

2021 SUMMIT

CanvAAS

Connected Assets iNteroperability

framework Via AAS

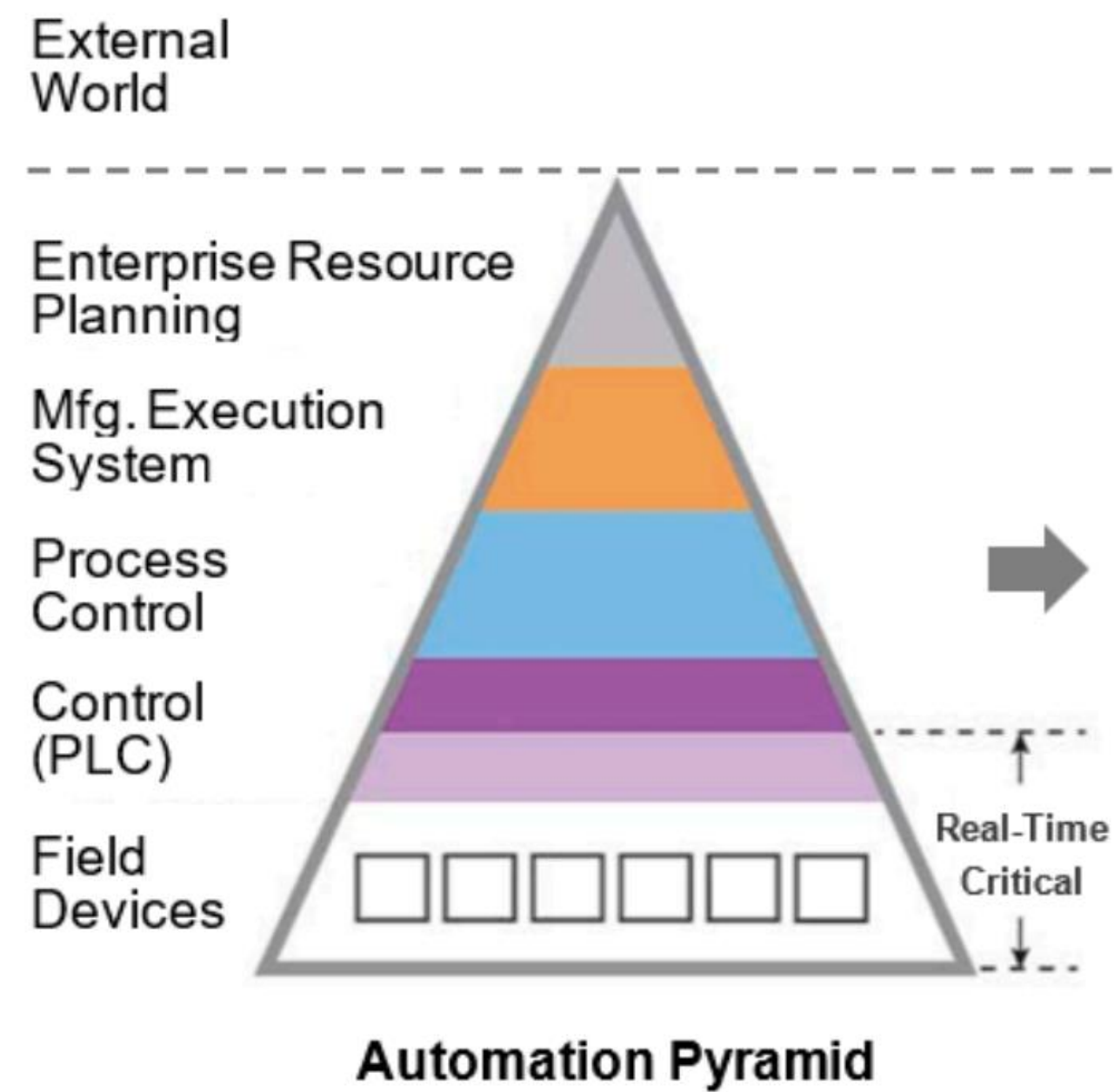


Saadia.dhouib@cea.fr

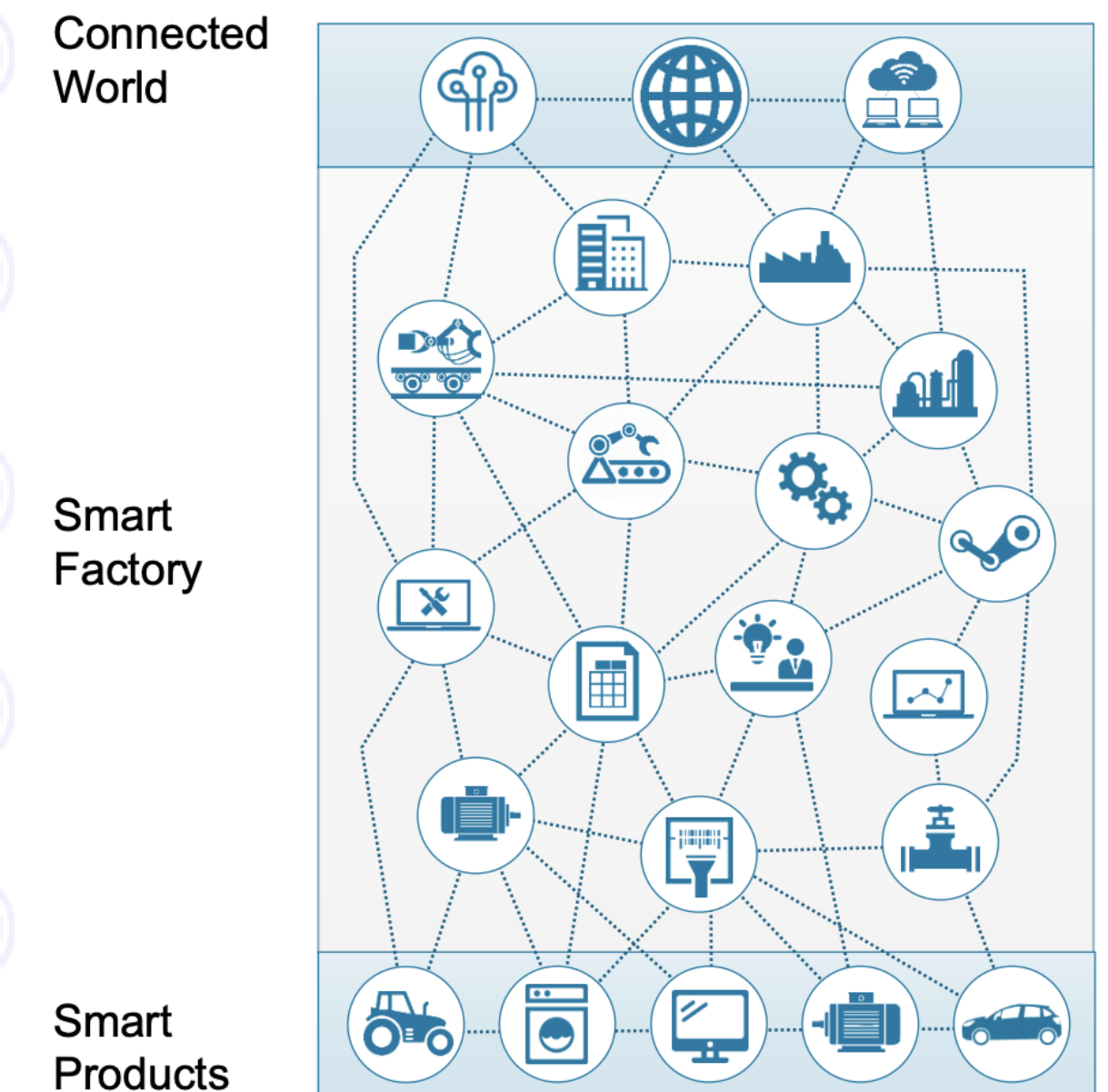


- **From** the *traditional automation pyramid* **to** an *integrated network of smart devices, services and enterprises*
- *Horizontal and Vertical* Interoperability
- **Interoperability -> Standardization**
- The **Asset Administration Shell** standard, IEC 63278-1 ED1

Industry 3.0



Industry 4.0

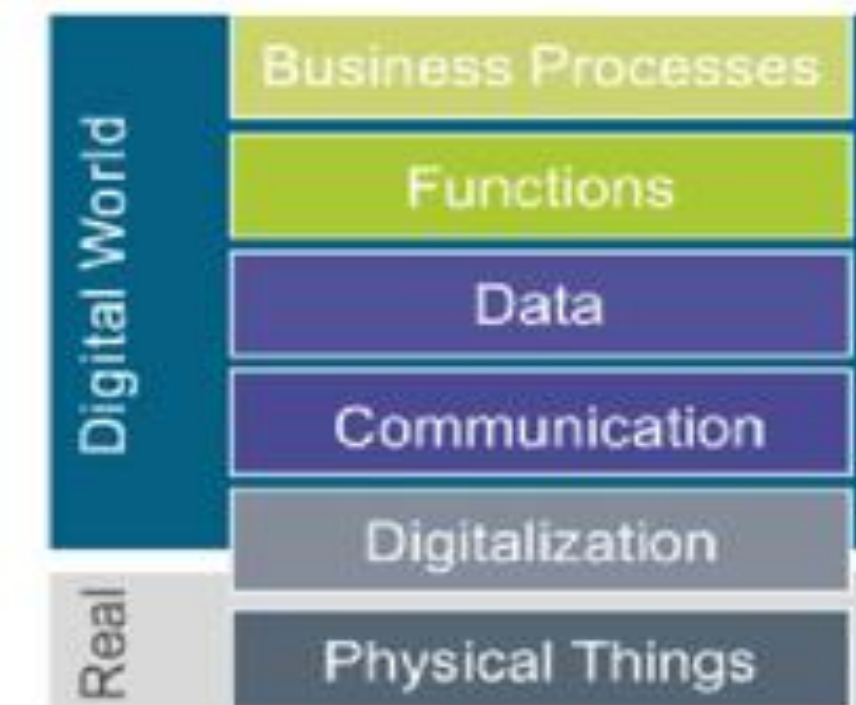
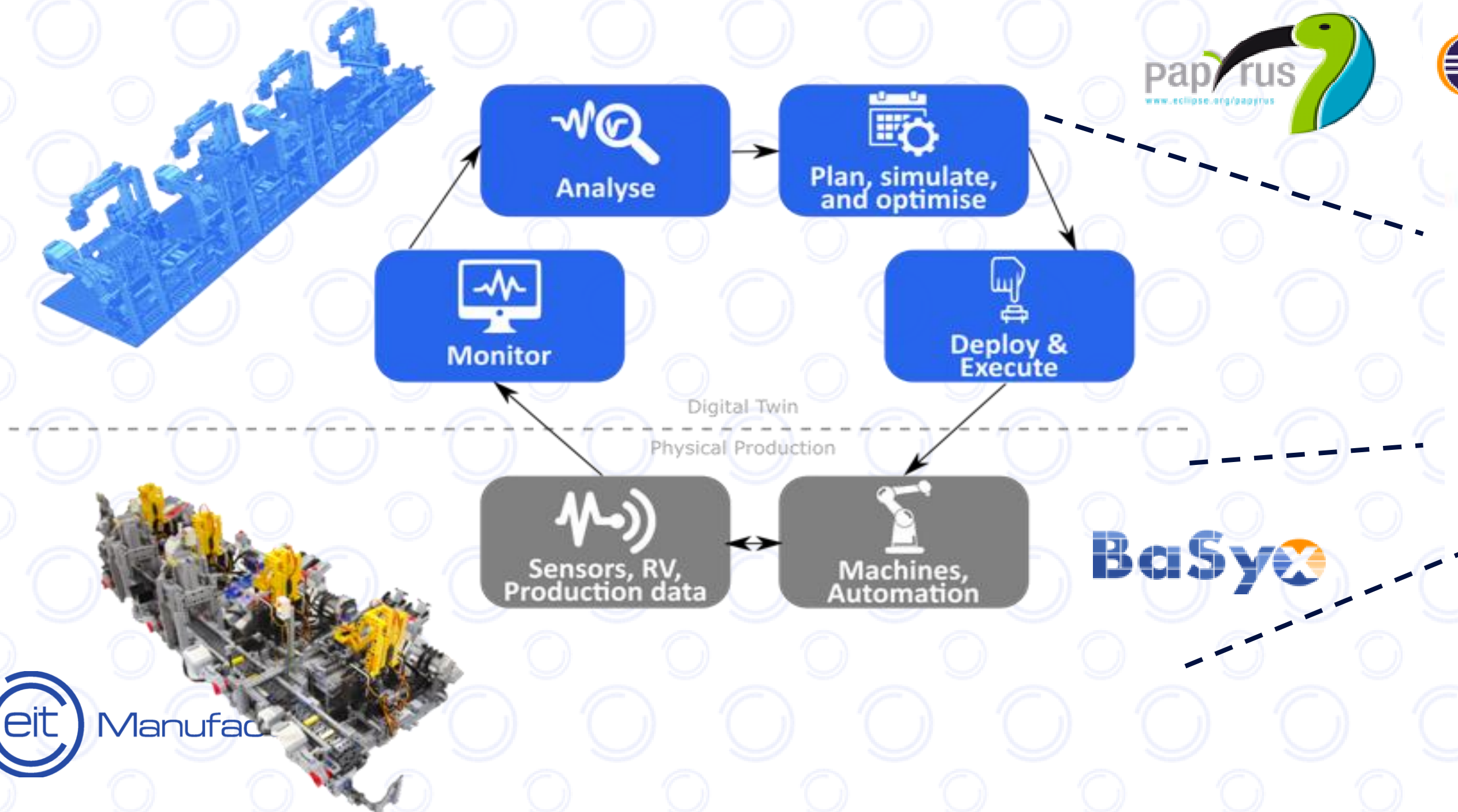


The solution: CanvAAS Toolset

CanvAAS: A model-based tool and methodology to plan, design, test and deploy the AAS I4.0 components on the end-user's manufacturing equipment to enable interoperability.



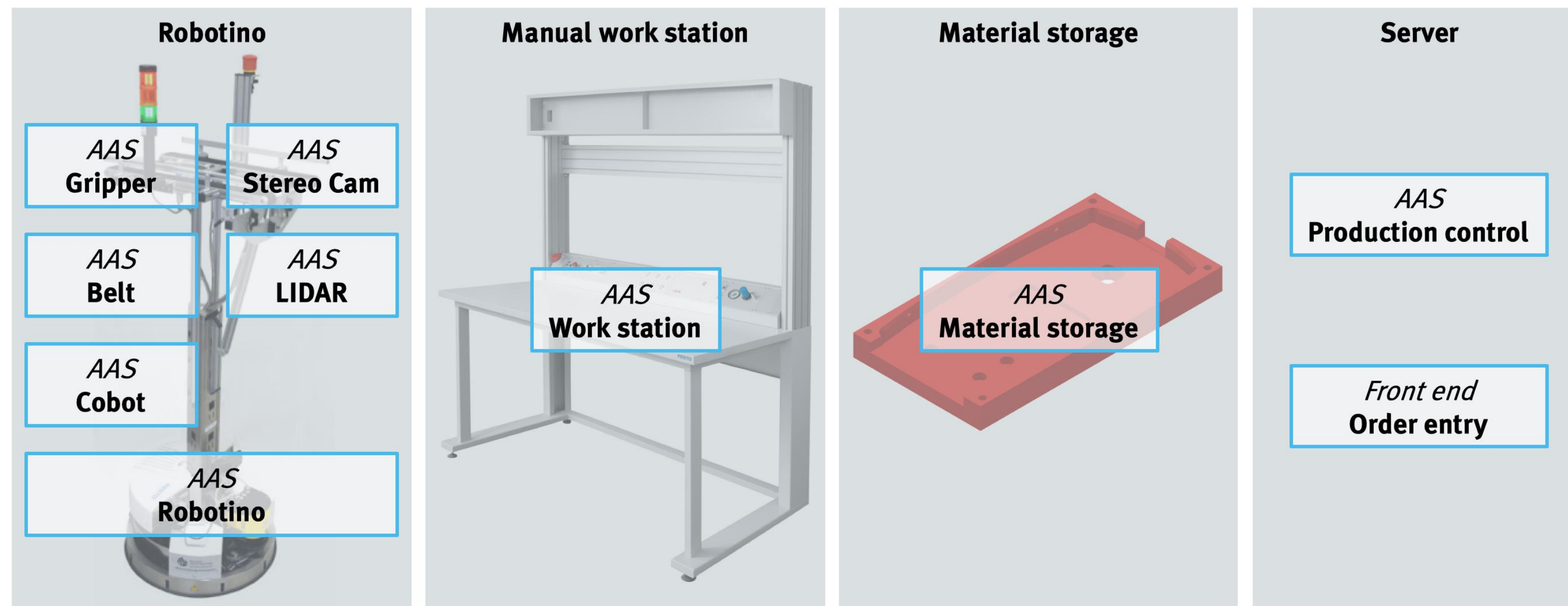
POLITECNICO
MILANO 1863



- A demonstration of the **CanvAAS** tool as an additional feature of **Festo Didactic's learning systems for Industry 4.0**.
- Festo Didactic will provide a **hands-on training MooC** course based on its learning systems on Industry 4.0 and Industrial Internet of Things.
- The training content will teach **how to deploy the AAS standard on Festo Didactic's automatic guided vehicle platform, Robotino 4**

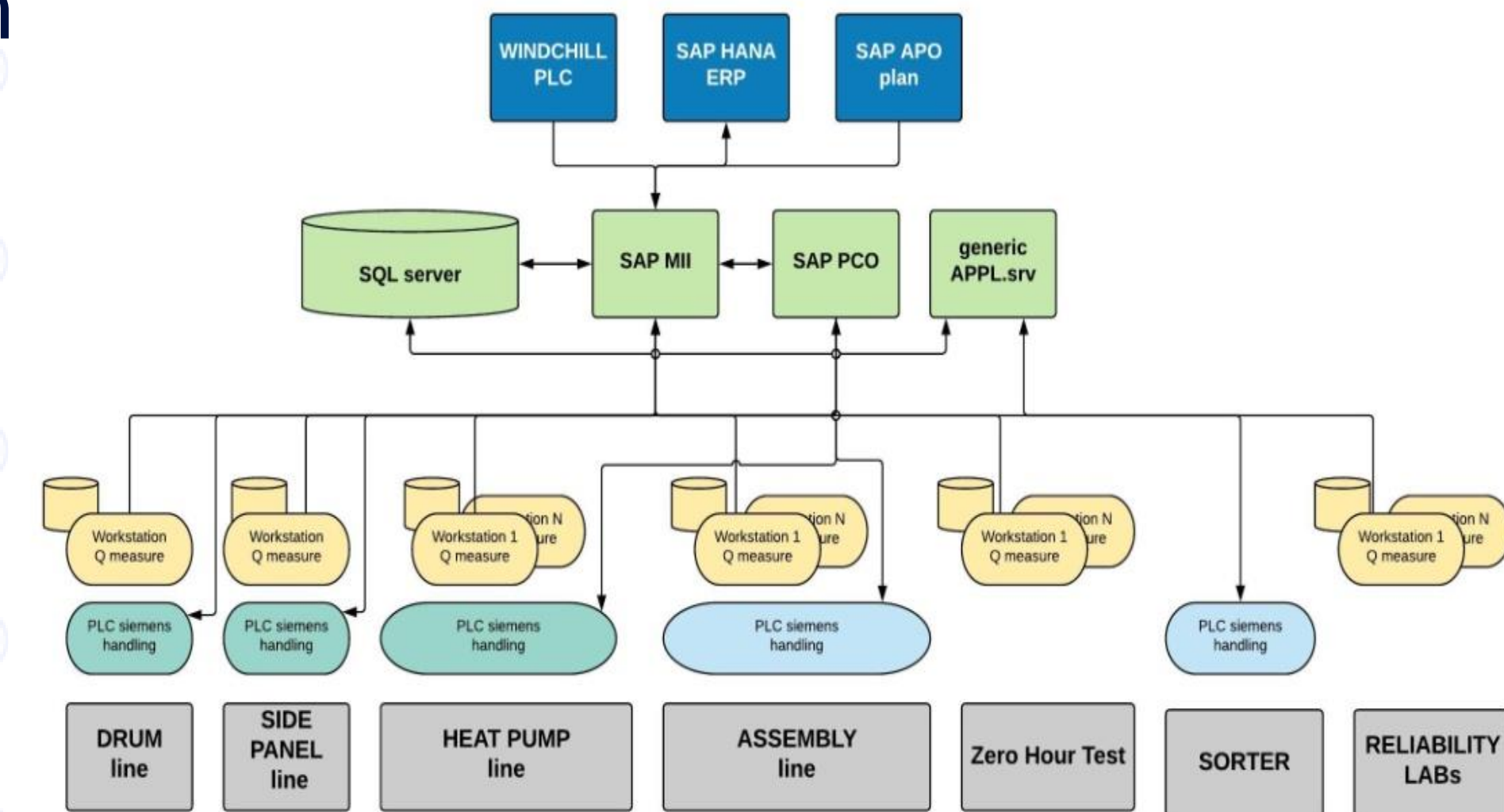


Use-Case: Robotino-Addon for AAS



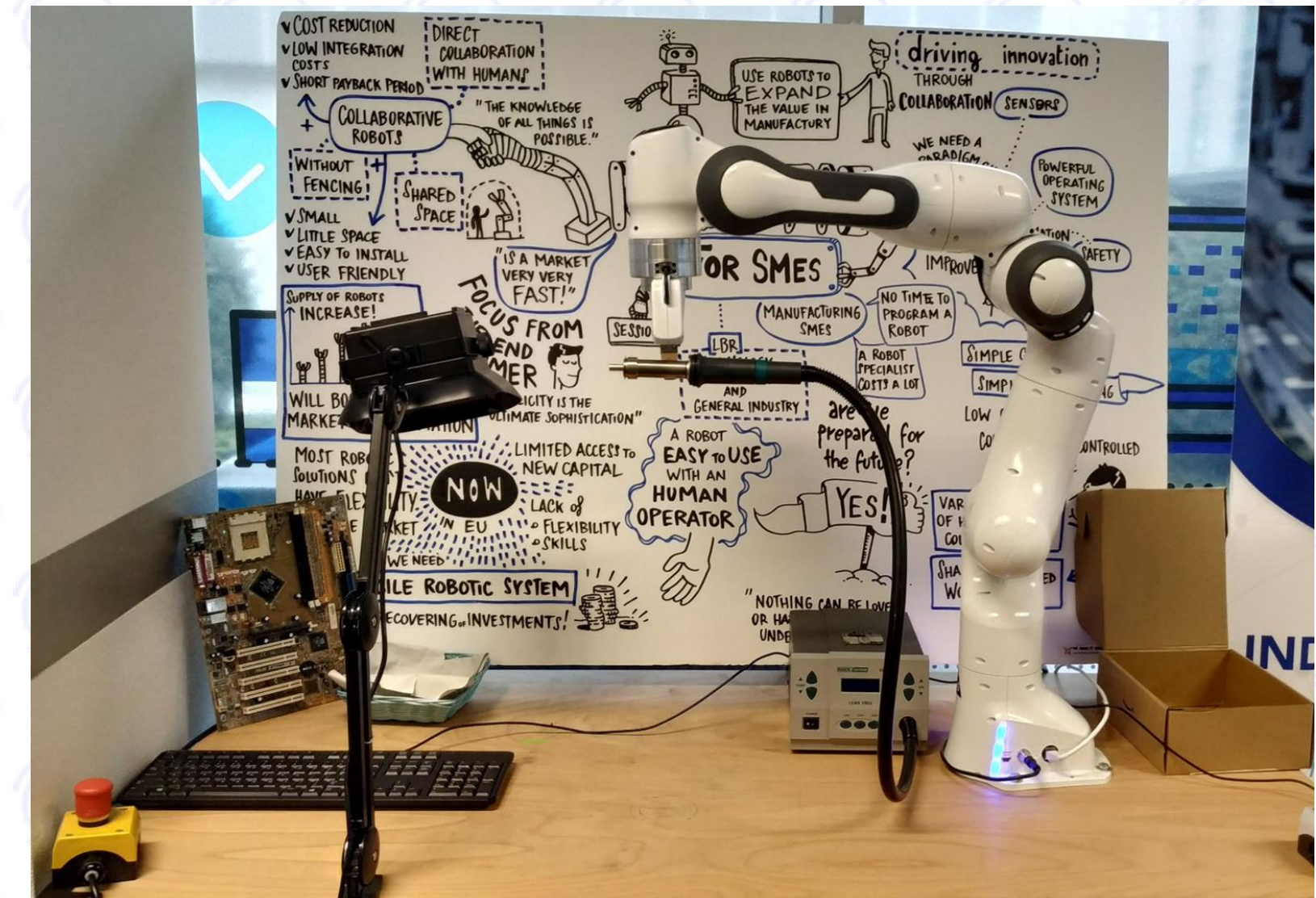
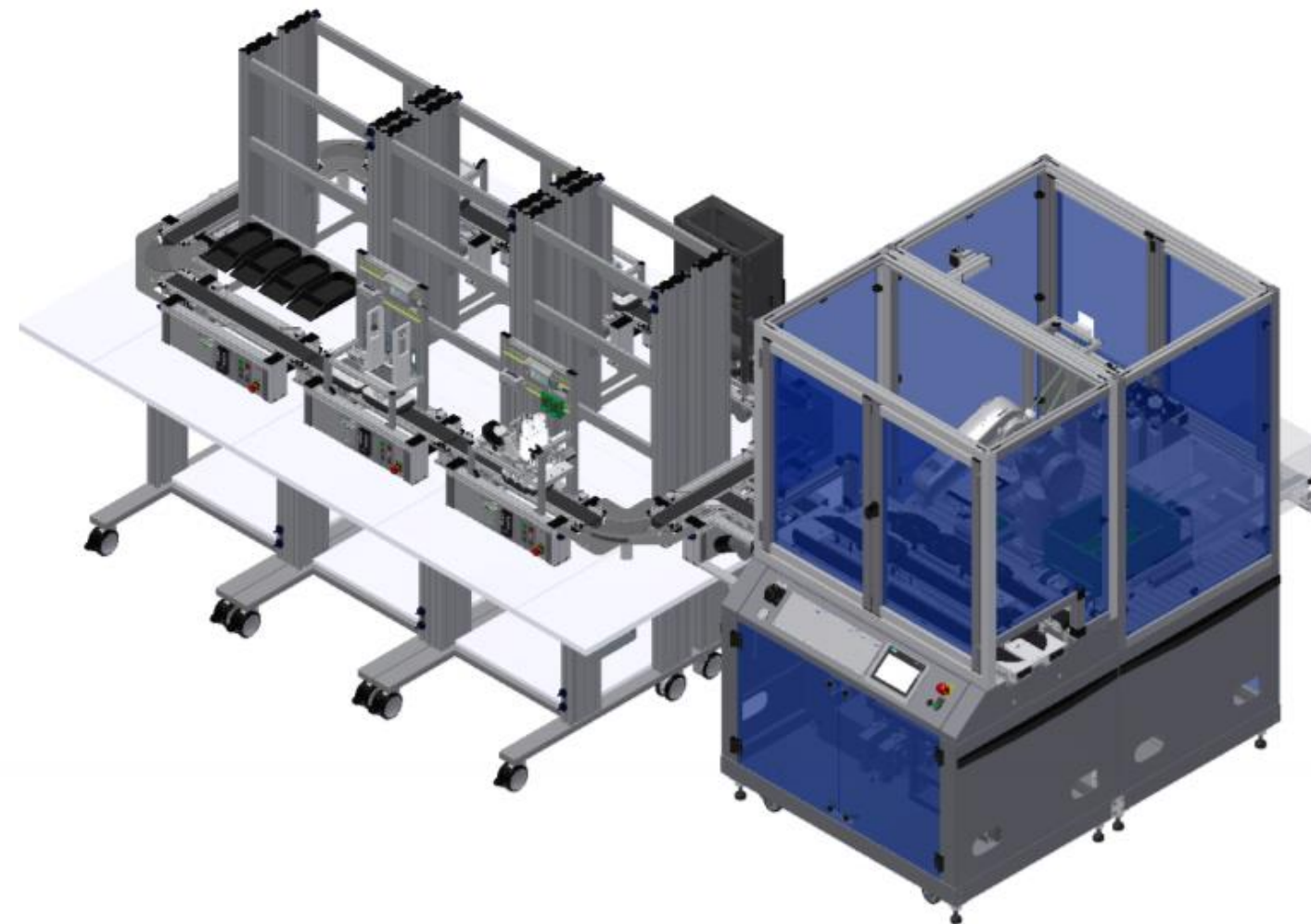
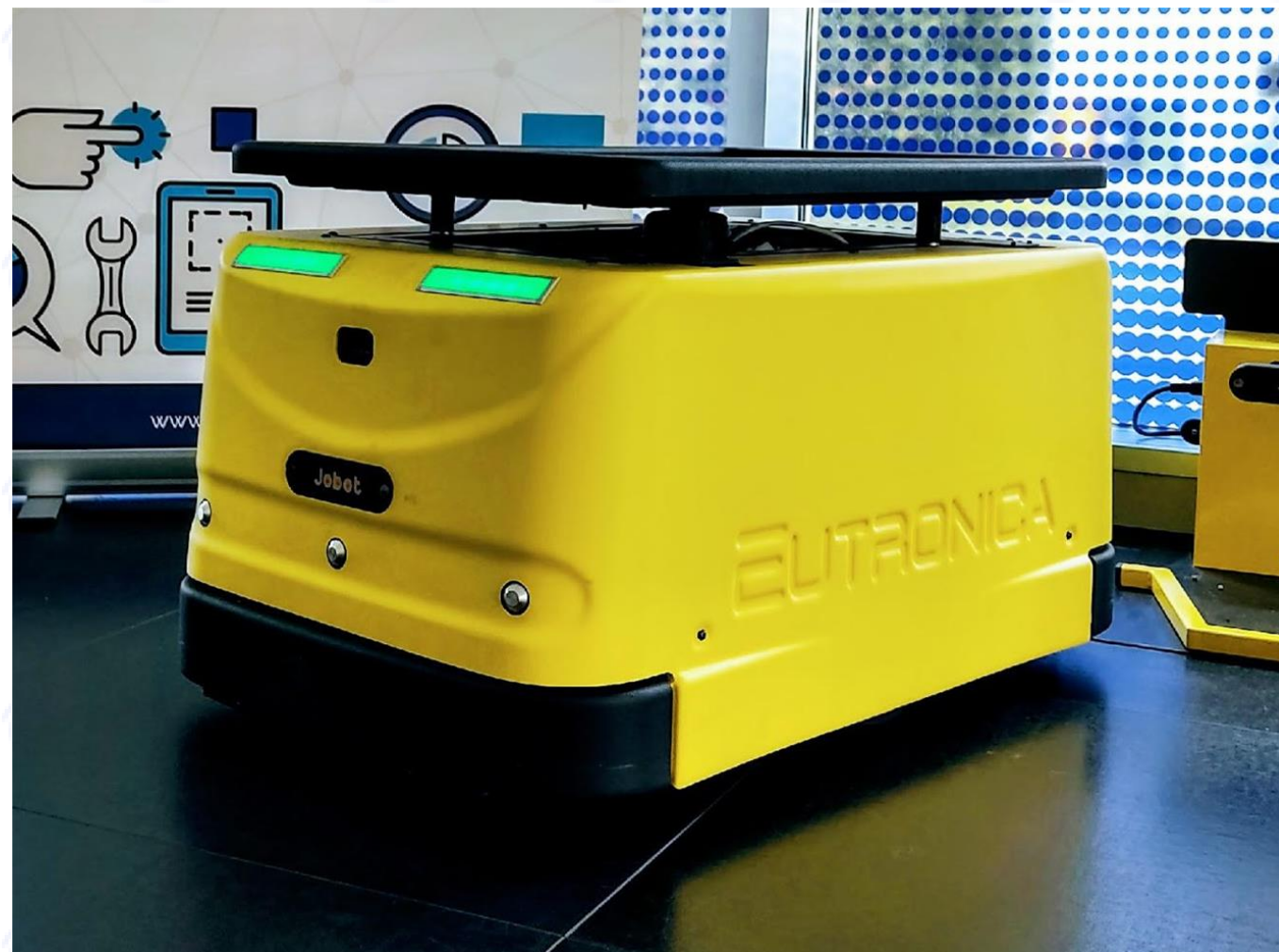
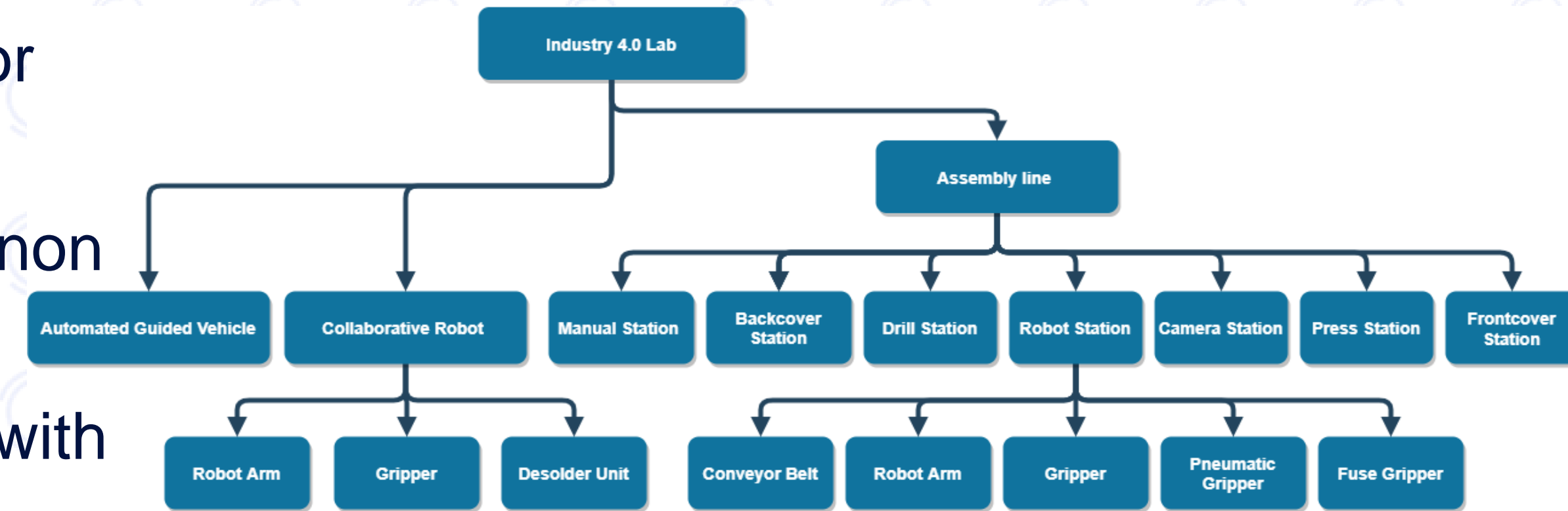
Demonstration in industrial example: Drumline at Whirlpool EMEA

- Reference methodology and approach for AAS utilization in industrial context
- Reference Submodels definition for robust and reusable AAS template
- Industrial ontology to be used as general schema for submodels definition
- AAS model Library implementing the above mentioned Submodels and layers
- Methodology and submodels validation through drumline digital twin
- CanvAAS tool validation and improvement suggestion



Demonstrator in Teaching factory at Industry 4.0 Lab Polimi

- Multivendor environment: AAS as core integration tool for assets vertical interoperability
- Researchers and students: test the tool with expert and non expert users
- AAS model based on common methodology developed with WHR
- CanvAAS tool validation and Empowerment suggestion



CanvAAS: Open source strategy

The toolset is available as a component of the Eclipse project

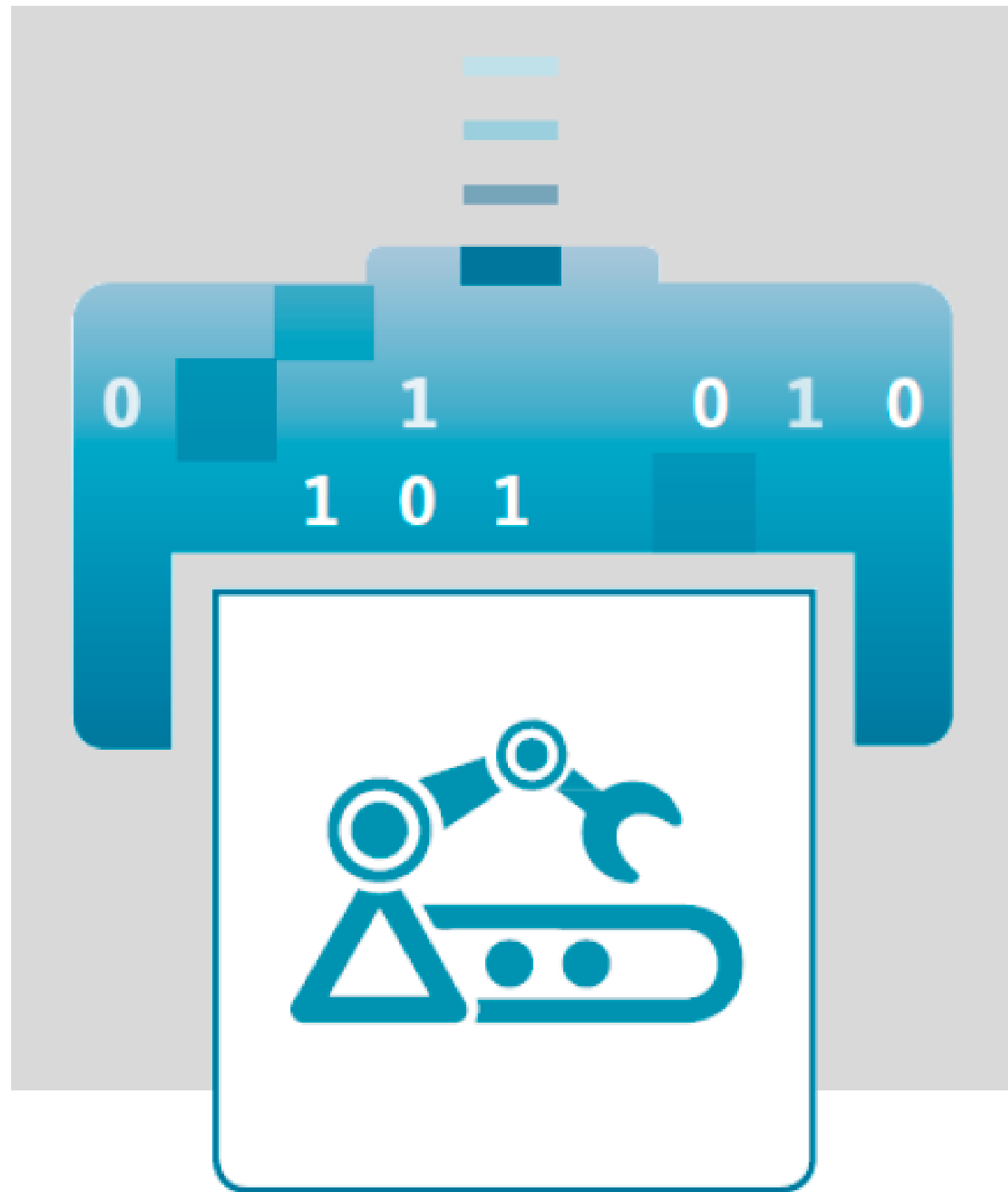
Papyrus: Papyrus4Manufacturing

<https://www.eclipse.org/papyrus/components/manufacturing/>



AAS Tutorial

Asset Administration Shell



- **Digital Twin**

Definition: digital representation (= information that represents characteristics and behaviors of an entity), sufficient to meet the requirements of a set of use cases

note: in this context, the entity in the definition of digital representation is typically an asset, process or system



The Administration Shell is the implementation of the „Digital Twin“ for Industrie 4.0



Administration Shell

- The Administration Shell...

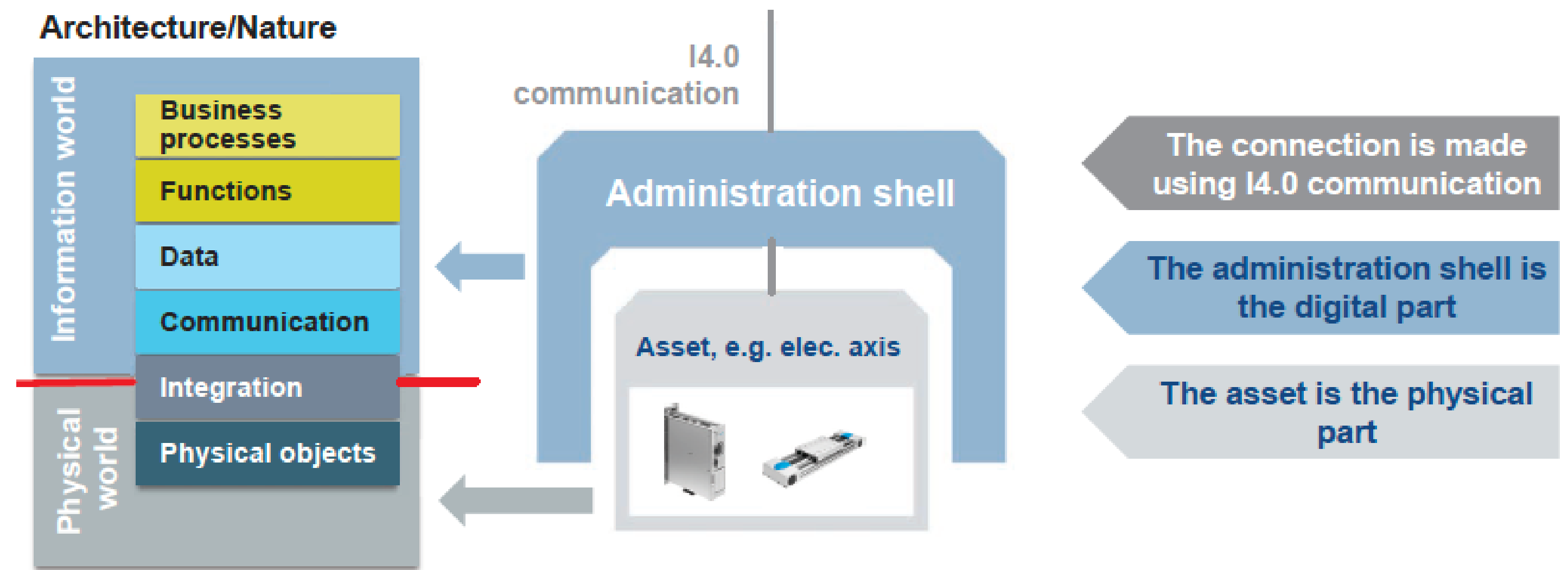
- integrates the asset into Industrie 4.0 communication.

- is addressable in the network and identifies the asset unambiguously.

- provides a controlled access to all information of the asset.

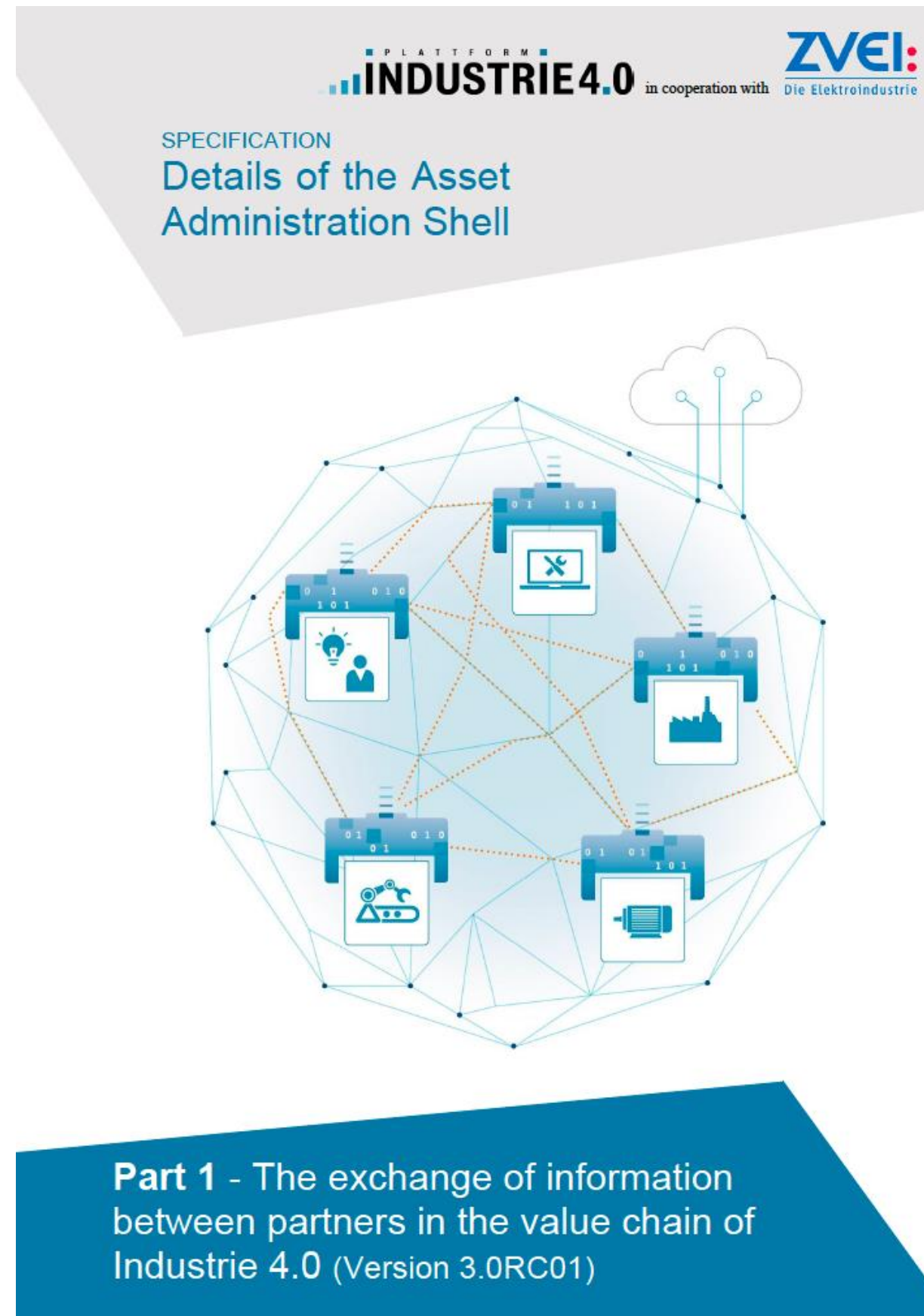
- is the standardised and secure communication interface.

- can integrate intelligent and also non-intelligent („passive“) assets (without a communication interface), e.g. via bar codes or QR codes.



Source: ZVEI SG models and standards

Details of the Asset Administration Shell Specification



- Scope and content:
 - Addresses developers mainly
 - describes a technology-neutral information model for Administration Shell (UML)
 - Mapping to OPC UA, AutomationML and RDF
 - Security by Design
 - Provides specific exchange formats for information (XML, JSON)
 - Defines a package format for exchanging content (.aasx)

https://www.plattform-i40.de/PI40/Redaktion/EN/Downloads/Publikation/Details_of_the_Asset_Administration_Shell_Part1_V3.html



Asset Administration Shell

Approach

External Requirements

Technology Neutral UML Model

AutomationML

XML, JSON

RDF

OPC UA Information Model

Engineering

Information Exchange

Analysis

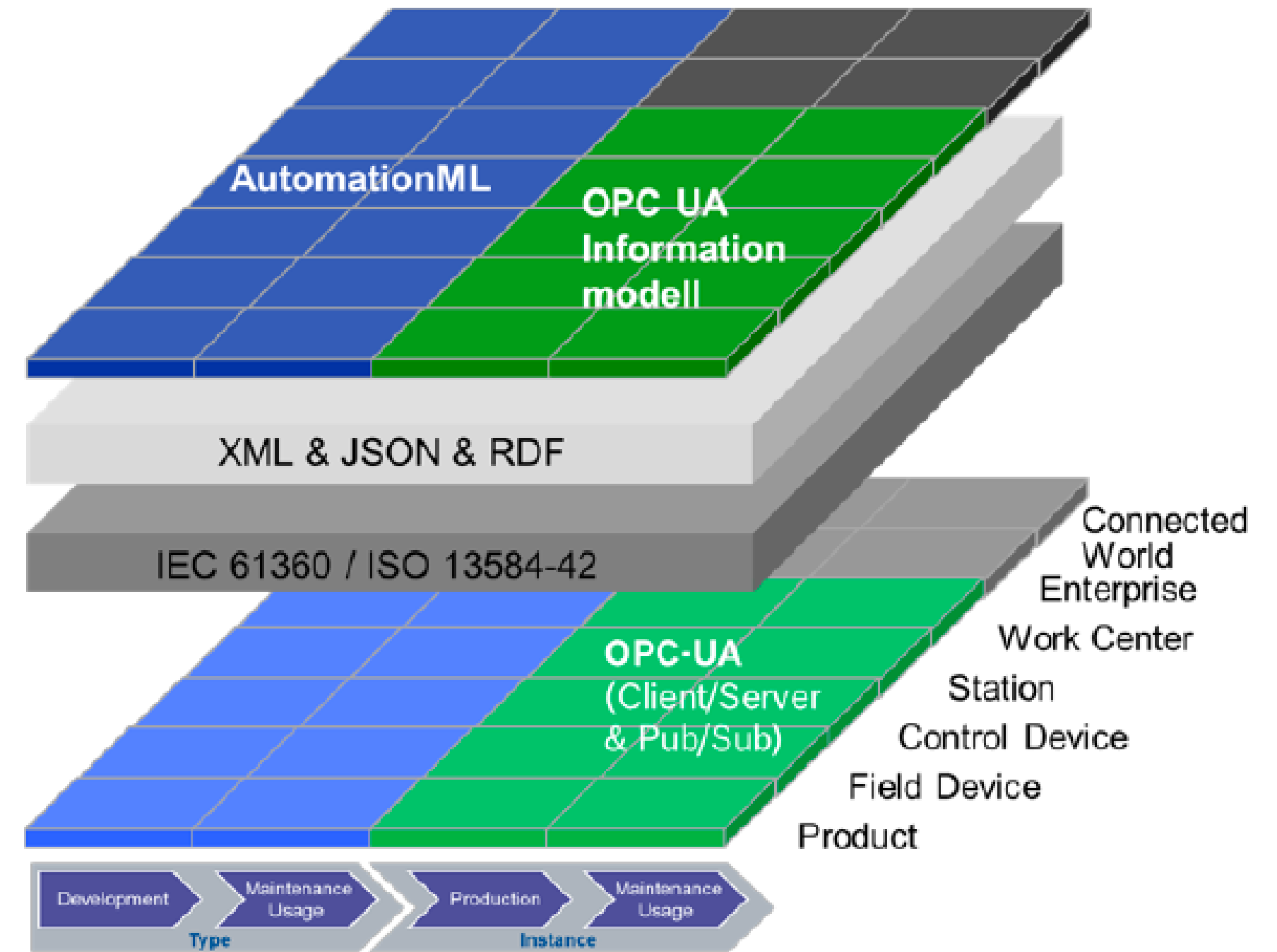
Operation

Asset Administration Shell Representation

Data Exchange Format / Payload

Concept Description

Communication



Source: Bosch Rexroth AG. Plattform Industrie 4.0



Asset Administration Shell

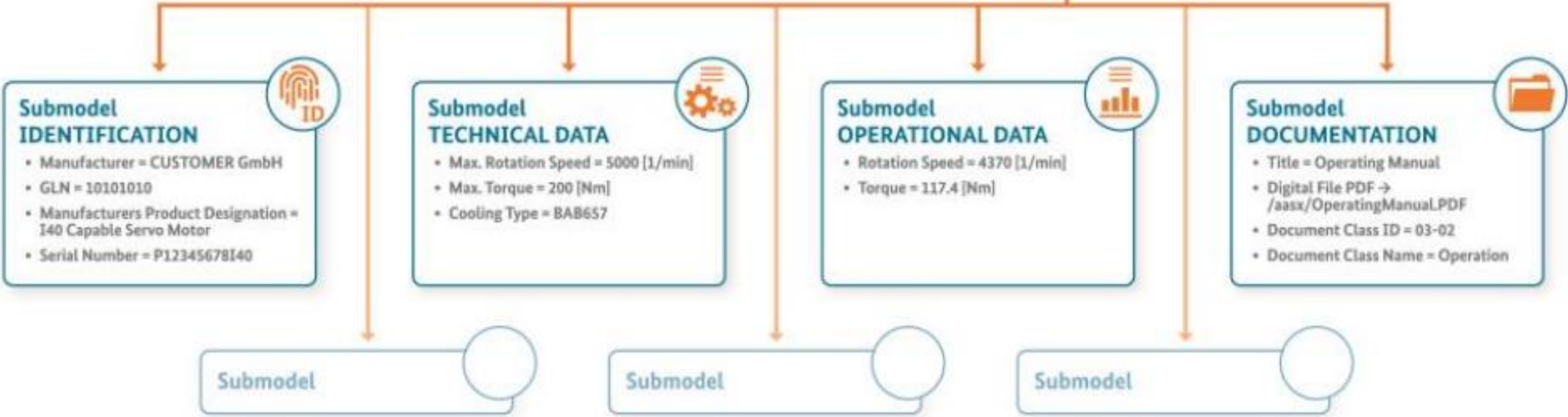
Submodels



Asset Administration Shell

Submodels

Submodel elements



Asset Administration Shell

Submodels

Describing functional aspects for different use cases by using suitable submodel elements

- *Product properties* in terms of IEC61360-1 or ecl@ss
- *Process variables* and parameters, telemetry data
- *Events* for observing properties
- *References* to external data sources or files
- *References* to other Administration Shells and their parts (submodels, properties), also from external partners in the value chain
- *Capabilities* of the asset, description of method calls
- *Sets* of properties, e.g. lists or arrays
- *Entities* for describing Composite I4.0 Components

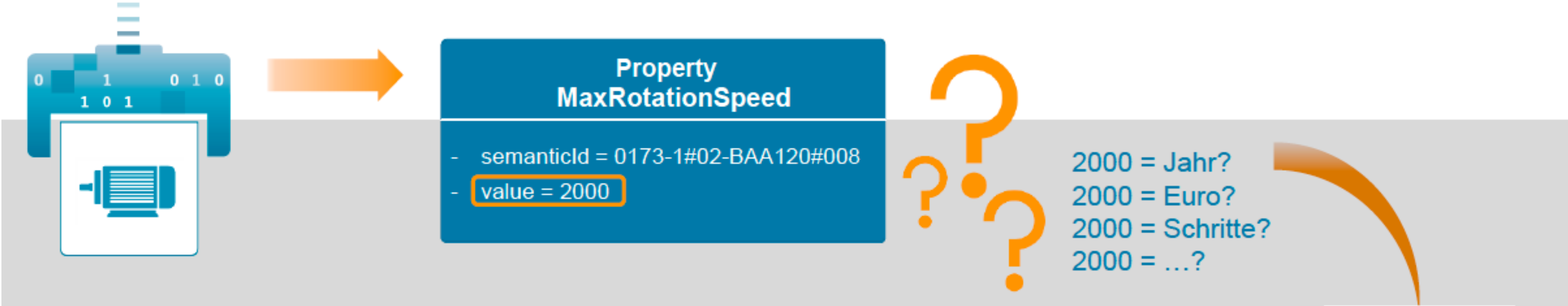


Submodel TECHNICAL DATA

- Max. Rotation Speed = 5000 [1/min]
- Max. Torque = 200 [Nm]
- Cooling Type = BAB657

Asset Administration Shell

Semantic Interoperability



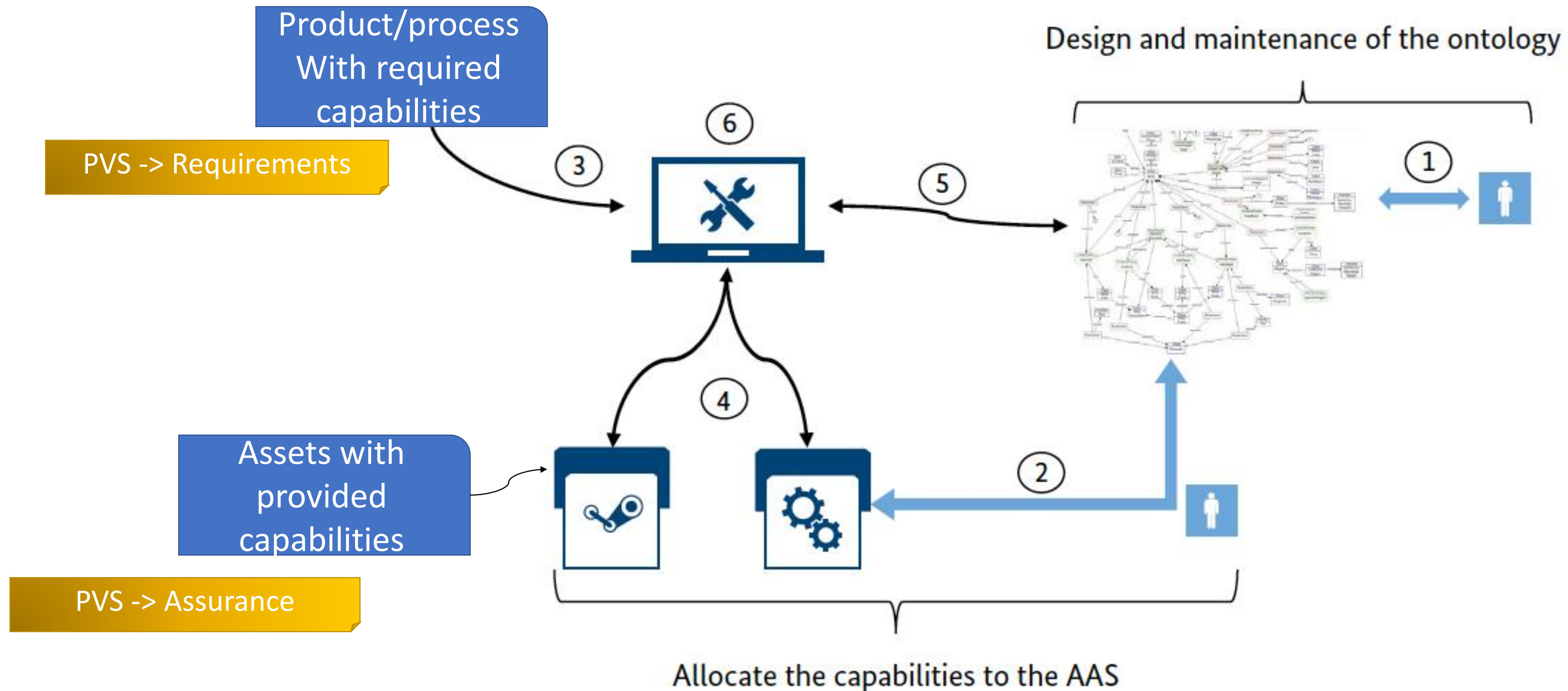
Property	0173-1#02-BAA120#008 Max. rotation speed
Data type	INTEGER_MEASURE
Unit of measure	1/min
Definition	Greatest possible rotation speed with which the motor or feeding unit may be operated

2000 = Max. rotation speed (1/min)

Asset Administration Shell

Semantic Interoperability

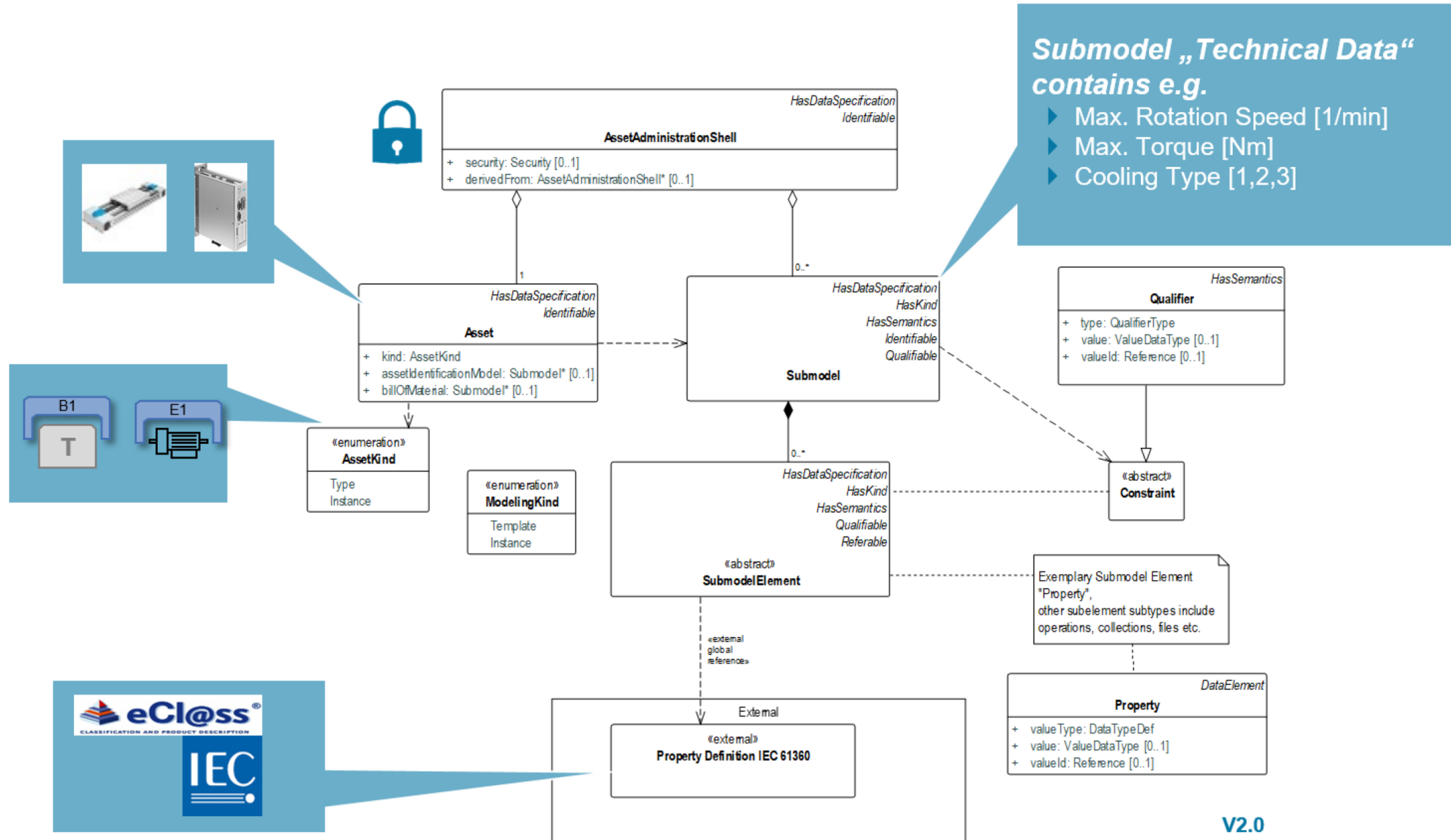
- Capability Checking



Source : « Describing Capabilities of Industrie 4.0 Components », Platform Industrie 4.0, Nov 2020

Asset Administration Shell

Meta Model - Basics

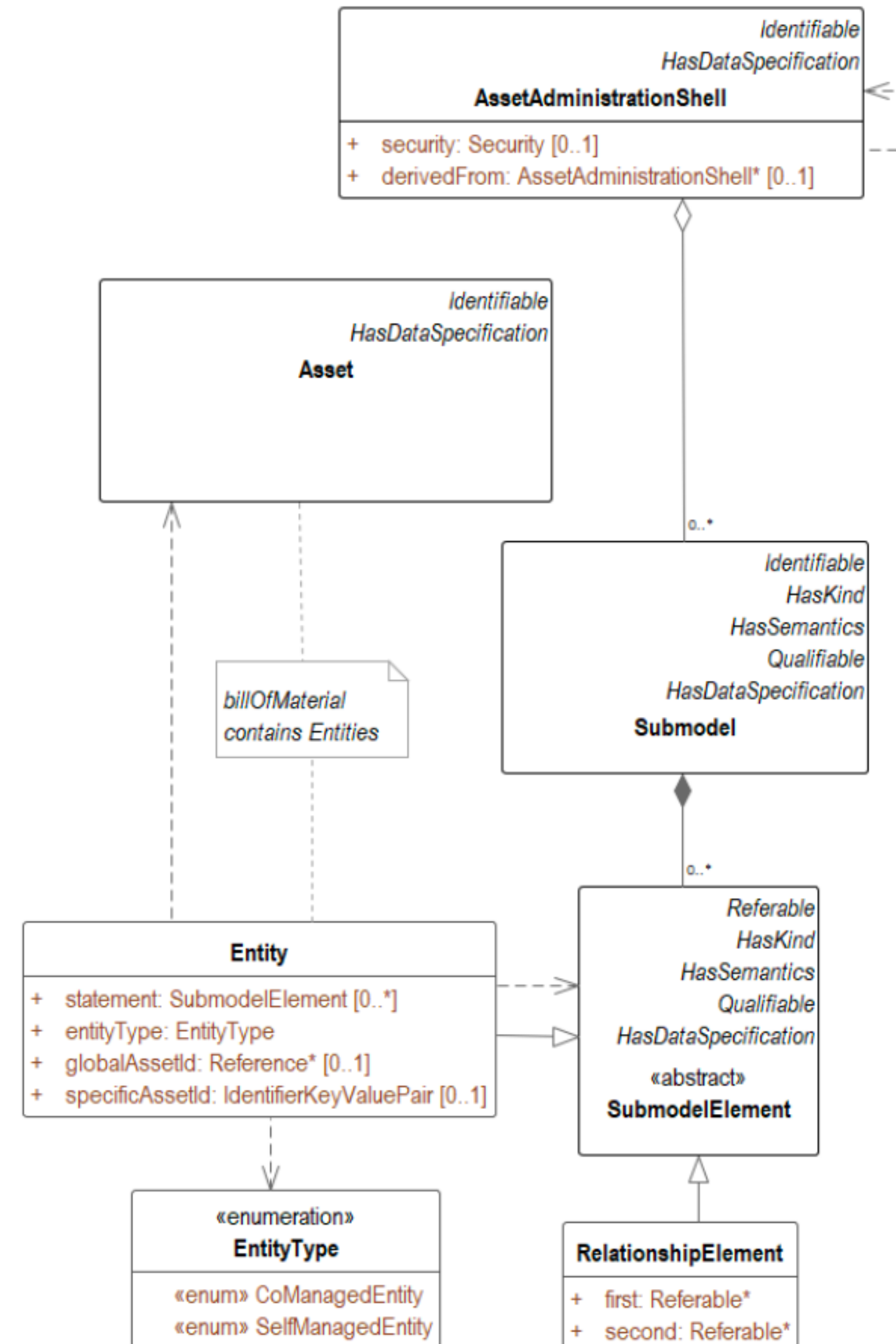


V2.0



Asset Administration Shell

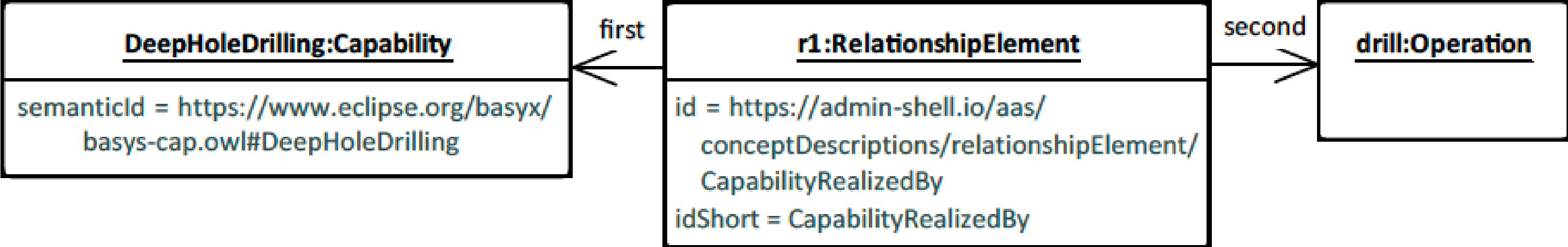
Meta Model – Composite I4.0 Components



Asset Administration Shell

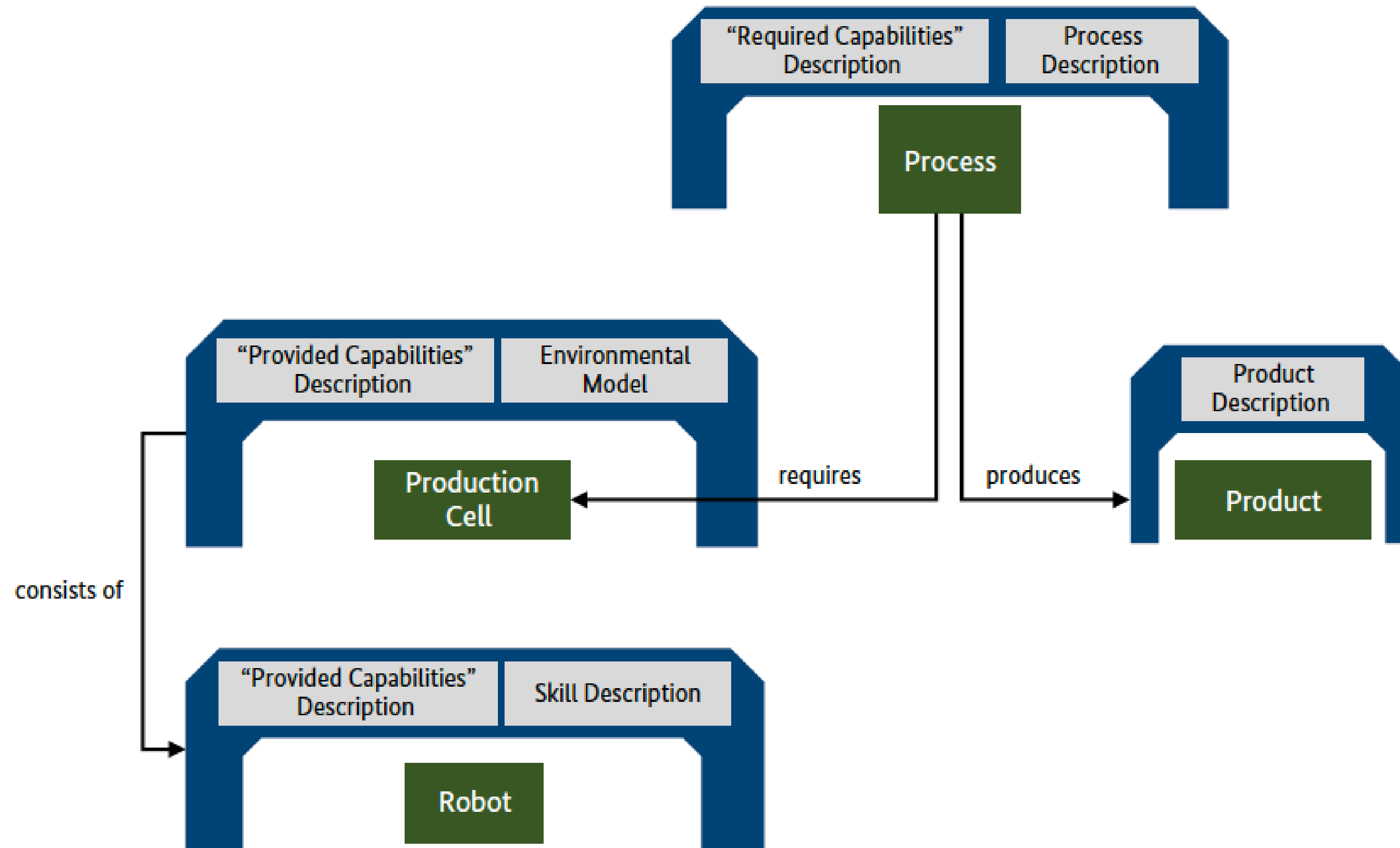
Meta Model – Capabilities and Skills

Skill Drill for Drilling Capability



Source: Plattform Industrie 4.0

Example: Asset Administration Shells for a Pick and Place Production Cell

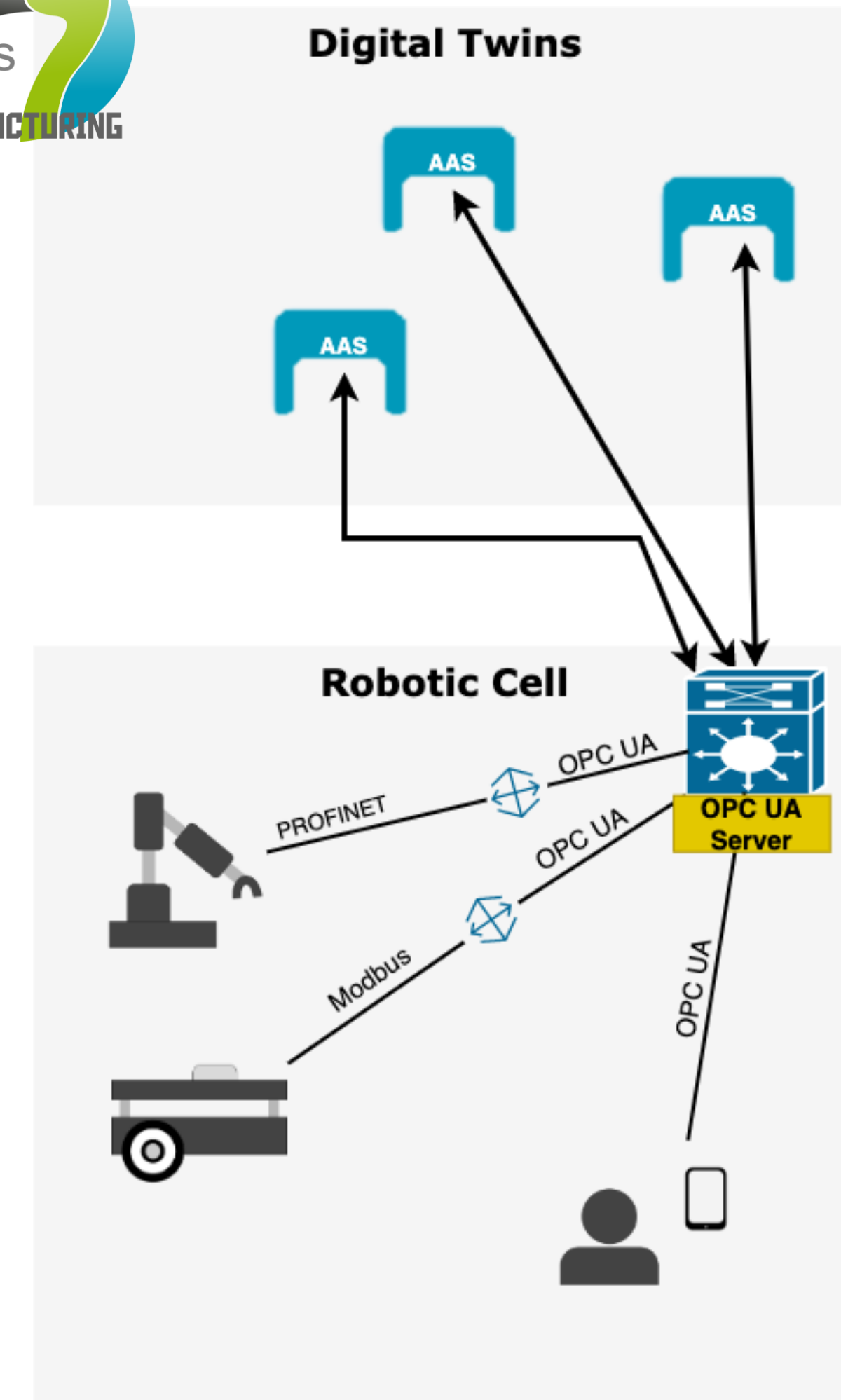
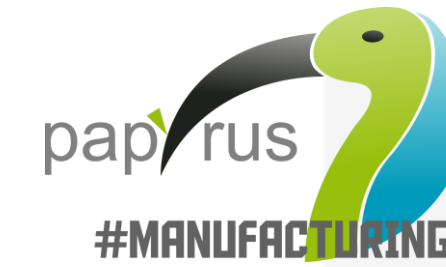


Source: Plattform Industrie 4.0



Papyrus4Manufacturing Tutorial

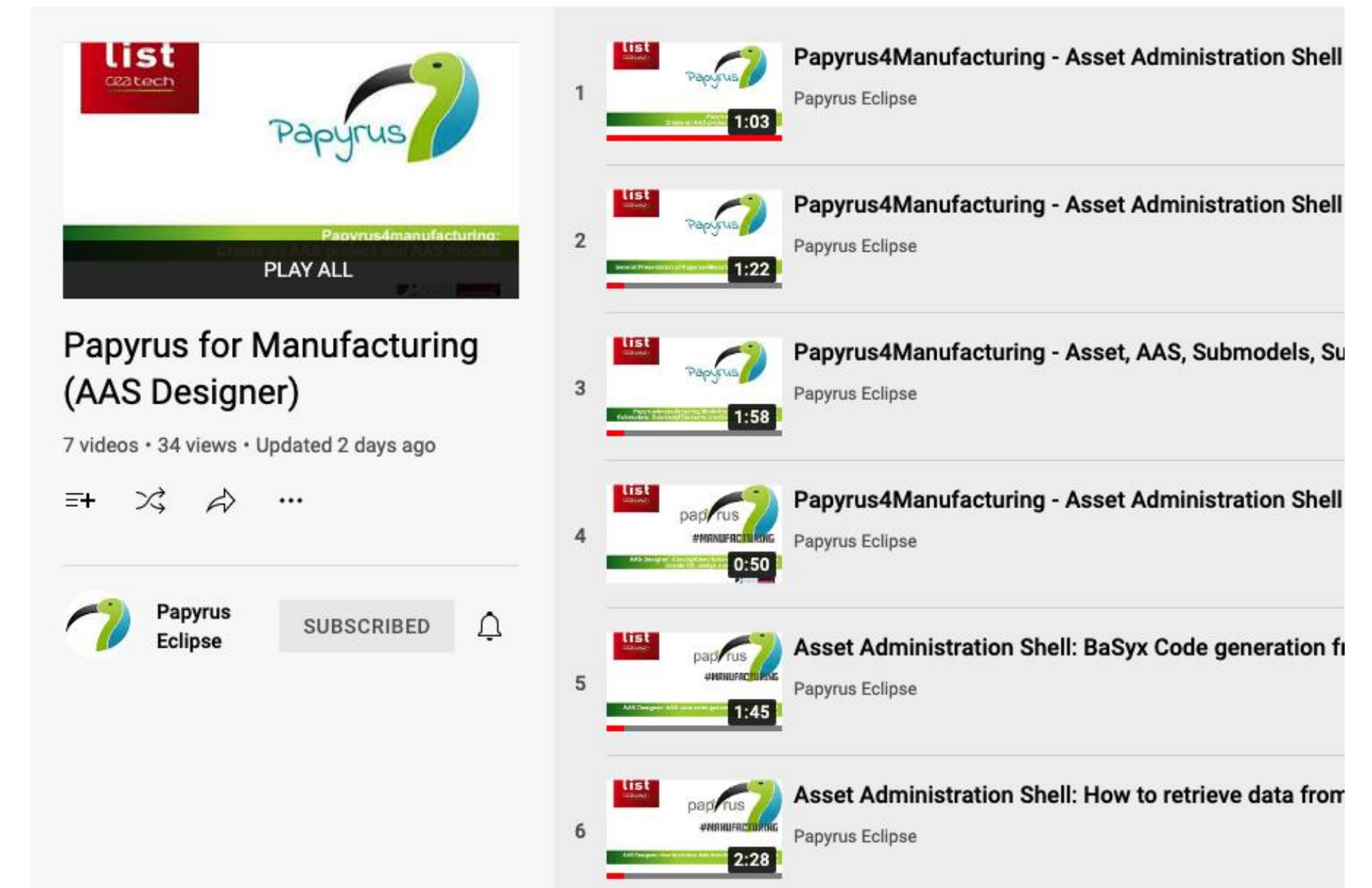
- **A Model Driven Tool providing:**
 - An Asset Administration Shells Modelling Environment
 - Asset Administration Shells automatic deployment to BaSyx
 - Digital Twins connectivity to physical assets using the OPC UA protocol



<https://www.eclipse.org/papyrus/components/manufacturing/>

Papyrus4Manufacturing Tutorial

- Graphical Modelling Interface Presentation
- How to create Assets, AASs, Submodels, SubmodelElements
- How to create a Submodel Instance from a SubmodelTemplate
- How to import an AASX package
- How to create Concept Descriptions and how to set SemanticIDs
- How to create a Production Process Submodel using BPMN
- How to create a Bill of Material (BOM) submodel
- Tabular views in Papyrus4Manufacturing
- How to generate BaSyx Java code
- How to set opc-ua connectivity information
- How to get real-time opc-ua data in the AAS



<https://www.youtube.com/playlist?list=PL9nkS1KDTMm7IH0ucDZ7YjIJyZnwSxTk9>

