

# Lecture Notes in Computer Science

2978

Edited by G. Goos, J. Hartmanis, and J. van Leeuwen

**Springer**

*Berlin*

*Heidelberg*

*New York*

*Hong Kong*

*London*

*Milan*

*Paris*

*Tokyo*

Roland Groz Robert M. Hierons (Eds.)

# Testing of Communicating Systems

16th IFIP International Conference, TestCom 2004  
Oxford, UK, March 17-19, 2004  
Proceedings



Springer

## Series Editors

Gerhard Goos, Karlsruhe University, Germany  
Juris Hartmanis, Cornell University, NY, USA  
Jan van Leeuwen, Utrecht University, The Netherlands

## Volume Editors

Roland Groz  
LSR-IMAG  
681, rue de la Passerelle, 38402 St Martin d'Hères Cedex, France  
E-mail: Roland.Groz@imag.fr

Robert M. Hierons  
Brunel University, Department of Information Systems and Computing  
Uxbridge, Middlesex, UB8 3PH, United Kingdom  
E-mail: rob.hierons@brunel.ac.uk

## Cataloging-in-Publication Data applied for

A catalog record for this book is available from the Library of Congress.

Bibliographic information published by Die Deutsche Bibliothek  
Die Deutsche Bibliothek lists this publication in the Deutsche Nationalbibliografie;  
detailed bibliographic data is available in the Internet at <<http://dnb.ddb.de>>.

CR Subject Classification (1998): D.2.5, D.2, C.2

ISSN 0302-9743  
ISBN 3-540-21219-1 Springer-Verlag Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

Springer-Verlag is a part of Springer Science+Business Media  
[springeronline.com](http://springeronline.com)

© 2004 IFIP International Federation for Information Processing, Hofstrasse 3, 2361 Laxenburg, Austria  
Printed in Germany

Typesetting: Camera-ready by author, data conversion by PTP-Berlin, Protago-TeX-Production GmbH  
Printed on acid-free paper      SPIN: 10988343      06/3142      5 4 3 2 1 0

# Preface

This volume contains the proceedings of the 16th IFIP TC6/WG6.1 International Conference on Testing of Communicating Systems (TestCom 2004). This conference was held at St Anne's College, Oxford, UK, from March 17 to March 19, 2004.

TestCom 2004 was the sixteenth in a series of IFIP-sponsored events that started in 1988. The previous events were held in Vancouver, Canada (1988); Berlin, Germany (1989); McLean, USA (1990); Leidschendam, Netherlands (1991); Montreal, Canada (1992); Pau, France (1993); Tokyo, Japan (1994); Evry, France (1995); Darmstadt, Germany (1996); Cheju Island, Korea (1997); Tomsk, Russia (1998); Budapest, Hungary (1999); Ottawa, Canada (2000); Berlin, Germany (2002); and Sophia Antipolis, France (2003). TestCom was not held in 2001 since at this point the conference moved from autumn to spring.

TestCom 2004 was organized by Brunel University, UK and LSR-IMAG, France and was sponsored by IFIP. Support was also provided by the Engineering and Physical Sciences Research Council (EPSRC). We are grateful to the keynote speaker, Prof. Sir Tony Hoare, FRS, and our invited speakers for agreeing to address TestCom 2004.

TestCom focuses on the testing of communicating systems within all application domains. Examples of such application domains include, but are not limited to, the automobile industry, avionics, banking, e-commerce, health, military, and telecommunications systems. The 14 papers contained in this volume are largely motivated by problems within the telecommunications domain, which is not surprising given the origins of TestCom. However, a number of papers cover topics outside of telecommunications, such as the testing of reactive systems and testing from UML. This is encouraging and we hope that it indicates the beginning of a closer dialogue between the telecommunications testing community and the general software testing community.

We are grateful to the many people who contributed to the activities required in order for TestCom 2004 to be held. These people include the members of the steering committee, who provided invaluable advice, and the members of the organizing committee, who were responsible for the smooth running of TestCom 2004. As ever, the referees were given the vital task of reviewing many papers in a short period of time. The individuals who contributed to this are listed in the following pages. We would also like to thank Ursula Barth of Springer-Verlag for her assistance in the production of this volume.

January 2004

Roland Groz  
Robert M. Hierons

# Conference Committees

## Conference Chairs

R.M. Hierons (Brunel University, UK)  
R. Groz (LSR-IMAG, France)

## Steering Committee

S.T. Chanson (Hong Kong University, China)  
R. Groz (LSR-IMAG, France)  
G. Leduc, Chairman (University of Liège, Belgium)  
A. Petrenko (CRIM, Canada)

## Technical Programme Committee

G. von Bochmann, University of Ottawa, Canada  
A.R. Cavalli, INT, France  
J. Clark, York University, UK  
R. Dssouli, Concordia University, Canada  
S. Dibuz, Ericsson, Hungary  
P. Frankl, Polytechnic University, USA  
J. Grabowski, University of Göttingen, Germany  
M. Harman, Brunel University, UK  
K. Harrison, Praxis Critical Systems, UK  
T. Higashino, Osaka University, Japan  
D. Hogrefe, University of Göttingen, Germany  
T. Jéron, IRISA, France  
M. Kim, ICU University, Korea  
D. Lee, Bell Labs Research, USA  
G. Maggiore, TIM, Italy  
J. Offutt, George Mason University, USA  
I. Schieferdecker, Fraunhofer FOKUS, Germany  
K. Suzuki, Kennisbron Co., Ltd., Japan  
J. Tretmans, University of Nijmegen, The Netherlands  
A. Ulrich, Siemens, Germany  
H. Ural, University of Ottawa, Canada  
M.U. Uyar, City University of New York, USA  
J. Wegener, DaimlerChrysler AG, Germany  
A. Wiles, ETSI, France  
J. Wu, Tsinghua University, China  
N. Yevtushenko, Tomsk State University, Russia

## Additional Reviewers

S. Balon, University of Liège, Belgium  
A. Baresel, DaimlerChrysler AG, Berlin, Germany  
E. Bayse, INT, France  
M. van der Bijl, University of Twente, The Netherlands  
S. Boroday, CRIM, Canada  
D. Chen, Tsinghua University, Beijing, China  
B. Daou, University of Ottawa, Canada  
A. Duale, IBM, USA  
M. Ebner, University of Göttingen, Germany  
K. El-Fakih, American University of Sharjah, United Arab Emirates  
M. Fecko, Telcordia Technologies, USA  
J.-M. François, University of Liège, Belgium  
L. Frantzen, University of Nijmegen, The Netherlands  
R. Gecse, Ericsson, Hungary  
A. Gotlieb, IRISA/INRIA, Rennes, France  
H. Hallal, CRIM, Canada  
T. Hasegawa, KDDI R&D Laboratories, Japan  
L. Hélouët, IRISA/INRIA, Rennes, France  
J.L. Huo, McGill University, Canada  
A. Idoue, KDDI R&D Laboratories, Japan  
Z. Janos Szabo, Ericsson, Hungary  
C. Jard, IRISA/ENS, Cachan/Rennes, France  
S. Kang, Information and Communications University, Korea  
P. Kremer, Ericsson Hungary  
K. Li, Bell Labs Research, China  
Z. Li, Tsinghua University, China  
F. Liu, Bell Labs Research, China  
H. Neukirchen, University of Göttingen, Germany  
J.-M. Orset, INT, France  
S. Prokopenko, Tomsk State University, Russia  
A. Riedel, University of Göttingen, Germany  
S. Seol, Information and Communications University, Korea  
F. Skivée, University of Liège, Belgium  
N. Sptisyna, Tomsk State University, Russia  
V. Trenkaev, Tomsk State University, Russia  
V. Tschaen, IRISA, France  
E.R. Vieira, INT, France  
R.G. de Vries, University of Nijmegen, The Netherlands  
D. Wang, Bell Labs Research, China  
X. Yin, Tsinghua University, China  
C. Werner, University of Göttingen, Germany  
M. Zibull, University of Göttingen, Germany

## Organization Committee

K. Derderian, Brunel University, UK

Q. Guo, Brunel University, UK

M. Parmar, Brunel University, UK

J. Whittaker, Brunel University, UK

H. Zhu, Oxford Brookes University, UK

## Sponsoring Institutions

Brunel University, UK

LSR-IMAG, France

EPSRC, UK

IFIP

Springer-Verlag, Germany

# Table of Contents

|                                                                                                                                 |     |
|---------------------------------------------------------------------------------------------------------------------------------|-----|
| Implementation of an Open Source Toolset for CCM Components and Systems Testing .....                                           | 1   |
| <i>Harold Batteram, Wim Hellenthal, Willem Romijn, Andreas Hoffmann, Axel Rennoch, Alain Vouffo</i>                             |     |
| A Multi-service and Multi-protocol Validation Platform – Experimentation Results .....                                          | 17  |
| <i>Ana Cavalli, Amel Mederreg, Fatiha Zaïdi, Pierre Combes, Wei Monin, Richard Castanet, Marcien MacKaya, Patrice Laurençot</i> |     |
| From Design to Test with UML (Applied to a Roaming Algorithm for Bluetooth Devices) .....                                       | 33  |
| <i>Zhen Ru Dai, Jens Grabowski, Helmut Neukirchen, Holger Pals</i>                                                              |     |
| BCMP Performance Test with TTCN-3 Mobile Node Emulator .....                                                                    | 50  |
| <i>Sarolta Dibuz, Tibor Szabó, Zsolt Torpis</i>                                                                                 |     |
| FSM Based Interoperability Testing Methods for Multi Stimuli Model .....                                                        | 60  |
| <i>Khaled El-Fakih, Vadim Trenkaev, Natalia Spitsyna, Nina Yevtushenko</i>                                                      |     |
| On Testing Partially Specified IOTS through Lossless Queues .....                                                               | 76  |
| <i>Jia Le Huo, Alexandre Petrenko</i>                                                                                           |     |
| Testing Multi Input/Output Transition System with All-Observer .....                                                            | 95  |
| <i>Zhongjie Li, Jianping Wu, Xia Yin</i>                                                                                        |     |
| Soip over Satellite Testing – TIM Experience .....                                                                              | 112 |
| <i>Giulio Maggiore, Letterio Pirrone, Gaethan Donlap Kouang, Federico Piován, Biagio Ricco Galluzzo</i>                         |     |
| Generation of Optimized Testsuites for UML Statecharts with Time .....                                                          | 128 |
| <i>Tilo Mücke, Michaela Huhn</i>                                                                                                |     |
| Communication Patterns for Expressing Real-Time Requirements Using MSC and Their Application to Testing .....                   | 144 |
| <i>Helmut Neukirchen, Zhen Ru Dai, Jens Grabowski</i>                                                                           |     |
| From Safety Verification to Safety Testing .....                                                                                | 160 |
| <i>Vlad Rusu, Hervé Marchand, Valéry Tschaen, Thierry Jéron, Bertrand Jeannet</i>                                               |     |

Derivation of Abstract Protocol Type Definitions for the  
Conformance Testing of Text-Based Protocols ..... 177  
*Stephan Schulz*

Mutation Testing Applied to Validate SDL Specifications ..... 193  
*Tatiana Sugeta, José Carlos Maldonado, W. Eric Wong*

Execution of External Applications Using TTCN-3 ..... 209  
*Theofanis Vassiliou-Gioles, George Din, Ina Schieferdecker*

**Author Index** ..... 225