Lecture Notes in Computer Science

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

Editorial Board

David Hutchison Lancaster University, Lancaster, UK Takeo Kanade Carnegie Mellon University, Pittsburgh, PA, USA Josef Kittler University of Surrey, Guildford, UK Jon M. Kleinberg Cornell University, Ithaca, NY, USA Friedemann Mattern ETH Zürich, Zürich, Switzerland John C. Mitchell Stanford University, Stanford, CA, USA Moni Naor Weizmann Institute of Science, Rehovot, Israel C. Pandu Rangan Indian Institute of Technology, Madras, India Bernhard Steffen TU Dortmund University, Dortmund, Germany Demetri Terzopoulos University of California, Los Angeles, CA, USA Doug Tygar University of California, Berkeley, CA, USA Gerhard Weikum Max Planck Institute for Informatics, Saarbrücken, Germany More information about this series at http://www.springer.com/series/7407

Jurriaan Hage · Jay McCarthy (Eds.)

Trends in Functional Programming

15th International Symposium, TFP 2014 Soesterberg, The Netherlands, May 26–28, 2014 Revised Selected Papers



Editors Jurriaan Hage Utrecht University Utrecht The Netherlands

Jay McCarthy Vassar College Wappingers Falls New York USA

ISSN 0302-9743 Lecture Notes in Computer Science ISBN 978-3-319-14674-4 DOI 10.1007/978-3-319-14675-1 ISSN 1611-3349 (electronic) ISBN 978-3-319-14675-1 (eBook)

Library of Congress Control Number: 2014959525

LNCS Sublibrary: SL1 - Theoretical Computer Science and General Issues

Springer Cham Heidelberg New York Dordrecht London

© Springer International Publishing Switzerland 2015

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media (www.springer.com)

Preface

This volume contains a selection of the papers presented at TFP2014: Symposium on Trends in Functional Programming 2014 held during May 26–28, 2014 in Soesterberg, The Netherlands.

TFP is an international forum for researchers with interests in all aspects of functional programming, taking a broad view of current and future trends in the area. It aspires to be a lively environment for presenting the latest research results, and other contributions, described in draft papers submitted prior to the symposium. For the symposium, these draft submissions were screened by the Program Committee Chair to make sure that they were within the scope of TFP. Submissions appearing in the draft proceedings are not considered as peer-reviewed publications.

The TFP 2014 program consisted of two invited talks and 29 presentations. The invited talks were given by John Hughes of Chalmers University of Technology, Sweden, and Geoffrey Mainland of Drexel University, USA. The 29 presentations led to a total of 22 full papers submitted to the formal post-refereeing process. Each submission was reviewed by at least three reviewers. The Program Committee decided to accept eight papers, which are included in these proceedings.

This year, TFP gave out two best paper awards: one for the Best Student Paper (a paper presented at the symposium and primarily written by a student), and one for the Best Paper Overall. These prizes were awarded by majority vote among the PC members. Among the papers selected for these proceedings, two papers stood out. The award for Best Student Paper went to Joachim Breitner for his paper entitled Call Arity, and the award for Best Paper Overall went to Edwin Brady for his paper entitled Resource-dependent Algebraic Effects. Congratulations!

We are grateful to many people for their help in preparing for TFP 2014: from the Department of Information and Computing Sciences, we mention Marinus Veldhorst, Edith Stap, Geraldine Leebeek, Martijn Dekker and Corine Jolles, and members of the Software Technology group at Utrecht University. We want to thank in particular the PhD students who helped with all the preparations for TFP: Jeroen Bransen, Alexander Elyasov, Ruud Koot, and Amir Saeidi. We also gratefully acknowledge the assistance of the PC and the TFP Steering Committee for their advice while organizing the symposium. We had the pleasure of using EasyChair for managing the post-symposium refereeing process.

VI Preface

We gratefully ackowledge the financial support of the Department of Information and Computing Sciences, and we were extremely happy to find that both Erlang Solutions and Well-Typed were willing to sponsor TFP 2014, allowing us to decrease the student registration fees substantially. Finally, the grant we obtained from the NWO provided the money to pay for the trips and stays of the two invited speakers of TFP 2014.

November 2014

Jurriaan Hage Jay McCarthy

Organization

TFP 2014 was organized by members of the Software Technology group of the Department of Information and Computing Sciences of Utrecht University in The Netherlands.

Executive Committee

Organizing Chair

Jurriaan Hage

Organizing Committee

Jeroen Bransen Alexander Elyasov Ruud Koot Amir Saeidi

Program Committee

Peter Achten Emil Axelsson Lucilia Camarão de Figueiredo Laura Castro Matthew Fluet Jurriaan Hage (Co-chair) Frank Huch Yukiyoshi Kameyama Andrew Kennedy Tamás Koszik Ben Lippmeier Luc Maranget Jay McCarthy (Co-chair) Marco T. Morazán Ricardo Peña Alexey Rodriguez Sven-Bodo Scholz Manuel Serrano Simon Thompson Tarmo Uustalu David Van Horn

Janis Voigtländer

Radboud University Nijmegen, The Netherlands Chalmers University of Technology, Sweden Universidade Federal de Ouro Preto, Brazil University of A Coruña, Spain Rochester Institute of Technology, USA Utrecht University, The Netherlands Christian-Albrechts-Universität zu Kiel, Germany University of Tsukuba, Japan Microsoft Research, UK Eötvös Loránd University, Hungary University of New South Wales, Australia Inria (Institut National de Recherche en Informatique et Automatique), France Brigham Young University, USA Seton Hall University, USA Universidad Complutense de Madrid, Spain LiquidM, Germany Heriot-Watt University, UK Inria Sophia Antipolis, France University of Kent, UK Institute of Cybernetics, Estonia University of Maryland, USA University of Bonn, Germany

Additional Reviewers

Antunez, Rosario Dylus, Sandra Dévai, Gergely Jeltsch, Wolfgang Kastens, Uwe Lindley, Sam Mackie, Ian Mehner, Stefan Montenegro, Manuel Rubio, Fernando Trancón y Widemann, Baltasar Viera, Marcos Wang, Meng

Sponsoring Institutions

The symposium is supported by Erlang Solutions, Well-Typed, The Netherlands Organisation for Scientific Research (NWO), and the Department of Information and Computing Sciences of Utrecht University, The Netherlands.









Universiteit Utrecht

Contents

Balancing Shared and Distributed Heaps on NUMA Architectures	1
Resource-Dependent Algebraic Effects	18
Call Arity	34
Graph Problems and Vector-Matrix Multiplications in Haskell	51
A Functional Approach to Sex: Reproduction in the Créatúr Framework Amy de Buitléir, Mark Daly, Michael Russell, and Daniel Heffernan	68
Type Generic Observing	84
Refactorings to Enable Parallelization	104
Tonic: An Infrastructure to Graphically Represent the Definition and Behaviour of Tasks	122
Author Index	143