Lecture Notes in Computer Science 7890

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Rocco De Nicola Christine Julien (Eds.)

Coordination Models and Languages

15th International Conference, COORDINATION 2013
Held as Part of the 8th International Federated Conference on Distributed Computing Techniques, DisCoTec 2013
Florence, Italy, June 3-5, 2013
Proceedings

Springer

Volume Editors

Rocco De Nicola
IMT - Institute for Advanced Studies Lucca
Piazza San Ponziano 6, 55100 Lucca, Italy
E-mail: rocco.denicola@imtlucca.it

Christine Julien
The University of Texas at Austin
One University Station, C5000, Austin, TX 78712, USA
E-mail: c.julien@mail.utexas.edu

ISSN 0302-9743 e-ISSN 1611-3349
ISBN 978-3-642-38492-9 e-ISBN 978-3-642-38493-6
DOI 10.1007/978-3-642-38493-6
Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2013938179

CR Subject Classification (1998): D.2, D.4, F.1, F.3, C.2, C.3

LNCS Sublibrary: SL 2 – Programming and Software Engineering

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Foreword

In 2013 the 8th International Federated Conference on Distributed Computing Techniques (DisCoTec) took place in Florence, Italy, during June 3–6. It was hosted and organised by Università di Firenze. The DisCoTec series of federated conferences, one of the major events sponsored by the International Federation for Information processing (IFIP), included three conferences:

- The 15th International Conference on Coordination Models and Languages (Coordination)
- The 13th IFIP International Conference on Distributed Applications and Interoperable Systems (DAIS)
- The 2013 IFIP Joint International Conference on Formal Techniques for Distributed Systems (33rd FORTE / 15th FMOODS)

Together, these conferences cover the complete spectrum of distributed computing subjects ranging from theoretical foundations to formal specification techniques to systems research issues.

Each of the first three days of the federated event began with a plenary speaker nominated by one of the conferences. The three invited speakers were: Tevfik Bultan, Department of Computer Science at the University of California, Santa Barbara, UCSB; Gian Pietro Picco, Department of Information Engineering and Computer Science at the University of Trento, Italy; and Roberto Baldoni, Department of Computer, Control and Management Engineering "Antonio Ruberti", Università degli Studi di Roma "La Sapienza", Italy. In addition, on the second day, there was a joint technical session consisting of one paper from each of the conferences. There were also three satellite events:

1. The 4th International Workshop on Interactions between Computer Science and Biology (CS2BIO) with keynote talks by Giuseppe Longo (ENS Paris, France) and Mario Rasetti (ISI Foundation, Italy)
2. The 6th Workshop on Interaction and Concurrency Experience (ICE) with keynote lectures by Davide Sangiorgi (Università di Bologna, Italy) and Damien Pous (ENS Lyon, France)
3. The 9th International Workshop on Automated Specification and Verification of Web Systems (WWV) with keynote talks by Gerhard Friedrich (Universität Klagenfurt, Austria) and François Taïani (Université de Rennes 1, France)

I believe that this program offered each participant an interesting and stimulating event. I would like to thank the Program Committee Chairs of each conference and workshop for their effort. Moreover, organizing DisCoTec 2013 was only possible thanks to the dedicated work of the Publicity Chair Francesco Tiezzi (IMT Lucca, Italy), the Workshop Chair Rosario Pugliese (Università

di Firenze, Italy), and members of the Organizing Committee from Università di Firenze: Luca Cesari, Andrea Margheri, Massimiliano Masi, Simona Rinaldi, and Betti Venneri. To conclude I want to thank the International Federation for Information Processing (IFIP) and Università di Firenze for their sponsorship.

June 2013 Michele Loreti

Preface

This volume contains the papers presented at Coordination 2013: the 15th International Conference on Coordination Models and Languages held in Florence during June 3–5. The conference focused on the design and implementation of models and technologies for collaboration and coordination in concurrent, distributed, and socio-technical systems, including both practical and foundational models, runtime systems, and related verification and analysis techniques.

The Program Committee (PC) of Coordination 2012 consisted of 25 top researchers from 13 different countries. We received more than 50 abstracts that materialized in a total of 42 submissions out of which the PC selected 17 papers for inclusion in the program. Each submission was reviewed by at least three independent referees; papers were selected based on their quality, originality, contribution, clarity of presentation, and relevance to the conference topics. The review process included an in-depth discussion phase, during which the merits of all papers were discussed by the committee. The process culminated in a shepherding phase whereby some of the authors received active guidance by one member of the PC in order to produce a high-quality final version. The selected papers constituted a program covering a varied range of topics including coordination of social collaboration processes, coordination of mobile systems in peer-to-peer and ad-hoc networks, programming and reasoning about distributed and concurrent software, types, contracts, synchronization, coordination patterns, and families of distributed systems. The program was further enhanced by an invited talk by Gian Pietro Picco from the University of Trento entitled "Of Tuples, Towers, Tunnels, and Wireless Sensor Networks."

The success of Coordination 2013 was due to the dedication of many people. We thank the authors for submitting high-quality papers and the Program Committee (and their sub-reviewers) for their careful reviews and lengthy discussions during the final selection process. We thank Francesco Tiezzi from IMT Lucca, who acted as the Publicity Chair of Coordination 2013. We thank the providers of the EasyChair conference management system, which was used to run the review process and to facilitate the preparation of the proceedings. Finally, we thank the Distributed Computing Techniques Organizing Committee (led by Michele Loreti) for their contribution in making the logistic aspects of Coordination 2012 a success.

June 2013

Rocco De Nicola
Christine Julien

Organization

Steering Committee

Farhad Arbab	CWI and Leiden University, The Netherlands (Chair)
Gul Agha	University of Illinois at Urbana-Champaign, USA
Dave Clarke	KU Leuven, Belgium
Jean-Marie Jacquet	University of Namur, Belgium
Wolfgang De Meuter	Vrije Universiteit Brussel, Belgium
Rocco De Nicola	IMT - Institute for Advanced Studies Lucca, Italy
Marjan Sirjani	Reykjavik University, Iceland
Carolyn Talcott	SRI, USA
Vasco T. Vasconcelos	University of Lisbon, Portugal
Gianluigi Zavattaro	Università di Bologna, Italy

Program Committee

Gul Agha	University of Illinois at Urbana-Champaign, USA
Saddek Bensalem	VERIMAG Laboratory, France
Borzoo Bonakdarpour	The University of Waterloo, Canada
Giacomo Cabri	Università di Modena e Reggio Emilia, Italy
Paolo Ciancarini	Università di Bologna, Italy
Dave Clarke	KU Leuven, Belgium
Frank De Boer	CWI, The Netherlands
Wolfgang De Meuter	Vrije Universiteit Brussel, Belgium
Rocco De Nicola	IMT - Institute for Advanced Studies Lucca, Italy
José Luiz Fiadeiro	Royal Holloway, University of London, UK
Chien-Liang Fok	The University of Texas at Austin, USA
Chris Hankin	Imperial College London, UK
Raymond Hu	Imperial College London, UK
Christine Julien	The University of Texas at Austin, USA
K.R. Jayaram	HP Labs, USA
Eva Kühn	Vienna University of Technology, Austria
Mieke Massink	ISTI-CNR, Pisa, Italy
Jamie Payton	The University of North Carolina at Charlotte, USA
Rosario Pugliese	Università di Firenze, Italy
Nikola Serbedzija	Fraunhofer FOKUS, Germany
Marjan Sirjani	Reykjavik University, Iceland

Robert Tolksdorf	Freie Universität Berlin, Germany
Emilio Tuosto	University of Leicester, UK
Vasco T. Vasconcelos	University of Lisbon, Portugal
Mirko Viroli	Università di Bologna, Italy

Additional Reviewers

Bocchi, Laura	Marek, Alexander
Bourgos, Paraskevas	Marques, Eduardo R.B.
Bruni, Roberto	Marr, Stefan
Capodieci, Nicola	Martins, Francisco
Charalambides, Minas	Melgratti, Hernan
Ciancia, Vincenzo	Mezzina, Claudio Antares
Craß, Stefan	Mostrous, Dimitris
Creissac Campos, José	Nobakht, Behrooz
De Wael, Mattias	Poplavko, Peter
Dinges, Peter	Proenca, Jose
Fabiunke, Marko	Puviani, Mariachiara
Harnie, Dries	Quilbeuf, Jean
Jafari, Ali	Ridge, Tom
Jaghoori, Mohammad Mahdi	Sabouri, Hamideh
Jongmans, Sung-Shik T.Q.	Scholliers, Christophe
Khamespanah, Ehsan	Senni, Valerio
Kock, Gerd	Sesum-Cavic, Vesna
Lanese, Ivan	Tiezzi, Francesco
Latella, Diego	Vandriessche, Yves

Of Tuples, Towers, Tunnels, and Wireless Sensor Networks

Gian Pietro Picco

Department of Information Engineering and Computer Science (DISI),
University of Trento, Italy
gianpietro.picco@unitn.it

Wireless sensor networks (WSNs) have been around for more than a decade. They are distributed systems made of tiny, resource-scarce, often battery-powered devices that cooperate toward distributed monitoring and control. Their small size, autonomy, and flexibility has placed them at the forefront of pervasive computing scenarios. Yet, their programming is still largely carried out by using directly the low-level primitives provided by the operating system. This approach steers the programmer away from the application, hampers reusability and decoupling, and ultimately makes development unnecessarily complex.

In this talk, we report our research efforts in simplifying WSN programming through the notion of tuple space, embodied in a middleware called TeenyLime [1]. As the name implies, TeenyLime borrows the transiently shared tuple space model introduced by the Lime middleware for mobile ad hoc networks, but also deeply revisits it to match the peculiar characteristics of WSNs, e.g., to deal with the limited resources of WSN nodes and to provide additional visibility and control on the lower levels of the stack. TeenyLime was indeed designed as a thin veneer atop the basic OS communication facilities, to support the development of both the application logic and system tasks such as routing.

TeenyLime and its particular incarnation of the tuple space concept proved successful in developing several *real-world* applications where the WSN was deployed for a long time, in an operational setting, and most importantly to fulfill the needs of real users. This talk reports on two of these experiences: the structural health monitoring of a medieval tower [2], and the closed-loop control of adaptive lighting of a road tunnel [3]. Facing real-world challenges forced a redesign of the TeenyLime implementation, but left its original abstractions essentially unaltered. As expected, the higher level of abstraction provided by TeenyLime w.r.t. using directly the OS primitives resulted in a significant reduction of the source code size, hinting at a lower burden on the programmer. Less expected, it also resulted in a smaller binary size, therefore enabling one to pack more functionality on the resource-scarce WSN nodes. Ultimately, these experiences clearly showed that it is possible to simplify the chore of programming WSN applications without sacrificing their performance and efficiency.

TeenyLime is available as open source at `teenylime.sourceforge.net`.

References

1. Costa, P., Mottola, L., Murphy, A.L., Picco, G.P.: Programming Wireless Sensor Networks with the TeenyLime Middleware. In: Cerqueira, R., Campbell, R.H. (eds.) Middleware 2007. LNCS, vol. 4834, pp. 429–449. Springer, Heidelberg (2007)
2. Ceriotti, M., Mottola, L., Picco, G.P., Murphy, A.L., Guna, S., Corrà, M., Pozzi, M., Zonta, D., Zanon, P.: Monitoring Heritage Buildings with Wireless Sensor Networks: The Torre Aquila Deployment. In: Proc. of the 8th ACM/IEEE Int. Conf. on Information Processing in Sensor Networks (IPSN) (2009)
3. Ceriotti, M., Corrà, M., D'Orazio, L., Doriguzzi, R., Facchin, D., Guna, S., Jesi, G.P., Cigno, R.L., Mottola, L., Murphy, A.L., Pescalli, M., Picco, G.P., Pregnolato, D., Torghele, C.: Is There Light at the Ends of the Tunnel? Wireless Sensor Networks for Adaptive Lighting in Road Tunnels. In: Proc. of the 10th ACM/IEEE Int. Conf. on Information Processing in Sensor Networks (IPSN) (2011)

Table of Contents