

The Road to Successful Digital Transformation and Big Data Utilizing AWS SiteWise



Introducing Sparkplug SiteWise Bridge:

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By Arlen Nipper, President and CTO of Cirrus Link

Introduction

Digital transformation is particularly challenging in the industrial world, where equipment and systems often live in the field or factory for 20 to 30 years. Change is slow, but over time the manufacturing industry is digitizing, which opens a long list of benefits including improved efficiency, processes, and quality.

According to [Statista](#), worldwide spending on digital transformation will reach 1.3 trillion U.S. dollars in 2020, growing 10.4 percent year-over-year, despite the economic recession caused by the coronavirus pandemic. Along with the growth in digital transformation comes a growth of big data as companies realize there is a lot of value hiding in their equipment.

Collecting data and performance metrics from modern and legacy industrial equipment is a common challenge for any company working to digitally transform. It is not cost-effective, requires custom code, is not scalable and creates a laundry list of proprietary protocol issues. Data is often locked in legacy, proprietary data stores and typically requires special expertise to retrieve the data and change it into a usable format for further analysis. As a result, many companies collect and store a great deal of data but analyze only a fraction.

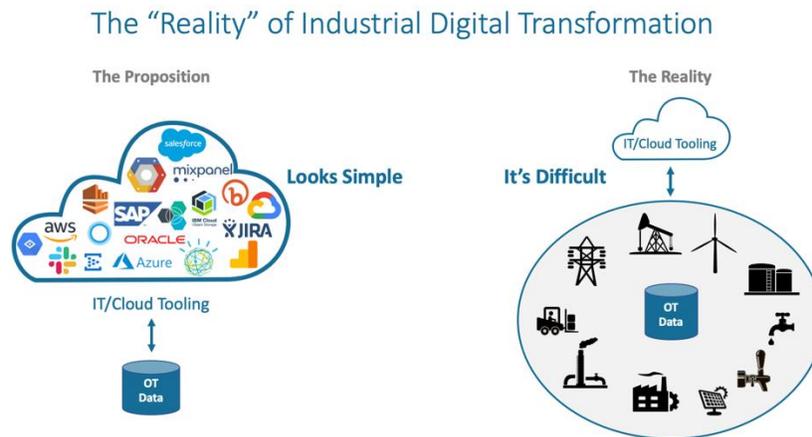


Figure 1: Some vendors make collecting OT data sound simple, but it requires a great deal of tooling to collect OT data and send it to the cloud in a readable format.

In recent years, the convergence of operational technology (OT) and information technology (IT) has been well documented as companies work to digitally transform. OT data is designed for operations, consists of proprietary protocols, multiple data formats, provides no contextual information, uses poll/response data retrieval, and is directly coupled to applications. IT needs data objects and modeling,

standard data formats, contextual information, must be decoupled to the enterprise, uses publish/subscribe for data retrieval, and must be secure and easy to integrate. Digital transformation requires devices in the field to be connected, with data made available that can speak the language of both OT and IT for improved business intelligence.

Out of these digital transformation and big data challenges grew a solution – AWS IoT SiteWise to easily collect, organize and analyze data from industrial equipment at scale. AWS needed a tool to bridge the OT-IT gap, to make the data interoperable across the enterprise. Enter MQTT Sparkplug, an open source software specification that enables the normalization of data from the shop floor to AWS and beyond.

MQTT Sparkplug to Bridge the OT-IT Gap

MQTT has become the dominant messaging protocol for industrial IoT as a lightweight, publish-subscribe, message-oriented middleware that allows for multiple data consumers. MQTT is simple, efficient and an open standard, enabling companies to gain access to more data and then share it throughout the enterprise across both IT and OT teams.

By design, MQTT does not dictate a Topic Namespace or payload encoding because it was developed to provide maximum flexibility across any solution sector. The lack of detail is both a benefit and a limitation, since it inhibits interoperability in the OT and IT worlds. OT data has always been collected on the factory floor for a specific purpose. The plant floor manager knows and understands how to use the data. Now that the IT team wants to see that data and make use of it – they need a better way to understand the data. Enter MQTT Sparkplug.

The Sparkplug Working Group was established to “improve the interoperability and scalability of industrial IoT solutions and provide an overall framework for supporting Industry 4.0 for oil and gas, energy, manufacturing, smart cities, and other related industries.”

MQTT Sparkplug is an open source software specification that provides MQTT clients with a framework to integrate data. The [specification](#) articulates three goals:

1. Define an MQTT Topic Namespace optimized for industrial IoT.
2. Define MQTT State Management to take advantage of continuous session awareness.
3. Define the MQTT Payload.

MQTT Sparkplug takes the message and defines how to publish and represent it, so any subscriber knows what it is and how to utilize the data. Sparkplug adds features including tag meta data, reporting by exception and control, auto-discovery of assets, store and forward, and provides a source of truth for data at the edge.

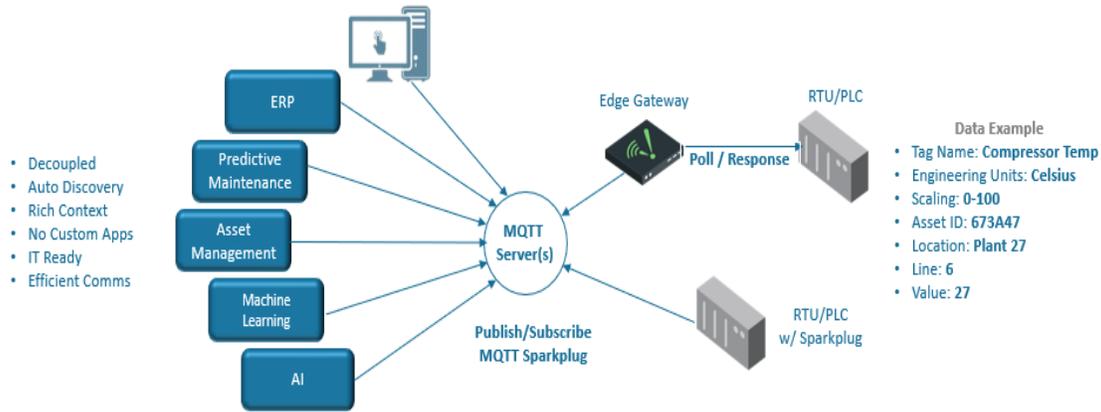


Figure 2: MQTT Sparkplug allows data to be easily shared from industrial equipment to the cloud or enterprise application.

MQTT Sparkplug makes this process fast, secure, and open standard so anyone can make use of the framework for MQTT interoperability. Many device manufacturers are supporting Sparkplug, which means it is built in natively on the device on the OT floor. With all of the necessary textual information for the data object instead of one proprietary piece of data, it is shareable across the enterprise.

Using Ignition to Connect OT Data

If MQTT Sparkplug is the transmission engine, Ignition or Ignition Edge from Inductive Automation is the platform for digital transformation and big data. Ignition is server software that acts as the hub for everything on the plant floor for total system integration. Ignition provides a single source of truth, or tag standardization, quick and simple configuration, no coding required, and is cost-efficient and scalable.

Ignition comes with various protocols including Allen-Bradley, Modbus, Siemens, DNP3.0, BACnet, Emerson ROC, ABB TotalFlow, and MQTT Sparkplug. An MQTT Transmission Module sends the data to an MQTT server where it can be accessed by any client, such as AWS IoT Hub.

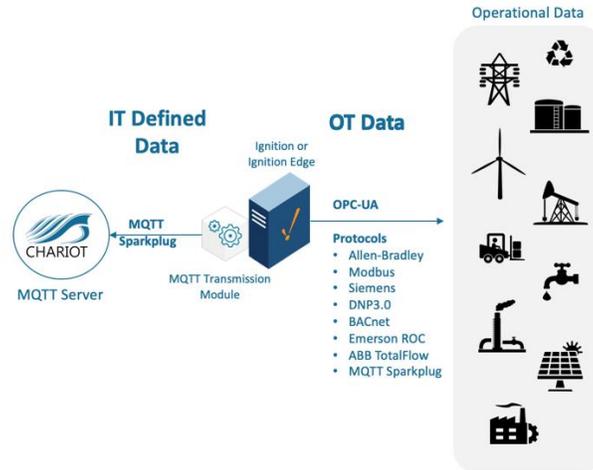


Figure 3: Ignition collects OT data, then Cirrus Link provides the MQTT Transmission Module with MQTT Sparkplug to share the data with an MQTT Server for easy access across the enterprise.

AWS IoT SiteWise for Data-driven Decisions

[AWS IoT SiteWise](#) is a managed service that makes it easy to collect, store, organize and monitor data from industrial equipment to help customers make better, data-driven decisions. The service takes OT data and puts it into a standard interface to monitor operations across facilities, quickly compute common industrial performance metrics, and create applications that analyze industrial equipment data to prevent costly equipment issues and reduce gaps in production.

AWS IoT SiteWise simplifies getting data from industrial equipment by providing software running on a gateway that resides in the facility and automates the process of collecting and organizing industrial equipment data. This gateway securely connects to on-premises data servers, collects data, and sends the data to the AWS Cloud. AWS IoT SiteWise provides interfaces for collecting data from modern industrial applications through MQTT messages or APIs, then stores data into a Time Series Database and provides a data model representation of the assets.

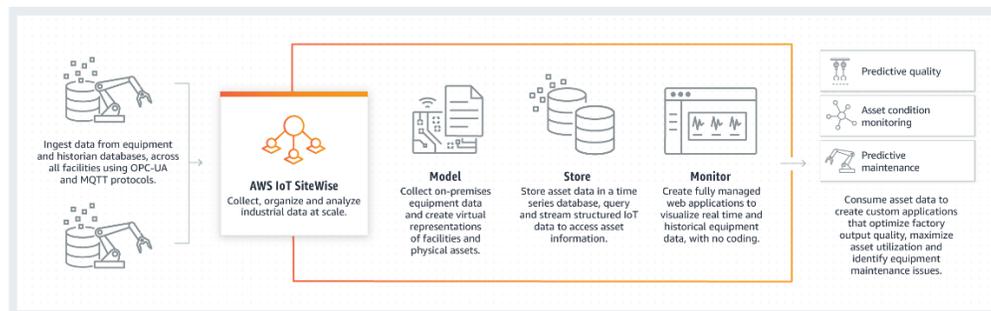


Figure 4: AWS IoT SiteWise collects, organizes and analyzes industrial data at scale. They partnered with industry-leaders for the far-left, data ingestion piece of the puzzle.

Putting it All Together: AWS SiteWise plus MQTT Sparkplug

AWS, Inductive Automation, and Cirrus Link partnered to develop the data ingestion portion of the AWS IoT SiteWise solution in Figure 4. To get the data from left to right, the data must first be collected from industrial equipment, converted, and then sent to AWS IoT SiteWise for further processing.

One of the biggest pain points for big data and enterprise applications in the past has been that all OT data was sent to the cloud to create a massive data lake with inconsistent data that still needed to be cleaned. Now customers can drop a box into the factory, point to AWS IoT SiteWise, and all the rest of the work is self-created. Services can utilize clean data with minimal effort.

There are three key parts to this solution for digital transformation and big data:

Ignition at the Edge from Inductive Automation:

- Connect to OT data
- Configure data assets in models
- Convert data to MQTT Sparkplug
- Connect to AWS IoT Core via MQTT
- No programming or code required

[Sparkplug SiteWise Bridge](#) from Cirrus Link:

- Consumes MQTT Sparkplug data (data model and tags)
- Auto-discovers data assets
- Auto-creates data model to AWS SiteWise
- Pushes tag data to AWS SiteWise
- No Programming or Code Required

AWS IoT SiteWise

- Provide Standard Interface to Applications
- Provides Data Models for Assets
- Provides Time Series DB for OT data
- No Programming or Code Required

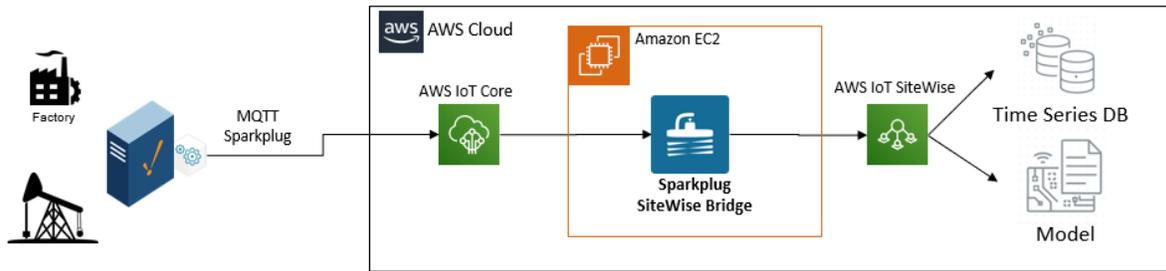


Figure 5: Ignition sends shop floor data to AWS IoT Core via MQTT Sparkplug, then an Asset Converter from Cirrus Link prepares the data for AWS IoT SiteWise for further processing.

The Sparkplug SiteWise Bridge is a key piece of the puzzle, as shown in Figure 5. The Sparkplug SiteWise Bridge is a software application that runs in AWS and does the Sparkplug to SiteWise conversion automatically with zero code. Without it, the data would not be activated, it would not be able to go from AWS IoT Core to AWS IoT SiteWise. OT data is converted to IT data, then put into a standard interface for big data, and then data insights are gained.

Cirrus Link developed the Asset Converter to use MQTT Sparkplug to connect data from AWS IoT Core to AWS IoT SiteWise. New devices or factories can be added automatically and added to a time series database and data model. Previously MQTT Sparkplug has been a play on the factory floor, but this solution moves it to the cloud to connect data anywhere. Customers can download and install the software and within 30 minutes they can automatically have data in SiteWise for any application. The Sparkplug SiteWise Bridge takes OT data and points it to IT quickly and easily with an open standard approach.

Conclusion

Many industrial customers spend a lot of time and money coding to get data into a time series database, and into their cloud services and custom applications. AWS IoT SiteWise is activated by MQTT Sparkplug, providing a way for companies to cut this development time down from 12 to 18 months to just 3 to 4 days. They can install an Ignition platform, send data to AWS IoT Hub and the Sparkplug SiteWise Bridge will share it with AWS IoT SiteWise immediately with tags, auto-discovery, and more flexibility than ever before.

The benefits of digital transformation and the growth of big data includes the digitization of business operations, greater resource management, greater customer insights, better customer experience, and greater efficiencies.

About the Author:

Arlen Nipper brings over 42 years of experience in the SCADA industry to Cirrus Link as President and CTO. He was one of the early architects of pervasive computing and the Internet of Things and co-invented MQTT, a publish-subscribe network protocol that has become the dominant messaging standard in IoT. Arlen holds a bachelor's degree in Electrical and Electronics Engineering (BSEE) from Oklahoma State University.