Ontologies Modularization to Support Digital Continuity in Industrial Domains

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General Purpose

The idea behind this proposal is the integration of modularization in the ontology development process from the first stages. This practice enhances the quality of the built ontology in terms of consistency, usability, extensibility and interoperability in multidisciplinary contexts.

Context

In the reuse of wide scale ontologies, stakeholders analyze heterogeneous data with different knowledge sources. Ontology users tend to divide the ontology in different fragments *after* its development to allow an efficient data analysis and reuse processes. However, this task may be error-prone in terms of knowledge loss and ontology extensibility.

Knowledge sharing is a major issue to deal with semantic heterogeneity since it establishes an efficient communication between domain actors. From this context, it is important to integrate a complete set of pertinent concepts that represent a specific domain/task/application.

In order to facilitate the knowledge acquisition and integration, the split of the domain of discourse into different modules is a key factor to cover all intended goals of the ontology. This principle is called **modularization** and has to be considered from the *first phases* of the ontology development. **The aim** of this proposal is to deal with multi-view modeling issues and to provide a complete and shared view between stakeholders and an homogeneous data integration process.

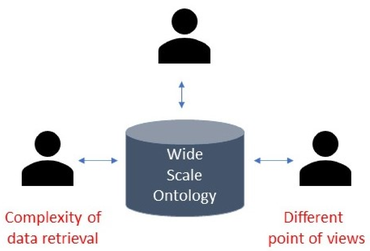

Figure 1:Constraints of wide scale ontologies reuse

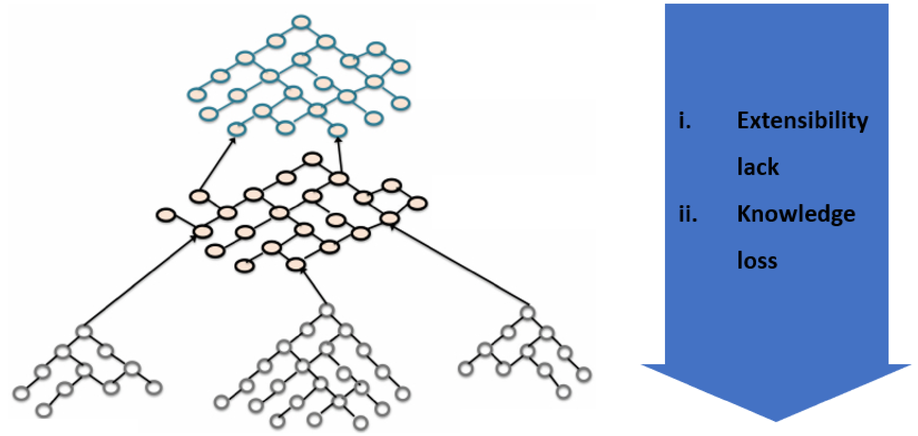

Figure 2:Traditional ontology modularization

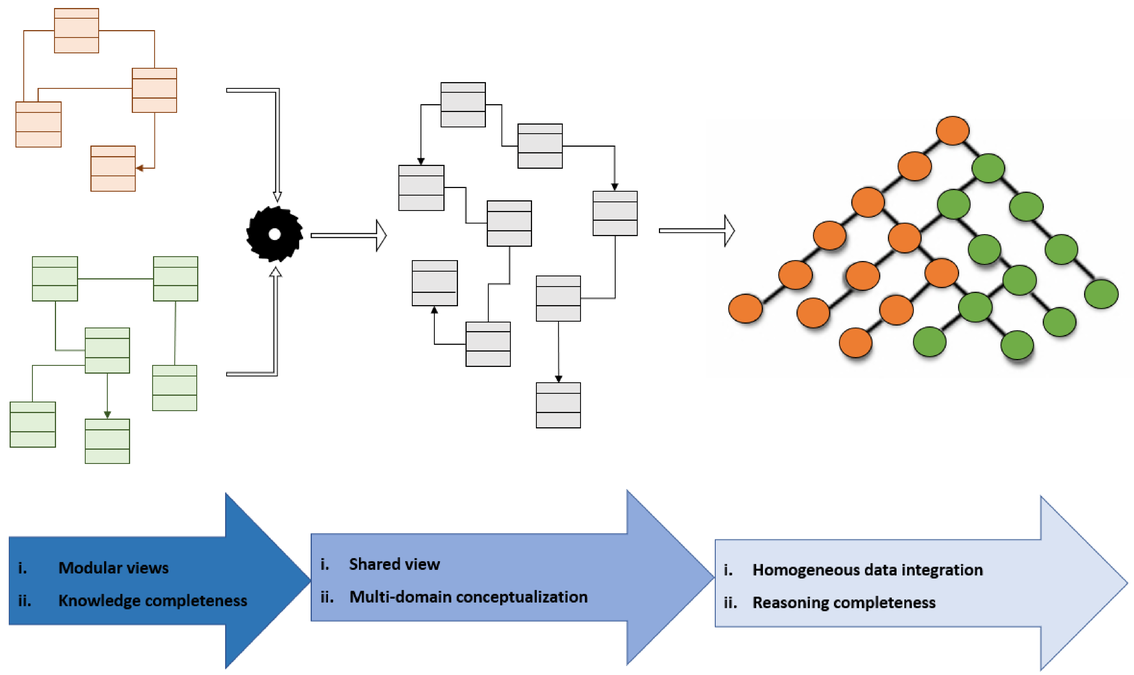

Figure 3:Proposed ontology modularization approach

Performance Criteria

i Usability : extensibility for different uses cases

ii Interoperability : shared view of knowledge and consistent data exchange

Conclusion and future enhancement

In contrast with existing research works which achieve ontology modularization at the end of the development process, we propose to integrate this principle from the first stages.

In fact, multi-view modeling at conceptual level copes with the system complexity by decomposing the model into several viewpoints or modules corresponding to different stakeholders and actors. The alignment of the obtained modules requires model transformation processes and tools in order to have a final model semantically consistent. This conceptual model is the whole model of the system that allows to generate the final ontology that combines the instantiated views. The latter is then modular and its performance is enhanced. The performance criteria that are considered here are usability and interoperability. The first criterion is mainly represented by the extensibility factor. The latter is considered from the view of matching and merging with new domains. We show that, modularization from the conceptualization step, allows to have modular views that can be shared. At the instantiating step, we obtain homogeneous integrated data. At the second criterion, we show that knowledge completeness guarantees reasoning completeness through multi-domain conceptualization. These performance results are required to enhance the digital continuity in innovative industrial domains.

References

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