



Editorial

Marco Carbone¹, Thomas Hildebrandt¹, Joachim Parrow² and Matthias Weidlich³

¹ IT University of Copenhagen, Rued Langgaards vej 7, 2300 Copenhagen, Denmark

² Uppsala University, Box 337, 751 05 Uppsala, Sweden

³ Humboldt-Universität zu Berlin, Unter den Linden 6, 10099 Berlin, Germany

Large software systems become more and more communication-centered and formal methods play a key role in the design and analysis of them. They can help us to define unambiguous semantics for the languages that underpin existing infrastructures, facilitate consistency checking of interactions, empower dynamic discovery, and drive the analysis of security and performance properties of applications.

This Special Issue on Web Services, Formal Methods, and Behavioral Types comprises research papers that target the formal foundations of communication-centered systems. We are pleased to present a collection of papers extended and revised from the 11th International Workshop on Web Services and Formal Methods (WS-FM 2014) and the Third International Workshop on Behavioral Types (BEAT 2014). WS-FM 2014 was held in September 2014 in Eindhoven, The Netherlands, co-located with the 12th International Conference on Business Process Management (BPM 2014). BEAT 2014 was affiliated with the 25th International Conference on Concurrency Theory (CONCUR 2014) and took place in Rome, Italy, in September 2014. The WS-FM 2014 proceedings have been published as part of the Volume 9421 in Springer's Lecture Notes in Computer Science (LNCS). The BEAT 2014 proceedings appeared as Volume 162 in the Electronic Proceedings in Theoretical Computer Science (EPTCS).

A total of eight papers that had been presented at WS-FM 2014 and BEAT 2014 were invited to submit significantly extended and revised versions for inclusion in this special issue. Each submission was reviewed by at least three reviewers and a final selection of seven accepted papers was made for this collection. These papers cover diverse aspects of formal methods in the field of communication-centered systems:

Event-Based Runtime Adaptation in Communication-Centric Systems by Cinzia Di Giusto and Jorge A. Pérez presents a new event-based model of session-based concurrency with mechanisms for run-time adaptation. The presented type system guarantees absence of run-time communication errors and consistency. It also ensures that update actions do not disrupt already established session protocols.

ASM-based formal design of an adaptivity component in a Cloud system by Paolo Arcaini, Roxana-Maria Holom, and Elvinia Riccobene provides a rigorous engineering process for distributed systems, based on the Abstract State Machines (ASM) formal method and model refinement. The process is supported by a number of validation and verification activities to guarantee consistency, correctness, and reliability properties.

On the Expressive Power of Behavioral Profiles by Artem Polyvyanyy, Abel Armas, Marlon Dumas, and Luciano García-Bañuelos focuses on the expressiveness of relational abstractions of a system's behavior, captured by means of binary relations over a system's actions. The authors show that for systems that can be captured by a restricted class of Petri nets, i.e., unlabeled acyclic workflow net systems, behavioral profiles as one particular abstraction are expressive up to configuration equivalence. They further answer the long-standing question whether a specific notion of behavioral profiles allows for a complete characterization of regular language systems—they prove that such a set of behavioral relations does not exist. Hence, their work makes explicit the boundaries of system analysis based on relational abstractions of a system's behavior.

Formal Verification of Petri Nets with Name Creation and Management by Marco Montali and Andrey Rivkin explores the verification of systems that can be described by ν -Petri nets, a Petri net variant that supports name creation and management. Specifically, they focus on the verification of properties that are specified in first-order μ -calculus. Starting with the general undecidability of the respective verification problem, they show that for nets that satisfy different notions of boundedness, the problem becomes decidable. As such, their work lays the foundation for verification of a broad class of communication-centered systems, e.g. those that rely on dynamic binding of services.

Dynamic Role Authorization in Multiparty Conversations by Silvia Ghilezan, Svetlana Jaksic, Jovanka Pantovic, Jorge A. Pérez, and Hugo Torres Vieira is about systems implementing distributed protocols whose roles can be implemented by different locations according to an authorisation policy that changes dynamically, while the protocol is executed. Building on the theory of conversation types, this work provides a type systems for a variant of the π -calculus, which ensures that well-typed systems never reduce to errors, i.e., locations never use resources unless they are authorized.

Self-Adaptation and Secure Information Flow in Multiparty Communications by Ilaria Castellani, Mariangiola Dezani-Ciancaglini, and Jorge A. Pérez proposes a model for communication-based systems focussing on self-adaptation and security. Such a model is built on the theory of multiparty session types: a type systems guarantees that a well-typed system is correctly executed, preserving the system security.

Reversible client/server interactions by Franco Barbanera, Mariangiola Dezani and Ugo De'Liguoro studies a notion of compliance for composing clients and servers safely. Then, it is shown that the proposed notion of compliance is decidable, also when the protocol language is extended with other construct.

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