DevOps Stack

DevOps/SRE Stack

DevOps/SRE Stack for Drop (originally FontelePay)

> **Rebrand note (2026-02-14):** FontelePay was renamed to Drop. Some references to FontelePay remain in this document (metric names, Sentry projects, API URLs). These should be updated when implementing the actual DevOps stack. Drop uses a PSD2 pass-through model — no wallet, no balance held by Drop.

Table of Contents

---

1. Executive Summary

Stack Philosophy

Drop requires a DevOps/SRE stack that balances:

- **Fintech compliance** (audit trails, security, GDPR)
- **Cost efficiency** for MVP phase
- **Scalability** for growth to 100K+ users
- **EU data residency** where possible
- **Small team maintainability** (1-2 DevOps engineers)

Recommended Stack Overview

Area	MVP Tool	Scale Tool	Reason
CI/CD	GitHub Actions	GitHub Actions + ArgoCD	Native GitHub, EU runners available
E2E Testing	Playwright	Playwright	Open-source, excellent mobile web
Load Testing	k6	k6 + Grafana Cloud	Grafana ecosystem, scriptable
APM	Grafana Cloud	Grafana Cloud	EU-hosted, cost-effective
Logs	Grafana Loki	Grafana Loki	Part of Grafana stack
Errors	Sentry	Sentry	Best-in-class, EU hosting
Alerts	Slack + PagerDuty	PagerDuty	Start simple, scale
Secrets	AWS Secrets Manager	AWS Secrets Manager	Native AWS, compliant
Security Scan	Snyk	Snyk + DAST	Developer-friendly

Total MVP Monthly Cost: EUR 800-1,200/month

Total Scale Monthly Cost: EUR 2,500-4,000/month

---

2. CI/CD Pipeline

2.1 Recommendation: GitHub Actions

Why GitHub Actions over alternatives:

Criteria	GitHub Actions	GitLab CI	CircleCI
Native Integration	Best (GitHub)	Requires migration	Good
EU Runners	Yes (Azure EU)	Yes	Limited
Free Tier	2,000 min/month	400 min/month	6,000 min/month
Secrets Management	Native	Native	Native
Self-hosted Runners	Yes	Yes	Limited
Marketplace	Largest	Growing	Medium
Learning Curve	Low	Medium	Medium
OIDC for AWS	Native	Requires setup	Requires setup

Decision: GitHub Actions

- Already using GitHub for source control
- Native OIDC integration with AWS (no long-lived credentials)
- EU-hosted runners available
- Excellent ecosystem of actions
- Cost-effective at scale

2.2 Pipeline Architecture

```
# .github/workflows/main.yml structure

Triggers:
  - push to main/develop
  - pull request
  - manual dispatch

Jobs:
  1. lint-and-format
     - ESLint, Prettier
     - Parallel for speed

  2. security-scan
     - Snyk dependency check
     - Secret scanning
     - SAST (CodeQL)

  3. test-unit
```

```
     - Jest (backend/frontend)
     - Coverage threshold: 80%

  4. test-integration
     - Database tests
     - API contract tests

  5. build
     - Docker image build
     - Multi-arch (amd64/arm64)

  6. test-e2e (staging only)
     - Playwright
     - Against staging environment

  7. deploy-staging
     - Automatic on develop merge

  8. deploy-production
     - Manual approval required
     - Canary deployment
```

2.3 Deployment Strategies

MVP Phase: Rolling Deployment

- Simple, works with small user base
- Zero-downtime with K8s rolling updates
- Easy rollback

Scale Phase: Canary Deployment

```
Production Traffic:
  ├── 95% → Current Version
  └── 5%  → New Version (canary)

Promotion: Manual after metrics validation
Rollback: Automatic on error rate spike
```

Implementation: ArgoCD + Argo Rollouts

- GitOps model (infrastructure as code)
- Automated sync from Git
- Progressive delivery
- Audit trail of all deployments

2.4 Branch Strategy

```
main (production)
  ↑
  └── develop (staging)
        ↑
        └── feature/* (development)
        └── hotfix/* (emergency fixes)
```

Rules:

- `main`: Protected, requires PR + approval + passing CI
- `develop`: Protected, requires PR + passing CI
- Feature branches: Deleted after merge
- Hotfixes: Can bypass develop in emergencies

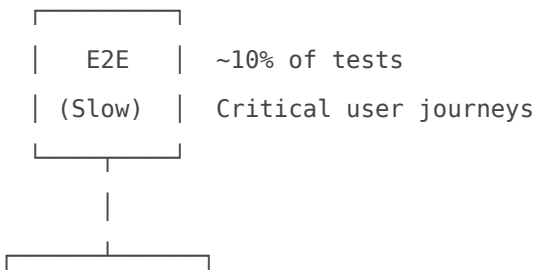
2.5 GitHub Actions Cost Estimate

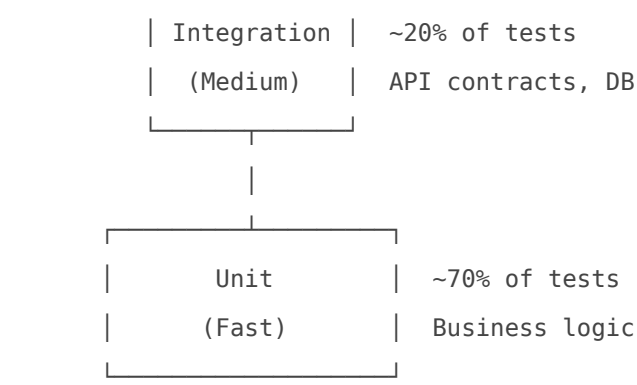
Phase	Minutes/Month	Cost
MVP (5 devs)	~3,000	Free (2,000) + EUR 20
Scale (15 devs)	~15,000	EUR 120/month

---

3. Testing Strategy

3.1 Testing Pyramid





3.2 Unit Testing

Current Stack: Jest (already configured)

Coverage Requirements:

Component	Minimum	Target
Business Logic	90%	95%
API Controllers	80%	90%
Utilities	70%	80%
UI Components	60%	70%

Best Practices:

- Test business logic, not implementation
- Mock external dependencies
- Use factories for test data
- Run on every commit

3.3 Integration Testing

Tools:

- **Testcontainers** - Spin up PostgreSQL, Redis in Docker
- **Supertest** - HTTP assertions for API testing
- **Pact** - Contract testing between services

What to Test:

- Database queries (with real PostgreSQL)
- Redis caching behavior
- API contract between services

- BaaS webhook handlers
- Payment flow integration (sandbox)

3.4 E2E Testing

Recommendation: Playwright

Criteria	Playwright	Cypress
Browser Support	All major + mobile	Chrome, Firefox, Edge
Speed	Faster (parallel)	Slower
Auto-wait	Built-in	Built-in
Mobile Testing	Better (device emulation)	Limited
CI Integration	Excellent	Good
Cost	Free	Free (cloud paid)
Learning Curve	Medium	Lower

Decision: Playwright

- Better mobile web testing (critical for Drop)
- True parallel execution
- Multiple browser contexts
- API testing built-in
- Network interception for mocking

Critical User Journeys to Test:

1. User registration + KYC start
2. Login flow (email + biometric)
3. View balance and transactions
4. Send P2P transfer
5. Card top-up flow
6. Card freeze/unfreeze
7. SEPA transfer initiation

Playwright Configuration:

```
// playwright.config.ts
{
  projects: [
    { name: 'Desktop Chrome', use: { ...devices['Desktop Chrome'] } },
    { name: 'Mobile Safari', use: { ...devices['iPhone 14'] } },
```

```
    { name: 'Mobile Chrome', use: { ...devices['Pixel 7'] } },
  ],
  retries: 2,
  reporter: [['html'], ['junit', { outputFile: 'results.xml' }]],
}
```

3.5 Load Testing

Recommendation: k6

Why k6:

- Open-source, scriptable in JavaScript
- Integrates with Grafana (our monitoring stack)
- Cloud option available for distributed load
- Can run locally or in CI/CD

Load Test Scenarios:

Scenario	Virtual Users	Duration	Success Criteria
Baseline	50	5 min	p95 < 500ms
Peak	200	10 min	p95 < 1000ms
Stress	500	5 min	No crashes
Soak	100	1 hour	No memory leaks

Critical Endpoints:

- `POST /api/auth/login` - 100 req/sec target
- `GET /api/accounts/balance` - 500 req/sec target
- `POST /api/transfers` - 50 req/sec target
- `GET /api/transactions` - 200 req/sec target

3.6 Security Testing

SAST (Static Analysis):

- **CodeQL** (GitHub native) - Free, good coverage
- **Snyk Code** - Better for JavaScript/TypeScript
- **SonarQube** - Alternative if self-hosted preferred

DAST (Dynamic Analysis):

- **OWASP ZAP** - Free, CI-integrated
- **Burp Suite** - For manual penetration testing

Dependency Scanning:

- **Snyk** - Primary recommendation
- **Dependabot** - Free, GitHub native (backup)

Schedule:

Test Type	Frequency	Blocker?
SAST	Every PR	Yes (high severity)
Dependency Scan	Daily	Yes (critical)
DAST	Weekly	No (review)
Pen Test	Quarterly	N/A (manual)

---

4. Monitoring & Observability

4.1 Strategy: Unified Grafana Stack

Why Grafana Cloud over alternatives:

Criteria	Grafana Cloud	Datadog	New Relic
EU Hosting	Yes (Frankfurt)	Yes	Yes
Pricing Model	Usage-based	Per-host	Per-user
MVP Cost	EUR 0-200	EUR 400+	EUR 300+
Scale Cost	EUR 500-1,000	EUR 2,000+	EUR 1,500+
Open Standards	Full (Prometheus, OTel)	Partial	Partial
Vendor Lock-in	Low	High	High
Self-host Option	Yes (fallback)	No	No

Decision: Grafana Cloud

- Best cost/value for startup
- EU data residency (Frankfurt region)
- Open standards (can migrate if needed)
- Unified platform (metrics, logs, traces)
- Free tier generous for MVP

4.2 Metrics (Prometheus + Grafana)

Infrastructure Metrics:

- CPU, Memory, Disk, Network
- Kubernetes pod health
- Database connections, query latency
- Redis hit/miss ratio

Application Metrics:

- Request rate, latency, error rate (RED)
- Active users (DAU/MAU)
- Transaction volume and value
- KYC conversion funnel
- Card activation rate

Business Metrics (Custom):

```
fontelepay_transactions_total{type="p2p|sepa|card"}
fontelepay_transaction_value_eur{type="p2p|sepa|card"}
fontelepay_users_registered_total
fontelepay_users_kyc_passed_total
fontelepay_cards_issued_total{type="virtual|physical"}
fontelepay_api_latency_seconds{endpoint="/api/..."}
```

4.3 Log Aggregation (Loki)

Why Loki:

- Part of Grafana stack (unified UI)
- Cost-effective (indexes labels, not content)
- Kubernetes native
- Query language similar to Prometheus

Log Structure (JSON):

```
{
  "timestamp": "2026-02-05T10:30:00Z",
  "level": "info",
  "service": "payment-service",
  "trace_id": "abc123",
  "user_id": "usr_xxx",  // pseudonymized
```

```
  "message": "Transfer initiated",
  "amount_eur": 100,
  "transfer_type": "sepa"
}
```

Retention Policy:

Log Type	Retention	Reason
Application	30 days	Debugging
Security/Audit	7 years	Compliance
Access Logs	90 days	Security review

GDPR Considerations:

- No PII in logs (use pseudonymized IDs)
- User IDs hashed or tokenized
- IP addresses masked after 30 days

4.4 Distributed Tracing (Tempo)

Implementation: OpenTelemetry

Why OpenTelemetry:

- Vendor-neutral standard
- Supports all our languages (Java, Node.js, Dart)
- Auto-instrumentation available
- Future-proof (industry standard)

Trace Critical Paths:

1. User login (app -> API -> auth -> DB)
2. Payment initiation (app -> API -> payment -> BaaS -> ledger)
3. Card transaction (webhook -> processor -> notification)

Sampling Strategy:

- 100% for errors
- 100% for slow requests (>1s)
- 10% for successful requests (MVP)
- 1% for successful requests (scale)

4.5 Real User Monitoring (RUM)

For Web (Next.js):

- Grafana Faro (free, part of Grafana)
- Captures: Page load, Web Vitals, JS errors

For Mobile (Flutter):

- Custom implementation with OpenTelemetry
- Track: App start time, screen transitions, API calls

Key Metrics:

Metric	Target	Threshold
LCP (Largest Contentful Paint)	<2.5s	<4s
FID (First Input Delay)	<100ms	<300ms
CLS (Cumulative Layout Shift)	<0.1	<0.25
App Cold Start	<2s	<3s
API Response (p95)	<500ms	<1s

4.6 Grafana Cloud Cost Estimate

Component	MVP Usage	MVP Cost	Scale Usage	Scale Cost
Metrics	10K series	Free	50K series	EUR 150
Logs	50 GB/mo	Free	200 GB/mo	EUR 200
Traces	10 GB/mo	Free	50 GB/mo	EUR 100
Total	-	**EUR 0-50**	-	**EUR 450**

---

5. Error Tracking

5.1 Recommendation: Sentry

Comparison:

Criteria	Sentry	Bugsnag	Rollbar
EU Hosting	Yes	Yes	No
Flutter SDK	Excellent	Good	Limited

Criteria	Sentry	Bugsnag	Rollbar
Source Maps	Automatic	Automatic	Manual
Performance	Included	Separate	Included
Pricing (MVP)	Free	EUR 100	EUR 100
Pricing (Scale)	EUR 300	EUR 400	EUR 350
Slack Integration	Native	Native	Native
Issue Grouping	Best	Good	Good

Decision: Sentry

- Best Flutter support (critical for mobile)
- EU data residency available
- Excellent source map integration
- Issue grouping reduces noise
- Performance monitoring included
- Generous free tier (5K errors/month)

5.2 Sentry Configuration

Projects:

- `fontelepay-web` (Next.js frontend)
- `fontelepay-api` (Node.js/Java backend)
- `fontelepay-mobile` (Flutter app)

Settings:

```
// sentry.config.js
{
  dsn: "https://xxx@sentry.io/xxx",
  environment: process.env.NODE_ENV,
  release: process.env.GIT_SHA,
  tracesSampleRate: 0.1,  // 10% of transactions

  // Filter sensitive data
  beforeSend(event) {
    // Remove PII
    if (event.user) {
      delete event.user.email;
      delete event.user.ip_address;
```

```
    }
    return event;
  }
}
```

Alert Rules:

Condition	Action	Priority
New issue (high severity)	Slack + PagerDuty	P1
Issue spike (>10x baseline)	Slack + PagerDuty	P1
New issue (medium)	Slack only	P2
Regression (resolved reopened)	Slack	P2

5.3 Source Maps

Web (Next.js):

- Automatic upload via `@sentry/nextjs`
- Hidden from production (security)

Mobile (Flutter):

- Upload dSYM (iOS) and mapping files (Android)
- Integrated with CI/CD

5.4 Sentry Cost Estimate

Phase	Events/Month	Cost
MVP	<5,000	Free
Growth	~50,000	EUR 26/month
Scale	~500,000	EUR 300/month

---

6. Alerting & Incident Management

6.1 Phased Approach

MVP (Team <5): Slack + Grafana Alerts

- Simple, no additional cost
- On-call rotation manual
- Suitable for low traffic

Growth (Team 5-15): Add PagerDuty

- Proper escalation policies
- On-call schedules
- Mobile alerts
- Incident timeline

Scale (Team 15+): Full Incident Management

- PagerDuty + Statuspage
- War room automation
- Post-incident reviews

6.2 Alert Levels

Level	Response Time	Examples	Notification
P1 - Critical	15 min	Payment processing down, data breach	PagerDuty + Slack + SMS
P2 - High	1 hour	High error rate, degraded performance	PagerDuty + Slack
P3 - Medium	4 hours	Non-critical service degraded	Slack only
P4 - Low	Next business day	Warning thresholds	Slack (daily digest)

6.3 Critical Alerts (P1)

Alert	Condition	Action
API Down	0 successful requests for 2 min	Page on-call
Payment Failures	>5% failure rate for 5 min	Page on-call
Database Unreachable	Connection failures >10/min	Page on-call
Security Event	Suspicious activity detected	Page on-call + security
Error Spike	10x baseline errors	Page on-call

6.4 On-Call Rotation

MVP Setup:

```
Week 1: Dev A (primary)
Week 2: Dev B (primary)
Week 3: Dev A (primary)
...

Escalation:
  0-15 min: Primary on-call
  15-30 min: Secondary on-call
  30+ min: Engineering lead
```

PagerDuty Cost:

Plan	Cost	Features
Free	EUR 0	5 users, basic
Professional	EUR 21/user/mo	Full features

MVP: Free tier (5 users) Scale: Professional for core team

6.5 Incident Response Runbook Template

```
## Incident: [Title]

### Detection
- Alert source: [Grafana/Sentry/PagerDuty]
- Time detected: [timestamp]
- Severity: [P1/P2/P3]

### Impact
- Users affected: [estimate]
- Services affected: [list]
- Financial impact: [if applicable]

### Timeline
- HH:MM - [Event]
- HH:MM - [Event]

### Root Cause
[Description]
```

```
### Resolution
[Steps taken]

### Action Items
- [ ] [Preventive measure]
- [ ] [Process improvement]

### Participants
- Incident Commander: [name]
- Responders: [names]
```

---

7. Documentation

7.1 API Documentation

Recommendation: OpenAPI 3.1 + Swagger UI

Why:

- Industry standard
- Auto-generated from code annotations
- Interactive testing
- Client SDK generation

Implementation:

```
# openapi.yaml (partial)
openapi: 3.1.0
info:
  title: Drop API
  version: 1.0.0
  description: Mobile banking API

servers:
  - url: https://api.fontelepay.com/v1
    description: Production
  - url: https://api.staging.fontelepay.com/v1
    description: Staging
```

```
security:
  - bearerAuth: []

paths:
  /accounts/{id}/balance:
    get:
      summary: Get account balance
      tags: [Accounts]
      ...
```

Hosting:

- Swagger UI at `/docs` endpoint
- Redoc as alternative (cleaner for external)
- Postman collection export for testing

7.2 Runbooks

Location: `/docs/runbooks/` in repository

Required Runbooks:

Runbook	Purpose
`deploy-production.md`	Production deployment steps
`rollback.md`	How to rollback a bad deploy
`database-migration.md`	Safe DB migration process
`incident-response.md`	General incident handling
`scaling.md`	How to scale services
`secrets-rotation.md`	Rotating API keys, certs
`disaster-recovery.md`	Full recovery procedures

Runbook Template:

```
# Runbook: [Title]

## Overview
[What this runbook covers]

## Prerequisites
```

```
- [ ] Access to [system]
- [ ] Permissions: [list]

## Steps
1. [Step with command examples]
2. [Step with verification]

## Verification
[How to confirm success]

## Rollback
[If something goes wrong]

## Contacts
- Primary: [name/slack]
- Escalation: [name/slack]
```

7.3 Architecture Decision Records (ADRs)

Location: `/docs/adr/` in repository

Format:

```
# ADR-001: Use PostgreSQL as Primary Database

## Status
Accepted

## Context
We need a reliable, ACID-compliant database for financial transactions.

## Decision
Use PostgreSQL 16 as our primary database.

## Consequences
### Positive
- Strong ACID compliance
- Excellent JSON support
- Proven in fintech
```

```
### Negative
- Requires more ops than managed NoSQL
- Horizontal scaling more complex

## Alternatives Considered
- MySQL: Less JSON support
- MongoDB: Not ACID by default
- CockroachDB: Higher cost, complexity
```

Key ADRs to Create:

- ADR-001: Database selection (PostgreSQL)
- ADR-002: Cloud provider (AWS)
- ADR-003: BaaS provider (Swan)
- ADR-004: Mobile framework (Flutter)
- ADR-005: Monitoring stack (Grafana)
- ADR-006: CI/CD platform (GitHub Actions)

7.4 Documentation Tooling

Type	Tool	Cost
API Docs	Swagger/OpenAPI	Free
Internal Docs	Notion or Confluence	Free-EUR 50/mo
Runbooks	Git repository	Free
Diagrams	Mermaid (in Markdown)	Free
Postmortems	Notion template	Free

---

8. Security Operations

8.1 Dependency Scanning

Recommendation: Snyk

Why Snyk:

- Best JavaScript/TypeScript support
- Dart/Flutter support
- Automatic PR fixes

- License compliance
- Container scanning

Integration:

```
# .github/workflows/security.yml
- name: Snyk Security Scan
  uses: snyk/actions/node@master
  with:
    args: --severity-threshold=high
```

Policy:

Severity	Action	SLA
Critical	Block PR, fix immediately	24 hours
High	Block PR, fix before merge	72 hours
Medium	Warning, fix in sprint	2 weeks
Low	Track, fix when convenient	1 month

Snyk Cost:

Plan	Cost	Limits
Free	EUR 0	200 tests/month
Team	EUR 52/dev/mo	Unlimited

MVP: Free tier Scale: Team plan

8.2 Secret Management

Recommendation: AWS Secrets Manager

Why AWS Secrets Manager:

- Native AWS integration (using AWS already)
- Automatic rotation support
- Audit trail via CloudTrail
- GDPR compliant (EU region)
- No additional infrastructure

Alternative: HashiCorp Vault

- More features but more operational overhead

- Consider for Scale phase if multi-cloud

Secrets to Manage:

Secret	Rotation	Access
Database credentials	90 days	Backend services
API keys (Swan, Stripe)	180 days	Backend services
JWT signing keys	365 days	Auth service
Encryption keys	Never (versioned)	All services

Implementation:

```
// secrets.ts
import { SecretsManager } from '@aws-sdk/client-secrets-manager';

const client = new SecretsManager({ region: 'eu-central-1' });

export async function getSecret(name: string): Promise<string> {
  const response = await client.getSecretValue({ SecretId: name });
  return response.SecretString!;
}
```

AWS Secrets Manager Cost:

Secrets	Cost
10 secrets	EUR 4/month
50 secrets	EUR 20/month
100 secrets	EUR 40/month

8.3 Penetration Testing

Schedule:

Test Type	Frequency	Provider
Automated DAST	Weekly	OWASP ZAP
Web App Pen Test	Quarterly	External firm
Mobile App Pen Test	Quarterly	External firm
Infrastructure Pen Test	Annually	External firm

Budget:

Test	Cost
Web + API Pen Test	EUR 5,000-10,000
Mobile Pen Test	EUR 5,000-8,000
Infrastructure	EUR 8,000-15,000
Annual Total	**EUR 25,000-45,000**

EU-Based Pen Testing Firms:

- Cure53 (Germany) - Excellent reputation
- Securitum (Poland) - Cost-effective
- WithSecure (Finland) - Enterprise grade
- Secura (Netherlands) - Banking expertise

8.4 Security Monitoring

SIEM Considerations:

- MVP: CloudWatch + Grafana alerts (sufficient)
- Scale: Consider AWS Security Hub or Elastic SIEM

Security Alerts:

Event	Action
Failed login spike	Alert + temp block
New device login	User notification
Large transfer	Manual review queue
Admin action	Audit log + alert
API key usage anomaly	Alert + investigate

8.5 Compliance Automation

Tools:

- **AWS Config** - Configuration compliance
- **Prowler** - AWS security assessment (free)
- **Checkov** - Infrastructure as code scanning

Automated Checks:

- S3 buckets not public
- Encryption at rest enabled
- Security groups not overly permissive
- IAM policies least-privilege
- Audit logging enabled

---

9. Cost Summary

9.1 MVP Phase (Monthly)

Category	Tool	Cost (EUR)
CI/CD	GitHub Actions	20-50
Monitoring	Grafana Cloud (free tier)	0-50
Error Tracking	Sentry (free tier)	0
Alerting	Slack + PagerDuty Free	0
Security	Snyk (free tier)	0
Secrets	AWS Secrets Manager	10
Testing	Playwright, k6 (OSS)	0
Total		**EUR 30-110**

9.2 Growth Phase (Monthly)

Category	Tool	Cost (EUR)
CI/CD	GitHub Actions	100-150
Monitoring	Grafana Cloud	200-400
Error Tracking	Sentry Team	100-300
Alerting	PagerDuty Professional	100-200
Security	Snyk Team	200-400
Secrets	AWS Secrets Manager	20-40
Testing	k6 Cloud (load testing)	100-200
Total		**EUR 820-1,690**

9.3 Scale Phase (Monthly)

Category	Tool	Cost (EUR)
CI/CD	GitHub Actions + ArgoCD	200-300
Monitoring	Grafana Cloud	500-1,000
Error Tracking	Sentry Business	300-500
Alerting	PagerDuty + Statuspage	300-500
Security	Snyk + DAST	500-800
Secrets	AWS Secrets Manager	40-60
Testing	k6 Cloud	200-400
Documentation	Confluence	50-100
Total		**EUR 2,090-3,660**

9.4 Annual Security Costs

Item	Cost (EUR)
Penetration Testing (4x/year)	25,000-45,000
Compliance Audit (annual)	10,000-20,000
Security Training	2,000-5,000
Total	**EUR 37,000-70,000**

---

10. Implementation Priority

10.1 Phase 1: Foundation (Week 1-2)

Must Have:

- ☐ GitHub Actions basic pipeline (lint, test, build)
- ☐ Sentry error tracking (all environments)
- ☐ Basic Slack alerting
- ☐ AWS Secrets Manager setup
- ☐ Snyk dependency scanning

Outcome: Can deploy safely with visibility into errors

10.2 Phase 2: Observability (Week 3-4)

Must Have:

- [ ] Grafana Cloud setup (metrics, logs)
- [ ] Prometheus metrics in application
- [ ] Structured logging (JSON)
- [ ] Basic dashboards (RED metrics)
- [ ] Critical alerts configured

Outcome: Can monitor application health

10.3 Phase 3: Testing (Week 5-6)

Must Have:

- [ ] Unit test coverage >70%
- [ ] Integration tests for critical paths
- [ ] Playwright E2E for happy paths
- [ ] k6 load test baseline
- [ ] Test runs in CI/CD

Outcome: Confidence in deployments

10.4 Phase 4: Security (Week 7-8)

Must Have:

- [ ] CodeQL SAST enabled
- [ ] OWASP ZAP in staging
- [ ] Security headers configured
- [ ] Audit logging implemented
- [ ] First penetration test scheduled

Outcome: Security baseline established

10.5 Phase 5: Operations (Week 9-12)

Should Have:

- [ ] PagerDuty on-call rotation
- [ ] Runbooks for critical scenarios
- [ ] Disaster recovery tested
- [ ] OpenAPI documentation complete
- [ ] ADRs documented

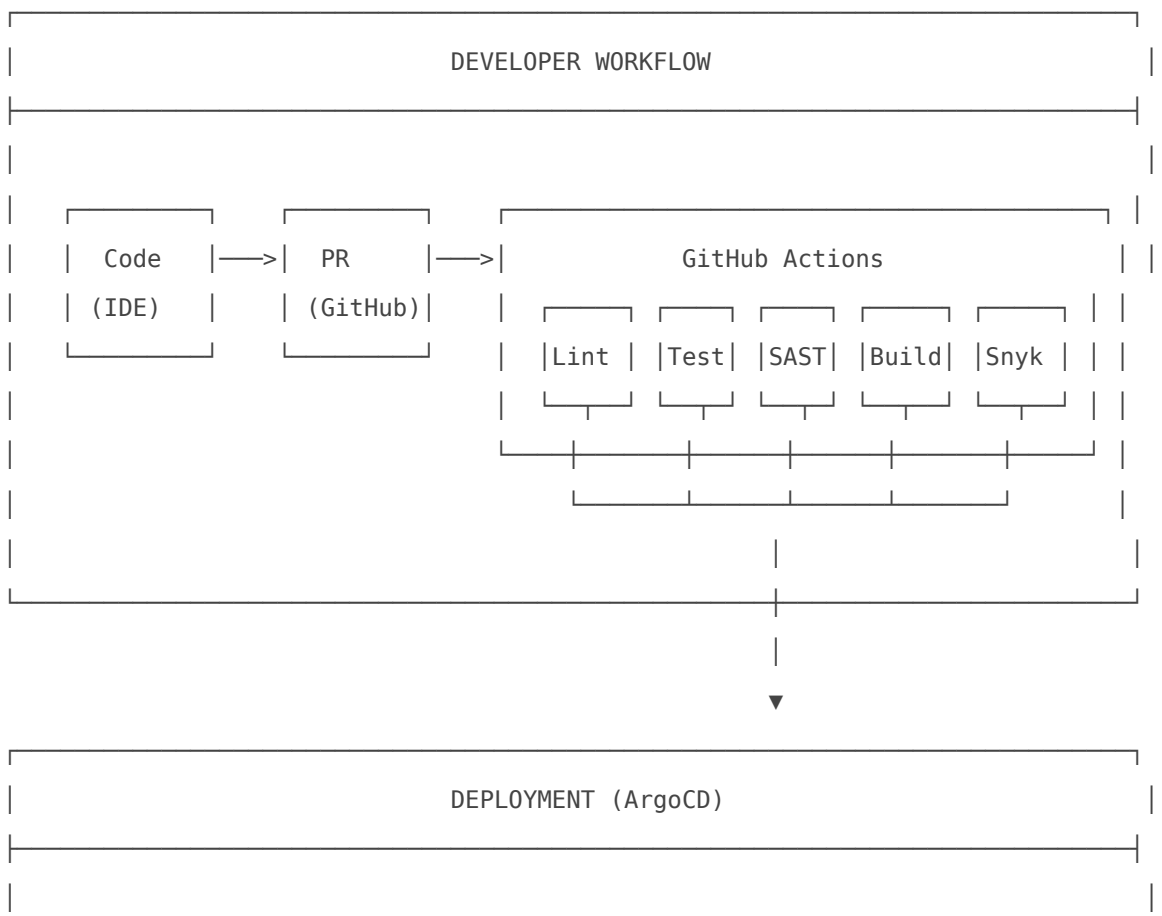
Outcome: Production-ready operations

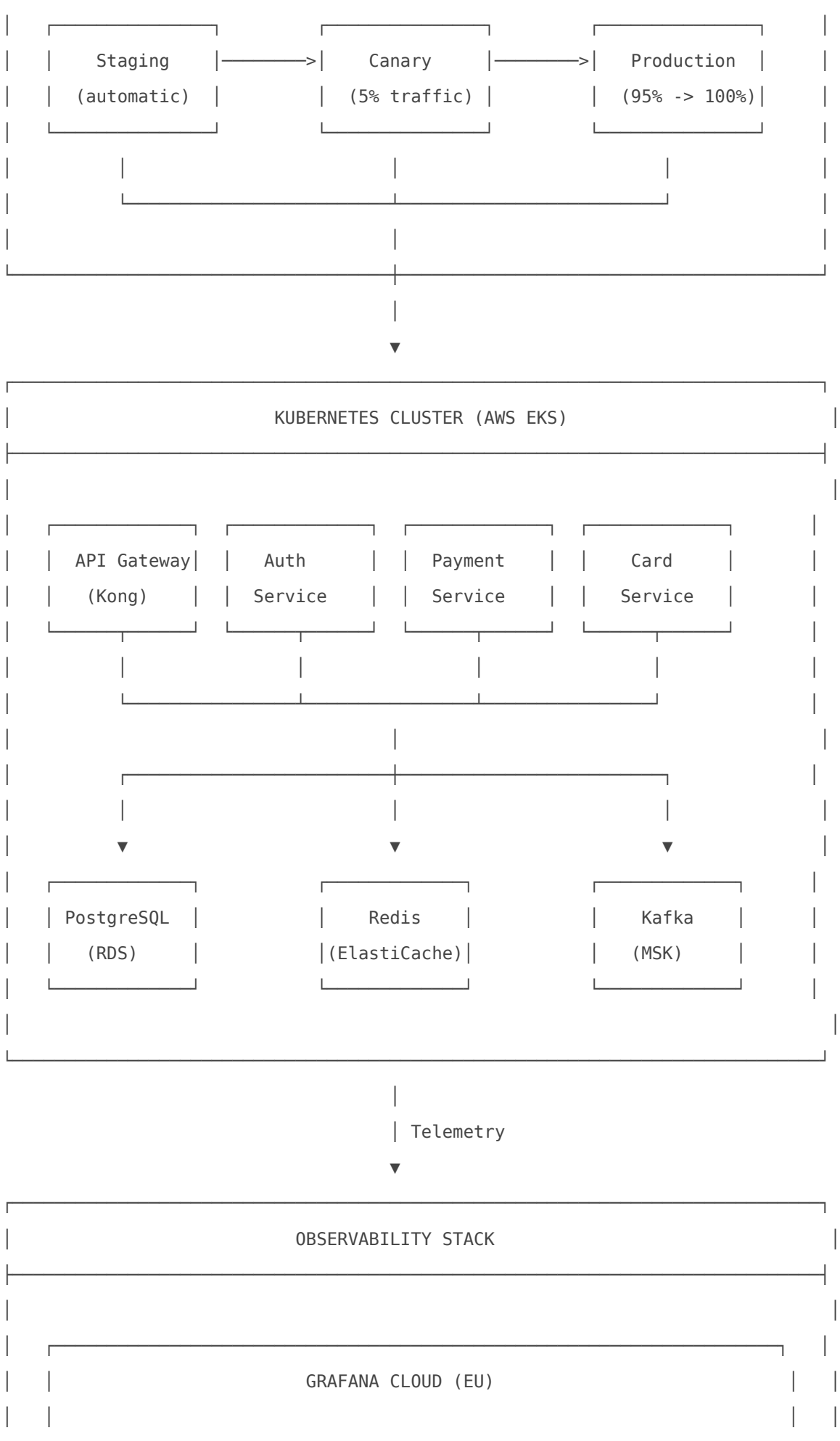
10.6 Checklist Summary

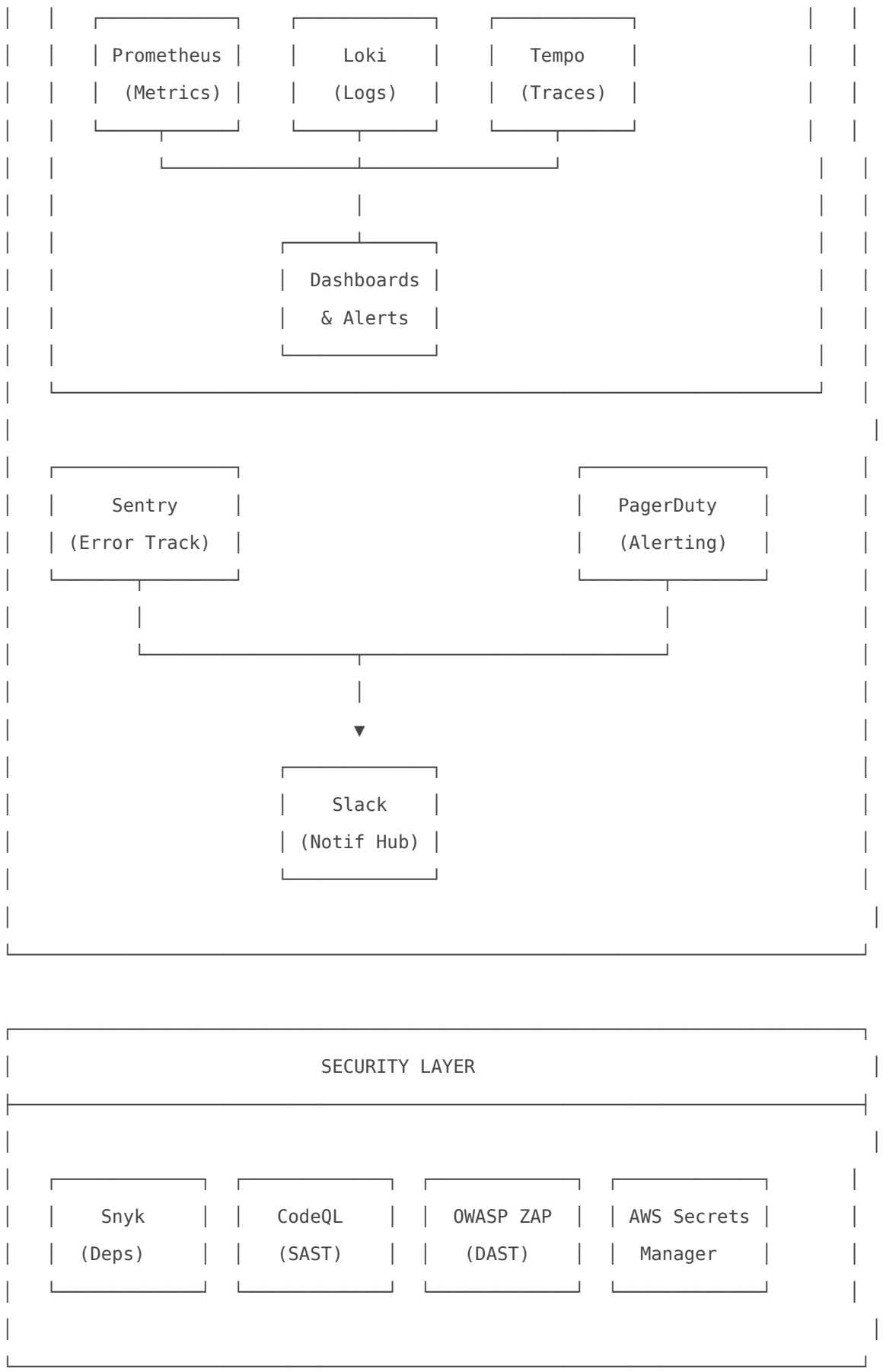
```
Week 1-2:  CI/CD + Errors + Secrets
Week 3-4:  Monitoring + Logs + Alerts
Week 5-6:  Tests + E2E + Load
Week 7-8:  Security + Audit + Pen Test
Week 9-12: On-call + Docs + DR
```

---

11. Integration Diagram




Staging
(automatic)
Canary
(5% traffic)
Production
(95% -> 100%)
KUBERNETES CLUSTER (AWS EKS)
API Gateway
(Kong)
Auth
Service
Payment
Service
Card
Service
PostgreSQL
(RDS)
Redis
(ElastiCache)
Kafka
(MSK)
Telemetry
OBSERVABILITY STACK
GRAFANA CLOUD (EU)


Prometheus
(Metrics)
Loki
(Logs)
Tempo
(Traces)
Dashboards
& Alerts
Sentry
(Error Track)
PagerDuty
(Alerting)
Slack
(Notif Hub)
SECURITY LAYER
Snyk
(Deps)
CodeQL
(SAST)
OWASP ZAP
(DAST)
AWS Secrets
Manager

Appendix A: Tool Links

Tool	URL	Purpose
GitHub Actions	github.com/features/actions	CI/CD
ArgoCD	argoproj.github.io/cd	GitOps deployment
Grafana Cloud	grafana.com/cloud	Monitoring
Sentry	sentry.io	Error tracking
PagerDuty	pagerduty.com	Incident management
Snyk	snyk.io	Security scanning
Playwright	playwright.dev	E2E testing
k6	k6.io	Load testing
OpenTelemetry	opentelemetry.io	Observability

Appendix B: Decision Matrix

Decision	Options Considered	Winner	Key Factor
CI/CD	GitHub Actions, GitLab, CircleCI	GitHub Actions	Native GitHub, EU runners
Monitoring	Datadog, New Relic, Grafana	Grafana Cloud	Cost, EU hosting, open standards
E2E Testing	Playwright, Cypress	Playwright	Mobile web support, speed
Error Tracking	Sentry, Bugsnag, Rollbar	Sentry	Flutter SDK, EU hosting
Alerting	PagerDuty, Opsgenie, Slack	PagerDuty	Industry standard, free tier
Secrets	AWS SM, Vault, GCP SM	AWS Secrets Manager	Already on AWS, simple
Security	Snyk, Dependabot, Sonar	Snyk	Best JS/TS coverage

Appendix C: Compliance Mapping

Requirement	Solution	Evidence
PCI DSS 10.x (Logging)	Grafana Loki, 7yr retention	CloudTrail + Loki
GDPR (Data Residency)	Grafana EU, Sentry EU	Region configs

Requirement	Solution	Evidence
GDPR (Right to Erasure)	Pseudonymized logs	No PII in logs
SOC 2 (Change Mgmt)	GitHub PRs, ArgoCD	Audit trail
ISO 27001 (Incident)	PagerDuty, Runbooks	Incident records

Document created: 2026-02-05 Last updated: 2026-02-05 Author: DevOps Research

WAF Rules

WAF Rules — Drop Payment App

MC #1229 — Web Application Firewall configuration for Drop fintech.

Overview

Drop runs on Fly.io which does not provide a built-in WAF. Protection is layered:

1. **Middleware-level** (Next.js Edge Middleware) — first line of defense
2. **Fly.io Proxy** — TLS termination, DDoS mitigation at network edge
3. **Application-level** — input validation, parameterized SQL, CSRF checks

Middleware WAF Rules (Implemented in `src/drop-app/src/middleware.ts`)

1. CSRF Origin Validation

- **Rule:** All mutation requests (POST/PUT/PATCH/DELETE) to `/api/*` must have valid `Origin` or `Referer` header
- **Action:** Block with 403
- **Bypass:** None

2. Rate Limiting

- **Rule:** Per-IP rate limits on auth endpoints (10 req/window)
- **Action:** Block with 429
- **Scope:** `/api/auth/*`

3. Content-Security-Policy

- **Rule:** Strict CSP with nonce-based script/style loading in production
- **Action:** Browser enforcement (block inline scripts/styles without nonce)
- **Dev mode:** `unsafe-inline` permitted for HMR

Recommended Reverse Proxy Rules (Fly.io / Cloudflare)

If a CDN or reverse proxy is added in front of Fly.io, configure these rules:

SQL Injection (SQLi)

- **Pattern:** Block requests containing SQL keywords in query params and body:
  - `UNION SELECT`, `OR 1=1`, `DROP TABLE`, `; --`, `' OR '`
- **Action:** Block with 403
- **Note:** Drop uses parameterized queries exclusively — this is defense-in-depth

Cross-Site Scripting (XSS)

- **Pattern:** Block requests containing:
  - `<script>`, `javascript:`, `on\w+=`, `<img.*onerror`
- **Action:** Block with 403
- **Note:** React auto-escapes output; CSP blocks inline scripts

Path Traversal

- **Pattern:** Block requests containing:
  - `../`, `..\\`, `%2e%2e`, `/etc/passwd`, `/proc/self`
- **Action:** Block with 403

Request Size Limits

- **Rule:** Max request body 1MB (API), 10KB (auth endpoints)
- **Action:** Block with 413

Geo-blocking (Optional)

- **Rule:** Drop targets Norway/Scandinavia. Consider restricting to EU/EEA IPs for reduced attack surface.
- **Action:** Block with 403 for non-allowed regions

- **Note:** Requires Cloudflare or similar CDN with geo-IP support

Bot Protection

- **Rule:** Rate limit on `/api/auth/*` endpoints (already in middleware)
- **Supplemental:** Add CAPTCHA challenge after 3 failed BankID attempts
- **Action:** Challenge or block

Implementation Priority

Priority	Rule	Status
P0	CSRF Origin check	Implemented (middleware.ts)
P0	CSP headers	Implemented (middleware.ts + next.config.ts)
P0	Rate limiting	Implemented (per-endpoint)
P1	Trivy container scan	Implemented (CI/CD)
P1	npm audit	Implemented (CI/CD)
P2	SQLi WAF rules	Pending — requires CDN/proxy
P2	XSS WAF rules	Pending — requires CDN/proxy
P2	Path traversal rules	Pending — requires CDN/proxy
P3	Geo-blocking	Pending — requires CDN/proxy
P3	Bot protection (CAPTCHA)	Pending — requires frontend integration

Testing WAF Rules

When WAF rules are deployed via CDN:

```
# Test SQLi blocking
curl -X POST "https://getdrop.no/api/test" -d "id=1 OR 1=1"
# Expected: 403 Forbidden

# Test XSS blocking
curl -X POST "https://getdrop.no/api/test" -d "name=<script>alert(1)</script>"
# Expected: 403 Forbidden
```

```
# Test path traversal blocking
curl "https://getdrop.no/../../etc/passwd"
# Expected: 403 Forbidden
```

Monitoring

- All WAF blocks should be logged with: timestamp, rule ID, client IP, request path, matched pattern
- Alert on >100 blocks/hour from single IP (potential attack)
- Weekly WAF report for security review

Cloud Deployment Options

Cloud Deployment Options for Drop

> **Rebrand note (2026-02-14):** Originally titled "FontelePay". Product rebranded to **Drop**. See Drop CLAUDE.md.

Date: 2026-02-05 **Purpose:** Evaluate cloud deployment options for European mobile banking MVP

Requirements Summary

Requirement	Priority
Next.js support (static + SSR/API routes)	Must-have
EU data residency (GDPR)	Must-have
Financial compliance ready (PCI-DSS, SOC2)	Must-have
Cost-effective for MVP	High
Easy CI/CD integration	High
Scalability for production	Medium

Provider Comparison

Overview Table

Feature	Vercel	AWS (Amplify/Lambda)	Google Cloud Run
Next.js Support	Native (created by Vercel)	Full SSR support (v15)	Via container deployment

Feature	Vercel	AWS (Amplify/Lambda)	Google Cloud Run
EU Regions	Edge caching only	Frankfurt, Ireland, Paris, Stockholm + ESC	Frankfurt, Belgium, Netherlands, Zurich
Data Residency	US-based storage*	Full EU residency available	Full EU residency available
PCI-DSS	v4.0 (SAQ-D AOC)	v4.0.1 certified	v4.0.1 certified
SOC 2	Type 2 certified	Type 2 certified	Type 2 certified
ISO 27001	Certified	Certified	Certified
GDPR	EU-US DPF certified	Compliant	Compliant
Ease of Use	Excellent	Moderate	Moderate
Vendor Lock-in	Medium	Low	Low

*Vercel: Static assets and function responses cached in EU, but primary storage remains US-based.

Detailed Analysis

1. Vercel

Strengths:

- Native Next.js support (Vercel created Next.js)
- Zero-config deployment from Git
- Excellent DX (Developer Experience)
- Edge Functions for low latency
- Preview deployments per PR
- PCI-DSS v4.0 compliant
- SOC 2 Type 2, ISO 27001 certified

Weaknesses:

- **No true EU data residency** - data primarily stored in US
- Per-seat pricing scales poorly for teams
- Limited backend flexibility
- Enterprise tier required for some compliance features

Pricing:

Tier	Cost	Includes
Hobby	Free	100GB bandwidth, limited features

Tier	Cost	Includes
Pro	$20/user/month	1TB bandwidth, $20 credits, viewer seats free
Enterprise	Custom	SAML SSO, SLAs, dedicated support

GDPR Concern: Vercel is certified under EU-US Data Privacy Framework, but for banking applications requiring strict EU data residency, this may not be sufficient. Functions can run in EU regions, but metadata and logs may still traverse US infrastructure.

---

2. AWS (Amplify + Lambda)

Strengths:

- **True EU data residency** with European Sovereign Cloud (ESC)
- Full Next.js 15 SSR support via Amplify
- 140+ security certifications including PCI-DSS v4.0.1
- Frankfurt region well-established for EU fintech
- Pay-per-use with generous free tier
- No per-seat pricing
- Full infrastructure control

Weaknesses:

- Steeper learning curve
- Complex billing (multiple services)
- Requires AWS expertise
- CI/CD via external tools (GitHub Actions, GitLab)

Pricing (AWS Amplify):

Resource	Free Tier	Paid
Build minutes	1,000/month	$0.01/min
Data served	15 GB/month	$0.15/GB
Data stored	5 GB/month	$0.023/GB
SSR requests	Varies	~$0.20/1M

Estimated MVP Cost: $5-25/month for low-moderate traffic

European Sovereign Cloud (ESC): Launched January 2026, provides EU-resident personnel and hardware-enforced access restrictions. Ideal for regulated financial services.

---

3. Google Cloud Run

Strengths:

- Containerized deployment (flexible)
- Full EU data residency (Frankfurt, Belgium, Netherlands, Zurich)
- PCI-DSS v4.0.1 and SOC 2 certified
- Generous free tier
- Auto-scaling to zero
- Pay only for actual compute time

Weaknesses:

- Requires containerization (Dockerfile)
- No native Next.js integration
- More DevOps overhead
- Less seamless than Vercel for frontend

Pricing (Tier 1 - EU regions):

Resource	Free Tier	Paid
CPU	180,000 vCPU-seconds/month	$0.000024/vCPU-second
Memory	360,000 GiB-seconds/month	$0.0000025/GiB-second
Requests	2 million/month	$0.40/million

Estimated MVP Cost: $0-15/month for low-moderate traffic (often within free tier)

Compliance Matrix for Fintech

Certification	Vercel	AWS	GCP	Required for Drop
PCI-DSS v4.0+	Yes	Yes	Yes	Yes (payment processing)
SOC 2 Type 2	Yes	Yes	Yes	Yes (enterprise clients)
ISO 27001	Yes	Yes	Yes	Recommended
GDPR	DPF	Full	Full	Yes (EU operations)
EU Data Residency	Partial	Full	Full	**Critical**

Recommendation

MVP Phase (0-6 months)

Primary: AWS Amplify (Frankfurt region)

Rationale:

1. **True EU data residency** - critical for banking MVP regulatory approval
2. **Full Next.js support** - SSR, API routes, ISR all work
3. **Cost-effective** - likely $10-30/month for MVP traffic
4. **Compliance-ready** - PCI-DSS, SOC 2, ISO 27001 from day one
5. **No per-seat pricing** - scales with team growth
6. **Path to production** - same platform, just scale up

Setup recommendation:

- Region: eu-central-1 (Frankfurt)
- CI/CD: GitHub Actions
- Database: Aurora Serverless or PlanetScale (EU region)
- Auth: Cognito or Auth0 (EU tenant)

Production Phase (6+ months)

Stay with AWS but consider:

- AWS European Sovereign Cloud (ESC) for maximum compliance
- ECS/EKS for more control if needed
- Multi-region deployment (Frankfurt + Ireland) for redundancy

Why Not Vercel?

Despite excellent DX, Vercel's **partial EU data residency** is a significant concern for a banking application. While Vercel is PCI-DSS compliant, regulators may question data flows through US infrastructure. For an MVP seeking banking licenses or partnerships, demonstrating full EU data residency is simpler with AWS or GCP.

Why Not GCP Cloud Run?

GCP is technically excellent but:

- Requires containerization overhead

- Less native Next.js support
- Smaller fintech ecosystem in EU compared to AWS
- AWS has more established EU banking relationships

Cost Projection (12 months)

Scenario	Vercel Pro	AWS Amplify	GCP Cloud Run
MVP (2 devs, 10k users)	$480/year	$120-300/year	$0-180/year
Growth (5 devs, 50k users)	$1,200/year	$300-600/year	$200-400/year
Scale (10 devs, 200k users)	$2,400/year	$600-1,500/year	$500-1,200/year

AWS and GCP costs vary based on usage patterns; Vercel costs fixed per-seat

---

Action Items

- [ ] Set up AWS account with Frankfurt region default
- [ ] Configure Amplify for Next.js deployment
- [ ] Implement GitHub Actions CI/CD pipeline
- [ ] Document compliance controls for future audits
- [ ] Evaluate AWS ESC when banking license process begins

Sources

- Vercel Pricing
- Vercel Security & Compliance
- Vercel PCI Compliance Guide
- AWS Amplify Pricing
- AWS European Sovereign Cloud
- AWS PCI DSS Compliance
- Google Cloud Run Pricing
- GCP PCI DSS Compliance
- GCP SOC 2 Compliance

Infrastructure Overview

Infrastructure Resources

Infrastructure resources for Drop project: deployment, monitoring, CI/CD.