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LBBC Technologies: Making the Most of Process Data with MQTT, AWS, and InfluxDB

LBBC TECHNOLOGIES

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Company in brief

LBBC Technologies dedicated several decades to pushing the boundaries of pressure vessel and autoclave design through precision engineering, advanced technologies, and electronic intelligence. They prioritize investments in research and development to advance their vision for the future.

Case overview

LBBC Technologies aims to not only optimize the lifespan of their equipment sold to customers, but to also offer top-tier customer service. As part of their package, they offer customers technical support and preventive maintenance reinforced by time series data and InfluxDB. LBBC uses InfluxDB and Amazon Web Services (AWS) to support their data monitoring platform where they store historical records of machine process data throughout the lifetime of each machine. This enables LBBC to best serve their customers and the machines by reducing expensive repairs and quality defects using predictive analytics.

Technologies used: InfluxDB, AWS, MQTT

> *"InfluxDB has been a game changer for us in terms of being able to visualize, process, and explore our data."*
>
> **Andrew Smith,** *Lead Innovation Engineer, LBBC Technologies*

The business challenge

LBBC Technologies manufactures and sells industrial autoclaves into multiple industries including the 'Investment Casting' industry. They provide customers with extended warranties and ongoing technical support to optimize the lifetime of their machines. In order to streamline customer support, LBBC required both real-time dashboards and process data visualizations that they share between technical support and customers.

Visualizing a machine's live state, as well as historical process data, is vital for understanding any issues and catching them before they become major problems. For example, if a valve isn't opening properly, the traditional approach was to alarm and notify the user locally. LBBC Technologies wants their technical support function to also have access to that information as soon as it happens, wherever it happens. For this, LBBC requires the reliability and immediacy of proactive insights from live dashboards and time series data over traditional, reactive approaches like routine maintenance scheduling or troubleshooting potential product defects.

There's also a data-driven component for condition monitoring and spotting imperceptible changes such as bearing degradation. A motor's consumption of 5% more power can be a physical manifestation of bearing degradation. But according to Andrew Smith, LBBC Group's lead innovation engineer "you can only do that if you know what the power was two or five years ago. And actually you need to know the power consumption in each and every possible machine state". Process data provides the key to understanding this. Harnessing this information is the beginning of a predictive maintenance program. Time series data and predictive maintenance are necessary tools for truly optimizing the lifespan of modern factory equipment.

The technical challenge

Industrial control devices known as programmable logic controllers (PLCs) control processes locally. Piping this data to cloud databases and doing that securely presents a number of technical challenges. First, with respect to customers' security policies, it is usually inappropriate for PLCs to have a direct internet connection. Second, in order to standardize the format of data provided it was necessary to use an industrial gateway that could connect securely to any PLC using the manufacturers' different communication protocols.

Time series data comes with its own set of technical challenges. Industrial machines generate a lot of time series data and LBBC Technologies needs to store every data point for each machine throughout the lifetime of the machine for the lowest cost possible. No matter how large the data store is, the ingest speed must keep up with the real-time pace. They want real-time and historical data available for creating powerful visualizations and complex post-processing.

LBBC Technologies stores customer data for the lifetime of the machine. They require assurances that competitors can't view or steal so much as a single data point. LBBC Technologies needed an incredibly robust system without so much as a single server on site. They wanted everything in the cloud.

The solution

LBBC Technologies built a multi-faceted solution to address their challenges. The physical component exists inside their customers' factories. This includes data extraction and entry to the cloud pipeline. The cloud component includes a pathway to InfluxDB for storage, querying, and analysis. There is also a pathway to Servitly real-time dashboards for the immediate identification and troubleshooting of smaller issues. Once data enters the cloud, both LBBC Technologies and their customers have access to all respective InfluxDB and Servitly data.
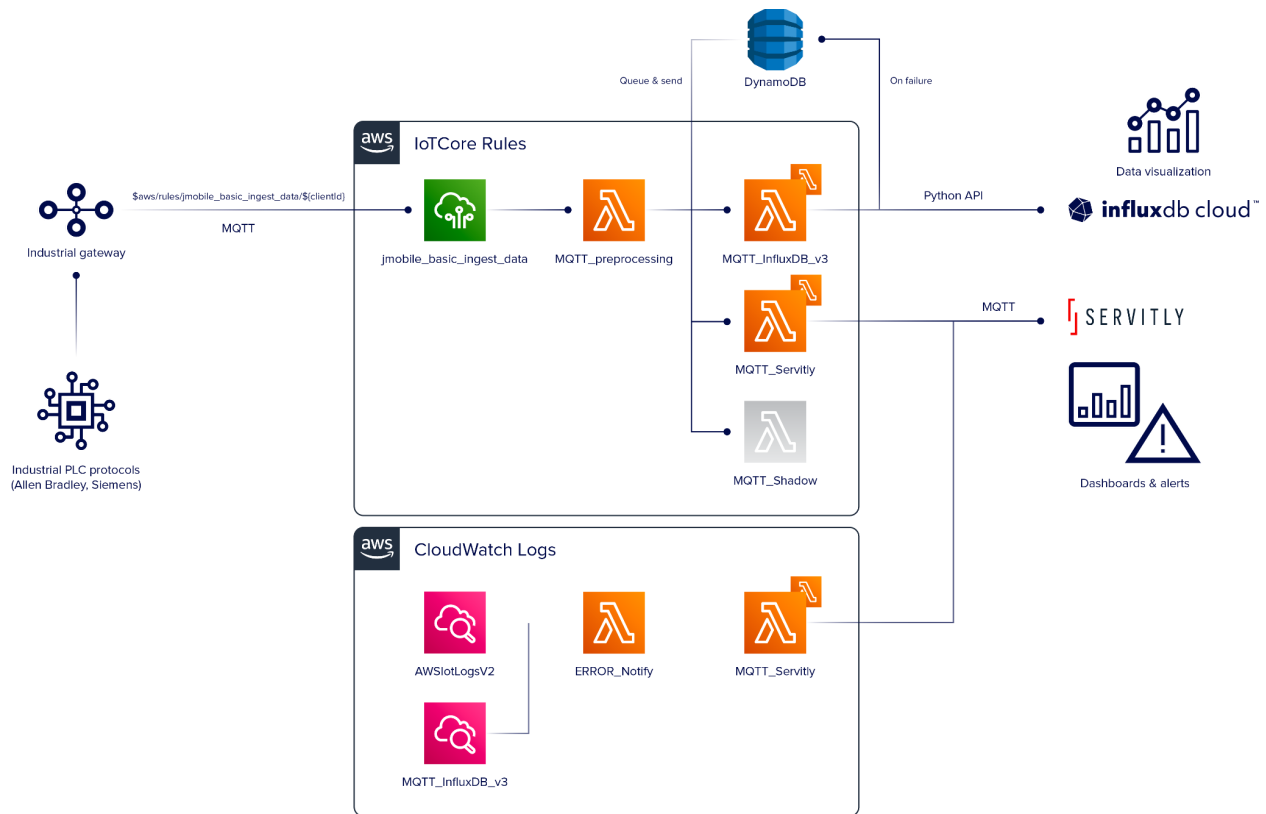
Data extraction is the first step in the process. LBBC customers use an industrial gateway running Linux as an intermediary between PLCs and the cloud to make up for the PLCs' lack of internal security. LBBC identified MQTT as a de facto standard and the MQTT protocol is built into a wide variety of industrial gateways. LBBC adopted a solution in which the industrial gateway reads process data from the PLC, encrypts it with a local certificate, and sends the data securely out on the MQTT server to AWS Iot Core.

There are also multiple security enhancements. First, AWS IoT core only accepts encrypted connections from devices that have a pre-generated certificate. Second, only secure ports dedicated to MQTT messages are used for sending out data. Third, only the gateway can initiate the connection to prevent unauthorized access from outside. Because InfluxDB requires data to be in line protocol format for ingestion, AWS IoT Core transforms each message into line protocol using Lambda functions. Lambda functions also send data to Servitly, a live dashboarding platform.

Collecting a machine's process data with InfluxDB begins the first time a machine turns on. InfluxDB stores every data point – starting with the factory acceptance test data and all subsequent data for the remainder

of the machine's lifespan. InfluxDB provides security measures to meet LBBC's security needs. InfluxDB encrypts data in motion and offers multi-factor authentication for data at rest. LBBC Technologies found that InfluxDB is inexpensive for storing and processing a high volume of time series data. They rely heavily on InfluxDB for data processing, writing complex queries, and identifying specific issues with the machinery.

> *"Processing data and the ability to write complex queries is something that InfluxDB does very, very well... when you're trying to kind of pick out some particular issues, being able to do that is very, very valuable."*
>
> **Andrew Smith,** *Lead Innovation Engineer*

Results

While the live dashboards provided by Servitly provide enough information to resolve the majority of issues, LBBC treats InfluxDB as a kind of 'oracle' which becomes the go-to for more challenging issues that are difficult to track down or related to complex process interactions. This includes troubleshooting issues, looking for and analyzing trends within data sets, and providing the tools LBBC needed to shift their customers from preventive to predictive maintenance programs.

InfluxDB in action

One example of the benefits of time series data is on LBBC's "Core Leaching" machines supplied to many aerospace manufacturers. This machine uses potassium hydroxide, a dangerous and costly chemical. In the core leaching process the hydroxide slowly generates silicates that gradually impair its ability to leach cores. High silica levels lead to a higher likelihood of quality defects, but measuring silica levels and predicting when a customer will need to replace it is a technical challenge. Through data collected in InfluxDB and its powerful visualizations that are built into InfluxDB, LBBC spotted a data pattern that offered an opportunity for them to monitor hydroxide condition without complex, sensitive, and very expensive

online analysis equipment or cumbersome laboratory tests.

The data showed that the generation of silicates measurably impacted the naturally low vapor pressure of strong hydroxides. Seeing this opportunity, LBBC took on the challenge of using data processing in InfluxDB to quantify hydroxide quality rather than outfitting the machine with a suite of new gadgets.

LBBC collected a rich data set to use for their calculations. Over the course of a year, they stored 1.3 million data points, including process details about pressure, temperature, valves, pumps, and other important characteristics. The data points spanned 150 cycles with both fresh and spent hydroxide. The data processing algorithm, written in Flux, isolates certain sets of data for each cycle and applies least-squares regression to produce an entirely new variable 'Resting Vapor Pressure' which can't be directly measured. This new variable was then plotted using InfluxDB's visualization tools, which also helped to develop the algorithms.
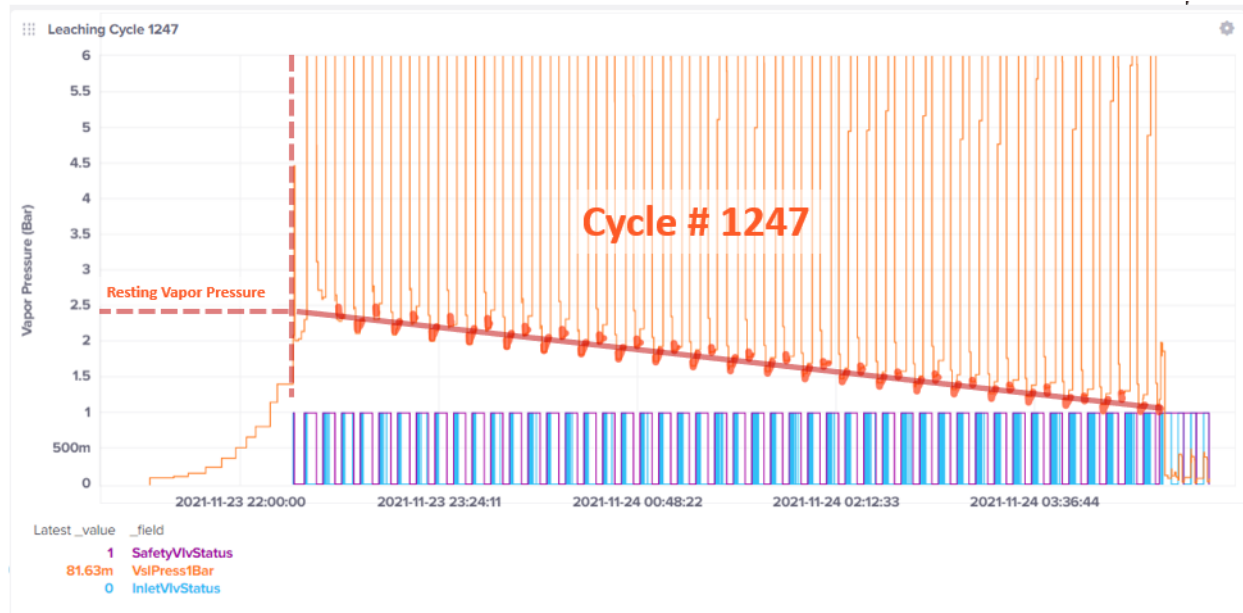
LBBC used Flux to process the entire set of 150 cycles comprising 1.3 million data points. The serverless analysis takes a mere 10 seconds to perform. The resulting plot of Resting Vapor Pressure over time confirmed their hypothesis that RVP rises as silicates build up, and then falls when the customer refreshes the Potassium Hydroxide supply.

LBBC were able to leverage this valuable information to proactively notify a customer that RVP had reached a level indicating that hydroxide should be changed before it led to quality issues.
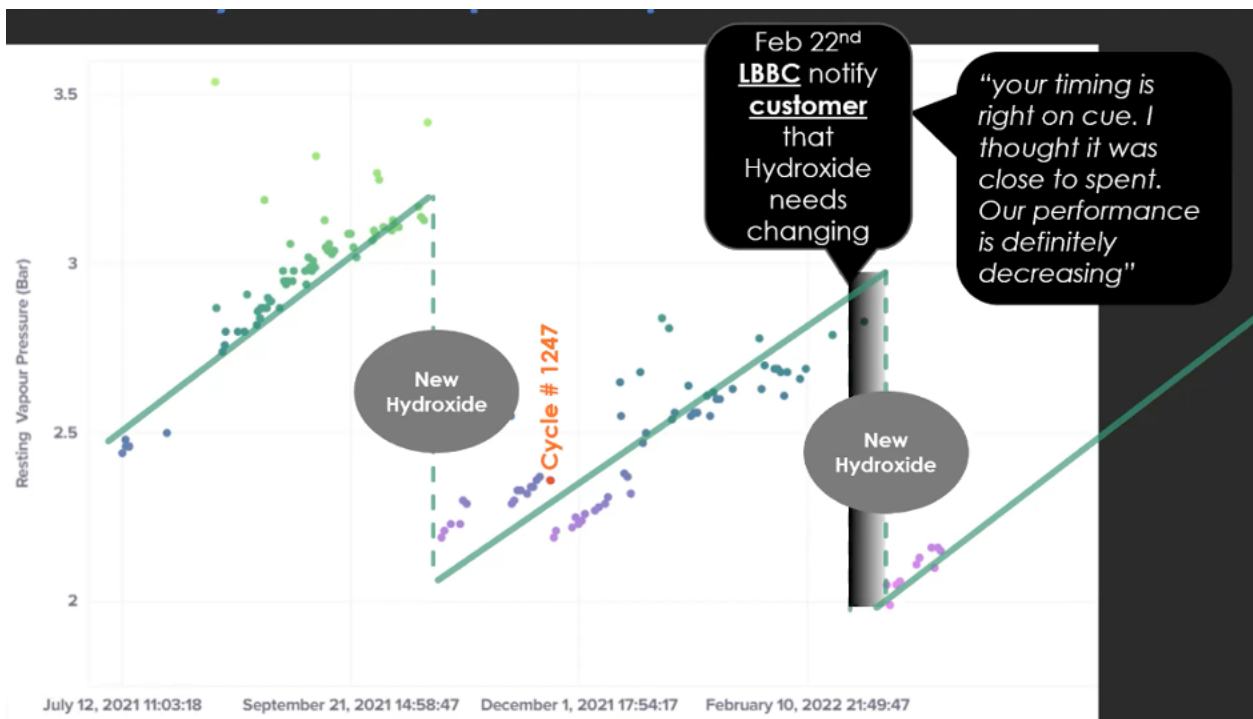
LBBC Technologies continues to refine their predictive maintenance approaches and best practices as they gain deeper expertise working with time series data.

About InfluxData

InfluxData is the creator of InfluxDB, the leading time series platform. More than 1,900 customers use InfluxDB to collect, store, and analyze all time series data at any scale. Developers can query and analyze their time-stamped data in real-time to discover, interpret, and share new insights to gain a competitive edge. InfluxData is a remote-first company with a globally distributed workforce. For more information, visit www.influxdata.com.

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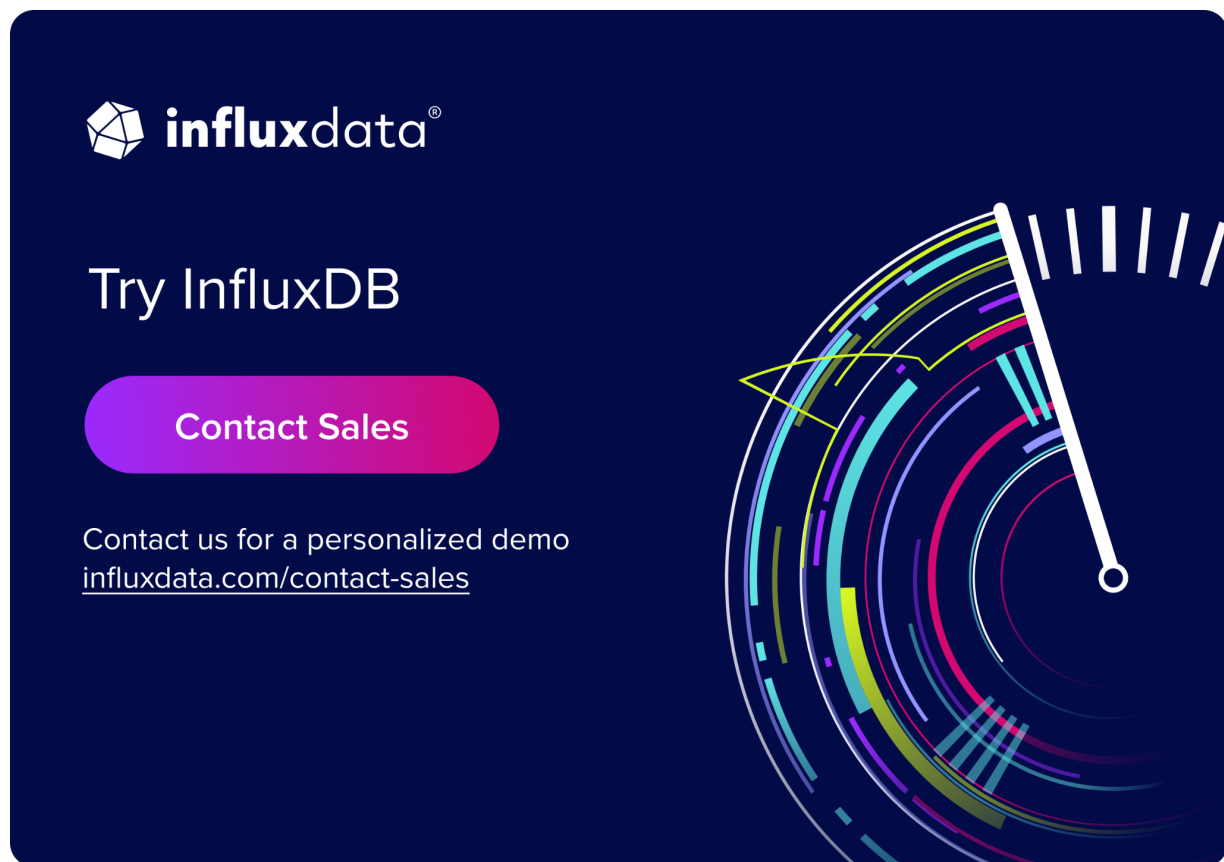
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