

# CanvAAS

Connected Assets iNteroperability

framework Via AAS

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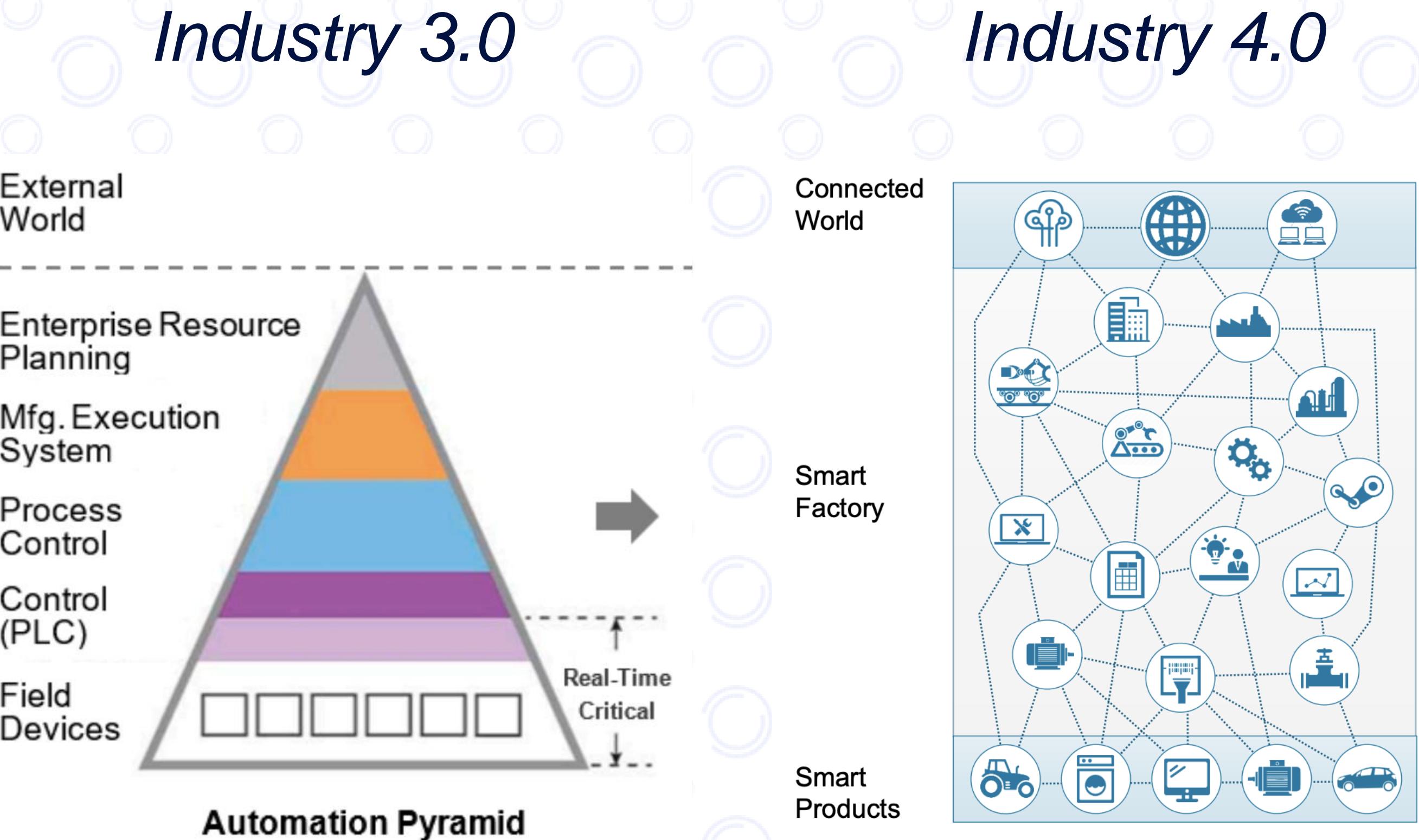
Saadia.dhouib@cea.fr



Co-funded by the  
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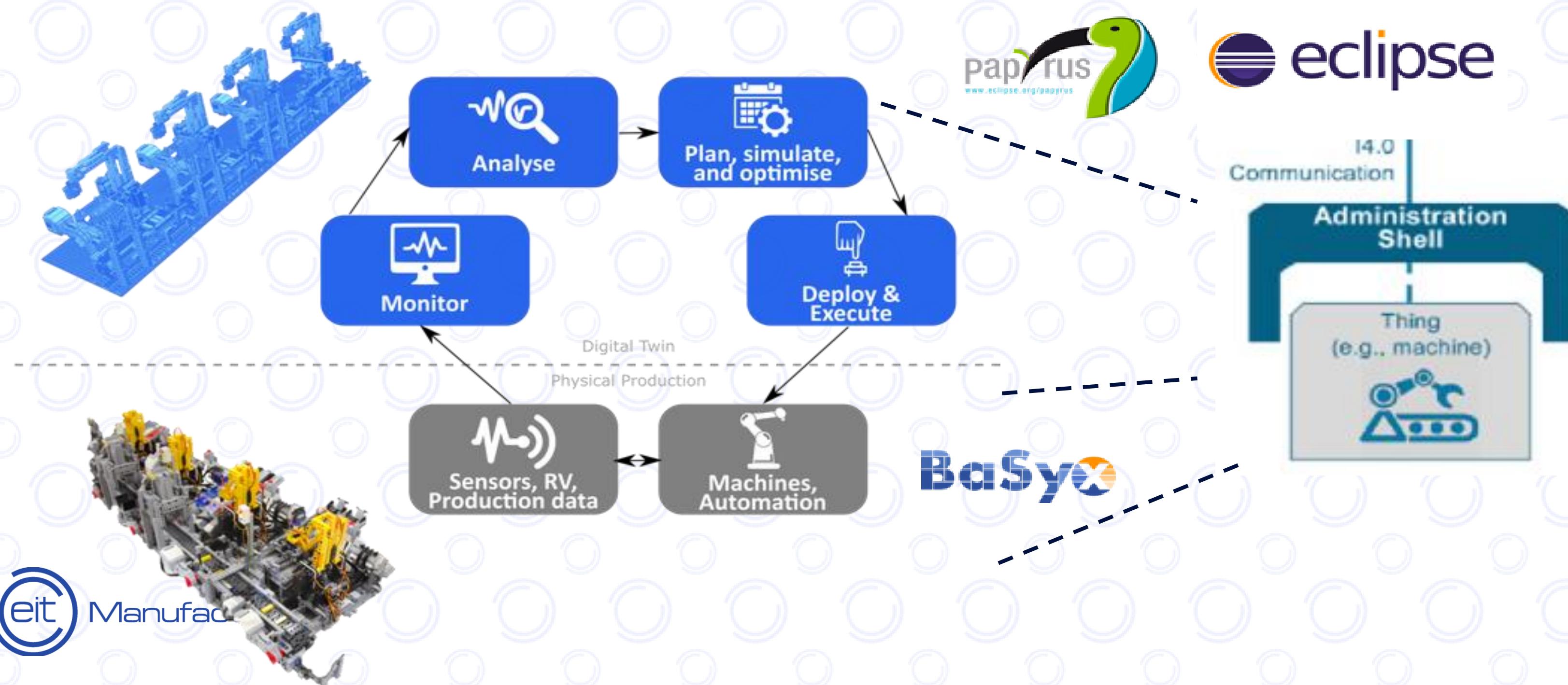
# The Challenge

- **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**



# 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.

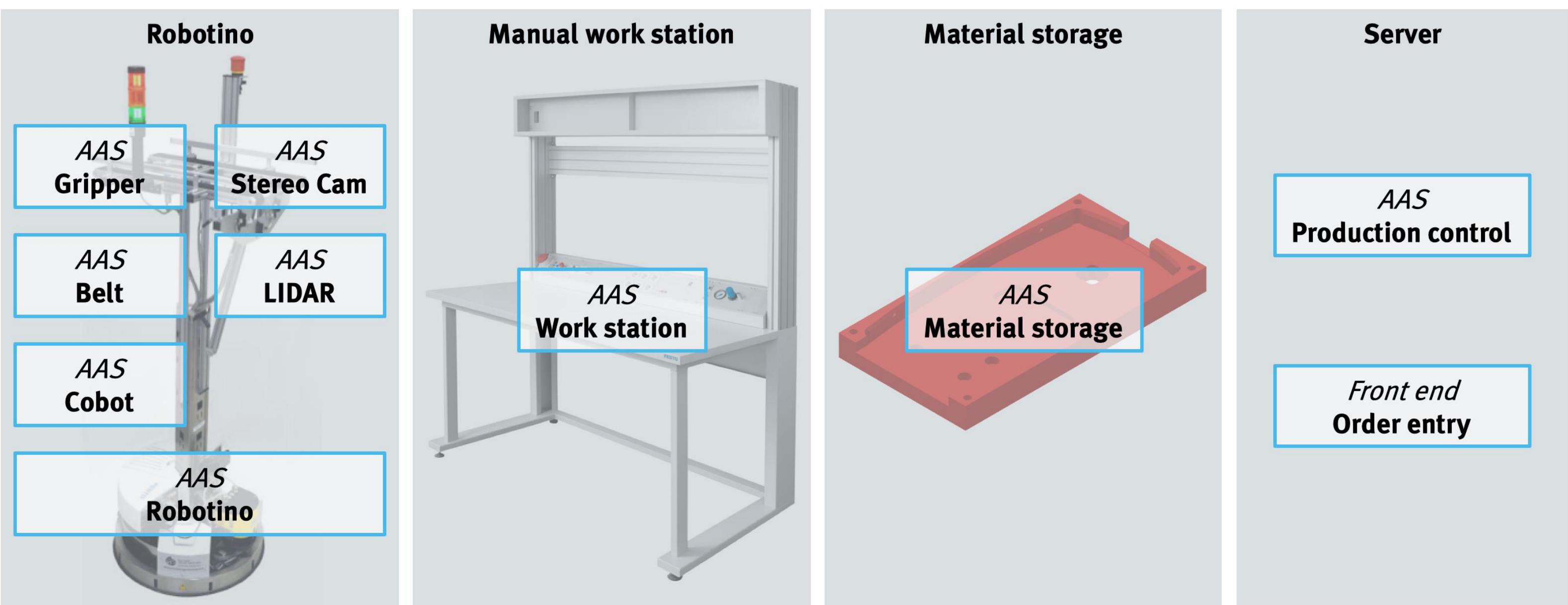


# Demonstration in Didactic Factories and Training course MooC

- 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**

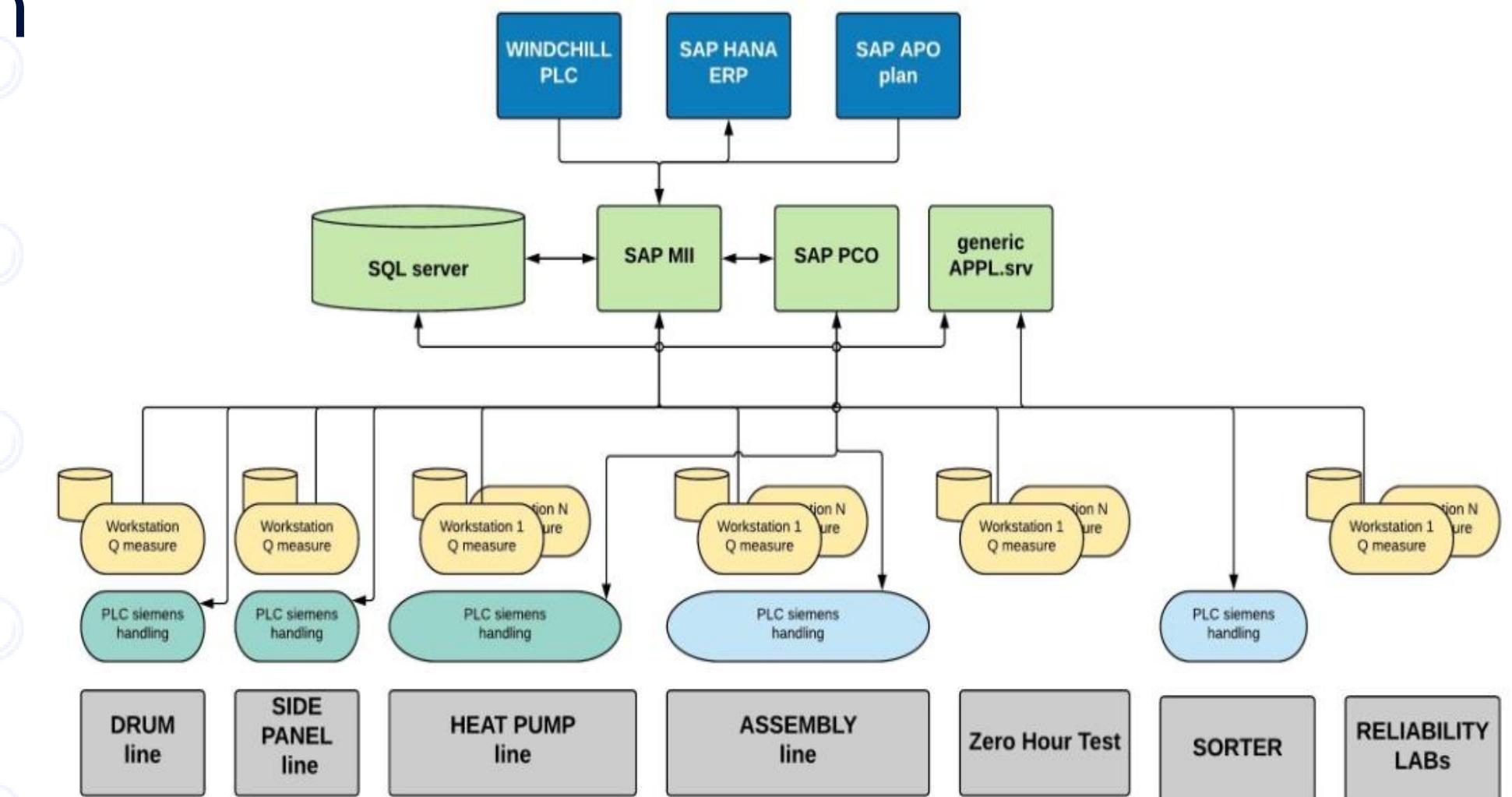


## Use-Case: Robotino-Addon for AAS



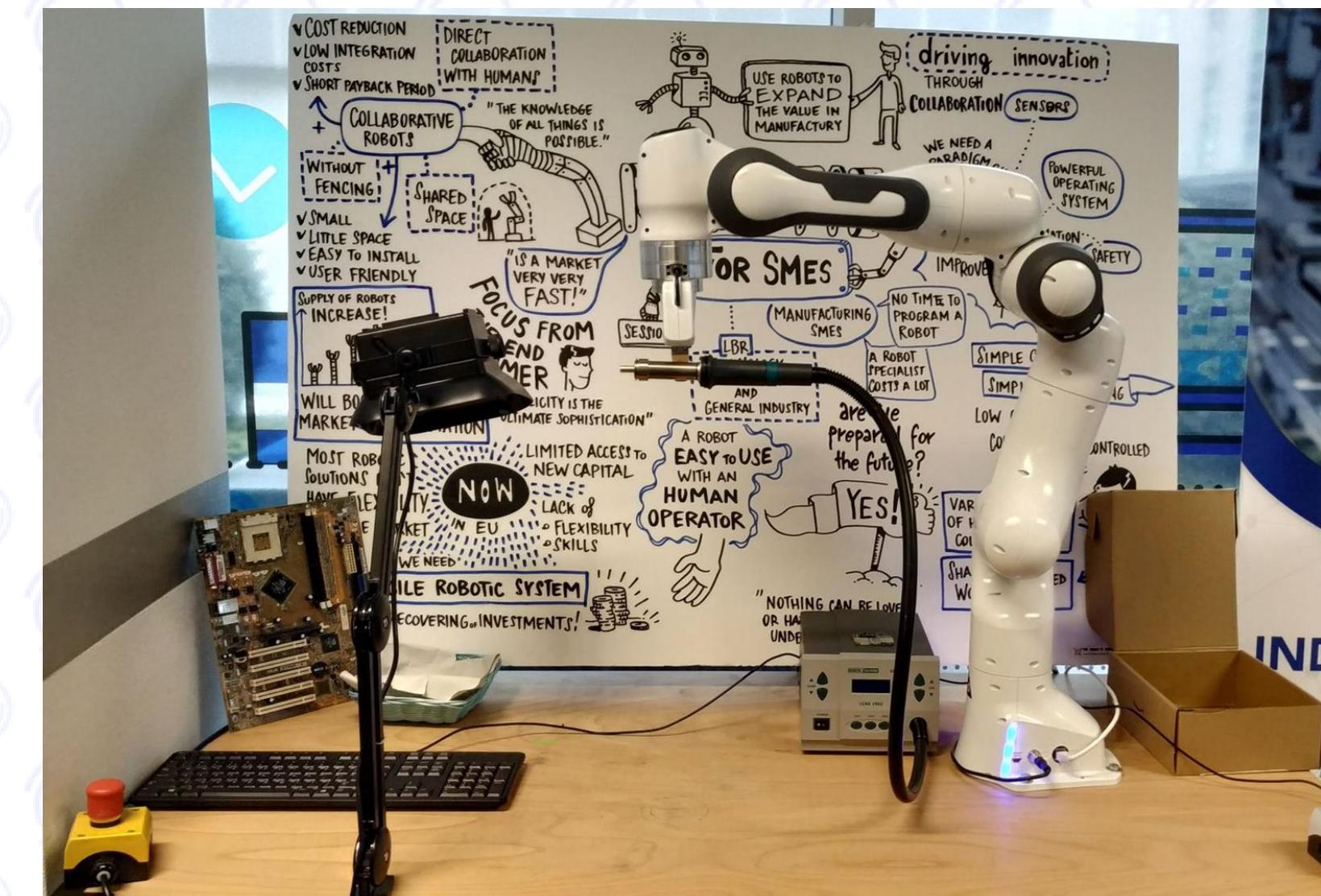
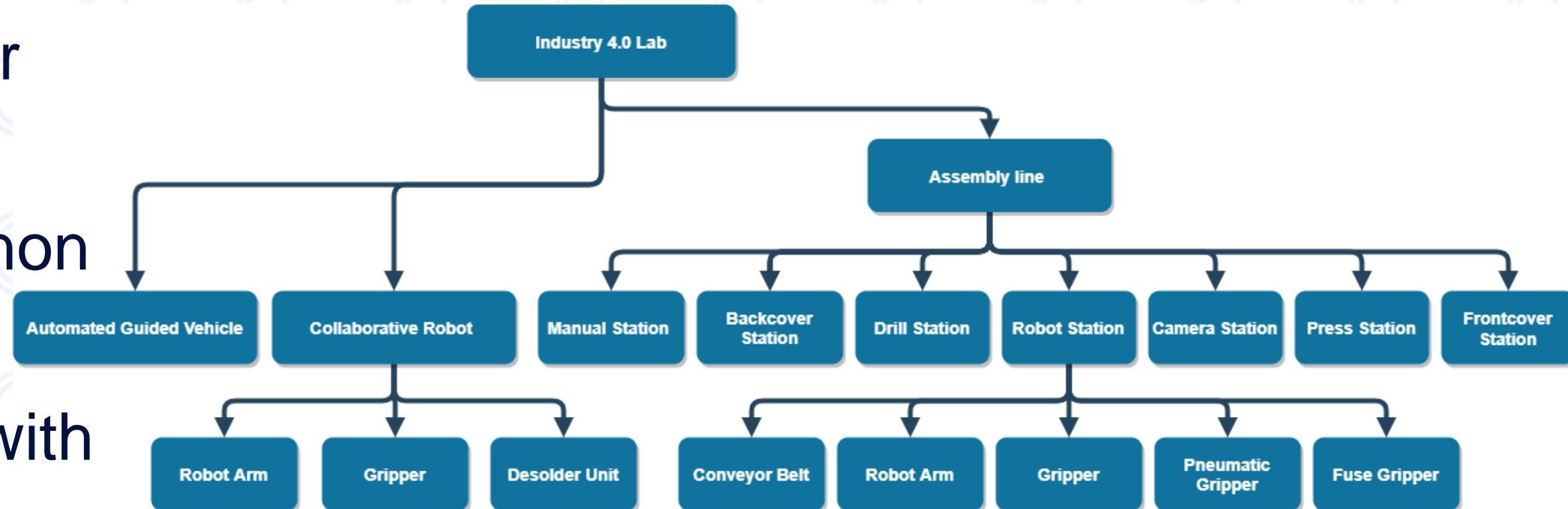
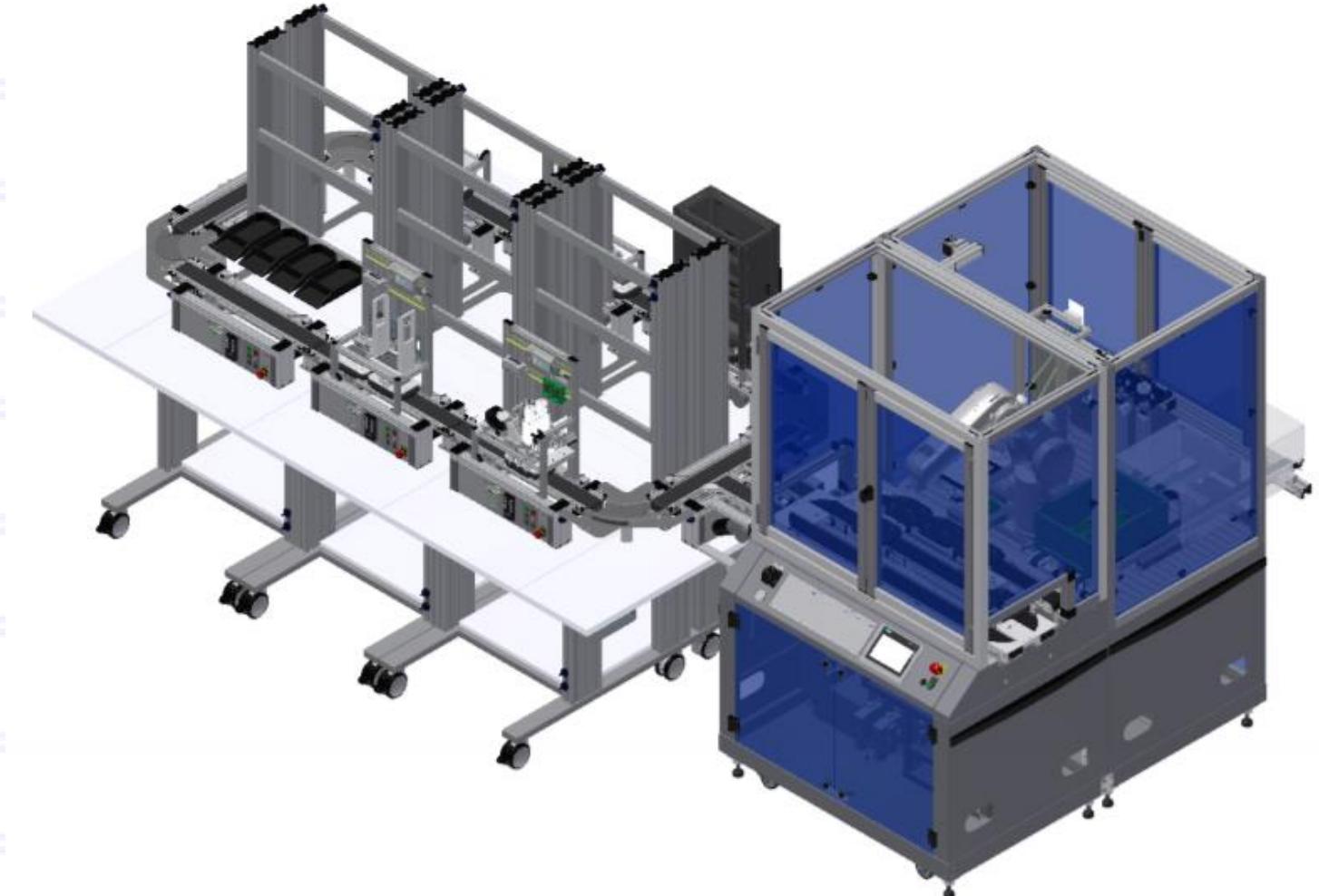
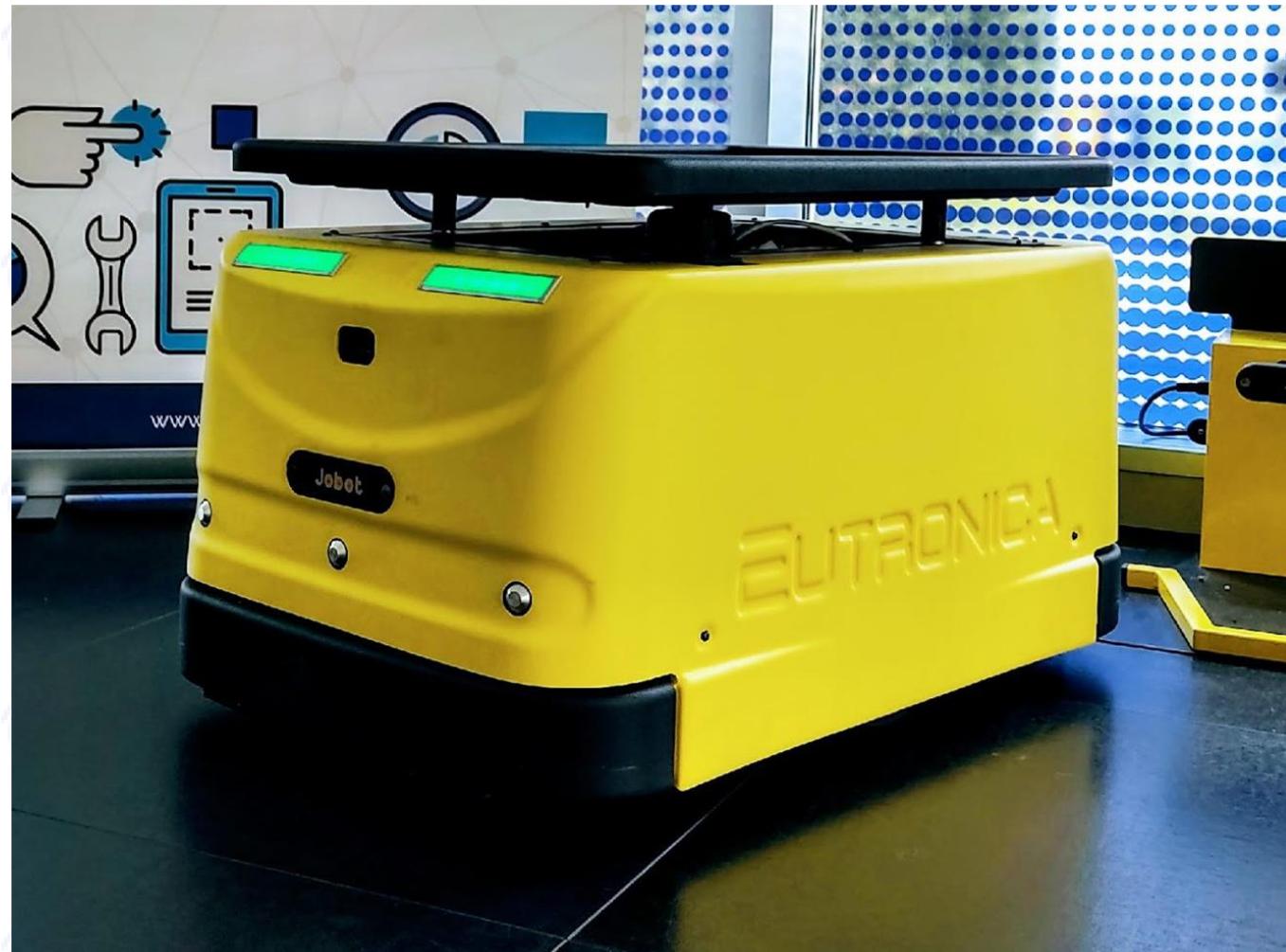
# Demonstration in industrial example: Drumline at Whirlpool EMEA

- 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

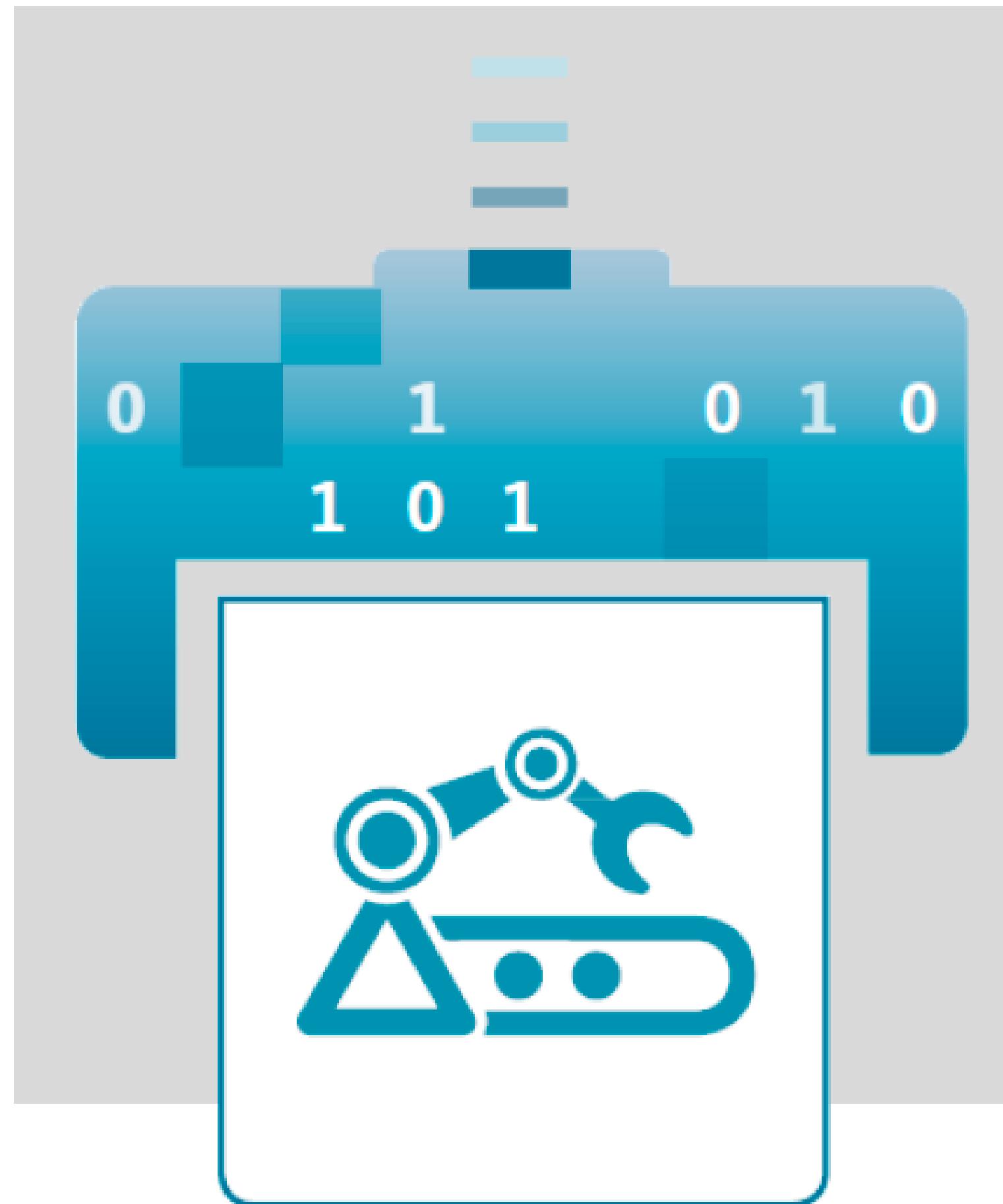
<https://www.eclipse.org/papyrus/components/manufacturing/>





# 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*

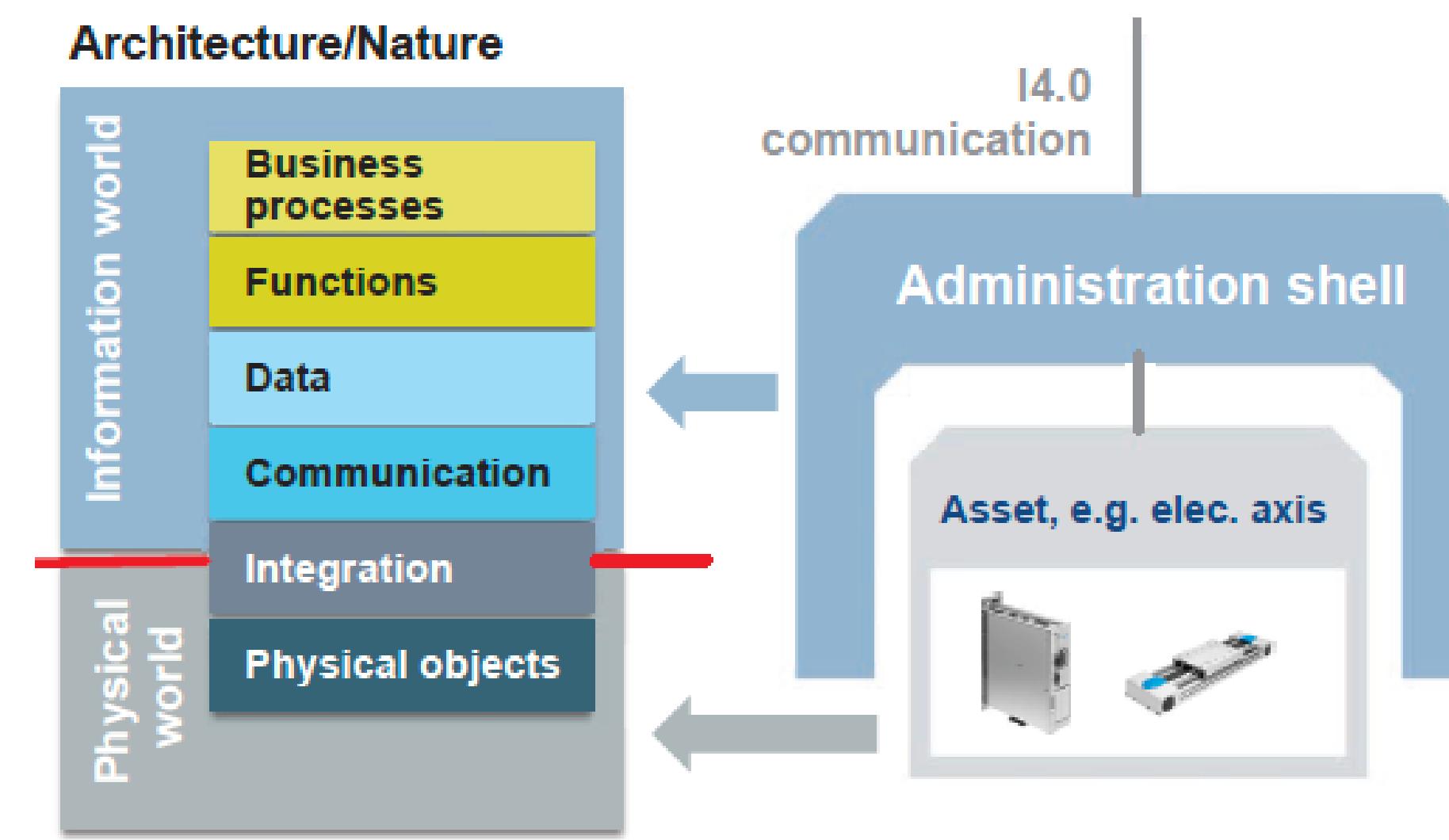


***The Administration Shell is the implementation of the „Digital Twin“ for Industrie 4.0***

# Administration Shell

- The Administration Shell...

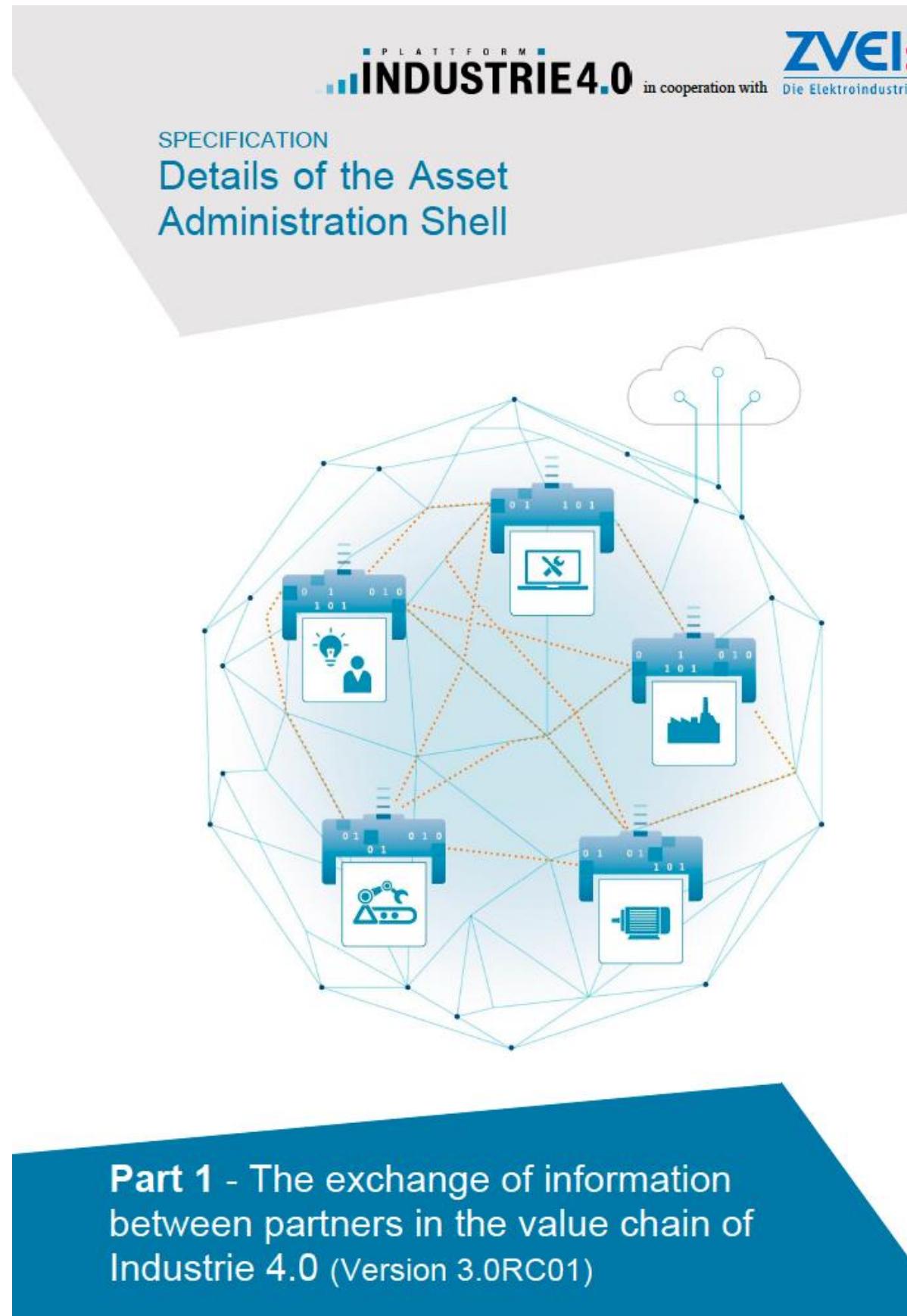
- integrates the asset into Industrie 4.0 communication.
- is addressable in the network and identifies the asset unambiguously.
- provides a controlled access to all information of the asset.
- is the standardised and secure communication interface.
- can integrate intelligent and also non-intelligent („passive“) assets (without a communication interface), e.g. via bar codes or QR codes.



Source: ZVEI SG models and standards

- The connection is made using I4.0 communication
- The administration shell is the digital part
- The asset is the physical part

# Details of the Asset Administration Shell Specification



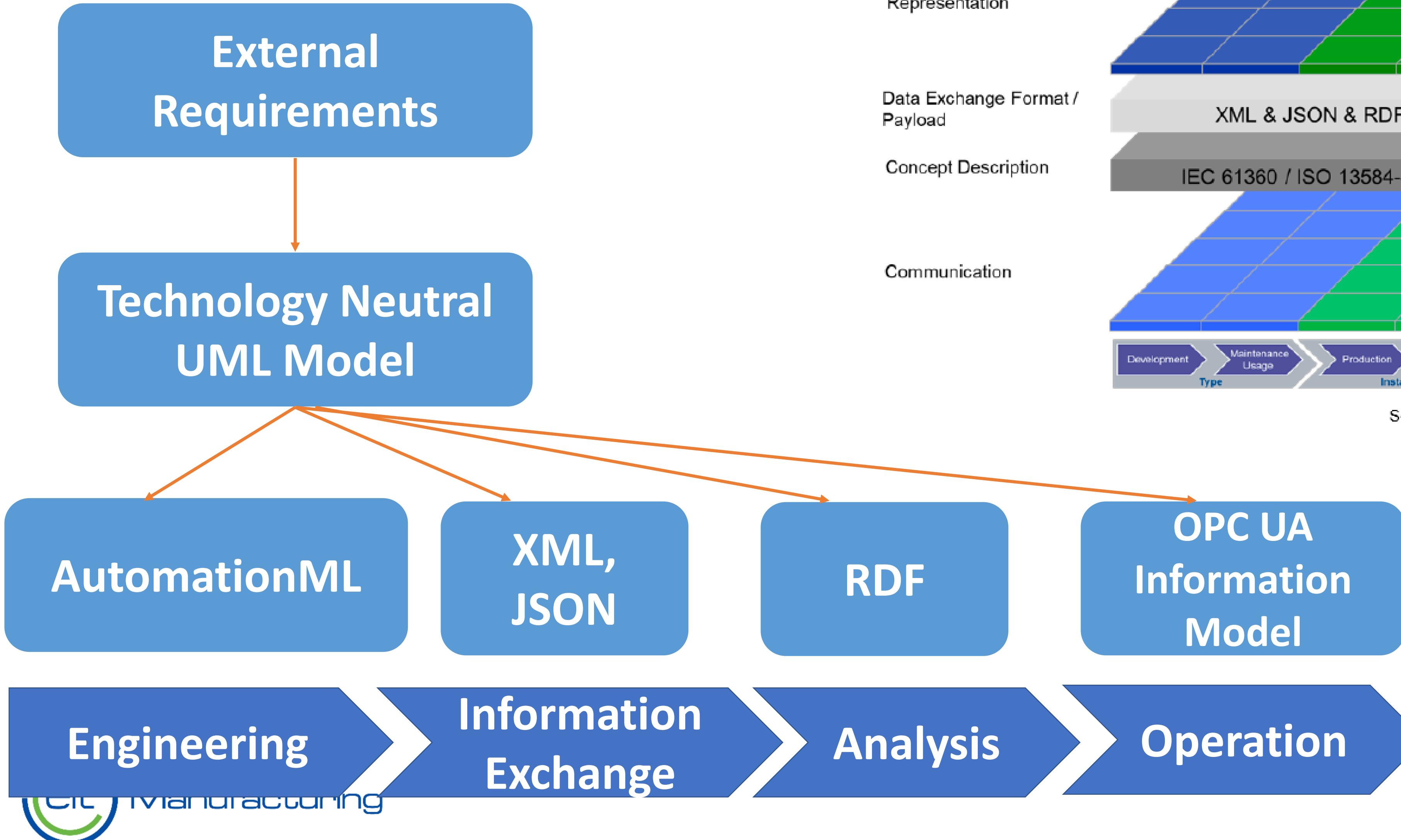
- Scope and content:

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

# Asset Administration Shell

## Approach



Engineering

Information  
Exchange

Analysis

Operation

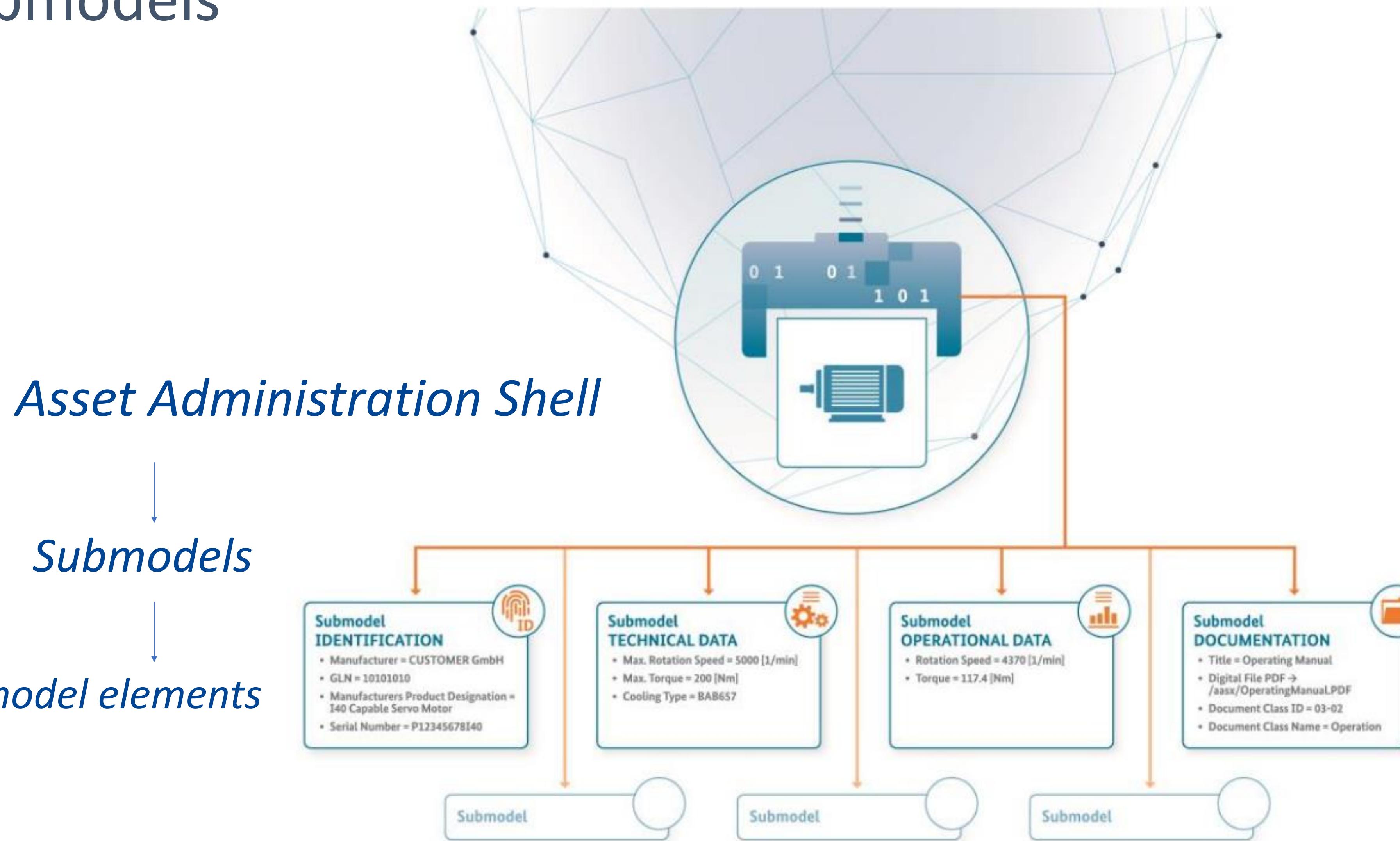


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# Asset Administration Shell

## Submodels

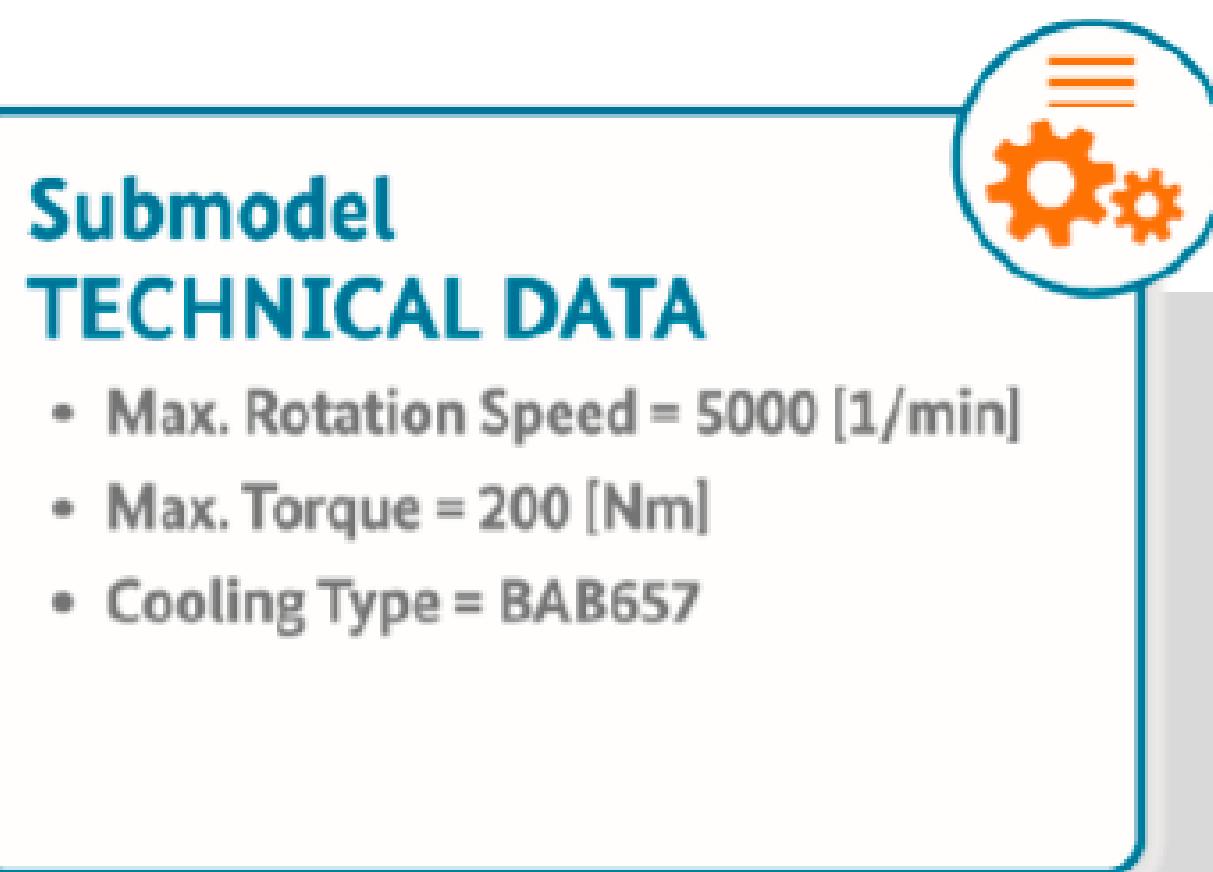


# Asset Administration Shell

## Submodels

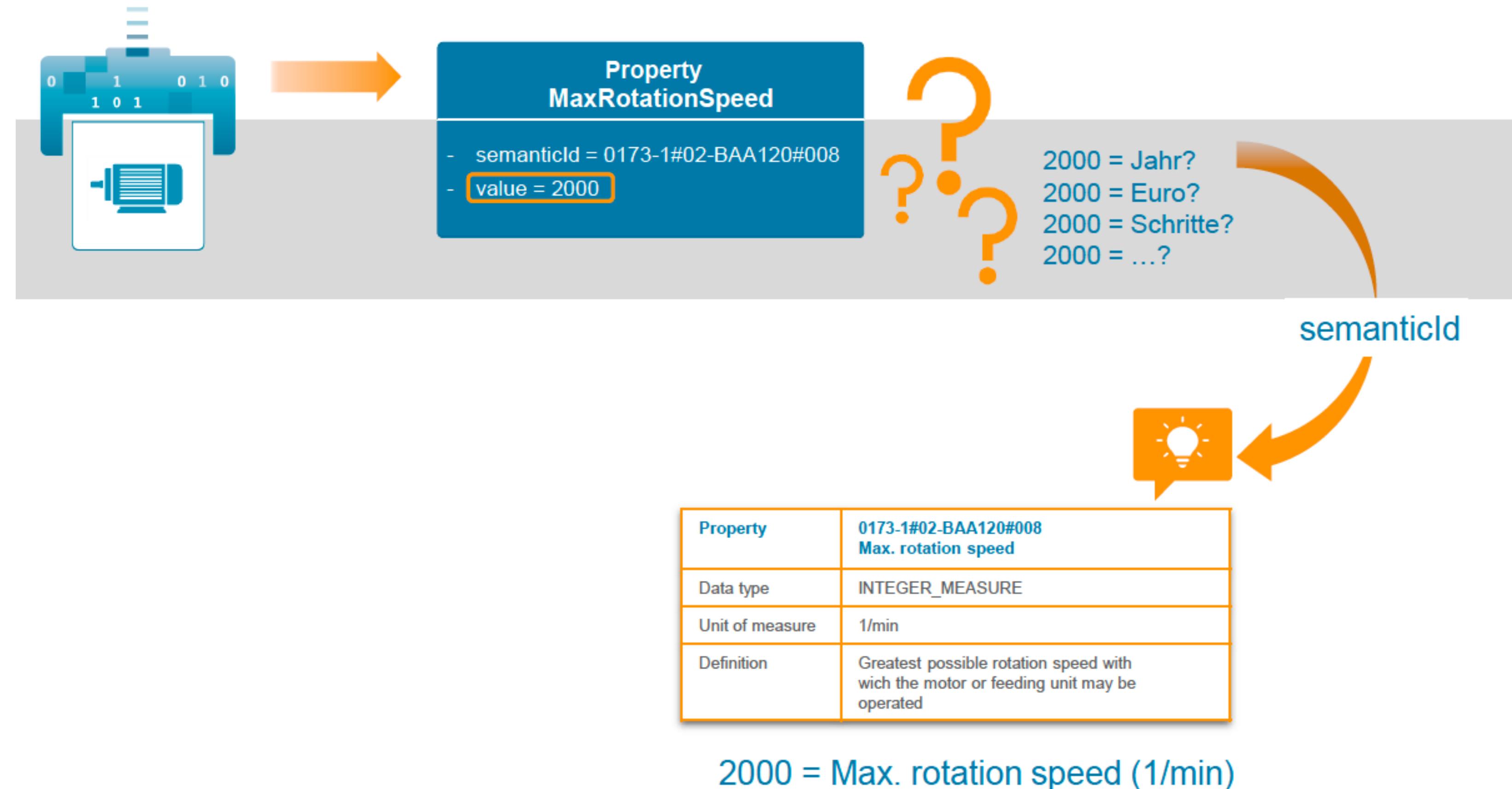
***Describing functional aspects*** for different use cases by using suitable submodel elements

- *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



# Asset Administration Shell

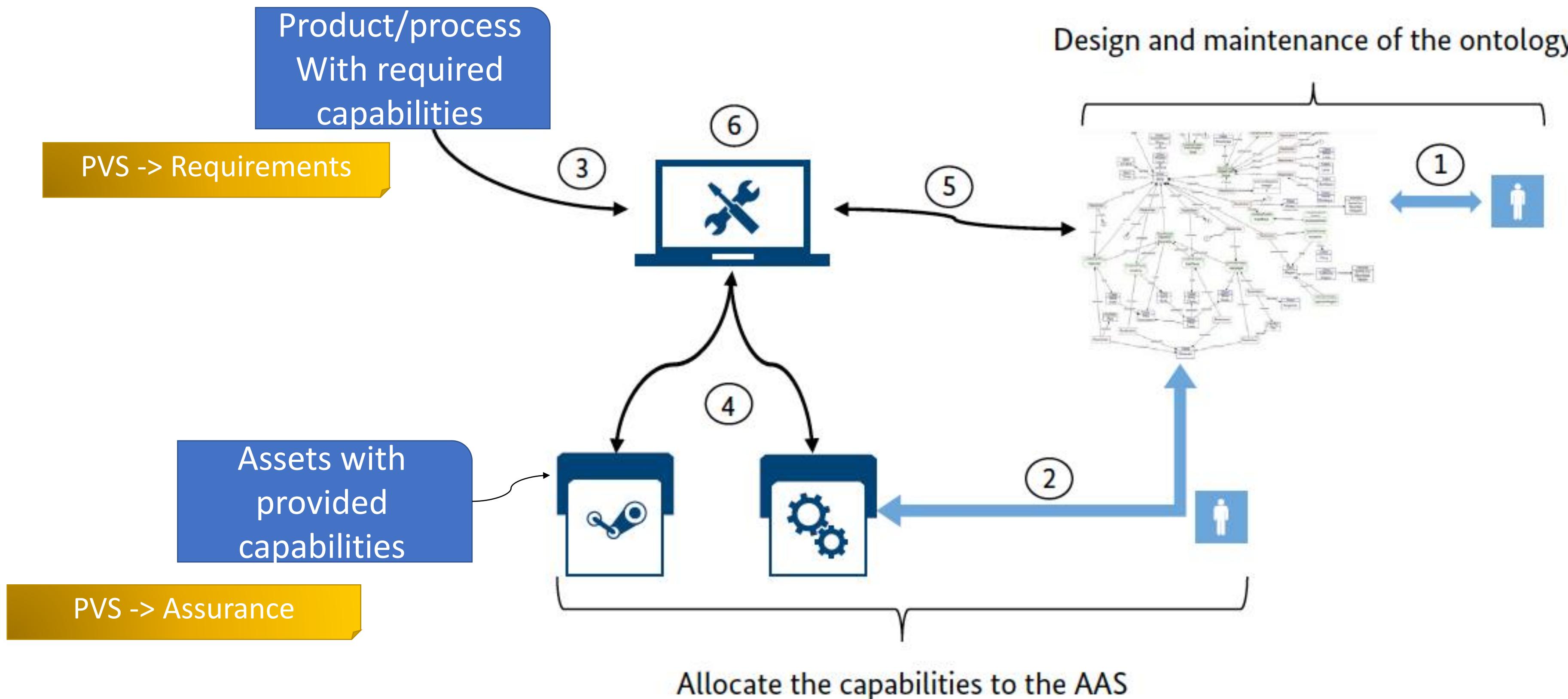
## Semantic Interoperability



# Asset Administration Shell

## Semantic Interoperability

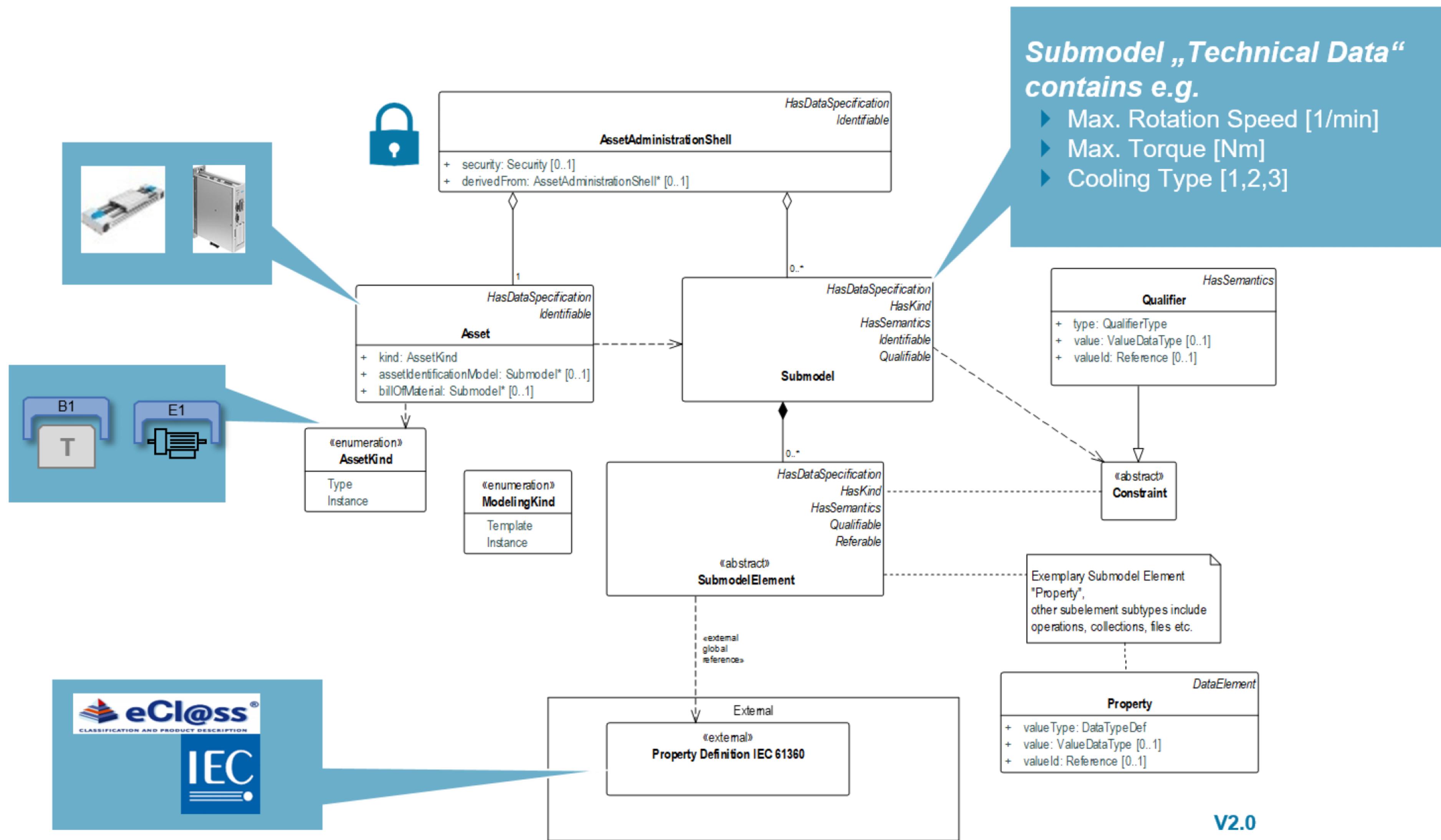
- Capability Checking



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

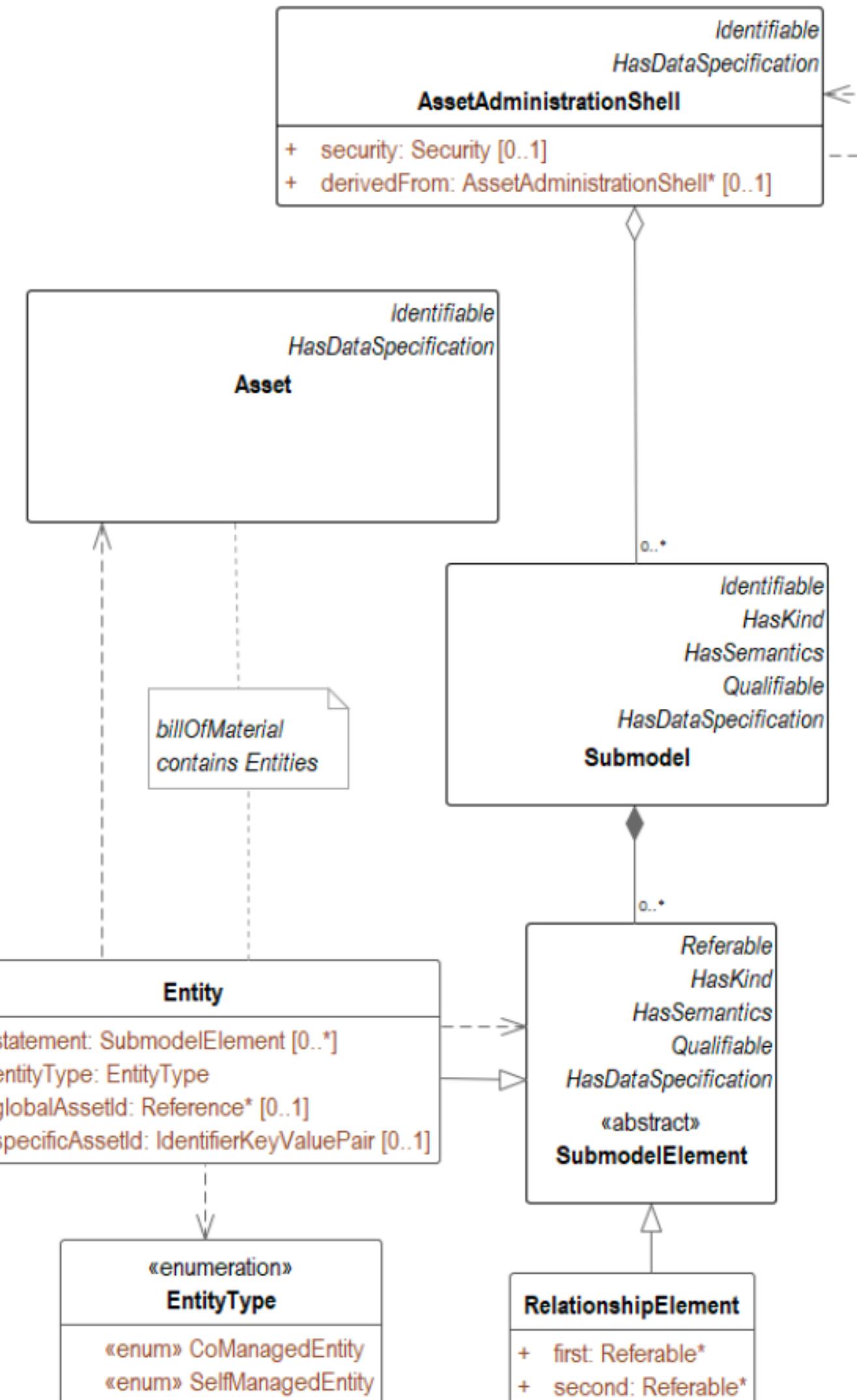
# Asset Administration Shell

## Meta Model - Basics



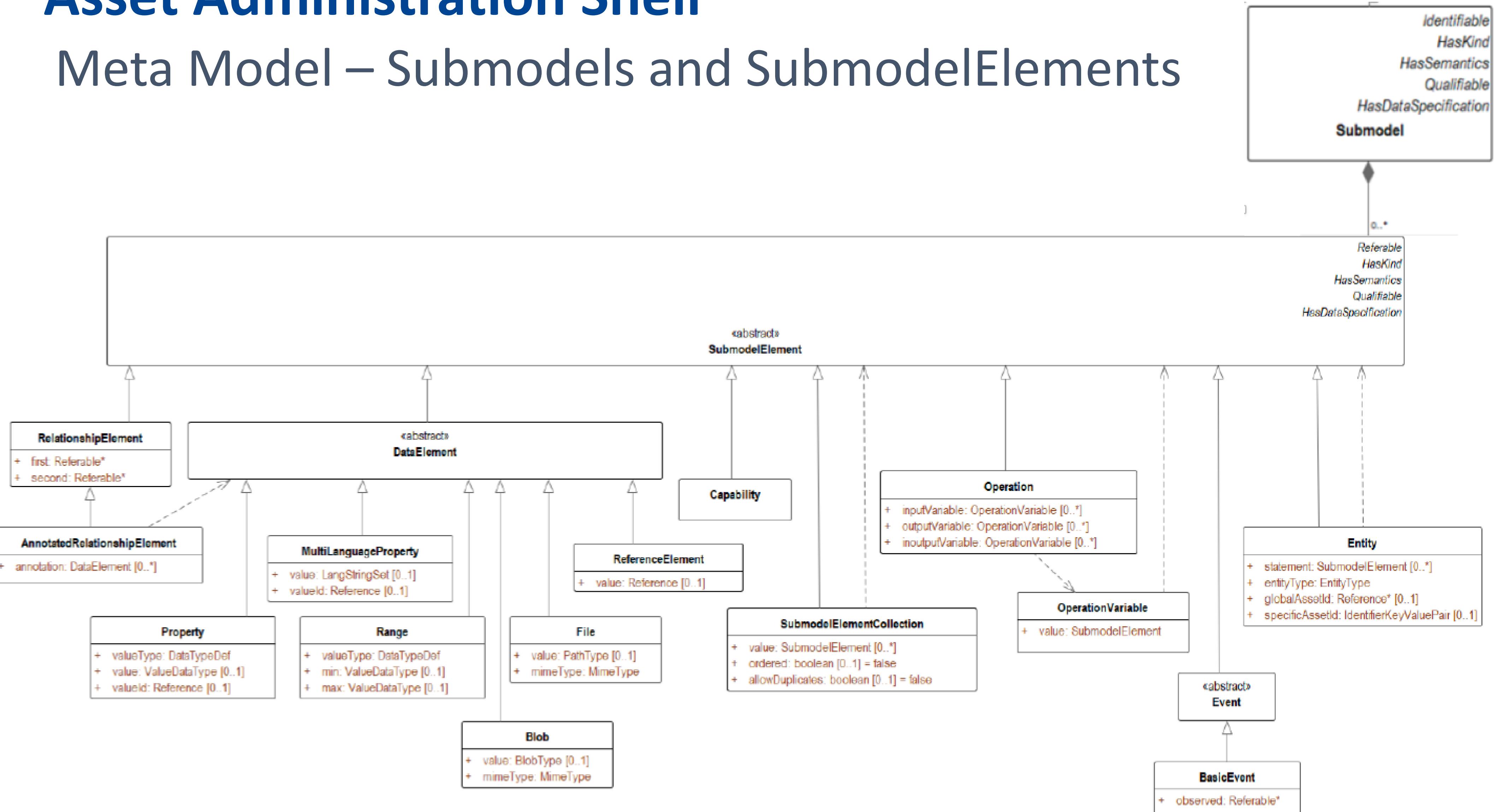
# Asset Administration Shell

## Meta Model – Composite I4.0 Components



# Asset Administration Shell

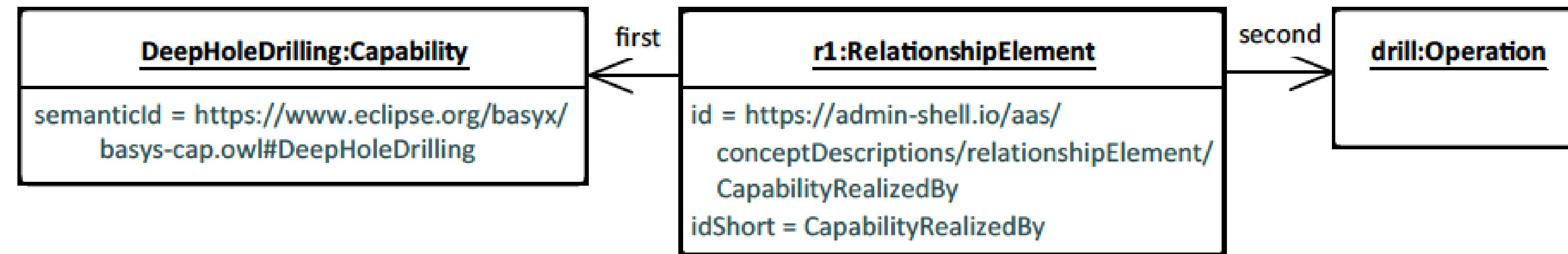
## Meta Model – Submodels and SubmodelElements



# Asset Administration Shell

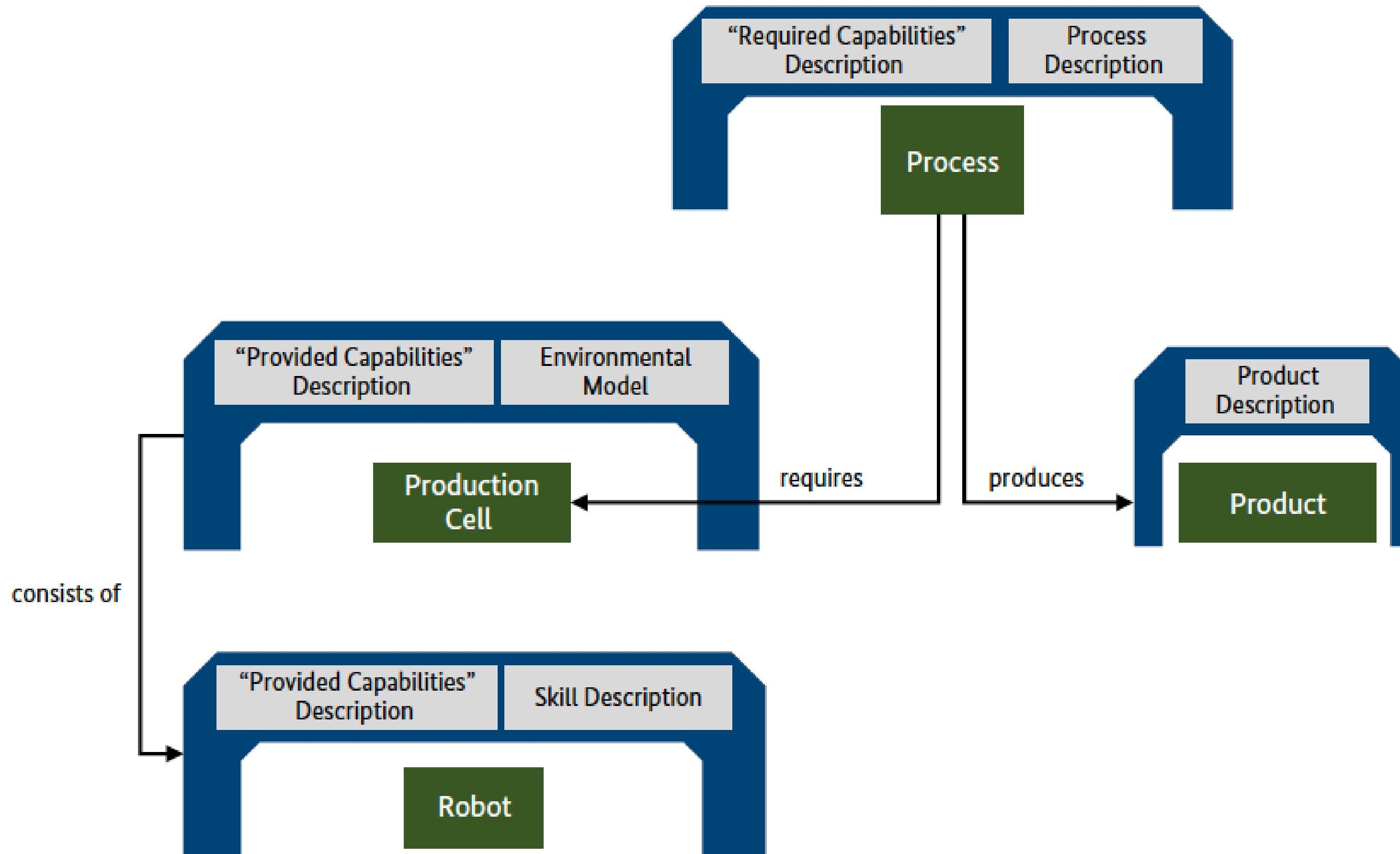
## Meta Model – Capabilities and Skills

### 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

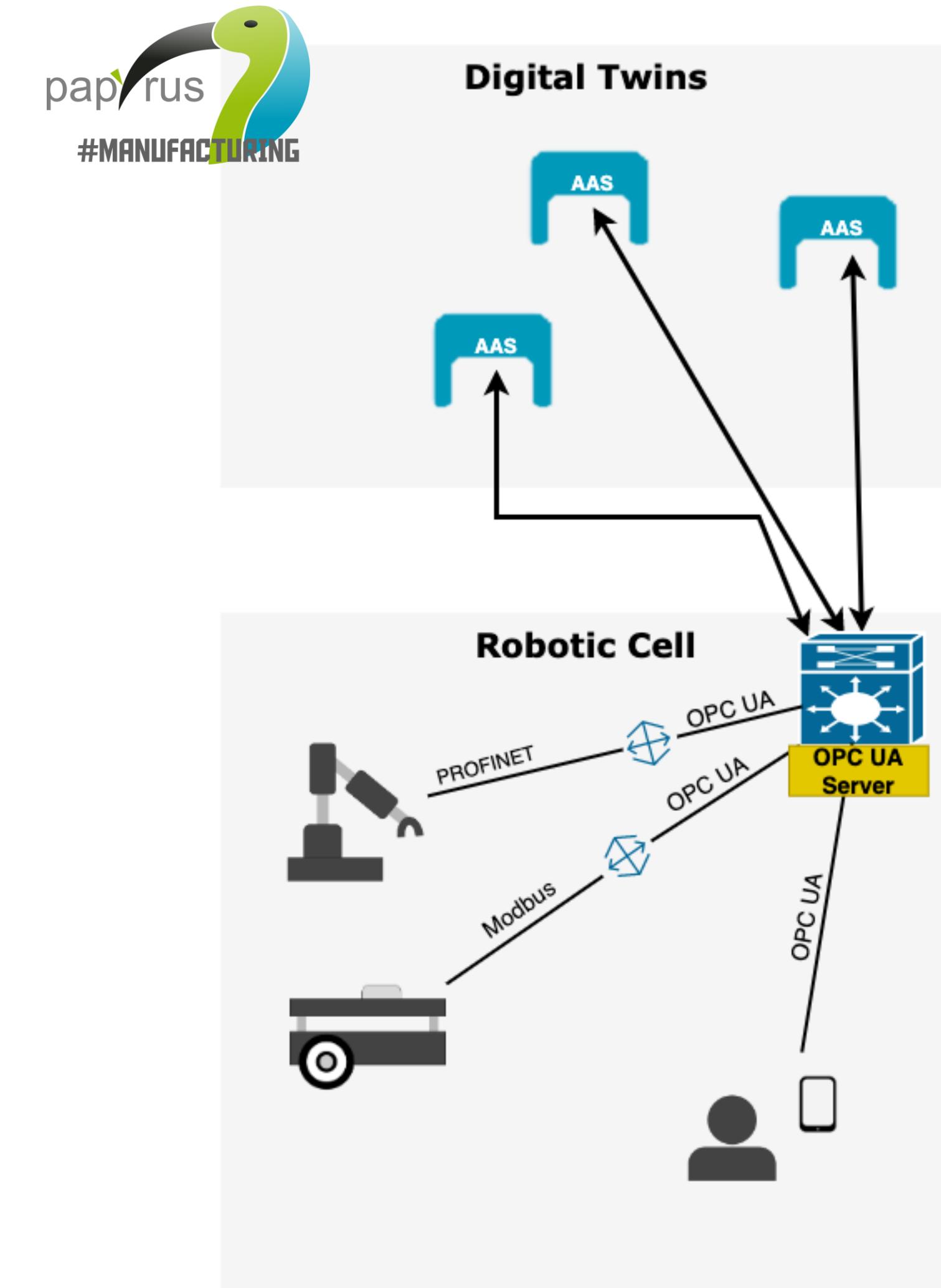


# Papyrus4Manufacturing Tutorial

# PAPYRUS4MANUFACTURING: AAS DESIGNER

- A Model Driven Tool providing:

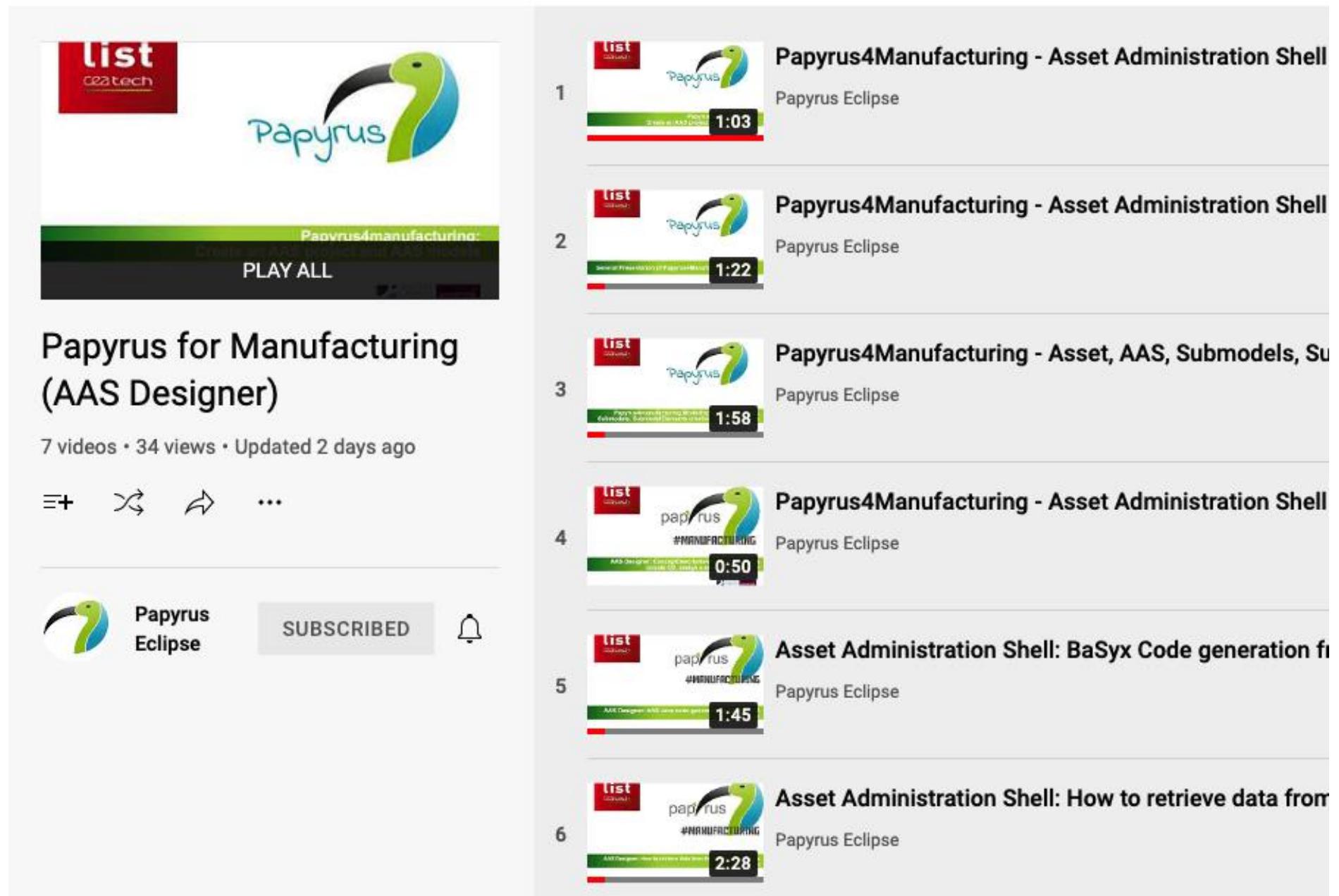
- An Asset Administration Shells Modelling Environment
- Asset Administration Shells automatic deployment to BaSyx
- Digital Twins connectivity to physical assets using the OPC UA protocol



<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=PL9nkS1KDTMm7IH0ucDZ7YjlJyZnwSxTk9>