Unified Namespace:
Real Life Implementations in Manufacturing Industries

Kudzai Manditereza
Sr. Industry Solutions Advocate

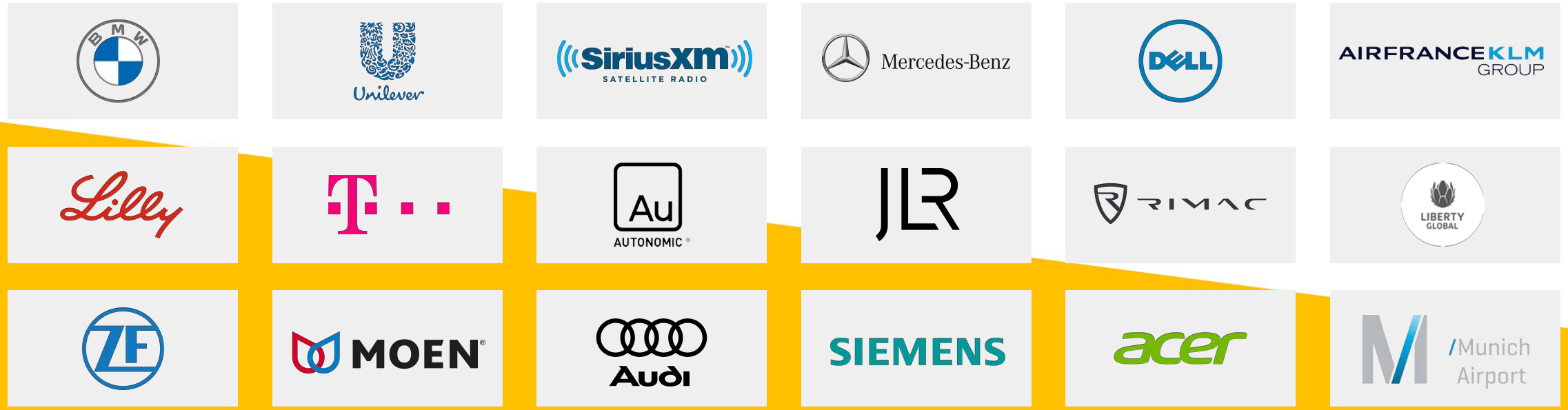
Alejandro Simo
IIoT Solution Architect

Jens Deters
Principal Consultant

Agenda

- Introductions
  - HiveMQ
  - Mayker
  - UNS
- Path from PoC to Full UNS Implementation
- Key MQTT Aspects and Best Practices
- Use Case Examples
- Q&A

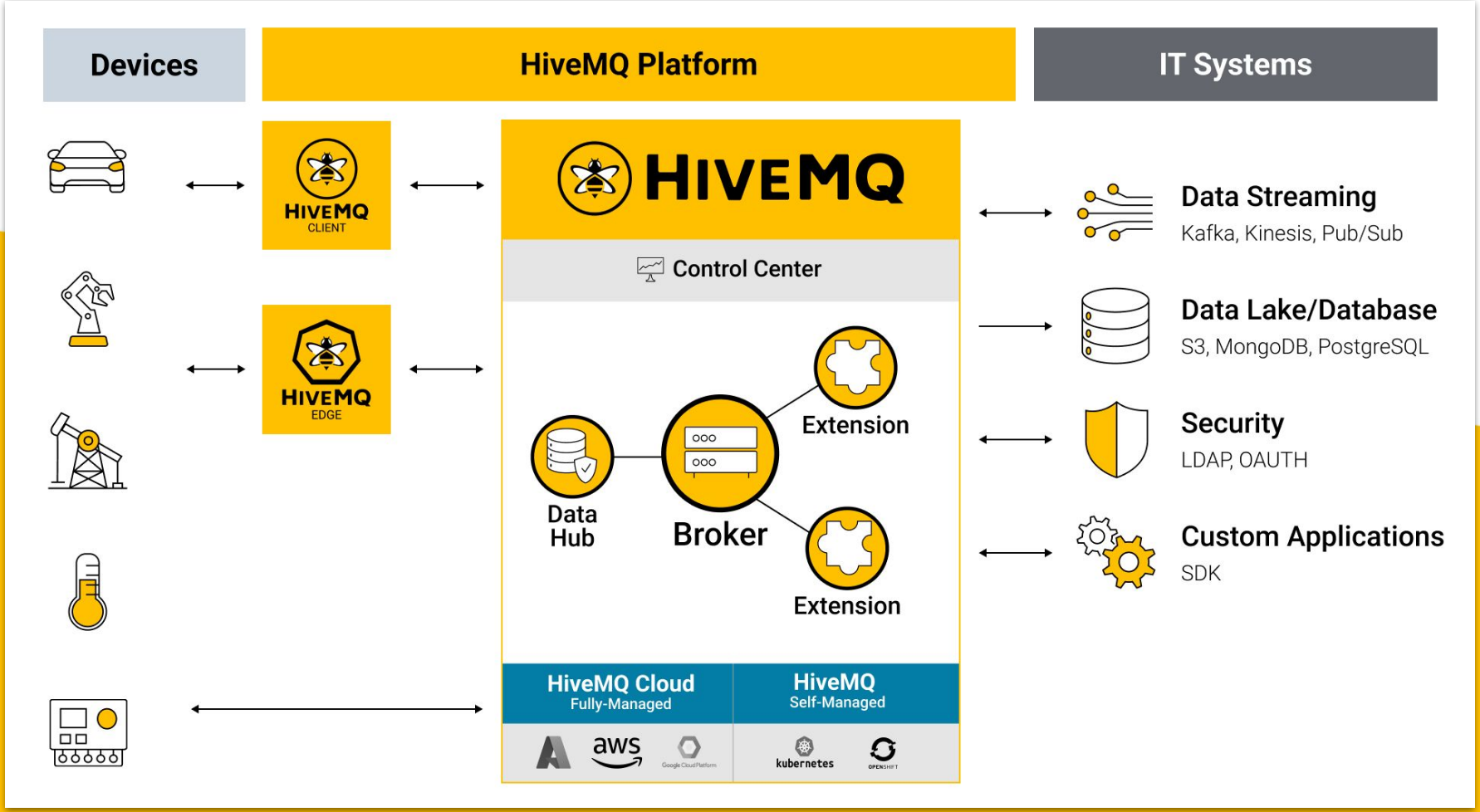
Trusted by Global Industry Leaders



Enabling 5000+ businesses to derive insights from connected devices

HiveMQ Platform Overview

Setting the Enterprise Standard for MQTT



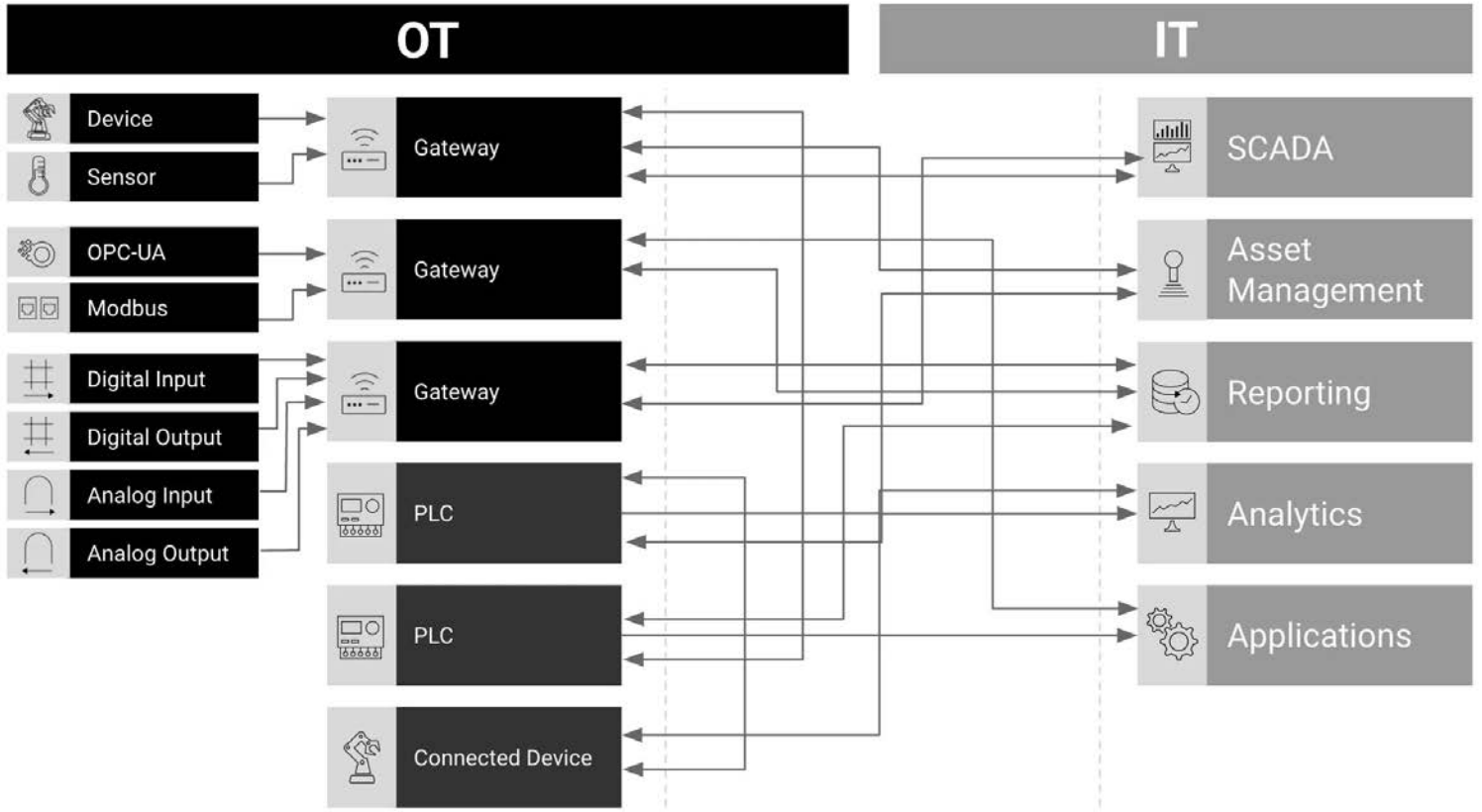
Mayker

- Founded in 2022
- Reference in Belgium with regards to Industry 4.0 Projects
- Unified Namespace frontrunner
- End-to-end partner: from assessment to implementation
- 50 experts
- Offices in Belgium, Netherlands, Luxembourg and Kosovo

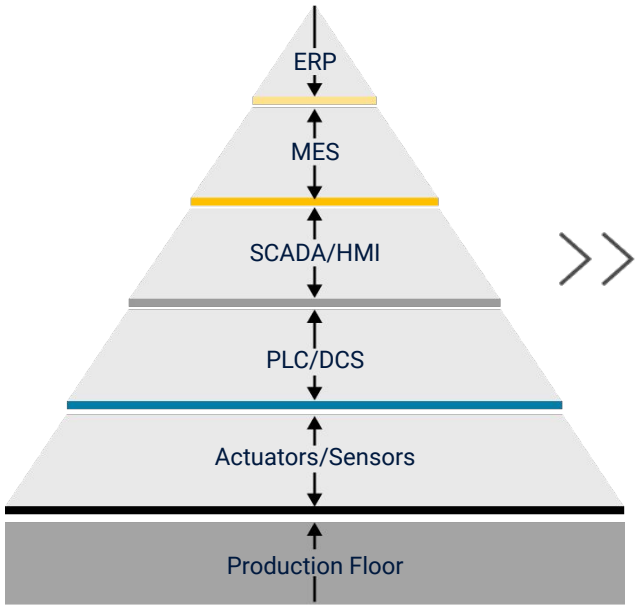
Trusted by great clients

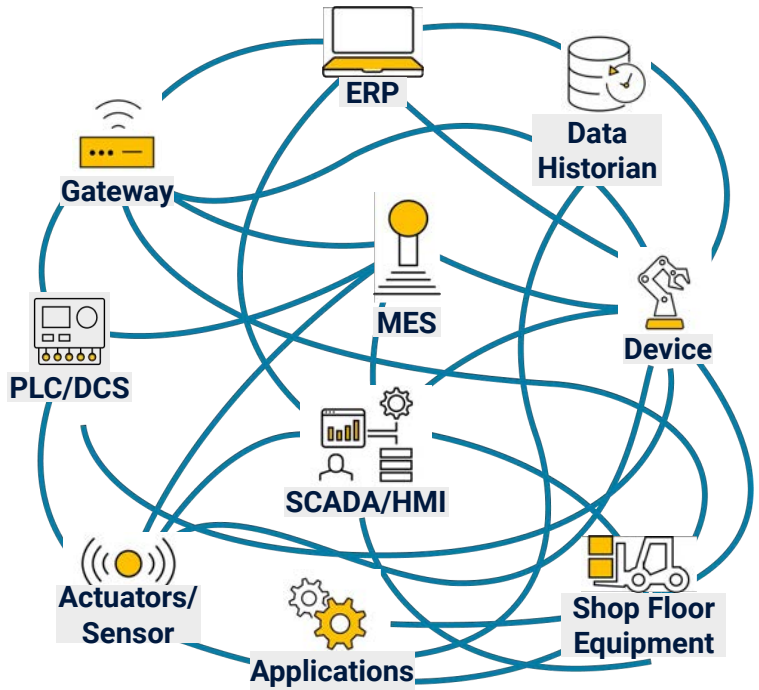
IT-OT Convergence Challenges

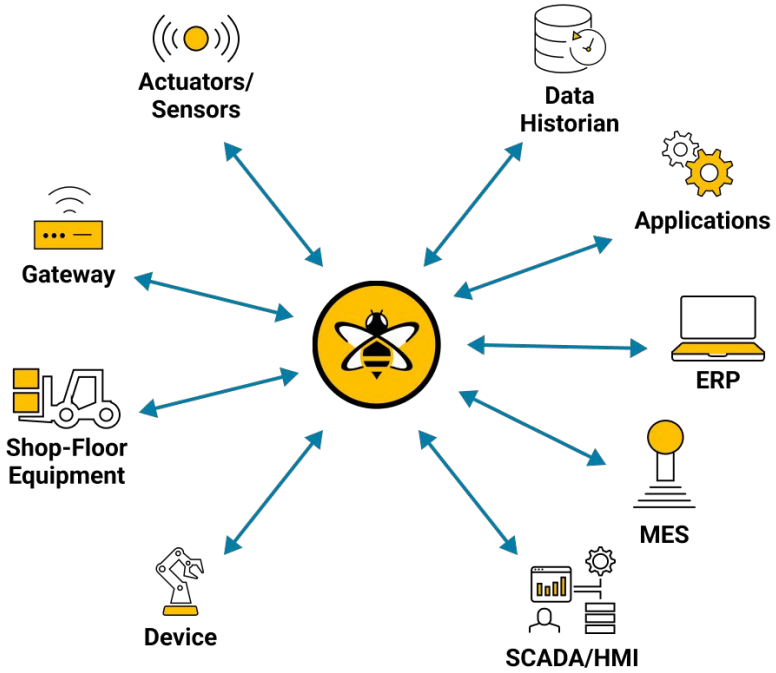
- System Integration
- Manual Processes
- Data Quality
- Governance
- Security Risks
- Scalability & Complexity



The Need for a UNS







ISA-95 | **Distributed Architecture** | **IIoT-native UNS architecture**

The Need for a UNS

Unify Data from OT to IT

- Achieve a single source of truth that reflects the state of the business from OT to IT
- Enhance decision-making and increase efficiency

Scalable Infrastructure

- Ensure long-term agility with a flexible data architecture
- Provide instant insights and scale as your organization grows

Improved Data Hierarchy

- Establish a clear data hierarchy that enhances governance and context
- Seamless across diverse platforms and applications

Enhanced Business Performance

- Centralize information in a single hub to drive innovation
- Optimize processes and improve overall business outcomes

MAYKER

HIVEMQ

MAYKER

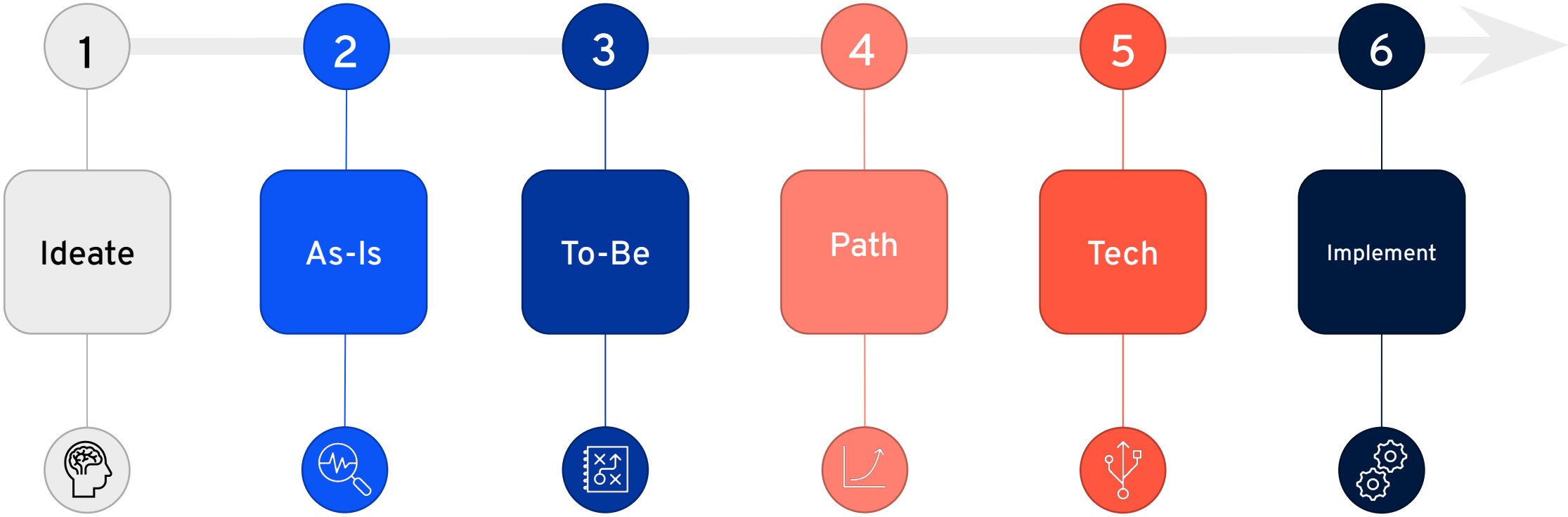
Path from PoC to Full UNS Implementation

Architecture Implementation Framework

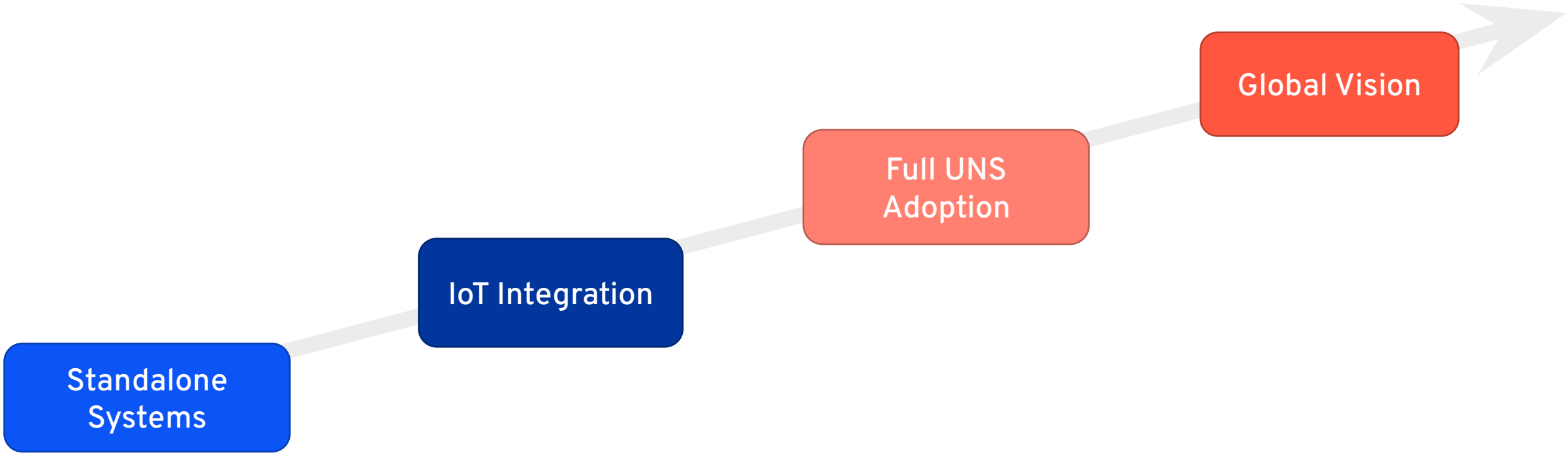
Framework with six milestones for implementing or adapting future architecture

Flexible Engagement

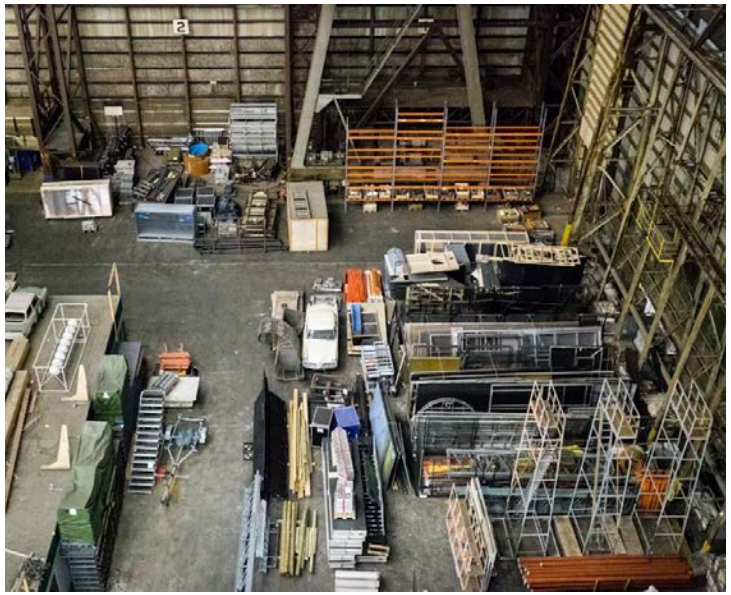
- Tailored involvement based on customer maturity
- Customized to specific customer needs
- Adjustable participation across different phases


1
Ideate
2
As-Is
3
To-Be
4
Path
5
Tech
6
Implement

Evolution of the Unified Namespace

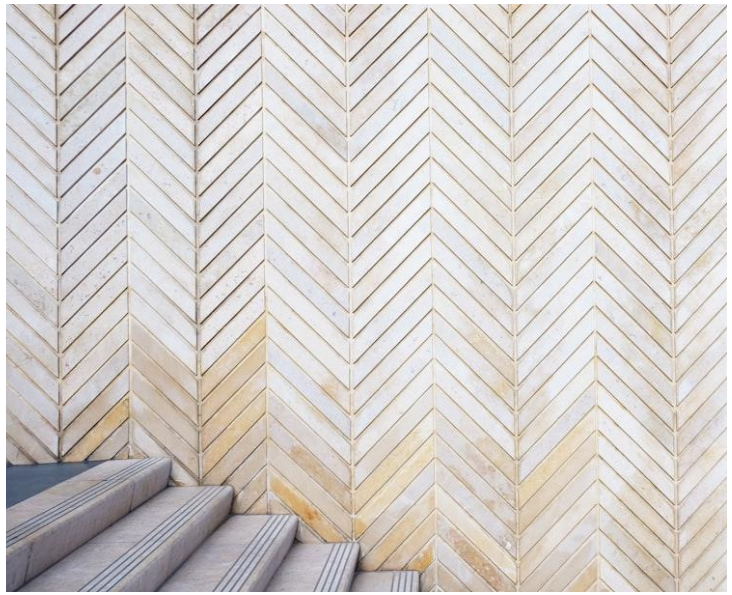


Rollout Strategy



PoV

Setup Broker
Setup Namespace and Standardize tags
Connect Applications and Client Subscriptions



Scaling

Sequential production line onboarding
Expand tag coverage

Optimization & Expansion

Expanding capabilities

Example: UNS Implementation in Food & Beverage Industry

Business Case: The client needed a scalable, secure Unified Namespace architecture to centralize data, enhance operational efficiency, and prepare for future AI/ML integration.

As-Is

- Connections between Shopfloor, SCADA, MES, Historian, and Cloud data lake.
- Concerns about the scalability of the current architecture.
- Need for:
  - Resilient IT/OT architecture.
  - Governance framework.
  - Address security risks.

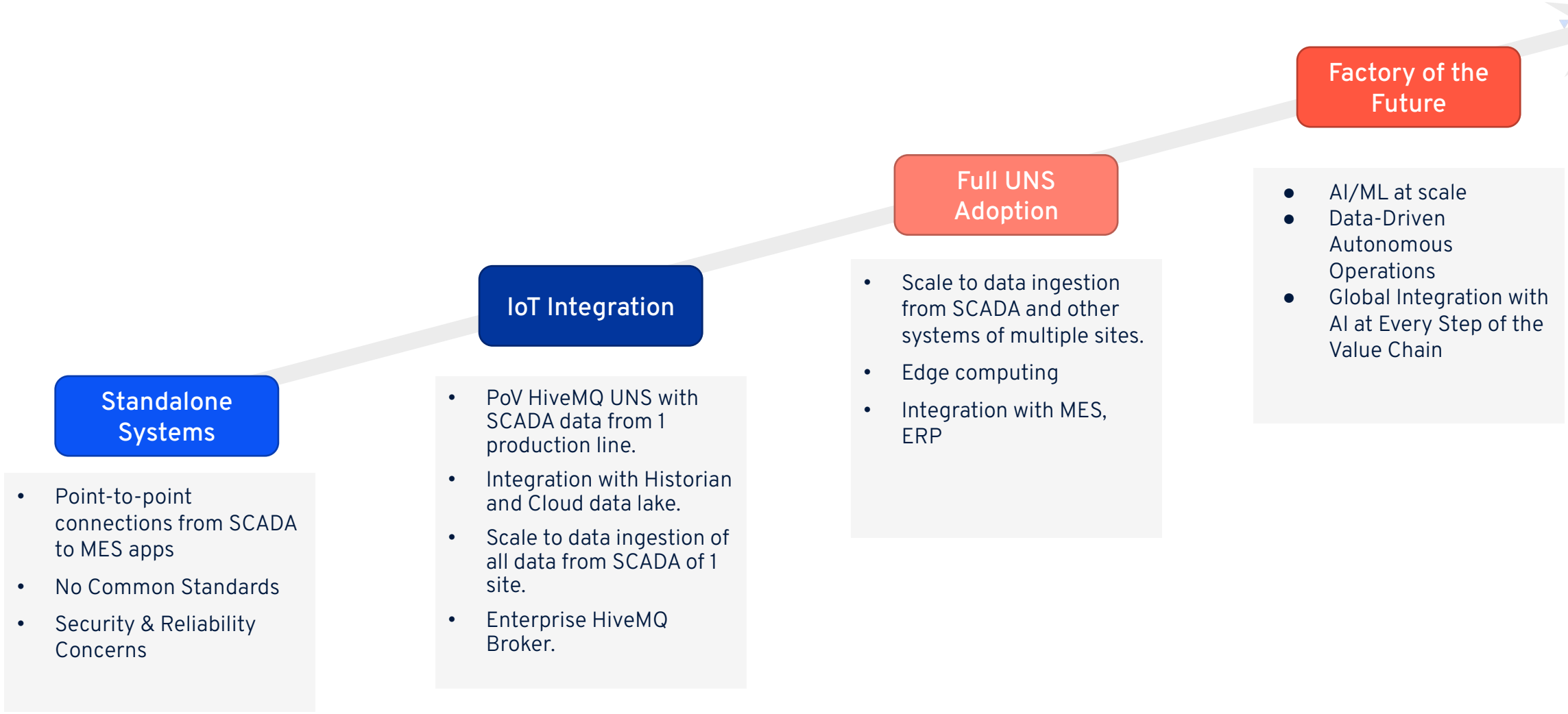
To-Be

- UNS Architecture
- Defined IT/OT Team Responsibilities

Technology

- HiveMQ Cloud

Example: UNS Implementation in Food & Beverage Industry



Best Practices for Topic Tree Design

Topic

Should contain information for routing/filtering.

Payload

Carries the data.

- If the **topic contains semantics**: the information about the communication structures is available outside the payload.
  → This also allows effective filtering.
- Verify using existing specifications guides already in the industry, like **ISA95** or **Eclipse Sparkplug**

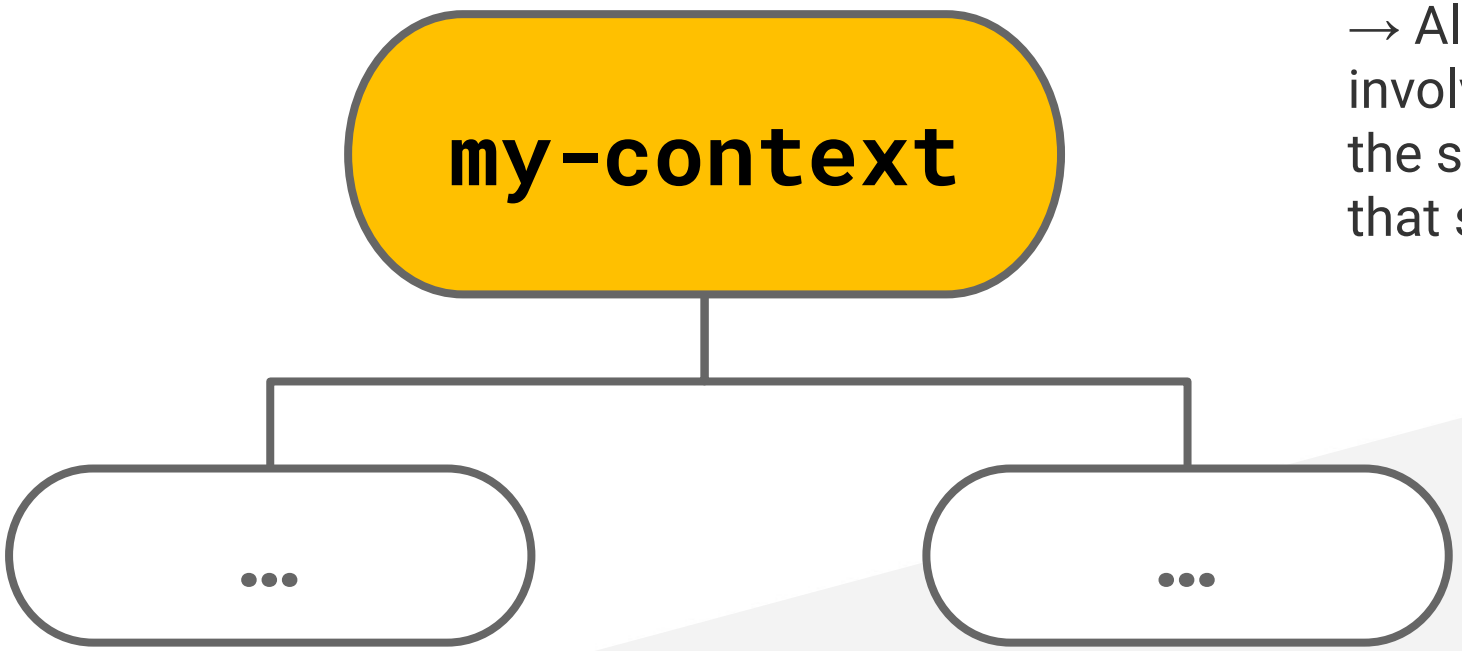
Structure and Hierarchy

Use a logical, hierarchical structure that reflects your organizational or system architecture

Start with broad categories then get specific:

```
enterprise/site/area/production-line/work-cell/equipment/{data_type}
```

Define your namespace

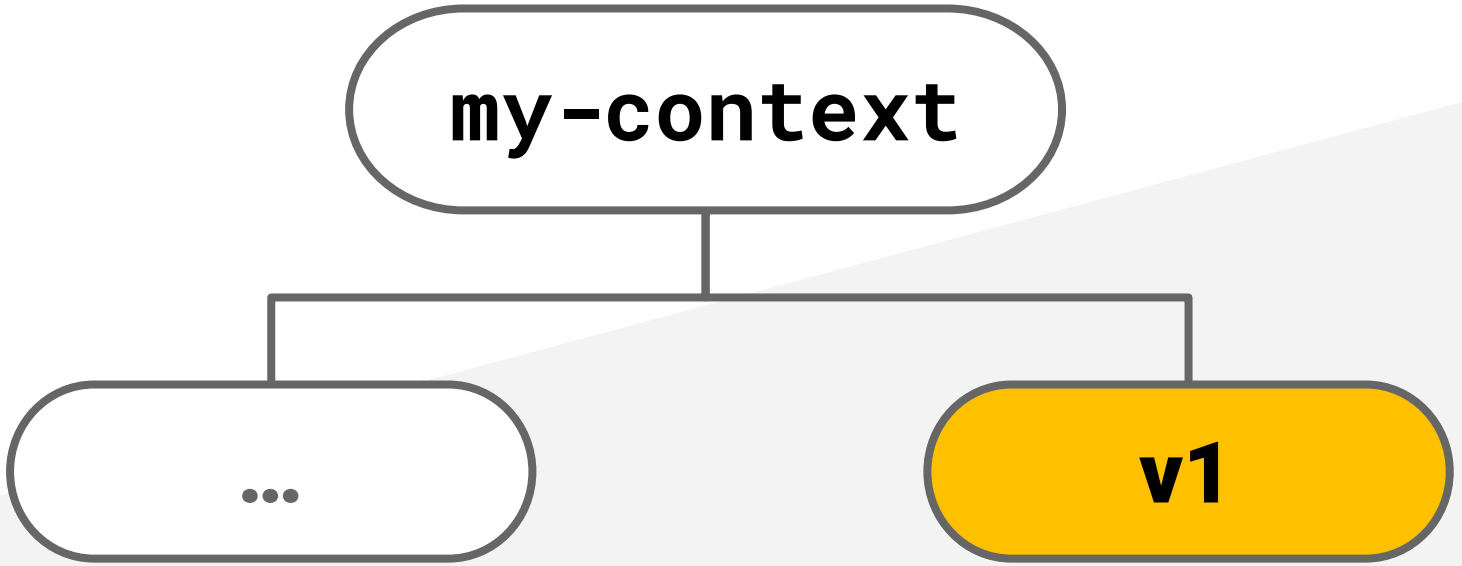


→ All devices and applications involved know, understand, and use the same terms and relationships in that space.

`enterprise/site/area/production-line/[...]`

Enable Versioning

- **Future proof!**
- Consider to use a version string to identify the effective **topic structure and payload schema** (common pattern for Rest APIs) if it is likely there are future modifications
- Eclipse Sparkplug has a combination: **`spBv1.0/`**



`enterprise/{version}/site/area/production-line/[...]`

Avoid leading /

- MQTT topics always do start with a topic-level!
- **A leading slash creates** an unnecessary first-level topic that is essentially **an empty string**

Avoid metadata in Topics

- **Avoid embedding metadata** (e.g., timestamps or IDs) in topics; instead, include it in the payload.
- **Exception**:
  When metadata is critical for routing or filtering.

Avoid Key/Value Pairs

Using key/value pairs in topics (e.g., **`temperature/20.5`** or **`status/online`**) creates a nearly infinite number of possible topics.

This leads to **unmanageable topic trees** and makes it harder to scale and maintain as well as filtering

`enterpriseA/site1/area1/line1/cell1/machine1/status`
`online`

`enterpriseA/site1/area1/line1/cell1/machine1/temperature`
`20.5`

Avoid Blanks

- More **prone to errors** when being typed or copied
- Blanks can **complicate parsing** and handling (e.g. config files, Scripts)
- Integrating with web technologies or file systems may require encoding (“%20)
- **Use underscores _ or dashes -**

Avoid uppercase letters

- **MQTT topics are case-sensitive!**
- Uppercase letters increases the risk of mismatched topics due to case sensitivity errors
- Avoid “camelCase” use “snake_case”

Avoid ambiguous terms

- Use a **consistent naming convention** that defines how to structure topics, and the avoidance of uppercase letters.
- **Document and enforce these conventions** within your team or organization to ensure everyone follows the same practices, minimizing the risk of errors

Mapping ISA-95 Levels to Topics

Level 0 (Physical Processes)

Real-time data from physical processes.

enterprise/site/area/production-line/machine/sensor

enterprise/site/area/production-line/machine/actuator

```
{
      "value": 85.5,
      "unit": "C",
      "Timestamp": "2024-12-02T10:00:00Z"
}
```

Level 1 (Equipment Control)

Data from controllers like PLCs.

enterprise/site/area/production-line/machine/controller/status

enterprise/site/area/production-line/machine/controller/command

Mapping ISA-95 Levels to Topics

Level 2 (Supervisory Control)

SCADA data, alarms, events.

`enterprise/site/area/production-line/machine/scada/alarms`

`enterprise/site/area/production-line/machine/scada/metrics`

Level 3 (Manufacturing Operations Management)

MES data, work orders, quality checks.

`enterprise/site/area/production-line/mes/work-order`

`enterprise/site/area/production-line/mes/quality`

```
{
    "orderId": "WO12345",
    "product": "WidgetA",
    "quantity": 500,
    "dueDate": "2024-12-15T17:00:00Z"
}
```

Level 4 (Business Systems)

ERP-level data, inventory, schedules.

`enterprise/site/logistics/inventory`

`enterprise/site/scheduling`

Use Cases

Food and Beverage Industry

CHALLENGES & SOLUTION

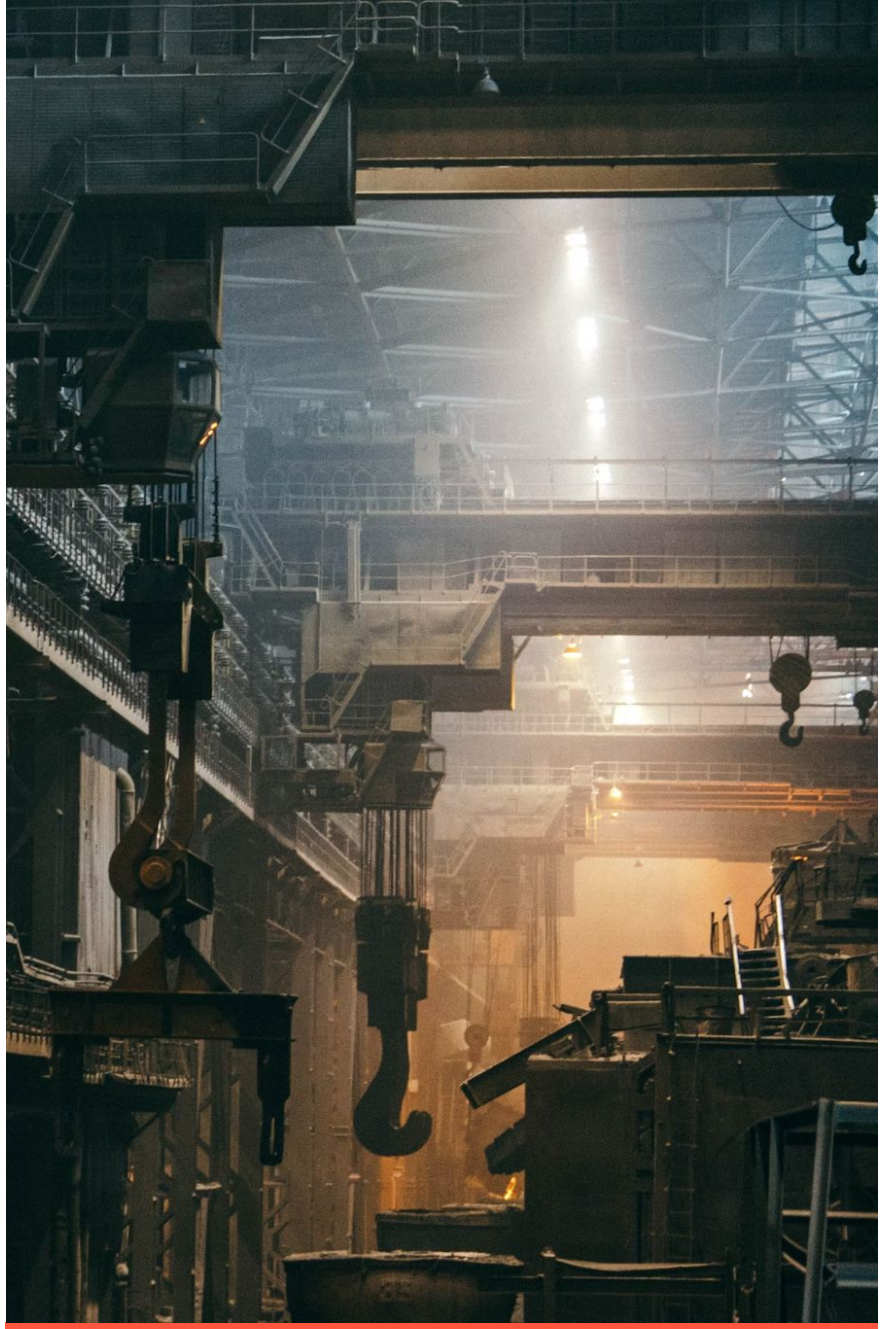
Challenges

- End-to-end IoT architecture missing
- Lack of governance
- Not scalable data collection systems
- Upcoming greenfield plants

Solution

- HiveMQ broker implementation with UNS
- Edge computing solutions
- Integration with cloud data analytics pipeline.
- MES integration

MAYKER



Remote Assets

CHALLENGES & SOLUTION

Challenges

- Data collection across remote sites and equipment
- Diverse and non-standardized OT/IT landscape
- Lack of real-time insights

Solution

- Implemented a Unified Namespace (UNS) architecture
- Standardizing data flows across remote locations
- Connect devices from legacy systems to central UNS
- Enabled real-time data collection

MAYKER

PHARMA - SMART MANUFACTURING

Medicine company turning science into healing to make life better for people around the world.

Challenges

- Connectivity gap across lab and manufacturing facilities.
- Lack of connectivity led to potential data compliance challenges

Results

- Connected several hundred instruments across countless laboratory and manufacturing sites.
- Automatic data capture and flow meets regulatory requirements.
- Standardization across multiple sites, reducing paper processes and streamlining workflows.

WATER & WATER RECYCLING

love every drop
anglianwater

Largest water and water recycling company in the UK

Challenges

- Improve customer service, environmental performance, and operational efficiency
- Bring disparate data into a single source of truth

Results

- Better insight into asset performance
- Improved integration between IT and OT environments
- Maintained a high level of security

Q&A

Thank You!