Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering

398

Editorial Board Members

Ozgur Akan

Middle East Technical University, Ankara, Turkey

Paolo Bellavista

University of Bologna, Bologna, Italy

Jiannong Cao

Hong Kong Polytechnic University, Hong Kong, China

Geoffrey Coulson

Lancaster University, Lancaster, UK

Falko Dressler

University of Erlangen, Erlangen, Germany

Domenico Ferrari

Università Cattolica Piacenza, Piacenza, Italy

Mario Gerla

UCLA, Los Angeles, USA

Hisashi Kobayashi

Princeton University, Princeton, USA

Sergio Palazzo

University of Catania, Catania, Italy

Sartaj Sahni

University of Florida, Gainesville, USA

Xuemin (Sherman) Shen

University of Waterloo, Waterloo, Canada

Mircea Stan

University of Virginia, Charlottesville, USA

Xiaohua Jia

City University of Hong Kong, Kowloon, Hong Kong

Albert Y. Zomava

University of Sydney, Sydney, Australia

More information about this series at http://www.springer.com/series/8197

Joaquin Garcia-Alfaro · Shujun Li · Radha Poovendran · Hervé Debar · Moti Yung (Eds.)

Security and Privacy in Communication Networks

17th EAI International Conference, SecureComm 2021 Virtual Event, September 6–9, 2021 Proceedings, Part I



Editors
Joaquin Garcia-Alfaro

Télécom SudParis,
Institut Polytechnique de Paris
Palaiseau, France

Radha Poovendran D
University of Washington
Seattle, WA, USA

Moti Yung D
Google Inc.
New York, NY, USA

Shujun Li
University of Kent Canterbury Canterbury, Kent, UK

Hervé Debar Debar Télécom SudParis, Institut Polytechnique de Paris Palaiseau, France

ISSN 1867-8211 ISSN 1867-822X (electronic) Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering ISBN 978-3-030-90018-2 ISBN 978-3-030-90019-9 (eBook) https://doi.org/10.1007/978-3-030-90019-9

© ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering 2021 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

We are delighted to introduce the proceedings of the 17th EAI International Conference on Security and Privacy in Communication Networks (SecureComm 2021). This conference brought together cybersecurity scholars from all around the world, advancing the state of the art and knowledge of cybersecurity and privacy by proposing new methods and tools to address the major cybersecurity challenges faced by our digital systems.

These proceedings contain 43 papers from the main conference, which were selected out of 126 submissions (with an acceptance rate around 34%) from authors in universities, national laboratories, and the private sector from the Americas, Europe, Asia, Australasia, and Africa. All submissions went through an extensive review process undertaken by 82 internationally-recognized experts in cybersecurity. The accepted papers are authored by researchers from 16 countries, with the USA and China being the top two countries with the most papers (18 and 12, respectively).

These proceedings also contain the following papers from two co-located workshops and two other tracks of the conference: five papers accepted to the International Workshop on Post-quantum Cryptography for Secure Communications (PQC-SC), two papers accepted to the International Workshop on Cyber-Physical Systems Strategic and Technical Security (CPS-STS), and four papers to the PhD and Poster Tracks. Submissions to these workshops and tracks were organized by the separate (co-)chairs: Kalpana Singh, Elisa Lorenzo Garcia, Rajeev Anand Sahu, Gaurav Sharma, and T. Chithralekha who co-chaired PQC-SC, Ali Ismail Awad, Charalambos Konstantinou, and Mohammed M. Alani who co-chaired CPS-STS, and Roger A. Hallman who chaired the PhD and Poster Tracks. The accepted papers in these workshops and tracks are authored by researchers from seven different countries (USA, China, Brazil, Italy, South Korea, UAE, and UK).

Any successful conference relies on the contribution of multiple stakeholders, who have volunteered their time and energy in disseminating and publicizing the call for papers, submitting original research results, participating in the reviewing process, and in the end contributing altogether to a great program. First and foremost, we would like to offer our gratitude to the entire Organizing Committee for guiding the entire process of the conference, keeping everything organized and in check. We are also deeply grateful to all the Technical Program Committee (TPC) members for their time and effort in reading, commenting, debating, and finally selecting the papers. We also thank the (co-)chairs, TPC members, and external reviewers of the co-located workshops and the PhD/Poster Tracks for their contributions to the conference. Last but not least, we also thank all the authors who submitted papers to the conference and all participants who attended the conference to support the conference and make it a successful event. Support from the Steering Committee and EAI staff members was also crucial in ensuring the success of the conference. It was a great privilege to work with such a large group of dedicated and talented individuals.

vi Preface

We had hoped for a physical event, and it is unfortunate that we once more had to revert to an online one. We nevertheless hope that you found the discussions and interactions at SecureComm 2021 enjoyable and that the proceedings will simulate further research.

August 2021

Shujun Li Radha Poovendran Hervé Debar Moti Yung

Conference Organization

Steering Committee

Imrich Chlamtac University of Trento, Italy
Guofei Gu Texas A&M University, USA

Peng Liu Pennsylvania State University, USA Sencun Zhu Pennsylvania State University, USA

Organizing Committee

General Chair

Shujun Li University of Kent, UK

General Co-chair

Radha Poovendran University of Washington, USA

Technical Program Committee Chair and Co-chair

Hervé Debar Télécom SudParis/Institut Polytechnique de Paris,

France

Moti Yung Google Inc./Columbia University, USA

Sponsorship and Exhibit Chair

Theodosios Dimitrakos Munich Research Centre, Huawei Technologies

Ltd, Germany

Local Chairs

Budi Arief University of Kent, UK
Gareth Howells University of Kent, UK

Workshops Chair

David Arroyo Guardeño CSIC, Spain

Publicity and Social Media Chairs

Jason Nurse University of Kent, UK
Kaitai Liang TU Delft, The Netherlands

Publications Chair

Joaquin Garcia-Alfaro Télécom SudParis/Institut Polytechnique de Paris,

France

Web Chair

Christophe Kiennert Télécom SudParis/Institut Polytechnique de Paris,

France

Posters and PhD Track Chair

Roger A. Hallman Naval Information Warfare Center

Pacific/Dartmouth College, USA

Panels Chairs

Julio Hernandez-Castro University of Kent, UK Sanjay Bhattacherjee University of Kent, UK

Tutorials Chair

Anyi Liu Oakland University, USA

Technical Program Committee

Magnus Almgren Chalmers University of Technology, Sweden

Elias Athanasopoulos University of Cyprus, Cyprus

Gregory Blanc Télécom SudParis/Institut Polytechnique de Paris,

France

Sébastien Bardin CEA LIST, France

Lorenzo Cavallaro Kings College London, UK

Lucas Davi University of Duisburg-Essen, Germany Gabi Dreo Bundeswehr University Munich, Germany

Sven Dietrich City University of New York, USA
Daniel Gruss Graz University of Technology, Austria
Christophe Hauser University of Southern California, USA

Vasileios Kemerlis Brown University, USA Andrea Lanzi University of Milan, Italy

Fabio Martinelli CNR, Italy

Michael Meier University of Bonn/Fraunhofer FKIE, Germany Marius Muench Vrije Universiteit Amsterdam, The Netherlands

William Robertson Northeastern University, USA

Thomas Schreck Munich University of Applied Sciences, Germany

Seungwon Shin KAIST, South Korea

Angelos Stavrou George Mason University, USA

Gianluca Stringhini Boston University, USA

Giovanni Apruzzese University of Liechtenstein, Liechtenstein

Urko Zurutuza Mondragon University, Spain

Fabio Di Franco ENISA, Greece

Platon Kotzias NortonLifeLock Research Group, Greece

Sokratis Katsikas NTNU, Norway Razvan Beuran JAIST, Japan Youki Kadobayashi NAIST, Japan Franco Chiaraluce UNIVPM, Italy

Igor Kotenko St. Petersburg Federal Research Center of the

Russian Academy of Sciences, Russia

Evangelos Markatos FORTH, Greece

Silvia Bonomi Sapienza University of Rome, Italy

Apostolis Zarras TU Delft, The Netherlands

Jan Hajný Brno University of Technology, Czech Republic

Gabriele Restuccia CNIT, Italy
Jacques Traore Orange, France
Jouni Viinikka 6Cure, France

Pavel Laskov University of Lichtenstein, Lichtenstein

Michal Choras ITTI, Poland
Olivier Thonnard Amadeus, France

Roland Rieke Fraunhofer SIT, Germany

Ali Abbasi Ruhr University Bochum, Germany

Claudio Canella TU Graz, Austria

Jun Xu Stevens Institute of Technology, USA

Cristian-Alexander Staicu CISPA, Germany
Guillaume Hiet CentraleSupelec, France

Sharif Abuadbba Data61, CSIRO, Australia

Mohiuddin Ahmed Edith Cowan University, Australia

Nadeem Ahmed Cyber Security Cooperative Research Centre,

Australia

Ehab Al-Shaer Carnegie Mellon University, USA

Budi Arief University of Kent, UK

Anirban Basu Hitachi, Ltd, Japan/University of Sussex, UK

Sanjay Bhattacherjee University of Kent, UK

Liquan Chen Southeastern University, China

Jinguang Han Nanjing University of Finance and Economics,

China

Debiao He Wuhan University, China Julio Hernandez-Castro University of Kent, UK

Darren Hurley-Smith Royal Holloway University of London, UK

Zahid Islam Charles Sturt University, Australia

Helge Janicke Cyber Security Cooperative Research Centre,

Australia

Shancang Li University of the West of England, UK

Yingjiu Li University of Oregon, USA Kaitai Liang TU Delft, The Netherlands Anyi Liu Oakland University, USA

Zhe Liu Nanjing University of Aeronautics and

Astronautics, China

George Loukas University of Greenwich, UK

Xiapu Luo Hong Kong Polytechnic University, Hong Kong

Leandros Maglaras De Montfort University, UK

Kalikinkar Mandal University of New Brunswick, Canada

Mark Manulis University of Surrey, UK
Carsten Maple University of Warwick, UK

Wojciech Mazurczyk Warsaw University of Technology, Poland Weizhi Meng Technical University of Denmark, Denmark

Nour Moustafa
UNSW Canberra, Australia
Toni Perković
University of Split, Croatia
Siraj Ahmed Shaikh
University of Coventry, UK
Chunhua Su
University of Aizu, Japan

Zhiyuan Tan Edinburgh Napier University, UK

Ding Wang Nankai University, China

Wei Wang Beijing Jiaotong University, China

Yongdong Wu Jinan University, China

Xiaosong Zhang University of Electronic Science and Technology

of China, China

Deqing Zou Huazhong University of Science and Technology,

China

Sushmita Ruj Data61, CSIRO, Australia/ISI, Kolkata, India

Guomin Yang University of Wollongong, Australia

Louis Rilling Inria Rennes - Bretagne Atlantique, France

Contents – Part I

Cyber Tiffeats and I	Defence
DeepHunter: A Graph	n Neural Network Bas

DeepHunter: A Graph Neural Network Based Approach for Robust Cyber	_
Threat Hunting	3
SIEMA: Bringing Advanced Analytics to Legacy Security Information and Event Management	25
Pejman Najafi, Feng Cheng, and Christoph Meinel	
Automatic Generation of Malware Threat Intelligence from Unstructured Malware Traces	44
Yuheng Wei and Futai Zou	
Towards Automated Assessment of Vulnerability Exposures in Security	
Operations Philip Huff and Qinghua Li	62
Repeatable Experimentation for Cybersecurity Moving Target Defense Jaime C. Acosta, Luisana Clarke, Stephanie Medina, Monika Akbar, Mahmud Shahriar Hossain, and Frederica Free-Nelson	82
MPD: Moving Target Defense Through Communication Protocol Dialects Yongsheng Mei, Kailash Gogineni, Tian Lan, and Guru Venkataramani	100
Blockchain and P2P Security	
GuardedGossip: Secure and Anonymous Node Discovery in Untrustworthy Networks Andriy Panchenko, Asya Mitseva, Torsten Ziemann, and Till Hering	123
An Extensive Security Analysis on Ethereum Smart Contracts	144
A Distributed Ledger for Non-attributable Cyber Threat Intelligence Exchange	164
Philip Huff and Qinghua Li	

AI and Security/Privacy

Understanding ε for Differential Privacy in Differencing Attack Scenarios Narges Ashena, Daniele Dell'Aglio, and Abraham Bernstein	187
Explanation-Guided Diagnosis of Machine Learning Evasion Attacks	207
ToFi: An Algorithm to Defend Against Byzantine Attacks in Federated Learning Qi Xia, Zeyi Tao, and Qun Li	229
TESLAC: Accelerating Lattice-Based Cryptography with AI Accelerator Lipeng Wan, Fangyu Zheng, and Jingqiang Lin	249
Research of CPA Attack Methods Based on Ant Colony Algorithm	270
Local Model Privacy-Preserving Study for Federated Learning	287
Applied Cryptography	
Cryptonite: A Framework for Flexible Time-Series Secure Aggregation with Non-interactive Fault Recovery Ryan Karl, Jonathan Takeshita, and Taeho Jung	311
Cryptonomial: A Framework for Private Time-Series Polynomial Calculations Ryan Karl, Jonathan Takeshita, Alamin Mohammed, Aaron Striegel, and Taeho Jung	332
Provably Secure Contact Tracing with Conditional Private Set Intersection Jonathan Takeshita, Ryan Karl, Alamin Mohammed, Aaron Striegel, and Taeho Jung	352
Origin Attribution of RSA Public Keys Enrico Branca, Farzaneh Abazari, Ronald Rivera Carranza, and Natalia Stakhanova	374

	Networ	k Se	curity
--	--------	------	--------

Fine-Grained Intra-domain Bandwidth Allocation Against DDoS Attack Lijia Xie, Shuang Zhao, Xiao Zhang, Yiming Shi, Xin Xiao, and Zhiming Zheng	399
TMT-RF: Tunnel Mixed Traffic Classification Based on Random Forest	418
CROCUS: An Objective Approach for SDN Controllers Security	
Assessment	438
Controlling Network Traffic Microstructures for Machine-Learning Model	
Probing Henry Clausen, Robert Flood, and David Aspinall	456
Henry Clausen, Kobert Flood, and David Aspindit	
Using NetFlow to Measure the Impact of Deploying DNS-based Blacklists Martin Fejrskov, Jens Myrup Pedersen, and Emmanouil Vasilomanolakis	476
Digital Forensics	
A Forensic Tool to Acquire Radio Signals Using Software Defined Radio M. A. Hannan Bin Azhar and German Abadia	499
SEMFLOW: Accurate Semantic Identification from Low-Level System Data Mohammad Kavousi, Runqing Yang, Shiqing Ma, and Yan Chen	513
Author Index	537

Contents – Part II

Web/OSN Security and Privacy	
Analyzing Security Risks of Ad-Based URL Shortening Services Caused by Users' Behaviors Naoki Fukushi, Takashi Koide, Daiki Chiba, Hiroki Nakano, and Mitsuaki Akiyama	3
XHunter: Understanding XXE Vulnerability via Automatic Analysis Zhenhua Wang, Wei Xie, Jing Tao, Yong Tang, and Enze Wang	23
Anonymous Short Communications over Social Networks	43
A Sybil Detection Method in OSN Based on DistilBERT and Double-SN-LSTM for Text Analysis Xiaojie Xu, Jian Dong, Zhengyu Liu, Jin Yang, Bin Wang, and Zhaoyuan Wang	64
ePayment Security	
An Empirical Study on Mobile Payment Credential Leaks and Their Exploits Shangcheng Shi, Xianbo Wang, Kyle Zeng, Ronghai Yang, and Wing Cheong Lau	7 9
System-Wide Security for Offline Payment Terminals	99
Horus: A Security Assessment Framework for Android Crypto Wallets	120
Systems Security	
Leakuidator: Leaky Resource Attacks and Countermeasures	143
JABBIC Lookups: A Backend Telemetry-Based System for Malware Triage Octavian Ciprian Bordeanu, Gianluca Stringhini, Yun Shen, and Toby Davies	164

Facilitating Parallel Fuzzing with Mutually-Exclusive Task Distribution Yifan Wang, Yuchen Zhang, Chenbin Pang, Peng Li, Nikolaos Triandopoulos, and Jun Xu	185
Flowrider: Fast On-Demand Key Provisioning for Cloud Networks	207
Mobile Security and Privacy	
Mobile Handset Privacy: Measuring the Data iOS and Android Send to Apple and Google	231
Who's Accessing My Data? Application-Level Access Control for Bluetooth Low Energy	252
HTPD: Secure and Flexible Message-Based Communication for Mobile	
Apps Yin Liu, Breno Dantas Cruz, and Eli Tilevich	273
Smartphone Location Spoofing Attack in Wireless Networks Chengbin Hu, Yao Liu, Zhuo Lu, Shangqing Zhao, Xiao Han, and Junjie Xiong	295
IoT Security and Privacy	
Compromised Through Compression: Privacy Implications of Smart Meter Traffic Analysis Pol Van Aubel and Erik Poll	317
iDDAF: An Intelligent Deceptive Data Acquisition Framework for Secure Cyber-Physical Systems Md Hasan Shahriar, Mohammad Ashiqur Rahman, Nur Imtiazul Haque, Badrul Chowdhury, and Steven G. Whisenant	338
PhD and Poster Track	
Encouraging the Adoption of Post-Quantum Hybrid Key Exchange in Network Security Alexandre Augusto Giron	363
Quantitative and Qualitative Investigations into Trusted Execution Environments Ryan Karl	372

Contents – I art II	AVII
Phishing Web Page Detection with Semi-Supervised Deep Anomaly Detection	384
Poisoning Attack for Inter-agent Transfer Learning	394
PQC-SC Workshop	
An Efficient Post-Quantum PKE from RLWR with Simple Security Proof Parhat Abla and Mingsheng Wang	407
Kyber on ARM64: Compact Implementations of Kyber on 64-Bit ARM Cortex-A Processors Pakize Sanal, Emrah Karagoz, Hwajeong Seo, Reza Azarderakhsh, and Mehran Mozaffari-Kermani	424
Compressed SIKE Round 3 on ARM Cortex-M4	441
A Quantum Circuit to Speed-Up the Cryptanalysis of Code-Based Cryptosystems Simone Perriello, Alessandro Barenghi, and Gerardo Pelosi	458
Hardware Deployment of Hybrid PQC: SIKE+ECDH Reza Azarderakhsh, Rami Elkhatib, Brian Koziel, and Brandon Langenberg	475
CPS-STS Workshop	
Towards Stealing Deep Neural Networks on Mobile Devices	495
Phishing Website Detection from URLs Using Classical Machine Learning ANN Model Said Salloum, Tarek Gaber, Sunil Vadera, and Khaled Shaalan	509
Author Index	525