FO(ID) as an extension of DL with rules

Joost Vennekens*, Marc Denecker, and Maurice Bruynooghe

{joost.vennekens, marc.denecker, maurice.bruynooghe}@cs.kuleuven.be
Dept. of Computer Science, K.U. Leuven, Belgium

Abstract. There are many interesting Knowledge Representation questions surrounding rule languages for the Semantic Web. The most basic one is of course: which kind of rules should be used and how do they integrate with existing Description Logics? Similar questions have already been addressed in the field of Logic Programming, where one particular answer has been provided by the language of FO(ID). FO(ID) is an extension of first-order logic with a rule-based representation for inductive definitions. By offering a general integration of first-order logic and Logic Programs, it also induces a particular way of extending Description Logics with rules. The goal of this paper is to investigate this integration and discover whether there are interesting extensions of DL with rules that can be arrived at by imposing appropriate restrictions on the highly expressive FO(ID).

1 Introduction

Over the past decades, Description Logics (DL) have emerged as an important Knowledge Representation (KR) technology. More recently, they have also had a significant impact on industry, most notably with the adoption of OWL as a W3C standard. In current research, we find a trend to investigate extensions of OWL with *rules* (e.g. [11]), and, in fact, the hierarchical Semantic Web architecture already prescribes a *rule layer* on top of the *ontology layer* formed by OWL. There are a number of interesting KR questions surrounding this topic:

- *Which kind of rules are to be used?* There are numerous kinds of rules known in the literature (inference rules, rewrite rules, ...), with subtle differences between them.
- *What precisely do this kind of rules mean?* It should be possible to explain exactly the information content of such a rule and, obviously, this explanation should be consistent with the formal semantics of the rules.
- *How do the rules complement DL?* We should be able to clearly indicate how the rules extend the class of knowledge that can be represented by the logic.

In this paper, we will present an answer to these questions based on the language of FO(ID), a general integration of classical first-order logic (FO) and Logic Programming (LP). Conceptually, FO(ID) is an extension of FO with

* Joost Vennekens is a postdoctoral researcher of the FWO.