



universidade
de aveiro

OPSLITE

Smart Stadium Staff App - ELABORATION PHASE

Group 12:

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OUR TEAM



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Modeling/Analytics Lead - queueing, routing cost, evaluation
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GOALS

- 01** Improve efficiency and safety in stadium operations.
- 02** Ensure real-time coordination among all staff roles.
- 03** Design a system that is fast, reliable, and privacy-preserving.
- 04** Achieve a usable MVP that works in real match-day scenarios.



1. STATE OF THE ART



Nagine



Mapsted



Staffcloud

	Indoor Positioning	Crowd monitoring	Staff Management	Dashboard /Analytics	Real-time updates	Routing	Queueing Management
Nagine	✓	✗	✓	✓	✓	✓	✗
Mapsted	✓	✗	✓	✓	✓	✓	✗
Staffcloud	✗	✗	✓	✓	✗	✗	✗

<https://mapsted.com/en-nl/industries/stadiums>

<https://www.staff.cloud/en/industries/sports-stadiums>

<https://nagine.com/industries/sport/>

2. REQUIREMENTS

2.1 Information Gathering & Analysis

- Main functionalities from **real staff operations**
- Requirements aligned with Stadium Emulator
- Intuitive staff workflow, based on real practices
- **Collaboration:** Fan App integration & supervisor interviews



REQUIREMENTS

2.2 Main functional requirements

Staff-Specific

- Real-time crowd monitoring & wait times
- Emergency reporting & evacuation guidance
- Automated maintenance alerts & assignment
- Interactive operations map
- Role-based staff interfaces
- Offline operation (cached essential data)



REQUIREMENTS

2.2 Main functional requirements

Shared System Requirements

- Unified stadium graph
- Congestion & wait-time engine
- Shared routing API



REQUIREMENTS

2.3 Non functional requirements

- 01** Performance & Latency: real-time **WebSocket updates**, resilient fallback HTTP, **offline cache**
- 02** **Security**: strong authentication, **RBAC**, audit logs, **HTTPS/WSS**, input sanitization, rate-limiting
- 03** **Data Integrity**: synthetic/anonymous data only, consistent event generation
- 04** **Availability**: **Docker-based microservices** for scalability & fault tolerance
- 05** Usability & Interoperability: **shared event format** (JSON/YAML) across **Fan App** & **Staff App**

REQUIREMENTS

2.4 Assumptions and dependencies

Assumptions

- Stadium has **Wi-Fi & low-latency network**
- Staff devices: Android 10+ + **stable WebSockets**
- App supports real-time events
- Client **provides updated maps & test data**
- HTTPS/TLS + OAuth2/JWT
- Approved tech stack (Java + Node.js + Kafka)

Dependencies

- Client provides Wi-Fi, stadium maps, staff lists and past crowd data
- **DevOps** configures **PostgreSQL and Kafka**
- **Frontend** team develops **UI** (heatmaps, SOS, routing, login)
- **Mockups/UI** must be delivered
- **Stadium simulator** & sensors must be configured

3. ACTORS, USE CASES & UI

3.1 Actors Overview



Operations Manager

- Oversees **stadium**;
- Assigns **incidents**;
- Activates emergency mode



Zone Supervisor

- Manages a **specific zone**;
- Receives **alerts**;
- **Monitors** local situation



Staff on Field

- **Responds** to incidents;
- **Navigates** stadium;
- **Communicates** with team



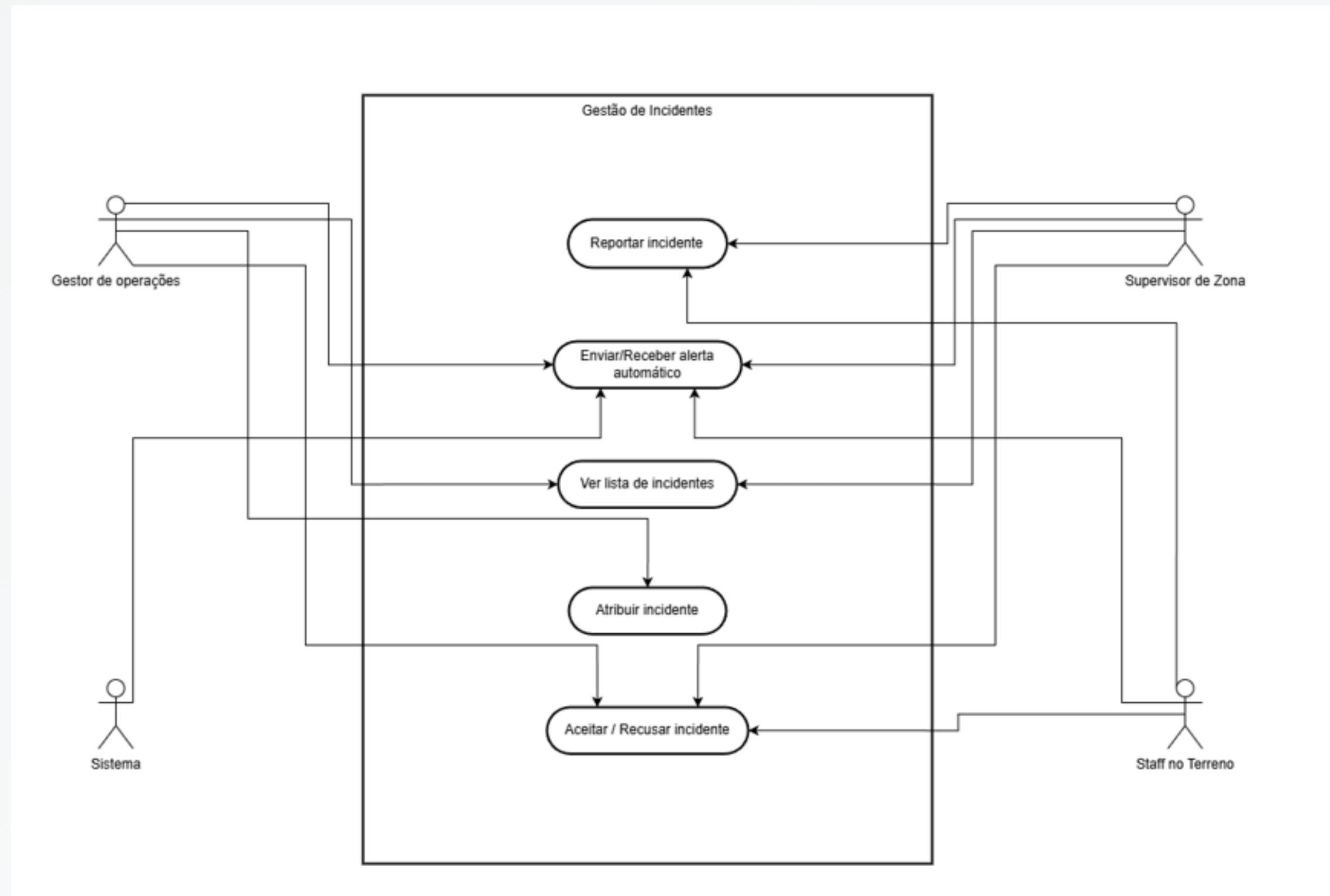
System

- **Sends** alerts;
- **Calculates** routes;
- **Provides** real-time data

3. ACTORS, USE CASES & UI

3.2 Use Cases

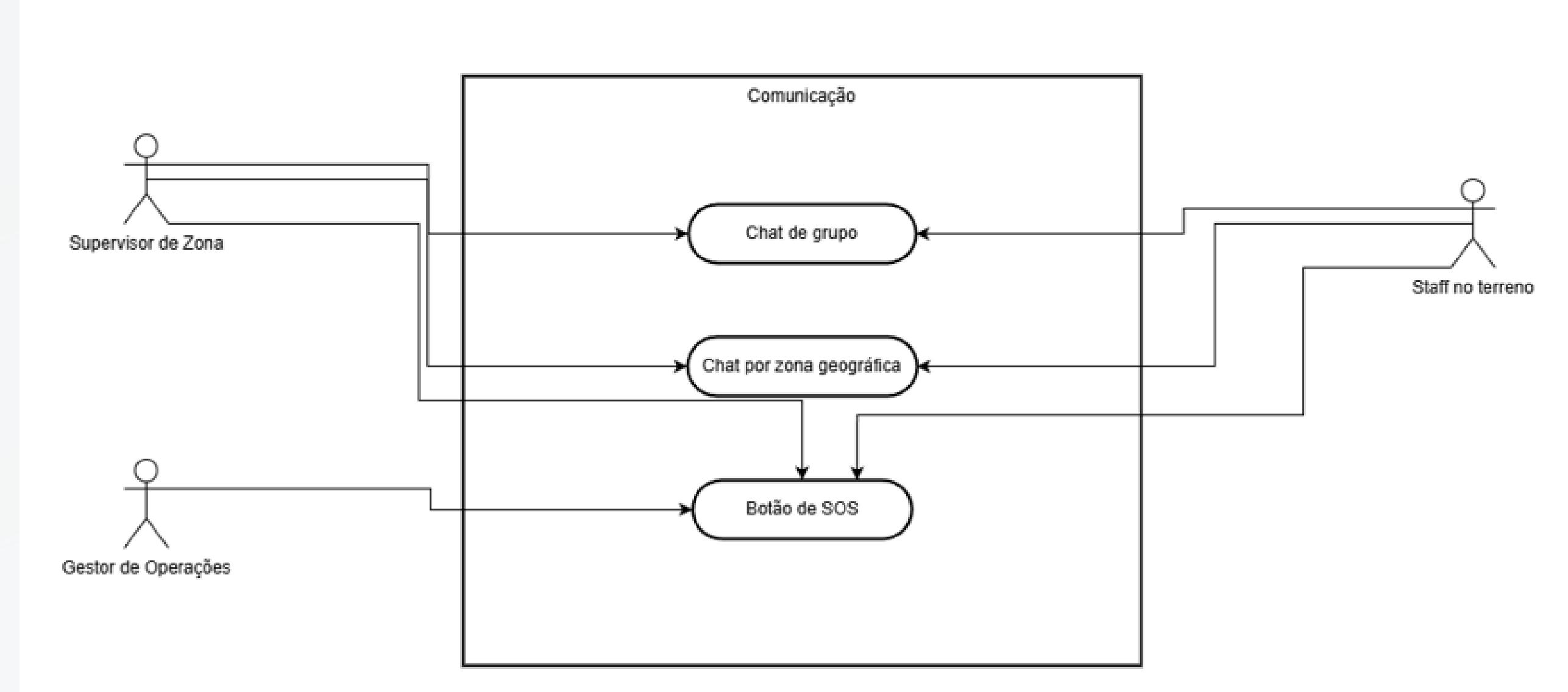
Incident Management



3. ACTORS, USE CASES & UI

3.2 Use Cases

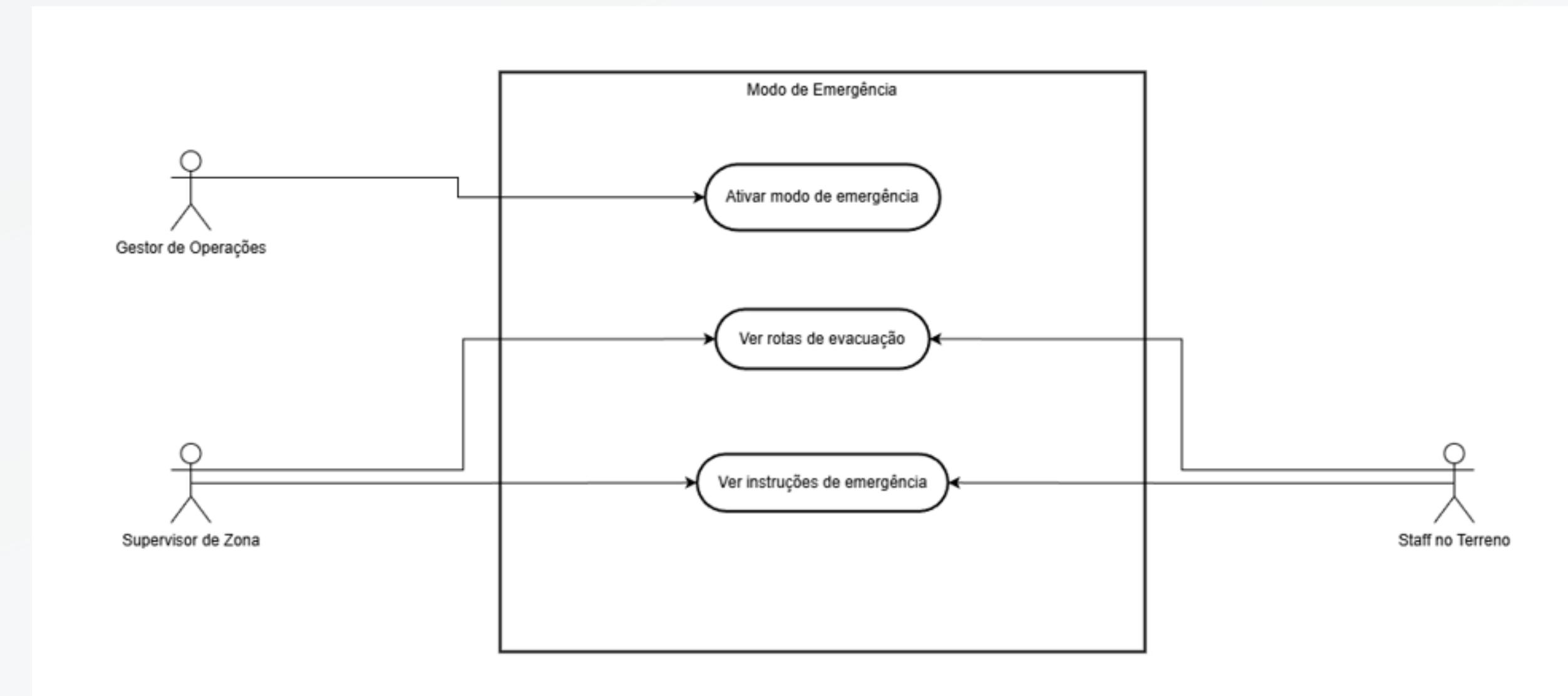
Communication



3. ACTORS, USE CASES & UI

3.2 Use Cases

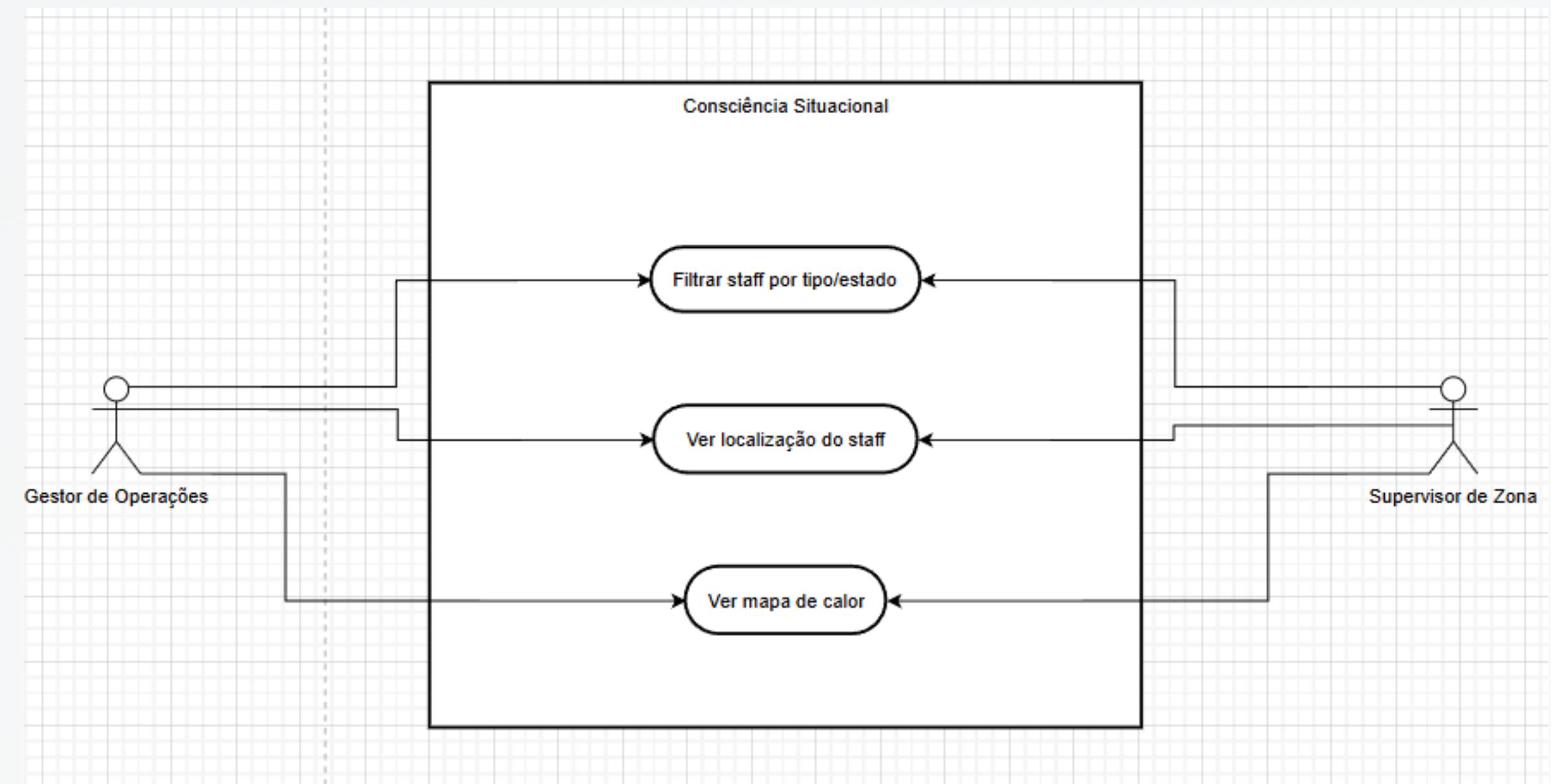
Emergency Mode



3. ACTORS, USE CASES & UI

3.2 Use Cases

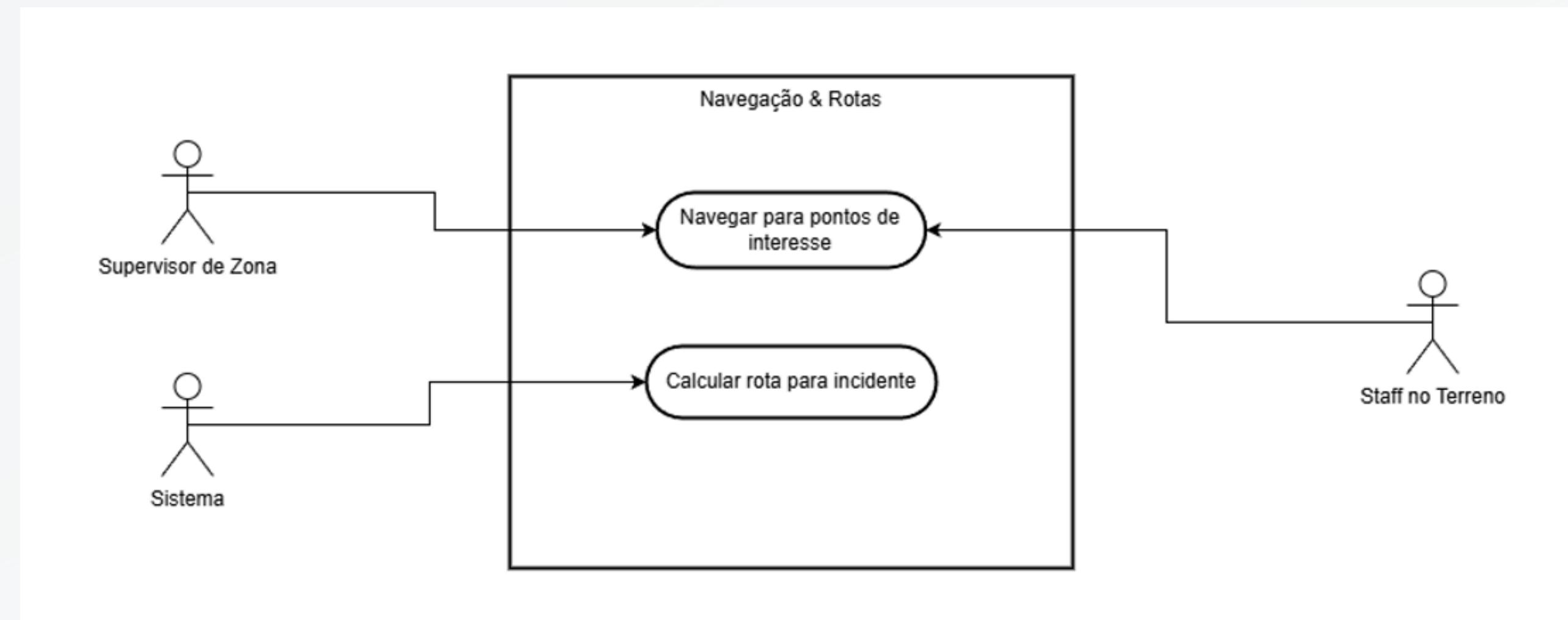
Situational Awareness



3. ACTORS, USE CASES & UI

3.2 Use Cases

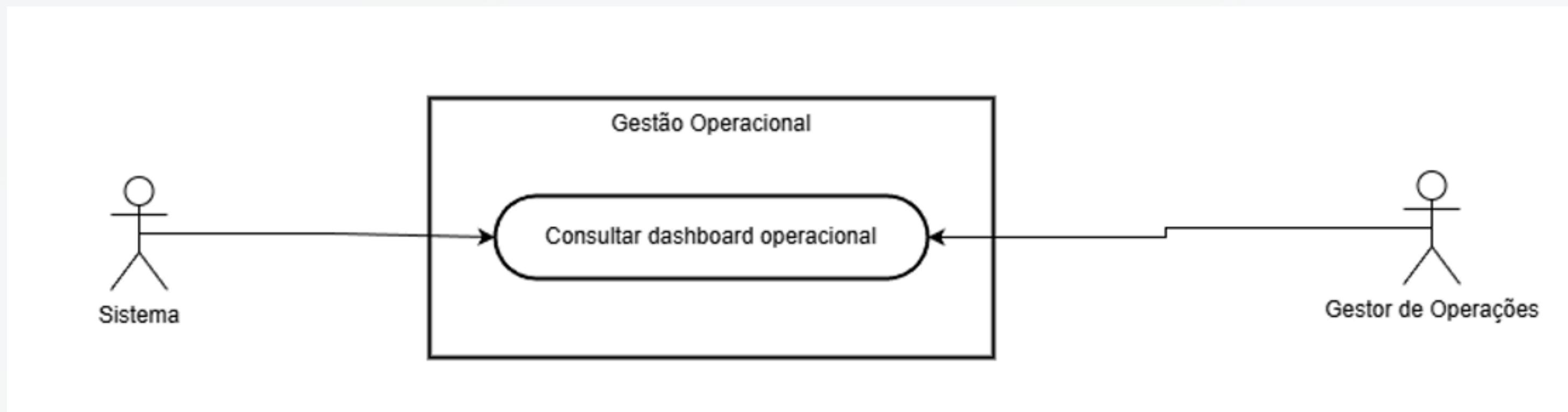
Navigation



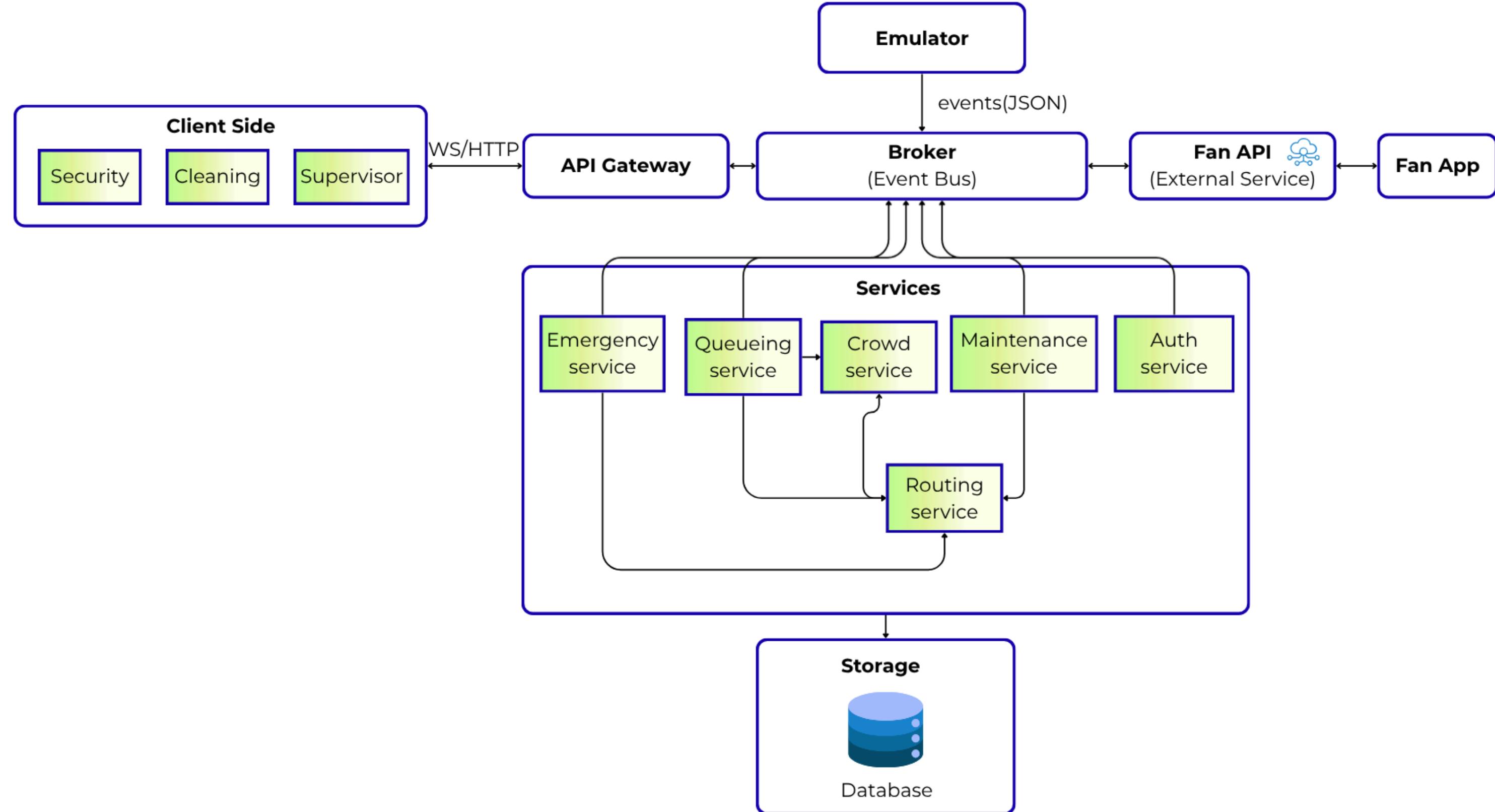
3. ACTORS, USE CASES & UI

3.2 Use Cases

Operational Management

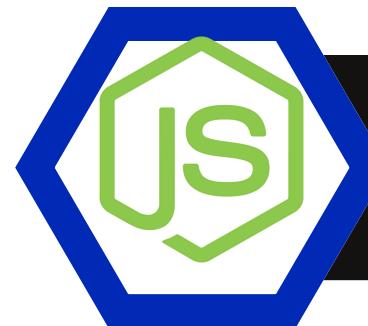
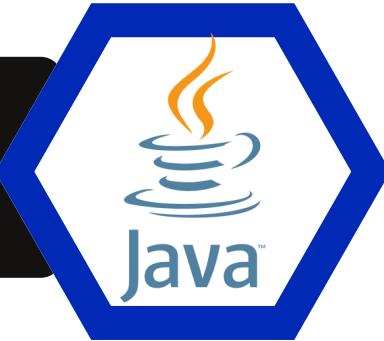


SYSTEM ARCHITECTURE

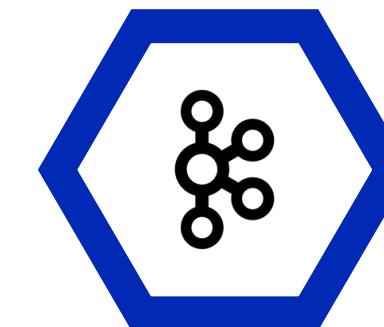


COMPONENTS & TECHNOLOGIES

Core Microservices (Java/Spring Boot):Auth, Map, Crowd, Pathfinding, Emergency, Maintenance



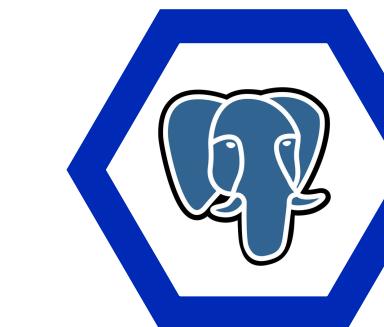
WebSocket Gateway (Node.js + NestJS): real-time connections, integrates with Kafka



Broker:
Apache Kafka



Analytics / Simulation:
heatmaps, simulations

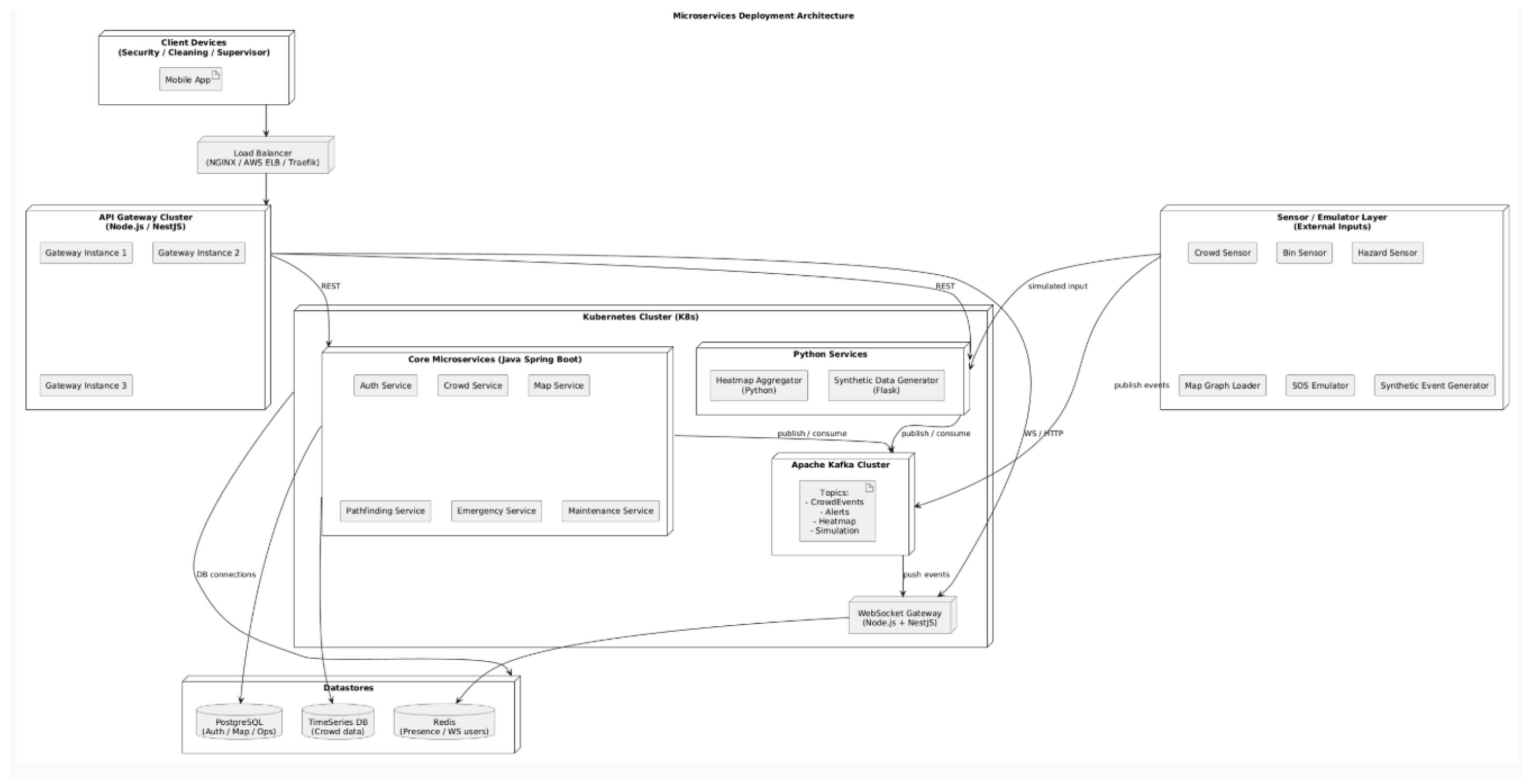


Databases:
PostgreSQL (relational), Redis (presence)

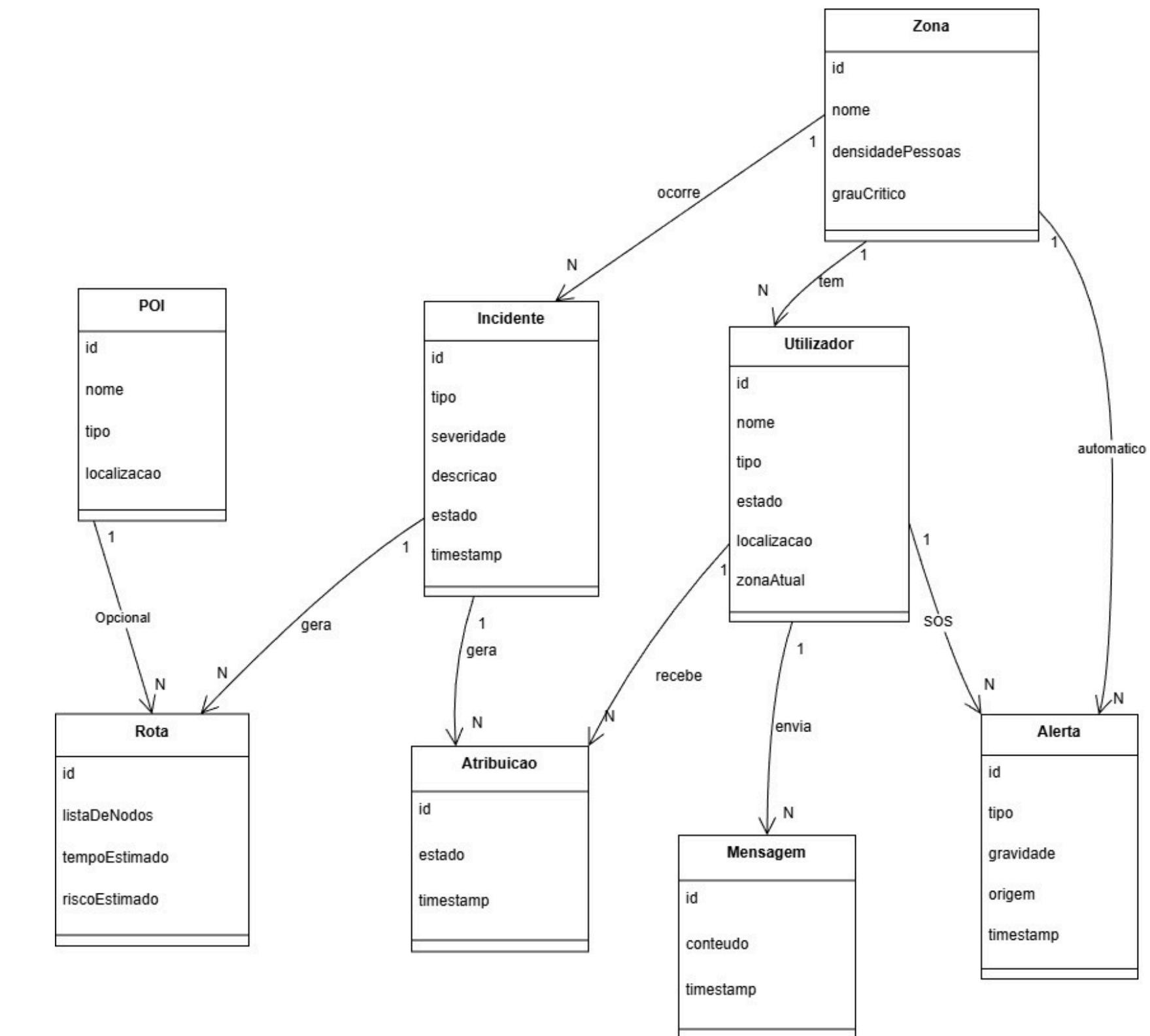


Authentication:
Spring Security

DEPLOYMENT DIAGRAM

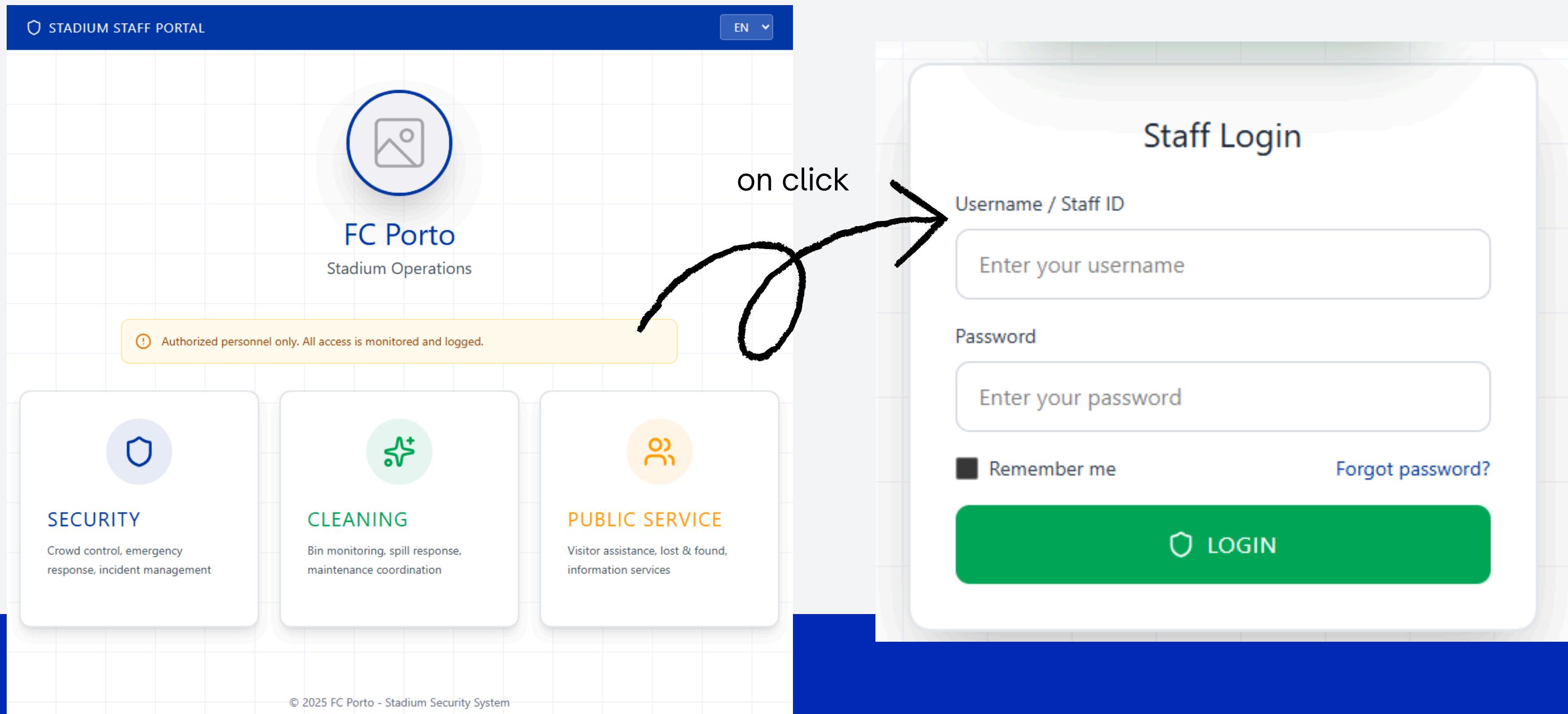


DOMAIN MODEL



USER INTERFACE

5.1 Staff Portal and Login



5.2 Security Interface

SECURITY DASHBOARD ● securitystaff

Map Alerts Analytics Profile ⚠️

Search gates, sections... Critical Areas All Gates VIP Areas Exits

Layers ⌂ ⌂ ⌂ ⌂

Normal Warning Critical

ACTIVE INCIDENTS ON MAP

- SOS South Stand Medical assistance needed
- WARNING Gate G03, G05 High capacity levels detected

SECURITY DASHBOARD ● securitystaff

Map Alerts Analytics Profile ⚠️

Gates 8 Total People 12.4K

Active SOS 2 Critical Zones 1

PRIORITY ALERTS

- HIGH 2 min ago Overcrowding at Gate G05
- MEDIUM 5 min ago Medical Assistance Requested
- LOW 12 min ago Lost Child Report - Sector C

LIVE GATE STATUS

Gate	Status	Utilization (%)
G01	Normal	45%
G02	Warning	78%
G03	Critical	92%
G04	Normal	58%
G05	Critical	88%
G06	Normal	34%
G07	Warning	71%
G08	Normal	52%

SECURITY DASHBOARD ● securitystaff

Map Alerts Analytics Profile ⚠️

PERFORMANCE OVERVIEW Today

- Incidents 23 ↘ 12%
- Avg Response 3:42 ↘ 8%
- Crowd Peak 15.2K ↗ 5%
- Resolution 94% ↗ 3%

Event Comparison vs Avg

Event	Value	Variance
Dragão Stadium	120	+12%
Average Stadium	100	0%

REAL-TIME DATA Live

Crowd Flow Throughout Event

14h 17h 20h 23h

Gate Utilization by Hour

Gate	Utilization (%)
Gate G01	92%
Gate G02	70%

SECURITY DASHBOARD ● securitystaff

Map Alerts Analytics Profile ⚠️

Profile securitystaff Senior Security Officer
On Duty Estádio do Dragão Certified

127 Incidents 98% Success Rate 3:42 Avg Response

QUICK ACTIONS

- End Shift
- Emergency Protocols
- Training Materials
- Contact Supervisor

PREFERENCES

- Notification Settings
- Push Notifications

5.2 Cleaning Interface

CLEANING OPERATIONS ● cleaning1

ALERTS PROFILE

Report Spill **Bin Emptied**

Request Supplies **Break Mode**

PRIORITY CLEANING ALERTS

- Bin 47 - Section A3** 2 min ago
95% Full - Overflow Risk
📍 North Stand **HIGH**
- Biohazard Alert** 5 min ago
Medical waste reported
📍 Section B7 **HIGH**
- Major Spill** 8 min ago
Beverage spill on stairs
📍 Entrance Gate 3 **HIGH**
- Bin 23 - Section C2** 15 min ago
78% Full
📍 East Stand **MEDIUM**
- Minor Spill** 20 min ago
Food debris

ALERTS PROFILE

ACTIVE TASK QUEUE

- Assigned to Me
Section A1 - Bins 12-15 **In Progress**
Assigned: 14:30
- Restroom M3 - Cleaning **Pending**
Assigned: 15:00

Unassigned Tasks

- Section D4 - Bins 34-38 **Pick Up**
- VIP Lounge - Full Service **Pick Up**

Completed Today

- Section B2 - Bins 20-24 **13:45**
- Restroom W2 - Deep Clean **12:30**
- Concourse Level 1 **11:15**

BIN STATUS OVERVIEW

	<60%	60-85%	>85%
A1	92%	45%	78%

CLEANING OPERATIONS ● cleaning1

← Back to Alerts

cleaning1
Cleaning Operations Staff
● Available

24 Tasks Today 38 Bins Emptied 4:22 Current Shift

AVAILABILITY STATUS

Start Break

Next Break Schedule 16:30
Team Coordinator Ana Silva

TODAY'S PERFORMANCE

● Tasks Completed 24
85% of daily target (28 tasks)

Bins Emptied 38
76% of daily target (50 bins)

⚡ Avg Response Time 4m 32s

Bins Emptied 38
76% of daily target (50 bins)

⚡ Avg Response Time 4m 32s

⌚ Current Shift Duration 4h 22m

EQUIPMENT STATUS

▢ Cleaning Cart Battery 85%

▢ Supplies Level Medium
Low on: Paper towels, Trash bags

Report Equipment Issue

SESSION INFO

Shift Start Today 10:00
Last Break 12:15 (15 min)
Device Samsung Galaxy A54
App Version v2.4.1

5.2 Public Service Dashboard

PUBLIC SERVICE • aaa

ALERTS PROFILE

ACTIVE VISITOR REQUESTS 6 waiting

- VIP Section Directions** HIGH
Gate C Waiting 18m
Assign to Me **Mark Resolved**
- Payment Issue - Card Declined** HIGH
Stand 12 Waiting 22m
Assign to Me **Mark Resolved**
- Ticket Validation Problem** MEDIUM
Gate A Waiting 8m
Assign to Me **Mark Resolved**
- Wheelchair Access Request** MEDIUM
Section D4 Waiting 12m
Assign to Me **Mark Resolved**
- Restroom Location** LOW
Concourse L2 Waiting 3m
Assign to Me **Mark Resolved**
- Exit Route Information** LOW
Section B7 Waiting 4m
Assign to Me **Mark Resolved**

ALERTS PROFILE

LOST & FOUND MANAGEMENT 4 active

- New Items Today**
 - Black Wallet - Leather** Gate G12 14:25
Mark as Claimed
 - iPhone 14 Pro - Blue** Stand N7 14:40
Mark as Claimed
 - Blue FC Porto Jacket** Section B15 15:10
Mark as Claimed
 - Red Backpack** Restroom W4 13:30
Mark as Claimed
- Claimed Items**
 - Car Keys - VW** Parking Lot B 13:55 **CLAIMED**
 - Sunglasses - Ray-Ban** VIP Lounge 12:15 **CLAIMED**

ALERTS PROFILE

INFORMATION RESOURCES

- FAQ Answers**
- Transport**
- Restrooms**
- Exits**
- First Aid**
- Stadium Map**

SERVICE TEAM STATUS

- Maria Santos** Available 0 active Gate A
- Pedro Silva** Busy 2 active Section C
- aaa YOU** Available 1 active Mobile
- Ana Costa** On Break 0 active Staff Room

PUBLIC SERVICE • aaa

Back to Alerts

aaa Public Service Staff Available

47 Requests Today 3:12 Avg Time 4.8 Rating

AVAILABILITY STATUS

Start Break

Next Break 17:00

Team Supervisor João Costa

TODAY'S PERFORMANCE

Requests Handled 47 94% of daily target (50 requests)

Avg Resolution Time 3m 12s

Visitor Satisfaction 4.8 /5.0

Current Shift Duration 5h 47m

6. RISKS & MITIGATIONS

Risk	Mitigation
Queue overload (M/M/1)	Automatic alerts, scale to M/M/k
High congestion	Crowd heatmaps, hazard-aware routing
Network failures	Offline cache, retries, HTTP fallback
Group inconsistency	Common schema, integration tests
Security & privacy	RBAC, audit, synthetic data
Scalability	Load tests, performance validation





OPSLITE



THANKS FOR
WATCHING

