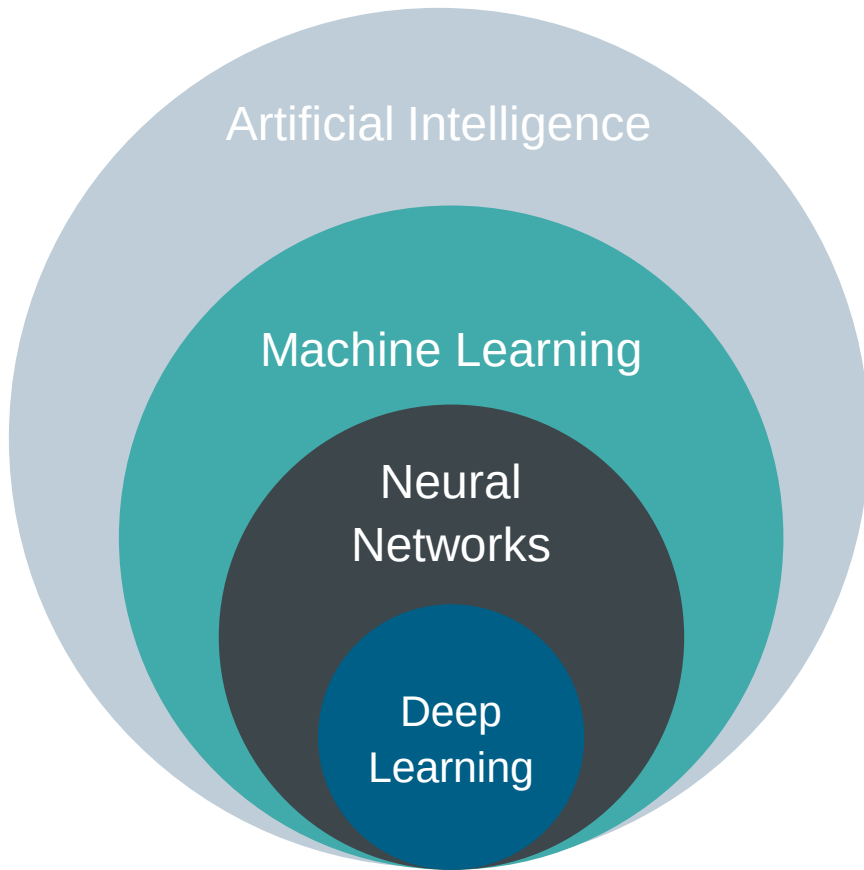


How AI boosts Industry 4.0

1. **Demystifying** artificial intelligence
2. How to **approach** artificial intelligence in industry?
3. How to **implement** artificial intelligence in industry?
4. What is the **value** of artificial intelligence (1-2 use cases)?

Demystifying Artificial Intelligence

Basic Definitions for common Buzzwords



Artificial Intelligence (AI)

Ability to interpret external data + learn from them + use those learnings for a goal.

Machine learning (ML)

Learn making decisions without being explicitly programmed.

Neural Network (NN)

Learn to perform tasks by considering examples.

Deep Learning (DL)

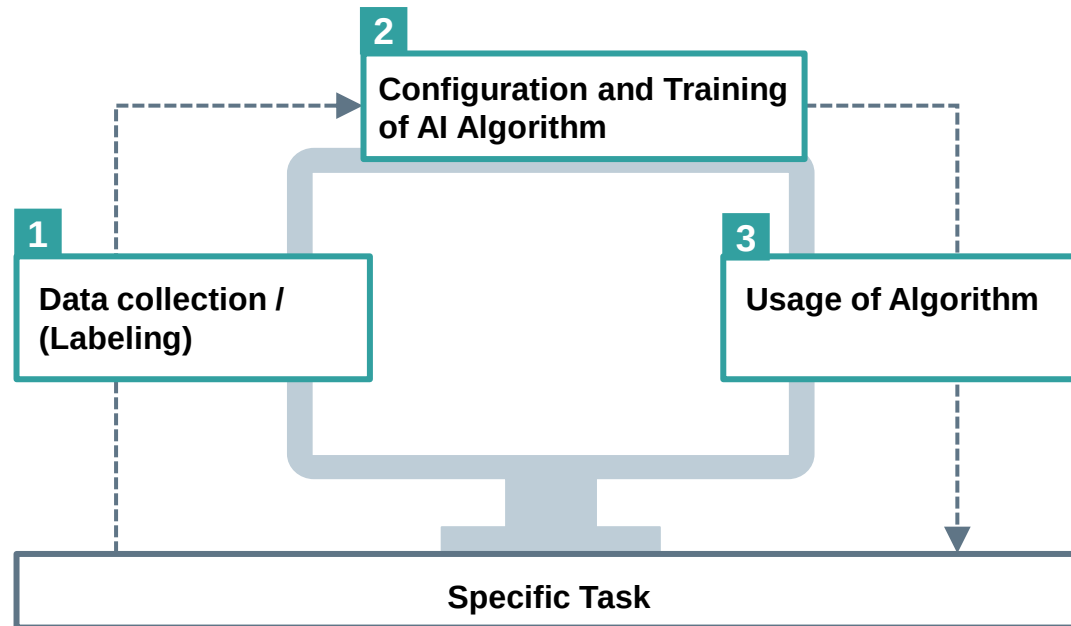
Cascade of multiple layers of nonlinear processing units.

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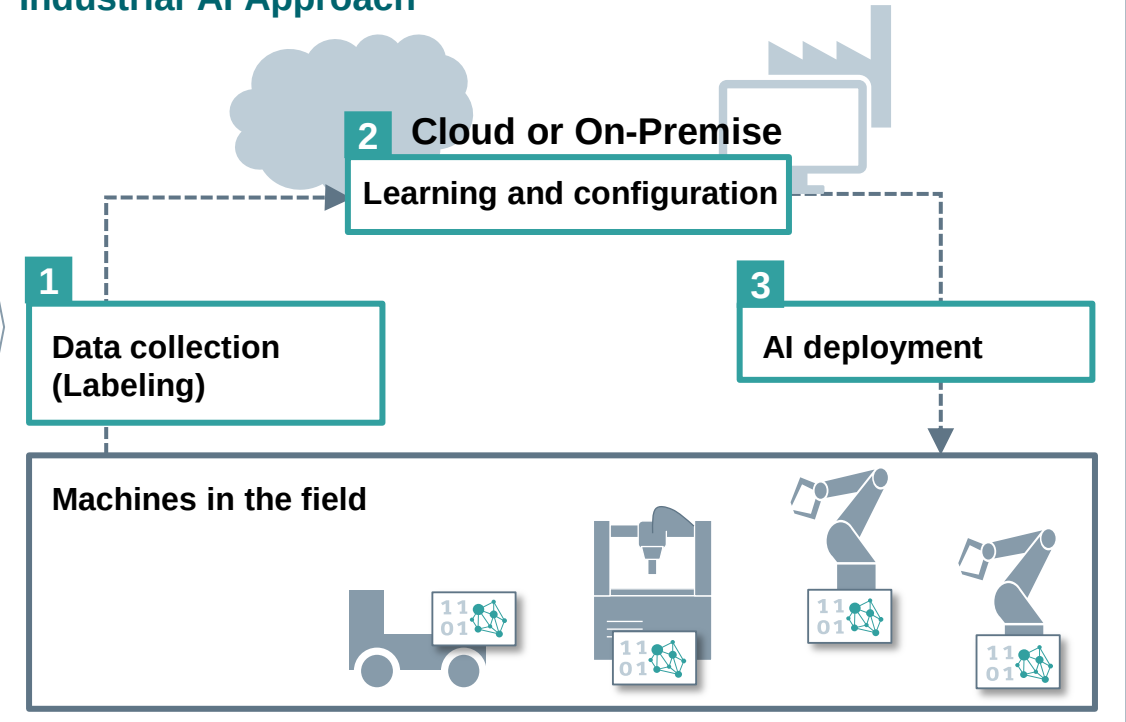
Artificial Intelligence in Industry

The way to an Industrial AI Approach

General AI Approach



Industrial AI Approach



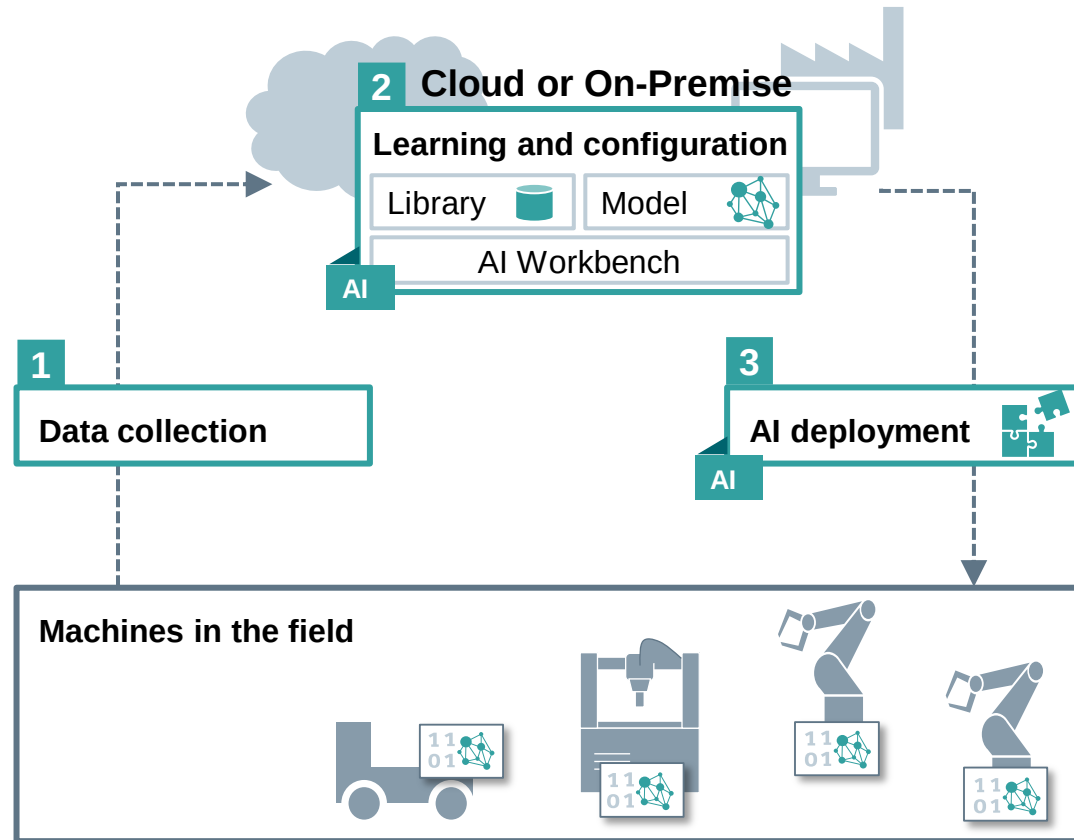
Computer as central system for AI Applications

Focus on Industry – other surrounding, new challenges

Artificial Intelligence in Industry

Vision for Industrial AI Approach

Industrial AI Approach



→ Requirements:

- 1. Data Collection:**
Data directly from machines
branch and process knowledge needed
labeling of data
- 2. Learning and configuration of AI Algorithm:**
Algorithm and training knowledge needed
Cloud or on-Premise
- 3. Deployment of AI:**
Industrial-suited Hardware required

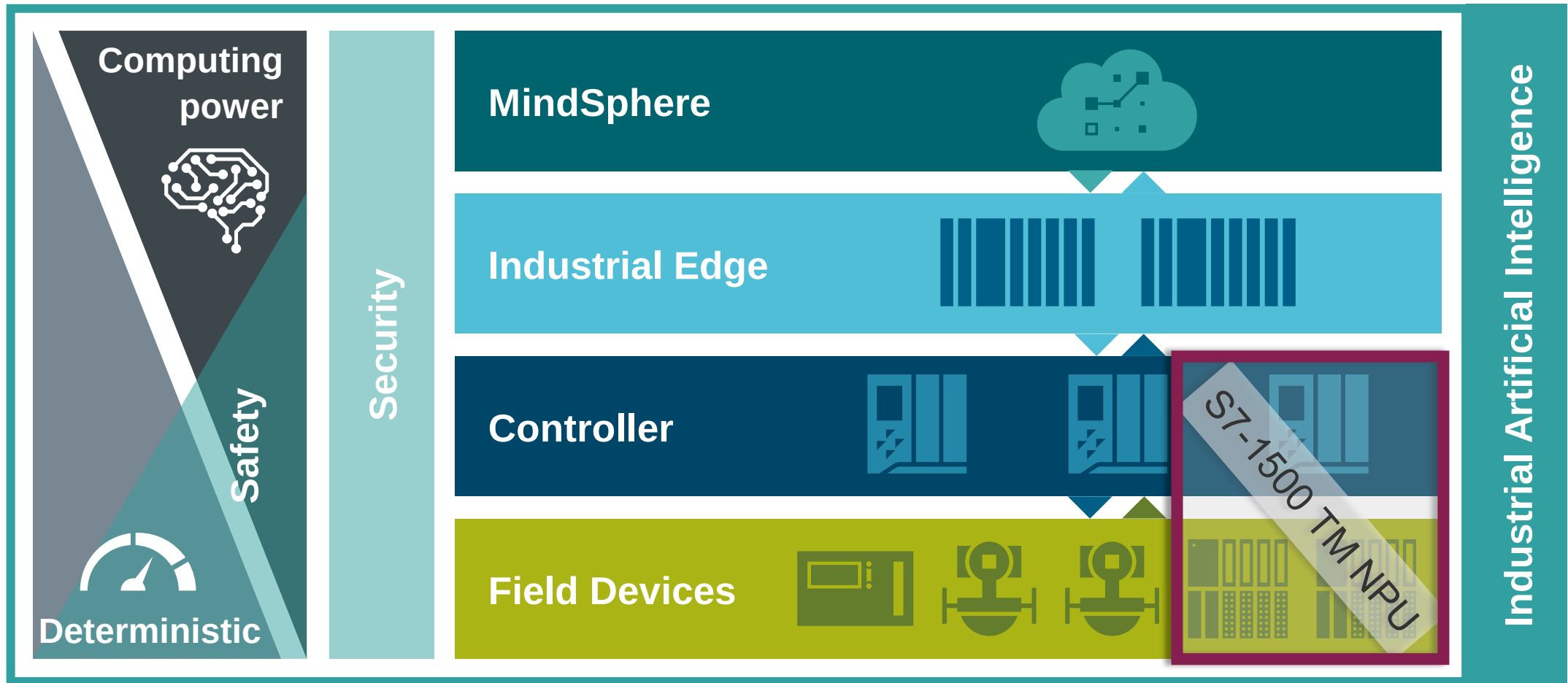
→ Objective:

Automized Usage of AI Algorithms in an industrial environment

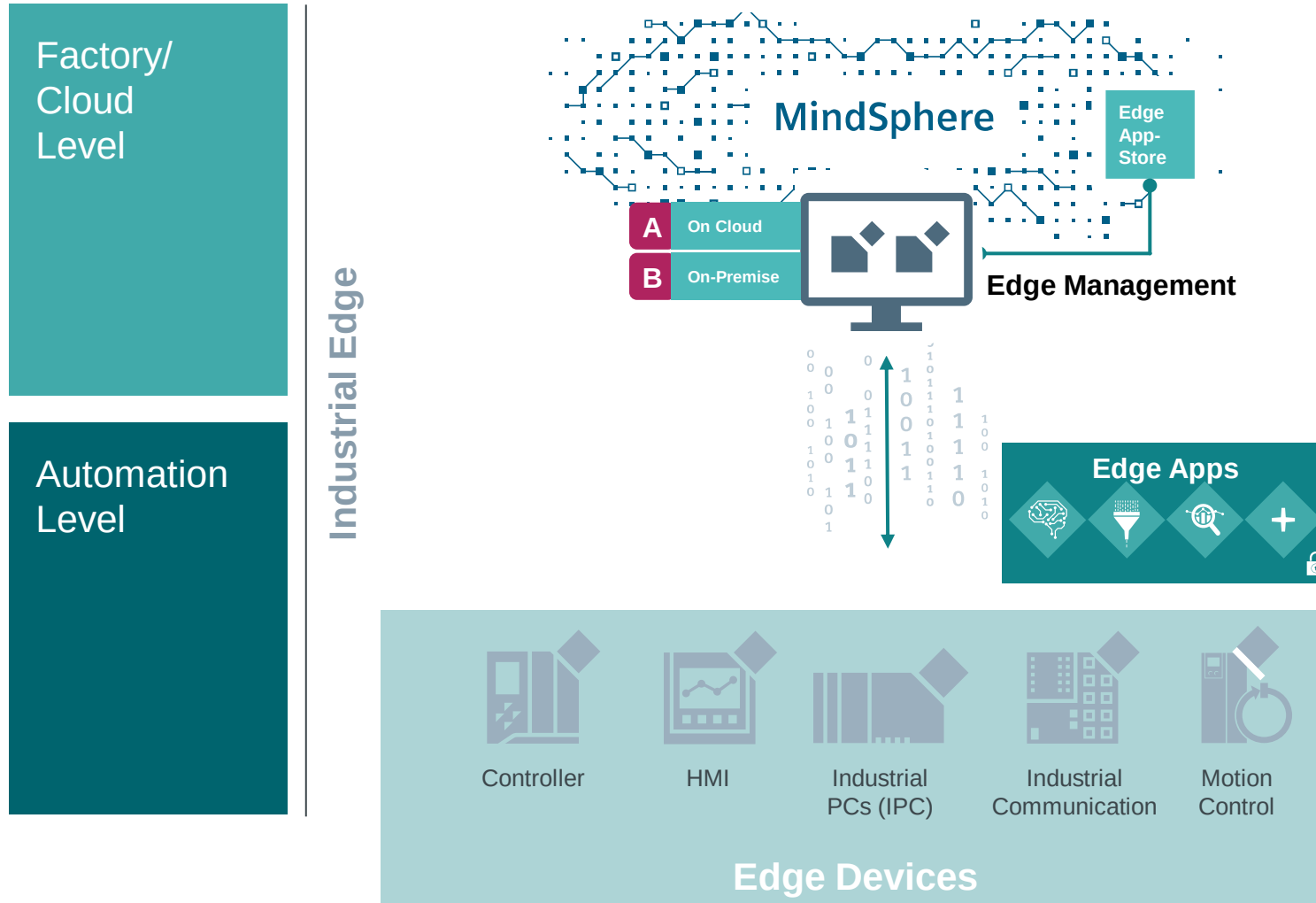
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Future portfolio enables AI across all levels of Totally Integrated Automation - Best fit to customers needs

SIEMENS
Ingenuity for life



Siemens Industrial Edge – Integrates decentral data intelligence on automation level



Edge Management

- Edge App Store
- Edge Apps Management
- Edge Device Management



Edge Apps

- Data processing and connectivity applications
- Apps provided by Siemens, Partners and own developed

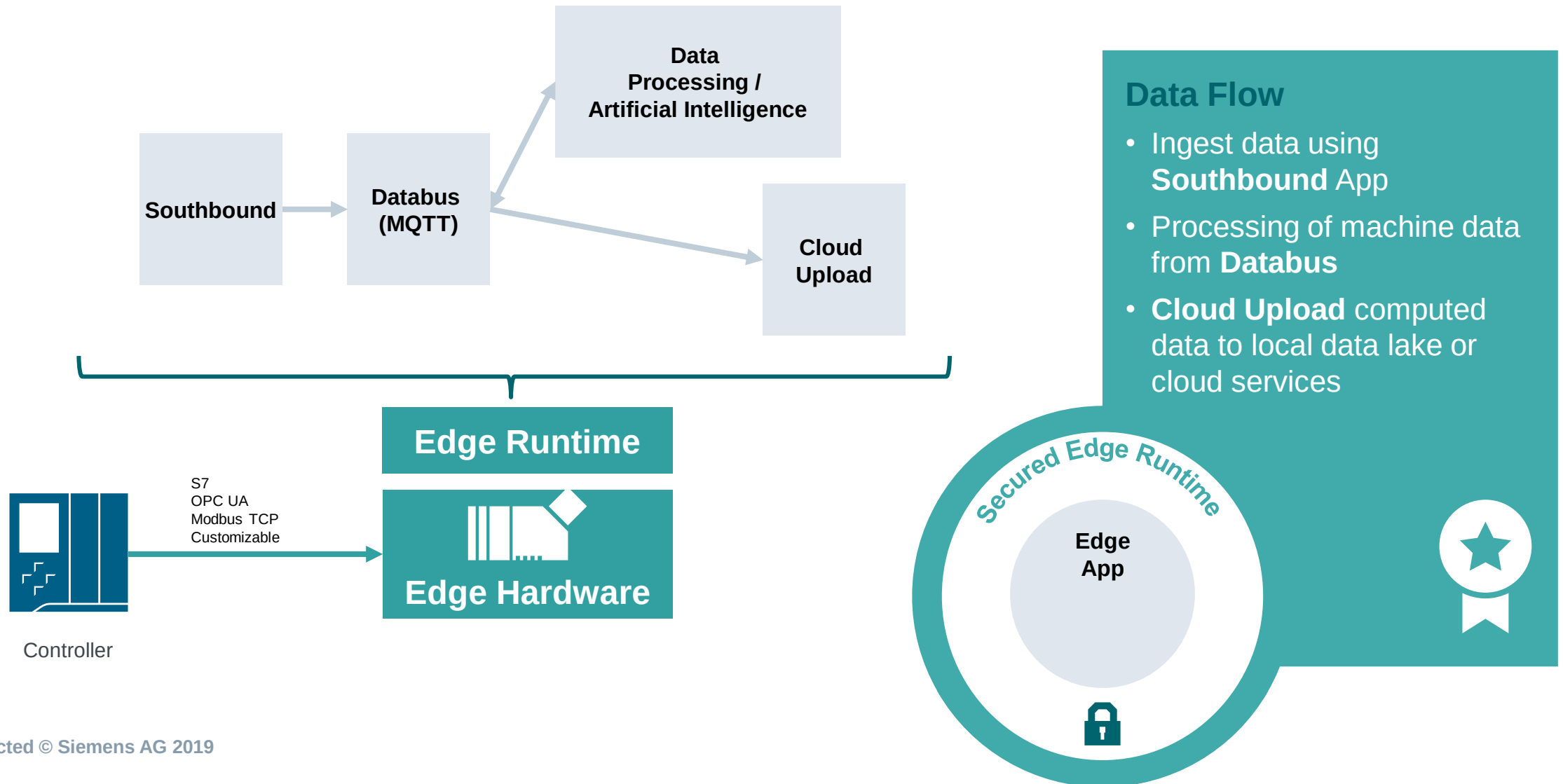


Edge Devices

- Infrastructure to execute Edge apps
- Remote updating of apps
- Integrated security and connectivity



Siemens Industrial Edge for machines and plants – Example Edge App



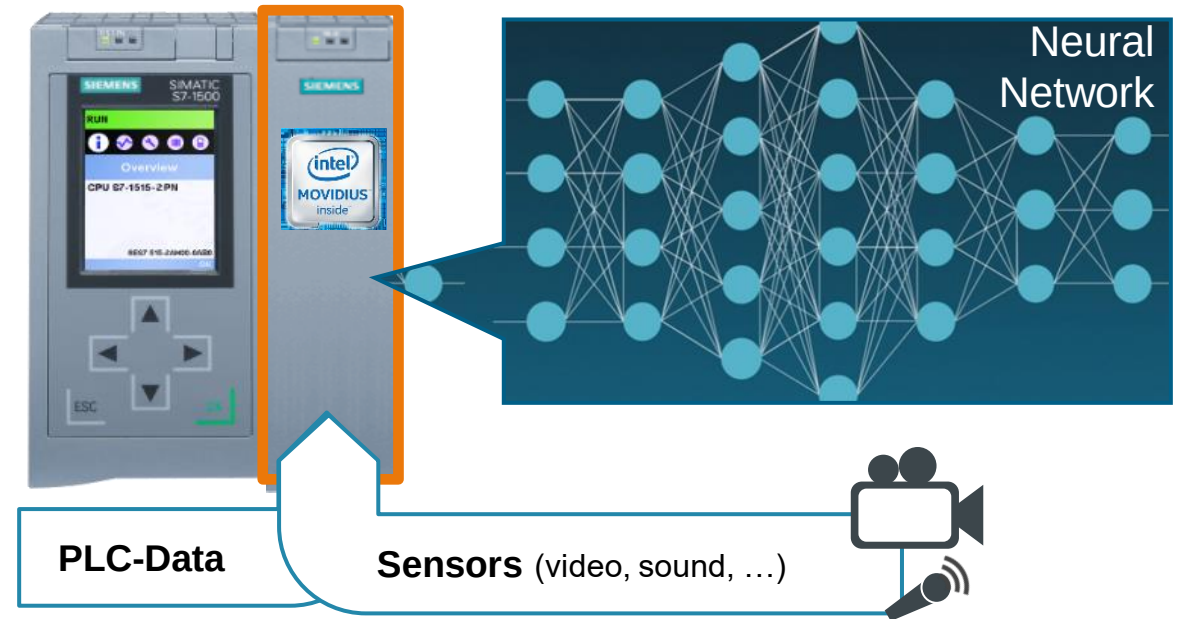
Artificial Intelligence in the SIMATIC world

Introduction to the TM NPU



A new module for the S7-1500 / ET 200MP:

S7-1500 TM **NPU**
(**N**eural **P**rocessing **U**nit)



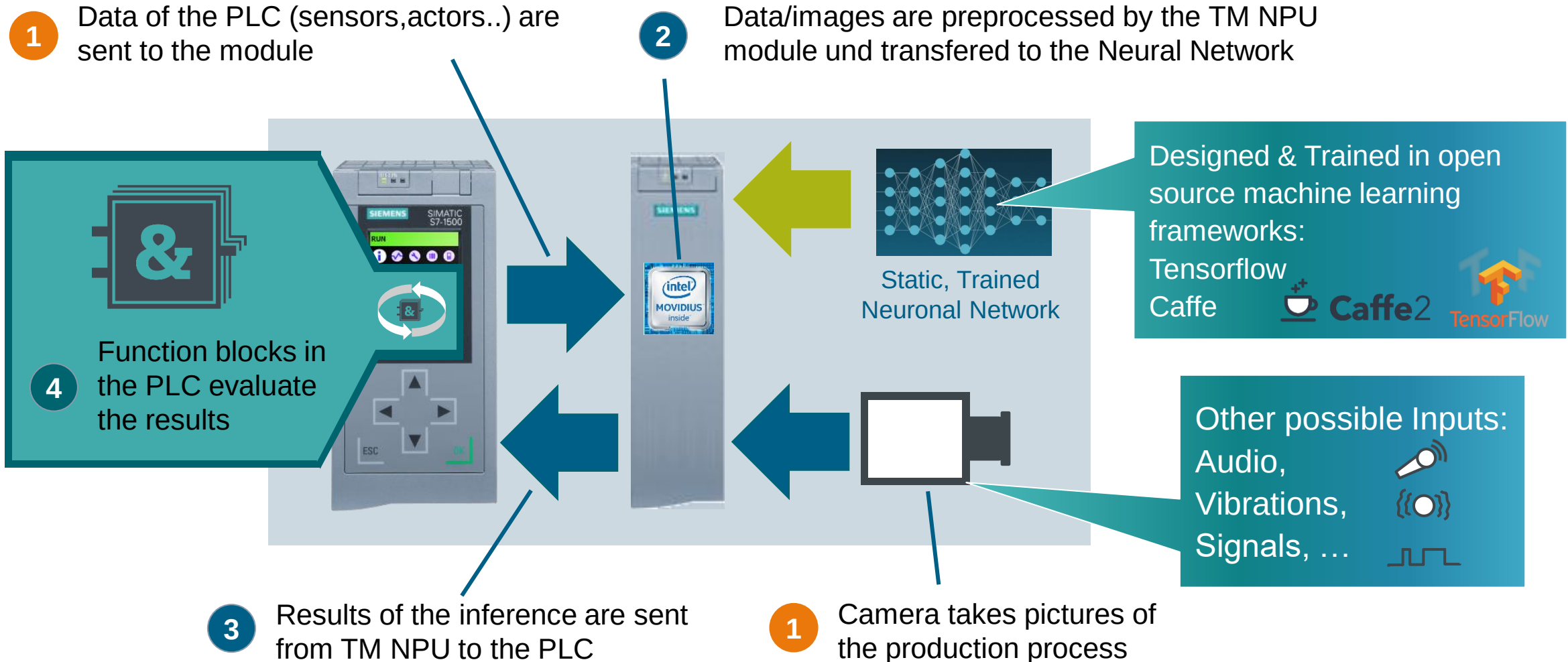
“(Artificial) neural networks are computing systems vaguely inspired by the biological neural networks that constitute (animal) brains. Such systems “**learn**” to perform tasks by considering examples, generally without being programmed with any task-specific rules.”*

Transfer of human expertise to the machine through training

*source: Wikipedia

Artificial Intelligence in the SIMATIC world

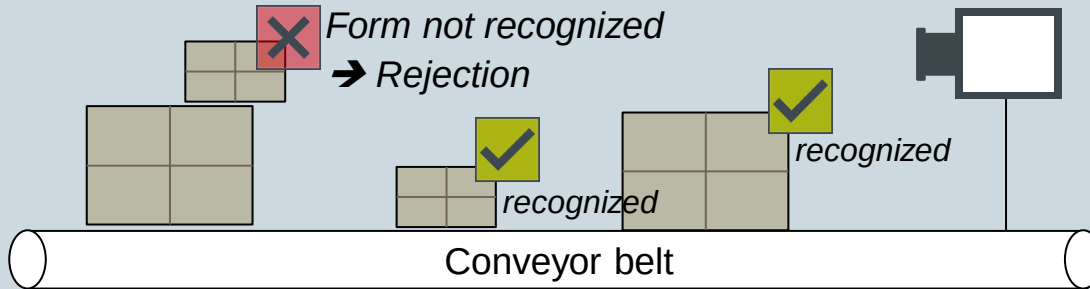
Basic Processing Procedure



Artificial Intelligence in SIMATIC

Benefits of using AI

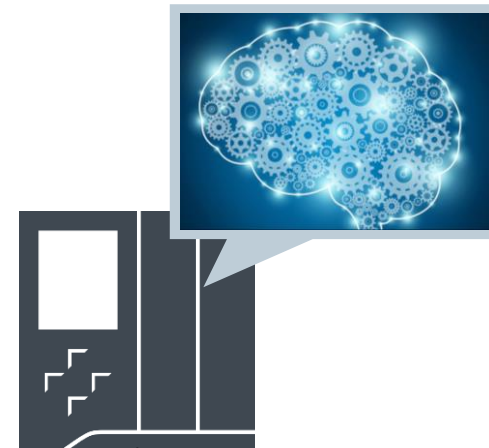
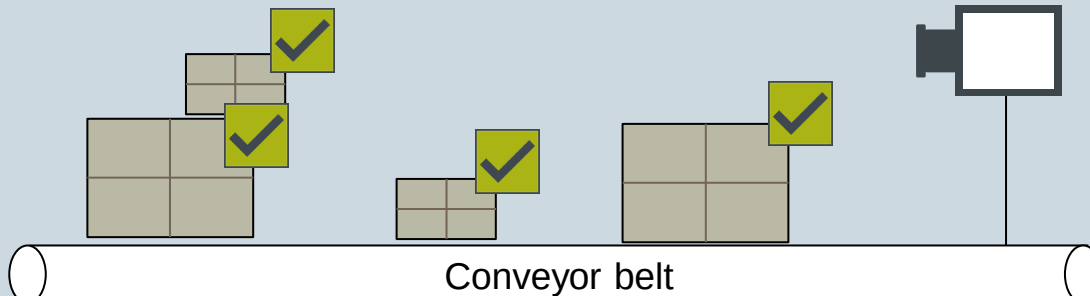
Conventional object recognition



Properties

- Processing of data via programmed image capture system
- Each object to be recognized has to be precisely defined (deviations = rejection)
- Time-consuming programming for new objects

In the future (with Artificial Intelligence)



Properties

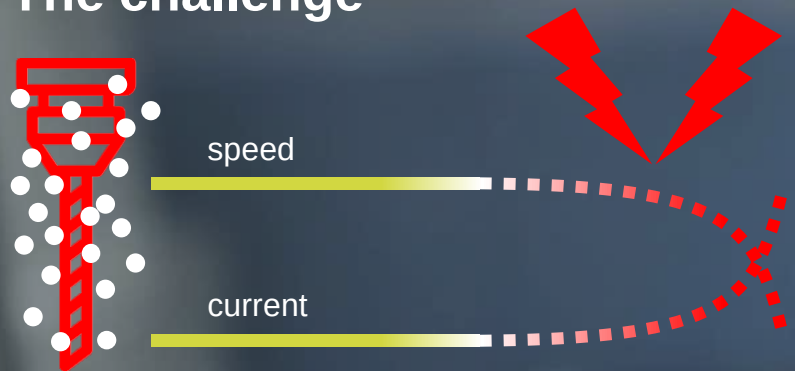
- Processing of input data via neural networks
- Higher availability through detection of **complex patterns**
- Easier handling also of unknown objects

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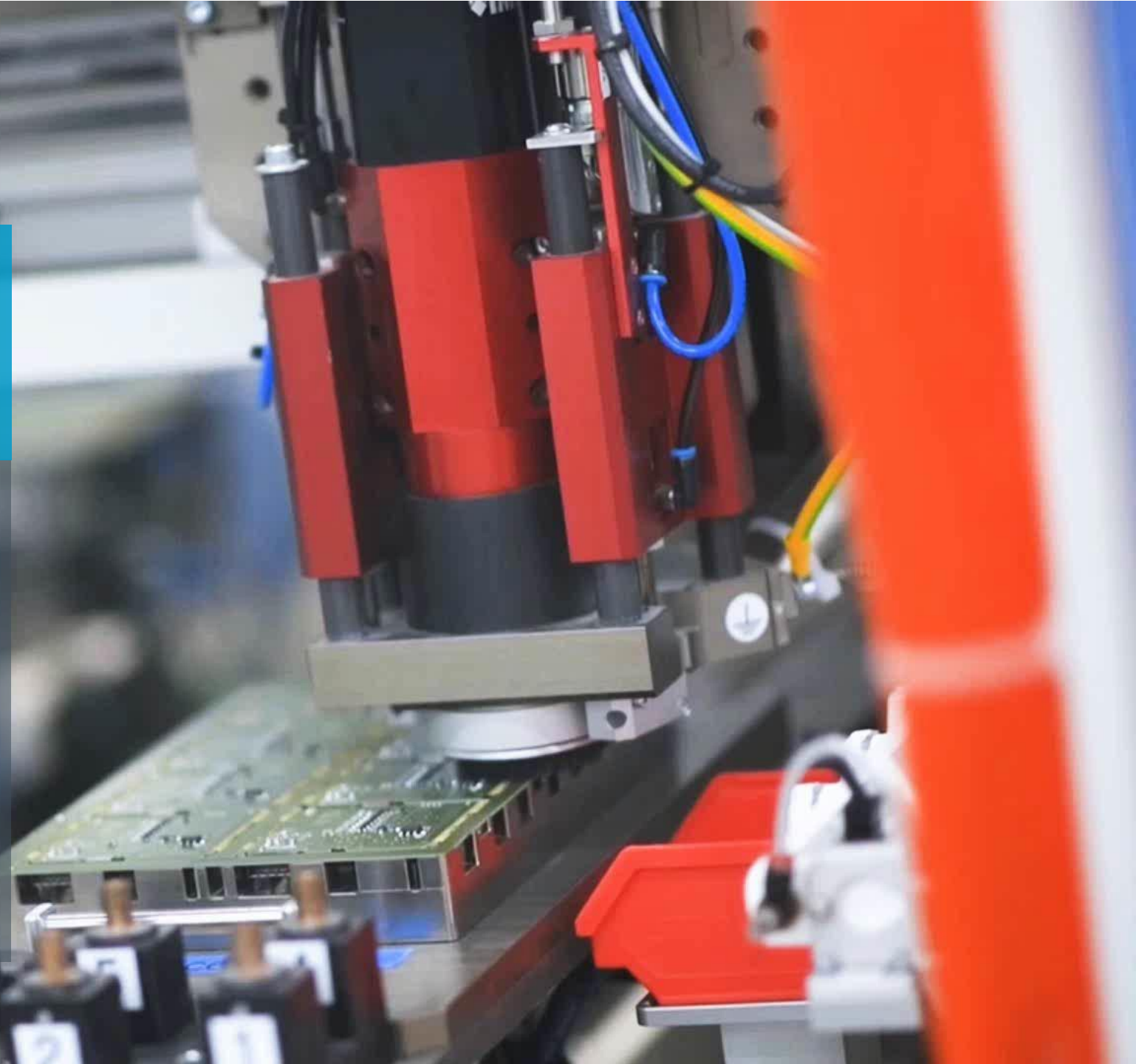
PCB cutting machine

Siemens Electronics Factory
Amberg, Germany

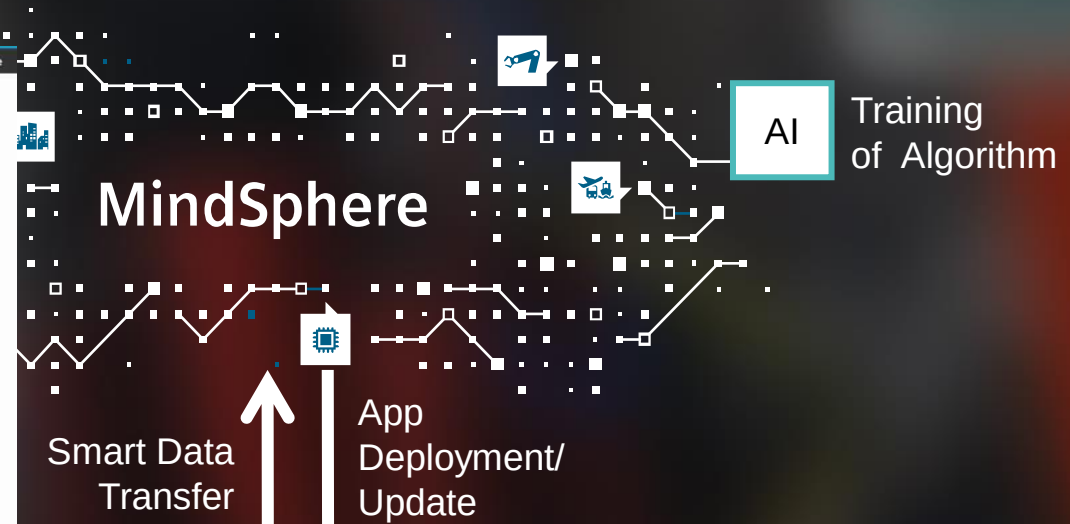
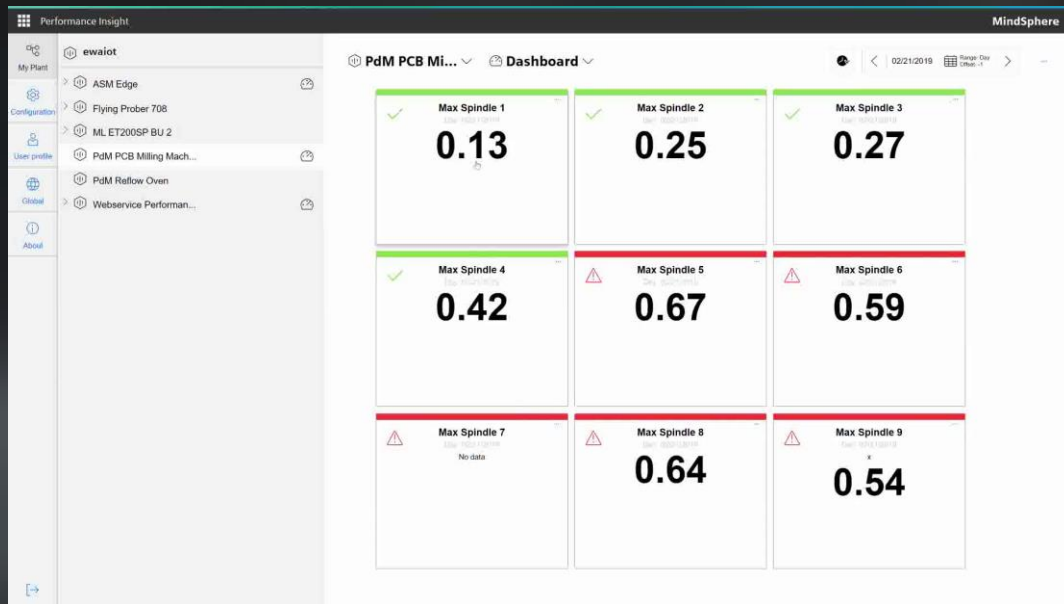
The challenge



Aggressive milling dust causes
drive bearing to get stuck



Non production critical level



Production critical level

Anomaly detection
for Predictive maintenance



Machine data



PCB cutting machine

AI predicts spindle
maintenance
for PCB cutting
machine up to

2 days
in advance

Reducing preliminary
spindle failures of
this type by

100%

Total calculated
savings for 18
machines

200k€
p.a.

X-ray-based PCB quality assurance

Siemens Electronics Factory Amberg, Germany

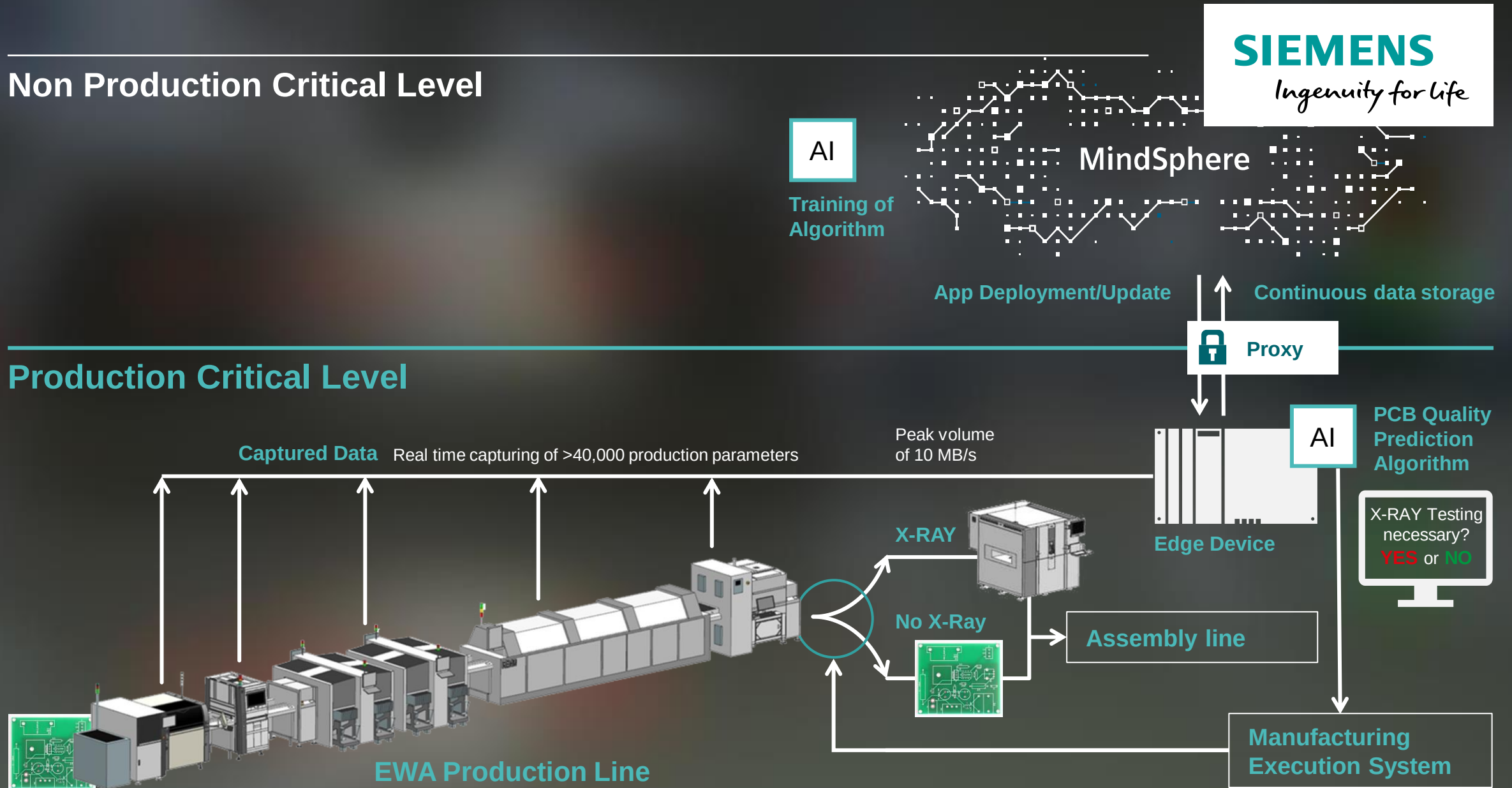
Challenge

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

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

Non Production Critical Level

Production Critical Level



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

Set the pace for Digitalization
The challenge is on



Thank you!

Dr. Daniel Schall
Head of Research Group
Distributed AI Systems (DAS-AT)

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daniel.schall@siemens.com