

Chapter 8

Semantic Verification of Business Process Models: Prospects and Limitations

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ABSTRACT

This chapter presents an ontology-driven approach that aims at supporting semantic verification of semi-formal process models. Despite the widespread use of these models in research and practice, innovative solutions are needed in order to address the verification of process model information. But what are the prospects and limitations of semantic verification? In order to investigate this issue we suggest an ontology-driven approach consisting of two steps. The first step is the development of a model for ontology-based representation of process models. In the second step, we use this model to support the semantic verification based on this representation and on machine reasoning. We apply our approach using real-life administrative process models taken from a capital city.

INTRODUCTION

Motivation

Models are important to manage complexity. They provide a means for understanding the business process, and understanding already is a benefit.

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This is indicated by a study from Gartner revealing an increase in efficiency of 12 percent gained solely by documenting actions and organizational responsibilities using process models (Melenovsky 2005, p. 4). Moreover, process models serve for optimization, reengineering, and implementation of supporting IT systems. Due to the importance of process models, model quality is important. According to ISO 8402, quality is “the totality of

characteristics of an entity that bear on its ability to satisfy stated and implied needs”. Facets of quality are – amongst others – adequate coverage of the domain or system to be modeled, appropriateness in respect to the abstraction level of the representation (scale), detail of representation (granularity) and the correctness of a model. We concentrate on correctness as the most fundamental quality aspect. Among the aspects of correctness are: (a) syntactical correctness, (b) correctness in regard to the formal semantics, (c) correctness in regard to linguistic aspects focusing on the labels used in models, (d) correctness in regard to the coherence of connected models and (e) compliance to rules and regulations focusing on the correctness of the model’s content and thus on semantic correctness. While there are numerous verification approaches available to ensure (a-d), only a few approaches focus on (e) in the sense of the verification of the semantic correctness. With the term “verification”, we denote criteria targeting the internal, syntactic and semantic constitution of a model. In contrast to that, validation means the eligibility of a model in respect to its intended use (Desel 2002, p. 24) – in other words: if the criteria is something outside the model (Chapurlat & Braesch 2008; Mendling 2009, p. 2). Following this distinction, we call the procedures to ensure semantic correctness “semantic verification”.

A major problem regarding semantic verification is how to automate it. This problem is rooted in natural language being used for labeling model elements, thus introducing terminological problems such as ambiguity (homonyms, synonyms) and other linguistic phenomena. Model creators and readers do not necessarily share the same understanding as the concepts they use are usually not documented and mix both discipline-specific terminology and informal, ordinary language. Therefore, it is hard for humans to judge if a model is semantically correct and almost impossible for machines (apart from using heuristics) because the model element labels are not backed with machine processable semantics. The result

is that the machine cannot interpret the contents of model elements. Our solution approach is to encode the model element semantics in a precise, machine readable form using ontologies. Further, we then use rules to encode constraints used for verifying aspects of semantic correctness.

Prospects of Semantic Verification

The proposed approach of semantic verification allows performing additional checks on process models. Such checks are possible by annotating process models with instances of a formal ontology containing terminological knowledge of the domain under consideration. The ontology in conjunction with an inference engine can then be used to automatically verify several aspects of models based on the semantics of the individual model elements. This decoupling from human labor makes semantic verification scalable even in incremental approaches to model construction where a model has to be re-verified repeatedly. An important additional benefit thereby is that the semantic verification rules can be formalized on a more abstract and generic level and the inference engine interprets them with the help of both explicitly encoded and inferred knowledge from the ontology. Therefore, it is possible to formulate semantic verification rules in a more natural and understandable way that accommodates to the nature of generic rules such as guidelines, best practices, conventions, recommendations or laws being rather abstract in order to ensure broad applicability.

The paper is organized as follows. In the related work section, we provide an overview of approaches and tools in the state-of-the-art of model verification. In the next section, we present a case study that motivates our approach. In the section “Ontology-driven Approach for Semantic Verification” we present our approach of semantic verification along with a rule classification and examples illustrating the application of such rules to the real-world problems of the case study. In the

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