Ülgen

Residence Activity Monitor & OR Solutions to Disasters

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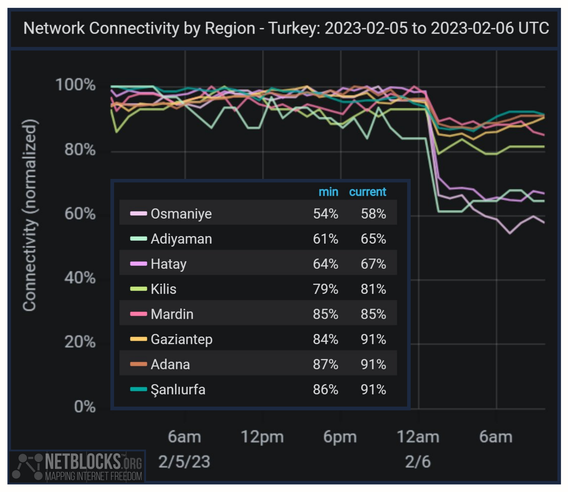
Project Description

The Scope & Definition

- Ülgen is a response to the shortcomings of current technology and applications in managing earthquake scenarios.
- Communication breakdowns and coordination challenges in the recent events have highlighted the need for an innovative solution.



- Ülgen aims to **revolutionize crisis management during earthquakes.**

The Goal

- The primary focus is on enabling communication with authorities and others even **when users don't have access to the internet, messaging systems, or electronic devices** during an earthquake using periodically collected data.

Trustworthy	Easy-to-use	**Secure**
Compatible	**Lightweight**	Accurate

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Methodology

The Steps

1. Data Collection and Analysis: Our application collects user data on local network connectivity periodically to then estimate household populations during the time of the earthquake.
2. Data Preservation: The sensitive data of the users are stored securely and with long-term retention while making sure of its availability for emergency scenarios.
3. Operational Research Solutions: With the collected data, operational research (OR) solutions are created and presented with dynamic data visualization to empower authorities and others in making informed decisions and optimizing response strategies during crisis situations.

Technology Stack

Development Frameworks & Libraries: spring boot, spring security, JWT, Caffeine, Lombok, FastAPI

Data Management: PostgreSQL, kafka, ZooKeeper, H2

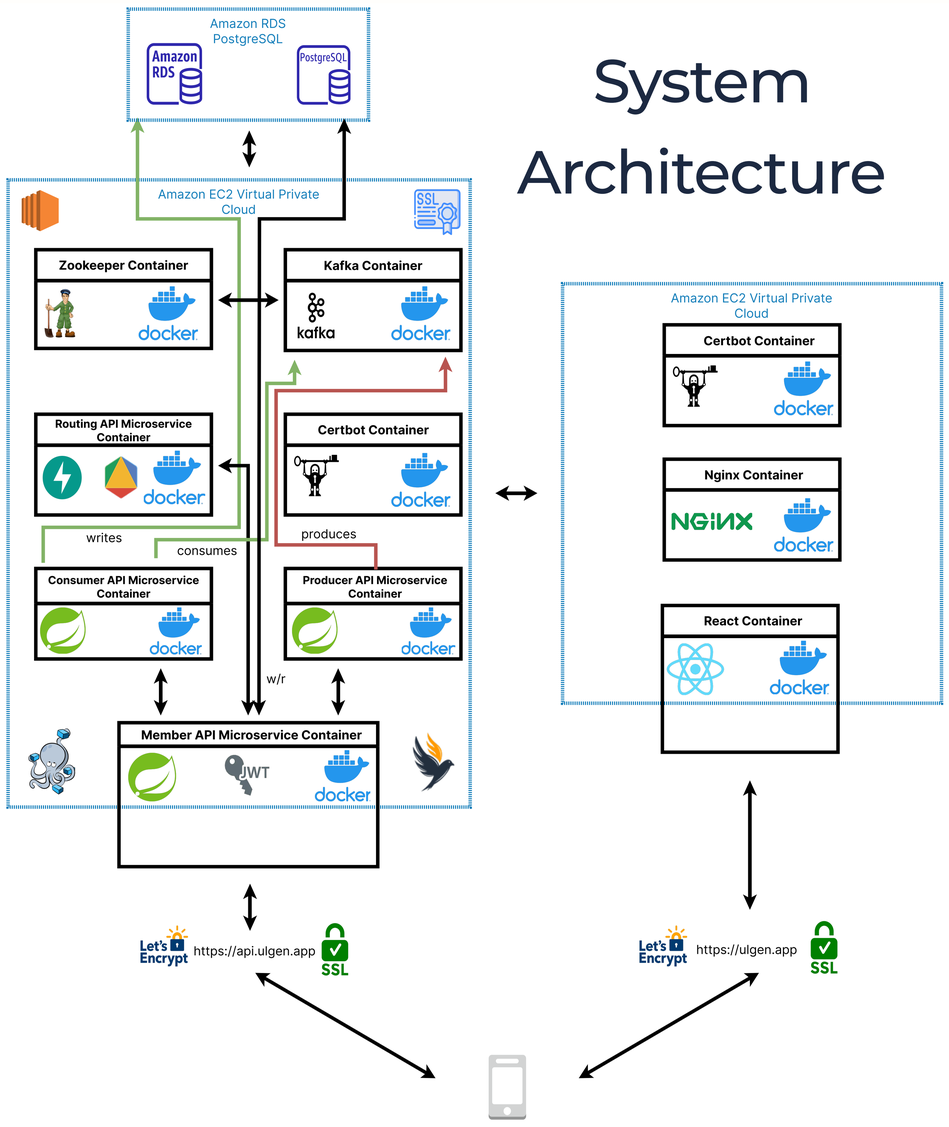
Testing: mockito, JUnit, Chaos Monkey, k6

Infrastructure: aws, Amazon Linux, docker, Let's Encrypt, certbot, docker compose

Data Science: Google OR, scikit learn, NumPy

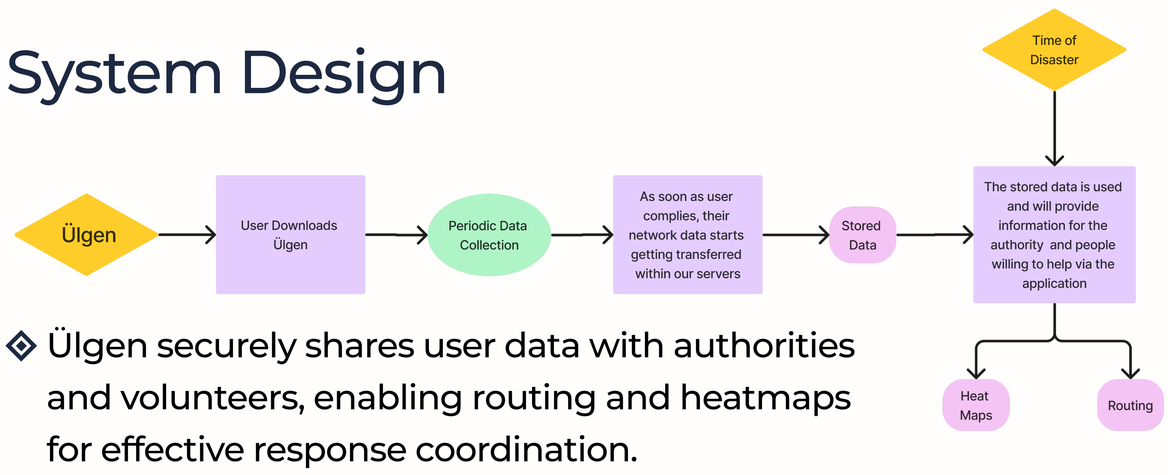
Java, python, JS, Kotlin, YAML, HTML

System Architecture



- The system adopts a Microservice Architecture for resilience, uses HTTPS via Let's Encrypt for secure data transmission to Ulgen Servers, and employs Kafka and PostgreSQL for handling and storing real-time streaming data effectively.

System Design

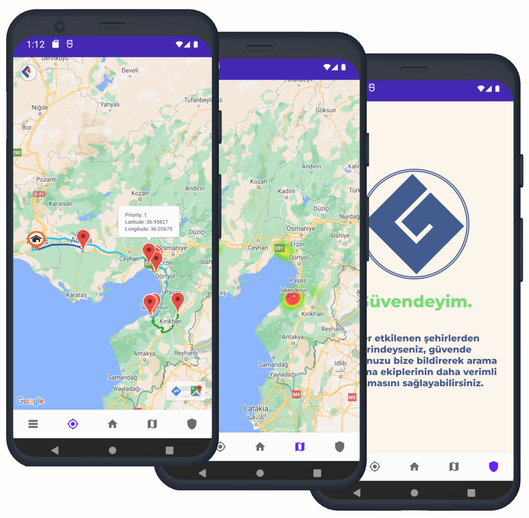


- Ülgen securely shares user data with authorities and volunteers, enabling routing and heatmaps for effective response coordination.

Results

Features

- Routing and heatmapping solutions of the affected cities.
- "Self-Rescue" button, removes self-evacuated users from routing and heatmap data.



Future Works

- API Integration for Service Providers for more accurate data.
- Implementing Kubernetes to ensure a load-balanced system.