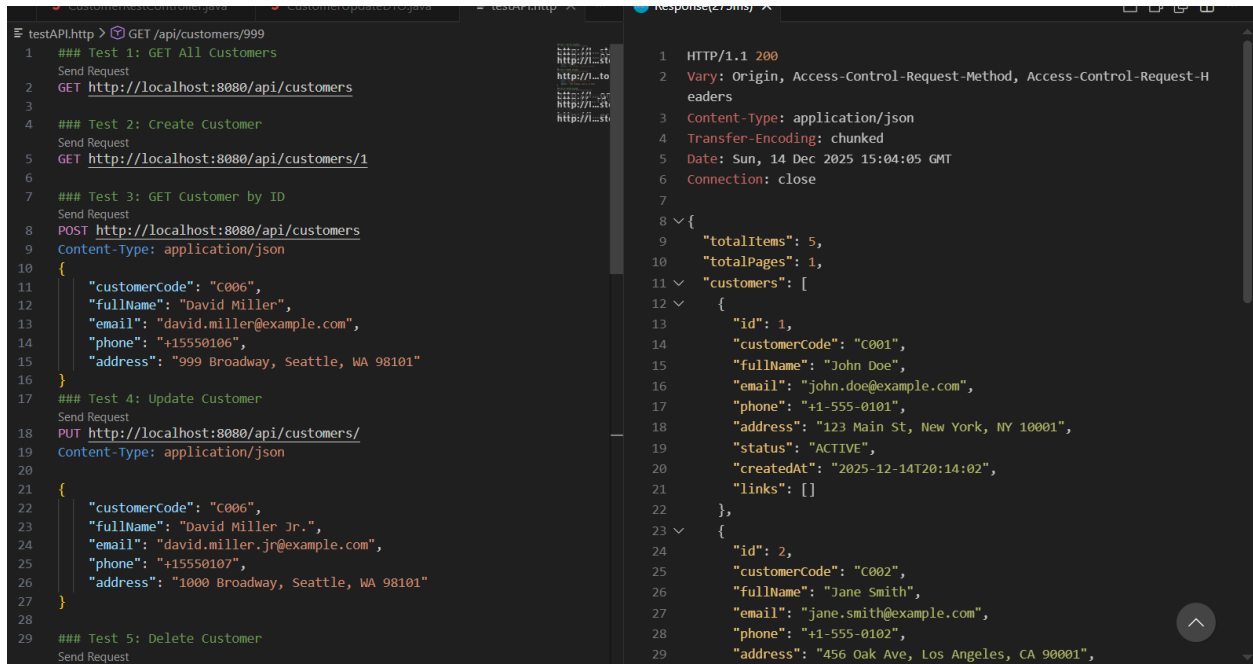


Test 1: GET All Customers

The screenshot shows an IDE with two panels. The left panel contains test code for a REST API, and the right panel shows the response for the first test.

```
testAPI.http > GET /api/customers/999
1  ### Test 1: GET All Customers
2  Send Request
3  GET http://localhost:8080/api/customers
4
5  ### Test 2: Create Customer
6  Send Request
7  GET http://localhost:8080/api/customers/1
8
9  ### Test 3: GET Customer by ID
10 Send Request
11 POST http://localhost:8080/api/customers
12 Content-Type: application/json
13 {
14   "customerCode": "C006",
15   "fullName": "David Miller",
16   "email": "david.miller@example.com",
17   "phone": "+15550106",
18   "address": "999 Broadway, Seattle, WA 98101"
19 }
20
21 ### Test 4: Update Customer
22 Send Request
23 PUT http://localhost:8080/api/customers/
24 Content-Type: application/json
25 {
26   "customerCode": "C006",
27   "fullName": "David Miller Jr.",
28   "email": "david.miller.jr@example.com",
29   "phone": "+15550107",
30   "address": "1000 Broadway, Seattle, WA 98101"
31 }
32
33 ### Test 5: Delete Customer
34 Send Request
```

```
1 HTTP/1.1 200
2 Vary: Origin, Access-Control-Request-Method, Access-Control-Request-Headers
3 Content-Type: application/json
4 Transfer-Encoding: chunked
5 Date: Sun, 14 Dec 2025 15:04:05 GMT
6 Connection: close
7
8 {
9   "totalItems": 5,
10  "totalPages": 1,
11  "customers": [
12    {
13      "id": 1,
14      "customerCode": "C001",
15      "fullName": "John Doe",
16      "email": "john.doe@example.com",
17      "phone": "+1-555-0101",
18      "address": "123 Main St, New York, NY 10001",
19      "status": "ACTIVE",
20      "createdAt": "2025-12-14T20:14:02",
21      "links": []
22    },
23    {
24      "id": 2,
25      "customerCode": "C002",
26      "fullName": "Jane Smith",
27      "email": "jane.smith@example.com",
28      "phone": "+1-555-0102",
29      "address": "456 Oak Ave, Los Angeles, CA 90001",
```

1. Controller: `CustomerRestController.getAllCustomers()` Receives GET `/api/customers`.
2. Service: `CustomerServiceImpl.getAllCustomers()` calls the repository to fetch all entities.
3. Repository: `CustomerRepository.findAll()` executes SQL to retrieve all records from the customers table.
4. Returns `List<Customer>`.
5. Service: `CustomerServiceImpl` streams the `List<Customer>` and maps each entity to a `CustomerResponseDTO` using helper methods.
6. Controller `CustomerRestController` returns the `List<CustomerResponseDTO>` with status 200 OK.

Test 2: GET Customer by ID

```
testAPIhttp > GET /api/customers/1
1  ### Test 1: GET All Customers
2  Send Request
3  GET http://localhost:8080/api/customers
4
5  ### Test 2: Create Customer
6  Send Request
7  GET http://localhost:8080/api/customers/1
8
9  ### Test 3: GET Customer by ID
10 Send Request
11 POST http://localhost:8080/api/customers
12 Content-Type: application/json
13 {
14   "customerCode": "C006",
15   "fullName": "David Miller",
16   "email": "david.miller@example.com",
17   "phone": "+15550106",
18   "address": "999 Broadway, Seattle, WA 98101"
19 }
20
21 ### Test 4: Update Customer
22 Send Request
23 PUT http://localhost:8080/api/customers/
24 Content-Type: application/json
25 {
26   "customerCode": "C006",
27   "fullName": "David Miller Jr.",
28   "email": "david.miller.jr@example.com",
29   "phone": "+15550107",
30   "address": "1000 Broadway, Seattle, WA 98101"
31 }
32
33 ### Test 5: Delete Customer
34 Send Request

HTTP/1.1 200
Vary: Origin, Access-Control-Request-Method, Access-Control-Request-Headers
Content-Type: application/hal+json
Transfer-Encoding: chunked
Date: Sun, 14 Dec 2025 15:06:48 GMT
Connection: close

{
  "id": 1,
  "customerCode": "C001",
  "fullName": "John Doe",
  "email": "john.doe@example.com",
  "phone": "+1-555-0101",
  "address": "123 Main St, New York, NY 10001",
  "status": "ACTIVE",
  "createdAt": "2025-12-14T20:14:02",
  "_links": {
    "self": {
      "href": "http://localhost:8080/api/customers/1"
    },
    "all-customers": {
      "href": "http://localhost:8080/api/customers?page=0&size=10&sortBy=id&sortDir=asc"
    }
  }
}
```

The request to `GET /api/customers/{id}` starts at the Controller, where the path variable `{id}` is extracted. The Controller calls the Service's `getCustomerById(id)` method. The Service immediately calls the Repository's `findById(id)` method, which executes a `SELECT` query in the database. The Repository returns an `Optional<Customer>`. The Service unwraps the result (or throws a `ResourceNotFoundException` if empty), converts the resulting `Customer` entity into a `CustomerResponseDTO`, and passes it back. Finally, the Controller returns the `CustomerResponseDTO` with a 200 OK status.

Test 3: POST Create Customer

```
testAPI.http > POST /api/customers
1  ### Test 1: GET All Customers
   Send Request
2  GET http://localhost:8080/api/customers
3
4  ### Test 2: GET Customer by ID
   Send Request
5  GET http://localhost:8080/api/customers/1
6
7  ### Test 3: Create Customer
   Send Request
8  POST http://localhost:8080/api/customers
9  Content-Type: application/json
10
11 {
12     "customerCode": "C006",
13     "fullName": "David Miller",
14     "email": "david.miller@example.com",
15     "phone": "+1555010699",
16     "address": "999 Broadway, Seattle, WA 98101"
17 }
18
19 ### Test 4: Update Customer
   Send Request
20 PUT http://localhost:8080/api/customers/6
21 Content-Type: application/json
22
23 {
24     "customerCode": "C006",
25     "fullName": "David Miller Jr.",
26     "email": "david.miller.jr@example.com",
27     "phone": "+15550107",
28 }
```

```
1 HTTP/1.1 201
2 Vary: Origin, Access-Control-Request-Method, Access-Control-Request-Headers
3 Content-Type: application/hal+json
4 Transfer-Encoding: chunked
5 Date: Sun, 14 Dec 2025 15:15:41 GMT
6 Connection: close
7
8 {
9     "id": 6,
10    "customerCode": "C006",
11    "fullName": "David Miller",
12    "email": "david.miller@example.com",
13    "phone": "+1555010699",
14    "address": "999 Broadway, Seattle, WA 98101",
15    "status": "ACTIVE",
16    "createdAt": "2025-12-14T22:15:41.6690413"
17 }
```

The POST /api/customers request is received by the Controller and is checked for Validation (@Valid). After successful validation, the Service executes the business logic: checking for duplicate customer code and email by calling existsByCustomerCode() and existsByEmail() in the Repository. If no duplicates are found, the Service converts the CustomerRequestDTO into a Customer entity, and the Repository performs save() (INSERT into DB). The Service converts the saved entity into a CustomerResponseDTO, and the Controller returns it with a 201 Created status.

Test 4: PUT Update Customer

```
testAPI.http > PUT /api/customers/6
1  ### Test 1: GET All Customers
2  Send Request
3  GET http://localhost:8080/api/customers
4
5  ### Test 2: GET Customer by ID
6  Send Request
7  GET http://localhost:8080/api/customers/1
8
9  ### Test 3: Create Customer
10 Send Request
11 POST http://localhost:8080/api/customers
12 Content-Type: application/json
13 {
14   "customerCode": "C006",
15   "fullName": "David Miller",
16   "email": "david.miller@example.com",
17   "phone": "+1555010699",
18   "address": "999 Broadway, Seattle, WA 98101"
19 }
20
21 ### Test 4: Update Customer
22 Send Request
23 PUT http://localhost:8080/api/customers/6
24 Content-Type: application/json
25 {
26   "customerCode": "C006",
27   "fullName": "David Miller Jr.",
28   "email": "david.miller.jr@example.com",
29   "phone": "+1555010799",
30   "address": "1000 Broadway, Seattle, WA 98101"
31 }
32
33 ### Test 5: Delete Customer
34 Send Request
35 DELETE http://localhost:8080/api/customers/6
36
37 ### Test 6: Search Customers by Name

1 HTTP/1.1 200
2 Vary: Origin, Access-Control-Request-Method, Access-Control-Request-Headers
3 Content-Type: application/hal+json
4 Transfer-Encoding: chunked
5 Date: Sun, 14 Dec 2025 15:16:45 GMT
6 Connection: close
7
8 {
9   "id": 6,
10  "customerCode": "C006",
11  "fullName": "David Miller Jr.",
12  "email": "david.miller.jr@example.com",
13  "phone": "+1555010799",
14  "address": "1000 Broadway, Seattle, WA 98101",
15  "status": "ACTIVE",
16  "createdAt": "2025-12-14T22:15:42"
17 }
```

The PUT `/api/customers/{id}` request is received by the Controller, and the incoming `CustomerRequestDTO` undergoes Validation (`@Valid`). Upon success, the Controller calls the Service's `updateCustomer(id, requestDTO)` method. The Service first calls the Repository's `findById(id)` to retrieve the existing customer entity, ensuring it exists. The Service performs a duplicate check on the new email address, ensuring the new email doesn't belong to any other customer.

If checks pass, the Service updates the fields of the retrieved entity. The Service then calls the Repository's `save(existingCustomer)` method, which executes an UPDATE query. The Service converts the updated entity to a `CustomerResponseDTO`, and the Controller returns it with a 200 OK status.

Test 5: DELETE Customer

```

testAPIHttp > PUT /api/customers/6
17 }
18 ### Test 4: Update Customer
Send Request
19 PUT http://localhost:8080/api/customers/6
20 Content-Type: application/json
21
22 {
23   "customerCode": "C006",
24   "fullName": "David Miller Jr.",
25   "email": "david.miller.jr@example.com",
26   "phone": "+1555010799",
27   "address": "1000 Broadway, Seattle, WA 98101"
28 }
29
30 ### Test 5: Delete Customer
Send Request
31 DELETE http://localhost:8080/api/customers/6
32
33 ### Test 6: Search Customers by Name
Send Request
34 GET http://localhost:8080/api/customers/search?keyword=John
35
36 ### Test 7: Validation error
Send Request
37 POST http://localhost:8080/api/customers
38 Content-Type: application/json
39
40 {
41   "customerCode": "C",
42   "email": "invalid-email"
43 }
44 ### Test 8: Resource Not Found
Send Request
45 GET http://localhost:8080/api/customers/999
46 ### Test 9: Duplicate Resource
Send Request
47 POST http://localhost:8080/api/customers
48 Content-Type: application/json

```

```

1 HTTP/1.1 200
2 Vary: Origin, Access-Control-Request-Method, Access-Control-Request-Headers
3 Content-Type: application/json
4 Transfer-Encoding: chunked
5 Date: Sun, 14 Dec 2025 15:18:52 GMT
6 Connection: close
7
8 {
9   "message": "Customer deleted successfully"
10 }

```

The DELETE /api/customers/{id} request is received by the Controller, which calls the Service's deleteCustomer(id) method. The Service first calls the Repository's existsById(id) to confirm the resource exists. If the customer exists, the Service calls the Repository's deleteById(id) method, which executes a DELETE query. If the deletion is successful (or the operation completes), the Controller constructs a simple success JSON map and returns it with a 200 OK status.

Test 6: Search Customers

```
testAPI.http > PUT /api/customers/6
17 }
18 ### Test 4: Update Customer
19 Send Request
20 PUT http://localhost:8080/api/customers/6
21 Content-Type: application/json
22 {
23   "customerCode": "C006",
24   "fullName": "David Miller Jr.",
25   "email": "david.miller.jr@example.com",
26   "phone": "+1555010799",
27   "address": "1000 Broadway, Seattle, WA 98101"
28 }
29
30 ### Test 5: Delete Customer
31 Send Request
32 DELETE http://localhost:8080/api/customers/6
33
34 ### Test 6: Search Customers by Name
35 Send Request
36 GET http://localhost:8080/api/customers/search?keyword=John
37
38 ### Test 7: Validation error
39 Send Request
40 POST http://localhost:8080/api/customers
41 Content-Type: application/json
42 {
43   "customerCode": "C",
44   "email": "invalid-email"
45 }
46
47 ### Test 8: Resource Not Found
48 Send Request
49 GET http://localhost:8080/api/customers/999
50
51 ### Test 9: Duplicate Resource
52 Send Request
53 POST http://localhost:8080/api/customers
54 Content-Type: application/json

1 HTTP/1.1 200
2 Vary: Origin, Access-Control-Request-Method, Access-Control-Request-Headers
3 Content-Type: application/json
4 Transfer-Encoding: chunked
5 Date: Sun, 14 Dec 2025 15:19:18 GMT
6 Connection: close
7
8 [
9   {
10     "id": 1,
11     "customerCode": "C001",
12     "fullName": "John Doe",
13     "email": "john.doe@example.com",
14     "phone": "+1-555-0101",
15     "address": "123 Main St, New York, NY 10001",
16     "status": "ACTIVE",
17     "createdAt": "2025-12-14T20:14:02",
18     "links": []
19   },
20   {
21     "id": 3,
22     "customerCode": "C003",
23     "fullName": "Bob Johnson",
24     "email": "bob.johnson@example.com",
25     "phone": "+1-555-0103",
26     "address": "789 Pine Rd, Chicago, IL 60601",
27     "status": "ACTIVE",
28     "createdAt": "2025-12-14T20:14:02",
29     "links": []
30   }
31 ]
```

The **GET /api/customers/search?keyword={keyword}** request is received by the Controller, which extracts the keyword request parameter. The Controller calls the Service's **searchCustomers(keyword)** method. The Service immediately calls the Repository's **searchCustomers(keyword)** method. The Repository executes a specialized **@Query (JPQL/HQL)** that searches across multiple fields (**fullName**, **email**, **customerCode**) using **LOWER(..)** and **LIKE %keyword%** for case-insensitive partial matching. The Repository returns a **List<Customer>**. The Service converts this list to a **List<CustomerResponseDTO>**, and the Controller returns the results with a **200 OK** status.

Test 7: Validation Error

```
testAPIhttp > ...
19 PUT http://localhost:8080/api/customers/6
20 {
21   "customerCode": "C006",
22   "fullName": "David Miller Jr.",
23   "email": "david.miller.jr@example.com",
24   "phone": "+1555010799",
25   "address": "1000 Broadway, Seattle, WA 98101"
26 }
27
28
29
30 ### Test 5: Delete Customer
31 Send Request
32 DELETE http://localhost:8080/api/customers/6
33
34 ### Test 6: Search Customers by Name
35 Send Request
36 GET http://localhost:8080/api/customers/search?keyword=John
37
38 ### Test 7: Validation error
39 Send Request
40 POST http://localhost:8080/api/customers
41 Content-Type: application/json
42 {
43   "customerCode": "C",
44   "email": "invalid-email"
45 }
46
47 ### Test 8: Resource Not Found
48 Send Request
49 GET http://localhost:8080/api/customers/999
50
51 ### Test 9: Duplicate Resource
52 Send Request
53 POST http://localhost:8080/api/customers
54 Content-Type: application/json
55 {
56   "customerCode": "C007",
57   "fullName": "Test User",
58   "email": "john.doe@example.com"
59 }
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Test 8: Resource Not Found

```
testAPI.http > ...
31 DELETE http://localhost:8080/api/customers/6
32
33 ### Test 6: Search Customers by Name
34 Send Request
35 GET http://localhost:8080/api/customers/search?keyword=John
36
37 ### Test 7: Validation error
38 Send Request
39 POST http://localhost:8080/api/customers
40 Content-Type: application/json
41 {
42   "customerCode": "C",
43   "email": "invalid-email"
44 }
45
46 ### Test 8: Resource Not Found
47 Send Request
48 GET http://localhost:8080/api/customers/999
49
50 ### Test 9: Duplicate Resource
51 Send Request
52 POST http://localhost:8080/api/customers
53 Content-Type: application/json
54 {
55   "customerCode": "C007",
56   "fullName": "Test User",
57   "email": "john.doe@example.com"
58 }
```

```
1 HTTP/1.1 404
2 Vary: Origin, Access-Control-Request-Method, Access-Control-Request-Headers
3 Content-Type: application/json
4 Transfer-Encoding: chunked
5 Date: Sun, 14 Dec 2025 15:19:58 GMT
6 Connection: close
7
8 {
9   "timestamp": "2025-12-14T22:19:58.1957165",
10  "status": 404,
11  "error": "Not Found",
12  "message": "Customer not found with id: 999",
13  "path": "/api/customers/999",
14  "details": null
15 }
```

When the GET /api/customers/999 request (non-existent ID) is sent, the Service calls findById(999L) on the Repository. The Repository returns an Optional.empty(). The Service checks the result and throws a ResourceNotFoundException. This exception is caught by the GlobalExceptionHandler, which then creates an ErrorResponseDTO with the message "Customer not found..." and returns it with a 404 Not Found status.

Test 9: Duplicate Resource

```
testAPI.http > ...
31 DELETE http://localhost:8080/api/customers/6
32
33 ### Test 6: Search Customers by Name
34 Send Request
35 GET http://localhost:8080/api/customers/search?keyword=John
36
37 ### Test 7: Validation error
38 Send Request
39 POST http://localhost:8080/api/customers
40 Content-Type: application/json
41 {
42   "customerCode": "C",
43   "email": "invalid-email"
44 }
45 ### Test 8: Resource Not Found
46 Send Request
47 GET http://localhost:8080/api/customers/999
48
49 ### Test 9: Duplicate Resource
50 Send Request
51 POST http://localhost:8080/api/customers
52 Content-Type: application/json
53 {
54   "customerCode": "C007",
55   "fullName": "Test User",
56   "email": "john.doe@example.com"
57 }

1 HTTP/1.1 409
2 Vary: Origin, Access-Control-Request-Method, Access-Control-Request-Headers
3 Content-Type: application/json
4 Transfer-Encoding: chunked
5 Date: Sun, 14 Dec 2025 15:20:17 GMT
6 Connection: close
7
8 {
9   "timestamp": "2025-12-14T22:20:17.111316",
10  "status": 409,
11  "error": "Conflict",
12  "message": "Email already exists: john.doe@example.com",
13  "path": "/api/customers",
14  "details": null
15 }
```

When the POST /api/customers request contains an existing email, basic validation succeeds. The Service calls existsByEmail() on the Repository, and the Repository returns true. The Service immediately throws a DuplicateResourceException. This exception is caught by the GlobalExceptionHandler, which constructs an ErrorResponseDTO with a conflict message and returns it with a 409 Conflict status. Using cURL (Command Line)

GET all customers

curl http://localhost:8080/api/customers

GET customer by ID

curl http://localhost:8080/api/customers/1

POST create customer

curl -X POST http://localhost:8080/api/customers \

-H "Content-Type: application/json" \

-d '{

"customerCode": "C006",

"fullName": "David Miller",

"email": "david.miller@example.com",

"phone": "+1-555-0106",

"address": "999 Broadway, Seattle, WA 98101"

}'

PUT update customer

```
curl -X PUT http://localhost:8080/api/customers/6 \  
-H "Content-Type: application/json" \  
-d '{  
  "customerCode": "C006",  
  "fullName": "David Miller Jr.",  
  "email": "david.miller.jr@example.com",  
  "phone": "+1-555-0107",  
  "address": "1000 Broadway, Seattle, WA 98101"  
}'  
# DELETE customer  
curl -X DELETE http://localhost:8080/api/customers/6  
# Search customers  
curl "http://localhost:8080/api/customers/search?keyword=john"
```