Lecture Notes in Computer Science

13556

Founding Editors

Gerhard Goos

Karlsruhe Institute of Technology, Karlsruhe, Germany

Juris Hartmanis

Cornell University, Ithaca, NY, USA

Editorial Board Members

Elisa Bertino

Purdue University, West Lafayette, IN, USA

Wen Gao

Peking University, Beijing, China

Bernhard Steffen

TU Dortmund University, Dortmund, Germany

Moti Yung

Columbia University, New York, NY, USA

More information about this series at https://link.springer.com/bookseries/558

Vijayalakshmi Atluri · Roberto Di Pietro · Christian D. Jensen · Weizhi Meng (Eds.)

Computer Security – ESORICS 2022

27th European Symposium on Research in Computer Security Copenhagen, Denmark, September 26–30, 2022 Proceedings, Part III



Editors Vijayalakshmi Atluri D Rutgers University Newark, NJ, USA

Christian D. Jensen D
Technical University of Denmark
Kongens Lyngby, Denmark

Roberto Di Pietro D Hamad Bin Khalifa University Doha, Oatar

Weizhi Meng (1)
Technical University of Denmark
Kongens Lyngby, Denmark

ISSN 0302-9743 ISSN 1611-3349 (electronic) Lecture Notes in Computer Science ISBN 978-3-031-17142-0 ISBN 978-3-031-17143-7 (eBook) https://doi.org/10.1007/978-3-031-17143-7

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Switzerland AG 2022

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The 27th European Symposium on Research in Computer Security (ESORICS 2022) was held together with the affiliated workshops during the week of September 26–30, 2022. Due to the COVID-19 pandemic, the conference and the workshops took place in a hybrid mode. The virtual and in-person attendance was hosted and managed by the Technical University of Denmark.

ESORICS is a flagship European security conference. The aim of ESORICS is to advance the research in computer security and privacy by establishing a European forum, bringing together researchers in these areas, and promoting the exchange of ideas with developers, standardization bodies, and policy makers, as well as by encouraging links with researchers in related fields.

Continuing the model introduced in 2021, this year ESORICS also offered two review cycles: a winter cycle and a spring cycle. We believe that such an approach sports great advantages. On the one hand, it is more convenient for the authors and, on the other hand, it also increases the number of submissions, thus securing high-quality papers. In response to the call for papers, which covered a few new topics, we received a record-high number of papers: 562. This is a testimony of the growth and vitality of the computer security field, the expansion of the research community in this field, and the growing importance of ESORICS itself.

These papers were peer-reviewed and subsequently discussed based on the quality of their scientific contribution, novelty, and impact by the members of the Program Committee. The submissions were single-blind, and in almost all cases there were vivid discussions among the members of the Program Committee to decide the merit of reviewed papers.

The submission of the papers and the review process was carried out using the Easy-Chair platform. Based on the reviews and the discussion, 104 papers were selected for presentation at the conference, resulting in an acceptance rate of 18.5%. The most tangible result of this whole process was that ESORICS had an exciting scientific program covering timely and interesting security and privacy topics in theory, systems, networks, and applications.

The papers that were selected for presentation at ESORICS 2022 have been published in a three-volume set of proceedings: LNCS 13554, LNCS 13555, and LNCS 13556.

Aside from the paper presentations, we were honored to have four outstanding keynote speakers: Giuseppe Ateniese, Paulo Esteves-Verissimo, Ahmad Reza Sadeghi, and Ravi Sandhu. Their talks provided interesting insights and research directions in important research areas.

The Program Committee (PC) consisted of 180 members. We would like to thank the members of the PC and the external referees for their hard work in supporting the review process, as well as everyone who supported the organization of ESORICS 2022. In particular, the exceptional number of submissions put quite a burden on the reviewers (over the two cycles of submission, an average of 12 papers were reviewed by each reviewer).

vi Preface

We are grateful to the general co-chairs, Christian D. Jensen and Weizhi Meng; the workshops chairs, Mauro Conti and Jianying Zhou, and all of the workshop co-chairs; the poster chair, Joaquin Garcia-Alfaro; the publicity co-chair's Cristina Alcaraz and Wenjuan Li; the web chair, Wei-Yang Chiu; and the ESORICS Steering Committee and its chair, Sokratis Katsikas.

We are also grateful to BlockSec for supporting the organization of ESORICS 2022. Finally, we would like to provide a heartfelt thank you to the authors for submitting their papers to ESORICS 2022. It is their efforts that, in the end, decided the success of ESORICS 2022, confirmed ESORICS as a top-notch security conference, planted the seeds for future successes, and advanced science.

We hope that the proceedings will promote research and facilitate future work in the exciting, challenging, and evolving field of security.

September 2022

Roberto Di Pietro Vijayalakshmi Atluri

Organization

General Chairs

Christian D. Jensen Technical University of Denmark, Denmark
Weizhi Meng Technical University of Denmark, Denmark

Program Committee Chairs

Vijayalakshmi Atluri Rutgers University, USA

Roberto Di Pietro Hamad Bin Khalifa University, Qatar

Steering Committee

Sokratis Katsikas (Chair) NTNU, Norway

Joachim Biskup University of Dortmund, Germany

Véronique Cortier CNRS, France

Frédéric Cuppens Polytechnique Montréal, Canada

Sabrina De Capitani di Vimercati Università degli Studi di Milano, Italy Joaquin Garcia-Alfaro Institut Polytechnique de Paris, France

Dieter Gollmann Hamburg University of Technology, Germany Kutylowski Mirek Wroclaw University of Technology, Poland

Javier Lopez Universidad de Malaga, Spain Jean-Jacques Quisquater University of Louvain, Belgium

Peter Ryan University of Luxembourg, Luxembourg
Pierangela Samarati Università degli Studi di Milano, Italy

Einar Snekkenes NTNU, Norway Michael Waidner ATHENE, Germany

Program Committee

Abu-Salma, Ruba King's College London, UK Afek, Yehuda Tel-Aviv University, Israel

Akiyama, Mitsuaki NTT, Japan

Albanese, Massimiliano George Mason University, USA Alcaraz, Cristina University of Malaga, Spain

Allman, Mark International Computer Science Institute, USA

Alrabaee, Saed United Arab Emirates University, UAE

Asif, Hafiz Rutgers University, USA

Ayday, Erman Case Western Reserve University, USA, and

Bilkent University, Turkey

Bai, Guangdong University of Queensland, Australia

Bakiras, Spiridon Singapore Institute of Technology, Singapore

Bardin, Sebastien CEA LIST, France

Batra, Gunjan Kennesaw State University, USA

Bertino, Elisa Purdue University, USA

Blasco, Jorge Royal Holloway, University of London, UK Blundo, Carlo Università degli Studi di Salerno, Italy

Bonaci, Tamara Northeastern University, USA
Camtepe, Seyit CSIRO Data61, Australia
Ceccato, Mariano Università di Verona, Italy
Chakraborti, Anrin Stony Brook University, USA

Chan, Aldar C-F. University of Hong Kong, Hong Kong
Chen, Bo Michigan Technological University, USA

Chen, Xiaofeng Xidian University, China Chen, Liqun University of Surrey, UK

Chen, Rongmao National University of Defense Technology,

China

Chen, Yu Shandong University, China

Chow, Sherman S. M. The Chinese University of Hong Kong,

Hong Kong

Chowdhury, Omar University of Iowa, USA Conti, Mauro Università di Padova, USA

Coull, Scott Mandiant, USA

Crispo, Bruno University of Trento, Italy
Cukier, Michel University of Maryland, USA
Cuppens, Frédéric Polytechnique Montréal, Canada
Cuppens-Boulahia, Nora Polytechnique Montréal, Canada

Damiani, Ernesto University of Milan, Italy

Daza, Vanesa Universitat Pompeu Fabra, Spain
De Capitani di Vimercati, Sabrina Università degli Studi di Milano, Italy

Debar, Hervé Télécom SudParis, France

Desmedt, Yvo University of Texas at Dallas, USA
Diao, Wenrui Shandong University, China
Dimitriou, Tassos Kuwait University, Kuwait
Domingo-Ferrer, Josep Universitat Rovira i Virgili, Spain

Dong, Changyu Newcastle University, UK Ferrara, Anna Lisa University of Bristol, UK

Ferrer-Gomila, Jose-Luis University of the Balearic Islands, Spain

Fila, Barbara INSA Rennes, IRISA, France Fischer-Hübner, Simone Karlstad University, Sweden

Gadyatskaya, Olga Leiden University, The Netherlands

Gao, Debin Singapore Management University, Singapore

Garcia-Alfaro, Joaquin Institut Polytechnique de Paris, France

Garg, Siddharth New York University, USA Giacinto, Giorgio University of Cagliari, Italy

Gollmann, Dieter Hamburg University of Technology, Germany

Gong, Neil Duke University, USA
Gope, Prosanta University of Sheffield, UK

Gosain, Devashish Max Planck Institute for Informatics, Germany

Gritzalis, Stefanos University of Piraeus, Greece

Gu, Zhongshu IBM, USA

Gulmezoglu, Berk Iowa State University, USA

Haines, Thomas Queensland University of Technology, Australia

He, Xinlei CISPA Helmholtz Center for Information

Security, Germany

Hernández-Serrano, Juan Universitat Politècnica de Catalunya, Spain

Hong, Yuan Illinois Institute of Technology, USA Huang, Xinyi Fujian Normal University, China

Jager, Tibor Bergische Universität Wuppertal, Germany Jeon, Yuseok Ulsan National Institute of Science and

Technology, South Korea Zhejiang University, China

Jonker, Hugo Open University of the Netherlands,

The Netherlands

Karame, Ghassan NEC Laboratories Europe, Germany

Katsikas, Sokratis NTNU, Norway

Kim, Hyoungshick Sungkyunkwan University, South Korea

Klai, Kais Sorbonne University, France

Kremer, Steve Inria, France

Ji, Shouling

Krotofil, Marina Kudelski Security, Switzerland

Kruegel, Christopher University of California, Santa Barbara, USA

Lambrinoudakis, Costas University of Piraeus, Greece Landau Feibish, Shir The Open University of Israel, Israel

Lee, Adam University of Pittsburg, USA

Leita, Corrado VMware, UK

Li, Shujun University of Kent, UK
Li, Zitao Purdue University, USA
Liang, Kaitai TU Delft, The Netherlands
Lin, Zhiqiang Ohio State University, USA

Liu, Xiangyu Alibaba Inc., China

Liu, Peng Pennsylvania State University, USA

Livraga, Giovanni University of Milan, Italy

Lombardi, Flavio National Research Council, Italy

Lou, Wenjing Virginia Tech, USA

Lu, Rongxing University of New Brunswick, Canada

Lu, Haibing Santa Clara University, USA

Luo, Xiapu The Hong Kong Polytechnic University,

Hong Kong

Ma, Shiqing Rutgers University, USA

Marin-Fabregas, Eduard Telefonica Research, Spain
Martinelli, Fabio National Research Council, Italy

Mauw, Sjouke University of Luxembourg, Luxembourg
Meng, Weizhi Technical University of Denmark, Denmark

Mohan, Sibin Oregon State University, USA Mori, Tatsuya Waseda University, Japan

Mueller, Johannes University of Luxembourg, Luxembourg Ng, Siaw-Lynn Royal Holloway, University of London, and

Bedford New College, UK

Ning, Jianting Singapore Management University, Singapore

Obana, Satoshi Hosei University, Japan

Oligeri, Gabriele Hamad Bin Khalifa University, Qatar Overdorf, Rebekah Ecole Polytechnique Fédérale de Lausanne,

Switzerland

Pal, Shantanu Queensland University of Technology, Australia

Pan, Jiaxin NTNU, Norway

Papadimitratos, Panos KTH Royal Institute of Technology, Sweden

Paraboschi, Stefano Università di Bergamo, Italy
Patranabis, Sikhar IBM Research India, India
Pernul, Günther Universität Regensburg, Germany
Poovendran, Radha University of Washington, USA
Posegga, Joachim University of Passau, Germany

Quiring, Erwin Technische Universität Braunschweig, Germany

Quisquater, Jean-Jacques University of Louvain, Belgium Rao, Siddharth Prakash Aalto University, Finland Rashid, Awais University of Bristol, UK

Ren, Kui State University of New York at Buffalo, USA Rhee, Junghwan University of Central Oklahoma, USA

Ricci, Laura University of Pisa, Italy

Russello, Giovanni University of Auckland, New Zealand Ryan, Peter University of Luxembourg, Luxembourg

Safavi-Naini, Reihaneh University of Calgary, Canada

Saileshwar, Gururaj Georgia Institute of Technology, USA

Sakzad, Amin Monash University, Australia

Samarati, Pierangela Università degli Studi di Milano, Italy

Schinzel, Sebastian Münster University of Applied Sciences,

Germany

Schneider, Steve University of Surrey, UK Schroeder, Dominique Friedrich-Alexander-Universiät

Erlangen-Nürnberg, Germany

Schwarz, Michael CISPA Helmholtz Center for Information

Security, Germany

Schwenk, Joerg Ruhr-Universität Bochum, Germany Sciancalepore, Savio Eindhoven University of Technology,

The Netherlands

Shahandashti, Siamak University of York, UK

Sharma, Piyush Kumar Indraprastha Institute of Information Technology

Delhi, India

Shulman, Haya Fraunhofer SIT, Germany

Sinanoglu, Ozgur New York University Abu Dhabi, UAE

Sklavos, Nicolas University of Patras, Greece

Snekkenes, Einar NTNU, Norway

Somorovsky, Juraj Paderborn University, Germany

Strufe, Thorsten Karlsruhe Institute of Technology, Germany

Sural, Shamik IIT Kharagpur, India

Susilo, Willy University of Wollongong, Australia Tang, Qiang University of Sydney, Australia

Tang, Qiang Luxembourg Institute of Science and Technology,

Luxembourg

Tapiador, Juan Manuel Universidad Carlos III de Madrid, Spain

Tian, Dave Purdue University, USA

Torrey, Jacob Thinkst Applied Research, USA

Trachtenberg, Ari
Treharne, Helen
University, USA
University of Surrey, UK
Arizona State University, USA
Tripunitara, Mahesh
University of Waterloo, Canada
Tsohou, Aggeliki
Ionian University, Greece

Urban, Tobias Institute for Internet Security, Germany

Esteves-Verissimo, Paulo KAUST, Saudi Arabia
Viganò, Luca King's College London, UK
Visconti, Ivan University of Salerno, Italy

Voulimeneas, Alexios KU Leven, Belgium Waidner, Michael ATHENE, Germany

Wang, Cong City University of Hong Kong, Hong Kong

Wang, Tianhao Purdue University, USA

Wang, Di State University of New York at Buffalo, USA

Wang, Haining University of Delaware, USA

Wang, Lingyu Concordia University, Canada Wool, Avishai Tel Aviv University, Israel Xenakis, Christos University of Piraeus, Greece

Xiang, Yang Swinburne University of Technology, Australia

Xu, JunUniversity of Utah, USAYang, JieFlorida State University, USA

Yang, Kang State Key Laboratory of Cryptology, China Yang, Guomin University of Wollongong, Australia Yeun, Chan Khalifa University, Abu Dhabi, UAE

Yi, Xun RMIT University, Australia

Yu, Yu Shanghai Jiao Tong University, China Yuen, Tsz University of Hong Kong, Hong Kong Zhang, Zhikun CISPA Helmholtz Center for Information

Security, Germany

Zhang, Yuan Fudan University, China

Zhang, Kehuan The Chinese University of Hong Kong,

Hong Kong

Zhao, Yunlei Fudan University, China

Zhou, Jianying Singapore University of Technology and Design,

Singapore

Zhu, Rui Indiana University, USA

Zhu, Sencun Pennsylvania State University, USA

Workshops Chairs

Conti Mauro University of Padua, Italy

Zhou Jianying Singapore University of Technology and Design,

Singapore

Poster Chair

Garcia-Alfaro Joaquin Institut Polytechnique de Paris, France

Publicity Chairs

Alcaraz Cristina University of Malaga, Spain

Li Wenjuan Hong Kong Polytechnic University, Hong Kong

Web Chair

Chiu Wei-Yang Technical University of Denmark, Denmark

Posters Program Committee

Atluri, Vijay Rutgers University, USA

de Fuentes, Jose M.

Universidad Carlos III de Madrid, Spain
Di Pietro, Roberto

Hamad Bin Khalifa University, Qatar
González Manzano, Lorena

Universidad Carlos III de Madrid, Spain

Hartenstein, Hannes Karlsruhe Institute of Technology, Germany
Kikuchi, Hiroaki Meiji University, Japan

Kikuchi, Hiroaki Meiji University, Japan Matsuo, Shin'Ichiro Georgetown University, USA

Navarro-Arribas, Guillermo Universitat Autonoma de Barcelona, Spain

Nespoli, Pantaleone Universidad de Murcia, Spain

Ranise, Silvio University of Trento and Fondazione Bruno

Kessler, Italy

Saint-Hilarire, Kéren Institut Polytechnique de Paris, France

Signorini, Matteo Nokia Bell Labs, France

Vasilopoulos, Dimitrios IMDEA Software Institute, Spain Zannone, Nicola Eindhoven University of Technology,

The Netherlands

Additional Reviewers

Abadi, Aydin Berger, Christian Abbadini, Marco Berrang, Pascal

Ahmadi, Sharar Blanco-Justicia, Alberto

Akand, Mamun

Akbar, Yousef

Bolgouras, Vaios

Alrahis, Lilas

Botta, Vincenzo

Bountakas, Panagiotis

Amine Merzouk, Mohamed

Brighente, Alessandro

Anagnostopoulos, Marios

Angelogianni, Anna

Anglés-Tafalla, Carles

Apruzzese, Giovanni

Arapinis, Myrto

Bursuc, Sergiu

C. Pöhls, Henrich

Cachin, Christian

Cai, Cailing

Cao, Chen

Arriaga, Afonso Casolare, Rosangela

Arzt, Steven Chen, Xihui
Avitabile, Gennaro Chen, Niusen
Avizheh, Sepideh Chen, Min
Bag, Arnab Chen, Jinrong
Bagheri, Sima Chen, Chao
Bampatsikos, Michail Chen, Long

Battarbee, Christopher Chen, Zeyu
Baumer, Thomas Chu, Hien
Benaloh, Josh Ciampi, Michele

Organization

xiv

Cicala, Fabrizio
Cinà, Antonio
Coijanovic, Christoph
Costantino, Gianpiero
Craaijo, Jos

Crochelet, Pierre
Cui, Hui
Cui, Handong
Dai, Tianxiang
Damodaran, Aditya
Daniyal Dar, Muhammad
Das Chowdhury, Partha
Daudén-Esmel, Cristòfol

Davies, Gareth de Ruck, Dairo Debant, Alexandre Debnath, Joyanta Degani, Luca Demetrio, Luca Deuber, Dominic

Davies, Peter

Dexheimer, Thomas Diemert, Denis Dodd, Charles

Dragan, Constantin Catalin Driouich, Youssef

Du, Changlai Du, Linkang Du, Minxin

Duman, Onur
Duong, Dung
Dutta, Priyanka
Dutta, Sabyasachi
Dutta, Moumita
Duttagupta, Sayon
Ebrahimi, Ehsan

Echeverria, Mitziu

Ehsanpour, Maryam

Eichhammer, Philipp Ekramul Kabir, Mohammad

Empl, Philip Eyal, Ittay

Facchinetti, Dario Fadavi, Mojtaba Fallahi, Matin Farao, Aristeidis Fauzi, Prastudy Feng, Hanwen Feng, Qi Feng, Shuya

Fisseha Demissie, Biniam Fournaris, Apostolos Fraser, Ashley Friedl, Sabrina Friess, Jens

Friolo, Daniele
Gao, Jiahui
Gardiner, Joseph
Garfatta, Ikram
Gattermayer, Tobias

Gellert, Kai George, Dominik Gerault, David Gerhart, Paul Ghadafi, Essam

Gholipourchoubeh, Mahmood

Gil-Pons, Reynaldo Glas, Magdalena Golinelli, Matteo Gong, Junqing Grisafi, Michele Groll, Sebastian

Große-Kampmann, Matteo

Guan Tan, Teik
Guo, Xiaojie
Haffar, Rami
Haffey, Preston
Hallett, Joseph
Hammad Mazhar, M.
Han, Jinguang
Handirk, Tobias
Hao, Xuexuan
Hao, Shuai

Hasan Shahriar, Md Heftrig, Elias Heitjohann, Raphael Henry Castellanos, John

Herranz, Javier Hirschi, Lucca Hlavacek, Tomas Hobbs, NathanielLi, ShuangHong, HanbinLi, GuangpuHorne, RossLiang, Yuan

Horváth, Máté Likhitha Mankali, Lakshmi

Hu, Zhenkai Limbasiya, Trupil Hu, Lijie Lin. Chao Hu, Yan Lin Aung, Yan Huang, Jianwei Liu, Lin Huso, Ingrid Liu, Xiaoning Iadarola, Giacomo Liu. Bingvu Ioannidis, Thodoris Liu, Guannan Iovino, Vincenzo Liu, Xiaoyin Liu, Jiahao Ising, Fabian Liu, Zhen Jacobs, Adriaan Jebreel, Najeeb Liu, Xuegiao Liu, Xiaoyuan Jeitner, Philipp Jensen, Meiko Lu. Yun

Jesús A., Zihang Lucchese, Marco Jin, Lin Luo, Junwei Kailun, Yan Lv, Chunyang Kaiser, Fabian Lyu, Lin Kaplan, Alexander Lyvas, Christos Karim, Imtiaz Ma, Wanlun Karyda, Maria Ma, Mimi Katsis, Charalampos Maiorca, Davide Kavousi, Alireza Maitra, Sudip

Kelarev, Andrei Makriyannis, Nikolaos Kempinski, Stash Manjón, Jesús A. Kermabon-Bobinnec, Hugo Martinez, Sergio Kern, Sascha Mccarthy, Sarah

Khalili, Mojtaba Mei, Qian

Khandpur Singh, Ashneet Menegatos, Andreas

Khin Shar, Lwin Meng, Long

Knechtel, Johann Mercaldo, Francesco Kokolakis, Spyros Merget, Robert Krumnow, Benjamin Mestel, David Ksontini, Rym Meyuhas, Bar Kulkarni, Tejas Michalas, Antonis Lai, Jianchang Mirdita, Donika Lee, Hyunwoo Mizera, Andrzej Léger, Marc-André Mohammadi, Farnaz Mohammed, Ameer Li, Jinfeng

Li, Rui Morillo, Paz
Li, Shaoyu Morrison, Adam

Li, Yanan Mujeeb Ahmed, Chuadhry

Organization

Nabi, Mahmudun Neal, Christopher Nguyen, Son Niehues, David Nixon, Brian Oldani, Gianluca Oqaily, Momen Oqaily, Alaa Osliak, Oleksii P. K. Ma, Jack Pan, Shimin

xvi

Pang, Chengbin Pang, Bo Panja, Somnath Paolo Tricomi, Pier Paspatis, Ioannis

Peng, Hui

Pan, Jianli

Pitropakis, Nikolaos Polato, Mirko Pryvalov, Ivan Pu, Sihang

Puchta, Alexander Putz, Benedikt Qian, Chen Oin, Baodong

Qin, Xianrui Rabhi, Mouna Radomirovic, Sasa Ramokapane, Kopo M. Rangarajan, Nikhil

Ravi, Divya

Rawat, Abhimanyu

Raza, Ali

Román-García, Fernando

Rossi, Matthew Rovira, Sergi

S. M. Asadujjaman, A. Saatjohann, Christoph Sadighian, Alireza Saha, Rahul

Samanis, Emmanouil Sarathi Roy, Partha Sarkar, Pratik Schiff Agron, Shir Schlette, Daniel Schmidt, Carsten Sentanoe, Stewart Sha, Zeyang Shao, Jun Shi, Shanghao Shibahara, Toshiki Shioji, Eitaro

Shojafar, Mohammad Shreeve, Benjamin Silde, Tjerand Singh, Animesh Singh Sehrawat, Vipin

Sinha, Savani

Siniscalchi, Luisa Skrobot, Marjan Sohrabi, Nasrin Sollomoni, Avi Song, Shang Sotgiu, Angelo Souid, Nourelhouda Soumelidou, Katerina

Sun, Shihua

Tabatabaei, Masoud Tabiban, Azadeh

Taha Bennani, Mohamed Talibi Alaoui, Younes

Tang, Lihong
Tao, Youming
Tedeschi, Pietro
Terrovitis, Manolis
Tian, Guohua
Tian, Yangguang
Turrin, Federico
Umayya, Zeya

Vinayagamurthy, Dhinakaran

Visintin, Alessandro Vollmer, Marcel von der Heyden, Jonas Voudouris, Anastassios W. H. Wong, Harry Wagner, Benedikt

Wang, Han Wang, Ning Wang, Kailong Wang, Xiuhua Yang, Xu Wang, Yalan Yang, S. J. Wang, Shu Yang, Xuechao Wang, Jiafan Yang, Junwen Wang, Haizhou Yin Chan, Kwan Wang, Zhilong You, Weijing Wang, Xiaolei Yu, Hexuan Wang, Yunling Yurkov, Semen Wang, Qin Zeng, Runzhi Wang, Yu Zhang, Sepideh Wang, Cheng-Long Zhang, Min Wang, Weijia

Zhang, Yanjun Wang, Xinyue Zhang, Zicheng Wang, Yi Zhang, Cong Wang, Yuyu Zhang, Lan Wang, Yangde Zhang, Yuchen Watanabe, Takuya Zhang, Xinyu Wu, Huangting Zhang, Kai Wu, Yulian Zhang, Tao Wu, Chen Zhang, Yunhang Wu, Mingli Zhang, Xiaoyu Wu, Qiushi Zhang, Zidong Xiang, Zihang Zhang, Rongjunchen Xiao, Yang Zhao, Yongjun

Xiao, JidongZhao, ShujieXie, ShangyuZhao, LingchenXu, ShengminZheng, XiangYadav, TarunZhou, Xiaotong

Yan, Di Zhu, Fei Yang, Zhichao Zikas, Vassilis Yang, Shishuai Zou, Qingtian

Contents - Part III

Formal Analysis	
A Formal Analysis of the FIDO2 Protocols	3
A Composable Security Treatment of ECVRF and Batch Verifications	22
Efficient Proofs of Knowledge for Threshold Relations	42
A Tale of Two Models: Formal Verification of KEMTLS via Tamarin	63
Web Security	
Browser-Based CPU Fingerprinting	87
Polymorphic Protocols at the Example of Mitigating Web Bots	106
Unlinkable Delegation of WebAuthn Credentials	125
Large Scale Analysis of DoH Deployment on the Internet	145
Equivocal URLs: Understanding the Fragmented Space of URL Parser Implementations	166
Joshua Reynolds, Adam Bates, and Michael Bailey	100
Exploring the Characteristics and Security Risks of Emerging Emoji	107
Domain Names Mingxuan Liu, Yiming Zhang, Baojun Liu, and Haixin Duan	186

Hardware Security

CPU Port Contention Without SMT	209
Protocols for a Two-Tiered Trusted Computing Base	229
Using Memristor Arrays as Physical Unclonable Functions Florian Frank, Tolga Arul, Nikolaos Athanasios Anagnostopoulos, and Stefan Katzenbeisser	250
Multiparty Computation	
SecureBiNN: 3-Party Secure Computation for Binarized Neural Network	
Inference Wenxing Zhu, Mengqi Wei, Xiangxue Li, and Qiang Li	275
Mixed-Technique Multi-Party Computations Composed of Two-Party	20.5
Computations Erik-Oliver Blass and Florian Kerschbaum	295
PEA: Practical Private Epistasis Analysis Using MPC Kay Hamacher, Tobias Kussel, Thomas Schneider, and Oleksandr Tkachenko	320
ML Techniques	
Hide and Seek: On the Stealthiness of Attacks Against Deep Learning	
Systems Zeyan Liu, Fengjun Li, Jingqiang Lin, Zhu Li, and Bo Luo	343
Precise Extraction of Deep Learning Models via Side-Channel Attacks	
on Edge/Endpoint Devices Younghan Lee, Sohee Jun, Yungi Cho, Woorim Han, Hyungon Moon, and Yunheung Paek	364
Real-Time Adversarial Perturbations Against Deep Reinforcement	
Learning Policies: Attacks and Defenses Buse G. A. Tekgul, Shelly Wang, Samuel Marchal, and N. Asokan	384
FLMJR: Improving Robustness of Federated Learning via Model Stability Qi Guo, Di Wu, Yong Qi, Saiyu Qi, and Qian Li	405

MaleficNet: Hiding Malware into Deep Neural Networks Using Spread-Spectrum Channel Coding Dorjan Hitaj, Giulio Pagnotta, Briland Hitaj, Luigi V. Mancini, and Fernando Perez-Cruz	425
Long-Short History of Gradients Is All You Need: Detecting Malicious and Unreliable Clients in Federated Learning	445
MLFM: Machine Learning Meets Formal Method for Faster Identification of Security Breaches in Network Functions Virtualization (NFV)	466
Cyber-Physical Systems Security	
Perspectives from a Comprehensive Evaluation of Reconstruction-based Anomaly Detection in Industrial Control Systems Clement Fung, Shreya Srinarasi, Keane Lucas, Hay Bryan Phee, and Lujo Bauer	493
A Novel High-Performance Implementation of CRYSTALS-Kyber	514
with AI Accelerator Lipeng Wan, Fangyu Zheng, Guang Fan, Rong Wei, Lili Gao, Yuewu Wang, Jingqiang Lin, and Jiankuo Dong	514
From Click to Sink: Utilizing AIS for Command and Control in Maritime	
Cyber Attacks Ahmed Amro and Vasileios Gkioulos	535
Efficient Hash-Based Redactable Signature for Smart Grid Applications Fei Zhu, Xun Yi, Alsharif Abuadbba, Junwei Luo, Surya Nepal, and Xinyi Huang	554
Can Industrial Intrusion Detection Be SIMPLE? Konrad Wolsing, Lea Thiemt, Christian van Sloun, Eric Wagner, Klaus Wehrle, and Martin Henze	574
For Your Voice Only: Exploiting Side Channels in Voice Messaging	
for Environment Detection Matteo Cardaioli, Mauro Conti, and Arpita Ravindranath	595
Towards Efficient Auditing for Real-Time Systems Ayoosh Bansal, Anant Kandikuppa, Chien-Ying Chen, Monowar Hasan, Adam Bates, and Sibin Mohan	614

Network and Software Security

Towards a Systematic and Automatic Use of State Machine Inference to Uncover Security Flaws and Fingerprint TLS Stacks Aina Toky Rasoamanana, Olivier Levillain, and Hervé Debar	637
PanoptiCANs - Adversary-Resilient Architectures for Controller Area Networks Bogdan Groza, Lucian Popa, Tudor Andreica, Pal-Stefan Murvay, Asaf Shabtai, and Yuval Elovici	658
Detecting Cross-language Memory Management Issues in Rust	680
Reach Me if You Can: On Native Vulnerability Reachability in Android Apps Luca Borzacchiello, Emilio Coppa, Davide Maiorca, Andrea Columbu, Camil Demetrescu, and Giorgio Giacinto	701
Extensible Virtual Call Integrity	723
Posters	
Is Your Password Sexist? a Gamification-Based Analysis of the Cultural Context of Leaked Passwords	743
A Fast, Practical and Simple Shortest Path Protocol for Multiparty Computation	749
Audio Spoofing Detection Using Constant-Q Spectral Sketches and Parallel-Attention SE-ResNet	756
MixCT: Mixing Confidential Transactions from Homomorphic Commitment Jiajun Du, Zhonghui Ge, Yu Long, Zhen Liu, Shifeng Sun, Xian Xu, and Dawu Gu	763

Multi-Freq-LDPy: Multiple Frequency Estimation Under Local Differential Privacy in Python Héber H. Arcolezi, Jean-François Couchot, Sébastien Gambs, Catuscia Palamidessi, and Majid Zolfaghari	770
The Devil Is in the GAN: Backdoor Attacks and Defenses in Deep Generative Models	776
Author Index	785

Contents - Part III xxiii