Interoperability Standards as an essential basis

The role of OPC UA Companion Specifications

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Department Machine Information Interoperability

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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,
  - 6 regional subsidiaries,
  - Berlin, Brussels and foreign subsidiaries (Brazil, China, India, Japan, America, Italy, BeNeLux, Poland, Austria)
  - Working groups and forums,
  - Departments and competence centers and
  - Companies and foundations.
- 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

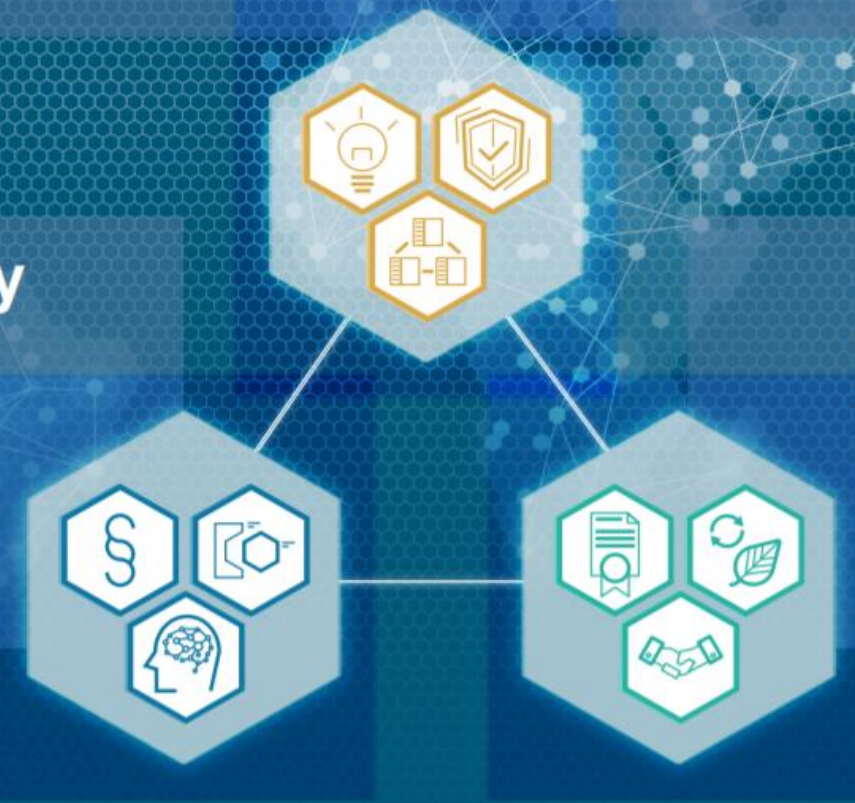
2030 VISION FOR INDUSTRIE 4.0

Shaping Digital Ecosystems Globally

Autonomy

Self-determination and free scope for action guarantee competitiveness in digital business models.

- Technology development
- Security
- Digital infrastructure



Interoperability

Cooperation and open ecosystems permit plurality and flexibility.

- Regulatory framework
- Standards and integration
- Decentralised systems and artificial intelligence

Sustainability

Modern industrial value creation ensures high standard of living.

- Decent work and education
- Climate change mitigation and the circular economy
- Social participation

Inhibited industrial transformation

by proprietary data and information

- ✓ 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

Interoperability Goals

- 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”

Manufacturer-neutral interoperability in the industrial environment desired

Bluetooth®

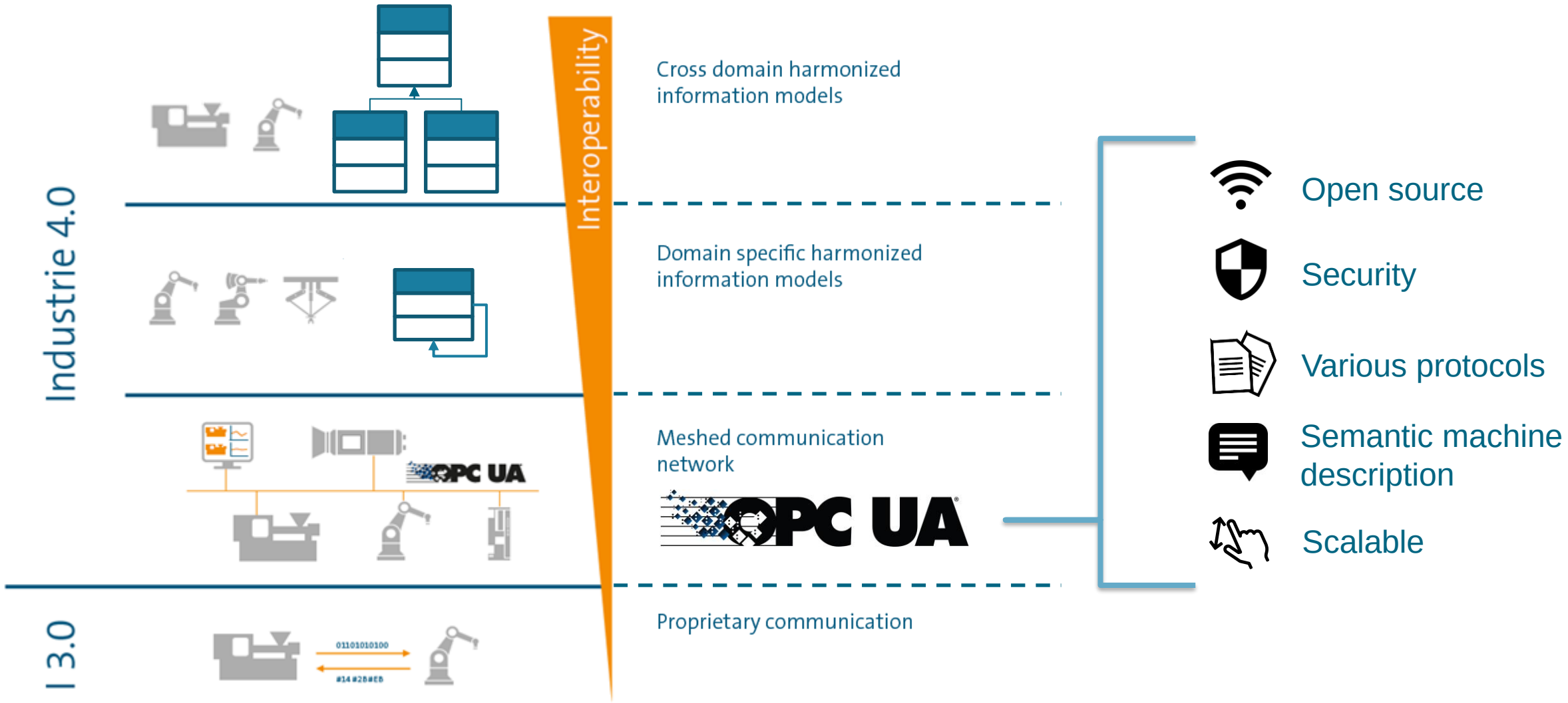
Help & Support | Join the SIG

TECHNOLOGY | MARKETS | DEVELOP WITH BLUETOOTH | SPECIFICATIONS | RESOURCES

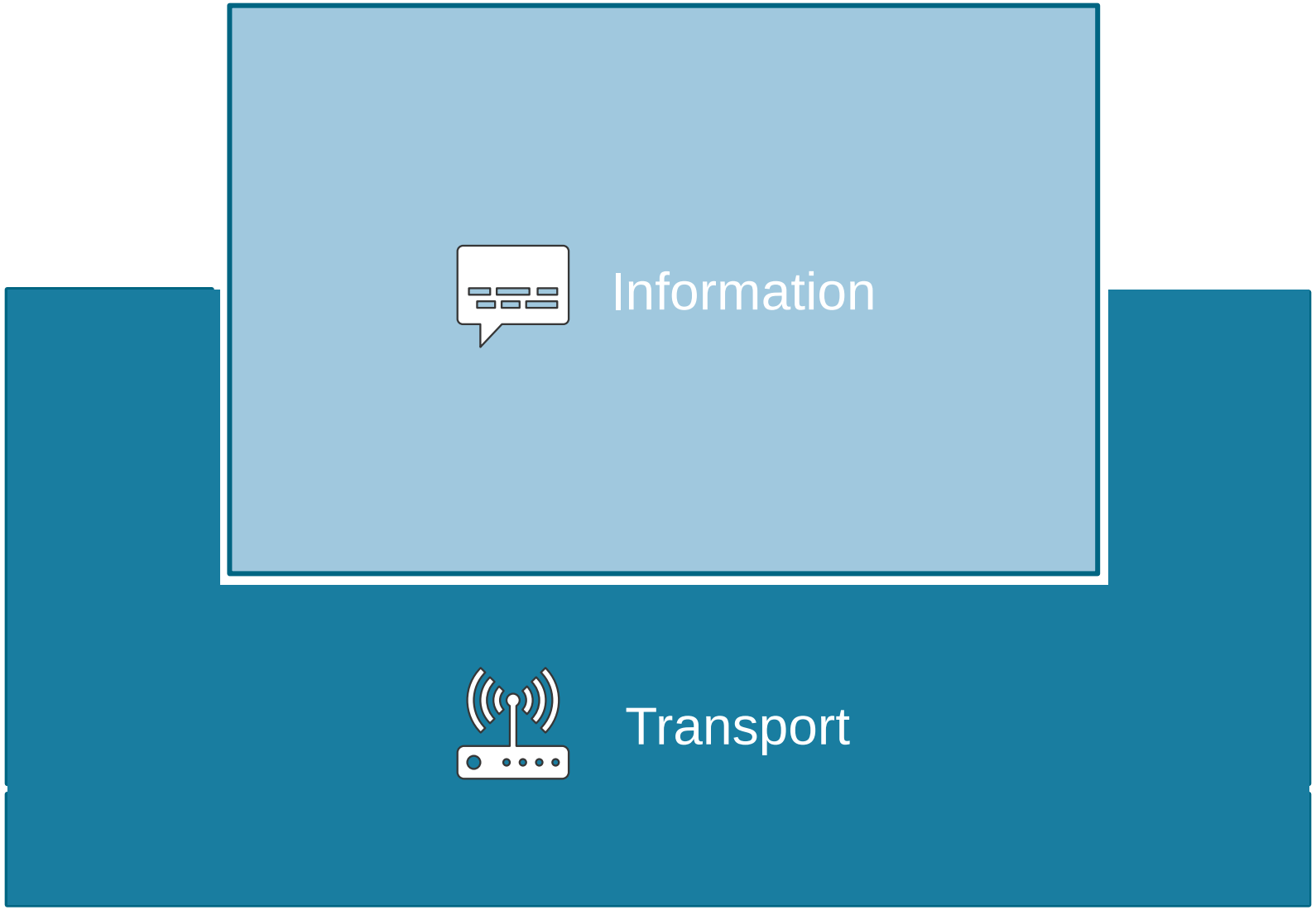
specifications

Working Groups	
Audio, Telephony, & Automotive (ata)	Automation (automation)
Camera Control (cam)	Core Specification (core)
Direction Finding (df)	Discovery of Things (dot)
Easy Pairing (easypair)	Generic Audio Working Group (ga)
Hearing Aid (ha)	Human Interface Device (hid)

OPC UA serves as basis for the Global Production Language



The OPC UA technology



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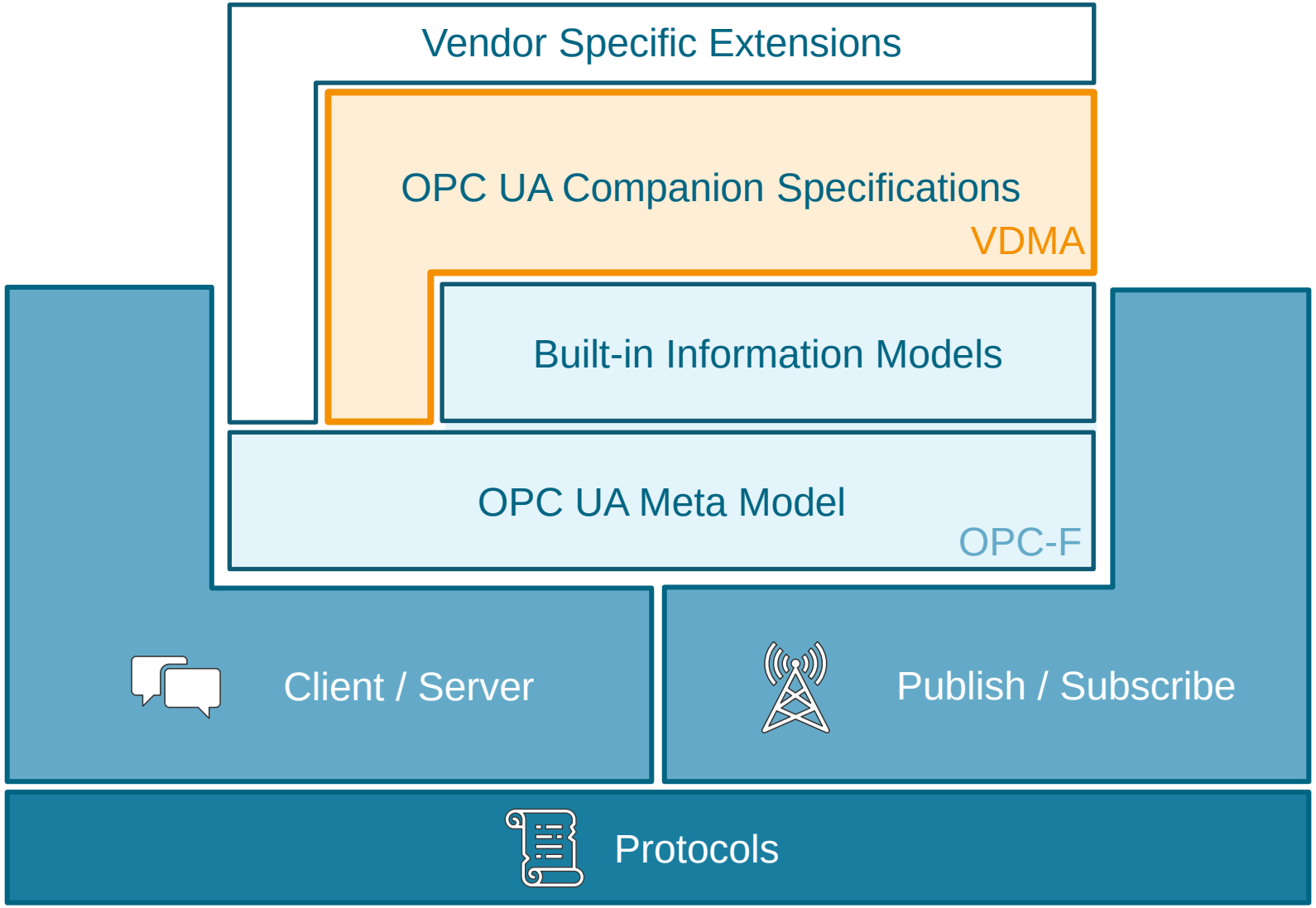
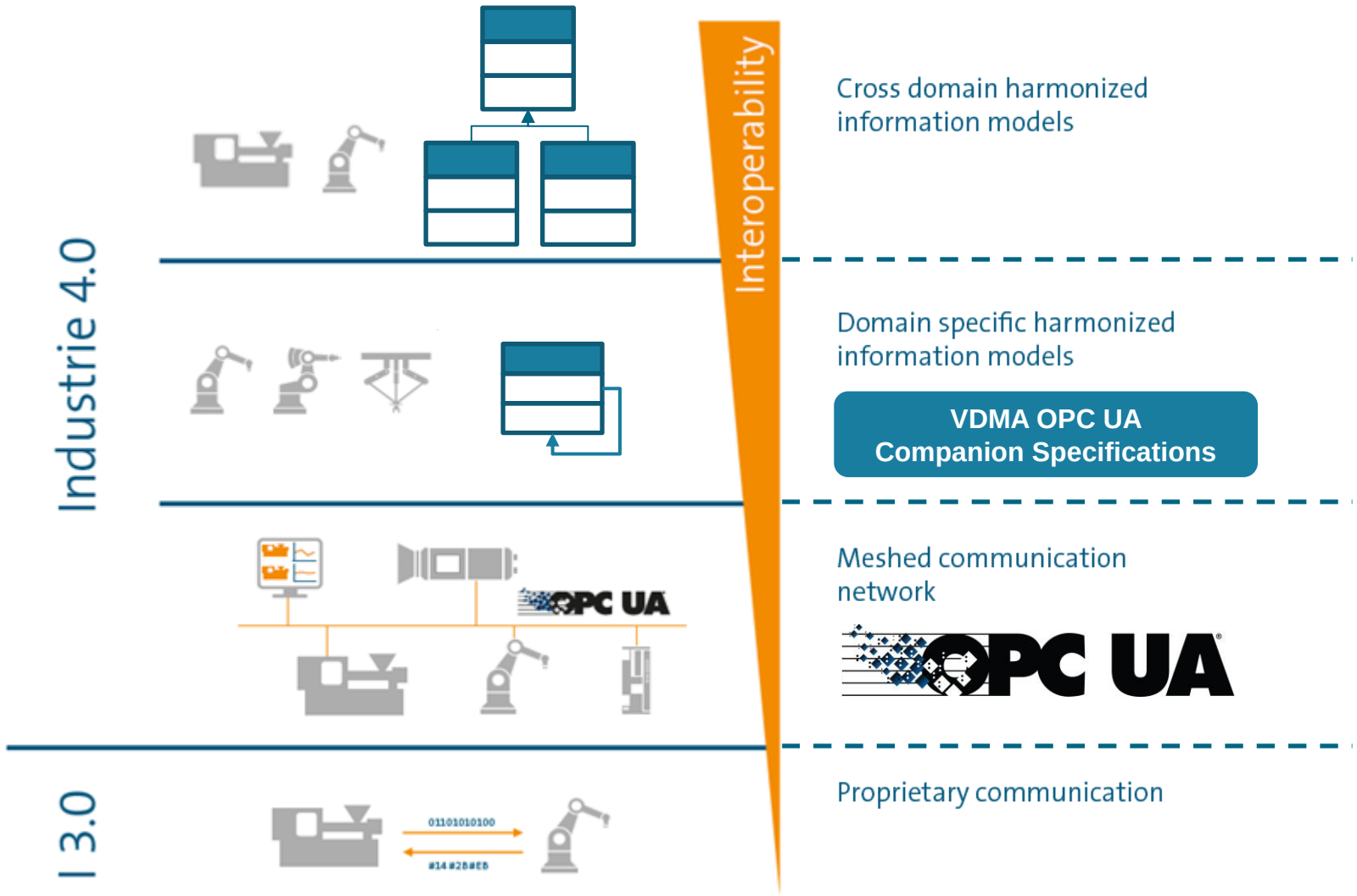


OPC UA serves as basis for the Global Production Language



OPC UA serves as basis for the Global Production Language

- Additive Manufacturing
- Agricultural Machinery
- Air Conditioning & Ventilation
- Air Pollution Control
- Automated Guided Vehicles
- Battery Production
- Building Control and Management
- Building Materials
- Ceramic Machinery
- Cleaning Systems
- Compressors, Compressed Air and Vacuum Technology
- Construction Equipment
- Continuous Conveyors
- Cranes
- Die & Mould
- Drying Technology
- Electrical Automation
- Engines & Systems
- Fire Fighting Equipment
- Fluid Power
- Food Processing and Packaging Machinery
- Foundry Machinery
- Glass Machinery
- Hydro Power Plants
- Industrial Trucks
- Integrated Assembly Solutions
- Intralogistic Systems
- Lasers and Laser Systems for Material Processing
- Length Measurement Technology
- Lifts & Escalators
- Machine Tools and Manufacturing Systems
- Machine Vision
- Metallurgical Plants and Rolling Mills
- Micro Technologies
- Mining
- Photovoltaic Equipment
- Plastics & Rubber Machinery
- Power Transmission Engineering
- Precision Tools
- Printing & Paper Technology
- Process Plant & Equipment
- Productronic
- Pumps & Systems
- Refrigeration & Heat Pump Technology
- Robotics
- Security Systems
- Software & Digitalization
- Surface Technology
- Testing Technology
- Textile Care, Fabric and Leather Technology
- Textile Machinery
- Thermal Power Plants
- Thermo Process Technology
- Valves
- Waste Treatment & Recycling
- Weighing Technology
- Welding & Pressure Gas Equipment
- Wind Power Plants
- Woodworking Machinery

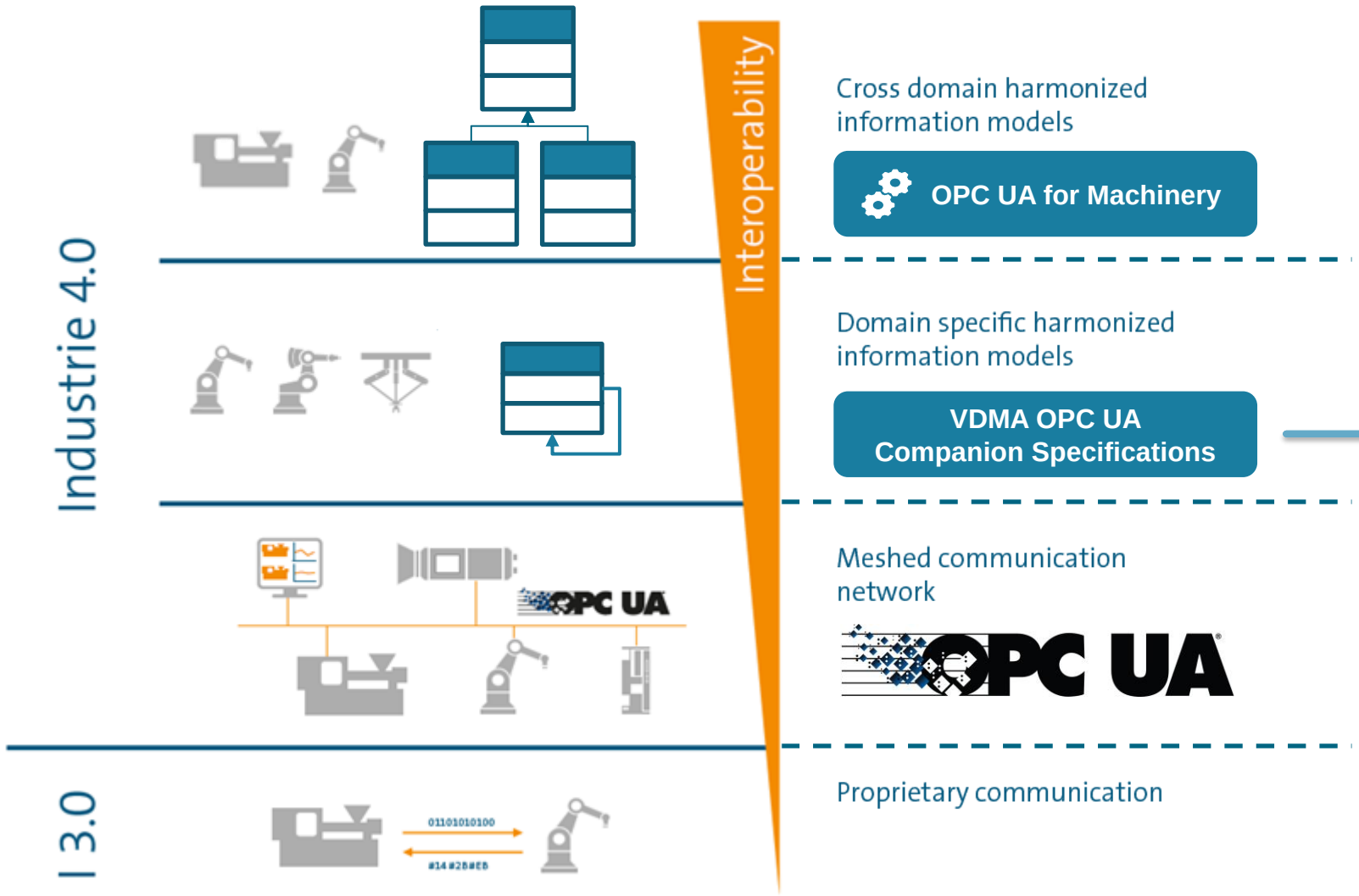
OPC UA CS released

Release Candidate

Joint Working Group with OPC Foundation

OPC UA CS in work

OPC UA serves as basis for the Global Production Language



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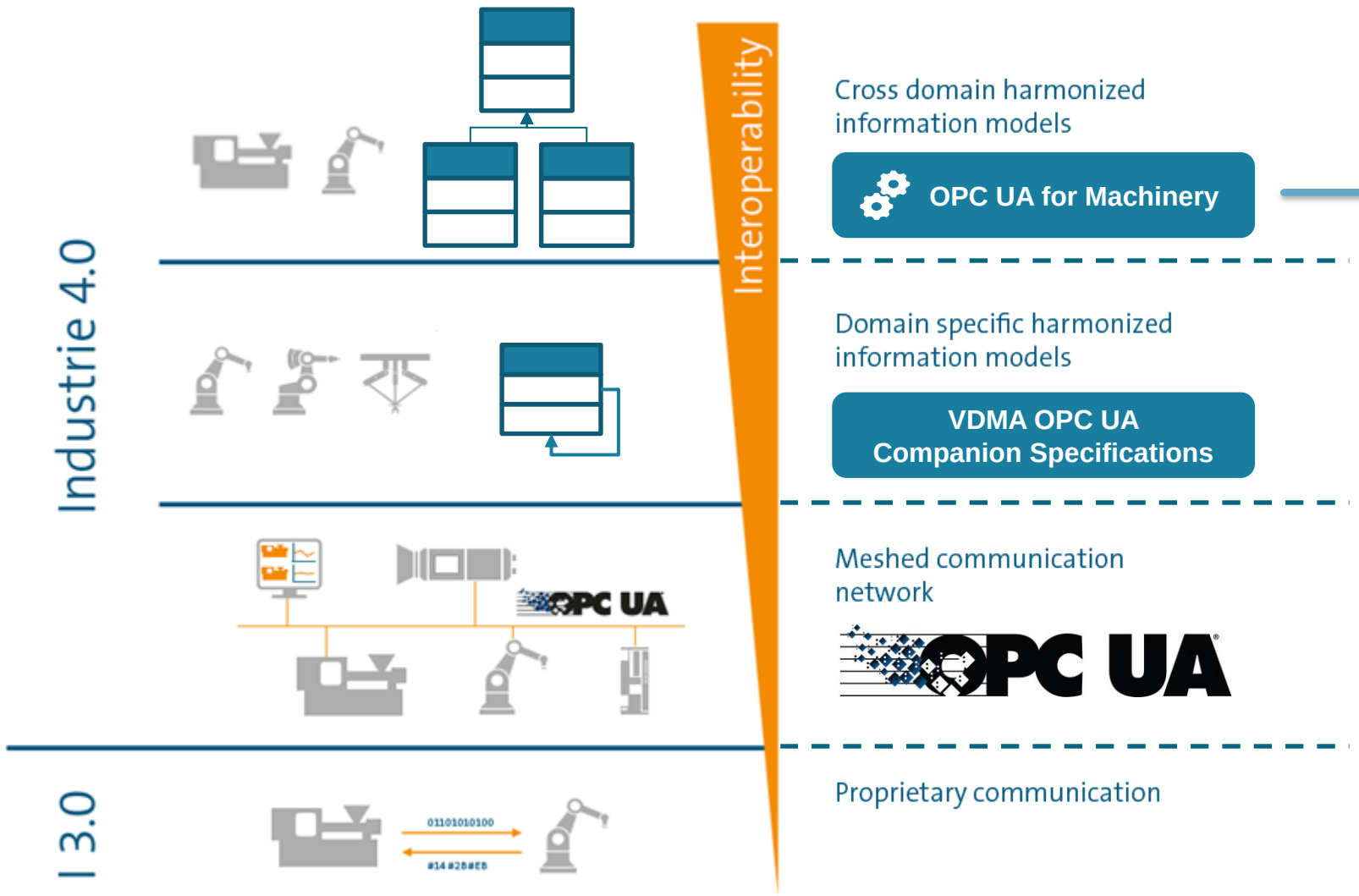


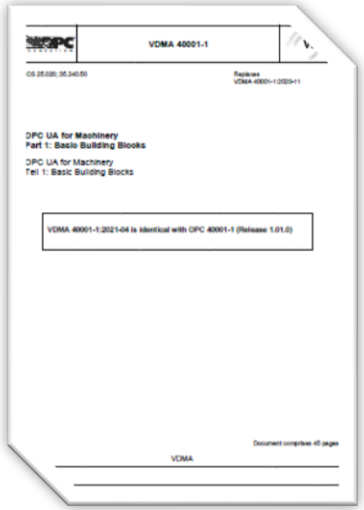
Published:

- Machine Identification
- Component Identification
- Machinery State
- Process Values
- Result Transfer
- Counters
- Job Management

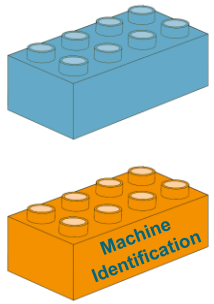
In Work:

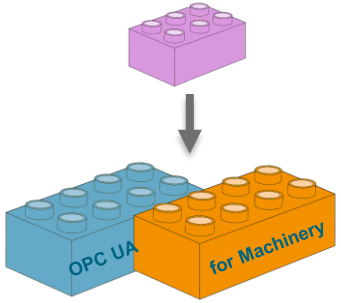
- Basic Server Structure
- Energy Management

OPC UA for Machinery



- **OPC UA Companion Specification for the whole Mechanical Engineering Industry**
  - Defines harmonized basic building blocks for broad use
  - Each building block stands for a specific use case

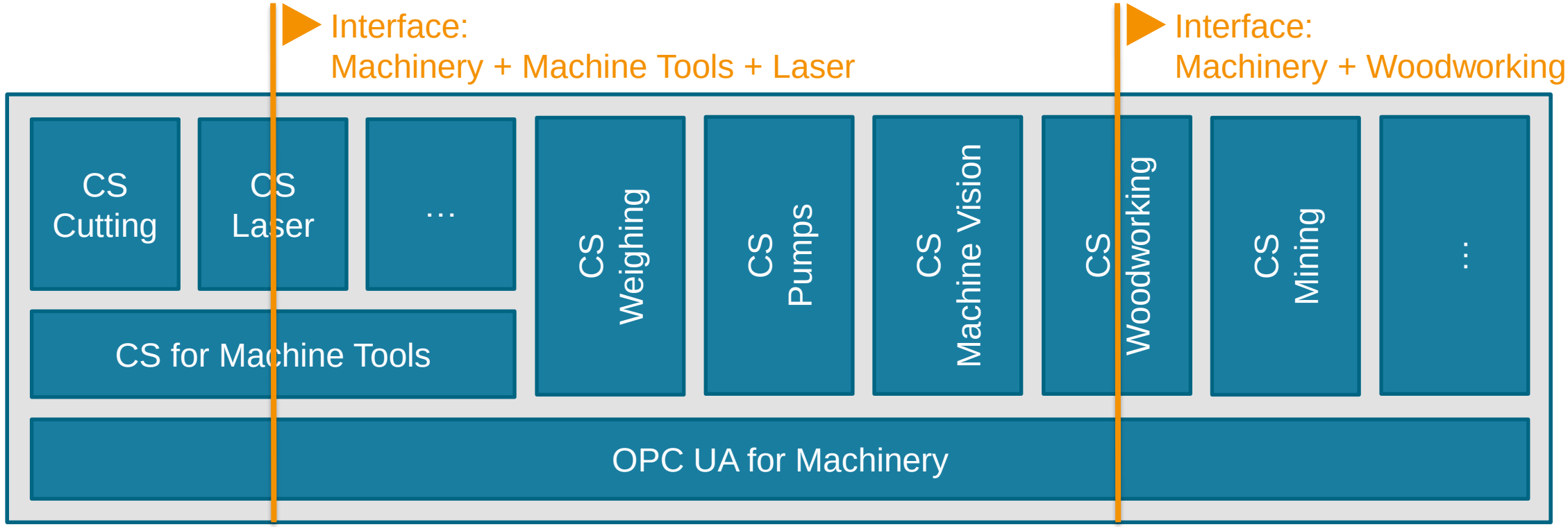




- **Can be referenced from other Companion Specifications or implemented as standalone model**

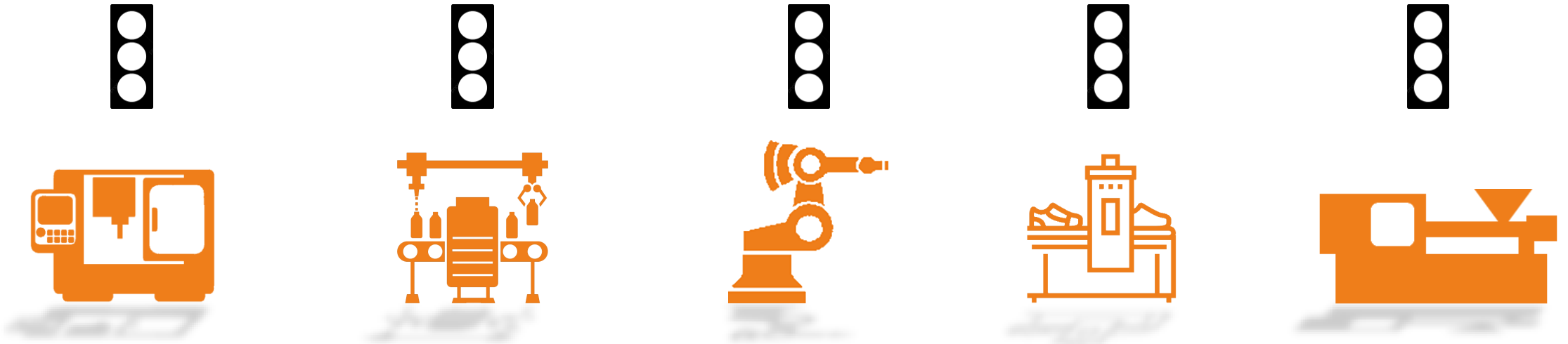
→ OPC UA for Machinery forms the basis for interoperability

OPC UA for Machinery
Target Image



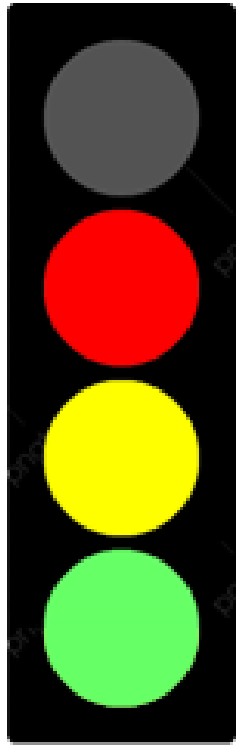
→ **OPC UA for Machinery as Base CS for the whole field of mechanical engineering.**

Standardization Example
Machinery State



Machinery State

Machinery Item State Definition



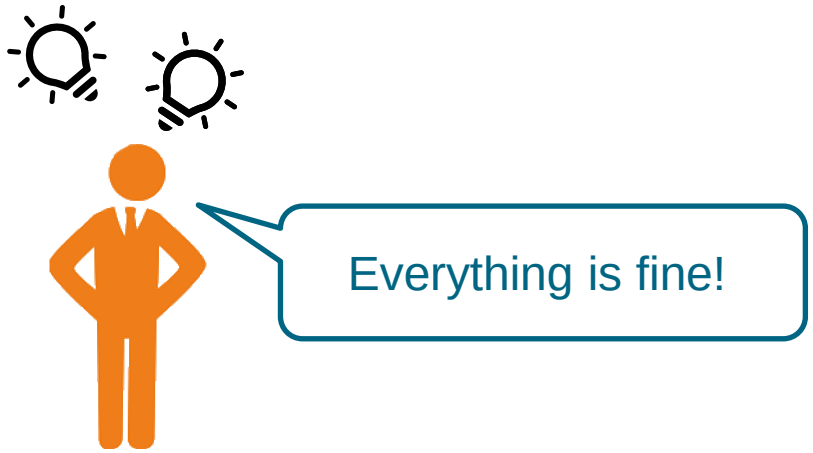
Applicability: OPC UA Server running

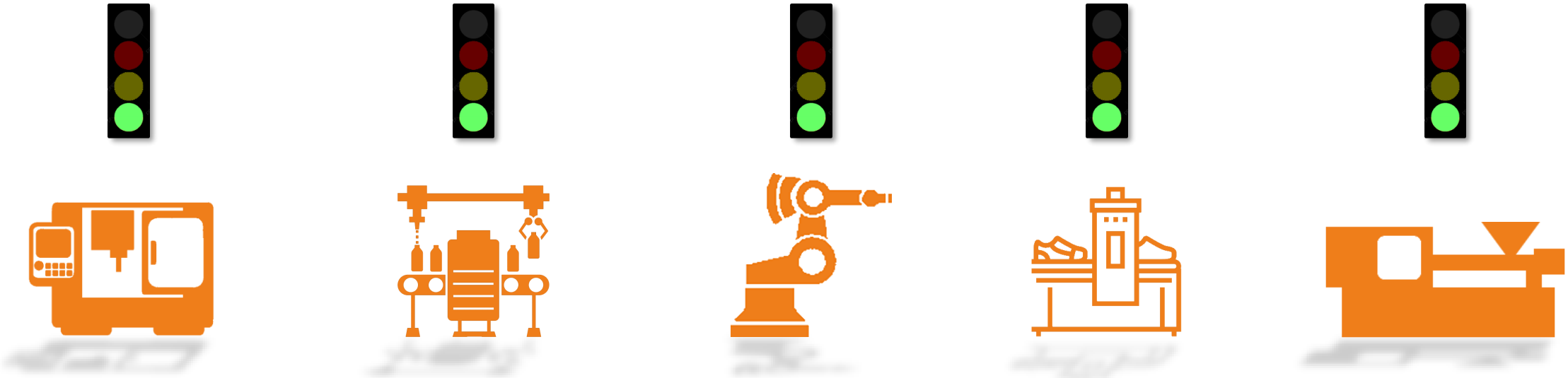
Not available 	The unit is **not available** and does not perform any activity*. (e.g. Switched Off, in Energy Saving Mode)
Out of Service 	The unit is **not functional** and does not perform any activity*. (e.g. Error, Blocked)
Not Executing 	The unit is available & functional and is **not performing** 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

Machinery State

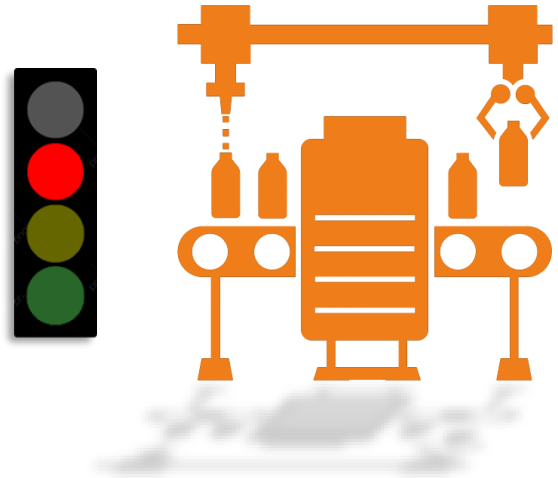
Machine View

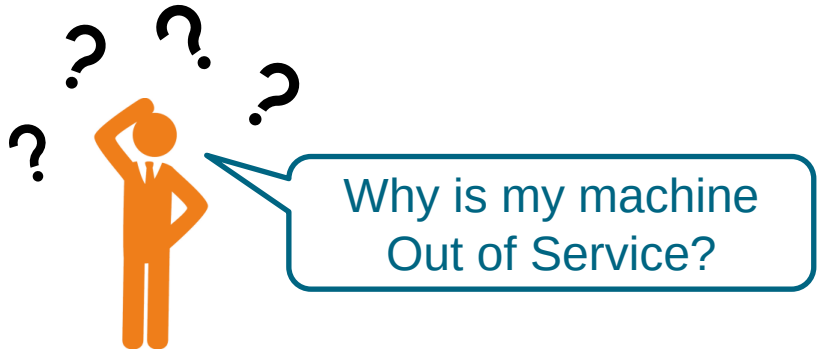


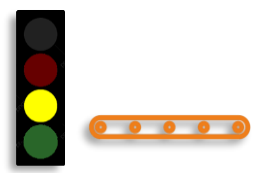


Executing | Executing | Executing | Executing | Executing

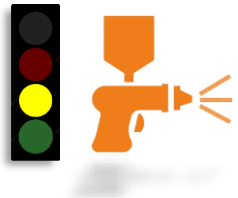
Machine Monitoring
Component View



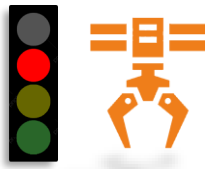




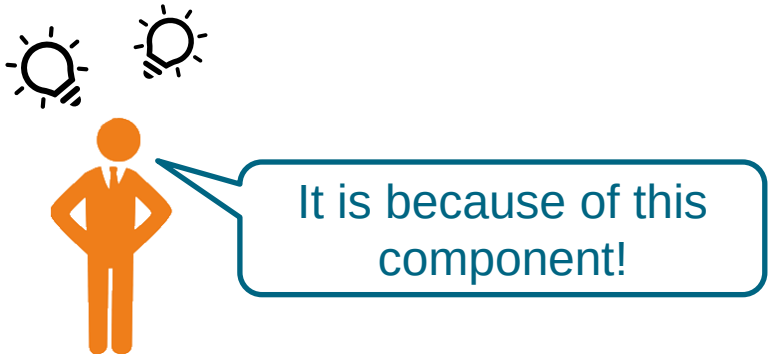
Conveyer



Injection



Gripper



*This example shows a beverage filling line that is Out of Service due to a jammed gripper.

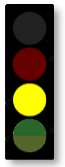
KPI Calculations

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

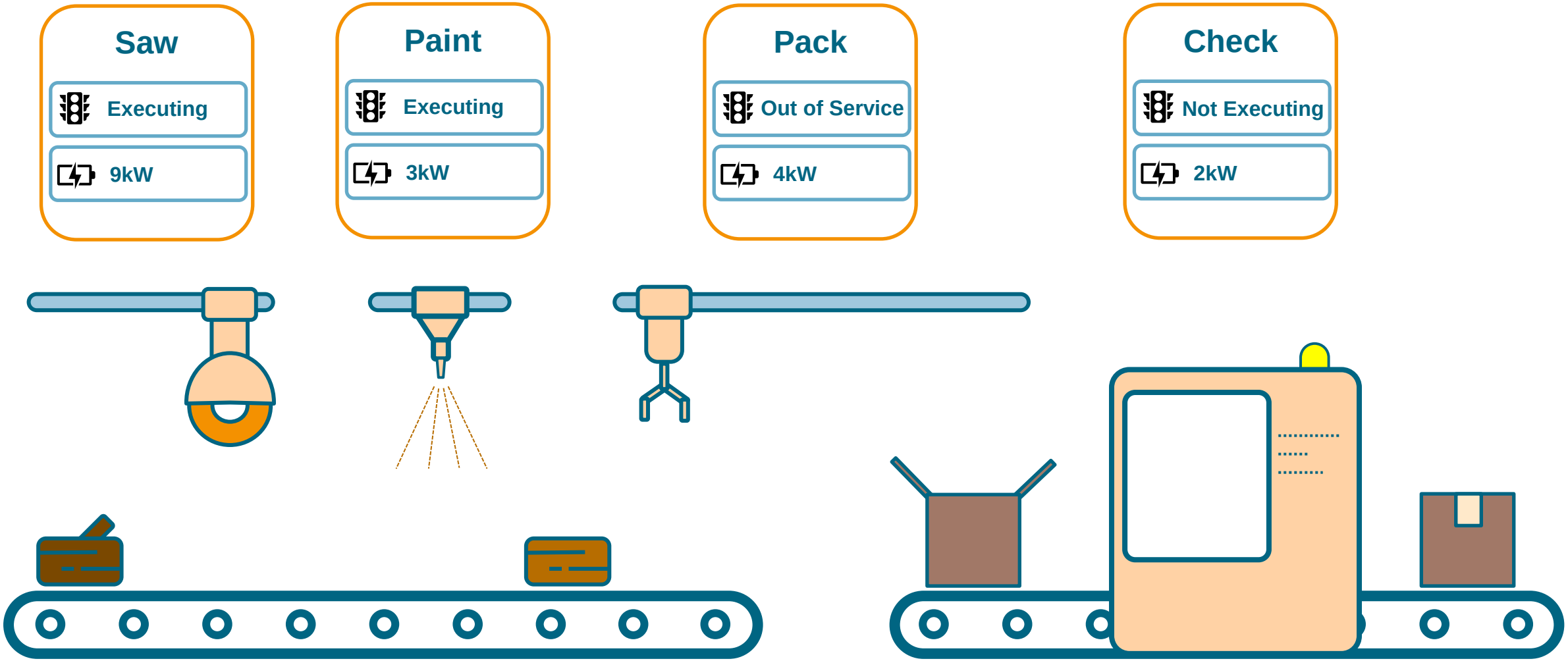
$$Availability = \frac{APT}{PBT} = 62,5\%$$

Easy example for a KPI Calculation
(Other calculations need more information than provided here)

Machinery Item State
+ Machinery Operation Mode

→ **Enables KPI Calculations***

Cross-domain interoperability brought to reality
by OPC UA for Machinery



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 40001-101 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 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 40719 for Plasma Surface Technology
OPC 40740 for Process Air Extraction and Filtration Systems

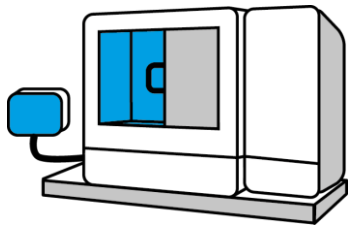
Upcoming

OPC UA for Machinery – Energy Management
Battery Production
Cleaning Machines
Dryer
Electrolyzers
Foam Cutting Machines
High Pressure Die Casting
M2X Intralogistics Communication
Machine Tending
Material Supply Systems
Mining - Conveying
Shot-Blasting Technology
Temperature Control Devices
Weihenstephan Standards – WS Sweets
Weihenstephan Standards – WS Bake
Wind Turbines
Wireless Machine Tool Peripherals

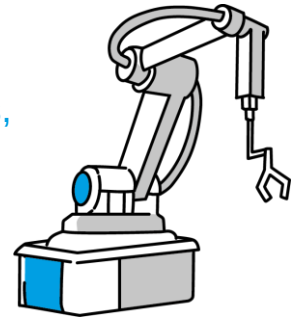
More than 115 publications!

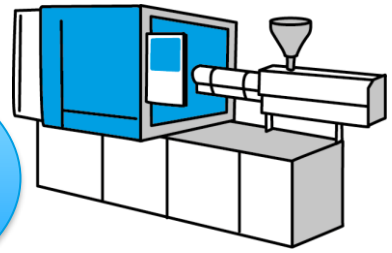
Download https://www.vdma.org/catalogs

Bringing machine builders and users together

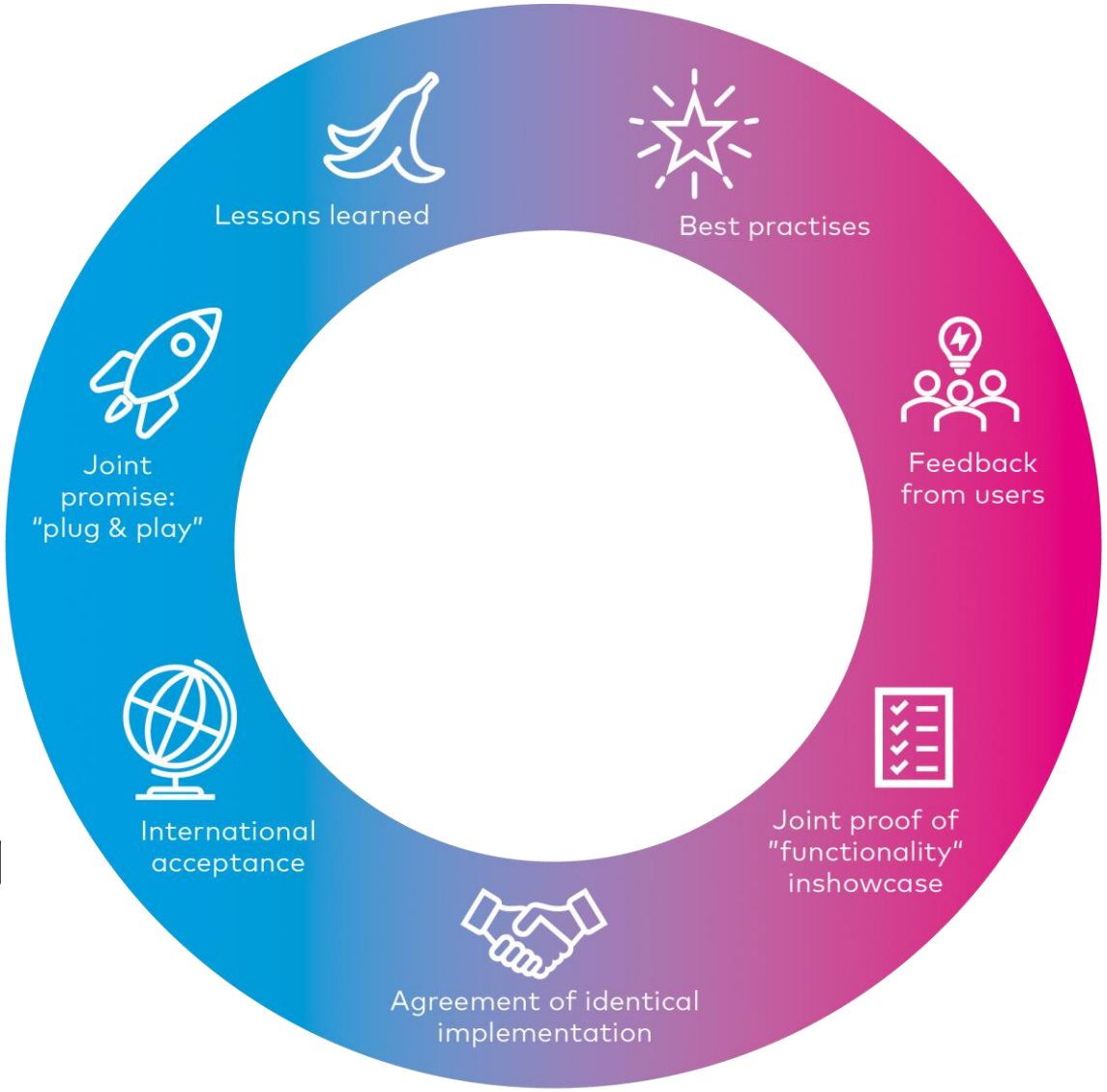


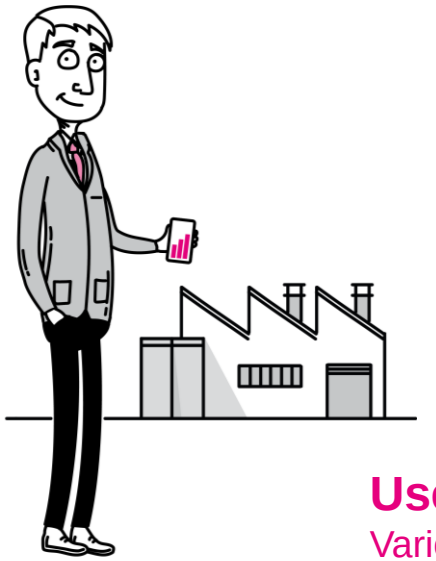
Machine builders
Associations, working groups





Standards: 50+ groups!





Users
Various sectors, multiple machinery

The World: Millions

a network of strong partners

Currently ~350 partners worldwide

Use Case EU Data Act

EU Data Act

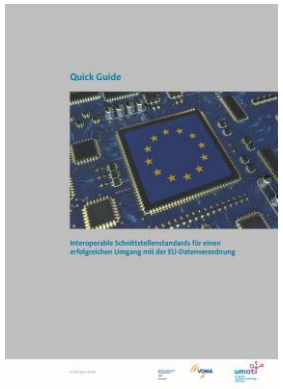
A fundamental legal reorganization of data access and data use

- **Data** should be able to **flow within the EU and across sectors** for the benefit of all
- **Balanced** relationship between right to data **access** and incentive to **invest** in data without changing existing data protection rules (fair value distribution)
- The EU Commission wants to create a **data economy**, a **single market** for data with **more data** available (easier access and use)
- The EU should become an attractive, secure and dynamic data economy. The new regulations are expected to create an **additional EUR 270 billion in GDP** for the EU member states by 2028.

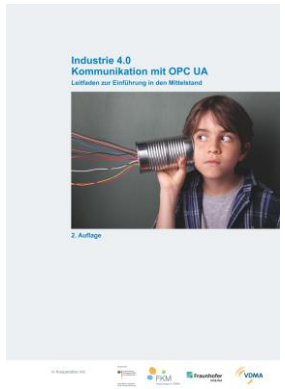
Establishing a data economy as the primary goal

- Cross-industry **regulation of who may use which data for which purposes** (fair distribution of benefits, data use between companies, consumers and public institutions)
- The **rules for access** to and use of data should **be fair, practical and clear**.
- **European regulations**, in particular the protection of privacy and data protection as well as competition law, should be **fully complied** with.
- Facilitate provider **switching between cloud providers** and strengthen **interoperability.**

Publication Overview: Interoperability

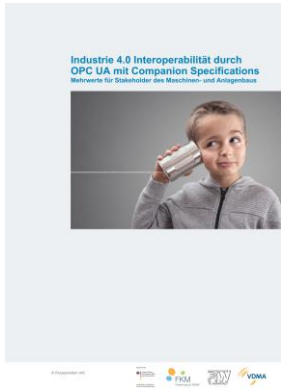


VDMA Quick Guide “Interoperable interface standards for successfully dealing with the EU Data Act”

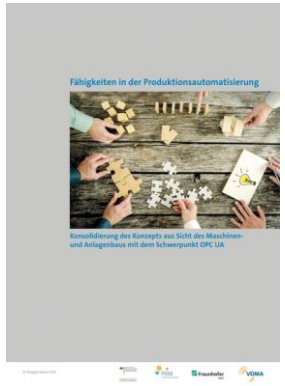


Industrie 4.0 Communication Guideline - Based on OPC UA

VDMA study "Interoperability in Machinery and Plant Engineering"



Industrie 4.0 Interoperability through OPC UA with Companion Specifications - Benefits for Stakeholders in Machinery and Equipment Manufacturing



Capabilities and Skills in Production Automation

Image Source: shutterstock

Thank you for your attention!

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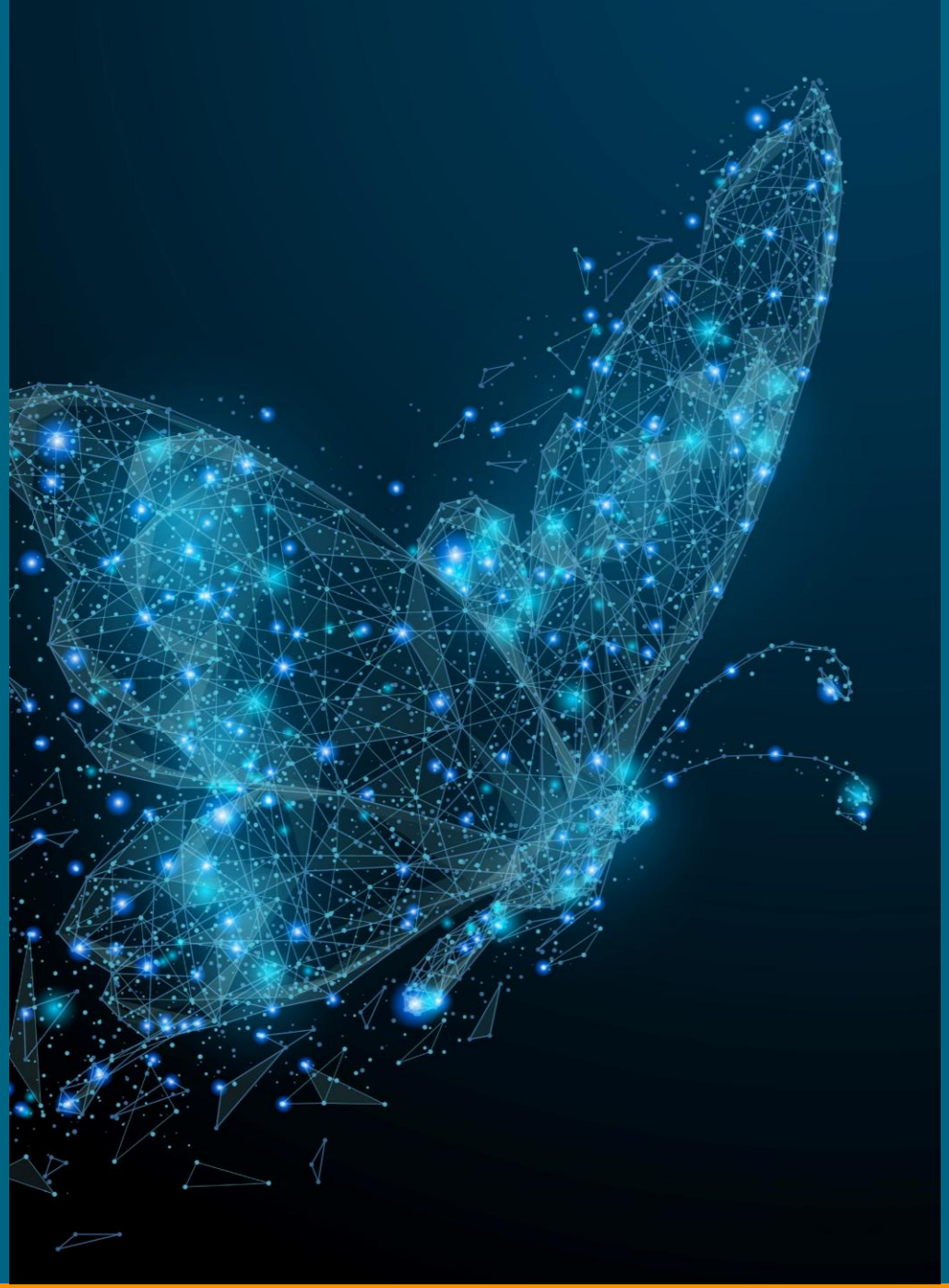

Image Source: shutterstock

Thank you

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