Report: Research Visit to University of Trento
August 30th to September 10th 2004

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Topic/Goals:

Distributed First Order Logic and its Application to Ontology Mapping and Information Integration.

The goal of the research visit was to discuss the theoretical foundation for ontology mapping and information integration. Distributed First Order Logic, which can be seen as a synergy of Context Logic and the logic foundation for C-OWL, was discussed as logical foundation for approaches which establish meaningful connections between different ontologies or different data schemas of several information sources. A further "side effect" will be to learn the current research activities at the University of Trento and to identify possible links for further joint research.

Background:

A number of logical languages for representing and reasoning about ontologies have been proposed and there are even language standards now that guarantee a stability and homogeneity on the language level. However, a number of different proposals have been made for mapping between ontologies and information sources including the extension of ontology languages with notions of mappings between different models. The need for being able to talk about mappings has been recognized as a result of the fact that different sources may partially overlap or even represent the same domain from different points of view. Unlike for the case of ontology languages or information sources, work on mapping languages has not yet reached a state where a common understanding of the basic principles exists. As a consequence, existing proposals show major differences concerning almost all possible aspects which make it difficult to compare approaches and make a decision about the usefulness of a particular approach in a given situation.

Activities:

The purpose of this research activity is to support a better understanding of the commonalities and differences of existing proposals for mapping languages. We encode the different mapping languages in an extended version of distributed first-order logic (DFOL), a logical framework for representing distributed knowledge systems. DFOL consists of two components: a family of first order theories and a set of axioms describing the relations between these theories. Most proposals for mapping languages base on a subset of first-order logic for describing local models. These mapping languages can be expressed in distributed first order logic in the following way that descriptions of domain models are restricted to first order sentences and relations between domain models are represented in mapping axioms describing the assumptions that are encoded in the specific semantics of mappings.

Encoding the different mapping approaches in first-order logic in this way has several advantages with respect to an analysis and comparison of existing work. In particular it allows doing a formal analysis and comparison of different approaches in a uniform logical

framework. In the course of the investigations, we make the following contributions to the state of the art in distributed knowledge representation and reasoning:

- we show how DFOL formalism can be used to model relations between heterogeneous domains (Proposition 1)
- we encode existing mapping approaches in a common framework making them more comparable
- we make hidden assumptions explicit in terms of distributed first order logic axioms
- we provide first results on the relative expressiveness of the approaches and identify shared fragments

Furthermore the visit was scheduled for the 2K* symposium, September 6th-8th 2004 in Madonna di Campiglio, where many researchers from the University of Trento, the ITC and other places presented their research results. Many links could be identified concerning context reasoning and ontology mapping. Connection between the researchers from University of Trento and Vrije Universiteit Amsterdam was established.

Follow-Up Activities:

There are concrete plans for follow-up activities in which the above mentioned activities will be continued.

1. Research paper "A Formal Investigation of Mapping Language for Terminological Knowledge"

    The research concerning DFOL for Ontology mapping/Information Integration was and will be continued. As a first step a paper was written concerning DFOL as foundation for logic-based ontology mapping approach and was submitted to the "Nineteenth International Joint Conference on Artificial Intelligence (IJCAI05)". The paper is currently under review.

2. Organisation of "The First International Workshop on Contexts and Ontologies: Theory, Practice and Applications"

    In order to enforce the research on context reasoning and ontologies and in order to collect feedback from the industry we decided to organize the workshop which will be held July 9-10, 2005 during the Twentieth National Conference on Artificial Intelligence (AAAI-05). For more information please refer to www.c-and-o.net.