Lecture Notes in Computer Science 5218

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

Editorial Board

David Hutchison
Lancaster University, UK

Takeo Kanade
Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler
University of Surrey, Guildford, UK

Jon M. Kleinberg
Cornell University, Ithaca, NY, USA

Alfred Kobsa
University of California, Irvine, CA, USA

Friedemann Mattern
ETH Zurich, Switzerland

John C. Mitchell
Stanford University, CA, USA

Moni Naor
Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz
University of Bern, Switzerland

C. Pandu Rangan
Indian Institute of Technology, Madras, India

Bernhard Steffen
University of Dortmund, Germany

Madhu Sudan
Massachusetts Institute of Technology, MA, USA

Demetri Terzopoulos
University of California, Los Angeles, CA, USA

Doug Tygar
University of California, Berkeley, CA, USA

Gerhard Weikum
Max-Planck Institute of Computer Science, Saarbruecken, Germany

Gadi Taubenfeld (Ed.)

Distributed Computing

22nd International Symposium, DISC 2008
Arcachon, France, September 22-24, 2008
Proceedings

Volume Editor

Gadi Taubenfeld
School of Computer Science
The Interdisciplinary Center
P.O.Box 167
Herzliya 46150, Israel
E-mail: tgadi@idc.ac.il

Library of Congress Control Number: 2008935023

CR Subject Classification (1998): C.2.4, C.2.2, F.2.2, D.1.3, F.1.1, D.4.4-5

LNCS Sublibrary: SL 1 – Theoretical Computer Science and General Issues

ISSN 0302-9743
ISBN-10 3-540-87778-9 Springer Berlin Heidelberg New York
ISBN-13 978-3-540-87778-3 Springer Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

Springer is a part of Springer Science+Business Media

springer.com

© Springer-Verlag Berlin Heidelberg 2008
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 12525812 06/3180 5 4 3 2 1 0

Preface

DISC, the International Symposium on Distributed Computing, is an annual forum for presentation of research on all aspects of distributed computing, including the theory, design, implementation and applications of distributed algorithms, systems and networks. The 22nd edition of DISC was held during September 22-24, 2008, in Arcachon, France.

There were 101 submissions submitted to DISC this year and this volume contains 33 15-page-long regular papers selected by the Program Committee among these submissions. Every submitted paper was read and evaluated by Program Committee members assisted by external reviewers. The final decisions regarding acceptance or rejection of each paper were made during the electronic Program Committee meeting held during June 2008. Revised and expanded versions of a few best selected papers will be considered for publication in a special issue of the journal *Distributed Computing*.

The Program Committee selected Robert Danek and Wojciech Golab as the recipients of this year's Best Paper Award for their paper "Closing the Complexity Gap Between FCFS Mutual Exclusion and Mutual Exclusion." The Program Committee selected Wojciech Wawrzyniak as the recipient of this year's Best Student Paper Award for the paper "Fast Distributed Approximations in Planar Graphs" coauthored with Andrzej Czygrinow and Michal Hańćkowiak.

This volume of the proceedings also contains 11 two-page-long brief announcements (BA). These BAs present ongoing work or recent results whose full description is not yet ready; it is expected that full papers containing these results will soon appear in other conferences or journals. The main purpose of the BA track is to announce ongoing projects to the distributed computing community and to obtain feedback for the authors. Each BA was also read and evaluated by the Program Committee.

The support of the sponsors, which are mentioned later, is gratefully acknowledged.

July 2008 Gadi Taubenfeld

The 2008 Edsger W. Dijkstra Prize in Distributed Computing

The Edsger W. Dijkstra Prize in Distributed Computing is awarded for an outstanding paper on the principles of distributed computing, whose significance and impact on the theory and/or practice of distributed computing has been evident for at least a decade.

The Dijkstra Award Committee has selected Baruch Awerbuch and David Peleg as the recipients of this year's Edsger W. Dijkstra Prize in Distributed Computing. The prize is given to them for their outstanding paper: "Sparse Partitions" published in the proceedings of the 31st Annual Symposium on Foundations of Computer Science, pp. 503–513, 1990.

The "Sparse Partitions" paper by Awerbuch and Peleg signified the coming-of-age of the area of distributed network algorithms. A line of research that started with Awerbuch's synchronizer and Peleg's spanner has culminated in this ground-breaking paper that has had a profound impact on algorithmic research in distributed computing and in graph algorithms in general.

The paper presents concrete definitions of the intuitive concepts of locality and load, and gives surprisingly effective constructions to trade them off. The fundamental technical contribution in the paper is the algorithm of coarsening, which takes, as input, a decomposition of the graph to possibly overlapping components, and generates a new decomposition whose locality is slightly worse, but whose load is far better. The desired balance between locality and load is controlled by a parameter provided by the user. While many other underlying ideas were present in prior work of Awerbuch and Peleg (separately), in the "Sparse Partitions" paper these ideas have come together, with a unified view, resulting in a new powerful toolkit that is indispensable for all workers in the field.

The magnitude of the progress achieved by the new techniques was immediately recognized, and its implications spawn much research to this day. In the "Sparse Partitions" paper itself, the authors improve on the best known results for two central problems of network algorithms, and many other applications of the results followed, quite a few of them in applications that were visionary at their time. To mention just a few, these include computation of compact routing tables and location services of mobile users (in the original paper), dramatically more efficient synchronizers, effective peer-to-peer network design, and scheduling in grid-like computing models. Besides these applications of the results, the paper can be viewed as one of the important triggers to much of the fundamental research that was dedicated to exploring other variants of the basic concepts, including the notions of bounded-growth graphs, tree metrics, general and geometric spanners.

It is interesting to view the Sparse Partitions paper in a historical context. The area of network algorithms has its roots in classical graph algorithms. Distributed algorithms have proved to be an algorithmically rich field with the "Minimum Spanning Tree" paper of Gallager, Humblet and Spira. Motivated by the asynchronous nature of distributed systems, Awerbuch invented the concept of a synchronizer. Peleg, coming from the graph theoretic direction, generalized the notion of spanning tree and invented the concept of spanners. In the "Sparse Partitions" paper, the additional ingredient of load was added to the combination, yielding a powerful conceptual and algorithmic tool. The results superseded the best known results for classical graph algorithms, thus showing the maturity of the field, which closed a circle by becoming a leading source for graph algorithms of any kind.

Award Committee 2008:

Yehuda Afek	Tel-Aviv University
Faith Ellen	University of Toronto
Shay Kutten	Technion
Boaz Patt-Shamir	Tel-Aviv University
Sergio Rajsbaum	UNAM
Gadi Taubenfeld, Chair	IDC

Organization

DISC is an international symposium on the theory, design, analysis, implementation and application of distributed systems and networks. DISC is organized in cooperation with the European Association for Theoretical Computer Science (EATCS). The symposium was established in 1985 as a biannual International Workshop on Distributed Algorithms on Graphs (WDAG). The scope was soon extended to cover all aspects of distributed algorithms as WDAG came to stand for International Workshop on Distributed AlGorithms, and in 1989 it became an annual symposium. To reflect the expansion of its area of interest, the name was changed to DISC (International Symposium on DIStributed Computing) in 1998. The name change also reflects the opening of the symposium to all aspects of distributed computing. The aim of DISC is to reflect the exciting and rapid developments in this field.

Program Committee Chair

Gadi Taubenfeld IDC Herzliya, Israel

Organization Committee Chair

Cyril Gavoille University of Bordeaux, France

Steering Committee Chair

Rachid Guerraoui EPFL, Switzerland

Program Committee

James Anderson UNC at Chapel Hill, USA
Bernadette Charron-Bost Ecole Polytechnique, France
Cyril Gavoille University of Bordeaux, France
Chryssis Georgiou University of Cyprus, Cyprus

Phil Gibbons	Intel Research Pittsburgh, USA
Seth Gilbert	EPFL, Switzerland
Tim Harris	Microsoft Research Cambridge, UK
Danny Hendler	Ben Gurion University, Israel
Dariusz Kowalski	University of Liverpool, UK
Amos Korman	CNRS and University of Paris 7, France
Shay Kutten	Technion, Israel
Marios Mavronicolas	University of Cyprus, Cyprus
Michel Raynal	IRISA, University of Rennes, France
Luis Rodrigues	INESC-ID, IST, Portugal
Tami Tamir	IDC Herzliya, Israel
Gadi Taubenfeld (Chair)	IDC Herzliya, Israel
Sébastien Tixeuil	University of Paris 6, France
Philippas Tsigas	Chalmers University, Sweden
Mark Tuttle	Intel, USA
Roger Wattenhofer	ETH Zurich, Switzerland
Haifeng Yu	National University of Singapore, Singapore

Organization Committee

Cyril Gavoille (Chair)	University of Bordeaux, France
Nicolas Hanusse	CNRS, University of Bordeaux, France
David Ilcinkas	CNRS, University of Bordeaux, France
Ralf Klasing,	CNRS, University of Bordeaux, France
Michael Montassier	University of Bordeaux, France
Akka Zemmari	University of Bordeaux, France
Sergio Rajsbaum (publicity)	UNAM, Mexico

Steering Committee

Shlomi Dolev	BGU, Israel
Antonio Fernández	University Rey Juan Carlos, Spain
Rachid Guerraoui (Chair)	EPFL, Switzerland
Andrzej Pelc	University of Quebec, Canada
Sergio Rajsbaum	UNAM, Mexico
Nicola Santoro	Carleton University, Canada
Gadi Taubenfeld	IDC, Israel

External Reviewers

Ittai Abraham
Uri Abraham
Filipe Araujo
James Aspnes
Amos Beimel
Samuel Bernard
Nicolas Bonichon
Olivier Bournez
Nicolas Burri
Ran Canetti
Nuno Carvalho
Daniel Cederman
Wei Chen
Gregory Chokler
Andrzej Czygrinow
Paolo D'Arco
Shantanu Das
Gianluca De Marco
Roberto De Prisco
Bilel Derbel
Shlomi Dolev
Raphael Eidenbenz
Michael Elkin
Yuval Emek
Hugues Fauconnier
Antonio Fernandez
Paola Flocchini
Roland Flury
Felix Freiling
Zhang Fu
Eli Gafni
Leszek Gasieniec
Georgios Georgiadis
Anders Gidenstam
Olga Goussevskaia
Vincent Gramoli
Fabiola Greve
Phuong Ha
Nicolas Hanusse
David Hay
Ted Herman
Martin Hutle
David Ilcinkas
Sidharth Jaggi
Yuh-Jzer Joung
Erez Kantor
Jasleen Kaur
Ralf Klasing
Marina Kopeetsky
Adrian Kosowski
Evangelos Kranakis
Danny Krizanc
Ajay Ksemkalyani
Michael Kuhn
Arnaud Labourel
Emmanuelle Lebhar
João Leitão
Christoph Lenzen
Andrzej Lingas
Zvi Lotker
Olivier Ly
Urmi Majumder
Lior Malka
Dahlia Malkhi
Jean-Philippe Martin
Toshimistu Masuzawa
Remo Meier
Michael Merideth
Stephan Merz
Alessia Milani
Dorian Miller
Alan Mislove
Neeraj Mittal
José Mocito
Peter Musial
Mikhail Nesterenko
Nicolas Nicolaou
Tim Nieberg
Yvonne Anne Oswald
Charis Papadakis
Marina Papatriantafilou
Boaz Patt-Shamir
Andrzej Pelc
David Peleg
Ljubomir Perkovic
Maria Potop-Butucaru
Sergio Rajsbaum
Pascal von Rickenbach

Etienne Riviere
Paolo Romano
Adi Rosen
Matthieu Roy
Eric Ruppert
Johannes Schneider
Alex Shvartsman
Vasu Singh
Philipp Sommer
Håkan Sundell
Corentin Travers
Frédéric Tronel
Sara Tucci-Piergiovanni
Milan Vojnovic
Jennifer Welch
Josef Widder
Eric Winfree
Piotr Zielinski

Sponsors

Pôle RésCom

Table of Contents

Regular Papers

The Mailbox Problem (Extended Abstract) 1
Marcos K. Aguilera, Eli Gafni, and Leslie Lamport

Matrix Signatures: From MACs to Digital Signatures in Distributed Systems 16
Amitanand S. Aiyer, Lorenzo Alvisi, Rida A. Bazzi, and Allen Clement

How to Solve Consensus in the Smallest Window of Synchrony 32
Dan Alistarh, Seth Gilbert, Rachid Guerraoui, and Corentin Travers

Local Terminations and Distributed Computability in Anonymous Networks 47
Jérémie Chalopin, Emmanuel Godard, and Yves Métivier

A Self-stabilizing Algorithm with Tight Bounds for Mutual Exclusion on a Ring (Extended Abstract) 63
Viacheslav Chernoy, Mordechai Shalom, and Shmuel Zaks

Fast Distributed Approximations in Planar Graphs 78
Andrzej Czygrinow, Michal Hańćkowiak, and Wojciech Wawrzyniak

Closing the Complexity Gap between FCFS Mutual Exclusion and Mutual Exclusion 93
Robert Danek and Wojciech Golab

The Weakest Failure Detector for Message Passing Set-Agreement 109
Carole Delporte-Gallet, Hugues Fauconnier, Rachid Guerraoui, and Andreas Tielmann

Local Maps: New Insights into Mobile Agent Algorithms 121
Bilel Derbel

r^3: Resilient Random Regular Graphs 137
Stanko Dimitrov, P. Krishnan, Colin Mallows, Jean Meloche, and Shalini Yajnik

Online, Dynamic, and Distributed Embeddings of Approximate Ultrametrics 152
Michael Dinitz

Constant-Space Localized Byzantine Consensus 167
Danny Dolev and Ezra N. Hoch

Optimistic Erasure-Coded Distributed Storage 182
Partha Dutta, Rachid Guerraoui, and Ron R. Levy

On the Emulation of Finite-Buffered Output Queued Switches Using Combined Input-Output Queuing 197
Mahmoud Elhaddad and Rami Melhem

On Radio Broadcasting in Random Geometric Graphs 212
Robert Elsässer, Leszek Gąsieniec, and Thomas Sauerwald

Ping Pong in Dangerous Graphs: Optimal Black Hole Search with Pure Tokens 227
Paola Flocchini, David Ilcinkas, and Nicola Santoro

Deterministic Rendezvous in Trees with Little Memory 242
Pierre Fraigniaud and Andrzej Pelc

Broadcasting in UDG Radio Networks with Missing and Inaccurate Information 257
Emanuele G. Fusco and Andrzej Pelc

Efficient Broadcasting in Known Geometric Radio Networks with Non-uniform Ranges 274
Leszek Gąsieniec, Dariusz R. Kowalski, Andrzej Lingas, and Martin Wahlen

On the Robustness of (Semi) Fast Quorum-Based Implementations of Atomic Shared Memory 289
Chryssis Georgiou, Nicolas C. Nicolaou, and Alexander A. Shvartsman

Permissiveness in Transactional Memories 305
Rachid Guerraoui, Thomas A. Henzinger, and Vasu Singh

The Synchronization Power of Coalesced Memory Accesses 320
Phuong Hoai Ha, Philippas Tsigas, and Otto J. Anshus

Optimizing Threshold Protocols in Adversarial Structures 335
Maurice Herlihy, Flavio P. Junqueira, Keith Marzullo, and Lucia Draque Penso

Hopscotch Hashing 350
Maurice Herlihy, Nir Shavit, and Moran Tzafrir

Computing Lightweight Spanners Locally 365
Iyad A. Kanj, Ljubomir Perković, and Ge Xia

Dynamic Routing and Location Services in Metrics of Low Doubling Dimension (Extended Abstract) 379
Goran Konjevod, Andréa W. Richa, and Donglin Xia

Leveraging Linial's Locality Limit 394
Christoph Lenzen and Roger Wattenhofer

Continuous Consensus with Failures and Recoveries 408
Tal Mizrahi and Yoram Moses

No Double Discount: Condition-Based Simultaneity Yields Limited Gain 423
Yoram Moses and Michel Raynal

Bosco: One-Step Byzantine Asynchronous Consensus 438
Yee Jiun Song and Robbert van Renesse

A Limit to the Power of Multiple Nucleation in Self-assembly 451
Aaron D. Sterling

Using Bounded Model Checking to Verify Consensus Algorithms 466
Tatsuhiro Tsuchiya and André Schiper

Theoretical Bound and Practical Analysis of Connected Dominating Set in Ad Hoc and Sensor Networks 481
Alireza Vahdatpour, Foad Dabiri, Maryam Moazeni, and Majid Sarrafzadeh

Brief Announcements

On the Solvability of Anonymous Partial Grids Exploration by Mobile Robots 496
Roberto Baldoni, François Bonnet, Alessia Milani, and Michel Raynal

The Dynamics of Probabilistic Population Protocols 498
Ioannis Chatzigiannakis and Paul G. Spirakis

A Distributed Algorithm for Computing and Updating the Process Number of a Forest 500
David Coudert, Florian Huc, and Dorian Mazauric

Corruption Resilient Fountain Codes 502
Shlomi Dolev and Nir Tzachar

An Early-Stopping Protocol for Computing Aggregate Functions in Sensor Networks 504
Antonio Fernández Anta, Miguel A. Mosteiro, and Christopher Thraves

Easy Consensus Algorithms for the Crash-Recovery Model 507
Felix C. Freiling, Christian Lambertz, and Mila Majster-Cederbaum

Evaluating the Quality of a Network Topology through Random Walks 509
Anne-Marie Kermarrec, Erwan Le Merrer, Bruno Sericola, and Gilles Trédan

Local-Spin Algorithms for Abortable Mutual Exclusion and Related Problems 512
Robert Danek and Hyonho Lee

Data Failures 514
Simona Orzan and Mohammad Torabi Dashti

Reliable Broadcast Tolerating Byzantine Faults in a Message-Bounded Radio Network 516
Marin Bertier, Anne-Marie Kermarrec, and Guang Tan

Eventual Leader Election in the Infinite Arrival Message-Passing System Model 518
Sara Tucci-Piergiovanni and Roberto Baldoni

Author Index 521