CATENA-X

STANDARD

CX - 0047 Demand and Capacity Management Data Models v.1.0.0

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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

For cross-company demand and capacity management (DCM), the exchange of demand and capacity information is the foundation. The demand information describes the material-demand of a company and is send to a supplier, in order to tell the supplier which materials and how many of them are needed in a given calendar week. The capacity group is sent from the supplier to the customer in order to communicate the production capacity for a specific material in a specific calendar week.

In this document, the data model of the material demand and capacity group information is described and standardized. There are two separate data models, as the information has a different meaning and because of the split business responsibilities within DCM.

The cross-company interactions required during the demand and capacity management process together with the corresponding common business logic are standardised in [CX-0046], while the APIs are standardized in [CX-0048].

1. INTRODUCTION

This document describes the `WeekBasedMaterialDemand` and `WeekBasedCapacityGroup` semantic models used in the Catena-X network.

1.1 AUDIENCE & SCOPE

> *This section is non-normative*

This standard is relevant for:

> **Data Provider / Consumer**
> **Business Application Provider**

The `WeekBasedMaterialDemand` object will be send by customers to their suppliers in order to communicate how many parts they need in which period of time. The customers of materials therefore need to be able to create `WeekBasedMaterialDemand` objects and the suppliers need to be able to interpret them. As most suppliers have their own suppliers, who produce materials for them, most suppliers are therefore acting as customers as well and need to be able to also create WeekBasedMaterialDemand objects on for sending them to their suppliers.

The `WeekBasedCapacityGroup` object is sent by the suppliers to their customers to communicate which materials are bundled together, representing a common bottleneck. And what the capacity for these materials is, considering their common bottleneck.This information is represented as weekly buckets within the WeekBasedCapacityGroup. Therefore, all companies, that supply materials to other companies, need to be able to create `WeekBasedCapacityGroup` objects in a consistent and standardized structure and send them to their customers. The customers need to be able to receive and interpret the `WeekBasedCapacityGroup` information.

The underlying business process is described and standardized in [CX-0046].

This document only describes the structure of the data model in order to exchange demand and capacity information. Further information regarding processing or the interface will be described in [CX-0048].

1.2 CONTEXT

> *This section is non-normative*

This standardization defines the `WeekBasedMaterialDemand` and the `WeekBasedCapacityGroup` data models for the Catena-X network. This standard ensures that the demand and capacity information can be consumed through the Catena-X network by all customers and suppliers and ensures, that the data objects from different customers can be handled and interpreted in an identical manner.

The underlying business process is described and standardized in [CX-0046].

In this document the `WeekBasedMaterialDemand` data models and `WeekBasedCapacityGroup` data model are described and standardized to ensure a consistent data exchange structure within the DCM participants. Thereby an identical interpretation of the data across companies is ensured.

1.3 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.

1.4 PROOF OF CONFORMITY

> *This section is non-normative*

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

The proof of conformity for a single semantic model is done according to the general rules for proving the conformity of data provided to a semantic model or the ability to consume the corresponding data.

1.5 EXAMPLES

In this chapter, examples for the value-only serialization of `WeekBasedMaterialDemand` and `WeekBasedCapacityGroup` payloads in JSON format are listed for reference. The attributes are described further in [CX-0046]. Note that the values in *{{brackets}}* need to be replaced with actual valid values.

1.5.1 `WeekBasedMaterialDemand` data model JSON structure

```json
// value-only payload serialization example
{
    "unitOfMeasure": "GRM",
    "materialDescriptionCustomer": "Spark Plug",
    "materialDemandId": "0157ba42-d2a8-4e28-8565-7b07830c1110",
    "materialNumberSupplier": "MNS-8101-ID146955.001",
    "supplier": "{{CATENAX-BUSINESS-PARTNER-NUMBER}}",
    "changedAt": "2023-03-08T11:01:02.085+01:00",
    "demandSeries": [
        {
            "expectedSupplierLocation": "{{CATENAX-SUPPLIER-BPNS}}",
            "demands": [
                {
                    "demand": 1,
                    "calendarWeek": "2022-03-13"
                },
                {
                    "demand": 1,
                    "calendarWeek": "2022-03-20"
                }
            ],
            "customerLocation": "{{CATENAX-CUSTOMER-BPNS}}",
            "demandCategory": {
                "demandCategoryCode": "0001"
            }
        }
    ],
    "materialNumberCustomer": "MNC-7307-AU340474.002",
    "customer": "{{CATENAX-SUPPLIER-BPNL}}"
}
```

1.5.2 `WeekBasedCapacityGroup` data model JSON structure

```
// value-only payload serialization example
{
    "unitOfMeasure": "GRM",
    "linkedDemandSeries": [
        {
            "materialNumberCustomer": "MNC-7307-AU340474.002",
            "materialNumberSupplier": "MNS-8101-ID146955.001",
            "customerLocation": " {{CATENAX-CUSTOMER-BPNS}}",
            "demandCategory": {
                "demandCategoryCode": "0001"
            }
        }
    ],
    "supplier": "{{CATENAX-BUSINESS-PARTNER-NUMBER}}",
    "name": "Spark Plugs on drilling machine for car model XYZ",
    "supplierLocations": [
        "{{CATENAX-SUPPLIER-BPNS}}"
    ],
    "capacities": [
        {
            "calendarWeek": "2023-03-13",
            "actualCapacity": 1,
            "maximumCapacity": 2
        },
        {
            "calendarWeek": "2023-03-20",
            "actualCapacity": 1,
            "maximumCapacity": 2
        }
    ],
    "changedAt": "2023-03-08T11:44:27.701+01:00",
    "capacityGroupId": "0157ba42-d2a8-4e28-8565-7b07830c1110",
    "customer": "{{CATENAX-SUPPLIER-BPNL}}"
}
```

1.6 TERMINOLOGY

> *This section is non-normative*

Aspect Model : a formal, machine-readable semantic description (expressed with RDF/turtle) of data accessible from an Aspect.

: *Note 1 to entry: An Aspect Model must adhere to the Semantic Aspect Meta Model (SAMM), i.e., it utilizes elements and relations defined in the Semantic Aspect Meta Model and is compliant to the validity rules defined by the Semantic Aspect Meta Model.*

: *Note 2 to entry: Aspect model are logical data models which can be used to detail a conceptual model in order to describe the semantics of runtime data related to a concept. Further, elements of an Aspect model can/should refer to terms of a standardized Business Glossary (if existing).*

: *[Source: Catena-X, CX-0002, note 3 removed]*

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

2 ASPECT MODEL "WeekBasedMaterialDemand"

2.1 INTRODUCTION

The material demand information MUST be sent from the customer to the supplier according to the [CX-0048] standard. The data format described here MUST be followed for the exchange of the `WeekBasedMaterialDemand` information.

The `WeekBasedMaterialDemand` data model MUST be implemented by all participants who wish to participate in the Catena-X DCM network as a customer or supplier.

Companies, who participate in the Catena-X Network as a supplier, MUST be able to receive material demand information and MUST be able to send capacity group information.

Companies, who participate in the Catena-X Network as a customer, MUST be able to send material demand information and MUST be able to receive capacity group information.

Companies who participate in the Catena-X Network with both roles therefore MUST be able to receive and send both, material demand as well as capacity group information. It is recommended that companies implement both standards.

Every data provider of `WeekBasedMaterialDemand` data MUST provide the data conformant to the semantic model specified in this document.

The unique identifier of the semantic model specified in this document MUST be used by the data provider to define the semantics of the data being transferred.

Every certified business application relying on `WeekBasedMaterialDemand` data MUST be able to consume data conformant to the semantic model specified in this document.

This semantic model MUST be made available in the central Semantic Hub.

Data consumers and data provider MUST comply with the license of the semantic model defined in Chapter 2.3.

In the Catena-X data space `WeekBasedMaterialDemand` data MUST be requested and exchanged via Eclipse Dataspace Connector (EDC) conformant to [CX-0018] and [CX-0002].

The JSON Payload of data providers MUST be conformant to the JSON Schema as specified in this document.

The characteristics BPNL and BPNS MUST be used according to the standard [CX-0010].

2.2 SPECIFICATION ARTIFACTS

The modeling of the semantic model specified in this document was done in accordance to the "semantic driven workflow" to create a submodel template specification [SMT].

This aspect model is written in SAMM 2.0.0 as a modeling language conformant to [CX-0003] as input for the semantic driven workflow.

Like all Catena-X data models, this model is available in a machine-readable format on GitHub conformant to [CX-0003].

2.3 LICENSE

This Catena-X data model is made available under the terms of the Creative Commons Attribution 4.0 International (CC-BY-4.0) license, which is available at Creative Commons.

2.4 IDENTIFER OF SEMANTIC MODEL

The semantic model has the unique identifier

```
urn:bamm:io.catenax.week_based_material_demand:1.0.0
```

This identifier MUST be used by the data provider to define the semantics of the data being transferred.

2.5 FORMATS OF SEMANTIC MODEL

2.5.1 RDF Turtle

The rdf turtle file, an instance of the Semantic Aspect Meta Model, is the master for generating additional file formats and serializations.

```
https://github.com/eclipse-tractusx/sldt-semantic-
models/blob/main/io.catenax.week_based_material_demand/1.0.0/WeekBasedMaterialDemand.ttl
```

The open source command line tool of the Eclipse Semantic Modeling Framework is used for generation of other file formats like for example a JSON Schema, aasx for Asset Administration Shell Submodel Template or a HTML documentation.

2.5.2 JSON Schema

A JSON Schema can be generated from the RDF Turtle file. The JSON Schema defines the Value-Only payload of the Asset Administration Shell for the API operation "GetSubmodel".

2.5.3 aasx

An AASX file can be generated from the RDF Turtle file. The AASX file defines one of the requested artifacts for a Submodel Template Specification conformant to [SMT].

Note: As soon as the specification V3.0 of the Asset Administration Shell specfication is available an update will be provided.

2.6 SEMANTIC MODEL

Not applicable.

3 ASPECT MODEL "WeekBasedCapacityGroup"

> This section is normative

3.1 INTRODUCTION

The capacity group information MUST be sent from the supplier to the customer according to the [CX-0048] standard. The data format described here MUST be followed for the exchange of the capacity group information.

The capacity group endpoint MUST be implemented by all participants who wish to participate in the Catena-X DCM network as a customer or supplier.

Companies, who participate in the Catena-X Network as a supplier, MUST be able to receive material demand information and MUST be able to send capacity group information.

Companies, who participate in the Catena-X Network as a customer, MUST be able to send material demand information and MUST be able to receive capacity group information.

Companies who participate in the Catena-X Network with both roles therefore MUST be able to receive and send both, material demand as well as capacity group information. It is recommended that companies implement both standards.

Every data provider of `WeekBasedCapacityGroup` data MUST provide the data conformant to the semantic model specified in this document.

The unique identifier of the semantic model specified in this document MUST be used by the data provider to define the semantics of the data being transferred.

Every certified business application relying on `WeekBasedCapacityGroup` data MUST be able to consume data conformant to the semantic model specified in this document.

This semantic model MUST be made available in the central Semantic Hub.

Data consumers and data provider MUST comply with the license of the semantic model defined in Chapter 3.3.

In the Catena-X data space `WeekBasedCapacityGroup` data MUST be requested and exchanged via Eclipse Dataspace Connector (EDC) conformant to [CX-0018] and [CX-0002].

The JSON Payload of data providers MUST be conformant to the JSON Schema as specified in this document.

The characteristics BPNL and BPNS MUST be used according to the standard [CX-0010].

3.2 SPECIFICATION ARTIFACTS

The modeling of the semantic model specified in this document was done in accordance to the "semantic driven workflow" to create a submodel template specification [SMT].

This aspect model is written in SAMM 2.0.0 as a modeling language conformant to [CX-0003] as input for the semantic deriven workflow.

Like all Catena-X data models, this model is available in a machine-readable format on GitHub conformant to [CX-0003].

3.3 LICENSE

This Catena-X data model is made available under the terms of the Creative Commons Attribution 4.0 International (CC-BY-4.0) license, which is available at Creative Commons.

3.4 IDENTIFER OF SEMANTIC MODEL

The semantic model has the unique identifier

```
urn:bamm:io.catenax.week_based_capacity_group:1.0.0
```

This identifier MUST be used by the data provider to define the semantics of the data being transferred.

3.5 FORMATS OF SEMANTIC MODEL

3.5.1 RDF Turtle

The rdf turtle file, an instance of the Semantic Aspect Meta Model, is the master for generating additional file formats and serializations.

```
https://github.com/eclipse-tractusx/sldt-semantic-
models/blob/main/io.catenax.week_based_capacity_group/1.0.0/WeekBasedCapacityGroup.ttl
```

The open source command line tool of the Eclipse Semantic Modeling Framework is used for generation of other file formats like for example a JSON Schema, aasx for Asset Administration Shell Submodel Template or a HTML documentation.

3.5.2 JSON Schema

A JSON Schema can be generated from the RDF Turtle file. The JSON Schema defines the Value-Only payload of the Asset Administration Shell for the API operation "GetSubmodel".

3.5.3 aasx

An AASX file can be generated from the RDF Turtle file. The AASX file defines one of the requested artifacts for a Submodel Template Specification conformant to [SMT].

Note: As soon as the specification V3.0 of the Asset Administration Shell specfication is available an update will be provided.

3.6 SEMANTIC MODEL

Not applicable.

4 REFERENCES

4.1 NORMATIVE REFERENCES

[CX-0002] Digital Twins in Catena-X, Version 1.0.1

[CX-0003] SAMM Aspect Meta Model, Version 1.0.1

[CX-0010] Business Partner Number, Version 1.0.1

[CX-0018] Eclipse Data Space Connector (EDC), Version 1.0.1

[CX-0046] Demand and Capacity Management Process & Core Business Logic, Version 1.0.0

[CX-0048] Demand and Capacity Management APIs, Version 1.0.0

4.2 NON-NORMATIVE REFERENCES

This section is non-normative

[SMT] How to create a submodel template specification. Guideline. Download from: https://industrialdigitaltwin.org/wp-content/uploads/2022/12/I40-IDTA-WS-Process-How-to-write-a-SMT-FINAL-.pdf

4.3 REFERENCE IMPLEMENTATIONS

This section is non-normative

Not applicable.

ANNEXES

FIGURES

> *This section is non-normative*

Not applicable.

TABLES

> *This section is non-normative*

Not applicable.