Chapter VIII

An Evaluation of UML and OWL Using a Semiotic Quality Framework

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ABSTRACT

This chapter performs a systematic evaluation of two domain models and modeling languages – UML and OWL. A semiotic quality framework is used to evaluate a UML class model and an OWL ontology model in the travel domain. Next, an extended semiotic quality framework is used to evaluate the OWL language. Furthermore, we compare UML and OWL through the joint evaluation result. The comparison of the two languages highlighted the strengths and weaknesses of the two modeling languages from a semiotic perspective. This evaluation is to assist researchers in the selection and justification of modeling languages in specific scenarios.


INTRODUCTION

The next generation of the Web, the Semantic Web aims at making Web resources more readily accessible to automated processes. This will be accomplished by adding information that describes Web content in a machine-readable and manipulable fashion (Horrocks & Patel-Schneider, 2003). It means the content in the Web should be machine understandable. That is to say, the machine should be able to manipulate and analyze the semantics of information and data. Ontology is chosen as a means to enrich the semantics of the data and information on the Web since ontologies can provide shared domain models, which are understandable to both humans and machines (Pan & Horrocks, 2001).

Ontology can be described as “what there is” and relies on the use of specific terms to construct a description of reality. In the context of the Semantic Web, we think about ontology as referring to the consensual and formal description of shared concepts in a domain. Ontologies are said to be a way to aid communication between humans and machines and also between machines for agent communication. A number of recommendations have been proposed for languages that support the creation of ontologies for such communication and understanding. If one can draw an analogy between the processes of conceptual modeling and ontology building, the languages used might be quite different. In the former, one would use traditional modeling languages, such as UML, ER-model, and so forth. In the latter, one would be using traditional knowledge representation language like Cyc (Lenat, 1995), Telos (Mylopoulos et al., 1990), or some of the emerging Web-ontology languages, such as OWL, DAML+OIL, or Topic Maps. An ontology is not entirely equivalent to a conceptual model because a conceptual model is usually more oriented towards problem solving. An ontology model describes the general conceptualization of a specific domain, while a conceptual model could be used to express concepts, processes, or the system structure involved in a certain task. However, ontology building and conceptual modeling still share some common principles, and traditional conceptual modeling languages, tools, and methodologies also provide a basis for ontology building.

Research comparing conceptual modeling and ontology building is important because an explicit comparison of two languages will highlight the strengths and weaknesses of the two modeling languages. A systematic evaluation of models and modeling languages under the same domain assists researchers to choose and justify the usage of modeling languages in specific scenarios. The problem is not so much associated with creating ontologies but with providing support for reasoning and mapping between ontologies. The challenge is to create a language which is formal enough to support machine-to-machine processing and also one which is simple to use and understand. One step towards meeting this
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