

*Commenced Publication in 1973*

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

## Editorial Board

David Hutchison

*Lancaster University, UK*

Takeo Kanade

*Carnegie Mellon University, Pittsburgh, PA, USA*

Josef Kittler

*University of Surrey, Guildford, UK*

Jon M. Kleinberg

*Cornell University, Ithaca, NY, USA*

Friedemann Mattern

*ETH Zurich, Switzerland*

John C. Mitchell

*Stanford University, CA, USA*

Moni Naor

*Weizmann Institute of Science, Rehovot, Israel*

Oscar Nierstrasz

*University of Bern, Switzerland*

C. Pandu Rangan

*Indian Institute of Technology, Madras, India*

Bernhard Steffen

*University of Dortmund, Germany*

Madhu Sudan

*Massachusetts Institute of Technology, MA, USA*

Demetri Terzopoulos

*University of California, Los Angeles, CA, USA*

Doug Tygar

*University of California, Berkeley, CA, USA*

Moshe Y. Vardi

*Rice University, Houston, TX, USA*

Gerhard Weikum

*Max-Planck Institute of Computer Science, Saarbruecken, Germany*

Alexandre Petrenko Margus Veanes  
Jan Tretmans Wolfgang Grieskamp (Eds.)

# Testing of Software and Communicating Systems

19th IFIP TC6/WG6.1 International Conference, TestCom 2007  
7th International Workshop, FATES 2007  
Tallinn, Estonia, June 26-29, 2007  
Proceedings



Springer

## Volume Editors

Alexandre Petrenko  
CRIM  
Montreal, Canada  
E-mail: petrenko@crim.ca

Margus Veanes  
Microsoft Research  
Redmond, WA, USA  
E-mail: margus@microsoft.com

Jan Tretmans  
Embedded Systems Institute  
Eindhoven, The Netherlands  
E-mail: jan.tretmans@esi.nl

Wolfgang Grieskamp  
Microsoft Research  
Redmond, WA, USA  
E-mail: wrwg@microsoft.com

Library of Congress Control Number: 2007928493

CR Subject Classification (1998): D.2.5, D.2-3, C.2, F.3, K.6

LNCS Sublibrary: SL 5 – Computer Communication Networks and  
Telecommunications

ISSN	0302-9743
ISBN-10	3-540-73065-6 Springer Berlin Heidelberg New York
ISBN-13	978-3-540-73065-1 Springer 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. Violations are liable to prosecution under the German Copyright Law.

Springer is a part of Springer Science+Business Media  
springer.com

© IFIP International Federation for Information Processing 2007  
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India  
Printed on acid-free paper      SPIN: 12076826      06/3180      5 4 3 2 1 0

*The original version of the book frontmatter was revised:  
The copyright line was incorrect. The Erratum  
to the book frontmatter is available at  
DOI: [10.1007/978-3-540-73066-8\\_26](https://doi.org/10.1007/978-3-540-73066-8_26)*

# Preface

Testing is one of the most important techniques for validating the correctness of communicating and software systems. Triggered by the quest for improved quality of systems, and by the high and ever-increasing costs of making and executing the necessary tests, testing has evolved during the last two decades from an ad-hoc and under-exposed area of systems development to an important and active area, where a lot of research and development, in academia as well as in industry, is taking place. This evolvement is also reflected in an increasing number of testing conferences and workshops being regularly organized. Two of these, TestCom the 19th IFIP TC6/WG6.1 International Conference on Testing of Communicating Systems – and Fates the seventh International Workshop on Formal Approaches to Testing of Software, were jointly held in Tallinn, Estonia, June 27–29, 2007. In addition, FORTE, the 27th IFIP International Conference on Formal Methods for Networked and Distributed Systems, was also held in Tallinn during these dates, together thus forming a large event on testing, validation, and specification of software, communicating, and distributed systems.

The objective of TESTCOM/FATES 2007 was to offer a forum for researchers from academia as well as industry, developers, and testers to present, discuss, and learn about new approaches, theories, methods, and tools in the field of testing of software and communicating systems.

TESTCOM - Testing of Communicating Systems is an IFIP-sponsored series of international conferences, previously also called the International Workshop on Protocol Test Systems (IWPTS) or International Workshop on Testing of Communicating Systems (IWTCS). It is devoted to testing of communicating systems, including testing of communication protocols, services, distributed platforms, and middleware. The previous events were held in Vancouver, Canada (1988); Berlin, Germany (1989); McLean, USA (1990); Leidschendam, The 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); Sophia Antipolis, France (2003); Oxford, UK (2004); Montreal, Canada (2005); and New York, USA (2006).

FATES - Formal Approaches to Testing of Software is a series of workshops devoted to the use of formal methods in software testing. Previous events were held in Aalborg, Denmark (2001); Brno, Czech Republic (2002); Montreal, Canada (2003); Linz, Austria (2004); Edinburgh, UK (2005); and Seattle, USA (2006).

This volume contains the proceedings of TESTCOM/FATES 2007, the joint conference of TESTCOM and FATES. Out of 61 submitted papers, the Program Committee selected 24 papers for presentation at the conference. Together with the invited presentation by Antti Huima from Conformiq Software Ltd., Finland, they form the contents of these proceedings. The conference itself, in addition,

contained another invited presentation, jointly with Forte, by Susanne Graf from Verimag (France), and presentations of work-in-progress papers, position papers, short experience reports, and tool demonstrations, which were separately published. A tutorial day preceded the main conference.

We would like to thank the numerous people who contributed to the success of TESTCOM/FATES 2007: the Steering Committee of IFIP for the TESTCOM conference, the Program Committee and the additional reviewers for their support in selecting and composing the conference program, and the authors and the invited speakers for their contributions without which, of course, these proceedings would not exist. We thank Conformiq Software Ltd., CRIM, and Microsoft Research for their financial support and Springer for their support in publishing these proceedings. We acknowledge the use of EasyChair for the conference management and wish to thank its developers. Last, but not least, we thank the Institute of Cybernetics at Tallinn University of Technology and the Department of Computer Science of TUT, in particular, Juhan Ernits, Monika Perkmann, Jaagup Irve, Ando Saabas, Kristi Uustalu, and Tarmo Uustalu, for all matters regarding the local organization and for making TestCom/Fates 2007 run smoothly.

April 2007

Alexandre Petrenko  
Margus Veanes  
Jan Tretmans  
Wolfgang Grieskamp

# Conference Organization

## Program Chairs

Alexandre Petrenko (CRIM, Canada)  
Margus Veanes (Microsoft Research, USA)  
Jan Tretmans (Embedded Systems Institute, The Netherlands)  
Wolfgang Grieskamp (Microsoft Research, USA)

## Steering Committee

John Derrick (University of Sheffield, UK), Chair  
Ana R. Cavalli (INT, France)  
Roland Groz (LSR-IMAG, France)  
Alexandre Petrenko (CRIM, Canada)

## Program Committee

Bernhard K. Aichernig (Graz University of Technology, Austria)  
Paul Baker (Motorola, UK)  
Antonia Bertolino (ISTI-CNR, Italy)  
Gregor v. Bochmann (University of Ottawa, Canada)  
Juris Borzovs (LVU, Latvia)  
Rachel Cardell-Oliver (The University of Western Australia, Australia)  
Richard Castanet (LABRI, France)  
Ana R. Cavalli (INT, France)  
John Derrick (University of Sheffield, UK)  
Sarolta Dibuz (Ericsson, Hungary)  
Khaled El-Fakih (American University of Sharjah, UAE)  
Marie-Claude Gaudel (University of Paris-Sud, France)  
Jens Grabowski (University of Gottingen, Germany)  
Roland Groz (LSR-IMAG, France)  
Rob Hierons (Brunel University, UK)  
Teruo Higashino (Osaka University, Japan)  
Dieter Hogrefe (University of Gottingen, Germany)  
Antti Huima (Conformiq Software Ltd., Finland)  
Thierry Jeron (IRISA Rennes, France)  
Ferhat Khendek (Concordia University, Canada)  
Myungchul Kim (ICU, Korea)  
Victor Kuliainin (ISP RAS, Russia)  
Hartmut Konig (BTU Cottbus, Germany)  
David Lee (Ohio State University, USA)

Bruno Legeard (Leirios, France)  
 Alexander Letichevsky (Institute of Cybernetics, Ukraine)  
 Giulio Maggiore (Telecom Italia Mobile, Italy)  
 Brian Nielsen (University of Aalborg, Denmark)  
 Manuel Núñez (UC de Madrid, Spain)  
 Ian Oliver (Nokia Research, Finland)  
 Doron Peled (University of Bar-Ilan, Israel)  
 Alexander Pretschner (ETH Zurich, Switzerland)  
 Harry Robinson (Google, USA)  
 Vlad Rusu (IRISA Rennes, France)  
 Ina Schieferdecker (Fraunhofer FOKUS, Germany)  
 Kenji Suzuki (University of Electro-Communications, Japan)  
 Andreas Ulrich (Siemens, Germany)  
 Hasan Ural (University of Ottawa, Canada)  
 Mark Utting (University of Waikato, New Zealand)  
 M Umit Uyar (City University of New York, USA)  
 Juri Vain (Tallinn University of Technology, Estonia)  
 Carsten Weise (Ericsson, Germany)  
 Burkhart Wolff (ETH Zurich, Switzerland)  
 Jianping Wu (Tsinghua University, China)  
 Nina Yevtushenko (Tomsk State University, Russia)  
 Zheng Zhang (Microsoft Research, China)

## Local Organization

Juhan Ernits, Monika Perkmann, Jaagup Irve, Ando Saabas, Kristi Uustalu,  
 Tarmo Uustalu (Tallinn University of Technology, Estonia)

## External Reviewers

Benharef Abdel	Fang-Chun Kuo
Jongmoon Baik	Mounir Lallali
Lydie du Bousquet	Shuhao Li
Henrik Brosenne	Luis Llana
Patryk Chamuczynski	Stephane Maag
Camille Constant	Wissam Mallouli
Guglielmo De Angelis	Mercedes G. Merayo
Jeremy Dubreil	Marius Mikucionis
Maxim Gromov	Helmut Neukirchen
Toru Hasegawa	Tomohiko Ogishi
Hatem Hamdi	Jean-Marie Orset
Jukka Honkola	Patrizio Pelliccione
Akira Idoue	Larry Quo
Guy-Vincent Jourdan	Ismael Rodriguez
Sungwon Kang	Soonuk Seol



Natalia Shabaldina  
Xingang Shi  
Atsushi Tagami  
Abel Vamos  
Vianney Darmaillacq  
Jean-Luc Richier

Zhiliang Wang  
Edith Werner  
Constantin Werner  
Xia Yin  
Benjamin Zeiss

# Table of Contents

Implementing Conformiq Qtronic .....	1
<i>Antti Huima</i>	
New Approach for EFSM-Based Passive Testing of Web Services .....	13
<i>Abdelghani Benharref, Rachida Dssouli, Mohamed Adel Serhani, Abdeslam En-Nouaary, and Roch Glitho</i>	
Automation of Avionic Systems Testing .....	28
<i>David Cebrián, Valentín Valero, and Fernando Cuartero</i>	
Automatic Test Generation from Interprocedural Specifications .....	41
<i>Camille Constant, Bertrand Jeannet, and Thierry Jéron</i>	
A New Method for Interoperability Test Generation .....	58
<i>Alexandra Desmoulin and César Viho</i>	
Component Testing Is Not Enough - A Study of Software Faults in Telecom Middleware .....	74
<i>Sigrid Eldh, Sasikumar Punnekkat, Hans Hansson, and Peter Jönsson</i>	
Symbolic Model Based Testing for Component Oriented Systems .....	90
<i>Alain Faivre, Christophe Gaston, and Pascale Le Gall</i>	
A Compositional Testing Framework Driven by Partial Specifications ...	107
<i>Yliès Falcone, Jean-Claude Fernandez, Laurent Mounier, and Jean-Luc Richier</i>	
Nodes Self-similarity to Test Wireless Ad Hoc Routing Protocols .....	123
<i>Cyril Grepet and Stephane Maag</i>	
Testing and Model-Checking Techniques for Diagnosis .....	138
<i>Maxim Gromov and Tim A.C. Willemse</i>	
Model-Based Testing of Service Infrastructure Components .....	155
<i>László Gönczy, Reiko Heckel, and Dániel Varró</i>	
Testing Input/Output Partial Order Automata .....	171
<i>Stefan Haar, Claude Jard, and Guy-Vincent Jourdan</i>	
A Framework for Testing AIS Implementations .....	186
<i>Tamás Horváth and Tibor Sulyán</i>	

An Object-Oriented Framework for Improving Software Reuse on Automated Testing of Mobile Phones .....	199
<i>Luiz Kawakami, André Knabben, Douglas Rechia, Denise Bastos, Otavio Pereira, Ricardo Pereira e Silva, and Luiz C.V. dos Santos</i>	
Model Based Testing of an Embedded Session and Transport Protocol .....	212
<i>Vesa Luukkala and Ian Oliver</i>	
Utilising Code Smells to Detect Quality Problems in TTCN-3 Test Suites .....	228
<i>Helmut Neukirchen and Martin Bisanz</i>	
A Bounded Incremental Test Generation Algorithm for Finite State Machines .....	244
<i>Zoltán Pap, Mahadevan Subramaniam, Gábor Kovács, and Gábor Árpád Németh</i>	
Experimental Testing of TCP/IP/Ethernet Communication for Automatic Control .....	260
<i>Przemysław Plesowicz and Mieczysław Metzger</i>	
Towards Systematic Signature Testing .....	276
<i>Sebastian Schmerl and Hartmut Koenig</i>	
TPLan-A Notation for Expressing Test Purposes .....	292
<i>Stephan Schulz, Anthony Wiles, and Steve Randall</i>	
Testing Nondeterministic Finite State Machines with Respect to the Separability Relation .....	305
<i>Natalia Shabaldina, Khaled El-Fakih, and Nina Yevtushenko</i>	
Learning and Integration of Parameterized Components Through Testing .....	319
<i>Muzammil Shahbaz, Keqin Li, and Roland Groz</i>	
An EFSM-Based Passive Fault Detection Approach .....	335
<i>Hasan Ural and Zhi Xu</i>	
Test Data Variance as a Test Quality Measure: Exemplified for TTCN-3 .....	351
<i>Diana Vega, Ina Schieferdecker, and George Din</i>	
Model-Based Testing of Optimizing Compilers .....	365
<i>Sergey Zelenov and Sophia Zelenova</i>	
Erratum to: Testing of Software and Communicating Systems .....	E1
<i>Alexandre Petrenko, Margus Veanes, Jan Tretmans, and Wolfgang Grieskamp</i>	
<b>Author Index</b> .....	379