FIRST
ECLIPSE TRACTUS-X COMMUNITY DAYS
7. / 8. DECEMBER 2024
STUTTGART
Who?

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The Asset Administration Shell
Timeline

Industry 4.0

2013
Start of Industry 4.0

2015
Concepts and Specifications

2019
Introduction of the Digital Nameplate

2020
Founding of IDTA with 23 Organisations

2021
Founding of Catena-X with 17 Organisations

Asset Administration Shell

Industrial Implementation

Technology Spin-off

Dataspace

IDTA
Industrial Digital Twin Association

Catena-X
Your Automotive Network

ECLIPSE FOUNDATION

Eclipse Tractus-X
The Digital Product Passport can be represented by aspects of a digital twin. Each stamp represents data provided or needed by different stakeholders and apps in the lifecycle of the product.
BMW Group Technology Trend Radar

Source: bmwgroup.com
Digital Product Passport I4.0

German Digital Summit 2022


https://dpp40-1-v1.industrialdigitaltwin.org/backend/pcf
https://dpp40-2-v1.industrialdigitaltwin.org/backend/pcf
What is a Digital Twin?

https://www.youtube.com/watch?v=w_yvE7Dq-F0

Source: IDTA
Specifications

Part 1: Metamodel

Part 2: Application Programming Interfaces

Part 3a: Data Specification – IEC 61360

Part 5: Package File Format (AASX)

IEC 63278
Open API Standards

data consumer need to find the data provided

Digital Twin
Discovery and Registry
Open API Standards for Asset Administration Shell

Profiles relevant for Certification (see CX-0002)

https://github.com/admin-shell-io/
Tutorial on Open Standards

Youtube Playlist „AAS Tutorials“

See YouTube channel of IDTA „Industrial Digital Twin“ for AAS Tutorials, Testimonials and many more…
Questions and Answers

Recommended documents

For this reading guide the documents have been sorted by interest groups rather than topics. In some cases, only specific pages or sections of the recommended reading material.

- **Where to start**: If you have never heard of the AAS
- **For the generally interested reader**: If you want to learn more about the subject
- **For decision makers**: If you are interested in the business side of I4.0
- **For software developers and architects**: If you want to know how to create software for the AAS
- **For users of the AAS and domain experts**: If you are interested in using the AAS for specific tasks
- **Security and AI**: If you want to deep dive into these special topics.

Asset Administration Shell Frequently Asked Questions List

https://github.com/admin-shell-io/questions-and-answers
Meaning of Data

Source: IDTA

<table>
<thead>
<tr>
<th>Property</th>
<th>0173-1#02-BAA120#008 Max. rotation speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data type</td>
<td>INTEGER_MEASURE</td>
</tr>
<tr>
<td>Unit of measurement</td>
<td>1/min</td>
</tr>
<tr>
<td>Definition</td>
<td>Greatest possible rotation speed with which the motor or feeding unit may be operated</td>
</tr>
</tbody>
</table>

2000 • MAX. ROTATION SPEED (1/MIN)
Semantic Modeling and Standardisation

Tractus-X

Eclipse Semantic Modeling Framework

Catena-X

SAMM (.ttl)
Editing Semantic Models for Digital Twins

https://github.com/eclipse-esmf/esmf-aspect-model-editor
Submodel Template in AASX Package Explorer

https://github.com/admin-shell-io/aasx-package-explorer
Governance Process for Semantic Models

Several Quality Gates to ensure
- New or updated model needed?
- Modelling Style conformant to follows best practices?
- Shared models used? Needed?
- Validation successful (Correctness of models)
- Review conducted, findings incorporated?

etc.
Open Semantic Models for Data Exchange

Both, data provider and data consumer need to understand the data

https://industrialdigitaltwin.org/en/content-hub/submodels

https://catena-x.net/de/standard-library
Open and Collaborative Digital Twin Communities

Eclipse Tractus-X

IDTA

Eclipse Digital Twin

Project Hierarchy:
- Eclipse Digital Twin
- Eclipse AAS Model for Java
- Eclipse AAS Web Client
- Eclipse AASX Package Explorer
- Eclipse BaSyx™
- Eclipse Semantic Modeling Framework
- Eclipse Service Lifecycle Manager
Discovery of Data including Decentralized Digital Twin Registries
Discovery of Data

Data Usage Policy allows data consumer to consume + terms and conditions for usage

Data Model Definition
Twin / Aspect Registration
Data Discovery
Data Share
Internal of Enterprise
Discovery of Data

5. Digital Twin Registry
6. Data Providing Submodel Server
4. Eclipse Datospace Components

Data Usage Policy allows data consumer to consume + terms and conditions for usage

Data Model Definition
Twin / Aspect Registration
Data Discovery
Data Share
Internal of Enterprise
Discovery Flow

1. Discovery Finder → BPN / EDC Discovery
2. BPN Discovery: identifier → BPN
3. EDC Discovery: BPN → EDC-endpoint
4. Eclipse Dataspace Components: data catalogue → Digital Twin Registry endpoint
5. Digital Twin Registry: specificAssetId → Digital Twin(s) → Submodel(s)/Aspect(s)
6. Submodel Server: Aspect → Data Endpoint
1. Discovery Finder

- Swagger UI from CX-0053

- **POST** define endpoints to BPN / EDC Discovery

- **DELETE** delete endpoints to BPN / EDC Discovery

- **POST** find endpoints from BPN / EDC Discovery
1. Discovery Finder

**POST** /api/administration/discovery/search

**REQUEST**

```json
{
   "types": [
      "wmi"
   ]
}
```

**RESPONSE**

```json
{
   "endpoints": [
      {
         "type": "wmi",
         "description": "world manufacturing index",
         "endpointAddress": "api/administration/bpnDiscovery/wmi/search",
         "documentation": "The world manufacturing index is the first 3 characters of the vehicle information number",
         "resourceId": "f20e1ce4-56a5-47a0-9443-4672c7f373f1"
      }
   ]
}
```
2. BPN Discovery

- Swagger UI from CX-0053
- POST: create identifier-BPN matching(s)
- DELETE: delete identifier-BPN matching
- POST: find identifier-BPN matching(s)
2. BPN Discovery

POST /api/administration/bpnDiscovery/wmi/search

REQUEST
{
    "searchFilter": [
        {
            "type": "wmi",
            "keys": ["WBA"
            ]
        }
    ]
}

RESPONSE
{
    "bpns": [
        {
            "type": "wmi",
            "key": "WBA",
            "value": "BPNL000000000SFW",
            "resourceId": "f20e1ce4-56a5-47a0-9443-4672c7f373f1"
        }
    ]
}
3. EDC Discovery

Swagger UI from CX-0001

POST find EDC-endpoint(s) linked to BPN(s)
3. EDC Discovery

**POST**

/api/administration/Connectors/discovery

**REQUEST**

```json
[
  "BPNL000000000SFW"
]
```

**RESPONSE**

```json
[
  {
    "bpn": "BPNL000000000SFW",
    "connectorEndpoint": [
      "https://edc.control.plane/
    ]
  }
]
```
4. Eclipse Dataspace Components

- POST create data asset on DTR & Submodel Server(s)
- DELETE delete data asset on DTR & Submodel Server(s)
- POST find data asset on DTR & Submodel Server(s)
4. Eclipse Dataspace Components

```json
POST https://edc.control.plane/catalog/request
"asset:prop:type": "data.core.digitalTwinRegistry"

RESPONSE
{
   "@id": "6e1cf597-7694-4153-a082-ac8f683e28f2",
   "@type": "dcat:Catalog",
   "dcat:dataset": [
      {
         "@id": "1",
         "@type": "dcat:Dataset",
         "odrl:hasPolicy": {
            ...
         },
         "dcat:distribution": [
            ...
         ]
      },
      {
         "@id": "edc:00000001",
         "@type": "dcat:Dataset",
         "edc:hasProperty": {
            "edc:participantId": "BPNL000000385M3J",
            "@context": {
               ...
            }
         }
      }
   ]
}
```

"edc:type": "data.core.digitalTwinRegistry",
   "edc:description": "Product EDC Demo Asset",
   "edc:id": "1"
}
5. Digital Twin Registry (Discovery)

Swagger UI from CX-0002

- **GET**: find AAS ids linked to specific asset identifiers
- **GET**: find specific asset identifiers based on an AAS identifier
- **GET**: returns the self-describing information of a network resource
5. Digital Twin Registry (Discovery)

GET /lookup/shells?assetIds=xyz

RESPONSE
[
  "d17f8c54-1950-434d-9bb9-c2e3ceefd868",
  "71d968f4-021a-48a4-96f8-7e2f8ea281ad",
  "94d2ef9a-b234-45ae-9176-b08c65645184"
]
5. Digital Twin Registry

Swagger UI from CX-0002

GET
read all Asset Administration Shell descriptors

GET
read all Asset Administration Shell Submodel descriptors

GET
read a specific Asset Administration Shell descriptor

GET
read a specific Asset Administration Shell Submodel descriptor
5. Digital Twin Registry

GET /shell-descriptors/:aasIdentifier

RESPONSE

```
{
  "idShort": "idShortExample",
  "id": "94d2ef9a-b234-45ae-9176-b08c65645184",
  "description": [
    {
      "language": "en",
      "text": "Example of human readable description of digital twin."
    }
  ],
  "specificAssetIds": [
    {
      "name": "partInstanceID",
      "value": "SN12345678"
    }
  ],
  "submodelDescriptors": [
    {
      "endpoints": [
        {
          "protocolInformation": {
            "href": "https://edc.data.plane/mypath/submodel/1234",
            "subprotocolBody": "id=1234, dspEndpoint=https://edc.control.plane/mypath/submodel"
          }
        }
      ],
      "idShort": "serialPart",
      "id": "cd47615b-daf3-4036-8670-d2f89349d388-2",
      "semanticId": {
        "type": "ExternalReference",
        "keys": [
          {
            "type": "Submodel",
            "value": "urn:bamm:io.catenax.serial_part:1.0.1#serialPart"
          }
        ]
      }
    }
  ]
}
```
6. Submodel Server

Swagger UI

GET  read self-describing information of a network resource

GET  read Submodel in the ValueOnly representation
6. Submodel Server

GET /submodel/$value

RESPONSE

{
  "localIdentifiers": [
    {
      "value": "SN12345678",
      "key": "partInstanceID"
    }
  ],
  "manufacturingInformation": {
    "date": "2022-02-04T14:48:54",
    "country": "HUR"
  },
  "catenaXId": "urn:uuid:580d3adf-1981-44a0-a214-13d6ceed9379",
  "partTypeInformation": {
    "manufacturerPartId": "123-0.740-3434-A",
    "customerPartId": "PRT-12345",
    "classification": "product",
    "nameAtManufacturer": "Mirror left",
    "nameAtCustomer": "side element A"
  }
}
Digital Twin Kit
Join Hands-On Session on Digital Twins Stream 3
Stream 3 Digital Twins in Dataspace Catena-X

For data providers / consumers

- First exercise: Get familiar with the AAS
- Practical exercise: Build a digital twin
Let’s work together
tractus-x.com