Chapter 8

MDA STANDARDS FOR ONTOLOGY DEVELOPMENT

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Abstract: Ontologies and Model-Driven Architecture (MDA) are two modeling approaches being developed in parallel, but by different communities. They have common points and issues and can be brought closer together. Many authors have so far attempted to bridge gaps and have proposed several solutions. The result of these efforts is the recent OMG’s initiative for defining an ontology development platform. In this chapter, we are giving an overview of the state-of-the-art research on the subject of applications of MDA standards for ontology development. The chapter is a result of our experience in developing the MDA-based ontology infrastructure as well as a series of tutorials we gave at many international conferences. The chapter tries to indicate the most important definition for both of the considered modeling approaches. Using those definitions, we depict their mutual similarities and differences. Then, we show the present solution pursuing to apply MDA standard to ontology development with the main stress on OMG’s standardization efforts.

Key words: Ontology modeling; Model-Driven Architecture; The Semantic Web; Ontology development; Web Ontology Language (OWL); Resource Description Framework (RDF); RDF Schema (RDFS) Ontology Definition Metamodel (ODM)

1. INTRODUCTION

With the development of the Semantic Web initiative, the importance of ontologies increases rapidly. Semantic Web researchers try to make ontology development and ontologies in general closer to software practitioners...
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[Knublauch, 2004]. However, ontologies have more rigorous foundation closely related to the well-known AI paradigms (e.g. description logic, semantic networks, frames, etc.). Thus, most of the current Semantic Web ontologies are developed in AI laboratories. Accordingly, we should answer some questions such as: How can we increase the extent of ontologies developers? How can we motivate software engineering practitioners to develop and use ontologies? Can we use software development tools to develop ontologies? Therefore, we need some ways to integrate software development and ontologies.

The integration of the ongoing software engineering efforts with the concept of the Semantic Web is not a new idea [Kogut et al, 2002]. Many researchers have previously suggested using UML in order to solve this problem. However, UML is based upon object-oriented paradigm, and has some limitation regarding ontology development. Hence, we can only use UML in initial phases of ontology development. We believe that these limitations can be overcome using UML extensions (i.e. UML profiles) [Duddy, 2002], as well as other Object Modeling Group (OMG) standards, like Model Driven Architecture – MDA. In addition, if we want to offer a solution consistent with MDA proposals, we should also support automatic generation of completely operational ontology definitions (e.g. in OWL language) that are model driven [Selic, 2003]. Currently, the most important direction toward this goal is the one pursued by a dedicated research group within OMG that tries to converge many different proposals of solutions to this problem [OMG ODM, 2003]. The result of this effort should be a standard language (i.e. a metamodel) based on the MDA standards [Miller & Mukerji, 2003] and the W3C Web Ontology Language (OWL) recommendation [Dean & Schreiber, 2004].

In this chapter, we try to address the current efforts towards the use of MDA standards for ontology development in order to have a comprehensive reference covering recent research on this subject. The chapter is a result of our experience on developing MDA-based infrastructure for ontologies [Djuric et al., 2005b] as well as a series of tutorials on this subject we have given at several international conferences (e.g. UML Conference, Conference on Web Engineering, World Wide Web Conference, etc.). Accordingly, the next section gives the most important definition of both ontologies and the Semantic Web. Section 3 briefly discusses basic MDA concepts, while section 4 attempts to clarify different modeling origins of both MDA and ontologies in terms of modeling spaces. In section 5, we list the previous work on the use of software engineering languages for ontology development, whereas in section 6 we show the starting points for developing an MDA-based infrastructure for ontologies. Finally, sections 7