Summary of Workshop on Model-Driven Engineering Tools (MDETools'17)

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***Abstract*—The first workshop specifically devoted to tools supporting Model Driven Engineering was held September 19, 2017 in Austin, Texas, USA. The motivation, scope, objectives, and results of the workshop are summarized.**

***Index Terms*—Model-driven Engineering, tools, software and systems modeling**

I. Motivation

The easy availability of high-quality tools with effective supporting materials and documentation significantly increases the chances of adoption for any new software development approach. Several research communities have recognized the importance of tools and, e.g., created workshops specifically designed to facilitate the evaluation and comparison of tools (for, e.g., language workbenches [1], transformations [2], satisfiability solving [3], and verification [4]).

In contrast, the modeling research community does not appear to be paying as much attention to effectively leveraging tools for illustrating, evaluating, and disseminating research results, and for making a convincing case for more widespread adoption of modeling and MDE. More specifically,
1) there is evidence suggesting that the quality of documentation of many MDE tools is too low [5],
2) while efforts have been made to compare modeling approaches (in, e.g., the Comparing Modeling Approaches Workshop [6]), there is insufficient support for evaluating and comparing MDE tools, their suitability for specific tasks, and opportunities for interoperation and reuse, and
3) few repeatable tool evaluations and comparisons exist that use appropriate, publicly accessible use cases and that have been carried out by independent third parties.

II. Challenge problems and video tutorials

To facilitate the comparison of tools, two challenge problems were defined by the organizers, called 'Rover' and 'The Intelligent House'. Descriptions were made available online[1].

[1]http://mase.cs.queensu.ca/mdetools

III. Program

A total of eight submissions were received. Five of these were accepted. The program consisted of a keynote, paper presentations, a demo session, and a discussion session.

The keynote 'MDE Tools in Industry and Education: Understanding, Comparing and Improving the Tools' was given by Cortland Starrett, currently president of One Fact Inc, a company developing open source modeling tools (BridgePoint) as well as modeling client applications. In his presentation, Cortland drew on his experience in both industry and education and discussed some of the challenges of comparing tools, but also showed several inspiring examples involving modeling and design challenges such as ET-Robocon, a UML robot contest that has been held annually since 2002 and whose attendance has grown from 20 (2002) to 1800 (2013) with over 360 teams from industry, academia, and education [7].

Two of the accepted papers used the 'Rover' challenge problem as example: the paper "Engineering a Rover Language in GEMOC Studio & MontiCore" by Thomas Degueule, Tanja Mayerhofer and Andreas Wortmann compared language design using a 'modelware' tool (GEMOC) and a 'grammarware' tool (MontiCore). The paper "A Scenario-based MDE process for Developing Reactive Systems: A Cleaning Robot Example" by Joel Greenyer, Daniel Gritzner, Jianwei Shi and Eric Wete illustrated the use and utility of scenario-based modeling.

Another pair of papers was devoted to identifying promising new research problems. The paper "Modelling as a Service: A Survey of Existing Tools" by Saheed Popoola, Jeffrey Carver and Jeff Gray presented a first classification of web-based modeling tools and the paper "Challenges and Research Directions for Successfully Applying MDE Tools in Practice" by Francis Bordeleau, Grischa Liebel, Alexander Raschke, Gerald Stieglbauer and Matthias Tichy focussed on how best to integrate MDE tools into industrial practice.

Also, two papers from the Workshop on Human Factors in Modeling were presented: "Investigating the Effects of Integrating Handcrafted Code in Model-Driven Engineering" by Tim Bolender, Bernhard Rumpe and Andreas Wortmann, and "Visual Variables in UML: a First Empirical Assessment" by Yosser El Ahmar, Xavier Le Pallec and Sébastien Gérard. Both of these papers emphasized the need for more empirical studies, albeit on different topics.

Finally, demos of a tool for scenario modeling (ScenarioTools) and an Eclipse plugin for collaborative modeling using the ReMoDD model repository were given.

IV. Discussion and results

Overall, the different parts of the workshop were attended by about 30 people, Most had academic affiliations, but some representatives from industry were present as well. Discussion was lively, continued past the scheduled end of the workshop, and focussed mostly on the following topics:

1) Challenge problems: Two challenge problems had been defined by the workshop organizers to facilitate comparison of tools. The problems were phrased in very general terms to allow for the participation of a broad set of MDE tools that leverage models for different purposes. The keynote had encouraged the use of challenges and contests and shown several successful examples. In the 1995, the 'Production Cell' problem had allowed the comparison of different formal methods [8]. On the other hand, the effort required to define suitable problems was acknowledged. Overall, the use of challenge problems was considered worthwhile and the formulation of, e.g., a 'rover contest', in which MDE tools are to be used to develop software for a rover to accomplish some task, was suggested for next year.

2) Systems engineering and integration: The industry participants noted that modeling is extensively used in systems engineering, where it supports the development of the entire product and not just its software. Due to the many different kinds of models and tools used, integration of the relevant information contained in different models constitutes a major challenge. It was noted that the 'Open Services for Lifecycle Collaboration (OSLC)' effort aims at facilitating this kind of large-scale, product-wide integration and helping organizations transition from 'document-centric' to 'model-centric' production processes that are organized around linked data and model repositories [9]. Despite OSLC's use of open standards and technology such as the Resource Description Framework (RDF), linked data, representational state transfer (REST), and HTTP and open source tools such as Eclipse Lyo and OSLC4Net, there appears to be little interest and use in academic research and teaching. As an interesting aside, efforts to address interoperability challenges using modeling were made in, e.g., [10], [11].

3) Digital twin and digital thread: The concepts of 'Digital Twin' and 'Digital Thread' were first introduced by the military aircraft industry, but are gaining interest in other domains such as digital and smart manufacturing and 'Industrie 4.0'. In short, the digital twin refers to a digital model of a product that allows, e.g., effective assessment of the product's current and future performance and expected lifetime (e.g., preventative maintenance) as well as optimization and improvements in product design and operating conditions. The digital twin is thus relevant not only for defect prediction and avoidance, but also to systems engineering and lifecycle management. The digital thread, however, refers to the ability to integrate relevant information from different, traditionally disjoint sources to allow for the "right information to be available in the right place at the right time" [12]. Realization and use of both concepts could benefit from the expertise in the modeling community on, e.g., domain-specific modeling; monitoring, animation, simulation; 'models at runtime'; and support for different views. However, they also require solutions to the model integration problem already mentioned above.

4) Human factors: The presentations on human factors were very well received and triggered comments about the need to improve the usability of MDE tools and the current scarcity of empirical studies investigating usability or the impact of modeling.

V. Conclusion

The workshop provided a forum for the exchange of ideas and identification of challenges and opportunities related to the development and use of MDE tools. The use of challenge problems was recommended, together with an increased focus on systems engineering, interoperability and integration (e.g., in the context of OSLC and the digital twin and digital thread concepts), usability and empirical studies.

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