CATENA-X

STANDARD

CX - 0059 Triangle Behavioral Twin Endurance Predictor 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

Behavioral product models, based on a structured and consistent architecture of reusable and standard functional components and applied in a common ecosystem such as Catena-X, permit a wide range of new business concepts and digital services. Consequently, the central scope of consideration for the “Data-centric and model-centric development and operational support” use case is the concept of the “digital twin” for the integrated mapping of products with their functions, properties and key business figures via a common data model.

One typical requirement of the digital behavior twin relies on dynamic services, which offer up to date information of a built vehicle.

Different parties like automobile clubs, recyclers, and others want to know more about the current state of a specific vehicle. One such information is the expected lifetime of components. This information can be used e.g., to support a decision if a component is worth recycling.

1. INTRODUCTION

This triangle document acts as a bracket for single standards required to request "Remaining Useful Life (RUL)" data as well as providing a service for its calculation at a component level. Included are APIs to be provided by the service provider and the service requestor, as well as aspect models for the respective payloads being exchanged in an asynchronous pattern leveraging those APIs.

1.1 AUDIENCE & SCOPE

> *This section is non-normative*

The standard is relevant for the following roles within the scope of the Use Case Live Quality Loops * Data Provider / Consumer * Business Application Provider

NOTE: Fulfilling a use-case standard by a data provider / consumer can be done in two ways: A) Purchase a certified app for the use-case. In this case the data provider / consumer does not need to proof conformity again and B) Data Provisioning / Consumption without a certified app for the use-case. In this case the data provider / consumer needs to proof conformity with all single standards listed in this document

1.2 CONTEXT

> *This section is non-normative*

This triangle/use-case document contains two aspect models.

1. **CX-0056** Aspect Model for load spectrums, acting as the main input for a component specific calculation for remaining useful life.
2. **CX-0057** Aspect Model for Remaining Useful Life data, acting as the main output for a component specific calculation for remaining useful life.

It also contains the API descriptions for the APIs to exchange requests as well as results of a remaining useful life calculation:

1. **CX-0058** API Endurance Predictor (contains both API descriptions)

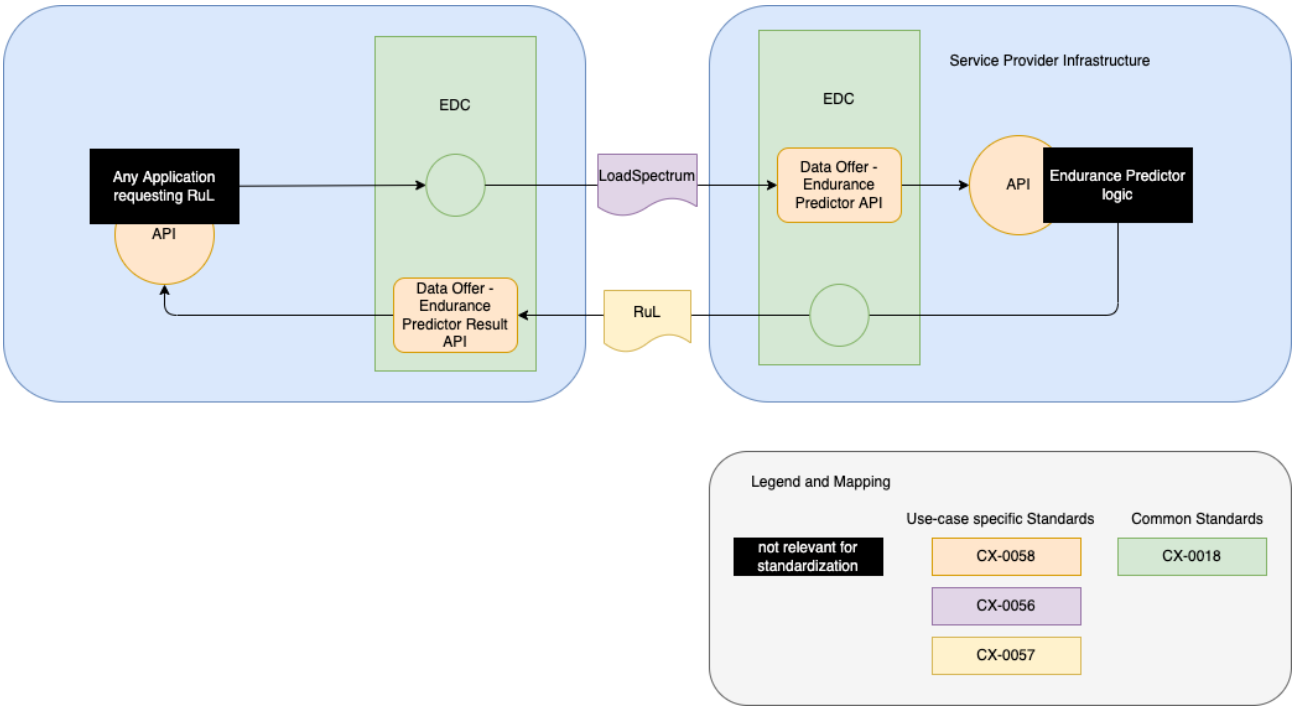
The calculation is asynchronous, therefore both parties involved in a calculation request require to provide API endpoints, as the results are sent back at a later stage and not as part of the HTTP response body.

Since Data Transfer in Catena-X requires IDSA compliance, both parties involved **MUST** use an IDSA compliant connector and provision the API endpoints as specific data assets in those connectors. The data asset structure is described as part of **CX-0058**.

1.3 ARCHITECTURE OVERVIEW

> *This section is non-normative*

This graphic shows the mapping of standard documents into the general architectural overview for this triangle.



1.4 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.

1.5 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). Please refer to: *[!LINK Conformity Assessment]* for the process of conformity assessment and certification.

Since this Triangle document describes a set of standards to be fulfilled, participants MUST fulfill all mentioned standards and the respective conformity assessment criteria in addition to the specific criteria mentioned in this document.

The specific criteria described in this document are describing the usage of the central tools as well as common tools described in the linked standardization documents and therefore compliance should be checked with the tools provided for these components.

The Eclipse Dataspace Connector (EDC) is **RECOMMENDED** to be used as an IDSA compliant connector, as it is the current reference implementation of the IDSA protocol.

1.6 EXAMPLES

1.7 TERMINOLOGY

> *This section is non-normative*

Business Partner Number (BPN) : A BPN is the unique identifier of a partner within Catena-x

Eclipse Dataspace Connector (EDC) : The EDC is a reference implementation of a connector for IDSA conform sovereign data exchange

Behavior Twin : Behavioural product models, based on a structured and consistent architecture of reusable and standard functional components and applied in a common ecosystem.Additional terminology used in this standard can be looked up in the glossary on the association homepage.

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2. STANDARDS FOR "Triangle Behavioral Twin Endurance Predictor"

> *This section is normative*

As a Service Provider for an Endurance Predictor Service I need to fulfill the following standards in the following contexts:

> **CX-0056 Semantic Model: Classified load spectrum MUST** be understood by my service and **MUST** be consumed by my service provider API.
> **CX-0057 Semantic Model: Remaining Useful Life MUST** be provided as part of my communication of the result towards the requestor and/or requesting application
> **CX-0058 API: Endurance Predictor**: **MUST** be followed in terms of all relevant parts for a service provider

As a Service Requestor or Service Requestor Application I need to fulfill the following standards in the following contexts:

> **CX-0056 Semantic Model: Classified load spectrum MUST** be provided as part of the request for a remaining useful life calculation towards a service operator's API

CX-0057 Semantic Model: Remaining Useful Life MUST be consumable by my connected underlying application.
CX-0058 API: Endurance Predictor: **MUST** be followed in terms of all relevant parts for a service requestor

2.1 LIST OF STANDALONE STANDARDS

> *This section is normative*

To participate in the Triangle Behavioral Twin Endurance Predictor, the following single standards **MUST** be fulfilled:

CX - 0018 Eclipse Data Space Connector (EDC)

2.2 ADDITIONAL REQUIREMENTS

3 REFERENCES

3.1 NORMATIVE REFERENCES

CX – 0018 Sovereign Data Exchange

3.2 NON-NORMATIVE REFERENCES

> *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*