MoDELS 2007 Doctoral Symposium Summary

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Abstract. The MoDELS 2007 Doctoral Symposium provided a forum for Ph.D. students, conducting research in model-driven software engineering, to discuss their goals, methodology and results at an early stage in their research, in a critical but supportive and constructive environment. The symposium offered an opportunity for the eight student participants to interact with other students at a similar stage in their careers and with the mentoring board composed of five experts in the software modeling field. The students received practical guidance for the completion of the dissertation research and motivation for a research career. This summary offers an overview of the activities that occurred at the Symposium.

1. Introduction

Model-driven software engineering (MDE) is a dynamic new field of research, creating a paradigm shift in the way software applications are designed and maintained. This paradigm proposes the use of models as the basic building blocks, which are used to design and build software. This process is achieved by successively applying model transformations until the executable code is obtained. MDE builds on ideas and experiences from many different fields to produce the novel research needed to drive this paradigm shift.

The MoDELS 2007 Doctoral Symposium provided a forum for PhD. students, conducting research in MDE, to discuss their goals, methodology and results at an early stage in their research, in a critical but supportive and constructive environment. The symposium offered an opportunity for student participants to interact with other students at a similar stage in their careers and with established researchers in the software modeling community. The closed character of this symposium (participation on invitation only) was a premise for deep and constructive discussions.

Each presentation was organized as a mock thesis-defense, with a committee of 5 mentors providing extensive feedback and advice for completing a successful PhD thesis. The research topics presented by student during the symposium covered hot topics in the MDE field such as version control for models, modeling language semantics, methodologies for developing model transformations, model composition, aspects in models, etc.

This year we received 12 submissions from 6 countries. Submissions were judged on originality, overall contribution, technical merit, presentation quality and relevance

to the conference topics. The symposium was intended for students who had already settled on a specific research topic (closely related to model-driven engineering) and had obtained initial results, but still had enough time remaining before their final defence so that they might benefit from the symposium experience. Each submission was reviewed by two mentors from the Selection Committee. The committee finally selected 9 proposals (although one of the students was unable to attend the symposium).

The closing session of the symposium was a panel discussion that was organized in conjunction with the Educator's Symposium. The main topic of the panel was what to teach (and learn) in modeling in order to feel the needs for a research career in industry and/or academia.

2. Organization and Committees

The Symposium was held in conjunction with the ACM/IEEE 10th International Conference on Model Driven Engineering Languages and Systems. It was organized as a whole- day event on October 1st, 2007 in Nashville (TN), USA. The home page of the symposium is at:

http://sol.info.unlp.edu.ar/models2007ds/

Mentoring Committee

Jordi Cabot (Universitat Oberta de Catalunya, Spain)
Alexandre Correa (Universidade Federal do Rio de Janeiro, Brazil)
Ileana Ober (Université Paul Sabatier, Toulouse, France)
(chair) Claudia Pons (Universidad Nacional de La Plata, Argentina)
Dániel Varró (Budapest University of Technology and Economics, Hungary)

Selection Committee

David Akehurst (University of Kent at Canterbury, UK)
Thomas Baar (Ecole Polytechnique Fédéral de Lausanne, Switzerland)
Jean-Michel Bruel (Université de Pau, France)
Maja D'Hondt (Université des Sciences et Technologies de Lille, France)
Tom Mens (University of Mons-Hainaut, Belgium)
Ana Moreira (Universidad Nova de Lisboa, Portugal)
Ivan Porres (Åbo Akademi University, Findland)

We would like to thank everyone who contributed to the success of the Symposium, specially the experts comprising the committees who supported the review process and the mentoring activities.

3. Summary of Student Presentations

Each student prepared a short paper that was published in the Symposium Proceedings, online at http://CEUR-WS.org/Vol-262. The participating students, along with the titles of their presentations and their affiliation, are (in alphabetical order):

- **Kerstin Altmanninger**. Johannes Kepler University, Linz, Austria.
  Models in Conflict – Towards a Semantically Enhanced Version Control System for Models.
- **Michelle Crane**. Queen's University, Kingston, Ontario, Canada.
  Slicing the Three-layer Architecture: A Semantic Foundation for Behavioural Specification.
- **Gunter Mussbacher**, University of Ottawa, Canada.
  Aspect oriented User Requirements Notation
- **Hongzhi Liang**. School of Computing, Queen's University, Canada.
  Scenario integration via the transformation and manipulation of higher-order graphs.
- **Torbjörn Lundkvist**. Åbo Akademi University, Finland.
  Definition of Visual Language Editors Using Declarative Languages.
- **Jon Oldevik**. University of Oslo, Norway.
  Semantics Preserving Model Composition.
- **Rick Salay**. University of Toronto, Canada.
  Towards a Formal Framework for Multimodeling in Software Engineering.
- **Andres Vignaga**. Universidad de Chile, Chile.
  Methodological Approach to Developing Model Transformations.

This section offers a brief summary of the student presentations. Further information can be found in [1].

First presentation: Michelle Crane presented a research proposal whose overall goal is to contribute to the definition of a formal semantics for UML, and indeed visual behavioral modeling languages in general. Specifically, Michelle's work aims to validate the three-layer semantic architecture, used as a way of explaining the behavioral semantics of UML. The validation includes a definition of the semantics of UML actions and activities, as well as a prototype interpreter.

Second presentation: the doctoral work of Kerstin Altmanninger was focused on "Version Control Systems" (VCS). She explained that for a widespread success of the model-driven paradigm, appropriate tools such as "Version Control Systems" (VCS) are required to adequately support a model-based development process. First attempts to model-based versioning, however, perform conflict detection mainly on basis of a syntactic representation of models without exploiting their semantics. Consequently, Kerstin's proposal consists in defining an approach towards a semantically enhanced VCS, which enables for semantic conflict detection allowing not only a more precise conflict detection but also the determination of a conflict's reason, which can simplify the merge process. This is achieved by introducing the concept of semantic views

which explicate a certain aspect of a modeling language's semantics relevant for conflict detection

Third presentation: Rick Salay's doctoral research is motivated by the fact that the relations between models are seldom just generic "mappings" but instead usually realize an incremental modeling step of some kind. Thus, we have steps like translations, projections, refactorings, refinements, decompositions, merges, the taking of sub-models or aspects, etc. In each case, the relation contains the details of how the elements of the component models in the step are related. These details constitute the syntactic and semantic aspects of a relation while the modeling step enacted by it is its "pragmatic" aspect. In order to provide tool support for modeling with many models, a formalism is required that treats model relations and sets of interrelated models, including their pragmatic aspects, as first class entities that can be typed, characterized using metamodels, reasoned about and manipulated using operators. To achieve this Rick proposes an approach with two key facets. Firstly, a set of interrelated models can be viewed as a kind of hierarchical model – a multimodel. Secondly, relations types can be classified using meta-types corresponding to the typical modeling steps that arise in software engineering. Together, these provide a unified framework in which to express modeling scenarios within software engineering.

Fourth presentation: Torbjörn Lundkvist discussed his work on how to reduce the effort of designing visual interactive editors that can be customized for several domain-specific visual languages. In the context of this research work, a high level of reuse of configurable general editor components is considered to reduce the effort of designing editors for domain specific environments. This research work aims to show that this can be achieved by defining a general language independent editor architecture that is configured to a specific language notation by the use of declarative languages. A declarative language can be used to describe what a system should be like, not how to implement it. He believes this brings many benefits, as the information expressed in a declarative language can be reused by many different components in a tool. The focus of this research work is finding methods that allow the definition of a visual language editor based on declarative languages. This problem can be decomposed into several related areas, including the definition of languages and visual notations, how to edit and manipulate structures expressed in these languages, and the definition of query and model transformation languages.

Fifth presentation: Hongzhi Liang spoke at the Symposium about the integration of different models, such as scenarios. He remarked that this integration is an important component of the requirements engineer's work. If manually performed, the integration operation is error-prone and time consuming. Thus, an integrated computer-aided environment would be desirable. In his work he proposes a framework based on mathematical category theory machinery of algebraic operations with higher-order graphs that provides formalization and a generic pattern for scenario integration. In order to evaluate the proposed framework, Hongzhi has instantiated the framework and is currently developing an experimental tool.

Sixth presentation: the presentation by Andres Vignaga introduced his work on the definition of a methodology specifically aimed at developing and evolving model

transformations. The focus will be set on design and implementation activities; however the scope shall include the entire life-cycle. A development process is built on best practices collected throughout the experience of the community. For model transformations, a collection of best practices is still to be completed. To that end, general Software Engineering best practices may serve, at least, as an inspiration. This claim demonstrated to be particularly valid, for example, in model transformation testing. However, adapting existing application development methodologies to the model transformation domain would result unnecessary restrictive. Andres considers more appropriate to come up with a solution that freely combines established knowledge of traditional development with research in the model transformation area, from an MDE-minded point of view. The solution will be a full-edged process expressed as a SPEM model. He proposes a lifecycle based on an iterative and incremental model, and structured in phases; at least one for construction and one for evolution. The scope of the proposed activities includes requirements, analysis, design, implementation, testing and management. Activities will be associated to process roles and input and output work products, organized into disciplines, and refined into steps. Whenever possible, the proposal shall also provide guidance on process elements, especially for activities, steps and work products. Activities and steps will be described in detail, and the procedure for generating output work products from input work products will be made explicit. Work products, in turn, will be precisely described, enabling automatic work product manipulation.

Seventh presentation: Jon Oldevik discussed his work on Semantics Preserving Model Composition. He remarked that separation of concerns (SoC) and modularization are well established strategies for managing complex specifications. However, although software is designed with SoC in mind, the language mechanisms at hand often lead to tangling and scattering of concerns. This has motivated a range of language extensions to support concern specification, such as aspects and subjects in programming and modeling. The current trend is modularization of cross-cutting concerns into units, e.g. aspects that can later be composed by some transformation process (composition/merging/weaving). An important issue in this process is how the semantics of the models/programs is preserved. The focus of Jon's work is on composition and configuration of software specifications from a modeling perspective. Standard mechanisms in modeling (e.g. in UML) provide composition and configuration with well understood characteristics. Examples from UML are class redefinitions, composite structures, composite states, structured activities, interaction decomposition, and package merge. This work goes beyond those by exploring modeling and composition of concerns at a collaboration level, focusing on their architecture and interaction dimensions. The semantics governing such compositions and their results is of particular interest in this regard. Jon proposes to address how generative techniques can be used for implementing the compositions and guide semantics preservation, and also address what semantics preservation means in different modeling and composition contexts.

Eighth presentation: Gunter Mussbacher introduced a proposal on aspect oriented user requirements notation (AoURN). This notation extends the user requirements notation (URN) with aspects and thus unifies goal-oriented, scenario based, and aspect-oriented concepts in one framework. Minimal changes to URN ensure that

requirements engineers can continue working with goal and scenario models expressed in a familiar notation. At the same time, concerns in goal and scenario models, regardless of whether these concerns crosscut or not, can be managed across model types. Typical concerns in URN are non-functional requirements (NFRs), use cases and stakeholder goals. As AoURN expresses concern composition rules with URN itself, it is possible to describe rules in a highly flexible way that prove the modularity, reusability, scalability, and maintainability of URN models. Considering the strong overlap between NFRs and crosscutting concerns, aspects can help bridge the gap between goals and scenarios.

4. Conclusion

The fruitful exchange among mentors and students at the Symposium provided mutual benefit toward addressing promising research ideas for future exploration. After each student presentation, mentors offered words of general advice and suggestions regarding all facets of research. Mentors challenged the student to think about potential weaknesses in his/her thesis. Apart from the technical advices, the following topics were mentioned in the selection reviews and during the symposium,

- *The importance of a literature search*. A characteristic of a good literature search is that it does more than simply enumerate references; a good literature search provides a comparative description that offers a discussion of the advantages and disadvantages of the related work.

- *The importance of setting the focus of the thesis.* It was suggested to the students that they always be able to define their research problem concisely, as well as the associated questions on why the problem is important. The key challenges of the problem need to be understood and explained well to others.

- *The importance of the validation of the results.* The validation of the results of the research is a critical part of evaluating the impact of the contribution and proving the merit of the approach to others.

- *The importance of publishing the results.* Publishing provides feedback from research peers that may be useful to influencing the direction of the dissertation. Also, writing throughout the PhD process eases the trouble of having to write a large dissertation at the end. Writing helps to provide structure to incubating ideas and also offers a historical account of the decisions and rationalizations made along the way.

Additional information can be found in the home page of the symposium, at:
http://sol.info.unlp.edu.ar/models2007ds/

References

[1] Pons, Claudia (Ed.). “Doctoral Symposium at MoDELS 2007 Proceedings”. CEUR Workshop Proceedings, Vol 262. ISSN 1613-0073, online at http://CEUR-WS.org/Vol-262. (2007).