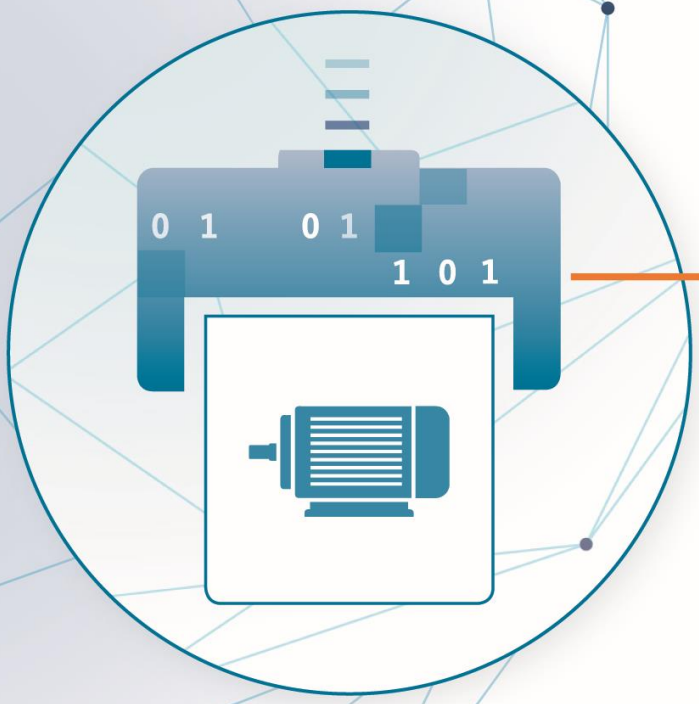
PLATTFORM INDUSTRIE 4.0 in cooperation with ZVEI: Die Elektroindustrie

SPECIFICATION

Submodel Templates of the Asset Administration Shell



Submodel
TECHNICAL DATA
- Max. Rotation Speed = 5000 [1/min]
- Max. Torque = 200 [Nm]
- Cooling Type = BAB657

Submodel
OPERATIONAL DATA
- Rotation Speed = 4370 [1/min]
- Torque = 117.4 [Nm]

Submodel
DOCUMENTATION
- Title = Operating Manual
- Digital File PDF → /aasx/OperatingManual.PDF
- Document Class ID = 03-02

Minimum requirements for the **Handover documentation from the manufacturer to the operator based on the VDI 2770 specification**

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1 General

1.1 About this document

This document is a 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 by the "Administration Shell in Practice" [5]. The format aims to be very concise, giving only minimal necessary information for applying a Submodel template, while leaving deeper descriptions and specification of concepts, structures and mapping to the respective documents [1] to [6].

The target audience of the specification are developers and editors of technical documentation and manufacturer information, which are describing 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 especially details on the question, which SubmodelElements with which semantic identification shall be used for this purpose.

1.2 Scope of the Submodel

This Submodel template aims at interoperable provision of information, especially documentation, from manufacturers to operators of industrial equipment. It primarily targets process industry but is also suitable for equipment in factory automation by defining standardadized meta data and a classification for documents. The hereby provided documents "contain information required for 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 CE declarations of conformity, ATEX certificates or material certificates. The transfer of this information to the IT systems of the plant operators is standardised […] in order to minimise the effort for manufacturers and operators" [7].

This Submodel template specifies a basic set of SubmodelElements (see "Terms & Definitions" [6], pp. 19 or clause 3.5.1 in [5], pp. 31) in order to bring about the necessary information according to VDI 2770-1 [7].

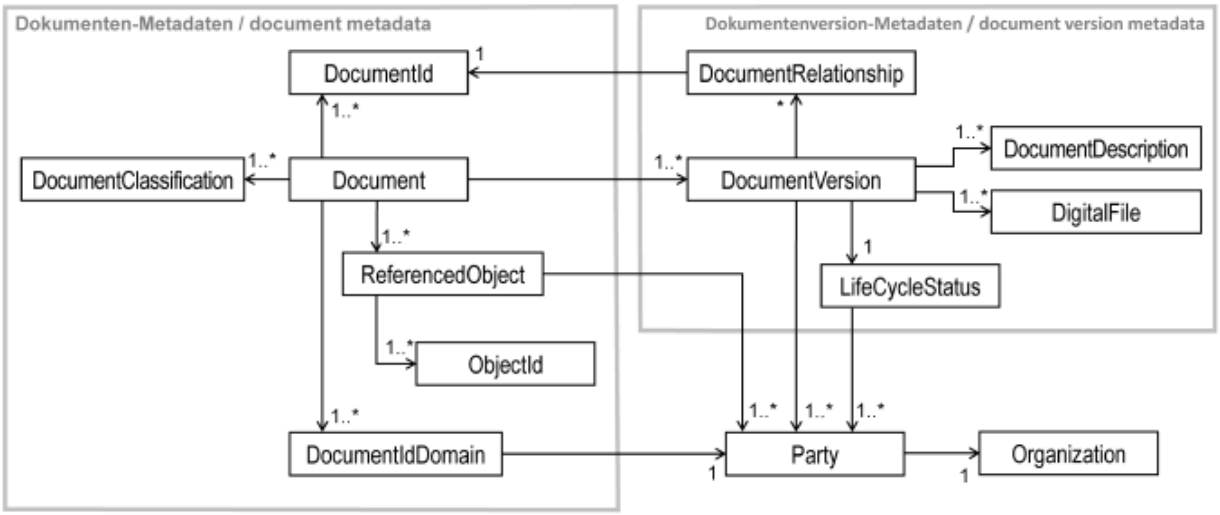
1.3 Relevant standards for the Submodel template

VDI 2770

VDI 2770 [7] standardizes the documentation with regard to their meta data, classification and format. The idea is that manufacturer handover their documentation in a standardized manner, so that it gets easier for the operator to load the documentation for a component or a complete machine (both referred to in the following as asset) into their IT infrastructure and, subsequently, that it gets easier to find relevant documents during the operation phase of an asset. The central concepts of the specification are the entities of “Document” and “DocumentVersion”, that are described in an UML and XML specification.

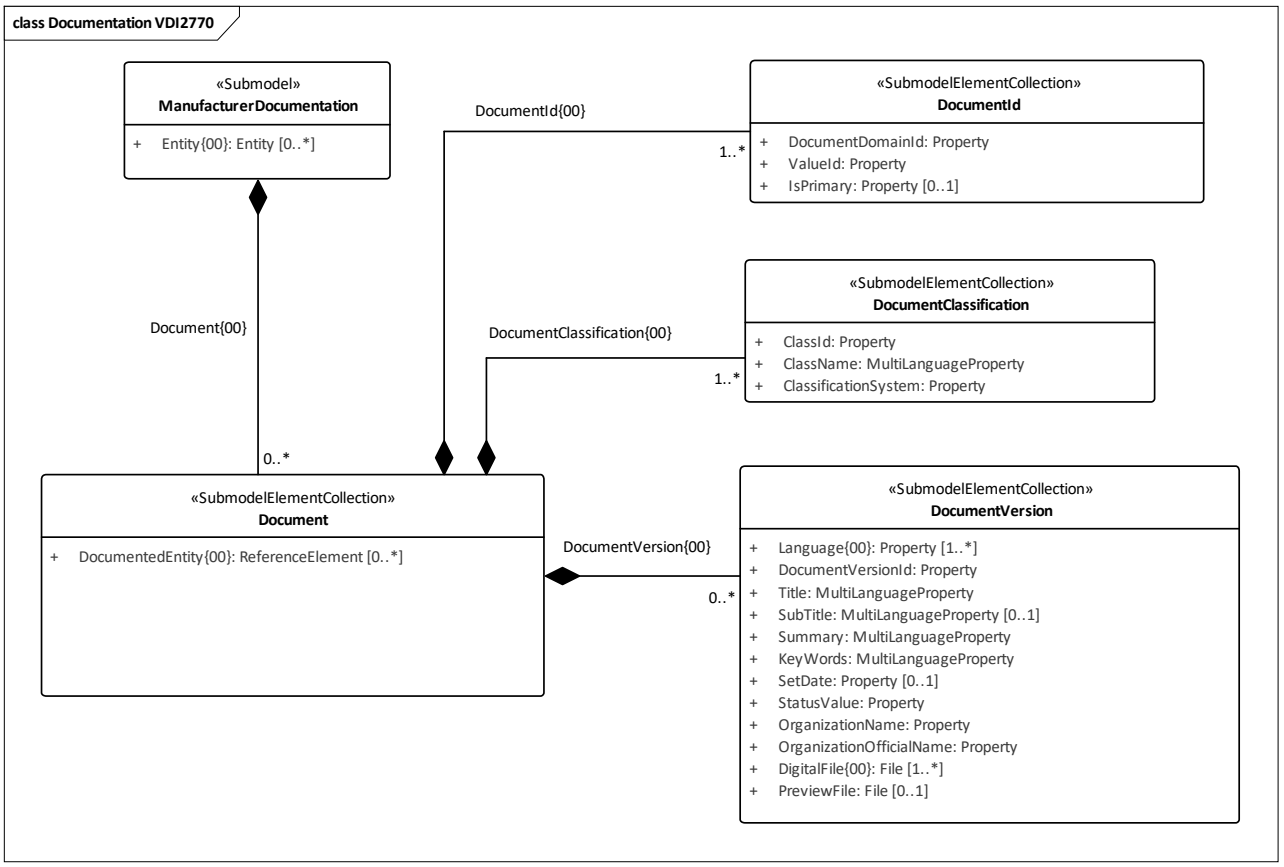
The entity "Document" describes the understanding of a document in total as a specific concept of product related information. The entity "DocumentVersion" represents a specific instance of the “Document” within its life cycle, for instance a released version of the Document.

The following diagram gives an overview on the concepts of VDI 2770.



Overview on oncepts of the VDI2770 according [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 the VDI 2770 are relevant to the Submodel template specification. VDI 2770 targets the handover documentation from the manufacturer to the operator. More advanced models, or models including other stakeholders, might be specified in the future based on VDI 2770.



Selected basic concepts from the VDI2770 specification

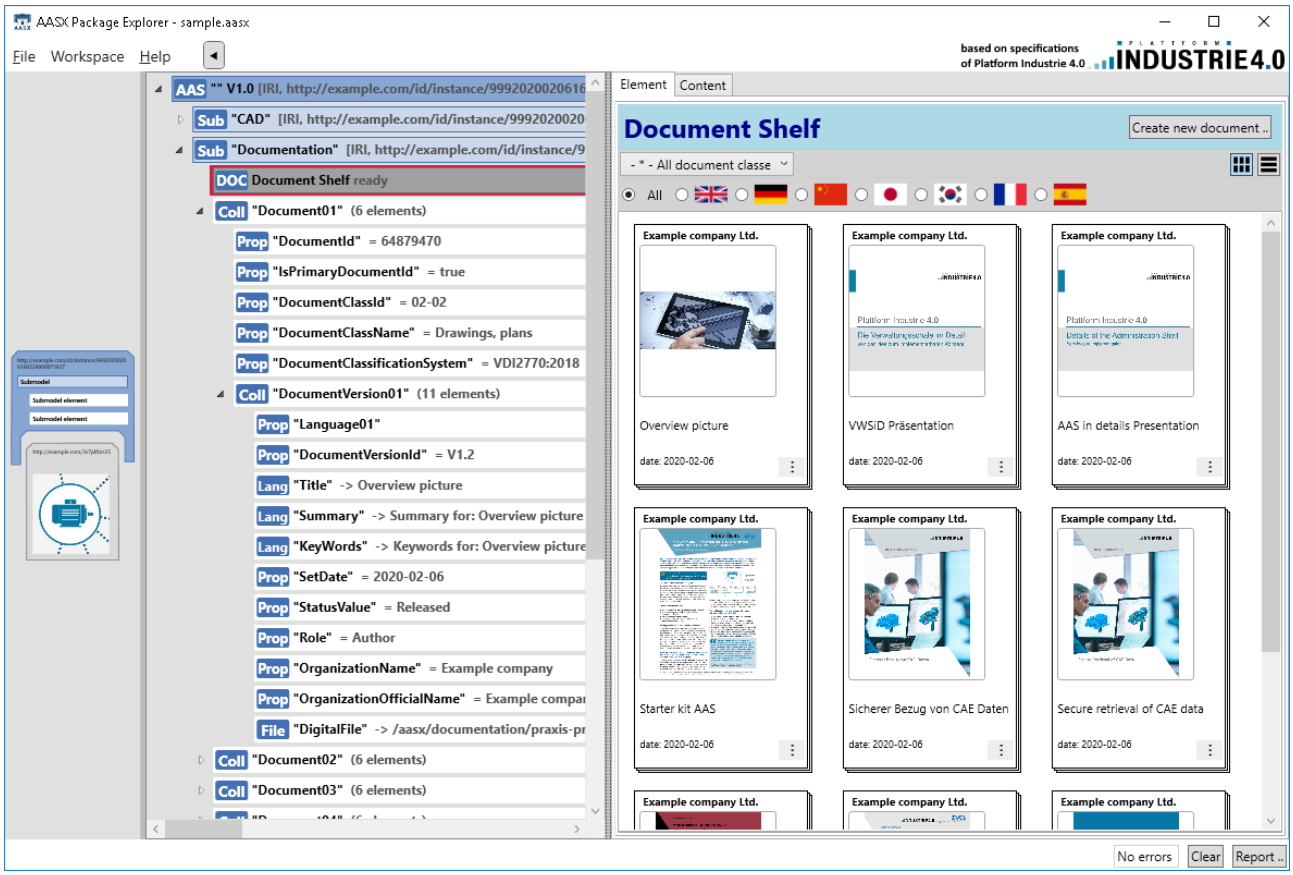
2 Submodel for Handover documentation according to VDI 2770

2.1 Approach

This Submodel template specification models the two main VDI 2770 concepts "Document" and "DocumentVersion" with their mandatory information elements. For each Document, multiple DocumentVersions can be assigned. The specification for an instance of the overall Submodel, the Document and the DocumentVersion are given by respective clauses 2.4, 2.5 and 2.8.

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

A "DocumentVersion" shall contain at least one "DigitalFile" according to ISO 19005-1 (PDF/A). Multiple "DigitalFiles" with different MIME types[1] might be given, but each of them is assumed to represent the "DocumentVersion" in total and they must contain equal content.



Screen shot of the AASX Package Explorer with Submodel "Documentation" of an example asset, featuring multiple Documents, each with at least one DocumentVersion, and visualization of the Submodel information via a specific plug-in "Document shelf"

For further information see section Annex B.

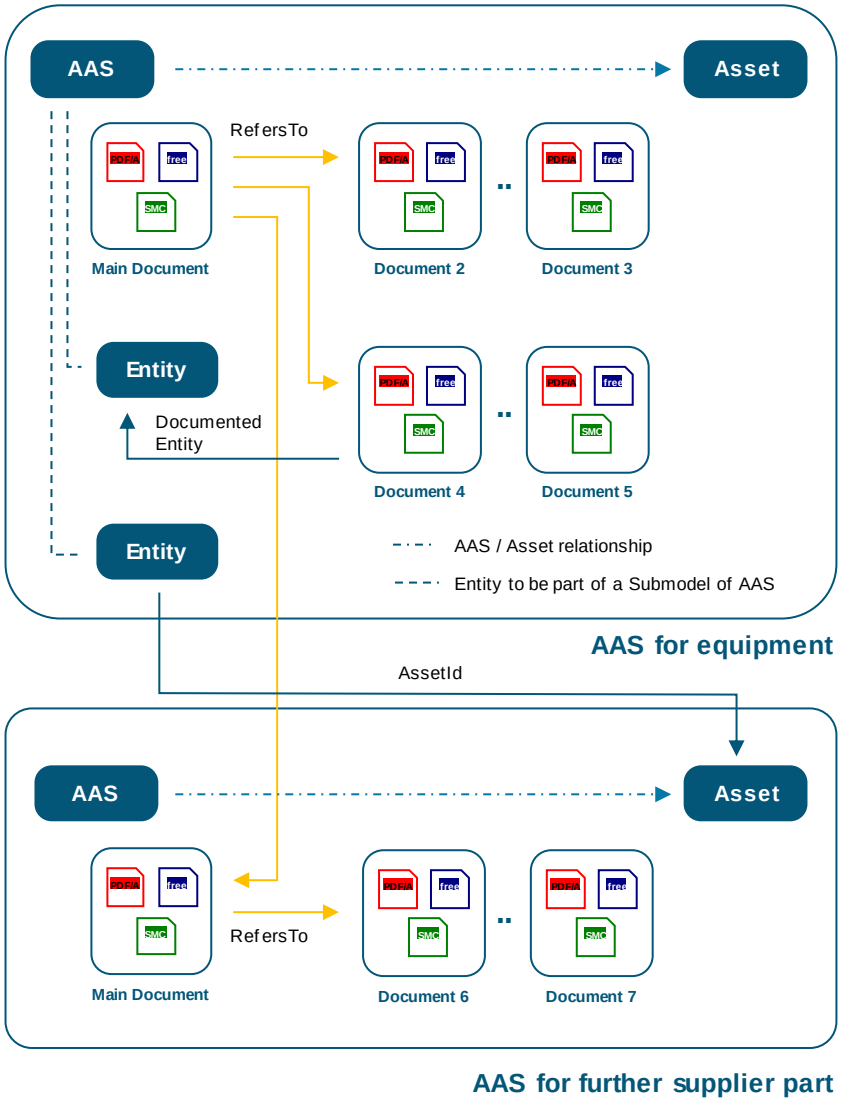
[1] Multipurpose Internet Mail Extensions, see: https://www.iana.org/assignments/media-types/media-types.xhtml

2.2 Association of documents to Assets and Entities

VDI 2770 uses so called ObjectId's to express the association of documents towards different objects. In Asset Administration Shell (AAS), the associoation with the object is already given implicitely by the basic relation of Asset Administration Shell to the respective asset [3].

However, the documentation of a complex equipment may include further supplier parts. These parts could be marked out as separate entities within the AAS of the equipment by introducing EntityElements within the Submodel for Documentation.

If these introduced Entities are categorized as 'self-managed', they might refer via the Entitie's attribute AssetId to self-standing AAS for the supplier parts. In this case, the provider of the equipment will provide two AAS: for the equipment and for the supplier part. This is a complex scenario, thus, the recommendation for simple cases[2] is to mark out included supplier parts as included 'co-managed' Entities. However, the EntityElement needs to be created in any case.



[Association of documents to Assets and Entities]

[2] Please note: EntityElements may contain SubmodelElements such as Proprties or SubmodelElemementCollection, but no self-standing Submodels. Therefore, for complex cases (e.g. a Submodel for Technical Data shall be provided), self-managed entities shall be used.

The linking of the main document of an Asset, e.g. an equipment, to its subordinate documents is done by ReferenceElements called "RefersTo". These references can span multiple AAS; in this case, as first Key, the AssetId shall be used. For details on ReferenceElement, see [6].

If a "Document" does not relate to the Asset of the AAS itself, but to a dependent (self-managed or co-managed) Entity, a ReferenceElements called "DocumentedEntity" shall be used.

2.3 Enumeration: Document classification according VDI2770:2018

VDI 2770 defines a consise set of different classes of documents, which allows the operator of the industrial equipment an efficient management and retrieval of information. This classification is understood as ClassificationSystem identified by the value "VDI2770:2018" within this Submodel template. For each class of documents ("DocumentClassification"), a "ClassId" and "ClassName" is given, the latter could be given in multiple languages, EN to be mandatory.

ClassID	ClassName (EN)	ClassName (DE)
01-01	Identification	Identifikation
02-01	Technical specifiction	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

Within a "Document", multiple "DocumentClassifications" can be given, for different but also a same ClassificationSystem. One classification according to VDI2770:2018 is mandatory.

Futher document classifications are described in Annex C. Users are encouraged to consider classifying documents according to IEC 61355-1:2008, as well.

2.4 Attributes of the Submodel instance

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

idShort:	ManufacturerDocumentation{00} Note: a different idShort might be used, as long as it is unqiue in the Submodel.		
Class:	Submodel (SM)		
semanticId:	[IRI] https://admin-shell.io/vdi/2770/1/1/Documentation		
Parent:	Asset Administration Shell, to which the documents shall be associated to		
Explanation:	The Submodel defines a set of manufacturer documentation to bring about information from manufacturer to operator of industrial equipment.		
[SME type]	**semanticId = [idType]value**	**[valueType]**	**card.**
idShort	**Description@en**	**example**	

[SMC] Document{00}	[IRI] http://admin-shell.io/vdi/2770/1/0/Document Each SMC describes a Document (see IEC 82045-1 and IEC 8245-2), which is asscoated to the particular Asset Administration Shell.	n/a	0..*
[Entity] Entity{00}	[IRI] http://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 quipment.	0..*

2.5 SubmodelElements of Document

The SubmodelElementCollection (SMC) described as follows 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.

idShort:	Document{00} Note: a different idShort might be used, as long as it is unqiue in the Submodel.		
Class:	SubmodelElementCollection (SMC)		
semanticId:	[IRI] https://admin-shell.io/vdi/2770/1/0/Document		
Parent:	Submodel with idShort = ManufacturerDocumentation 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}	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentId 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}	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentClassification Set of information for describing the classification of the Document according to ClassificationSystems.	see below	1..*

	Constraint: at least one classification according to VDI 2770 shall be provided.		
[SMC] DocumentVersion{00}	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentVersion 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}	[IRI] https://admin-shell.io/vdi/2770/1/0/Document/DocumentedEntity 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 clause 2.2 is referenced, this ReferenceElement is not required at all. Note: This mechanism substitutes the ObjectId-provision of the VDI2770 (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) described as follows contains information identifying the Document in a given Domain. The table convention is explained in Annex A.2.

idShort:	DocumentId{00} Note: a different idShort might be used, as long as it is unqiue in the Submodel.		
Class:	SubmodelElementCollection (SMC)		
semanticId:	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentId		
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	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentId/DocumentDomainId Identification of the domain in which the given DocumentId is unique. The domain ID can e.g. be the name or acronym of the providing organisation.	[string] 1213455566	1
[Property] ValueId	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentId/ValueId Identification number of the Document within a given domain, e.g. the providing organisation.	[string] 1213455566 [string]	1

		XF90-884	
[Property] IsPrimary	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentId/IsPrimary Flag indicating that a DocumentId within a collection of at least two DocumentId`s 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 for a Document. Contraint: only one DocumentId in a collection may be marked as primary.	[Boolean] true	0..1

2.7 SubmodelElements of DocumentClassification

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

idShort:	DocumentClassification{00} Note: a different idShort might be used, as long as it is unqiue in the Submodel.		
Class:	SubmodelElementCollection (SMC)		
semanticId:	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentClassification		
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	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentClassification/ClassId Unique ID of the document class within a ClassficationSystem. Constraint: If ClassificationSystem is set to "VDI2770:2018", the given IDs of VDI2770:2018 shall be used (see table at page 7).	[string] 03-02 [string] BB	1
[MLP] ClassName	[IRI] http://admin-shell.io/vdi/2770/1/0/DocumentClassification/ClassName List of language-dependent names of the selected ClassID. Constraint: If ClassificationSystem is set to "VDI2770:2018" then the given names of VDI2770:2018 need be used (see table at page 7).	Operation@en Bedienung@de Berichte@de Reports@de	1

	Constraint: languages shall match at least the language specifications of the included DocumentVersions (below).		
[Property] ClassificationSystem	[IRI] http://admin-shell.io/vdi/2770/1/0/DocumentClassification/ClassificationSystem Identification of the classification system. For classifications according VDI 2270 always set to "VDI2770:2018". Further classification systems are commonly used, such as "IEC61355-1:2008".	[string] VDI2770:2018 [string] IEC61355-1:2008	1

2.8 SubmodelElements of DocumentVersion

The SubmodelElementCollection described as follows contains the information for a VDI 2770 DocumentVersion. The table convention is explained in Annex A.2.

idShort:	DocumentVersion{00} Note: a different idShort might be used, as long as it is unqiue in the SubmodelElementCollecion of parent Document.		
Class:	SubmodelElementCollection (SMC)		
semanticId:	[IRI] http://admin-shell.io/vdi/2770/1/0/DocumentVersion		
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}	[IRI]https://admin-shell.io/vdi/2770/1/0/DocumentDescription/Language 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	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentVersion/DocumentVersionId Unambigous identification number of a DocumentVersion.	[string] V1.2	1
[MLP] Title	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentDescription/Title List of language-dependent titles of the Document. Constraint: For each language-depended Title a Summary and at least one KeyWord shall exist for the given language.	Examplary title@en Deutscher Titel@de	1
[MLP] SubTitle	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentDescription/SubTitle	Examplary subtitle@en	0..1

	List of language-dependent sub titles of the Document.	Deutscher Untertitel@de	
[MLP] Summary	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentDescription/Summary List of language-dependent summaries of the Document. Constraint: For each language-depended Summary a Title and at least one KeyWord shall exist for the given language.	Abstract@en Deutsche Zusammenfassung@de	1
[MLP] KeyWords	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentDescription/KeyWords List of language-dependent keywords of the Document. Note: Mutiple keywords are given as comma separated list for each language. Constraint: For each language-depended KeyWord a Title and Summary shall exist for the given language.	Examplary keywords@en Deutsche Stichwörter@de	1
[Property] SetDate	[IRI]https://admin-shell.io/vdi/2770/1/0/LifeCycleStatus/SetDate Date when the document status was set. Format is YYYY-MM-dd.	[date] 2020-02-06	1
[Property] StatusValue	[IRI]https://admin-shell.io/vdi/2770/1/0/LifeCycleStatus/StatusValue Each document version represents a point in time in the document life cycle. This status value refers to the milestones in the document life cycle. The following two values should be used for the application of this guideline: InReview (under review), Released (released).	[string] Released	1
[Property] OrganizationName	[IRI] https://admin-shell.io/vdi/2770/1/0/Organization/OrganizationName Organiziation name of the author of the Document.	[string] Example company	1
[Property] OrganizationOfficialName	[IRI] https://admin-shell.io/vdi/2770/1/0/Organization/OrganizationOfficialName Official name of the organization of author of the Document.	[string] Example company Ltd.	1
[File] DigitalFile{00}	[IRI] https://admin-shell.io/vdi/2770/1/0/StoredDocumentRepresentation/DigitalFile 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.	mimeType = application/pdf value = /aasx/documentation/docu_cecc_fullmanual_DE.PDF	1..*
[File] PreviewFile{00}	[IRI] https://admin-shell.io/vdi/2770/1/0/StoredDocumentRepresentation/PreviewFile Provides a preview image of the DocumentVersion, e.g. first page, in a commonly used image format and low resolution. Note: low resolution e.g. < 512 x 512 pixels. Constraint: the MIME type needs to match the file type. Allowed file types are JPG, PNG, BMP.	mimeType = image/jpg value = /aasx/documentation/preview/docu_cecc_fullmanual_DE.jpg	0..1

[Ref] RefersTo{00}	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentVersion/RefersTo 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}	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentVersion/BasedOn Forms a BasedOn-relationship to another Document or DocumentVersion. Typically states, that the content of the document bases 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]~~ ~~Affecting{00}~~	~~[IRI] https://admin-shell.io/vdi/2770/1/0/Document/Affecting~~ ~~Forms an Affecting-relationship to another Document oder DocumentVersion. Both have a strong relationship.~~ ~~The target Document or DocumentVersion. Document revision of of the target Document or DocumentVersion may be needed. Constraint: reference targets a SMC "Document" or a “DocumentVersion”.~~	~~n/a~~	~~0..*~~
[Ref] TranslationOf{00}	[IRI] https://admin-shell.io/vdi/2770/1/0/DocumentVersion/TranslationOf Forms a TranslationOf-relationship to another Document or DocumentVersion. Both have a strong relationship. Constaint: The (language independent) content must be identical in both documents or document versions. Constraint: reference targets a SMC "Document" or a “DocumentVersion”.	n/a	0..*

Annex A. Explanations on used table formats

1. General

The used tables in this document try to outline information as concise as possible. They do not convey all information on Submodels and SubmodelElements. For this purpose, 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 for describing Submodels and SubmodelElements.

- The tables follow in principle the same conventions as in [5].
- The table heads abbreviate 'cardinality' with 'card'.
- The tables often place two informations in different rows of the same table cell. In this case, the first information is marked out by sharp brackets [] form the second information. A special case are the semanticIds, which are marked out by the format: (type)(local)[idType]value.
- The types of SubmodelElements are abbreviated:

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, in order to make the idShort unique. A different idShort might be choosen, 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. VDI2770 Meta-Model

1. General

This chapter provides furter information on approach and realization of Submodel information according VDI2770.

2. Background

VDI 2770 was developed to simplify documentation handover in the process industry according to the specific requirements and general condition of this industry. The assets addressed are complex, often expensive and have a long lifespan. The documentation of these assets may be complex including 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, PDF/A is a key demand as file format.
- 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 container defined 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 these data in a different manner.

The information model of VDI 2770 bases on IEC 82045-2. It distinguishes between documents and document versions. So, 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 on the object. Identification numbers and identificators are used to refer to objects.

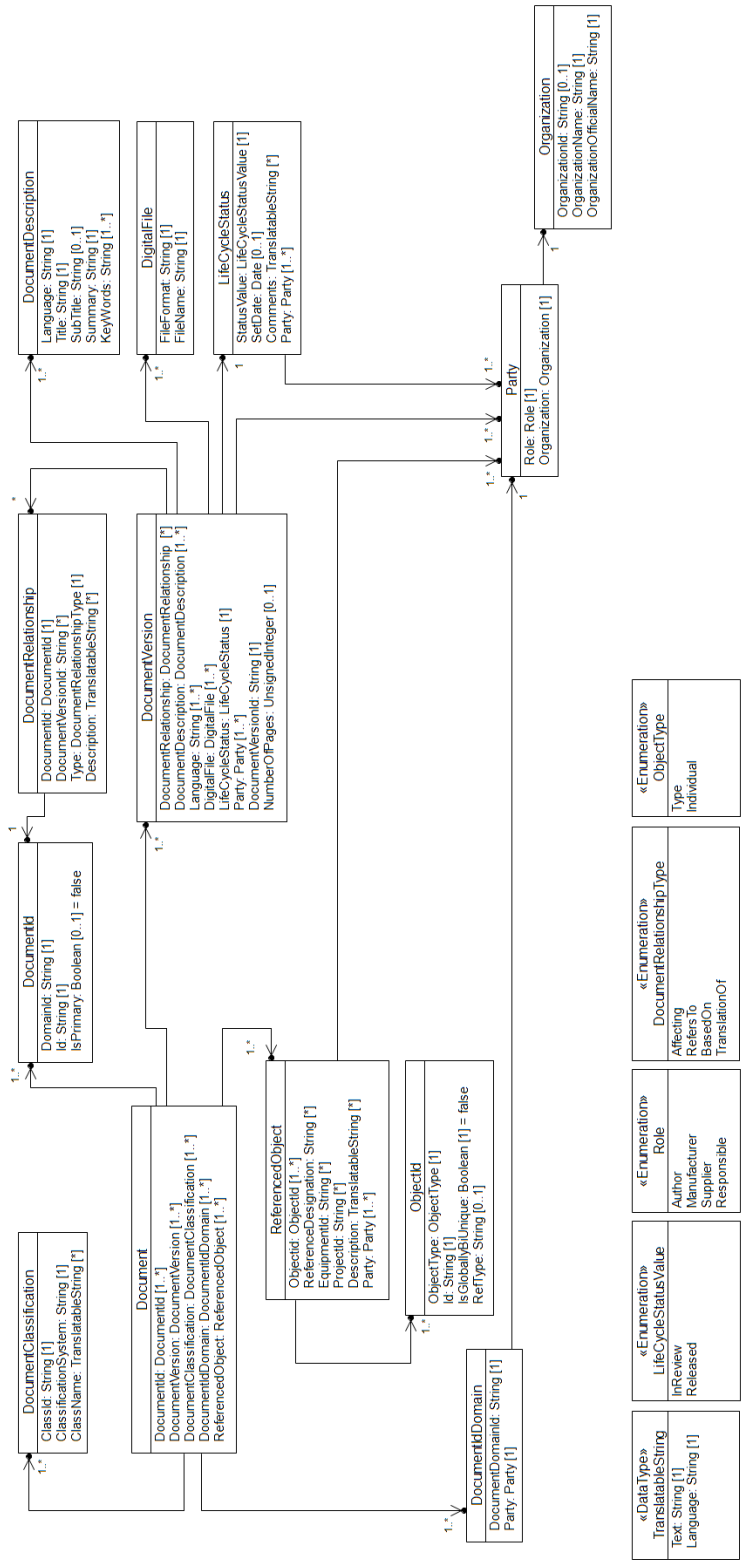
For data exchange, a container format is specified. For VDI 2770 Submodel template, this format is not relevant.

VDI 2770 contains normative definitions with regard to object identification. The guidline demands, that object identificators, that are used for the nameplate for 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].

3. Information model of VDI 2770

The information model of VDI 2770 contains of 13 entities. The following diagram of the meta-model is published with permission of the editor.



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

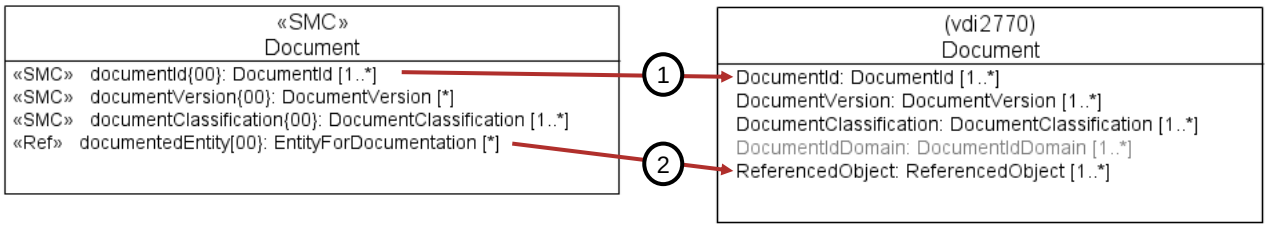
4. Mappings

The structure of SMC Document is almost identically to VDI 2770 guideline, but

- a simplified document ID is used.
- Entity and ReferenceElement are used for asset associations.
- MultiLanguageProperty type is used instead of VDI 2770 TranslateableString type.

- asset / object identification properties may be provided by other AAS submodels.

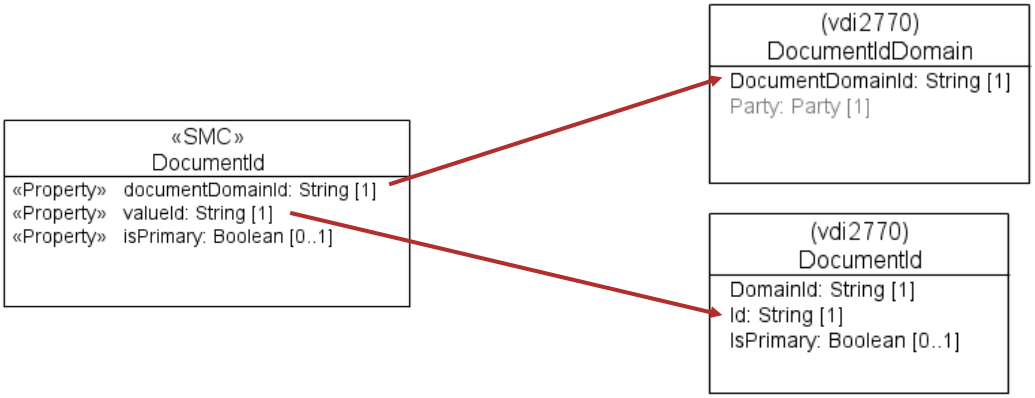
The following mapping figure depicts the differences between the AAS and VDI 2770 Document entity. Dropped properties are shown in grey.



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 biunique by default. Within a document domain, a document ID may be unique. This domain is described by a domain ID as well as a responsible party. In the Sumbmodel template, the document ID is a simplified tuple of document domain ID and document ID.

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



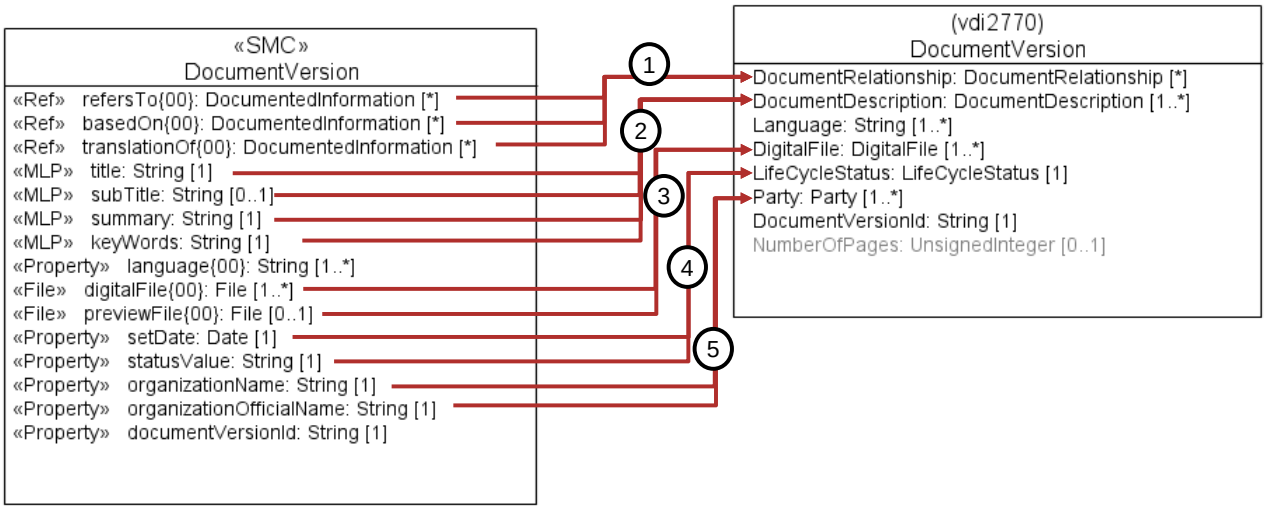
Mapping between AAS and VDI 2770 DocumentId

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.

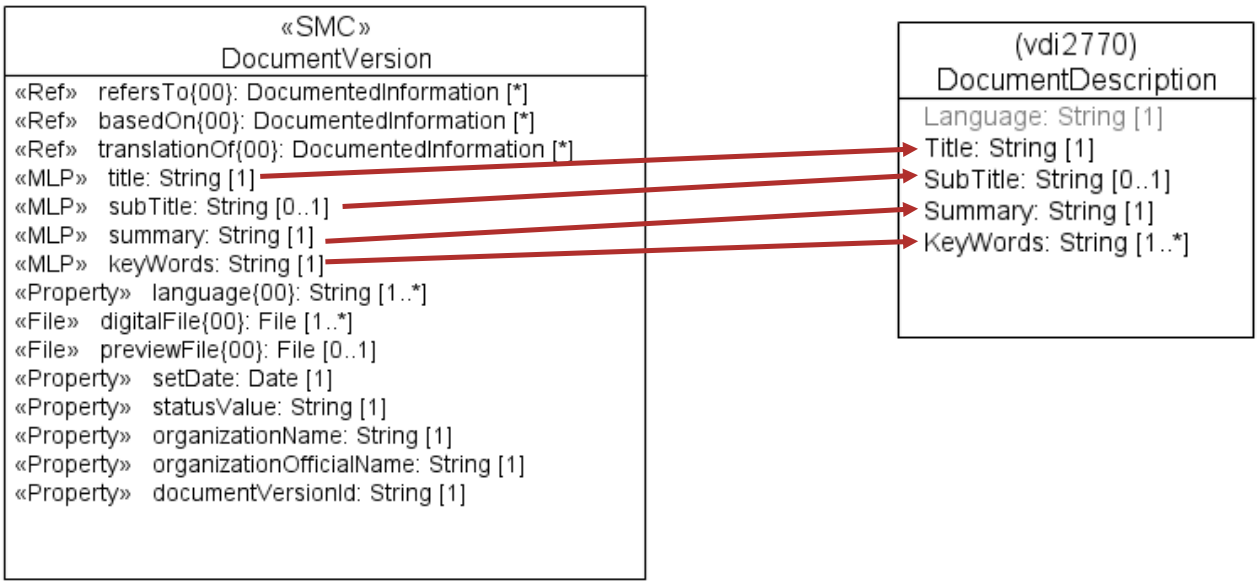
Futhermore, file management approaches differ between VDI 2770 and the AAS meta model.

The following mapping diagram depicts the differences. Dropped properties are shown in grey.



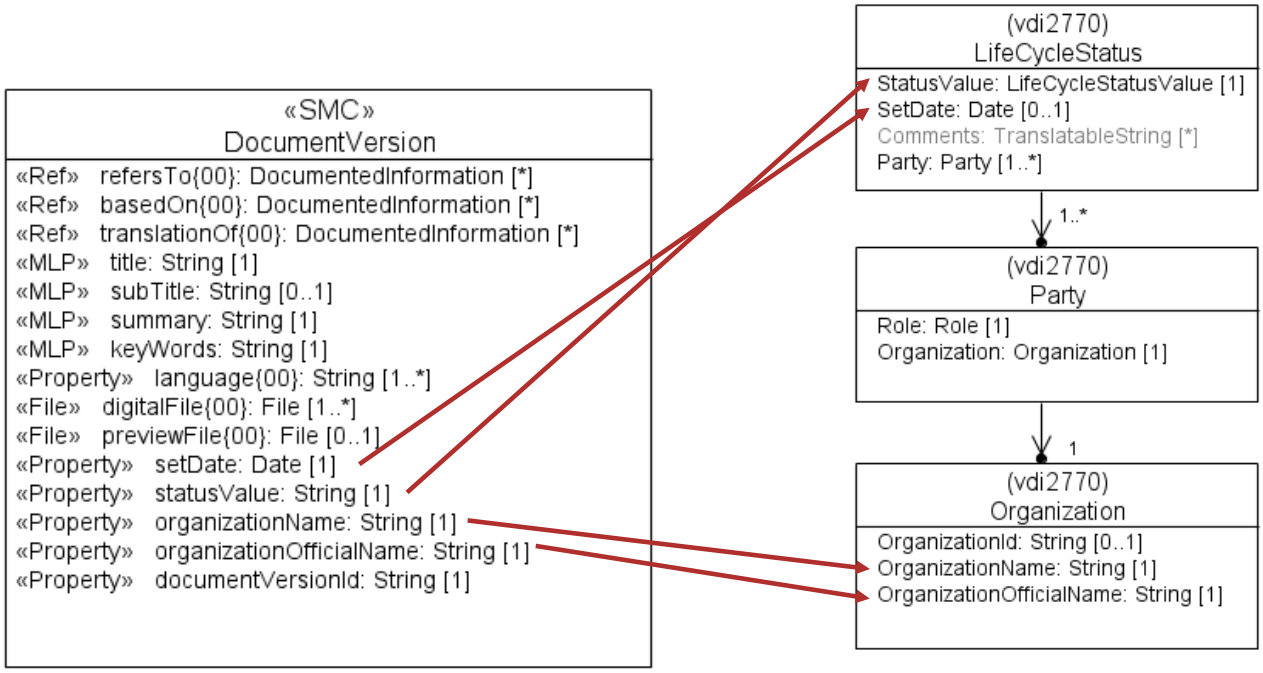
Mapping between AAS und VDI 2270 DocumentVersion, 1: three relation properties instead of generic relation model element, 2: describing information directly contained in document version, 3: different file handling approach, 4: simplified document status (only status and date), 5: simplified roles (only author)

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



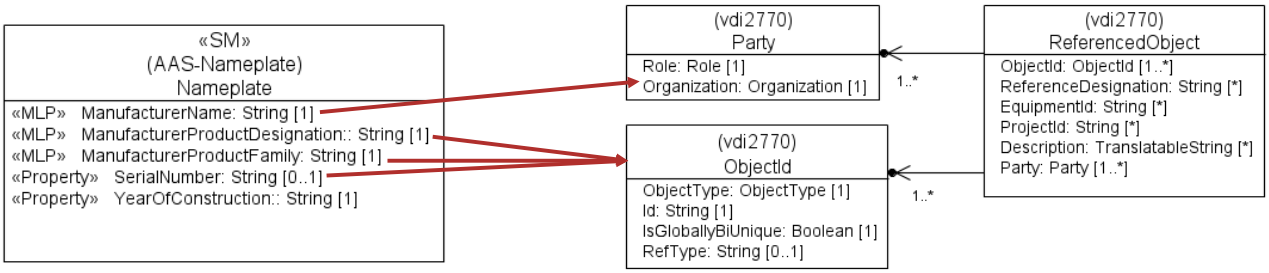
Mapping between AAS and VDI 2770 document descriptions

This Submodel template uses simpliefied 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.



Mapping between ASS and VDI 2770 of document lifecycle

To document object identification meta data, the additional application of 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 supporte, e.g. a numeric value or an URL according to DIN SPEC 91406. Using ZVEI Digital Nameplate submodel, the most important IDs can be documented (see the following figure).



Mapping of AAS and VDI 2770 object indentifiers

Annex C. Further classifications

1. Document classification according IEC 61355

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

Note: a comprehensive list can be found here: https://en.wikipedia.org/wiki/IEC_61355

For describing the classification (see section 2.7), the value of "DocumentClassificationSystem" shall be set to "IEC 61355-1:2008". 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.

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	Gewährielstungsdokumente	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

Doc.Class.ID	DocumentClassName (DE)	DocumentClassName (EN)
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	Funktionsubersichtsdokumente	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	Funktionsschaltplane	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	Verbindungs- beschreibende 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

Doc.Class.ID	DocumentClassName (DE)	DocumentClassName (EN)
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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[9] "AAS Technical Data"

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