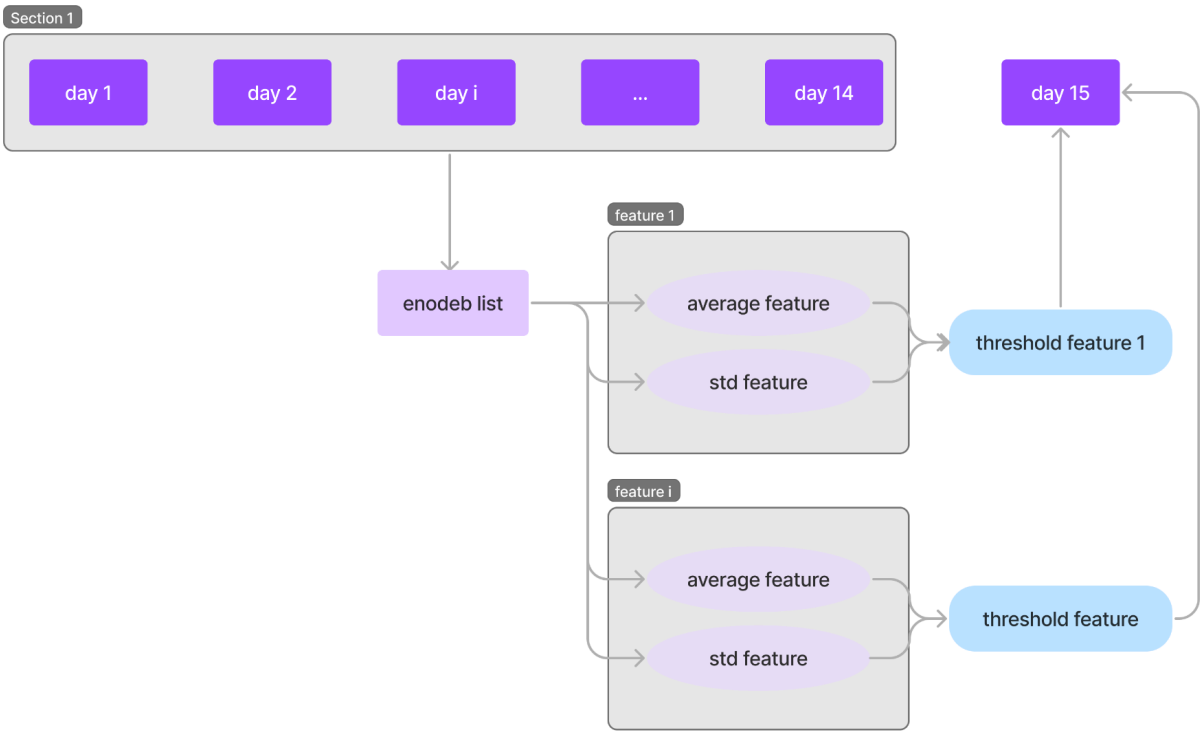


Project Overview

Monitor and detect anomalies during the vendor transition of Verizon's signal towers from **Nokia to Samsung**

.

1. **Validation Process**

Monitor KPI fluctuations over the **two weeks before the transition** to validate signal towers experiencing vendor changes.

2. **Anomaly Detection Methodology**

   - Compare **Samsung KPIs** to the **previous 14 days' Nokia KPIs**.
   - Use the **average** and **standard deviation** of the previous 14 days to set anomaly standards.

3. **Customer Tickets**

Coordinate-Based Analysis:

   - Correlate multiple customer tickets with signal tower locations based on their **coordinates**.

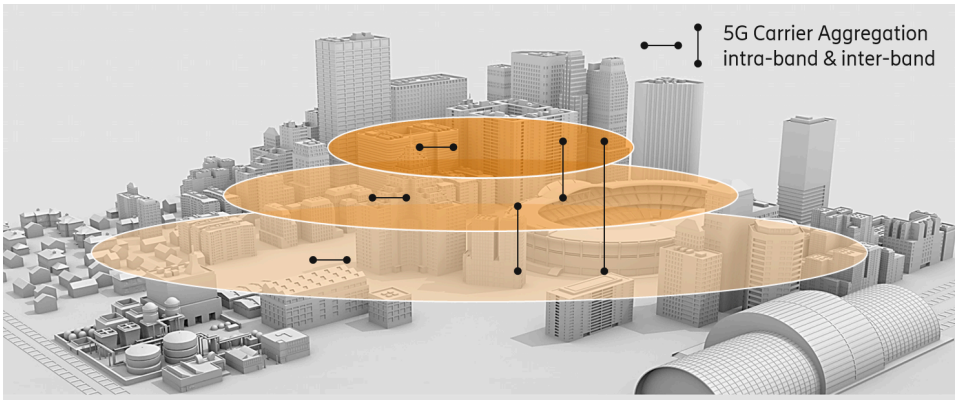
4. **Lower hierarchy detection**

5G Spectrum evolution

— **Low-band** for nationwide coverage & indoor penetration

— **Mid-band** for coverage & capacity

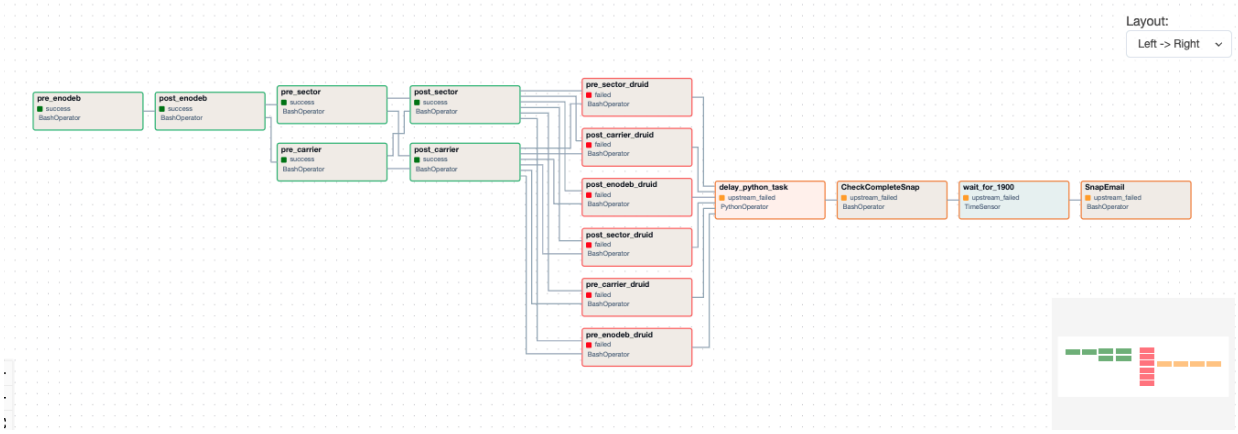
— **High-band** (or millimeter wave) for targeted high-capacity areas & services



Fully coordinated multi-layer network for best performance and best flexibility to secure service differentiation

Major Modifications

1. **Grace Period**:
    - Significant KPI fluctuations occur immediately after the transition event.
    - Implement a **3-day grace period**, focusing only on anomalies occurring **3 days after the event**.
2. **Weekly Seasonality Adjustment**:
    - Significant weekly patterns in KPIs were observed.
    - Adjust anomaly standards by:
        - Considering the combination of **past two same weekdays**,
        - Using the **average** and **standard deviation** of the past **two weeks**.



Key Lessons Learned

1. Coding Complexity

- **Multiple Steps Involved**:
  - Detect event enodeb.
  - Calculate pre-event KPI statistics.
  - Define anomaly standards.
  - Compare current KPIs to the anomaly standards.

- **Hierarchical Task Structure**:

  - The project requires a **three-level hierarchy**, best managed through **object-oriented programming (OOP)** and class hierarchies.

- **Resource Dependencies**:

  - Integrate data from various sources:
    - **Enodeb information**
    - **Customer information**
    - **Tickets information**

2. Collaboration Requirements

- **Domain Knowledge**:
  - Cooperation with the **hard-drive team** to:
    - Understand the meaning of multiple features.
    - Apply appropriate statistical methods.
- **Cross-Functional Teamwork**:

- Collaboration with different teams:
  - **Data Engineers** for handling data pipelines and integrations.
  - **Front-End Engineers** for web product development.
  - **UI/UX Designers** to ensure a user-friendly interface.

This project underscores the importance of **technical coding skills** and **cross-team collaboration** to achieve a successful outcome.