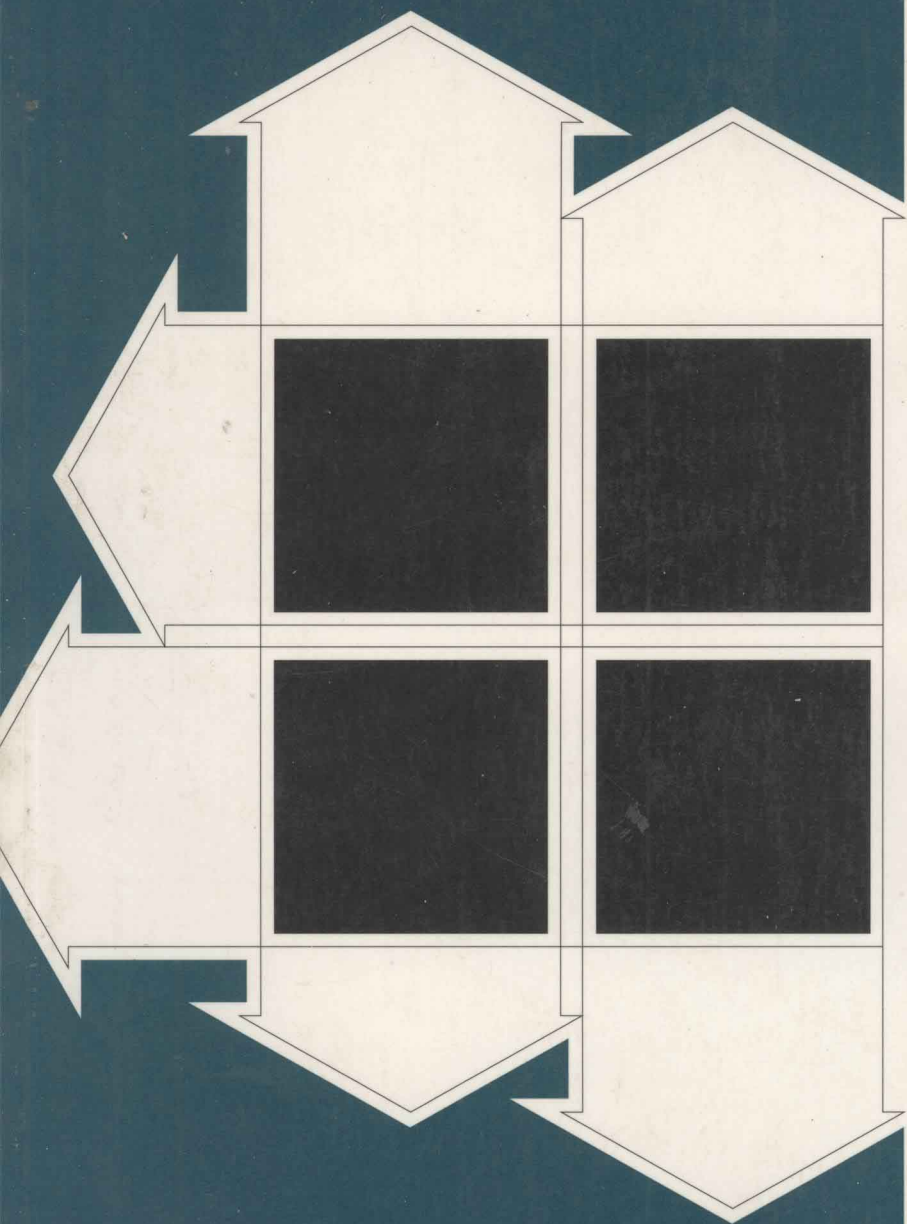


# PROCEEDINGS



**The 13th International  
Conference on**

## Distributed Computing Systems

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**Pittsburgh, Pennsylvania  
May 25–28, 1993**

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Sponsored by



IEEE Computer Society  
Technical Committee on Distributed Processing



IEEE Computer Society Press



The Institute of Electrical and Electronics Engineers, Inc.

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IEEE Computer Society Press  
Los Alamitos, California

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THE INSTITUTE OF ELECTRICAL AND  
ELECTRONICS ENGINEERS, INC.

*PROCEEDINGS*

The 13th International  
Conference on  
Distributed Computing  
Systems

## **General Chair's Message**

The 13th International Conference on Distributed Computing Systems (ICDCS) has continued the tradition of presenting high-quality research results in the growing area of distributed computing. Over the last 14 years this conference has evolved into one of the most reputable in this area.

As general chair of the conference, I am indebted to many individuals who have devoted a lot of their time and efforts to make this conference a successful one.

First, thanks to Larry Wittie, who has done an excellent job in organizing the program committee and in selecting a collection of high-quality papers for this conference. He often worked overnight to put together all the necessary materials to meet our deadlines. Thanks are due to Yao-Nan Lien, who has organized an excellent tutorial program that strikes a balance between theory and practice in distributed computing.

Thanks are also due to Bruce McMillin for coordinating publicity for the conference and for putting together the advance program, and to our international liaison chairs, Makoto Takizawa and A.M. Tjoa, for publicity in Asia and Europe. I am grateful to Mario Barbacci and Charles Weinstock, the local arrangements committee, for determining all the details in Pittsburgh for our conference site and social events. I am indebted to Joseph Urban and his awards committee for selecting the best paper of this conference, and to Susan Urban for serving as our treasurer. I would like to thank Mike Liu, who was always ready to help and share his experience with me in running this conference.

Finally, I would like to thank Maurice Herlihy, H.T. Kung, and Richard Rashid for serving as our keynote speakers at the three plenary sessions. The three exciting topics they will present will be the highlight of the conference.

Thank you for attending ICDCS, and I hope that you will find it rewarding.

Benjamin W. Wah  
General Chair  
University of Illinois at Urbana-Champaign  
Urbana, Illinois, USA

## Program Chair's Message

Thank you for the interest in distributed computing systems that you show by reading this frontispiece. Our field continues to expand. The new widespread interest in high-speed optical networks ("data highways") and ubiquitous cellular radio systems linking mobile personal computers, fast workstations and massively parallel supercomputers is part of a world-wide blossoming of distributed systems into all aspects of our lives, personal and professional. It is exciting to be present in the beginning years of a global shift in computing paradigms.

The interest in this conference is also spreading globally, especially given our by now well-established policy of meeting in North America, Europe/Africa, North/South America, and Asia/Australia in a regular four year cycle. In June 1994, ICDCS-14 will be held in Poznan, Poland. For ICDCS-13, we received 306 manuscripts from 24 nations (205 from North America, 57 from Europe, 41 from Asia, 2 from Australia, and 1 from Africa), but seven were withdrawn from submission.

Reviewing of the 299 manuscripts was handled by 12 area chairs from seven different nations. Care was taken by each to select program committee members and other reviewers from experts in all parts of the world. Authors were asked to suggest one or two target areas to help in the time-consuming task of assigning arriving papers to area chairs. The suggestions helped very much.

Almost all papers had four careful reviews, and many several more. The goal was at least three thorough, consistent reviews for each potential paper. Papers by members of the program and organizing committees were reviewed without author or institutional identification and were held to a higher standard for acceptance. Hidden author identities were not revealed even at the program committee meeting in Stony Brook January 15-16, where a very select set of 63 papers were chosen. The overall acceptance rate was a mere 21 percent because of time limitations in the program. Many well qualified papers could not be accepted. The following table lists the number of papers suggested, reviewed, and accepted for each area.

Area	Accepted	Reviewed	Suggested
Computer Architecture & Distributed Shared Memory	3	26	30
Communication Architectures and Protocols	6	25	58
Cooperative Work and Artificial Intelligence	5	23	26
Distributed Algorithms	6	28	63
Distributed Databases	7	27	40
Distributed Operating Systems	10	28	54
Distributed System Services & Management	8	28	53
Languages, Tools, and Software Engineering	4	29	54
Multimedia Computing and Communication	2	13	16
Modeling and Performance Evaluation	6	25	48
Reliability and Fault Tolerance	3	26	49
Real-Time Issues	3	21	30
<b>Totals</b>	<b>63</b>	<b>299</b>	<b>521</b>

Besides the 21 paper sessions, the conference program includes three invited keynote talks and three technical panel discussions. We are grateful to the speakers and panelists for taking time from their busy schedules to address us.

Many hundreds of people have worked hard to make this proceedings for ICDCS-13 a reality. Our first thanks go to the 690 authors of submitted manuscripts and the 429 reviewers, including the 138 program committee members. Thanks also to the 24 persons who have volunteered to chair the paper and panel

sessions. My personal thanks go to the 12 program committee area chairs who performed so well under such short deadlines, and especially to Amy Zwarico, Andre van Tilborg, and John Lahoczky for finding last-minute reviewers for the real-time manuscripts. Thanks also go to the general chair Benjamin Wah for repeated help in deciding what was needed next, to the ICDCS-12 program chair Joe Urban for warning what to expect when, and to the publicity chair Bruce McMillan for working long and hard to get the final program ready in time for use as an advance program. The chair of the steering committee, Mike Liu, must be honored for his wisdom in making this a truly international conference series and for his wealth of knowledge about people around the world who are willing to help review our papers and organize our conferences. Our job was made much easier by the quiet work of Janet Harward-Colopy, Bob Werner, and Anne Marie Kelly at the IEEE Computer Society — thank you. Finally, my thanks go to the Stony Brook people who helped sort and organize the twin floods of manuscripts (306) and reviews (1500): Susan Choudhari, Ai Li, Gudjon Hermannsson, and Tracey Chan.

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*Liba Svobodova, IBM Zurich Research Laboratory, Switzerland*  
*Daniel Duchamp, Columbia University, USA*  
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