

Chapter 18

Toward UML–Compliant Semantic Web Services Development

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ABSTRACT

The emerging Semantic Web and, in particular, Semantic Web services (SWS), demands the inclusion of new components in applications involving this technology. Therefore, Web development methodologies must be tailored to support the systematic development of such new components. In previous works we presented a UML profile, which extends the SOD-M method for service oriented Web Information System development of the MIDAS model-driven framework, to address the development of Semantic Web Services using WSMO (Web Service Modeling Ontology). The UML profile allows for the modeling of the new elements required by WSMO Web Services. This paper focuses on studying the possibility of improving the proposed UML profile, including the OCL (Object Constraint Language), for the representation of WSMO logical axioms through three case studies. This would allow developers, whose knowledge does not extend beyond UML, to develop applications that use Semantic Web services.

DOI: 10.4018/978-1-4666-1761-2.ch018

INTRODUCTION

Many different Web development methodologies have been proposed to address different aspects of Web application development since the Web appeared. These methodologies were later adapted with the evolution of the Web and its underlying technologies. For example, with Web services existing methodologies were modified to include new models of WSDL document generation (Lausen, de Bruijn, Polleres, & Fensel, 2005), new models of service composition, and so on. Semantic Web Services (SWS) expand the capabilities of a Web service by associating a semantic description of the service in order to enable automatic search, discovery, selection, composition, and integration (Dimitrov, Simov, Momtchev, & Ognyanov, 2005). Semantic Web services technology demands the inclusion of new components in the applications involving them. Nevertheless, current Web development methodologies do not include specific techniques or models to develop the new elements required to build SWS-based applications. In general, SWS should be included in Web application development methodologies for several reasons. Most importantly: (a) to enable the systematic development of new required components and (b) to promote the widespread adoption of SWS. Unfortunately, for the average software developer, the learning curve for semantically rich languages, used to describe SWS, can be steep. This fact provides a barrier to the adoption and widespread use of such technologies (Gannod & Timm, 2004). To be widely adopted by users and to succeed in real-world applications, SWS development must be aligned with mainstream software trends such as Model Driven Architecture (Miller & Mukerji, 2001).

Based on the above reasons, in Acuña and Marcos (2006), we presented a UML profile for modeling the new elements required by SWS-based applications. This profile was developed as an extension of the SOD-M (Service Oriented Development Method) (De Castro, Marcos, & López, 2006) included in the MIDAS framework.

MIDAS is an MDA framework for Service-Oriented Web Information Systems Development. The motivation for that work was the lack of specific techniques and methodological approaches to develop SWS. Our proposal is developed within the MDA framework in order to reap the benefits that the framework already provides.

The first version of the SWS UML profile enables the modeling of SWS based on the WSMO (Web Services Modeling Ontology) proposal (Grønmo, Jaeger, & Hoff, 2005). In WSMO, a SWS description requires the definition of four basic components: ontologies, Semantic Web services, goals and mediators. As a consequence, the profile contains four models at a Platform Specific level, one for each WSMO modeling element. Starting from the UML models defined to model the SWS and generating the corresponding XMI description (Object Management Group, 2005), the WSML description of each element of WSMO could be generated through the implementation of mappings rules.

Although the UML profile enables the modeling of those four main elements, WSMO axioms were modeled by means of UML notes and using WSML code directly on the models. In this work we focus on the improvement of the UML profile with the aim of making Semantic Web services development fully UML-compliant. We propose to complete the profile by using the Object Constraint Language (OCL) (Object Management Group, 2006) for the representation of the WSMO axioms. Note that OCL is a language familiar to the average software developer. We analyze three case studies in which we have tried to convert an axiom, expressed in WSML, using OCL expressions.

The rest of the paper is structured as follows. The following section discusses related work and provides a background to this study. Definitions of concepts required in order to set up the context of this research are then provided. This is followed by a description of the three case studies. Finally, conclusions are presented along with directions for future research.

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