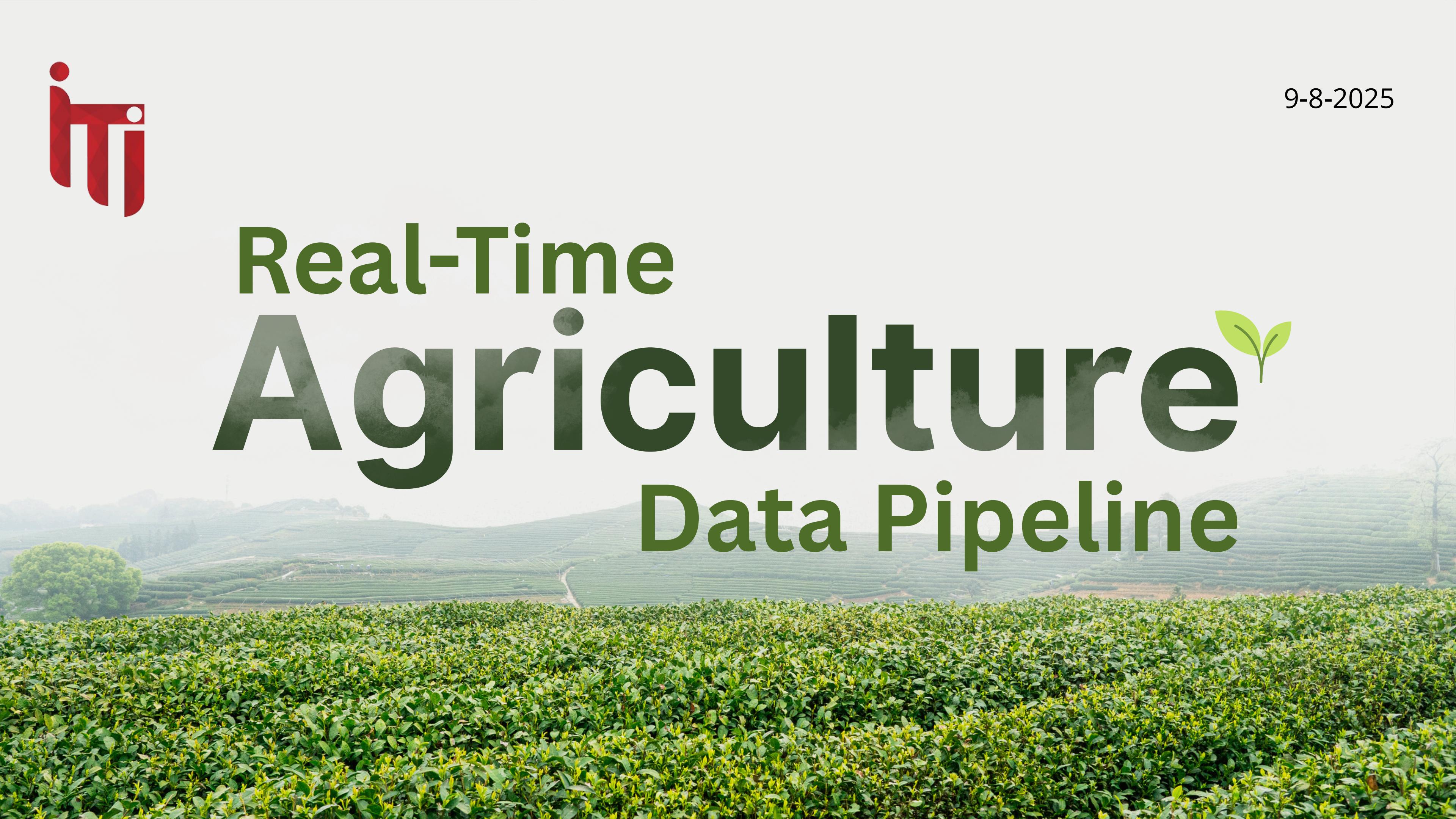




9-8-2025

Real-Time Agriculture Data Pipeline

A wide-angle photograph of a tea plantation. In the foreground, there's a dense field of young tea plants. In the middle ground, the plantation continues across rolling hills. The background shows more hills under a clear sky. A small green sprout with two leaves is positioned above the letter 'e' in 'Agriculture'.

MEET OUR TEAM



Ahmed Hisham



Ahmed Safty



Abdelrahman
Mohamed



Ahmed Saad



Mustafa Rezk



OUTLINE

- 01 OBJECTIVE
- 02 PROJECT ARCHITECTURE
- 03 DATA PIPELINE
- 04 VISUALIZATION & ANALYSIS
- 05 OUTCOME
- 06 DEMO

Current Challenges



Water Scarcity

The Nile Delta region faces increasing water scarcity.



Soil Salinization

Improper irrigation practices exacerbate soil salinization.



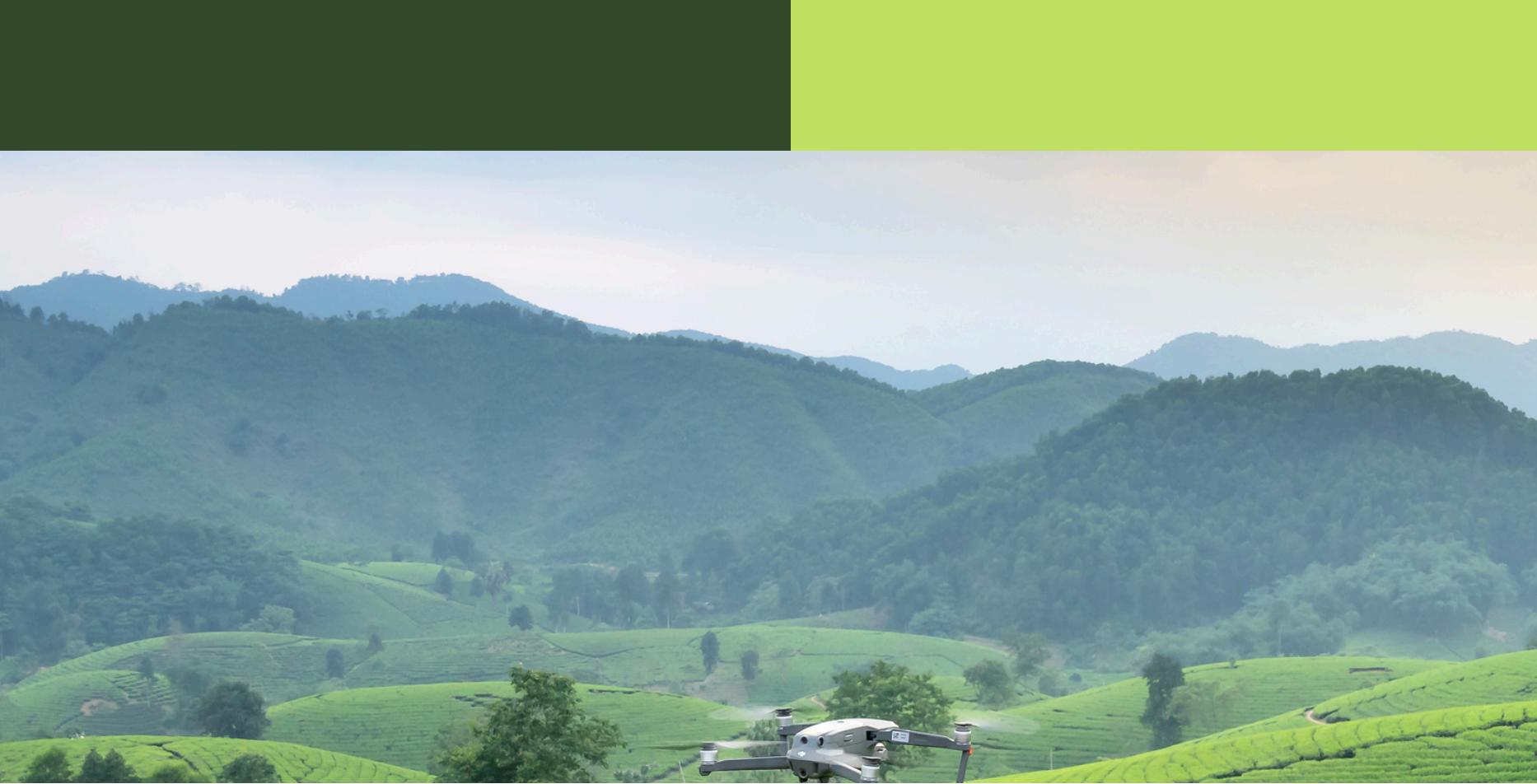
Unpredictable Yields

Poor soil and weather data leads to inefficient resource use.



Inefficient Irrigation

Traditional irrigation methods lead to over-irrigation and wasted water.



our Solution



With our smart irrigation pipeline

Framer installs sensors that continuously monitor key parameters.



Soil Temperature



Soil Humidity



Soil pH



N, P, K Content



Location



Weather Data

About Data

Soil Nutrients

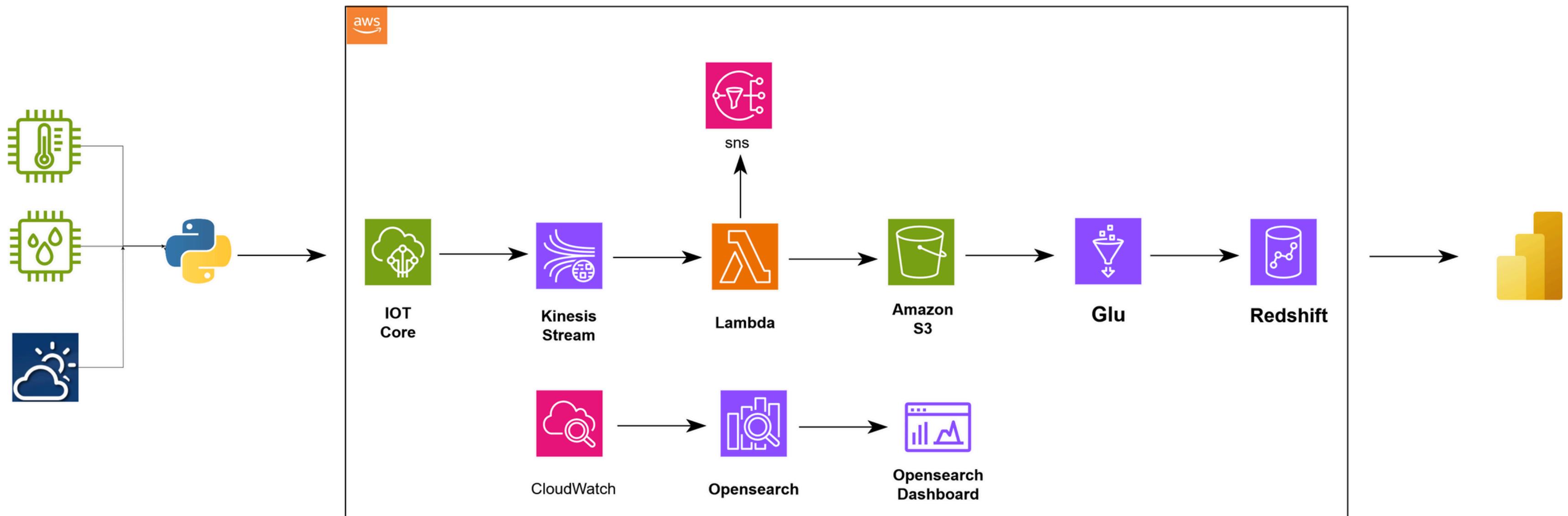
- **Nitrogen (N):** Supports leaf growth.
- **Phosphorus (P):** Boosts root and fruit development.
- **Potassium (K):** Enhances plant health and resistance.

Weather Factors

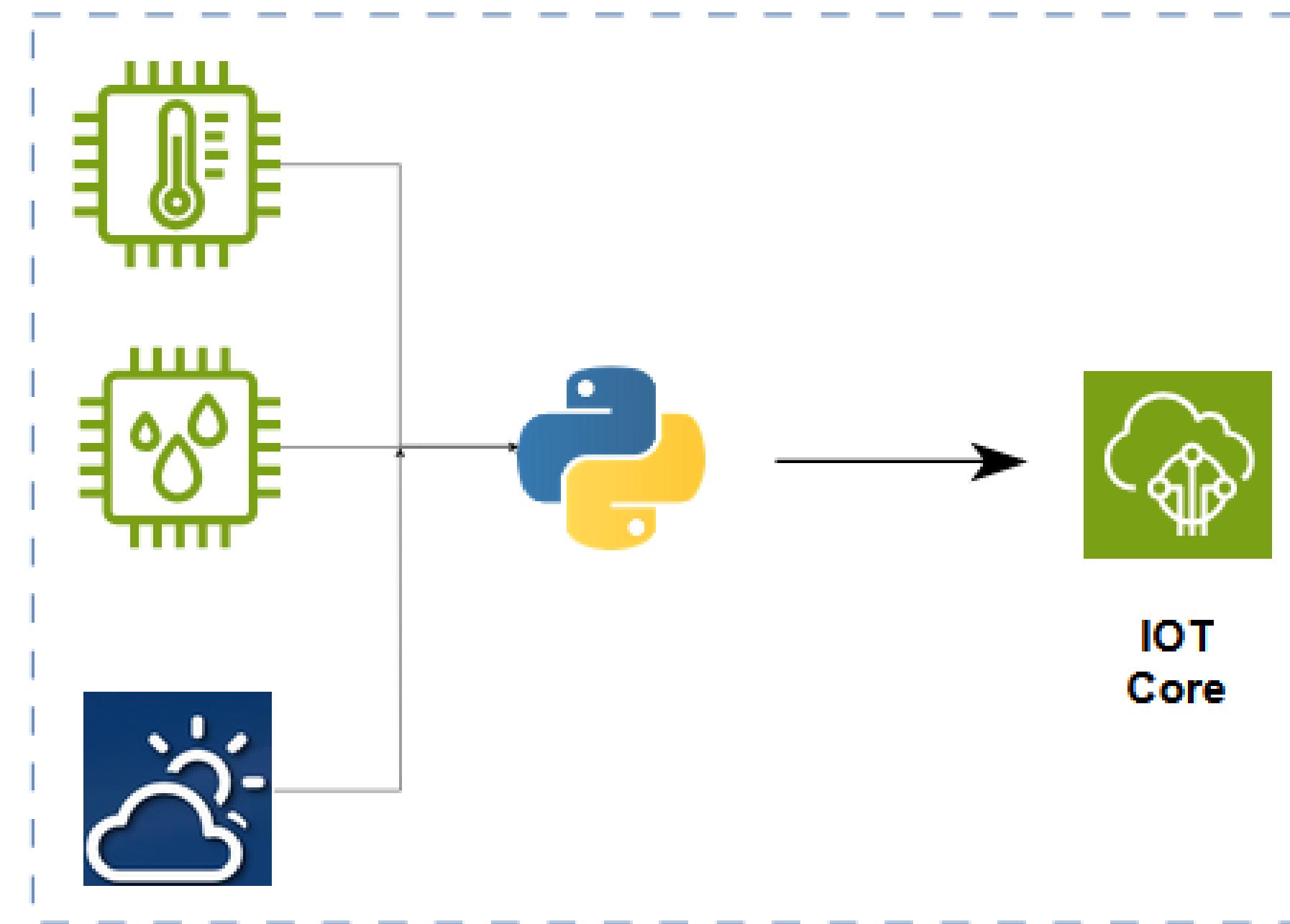
- **Wind Speed:** Speeds up soil drying.
- **Wind Direction:** Affects heat and moisture distribution.
- **Air Temperature:** Influences plant growth.
- **Humidity:** Affects water needs of plants.



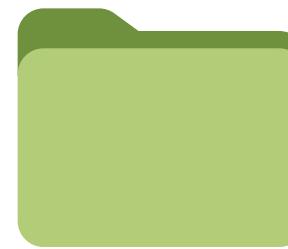
Pipeline Architecture



Ingestion Layer



Data Collection



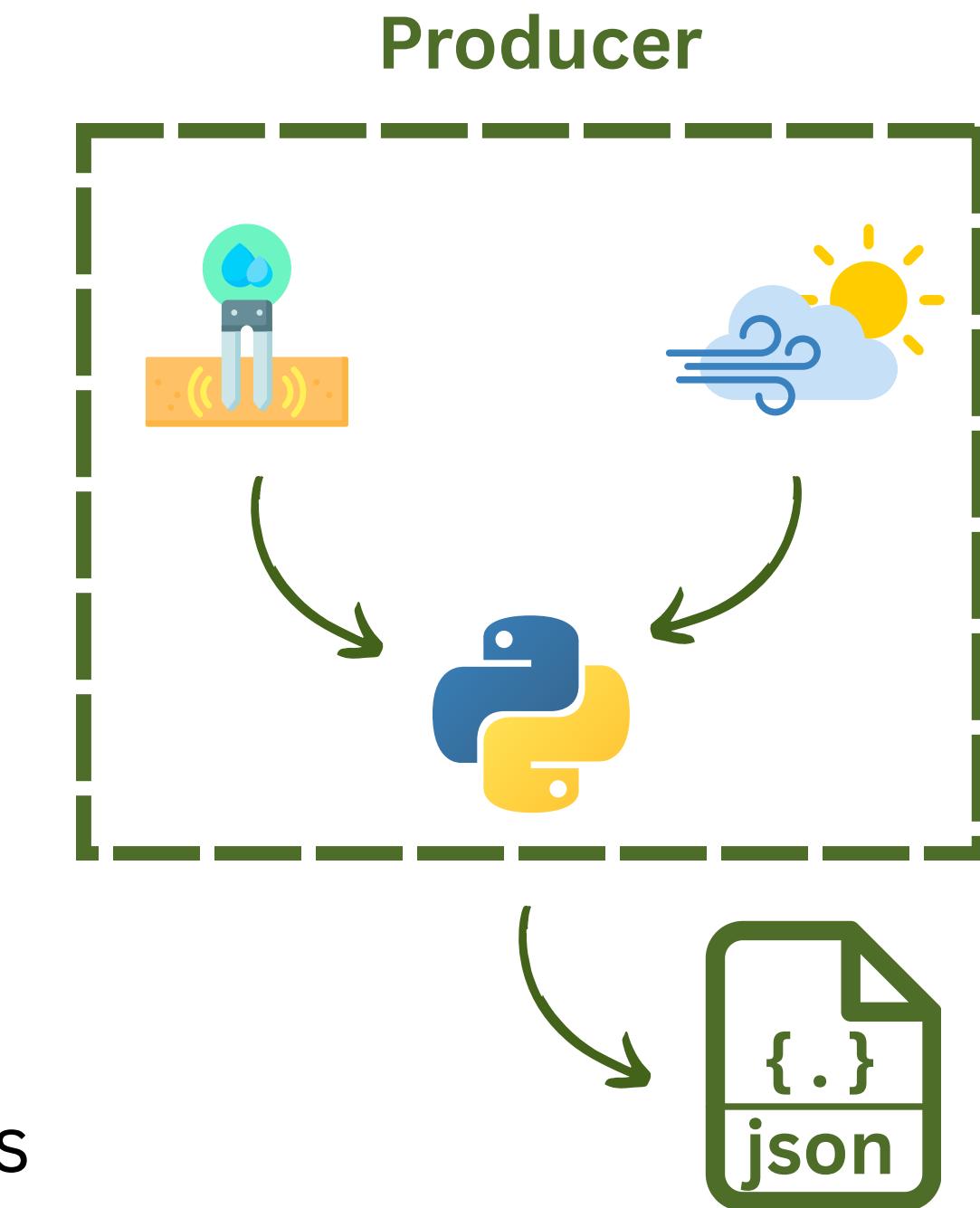
Soil Sensors

Collected real-time data
(soil status)



API

fetch weather data in our special locations



Data Ingestion



AWS IoT Core

Cloud Gateway

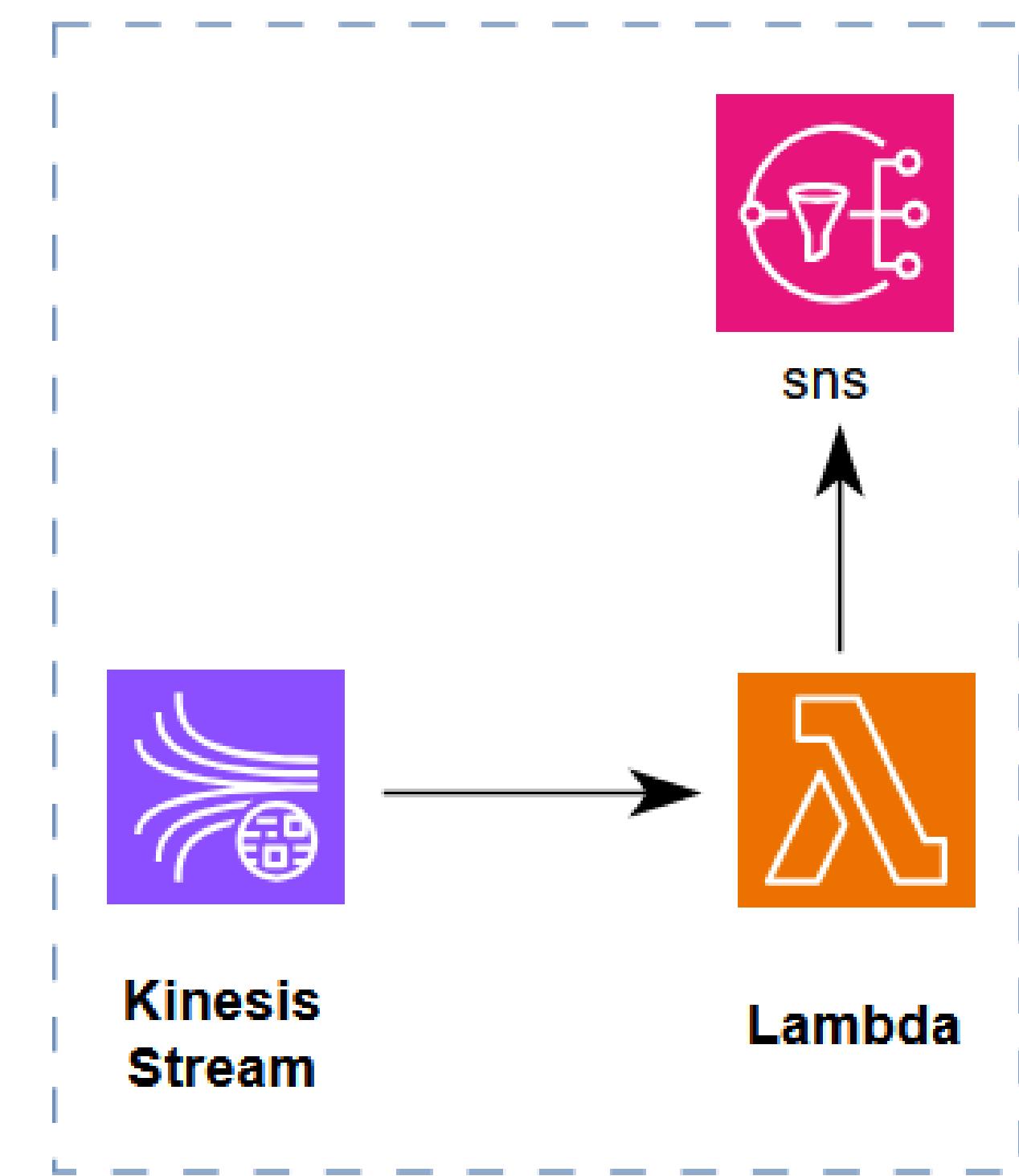
Receive data from sensors (via MQTT).

Producer



Streaming & Processing

Layer

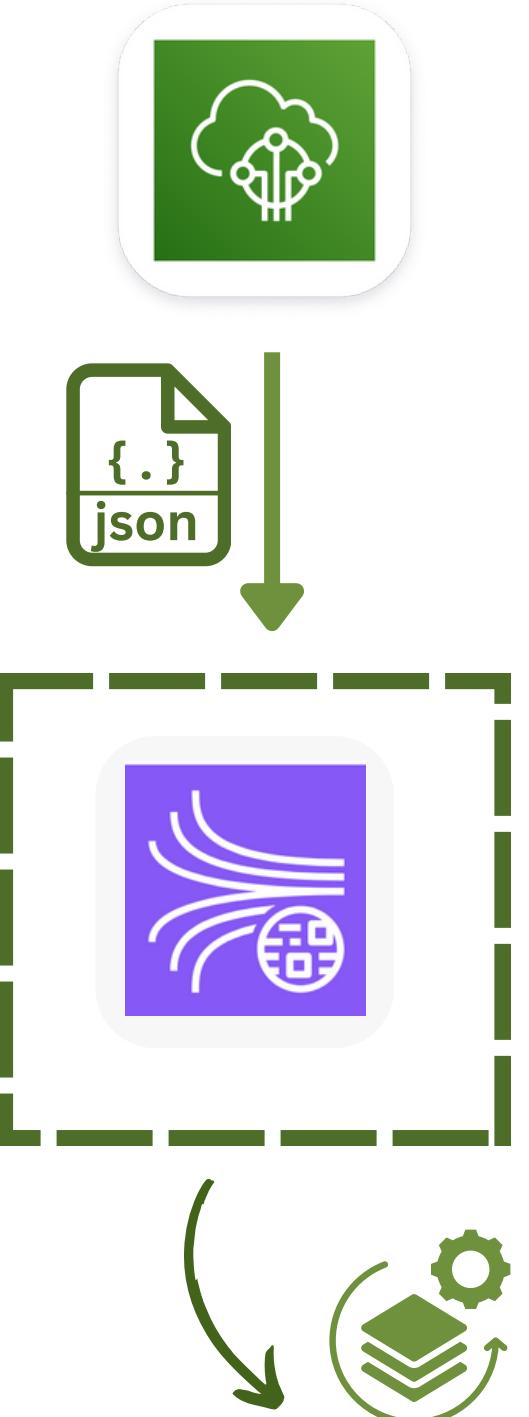


Data Streaming



Kinesis Data Streams

Real-time or near-real-time data as a batches transfer to Lambda.



Data Processing



lambda processing

to check data validation

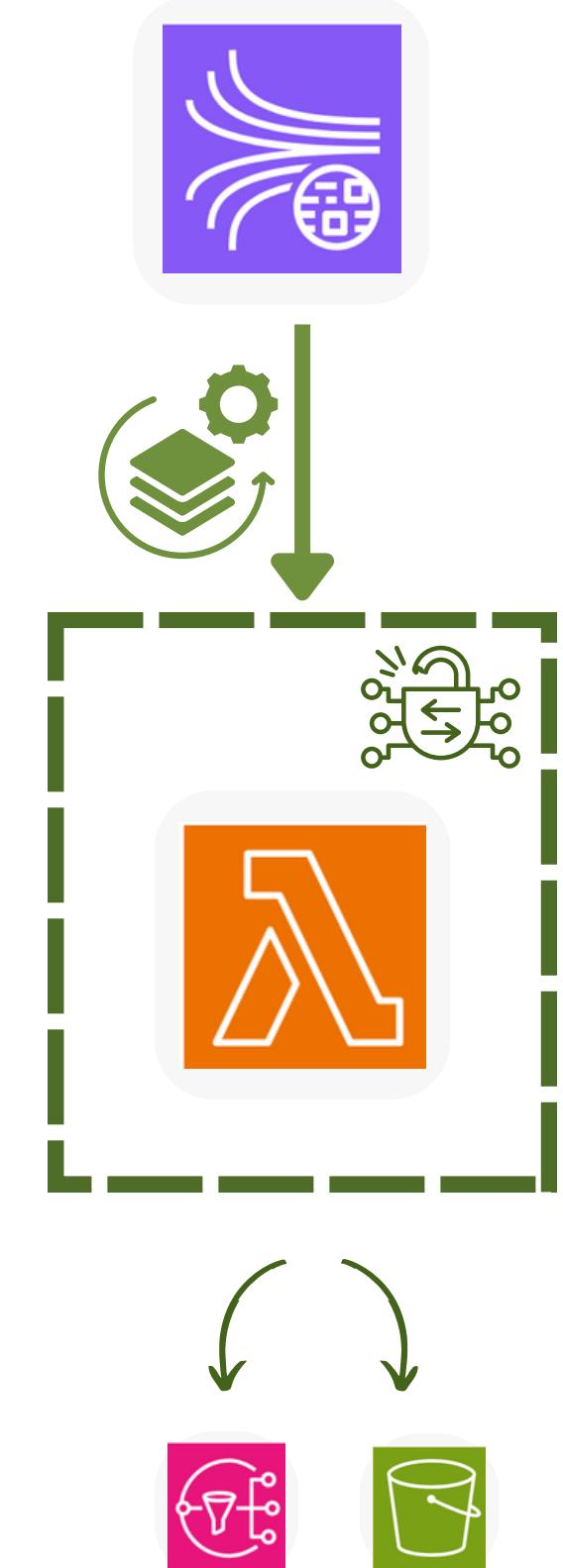
→ Structure

✓ **Valid**

→ Missing values

✗ **In Valid**

→ sensors vs
 ↳ Weather data
 ↳ Expected range
→ Detect sensors failure





Alerting



Alerting handling (SNS)

Send alerts when there are problems in the agricultural environment.

Farm IoT Alert Notification

Location: loc_1

Timestamp: 2025-08-05T17:51:45.186719Z

Alert Type: Low Water Level

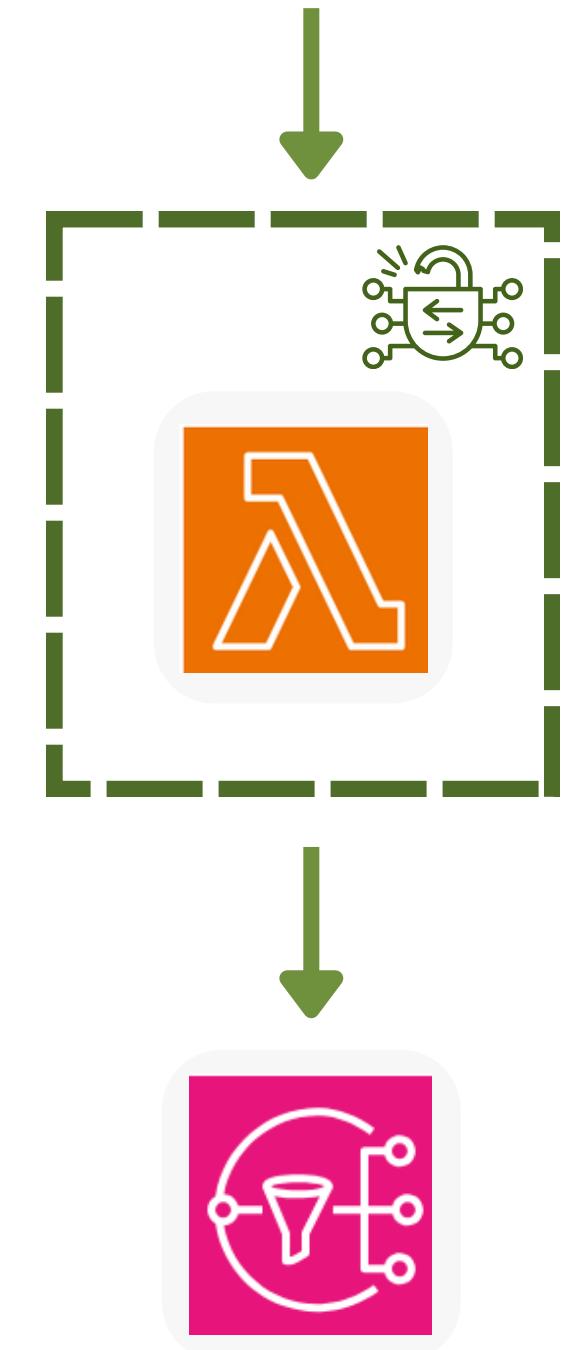
Priority: HIGH

Description: Low water level alert: 0.81m at loc_1

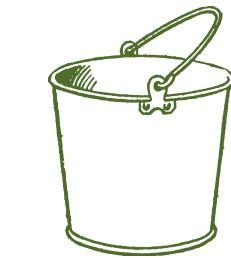
Recommended Action: Inspect irrigation system and water supply

Event ID: evt_1096ee6f256c

Generated by Farm Monitoring System



Data Storage



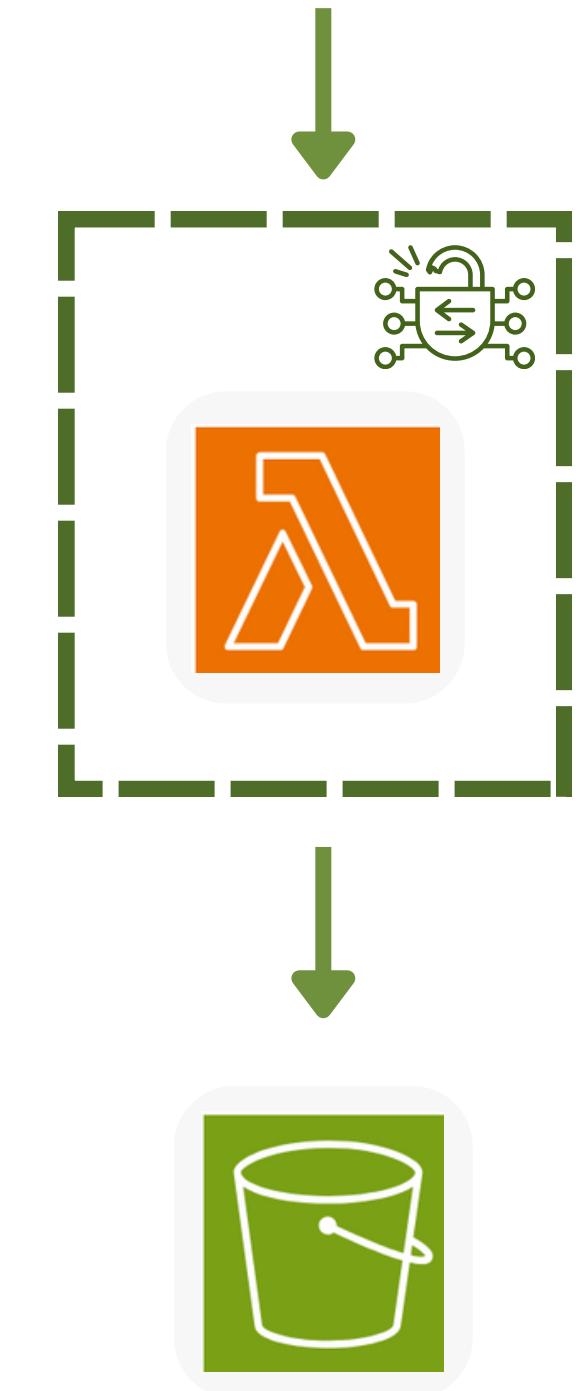
S3 Data lake storage



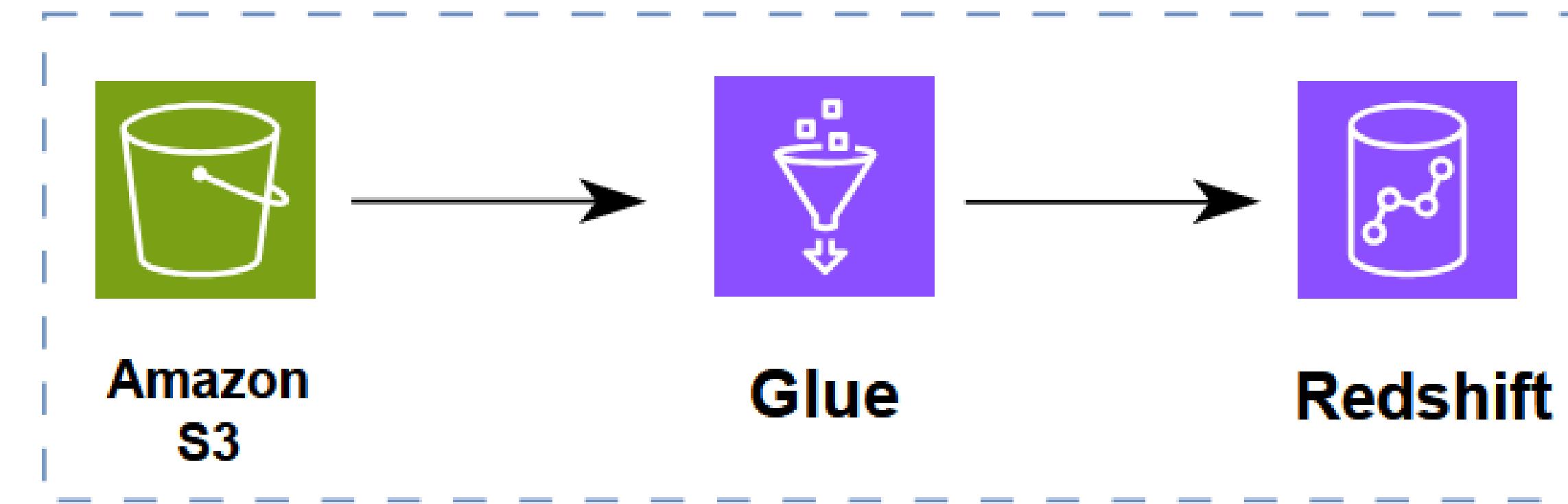
Valid → ETL & analysis ready data



In Valid → Data with structural or logical problems



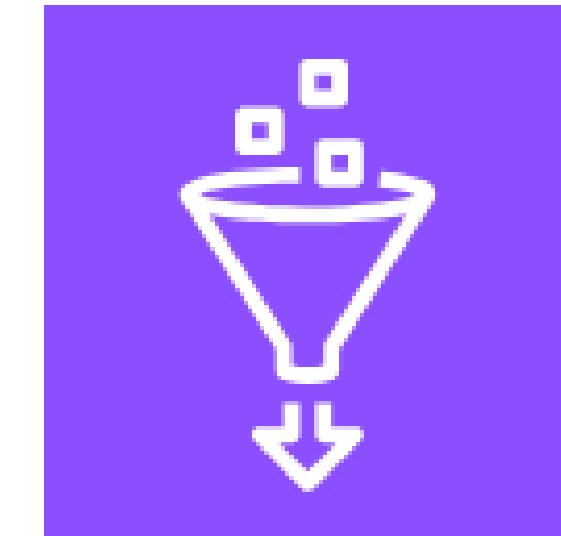
ETL Layer



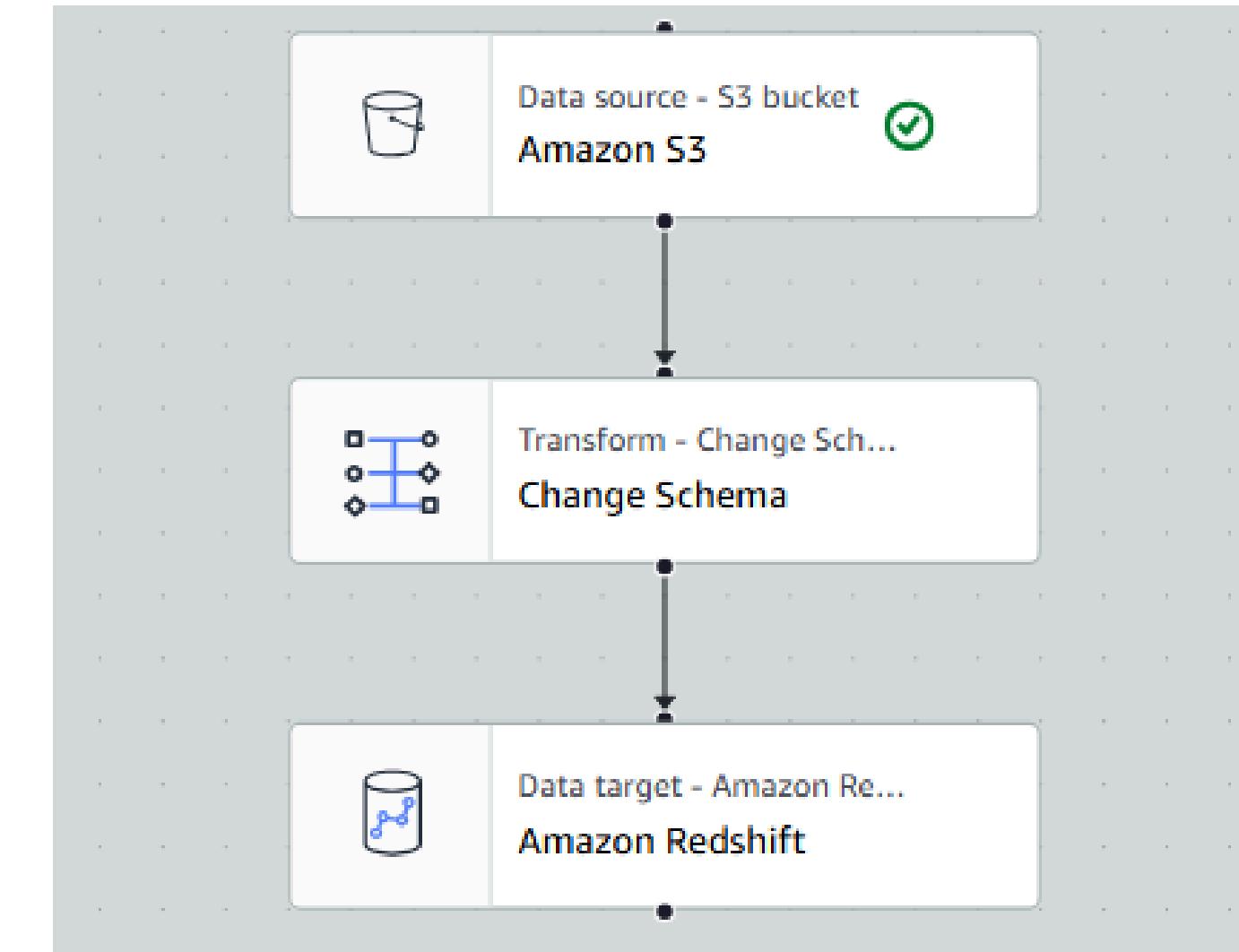
ETL Process



- Crawler scans S3 data and creates metadata tables.
- Connection defines access to Redshift.
- ETL Job extracts, transforms, and loads the data from S3 into Redshift.



AWS Glue

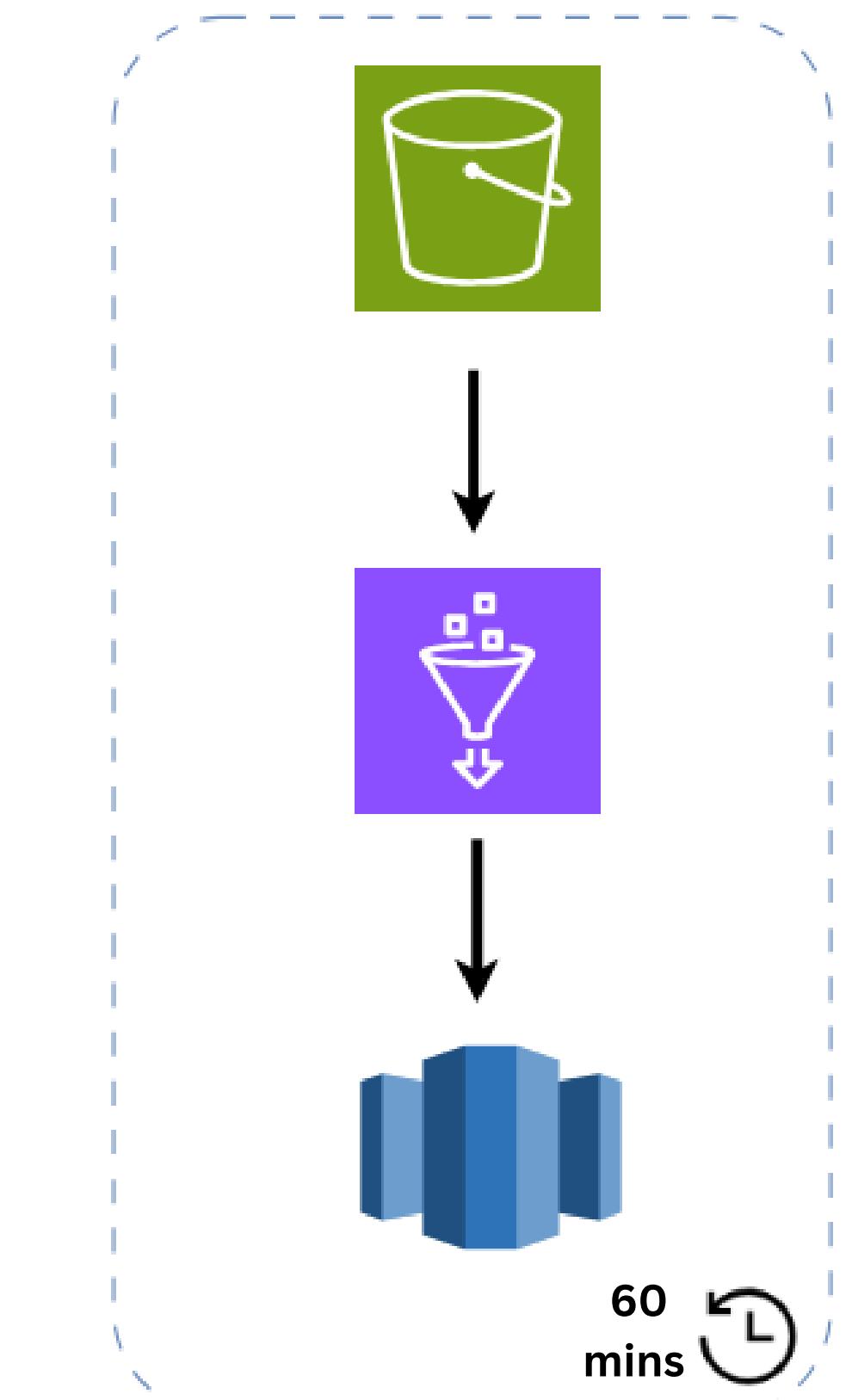


Data

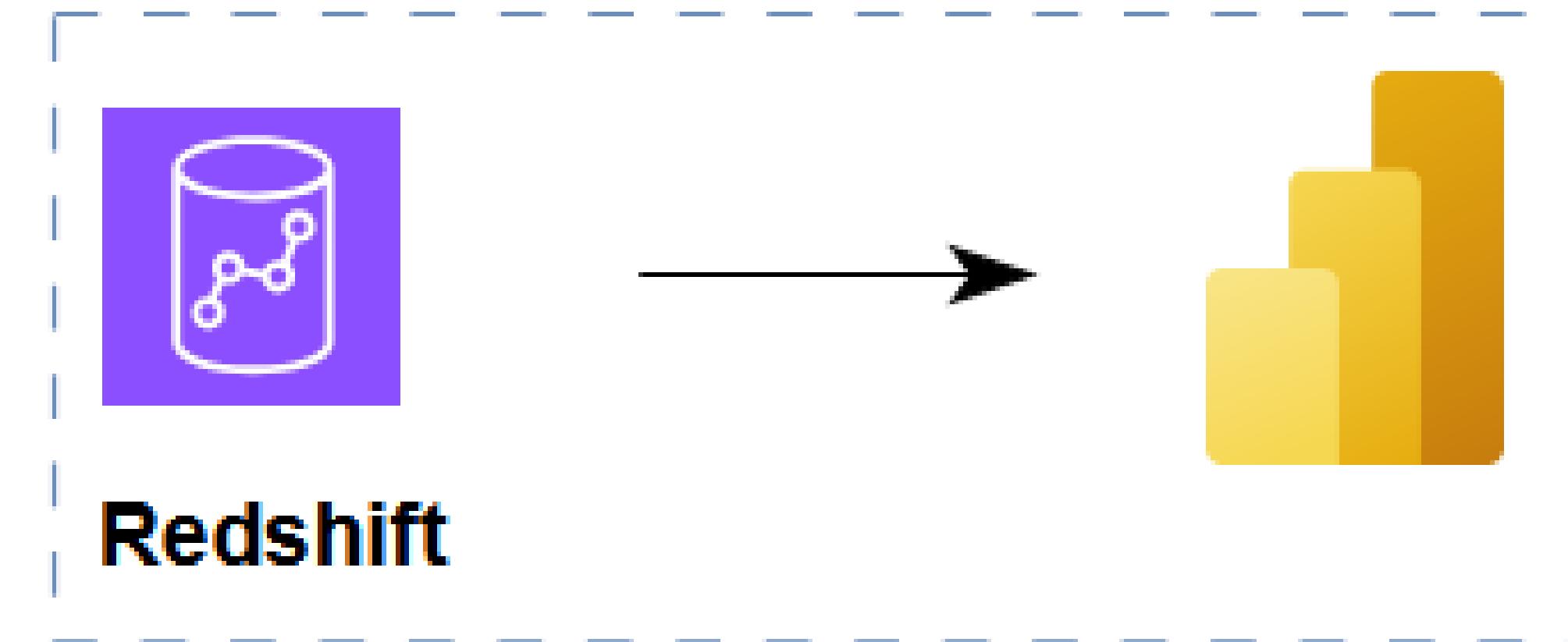
Orchestration



- A scheduled job runs every 60 minutes to load new data from S3 to Redshift.
- After successful load, another job is triggered.
- This second job moves data from the staging table to the dimension tables in Redshift.

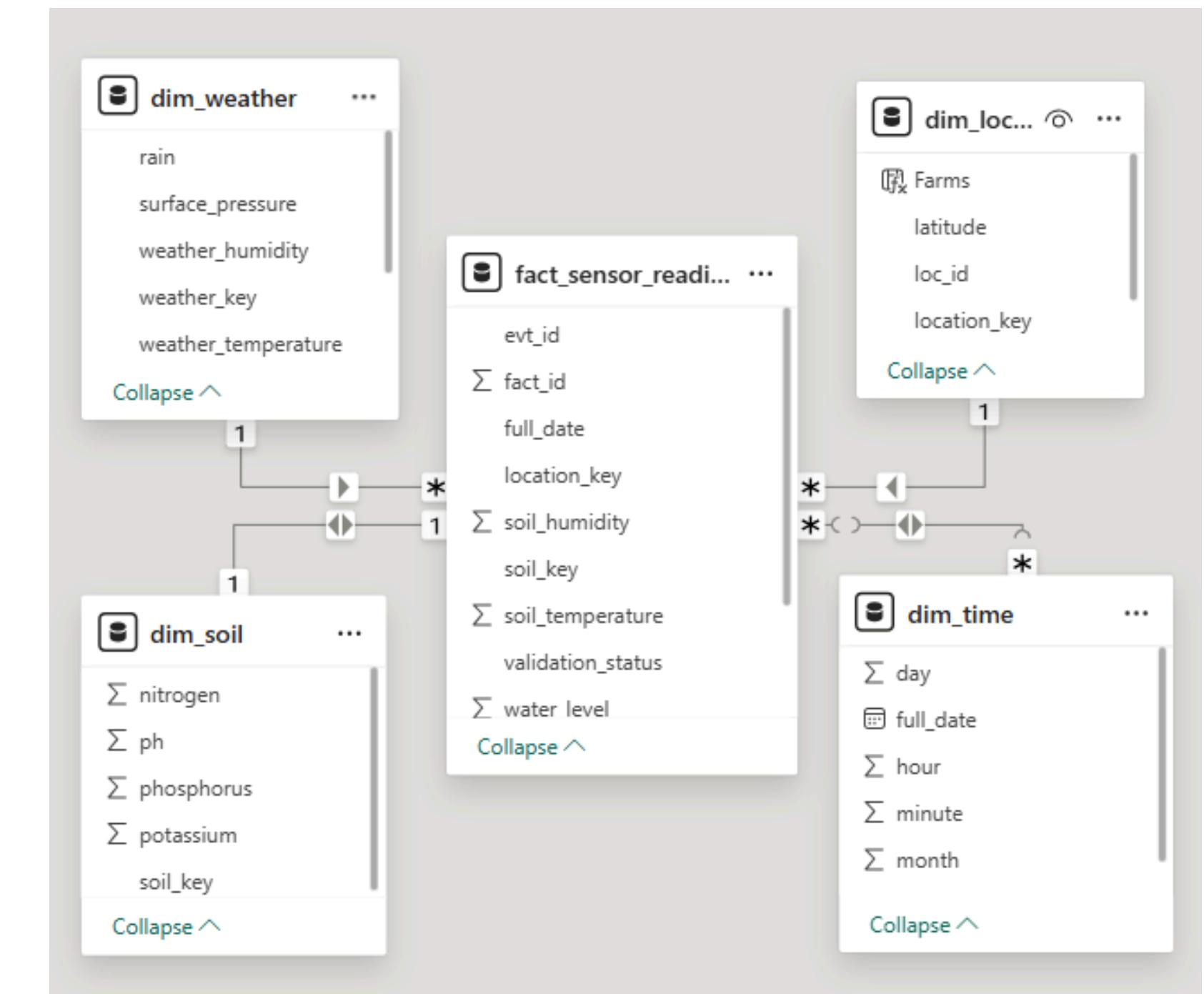


Visualization Layer

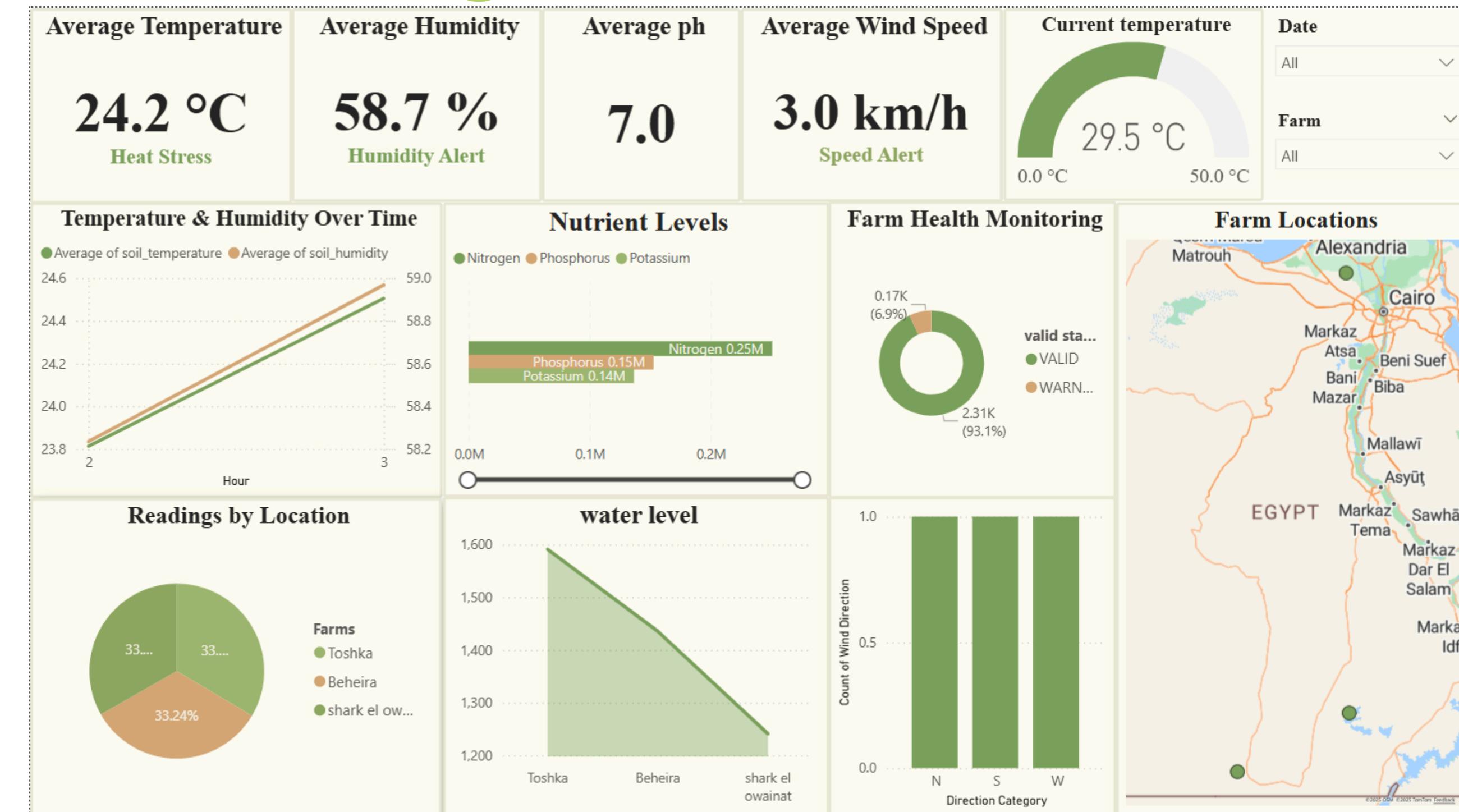


Data Warehouse

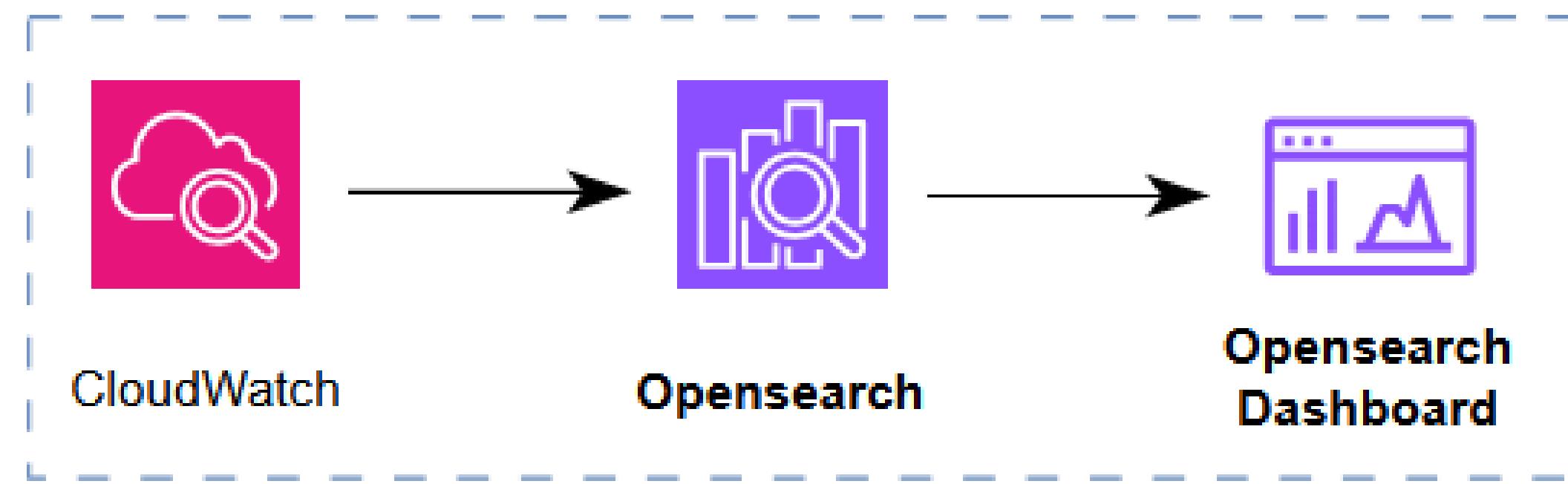
- Follows a Star Schema structure.
- Optimized for analytical queries and reporting.
- Supports efficient analysis of sensor data and weather information.



Data Analytics



Monitoring Layer



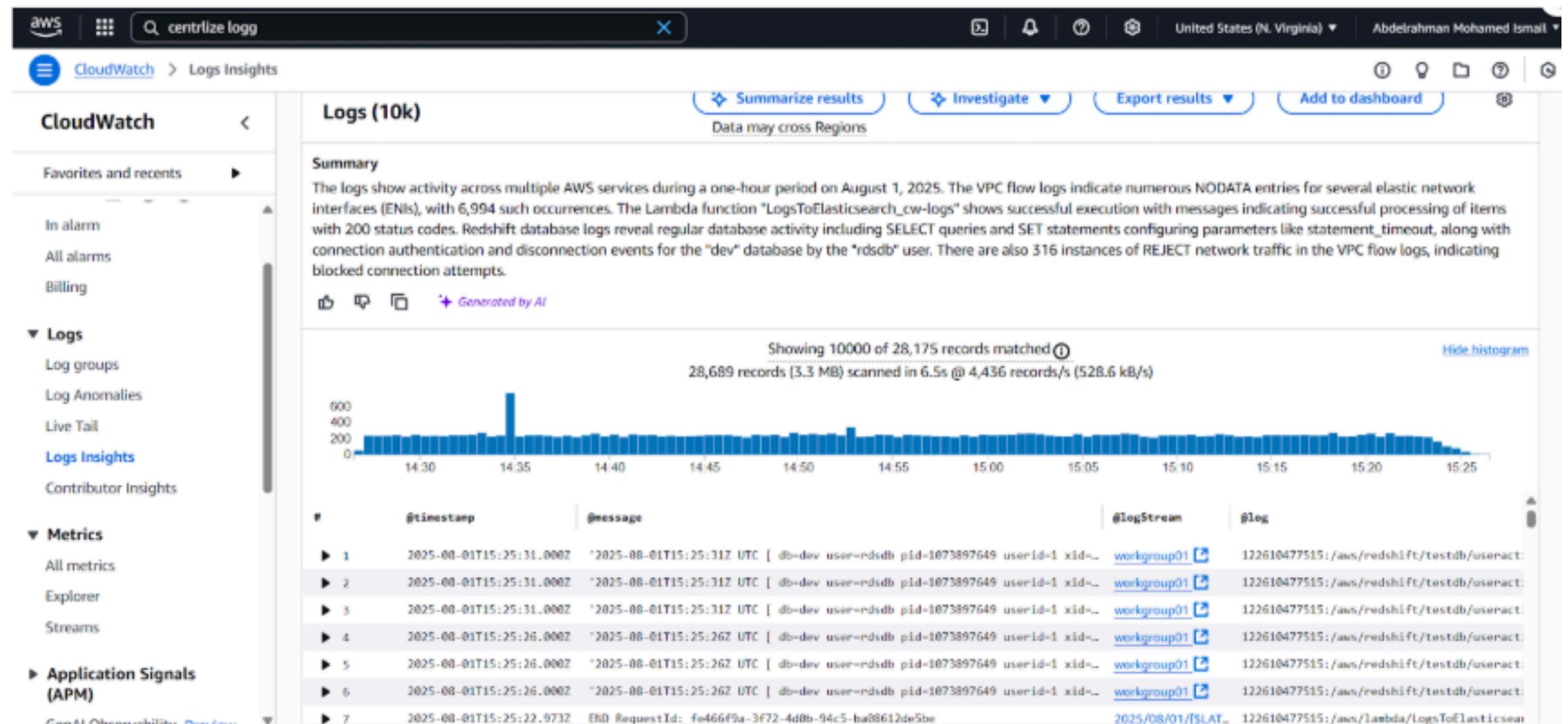
Real-time Monitoring System



CloudWatch collects monitoring and operational data in the form of logs, metrics, and events from all AWS services used in the pipeline



AWS
CloudWatch



Log Monitoring with OpenSearch



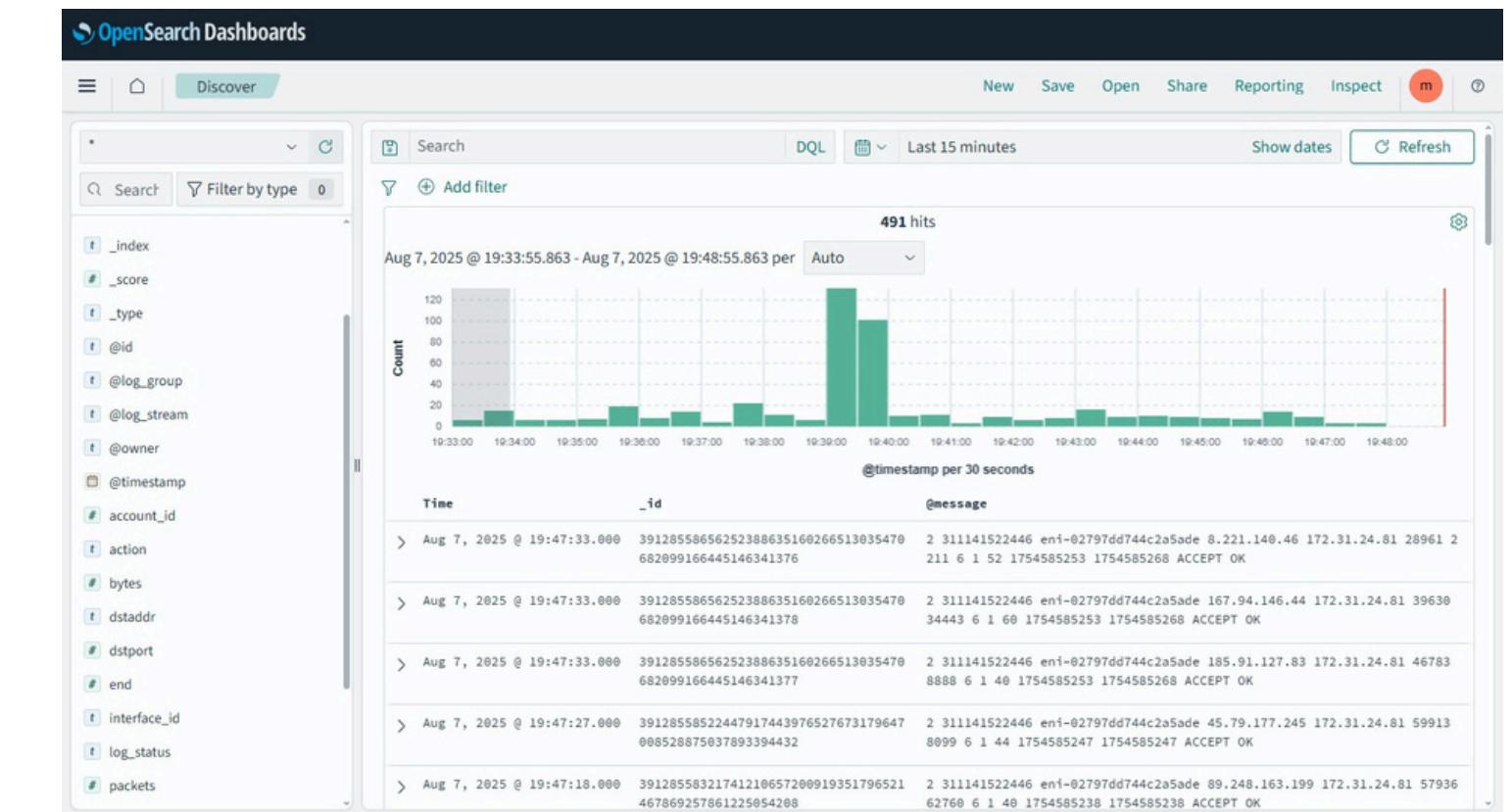
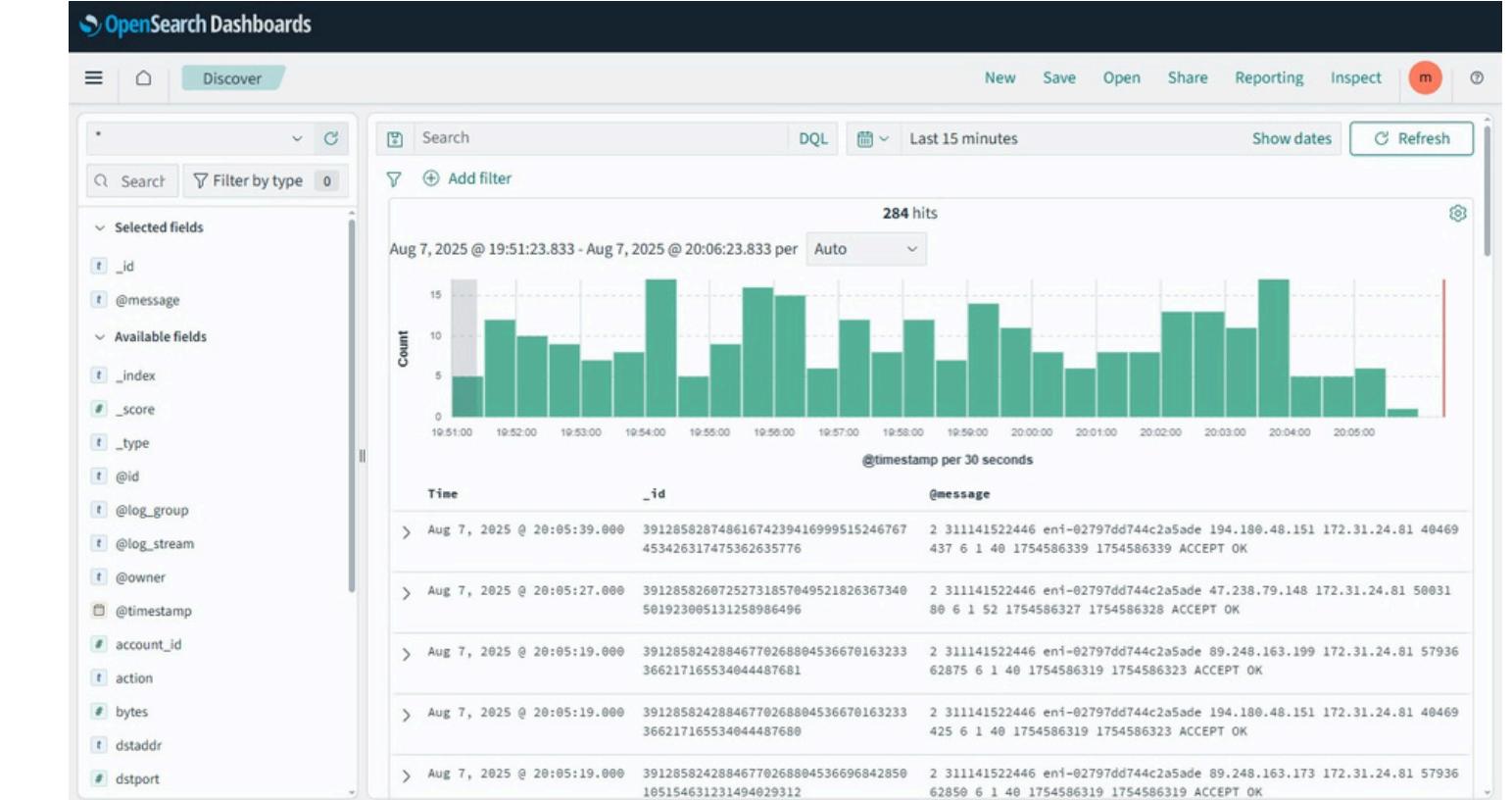
- Real-Time Visibility: Enabled real-time monitoring of ETL pipelines, Redshift queries, and serverless executions.
- Troubleshooting: Simplified root cause analysis using powerful full-text search and filtering on logs.



Opensearch



Opensearch
Dashboard





Outcoms

- Real-time soil monitoring for smarter irrigation and fertilization.
- Combined weather & location data for deeper farm insights.
- Centralized platform for live dashboards & analytics.
- Improved water efficiency with soil condition analysis.
- Foundation for smart farming tools like auto-irrigation.
- Holistic view of farm conditions over time and space.



Dem^o





9-8-2025

Thank
you

