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Coordination Models and Languages

21st IFIP WG 6.1 International Conference, COORDINATION 2019
Held as Part of the 14th International Federated Conference
on Distributed Computing Techniques, DisCoTec 2019
Kongens Lyngby, Denmark, June 17–21, 2019
Proceedings

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Foreword

The 14th International Federated Conference on Distributed Computing Techniques (DisCoTec) took place in Kongens Lyngby, Denmark, during June 17–21, 2019. It was organized by the Department of Applied Mathematics and Computer Science at the Technical University of Denmark.

The DisCoTec series is one of the major events sponsored by the International Federation for Information Processing (IFIP). It comprised three conferences:

- COORDINATION, the IFIP WG 6.1 21st International Conference on Coordination Models and Languages
- DAIS, the IFIP WG 6.1 19th International Conference on Distributed Applications and Interoperable Systems
- FORTE, the IFIP WG 6.1 39th International Conference on Formal Techniques for Distributed Objects, Components and Systems

Together, these conferences cover a broad spectrum of distributed computing subjects, ranging from theoretical foundations and formal description techniques to systems research issues.

In addition to the individual sessions of each conference, the event included several plenary sessions that gathered attendants from the three conferences. This year, the general chair and the DisCoTec Steering Committee joined the three DisCoTec conferences in the selection and nomination of the plenary keynote speakers, whose number was accordingly increased from the traditional three to five. The five keynote speakers and the title of their talks are listed below:

- Prof. David Basin (ETH Zürich, Switzerland) – “Security Protocols: Model Checking Standards”
- Dr. Anne-Marie Kermarrec (Inria Rennes, France) – “Making Sense of Fast Big Data”
- Prof. Marta Kwiatkowska (University of Oxford, UK) – “Versatile Quantitative Modelling: Verification, Synthesis and Data Inference for Cyber-Physical Systems”
- Prof. Silvio Micali (MIT, USA) – “ALGORAND – The Distributed Ledger for the Borderless Economy”
- Prof. Martin Wirsing (LMU, Germany) – “Toward Formally Designing Collective Adaptive Systems”

As is traditional in DisCoTec, an additional joint session with the best papers from each conference was organized. The best papers were:

- “Representing Dependencies in Event Structures” by G. Michele Pinna (Coordination)
- “FOUGERE: User-Centric Location Privacy in Mobile Crowdsourcing Apps” by Lakhdar Meftah, Romain Rouvoy and Isabelle Chrisment (DAIS)

- “Psi-Calculi Revisited: Connectivity and Compositionality” by Johannes Åman Pohjola (FORTE)

Associated with the federated event were also two satellite events that took place:

- ICE, the 12th International Workshop on Interaction and Concurrency Experience
- DisCoRail, the First International Workshop on Distributed Computing in Future Railway Systems

I would like to thank the Program Committee chairs of the different events for their help and cooperation during the preparation of the conference, and the Steering Committee and Advisory Boards of DisCoTec and their conferences for their guidance and support. The organization of DisCoTec 2019 was only possible thanks to the dedicated work of the Organizing Committee, including Francisco “Kiko” Fernández Reyes and Francesco Tiezzi (publicity chairs), Maurice ter Beek, Valerio Schiavoni, and Andrea Vandin (workshop chairs), Ann-Cathrin Dunker (logistics and finances), as well as all the students and colleagues who volunteered their time to help. Finally, I would like to thank IFIP WG 6.1 for sponsoring this event, Springer’s *Lecture Notes in Computer Science* team for their support and sponsorship, EasyChair for providing the reviewing infrastructure, the Nordic IoT Hub for their sponsorship, and the Technical University of Denmark for providing meeting rooms and additional support.

June 2019

Alberto Lluch Lafuente

Preface

This volume contains the papers presented at COORDINATION 2019 held in Lyngby during June 17–21, 2019, as part of the federated DisCoTeC conference. Continuing a tradition started in 1996, the proceedings of COORDINATION 2019 are published in Springer’s *Lecture Notes in Computer Science* (LNCS). The conference’s main topics of interest are related to architectures, models, and languages for the specification and verification of coordination mechanisms of modern information systems. The separation of concerns between coordination and computation is key to cope with the complexity of modern systems which involve concurrency, distribution, mobility, adaptiveness, and reconfigurability. In fact, the identification of suitable coordination mechanisms allows us to cleanly separate local behavior from communication, increase modularity, simplify reasoning, and ultimately enhancing software development.

The Program Committee (PC) of COORDINATION 2019 consisted of 28 prominent researchers from 14 different countries. A total of 35 abstracts were submitted to the conference and 15 papers were selected among the 25 actual submissions. Each submission was assessed by at least three reviewers and this process was supplemented by an in-depth discussion phase during which the merits of all the papers were considered. The contributions published in this volume were selected according to their quality, originality, clarity, and relevance. The program also includes the invited talk of Prof. Martin Wirsing from the Ludwig-Maximilians-Universität München, Germany; a short abstract of Martin’s speech entitled “Machine-Learning Techniques for Systematically Engineering Adaptive Systems” is included in these proceedings.

Many people contributed to the success of COORDINATION 2019. We first of all would like to thank the authors for submitting high-quality papers. We also thank the PC members for their effort and time to read and discuss the papers. The reviews and the comments were very thorough and constructive. The use of external reviewers, whom we also thank, has been very limited to the few cases where specific expertise was required.

This edition of the conference has been enriched by the organization of a “tool track” and three special topics. We are grateful to Omar Inverso and Hugo Torres Vieira, who took care of identifying an innovative reviewing process whereby tool papers were selected according to the combination of an extended abstract and a short video demonstration, after which full papers were produced to be included in these proceedings. A special thank you also goes to the PC members who identified new topics aiming to connect coordination to other research areas. In particular we thank Laura Bocchi for suggesting the topic “From Coordination to Verification and Back,” Chiara Bodei and Hugo Torres Vieira for the topic “Exploring the Frontiers Between Coordination and Control Systems,” and Jean-Marie Jaquet for the topic “Coordination of Emerging Parallel/Distributed Architectures.” As a result of the efforts of these PC members, COORDINATION 2019 had one session dedicated to the emerging topics and two sessions dedicated to tool papers.

Furthermore, we wish to thank the Steering Committee of Coordination and the Steering Board of DisCoTeC for their support. The organization of COORDINATION 2019 would have been much harder without the assistance of the Organizing Committee; we are indeed very grateful to Alberto Lluch Lafuente, the general chair of DisCoTeC 2019, and to the publicity chairs, Kiko Fernández-Reyes and Francesco Tiezzi. It was also a pleasure to collaborate with the other members of the Scientific Committee: José Orlando Pereira, Jorge A. Pérez, Laura Ricci, and Nobuko Yoshida.

We are indebted to the conference attendees for keeping this research community lively and interactive, and ultimately ensuring the success of this conference series.

Emilio Tuosto thanks the GSSI for the financial support provided.

Finally, we thank the providers of the EasyChair conference management system, whose facilities greatly helped us run the review process and facilitate the preparation of the proceedings. With respect to the latter, we also warmly thank Anna Kramer, from Springer, for her help in producing the proceedings.

May 2019

Hanne Riis Nielson
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Machine-Learning Techniques for Systematically Engineering Adaptive Systems (Invited Talk)

Martin Wirsing

Ludwig-Maximilians-Universität München, München, Germany

Abstract. Many modern software systems are distributed and have to cope at runtime with dynamically changing environments and possibly also with new requirements [3]. Examples of such adaptive systems are autonomous robots, robot swarms and also socio-technical systems such as smart city or smart health care applications. The ASCENS project [1] has developed foundations for building adaptive systems in a way that combines software engineering approaches with the assurance about functional and non-functional properties provided by formal methods and the flexibility, low management overhead, and optimal utilisation of resources promised by autonomic, self-aware systems.

In this talk we review the engineering approach of ASCENS and by integrating machine learning techniques we complement it to “AISCENS.” The ASCENS life cycle for developing autonomous and adaptive systems is presented and it is illustrated with two complementary approaches: the development of a swarm of robots using “classical” software design methods [4] and the use of simulation-based online planning for autonomously adapting the behaviour of a robot [2]. In addition, a new machine learning approach for synthesizing agent policies from hard and soft requirements is presented and the performance-safety tradeoff for such requirements is discussed.

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