36th International Symposium on Distributed Computing

DISC 2022, October 25–27, 2022, Augusta, Georgia, USA

Edited by

Christian Scheideler

Editors

Christian Scheideler
Universität Paderborn, Germany
scheideler@upb.de

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Brief Announcements

Preface

Welcome to DISC 2022, the 36th International Symposium on Distributed Computing, held on October 25–27, 2022, in Augusta, Georgia, USA. DISC is an international forum on the theory, design, analysis, and implementation of distributed systems and networks, focusing on distributed computing in all its forms. DISC is organized in cooperation with the European Association for Theoretical Computer Science (EATCS).

This volume contains the papers presented at DISC 2022. We received 117 regular paper submissions and 2 brief announcement submissions. The program committee consisted of 34 members, and the committee was assisted by 110 external reviewers. All submissions were evaluated by at least three reviewers. The program committee used a relaxed form of double-blind review: the submissions were anonymous but the authors were allowed to disseminate their work through arXiv or other online repositories and to give presentations of their works. Final decisions were made during a virtual PC meeting. We accepted 34 regular papers (an acceptance rate of 29%) and 15 brief announcements for presentation at DISC 2022. The keynotes were given by Roberto Baldoni, Jennifer Welch, and Sepehr Assadi.

This volume also includes the citations for the best paper and best student paper awards at DISC 2022, as well as citations for two awards jointly sponsored by DISC and the ACM Symposium on Principles of Distributed Computing (PODC):

- The 2022 Edsger W. Dijkstra Prize in Distributed Computing was presented at PODC 2022 to Maged M. Michael for his paper "Safe Memory Reclamation for Dynamic Lock-Free Objects Using Atomic Reads and Writes" and to Maurice Herlihy, Victor Luchangco, and Mark Moir for their paper "The Repeat Offender Problem: A Mechanism for Supporting Dynamic-Sized, Lock-Free Data Structures."
- The 2022 Principles of Distributed Computing Doctoral Dissertation Award was presented at DISC 2022 to Dr. Naama Ben-David for her dissertation "Theoretical Foundations for Practical Concurrent and Distributed Computation" and to Dr. Manuela Fischer for her dissertation "Local Algorithms for Classic Graph Problems."

I would like to thank everyone who contributed to DISC 2022: the authors of the submitted papers, PC members and external reviewers, keynote speakers, members of the organizing committee, workshop organizers, members of the award committees, and participants at the conference. I would also like to thank the members of the steering committee, former chairs and many other members of the community for their valuable assistance and suggestions, EATCS for their support, and the staff at Schloss Dagstuhl – Leibniz-Zentrum für Informatik for their help in preparing these proceedings.

October 2022

Christian Scheideler
DISC 2022 Program Chair

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Organization

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 is organized in cooperation with the European Association for Theoretical Computer Science (EATCS).

Awards

Best Paper

The DISC Program Committee has selected the following paper to receive the DISC 2022 best paper award:

Smoothed Analysis of Information Spreading in Dynamic Networks
by Michael Dinitz, Jeremy Fineman, Seth Gilbert, and Calvin Newport.

This paper applies smoothed analysis to the study of k-message broadcast in dynamic networks. It shows that even with a small amount of smoothing, a simple distributed random broadcast strategy can significantly outperform the existing worst-case lower bounds. In addition to that, it proves that in static networks the runtime of this strategy further improves, establishing that even in the context of smoothing, changing topologies remain more difficult to move information through than their static counterparts. Interestingly, the tools developed for these analyses can be applied to improve the best-known bounds for k-message broadcast, without smoothing, in the well-mixed dynamic network setting.

Best Student Paper

The DISC Program Committee has selected the following two papers to receive the DISC 2022 best student paper award:

Polynomial-Time Verification and Testing of Implementations of the Snapshot Data Structure
by Gal Amram, Avi Hayoun, Lior Mizrahi and Gera Weiss

and

Byzantine Consensus Is $\Theta(n^2)$: The Dolev-Reischuk Bound Is Tight Even in Partial Synchrony!
by Pierre Civit, Muhammad Ayaz Dzulfikar, Seth Gilbert, Vincent Gramoli, Rachid Guerraoui, Jovan Komatovic, and Manuel Vidigueira.

The first paper focuses on the correctness of implementations of the snapshot data structure in terms of linearizability and shows that such implementations can be verified in polynomial time. This presents a significant improvement considering that verifying linearizability of implementations of concurrent data structures, in general, is EXPSPACE-complete in the number of program states, and testing linearizability is NP-complete in the length of the tested execution.

The second paper presents SQUAD, a partially synchronous Byzantine consensus protocol with quadratic worst-case communication complexity. The Dolev-Reischuk bound says that any deterministic Byzantine consensus protocol has at least quadratic communication complexity in the worst-case, but a protocol with such a complexity was only known for synchronous environments and the previously best protocols for partial synchrony had a cubic communication complexity.

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2022 Edsger W. Dijkstra Prize in Distributed Computing

The Edsger W. Dijkstra Prize in Distributed Computing is awarded for 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. It is sponsored jointly by the ACM Symposium on Principles of Distributed Computing (PODC) and the EATCS Symposium on Distributed Computing (DISC). The prize is presented annually, with the presentation taking place alternately at PODC and DISC.

The 2022 Edsger W. Dijkstra Prize in Distributed Computing has been awarded to the papers

- **Safe Memory Reclamation for Dynamic Lock-Free Objects Using Atomic Reads and Writes**, by Maged M. Michael (Proceedings of the 22nd ACM Symposium on Principles of Distributed Computing, PODC 2002, pages 21–30), and
- **The Repeat Offender Problem: A Mechanism for Supporting Dynamic-Sized, Lock-Free Data Structures**, by Maurice Herlihy, Victor Luchangco, and Mark Moir (Proceedings of the 16th International Symposium on Distributed Computing, DISC 2002, pages 339–353).

for providing the first general approach to memory reclamation in nonblocking data structures, with significant impact both in research and practice.

Nonblocking concurrent data structures are central to the theory and practice of parallel programming. Unfortunately, correct nonblocking structures are difficult to write. A key challenge is to ensure, before reclaiming an unlinked node, that no still-active operation retains a reference to that node.

Hazard Pointers, also known as the "Pass the Buck" solution to the Repeat Offenders Problem, were the first general-purpose solution to the memory management problem in nonblocking concurrent data structures. They remain the dominant solution today. By maintaining a global set of references to objects (nodes) to which active threads hold private references, they enable nonblocking code to determine when a node can safely be reclaimed. By organizing the set as a collection of per-thread structures, each of which is accessed primarily by its owner, they avoid most nonlocal references, keeping overhead low enough for all but the most demanding applications.

Together, the winning papers revolutionized both the theory and practice of nonblocking algorithms. They have inspired dozens of follow-on projects and well over a thousand citations. Today, hazard pointers are used in an enormous variety of commercial libraries and systems, making them essential to most of the world's data centers and multicore devices.

2022 Award Committee:

Marcos Aguilera, VMware Research
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2022 Principles of Distributed Computing Doctoral Dissertation Award

Many exceptionally high-quality doctoral dissertations were submitted for the 2022 Principles of Distributed Computing Doctoral Dissertation Award. After careful long deliberation, the award committee decided to share the award among two:

- **Dr. Naama Ben-David** for her dissertation "Theoretical Foundations for Practical Concurrent and Distributed Computation."
- **Dr. Manuela Fischer** for her dissertation "Local Algorithms for Classic Graph Problems."

Dr. Naama Ben-David completed her thesis on July 22nd, 2020, under the supervision of Prof. Guy E. Blelloch, at Carnegie Mellon University. In her thesis, Dr. Ben-David addressed three modern technologies that play a significant role in concurrent/distributed computing and carefully developed faithful, clean, and theoretically elegant models for each. Based on these models and theories she then developed for each a new distributed algorithm, showed the algorithms applicability in practice, and finally developed practical tools to enable practitioners and theoretical researchers to analyze these systems, and the benefits of the new models and algorithms. The three technologies which Dr. Ben-David addressed in her thesis are: (1) remote direct memory access (RDMA) as a means to share memory among message- passing communicating processors whether in a large network or in a data center, (2) non-volatile random access memories (NVRAM) for which she developed a general simulation that can adapt many classic concurrent algorithms to a setting in which processes using NVRAM can recover after a system fault, and (3) shared-memory concurrent access where Dr. Ben-David developed new careful analysis reflecting their performance in practice.

Dr. Manuela Fischer completed her thesis on 14th June, 2021, under the supervision of Prof. Mohsen Ghaffari, at ETH Zurich. Dr. Fischer's thesis contains a large consistent set of outstanding achievements in the design of distributed algorithms for numerous graph problems in models such as LOCAL and CONGESTED-CLIQUE, with strong connections to the MPC model for parallel computing. Dr. Fischer introduced new techniques for distributed algorithm design, as well as for the analysis of randomized algorithms for graph problems. Two of the results presented in her thesis resolve central problems that were open for over 25 years: the first efficient deterministic distributed algorithm for $(2\Delta - 1)$-edge-coloring, and a tight analysis of a randomized greedy MIS algorithm. The thesis is technically broad and deep, spanning at least five intrinsically different technical challenges: (1) rounding for linear programs, (2) bootstrapping Lovasz Local Lemma algorithms, (3) analyzing an intricate stochastic process, (4) bounding convergence of a Markov chain via path coupling, and (5) a number of randomized ideas in massively parallel computation. Dr. Fischer's techniques have already been adopted by the leading researchers in the field, and are used in several follow-up works.

The award is sponsored jointly by the ACM Symposium on Principles of Distributed Computing (PODC) and the EATCS Symposium on Distributed Computing (DISC). It is presented annually, with the presentation taking place alternately at PODC and DISC. This year it will be presented at DISC, to be held at Augusta, Georgia USA, October 25-27, 2022.

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