Ontology matching system for future energy smart grids

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Abstract— Future power systems (commonly referred to as Smart Grids) will be managed by numerous intelligent electronic devices. These devices will have to interoperate; that is, they will need to exchange data with each other in order to co-operate over complex control tasks. Interoperability will only be achieved when Smart Grid devices share common semantics on the data they exchange. Standardization bodies have created standard data models defining these common semantics, but a unified standard data model has not been created for all Smart Grids. Consequently, in order to achieve interoperability in this domain, it is mandatory to find semantic correspondences (alignments) between different standard data models. Creating equivalent ontologies from the standard data models facilitates this task, because ontologies provide powerful reasoning services that can be used for automating ontology aligning. The majority of ontology matchers proposed in the state of the art, however, are only able to find simple equivalences of terms, while most alignments in Smart Grids are complex correspondences involving more than two terms. This paper presents an innovative ontology matching system that finds complex correspondences by processing expert knowledge from external domain ontologies and by using novel matching methods. The tests carried out in this study were based on the main interoperability issue within Smart Grids: interactions between CIM and SCL data models. In such tests, the proposed system outperformed one of the best ontology matchers according to the Ontology Alignment Evaluation Initiative (OAEI).

Index Terms— Expert system; Interoperability; Knowledge processing; Ontology matching; Power system; Smart grid

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