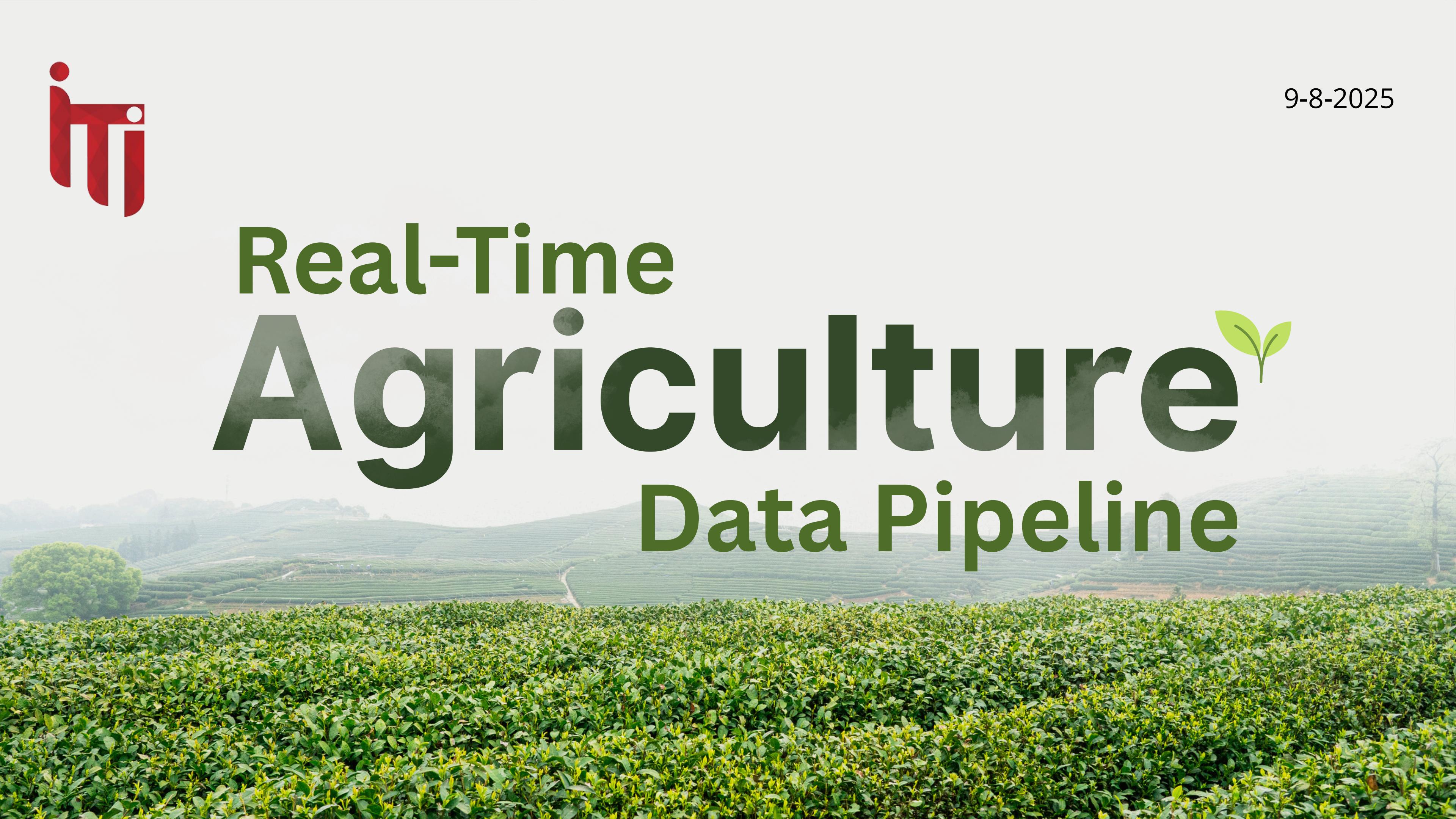




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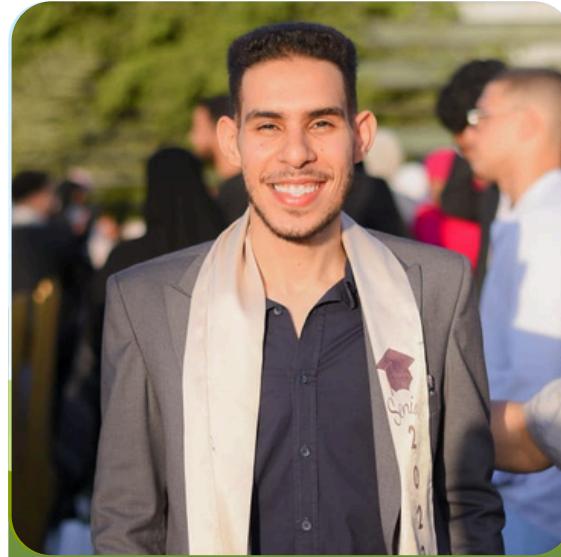
# Real-Time Agriculture Data Pipeline

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

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## Water Scarcity

The Nile Delta region faces increasing water scarcity.



## Soil Salinization

Improper irrigation practices exacerbate soil salinization.



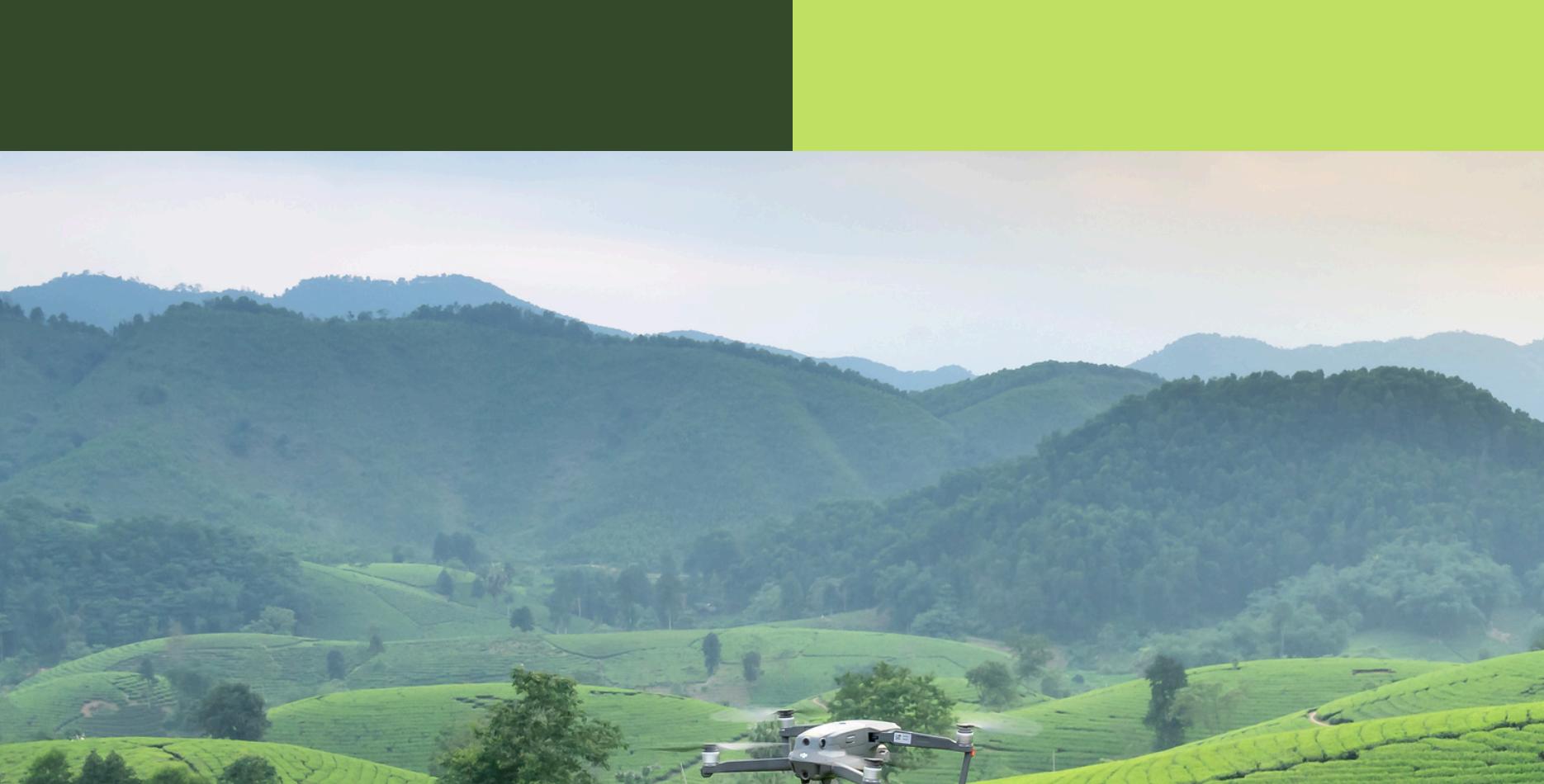
## Unpredictable Yields

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

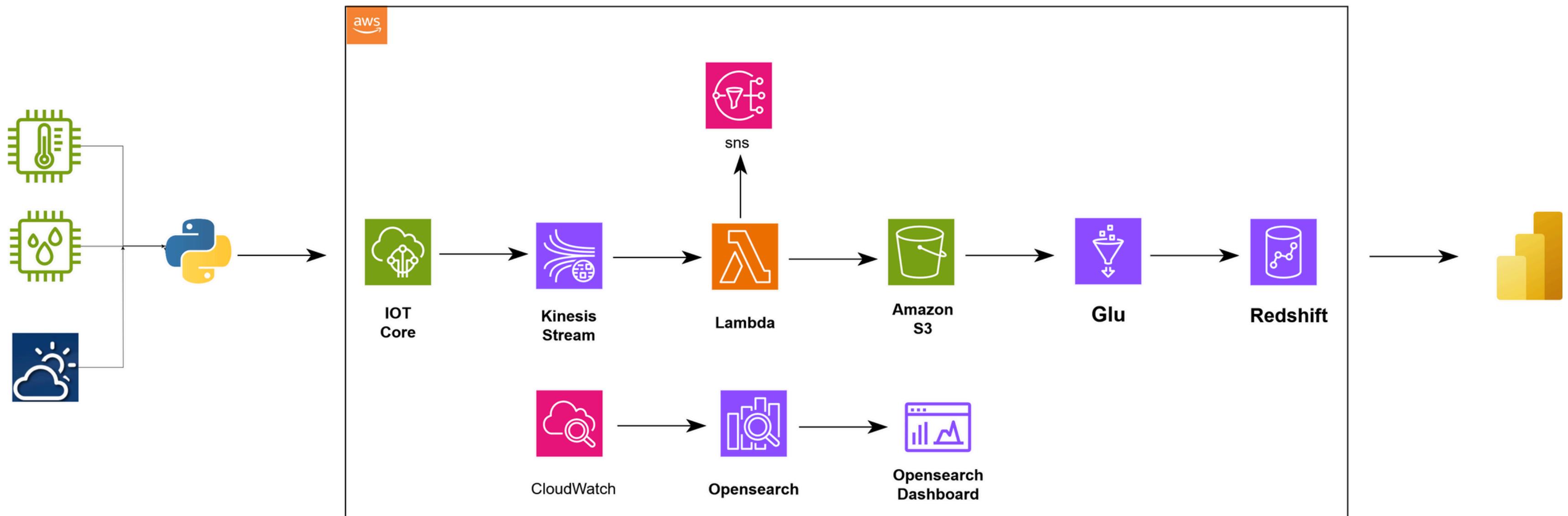
- **Nitrogen (N):** Supports leaf growth.
- **Phosphorus (P):** Boosts root and fruit development.
- **Potassium (K):** Enhances plant health and resistance.

## Weather Factors

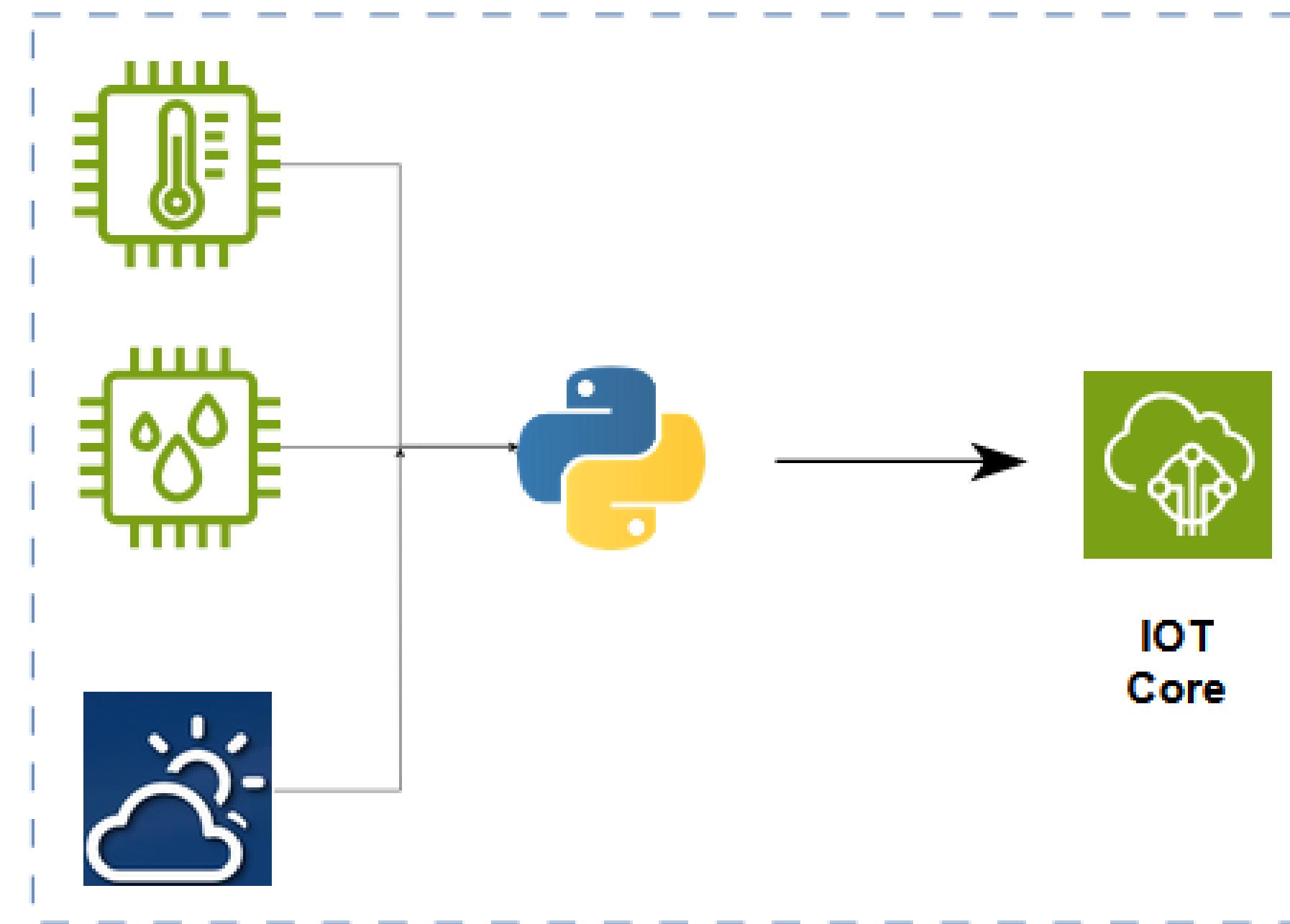
- **Wind Speed:** Speeds up soil drying.
- **Wind Direction:** Affects heat and moisture distribution.
- **Air Temperature:** Influences plant growth.
- **Humidity:** Affects water needs of plants.



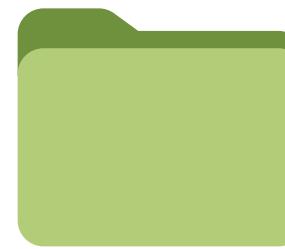
# Pipeline Architecture



# Ingestion Layer

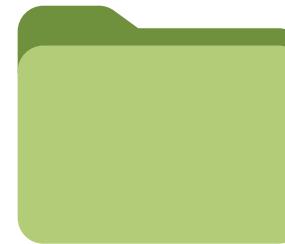


# Data Collection



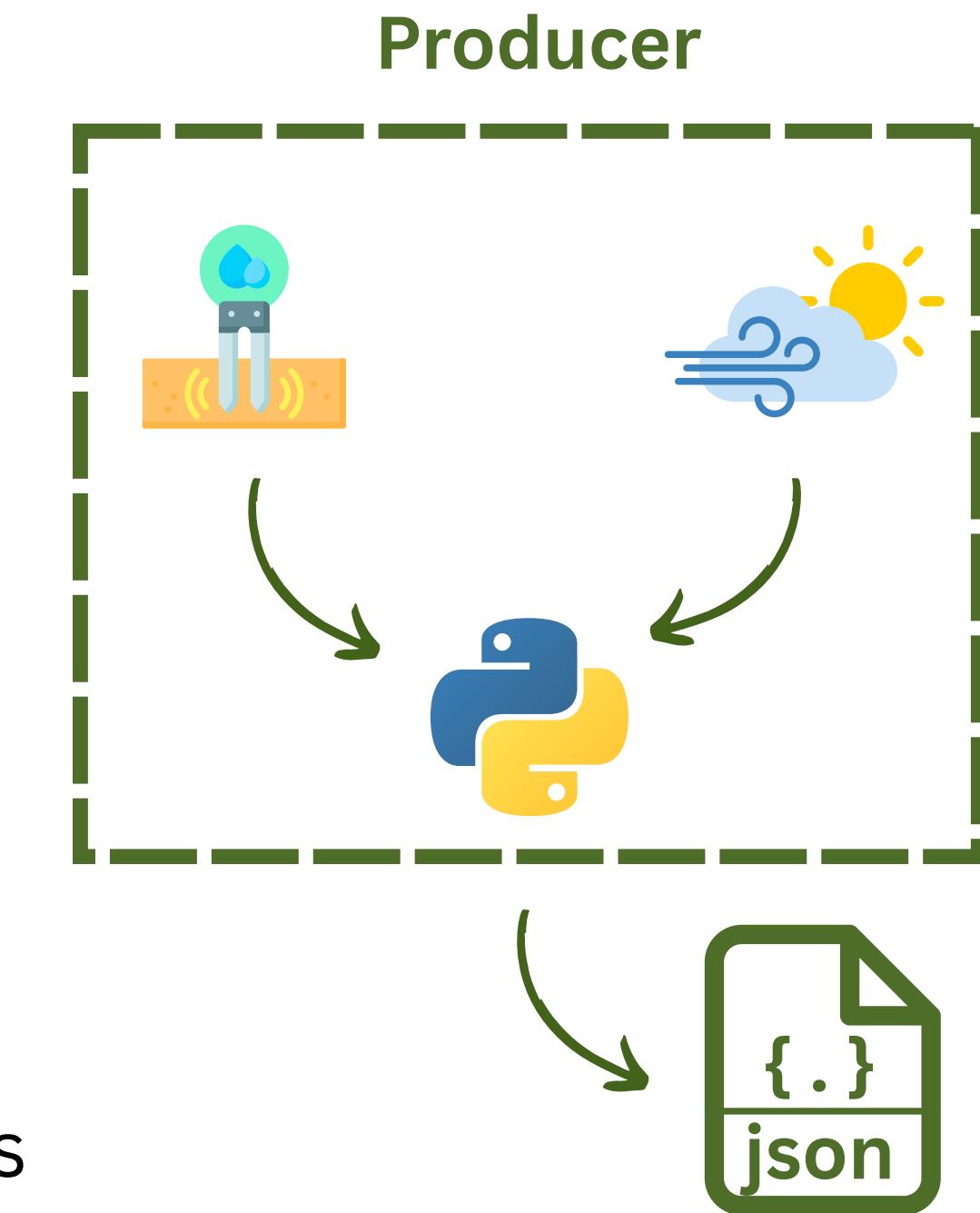
## Soil Sensors

Collected real-time data  
(soil status)



## API

fetch weather data in our special locations



# Data Ingestion

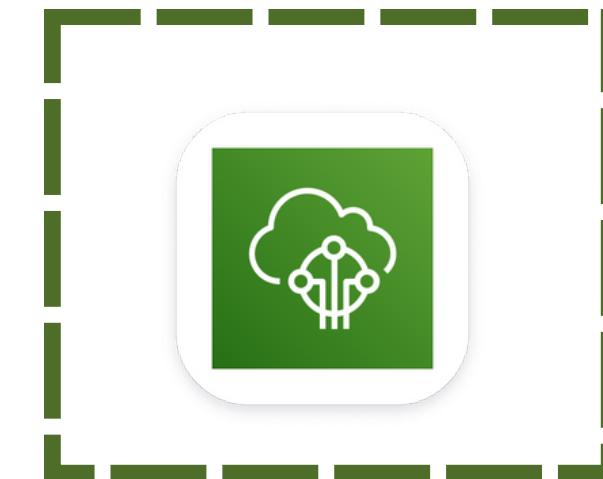


## AWS IoT Core

Cloud Gateway

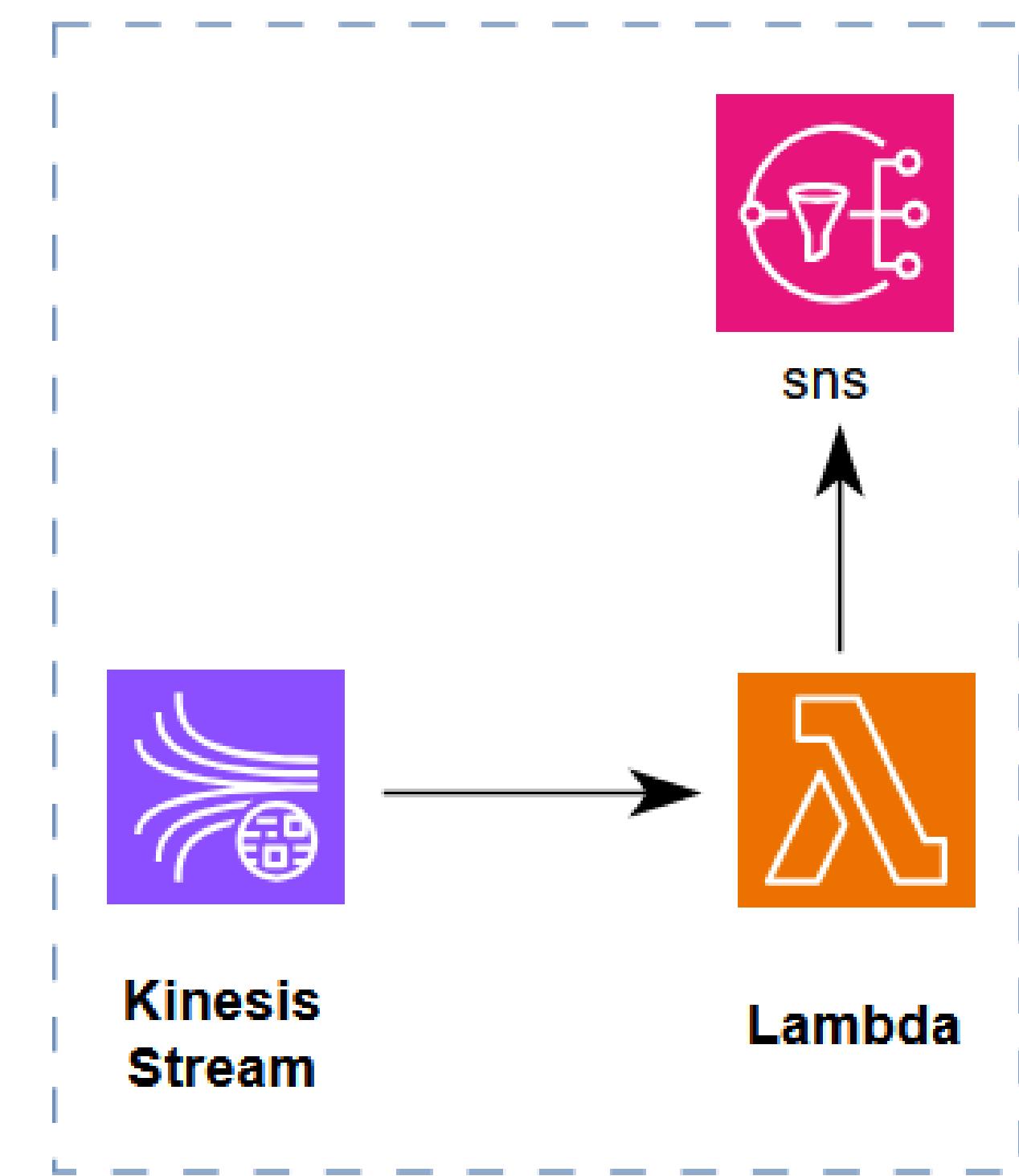
Receive data from sensors (via MQTT).

Producer



# Streaming & Processing

## Layer

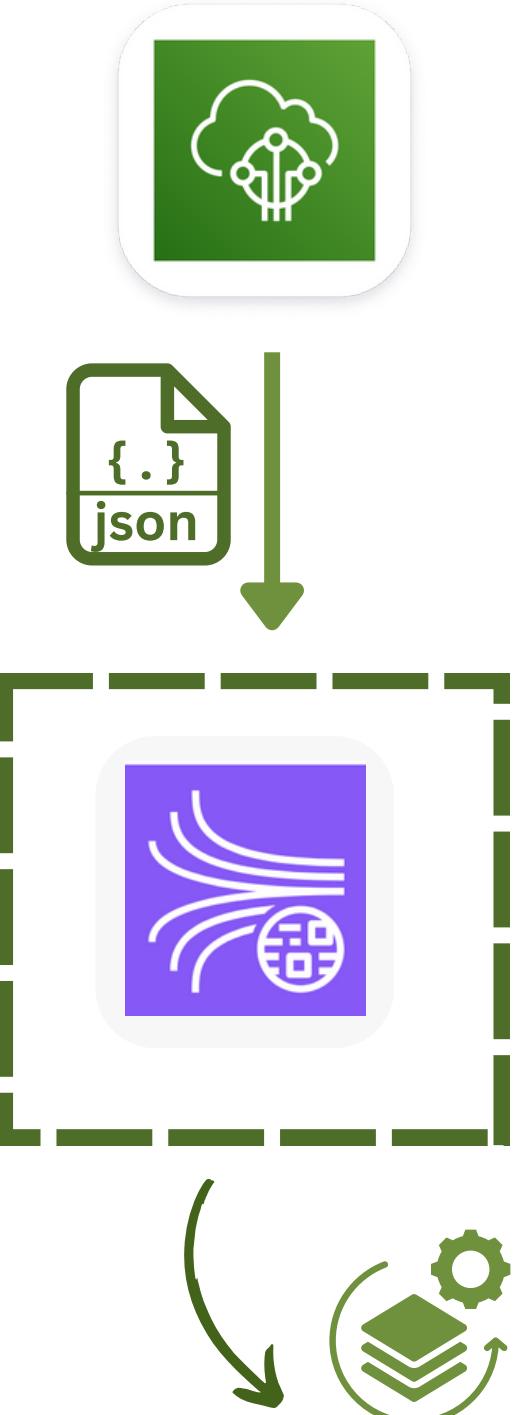


# Data Streaming



## Kinesis Data Streams

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



# Data Processing



**lambda processing**

to check data validation

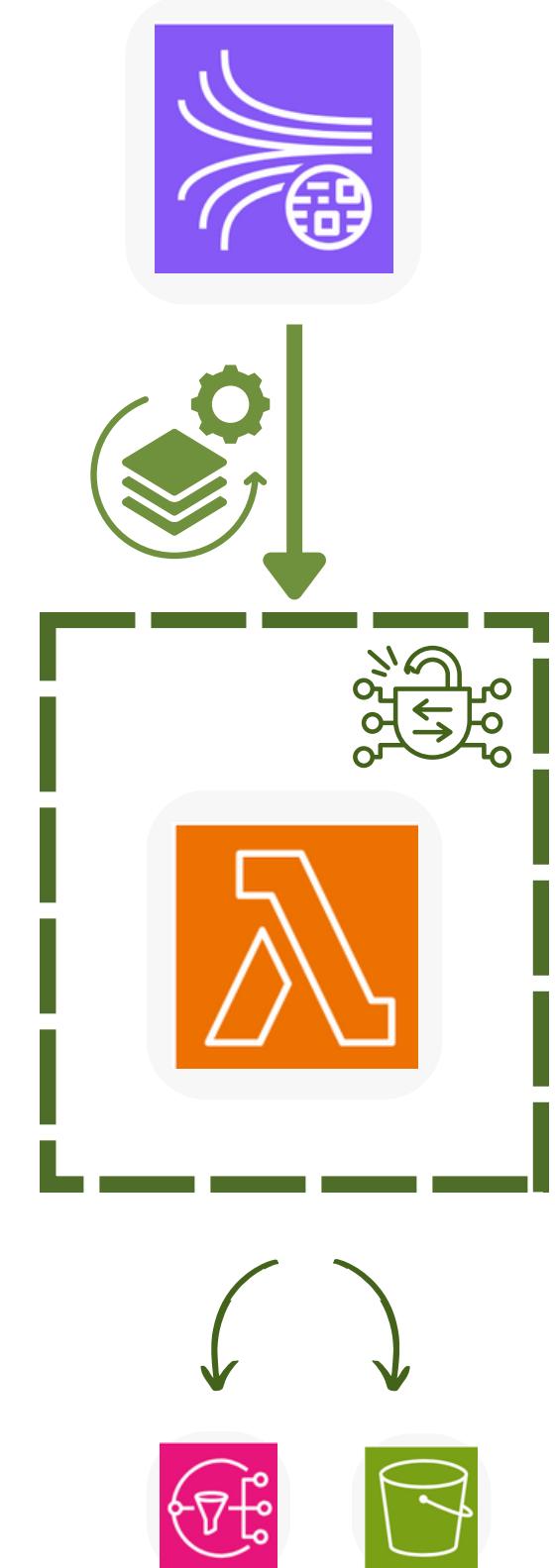
→ Structure

✓ **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

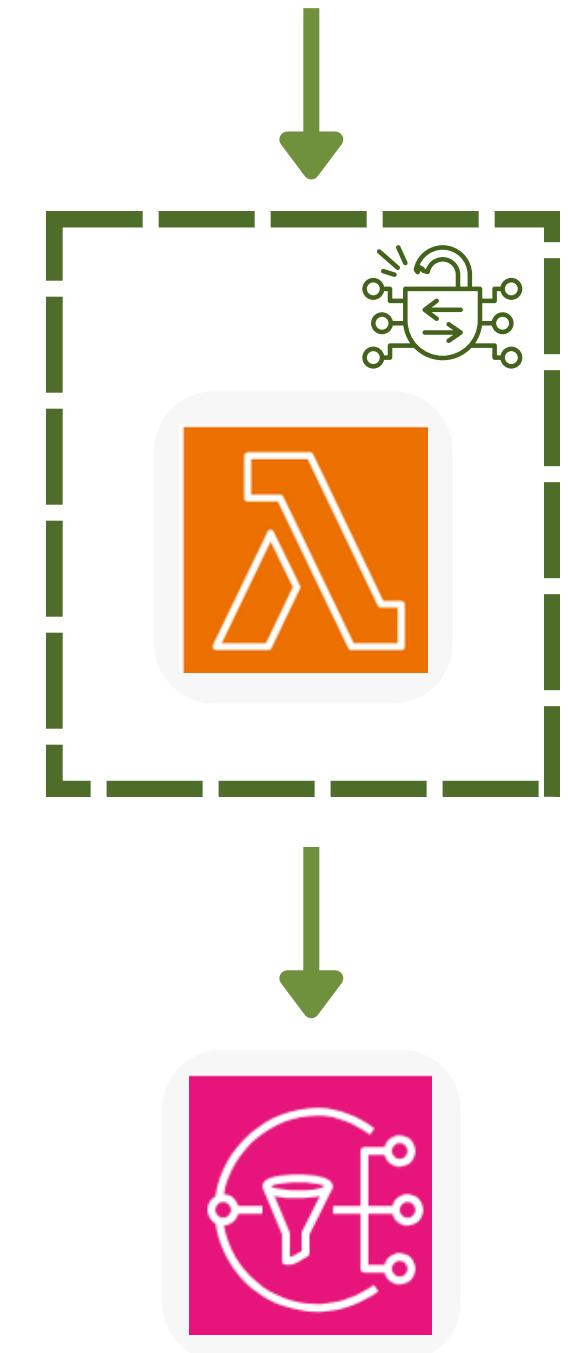
Priority: HIGH

Description: Low water level alert: 0.81m at loc\_1

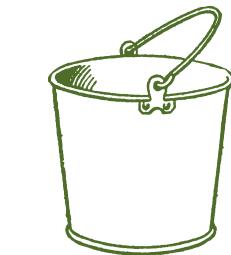
Recommended Action: Inspect irrigation system and water supply

Event ID: evt\_1096ee6f256c

Generated by Farm Monitoring System



# Data Storage



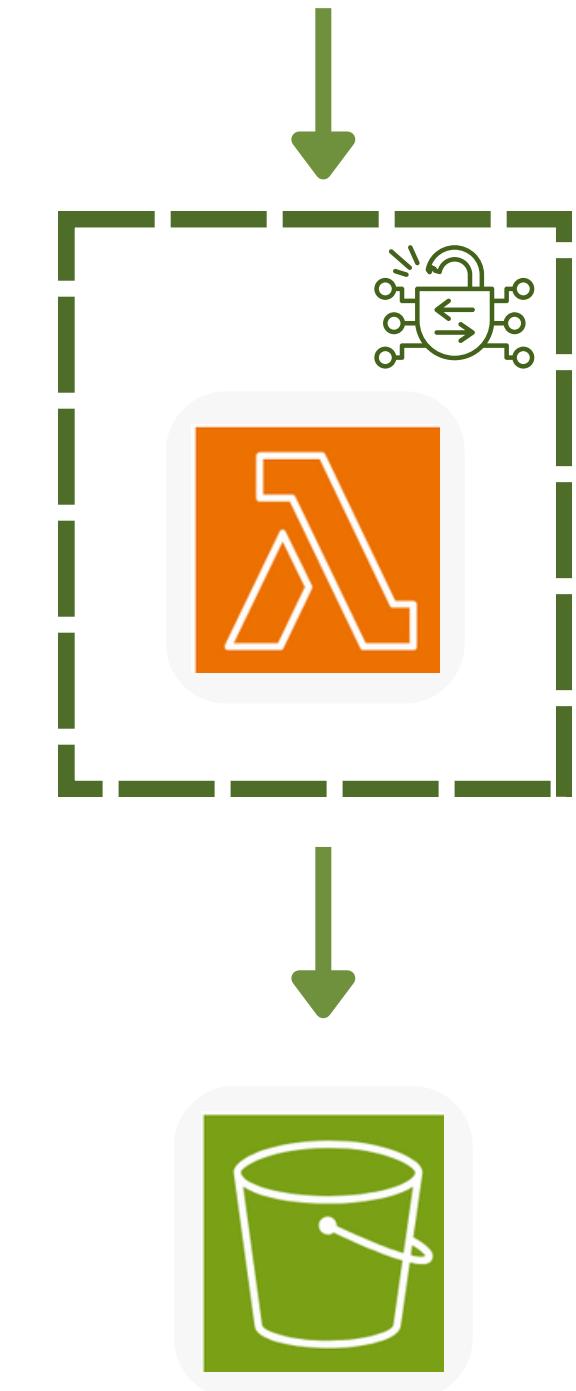
**S3 Data lake storage**



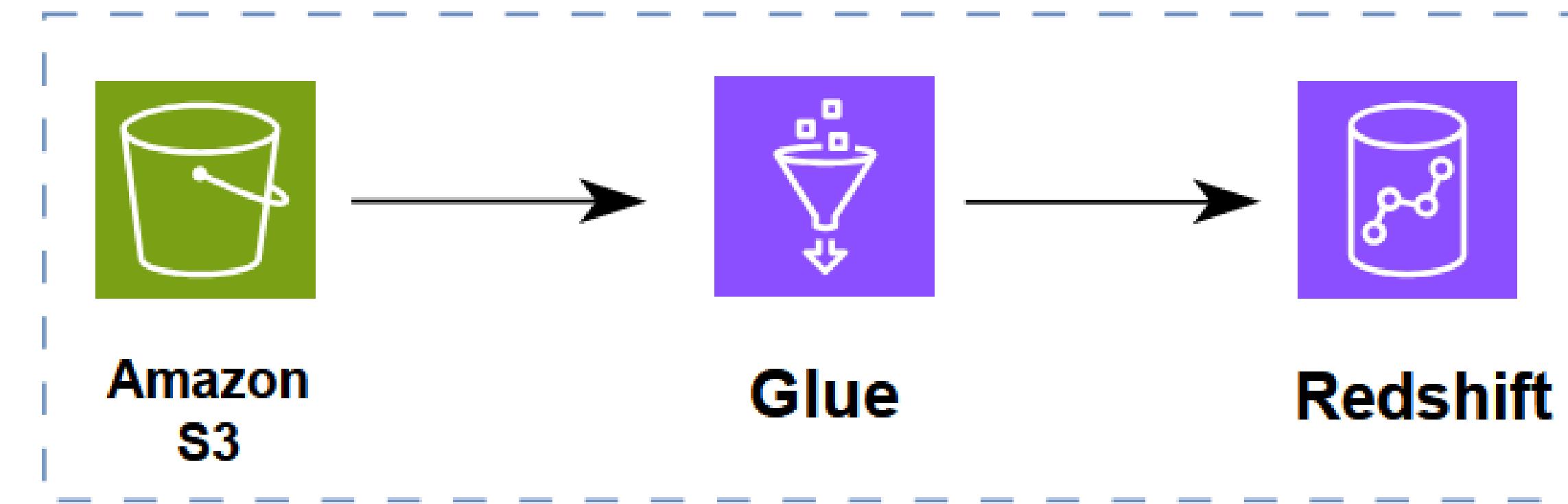
**Valid** → ETL & analysis ready data



**In Valid** → Data with structural or logical problems



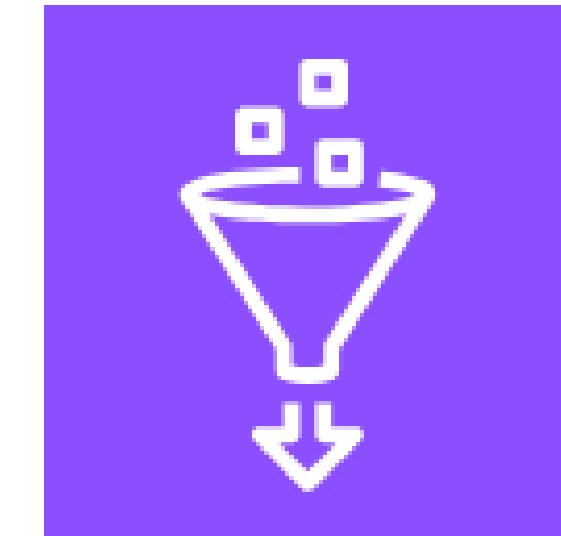
# ETL Layer



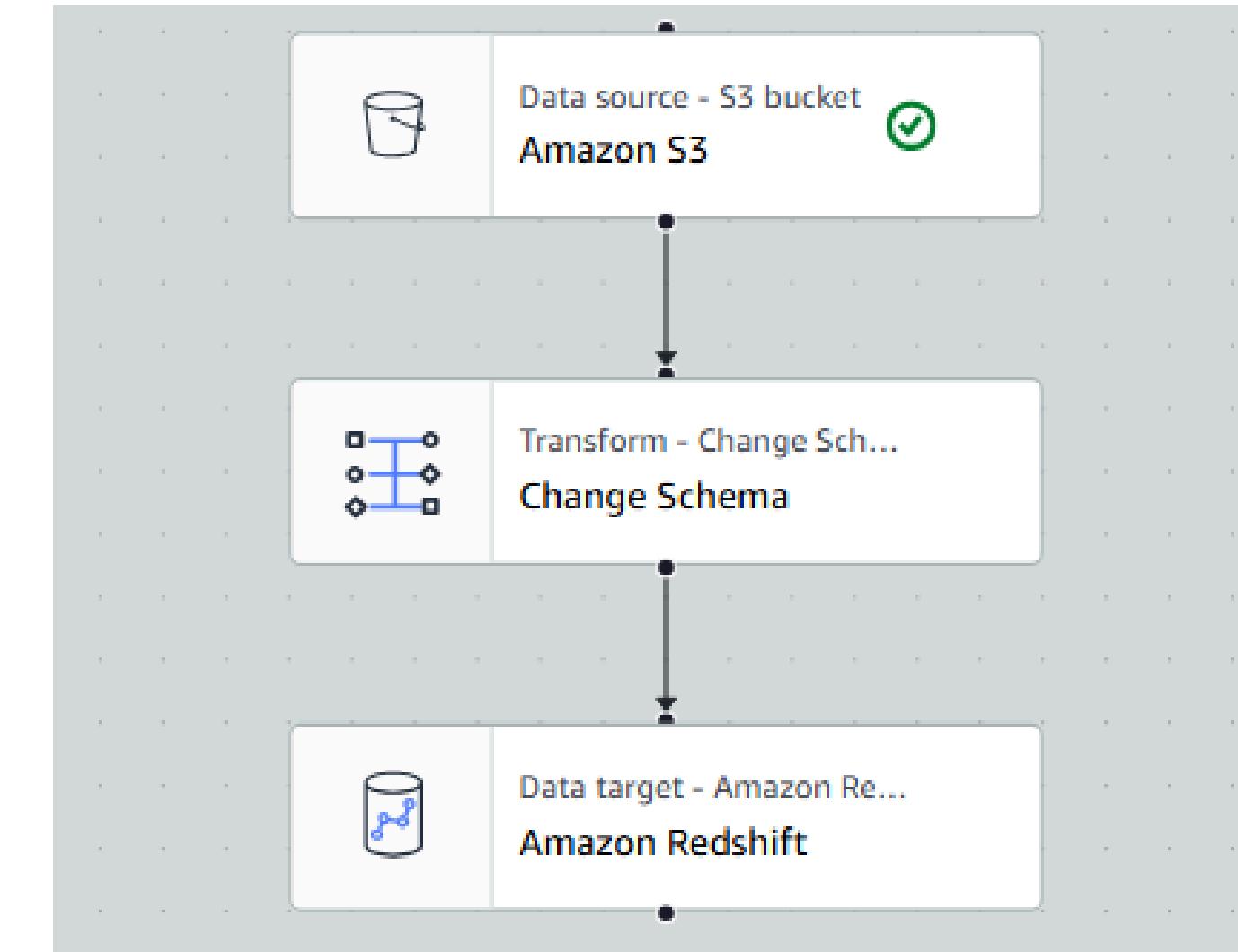
# ETL Process



- 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

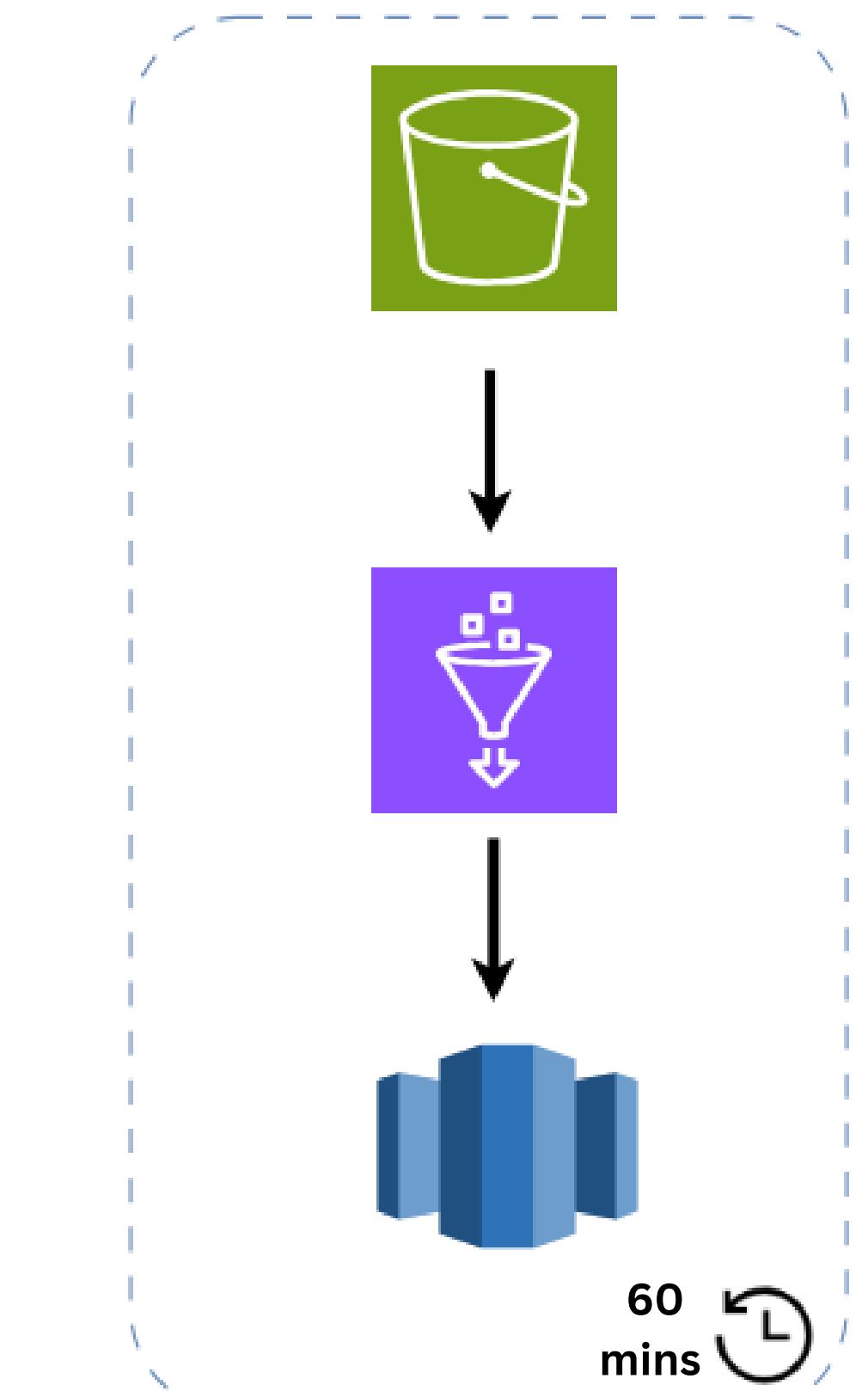


# Data

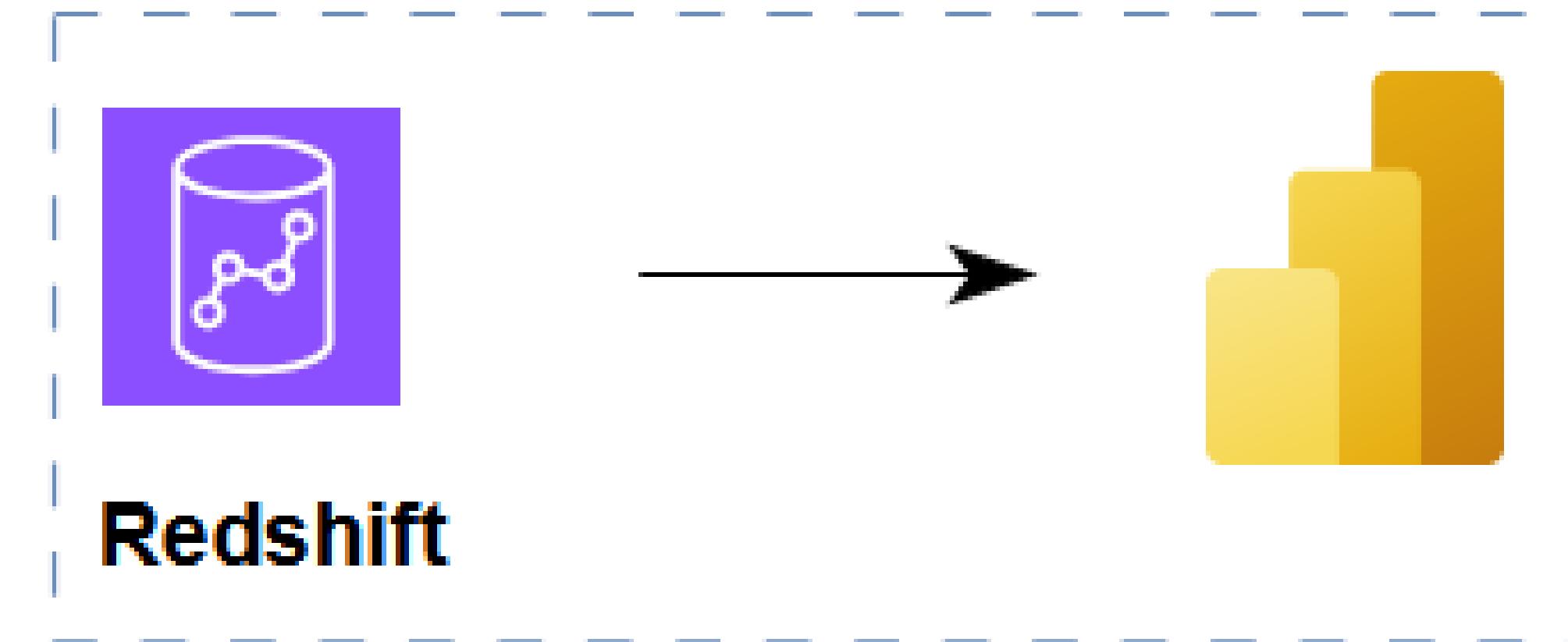
# Orchestration



- 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.

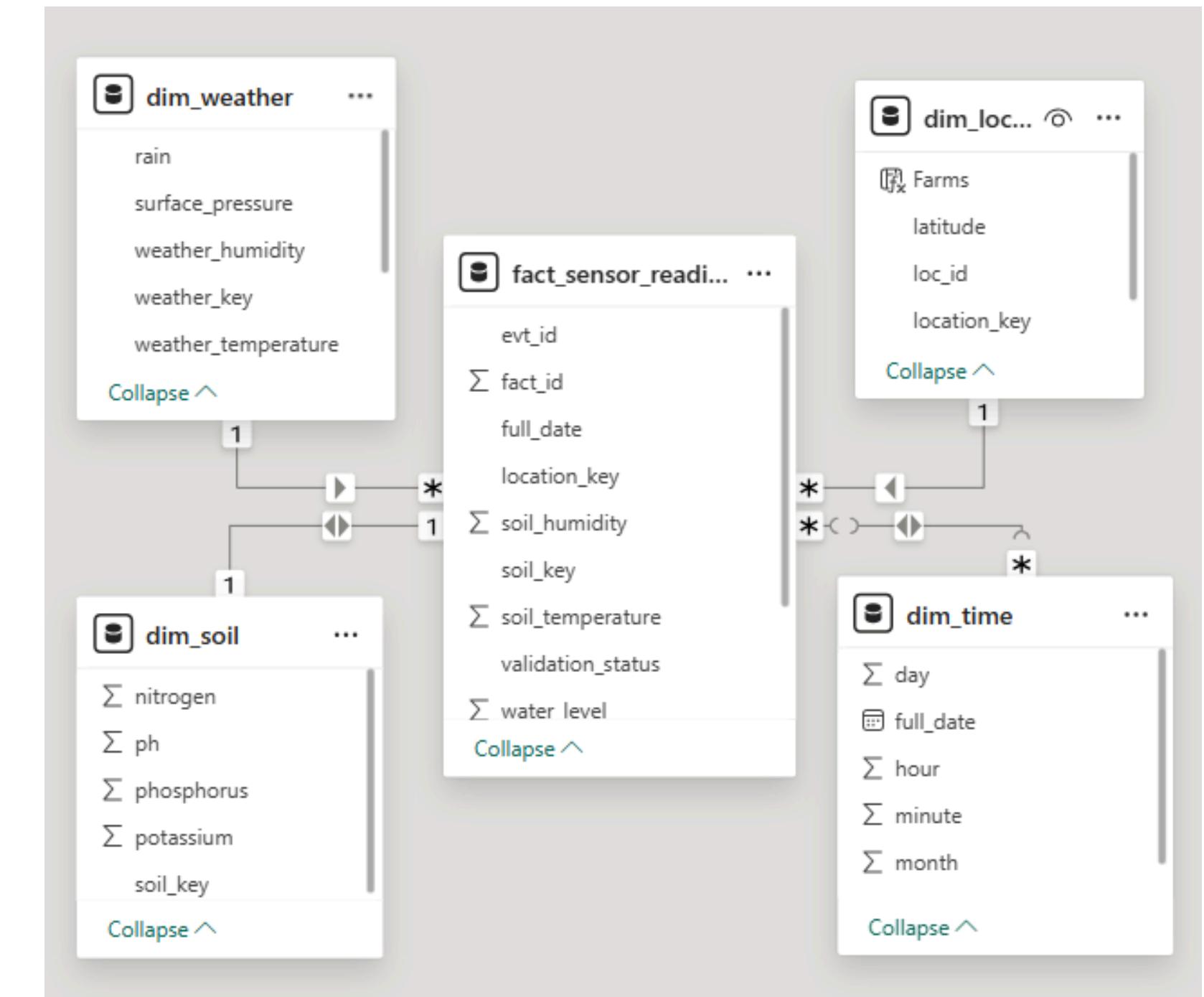


# Visualization Layer

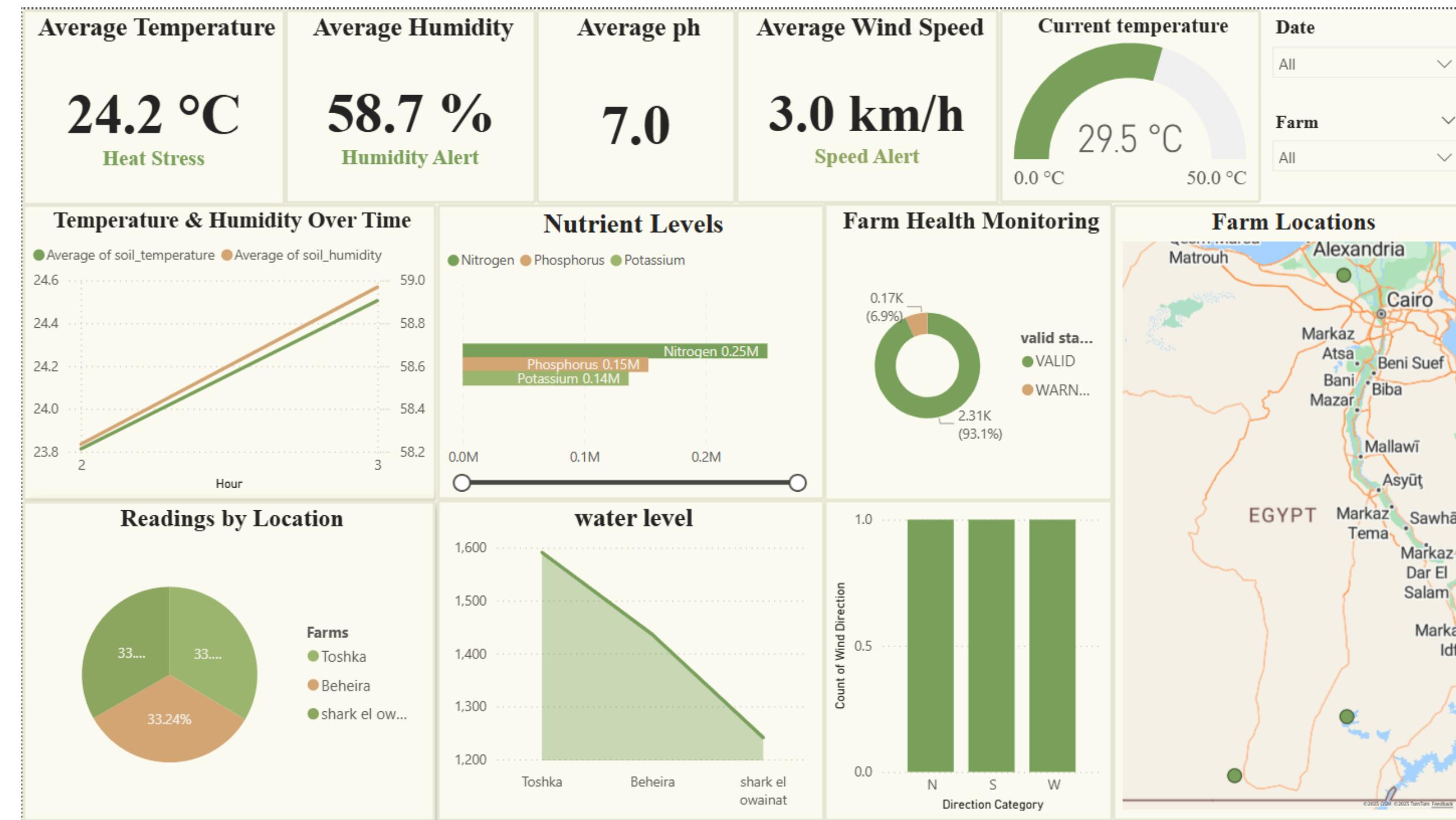


# Data Warehouse

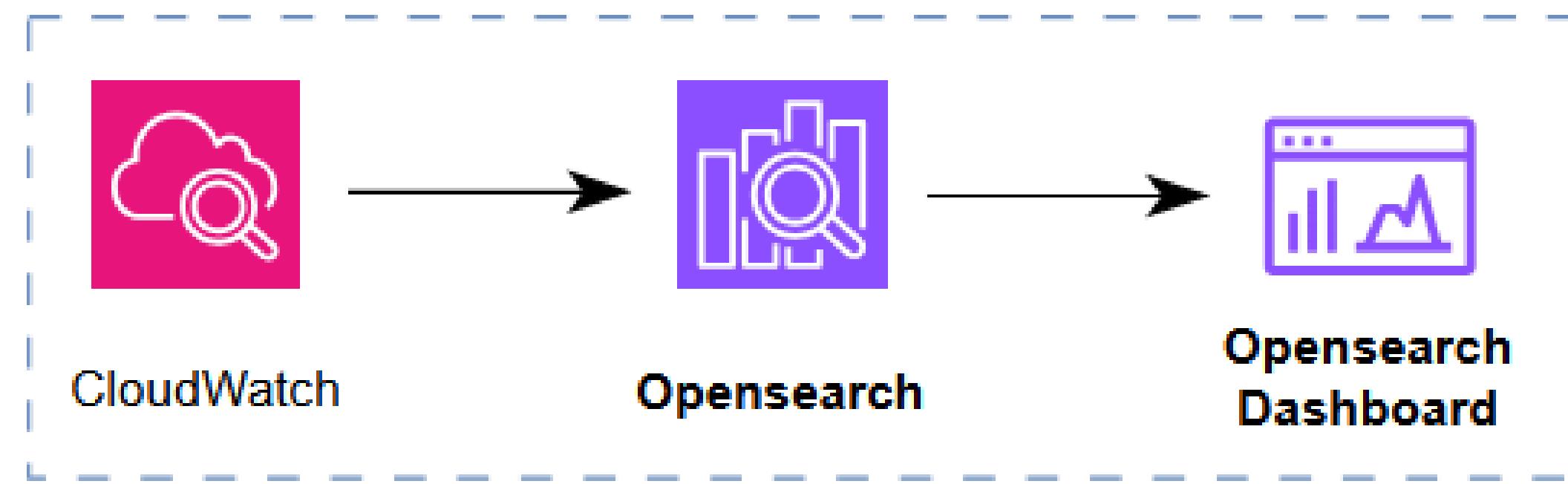
- Follows a Star Schema structure.
- Optimized for analytical queries and reporting.
- Supports efficient analysis of sensor data and weather information.



# Data Analytics



# Monitoring Layer



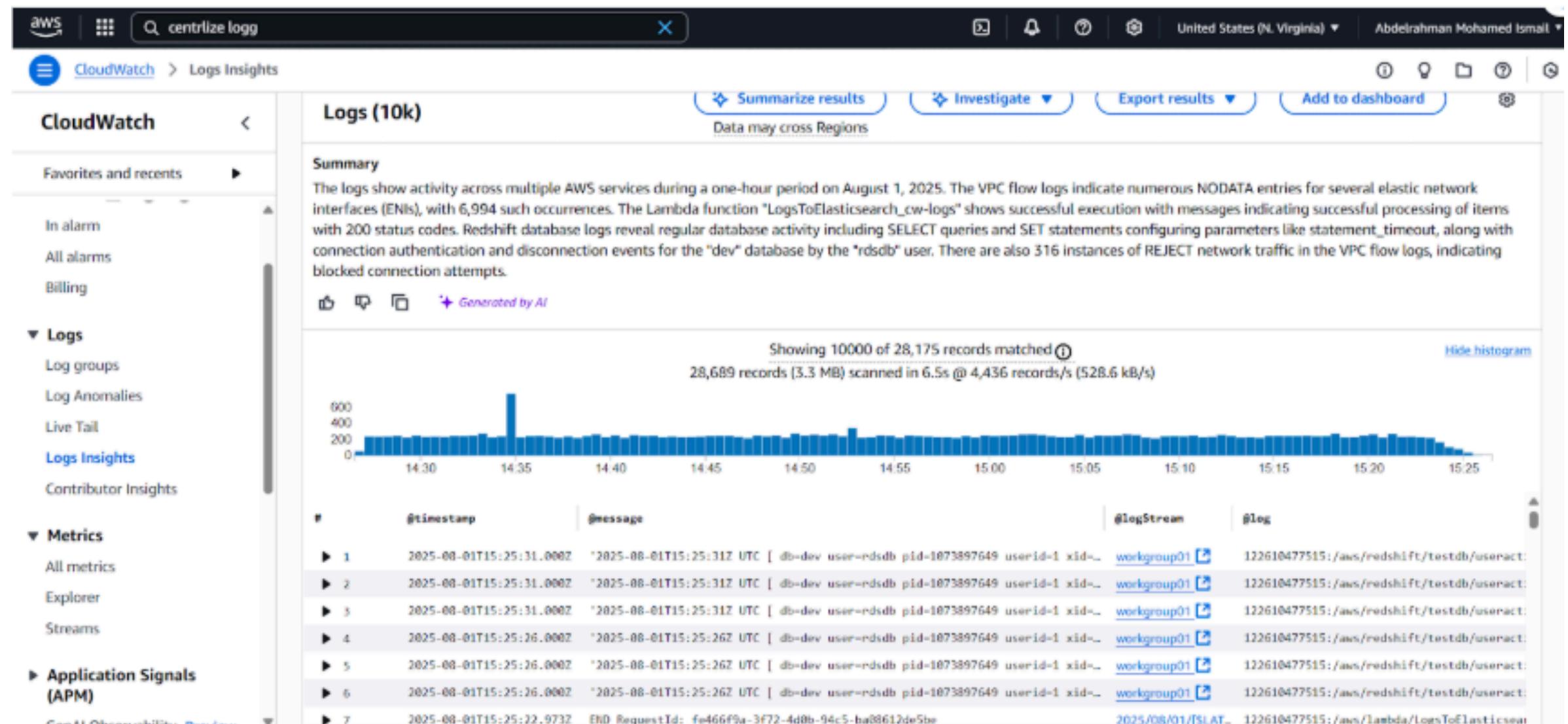
# Real-time Monitoring System



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



AWS  
CloudWatch



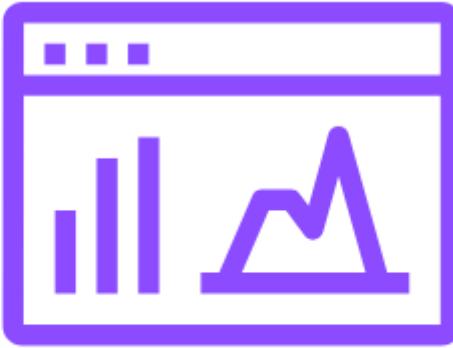
# Log Monitoring with OpenSearch



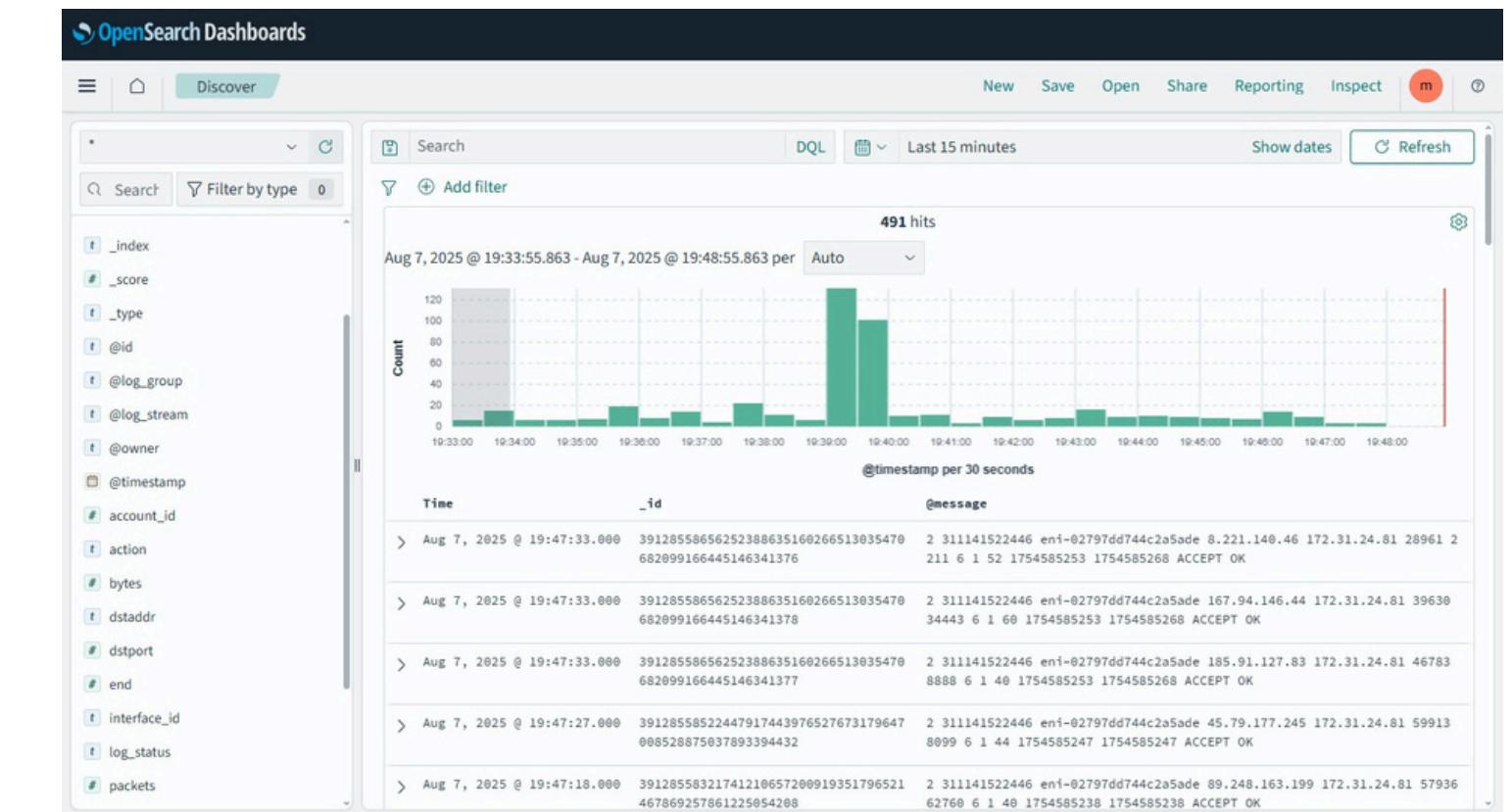
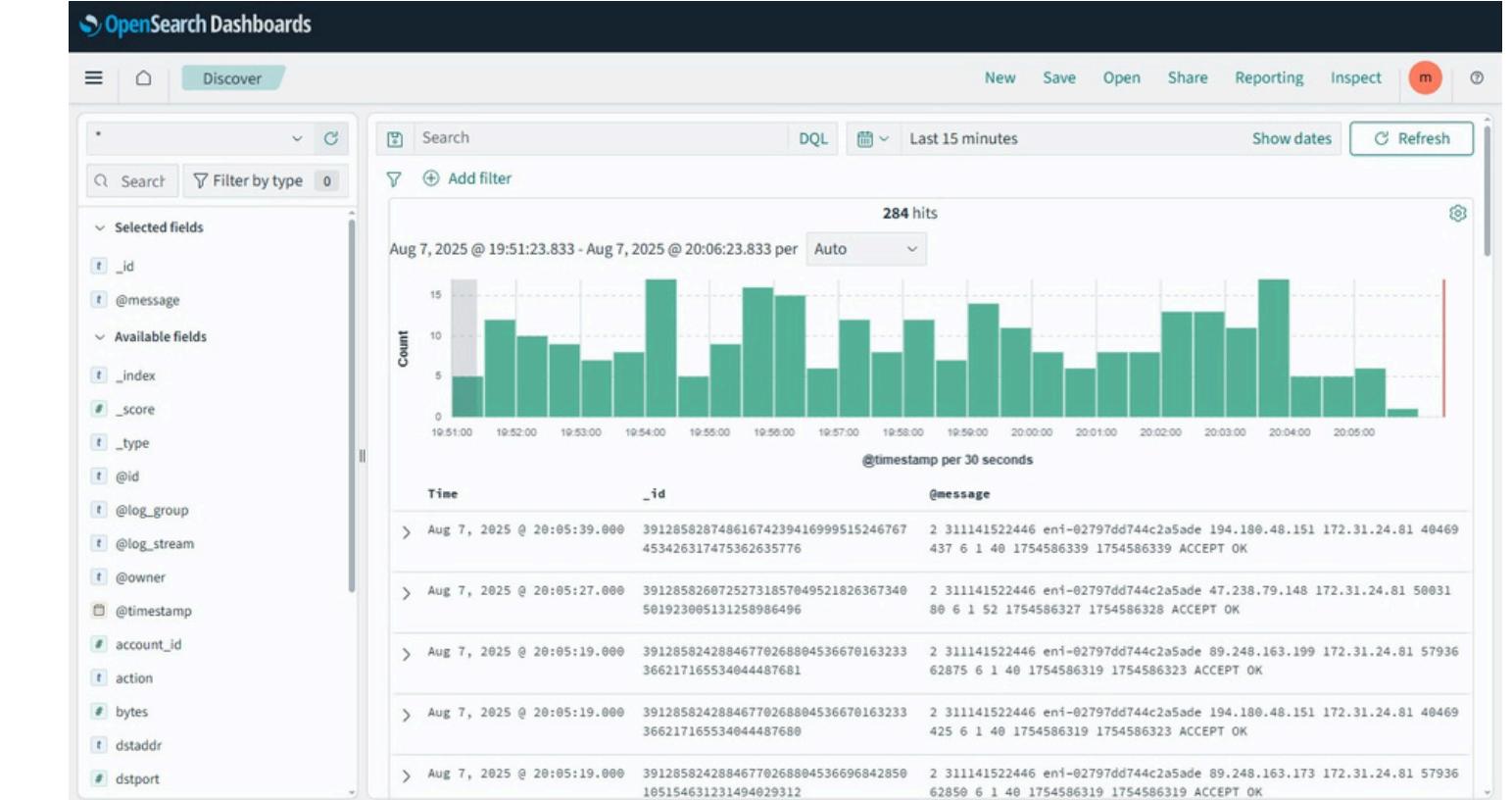
- Real-Time Visibility: Enabled real-time monitoring of ETL pipelines, Redshift queries, and serverless executions.
- Troubleshooting: Simplified root cause analysis using powerful full-text search and filtering on logs.

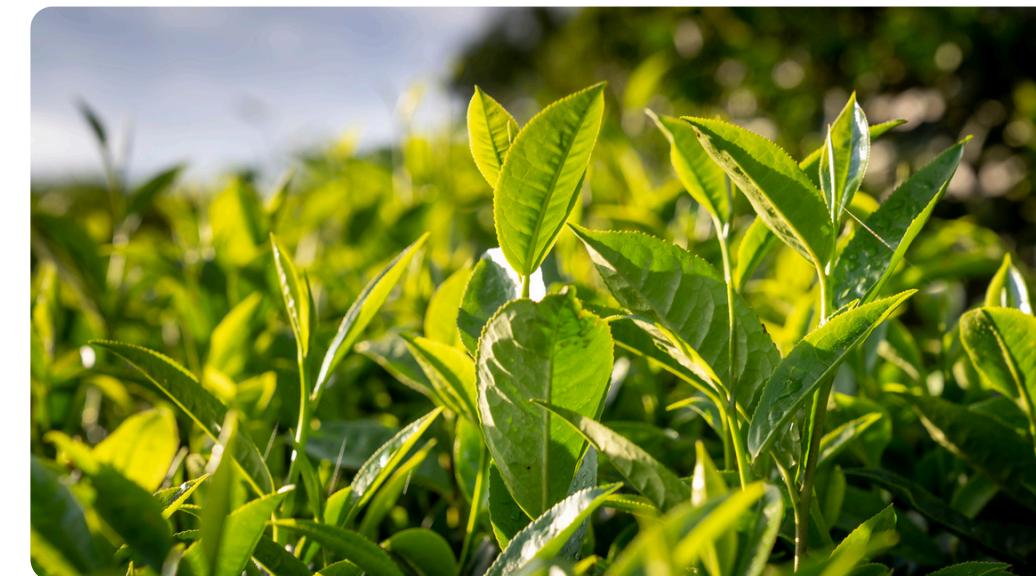


Opensearch



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.

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**Dem<sup>o</sup>**





9-8-2025

Thank  
you

