CAPSTONE PROJECT E-COMMERCE APPLICATION USING MICROSERVICES BATCH-8-J2EE

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Introduction:

This documentation provides a detailed overview of a distributed eCommerce application built using a microservices architecture with Spring Boot, Spring Cloud, and related technologies. The application supports both Admin and User roles, allowing for effective management of products, orders, and customers.

Objective:

Develop a scalable and maintainable eCommerce application that:

- Admins can use to manage products, orders, and customers.
- Users can browse products, place orders, and manage their profiles and account information.

The application leverages a microservices architecture to provide modularity, flexibility, and ease of maintenance.

Phases & Tasks:

Planning Phase

1. Requirements Gathering (1 day):

- Identify the required microservices:
 - Auth-Service
 - Customer-Service
 - Product-Service
 - Cart-Service
 - Order-Service
- Define the interactions between the services using an API Gateway.

2. Architecture Design (1 day):

- Design the microservices architecture.
- Set up the **Eureka Server** for service registry and discovery.
- Set up the API Gateway for routing requests between the microservices.

Development Phase

Day 1: Eureka Server & API Gateway Setup

- Set up the **Eureka Server** for service registration and discovery.
- Implement the API Gateway to route requests to the respective microservices.

Day 2: Customer-Service Development

- Develop CRUD operations for managing customer profiles.
- Integrate with the **Auth-Service** to handle customer data during registration.

Day 3: Product-Service Development

- Build functionalities for managing products, including categories and search features.
- Implement APIs for product CRUD operations.

Days 4-5: Cart-Service Development

- Develop features for managing the shopping cart, such as adding, updating, and deleting items.
- Integrate with the **Product-Service** to fetch product details.
- Implement the item entry table to store individual cart items.

Day 6: Order-Service Development

- Implement functionalities for processing orders, including placing orders and tracking their status.
- Integrate with the Cart-Service to process cart items during order placement.

Days 7-8: Auth-Service Development

- Create user registration and login functionalities.
- Implement JWT token generation and validation for secure access.

MICROSERVICES

1. Service Registry & Discovery (Eureka Server):

- A Service Registry is a centralized database where all microservices in an application register themselves, enabling dynamic service discovery.
- *Registration*: Each microservice registers its network location (port, etc.) with the Eureka Server.
- *Discovery*: Microservices can dynamically discover and communicate with each other by querying the registry.
- *Benefits:* Enhances scalability and resilience by allowing services to discover and communicate without hardcoded endpoints, ensuring smooth interaction across the application.

2. API Gateway:

- The API Gateway is the single entry point for all client requests in the eCommerce application. It is built using **Spring Cloud Gateway** and provides the following key functions:
- *Routing:* Directs incoming requests to the appropriate microservice (e.g., Product, Order, Authentication).
- Security: Validates JWT tokens and manages authentication and authorization for secure service access.
- Load Balancing: Distributes traffic evenly across multiple microservices instances, improving performance and availability.

3. E-commerce Config Server:

- The Configuration Server centralizes and manages configuration settings for all microservices in the eCommerce application. It is set up using Spring Cloud Config and integrates with a GitHub repository for storing configuration files.
- It provides a single source of truth for configuration files, reducing duplication and ensuring consistency across all services.
- Allows microservices to fetch their configuration settings from the GitHub repository at startup or during runtime, supporting dynamic updates without redeployment.

4. Customer Service:

- The Customer Microservice manages all customer-related information and interactions in the eCommerce application. Its primary functions include:
- It allows customers to create, update, and manage their personal information, such as name, email address, and shipping addresses.

5. Product Microservice:

- The Product Microservice is responsible for managing the product catalog and handling all operations related to products within the eCommerce application.
- Key Functions:
- Product CRUD Operations: Provide APIs to create, read, update, and delete products.
- Product Search & Filter: Implement search functionality and allow product filtering by various attributes (e.g., ID, category).

6. Cart Service:

- The Cart Service manages the shopping cart functionality for users, handling operations related to adding, updating, and removing products in the cart before an order is placed.
- Key Functions:
 - Add to Cart: Provide APIs to allow users to add products to their cart.
 - *Update Cart Items*: Enable users to change the quantity of items or remove products from their cart.
 - *View Cart*: Retrieve and display the current contents of the user's cart, including product details, quantities, and total price.

7. Order Microservice:

- The Order Microservice handles all operations related to customer orders in the eCommerce application, managing the complete lifecycle from order creation to fulfillment.
- Key Functions:
 - Order Creation: Provide APIs to create new orders for the customers
 - *Order Status:* Manage the status of orders (e.g., Paid, Delivered, Canceled) and provide updates to customers.

Order History: Store and provide access to past orders for both users and admins

8. Authentication Service:

- The Authentication Service handles all user authentication and authorization functions within the eCommerce application. It plays a crucial role in ensuring secure access to different parts of the system. Key responsibilities include:
- *User Registration*: Provides endpoints for users to sign up and securely store their credentials in the database.

- *JWT Token Generation:* Issues JWT (JSON Web Token) for authenticated users, enabling secure, stateless communication between clients and microservices
- *Token validation*: Checks whether the issued token is valid or not

Technologies Used:

• Backend: Java, Spring Boot, Spring Cloud, Spring Data JPA

Database: MySQL

• API: RESTful APIs

• Service Registry: Eureka Server

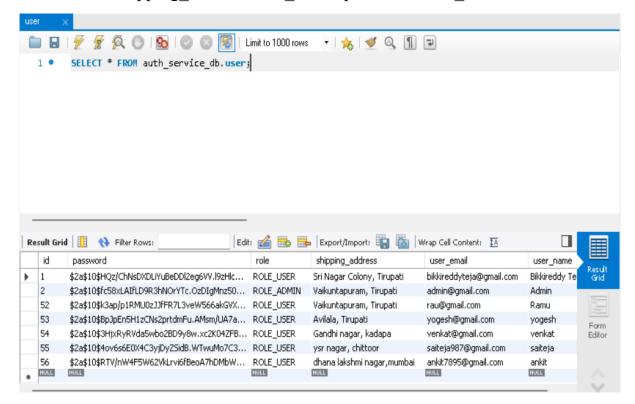
API Gateway: Spring Cloud Gateway

• Security: JWT (JSON Web Tokens) for authentication and authorization

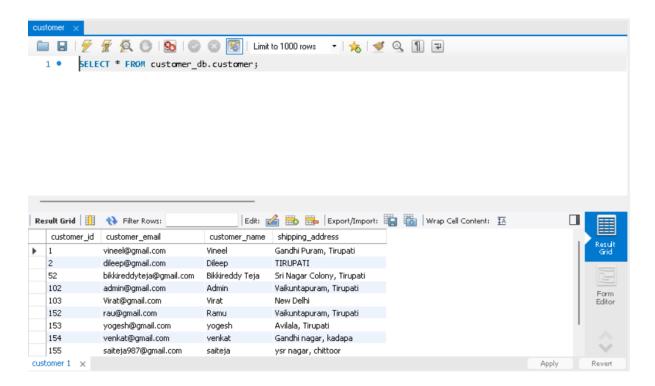
Database Design:

Tables:

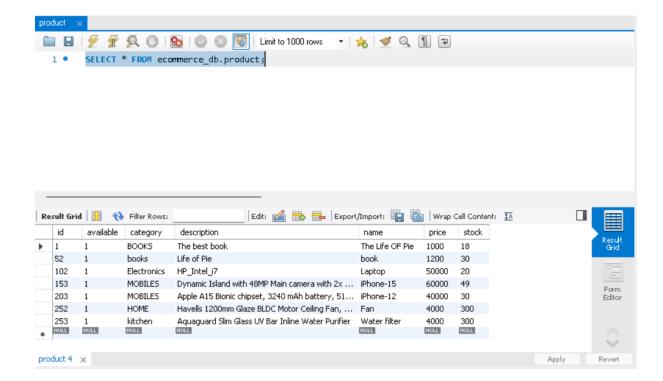
• users: id, shipping address, user name, password, user email, role



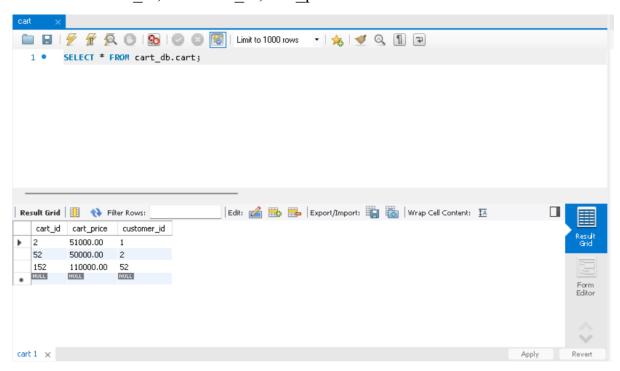
 customers: customer_id, customer_name, customer_email, shipping address



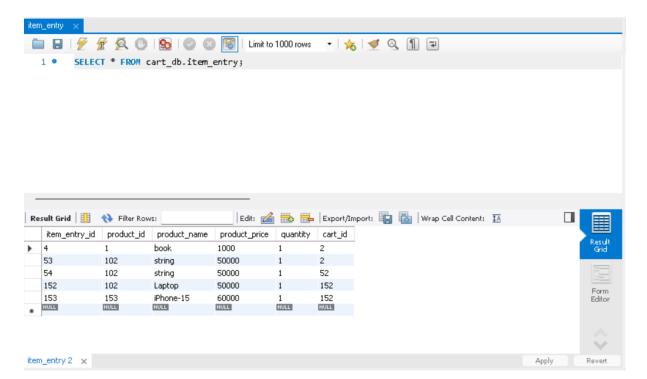
• products: id, name, description, price, category, stock, available



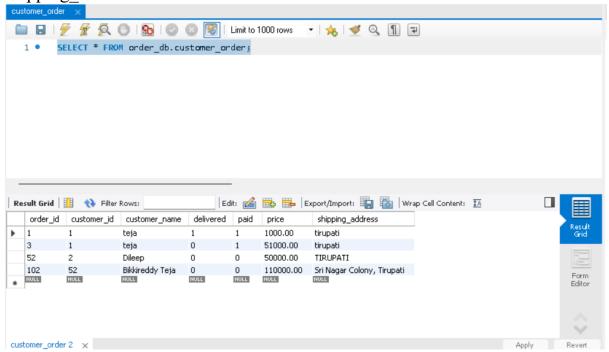
• carts: cart id, customer id, cart price



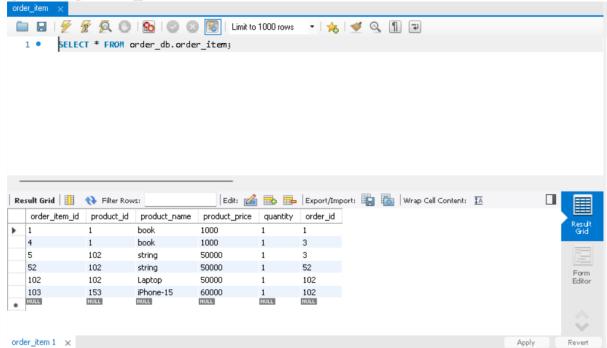
• item entry:item entry id, cart id, product id, quantity, product price, product name



 customer_orders: order_id, customer_id, customer_name, delivered, paid, shipping address



 order_items: order_item_id, order_id, product_id, product_price, quantity, product_name



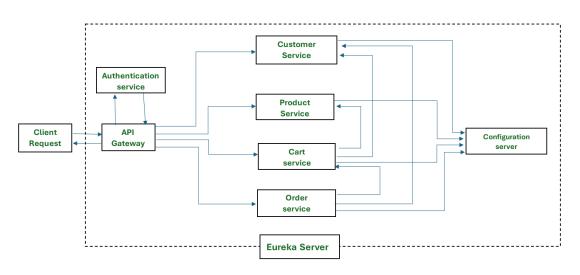
Database Relationships

- 1. Users: Stores all user information.
- 2. Customers: Connects to Users (adds extra details for each customer).
- 3. Carts: Connects to customers(each customer has a cart).
- 4. Item Entry: Connects to Carts and Products (tracks items in each cart).
- 5. *Orders:* Connects to Customers and Carts (each order is placed by a customer from a cart).
- 6. *Order_Items*: Connects to Orders and Products (details which products are in each order).

Design Flow Diagrams:

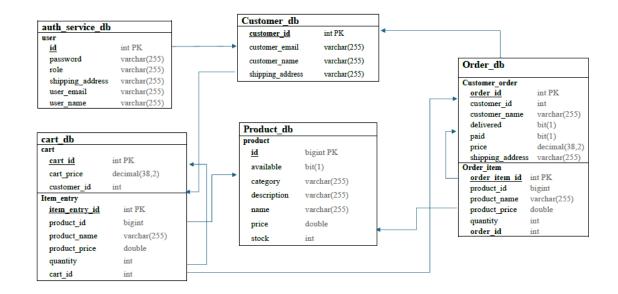
Microservices design:

Microservices Design Flow Diagram



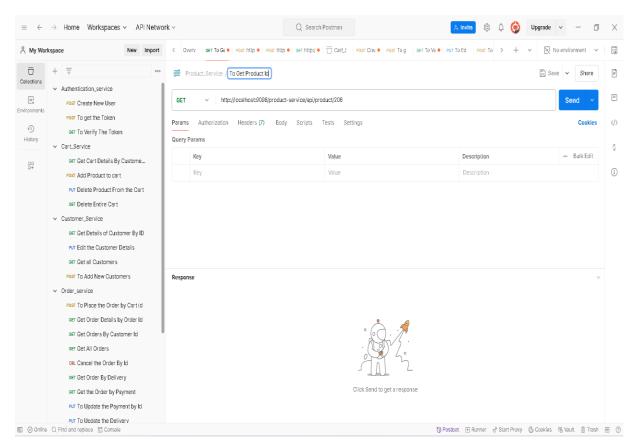
Database design:

Database Design Flow Diagram

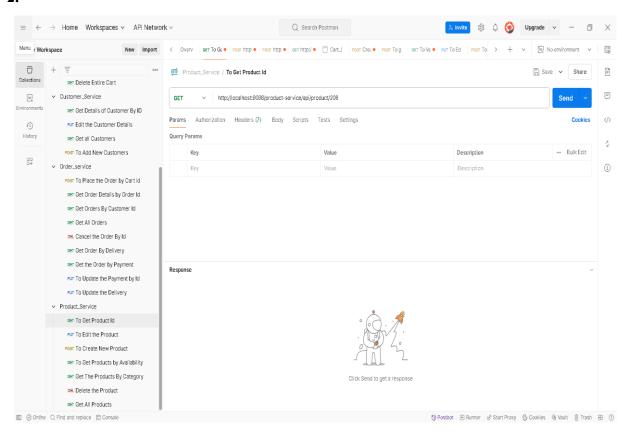


Postman Folder Structure:-

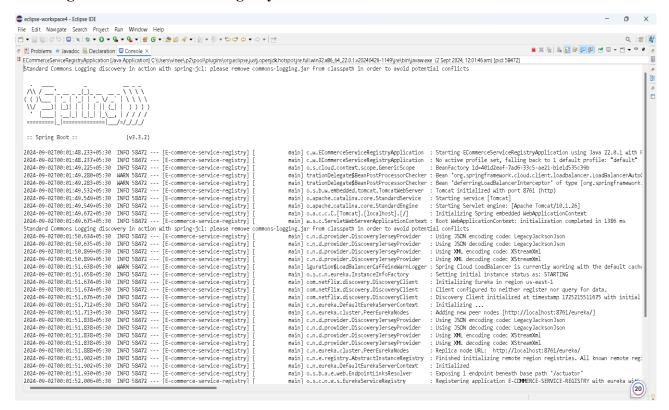
1.



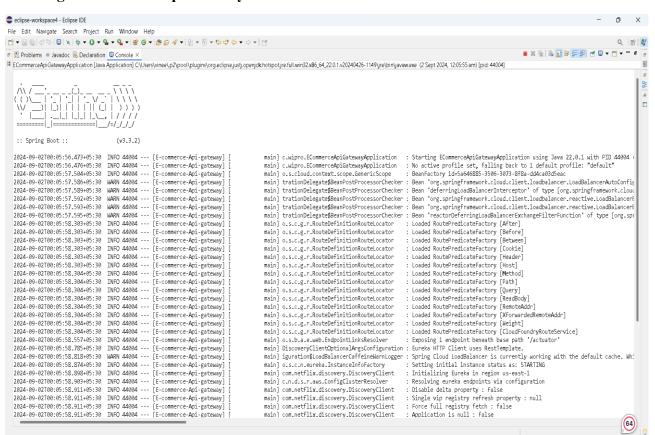
2.



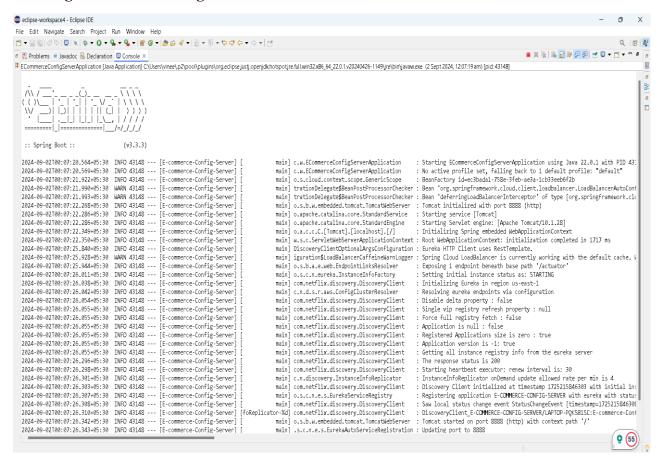
Running E-commerce-service-registry:-



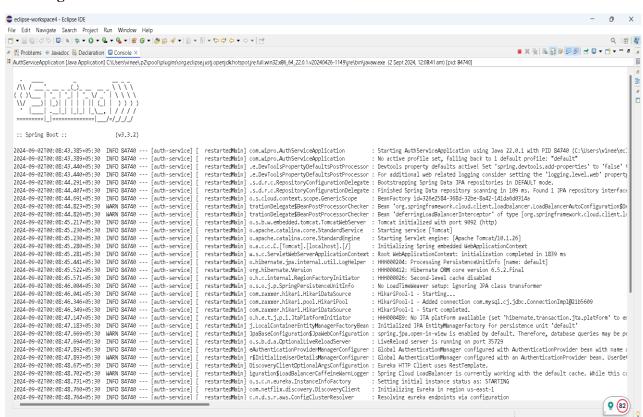
Running E-commerce-ApiGateway:-



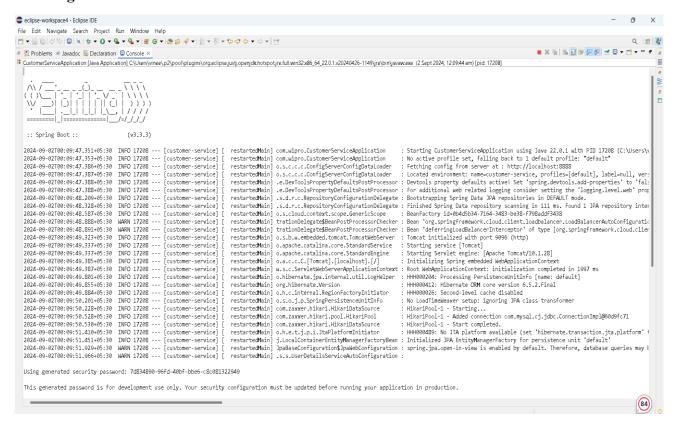
Running Ecommerce-config-server:-



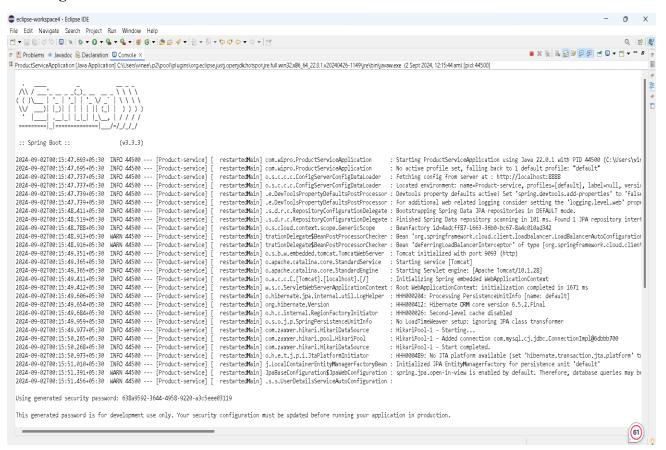
Running Auth-service:-



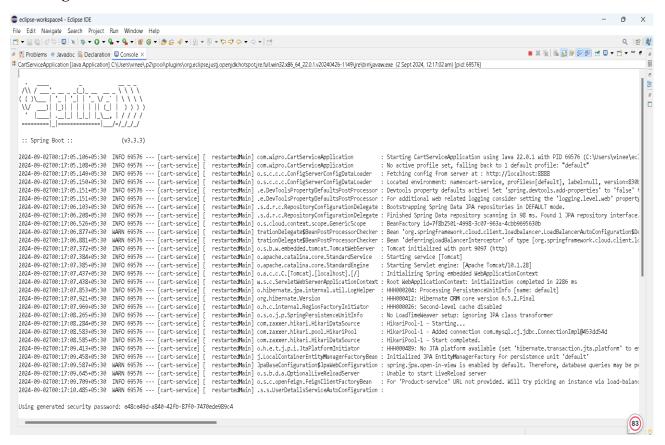
Running customer-service:-



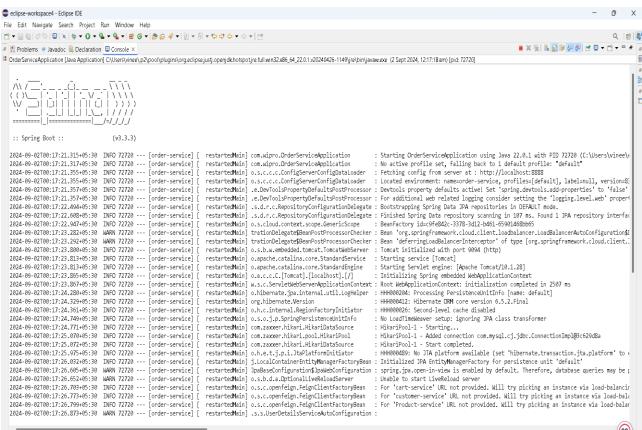
Running Product-service:-



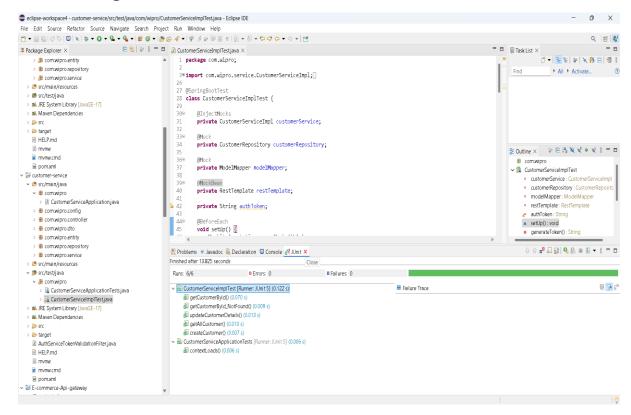
Running Cart-service:-

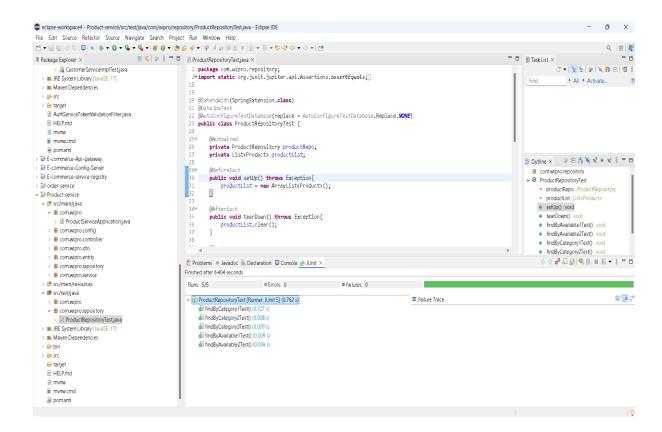


Running Order-service:-

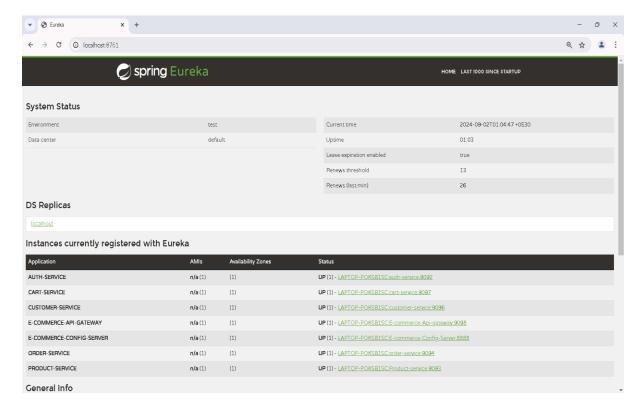


Junit Testing:

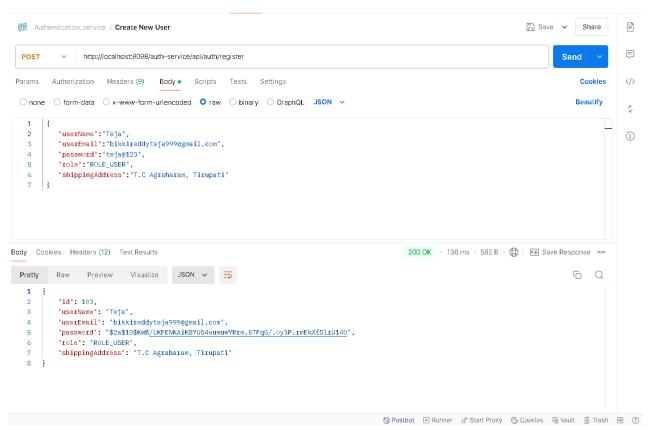




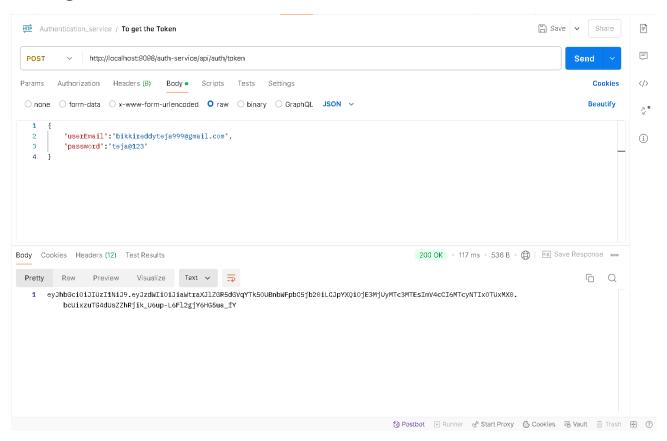
This is the Eureka Service where we show all Microservices:



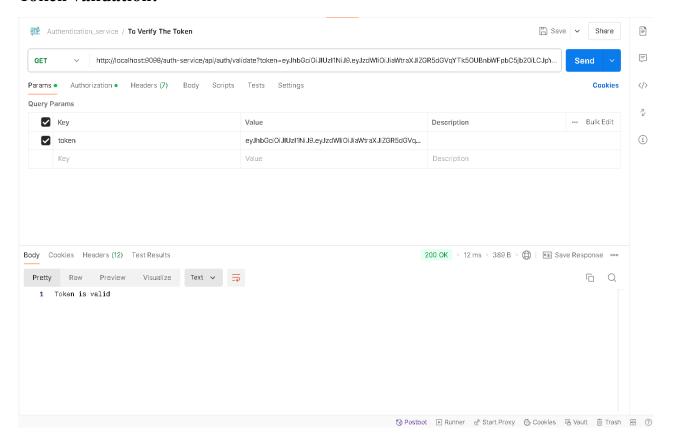
User Registration:



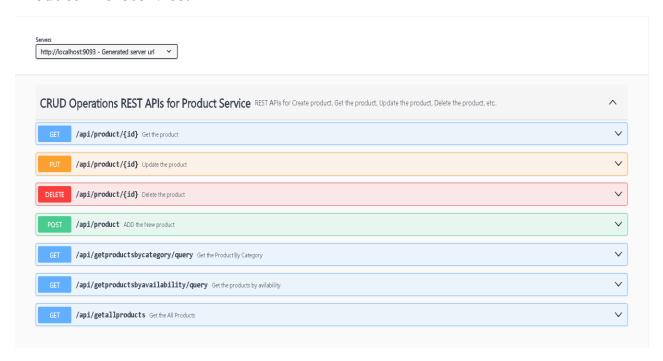
Token generation:



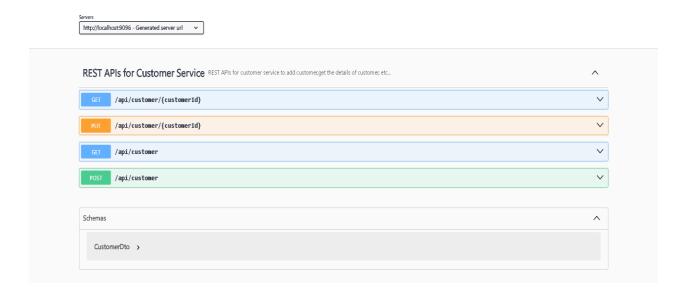
Token validation:



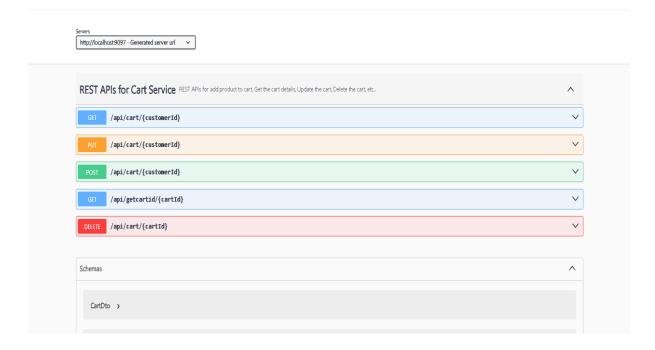
Product microservice:-



Customer microservice:-



Cart microservice:-



Order microservice:-

