Plug-and-Play Smart City Solutions: Sabetha's Success with EdgeLake

EDGELAKE

AnyLog bachelor controls DYNICS

ORGANIZATION

Using a virtual data lake, the city of Sabetha, Kansas enabled monitoring, alerts, and AI directly at the edge. This approach provides real-time insights, leaves old SCADA and Historian architecture behind without dependency on cloud services, and significantly cuts costs for edge projects and cloud services.

The City of Sabetha, Kansas is located in the northeastern part of Kansas and contains a local economy driven by manufacturing and agriculture.

Bachelor Controls is a Systems Integrator (SI) that orchestrates the digital transformation of Sabetha to a Smart City, and collaborates with LF Edge's **EdgeLake**

CHALLENGE

The City of Sabetha, Kansas has old technology, a retiring workforce, and fewer overall people with less experience to support the City's utilities and infrastructure. Often, resources will wear multiple hats as needs dictate. The City needs to update technology where it is old, and improve data monitoring and alerting in order to eliminate catastrophic failures, reduce overall operational risks, and reduce expensive maintenance costs at the Water, Waste Water, and Power facilities. Standard control systems with Human Machine Interfaces (HMI) are not as easily visible remotely and often not in front of the right people at the right time for maintenance and support needs. The system chosen needs to be clear, easy to use, mobile, in front of all appropriate personnel, and needs to alert key personnel with any mission critical condition that is time sensitive.

Recent incidents, such as a communications failure that temporarily shut down the water supply, a costly chemical delivery mishap in the wastewater process, and expensive blower replacements highlight the urgent need for modern, secure, reliable technology. The City needs a solution that is simple to deploy and maintain, allowing less experienced staff to manage operations effectively. Solutions must be plug-and-play to enable rapid integration across the infrastructure to minimize downtime, and must provide real-time monitoring and decision support of systems to prevent future issues and reduce maintenance costs. Addressing these challenges with a comprehensive solution will enhance the city's ability to maintain reliable services amidst workforce constraints.

Some examples of the requirements:

Water Facility

- Water levels are sufficient.
- Water Quality is Good (Turbidity, pH, Chlorine).
- Process equipment is functioning properly.
- All equipment maintenance is current.

CHALLENGE *(continued)*

Waste Water Facility

- Dissolved Oxygen, Influent, and Chemical Levels are correct.
- Process equipment is running.
- All equipment maintenance is current.

Monitoring Generator Feeders

- Real time operation.
- Historical trending for analysis.

Continuous Improvement Goals:

- Improvements will add generator operation data in addition to power output data.
- Bringing in Lift Station data remotely via cellular with new sensors.
- Adding property specific smart sensors for water and electricity usage. This will enable remote meter data collection, as well as offer residents and business owners an ability to monitor their own utilities for a nominal fee if desired, adding revenue to the City.
- Improve Asset Management, MRO workflow, and capture work history as a knowledge base for current and future workforce.
- With data managed on the Edge Nodes, this City is planning on leveraging Federated Learning so that the Edge Nodes will be able to create sub-models that will be integrated by the network into a unified model to provide real-time operational insights on the city's infrastructure.

SOLUTION

The City of Sabetha hired Bachelor Controls (BCI) to retrofit the current technology with a modern solution to solve their utility management challenges at the water, waste water, and power facilities. BCI implemented EdgeLake to meet the city's objectives. The control systems did not require upgrading before applying this technology. They were able to integrate with legacy systems that allows the user to use the data and analysis to guide them forward with any modernization they may need to plan for.

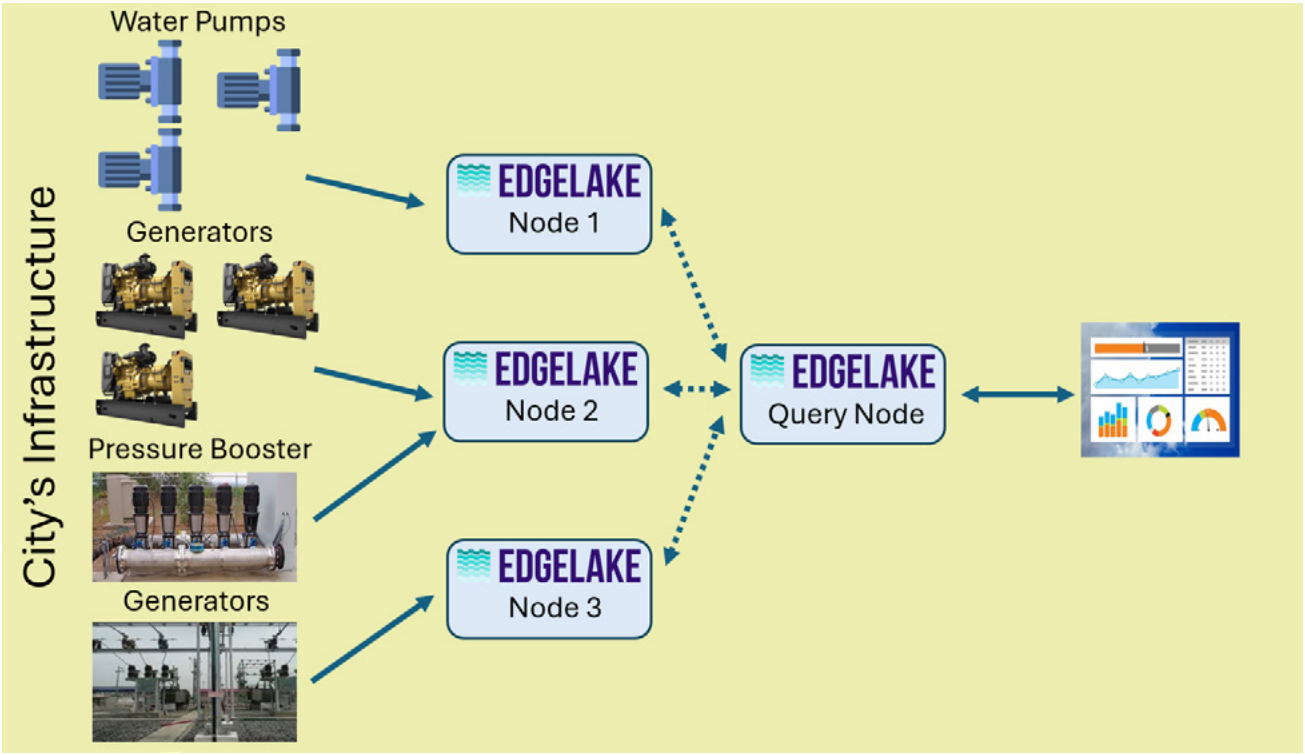
The Following is an example of one of many dashboards that provides real-time insights to the city pulling data directly from the EdgeLake in real-time augmented by real-time critical alerts.

More specifically, the cost of an edge infrastructure monitoring solution is based on multiple components which are summarized below with the relevant savings:

Cost component	Savings
System deployment	Replacing the multi-months planned project with EdgeLake deployed “out of the box” and a few days of config and testing.
System maintenance	A single software stack supports all the targeted use cases.
Interoperability	An open architecture allows simple integration to southbound connectors (like MQTT) and northbound connectors (Like REST) allowing simple integration with systems like Dynics ICS360. Fusion to pull the data and Grafana to query the data.
Infrastructure	Low Cost Edge Nodes and Lifecycle Management. Traditional Historian installations require high end servers, expensive licensing, and continuous IT administrative support, as well as future update and upgrade projects.
Cloud	Lowering cloud dependency as data insight delivered directly from the edge. The cloud is planned for archival that does not require extensive resources and therefore at a low cost.

By utilizing EdgeLake's in-place data management, the city now keeps all data local, enhancing security and reducing latency as compared to cloud-only storage. The open, containerized plug-and-play nature of the platform enables rapid deployment eliminating the need for one-off development efforts. This comprehensive solution significantly improves the city's operational reliability and long term support.

Architecture, Technology and Implementation



SOLUTION *(continued)*

Data generated from the city's resources (generators, pumps, etc) is pulled using **DYNICS ICS360.Fusion** and provided to the EdgeLake instances that are deployed at the edge. These nodes form a decentralized network of nodes that process the edge data - each EdgeLake instance hosts the data locally in a database. The data remains in-place at the distributed edge nodes; however, applications connect to one of the EdgeLake nodes that serve as a gateway to the EdgeLake network. The gateway node uses virtualization to present the distributed data as a unified collection. Applications issue SQL queries to this virtual view, and the network protocol satisfies these queries as if the data is centralized, ensuring seamless and efficient data access and management.

BENEFITS & RESULTS

- Replacing failing legacy systems led to reduced maintenance challenges and risks, such as providing both dashboard and alerts to maintain sufficient water level, restore power outages more quickly, extend life of expensive equipment, and maintain safe and effective chemical levels.
- Meet operational reliability expectations with reduced staff and wages, along with reduced maintenance costs due to errors. A premature blower failure can be 10's of thousands of dollars.
- Enable and automate management of SMS text alerts from the EdgeLake for critical alarms via PLC and remote devices using Twilio's communications Platform-as-a-Service (PaaS).
- Enhanced information security with a blockchain platform (EdgeLake) for city-wide infrastructure.
- Established an Operational Technology (OT) foundation that will enable the application of intelligent, collaborative Maintenance, Repair, and Operations (MRO) managed services to support effective city operations, reduce risks, and enhance training, helping the city manage operations more efficiently with fewer staff.
- Using EdgeLake's no-code approach, information is readily accessible via a unified data lake using simple SQL queries (rather than non-unified data streams of I/O point data from the equipment).
- The City maintains full control and custody of their data.
- With Disaster Recovery in mind, the EdgeLake is both on premise and decentralized, enabling continuous operation even in cases where cloud connectivity is lost and some resources are unavailable.
- The cloud is useful to extend the EdgeLake adding High Availability and redundancy if necessary. The cloud fees for storage are much less expensive than using the data services offered by the cloud. The node on the cloud would only leverage the EdgeLake software stack.
- Updating onsite hardware with Lenovo ThinkEdge SE 30 Industrial PC's minimizing support needs and allowing for flexible scaling and redundancy.
- Enhanced system reliability through better analytics and communication integrity with sensors and devices, facilitating easy expansion to include more sensors and remote sites.

About EdgeLake:

EdgeLake, an LF Edge project, creates a decentralized network specifically designed for the edge. An EdgeLake Network seamlessly captures, stores, and manages data at its source, while providing a complete and unified view of the data to satisfy SQL queries from edge and cloud applications, as if the data is organized in a centralized database. Using EdgeLake, companies manage their data on each distributed edge node using pre-configured services and gain real-time insight from their distributed edge data without dependency on the cloud.

A more detailed description of EdgeLake is available **here**.