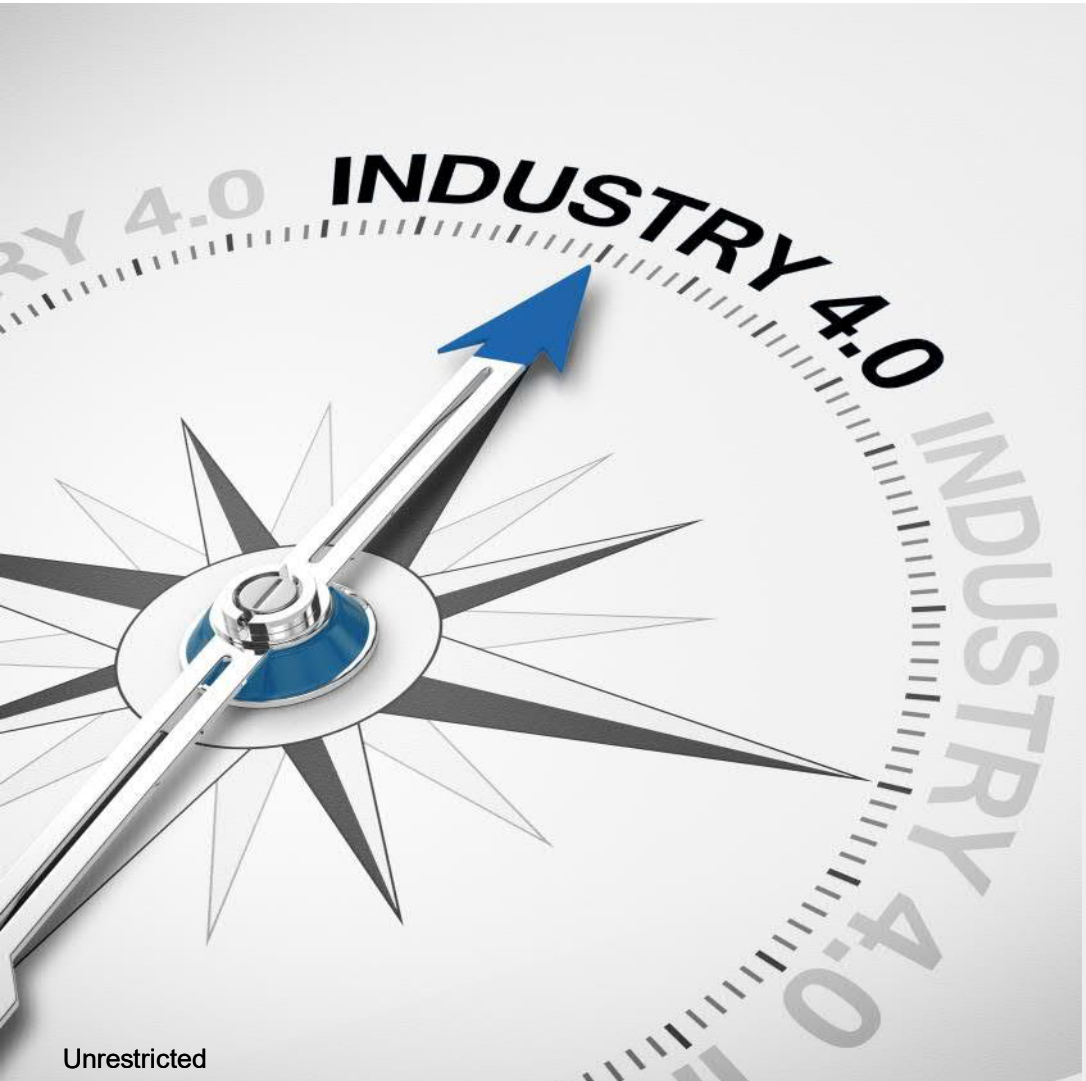

AI goes Edge: opportunità tecnologiche per il mercato manufatturiero

Massimiliano GALLI
Siemens S.p.A.

Organizzato da

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Today manufacturing..
…what’s next ?

Influence of B2C on B2B Strategies

	2019	2030	
Time to market	Time intensive	Instant delivery	**Reduced time to market**
Innovation	Product	Solution	**Shift to consumer oriented innovation**
Visibility	Limited	Across value chain	**Ability to track behind the scenes**
Production	Mass	Personalized	**Personalized solutions at scale**
Engagement	Death of loyalty	Competitive advantage	**Using brand loyalty for competitive advantage**
Accuracy	Error-prone	Zero defects	**Zero-defect delivery**

Changes in the *B2C market* are bleeding over to the *B2B market*, too...

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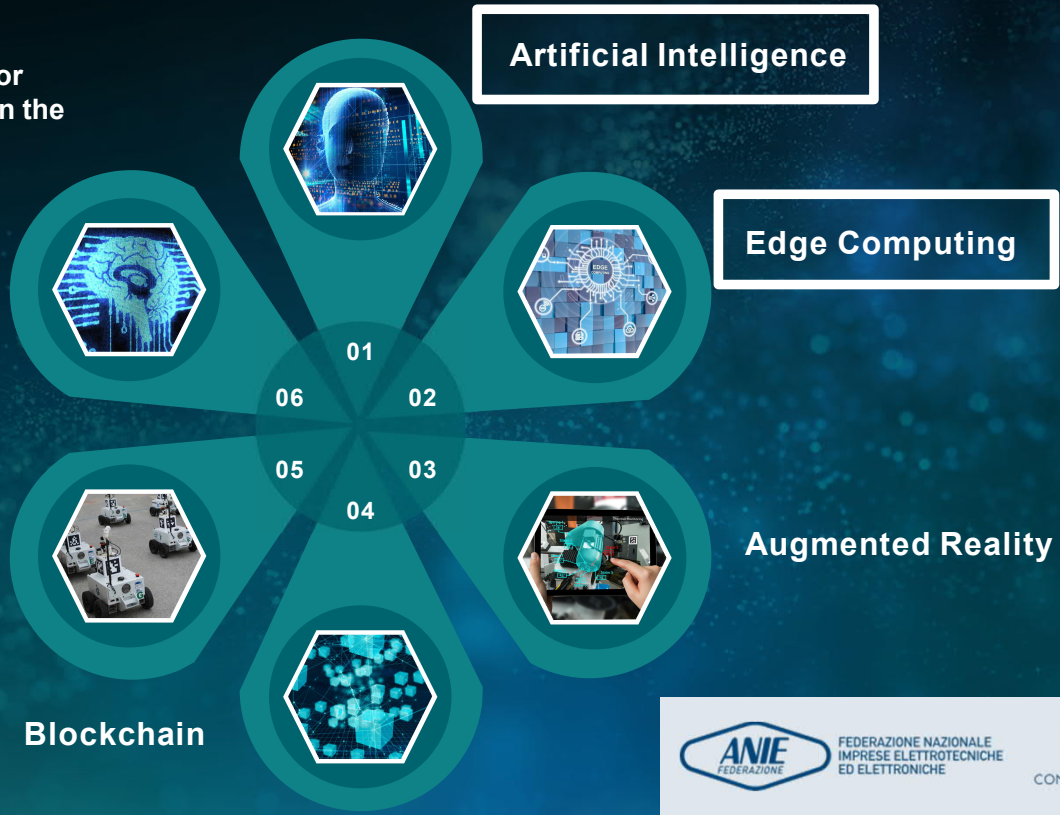
Digital Industries is driving a new vision for Factory Automation

SIEMENS

… A factory automation vision for manufacturing processes built upon the following ‘6 levers of change’



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X-ray-based PCB quality assurance

Siemens Electronics Factory Amberg, Germany

Challenge

Production output of SMT line limited by time consuming X-ray Quality tests

Every further X-ray machine requires additional invest of €500,000

Cloud

AI

Addestramento Algoritmo

MindSphere

Sviluppo e update di applicazioni

Archiviazione dati continua

Fabbrica di produzione (OT)

AI

Raccolta Dati in tempo reale >40,000 paremetri di produzione (10 MB/s)

Algoritmo di predizione

Il test con i X-RAY è necessario? YES o NO

X-RAY

No X-Ray

Dispositivo Edge

Linea di assemblaggio

Manufacturing Execution System

EWA Production Line

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Minimization of necessary X-ray tests by up to

30%

Quality rate of

100%

Reduced capital invest for further X-ray machines of

€500,000

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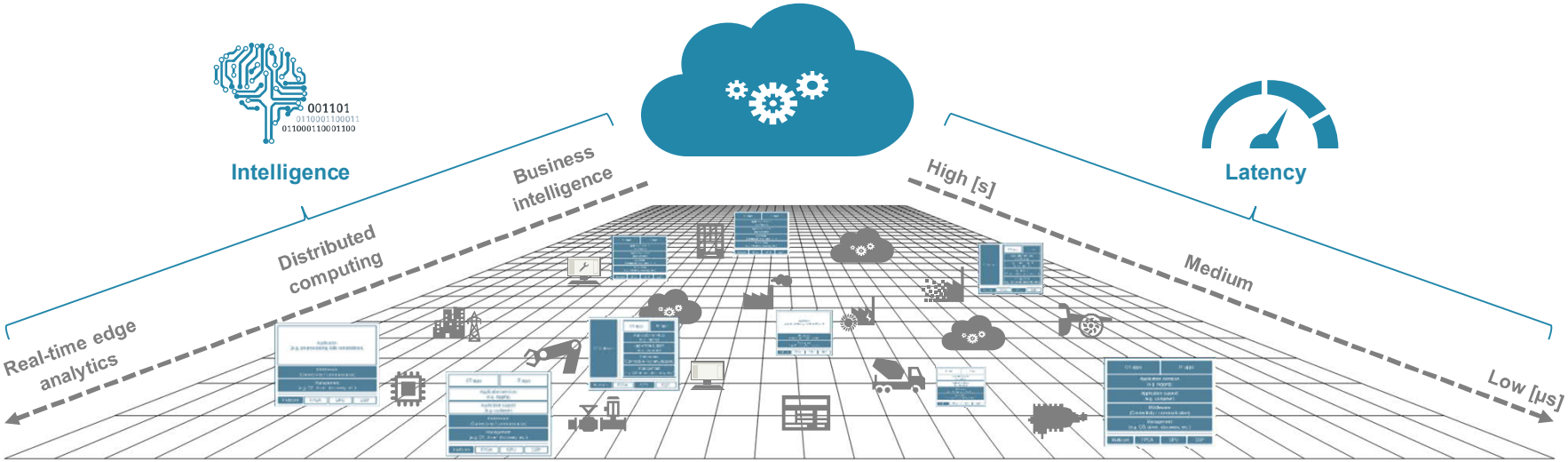
EDGE AI

Prepare for the future of automation

Devices must get smarter by moving data analytics and associated services from the cloud close to the data sources.



Fast response	• **Local processing** of data streams • **Real time**, **low latency** (e.g., for control)
Low cost	• **Use of existing hardware** in the field • Reduction of cloud **usage fees**
Availability	• **Independence from cloud backend** • **Offline operation** and reduction of network traffic
Security / Privacy	• Keep **sensitive data** on device • **Send only non-confidential data** to the cloud

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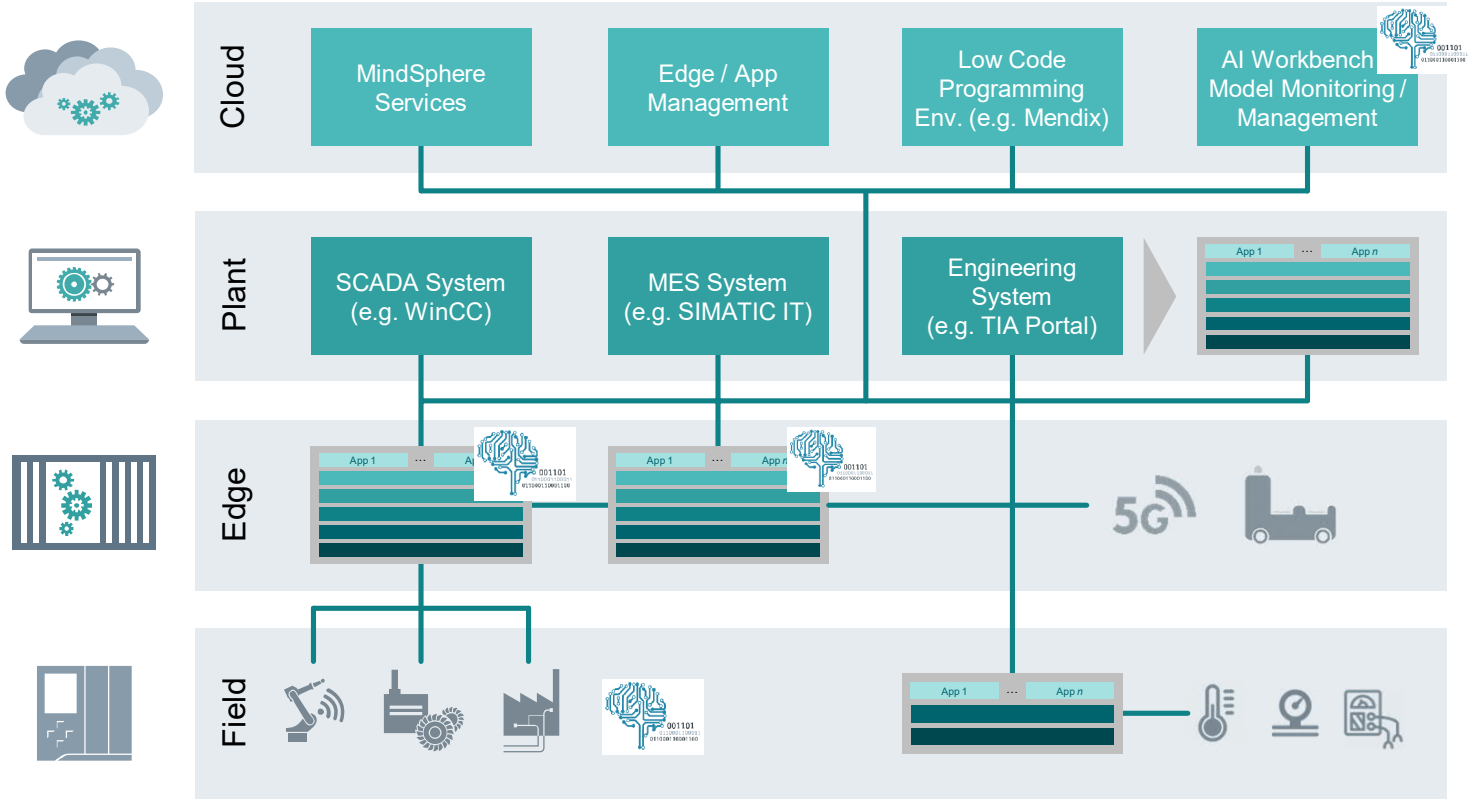
Embedding of Edge Devices into the IT/OT Landscape



- Mass device / campaign management
- Seamless integration of data and services

- Transformation to cloud-based platforms
- Tool interoperability
- Edge-enablement

- **Auto-discovery and ad-hoc communication**
- Collaboration between edge devices
- **Hardware heterogeneity**

- Real-time capability
- High bandwidth networking
- **Light-weight edge software stacks**

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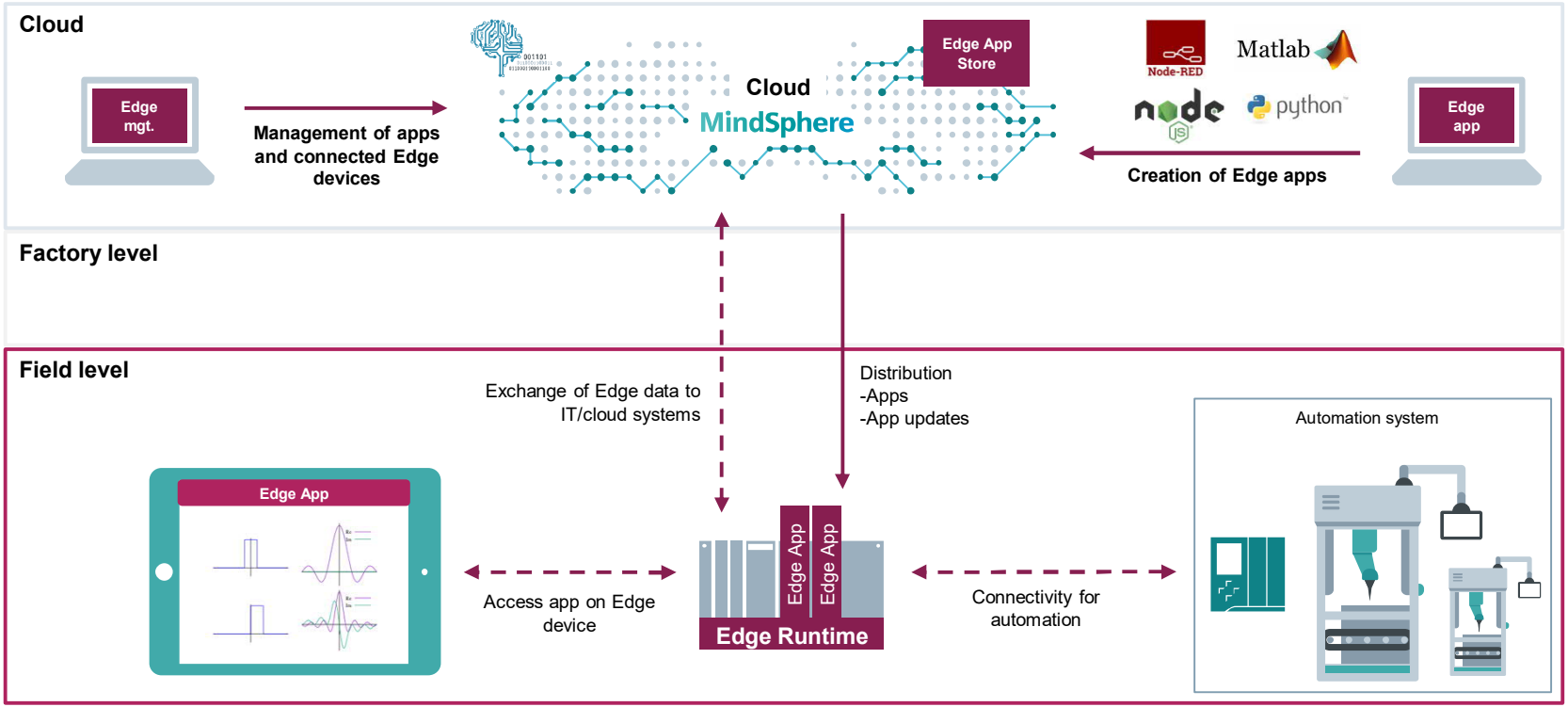
How it works…

Reaction-free updating of functions with Siemens Industrial Edge



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Pervasive Edge Device Portfolio

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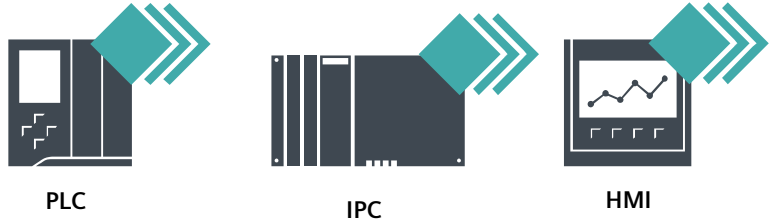
IPC
Edge-Enabled

PLC
Edge-Enabled

HMI
Edge-Enabled

Networking
Edge-Enabled

Automation Edge Devices



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Artificial Intelligence in Factory Automation

Approaches

Neural Processing Unit

Edge

CPU with ODK

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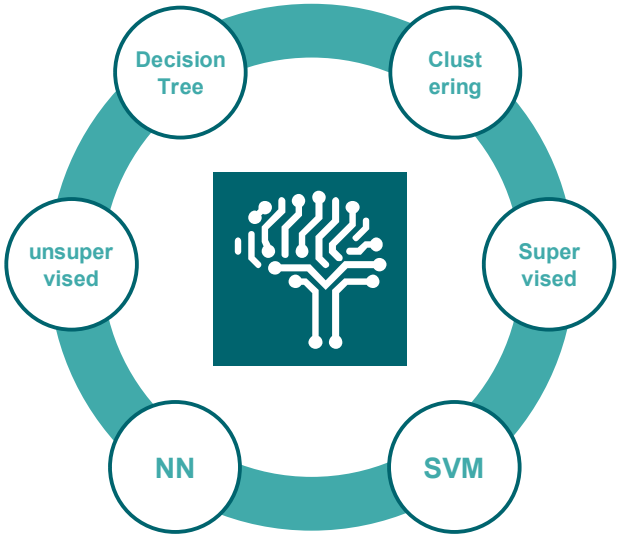
Edge Application

Containerization

Management System

No Limitation to specific AI Algorithms (e.g. Neural Networks)
Development of one Edge App → Deployment on various Hardware with different Software



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Edge Application

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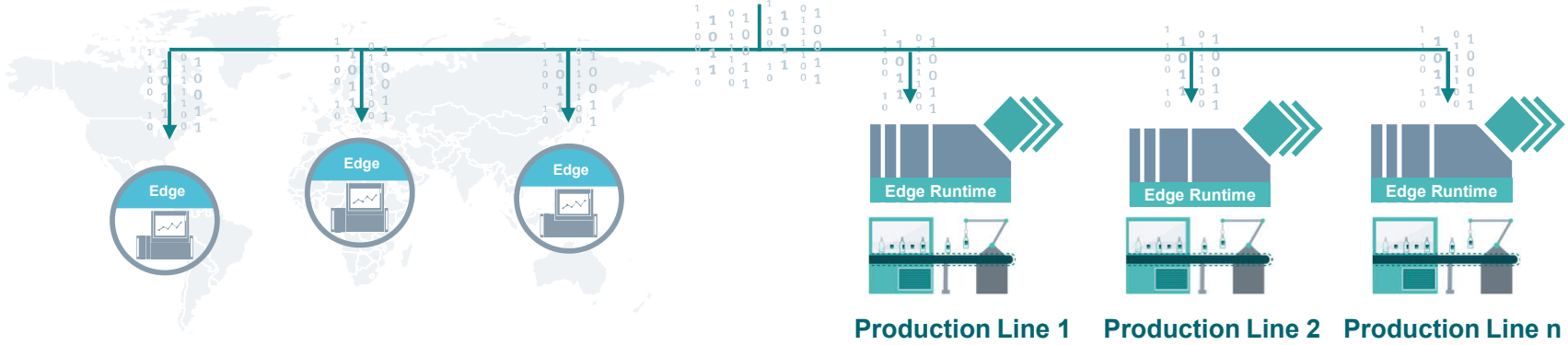
Containerization

Management System

Automized Data Collection and App Deployment

Automized Deployment of AI Algorithm – locally or globally



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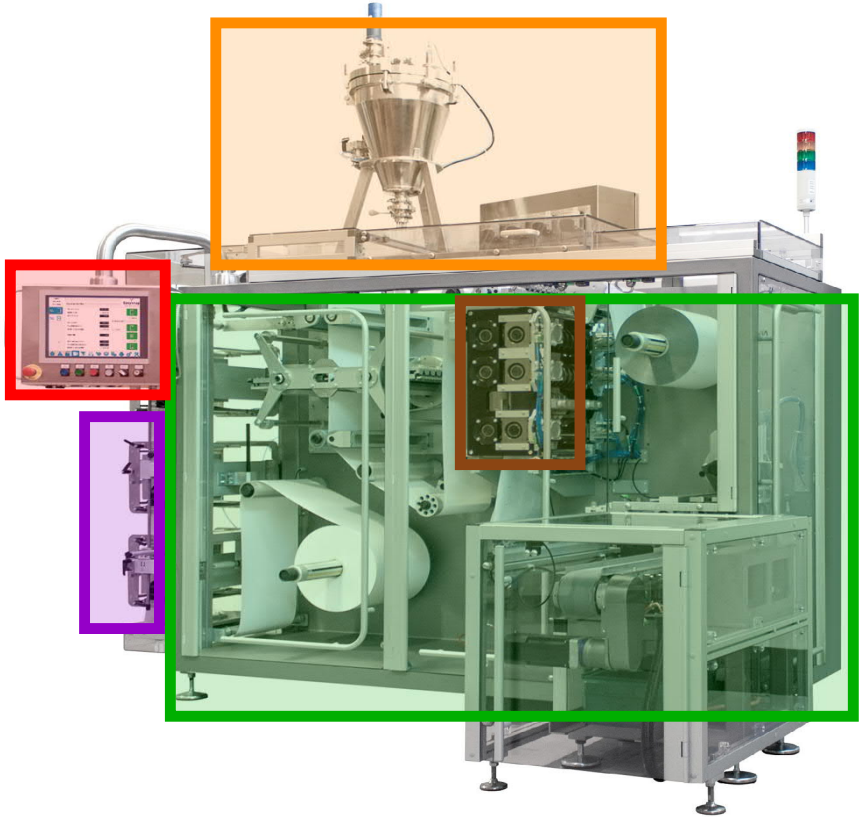
Engineering challenges at system level



- Is the same flowrate effectively flowing for each packet?
- What would be the outcome with different fluids?
- Will the packets be correctively weld?
- How to optimize the control design?

Control **Mechanical**
Pneumatic **Thermal**
Hydraulic

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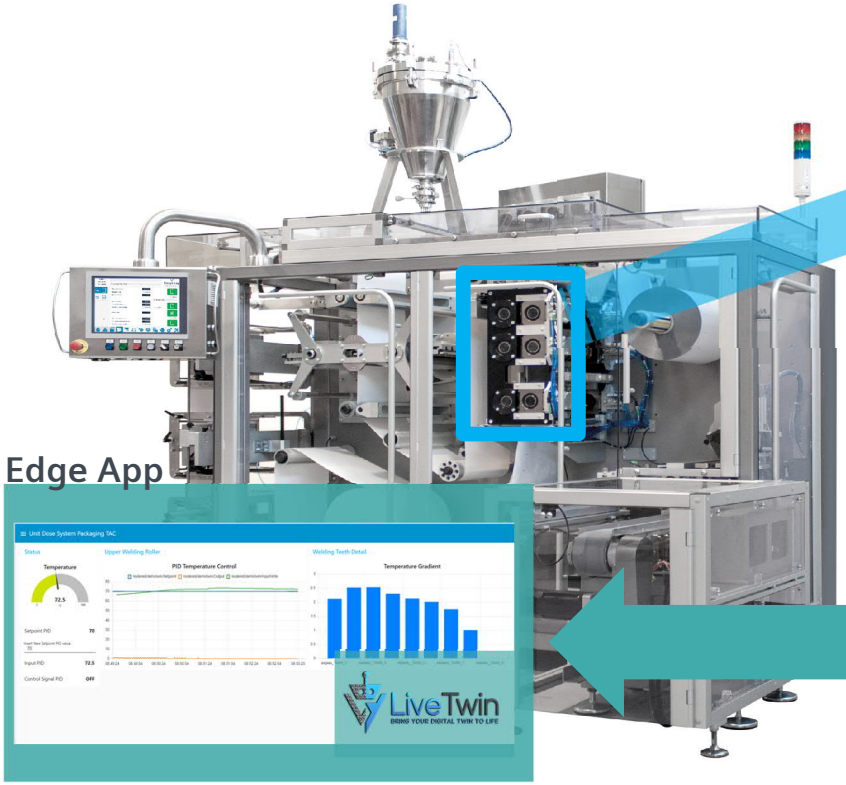
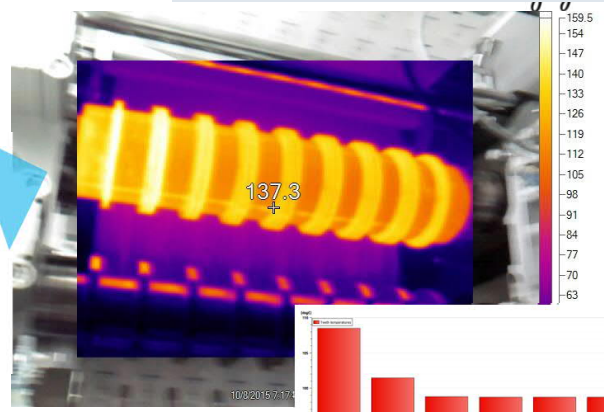
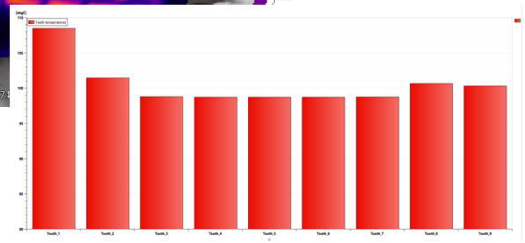
Use case: anomalous behaviour diagnosis and monitoring

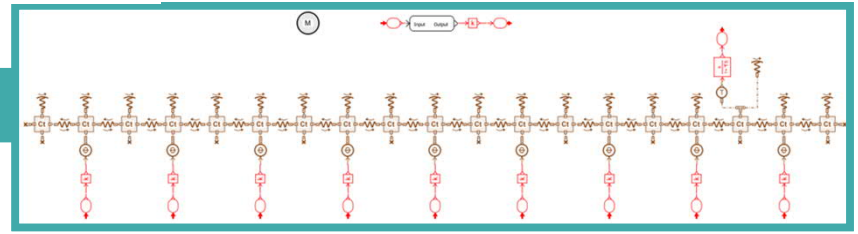






Edge App

Amesim Model



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X RAY AI&EDGE Application

Puppy
or
Muffin?

Google Cloud

AI use cases to be handled in three main application clusters using different signals and AI technologies

Vision based AI

1 Quality Inspection

2 State detection

3 Track and trace

Multi signal based AI

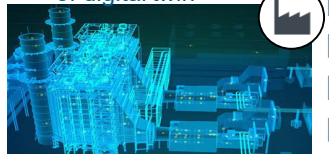
4 Machine-Parts Lifetime Prediction

5 Runtime Process Optimization

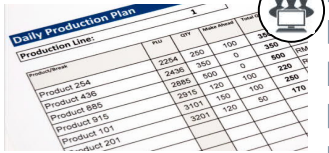
6 Scrap Rate Detection

Digital Twin based AI

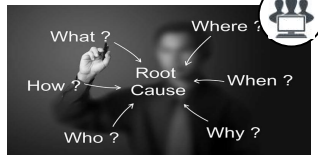
7 Creation and Adaption of digital twin



8 Dynamic Production Planning



9 Root Cause Analysis



Use Case type

Shop floor

Office

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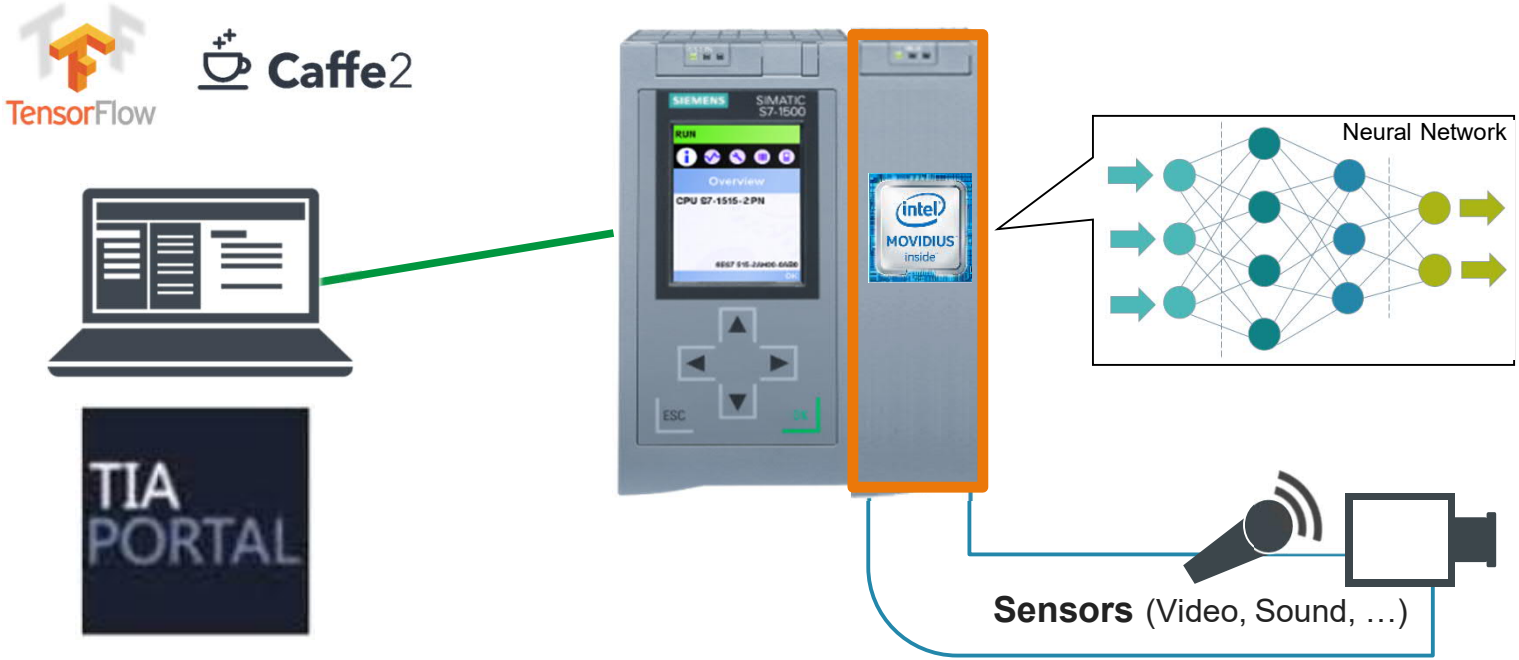
Neural Processing Unit

Artificial Intelligence – S7-1500 NPU



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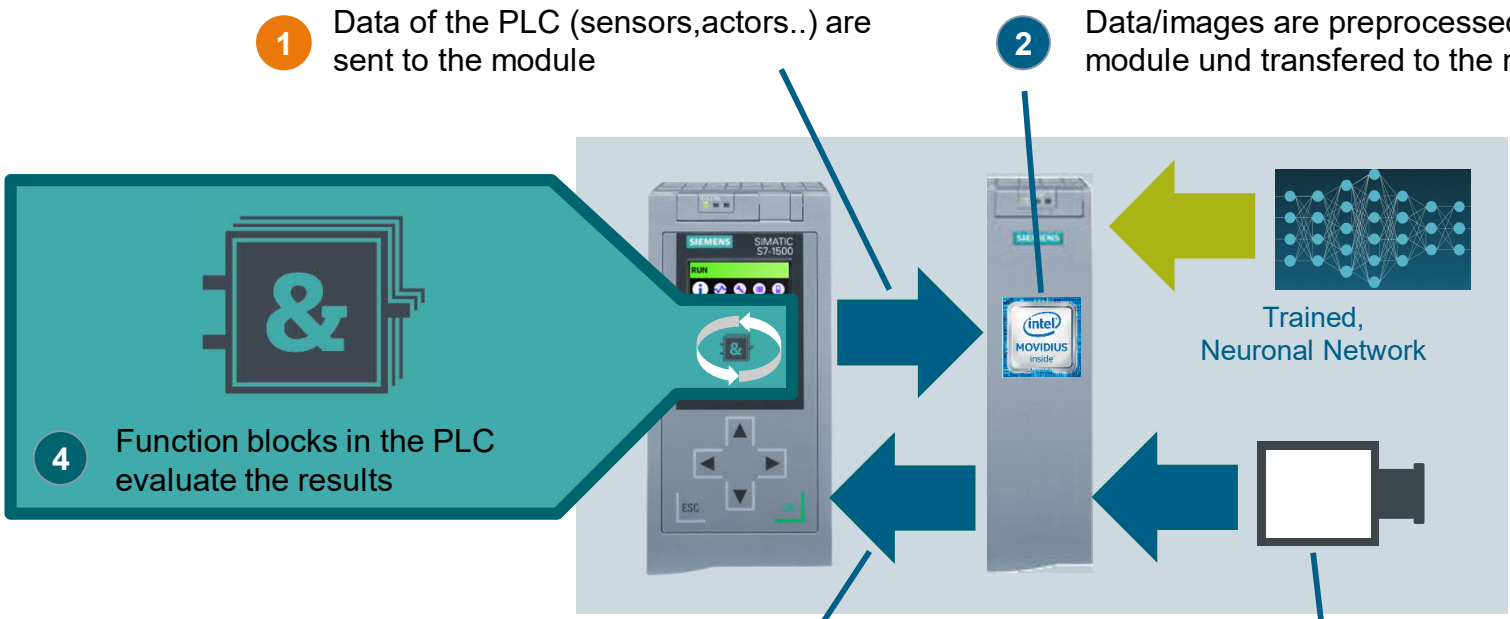
Artificial Intelligence in the SIMATIC world
Basic Processing Procedure



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Artificial Intelligence in the SIMATIC world

Central Setup with the SIMATIC S7-1500

S7-1500

Backplane bus

TM NPU Module

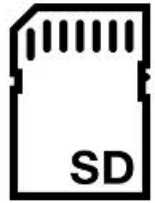
AI Accelerator Chip

Inputs*

- Camera,
- Audio,
- Vibrations,
- Signals
- …

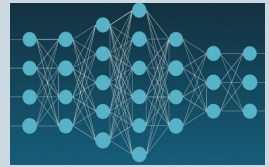
USB 3.1 Typ C

Gigabit Ethernet



Application-Program

Trained Neural Network



Designed & Trained in open source machine learning frameworks:
Tensorflow
Caffe

*No liability assumed

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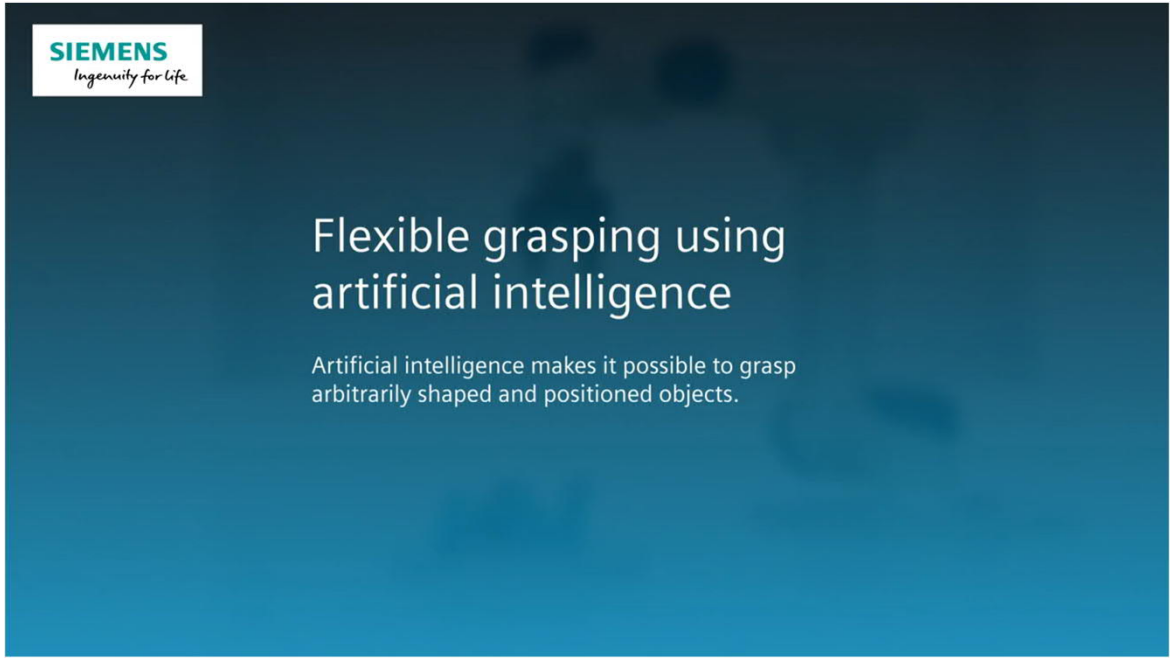
SIMATIC Artificial Intelligence
S7-1500 TM NPU – Use Cases

- Apprendimento Robot
- Controllo Qualità visuale
- Anomaly Detection
- Condition Monitoring
- Riconoscimento suoni (vocale)
- Riconoscimento oggetti
- Riconoscimento Facciale
- …



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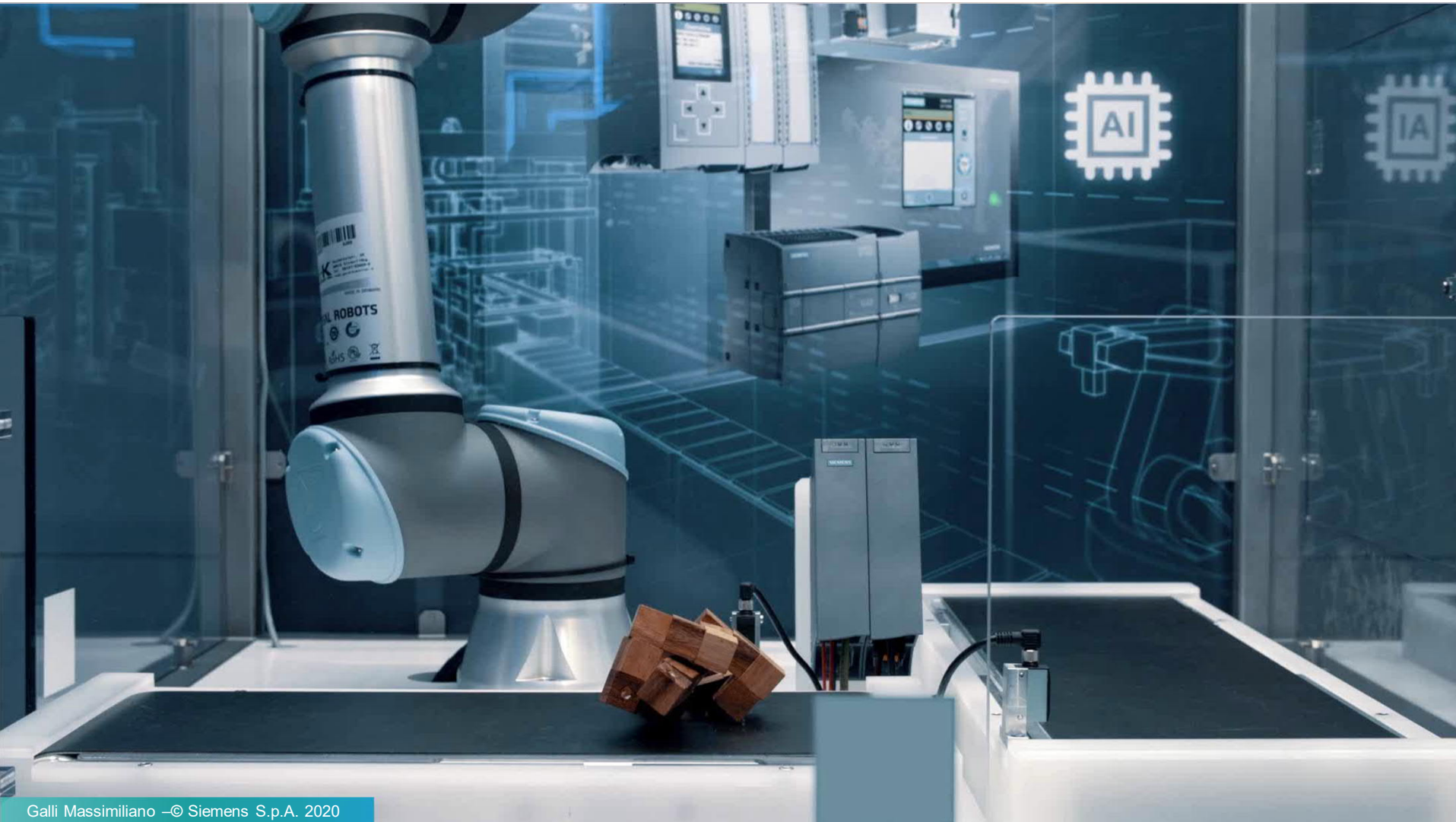

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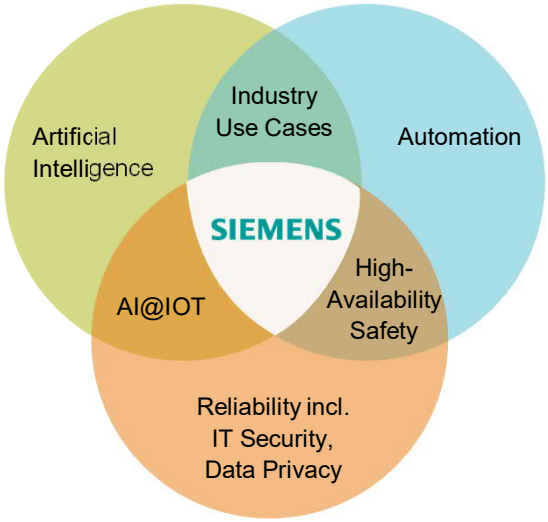
We need to bring AI to industry by addressing industrial use cases and by offering comfortable access and robust/reliable portfolio



„Siemens brings technology trends into the world of production“

Vision: **We make AI ‘industry-grade’!**

Create customer value

Use-case focused solution packages
- Industry specific applications: E2E package offering for a variety of use cases

Holistic AI solution
- Siemens solves your problem. We offer the complete solution, not just the infrastructure!

Easy to Use

Automation integration
- Seamless integration with Siemens automation environment

Operation
- Easy to handle interaction for production line staff

Serviceability
- Toolset and runtime support for automation engineers

Robust and reliable

Reliable hardware
- Production-grade casing, fan-less cooling, industry-grade connectivity
  ➔ SIMATIC quality

Integrated Lifecycle
- Lifecycle of AI and SIMATIC in sync

Monitoring
- Integration in SIMATIC System Diagnostics

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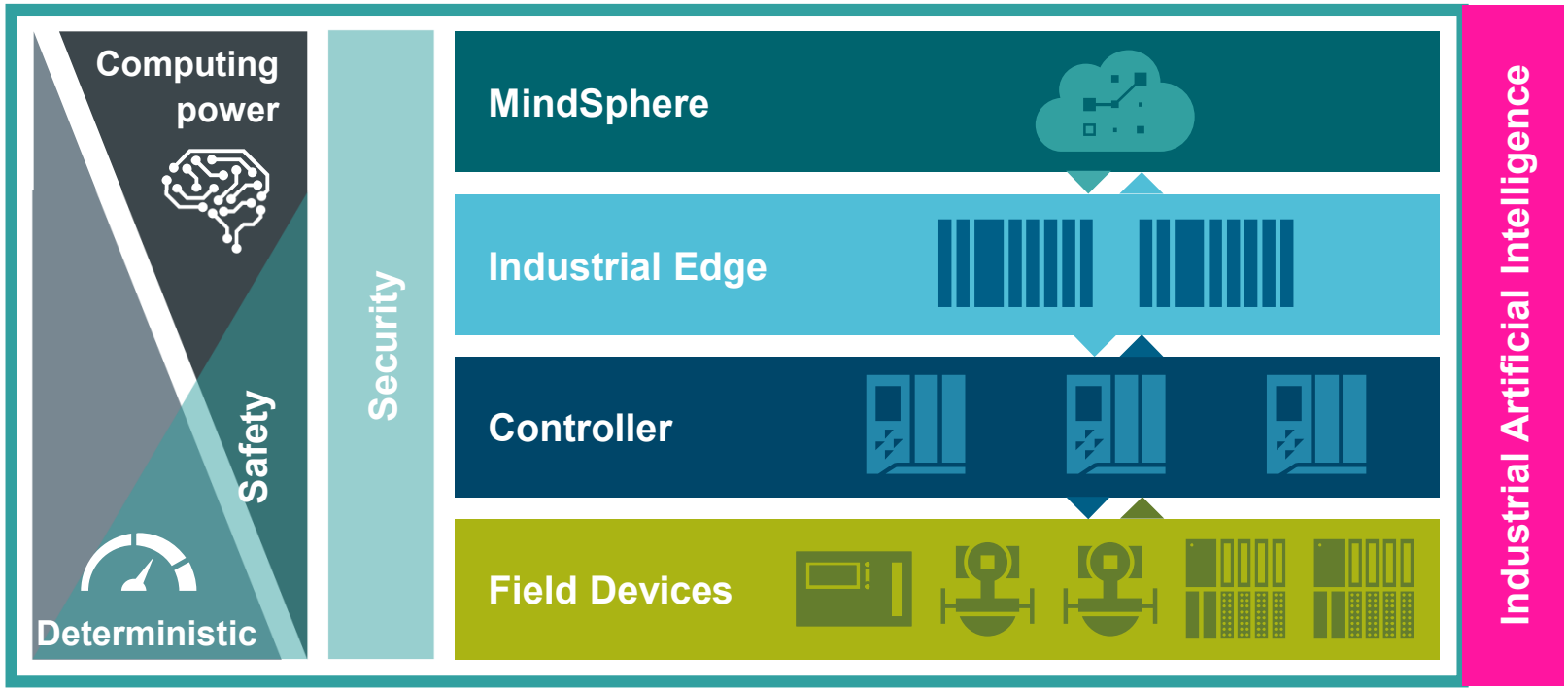
Conclusions & Take away..



Grazie per l'attenzione !

SIEMENS
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