



CIM and CGMES

Exchanging data between systems within a company and between companies becomes more and more important as the complexity of requirements increases and no single tool is able and designed to fulfil all requirements. To avoid the implementation of custom interfaces for each tool and each company, it is necessary to have data exchange standards that are supported by all parties.

1 CIM and CGMES

The following profiles are currently available in CGMES:

- **Equipment (EQ):** General information about the electrical equipment (name, basic electrical parameters) and the network connectivity (which element is connected to which bus, etc.).
- **Topology (TP):** Additional information about the network topology (equipotential areas, simplified bus-branch connectivity).
- **Steady State Hypothesis (SSH):** Operational data (current tap positions, active and reactive power injection of loads and generation, regulating control settings, etc.).
- **State Variables (SV):** Load flow results (voltages, branch power flows, calculated tap positions, etc.).
- **Short Circuit (SC):** Information about short circuit data. Exchanged as an extension of the EQ profile.
- **Dynamics (DY):** Dynamic data (dynamic controller models, load models, etc.).
- **Diagram Layout (DL):** Single-line diagram data.
- **Geographic Location (GL):** Geographic coordinates of the location of network elements.

The CIM converter framework in *PowerFactory* is designed to allow additional profiles to be added in the future as required. It's also possible to add individual profiles and handle them separately from the conversion process without the need to install a new version of *PowerFactory*.

PowerFactory supports the import and export of CIM data based on CGMES for the versions *CGMES 2.4.15* and *CGMES 3.0.0*. *DlgSILENT* has declared conformity to the previously named CGMES versions and supports new versions as far as possible after publication.

2 Import and Export of CIM data

The CGMES data to be imported can be presented as XML or ZIP file. The process of retrieving a network model in *PowerFactory* based on CGMES is divided in three steps - vice-versa for the export:

1. Import
2. Validation
3. Conversion

This approach allows the user to interact with the

original data within *PowerFactory* and to make corrections identified by the validator. The validator helps the user to check the consistency of models according to CGMES and to import clean data. Reports can be created and provided to external parties providing the models.

The converter is a module within *PowerFactory*, no installation of an additional tool is needed. After importing and converting the CIM data in the *PowerFactory* model, all functions are available and studies can be carried out.

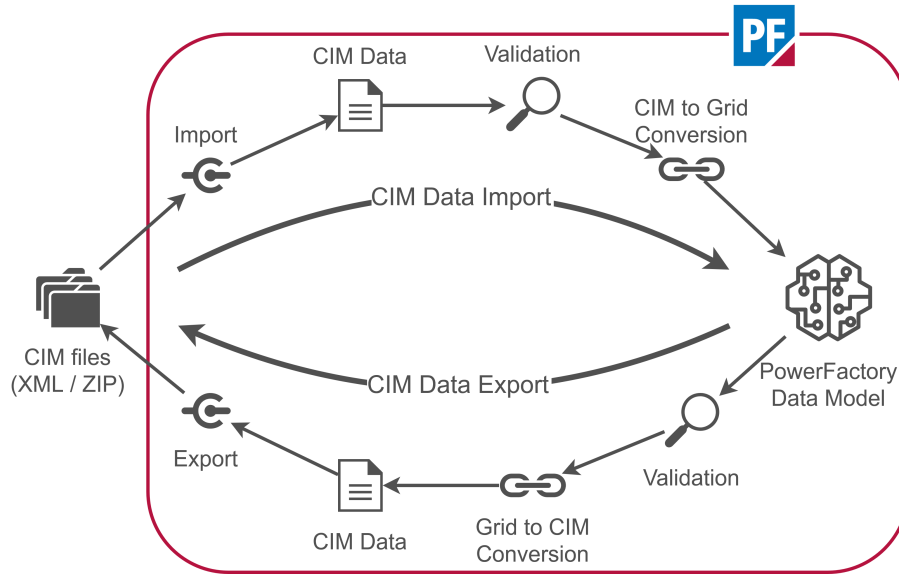


Figure 1: CGMES Import and Export

The *PowerFactory* data model is based on a detailed node-breaker representation of grid data. Bus-branch as well as node-breaker models are supported for import, and export as a bus-branch model is just a special case of a node-breaker model. For the export, *PowerFactory* automatically reduces the bus-branch models.

The *PowerFactory* data model allows flexibility regarding the hierarchical organisation of a network model. Models can be modelled flat or structured in multiple hierarchy levels. The CGMES model is a hierarchical model. If the user wants to use a flat model, the export converter creates hierarchy objects wherever applicable to fulfil the requirements of the standard.

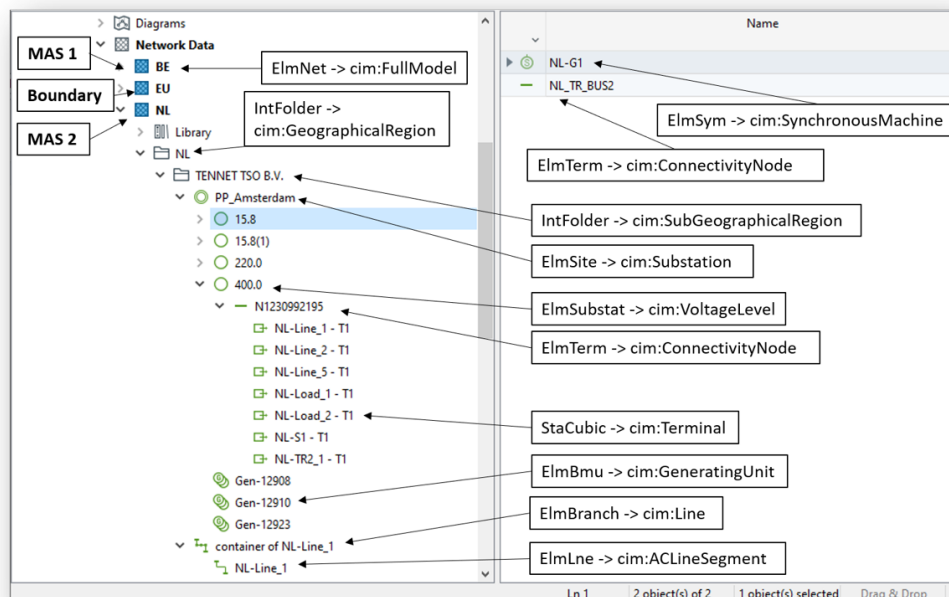


Figure 2: Hierarchy and Mapping

3 Use Cases based on CGMES

In this section some functions needed to support processes based on CGMES are described.

Creation of an Individual Grid Model (IGM)

A network model in *PowerFactory* can be very large and can contain multiple grids of one or various model authorities. It's also possible that one model authority owns multiple grids. The configuration for conversion and export of an IGM allows the selection of individual grids and the definition of boundaries between grids.

Full and Difference Model

To reduce the amount of data, difference models can be used for export and import

Network Reduction

In some cases it's necessary to anonymise grid data prior to the export and provisioning of the model to other parties. *PowerFactory* offers a functionality to reduce the network and to create

equivalent impedances and injections for different network configurations.

Automation for ENTSO-E Processes

Some ENTSO-E processes such as Intraday, Day-Ahead (D-1) or Two-Day-Ahead (D-2) require a regular provisioning of data on an hourly or even quarter-hourly basis. In such cases, *PowerFactory* operates as an engine in an automated environment. All CGMES functionality needed in the processes can be automated via script.

CIM Data Extension

Sometimes the CGMES standard is not sufficient to consider all information. In this case, the information can be described in the CIM model. This additional data can be imported into *PowerFactory* but is not considered in the conversion as it is not specified in CGMES. By means of our powerful scripting interface this data can be handled and added to the network model in *PowerFactory*.

4 Licence Configuration

Required

- ✓ CIM Import/Export or Import only

Optional

- ✓ Network Reduction



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