FINAL PROJECT

INFO 8985 - Monitoring and Logging

Nikhil Shankar Chirakkal Sivasankaran - 9026254
Deepak Tamizhalagan - 8983627
Cibi Sharan Cholarani - 9015927
Zafar Ahmed Shaik - 9027671
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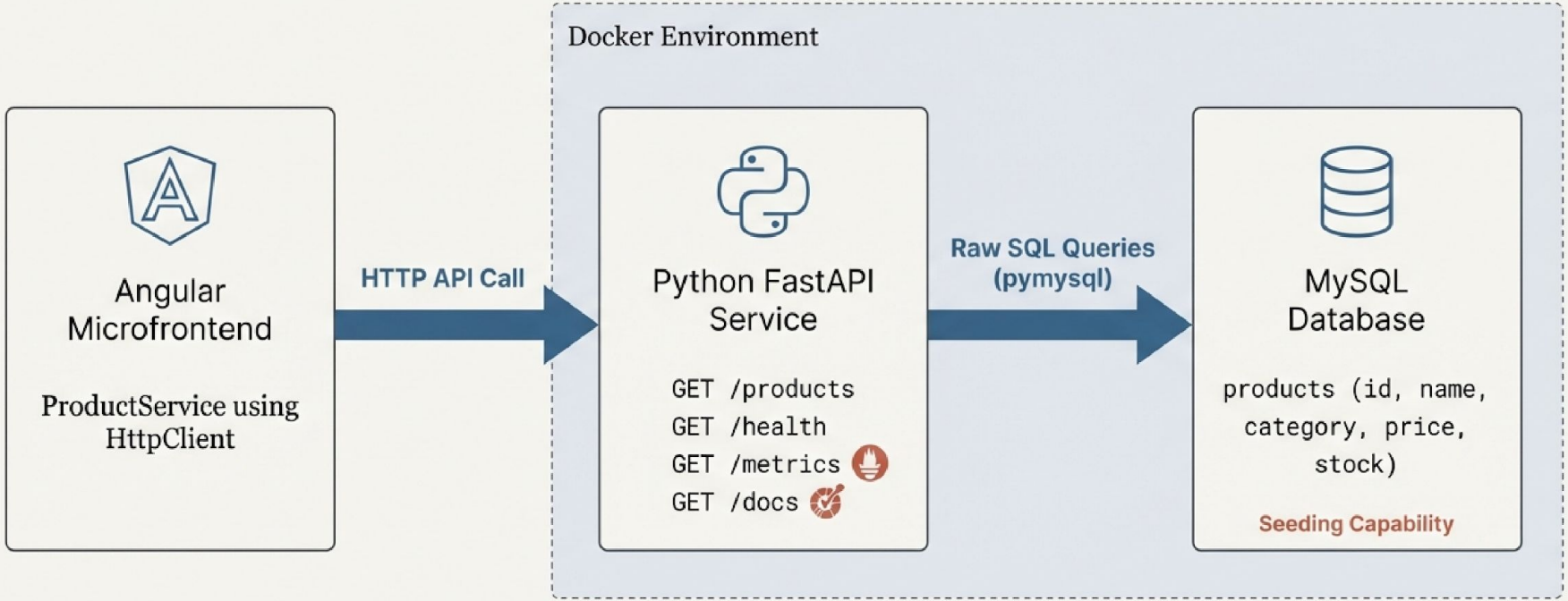
Full-Stack Microservice Architecture: From UI to Database

A containerized, end-to-end data flow powering a dynamic product catalog.



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Outcomes: A Scalable & Developer-Friendly Foundation

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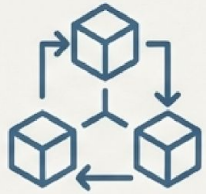

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Built-in Observability

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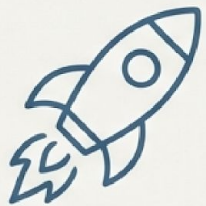


Accelerated Development

With automated database seeding for easy setup and self-generating API documentation at the `/docs` endpoint, the system is designed for developer efficiency and rapid onboarding.

This project establishes a resilient foundation for all future CRUD (Create, Read, Update, Delete) operations and long-term data persistence.

Technology Stack: Deliberate Choices for Performance

Utilizing lightweight, modern tools to build an efficient and maintainable system.

Backend & Database

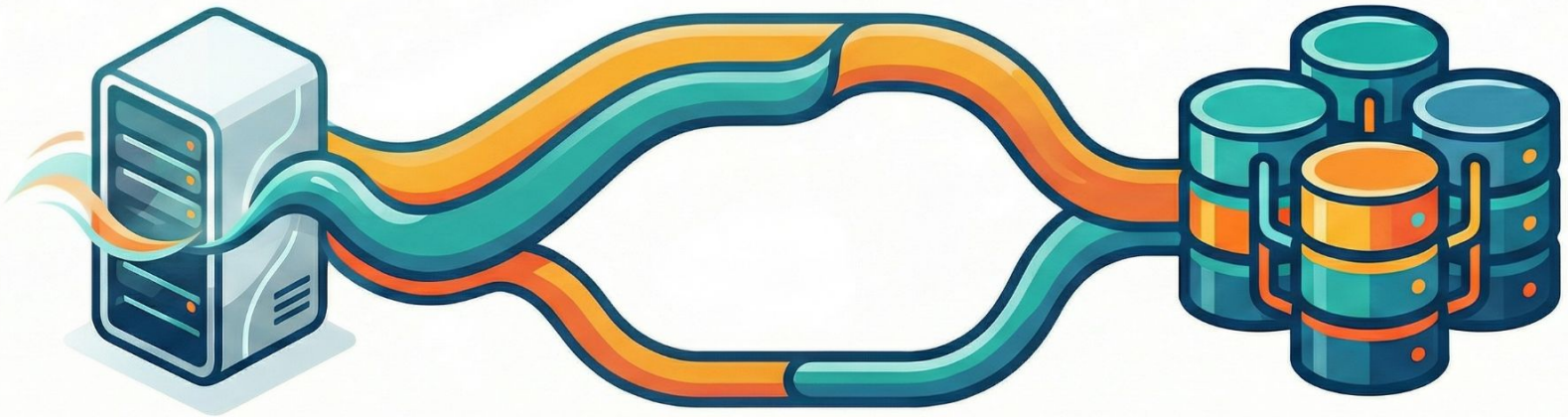
- **FastAPI Framework:** For high-performance, asynchronous API development and automatic OpenAPI documentation.
- **Pymysql Library:** Chosen for its lightweight, dependency-free nature for direct, efficient raw SQL operations.
- **RESTful API Design:** Clean, intuitive endpoints for product retrieval and standardized health checks.
- **Relational Schema:** A structured `products` table designed for data integrity and future query complexity.

Frontend & DevOps

- **Angular Microfrontend:** A decoupled client application for a clean separation from the backend logic.
- **HttpClient Module:** The standard, robust method for consuming RESTful services in Angular.
- **Docker & Docker Compose:** Containerization of both the API and MySQL services, ensuring consistent environments and simple orchestration.
- **Database Health Checks:** Integrated into the Docker setup to ensure service dependencies are managed correctly on startup.

Every component was selected to optimize for performance, scalability, and an excellent developer experience.

Backend Architecture Flow



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2. Direct Database Communication

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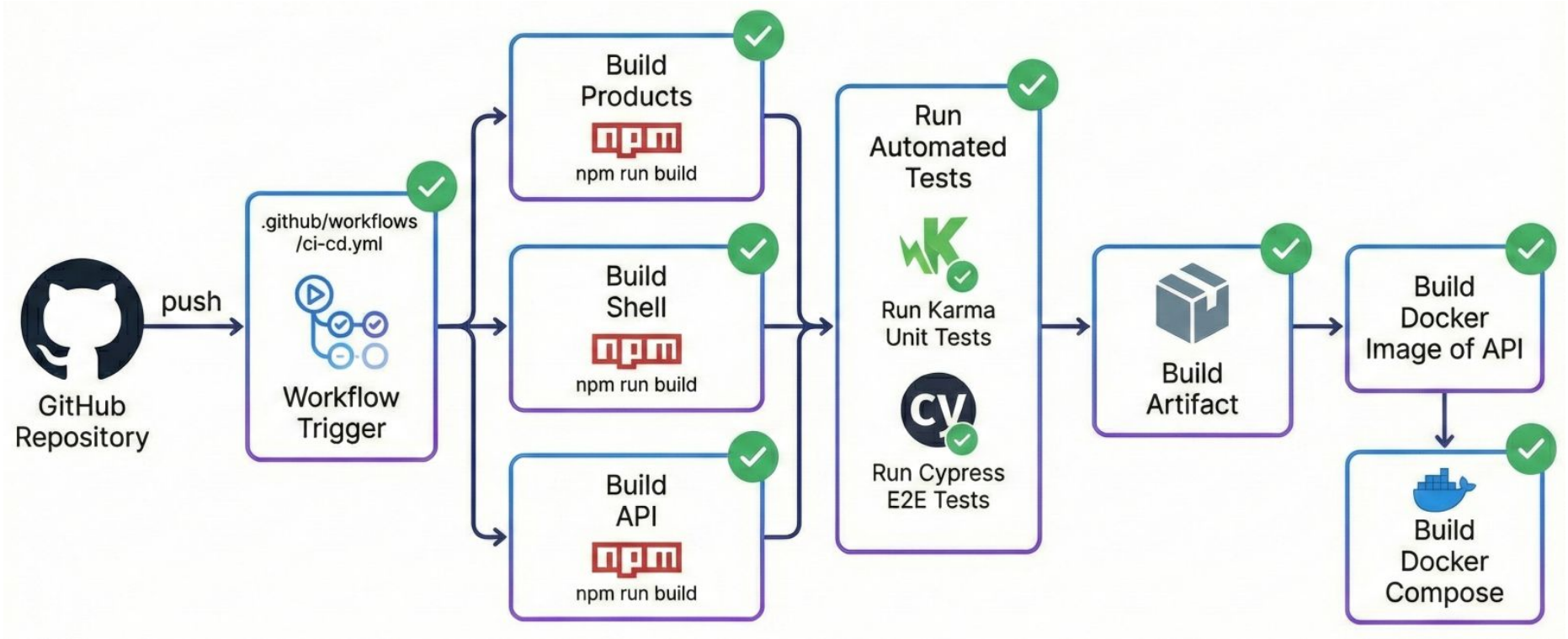

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- Configured parallel job execution for faster build times
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Key Outcomes

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- Early detection of build failures and integration issues
- Consistent build environment across development and CI
- Ready for Docker image publishing to container registry
- Foundation laid for automated deployment to production

Testing Strategy for Micro-Frontend Application

Importance of testing in Microfrontend applications:

- Ensures each microfrontend works independently.
- Detects UI and functional errors earlier.
- Checks the integration between Shell and Products app
- Improves application reliability
- Prevents breaking changes during pipeline execution.

Testing Tools and Types of tests

Tools used here are:

- Jasmine - Unit testing framework
- Karma - Test runner for Angular unit tests
- Cypress - End-to-end testing tool

Types of tests performed:

- Component Unit test
- Module federation Integration test
- Cypress end-to-end test

Component Unit Testing

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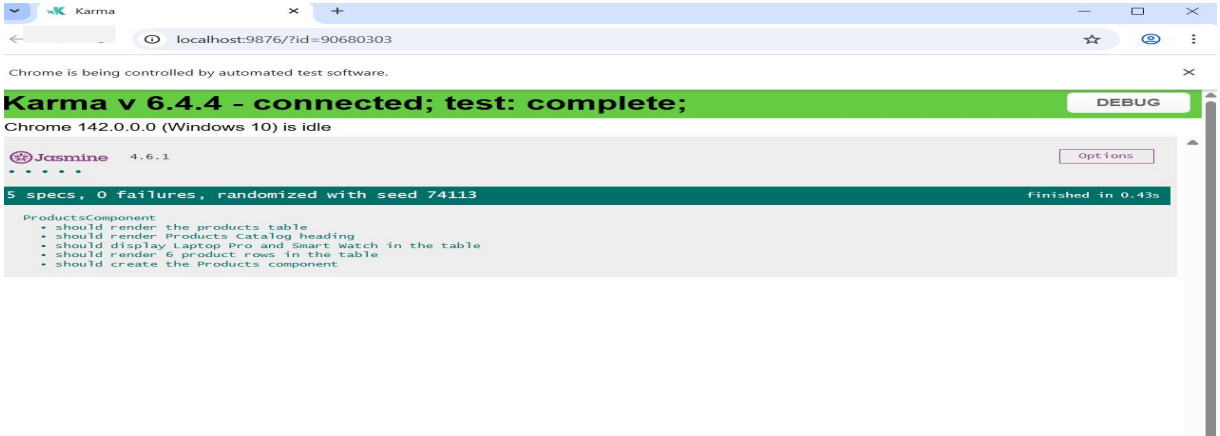

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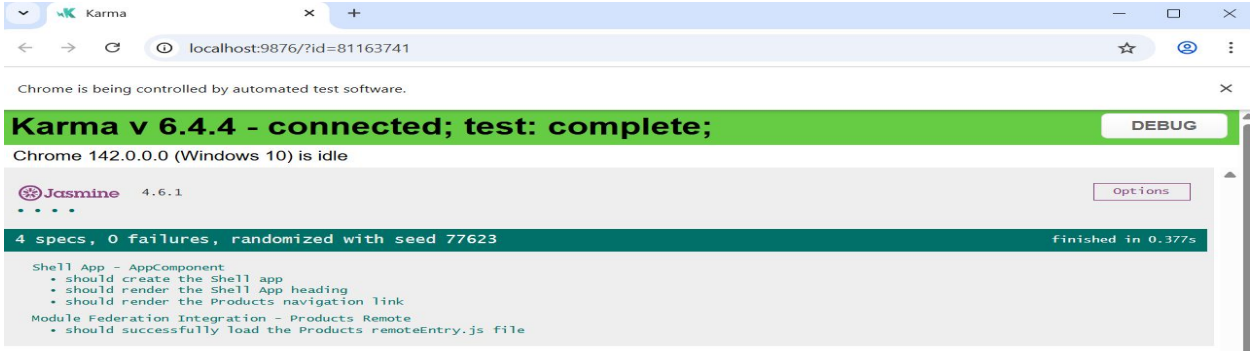

Monitoring & Observability Implementation

To ensure the reliability and performance of the backend API, a complete monitoring and observability stack was implemented using **Prometheus** and **Grafana**. This setup provides real-time insights into service health, request traffic, and resource consumption.

1. Prometheus Setup

Prometheus was configured to scrape application metrics exposed from the FastAPI service at:

http://api:5000/metrics

A custom job named **products-api** was added inside `prometheus.yml` to collect the following key indicators:

Metric Name	Purpose
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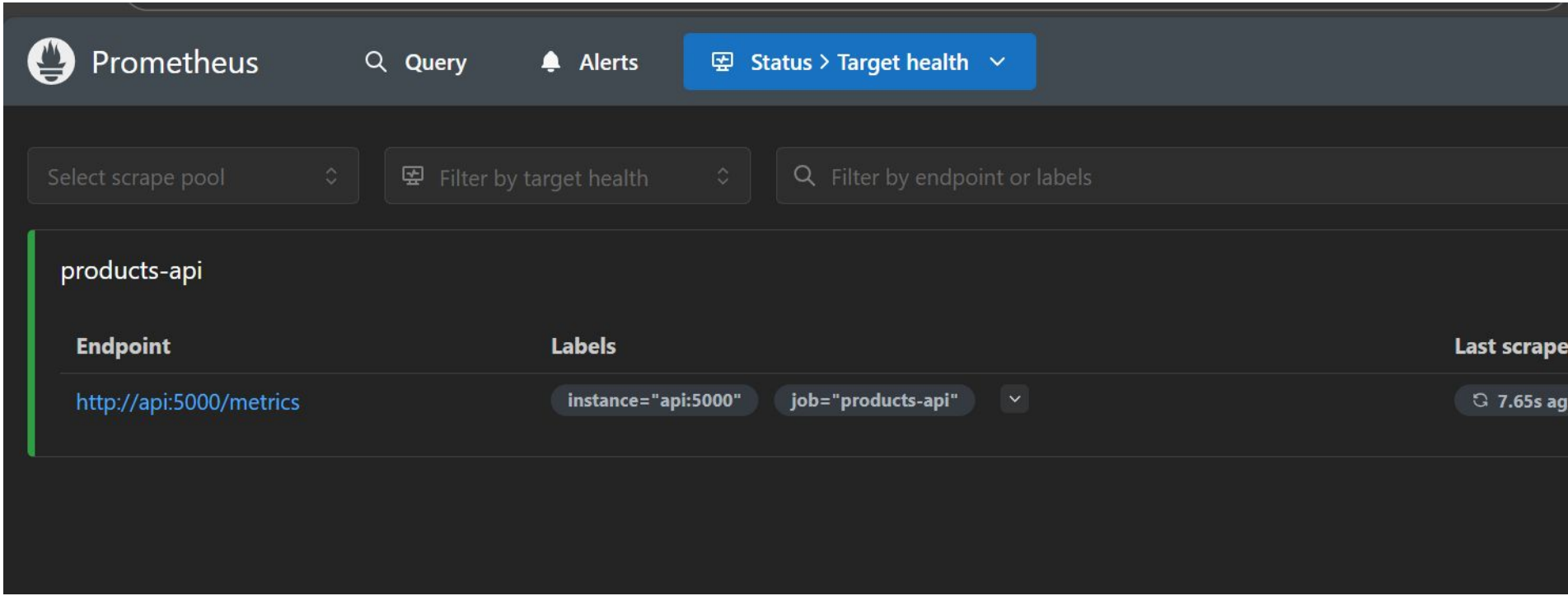
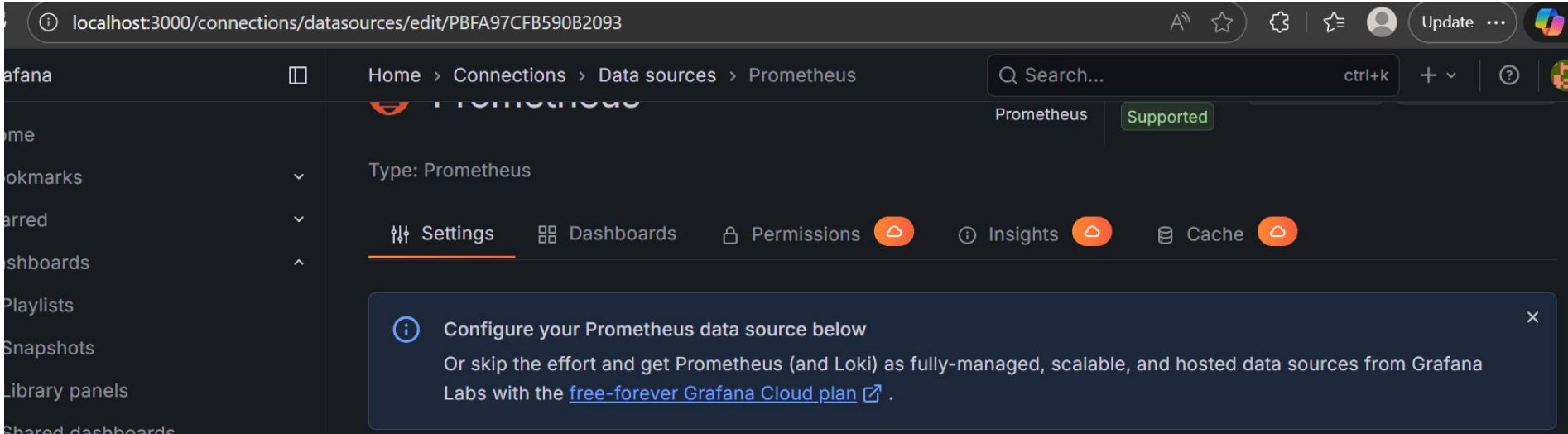


2. Grafana Data Source Configuration

Grafana was connected to Prometheus as its main data source:

Setting	Value
Type	Prometheus
Default	Yes
URL	`http://prometheus:9090`

This allows Grafana to query Prometheus and visualize application metrics in dashboard panels.



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Panel	Description
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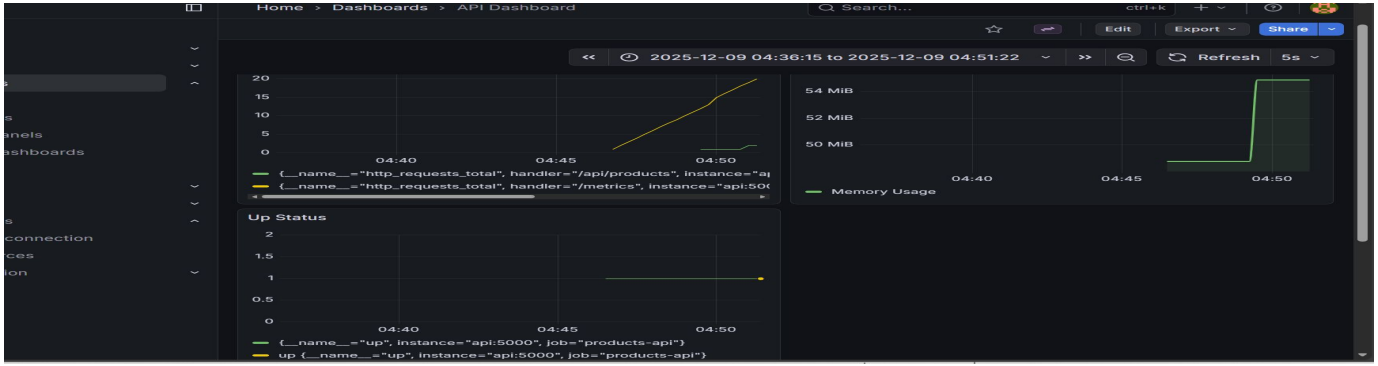

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📌 Conclusion

The monitoring architecture successfully provides:

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- Early detection of failures
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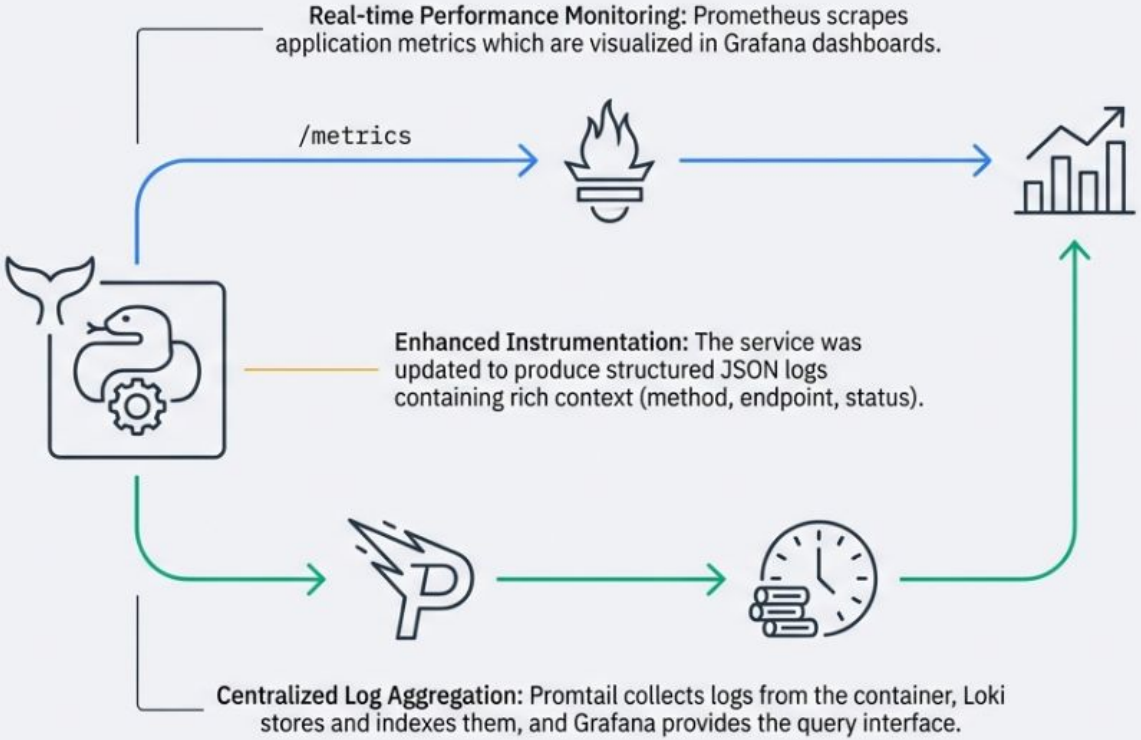
Architecting Full Observability for a FastAPI Service



The final design provides a unified observability plane, combining metrics and logs into a single interface for comprehensive analysis.

Live System Visibility: From Metrics to Actionable Logs

Structured JSON Log: Includes critical context like `http_method`, `endpoint`, and `client_address` for powerful filtering and analysis.

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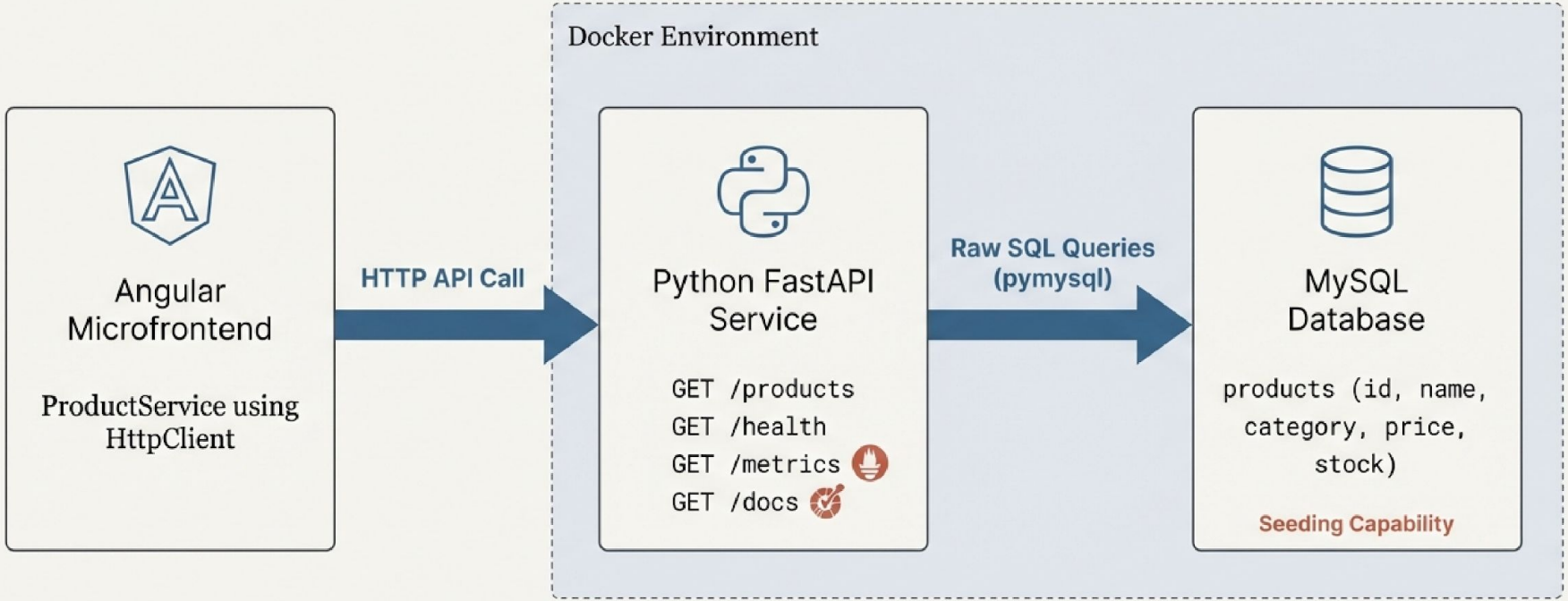

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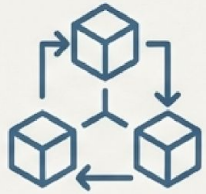

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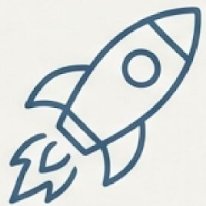

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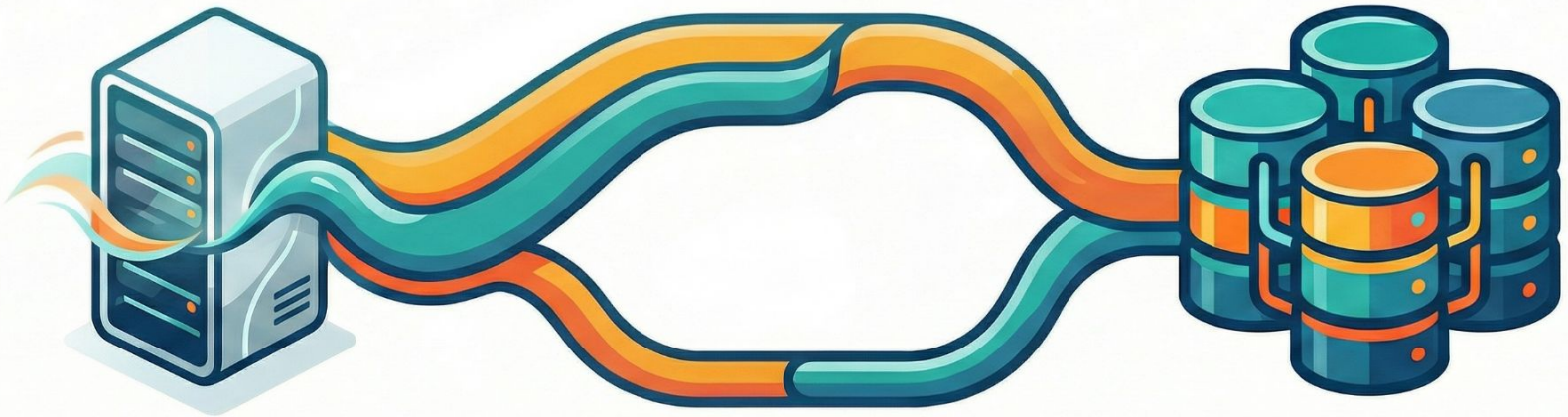

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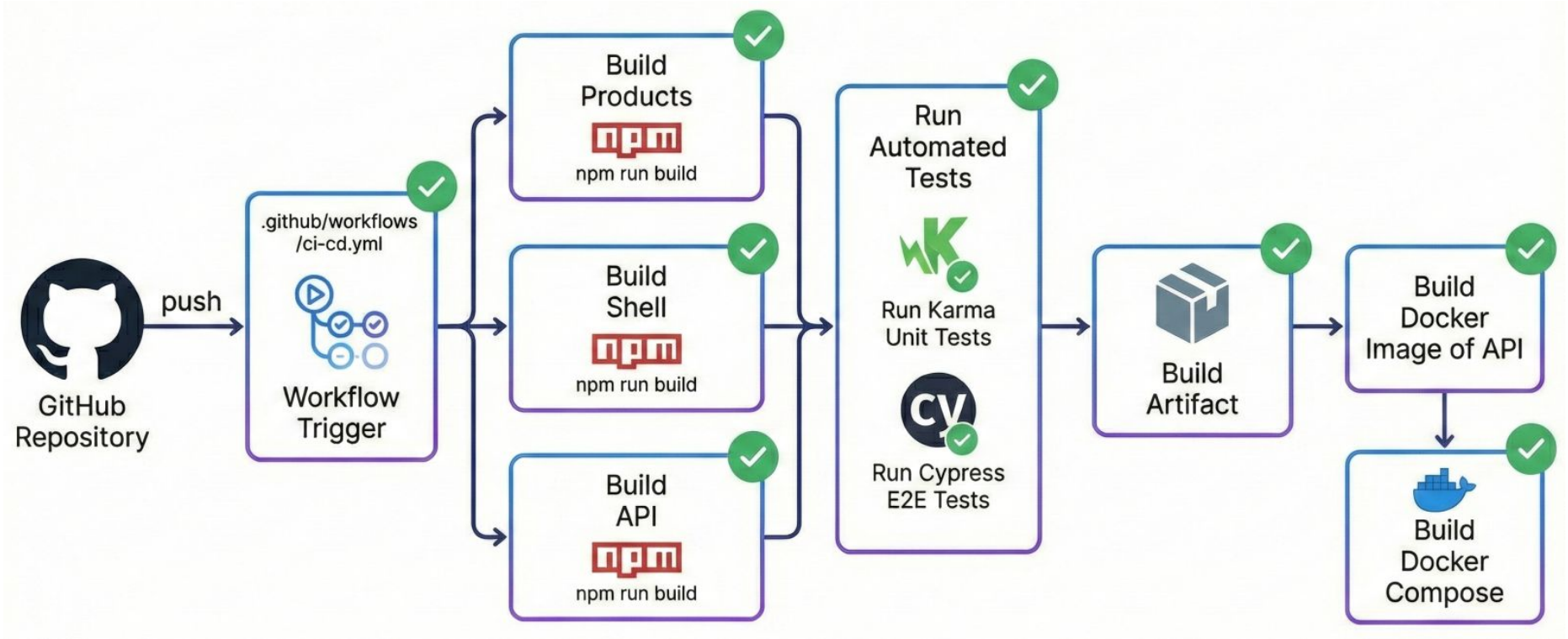

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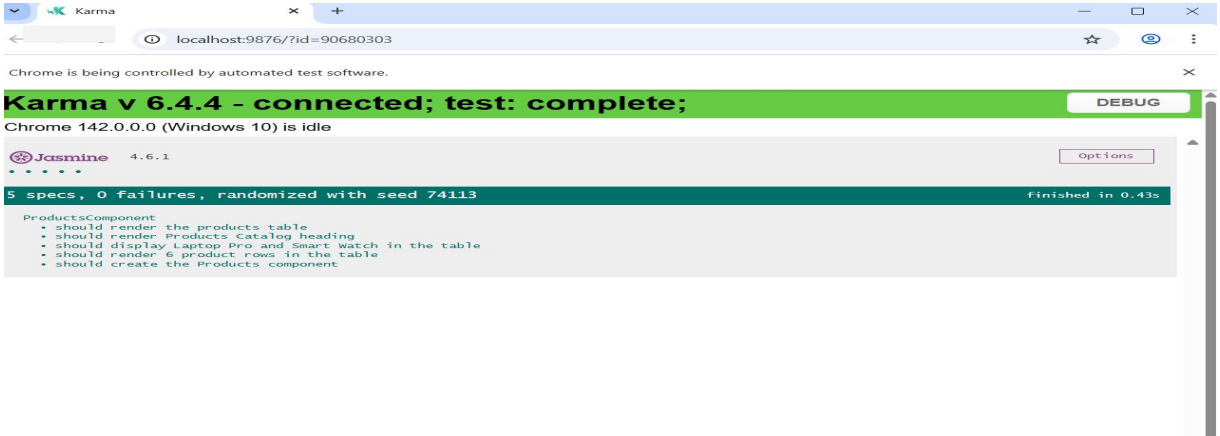

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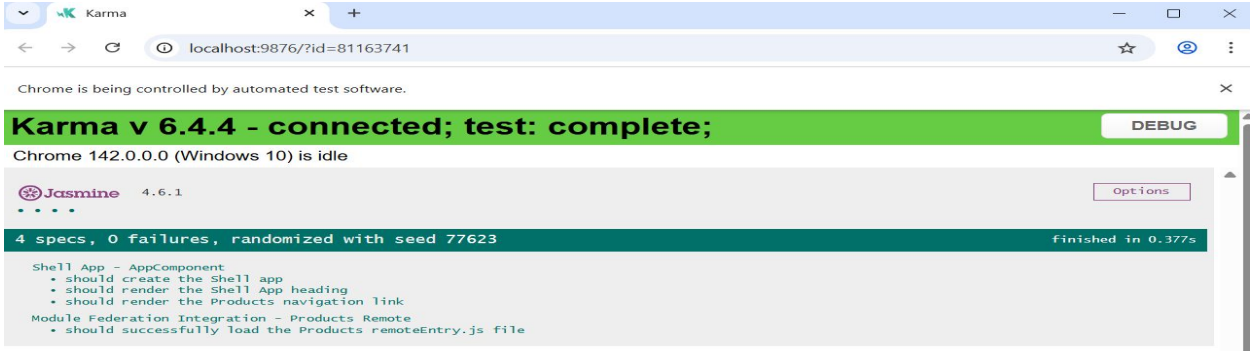

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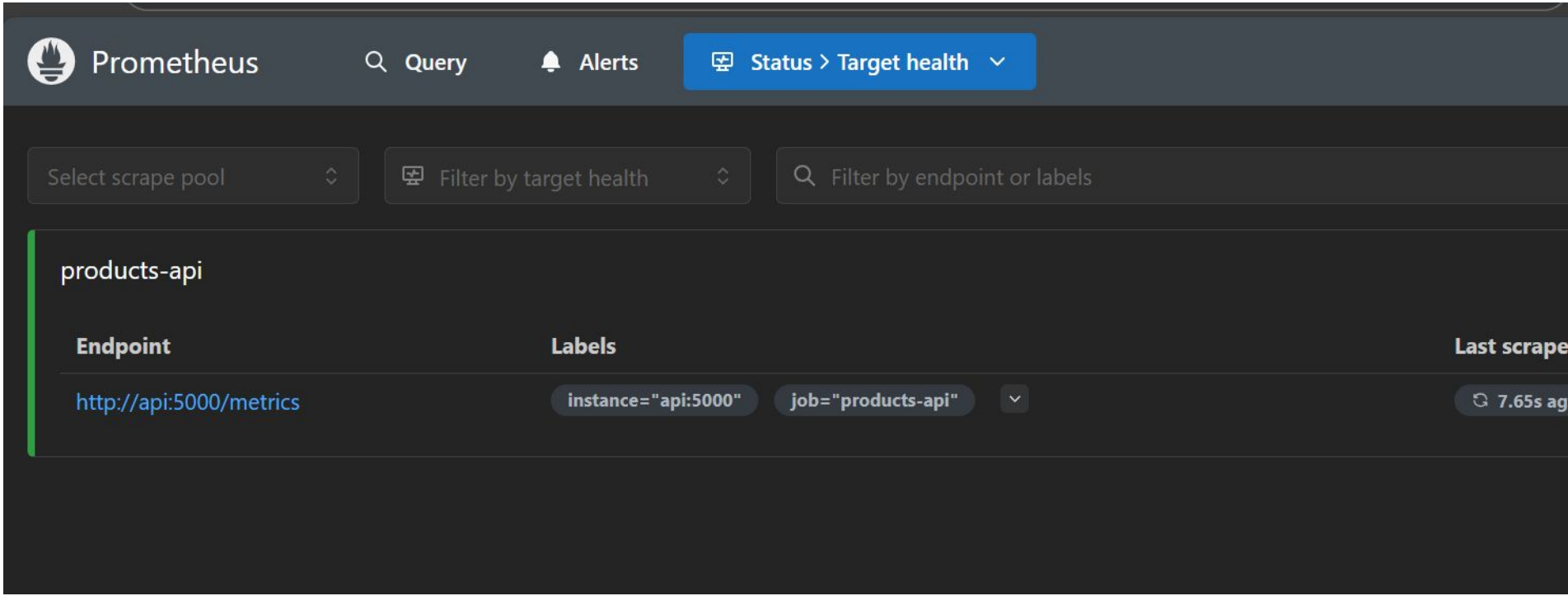

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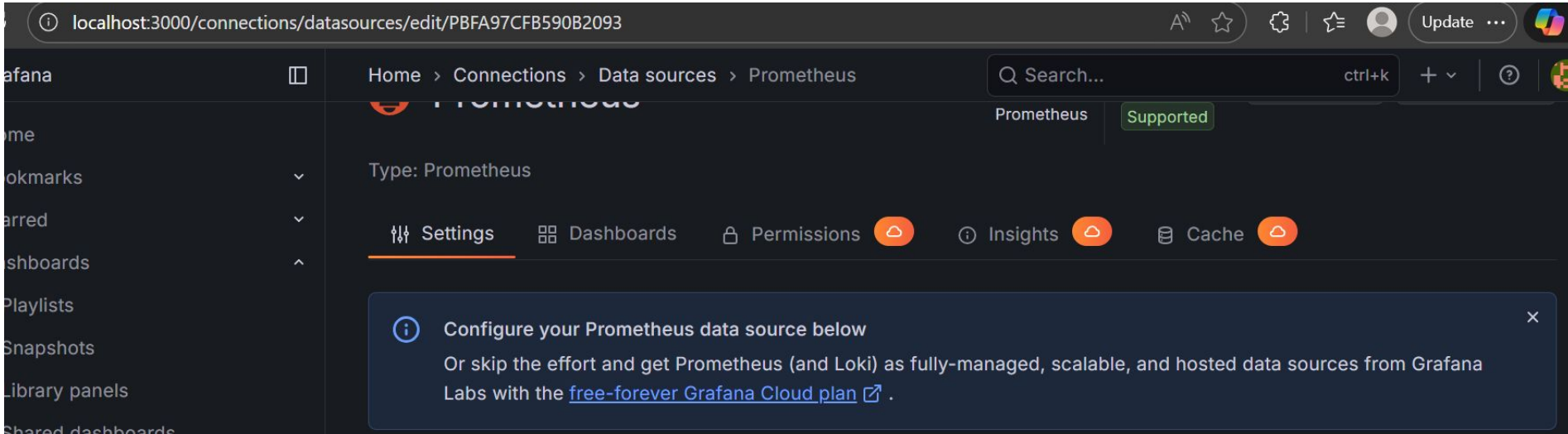

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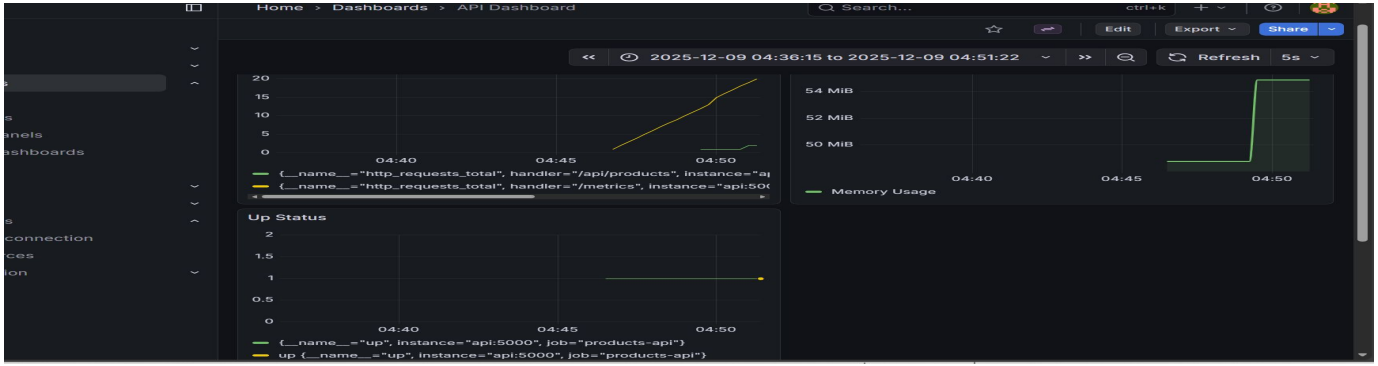

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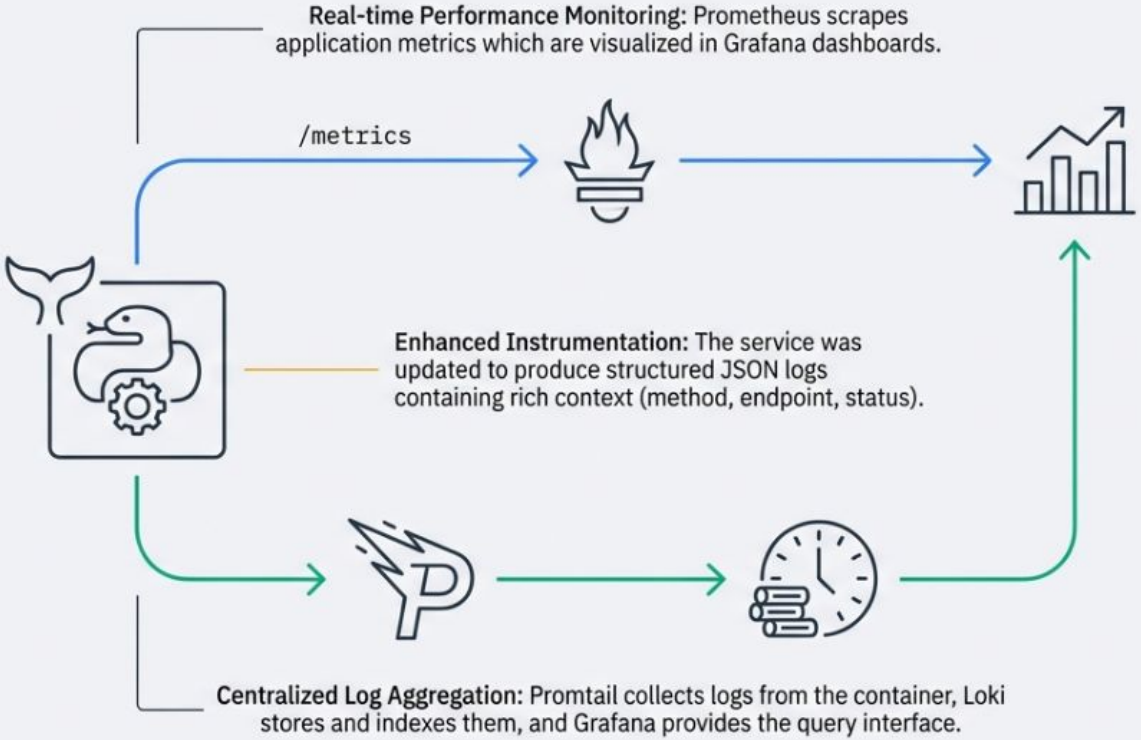

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