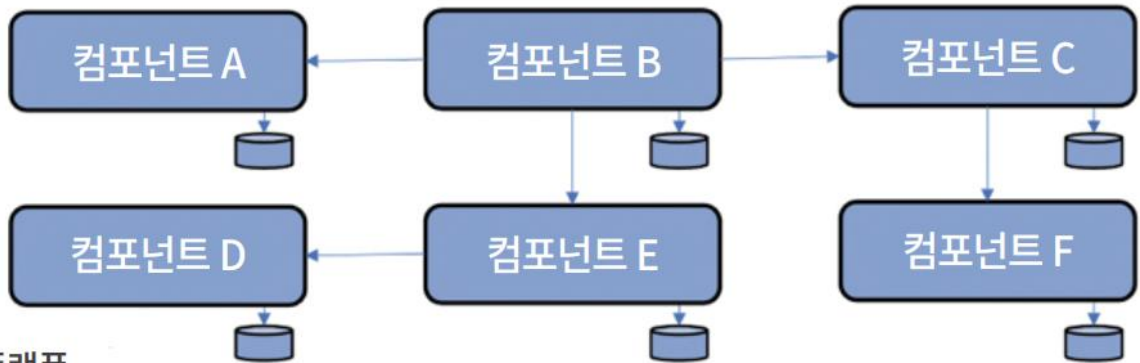
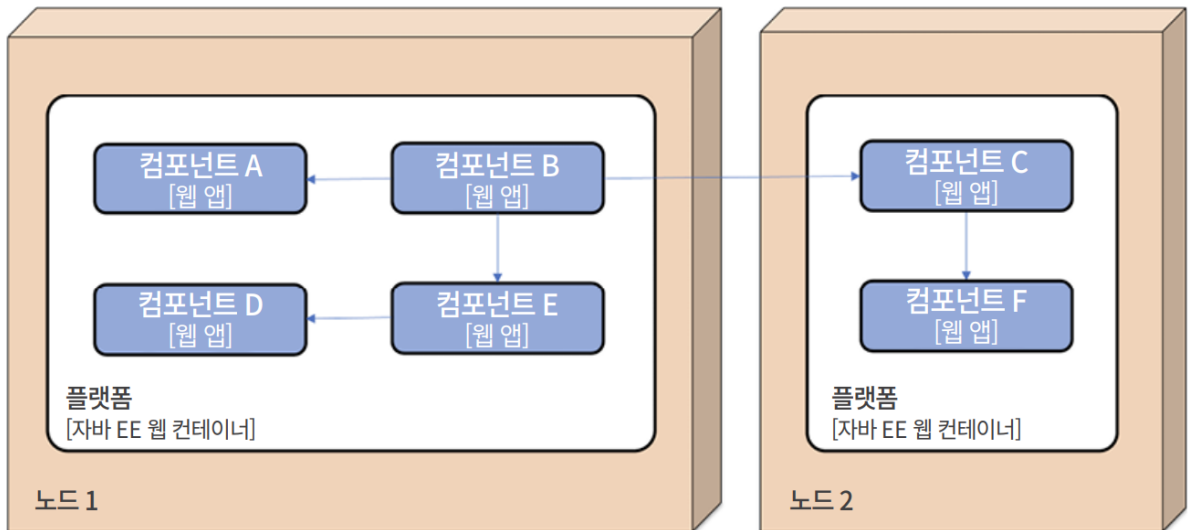
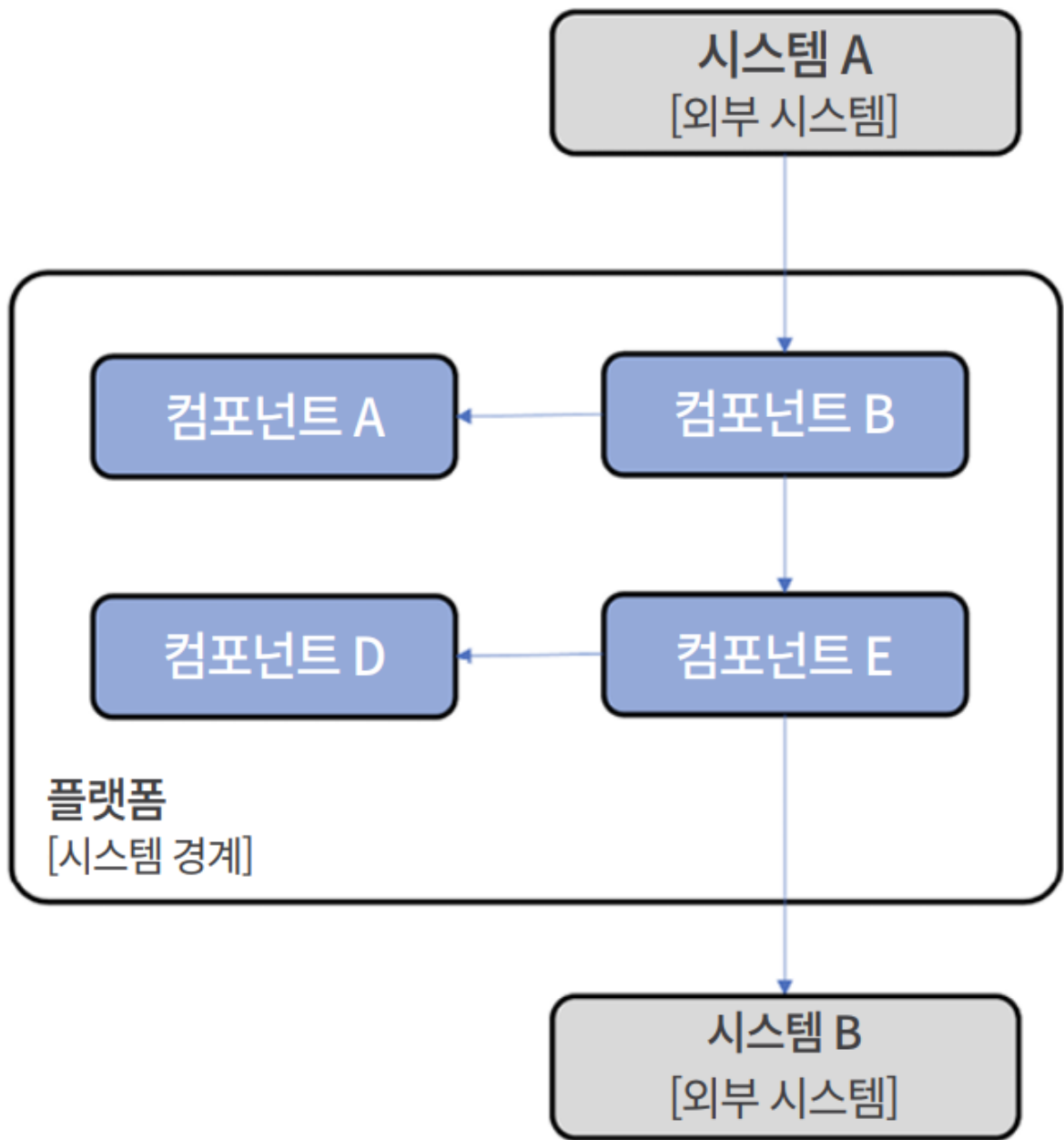


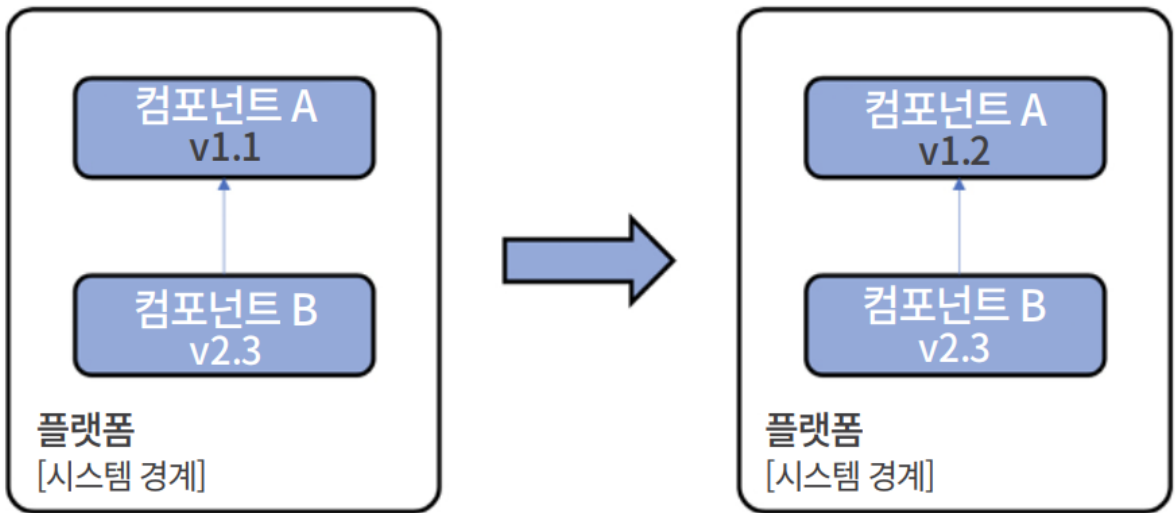
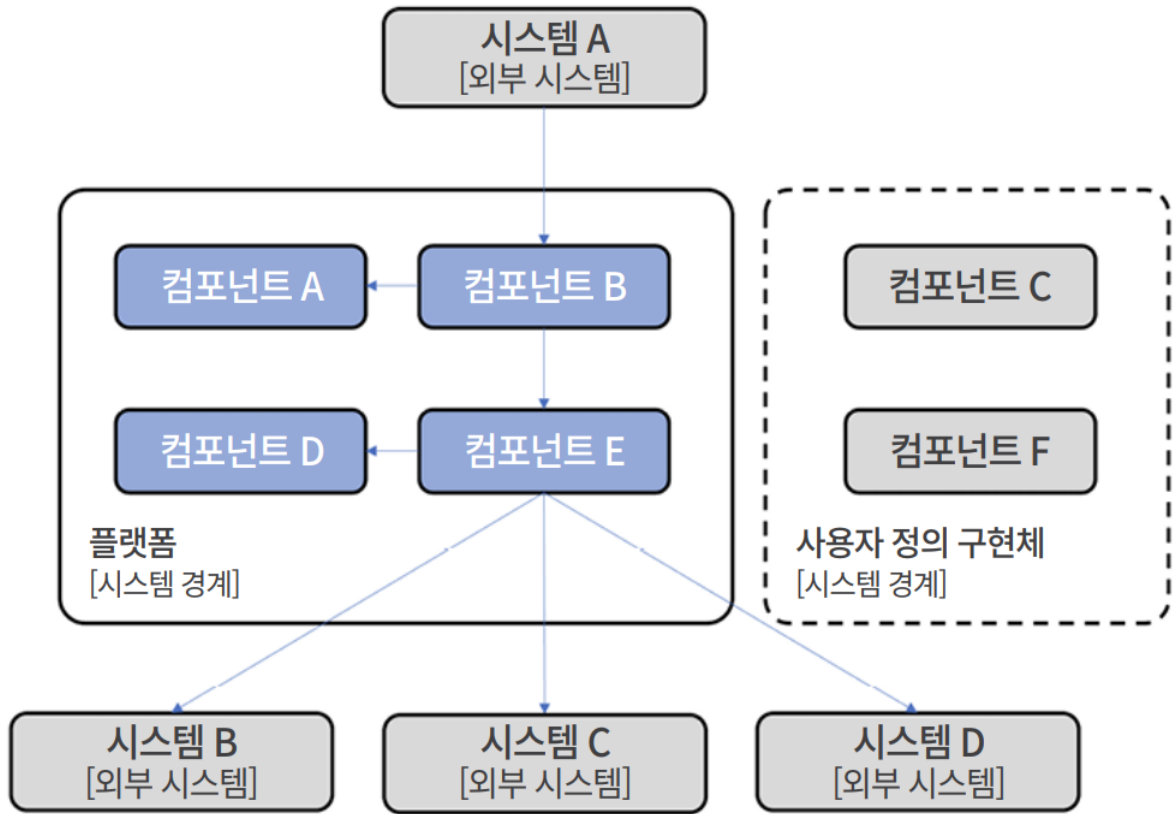
# 01장: 마이크로서비스 소개

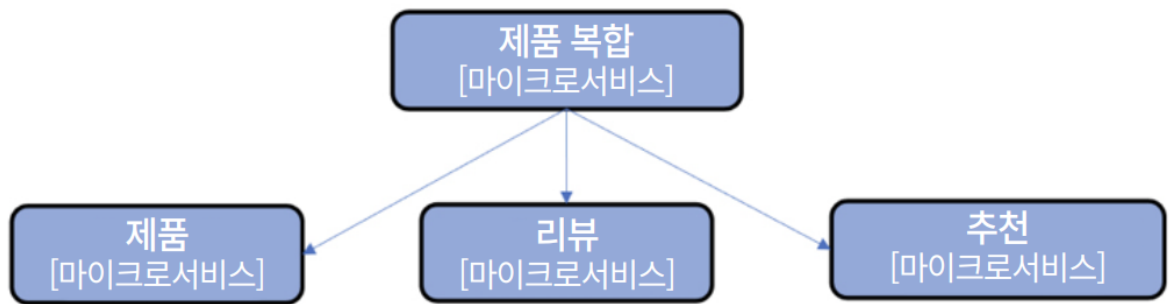
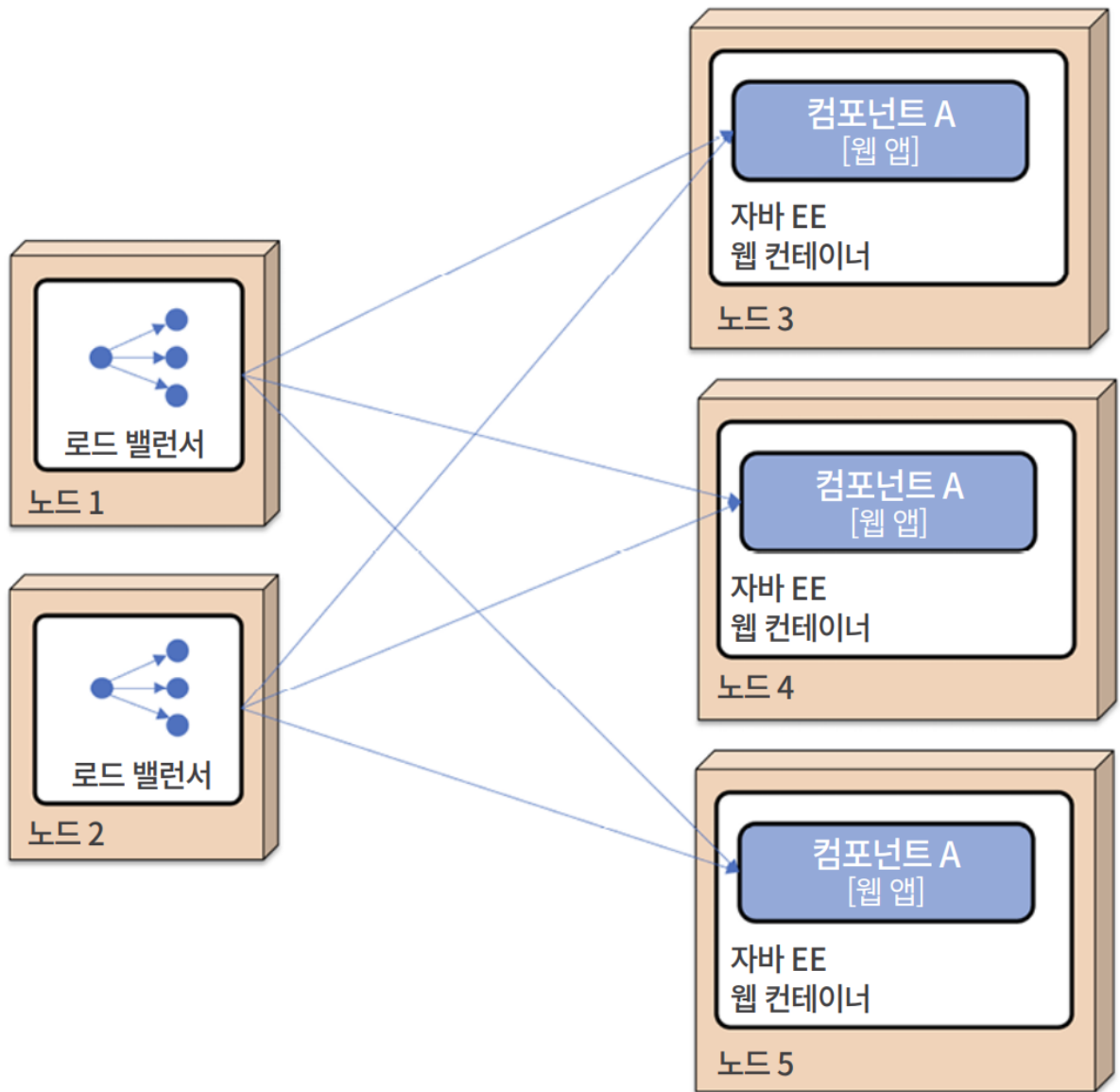


플랫폼  
[시스템 경계]

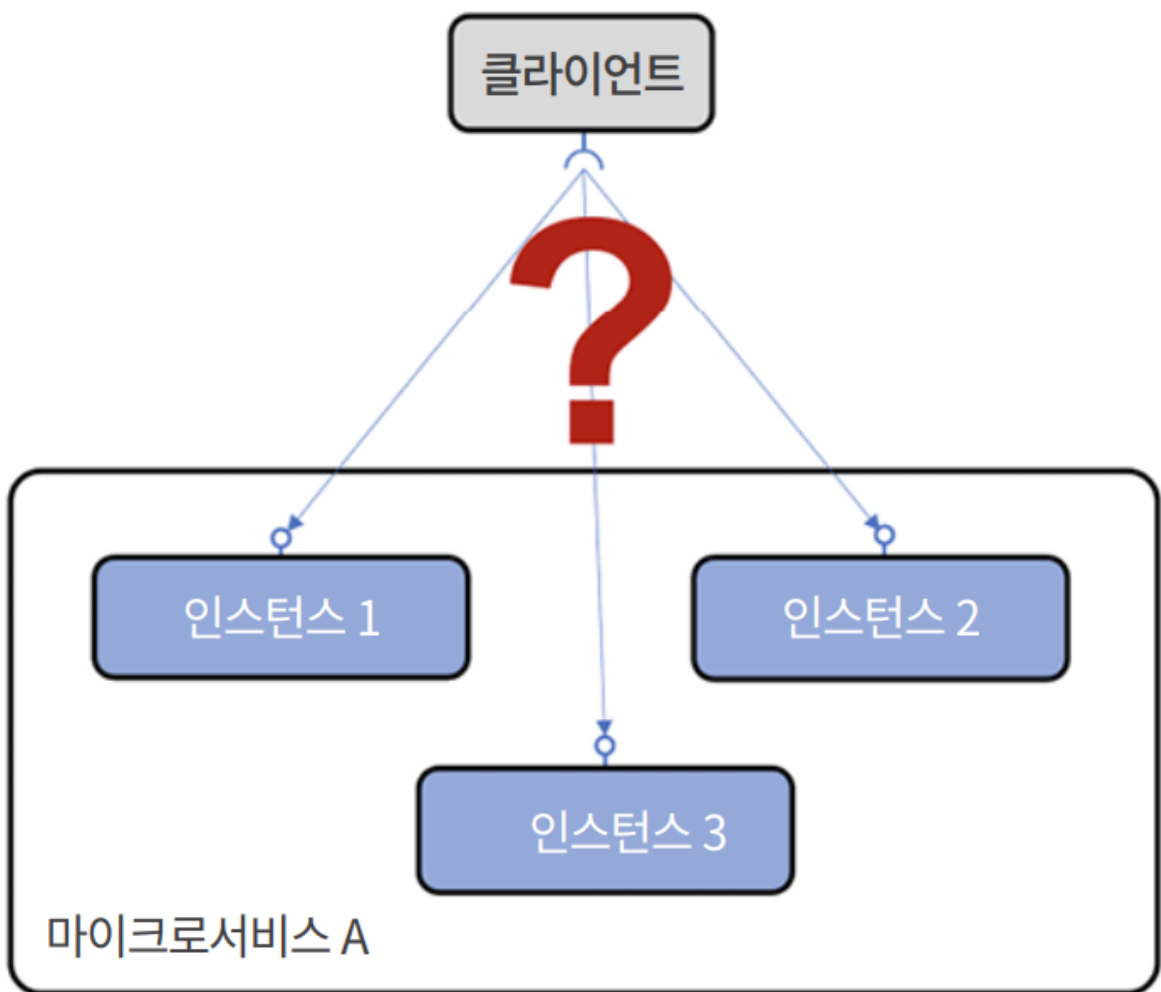
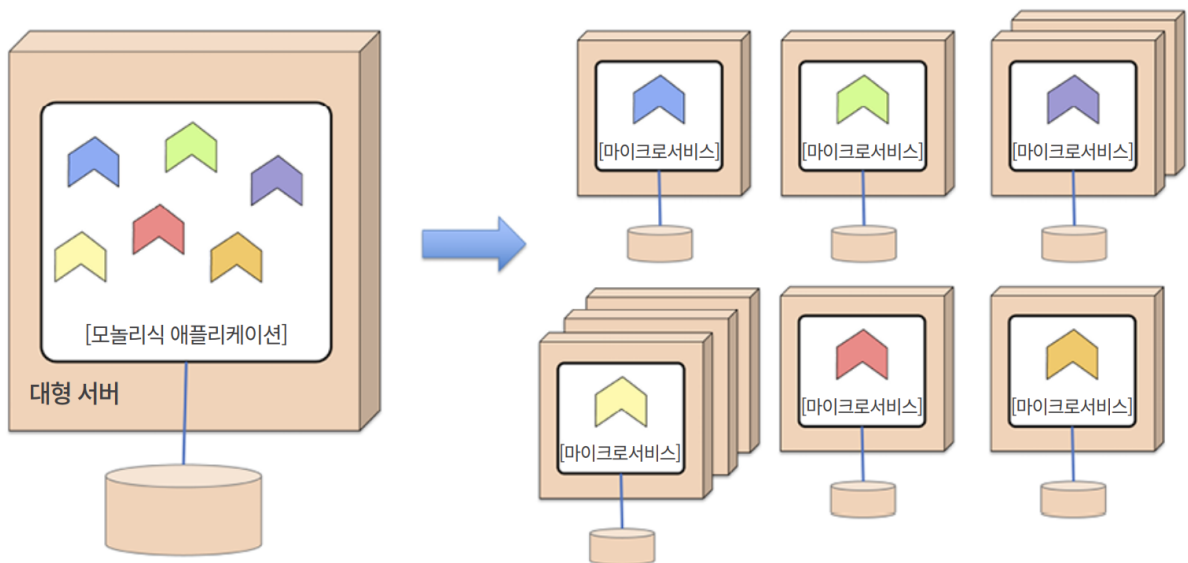


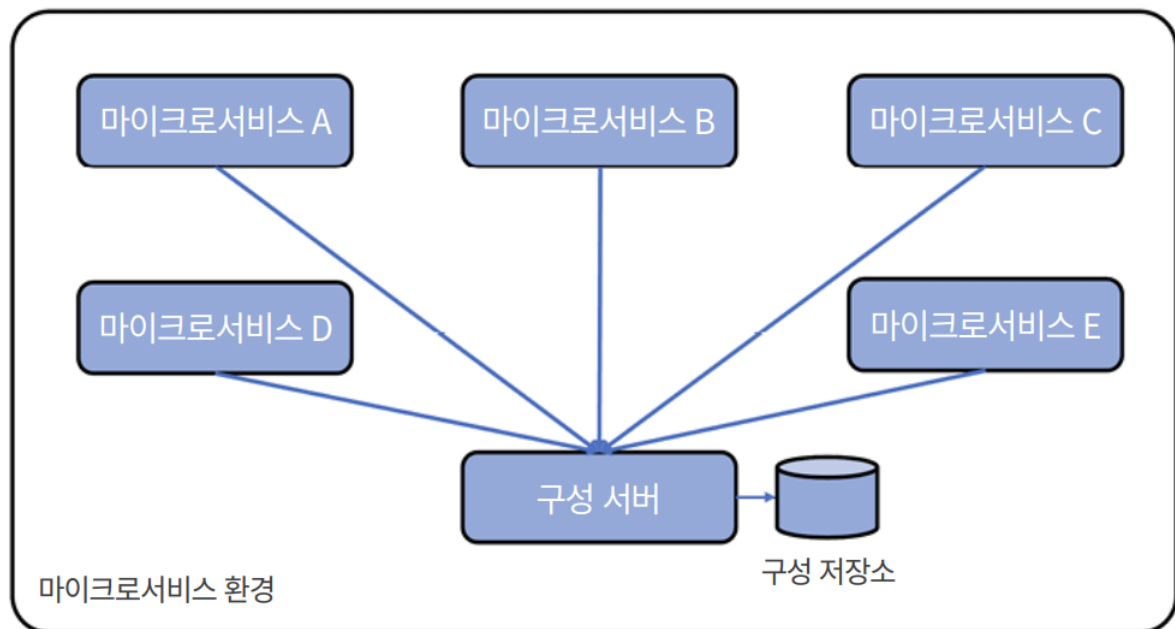
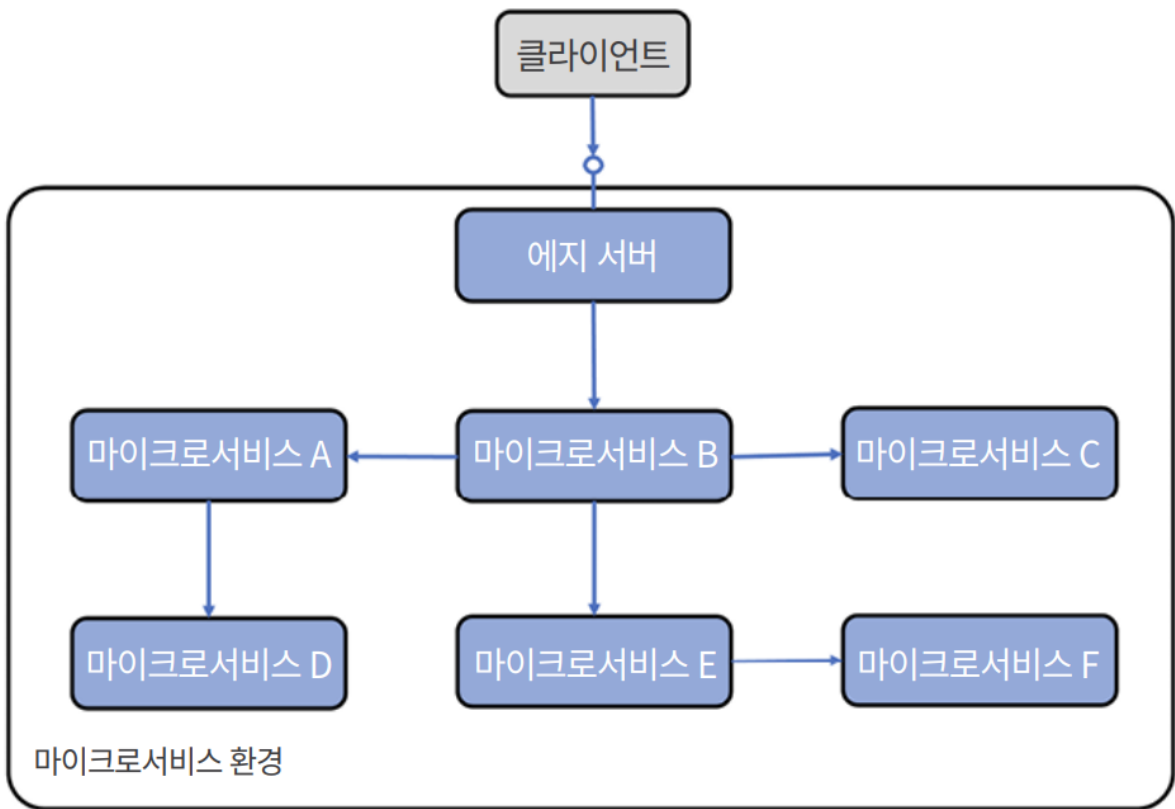


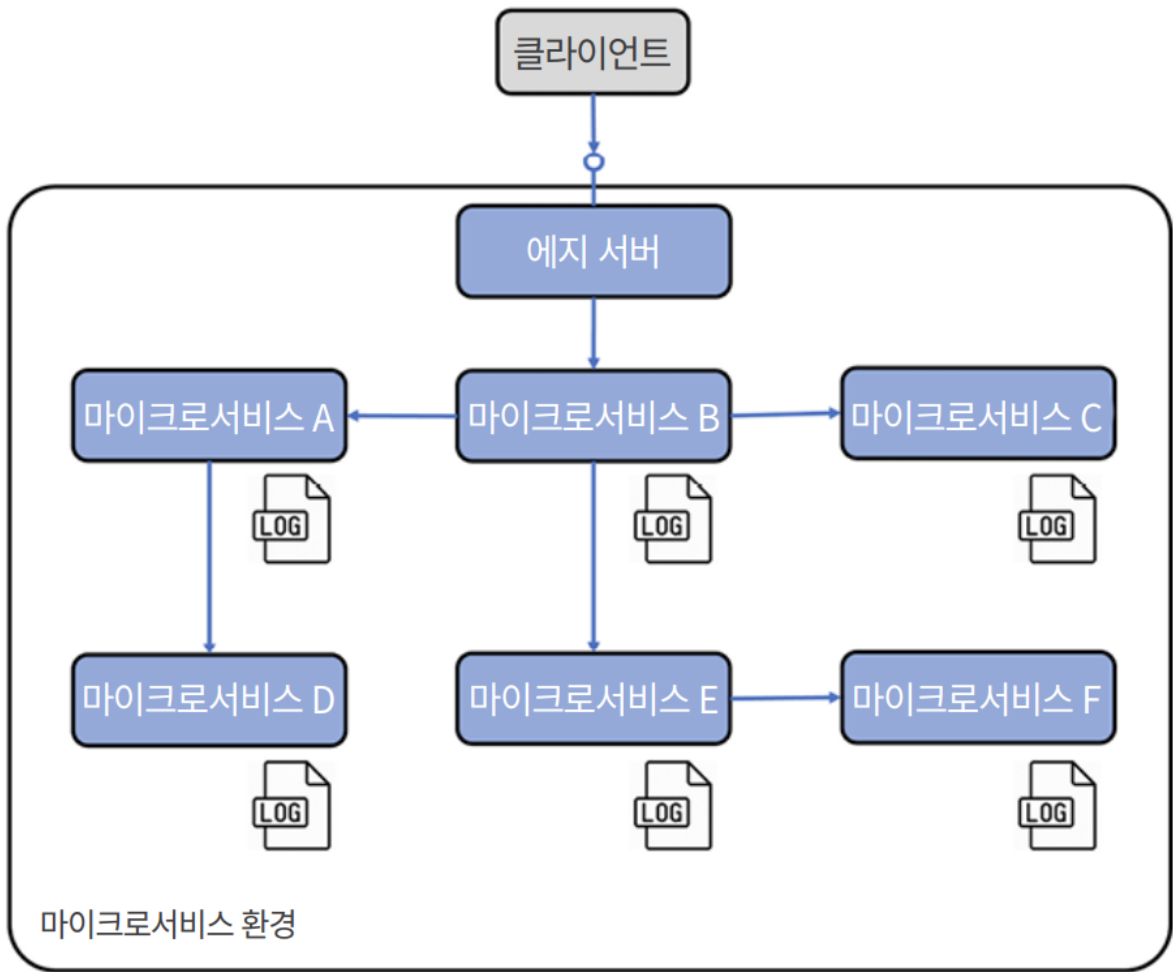


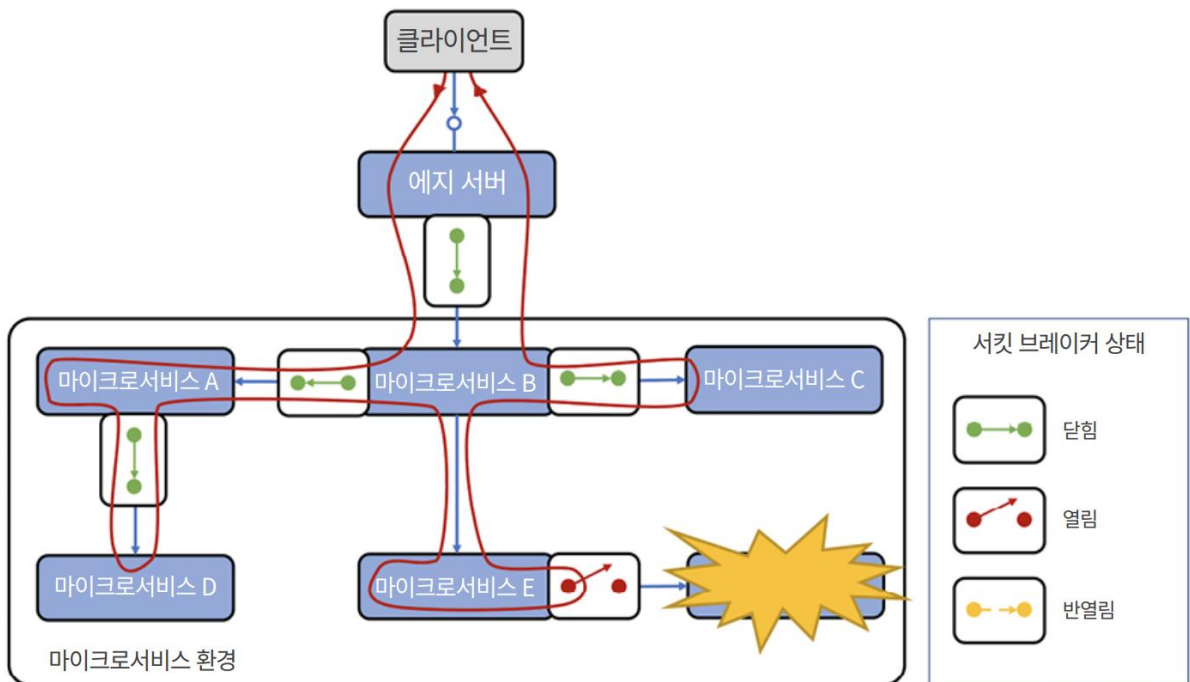
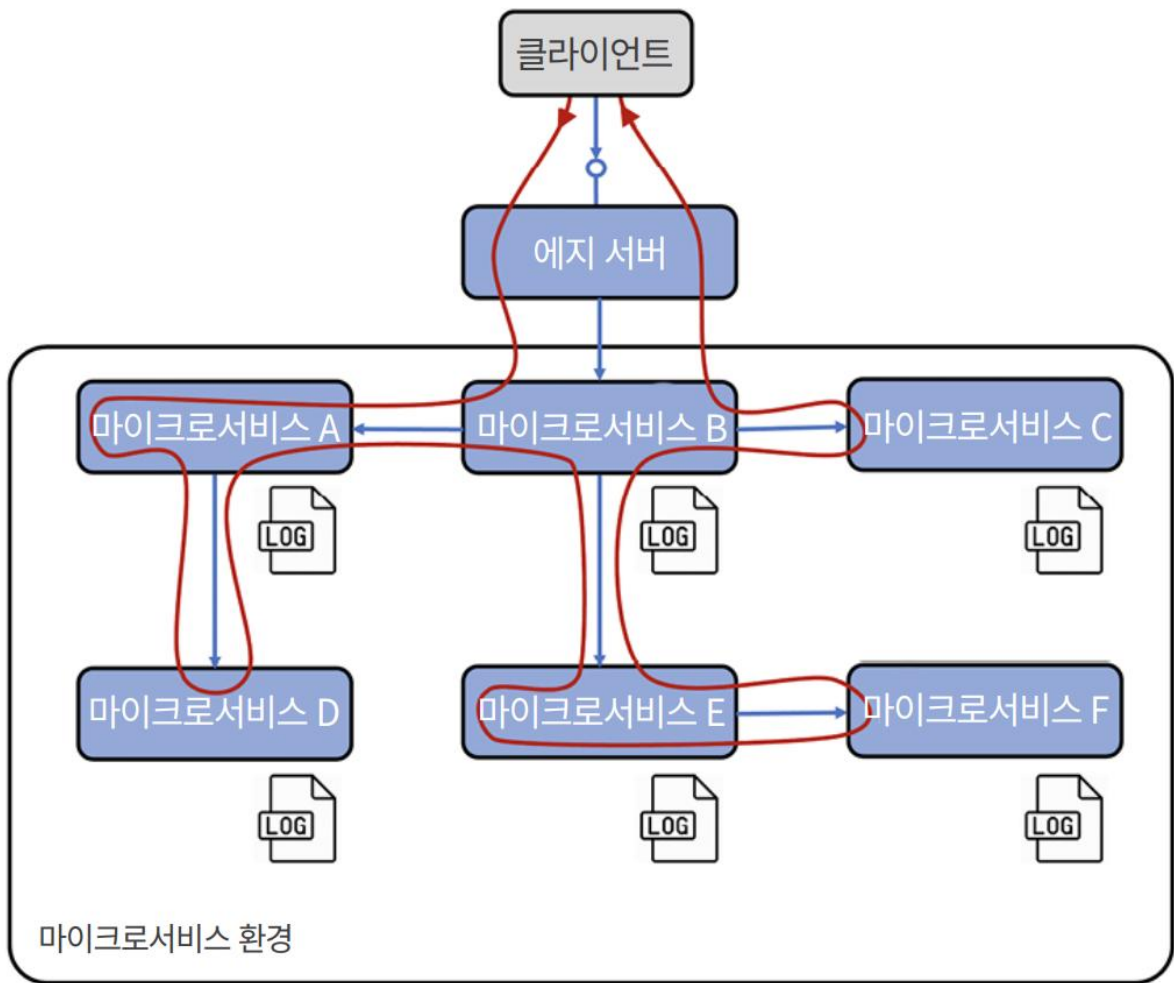


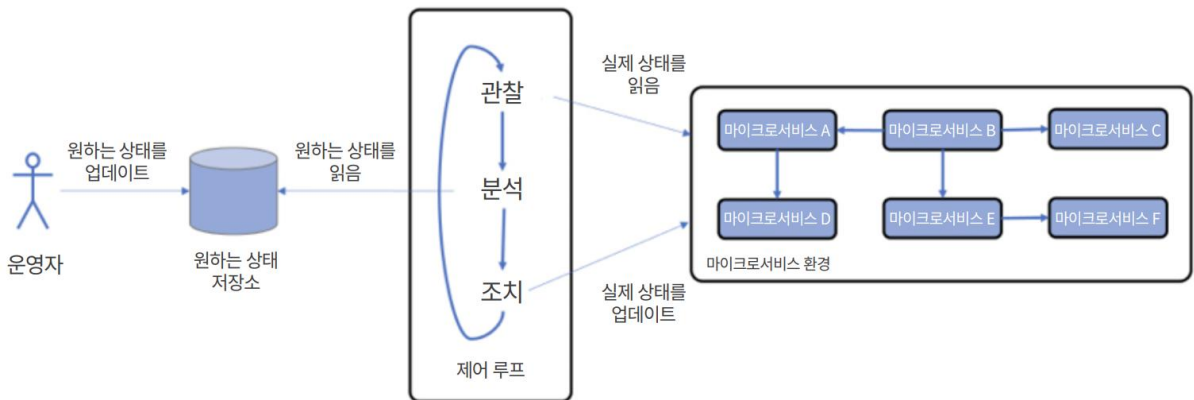
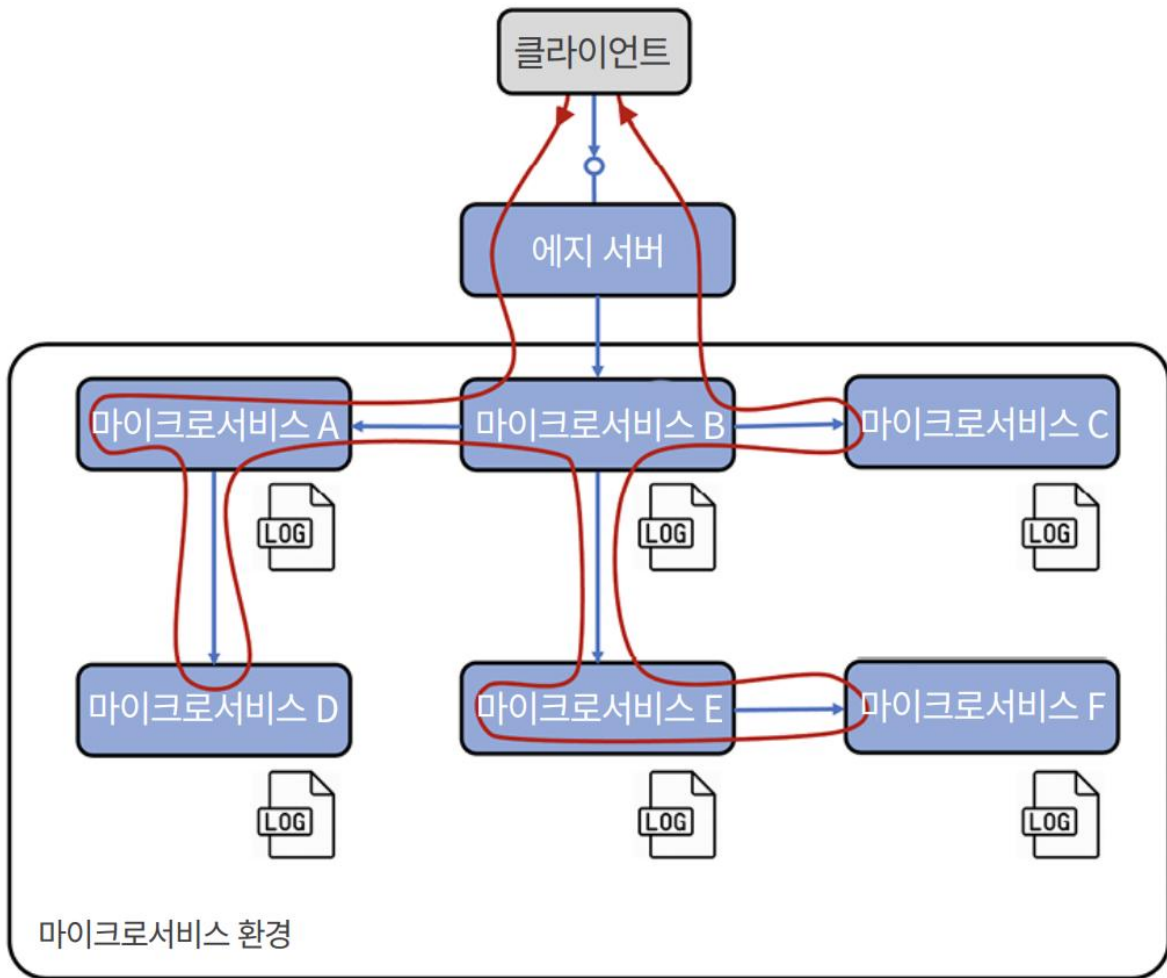
마이크로서비스 환경  
[시스템 경계]

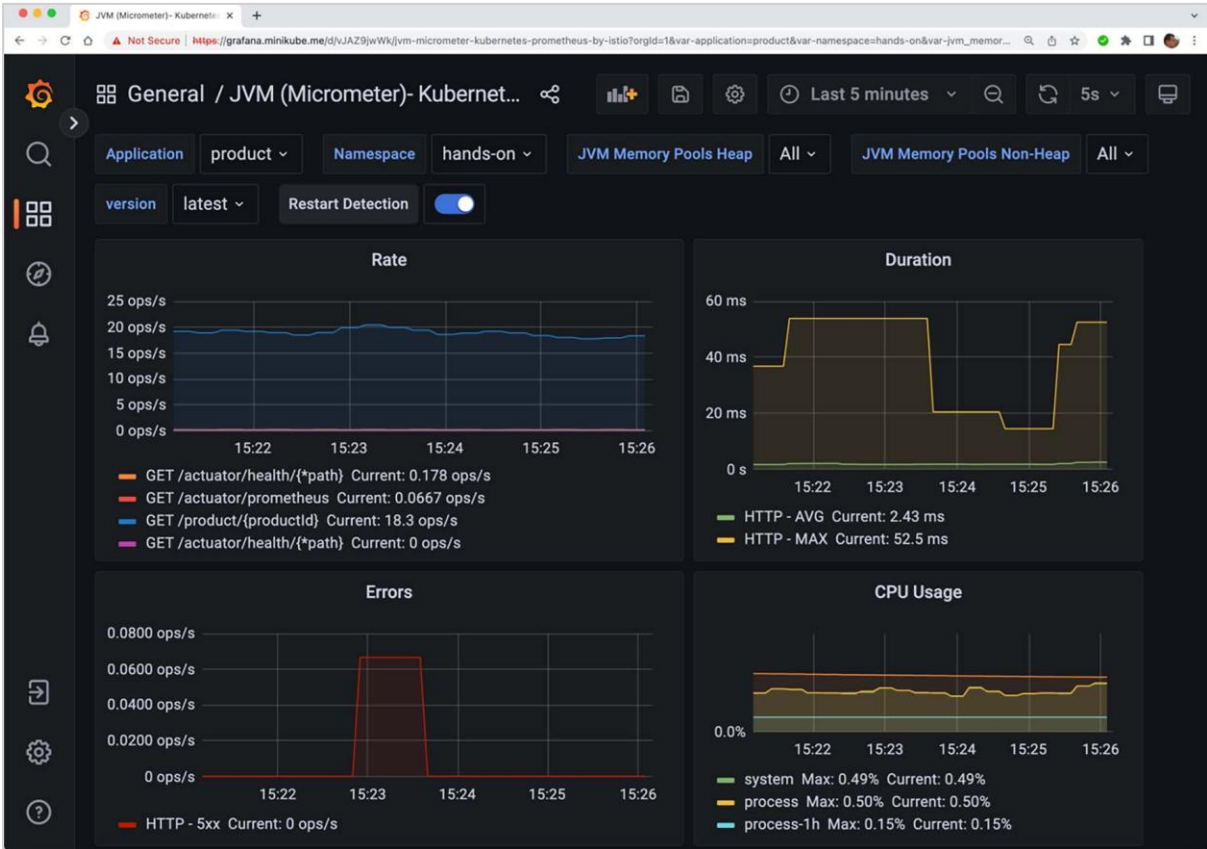












## 02장: 스프링 부트 소개

The screenshot displays the Swagger UI interface in a web browser. The browser's address bar shows the URL `https://localhost:8443/webjars/swagger-ui/index.h` with a zoom level of 80%. The Swagger logo and version information (1.0.0 OAS3) are visible at the top left. The main content area is titled "Sample API" and lists two endpoints:

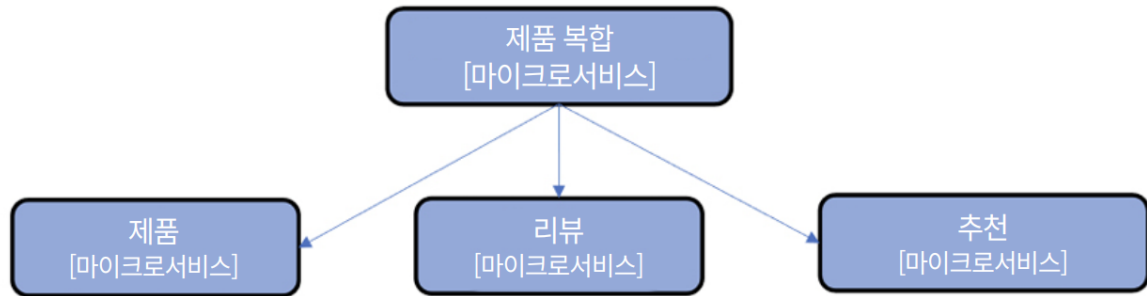
- POST** `/product-composite`: Creates a composite product.
- GET** `/product-composite/{productId}`: Returns a composite view of the specified product id.

The "Parameters" section for the GET endpoint is expanded, showing a table with the following details:

Name	Description
<b>productId</b> * required integer(\$int32) (path)	<input type="text" value="productId"/>

Below the parameters table, there is a large blue "Execute" button. At the bottom of the interface, the "Responses" section is partially visible.

### 03장: 협력하는 마이크로서비스 만들기



마이크로서비스 환경  
[시스템 경계]

```
4. bash
$ find microservices/product-service -type f
microservices/product-service/gradle/wrapper/gradle-wrapper.jar
microservices/product-service/gradle/wrapper/gradle-wrapper.properties
microservices/product-service/gradlew
microservices/product-service/.gitignore
microservices/product-service/build.gradle
microservices/product-service/gradlew.bat
microservices/product-service/settings.gradle
microservices/product-service/src/test/java/se/magnus/microservices/core/product/ProductServiceApplicationTests.java
microservices/product-service/src/main/resources/application.properties
microservices/product-service/src/main/java/se/magnus/microservices/core/product/ProductServiceApplication.java
$
```

```
4. bash
$ ./gradlew build
Starting a Gradle Daemon (subsequent builds will be faster)
Download ...
> Task :microservices:product-composite-service:test
...
> Task :microservices:product-service:test
...
> Task :microservices:recommendation-service:test
...
> Task :microservices:review-service:test
...
BUILD SUCCESSFUL in 34s
$
```



```
bash
$ curl http://localhost:7001/product-composite/1 -s | jq .
{
  "productId": 1,
  "...",
  "recommendations": [ ... ],
  "reviews": [ ... ],
  "serviceAddresses": { ... }
}
```

The screenshot displays an IDE environment with a Spring Boot dashboard on the left and a code editor on the right. The dashboard shows a list of services under the 'APPS' section:

- product-composite-service [7001]
- product-service [7002]
- recommendation-service [7003]
- review-service [7004]

The 'ENDPOINT MAPPINGS' section for the product-composite-service (pid: 60658) includes:

- /actuator [GET]
- /actuator/health [GET]
- /actuator/health/{\*path} [GET]
- /product-composite/{productId} [GET]
- /webjars/\*\*

The code editor shows the `ProductCompositeServiceImpl.java` file, which implements the `ProductCompositeService` interface. The code includes a `@RestController` annotation and a `public class ProductCompositeServiceImpl implements ProductCompositeService` declaration. The class contains two private fields: `private final ServiceUtil serviceUtil;` and `private ProductCompositeIntegration integration;`. The `ProductCompositeServiceImpl` constructor takes `ServiceUtil serviceUtil, ProductCompositeIntegration integration` as arguments and initializes the fields: `this.serviceUtil = serviceUtil;` and `this.integration = integration;`.

The terminal output shows the application starting successfully with Spring Boot v3.5.0-M3. The logs include:

```
INFO 60658 --- [main] m.c.p.ProductCompositeServiceApplication : Starting ProductCompositeServiceApplication using Java 24 with PID 60658 (/Users/magnus/Documents/projects/books/4th/git/3E-INIT/Chapter03/2-basic-rest-services/microservices/product-composite-service/build/classes/java/main started by magnus in /Users/magnus/Documents/projects/books/4th/git/3E-INIT/Chapter03/2-basic-rest-services/microservices/product-composite-service)
DEBUG 60658 --- [main] m.c.p.ProductCompositeServiceApplication : Running with Spring Boot v3.5.0-M3, Spring v6.2.5
INFO 60658 --- [main] m.c.p.ProductCompositeServiceApplication : No active profile set, falling back to 1 default profile: "default"
WARNING: A terminally deprecated method in sun.misc.Unsafe has been called
WARNING: sun.misc.Unsafe:allocateMemory has been called by io.netty.util.internal.PlatformDependent0$2 (file:/Users/magnus/.gradle/caches/modules-2/files-2.1/io.netty/netty-common/4.1.119.Final/2f7c360b03c0aceab7efc1f7c2b75274f0f35909/netty-common-4.1.119.Final.jar)
WARNING: Please consider reporting this to the maintainers of class io.netty.util.internal.PlatformDependent0$2
WARNING: sun.misc.Unsafe:allocateMemory will be removed in a future release
INFO 60658 --- [main] o.s.b.a.e.web.EndpointLinksResolver : Exposing 1 endpoint beneath base path '/actuator'
INFO 60658 --- [main] o.s.b.w.e.n.n.NettyWebServer : Netty started on port 7001 (http)
INFO 60658 --- [main] m.c.p.ProductCompositeServiceApplication : Started ProductCompositeServiceApplication in 1.285 seconds (process running for 1.717)
```

```
@52ed908dac59:/
./test-em-all.bash
HOST=localhost
PORT=7001
Test OK (HTTP Code: 200)
Test OK (actual value: 1)
Test OK (actual value: 3)
Test OK (actual value: 3)
Test OK (HTTP Code: 404, {"timestamp":"YYYY-MM-DDT12:55:59.65947+02:00","path":"/product-composite/13","message":"No product found for productId: 13","status":404,"error":"Not Found"})
Test OK (actual value: No product found for productId: 13)
Test OK (HTTP Code: 200)
Test OK (actual value: 113)
Test OK (actual value: 0)
Test OK (actual value: 3)
Test OK (HTTP Code: 200)
Test OK (actual value: 213)
Test OK (actual value: 3)
Test OK (actual value: 0)
Test OK (HTTP Code: 422, {"timestamp":"YYYY-MM-DDT12:55:59.754238+02:00","path":"/product-composite/-1","message":"Invalid productId: -1","status":422,"error":"Unprocessable Entity"})
Test OK (actual value: "Invalid productId: -1")
Test OK (HTTP Code: 400, {"timestamp":"YYYY-MM-DDT10:55:59.771+00:00","path":"/product-composite/invalidProductId","status":400,"error":"Bad Request","requestId":"5d6271ba-12","message":"Type mismatch."})
Test OK (actual value: "Type mismatch.")
End, all tests OK: Fri MMM DD 12:55:59 CEST YYYY
$
```

## 04장: 도커를 활용한 마이크로서비스 배포



```
4. root@435dc56d39f6: / (docker)
$ docker run -it --rm ubuntu
root@435dc56d39f6: /#
```

```
root@5a9c0bae8632: /# cat /etc/os-release | grep 'PRETTY_NAME'
PRETTY_NAME="Ubuntu 24.04.1 LTS"
root@5a9c0bae8632: /#
```

```
@52ed908dac59:/
$ docker run --rm -it fedora
[root@52ed908dac59 /]# cat /etc/os-release | grep 'PRETTY_NAME'
PRETTY_NAME="Fedora Linux 41 (Container Image)"
[root@52ed908dac59 /]#
```

```
bash ~#3  
$ echo 'Runtime.getRuntime().availableProcessors()' |  
  docker run --rm -i eclipse-temurin:24 jshell -q  
jshell> $1 ==> 8  
$
```

```
bash ~#3  
$ docker run -it --rm eclipse-temurin:24 java -XX:+PrintFlagsFinal |  
  grep "size_t MaxHeapSize"  
size_t MaxHeapSize = 4188012544  
$
```

```
bash ~#2  
$ ls -l microservices/product-service/build/libs  
total 46472  
-rw-r--r-- 1 magnus staff 23791030 Mar 21 09:41 product-service-1.0.0-SNAPSHOT.jar  
$
```

```
bash ~#2  
$ docker images | grep product-service  
product-service latest 1896ce04468b 6 seconds ago 289MB  
$
```



```
bash
$ docker ps
CONTAINER ID   IMAGE                COMMAND                  CREATED
STATUS        PORTS              NAMES
327dc680a0e5   product-service     "java org.springfram..." 35 second
s ago        Up 35 seconds     0.0.0.0:8080->8080/tcp    my-prd-srv
$
```

```
bash
$ docker images | grep chapter04
chapter04-product-composite   latest   2cf0d012a652   10 seconds ago   289MB
chapter04-review              latest   e8b95c4afec7   10 seconds ago   289MB
chapter04-recommendation      latest   3b1a1be6b5e7   10 seconds ago   289MB
chapter04-product             latest   1896ce04468b   14 minutes ago   289MB
$
```

```
bash
$ docker-compose logs -f
...
chapter04-product-1          ... Started ProductServiceApplication in 1.935 seconds
...
chapter04-review-1          ... Started ReviewServiceApplication in 1.883 seconds
...
chapter04-product-composite-1 ... Started ProductCompositeServiceApplication in 1.993 seconds
...
chapter04-recommendation-1   ... Started RecommendationServiceApplication in 1.904 seconds
$
```

```
bash
$ curl localhost:8080/product-composite/123 -s | jq .
{
  "productId": 123,
  ...
  "recommendations": [ ... ],
  "reviews": [ ... ],
  "serviceAddresses": { ... }
}
$
```

```
bash ㄿ#2
"serviceAddresses": {
  "cmp": "2ee20b47521b/172.18.0.5:8080",
  "pro": "e5e4907e1332/172.18.0.3:8080",
  "rev": "bde9f32737bf/172.18.0.2:8080",
  "rec": "93bd0c3e02d8/172.18.0.4:8080"
}
```

```
@52ed908dac59/ ㄿ%3
$ ./test-em-all.bash start stop
Start Tests: Wed MMM DD 17:57:28 CEST YYYY
HOST=localhost
PORT=8080
Restarting the test environment...
$ docker-compose down --remove-orphans
$ docker-compose up -d
[+] Running 5/5
  :: Network chapter04_default                C...      0.0s
  :: Container chapter04-recommendation-1     Started   0.4s
  :: Container chapter04-product-composite-1  Started   0.4s
  :: Container chapter04-review-1             Started   0.6s
  :: Container chapter04-product-1            Started   0.6s
Wait for: curl http://localhost:8080/product-composite/1... ,
  retry #1 DONE, continues...
...Test OK...
We are done, stopping the test environment...
$ docker-compose down
[+] Running 5/5
  :: Container chapter04-review-1             Removed   2.4s
  :: Container chapter04-product-1            Removed   2.2s
  :: Container chapter04-product-composite-1  Removed   2.4s
  :: Container chapter04-recommendation-1     Removed   2.4s
  :: Network chapter04_default                R...      0.1s
End, all tests OK: Wed MMM DD 17:57:37 CEST YYYY
$
```

```
bash ㄿ%2
$ docker-compose ps
NAME                                COMMAND                                SERVICE    STATUS    PORTS
chapter04-product-1                 "java org.springfram..."            product   running   8080/tcp
chapter04-product-composite-1       "java org.springfram..."            product-composite  running   0.0.0.0:8080->8080/tcp
chapter04-recommendation-1          "java org.springfram..."            recommendation  running   8080/tcp
chapter04-review-1                  "java org.springfram..."            review     running   8080/tcp
$
```

```
@52ed908dac59/ ㄸ#3
$ docker-compose logs product
...
chapter06-product-1 | ... INFO 1 --- [{}-mongodb:27017] org.mongodb.driver.cluster
                    | : Exception in monitor thread while connecting to server mongodb:27017
chapter06-product-1 | com.mongodb.MongoSocketException: mongodb: Name or service not known
...
$
```

## 05장: OpenAPI를 활용한 API 문서화

Swagger **v3/api-docs** [Explore](#)

### Sample API 1.0.0 OAS3

[v3/api-docs](#)

ProductComposite REST API for composite product information.

**GET** `/product-composite/{productId}` Returns a composite view of the specified product id

**Parameters** [Cancel](#)

Name	Description
<b>productId</b> * required integer(int32) (path)	productId

**Execute**

**Responses**

Swagger  
Supported by SMARTBEAR

/openapi/v3/api-docs **Explore**

# Sample API 1.0.0 OAS3 **1**

</openapi/v3/api-docs>

Description of the API...

[Terms of service](#)

[NAME OF CONTACT - Website](#)

[Send email to NAME OF CONTACT](#)

[MY LICENSE](#)

[MY WIKI PAGE](#)

**Servers**

[http://localhost:8080 - Generated server url](http://localhost:8080) ▾

**ProductComposite** REST API for composite product information. **2** >

**Schemas** **3** >

localhost

## ProductComposite

REST API for composite product information.

**GET** `/product-composite/{productId}` Returns a composite view of the specified product id **1**

### Normal response **2**

If the requested product id is found the method will return information regarding:

1. Base product information
2. Reviews
3. Recommendations
4. Service Addresses\n(technical information regarding the addresses of the microservices that created the response)

### Expected partial and error responses

In the following cases, only a partial response be created (used to simplify testing of error conditions)

#### Product id 113

200 - Ok, but no recommendations will be returned

#### Product id 213

200 - Ok, but no reviews will be returned

#### Non numerical product id

400 - A **Bad Request** error will be returned

#### Product id 13

404 - A **Not Found** error will be returned

#### Negative product ids

422 - An **Unprocessable Entity** error will be returned

**Parameters** Try it out

Name	Description
<b>productId</b> <small>required</small>	
<code>integer(\$int32)</code> (path)	<input type="text" value="productId"/>

localhost

### Responses

Code	Description	Links
200	OK. Media type <input type="text" value="application/json"/> <small>Controls Accept header.</small> Example Value   Schema	No links

```
{
  "productId": 0,
  "name": "string",
  "weight": 0,
  "recommendations": [
    {
      "recommendationId": 0,
      "author": "string",
      "rate": 0
    }
  ],
  "reviews": [
    {
      "reviewId": 0,
      "author": "string",
      "subject": "string"
    }
  ],
  "serviceAddresses": {
    "cmp": "string",
    "pro": "string",
    "rev": "string",
    "rec": "string"
  }
}
```

localhost

400 No links

Bad Request, invalid format of the request. See response message for more information

Media type

Example Value | Schema

```
{
  "timestamp": "YYYY-MM-DDT10:49:47.238Z",
  "path": "string",
  "message": "string",
  "status": 0,
  "error": "string"
}
```

404 No links

Not found, the specified id does not exist

Media type

Example Value | Schema

```
{
  "timestamp": "YYYY-MM-DDT10:49:47.239Z",
  "path": "string",
  "message": "string",
  "status": 0,
  "error": "string"
}
```

422 No links

Unprocessable entity, input parameters caused the processing to fail. See response message for more information

Media type

Example Value | Schema

```
{
  "timestamp": "YYYY-MM-DDT10:49:47.239Z",
  "path": "string"
```

localhost

### Parameters

Name	Description
<b>productId</b> * required integer(\$int32) (path)	<input type="text" value="123"/>

### Responses

**Curl**  
`curl -X GET "http://localhost:8080/product-composite/123" -H "accept: application/json"`

**Request URL**  
`http://localhost:8080/product-composite/123`

### Server response

Code	Details
200	<p><b>Response body</b></p> <pre>{   "productId": 123,   "name": "name-123",   "weight": 123,   "recommendations": [     {       "recommendationId": 1,       "author": "Author 1",       "rate": 1     }   ] }</pre>

localhost

### Parameters

**Cancel**

Name	Description
<b>productId</b> * required integer(\$int32) (path)	<input type="text" value="-1"/>

**Execute** **Clear**

### Responses

**Curl**

```
curl -X 'GET' \  
  'http://localhost:8080/product-composite/-1' \  
  -H 'accept: application/json'
```

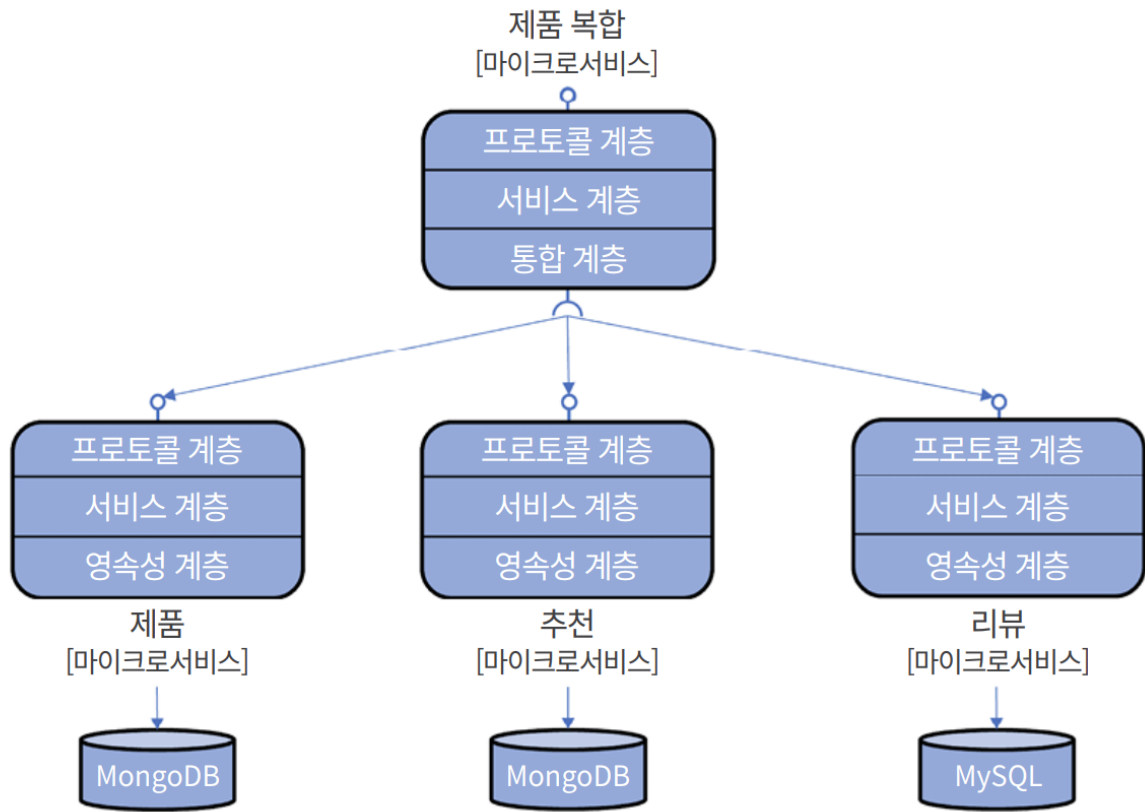
**Request URL**

```
http://localhost:8080/product-composite/-1
```

**Server response**

Code	Details
422	<p>Error: Unprocessable Entity</p> <p><b>Response body</b></p> <pre>{   "timestamp": "YYYY-MM-DDT11:02:57.195240423Z",   "path": "/product-composite/-1",   "message": "Invalid productId: -1",   "status": 422,   "error": "Unprocessable Entity" }</pre> <p><b>Download</b></p>

## 06장: 영속성 추가



마이크로서비스 환경  
[시스템 경계]

```
2. bash
{ "_id" : ..., "productId" : 1, "name" : "product 1", "weight" : 1 }
{ "_id" : ..., "productId" : 113, "name" : "product 113", "weight" : 113 }
{ "_id" : ..., "productId" : 213, "name" : "product 213", "weight" : 213 }
$
```

```
2. bash
+-----+-----+-----+-----+
| id | author | content | product_id | review_id |
+-----+-----+-----+-----+
| 1 | author 1 | content 1 | 1 | 1 |
| 2 | author 2 | content 2 | 1 | 2 |
+-----+-----+-----+-----+
$ █
```

```
2. bash
BUILD SUCCESSFUL
$ █
```

```
2. bash
Connected to MongoDB: localhost:27017
```

The image shows a browser window displaying the REST API documentation for 'ProductComposite'. The browser's address bar shows 'localhost'. The page title is 'ProductComposite REST API for composite product information.' with a dropdown arrow on the right. There are three API endpoints listed:

- POST** `/product-composite` Creates a composite product
- GET** `/product-composite/{productId}` Returns a composite view of the specified product id
- DELETE** `/product-composite/{productId}` Deletes a product composite

The **DELETE** endpoint section is expanded to show a 'Normal response' section. The text in this section reads: 'Entities for product information, recommendations and reviews related to the specified productId will be deleted. The implementation of the delete method is idempotent, i.e. it can be called several times with the same response. This means that a delete request of a non existing product will return **200 Ok**.' At the bottom left of this section is the label 'Parameters' and at the bottom right is a button labeled 'Try it out'.

**ProductComposite** REST API for composite product information.

**1** **POST** /product-composite Creates a composite product

Request body required application/json

```
{
  "productId": 123456,
  "name": "string",
  "weight": 0,
  "recommendations": [
    {
      "recommendationId": 0,
      "author": "string",
      "rate": 0,
      "content": "string"
    }
  ],
  "reviews": [
    {
      "reviewId": 0,
      "author": "string",
      "subject": "string",
      "content": "string"
    }
  ],
  "serviceAddresses": {
```

**4** **Execute** Clear

Server response

**5** **Code** Details

200

Response headers

content-length: 0

```
2. bash
product-composite_1 | ... createCompositeProduct: creates a new composite entity for productId: 123456
product_1 | ... createProduct: entity created for productId: 123456
recommendation_1 | ... createRecommendation: created a recommendation entity: 123456/0
review_1 | ... createReview: created a review entity: 123456/0
```

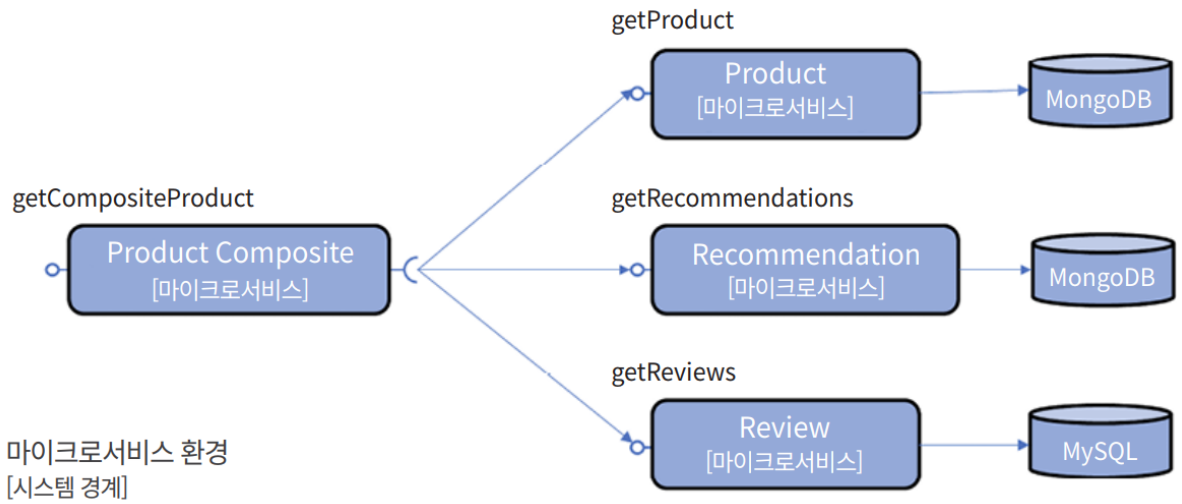
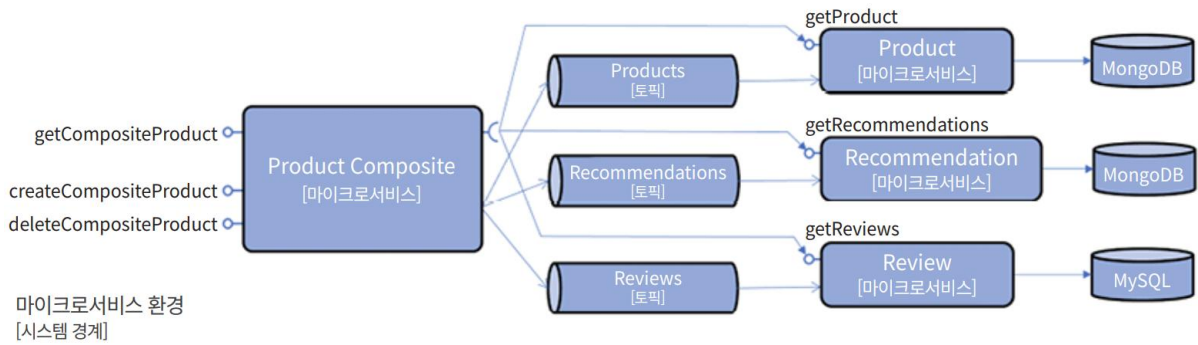
```
bash
$ docker-compose exec mongodb mongosh product-db --quiet --eval "db.products.find()"
[
  {
    _id: ObjectId("6419b18e62925d253399fe46"),
    version: 0,
    productId: 123456,
    name: 'string',
    weight: 0,
    _class: 'se.magnus.microservices.core.product.persistence.ProductEntity'
  }
]
$
```

```
bash
$ docker-compose exec mongodb mongosh recommendation-db --quiet --eval "db.recommendations.find()"
[
  {
    _id: ObjectId("6419b18ef5533a465e39565a"),
    version: 0,
    productId: 123456,
    recommendationId: 0,
    author: 'string',
    rating: 0,
    content: 'string',
    _class: 'se.magnus.microservices.core.recommendation.persistence.RecommendationEntity'
  }
]
$
```

```
2. bash
+-----+-----+-----+-----+-----+-----+-----+
| id | author | content | product_id | review_id | subject | version |
+-----+-----+-----+-----+-----+-----+-----+
| 1 | string | string | 123456 | 0 | string | 0 |
+-----+-----+-----+-----+-----+-----+-----+
$
```

```
@52ed908dac59:/
End, all tests OK: Wed MMM DD 17:57:37 CEST YYYY
$
```

## 07장: 반응형 마이크로서비스 개발



```

bash
17:01:09.603 [Test worker] INFO reactor.Flux.MapFuseable.1 - | onSubscribe([Fuseable]
FluxMapFuseable.MapFuseableSubscriber)
17:01:09.604 [Test worker] INFO reactor.Flux.MapFuseable.1 - | request(unbounded)
17:01:09.604 [Test worker] INFO reactor.Flux.MapFuseable.1 - | onNext(4)
17:01:09.604 [Test worker] INFO reactor.Flux.MapFuseable.1 - | onNext(8)
17:01:09.605 [Test worker] INFO reactor.Flux.MapFuseable.1 - | onComplete()
    
```

```

@52ed908dac59:/
YYYY-MM-DD 17:08:47.006 INFO 62314 --- [ctor-http-nio-2] reactor.Mono.SwitchIfEmpty.1 : onSubscribe(FluxSwitchIf
Empty.SwitchIfEmptySubscriber)
YYYY-MM-DD 17:08:47.007 INFO 62314 --- [ctor-http-nio-2] reactor.Mono.SwitchIfEmpty.1 : request(unbounded)
YYYY-MM-DD 17:08:47.034 INFO 62314 --- [ntLoopGroup-2-2] reactor.Mono.SwitchIfEmpty.1 : onNext(ProductEntity: 1)
YYYY-MM-DD 17:08:47.048 INFO 62314 --- [ntLoopGroup-2-2] reactor.Mono.SwitchIfEmpty.1 : onComplete()
    
```

```

@52ed908dac59:/
YYYY-MM-DD 17:09:52.643 INFO 62314 --- [ctor-http-nio-3] reactor.Mono.SwitchIfEmpty.2 : onSubscribe(FluxSwitchIfEmpty,SwitchIfEmptySubscriber)
YYYY-MM-DD 17:09:52.643 INFO 62314 --- [ctor-http-nio-3] reactor.Mono.SwitchIfEmpty.2 : request(unbounded)
YYYY-MM-DD 17:09:52.648 ERROR 62314 --- [ntLoopGroup-2-2] reactor.Mono.SwitchIfEmpty.2 : onError(se.magnus.util.exceptions.NotFoundException: No product found for productId: 2)
YYYY-MM-DD 17:09:52.654 ERROR 62314 --- [ntLoopGroup-2-2] reactor.Mono.SwitchIfEmpty.2 :
se.magnus.util.exceptions.NotFoundException: No product found for productId: 2
    at se.magnus.microservices.core.product.services.ProductServiceImpl.getProduct(ProductServiceImpl.java:58) ~[classes/:na]
    ...

```

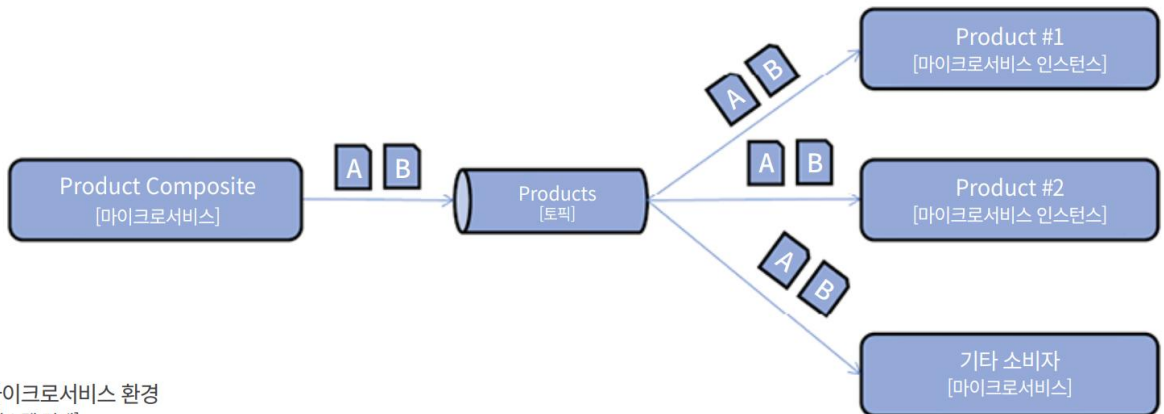
```

@52ed908dac59:/
YYYY-MM-DD 17:10:13.376 INFO --- [ctor-http-nio-4] s.m.m.c.r.services.ReviewServiceImpl: Will get reviews for product with id=1
YYYY-MM-DD 17:10:13.423 DEBUG --- [ jdbc-pool-1] org.hibernate.SQL :
select ... from reviews reviewenti0_ where reviewenti0_.product_id=?

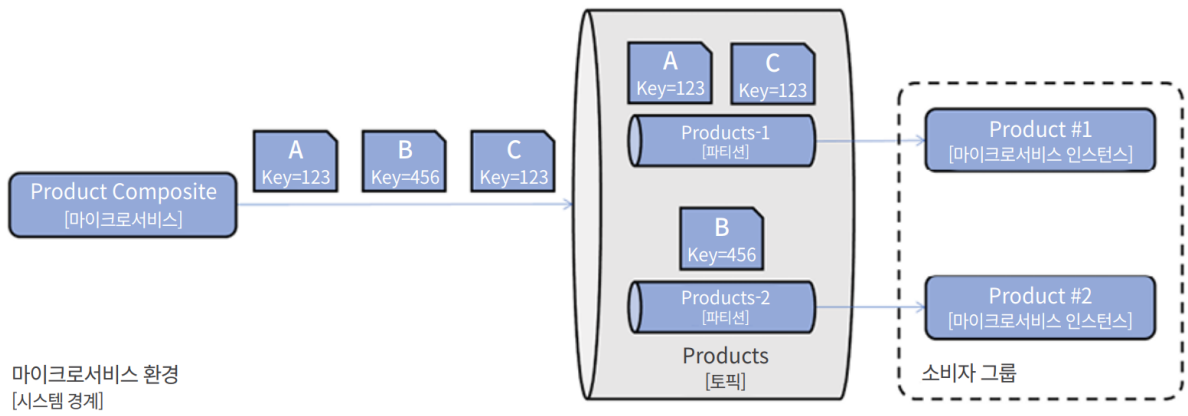
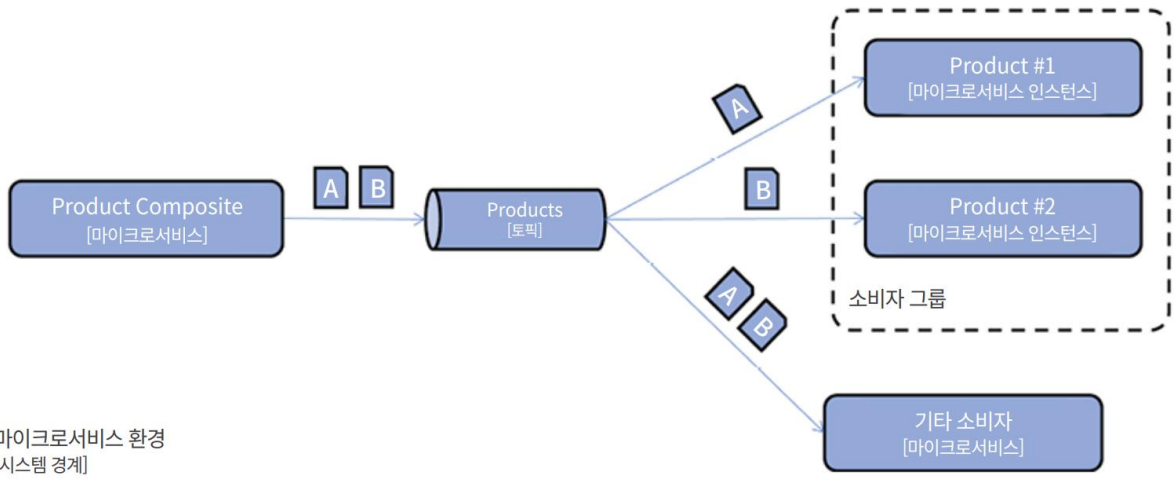
```



마이크로서비스 환경  
[시스템 경계]



마이크로서비스 환경  
[시스템 경계]



```
bash 2
{
  "status": "UP",
  "components": {
    "coreServices": {
      "status": "UP",
      "components": {
        "product": {
          "status": "UP"
        },
        "recommendation": {
          "status": "UP"
        },
        "review": {
          "status": "UP"
        }
      }
    },
    ...
  }
}
```

localhost

Refreshed 2025-04-12 20:59:05 Refresh every 5 seconds

RabbitMQ 4.0.7 Erlang 27.3.1

Virtual host All

Cluster **rabbit@bcd73b4d7a25**

User **guest** Log out

Overview Connections Channels Exchanges **Queues and Streams** Admin

## Queues

▼ All queues (9)

Page 1 of 1 - Filter:   Regex ?

Displaying 9 items, page size up to: 100

Overview				Messages			Message rates			
Virtual host	Name	Type	Features	State	Ready	Unacked	Total	incoming	deliver / get	ack
/	products.auditGroup	classic	D Args	running	1	0	1	0.00/s		
/	products.productsGroup	classic	D DLX DLK Args	running	0	0	0	0.00/s	0.00/s	0.00/s
/	products.productsGroup.dlq	classic	D Args	running	0	0	0			
/	recommendations.auditGroup	classic	D Args	running	3	0	3	0.00/s		
/	recommendations.recommendationsGroup	classic	D DLX DLK Args	running	0	0	0	0.00/s	0.00/s	0.00/s
/	recommendations.recommendationsGroup.dlq	classic	D Args	running	0	0	0			
/	reviews.auditGroup	classic	D Args	running	3	0	3	0.00/s		
/	reviews.reviewsGroup	classic	D DLX DLK Args	running	0	0	0	0.00/s	0.00/s	0.00/s
/	reviews.reviewsGroup.dlq	classic	D Args	running	0	0	0			

▶ Add a new queue

HTTP API Documentation Tutorials New releases Commercial edition Commercial support Discussions Discord Plugins GitHub

localhost

Refreshed 2025-04-13 16:32:43 Refresh every 5 seconds

RabbitMQ 4.0.7 Erlang 27.3.1

Virtual host All

Cluster **rabbit@bcd73b4d7a25**

User **guest** Log out

Overview Connections Channels Exchanges **Queues and Streams** Admin

## Get messages

Warning: getting messages from a queue is a destructive action. ?

Ack Mode: Nack message requeue true

Encoding: Auto string / base64 ?

Messages:

Get Message(s)

Message 1

The server reported 0 messages remaining.

Exchange	products
Routing Key	products
Redelivered	0
Properties	timestamp: 1744484008 message_id: b187b046-2850-7222-e70a-645a7e6e68d1 priority: 0 delivery_mode: 2 headers: <ul style="list-style-type: none"> <li>partitionKey: 1</li> <li>target-protocol: amqp</li> </ul> content_type: application/json
Payload	161 bytes Encoding: string <pre>{ "eventType": "CREATE", "key": 1, "data": { "productId": 1, "name": "product name C", "weight": 300, "serviceAddress": null }, "eventCreatedAt": "</pre>

RabbitMQ 4.0.7 Erlang 27.3.1

Refreshed 2025-04-13 16:44:31

Virtual host: All

Cluster: rabbit@0981164ccad8

User: guest Log out

Overview Connections Channels Exchanges **Queues and Streams** Admin

### Queues

All queues (15)

Pagination: Page 1 of 1 - Filter:   Regexp ?

Displaying 15 items, page size up to: 100

Overview					Messages			Message rates			
Virtual host	Name	Type	Features	State	Ready	Unacked	Total	incoming	deliver / get	ack	+/-
/	products.auditGroup-0	classic	D Args	running	1	0	1	0.00/s			
/	products.auditGroup-1	classic	D Args	running	1	0	1	0.00/s			
/	products.productsGroup-0	classic	D DLX DLK Args	running	0	0	0	0.00/s	0.00/s	0.00/s	
/	products.productsGroup-1	classic	D DLX DLK Args	running	0	0	0	0.00/s	0.00/s	0.00/s	
/	products.productsGroup.dlq	classic	D Args	running	0	0	0				
/	recommendations.auditGroup-0	classic	D Args	running	3	0	3	0.00/s			
/	recommendations.auditGroup-1	classic	D Args	running	3	0	3	0.00/s			
/	recommendations.recommendationsGroup-0	classic	D DLX DLK Args	running	0	0	0	0.00/s	0.00/s	0.00/s	
/	recommendations.recommendationsGroup-1	classic	D DLX DLK Args	running	0	0	0	0.00/s	0.00/s	0.00/s	
/	recommendations.recommendationsGroup.dlq	classic	D Args	running	0	0	0				
/	reviews.auditGroup-0	classic	D Args	running	3	0	3	0.00/s			
/	reviews.auditGroup-1	classic	D Args	running	3	0	3	0.00/s			
/	reviews.reviewsGroup-0	classic	D DLX DLK Args	running	0	0	0	0.00/s	0.00/s	0.00/s	
/	reviews.reviewsGroup-1	classic	D DLX DLK Args	running	0	0	0	0.00/s	0.00/s	0.00/s	
/	reviews.reviewsGroup.dlq	classic	D Args	running	0	0	0				

▶ Add a new queue

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```

bash
error.products.productsGroup
error.recommendations.recommendationsGroup
error.reviews.reviewsGroup
products
recommendations
reviews
$

```

```
bash ㉿ 2
Topic: products TopicId: awodZFheRTmPAQwHC0FOBQ PartitionCount: 2
ReplicationFactor: 1 Configs:
  Topic: products Partition: 0 Leader: 1 Replicas: 1 Isr: 1
  Topic: products Partition: 1 Leader: 1 Replicas: 1 Isr: 1
$
```

```
bash ㉿ 2
{"eventType":"CREATE","key":1,"data":{"productId":1,"name":"product name C","weight":300,
"serviceAddress":null},"eventCreatedAt":"2023-03-21T18:58:12.71942305Z"}
[2023-03-21 18:59:28,573] ERROR Error processing message, terminating consumer process:
(kafka.tools.ConsoleConsumer$)
org.apache.kafka.common.errors.TimeoutException
Processed a total of 1 messages
$
```

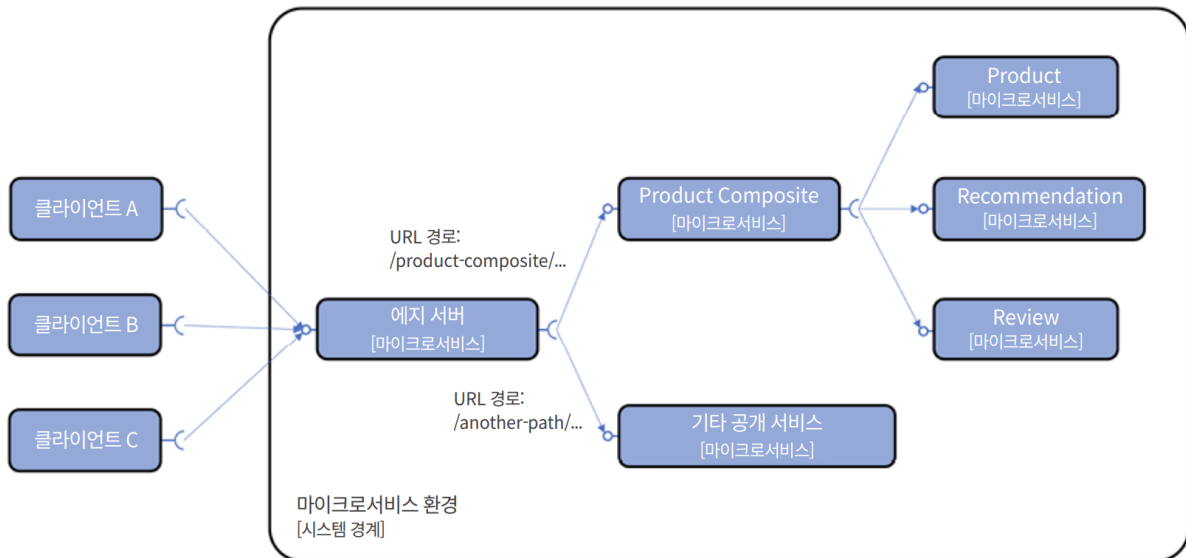
## 08장: 스프링 클라우드 소개

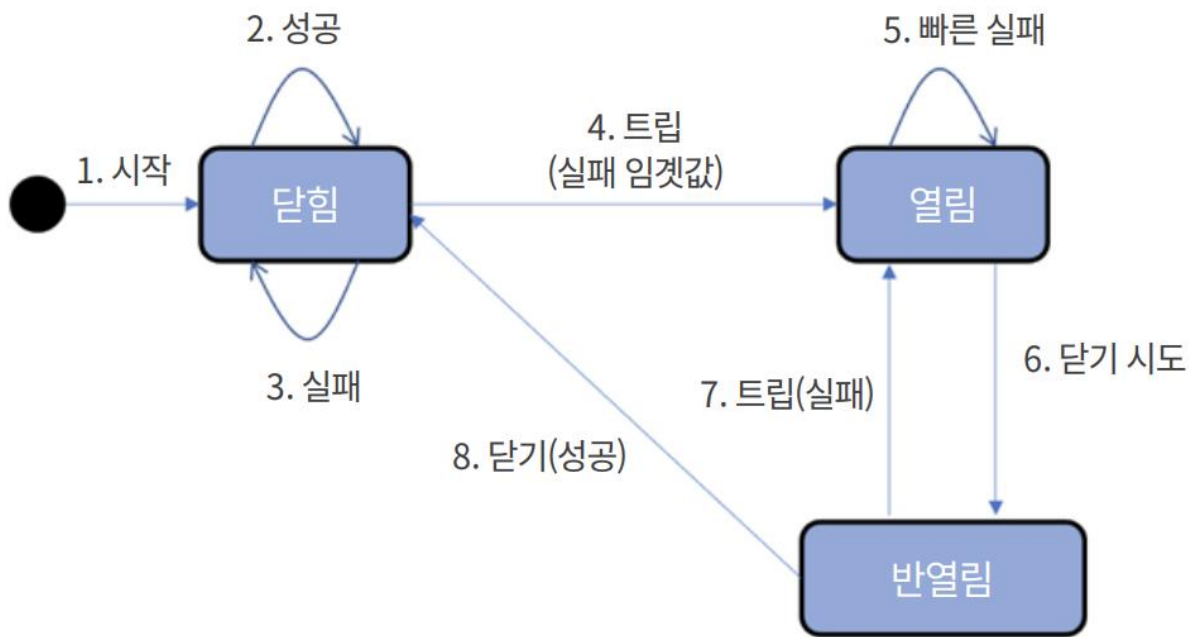
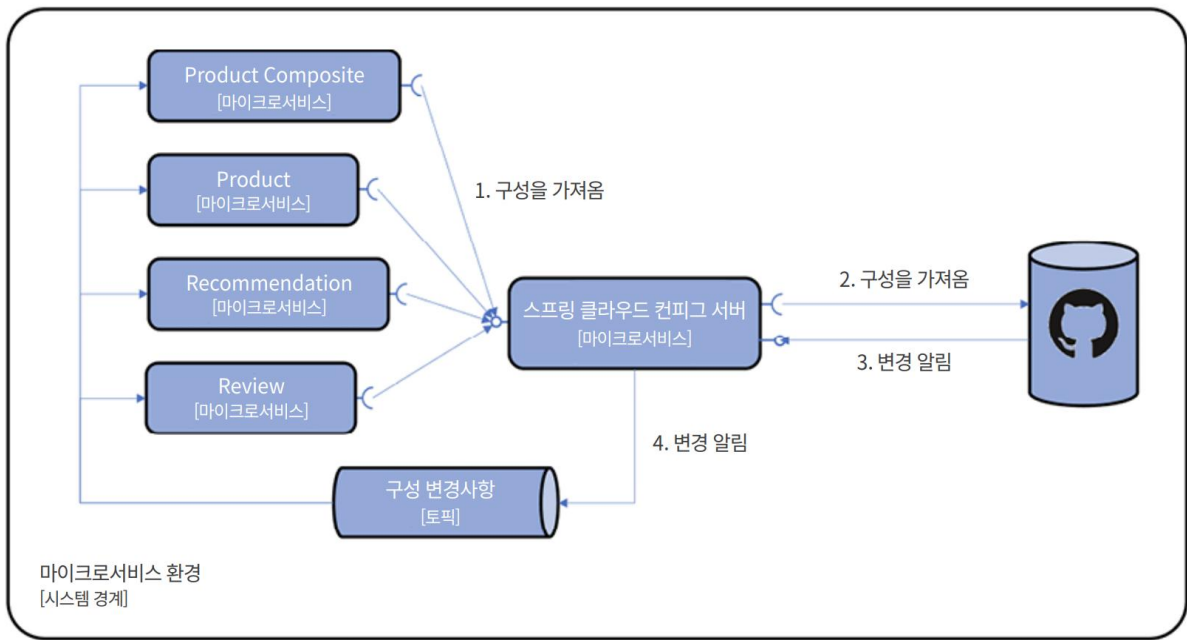
The screenshot shows the Spring Eureka web interface. At the top, there's a navigation bar with the Spring Eureka logo and links for 'HOME' and 'LAST 1000 SINCE STARTUP'. Below this is the 'System Status' section, which contains two columns of key-value pairs:

Environment	test	Current time	2025-04-13T15:44:03 +0000
Data center	default	Uptime	00:02
		Lease expiration enabled	true
		Renews threshold	11
		Renews (last min)	48

Below the system status is the 'DS Replicas' section, followed by 'Instances currently registered with Eureka'. This section contains a table with the following data:

Application	AMIs	Availability Zones	Status
PRODUCT	n/a (1) (1)		UP (1) - <a href="#">2c486a2c6649:product:8080</a>
PRODUCT-COMPOSITE	n/a (1) (1)		UP (1) - <a href="#">9c4dd9c9c076:product-composite:8080</a>
RECOMMENDATION	n/a (1) (1)		UP (1) - <a href="#">84171c38d0e3:recommendation:8080</a>
REVIEW	n/a (3) (3)		UP (3) - <a href="#">dd19b99b5607:review:8080</a> , <a href="#">0e147ab738df:review:8080</a> , <a href="#">6cc8a1cf1f46:review:8080</a>





```
bash
{
  "status": "UP",
  "details": {
    "product": {
      "status": "UP",
      "details": {
        "failureRate": "-1.0%",
        "failureRateThreshold": "50.0%",
        "slowCallRate": "-1.0%",
        "slowCallRateThreshold": "100.0%",
        "bufferedCalls": 0,
        "slowCalls": 0,
        "slowFailedCalls": 0,
        "failedCalls": 0,
        "notPermittedCalls": 0,
        "state": "CLOSED"
      }
    }
  }
}
```

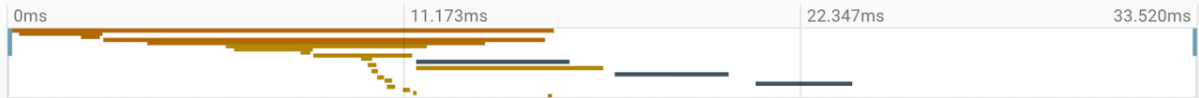
```
bash
{
  "status": "UNKNOWN",
  "details": {
    "product": {
      "status": "CIRCUIT_OPEN",
      "details": {
        "failureRate": "60.0%",
        "failureRateThreshold": "50.0%",
        "slowCallRate": "0.0%",
        "slowCallRateThreshold": "100.0%",
        "bufferedCalls": 5,
        "slowCalls": 0,
        "slowFailedCalls": 0,
        "failedCalls": 3,
        "notPermittedCalls": 3,
        "state": "OPEN"
      }
    }
  }
}
```



### gateway: http post

SPAN TABLE

Duration 33.520ms | Services 5 | Total Spans 31 | Trace ID 06c0eef80b15e4838543f20cedfde8a7



Focus on selected span | Reset focus

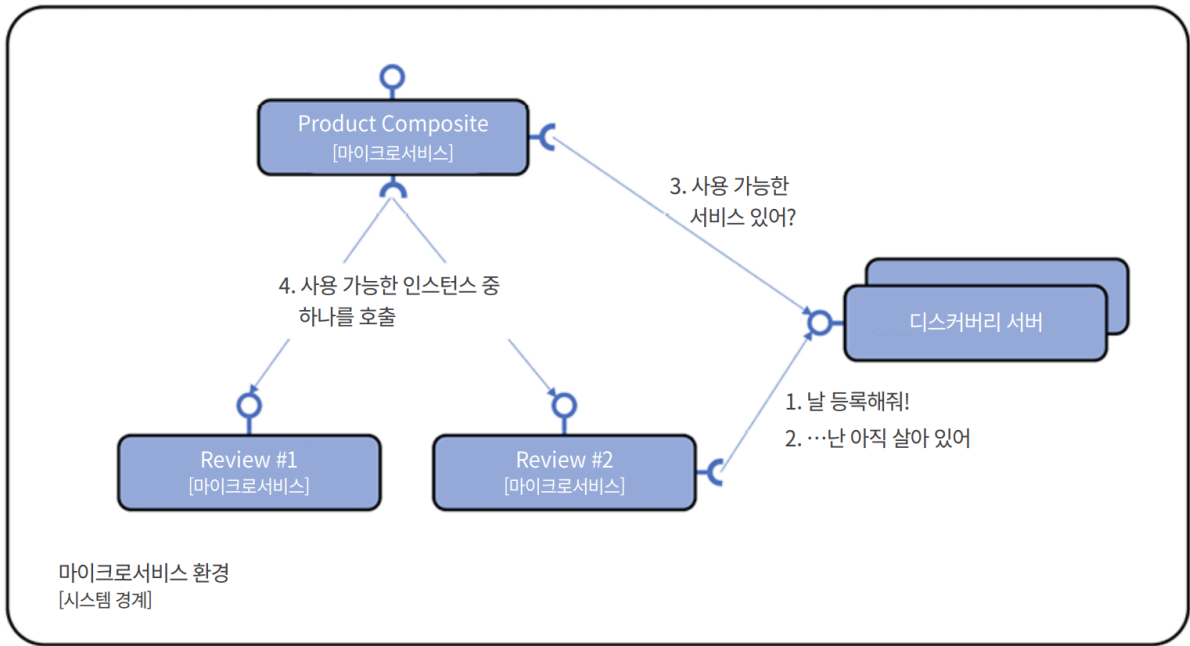
Span ID	Span Name	Duration
30 -	gateway: http post	15.392ms
	gateway: security filterchain before	2.352ms
	gateway: authorize -security-context-server-web-exchange	533µs
	gateway: secured request	12.452ms
25 -	gateway: http post	9.519ms
24 -	product-composite: http post /product-composite	5.665ms
	product-composite: security filterchain before	2.220ms
	product-composite: authorize -security-context-server-web-exchange	276µs
	product-composite: secured request	2.782ms
	product-composite: recommendations/recommendations send	310µs
	recommendation: recommendations.recommendationsgroup receive	4.321ms
	product-composite: products/products send	246µs
	product: products.productsgroup receive	5.274ms
	product-composite: recommendations/recommendations send	184µs
	recommendation: recommendations.recommendationsgroup receive	3.210ms
	product-composite: reviews/reviews send	194µs
	product-composite: recommendations/recommendations send	212µs
	recommendation: recommendations.recommendationsgroup receive	2.722ms
	product-composite: reviews/reviews send	231µs
	product-composite: reviews/reviews send	202µs
	product-composite: security filterchain after	97µs
	gateway: security filterchain after	116µs

## 09장: 넷플릭스 유레카를 활용한 서비스 디스커버리

```
bash ㄹ⌘3
192.168.96.9      review
192.168.96.8      review
```

```
bash ㄹ⌘3
192.168.96.8      70eb82fc7e61
$ █
```

```
bash ㄹ⌘3
70eb82fc7e61/192.168.96.8:8080
$ █
```



```

$ ./test-em-all.bash start
Start Tests: Wed MMM DD 11:45:59 CEST YYYY
...
:: Container chapter09-eureka-1           Started
...
Wait for: curl http://localhost:8080/actuator/health... DONE, continues...
Test OK ...
End, all tests OK: Wed MMM DD 11:46:22 CEST YYYY
$

```

spring Eureka HOME LAST 1000 SINCE STARTUP

### System Status

Environment	test	Current time	2025-04-13T15:44:03 +0000
Data center	default	Uptime	00:02
		Lease expiration enabled	true
		Renews threshold	11
		Renews (last min)	48

### DS Replicas

#### Instances currently registered with Eureka

Application	AMIs	Availability Zones	Status
PRODUCT	n/a (1) (1)		UP (1) - <a href="#">2c486a2c6649:product:8080</a>
PRODUCT-COMPOSITE	n/a (1) (1)		UP (1) - <a href="#">9c4dd9c9c076:product-composite:8080</a>
RECOMMENDATION	n/a (1) (1)		UP (1) - <a href="#">84171c38d0e3:recommendation:8080</a>
REVIEW	n/a (3) (3)		UP (3) - <a href="#">dd19b99b5607:review:8080</a> , <a href="#">0e147ab738df:review:8080</a> , <a href="#">6cc8a1cf1f46:review:8080</a>

```
chapter09-review-2 ... Started ReviewServiceApplication in 5.254 seconds
chapter09-review-3 ... Started ReviewServiceApplication in 5.202 seconds
```

```
c983c84cd214:product-composite:8080
3e2583567ff7:product:8080
d2583dfd2c6d:review:8080
2f19e5a1695b:review:8080
283ab4318911:review:8080
ce425f147212:recommendation:8080
$
```

```
bash ~%3  
d2583dfd2c6d/192.168.112.10:8080  
2f19e5a1695b/192.168.112.9:8080  
283ab4318911/192.168.112.11:8080
```

```
bash ~%3  
chapter09-review-2 ... DEBUG ... Response size: 3  
chapter09-review-3 ... DEBUG ... Response size: 3  
chapter09-review-1 ... DEBUG ... Response size: 3
```

```
bash ~%3  
curl: (28) Operation timed out after 2005 milliseconds with 0 bytes received  
$
```

```
bash ~%3  
"rev": "3d71f0dade20/192.168.112.9:8080"  
"rev": "81308b0a3bcb/192.168.112.10:8080"
```

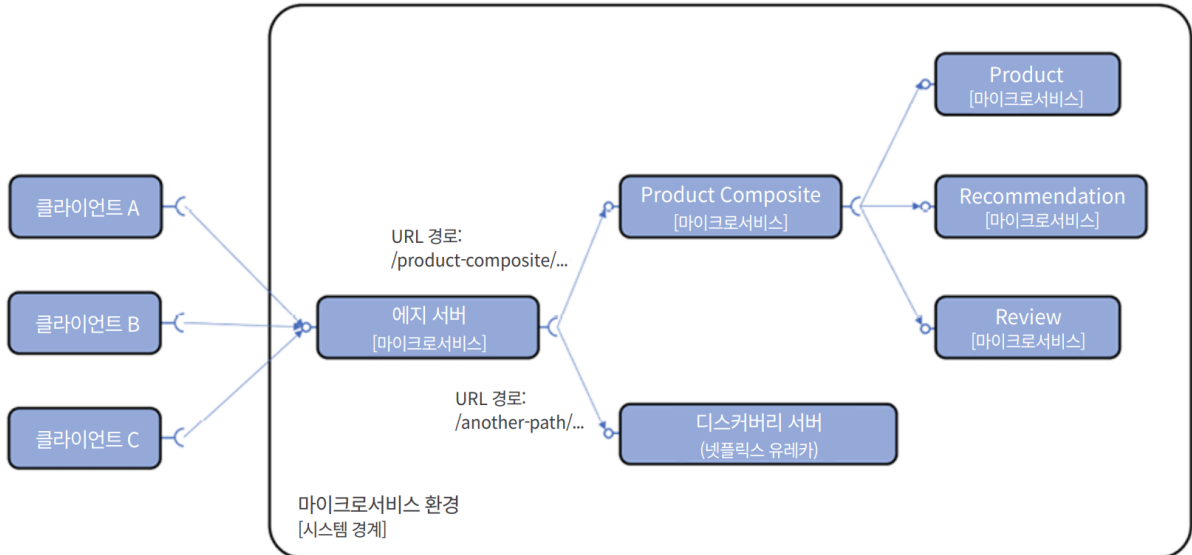
```
bash ~%3  
3d71f0dade20/192.168.112.9:8080  
81308b0a3bcb/192.168.112.10:8080
```

```
bash ~%3  
"pro": "0f5cf99dfcd/192.168.128.4:8080"
```

```
bash ⌘3  
"pro": "0f5cf99dffcd/192.168.128.4:8080",  
"rev": "ac38f5642c2b/192.168.128.8:8080",
```

```
bash ⌘3  
"pro": "d9f3e6f3fe95/192.168.128.10:8080",  
"rev": "ac38f5642c2b/192.168.128.8:8080",
```

# 10장: 스프링 클라우드 게이트웨이를 활용해 에지 서버 뒤에 마이크로서비스 숨기기



```

$ ./test-em-all.bash start
Start Tests: Wed MMM DD 15:42:42 CEST YYYY
...
:: Container chapter10-gateway-1           Started
...
Wait for: curl http://localhost:8080/actuator/health... DONE, continues...
...
Test OK (actual value: http://localhost:8080)
Test OK (HTTP Code: 200)
End, all tests OK: Wed MMM DD 15:43:10 CEST YYYY
$
    
```

```

bash
NAME                SERVICE      STATUS      PORTS
chapter10-eureka-1  eureka      running     8761/tcp
chapter10-gateway-1 gateway      running     0.0.0.0:8080->8080/tcp
chapter10-product-1 product      running     8080/tcp
chapter10-product-composite-1 product-composite running     8080/tcp
chapter10-recommendation-1 recommendation running     8080/tcp
chapter10-review-1  review      running     8080/tcp
$
    
```

```
bash
"product-composite": "lb://product-composite"
"product-composite-swagger-ui": "lb://product-composite"
"eureka-api": "http://eureka:8761"
"eureka-web-start": "http://eureka:8761"
"eureka-web-other": "http://eureka:8761"
"host_route_200": "http://httpstat.us:80"
"host_route_418": "http://httpstat.us:80"
"host_route_501": "http://httpstat.us:80"
```

```
bash
{"productId":1, ... "recommendations":[...],"reviews":[...],"serviceAddresses":{"...}}
$
```

```
bash
Pattern "/product-composite/**" matches against value "/product-composite/1"
Route matched: product-composite
...
LoadBalancerClientFilter url chosen: http://2911a48d86ec:8080/product-composite/1
```

Swagger UI

localhost:8080/openapi/webjars/swagger-ui/index.html

Swagger  
Supported by SMARTBEAR

/openapi/v3/api-docs Explore

# Sample API 1.0.0 OAS3

/openapi/v3/api-docs

Description of the API...

[Terms of service](#)  
[NAME OF CONTACT - Website](#)  
[Send email to NAME OF CONTACT](#)  
[MY LICENSE](#)  
[MY WIKI PAGE](#)

Servers

http://localhost:8080 - Generated server url

## ProductComposite

REST API for composite product information.

- POST** /product-composite Creates a composite product
- GET** /product-composite/{productId} Returns a composite view of the specified product id
- DELETE** /product-composite/{productId} Deletes a product composite

```
bash
```

```
d94d651b2d0b:gateway:8080
2911a48d86ec:product-composite:8080
9e0000bdd56e:product:8080
8a0eef3e8fbd:review:8080
84a68e56553b:recommendation:8080
$
```

localhost

spring Eureka HOME LAST 1000 SINCE STARTUP

### System Status

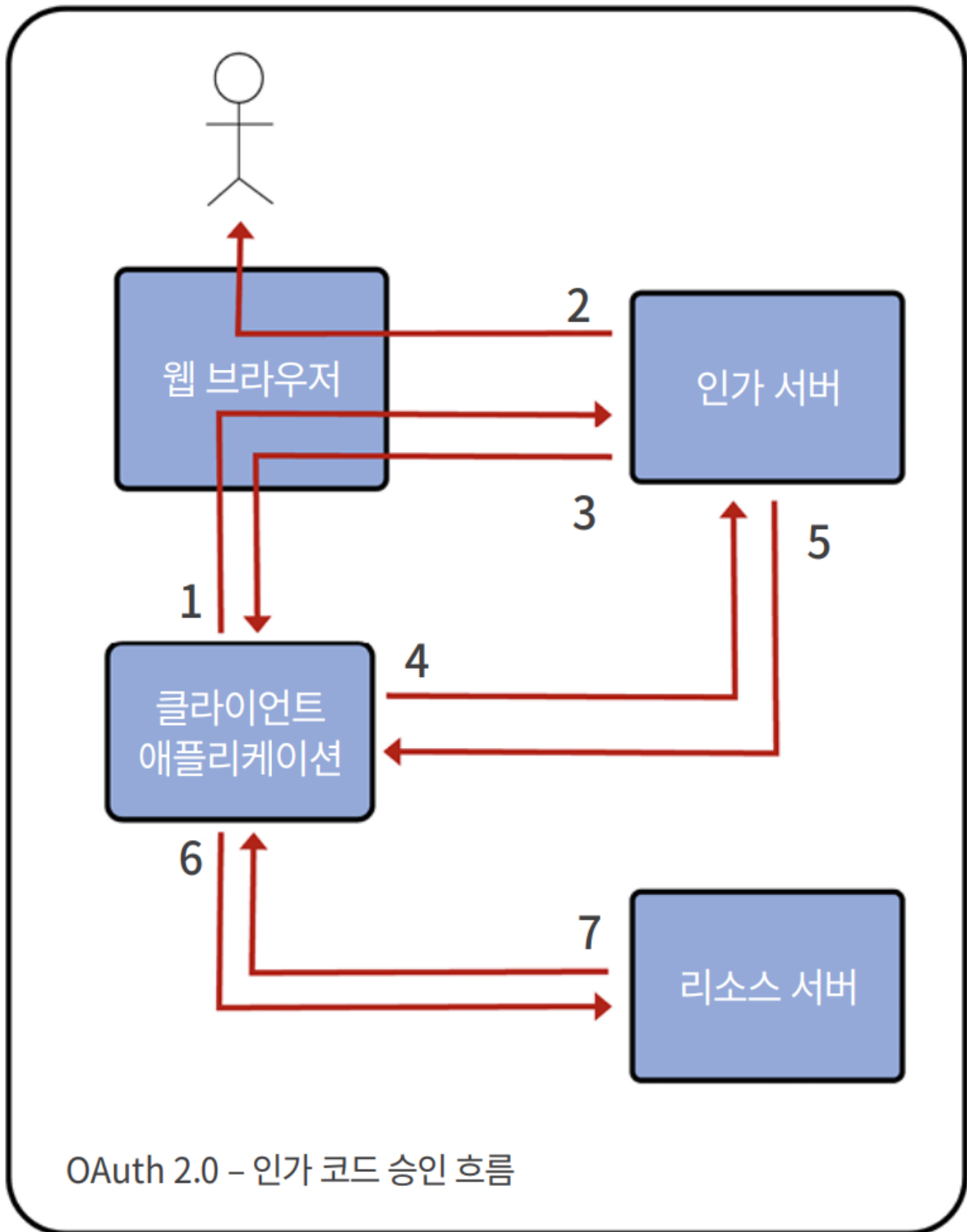
Environment	test	Current time	2025-04-16T05:45:41 +0000
Data center	default	Uptime	00:15
		Lease expiration enabled	true
		Renews threshold	10
		Renews (last min)	60

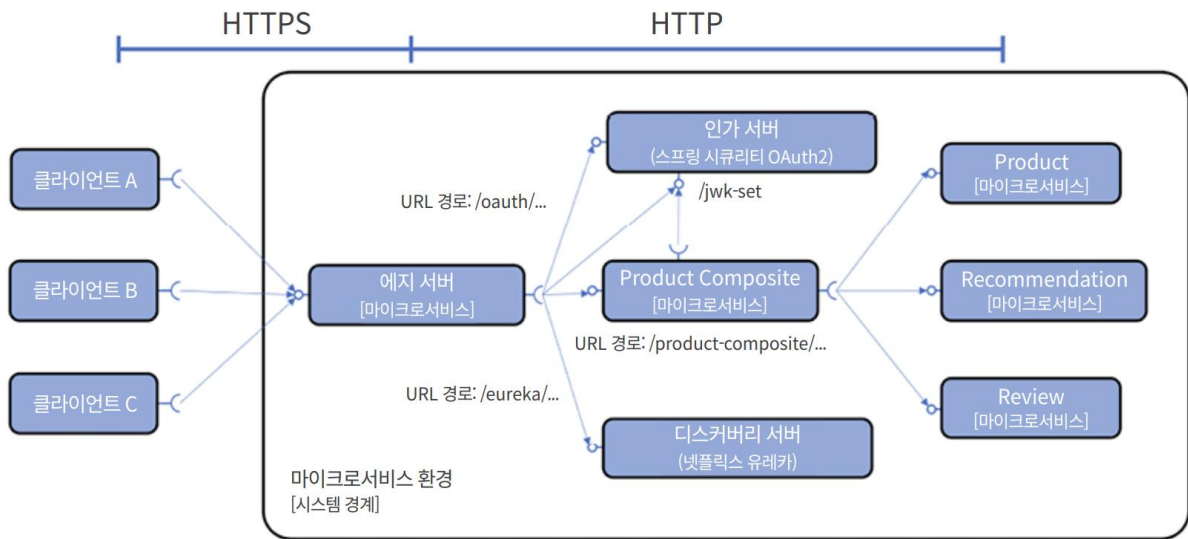
### DS Replicas

#### Instances currently registered with Eureka

Application	AMIs	Availability Zones	Status
GATEWAY	n/a (1)	(1)	UP (1) - <a href="#">f504f66325b1:gateway:8080</a>
PRODUCT	n/a (1)	(1)	UP (1) - <a href="#">9d15e00916f7:product:8080</a>
PRODUCT-COMPOSITE	n/a (1)	(1)	UP (1) - <a href="#">a550f6de3168:product-composite:8080</a>
RECOMMENDATION	n/a (1)	(1)	UP (1) - <a href="#">380fa71db1cc:recommendation:8080</a>
REVIEW	n/a (1)	(1)	UP (1) - <a href="#">dfffaf04e30c:review:8080</a>

11장: API에 대한 접근 보안

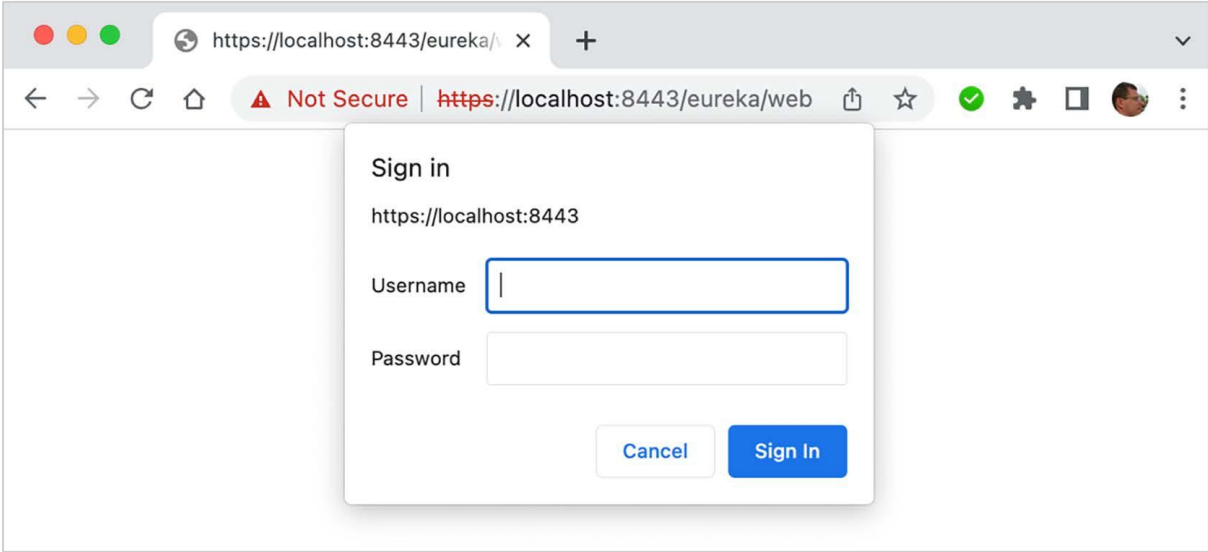




```

bash
b4b0637cf8c6:gateway:8443
55a237832856:auth-server:9999
90a30474d7cb:product-composite:8080
697f17159678:product:8080
6d49c12522bb:review:8080
251a152c737c:recommendation:8080
$

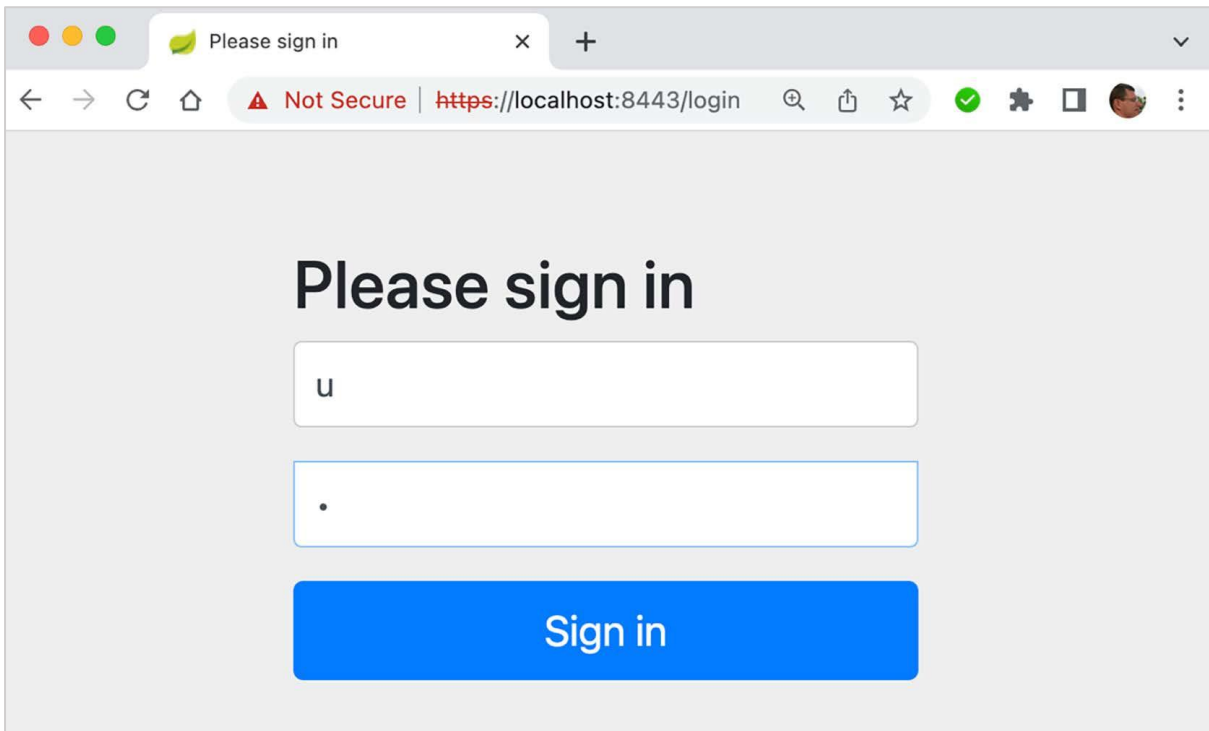
```



A screenshot of the Eureka web interface. The page title is 'Instances currently registered with Eureka'. Below the title is a table with the following columns: Application, AMIs, Availability Zones, and Status. The table lists several applications and their registration details.

Application	AMIs	Availability Zones	Status
AUTH-SERVER	n/a (1)	(1)	UP (1) - <a href="#">781f8298fd2f:auth-server:9999</a>
GATEWAY	n/a (1)	(1)	UP (1) - <a href="#">dbf6372880b2:gateway:8443</a>
PRODUCT	n/a (1)	(1)	UP (1) - <a href="#">9f1deef92da2:product:8080</a>
PRODUCT-COMPOSITE	n/a (1)	(1)	UP (1) - <a href="#">fc578652b403:product-composite:8080</a>
RECOMMENDATION	n/a (1)	(1)	UP (1) - <a href="#">00bcc1a9954e:recommendation:8080</a>
REVIEW	n/a (1)	(1)	UP (1) - <a href="#">552632decc14:review:8080</a>

```
bash
{
  "access_token": "eyJr...jtDA",
  "scope": "product:write product:read",
  "token_type": "Bearer",
  "expires_in": 3599
}
$
```



Consent required

Not Secure | <https://localhost:8443/out...>

# Consent required

**reader** wants to access your account **u**

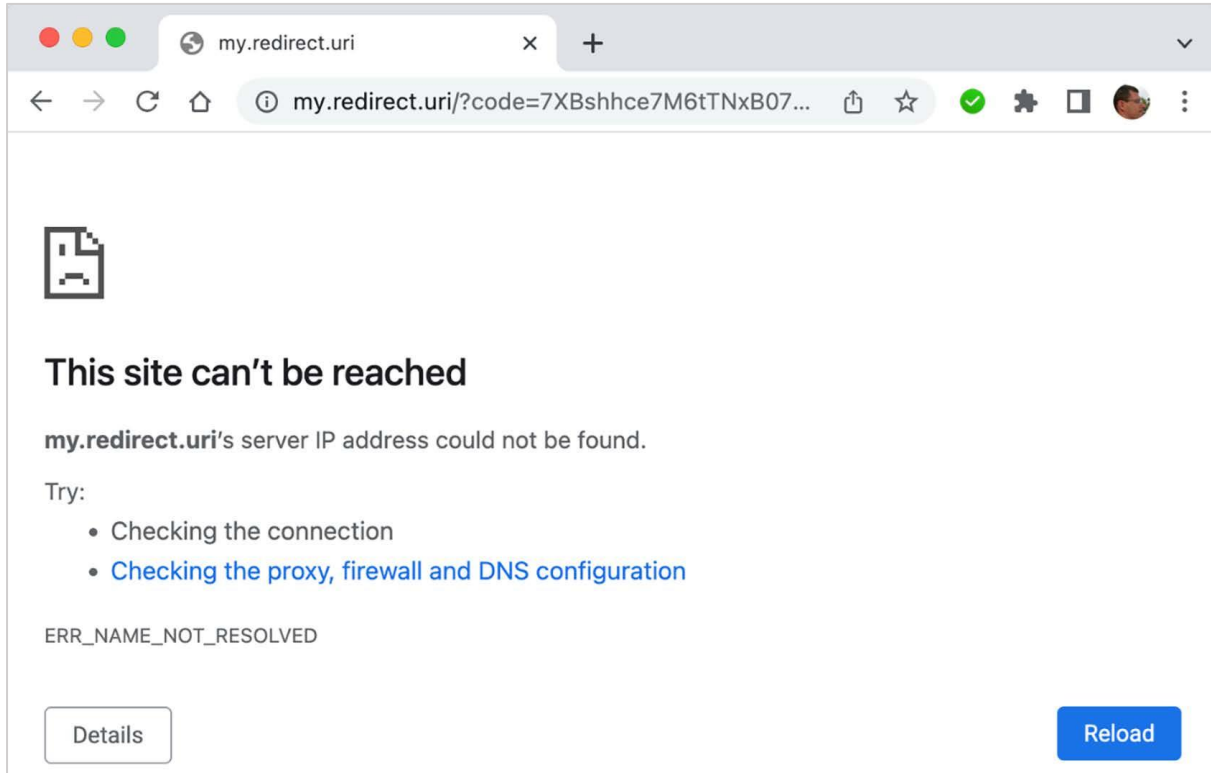
The following permissions are requested by the above app.  
Please review these and consent if you approve.

product:read

[Submit Consent](#)

[Cancel](#)

Your consent to provide access is required.  
If you do not approve, click Cancel, in which case no information will be shared with the app.



```
bash
HTTP/1.1 401 Unauthorized
WWW-Authenticate: Bearer error="invalid_token",
```

```
bash
HTTP/1.1 200 OK
...
{"productId":1, ...}
$
```

```
bash
HTTP/1.1 403 Forbidden
WWW-Authenticate: Bearer error="insufficient_scope", error_description="The request requires higher privileges than provided by the access token.", error_uri="https://tools.ietf.org/html/rfc6750#section-3.1"
$
```

```
bash
chapter11-product-composite-1 | ... Authorization info: Subject: u,
scopes: [product:write, product:read], expires 2023-04-07T05:27:38Z:
issuer: http://auth-server:9999, audience: [writer]
$
```

Swagger UI

Not Secure | https://localhost:8443/openapi/webjars/swagger-ui/index.html

### Available authorizations

Scopes are used to grant an application different levels of access to data on behalf of the end user. Each API may declare one or more scopes.  
API requires the following scopes. Select which ones you want to grant to Swagger UI.

#### security\_auth (OAuth2, authorizationCode)

Authorization URL: https://localhost:8443/oauth2/authorize  
Token URL: https://localhost:8443/oauth2/token  
Flow: authorizationCode

**client\_id:**

**client\_secret:**

**Scopes:** [select all](#) [select none](#)

- product:read*  
read scope
- product:write*  
write scope

[Authorize](#) [Close](#)

Swagger UI

Not Secure | https://localhost:8443/openapi/webjars/swagger-ui/index.html

Swagger  
Supported by SMARTBEAR

/openapi/v3/api-docs

Explore

### Available authorizations

Scopes are used to grant an application different levels of access to data on behalf of the end user. Each API may declare one or more scopes.  
API requires the following scopes. Select which ones you want to grant to Swagger UI.

#### security\_auth (OAuth2, authorizationCode)

Authorized

Authorization URL: https://localhost:8443/oauth2/authorize  
Token URL: https://localhost:8443/oauth2/token  
Flow: authorizationCode

client\_id: \*\*\*\*\*  
client\_secret: \*\*\*\*\*

Logout Close

ProductComposite REST API for composite product information.

POST /product-composite Creates a composite product

manage.auth0.com

dev-ml-1 DEVELOPMENT

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### Auth0 Management API (Test Application)

Client Id: [REDACTED] Authorized

Select which permissions (scopes) should be granted to this client:

Grant ID [REDACTED]

Permissions Select: All None

<input checked="" type="checkbox"/> read:client_grants	<input checked="" type="checkbox"/> create:client_grants	<input checked="" type="checkbox"/> delete:client_grants	<input checked="" type="checkbox"/> update:client_grants
<input checked="" type="checkbox"/> read:users	<input checked="" type="checkbox"/> update:users	<input checked="" type="checkbox"/> delete:users	<input checked="" type="checkbox"/> create:users
<input checked="" type="checkbox"/> read:users_app_metadata	<input checked="" type="checkbox"/> update:users_app_metadata	<input checked="" type="checkbox"/> delete:users_app_metadata	
<input checked="" type="checkbox"/> create:users_app_metadata	<input checked="" type="checkbox"/> read:user_custom_blocks	<input checked="" type="checkbox"/> create:user_custom_blocks	

**⚠ You are about to create a grant with all scopes available. If you understand this well, choose to continue below.**

manage.auth0.com

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Thank you for signing up for Auth0! You have 22 days left in your trial to experiment with [features that are not in the Free plan](#). Like what you're seeing? Please enter your [billing information here](#). [View Plans](#)

← Back to Applications

## Auth0 Management API (Test Application)

Machine to Machine Client ID [REDACTED]

Quickstart Settings Credentials APIs Organizations

⚠ This feature is included in your current plan for up to 1,000 tokens per month. [Upgrade your subscription](#) or [contact enterprise sales](#) for additional monthly quota.

### Basic Information

**Name \***  
Auth0 Management API (Test Application)

**Domain**  
dev-m1-1.eu.auth0.com

**Client ID**  
[REDACTED]

**Client Secret**  
.....

The Client Secret is not base64 encoded.

Save changes \* + Return Cancel [Save Changes](#)

```
bash
Update the tenant, set its default connection to a user dictionary...
...
Creates reader client app...
...
Creates writer client app...
...
Creates API product-composite (https://localhost:8443/product-composite)...
...
Creates user with email NNN...
...
Create client grant for the reader app to access the product-composite API...
...
Create client grant for the writer app to access the product-composite API...
...
Auth0 - OAuth2 settings:

export TENANT=...
export WRITER_CLIENT_ID=...
export WRITER_CLIENT_SECRET=...
export READER_CLIENT_ID=...
export READER_CLIENT_SECRET=...
$
```

```
-bash
Update the tenant, set its default connection to a user dictionary...
...
Reader client app already exists
Writer client app already exists
API product-composite (https://localhost:8443/product-composite) already exists
User with email NNN already exists
Client grant for the reader app to access the product-composite API already exists
Client grant for the writer app to access the product-composite API already exists

Auth0 - OAuth2 settings:

export TENANT=...
export WRITER_CLIENT_ID=...
export WRITER_CLIENT_SECRET=...
export READER_CLIENT_ID=...
export READER_CLIENT_SECRET=...
$
```

```
product-composite-1 | ... Authorization info:  
Subject: ...@clients,  
scopes: product:read product:write,  
expires YYYY-MM-DDT06:09:45Z:  
issuer: https://dev-ml-1.eu.auth0.com/,  
audience: [https://localhost:8443/product-composite]
```

```
product-composite-1 | ... Authorization info:  
Subject: ...@clients,  
scopes: product:read,  
expires YYYY-MM-DDT06:09:49Z:  
issuer: https://dev-ml-1.eu.auth0.com/,  
audience: [https://localhost:8443/product-composite]
```



## Welcome

Log in to dev-ml-1 to continue to writer.

[Forgot password?](#)

Don't have an account? [Sign up](#)

OR





## Authorize App



Hi [REDACTED]

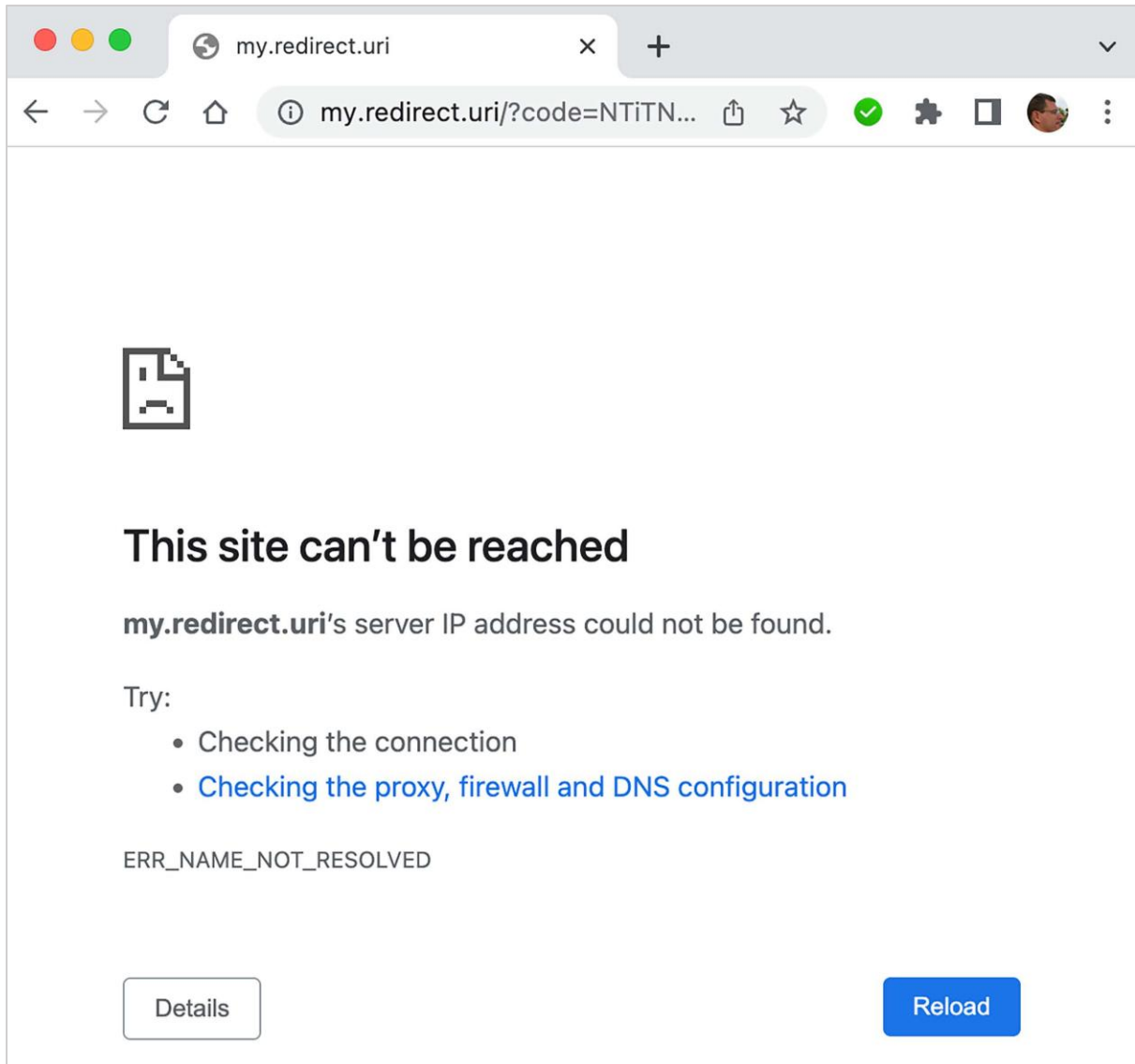
writer is requesting access to your dev-ml-1 account.

- **Profile:** access to your email
- **Read:** product your read
- **Write:** product your write

Decline

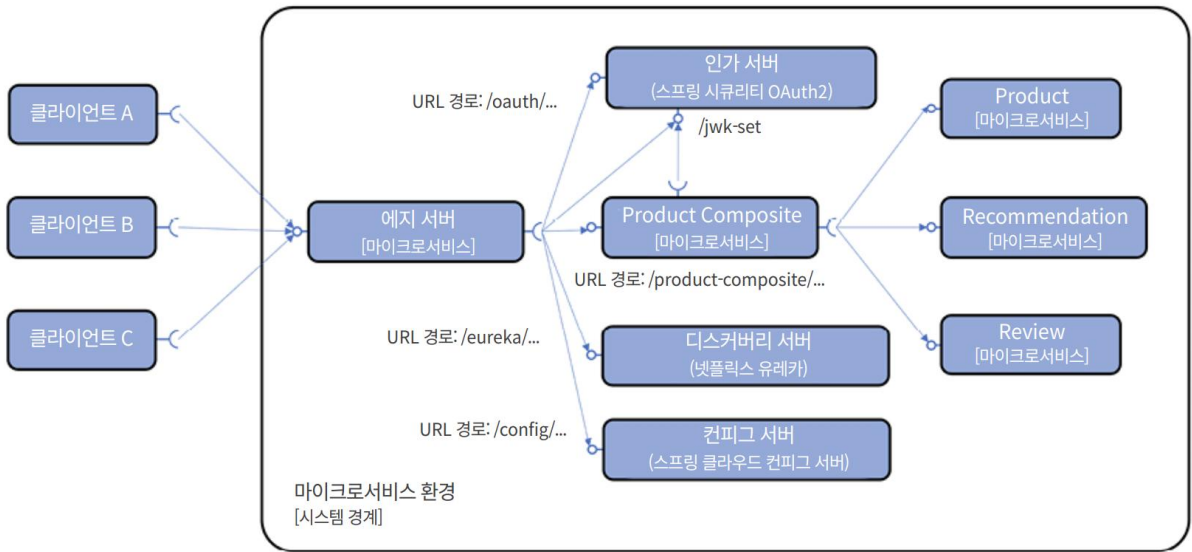
Accept





```
bash ~#2  
{  
  "sub": "auth0l...",  
  "email": "...my users email...",  
  "email_verified": true  
}  
$
```

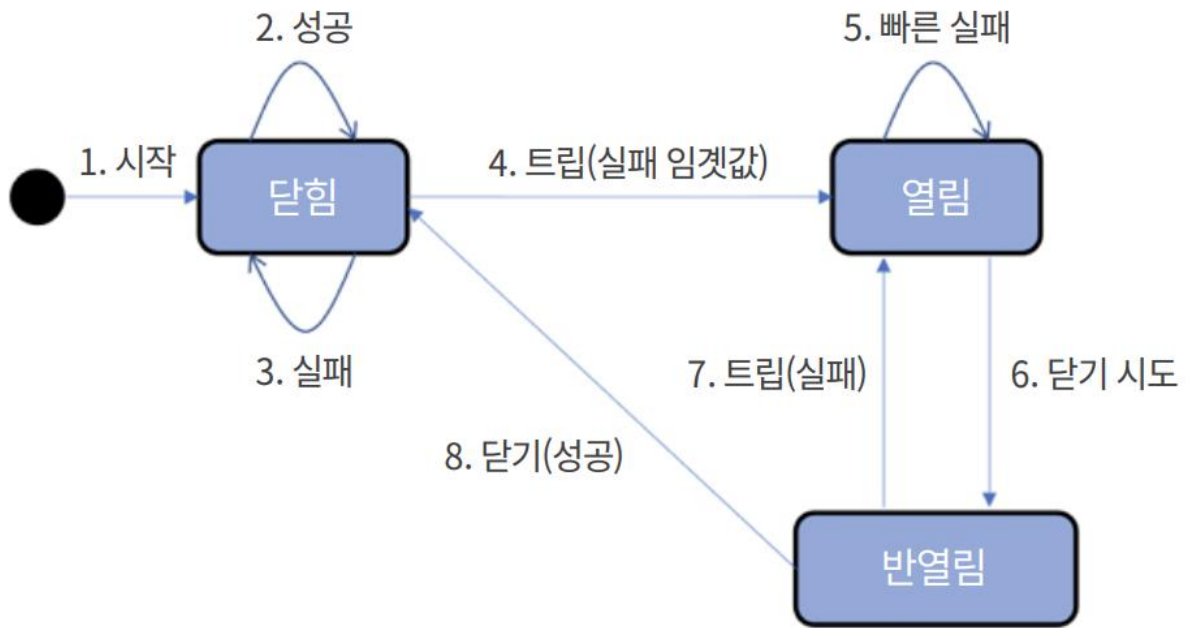
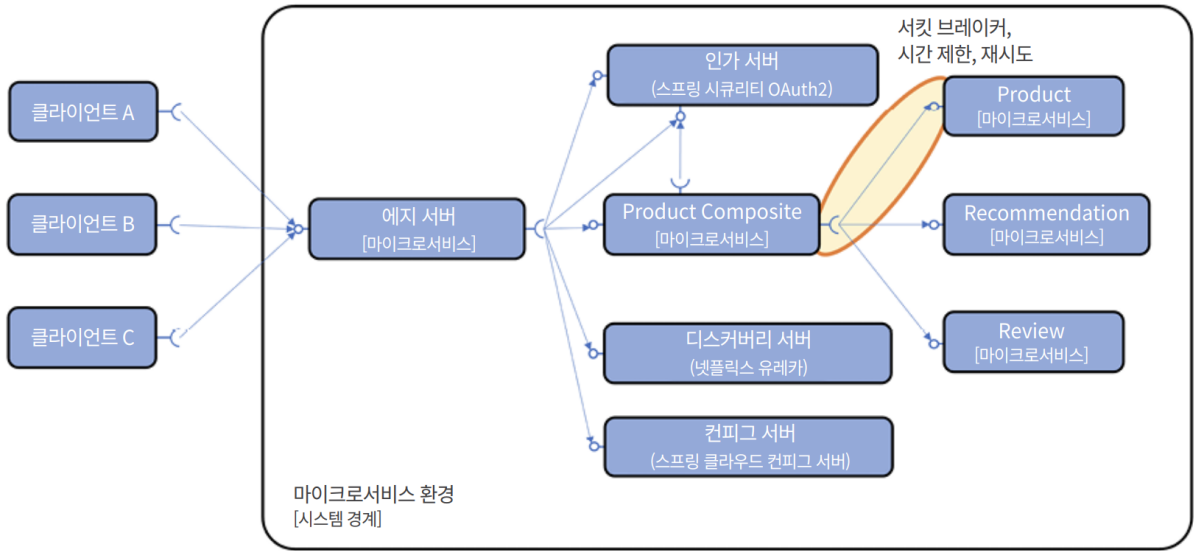
## 12장: 중앙 집중식 구성



```
bash
d91001603dcd3eb1392ccbd40ff201cdcf7b9af2fcaab3da39e37919033b206$
$
```

```
bash
hello world$
$
```

# 13장: Resilience4j를 활용한 복원력 개선



```
bash 1
{"path": "/product-composite/1",
  "status": 500,
  "error": "Internal Server Error",
  "requestId": "9d7254b5-42",
  "message": "Did not observe any item or terminal signal within
2000ms in 'onErrorResume' (and no fallback has been configured)"
}
```

```
bash 2
{
  "productId": 1,
  "name": "Fallback product1",
  "weight": 1,
}
```

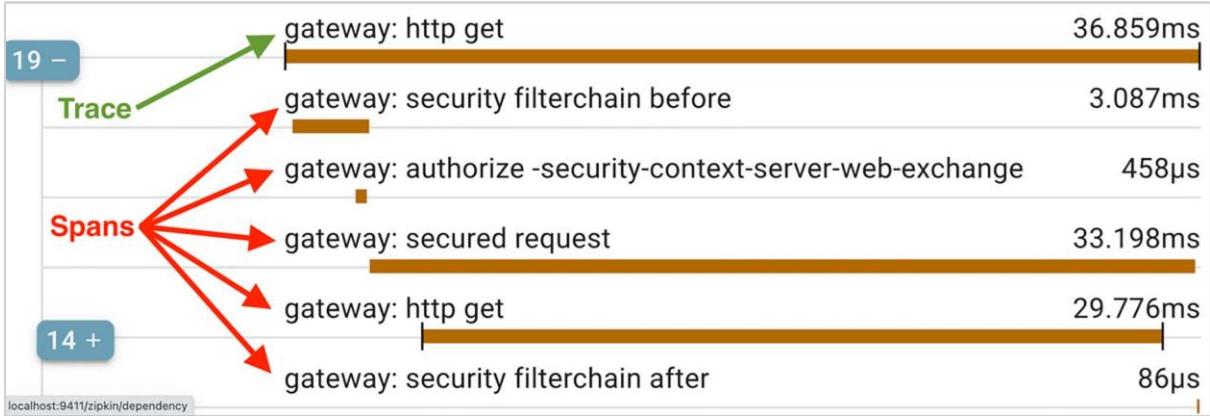
```
bash 2
CLOSED_TO_OPEN
OPEN_TO_HALF_OPEN
HALF_OPEN_TO_CLOSED
$
```

```
bash 2
200
real    0m0.066s
```

```
bash 2
200
real    0m1.072s
```

```
bash
{
  "retryName": "product",
  "type": "RETRY",
  "creationTime": "2025-04-24T17:09:40.999021381Z[Etc/UTC]",
  "errorMessage": "org.springframework.web.reactive.function.client.WebClientResponseException$InternalServerError: 500 Internal Server Error from GET http://0473acd8d79b:8080/product/1",
  "numberOfAttempts": 1
}
{
  "retryName": "product",
  "type": "SUCCESS",
  "creationTime": "2025-04-24T17:09:42.016292965Z[Etc/UTC]",
  "errorMessage": "org.springframework.web.reactive.function.client.WebClientResponseException$InternalServerError: 500 Internal Server Error from GET http://0473acd8d79b:8080/product/1",
  "numberOfAttempts": 1
}
$
```

# 14장: 분산 추적



Zipkin
Find a trace Dependencies ENGLISH Search by trace ID

serviceName gateway x + a
b RUN QUERY

10 Results EXPAND ALL COLLAPSE ALL Service filters

Root	c ↓ Start Time	Spans	Duration
gateway: http get	a minute ago (04/23 11:13:30:849)	21	26.751ms <span>SHOW</span>
gateway: http post	a minute ago (04/23 11:13:20:613)	12	22.687ms <span>SHOW</span>
gateway: http get	2 minutes ago (04/23 11:12:17:377)	20	37.461ms <span>SHOW</span>

Zipkin

localhost:9411/zipkin/traces/249b9b443ae721d1b278b524973cef26

Find a trace Dependencies ENGLISH Search by trace ID

### gateway: http get

SPAN TABLE

Duration 26.751ms Services 5 Total Spans 21 Trace ID 249b9b443ae721d1b278b524973cef26

Service name	Span name	Span ID	Parent ID
product-composite	product info	d3a20ec43ff3a30f	c4ef5246ed35e6cd

Focus on selected span Reset focus

Service name	Span name	Duration
gateway	http get	26.751ms
gateway	security filterchain before	1.363ms
gateway	authorize -security-context-server-web-exchange	239µs
gateway	secured request	24.899ms
gateway	http get	22.459ms
product-composite	http get /product-composite/(productid)	19.842ms
product-composite	security filterchain before	1.795ms
product-composite	authorize -security-context-server-web-exchange	288µs
product-composite	secured request	17.524ms
product-composite	product info	722µs
product-composite	http get	8.458ms
product	http get /product/(productid)	5.981ms
product-composite	http get	9.499ms
recommendation	http get /recommendation	10.133ms
product-composite	http get	12.466ms
review	http get /review	10.712ms
review	connection	5.052ms
review	query	822µs
review	result-set	723µs
product-composite	security filterchain after	103µs
gateway	security filterchain after	111µs

Tags

build.version	1.0.0-SNAPSHOT
otel.library.name	org.springframework.boot
otel.library.version	3.5.0
otel.scope.name	org.springframework.boot
otel.scope.version	3.5.0
productId	1

Zipkin

Find a trace Dependencies ENGLISH Search by trace ID

### gateway: http get

SPAN TABLE

Duration 26.751ms Services 5 Total Spans 21 Trace ID 249b9b443ae721d1b278b524973cef26

Tags

```
select
r1_0.id,r1_0.author,r1_0.conte
nt,r1_0.product_id,r1_0.review
_id,r1_0.subject,r1_0.version
from reviews r1_0 where
r1_0.product_id=?
```

jdbc.query[0]

otel.library.name org.springframework.boot

otel.library.version 3.5.0

otel.scope.name org.springframework.boot

otel.scope.version 3.5.0

peer.service review-db

Span Name	Duration
product-composite: http get	12.466ms
review: http get /review	10.712ms
review: connection	5.052ms
review: query	822µs
review: result-set	723µs
product-composite: security filterchain after	103µs
gateway: security filterchain after	111µs

Zipkin

Find a trace Dependencies ENGLISH Search by trace ID

serviceName gateway + RUN QUERY

7 Results EXPAND ALL COLLAPSE ALL Service filters

Root	Start Time	Spans	Duration
gateway: http get	10 minutes ago (04/23 11:31:15:780)	21	2.038s SHOW
gateway: http get	11 minutes ago (04/23 11:30:25:735)	19	32.853ms SHOW

Zipkin Find a trace Dependencies ENGLISH Search by trace ID

gateway: http get SPAN TABLE

Duration 2.038s Services 5 Total Spans 21 Trace ID 02a3e605a548f60e7748200d3b4732fd

Address composite)

Tags

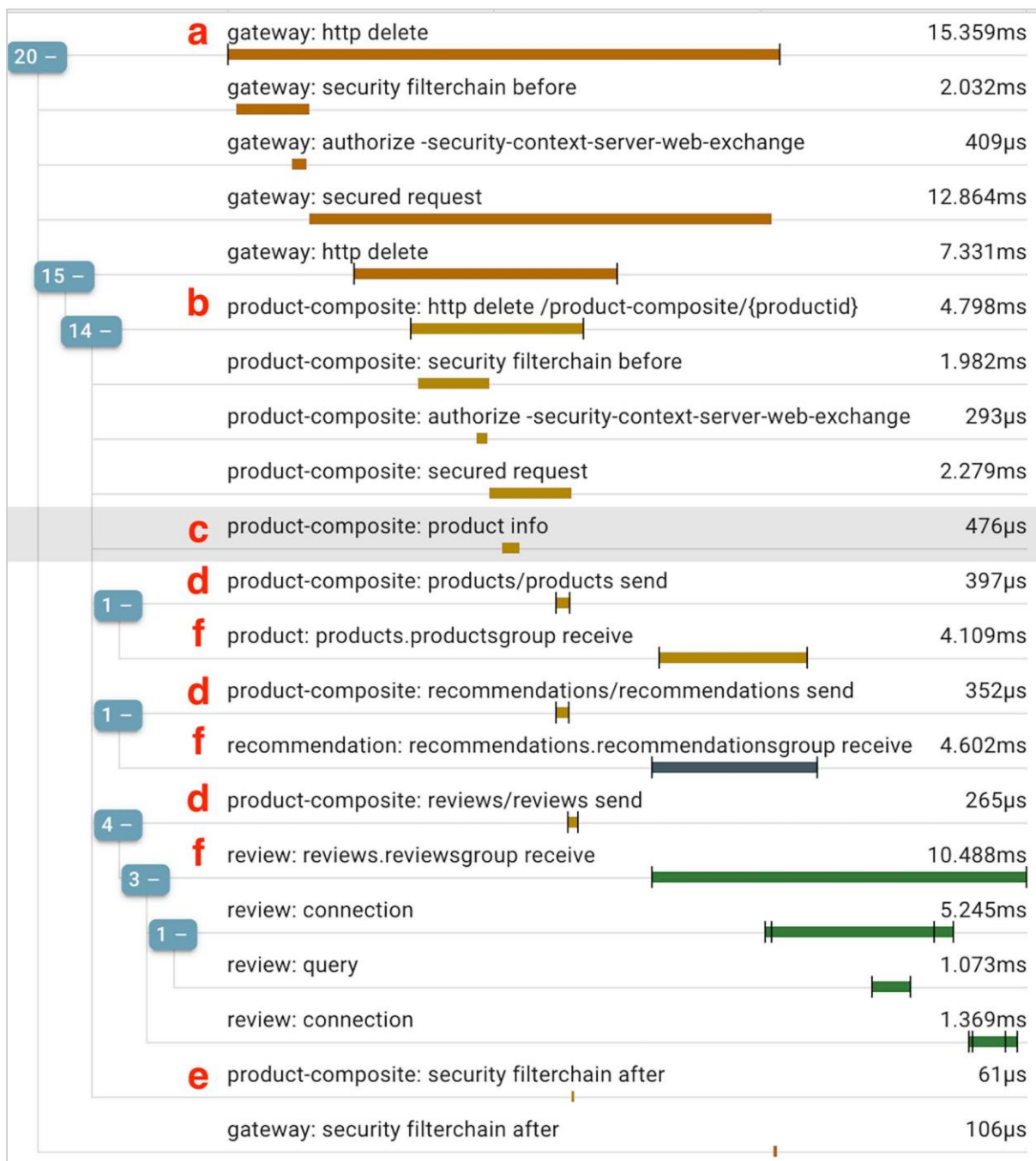
build.version	1.0.0-SNAPSHOT
error	Did not observe any item or terminal signal within 2000ms in 'onErrorResume' (and no fallback has been configured)
otel.library.name	org.springframework.boot
otel.library.version	3.5.0
otel.scope.name	org.springframework.boot
otel.scope.version	3.5.0
otel.status_code	ERROR

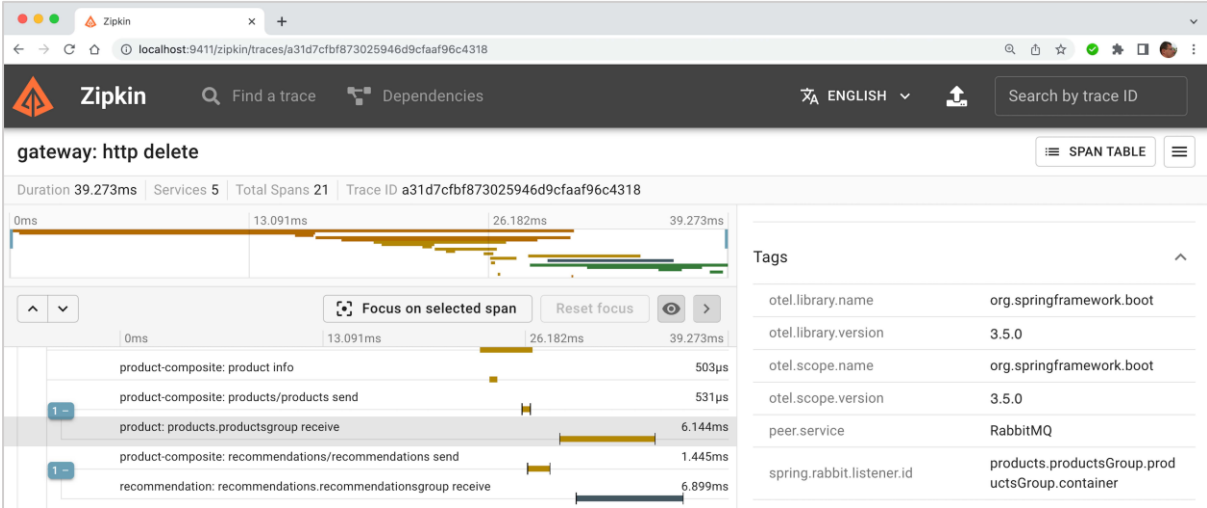
Zipkin Find a trace Dependencies ENGLISH Search by trace ID

serviceName gateway + RUN QUERY

10 Results EXPAND ALL COLLAPSE ALL Service filters

Root	Start Time	Spans	Duration	
gateway: http delete	a minute ago (04/23 11:42:54:382)	21	39.273ms	SHOW
gateway: http get	12 minutes ago (04/23 11:32:25:960)	21	2.027s	SHOW





localhost

Refreshed 2025-04-30 08:03:13 Refresh every 5 seconds

**RabbitMQ**™ RabbitMQ 4.0.7 Erlang 27.3.1

Virtual host **All**

Cluster **rabbit@b5369881e25c**

User **guest** Log out

**Overview** | **Connections** | **Channels** | **Exchanges** | **Queues and Streams** | **Admin**

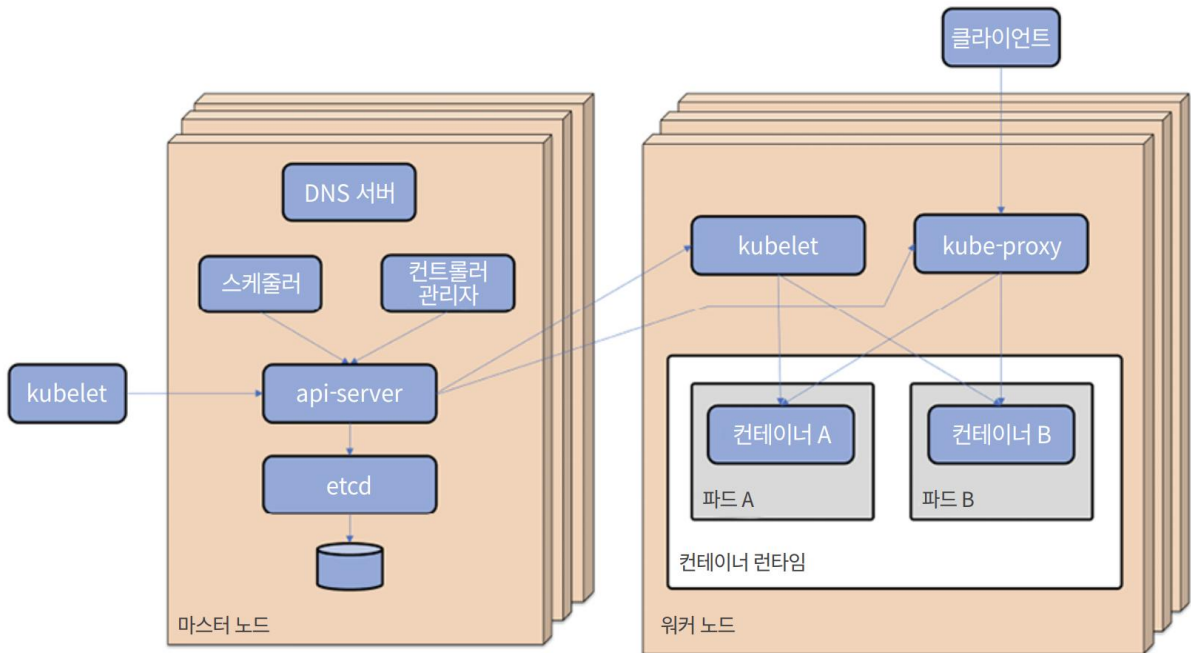
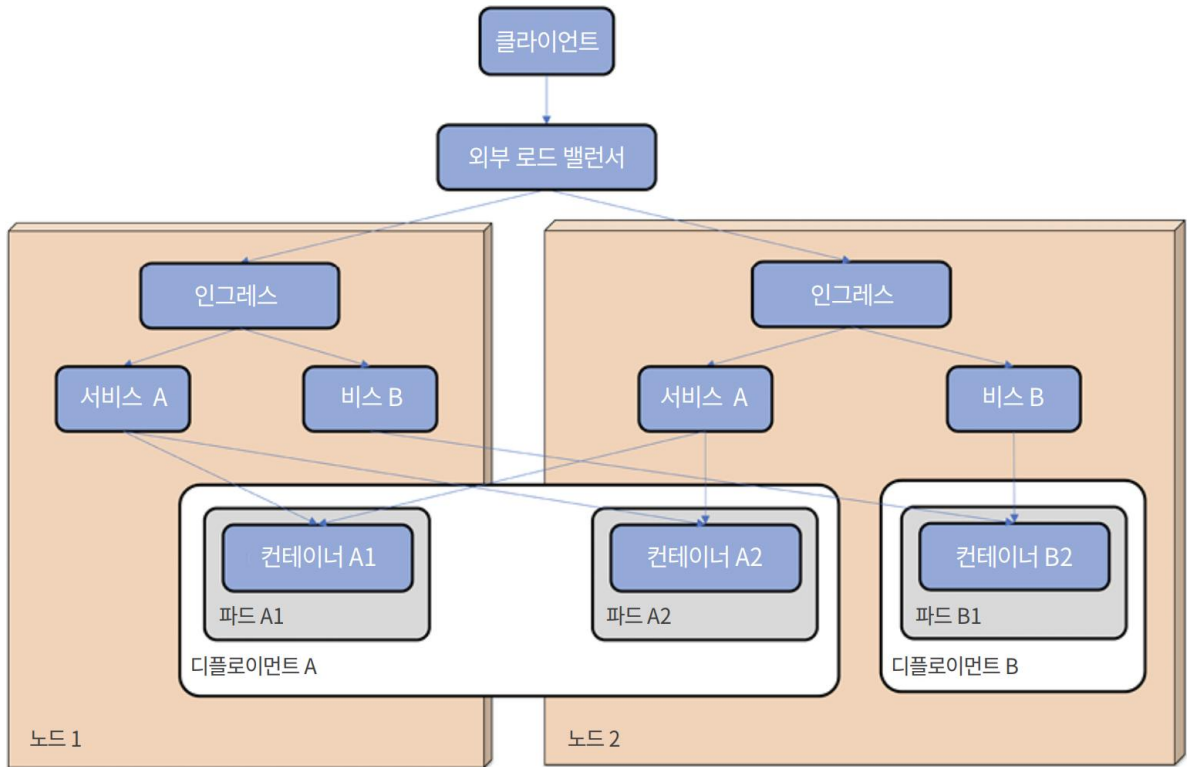
**Get Message(s)**

Message 1

The server reported 6 messages remaining.

<b>Exchange</b>	products
<b>Routing Key</b>	products
<b>Redelivered</b>	0
<b>Properties</b>	timestamp: 1745991632 message_id: 2f8f0d82-ca0e-4ab8-0107-4c5bfaf6d45f priority: 0 delivery_mode: 2 headers: partitionKey: 113 target-protocol: amqp traceparent: 00-8e7c97d44acab24bff4996f526292845-86ea25936acb6edc-01 content_type: application/json
<b>Payload</b> 93 bytes Encoding: string	{"eventType": "DELETE", "key": 113, "data": null, "eventCreatedAt": "2025-04-30T05:40:32.40102767Z"}

# 15장: 쿠버네티스 소개



```
bash
$ kubectl config get-contexts
CURRENT  NAME                CLUSTER                AUTHINFO                NAMESPACE
*        handson-spring-boot-cloud  handson-spring-boot-cloud  handson-spring-boot-cloud  first-attempts
        minikube             minikube                 minikube                 default
$
```

```
bash
NAME                STATUS    ROLES    AGE    VERSION
handson-spring-boot-cloud  Ready    control-plane  12m    v1.32.0
$
```

```
bash
$ kubectl get pods --all-namespaces
NAMESPACE    NAME                                                    READY    STATUS    RESTARTS    AGE
ingress-nginx  ingress-nginx-admission-create-88v7k                 0/1     Completed  0           41m
ingress-nginx  ingress-nginx-admission-patch-j2xws                  0/1     Completed  1           41m
ingress-nginx  ingress-nginx-controller-77669ff58-qfj5j             1/1     Running    0           41m
kube-system    coredns-787d4945fb-wbp2r                             1/1     Running    0           63m
kube-system    etcd-handson-spring-boot-cloud                       1/1     Running    0           63m
kube-system    kube-apiserver-handson-spring-boot-cloud              1/1     Running    0           63m
kube-system    kube-controller-manager-handson-spring-boot-cloud     1/1     Running    0           63m
kube-system    kube-proxy-prrjn                                     1/1     Running    0           63m
kube-system    kube-scheduler-handson-spring-boot-cloud              1/1     Running    0           63m
kube-system    metrics-server-5f8fcc9bb7-llns9                     1/1     Running    0           40m
kube-system    storage-provisioner                                  1/1     Running    1 (62m ago)  63m
$
```

```
bash
$ kubectl get all
NAME                READY    STATUS    RESTARTS    AGE
pod/nginx-deploy-79f9d4bcf5-vxmw7  1/1     Running    0           99s

NAME                READY    UP-TO-DATE    AVAILABLE    AGE
deployment.apps/nginx-deploy  1/1     1             1           99s

NAME                DESIRED    CURRENT    READY    AGE
replicaset.apps/nginx-deploy-79f9d4bcf5  1         1         1       99s
$
```

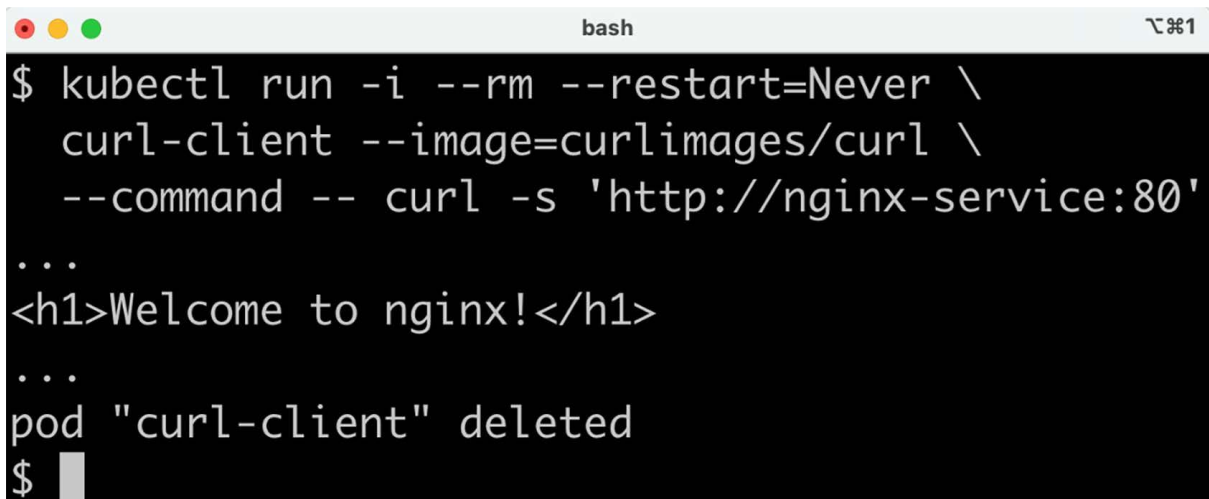
```
kubectl
$ kubectl get pod --watch
NAME                                READY   STATUS    RESTARTS   AGE
nginx-deploy-58bfb487f9-cgc2v       1/1    Running   0           51s
nginx-deploy-58bfb487f9-cgc2v       1/1    Terminating   0           54s
nginx-deploy-58bfb487f9-knhfp       0/1    Pending    0           0s
nginx-deploy-58bfb487f9-knhfp       0/1    Pending    0           0s
nginx-deploy-58bfb487f9-knhfp       0/1    ContainerCreating   0           0s
nginx-deploy-58bfb487f9-cgc2v       0/1    Terminating   0           55s
nginx-deploy-58bfb487f9-cgc2v       0/1    Terminating   0           55s
nginx-deploy-58bfb487f9-cgc2v       0/1    Terminating   0           55s
nginx-deploy-58bfb487f9-knhfp       1/1    Running     0           2s
```

```
8. bash
$ kubectl get all
NAME                                READY   STATUS    RESTARTS   AGE
pod/nginx-deploy-59b8c5f7cd-mt6pg    1/1    Running   0           46s
pod/nginx-deploy-59b8c5f7cd-pmns9    1/1    Running   0           12s
pod/nginx-deploy-59b8c5f7cd-vtstj    1/1    Running   0           12s

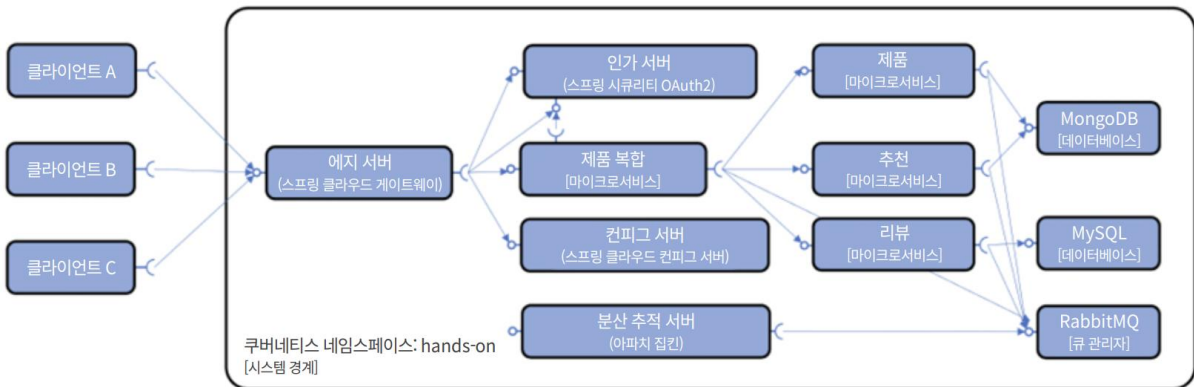
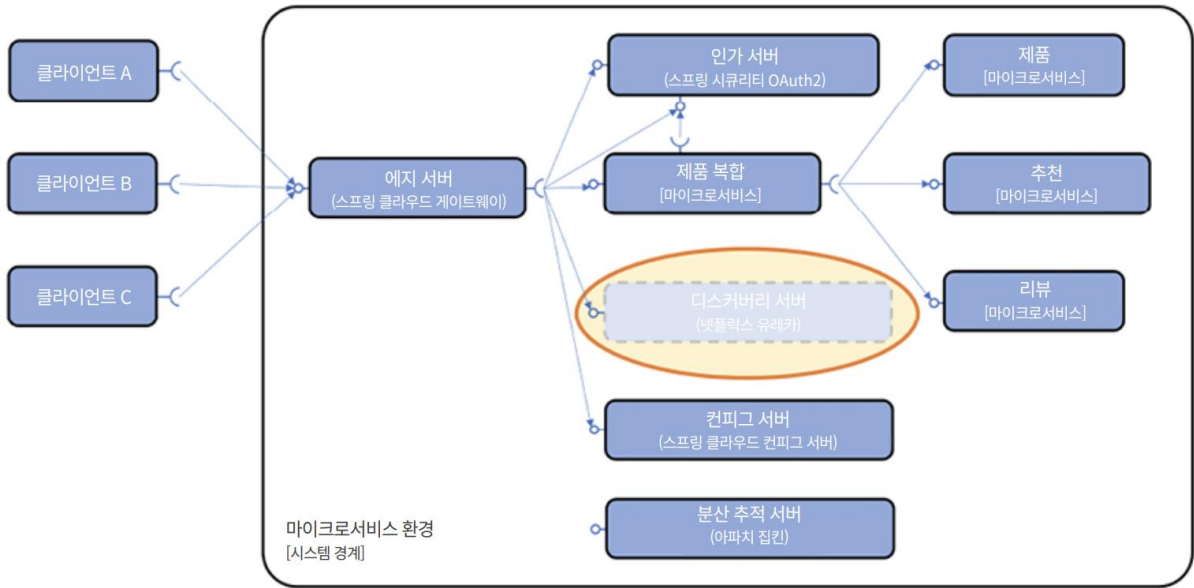
NAME                                READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/nginx-deploy         3/3     3             3           46s

NAME                                DESIRED   CURRENT   READY   AGE
replicaset.apps/nginx-deploy-59b8c5f7cd 3         3         3       46s
$
```

```
bash
$ kubectl get svc
NAME            TYPE        CLUSTER-IP    EXTERNAL-IP   PORT(S)          AGE
nginx-service   NodePort    10.100.230.194 <none>        80:30080/TCP    30s
$
```



# 16장: 쿠버네티스에 마이크로서비스 배포



```
-bash 1361
NAME          VERSION REPOSITORY          STATUS
common        1.0.0 file:///./././common      ok
rabbitmq      1.0.0 file:///./././components/rabbitmq  ok
mongodb       1.0.0 file:///./././components/mongodb   ok
mysql         1.0.0 file:///./././components/mysql     ok
config-server 1.0.0 file:///./././components/config-server ok
gateway       1.0.0 file:///./././components/gateway   ok
auth-server   1.0.0 file:///./././components/auth-server ok
product       1.0.0 file:///./././components/product   ok
recommendation 1.0.0 file:///./././components/recommendation ok
review        1.0.0 file:///./././components/review    ok
product-composite 1.0.0 file:///./././components/product-composite ok
zipkin-server 1.0.0 file:///./././components/zipkin-server ok
$
```

```
kubectl 1361
config-server-6b9f6c6988-slt9n    0/1    ContainerCreating    0    5s
product-76bb56d7fc-7qrgf         0/1    ContainerCreating    0    5s
mongodb-d466986f-xtlsj           0/1    ContainerCreating    0    6s
auth-server-5c58bbcb9b-c9npg     0/1    Running              0    6s
rabbitmq-6c7b9bf547-c44dj        0/1    Running              0    7s
gateway-7bdcf586df-pm9l4         0/1    Running              0    7s
product-composite-f45fccdf5-46dpt 0/1    Running              0    7s
mongodb-d466986f-xtlsj           1/1    Running              0    8s
review-777ff7d5b4-g7zrj         0/1    Running              0    8s
product-76bb56d7fc-7qrgf         0/1    Running              0    9s
mysql-5846f7fb7c-kxxd7           1/1    Running              0    9s
zipkin-server-586bcccd96-lgrj7    0/1    Running              0    9s
```

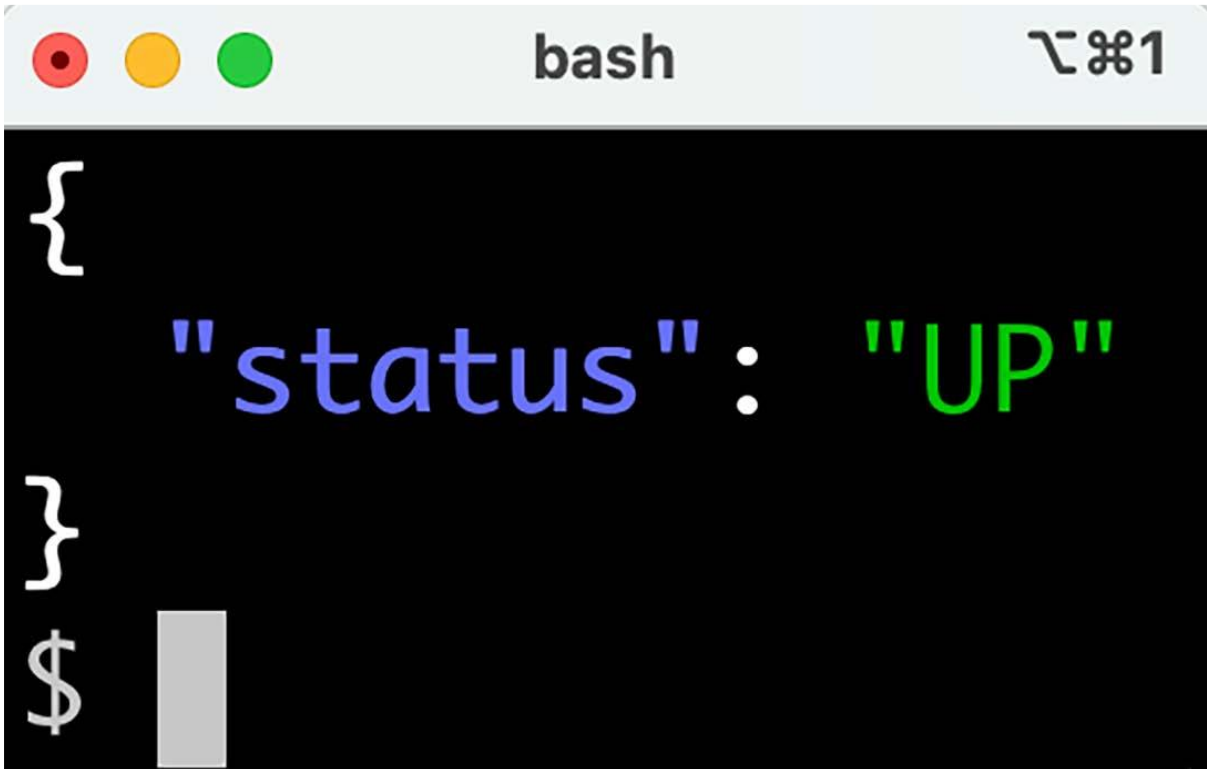
```
⌘1
"hands-on/auth-server:latest"
"hands-on/config-server:latest"
"hands-on/gateway:latest"
"registry.hub.docker.com/library/mongo:8.0.5"
"registry.hub.docker.com/library/mysql:9.2.0"
"hands-on/product-service:latest"
"hands-on/product-composite-service:latest"
"registry.hub.docker.com/library/rabbitmq:4.0.7-management"
"hands-on/recommendation-service:latest"
"hands-on/review-service:latest"
"registry.hub.docker.com/openzipkin/zipkin:3.5.0"
$
```

```
⌘2
Start Tests: Mon MMM DD 16:41:35 CEST YYYY
HOST=localhost
PORT=30443
USE_K8S=true
SKIP_CB_TESTS=false
Wait for: curl -k https://localhost:30443/actuator/health...
  DONE, continues...
ACCESS_TOKEN=eyJraW...
Test OK (HTTP Code: 200)
.
.
.
End, all tests OK: Mon MMM DD 16:42:03 CEST YYYY
$
```

```
YYYY-MM-DDT14:12:30.877Z INFO 1 --- [ionShutdownHook]
[product,,] o.s.b.w.embedded.netty.GracefulShutdown :
Commencing graceful shutdown. Waiting for active requests to complete
.
.
.
YYYY-MM-DDT14:12:35.245Z INFO 1 --- [ netty-shutdown]
[product,,] o.s.b.w.embedded.netty.GracefulShutdown :
Graceful shutdown complete
```

```
YYYY-MM-DDT14:38:51.191Z INFO 1 --- [ionShutdownHook]
[product,,] o.s.b.w.embedded.netty.GracefulShutdown :
Commencing graceful shutdown. Waiting for active requests to complete
.
.
.
YYYY-MM-DDT14:39:01.205Z INFO 1 --- [ionShutdownHook]
[product,,] o.s.c.support.DefaultLifecycleProcessor :
Shutdown phase 2147482623 ends with 1 bean still running after timeout
of 10000ms: [webServerGracefulShutdown]
YYYY-MM-DDT14:39:01.207Z INFO [product,,] 1 ---
[ netty-shutdown] o.s.b.w.embedded.netty.GracefulShutdown :
Graceful shutdown aborted with one or more requests still active
```

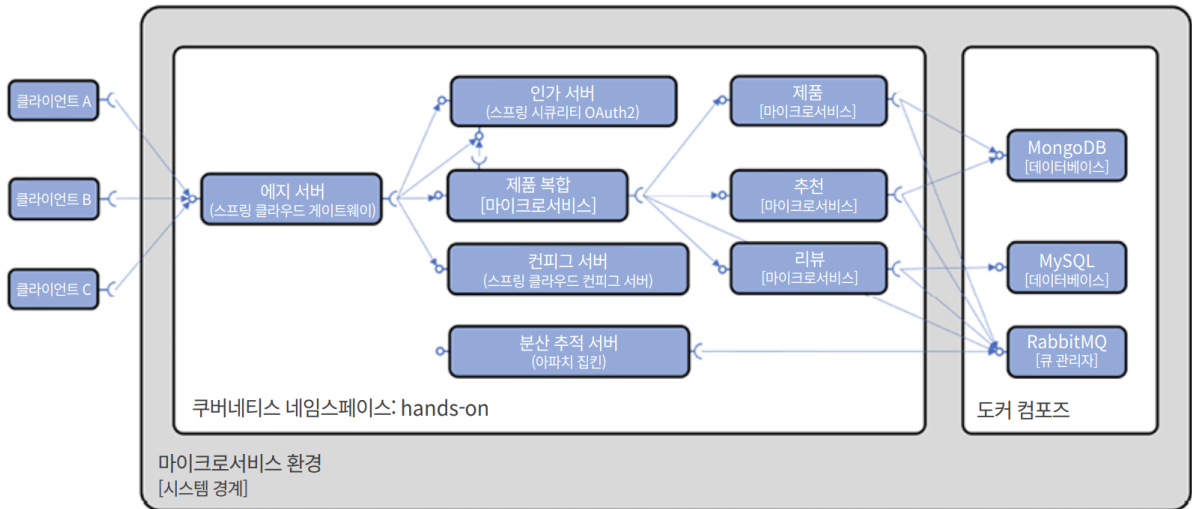
```
bash
HTTP/1.1 200 15.06 secs: 771 bytes ==> GET /product-composite/1?delay=15
HTTP/1.1 500 13.76 secs: 205 bytes ==> GET /product-composite/1?delay=15
HTTP/1.1 200 15.12 secs: 771 bytes ==> GET /product-composite/1?delay=15
```



A terminal window titled "bash" with a window control bar (red, yellow, green buttons) and a system tray icon (⌘1). The terminal content is as follows:

```
{  
    "status": "UP"  
}  
$ █
```

```
⌘#1
{
  "status": "UP",
  "components": {
    "mongo": {
      "status": "UP",
      "details": {
        "maxWireVersion": 25
      }
    },
    "rabbit": {
      "status": "UP",
      "details": {
        "version": "4.0.7"
      }
    },
    "readinessState": {
      "status": "UP"
    }
  }
}
$
```

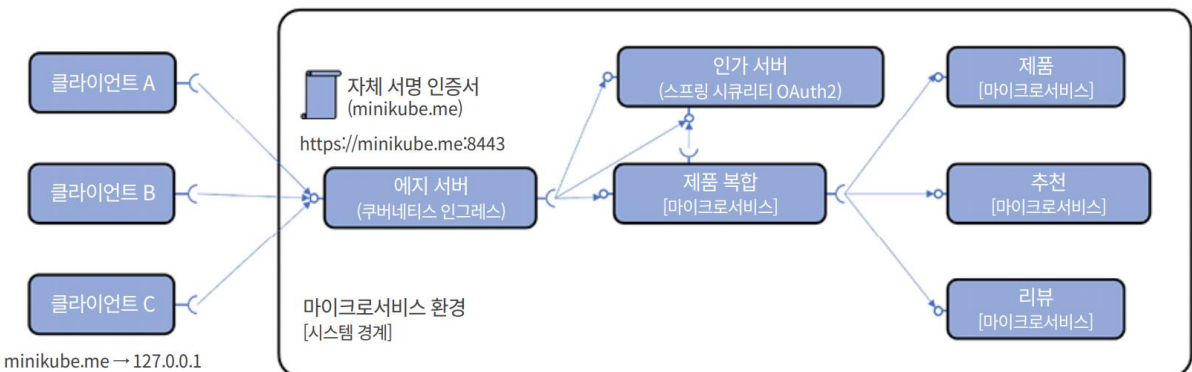
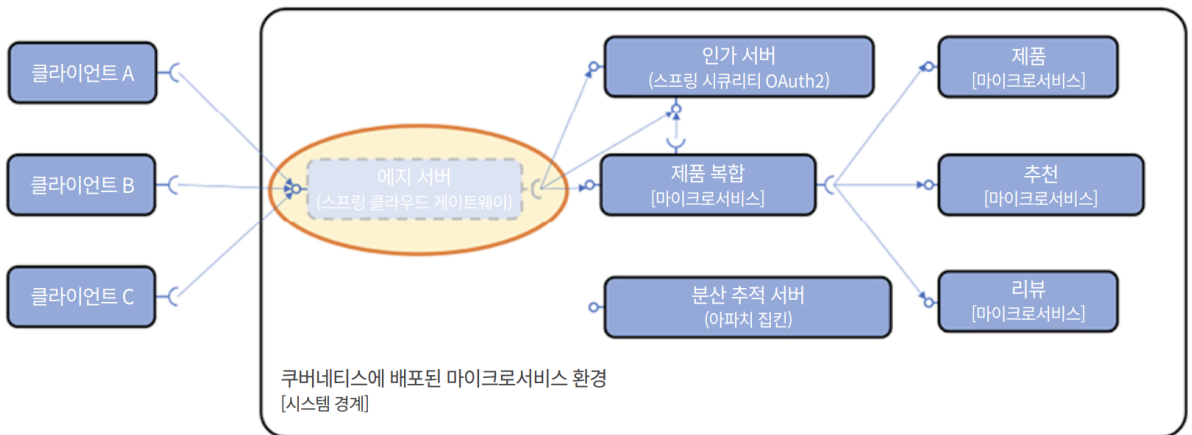
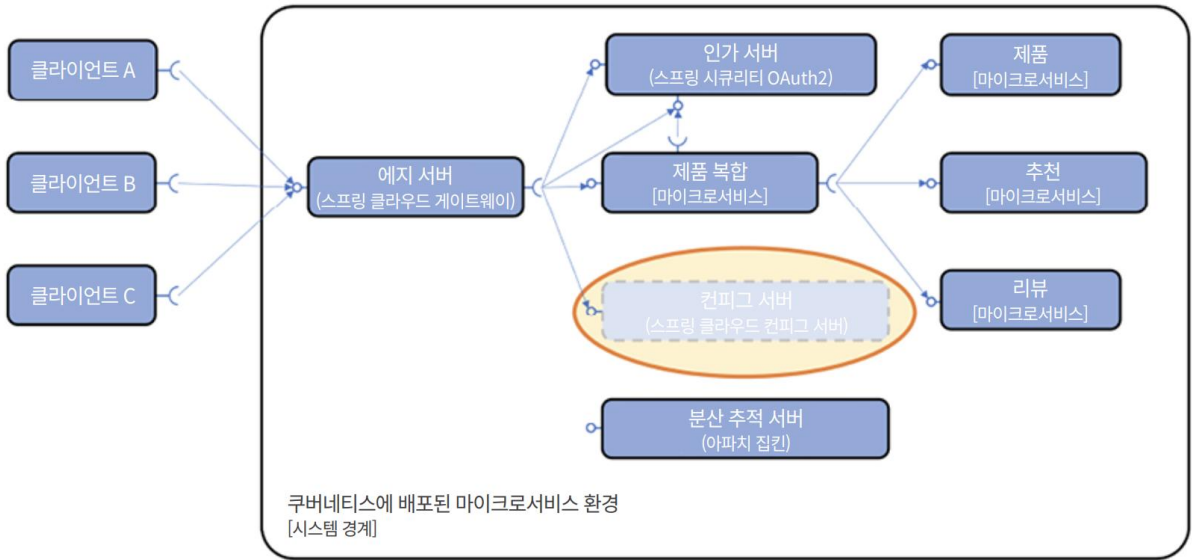


```

"hands-on/auth-server:v1"
"hands-on/config-server:v1"
"hands-on/gateway:v1"
"hands-on/product-service:v1"
"hands-on/product-composite-service:v1"
"hands-on/recommendation-service:v1"
"hands-on/review-service:v1"
"registry.hub.docker.com/openzipkin/zipkin:3.5.0"
$

```

# 17장: 시스템 환경을 단순화하기 위한 쿠버네티스 기능구현



```
bash ~%1
NAME                READY   STATUS    RESTARTS   AGE
cert-manager-64f9f45d6f-2dml d    1/1     Running    0           10h
cert-manager-cainjector-56bbdd5c47-krzpw  1/1     Running    0           10h
cert-manager-webhook-d4f4545d7-zrhvf    1/1     Running    0           10h
$
```

```
bash ~%1
EVENT   NAME                READY   SECRET          AGE
ADDED   tls-certificate     True    tls-certificate  0s
...
MODIFIED  tls-certificate    False   tls-certificate  0s
...
MODIFIED  tls-certificate    True    tls-certificate  1s
```

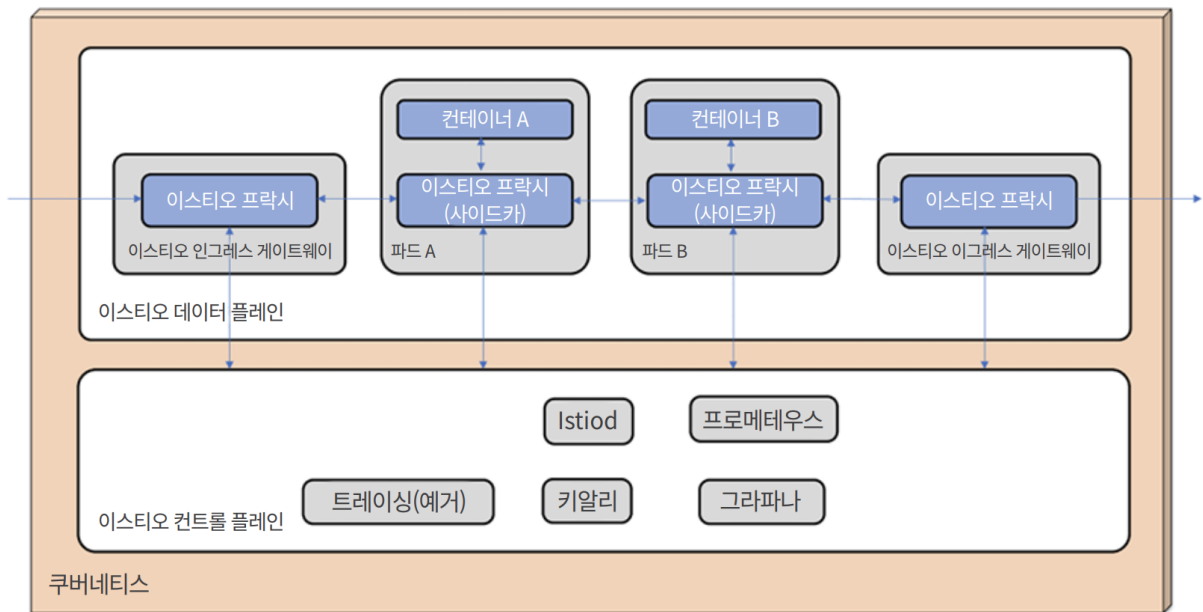
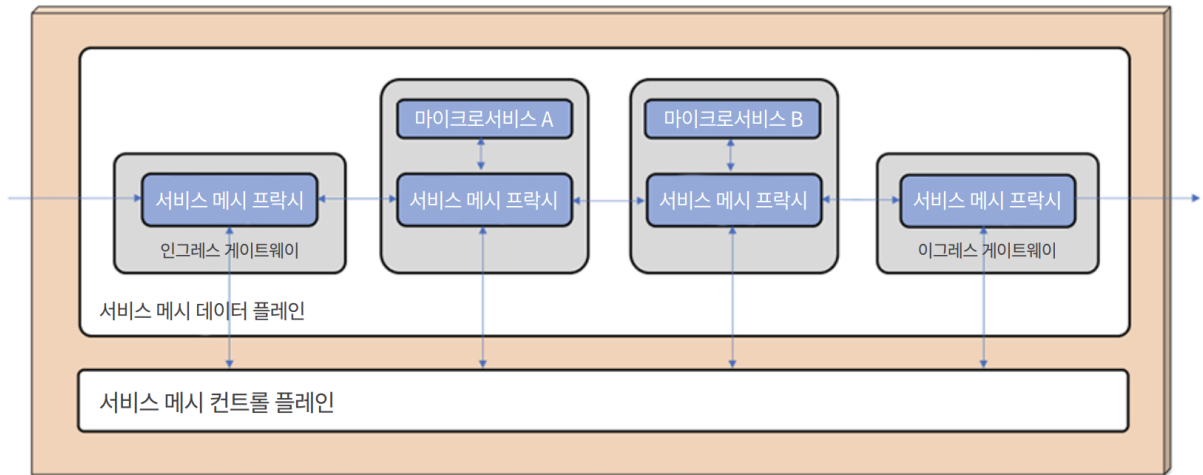
```
~%2
HOST=minikube.me
PORT=8443
USE_K8S=true
SKIP_CB_TESTS=false
Wait for: curl -k https://minikube.me:8443/actuator/health...
DONE, continues...
ACCESS_TOKEN=eyJra...
Test OK (HTTP Code: 202, )
...
End, all tests OK: Sun MMM DD 07:48:58 CEST YYYY
$
```

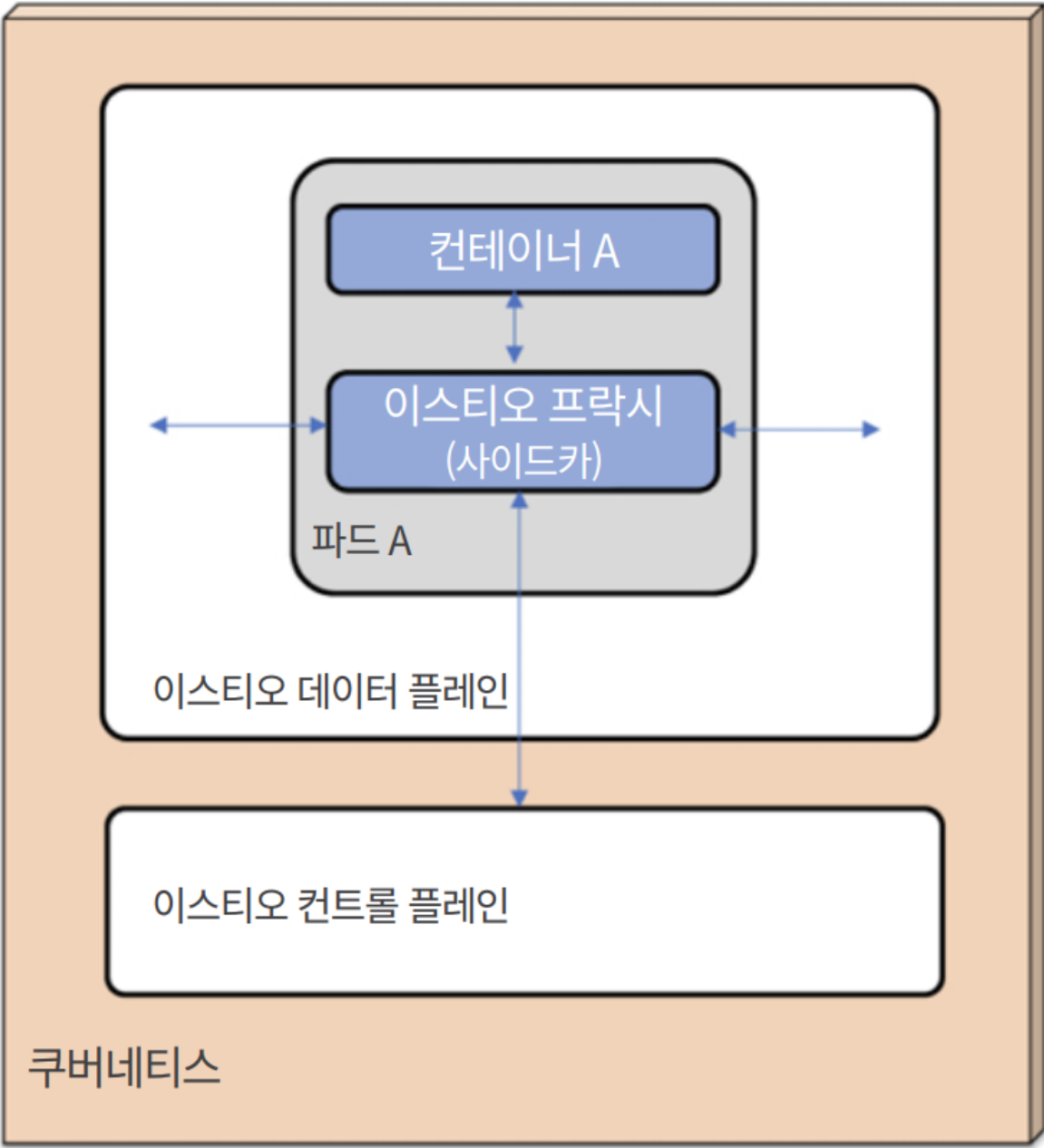
```
~%2
Not After:                2025-08-03T18:43:47Z
Not Before:               2025-05-05T18:43:47Z
Renewal Time:             2025-07-04T18:43:47Z
```

```
0s      Normal    Issuing    certificate/tls-certificate
Renewing certificate as renewal was scheduled at YYYY-MM-DD 05:55:40 +0000 UTC
...
0s      Normal    Issuing    certificate/tls-certificate
The certificate has been successfully issued
```

```
Start Tests: Sun MMM DD 08:13:43 CEST YYYY
HOST=localhost
PORT=8443
USE_K8S=false
SKIP_CB_TESTS=false
Restarting the test environment...
$ docker-compose down --remove-orphans
$ docker-compose up -d
...
:: Container chapter17-auth-server-1      Healthy    6.1s
...
:: Container chapter17-zipkin-server-1    Started    0.8s
...
Wait for: curl -k https://localhost:8443/actuator/health... ,
  retry #1 , retry #2 DONE, continues...
ACCESS_TOKEN=eyJra...
Test OK (HTTP Code: 202, )
...
We are done, stopping the test environment...
$ docker-compose down
...
:: Container chapter17-auth-server-1      Removed    1.3s
...
:: Container chapter17-zipkin-server-1    Removed    2.6s
...
End, all tests OK: Sun MMM DD 08:14:43 CEST YYYY
$
```

# 18장: 서비스 메시지를 활용한 관찰 가능성과 관리 개선





```
bash
handson-spring-boot-cloud
type: Control Plane
host: Running
kubelet: Running
apiserver: Running
kubeconfig: Configured
$
```

```
bash
✓ No issues found when checking the cluster.
Istio is safe to install or upgrade!
  To get started, check out https://istio.io/latest/docs/setup/getting-started/
$
```

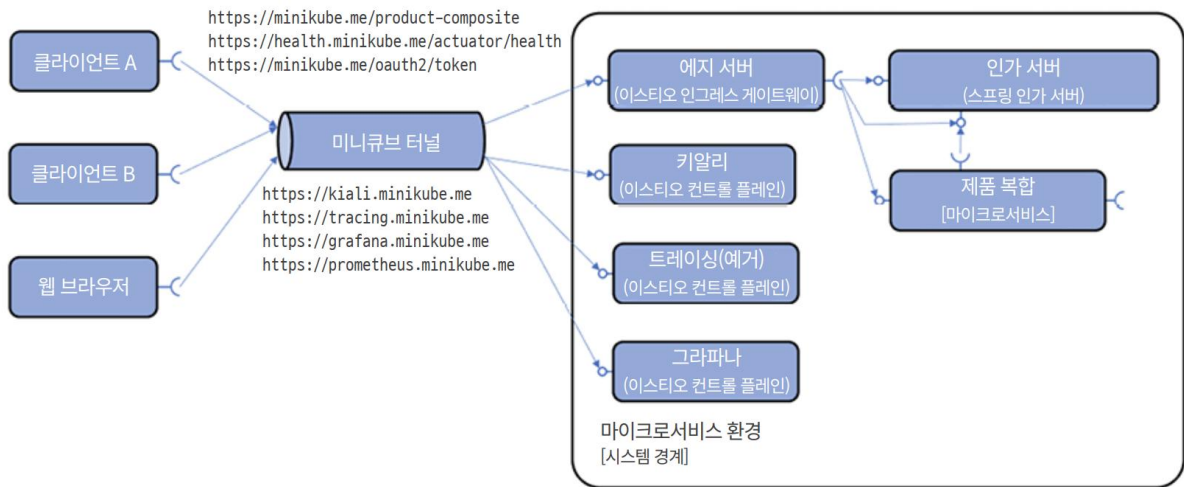
```
bash
NAME                READY    UP-TO-DATE    AVAILABLE    AGE
grafana              1/1      1              1            46s
istio-egressgateway 1/1      1              1            3m45s
istio-ingressgateway 1/1      1              1            3m45s
istiod               1/1      1              1            4m1s
jaeger               1/1      1              1            62s
kiali                1/1      1              1            72s
prometheus           1/1      1              1            54s
$
```

```

NAME                               TYPE                DATA  AGE
hands-on-certificate               kubernetes.io/tls  3      59s

NAME                               READY  SECRET  AGE
hands-on-certificate               True   hands-on-certificate  65s
$

```



```

bash
$ cat /etc/hosts
...
127.0.0.1 minikube.me grafana.minikube.me kiali.minikube.me
prometheus.minikube.me tracing.minikube.me kibana.minikube.me
elasticsearch.minikube.me mail.minikube.me health.minikube.me
$

```

```
bash
NAME          READY  STATUS   RESTARTS  AGE
auth-server-cf57b9bff-l2wnf  2/2    Running  0          39s
mongodb-6f4b595bbf-kvwnm    1/1    Running  0          39s
mysql-5dd488c7d-l7lvz      1/1    Running  0          39s
product-5454d77458-dvrtz    2/2    Running  0          39s
product-composite-59fb54568c-t8czm  2/2    Running  0          39s
rabbitmq-9cbbbb894-wlkgv    1/1    Running  0          39s
recommendation-96984995d-mpvq9  2/2    Running  0          39s
review-5f965dcd76-dsgsm     2/2    Running  0          39s
$
```

```
bash
Start Tests: Tue MMM DD 18:12:07 CEST YYYY
...
Wait for: curl -k https://health.minikube.me/actuator/health...
DONE, continues...
...
Test OK (HTTP Code: 200)
...
End, all tests OK: Tue MMM DD 18:12:33 CEST YYYY
$
```

```
bash
** SIEGE 4.1.6
** Preparing 1 concurrent users for battle.
The server is now under siege...
HTTP/1.1 200 0.08 secs: 771 bytes ==> GET /product-composite/1
HTTP/1.1 200 0.03 secs: 771 bytes ==> GET /product-composite/1
HTTP/1.1 200 0.03 secs: 771 bytes ==> GET /product-composite/1
HTTP/1.1 200 0.05 secs: 771 bytes ==> GET /product-composite/1
HTTP/1.1 200 0.03 secs: 771 bytes ==> GET /product-composite/1
```

kiالي minikube.me

Kubernetes

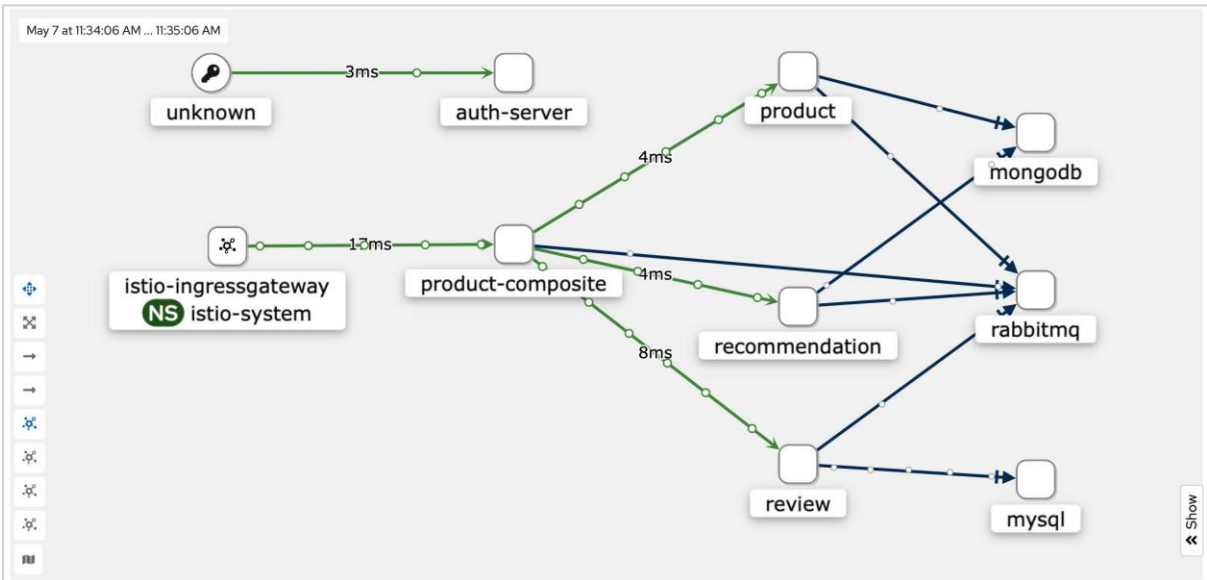
anonymous

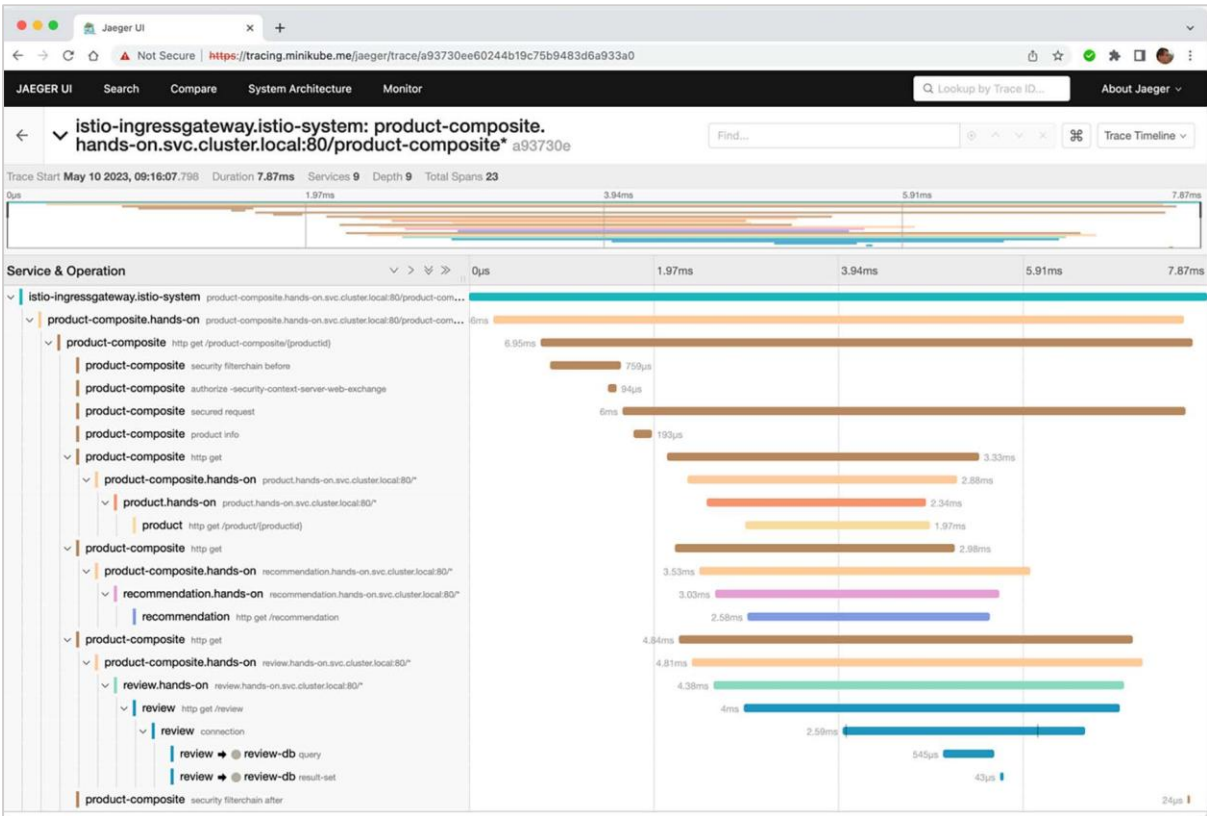
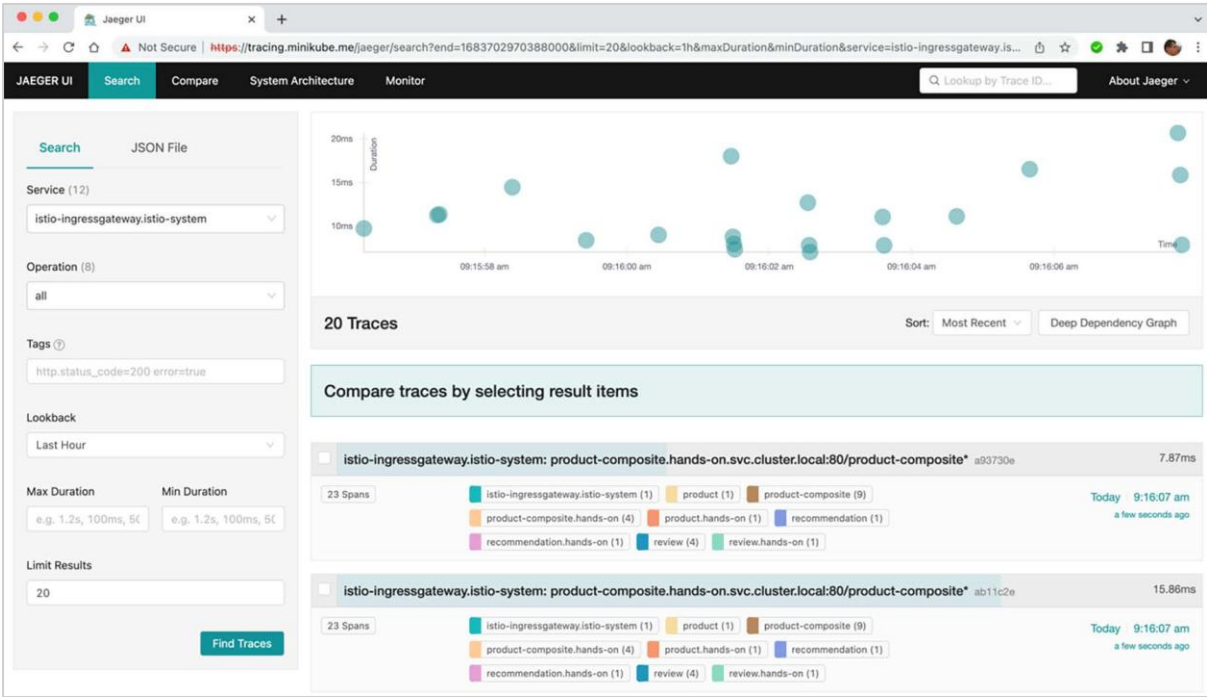
Overview

Namespace Filter by Namespace Name Last 1m Every 1m

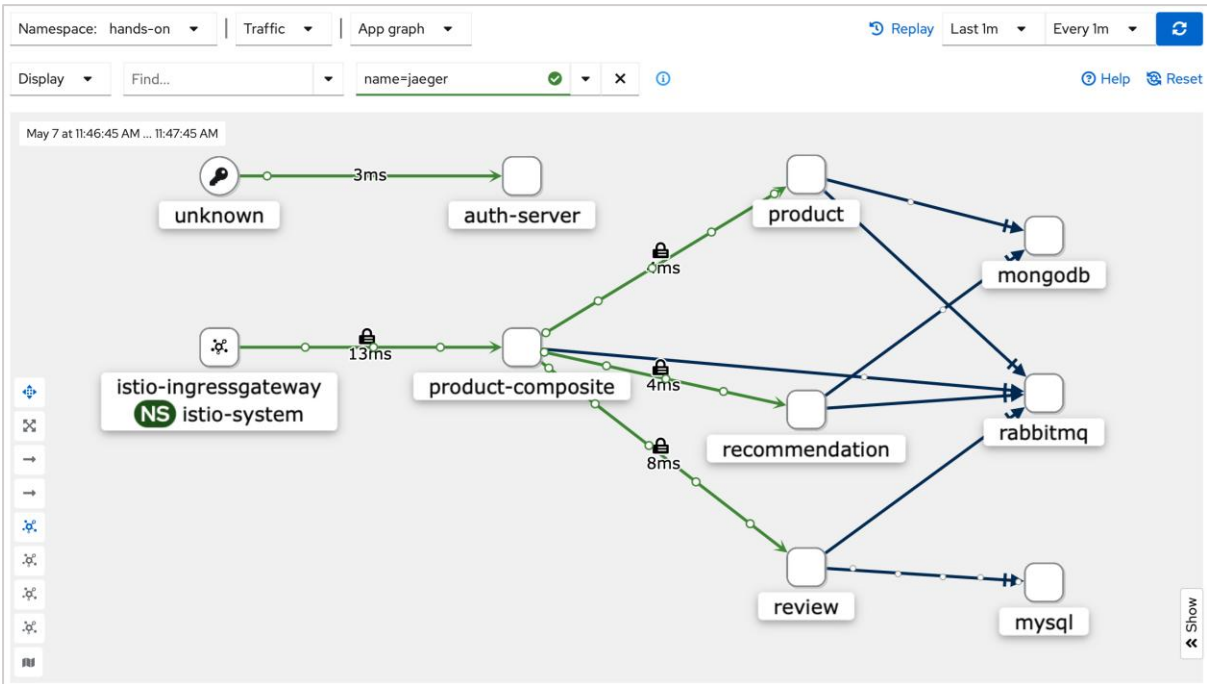
Health for Apps Traffic Inbound

Namespace	Labels	Istio Config	Applications	Health	Traffic
cert-manager	2 labels	N/A	3 application	3/3	No inbound traffic
default	1 label	N/A	0 application	N/A	No inbound traffic
hands-on	2 labels	mTLS is partially enabled for this namespace	8 application	8/8	ops inbound traffic, 1m
ingress-nginx	3 labels	N/A	0 application	N/A	No inbound traffic
istio-system	1 label	Control plane	5 application	5/5	No inbound traffic





```
bash
Owner: SERIALNUMBER=my-sn, CN=minikube.me, OU=my-ou, O=my-org, OID.2.5.4.17
=my-pc, STREET=my-address, L=my-locality, ST=my-province, C=my-country
Issuer: CN=hands-on-ca
$
```



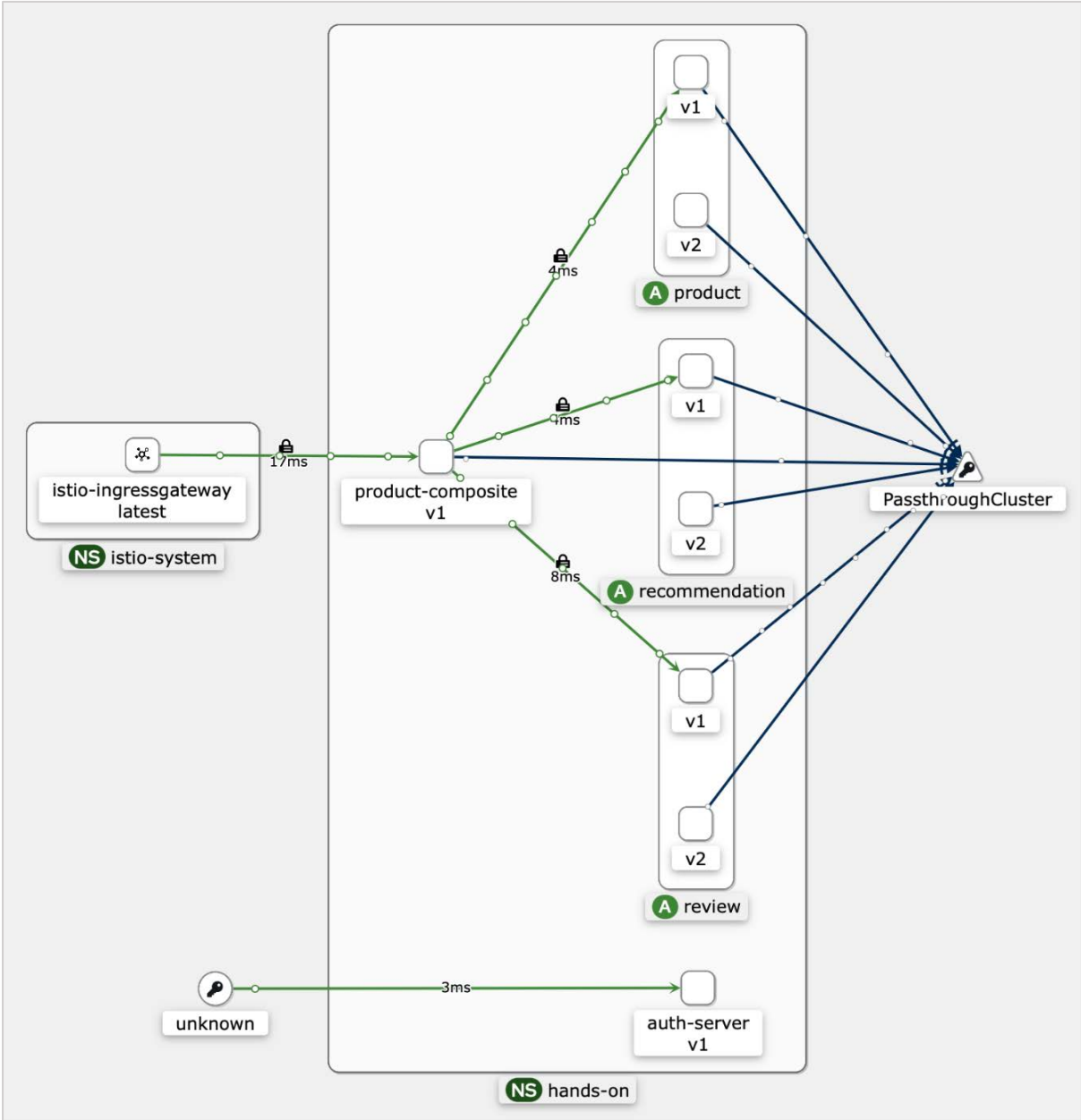
```
bash
HTTP/1.1 200 0.03 secs: 771 bytes ==> GET /product-composite/1
HTTP/1.1 200 1.02 secs: 771 bytes ==> GET /product-composite/1
HTTP/1.1 200 0.03 secs: 771 bytes ==> GET /product-composite/1
HTTP/1.1 200 1.05 secs: 771 bytes ==> GET /product-composite/1
HTTP/1.1 200 0.02 secs: 771 bytes ==> GET /product-composite/1
HTTP/1.1 200 0.03 secs: 771 bytes ==> GET /product-composite/1
HTTP/1.1 200 0.01 secs: 771 bytes ==> GET /product-composite/1
```

```
bash
{"timestamp":"YYYY-MM-DDT09:54:40.942+00:00","path":"/product-composite/1",
,"status":500,"error":"Internal Server Error","requestId":"183bedda-3201",
,"message":"Did not observe any item or terminal signal within 2000ms in
'onErrorResume' (and no fallback has been configured)"}
real 0m2.038s
```

```
bash
{"productId":1,"name":"Fallback product1",...}
real    0m0.236s
$
```

```
bash
NAME                READY   STATUS    RESTARTS   AGE
auth-server-78c4d44b55-ml2rg    2/2     Running   0           47s
product-composite-546597978c-j2cdc 2/2     Running   0           47s
product-v1-76dd48574-hlfgt      2/2     Running   0           47s
product-v2-5ff8575567-s6j2b     2/2     Running   0           47s
recommendation-v1-8fc6456fd-dv92b 2/2     Running   0           47s
recommendation-v2-655b4c4cc7-l7jxz 2/2     Running   0           47s
review-v1-5f5f74b49d-bpprh      2/2     Running   0           47s
review-v2-5d86f74c6f-f7rgm      2/2     Running   0           47s
$
```

```
bash
Start Tests: Wed MMM DD 10:07:21 CEST YYYY
...
Wait for: curl -k https://health.minikube.me/actuator/health...
DONE, continues...
...
Test OK (HTTP Code: 200)
...
End, all tests OK: Wed MMM DD 10:07:48 CEST YYYY
$
```

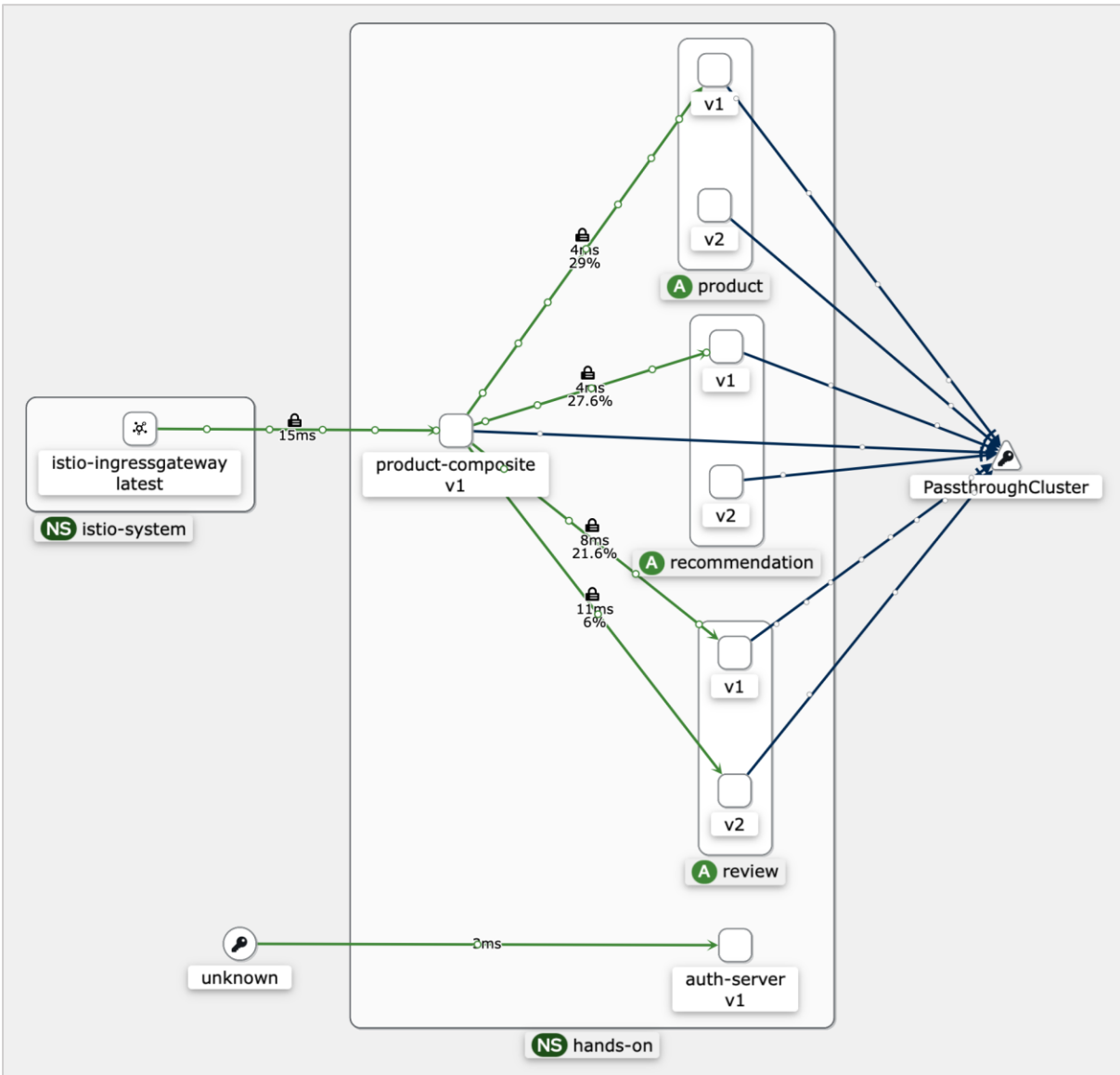


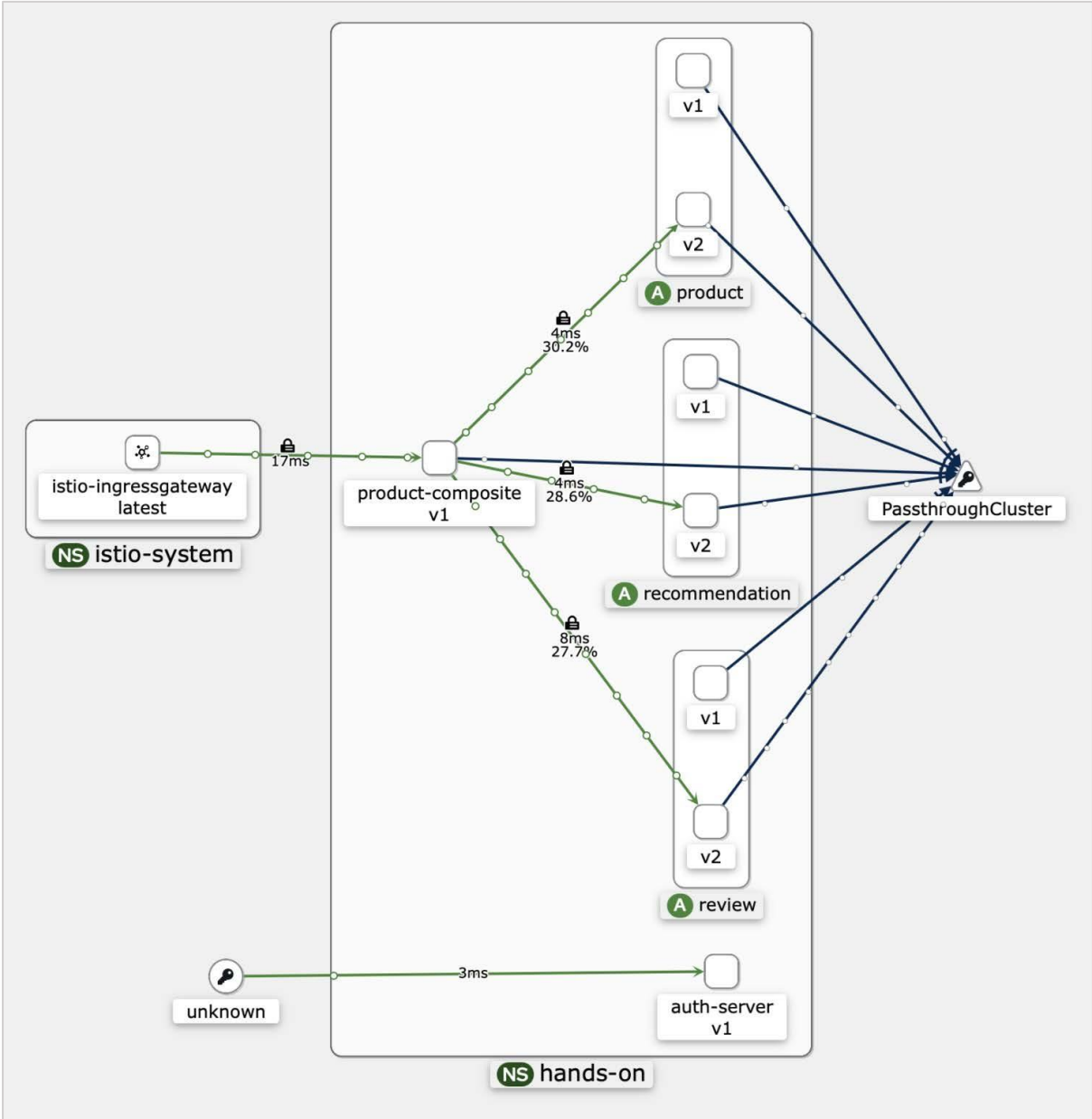
```

bash
{
  "cmp": "product-composite-546597978c-j2cdc/10.244.0.26:80",
  "pro": "product-v1-76dd48574-hlfgt/10.244.0.28:80",
  "rev": "review-v1-5f5f74b49d-bpprh/10.244.0.29:80",
  "rec": "recommendation-v1-8fc6456fd-dv92b/10.244.0.30:80"
}
$

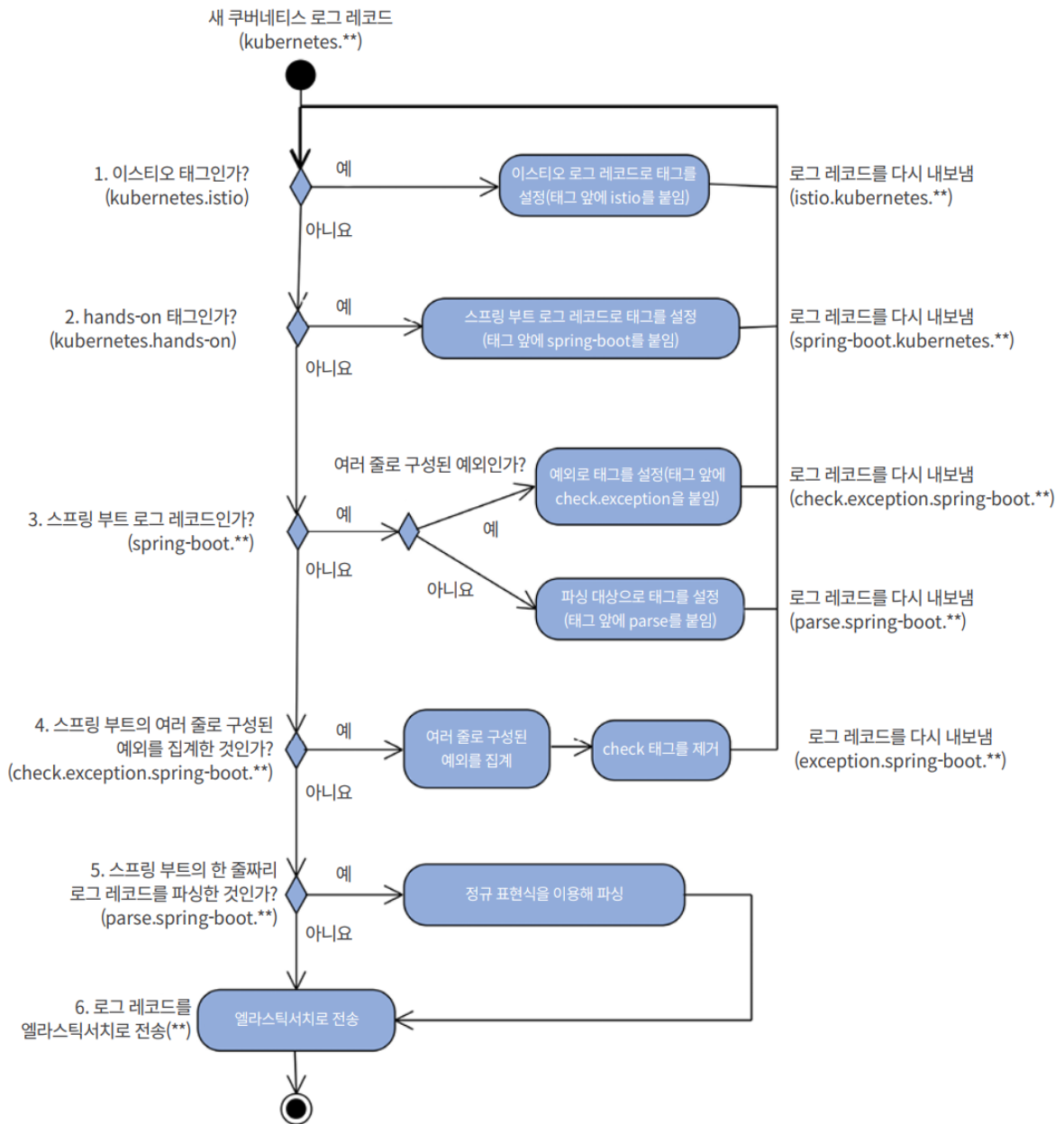
```

```
bash
{
"cmp": "product-composite-546597978c-j2cdc/10.244.0.26:80",
"pro": "product-v2-5ff8575567-s6j2b/10.244.0.27:80",
"rev": "review-v2-5d86f74c6f-f7rgm/10.244.0.31:80",
"rec": "recommendation-v2-655b4c4cc7-l7jxz/10.244.0.33:80"
}
$
```

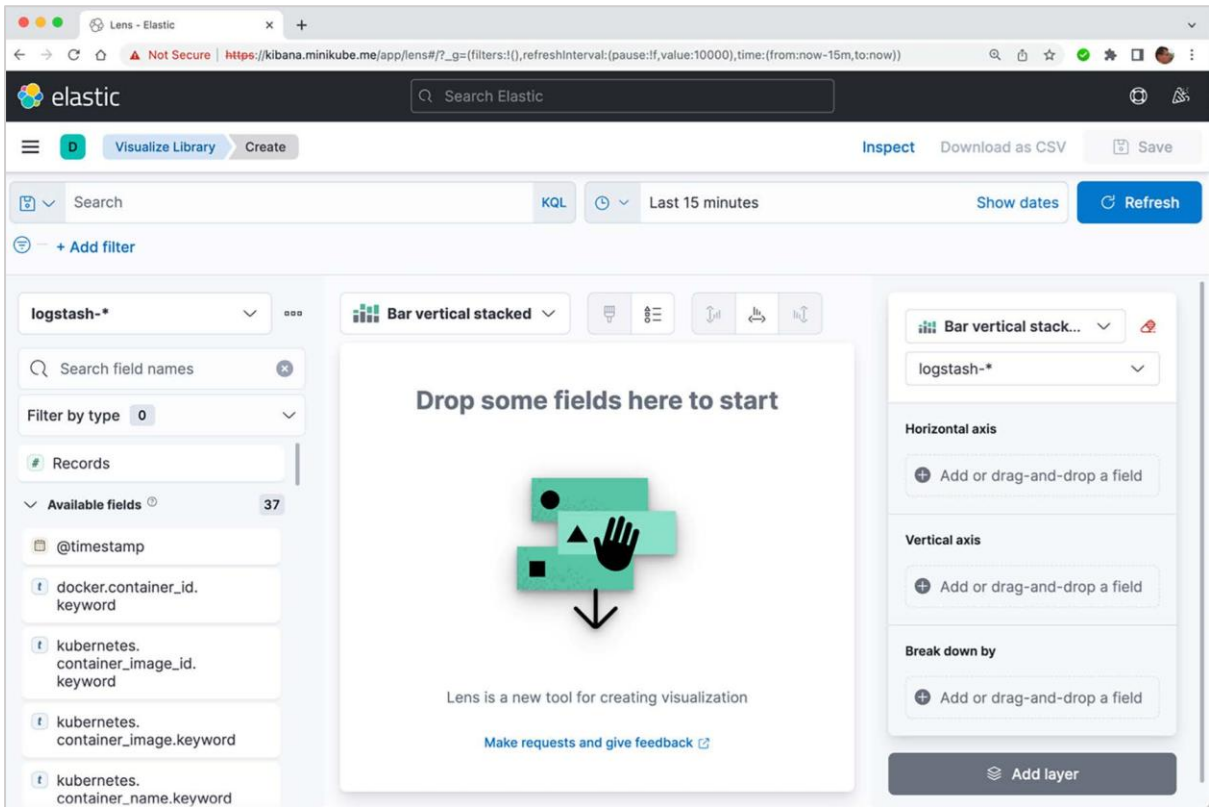


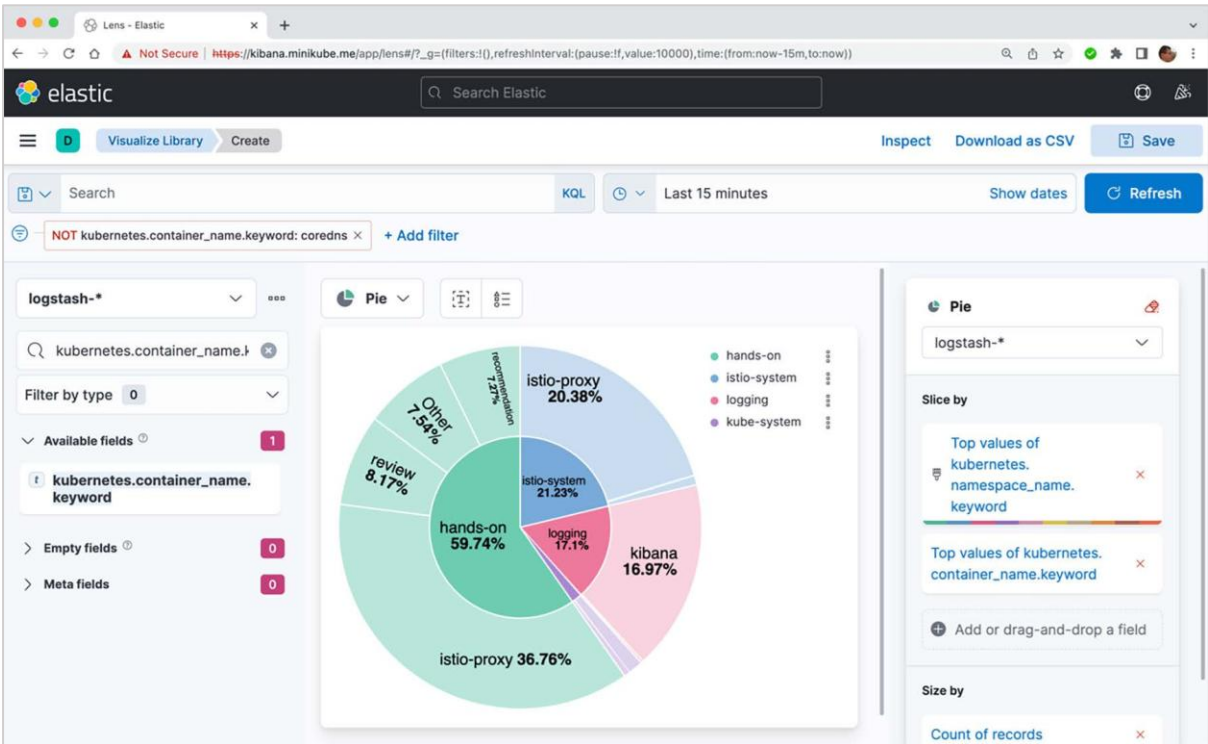
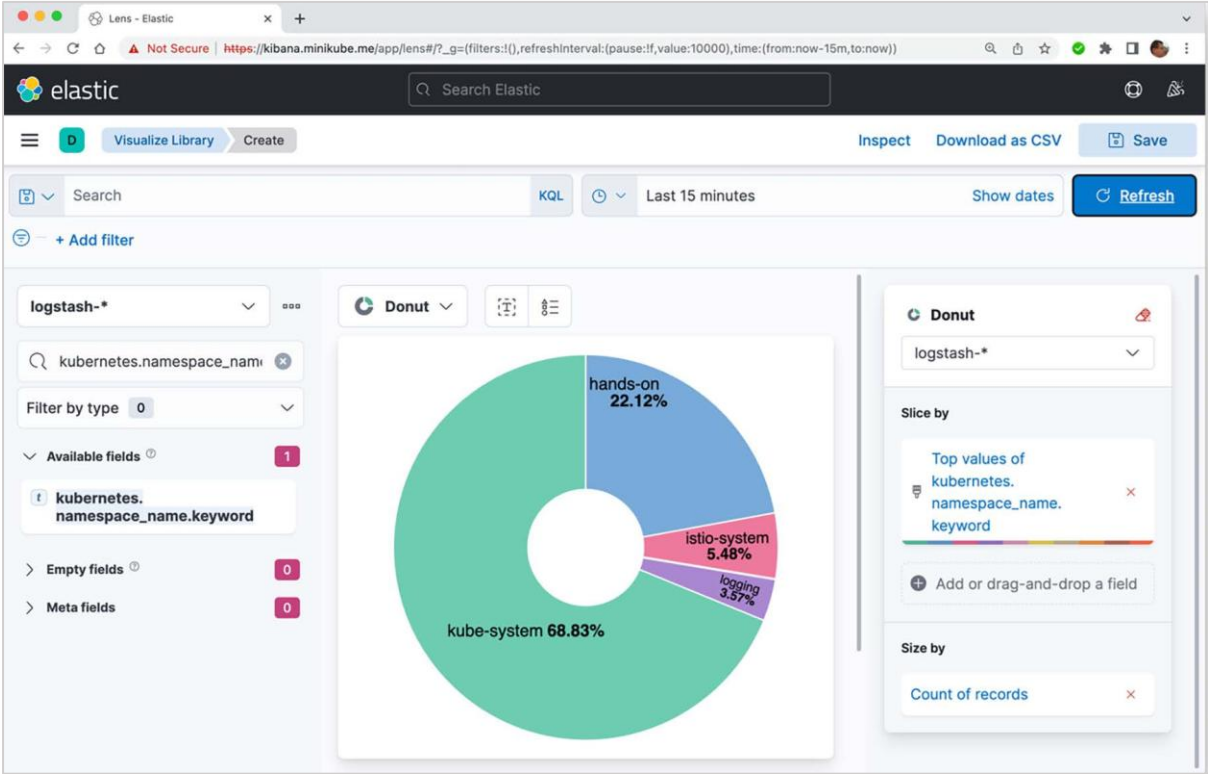


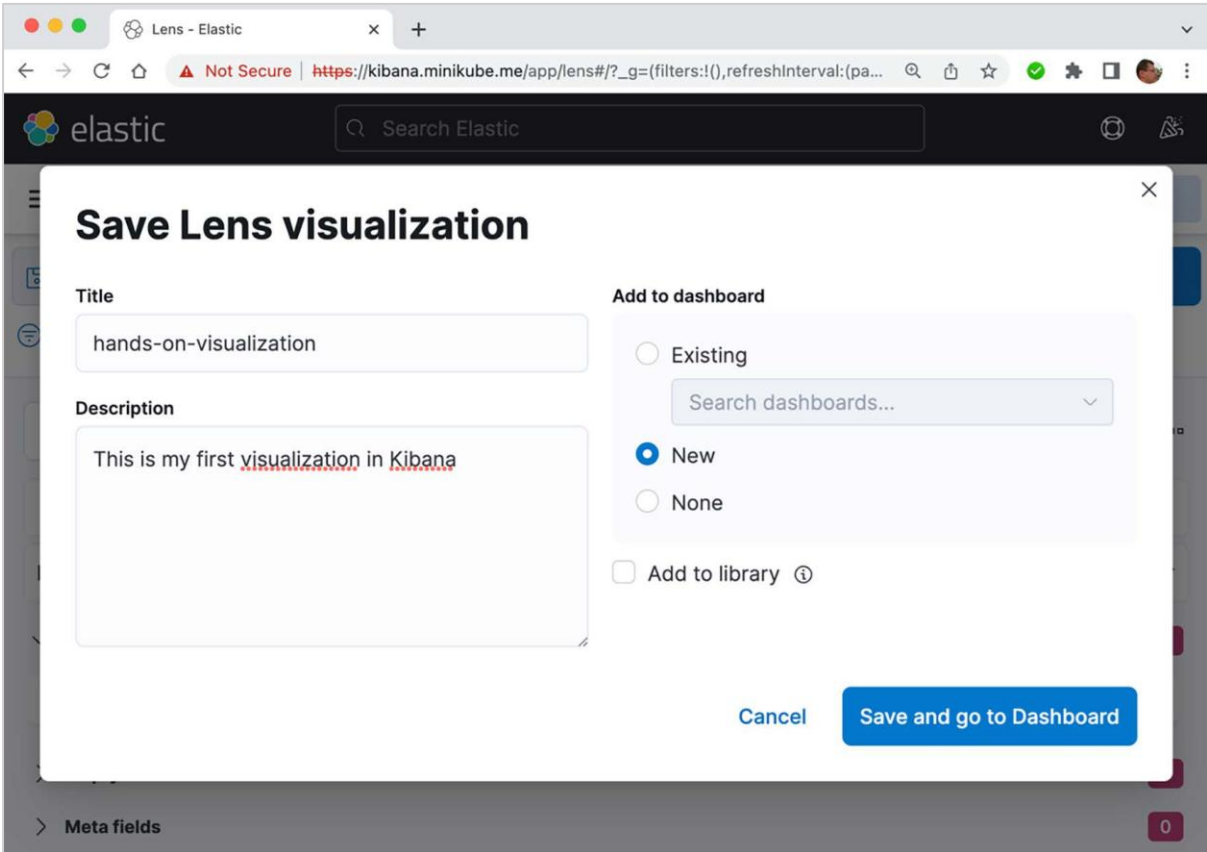
# 19장: EFK 스택을 활용한 중앙 집중식 로깅

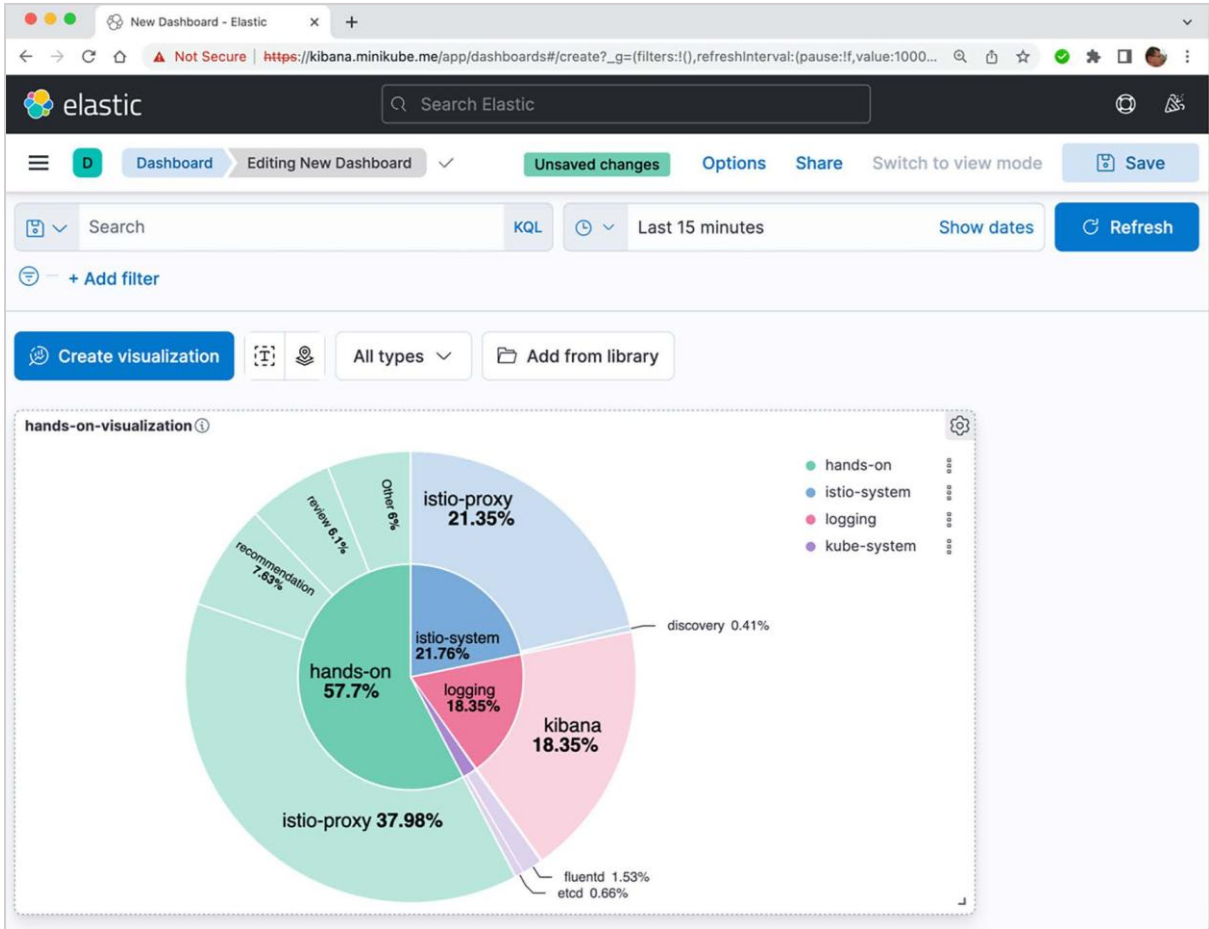


```
Start Tests: Thu MMM DD 09:27:34 CEST YYYY
...
Wait for: curl -k https://health.minikube.me/actuator/health...
DONE, continues...
...
Test OK (HTTP Code: 200)
...
End, all tests OK: Thu MMM DD 09:28:01 CEST YYYY
$
```





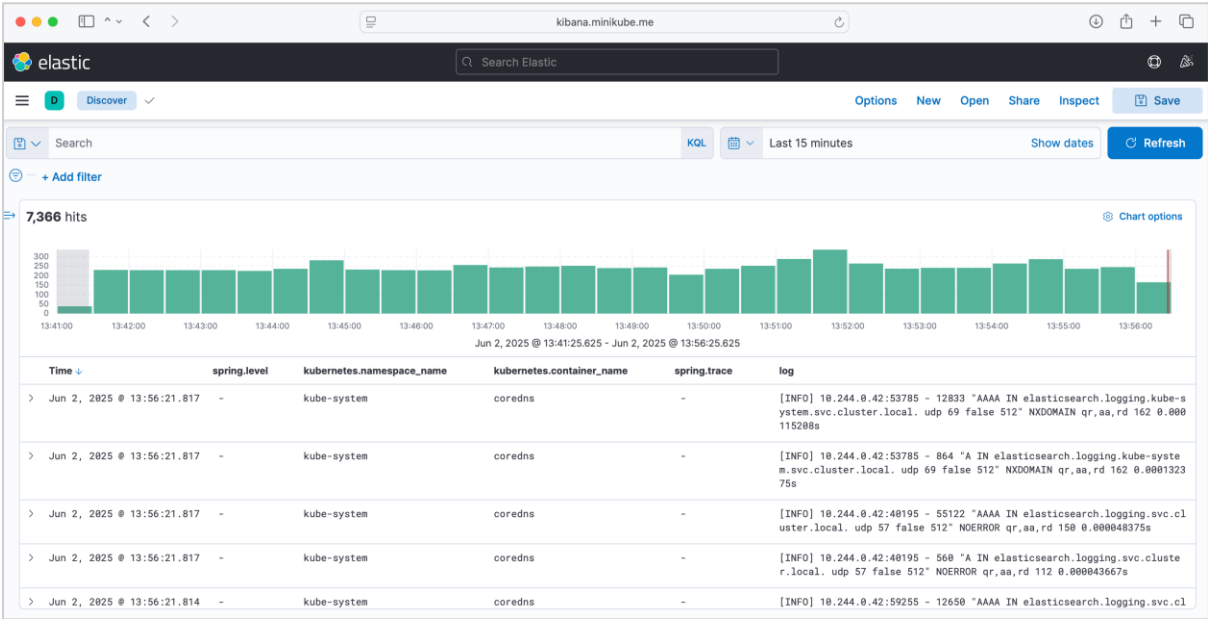
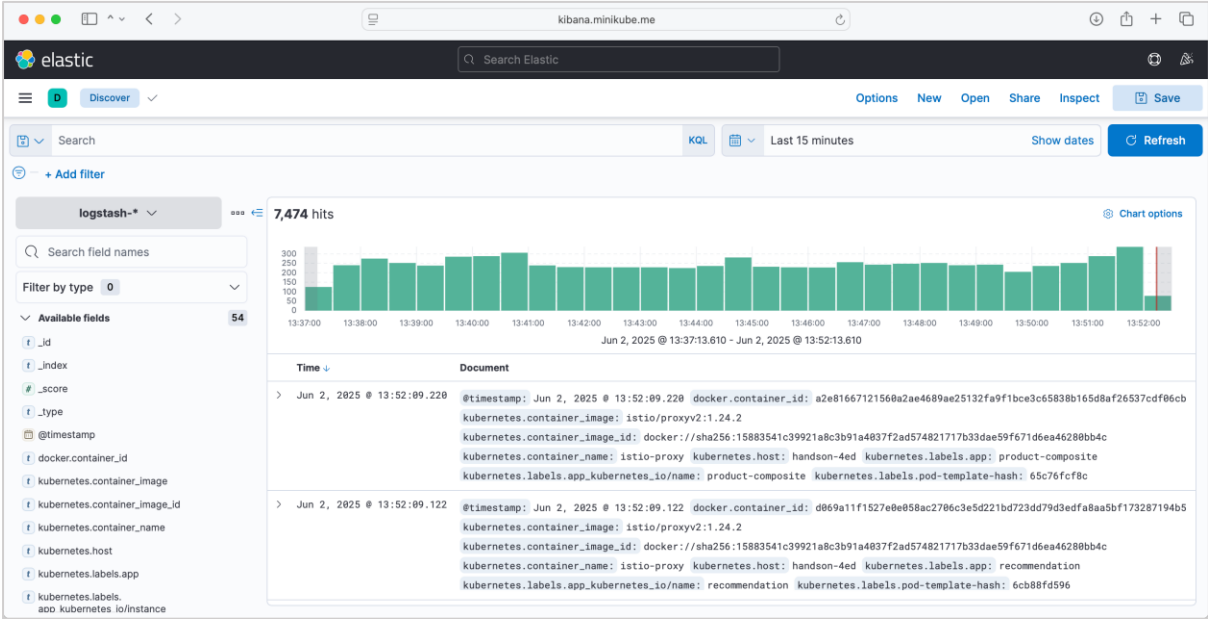


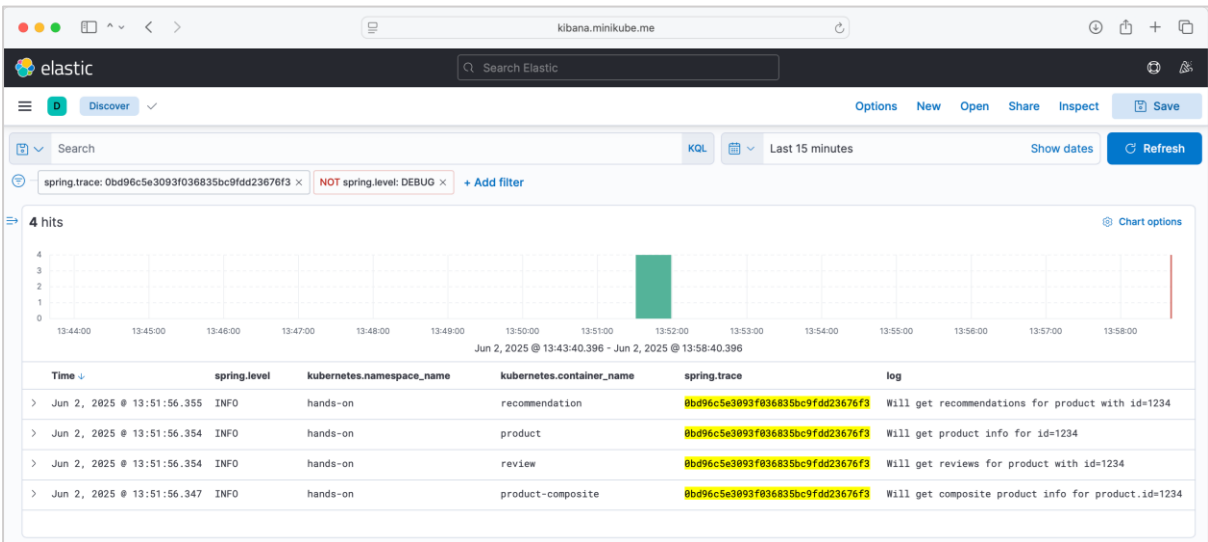
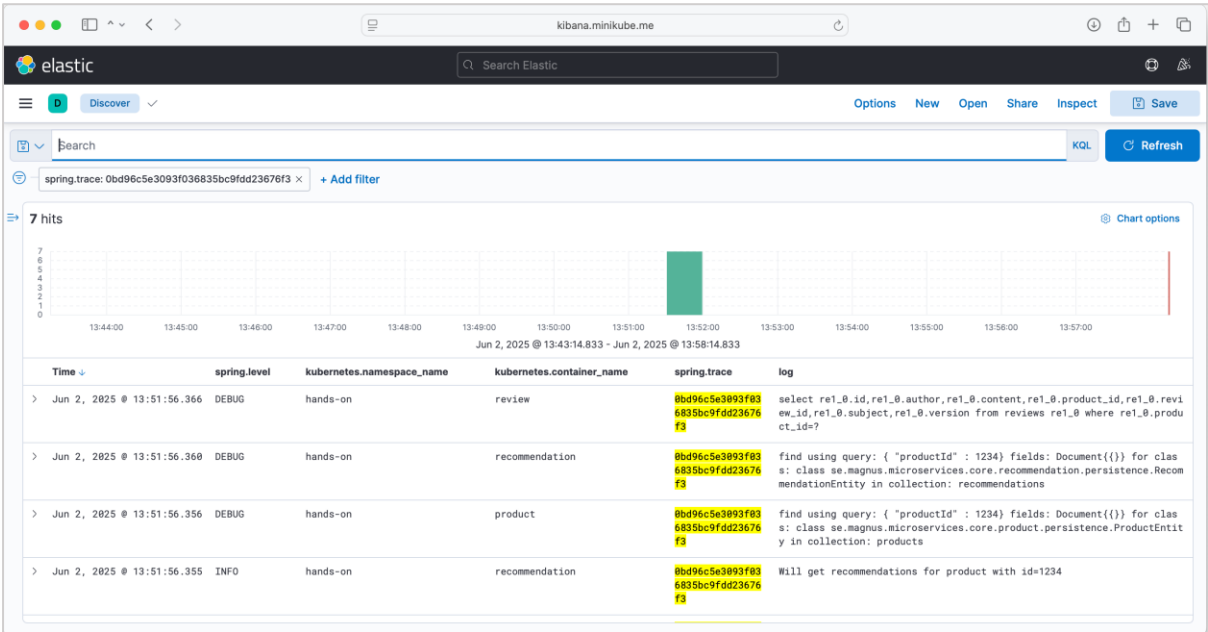
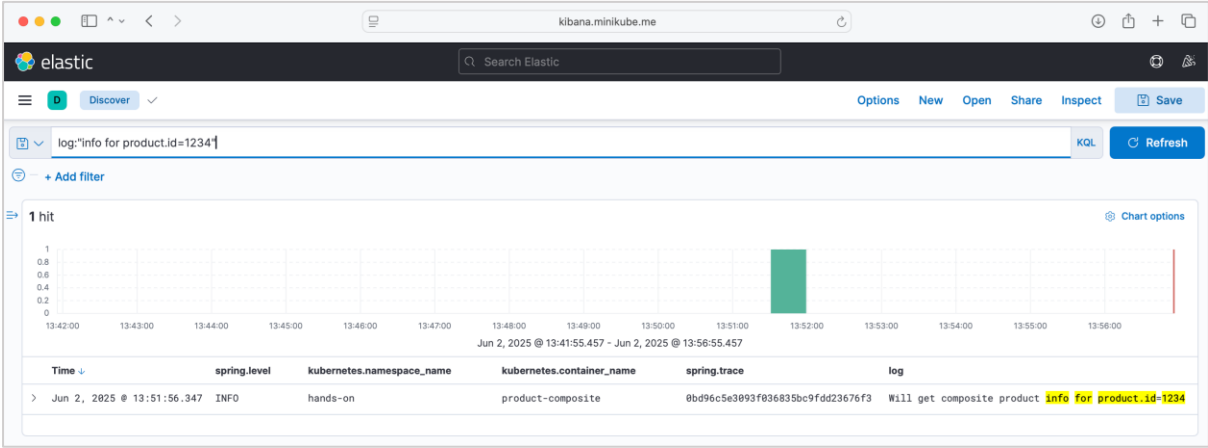


```

bash
{
  "productId": 1234,
  "name": "product name 1234",
  "weight": 1234,
  "recommendations": [],
  "reviews": [],
  "serviceAddresses": {
    "cmp": "product-composite-59fb54568c-p8kzd/10.244.0.166:80",
    "pro": "product-5454d77458-9b565/10.244.0.156:80",
    "rev": "",
    "rec": ""
  }
}
$

```





```
bash (bash)
{
  "timestamp": "2025-05-13T17:41:35.534+00:00",
  "path": "/product-composite/1234",
  "status": 500,
  "error": "Internal Server Error",
  "requestId": "2bffd47-819",
  "message": "500 Internal Server Error from GET
http://product/product/1234"
}
```

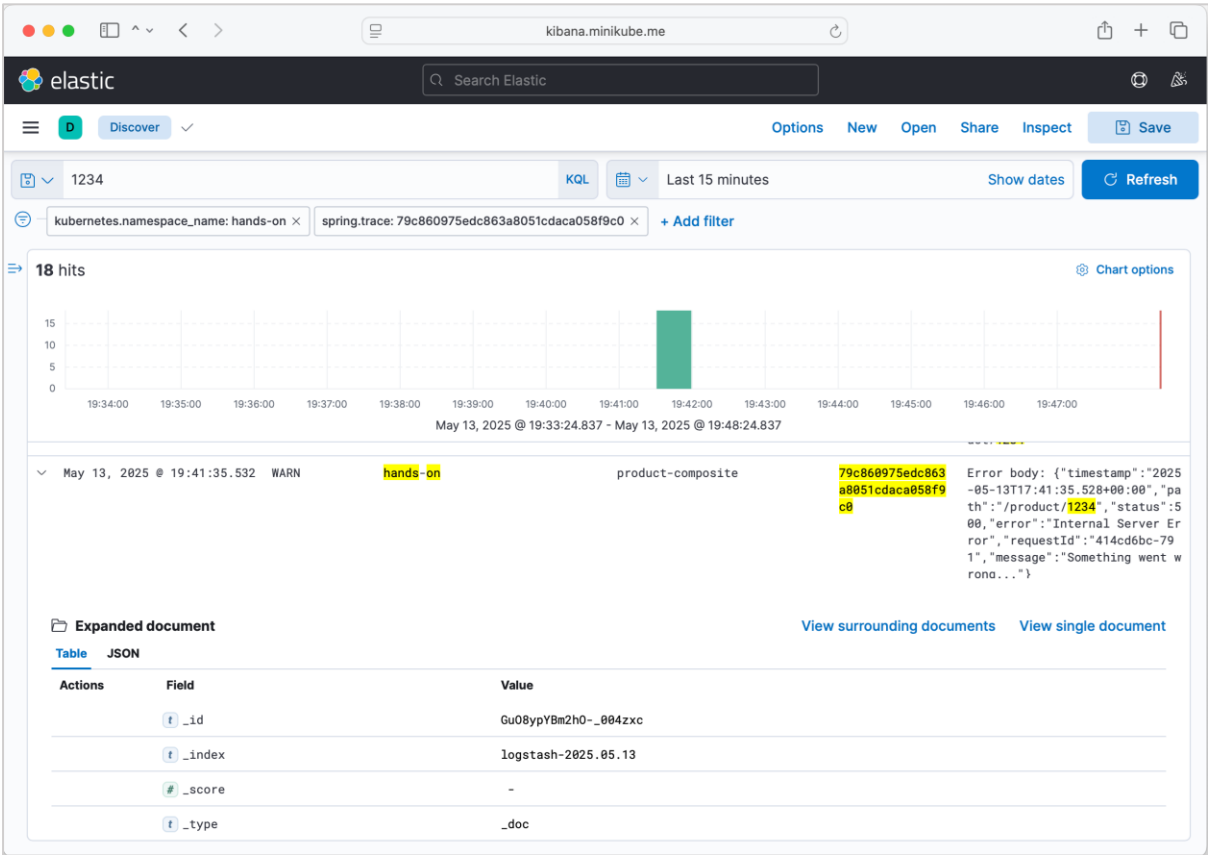
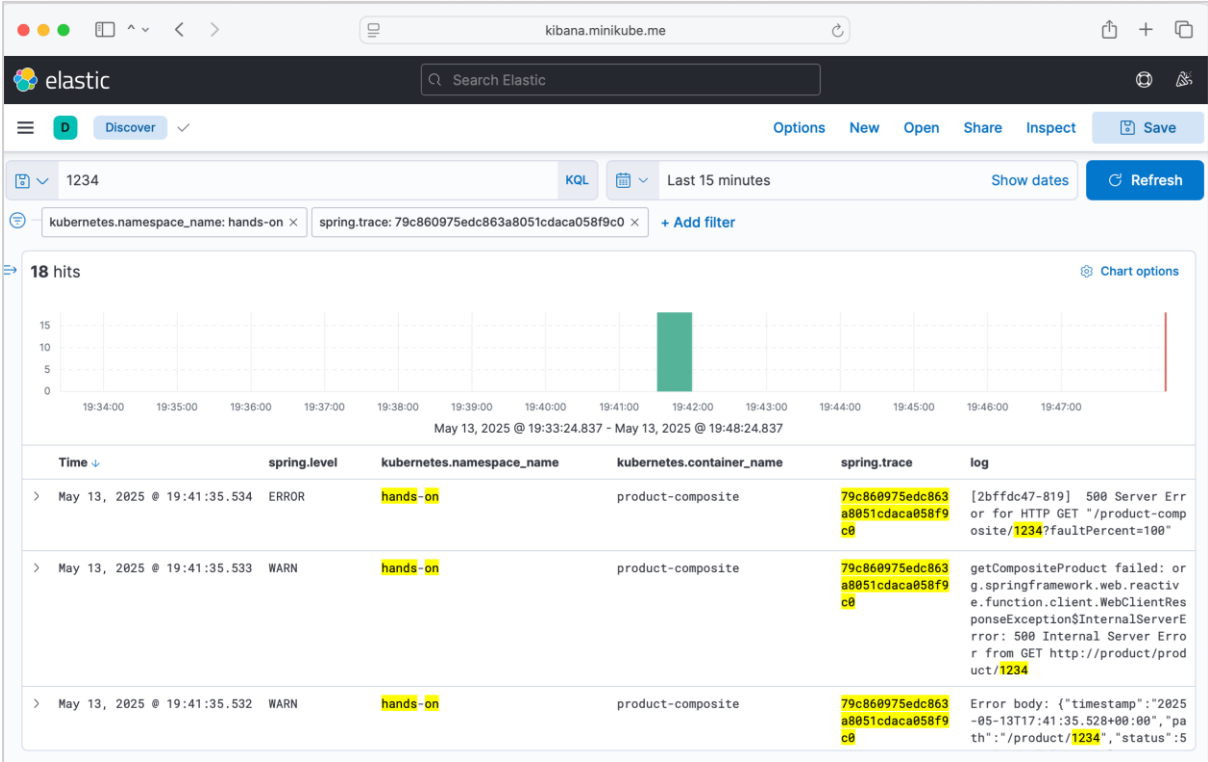
elastic kibana.minikube.me

Discover 1234

kubernetes.namespace\_name: hands-on × spring.level: WARN × + Add filter

4 hits

Time ↓	spring.level	kubernetes.namespace_name	kubernetes.container_name	spring.trace	log
May 13, 2025 @ 19:41:35.533	WARN	hands-on	product-composite	79c860975edc863a8051cdaca058f9c0	getCompositeProduct failed: org.springframework.web.reactive.function.client.WebClientResponseException\$InternalServerError: 500 Internal Server Error from GET http://product/product/1234
May 13, 2025 @ 19:41:35.532	WARN	hands-on	product-composite	79c860975edc863a8051cdaca058f9c0	Error body: {"timestamp": "2025-05-13T17:41:35.528+00:00", "path": "/product/1234", "status": 500, "error": "Internal Server Error", "requestId": "414cd6bc-791", "message": "Something went wrong..."}



Time	Level	Source	Target	Message	
May 13, 2025 @ 19:41:35.532	WARN	hands-on	product-composite	79c86e975edc863a8051cdaca058f9c0	Internal Server Error: 500 Internal Server Error from GET http://product/product/1234
May 13, 2025 @ 19:41:35.532	WARN	hands-on	product-composite	79c86e975edc863a8051cdaca058f9c0	Error body: {"timestamp":"2025-05-13T17:41:35.528+00:00","path":"/product/1234","status":500,"error":{"Internal Server Error","requestId":"414cd6bc-791","message":"Something went wrong..."}}
May 13, 2025 @ 19:41:35.530	-	hands-on	product	-	Got an unexpected HTTP error: 500 INTERNAL_SERVER_ERROR, will rethrow it
May 13, 2025 @ 19:41:35.530	-	hands-on	product	-	java.lang.RuntimeException: Something went wrong... at se.magnus.microservices.core.product.services.ProductServiceImpl.throwErrorIfBadLuck(ProductServiceImpl.java:102) ~[classes/:1.0.0-SNAPSHOT] at se.magnus.microservices.core.product.services.ProductServiceImpl.throwErrorIfBadLuck(ProductServiceImpl.java:102) ~[classes/:1.0.0-SNA
May 13, 2025 @ 19:41:35.530	-	hands-on	product	-	
May 13, 2025 @ 19:41:35.529	ERROR	hands-on	product	79c86e975edc863a8051cdaca058f9c0	[414cd6bc-791] 500 Server Error for HTTP GET "/product/1234?delay=0&faultPercent=100"
May 13, 2025 @ 19:41:35.528	INFO	hands-on	product	79c86e975edc863a8051cdaca058f9c0	Bad Luck, an error occurred, 100 >= 75
May 13, 2025 @ 19:41:35.526	DEBUG	hands-on	product	79c86e975edc863a8051cdaca058f9c0	find using query: { "productId" : 1234} fields: Document({}) for class: class se.magnus.microservices.core.product.persistence.ProductEntity in collection: products
May 13, 2025 @ 19:41:35.525	INFO	hands-on	product	79c86e975edc863a8051cdaca058f9c0	Will get product info for id=1234

Discover - Elastic

Not Secure | https://kibana.minikube.me/app/discover/#/?\_g=(filters:!),refreshln...

elastic Search Elastic

Discover Options New Open Share Inspect Save


Search KQL Last 30 days Show dates Refresh

spring.level: INFO x NOT kubernetes.namespace\_name: hands-on x + Add filter

## No results match your search criteria

**Expand your time range**  
Try searching over a longer period of time.

**Adjust your filters**  
Try removing or temporarily disabling filters.



Discover - Elastic

Not Secure | https://kibana.minikube.me/app/discover#/?\_g=(filters:!),refreshInterval:(...)

elastic Search Elastic

Discover Options New Open Share Inspect Save

Search KQL Last 1 hour Show dates Refresh

kubernetes.namespace\_name: hands-on x spring.level: INFO x + Add filter

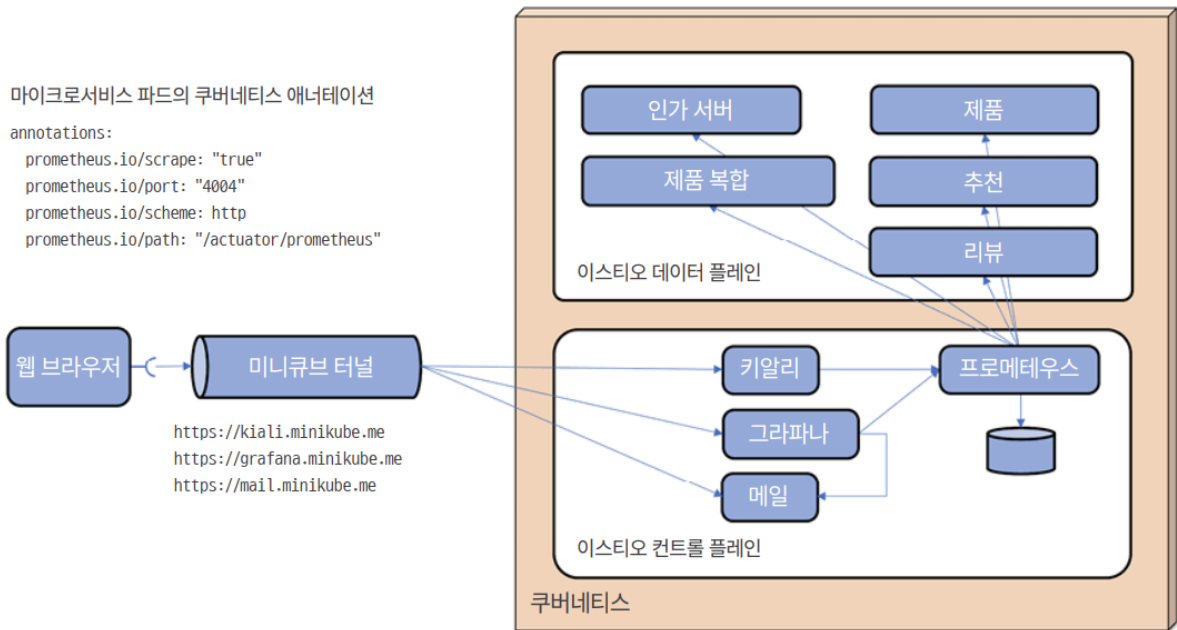
9 hits Chart options

log	Will get composite product info for product.id=1234
spring.class	s.m.m.c.p.s.ProductCompositeServiceImpl
spring.level	INFO
spring.pid	1
spring.service	product-composite
spring.span	bed8522970670d65
spring.thread	parallel-2
spring.trace	55d35b33a9a539250fc4a8af208fa8ae

Time	spring.level	kubernetes.namespace_name	kubernetes.container_name	spring.trace	log
May 24, 2023 @ 16:44:19.173	WARN	hands-on	product-composite	f4861c653b9238b39dff9b78a0ff69f9	getCompositeProduct failed: se.ma gnus.api.exceptions.InvalidInputE xception: invalid productId: -1

Expanded document View surrounding documents View single document

## 20장: 마이크로서비스 모니터링



```

Start Tests: Sat MMM DD 17:02:59 CEST YYYY
...
Wait for: curl -k https://health.minikube.me/actuator/health...
DONE, continues...
...
Test OK (HTTP Code: 200)
...
End, all tests OK: Sat MMM DD 17:03:26 CEST YYYY
$
  
```

mail.minikube.me

# MailDev

Search...

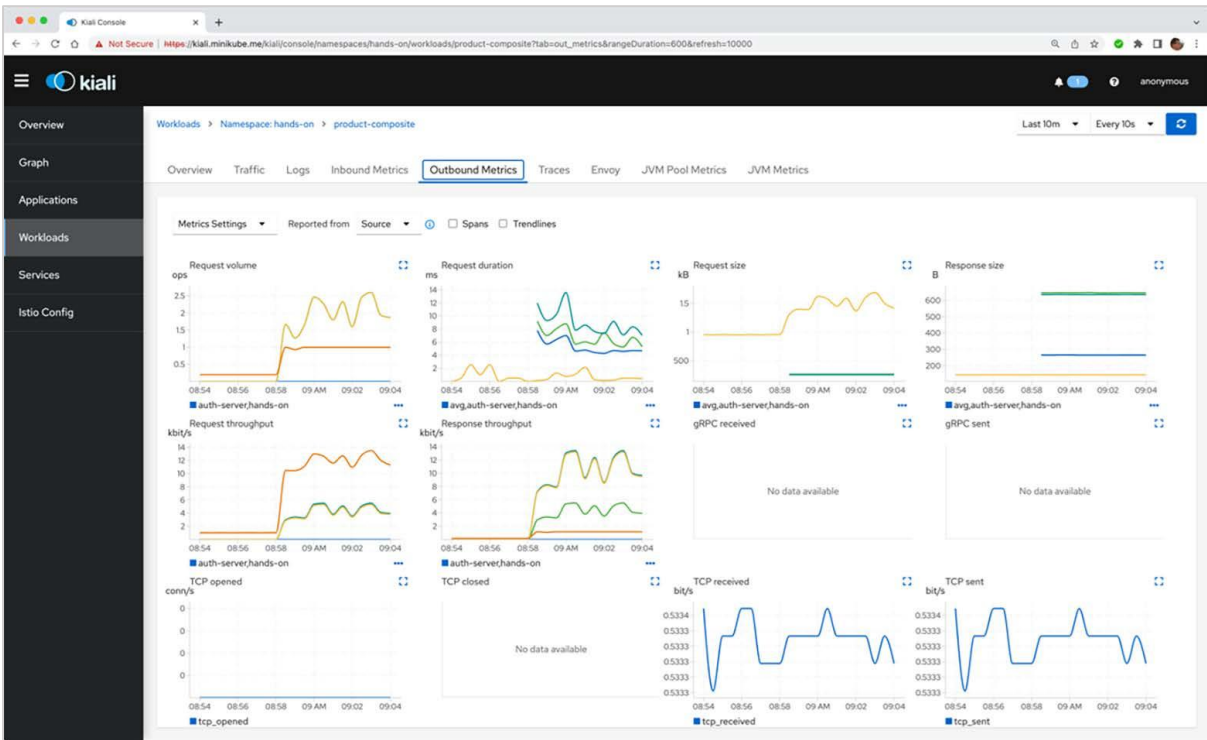
No emails

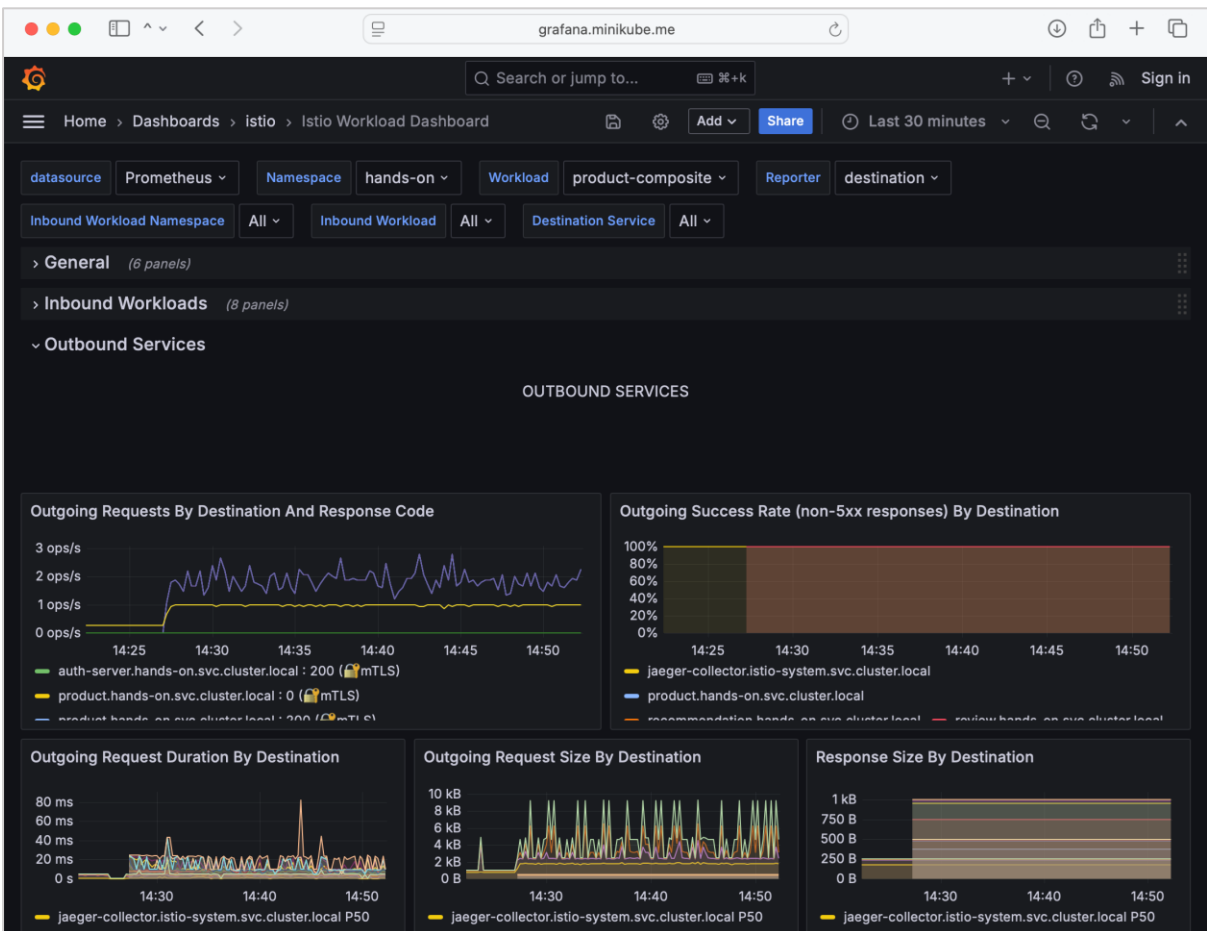
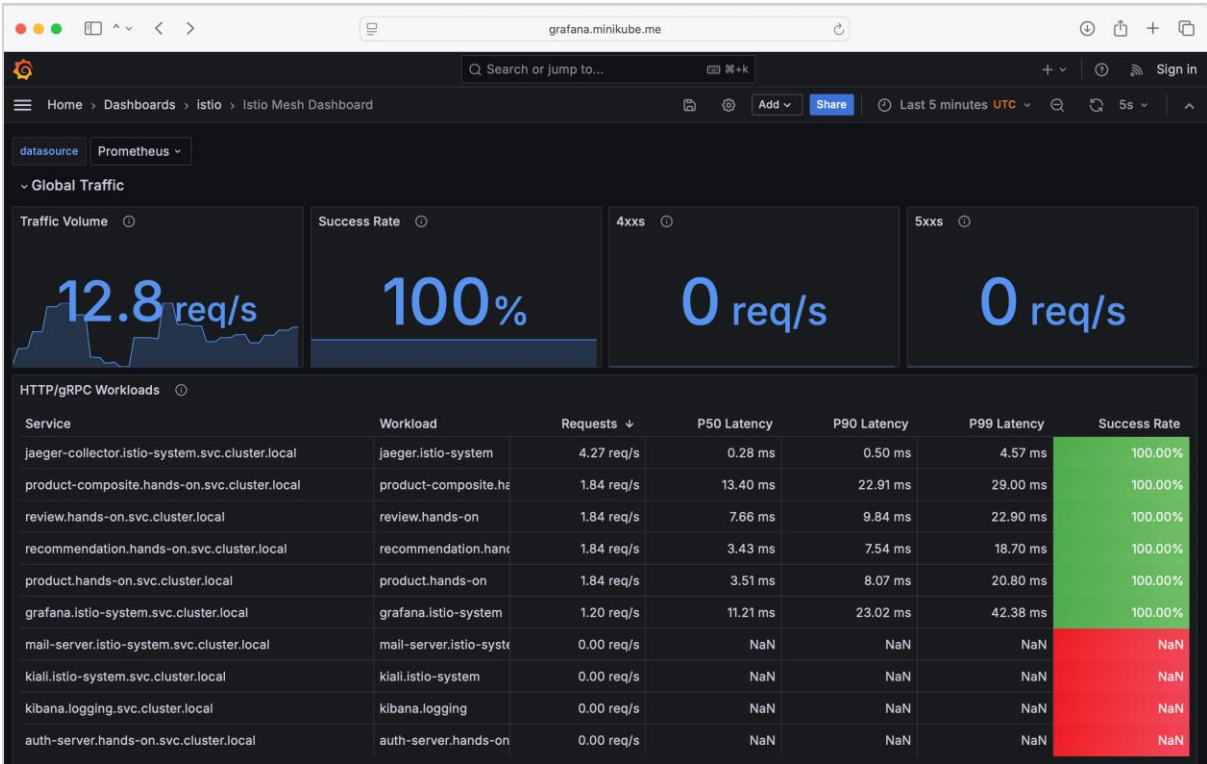
## Now receiving all emails on port 1025

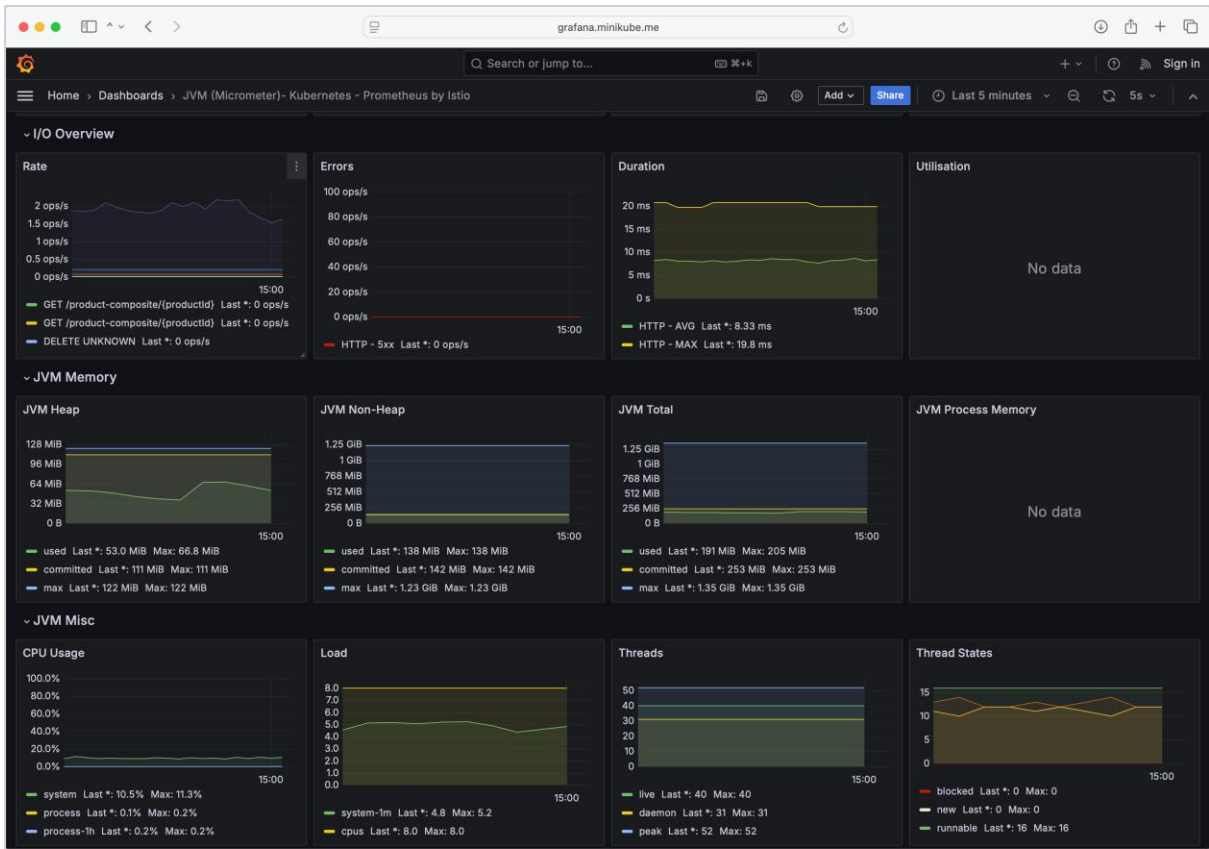
For information on how to send emails from your application, please refer the "[Configure your project](#)" guide.

For questions, feature requests or to report issues visit the [GitHub repository](#).

You are running MailDev 2.0.5



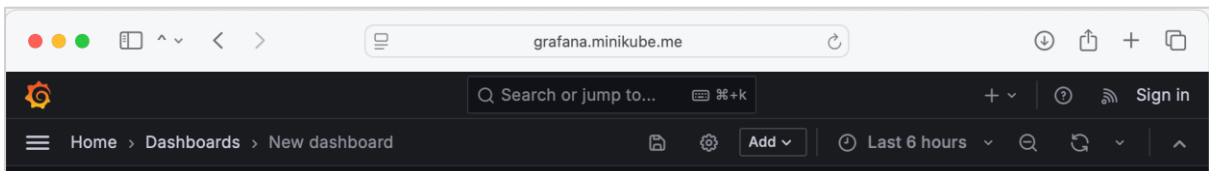




```

...
resilience4j_retry_calls_total{application="product-composite",kind="successful_with_retry",name="product",} 0.0
resilience4j_retry_calls_total{application="product-composite",kind="failed_with_retry",name="product",} 0.0
resilience4j_retry_calls_total{application="product-composite",kind="successful_without_retry",name="product",} 11978.0
resilience4j_retry_calls_total{application="product-composite",kind="failed_without_retry",name="product",} 6.0
...
resilience4j_circuitbreaker_state{application="product-composite",name="product",state="open",} 0.0
resilience4j_circuitbreaker_state{application="product-composite",name="product",state="forced_open",} 0.0
resilience4j_circuitbreaker_state{application="product-composite",name="product",state="half_open",} 0.0
resilience4j_circuitbreaker_state{application="product-composite",name="product",state="closed",} 1.0
...
$

```



▼ A (Prometheus) ? 📄 👁 🗑 ☰

Kick start your query Explain  Run queries Builder Code

Metric: resilience4j\_circuitbreaker\_state ▼ Label filters: state ▼ = ▼ closed ▼ × +

+ Operations

```
resilience4j_circuitbreaker_state{state="closed"}
```

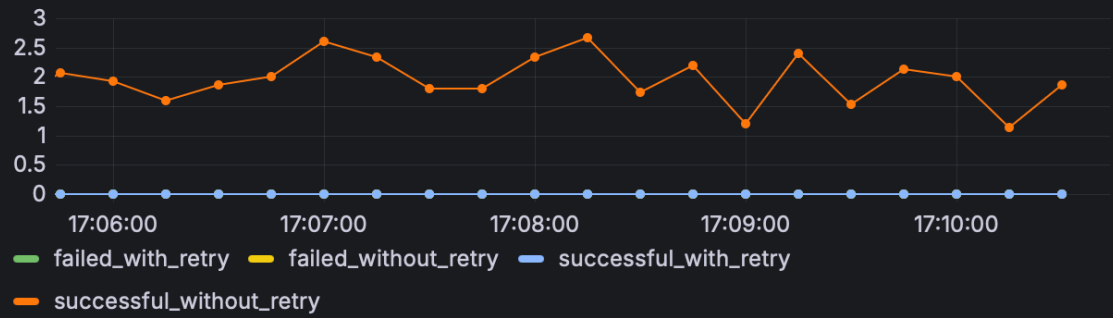
▼ Options

Legend ⓘ Min step ⓘ Format

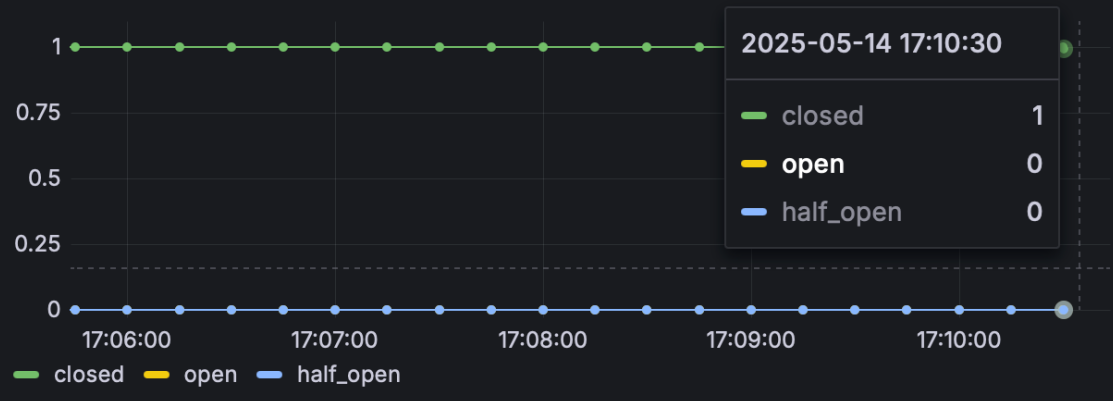
{{state}} auto Time series ▼

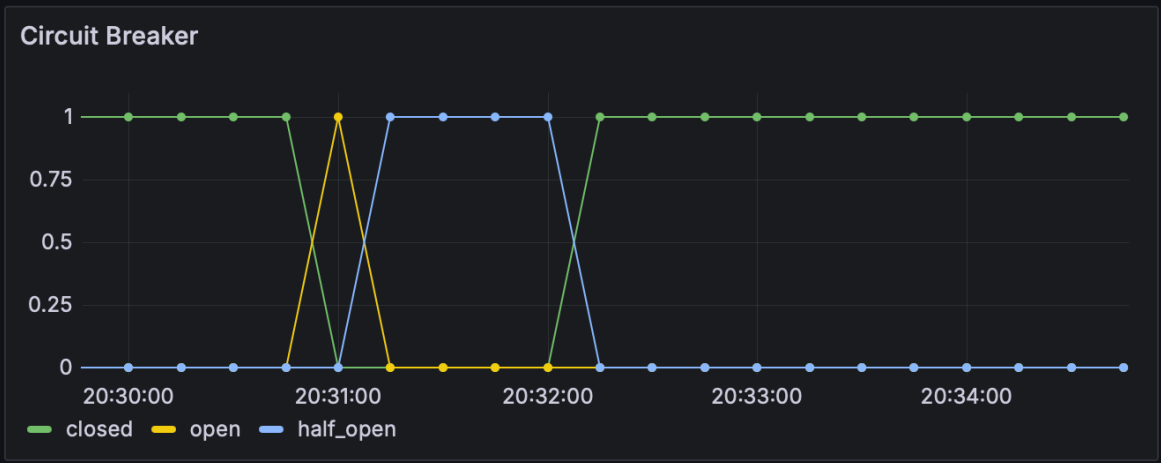
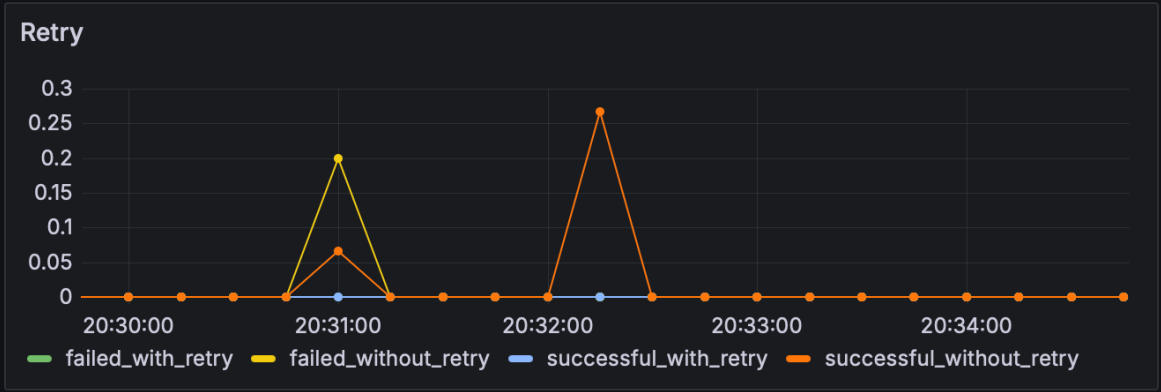
Type: Range Instant Both Exemplars

### Retry



### Circuit Breaker







Search or jump to...

⌘+k

+ v

?

📶

Sign in



Home > Dashbo... > Hands-on...

Share

🕒 v

🔍

🔄

5s v

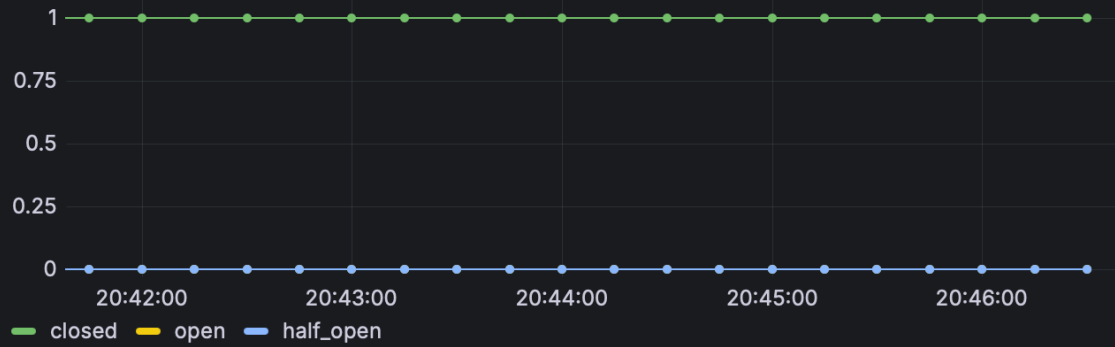
⋮

^

### Retry



### Circuit Breaker



grafana.minikube.me

Search or jump to... %k Sign in

Home > Alerting > Contact points

# Contact points

Alertmanager Grafana

Choose how to notify your contact points when an alert instance fires

## Update contact point

Name \*

grafana-default-email

Integration

Email

Test Duplicate Delete

Addresses

You can enter multiple email addresses using a ";", "\n" or "," separator

magnus@minikube.me

> Optional Email settings

> Notification settings

+ Add contact point integration

Save contact point Cancel

mail.minikube.me


MailDev 1 HTML 100% Download Relay Delete


Search...


[FIRING:1] TestAlert Grafana

To: magnus@minikube.me  
2025-06-06 13:29:25 (+0200)

From: Grafana <grafana@minikube.me>  
To: magnus@minikube.me

 **Grafana**

 **Grouped by**

alertname=TestAlert instance=Grafana  
 **1 firing instances**

Firing TestAlert

## New alert rule

### 1. Enter alert rule name

Enter a name to identify your alert rule.

Name

input: circuit\_breaker\_rule

### 2. Define query and alert condition

Define query and alert condition [Need help?](#)

**A** Prometheus Options 10 minutes Set as alert condition

Kick start your query Explain Run queries Builder Code

Metric: resilience4j\_circuitbreaker\_state

Label filters: state = closed

`resilience4j_circuitbreaker_state{state="closed"}`

### Expressions

Manipulate data returned from queries with math and other operations.

**B** Reduce Set as alert condition

Takes one or more time series returned from a query or an expression and turns each series into a single number.

Input: A

Function: Min

**C** Threshold Alert condition

Takes one or more time series returned from a query or an expression and checks if any of the series match the threshold condition.

Input: B

IS BELOW 0.5

### 3. Set evaluation behavior

Define how the alert rule is evaluated. [Need help?](#)

Folder

Select a folder to store your rule.

rules\_folder

+ New folder

Evaluation group and interval

Define how often the alert rule is evaluated.

evaluation\_group

+ New evaluation group

All rules in the selected group are evaluated every 10s.

Pending period

Period the threshold condition must be met to trigger the alert. Selecting "None" triggers the alert immediately once the condition is met.

0s

None

10s

20s

30s

40s

50s

### 4. Configure labels and notifications

Contact point

grafana-default-email

[View or create contact points](#)

grafana.minikube.me

Search or jump to... %k

Home > Dashboards > Hands-on Dashboard > Edit panel

Discard Save Apply

Table view Fill Actual Last 5 minutes Alert list

### Circuit Breaker alert status

circuit\_breaker\_rule [View alert rule](#)

✓ Normal

> 1 instance

Search options

Datasource  
Filter from alert source  
-- Grafana -- Clear

Folder  
Filter for alerts in the selected folder (only for Grafana alerts)  
rules\_folder

Alert state filter

- Alerting / Firing
- Pending
- No Data
- Normal
- Error



Search or jump to...

⌘+k



Sign in

Home > Dashb... > Hands-o...

Share



5s

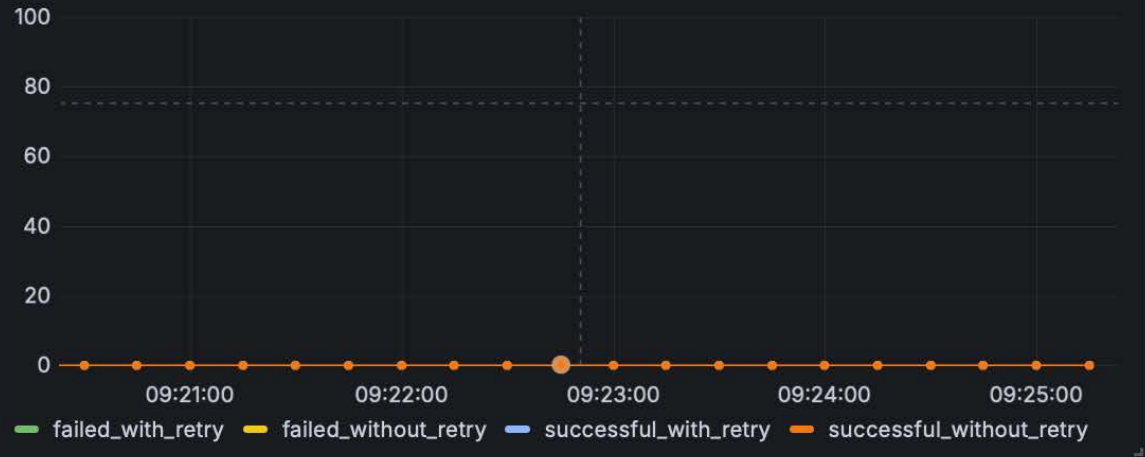


### Circuit Breaker alert status

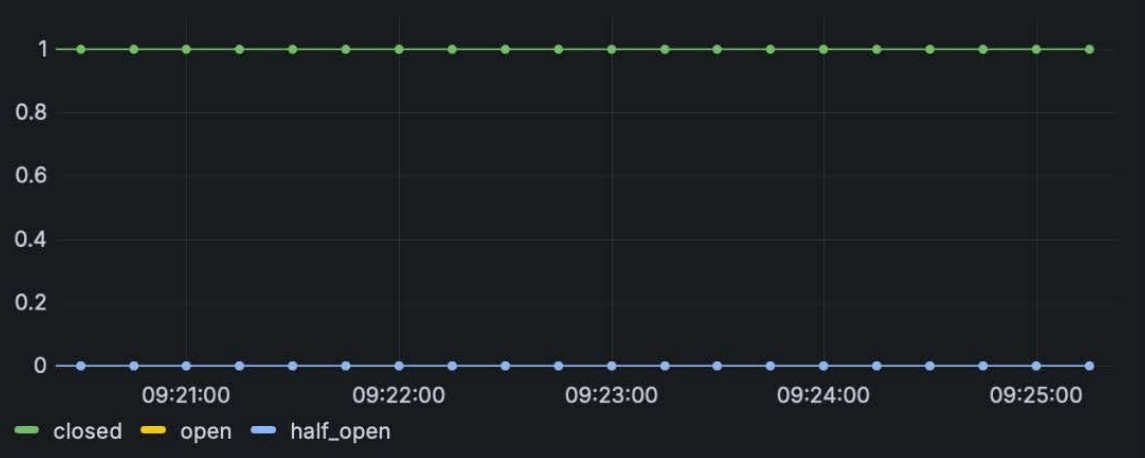
**circuit\_breaker\_rule** [View alert rule](#)

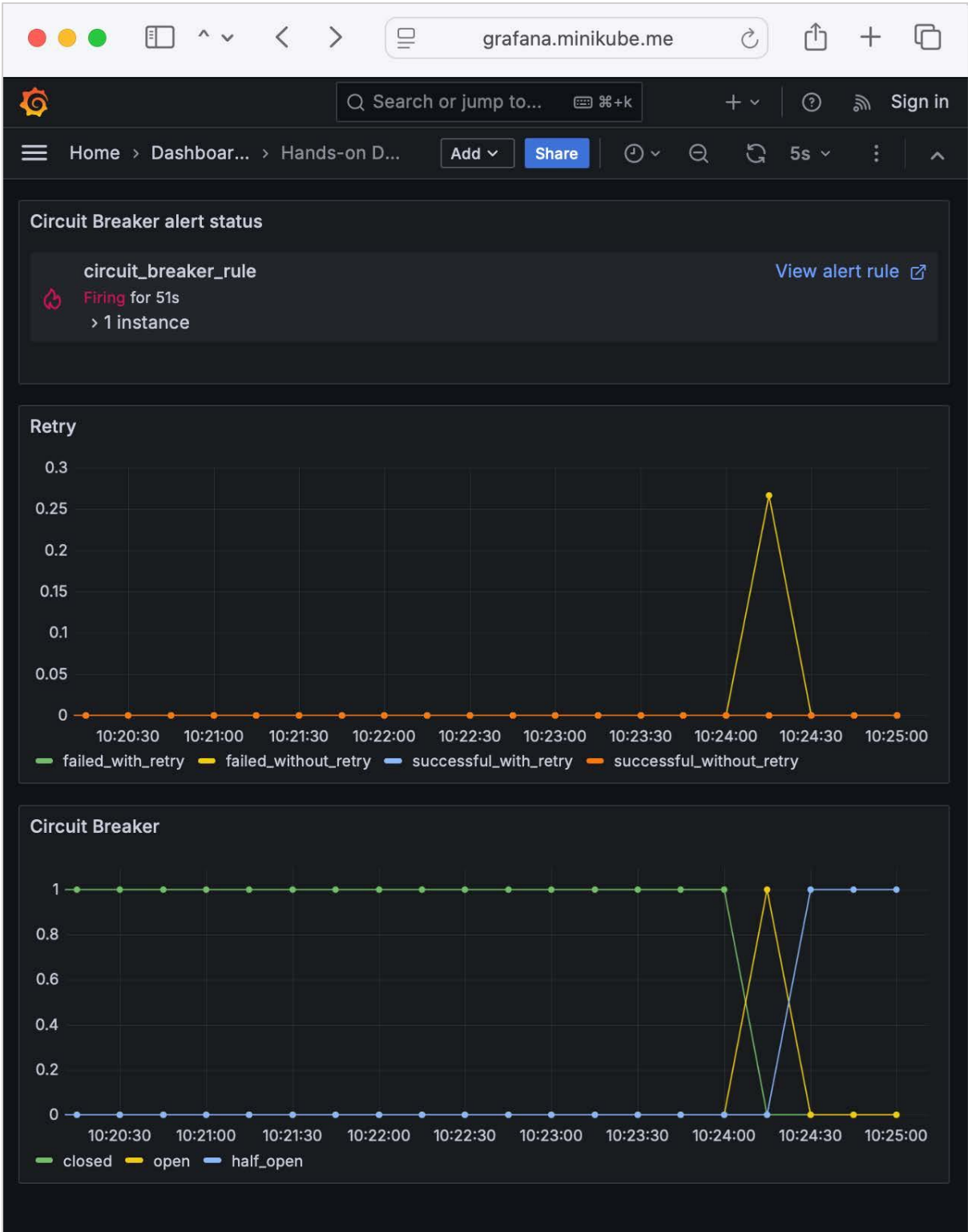
✓ Normal  
> 1 instance

### Retry



### Circuit Breaker





mail.minikube.me


MailDev


MailDev 1 HTML 100% Download Relay Delete


Search...

[FIRING:1] circuit\_breaker\_rule rules\_folder (product-composite product-composite product-composite 10.244.0.25:15020 kubernetes-pods product hands-on handson-4ed product-composite-77c44d55d4-rzkft 77c44d55d4 istio product-composite latest closed latest)

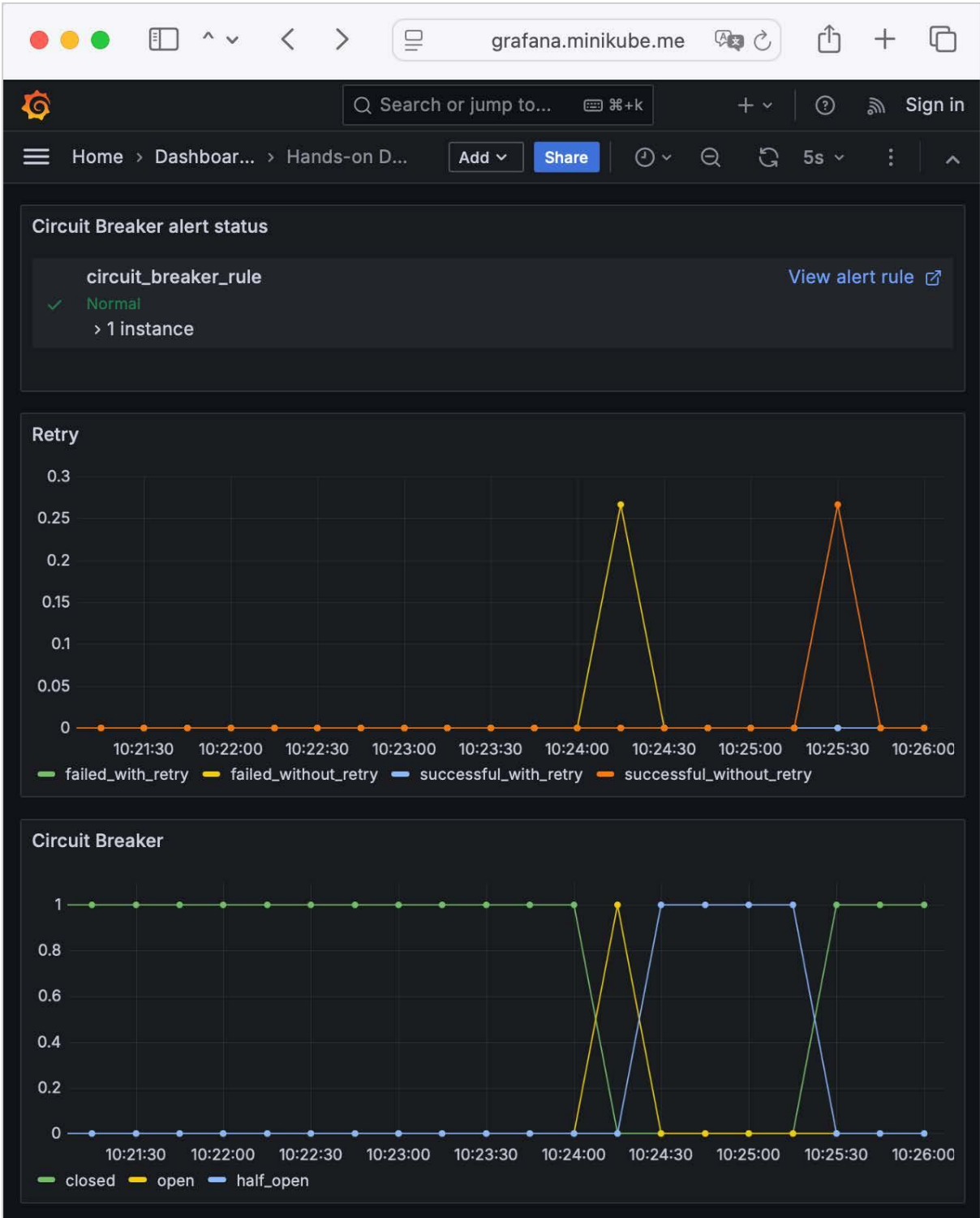
From: Grafana <grafana@minikube.me>  
To: magnus@minikube.me  
2025-06-07 10:24:30 (+0200)

 **Grafana**

 **rules\_folder > circuit\_breaker\_rule**

 **1 firing instances**

Firing	circuit_breaker_rule	<a href="#">View alert</a>
--------	----------------------	----------------------------



mail.minikube.me


MailDev


MailDev 2 HTML 100% Download Relay Delete


Search...

[RESOLVED] circuit\_breaker\_rule rules\_folder (product-composite product-composite product-composite 10.244.0.25:15020 kubernetes-pods product hands-on handson-4ed product-composite-77c44d55d4-rzkft 77c44d55d4 istio product-composite latest closed latest)  
From: Grafana <grafana@minikube.me>  
To: magnus@minikube.me  
2025-06-07 10:25:30 (+0200)

[FIRING:1] circuit\_breaker\_rule rules\_folder (product-composite product-composite product-composite 10.244.0.25:15020 kubernetes-pods product hands-on handson-4ed product-composite-77c44d55d4-rzkft 77c44d55d4 istio product-composite latest closed latest)

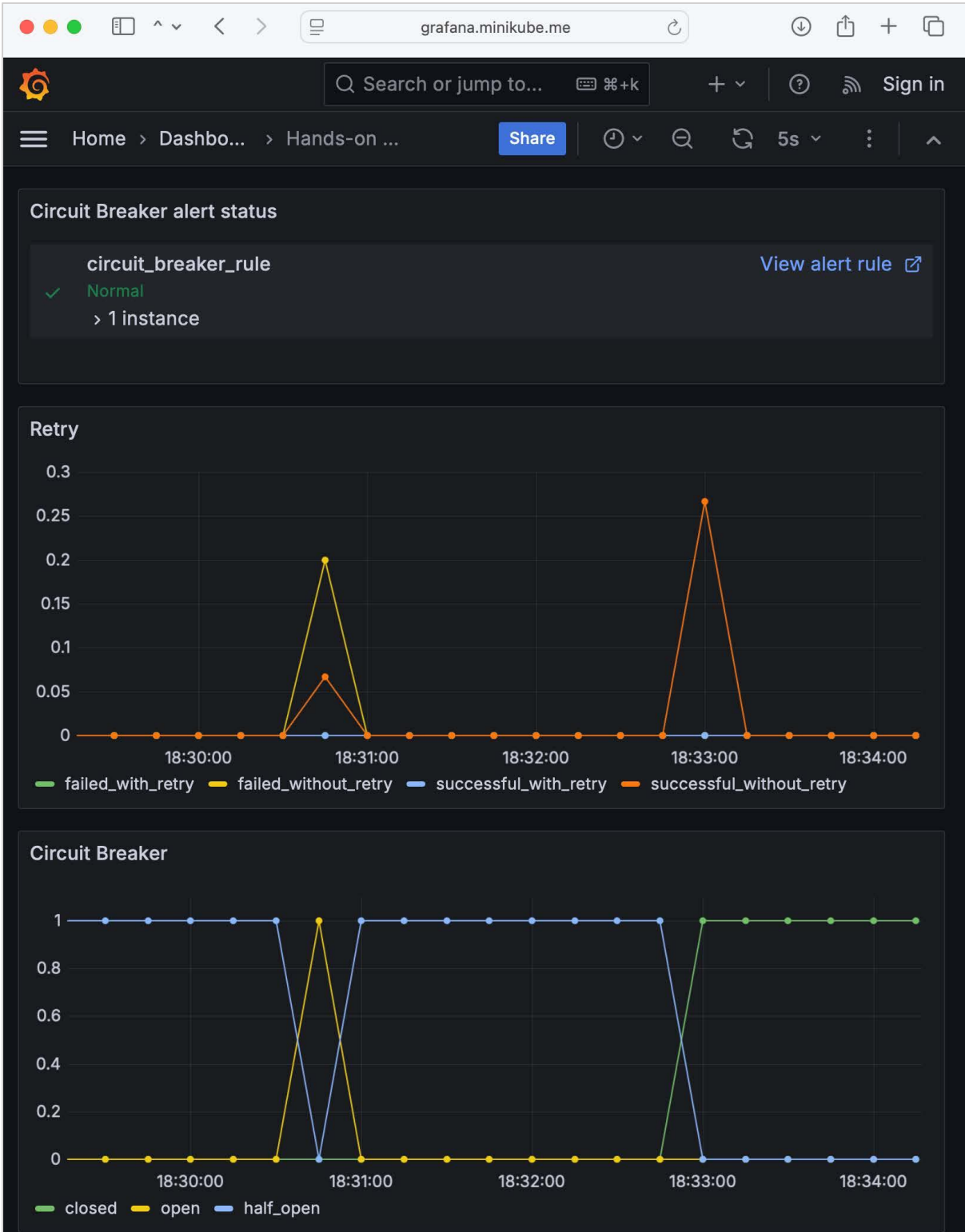
 **Grafana**

 **rules\_folder > circuit\_breaker\_rule**

 **1 resolved instances**

Resolved **circuit\_breaker\_rule** View alert

Open #/email/EkVvedSI on this page in a new tab



## 21장: macOS용 설치 안내

The screenshot shows the Docker Desktop settings window for a personal installation. The 'Resources' section is selected, and the 'Advanced' sub-section is active. The 'Resource Allocation' area displays five sliders for configuring system resources:

- CPU limit:** Set to 8. The slider ranges from 1 to 10.
- Memory limit:** Set to 10 GB. The slider ranges from 1 GB to 64 GB.
- Swap:** Set to 1 GB. The slider ranges from 0 Bytes to 4 GB.
- Disk usage limit:** Set to 104 GB. The slider ranges from 8 GB to 2 TB. A note below states: "Limit to the amount of disk space the engine can use, including overheads."

At the bottom right, there are 'Cancel' and 'Apply & restart' buttons. The status bar at the bottom indicates: 'Engine running | RAM 11.15 GB CPU 12.72% Disk: 80.05 GB used (limit 102.06 GB)'. The user's initials 'M' are visible in the top right corner of the window.

docker:desktop PERSONAL

Settings [Give feedback](#)

- General
- Resources
- Docker Engine
- Builders
- Kubernetes
- Software updates


### General

- Start Docker Desktop when you sign in to your computer
- Open Docker Dashboard when Docker Desktop starts

Choose theme for Docker Desktop

Light  Dark  Use system settings

Configure shell completions

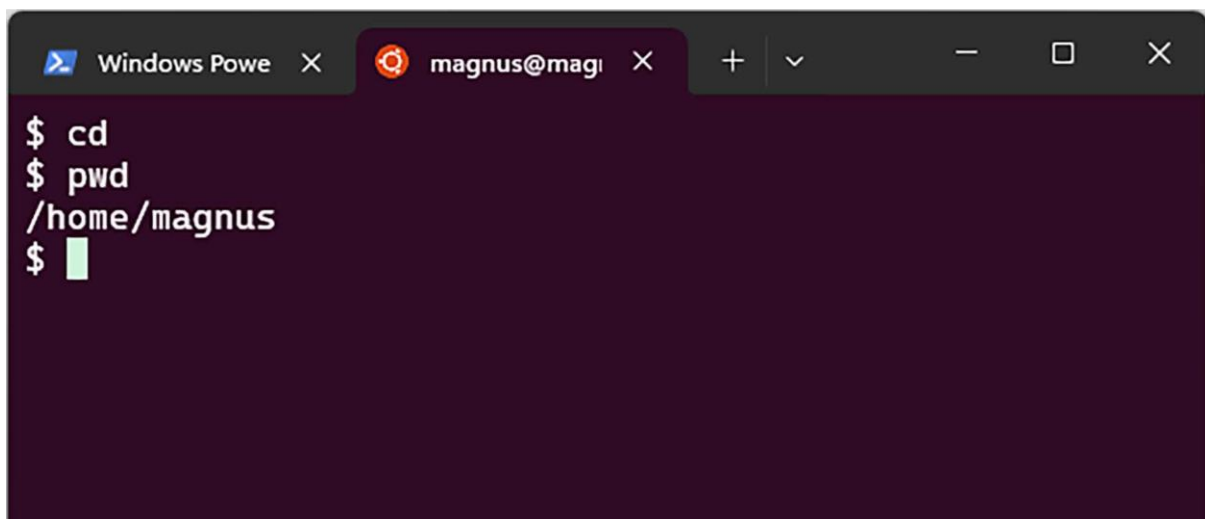
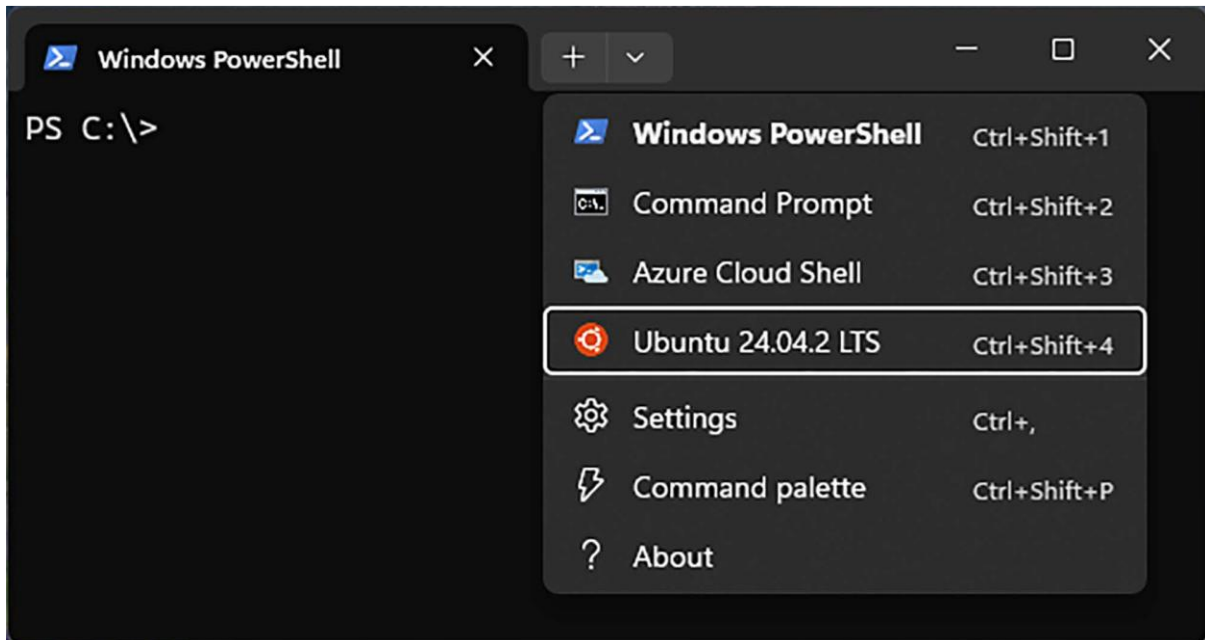
 Completions not installed

Cancel Apply & restart

Engine running | RAM 11.19 GB CPU 2.82% Disk: 80.05 GB used (limit 102.06 GB)

```
git version 2.39.5 (Apple Git-154)
28.0.4
openjdk version "24" 2025-03-18
curl 8.7.1
jq-1.7.1
Spring CLI v3.5.0
SIEGE 4.1.7
v3.17.2+gcc0bbbd
v1.32.0
minikube version: v1.35.0
client version: 1.24.2
$
```

## 22장: WSL 2와 우분투가 탑재된 마이크로소프트 윈도우용 설치 안내



docker desktop PERSONAL Search Help Notifications Settings Sign in

**Settings** [Give feedback](#)

- General**
- Resources
- Docker Engine
- Builders
- Kubernetes
- Software updates
- Extensions
- Features in development
- Notifications

### General

- Start Docker Desktop when you sign in to your computer
- Open Docker Dashboard when Docker Desktop starts

Choose theme for Docker Desktop

Light  Dark  Use system settings

Choose container terminal

Integrated  System default

Determines which terminal is launched when opening the terminal from a container.

Enable Docker terminal

Customize terminal appearance

Font family:  Font size:

Enable Docker Debug by default [Learn more](#)

Must be signed in with an active subscription

Expose daemon on tcp://localhost:2375 without TLS

Exposing daemon on TCP without TLS helps legacy clients connect to the daemon. It also makes yourself vulnerable to remote code execution attacks. Use with caution.

Use the WSL 2 based engine

WSL 2 provides better performance than the Hyper-V backend. [Learn more](#)

Resource Saver mode RAM 2.47 GB CPU 0.08% Disk: 32.51 GB used (limit 1006.85 GB)

```
Windows Powe x magnus@magi x + v - □ ×

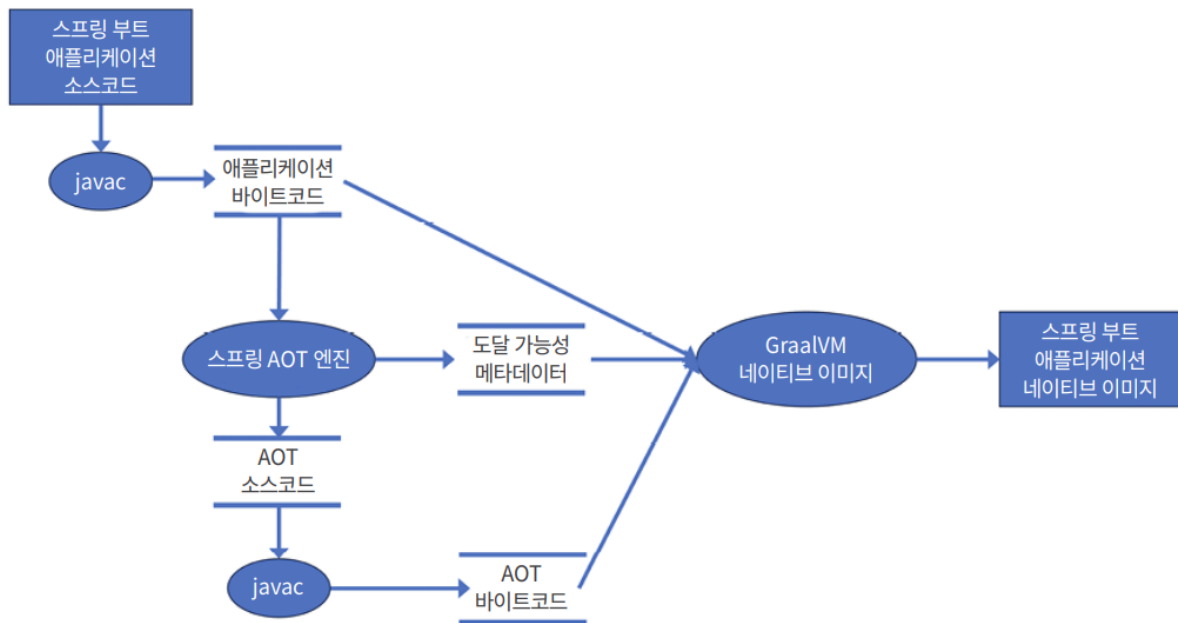
git version 2.43.0
28.0.4
openjdk version "24" 2025-03-18
curl 8.5.0
jq-1.7
Spring CLI v3.5.0
SIEGE 4.0.7
v3.17.2+gcc0bbbd
v1.32.0
minikube version: v1.35.0
client version: 1.24.2
$ █
```

The screenshot shows an IDE window titled "Microservices-with-Spring-Boot-and-Spring-Cloud-Fourth-Edition [WSL: Ubuntu]". The Explorer pane on the left shows a project structure with folders for "Chapter03" through "Chapter12", "OUTLINE", and "TIMELINE". The "product-composite-service" folder is expanded, showing subfolders like "src", ".gitignore", "build.gradle", "Dockerfile", "settings.gradle", "product-service", "recommendation-service", "review-service", "util", ".gitignore", "gradlew.bat", "settings.gradle", and "test-em-all.bash". The "build.gradle" file is selected and its content is displayed in the main editor:

```
1 plugins {
2     id 'org.springframework.boot' version '3.5.0-RC1'
3     id 'io.spring.dependency-management' version '1.1.7'
4     id 'java'
5 }
6
7 group = 'se.magnus.microservices.composite.product'
8 version = '1.0.0-SNAPSHOT'
9
10 java {
11     toolchain {
12         languageVersion = JavaLanguageVersion.of(24)
13     }
14 }
15
16 repositories {
17     mavenCentral(); maven { url = 'https://repo.spring.io/milestone' }
18 }
19
20 jar {
21     enabled = false
22 }
23
24 dependencies {
25     implementation project(':api')
26     implementation project(':util')
27     implementation 'org.springframework.boot:spring-boot-starter-actuator'
```

At the bottom, a terminal window shows the command prompt: "magnus@magnus-mini-pc:~/Microservices-with-Spring-Boot-and-Spring-Cloud-Fourth-Edition\$". The status bar at the bottom indicates "Ln 1, Col 1 Spaces: 4 UTF-8 LF Groovy".

## 23장: 자바 마이크로서비스의 네이티브 컴파일



```
hands-on/native-review-service ... 3 minutes ago
hands-on/native-recommendation-service ... 5 minutes ago
hands-on/native-product-composite-service ... 8 minutes ago
hands-on/native-product-service ... 11 minutes ago
$
```

```
recommendation-1 | ... Started RecommendationServiceApplication in 5.809 seconds
product-composite-1 | ... Started ProductCompositeServiceApplication in 6.696 seconds
product-1 | ... Started ProductServiceApplication in 5.611 seconds
review-1 | ... Started ReviewServiceApplication in 6.901 seconds
$
```

```
Start Tests: Sat MMM DD 09:36:19 CEST YYYY
...
Wait for: curl -k https://health.minikube.me/actuator/health...
DONE, continues...
...
Test OK (HTTP Code: 200)
...
End, all tests OK: Sat MMM DD 09:36:40 CEST YYYY
$
```

```
bash
CONTAINER ID   NAME                                     CPU %     MEM USAGE ...
c2fd8c3cf276   chapter23-review-1                     0.14%    307.7MiB ...
ecb84348619f   chapter23-recommendation-1             0.13%    251.4MiB ...
d276f9d9c4bf   chapter23-product-composite-1          0.16%    293.6MiB ...
0aa87dcc0145   chapter23-product-1                    0.19%    245.2MiB ...
8a37a5918b2f   chapter23-jaeger-collector.istio-system-1 0.13%    198.4MiB ...
6ee062ef5073   chapter23-gateway-1                    0.12%    232.9MiB ...
efc90cd09472   chapter23-auth-server-1                 0.20%    164.2MiB ...
32cf0ffa6870   chapter23-mongodb-1                    1.17%    164.7MiB ...
7ead773af325   chapter23-mysql-1                       0.85%    394.6MiB ...
b46099e0b2ab   chapter23-rabbitmq-1                   7.96%    122.8MiB ...
$
```

```
bash
product-composite-1 | ... Started ProductCompositeServiceApplication in 0.482 seconds
product-1           | ... Started ProductServiceApplication in 0.205 seconds
recommendation-1   | ... Started RecommendationServiceApplication in 0.198 seconds
review-1           | ... Started ReviewServiceApplication in 0.269 seconds
$
```

```
bash
CONTAINER ID   NAME                                     CPU %     MEM USAGE ...
bc0db067daef   chapter23-review-1                     0.03%    98.16MiB ...
5dd4faceb8ab   chapter23-product-1                   0.04%    81.8MiB ...
f2add10d08de   chapter23-recommendation-1            0.03%    87.82MiB ...
b5fa5e14d4a6   chapter23-product-composite-1         0.02%    131.8MiB ...
aedcef0006a5   chapter23-jaeger-collector.istio-system-1 0.58%    202.4MiB ...
29051d43ede6   chapter23-gateway-1                   0.22%    238.7MiB ...
960630b2ecf0   chapter23-auth-server-1                0.39%    160.1MiB ...
2ba3e34a60a8   chapter23-mongodb-1                   3.11%    164.4MiB ...
ab50716bc791   chapter23-rabbitmq-1                   0.72%    119.7MiB ...
d505bd4e5713   chapter23-mysql-1                     1.33%    397.3MiB ...
$
```

```
bash 1
2023-06-17T08:20:50.759Z ... Started ProductCompositeServiceApplication in 0.442 seconds
$
```

```
bash 1
hands-on/auth-server:latest
hands-on/native-product-service:latest
hands-on/native-product-composite-service:latest
hands-on/native-recommendation-service:latest
hands-on/native-review-service:latest
$
```