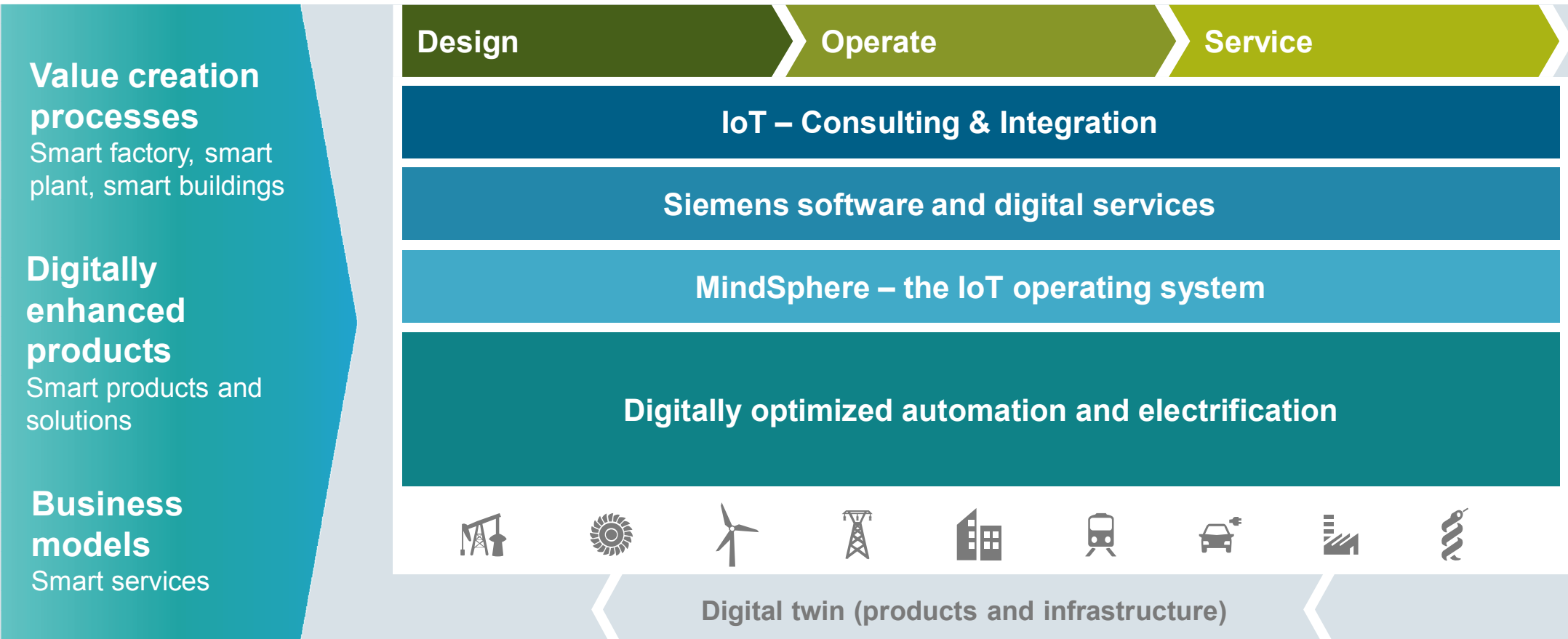# Industrie 4.0 - from vision to implementation

Dr. Norbert Gaus | October 26, 2018
4th CII Smart Manufacturing Summit 2018

siemens.com/innovation

Digitalization is changing everything …
…and needs a holistic approach

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Value creation processes
Smart factory, smart plant, smart buildings

Digitally enhanced products
Smart products and solutions

Business models
Smart services

Design	Operate	Service

IoT – Consulting & Integration

Siemens software and digital services

MindSphere – the IoT operating system

Digitally optimized automation and electrification

Digital twin (products and infrastructure)

Corporate Technology

A holistic view on technology for industrial Digitalization

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Connectivity and Edge Devices
Devices become intelligent and connected

Simulation and Digital Twin
Expanding the Digital Twin

Data Analytics, Artificial Intelligence
Making automated decisions

Software Systems and Processes
Managing the SW Life-cycle

Future of Automation
From automated towards autonomous systems

Autonomous Robotics
Controlling pervasive robotics

Cyber Security
Enabling Digitalization

Block-chain Applications
Managing Transactions

Corporate Technology

Industrie 4.0 is driven by the needs of our customers

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Customer needs

New business models

Speed | Flexibility | Quality | Efficiency

Security

Future of Automation
From automated towards autonomous systems

PLATTFORM
INDUSTRIE 4.0

Enabling Technology

Connectivity and Edge Devices
Devices become intelligent and connected

Data Analytics, Artificial Intelligence
Making automated decisions

Simulation and Digital Twin
Expanding the Digital Twin

Cyber Security
Enabling Digitalization

Corporate Technology

Let's make it concrete!

Edge devices bring intelligence, flexibility and fast innovation

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

MindSphere

**In-Cloud
(Cloud level)**

Edge Apps developed by Siemens, customers, partners (OEM), 3rd-party

Selected data: M2M communication, non RT optimization,…

Selected data

Edge Apps

**In-Machine
(Field/Edge level)**

Edge Devices

Secure and decoupled edge runtime infrastructure for edge apps

Local activity

High frequency data

Field device

Edge device

Corporate Technology
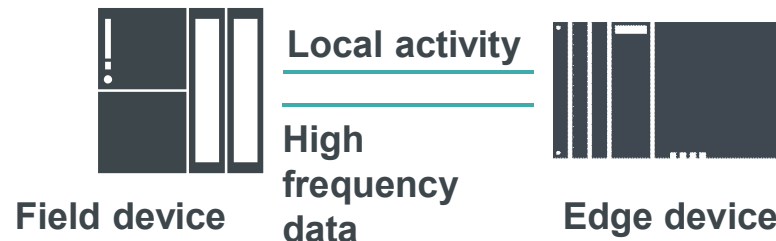
Architecture of the industrial edge in manufacturing

**In-Cloud
(Cloud level)**

App

Edge
mgt

MindSphere

Edge App
Store

Examples:

mx mendix

Node-RED

python

node

Edge
app
devel.

**In-Machine
(Field/Edge level)**

Automation system

Exchange of data

Distribution
• App deployment
• App updates

(Edge)-App

Connectivity for
automation

Edge App
Edge App
Edge Runtime

Access app on
Edge device
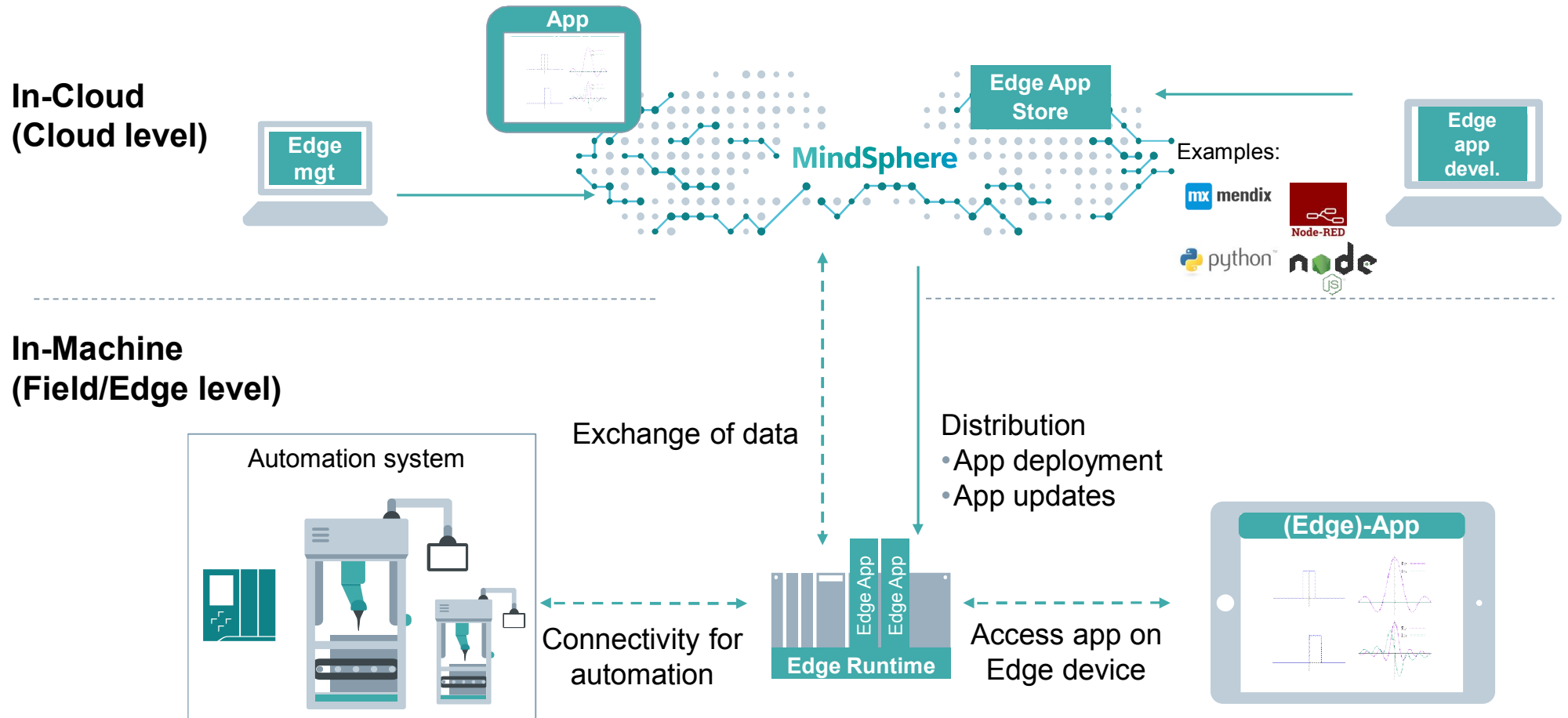
SINUMERIK Edge – an open system to provide local machine intelligence as add-on functionality

Manage MyResources / magazine optimization
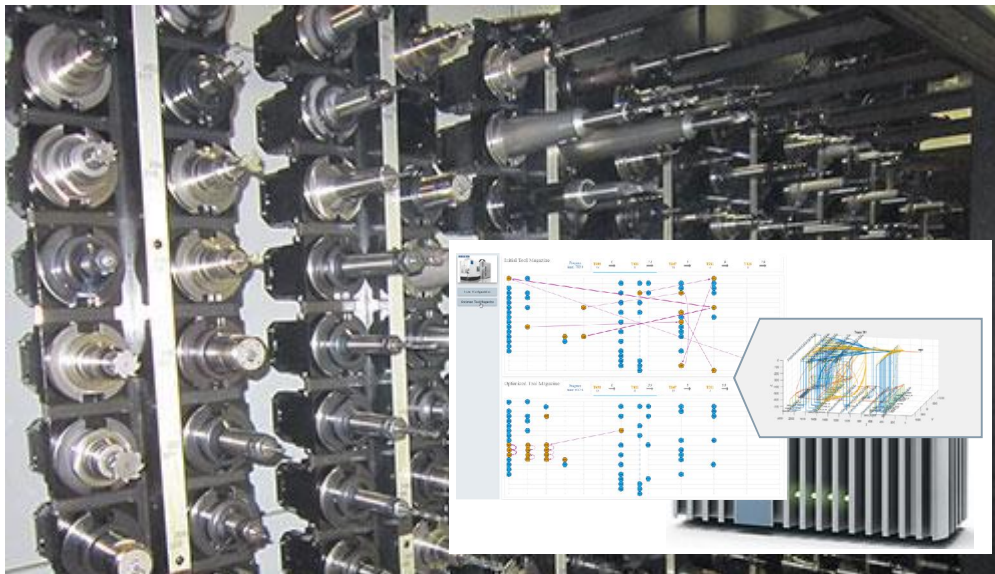
Optimize tool placement in large magazines

⇨ Shortened idle times in machining

Analyze MyWorkpiece
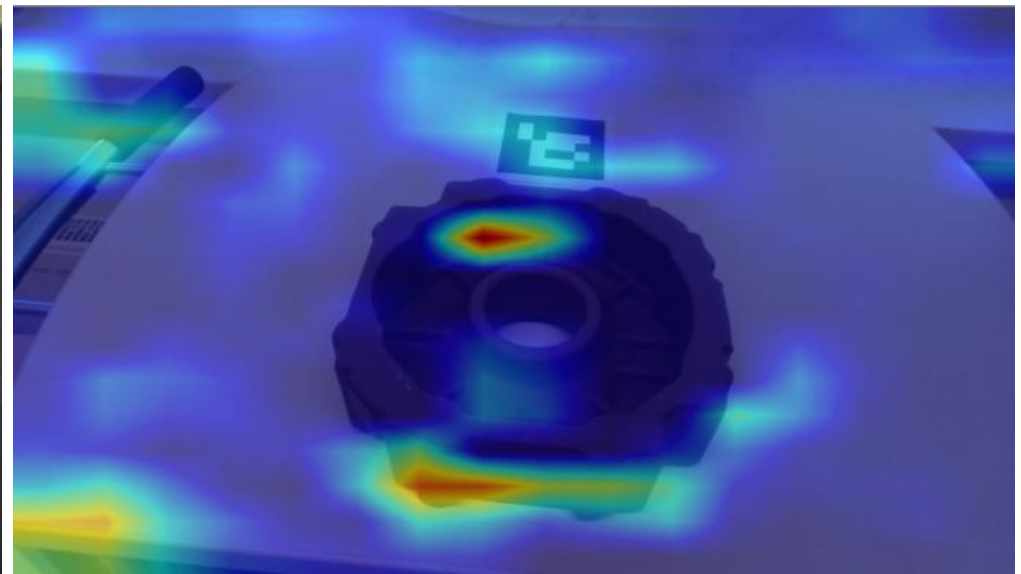
Machine awareness: detecting incorrect or displaced workpieces

⇨ Preventing machine damages and faulty workpieces

Implementing "data driven services"
to optimize service delivery and to generate new business

Motivation
- Optimizing service delivery via remote access
- New service offerings and new business models

End-customer benefit
- Higher uptime, more efficient service
- Faster access to innovation

Implementation – connecting assets to Mindsphere
- Providing/implementing basic network connectivity to assets where not yet available
- Configuration to allow remote access (@Sinumerik, network)

⇨ Mindsphere enables connectivity and provides applications for Industrie 4.0 businesses

Industrie 4.0 @ work in India – transforming the manufacturing process of low voltage switchgear at Kalwa Works

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>**180** product variants in **1** line

~**9** sec cycle time in spite of varied product-mix

68 quality parameters check in **9** secs

**Local** for **local** & **global** market

Corporate Technology

Where to find technologies and help for my future digitalization business?

Industrie 4.0 is becoming reality with OPC-UA as its backbone for communication and information modeling

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Source: VDMA, VDW, ZVEI, Plattform Industrie 4.0, Labs Network Industrie 4.0, Standardization Council Industrie 4.0, OPC Foundation

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Industrie 4.0 is becoming reality with OPC-UA as its backbone for communication and information modeling

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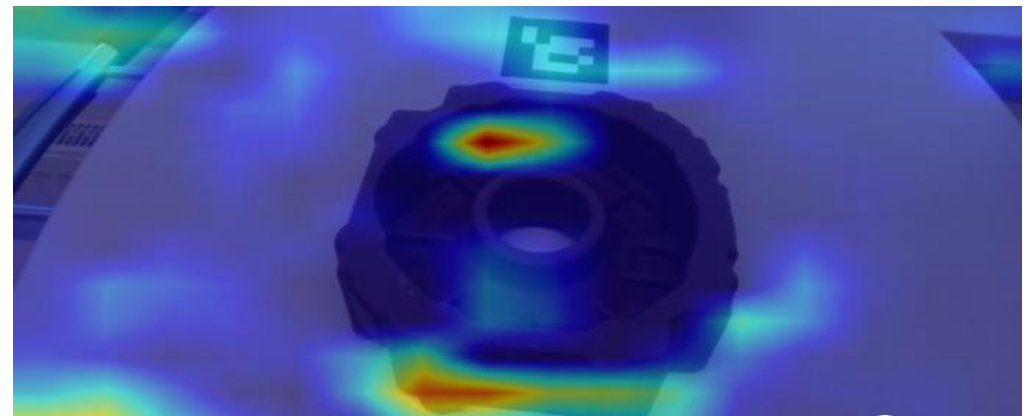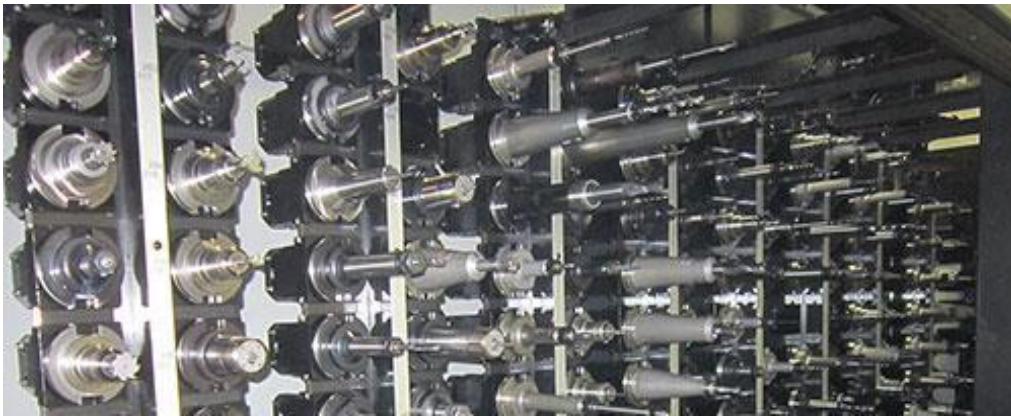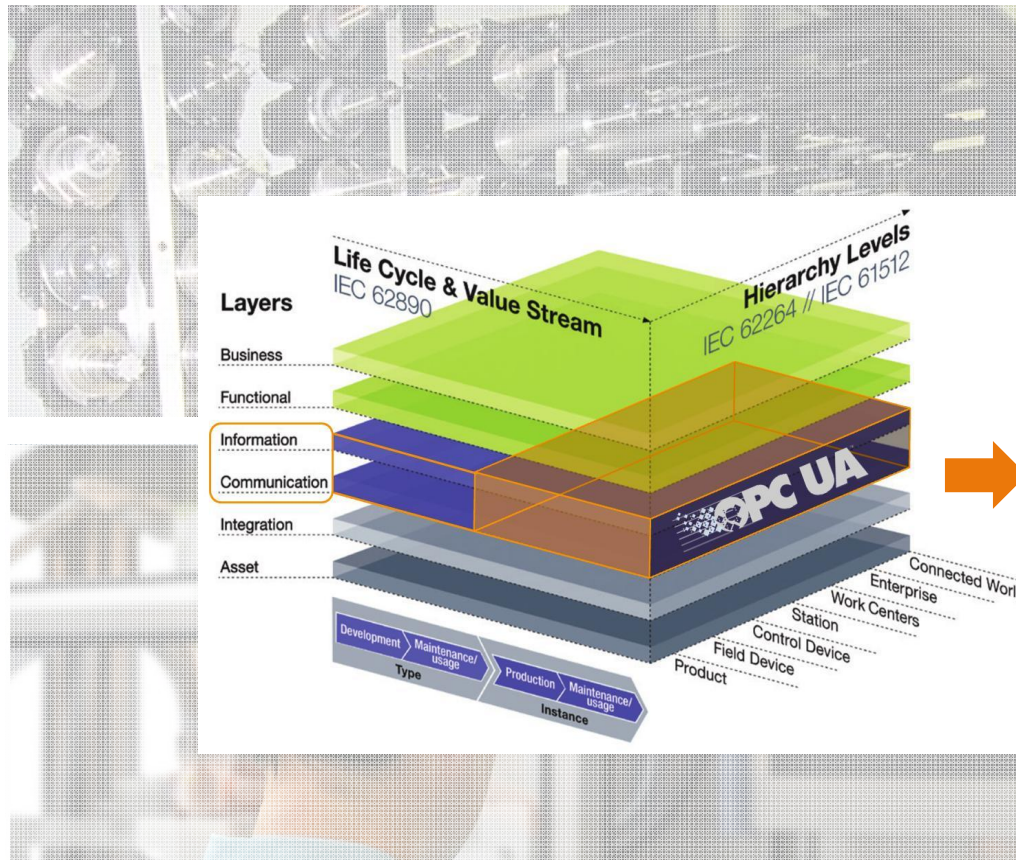
Standardized Communication „How"

- OPC UA: provided by OPC Foundation. Open Source
- standardized data connectivity method in automation
- establishing itself as the leading IoT standard in the manufacturing industry

⇨ basic prerequisite: IP based network

Modeling data structures „What"

- Standardized information models (Companion Specifications for OPC UA): core functionality of machines from different vendors
- standardized to enable easy integration, uniform usage and interoperability of machines.

⇨ provided by industry associations, e.g. robotics, machine vision, machine tools

Source: VDMA, VDW, ZVEI, Plattform Industrie 4.0, Labs Network Industrie 4.0, Standardization Council Industrie 4.0, OPC Foundation

Connecting assets and enhancing data with context –
the key to a successful Industrie 4.0 / Digitalization strategy

Information Models

- Extended Information Models
- Companion Specifications
- Device Integration

Basic functions

- Information Access
- Discovery
- Transport Layer
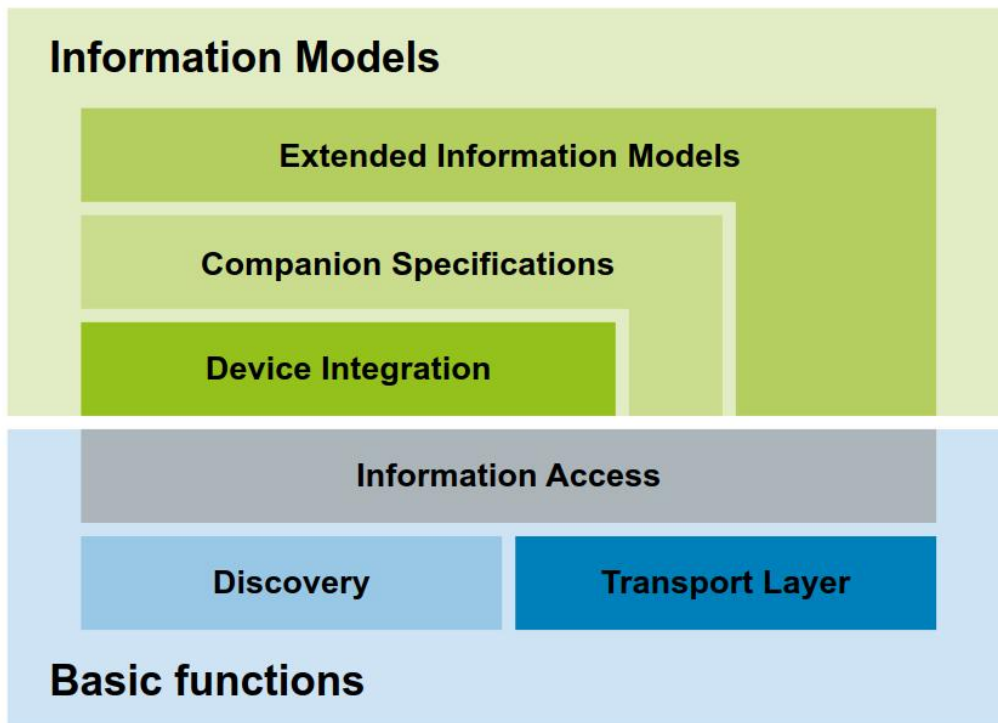
OPC UA Connectivity

- Platform **independence** (C++, Java, …, iOS, Windows…)
- **Scalability** through profiles
- Built in **security** features
- Standard internet and IP based protocols

OPC UA Companion Specification (data models) available or work-in-progress

- E.g. for robotics, plastics and rubber machines, machine tools and manufacturing systems, machine vision, electrical automation, integrated assembly solutions
- OEM specific extensions possible

Source: Industrie 4.0 Communication Guideline Based on OPC UA • VDMA • Fraunhofer IOSB-INA • 2017

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Implementation guideline for OPC-UA available from VDMA – 4 steps to a successful OPC-UA implementation
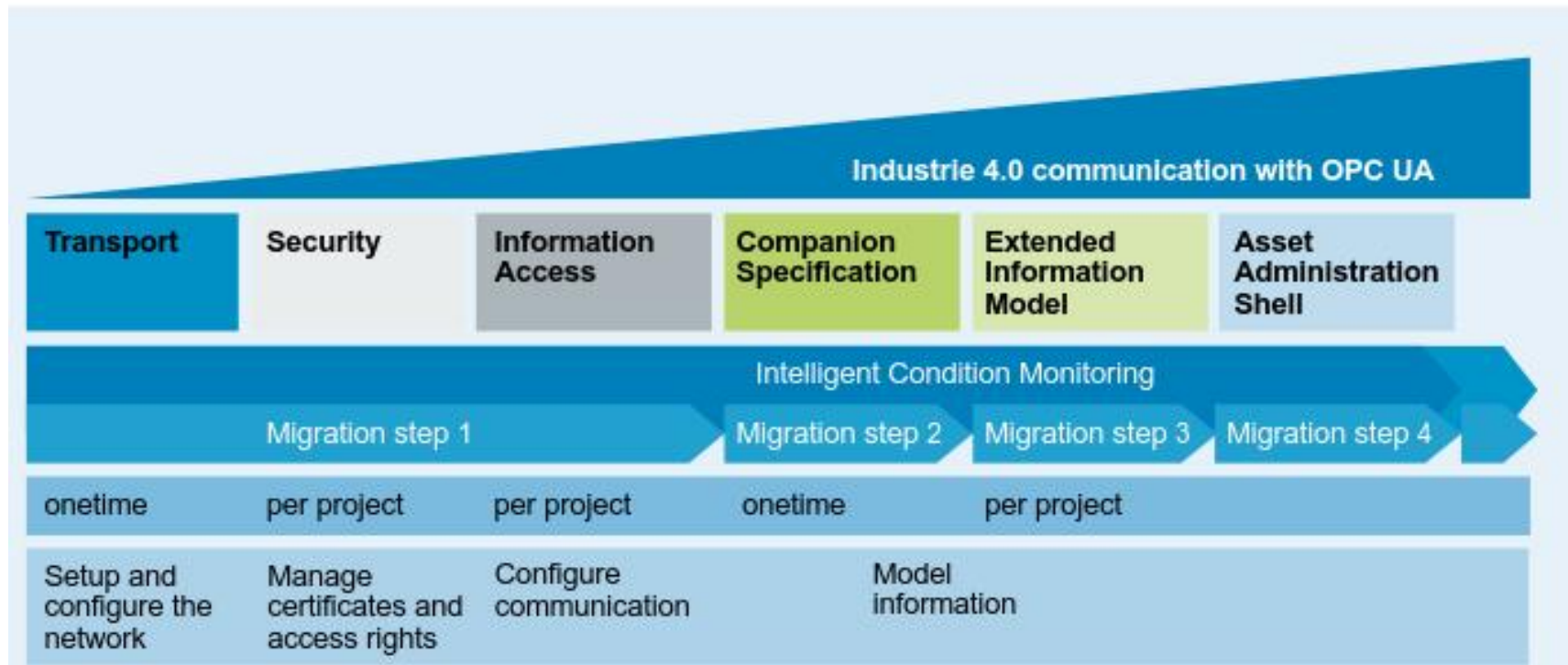
Source: Industrie 4.0 Communication Guideline Based on OPC UA • VDMA • Fraunhofer IOSB-INA • 2017

https://industrie40.vdma.org/documents/4214230/20743172/Leitfaden_OPC_UA_Englisch_1506415735965.pdf/a218 1ec7-a325-44c0-99d2-7332480de281

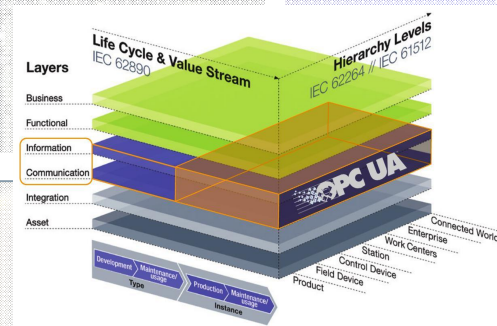# Industrie 4.0 is becoming reality with OPC-UA as its backbone for communication and information modeling

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Recommendations and help

PLATFORM
INDUSTRIE 4.0

STANDARDIZATION COUNCIL INDUSTRIE 4.0

LNI4.0 LABS NETWORK INDUSTRIE 4.0

Holistic process for strategy, testing and standardization

Implementation

VDMA

ZVEI: Die Elektroindustrie

VDW

To provide industry knowledge

Source: VDMA, VDW, ZVEI, Plattform Industrie 4.0, Labs Network Industrie 4.0, Standardization Council Industrie 4.0, OPC Foundation

Industrie 4.0 – a holistic approach to strategy, standardization and hands-on implementation

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...ıl INDUSTRIE4.0

Building on the strengths
of the German industry and Mittelstand

Close cooperation among the private sector, academia, politics, trade unions and associations on thematic priorities: Reference architectures, research, security, legal aspects, work and education, platform economy

Digital Transformation

STANDARDIZATION COUNCIL INDUSTRIE 4.0

Coordinating approach to global standardization

Orchestration of cross-sector standards; strengthen international standardization cooperation in EU/worldwide

LNI4.0 LABS NETWORK INDUSTRIE 4.0

Helping to find the right place for testing

Providing the access to the appropriate test lab; testing before productive use and standardization

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"Industrie 4.0" has become a blueprint for implementation …
… worldwide

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Plattform Industrie 4.0 and Siemens cooperates with all these initiatives worldwide
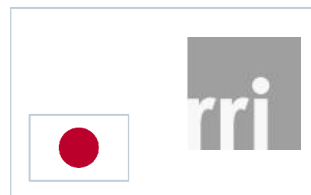
and others…

India?

Industry must transform on a global scale – reaching out for international collaboration

Corporate Technology

"Industrie 4.0" has become a blueprint for implementation – let us jointly bring it to India

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Plattform Industrie 4.0 and Siemens cooperates with all these initiatives worldwide
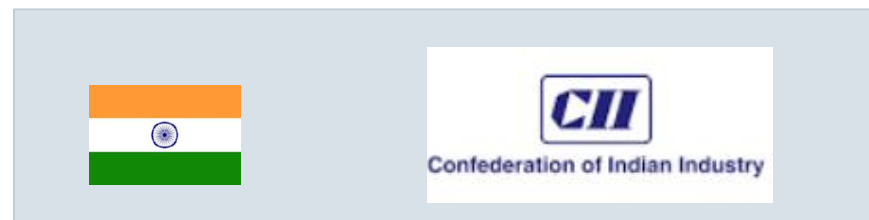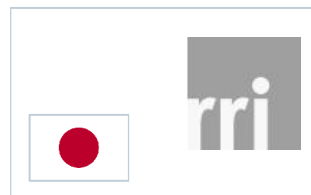
and others…

Industry must transform on a global scale – reaching out for international collaboration

Corporate Technology

"Industrie 4.0" for India – first steps achieved

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OPC Foundation hub in India founded October 23rd at the OPC day in Bengaluru, hub is hosted by Siemens in strong cooperation with CII and others industrial partners

CII can take the lead to build a systematic approach to Industrie 4.0 in India

Thank you.

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