Lecture Notes in Computer Science

1556

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

Springer Berlin

Berlin
Heidelberg
New York
Barcelona
Hong Kong
London
Milan
Paris
Singapore
Tokyo

Stafford Tavares Henk Meijer (Eds.)

Selected Areas in Cryptography

5th Annual International Workshop, SAC'98 Kingston, Ontario, Canada, August 17-18, 1998 Proceedings



Series Editors

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

Volume Editors

Stafford Tavares
Henk Meijer
Department of Electrical and Computer Engineering
Queen's University
Kingston, Ontario K7L 3N6, Canada
E-mail: tavares@ee.queensu.ca
henk@qucis.queensu.ca

Cataloging-in-Publication data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

Selected areas in cryptography: 5th annual international workshop; proceedings / SAC '98, Kingston, Ontario, Canada, August 17 - 18, 1998. Stafford Tavares; Henk Meijer (ed.). - Berlin; Heidelberg; New York; Barcelona; Hong Kong; London; Milan; Paris; Singapore; Tokyo: Springer, 1999
(Lecture notes in computer science; Vol. 1556)
ISBN 3-540-65894-7

CR Subject Classification (1998): E.3, G.2.1, D.4.6, K.6.5, F.2.1-2, C.2, J.1

ISSN 0302-9743 ISBN 3-540-65894-7 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 Berlin Heidelberg 1999 Printed in Germany

Typesetting: Camera-ready by author

SPIN: 10693237 06/3142 – 5 4 3 2 1 0 Printed on acid-free paper

Preface

SAC D8 is the Ifth in a series of annual workshops on Selected Areas in Cryptography. SAC D4 and SAC D6 were held at Queen University in Kingston and SAC D5 and SAC D7 were held at Carleton University in Ottawa. The purpose of the workshop is to bring together researchers in cryptography to present new work on areas of current interest. It is our hope that focusing on selected topics will present a good opportunity for in-depth discussion in a relaxed atmosphere. The themes for the SAC D8 workshop were:

- Design and Analysis of Symmetric Key Cryptosystems
- Ell cient Implementations of Cryptographic Systems
- Cryptographic Solutions for Internet Security
- Secure Wireless/Mobile Networks

Of the 39 papers submitted to SAC [98, 26 were accepted and two related papers were merged into one. There were also two invited presentations, one by Alfred Menezes entitled [Key Agreement Protocols] and the other by Eli Biham entitled [Initial Observations on SkipJack: Cryptanalysis of SkipJack-3XOR]. There were 65 participants at the workshop.

The Program Committee members for SAC D8 were Carlisle Adams, Tom Cusick, Howard Heys, Henk Meijer, Doug Stinson, Stallord Tavares, Serge Vaudenay, and Michael Wiener. We also thank the following persons who acted as reviewers for SAC D8: Zhi-Guo Chen, Mike Just, Liam Keliher, Alfred Menezes, Serge Mister, Phong Nguyen, David Pointcheval, Thomas Pornin, Guillaume Poupard, Yiannis Tsioumi, Amr Youssef, and Robert Zuccherato.

This year, in addition to the Workshop Record distributed at the workshop, the papers presented at SAC D8 are published by Springer-Verlag in the Lecture Notes in Computer Science Series. Copies of the Springer Proceedings are being sent to all registrants.

The organizers of SAC D8 are pleased to thank Entrust Technologies for their Inancial support and Sheila Hutchison of the Department of Electrical and Computer Engineering at Queen University for administrative and secretarial help. Yifeng Shao put together the Workshop Record and provided invaluable assistance in the preparation of these Proceedings. We also thank Laurie Ricker who looked after registration.

November 1998

Stallord Tavares and Henk Meijer SAC 198 Co-Chairs

Organization

Program Committee

Carlisle Adams Entrust Technologies

Tom Cusick SUNY Bullalo

Howard Heys Memorial University of Newfoundland

Henk Meijer Queen University
Doug Stinson University of Waterloo
Stallord Tavares Queen University

Serge Vaudenay Ecole Normale Superieure/CNRS

Mike Wiener Entrust Technologies

Local Organizing Committee

Stallord Tavares (Co-Chair) Queen University
Henk Meijer (Co-Chair) Queen University

Table of Contents

Design of Secret Key Cryptosystems	
Feistel Ciphers with L_2 -Decorrelation	1
Key-Dependent S-Box Manipulations	15
On the Twolsh Key Schedule	27
Toward Provable Security of Substitution-Permutation Encryption	
Networks	43
Randomness and Computational Issues	
An Accurate Evaluation of Maurer & Universal Test	57
Computational Alternatives to Random Number Generators David M'Raïhi (Gemplus Corporation), David Naccache (Gemplus Card International), David Pointcheval, Serge Vaudenay (Ecole Normale Supérieure)	72
Storage-El cient Finite Field Basis Conversion	81
Verilable Partial Sharing of Integer Factors	94
Analysis of Secret Key Cryptosystems	
Higher Order Dillerential Attack Using Chosen Higher Order Dillerences . Shiho Moriai (NTT Labs), Takeshi Shimoyama (TAO), Toshinobu Kaneko (TAO & Science University of Tokyo)	106
On Maximum Non-averaged Dillerential Probability	118

VIII Contents

Cryptanalysis of RC4-like Ciphers	131
Cryptographic Systems	
Key Preassigned Traceability Schemes for Broadcast Encryption	144
Mix-Based Electronic Payments	157
Over the Air Service Provisioning	174
Public Key Cryptosystems	
Faster Attacks on Elliptic Curve Cryptosystems	190
Improved Algorithms for Elliptic Curve Arithmetic in $GF(2^n)$ Julio López (University of Valle), Ricardo Dahab (State University of Campinas)	201
Cryptanalysis of a Fast Public Key Cryptosystem Presented at SAC \LaTeX . Phong Nguyen, Jacques Stern (Ecole Normale Supérieure)	213
A Lattice-Based Public-Key Cryptosystem	219
Design and Implementation of Secret Key Cryptosystems	
Fast DES Implementation for FPGAs and Its Application to a Universal Key-Search Machine	234
IDEA: A Cipher for Multimedia Architectures?	248
A Strategy for Constructing Fast Round Functions with Practical Security Against Dillerential and Linear Cryptanalysis	264
The Nonhomomorphicity of Boolean Functions	280

Contents

Attacks on Secret Key Cryptosystems	
Cryptanalysis of ORYX	296
A Timing Attack on RC5	306
Cryptanalysis of SPEED	319
Invited Talks	
Authenticated Dill e-Hellman Key Agreement Protocols	339
Initial Observations on Skipjack: Cryptanalysis of Skipjack-3XOR Eli Biham, Alex Biryukov, Orr Dunkelman, Eran Richardson (Technion - Israel Institute of Technology), Adi Shamir (Weizmann Institute of Science)	362
Author Index	377