Preface

MDE4IoT

By 2020, Gartner envisions that 21 billion Internet-of-Things (IoT) endpoints will be in use, representing great business opportunities. However, complex challenges remain to be solved to efficiently exploit the full potential of the rapidly growing IoT infrastructure. In particular, the next generation IoT systems need to perform distributed processing and coordinated behavior across IoT, edge and cloud infrastructures, manage the closed loop from sensing to actuation, and cope with vast heterogeneity, scalability and dynamicity of IoT systems and their environments.

On the one hand, Model-driven engineering (MDE) techniques can support the design, deployment, and operation of IoT systems. For instance, to manage abstractions in IoT systems definition and to provide means to automate some of the development and operation activities of IoT systems, e.g., domain specific modeling languages can provide a way to represent different aspects of systems leveraging a heterogeneous software and hardware IoT infrastructure and to generate part of the software to be deployed on it. On the other hand, the application of modeling techniques in the IoT poses new challenges for the MDE community.

The International Workshop on Model-Driven Engineering for the Internet of Things (MDE4IoT) is one of the most accurate venues to offer researchers a dedicated forum to discuss fundamental as well as applied research that attempts to exploit model-driven techniques in the IoT domain. This third edition has been held as a full-day event of the ACM/IEEE 22$^{\text{nd}}$ International Conference on Model Driven Engineering Languages and Systems (MODELS) on the September 15$^{\text{th}}$, 2019 in Munich, Germany. Seven contributions were accepted after a rigorous review process, addressing several challenges such as validation and verification of IoT applications and dedicated modeling language support for IoT. The workshop's program consisted of the accepted papers presentation and of a keynote given by Benoit Combemale.

We would like to thank the MODELS 2019 organization for giving us the opportunity to organize this workshop, especially to the workshop chairs Michel Chaudron (Chalmers and Gothenburg University, Sweden) and Jörg Kienzle (McGill University, Canada), who were always very helpful and supportive. Many thanks to all those that submitted papers, and particularly to the presenters of the accepted papers. We also warmly thank Benoit

Combemale for providing a very inspiring keynote talk and 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, for their timely and accurate reviews and for their help in choosing and suggestions for improving the selected papers.

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ModComp

The design of modern software systems requires support capable of properly dealing with their ever-increasing complexity. In order to account for such a complexity, the whole software engineering process needs to be rethought and, in particular, the traditional division among development phases to be revisited, hence moving some activities from design time to deployment and runtime. Model-Driven Engineering (MDE) and Component-Based Software Engineering (CBSE) can be considered as two orthogonal ways of reducing development complexity: the former shifts the focus of application development from source code to models in order to bring system reasoning closer to domain-specific concepts; the latter aims to organize software into encapsulated independent components with well-defined interfaces, from which complex applications can be built and incrementally enhanced.

When exploiting these development approaches, numerous different modelling notations and consequently several software models are involved during the software life cycle. On the one hand, effectively dealing with all the involved models and heterogeneous modelling notations that describe software systems needs to bring component-based principles at the level of the software model landscape hence supporting, e.g., the specification of model interdependencies, and their retrieval, as well as enabling interoperability between the different notations used for specifying the software. On the other hand, MDE techniques must become part of the CBSE process to enable the effective reuse of third-party software entities and their integration as well as, generally, to boost automation in the development process.

An effective interplay of CBSE and MDE approaches could help in handling the intricacy of modern software systems and thus reducing costs and risks by: (i) enabling efficient modelling and analysis of extra-functional properties, (ii) improving reusability through the definition and implementation of components loosely coupled into assemblies, (iii) providing automation where applicable (and favourable) in the development process. In the last fifteen years, such a cooperation has been recognized as extremely promising; tools and frameworks have been developed for supporting this kind of integrated development process. Nevertheless, when exploiting interplay of MDE and CBSE, clashes arise due to misalignments in the related terminology but also, and more importantly, due to differences in some of their basic assumptions and focal points.

The goal of the workshop on Interplay of Model-Driven and Component-Based Software Engineering 2019 (ModComp'19) was to gather researchers

and practitioners to share opinions, propose solutions to open challenges and generally explore the frontiers of collaboration between MDE and CBSE. ModComp'19 aimed at attracting contributions related to the subject at different levels, from modelling to analysis, from componentization to composition, from consistency to versioning; foundational contributions as well as concrete application experiments were sought.

The workshop was co-located with ACM/IEEE 22nd International Conference on Model Driven Engineering Languages & Systems, and represented a forum for practitioners and researchers. We would like to thank the MODELS 2019 organization for giving us the opportunity to organize this workshop, especially to the workshop chairs Michel Chaudron (Chalmers and Gothenburg University, Sweden) and Jrg Kienzle (McGill University, Canada), who were always very helpful and supportive. Three papers were selected for inclusion in the proceedings and would like to thank the authors – without them the workshop simply would not have taken place – and the program committee for their hard and precious work. We greatly thank Tullio Vardanega for holding a mind-opening keynote talk and all the participants who contributed to the open discussions with their comments and experience.

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