

Preface to the 1st International Workshop on Sustainability and Modeling (SusMod) 2024

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Overview

The perception of the value of modern engineered systems is changing. In addition to their functional and extra-functional properties, nowadays' systems are also evaluated by their sustainability properties [3]. It is fully expected that, in the decade ahead of us, users and organizations will reward and demand efforts toward sustainability. While this expectation is relatively straightforward, it is less clear how these sustainability ambitions should be supported. The multi-systemic and stratified nature of sustainability [6] poses challenges in designing sustainable systems and analyzing sustainability properties [5]. Finding trade-offs between economic, environmental, societal, and technological aspects of sustainability is a wicked problem and calls for advanced modeling methods [1].

Model-driven engineering (MDE) excels in taming the complexity of convoluted problems—of which sustainability is a prime example. Through the mechanism of abstraction, modeling methods aid stakeholders in articulating their sustainability-related goals efficiently [4]. Explicit models of sustainability [2] support formal reasoning to uncover trade-offs among often contradicting sustainability goals. Advanced MDE techniques, such as collaborative and blended modeling, foster participatory modeling methods to externalize sustainability ambitions. It is urgent to investigate how MDE can be used in engineering more sustainable systems and how MDE itself can become sustainable.

This workshop aimed to bring together researchers with MDE and sustainability backgrounds and researchers and practitioners from other domains with concerns, challenges, or contributions about sustainability that a model-driven approach might address. The workshop was intended for a broad spectrum of professionals working on various aspects of sustainability *by* MDE or sustainability *of* MDE.

Accepted papers and summaries

We received five submissions and accepted four for presentation.

- *Waste Management Through Digital Twins and Business Process Modeling* – by Amleto Di Salle, Arianna Fedeli, Ludovico Iovino, Leonardo Mariani, Daniela Micucci, Luciana Rebelo, and Maria Teresa Rossi. This paper presents a vision and preliminary proposal of a model-driven approach to address the automated localization and identification of abandoned waste. The solution used digital process twins to enable the specification of cost-effective and self-adaptive procedures fed by real-world data.
- *Cross-Detection of Mobile-specific Energy Hotspots: MBSE to the Rescue* – by Léa Brunshwig and Olivier Le Goaër. This paper proposes an MBSE-based approach for the automated detection of mobile-specific energy code smells in Android and iOS mobile

apps. The paper presents two meta-models and the first steps towards code generation for the integration of app energy smell detection mechanisms into a static analysis tool.

- *Model-Driven Software Product Line Engineering of AI-Based Applications for Achieving Sustainable Development Goals: Vision Paper* – by Tiago Sousa, Benoît Ries and Nicolas Guelfi. This paper proposes an integrated approach that combines MDE with Software Product Line Engineering (SPLE) to address the engineering of AI-based applications. This approach aims to provide automated derivation of flexible and reusable AI architectures tailored to specific SDG contexts, thereby reducing the development time of AI-based solutions for sustainability efforts.
- *Breaking Down Barriers: Building Sustainable Microservices Architectures with Model-Driven Engineering* – Gabriel Morais, Mehdi Adda, and Dominik Bork. Albeit their wide and successful adoption, microservice architectures fall short in naturally achieving sustainability goals. In this paper, the authors initiate an open discussion on the root causes of this situation and relate exemplarily the foundational microservices tenets of independence and autonomy to the challenges of sustainable microservice architectures. Eventually, the paper shows how MDE can help mitigate some of these challenges.

Organization

Organizing Committee

- Istvan David, McMaster University, Canada
- Dominik Bork, TU Wien, Austria
- Judith Michael, RWTH Aachen University, Germany

Program Committee We thank the members of the program committee who contributed to the workshop's success through their timely and insightful reviews.

- Ruzanna Chitchyan, University of Bristol, UK
- Rik Eshuis, TU Eindhoven, the Netherlands
- Sergio España, Utrecht University, the Netherlands
- Iris Groher, JKU Linz, Austria
- John Grundy, Monash University, Australia
- Giancarlo Guizzardi, University of Twente, the Netherlands
- Alexandra Mazak-Huemer, Austrian Council for Research and Technology Development, Austria
- Elisa Yumi Nakagawa, University of Sao Paulo, Brazil
- Henderik Proper, TU Wien, Austria
- Riccardo Rubei, Università Degli Studi Dell'Aquila, Italy
- Ivan Ruchkin, University of Florida
- June Sallou, TU Delft, the Netherlands
- Yves Wautelet, KU Leuven, Belgium

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