European Network of
Transmission System Operators
for Electricity

METADATA AND DOCUMENT HEADER DATA EXCHANGE SPECIFICATION

2023-10-19

ICTC APPROVED
VERSION 2.3.0

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NOTE CONCERNING WORDING USED IN THIS DOCUMENT

The force of the following words is modified by the requirement level of the document in which they are used.

- SHALL: This word, or the terms “REQUIRED” or “MUST”, means that the definition is an absolute requirement of the specification.
- SHALL NOT: This phrase, or the phrase “MUST NOT”, means that the definition is an absolute prohibition of the specification.
- SHOULD: This word, or the adjective “RECOMMENDED”, means that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- SHOULD NOT: This phrase, or the phrase “NOT RECOMMENDED”, means that there may exist valid reasons in particular circumstances when the particular behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.
- MAY: This word, or the adjective “OPTIONAL”, means that an item is truly optional.

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Revision History

Version	Release	Date	Paragraph	Comments
1	0	2021-03-22		Document for SOC approval.
2	0	2022-02-16		Document for SOC approval. Attributes added to the header to match DCAT3. Attributes of md namespace header are set to optional to enable transition. SOC approved.
2	1	2022-09-21		SOC approved.
2	2	2023-04-20		For ICTC approval.
2	2	2023-05-10		Updated with maintenance request to fix a bug and make clarifications Added section 6.4 RDFS schema and SHACL constraints modified Examples in Annex B modified ICTC approved.
2	3	2023-10-19		Implements maintenance request on the header Added new attributes to better manage version control identified by CSA Business Process and in order to align with DCAT-3 vocabulary. Other attributes were deprecated. Refer to Annex C better understanding of the change log. ICTC approved.

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1 Scope

This document is a deliverable of the ENTSO-E project “Header and metadata for CGM BP and NC data exchanges”. The objective of the project is to support the Common Grid Model Building Process (CGM BP) and the Network Code (NC) (including Coordinated Security Analysis (CSA)) data exchange project by building a metadata model and header schema to be used by ENTSO-E CGM BP and ENTSO-E NC (Network codes) related projects for data exchange.

Therefore, the items which are in scope and out of scope are illustrated in Figure 1 can be summarized as follows:

- In scope
  - Meet requirements for CGM BP and NC data exchange projects;
  - Focus on dataset data header that can be used in upcoming IEC standards and to support Common European Data Spaces
  - Develop canonical model and a “header application profile” for the purpose of generating machine understandable artifacts.
- Out of scope
  - The standardization work related to the process defined in IEC;
  - The implementation of the header in different projects based on IEC 61970 – CGMES exchanges.

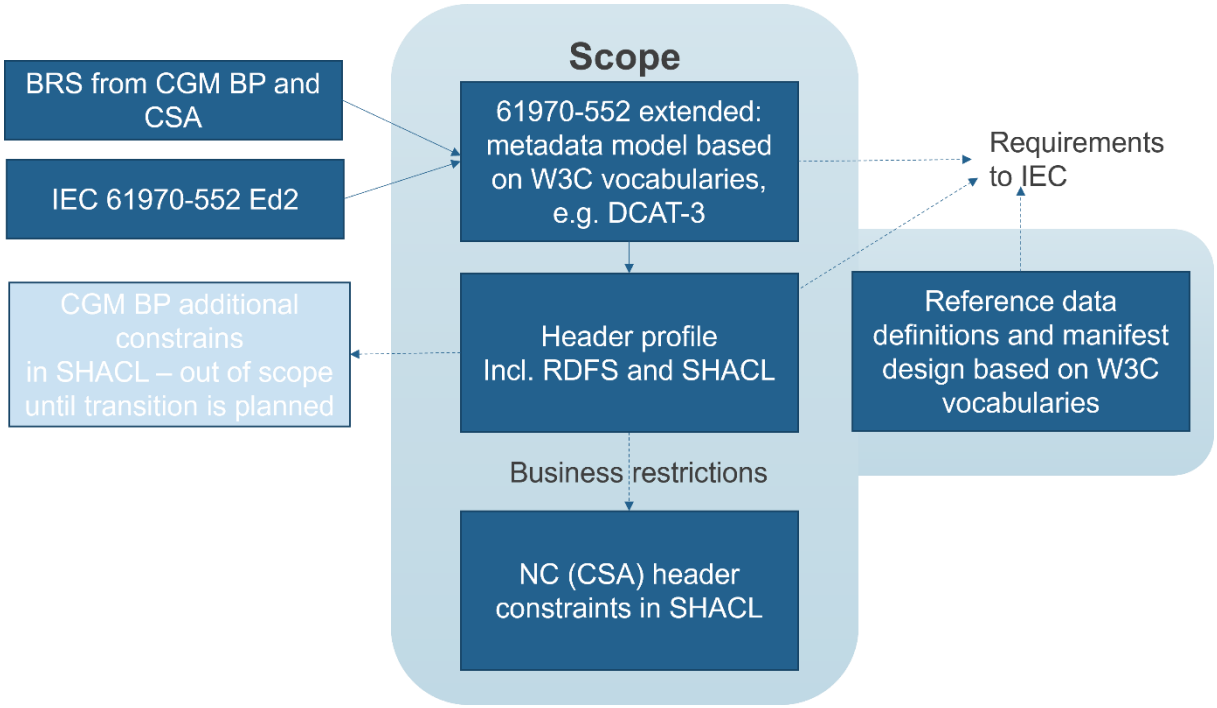


Figure 1. Scope of the project

The document specifies the packaging of reference data and the header of dataset and distribution provided in instance files. This version of the specification aligns with W3C DCAT version 3 which is in its final stage of approval by W3C. The way how the main body of reference

data instances are structured is explained in the “Boundary and reference data exchange application specification” document.

Dataset (Model), distribution (document) header, manifest and reference data use the following W3C vocabulary. These vocabulary are used in a relation to be able to better describe the semantic meaning of the data.

- DCAT (W3C Data Catalog Vocabulary) is an RDF vocabulary designed to facilitate interoperability between data catalogs published on the Web. By using DCAT to describe datasets in catalogs, publishers increase discoverability and enable applications to consume metadata from multiple catalogs. It enables decentralized publishing of catalogs and facilitates federated dataset search across catalogs. Aggregated DCAT metadata can serve as a manifest file to facilitate digital preservation.

- SKOS (W3C Simple Knowledge Organization System) designed for representation of thesauri, classification schemes, taxonomies, subject-heading systems, or any other type of structured controlled vocabulary. SKOS is part of the Semantic Web family of standards built upon RDF and RDFS, and its main objective is to enable easy publication and use of such vocabularies as linked data.

Annex A gives background information on the dataset (model) and distribution (document) header in the part related to modelling authority sets and versioning. Annex B contains one example of a document header which is used to illustrate some of the properties included in the header.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- W3C PROV-O: The PROV Ontology,
- W3C Data Catalog Vocabulary (DCAT) – version 3
- European Commission: Data Catalog Vocabulary Application Profile (DCAT-AP) for data portals in Europe[1]
- IEC 61970-552 Energy management system application program interface (EMS-API) Part 552: CIMXML Model exchange format
- Semantic versioning, Semantic Versioning 2.0.0 | Semantic Versioning (semver.org)

3 Terms and definitions

3.1

serialisation
encoding of an ontology or dataset into a format that can be stored, typically in a file.

Note 1 to entry: The definition is adapted from W3C-RDF11-XML.

[SOURCE: ISO 21597-1:2020, 3.1.13]

3.2

ontology
specification of concrete or abstract things, and the relationships among them, in a prescribed domain of knowledge

[1] For details, see here: https://joinup.ec.europa.eu/collection/semantic-interoperability-community-semic/solution/dcat-application-profile-data-portals-europe/releases

Note 1 to entry: The specification should be computer processable.

Note 2 to entry: The definition is adapted from W3C-OWL2-SPEC.

[SOURCE: ISO 21597-1:2020, 3.1.7]

3.3

payload
primary information in the form of documents that is included within the container

Note 1 to entry: This does not include the header file or the ontology resource files.

[SOURCE: ISO 21597-1:2020, 3.1.2]

3.4

document
fixed and structured amount of information that can be managed and interchanged as a unit between users and systems

Note 1 to entry: This unit may not necessarily be human perceptible. Information is usually stored on a data medium.

Note 2 to entry: Used in the ISO 21597 series to refer to any document that forms part of the payload in the container, including any 2D or 3D models that represent built or natural assets in the physical world; these may be held in any standard or proprietary format.

[SOURCE: ISO 21597-1:2020, 3.1.3]

3.5

namespace
group of identifiers for elements and attributes that are collectively bound to a URI such that their use will not cause naming conflicts

Note 1 to entry: The definition is adapted from W3C-RDF11-CONCEPTS, 1.

[SOURCE: ISO 21597-1:2020, 3.1.19]

3.6

resource
something in the world (the “universe of discourse”) denoted by an IRI or literal

Note 1 to entry: Anything can be a resource, including physical things, documents, abstract concepts, numbers and strings; the term is synonymous with “entity” as it is used in the RDF Semantics specification.

Note 2 to entry: The definition is adapted from W3C-RDF11-CONCEPTS.

[SOURCE: ISO 21597-1:2020, 3.1.14]

3.7

dataset
RDF(S)/OWL file that contains individuals that comply with the classes as specified by ontologies

[SOURCE: ISO 21597-1:2020, 3.1.10]

3.8
supersede
an entity (document, model, standard, profile, etc.) that has been replaced with a newer version of the same entity, or by a suitable other entity that contains the most current, reliable and/or available information

Note 1 to entry: The definition is adapted from ISO/IEC Guide 59:2019, 3.11.

3.9

model
collection of data describing instances, objects or entities, real or computed. In the context of CIM the semantics of the data is defined by profiles. Hence a model can contain equipment data, power flow initial values, power flow results etc.

Note 1 to entry: In power system analysis, a model is a set of static data describing the power system. Examples of Models include the Static Network Model, the Topology Solution, and the Network Solution produced by a power flow or state estimator application.

[SOURCE: IEC 61970-552:2016, 3.8]

3.10
modelling authority set
an abstract entity which is attributed to an agent (modelling authority). The modelling authority set is versioned by the agent.

3.11
modelling authority set version
a specialization of the modelling authority set which is attributed to an agent. A version of the modelling authority set can be seen as an envelop for models which conform to different profiles.

3.12

model exchange
the storing, accessing, transferring, and archiving of models

3.13

profile
A specification that constrains, extends, combines, or provides guidance or explanation about the usage of other specifications. This definition includes what are sometimes called "application profiles", "metadata application profiles", or "metadata profiles".

Note 1 to entry: A Profile is a restricted subset of the more general CIM. Schema that defines the structure and semantics of a model that may be exchanged [SOURCE: IEC 61970-552:2016, 3.9]

[SOURCE: W2C DX-PROF]

3.14

profile document
collection of profiles intended to be used together for a particular business purpose

[SOURCE: IEC 61970-552:2016, 3.10]

3.15

object property; property
name that may be used to qualify an object reference to get a value from or pass a value to an object

[SOURCE: ISO/IEC 1989:2014, 4.140]

4 Abbreviated terms

CIM	Common Information Model (electricity)
CGMES	Common Grid Model Exchange Standard

CGM BP	Common Grid Model Building Process
DSO	Distribution System Operator
ENTSO-E	European Network of Transmission System Operators for Electricity
IEC	The International Electrotechnical Commission
IOP	Interoperability Test
SO	System Operator
MAS	Model Authority Set
mRID	CIM Master Resource Identifier
OCL	Object Constraint Language
OWL	Web Ontology Language
RDF	Resource Description Framework
RDFS	RDF Schema
SHACL	Shapes Constraint Language
TSO	Transmission System Operator
URI	Uniform Resource Identifier
UUID	Universally Unique Identifier
XML	Extensible Markup Language
XSD	XML Schema Definition

5 Overview and methodology

5.1 Overview of current status of metadata discussion

A few years ago, IEC WG13 opened the discussion on 61970-303 (canonical metadata) and 61970-459 (profile) realizing this will need to grow to cover many use cases and wanted to remove the header from IEC 61970-552.

All IEC 61970-45x series and -600 series profiles (CGMES), as well as CGMES 2.4 do not include document header as part of the profile, i.e. when documents refer to EQ profile this does not include header definition.

There is a requirement that the current header (IEC 61970-552) shall not be changed, and all additional requirements should be implemented as extensions to allow transition and compatibility with CGMES v3.0. Main driver is the scheduled implementation of CGMES 2.4 and eventual transition to higher versions. It should be noted that when a document header is to be implemented, it impacts every import and export tool as it affects every single instance file.

Figure 2 Is a high-level illustration on different export types that are maintained in tools.

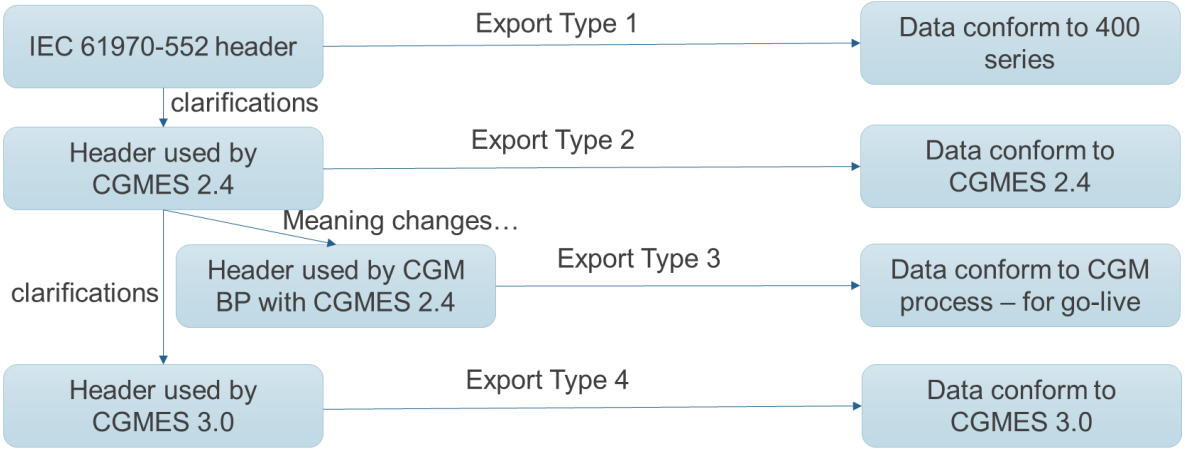


Figure 2. Different types of headers existing for IEC 61970 implementations

This document is not providing the implementation instruction on how this dataset and distribution header information should be in different project. This and the recommendation transition from existing header information will be provided in supporting documents.

5.2 Methodology and approach taken

As the metadata is in general data that describes other data, the project had to keep close collaboration with CGM BP and NC projects in order to collect requirements and consult to collect feedback on the proposed solution for header and metadata. During the stage of collecting requirement more than 50 potential data fields (attributes or properties) were collected. These data field covered the following main groups:

- Data identification (e.g. identifiers, date of creation, version)
- Data linking (e.g. dependency or revision of data)
- Instance file type (e.g. type of profile, conformance to document/standard)
- Exact time period which the data represents/is valid for (e.g. scenario time, period start and end)
- Data description (e.g. free text description)
- Involved entity and its role (e.g. source data provider, service provider, intended data receiver)
- The area which the data represents (e.g. region, domain level)
- Process type (e.g. usage, service, CGM creation process, CSA)
- Process target period (e.g. time frame, target period)
- Document or process status (e.g. coordination run, iteration, document status)
- Data on the tool that created the data (e.g. Name of the tool and version or release)
- Data on Process Settings (e.g. power flow settings)

The project reviewed all requirements and identified which of the requested data fields are overlapping in terms of meaning. A harmonization effort was performed and as a result a smaller set of data fields remained to be described and included in the proposed solution.

The project took into account the fact that both CGMES v2.4 (IEC TS 61970-600-1 and -2) and CGMES v3.0 (IEC 61970-600-1 and -2) utilize the header and metadata definitions by IEC 61970-552 with minimal adaptations. Within ENTSO-E and IEC there are discussions and standardisation work in progress which is focused on defining dedicated data model and profiles related to the exchange of metadata. These efforts aim at separation of the metadata from the instance data related to the so called “content” profiles.

Considering this the project investigated several W3C recommendations which are used worldwide and are positively recognised by the European Commission (EC). The analysis of available material from W3C and EC concluded that it is recommended to design a solution which mainly uses Provenance ontology (PROV-O[2]), Time Ontology and Data Catalog Vocabulary (DCAT[3]). However, in cases where it is not possible to find necessary information in the ontologies the project agreed to extend with properties under European metadata namespace (eumd).

The header/metadata requires availability of a set of reference metadata. For instance, the attribute prov:wasGeneratedBy requires a reference to an activity which produced the model or the related process. The activities are defined as reference metadata and their identifiers are referenced from the header to enable the receiving entity to retrieve the “static” (reference) information that it is not modified frequently. This approach imposes a requirement that both the sending entity and the receiving entity have access to a unique version of the reference metadata. Therefore, each business process shall define which reference metadata is used and where it is located.

The proposed solution based on W3C approach will support any direction chosen in future, including the manifest approach currently under discussion in the scope of IEC 61970-303. In addition, the use of W3C ontologies will enable implementors to use a wide range of tooling not necessary designed for power system modelling, but which can interpret and visualise metadata natively.

In order to link between W3C Time Ontology, W3C Provenance ontology, W3C DCAT, the existing header defined in IEC 61970-552 is extended with attributes and associations. It should be noted that the objective is to extend the existing header and the task to finalise the canonical model clarifying all details, which are to a large extent related to overall metadata exchange, is still to happen. In addition, this work faces multiple constraints such as profiling methods are currently not designed for metadata related profiles, the backwards compatibility, etc. Various directions were considered and the option to not introduce nested structure in the document header in order to keep the same kind of exchange as currently done. However, this is seen as a transition and to fully utilize W3C DCAT and Provenance next versions will need to be allowed to go beyond current practices. Especially for the purpose of manifest data exchange and in the description of provenance of the data. Therefore the approach to extend the md:Model class was taken to support a transition to new header setup. Headers related to reference data and manifest shall use dcat:Dataset as defined in this document.

5.3 Dataset (Model), Distribution (Document) and its header

W3C DCAT-3 introduces terminology for Dataset and Distribution which can be applied to CIM based data exchanges. DCAT Dataset is matching with Model and DCAT Distribution is matching with Document, which represent the instance data of a model serialised in some form, e.g., CIM XML. The Distribution has a header which provides basis metadata information that is referred from the Manifest (which described the rest of the metadata).

At present stage the header contains information about the metadata related to the dataset as well as its serialisation – the distribution. This is considered intermediate solution until the overall framework and manifest exchange is standardised. However, this approach may cause confusion and misinterpretation.

2 PROV-O: The PROV Ontology (w3.org)

3 Data Catalog Vocabulary (DCAT) - Version 3 (w3.org)

As the description of the properties/attributes in the header profile may not fully clarify, the following table contains information which properties part of the header relate to the dataset that is serialised in the distribution and which - relate to the dataset itself.

Table 1 – Document header properties. Relationship to dataset (model) or distribution (document)

name	Classification: dataset (model) or distribution (document)
md:created	Attribute, relates to the distribution.
md:description	Attribute, relates to the dataset.
dcterms:description	Attribute, relates to the dataset.
md:modelingAuthoritySet	Attribute, relates to the dataset. The version of the MAS.
md:scenarioTime	Attribute, relates to the dataset.
md:profile	Attribute, relates to the dataset.
md:version	Attribute, relates to the dataset.
dcat:version	Attribute, relates to the dataset.
adms:versionNotes	Attribute, relates to the dataset.
dcat:keyword	Attribute, relates to the dataset.
dcterms:accessRights	Association, relates to the dataset.
dcterms:conformsTo	Association, relates to the dataset and the distribution. For instance, a dataset conforms to the profile and the URI of the profile is given; a dataset also conforms to specifications and quality rules or constraints; the distribution conforms to the serialisation specifications, etc.
prov:generatedAtTime	Attribute, relates to the distribution.
dcat:startDate	Attribute, relates to the dataset.
eumd:applicationSoftware	Attribute, relates to the distribution.
dcat:endDate	Attribute, relates to the dataset.
dcterms:identifier	Attribute, relates to the dataset.
dcterms:license	Association, relates to the dataset.

name	Classification: dataset (model) or distribution (document)
dcterms:rights	Attribute, relates to the dataset.
dcterms:rightsHolder	Attribute, relates to the dataset.
dcterms:type	Association, relates to the dataset.
prov:atLocation	Attribute, relates to the dataset. This property is deprecated. Use dcterms:spatial.
euvoc:status	Attribute, relates to the dataset.
prov:wasInfluencedBy	Attribute, relates to the dataset. This property is deprecated. Use dcterms:references.
prov:hadPrimarySource	Attribute, relates to the dataset. The version of the MAS from where a version of a dataset is originating. This property is deprecated. Use dcat:isVersionOf and dcterms:publisher.
prov:wasGeneratedBy	Association, relates to the dataset.
prov:wasAttributedTo	Attribute, relates to the dataset. This property is deprecated. Use dcterms:publisher.
eumd:usedSettings	Association, relates to the dataset.
prov:wasRevisionOf	Attribute, relates to the dataset. This property is deprecated. Use dcterms:replaces.
prov:specializationOf	Attribute, relates to the dataset. The version of the MAS that is managing the version of the dataset. This property is deprecated. Use dcterms:publisher.
md:DependentOn	Association, relates to the dataset.
md:Supersedes	Association, relates to the dataset.
dcterms:accrualPeriodicity	Association, relates to the dataset.
eumd:processType	Association, relates to the dataset.
dcterms:creator	Attribute, relates to the dataset. This property is deprecated. Use dcterms:publisher.

name		Classification: dataset (model) or distribution (document)
eumd:serviceLocation		Attribute, relates to the dataset. This property is deprecated.
dcat:hasVersion		Attribute, relates to the dataset. This property is deprecated.
dcat:isVersionOf		Association, relates to the dataset.
dcat:previousVersion		Association, relates to the dataset.
dcterms:issued	Attribute, relates to the dataset.	
dcterms:title	Attribute, relates to the dataset.	
dcterms:spatial	Association, relates to the dataset.	
dcterms:references	Association, relates to the dataset.	
dcterms:publisher	Association, relates to the dataset.	
dcat:nextVersion	Association, relates to the dataset.	
dcat:temporalResolution	Attribute, relates to the dataset.	
dcterms:replaces	Association, relates to the dataset.	
dcterms:source	Association, relates to the dataset.	

5.4 Business Process, Time Horizon, Run and Iteration

This section is providing background information related to the relationship between business process, time horizon, run and iteration. The information provided here is not meant to be directly used in the header, but it needs to be taken into account when reference data is prepared. Then this reference data is referred to from the header. This section maybe removed in next versions of the document in case the information is provided in a document describing the content of reference data related to this topic.

A concept was introduced to reason about granularity of the Business. The idea is to enable data provider to implicitly indicate for which Business Process sub process the data is intended for and the Service Provider to explicitly indicate in which Business Process sub process the data was generated in.

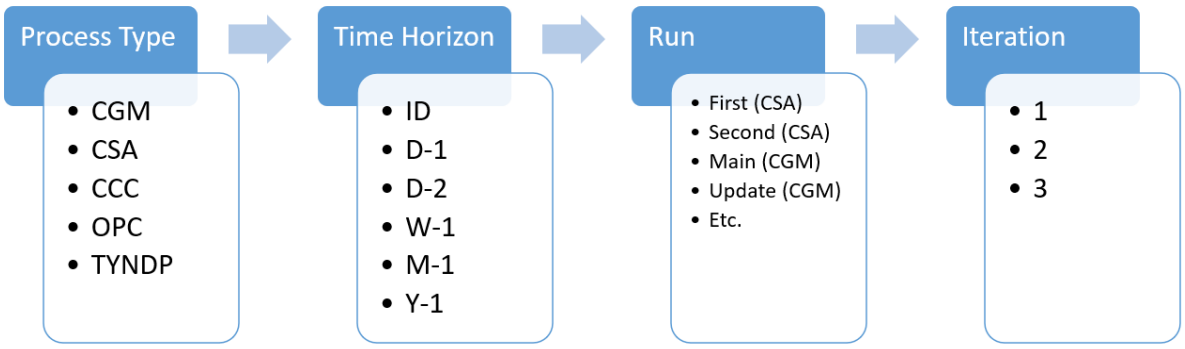
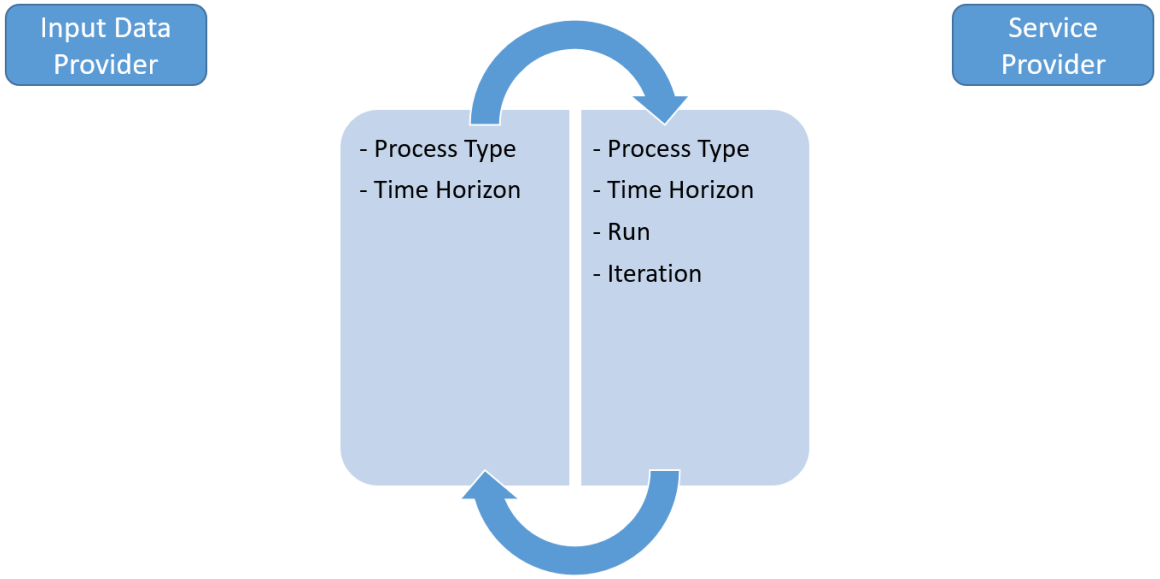


Figure 3. Business Granularity

This for example allows different input data used for different business sub processes. For example, if data provider does not plan to update their data for specific Run and Iteration, then they only need to define the Process Type and Time Horizon and Service Provider can pick up the latest version of data with that metadata for each Run and Iteration. Data Provider could also want to provide data without Time Horizon or Process Type, if they do plan to use exactly the same data in different Time Horizons and Processes. Below Is an example for most common use case, where input data provider intends to have only same data to be used within given Process and Time Horizon.

Meaning:

- Data Provider indicates:
  - Process Type
  - Time Horizon
- Service Provider indicates:
  - Process Type
  - Time Horizon
  - Run
  - Iteration



412
413 **Figure 4. Expected Business Metadata**

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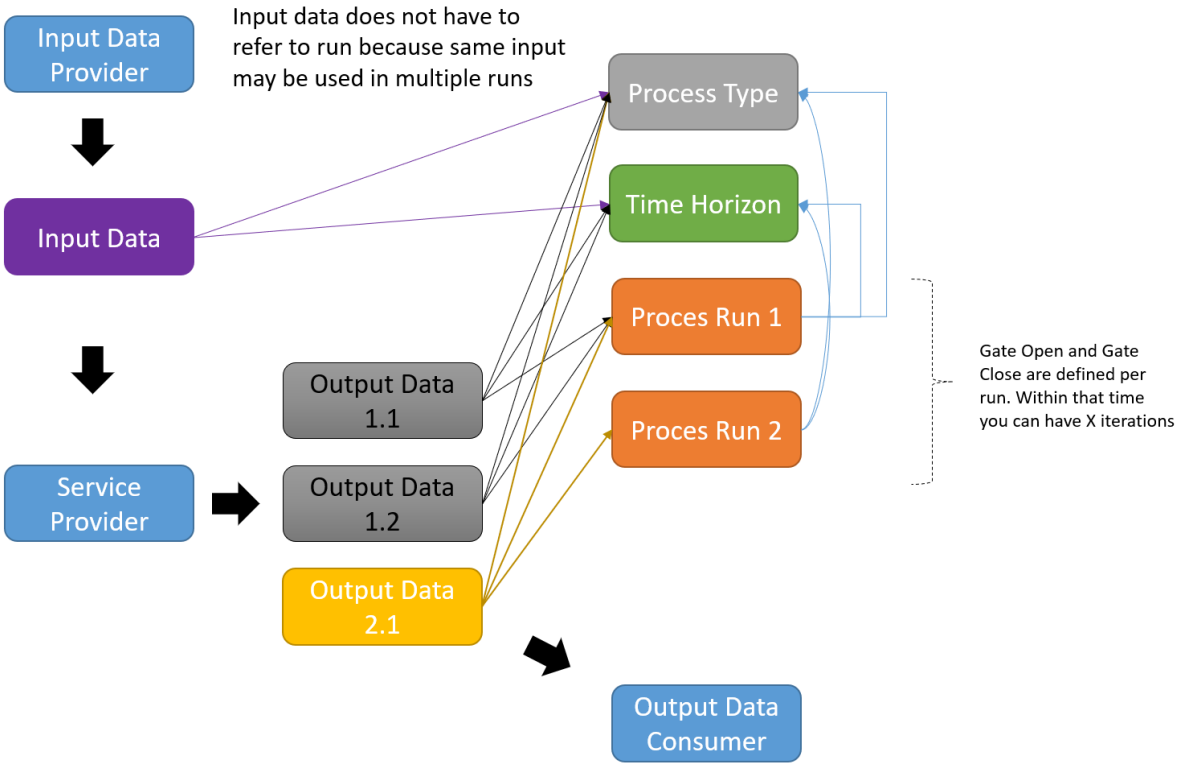
415



416
417 **Figure 5. Example**

5.5 Process settings

This section is providing background information related to process settings. The information provided here is not meant to be directly used in the header, but it needs to be taken into account when reference data is prepared. Then this reference data is referred to from the header. This section will be removed in next versions of the document when IEC 61970-457 is published.

It was identified that there is a need to know under which conditions the input or output data was generate. In case of CSA and CGM building process, the setting are power flow settings used by Data Providers and Service Providers, but it could be any arbitrary set of settings that a project defines.

Meaning:

1. A Project will define a number of settings, that can be used
2. Data Provider or Service Provider refers in the Document Header to the concrete settings that were used to generate the data.

In general, this approach could be also used out of context of Projects where in data exchange Parties refer to their own settings (preferably publicly available)

Example of settings that CSA and Building process Sub Team have collected to define Power Flow (this is not final nor complete example). For updated information on this please refer to IEC 61970-302:Ed2 FDIS and IEC 61970-457:Ed2 FDIS. The profile for exchange of simulation settings is defined in IEC 61970-457, however the latest Edition of this standard is not published yet[4]. The information below represents the profile and it is valid until the standard gets published. The publication of IEC 61970-457 will automatically supersede the information below and this document will be updated to delete this section.

Compared to version 2.2 of this document the table below was updated with the following three attributes: maxIterationsInnerLoop, maxIterationsOuterLoop and loadResponseCharacteristicsEnabled.

name	mult	type	description
algorithmKind	1..1	PowerFlowAlgorithmKind	It defines the power flow algorithm.
flatStart	1..1	Boolean	True means that power flow used a flat start.
activePowerTolerance	1..1	ActivePower	The active power tolerance for a given power flow solution. SvInjection.pInjection shall not be greater than this tolerance.
reactivePowerTolerance	1..1	ReactivePower	The reactive power tolerance for a given power flow solution. SvInjection.qInjection shall not be greater than this tolerance.
voltageTolerance	1..1	PU	The largest difference between actual and scheduled voltage magnitude for controlled node, in per unit of BaseVoltage, - at each node where voltage is subject to control to a set point, and - for which at least one of the devices participating in the control of bus voltage to its set point is not at a reactive power limit. It shall be less than the controlled bus voltage error convergence tolerance.
voltageAngleLimit	1..1	AngleDegrees	The maximum allowed voltage angle between two nodes for a given power flow solution.
impedanceThreshold	1..1	PU	Zero impedance threshold used considered when calculating zero or low impendence branches. The per unit value is calculated with base power

[4] Publication expected in early 2024.

name	mult	type	description
			of 100 MW. If set to 0 the impedance threshold is not used.
loadVoltageDependency	1..1	Boolean	Defines if voltage dependency of loads is considered. True means voltage dependency is considered. False means it is not considered.
respectReactivePowerLimits	1..1	Boolean	Indicates if reactive power of limits of the equipment are respected during power flow calculation. True means limits are respected. False means limits are ignored.
transformerRatioTapControlPriority	1..1	Integer	Indicates if ratio tap change control is applied on transformers. 0 means it is not used, i.e. it is disabled. 1 means it is enabled and indicates it is the highest priority among the following control related settings: transformerRatioTapControlPriority, transformerPhaseTapControlPriority, switchedShuntControlPriority and staticVarCompensatorControlPriority. Allowed values are in the range [0,4].
transformerPhaseTapControlPriority	1..1	Integer	Indicates if phase tap change control is applied on transformers. 0 means it is not used, i.e. it is disabled. 1 means it is enabled and indicates it is the highest priority among the following control related settings: transformerRatioTapControlPriority, transformerPhaseTapControlPriority, switchedShuntControlPriority and staticVarCompensatorControlPriority. Allowed values are in the range [0,4].
switchedShuntControlPriority	1..1	Integer	Indicates if control is applied on switched shunts. 0 means it is not used, i.e. it is disabled. 1 means it is enabled and indicates it is the highest priority among the following control related settings: transformerRatioTapControlPriority, transformerPhaseTapControlPriority, switchedShuntControlPriority and staticVarCompensatorControlPriority. Allowed values are in the range [0,4].
staticVarCompensatorControlPriority	1..1	Integer	Indicates if control is applied on static var compensators. 0 means it is not used, i.e. it is disabled. 1 means it is enabled and indicates it is the highest priority among the following control related settings: transformerRatioTapControlPriority, transformerPhaseTapControlPriority, switchedShuntControlPriority and staticVarCompensatorControlPriority. Allowed values are in the range [0,4].
slackDistributionKind	1..1	SlackDistributionKind	Defines slack distribution used in power flow calculation.
interchangeControlEnabled	1..1	Boolean	Define if the interchange control is enabled during power flow calculation. True means area interchange control is enabled. False means it is disabled.
shiftKind	0..1	PowerShiftKind	Defines type of scaling used to reach defined net-position.
respectActivePowerLimits	1..1	Boolean	Indicates if active power limits of the equipment are respected during power flow calculation. True means limits are respected. False means limits are ignored.

name	mult	type	description
maxIterationsInnerLoop	1..1	Integer	Maximum iterations of the power flow calculation algorithm inner loop.
maxIterationsOuterLoop	1..1	Integer	Maximum iterations of the power flow calculation algorithm outer loop. This can refer to the maximum number of iterations when area interchange control is performed as part of an outer loop or when specific control actions are done in the outer loop.
loadResponseCharacteristicsEnabled	1..1	Boolean	True means load response characteristics are considered, if present in the model. False, means that even if enabled, the load response characteristics are not taken into account by the power flow calculation algorithm.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

6 Application profile specification

6.1 Version information

The content is generated from UML model file CIM100_CGMES31v01_501-20v02_NC23v17_MM10v01.eap.

The document header profile uses extensions. The prefix and the uri of the namespaces used are as follows:

- Prefix: eumd; URI: http://entsoe.eu/ns/Metadata-European# - created by ENTSO-E to separate ENTSO-E extensions to the header
- Prefix: md; URI: http://iec.ch/TC57/61970-552/ModelDescription/1# - namespace defined in IEC 61970-552
- Prefix: dm; URI: http://iec.ch/TC57/61970-552/DifferenceModel/1# - namespace defined in IEC 61970-552
- Prefix: dcat; URI: http://www.w3.org/ns/dcat# - namespace defined by W3C
- Prefix: dcat-cim; URI: http://entsoe.eu/ns/dcat-cim# - namespace defined by ENTSO-E
- Prefix: dcterms; URI: http://purl.org/dc/terms/# - namespace defined by W3C, note that # sign is added in order to cope with CIM XML serialisation
- Prefix: adms; URI: http://www.w3.org/ns/adms# - namespace defined by W3C
- Prefix: prov; URI: http://www.w3.org/ns/prov# - namespace defined by W3C
- Prefix: euvoc; URI: http://publications.europa.eu/ontology/euvoc# - namespace defined by European Commission

6.1.1 Distribution (Document header profile

- Title: Document header vocabulary
- Keyword: DH|Document header

- Description: This vocabulary is describing the document header profile.
- Version IRI: http://entsoe.eu/ns/CIM/DocumentHeader-EU/2.3
- Version info: 2.3.0
- Prior version: http://entsoe.eu/ns/CIM/DocumentHeader-EU/2.2
- Conforms to: urn:iso:std:iec:61970-401:draft:ed-1|urn:iso:std:iec:61970-501:draft:ed-2
- Identifier: 0693858e-f49d-46c2-805d-1dbb9fd9d90f

6.2 Profile constraints

This clause defines requirements and constraints that shall be fulfilled by applications that conform to this document. The naming of the rules shall not be used for machine processing. The rule names are just a string. The naming convention of the constraints is as follows.

“{rule.Type}:{rule.Standard}:{rule.Profile}:{rule.Property}:{rule.Name}”

where

rule.Type: C – for constraint; R – for requirement

rule.Standard: the number of the standard e.g. 301 for 61970-301, 456 for 61970-456, 13 for 61968-13. 61970-600 specific constraints refer to 600 although they are related to one or combination of the 61970-450 series profiles. For document header, DH is used. For reference data, RD is used.

rule.Profile: the abbreviation of the profile, e.g. TP for Topology profile. If set to “ALL” the constraint is applicable to all IEC 61970-600 profiles.

rule.Property: for UML classes, the name of the class, for attributes and associations, the name of the class and attribute or association end, e.g. EnergyConsumer, IdentifiedObject.name, etc. If set to “NA” the property is not applicable to a specific UML element.

rule.Name: the name of the rule. It is unique for the same property.

Example: C:600:ALL:IdentifiedObject.name:stringLength

This document is the master for rules and constraints tagged "MD". For the sake of self-containment, the list below also includes a copy of the relevant rules from IEC 61970-452, tagged "452".

- C:452:ALL:NA:datatypes

  According to 61970-501, datatypes are not exchanged in the instance data. The UnitMultiplier is 1 in cases none value is specified in the profile.

- R:452:ALL:NA:exchange

  Optional and required attributes and associations must be imported and exported if they are in the model file prior to import.

- R:452:ALL:NA:exchange1

  If an optional attribute does not exist in the imported file, it does not have to be exported in case exactly the same data set is exported, i.e. the tool is not obliged to automatically provide this attribute. If the export is resulting from an action by the user performed after

the import, e.g. data processing or model update the export can contain optional attributes.

- R:MD:ALL:NA:exchange

The selection of optional and required attributes as well as their cardinality is made so as to ensure a minimum set of required attributes without which the exchange does not fulfil its basic purpose. Business processes governing different exchanges can require mandatory exchange of certain optional attributes or associations or restrict the usage of some attributes, without modifying their meaning. Optional and required attributes and associations shall therefore be supported by applications which claim conformance with this document. This provides flexibility for the business processes to adapt to different business requirements and base the exchanges on profile compliant applications.

- R:MD:ALL:NA:exchange1

An exporter may, at his or her discretion, produce a serialization containing additional data described by the metadata profiles or in a custom namespace. This data is not subject to extensive data validation and shall not invalidate the document which is exchanged.

- R:MD:ALL:NA:previousHeader

The present version of the header contains all attributes defined in IEC 61970-552. This is done only for the purpose of having one vocabulary for header and to ensure transition for data exchanges that are using IEC 61970-552:2016 header. New profiles shall not use previous header attributes but rely only on the new attributes.

6.3 Available code components

The following code components are available:

- Enterprise architect project file
- RDFS: The RDFS for the header is generated by CimSyntaxGen. The version (type of export) of RDFS v2020 which represents an augmented version if IEC 51970-501. Version information related to the RDFS is included in an ontology-based file header of the RDFS.
- SHACL constraints for the header: In this release only basic SHACL shapes are derived. In case of additional requirements and dependencies are found the set of constraints can be further developed.

6.4 Header serialisation

To support transition, process the header follows most of the serialisation principles defined in IEC 61970-552. However new attributes added to the md:Model class follow principles defined by W3C RDF-serialisation RDF/XML version 1.1. The difference is that in IEC 61970-552, which is inspired by an earlier version of the standard, the predicate of the triple i.e., the property (attribute or association) of the instantiated class has the following notation:

{Class}.{Property}, e.g. md:Model.scenarioTime

while the new properties are serialised without the {Class} notation, e.g.

- dcat:keyword not dcat:Model.keyword
- dcterms:conformsTo not dcterms:Model.conformsTo

549 This rule applies for new attributes that are defined in DCAT, Dublin Core terms[5] and PROV
550 vocabularies used in the header.

551 It should be taken into account that header definitions, in general, are not following all rules in
552 CIM. For instance, when CIM classes are defined and serialised attributes (serialised as literal
553 in RDF serialisation) have cardinality 0..1, while in the header a literal (attribute) can have
554 cardinality 0..*. This is the case in the existing header defined in IEC 61970-552 where
555 md:Model.profile is defined as literal and cardinality 0..*. In the new header defined in this
556 document this rule applied for dcat:keyword. Since update of the header need to be done by
557 create a new version, there is no need to be able to identify the separate dcat:keyword.

558 Chapter 7 lists the relationships in the distribution header. In order to conform with W3C and
559 be able to serialise some properties as rdf:resource, it was necessary that they are modelled
560 as self-associations to md:Model class. This is why in Chapter 7 tables, there are many
561 references to md:Model. It should be noted that in many cases these assosation are not to a
562 md:Model but is referencing dcat:Resource that can be reference data or dataset.

563 7 Detailed document header specification

564 7.1 General

565 The package describes the profile for the extended header.

[5] DCMI: DCMI Metadata Terms (dublincore.org)

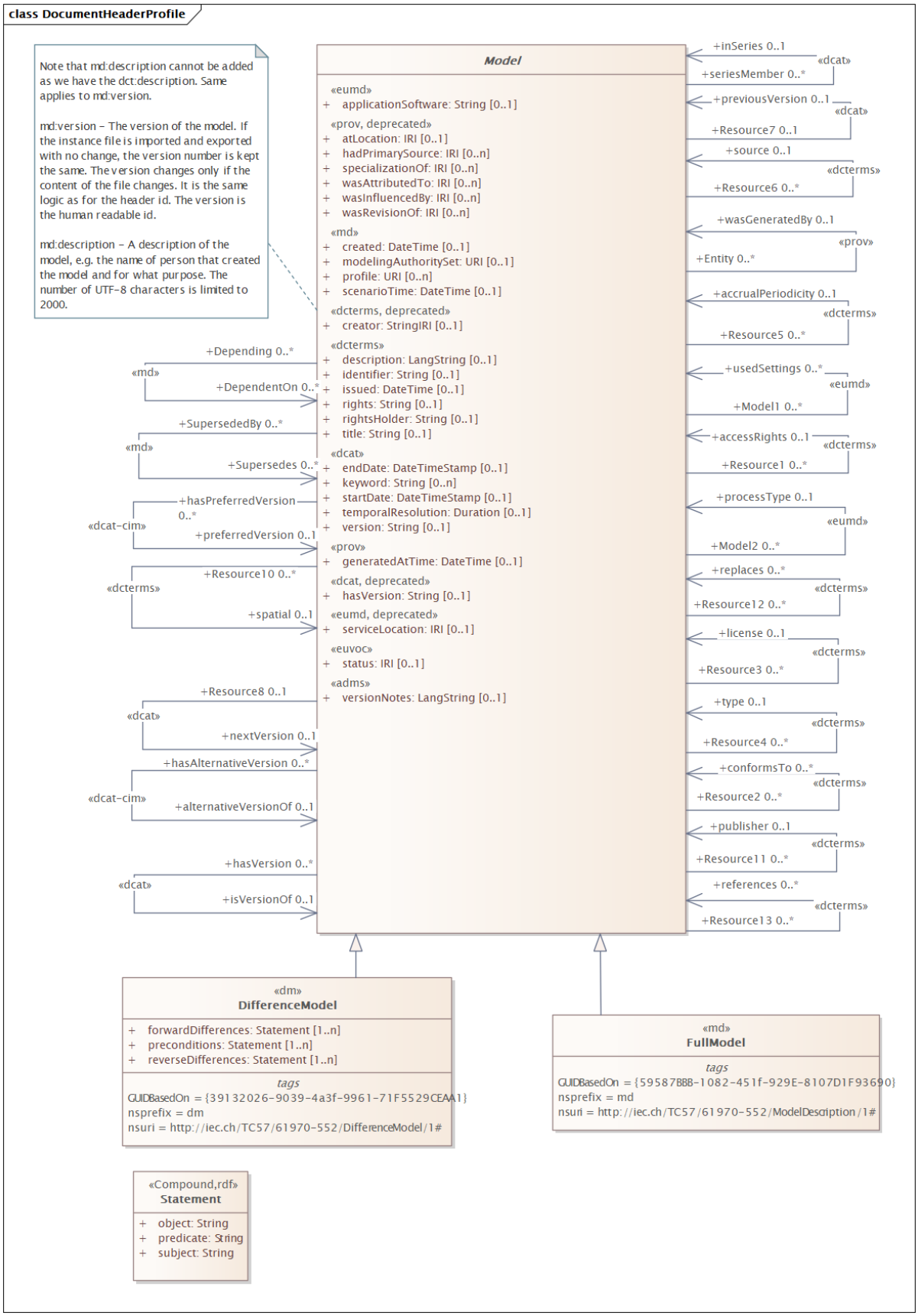

class DocumentHeaderProfile
Note that md:description cannot be added as we have the dct:description. Same applies to md:version.
md:version – The version of the model. If the instance file is imported and exported with no change, the version number is kept the same. The version changes only if the content of the file changes. It is the same logic as for the header id. The version is the human readable id.
md:description – A description of the model, e.g. the name of person that created the model and for what purpose. The number of UTF-8 characters is limited to 2000.
Model
«eumd»
+ applicationSoftware: String [0..1]
«prov, deprecated»
+ atLocation: IRI [0..1]
+ hadPrimarySource: IRI [0..n]
+ specializationOf: IRI [0..n]
+ wasAttributedTo: IRI [0..n]
+ wasInfluencedBy: IRI [0..n]
+ wasRevisionOf: IRI [0..n]
«md»
+ created: DateTime [0..1]
+ modelingAuthoritySet: URI [0..1]
+ profile: URI [0..n]
+ scenarioTime: DateTime [0..1]
«dcterms, deprecated»
+ creator: StringIRI [0..1]
«dcterms»
+ description: LangString [0..1]
+ identifier: String [0..1]
+ issued: DateTime [0..1]
+ rights: String [0..1]
+ rightsHolder: String [0..1]
+ title: String [0..1]
«dcat»
+ endDate: DateTimeStamp [0..1]
+ keyword: String [0..n]
+ startDate: DateTimeStamp [0..1]
+ temporalResolution: Duration [0..1]
+ version: String [0..1]
«prov»
+ generatedAtTime: DateTime [0..1]
«dcat, deprecated»
+ hasVersion: String [0..1]
«eumd, deprecated»
+ serviceLocation: IRI [0..1]
«euvoc»
+ status: IRI [0..1]
«adms»
+ versionNotes: LangString [0..1]
+inSeries 0..1
«dcat»
+seriesMember 0..*
+previousVersion 0..1
«dcat»
+Resource7 0..1
+source 0..1
«dcterms»
+Resource6 0..*
+wasGeneratedBy 0..1
«prov»
+Entity 0..*
+accrualPeriodicity 0..1
«dcterms»
+Resource5 0..*
+usedSettings 0..*
«eumd»
+Model1 0..*
+accessRights 0..1
«dcterms»
+Resource1 0..*
+processType 0..1
«eumd»
+Model2 0..*
+replaces 0..*
«dcterms»
+Resource12 0..*
+license 0..1
«dcterms»
+Resource3 0..*
+type 0..1
«dcterms»
+Resource4 0..*
+conformsTo 0..*
«dcterms»
+Resource2 0..*
+publisher 0..1
«dcterms»
+Resource11 0..*
+references 0..*
«dcterms»
+Resource13 0..*
+Depending 0..*
«md»
+DependentOn 0..*
+SupersededBy 0..*
«md»
+Supersedes 0..*
+hasPreferredVersion 0..*
«dcat-cim»
+preferredVersion 0..1
+Resource10 0..*
«dcterms»
+spatial 0..1
+Resource8 0..1
«dcat»
+nextVersion 0..1
+hasAlternativeVersion 0..*
«dcat-cim»
+alternativeVersionOf 0..1
+hasVersion 0..*
«dcat»
+isVersionOf 0..1
«dm»
DifferenceModel
+ forwardDifferences: Statement [1..n]
+ preconditions: Statement [1..n]
+ reverseDifferences: Statement [1..n]
tags
GUIDBasedOn = {39132026-9039-4a3f-9961-71F5529CEAA1}
nsprefix = dm
nsuri = http://iec.ch/TC57/61970-552/DifferenceModel/1#
«md»
FullModel
tags
GUIDBasedOn = {59587BBB-1082-451f-929E-8107D1F93690}
nsprefix = md
nsuri = http://iec.ch/TC57/61970-552/ModelDescription/1#
«Compound,rdf»
Statement
+ object: String
+ predicate: String
+ subject: String

Figure 6 – Class diagram DocumentHeaderProfile::DocumentHeaderProfile

Figure 6: The diagram defines the extended document header model.

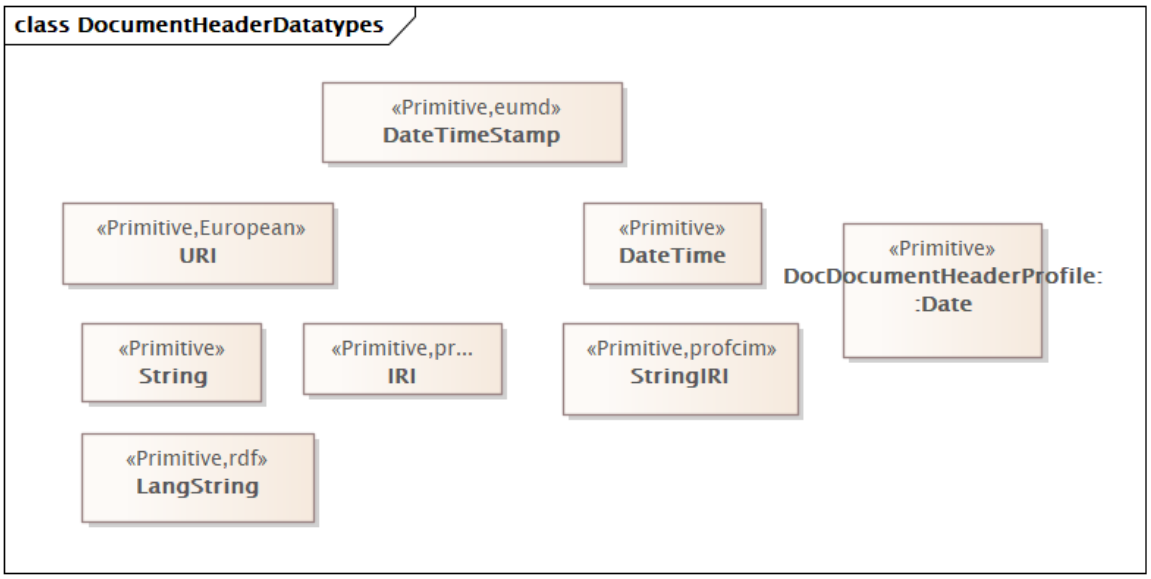


Figure 7 – Class diagram DocumentHeaderProfile::DocumentHeaderDatatypes

Figure 7: The diagram shows datatypes that are used by classes in the profile. Stereotypes are used to describe the datatypes. The following stereotypes are defined:
<<enumeration>> A list of permissible constant values.
<<Primitive>> The most basic data types used to compose all other data types.
<<CIMDatatype>> A datatype that contains a value attribute, an optional unit of measure and a unit multiplier. The unit and multiplier may be specified as a static variable initialized to the allowed value.
<<Compound>> A composite of Primitive, enumeration, CIMDatatype or other Compound classes, as long as the Compound classes do not recurse.
For all datatypes both positive and negative values are allowed unless stated otherwise for a particular datatype.

7.2 (abstract) Model root class

A Model is a collection of data describing instances, objects or entities, real or computed. In the context of CIM the semantics of the data is defined by profiles. Hence a model can contain equipment data, power flow initial values, power flow results etc.
The Model class describes the header content that is the same for the FullModel and the DifferenceModel. A Model is identified by an rdf:about attribute. The rdf:about attribute uniquely describes the model data and not the CIMXML document. A new rdf:about identification is generated for created documents only when the model data has changed. A repeated creation of documents from unchanged model data shall have the same rdf:about identification as previous document generated from the same model data.
Table 2 shows all attributes of Model.

Table 2 – Attributes of DocumentHeaderProfile::Model

name	mult	type	description
applicationSoftware	0..1	String	(eumd) Identifies the application software which generated this instance file. The application software term is defined in ISO/IEC/IEEE 24765:2017. The application software can be identified either:

name	mult	type	description
			- as a string which contains information on the software name and version, e.g. <tool_name>-<major_version>.<minor_version>.<patch>, or - as a reference to a software identification tag as defined by ISO/IEC 19770-2:2015 and ISO/IEC/IEEE 24765:2017.
atLocation	0..1	IRI	(deprecated,prov) A location can be an identifiable geographic place (ISO 19112), but it can also be a non-geographic place such as a directory, row, or column. As such, there are numerous ways in which location can be expressed, such as by a coordinate, address, landmark, and so forth. [CIM context: Reference to a region or a domain for which this model is provided. This property is deprecated. Use dcterms:spatial.].
created	0..1	DateTime	(md) The date and time when the model was created. It is the time of the serialization. The format is an extended format according to the ISO 8601-2005. European exchanges shall refer to UTC, e.g. <md:Model.created>2014-05-15T17:48:31.474Z</md:Model.created>.
creator	0..1	StringIRI	(deprecated,dcterms) An entity responsible for making the resource. Recommended practice is to identify the creator with a URI. If this is not possible or feasible, a literal value that identifies the creator may be provided. [CIM context: The name of the agent (Modeling Authority) from which the model originates. This property is deprecated. Use dcterms:publisher.].
description	0..1	LangString	(dcterms) A free-text account of the item.
generatedAtTime	0..1	DateTime	(prov) Generation is the completion of production of a new entity by an activity. This entity did not exist before generation and becomes available for usage after this generation. [CIM context: The date and time when the model was serialized in the document where the header is located. The format is an extended format according to the ISO 8601-2005. European exchanges shall refer to UTC.].
hadPrimarySource	0..n	IRI	(deprecated,prov) A primary source for a topic refers to something produced by some agent with direct experience and knowledge about the topic, at the time of the topic's study, without benefit from hindsight. Because of the directness of primary sources, they 'speak for themselves' in ways that cannot be captured through the filter of secondary sources. As such, it is important for secondary sources to reference those primary sources from which they were derived, so that their reliability can be investigated. A primary source relation is a particular case of derivation of secondary materials from their primary sources. It is recognized that the determination of primary sources can be up to interpretation, and should be done according to conventions accepted within the application's domain. [CIM context:

name	mult	type	description
			Reference to a modelling authority set version sourcing the model. It is only used in cases where a model is modified by an agent which has different version of modelling authority set. The agent that makes a revision of a model indicates the primary source using this property and also refers to its own version of modelling authority set using prov:specializationOf. This property is deprecated. Use dcat:isVersionOf and dcterms:publisher.].
hasVersion	0..1	String	(deprecated,dcat) This resource has a more specific, versioned resource. This property is intended for relating a non-versioned or abstract resource to several versioned resources, e.g. snapshots [PAV]. The notion of version used by this property is limited to versions resulting from revisions occurring to a resource as part of its life-cycle. Therefore, its semantics is more specific than its super-property dcterms:hasVersion, which makes use of a broader notion of version, including editions and adaptations. This property is deprecated.
identifier	0..1	String	(dcterms) An unambiguous reference to the resource within a given context. Recommended practice is to identify the resource by means of a string conforming to an identification system. Examples include International Standard Book Number (ISBN), Digital Object Identifier (DOI), and Uniform Resource Name (URN). Persistent identifiers should be provided as HTTP URIs. [CIM context: A unique identifier of the model which is serialised in the document where the header is located. The identifier is persistent for a given version of the model and shall change when the model changes. If a model is serialized as complete (full) model or as difference model exchange the identifier shall be the same. The identifier shall not be used as an identifier of the document which can be different for a given version of a model.].
keyword	0..n	String	(dcat) A keyword or tag describing a resource. [CIM context: The intended content type of the model, usually the profile keyword. Used to identify what profiles and content is expected in the document, e.g., Equipment, Boundary, SSH, AE, etc. The same keyword is used for different versions of same profile. It can be also used to identify different content based on the same profile. For instance, as the equipment profile can be used for both boundary data and equipment not related to boundary, the keyword is different to indicate that boundary data is exchanged. In order to avoid ambiguity the property is not exchanged in cases where the document contains multiple profiles referenced by dct:conformsTo.].
modelingAuthoritySet	0..1	URI	(md) A URN/URI referring to the organisation role / model authority set reference. The organization role is the source of the model. It is

name	mult	type	description
			the same for all profiles part of a model exchange.
profile	0..n	URI	(md) URN/URI describing the profiles that governs this model. It uniquely identifies the profiles and its version, e.g. http://iec.ch/TC57/61970-456/SteadyStateHypothesis/2/0.
rights	0..1	String	(dcterms) A statement that concerns all rights not addressed with dct:license or dct:accessRights, such as copyright statements.
rightsHolder	0..1	String	(dcterms) Information about rights held in and over the resource. Typically, rights information includes a statement about various property rights associated with the resource, including intellectual property rights. Recommended practice is to refer to a rights statement with a URI. If this is not possible or feasible, a literal value (name, label, or short text) may be provided.
scenarioTime	0..1	DateTime	(md) The date and time that this model represents, i.e. for which the model is valid. The format is an extended format according to the ISO 8601-2005. European exchanges shall refer to UTC, e.g. <md:Model.scenarioTime>2030-01-15T17:00:00.000Z</md:Model.scenarioTime>.
serviceLocation	0..1	IRI	(deprecated,eumd) Reference to a service location (region or a domain).
specializationOf	0..n	IRI	(deprecated,prov) An entity that is a specialization of another shares all aspects of the latter, and additionally presents more specific aspects of the same thing as the latter. In particular, the lifetime of the entity being specialized contains that of any specialization. Examples of aspects include a time period, an abstraction, and a context associated with the entity. [CIM context: Reference to modelling authority set version sourcing the model. The agent that makes a revision of a model indicates the primary source using prov:hadPrimarySource and refers to its own version of modelling authority set using this property. This property is deprecated. Use dcterms:publisher.].
status	0..1	IRI	(euvoc) Indicates the status of a skos:Concept or a skosxl:Label, or any resource related to controlled vocabulary management. [CIM context: The condition or position of an object with regard to its standing. (Validated, Primary, Backup etc.)].
version	0..1	String	(dcat) The version number of a resource.
versionNotes	0..1	LangString	(adms) A description of changes between this version and the previous version of the resource.
wasAttributedTo	0..n	IRI	(deprecated,prov) Attribution is the ascribing of an entity to an agent. [CIM context: Reference to the agent (or service provider) from which the model originates. This property is deprecated. Use dcterms:publisher.].

name	mult	type	description
wasInfluencedBy	0..n	IRI	(deprecated,prov) Influence is the capacity of an entity, activity, or agent to have an effect on the character, development, or behavior of another by means of usage, start, end, generation, invalidation, communication, derivation, attribution, association, or delegation. [CIM context: A reference to the model on which the model serialised in this document depends on. The references are maintained by the producer of the model. Minimum requirements for the dependency are specified and can be restricted within a business process as long as they do not contradict requirements by standards. For instance, IEC 61970-600-1 defines minimum requirements for the profiles defined in that standard. This property is deprecated. Use dcterms:references.].
wasRevisionOf	0..n	IRI	(deprecated,prov) A revision is a derivation for which the resulting entity is a revised version of some original. The implication here is that the resulting entity contains substantial content from the original. Revision is a particular case of derivation. [CIM context: When a model is updated the resulting model supersedes the models that were used as basis for the update. Hence this is a reference to the model which are superseded by this model. A model can supersede 1 or more models, e.g. a difference model or a full model supersede multiple models (difference or full). In this case, multiple properties are included in the header. The referenced document(s) is (are) identified by the URN/MRID/UUID in the FullModel rdf:about attribute when full model(s) is (are) referenced and by the URN/MRID/UUID in the DifferenceModel rdf:about attribute when difference model(s) is (are) referenced. This property is deprecated. Use dcterms:replaces.].
endDate	0..1	DateTimeStamp	(dcat) This property contains the end of the period. [CIM context: The end date and time of the validity period of the model that it is serialized in the document where the header is located. It is only used in relation to the startDate property which indicates the beginning of the validity period of the model.].
startDate	0..1	DateTimeStamp	(dcat) This property contains the start of the period. [CIM context: The date and time that this model represents, i.e. for which the model is (or was) valid. It indicates the beginning of the validity period. It is indicating either an instant (in cases where the model is only valid for a point in time) or the start time of a period. If not provided the model is considered valid for any time stamp. The format is an extended format according to the ISO 8601-2005. European exchanges shall refer to UTC.].

name	mult	type	description
issued	0..1	DateTime	(dcterms) The date of listing (i.e., formal recording) of the corresponding dataset or service in the catalog. [CIM context: Reference to the date that the complete data set was made valid/available.].
temporalResolution	0..1	Duration	(dcat) Minimum time period resolvable in the dataset. [CIM context: Describes the Market Time Unit (MTU), e.g. hourly, 15 min., etc.]
title	0..1	String	(dcterms) A name given to the resource [CIM context: The human readable name of the dataset that can form the instance file name.]
description	0..1	String	(md) A description of the model, e.g. the name of person that created the model and for what purpose. The number of UTF-8 characters is limited to 2000.
version	0..1	String	(md) The version of the model. If the instance file is imported and exported with no change, the version number is kept the same. The version changes only if the content of the file changes. It is the same logic as for the header id. The version is the human readable id. [CIM context: It relates to the version of the document and not the version of the model which is serialized.].

Table 3 shows all association ends of Model with other classes.

Table 3 – Association ends of DocumentHeaderProfile::Model with other classes

mult from	name	mult to	type	description
0..*	DependentOn	0..*	Model	(md) A reference to the model documents that the model described by this document depends on. In general there can be 0 or many Model.DependentOn depending on the profile and the content of the instance file. For instance: – A load flow solution depends on the topology model it was computed from – A topology model computed by a topology processor depends on the network model it was computed from. The referenced models are identified by the FullModel rdf:about attribute for full model documents and by DifferenceModel rdf:about attribute for difference model documents. The references are maintained by the producer of the CIMXML document and the references are valid for the model with version and identifier for which the document was created.
0..*	Supersedes	0..*	Model	(md) When a model is updated the resulting model supersedes the models that were used as basis for the update. Hence this is a reference to the CIMXML

mult from	name	mult to	type	description
				documents which are superseded by this model. A model (or instance file) can supersede 1 or more models, e.g. a difference model or a full model supersede multiple models (difference or full). In this case more than one Model.Supersedes are included in the header. The referenced document(s) is (are) identified by the URN/MRID/UUID in the FullModel rdf:about attribute when full model(s) is (are) referenced and by the URN/MRID/UUID in the DifferenceModel rdf:about attribute when difference model(s) is (are) referenced.
0..*	publisher	0..1	Model	(dcterms) An entity responsible for making the resource available. [CIM context: The agent that is publishing the dataset on the given platform.]
0..*	conformsTo	0..*	Model	(dcterms) An established standard to which the described resource conforms. [CIM context: An IRI describing the profile that governs this model. It uniquely identifies the profile and its version. Multiple instances of the property describe all standards or specifications to which the model and the document representing this model conform to. A document would normally conform to profile definitions, the constraints that relate to the profile and/or the set of business specific constrains. A reference to a machine- readable constraints or specification indicates that the document was tested against these constraints and it conforms to them.].
0..*	type	0..1	Model	(dcterms) The nature or genre of the resource. Recommended practice is to use a controlled vocabulary such as the DCMI Type Vocabulary [DCMI-TYPE]. To describe the file format, physical medium, or dimensions of the resource, use the property Format.
0..*	license	0..1	Model	(dcterms) A legal document giving official permission to do something with the resource. Recommended practice is to identify the license document with a URI. If this is not possible or feasible, a literal value that identifies the license may be provided. [CIM context: Reference to the license under which the data is made available. If no license holder is defined, then the original data provider holds the license.].
0..*	replaces	0..*	Model	(dcterms) A related resource that is supplanted, displaced, or superseded by the described resource [CIM context: The referenced dataset is being replaced by this dataset.]

mult from	name	mult to	type	description
0..*	processType	0..1	Model	(eumd) The exact business nature. Reference to Business Process configurations.
0..*	isVersionOf	0..1	Model	(dcat) This resource has a more specific, versioned resource. This property is intended for relating a non-versioned or abstract resource to several versioned resources, e.g., snapshots. The notion of version used by this property is limited to versions resulting from revisions occurring to a resource as part of its life-cycle. Therefore, its semantics is more specific than its super-property dcterms:hasVersion, which makes use of a broader notion of version, including editions and adaptations.
0..*	alternativeVersionOf	0..1	Model	(dcat-cim) This resource is an alternative version of a non-versioned or abstract resource. This property is intended for relating a versioned resource to a non-versioned or abstract resource at the same time express that multiple versions exist. dcat-cim:alternativeVersionOf is a specialisation of dcat:isVersionOf with the restriction that the resource shall have a preferred version (dcat-cim:preferredVersion) so that the preferred dataset can be used when there is no need to access all alternative versions.
0..*	usedSettings	0..*	Model	(eumd) Reference to a set of parameters describing used settings (e.g. power flow settings, process settings, etc.) applied to the model prior its serialisation.
0..*	references	0..*	Model	(dcterms) A related resource that is referenced, cited, or otherwise pointed to by the described resource[. [CIM context: The referenced resource that is being complemented in this dataset, e.g. SSH is referencing EQ.]
0..*	accessRights	0..1	Model	(dcterms) Information about who access the resource or an indication of its security status. Access Rights may include information regarding access or restrictions based on privacy, security, or other policies. [CIM context: Reference to the confidentiality level that shall be applied when handling this model.].
0..*	accrualPeriodicity	0..1	Model	(dcterms) The frequency with which items are added to a collection. [CIM context: Reference to the time frame.].
0..*	wasGeneratedBy	0..1	Model	(prov) Generation is the completion of production of a new entity by an activity. This entity did not exist before

mult from	name	mult to	type	description
				generation and becomes available for usage after this generation. [CIM context: Reference to an activity or the exact business nature (process, configuration) which produced or uses the model.].
0..*	source	0..1	Model	(dcterms) A related resource from which the described resource is derived. This property is intended to be used with non-literal values. The described resource may be derived from the related resource in whole or in part. Best practice is to identify the related resource by means of a URI or a string conforming to a formal identification system.
0..1	previousVersion	0..1	Model	(dcat) The previous version of a resource in a lineage. This property is meant to be used to specify a version chain, consisting of snapshots of a resource. The notion of version used by this property is limited to versions resulting from revisions occurring to a resource as part of its life-cycle. One of the typical cases here is representing the history of the versions of a dataset that have been released over time.
0..*	spatial	0..1	Model	(dcterms) The geographical area covered by the dataset. [CIM context: The responsibility area that multiple model can describe, also referred to frame.]
0..1	nextVersion	0..1	Model	(dcat) The next version for the resource.
0..*	inSeries	0..1	Model	(dcat) A dataset series of which the dataset is part.
0..*	preferredVersion	0..1	Model	(dcat-cim) The preferred version of a resource in a lineage of alternative versions. This property is used to specify a specific version to be the preference in a chain of alternatives, consisting of snapshots of a resource.

7.3 (dm) DifferenceModel

Inheritance path = Model

It represents the difference model header. The content is described by the Model class, the association role forwardDifferences and association role reverseDifferences. Both association roles may have one set of Statements.

Table 4 shows all attributes of DifferenceModel.

Table 4 – Attributes of DocumentHeaderProfile::DifferenceModel

name	mult	type	description
preconditions	1..n	Statement	A property of the difference model whose value is the collection of precondition statements.

name	mult	type	description
reverseDifferences	1..n	Statement	A property of the difference model whose value is the collection of reverse difference statements.
forwardDifferences	1..n	Statement	A property of the difference model whose value is a collection of statements (i.e., resources of type rdf:Statement) representing the forward difference statements.
applicationSoftware	0..1	String	(eumd) inherited from: Model
atLocation	0..1	IRI	(deprecated,prov) inherited from: Model
created	0..1	DateTime	(md) inherited from: Model
creator	0..1	StringIRI	(deprecated,dcterms) inherited from: Model
description	0..1	LangString	(dcterms) inherited from: Model
generatedAtTime	0..1	DateTime	(prov) inherited from: Model
hadPrimarySource	0..n	IRI	(deprecated,prov) inherited from: Model
hasVersion	0..1	String	(deprecated,dcat) inherited from: Model
identifier	0..1	String	(dcterms) inherited from: Model
keyword	0..n	String	(dcat) inherited from: Model
modelingAuthoritySet	0..1	URI	(md) inherited from: Model
profile	0..n	URI	(md) inherited from: Model
rights	0..1	String	(dcterms) inherited from: Model
rightsHolder	0..1	String	(dcterms) inherited from: Model
scenarioTime	0..1	DateTime	(md) inherited from: Model
serviceLocation	0..1	IRI	(deprecated,eumd) inherited from: Model
specializationOf	0..n	IRI	(deprecated,prov) inherited from: Model
status	0..1	IRI	(euvoc) inherited from: Model
version	0..1	String	(dcat) inherited from: Model
versionNotes	0..1	LangString	(adms) inherited from: Model
wasAttributedTo	0..n	IRI	(deprecated,prov) inherited from: Model
wasInfluencedBy	0..n	IRI	(deprecated,prov) inherited from: Model
wasRevisionOf	0..n	IRI	(deprecated,prov) inherited from: Model
endDate	0..1	DateTimeStamp	(dcat) inherited from: Model
startDate	0..1	DateTimeStamp	(dcat) inherited from: Model
issued	0..1	DateTime	(dcterms) inherited from: Model
temporalResolution	0..1	Duration	(dcat) inherited from: Model
title	0..1	String	(dcterms) inherited from: Model

Table 5 shows all association ends of DifferenceModel with other classes.

Table 5 – Association ends of DocumentHeaderProfile::DifferenceModel with other classes

mult from	name	mult to	type	description
0..*	DependentOn	0..*	Model	(md) inherited from: Model
0..*	Supersedes	0..*	Model	(md) inherited from: Model

mult from	name	mult to	type	description
0..*	publisher	0..1	Model	(dcterms) inherited from: Model
0..*	conformsTo	0..*	Model	(dcterms) inherited from: Model
0..*	type	0..1	Model	(dcterms) inherited from: Model
0..*	license	0..1	Model	(dcterms) inherited from: Model
0..*	replaces	0..*	Model	(dcterms) inherited from: Model
0..*	processType	0..1	Model	(eumd) inherited from: Model
0..*	isVersionOf	0..1	Model	(dcat) inherited from: Model
0..*	alternativeVersionOf	0..1	Model	(dcat-cim) inherited from: Model
0..*	usedSettings	0..*	Model	(eumd) inherited from: Model
0..*	references	0..*	Model	(dcterms) inherited from: Model
0..*	accessRights	0..1	Model	(dcterms) inherited from: Model
0..*	accrualPeriodicity	0..1	Model	(dcterms) inherited from: Model
0..*	wasGeneratedBy	0..1	Model	(prov) inherited from: Model
0..*	source	0..1	Model	(dcterms) inherited from: Model
0..1	previousVersion	0..1	Model	(dcat) inherited from: Model
0..*	spatial	0..1	Model	(dcterms) inherited from: Model
0..1	nextVersion	0..1	Model	(dcat) inherited from: Model
0..*	inSeries	0..1	Model	(dcat) inherited from: Model
0..*	preferredVersion	0..1	Model	(dcat-cim) inherited from: Model

7.4 (md) FullModel

Inheritance path = Model
It represents the full model header and its contents is described by the Model class.
Table 6 shows all attributes of FullModel.

Table 6 – Attributes of DocumentHeaderProfile::FullModel

name	mult	type	description
applicationSoftware	0..1	String	(eumd) inherited from: Model
atLocation	0..1	IRI	(deprecated,prov) inherited from: Model
created	0..1	DateTime	(md) inherited from: Model
creator	0..1	StringIRI	(deprecated,dcterms) inherited from: Model
description	0..1	LangString	(dcterms) inherited from: Model
generatedAtTime	0..1	DateTime	(prov) inherited from: Model
hadPrimarySource	0..n	IRI	(deprecated,prov) inherited from: Model
hasVersion	0..1	String	(deprecated,dcat) inherited from: Model
identifier	0..1	String	(dcterms) inherited from: Model
keyword	0..n	String	(dcat) inherited from: Model
modelingAuthoritySet	0..1	URI	(md) inherited from: Model
profile	0..n	URI	(md) inherited from: Model
rights	0..1	String	(dcterms) inherited from: Model
rightsHolder	0..1	String	(dcterms) inherited from: Model

name	mult	type	description
scenarioTime	0..1	DateTime	(md) inherited from: Model
serviceLocation	0..1	IRI	(deprecated,eumd) inherited from: Model
specializationOf	0..n	IRI	(deprecated,prov) inherited from: Model
status	0..1	IRI	(euvoc) inherited from: Model
version	0..1	String	(dcat) inherited from: Model
versionNotes	0..1	LangString	(adms) inherited from: Model
wasAttributedTo	0..n	IRI	(deprecated,prov) inherited from: Model
wasInfluencedBy	0..n	IRI	(deprecated,prov) inherited from: Model
wasRevisionOf	0..n	IRI	(deprecated,prov) inherited from: Model
endDate	0..1	DateTimeStamp	(dcat) inherited from: Model
startDate	0..1	DateTimeStamp	(dcat) inherited from: Model
issued	0..1	DateTime	(dcterms) inherited from: Model
temporalResolution	0..1	Duration	(dcat) inherited from: Model
title	0..1	String	(dcterms) inherited from: Model

Table 7 shows all association ends of FullModel with other classes.

Table 7 – Association ends of DocumentHeaderProfile::FullModel with other classes

mult from	name	mult to	type	description
0..*	DependentOn	0..*	Model	(md) inherited from: Model
0..*	Supersedes	0..*	Model	(md) inherited from: Model
0..*	publisher	0..1	Model	(dcterms) inherited from: Model
0..*	conformsTo	0..*	Model	(dcterms) inherited from: Model
0..*	type	0..1	Model	(dcterms) inherited from: Model
0..*	license	0..1	Model	(dcterms) inherited from: Model
0..*	replaces	0..*	Model	(dcterms) inherited from: Model
0..*	processType	0..1	Model	(eumd) inherited from: Model
0..*	isVersionOf	0..1	Model	(dcat) inherited from: Model
0..*	alternativeVersionOf	0..1	Model	(dcat-cim) inherited from: Model
0..*	usedSettings	0..*	Model	(eumd) inherited from: Model
0..*	references	0..*	Model	(dcterms) inherited from: Model
0..*	accessRights	0..1	Model	(dcterms) inherited from: Model
0..*	accrualPeriodicity	0..1	Model	(dcterms) inherited from: Model
0..*	wasGeneratedBy	0..1	Model	(prov) inherited from: Model
0..*	source	0..1	Model	(dcterms) inherited from: Model
0..1	previousVersion	0..1	Model	(dcat) inherited from: Model
0..*	spatial	0..1	Model	(dcterms) inherited from: Model
0..1	nextVersion	0..1	Model	(dcat) inherited from: Model
0..*	inSeries	0..1	Model	(dcat) inherited from: Model
0..*	preferredVersion	0..1	Model	(dcat-cim) inherited from: Model

7.5 (profcim) IRI primitive

An IRI (Internationalized Resource Identifier) within an RDF graph is a Unicode string that conforms to the syntax defined in RFC 3987.
The primitive is serialized as rdf:resource in RDFXML.
IRIs in the RDF abstract syntax must be absolute, and may contain a fragment identifier.
IRI equality: Two IRIs are equal if and only if they are equivalent under Simple String Comparison according to section 5.1 of [RFC3987]. Further normalization must not be performed when comparing IRIs for equality.
IRIs are a generalization of URIs [RFC3986] that permits a wider range of Unicode characters. Every absolute URI and URL is an IRI, but not every IRI is an URI. When IRIs are used in operations that are only defined for URIs, they must first be converted according to the mapping defined in section 3.1 of [RFC3987]. A notable example is retrieval over the HTTP protocol. The mapping involves UTF-8 encoding of non-ASCII characters, %-encoding of octets not allowed in URIs, and Punycode-encoding of domain names.

7.6 (rdf) LangString primitive

According to RDF 1.1 and RDF 1.2 the rdf:langString returns the given value and language tag. The rdf:langString type extends xs:string, and represents a language tagged string in RDF.

7.7 (profcim) StringIRI primitive

An IRI (Internationalized Resource Identifier) within an RDF graph is a Unicode string that conforms to the syntax defined in RFC 3987.
The primitive is serialized as literal without language support.
IRIs in the RDF abstract syntax must be absolute, and may contain a fragment identifier.
IRI equality: Two IRIs are equal if and only if they are equivalent under Simple String Comparison according to section 5.1 of [RFC3987]. Further normalization must not be performed when comparing IRIs for equality.
IRIs are a generalization of URIs [RFC3986] that permits a wider range of Unicode characters. Every absolute URI and URL is an IRI, but not every IRI is an URI. When IRIs are used in operations that are only defined for URIs, they must first be converted according to the mapping defined in section 3.1 of [RFC3987]. A notable example is retrieval over the HTTP protocol. The mapping involves UTF-8 encoding of non-ASCII characters, %-encoding of octets not allowed in URIs, and Punycode-encoding of domain names.

7.8 String primitive

A string consisting of a sequence of characters. The character encoding is UTF-8. The string length is unspecified and unlimited.

7.9 DateTime primitive

Date and time as "yyyy-mm-ddThh:mm:ss.sss", which conforms with ISO 8601. UTC time zone is specified as "yyyy-mm-ddThh:mm:ss.sssZ". A local timezone relative UTC is specified as "yyyy-mm-ddThh:mm:ss.sss-hh:mm". The second component (shown here as "ss.sss") could have any number of digits in its fractional part to allow any kind of precision beyond seconds.

7.10 (European) URI primitive

URI is a string following the rules defined by the W3C/IETF URI Planning Interest Group in a set of RFCs of which one is RFC 3305.

7.11 (eumd) DateTimeStamp primitive

Position of an instant, expressed using xsd:dateTimeStamp, in which the time-zone field is mandatory.

7.12 (rdf) Statement compound

It represent a set of Definition and/or Description elements.
Table 8 shows all attributes of Statement.

667 **Table 8 – Attributes of DocumentHeaderProfile::Statement**

name	mult	type	description
subject	1..1	String	Statement subject.
predicate	1..1	String	Statement predicate.
object	1..1	String	Statement object.

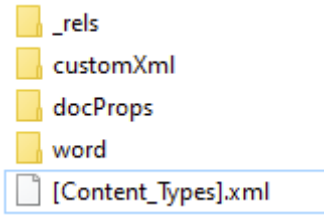
668

669 # 8 Metadata packaging

670 ## 8.1 General

671 The approach on data packaging is inspired by Office Open XML File Formats specification

672 In short this means that a zip file is created that has the file extension .cimx (similar to .docx).
673 For illustration, renaming a .docx to zip that can be unzipped results in the following structure:

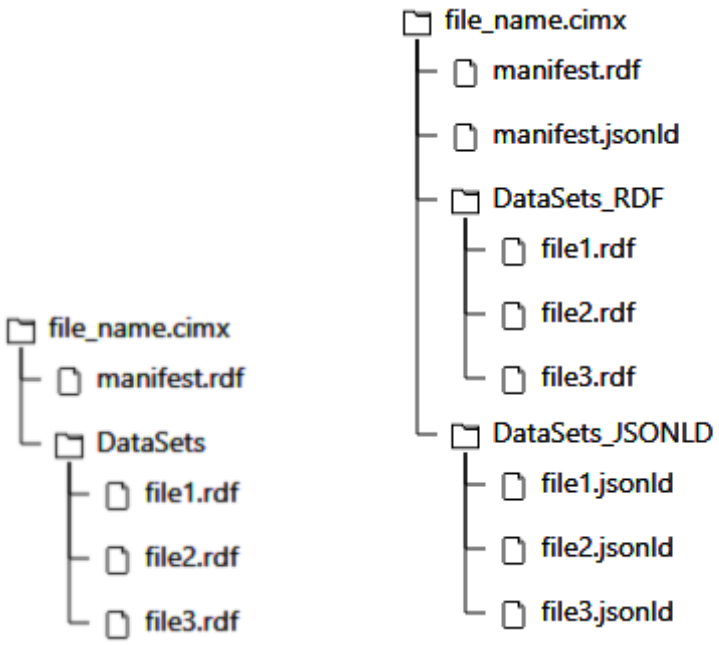


674

675 **Figure 8. Structure of docx**

676 The advantage of using .cimx approach enables better understanding that this file can be
677 directly read by using efficient data parsing technique and not necessarily unzipped, stored
678 separately and then processed. In any case both options are still available, but with this
679 technique the implementations are leaner.

680 The data package of cimx can include different structure. The following figure illustrates two
681 options.



682

Figure 9. Structure of cimx

The structure allows different organisation of the data depending on the serialisation format used for this data. It is not meant that such structure is required. The only required part is that there is manifest.xml in the root of the structure. Subfolders are optional and only facilitate data organisation. Note that specifications related to JSON-LD are still to be developed, so this should be considered in future releases.

Manifest file explains the content of the package. It can be in different serialisation forms, but the content shall be identical. The name of the file shall be manifest, the file extension will be different depending on the serialisation format.

The manifest file is based on DCAT. Reference data folder contains different reference data in different serialisation forms referenced from the manifest. Selections of different serialisation forms can change over time and different business processes can pick the form they need. For instance, a given process can use a subset of reference data provided by OPDE in a single serialisation form and then transition to other serialisation forms.

This approach is applied for any package. It could be all files though history (e.g., year ahead process) or just only one time stamp. The package can also contain boundary data in cases where it is desired to package boundary data and reference data in one package. The general approach is that the package can contain any file and the manifest describes it. The business processes will decide how this will be applied for different use cases. Inclusion of more data in the package supports applications that are in secure environment that cannot link to any outside sources.

8.2 Manifest specification

Manifest specification is built on DCAT, namely using the classes dcat:Catalog, dcat:Dataset, dcat:DatasetSeries and dcat:Distribution. Figure 10 provides information on what is included in DCAT and the relationships. This manifest specification follows the main concepts outlines in DCAT and further specifies how this is used for CIM based data exchanges.

The manifest instance file has the following main elements:

- A file header which is using the main dcat:Catalog
- A file body which contains classes describing the content of the manifest.

In general, the objective of the manifest instance file is to provide a linking mechanism between different datasets and their distributions (instances of datasets in different serialisation formats, e.g. a pdf document of a profile, CIMXML serialisation of a profile or dataset, JSON-LD serialisation, etc.).

This document focuses on reference data, but the manifest specification is applicable to reference data as well as other data exchanges which involve CGMES or NC profiles.

8.2.1 Manifest file/document header

The file header for the manifest uses dcat:Catalog. The following commented example illustrates the usage. In case of multiple dcat:Catalog objects in the manifest then main dcat:Catalog serves as a header of the manifest.

```
  <dcat:Catalog rdf:about="urn:uuid:4261296f-4625-4a92-9b8e-ab5369f29a86"> <!-- the ID of the
manifest catalog which is serialised in this instance file -->
    <dcterms:modified>2022-09-16T11:29:33.781670</dcterms:modified> <!--  Indicates when the
content of the data was modified-->
    <dcat:startDate>2022-09-17T13:30:00Z</dcat:startDate> <!--  Indicates the start date for
the validity of this manifest instance file. This property is a result of flattening of the
dcterms:temporal in order to avoid usage of compound in the header.-->
```

```
729         <dcat:endDate>2023-01-17T13:30:00Z</dcat:endDate> <!--  Indicates the end date for the
730     validity of this manifest instance file. This property is a result of flattening of the
731     dcterms:temporal in order to avoid usage of compound in the header.-->
732         <dcat:version>2.0.0</dcat:version> <!--  the current version-->
733         <dcterms:title>OPDE Reference data</dcterms:title>
734         <dcterms:identifier> 4261296f-4625-4a92-9b8e-ab5369f29a86</dcterms:identifier>
735         <dcterms:description xml:lang="en">Manifest for OPDE reference data</dcterms:description>
736         <adms:versionNotes xml:lang="en">This version includes update version of BaseVoltage
737     reference data</adms:versionNotes>
738          <dcat:previousVersion rdf:resource="urn:uuid:6c64405d-0142-48ff-91cf-111f69255d67"/> <!--
739     the ID of the previous version of a manifest.-->
740          <dcterms:replaces rdf:resource="urn:uuid:6c64405d-0142-48ff-91cf-111f69255d67"/> <!--
741     the ID of the previous version of a manifest, which this version is replacing.-->
742           <dcterms:catalog rdf:resource="urn:uuid:5c4ab034-a673-4af6-a2af-35de5cc2dfce"/> <!--
743     the ID of other catalogs present in the manifest.-->
744           <dcterms:catalog rdf:resource="urn:uuid:1497b3f4-71fb-4bad-a55f-9ace42555aec"/> <!--
745     the ID of other catalogs present in the manifest.-->
746
747       </dcat:Catalog>
748
```

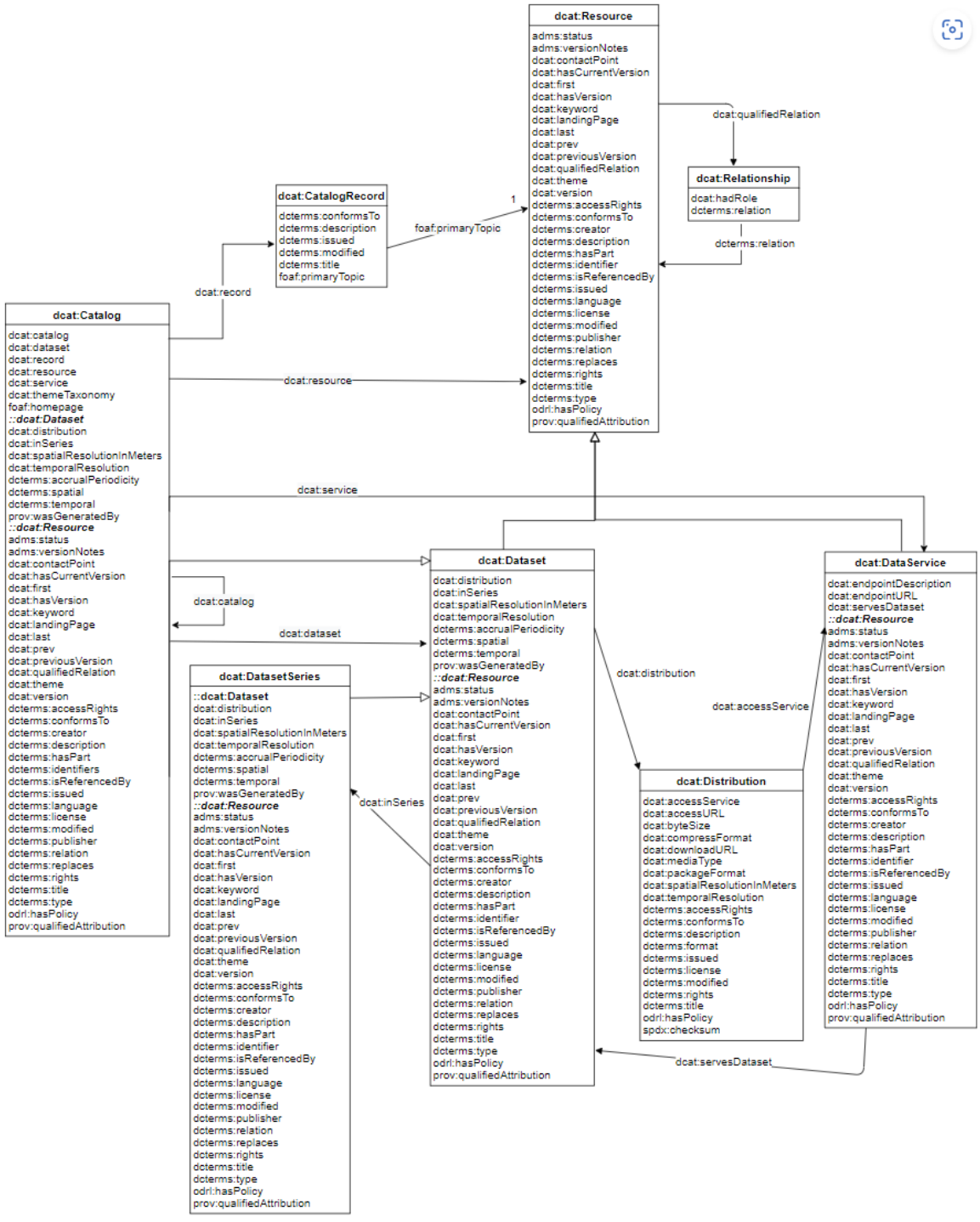


Figure 10. Overview of DCAT model, showing the classes of resources that can be members of a Catalog, and the relationships between them.

8.2.2 Manifest file/document body

Using DCAT and the classes related to the dcat:Catalog, a relationship between abstract entities can be described. For instance, a dcat:Catalog for reference data includes a dcat:Dataset representing reference data for base voltages as well as a reference data (another

dcat:Dataset) for confidentiality. This abstract description of the relationship can include also information on different data services described by using dcat:DataService. The description of abstract entities and the relationship between them would be used in the implementation of different applications that would need to understand the process.

Here for the purpose of the manifest only concrete instances are included as the manifest needs to contain all references to various parts of reference data for the purpose of a process.

The commented example below specifies how DCAT is used to support the package of reference data. Note that the manifest can also include references to boundary datasets as they could be seen as part of reference data.

Although the example presented below serialises dcat:Dataset and dcat:Distribution as well defined RDF nodes, i.e. not blank nodes, it is possible that blank nodes serialisation is used as the dcat:Distribution does not need rdf:about identifier and dcat:Dataset has separate property dcterms:identifier.

A. One Catalog that is describing the collection of files related to boundary data. The example includes one Dataset which is representing Equipment Boundary dataset and two distributions in CIMXML and JSON-LD. Note that if the boundary equipment data is separated in different datasets (instance files) that represent boundary points per border between two MAS, there will be multiple dcat:Dataset objects in this dcat:Catalog.

```
<dcat:Catalog rdf:about="urn:uuid:5c4ab034-a673-4af6-a2af-35de5cc2dfce"> <!-- the ID of the catalog which is serialised in this instance file-->
    <dcterms:identifier> 5c4ab034-a673-4af6-a2af-35de5cc2dfce</dcterms:identifier>
    <dcterms:modified>2022-09-15T11:29:33.781670</dcterms:modified> <!-- Indicates when the content of the data was modified-->
    <dcat:startDate>2022-09-16T13:30:00Z</dcat:startDate> <!-- Indicates the start date for the validity of this catalog. This property is a result of flattening of the dcterms:temporal in order to avoid usage of compound in the header.-->
    <dcat:endDate>2023-01-17T13:30:00Z</dcat:endDate> <!-- Indicates the end date for the validity of this catalog. This property is a result of flattening of the dcterms:temporal in order to avoid usage of compound in the header.-->
    <dcat:version>2.0.0</dcat:version> <!-- the current version-->
    <dcterms:title>Boundary data</dcterms:title>
    <dcterms:description xml:lang="en">Boundary data for OPDE</dcterms:description>
    <adms:versionNotes xml:lang="en">This version includes update version of boundary points between Spain and Portugal.</adms:versionNotes>
     <dcat:previousVersion rdf:resource="urn:uuid:32775166-3a1a-4556-92ba-ee41f5e8a5c6"/> <!-- the ID of the previous version of the catalog.-->
     <dcterms:replaces rdf:resource="urn:uuid:32775166-3a1a-4556-92ba-ee41f5e8a5c6"/> <!-- the ID of the previous version of the catalog, which this version is replacing.
     <dcat:dataset rdf:resource="urn:uuid:e1ba0a36-0e27-4ce3-ba46-b386b20b89b0"/> <!-- the reference to the dataset-->
  </dcat:Catalog>
```

- Dataset which is representing Equipment Boundary dataset

```
  <dcat:Dataset rdf:about="urn:uuid:e1ba0a36-0e27-4ce3-ba46-b386b20b89b0"> <!-- the ID of the dataset which is representing boundary EQ instance file in different serialisations. This is also the ID that would appear in the file header of the distribution instance file-->
    <dcterms:identifier> e1ba0a36-0e27-4ce3-ba46-b386b20b89b0</dcterms:identifier>
    <dcterms:modified>2022-09-16T11:29:33.781670</dcterms:modified> <!-- Indicates when the content of the data was modified, in this example the content is instance of the EQ boundary-->
    <dcat:startDate>2022-09-17T13:30:00Z</dcat:startDate> <!-- Indicates the start date for the validity of this dataset. This property is a result of flattening of the dcterms:temporal in order to avoid usage of compound in the header.-->
    <dcat:endDate>2023-01-17T13:30:00Z</dcat:endDate> <!-- Indicates the end date for the validity of this dataset. This property is a result of flattening of the dcterms:temporal in order to avoid usage of compound in the header.-->
    <dcat:version>2.0.0</dcat:version> <!-- the current version-->
    <dcterms:title>Equipment boundary</dcterms:title>
    <dcterms:description xml:lang="en">Equipment boundary exported from NMD</dcterms:description>
```

```
    <adms:versionNotes xml:lang="en">This version includes update of two boundary
points</adms:versionNotes>
     <dcat:previousVersion rdf:resource="urn:uuid:24d4bfa1-280d-4f07-95fa-4f1197bf3b27"/> <!--
the ID of the previous version of a boundary EQ.-->
     <dcterms:replaces rdf:resource="urn:uuid:24d4bfa1-280d-4f07-95fa-4f1197bf3b27"/> <!-- the
ID of the previous version of a boundary EQ, which this version is replacing.-->
     <dcat:distribution rdf:resource="urn:uuid:9841e818-0f6f-4d26-899a-bb0d05ecacfb"/> <!--
the ID of the CIMXML distribution of this dataset.-->
     <dcat:distribution rdf:resource="urn:uuid:33320ecb-be41-43dc-b0a0-eab589a8244c"/> <!--
the ID of the JSON-LD distribution of this dataset.-->
  </dcat:Dataset>
```

- two distributions in CIMXML and JSON-LD

```
  <dcat:Distribution rdf:about="urn:uuid:9841e818-0f6f-4d26-899a-bb0d05ecacfb"> <!-- the ID of
the distribution. Used only for serialisation purposes. This could be URL if the distributions
are accessible via URL, e.g. https://test.org/distribution/1-->
    <dcterms:description xml:lang="en">CIMXML serialisation of the boundary
EQ</dcterms:description>
    <dcat:mediaType rdf:resource="https://www.iana.org/assignments/media-
types/application/rdf+xml"/> <!-- identifies that this is XML.-->
    <dcat:compressFormat rdf:resource="https://www.iana.org/assignments/media-
types/application/zip"/> <!-- identifies that the compression is ZIP.-->
    <dcterms:conformsTo>urn:iso:std:iec:61970-552:2016</dcterms:conformsTo> <!-- indicates to
which standard this distribution conforms to-->
    <dcat:downloadURL rdf:resource="https://entsoe.eu/data/EQBDxml.zip"/> <!-- this is the URL
where the distribution can be downloaded. The attribute is primarily used when HTTP Get
request is possible-->
    <dcat:accessURL rdf:resource="file://BoundaryData/EQBDxml.zip"/> <!-- It can be used to
refer to a zip file store in a folder structure -->
  </dcat:Distribution >

  <dcat:Distribution rdf:about="urn:uuid:33320ecb-be41-43dc-b0a0-eab589a8244c "> <!-- the ID
of the distribution. Used only for serialisation purposes. This could be URL if the
distributions are accessible via URL, e.g. https://test.org/distribution/1-->
    <dcterms:description xml:lang="en">JSON-LD serialisation of the boundary
EQ</dcterms:description>
    <dcat:mediaType rdf:resource="https://www.w3.org/ns/iana/media-types/application/ld-
json"/> <!-- identifies that this is JSON-LD.-->
    <dcat:compressFormat rdf:resource="https://www.iana.org/assignments/media-
types/application/zip"/> <!-- identifies that the compression is ZIP.-->
    <dcterms:conformsTo>urn:iso:std:iec:61970-553:draft:ed-1</dcterms:conformsTo> <!--
indicates to which standard this distribution conforms to. It can be URL as well:
https://www.w3.org/TR/json-ld11/  -->
    <dcat:downloadURL rdf:resource="https://entsoe.eu/data/EQBDjsonld.zip"/> <!-- this is the
URL where the distribution can be downloaded. The attribute is primarily used when HTTP Get
request is possible-->
    <dcat:accessURL rdf:resource="file://BoundaryData/EQBDjsonld.zip"/> <!-- It can be used to
refer to a zip file store in a folder structure-->
  </dcat:Distribution >
```

B. One Catalog that is describing the collection of files related to reference data. The example includes one Dataset which is representing reference data with base voltages and one Dataset representing reference data on confidentiality. Each of the datasets have one Distribution which is the CIMXML serialisation of the dataset. The logic is the same as the Catalog for boundary data, thus some of the comments are not included in the example below.

```
<dcat:Catalog rdf:about="urn:uuid:1497b3f4-71fb-4bad-a55f-9ace42555aec">
    <dcterms:identifier> 1497b3f4-71fb-4bad-a55f-9ace42555aec</dcterms:identifier>
    <dcterms:modified>2022-09-15T11:29:33.781670</dcterms:modified>
    <dcat:startDate>2022-09-16T13:30:00Z</dcat:startDate>
    <dcat:endDate>2023-01-17T13:30:00Z</dcat:endDate>
    <dcat:version>2.0.0</dcat:version>
    <dcterms:title>Reference data</dcterms:title>
    <dcterms:description xml:lang="en">Reference data for OPDE</dcterms:description>
    <adms:versionNotes xml:lang="en">This version includes update version of confidentiality
levels and additional 1 kV BaseVoltage.</adms:versionNotes>
```

```
      <dcat:previousVersion rdf:resource="urn:uuid:7cd64129-e435-41f2-aaeb-9619181ef0e5"/>
      <dcterms:replaces rdf:resource="urn:uuid:7cd64129-e435-41f2-aaeb-9619181ef0e5"/>
      <dcat:dataset rdf:resource="http://energy.referencedata.eu/BaseVoltage"/> <!-- The
reference to the BaseVoltage reference data-->
      <dcat:dataset rdf:resource="http://energy.referencedata.eu/Confidentiality"/> <!-- The
reference to the Confidentiality reference data-->
  </dcat:Catalog>
```

- Dataset which is representing BaseVoltage reference dataset

```
  <dcat:Dataset rdf:about="http://energy.referencedata.eu/BaseVoltage"> <!-- the ID of the
dataset which is representing Base voltage reference instance file in different
serialisations. This is also the ID that would appear in the file header of the distribution
instance file-->
    <dcterms:identifier> 4261296f-4625-4a92-9b8e-ab5369f29a86</dcterms:identifier>
    <dcterms:modified>2022-09-16T11:29:33.781670</dcterms:modified>
    <dcat:startDate>2022-09-17T13:30:00Z</dcat:startDate>
    <dcat:endDate>2023-01-17T13:30:00Z</dcat:endDate>
    <dcat:version>2.0.0</dcat:version>
    <dcterms:title>BaseVoltage reference data</dcterms:title>
    <dcterms:description xml:lang="en">List of commonly used Base
Voltages</dcterms:description>
    <adms:versionNotes xml:lang="en">This version includes 1kV BaseVoltage</adms:versionNotes>
     <dcat:previousVersion rdf:resource="urn:uuid:e92cd151-a423-49fb-9293-90f1aa87495b"/>
     <dcterms:replaces rdf:resource="urn:uuid:e92cd151-a423-49fb-9293-90f1aa87495b"/>
     <dcat:distribution rdf:resource="urn:uuid:95d276f6-0f15-4b9d-a159-7526097d3d87"/> <!--
the ID of the CIMXML distribution of this dataset.-->
  </dcat:Dataset>
```

- Dataset which is representing Confidentiality reference dataset

```
  <dcat:Dataset rdf:about="http://energy.referencedata.eu/Confidentiality"> <!-- the ID of the
dataset which is representing Confidentiality reference data instance file in different
serialisations. This is also the ID that would appear in the file header of the distribution
instance file-->
    <dcterms:identifier> 4d19c86f-884e-4e94-b8b5-386655d2fcb2</dcterms:identifier>
    <dcterms:modified>2022-09-16T11:29:33.781670</dcterms:modified>
    <dcat:startDate>2022-09-17T13:30:00Z</dcat:startDate>
    <dcat:endDate>2023-01-17T13:30:00Z</dcat:endDate>
    <dcat:version>2.0.0</dcat:version>
    <dcterms:title>Confidentiality levels</dcterms:title>
    <dcterms:description xml:lang="en">List of commonly used confidentiality
categories</dcterms:description>
    <adms:versionNotes xml:lang="en">This version includes update adding confidentiality level
Public</adms:versionNotes>
     <dcat:previousVersion rdf:resource="urn:uuid:4e2da394-cec6-4ef9-8814-6e76cd971693"/>
     <dcterms:replaces rdf:resource="urn:uuid:4e2da394-cec6-4ef9-8814-6e76cd971693"/>
     <dcat:distribution rdf:resource="urn:uuid:c85b471b-208a-4dd6-ad09-741cf29bad4c"/> <!--
the ID of the CIMXML distribution of this dataset.-->
  </dcat:Dataset>
```

- two distributions in CIMXML – one for BaseVoltage dataset and one for Confidentiality dataset

```
  <dcat:Distribution rdf:about="urn:uuid:95d276f6-0f15-4b9d-a159-7526097d3d87"> <!-- the ID of
the distribution. Used only for serialisation purposes. This could be URL if the distributions
are accessible via URL, e.g. https://test.org/distribution/1-->
    <dcterms:description xml:lang="en">CIMXML serialisation of the base voltage reference
data</dcterms:description>
    <dcat:mediaType rdf:resource="https://www.iana.org/assignments/media-
types/application/rdf+xml"/>
    <dcat:compressFormat rdf:resource="https://www.iana.org/assignments/media-
types/application/zip"/>
    <dcterms:conformsTo>urn:iso:std:iec:61970-552:2016</dcterms:conformsTo>
    <dcat:downloadURL rdf:resource="http://energy.referencedata.eu/BaseVoltage"/>
    <dcat:accessURL rdf:resource="file://ReferenceData/BaseVoltage_CIMXML.zip"/>
  </dcat:Distribution >

  <dcat:Distribution rdf:about="urn:uuid:c85b471b-208a-4dd6-ad09-741cf29bad4c"> <!-- the ID of
the distribution. Used only for serialisation purposes. This could be URL if the distributions
are accessible via URL, e.g. https://test.org/distribution/1-->
    <dcterms:description xml:lang="en">CIMXML serialisation of the confidentiality reference
data </dcterms:description>
```

```
    <dcat:mediaType rdf:resource="https://www.iana.org/assignments/media-
types/application/rdf+xml"/>
    <dcat:compressFormat rdf:resource="https://www.iana.org/assignments/media-
types/application/zip"/>
    <dcterms:conformsTo>urn:iso:std:iec:61970-552:2016</dcterms:conformsTo>
    <dcat:downloadURL rdf:resource=" http://energy.referencedata.eu/Confidentiality"/>
    <dcat:accessURL rdf:resource="file://ReferenceData/Confidentiality_CIMXML.zip"/>
  </dcat:Distribution >
```

9 Reference data document header

Reference data is by definition a DCAT dataset and uses SKOS skos:ConceptScheme and skos:Concept in combination with CIM attributes, where necessary in order to manage transition periods.

As illustrated in Section 8, the manifest is describing the linkage between different datasets representing reference data. Theoretically different distributions do not need a header, however for completeness and to support individual usage of the instance files independently of the manifest it is agreed that a reference data instance file shall also have a header. This header shall be either skos:ConceptScheme which plays the role of a header and it is also of type dcat:Dataset, or dcat:Dataset.

The two options are illustrated by the following examples:

A. Example of skos:ConceptScheme for reference data:

```
  <skos:ConceptScheme rdf:about="http://energy.referencedata.eu/BaseVoltage">
    <rdf:type rdf:resource="http://www.w3.org/ns/dcat#Dataset"/>
    <dcterms:identifier> 4261296f-4625-4a92-9b8e-ab5369f29a86</dcterms:identifier> <!--
Indicates when the content of the data was modified-->
    <dcterms:modified>2022-09-16T11:29:33.781670</dcterms:modified>
    <dcat:startDate>2022-09-17T13:30:00Z</dcat:startDate> <!-- Indicates the start date for
the validity of this manifest instance file. This property is a result of flattening of the
dcterms:temporal in order to avoid usage of compound in the header.-->
    <dcat:endDate>2023-01-17T13:30:00Z</dcat:endDate> <!-- Indicates the end date for the
validity of this manifest instance file. This property is a result of flattening of the
dcterms:temporal in order to avoid usage of compound in the header.-->
    <dcat:version>2.0.0</dcat:version> - the current version
    <dcterms:title>BaseVoltage reference data</dcterms:title> <!-- It can be omitted as the
information is already in the skos:prefLabel-->
    <dcterms:description xml:lang="en">List of commonly used Base
Voltages</dcterms:description> <!-- It can be omitted as the information is already in the
skos:definition-->
    <adms:versionNotes xml:lang="en">This version includes 1kV BaseVoltage</adms:versionNotes>
     <dcat:previousVersion rdf:resource="urn:uuid:e92cd151-a423-49fb-9293-90f1aa87495b"/> <!--
the ID of the previous version of a manifest.-->
     <dcterms:replaces rdf:resource="urn:uuid:e92cd151-a423-49fb-9293-90f1aa87495b"/> <!-- the
ID of the previous version of a manifest, which this version is replacing.-->
    <skos:prefLabel>BaseVoltage</skos:prefLabel>
    <skos:definition xml:lang="en">List of commonly used Base Voltages</skos:definition>
  </skos:ConceptScheme>
```

In this example the URL http://energy.referencedata.eu/BaseVoltage is providing the reference to the reference dataset that is describing BaseVoltage and the dcterms:identifier is the unique identifier. The skos:ConceptScheme is also of RDF type dcat:Dataset which allows to use it as a header and inherit important DCAT properties.

B. Example of dcat:Dataset for reference data:

```
  <dcat:Dataset rdf:about="urn:uuid:4261296f-4625-4a92-9b8e-ab5369f29a86">
    <dcterms:identifier> 4261296f-4625-4a92-9b8e-ab5369f29a86</dcterms:identifier> <!--
Indicates when the content of the data was modified-->
    <dcterms:modified>2022-09-16T11:29:33.781670</dcterms:modified>
    <dcat:startDate>2022-09-17T13:30:00Z</dcat:startDate> <!-- Indicates the start date for
the validity of this manifest instance file. This property is a result of flattening of the
dcterms:temporal in order to avoid usage of compound in the header.-->
    <dcat:endDate>2023-01-17T13:30:00Z</dcat:endDate> <!-- Indicates the end date for the
validity of this manifest instance file. This property is a result of flattening of the
dcterms:temporal in order to avoid usage of compound in the header.-->
    <dcat:version>2.0.0</dcat:version> - the current version
    <dcterms:title>BaseVoltage reference data</dcterms:title>
    <dcterms:description xml:lang="en">List of commonly used Base
Voltages</dcterms:description>
    <adms:versionNotes xml:lang="en">This version includes 1kV BaseVoltage</adms:versionNotes>
     <dcat:previousVersion rdf:resource="urn:uuid:e92cd151-a423-49fb-9293-90f1aa87495b"/> <!--
the ID of the previous version of a manifest.-->
     <dcterms:replaces rdf:resource="urn:uuid:e92cd151-a423-49fb-9293-90f1aa87495b"/> <!-- the
ID of the previous version of a manifest, which this version is replacing.-->
  </dcat:Dataset>
```

The option which uses skos:ConceptScheme is required for instance files representing reference data that is built using SKOS.

The option which uses dcat:Dataset is required for instance files representing any other reference data. This is necessary as in the reference data is not built using SKO there is no point to define skos:ConceptScheme as a header. In addition in cases where the reference data has to contain multiple skos:ConceptScheme objects it is recommended to have the header as dcat:Dataset. In general, it is not expected to have multiple skos:ConceptScheme objects in a dcat:Dataset, but the setup would allow this in case of a need.

Annex A: Distribution (Document) header and Dataset (model) exchange

A.1 General

Due to the present stage of development and standardisation of approaches related to metadata and document header information the defined solution in this document is considered as a transitory solution. Taking into account this nature it is necessary to clarify some assumptions that are applied when designing the solution. The aim of this section is to bring clarity of some of the attributes in the document header that were protentional misused in past and current model exchanges.

A.2 Modelling authority set, model and their versions

Modelling authority set (MAS) is seen as an abstract entity. It is more related to the sender of the information as it is linked and maintained by the sender of the information. A utility, a TSO, can have multiple abstract entities (in terms of W3C provenance Entity) to represent different scope. These could be MAS for planning, MAS for operation, MAS for asset, etc. The choice is up to the utility how to internally organise. Each of these abstract MAS entities have their versions which are important for the sending party to understand where models that are associated to a given MAS fit. This needs to be considered together with the knowledge of the definition of a model. The set of data governed by a profile is considered a model. For instance, data that relate to equipment profile is a model, data that relate to state variables profile is a model. However, a collection of equipment and state variables is also a model that can be called individual grid model.

Depending on the nature of models that are part of a version of a MAS, the MAS will be considered as a kind of envelop for models and will contain information where the MAS fits in the overall model exchange framework.

Note that the MAS or its version is not directly identifying the agent that is responsible for it or belonging to region or process, as this is more or less the current practice due to lack of other mechanisms to express that information. However, receiving party can retrieve information to the version of the modelling authority set via the reference data in case the business process agrees that this information is maintained in the master reference data. In this way, additional data such as the name of the agent, its location, role, models part of the version of the mas, contact information, other dependencies can be retrieved from the reference data.

Figure 11 is illustrating the relationship between a utility (agent), the modelling authority set, its versions, models part of a version of MAS and the versions of the models. Please note that some part of the abstraction is not explicitly included in the figure in order not to confuse. Also, only the terms related to W3C provenance are indicated as the link to W3C DCAT will make the view more complex. More detailed information will be part of the standardisation efforts which will be dealing with overall framework.

When using master reference data, the concept is that a document header or a manifest document (in the future) would refer to an identification of a version of a MAS. The URN, IRI or URL of the version of the MAS is part of the reference data and when that data is consulted (queried) additional information about the version of the MAS can be collected. Such information can be the name of the utility (TSO), what models' types are part of this version of MAS, e.g. is it only EQ and SSH or also TP or DL can be part of it, etc.

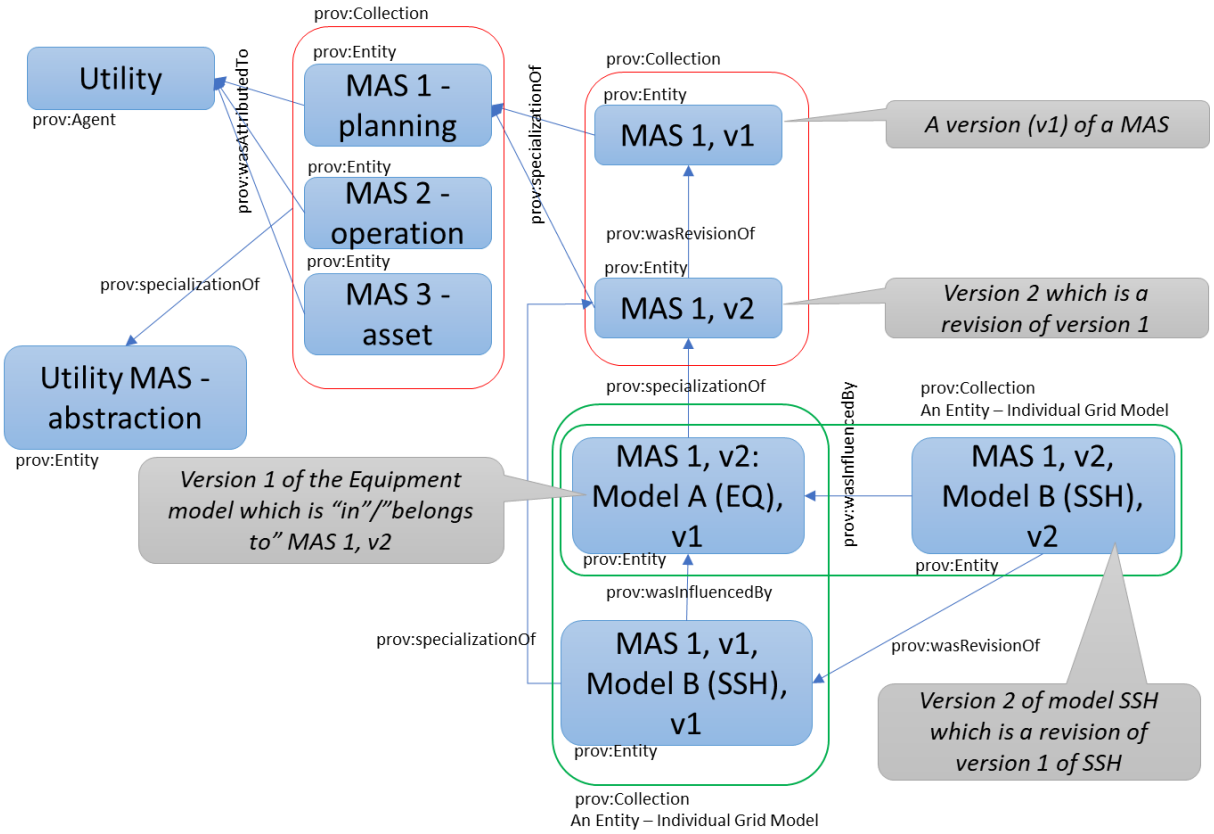


Figure 11. Modelling authority set, its version and model versions

A.3 Identification and versioning

The following terms are important for the understanding of the identification of the datasets:

- a distribution serialised as a RDF (Resource Description Framework) is uniquely identified as a resource through rdf:about and the use of URI (Uniform Resource Identifier) or IRI (Internationalized Resource Identifier).

- dcterms:identifier is a property from the Dublin Core Metadata Initiative (DCMI) vocabulary. It is used to provide a value that uniquely identifies the resource described in an RDF triple. Unlike rdf:about, which identifies the subject of the triple (i.e., the resource itself), dcterms:identifier is used to specify a particular identifier for the resource.

In order to respect these terms, the following rules are defined:

- The rdf:about shall be using urn:uuid: namespace for the UUID, e.g.,

```
<md:FullModel rdf:about="urn:uuid:d2630bd5-9578-4fab-9647-13991c692d07">
```

- The dcterms:identifier shall be a UUID without any namespace since the identifier does not need to be resolvable, e.g,

```
<dcterms:identifier>d2630bd5-9578-4fab-9647-13991c692d07</dcterms:identifier>
```

- The rdf:about shall include the same UUID as used in the dcterms:identifier (rdf:about = urn:uuid: + dcterms:identifier UUID).

Therefore, the dcterms:identifier and rdf:about (in case of RDF serialization) of the distribution header have an identical identification.

The versioning information included in the header is following the DCAT-3 vocabulary, which is built upon existing W3C vocabularies. The versioning supports the life-cycle of a resource and can be applied to all the classes inheriting DCAT resource, including Catalog (Manifest), Datasets (FullModel) and Distribution (instance of CIM XML).

Versioning relies on the following:

- All versions are uniquely identifiable through rdf:about and dcterms:identifier.
- Additional pieces of information like dcat:version (md:version in the previous header) are used to understand the changes in a revision where a version is replaced/superseded by another one. For all version chain and hierarchy (the version history) where the version will typically have different validity period, the dcat:version is giving the "quality" (e.g. is this a test model etc). This is why it is important that dcat:version uses the semantic versioning (Semantic Versioning 2.0.0 | Semantic Versioning (semver.org)), i.e. a given version number follows the form Major.Minor.Patch.
- The dcat:version information provided in a header of a distribution related to the dataset and not to its distribution, its specific serialisation.
- There are different properties such as dcat:isVersionOf, dcat:previousVersion and dcterms:replaces that provide important information on the relationships between versions

For instance, a chain of version of My-Power System Model (PSM) Remedial Action offline (i.e., structural) dataset can be described as shown in the following figure:

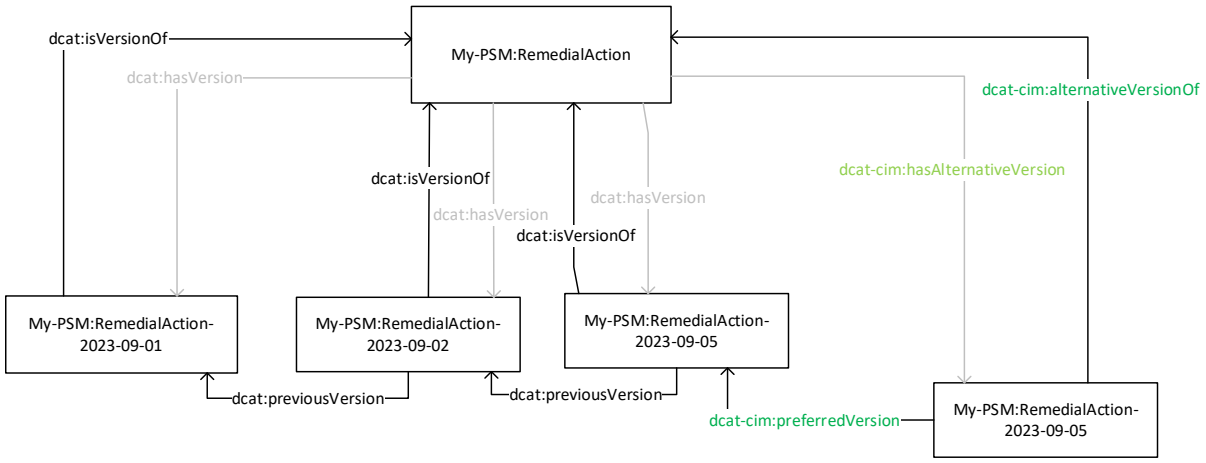


Figure 12. Chain of version using DCAT

This figure shows the standard use. The inverse associations are provided in a lighter colour. This information is not exchanged, but created as part of reasoning. ENTSO-E DCAT extension (dcat-cim) was added to the standard vocabulary to address the need for alternative model (dataset) that represents potential development. This information could have been added as attributes to the dataset and just used dcat:isVersionOf. However, this would not enable us to require needed functionality when creating consistent IGM and CGM in an efficient way also for future scenarios.

My-PSM:RemedialAction is the abstract representation the of My-PSM:RemedialAction and the persistent identification of all version of the remedial action for the same relevance. My-PSM:RemedialAction-2023-09-01 represents a particular version of the remedial action with a particular validity, e.g. startDate 2023-09-01.

All versioned datasets are related to the My-PSM:RemedialAction through the relationship dcat:isVersionOf and the inverse association dcat:hasVersion.

dcat:previousVersion provides the lineage of a version chain, consisting of snapshots of an abstract resource given by dcat:isVersionOf. This gives the possibility to navigate the resource (dataset) through it life-cycle. Specifying dcat:previousVersion is preventing us to fully rely on the temporal (validity period) to secure that the chain is consistent and not missing any item.

dcat-cim:alternativeVersionOf (dcat-cim:hasAlternativeVersion, the inverse association, is derived through reasoning of the vocabulary) provides the information that the dataset is a version of My-PSM:RemedialAction, but should not be considered to be in the chain of version. It is only relevant when alternative version should be analysed as part of a specific business process. This would present these datasets to be assembled as part of the chain of IGM and CGM.
dcat-cim:preferredVersion is a required association for an alternative version to be able to navigate to the dataset version that is part of the chain of versions. In the case of multiple alternative version for a given dataset, the dcat-cim:preferredVersion for the set can all point to directly to the dataset that is part of the chain or they can provide a chain of prioritised dataset versions.

A dataset version can be valid for multiple days, e.g. My-PSM:RemedialAction-2023-09-02, that is valid from 2023-09-02 to 2023-09-05. In the case that we would like to interject a dataset that should be valid only for 2023-09-03. This is done by including the two associations dcat:previousVersion and dcat:nextVersion that point to the same version.

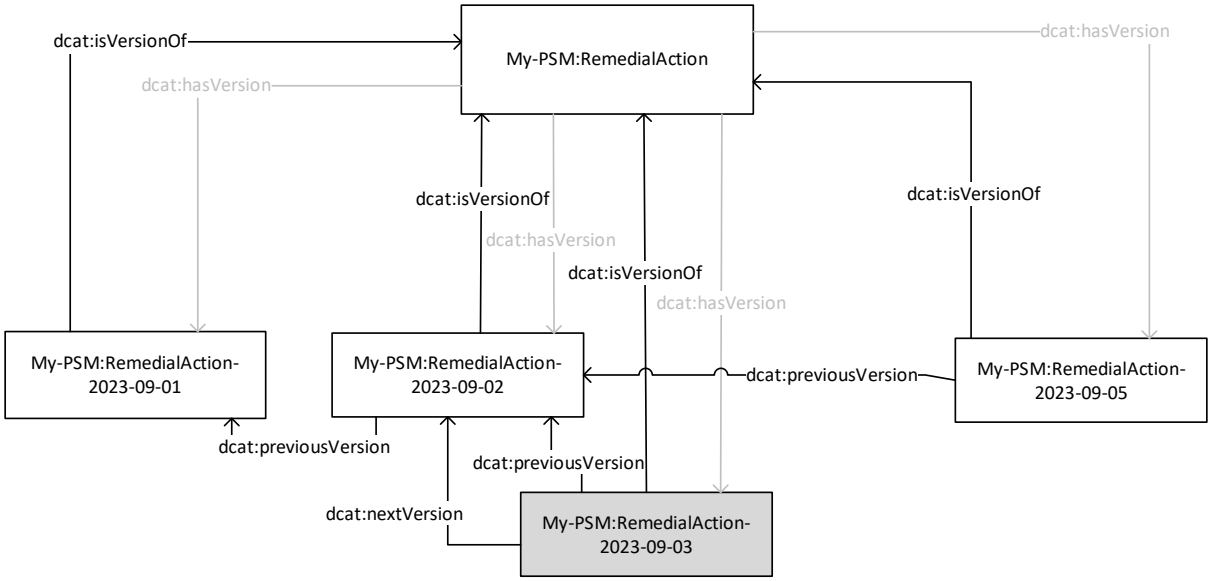


Figure 13. Inserting a dataset into an existing chain of version

The figure shows the insertion of My-PSM:RemedialAction-2023-09-03 into the chain to give valid for the period for only 2023-09-03. This method makes it possible to insert it without the need to update the existing dataset My-PSM:RemedialAction-2023-09-02 and My-PSM:RemedialAction-2023-09-05. This is, in principle, only relevant for dataset that is valid into the future. However, this is controlled by business rules. This feature is relevant for supporting the year-ahead process when there is a need to describe the general assumed sitituation, but would need to address particular senarios as part of improved forcasting.

Deleting a version is done by providing a replacement of a dataset that is empty. Replacing a dataset with another dataset into the chain of version is done by using dcterms:replaces.

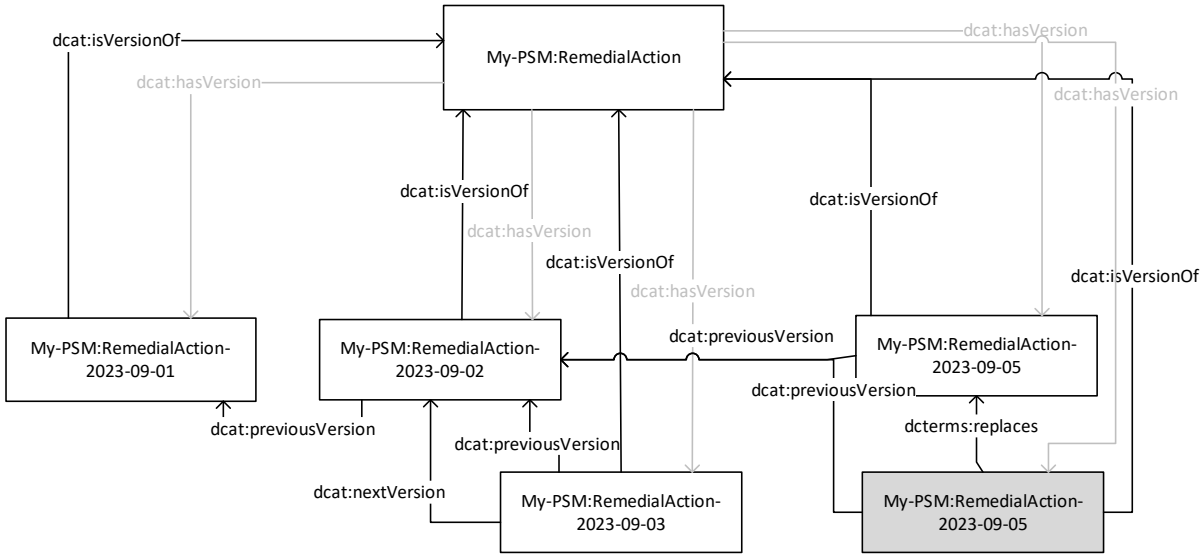


Figure 14. Replacing a dataset usind dcterms:replaces

dcterms:replaces provides the information that a previous exchanged dataset has now been replaced another dataset. The replacing dataset must be for the same dcat:isVersionOf and it must fit into the chain of version. That could mean that there is a need for multiple dataset set to be replaced. The dcat:version must be updated and should follow the semantic versioning so that application can provide necessary function to handle different level of updates, e.g. handling non breaking change versus breaking change (patch, minor version or major version). The adms:versionNotes shall also be updated so that a user can understand the changes that is done to make necessary action.

Annex B (informative): Sample data

B.1 General

This Annex is designed to illustrate the profile by using fragments of sample data. It is not meant to be a complete set of examples covering all possibilities of using the profile. Defining a complete set of test data is considered a separate activity to be performed for the purpose of setting up interoperability testing and conformity related to this profile.

The sample data is not covering all possibilities of different references or information that can be provided.

B.2 Sample instance data – extended header based on md:Model

```
<?xml version="1.0" encoding="utf-8"?>
<rdf:RDF
  xmlns:cim="http://iec.ch/TC57/CIM100#"
  xmlns:md="http://iec.ch/TC57/61970-552/ModelDescription/1#"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:eu="http://iec.ch/TC57/CIM100-European#"
  xmlns:dcterms="http://purl.org/dc/terms/#"
  xmlns:dcat="http://www.w3.org/ns/dcat#"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:eumd="http://entsoe.eu/ns/Metadata-European#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:nc="http://entsoe.eu/ns/nc#"
  xmlns:prov="http://www.w3.org/ns/prov#">

  <!--Header -->
  <md:FullModel rdf:about="urn:uuid:d2630bd5-9578-4fab-9647-13991c692d07"><!-- ID
of the Full Model in RDF-->

    <!-- ID of the Full Model in Data Model-->
    <dcterms:identifier>d2630bd5-9578-4fab-9647-13991c692d07</dcterms:identifier>
<!--This is an example for mRID of the header -->

    <!-- creation time of the Document  -->
    <prov:generatedAtTime>2021-01-28T17:01:03Z</prov:generatedAtTime>

    <!-- Version of the Document -->
    <dcat:version>1.0.0</dcat:version>

    <!-- Validity/scenario period / delivery day [Optional]-->
    <dcat:startDate>2023-01-25T17:00:00Z</dcat:startDate>
    <dcat:endDate>2023-02-25T17:00:00Z</dcat:endDate>

    <!-- Description -->
    <dcterms:description xml:lang="en">This is an example of available remedial
action</dcterms:description>

    <!-- Profile, Schema or Specification -->
    <dcterms:conformsTo rdf:resource="http://entsoe.eu/ns/CIM/RemedialAction-
EU/2.2" />
    <dcterms:conformsTo rdf:resource="http://entsoe.eu/ns/CIM/RemedialAction-
EU/constraints/2.2" />    <!--This is an example how to refer to SHACL constraints
-->

    <!-- Message Type -->
    <dcat:keyword>RA</dcat:keyword>
    <dcat:keyword>Remedial Action</dcat:keyword>

    <!-- md:Model.DependentOn -->
```

```
    <dcterms:references rdf:resource="urn:uuid:f0063d01-1dac-46f0-91a4-
2b7479991173" />

    <!-- md:Model.Supersedes [OPTIONAL] (ID of pervious version of the Model) -->
    <dcterms:replaces rdf:resource="urn:uuid:8341cd19-779b-4a84-bafb-06b8bb56f767"
/>

    <!-- Modeling Authority -->
    <dcterms:publisher
rdf:resource="http://energy.referencedata.eu/EIC/10X1001A1001A094"/>


    <!-- Confidentiality for Security Plan -->
    <dcterms:accessRights
rdf:resource="http://energy.referencedata.eu/Confidentiality/OPDEConfidential"/>

<prov:wasGeneratedBy   rdf:resource=http://energy.referencedata.eu/CGM/Action/CGM-1D-
RAS/>
            <!--The attribute below is the persistent part between each of the RAS
dataset versions.-->
<dcat:isVersionOf         rdf:resource=http://energy.referencedata.eu/Model/ELIA-CGM-
RAS/>  <!--The attribute below indicates that this model is filling the frame of the
Belgian electrical power transmission system-->
<dcterms:spatial          rdf:resource=http://energy.referencedata.eu/Frame/BE-Power-
Transmission-System/>
            <!--The title below should be the name of the file. Convention could be
start date, publisher and then the wasGeneratedBy.-->
<dcterms:title>20221219_ELIA_CGM-1D-RAS</dcterms:title>


  </md:FullModel>

<!-- Here below is the content of the RA (remedial action) instance data -->

</rdf:RDF>
```

The example below shows a combination of old IEC 61970-552 reader and usage of some of the new header attributes.

```
  <md:FullModel rdf:about="urn:uuid:062cf28e-499f-434f-b95d-73768b5c975f">
    <dcterms:identifier>062cf28e-499f-434f-b95d-73768b5c975f</dcterms:identifier>
    <md:Model.profile>http://entsoe.eu/CIM/EquipmentOperation/3/1</md:Model.profile>
    <md:Model.profile>http://entsoe.eu/CIM/EquipmentCore/3/1</md:Model.profile>
    <dcterms:conformsTo rdf:resource="http://entsoe.eu/CIM/EquipmentOperation/3/1" />
    <dcterms:conformsTo rdf:resource=" http://entsoe.eu/CIM/EquipmentCore/3/1" />
<md:Model.modelingAuthoritySet>http://www.elia.be/OperationalPlanning</md:Model.modelingAuthor
itySet>
    <dcterms:publisher rdf:resource="http://energy.referencedata.eu/EIC/10X1001A1001A094"/>
    <md:Model.version>001</md:Model.version>
    <dcat:version>1.0.0</dcat:version>
    <md:Model.DependentOn rdf:resource="urn:uuid:cc7a2f34-c0a0-46a9-b602-9d33c8b2a476"/>
    <dcterms:references rdf:resource="urn:uuid:cc7a2f34-c0a0-46a9-b602-9d33c8b2a476" />
    <md:Model.created>2021-04-20T13:02:42Z</md:Model.created>
    <prov:generatedAtTime>2021-04-20T13:02:42Z</prov:generatedAtTime>
    <md:Model.scenarioTime>2023-03-10T00:30:00Z</md:Model.scenarioTime>
    <dcat:startDate>2023-03-10T00:30:00Z</dcat:startDate>
    <dcterms:rightsHolder>urn:eic:10X1001A1001A094</dcterms:rightsHolder>
    <dcterms:rights>Highly Critical</dcterms:rights>
    <md:Model.description>This is an example</md:Model.description>
    <dcterms:description xml:lang="en">This is an example</dcterms:description>
  </md:FullModel>
```

Annex C (informative): Change Log Version 2.2 to 2.3

Motivated by the use of DCAT-3 vocabulary, a new version of this specification was proposed. The changes made during this process are described in the following paragraphs for ease and for the sake of a better understanding.

C.1 Deprecated Attributes

The following attributes were deprecated. For more information about them, please consult chapter 7.

- prov:atLocation - Use dcterms:spatial instead.
- prov:wasInfluencedBy - Use dcterms:references instead.
- prov:hadPrimarySource - Use dcat:isVersionOf and dcterms:publisher instead.
- prov:wasAttributedTo - Use dcterms:publisher instead.
- prov:wasRevisionOf - Use dcterms:replaces instead.
- prov:specializationOf - Use dcterms:publisher instead.
- eumd:serviceLocation – Use reference data and dcterms:spatial instead
- dcat:hasVersion – Use dcat:isVersionOf instead.
- dcterms:creator - Use dcterms:publisher instead.

C.2 Added Attributes

In exchange, the attributes listed down below were added to fulfil the same function as the replaced ones but using *dcterms* and *dcat*. In addition, DCAT 3 was updates and ENTSO-E aligned as much as possible. Please, refer to chapter 7 for more guidance on their use.

- dcterms:issued
- dcterms:title
- dcterms:spatial
- dcterms:references
- dcterms:publisher
- dcat:nextVersion
- dcat:temporalResolution
- dcterms:replaces
- dcat-cim:altternativeVersionOf and inverse association dcat-cim:hasAltternativeVersion
- dcat-cim:preferredVersion

C.3 Functional Changes

In version 2.2. of this specification all properties of md:Model class were modelled as attributes. This means that when the data is serialised in RDF the attributes are expressed as literal. However, W3C vocabularies require or recommend that these properties are resources, i.e. serialised as rdf:resource. See below two example to see the difference between literal and resource property serialisation.

Example of literal:

```
<dcterms:description>This is an example of available remedial action</dcterms:description>
```

Example of rdf:resource:

```
<dcterms:conformsTo rdf:resource="http://entsoe.eu/ns/CIM/RemedialAction-EU/2.2" />
```

In order to conform with this requirement by W3C the profile had to be modified so that properties that are defined as rdf:resource are modelled as associations instead of attributes. In this way the RDFS is exported correct and the SHACL constrains derived from it is also correct. In addition, in W3C vocabularies not all properties have inverse role names. Due to tooling constraints ENTSO-E had to specify names for association ends and this is the reason to see names like Resource11 or Resource 12 as these names need to be unique.