

1 Problem

A stable and secure electrical power system in Europe is the aim of Regulation (EC) No. 714/2009 of the European Parliament and of the Council of 13 July 2009 on *conditions for access to the network for cross-border exchanges in electricity and repealing Regulation* [2] from 2009. Since then each of European Transmission System Operator must embed their Individual Grid Model into the Common Grid Model. For this purpose, the European Network of Transmission System Operators for Electricity (ENTSO-E) released the Common Grid Model Exchange Standard [1] based on semantic web technologies. The definition of CGMES comes with requirements onto the modelled data in terms of common assumptions and model completeness, but the evaluation is left open for development. These evaluations are crucial in CGMES based processes to determine data quality for imports and avoid requirement violating manipulations.

2 Methodological Approach

The Definition of CGMES [1] defines two different types of requirements, those who are model-based and those who are common-assumption-based. The model underlying CGMES is defined using the Unified Modeling Language (UML) class diagram feature, which provides cardinalities for references and datatypes for class attributes. Common assumptions come as Object Constraint Language invariants or in natural language. This work looks at all requirements, groups them and for each category develops a blueprint for executable rules.

3 Results

The analysis of the requirements in the definition of CGMES [1] lead to five different categories for requirements:

1. Cardinality requirements
2. Datatype requirements
3. Containment requirements
4. Conditional requirements
5. Contextual requirements

The work develops a Shape Constraint Language (SHACL) [3] based blueprint for the first four groups and shows the correctness. The performance of analysis with the 7000 derived shapes is measured and analyzed for different grid sizes and manipulations. The last requirement group is not possible with the current SHACL version; This work also identifies the gaps.

4 Conclusion

The work gives a solution with which quality evaluations for CGMES based data is possible and shows gaps slowing down the industrial adoption of SHACL. The proposed solution performs sufficiently for the import and data manipulation use case. Based on this solution the Redispatch Ermittlungs Server of FGH and SOPTIM AG¹ will determine the data quality and credit of calculation results.

References

1. ENTSO-E. *Common Grid Model Exchange Specification (CGMES) - Structure and rules*. Version 2. ENTSO-E. 2017.
2. European Parliament and Council of the European Union. *REGULATION (EC) No 714/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003*. 2009.
3. H. Knublauch and D. Kontokostas. *Shapes constraint language (SHACL)*. *W3C recommendation, W3C, July 2017*. 2017.

¹<https://www.soptim.de/de/presse/pressemitteilungen/leuchtturmprojekt-der-deutschen-uebertragungsnetzbetreiber/> (announcing the kick-off in 2018)