

Artificial Intelligence in Manufacturing – Benefits, Applications and Limitations

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Broad Range of Applications for Every Industry



Application fields of AI

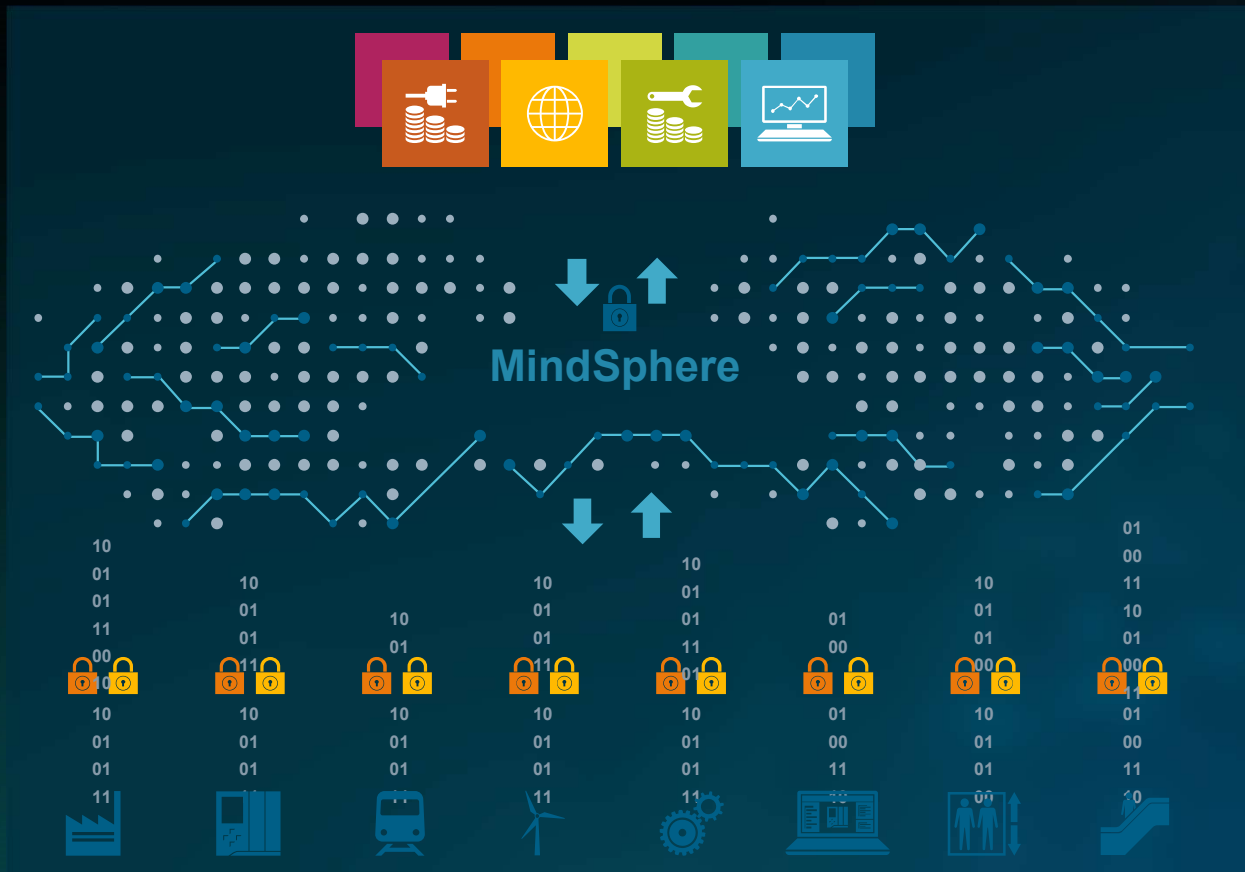
Industries (examples)



MindSphere

The cloud-based, open IoT operating system

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MindApps

Powerful industry applications and digital services for asset transparency and analytical insights. Partners and customers can create MindSphere applications

MindSphere

Open Platform as a Service (PaaS) for scalable, global IoT connectivity and application development with native cloud accessibility

MindConnect

Connecting products, plants, systems, machines, enterprise applications and legacy databases with secured plug and play connection of Siemens and third-party products and equipment

Use Case: Novelty Detection for Gas Turbine Compressors



Gas Field Operations

- ✓ 24X7 operations
- ✓ High monitoring effort



Compressors

- ✓ Compressors vital to gas field operations
- ✓ High frequency data (vibrations, sounds)
- ✓ Data unlabeled



Deep Neural Novelty Detection

- ✓ Detection of changed system dynamics
- ✓ Unsupervised Learning

Results

- ✓ Improve process efficiency by providing notifications to the operator
- ✓ Increased compressor uptime

Use Case: Autonomous Health Check on Crane Gearboxes



Crane Operations

- ✓ High cost of unscheduled downtime



Gears & Bearings

- ✓ Broken gears and bearing are main source of downtime
- ✓ High Frequency Acoustic and Acceleration Sensor Data



Convolutional Neural Networks

- ✓ Classify healthy and non-healthy gear conditions
- ✓ Supervised Learning



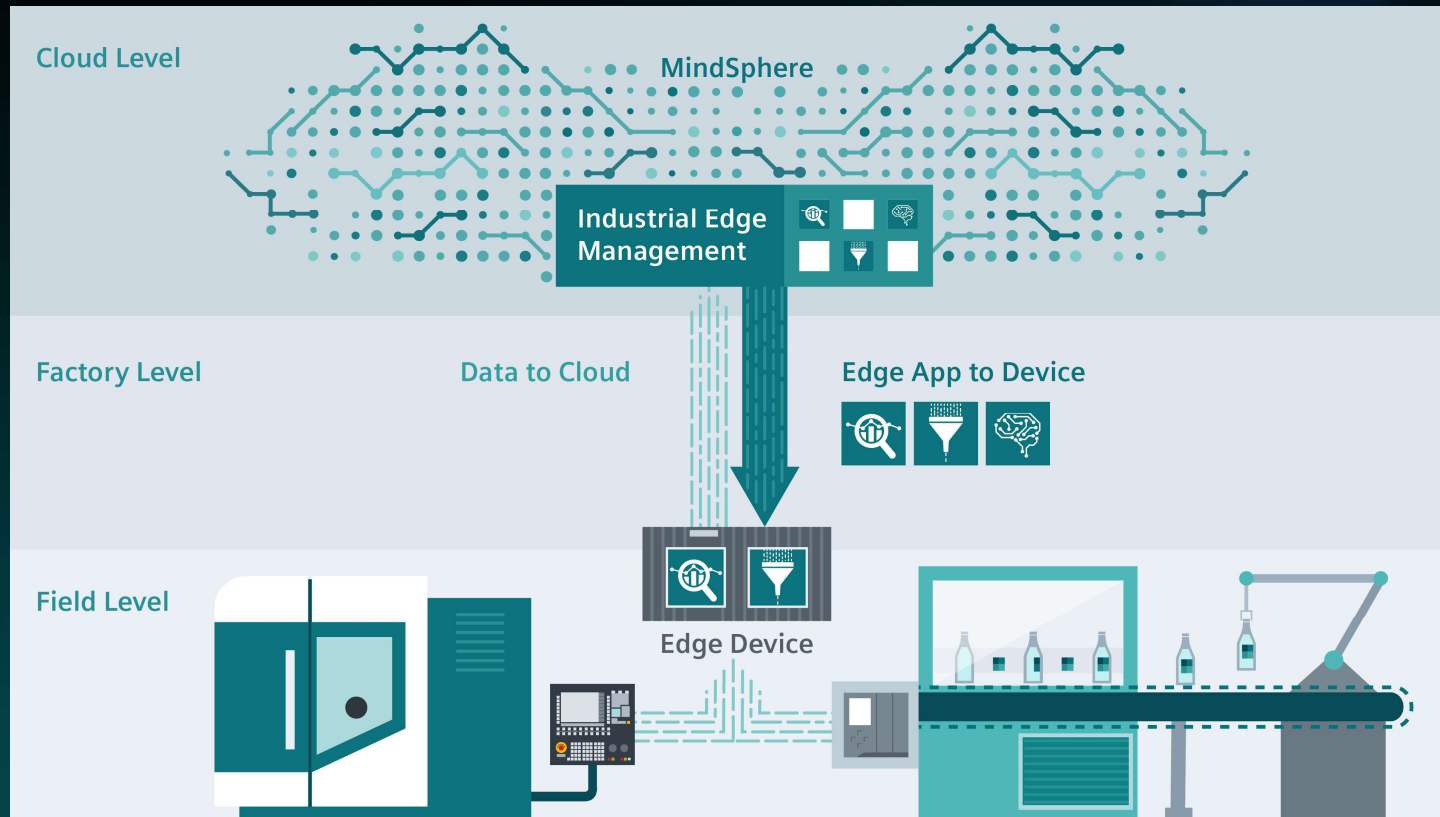
Results

- ✓ Real time prediction to reduce unscheduled downtime



Industrial Edge: a remotely managed extension of an automation system to locally run added-value applications

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Use Case: AI for In-Line Quality Prediction in Siemens Electronics Factory Amberg

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AI
Training of
Algorithm

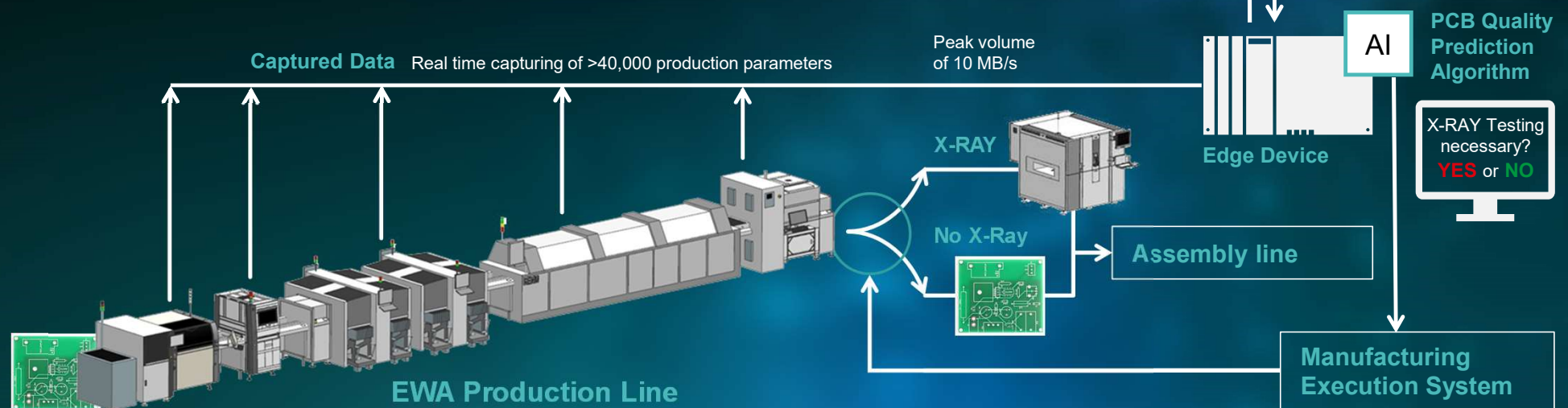
MindSphere

Continuous
data storage

App Deployment/Update

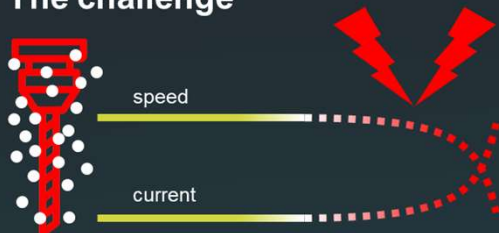
Proxy

Production Critical Level



Use Case: Printed Circuit Board Cutting Machine

The challenge



Aggressive milling dust causes drive bearing to get stuck

Production critical level

Anomaly detection
for Predictive maintenance

AI

Edge Device

Proxy

Smart Data
Transfer

App
Deployment/
Update

MindSphere

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AI

Training
of Algorithm

Machine data



PCB cutting machine

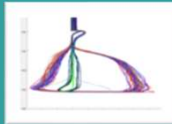
SINUMERIK Edge Apps: closely coupled with the machine extending and improving its functionality

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Workpiece Analytics
Real-time visualization



Workpiece Analytics
On-line quality
monitoring



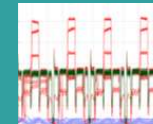
Safety Analytics
Visual workspace
safety verification



SINUMERIK Edge Apps



Process Analytics
Collision avoidance



Machine Analytics
Condition analytics

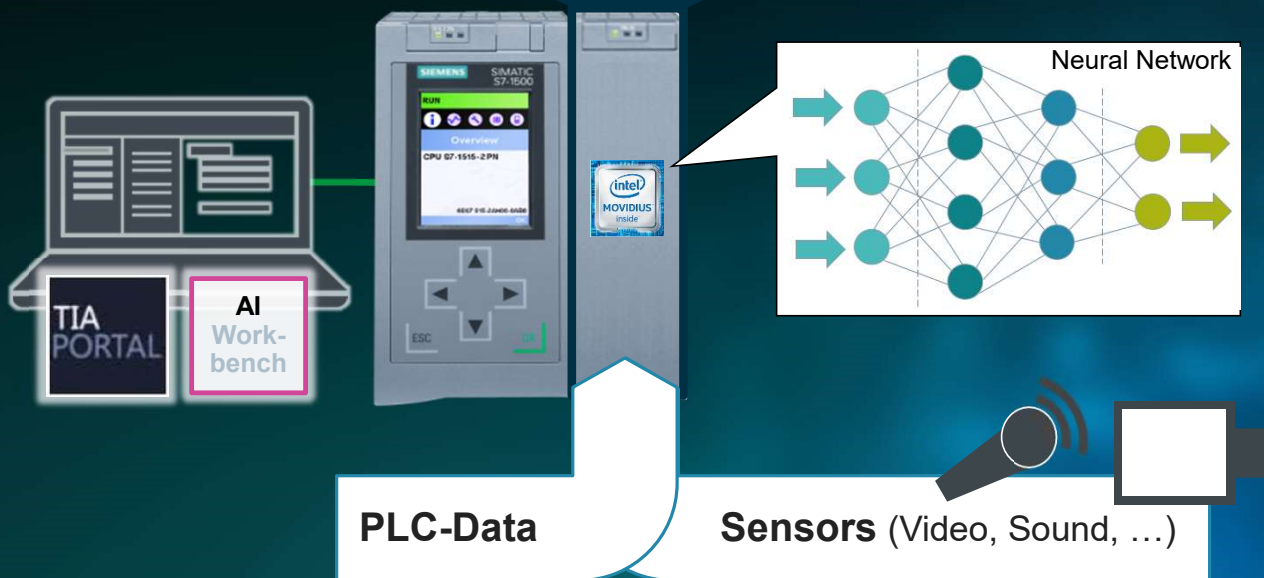


Machine Analytics
Magazine
optimization

Artificial Intelligence in SIMATIC... ... realized via a new module for the S7-1500 / ET 200MP

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S7-1500 TM NPU (Neural Processing Unit)



Features / Functions

- Integrated high performance AI chip
- Processing of input data (camera, sound, CPU) via trained neural networks
- Connection of sensors via USB and Ethernet interface
- Engineering and handling via TIA Portal and AI Workbench

Artificial Intelligence in the SIMATIC world

Common Use Cases and Applications

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Robotics:

Handling of **any and unknown** objects detected by camera



(Visual) quality control:

Application of **human “expertise and know-how”** about the perfect consistency, color texture, etc.

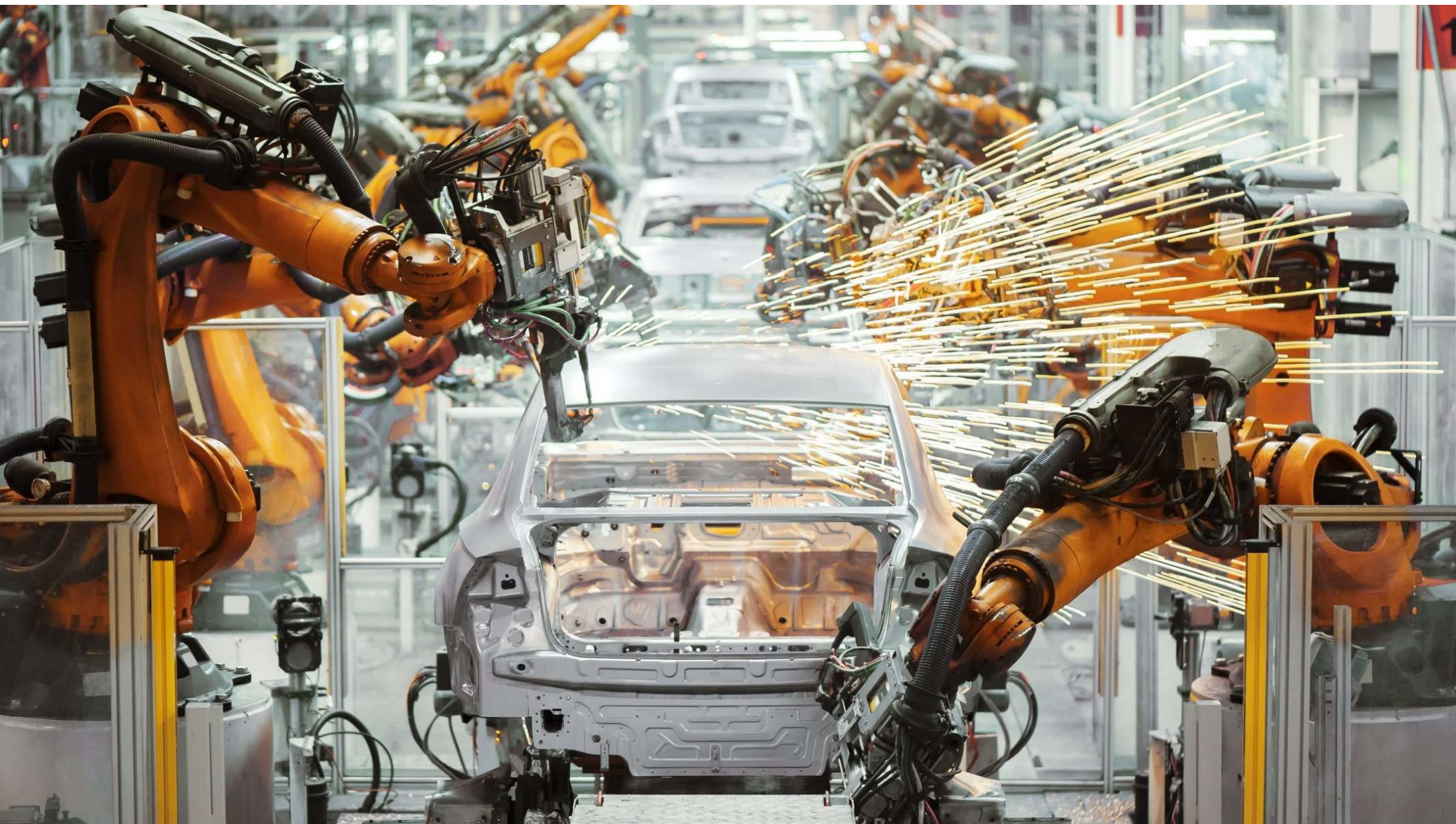
- of a product (chocolate mass, metal, ...)
- of a process (flame color in the furnace)



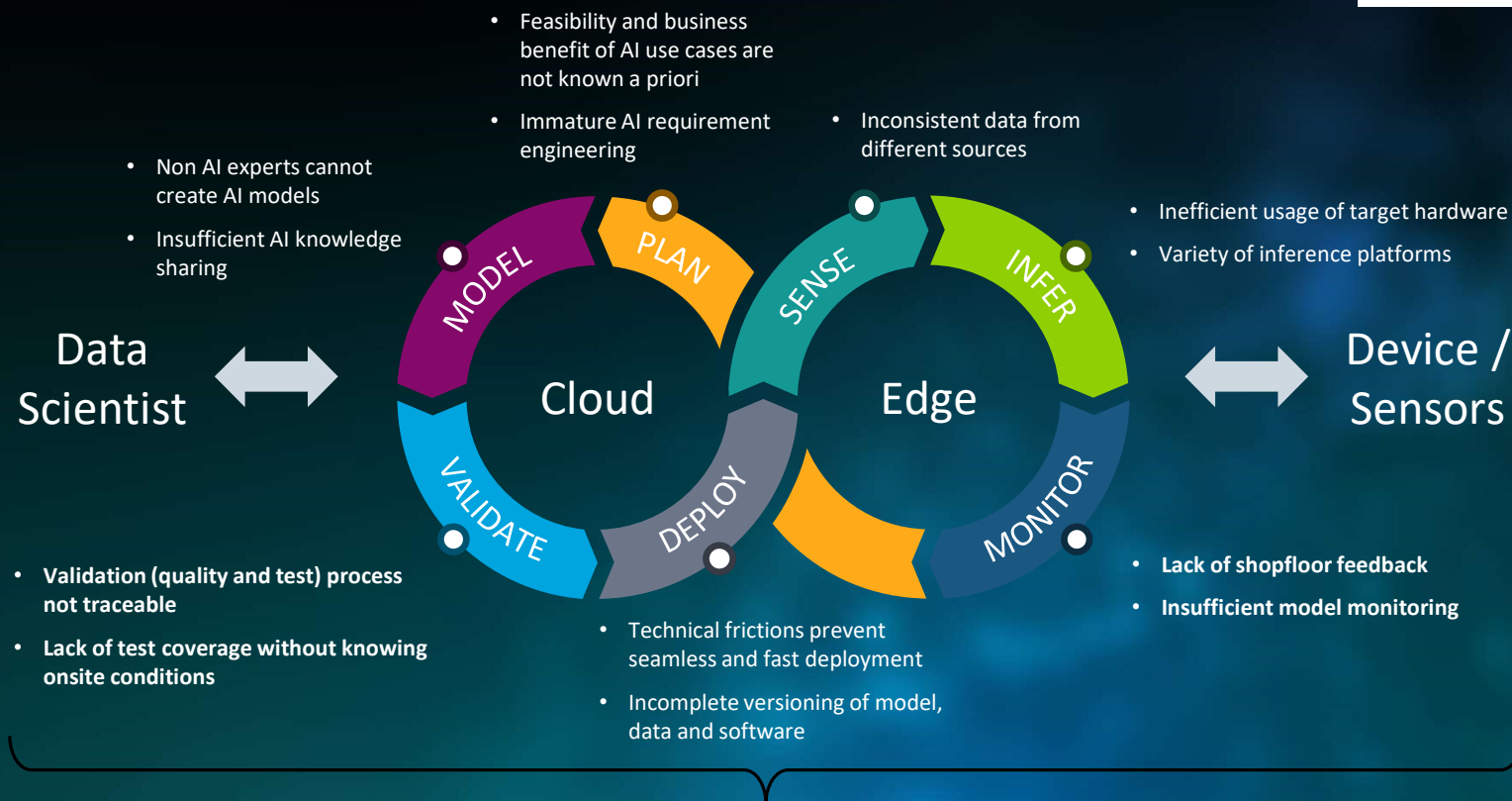
Detection of process anomalies

(e.g. recording of the sound profile in paper machines)





Challenges in Moving from Proof of Concept to AI Operations



Vision: Autonomous Production with AI



Thanks for your attention



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