Building an Enterprise Unified Namespace (UNS) to Power Your Smart Factory

HOSTED BY

HIVEMQ

IN COLLABORATION WITH

HighByte

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Agenda

Introduction to HiveMQ

- **Founded in 2012**, based outside of Munich

- HiveMQ helps **move data to and from connected devices** in an **efficient**, **fast** and **reliable** manner

- **130+ customers** with production IoT applications

Our Customers...

- Building new digital products

- Improving customer experience

- Creating more efficient operations

Audi · Heraeus · MATTERNET · SiriusXM

SIEMENS · Au AUTONOMIC · M /Flughafen München · BMW

LIBERTY GLOBAL · HPA Hamburg Port Authority · ZF · RIMAC

DAIMLER · Honeywell · T · · · E CARX

ARKEA ON LIFE · flo BY MOEN · Hytera · ...and more

HighByte

On a mission to provide manufacturers with the critical data infrastructure required for Industry 4.0

Headquartered in **Portland, Maine** USA

Established in **August 2018** by founding team with 50+ years of experience delivering industrial software solutions

Serving **dozens of the world's most innovative industrial companies** with software deployments in 9 countries

Working with **a global network** of distributors, system integrators, and technology partners to support our customers

Delivering solutions to a **wide range of industries**, including Food & Beverage, Pharmaceuticals, Pulp & Paper, Industrial Products, Consumer Products, Energy & Mining, and more

Recently named **DataOps Solution of the Year** by the 2021 Data Breakthrough Awards program recognizing outstanding data technology products and companies

Agenda

01 **Introduction**

  ✔ HiveMQ
  ✔ HighByte

02 **Unified Namespace (UNS)**
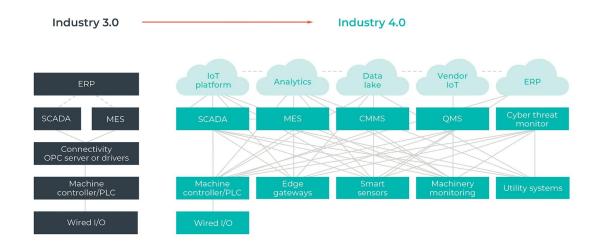
  ❑ Industrial Data Integration Challenges
  ❑ Integration Patterns
  ❑ What is a UNS
  ❑ UNS Ecosystem
  ❑ UNS Structure
  ❑ Use Case

03 **Conclusion**

  ❑ HighByte Intelligence Hub
  ❑ HiveMQ
  ❑ Next Steps

Manufacturing's Technology Landscape Has Changed

Industrial data architectures have become exponentially more complex

State of Industry 4.0

- Increased number of users and systems that want access
- Data lacks context, uniformity, and not correlated for use outside of operations
- Engineers are writing custom code and redundantly modeling data in each consuming application
- Flow of information is complex, not well understood, and presents security concerns

Data Challenges Are Threatening Industry 4.0 Success

The existing data infrastructure does not support scale and broad adoption

IT systems using industrial data are not scaling.

Custom scripts are slowing integration time and creating technical debt.

Data science is spending 80% of time finding and preparing data for analytics.

IT is paying high, variable cloud storage and processing fees for unusable data.

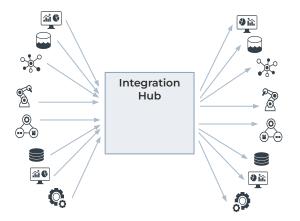OT is backlogged with requests to grant access to and explain machine data.

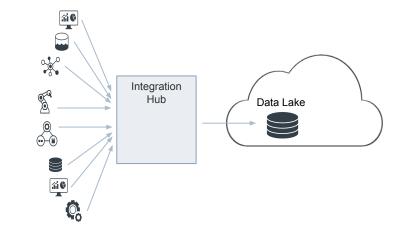Security is unknown.

Integration design patterns: Hub Architecture

- Benefits
  - Central location to manage integrations
  - Streamline data flows
  - Codeless configuration of integrations
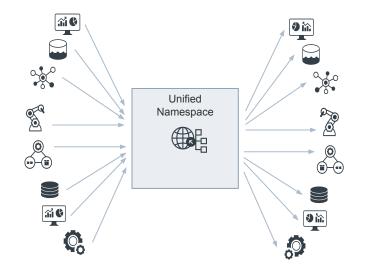 - Reuse data transformations where applicable

Integration design patterns: Cloud Gateway

- Benefits
  - OT team contextualizes and curates data
  - Govern and standardize data sent to the cloud
  - Accelerate data usage in the cloud

Integration design patterns: Unified Namespace (UNS)

- Benefits
  - Open and accessible industrial data for the company
  - Highly scalable
  - Consistent, standardized data structures
  - Easy to traverse the structure and subscribe to required data

Unified Namespace

"Consolidated, abstracted structure by which business and industrial applications can exchange industrial data"

What is a Unified Namespace

"Consolidated, abstracted structure by which business and industrial applications can exchange industrial data"
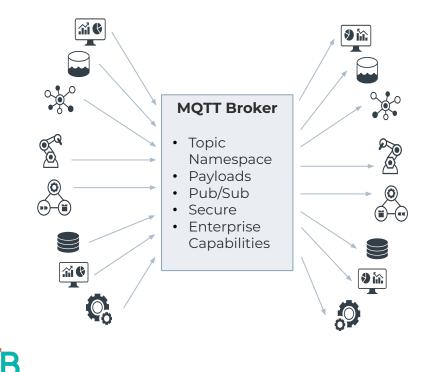
"Consolidated, abstracted structure"
- MQTT Broker
  - Scalable
  - Open
  - Secure

- MQTT Topics
  - Organization of information

"exchange industrial data"
- Data Transfer
  - Publish / Subscribe

- MQTT Payloads
  - Complex data sets
  - Open standard information models
  - Custom payloads for use case
  - Standardized
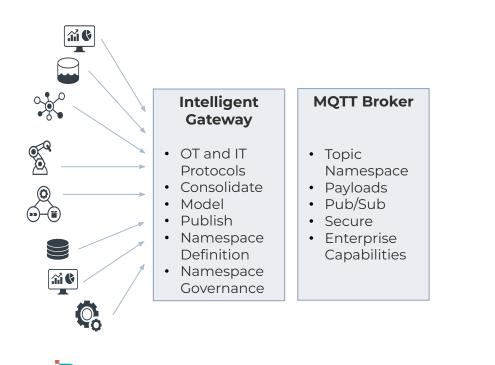 - Normalized
  - Contextualized
  - Consolidated

Unified Namespace
Broker

MQTT Broker

- Topic Namespace
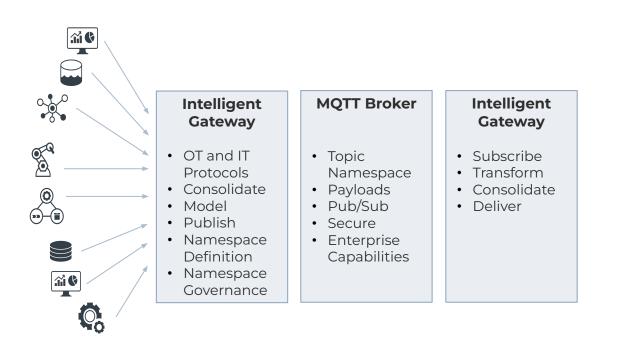- Payloads
- Pub/Sub
- Secure
- Enterprise Capabilities

Challenges

❏ Many systems with industrial data do not support MQTT

❏ Many systems with MQTT publishing are constrained how and where the data is published

❏ Many payloads require data from multiple systems

❏ Data is not standardized across devices, vendors or implementors

❏ Data is not described in an understandable structure

❏ Data is not assembled for business use cases

❏ Target systems do not support MQTT

15

Unified Namespace
Broker + Intelligent Gateway

Intelligent Gateway

- OT and IT Protocols
- Consolidate
- Model
- Publish
- Namespace Definition
- Namespace Governance

MQTT Broker

- Topic Namespace
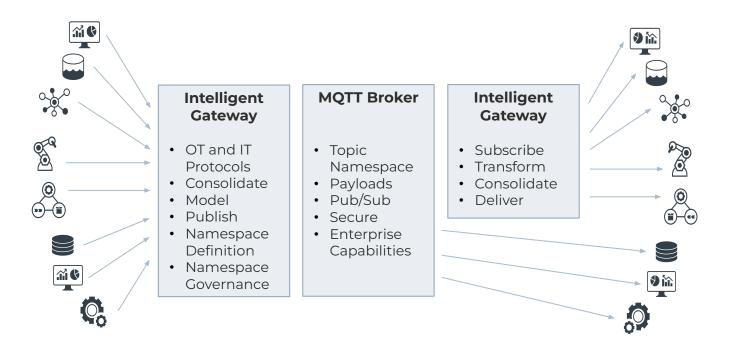- Payloads
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16

Unified Namespace
Broker + Intelligent Gateway (Inbound and Outbound)

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MQTT Broker

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- Payloads
- Pub/Sub
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Intelligent Gateway

- Subscribe
- Transform
- Consolidate
- Deliver

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Unified Namespace

- Topic Structure

- Payload

- Governance

- Use Case

- How To

- Benefits

UNS Structure/Hierarchy

Topic Path

- MQTT topics are structured in a hierarchy similar to folders in a file system.

- ISA 95 Hierarchy is a logical organization of industrial information
  - **Company**
    - **Site**
      - **Area**
        - **Line**
          - **Work Cell**
            - **Asset**
              - **Sensor**

▼ **127.0.0.1**
  ▶ **$SYS** (45 topics, 63118 messages)
  ▼ **HighByte**
    ▼ **Site1**
      ▶ **Building** (4 topics, 64629 messages)
      ▼ **Packaging**
        Line1_LotData = {"Line1_LotData": {"_model":"Line_LotData","_t
        Line2_LotData = {"Line2_LotData": {"_model":"Line_LotData","_t
      ▶ **Production** (1 topic, 984 messages)
  ▶ **spBv1.0** (4 topics, 37271 messages)

Define UNS Information Payloads

Payload

- A discrete set of information that is correlated and time or event synchronized
- In many cases the payload is defined by the use case and is dictated by the subscribing system

  - **Site/Area**
    - Profit & Loss
    - Schedule
  - **Line**
    - OEE
    - Lot data
    - Electronic Batch Records
  - **Cell**
    - Compliance
    - Quality
  - **Asset**
    - Predictive asset maintenance
    - Power Consumption

```
{
        "Line1_LotData": {
                "_model":"Line_LotData",
                "_timestamp":1629775211408,
                "LineId":1,
                "LineDescription":"Filling Line1",
                "LotNumber":"LOT120531",
                "ProductionOrder":"PO120531",
                "ProductionCode":"PCD120531",
                "ProductionDescription":"PRODESC12
0531",
                "RecordDate":"Thu Jul 16 00:00:00
EDT 2021",
                "StartTime":"Thu Jul 16 20:41:22 EDT
2021",
                "EndTime":"Fri Jul 17 18:13:08 EDT
2021",
                "LotSize":152300,
                "ProductWeight":0.0009659,
                "ActualLotWeight":14.5162000,
                "Metrics":{
                        "OEE":20.43177,
                        "TargetOEE":35,
                        "RTE":20.77051,
                        "TargetRTE":75,
                        "ProductionCount":145162,
                        "WasteCount":14687,
                        "WastePercentage":0.1011
7,
                        "TUT":"50",
                        "ChangeoverTime":0.35111,
                        "Runtime":21.178,
                        "PerformanceLoss":16.33,
                        "EquipmentFailure":15.00,
                        "ReducedSpeed":0.0,
                        "TimeNotDocumented":1.3
2,
                        "QualityLoss":0.442
```

Namespace Governance

- Critical to the success of the UNS

- Control the publication of data to the UNS, focus on consistency, usability and reliability

- Define standard structures and replicate these across like applications

- Define users and roles

- Create audit logs and baseline rollback points

UNS Use Cases

- Production Metrics – OEE/SPC
- Dashboards
- Predictive Maintenance
- Batch Details
- ERP Schedule
- Work Orders
- Recipe
- Setpoints

- Quality
- Work Cell Reports
- Power Consumption
- Building Monitoring
- Inventory Consumption
- Compliance
- Electronic Batch Reports
- Process Trains
- Traceability

How to setup a UNS

1. Infrastructure
   - MQTT Broker
   - Intelligent Gateway
2. Define UNS Structure/Hierarchy to organize the data
   - ISA95
3. Identify use cases and where the data will be accessible in UNS structure
4. Define data structures for use cases
   - Any standard approaches to structuring the data
   - Include context to uniquely identify, clearly define and use specific nomenclature
5. Identify systems that create the input data
   - Some data may need to be calculate from other systems
6. Identify the target system data requirements
   - Structures, context, and frequency
7. Iterate, Iterate, Iterate
   - Do not try to replace everything at once
   - Expect analytics, dashboard and reporting data requirements to change
   - Expect changes in the source data systems

Unified Namespace Benefits

- Accelerate data usage by business teams

- Make the data highly accessible

- Simplify system integrations

- Distribute the effort

- Enable factory agility

- Leverage open standards and COTS solutions

- Allow the data consumer/user to decide what they need

Agenda

Unified Namespace

Broker + Intelligent Gateway (Inbound and Outbound)

Intelligent Gateway	MQTT Broker	Intelligent Gateway
HighByte Intelligence Hub	**HiveMQ**	**HighByte Intelligence Hub**

Introducing HighByte Intelligence Hub

Streamline your data architecture & reduce time to deploy new systems

- Data modeling and management abstraction layer
  - Standardize and contextualize information models
  - Consolidate and normalize data
  - Manage information flows
- Designed for OT information accessibility
  - Edge-native, on-premises
  - Light-weight
  - Web-based
  - System agnostic
  - Codeless interface

HighByte Intelligence Hub

Why HighByte Intelligence Hub

Designed for OT to unlock the value of industrial data for the enterprise

Built for industrial data
- ✔ Real-time data collection, standardization, contextualization and publication

Ready to scale
- ✔ 10,000+ data flows supported with no built-in product limitations
- ✔ Centrally manage multiple hubs' configuration

Built-in security
- ✔ Secure protocol communication
- ✔ Users, Roles and Audit log

Fast to deploy, easy to maintain
- ✔ Designed for OT with browser UI and codeless implementation
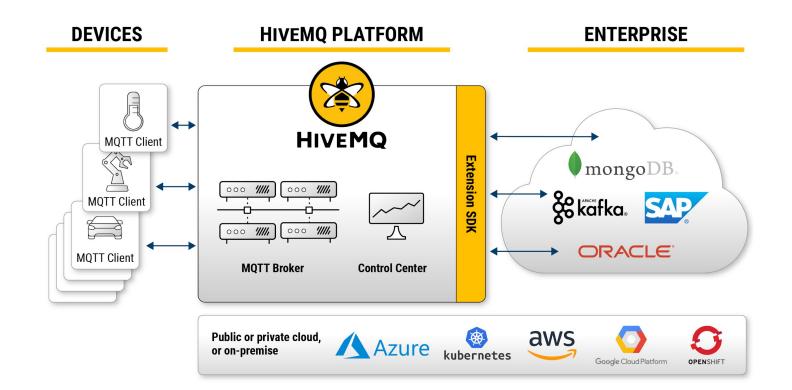- ✔ Containerized

Experienced team
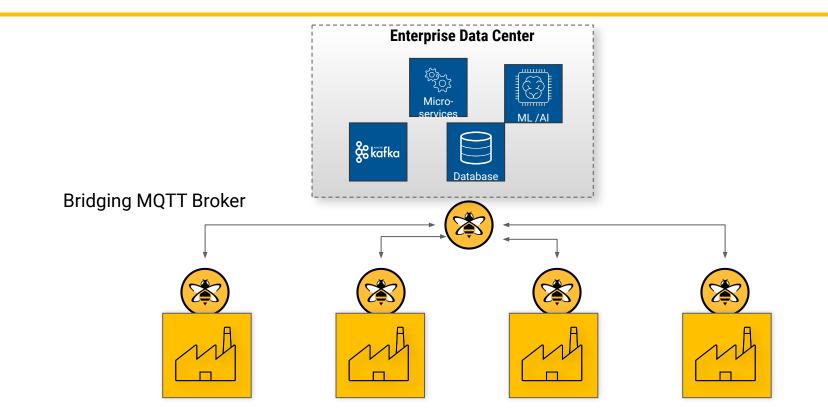- ✔ HighByte team from Industrial software industry
- ✔ Customer focused

Low cost
- ✔ Annual subscription of $5000 / hub or $12,500 / site

Introducing HiveMQ

Multi-Factory Deployment

Enterprise Data Center

Micro-services

ML /AI

Database

Bridging MQTT Broker

Scales to millions of devices

Implements business critical reliability

Support for high availability and always-on connections

In-depth observability and monitoring of connected devices

Integration of IoT data with enterprise services

Freedom to run anywhere

ANY QUESTIONS?

HiveMQ

THANK YOU

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HiveMQ