Toshimitsu Masuzawa
Sébastien Tixeuil (Eds.)

LNCS 4838

Stabilization, Safety, and Security of Distributed Systems

9th International Symposium, SSS 2007
Paris, France, November 2007
Proceedings

SSS 2007

Springer

Toshimitsu Masuzawa Sébastien Tixeuil (Eds.)

Stabilization, Safety, and Security of Distributed Systems

9th International Symposium, SSS 2007
Paris, France, November 14-16, 2007
Proceedings

Springer

Volume Editors

Toshimitsu Masuzawa
Osaka University
Graduate School of Information Science and Technology
1-3 Machikaneyama, Toyonaka, Osaka 5608531, Japan
E-mail: masuzawa@ist.osaka-u.ac.jp

Sébastien Tixeuil
Université Pierre et Marie Curie - Paris 6
LIP6 - CNRS 7606
104 avenue du Président Kennedy, 75016 Paris, France
E-mail: Sebastien.Tixeuil@lip6.fr

Library of Congress Control Number: 2007938253

CR Subject Classification (1998): C.2.4, C.3, F.1, F.2.2, K.6

LNCS Sublibrary: SL 1 – Theoretical Computer Science and General Issues

ISSN 0302-9743
ISBN-10 3-540-76626-X Springer Berlin Heidelberg New York
ISBN-13 978-3-540-76626-1 Springer Berlin Heidelberg New York

Springer is a part of Springer Science+Business Media

springer.com

Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 12184118 06/3180 5 4 3 2 1 0

Lecture Notes in Computer Science 4838

Lecture Notes in Computer Science

Sublibrary 1: Theoretical Computer Science and General Issues

For information about Vols. 1–4492
please contact your bookseller or Springer

Vol. 4838: T. Masuzawa, S. Tixeuil (Eds.), Stabilization, Safety, and Security of Distributed Systems. XIII, 409 pages. 2007.

Vol. 4783: J. Holub, J. Žďárek (Eds.), Implementation and Application of Automata. XIII, 324 pages. 2007.

Vol. 4782: R. Perrott, B.M. Chapman, J. Subhlok, R.F. de Mello, L.T. Yang (Eds.), High Performance Computing and Communications. XIX, 823 pages. 2007.

Vol. 4771: T. Bartz-Beielstein, M.J. Blesa Aguilera, C. Blum, B. Naujoks, A. Roli, G. Rudolph, M. Sampels (Eds.), Hybrid Metaheuristics. X, 202 pages. 2007.

Vol. 4770: V.G. Ganzha, E.W. Mayr, E.V. Vorozhtsov (Eds.), Computer Algebra in Scientific Computing. XIII, 460 pages. 2007.

Vol. 4763: J.-F. Raskin, P.S. Thiagarajan (Eds.), Formal Modeling and Analysis of Timed Systems. X, 369 pages. 2007.

Vol. 4746: A. Bondavalli, F. Brasileiro, S. Rajsbaum (Eds.), Dependable Computing. XV, 239 pages. 2007.

Vol. 4743: P. Thulasiraman, X. He, T.L. Xu, M.K. Denko, R.K. Thulasiram, L.T. Yang (Eds.), Frontiers of High Performance Computing and Networking ISPA 2007 Workshops. XXIX, 536 pages. 2007.

Vol. 4742: I. Stojmenovic, R.K. Thulasiram, L.T. Yang, W. Jia, M. Guo, R.F. de Mello (Eds.), Parallel and Distributed Processing and Applications. XX, 995 pages. 2007.

Vol. 4736: S. Winter, M. Duckham, L. Kulik, B. Kuipers (Eds.), Spatial Information Theory. XV, 455 pages. 2007.

Vol. 4732: K. Schneider, J. Brandt (Eds.), Theorem Proving in Higher Order Logics. IX, 401 pages. 2007.

Vol. 4731: A. Pelc (Ed.), Distributed Computing. XVI, 510 pages. 2007.

Vol. 4726: N. Ziviani, R. Baeza-Yates (Eds.), String Processing and Information Retrieval. XII, 311 pages. 2007.

Vol. 4711: C.B. Jones, Z. Liu, J. Woodcock (Eds.), Theoretical Aspects of Computing – ICTAC 2007. XI, 483 pages. 2007.

Vol. 4710: C.W. George, Z. Liu, J. Woodcock (Eds.), Domain Modeling and the Duration Calculus. XI, 237 pages. 2007.

Vol. 4708: L. Kučera, A. Kučera (Eds.), Mathematical Foundations of Computer Science 2007. XVIII, 764 pages. 2007.

Vol. 4707: O. Gervasi, M.L. Gavrilova (Eds.), Computational Science and Its Applications – ICCSA 2007, Part III. XXIV, 1205 pages. 2007.

Vol. 4706: O. Gervasi, M.L. Gavrilova (Eds.), Computational Science and Its Applications – ICCSA 2007, Part II. XXIII, 1129 pages. 2007.

Vol. 4705: O. Gervasi, M.L. Gavrilova (Eds.), Computational Science and Its Applications – ICCSA 2007, Part I. XLIV, 1169 pages. 2007.

Vol. 4703: L. Caires, V.T. Vasconcelos (Eds.), CONCUR 2007 – Concurrency Theory. XIII, 507 pages. 2007.

Vol. 4700: C.B. Jones, Z. Liu, J. Woodcock (Eds.), Formal Methods and Hybrid Real-Time Systems. XVI, 539 pages. 2007.

Vol. 4699: B. Kågström, E. Elmroth, J. Dongarra, J. Waśniewski (Eds.), Applied Parallel Computing. XXIX, 1192 pages. 2007.

Vol. 4698: L. Arge, M. Hoffmann, E. Welzl (Eds.), Algorithms – ESA 2007. XV, 769 pages. 2007.

Vol. 4697: L. Choi, Y. Paek, S. Cho (Eds.), Advances in Computer Systems Architecture. XIII, 400 pages. 2007.

Vol. 4688: K. Li, M. Fei, G.W. Irwin, S. Ma (Eds.), Bio-Inspired Computational Intelligence and Applications. XIX, 805 pages. 2007.

Vol. 4684: L. Kang, Y. Liu, S. Zeng (Eds.), Evolvable Systems: From Biology to Hardware. XIV, 446 pages. 2007.

Vol. 4683: L. Kang, Y. Liu, S. Zeng (Eds.), Advances in Computation and Intelligence. XVII, 663 pages. 2007.

Vol. 4681: D.-S. Huang, L. Heutte, M. Loog (Eds.), Advanced Intelligent Computing Theories and Applications. XXVI, 1379 pages. 2007.

Vol. 4672: K. Li, C. Jesshope, H. Jin, J.-L. Gaudiot (Eds.), Network and Parallel Computing. XVIII, 558 pages. 2007.

Vol. 4671: V.E. Malyshkin (Ed.), Parallel Computing Technologies. XIV, 635 pages. 2007.

Vol. 4669: J.M. de Sá, L.A. Alexandre, W. Duch, D. Mandic (Eds.), Artificial Neural Networks – ICANN 2007, Part II. XXXI, 990 pages. 2007.

Vol. 4668: J.M. de Sá, L.A. Alexandre, W. Duch, D. Mandic (Eds.), Artificial Neural Networks – ICANN 2007, Part I. XXXI, 978 pages. 2007.

Vol. 4666: M.E. Davies, C.J. James, S.A. Abdallah, M.D. Plumbley (Eds.), Independent Component Analysis and Blind Signal Separation. XIX, 847 pages. 2007.

Vol. 4665: J. Hromkovič, R. Královič, M. Nunkesser, P. Widmayer (Eds.), Stochastic Algorithms: Foundations and Applications. X, 167 pages. 2007.

Vol. 4664: J. Durand-Lose, M. Margenstern (Eds.), Machines, Computations, and Universality. X, 325 pages. 2007.

Vol. 4649: V. Diekert, M.V. Volkov, A. Voronkov (Eds.), Computer Science – Theory and Applications. XIII, 420 pages. 2007.

Vol. 4647: R. Martin, M.A. Sabin, J.R. Winkler (Eds.), Mathematics of Surfaces XII. IX, 509 pages. 2007.

Vol. 4646: J. Duparc, T.A. Henzinger (Eds.), Computer Science Logic. XIV, 600 pages. 2007.

Vol. 4644: N. Azémard, L. Svensson (Eds.), Integrated Circuit and System Design. XIV, 583 pages. 2007.

Vol. 4641: A.-M. Kermarrec, L. Bougé, T. Priol (Eds.), Euro-Par 2007 Parallel Processing. XXVII, 974 pages. 2007.

Vol. 4639: E. Csuhaj-Varjú, Z. Ésik (Eds.), Fundamentals of Computation Theory. XIV, 508 pages. 2007.

Vol. 4638: T. Stützle, M. Birattari, H. H. Hoos (Eds.), Engineering Stochastic Local Search Algorithms. X, 223 pages. 2007.

Vol. 4630: H.J. van den Herik, P. Ciancarini, J. Donkers (Eds.), Computers and Games. XII, 283 pages. 2007.

Vol. 4628: L.N. de Castro, F.J. Von Zuben, H. Knidel (Eds.), Artificial Immune Systems. XII, 438 pages. 2007.

Vol. 4627: M. Charikar, K. Jansen, O. Reingold, J.D.P. Rolim (Eds.), Approximation, Randomization, and Combinatorial Optimization. XII, 626 pages. 2007.

Vol. 4624: T. Mossakowski, U. Montanari, M. Haveraaen (Eds.), Algebra and Coalgebra in Computer Science. XI, 463 pages. 2007.

Vol. 4623: M. Collard (Ed.), Ontologies-Based Databases and Information Systems. X, 153 pages. 2007.

Vol. 4621: D. Wagner, R. Wattenhofer (Eds.), Algorithms for Sensor and Ad Hoc Networks. XIII, 415 pages. 2007.

Vol. 4619: F. Dehne, J.-R. Sack, N. Zeh (Eds.), Algorithms and Data Structures. XVI, 662 pages. 2007.

Vol. 4618: S.G. Akl, C.S. Calude, M.J. Dinneen, G. Rozenberg, H.T. Wareham (Eds.), Unconventional Computation. X, 243 pages. 2007.

Vol. 4616: A.W.M. Dress, Y. Xu, B. Zhu (Eds.), Combinatorial Optimization and Applications. XI, 390 pages. 2007.

Vol. 4614: B. Chen, M. Paterson, G. Zhang (Eds.), Combinatorics, Algorithms, Probabilistic and Experimental Methodologies. XII, 530 pages. 2007.

Vol. 4613: F.P. Preparata, Q. Fang (Eds.), Frontiers in Algorithmics. XI, 348 pages. 2007.

Vol. 4600: H. Comon-Lundh, C. Kirchner, H. Kirchner (Eds.), Rewriting, Computation and Proof. XVI, 273 pages. 2007.

Vol. 4599: S. Vassiliadis, M. Bereković, T.D. Hämäläinen (Eds.), Embedded Computer Systems: Architectures, Modeling, and Simulation. XVIII, 466 pages. 2007.

Vol. 4598: G. Lin (Ed.), Computing and Combinatorics. XII, 570 pages. 2007.

Vol. 4596: L. Arge, C. Cachin, T. Jurdziński, A. Tarlecki (Eds.), Automata, Languages and Programming. XVII, 953 pages. 2007.

Vol. 4595: D. Bošnački, S. Edelkamp (Eds.), Model Checking Software. X, 285 pages. 2007.

Vol. 4590: W. Damm, H. Hermanns (Eds.), Computer Aided Verification. XV, 562 pages. 2007.

Vol. 4588: T. Harju, J. Karhumäki, A. Lepistö (Eds.), Developments in Language Theory. XI, 423 pages. 2007.

Vol. 4583: S.R. Della Rocca (Ed.), Typed Lambda Calculi and Applications. X, 397 pages. 2007.

Vol. 4580: B. Ma, K. Zhang (Eds.), Combinatorial Pattern Matching. XII, 366 pages. 2007.

Vol. 4576: D. Leivant, R. de Queiroz (Eds.), Logic, Language, Information and Computation. X, 363 pages. 2007.

Vol. 4547: C. Carlet, B. Sunar (Eds.), Arithmetic of Finite Fields. XI, 355 pages. 2007.

Vol. 4546: J. Kleijn, A. Yakovlev (Eds.), Petri Nets and Other Models of Concurrency – ICATPN 2007. XI, 515 pages. 2007.

Vol. 4545: H. Anai, K. Horimoto, T. Kutsia (Eds.), Algebraic Biology. XIII, 379 pages. 2007.

Vol. 4533: F. Baader (Ed.), Term Rewriting and Applications. XII, 419 pages. 2007.

Vol. 4528: J. Mira, J.R. Álvarez (Eds.), Nature Inspired Problem-Solving Methods in Knowledge Engineering, Part II. XXII, 650 pages. 2007.

Vol. 4527: J. Mira, J.R. Álvarez (Eds.), Bio-inspired Modeling of Cognitive Tasks, Part I. XXII, 630 pages. 2007.

Vol. 4525: C. Demetrescu (Ed.), Experimental Algorithms. XIII, 448 pages. 2007.

Vol. 4514: S.N. Artemov, A. Nerode (Eds.), Logical Foundations of Computer Science. XI, 513 pages. 2007.

Vol. 4513: M. Fischetti, D.P. Williamson (Eds.), Integer Programming and Combinatorial Optimization. IX, 500 pages. 2007.

Vol. 4510: P. Van Hentenryck, L.A. Wolsey (Eds.), Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems. X, 391 pages. 2007.

Vol. 4507: F. Sandoval, A.G. Prieto, J. Cabestany, M. Graña (Eds.), Computational and Ambient Intelligence. XXVI, 1167 pages. 2007.

Vol. 4502: T. Altenkirch, C. McBride (Eds.), Types for Proofs and Programs. VIII, 269 pages. 2007.

Vol. 4501: J. Marques-Silva, K.A. Sakallah (Eds.), Theory and Applications of Satisfiability Testing – SAT 2007. XI, 384 pages. 2007.

Vol. 4497: S.B. Cooper, B. Löwe, A. Sorbi (Eds.), Computation and Logic in the Real World. XVIII, 826 pages. 2007.

Vol. 4494: H. Jin, O.F. Rana, Y. Pan, V.K. Prasanna (Eds.), Algorithms and Architectures for Parallel Processing. XIV, 508 pages. 2007.

Vol. 4493: D. Liu, S. Fei, Z. Hou, H. Zhang, C. Sun (Eds.), Advances in Neural Networks – ISNN 2007, Part III. XXVI, 1215 pages. 2007.

¥603.00元

Preface

This volume contains the 27 regular papers and the abstracts of three invited keynotes that were presented at the Ninth International Symposium on Stabilization, Safety, and Security of Distributed Systems (SSS) held November 14–16, 2007 in Paris, France.

SSS, the International Symposium on Stabilization, Safety, and Security of Distributed Systems, is a prestigious international forum for researchers and practitioners in design and development of fault-tolerant distributed systems with self-* properties, such as self-stabilizing, self-configuring, self-organizing, self-managing, self-repairing, self-healing, self-optimizing, self-adaptive, and self-protecting properties. It started as the Workshop on Self-Stabilizing Systems (WSS), which was first held at Austin in 1989. From the second WSS in Las Vegas in 1995, the forum was held biennially, at Santa Barbara (1997), Austin (1999), Lisbon (2001), San Francisco (2003), and Barcelona (2005). With the growth of the research field of self-stabilization, the title of the forum changed to the Symposium on Self-Stabilizing Systems (SSS) in 2003. Since 2005, SSS was run annually to encourage the rapid and sustained growth of the field, and the 2006 edition was held in Dallas. In 2006, following the demand for self-stabilization in various areas of distributed computing including peer-to-peer networks, wireless sensor networks, mobile ad hoc networks, and robotic networks, the scope of the symposium was extended to cover all safety and security-related aspects of self-* systems. The title of the symposium changed to the International Symposium on Stabilization, Safety, and Security of Distributed Systems (SSS).

This year, we received 64 submissions from 22 countries. Each submission was carefully reviewed by four to six Program Committee members with the help of external reviewers, and the Program Committee selected the 27 papers. It is worthwhile noticing that the overall quality of submissions was excellent and there are many papers that we had to reject because of organization constraints yet deserved to be published. The three invited keynotes dealt with hot topics absorbing the interest of attendees: "The Power of Cryptographic Attacks: Is Your Network Really Secure Against Side Channels Attacks and Malicious Faults?" by Jean-Jacques Quisquater, "Role-Based Self-Configuration of Sensor Networks" by Kay Römer, and "Robots and Molecules" by Masafumi Yamashita. Following the recent tradition of SSS, Anurag Dasgupta, Sukumar Ghosh, and Xin Xiao received the Best Paper Award for their paper, "Probabilistic Fault-Containment."

On behalf of the Program Committee, we would like to thank all authors of submitted papers for their support. We also thank the members of the Steering Committee for their invaluable advice. We wish to express our appreciation to the Program Committee members and additional external reviewers for their tremendous effort and excellent reviews. We gratefully acknowledge the Organizing Committee members for their generous contribution to the success

of the symposium. Paper submission, selection, and generation in the proceedings was greatly eased by the use of the EasyChair conference system (`http://www.easychair.org`). We wish to thank the EasyChair creators and maintainers for their commitment to the scientific community.

"We gratefully acknowledge the financial support from *Microsoft Corporation*, the *Laboratoire de Recherche en Informatique (LRI)*, the *Laboratoire d'Informatique de Paris 6 (LIP6)*, and the *Présidence de l'Université Paris Sud XI*".

November 2007

Toshimitsu Masuzawa
Sébastien Tixeuil

Conference Organization

Steering Committee

Anish Arora, Ohio State Univ., USA
Ajoy K. Datta, Univ. of Nevada, Las Vegas, USA
Shlomi Dolev, Ben-Gurion Univ. of the Negev, Israel
Sukumar Ghosh (Chair), Univ. of Iowa, USA
Mohamed G. Gouda, Univ. of Texas at Austin, USA
Ted Herman, Univ. of Iowa, USA
Shing-Tsaan Huang, National Central Univ., Taiwan
Vincent Villain, Univ. de Picardie, France

Program Chairs

Toshimitsu Masuzawa, Osaka Univ., Japan
Sébastien Tixeuil, Univ. Pierre et Marie Curie - Paris 6, France

Program Committee

Tadashi Araragi, NTT Co., Japan
Anish Arora, Ohio State Univ., USA
James Aspnes, Yale Univ., USA
Doina Bein, Univ. of Texas at Dallas, USA
Jorge A. Cobb, Univ. of Texas at Dallas, USA
Frederic Cuppens, ENST Bretagne, France
Ajoy K. Datta, Univ. of Nevada, Las Vegas, USA
Hervé Debar, Orange Labs, France
Sylvie Delaët, Univ. Paris-Sud, France
Danny Dolev, Hebrew Univ. of Jerusalem, Israel
Shlomi Dolev, Ben-Gurion Univ., Israel
Eric Filiol, INRIA, France
Paola Flocchini, Univ. of Ottawa, Canada
Felix Freiling, Univ. of Mannheim, Germany
Toru Fujiwara, Osaka Univ., Japan
Sukumar Ghosh, Univ. of Iowa, USA
Dieter Gollmann, Hamburg Univ. of Technology, Germany
Maria Gradinariu, Univ. Pierre et Marie Curie - Paris 6, France
Isabelle Guérin-Lassous, ENS Lyon, France
Rachid Guerraoui, EPFL, Switzerland
Phuong Ha, Univ. Tromsø, Norway
Ted Herman, Univ. of Iowa, USA

Jaap-Henk Hoepman, TNO / Radboud Univ. Nijmegen, The Netherlands
Chin-Tser Huang, Univ. of South Carolina at Columbia, USA
Shing-Tsaan Huang, National Central Univ., Taiwan
Michiko Inoue, Nara Institute of Science and Technology, Japan
Hirotsugu Kakugawa, Osaka Univ., Japan
Mehmet H. Karaata, Kuwait Univ., Kuwait
Yoshiaki Katayama, Nagoya Institute of Technology, Japan
Boris Koldehofe, Univ. of Stuttgart, Germany
Sandeep S. Kulkarni, Michigan State Univ., USA
Shay Kutten, Technion, Israel
Toshimitsu Masuzawa (Program Chair), Osaka Univ., Japan
Ludovic Mé, Supelec Rennes, France
Miodrag Mihaljevic, Serbian Academy of Sciences and Arts, Belgrade / RCIS-AIST, Japan
Mikhail Nesterenko, Kent State Univ., USA
Marina Papatriantafilou, Chalmers Univ., Sweden
Andrzej Pelc, Univ. du Quebec en Outaouais, Canada
Franck Petit, LaRIA, Univ. de Picardie, France
Scott Pike, Texas A&M Univ., USA
Sergio Rajsbaum, Univ. Nacional Autonoma de Mexico, Mexico
Matthieu Roy, LAAS-CNRS, France
Kouichi Sakurai, Kyushu Univ., Japan
Pierre Sens, Univ. Pierre et Marie Curie - Paris 6, France
Neeraj Suri, TU Darmstadt, Germany
Sébastien Tixeuil (Program Chair), Univ. Pierre et Marie Curie - Paris 6, France
Eric Totel, Supelec Rennes, France
Tatsuhiro Tsuchiya, Osaka Univ., Japan
Masafumi Yamashita, Kyushu Univ., Japan

Organizing Committee

Luciana Arantes, Univ. Pierre et Marie Curie - Paris 6, France
Sylvie Delaët (Organizing Chair), Univ. Paris-Sud, France
Stéphane Devismes, Univ. Paris-Sud, France
Maria Gradinariu, Univ. Pierre et Marie Curie - Paris 6, France
Pierre Sens, Univ. Pierre et Marie Curie - Paris 6, France
Sébastien Tixeuil, Univ. Pierre et Marie Curie - Paris 6, France
Véronique Varenne, Univ. Pierre et Marie Curie - Paris 6, France

Additional Reviewers

Fabien Autrel
J. Alfonso Briones
Joffroy Beauquier
Zinaida Benenson
Bruhadeshwar Bezawada
Christophe Bidan

Erik-Olver Blaß
Christian Boulinier
Rainer Böhme
Hui Cao
Eddy Caron
Julien Clement
Nora Cuppens
Stéphane Devismes
Yoann Dieudonne
Dinil M. Divakaran
Hen Fitoussi
Zhang Fu
Kazuhide Fukushima
Joaquin Garcia-Alfaro
Leszek Gasieniec
Giorgos Georgiadis
Anders Gidenstam
Seth Gilbert
Andreas Grau
Sammy Haddad
Rachid Hadid
Yoshiaki Hori
Michel Hurfin
Yasunori Ishihara
Taisuke Izumi
David P. Jacobs
Mark Jelasity
Hyung Chan Kim
Gerald Georg Koch
Dariusz Kowalski
Rastislav Kralovic
Ioannis Krontiris
Vinod Kulkathumani
Ouiddad Labbani-Igbida
Limor Lahiani
William Leal
Francois Lesueur
Benjamin Morin
Vinayak Naik
Boaz Patt-Shamir
David Peleg
Lucia Draque Penso
Giuseppe Prencipe
Rami Puzis
Marisuz Rokicki
Elad M. Schiller
Mukundan Sridharan
Messika Stephane
Kenichi Takahashi
Cedric Tedeschi
Julien Thomas
Frederic Tronel
Nir Tzachar
Remi Vannier
Koichi Wada
Yi Xian
Reuve Yagel
Hongwei Zhang

Table of Contents

The Power of Cryptographic Attacks: Is Your Network Really Secure Against Side Channels Attacks and Malicious Faults?

Jean-Jacques Quisquater

UCL Crypto Group, Microelectronics Laboratory
Université Catholique de Louvain, Belgium
quisquater@dice.ucl.ac.be

Abstract. When speaking about attacks against networks and computers, people mainly think today about viruses, worms, Trojans, keyloggers, denial of services, etc.

In the last ten years a lot of new attacks were found against servers and smart cards. First are side-channels attacks: those are by using "esoteric" channels to obtain protected, secure and private informations. Esoteric here means very often channels related to the communication channel (time of interaction), processors (power, electromagnetic radiations, caches, branching, etc.). Second are the malicious faults related to secret key cryptography. The interaction of cryptographic algorithms with malicious faults must be carefully known and understood: one error sometimes means a totally broken system.

We will survey the field with a focus on distributed systems and networks.

T. Masuzawa and S. Tixeuil (Eds.): SSS 2007, LNCS 4838, p. 1, 2007.

Role-Based Self-configuration of Sensor Networks

Kay Römer

Institute for Pervasive Computing
ETH Zurich, Switzerland
roemer@inf.ethz.ch

Abstract. Wireless sensor networks consist of so-called sensor nodes – small untethered computing devices equipped with sensors, a wireless radio, a processor, and autonomous power supply. Large and dense networks of these devices can be deployed unobtrusively in the physical environment in order to monitor a wide variety of real-world phenomena with unprecedented quality and scale while only marginally disturbing the observed physical processes.

Many sensor network applications require some form of self-configuration, where sensor nodes take on specific functions in the network. Configuration of a sensor network is particularly challenging, as the anticipated large number of sensor nodes participating in a network typically precludes manual configuration of individual nodes. Additionally, pre-deployment configuration is often infeasible because some configuration parameters such as node location and network neighborhood are typically unknown prior to deployment. Also, node parameters may change over time, necessitating dynamic re-configuration.

In this talk we present a framework for the development of self-configuring sensor networks known as *generic role assignment*. The key idea is to consider self-configuration as the problem of assigning a *role* to each sensor node such that certain global constraints are satisfied. Both the set of available roles and the constraints can be specified by the developer using a declarative specification language. These specifications are compiled and executed in the sensor network, where a distributed role assignment algorithm finds an assignment of roles to sensor nodes that is compliant with the specification. Assigned roles are updated to reflect changes in the sensor network resulting, for example, from addition or removal of nodes. The role assignment algorithms are efficient regarding the communication overhead and robust with respect to message loss.

Using this framework, a variety of different self-configuration problems can be implemented. Example problems include *coverage* (assign roles `ACTIVE` and `SLEEP`, such that few active nodes cover the area of interest with their sensors while the remaining nodes can be turned into a power-saving sleep mode) or *clustering* (assign roles `SLAVE`, `GATEWAY`, and `HEAD` such that each slave has a cluster head neighbor where cluster heads are interconnected by gateway nodes to form a connected backbone). These and other problems can be specified with few lines of code using the declarative specification language, which effectively shields the developer from low-level implementation details.

T. Masuzawa and S. Tixeuil (Eds.): SSS 2007, LNCS 4838, p. 2, 2007.

Robots and Molecules

Masafumi Yamashita

Kyushu University, Fukuoka 819-0395 Japan
mak@csce.kyushu-u.ac.jp

Abstract. We survey some of the recent theoretical works about autonomous mobile robot systems and then discuss the possibility of extending robot models to analyze molecular computing systems. There are two types of robot systems appearing in the Distributed Computing literature. One is a self-reconfigurable system, which consists of a number of identical robotic modules that can connect to, disconnect from, and relocate relatively to adjacent modules. A behaviour of a self-reconfigurable system looks like the life game and we are interested in desigining an algorithm (local map) that makes the whole system behave in a consistent way. The other model is an autonomous mobile robot system, which consists of mobile robots with eye sensors as communication devices. The formation problem of a given geometrical pattern has been discussed extensively. Although those two systems have some common features and common goals, they were proposed independently and have been investigated separetely.

After surveying some of works on those robot systems, we introduce some works in molecular computing. We explain some of the examples in which those robot systems appear naturally. We then argue some problems that arise from the molecular computing applications. A key coincidence between the robot models and the molecular computing is that they are systems composed of anonymous modules.

T. Masuzawa and S. Tixeuil (Eds.): SSS 2007, LNCS 4838, p. 3, 2007.