

# Testbed Asset Administration Shell

Deutsche Messe Technology Academy GmbH



Mittelstand 4.0-Kompetenzzentrum Hannover



**mit uns digital!**  
Individuell. Unabhängig. Vor Ort.

Labs Network Industrie 4.0 e.V.

Co-initiated by: 



October 13th 2020

# Testbed partners

At the beginning



Mittelstand-Digital



Mittelstand 4.0  
Kompetenzzentrum  
Hannover

mit uns digital!  
Individuell. Unabhängig. Vor Ort.



Deutsche Messe  
Technology Academy



FAKULTÄT FÜR  
ELEKTROTECHNIK UND  
INFORMATIONSTECHNIK



Nutzfahrzeuge



SENNHEISER



WITTENSTEIN

micronex  
Electronic systems



adstec

seioTec  
digital change



ELYSIS Group

HEKUMA



MANSYSTEM



solutions  
Services IT<sup>2</sup>



hilscher  
COMPETENCE IN  
COMMUNICATION



MITSUBISHI  
ELECTRIC  
Changes for the Better



CEDALO  
ORCHESTRATING IDT AND THE DIGITAL INDUSTRY

Allisa

BECKHOFF

SIEMENS

Ingenuity for life



SCHMERSAL  
Safe solutions for your industry



Leuze electronic

the sensor people

In cooperation with

PLATTFORM  
INDUSTRIE 4.0



STANDARDIZATION  
COUNCIL  
INDUSTRIE 4.0



ZVEI:  
Die Elektroindustrie

bitkom



FESTO



BOSCH

# Plattform Industrie 4.0 in Germany

## 2030 VISION FOR INDUSTRIE 4.0

Shaping Digital Ecosystems Globally

PLATTFORM  
**INDUSTRIE4.0**

### 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

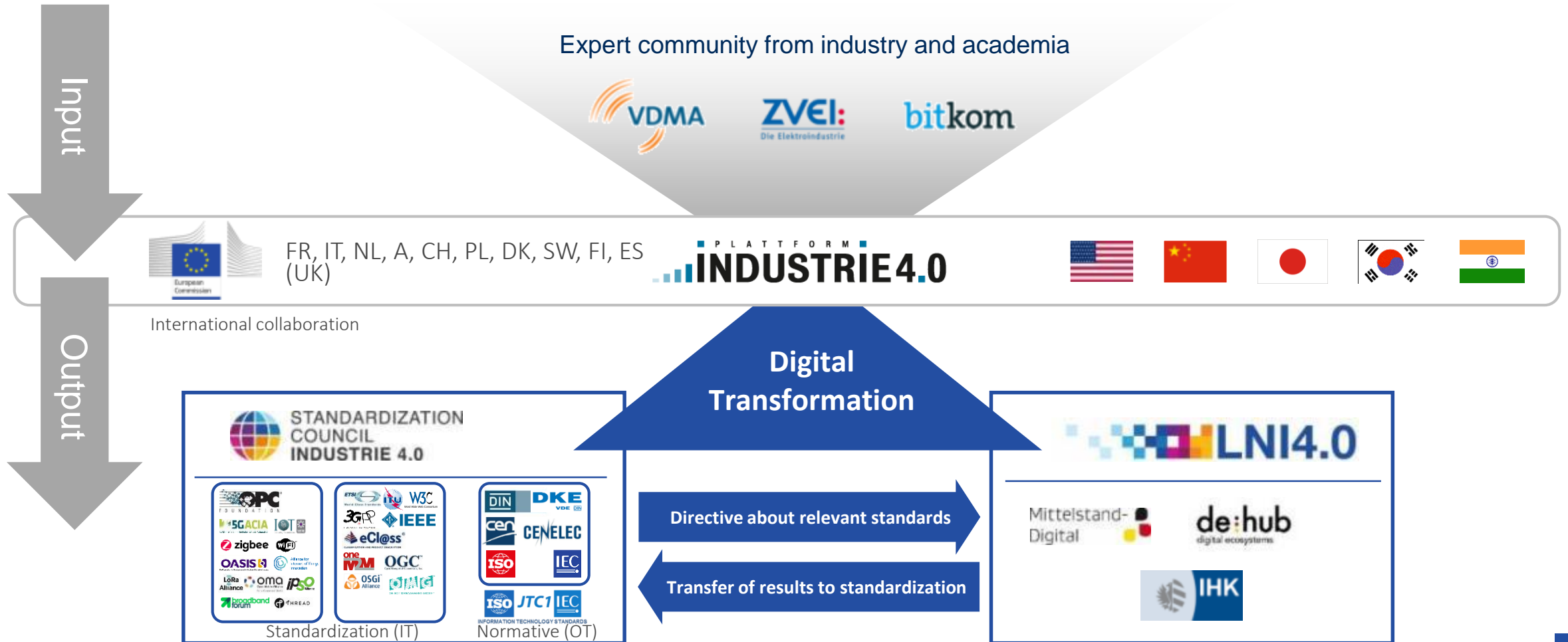
### Sustainability

Modern industrial value creation ensures high standard of living.

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

# Industrie 4.0 Stakeholders

Setup in Germany







Deutsche Messe Technology  
Academy  
&  
Worldwide largest 5G Network on  
the fairground in Hannover

Networking the industry





# Deutsche Messe Technology Academy

## Campus for Digitisation - Volkswagen Commercial Vehicles

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**Deutsche Messe**  
smart venue

# PROJECT DESCRIPTION



# INITIAL SITUATION

- The Hanover exhibition center will be further developed into a unique, highly innovative multifunctional campus with a comprehensive 5G infrastructure
- The 5G network will be available in all halls, on the outdoor area and in the buildings of Deutsche Messe Technology Academy
- **One of the largest private 5G networks worldwide is created**
- Enable new services at existing trade fairs and exhibitions
- Enrich existing trade fairs with the practical demonstration of new industry solutions
- Enable the further development and testing of new applications and solutions in a protected and controlled environment
- Represent a real laboratory (living lab) in which visionary applications can be born and tested before they need approval
- The LNI 4.0 testbed could be the central test facility for this living lab



# FLÄCHENDECKENDES PRIVATES UND ÖFFENTLICHES 5G-NETZ





# | CURRENT PLANNING

- Start with a “non-stand-alone solution” in the transition from LTE → 5G from 2020 (real 5G probably in 2021)
  - Combination of public and private 5G network offers maximum spectrum
  - Ensuring local data storage on the exhibition site
- Additional equipment for initially 1-2 halls and in the Technology Academy with fully redundant network technology
  - Independent technical operator
  - Successive expansion of the infrastructure based on demand





## >> Competence Centers: Supporting SME locally

### Mittelstand-Digital: 26 Competence Centers

supporting SME locally with Information,  
Sensation, Qualification and Expert knowledge



Mittelstand-  
Digital

Gefördert durch:



Bundesministerium  
für Wirtschaft  
und Energie

aufgrund eines Beschlusses  
des Deutschen Bundestages

### The Competence Centers Hannover



**Mittelstand 4.0**  
Kompetenzzentrum  
Hannover

**mit uns digital!**  
Individuell. Unabhängig. Vor Ort.

### Project partners:



Produktionstechnisches  
Zentrum Hannover



### Expert network:

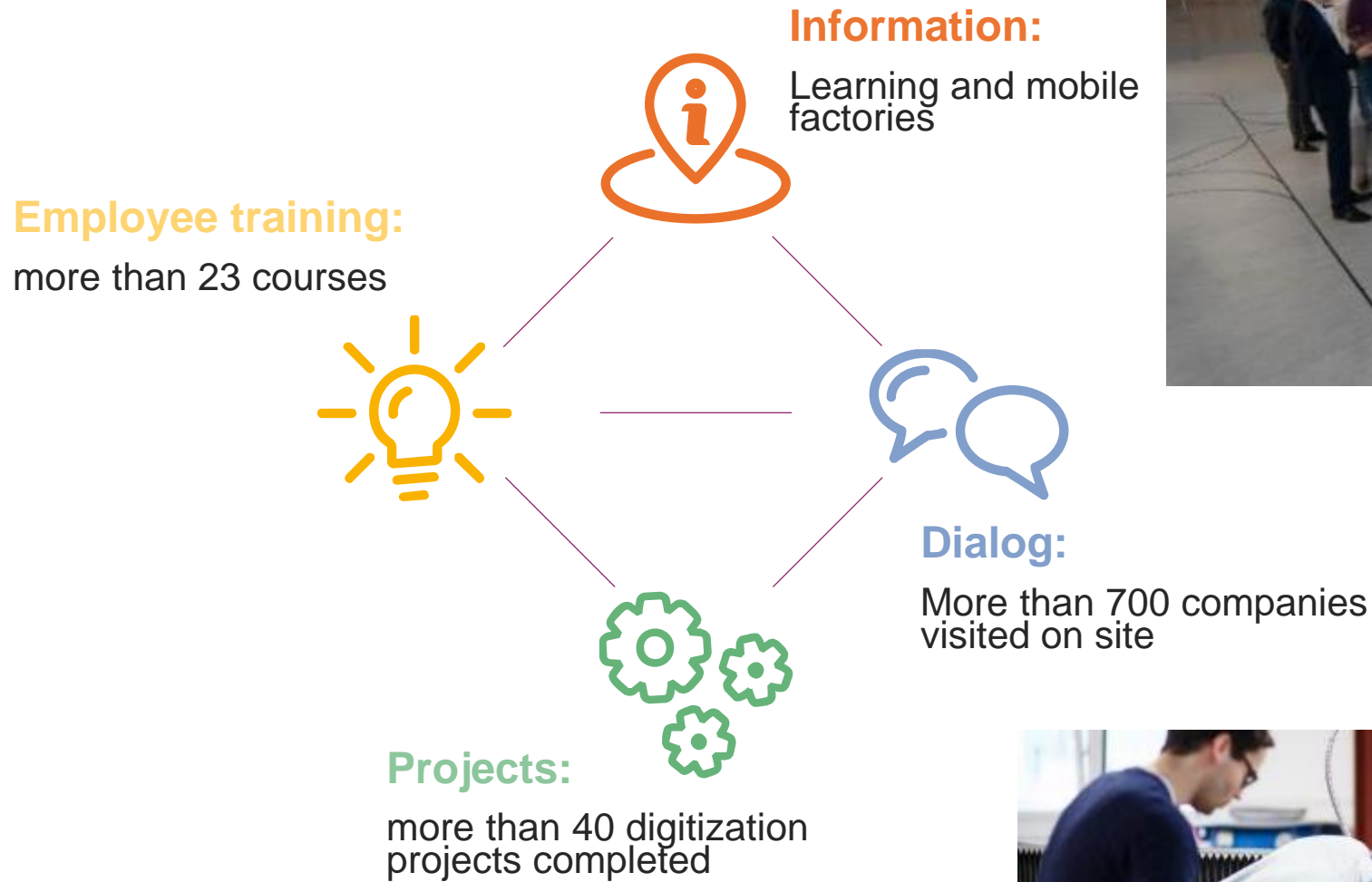


**SOFI**

herfurth.partner  
RECHT INTERNATIONAL



# >> The Competence Center Hannover



# New Testbed: Asset Administration Shell (AAS)\*,\*\*

at DEUTSCHE MESSE Hannover exhibition area hall 36



\*Interoperability

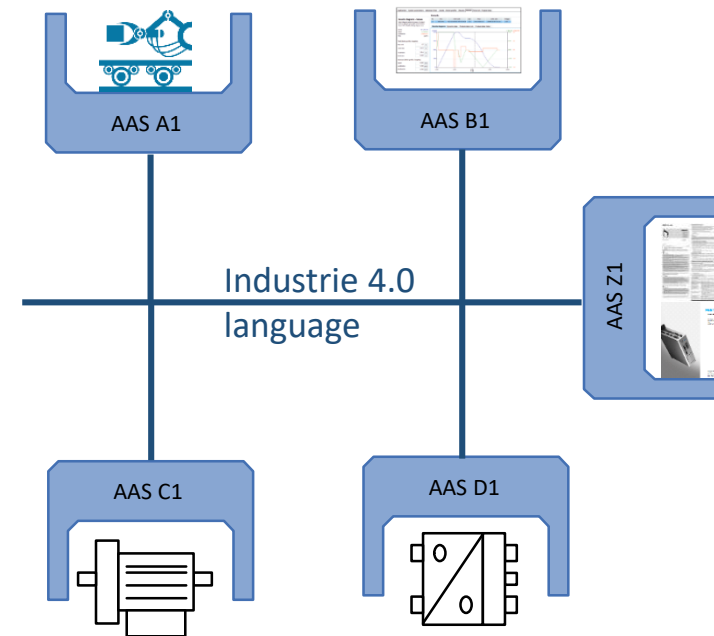
\*\*5G connectivity as a major pre-requisite for interoperability



# Testbed goal

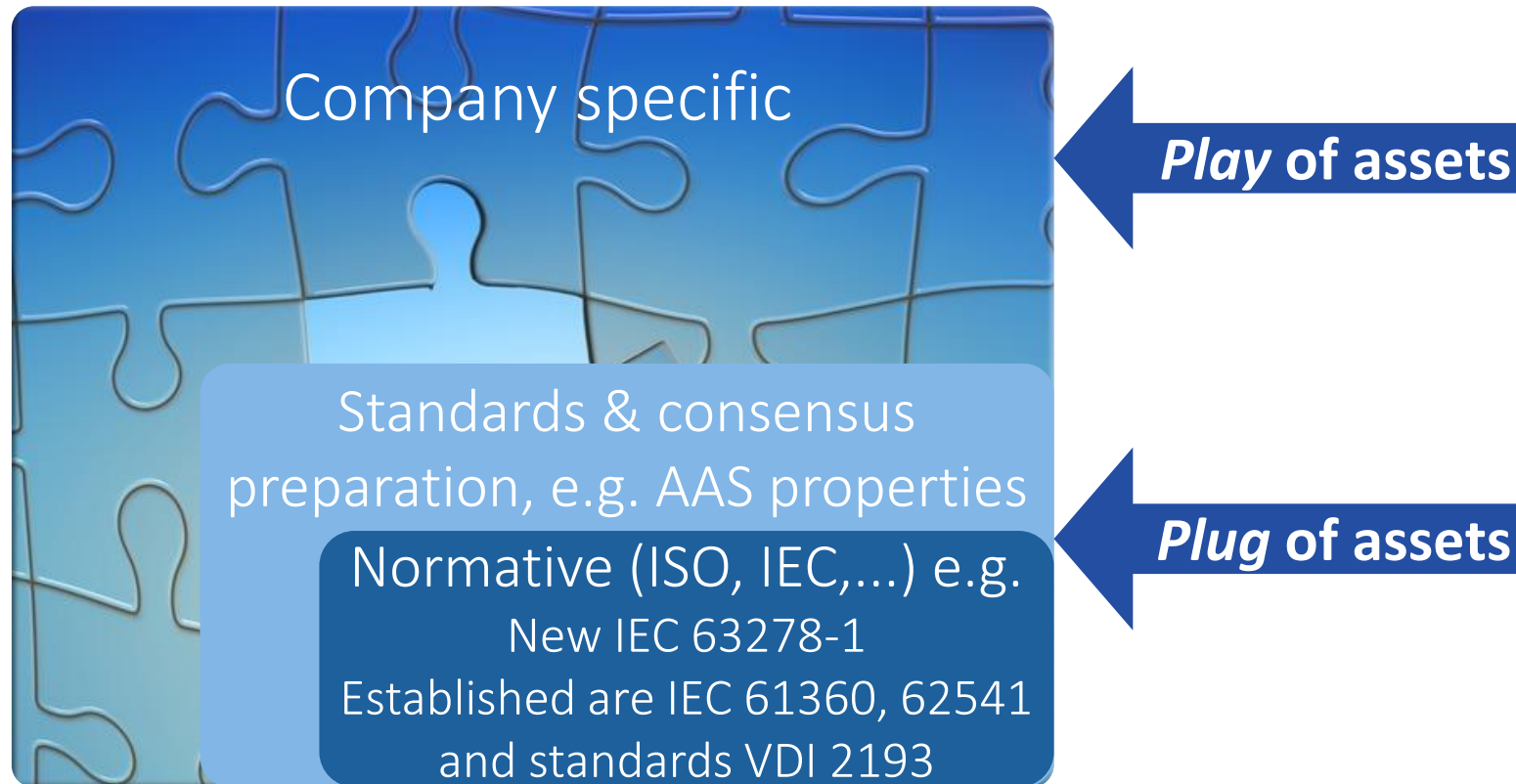
Why (Influence and speed-up international standardization)

- Validation of the Asset Administration Shell (AAS)
- Support new IEC 63278-1, etc.
- Interoperability among all assets at as little cost as possible
- Assets are humans, products, production, facilities, supplies over the entire life cycle incl. contracting
- Digital twin
- Connectivity with 5G is available
- Build a demonstrator
- Education and up-skilling

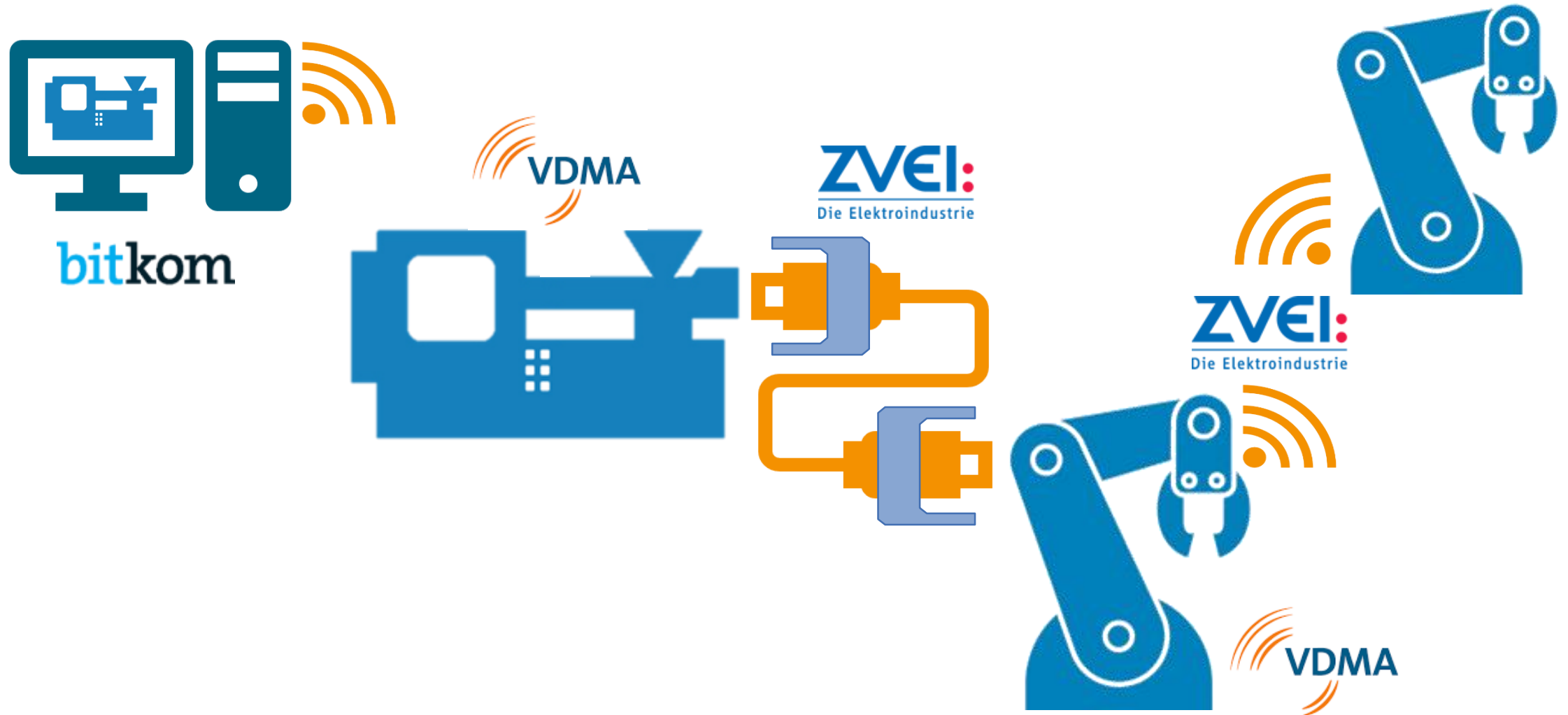


# Testbed

Why (Influence and speed-up international standardization)



# Association collaboration for AAS





# Asset Administration Shell

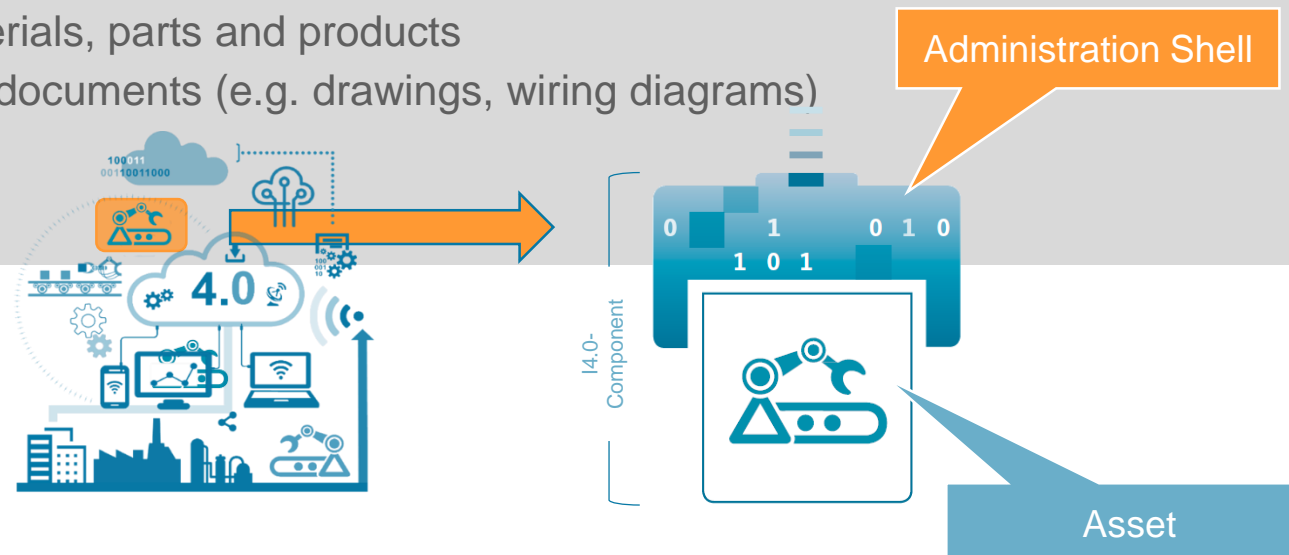
## Asset

Integration of *assets and the humans* into the world of information

Asset = everything that requires a "connection" for an Industrie 4.0 solution  
= is an item an organization has interest in

- ▶ People
- ▶ Machines and their components
- ▶ Supply materials, parts and products
- ▶ Exchanged documents (e.g. drawings, wiring diagrams)
- ▶ Contracts
- ▶ Orders,...

PLATFORM  
INDUSTRIE4.0



# Asset Administration Shell

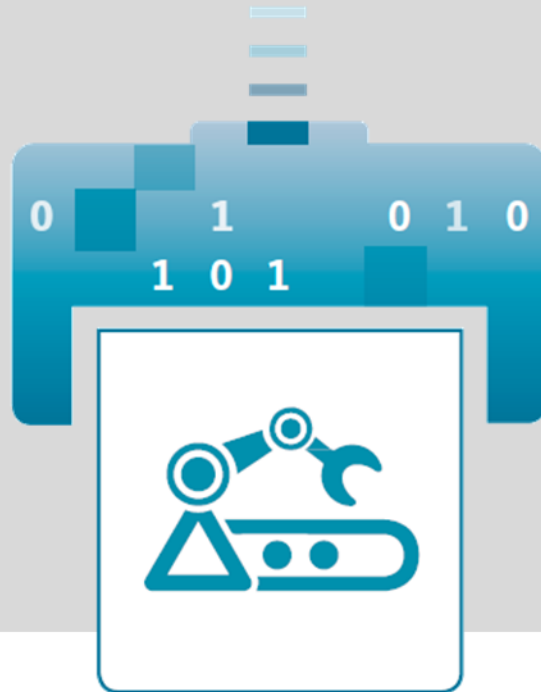
What is it

- ▶ The Administration Shell is the **implementation of the „Digital Twin“** for Industrie 4.0
- ▶ The Administration Shell establishes **cross-company interoperability**.
- ▶ The Administration Shell is available for **non-intelligent and intelligent products**.
- ▶ The Administration Shell covers the **complete life cycle** of products, devices, machines and facilities.
- ▶ The Administration Shell enables **integrated value chains**.
- ▶ The Administration Shell is the **digital basis for autonomous systems and AI**.



# Asset Administration Shell

## Digital Twin



### 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*

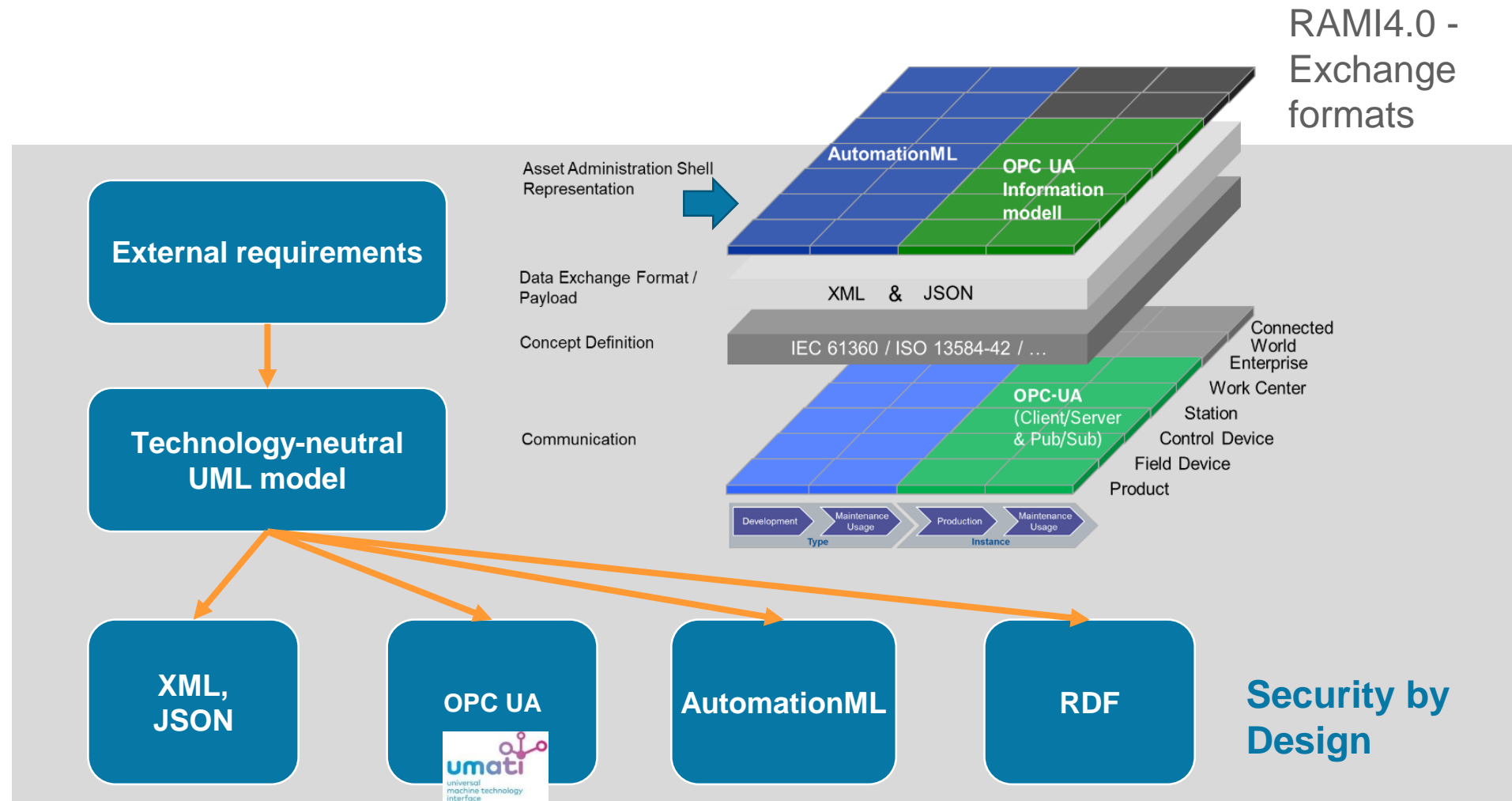


**The Administration Shell is the implementation of the „Digital Twin“ for Industrie 4.0**



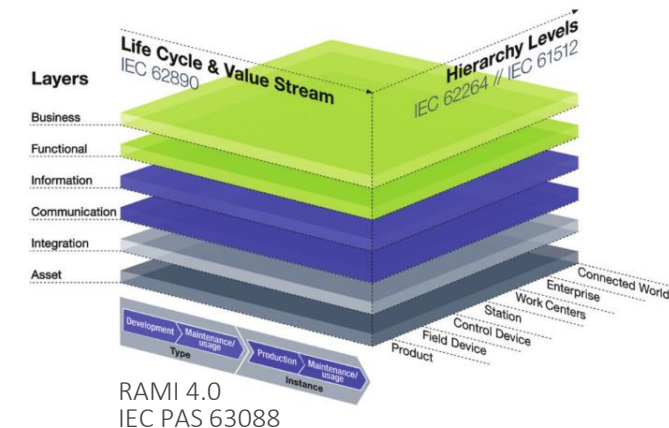
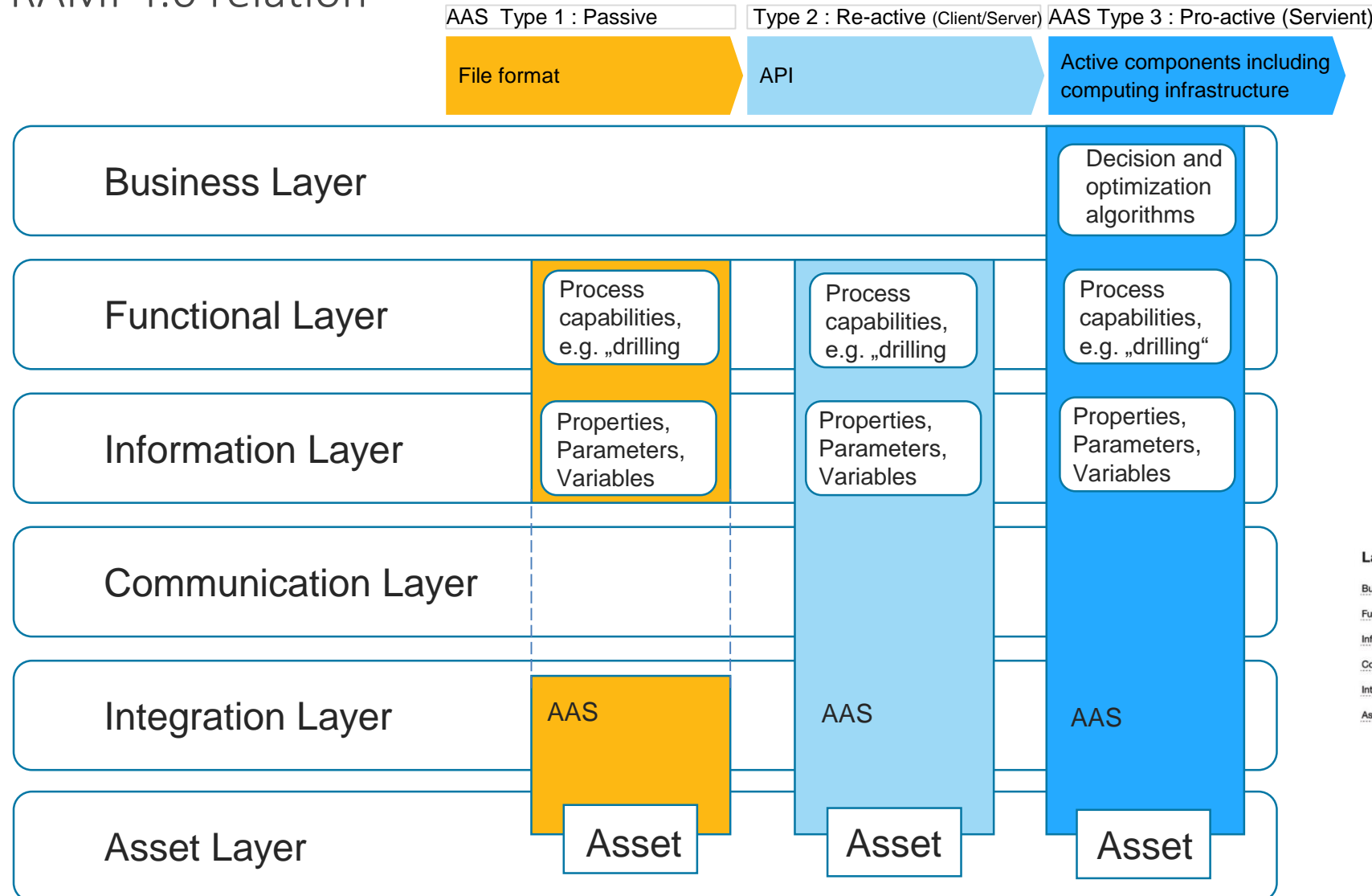
# Asset Administration Shell

## Life cycle & Implementation



# Asset Administration Shell

RAMI 4.0 relation

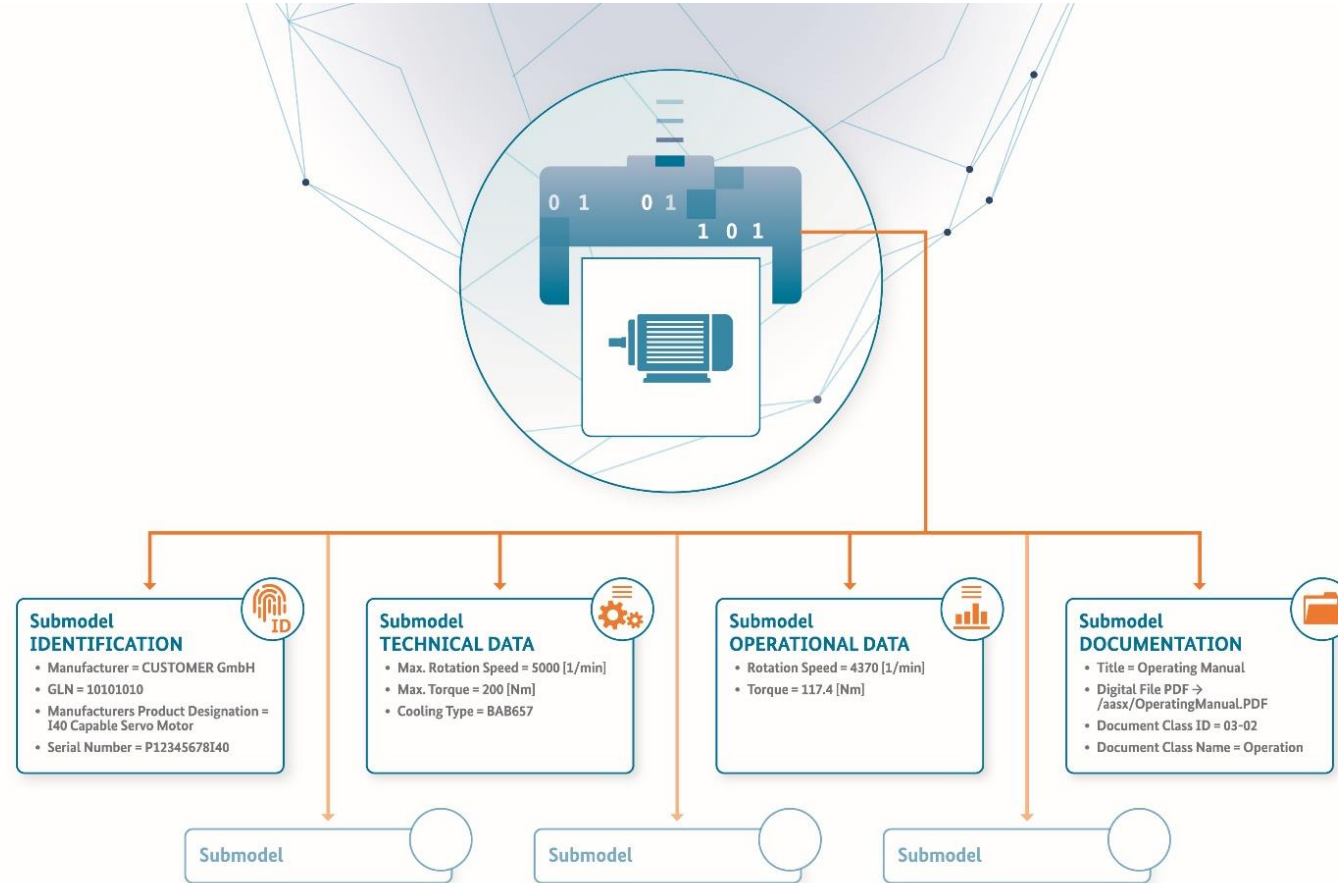






# Asset Administration Shell

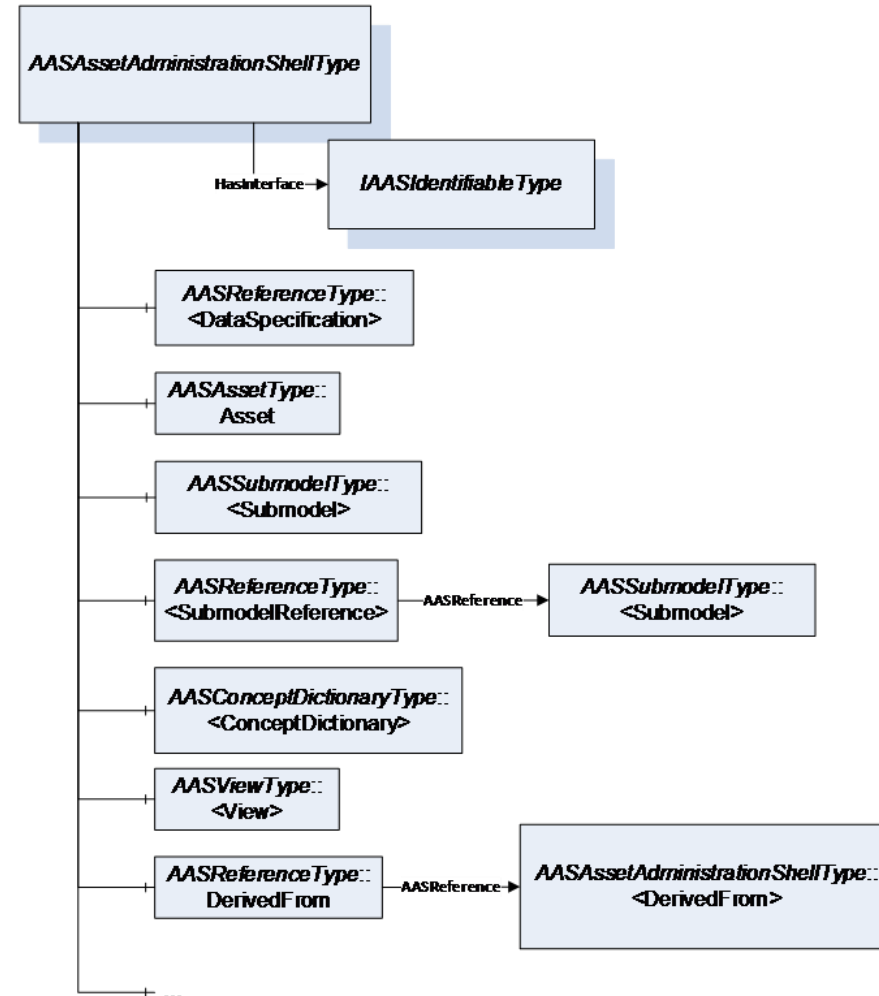
## Sub-models



- **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

VDMA OPC UA companion specifications



Unified Automation Ltd Asset - the OPC Unified Architecture Client - AAS PC

File View Server Document Settings Help

Project: UA Core Sample Server

Address Space: No Highlight

Objects: AASROOT, AAS, Asset, Documentation, Identification, OperationalData, TechnicalData, CoolingType, Identification, Kind, MaxRotationSpeed, Kind, Value, category, hasSemantics, idShort, valueType, category

Server	Node Id	Display Name	Value	Datatype
1	UA Core Sample Server	NS3.Numeric65	Kind	Instance
2	UA Core Sample Server	NS3.Numeric66	category	CONSTANT
3	UA Core Sample Server	NS3.Numeric67	idShort	TechnicalData
4	UA Core Sample Server	NS3.Numeric68	Key	GlobalReference
5	UA Core Sample Server	NS3.Numeric69	Value	Instance
6	UA Core Sample Server	NS3.Numeric70	category	PARAMETER
7	UA Core Sample Server	NS3.Numeric71	idShort	MaxTorque
8	UA Core Sample Server	NS3.Numeric72	idShort	MaxTorque
9	UA Core Sample Server	NS3.Numeric73	idShort	MaxTorque
10	UA Core Sample Server	NS3.Numeric74	idShort	MaxTorque
11	UA Core Sample Server	NS3.Numeric75	idShort	MaxTorque
12	UA Core Sample Server	NS3.Numeric76	idShort	MaxTorque
13	UA Core Sample Server	NS3.Numeric77	idShort	MaxTorque
14	UA Core Sample Server	NS3.Numeric78	idShort	MaxTorque
15	UA Core Sample Server	NS3.Numeric79	idShort	MaxTorque
16	UA Core Sample Server	NS3.Numeric80	idShort	MaxTorque
17	UA Core Sample Server	NS3.Numeric81	idShort	MaxTorque
18	UA Core Sample Server	NS3.Numeric82	idShort	MaxTorque
19	UA Core Sample Server	NS3.Numeric83	idShort	MaxTorque
20	UA Core Sample Server	NS3.Numeric84	idShort	MaxTorque
21	UA Core Sample Server	NS3.Numeric85	idShort	MaxTorque
22	UA Core Sample Server	NS3.Numeric86	idShort	MaxTorque
23	UA Core Sample Server	NS3.Numeric87	idShort	MaxTorque
24	UA Core Sample Server	NS3.Numeric88	idShort	MaxTorque
25	UA Core Sample Server	NS3.Numeric89	idShort	MaxTorque

Attributes:

Attribute	Value
ModelId	ns-3j-58
NamespaceIndex	3
IdentifierType	Numeric
Identifier	58
NodeClass	Object
DisplayName	TechnicalData
Description	TechnicalData
WriteMask	0
UserWriteMask	0

References:

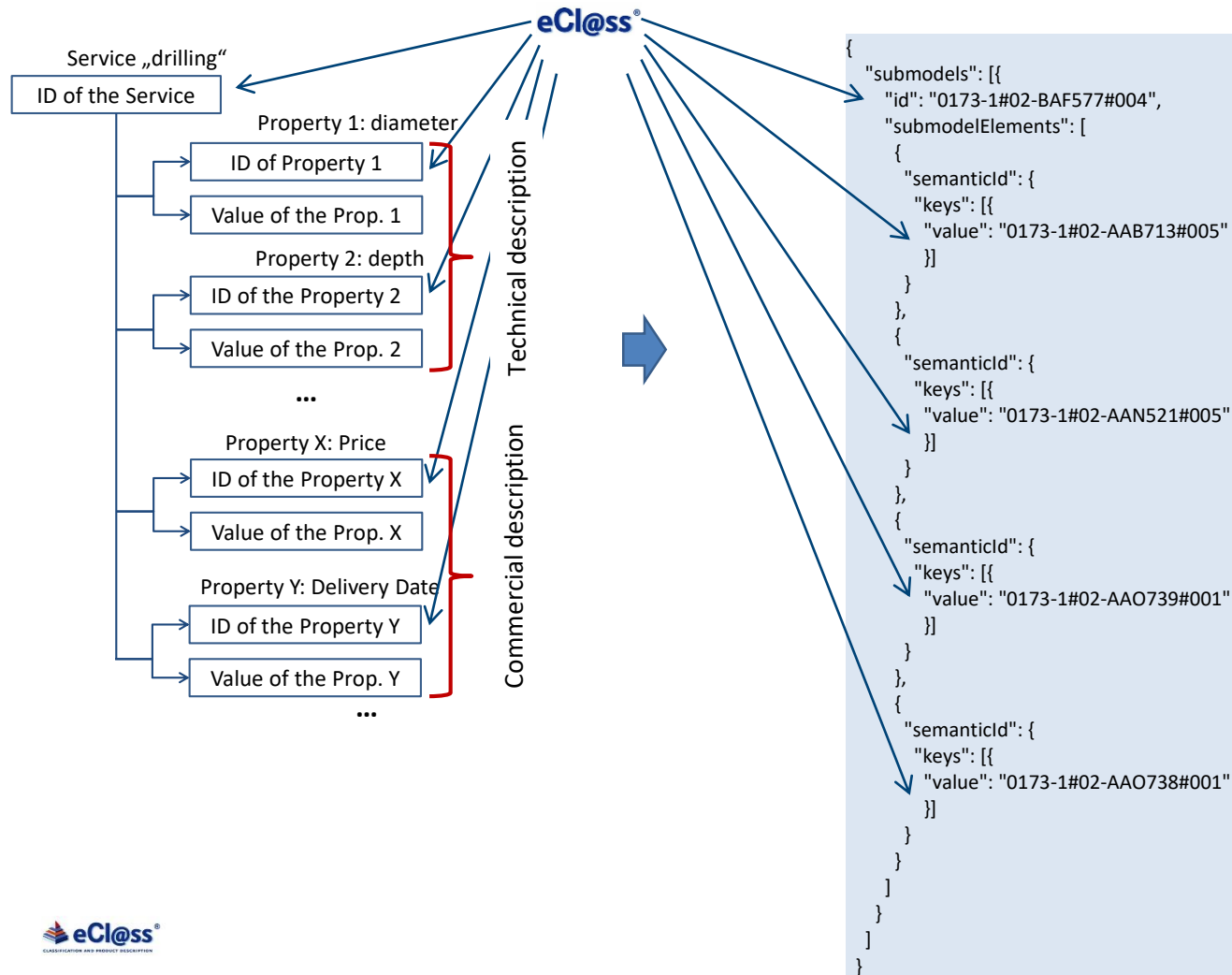
Reference	Target Display Name
HasComponent	Identification
HasComponent	hasSemantics
HasComponent	MaxRotationSpeed
HasComponent	MaxTorque
HasComponent	CoolingType
HasTypeDefinition	SubmodelType
HasProperty	IdShort
HasProperty	category
HasComponent	Identification
HasComponent	hasSemantics
HasProperty	Kind
HasComponent	MaxRotationSpeed
HasComponent	MaxTorque

Log:

Timestamp	Source	Server	Message
10.08.2019 10:38:40.755	Reference Plugin	UA Core Sample S...	Browse succeeded.
10.08.2019 10:38:44.214	Attribute Plugin	UA Core Sample S...	Read attributes of node NS3(Numeric)58 succeeded (ret = Good).
10.08.2019 10:38:44.217	Reference Plugin	UA Core Sample S...	Browse succeeded.

# Asset Administration Shell

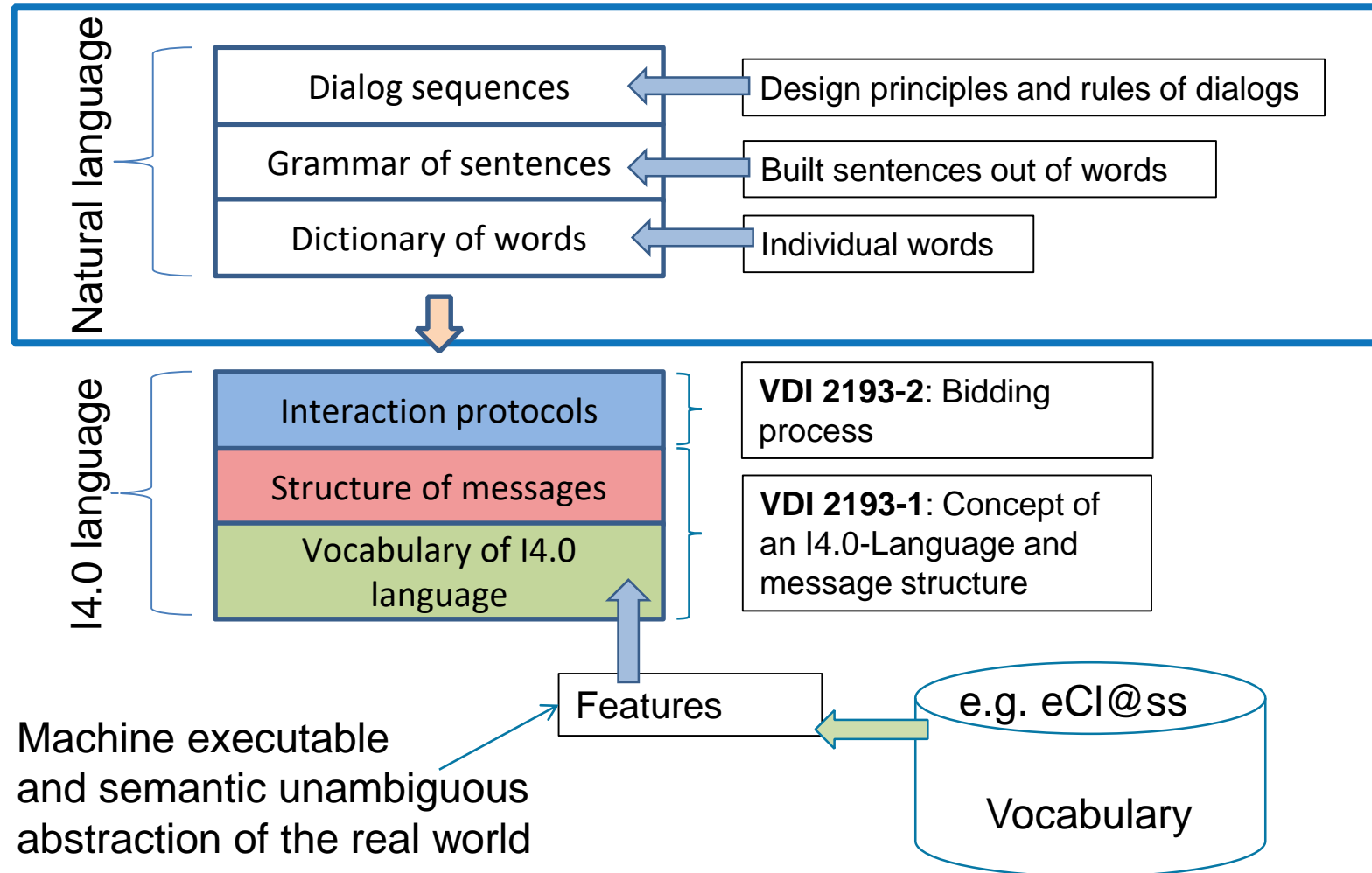
eCl@ss relation





# Asset Administration Shell

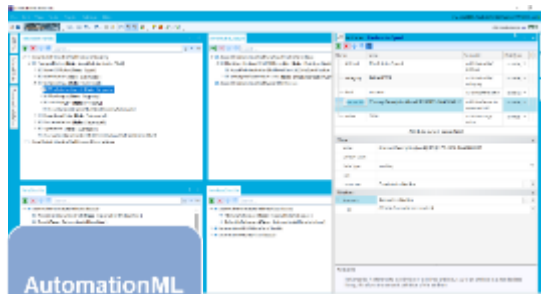
Relation to Industrie 4.0 language (VDI 2193)



# Asset Administration Shell

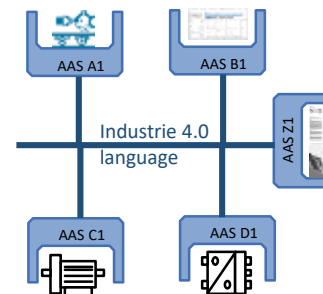
Implementations along the life cycle exist (many are open-source)

Engineering



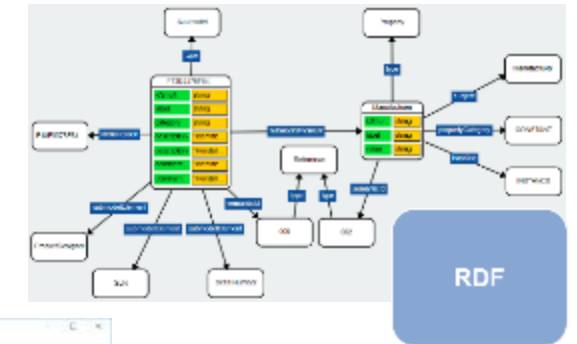
AutomationML

API

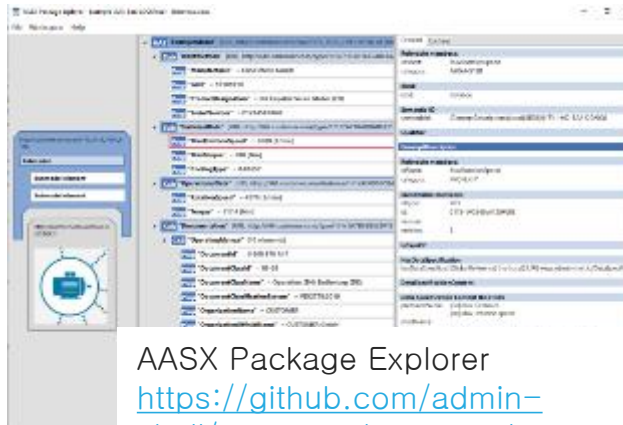


Operations

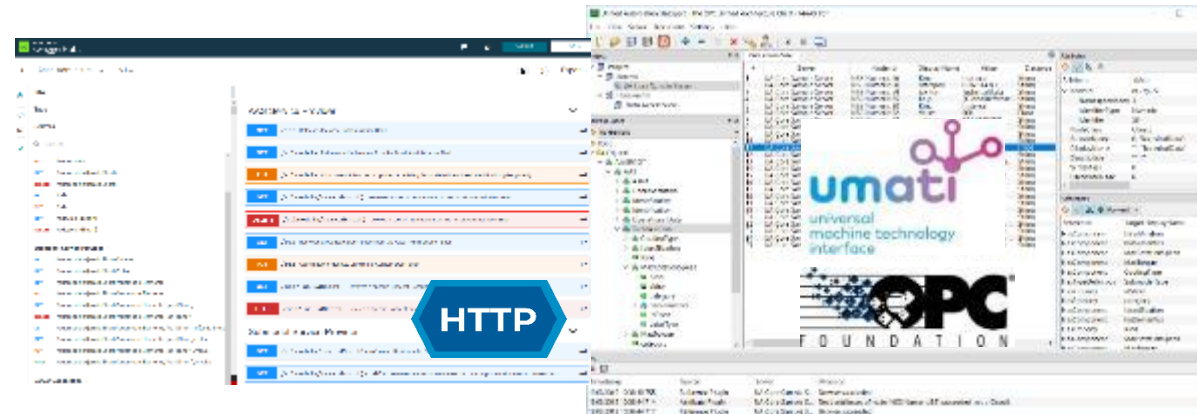
Analyze



RDF



AASX Package Explorer  
<https://github.com/admin-shell/aasx-package-explorer>



HTTP

Development

Type

Maintenance / Usage

Production

Instance

Maintenance / Usage

# Asset Administration Shell

## Standardization

- *IEC PAS 63088* Reference Architecture Model Industry 4.0 (RAMI 4.0)
- *ISO/IEC JWG21* Smart Manufacturing Architecture Reference Model
- *IEC TC 65 WG 23 & WG24* Asset Administration Shell for Industrial Applications
- *IEC 62832* Smart Manufacturing Framework and System Architecture (“Digital Factory”)
- *ISO/IEC JTC 1 AG 11* (Digital Twin)
- *IEEE P2806* System architecture of digital representation for physical objects in factory environments
- Digital Twin Manufacturing Framework *ISO/AWI 23247* within *ISO TC 184 SC4 WG15 (STEP)*





**Thank you**

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