

Chapter 72

A Generic Approach for the Semantic Annotation of Conceptual Models Using a Service–Oriented Architecture

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ABSTRACT

In this paper a generic service oriented architecture for the semantic annotation of conceptual models is described. It allows to annotate elements of conceptual models with concepts from formal semantic schemata. Thereby, additional semantic functionalities for models can be realized. Due to the integration of aspects of service orientation, the platform can be easily extended to support different modeling and semantic schema languages. Furthermore, it can act as an integration platform for other tools working on models and ontologies.

INTRODUCTION

The capturing of knowledge using conceptual models has been discussed in several areas such as strategic and business process management, software engineering or enterprise architecture management cf. (Borgida, Chaudhri, Giorgini, & Yu, 2009; Fill, 2009). Thereby, conceptual

models are used to formally describe aspects of the physical and social world for the purposes of understanding and communication (Mylopoulos, 1992). They are based on a formal syntactic definition that requires human interpretation in order to be processed. To leverage the semantics contained in these models to a machine processable level, the annotation of conceptual models using formal

DOI: 10.4018/978-1-4666-6042-7.ch072

semantic schemata has been proposed (Lautenbacher, Bauer, & Seitz, 2008; Höfferer, 2007). With these annotations additional functionalities can be provided to the users of conceptual models. Examples include mechanisms to achieve the interoperability of different modeling languages (Höfferer, 2007), to measure the similarity of model instances (Ehrig, Koschmider, & Oberweis, 2007), to prepare process models for the further transformation to executable workflows (Lautenbacher & Bauer, 2007) or to identify dependencies on compliance requirements (Fill & Reischl, 2009).

When implementing these approaches in IT tools two directions can be taken: Either the modeling tools are extended to support the annotation functionality and thus preserve the modeling environment that the user is familiar with (Born et al., 2008; Fill & Burzynski, 2009). Or, completely new modeling tools are designed. However, in both cases the annotation functionalities and the modeling tools are tightly coupled. Furthermore, the re-use of the functionalities for different types of modeling languages and formal semantic schemata is often limited due to this close integration.

To overcome these deficiencies we will describe an approach that allows for the combination of modeling components for arbitrary modeling and formal semantic schema languages to support semantic annotation. The approach is based on the concepts of service orientation. This permits to achieve a greater flexibility and adaptability in regard to modeling languages, semantic schema languages, and other modeling tools. The remainder of the paper is structured as follows: In the section “Foundations” we will outline the foundations used for our approach, in the section “Semantic Annotation Architecture” the conceived architecture is presented. In the section “Implementation using ADOxx® and Protégé” the concrete implementation of the approach is discussed. The article is concluded with an outlook on the future work.

FOUNDATIONS

In this section we will give a short introduction to modeling methods and conceptual models, semantic annotations and the concepts of service orientation that are necessary to describe our approach.

Modeling Methods and Conceptual Models

To ensure a common understanding of the terms in regard to modeling methods and modeling languages we will refer in the following to a framework from the area of meta modeling that has been developed in (Karagiannis & Kühn, 2002). In this framework, the central components of a modeling method are a modeling technique and mechanisms and algorithms (see Figure 1). The modeling technique consists of a modeling language that is defined by its syntax, semantics, and notation. The notation is thereby separated from the syntax to allow for an independent specification of the visual representation of the modeling language (Fill, 2009). The modeling procedure defines the steps that can be applied to the modeling language to create results. The mechanisms and algorithms can either be generic, specific or hybrid and are used by the modeling procedure. Generic mechanisms and algorithms can be applied to all modeling languages, whereas specific mechanisms and algorithms are only applicable to a particular modeling language. In the hybrid case, mechanisms and algorithms are basically generic but can be specifically adapted to a modeling language, for example to improve usability (Karagiannis & Kühn, 2002). The representation of the modeling language can itself be represented as a model which is then commonly denoted as a meta model cf. (Höfferer, 2007). This meta model provides the abstract syntax of the modeling language that can be instantiated to a concrete syntax in the form of models.

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