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ROBOTICS

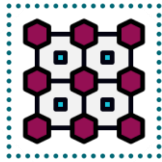
5G CLOUD ROBOTIK

Navigation "as a Service" und intelligente Mehrwertdienste

Prof. Dr.-Ing. Jens Lambrecht (MBA)
09.12.2020 | Fachforum Mobile Robotik 2020

Gestalt Robotics GmbH, Berlin
www.gestalt-robotics.com

OUR OFFER



Technology Modularity

Concepts for individual automation demands

- ◇ Consulting & development
- ◇ Modular & scalable services
- ◇ Industry-spanning experience
- ◇ Broad technology portfolio



Networking & Virtualization

Intelligent automation for excellent communication

- ◇ 4G/5G radio network support
- ◇ Support all major industrial interfaces
- ◇ Distributed systems (i.e. container, docker...)
- ◇ Cloud- & Edge-computing



Artificial Intelligence

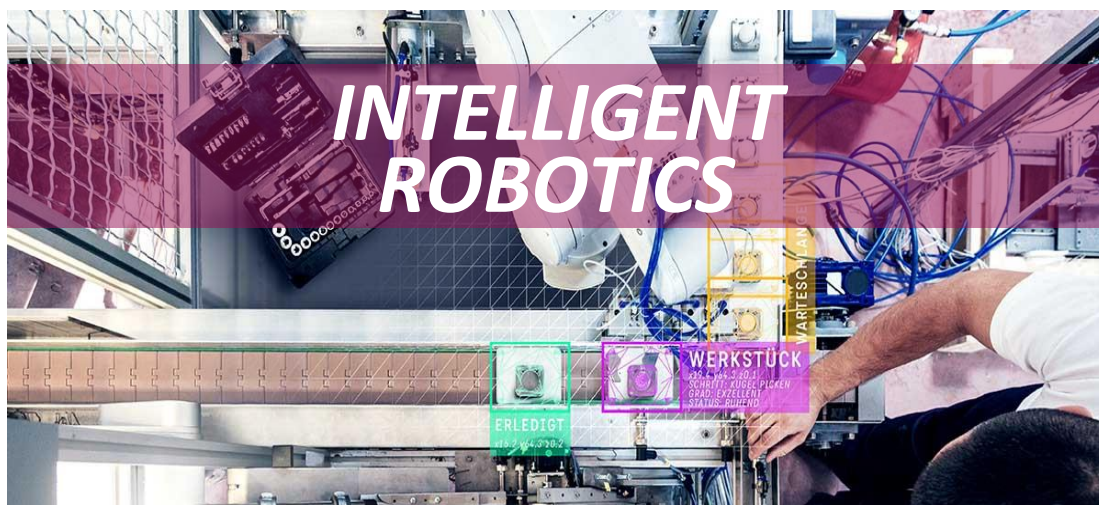
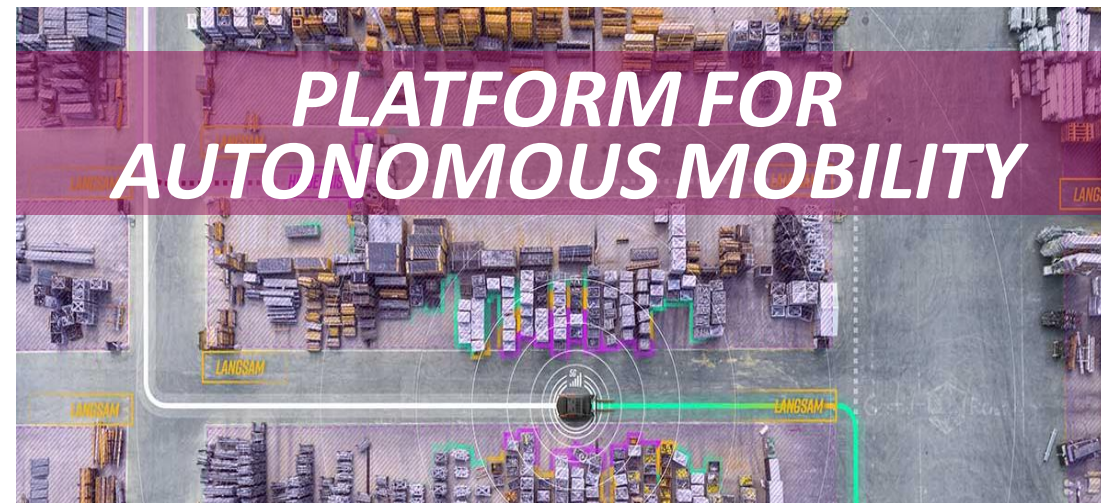
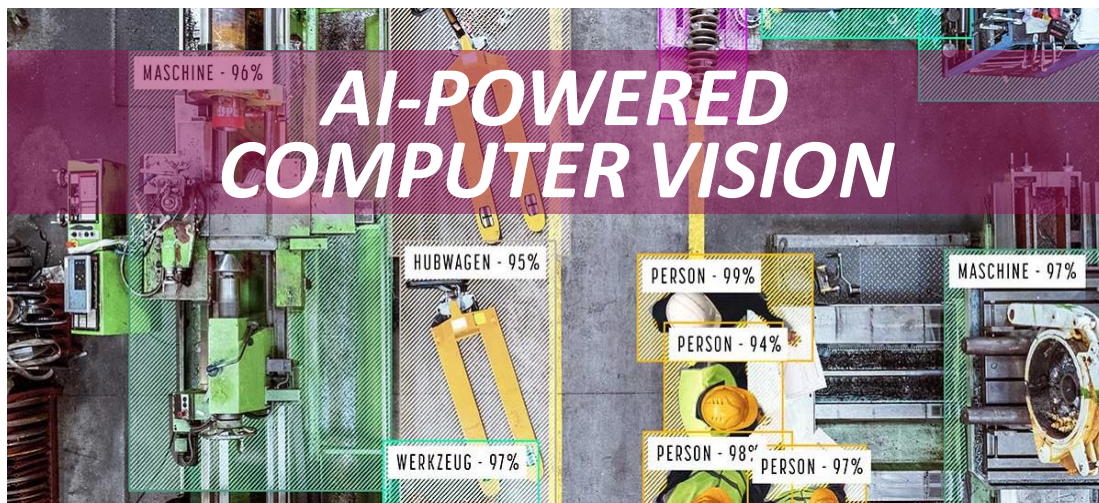
Machine learning as powerful tools for innovative solutions

- ◇ Adaptivity & reliability
- ◇ Combine AI & classic approaches
- ◇ Maximum value in intersection of time, quality & cost



THE LEADING SERVICE PROVIDER FOR INTELLIGENT AUTOMATION

OUR APPLICATION FIELDS



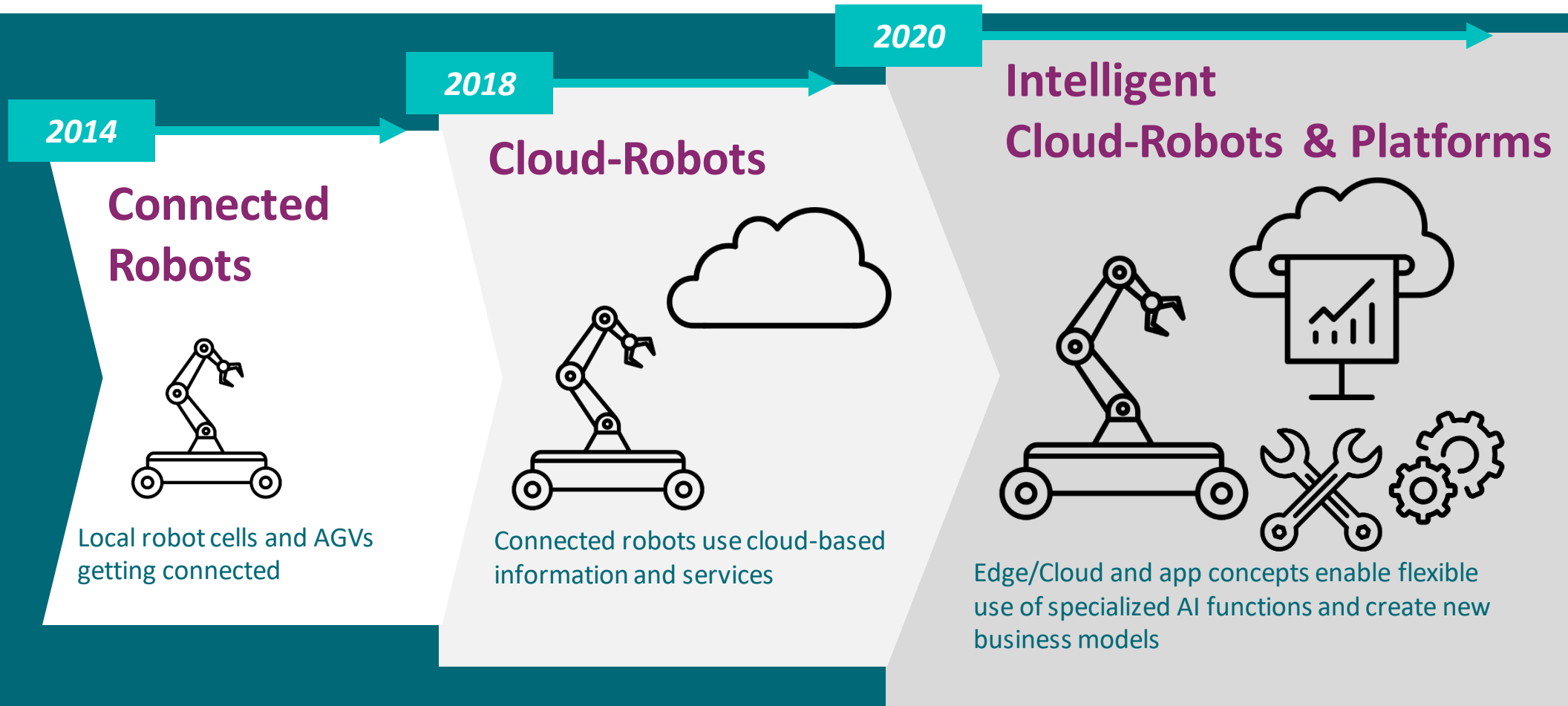
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EDGE COMPUTING & 5G IN (MOBILE) ROBOTICS

From Industry 4.0 to a Break-Through
of Scalable AI "as a Service" on the Shop Floor



INTELLIGENT CLOUD ROBOTICS



EDGE & CLOUD ROBOTICS

Benefits All Along the Lifecycle

System Commissioning & Software Updates

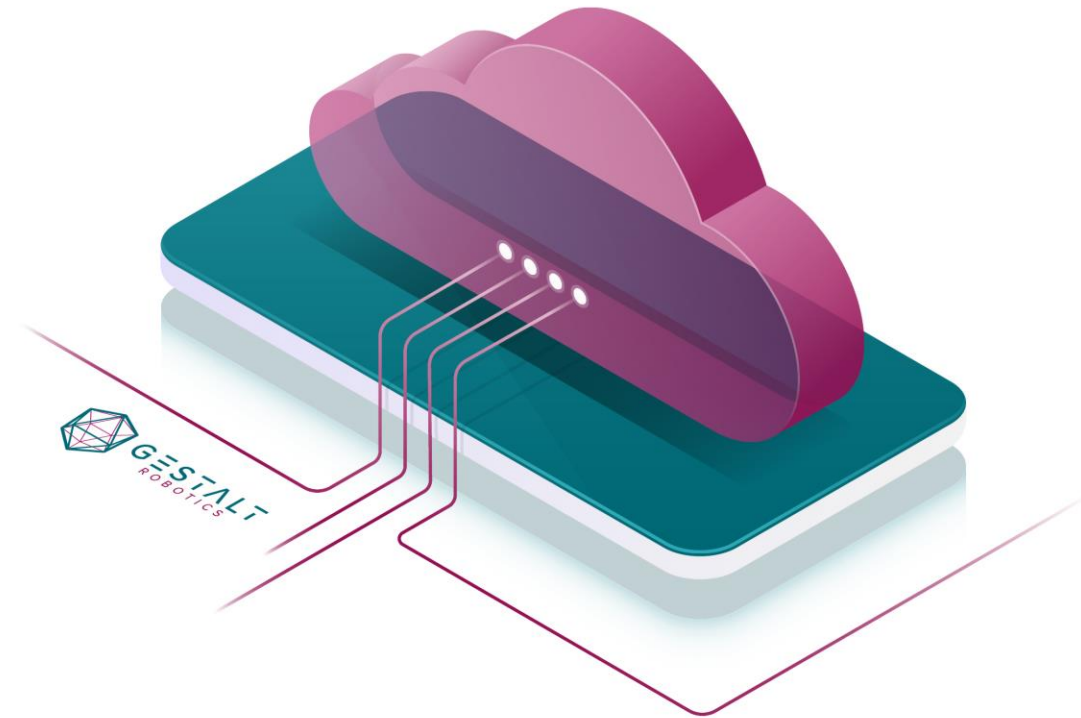
- ◇ Faster commissioning
- ◇ Deploy software updates "on-the-fly"

Operations

- ◇ Modular expandability and broader function range (especially towards high-performance AI)
- ◇ Seamless scaling and redundancies
- ◇ Comprehensive fleet management for mixed robot fleets
- ◇ Longer operation time (8-25%) through less on-board energy consumption as well as opportunities to minimize onboard hardware

Business Models

- ◇ Enables Software-as-a-Service models in an open eco-system



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EDGE-BASED AUTONOMOUS MOBILITY

Closed-Loop Control as a Service
- Campus Network Use Case at Osram -



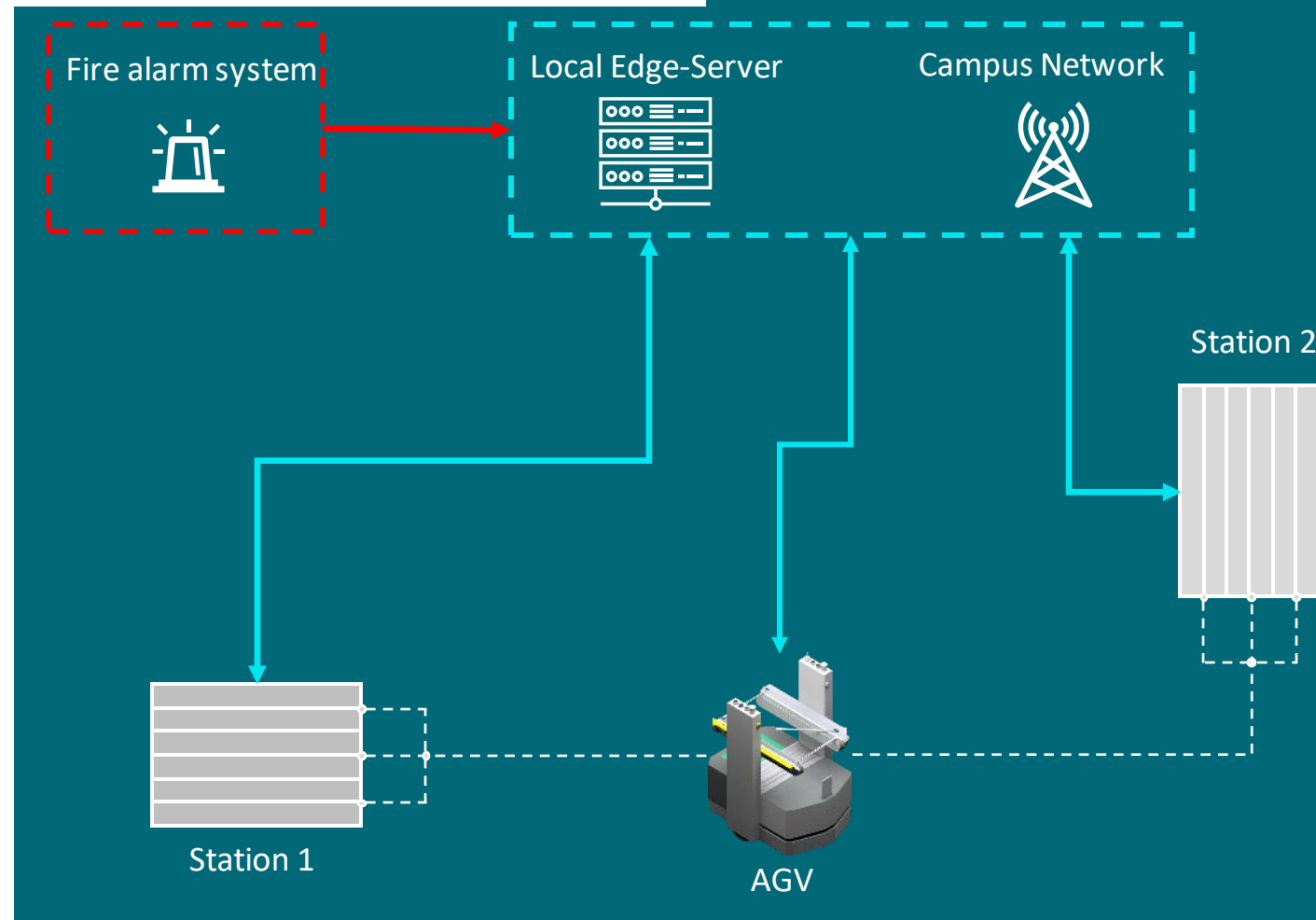
NAVIGATION AS A Service

Preliminaries

- ◇ Microservice-based modular navigation stack
- ◇ Communications middleware for distributed computing
- ◇ Optional: redundancies and fallback

Key Facts

- ◇ Low Latency radio network enables even closed-loop control of real-time critical functions on the Edge
- ◇ Basic safety functions remain onboard
- ◇ Solutions includes M2M communication and integration of corporate IT systems (e.g. MES and ERP)
- ◇ Certificate of Conformity (CE)



Pilot case at OSRAM





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AUTONOMOUS INDOOR MOBILITY ON CAMPUS: [YOUTUBE \(1\)](#) & [YOUTUBE \(2\)](#)



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AUTONOMOUS OUTDOOR NAVIGATION ON CAMPUS: [YOUTUBE](#)

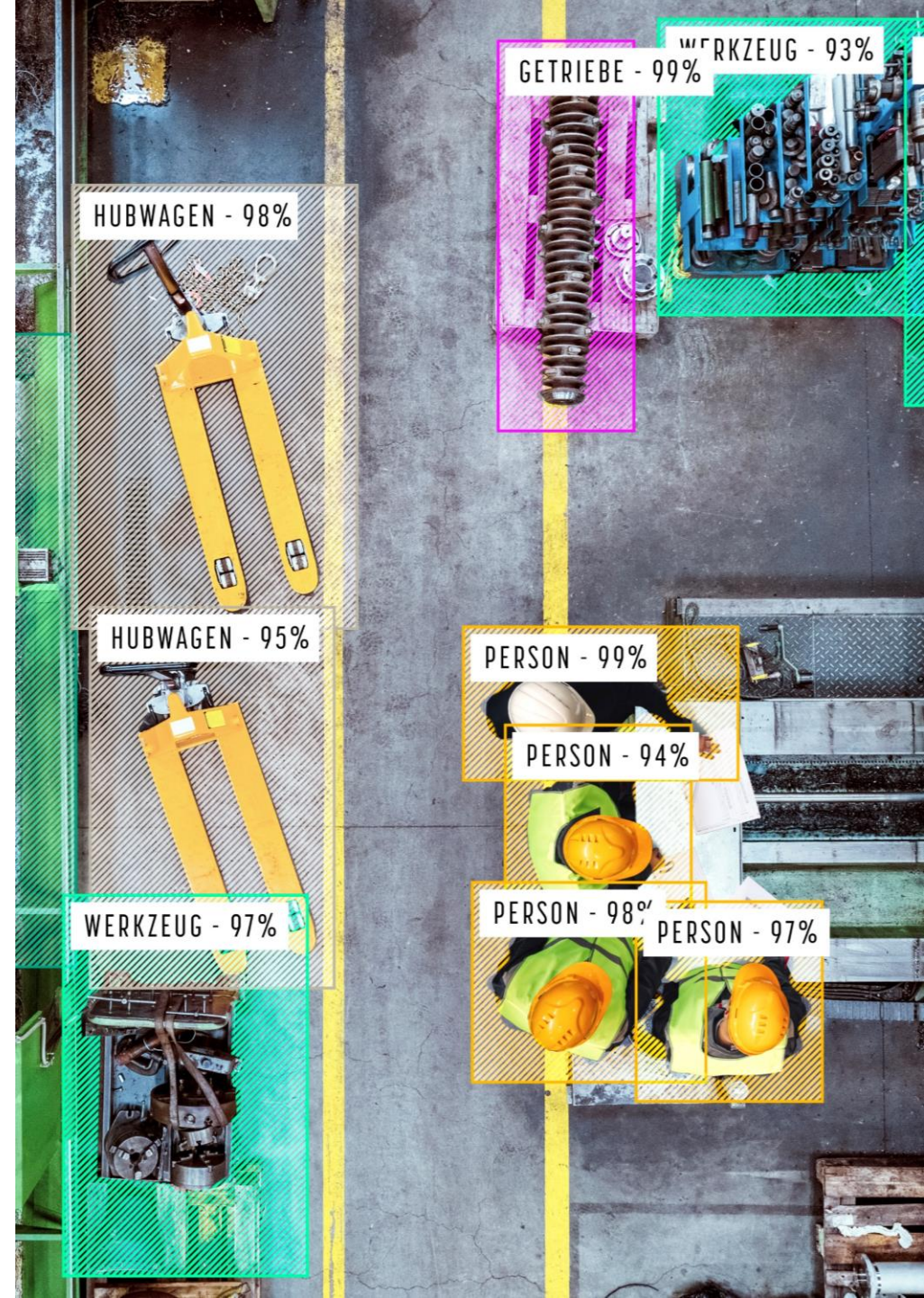


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VALUE ADDED AI AS A SERVICE

Next Level of Environmental Sensing
- Semantic Mapping & Navigation -

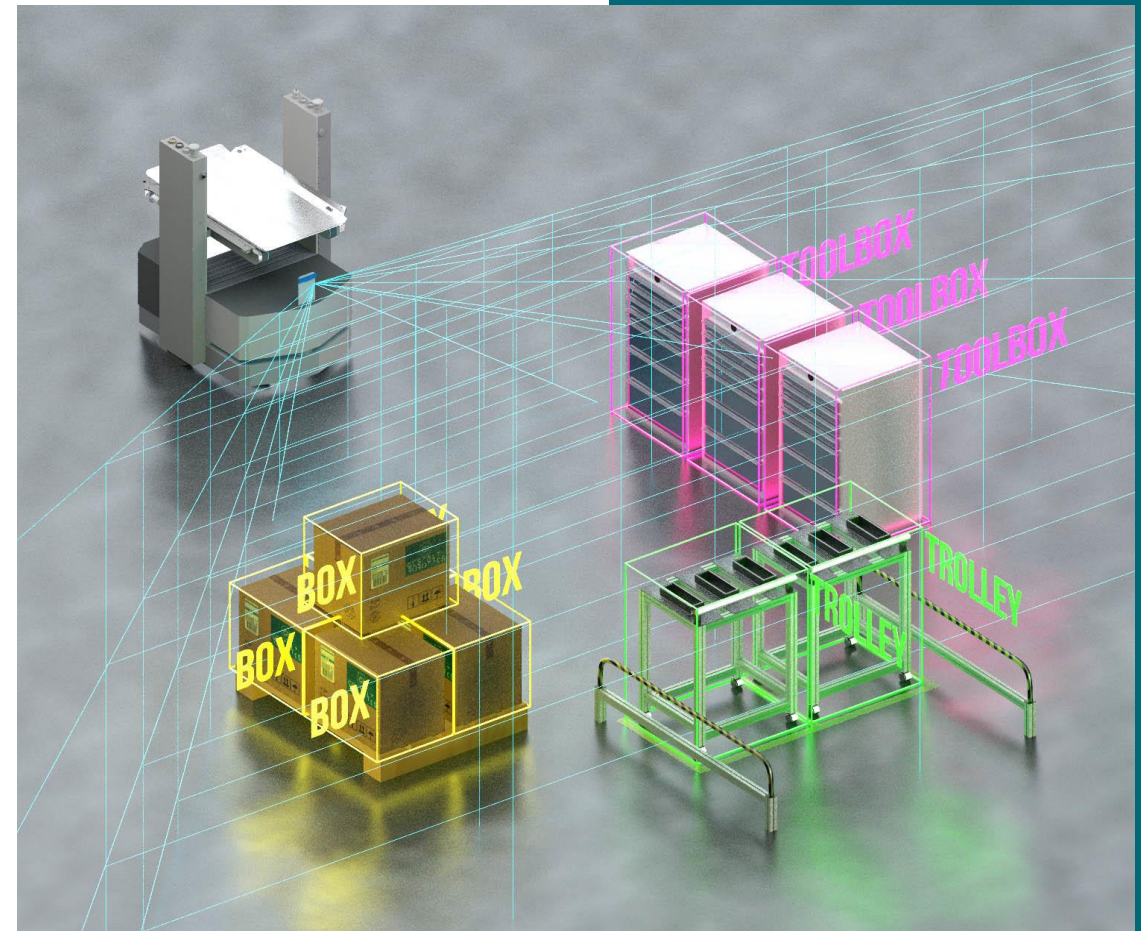


ADDED VALUE

Deep Learning on the Edge

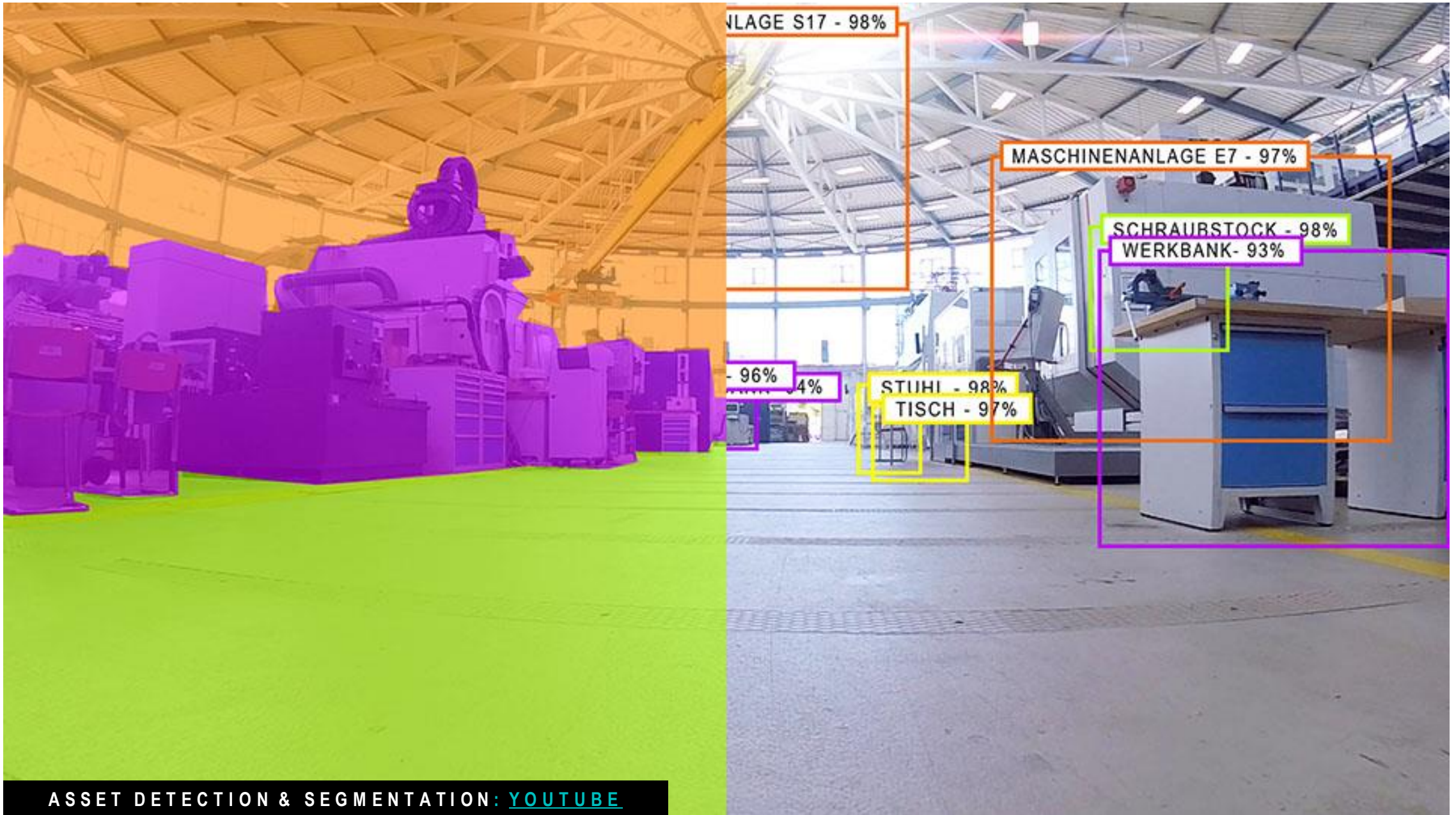
AI-based Object Recognition, Detection & Localization

- ◇ Stream RGB & depth images to the Edge
- ◇ Use state-of-the-art Convolutional Neural Networks in terms of recognizing localizing and tracking items
- ◇ Combine localization with robot's map
- ◇ GDPR compliant



Autonomous Navigation Combined with Visual AI





ASSET DETECTION & SEGMENTATION: [YOUTUBE](#)



SEMANTIC MAPPING FOR MOBILE PLATFORMS

AGV BASE
FLEET CTRL
AUTOMATION OS



SEMANTIC MAPPING & NAVIGATION [YOUTUBE](#)

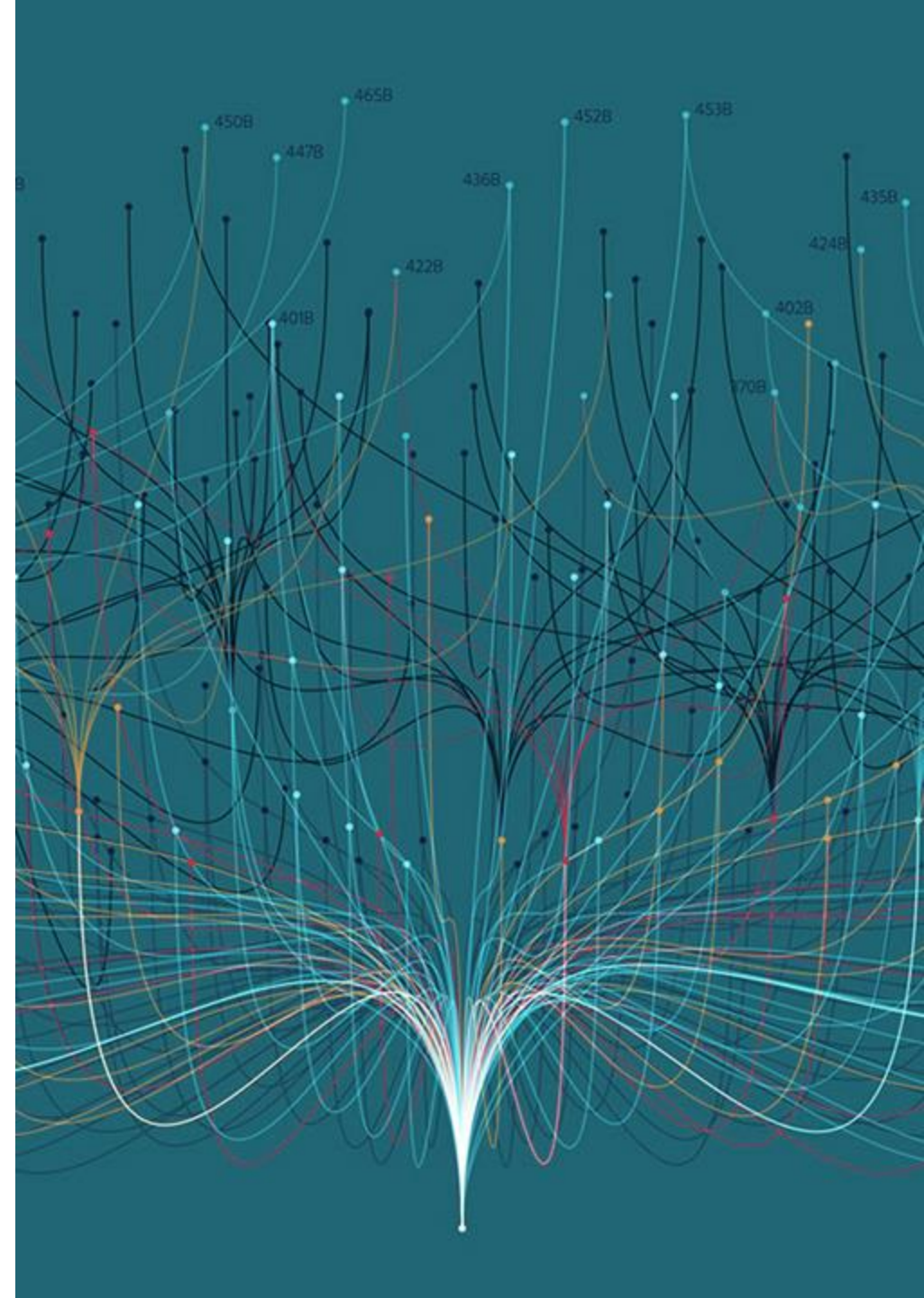


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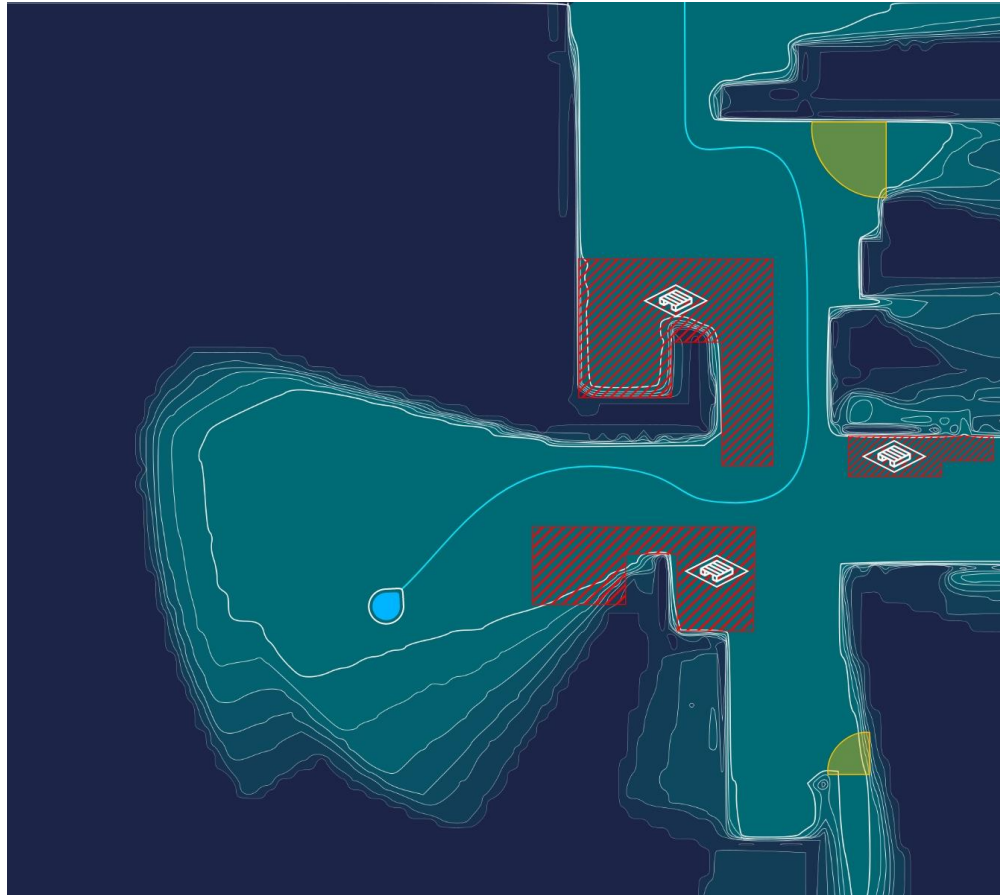
DIGITAL TWIN

A Live Virtual Representation of
Logistics and Manufacturing Environments

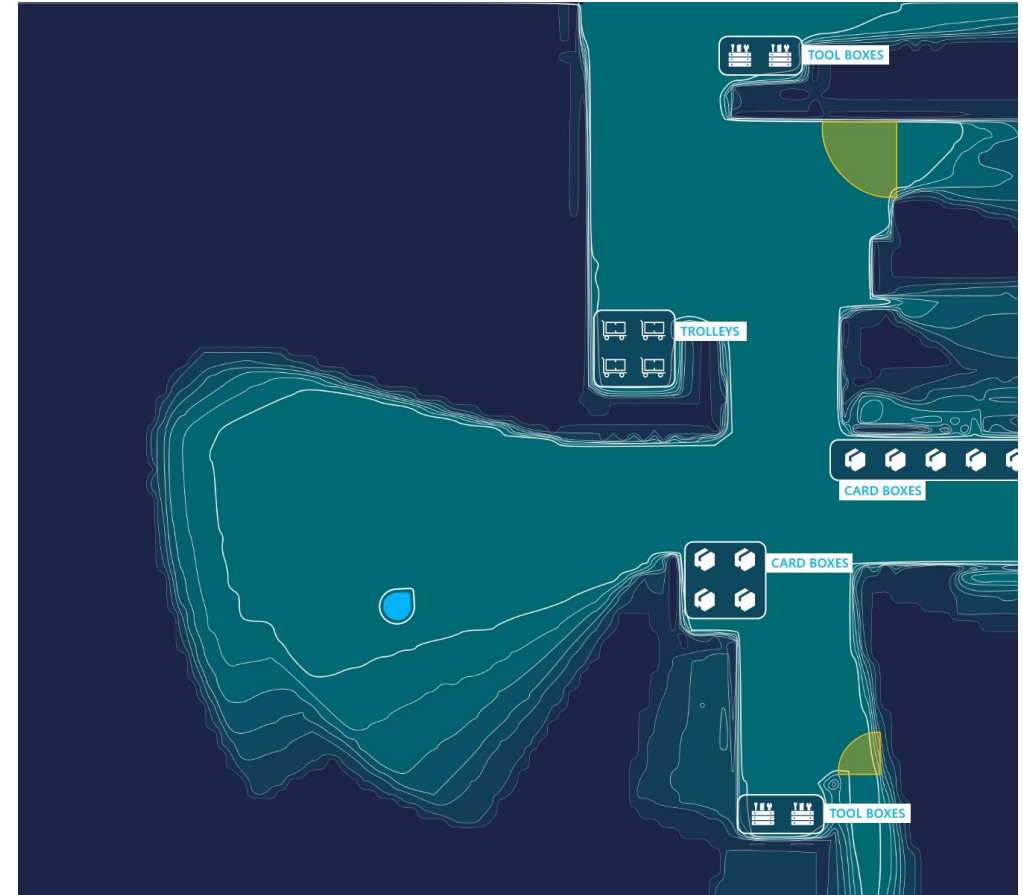


UP-TO-DATE SEMANTIC MAPS

Asset Tracking



Lost & Found



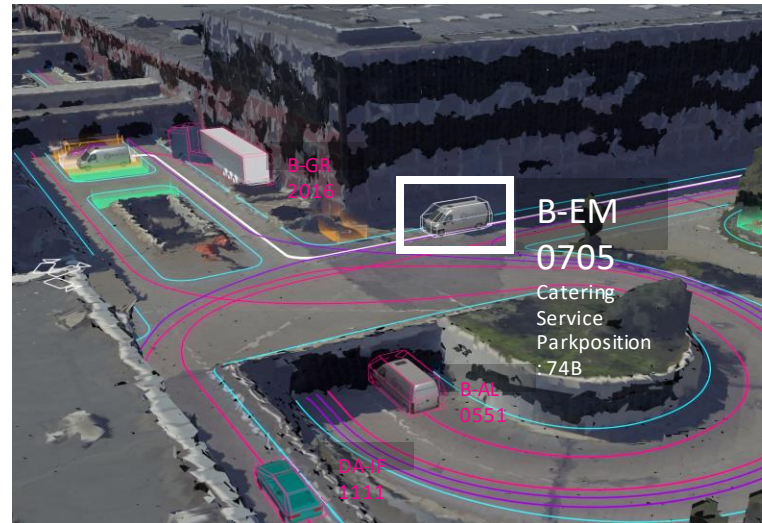
DIGITAL FACTORY TWINS

From Environmental Understanding towards the Digital Twin

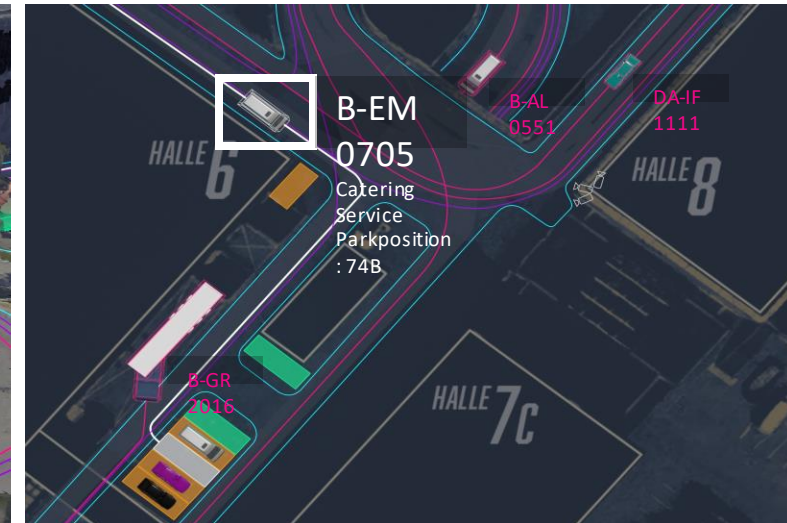
Novel Opportunities through AI on the Edge

- ◇ Semantic Navigation
 - ◇ Improve performance & safety of the navigation
- ◇ Semantic Mapping & Tracking
 - ◇ Understand & map environments
 - ◇ Advanced analytics: collect and analyze spatio-temporal data
 - ◇ Create Digital Twins of factory environments
- ◇ Novel Use Cases
 - ◇ Inventory assessment
 - ◇ Assistance for (automatic) planning, decision making and operation
 - ◇ ...

Live Camera View with Overlay



Top-Down View – Digital Twin



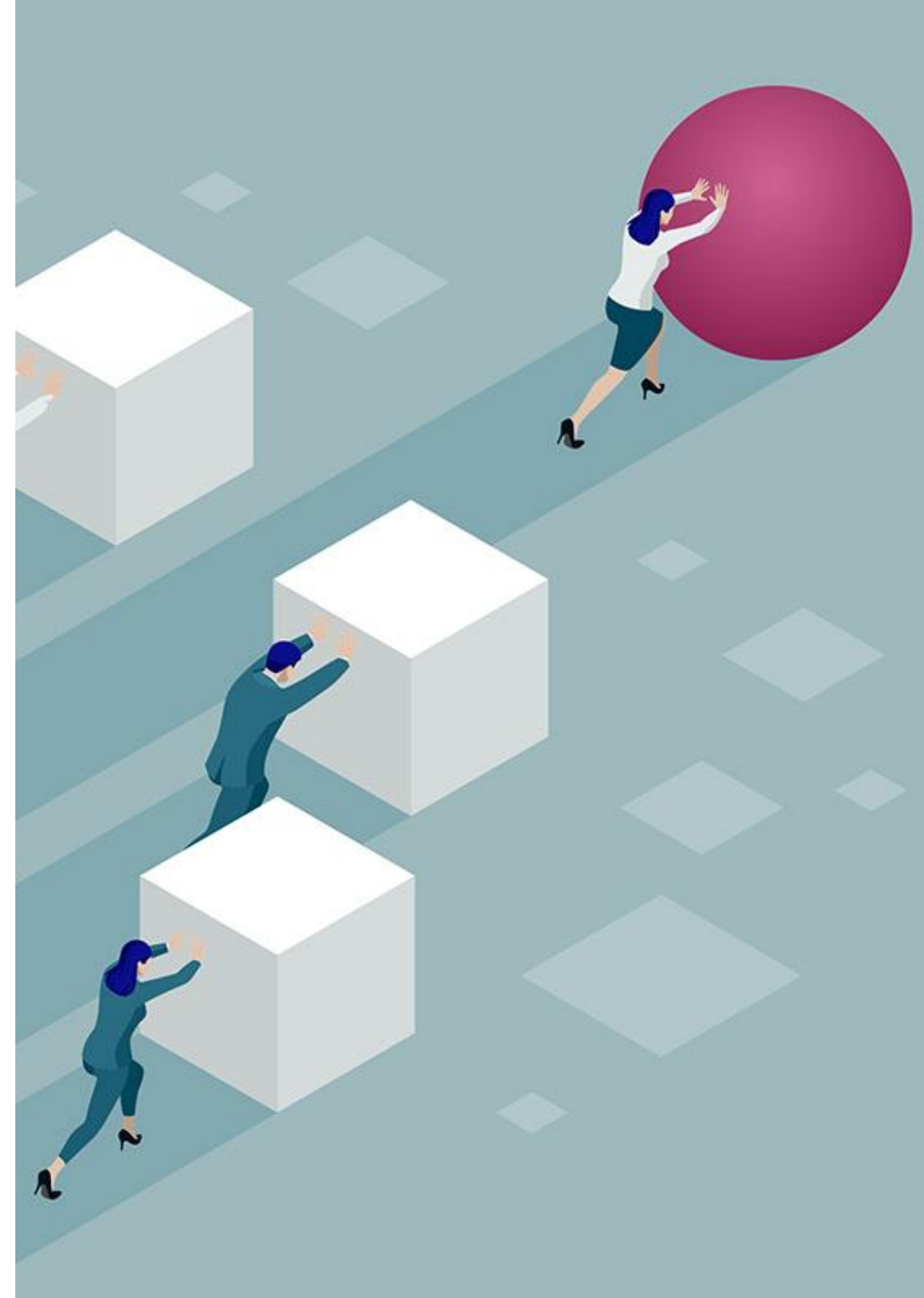
— Selected Vehicle — Arriving Vehicles — Departing Vehicles — Free Parking Space — Occupied Parking Space

DIGITAL TWINS OF LOGISTICS ENVIRONMENTS



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OUR OFFERING



BENEFITS FOR OUR CUSTOMERS

Service Opportunities

- ◇ **Consulting Activities** regarding distributed automation solutions & AI regarding 5G and Edge computing
- ◇ **Software Development & Services**
 - ◇ From PoC to complex modular automations systems
 - ◇ Manufacturer independent and hardware agnostic
 - ◇ AI, Cloud & Edge for value-added automation services
 - ◇ Agile & customer-tailored solutions
- ◇ **Integrations & Support**





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