

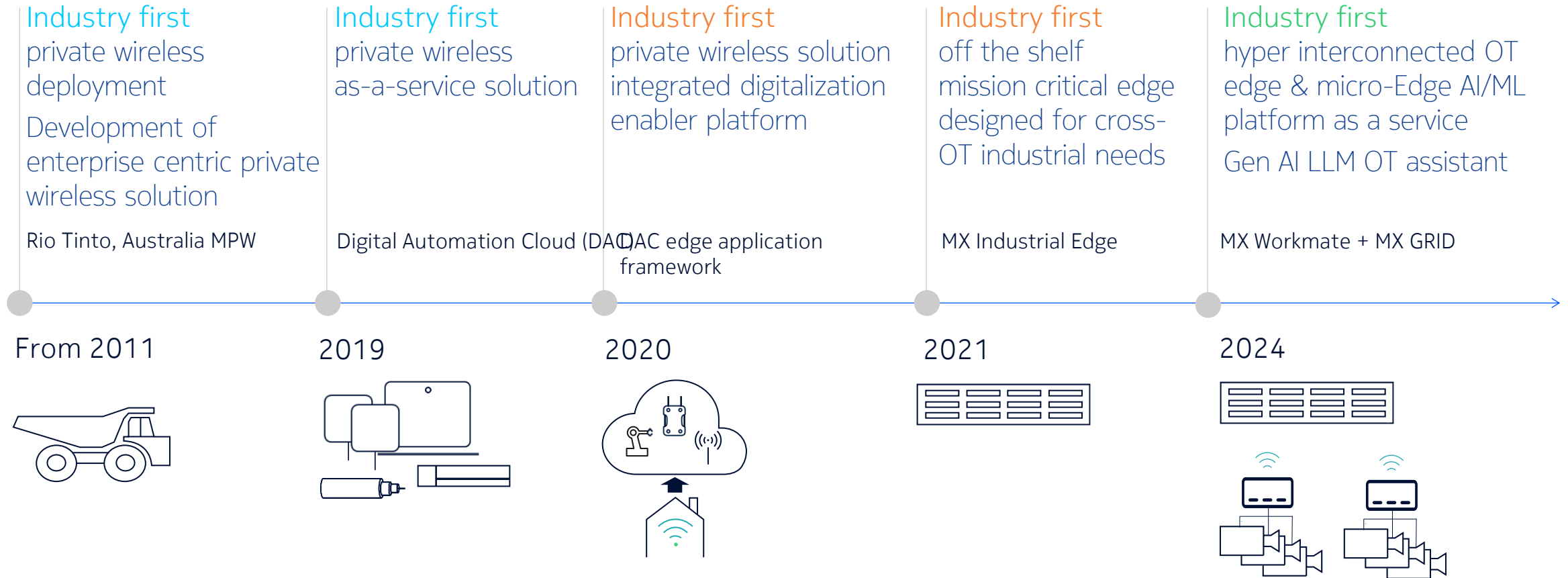
MTP and Modular Automation in the Biopharmaceutical Industry

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MXIE industrial apps
March 2025

The Nokia logo is displayed in white, bold, sans-serif capital letters. It is positioned in the bottom left corner of the slide, which features a blue background with a white diagonal stripe running from the top left towards the bottom right.

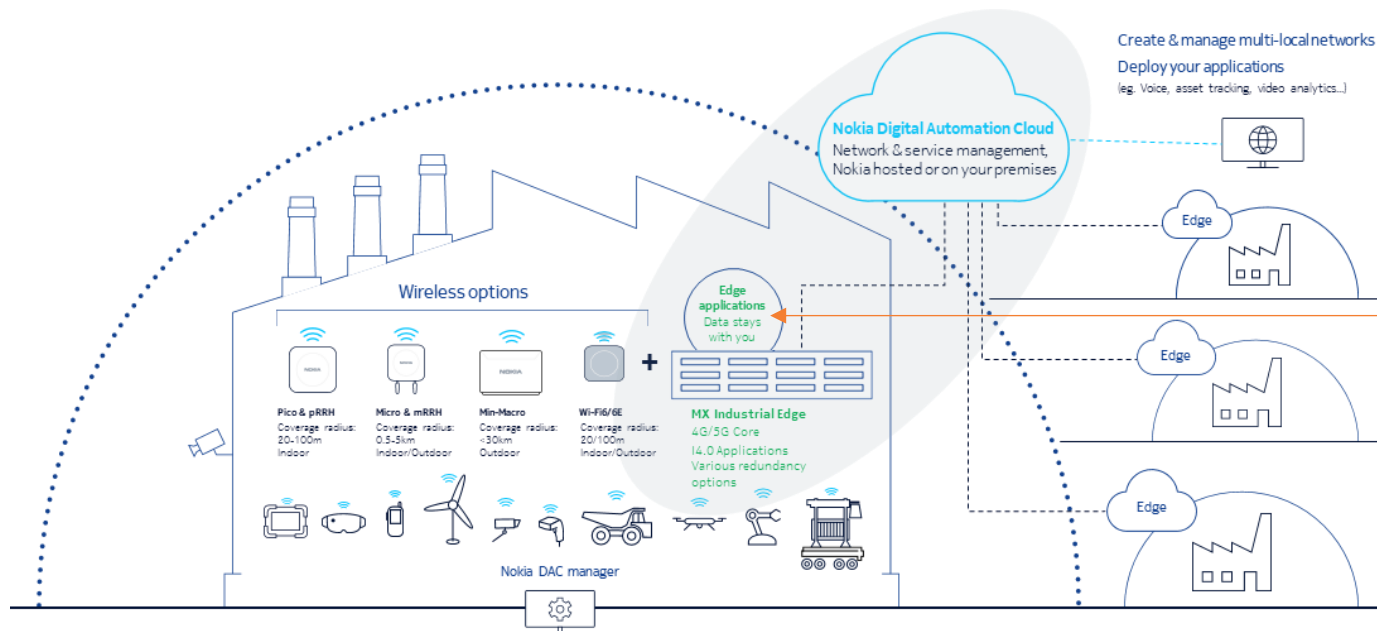
Evolving solution to meet OT digitalization requirements

From industry first in Private Wireless towards an industrial digitalization platform



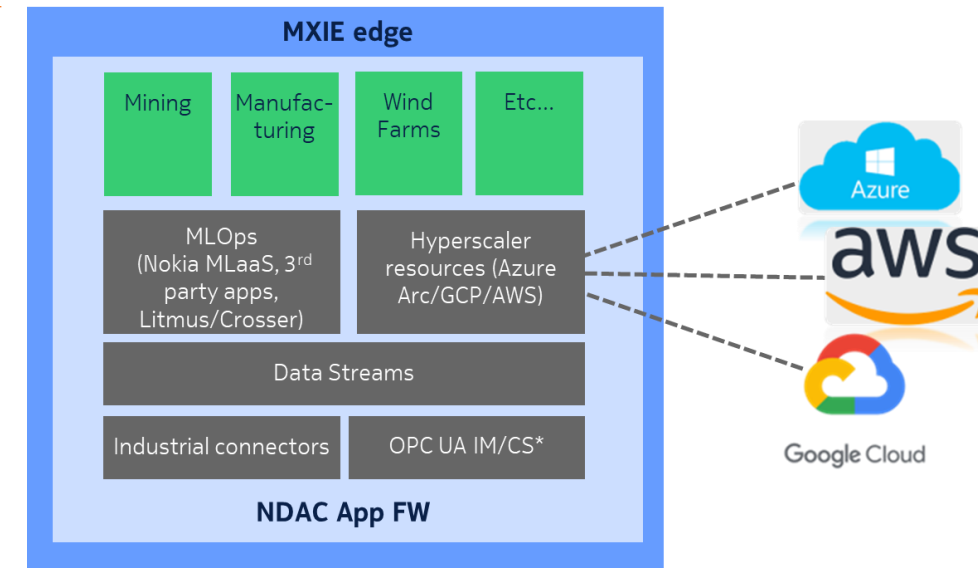
Nokia private 5G for communication with “Smart” enablement

Accelerate your digital transformation with a proven on-premise edge solution and industrial-grade private wireless connectivity

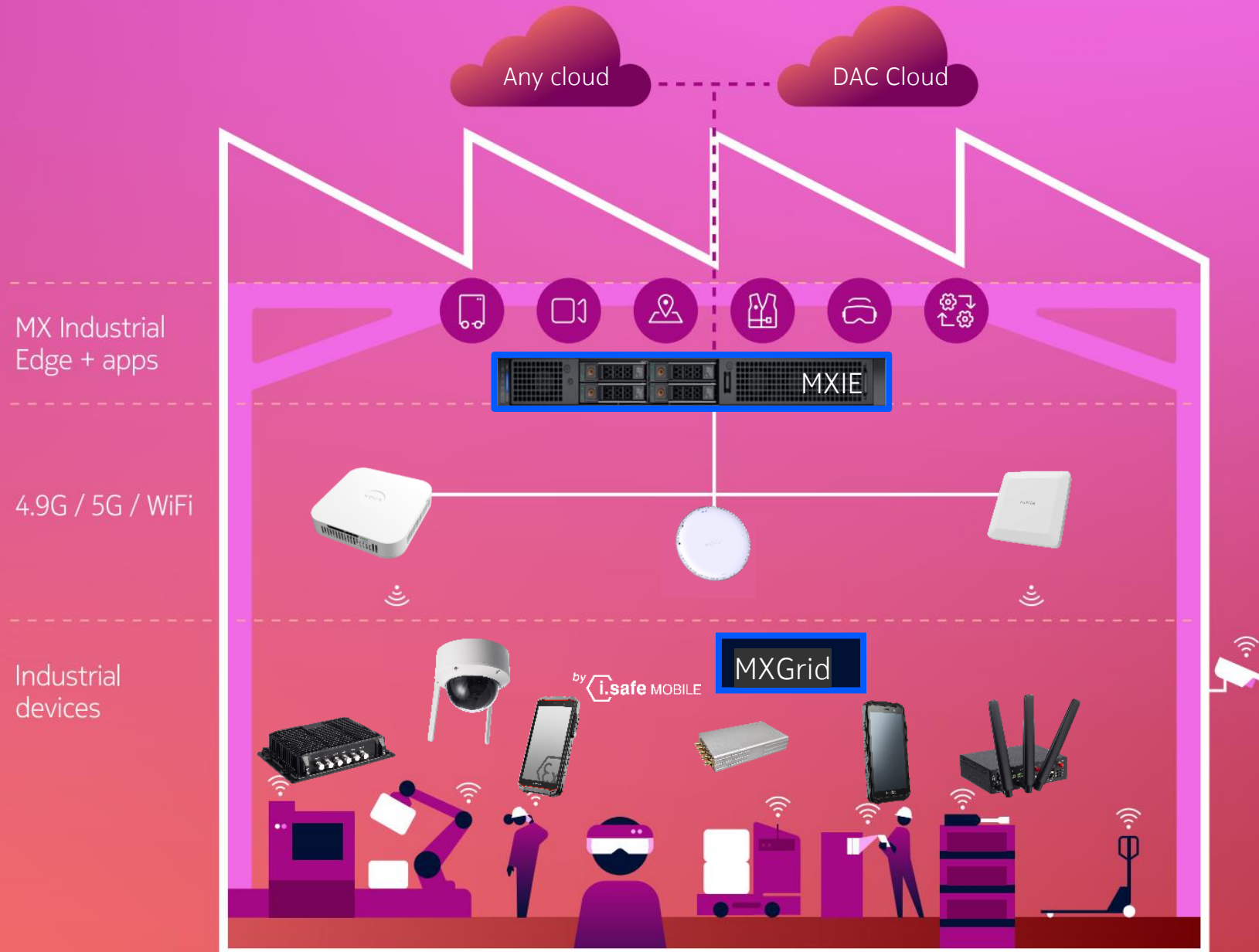


Industrial Edge capabilities for “Smart”

- Hybrid edge cloud continuum - Centrally managed, distributed runtime
- Confidential data kept on site
- Local processing of data for critical applications
- Strong baseline for data-driven use case development with near-real time data steaming



Nokia one platform for industrial digitalization



Cloud managed

Plug & play

Pay as you grow,
subscription-based
business model

Unified multi-site

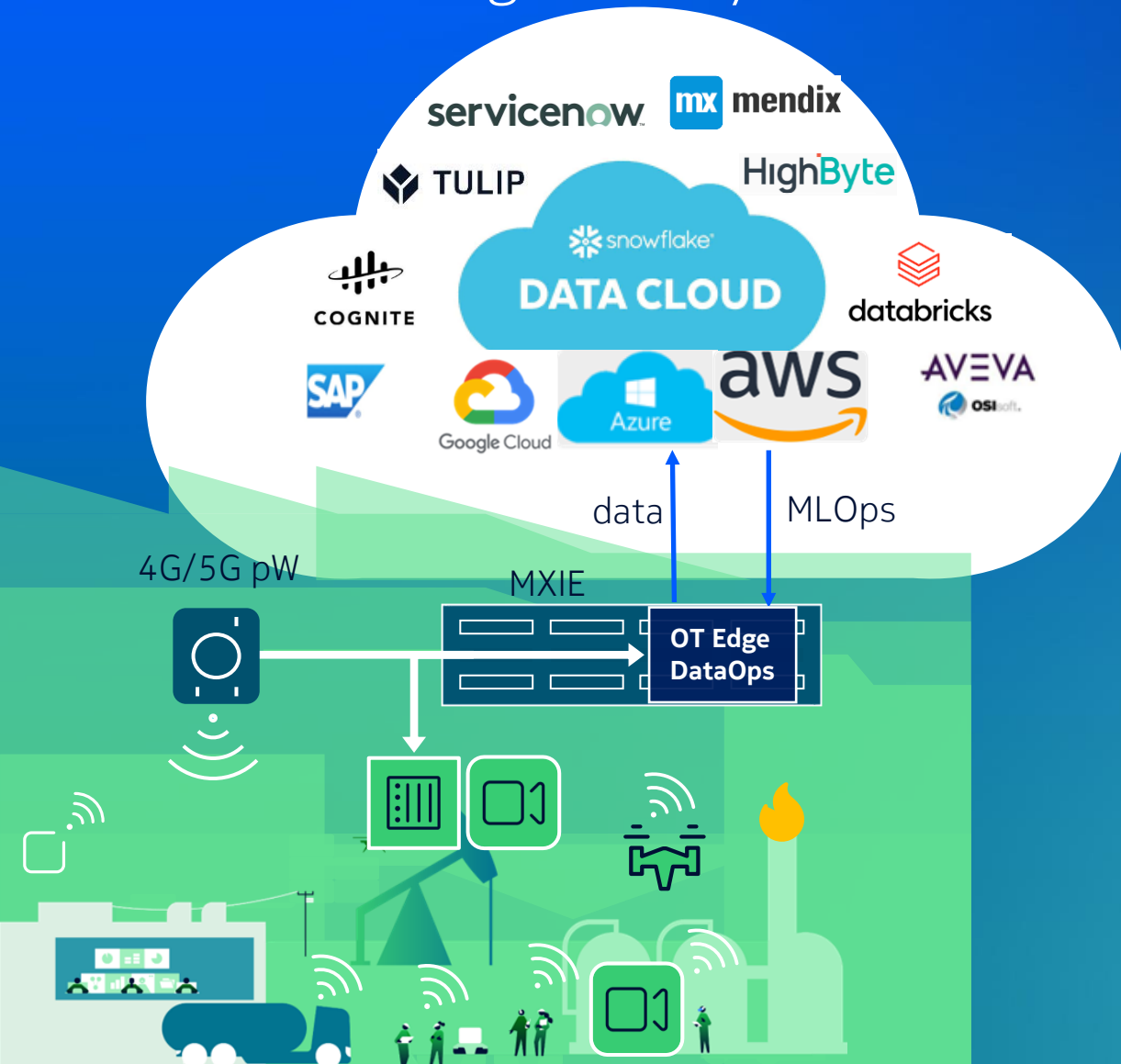
Expose APIs

Edge data lake and
integrate with world's
leading digital ecosystems
and solution providers
management

NOKIA

Edge DataOps – integral part of enterprise data architecture

Consumable edge data layer (UNS) enables extensible edge AI & data-driven use cases



Consumable edge data layer with Unified Namespace (UNS)

Abstract OT asset diversity and protocol complexity from readily actionable data layer

Single-source-of-truth" for OT digitalization, systems & apps and cloud data ecosystems

Event-driven, real-time harmonized data provides runtime for edge inferencing with MLOps

Centrally managed, distributed execution to combine data fabric & mesh benefits

Seamless integration to hyperscalers (Azure, AWS, Google, Snowflake)

Harmonize data between sites/plants for scalability and flexibility

High cyber security and compliance with central governance and data security

Productivity gains throughout supply chain and data ecosystems

Harness Edge AI & Decision Intelligence for Operational Excellence

Support Intelligent Supply Networks for Smarter Manufacturing

Address top challenges to scale edge AI and reduce tech debt across the enterprise

OT Edge DataOps

=



Read More: [OT Edge DataOps](#)

NOKIA

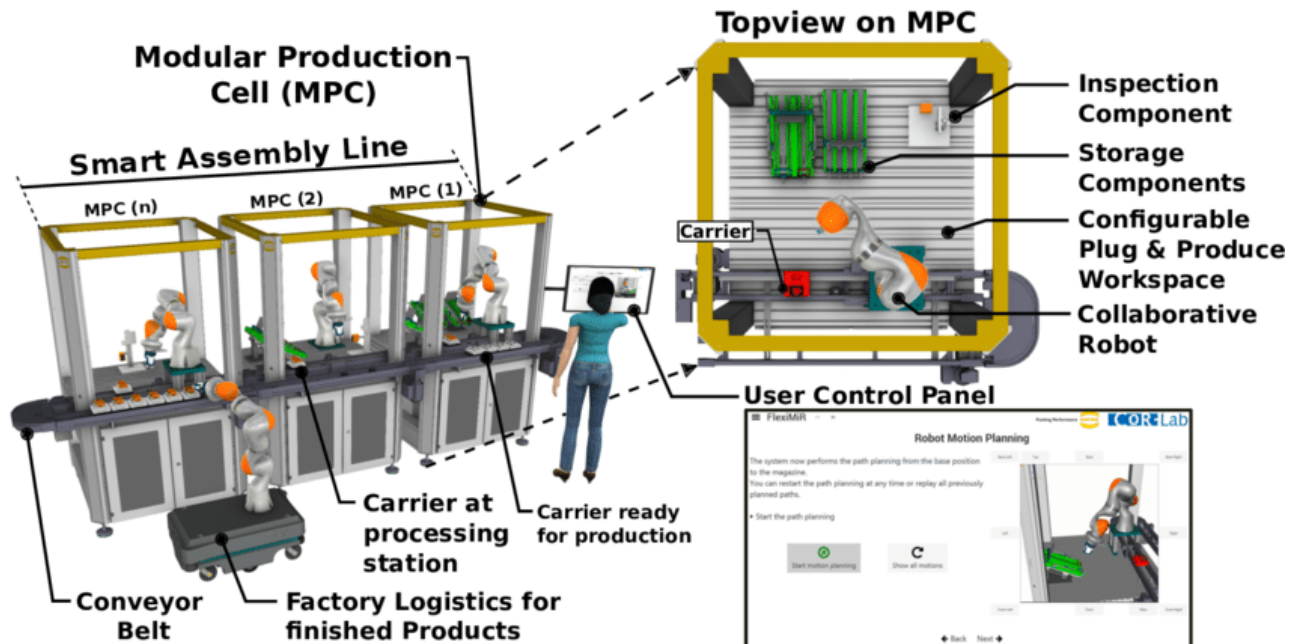
Modular Type Package

The Nokia logo is a large, white, stylized 'N' shape that serves as a background element on the right side of the slide. It is composed of two thick, parallel diagonal lines that meet at a point on the left and diverge towards the right.

NOKIA

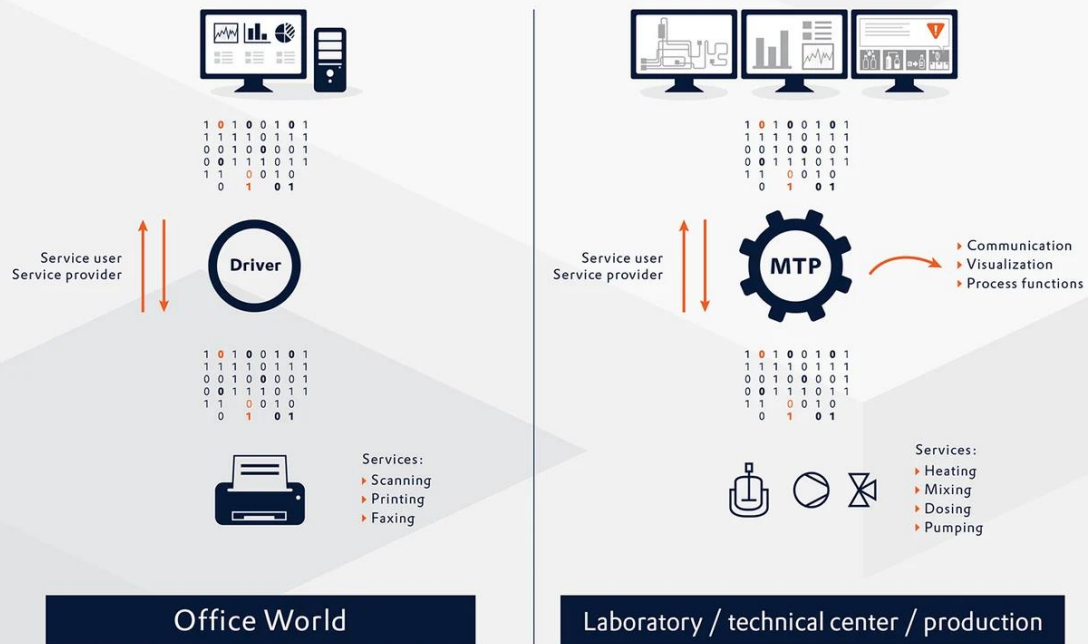
Modular Production Systems

Cost-efficient production of variants with the same system & standardized interfaces



Modularization

Service-oriented and independent of manufacturer



Module Type Package

Module Type Package (MTP) means...



- Interface and capability description of intelligent equipment modules via standardized equipment data models and description language

MODULAR PRODUCTION



Goals of MTP are



- Time reduction of automation engineering and commissioning
- Manufacturer-independent connectivity of equipment modules

MODULE CONTROL

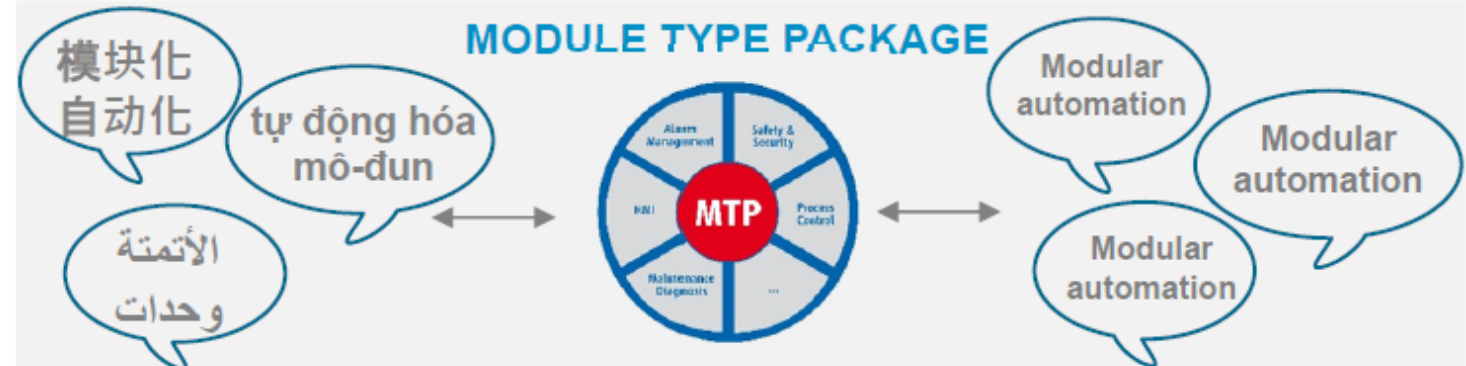


Benefits of MTP are

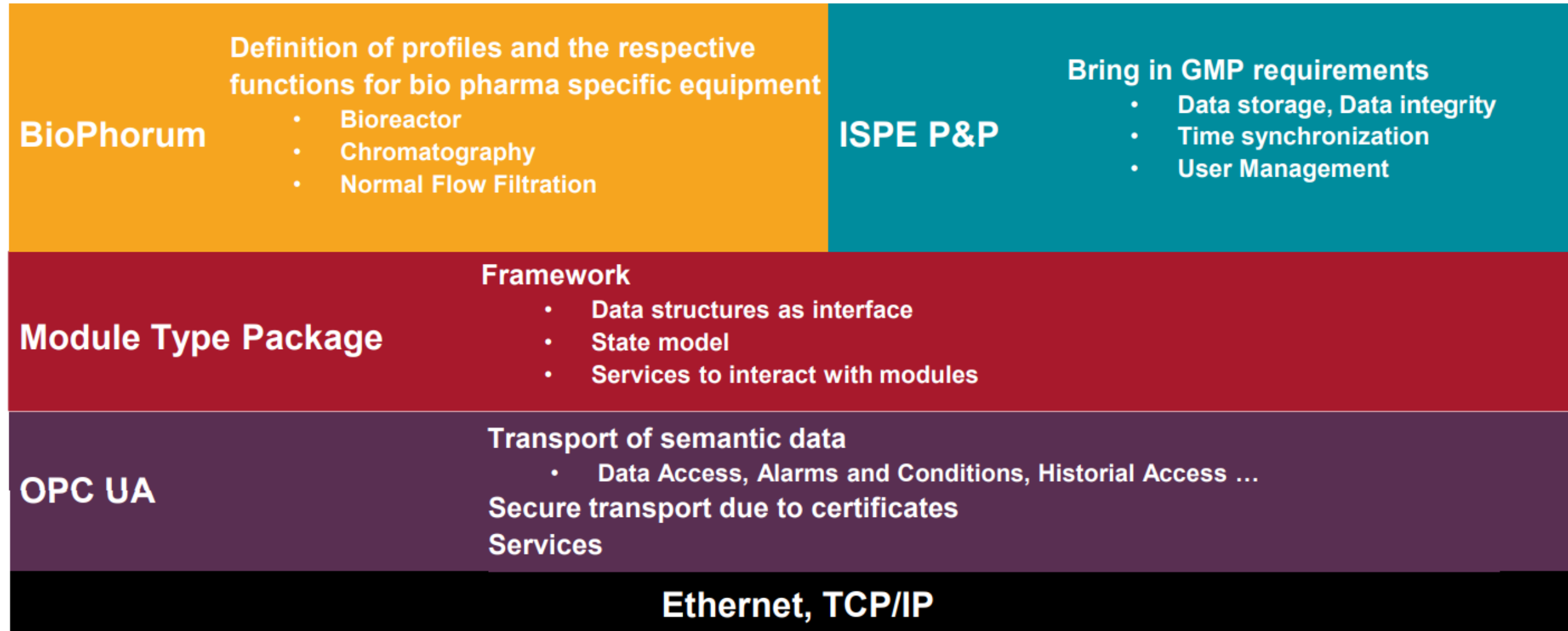


- Separation of automation engineering of plant and modules
- Easy integration via standardized, pre-tested and -qualified interfaces

MODULE TYPE PACKAGE



MTP basics for life science manufacturing



Edge Intelligence start with semantic OT data

Smart “anything” at shop-floor requires AI and [Networked Digital Twins](#), which requires structured, contextual data and semantic interoperability – and data automation

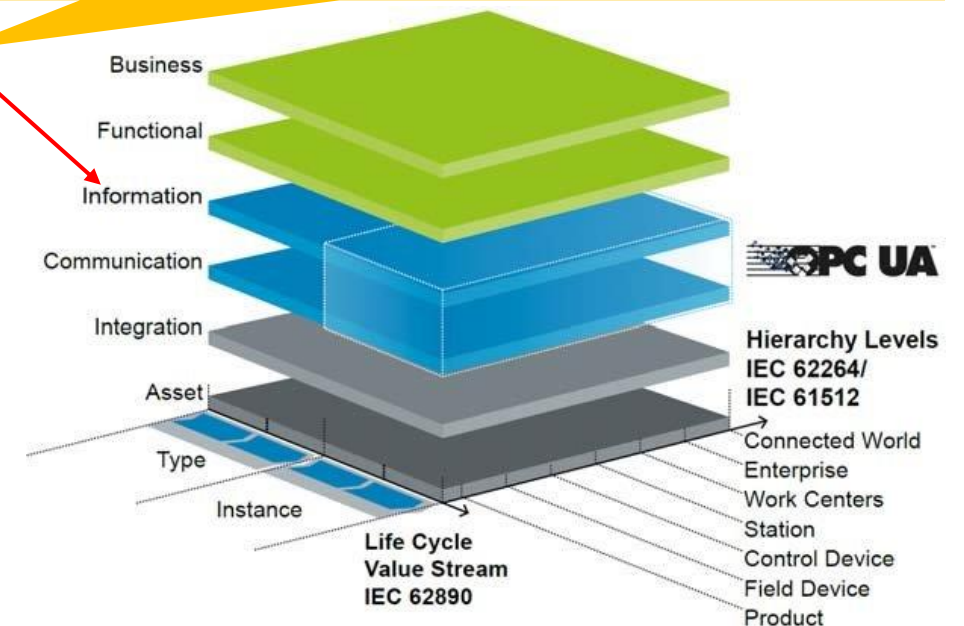
Industry 4.0 [Cyber-Physical systems](#) are backbone and core elements of Industry 5.0 (adds human and sustainability aspects) and Industrial Metaverse (adds remote operations and AR/VR interface to data and functions) too.

There Is No Industry 4.0 without OPC UA - RAMI 4.0

Industry 4.0-compliant Smart “anything” builds on few key concepts:

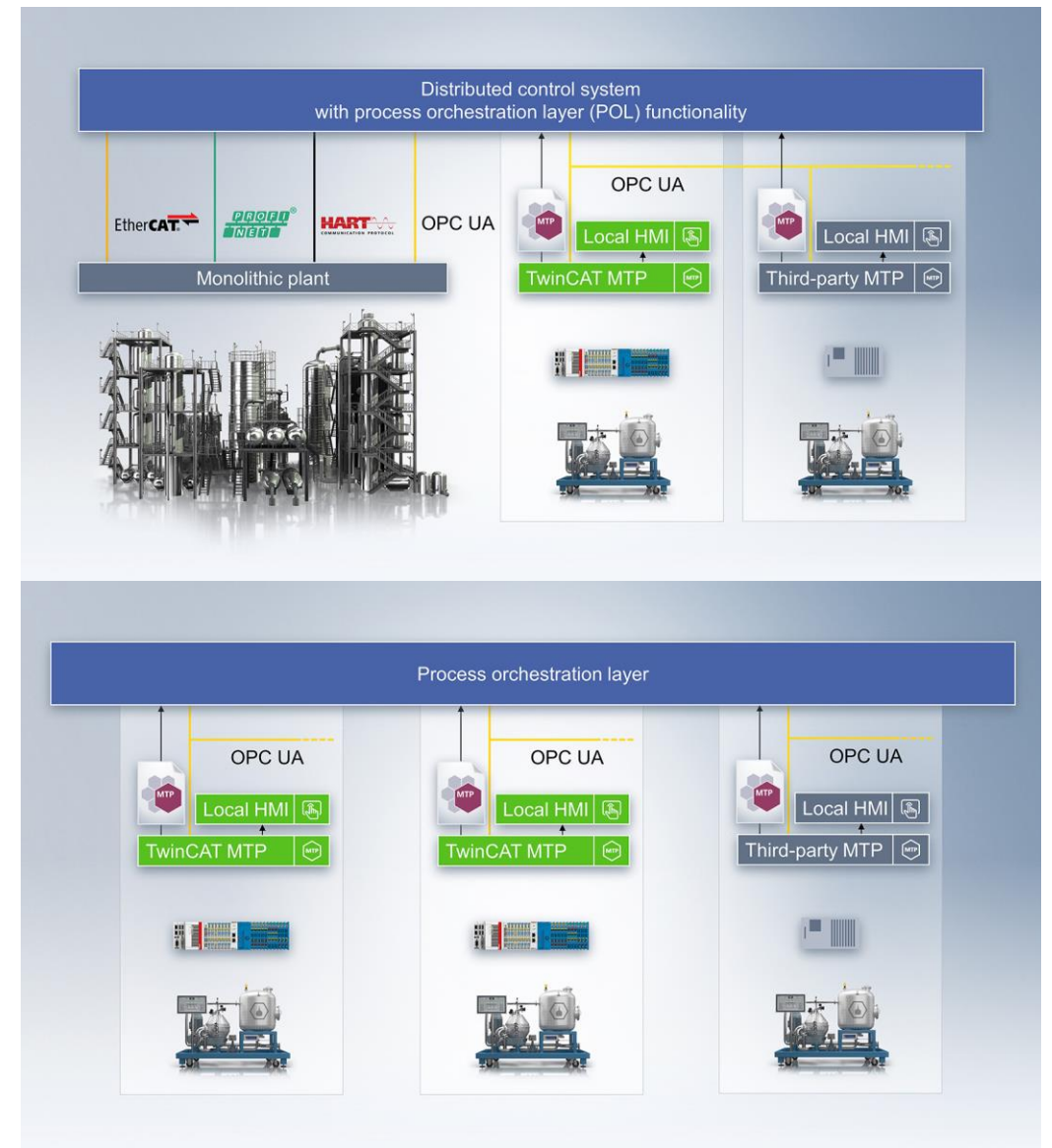
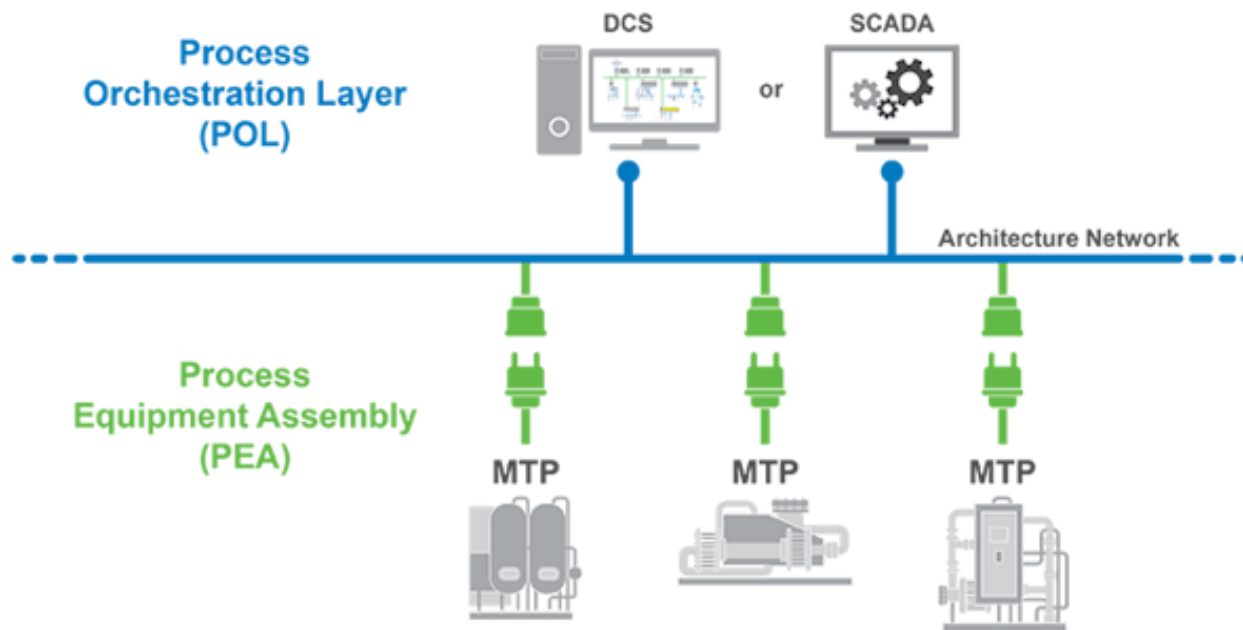
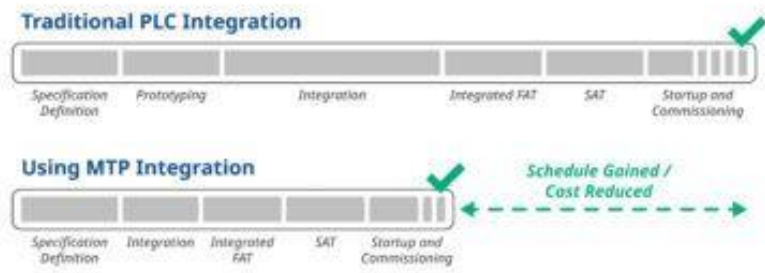
- **Industrial (Cloud) DataOps** (Cognite, Highbyte, Azure / AWS Data Fabric etc) - efficient way to refine value from OT data for the various data-driven applications running at the edge, on-premise, and in the cloud. Together **with Edge DataOps / Hub / Smart IIoT apps** realizes **RAMI 4.0 “Information layer”** for semantic interoperability
- **OPC UA** – vendor-agnostic interoperability with structured data, semantic information; ensure data value through data life-cycle and enterprise functions
- **Networked Digital Twins** - semantically networked virtual elements of real assets in Industry 4.0 value networks, realizing cyber-physical interaction. **Real-time data management with Edge DataOps is core enabler for any digital twin.** To build effective digital twin solutions, the capability of integrating "Simulation, Optimization, Prediction, and Visualization models" is also crucial.
- **MLOps** - data-based model's efficient deployment and management at scale, to enable replicable and efficient Edge AI solutions

[MXIE OT Edge DataOps](#) abstracts diversified field assets and protocols from data plane, simplifying data operations through data lifecycle drastically, and producing composable edge data layer e.g. for edge AI



MTP in production

Suitable for both brownfield and greenfield



Experiences and benefits

open and standardized automation solutions

ZVEI the benefits from the first pilot projects can be summarized as follows:

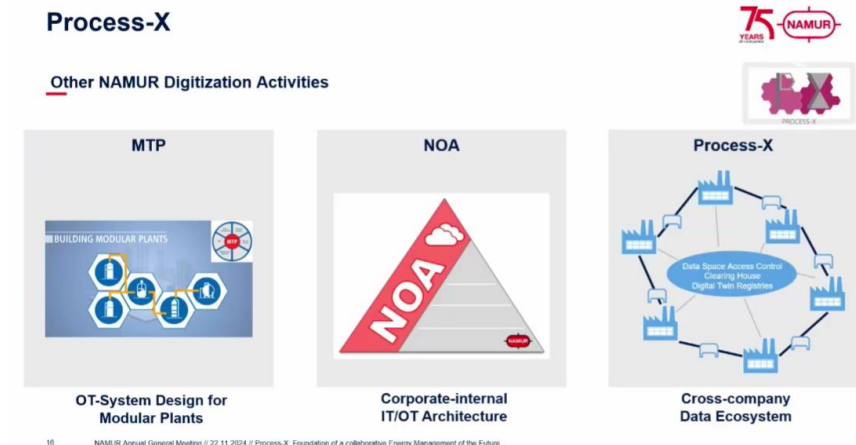
- 50% on reducing time-to-market
- 70% on reducing engineering effort
- +80% on increasing flexibility.

Skid and machine builder OEMs can use MTP to future-proof their offering

Controls engineers and systems integrators appreciate how MTP streamlines integration work, cutting integration time by half in many cases, while improving quality, reducing errors, and easing support

[OPC Day Finland 2021: Module Type Package \(MTP\), VDI/VDE/NAMUR 2658, IEC 63280](#)

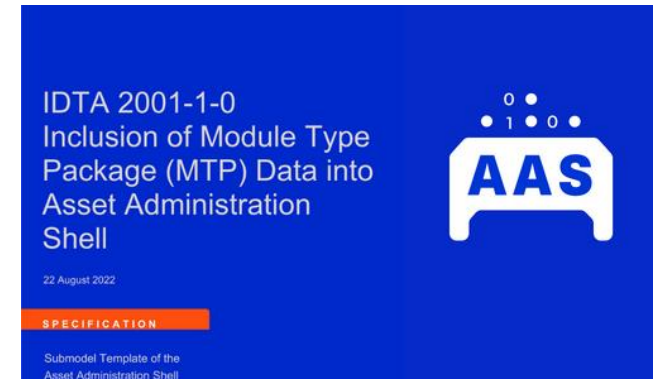
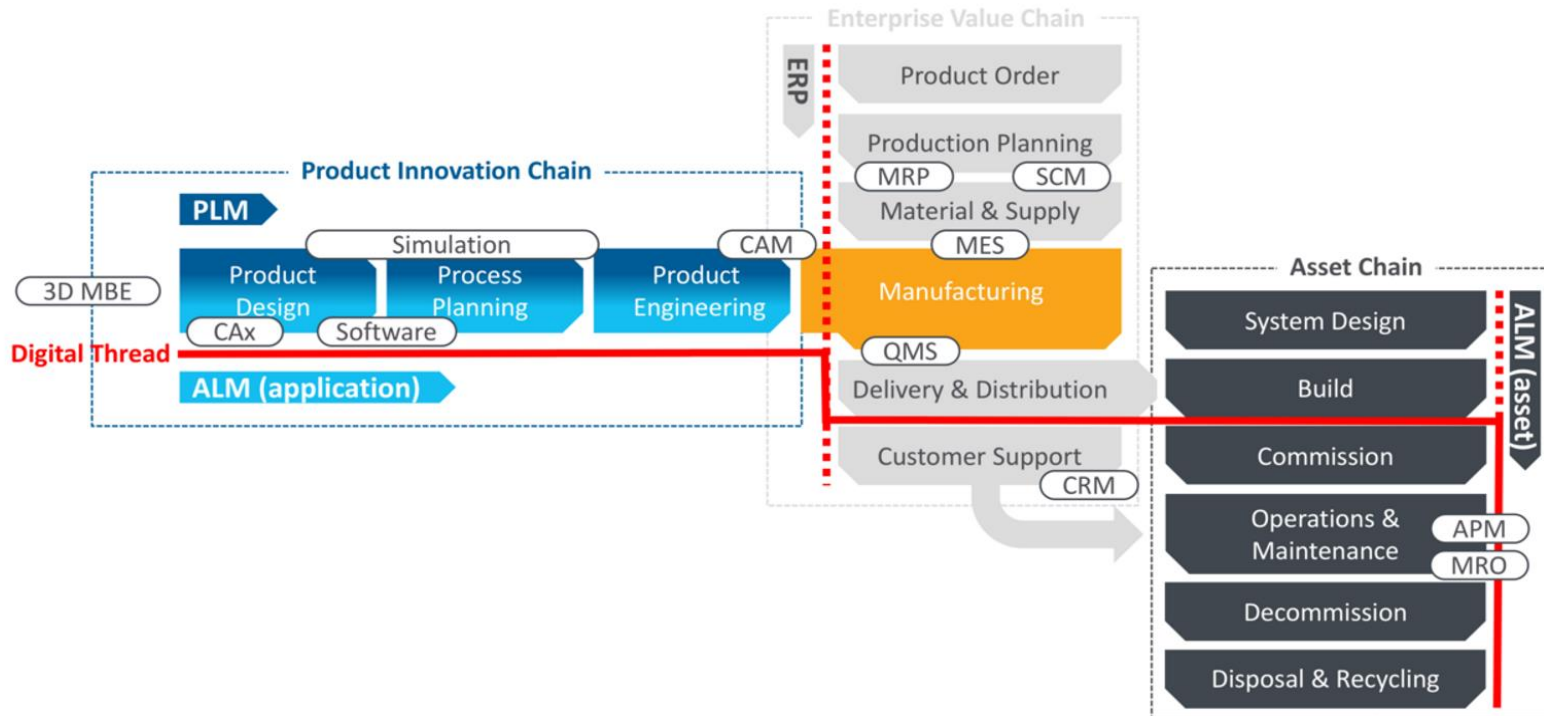
[OPC Day Finland 2024: MTP and Modular Automation in the Biopharmaceutical Industry](#)



Digital twin and digital thread

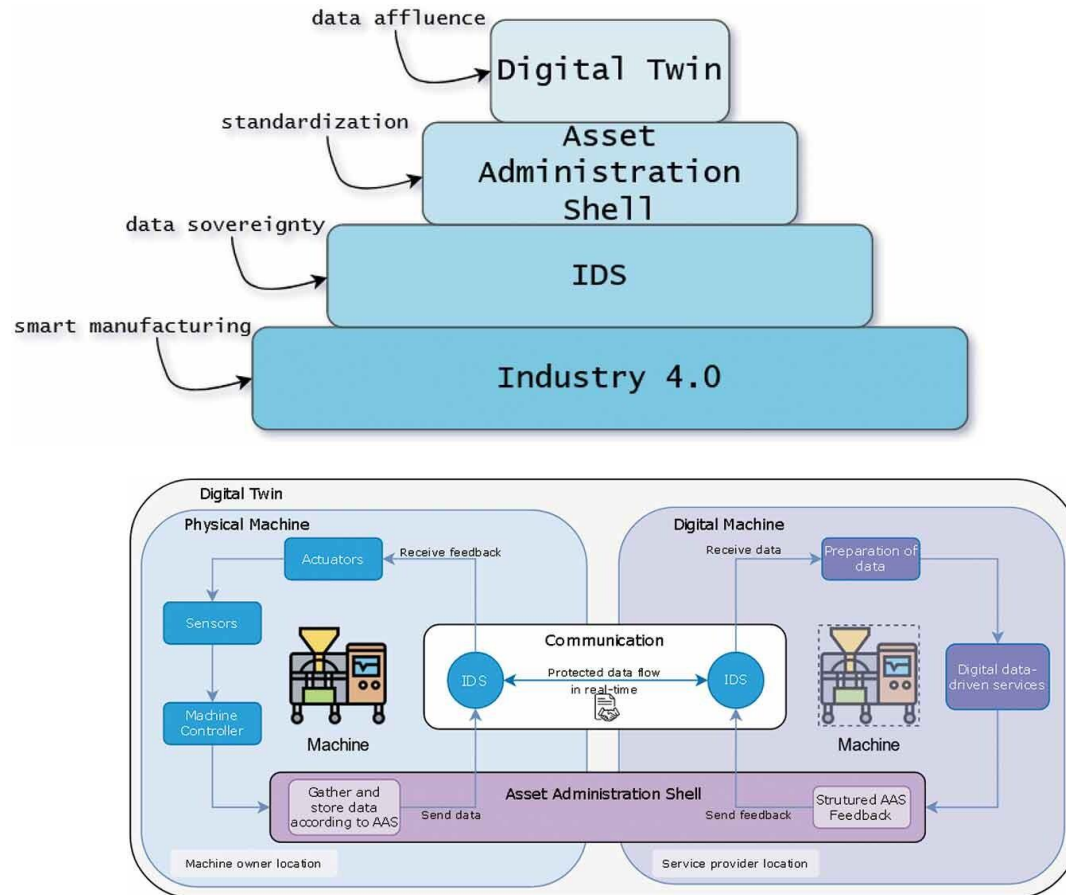
Asset lifecycle Management – digital twin from engineering to operations

"The information modeling capabilities and the OT connectivity of OPC UA, coupled with the comprehensive asset representation and life-cycle focus of AAS, result in a powerful architecture not only for the Digital Product Passport (DPP) but for Industry 4.0 applications in general" - [source](#)



Standardized manufacturing – unexpected benefits!?

OPC UA, Asset Administration Shell, Industrial Data Spaces – food for advanced AI!



Harmonized Business Models

Multi-Agent Systems



Model Processes • Orchestrate Workflows • Deploy AI Agent Networks • Govern Operations

AI Model Ecosystem

SLMs

Knowledge Models

Causal Models

Small, Specialized Sovereign

Entity & relationship Schemas

Cause-and-effect Mechanisms

Data & AI Platform



LLMs

Generative AI

Language Models

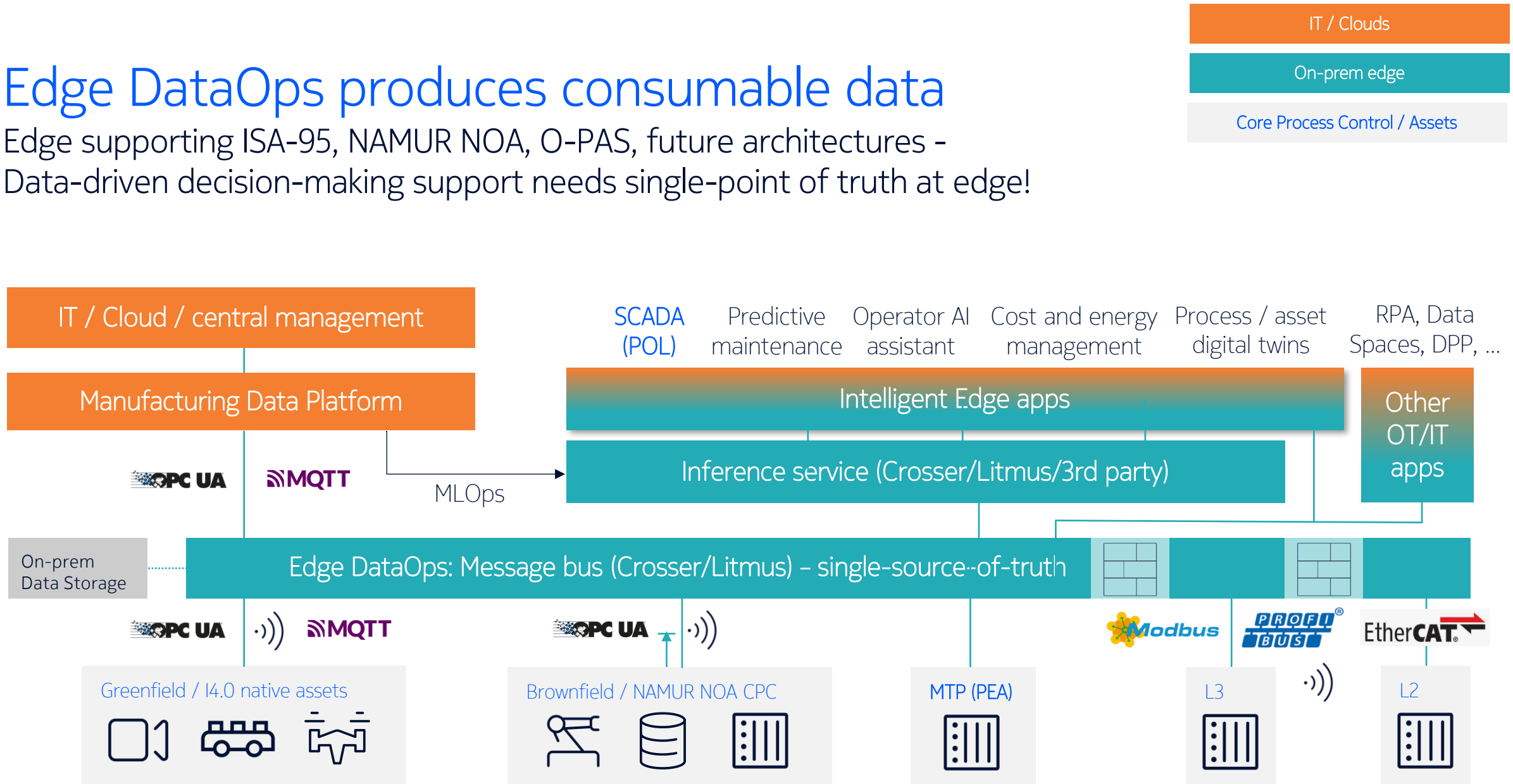
Foundational Models

Self-Sourced • Open-Sourced • Closed-Sourced

Dynamic Feedback Loop Fine-Tuning

Edge DataOps produces consumable data

Edge supporting ISA-95, NAMUR NOA, O-PAS, future architectures -
Data-driven decision-making support needs single-point of truth at edge!

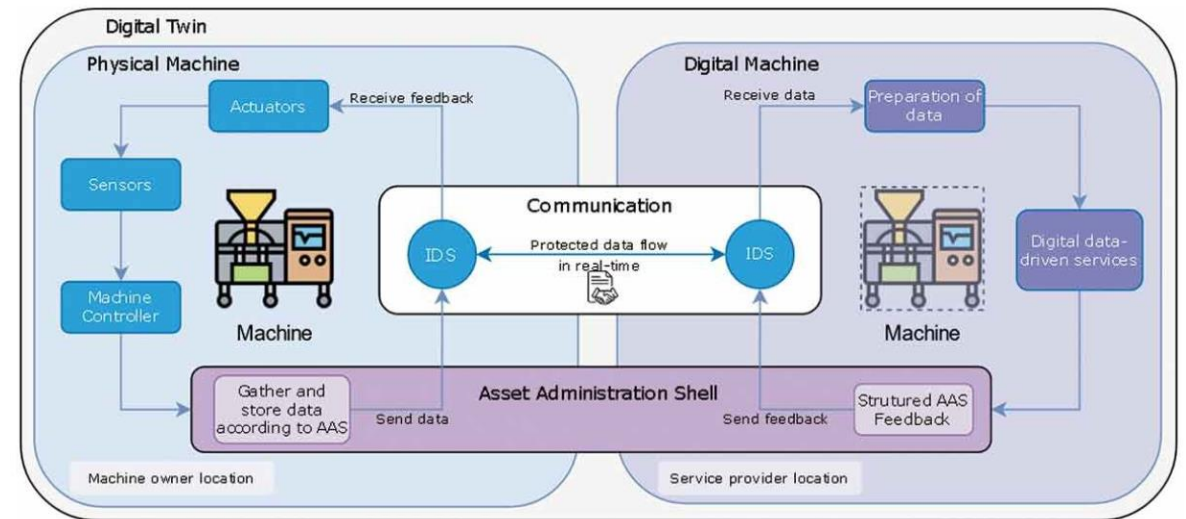


Edge DataOps for Industrial Digital Twins – forward-looking way

Benefits of standardized approach with consumable edge data layer

I4.0 asset digital twin "blueprint" for lifecycle mgmt

- Edge data practices (DataOps); decoupling data generation from data consumers, consumable data layer
- Asset Admin Shell (AAS) – core role for asset lifecycle AND operational excellence (data models)
- IDS (data ownership and sharing contracts) + data connectors for data sharing
- **AAS is "base digital twin" for I4 asset management**
 - connects multiple data streams during asset lifecycle
- ALM by SAP ([BNAC](#)) is based on AAS, realizing '**digital thread**'
- [DPP](#) (Battery Passport, Product Carbon Footprint etc) is required for electric vehicles, mandatory in Europe 2027
- Secure data sharing via **IDS data spaces** when ever needed in ecosystem (like for co-operation with 3rd party ML/AI vendor)



Following the industry 4.0 paradigm, [concepts have been presented](#) to introduce innovative data-driven digital services that can now be introduced by Digital Twins, backed up by a secure and reliable communication infrastructure based on OPC UA and IDS technologies, and the standardization of information models based on the Asset Administration Shell.

Shop-floor decision-making - demands for Edge Platform

Operational intelligence sets clear demand for edge & smart IIoT app capabilities

1

AI and DT on-prem

Proliferation of artificial intelligence, machine learning and networked digital twins at scale - on-prem

2

Hybrid edge-cloud

Processing edge data needs to be performed at the edge and in the cloud or enterprise.

3

OPC UA (over MQTT)

IEC 62541, framework for industrial interoperability based on data models, context and metadata – data modelling is key for all intelligent operations!

4

Semantic interoperability

Interoperable API's (data products) which serve standardized information modelling are key for successful intelligent use cases

5

Open standards - tested

Supporting open Industry 4.0 standards enables interoperability and secure data sharing to partners – best served via collaboration like Open Industry 4.0 Alliance

6

OT Edge DataOps

Edge must support enterprise data governance and Industrial DataOps (semantics, knowledge databases)

Summary - Edge enables Modern Data Governance at any Industry

Modern data approach starts from edge and reach trough data lifecycle

1

Modern Edge Data Stack:

Smart IIoT at edge abstracts protocol and asset diversity and enables OT digitalization acceleration

2

Data Models: Smart IIoT at edge delivers structured OT data with metadata to IT tools to scale up OT digitalization, and fosters OT teams' data ownership

3

Refine IT/OT convergence:

Smart enterprise data governance understand OT data nature and specialty

Industrial DataOps definition (according to IoT Analytics)

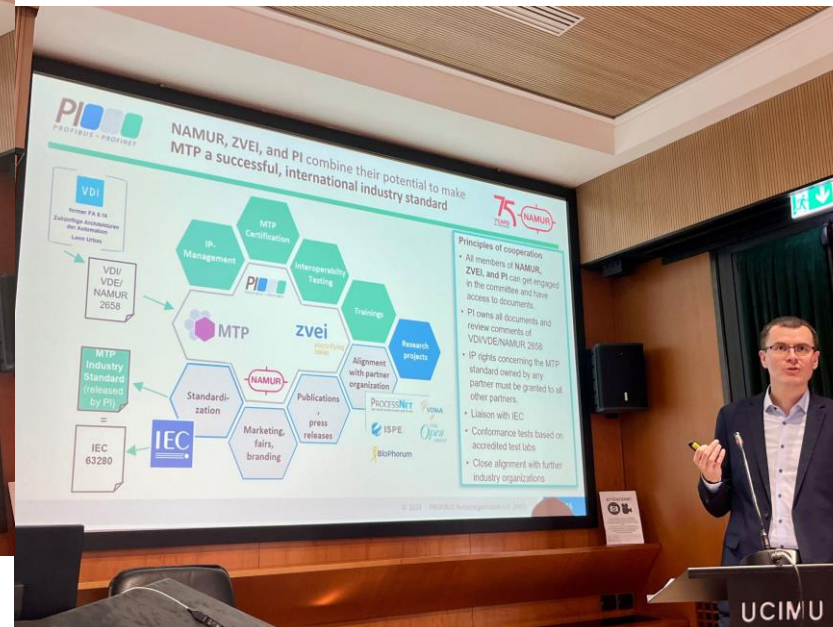
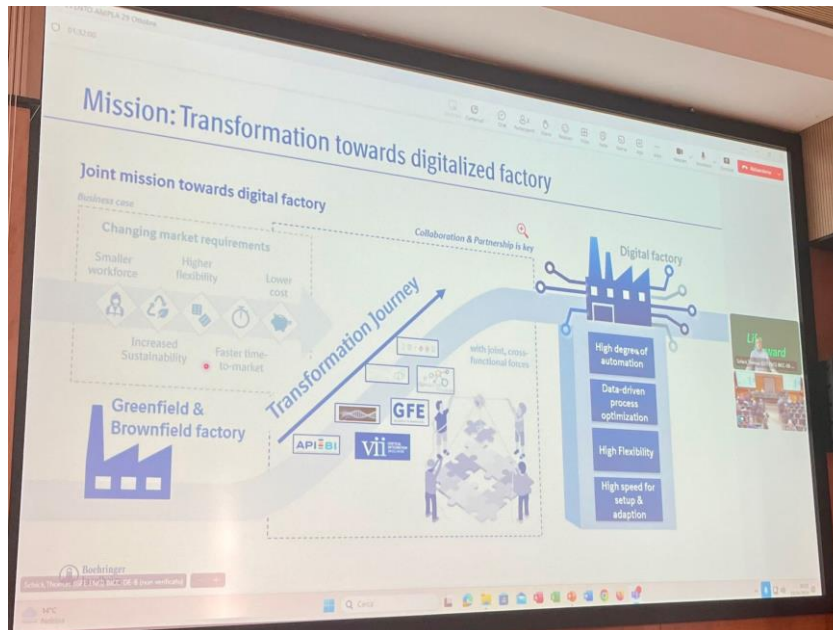
The process of enhancing data quality by providing structure and context for accurate, logical data representation, ensuring usability by downstream applications

Related information

[OPC Day Finland 2021,Keynote: ISPE Pharma 4.0 Plug & Produce, Josef Trapl, Takeda & Henrik Stellmann](#)

[The ISPE Baseline® Guide: Pharma 4.0™ is a valuable resource for any size company to begin, reinvigorate, or advance their transformation journey](#)

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