IDTA 02004-1-2 Handover Documentation

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Submodel Template of the Asset Administration Shell

Submodel Template
IDTA approved
- 100% AAS compliant
- Consistent & interoperable
- Released by the AAS experts

Imprint

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	1.1	Used for development only. No official version published.
2023-03-01	1.2	Release of the official Submodel template published by IDTA.

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1 General

1.1 About this document

This document is part of a specification series. Each part specifies the contents of a Submodel template for the Asset Administration Shell (AAS). The AAS is described in [1], [2], [3], and [6]. First exemplary Submodel contents were described in [4], while the actual format of this document was derived from the "Administration Shell in Practice" [5]. The format aims at being very concise. It gives only minimal necessary information for applying a Submodel template, while leaving more in-depth descriptions and specifications of concepts, structures, and mapping to the respective documents [1] to [6].

The target group of the specification are developers and editors of technical documentation and manufacturer information, which describe assets in smart manufacturing by means of the Asset Administration Shell (AAS) and therefore need to create a Submodel instance with a hierarchy of SubmodelElements. This document focuses on the question which SubmodelElements shall be used for this purpose with which semantic identification.

1.2 Scope of the Submodel

The Submodel Handover Specification defines a standardized exchange format for information or documentation for a specific asset. The scope of this Submodel is to increase the interoperability between the parties that are exchanging asset documentation. These parties can be manufacturers of components or complete machines, or operators using these components or machines. In case a machine manufacturer sells a machine to a customer (operator), the manufacturer hands over the machine and its documentation in form of an AAS with the Submodel "Handover Documentation". The documents provided can contain information required for e.g. correct design, installation, commissioning, spare parts stocking, operation, cleaning, inspection, maintenance, and repair. In addition, there are legal regulations that stipulate the existence of certain manufacturer documents, such as Communauté Européenne (CE) declarations of conformity, Atmosphères Explosives (ATEX) certificates, or material certificates.

Besides the structure of a Submodel and the exchange format of an AAS, this Submodel standardizes the meta data that comes with the asset documentation and the classes that classify the type of the document. With these standardized meta data and classes, the asset documentation can be automatically integrated in the customer's document management system, backend system, or any other system.

The meta data as well as the classification classes of this Submodel are based on the VDI Guideline VDI 2770 Blatt 1 "Operation of process engineering plants – Minimum requirements for digital manufacturer information for the process industry" [7]. While the classification of documents according to VDI 2770 is mandatory, additional classification classes can be added.

1.3 Relevant standards for the Submodel template

VDI 2770 Blatt 1

VDI 2770 Blatt 1 [7] standardizes the documentation regarding their meta data, classification, and format. The idea is that manufacturers hand over their documentation in a standardized manner, making it easier for operators to load the documentation for a component or a complete machine (both referred to in the following as asset) into their IT infrastructure and to find relevant documents during the operation phase of an asset. The central concepts of the specification are the entities "Document" and "DocumentVersion", which are described in the Unified Modeling Language (UML) below.

The entity "Document" describes the understanding of a document in total as a specific concept of product-related information. The entity "DocumentVersion" represents a specific instance of the "Document" within its lifecycle, e.g. a released version of the Document.

The following diagram gives an overview on the concepts of VDI 2770.
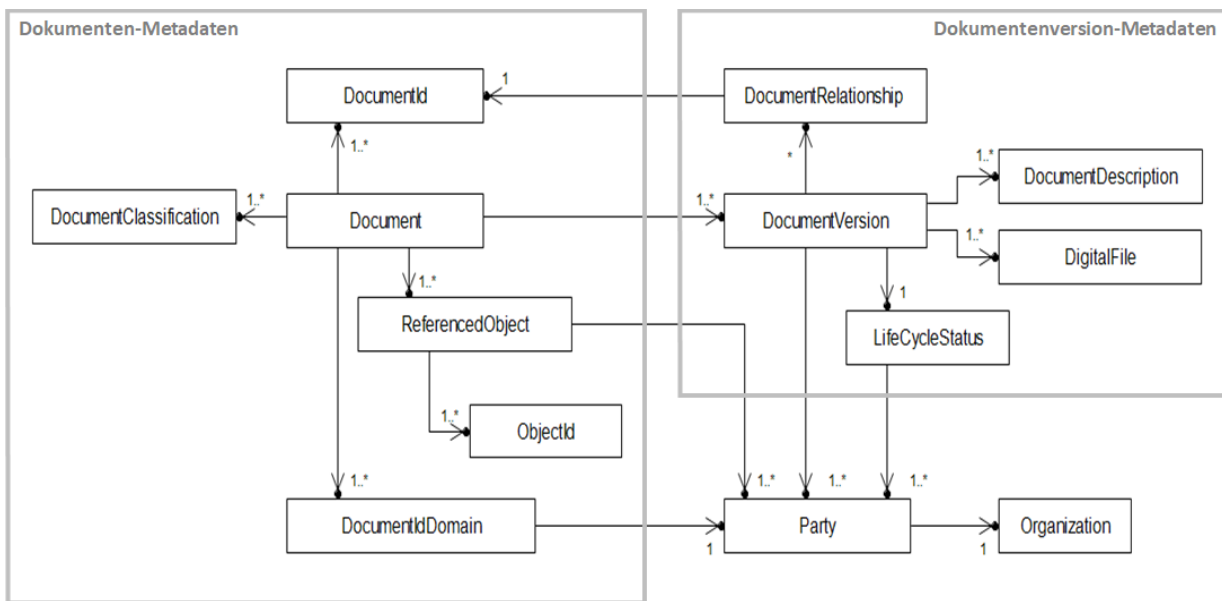
Figure 1: Overview of concepts Documents and DocumentVersion of the VDI 2770 according to [7], by courtesy of VDI

Taking advantage of the already formalized structures of the Asset Administration Shell and its SubmodelElements, the following concepts based on VDI 2770 Blatt 1 are relevant for the Submodel template specification.
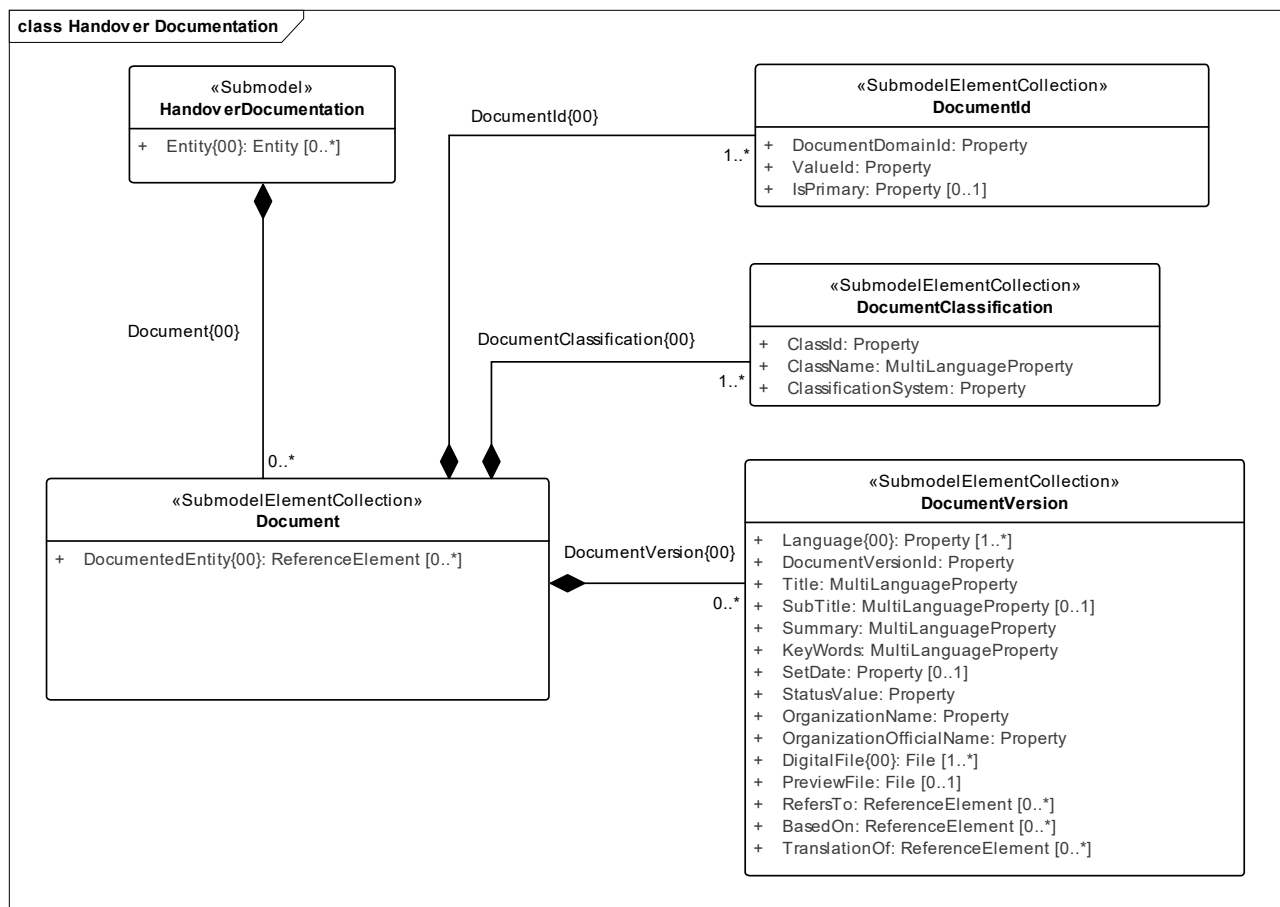
Figure 2: Submodel Handover Documentation based on basic concepts of the VDI 2770 Blatt 1

The Submodel "Handover Documentation" specifies a document in more detail via the DocumentID, the DocumentClassification, and the DocumentVersion with its respective characteristics.

2 Submodel for Handover Documentation based on VDI 2770 Blatt 1

2.1 Approach

This Submodel template specification models the two main VDI 2770 Blatt1 concepts "Document" and "DocumentVersion" with their mandatory information elements. Multiple DocumentVersions can be assigned to each Document. The specifications for an instance of the overall Submodel, the Document, and the DocumentVersion are provided in clauses 2.4, 2.5, and 2.8.

If a document exists in multiple languages, it shall be represented by different "Documents". If a document features multiple languages within itself, it shall be represented by a single "DocumentVersion" with multiple associated languages. If an AAS contains more than one version of one and the same document, they can be represented by different instances of "DocumentVersion".

A SubmodelElementCollection (SMC) "DocumentVersion" shall contain at least one file element "DigitalFile". According to VDI 2770, PDF/A files are required including ISO 19005-1, ISO 19005-2 and ISO 19005-3 meaning PDF/A-1, PDF/A-2 and PDF/A-3. The "DigitalFile" described above can also be provided in the Submodel via a link, which is technically supported by the file element of an AAS. Nevertheless, the legal requirements (e.g. Machinenrichlinie)[1] for the "DigitalFile" according to ISO 19005 and the document/information provided by a link should be identical. If multiple "DigitalFiles" with different MIME-Types[2] are used, each of them is assumed to represent the "DocumentVersion" in total and must contain equal content.

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[1] Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast)

[2] Multipurpose Internet Mail Extensions, see: https://www.iana.org/assignments/media-types/media-types.xhtml
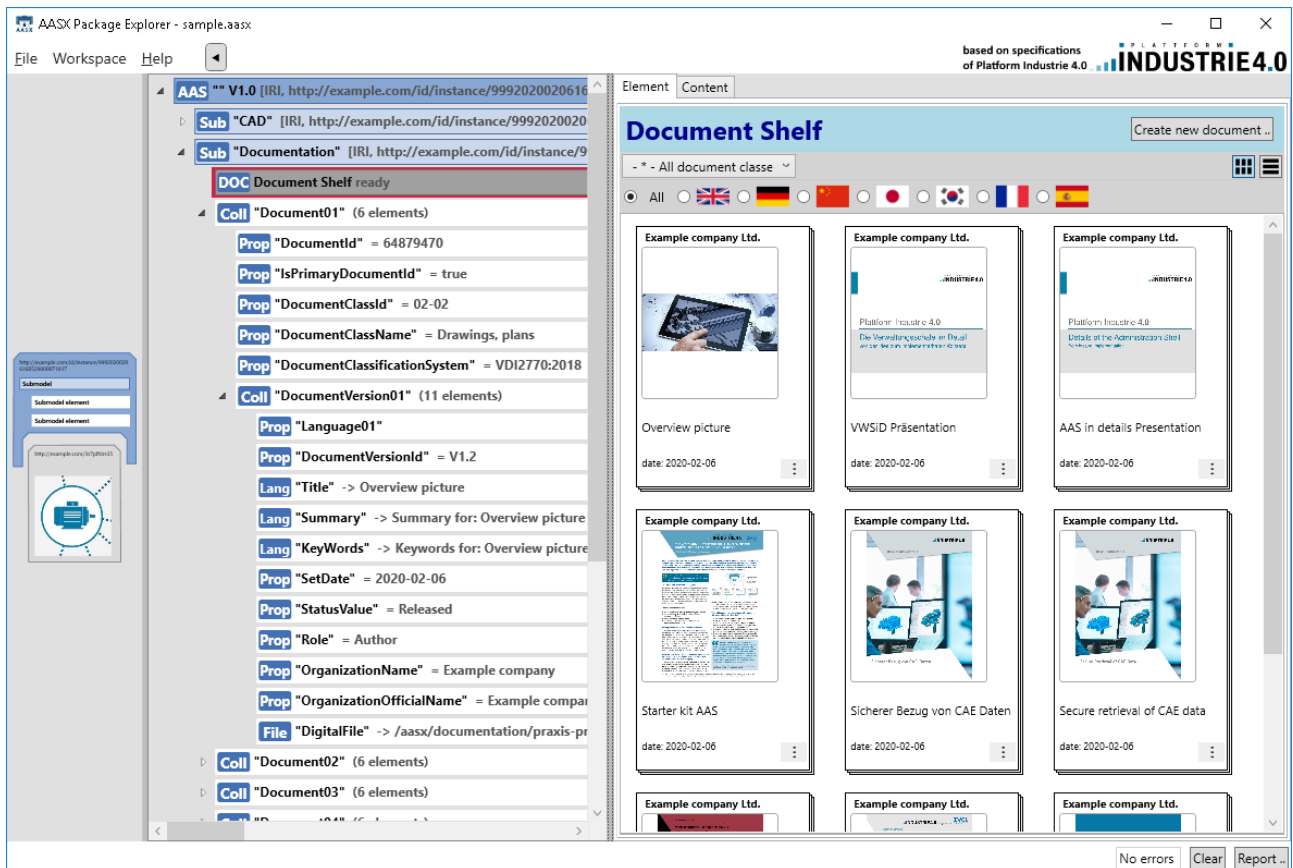
Figure 3: AASX Package Explorer with Submodel "Documentation" of an example asset, featuring multiple documents, each with at least one "DocumentVersion"

For further information on the approaches of VDI 2770 Blatt 1, see **Annex B**.

2.2 Association of documents to Assets and Entities

VDI 2770 Blatt 1 uses so called ObjectIds to express the association of documents with different objects. In an Asset Administration Shell (AAS), the association with the object is already given implicitly by the basic relation of the AAS to the respective asset [3].

However, the documentation of a complex piece of equipment may include further supplier parts. These parts can be marked as separate entities within the AAS of the equipment by introducing Entity submodel elements within the Submodel for Documentation.

If these Entities are categorized as 'self-managed', they might refer to self-standing AAS for the supplier parts via the Entity attribute global AssetId. In this case, the provider of the equipment will provide two AAS, one for the equipment, and one for the supplier part. The recommendation for simple cases[3] is to mark included supplier parts as included 'co-managed' Entities. In any case, the creation of an Entity element is required.

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[3] Please note: Entity elements may contain SubmodelElements such as Properties or SubmodelElemementCollection, but no self-standing Submodels. Therefore, self-managed entities shall be used for complex cases (e.g., a Submodel for Technical Data shall be provided).
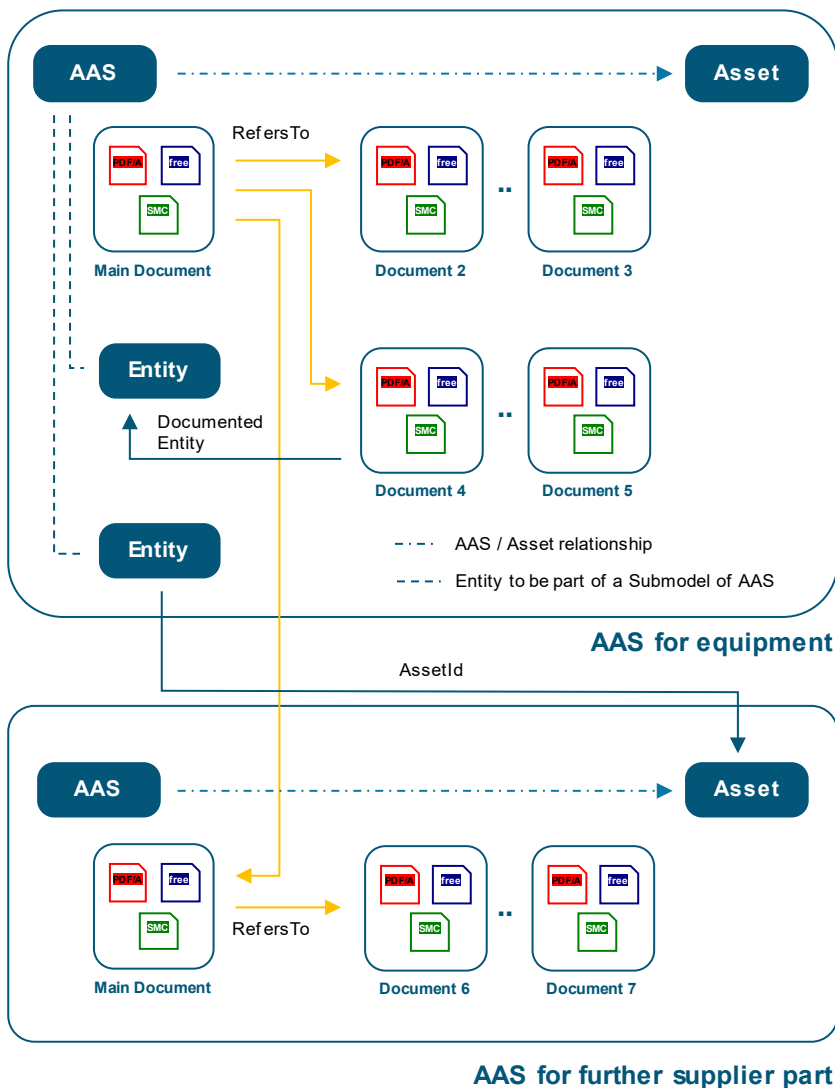
Figure 4: Association of documents to Assets and Entities

ReferenceElements called "RefersTo" link the main document of an Asset, e.g., a piece of equipment, to its subordinate documents"". These references can span multiple AAS. In this case, the AssetId shall be used as first key. For further details on ReferenceElement, see [6].

If a "Document" relates to a dependent (self-managed or co-managed) Entity and not to the Asset of the AAS itself, a ReferenceElement called "DocumentedEntity" shall be used.

2.3 Enumeration: document classification according to VDI 2770 Blatt 1:2020

VDI 2770 Blatt 1 defines a basic set of different classes for documents, which allows the operator of the industrial equipment to manage and retrieve information efficiently. This classification is understood as ClassificationSystem identified by the value "VDI 2770 Blatt 1:2020" within this Submodel template. For each class of documents ("DocumentClassification"), a "ClassId" and "ClassName" is given. While the latter can be given in multiple languages, EN is mandatory. The existing Document Classes according to VDI 2770 Blatt 1:2020 are listed in the table below.

Table 1: DocumentClassification according to VDI 2770 Blatt 1: 2020

ClassID	ClassName (EN)	ClassName (DE)
01-01	Identification	Identifikation
02-01	Technical specification	Technische Spezifikation
02-02	Drawings, plans	Zeichnungen, Pläne
02-03	Assemblies	Bauteile
02-04	Certificates, declarations	Zeugnisse, Zertifikate, Bescheinigungen
03-01	Commissioning, de-commissioning	Montage, Demontage
03-02	Operation	Bedienung
03-03	General safety	Allgemeine Sicherheit
03-04	Inspection, maintenance, testing	Inspektion, Wartung, Prüfung
03-05	Repair	Instandsetzung
03-06	Spare parts	Ersatzteile
04-01	Contract documents	Vertragsunterlagen

A "Document" can be assigned to multiple "DocumentClassifications" of one single classification system, as well as to different "DocumentClassifications" of different classification systems. The classification according to VDI 2770 Blatt 1:2020 is mandatory in the Submodel Handover Documentation.

Further document classification systems such as IEC 61355-1:2008 are mentioned and described in **Annex C**.

2.4 Attributes of the Submodel instance

The following attributes need to be set for the Submodel instance. The table convention is explained in Annex A.2.

The ECLASS IRDIs referenced in this Submodel are based on ECLASS Release 13. This version of the Submodel with these ECLASS IRDIs is also available in the download area of the ECLASS website: www.eclass.eu in form of the Asset.xml. The Asset.xml (Release 13) is the ECLASS file that contains submodels. The use of these Submodels is free of charge.

Table 2: Attributes of the Submodel instance

idShort:	HandoverDocumentation{00} Note: a different idShort might be used, as long as it is unique in the Submodel.
Class:	Submodel (SM)
semanticId:	[IRDI] 0173-1#01-AHF578#001
Parent:	Asset Administration Shell, which the documents shall be associated to
Explanation:	The Submodel defines a set meta data for the handover of documentation from the manufacturer to the operator for industrial equipment.

[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	Description@en	example	
[SMC] Document{00}	[IRDI PATH4] 0173-1#02-ABI500#001/0173-1#01-AHF579#001 [IRDI for number of Documents (optional)]: 0173-1#02-ABH990#001 Each SMC describes a Document (see IEC 82045-1 and IEC 8245-2), which is associated with the particular Asset Administration Shell.	n/a	0..*
[Entity] Entity{00}	[IRI] https://admin-shell.io/vdi/2770/1/0/EntityForDocumentation States that the described Entity is an important entity for documentation of the superordinate Asset of the Asset Administration Shell. Note: typically, such Entities are well-identified sub-parts of the Asset, such as supplier parts delivered to the manufacturer of the Asset. Note: these Entities are the target of the "DocumentedEntity"-ReferenceElements of the particular Documents contained in this Submodel. This mechanism substitutes the ObjectId-provision of VDI 2770 (see section 2.2). Note: if the described Entity has an own Asset Administration Shell, the SelfManaged-flag and AssetId-reference of the Entity shall be set accordingly.	Entity for an important sealing or bearing of the equipment.	0..*

2.5 SubmodelElements of Document

The SubmodelElementCollection (SMC) Document contains the information for a VDI 2770 "Document". Such a "Document" can refer to multiple "DocumentVersions", which are individual SubmodelElementCollections contained within the superordinate "Document" SMC. The table convention is explained in Annex A.2.

Table 3: SubmodelElements of Document

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4 The IRDI path consists of the reference property to the block and the block itself separated with a slash.

idShort:	Document{00} Note: a different idShort might be used, as long as it is unique in the Submodel.
Class:	SubmodelElementCollection (SMC)
semanticId:	[IRDI PATH] 0173-1#02-ABI500#001/0173-1#01-AHF579#001
Parent:	Submodel with idShort = HandoverDocumentation and respective semanticId.
Explanation:	This SubmodelElementCollection holds the information for a VDI 2770 Document entity.

[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	**Description@en**	**example**	
[SMC] DocumentId{00}	[IRDI PATH] 0173-1#02-ABI501#001/0173-1#01-AHF580#001 [IRDI for number of DocumentIds (optional)]: 0173-1#02-ABH991#001 Set of document identifiers for the Document. One ID in this collection should be used as a preferred ID (see isPrimary below)	see below	1..*
[SMC] DocumentClassification{00}	[IRDI PATH] 0173-1#02-ABI502#001/0173-1#01-AHF581#001 [IRDI for number of DocumentClassifications (optional)]: 0173-1#02-ABH992#001 Set of information for describing the classification of the Document according to ClassificationSystems. Constraint: at least one classification according to VDI 2770 shall be provided.	See below	1..*
[SMC] DocumentVersion{00}	IRDI PATH] 0173-1#02-ABI503#001/0173-1#01-AHF582#001 [IRDI for number of DocumentVersions (optional)]: 0173-1#02-ABH993#001 Information elements of individual VDI 2770 DocumentVersion entities. Note: at the time of handover, this collection shall include at least one DocumentVersion.	See below	0..*

| [Ref]

DocumentedEntity{00} | For DocumentId{00}:

[IRDI PATH] 0173-1#02-ABI501#001/0173-1#01-AHF580#001*00

For DocumentClassification{00}:

[IRDI PATH] 0173-1#02-ABI502#001/0173-1#01-AHF581#001*00

For DocumentVersion{00}:

[IRDI PATH] 0173-1#02-ABI503#001/0173-1#01-AHF582#001*00

Identifies entities, which are subject to the Document.

Note: can be omitted, if the subject of the Document is the overall Asset of the Asset Administration Shell.

Note: if no Entity according to clause 2.2 is referenced, this ReferenceElement is not required at all.

Note: this mechanism substitutes the ObjectId-provision of VDI 2770 Blatt 1 (see section 2.2 and appendix B).

Constraint: reference targets an Entity within the Submodel "ManufacturerDocumentation". | n/a | 0..* |

2.6 SubmodelElements of DocumentID

The SubmodelElementCollection (SMC) DocumentId identifies the Document in a given Domain. The table convention is explained in Annex A.2.

Table 4: SubmodelElements of DocumentID

idShort:	DocumentId{00}
	Note: a different idShort might be used, as long as it is unique in the Submodel.
Class:	SubmodelElementCollection (SMC)
semanticId:	[IRDI PATH] 0173-1#02-ABI501#001/0173-1#01-AHF580#001
Parent:	SubmodelElementCollection of Document with respective idShort and semanticId (see above)
Explanation:	This SubmodelElementCollection holds the information for a VDI 2770 DocumentIdDomain entity and the DocumentId property.

[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	**Description@en**	**example**	
[Property] DocumentDomainId	[IRDI] 0173-1#02-ABH994#001 Identification of the domain in which the given DocumentId is unique. The domain ID can be e.g. the name or acronym of the providing organization.	[string] 1213455566	1
[Property] ValueId	[IRDI] 0173-1#02-AAO099#002 Identification number of the Document within a given domain, e.g. the providing organization.	[string] 1213455566 [string] XF90-884	1
[Property] IsPrimary	[IRDI] 0173-1#02-ABH995#001 Flag indicating that a DocumentId within a collection of at least two DocumentIds is the 'primary' identifier for the document. This is the preferred ID of the document (commonly from the point of view of the owner of the asset). Note: can be omitted, if the ID is not primary. Note: can be omitted, if only one ID is given for a Document. Constraint: only one DocumentId in a collection may be marked as primary.	[Boolean] true	0..1

2.7 SubmodelElements of DocumentClassification

The SubmodelElementCollection (SMC) "DocumentClassification" contains the information for a classification of a document according to a classification system. A Document might have multiple classifications in multiple systems. The table convention is explained in Annex A.2.

Table 5: SubmodelElements of DocumentClassification

idShort:	DocumentClassification{00}
	Note: a different idShort might be used, as long as it is unique in the Submodel.
Class:	SubmodelElementCollection (SMC)
semanticId:	[IRDI PATH] 0173-1#02-ABI502#001/0173-1#01-AHF581#001
Parent:	SubmodelElementCollection of Document with respective idShort and semanticId (see above)
Explanation:	This SubmodelElementCollection holds the information for a VDI 2770 DocumentClassification entity.

[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	**Description@en**	**example**	
[Property] ClassId	[IRDI] 0173-1#02-ABH996#001 Unique ID of the document class within a ClassificationSystem. Constraint: if ClassificationSystem is set to "VDI2770 Blatt 1:2020", the given IDs of VDI2770 Blatt 1:2020 shall be used (see Table 1).	[string] 03-02 [string] BB	1
[MLP] ClassName	[IRDI] 0173-1#02-AAO102#003 List of language-dependent names of the selected ClassID. Constraint: if ClassificationSystem is set to "VDI2770 Blatt 1:2020", the given names of VDI2770:2020 need be used (see Table 1). Constraint: languages shall match at least the language specifications of the included DocumentVersions (below).	Operation@en Bedienung@de Berichte@de Reports@de	1
[Property] ClassificationSystem	[IRDI] 0173-1#02-ABH997#001 Identification of the classification system. For classifications according to VDI 2270 Blatt 1, always set to "VDI2770 Blatt 1:2020". Further classification systems are commonly used, such as "IEC61355-1:2008".	[string] VDI2770 Blatt 1:2020 [string] IEC61355-1:2008	1

2.8 SubmodelElements of DocumentVersion

The SubmodelElementCollection (SMC) DocumentVersion contains the information for a VDI 2770 DocumentVersion. The table convention is explained in Annex A.2.

Table 6: SubmodelElements of DocumentVersion

idShort:	DocumentVersion{00}
	Note: a different idShort might be used, as long as it is unique in the SubmodelElementCollection of the parent Document.
Class:	SubmodelElementCollection (SMC)
semanticId:	[IRDI PATH] 0173-1#02-ABI503#001/0173-1#01-AHF582#001
Parent:	SubmodelElementCollection of Document with respective idShort and semanticId (see above)
Explanation:	This SubmodelElementCollection holds the information for a VDI2770 DocumentVersion entity.

[SME type]	semanticId = [idType]value	[valueType]	card.
idShort	Description@en	example	
[Property] Language{00}	[IRDI] 0173-1#02-AAN468#006 This property contains a list of languages used within the DocumentVersion. Each property codes one language identification according to ISO 639-1 or ISO 639-2 used in the Document.	[string] en	1..*
[Property] DocumentVersionId	[IRDI] 0173-1#02-AAO100#002 Unambiguous identification number of a DocumentVersion.	[string] V1.2	1
[MLP] Title	[IRDI] 0173-1#02-AAO105#002 List of language-dependent titles of the Document. Constraint: for each language-dependent Title, a Summary and at least one KeyWord shall exist for the given language.	Exemplary title@en Deutscher Titel@de	1
[MLP] SubTitle	[IRDI] 0173-1#02-ABH998#001 List of language-dependent subtitles of the Document.	Exemplary subtitle@en Deutscher Untertitel@de	0..1
[MLP] Summary	[IRDI] 0173-1#02-AAO106#002 List of language-dependent summaries of the Document. Constraint: for each language-dependent Summary, a Title and at least one KeyWord shall exist for the given language.	Abstract@en Deutsche Zusammenfassung@de	1

[MLP] KeyWords	[IRDI] 0173-1#02-ABH999#001 List of language-dependent keywords of the Document. Note: multiple keywords are given as comma separated list for each language. Constraint: for each language-dependent KeyWord, a Title and Summary shall exist for the given language. Note: this can intentionally be a blank.	Exemplary keywords@en Deutsche Stichwörter@de	1
[Property] StatusSetDate	[IRDI] 0173-1#02-ABI000#001 Date when the document status was set. Format is YYYY-MM-dd.	[date] 2020-02-06	1
[Property] StatusValue	[IRDI] 0173-1#02-ABI001#001 Each document version represents a point in time in the document lifecycle. This status value refers to the milestones in the document lifecycle. The following two values should be used for the application of this guideline: InReview (under review), Released (released). [IRDIs for values]: under review – 0173-1#07-ABZ640#001 released – 0173-1#07-ABZ641#001	[string] Released	1
[Property] OrganizationName	[IRDI] 0173-1#02-ABI002#001 Organization short name of the author of the Document.	[string] Example company	1
[Property] OrganizationOfficialName	[IRDI] 0173-1#02-ABI004#001 Official name of the organization of author of the Document.	[string] Example company Ltd.	1

[File] DigitalFile{00}	[IRDI PATH] 0173-1#02-ABI504#001/0173-1#01-AHF583#001 [IRDI for number of DigitalFiles (optional)]: 0173-1#02-ABI003#001 [IRDI] 0173-1#02-AAO214#002 (MIME-Type) [IRDI] 0173-1#02-ABI005#001 (Documentpath) MIME-Type, file name, and file contents given by the File SubmodelElement. Constraint: the MIME-Type needs to match the file type. Constraint: at least one PDF/A file type shall be provided. Note: each DigitalFile represents the same content or Document version, but can be provided in different technical formats (PDF, PDFA, html, etc.) or by a link.	MIME-Type = application/pdf value = /aasx/documentation/ docu_cecc_fullmanual_DE.PDF	1..*
[File] PreviewFile{00}	[IRDI PATH] 0173-1#02-ABI505#001/0173-1#01-AHF584#001 [IRDI] 0173-1#02-AAO214#002 (MIME-Type) [IRDI] 0173-1#02-ABI005#001 (Documentpath) Provides a preview image of the DocumentVersion, e.g. first page, in a commonly used image format and in low resolution. Note: low resolution is < 512 x 512 pixels. Constraint: the MIME-Type needs to match the file type. Allowed file types are JPG, PNG, BMP.	MIME-Type = image/jpg value = /aasx/documentation/ preview/docu_cecc_fullmanual_DE.jpg	0..1
[Ref] RefersTo{00}	[IRDI] 0173-1#02-ABI006#001 Forms a generic RefersTo relationship to another Document or DocumentVersion. They have a loose relationship. Constraint: reference targets a SMC "Document" or a "DocumentVersion".	n/a	0..*
[Ref] BasedOn{00}	[IRDI] 0173-1#02-ABI007#001 Forms a BasedOn relationship to another Document or DocumentVersion. Typically states that the content of the document is based on another document (e.g. specification requirements). Both have a strong relationship. Constraint: reference targets a SMC "Document" or a "DocumentVersion".	n/a	0..*

[Ref]	[IRDI] 0173-1#02-ABI008#001	n/a	0..*
TranslationOf{00}	Forms a TranslationOf relationship to another Document or DocumentVersion. Both have a strong relationship.		
	Constraint: the (language-independent) content must be identical in both Documents or DocumentVersions.		
	Constraint: reference targets a SMC "Document" or a "DocumentVersion".		

Annex A. Explanations of table formats used

1. General

The tables used in this document try to outline information as concise as possible. They do not convey all information on Submodels and SubmodelElements. The definitive definitions are given by a separate file in form of an AASX file of the Submodel template and its elements.

2. Tables on Submodels and SubmodelElements

For clarity and brevity, a set of rules is used for the tables describing Submodels and SubmodelElements.

- In principle, the tables follow the same conventions as in [5].

- The table heads abbreviate 'cardinality' with 'card'.

- The tables often place two sets of information in different rows of the same table cell. In this case, the first information is distinguished from the second information by sharp brackets []. semanticIds are a special case; they are marked by the format (type)(local)[idType]value.

- The types of SubmodelElements are abbreviated as follows:

SME type	SubmodelElement type
Property	Property
MLP	MultiLanguageProperty
Range	Range
File	File
Blob	Blob
Ref	ReferenceElement
Rel	RelationshipElement
SMC	SubmodelElementCollection

- If an idShort ends with '{00}', this indicates a suffix of the respective length (here: 2) of decimal digits to make the idShort unique. A different idShort might be chosen, as long as it is unique in the parent's context.
- The Keys of semanticId in the main section feature only idType and value, such as [IRI]https://admin-shell.io/vdi/2770/1/0/DocumentId/Id. The attributes "type" and "local" (typically "ConceptDescription" and "(local)" or "GlobalReference" and (no-local)") need to be set accordingly; see [6].
- If a table does not contain a column with "parent" heading, all represented attributes share the same parent. This parent is denoted in the head of the table.
- Multi-language strings are represented by the text value, followed by '@'-character and the ISO 639 language code: example@EN.
- The [valueType] is only given for Properties.

Annex B. VDI 2770 Blatt 1 Metamodel

3. General

This chapter provides further information on approach and realization of Submodel information according to VDI 2770 Blatt 1.

4. Background

VDI 2770 Blatt 1 was developed to simplify documentation handover in the process industry according to the specific requirements and general conditions of this industry. The assets addressed are complex, often expensive, and have a long lifespan. The documentation of these assets may be complex and may include legal and technical requirements.

The VDI 2770 working group focused on two main aspects: the structure of the handover documentation, and specifications for digital files and their meta data. The most import normative specifications are:

- Documents shall be classified at least according to the classification system provided by VDI 2770.
- To ensure long-term access, the file format PDF/A is a key demand.
- Meta data shall conform to a VDI 2770 information model.
- XML and ZIP are used for data exchange. Meta data and documents are disclosed as so-called containers.

The overall documentation of an asset may be the sum of multiple handover tasks. VDI 2770 only represents documentations for an object at a single point in time. The defined containers are not indented to be updated. Instead, the container formats provide complete meta data for documents that can be processed in business information systems. Each consumer may process this data in a different manner.

The information model of VDI 2770 Blatt 1 is based on IEC 82045-2. It distinguishes between documents and document versions. Hence, associations between objects and documents are quite stable, regardless of the current document version.

A documentation is summarized by a main document according to IEC 62023.

VDI 2770 does not address technical properties or details of the object. Identification numbers and identifiers are used to refer to objects.

A container format is specified for data exchange. This format is, however, not relevant for the Submodel template defined.

VDI 2770 contains normative definitions regarding object identification. The guideline demands that object identifiers that are used for the nameplate of an object shall be included in the meta data of the documentation. Especially, a serial ID and/or a product ID is required. To address this requirement, we refer to the AAS Submodel template "ZVEI Digital Nameplate for industrial equipment" [8].

Furthermore, VDI 2770 demands fundamental information about the manufacturer or supplier of an object. To address this requirement, we refer to the AAS Submodel template "Generic Frame for Technical Data for Industrial Equipment in Manufacturing" [9].

5. Information model of VDI 2770 Blatt 1

The information model of VDI 2770 Blatt 1 consists of 13 entities. The following diagram of the metamodel is published with permission of the editor.
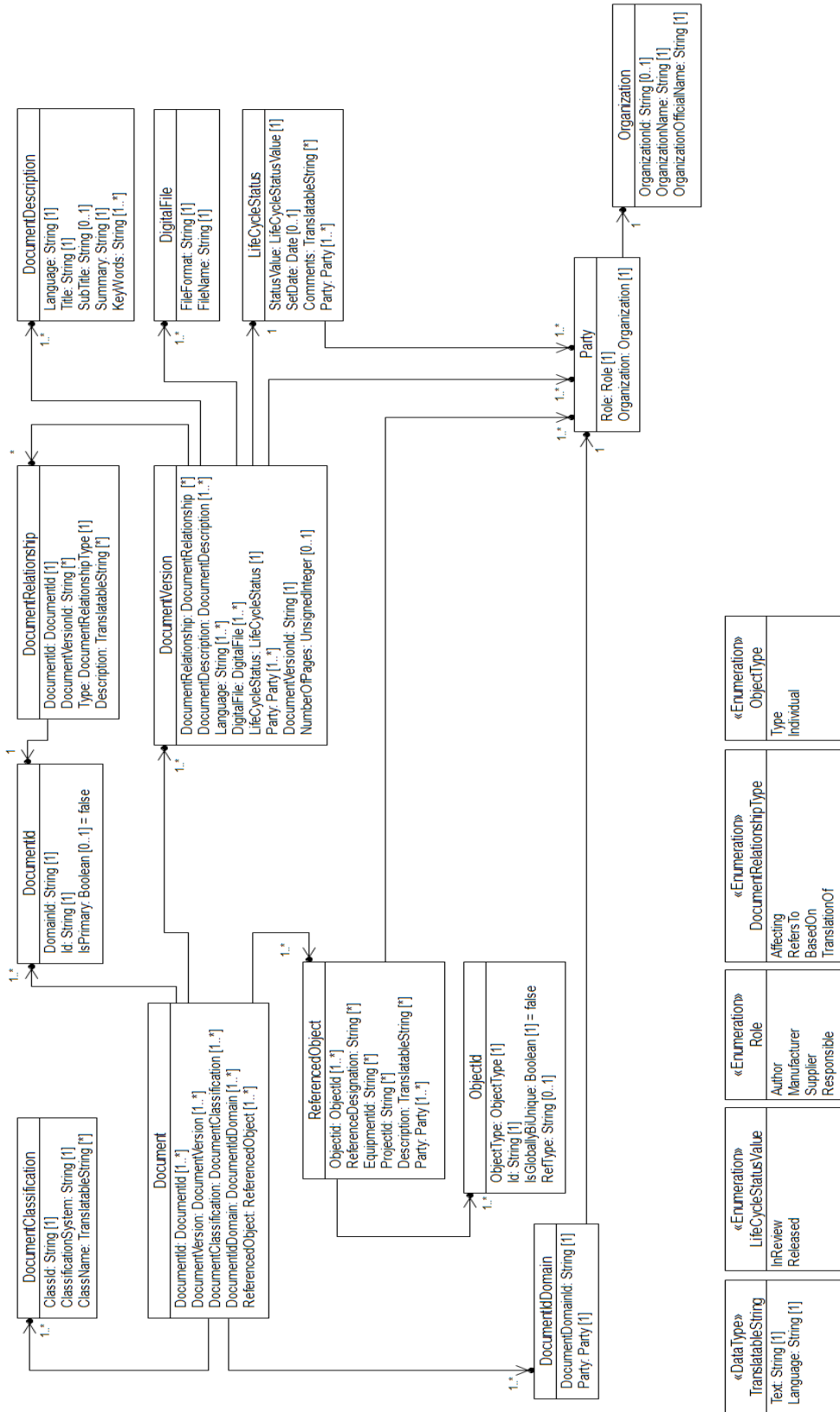

Figure 5: UML information model of documentation meta data according to VDI 2770 [7]

6. Mappings

The structure of a SMC Document is almost identical to the VDI 2770 guideline, but

- uses a simplified document ID,
- uses Entity and ReferenceElement for asset associations,
- uses MultiLanguageProperty type instead of VDI 2770 TranslateableString type,
- asset / object identification properties may be provided by other AAS submodels.

The following mapping figure depicts the differences between the AAS and VDI 2770 Document entity. Dropped properties are shown in grey.
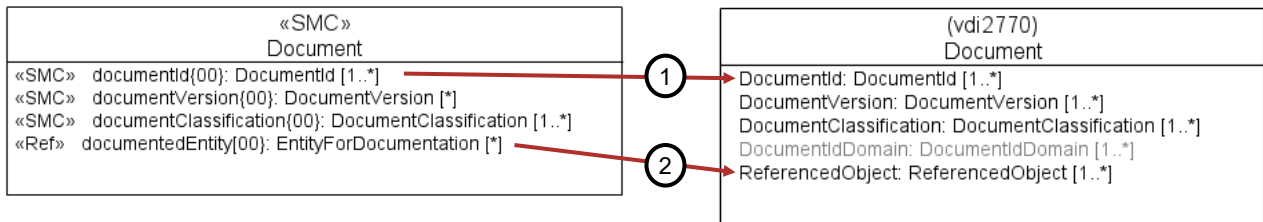

Figure 6: Mapping between AAS and VDI 2770 Document entity, 1: document ID with simplified document domain, 2: using Entity and ReferenceElement for asset / object associations.

Document IDs are not globally unique by default. A document ID may be unique within a document domain. This domain is described by a domain ID as well as a responsible party. In the Submodel template, the document ID is a simplified tuple of document domain ID and document ID.

The following mapping diagram depicts the differences between the AAS DocumentID and the VDI 2770 entities. Dropped properties are shown in grey.
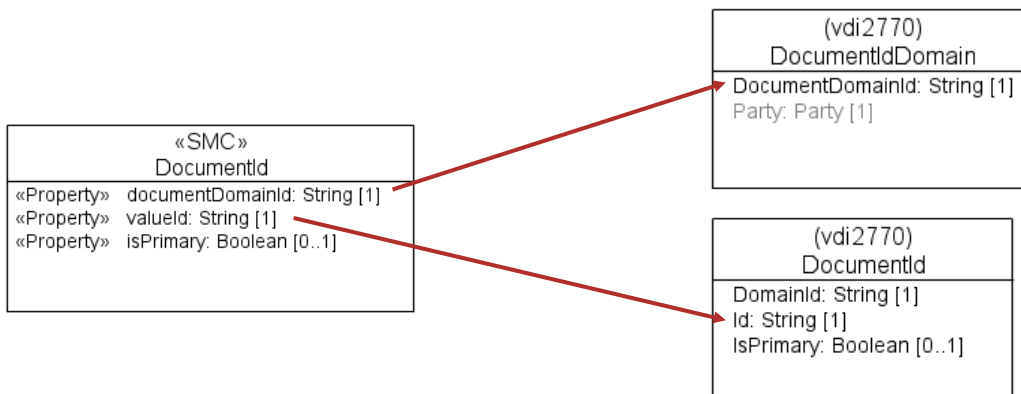

Figure 7: Mapping between AAS and VDI 2770 Blatt 1 DocumentId

Compared to VDI 2770, the DocumentVersion of this Submodel template has some structural differences:

- document relationship types are modelled as references,
- describing information for documents (like title or keywords) are properties of the DocumentVersion,
- lifecycle status information has been simplified including information on the author.

Furthermore, file management approaches differ between VDI 2770 and the AAS metamodel.

The following mapping diagram depicts the differences. Dropped properties are shown in grey.
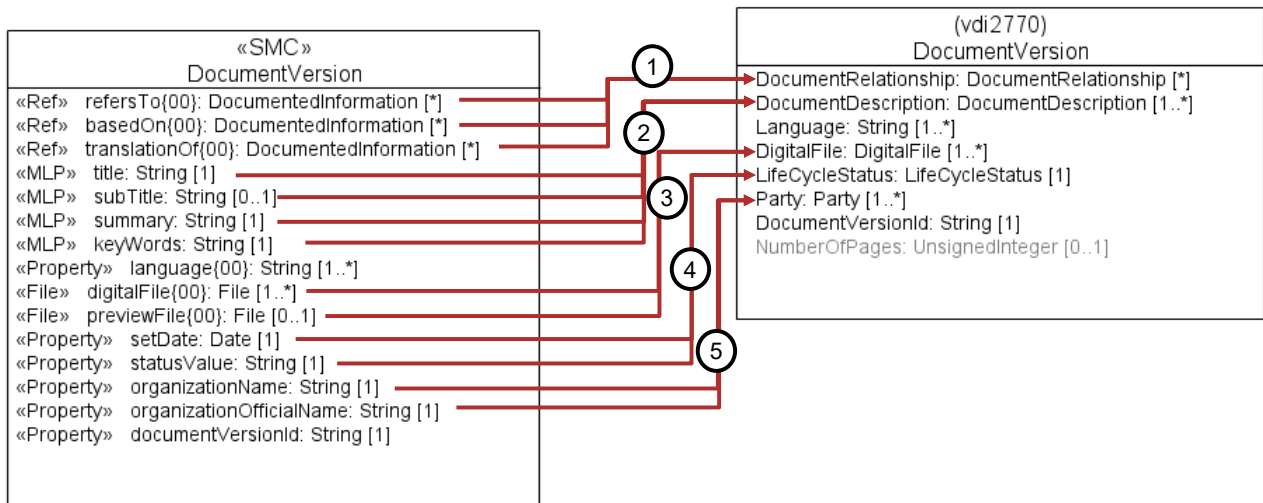
Figure 8: Mapping between AAS und VDI 2270 DocumentVersion, 1: three relation properties instead of generic relation model element, 2: describing information contained in document version, 3: different file handling approach, 4: simplified document status (only status and date), 5: simplified roles (only author)

VDI 2770 defines an entity called DocumentDescription to aggregate describing document meta data for a document version in one language. This kind of information grouping is modelled in this Submodel using constraints. The following mapping diagram depicts the differences. Dropped properties are shown in grey.
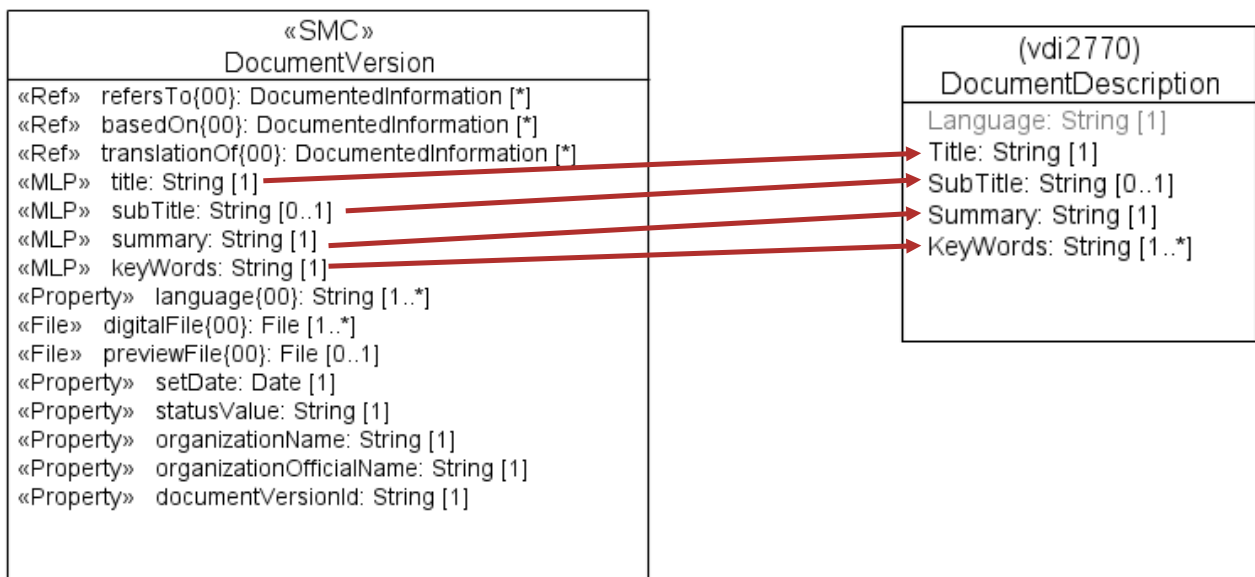

Figure 9: Mapping between AAS and VDI 2770 document descriptions

This Submodel template uses simplified document lifecycle meta data. The parties involved in the document lifecycle are simplified. The following mapping diagram depicts the differences. Dropped properties are shown in grey.
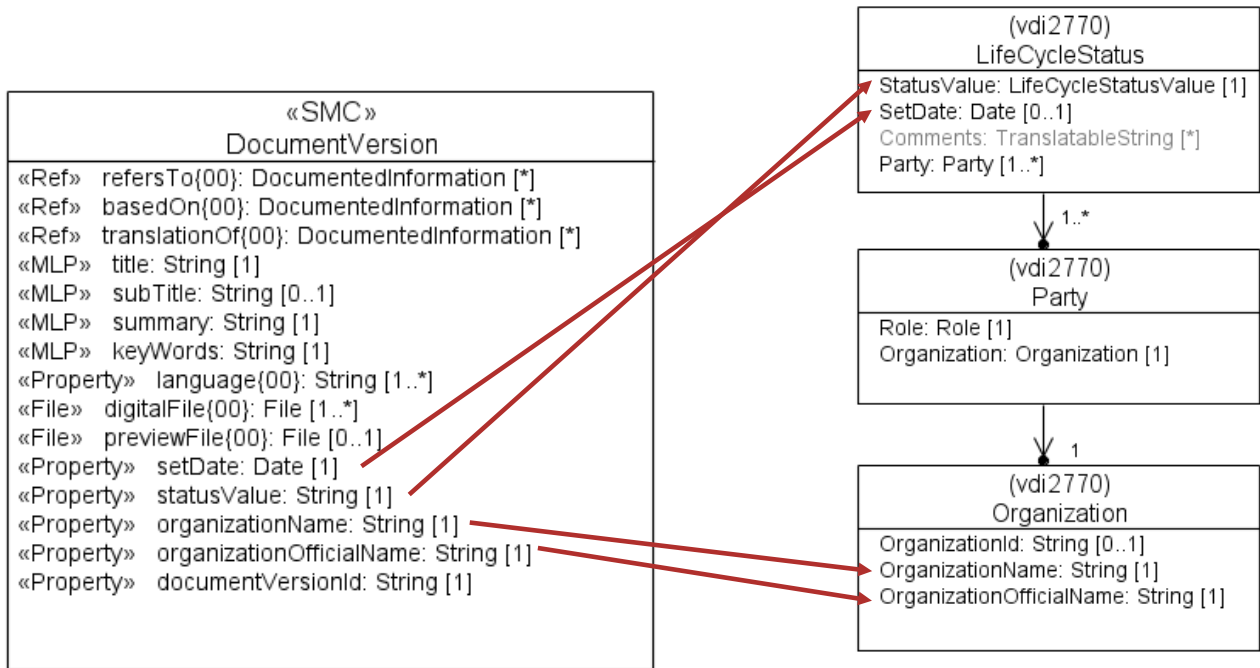
Figure 10: Mapping between AAS and VDI 2770 document lifecycle

To document object identification meta data, the additional application of the AAS Submodel "ZVEI Digital Nameplate for industrial equipment" [8] is recommended. In VDI 2770, an object may have a list of identification numbers, like a reference designation code, a serial-ID, a product ID. Different types of IDs are supported, e.g. a numeric value or a URL according to IEC 61406 (Identification Link). The most important IDs can be documented using the ZVEI Digital Nameplate submodel (see the following figure).

Figure 11: Mapping between AAS and VDI 2770 object identifiers

Annex C. Further classifications

7. Document classification according to IEC 61355

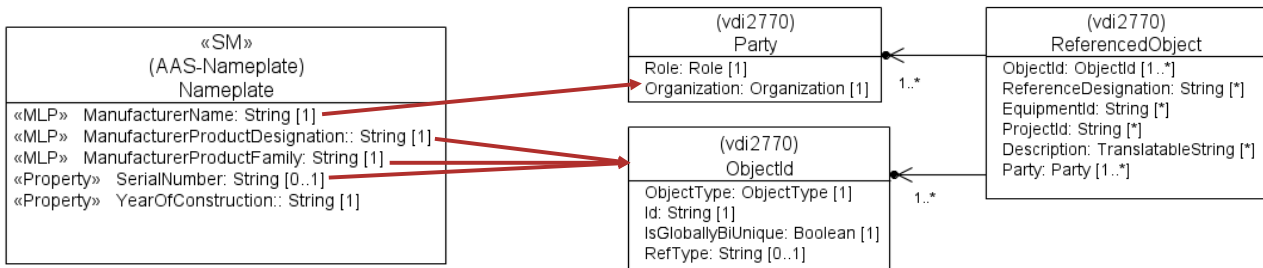The following table shows a selection of document classes according to "IEC 61355-1 Classification and designation of documents for plants, systems and equipment". [10]

The value of "DocumentClassificationSystem" shall be set to "IEC 61355-1:2008" to describe the classification (see section 2.7). The value of "DocumentClassId" shall be set to a two-letter, upper-case code. The full range of two-letter codes of IEC 61355-1:2008 may be used.

Table 7: Document classification according to IEC 61355

Doc.Class.ID	DocumentClassName (DE)	DocumentClassName (EN)
A	Dokumentationsbeschreibende Dokumente	Documentation describing documents
AA	Verwaltungstechnische Dokumente	Administrative documents
AB	Listen (Dokumente betreffend)	Lists (regarding documents)
AC	Erläuternde Dokumente (Dokument betreffend)	Explanatory documents (regarding documents)
B	Managementdokumente	Management documents
BB	Berichte	Reports
BC	Schriftwechsel	Correspondence
BD	Projektleitungsdokumente	Project control documents
BE	Ressourcenplanungsdokumente	Resource planning documents
BF	Versand-, Lager- und Transportdokumente	Dispatch, storage and transport documents
BG	Standortplanungs- und Standortorganisationsdokumente	Site planning and site organization documents
BH	Dokumente zum Änderungswesen	Documents regarding changes
BS	Objektschutzdokumente	Security documents
BT	Schulungsdokumente	Training specific documents
C	Vertragliche und nicht-technische Dokumente	Contractual and non-technical documents
CA	Anfrage-, Kalkulations- und Angebotsdokumente	Inquiry, calculation and offer documents
CB	Genehmigungsdokumente	Approval documents
CC	Vertragliche Dokumente	Contractual documents
CD	Bestell- und Lieferdokumente	Order and delivery documents
CE	Rechnungsdokumente	Invoice documents
CF	Versicherungsdokumente	Insurance documents
CG	Gewährleistungsdokumente	Warranty documents
CH	Gutachten	Expertises
D	Dokumente mit allgemeiner technischer Information	General technical information documents
DA	Datenblätter	Data sheets
DB	Erläuternde Dokumente	Explanatory documents
DC	Anleitungen und Handbücher	Instructions and manuals
DD	Technische Berichte	Technical reports
DE	Kataloge, Werbeschriften	Catalogues Advertising documents
DF	Technische Veröffentlichungen	Technical publications
E	Dokumente für technische Anforderungen und Auslegung	Technical requirement and dimensioning documents

EA	Dokumente über gesetzliche Anforderungen	Legal requirement documents
EB	Normen und Richtlinien	Standards and regulations
EC	Technische Spezifikations- / Anforderungsdokumente	Technical specification / requirement documents
ED	Dimensionierungsdokumente	Dimensioning documents
F	Funktionsbeschreibende Dokumente	Function describing documents
FA	Funktionsübersichtsdokumente	Functional overview documents
FB	Fließschemata	Flow diagrams
FC	Dokumente der MMS-Gestaltung (Mensch-Machine-Schnittstelle)	MMI layout documents (MMI = man-machine interface)
FE	Funktionsbeschreibungen	Function descriptions
FF	Funktionsschaltpläne	Function diagrams
FP	Signalbeschreibungen	Signal descriptions
FQ	Einstellwertdokumente	Setting value documents
FS	Schaltkreisdokumente	Circuitry documents
FT	Softwarespezifische Dokumente	Software specific documents
L	Ortsbeschreibende Dokumente	Location documents
LA	Erschließungs- und Vermessungsdokumente	Exploitation and survey documents
LB	Erdbau- und Fundamentbaudokumente	Earthwork and foundation work documents
LC	Rohbaudokumente	Building carcass documents
LD	Dokumente, die Orte an Standorten beschreiben	On-site location documents
LH	Orte in Gebäuden (Schiffen, Flugzeugen, etc.) beschreibende Dokumente	In-building location documents (also applied for ships, aircraft, etc.)
LU	Orte in/auf Einrichtungen beschreibende Dokumente	In/on-equipment location documents
M	Verbindungsbeschreibende Dokumente	Connection describing documents
MA	Verbindungsbezogene Dokumente	Connection documents
MB	Verkabelungs- und Rohrleitungsdokumente	Cabling or piping documents
P	Objektlisten	Object listings
PA	Materiallisten	Material lists
PB	Teilelisten	Parts lists
PC	Stücklisten	Item lists
PD	Produktlisten und Produkttypenlisten	Product lists and product type lists
PF	Funktionslisten	Function lists
PL	Ortslisten	Location lists
Q	Qualitätsmanagementdokumente und sicherheitsbeschreibende Dokumente	Quality management documents; safety-describing documents
QA	Qualitätsmanagementdokumente	Quality management documents
QB	Sicherheitsbeschreibende Dokumente	Safety-describing documents
QC	Qualitätsnachweisdokumente	Quality verifying documents
T	Dokumente zur Beschreibung geometrischer Formen	Geometry-related documents
TA	Entwurfszeichnung	Planning drawings
TB	Konstruktionszeichnungen	Construction drawings
TC	Fertigungs- und Errichtungszeichnungen	Manufacturing and erection drawings

TL	Anordnungszeichnung	Arrangement documents
W	Betriebliche Protokolle und Aufzeichnungen	Operation records
WA	Einstellwertdokumente	Set point documents
WT	Logbücher	Logbooks

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