SECOND ECLIPSE TRACTUS-X COMMUNITY DAYS

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STUTTGART

SUPPORTED BY:

Cofinity-X  polygran  smartSense Consulting Solutions Pvt. Ltd  IDTA
Open Source for Digital Twins with the Asset Administration Shell

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Evolution of Industry 4.0

- **2013**
  - Start of Industry 4.0

- **2015**
  - Asset Administration Shell
  - Concepts and Specifications

- **2019**
  - Industrial Implementation
  - Introduction of the Digital Nameplate

- **2020**
  - Technology Spin-off
  - Founding of IDTA with 23 Organisations

- **2021**
  - Drive Open Source with Eclipse Tractus-X Community Days
  - Establishment of Eclipse Digital Twin Top-Level Project

Eclipse Tractus-X Community Days
International Standard available

IEC 63278-1
AAS Structure

Prototype for an AAS based Manufacturing Dataspaces

Dataspaces

2023

2024

Asset Administration Shell

Worldwide Standard for the Industrial Digital Twin
Shaping the Digital Twin Ecosystem

Founding Associations

- bitkom
- INDUSTRIE 4.0
- VDMA
- zvei

MoUs signed

- Alliance Industrie du Futur
- BaSyx
- Catena-X
- DENEFF
- Digital Data Chain Consortium
- digital twin consortium
- EUROMAP
- CLASS
- KOSMO
- NAMUR
- OPC Foundation
- Open Industry 4.0 Alliance
- PI
- smartFactory

Associated Partner

- MX
- Factory-X
- Robot-X
- Process-X
- antrieb 4.0
- FLUID 4.0
Digital Product Passport

German Digital Summit 2022

Digital Twin for the entire Asset Life Cycle…

Digital Twins today
- Application driven
- Specific & Efficient
- Only one Life Cycle Element

Our goal
- Efficient scaling
- Standardization
- Entire life cycle
Access to the Digital Product Data of Assets

Asset Administration Shell of the Asset

https://demo-digital-twin.r-stahl.com/FDGHJKLS001

QR Code on the product → Smartphone camera app → Server of product manufacturer → Asset Administration Shell from the product manufacturer
Meaning of Data

Property
MaxRotationSpeed

- semantic ID: 0173-1#02-BAA120#008
- value: 2000

2000 = year?
2000 = Euro?
2000 = steps
2000 = ...

semanticId

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)
## Standardised Information Models

### Submodels: Content for the AAS Dataspace

<table>
<thead>
<tr>
<th>Digital Nameplate</th>
<th>Contact Information</th>
<th>Handover Documentation</th>
<th>Module Type Package (MTP)</th>
<th>OPC UA Server Data Sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Nameplate</td>
<td>Technical Data</td>
<td>Product Carbon Footprint</td>
<td>Energy Monitoring</td>
<td>Time Series Data</td>
</tr>
<tr>
<td>Engineering of Power Drives Trains</td>
<td>Bill of Material (BOM)</td>
<td>MCAD / ECAD</td>
<td>Plant Asset Management</td>
<td>Simulation</td>
</tr>
<tr>
<td>Reliability</td>
<td>Functional Safety</td>
<td>Control Component Type/Instance</td>
<td>Service Notification</td>
<td>Sizing of power drive trains</td>
</tr>
<tr>
<td>Asset Interface Description</td>
<td>Maintenance</td>
<td>Plant Asset Management</td>
<td>Capability Description</td>
<td>DEXPI</td>
</tr>
</tbody>
</table>

- **85+ Submodels in the IDTA repository published or in development**
- **IDTA the platform for agile information models development**
- **Advanced Submodel Template repository available soon…**

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*07.05.2024*
Data Spaces only with digital twins!
From Specification to Execution

Open Source as an enabler for digital twin solutions presented at Hannover Fair 24!
What are our goals...

Make it easy and simple for developers to contribute, for users to consume, and for the industry to adopt and to deploy Asset Administration Shell (AAS) into their solutions, products, and processes for Digital Twins (DT).

AAS as the de-facto standard for the industrial digital twin through code

Build a vivid community for DT

Reference implementations

Nourish co-innovation, openness, transparency

Source: IDTA Open Tech Days 2023
How we drive AAS with Open Source…

Development of Specifications:

- AAS (metamodel, API, Security, …)
- AAS Submodel Templates
- Use Cases
- …

Open Source development:

- Coding is done as Open Source Software
- Partnership with Eclipse Foundation
- Building a global open source community

Source: EclipseCon 2023
How we drive AAS with Open Source…

https://projects.eclipse.org/projects/dt
Eclipse AAS4J

- Fraunhofer & SAP cooperation
- Reusable libraries and tools for I4.0 applications

**Features**
- AAS Java Generator
- AAS Java Model
- AAS Java Serializer
- AAS Transformation Library

**Used by**
- Eclipse BaSyx
- Eclipse FA³ST
- Eclipse Semantic Modelling Frameworks (ESMF)
- Catena-x
Eclipse AASX Package Explorer and Server

- **AASX Package Explorer (AASPE)**
  - Editor and viewer for AAS
  - Available as Windows & Web version
  - 15 plugins (SMTs, OPC UA, Plotting)
  - Connection with AAS Server
  - Connection with ECLASS and IEC/CDD

- **AASX Server**
  - Host and server AAS
  - Available in core and web (GUI) version
  - Persistence: in memory, file and external database
  - Other features: Security, PCF, plotting, AAS-registry

The web interface (left) and Swagger definition of the HTTP/REST API (right) of an AASXServer available on the Internet.
• Highly configurable off-the-shelf components
• SDKs in multiple programming languages
• BaSyx DataBridge for integration of third party data sources

• Features
• Eventing with MQTT
• Security
• Persistence (e.g., MongoDB, In Memory)
• Integration between components (AAS Repository, AAS Registry)
• GUI Support: BaSyx AAS Web GUI

• MIT License
Eclipse FA³ST

- Implementation of re-active (type 2) AAS
- Deployment at edge-level

- Features
  - Easy to configure, set-up and use
  - Open architecture: easily extendable and configurable
  - Asset synchronization
  - Accessibility using multiple endpoints (e.g., HTTPS, OPC UA)

- JAVA based
- Apache License 2.0
Eclipse Semantic Modelling Framework

- Model aspects of digital twins
- Creating APIs and UIs based on semantic information
- Developing Semantic Aspect Metamodel (SAMM)
- Ontologies and tooling to manage and leverage Aspect Models

- Features
  - A specification of SAMM and its usage
  - Implementation of SAMM
  - Different SDKs to work with SAMM
  - Aspect Model Editor
  - Command Line Interface
  - I4.0 Core Information Model

- Mozilla Public License 2.0
Eclipse AAS Web Client

- Browse Remote AAS
- Viewer and client for AAS servers and registries

- Features
  - Cyclic update of variable properties
  - Executing AAS Operation
  - No hosting server infrastructure necessary

- Javascript, HTML5 and CSS
- Apache License 2.0
Eclipse Service Lifecycle Management

- Manage the lifecycle of AI services
- Resource Management
- Service Management
- Deployment
- Semantic description of managed entities via AAS

- Features
  - Semantically describing resources capabilities, service offerings, requirements
  - Semantically describing IT and OT components
  - Uses Eclipse BaSyx Framework

- Apache License 2.0
AAS Dataspace for Everybody

Common game rules:
- Technical
- Legal/Organizational
- Economic

Provided as-a-Service

AAS Server Component Supplier X
AAS Server Component Supplier Y
AAS Server Factory Operator A
AAS Server IDTA

Operated by interested Companies (or their cloud operators)

Operated by AAS Dataspace for Everybody

Image: Plattform Industrie 4.0 (Modified)
Submodel Template (SMT) Repository

**Eclipse Tractus-X Community Days**

**Back-End**
- File System Database
- Server
- APIs

**Front-End**
- Client Application

**Short Term**
- Retrieving the SMTs

**Mid Term**
- Uploading the SMTs
- Access control
- GUI for searching and downloading

**Long Term**
- GitHub integration with SMT Repo

Import and validate against IDTA submodel templates !!
27 Solutions available in the IDTA Solutions Hub
Numerous product type information available as AAS

AAS in the industrial implementation

many more to come…
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