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Editorial

Formal Aspects of Component Software (FACS'09)

This issue contains extended versions of selected best papers from the 6th International Workshop on Formal Aspects of Component Software (FACS'09), which was held in November 2009 in Eindhoven, The Netherlands.

Component-based software has emerged as a promising paradigm to deal with the ever-increasing need for mastering the complexity of systems, for enabling evolution and reuse, and for bringing sound production and engineering standards into software engineering. However, many issues in component-based software development remain open and pose challenging research questions. On the other hand, formal methods consist of mathematically based techniques for the specification, development, and verification of software and hardware systems. They have shown their great utility for setting up the formal foundations of component software and working out challenging issues such as mathematical models for components, their composition and adaptation, or rigorous approaches to verification, deployment, testing and certification.

The objective of the FACS workshops is to bring together researchers in the areas of component software and formal methods to promote a deep understanding of component-based software and its applications. Topics include, but are not limited to, the following:

- formal models for software components and component interaction
- design and verification methods for component software
- component composition and deployment: models, calculi, languages
- component testing, re-engineering and reuse
- specification of extra-functional properties in component software
- certification of components and software architectures
- component software versus object orientation, multi-agent systems, and aspect oriented development
- components for real-time, safety-critical, secure, and/or embedded systems
- standard models for software components (e.g., Fractal, GCM, etc.)
- industrial or experience reports, and case studies in component software
- partial behavior models for software components
- updating and reconfiguration of component architectures
- component system evolution and maintenance
- formal methods and modeling languages for components
- autonomic components and self-managed applications
- formal/rigorous approaches to software adaptation and self-adaptive systems
- formal aspects of Web services and business processes
- component-based Web services and service-oriented architectures
- quality-of-service issues in Web services, multi-agent systems, and component-based systems

There were 24 papers submitted to FACS 2009, of which 12 were accepted and published in the ENTCS proceedings. The submissions received at least three reviews. An initial selection for the special issue from the 12 accepted papers was made by the Program Committee, and their authors were invited to submit an extended version to this special issue. These extended papers went through an anonymous peer review process, and the revised versions of the three papers finally accepted are included in this special issue. We believe that the papers perfectly demonstrate the range of key insights on different formal aspects of component software provided by the FACS workshops.

The first contribution, *Formal Modeling of Evolving Self-Adaptive Systems*, presents a formal model for developing and modeling self-adaptive evolving systems based on policies enforced by autonomous managers, governing managed actors. A combination of an algebraic formalism and an actor-based model is provided as the specification approach, using an operational semantics, including suitable notions of bisimulation. The latter is used to show that the overall behavior of a system is preserved by substituting a manager by an equivalent one.

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To attack the issue of complexity when analyzing composability, *Partition Refinement of Component Interaction Automata* investigates the relation of partition refinement, synchronization cliques, and weak bisimulation, with the goal of making state-space reduction through partition refinement aware of the existence of synchronization cliques. Furthermore, other attributes of Component Interaction Automata specifications are studied, providing additional cues to forecast the possible outcome of the partition refinement process.

Building on software adaptation principles to support reconfiguration capabilities to black-box components, the third contribution, *Structural Reconfiguration of Components under Behavioral Adaptation*, introduces a framework unifying behavioral adaptation and structural reconfiguration of components and applies it to the static detection of reconfigurability. Furthermore, different notions of reconfiguration – motivated from practical applications – including relevant properties are introduced.

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