Using Analogy to Promote Conceptual Modeling Reuse

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Abstract. This paper argues in favor of a database conceptual schema and Semantic Web ontology design discipline that explores analogy mappings to reuse the structure and integrity constraints of conceptual models, stored in a repository. We presuppose that a team of expert conceptual designers would build a standard repository of source conceptual models, which less experienced designers would use to create new target conceptual models in other domains. The target models will then borrow the structure and the integrity constraints from the source models by analogy. The concepts are expressed in the contexts of Description Logics, the RDF model and OWL to reinforce the basic principles and explore additional questions, such as the consistency of the target model.

1 Introduction

Metaphor is not merely a rhetorical device, characteristic of language alone. Lakoff and Johnson (1980) argue that "the human conceptual system is fundamentally metaphorical in nature. The essence of metaphor is understanding and experiencing one kind of thing in terms of another." Holyoak and Thagard (1995, p. 220) argue that "metaphor uses the same mental processes as analogical thinking ... a metaphor is understood by finding an analogy mapping between the target domain (the topic of the metaphor) and the source domain. The degree to which an analogy is viewed as metaphorical will tend to increase the more remote the target and source domains are from each other."

In this paper, we claim that analogy mappings facilitate conceptual modeling by allowing the designer to reinterpret fragments of familiar conceptual models in other contexts. This may have applications in developing new versions of ground control systems or flight software for a new spacecraft, for example. Exploitation of such an approach requires a sound approach and a methodology to support conceptual modeling. To that end, we propose a discipline for database conceptual schema design, and Semantic Web ontologies as well, that we call conceptual modeling by analogy and metaphor.

The discipline is based on two simple ideas Breitman et al. (2007). First, a team of expert conceptual designers would build a standard repository of *source* conceptual models that cover commonly found conceptual design patterns and that are expressed in familiar terms. The source conceptual models will naturally contain fully formalized integrity constraints, as defined by the conceptual design experts. For example, instead of a generic weak entity pattern, the collection will contain a sample model of employees and their dependents, which is