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Data Assimilation Platform and Architecture

B.S. Electrical Engineering
Eastern Nazarene College

Virtual Summer Research 2020

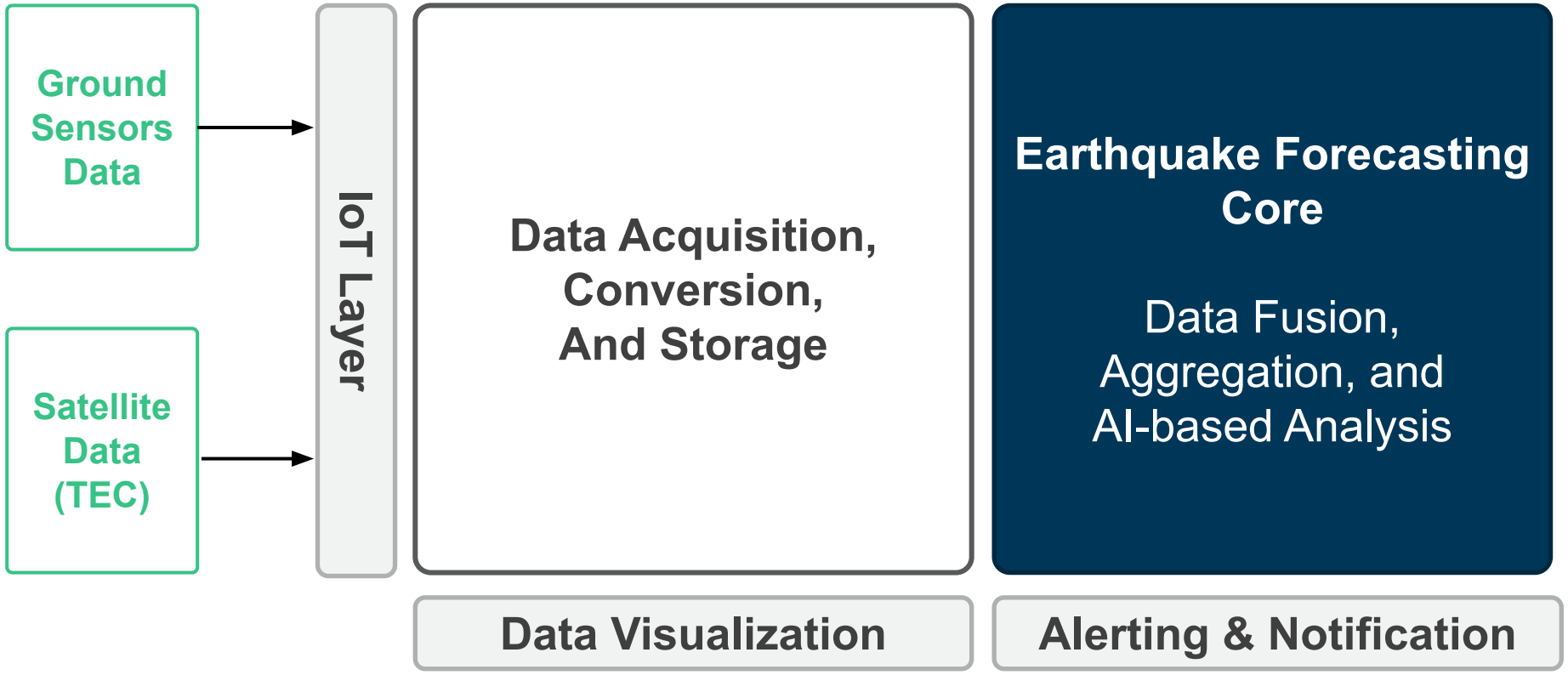
Sponsored by:
NASA Ames Research Centre,
Eastern Nazarene College,
& Precursor SPC

Current State of the Art

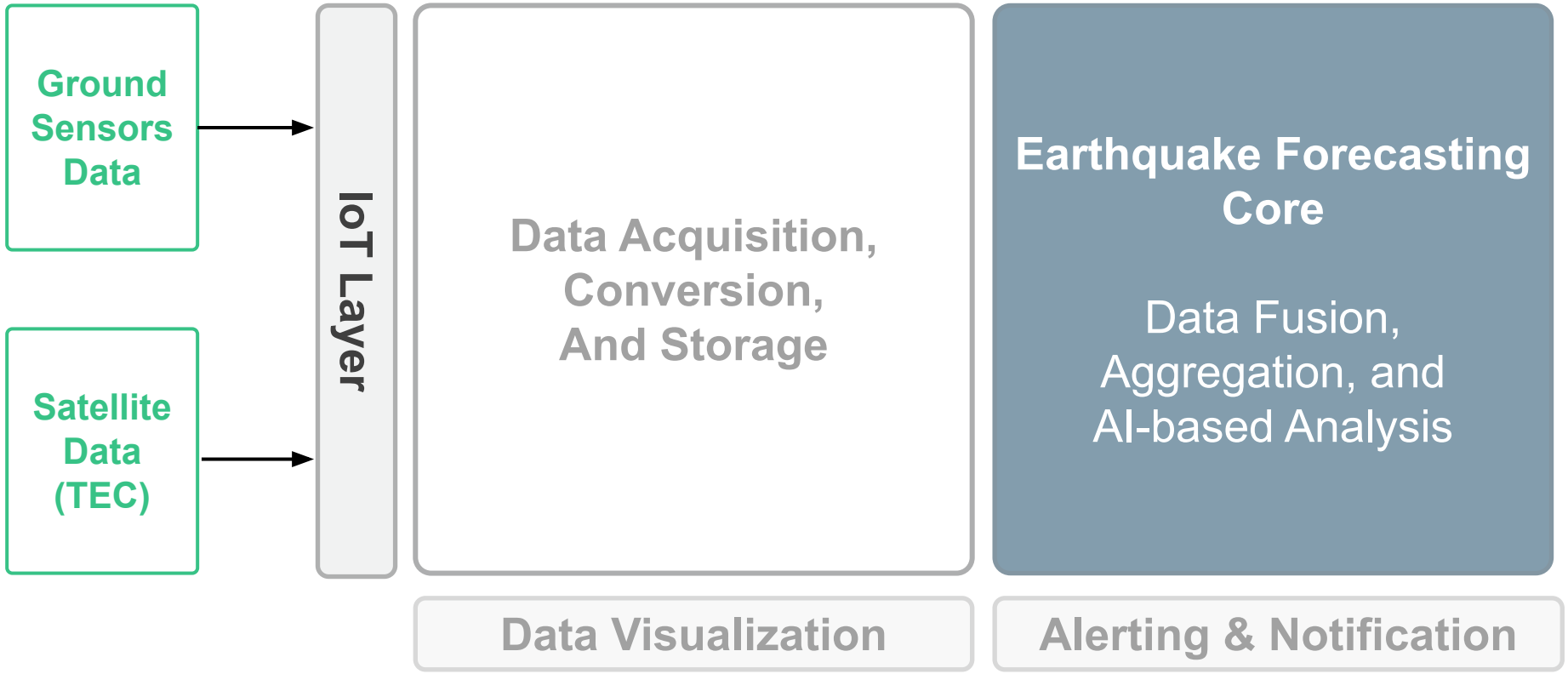
Distributed Microservices-oriented architecture

- Data Acquisition System
- Data Conversion System
- Data Scanning and Analysis in real-time
- Alerting and Notification System
- Continuous Integration
- Continuous Deployment Capabilities
- Comprehensive Documentation

System Architecture Design



Data Collection System



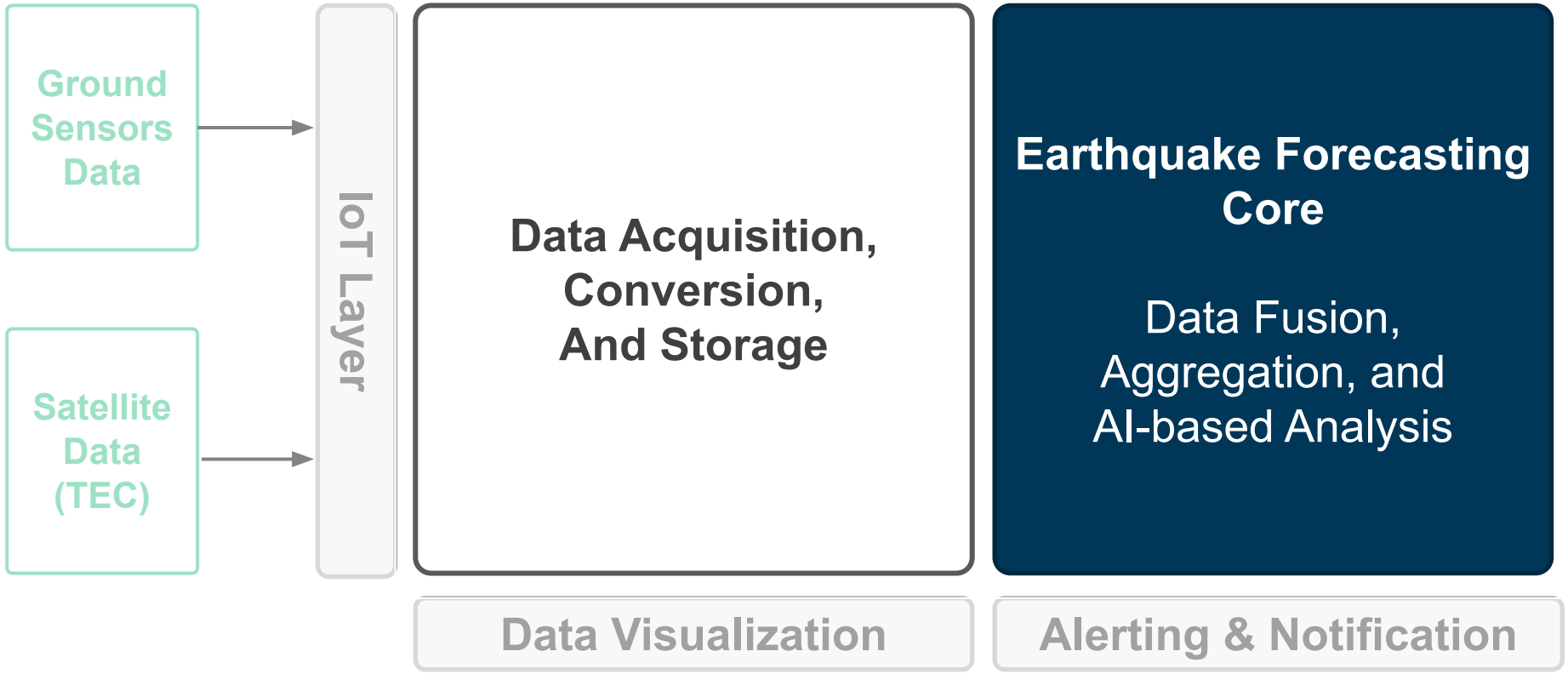
Data Collection System

We use a small computer (Raspberry Pi) to read data from 16 sensors and send it to our ENC servers through **MQTT**.

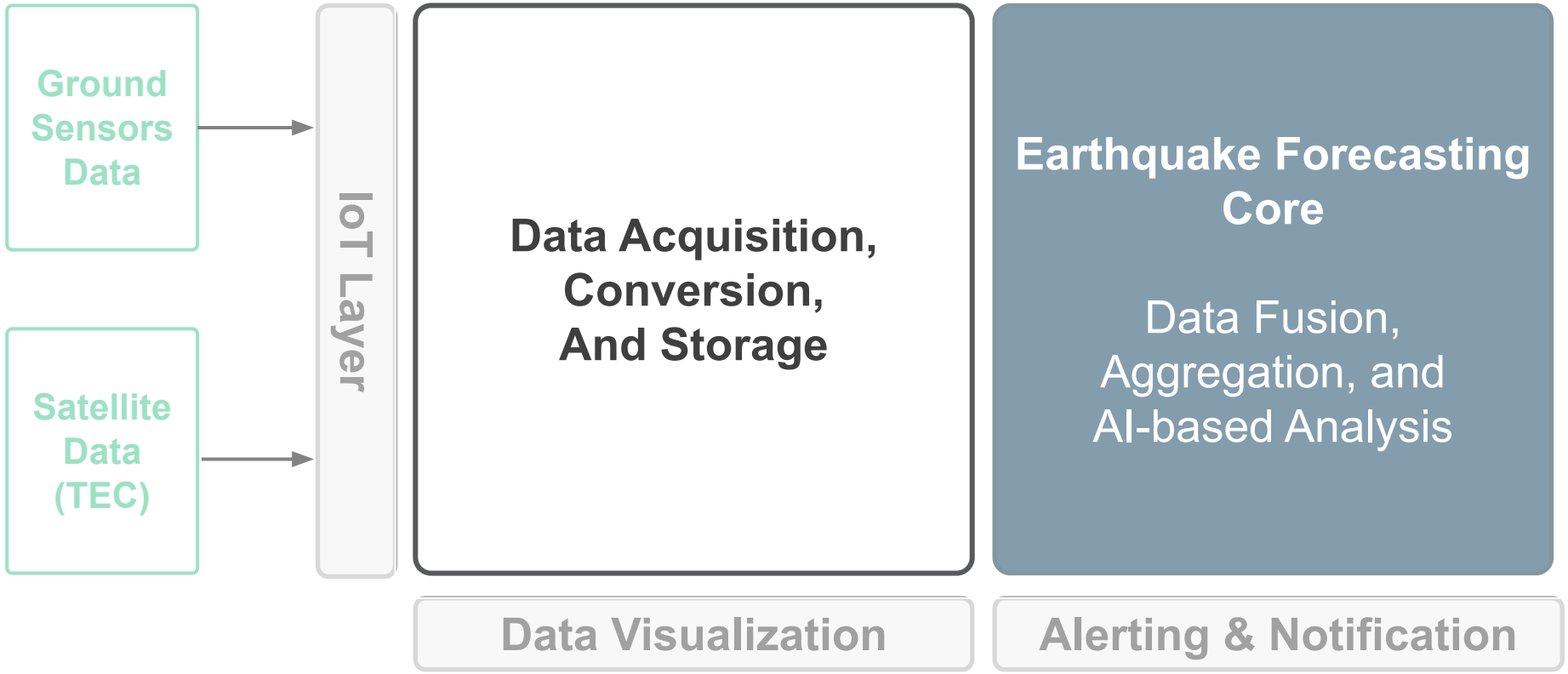
This data includes:

- Magnetic Field
- Surface Charges
- CO2 Levels

Backend Architecture



Data Acquisition, Conversion, and Storage



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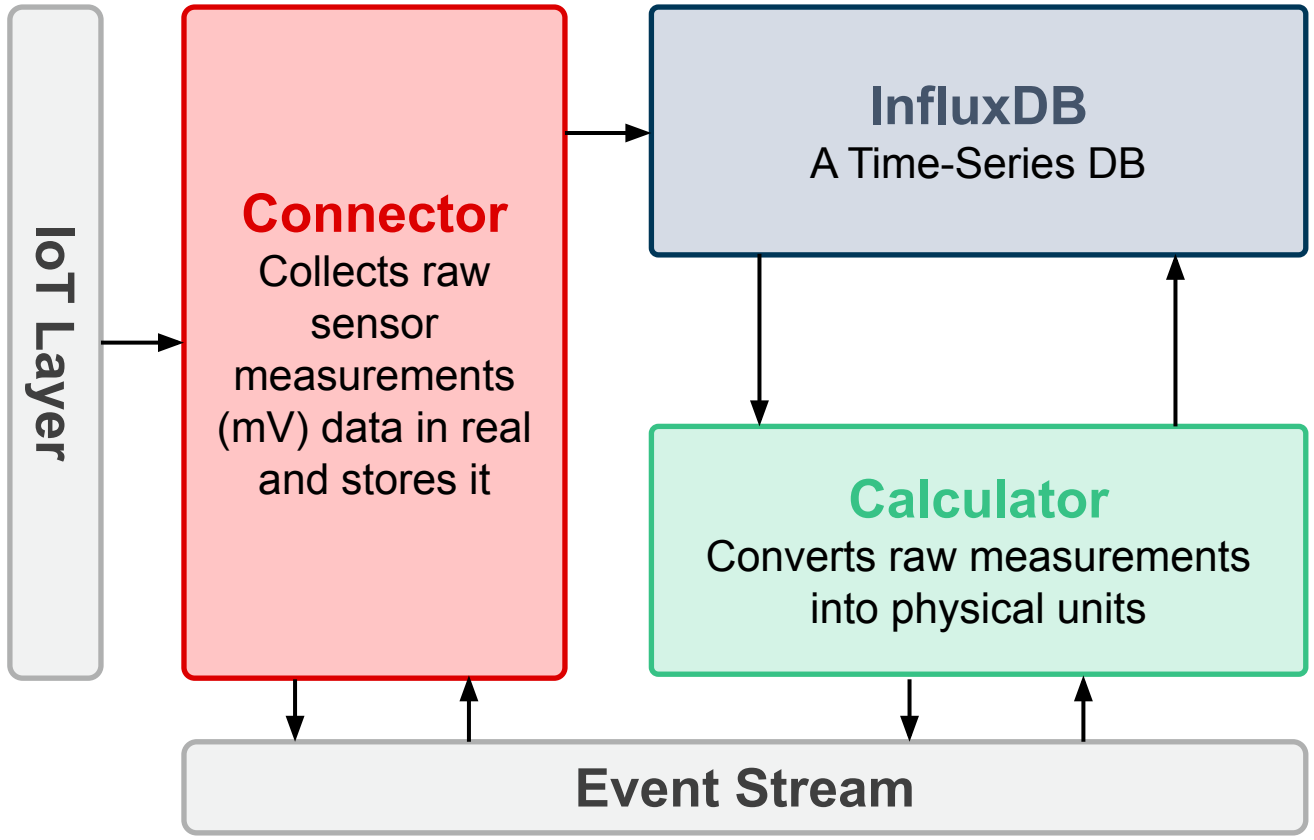


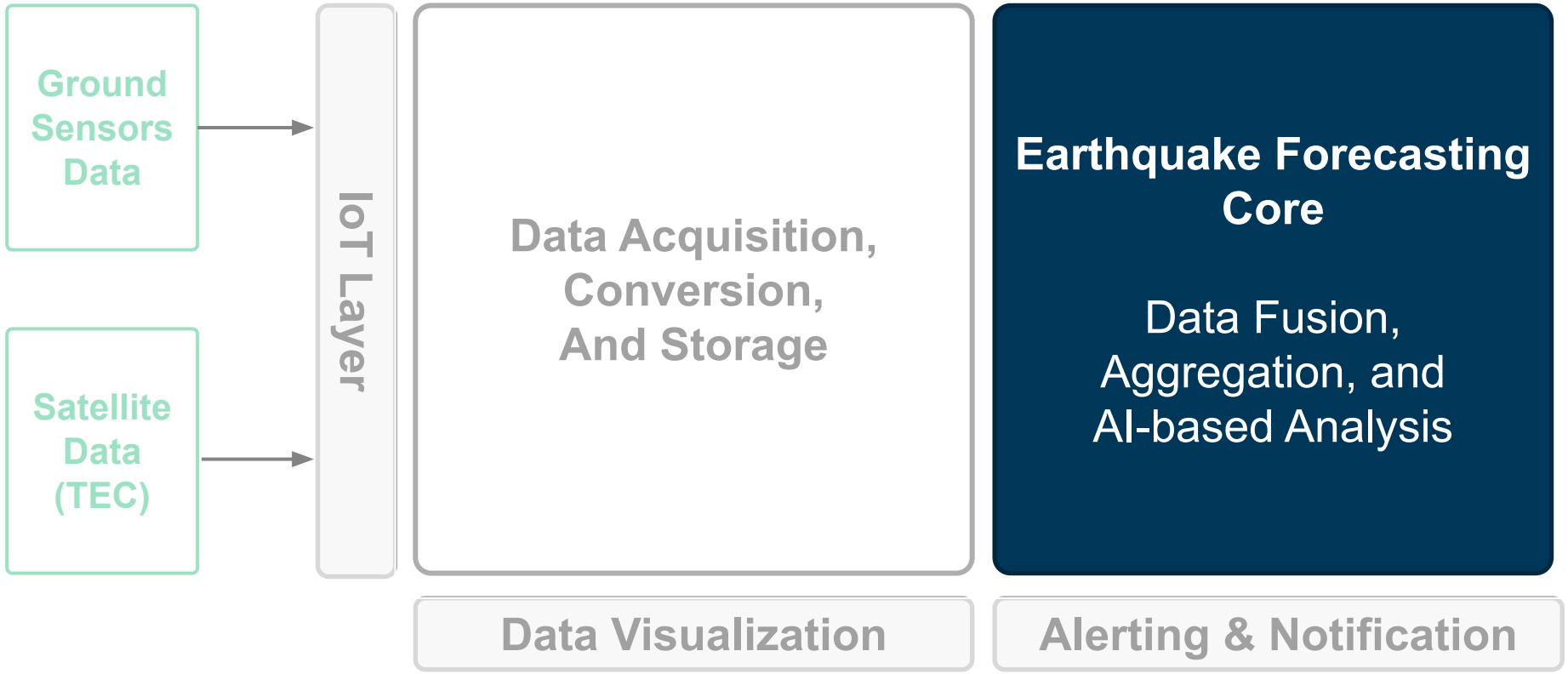
Data Acquisition, Conversion and Storage System

Data is first sent to our **connector** system, which stores it in a time-series database.

We store the raw sensor measurements initially as mV, to prevent time delays in our data collection system.

Then, a **calculator** service that takes these raw measurements, and using the sensors' documentation, converts the data into actual physical units.

Data Fusion and Analysis System



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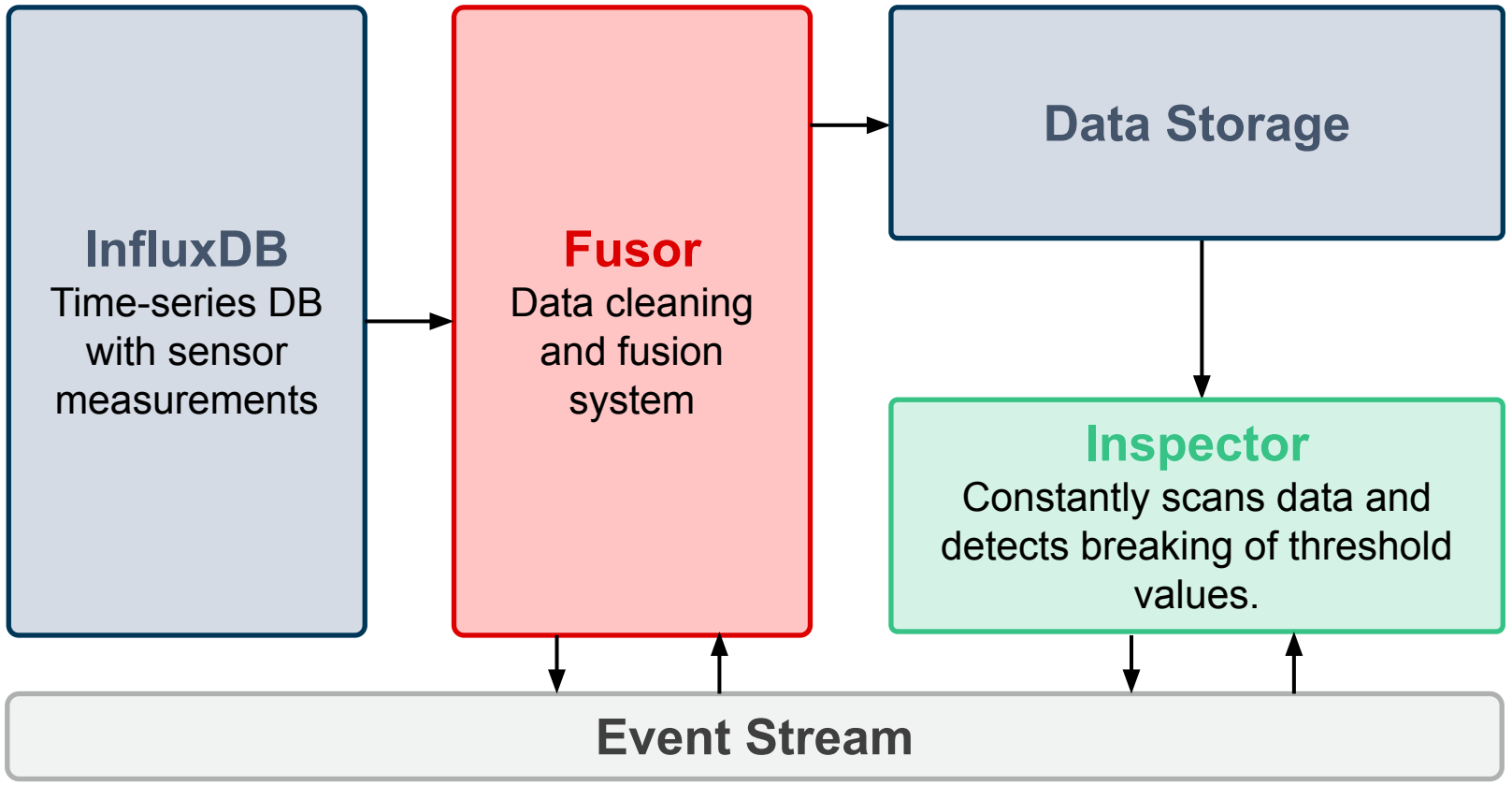
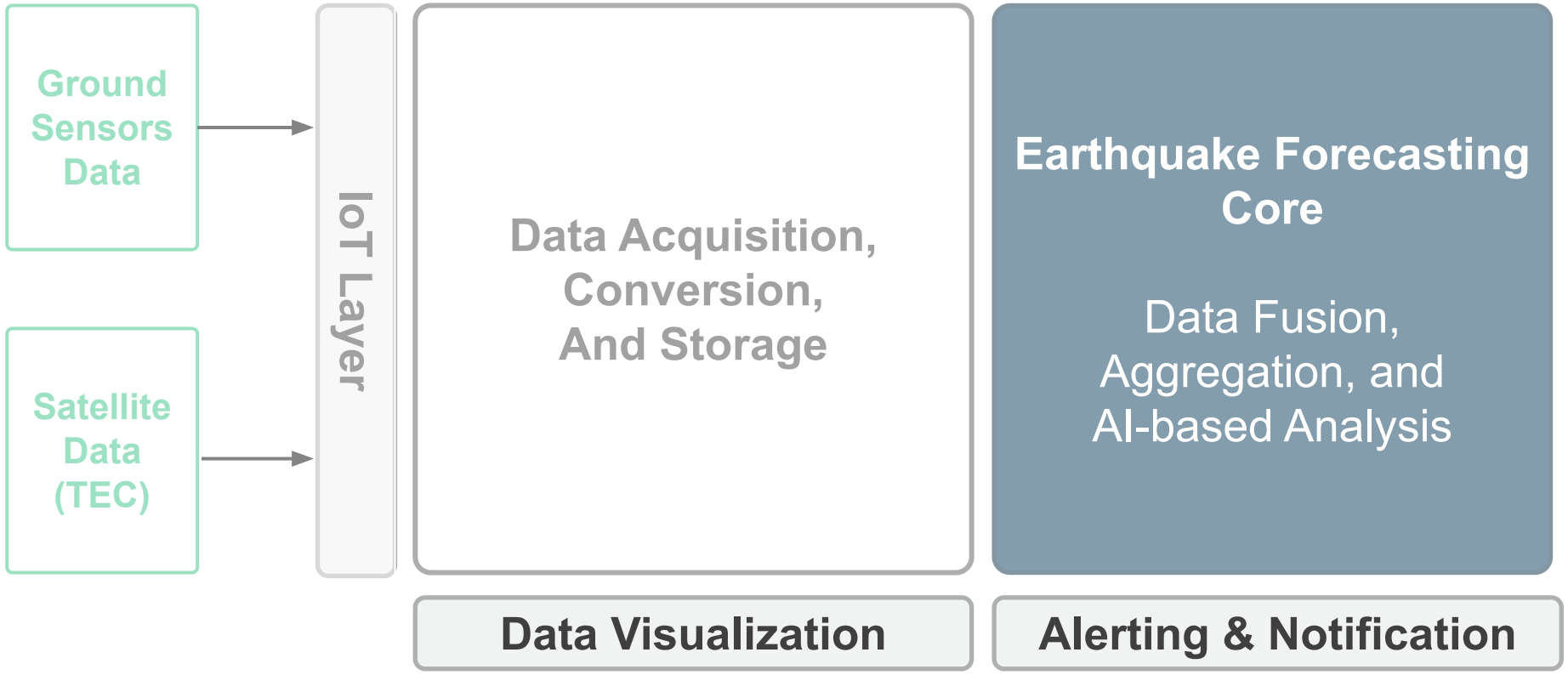


Data Fusion and Analysis System

We are using **Machine Learning** and **AI** prediction techniques to analyze our acquired data in near real-time looking for anomalies.

We are currently testing different Artificial Neural Networks, including Autoencoders and Recurrent Neural Networks to see what the best approach is.

Data Visualization and Alerting System



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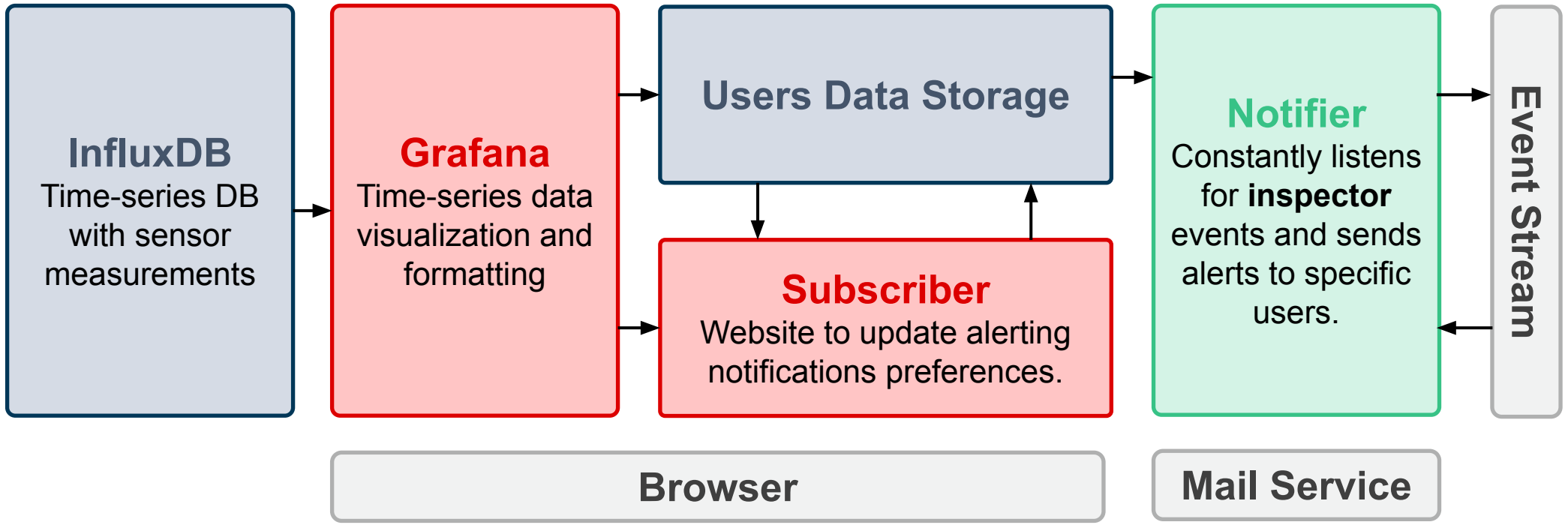


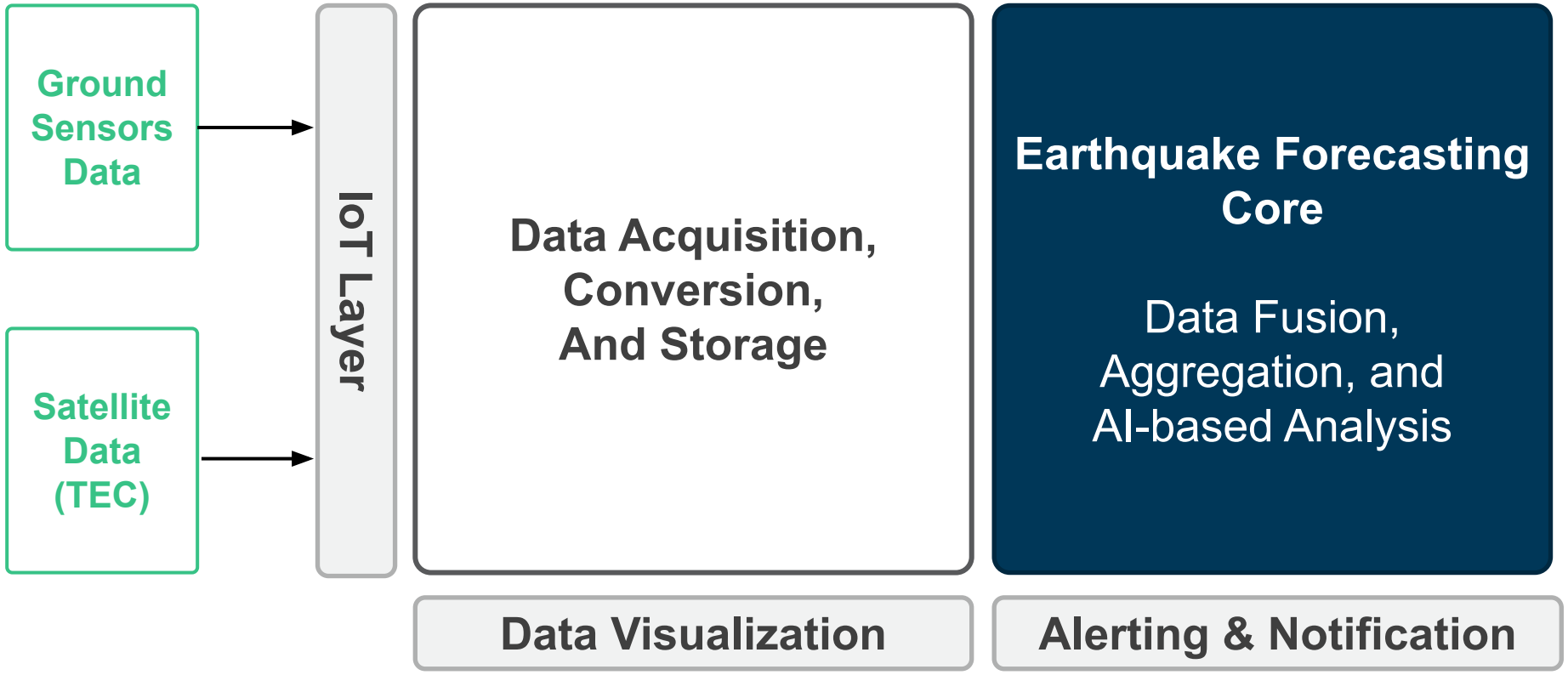
Data Visualization and Alerting System

We want the data to be available to our team anywhere for 2D graph visualization and downloads.

We are using **Grafana** which allows team members to graph all sensor measurements.

We also serve a **subscription**-based, real-time **notification** system to alert team members of suspicious activity.

Data Assimilation Platform



Open Forum – Q & A

“Knowledge is power. Information is liberating. Education is the premise of progress, in every society, in every family.”

- Kofi Annan

United Nations Press Release SG/SM/6268 23 June 1997