

CATENA-X
STANDARD



CX - 0045 Aspect Model Data Chain Template

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ABOUT THIS DOCUMENT & MOTIVATION

Catena-X is the first open and collaborative data ecosystem. The goal is to provide an environment for the creation, operation, and joint use of end-to-end data chains along the entire automotive value chain. All partners are on an equal ground, have sovereign control over their data and no lock-in effects occur. This situation provides a sustainable solution for the digitalization of supply chains, especially for medium-sized and small companies, and supports the cooperation and collaboration of market participants and competitors.

The ever-growing Catena-X ecosystem will enable enormous amounts of data to be integrated and collaboratively harnessed. To ensure that these complex data volumes can be sent, received, and processed smoothly across all stages of the value chain, one language for all players: common standards. The standards of the Catena-X data ecosystem define how the exchange of data and information in our network works. They are the basis for ensuring that the technologies, components, and processes used are developed and operated according to uniform rules.

Common standards create added value for all partners: Within our network, data flows more smoothly through interfaces. In addition, we avoid cumbersome individual IT solutions for sharing data with other partners. In the field of international

standardization, Catena-X follows the proven international standardization institutions: ISO/IEC/ITU and CEN-CENELC/ETSI.

For users and data providers, implementation of standards will reduce the costs that would arise from adapting different systems. In addition, no important data is lost. On the contrary, it even becomes easier to collect data across companies. For operators and developers, standards will create a framework that provides reliable orientation and planning security.

The following document describes one of the standards used in the Catena-X ecosystem and the requirements needed to implement it. Here, it serves as main resource to illustrate the following data model. It contains information starting from the format of the model, up to the conceptual and physical model. The standardisation of the data model will enable faster information sharing and homogeneity throughout the entire Catena-X ecosystem.

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ABSTRACT

This component of the capability Cross Company Data Chain Management is a data model, so that the Item Relationship Service API, and other applications can work not only on existing semantic models, but also to new defined data chain relevant aspect models which fit to the template. With this model template in place, interoperability is being provided, because participants defining their connection between digital twins according to that template, will be able to access connected data. A data chain is a chain of linked data. The minimal set of information necessary to build this are two objects and one link between those objects. Objects in Catena-X are called Asset Administration Shell (AAS) or digital twins and linked digital twins are data chains. This template describes the minimal information of a link between two digital twins, so the most flexibility is given for further use-cases to build use-case specific data chains.

1. INTRODUCTION

This component is used to standardize the way in which an aspect model of a digital twin needs to be modelled, so that services and products which consume linked data can work and that an interoperability on data chain level can exist. It is a minimal set of conditions to be applied to such aspect models that model a connection between two digital twins. This minimal set of conditions shall guide developer of new services and semantic models, in the process of creating new solutions for Catena-X. It is an easy extendable template to fit the use-case needs.

1.1 AUDIENCE & SCOPE

This section is non-normative

List for which roles the standard is relevant.

- Core Service Provider
- Enablement Service Provider
- Consulting Services Provider

This standard is only applicable when a use-case has the need to extend existing Aspect Models with models connecting several Digital Twins. When a use-case has the need to extend the existing Aspect Models with models which connect several Digital Twins with each other. Then this standard applies. A so-called Data Chain exists, when multiple Digital Twins are semantically connected to each other. For example, a Bill of Materials (BoM) Structure, where each part results in a separate Digital Twin. To have the same structure on how Data Chains can be build this template applies. This provides a lean structure that can be extended with Use-Case specific information and attributes.

This standard is only to be applied in the creation process of new aspect models, which connects digital twins in the Catena-X Network.

1.2 CONTEXT

This section is non-normative

The following dependencies and preconditions exist. This aspect model template is written in BAMM 2.0 as a modeling language, which is an industry standard from the [open manufacturing platform](#).

BAMM is used to model Asset Administration Shell submodels, which are attached to digital twins in the form of an Asset Administration Shell (AAS). All submodels in Catena-X are managed in the semantic hub. A data model is requested and exchanged via Catena-X using an Eclipse Dataspace Connector (CX - 0001 EDC Discovery API), which is a separate Catena-X standard.

The following preconditions must be met that a developer is bound to use this template as reference:

- The to be developed semantic model describes a data chain (e.g., linking one digital twin with another)
- The to be developed semantic model is used or meant to be accessed by multiple use-cases.

1.3 CONSTRAINTS AND LIMITATIONS

Data Chains can be built on identifiable objects. The objects to be connected have the following properties:

- The object is a discrete identifiable object (e.g., a part, a company, etc.)
- The object **MUST** be a digital twin / AAS (Asset Administration Shell)
- The object can be identified via the catenaXId (a unique identifier within Catena-X)

1.4 ARCHITECTURE OVERVIEW

This section is non-normative

This chapter is not applicable

1.5 CONFORMANCE

As well as sections marked as non-normative, all authoring guidelines, diagrams, examples, and notes in this specification are non-normative. Everything else in this specification is normative.

The key words **MAY**, **MUST**, **MUST NOT**, **OPTIONAL**, **RECOMMENDED**, **REQUIRED**, **SHOULD** and **SHOULD NOT** in this document document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

1.6 PROOF OF CONFORMITY

This section is non-normative

All participants and their solutions will need to proof, that they are conform with the Catena-X standards. To validate that the standards are applied correctly, Catena-X employs Conformity Assessment Bodies (CABs).

To proof conformity with the Data Chain Template, use the schema (Appendix) and check if the necessary structure is implicitly in the Aspect to prove. What is necessary:

Attributes name **MUST** be the same

The Object structure **MUST** match the template, but **CAN** contain more attributes.

1.7 EXAMPLES

The JSON schema in the Appendix describes the schema of the template. The following examples show minimal setup's of this template.

```
{
  "catenaXId": "urn:uuid:055c1128-0375-47c8-98de-7cf802c3241d",
  "childItems": [
    {
      "catenaXId": "urn:uuid:7BeA9fAE-A1ca-D164-3BDF-0E5bac5E5b7d"
    }
  ]
}
```

or

```
{
  "catenaXId": "urn:uuid:055c1128-0375-47c8-98de-7cf802c3241d",
  "parentItems": [
    {
      "catenaXId": "urn:uuid:7BeA9fAE-A1ca-D164-3BDF-0E5bac5E5b7d"
    }
  ]
}
```

This template describes the minimal necessary set of attributes for a valid data chain in Catena-X. A "parent" catenaXId and at least one linked "child" catenaXId to connect two individual digital twins, which can be provided by two different companies. The use-cases have the possibility to extend this to their behalf and publish it as a separate Aspect Model.

An Example of that is the AssemblyPartRelationship Aspect

1.8 TERMINOLOGY

This section is non-normative

Aspect Meta Model (BAMM) : A Meta description model to describe AAS

Additional terminology used in this standard can be looked up in the glossary on the association homepage.

2 DATA CHAIN ASPECT TEMPLATE

This section is normative

The purpose of this data model is to enable newly defined data chain relevant aspect models to operate with the Item Relationship Service API, which is described in a separate [reference implementation](#).

Classical naming convention:

- the object **MUST** be a digital twin / AAS (Asset Administration Shell)
- the object **MUST** be identified by catenaXId
- the array of "child" objects **MUST** be identified by childItems
- the array of "child" objects **MUST** contain at least one element
- the item of a child item array element **MUST** be identified by catenaXId

This template **MAY** be extended with use-case specific attributes. The template **MUST** be published as a new aspect model.

Changes in the minimal aspect model regarding the relationship of a data chain **RECOMMENDED** to be always backward compatible, so that existing data chains do not break.

2.5 FORMATS OF TEMPLATE

2.5.1 JSON Schema

JSON Schema for Relationship types of children

```
{
  "$schema": "https://json-schema.org/draft-04/schema",
  "type": "object",
  "components": {
    "schemas": {
      "urn_bamm_io.catenax.relationship_template_0.0.0_CatenaXIdTraitCharacteristic": {
        "type": "string",
        "pattern": "^(^([0-9a-fA-F]{8}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{12})$)|(^urn:uuid:[0-9a-fA-F]{8}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{12})$"
      },
      "urn_bamm_io.catenax.relationship_template_0.0.0_ChildData": {
        "type": "object",
        "properties": {
          "catenaXId": {
            "$ref":
            "#/components/schemas/urn_bamm_io.catenax.relationship_template_0.0.0_CatenaXIdTraitCharacteristic"
          }
        },
        "required": [
          "catenaXId"
        ]
      },
      "urn_bamm_io.catenax.relationship_template_0.0.0_SetOfChildPartsCharacteristic": {
        "type": "array",
        "items": {
          "$ref":
          "#/components/schemas/urn_bamm_io.catenax.relationship_template_0.0.0_ChildData"
        },
        "uniqueItems": true
      }
    }
  },
  "properties": {
    "catenaXId": {
```

```

        "$ref":
"#/components/schemas/urn_bamm_io.catenax.relationship_template_0.0.0_CatenaXIdTraitCharacteristic
    },
    "childItems": {
        "$ref":
"#/components/schemas/urn_bamm_io.catenax.relationship_template_0.0.0_SetOfChildPartsCharacteristi
    }
    },
    "required": [
        "catenaXId",
        "childItems"
    ]
}

```

JSON Schema for Relationship types of parent

```

{
  "$schema": "https://json-schema.org/draft-04/schema",
  "type": "object",
  "components": {
    "schemas": {
      "urn_bamm_io.catenax.relationship_template_0.0.0_CatenaXIdTraitCharacteristic": {
        "type": "string",
        "pattern": "^(^([0-9a-fA-F]{8}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{12})$)|(^urn:uuid:[0-9a-fA-F]{8}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{4}-[0-9a-fA-F]{12})$"
      },
      "urn_bamm_io.catenax.relationship_template_0.0.0_ParentData": {
        "type": "object",
        "properties": {
          "catenaXId": {
            "$ref":
"#/components/schemas/urn_bamm_io.catenax.relationship_template_0.0.0_CatenaXIdTraitCharacteristic
          }
        },
        "required": [
          "catenaXId"
        ]
      },
      "urn_bamm_io.catenax.relationship_template_0.0.0_SetOfParentPartsCharacteristic": {
        "type": "array",
        "items": {
          "$ref":
"#/components/schemas/urn_bamm_io.catenax.relationship_template_0.0.0_ParentData"
        },
        "uniqueItems": true
      }
    }
  },
  "properties": {
    "catenaXId": {

```



```
        "$ref":
"#/components/schemas/urn_bamm_io.catenax.relationship_template_0.0.0_CatenaXIdTraitCharacteristic
    },
    "parentItems": {
        "$ref":
"#/components/schemas/urn_bamm_io.catenax.relationship_template_0.0.0_SetOfParentPartsCharacterist
    }
    },
    "required": [
        "catenaXId",
        "parentItems"
    ]
}
```

3 REFERENCES

3.1 NORMATIVE REFERENCES

CX - 0002 Digital Twins in Catena - X
CX - 0003 Bamm Aspect Meta Model
CX - 0004 Governance Process

3.2 NON-NORMATIVE REFERENCES

CX - 0001 EDC Discovery API

This section is non-normative

3.3 REFERENCE IMPLEMENTATIONS

This section is non-normative

ANNEXES

FIGURES

This section is non-normative

TABLES

This section is non-normative