Introduction to ACES^{MB} 2015
– Model-based Architecting of Cyber-physical and Embedded Systems –

Iulia Dragomir*, Susanne Graf†, Gabor Karsai‡, Florian Noyrit§, Iulian Ober¶
* Aalto University, Finland. iulia.dragomir@aalto.fi
† CNRS-VERIMAG, France. susanne.graf@imag.fr
‡ ISIS, Vanderbilt University, USA. gabor.karsai@vanderbilt.edu
§ CEA LIST, France. florian.noyrit@cea.fr
¶ IRIT-University of Toulouse, France. iulian.ober@irit.fr

***Abstract*—The 8th ACES^{MB} workshop took place on September 28, 2015 at the 2015 ACM/IEEE 18th International Conference on Model Driven Engineering Languages and Systems (MoDELS). The workshop brought together researchers and practitioners who work in the area of cyber-physical systems and apply model-based architecting techniques and tools. The workshop presented novel approaches, both theoretical and practical, as well as early results of their applications.**

Introduction

The design of embedded and cyber-physical systems with real-time and other critical constraints raises distinctive problems throughout the development process, in particular from system specifications to obtaining correct implementations. On the high-level side, system design is much more an art than a systematic activity, while on the low-level side design teams have to make specific architectural choices and handle non-functional constraints like real-time deadlines, energy consumption, etc., as early as possible in order to streamline the system development process. Model-based engineering techniques have now been established as the norm in industry since they are a major factor for further gains in productivity, quality and time-to-market such complex systems. They provide means to capture dedicated architectural and non-functional information in precise (and even formal) domain-specific models. They support compositional design of systems, in which functional aspects (platform independent) are separated from architectural and non-functional aspects (platform specific) until the integration step, etc. Many of the mentioned topics are emerging research areas, where efforts and results are still expected.

The 8th workshop on *Model-based architecting of cyber-physical and embedded systems*[1] brought together researchers and practitioners interested in model-based engineering to share and explore innovative ideas and experiences that contribute to better architecting embedded and cyber-physical systems, with a focus on approaches yielding efficient and provably correct designs.

[1] http://www.irit.fr/ACES-MB

Workshop contributions

The interest of the research and practice community for the ACES^{MB} workshop is attested by the steady number of attendees – around 20 people – at each edition. This year's program focused on novel approaches for the correct design of cyber-physical systems, both at the theoretical and the practical level. The selected talks ranged through experiences and challenges in industrial model-based engineering, incorporating formal methods in model-based systems engineering, and tools supporting design and analysis techniques. These contributions consist of an invited talk and 3 paper presentations detailed hereafter.

Invited talk. The keynote was given by Dr. Tao Yue from the Simula Research Laboratory, Norway, who discussed her experiences and insights gained from investigating the application of model-based engineering in different industrial domains (i.e., Communication, Oil&Gas, Maritime, Automated Material Handling and Geo Sports), for addressing different industrial challenges (i.e., Requirements, Architecture and Design, Testing, Product Line), and using diverse model-based engineering technologies.

Paper talks. 3 full papers had been accepted for presentation at the workshop, out of 4 full papers and 4 short papers, each being peer-reviewed by three independent reviewers. A synopsis of each presentation is given below.

I. Ruchkin et al. discussed dependency loops in the analysis of cyber-physical system designs. The authors defined the concept of dependency loops in the analysis process, as well as a spectrum of various relevant properties of the workflow, ranging from strong convergence to strong divergence. The authors also made proposals for resolving the analysis loops: iteration, constraint solving, and genetic algorithms.

J.O. Blech et al. introduced the concept of behavioral types for space-aware systems as a means to facilitate the development, commissioning, maintenance, and refactoring of cyber-physical systems with spatial characteristics. The approach is intended to be used in industrial automation, for which a formalization and analysis approach were presented.

V. Aravantinos et al. presented AUTOFOCUS3: a toolsuite for the design and analysis of cyber-physical systems. The

toolchain is comprehensive, as it covers a broad area of the engineering workflow (from requirements to design to synthesis to analysis, including safety analysis) and is well supported by tools. The authors paid particular attention to the details of the tool integration techniques used.

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