OWL Linker: A Tool for E-Connecting OWL Ontologies

Farnaz Derakhshan
Department of Computer Science
The University of Liverpool
L69 3BX, UK
farnaz@csc.liv.ac.uk

ABSTRACT

Developing ontologies in many different domain areas has led to a huge amount of distributed information. On one hand, correlating this distributed information seems so worthwhile for providing additional information and reusing ontologies. On the other hand, keeping ontologies in small modules would be helpful for maintaining and managing ontologies. Therefore, recently composing and decomposing ontologies become of the most significant topics in the semantic web researches and the related applications. In this poster, a new tool called "OWL Linker" which provides an environment for combining OWL ontologies would be presented. This novel tool is a plug-in extension of Protégé which provides a very flexible user interface for connecting two separate ontologies based on the e-connection method such that user is able to browse, edit and manipulate link properties and also define individuals and restrictions for these new types of properties. Providing reasoning and updating e-connected ontologies are the other main facilities of this system.

Keywords

OWL Linker, OWL Ontology, E-Connection, Protégé, ontology connection, Protégé plug-in.

1. INTRODUCTION

Developing ontologies in many different domain areas has led to a huge amount of distributed information. Correlating this distributed information is very valuable for providing additional information and reusing ontologies. In addition, keeping ontologies in small modules and using the appropriate connection (when it is necessary) will grow the performance of maintaining and managing ontologies. Therefore, recently composing and decomposing ontologies become of the most significant topics in the semantic web researches and the related applications. This poster presents a new tool called "OWL Linker" which provides an environment for combining OWL ontologies. In fact using this tool user can connect two separate OWL ontologies with e-connection method.

E-connection is an approach for connecting different types of knowledge representation systems that in this case it is used for OWL-DL ontologies. In the next section, this method will be explained.

Technically, OWL Linker is a plug-in extension of Protégé [1, 2] which is a successful ontology editor with a large community of users. It supports OWL ontologies in its OWL Plug-in. The well-designed graphical user interface, expandability, Plug-in-based architecture, and connecting to reasoners (such as RACER) are of the main characteristics of Protégé such that these features perform an appropriate infrastructure for this tool. Next, after a short explaining of the theory of the e-connection, OWL Linker and its features will be described.

2. E-Connecting OWL Ontologies

Among several methods for combining logics, E-connection is a new method which is robust in computational behavior and is defined for abstract description systems [3-5]. Since design of OWL ontologies has been influenced by Description Logics [6], thus, in this work for composing OWL ontologies the method of e-connecting of Description Logic systems has been applied[1].

In this part, we skip the mathematical aspects and describe the general idea of E-connections of description logics systems with an example.

As an example, suppose Medical and People ontologies are completely distinct and they have no common name in their classes or properties. The desired links for connecting these ontologies are:

$$\varepsilon = \{E1 = \text{hasDisease}, E2 = \text{prescribe}, E3 = \text{diagnose}\}$$

And the Description of People and Medical ontology are as follows (Figure 1).

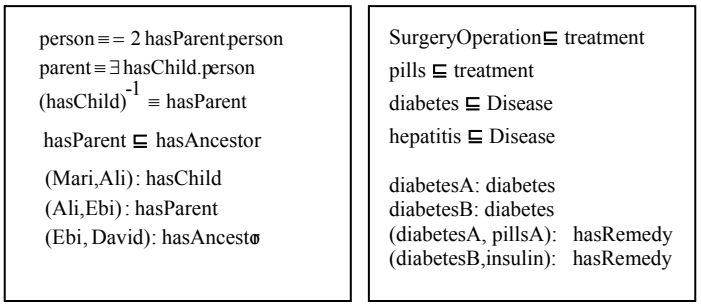

Figure 1- People Ontology & Medical Ontology

Now it is possible to define a new class which uses the link property between ontologies. For example, diabetesSuspicious is a person who has at least one ancestor with at least diabetes disease as shown in Figure 2.

diabetesSuspicious ⊑ person⊓ (∃ hasAncestor(∃ hasDisease.diabetes))
(David,diabetesB): hasDisease

Figure 2- An example of link relation

In this way, we can keep both ontologies separate and just by defining e-connection get the facility of combining them, defining new classes

[1] There are also other methods for connecting ontologies such as C-OWL. While E-Connection link ontologies using binary relation (property), C-OWL use subsumption relation. More information is available in:
[1] P. Bouquet, F. Giunchiglia, F. van Harmelen, L. Serafini, H.Stuckenschmidt: Contextualizing Ontologies. Journal of Web Semantics 2004.

and new constraints. With respect to the above assertions, Ali: diabetesSuspicious is satisfiable. Because from the first ontology, David is one of Ebi's ancestor, and Ebi is Ali's parent. And because hasParent is subsumed by hasAncestor, David is Ali's ancestor as well. On the other hand, based on the Medical ontology, diabetesB is a kind of Diabetes. So if David has diabetesB, Ali would be diabetesSuspicious by the definition of the above link property axiom.

3. OWL Linker

OWL Linker has been developed with Java and it benefits from using Protégé APIs. The main characteristics of Protégé such as well-designed graphical user interface, expandability, plug-in-based architecture, and connecting to reasoners perform an appropriate infrastructure for developing this tool. So OWL Linker is a new tab in the Protégé environment.

OWL Linker provides novel facilities for e-connecting distinct ontologies. It has a friendly user interface that user is able to browse and select the desirable two OWL ontologies. Next s/he can create, edit and manipulate link properties between these ontologies. Assigning new individuals to the classes and link properties is possible as well. In addition, defining new classes is possible to define new restriction using link properties which is too similar to define entities and axioms in Protégé.

One of the other main features of this tool is that if user leaves the session, then next time s/he wants to do any updates and changes on e-connection of ontologies, there exists the capability of reloading the previous environment for changing or updating of the link properties, classes and other entities of two ontologies. It means system will save all the activities during the session.

The next characteristic of the OWL Linker is its capability of connecting to reasoners to perform reasoning services over the e-connected ontologies. Currently the well-known reasoners such as RACER [7] have not been designed for performing such reasoning. Therefore to obtain the reasoning facility for e-connected ontologies, these two distinct systems and their e-connection links has to be combined as an integrated system. For this reason, OWL Linker provides such combined ontology which the definition of the link properties is similar to the standard OWL syntax of properties, however, the domain and range of properties are from two separate ontologies and also to differentiate from the usual properties system automatically adds an appropriate prefix to the name of the link properties. Creating the combined ontology provides an appropriate input for reasoners. In this way, reasoners can do reasoning just like the other Description Logics systems.

For instance, RACER as a powerful Description Logics reasoner system can be accessed from OWL Linker. By pressing the reasoning buttons in the main panel of the OWL Linker, connecting to RACER will be provided and the result of reasoning services of RACER will be displayed into OWL Linker environment.

4. Related Work

There exists a similar and progressive work in MindSwap group in The University of Maryland which results two new environments: SWOOP [8, 9] semantic web editor and Pellet [10] reasoner. SWOOP enables user to render different types of ontologies, edit and visualize classes, properties, individuals and define logical class characteristics as OWL expressions. Ontology linking with E-connection method [11] is of the other features of SWOOP. To perform e-connection between ontologies, it adds some extension to the normative OWL abstract syntax for link properties [11].

Currently, for reasoning services, SWOOP just can access to Pellet as the default reasoner by selecting Pellet in Reasoning Combo in the editor environment. Pellet [11, 12] is a novel tableau based DL reasoner specifically developed for working with OWL ontologies and also supports multi-ontology reasoning using E-Connections[13]. In comparison the advantage of our work is that the other existing DL reasoners like RACER also can be used to perform reasoning on e-connected system.

5. SUMMARY

To sum up, since from the implementation point of view requiring suitable tools and applications to support theoretical aspects are inevitable, this poster will present a tool to provide connecting ontologies with e-connection. In addition, this tool has the facility of connecting to the existing reasoners like RACER for reasoning over the linked ontologies can be provided.

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