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POWER OF PARTNERSHIP

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ADVANCED CONNECTORS TO CLOUD

MQTT Solutions in a Niagara Environment

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What is an Advanced Connector?

- Must haves:
  - Security is at the core of all the protocol layers.
  - Communication initiated from the edge.
  - Allows for read-only and read-write.

- Nice to haves:
  - Data is transported in a common standard across multiple vendors and device types.
  - Data is transported with an identity.
  - Data is transported with known relationships

Examples of Advanced Connectors

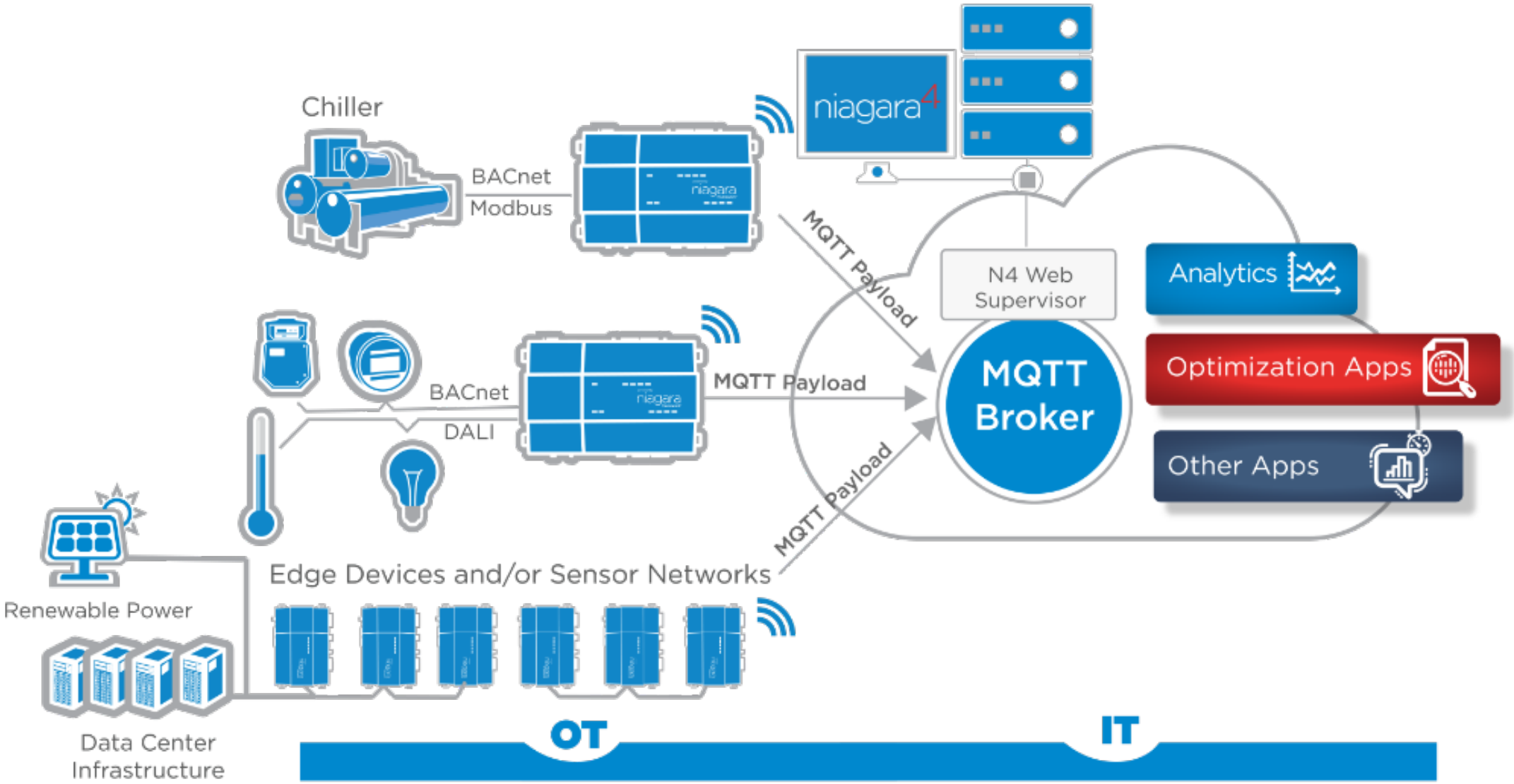
- MQTT
  - Sparkplug
  - UDMI (Google)
- Webhooks

UDMI

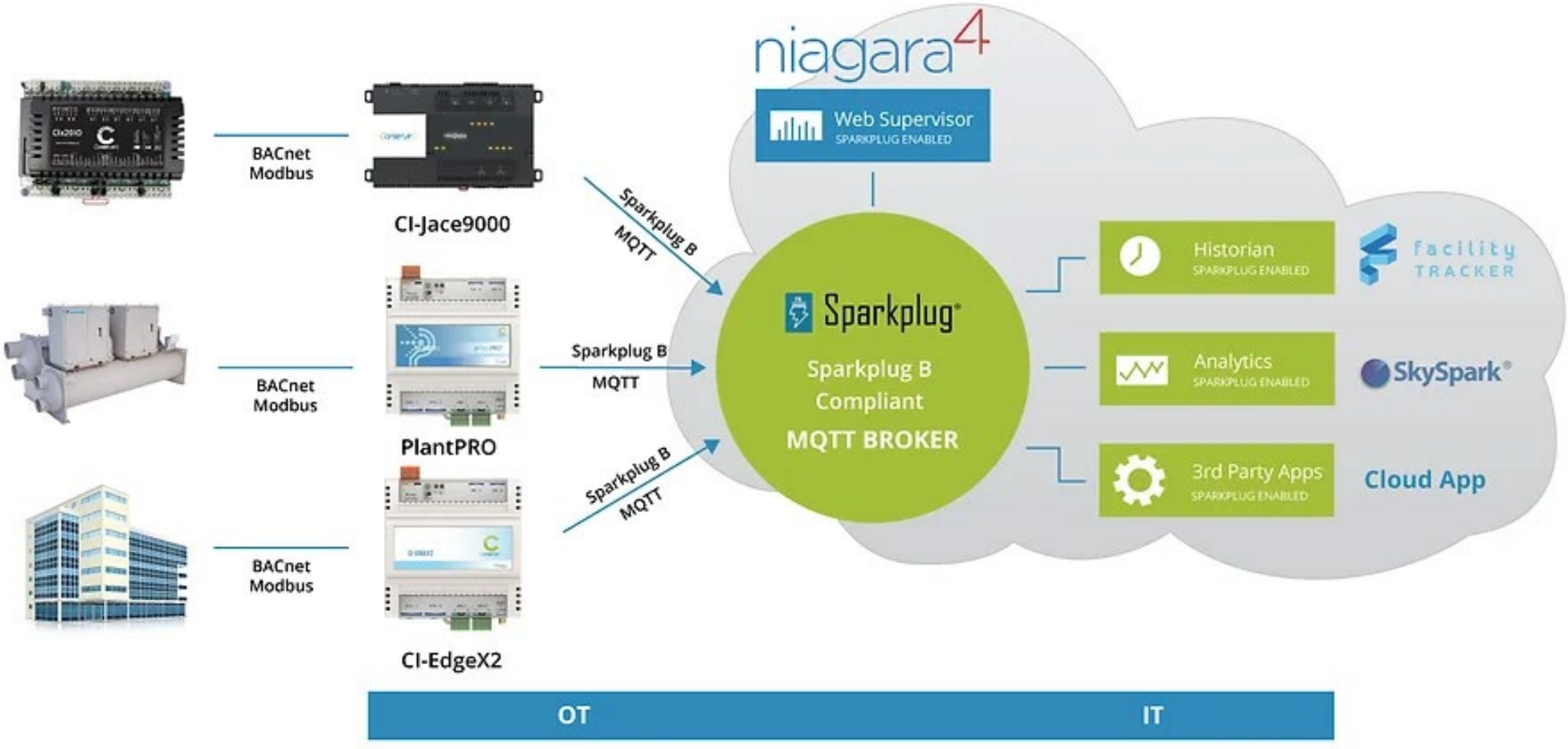
MQTT Introduction

- MQTT is a lightweight messaging protocol
- Easy to implement and customize
- Useful for IoT Devices
- Designed to TCP/IP Networks
- Uses “Topics” to transfer messages
- Clients can both Publish and Subscribe to Topics
- Publish and Subscribe commands are managed by a centralized MQTT Broker

Example Architecture In a Niagara Context



CI-Sparkplug in Niagara Framework



Chirayu Shah

Vice President of Operations

Conserve It

Enhanced MQTT with Sparkplug in Niagara

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Enhanced MQTT with CI-Sparkplug

- Standardizes the MQTT Payload
  - Serialized using Google's Protobuf
- Standardizes the Topic Names
  - namespace/group_id/message_type/edge_node_id/[device_id]
- Client (Node/Device) auto discovery and configuration
- Client (Node/Device) state management
- Adds Type Standards for modeling data:
  - Node
  - Device
  - Metrics

Enhanced MQTT with CI-Sparkplug

- Topics are handled by Sparkplug
  - Data is encoded and transmitted over MQTT using Sparkplug
  - No customization is required for transmission

- Data transmission format is also handled by Sparkplug
  - Entities that can send data are called Nodes and Devices
  - Entity data is represented by Metrics
  - Metrics represent a single point of data
  - Support for Meta Data which are represented by properties

- Data is only transmitted when values have changed
  - No polling required because of Sparkplugs state management

Enhanced MQTT with CI-Sparkplug

- Strong access control through known topic namespaces
- Low transmission requirements
  - State management ensures known active data
- Historical data supported within the Sparkplug Protocol
  - Ensures data missed while offline to still be collected
- Future support through known namespace topics.
  - Current version: spBv1.0
  - Next Version: spCv1.0
  - Ensures backwards compatibility

CI-Sparkplug in Niagara Framework

- Conserve It's largest sale of CI-Sparkplug Niagara driver is for single license of 150,000, with customer wanting to scale to over 1.3M points over multiple buildings in next 12-18 months in US.

- Grid Management companies with local Energy retailers are using CI-Sparkplug Niagara driver in over 30 buildings in Australia and HongKong
  - Used for control critical DR / DCM and load shedding events

- Conserve It and Daikin are heavily invested in Sparkplug technology

- Increasing interest across IoT development
  - IICA (Institute of Instrumentation, Control, and Automation)
  - Haystack Connect

CI-Sparkplug in Niagara Supported Extensions

- The following Extensions are currently supported:
  - Point Extension
  - Alarm Extension
  - History Extension

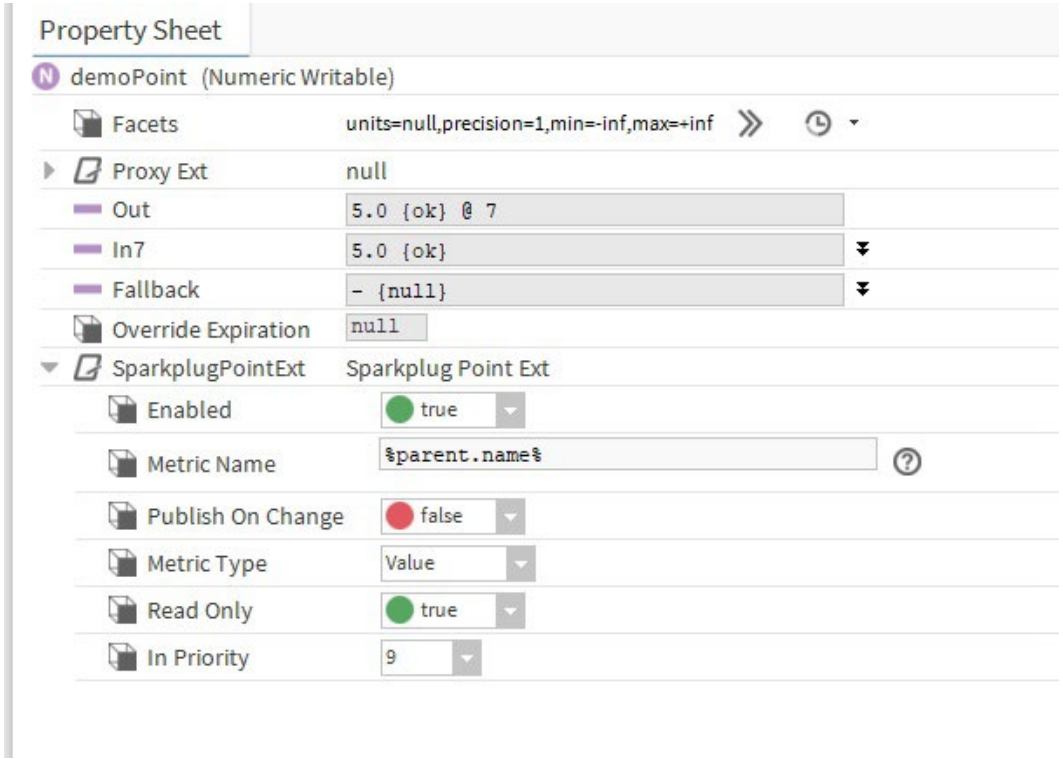
- Point Extensions will send the Out value of a point as a Metric with facets

- Alarm Extensions will send a DATA message when an Alarm triggers
  - The Alarm metadata is sent as Properties on the Metric

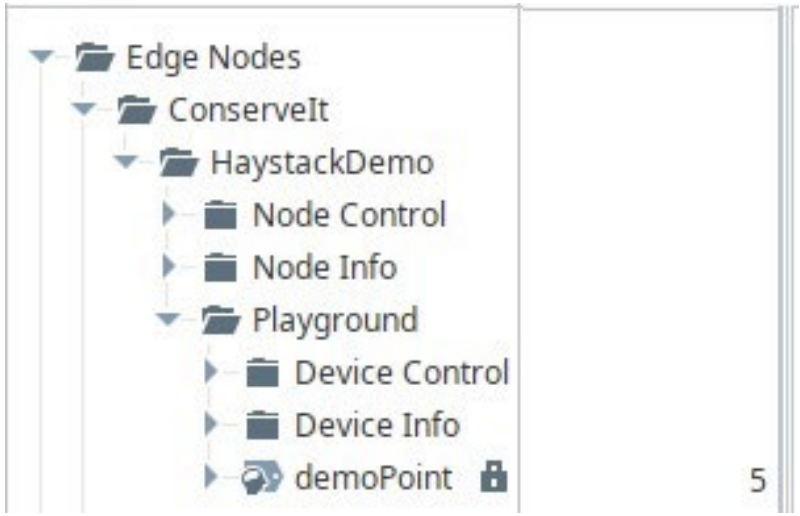
- History Extensions send the Niagara Historical data for a point
  - Data is sent in a DataSet with the following Columns: TimeStamp, Value, Status, TrendFlags

- All tags (Niagara, Haystack, Custom) are published up as Sparkplug properties to the host

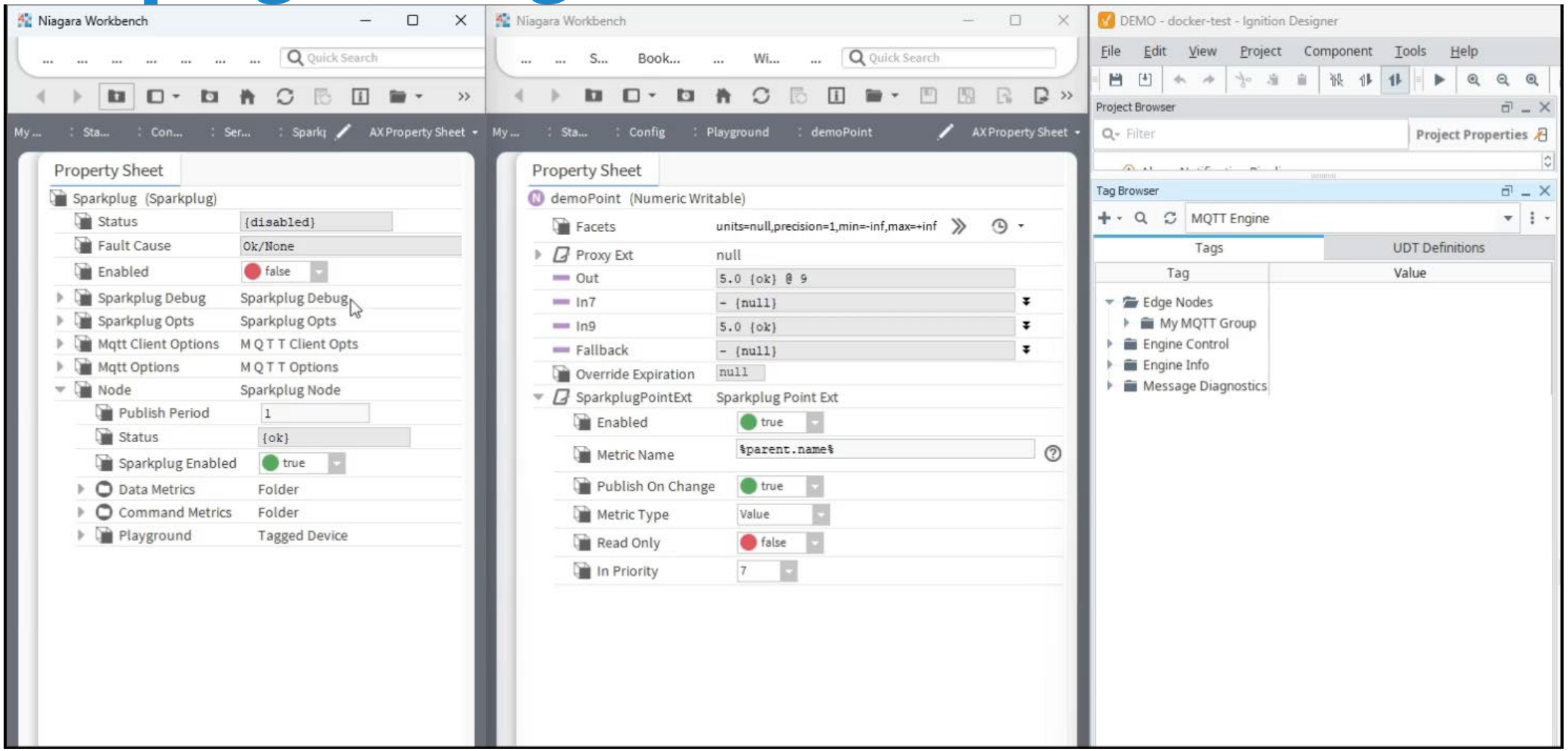
CI-Sparkplug in Niagara Framework



Sparkplug®



CI-Sparkplug in Niagara Framework



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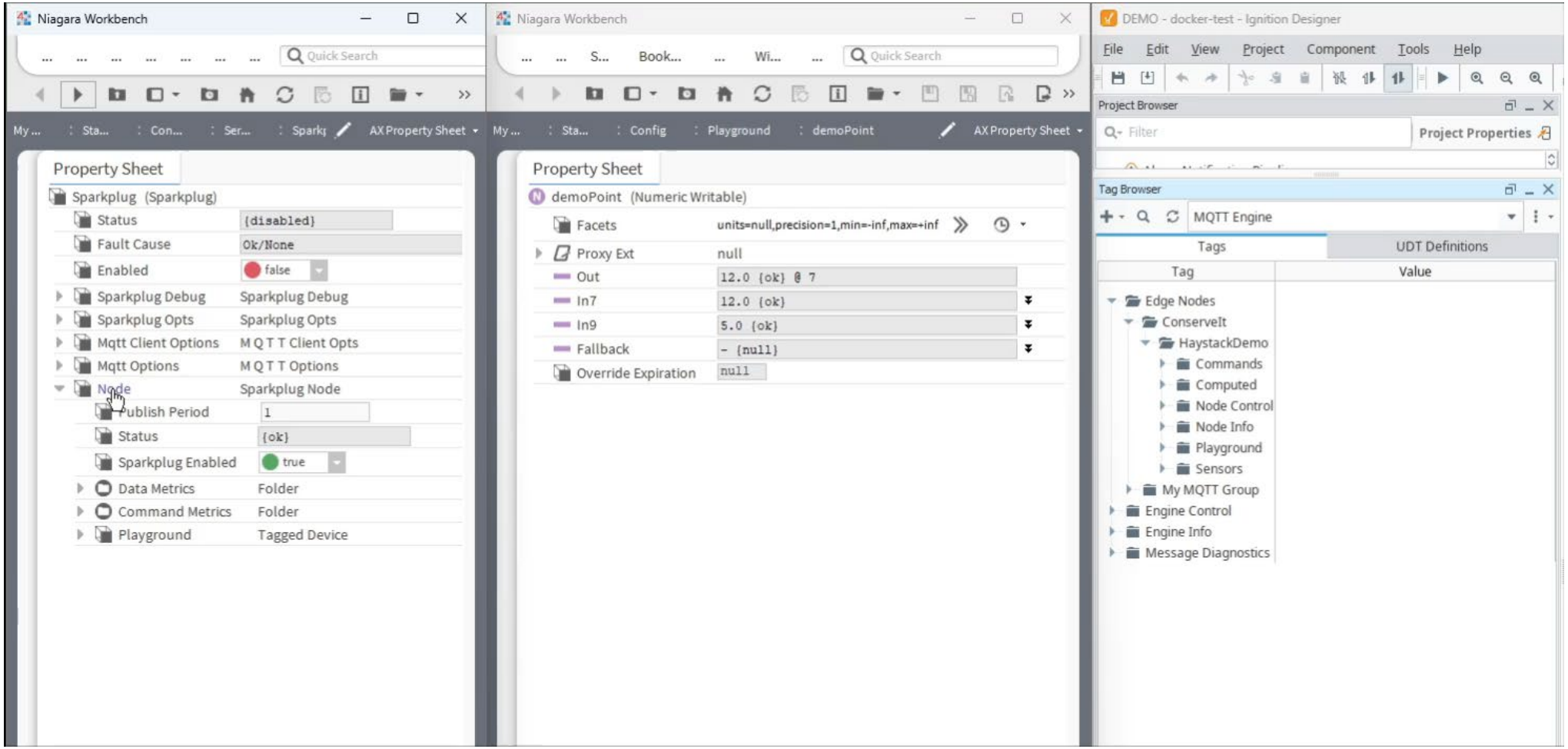
CI-Sparkplug in Niagara Framework



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Michael Melillo

Solutions Architect

Albireo Energy

MQTT in the Data Center

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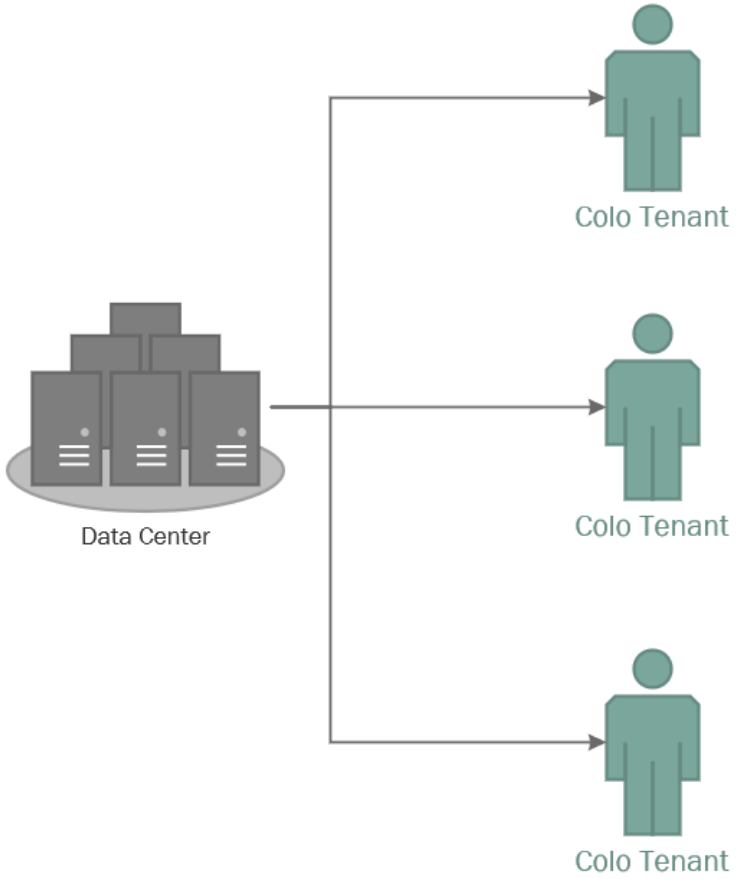
The Problem

Data Center Tenants want to be able to consume information about their remote assets and environmental conditions.



The Ask – Get Data OUT

Data Center client with existing system & tenants wants to provide telemetry data related to

- Environmental conditions in the data center
- SLA requirements of the contract
- Energy consumption of the facility.

The solution must be fast, secure, and scalable. It also must not affect performance of the base system.

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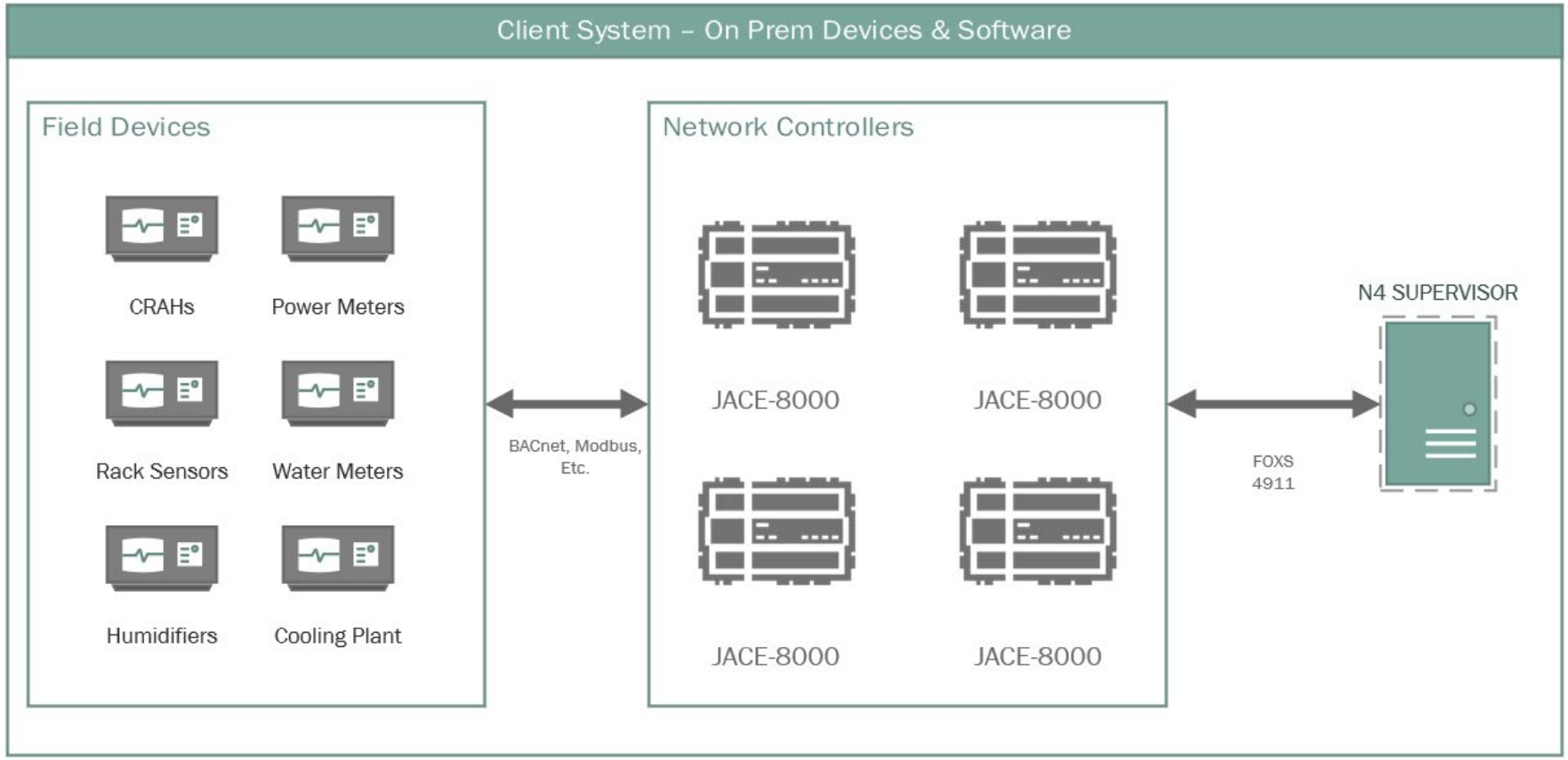
Definitions

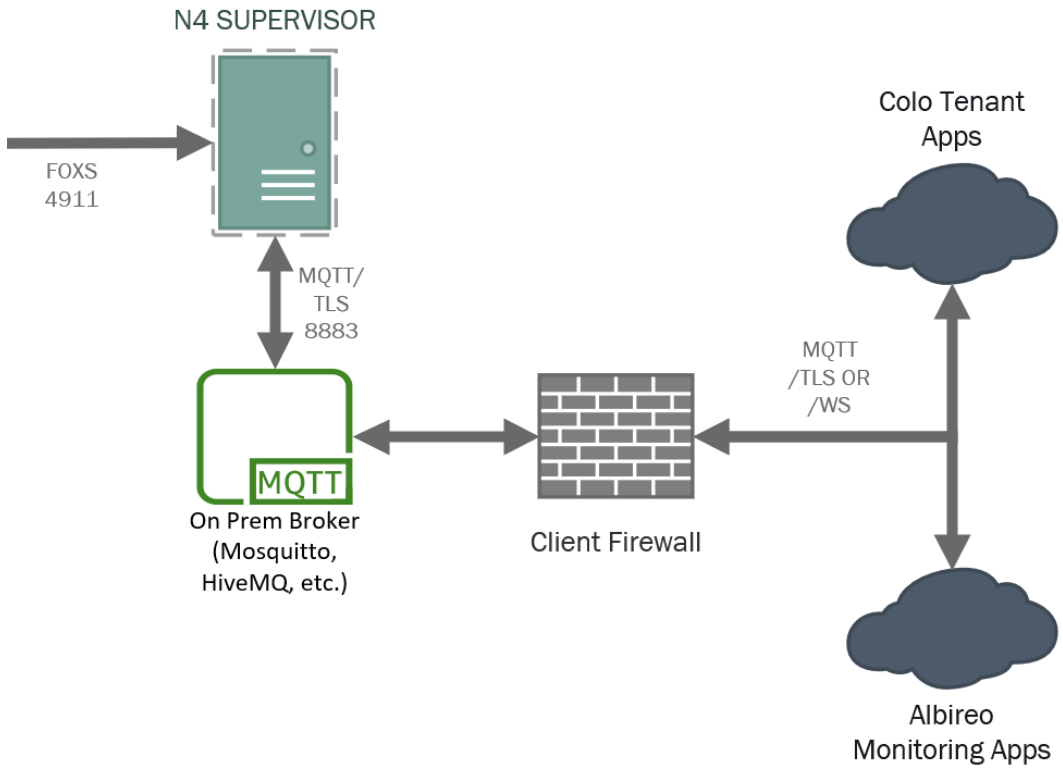
- Fast: All real time data values & status points with 60 second update frequency.
- Secure: TLS encryption capable, specific user authentication w/RO privileges for their assets, possible expansion for other solutions (SAML, LDAP, etc.)
- Scalable: Asset scope needs to grow with new tenant contracts and data hall build outs while maintaining performance levels and repeatable costs.
- Performant: Base system performance must not be negatively impacted by deployment of this solution.

Existing System



Solution

- IT whitelists End-Customer and Albireo Cloud to authenticate and subscribe to the broker.
- N4 Supervisor aggregates and publishes data to on prem broker.
- Broker immediately publishes new payload data to all external subscribers.



Benefits

- Pub/Sub model means we control the load on the system, not client polling.
- Architecture is modular and flexible.
- Major design goals were met: 60 second live data feed on 3k+ points out of a 50k point system, TLS encryption and user scoped topic access.

Some Considerations

- Topic Structure and Payload format will drive everything.
- Get familiar with your brokers, whether you deploy them on prem or in the cloud.
- Consider monitoring and validation solutions early (how will you prove it works/is still working?)
- Leverage scalable ways to query for data like tagging rather than one off links.

Implementation Details

- Topic Structure
  - site/tenant/category/asset
  - E.g., DataCenter_01/AcmeCo/Metrics/DH01
- JSON MQTT Payload


```
{"msgInfo":
    {"sysTime":"YYYY-MM-DD hh:mm:ss.zzz","stationName":"NIAGARA_SUPERVISOR","hostId":"Win-ABCD-EFGH-1234-5678"},
 "assetInfo":
    {"dataHall":"Data Hall 01","assetName":"DH01"},
 "points":[
        {"name":"hotAisleTempSensor_01"
        ,"value":74.575
        ,"quality":"{ok} @ 16"
        ,"facets":"°F"
        ,"navOrd":"local:|station:|slot:/Drivers/NiagaraNetwork/JACE_01/points/hotAisle_01/temperature/hotAisleTempSensor_01"}
        ,{"name":"hotAisleTempSensor_02"
        ,"value":74.225
        ,"quality":"{ok} @ 16"
        ,"facets":"°F"
        ,"navOrd":"local:|station:|slot:/Drivers/NiagaraNetwork/JACE_01/points/hotAisle_01/temperature/hotAisleTempSensor_02"}
    ]
}
```

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Questions?

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