

Preface to the 8th International Workshop on Multi-Level Modelling (MULTI 2021)

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Multi-level modeling (MLM) represents a significant extension to the traditional two-level object-oriented paradigm with the potential to dramatically improve upon the utility, reliability and complexity of models. Different from conventional approaches, they allow for an arbitrary number of classification levels and introduce other concepts that foster expressiveness, reuse and adaptability. A key aspect of the MLM paradigm is the use of entities that are simultaneously types and instances, a feature which has consequences for conceptual modeling, language engineering and for the development of model-based software systems.

Research into MLM has increased significantly over the last few years, manifesting itself in lively debates in the literature, seven previously held international workshops (MULTI 2014–2020), a published journal theme issue (SoSyM), a special issue for the EMISA journal, a Dagstuhl Seminar (in 2017) and an increasing number of tools and languages, including DMLA, DPF workbench, GModel, Melanee, MetaDepth, MultiEcore, Nivel, OMME, ML2 and XModeller. Successful applications of MLM have been reported in domains such as software engineering, process modeling, enterprise modeling and industrial engineering.

The objectives of the MULTI series is to provide a forum for the MLM community to address the foundations of MLM approaches and support future modelers through better modeling languages, tools, methods and guidelines. The workshop encouraged the presentation of case studies and tool demonstrations in addition to submissions on new concepts, implementation approaches, formalisms, controversial positions, and requirements for evaluation criteria. Contributions in the area of tool building, multi-level modeling applications, canonical examples and educational material were equally welcome. Furthermore, we have organized a challenge to encourage communication and collaboration between research groups.

The workshop received multiple submissions of high quality, one of them was a response to the previously mentioned challenge – the Collaborative Comparison Challenge. Research groups were asked to employ their multi-level modeling technique to represent a domain that was described in natural language. Once they completed the modeling task, two research groups had to explain their solutions to each other and come to a shared understanding of the commonalities and differences of their solutions. The main

goal of the challenge was to create a deeper understanding of the underlying mechanisms used by different schools of MLM. A paper describing the challenge is included in these proceedings.

The contributions to the workshop were organized into the following main sessions:

Fundamental Advances:

- *A Note on Properties in Multi-Level Modeling* by João Paulo Almeida, Victorio Albani Carvalho, Claudenir Fonseca and Giancarlo Guizzardi.
- *Associations in Multi-Level-Modelling: Motivation, Conceptualization, Modeling Guidelines, and Implications for Model Management* by Daniel Toepel.
- *A General Methodology for Internalising Multi-Level Model Typing* by Harald Koenig and Uwe Wolter.

Methods and Perspectives:

- *Prolegomena of a Multi-Level Modeling Method* by Ulrich Frank.
- *Towards an Empirical Perspective on Multi-Level Modeling and a Comparative Assessment to Conventional Meta Modeling* by Sybren de Kinderen, Monika Kaczmarek-Heß and Kristina Rosenthal.
- *Unifying multi-level modeling: A position paper* by HManfred Jeusfeld and Ulrich Frank.

Use cases of MLM:

- *Towards Multi-level Modeling of Just-in-Time Adaptive Interventions (JITAs) in Mobile Health* by Sebastian Gruber, Bernd Neumayr, Michael Schreffl and Josef Niebauer.
- *Leveraging Multi-Level Modeling for Multi-Domain Quality Assessment* by Maria Teresa Rossi, Martina Dal Molin, Ludovico Iovino, Martina De Sanctis and Manuel Wimmer.

Collaborative Comparison Challenge:

- *Melanee and DMLA – A Contribution to the MULTI 2021 Collaborative Comparison Challenge* by Sándor Bácsi, Arne Lange, Thomas Kuehne, Gergely Mezei and Colin Atkinson.

Keynote:

- *Multi-Level Modelling for Model-Driven Engineering* by Juan de Lara.

Acknowledgement We would like to thank the MODELS 2021 organization for giving us the opportunity to organize this workshop. Many thanks to all those who submitted papers, and particularly to the presenters of the accepted papers. We also warmly thank the many participants who contributed to the open discussions with their comments and experience. Last but not least, our thanks go to the reviewers and the members of the Program Committee and Steering Committee, for their timely and accurate reviews and for their help in choosing and suggestions for improving the selected papers.

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- Thomas Kühne (Victoria University of Wellington, NZ)
- Juan de Lara (Universidad Autónoma de Madrid, Spain)

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