API Gateway

👉 What is an API Gateway?

An **API Gateway** serves as a **single entry** point for all client requests to a microservices-based application. It acts as a reverse proxy, routing incoming requests to the appropriate microservices while providing **cross-cutting** functionalities like **authentication**, **logging**, and **monitoring**.

In simpler terms, an API Gateway is like a receptionist for your microservices architecture - it directs visitors to the right department and handles common tasks that would otherwise be repeated across services.

👉 Why Do We Need an API Gateway?

Single Entry Point for Users

From a user's perspective, they're interacting with one application, not multiple microservices. Users don't care (or need to know) that we have separate quiz and question services. They just want to use the application through a single, consistent URL.

Without an API Gateway:

- Users need to know different port numbers for different services (8090 for quiz service, 8080 for question service)
- URLs change depending on which service they're accessing
- The distributed nature of the application becomes visible to users

Handling Cross-Cutting Concerns

API Gateway helps solve several critical challenges in microservices architecture:

1. **Authentication**: Without an API Gateway, each microservice would need to implement its own authentication, forcing users to log in multiple times as they navigate between services.

2. **Logging & Monitoring**: An API Gateway provides a centralized place to log all requests and monitor traffic patterns.

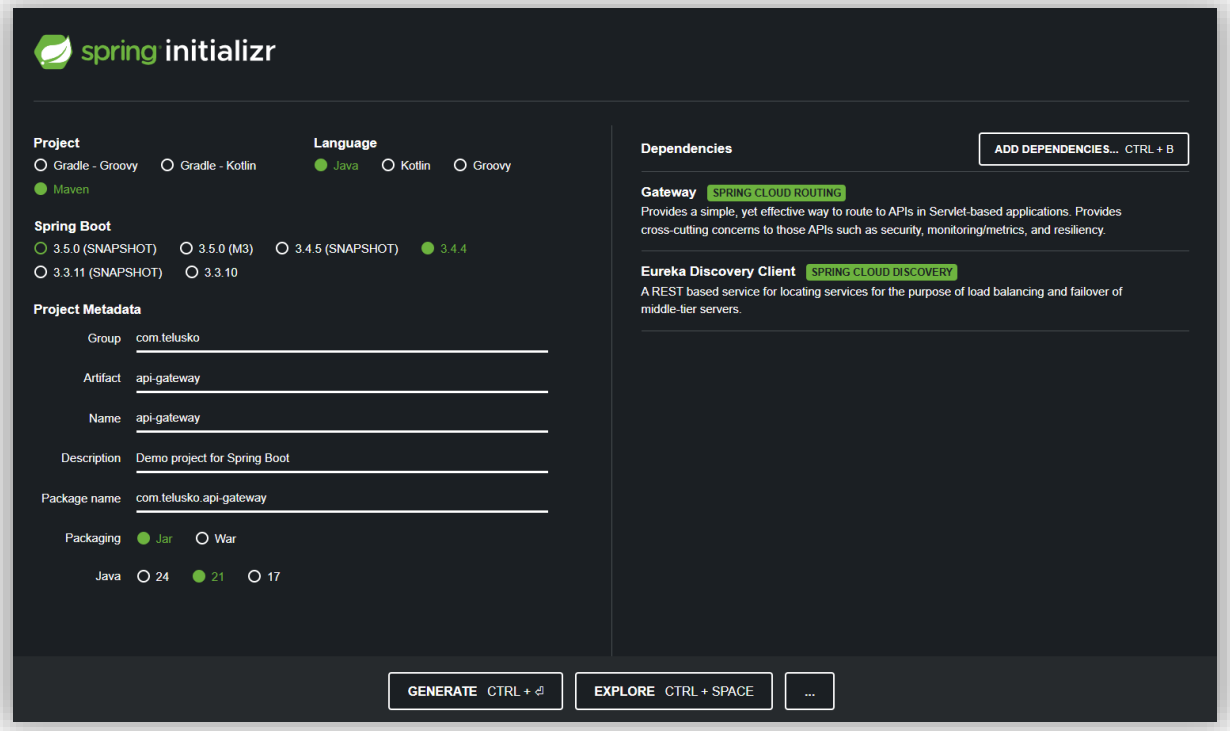
3. **Other Cross-Cutting Concerns**: Rate limiting, caching, request transformation, and other common concerns can be handled centrally.

👉 Implementing API Gateway with Spring Cloud Gateway

Spring Cloud provides a ready-to-use API Gateway that integrates seamlessly with our microservices ecosystem.

Setting Up the API Gateway Project

1. **Create a new project** with Spring Initializer:
   - Dependencies: Gateway and Eureka Client
   - The Eureka Client dependency is necessary so the gateway can register itself with Eureka Server and discover other services



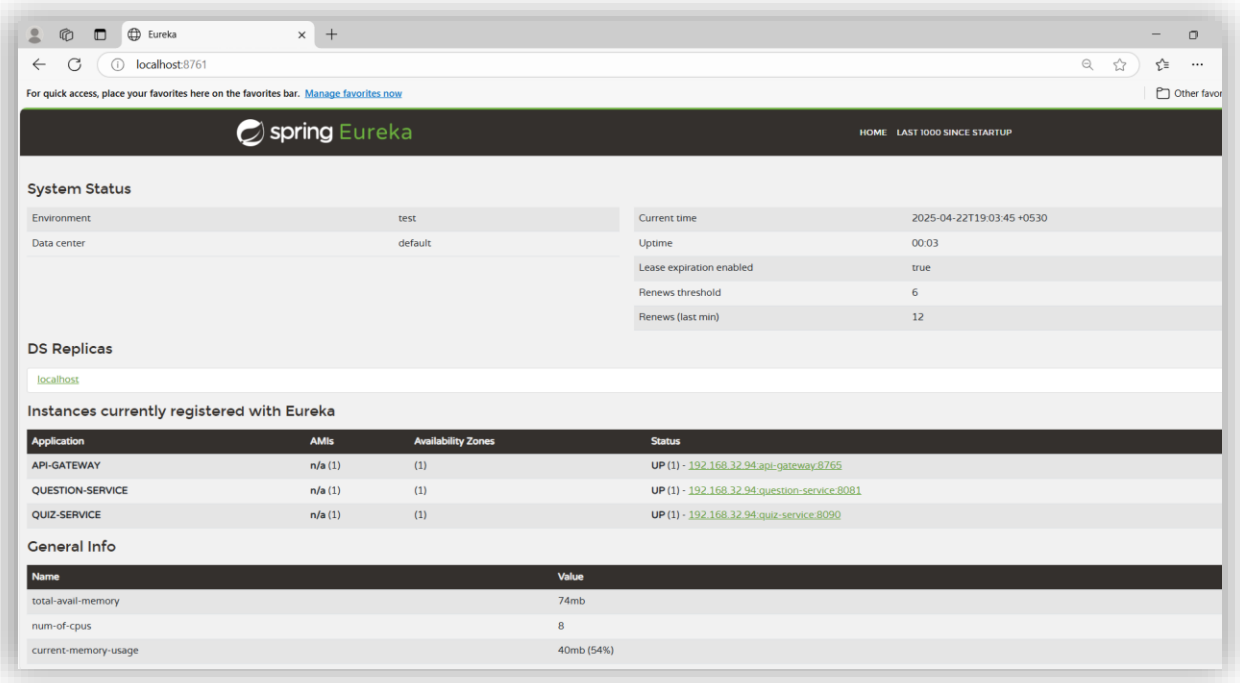
Configuring the API Gateway

After opening the project in your IDE, configure the gateway in the application.properties file:

```
# Name and port for the service
spring.application.name=api-gateway
server.port=8765
```

Verifying Gateway Registration

When we run the API Gateway, it registers itself with Eureka Server just like our other services:



Testing the Gateway

Now we can access our services through the API Gateway:

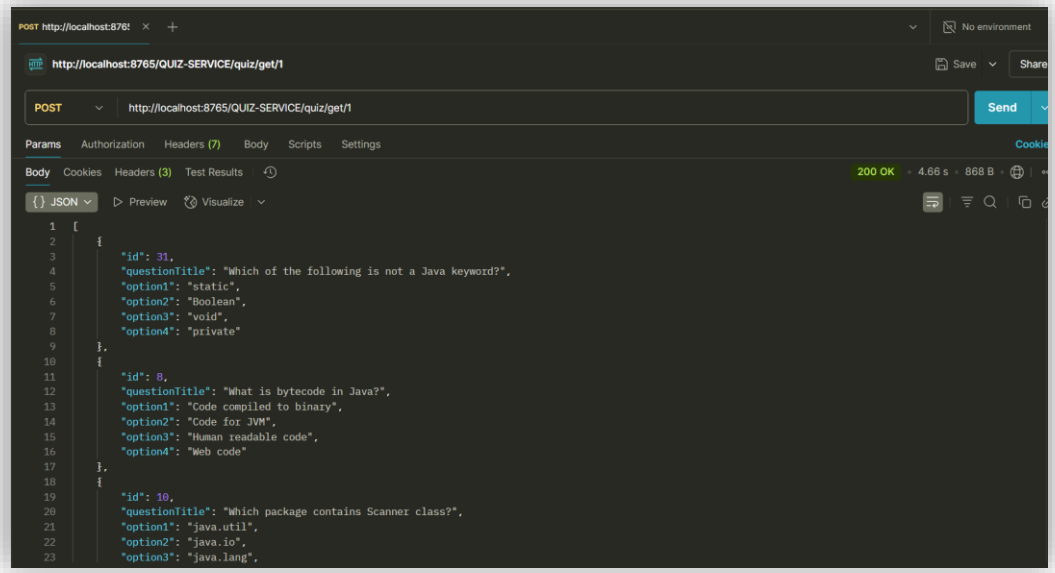
- Instead of calling http://localhost:8090/quiz/get/2 directly
- We call http://localhost:8765/QUIZ-SERVICE/quiz/get/2

However, this first attempt will result in a 404 error because we need to enable the discovery locator properly.

```
# Name and port for the service
spring.application.name=api-gateway
server.port=8765

# Enable service discovery for routing
spring.cloud.gateway.discovery.locator.enabled=true
```

With this configuration, the gateway can now route requests to the appropriate services by their names:



Improving User Experience with Lowercase Service IDs

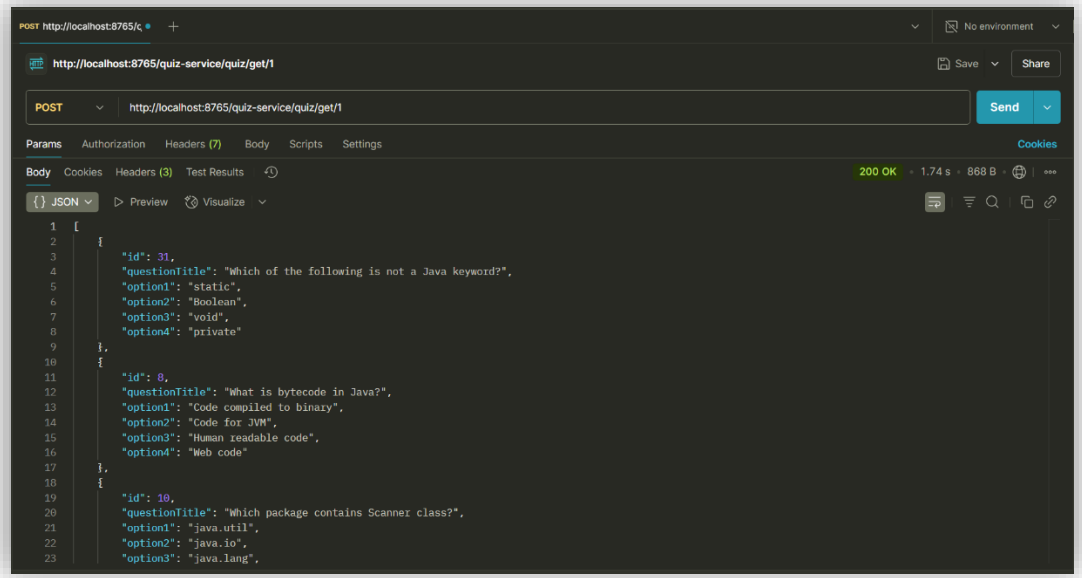
The default configuration requires uppercase service names (e.g., QUIZ-SERVICE), which isn't user-friendly. We can improve this by enabling lowercase service IDs:

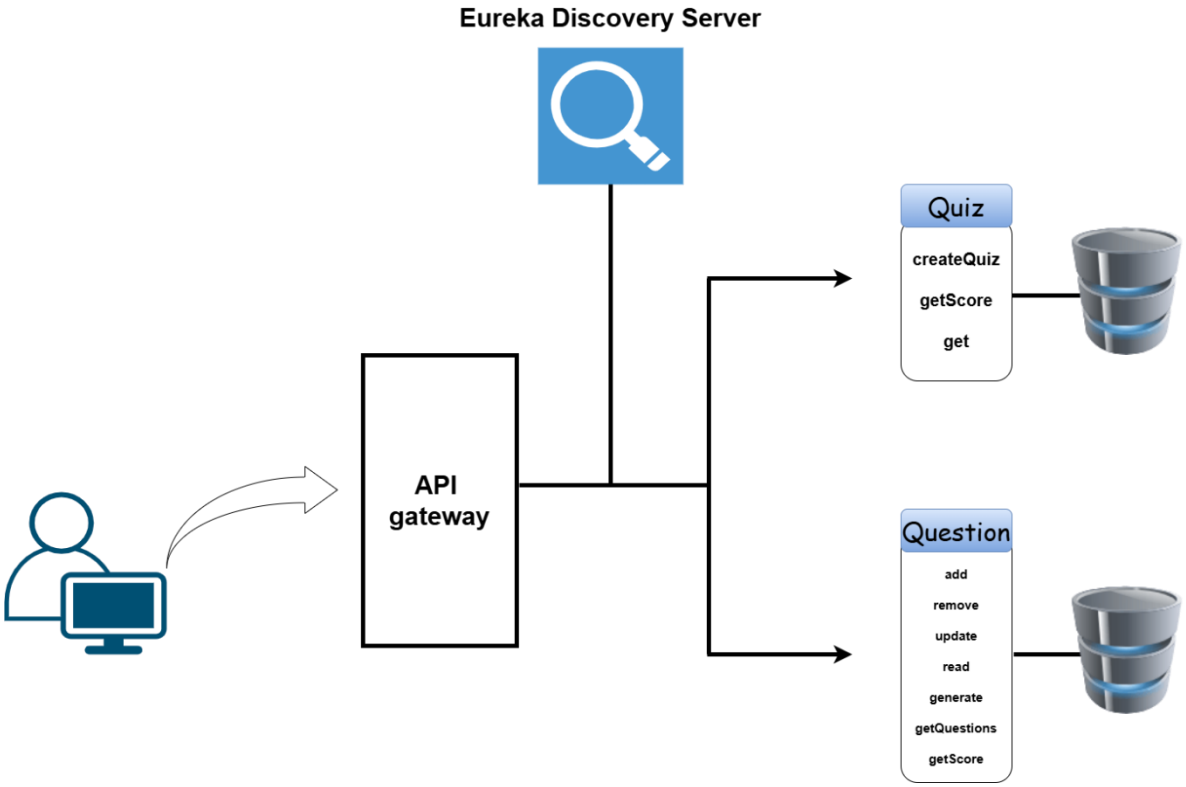
```
# Name and port for the service
spring.application.name=api-gateway
server.port=8765

# Enable service discovery for routing
spring.cloud.gateway.discovery.locator.enabled=true

# Allow lowercase service IDs in URLs
spring.cloud.gateway.discovery.locator.lower-case-service-id=true
```

Now we can use more natural URLs:





The Complete Architecture with API Gateway

With the API Gateway in place, our architecture now follows the industry-standard pattern for microservices:

1. **Clients** send all requests to the API Gateway
2. **API Gateway** routes requests to the appropriate service based on the URL
3. **Microservices** handle specific functionality and communicate with each other as needed
4. **Service Registry** keeps track of all available service instances

This approach provides:

- A simplified experience for clients (single entry point)
- Centralized handling of common concerns
- Abstraction of the underlying microservices structure
- Flexibility to evolve the microservices architecture without impacting clients