UML Profile for OWL

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Abstract. The paper presents Ontology UML Profile (OUP) that is based on OWL and a metamodel – Ontology Definition Metamodel. OUP is defined in the context of the MDA four-layer architecture and current the OMG's effort for ontology development. The proposed UML profile enables usage of the well-known UML notation in ontology development more extensively.

1 Ontology UML Profile: An Overview

The Semantic Web and its XML-based languages are the main directions of the future Web development. Domain ontologies are the most important part of the Semantic Web applications. In order to overcome the gap between software engineering practitioners and AI techniques, there are a few proposals for UML usage in ontology development [1]. But, UML itself does not satisfy needs for representation of ontology concepts that are borrowed from description logics, and that are included in Semantic Web ontology languages (e.g. RDF, RDF Schema, OWL, etc.). The OMG's Model Driven Architecture (MDA) concept has the ability to create (using metamodeling) a family of languages that are defined in the similar way like the UML is. Currently, there is a RFP (Request for Proposal) within OMG that tries to define a suitable language for modeling Semantic Web ontology languages in the context of MDA [2. According to this RFP we give our proposal of such architecture, which consists of: Ontology Definition Metamodel (ODM) and Ontology UML Profile (OUP) [3]. ODM is a metamodel defined using Meta-Object Facility (MOF), and is based on the Web Ontology Language (OWL).

OUP enables graphical editing of ontologies using UML diagrams as well as other benefits of using mature UML CASE tools. OUP is based on the basic UML constructs (model elements) that are customized and extended with new semantics by using four *UML extension mechanisms* defined in the UML Specification: stereotypes, tag definitions, tagged values, and constraints. *Stereotypes* enable defining virtual subclasses of UML metaclasses, assigning them additional semantics. OUP support the following OWL concepts: classes, individuals, properties, and statements. Since OUP supports ontology statements we can model ontology instances using OUP. We shortly illustrate the OUP's class concept. `Class` is one of the most fundamental concepts in ODM and Ontology UML Profile. In ODM, Ontology Class has several concrete species, according to the class description:

N. Koch, P. Fraternali, and M. Wirsing (Eds.): ICWE 2004, LNCS 3140, pp. 607–608, 2004.

`Class`, `Enumeration`, `Union`, `Intersection`, `Complement`, `Restriction` and `AllDifferent`. These constructs in the Ontology UML Profile are all inherited from the UML concept that is most similar to them, UML `Class`. But, we must explicitly specify that they are not the same as UML `Class`, which we can do using UML stereotypes. An example of `Classes` modeled in Ontology UML Profile is shown in Figure 1. We implemented the XSLT that transforms the OUP ontologies into OWL [4]. We tested this solution on the well-known Wine ontology. We used OUP to develop two ontologies: the Petri net ontology and the ontology of philosophers and saints.

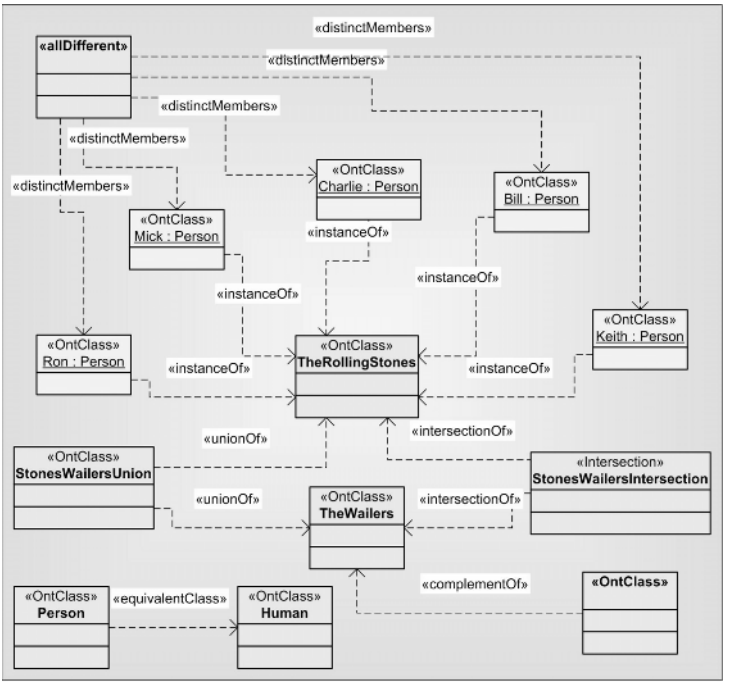

Fig. 1. Class Diagram showing relations between Ontology Classes and Individuals in the Ontology UML Profile

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