Reconciling Explanatory and Constructive Modes of Modeling through Deep Modeling

COLIN ATKINSON[1]

Abstract: In the long term, fully exploiting the synergies between ontology engineering and software engineering approaches to modelling is contingent on a complete understanding of their similarities and differences and the development of a unified modeling framework that can support both paradigms in a seamless way. In this talk Colin Atkinson will explain how this can be achieved by characterizing the fundamental modes of modelling the different approaches have evolved to support and by outlining a promising approach for unifying them. This is the potency-based, multi-level modeling paradigm (also known as deep modelling) which allows all ingredients of a comprehensive ontology (e.g. instances, classes and metaclasses) to be modelled in a level-agnostic way, and makes it possible for ontologies to include as many classification levels as needed to best represent the domain in hand (e.g. geographic data). The talk will explain how the basic deep modelling notion of potency can be enhanced to support an "exploratory", ontology-oriented mode of modeling alongside the "constructive", software engineering mode of modeling for which it was originally developed.

1 Overview

As the potential synergy between ontology-based reasoning services (á la OWL) and software-engineering-oriented specification capabilities (á la UML) becomes increasingly apparent, a growing number of researchers have started to explore ways of bringing the two schools of modeling together. In the short to medium term, "bridging" technologies that support mappings between the two paradigms offer the most practical way of jointly leveraging these two forms of modeling. Prime examples include the Ontology Definition Metamodel standardized by the OMG and the TwoUse interoperation tool (PARREIRAS et al. 2007) developed in the MOST project (http://www.mostproject.eu). Nevertheless, in the long term, the cleanest solution is to develop a single, unified modeling paradigm which supports both sets of the capabilities.

Accommodating the different assumptions and interpretations underlying software engineering oriented modeling and ontology (i.e. semantic web) oriented modeling within a single unified framework presents several fundamental challenges, however. Some of these have been identified and widely discussed in the literature. Examples include different underlying logics to define the meaning of classes and taxonomies (e.g. description logic, basic set theory), different interpretation of missing information (e.g. closed-world, open world assumptions) and different architectures used to organize model information (e.g. traditional four level OMG architecture, two level OWL architecture) (ATKINSON et al. 2006; STAAB 2010; JEKJANTUK 2010). Other differences, in contrast, have received relatively little attention and have yet to be fully elaborated. These relate to the fundamental modes by which models are developed and used in the software and ontology engineering communities and the criteria under which models are considered valid. One important difference relates to whether models

[1] Universität Mannheim, Software Engineering Group, Institute für Informatik, B6, 26, Gebäudeteil C, D-68159 Mannheim. E-Mail: atkinson@informatik.uni-mannheim.de

are developed and used in a "constructive" way or in an "exploratory" (aka as "explanatory" (KÜHNE 2016)) way. In constructive (i.e. software engineering oriented) modelling the role of class diagrams is to serve as templates from which populations of instances can be generated at a future point in time, while in exploratory (i.e. semantic web oriented) modeling the role of class models (i.e. ontologies) is to capture classification information wrapped up in an already existing population of instances. This is related to the distinction between "prescriptive" and "descriptive" models (SEIDEWITZ 2003; ASSMANN 2006), but focusses on the conditions under which model content can be considered complete or valid rather than on the purpose for which they are being deployed. Both prescriptive and descriptive models are often developed in exploratory mode and applied in constructive mode.
In this talk, which is based on the paper (ATKINSON et al 2011), Colin Atkinson will fully characterize these different modes of modeling and present a strategy for accommodating them seamlessly within a unified framework. This is based on the multi-level modeling paradigm which allows ontologies to include as many classification levels as needed to best represent the domain in hand and allows their ingredients (e.g. instances, classes and metaclasses) to be treated uniformly as first class citizens (ATKINSON 2009). In the talk Colin Atkinson will – (1) characterize the different modeling modes, (2) introduce and consolidate new terminology to discuss the properties of models in the context of these modes and (3) enhance the notion of potency, the key features that support arbitrary numbers of classification levels, to support the unification of these modes within a single, integrated modeling framework. He will also explain how this unified framework opens up the possibility of achieving a fundamental unification of the ontology engineering and software/database engineering approaches to modeling.

2 References

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