ASSET ADMINISTRATION SHELL
READING GUIDE (AS OF APRIL 2021)

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Aim of this document

Over the course of the last years the Plattform Industrie 4.0 and related organizations have published numerous papers concerning the Asset Administration Shell. This document acts as a guide by recommending selected „must-read" documents for different reader groups and will be updated regularly.

Goals of Industrie 4.0

Industrie 4.0 (I4.0) refers to the intelligent networking of machines and processes for industry with the help of information and communication technology. Today's rigid and strictly defined value chains are replaced by flexible, highly dynamic and globally connected value networks with new forms of cooperation. The Asset Administration Shell helps implementing digital twins for I4.0 and creating interoperability across the solutions of different suppliers.

Asset Administration Shell in a nutshell

The Asset Administration Shell (AAS) is the digital representation of an asset. The AAS consists of a number of submodels in which all the information and functionalities of a given asset – including its features, characteristics, properties, statuses, parameters, measurement data and capabilities – can be described. It allows for the use of different communication channels and applications and serves as the link between objects and the connected, digital and distributed world.

The structure of the AAS is defined via a technology independent meta-model and several technology specific serialization mappings such as XML, JSON or OPC UA. Its contents are defined via domain-specific submodel templates.

The interaction with the AAS can follow different patterns which have different technical requirements, i.e. file exchange, server-client and peer-to-peer interaction (Figure 1).

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 are 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.
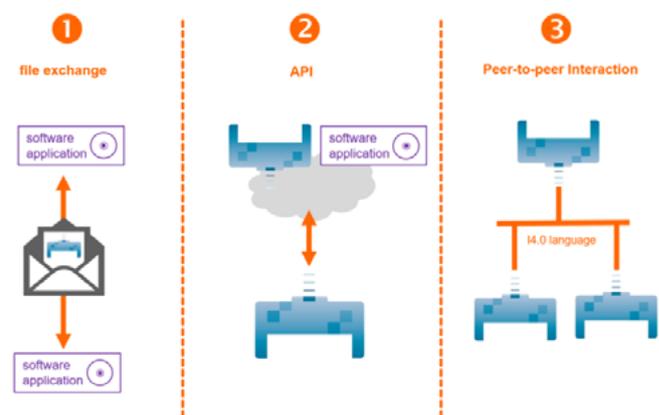
Figure 1: AAS interaction patterns

Where to start

When completely new to the topic of I4.0 and the AAS we highly recommend visiting the website of the Plattform Industrie 4.0 [1]. Then start with the Two-Pager [2] and the presentation slides [3]. The first few slides of the Presentation [4] cover general AAS topics, later slides introduce some advanced topics. All these should provide a brief and quick introduction into the topic in general. For a deep dive [5] gives a comprehensive overview of recent and current activities of the Plattform I4.0.

For the generally interested reader

The most extensive introduction into I4.0 can be found in the book [6]. The introduction and the chapters on how to transport semantic information are insightful, but the more technical sections are partially outdated. [7] gives a condensed overview of the concepts and serves in many ways as a leading picture. It also outlines how existing and future standards shall be brought into alignment to these concepts. [9] is recommended, because it covers all major aspects of I4.0 (including finding use cases, creating semantic models, and operation) by using a drive as an example. The described concepts can easily be transferred to sensors and actors in general.

For decision makers

[8] answers why semantic interoperability will become crucial for future manufacturing. [10] includes a detailed list of technical criteria that need to be fulfilled for an I4.0 component. It also includes a technology roadmap and lists several examples of commercially available products that fulfill these criteria. [11] provides companies with support in determining how their own data organization can be revised and gives step by step realization guidelines.

For software developers and architects

The most important documents are [12] and [13]. Part 1 of the Series "Asset Administration Shell in Detail" covers the AAS meta model and its technology specific serializations, whereas Part 2 focuses on the concept and realization of the common AAS API. For implementations the open source projects on https://github.com/admin-shell-io and others (see below) are highly recommended. As an overview [8] describes the different shapes of the AAS from a technical perspective including security.

Whereas the technical details for composite AAS (AAS for assets composed of multiple assets) are given in [12], the introduction to the concept can be found in [14].
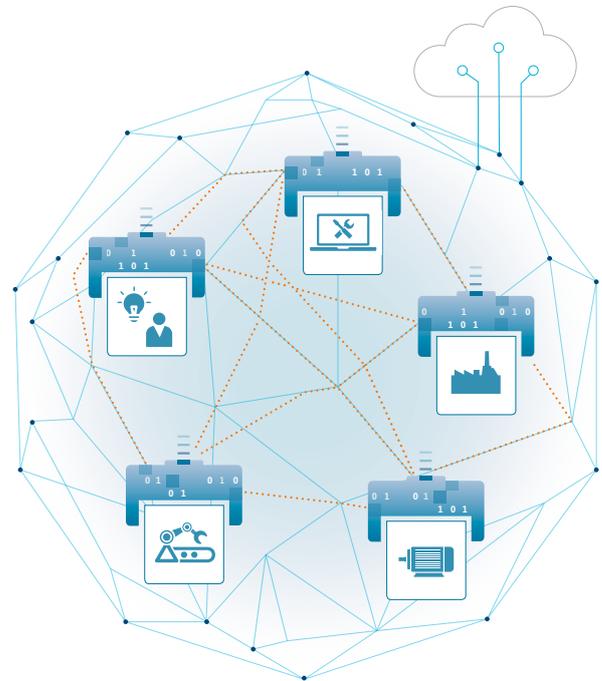
For users of the AAS and domain experts

If you are interested in using or creating AAS we recommend to start by looking into the software tool AASX package explorer (see below) and the screencasts at http://admin-shell-io.com/screencasts/. The first submodel templates have been released to define the contents of the submodels „Digital Nameplate" (https://bit.ly/2PmdHgr) and „Technical Data" (https://bit.ly/31zY0os). More will follow. [11] and [15] might also be of interest. [16] gives an introduction and example on how to model an asset using standardized properties, however some technical details might be outdated.

Security and AI

Although it does not deal specifically with the AAS, [15] highlights requirements for the secure use of OPC UA for communication in I4.0 scenarios and presents implementation options. [17] describes requirements and implementations of a secure communication in the engineering process.

[18] explains different secure data access architectures and looks at questions regarding at implementation and applicability. [19] focusses on the application of AI in industrial production and analyses different use cases for potential impact and questions. [22] discusses the means of capability and skill to provide standardized information about an assets functionality.

Tools, examples and prototypes

The website https://github.com/admin-shell-io contains the latest version of the **AASX package explorer**, which can be used to create, edit and view AAS file serializations

(*.aasx). The site also includes the **AASX-server** which makes AASX packages accessible via REST, OPC UA and MQTT, a highly recommended FAQ with best practices and further resources.

BaSyx (https://bit.ly/3mNRe85) provides various modules to cover a broad scope of I4.0 (including AAS). Hence its substantially more complex architecture. PyI40AAS (https://bit.ly/307hPmJ) is a Python module for manipulating and validating AAS. On http://www.i40-aas.de/ one can access numerous AAS examples of different vendors based on the use case of a digital nameplate.

References

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[19] „AI Application Guide,“ 09/2020: https://bit.ly/2GpHaS6.

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