Foundations for revising networks of ontologies

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The framework of belief revision has been studied for years in the context of logic theories. It has been considered several times for description logics and more recently for aligned ontologies. We consider more generally the problem of revising a network of ontologies: given a set of ontologies connected by alignments, how to evolve them such that they account for new information, i.e., new formulas or correspondences. Revision is a typical problem of the semantic web due to its open nature.

There are two extreme ways to approach this problem: on the one hand, transforming the network of ontologies in a single logic theory and applying classical revision; on the other hand, applying revision locally to each ontology and to each alignment and communicating the changes to related elements. We keep a middle term between these two approaches: local revision alone is not sufficient to revise networks of ontologies but preserving the separation of ontologies and alignments can be exploited by revision.

We first use existing semantics of networks of ontologies for defining the notions of closure and consistency for networks of ontologies. Inconsistency can come from two different sources: local inconsistency in a particular ontology or alignment, and global inconsistency between them. Revision, in turn, can affect any of these components: retracting assertions from closed ontologies, like in classical belief revision, or correspondences from closed alignments, like in current alignment repair.

Then, we define revision postulates for networks of ontologies and we show that revision cannot be simply based on local revision operators on both ontologies and alignments: they may fail to reach a consistent network of ontologies although solutions exist. We define a global revision operator by adapting the partial meet revision framework to networks of ontologies. We show that it indeed satisfies the revision postulates.

Finally, we discuss strategies based on network characteristics for designing concrete revision operators.