Designing an Information Model for Your Unified Namespace

Speaker

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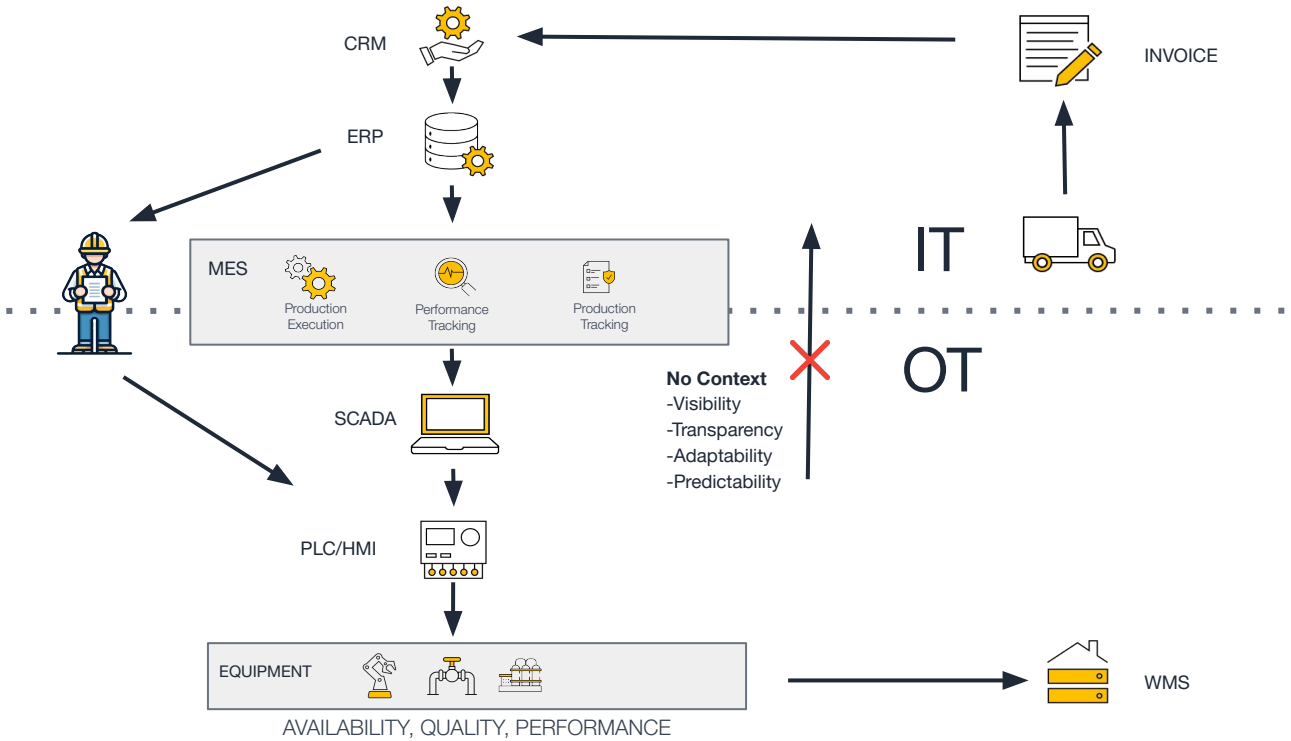
Sr. Industry Solutions Advocate

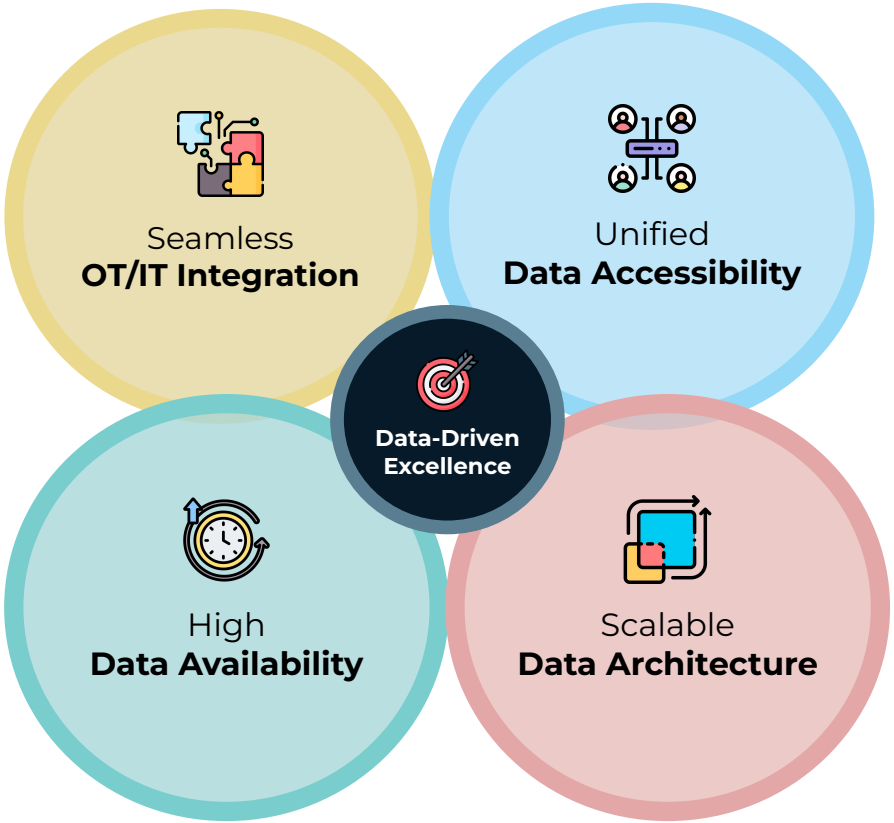
Agenda

- Unified Namespace Approach for Digital Transformation
- Design your Manufacturing Operations Data Architecture
- Standardizing Payload for Informational Elements
- Designing Unified Namespace Information Model
- Two Approaches for Building UNS Information Model
- HiveMQ Pulse
- Demo and Q&A

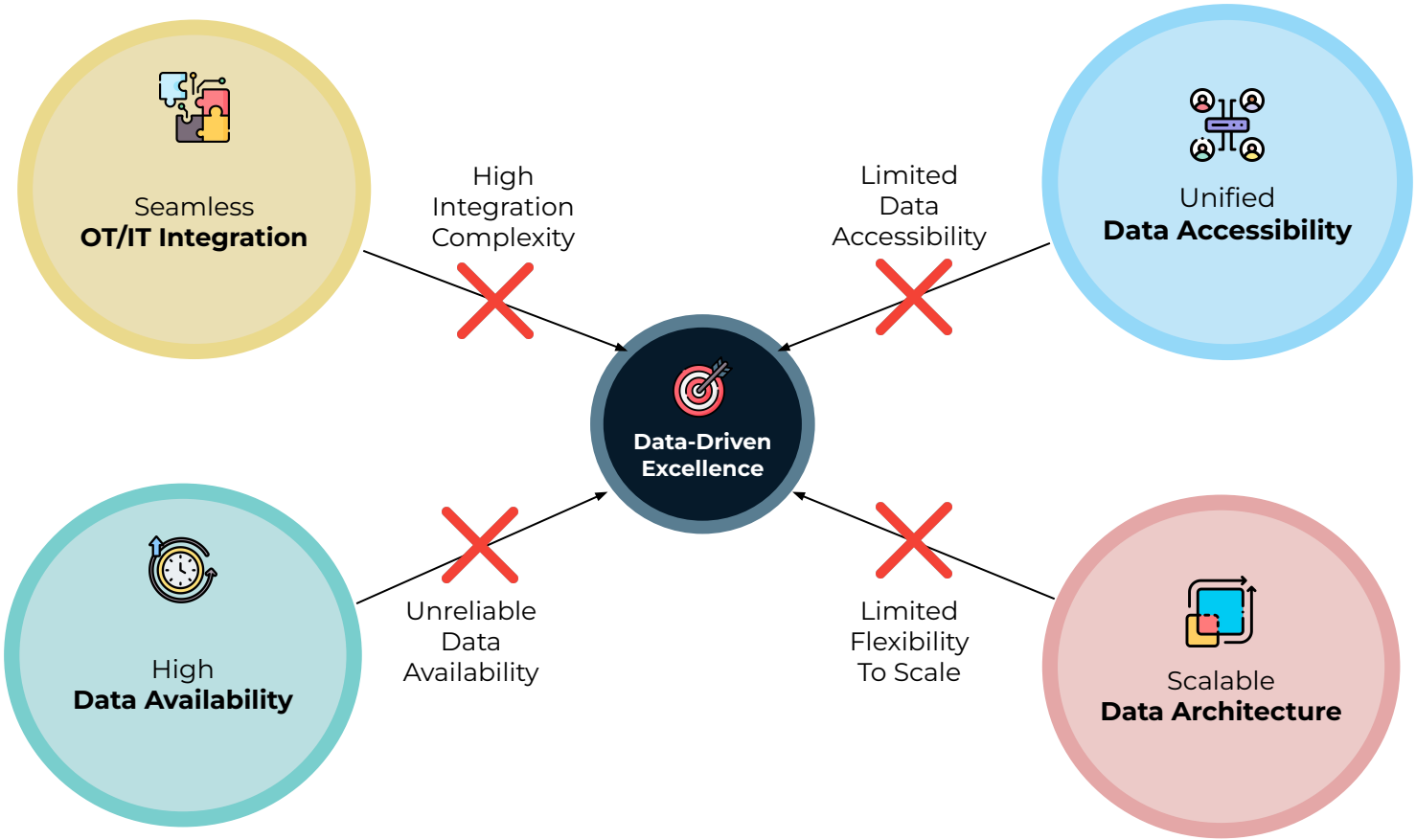
Key Challenge in Manufacturing



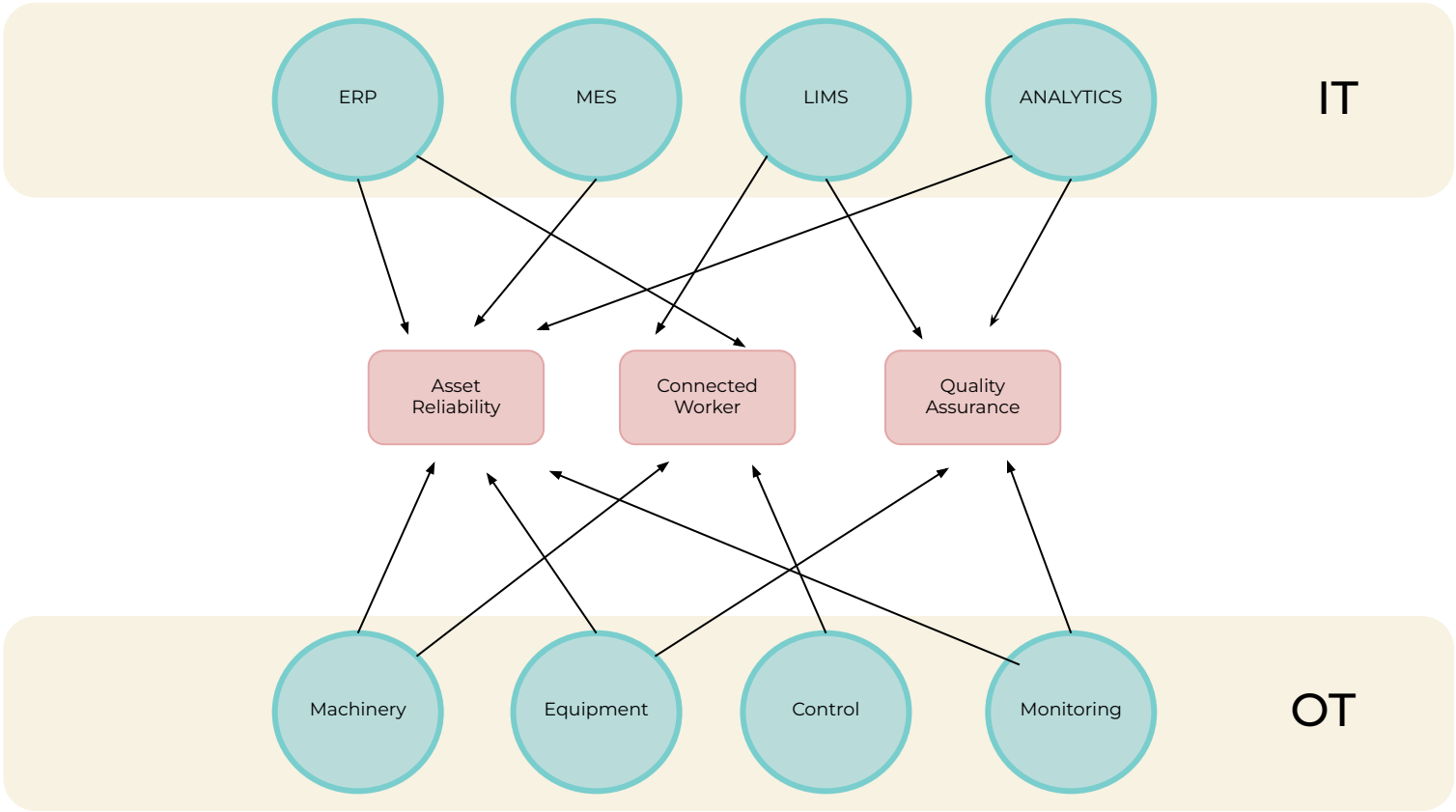
The 4 Core Pillars of Digital Manufacturing



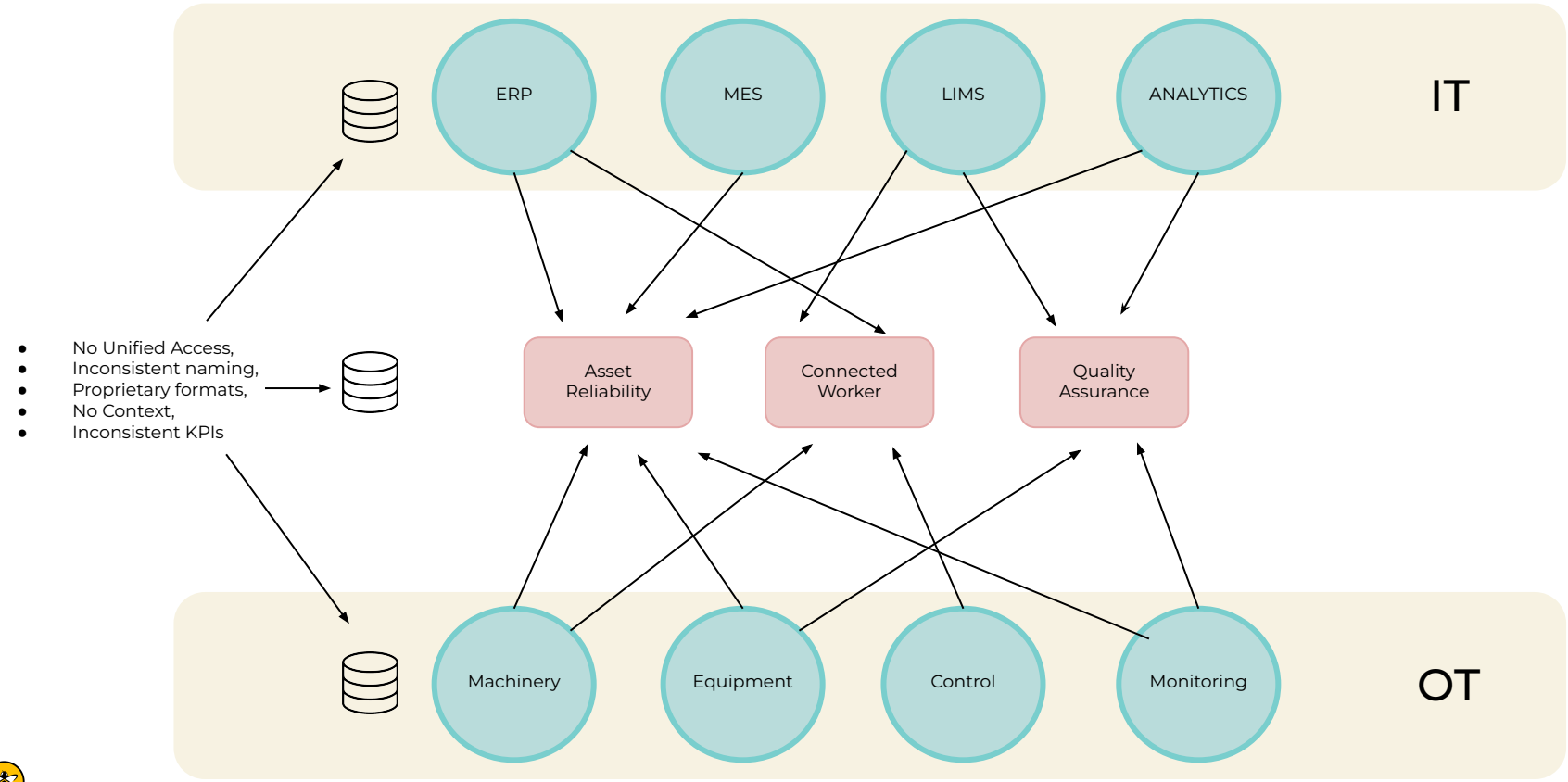
Why Traditional OT/IT Integration Falls Short



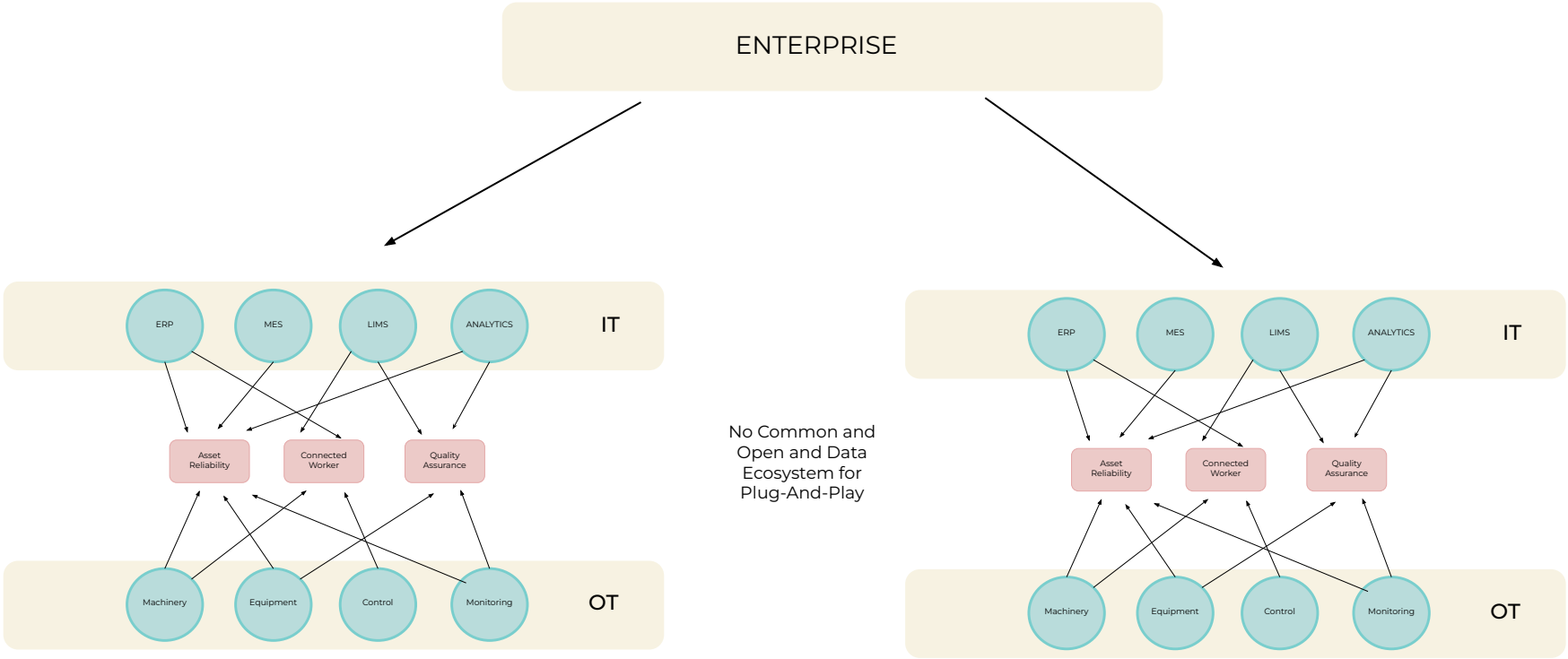
High Integration Complexity



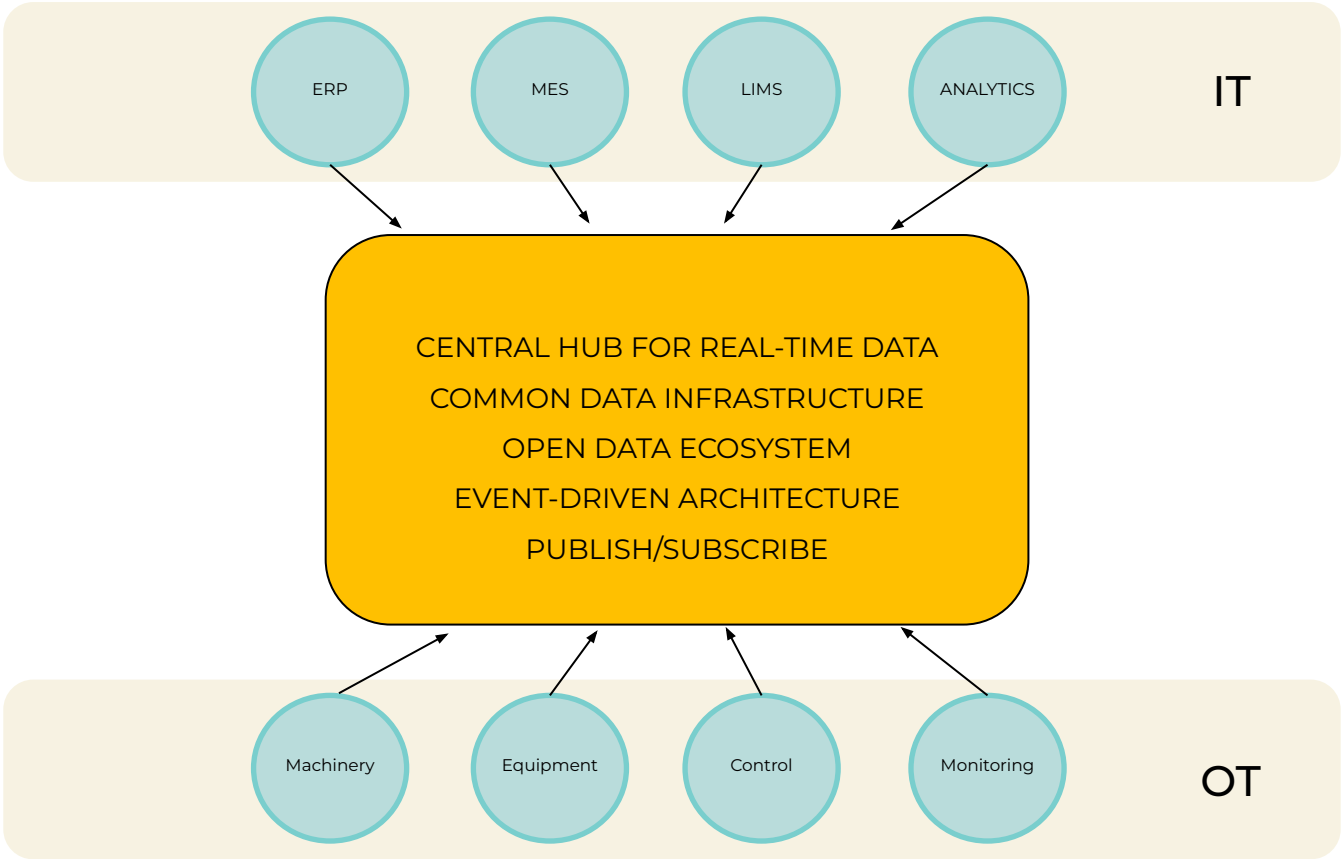
Limited Data Accessibility



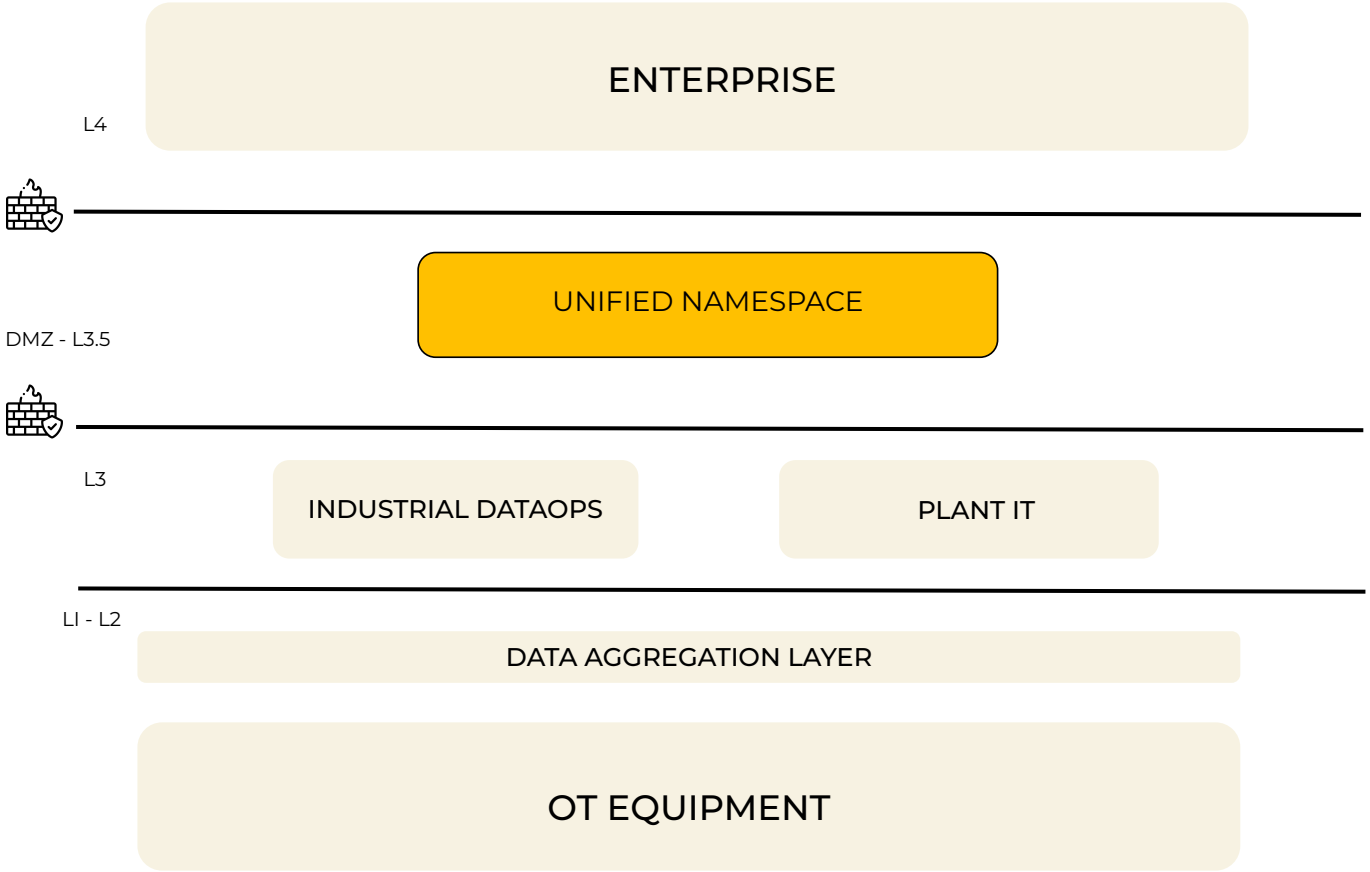
Lack of Flexibility to Scale



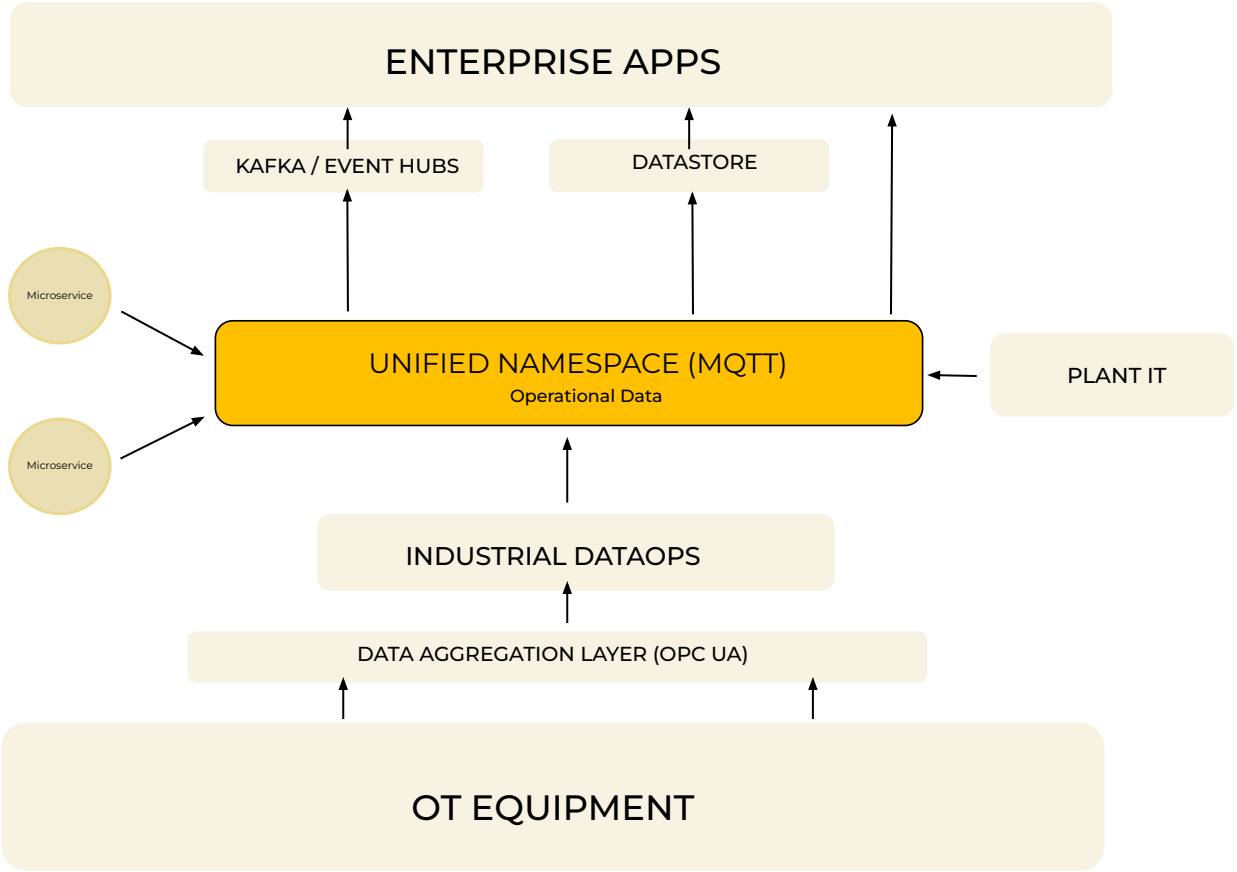
Introducing The Unified Namespace



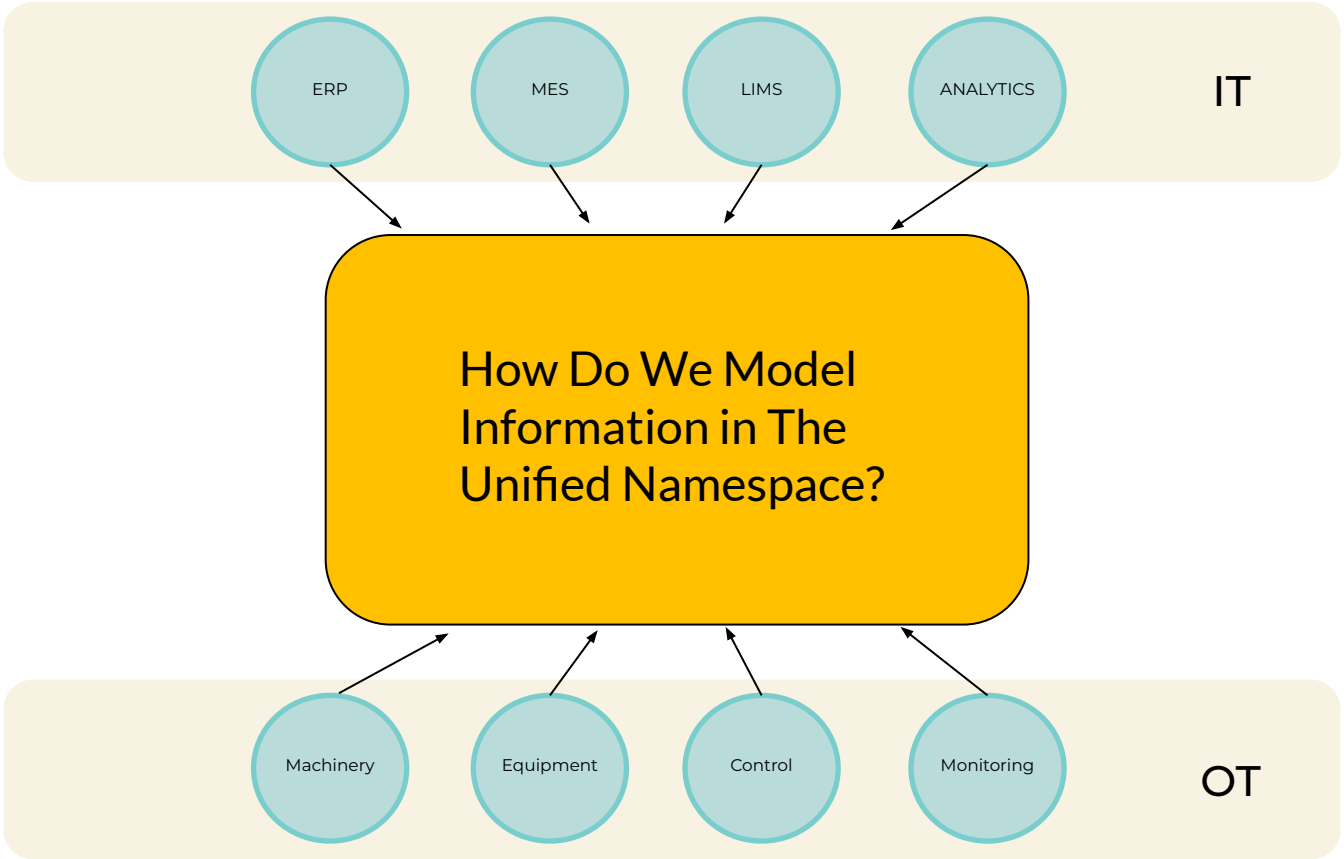
Unified Namespace Security Architecture



Unified Namespace Technology Stack



Designing Information Model for UNS



Designing
Unified Namespace
Information Model

Generalize Your Informational Elements

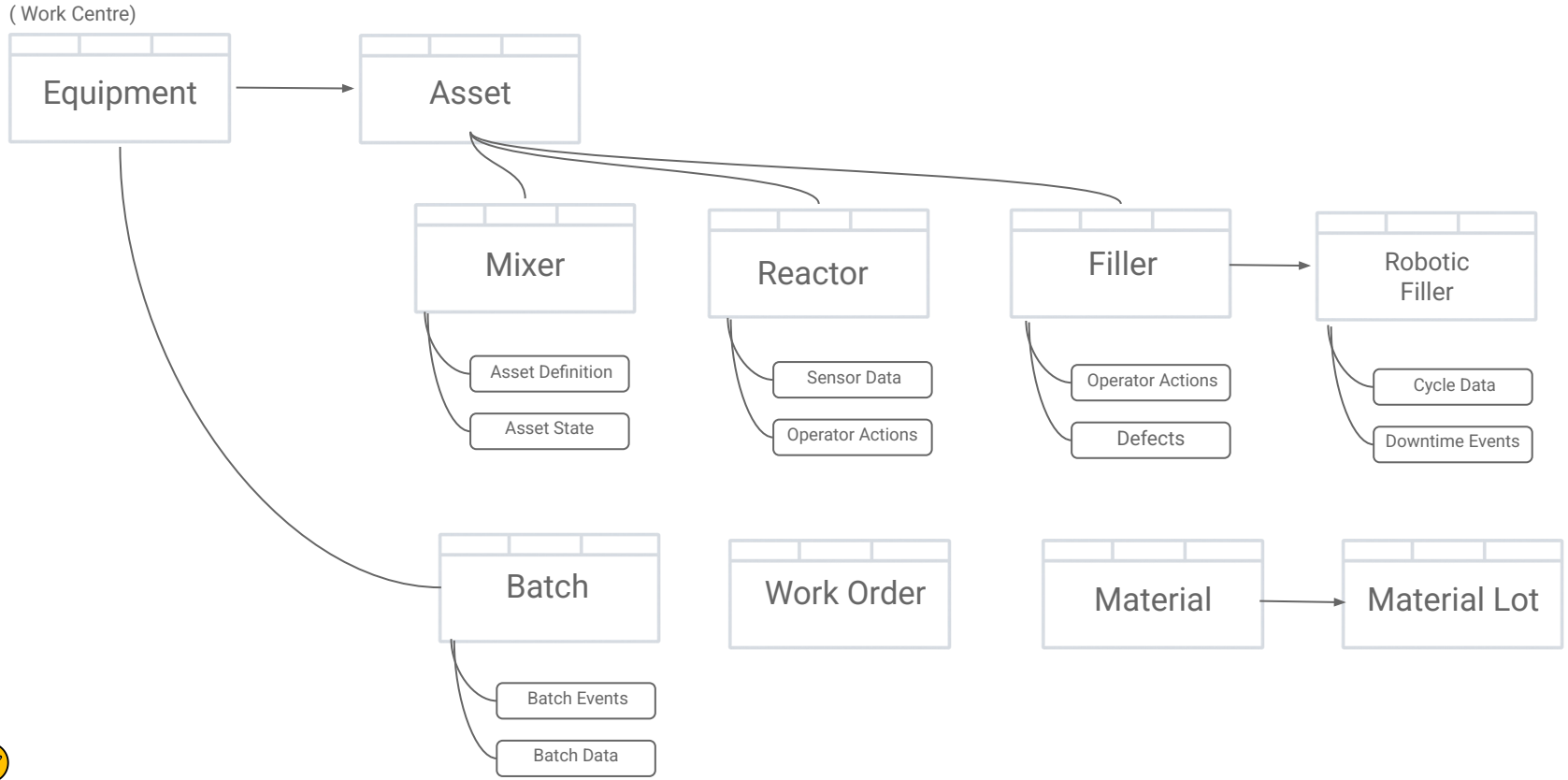
PHYSICAL CONTEXT

- Physical Location
- Equipment Used
- Material Consumed
- Batches Produced
- Tools Used

OPERATIONAL CONTEXT

- Work Orders
- Jobs Executed
- Operator Actions
- Defects
- Downtimes

Define Your Data Architecture



Standardize Payload of Informational Elements

Asset Definition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{
  "timestamp": "2024-03-20T14:30:00.123Z",
  "id": 201,
  "name": "Reactor-201",
  "description": "Continuous stirred tank reactor for chemical processing",

  "definition": {
    "asset_type": "CSTR Reactor",
    "manufacturer": "Pfaudler",
    "model": "RA-3000-GL",
    "capacity": "3000 L",
    "maxPressure": "6 bar",
    "maxTemperature": "200°C",
    "agitatorPower": "15 kW",
    "materialOfConstruction": "Glass-lined steel",
    "heatingMethod": "Steam jacket"
    },

  "attributes":{
    "serialNumber": "PF-2023-005678",
    "installationDate": "2023-04-22",
    "lastServiceDate": "2023-04-22",
    "nextServiceDate": "2023-04-22"
    },

  "parentAsset": {
    "id": 35,
    "name": "Reaction Unit 2",
    "description": "Primary chemical reaction processing unit"
  },
  "metadata": {
    "schema_version":"1.0",
    "schema_name": "Asset definition",
    "uri": "asset://201",
    "source": "Munich/Production/Reaction"
  }
}
```

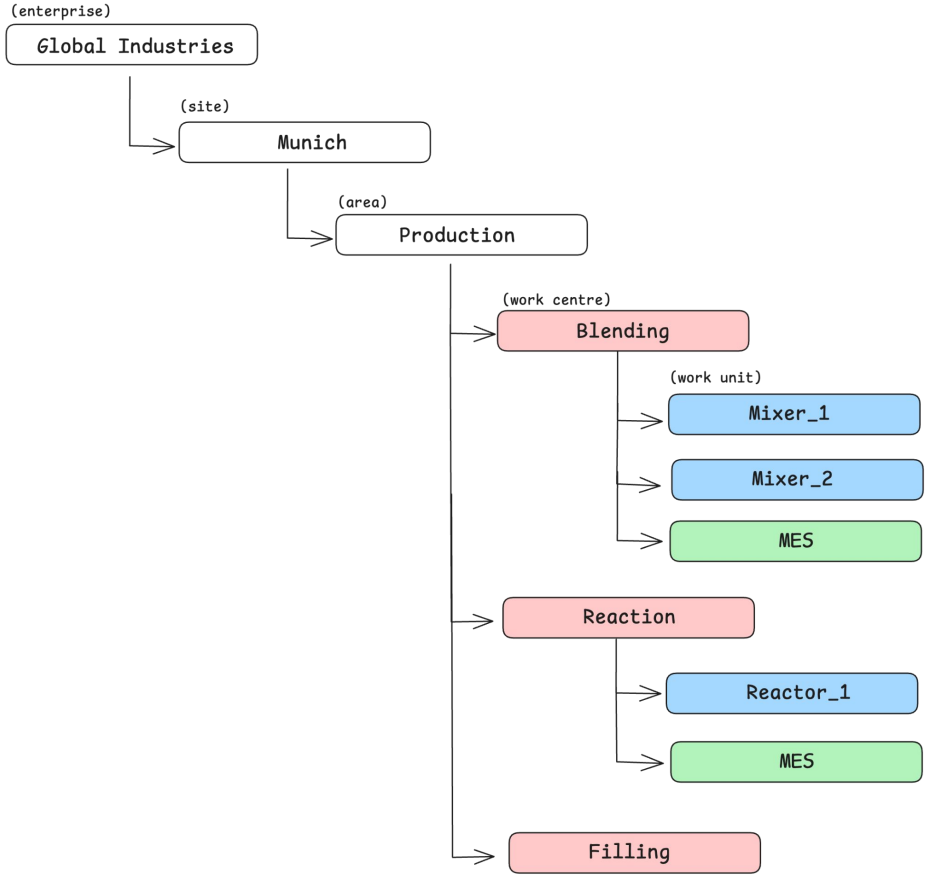

Sensor Data


```
{
    "equipment_id":"Reactor_1",
    "timestamp": "2024-03-20T14:35:00.123Z",
    "source": "Munich/Production/Reaction/Reatcor1/Edge",
    "metrics":[

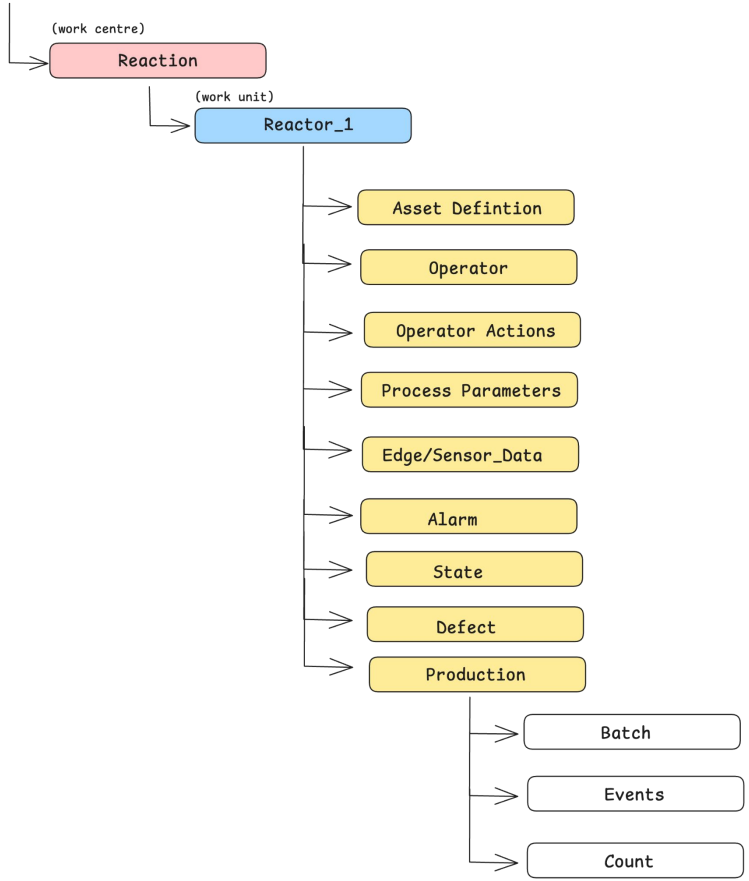
        {
            "timestamp": "2024-03-20T14:35:00.123Z",
            "name":"Temperature",
            "Value": 27.13,
            "unit_of_measure": "Deg C"
        },
        {
            "timestamp": "2024-03-20T14:35:00.123Z",
            "name":"Vibration",
            "Value": 9.7,
            "unit_of_measure": "mm/s"
        }
    ]
}
```


CUSTOM, OPC UA, AAS, DTDL

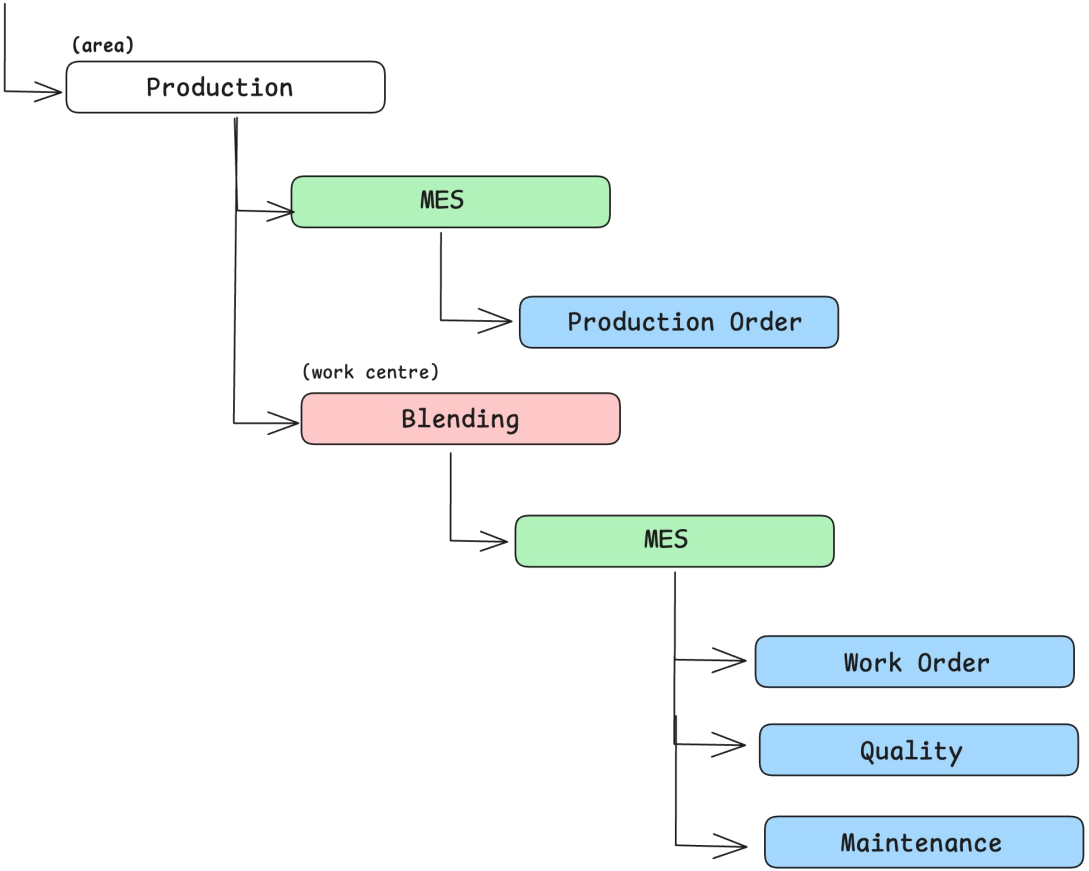
Design Your Semantic Hierarchy



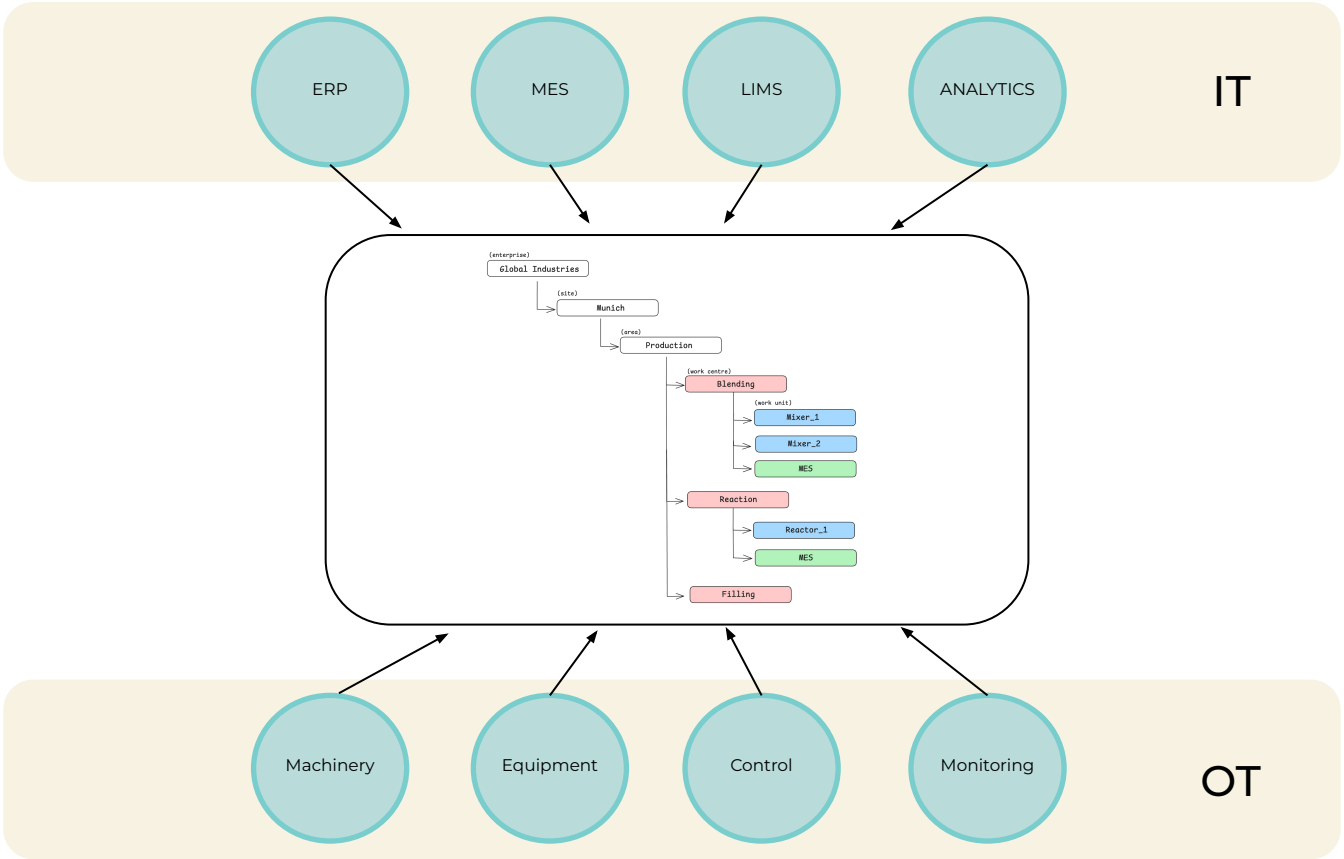
Map Your Informational Elements



Map Your Informational Elements



UNS Information Model



Where Does the Unified Namespace Definition Live?

Two Approaches to UNS Design

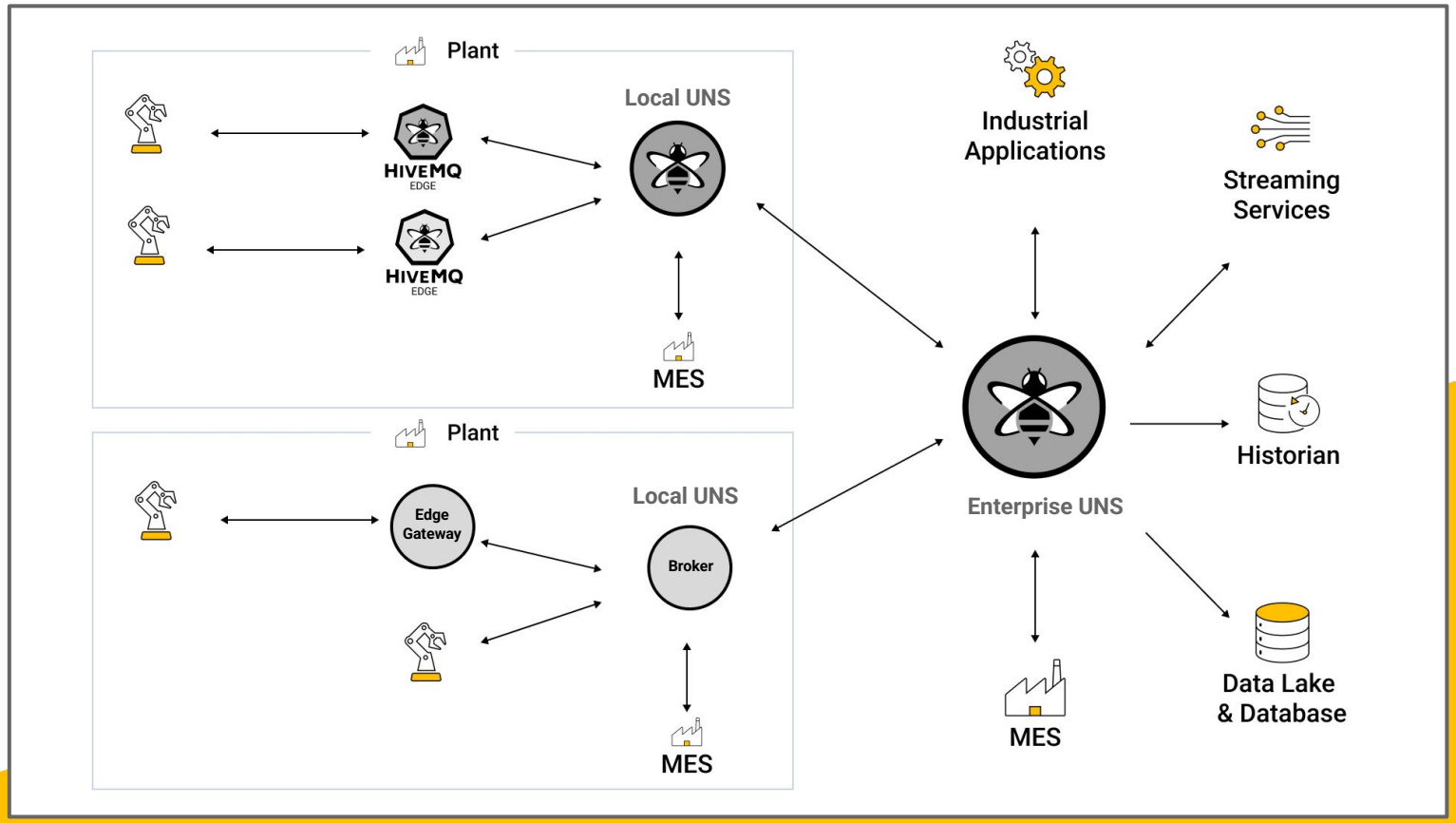
DYNAMICALLY DISCOVERED

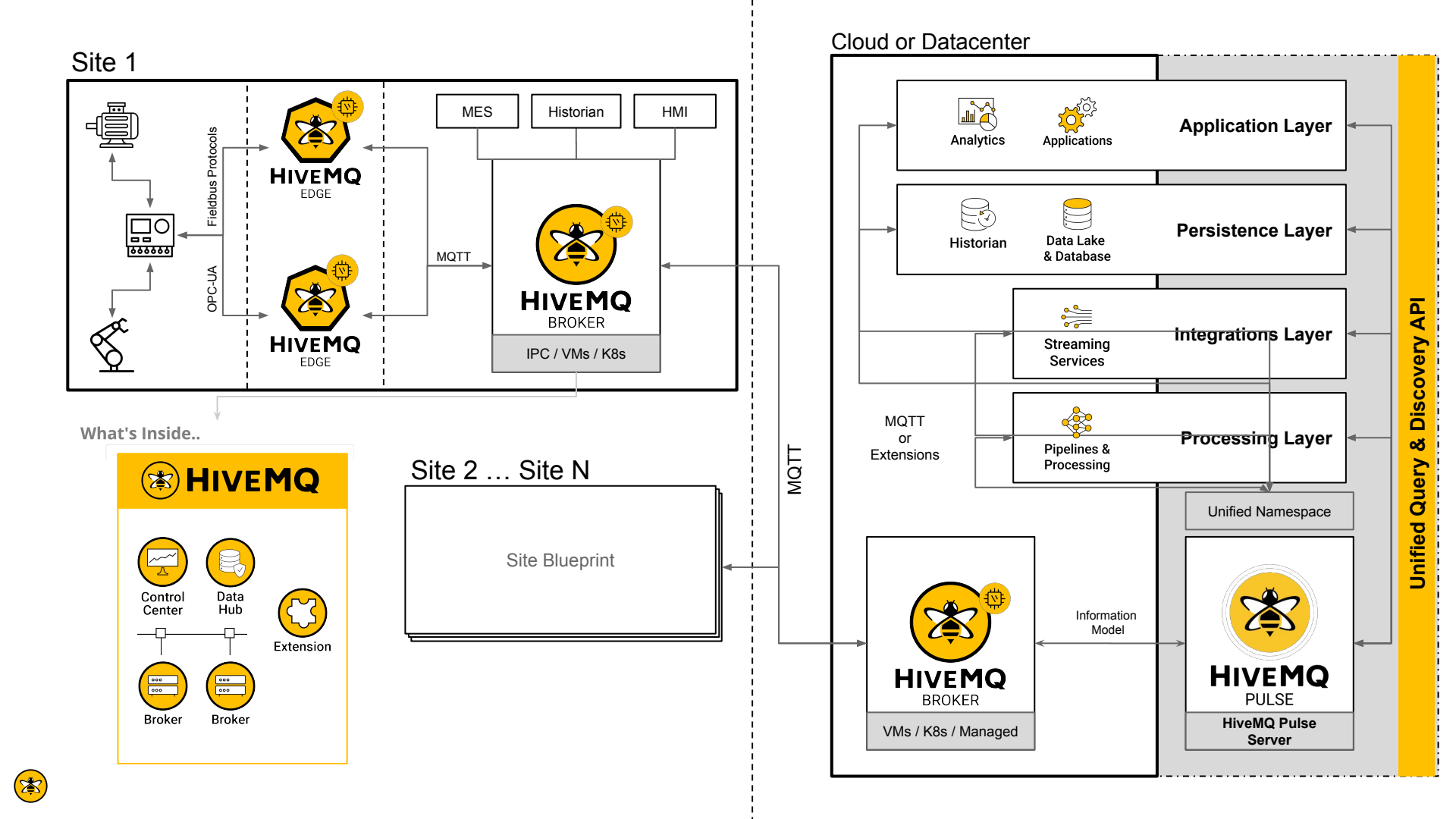
- Bottom-Up Definition
- Loosely Defined
- Multiple UNSes
- Ungovernable

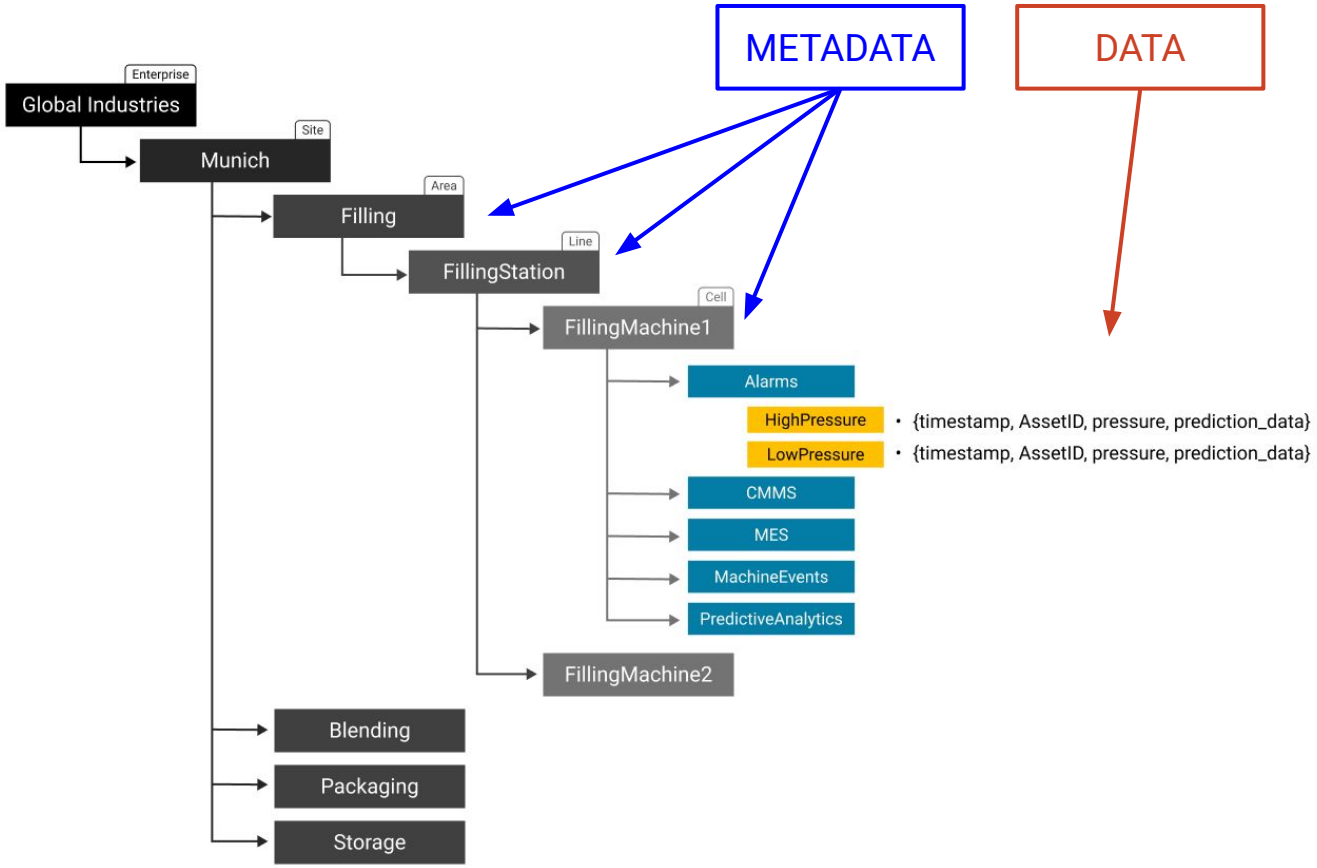
CENTRALLY DEFINED

- Top-Down Definition
- Strongly Typed
- One UNS
- Governable

UNS Approach




Site 1
Fieldbus Protocols
OPC-UA
HIVEMQ
EDGE
HIVEMQ
EDGE
MQTT
MES
Historian
HMI
HIVEMQ
BROKER
IPC / VMs / K8s
What's Inside..
HIVEMQ
Control Center
Data Hub
Extension
Broker
Broker
Site 2 … Site N
Site Blueprint
MQTT
Cloud or Datacenter
Analytics
Applications
Application Layer
Historian
Data Lake & Database
Persistence Layer
Streaming Services
Integrations Layer
MQTT or Extensions
Pipelines & Processing
Processing Layer
Unified Namespace
Unified Query & Discovery API
HIVEMQ
BROKER
VMs / K8s / Managed
Information Model
HIVEMQ
PULSE
HiveMQ Pulse Server


METADATA
DATA
Enterprise
Global Industries
Site
Munich
Area
Filling
Line
FillingStation
Cell
FillingMachine1
Alarms
HighPressure
• {timestamp, AssetID, pressure, prediction_data}
LowPressure
• {timestamp, AssetID, pressure, prediction_data}
CMMS
MES
MachineEvents
PredictiveAnalytics
FillingMachine2
Blending
Packaging
Storage

HiveMQ Pulse Capabilities

Real-Time Events

Leverage an enterprise-grade MQTT backbone for scalable, event-driven data streaming from edge to cloud.

IoT Streaming Governance

Transform data in flight, passing only the most relevant, contextualized data to cloud and enterprise systems.

UNS Data Catalog

Organize and standardize data into a consistent, queryable structure accessible across the enterprise.

Historical Analysis

Make decisions rapidly with the ability to store and analyze specific data sets where they are generated.

AI-Ready

Integrate AI and ML models directly at the edge for predictive insights and improved operational outcomes.

Questions