MoDeVVa 2012 Workshop Summary

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1. INTRODUCTION

The MoDeVVa workshop series is dedicated to the interaction between advancements in the field of Model-Driven Engineering (MDE) and in the field of Verification and Validation (V&V). During the eight previous editions, it became evident that this interaction works in both directions. On the one hand, the use of models facilitates the deployment of formal V&V tools and techniques by providing high-level abstractions of systems. Indicative of the research community's interest in MDE as a method for facilitating and popularizing formal methods for verification was the focus on MDE of the 12th International School on Formal Methods in Bertinoro, Italy in June 2012 [2]. On the other hand, the models and transformations in the context of MDE are becoming ever more complex, accentuating the need for formal V&V techniques to help manage this complexity. Growing academic maturity in this area is demonstrated by the establishment of new topic-specific workshops, such as VOLT'12, which is specificically oriented towards the challenges of the verification of model transformations, and was held in April 2012 in Montréal Canada [1].

For the 9th edition of MoDeVVa, we opted to focus on two key properties for applying the divide and conquer approach to the complexity of systems, namely *composability* and *compositionality*. In varying degrees, these two themes were reflected in the papers that were submitted to the workshop. The theme that generated the most interest and attention during the discussions that were held during on the workshop day, was the *usability* of verification tools and techniques.

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2. PURPOSE OF THE WORKSHOP

Over time, MoDeVVa aims to offer a forum for researchers and practitioners who are working on V&V and MDE. The main goals of the workshop are to identify, discuss, and elaborate mutual impacts of MDE and V&V. Models are purposeful abstractions of systems and of their environment and can be used at arbitrary abstraction levels for understanding complex systems. Because of this, validating requirements, simulation, or automatic code generation, using models is of increasing importance for industrial applications.

Model-Driven Engineering (MDE) is a development methodology that is based on models, meta-models, and model transformations. The shift from code or technical artifacts to software models is a key feature of MDE that opens promising perspectives for the formalization and the automation of verification and validation tasks, like model-based testing, consistency or refinement conformance checking, and so on. On the other hand, the growing complexity of models and of model transformations requires efficient techniques for V&V in the context of MDE.

Since complexity in general can be handled by hierarchically decomposing complex models into simpler ones, an important issue is the ability to predict the properties of the whole system from the properties of its subsystems and from the laws of combination of the subsystems. For the 2012 edition of MoDeVVa, we put the emphasis on composability and compositionality:

- How to divide a model into submodels that can be implemented as individually verified subsystems, integrated into a validated system?
- How to model composition rules to support compositionality?
- How to model model transformations to guarantee the preservation of properties of the models?
- How to model the dependencies between functional and non-functional requirements?

3. WORKSHOP PARTICULARS

The workshop opened with a keynote speech by Robert France, who set the pitch to the usability of V&V tools. Robert France argued that one of the main problems with model-driven development is the lack of usable analysis techniques. A usable analysis tool should not require more work than it saves, it should present results in terms of the model abstractions, and the techniques should fit the developer's style of work. Then, Robert France showed on which semantic foundations and approaches such tools could be built. The keynote was followed by a lively discussion about the (un)usability of V&V tools.

The keynote was followed by presentations of the accepted papers. Following the call for papers, we received 23 submissions. Each paper was reviewed by 3 different program committee members. Based on the recommendation of the reviewers, 8 papers were accepted for publication and presentation at the workshop (35% acceptance rate).

We organized the presentation of the accepted papers in three thematic sessions: reasoning tools, model transformations, and modeling languages. We give a brief summary of the papers in each session below.

Reasoning Tools. The papers in this session explored the use of different formalisms and tools for the analysis of different aspects of models. In *Comparing the Effectiveness of Reasoning Formalisms for Partial Models*, Saadatpanah et al. presented an experimental evaluation of reasoning tools for the verification of partial models. In *Feature Interaction Analysis of the Feature-Oriented Requirements-Modelling Language Using Alloy*, Dietrich et al. presented an approach for analyzing feature interactions in FORML models. In *Aligning SysML with the B method to provide V&V for systems engineering*, Bousse et al. described the semantic-preserving translation of a subset of SysML in the B method.

The three presentations relied on different formal tools (Alloy, Event B, SMT solvers, etc.) to analyze different aspects of models. Three main issues were present: choosing a tool, encoding the problem about the model into an input for the tool, and decoding the output of the tool.

Model Transformations. The papers in this session studied both the impact of transformations on the validation of a system and the use of verification techniques for model transformations. In *Incremental Formal Verification for Model Refining*, Wijs et al. presented a method for checking the preservation of properties in vertical transformations. Eriksson et al. presented their paper *Model Transformation Impact on Test Artifacts: An Empirical Study*, an industrial experimental study of the impact of model transformations on test models. In *Comparing Verification Techniques for Model Transformations*, Lano et al. presented a comparison of techniques for proving properties such as confluence, termination, and correctness of model transformations

The three presenters discussed transformations in three different contexts: model refining and the verification of refining transformations, code generation as a model transformation and its impact on test selection policies, and model transformations considered as models that must be verified.

Modeling Languages. The papers in this session dealt with both using languages and defining the semantics of languages. In *Improving Symbolic Execution for Statechart Formalisms*, Balasubramanian et al. presented an approach for improving the performance of symbolic execution by rewriting the original code of a model.

Finally, the paper *Implementing Modular Domain Specific Languages and Analyses* by Ratiu et al. presented how the use of language engineering to achieve modular definition of modeling language semantics can improve the usability of analysis tools. The presentation of the paper by co-author Zaur Molotnikov, was elected as the best of the workshop by the audience. Moreover, based on the reviews by the program committee, we gave the authors of this paper the best paper award.

4. DISCUSSION

The topics of the papers also lead us to choose a discussion topic for the workshop. Considering the many tools available for the syntactic aspects of modeling languages (parsers, editors, validators, and so on), we wanted to examine what could be done to provide tools for the semantic aspects of modeling languages. What are the most suitable semantic domains, how difficult is it to map the syntax to the semantic domain, how to map domain specific properties to properties of the underlying semantic concepts?

The workshop ended with a discussion about the usability of verification tools. A key point is that tools that bring their own formalism into the semantic domain of the DSL introduce too much accidental complexity and are not usable. Therefore, the general pattern for building usable verification tools seems to boil down to: (a) map the DSL concepts to some formalism that supports verification (transition systems, set theory, first order logics) (b) use the tools of the formalism (model-checkers, theorem provers) (c) translate the results back to the semantic domain of the DSL.

5. CONCLUSION AND PERSPECTIVES

The workshop received very good submissions, and we selected only 8 papers in order to have 30 minute presentation slots, and to keep time for discussions. We must thank Robert France for his perfectly fitted and enthusiastic keynote speech, and the authors for the quality of their presentations, which allowed the audience to keep interested in the workshop. This lead to very animated and interesting discussions, which are, from our point of view, the key point of MoDeVVa. We are looking forward organizing the next occurrence.

6. REFERENCES

[1] Levi Lúcio, Eugene Syriani, and Stephan Weissleder. VOLT12: Verification And Validation Of Model Transformations Montreal, Canada, April 21, 2012. `http://www.model-based-testing.de/volt12/` .

[2] Marco Bernardo and Vittorio Cortellessa and Alfonso Pierantonio, editors. *Formal Methods for Model-Driven Engineering, 12th International School on Formal Methods for the Design of Computer, Communication, and Software Systems, SFM 2012, Bertinoro, Italy, June 18-23, 2012.* . Springer, 2012.