

Accelerating The Journey From Edge To Cloud To Results



Today's Speakers



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Evangelist

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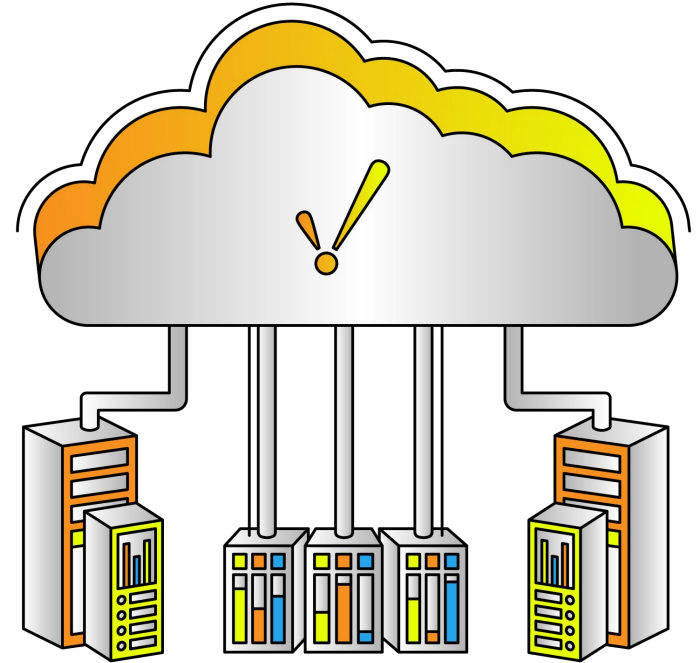
Industry Field CTO -

Manufacturing

Snowflake

Agenda

- Edge to Cloud Challenges
- Using Ignition to Connect / Transform OT Data
- Introduction to the Snowflake Platform
- MQTT & Sparkplug for Modeling OT Data
- Cirrus Link IoT Bridge for Snowflake
- Live Demos
- Solution Advantages
- Discussion & Q&A



About Inductive Automation

- We make software for problem solvers
- 57% of the Fortune 100 and 44% of the Fortune 500 use Ignition
- Highly diversified customer base across many industries
- Ignition installations in 100+ countries
- 4,000+ integrators worldwide
- Profitable and independent with no outside investors





The Unlimited Platform for SCADA and So Much More

- **Connect, Design, Deploy Without Limits:**
 - One central hub for everything on the plant floor
 - Create any kind of industrial application
 - Web-deploy clients to desktops, industrial displays & mobile devices
- **Unlimited licensing**
- **Industrial-strength security and stability**
- **Trusted by thousands of companies worldwide**

Edge-to-Cloud Challenges

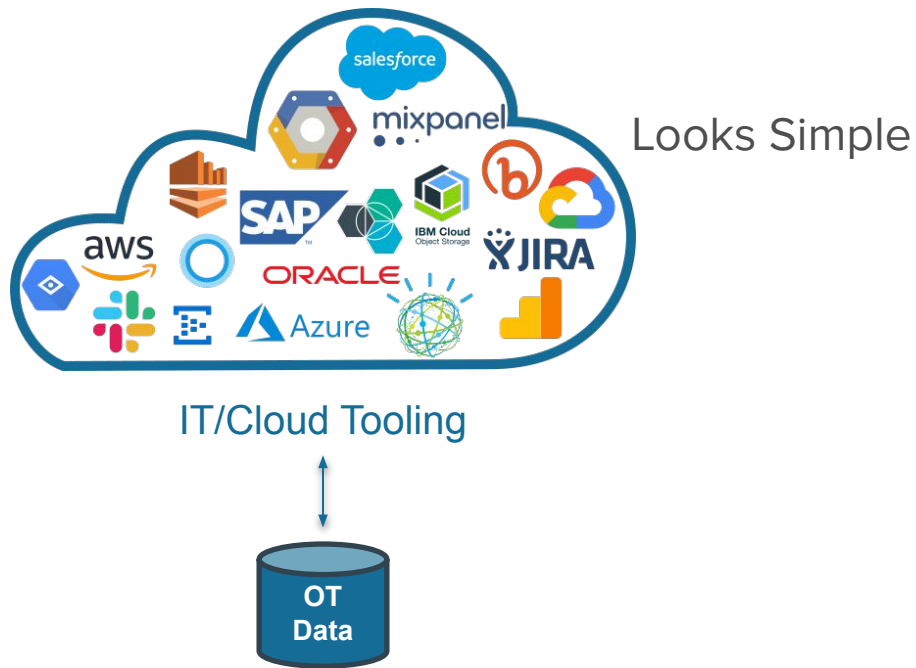
Many companies are striving to accelerate their Digital Transformation

- Difficulties in storing OT data in the cloud
- Complexity of moving / mapping data
- Expensive to transfer, store, and analyze data
- Lack of open standards

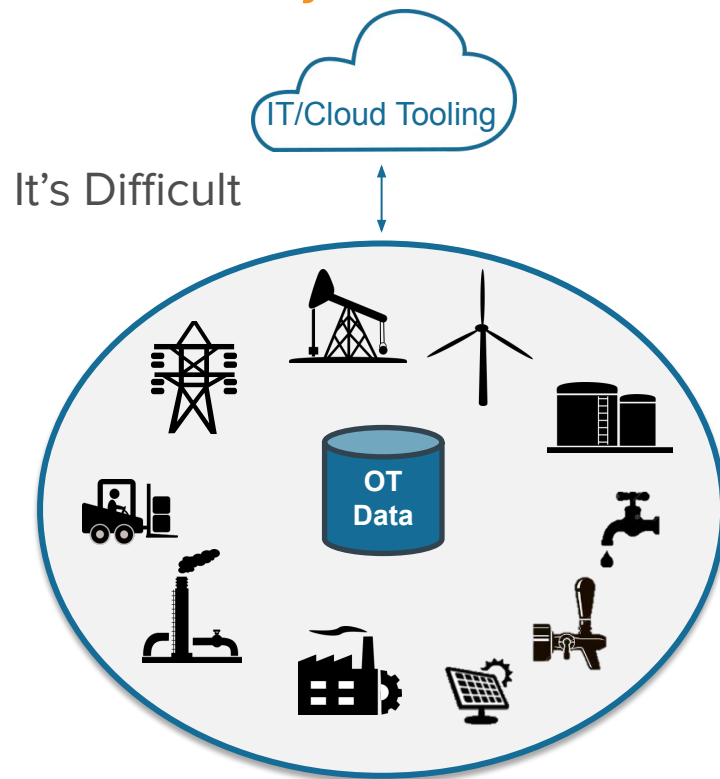


The “Reality” of Digital Transformation

The Proposition



The Reality



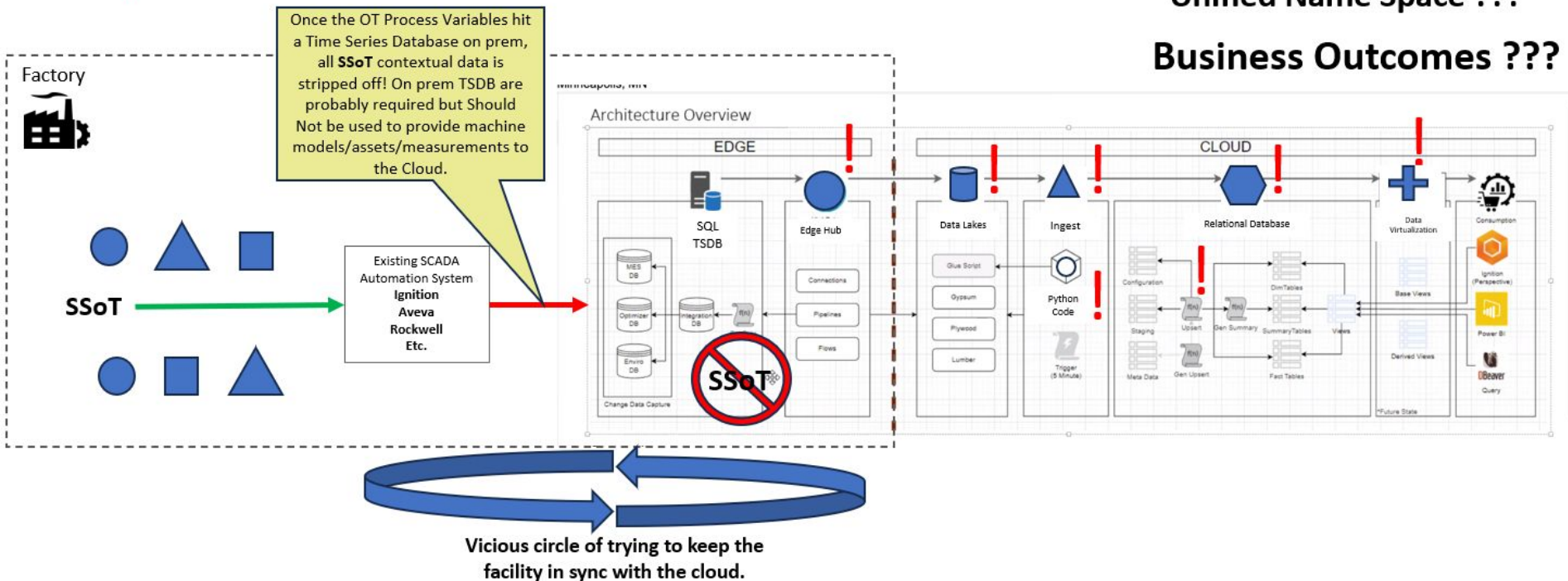
The “Digital Twin” Problem

! Requires additional skills, programming, administration, costs, etc.

Single Source of Truth - **SSoT**

Unified Name Space ???

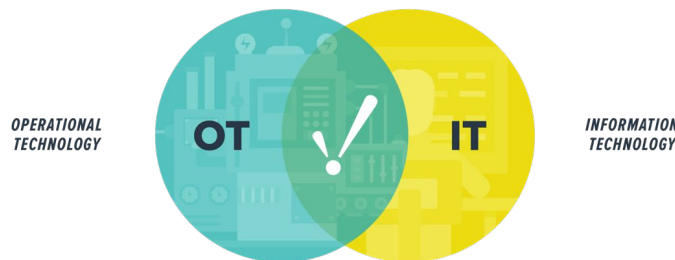
Business Outcomes ???



What is the Solution?

Easily store OT data with context to Snowflake database

- Leverage Ignition Edge & Standard Ignition
- Build data models (UDTs)
- Publish data to a cloud MQTT server (Chariot, HiveMQ, etc.)
- Leverage Cirrus Link IoT Bridge to Snowflake
- Data is stored in Snowflake database with context
- Build enterprise dashboards in Ignition by querying data through JDBC

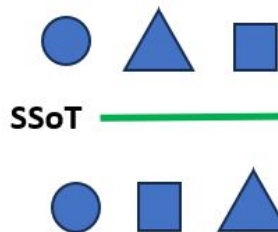


Snowflake Digital Twin

**Unified Name Space!
Business Outcomes !**

Single Source of Truth - SSoT

Factory



MQTT
Sparkplug

MQTT
Server



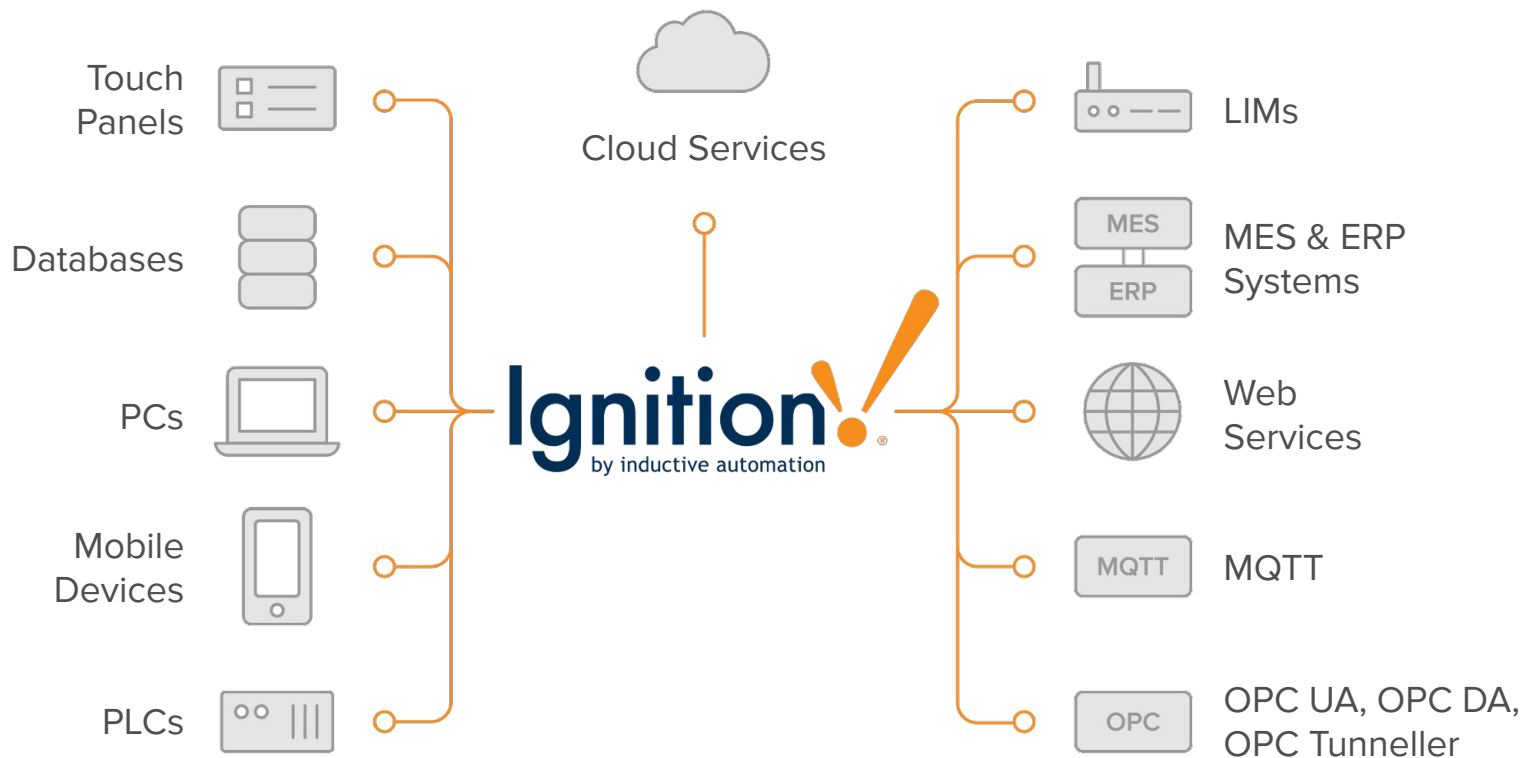
IoT Bridge
for Snowflake



Cloud



Ignition Connectivity



SSoT Architecture

OT Data



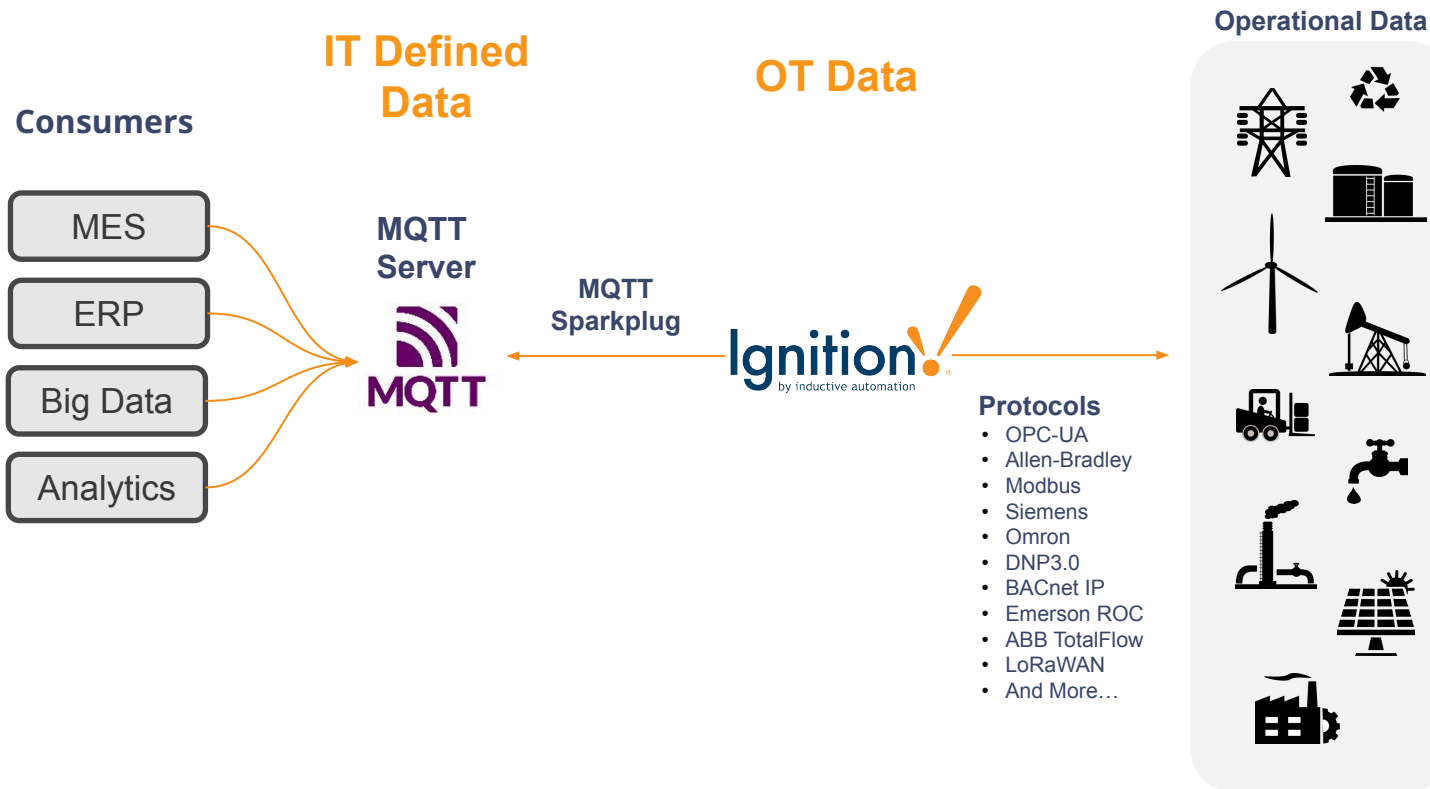
Protocols

- OPC-UA
- Allen-Bradley
- Modbus
- Siemens
- Omron
- DNP3.0
- BACnet IP
- Emerson ROC
- ABB TotalFlow
- LoRaWAN
- And More...

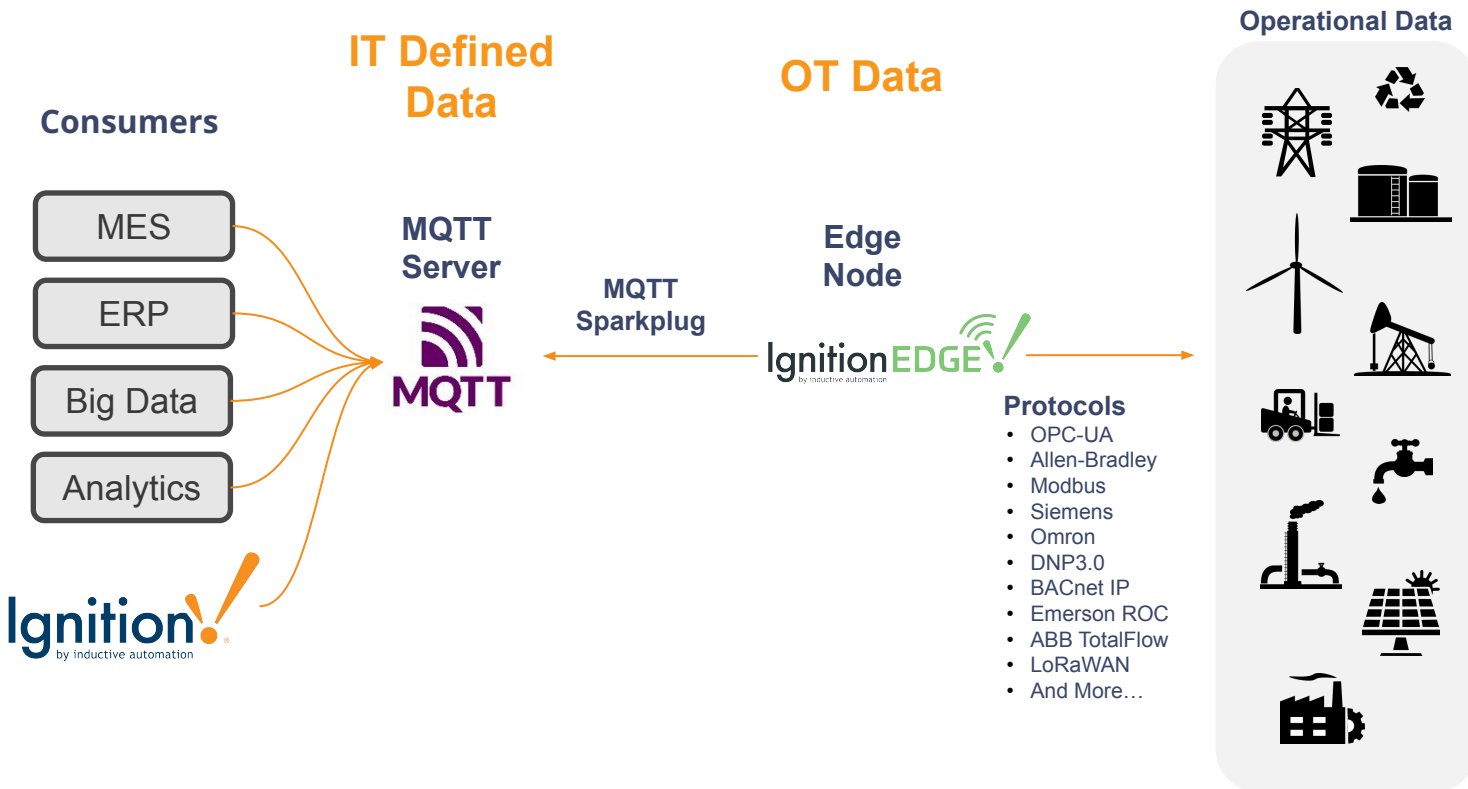
Operational Data



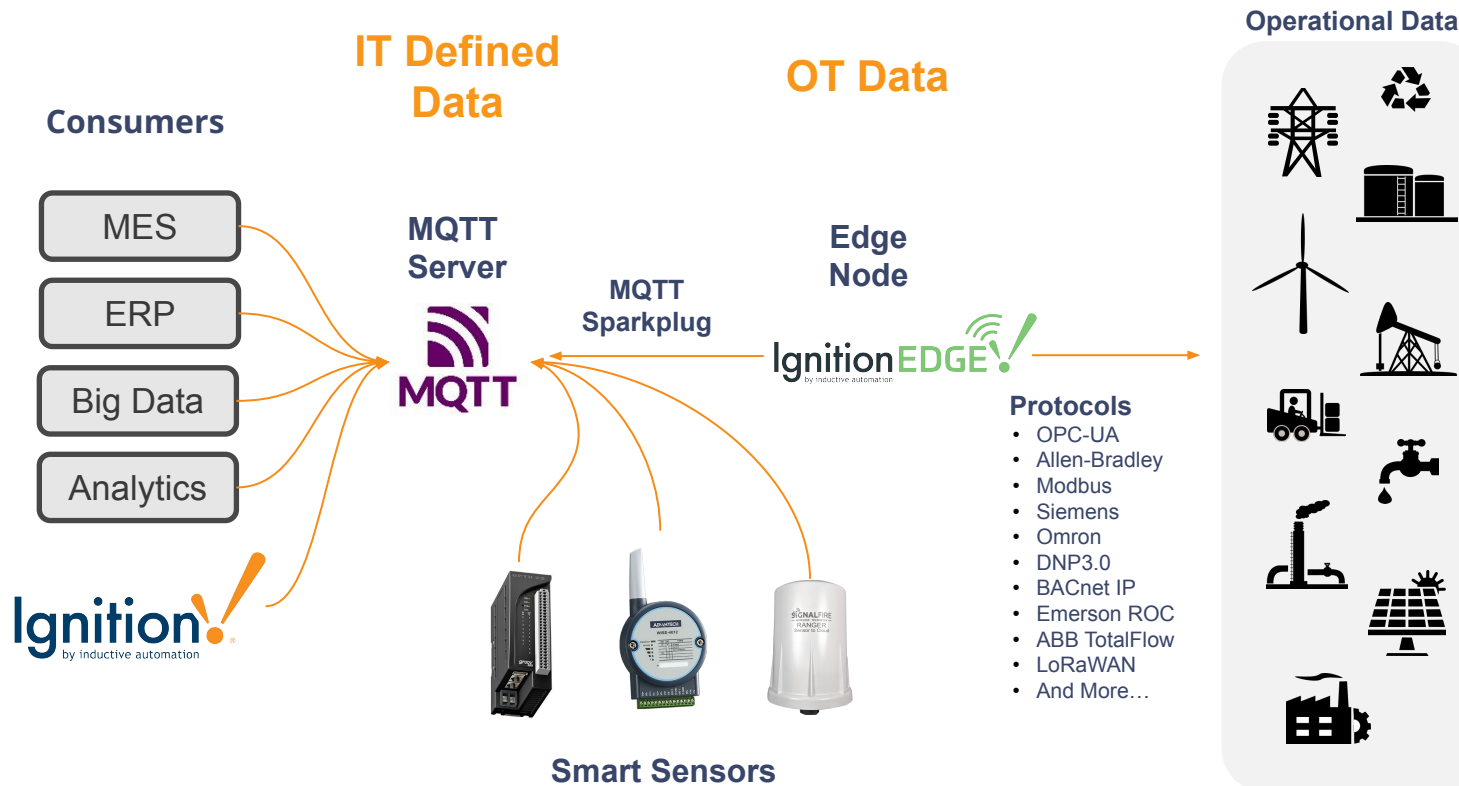
SSoT Architecture



Introducing Edge



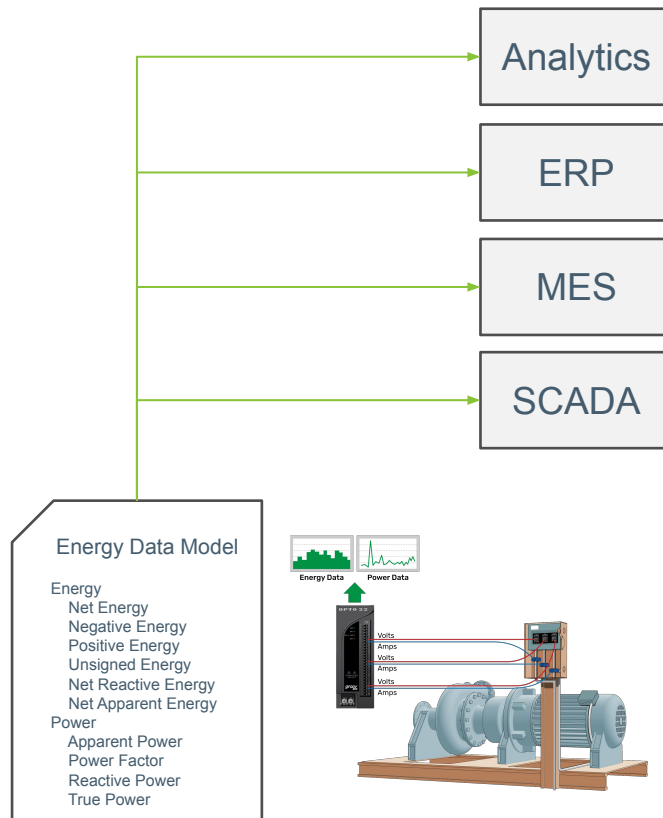
Introducing New Smart Sensors



Data Modeling

What is Data Modeling?

- Organizes elements of data
- Standardizes how they relate
- Mimics real-world objects
- Provides context
- Easy to understand
- Defined at the edge
- Single source of truth



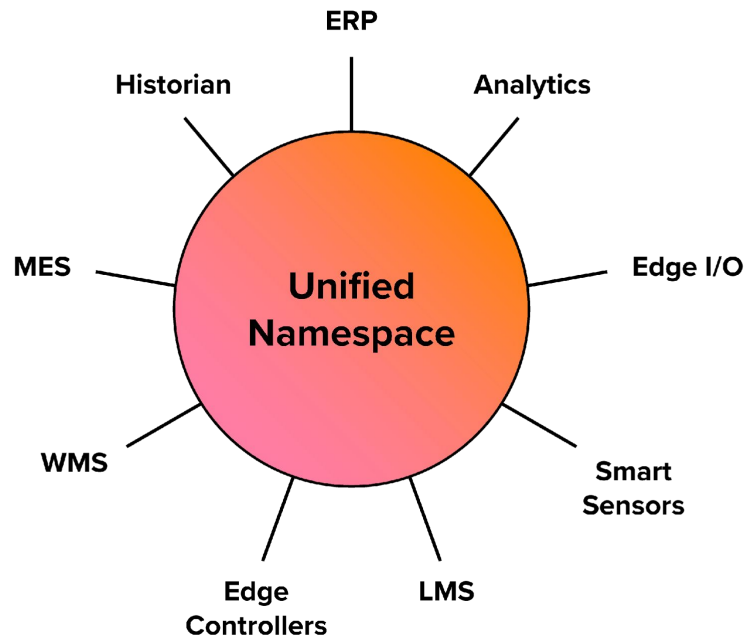
Unified Namespace

What is a UNS?

- Standardized way to organize and name data
- Contains an enterprise's structure and events
- One communication interface

Benefits of a UNS

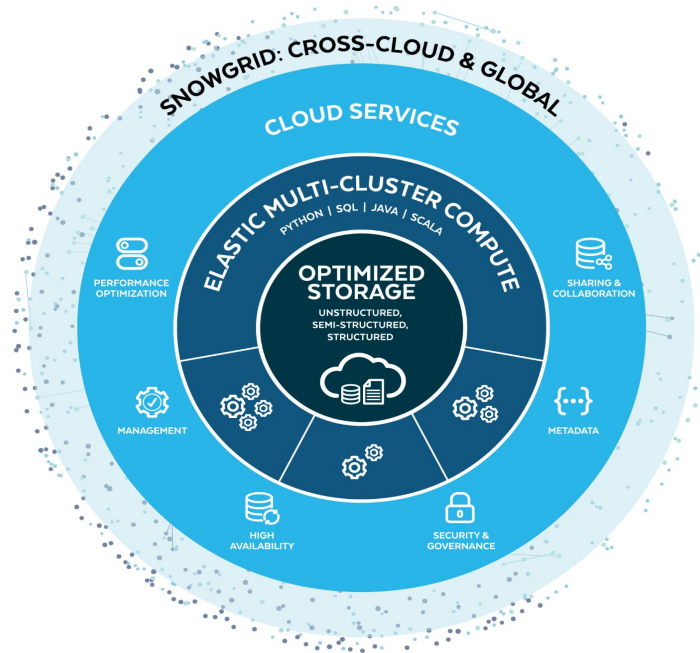
- Makes data accessible
- Easier scalability
- Single source of truth
- Less manpower/engineering
- Better decision-making



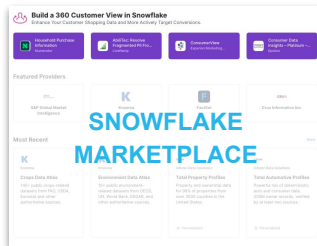
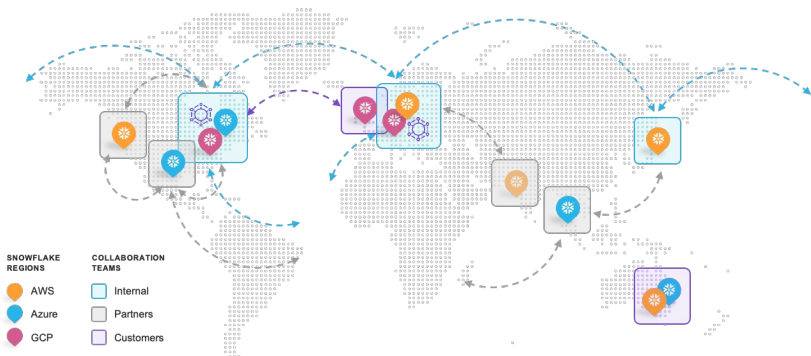
Snowflake Data Cloud Platform (UNS for IT / OT / 3rd Party Data)

- **Globally connected:** cloud agnostic data stack (move to cloud with a single governed service with SQL)
- **Speed:** Faster, more reliable data processes for IT/OT functions
- **Secure collaboration:** no data silos means a complete analytical picture
- **AI-ML based Analytics:** With SQL/ REST API support
- **Overall increase in analytics adoption for IT/OT**

SNOWFLAKE PLATFORM ARCHITECTURE



Build (monetize) data products at global scale



2.9B

Average daily queries
from April 1, 2023 to
April 30, 2023

50T+*

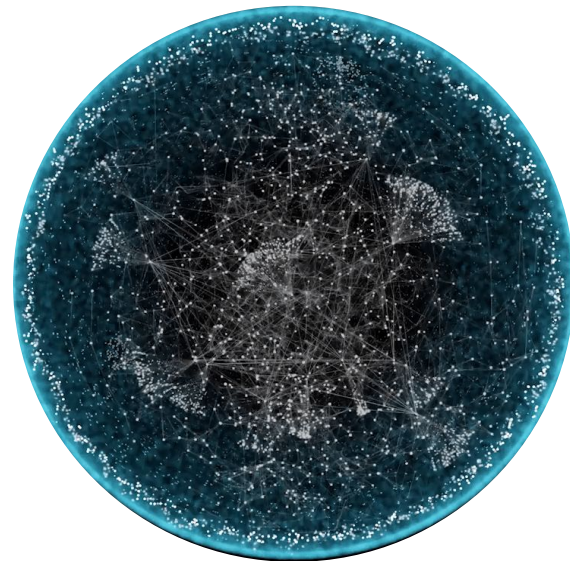
The number of rows in
the largest customer
table

160K+*

The largest number of
queries within a one
minute interval that a
customer is executing

177 PB*

The aggregate amount
of compressed data
stored in Snowflake by
the five largest
customers by data
volume



**THOUSANDS OF ORGANIZATIONS
COLLABORATING SEAMLESSLY**

Edge 2 Cloud Business Outcomes

Descriptive Analytics

Manuf & SC KPI's

- OEE
- Cycle Time
- Yield
- Throughput
- Peak Load
- ESG
- Quality
- Operational Digital Twin
- Inventory
- Spend Analytics

Diagnostic Analytics

- AI powered Root Cause Analysis (RCA)
- Vision based Quality Control (Reactive)

Predictive Analytics

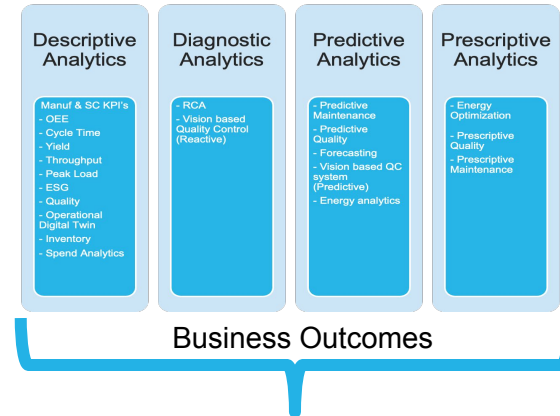
- Predictive Maintenance
- Predictive Quality
- Forecasting
- Vision based QC system (Predictive)
- Energy analytics / Peak Load
- Asset performance optimization

Prescriptive Analytics

- Energy Optimization
- Prescriptive Quality
- Prescriptive Maintenance



Edge 2 Cloud Outcomes with Snowflake



Multiple solutions available for ingesting IT data natively into Snowflake and via partners



IT Systems - ERP, Maintenance, HR, Quality, Warehouse, Inventory, BOM, PLM, ...



Manufacturing Data Platform

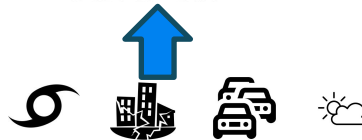
- Manufacturing Data Lake as both publisher and subscriber to data
- Data model representation of plant, plant hierarchy, line, machine / PLC / RTU / Sensor with Units established in cloud



HW – Sensors, Machines, PLC's, SCADA, Cameras, Power Meters, ...

OT Systems – Historians (process manuf), Factory Information Systems aka FIS (discrete / automotive)

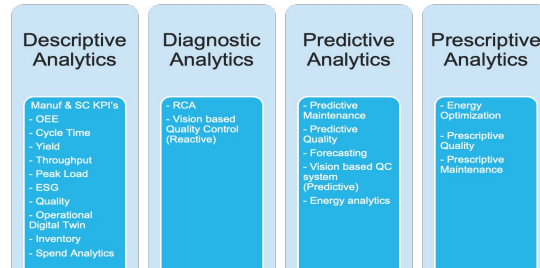
Capability to send OT data from any machine / PLC / Energy Meter data into Snowflake with zero coding



Third party data providers



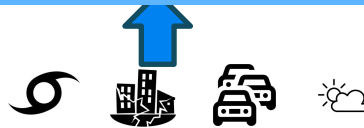
Edge 2 Cloud Outcomes with Snowflake



- OT First Mindset
- Edge Driven
- Publish by Exception (MQTT)
- Standards Based (SparkPlugB)
- Data Democratization (IT / OT) at,
 - Lowest possible cost
 - Preserve Contextualization
 - Highest possible fidelity

Multiple solutions available for ingesting IT data natively into Snowflake and via partners

Capability to send OT data from any machine / PLC / Energy Meter data into Snowflake with zero coding



Third party data providers



About Cirrus Link Solutions

Cirrus Link provides MQTT centric software for Industrial Automation Solutions

- Founded in 2012
- CTO is Co-Inventor of MQTT
- Strategic Partners with Inductive Automation in 2016
- Combined 90+ man-years of experience with MQTT
- Developed Sparkplug B to create a complete IIoT environment



IoT Bridge
for Snowflake



MQTT
Engine



MQTT
Distributor



MQTT
Transmission



MQTT
Recorder



Azure
Injector

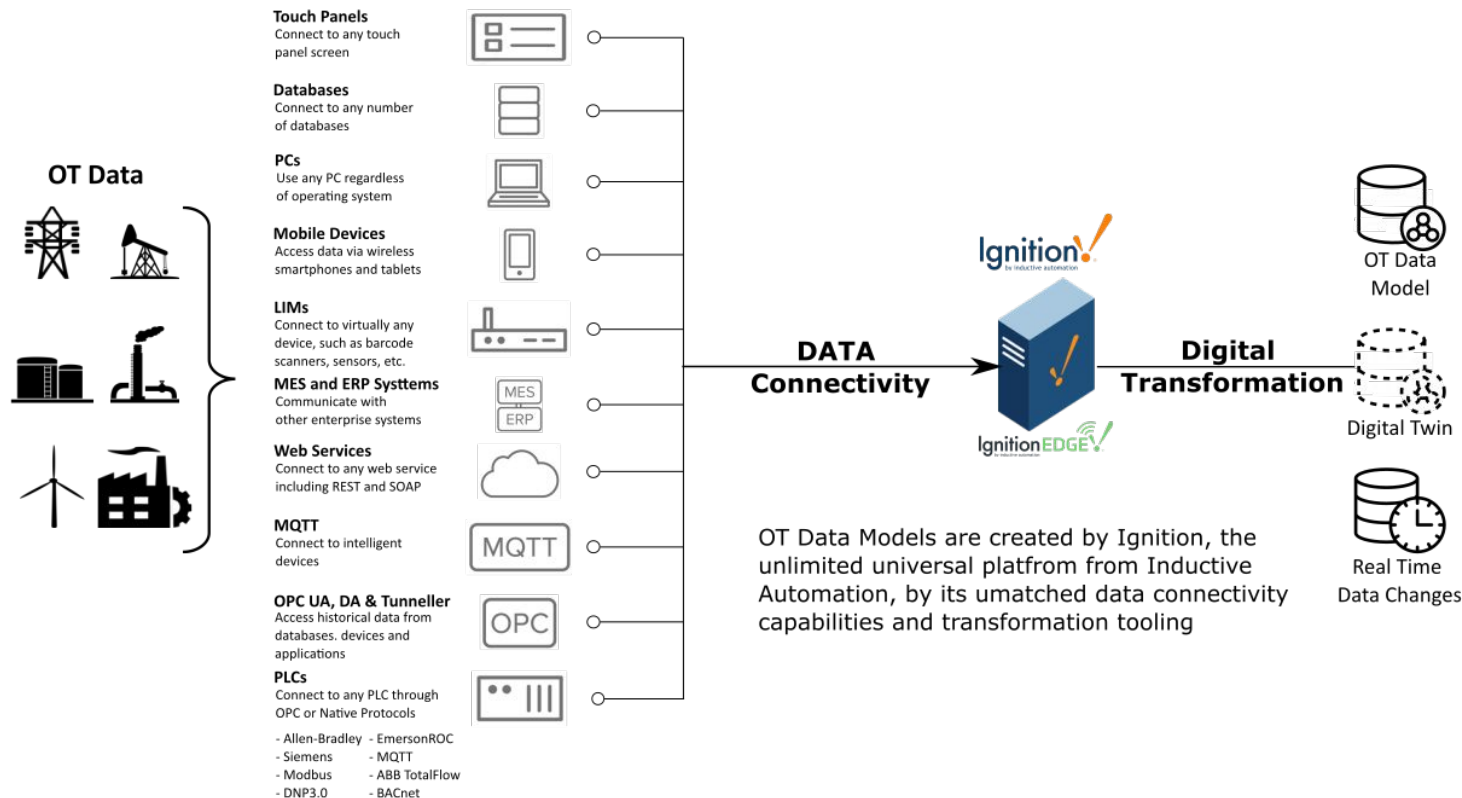


AWS
Injector



ROC/ABB
EFM

Ignition is the “Tool” for the Enterprise Connectivity



Sparkplug Provides Standard for Modeling OT Data

- *Sparkplug is a specification that defines how to use MQTT in a mission critical, real-time environment.*
- *Sparkplug does not change the underlying MQTT transport in any way.*



Plug and Play Auto-Discovery:

- GroupID/NodeID/DeviceID - Where did this message come from.
- NBIRTH/DBIRTH – New Nodes/Devices to discover.
- NDATA/DDATA – Node/Device Process Variable Updates.
- NCMD/DCMD – Node/Device level command for bi-directional command/control.
- NDEATH/DDEATH – Node/Device Offline indication.

Sparkplug B Specification Offers

- Defines an OT Centric Topic Namespace
- **Defines an OT Centric Data Model/Asset Structure**
- Defines an OT Centric Extensible Process Variable Payload
- Defines MQTT State Management
- Sparkplug establishes a *Single Source of Truth* for Models/Assets/Tags at the Origin for a complete UNS!

Define Models/Assets from the Edge:

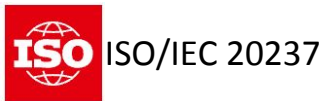
The Sparkplug “Template Definition” specification allows NBIRTH messages to define Data Models. Sparkplug “Template Instances” allow BIRTH messages to create associated Assets from these Models.

Efficient binary encoding of PV Objects:

- Name
- Value
- Timestamp
- Data Type
- Engineering Units/Ranges
- Quality
- ... Custom Properties as required

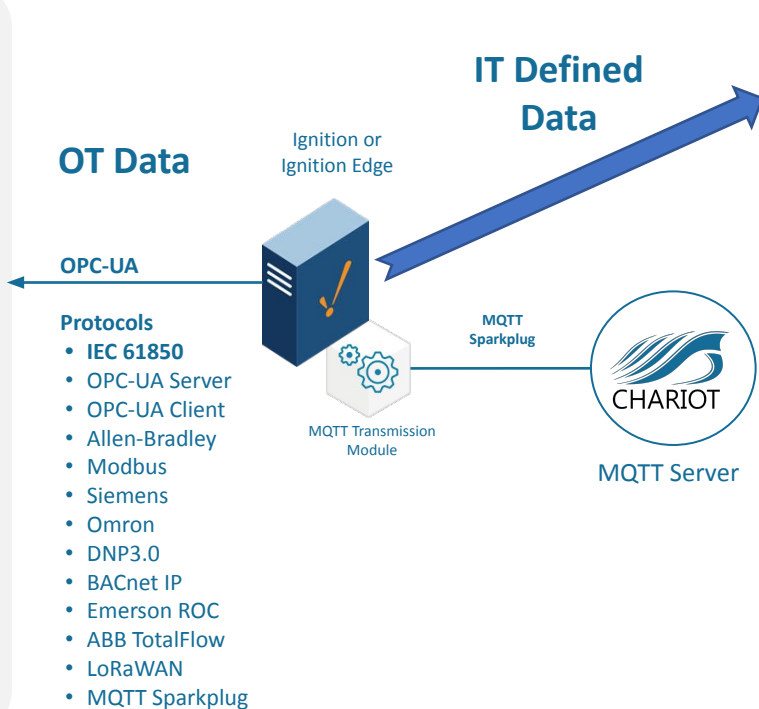
Proper MQTT State Management provides:

- Report by Exception
- Bi-directional for Command and Control
- Store & Forward



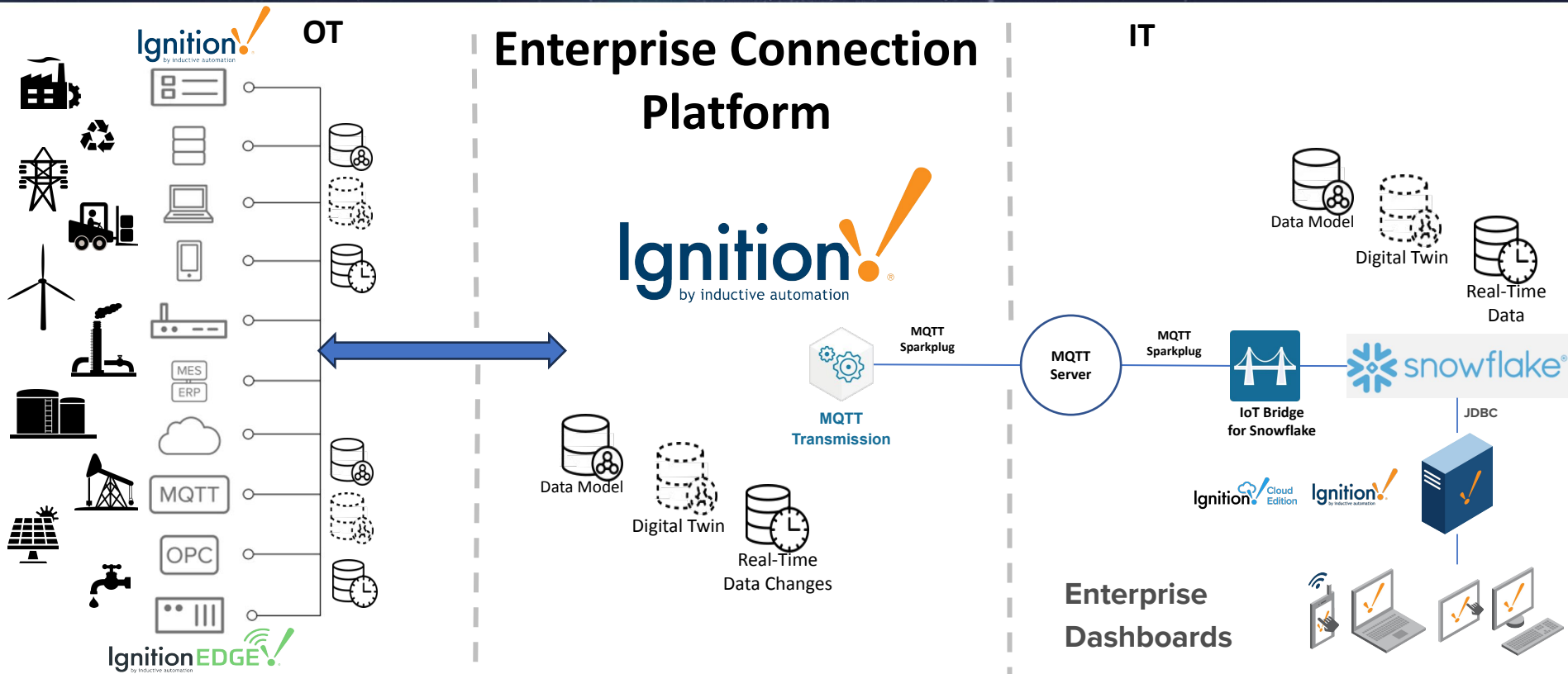
Using Ignition to Connect/Transform OT Data

Operational Data

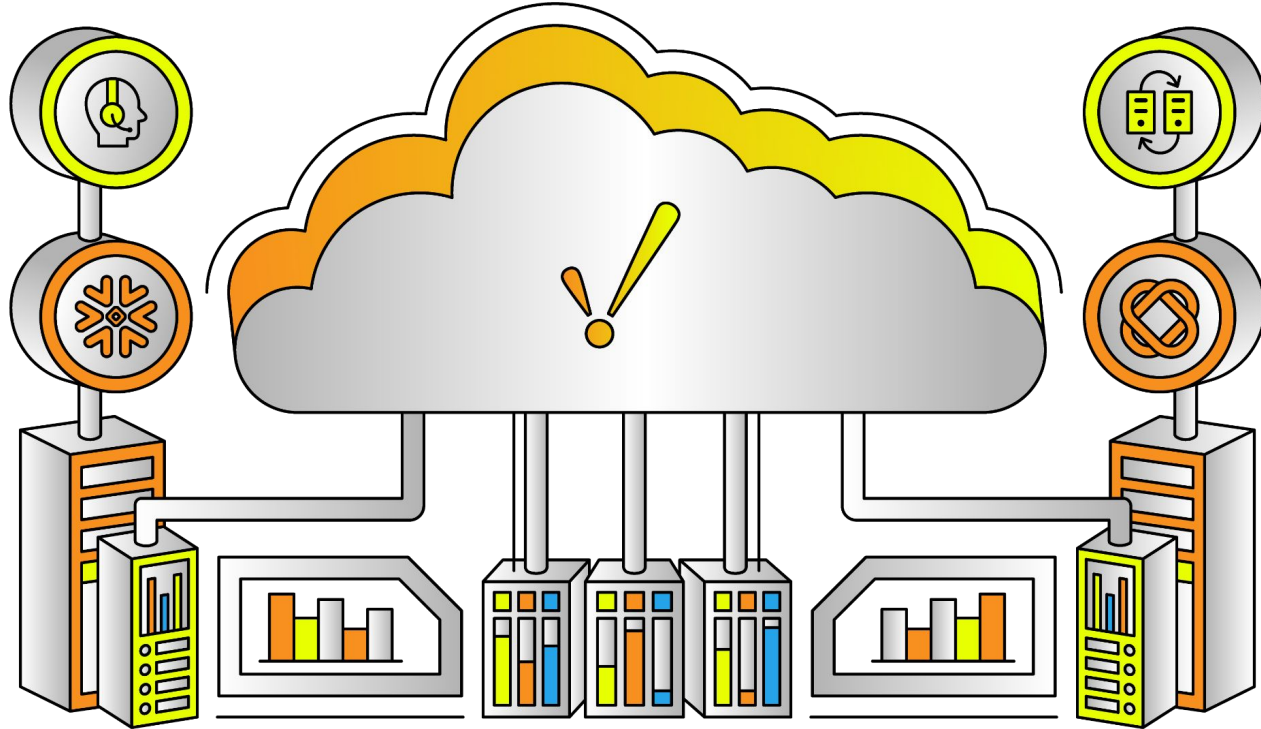


- Single source of truth
 - Model
 - Ignition UDTs define data models
 - Asset
 - Instantiation of UDTs create Assets with associated process variable
 - Measurement (Tag/Process Variable)
 - Time stamp
 - Real value
 - Engineering units / range
 - Data type
 - Custom properties
- Quick-and-simple configuration
 - Use tools, rather than coding, for configuration
- Cost efficient
 - Data sent on change
 - Time series efficiency
- Scalable

Live Demo Topology with Snowflake



Demo of IoT Bridge to Snowflake



Snowflake I4.0/IIoT Advantages

1. Snowflake resources already know how to leverage their tools and infrastructure. With **Snowflake IoT Bridge** you can immediately leverage the existing Snowflake knowledge base.
2. Supports all 20 existing Sparkplug data types. *Other Digital Twin services only support 4 basic data types.* 
3. ALL metadata is saved in a Snowflake “Raw” table. No loss of fidelity even if some data is not used in the original view.
4. No constraints/limitations with existing Model/Asset/Measurement APIs! i.e. nothing “New” to have to learn.
5. Support for ALL Model/Asset/Measurement metadata (Not just engineering units... High/Low/Deadband/etc.)
6. Automatic Model/Asset update/rebuild
7. Leverages existing SQL knowledge base
8. Simplicity
9. Scale – No preset “quotas” to negotiate (updates per time, model size, number of models, etc.)
10. Cost – Cost is based on Compute Warehouse and NOT around number of measurements/sec
11. Cross Cloud Compatibility (the “Switzerland of Cloud”)
12. ... and it's FUN

Tags		UDT Definitions	
Definition		Data Type	
Other Digital Twin Data Types			
Boolean Tag		Boolean	
Float Tag		Float	
Integer Tag		Integer	
String Tag		String	
Snowflake Data Types			
Bool Array Tag		Boolean Array	
Bool Tag		Boolean	
Byte Array Tag		Byte Array	
Byte Tag		Byte	
Dataset Tag		Dataset	
DateTime Array Tag		DateTime Array	
DateTime Tag		DateTime	
Document Tag		Document	
Double Array		Double Array	
Double Float Tag		Double	
Float Array Tag		Float Array	
Float Tag		Float	
Integer Array Tag		Integer Array	
Integer Tag		Integer	
Long Array Tag		Long Array	
Long Integer Tag		Long	
Short Array Tag		Short Array	
Short Tag		Short	
String Array Tag		String Array	
String Tag		String	

Leveraging Ignition with Snowflake

Ignition + Cloud SQL Database

- Easily connect over JDBC
- Issue SQL queries anywhere from Ignition
- Incredible throughput, speed and performance
- Easy to scale
- Connect using REST APIs as well



+



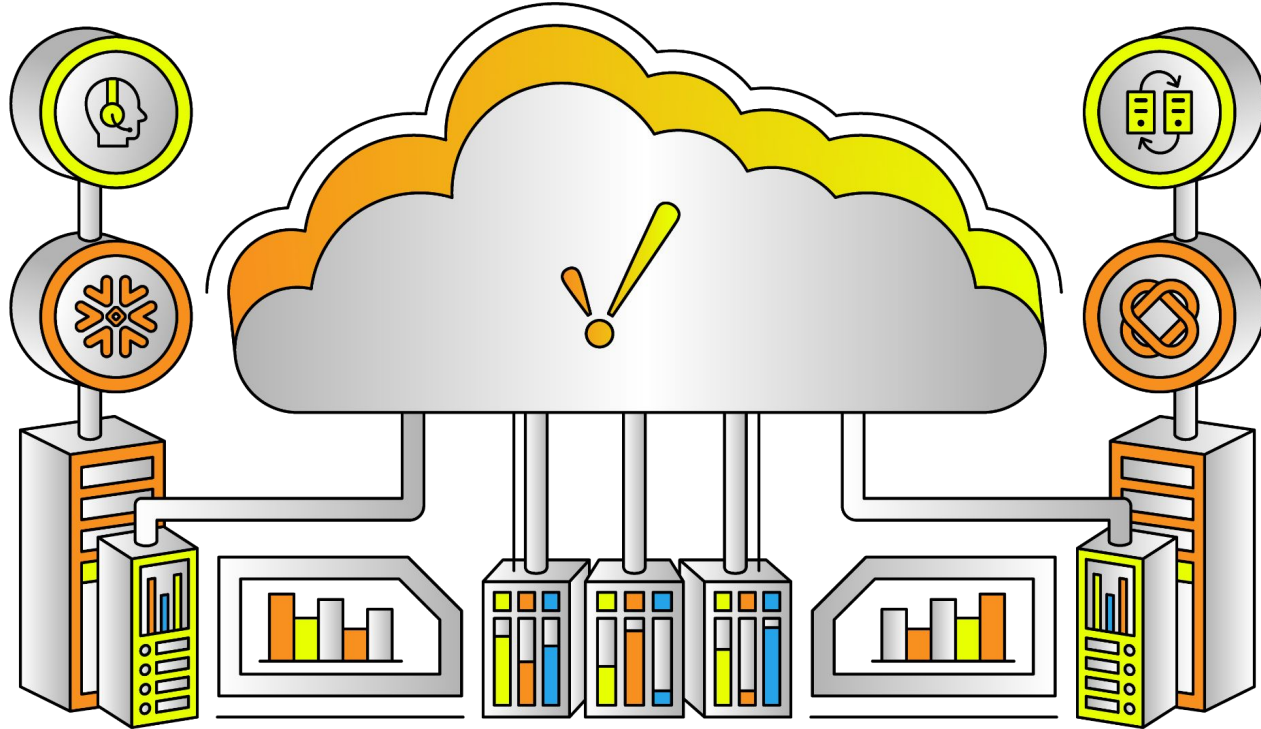
Leverage ML & AI

Leverage Snowflake ML & LLM Capabilities

- Turn data into insights
- Train a ML model based on a machine or asset data model
- Leverage anomaly detection and forecasting services
- Easily analyze new data
- Easily get results back into Ignition



Demo of Snowflake Dashboard





Ready to Try Ignition for Yourself?

Download the full version for free at:
inductiveautomation.com



inductiveuniversity.com

*Ignition User Manual also available at:
docs.inductiveautomation.com*



THE DISCOVER GALLERY

ICC 2024 SUBMISSIONS DUE SOON!

Ready to submit? Visit: icc.inductiveautomation.com/discover-gallery-2024

Questions? Email us at: ICC@inductiveautomation.com

Submission Deadline: April 30, 2024

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