First Workshop on Transforming and Weaving Ontologies in Model Driven Engineering (TWOMDE 2008)

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ABSTRACT

The First International Workshop on Transforming and Weaving Ontologies in Model Driven Engineering (TWOMDE 2008), affiliated with the 11th International Conference on Model Driven Engineering Languages and Systems (MoDELS2008), brought together researchers and practitioners from the modeling community with experience or interest in MDE and in Knowledge Representation to discuss about: (1) how the scientific and technical results around ontologies, ontology languages and their corresponding reasoning technologies can be used fruitfully in MDE; (2) the role of ontologies in supporting model transformation; (3) and how ontologies can improve designing domain specific languages.

1. INTRODUCTION

As Model Driven Engineering spreads, disciplines like model transformation and domain specific modeling become essential in order to support different kinds of models in an model driven environment. Understanding the role of ontology technologies like knowledge representation, automated reasoning, dynamic classification and consistence checking in these fields is crucial to leverage the development of such disciplines.

Thus, the objectives of the First International Workshop on Transforming and Weaving Ontologies in Model Driven Engineering (TWOMDE 2008) were to present success cases of integrated approaches and state-of-the-art researches covering ontologies in MDE; and to encourage the modeling community to explore different aspects of ontologies.

TWOMDE 2008 addressed how the scientific and technical results around ontologies, ontology languages and their corresponding reasoning technologies can be used fruitfully in MDE. More specifically, TWOMDE 2008 discussed the infrastructure for integrating ontologies and MDE and the application of ontologies in the following aspects of MDE: Domain Specific Languages, Design Patterns, and Conceptual Modeling.

This first edition counted on one invited talk and five paper presentations. The audience comprised 20 participants. Senior researchers and professors constitute at least half of audience. It indicates that the modeling community is willing to know about the integration of Ontologies and MDE.

This paper assesses the TWOMDE 2008 achievements as follows: Section 2 covers an analysis of papers presented in the workshop. Section 3 analyzes open questions and summarizes the discussions handled at the end of the workshop. Section 4 points to synergies and areas of interest to be covered in future editions of the workshop.

2. RESEARCH PAPERS

The workshop was divided in three parts. It started with the invited talk about about "potential applications of ontologies and reasoning for modeling and software engineering" following by a group of papers concerning application of ontologies in MDE.

Andreas Friesen gave a keynote talk about the experience of SAP's potential applications for ontologies and reasoning for enterprise applications [2]. Participating of at least five EU projects on the topic, SAP has collected a large number of potential applications. We illustrate two of them: Dynamic Integration of logistic service providers and business process composition.

The first involves the usage of semantic web services and ontologies to automatically find the most appropriate web service based on predefined requirements. This application replaces multiple manual steps for discovery and selection of suitable web services.

The second potential application relies on employing ontologies in business process composition. When composing business processes, currently, there is a manual effort in en-

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suring the correct message flow and integration logic among business processes. Applying ontologies may allow for semi-automatic generating the message flow for consistent execution.

An open issue is how to measure the value added by ontologies. Indeed, although the role of ontologies is clear, metrics to assess the impact of ontologies on enterprise systems lack so far. Ongoing EU projects like MOST[1] may contribute with use cases and patterns to support this issue.

2.1 Applications of Ontologies in MDE

Papers addressing the application of ontologies in MDE cover topics like design pattern integration, domain specific languages and multi-agent systems.

Cédric Bouhours presented the use of "an ontology to suggest design patterns integration" [3]. The paper analyses the application of an extended Design Pattern Intent Ontology (DPIO) in an pattern integration process. The process is composed by three steps: Alternative models detection, Validation of the propositions and Patterns integration. The DPIO ontology is used in the second step to validate the suggestions made. A future work would be the semi-automatic detection of alternative models by ontology. This task would make use of reasoning to infer relationships between the the model and the alternative model.

Another interesting application of ontologies is in "the domain analysis of domain-specific languages"[6], presented by Marjan Mernik. In such paper, ontologies are used during the initial phase of domain analysis in identifying common and variable elements of the domain that should be modeled in a language for that domain. Since the research is on its first steps, the analysis of applying ontologies in the other stages was not considered yet. Currently, ontologies are applied in the domain analysis and automated reasoning services have not been used. Indeed, reasoning services could be used to build a class diagram from the ontology. For example, the common subsumer [1] can be used to suggest an abstract super class based on the description of two or more concrete subclasses.

Daniel Okouya [5] presented a paper with the proposal of applying ontologies in conceptual modeling of multi-agent systems (MAS) and uses the expressive power of OWL based ontologies to deal with constraints verification and domain knowledge provision of MAS models. The idea is to support designers providing verification and validation of conceptual models produced during the MAS development process.

2.2 Integrated Approaches

Marion Murzek presented an infra-structure for integrating ontologies in MDE in the paper "Bringing Ontology Awareness into Model Driven Engineering Platforms" [7]. The architecture is based on the authors' experience with interoperability issues in metamodeling platforms. It should provide support to the following MDE disciplines: (1) modeling, (2) management and (3) guidance.

For example, the framework supports applying ontologies to validating models (1), simulations and model transformations (2) and Flexibility of process definitions(3). This is an ongoing research with first prototypes scheduled for the second semester of 2009.

An approach from a different point of view was presented by Guillaume Hillairet in the paper "MDE for publishing Data on the Semantic Web" [4]. It proposes the usage of the object model as pivot between persistence layer and ontology in semantic web applications. Mapping and transformations between the object model and an ontology are discussed. An interesting conclusion is that MDE helps to reduce the complexity of dealing with these mappings and transformations.

[1] www.most-project.eu

3. DISCUSSION

Many topics were discussed and still remain open issues. Firstly, the different objectives of applying ontologies in MDE demand attention. Among them, we point three: validation of conceptual models; specification with more expressiveness power; and information sharing. From these three applications, the first one presents the biggest amount of use cases until now. It happens maybe due to the facility of translating constructs of UML-based languages into Ontology Web Language (OWL). Moreover, since such translation is (or should be) an automatic step, developers do not have to learn ontology languages, which may be a hard task.

OWL has some characteristics that can be very useful in MDE. One of the mainly differences between ontologies and object-oriented paradigm is the notion of incomplete knowledge and the different ways of describing classes. Indeed, incomplete knowledge may be very useful in domains like medicine, where not all information about a disease or drug is known yet. However, some applications require complete information, like a airport timetable. The capability of describing class in many ways adds flexibility and can be useful to support domain analysis, as exemplified in [6].

3.1 Complexity of Ontologies

Ontology languages like OWL are logical languages and require different premisses, with influences the complexity level of such a language. For example, bridging of UML-like models and OWL-like ontologies invariably raises the questions about open world assumption (OWA) and closed world assumption (CWA). The question is whether the complexity of ontology languages like OWL and particularities like the open world assumption impair the adoption of such languages for software modeling. Some software modeling educators and practitioners claim that even OCL can be too complicated to be widely adopted. Is OWL even more complex?

To be able to answer those questions we still need to investigate how to evaluate the value added by ontology in MDE, as discussed in Sect. 3.4.

3.2 Need for integrated approaches

There is a visible research agenda attempting to integrate ontology technology (OT) into "standard" software development (SD) approaches. Such integration can be considered on very many different levels and corners of SD. Much of the technology attempted to be integrated have been developed in different communities and for different purposes (cf. UML vs. OWL).

In the context, the question is which integration style currently seems most rewarding (in the short run or the long run) from a language modeling point of view: tight or loose. The tight style involves strong integration of currently developed formalisms (languages and approaches). The loose style distinguish corners of SD where OT can be applied as stand-alone approaches, as black-boxes, hence being able to

reuse OT development and advances off-the-shelf. The latter seems to be more explored nowadays mainly due to the lack of integrated languages available and motivating use cases.

Integrating ontologies into existing formalisms and notions has been attempted before. Perhaps most notable in recent times is the attempt to integrate rules (Datalog, normal rules, Prolog rules etc.) with ontologies, resulting in the possibility to specify "hybrid programs". The objective has been to "bridge the best of two worlds" and exploit each approach for the other and thus achieve higher expressivity and more powerful formalisms. As for integrating ontologies (*a la* OWL) into system models (*a la* UML) today, the objectives seems to be very similar. When attempting to integrate ontologies into MDE today, an open question is what, if anything, we can learn from earlier attempts at ontology integration.

3.3 Visual Modeling of Ontologies

There are ways to deploy UML-profiles or similar techniques to achieve a visual syntax (arguably easier for end-users) for ontology development. UML-like visual syntax have been used to cover the expressivity of logic-based languages such as OWL. An open issue is whether using UML syntax for modeling OWL adds to the confusion of the two approaches. With a increasing focus on Domain Specific Languages (DSL), frameworks for developing visual languages have become popular and can be explored to develop alternatives for modeling OWL visually.

3.4 Assessment of Ontology Applications in MDE

Clearly, there are possible benefits of deploying ontology technology in the software engineering field. But software engineers are already required to have a good understanding of a legion of languages and techniques. Will, in the long run, the advances brought on by the application of ontology technology be worthwhile to deploy? Will the return of investment and added complication to the software engineering processes and methods by the addition of these new technologies result in higher quality software?

Thus, we need quality models of ontology driven applications. From the quantitative point of view, object oriented metrics could be used as starting point in the investigation of new quality metrics and quality models for integrated approaches.

4. CONCLUSION

The TWOMDE2008 was the first workshop at the MDE conference to address the application of ontologies in model driven development. The potential of this field has just started being explored.

Although we had papers covering different aspects of MDE, the employment of automated reasoning services to make use of the formal description provided by ontology languages has practically not been explored. Moreover, prominent topics in MDE like model transformation, traceability and query languages were not pondered by the papers of this first edition.

For the next editions, we expect more use cases in a wider range of topics. We would like to see successful industry use cases and mechanisms to evaluate the role of ontologies.

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