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Kirstin Peters · Tim A. C. Willemse (Eds.)

Formal Techniques for Distributed Objects, Components, and Systems

41st IFIP WG 6.1 International Conference, FORTE 2021
Held as Part of the 16th International Federated Conference on Distributed Computing Techniques, DisCoTec 2021
Valletta, Malta, June 14–18, 2021
Proceedings

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Editors
Kirstin Peters
TU Darmstadt
Darmstadt, Germany

Tim A. C. Willemse
Eindhoven University of Technology
Eindhoven, The Netherlands

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Foreword

The 16th International Federated Conference on Distributed Computing Techniques (DisCoTec 2021) took place during June 14–18, 2021. It was organized by the Department of Computer Science at the University of Malta, but was held online due to the abnormal circumstances worldwide affecting physical travel. The DisCoTec series is one of the major events sponsored by the International Federation for Information Processing (IFIP), the European Association for Programming Languages and Systems (EAPLS) and the Microservices Community. It comprises three conferences:

- *COORDINATION*, the IFIP WG 6.1 23rd International Conference on Coordination Models and Languages;
- *DAIS*, the IFIP WG 6.1 21st International Conference on Distributed Applications and Interoperable Systems;
- *FORTE*, the IFIP WG 6.1 41st 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. As is customary, the event also included several plenary sessions in addition to the individual sessions of each conference, which gathered attendants from the three conferences. These included joint invited speaker sessions and a joint session for the best papers from the three conferences. Associated with the federated event, four satellite events took place:

- *DisCoTec Tool*, a tutorial session promoting mature tools in the field of distributed computing;
- *ICE*, the 14th International Workshop on Interaction and Concurrency Experience;
- *FOCODILE*, the 2nd International Workshop on Foundations of Consensus and Distributed Ledgers;
- *REMV*, the 1st Robotics, Electronics, and Machine Vision Workshop.

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 its conferences for their guidance and support. The organization of DisCoTec 2021 was only possible thanks to the dedicated work of the Organizing Committee, including Caroline Caruana and Jasmine Xuereb (publicity chairs), Duncan Paul Attard and Christian Bartolo Burlo (workshop chairs), Lucienne Bugeja (logistics and finances), and all the students and colleagues who volunteered their time to help. I would also like to thank the invited speakers for their excellent talks. Finally, I would like to thank IFIP WG 6.1, EAPLS and the Microservices Community for sponsoring this event, Springer's Lecture Notes in Computer Science team for their support and sponsorship, EasyChair for providing the

reviewing framework, and the University of Malta for providing the support and infrastructure to host the event.

June 2021 Adrian Francalanza

Preface

This volume contains the papers presented at the 41st IFIP WG 6.1 International Conference on Formal Techniques for Distributed Objects, Components, and Systems (FORTE 2021), held as one of three main conferences of the 16th International Federated Conference on Distributed Computing Techniques (DisCoTec 2021), during June 14–18, 2021. The conference was hosted by the University of Malta but took place online due to the ongoing COVID-19 pandemic.

FORTE is a well-established forum for fundamental research on theory, models, tools, and applications for distributed systems, with special interest in

- Software quality, reliability, availability, and safety
- Security, privacy, and trust in distributed and/or communicating systems
- Service-oriented, ubiquitous, and cloud computing systems
- Component- and model-based design
- Object technology, modularity, and software adaptation
- Self-stabilization and self-healing/organizing
- Verification, validation, formal analysis, and testing of the above

The Program Committee received a total of 26 submissions, written by authors from 18 different countries. Of these, 13 papers were selected for inclusion in the scientific program. Each submission was reviewed by at least three Program Committee members with the help of 20 external reviewers in selected cases. The selection of accepted submissions was based on electronic discussions via the EasyChair conference management system.

As Program Committee, we actively contributed to the selection of the keynote speakers for DisCoTec 2021:

- Gilles Fedak, iExec, France
- Mira Mezini, Technical University of Darmstadt, Germany
- Alexandra Silva, University College London, UK

This year DisCoTec also included a tutorial session of four invited tutorials. This volume includes the following tutorial papers:

- Tutorial: Designing Distributed Software in mCRL2
- Better Late than Never or: Verifying Asynchronous Components at Runtime

We wish to thank all the authors of submitted papers, all the members of the Program Committee for their thorough evaluations of the submissions, and the external reviewers who assisted the evaluation process. We are also indebted to the Steering Committee of FORTE for their advice and suggestions. Last but not least, we thank the DisCoTec general chair, Adrian Francalanza, and his organization team for their hard,

effective work in providing an excellent environment for FORTE 2021 and all other conferences and workshops, in spite of the pandemic troubles.

June 2021

Kirstin Peters
Tim A. C. Willemse

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