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Contents

Preface and Symposium Organization

Andréa W. Richa ................................................................. 0:ix–0:x

2017 Edsger W. Dijkstra Prize in Distributed Computing

Yehuda Afek, Rachid Guerraoui, Taisuke Izumi, and Petr Kuznetsov ........... 0:xv–0:xvi

2017 Principles of Distributed Computing Doctoral Dissertation Award

Cyril Gavoille, Boaz Patt-Shamir, Michel Raynal, and Gadi Taubenfeld ......... 0:xvii

Keynote Talks

Blockchain Consensus Protocols in the Wild

Christian Cachin and Marko Vukolić ........................................ 1:1–1:16

Recommenders: from the Lab to the Wild

Anne-Marie Kermarrec ............................................................ 2:1–2:1

Phase Transitions and Emergent Phenomena in Random Structures and Algorithms

Dana Randall ................................................................. 3:1–3:2

Regular Papers

Reuse, Don’t Recycle: Transforming Lock-Free Algorithms That Throw Away Descriptors

Maya Arbel-Raviv and Trevor Brown ............................................ 4:1–4:16

Demand-Aware Network Designs of Bounded Degree

Chen Avin, Kaushik Mondal, and Stefan Schmid ............................... 5:1–5:16

Certification of Compact Low-Stretch Routing Schemes

Alkida Balliu and Pierre Fraigniaud ............................................. 6:1–6:16

Near-Optimal Approximate Shortest Paths and Transshipment in Distributed and Streaming Models

Ruben Becker, Andreas Karrenbauer, Sebastian Krinninger, and Christoph Lenzen 7:1–7:16

Asynchronous Approach in the Plane: A Deterministic Polynomial Algorithm

Sébastien Bouchard, Marjorie Bournat, Yoann Dieudonné, Swan Dubois, and Franck Petit .................................................. 8:1–8:16

Cost of Concurrency in Hybrid Transactional Memory

Trevor Brown and Srivatsan Ravi ...................................................... 9:1–9:16

Quadratic and Near-Quadratic Lower Bounds for the CONGEST Model

Keren Censor-Hillel, Seri Khoury, and Ami Paz .................................. 10:1–10:16

Derandomizing Local Distributed Algorithms under Bandwidth Restrictions

Keren Censor-Hillel, Merav Parter, and Gregory Schwartzman ............... 11:1–11:16

31st International Symposium on Distributed Computing (DISC 2017).
Editor: Andréa W. Richa

Leibniz International Proceedings in Informatics

Schloss Dagstuhl – Leibniz-Zentrum für Informatik, Dagstuhl Publishing, Germany
On the Number of Objects with Distinct Power and the Linearizability of Set Agreement Objects
  David Yu Cheng Chan, Vassos Hadzilacos, and Sam Toueg ......................... 12:1–12:14

Fast Plurality Consensus in Regular Expanders
  Colin Cooper, Tomasz Radzik, Nicolás Rivera, and Takeharu Shiraga .............. 13:1–13:16

Meeting in a Polygon by Anonymous Oblivious Robots
  Giuseppe A. Di Luna, Paola Flocchini, Nicola Santoro, Giovanni Viglietta, and Masafumi Yamashita ............................................................. 14:1–14:15

Three Notes on Distributed Property Testing

Error-Sensitive Proof-Labeling Schemes
  Laurent Feuilloley and Pierre Fraigniaud ........................................ 16:1–16:15

Improved Deterministic Distributed Matching via Rounding
  Manuela Fischer ............................................................................. 17:1–17:15

Sublogarithmic Distributed Algorithms for Lovász Local Lemma, and the Complexity Hierarchy
  Manuela Fischer and Mohsen Ghaffari ............................................. 18:1–18:16

Improved Distributed Degree Splitting and Edge Coloring
  Mohsen Ghaffari, Juho Hirvonen, Fabian Kuhn, Yannic Maus, Jukka Suomela, and Jara Uitto .............................................................. 19:1–19:15

Simple and Near-Optimal Distributed Coloring for Sparse Graphs
  Mohsen Ghaffari and Christiana Lymouri ......................................... 20:1–20:14

Near-Optimal Distributed DFS in Planar Graphs
  Mohsen Ghaffari and Merav P. Parter ........................................... 21:1–21:16

Dynamic Analysis of the Arrow Distributed Directory Protocol in General Networks
  Abdolhamid Ghodselahi and Fabian Kuhn ........................................ 22:1–22:16

Consistency Models with Global Operation Sequencing and their Composition
  Alexey Gotsman and Sebastian Burckhardt ..................................... 23:1–23:16

Improved Deterministic Distributed Construction of Spanners
  Ofer Grossman and Merav Parter .................................................. 24:1–24:16

An Efficient Communication Abstraction for Dense Wireless Networks
  Magnus M. Halldórsson, Fabian Kuhn, Nancy Lynch, and Calvin Newport .... 25:1–25:16

Two-Party Direct-Sum Questions Through the Lens of Multiparty Communication Complexity
  Itay Hazan and Eyal Kushilevitz .................................................... 26:1–26:15

Which Broadcast Abstraction Captures k-Set Agreement?
  Damien Imbs, Achour Mostefaoui, Matthieu Perrin, and Michel Raynal .......... 27:1–27:16
Extending Hardware Transactional Memory Capacity via Rollback-Only Transactions and Suspend/Resume
  Shady Issa, Pascal Felber, Alexander Matveev, and Paolo Romano 28:1–28:16

Some Lower Bounds in Dynamic Networks with Oblivious Adversaries
  Irvan Jahja, Haifeng Yu, and Yuda Zhao 29:1–29:16

Recoverable FCFS Mutual Exclusion with Wait-Free Recovery
  Prasad Jayanti and Anup Joshi 30:1–30:15

Interactive Compression for Multi-Party Protocols
  Gillat Kol, Rotem Oshman, and Dafna Sadeh 31:1–31:15

Self-Stabilising Byzantine Clock Synchronisation is Almost as Easy as Consensus
  Christoph Lenzen and Joel Rybicki 32:1–32:15

Neuro-RAM Unit with Applications to Similarity Testing and Compression in Spiking Neural Networks
  Nancy Lynch, Cameron Musco, and Merav Parter 33:1–33:16

How Large Is Your Graph?
  Varun Kanade, Frederik Mallmann-Trenn, and Victor Verdugo 34:1–34:16

Tight Bounds for Connectivity and Set Agreement in Byzantine Synchronous Systems
  Hammurabi Mendes and Maurice Herlihy 35:1–35:16

Recovering Shared Objects Without Stable Storage
  Ellis Michael, Dan R. K. Ports, Naveen Kr. Sharma, and Adriana Szekeres 36:1–36:16

Dalí: A Periodically Persistent Hash Map

Symmetry Breaking in the Congest Model: Time- and Message-Efficient Algorithms for Ruling Sets
  Shreyas Pai, Gopal Pandurangan, Sriram V. Pemmaraju, Talal Riaz, and Peter Robinson 38:1–38:16

Hybrid Consensus: Efficient Consensus in the Permissionless Model
  Rafael Pass and Elaine Shi 39:1–39:16

Dynamic Reconfiguration: Abstraction and Optimal Asynchronous Solution
  Alexander Spiegelman, Idit Keidar and Dahlia Malkhi 40:1–40:15

Brief Announcements

Brief Announcement: Practical Synchronous Byzantine Consensus
  Ittai Abraham, Srinivas Devadas, Kartik Nayak, and Ling Ren 41:1–41:4

Brief Announcement: The Synergy of Finite State Machines
  Yehuda Afek, Yuval Emek, and Noa Kolikant 42:1–42:3

Brief Announcement: Compact Self-stabilizing Leader Election in Arbitrary Graphs
  Lélia Blin and Sébastien Tixeuil 43:1–43:3
Brief Announcement: A Note on Hardness of Diameter Approximation
Karl Bringmann and Sebastian Krinninger ................................. 44:1–44:3

Brief Announcement: Black-Box Concurrent Data Structures for NUMA Architectures
Irina Calciu, Siddhartha Sen, Mahesh Balakrishnan, and Marcos K. Aguilera .... 45:1–45:3

Brief Announcement: Crash-Tolerant Consensus in Directed Graph Revisited

Brief Announcement: On the Parallel Undecided-State Dynamics with Two Colors
Andrea Clementi, Luciano Gualà, Francesco Pasquale, and Giacomo Scornavacca 47:1–47:4

Brief Announcement: Shape Formation by Programmable Particles
Giuseppe A. Di Luna, Paola Flocchini, Nicola Santoro, Giovanni Viglietta, and Yukiko Yamauchi .................................................. 48:1–48:3

Brief Announcement: Fast Aggregation in Population Protocols
Ryota Eguchi and Taisuke Iizumi ................................................. 49:1–49:3

Brief Announcement: A Persistent Lock-Free Queue for Non-Volatile Memory
Michal Friedman, Maurice Herlihy, Virendra Marathe, and Erez Petrank .......... 50:1–50:4

Brief Announcement: Lower Bounds for Asymptotic Consensus in Dynamic Networks
Matthias Függer, Thomas Nowak, and Manfred Schwarz ....................... 51:1–51:3

Brief Announcement: Applying Predicate Detection to the Stable Marriage Problem
Vijay K. Garg ........................................................................ 52:1–52:3

Brief Announcement: Towards Reduced Instruction Sets for Synchronization
Rati Gelashvili, Idit Keidar, Alexander Spiegelman, and Roger Wattenhofer .... 53:1–53:4

Brief Announcement: On Connectivity in the Broadcast Congested Clique
Tomasz Jurdziński and Krzysztof Nowicki .................................... 54:1–54:4

Brief Announcement: Towards a Complexity Theory for the Congested Clique

Brief Announcement: Compact Topology of Shared-Memory Adversaries
Petr Kuznetsov, Thibault Rieutord, and Yuan He .............................. 56:1–56:4

Brief Announcement: A Centralized Local Algorithm for the Sparse Spanning Graph Problem
Christoph Lenzen and Reut Levi .................................................. 57:1–57:3

Brief Announcement: Distributed SplayNets
Bruna S. Peres, Olga Goussevskaia, Stefan Schmid, and Chen Avin ........... 58:1–58:3

Brief Announcement: Rapid Mixing of Local Dynamics on Graphs
Laurent Massoulié and Rémi Varloot ............................................. 59:1–59:3
DISC, the International Symposium on DIStributed Computing, is an international forum 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).

This volume contains the papers presented at DISC 2017, the 31st International Symposium on Distributed Computing, held on October 16–20, 2017 in Vienna, Austria. The volume includes the citation for the 2017 Edsger W. Dijkstra Prize in Distributed Computing, jointly sponsored by DISC and the ACM Symposium on Principles of Distributed Computing (PODC), that was presented at DISC 2017 to Elizabeth Borowsky and Eli Gafni for their work Generalized FLP Impossibility Result for t-resilient Asynchronous Computations. The volume also includes the citation for the 2017 Doctoral Dissertation Award, also jointly sponsored by DISC and PODC, that was presented at PODC 2017 in Washington, DC, USA to Mohsen Ghaffari for his PhD thesis titled Improved Distributed Algorithms for Fundamental Graph Problems, supervised by Nancy Lynch at the Massachusetts Institute of Technology.

DISC 2017 received a very high number of submissions — 160 regular paper and 11 brief announcement submissions — which were all peer reviewed. The quality of the submissions was also very high this year, posing a challenge to the Program Committee (PC). Every submission was read and evaluated by at least three members of the PC, with the assistance of 134 external reviewers. Following a 7-day discussion period, the PC held a virtual meeting on June 28–29, 2017, which was attended by all but a few of its members. The PC selected 39 contributions out of the 160 regular paper submissions, for 37 regular presentations at the symposium: Three of the papers had highly overlapping results and were therefore asked to combine their published and oral presentations (the combined paper appears as Three Notes on Distributed Property Testing).

For each regular presentation, the authors were invited to submit a paper of up to 15 pages for this volume (the final number of pages per paper may vary slightly due to the final typesetting of this volume); the only exception was the paper resulting from the 3-way merge, which was allowed a longer proceedings version. Nineteen brief announcements were accepted in total, for a short presentation accompanied by a 3-page publication in the proceedings each: Four of those were originally submitted as a brief announcements; the other 15 were regular submissions that were rejected, but generated substantial interest among the members of the PC and were invited to be published as brief announcements. Each brief announcement summarizes ongoing work or recent results, and it can be expected that these results will appear as full papers in later conferences or journals.

This was the first year that DISC had its proceedings published by LIPIcs (Leibniz International Proceedings in Informatics): Jukka Suomela, the DISC 2017 proceedings chair, embraced the challenge and successfully led the transition to LIPIcs. Revised and expanded versions of several selected proceedings papers will be considered for publication in a special issue of the journal Distributed Computing.

The Best Paper Award for DISC 2017 was presented to Mohsen Ghaffari, Juho Hirvonen, Fabian Kuhn, Yannic Maus, Jukka Suomela and Jara Uitto for their paper Improved Distributed Degree Splitting and Edge Coloring. The Best Student Paper Award for DISC 2017 was presented to Manuela Fischer for her solo-authored paper Improved Deterministic Distributed Matching via Rounding.
The program featured three keynote lectures, presented by Anne-Marie Kermarrec (INRIA, Rennes, France), Christian Cachin (IBM Research Zurich, Switzerland), and Dana Randall (Georgia Tech, USA). An abstract of each keynote lecture is included in the proceedings. The program also included a celebration for Yoram Moses’ 60th birthday, organized by Nir Shavit, which included a set of invited talks by Shafi Goldwasser (MIT, USA), Joe Halpern (Cornell University, USA), Sergio Rajsbaum (UNAM, Mexico), Moshe Tenenholtz (Technion, Israel), and Moshe Vardi (Rice University, USA).

Six workshops were co-located with the DISC symposium this year. The following workshops were held on the day preceding the main conference (October 16): the 4th Workshop on Formal Reasoning in Distributed Algorithms (FRIDA), organized by Swen Jacobs, Igor Konnov, Stephan Merz, and Josef Widder; the 1st Workshop on Blockchain Technology and Theory, organized by Emmanuelle Anceaume, Christian Cachin, Maurice Herlihy, and Maria Potop-Butucaru; and the 1st Workshop on the Theory and Practice of Concurrency, organized by Dan Alistarh. The following workshops were held following the main conference on October 20: the 6th Workshop on Advances in Distributed Graph Algorithms (ADGA), chaired by Fabian Kuhn; the 2nd Workshop on Computing in Dynamic Networks (CoDyn), organized by Arnaud Casteigts and Swan Dubois; and the 1st Workshop on Hardware Design and Theory (HDT), chaired by Cristoph Lenzen.

We wish to thank the many contributors to DISC 2017: the authors of the submitted papers, the PC members and the reviewers, the three keynote speakers, the conference general chairs and local organizers Ulrich Schmid and Josef Widder, the publicity chair Dan Alistarh, the proceedings chair Jukka Suomela, the web chair Kyrill Winkler, all the workshop organizers led by the workshop chair Josef Widder, the DISC Steering Committee, under the guidance of Shlomi Dolev, and the sponsors for their generous support of DISC 2017.

October 2017

Andréa W. Richa,
DISC 2017 Program Chair
DISC, the International Symposium on Distributed Computing, is an annual forum for presentation of research on all aspects of distributed computing. It 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 and WDAG came to stand for International Workshop on Distributed Algorithms, becoming an annual symposium in 1989. To reflect the expansion of its area of interest, the name was changed to DISC (International Symposium on DiSTributed Computing) in 1998, opening the symposium to all aspects of distributed computing. The aim of DISC is to reflect the exciting and rapid developments in this field.

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DISC 2017 acknowledges the use of the EasyChair system for handling submissions and managing the review process, and LIPIcs for producing and publishing the proceedings.
2017 Edsger W. Dijkstra Prize in Distributed Computing

The Edsger W. Dijkstra Prize in Distributed Computing was created to acknowledge outstanding papers on the principles of distributed computing whose significance and impact on the theory or practice of distributed computing have been evident for at least a decade. The Prize is sponsored jointly by the ACM Symposium on Principles of Distributed Computing (PODC) and the EATCS Symposium on Distributed Computing (DISC). This award is presented annually, with the presentation taking place alternately at PODC and DISC.

The 2017 Award Committee, composed of Alexander Schwarzmann (Chair), Marcos K. Aguilera, Alessandro Panconesi, Andrzej Pelc, Andréa W. Richa, and Roger Wattenhofer, has selected

Elizabeth Borowsky and Eli Gafni

to receive the 2017 Edsger W. Dijkstra Prize in Distributed Computing for the outstanding paper:

Elizabeth Borowsky, Eli Gafni:

Generalized FLP impossibility result for $t$-resilient asynchronous computations.

This is a fundamental paper in the original sense. It contains two breakthrough contributions. First, it lays a new concept of read-write simulations in the very foundation of distributed computing. Second, it introduces the immediate-snapshot model. For the first contribution, the paper argues that, even though distributed systems exhibit multiple seemingly incomparable instantiations, they operate on the same fundamental principles. By deriving these principles, we could obtain computability and complexity results concerning a given specific distributed system via simulations and reductions.

The paper illustrates this approach by proposing an ingenious simulation tool, now commonly referred to as the BG Simulation. The tool allows a system of $k+1$ processes to consistently simulate algorithms designed for any $k$-resilient system. The BG Simulation proved to be instrumental in establishing impossibility results and building reductions between them. In particular, this paper uses the BG Simulation to derive the fundamental impossibility of $k$-resilient $k$-set consensus from the impossibility of wait-free set consensus.

The second key contribution, the immediate-snapshot model, leads to a simple and elegant combinatorial characterization of the set of runs of a protocol. This characterization then leads to the impossibility of wait-free set consensus through a simple application of Sperner’s Lemma.

These two points—the use of a simpler model of computation to establish the wait-free set-consensus impossibility and the use of simulation to derive the generalized $k$-resilient impossibility from the wait-free one—distinguishes this paper from two concurrent papers appeared at STOC 1993, by Herlihy and Shavit and by Saks and Zaharoglou, journal versions of which were later awarded the prestigious Gödel prize.
Since 1993, both contributions of this paper were widely adopted by the distributed-computing community. The illuminating BG Simulation technique gave rise to a broad spectrum of results in various contexts: from adversarial shared-memory computing to mobile Byzantine robots. The BG simulation and abstractions around it establish now the very basis of the state-of-the-art research field of distributed computability theory. The (iterated) immediate-snapshot model is widely adopted nowadays in combinatorial representations of distributed computations. As was correctly conjectured by the authors in a concurrent paper, the protocol complex of this model is precisely captured by the standard chromatic subdivision, enabling straightforward reasoning about the model’s computability. The two contributions also help us in teaching the foundations of resilience: it is much easier to deal with the wait-free model, and deduce computability of other models via simulation.

In summary, this paper turned out to be crucial for our understanding of fault-tolerant distributed computing. It proposed a powerful reduction technique, the BG simulation, it introduced the immediate-snapshot model, and it established the fundamental impossibility of $k$-resilient $k$-set consensus.

Yehuda Afek, Tel Aviv University, Israel
Rachid Guerraoui, EPFL, Switzerland
Taisuke Izumi, Nagoya Institute of Technology, Japan
Petr Kuznetsov, Télécom ParisTech, France
The winner of the 2017 Principles of Distributed Computing Doctoral Dissertation Award is Dr. Mohsen Ghaffari, for his dissertation Improved Distributed Algorithms for Fundamental Graph Problems, written under the supervision of Prof. Nancy Lynch at the Massachusetts Institute of Technology.

Ghaffari’s thesis represents an extraordinary study of network algorithms which is, at the same time, both deep and extensive. Many of the results included in this thesis (5, to be precise) have already been awarded “Best Student Paper” award or “Best Paper” award (and sometimes both) in top-notch conferences. The number of publications produced by Ghaffari while working on his thesis is also staggering (over 35 papers!): the thesis covers only a small part of his work. Most important, Ghaffari made a very significant contribution to the Theory of Network Algorithms, particularly to randomized network algorithms.

Specifically, the thesis contains three parts. In the first part, a new randomized algorithm for the Maximal Independent Set (MIS) problem is developed. The algorithm is simple and local in a strong sense: the termination time of a node depends only the coin-tosses within distance 2. This algorithm improves on all previous results and thus leads to improved time complexity in the many applications that use MIS as a building block. In the second part, Ghaffari presents results concerning vertex- and edge-connectivity in graphs, with applications to different problems such as Connected Dominated Set and Minimum Spanning Tree computation. And in the last part of the thesis, following classical packet routing results, scheduling multiple network tasks concurrently is considered. It is shown that in fact, there may be an unavoidable logarithmic gap between the case of packet routing and general tasks, but on the positive side, we never need to pay more than a single logarithmic factor (beyond the “congestion+dilation” lower bound) to schedule multiple tasks.

The award. The award is sponsored jointly by the ACM Symposium on Principles of Distributed Computing (PODC) and the EATCS Symposium on Distributed Computing (DISC). This award is presented annually, with the presentation taking place alternately at PODC and DISC. The 2017 award will be presented at PODC 2017, to be held in Washington DC, USA.

The 2017 Principles of Distributed Computing Doctoral Dissertation Award Committee:

- Cyril Gavoille (LaBRI, U. Bordeaux)
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