VDMA

MACHINE INFORMATION INTEROPERABILITY

Interoperability in production

OPC UA standardization as a key enabler

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LEAD OF OPC HARMONIZATION, VDMA MII

ADVANCING EUROPE'S MACHINERY INDUSTRY

Agenda

01 **INTRODUCTION**
The VDMA, digital Transformation and Problems with Proprietary Interfaces

02 **INTEROPERABILITY**
Explanation of the Concept of Interoperability and its Benefits

03 **MAKING INTEROPERABILITY A REALITY**
Workings Groups and Architecture

04 **USER PERSPECTIVE**
How to adopt the Specifications

05 **OPC UA FOR MACHINERY**
The Base Specification for Production Equipment

06 **BENEFITS**
Use and Business Cases

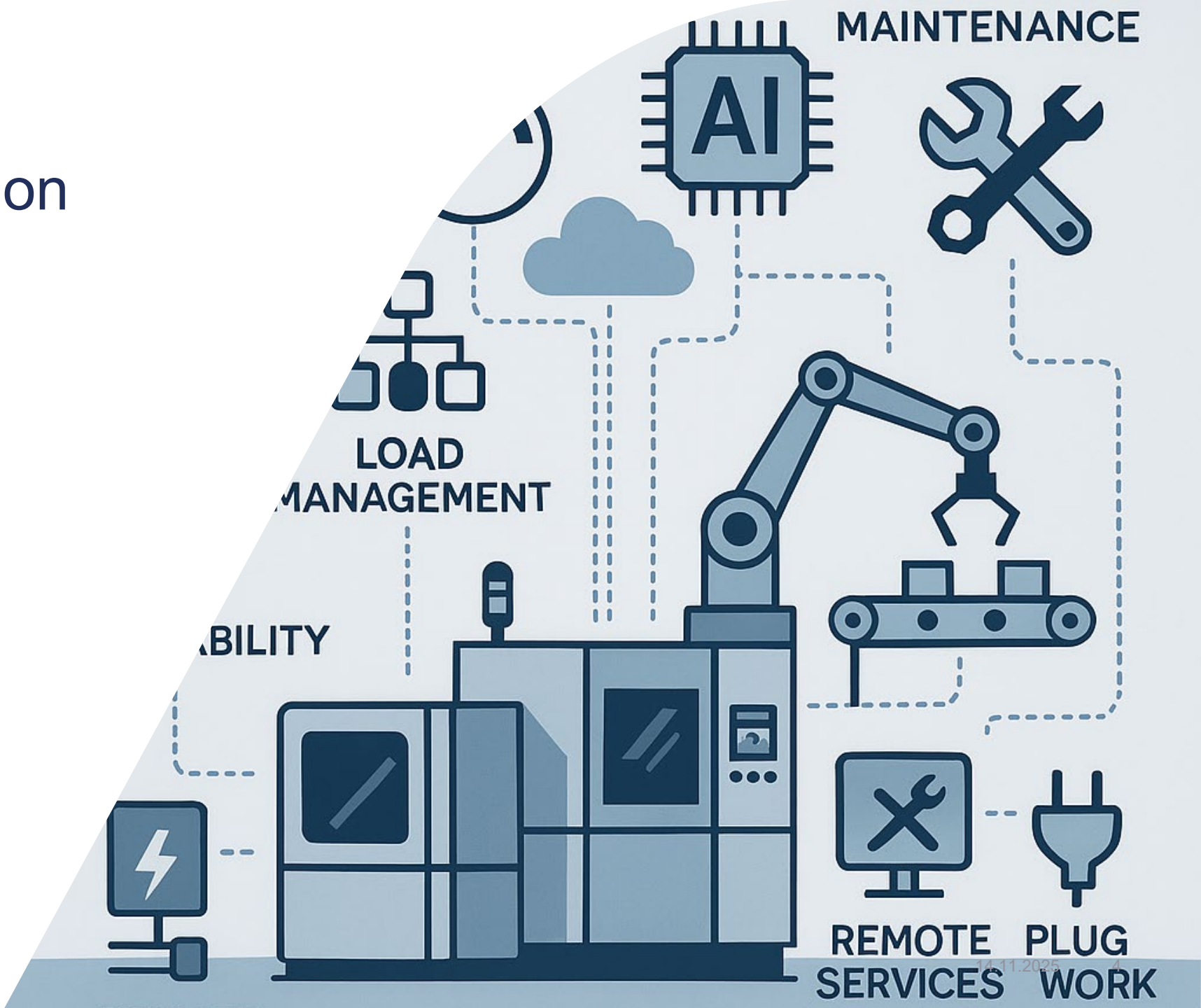
The VDMA

- Most important industrial association in Europe.
- The VDMA represents over 3,600 member companies in the engineering industry
- The VDMA is structured in
  - 38 trade associations,
  - Foreign subsidiaries (USA, Brazil, China, India, Japan Singapore, Austria, Italy, BeNeLux, Poland)
  - Departments and competence centers and
- The VDMA is host of several European and global sector committees

The VDMA represents the broad machine building industry and parts of the process industry

Digital Transformation

- Internet of Things
- Condition Monitoring
- Artificial Intelligence
- Predictive Maintenance
- Traceability
- Load Management
- Remote Services
- Plug & Work
- Dataspaces

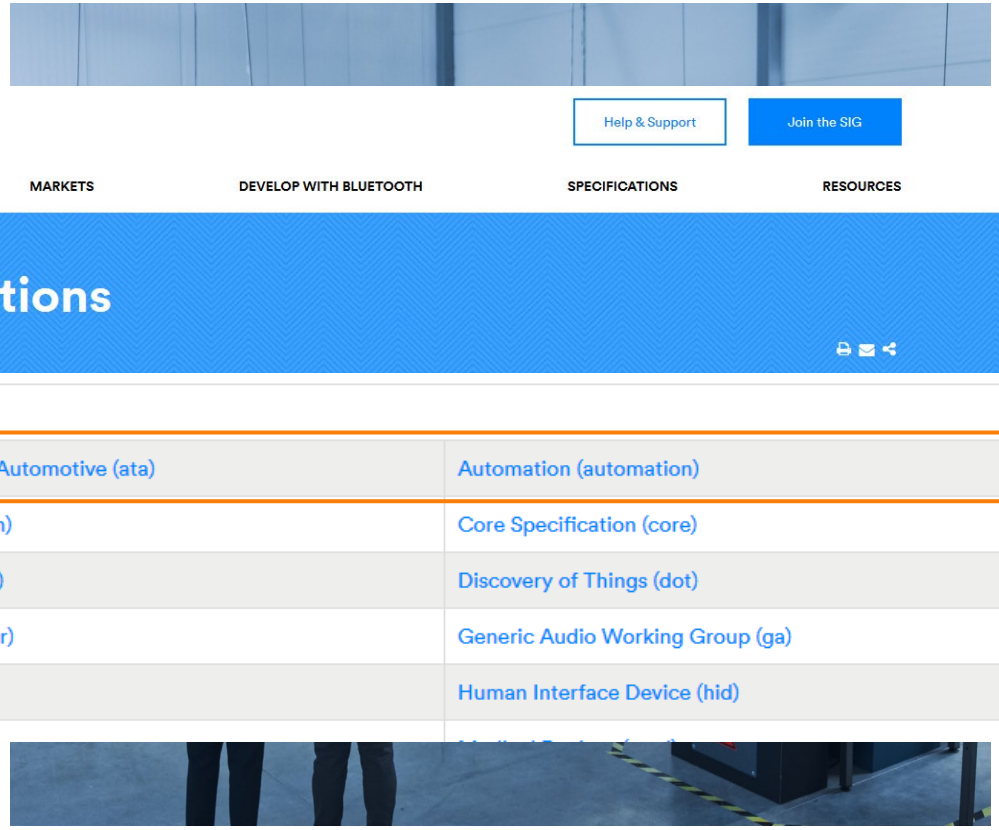


Proprietary Data

- ✓ Availability of „own“ Data
- ✓ Efficient data storage
- ✗ Availability of external Data
- ⊖ Efficient data transfer
- ⊖ Data transperancy
- ✗ Comparability of data
- ✗ Efficient data interpretation
- ⊖ Error proof data interpretation
- ✗ Information processing scalability
- ⊖ Information-driven business models
- ⊖ Efficient realization of information-related regulations

Manufacturer-neutral interoperability by using standards

Consumer Environment



Industrial Environment

Interoperability Benefits

Three pillars of economic benefit:

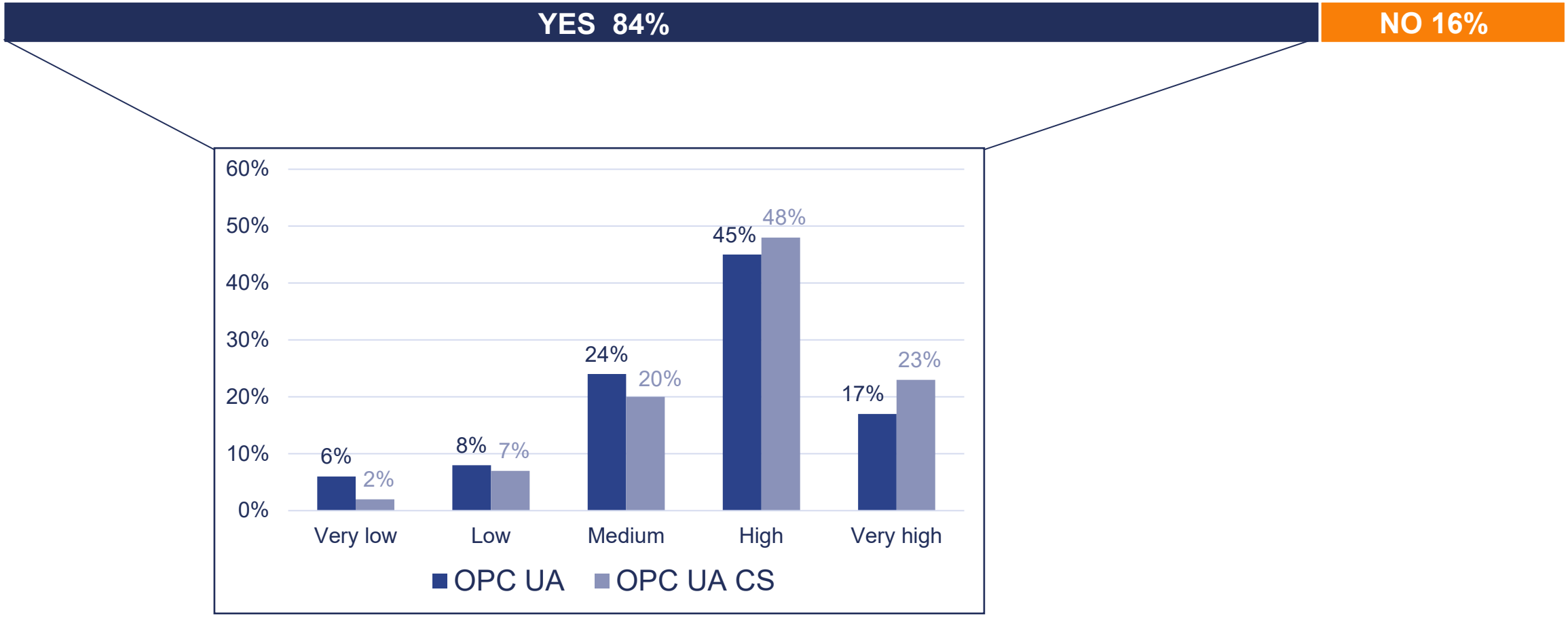
- Simplified interface development through standards
- Simplified integration into the shop floor through standard interfaces
- Simplified access to standardized production data

Increased competitiveness and cost reduction through standard interfaces

The Global Production Language

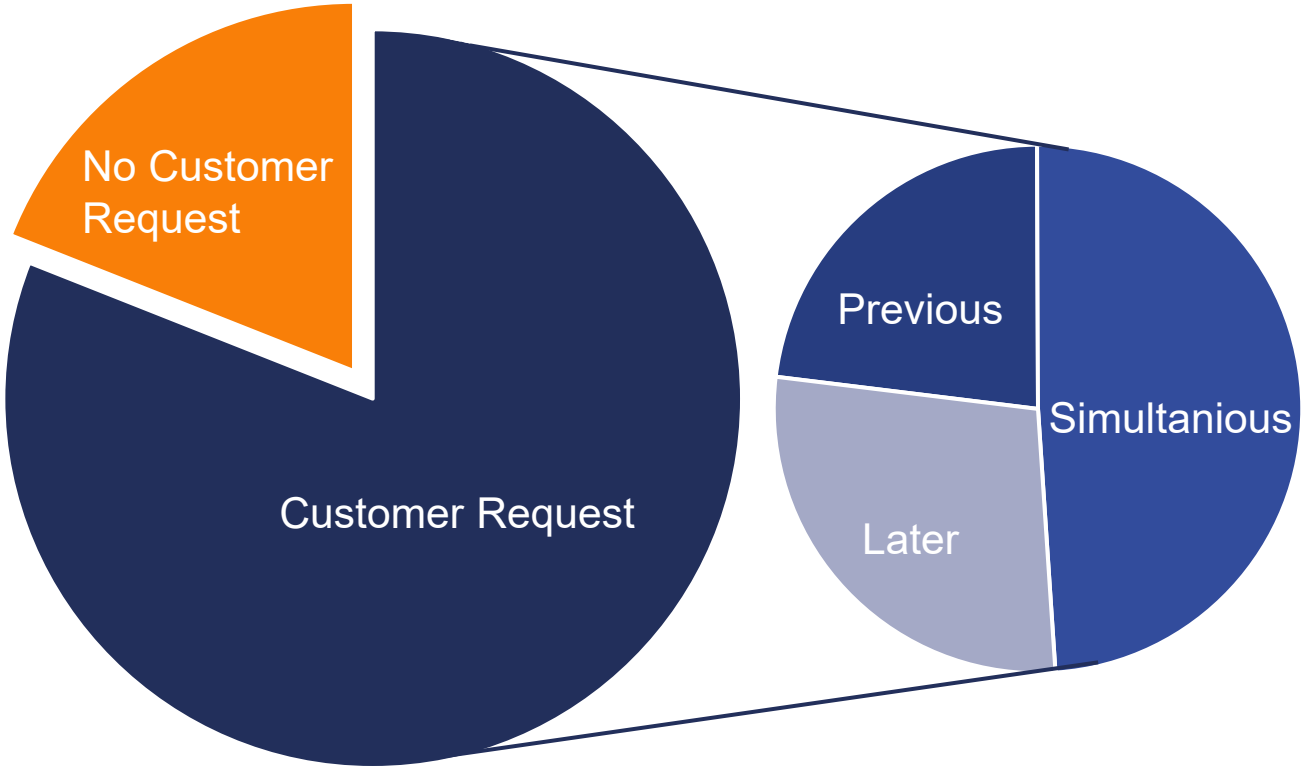
VDMA

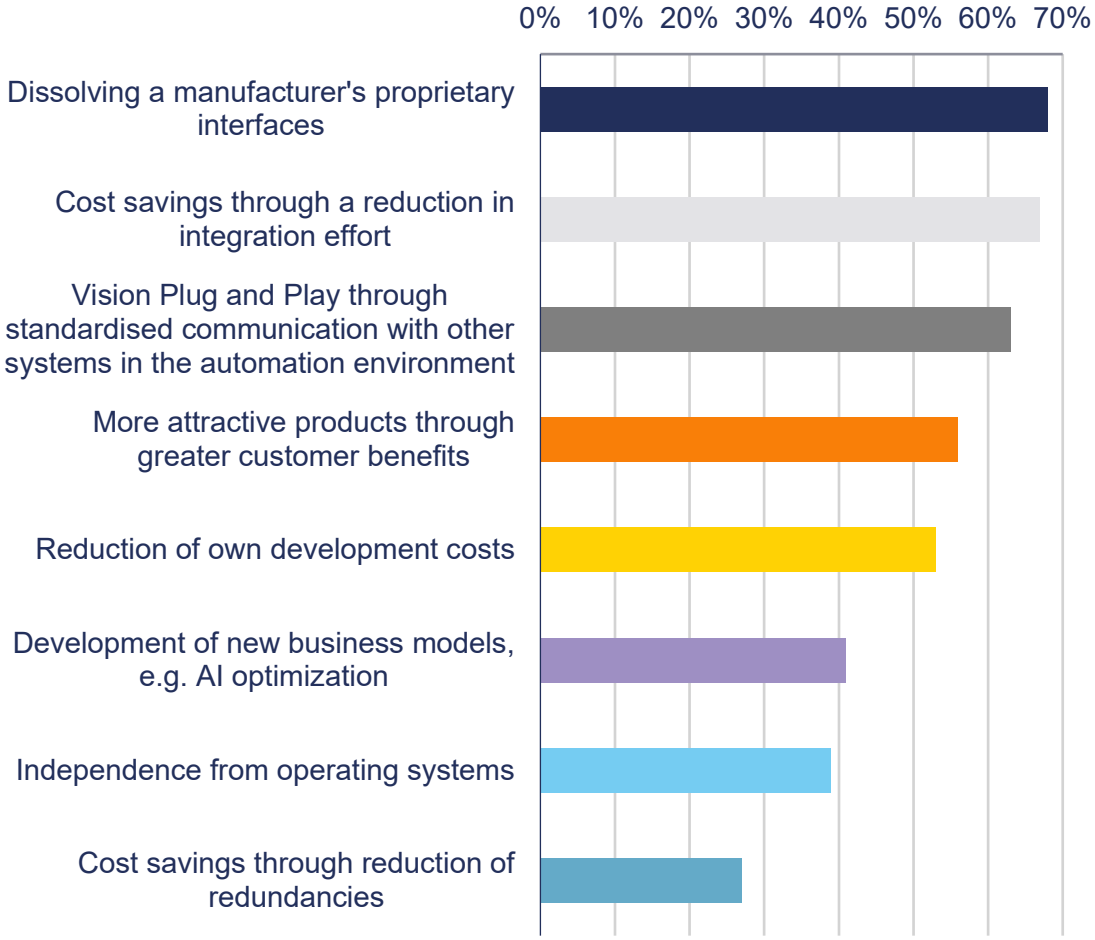
Relevance of Interoperable Interfaces



Source: VDMA Study on Interoperability in the mechanical and plant engineering industry – 2025

OPC UA requested by customers



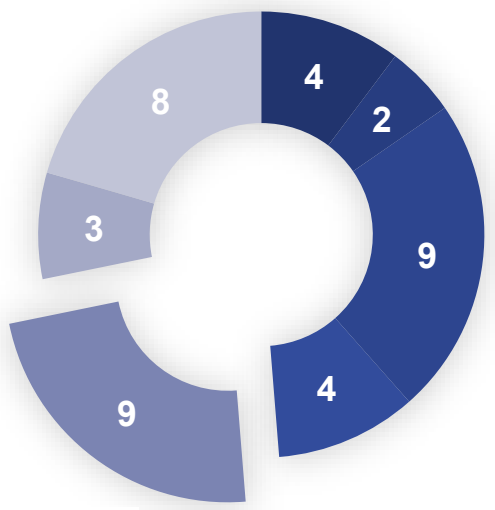


Source: VDMA Study on Interoperability in the mechanical and plant engineering industry – 2025

Industrial Equipment Manufacturers using OPC UA

- Additive Manufacturing
- Air Pollution Control
- Automated Guided Vehicles
- Battery Production
- Cleaning Systems
- Compressors, Compressed Air and Vacuum Technology
- Cranes
- Drying Technology
- Electrical Automation
- Food Processing and Packaging Machinery
- Foundry Machinery
- Glass Machinery
- Integrated Assembly Solutions
- Intralogistic Systems
- Lasers and Laser Systems for Material Processing
- Length Measurement Technology
- Machine Tools and Manufacturing Systems
- Machine Vision
- Mining
- Photovoltaic Equipment
- Plastics & Rubber Machinery
- Power-to-X for Applications
- Power Transmission Engineering
- Precision Tools
- Printing & Paper Technology
- Productronic
- Pumps & Systems
- Robotics
- Software & Digitalization
- Surface Technology
- Textile Machinery
- Thermo Process Technology
- Waste Treatment & Recycling
- Weighing Technology
- Wind Power Plants
- Woodworking Machinery

OPC UA Companion Specifications for Robotics

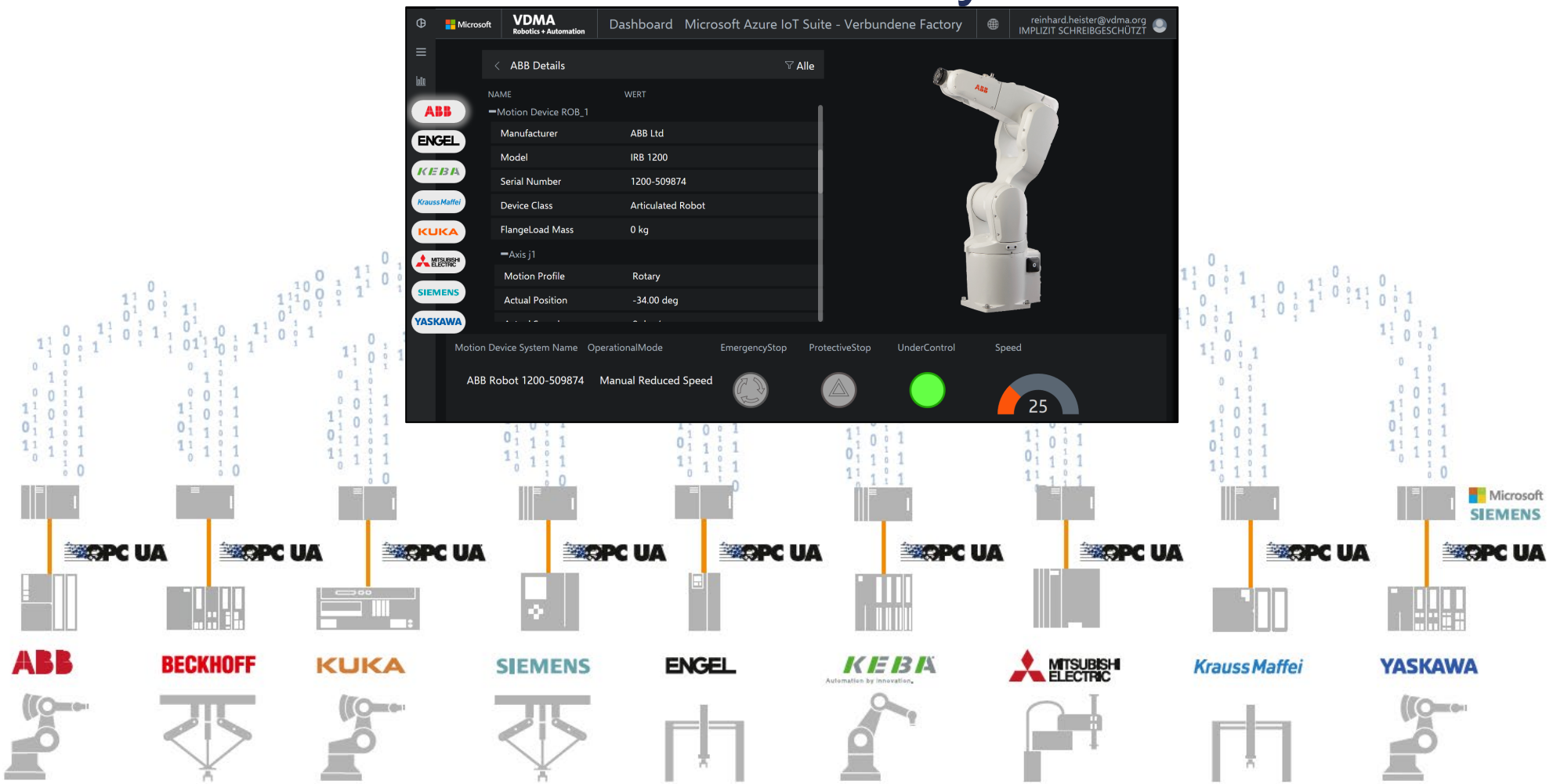


- End users
- Research
- Component manufacturers
- Machine builders
- Robot manufacturers
- System Intergartors
- IT/ Software

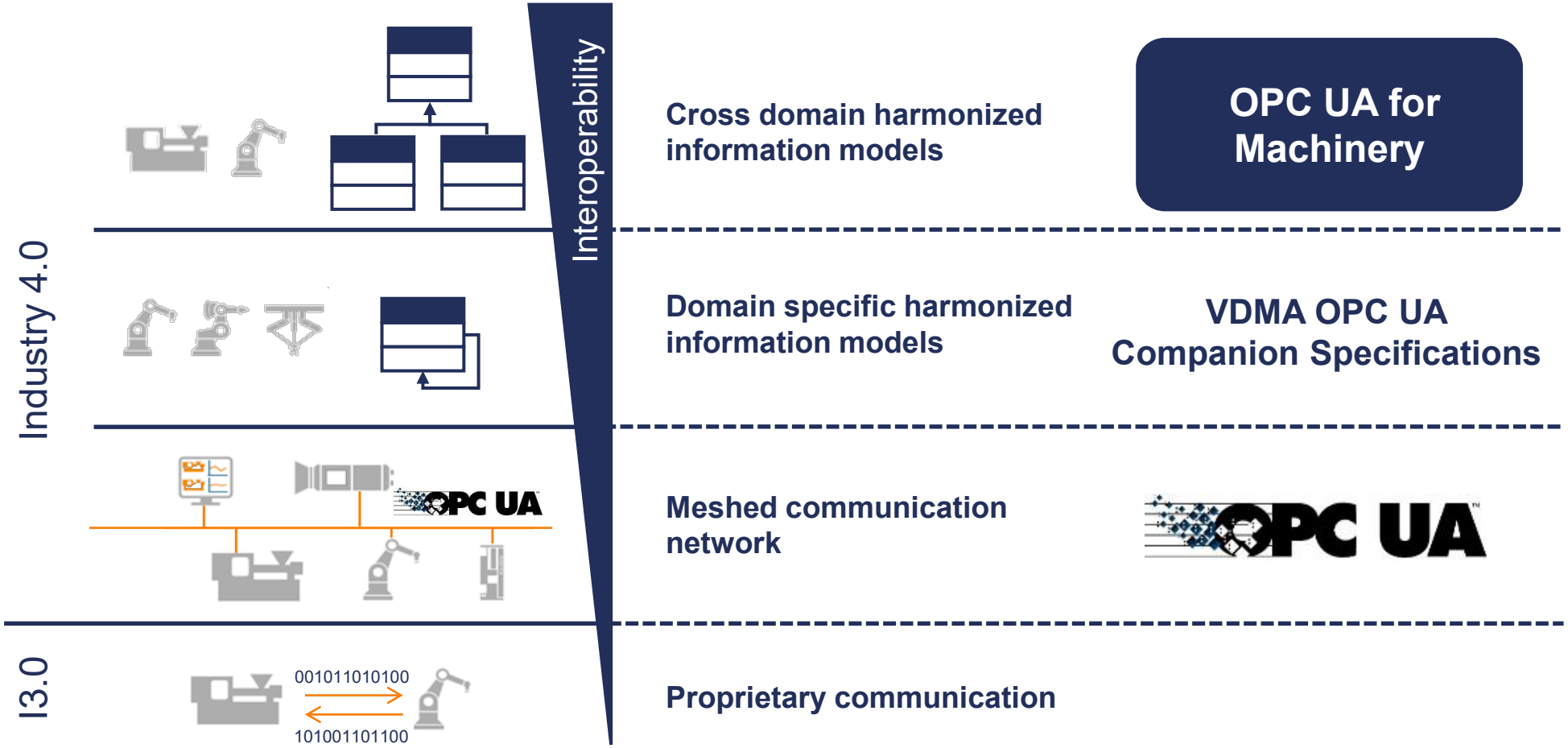
Use Cases

- Asset management
- Condition monitoring
- Predictive maintenance
- Vertical integration
- Geometry Reference
- Partial Control with State Machines

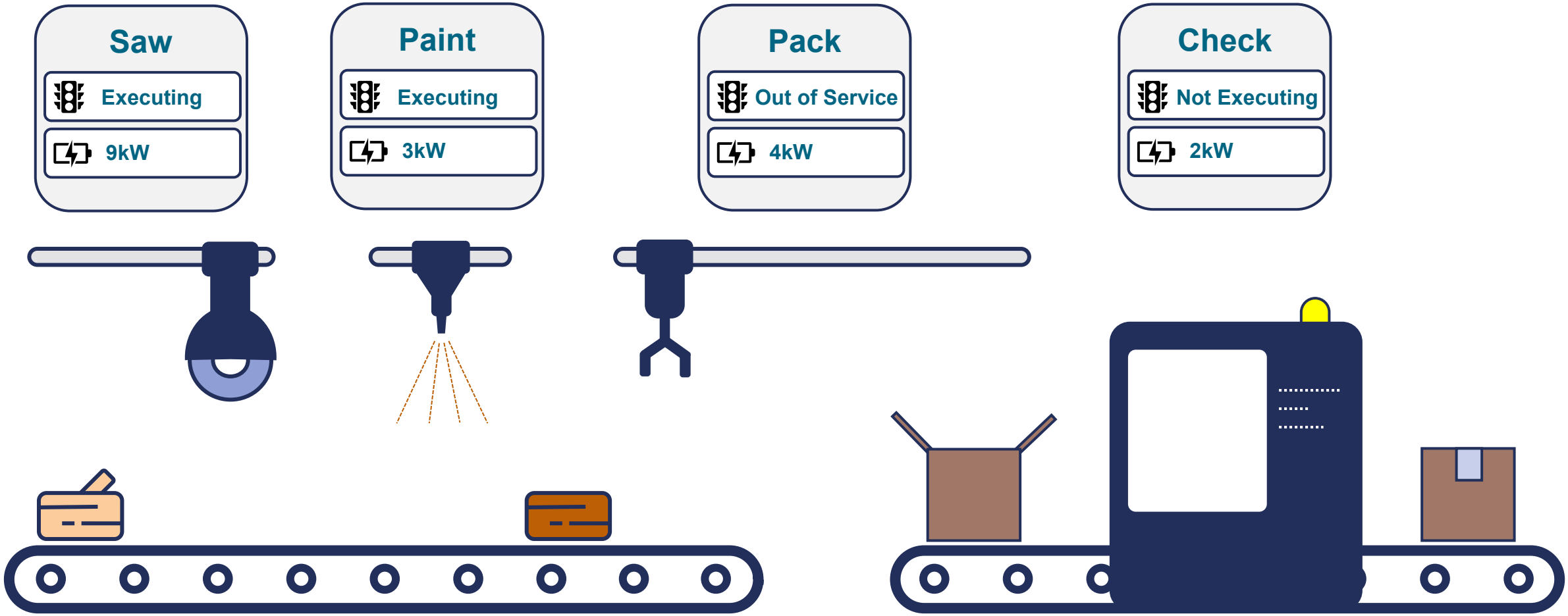
Harmonized Production Data of any Robot



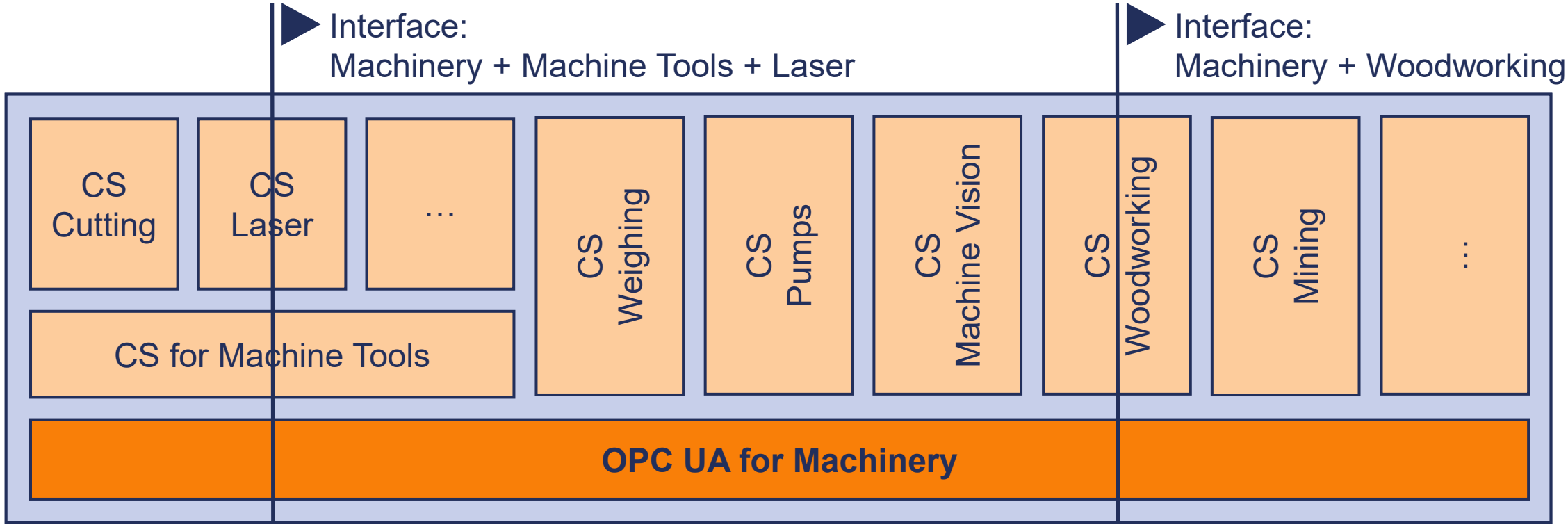
Standardized interfaces through OPC UA CS



Industrial production is diverse



Base specification for production equipment



USER PERSPECTIVE

Overview of Companion Specifications

Published

OPC 34100 for Energy Consumption Management
OPC 40001-1 for Machinery – Part 1: Basic Building Blocks
OPC 40001-2 for Machinery – Part 2: Process Values
OPC 40001-3 for Machinery – Part 3: Job Management
OPC 40001-4 for Machinery – Part 4: Energy Management
OPC 40001-101 for Machinery – Part 101: Result Transfer
OPC 40010 for Robotics
OPC 40020 for Cranes & Hoists
OPC 40077 for Plastics & Rubber – Data Exchange between Injection Moulding Machines and MES
OPC 40079 for Plastics & Rubber – Data Exchange between Injection Moulding Machines and Robots
OPC 40082 for Plastics & Rubber – Peripheral Devices
OPC 40083 for Plastics & Rubber – General Type Definitions
OPC 40084 for Plastics & Rubber – Extrusion
OPC 40086 for Plastics & Rubber – Material Supply Systems
OPC 40087 for Plastics & Rubber – Particle Foam Machines
OPC 40091 for Plastics & Rubber – Winder
OPC 40100 for Machine Vision
OPC 40200 for Weighing Technology
OPC 40210 for Geometric Measurement Systems
OPC 40223 for Pumps and Vacuum Pumps
OPC 40250 for Compressed Air Systems
OPC 40301 for Flat Glass
OPC 40400 for Powertrain
OPC 40444 for Textile Testing Devices
OPC 40450 for Joining Systems
OPC 40451 for Tightening Systems
OPC 40501 for Machine Tools
OPC 40502 for Computerized Numerical Control (CNC) Systems
OPC 40503 for Metal Forming
OPC 40504 for Cutting Tools
OPC 40505 for Wireless Machine Tool Peripherals
OPC 40530 for Laser Systems
OPC 40540 for Additive Manufacturing
OPC 40550 for Woodworking Machines
OPC 40560 for Mining – General
OPC 40561 for Mining – Extraction
OPC 40562 for Mining – Loading
OPC 40563 for Mining – Transport Dumping
OPC 40564 for Mining – Mineral Processing
OPC 40565 for Mining – Development Support
OPC 40566 for Mining – Monitoring Supervision Services
OPC 40567 for Mining – PELO Services
OPC 40568 for Mining - External Standards
OPC 40569 for Mining – Application and Use Cases
OPC 40570 for Wire Harness Manufacturing
OPC 40600 for Weihenstephan Standards
OPC 40700 for Surface Technology – General Types
OPC 40718 for Shot-Blasting Technology
OPC 40719 for Plasma Surface Technology
OPC 40740 for Process Air Extraction and Filtration Systems

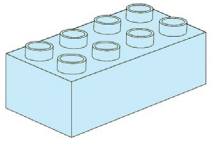
Upcoming

Battery Production
Cleaning Machines
Dryer
Electrolyzers
Foam Cutting Machines
High Pressure Die Casting
M2X Intralogistics Communication
Machine Tending
Mining - Conveying
Weihenstephan Standards – WS Sweets
Weihenstephan Standards – WS Bake
Waste Treatment and Recycling Technologies
Wind Turbines

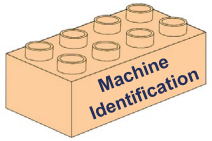
More than 120 publications!

Download https://www.vdma.org/catalogs

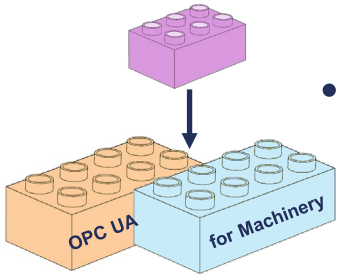
Building Blocks



- Defines harmonized basic building blocks for broad use



- Each building block stands for a specific use case



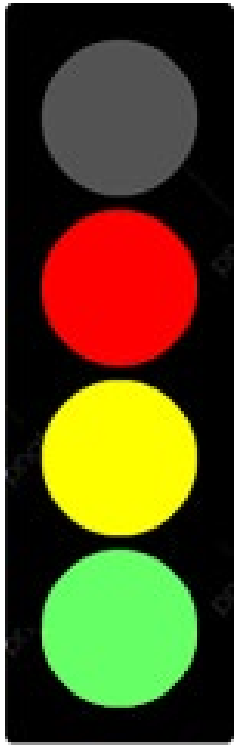
- Relevant parts can be referenced from other Companion Specifications

OPC UA for Machinery specification series

- OPC 40001-1 Basic Building Blocks
  - Machine Identification
  - Component Identification
  - Finding all machines in a server
  - Finding all components of a machine
  - Machinery State
  - Counters
  - Basic Server Structure
- OPC 40001-2 Process Values
- OPC 40001-3 Job Management
- OPC 40001-4 Energy Management
- OPC 40001-101 Result Transfer

Without Machinery Item State

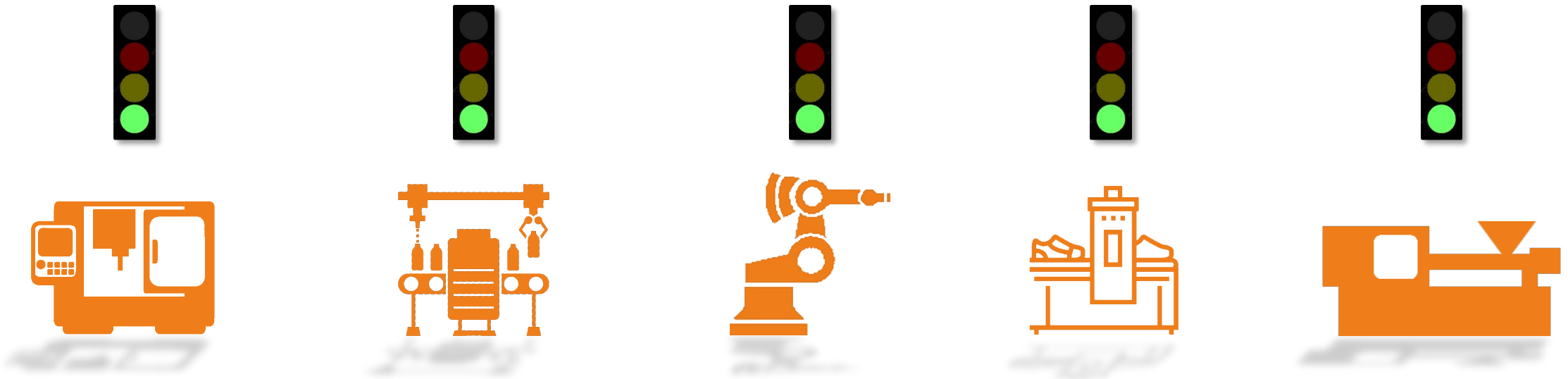
Machinery Item State



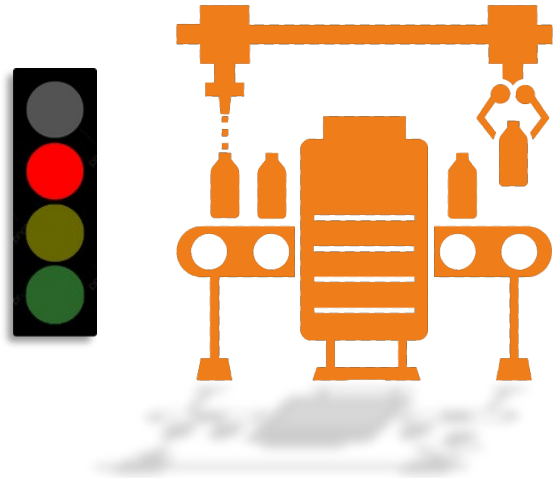
Not available**		The unit is **not available** and does not perform any activity*. (e.g. Switched Off, in Energy Saving Mode)
Out of Service		The unit is **not functional** and does not perform any activity*. (e.g. Error, Blocked)
Not Executing		The unit is available & functional and is **not performing** any activity*. It waits for an action from outside to start or restart an activity*.
Executing		The unit is **available** & **functional** and is actively **performing** an activity* (pursues a purpose)

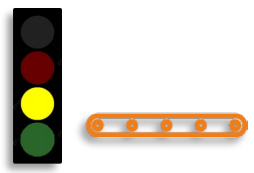
* activity = part of the production, preparation or maintenance process
** OPC UA server needs to run, otherwise an error code will occur

Machinery Item State
(Machine View)

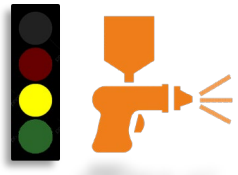


Machinery Item State
(Component View)

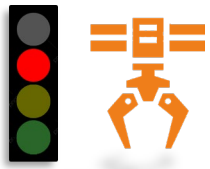




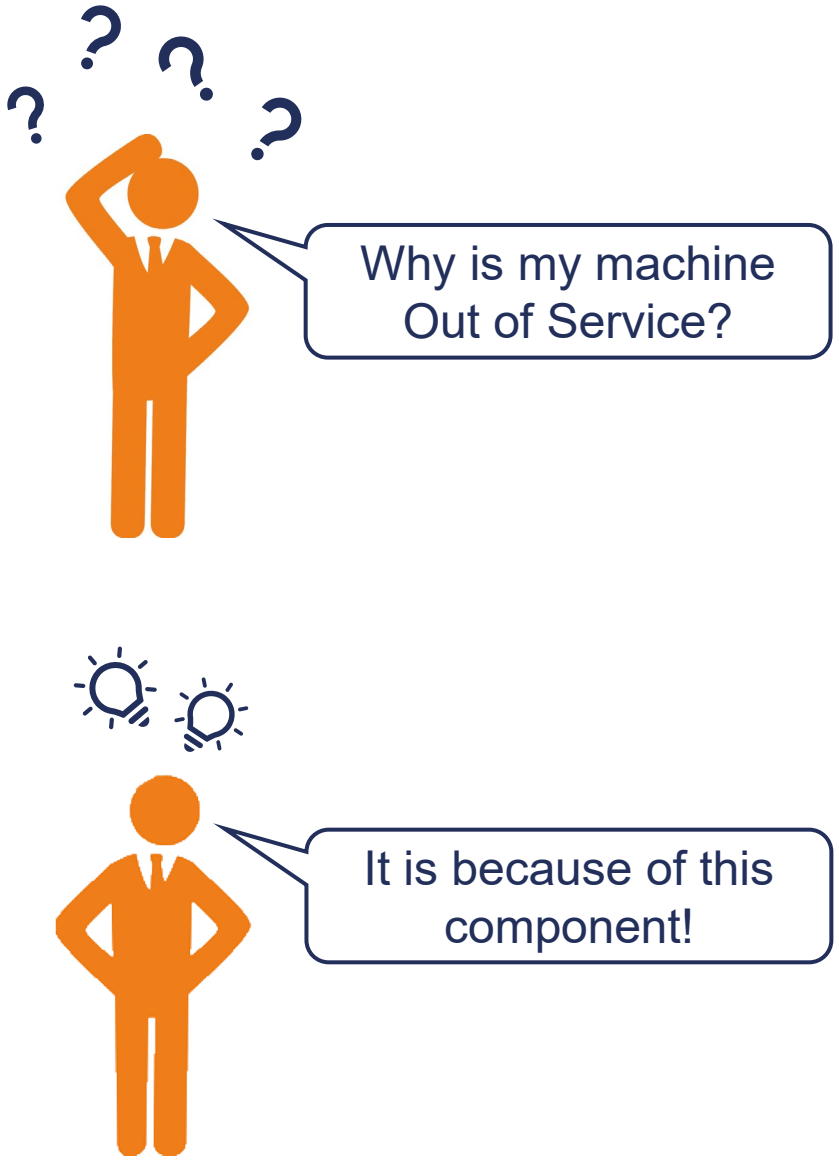
Conveyer



Injection

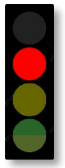


Gripper



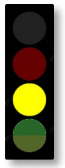
Key Performance Indicators

Out of Service
+⚙Processing



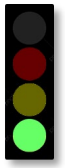
2 hours

Not Executing
+⚙Processing



1 hour

Executing
+⚙Processing



5 hours

ISO 22400

Actual **P**roduction **T**ime = 5 hours

Planned **B**usy **T**ime = 8 hours

$$Availability = \frac{APT}{PBT} = 62,5\%$$

Simple example for a KPI Calculation
(Other key figures need more information than provided here)

Machinery Item State
+ Machinery Operation Mode

Enables KPI Calculations*

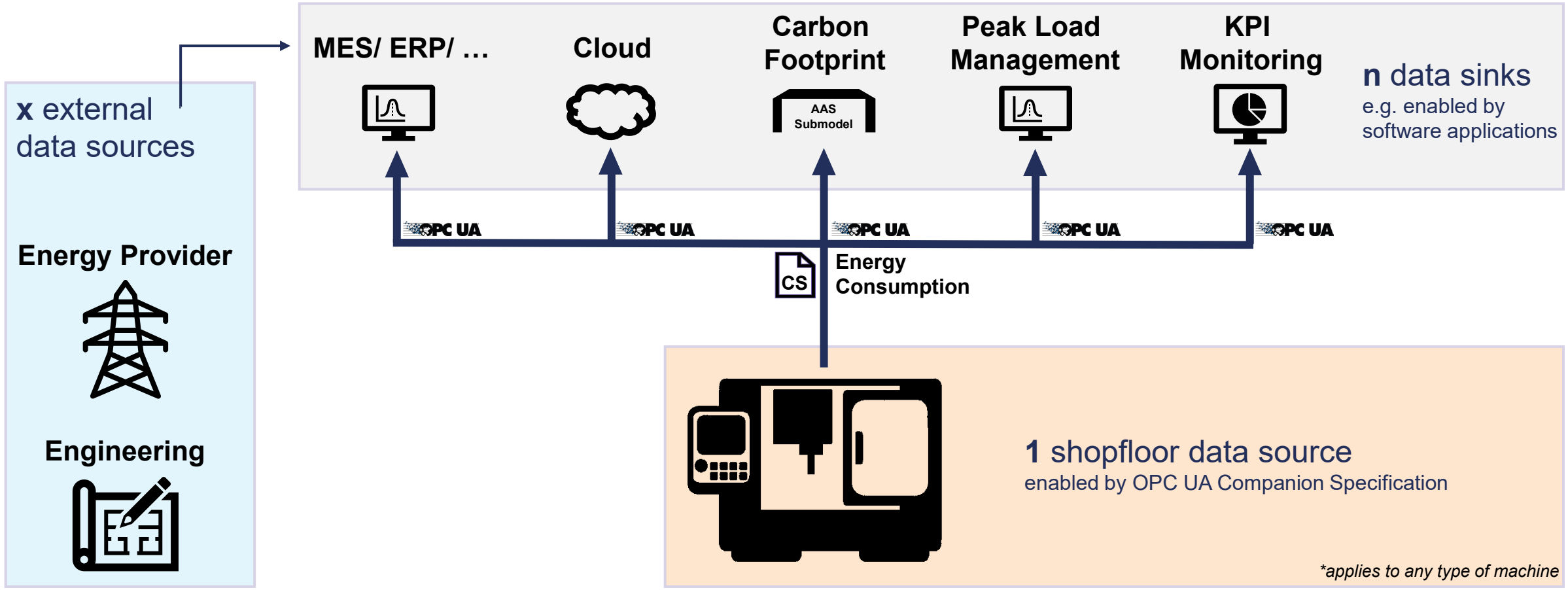
Enables Use and Business Cases

powered by machine information standardized in specifications

- Asset Management
- Preventive and Predictive Maintenance
- Traceability
- Key Performance Indicators (KPI)
- Energy Monitoring
- Production Control and Monitoring
- Product Carbon Footprint (PCF)
- Quality and Load Management

OPC UA CS as single source of truth for shopfloor data

Example of the processing of energy consumption values



Publications

Free download of information material about:

- Implementing OPC UA
- Overview of Companion Specifications
- Technical Implementation of EU Data Act
- Study on interoperability
- …

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FOR FURTHER INFORMATION PLEASE CONTACT:

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