Ontology alignment in browser-based P2P nodes

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Résumé : This paper presents an improvement of our previous work on collaborative inference-based ontology alignment in P2P networks. This prototype uses a P2P network simulator and can pop nodes out of the simulator and run them in a JavaScript node inside a Web browser. Such nodes have been implemented to fulfill locally various P2P requests among which semantic matching of concepts, using the JavaScript OWLReasoner inference engine. They can run in any WebSocket-enabled browser, including on mobile devices, and can be used for testing or demonstration purposes.

Mots-clés : Ontology alignment, Semantic Web, P2P, mobile web reasoning.

1 Introduction

Inference-based ontology alignment, among other reasoning tasks, is still often considered if not only for researchers, at least dedicated to heavy applications. Moreover, aligning ontologies in P2P networks requires lots of bidirectional message exchanges, which are not suitable for usual Web applications. Therefore, as web browsers evolve and get standardized and as mobile devices capacities grow, it is now possible to carry on such complex tasks in a "mobile Web reasoning" manner.

In this paper, we propose an HTML5-based implementation of a peer that can communicate with other nodes located in a P2P simulation environment or in other web browsers to collaboratively perform alignment queries. The middleware layer designed to join browser-based and simulation-based nodes is presented as well. This infrastructure was designed as a feasibility study of P2P reasoning on multiple browser-based nodes. It is designed for demonstrating the behavior of a particular node in an alignment task, as well as testing browser-based reasoning with different sizes of ontologies on desktop and mobile clients.

2 Context and motivation

Ontology Alignment (OA) is a key problem for enabling semantic interoperability. Numerous approaches have been developed and surveys such as [Shvaiko & Euzenat 2007] reference this work. We herein focus on semantic alignment approaches, which use inference engines to produce new mappings. They require the two ontologies and a set of preexisting mappings (i.e. *axioms*), to initiate the process. Emerging solutions are proposed to align large sets of ontologies distributed in a P2P network: *SomeWhere* and *SomeRDFS* [Adjiman & *Al.* 2007] are two P2P data management systems based on distributed algorithms specifically designed for P2P inference systems.

The SimTOLE project provides a Java simulation environment to evaluate the performance of alignment algorithms on a set of ontologies distributed through a P2P network. In order to grow the number of existing mappings in the network, we have proposed in [Lumineau & Médini 2010] an algorithm to collaboratively align ontologies, which both exploits the knowledge stored in the peers' neighborhood and limits the amount of knowledge to process for each peer. The original prototype is based on the Peersim P2P simulator [Montresor & Jelasity 2009]. Each peer is linked with an ontology and can process alignment queries using its own inference engine: Pellet[1]. The prototype has been tested with the set of 14 ontologies issued in OAEI'2010[2].

3 SimToleWeb prototype description

The architecture of our SimToleWeb prototype is based on a modified version of the PeerSim simulator, plus an overlay to generate specific configuration files and a simulation GUI allowing to control the simulation scenario and visualize the alignment results. Two different types of nodes run inside the simulator: i) "regular semantic" nodes that perform ontologies alignment in the simulator, as described in our SimTOLE approach, ii) proxy nodes, whose role is to allow communication between the simulator and Web-based peers. The latter nodes derive from the previous ones and surcharge their business methods by performing bidirectional communication through a dedicated WebSocket[3] running in a Jetty[4] Web server. The architecture of our prototype is illustrated in Figure 1.

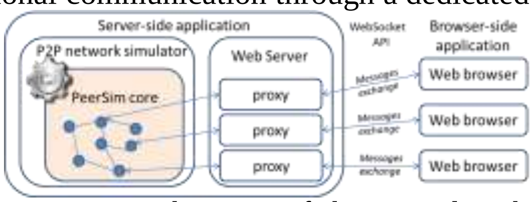

Figure 1. Architecture of the SimToleWeb prototype.

[1] http://clarkparsia.com/pellet

[2] http://oaei.ontologymatching.org/

[3] http://dev.w3.org/html5/websocket/

[4] http://jetty.codehaus.org/jetty/

On the client side run a configuration-defined number of Web-based peers that provide the same function as PeerSim-based peers. Each browsed-based node is related to the network by its own proxy node and WebSocket. JavaScript inference engine used for discovering new mappings is *OWLReasoner*[5]. The structure of a Web-based peer is shown in Figure 2.

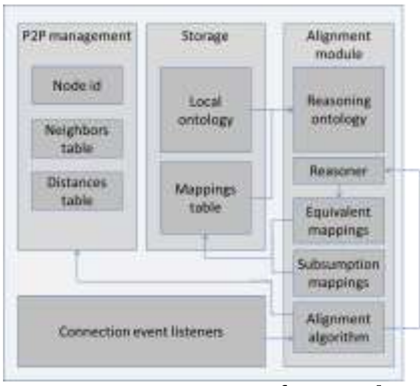

Figure 2. Structure of a Web-based peer.

4 Conclusion

In this paper, we presented the SimToleWeb prototype that fulfills our objective to pop nodes performing semantic ontology alignment out of a Java P2P simulator and run them in a Web browser. We will demonstrate our prototype with two browser-based nodes, one of which being executed on a smartphone.

Even if this project is a step towards full Web P2P ontology alignment, it is not yet possible to completely get rid of the server, since the WebSocket API does not allow communication between clients. Nevertheless, the prototype is usable in architectures including distributed servers (*i.e.* super-peers). Another limitation is the limited expressiveness of JavaScript alignment: Pellet (that performs inferences in the Java nodes) is capable of processing OWL-DL ontologies, whereas OWLReasoner (used in the JavaScript nodes) is limited to OWL2 EL. So we had to remove some properties from the OAEI'2010 ontologies. Our next objective will thus be to port Pellet or other Java engines into JS using an indirect GWT[6]-like library.

Références

P. ADJIMAN, F. GOASDOUÉ, AND M.-C. ROUSSET (2007). Journal on data semantics viii. chapter SomeRDFS in the semantic web, pages 158 181. Springer-Verlag, Berlin, Heidelberg, 2007.

N. LUMINEAU AND L. MÉDINI. SimTOLE : un Simulateur P2P dédié à l'Alignement d'Ontologies à Large Echelle, EGC'2010. January 2010.

A. MONTRESOR AND M. JELASITY (2009). Peersim: A scalable p2p simulator. In Peer-to-Peer Computing'09, pages 99-100, 2009.

P. SHVAIKO AND J. EUZENAT (2007). Ontology matching. springer, 2007, hardcover, isbn 978-3-540-49611-3.

[5] http://code.google.com/p/owlreasoner

[6] http://code.google.com/webtoolkit/