This is the first edition of the Latin American Symposium on Dependable Computing (proceedings of the LADC). LADC is the sole Latin American event dedicated to discussing the many issues related to computer system dependability. This symposium succeeded the well established Brazilian Symposium on Fault Tolerant Computers, which was a biennial event that lasted for 20 years.

Although the symposium was based in Latin America, the intention was to attract researchers from all over the world. There were 46 paper submissions from Europe, and South and North America. The selection process was rigorous, with each manuscript being sent out for review to four Program Committee members. A total of 19 papers were selected to be included in the proceedings, of which two were experience reports and three were short papers. In addition to these papers, we also invited Henrique Madeira and Eliane Martins to contribute with two papers, and we were very grateful that they accepted our invitation.

LADC 2003 was privileged to have a very prestigious and dedicated Program Committee, that embraced an electronic reviewing process that was demanding and time consuming. We would like to thank its members for their dedication and effort in helping to put together the final program. The electronic submission and reviewing process was only possible due to the efforts of Alan Cleber Borim and Lisandro Zambenedetti Granville in installing and maintaining the EDAS conference manager. As part of the technical program, we also included three invited talks and a panel. Again, we are very grateful to Karama Kanoun, Eno Siewerdt, and Aad van Moorsel for agreeing to deliver invited talks at the symposium, and to João Gabriel Silva for organizing and chairing the panel on dependability benchmarking.

We would also like to thank the LADC Steering Committee for their advice and support. Our special thanks goes to João Batista Camargo Jr., our enthusiastic and supportive General Chair who put so much effort into the organization of a successful LADC 2003. We are also thankful to Springer-Verlag for publishing the symposium proceedings in the prestigious series Lecture Notes in Computer Science.

Finally, we hope that these LADC 2003 proceedings will enlighten and deepen the knowledge of the symposium participants and future readers.

August 2003

Rogério de Lemos
Taisy Silva Weber
Organizing Committee

General Chair
João Batista Camargo Jr.
USP, Brazil

Program Co-chairs
Rogério de Lemos
University of Kent, UK
Taisy Silva Weber
UFRGS, Brazil

Local Arrangements Chair
Sérgio Miranda Paz
USP, Brazil

Publicity Chair
Jorge Rady de Almeida Jr.
USP, Brazil

Finance Chair
Paulo Sérgio Cugnasca
USP, Brazil

Publication Chair
Lucia Vilela Leite Filgueiras
USP, Brazil

Registration Chair
Ricardo Alexandre Veiga Gimenes
USP, Brazil
Lúcio Flávio Vismari
USP, Brazil

Tutorials Co-chairs
Marinho P. Barcellos
UNISINOS, Brazil
Francisco Vilar Brasileiro
UFCG, Brazil

LADC Steering Committee
Francisco Vilar Brasileiro, Brazil
Rogério de Lemos, UK
Joni da Silva Fraga, Brazil
Raimundo Macêdo, Brazil
Eliane Martins, Brazil (Chair)
Carlos A. Maziero, Brazil
Taisy Silva Weber, Brazil
X Organizing Committee

Program Committee

Jean Arlat, France
Marinho P. Barcellos, Brazil
Andrea Bondavalli, Italy
Luiz Eduardo Buzato, Brazil
Paulo Lício de Geus, Brazil
Elias P. Duarte Jr., Brazil
Markus Endler, Brazil
Paul Ezhilchelvan, UK
Gerhard Fohler, Sweden
Joni da Silva Fraga, Brazil
Pedro Gil, Spain
Roberto Gómez, Mexico
John Harauz, Canada
Ingrid Jansch-Pêrto, Brazil
Valérie Issarny, France
Kane Kim, USA
Jean-Claude Laprie, France
Raimundo Macêdo, Brazil
José Carlos Maldonado, Brazil
Eliane Martins, Brazil
Carlos A. Maziero, Brazil
Selma S.S. Melnikoff, Brazil
Fabio Panzieri, Italy
Sergio Rajsbaum, Mexico
Michel Raynal, France
Cecília M.F. Rubira, Brazil
William H. Sanders, USA
João Gabriel Silva, Portugal
Paulo Veríssimo, Portugal
Mladen A. Vouk, USA
Raul Weber, Brazil
Avelino Zorzo, Brazil

External Referees

Richard Achmatowicz
Nick Cook
Miguel Correia
Romulo Silva de Oliveira
Egon Hilgenstiefer
Andreá Luiz Pires Guedes
Andreas Kiefer
Graham Morgan
Bogdan Tomoyuki Nassu
Nuno M. Neves
José Rufino
Juan Carlos Ruiz-Garca
Frank Siqueira
Paulo Sousa

Organizer

University of São Paulo, Polytechnic School

Sponsor

Brazilian Computing Society (SBC)

In Co-operation with

Argentine Society for Informatics and Operations Research (SADIO)
Chilean Computer Science Society (SCCC)
IEEE Computer Society TC on Fault-Tolerant Computing
IFIP Working Group 10.4 “Dependable Computing and Fault-Tolerance”
European Workshop on Industrial Computer Systems – Reliability, Safety and Security (EWICS)
Table of Contents

Invited Talks

Dependability Benchmarking: How Far Are We? .......................... 1
    Karama Kanoun (LAAS-CNRS, France)

Safety-Critical Systems in Air Traffic Management .................... 2
    Eno Siewerdt (ATECH - Tecnologias Críticas, Brazil)

Managed Utility Computing: The Grid as Management Backplane ...... 4
    Vijay Machiraju, Akhil Sahai, Aad van Moorsel (HP Labs, USA)

Fault Injection

Plug and Play Fault Injector for Dependability Benchmarking .......... 8
    Pedro Costa (ISCAC, Portugal), Marco Vieira (ISEC, Portugal),
    Henrique Madeira, João Gabriel Silva (University of Coimbra, Portugal)

Non-intrusive Software Implemented Fault Injection in
Embedded Systems ............................................................ 23
    Pedro Yuste, Juan Carlos Ruiz, Lenin Lemus, Pedro Gil
    (Technical University of Valencia, Spain)

Constraints on the Use of Boundary-Scan for Fault Injection .......... 39
    Luís Santos (ISEC, Portugal), Mário Zenha Rela
    (University of Coimbra, Portugal)

A Strategy for Validating an ODBMS Component Using a High-Level
Software Fault Injection Tool .............................................. 56
    Regina Lúcia de Oliveira Moraes, Eliane Martins (Unicamp, Brazil)

Heavy-Ion Fault Injections in the Time-Triggered
Communication Protocol .................................................... 69
    Håkan Sivencrona (SP Swedish National Testing and
    Research Institute, Sweden), Per Johannessen
    (Volvo Car Corporation, Sweden), Mattias Persson, Jan Torin
    (Chalmers University of Technology, Sweden)

Security

Dependability and Performance Evaluation of Intrusion-Tolerant
Server Architectures ....................................................... 81
    Vishu Gupta, Vinh Lam, HariGovind V. Ramasamy,
    William H. Sanders, Sankalp Singh (UIUC, USA)
Building Trust Chains between CORBA Objects ............................... 102
   Emerson Ribeiro de Mello, Joni da Silva Fraga, Altair Olivo Santin,
   Frank Siqueira (UFSC, Brazil)

An Architecture for On-the-Fly File Integrity Checking .................. 117
   Mauro Borchardt, Carlos Maziero, Edgard Jamhour (PUC-PR, Brazil)

Fault Injection Tool for Network Security Evaluation ..................... 127
   Paulo César Herrmann Wanner, Raul Fernando Weber
   (UFRGS, Brazil)

Adaptive Fault Tolerance

Emulation of Software Faults: Representativeness and Usefulness
   (Invited Paper) ............................................................. 137
   Henrique Madeira, João Durães, Marco Vieira
   (University of Coimbra, Portugal)

Managing Adaptive Fault Tolerant CORBA Applications ................. 160
   Marcos A.M. de Moura (USP, Brazil), Markus Endler
   (PUC-RJ, Brazil)

Adaptable Objects for Dependability ....................................... 181
   José Lino Contreras (UTFSM, Chile), Jean Louis Sourrouille
   (INSA de Lyon, France)

A Genetic Algorithm for Fault-Tolerant System Design .................. 197
   Klaus Echtle, Irene Eusgeld (University of Duisburg-Essen, Germany)

Distributed Algorithms

Cyclic Strategies for Balanced and Fault-Tolerant Distributed Storage ...
   Ricardo Marcelín-Jiménez, Sergio Rajsbaum (UNAM, Mexico)

DisCusS and FuSe: Considering Modularity, Genericness, and
   Adaptation in the Development of Consensus and Fault
Detection Services .............................................................. 234
   Lásaro J. Camargos, Edmundo R.M. Madeira (Unicamp, Brazil)

A Lightweight Interface to Predict Communication Delays Using
   Time Series ........................................................................ 254
   Raúl Ceretta Nunes (UFSM, Brazil), Ingrid Jansch-Pôrto
   (UFRGS, Brazil)

A New Diagnosis Algorithm for Regular Interconnected Structures .... 264
   Antonio Caruso, Luiz Albini, Piero Maestrini
   (ISTI-CNR and University of Pisa, Italy)
### Components and Fault Tolerance

*Eliane Martins (Unicamp, Brazil), Maria de Fátima Mattiello-Francisco (INPE, Brazil)*

**A Fault-Tolerant Distributed Legacy-Based System and Its Evaluation** ................................................................. 303  
*Andrea Bondavalli (Università di Firenze, Italy), Silvano Chiaradonna (ISTI-CNR, Italy), Domenico Cotroneo, Luigi Romano (Università di Napoli Federico II, Italy)*

**An Architectural-Level Exception Handling System for Component-Based Applications** ........................................ 321  
*Fernando Castor Filho, Paulo Asterio de C. Guerra, Cecília Mary F. Rubira (Unicamp, Brazil)*

**On the Use of Formal Specifications to Analyze Fault Behaviors of Distributed Systems** ............................................. 341  
*Fernando L. Dotti, Osmar M. dos Santos, Eduardo T. Rödel (PUC-RS, Brazil)*

### Panel

**Dependability Benchmarks – Can You Rely on Them?** ...................... 361  
*João Gabriel Silva (University of Coimbra, Portugal)*

### Workshops

**Workshop on Safety: Computer Systems in Critical Applications** ........ 362  
*João Batista Camargo Jr. (USP, Brazil), Rogério de Lemos (University of Kent, UK)*

**Second Workshop on Theses and Dissertations in Dependable Computing** ......................................................... 363  
*Avelino Zorzo (PUC-RS, Brazil), Francisco Brasileiro (UFCG, Brazil), Ingrid Jansch-Pórto (UFRGS, Brazil)*

### Tutorials

**Development of Safety-Critical Systems and Model-Based Risk Analysis with UML** ........................................................... 364  
*Jan Jürjens, Siv Hilde Houmb (Munich University of Technology, Germany)*

**On the Cost of Fault-Tolerant Consensus when There Are No Faults – A Tutorial** .................................................. 366  
*Idit Keidar (Technion, Israel), Sergio Rajsbaum (UNAM, Mexico)*
A Practical Approach to Quality Assurance in Critical Systems 369
Carlos Augusto Teixeira de Moura (CLA, Brazil),
Carlos Henrique Netto Lahoz, Martha Adriana Dias Abdala
(IAE/CTA, Brazil)

Author Index 371
The 1st Latin American Symposium on Dependable Computing (LADC 2003) is the sole event in Latin America dedicated to discussing the many issues related to computer system dependability. This symposium succeeded the well established Brazilian Symposium on Fault Tolerant Computers (SCTF), which for almost two decades was the main Brazilian forum for exchanging state-of-the-art research and development in dependable computing. The objective of LADC 2003 was to provide a forum for international and Latin American researchers and practitioners to present their latest results and experiences in this very dynamic field.

The LADC 2003 program presented keynote talks from top international experts in the area, technical sessions, a panel, tutorials, and two workshops: an industrial-oriented workshop for discussing the application of computers in critical systems, and a students’ forum for discussing their latest research.


I would like to acknowledge the financial support received from the following LADC 2003 partners: FAPESP, CNPq, CAPES, FINEP, FDTE, Banco Real ABN AMRO, Scopus Tecnologia S.A., and Microsoft Corporation.

I would like also to thank the LADC 2003 Organizing Committee for their support in helping me with the symposium organization, especially Jorge Rady de Almeida Jr., Paulo Sérgio Cugnasca, Lúcio Flávio Vismari, Ricardo Alexandre Veiga Gimenes, Alan Cleber Borim and Lisandro Zambenedetti Granville. Another special thanks goes to Rogério de Lemos and Taisy Silva Weber, the Program Co-chairs, who exhaustively worked for a successful LADC 2003.

LADC 2003 was held in São Paulo, the major financial and business center of Latin America, responsible for half of Brazil’s GDP. São Paulo is the capital of fine cuisine, leisure and culture and is also the financial and commercial center of Brazil, offering visitors a great variety of attractions. I am sure that all participants appreciated and enjoyed LADC 2003 in São Paulo.

August 2003

João Batista Camargo Jr.