Building Consensus on Ontology Mapping

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Abstract. An approach to achieve ontology mapping agreements between autonomous entities is presented. In the proposed approach, entities relax their mapping requirements based on the reciprocal behavior from others. The process and protocol for agreement are presented.

1 Introduction

Ontology Mapping Negotiation aims to achieve agreements about the meanings of the information exchanged between autonomous entities or organizations.

The OM process is defined as $\mathcal{M} : \mathcal{O}^s \rightarrow \mathcal{O}^t$[2]. When two different organizations specify two $\mathcal{M}$ of the same ontologies, the result is easily divergent and contradictory, preventing them from interoperating. Currently, user-based approaches are used to promote the consensus between them. However, due to time constraints, it does not fulfil the requirements of on-line application scenarios (*e.g.* information retrieval, e-business, web services). Automatic Ontology Mapping Negotiation (AOMN) is envisaged as the potential solution as it applies well established negotiation strategies to model the behavior of autonomous entities (*e.g.* artificial agents) acting on behalf of ontology mapping negotiators. The goal of AOMN is to supply agents with convergence capabilities about $\mathcal{M}$.

2 Our approach

Our approach is based on the premise that each agent is able to generate its own valid $\mathcal{M}$[2]. $\mathcal{M}$ is composed by a set of semantic bridges (sb) [2], each of them relating through a function (S) a set of source ontology's concepts to a set of target ontology's concepts. Each S (*e.g.* Concatenation, Split, Equal) is complemented by two functions:

- $u(p_1, ..., p_n)$, responsible for the categorization of sb according to their relevance to $\mathcal{M}$. For that, u combines the result $(p_1, ..., p_n)$ of different matching algorithms [1] into an overall relevance value. Through this value every sb will be categorized either as SB^m (mandatory), SB^p (proposed), SB^n (negotiable), SB^r (rejected) (Figure 1);
- $U(p_1, ..., p_n)$, responsible for (i) re-categorize sb according to a set of relaxation rules and (ii) measure the effort to re-categorize sb.

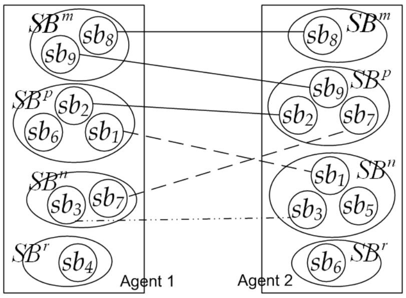

Fig. 1. Negotiation Metaphor

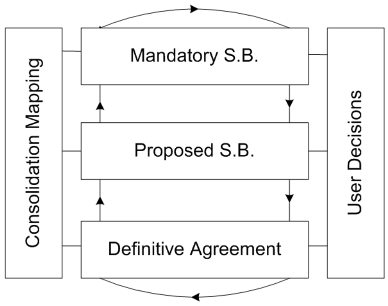

Fig. 2. Negotiation Process

The AOMN process (depicted in Figure 2), manipulates sb according to their categories. In the mandatory and proposed phases, each agent proposes to the other every $sb \in (SB^m \cup SB^p)$. The main difference between both phases is that the process will fail if any $sb \in SB^m$ is not accepted. During both phases, $sb \in SB^n$ may be re-categorized by the receiving agent through the U function. The re-categorization permits the acceptance of a not-evident sb, imposing an effort that has a negative impact on the quality of the $\mathcal{M}$. The effort (loss) is counterbalanced by the acceptance (gain) of another sb that would be re-categorized by the other agent in a similar situation. The balance between gain and loss is evaluated in the definitive agreement phase. The consolidation module guarantees that the set of agreed sb correspond to a valid $\mathcal{M}$, which might provoke further re-categorization of sb due to sb's dependencies.

3 Conclusions

The u and U functions are responsible for the categorization and relaxed re-categorization of sb. Matching algorithms are the knowledge input for both, playing a major role in the process. However, because of their evolving nature, matching algorithms are independent from the process. Currently, the implemented relaxation mechanism is based on heuristics rules acquired from the past user experiences. Instead, on-going research suggests to apply other methods such as Machine Learning, mathematical models based on Game Theory and argumentation-based negotiation.

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References

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[2] Nuno Silva and João Rocha. Service-oriented ontology mapping system. In *Semantic Integration Workshop at ISWC*, 2003.