Lecture Notes in Computer Science

3856

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

George Danezis David Martin (Eds.)

Privacy Enhancing Technologies

5th International Workshop, PET 2005 Cavtat, Croatia, May 30-June 1, 2005 Revised Selected Papers



Volume Editors

George Danezis
Katholieke Universiteit Leuven
Dept. Elektrotechniek-ESAT/COSOC
Kasteelpark Arenberg 10, 3001 Leuven-Heverlee, Belgium
E-mail: George.Danezis@esat.kuleuven.be

David Martin University of Massachusetts Computer Science Department One University Ave. Lowell, MA 01854, USA E-mail: dm@cs.uml.edu

Library of Congress Control Number: 2006926828

CR Subject Classification (1998): E.3, C.2, D.4.6, K.6.5, K.4, H.3, H.4

LNCS Sublibrary: SL 4 – Security and Cryptology

ISSN 0302-9743

ISBN-10 3-540-34745-3 Springer Berlin Heidelberg New York
 ISBN-13 978-3-540-34745-3 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

© Springer-Verlag Berlin Heidelberg 2006 Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India Printed on acid-free paper SPIN: 11767831 06/3142 5 4 3 2 1 0

Preface

PET 2005 held in Cavtat (Croatia) from May 30 to June 1, 2005, was the 5th Workshop on Privacy-Enhancing Technologies, which is now established as a yearly event. The workshop received 74 full paper submissions out of which 17 papers were ultimately selected to be presented. The selection process relied on over 200 reviews from the Program Committee, Program Chairs and additional reviewers, at least three per paper. A further 2-week long e-mail discussion led to consensus on the papers accepted—with the ultimate responsibility for the program resting on the Program Co-chairs. The number of accepted papers and final program format was to ensure that PET retains its character as a workshop, with ample time for discussion, two panel discussions, and space for the fermentation of new ideas and collaborations.

The Program Chairs would first like to thank the PET 2005 Program Committee for the high-quality reviews and discussion that led to the program:

- Martin Abadi, University of California at Santa Cruz, USA
- Alessandro Acquisti, Heinz School, Carnegie Mellon University, USA
- Caspar Bowden, Microsoft EMEA, UK
- Jean Camp, Indiana University at Bloomington, USA
- Richard Clayton, University of Cambridge, UK
- Lorrie Cranor, School of Computer Science, Carnegie Mellon University, USA
- Roger Dingledine, The Free Haven Project, USA
- Hannes Federrath, University of Regensburg, Germany
- Ian Goldberg, Zero Knowledge Systems, Canada
- Philippe Golle, Palo Alto Research Center, USA
- Marit Hansen, Independent Centre for Privacy Protection Schleswig-Holstein, Germany
- Markus Jakobsson, Indiana University at Bloomington, USA
- Dogan Kesdogan, Rheinisch-Westfaelische Technische Hochschule Aachen, Germany
- Brian Levine, University of Massachusetts at Amherst, USA
- Andreas Pfitzmann, Dresden University of Technology, Germany
- Matthias Schunter, IBM Zurich Research Lab, Switzerland
- Andrei Serjantov, The Free Haven Project, UK
- Paul Syverson, Naval Research Lab, USA
- Latanya Sweeney, Carnegie Mellon University, USA
- Matthew Wright, University of Texas at Arlington, USA

Additional reviewers included George Bissias, Rainer Böhme, Katrin Borcea, John Burgess, Jong Youl Choi, Sebastian Clauss, Elke Franz, Stephan Gross, Markus Hansen, Tom Heydt-Benjamin, Guenter Karjoth, Stefan Köpsell, Thomas Kriegelstein, Tobias Kölsch, Marc Liberatore, Katja Liesebach, Christian Maier, N. Boris Margolin, Martin Meints, Steven J. Murdoch,

Thomas Nowey, Lexi Pimenidis, Klaus Ploessl, Clay Shields, Adam Shostack, Sandra Steinbrecher, Alex Tsow, Madhu Venkateshaiah, Xiaofeng Wang, Rolf Wendolsky, and Andreas Westfeld. Their help was very much appreciated.

As is usual, final proceedings were produced only after authors had the chance to discuss their work with community members during the workshop. The final papers are now published as volume 3856 in Springer's *Lecture Notes in Computer Science*.

We are grateful to Damir Gojmerac, who originally invited PET 2005 to be held in Croatia when he was with the Financial Agency of Croatia (FINA). And we especially thank Tomislav Vintar, Slađana Miočić, and Ivor Županić for their faithful perseverance in realizing the complex logistics of the PET 2005 workshop.

Financial support for PET 2005 was generously provided by Microsoft Corporation and FINA. This funding was instrumental in making the workshop accessible to students and others who applied for travel and registration stipends. PET 2005 also benefited from synergy with the Privacy Technology Executive Briefing both in terms of overlapping attendance and organizational load sharing.

We are particularly indebted to Caspar Bowden and JC Cannon at Microsoft for the continuing support of the workshop and for funding the Award for Outstanding Research in Privacy-Enhancing Technologies. We also thank Andrei Serjantov for facilitating the process of selecting a winner for this 2005 PET award. Finally, we give our sincere thanks to Mike Gurski for his vision and his efforts in facilitating both PET 2005 and the Privacy Technology Executive Briefing immediately following it.

May 2005

George Danezis and David Martin Program Chairs PET 2005

Table of Contents

Privacy Vulnerabilities in Encrypted HTTP Streams George Dean Bissias, Marc Liberatore, David Jensen, Brian Neil Levine	1
An Analysis of Parallel Mixing with Attacker-Controlled Inputs Nikita Borisov	12
Message Splitting Against the Partial Adversary Andrei Serjantov, Steven J. Murdoch	26
Location Privacy for Cellular Systems; Analysis and Solution Geir M. Køien, Vladimir A. Oleshchuk	40
Towards Modeling Wireless Location Privacy Leping Huang, Hiroshi Yamane, Kanta Matsuura, Kaoru Sezaki	59
Failures in a Hybrid Content Blocking System Richard Clayton	78
Anonymity Preserving Techniques in Trust Negotiations Indrakshi Ray, Elisa Bertino, Anna C. Squicciarini, Elena Ferrari	93
Unmixing Mix Traffic Ye Zhu, Riccardo Bettati	110
Mix-Network with Stronger Security Jan Camenisch, Anton Mityagin	128
Covert Channels in IPv6 Norka B. Lucena, Grzegorz Lewandowski, Steve J. Chapin	147
Towards Privacy-Aware eLearning Katrin Borcea, Hilko Donker, Elke Franz, Andreas Pfitzmann, Hagen Wahrig	167
Anonymization of IP Traffic Monitoring Data: Attacks on Two Prefix-Preserving Anonymization Schemes and Some Proposed Remedies	
Tønnes Brekne, André Årnes, Arne Øslebø	179

VIII Table of Contents

Privacy Issues in Vehicular Ad Hoc Networks Florian Dötzer	197
High-Power Proxies for Enhancing RFID Privacy and Utility Ari Juels, Paul Syverson, Dan Bailey	210
Integrating Utility into Face De-identification Ralph Gross, Edoardo Airoldi, Bradley Malin, Latanya Sweeney	227
Privacy in India: Attitudes and Awareness Ponnurangam Kumaraguru, Lorrie Cranor	243
Economics of Identity Management: A Supply-Side Perspective Sven Koble, Rainer Böhme	259
Author Index	273