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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Asset Administration Shell for industrial applications – Part 1: Asset Administration Shell structure

Enveloppe de Gestion d'Actif pour applications industrielles – Partie 1: Structure de l'Enveloppe de Gestion d'Actif

IEC 63278-1:2023-12(en-fr)

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Asset Administration Shell for industrial applications – Part 1: Asset Administration Shell structure

Enveloppe de Gestion d'Actif pour applications industrielles – Partie 1: Structure de l'Enveloppe de Gestion d'Actif

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ASSET ADMINISTRATION SHELL FOR INDUSTRIAL APPLICATIONS –

Part 1: Asset Administration Shell structure

FOREWORD

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Draft	Report on voting
65/1012/FDIS	65/1027/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 63278 series, published under the general title *Asset Administration Shell for industrial applications*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

0.1 General

The production system life cycle focuses on the design, deployment, commissioning, operation and decommissioning of an entire production facility. Product life cycle management is the process of managing the entire life cycle of a product with the information flows and controls from inception, through engineering design and manufacture, to service and end of life treatment of manufactured products. The supply chain management is the management of the flow of products and services and includes processes that transform raw materials and parts components into final products, and it involves the streamlining of business activities to maximize customer value and gain a competitive advantage in the marketplace. Each of these dimensions intersects at the vertical integration of machines, plants, and enterprise systems in the equipment hierarchy of an enterprise pyramid. The integration of manufacturing software applications along each dimension and across dimensions helps to enable advanced controls at the shop floor and optimal decision-making at the enterprise. Details of existing manufacturing standards for each of the three life cycle dimensions are provided in [1][1].

Several integration technologies have been individually put into practical use (e.g. CAD/CAM) aiming to accelerate product innovation cycles, streamline supply chains, and increase production system flexibility through information exchange between the dimensions. Details of the integration technologies and capabilities supported by them are provided in [1].

The Asset Administration Shell (AAS) is seen as one interoperable manifestation of a digital twin in manufacturing that facilitates tighter integration within and across the three dimensions mentioned above.

This document is the first part of the series "Asset Administration Shell for industrial applications". The multiple parts of the series will detail structure, information models, definition of services and online interfaces, required security aspects and communication languages including mapping contents of OPC UA and AutomationML models to the Asset Administration Shell.

0.2 Overview on parts of the series

The current planning foresees parts covering the following topics:

- Asset Administration Shell structure (this document)
- information meta model (to allow to access standardized information)
- security provisions for Asset Administration Shells
- use cases and modelling examples
- interfaces to Asset Administration Shells
- communication language among sets of Asset Administration Shells
- specification of content of Asset Administration Shells for various domains

This part of IEC 63278 describes requirements towards the general structure, that each possible Asset Administration Shell should comply with. In a following part of the series, this structure will be developed further towards a meta-model of the Asset Administration Shell. Based on these specifications, individual Asset Administration Shells can be created. These individual Asset Administration Shells will be the actual containers of information and will provide information and services with respect to the described asset.

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1 Numbers in square brackets refer to the Bibliography.

0.3 Interoperability

The Asset Administration Shell pursues the overall purpose to support interoperability of software applications. According to ISO/IEC 21823-1, different facets for interoperability can be considered (see Figure 1).

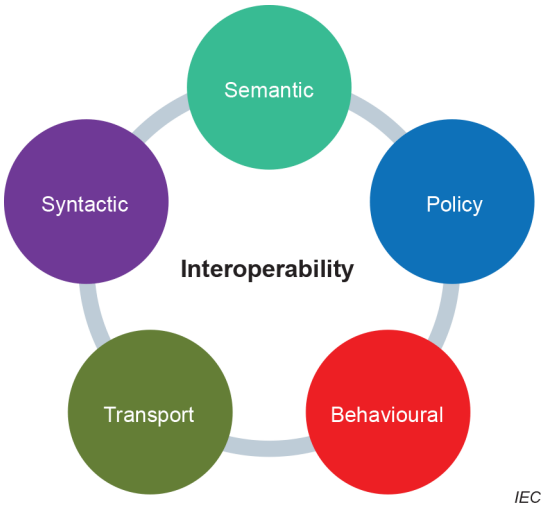

Figure 1 – Facets of interoperability according to ISO/IEC 21823-1

Semantic interoperability considers the meaning of the data model within the context of a subject area so that it is understood by the participating software applications. The Asset Administration Shell addresses semantic interoperability by associating well-known concepts to the data, which is exchanged between the software applications.

Policy interoperability considers the compliance with the legal, organizational, and policy frameworks applicable to the participating software systems. The Asset Administration Shell addresses policy interoperability in the following way:

- The Asset Administration Shell provides uniform identity and access control management including usage restriction for information and services of assets.
- The Asset Administration Shell enables uniform structuring of information and services of assets. This allows the Asset Administration Shell to define and maintain the structure of information and services of an asset and not the individual software applications. This simplifies information management in manufacturing industries by both reducing the effort and increasing the quality of information.

Transport interoperability considers the data transfer between software applications based on an established communication infrastructure between the participating software applications. This facet is not addressed in this part of the series but will be considered in further parts of the series.

Syntactic interoperability considers the data format by which the exchanged information can be understood by the participating software applications. This facet is not addressed in this part of the series but will be considered in further parts of the series.

Behavioural interoperability considers the expected outcomes to interface operations. This facet is addressed by the Asset Administration Shell in the sense that the Asset Administration Shell provides a standardized interface to software applications. The concrete behaviour of this standardized interface will be considered in further parts of the series.

0.4 Key objectives of the Asset Administration Shell

The following statements summarize these discussions and formulate some aims for the Asset Administration Shell, helping to keep the focus:

- Asset Administration Shell aims at establishing cross-company interoperability. Assets within manufacturing are provided by many different enterprises. In order to fulfil the scenarios of today and tomorrow, information and services on assets should be interoperable.
- Asset Administration Shell is intended for non-intelligent and intelligent products. The concept of asset comprises many different entities, with or without the ability to communicate actively or being intelligent. To leverage benefits in engineering, maintenance or operation throughout all hierarchy levels, the idea of the Asset Administration Shell is suitable to be applied by all assets.
- Asset Administration Shell aims at covering the complete life cycle of products, devices, machines and facilities.
  Much useful information on assets is formed in the early phase of their life cycle, such as design, engineering and marketing. To maintain economic efficiency, digitized information from these early phases should be preserved and used in later phases, such as engineering higher level structures and operating and maintaining these structures.
- Asset Administration Shell aims at enabling integrated value chains.
  Assets for manufacturing lines and products are provided by many different value chain partners. To maintain economic efficiency, digitized information should be exchanged among value chain partners. This will also enable advanced production modes (see 0.1).
- Asset Administration Shell is intended to be a base for autonomous systems and artificial intelligence.
  In the future, many benefits are expected from approaches such as autonomous systems and artificial intelligence. These approaches require a sound basis of information and identifiers of elements. The Asset Administration Shell provides both.

ASSET ADMINISTRATION SHELL FOR INDUSTRIAL APPLICATIONS –

Part 1: Asset Administration Shell structure

1 Scope

This part of IEC 63278 defines the structure of a standardized digital representation of an asset, called Asset Administration Shell (AAS). The Asset Administration Shell gives uniform access to information and services.

The purpose of the Asset Administration Shell is to enable two or more software applications to exchange information and to mutually use the information that has been exchanged in a trusted and secure way.

This document focuses on Asset Administration Shells representing assets of manufacturing enterprises including products produced by those enterprises and the full hierarchy of industrial equipment. It defines the related structures, information, and services.

The Asset Administration Shell applies to:

– any type of industrial process (discrete manufacturing, continuous process, batch process, hybrid production);
– any industrial sector applying industrial-process measurement, control and automation;
– the entire life cycle of assets from idea to end of life treatment;
– assets which are physical, digital, or intangible entities.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62443 (all parts), *Security for industrial automation and control systems*

3 Terms, definitions, abbreviated terms, and conventions

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
asset
entity owned by or under the custodial duties of an organization, which has either a perceived or actual value to the organization

Note 1 to entry: An asset can be single entity, a collection of entities, an assembly of entities or a composition of entities.

EXAMPLE 1 Examples for physical entities are equipment, raw material, parts components and pieces, supplies, consumables, physical products and waste.

EXAMPLE 2 Software is an example of a digital asset.

EXAMPLE 3 A software license is an example of an intangible asset.

[SOURCE: IEC TR 63283-1:2022, 3.1.26, modified – the notes and example have been added]

3.1.2
Asset Administration Shell
AAS
standardized digital representation of an asset

3.1.3
AAS interface
interface of an AAS giving uniform access to information and services

EXAMPLE Examples for services are exploration services, asset services, and asset related services.

3.1.4
AAS responsible
individual or organization having interest in an asset and governing an Asset Administration Shell

3.1.5
AAS user application
software application which accesses an AAS via its AAS interface(s) for use by humans or for automatic processing

3.1.6
asset integration
software or computing infrastructure, or both, needed to access asset services

3.1.7
asset service
service that is provided by the considered asset

3.1.8
asset related service
service that is not provided by the considered asset, but by the software or computing infrastructure, or both, outside of the considered asset

3.1.9
component
product used as a constituent in an assembled product, system or plant

[SOURCE: IEC 61666:2010+AMD1:2021 CSV, 3.6)

3.1.10
concept
unit of knowledge created by a unique combination of characteristics

[SOURCE: IEC 61360-1:2017, 3.1.8]

3.1.11
concept repository
collection of entries that allows lookup by concept identifier and where relationships between entries can be described

[SOURCE: IEC 62832-1:2020, 3.1.5, modified – in the term "concept dictionary" has been replaced with “concept repository”, in the definition “concept dictionary” has been deleted after “collection of”, the second part of the definition, starting with “and where…” has been added and the note has been deleted]

3.1.12
concept repository entry
description of a concept containing, at a minimum, an unambiguous concept identifier, a preferred name, and a description

[SOURCE: IEC 62832-1:2020, 3.1.6, modified – in the term, “dictionary” has been replaced with “repository” and in the definition, “definition” has been replaced with “description”]

3.1.13
digital representation
information and services representing an entity from a given viewpoint

EXAMPLE 1 Examples of information are properties (e.g. maximum temperature), actual parameters (e.g. actual velocity), events (e.g. notification of status change), schematics (electrical) and visualization information (2D drawings, 3D drawing).

EXAMPLE 2 Examples of services are asset services (for example providing the history of the configuration data or providing the actual velocity) and asset related services (for example providing a simulation).

EXAMPLE 3 Examples of viewpoints are mechanical, electrical, or commercial characteristics.

3.1.14
end of life treatment
operation after a waste has been handed over to a facility for product and product part reuse, material recycling, energy recovery and residue disposal

Note 1 to entry: This includes dismantling, material separation and disposal.

SOURCE: IEC TR 62635:2012, 3.3, modified – insertion of Note 1 to entry]

3.1.15
entity
thing (physical or non-physical) having a distinct existence

[SOURCE: ISO/IEC 20924:2021, 3.1.18]