


Proceedings of the Third Workshop




# Future Trends of Distributed Computing Systems

*April 14–16, 1992  
Taipei, Taiwan*

Sponsored by IEEE Computer Society Technical Committee on Distributed Processing

 IEEE Computer Society Press

 The Institute of Electrical and Electronics Engineers, Inc.

Proceedings of the  
**Third Workshop on  
Future Trends of Distributed  
Computing Systems**

*April 14–16, 1992*

*Taipei, Taiwan*

**Sponsored by**

IEEE Computer Society

IEEE Computer Society Technical Committee on Distributed Computing



IEEE Computer Society Press  
Los Alamitos, California

Washington • Brussels • Tokyo

---

The papers in this book comprise the proceedings of the meeting mentioned on the cover and title page. They reflect the authors' opinions and, in the interests of timely dissemination, are published as presented and without change. Their inclusion in this publication does not necessarily constitute endorsement by the editors, the IEEE Computer Society Press, or the Institute of Electrical and Electronics Engineers, Inc.



Published by the  
IEEE Computer Society Press  
10662 Los Vaqueros Circle  
PO Box 3014  
Los Alamitos, CA 90720-1264

© 1992 by the Institute of Electrical and Electronics Engineers, Inc. All rights reserved.

**Copyright and Reprint Permissions:** Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limits of US copyright law, for private use of patrons, those articles in this volume that carry a code at the bottom of the first page, provided that the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 29 Congress Street, Salem, MA 01970. Instructors are permitted to photocopy, without fee, isolated articles for noncommercial classroom use. For other copying, reprint, or republication permission, write to the Director of Publishing Services, IEEE, 345 East 47th Street, New York, NY 10017.

IEEE Computer Society Press Order Number 2755  
Library of Congress Number 91-78036  
IEEE Catalog Number 91TH0427-5  
ISBN 0-8186-2755-7(paper)  
ISBN 0-8186-2756-5 (microfiche)  
ISBN 0-8186-2757-3 (case)

Additional copies can be ordered from

IEEE Computer Society Press  
Customer Service Center  
10662 Los Vaqueros Circle  
PO Box 3014  
Los Alamitos, CA 90720-1264

IEEE Service Center  
445 Hoes Lane  
PO Box 1331  
Piscataway, NJ 08855-1331

IEEE Computer Society  
13, avenue de l'Aquilon  
B-1200 Brussels  
BELGIUM

IEEE Computer Society  
Ooshima Building  
2-19-1 Minami-Aoyama  
Minato-ku, Tokyo 107  
JAPAN

Editorial production: Penny Storms

Cover design: Joe Daigle

Cover photo: Collection of the National Palace Museum, Taiwan

Printed in the United States of America by McNaughton & Gunn, Inc.

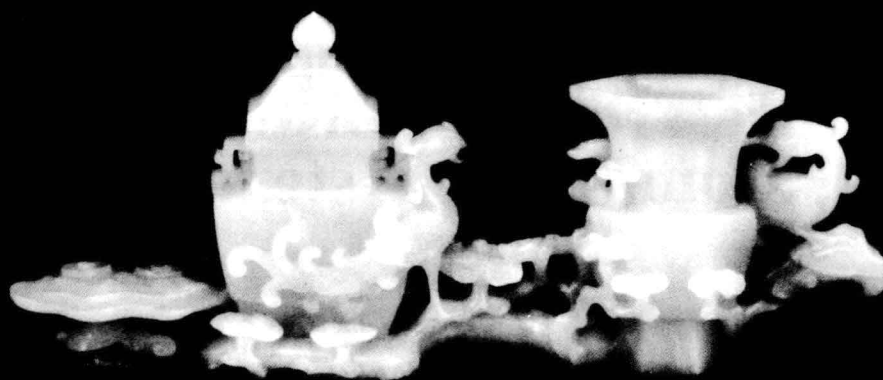


THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

Proceedings of the

**Third Workshop on  
Future Trends of Distributed  
Computing Systems**

Proceedings of the Third Workshop




# Future Trends of Distributed Computing Systems

*April 14–16, 1992  
Taipei, Taiwan*

Sponsored by IEEE Computer Society Technical Committee

 IEEE Computer Society Press

 The Institute of Electrical and Electronics Engineers

## **General Co-Chairmen's Message**

Due to the rapid progress in microelectronics and high-speed networking technologies as well as software engineering and fault-tolerant systems, distributed computing systems have become the most effective systems to provide the necessary computing resources to satisfy the demands of various applications because their configurations can match their application problem structures. In the 1990's, distributed computing systems constitute one of the main streams in computer science and engineering and their technological and application trends will have major impact on the industry and economy.

This workshop is the third workshop in a series devoted to the future trends of distributed computing systems — following 1988 in Hong Kong and 1990 in Cairo. These workshops have become important forums for the researchers around the world to present their most recent research results and exchange ideas and experiences. These discussions, we hope, will help identify the future trends of the research and development of distributed computing systems.

We are very pleased that Taipei was selected as the site of the workshop, not only because of the strong local support, but also because of the excellent research activities in this area. This is evident by the large number of contributions appearing in the proceedings.

We would like to thank the Workshop Committee and Program Committee, especially Radu Popescu-Zeletin, Chyan-Goei Chung, Norman F. Schneidewind, Feng-Jian Wang, and Ruey-Ming Yang for their special effort to make this workshop possible. Finally, we would like to thank the support provided by the Steering Committee, the IEEE Computer Society and its Technical Committee on Distributed Computing.

*Stephen S. Yau*  
*Daniel Yuen*

## Program Chairman's Message

With this, its third convening, *The IEEE Computer Society Workshop on Future Trends of Distributed Computing Systems* is becoming a mature event. Following Hong Kong in 1988, and Cairo in 1990, the 1992 workshop is taking place in Taipei, in recognition of its progress in computer science over the past years.

Enormous scientific and technological progress in network technologies, computer systems, and hardware and software structures, along with the expanding potential for distributed computing, have made this field dynamic and challenging. We've gone from megabits to gigabits, from conventional to multimedia workstations, and from homogeneous to heterogeneous systems. The purpose of this workshop is to provide a forum for specialists working in different areas of distributed computing systems. The workshop encourages the discussion of new ideas and the forecasting of research and development progress for the next two years.

These 58 papers have been carefully chosen by the Program Committee to represent the contribution to the sessions of the workshop. If the technical discussions are of the same caliber as the papers, the workshop is sure to be a success.

We would like to thank the local organizers and all authors for their efforts and contributions, which make this workshop possible.

A special thanks also to the Program and Steering Committees, the IEEE Computer Society, and the IEEE CS Technical Committee on Distributed Computing, for their support.

*Radu Popescu-Zeletin*

# Workshop Committee

## General Co-Chairmen

Stephen S. Yau  
*University of Florida*

Daniel Yuen  
*National Chiao Tung University*

## Program Committee

Radu Popescu-Zeletin, Chairman  
*GMD-FOKUS/TU-Berlin*

Chyan-Goei Chung, Vice-Chairman  
*National Chiao Tung University*

Norman F. Schneidewind, Vice Chairman  
*Naval Postgraduate School*

Kane H. Kim  
*University of California, Irvine*

Hanafy Meleis  
*IBM T.J. Watson Research Center*

Kinji Mori  
*Hitachi, Inc.*

Ahmed Tantawy  
*IBM T.J. Watson Research Center*

## Proceedings Editor and Registration Chairman

Ruey-Ming Yang  
*University of Florida*

## Steering Committee

Kane H. Kim, Chairman  
*University of California, Irvine*

Radu Popescu-Zeletin  
*GMD-FoKUS/TU-Berlin*

Stephen S. Yau  
*University of Florida*



## Local Committee

Feng-Jian Wang, Chairman  
*National Chiao Tung University*

Jen-Nann Chen  
*Chung Shan Institute of Technology*

Chyan-Goei Chung  
*National Chiao Tung University*

Wen-Tsuen Chen  
*National Tsing Hua University*

Yue-Sun Kuo  
*Academia Sinica*

Baw-Jhiung Liu  
*National Central University*

Shyue-Ching Lu  
*Telecommunication Laboratories*

Chien-Chiao Yang  
*National Taiwan Institute of Technology*

Steven S. Cheng  
*CCL/ITRI*

Ching-Chi Hsu  
*National Taiwan University*

Juh-Sheng Ke  
*Institute for Information Industry*

Suh-Yin Lee  
*National Chiao Tung University*

Chung-Shyan Liu  
*Chung-Yuan University*

Hsien-Ming Wu  
*Ministry of Transportation and  
Communication*

Wei-Pong Yang  
*National Chiao Tung University*

# Table of Contents

General Co-Chairmen's Message . . . . .	v
Program Chairman's Message . . . . .	vi
Workshop Committee . . . . .	vii

## Session 1: Opening Session

### Session 2A: Distributed System Architectures

Towards Open CSCW Systems . . . . .	4
<i>L. Navarro, W. Prinz, and T. Rodden</i>	
A Service Platform for Distributed Applications . . . . .	11
<i>R. Popescu-Zeletin, V. Tschammer, and M. Tschichholz</i>	
Improving the Performance of a Distributed Computing System Through Inconsistent Caches . . . . .	18
<i>A.L.P. Chen, K.-F. Chieng, T.C.T. Kuo, E.J.D. Lee, and S.-C. Su</i>	

### Session 2B: Formal Description Techniques

Distributed System Specification Using CO-OPN . . . . .	26
<i>D. Buchs and N. Guelfi</i>	
An Algebraic Approach to Validate Communication Protocols . . . . .	34
<i>A. Benslimane</i>	
Using Petri Nets as a Model for Petri Nets . . . . .	41
<i>R.J. Coelho da Costa and J.-P. Courtiat</i>	

### Session 3A: Distributed System Models

Towards a Synthetical Approach for the Construction of Distributed Applications . . . . .	50
<i>M. Zimmermann, M. Feldhoffer, and O. Drobnik</i>	
Group Orientation: A Paradigm for Distributed Systems of the Nineties . . . . .	57
<i>P. Veríssimo and L. Rodrigues</i>	
A Logical Model of Cooperation . . . . .	64
<i>M. Diaz</i>	

### Session 3B: Programming in Distributed Systems

High-Level Real-Time Distributed Programming . . . . .	72
<i>N.B. Šerbedžija and S. Jähnichen</i>	
Real-Time Descartes: A Real-Time Specification Language . . . . .	79
<i>K.-Y. Sung and J.E. Urban</i>	
A Heuristic Approach to Path Selection Problem in Concurrent Program Testing . . . . .	86
<i>S.-Y. Hsu and C.-G. Chung</i>	

EREBUS: A Debugger for Asynchronous Distributed Computing Systems . . . . .	93
<i>M. Hurfin, N. Plouzeau, and M. Raynal</i>	

## **Session 4A: Communication Architectures and Protocols**

A Model for Dynamic Configuration of Light-Weight Protocols . . . . .	100
<i>T. Plagemann, B. Plattner, M. Vogt, and T. Walter</i>	

TEMPO: A Lightweight Transport Protocol . . . . .	107
<i>S. Böcking</i>	

On the Use of Pre-Defined Implementation Constructs in Distributed Systems Design . . . .	114
<i>L.F. Pires, M. van Sinderen, and C.A. Vissers</i>	

## **Session 4B: Management in Distributed Systems**

The Performance of Multiple Traders Operating in the Same Domain . . . . .	122
<i>V. Tschammer, A. Wolisz, and M. Walch</i>	

A Management Paradigm in Large Distributed Computing Environment . . . . .	129
<i>R. Tsai and J.-L. Chen</i>	

An Optimal Distributed Algorithm for Failure-Driven Leader Election in Bounded-Degree Networks . . . . .	136
<i>Y.-C. Chow, K.C.K. Luo, and R. Newman-Wolfe</i>	

Supporting Action Management in Heterogeneous Distributed Systems . . . . .	142
<i>E. Nett</i>	

## **Session 5A: High Speed Networking**

Internetworking Across Public ATM Networks . . . . .	150
<i>A. Tantawy and M. Zitterbart</i>	

A Demand Driven Access Protocol for High-Speed Networks . . . . .	158
<i>F. Schaffa, M. Willebeek-LeMair, B. Patel and M. Gerla</i>	

An Approach for Fairness Improvement in DQDB Networks . . . . .	165
<i>K.H. Liang and Y.C. Chen</i>	

## **Session 5B: Distributed Operating System Support I**

Message-Based Microkernel for Real-Time System . . . . .	174
<i>S.R. Rim and Y.K. Cho</i>	

Design and Implementation of a Distributed Semaphore Facility . . . . .	180
<i>S.-M. Yuan, C.-J. Wu, H.-M. Lien, and I.-N. Chen</i>	

Support for Consistency-Preserving Dynamic Reconfigurations in Distributed Systems . . . . .	185
<i>M. Endler</i>	

## **Session 6A: Large Scale Broadband Systems**

Assessment of Advanced Broadband Scenarios in Europe . . . . .	194
<i>M. van der Schrier and B. Teunissen</i>	
IN and TMN: Key Concepts for Future Telecom Networks . . . . .	200
<i>T. Magedanz</i>	
The BERKOM Reference Model: The Base for a Taxonomy of Characteristics of Distributed Applications . . . . .	206
<i>P. Egloff, E. Moeller, A. Scheller, and G. Schürmann</i>	

## **Session 6B: Distributed Operating System Support II**

Reviewing Recovery-Management Under Real-Time Requirements in Distributed Systems . . . . .	214
<i>R. Schumann</i>	
Heavyweight Process Migration . . . . .	221
<i>H. Dediu, C.H. Chang, and H. Azzam</i>	
Reduction of Useless Services with Timing Constraints . . . . .	226
<i>C.-C. Lien and C.-C. Yang</i>	

## **Session 7A: Software Engineering**

Graphical Representations and Software Engineering . . . . .	234
<i>R. Gabriel and S. Jähnichen</i>	
A Framework for Software Development for Distributed Parallel Computing Systems . . . .	240
<i>S.S. Yau, D.-H. Bae, and M. Chidambaram</i>	
A Model and Methodology for Distributed Integration . . . . .	247
<i>C.V. Ramamoorthy, C. Chandra, H. Kim, Y.C. Shim, and V. Vij</i>	

## **Session 7B: Data Management in Distributed Systems**

Managing Personal Files Across Independent File Management Units . . . . .	254
<i>M.W. Mutka and L.M. Ni</i>	
Autonomous Decentralized File System and Its Application . . . . .	262
<i>M. Orimo, S. Hirasawa, H. Fujise, M. Takeuchi, and K. Mori</i>	
An Architecture for Multimedia Data Stream Handling and Its Implication for Multimedia Transport Service Interfaces . . . . .	269
<i>R.G. Herrtwich</i>	

## **Session 8A: Fault Tolerant Distributed Systems and Networks**

Structured Software Fault-Tolerance with BSM . . . . .	278
<i>A. Bondavalli and L. Simoncini</i>	

The PTC Scheme for Designing Loosely Coupled Recoverable Processes: Issues in Realizing Bounded Recovery Time . . . . .	287
<i>K.H. Kim</i>	

Distributed Fault-Tolerant Routing in Kautz Networks . . . . .	297
<i>W.-K. Chiang and R.-J. Chen</i>	

Decomposition of Object-Oriented Programs for Fault Tolerant Computing in Distributed Environment . . . . .	304
<i>S.-M. Sheu, J.-M. Ho, and J.-Y. Juang</i>	

## **Session 8B: Distributed Database Systems**

Using Dummy Reads to Maintain Consistency in Heterogeneous Database Systems . . . . .	312
<i>J. Tang</i>	

Semantic Query Processing in Multidatabase Systems: A Logic-Based Approach . . . . .	318
<i>M.-J. Pan, S.-K. Chang, and C.-C. Yang</i>	

Hash-Semijoin: A New Technique for Minimizing Distributed Query Time . . . . .	325
<i>T.-S. Chen, A.L.P. Chen, and W.-P. Yang</i>	

## **Session 9A: Performance Analysis I**

Delay Analysis of a Slotted Ring Medium Access Protocol . . . . .	332
<i>L. Sintonen</i>	

Parallelism and Performance in Communication Subsystems . . . . .	339
<i>S.-P. Chang, A. Tantawy, and H. Meleis</i>	

A Stochastic Performance Modeling Technique for Deterministic Medium Access Schemes . . . . .	346
<i>C. Lindemann</i>	

Two Classes of Effective Heuristics for Time Value Functions Based Scheduling . . . . .	354
<i>P. Muhlethaler and K. Chen</i>	

## **Session 9B: Multimedia Systems**

Distributed Multimedia Information Presenting Environment . . . . .	364
<i>S.-G. Jiang and G.-K. Ma</i>	

Constructing an X-Based Teleconferencing System . . . . .	370
<i>F.-J. Wang, S.T. Lu, and J.H. Liang</i>	

Monitoring Multimedia Systems . . . . .	377
<i>J. Scholten and J. Posthuma</i>	

## **Session 10A: Performance Analysis II**

A System Response Time Model for Local Area Networks . . . . .	382
<i>N.F. Schneidewind</i>	

Scientific Visualization: A Performance Study of CSMA/CD with Connected Data Links (Hybrid Ethernet) . . . . .	389
<i>C.K. Chang, Y.Y. Al-Salqan, T. DeFanti, R. Ramakrishnan, and C.-S. Kang</i>	
Distributed Program Reliability Analysis . . . . .	395
<i>M.-S. Lin and D.-J. Chen</i>	
<b>Session 10B: New Applications and System Architecture</b>	
Incorporating GUI in Integration of Molecular Biology Databases . . . . .	404
<i>N.N. Kamel, T. Song, and M. Kamel</i>	
A Loosely-Coupled Parallel Graphics Architecture Based on a Conflict-Free Multiport Frame Buffer . . . . .	411
<i>S. Nishimura, R. Mukai, and T.L. Kunii</i>	
Application of Autonomous Decentralized System to the Steel Production Computer Control . . . . .	419
<i>T. Kondo, M. Inoue, K. Nakai, K. Doi, and Y. Suzuki</i>	
<b>Session 11: Round Table Discussion and Closing Session</b>	
Author Index . . . . .	426

***Session 1:***  
***Opening Session***





***Session 2A:***  
***Distributed System Architectures***