AUTOWARE Autonomous Service Development Framework

Silvia de la Maza (Innovalia) –smaza@innovalia.org

22th May 2019

innovalia ASSOCIATION

What do you see?

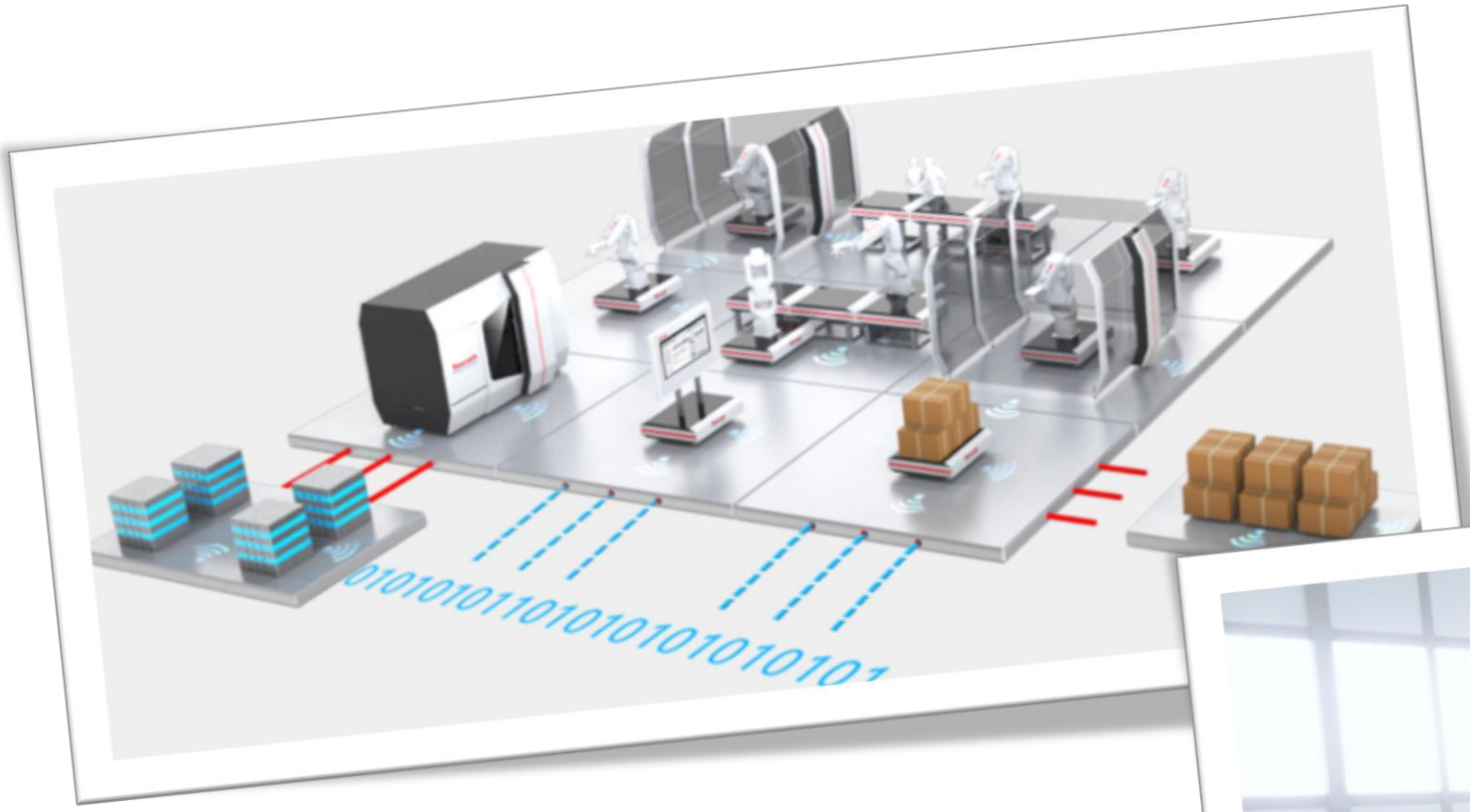
Complexity

High Investments

Long set-up times

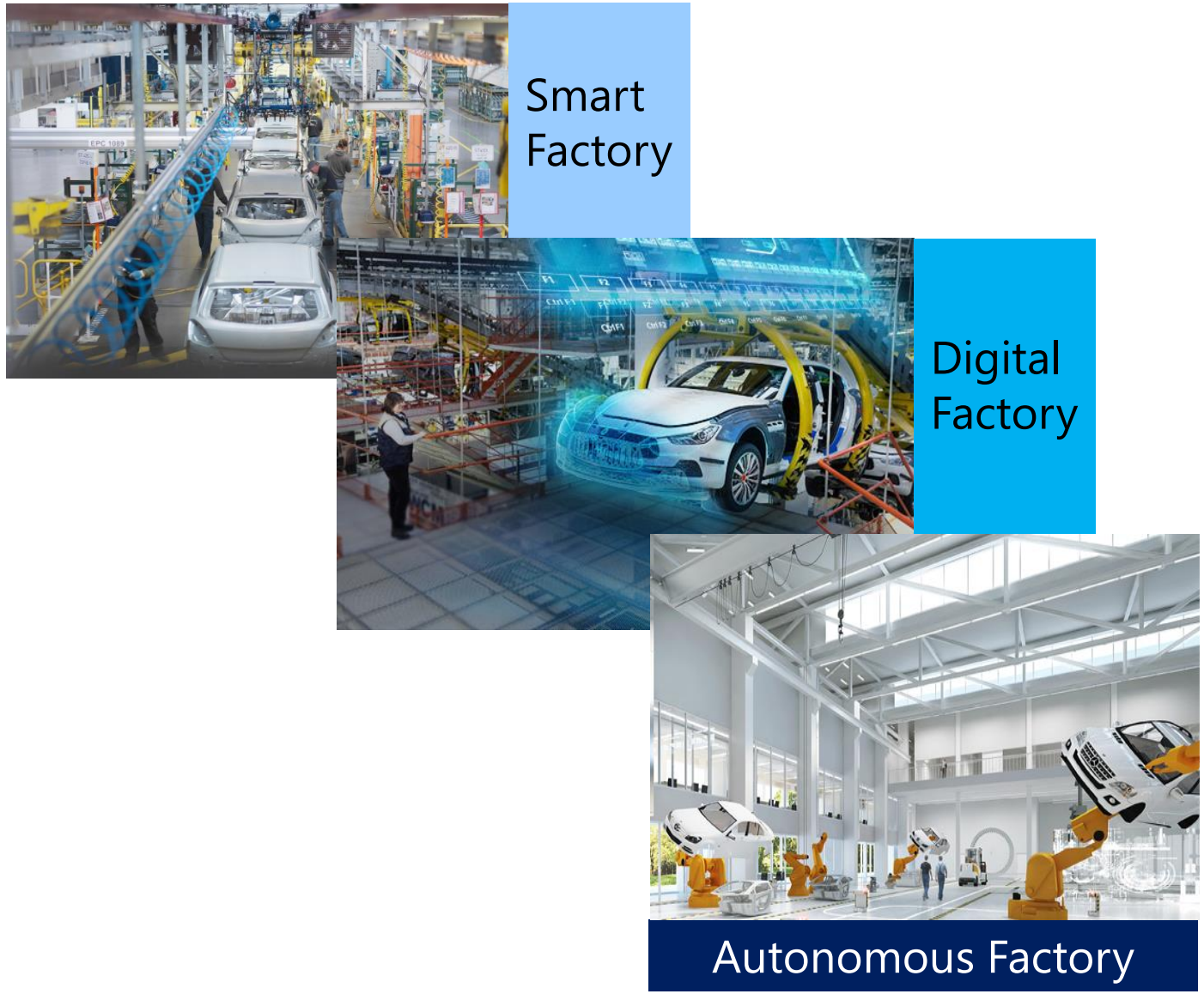
Low adaptation

Space



Autonomous Factory 4.0:
How do we **get there**?

Software-Defined Automation & Control for Autonomous Factory 4.0



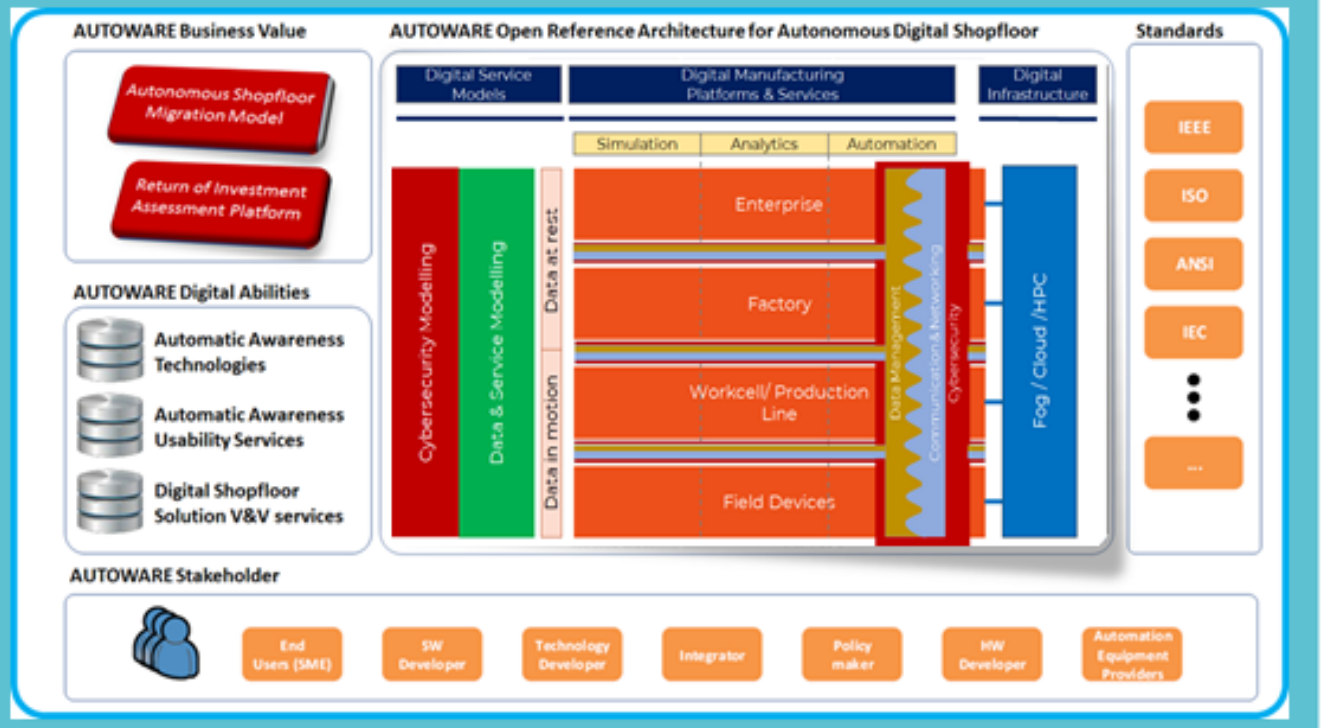
Vision

Fast product-process planning or proactive production control is realized through

- **Modular automation and control software services** that can be trusty deployed, reliably run and flexibly orchestrated at will anywhere, anytime and on any platform.
- **Data shared** across digital manufacturing platforms and factories with full usage control meeting production demands and
- **Factory reconfiguration, flexible human-robot collaboration** and easy task programming.

AUTOMATIC AWARENESS

Neutral Experimentation Facilities



Industrial Experimentation Facilities

3 Demonstrators

2 Use Cases

1 Software Defined Control & Automation Reference Arch.

1 Autonomous Service Migration Path

1 Certification Scheme

1 RoI Assessment Platform

AUTOWARE framework

Digital Migration Paths for Factories 4.0

EFFRA
EUROPEAN FACTORIES OF THE FUTURE RESEARCH ASSOCIATION

CONNECTED FACTORIES

Hyperconnected Factories

Networked enterprises in complex, dynamic supply chains and value networks

Autonomous Factories

AUTOWARE

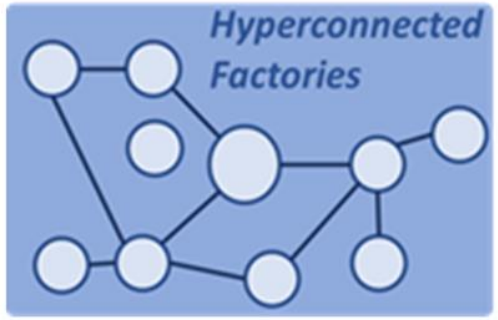
Optimised and sustainable manufacturing including advanced human-in-the-loop workspaces

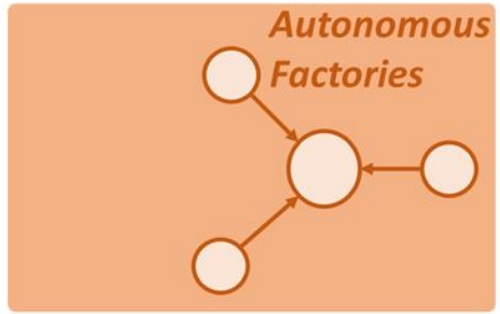
Collaborative Product-Service Factories

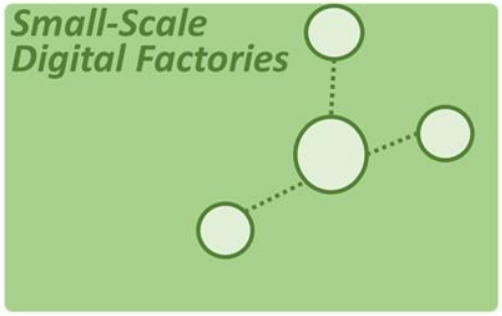
Data-driven product-service engineering in knowledge intensive factories

Small-Scale Digital Factories

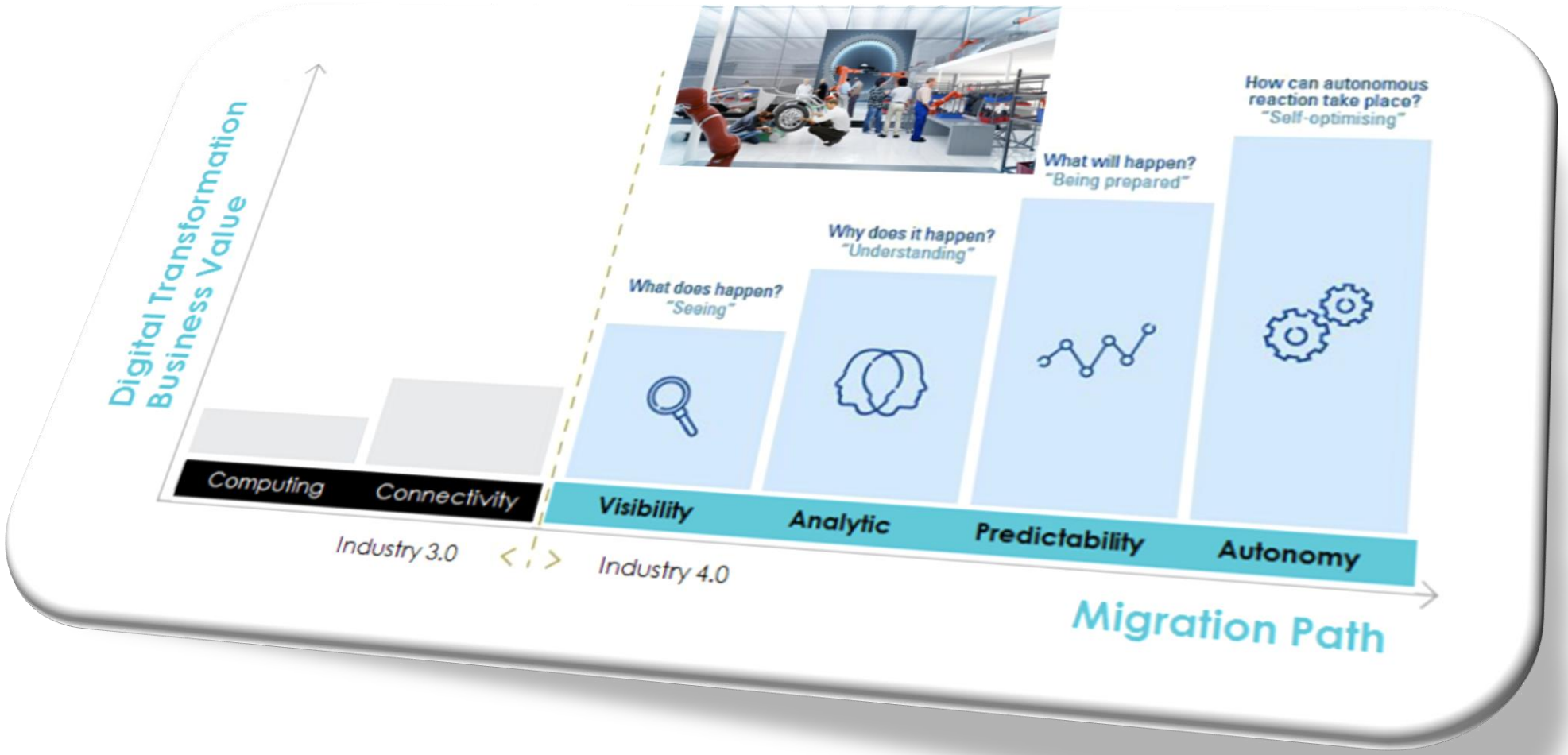
Mission-focused digitalisation for SME-driven sustainable manufacturing



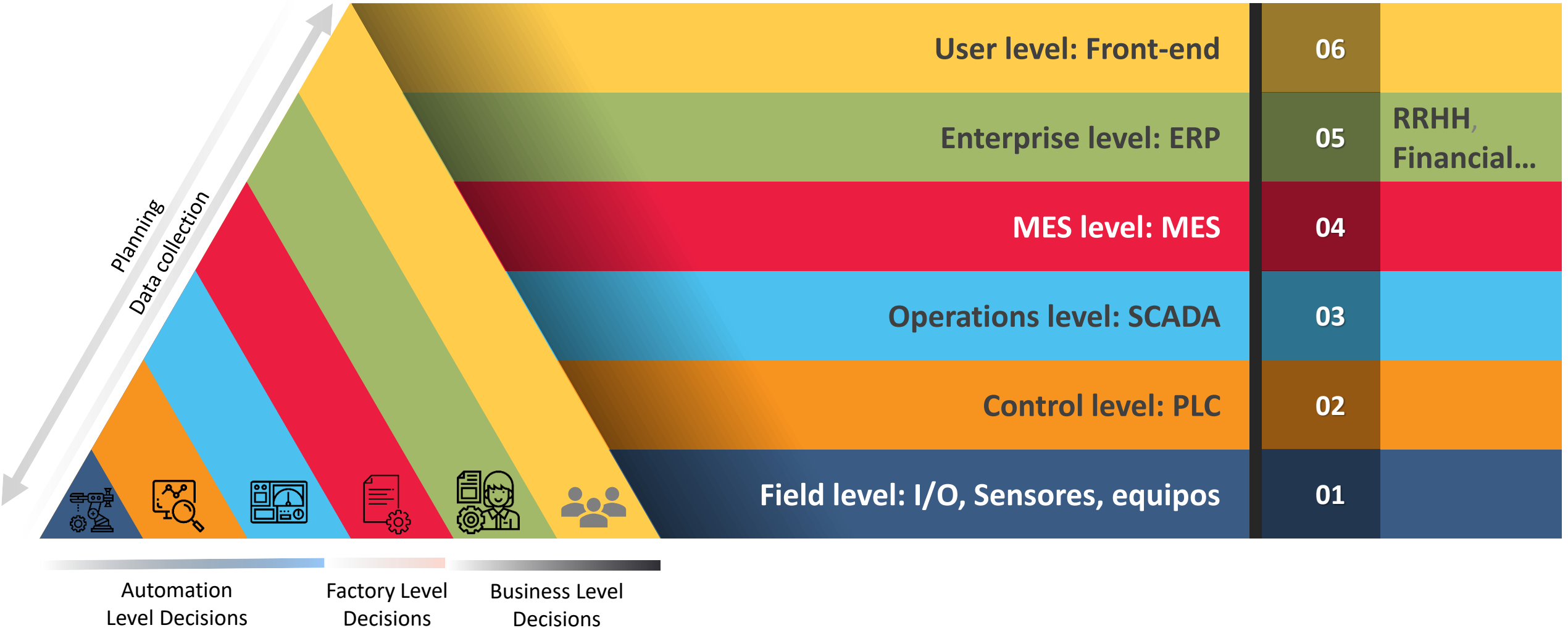




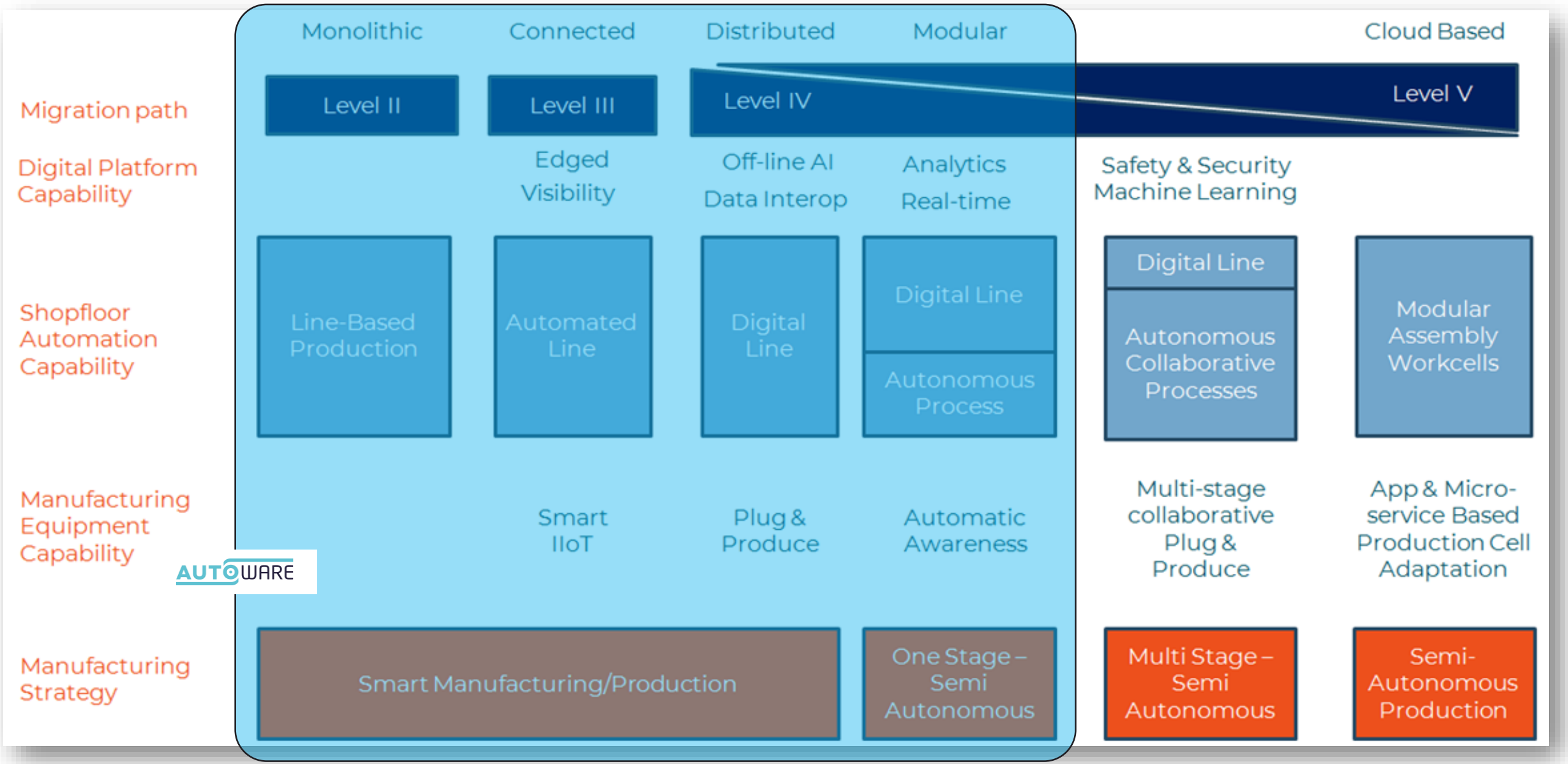
Autonomous Factories 4.0 Transformation: Digital Capabilities



Autonomous Factories 4.0 Transformation: Digital Capabilities



Autonomous Factories 4.0 Transformation Pathway



Software-Defined Automation & Control

3
Pillars

Data-Driven Trusted Digital Service Modelling

Cybersecurity, services, data management & networking

Open Digital Infrastructures

Fog, Multi-access Edge Computing (MEC), Cloud, HPC

Interoperable Digital Manufacturing Platforms & Services

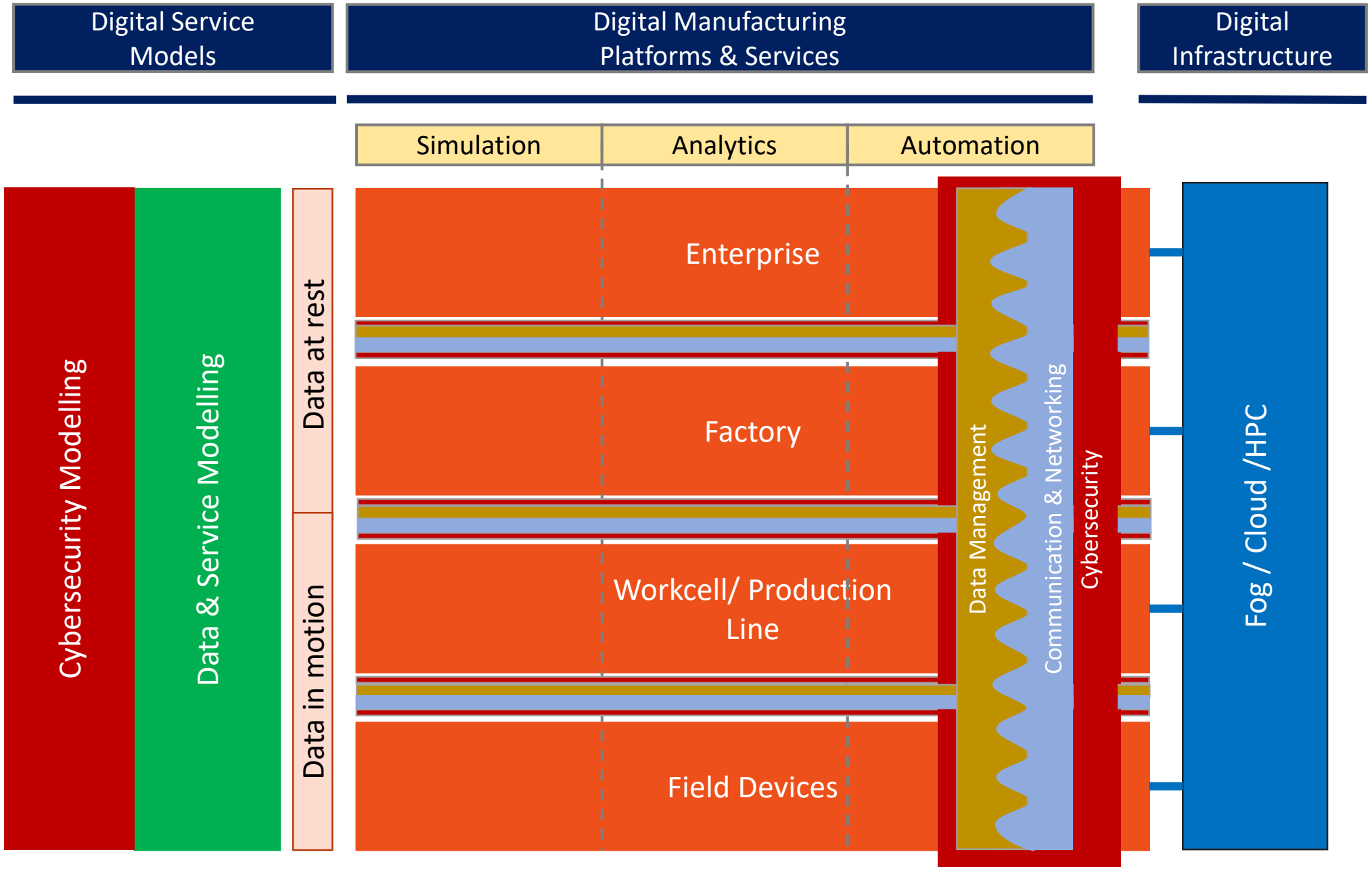
VM, Lightweight docker SWARM, micro-services , service-oriented & event-oriented, data sovereignty

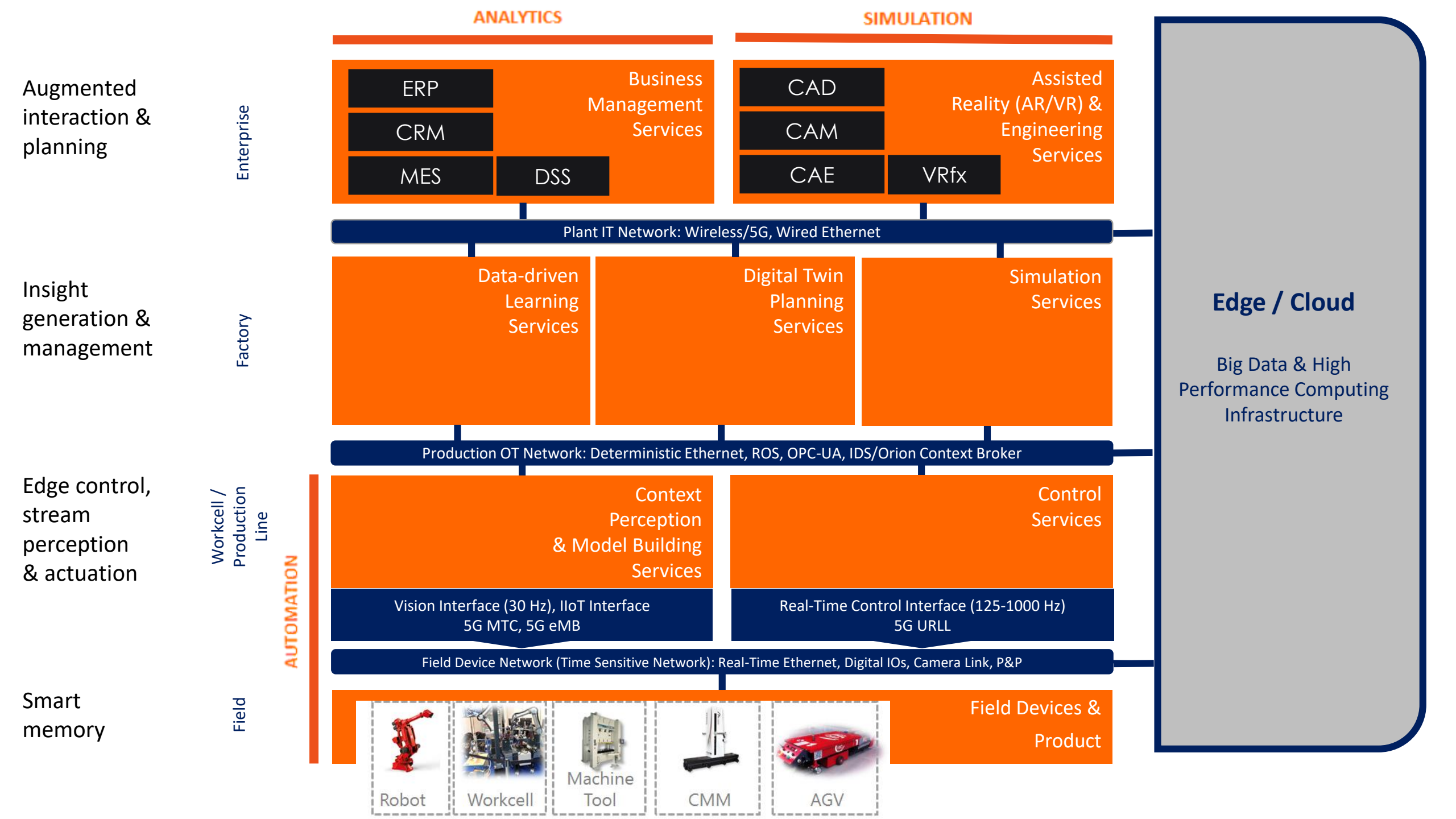
Software-Defined Automation & Control

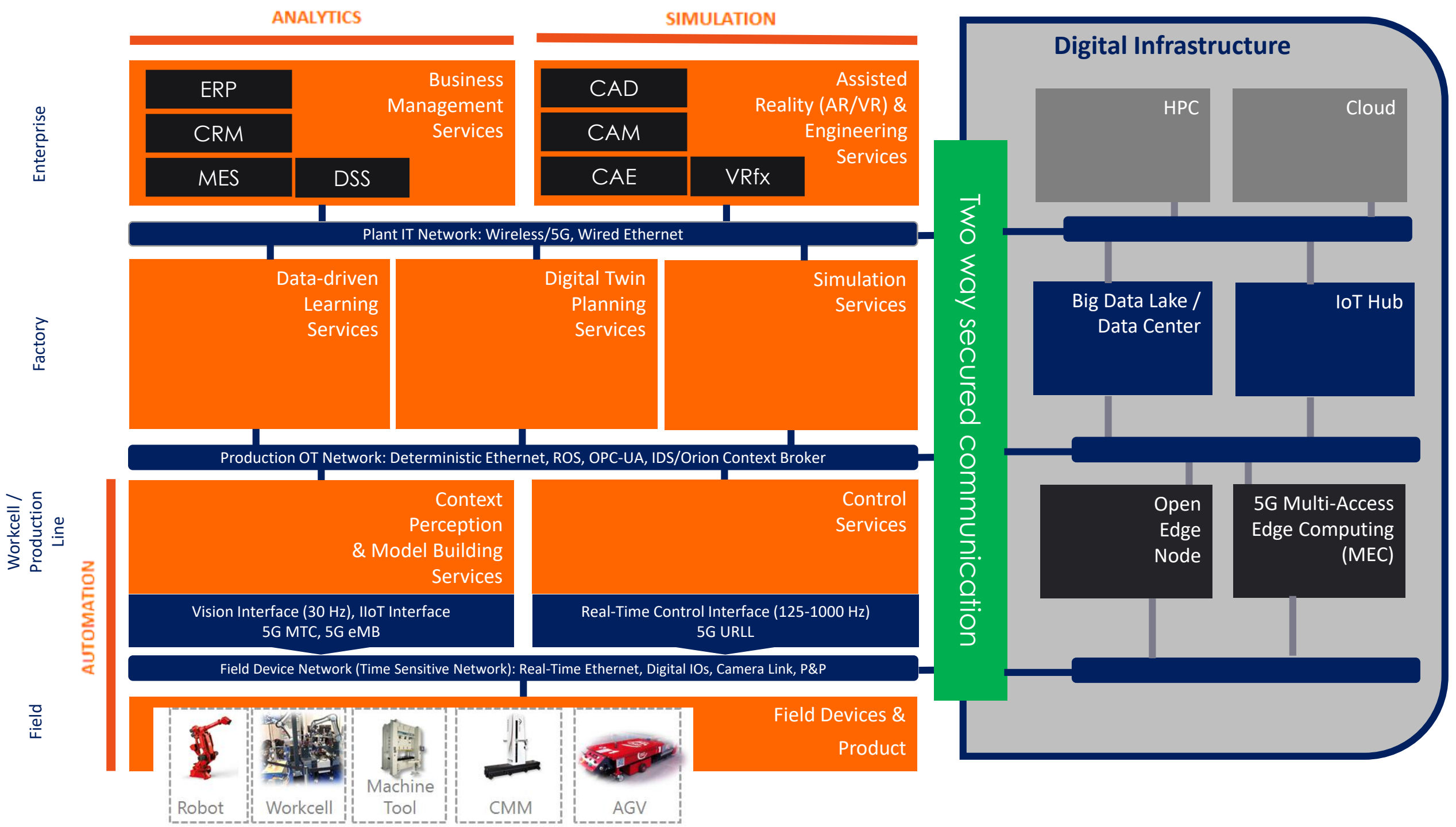
4
Layers

- Enterprise Level (Planning)
- Factory Level (Management)
- Workcell / Production Line Level (Control/Supervision)
- Field Level

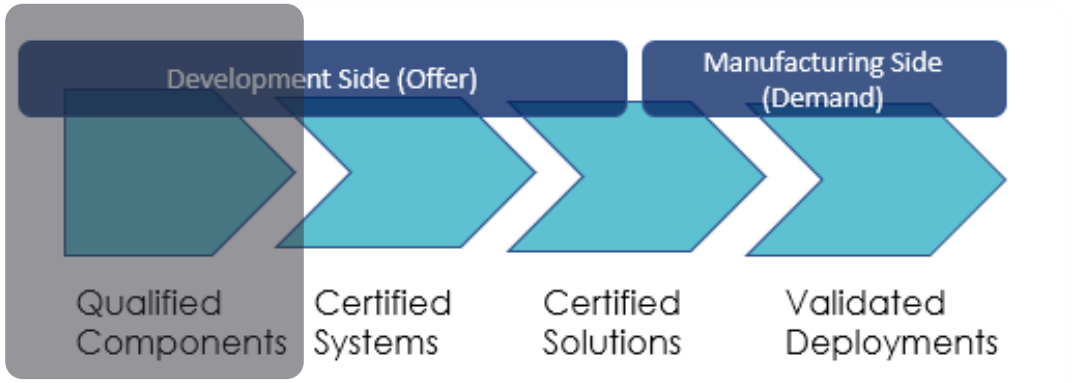
Autonomous Factory 4.0 Services Framework

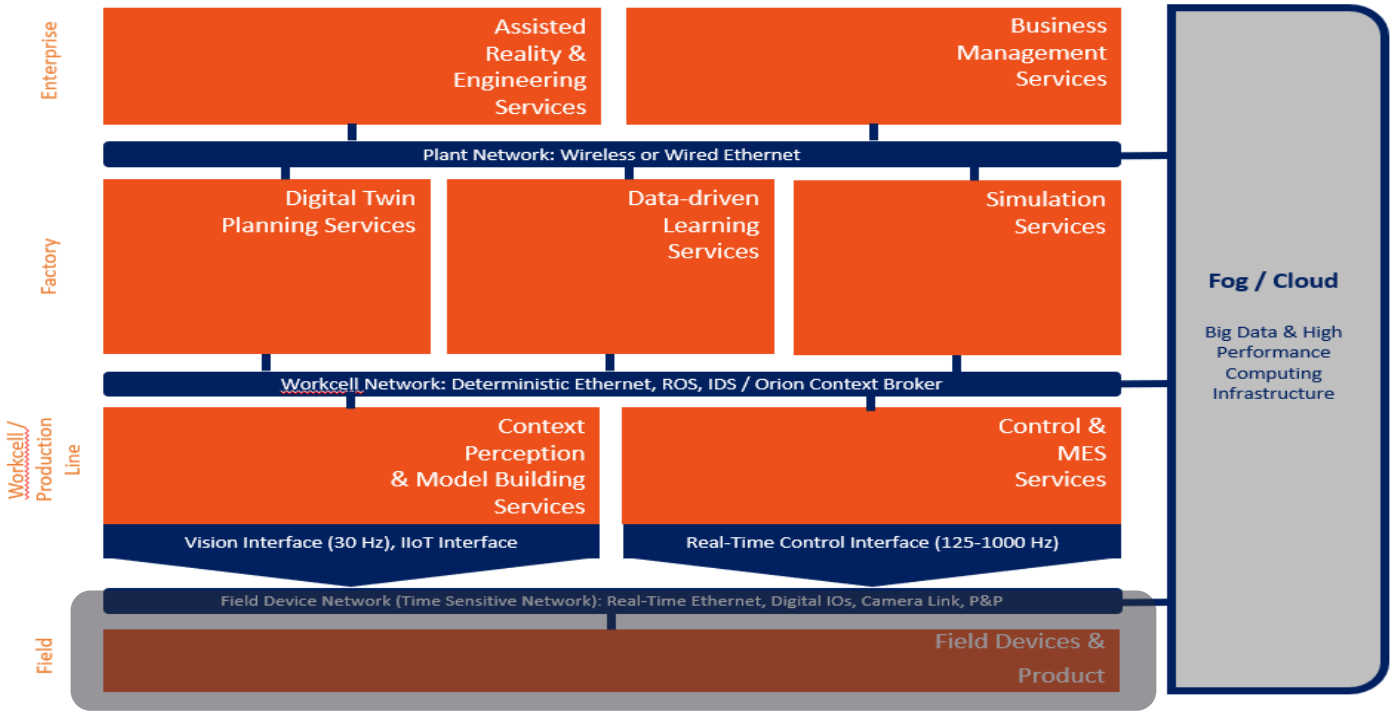



ANALYTICS
SIMULATION
Augmented interaction & planning
Enterprise
ERP
CRM
MES
DSS
Business Management Services
CAD
CAM
CAE
VRfx
Assisted Reality (AR/VR) & Engineering Services
Plant IT Network: Wireless/5G, Wired Ethernet
Insight generation & management
Factory
Data-driven Learning Services
Digital Twin Planning Services
Simulation Services
Production OT Network: Deterministic Ethernet, ROS, OPC-UA, IDS/Orion Context Broker
Edge control, stream perception & actuation
Workcell / Production Line
AUTOMATION
Context Perception & Model Building Services
Control Services
Vision Interface (30 Hz), IIoT Interface
5G MTC, 5G eMB
Real-Time Control Interface (125-1000 Hz)
5G URLL
Field Device Network (Time Sensitive Network): Real-Time Ethernet, Digital IOs, Camera Link, P&P
Smart memory
Field
Field Devices & Product
Robot
Workcell
Machine Tool
CMM
AGV
Edge / Cloud
Big Data & High Performance Computing Infrastructure


ANALYTICS
SIMULATION
Digital Infrastructure
Enterprise
Factory
Workcell / Production Line
Field
AUTOMATION
ERP
CRM
MES
DSS
Business Management Services
CAD
CAM
CAE
VRfx
Assisted Reality (AR/VR) & Engineering Services
HPC
Cloud
Plant IT Network: Wireless/5G, Wired Ethernet
Data-driven Learning Services
Digital Twin Planning Services
Simulation Services
Big Data Lake / Data Center
IoT Hub
Production OT Network: Deterministic Ethernet, ROS, OPC-UA, IDS/Orion Context Broker
Context Perception & Model Building Services
Control Services
Open Edge Node
5G Multi-Access Edge Computing (MEC)
Vision Interface (30 Hz), IIoT Interface
5G MTC, 5G eMB
Real-Time Control Interface (125-1000 Hz)
5G URLL
Field Device Network (Time Sensitive Network): Real-Time Ethernet, Digital IOs, Camera Link, P&P
Two way secured communication
Field Devices & Product
Robot
Workcell
Machine Tool
CMM
AGV

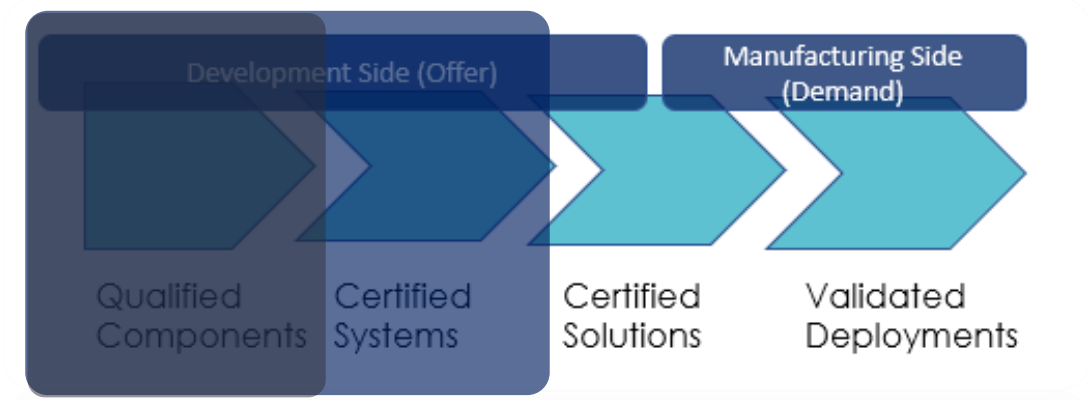
Deploying Autonomous Factory 4.0 Services



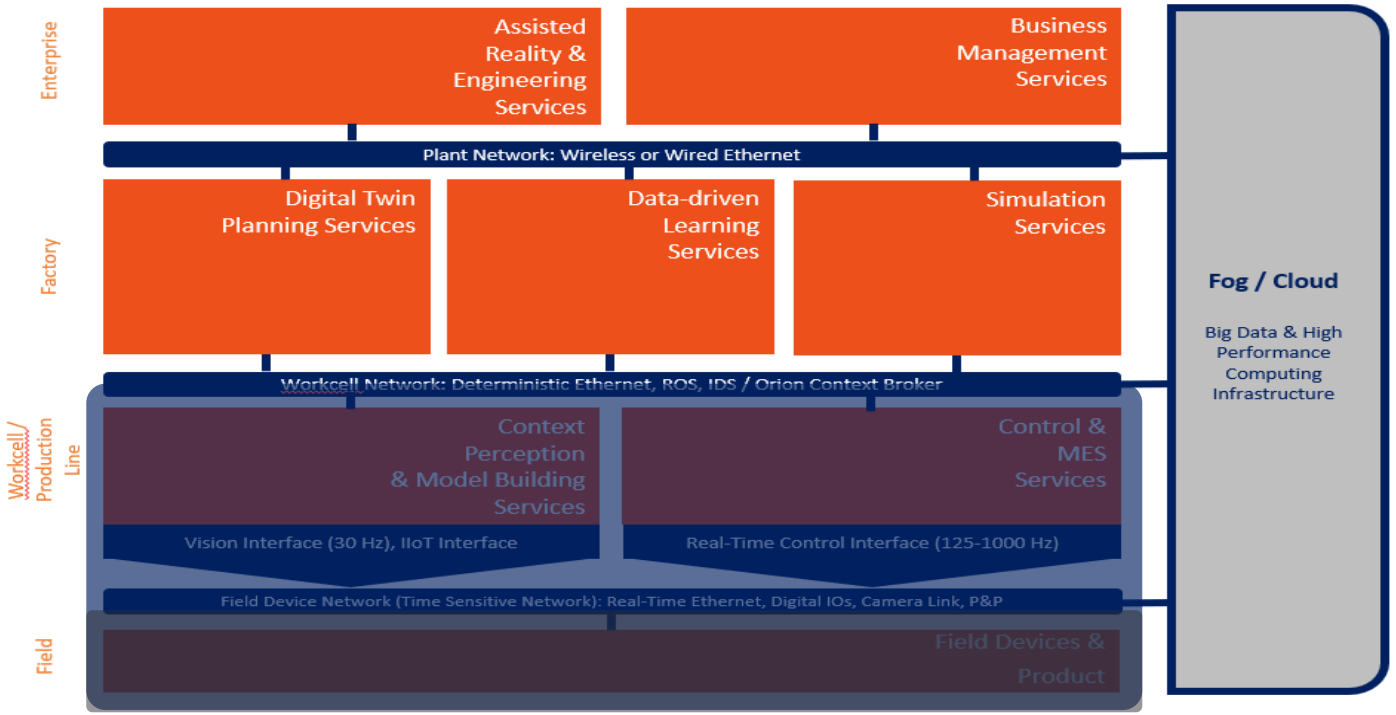


Qualified Field Devices

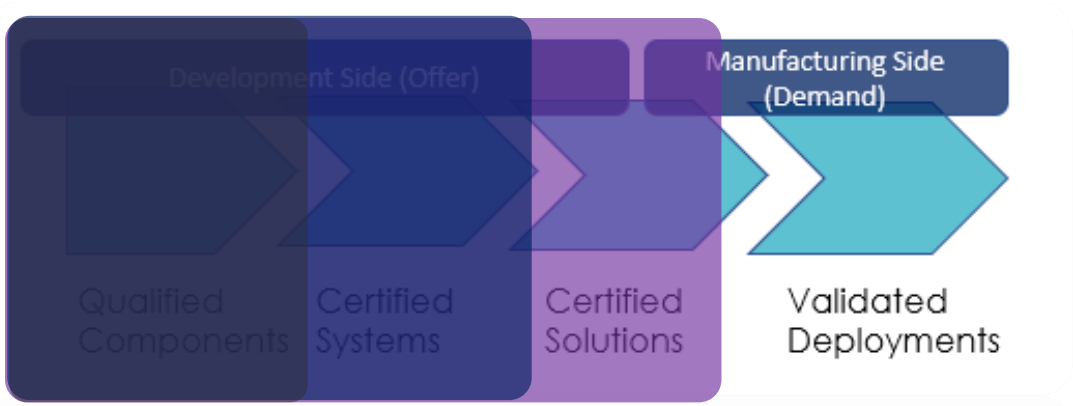
Deploying Autonomous Factory 4.0 Services



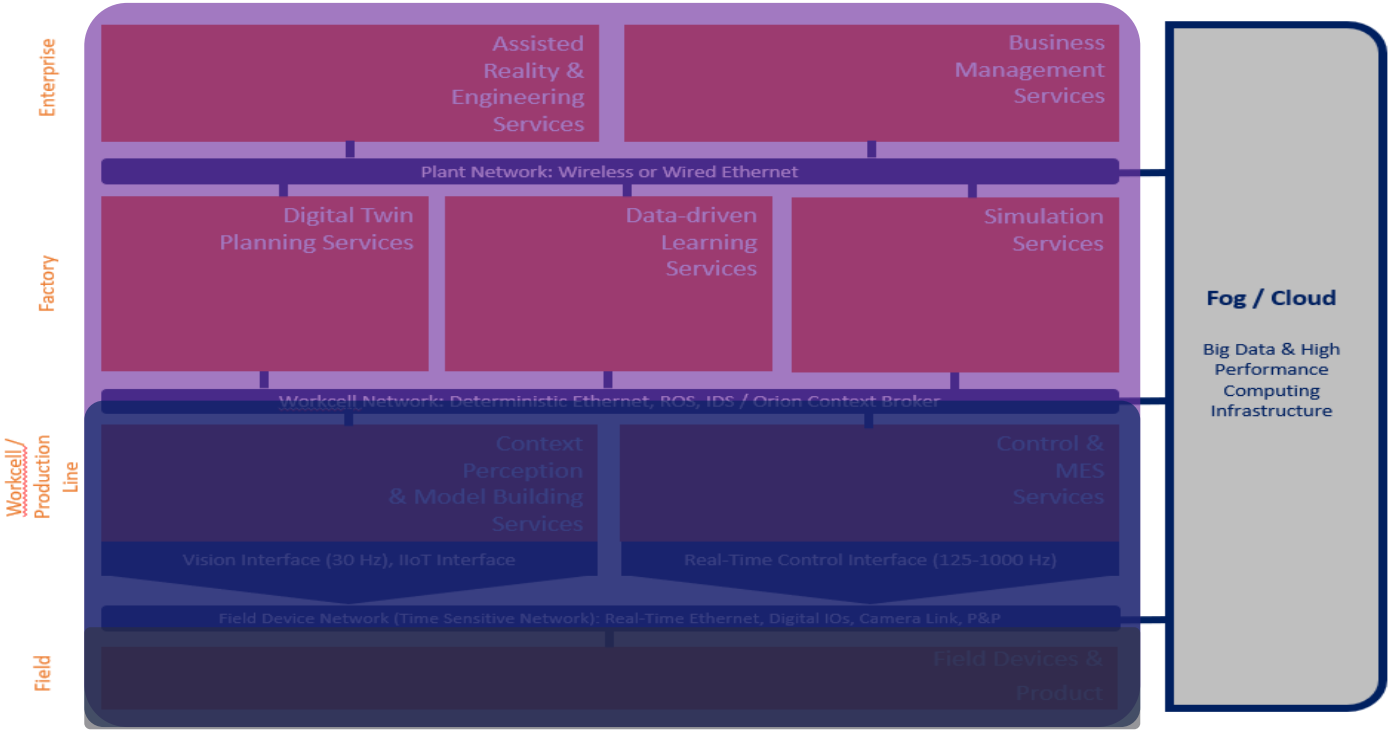
Certified Digital Systems

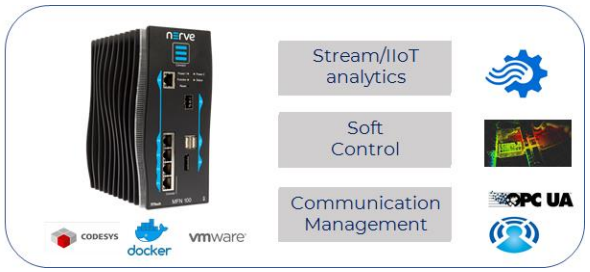


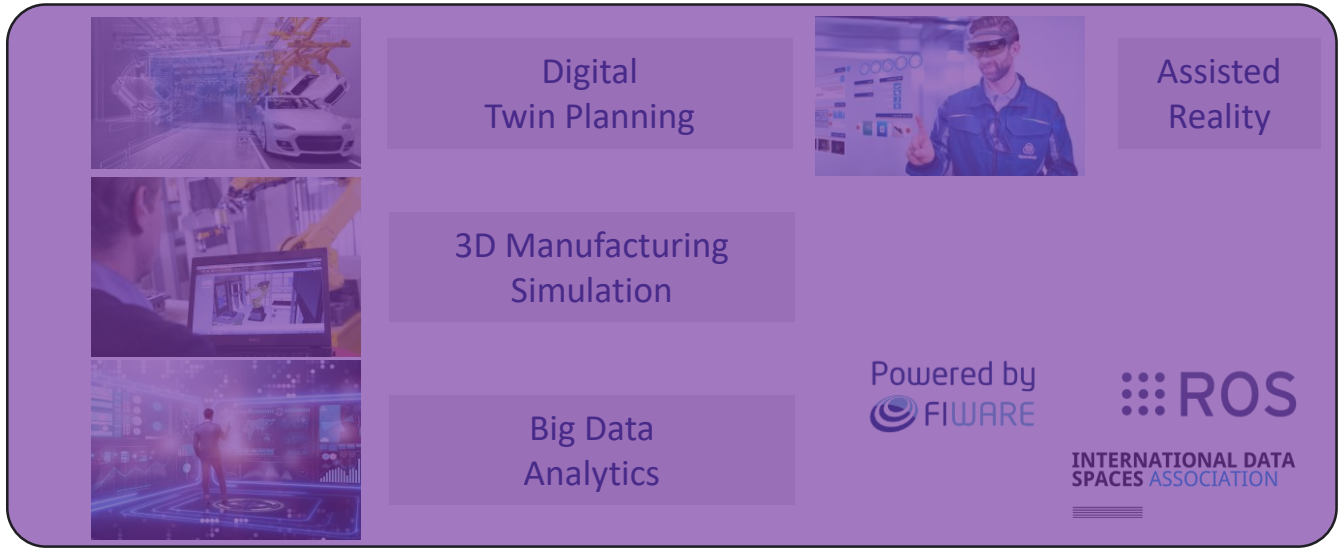
Deploying Autonomous Factory 4.0 Services



Certified Autonomous Solutions







Software-Defined Automation & Control

1
Certification
Programme

- Open Control & Automation Services – Virtual Machine, Docker, CODESYS
- Interoperable Trusted Data Paths – OPC-UA (Pub/Sub), ROS, IDSA/NGSI
- Cybersecurity – IEC 62433.
- Safety - Collaborative Robots ISO/TS 15066:2016, ISO 10218-1:2011, ISO 10218-2:2011.
- AUTOWARE Services
  - IoT data distribution.
  - Ultra reliable mobile wireless connectivity.
  - TSN connectivity
  - AGV fleet management & navigation.
  - Product identification / recognition.
  - Force-based control.
  - 3D visual inspection and workplace monitoring.
  - Programming by demonstration.

Digital Transformation Project Profile

50K€

Investment

Average digital transformation project investment goes from 50K€ to 100K€.

9

Duration

Over 60% of enterprises consider the optimum I4.0 project duration between 9 and 12 months

2

ROI

55% of enterprises expect a ROI of Industry 4.0 actions below 2 years

20%

Competitiveness

Productivity improvements 20%.

Low Deployment Cost

Fast Return of Investments

Easy Configuration & Operation

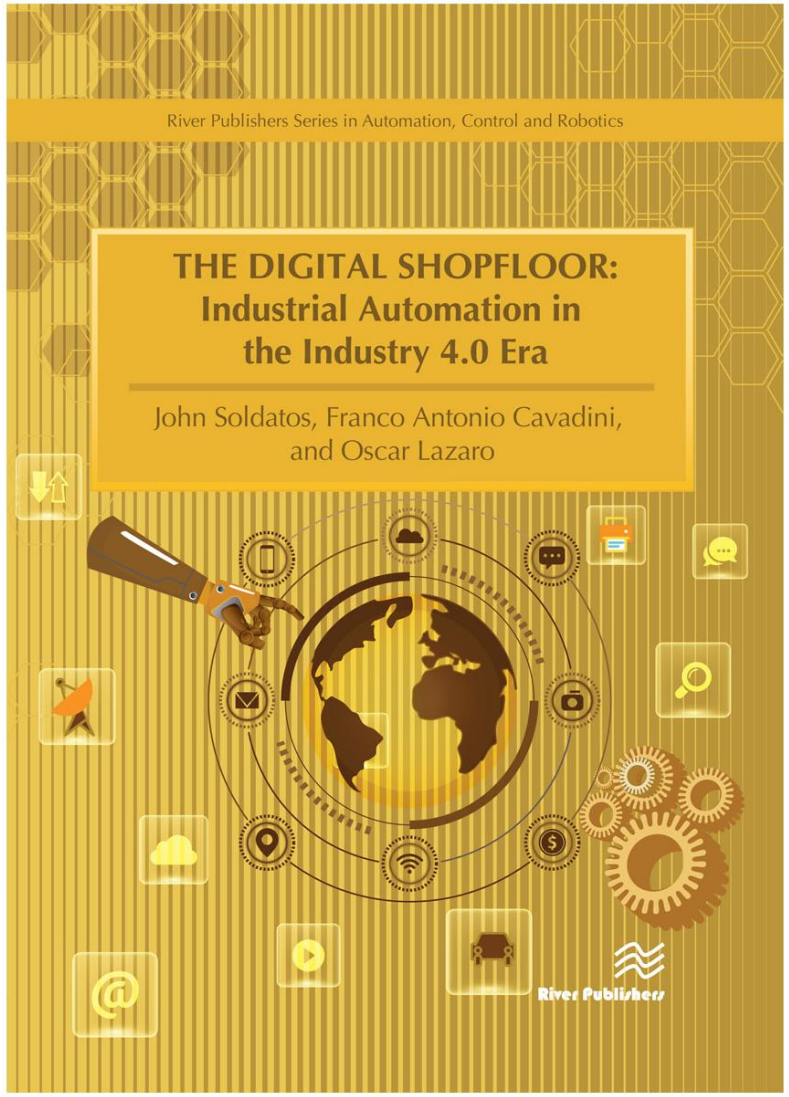
Reliable Solutions

Incremental deployment

Open Systems

Autonomous Services Value Proposition

Autonomous Service Framework



The Digital Shopfloor: Industrial Automation in the Industry 4.0 Era

The book reflects most recent R&I results from H2020 (European Commission funded) research and innovation projects; primarily from FAR-EDGE, AUTOWARE, DAEDALUS initiatives, which have formed the Digital Shopfloor Alliance (DSA). It provides insights on a variety of digital automation open reference architectures, platforms and solutions, based on advanced ICT technologies like open cloud/edge computing, distributed ledger technologies and data-driven cognitive computing, which will play a key role in supporting software-defined modular automation and collaborative robotic solutions in the factories of the future. Moreover, solutions based on the promising IEC 61499 standards are also addressed.

In particular, the work reflected in the book is perfectly aligned to the initial stages of the ConnectedFactories **"Autonomous Smart Factories" pathway**, as the presented technologies and use cases are boosting significant improvements in production time, quality, sustainability and cost-efficiency at the same time.

Download: https://lnkd.in/gYDe-G6 .