Service running on port: **http://localhost:8081**

API Gateway service running on port: **http://localhost:9191**

Service Registry service running on port: **http://localhost:8761**

6. Verify Registered Instances in Service Registry

Go to the browser and hit this link in a new tab: **http://localhost:8761**



7. Testing API Gateway using Postman Client

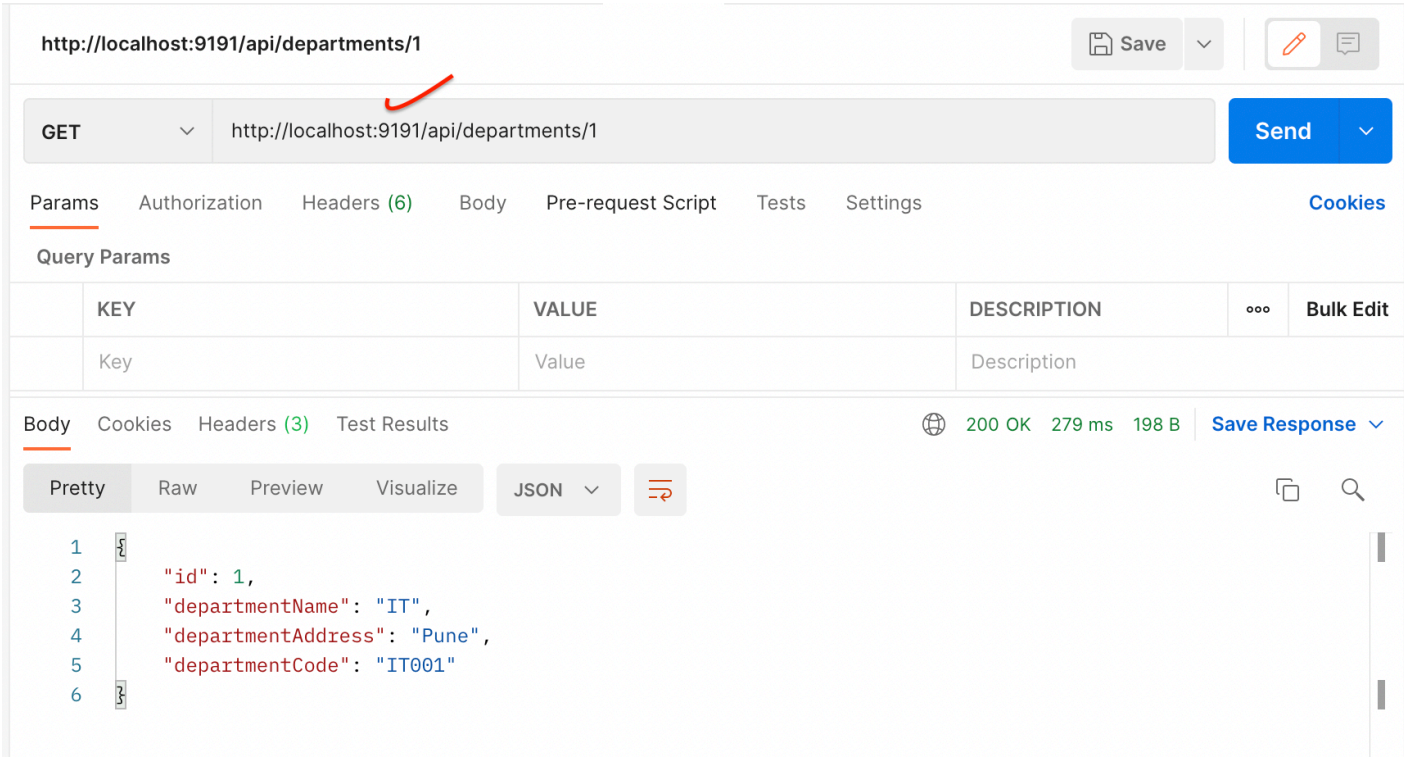
Get Department REST API:

Note that we are using API-Gateway service port (9191) to call department-service API (port 8080)

Department Service running on port: **http://localhost:8080**

API Gateway service running on port: **http://localhost:9191**

API Gateway route the request from **http://localhost:9191/api/departments/1** to **http://localhost:8080/api/departments/1**



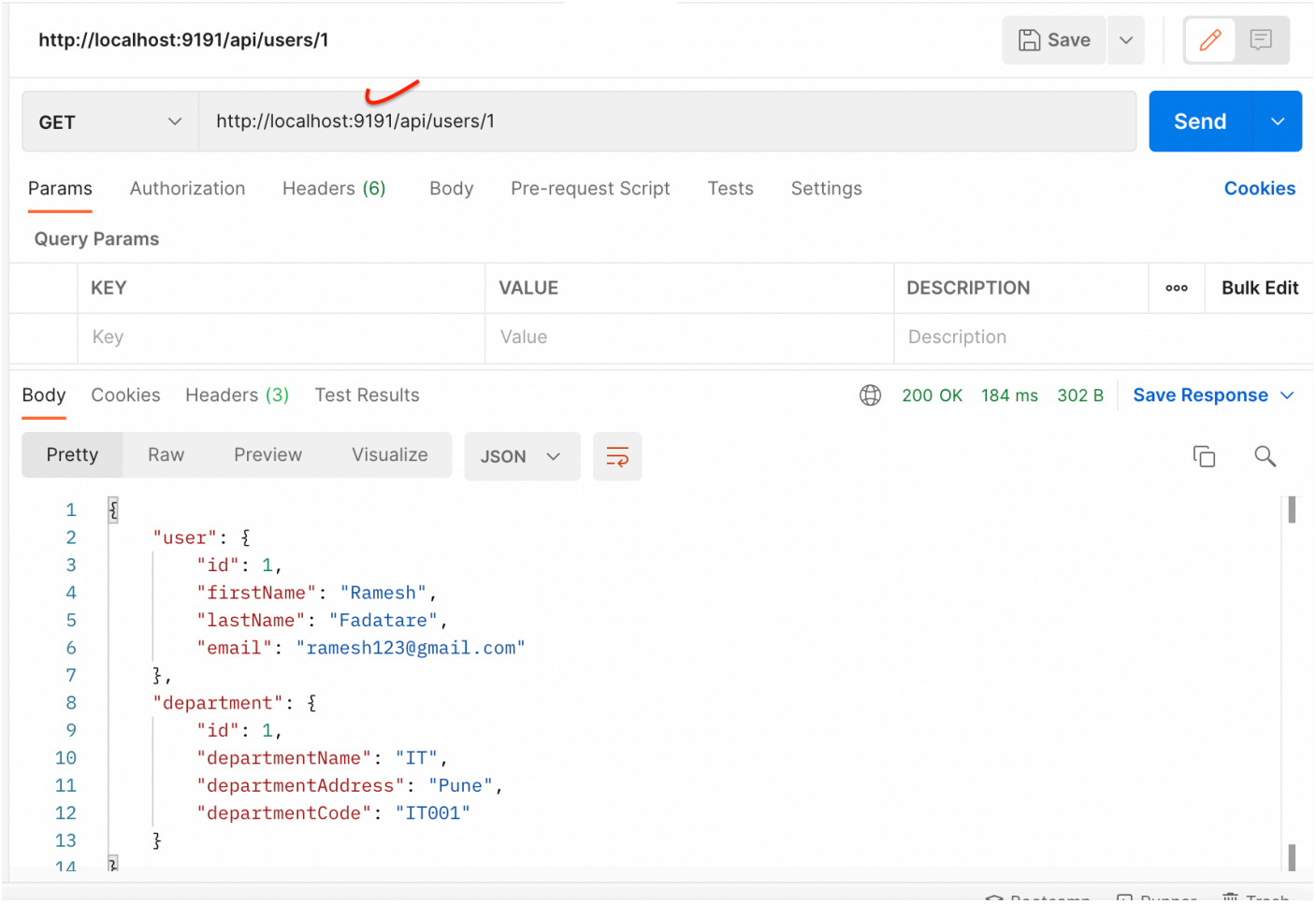
Get User REST API:

Note that we are using API-Gateway service port (9191) to call the user-service API port (8081).

User Service running on port: **http://localhost:8081**

API Gateway service running on port: **http://localhost:9191**

API Gateway route the request from **http://localhost:9191/api/users/1** to **http://localhost:8081/api/users/1**



8. Conclusion

In this tutorial, we learned how to set up an API gateway into our microservices project using the Spring Cloud Gateway library.