F5G OPENLAB FOR POC DEMOS ON INDUSTRIAL AUTOMATION

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OVERVIEW

- Twin transition of the manufacturing industry
  - Green transformation
  - Digital transformation
- ETSI ISG F5G use cases:
  - Cloud-based vision inspection for quality assurance
  - Cloud-based control of automated guided vehicles (AGV)
- F5G OpenLab for proof-of-concept demonstrations
- Conclusions and Outlook

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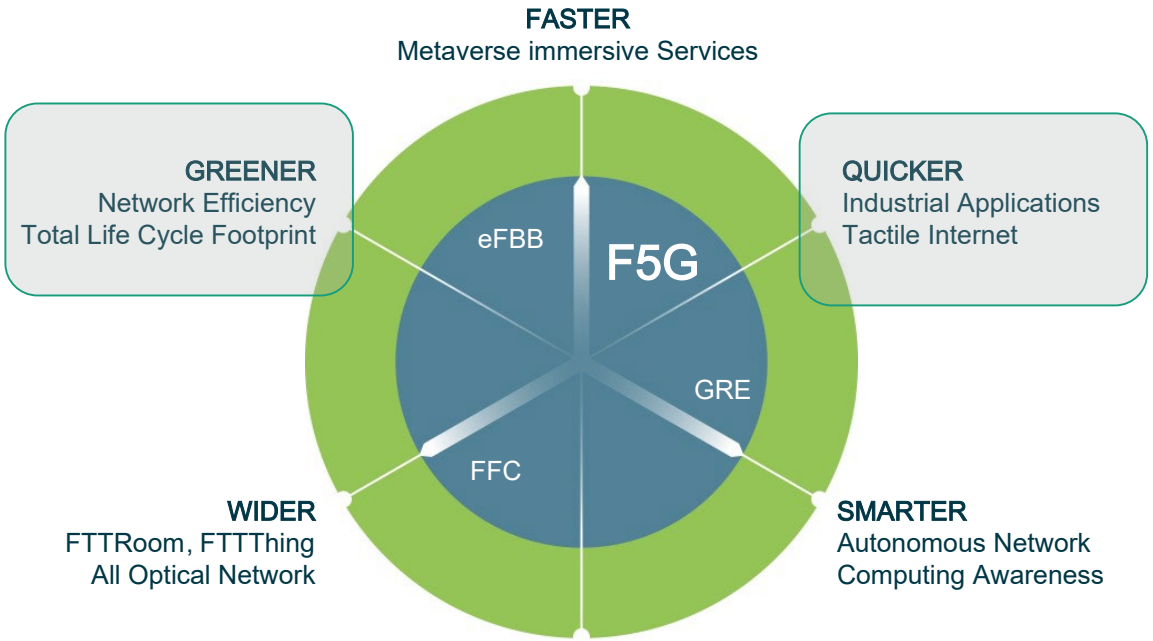
The six dimensions of F5G Advanced



FFC	Full-Fibre Connection
eFBB	enhanced Fixed BroadBand
GRE	Guaranteed Reliable Experience

ETSI White Paper No. #50, "Fixed 5th Generation Advanced and Beyond," Sep. 2022.

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Twin Transition of the Manufacturing Industry

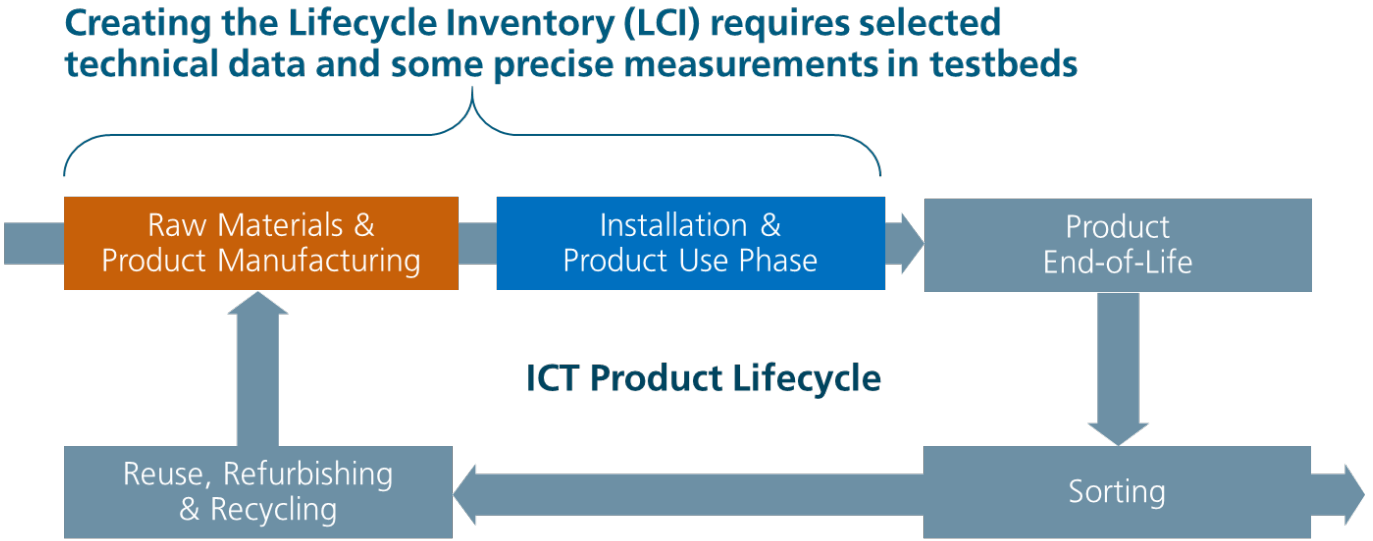
Green Transformation: Quantifying “Green”

System Version A

Baseline Technology
(conventional ICT)

System Version B

Low Carbon Footprint Technology
(Green ICT)



ITU-T Rec. L.1480, “Enabling the Net Zero transition: Assessing how the use of information and communication technology solutions impact greenhouse gas emissions of other sectors,” Dec. 2022.

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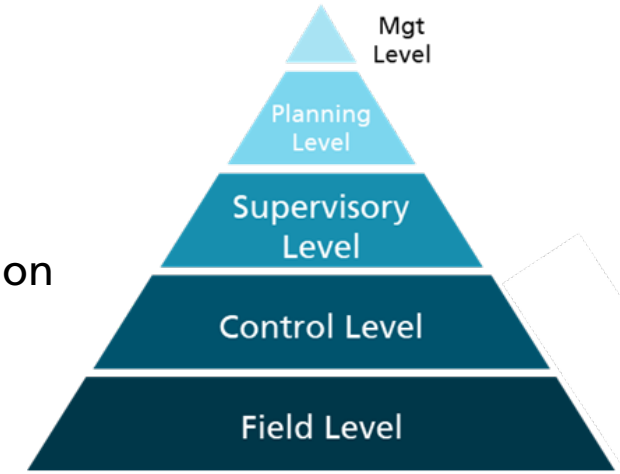
Twin Transition of the Manufacturing Industry

Digital Transformation



- Field Level: Physical manufacturing equipment on the factory shop floor (motors, actuators, video cameras and other sensors)
- Control Level: Receives sensor and monitoring information from Field Level. Based on that information, decisions are taken and control signals for the devices in the Field Level are generated, e.g. by using Programmable Logic Controllers (PLC)
- **Trend** is towards virtualization of control functions (virtual PLC) running in **edge cloud environments**
- vPLCs alleviates the need for costly and often proprietary solutions for local PLCs on the shop floor, where cooling, power consumption, space and environmental effects are critical issues.

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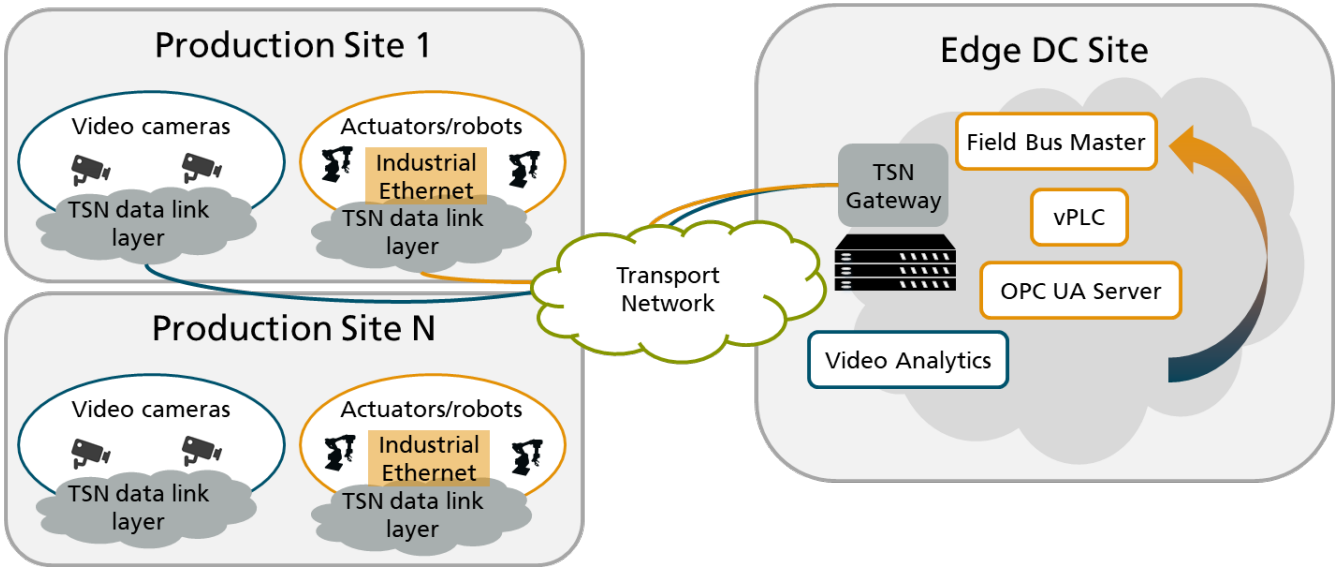
ETSI ISG F5G Use Case

Cloud-based visual inspection for automatic quality assessment in production*

Typical vision inspection applications require maximum cycle times of 5-10 ms, while some very time-critical vision inspection scenarios may even require 2 ms or less.

Data rate per vision inspection station:
1 Gb/s – 20 Gb/s



* ETSI GR F5G 008, "Fifth Generation Fixed Network (F5G); F5G Use Cases Release #2," V1.1.1 (2022-06).
* ETSI GS F5G 013, "Fifth Generation Fixed Network (F5G); F5G Technology Landscape R2," V0.0.8 (2023-02).

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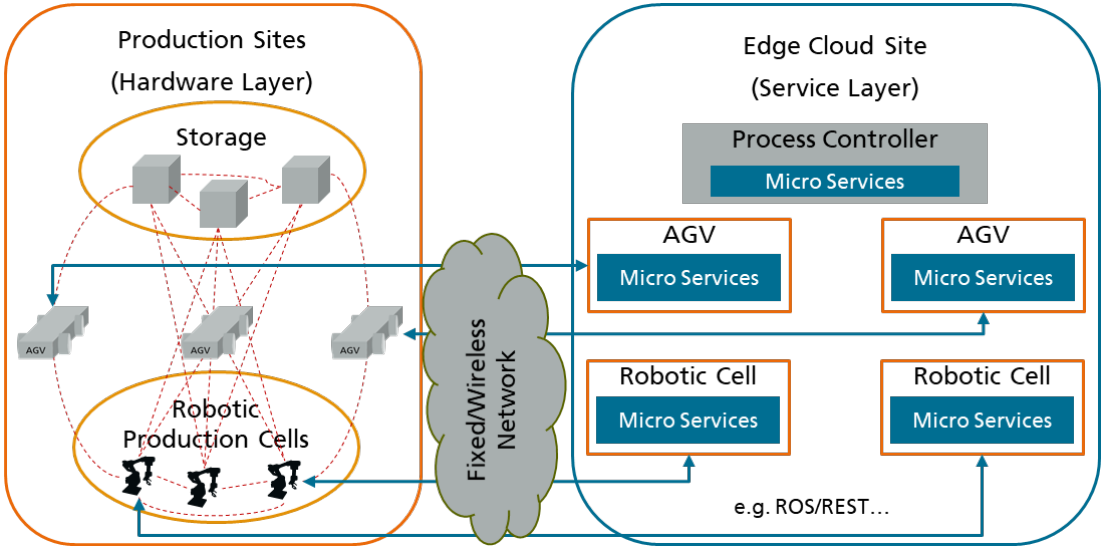
ETSI ISG F5G Use Case

Cloud-based control of automated guided vehicles (AGV) and robots

- Control of automated guided vehicles (AGV) via edge cloud services
- Flexible collaboration between AGVs and robots
- Combined fixed/wireless networking
- Communication service availabilty >99.9999%
- Cycle time: 10-50 ms



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F5G OpenLab

Open Environment for Collaboration

Mission

- Provide an ecosystem for validating networking solutions for twin transition
- Offer a vendor agnostic facility to verticals for evaluating their use cases
- Empower the development of fiber-based solutions

Ecosystem

- Open environment to test vertical use cases
- Networking hub to connect and interact with standards people, industry partners and customers
- Industry collaboration and ecosystem development, incubation of business opportunities

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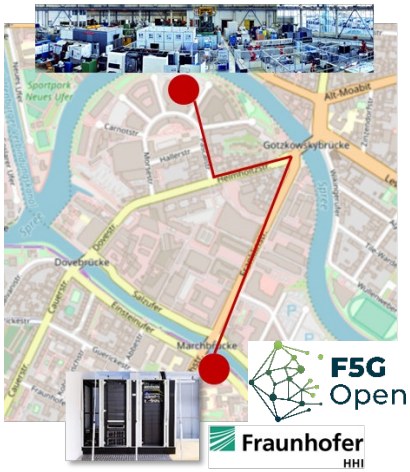
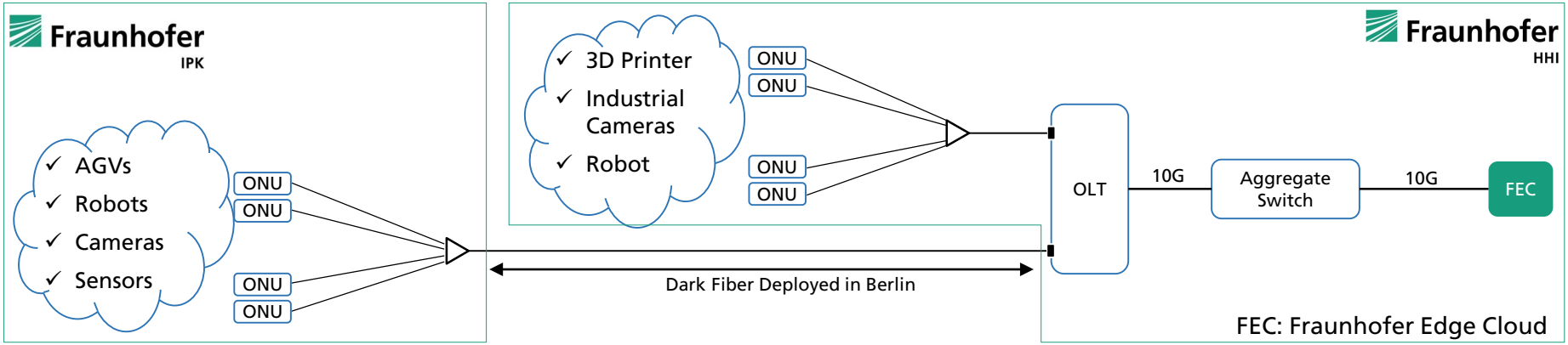
F5G OpenLab for F5G Proof-of-Concepts

Factory Shop Floor, Fraunhofer Edge Cloud

- Dark fiber connectivity between F5G Open Lab and the factory shop floor at Fraunhofer IPK
- PON/WiFi networking of the factory shop floor
- Enabler for industrial use case demonstrations and field trials at F5G Open Lab





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Fraunhofer Edge Cloud (FEC)

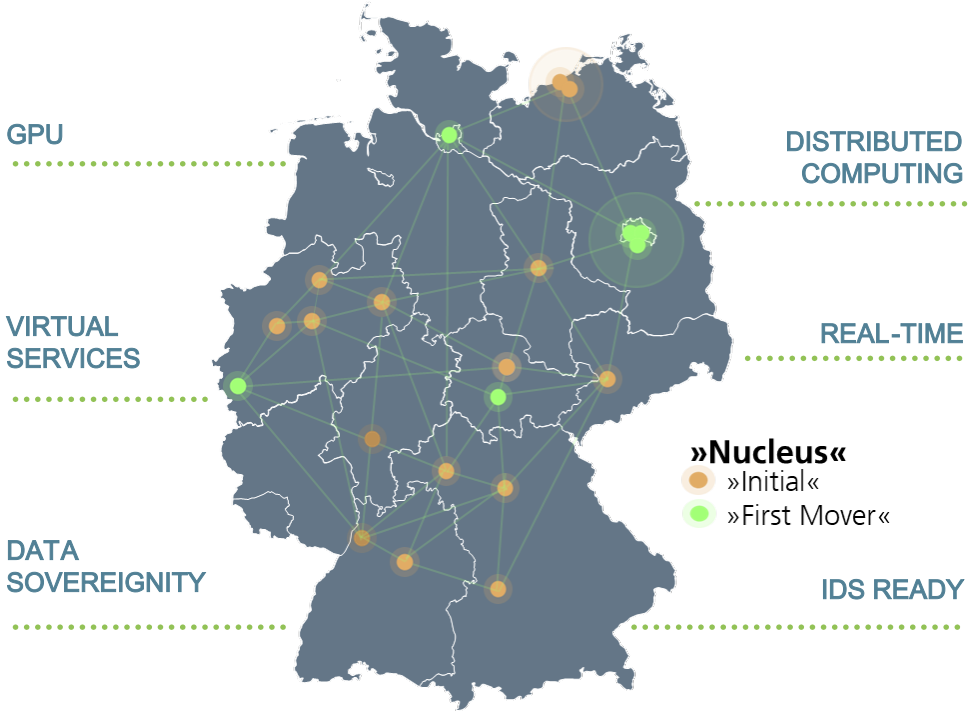
Distributed Real-Time Capable Edge Cloud

MISSION

FEC as a Research Platform

VISION

Distributed edge cloud in Germany for digital transformation



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Fraunhofer HHI

Test and Experimentation Facility for Vertical Sectors

Industrial and Medical Verticals

INDUSTRIAL TEST FIELD / FRAUNHOFER IPK

MEDICAL ENVIRONMENT / CARL-THIEM-HOSPITAL

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Summary

- Green Transformation: Challenging to quantify the improvement by ICT
  - Real-life data from testbeds required
- Digital Transformation: Industrial use cases have challenging requirements:
  - Time sensitive, cyclic communication with low latency and jitter
  - Potentially high bandwidth
- F5G OpenLab for F5G technologies in Berlin
  - First ETSI ISG F5G Proof-of-Concept (PoC) completed in Open Lab*
  - PoCs for ETSI ISG F5G use cases in progress: Open for collaborators! https://www.f5g-openlab.org/

* ETSI ISG F5G, "Precise Traffic Monitoring and Telemetry Streaming for Prediction and Analysis," F5G(22)000130, Jun. 2022.

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