

9th International Workshop on Models@run.time

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Abstract. The Models@run.time workshop (MRT) series offers a discussion forum for the rising need to leverage modeling techniques at runtime for the software of the future. MRT has become a mature research topic, which is, e.g., reflected in separate sessions at conferences covering MRT approaches only. The target venues of the workshops audience changed from workshops to conferences. Hence, new topics in the area of MRT need to be identified, which are not yet mature enough for conferences. In consequence, the main goal of this edition was to reflect on the past decade of the workshop's history and to identify new future directions for the workshop.

1 Workshop Overview

According to Rothenberg et al. [3], models are an *abstraction* of a given *aspect* of a system for a given *purpose*. The idea of the models@run.time paradigm is to leverage these features of models during execution and in different contexts like those associated with the needs of self-adaptation and autonomous properties. Models are used to represent the running system to support reasoning. The argument is that by reasoning on models the complexity can be reduced to a tractable degree [2].

The workshops aims for the last 9 years were to understand the current and future potential uses of models@run.time as well as to investigate their foundations. The MRT-workshop series has proven to be an effective discussion podium for the intersection of modeling techniques from the model-driven engineering and also the software engineering perspectives and the self-adaptive/autonomous systems community [1]. A key interest of the workshop was and is to initiate new and foster existing collaborations between these communities. This year's focus was to reflect on the last decade of MRT research and to identify the future directions of the workshop tackling the change from a young research area to a mature one.

2 Workshop Description

This year, the workshop opened with a session reflecting upon the outcomes of the Dagstuhl seminar on the topic in December 2011. For this, a general

overview on the foundations worked out at that seminar was given and the chapters of the book, which resulted from the seminar, have been presented. In addition to the presentation of the results from the Dagstuhl seminar, we did a 1-minute madness session at the beginning, where each participants had 1 minute to introduce himself and to argument for his interest in models@run.time as well as his envisioned goals for the workshop. Both activities allowed participants new to the MRT workshop, to understand the topics and community, which lead to very good, self-engaged discussions among all workshop participants.

The second and third session comprised paper presentations and discussions. The first of these sessions focused on concrete techniques of MRT covering two techniques to monitor cloud services and the application of MRT in the area of dynamic software product lines. The second session focused on foundations of MRT. First, the distinction between design time and runtime models has been questioned, by looking into the evolution of self-adaptive systems. Here, design time models become runtime models, as they reflect a system state of an older version. Second, distributed MRT have been discussed along with a classification of different types of distributed systems utilizing MRT. Especially these two talks resulted in very long debates at the workshop and by this showed up to be of high interest for the future of the workshop.

The last session covered a discussion with all participants about the future of the workshop. The following topics have been identified by the participants of the workshop to be of their interest in the future of MRT. In addition, each topic has been ranked by the participants, who could vote for two topics. The number of votes for each topic are shown in braces after each topic.

- The view concept in MRT or modularity of MRT in general (2)
- The causal connection between the system and the runtime model (1)
 - A transaction concept for this causal connection, especially its timing, roll-back ability and data-consistency (2)
- Distributed MRT, i.e., multiple, interfering MRT systems (6)
- Multi-paradigm Model at runtime (2)
- MRT for Business Processes (1)
- Industry and use cases (4)
- Compelling applications (0)
- A shared example or platform for joint research (2)
- Performance of design (0)

In total 20 votes were given by the participants. Distributed MRT clearly showed up to be the most interesting topic by having 6 votes. This might be due to the talk in the second-last session, which focused on exactly this topic, which has rarely been investigated in the past. The question on how to handle multiple, independent systems, which leverage on MRT, but potentially interfere with each other, is not yet solved. It actually crosses the boundary between self-adaptive systems, which have been a major focus of MRT research in the last 10 years, and self-organizing systems (e.g., agents).

Industrial participation and novel use cases have been ranked second with 5 votes, which shows the maturity gained by MRT research, which now is more and more about applying the concepts and foundations developed in the past.

Modularity, the causal connection and especially a transaction concept for it, Multi-paradigm MRT and a shared example or platform were ranked third by the participants. This shows the often observed crosscutting nature of MRT in terms of research areas. In particular modularity (e.g., aspect- and role-oriented programming) and multi-paradigm modeling are research areas on their own. The wish for a common example or platform to compare approaches is much in-line with the wish for industrial participation and novel uses cases.

Besides topics of interest, the participants also voted for new types of papers and activities for the workshop. These were:

- Experience papers
- Transfer papers (from research to industry)
- Demos
- Collaboration sessions with lightning talks about possible future joint papers

Again, the raised need for experience and transfer papers shows that research on MRT has evolved to a degree where concrete systems are built, whereof some are even ready for industrial usage. A major concern with regard to transferring research results to industry discussed in the workshop is about validation and verification of the approaches' safety. Therefore, this topic will need more research efforts.

3 Workshop Structure and Papers

The workshop was held during the full day, starting on the morning at 9 a.m. and ending in the evening at 5:30 p.m. In the morning, a summary of the Dagstuhl seminar's results was given to introduce the participants to the topic. The two sessions around lunch covered paper presentations. We had 2 types of papers: 3 long papers and 2 short papers showcasing a vision or position. In order to foster lively discussions, each paper had a second reader, who prepare questions in advance to the workshop. Nevertheless, the participants made a lively discussion for every paper by themselves.

The presentations for long papers were structured as follows: a 25 minute presentation by an author, summarizing the key points in the paper and a 10 minute discussion, which was initiated by the second reader of the paper.

All short paper presentations comprised a 15-minute presentation, followed by a 10-minute discussion including the second reader to start the discussions.

The following are the papers accepted in this edition of the workshop which are presented in the present proceedings.

- Fatih Gey, Dimitri Van Landuyt, Stefan Walraven and Wouter Joosen: *Feature Models at Run Time: Feature Middleware for Multi-tenant SaaS applications* (long paper)
- Priscila Cedillo, Javier Gonzalez-Huerta, Silvia Abrahao and Emilio Insfran: *Towards Monitoring Cloud Services using Models@run.time* (long paper)
- Sebastian Wtzoldt and Holger Giese: *Classifying Distributed Self-* Systems Based on Runtime Models and Their Coupling* (long paper)

- Robert Heinrich, Eric Schmieders, Reiner Jung, Kiana Rostami, Andreas Metzger, Wilhelm Hasselbring, Ralf Reussner and Klaus Pohl: *Integrating Run-time Observations and Design Component Models for Cloud System Analysis* (short paper)
- Thomas Vogel and Holger Giese: On Unifying Development Models and Runtime Models (short paper)

4 Program Committee

The program committee members of this years edition are listed as follows. We reiterate our thanks to these colleagues for their effort to support the workshop.

Christoph Bockisch,
Walter Cazzola,
Peter J. Clarke,
Antonio Filieri,
Martin Gogolla,
Jean-Marc Jezequel,
Hausi A. Muller,
Bernhard Rumpe,
Hui Song,
Mario Trapp,
Andreas Winter,

Thais Vasconcelos Batista,
Franck Chauvel,
Fabio Costa,
Holger Giese,
Gang Huang,
Sam Malek,
Rui Silva Moreira,
Arnor Solberg,
Matthias Tichy,
Thomas Vogel,
Uwe Zdun.

References

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3. Jeff Rothenberg, Lawrence E. Widman, Kenneth A. Loparo, and Norman R. Nielsen. The Nature of Modeling. In *Artificial Intelligence, Simulation and Modeling*, pages 75–92. John Wiley & Sons, 1989.