



# Implementation of event-driven Industrial IoT-Systems with Azure IoT Edge and NATS.io

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Schaeffler Technologies AG

## Agenda

- 1 IT@Schaeffler-Framework
- 2 NATS.io Messaging System
- 3 Open Platform Communications Unified Architecture
- 4 Gateway Development
- 5 Workshop Results
- 6 Digital Production System

## Connectivity and integration are the foundation of Smart Factories

Why

All relevant use cases for a Smart Factory require **access to current and high-quality data**, whether it is transparency about system states, prediction of problems and potential solutions, analytics, machine learning or **autonomous production**.

What

- Standardization of edge **hardware** to a clearly defined, manageable number of alternatives → Equipment
- Delivery of data in standard formats via standard **protocols** → Gateways
- A unified, secure and scalable data **distribution platform** to connect many agents → Messaging System

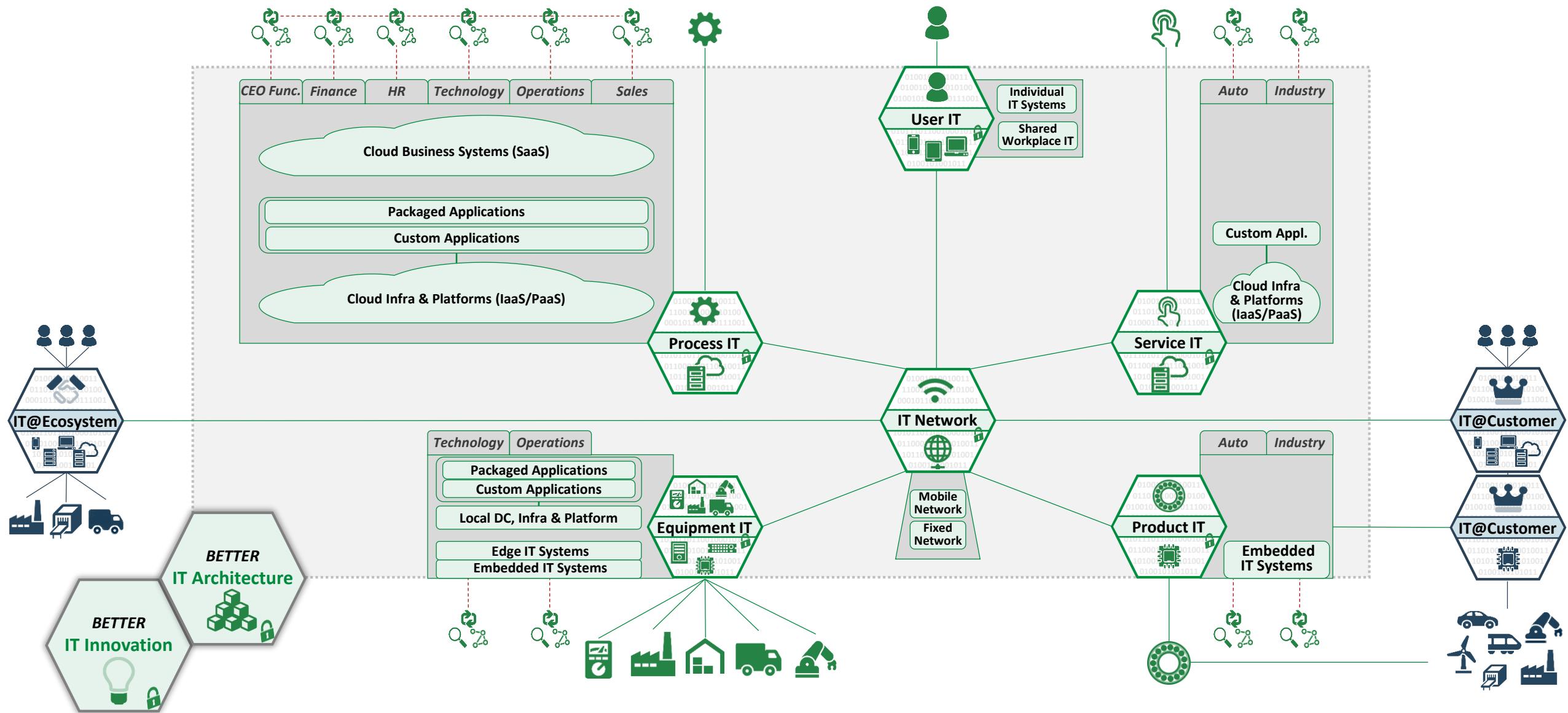
Architecture

How

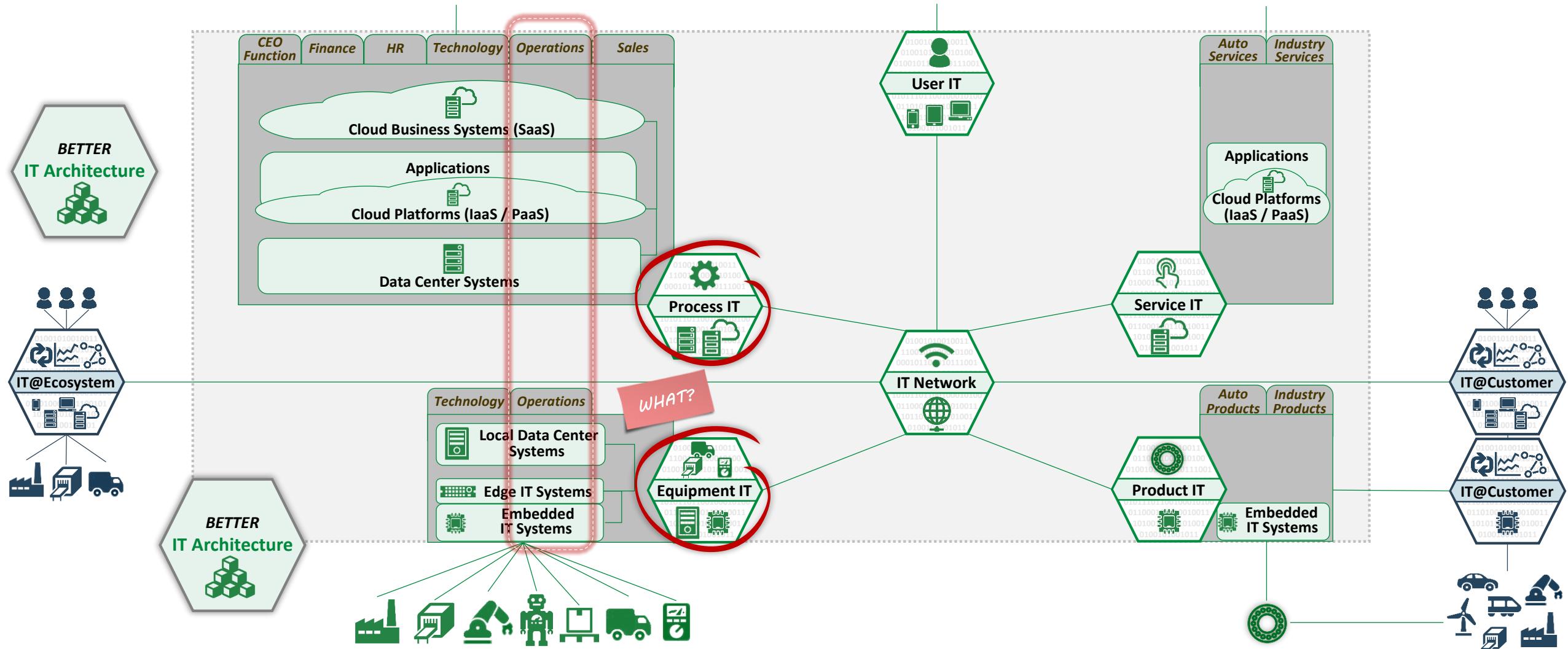
- The requirements for IT infrastructure need to be clarified
- The required solution components and infrastructure need to be assigned to Product Owners who provide
  - Documentation on the features and ‘unique selling points’ of their products
  - Operating models incl. roles and responsibilities
  - Dates for availability of the production-ready versions

Operating  
Model

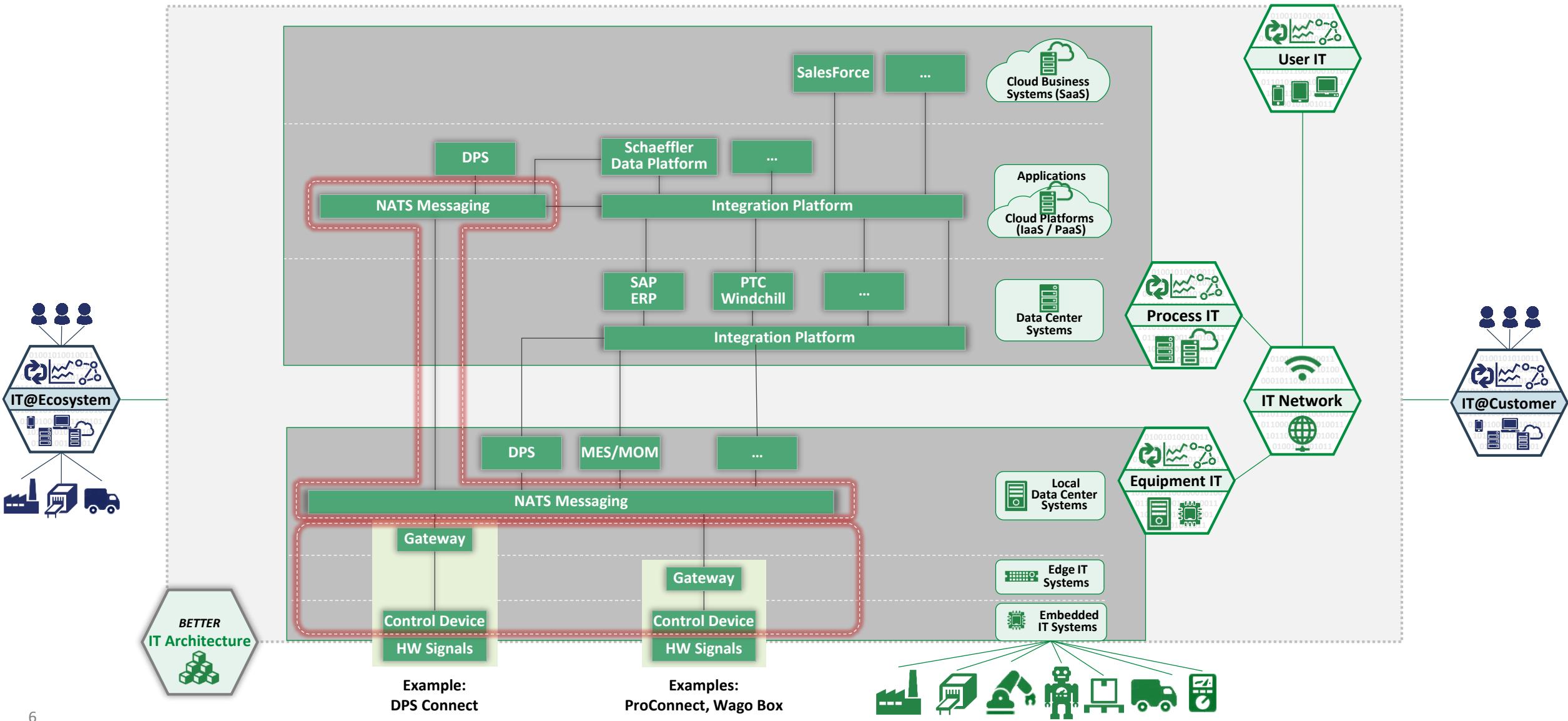
# Better IT Architecture – System Deployments across distributed Cloud and Edge Environments



# IT@Schaeffler - Context



# IT Architecture – Context Production IT – Equipment IT Integration



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## SPACE SHORTCUTS

## DevOps team delegates

PAGE TREE

- DevOps team delegates
  - Documentation
    - Server and Infrastructure
    - MicroServices
  - Documentation Files
  - Build & Release Documentati...
  - Monitoring & Logging
  - Azure Cloud
  - Containerized Environment
  - Export / Import of Locations ...
  - Export of Email Adresses for J...

▼ NATS

- NATS Worldwide Rollout Ta...
  - NATS Account Server and L...
  - Nats and PLS Exporter Bind...
  - NATS Cloud Cluster
  - Nats Cluster HZA

➤ NATS Concepts

  - NATS Configuration

➤ Processes

➤ Public meeting notes

[Dashboard](#) / DPS DevOps & Infrastructure / Documentation  

 Save for later  Watch  Share ...

NATS

Created by Matthias Wutke, last modified on May 29, 2019

This page contains all topics regarding NATS and NATS-Streaming in relation to development, operations and monitoring/logging.



## Contents

- NATS Worldwide Rollout TaskList
  - NATS Account Server and LeafNode Config
  - Nats and PLS Exporter Bindings
  - NATS Cloud Cluster
  - Nats Cluster HZA
  - NATS Concepts
  - NATS Configuration

## Additional Documentation

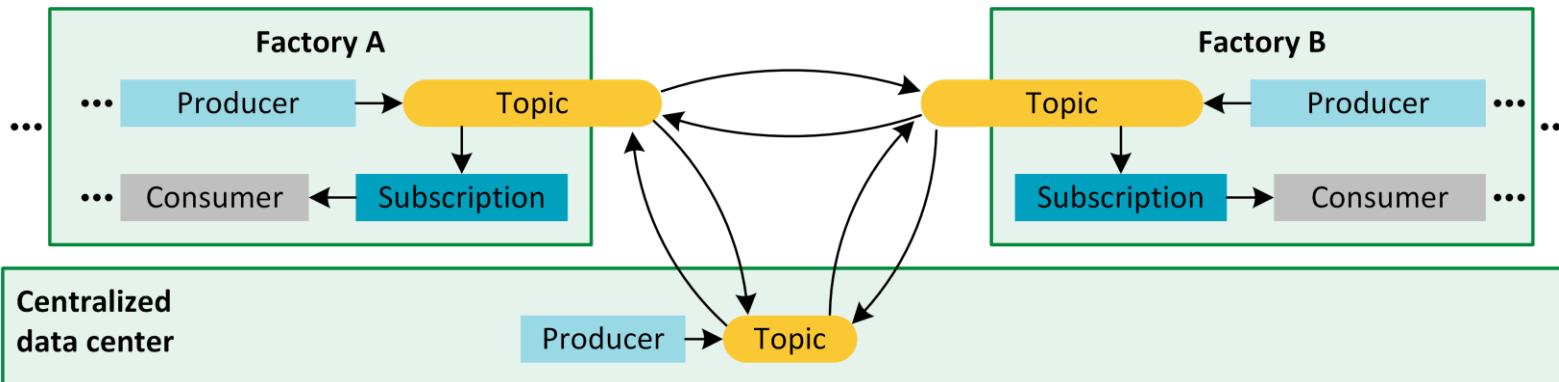
- [NATS on Github](#)
  - [NATS Homepage](#)
  - [Docker NATS-Streaming](#)
  - [Docker NATS-Server](#)
  - [Docker NATS-Prometheus-Exporter](#)

## Popular Labels

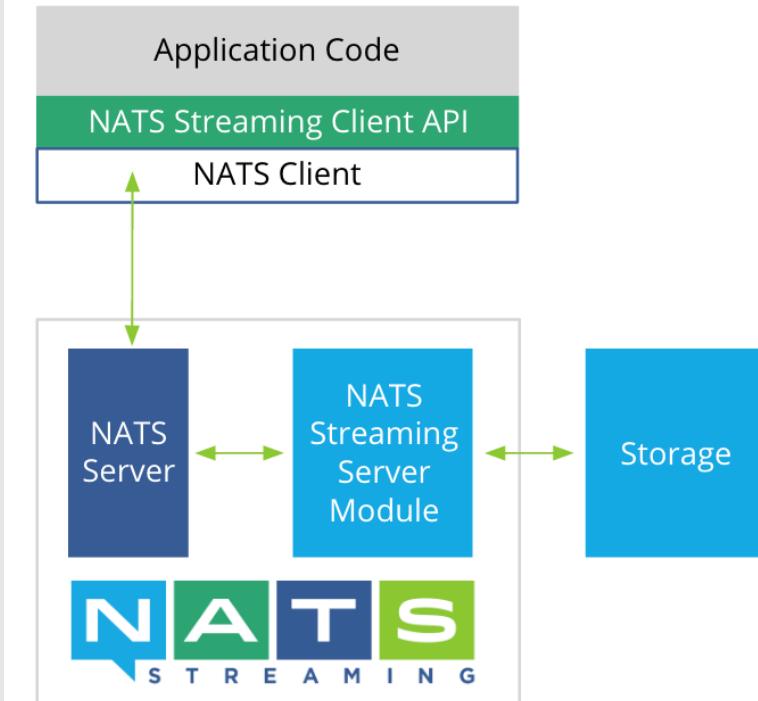
acceptance account ad add agent aks  
apppool azure backend build check

## Basic NATS concepts

NATS: Coupling of various NATS clusters with the geo-replication concept



Integration of a NATS Client in your application

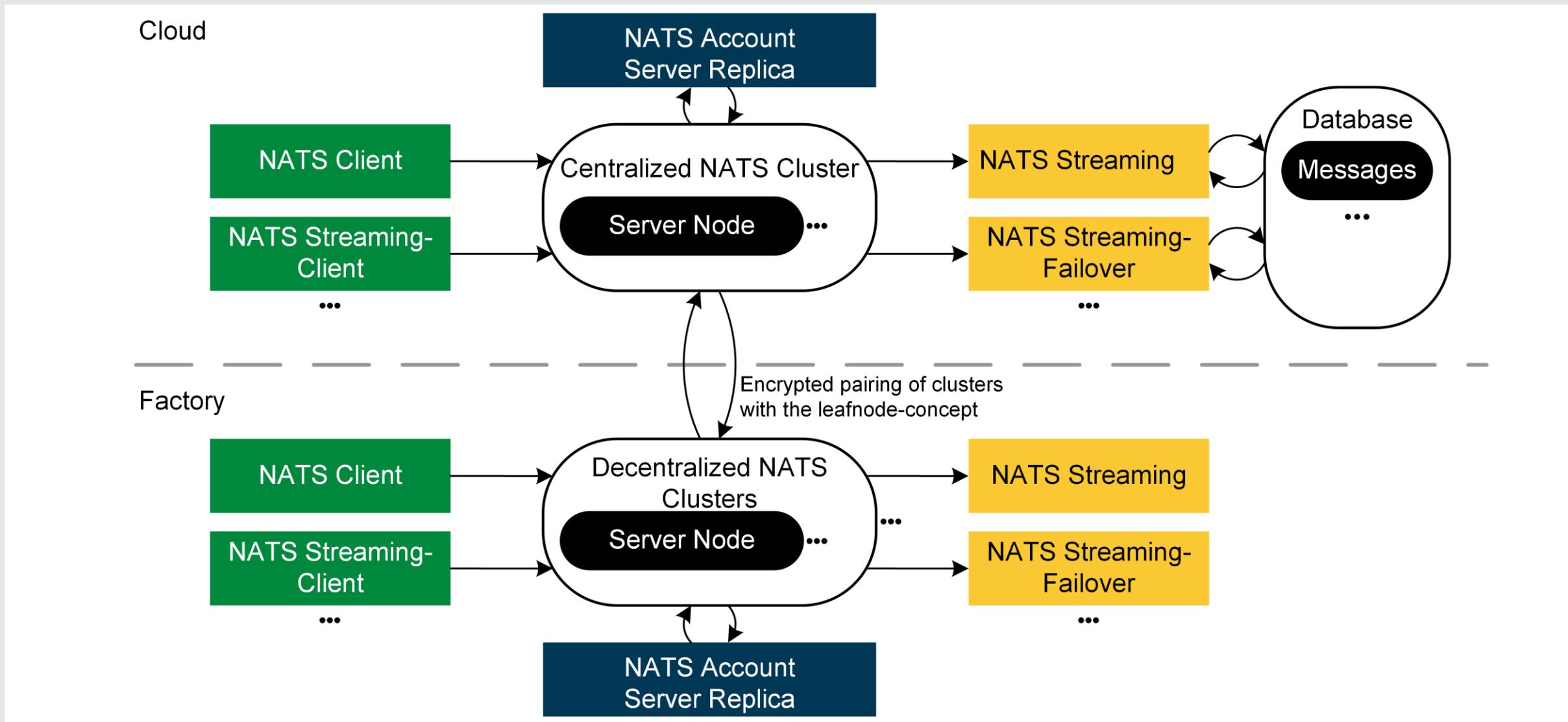


## Why NATS.io?

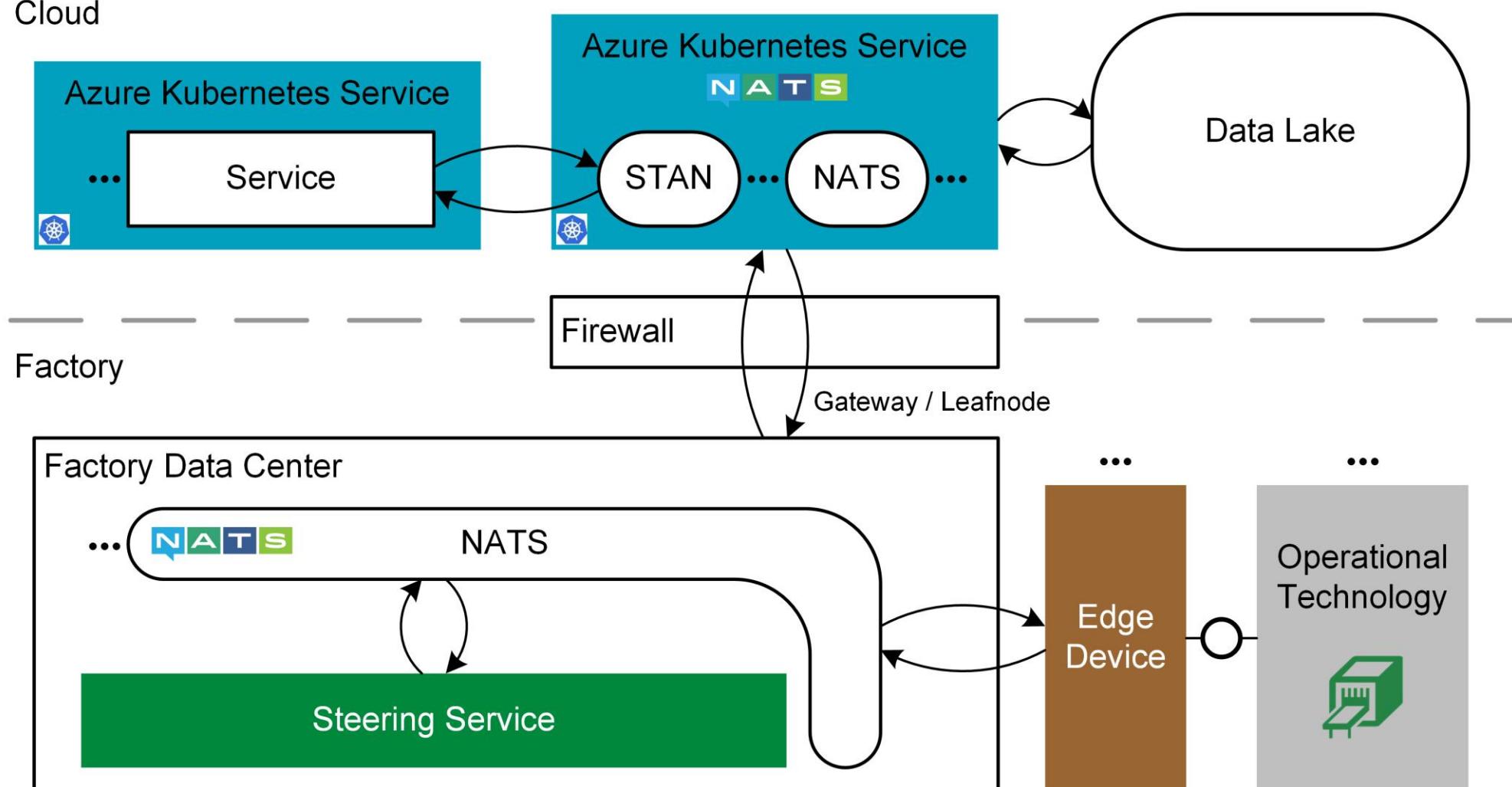


- Fast, scalable
- Easy to use
- Runs on Linux and Windows Operating Systems
- Lightweight
- Queue groups
- Provides persisting over NATS Streaming (STAN)
- Auto-Discovery automatically exchanges server topology
- Clients can failover to new servers that weren't originally configured
- NATS server clusters dynamically adjust to new or removed servers
- Rolling updates possible
- ....
- <https://www.cncf.io/wp-content/uploads/2019/09/NATS-CNCF-Webinar-Sep-2019.pdf>

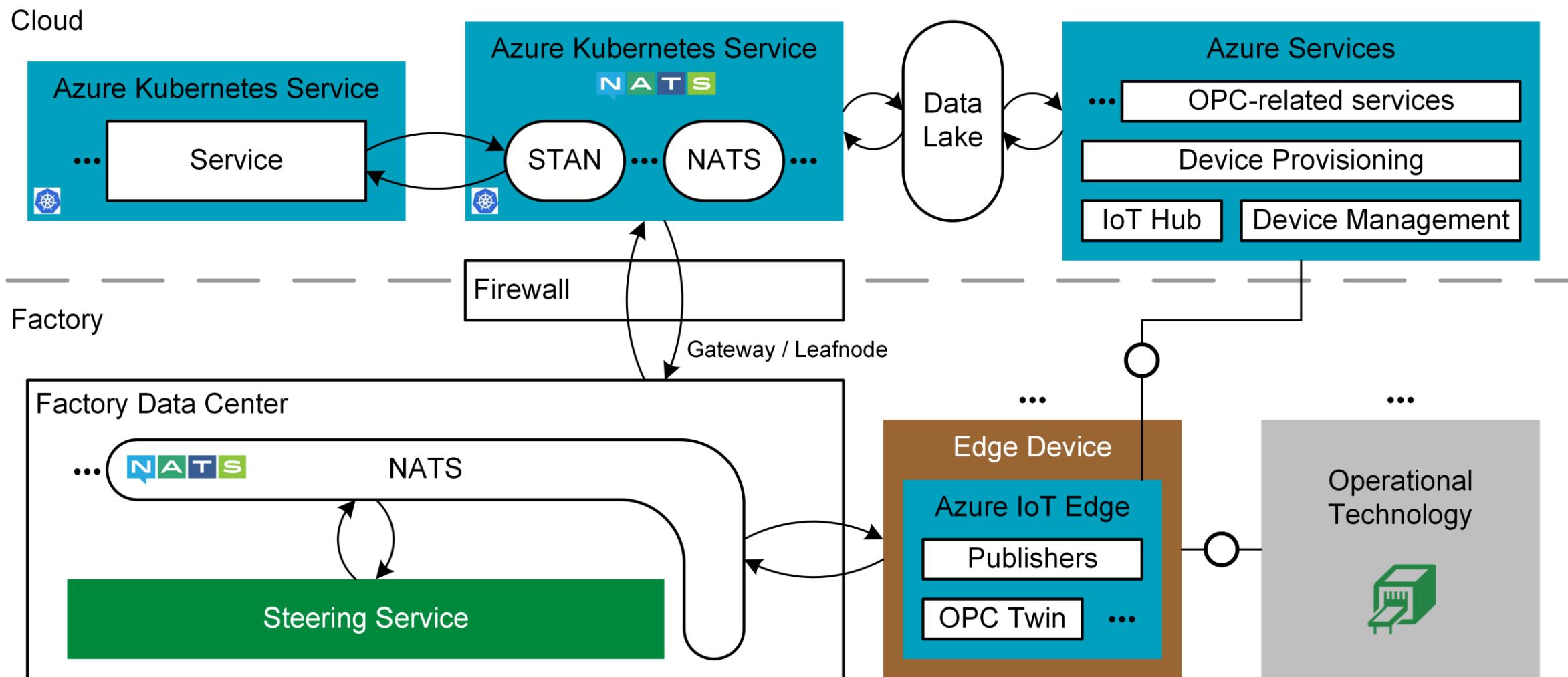
## Alignment of centralized and decentralized NATS Clusters



## Current NATS Deployment



# IoT Hub with NATS – using IoT Hub and IoT Edge for the management of devices



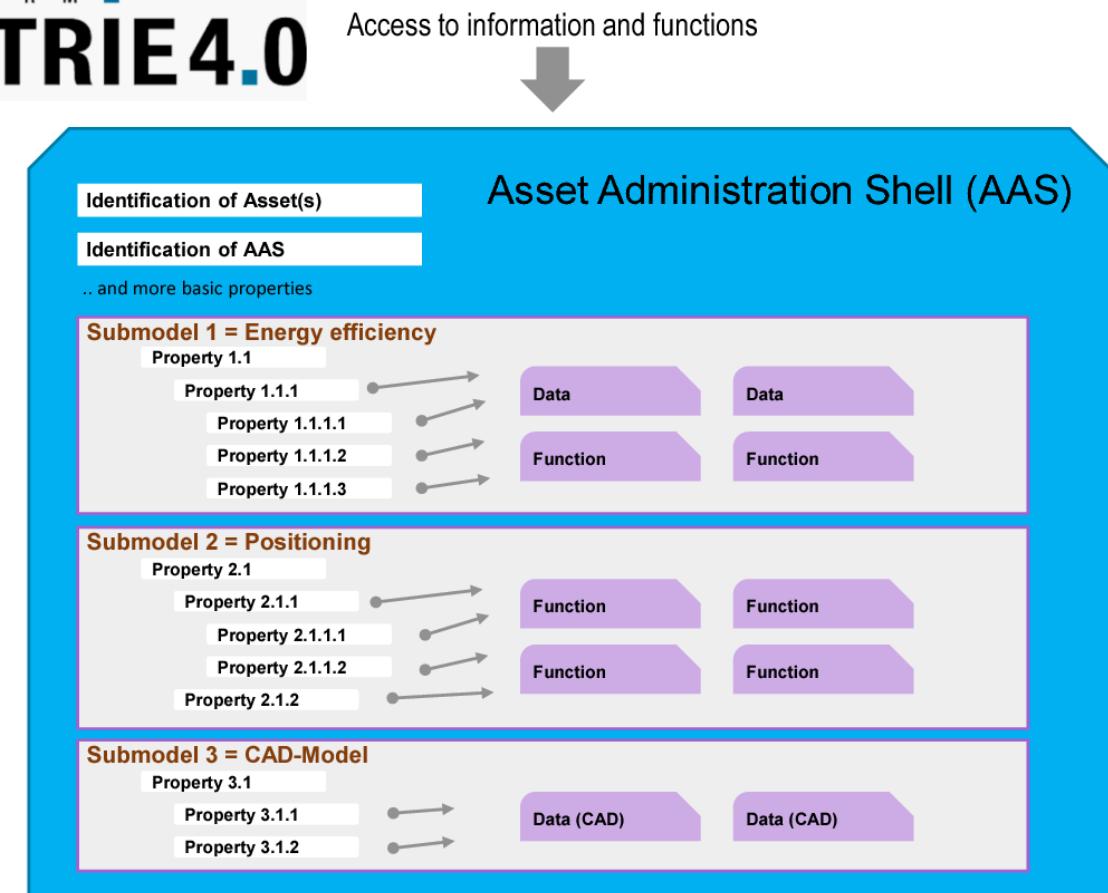
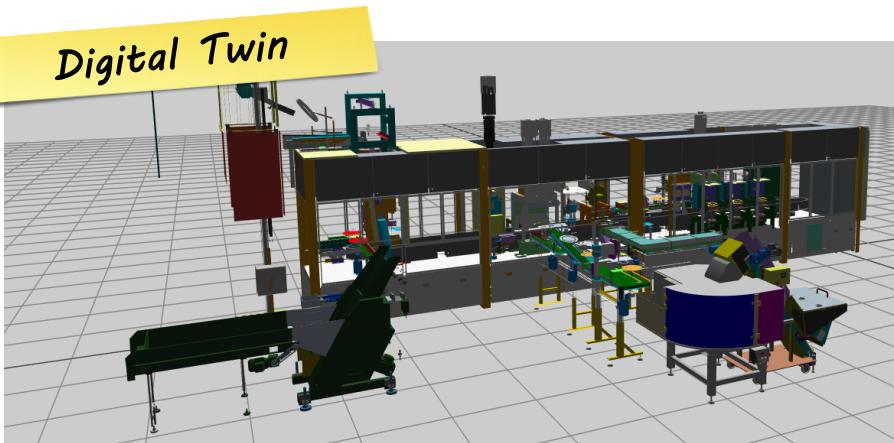
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Schaeffler Herzogenaurach,  
Bearing Assembly Line

## Asset Administration Shell – Realisation of a Digital Twin



Strict, standardized data format

Realtime data

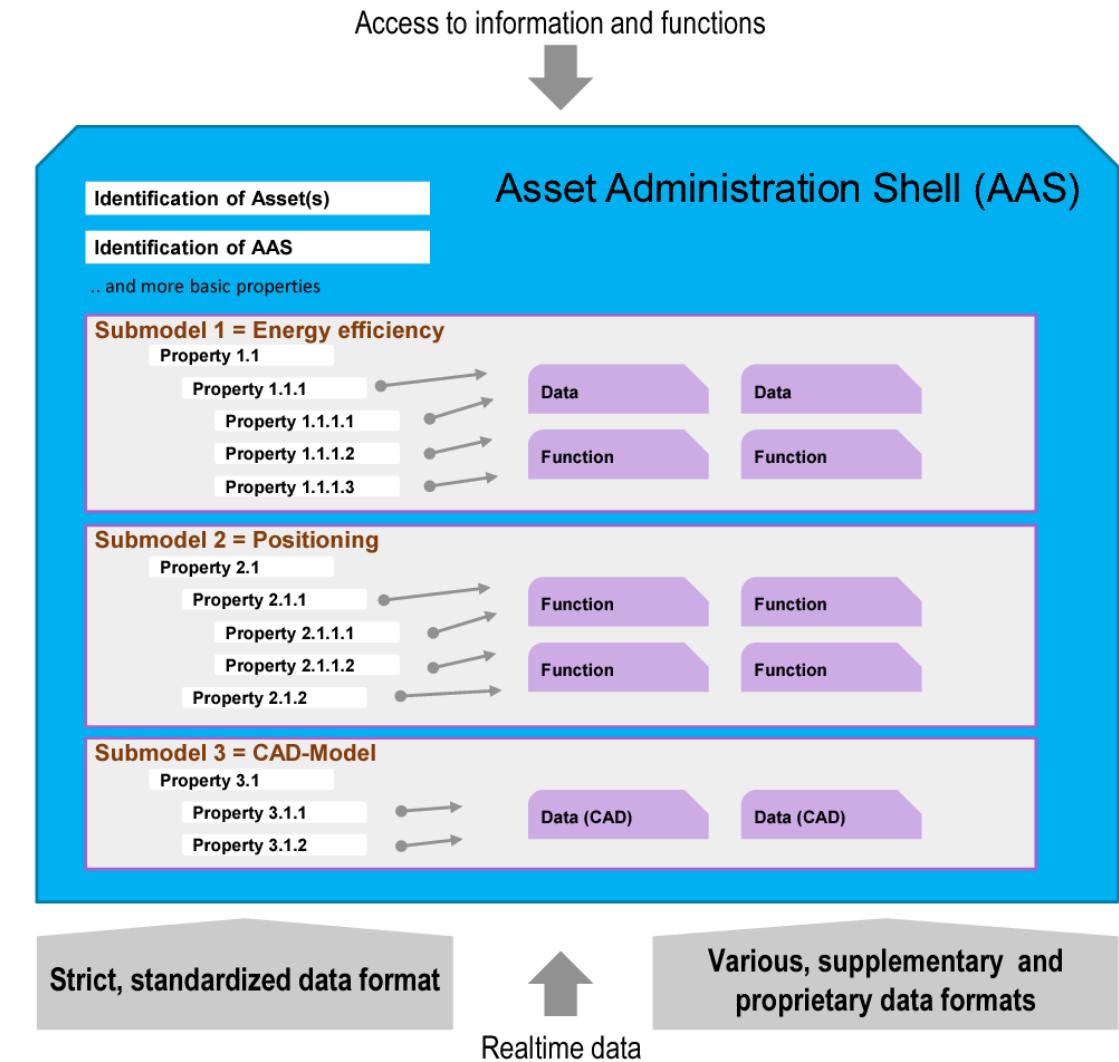
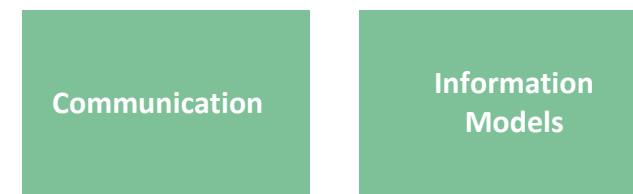
Various, supplementary and proprietary data formats

## Open Platform Communications Unified Architecture



“USB for automation components”

- ▶ Information centric architecture
  - ▶ M2M-Communication
  - ▶ Information modeling
- ▶ OPC UA is
  - ▶ Platform independent
  - ▶ Standardized in IEC 62541



## Azure IIoT: Industry leading OPC UA Support



### The Industrial Interoperability Standard

Microsoft is a member of the OPC Foundation since 1996

Microsoft supports OPC UA on Azure since 2016

#### Interoperability

Vendor, Platform and OS Independent

Open Source on GitHub (**Many Microsoft contributions**)

Discoverable Services Oriented Architecture (SOA) independent of the transport method

Owned by a Non-Profit (**OPC Foundation**)

50M installed base and exponential growth

#### Data Modelling

Rich data modeling preserves source context

Vendors can extend the data model of each product (Companion Specification)

Maps to field bus protocols, e.g. BACNet | PLCopen | MTConnect | ...

#### Security

Secure Design from group-up

Based on **open security standards**

**Authentication | Encryption**

Evolves as security technologies evolve

Vendors/Users can choose level of security

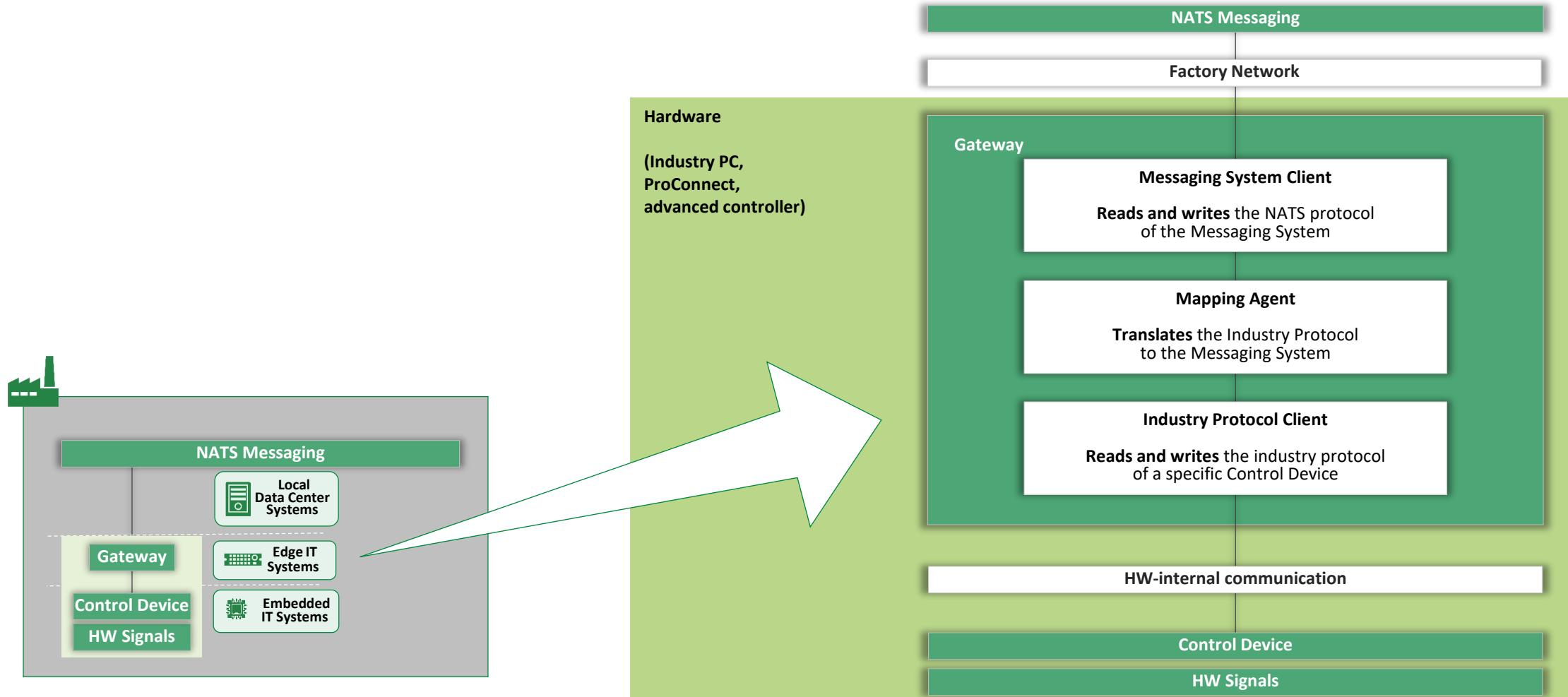
Easily acceptable by IT departments

[github.com/Azure?q=OPC](https://github.com/Azure?q=OPC)

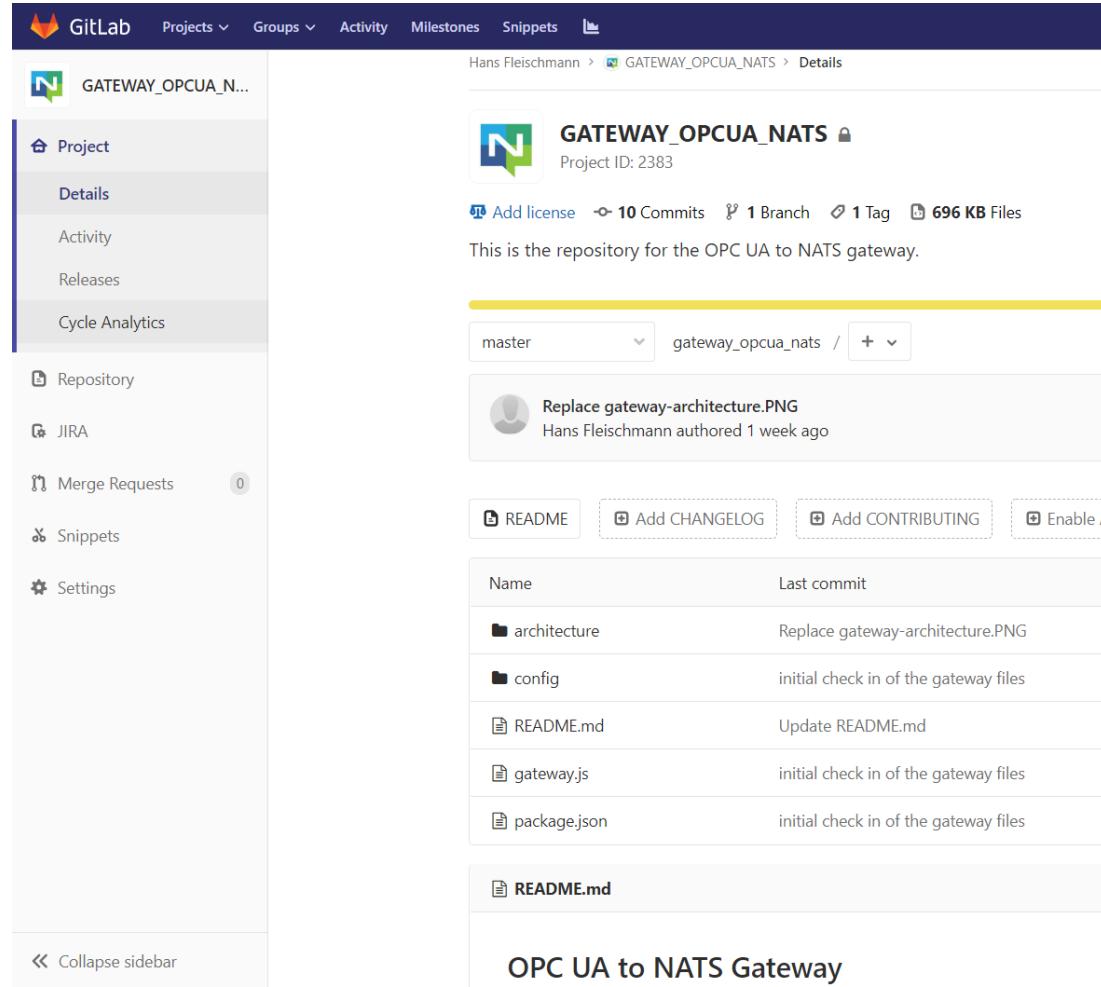
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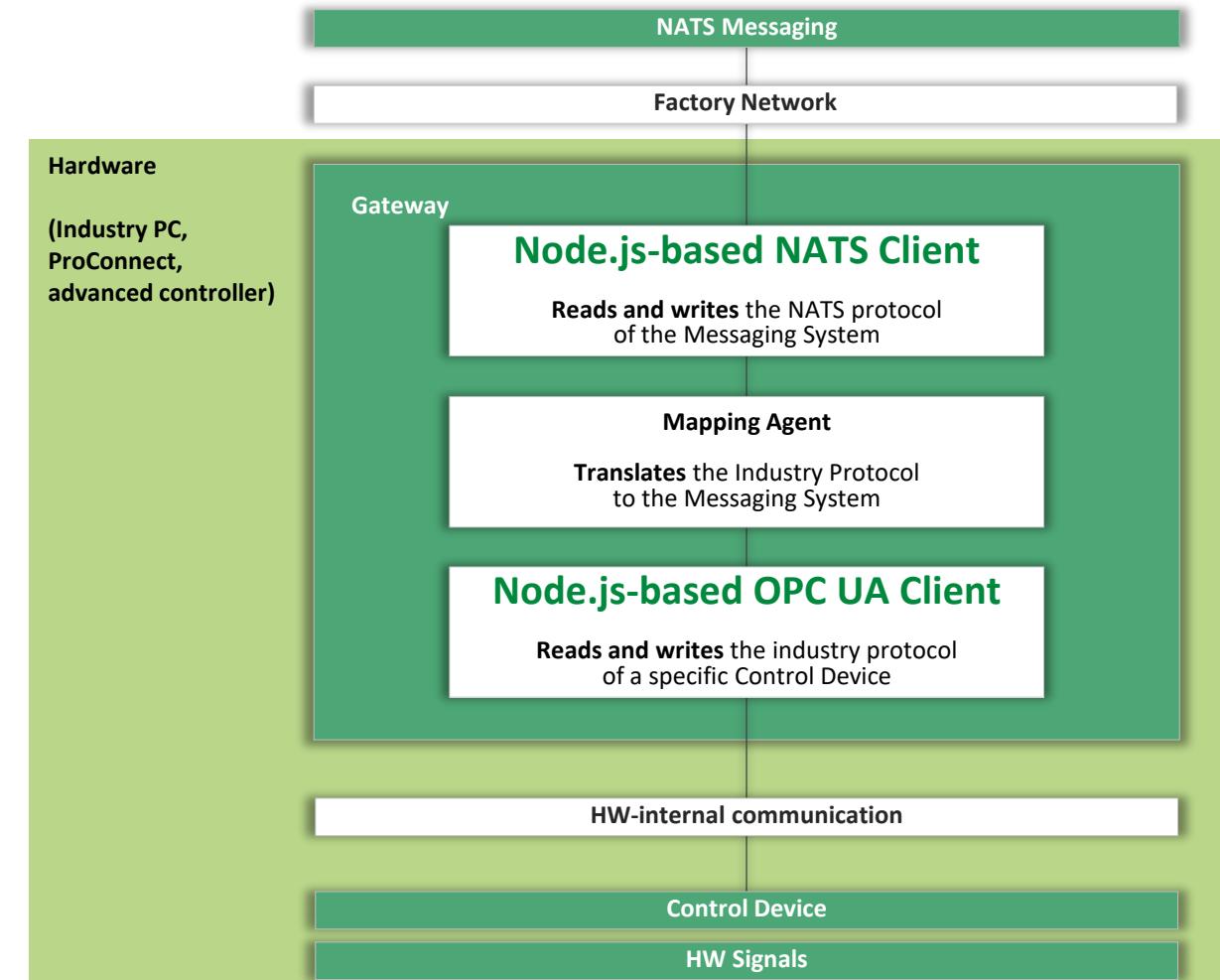
## Gateways act as translators from specific industry protocols to the Messaging System



# Gateways act as translators from specific industry protocols to the Messaging System

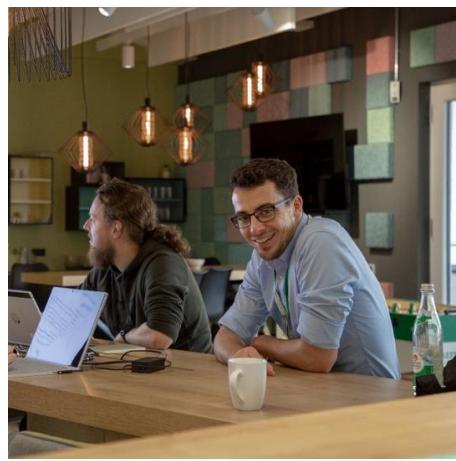


The screenshot shows the GitLab interface for the project "GATEWAY\_OPCUA\_NATS". The project ID is 2383. The description states: "This is the repository for the OPC UA to NATS gateway." The repository has 10 commits, 1 branch, 1 tag, and 696 KB files. The master branch is selected. A recent commit by Hans Fleischmann titled "Replace gateway-architecture.PNG" is shown. The repository contains files like README, README.md, gateway.js, package.json, and architecture. The sidebar includes links for Project, Details, Activity, Releases, Cycle Analytics, Repository, JIRA, Merge Requests (0), Snippets, and Settings.



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Hackathon for Industrial IoT - Connectivity with  
Microsoft, Schaeffler, Zeiss and HP Enterprise  
20.11.2019 - 21.11.2019, Digital Transformation  
Center Herzogenaurach

**SCHAEFFLER**

**Microsoft Azure**



Applications that **Solve Business Problems**, services for **Specific Use Cases**  
Data-driven identification of behavior models of automated production plants

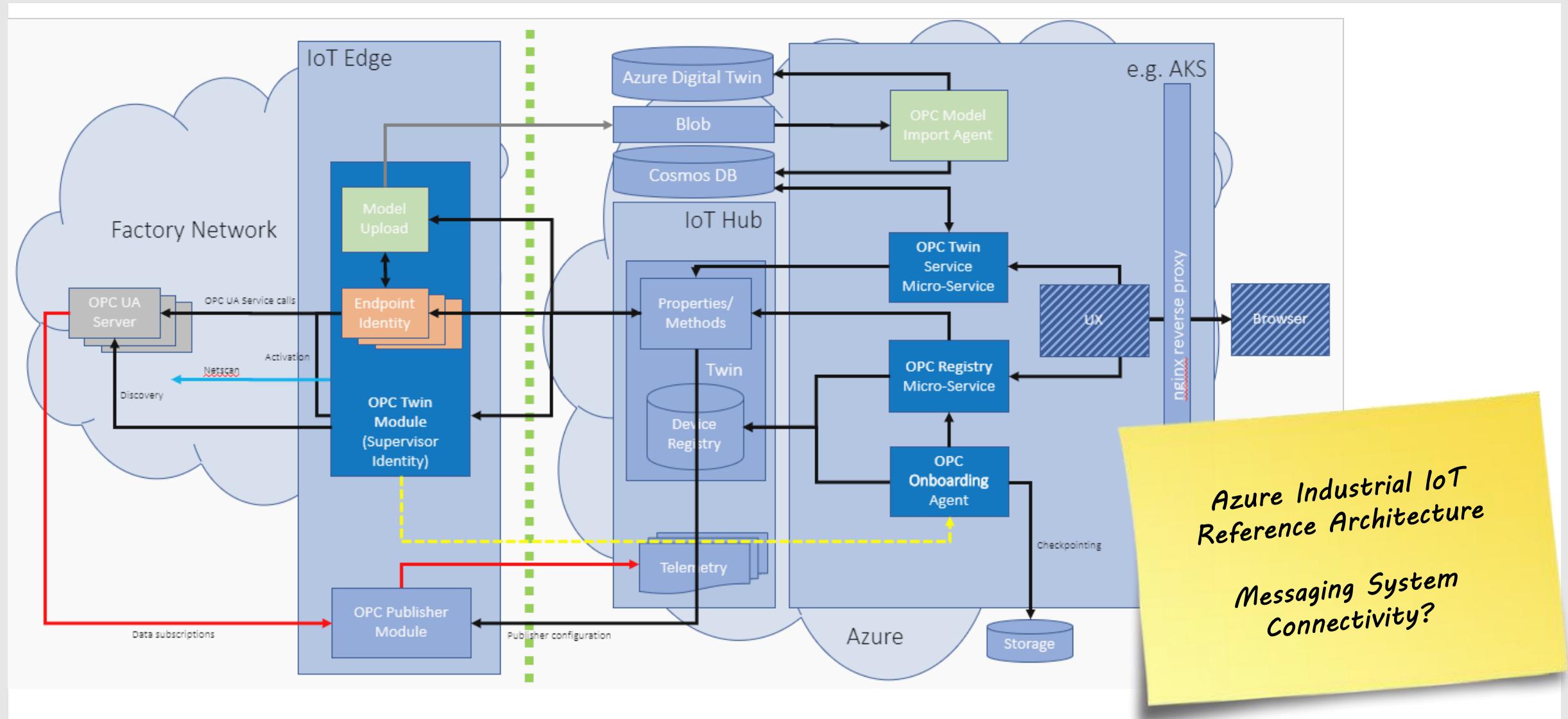
**Connectivity and Data Processing** modules

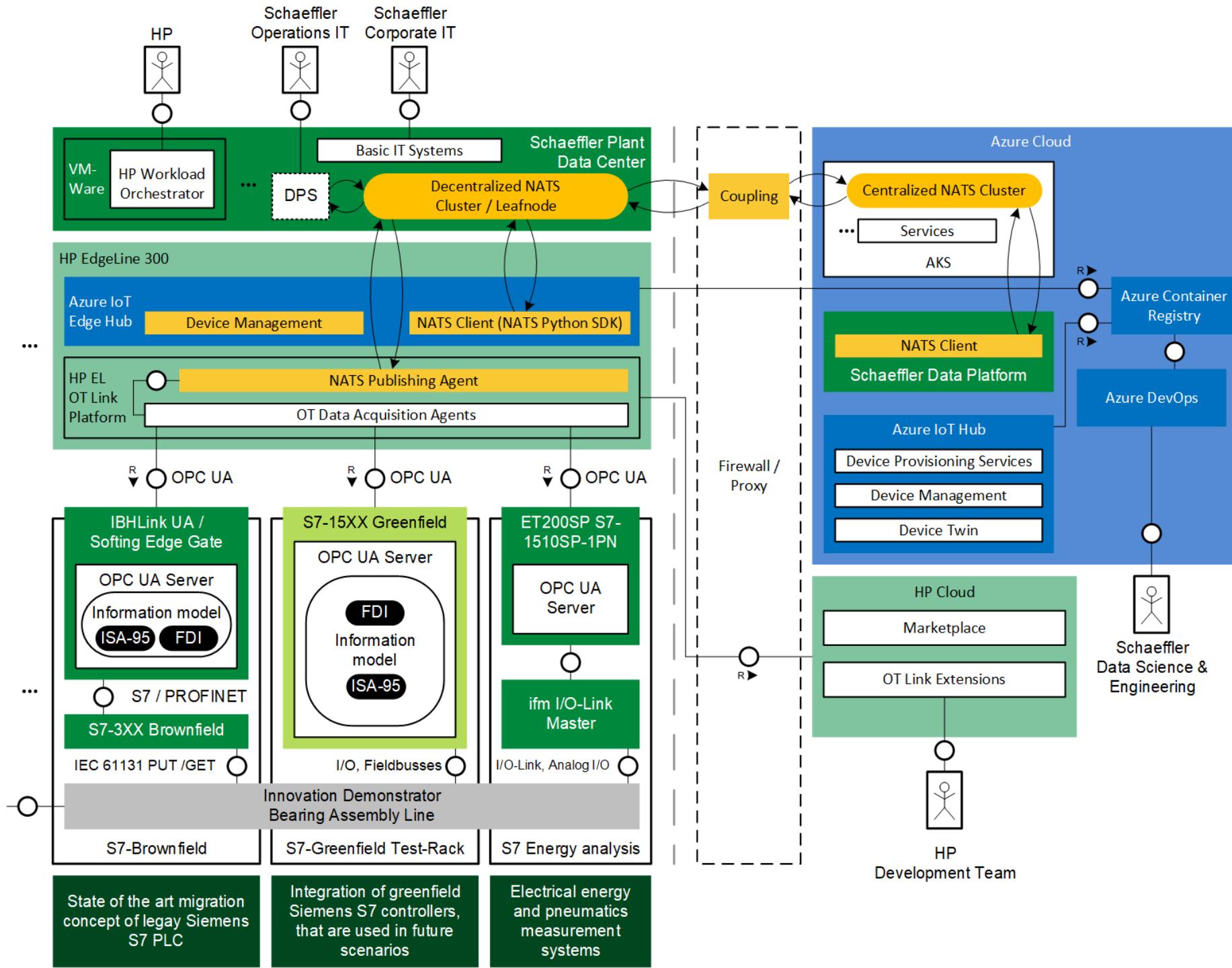
**Scalable Services for Manufacturing Interoperability and Data Modeling**  
Open Industrial IoT Reference Platform based on **Industrial Standards (OPC UA)**

**Scalable, Managed Services for Common Patterns (PaaS)**  
IoT Edge, IoT Hub, Stream Analytics, Data Lake, Azure Functions, AzureML, ...

**Globally Available Edge/Private/Public Cloud Infrastructure (IaaS)**  
Kubernetes Service, KeyVault, Azure Active Directory, Resource Manager, Azure Portal, ...

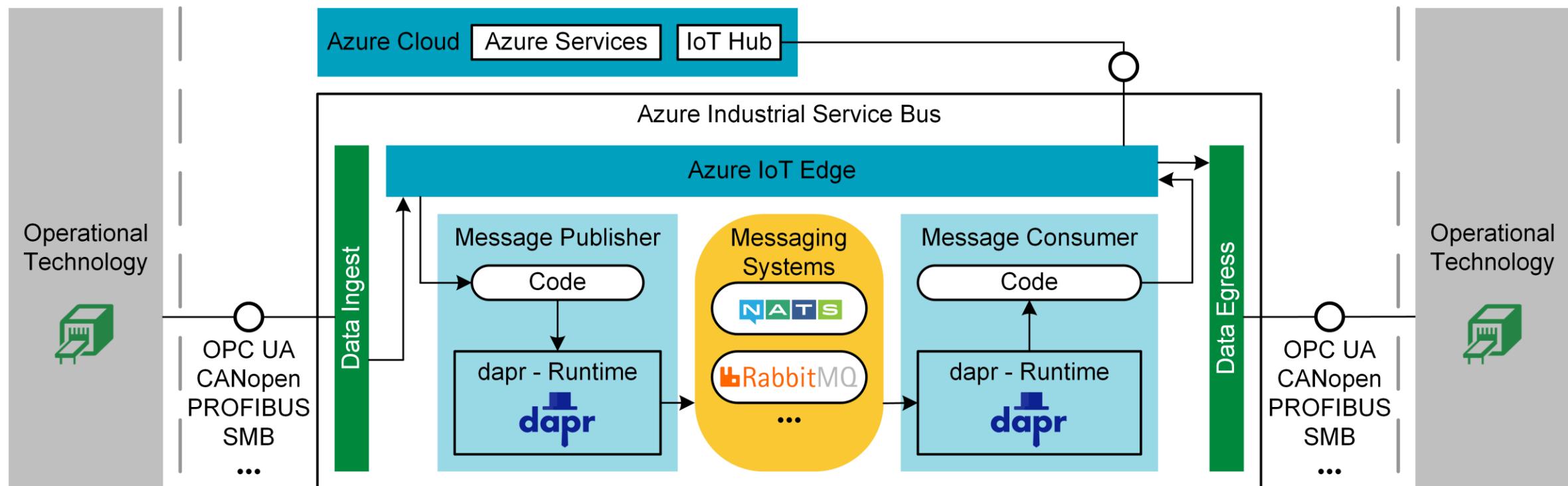
## Build solutions on your terms





- Results of the Workshop
- Evaluation of HP EdgeLine and the corresponding OT Link platform
- Device Management was tested successfully

## Outlook: Advancement of Azure IoT Edge to an Industrial Service Bus (ISB)

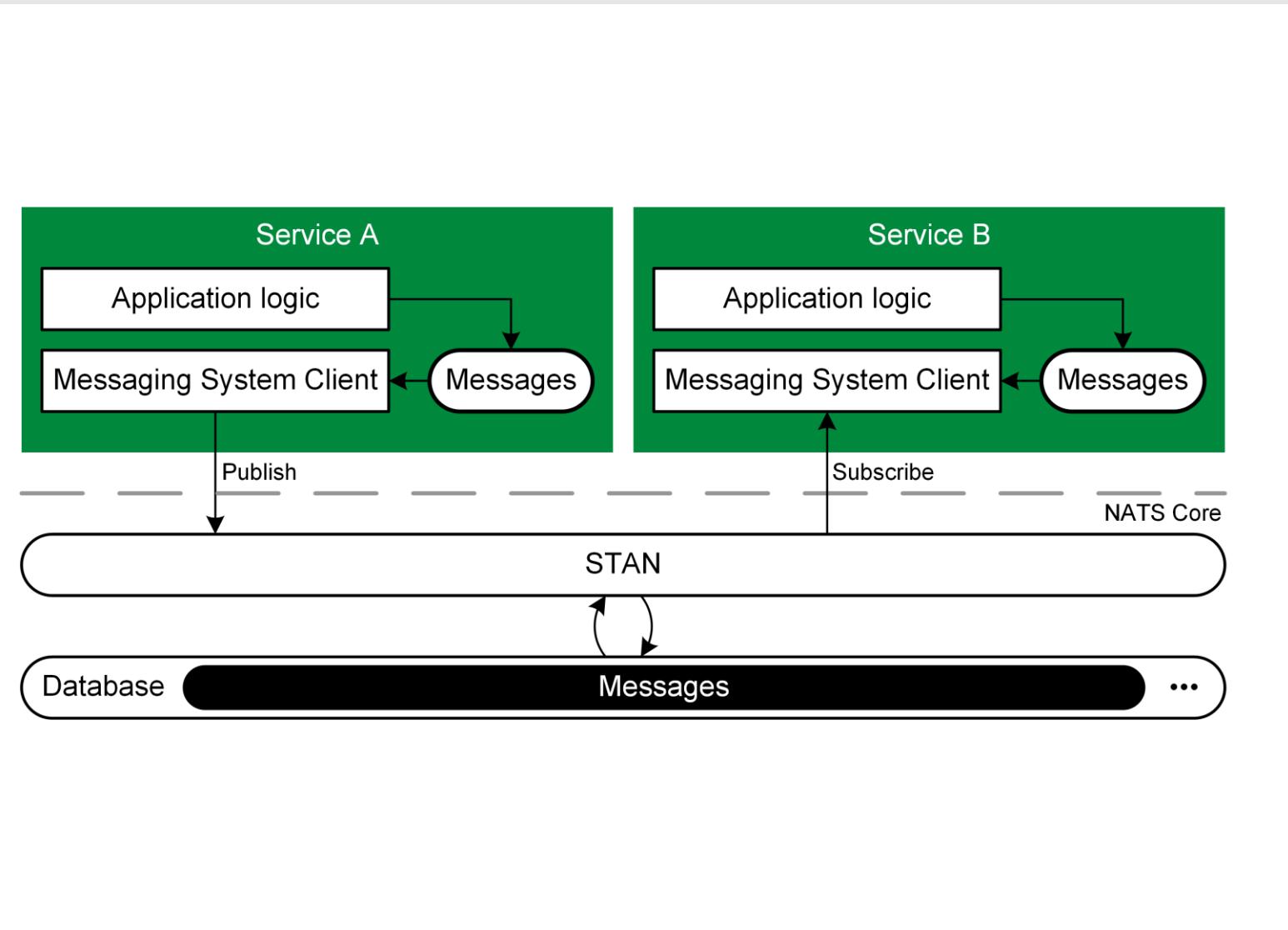


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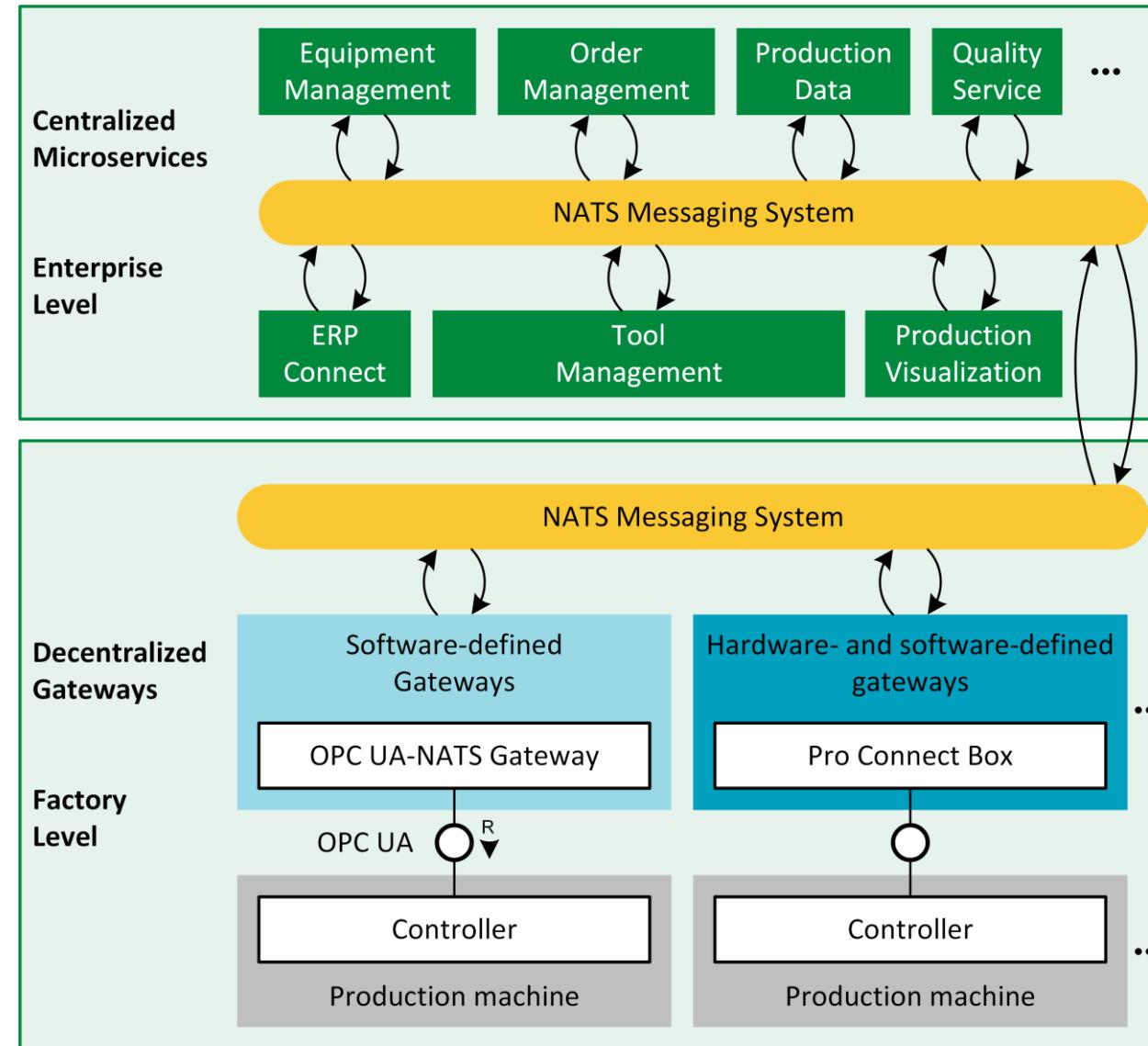
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## Digital Production System @ Schaeffler

- Implementation of services for custom use cases
- Production systems handle almost similar data -> reusable components  
-> Microservices architecture
- Based on Microservice Messaging Pattern
- Implemented with NATS Streaming



# Digital Production System Architecture



# Digital Production System Architecture

NATS.io

