

Global Retail Cloud Modernization

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Problem Statement

Modern retail APIs deployed in a *single region* face *critical architectural limitations*:

- **High latency for geographically distributed users**
- **Single-region dependency** creates a **failure domain**
- **Insecure credential handling practices**
- **Limited resilience and disaster recovery capability**

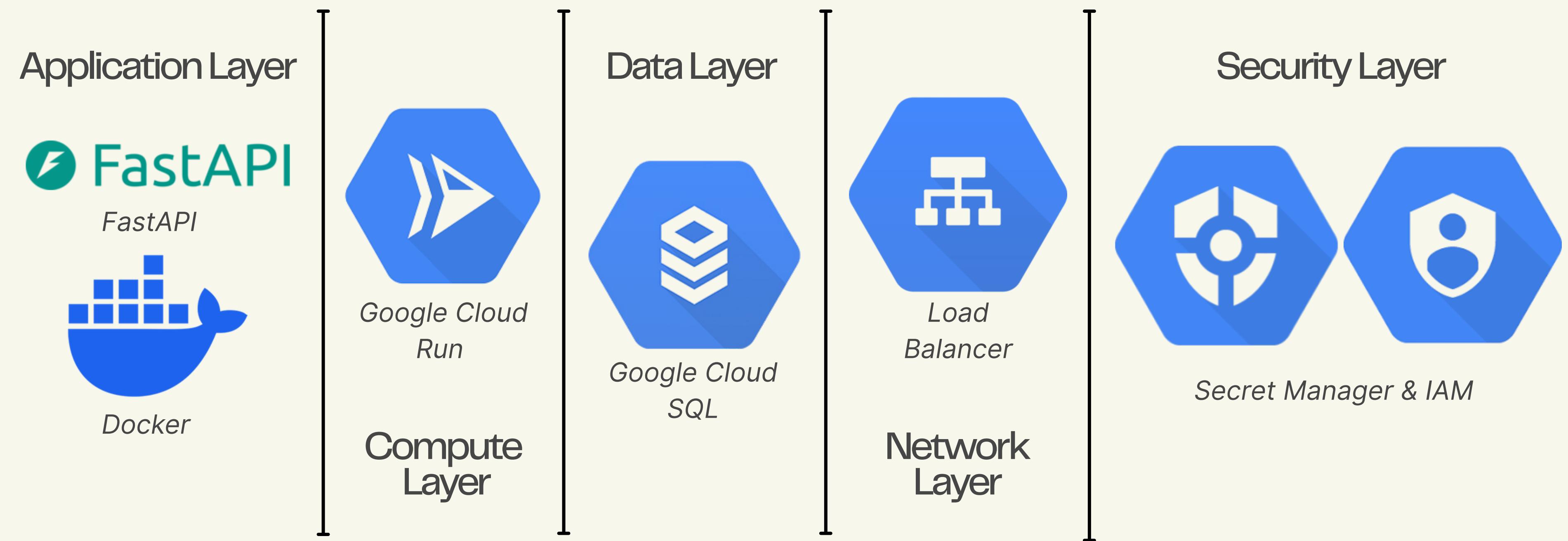


Objectives

- **Simultaneous-Active Multi-Region Deployment**
- **Global Load Balancing**
- **Secure Database Access (IAM + Secret Manager)**
- **Cross-Region Disaster Recovery**
- **Idempotent API Transactions**



Technology Stack



Key Design Decisions

1. Active-Active Multi-Region Deployment

- Simultaneous live traffic handling across europe-west3 and europe-west10.

2. Secure IAM-Based Authentication

- Eliminated hardcoded credentials using Secret Manager and IAM roles.

3. Cross-Region Database Replication

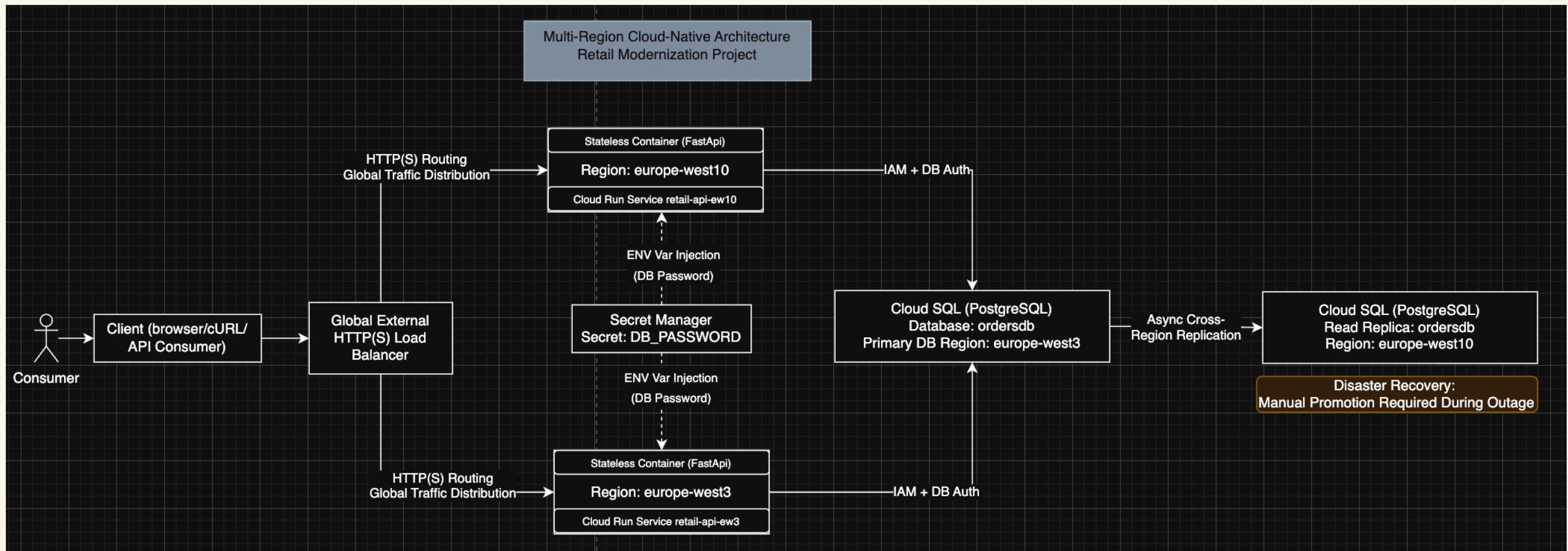
- Primary database in europe-west3 with read replica in europe-west10.

4. Stateless & Idempotent API Design

- Stateless containers and idempotency keys ensure safe retries & scalability.



System Architecture



Disaster Recovery Strategy

- **Failure Scenario**
 - Primary region (europe-west3) becomes unavailable
- **Recovery Mechanism**
 - Promote replica in europe-west10 and reconfigure service.
- **Recovery Characteristics**
 - Asynchronous replication with minimal data loss
- **Design Trade-Off**
 - Cost-efficient but requires manual intervention



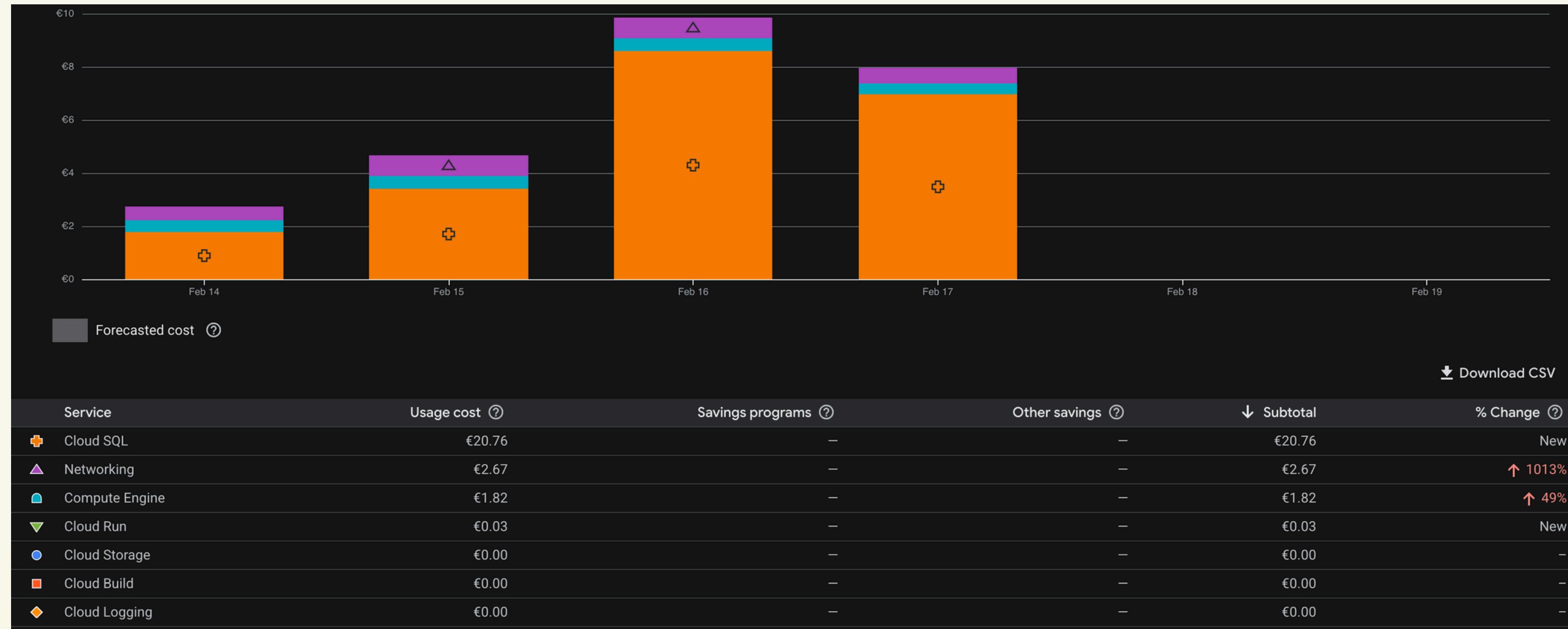
API Endpoints

Method	Endpoint	Purpose
GET	/health	Service health check
POST	/orders	Create order (idempotent)
GET	/orders	List recent orders
GET	/whoami	Region & deployment metadata

Project DEMO



Cost Estimation & Optimization



Cost Estimation

- **Estimated Monthly Cost (Scenario-Based)**

- **Normal Usage Projection:** ~€130–€160/month
- **Peak Testing Scenario:** ~€250–€270/month

“Actual monthly cost depends on workload intensity and database activity.”

- **Estimated Monthly Cost (Based on 4-Day Sample)**

- **Observed Daily Range:** ~€3 – €9
- **Projected Monthly Range:** ~€130 – €270
- **Primary Cost Driver:** Cloud SQL



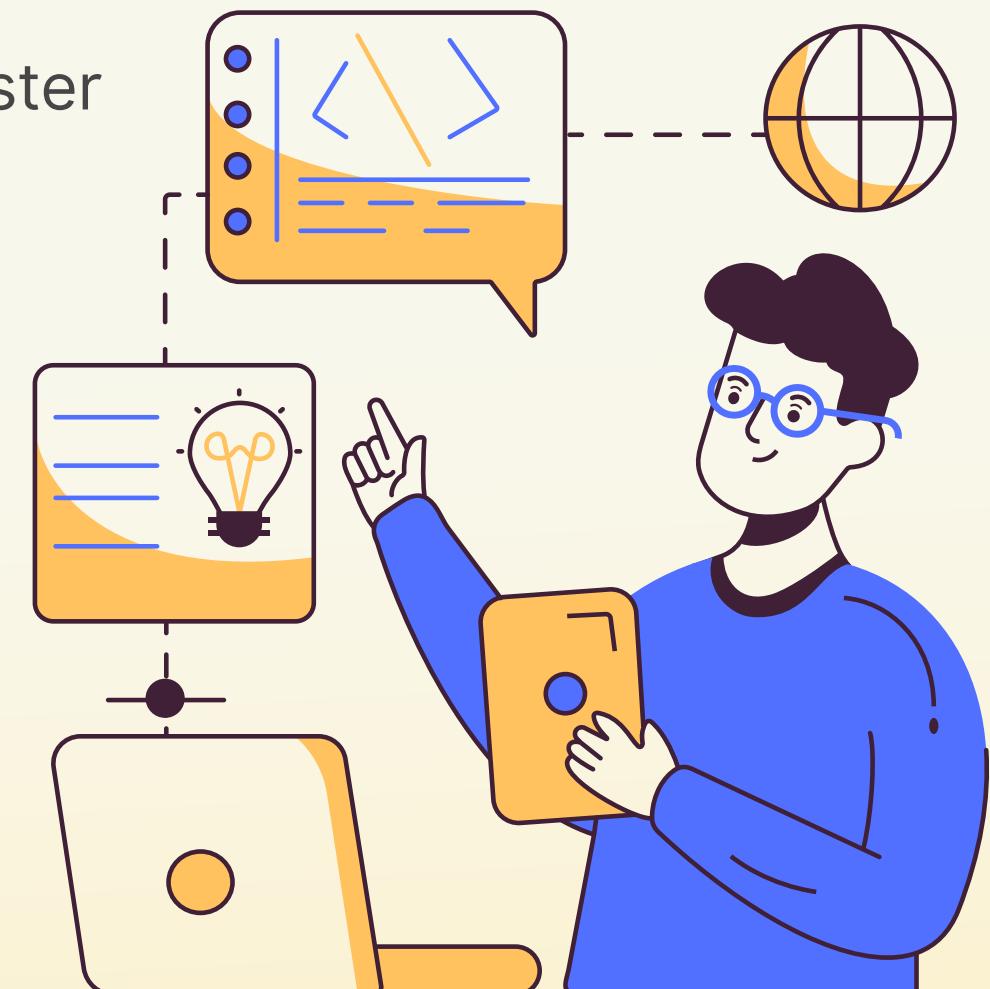
Future Improvements

- 1. Automated Failover**
- 2. Monitoring & Observability**
- 3. CI/CD Pipeline Integration**
- 4. Security Hardening**
- 5. Cost Optimization at Scale**



Conclusion

- **Cloud-Native Multi-Region Architecture**
 - Designed and deployed an active-active retail API eliminating single-region dependency.
- **Secure & Reliable Deployment**
 - Integrated IAM-based secret management with cross-region disaster recovery readiness.
- **Scalable & Resilient Design**
 - Enabled serverless auto-scaling with idempotent API logic for transactional consistency.
- **Cost-Aware Cloud Engineering**
 - Projected operational cost using real billing data while balancing performance and resilience.



Thank You

Any Questions?