

LAPORAN PRAKTIKUM WSE - 4

Mata Kuliah : Web Service Engineering

Dosen Pengampu : Muhayat, M.IT

Praktikum : P4 – Web Service Development Methodologies (AGILE)

Kelompok 2 :

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Kelas : TI23B

Tanggal Praktikum : 20 Oktober 2025

A. Tujuan Praktikum

1. Menerapkan metodologi Agile dalam pengembangan *Web Service* berbasis kontrak (OpenAPI).
2. Melakukan proses Design-First dan memastikan spesifikasi API tervalidasi (lint 0 error).
3. Mengimplementasikan Mock-First (Prism) untuk menguji skenario 201, 200, 400, dan 401.
4. Melakukan pendekatan Test-First (RED) hingga seluruh tes berhasil (*GREEN*).
5. Menyusun *Continuous Integration (CI)* untuk lint, typecheck, dan test otomatis menggunakan GitHub Actions (opsional mahasiswa).
6. Melakukan proses Hardening untuk meningkatkan keamanan dan observabilitas layanan, meliputi logging terstruktur, correlation-id, security headers, rate-limit, serta validasi error.

B. Lingkungan & Tools

- Node.js v18+ dan npm
- Visual Studio Code sebagai IDE utama
- Spectral (OpenAPI linter) dan Prism (mock server)
- TypeScript, Jest, ts-jest, Supertest
- Express, Zod, Helmet, express-rate-limit
- Pino / pino-http untuk logging
- GitHub Actions (opsional CI) dan Postman untuk uji manual

C. Arsitektur Singkat

- Services: order-service (POST /orders) dan notification-service (GET /notifications)
- Kontrak API: openapi/api.yaml (lint 0 error)
- Shared utilities: utils.ts berisi logger, correlation-id, auth dummy, validator, dan error handler.

D. Langkah Implementasi

1. Design-First

Menulis file openapi/api.yaml dan melakukan linting menggunakan npx spectral lint openapi/api.yaml dengan hasil 0 error.

2. Mock-First

Menjalankan npx prism mock openapi/api.yaml dan merekam hasil 201, 200, 401, 400 di folder mock_logs/.

3. Test-First(RED)

Menulis tes menggunakan Jest dan Supertest hingga semua tes gagal sesuai ekspektasi.

4. Implementasi (GREEN)

Mengembangkan middleware dan route hingga semua tes berhasil (*npm test* lulus semua).

5. CI Setup (*opsional mahasiswa*)

Menambahkan workflow .github/workflows/ci.yml dan memastikan seluruh lint dan tes berjalan otomatis.

6. Hardening

Menambahkan Helmet, rate-limit, redaksi auth di log, serta validasi JSON untuk mengembalikan error 400 jika format salah. Setiap respons mengandung header x-correlation-id.

7. Demo & Dokumentasi

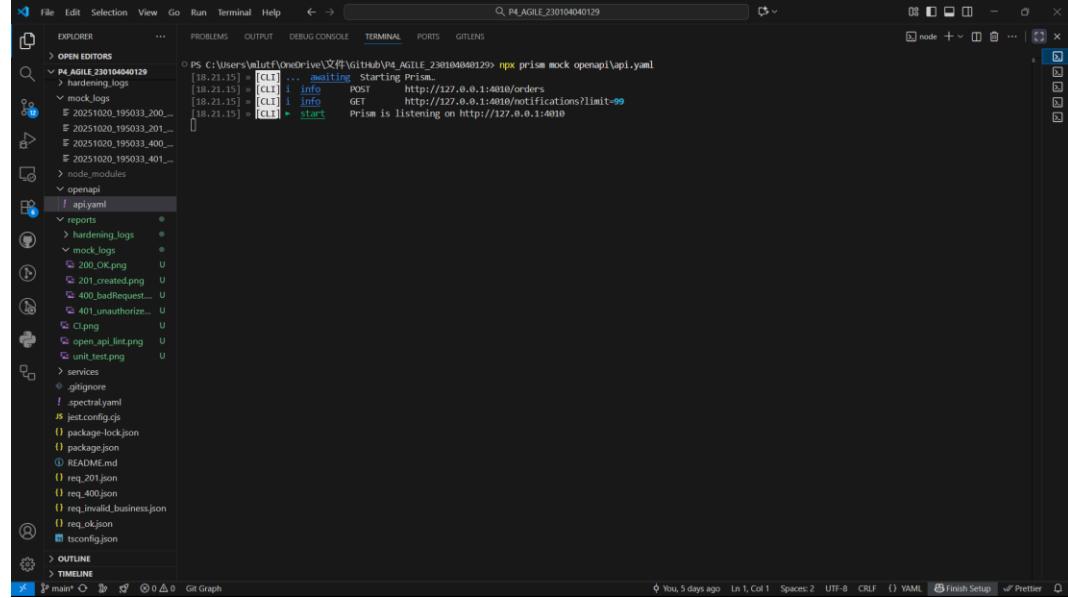
Seluruh bukti hasil lint, mock, dan tes disimpan di docs/, mock_logs/, dan hardening_logs/.

E. Hasil & Bukti

1. OpenAPI Lint

- Perintah: npx spectral lint openapi/api.yaml
- Hasil: **0 error / 0 warning**
- Bukti: docs/spectral_pass.png

Berikut Screenshoot nya

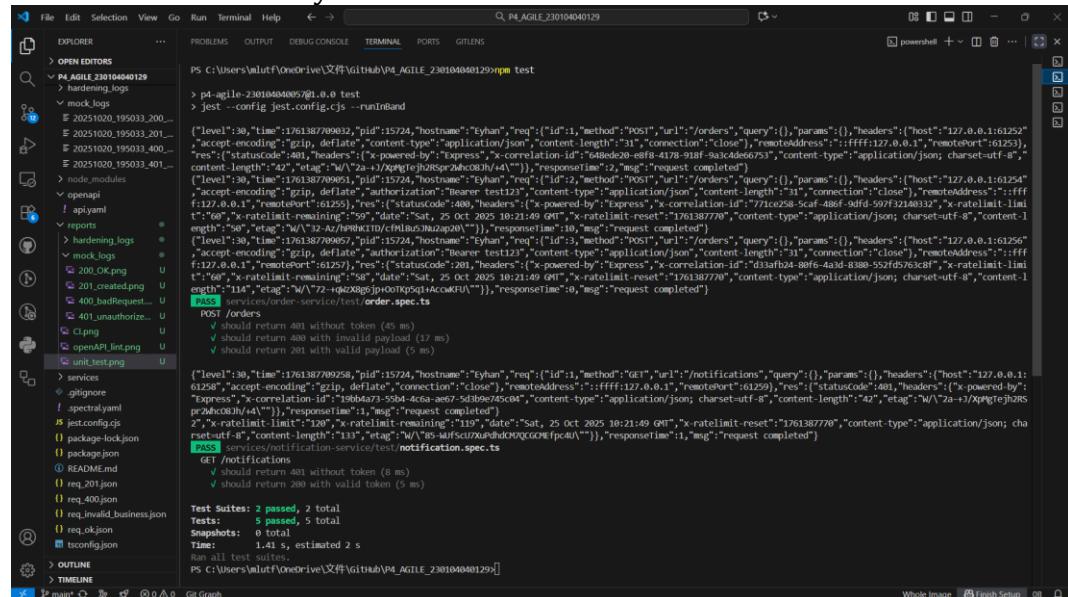


```
PS C:\Users\alutf\OneDrive\文件\GitHub\P4_AGILE_230104040129> npx prism mock openapi/api.yaml
[18-21.15] [CLI] 0 errors / 0 warnings Starting Prism...
[18-21.15] [CLI] 0 errors / 0 warnings POST http://127.0.0.1:4010/orders
[18-21.15] [CLI] 1 Info GET http://127.0.0.1:4010/notifications?limit=99
[18-21.15] [CLI] 1 Info start Prism is listening on http://127.0.0.1:4010
```

2. Unit Test (Jest)

- Perintah: npm test
- Hasil: **2 suites, 5 tests passed**
- Bukti: docs/npm_test_pass.png

Berikut Screenshoot nya



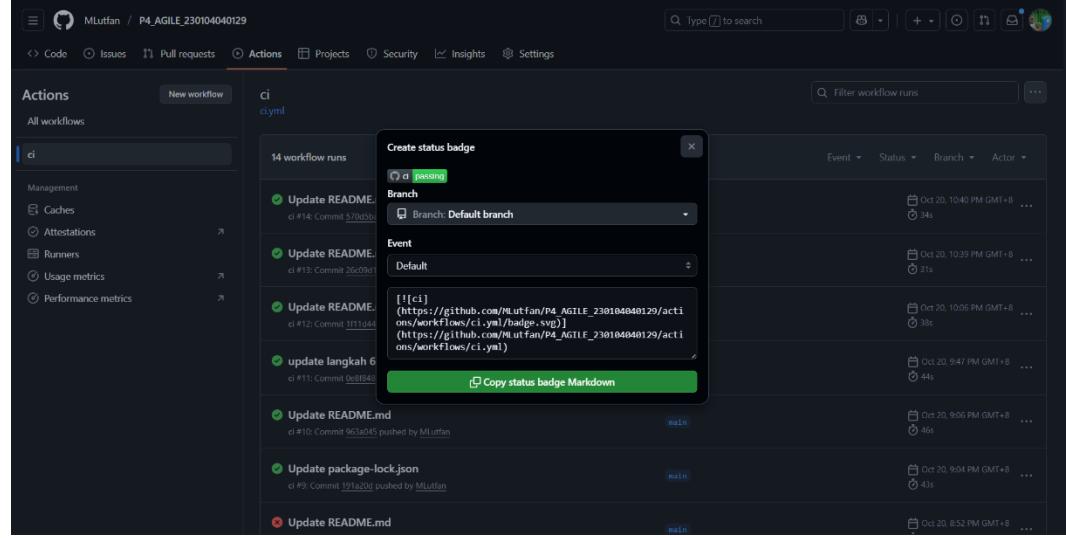
```
PS C:\Users\alutf\OneDrive\文件\GitHub\P4_AGILE_230104040129> npm test
p4-agile-230104040129@1.0.0 test
> jest --config jest.config.js --runInBand

("level":30,"time":176138770905,"pid":15724,"hostname":"Eyan","req":{"id":1,"method":"POST","url":"/orders","query":{},"params":{},"headers":{"host":"127.0.0.1:61259","accept-encoding":"gzip, deflate","content-type":"application/json","content-length":"31","connection":"close"}, "remoteAddress":"::ffff:127.0.0.1","remotePort":61259}, "res":{"statusCode":201,"headers":{"x-powered-by":"Express","x-correlation-id":"648ede20-e8f-4178-91af-9a3c4de66753","content-type":"application/json; charset=utf-8","content-length":"42","etag":"W\"2+0jQPejh0Sp2whC08h/4\""}, "responseTime":12,"msg":"request completed"}}, {"level":30,"time":176138770905,"pid":15724,"hostname":"Eyan","req":{"id":2,"method":"POST","url":"/orders","query":{},"params":{},"headers":{"host":"127.0.0.1:61259","accept-encoding":"gzip, deflate","content-type":"application/json","content-length":"31","connection":"close"}, "remoteAddress":"::ffff:127.0.0.1","remotePort":61259}, "res":{"statusCode":201,"headers":{"x-powered-by":"Express","x-correlation-id":"771cc058-5ca-f4ff-9d14-99f32140332","x-rateLimit-Limit":50,"x-rateLimit-Remaining":50,"date":"Sat, 25 Oct 2025 10:21:49 GMT","x-rateLimit-Reset":1761387700,"content-type":"application/json; charset=utf-8"}, "responseTime":10,"msg":"request completed"}}, {"level":30,"time":176138770905,"pid":15724,"hostname":"Eyan","req":{"id":3,"method":"POST","url":"/orders","query":{},"params":{},"headers":{"host":"127.0.0.1:61259","accept-encoding":"gzip, deflate","authorization":"Bearer test123","content-type":"application/json","content-length":"31","connection":"close"}, "remoteAddress":"::ffff:127.0.0.1","remotePort":61259}, "res":{"statusCode":201,"headers":{"x-powered-by":"Express","x-correlation-id":"19b4a473-95b4-4e67-8d39e745c04","content-type":"application/json; charset=utf-8","content-length":42,"etag":"W\"2+0kxgspjD0kPspQAcwKfU0\""}, "responseTime":11,"msg":"request completed"}}, {"level":30,"time":176138770928,"pid":15724,"hostname":"Eyan","req":{"id":4,"method":"GET","url":"/notifications","query":{},"params":{},"headers":{"host":"127.0.0.1:61259","accept-encoding":"gzip, deflate","connection":"close"}, "remoteAddress":"::ffff:127.0.0.1","remotePort":61259}, "res":{"statusCode":201,"headers":{"x-powered-by":"Express","x-correlation-id":"19b4a473-95b4-4e67-8d39e745c04","content-type":"application/json; charset=utf-8","content-length":133,"etag":"W\"05-wfscurxndhdc0qGGMfpc4U\""}, "responseTime":11,"msg":"request completed"}}, {"level":30,"time":176138770928,"pid":15724,"hostname":"Eyan","req":{"id":5,"method":"GET","url":"/notifications","query":{},"params":{},"headers":{"host":"127.0.0.1:61259","accept-encoding":"gzip, deflate","connection":"close"}, "remoteAddress":"::ffff:127.0.0.1","remotePort":61259}, "res":{"statusCode":201,"headers":{"x-powered-by":"Express","x-correlation-id":"19b4a473-95b4-4e67-8d39e745c04","content-type":"application/json; charset=utf-8","content-length":133,"etag":"W\"05-wfscurxndhdc0qGGMfpc4U\""}, "responseTime":11,"msg":"request completed"}}, {"Test Suites: 2 passed, 2 total
Tests:      5 passed, 5 total
Snapshots:  0 total
Time:       1.41 s, estimated 2 s
Run all test suites.
PS C:\Users\alutf\OneDrive\文件\GitHub\P4_AGILE_230104040129>
```

3. CI (GitHub Actions) (optional)S

- Workflow: .github/workflows/ci.yml
- Status: **Hijau / Tidak digunakan**

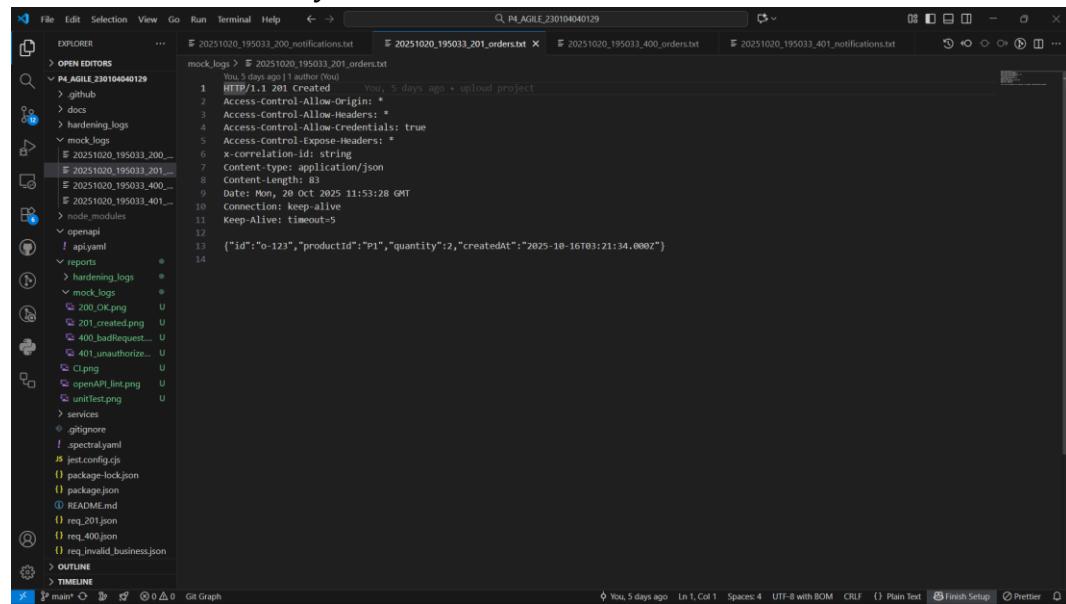
Berikut Screenshot nya



4. Mock Logs (mock_logs/)

- 201 Created (orders)

Berikut Screenshot nya



- 200 OK (notifications)

Berikut Screenshoot nya

```
File Edit Selection View Go Run Terminal Help ← → ○ P4 AGILE_230104040129
EXPLORER
OPEN EDITORS
PA_AGILE_230104040129
github
docs
hardening_logs
mock_logs
20251020_195033_200...
20251020_195033_201...
20251020_195033_400...
20251020_195033_401...
node_modules
openapi
api.yaml
reports
mock_logs
200.OK.png
201_created.png
400_badRequest...
401_unauthorize...
403_cl.png
openAPI_lint.png
unitTest.png
services
.ignore
spectral.yaml
jest.config.js
package-lock.json
package.json
README.md
req_201.json
req_400.json
req_invalid_business.json
OUTLINE
TIMELINE
main* 0 △ 0 Git Graph
mock_logs 20251020_195033_200.notifications.txt 20251020_195033_201_orders.txt 20251020_195033_400_orders.txt 20251020_195033_401_notifications.txt
You, 5 days ago | 1 author (You)
1 HTTP/1.1 200 OK You, 5 days ago + upload project
2 Access-Control-Allow-Origin: *
3 Access-Control-Allow-Headers: *
4 Access-Control-Allow-Credentials: true
5 Access-Control-Expose-Headers: *
6 x-correlation-id: string
7 Content-type: application/json
8 Content-Length: 133
9 Date: Mon, 20 Oct 2025 11:54:43 GMT
10 Connection: keep-alive
11 Keep-Alive: timeout=5
12
13 {"data": [{"id": "n1", "type": "ORDER_CREATED", "message": "Order created successfully", "createdAt": "2025-10-16T03:21:34.000Z"}], "total": 1}
```

- 401 Unauthorized

Berikut Screenshoot nya

```
File Edit Selection View Go Run Terminal Help ← → ○ P4 AGILE_230104040129
EXPLORER
OPEN EDITORS
PA_AGILE_230104040129
github
docs
hardening_logs
mock_logs
20251020_195033_200...
20251020_195033_201...
20251020_195033_400...
20251020_195033_401...
node_modules
openapi
api.yaml
reports
mock_logs
200.OK.png
201_created.png
400_badRequest...
401_unauthorize...
403_cl.png
openAPI_lint.png
unitTest.png
services
.ignore
spectral.yaml
jest.config.js
package-lock.json
package.json
README.md
req_201.json
req_400.json
req_invalid_business.json
OUTLINE
TIMELINE
main* 0 △ 0 Git Graph
mock_logs 20251020_195033_200.notifications.txt 20251020_195033_201_orders.txt 20251020_195033_400_orders.txt 20251020_195033_401_notifications.txt
You, 5 days ago | 1 author (You)
1 HTTP/1.1 401 Unauthorized You, 5 days ago + upload project
2 Access-Control-Allow-Origin: *
3 Access-Control-Allow-Headers: *
4 Access-Control-Allow-Credentials: true
5 Access-Control-Expose-Headers: *
6 x-correlation-id: string
7 Content-type: application/json
8 Content-Length: 42
9 Date: Mon, 20 Oct 2025 11:54:53 GMT
10 Connection: keep-alive
11 Keep-Alive: timeout=5
12
13 {"message": "Unauthorized", "code": "UNAUTH"}
```

Screenshot copied to clipboard
Automatically saved to screenshots folder.

- 400 Bad Request

Berikut Screenshoot nya

A screenshot of a terminal window titled "P4_AGILE_230104040129". The window displays a log entry for a 400 Bad Request error. The log content is as follows:

```
You, 5 days ago | author (You)
1 HTTP/1.1 400 Bad Request
2 Access-Control-Allow-Origin: *
3 Access-Control-Allow-Headers: *
4 Access-Control-Allow-Credentials: true
5 Access-Control-Expose-Headers: *
6 s1-violations: [{"location": ["request", "body", "quantity"], "severity": "error", "code": "minimum", "message": "Request body property quantity must be > 0"}, {"location": ["request", "body", "quantity"], "severity": "warning", "code": "maximum", "message": "Request body property quantity must be <= 100"}]
7 Content-Length: 50
8 Date: Mon, 20 Oct 2025 11:55:00 GMT
9 Connection: keep-alive
10 Keep-Alive: timeout=5
11
12
13 ("message": "Validation error", "code": "BAD_REQUEST")
14
```

The terminal also shows several other files and logs in the background, including "20251020_195033_200_notifications.txt", "20251020_195033_201_orders.txt", "20251020_195033_401_notifications.txt", and "20251020_195033_400_orders.txt". A "Snipping Tool" window is visible in the top right corner, indicating a screenshot has been copied to the clipboard.

5. Hardening Logs (hardening_logs/)

- 201 Created, 200 OK,

Berikut Screenshoot nya

A screenshot of a terminal window titled "P4_AGILE_230104040129". The window displays a log entry for a 201 Created response. The log content is as follows:

```
You, 5 days ago | author (You)
1 HTTP/1.1 200 OK
2 X-Powered-By: Express
3 X-Correlation-ID: 3060cdcb-2650-4c58-bb72-e3173ee1f4e8
4 X-RateLimit-Limit: 120
5 X-RateLimit-Remaining: 119
6 Date: Mon, 20 Oct 2025 13:27:07 GMT
7 X-RateLimit-Reset: 1769966888
8 Content-Type: application/json; charset=utf-8
9 Content-Length: 133
10 Etag: W/85-HkAeRVZgjnsfM8KuJmOpSyis
11 Connection: keep-alive
12 Keep-Alive: timeout=5
13
14 {"data": [{"id": "1", "type": "ORDER_CREATED", "message": "Order created successfully", "createdAt": "2025-10-20T13:27:07.974Z"}], "total": 1}
15
```

The terminal also shows several other files and logs in the background, including "401.png", "400.validationError.png", "201.png", "Screenshot 2025-10-25 185138.png", and "20251020_211425_200.notifications.txt".

- 401 Unauthorized,
Berikut Screenshot nya

```
File Edit Selection View Go Run Terminal Help < - > 20251020_212731_400_orders_bad.json.txt 20251020_211425_201_orders.txt 20251020_212731_400_orders_validation.txt 20251020_212731_401_orders.txt

hardening_logs 20251020_212731_401_orders.txt
1 [HTTP/1.1 401 Unauthorized] You, 5 days ago + update langkah 6 ...
2 X-Powered-By: Express
3 x-correlation-id: 7f2a9f2-493e-4581-a35a-066927c1258c
4 Content-type: application/json; charset=utf-8
5 Content-length: 42
6 ETag: W/"2a-+jXpMgTejhZnSpzWhcOBJh/+4"
7 Date: Mon, 20 Oct 2025 13:28:01 GMT
8 Connection: keep-alive
9 Keep-Alive: timeout=5
10
11 {"message": "Unauthorized", "code": "UNAUTH"}
12

mock_logs
20251020_195033_200...
20251020_195033_201...
20251020_195033_400...
20251020_195033_401...

node_modules
openapi
! api.yaml
reports
hardening_logs
200.png
201.png
400_badJSON.png
400_validationErr.png
401.png
mock_logs
200.png
201.png
400.png
401.png
CL.png
openAI_Lint.png
unittest.png

> OUTLINE
> TIMELINE
```

- 400 ValidationError,
Berikut Screenshoot nya

```
hardening_log > 20251020_212731_400_orders_validation.txt
20251020_211425_201_orders.txt
20251020_212731_400_orders_validation.txt
20251020_212731_401_orders.txt

hardening_logs
├── 20251020_211425_200_...
├── 20251020_211425_201_...
├── 20251020_212731_400_...
├── 20251020_212731_401_...
└── mock_logs
    ├── 200.png
    ├── 201.png
    ├── 400_badJSON.png
    ├── 400_validationErr...png
    ├── 401.png
    └── node_modules
        ├── openapi
        │   ├── apiyaml
        │   └── reports
        │       └── hardening_logs
        └── package.json

200.png
201.png
400_badJSON.png
400_validationErr...png
401.png
node_modules
openAPI_lint.png
unitTest.png
```

- 400 Bad JSON

Berikut Screenshoot nya

```
You, 1 second ago | 1 author (You)
1 HTTP/1.1 400 Bad Request
2 X-Powered-By: Express
3 Content-Security-Policy: default-src 'none'
4 X-Content-Type-Options: nosniff
5 Content-Type: text/html; charset=utf-8
6 Content-Length: 1238
7 Date: Mon, 20 Oct 2025 13:29:46 GMT
8 Connection: keep-alive
9 Keep-Alive: timeout=5
10
11 <!DOCTYPE html>
12 <html lang="en">
13 <head>
14 <meta charset="utf-8">
15 <title>Error</title>
16 </head>
17 <body>
18 <pre>SyntaxError: Expected property name or &#39;&#39; in JSON at position 2 (line 1 column 3)<br> &nbsp; at JSON.parse (&lt;anonymous&gt;)
19 </body>
20 </html>
21
```

- Setiap response memiliki x-correlation-id dan *Helmet headers* aktif.

F. Observability & Security Verification

Skenario	Endpoint	Ekspektasi	Status	Bukti
201 Created	POST /orders	201 + x-correlation-id	✓	hardening_logs/_201_orders.txt
401 Unauthorized	POST /orders tanpa bearer	401 Unauthorized	✓	hardening_logs/_401_orders.txt
400 ValidationError	POST /orders (quantity=0)	400 Bad Request	✓	hardening_logs/_400_orders_validation.txt
400 Bad JSON	POST /orders (JSON rusak)	400 InvalidJSON	✓	hardening_logs/_400_orders_badjson.txt
200 OK	GET /notifications	200 OK + x-correlation-id	✓	hardening_logs/_200_notifications.txt

Semua log menunjukkan keamanan aktif: authorization: [REDACTED] dan header Helmet lengkap (X-Frame-Options, X-Content-Type-Options, Content-Security-Policy).

G. Kendala & Solusi

1. PowerShell sering memecah argumen saat curl, solusi: gunakan curl.exe + single quotes.
2. Jest config tidak kompatibel dengan TypeScript tanpa ts-node, solusi: ubah ke jest.config.cjs.
3. Tes gagal karena lokasi file salah, solusi: pindahkan ke folder services/order-service/test/.
4. Error JSON rusak menghasilkan 500, solusi: tambahkan handler parse error agar mengembalikan 400 (*BAD_JSON*).

H. Cara Reproduksi Proyek

```
npm ci
npm run dev:orders      # jalankan di port 5002
npm run dev:notif       # jalankan di port 5003
npm test
npx spectral lint openapi/api.yaml
```

I. Kesimpulan

Praktikum 4 ini telah berhasil menerapkan seluruh alur kerja (workflow) metodologi Agile berbasis kontrak secara penuh. Kita memulai dari Design-First dengan mendefinisikan kontrak API dalam openapi/api.yaml, yang kemudian divalidasi 0 error menggunakan Spectral.

Tahap ini dilanjutkan dengan Mock-First menggunakan Prism untuk menguji skenario API sebelum implementasi. Selanjutnya, pendekatan Test-First (RED) dengan Jest menjadi panduan untuk tahap Implementasi (GREEN), di mana kedua *service* (orders dan notifications) dikembangkan hingga berhasil meluluskan semua 5 tes otomatis.

Alur kerja ini disempurnakan dengan CI (GitHub Actions) yang mengotomatiskan linting dan testing, serta tahap Hardening yang menambahkan lapisan keamanan (Helmet), observabilitas (Pino Logger dengan redaksi), dan *error handling* yang tangguh.

Setiap tahapan telah terverifikasi dengan bukti nyata: hasil CI yang hijau, tes yang lulus, serta log lengkap di mock_logs/ dan hardening_logs/. Praktikum ini membuktikan bahwa pendekatan Agile mampu menghasilkan layanan web yang terstruktur, aman, mudah diuji, dan siap untuk dikembangkan lebih lanjut.