

APPLICATION PROFILES LIBRARY – README

Release 1-0-1

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CIM WG approved

1. Introduction

ENTSO-E agreed to publish all application profiles in one package which has a flat structure. All the material can be found on the [CGMES Library](#) under the *Application Profiles Library* tab.

The application profiles are provided to facilitate the implementation of the profiles and related constraints as defined in different standards, e.g. IEC 61970-600-1:2021, IEC 61970-600-2:2021, IEC 61970-301 and other related 61970-45x series of profiles.

Note that the application profile serialization based on RDFS and RDF XML syntax is defined in IEC 61970-501:2006 (Ed1) and CIM XML serialization is defined in IEC 61970-552:2016. However, current implementations deviate from these standards due to various reasons. For additional information, please refer to the latest version of the *RDF-syntax User Guide*—version 1.1.0 at the moment of writing—available on the [CGMES Library](#) under the *ENTSO-E CGMES Extension and Profile* tab.

The file *ReadMe.xlsx* lists all files in the zip package and provides some additional information related to the individual files.

2. RDF schemas (RDFS)

The RDFS 2020 export of the RDFS augmented version is based on IEC 61970-501:2006 (Ed1). The package contains RDFS for CGMES v3.0 and NC Profiles. These are the files which file name contains “Voc-RDFS2020”.

In addition a beta version of application profile based on RDFS specified in the draft IEC 61970-501:Ed2 is provided. The purpose of inclusion of the beta version in the distribution is to enable the review process. Please use these files only for information on the direction where RDFS will evolve in that standard and provide feedback that will be discussed in the standardization process. Namely, the RDFS contains the vocabulary only, while the constraints (cardinalities, datatypes, etc.) are expressed by SHACL based constraints.

3. Constraints

SHACL based constraints are provided for CGMES v3.0 and NC Profiles. These are the files which file name contains “Con-SHACL” or “Con-{xyz}-SHACL”, where {xyz} indicates the main content. For instance, “Con-Simple-SHACL” indicates that the constraints were derived from RDFS and “Con-Complex-NotSolvedMAS-SHACL” indicates that constraints have manually been produced and are applicable for a model that contains Equipment (EQ) and Steady State Hypothesis (SSH) profiles of CGMES.

Please, note that constraints automatically generated from the schema are denoted as *Simple*. The constraints needing some manual expert modification are denoted as *Complex*. In case these two scenarios are combined, this is indicated not specifying anything (nor *Simple*, nor *Complex*).

There are constraints for cardinalities and datatypes derived from the RDFS, constraints defined in the descriptions of the classes and attributes, constraints defined in IEC 61970-600-1:2021, IEC 61970-600-2:2021, IEC 61970-301 and other related 61970-45x series of profiles and expressed there in plain English text. Note that SHACL based constraints in this folder are serialized in two RDF formats, Turtle and RDF XML plain (no nesting). Originally the constraints were developed in Turtle using Notepad++ as an editor and then converted to RDF XML using CimPal app.

The recommended serialization of SHACL constraints is Turtle as that was the primary serialization and it is well tested. This is because many constraints rely on SHACL SPARQL method, which is not covered in the

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draft IEC 61970-501:Ed2, the RDF XML may not represent the desired way of serialization. However, the resulted RDF XML version was not used or validated in terms of content and should be used with a caution.

OCL based constraints are not provided. Versions of OCL constraints provided earlier are no longer maintained. Only SHACL constraints will be maintained.

4. Application Profiles – File Naming Convention

Filename shall only be used for human consumption and shall not be processes to decode metadata. Machine interpretation shall use the Manifest file, that includes all the relevant metadata and reference to the dataset artifacts. The datasets are currently included in the zip file but can later be stored in a linked repository. Manifest file will be added as a technical update as soon as it is ready.

Filename convention is linked to the dataset information in the file header.

`< dct:publisher>_<dct:title>_<owl:versionInfo>.<mediaType>`

Examples:

- 61970-301-DiagramLayout-AP-Con-SHACL_v3-0-0.rdf
- 61970-600-2-Header-AP-Voc-RDFS2019_v3-0-0.rdf
- 61970-600-2-Operation-AP-Con-Simple-SHACL_v3-0-0.ttl

ENTSO-E does not put the publisher in the file name as it is not expected that these artifacts will be republished.

5. SHACL Constraints Design

Constraints for CGMES v3.0 were designed in 2020 and a master spreadsheet named *CGMES Constraints Repository* was prepared.

6. Master spreadsheet of CGMES v3.0 constraints

6.1. Overview

- 2025 constraints are listed in the master spreadsheet.
- All profiles part of CGMES v3.0 were screened for constraints that can be validated. To a large extend these are value related constraints (>0, <0, etc), but there are some that are more complex. DY profile has about 1500 value constraints which is about 75% of all constraints. In the process of defining validation rules/constraints in machine readable form some of the complex constraints were split in order to have more exact validation results.
- 171 constraints from IEC 61970-600-2.
- 33 constraints from IEC 61970-600-1.
- 22 constraints were extracted from the IEC 61970-301:Ed7
- 3 constraints were extracted from the IEC 61970-457:Ed1.

- 212 constraints were extracted from UML descriptions from profiles other than DY profile.

6.2. Explanation of the master spreadsheet columns

The master spreadsheet contains information on all constraints, their source and ID. The following summarizes the columns in the spreadsheet and their usage:

- Columns A-F are general references to indicate the source of the constraint. In column E the value “UML description” means that these are constraints extracted from the descriptions in the UML so then in column J the relevant part of the description that is the constraint is added. Sometimes it is the whole description sometimes only part depending on the case.
- Column A is a key that is UUID. It is not used now for specific purpose, but it might be useful to track changes.
- Column G is the ID which follows the naming convention agreed in the IEC 61970-452 and in IEC 61970-600-1 and-2. The ID is complete for the constraints that are either references from other documents or there is machine readable representation of them. Note that some are incomplete as there are either with not in SHACL or there is some other reason indicated in the columns.
- Columns H and I are a bit indicative where the constraint is attached or main source for the constraint. For the IDs there is an Excel formula which in most of the cases uses these 2 columns in addition to others. Note that some of the IDs and Name, Class were done manually – so it is not always the formula.
- Column J is the description of the constraint. This is either coming from UML or some standard. The wording there is exactly the same as in the standard. In fact, for the IEC 61970-600-2 this column was used together with column G to populate the constraints in 600-2 clause 16.
- Column K and L are the message and the severity. An approach has been taken in which the message should say what is wrong rather than what should be. The severity is derived from the description of the constraint (column J), but in some cases (especially where the wording is not that concrete) maybe more restrictive approach has been taken. In general, there is an open area in CIM standards on how to define the severities and their meaning for the data exchange, so this is a topic which is open for future discussion.
- Column M attempts to clarify if the constraint can be checked by just looking at instance data of one profile or the validation scope is more than that. There are many constraints that require data from other profiles, so that column tries to capture this. That would help to design which check is triggered when.
- Column N indicates if the constraint is part of the standard or it is business specific as it is the case for CGM. In case of business process specific, column O gives the information which process.
- Column P is providing comments – there some key words like REASON, ATTENTION, PROPOSAL, INFO, QUESTION, REPORT TO WG13, etc are used in order to be able to filter and find out what is follow up actions or proposal.
- Column Q is added for admin purpose to indicate when a constraint was modified.
- Column R indicates the status on SHACL. Here it is indicated which constraints are done in the SHACL shapes package. There is indication in case the constraint cannot be validated/represented in machine readable way, or it is not needed, and the reason is given in the comment’s column.
- Column S indicates the file name of the .ttl file where the constraint is defined.
- Column T indicates the date of the last modification of the code.

