

**USENIX Security '18:
27th USENIX Security Symposium
August 15–17, 2018
Baltimore, MD, USA**

Security Impacting the Physical World

Fear the Reaper: Characterization and Fast Detection of Card Skimmers1
Nolen Scaife, Christian Peeters, and Patrick Traynor, *University of Florida*

BlackIoT: IoT Botnet of High Wattage Devices Can Disrupt the Power Grid15
Saleh Soltan, Prateek Mittal, and H. Vincent Poor, *Princeton University*

Skill Squatting Attacks on Amazon Alexa33
Deepak Kumar, Riccardo Paccagnella, Paul Murley, Eric Hennenfent, Joshua Mason, Adam Bates, and Michael Bailey, *University of Illinois, Urbana-Champaign*

CommanderSong: A Systematic Approach for Practical Adversarial Voice Recognition.49
Xuejing Yuan, *SKLOIS, Institute of Information Engineering, Chinese Academy of Sciences, School of Cyber Security, University of Chinese Academy of Sciences*; Yuxuan Chen, *Florida Institute of Technology*; Yue Zhao, *SKLOIS, Institute of Information Engineering, Chinese Academy of Sciences, School of Cyber Security, University of Chinese Academy of Sciences*; Yunhui Long, *University of Illinois at Urbana-Champaign*; Xiaokang Liu and Kai Chen, *SKLOIS, Institute of Information Engineering, Chinese Academy of Sciences, School of Cyber Security, University of Chinese Academy of Sciences*; Shengzhi Zhang, *Florida Institute of Technology, Department of Computer Science, Metropolitan College, Boston University, USA*; Heqing Huang, *unaffiliated*; Xiaofeng Wang, *Indiana University Bloomington*; Carl A. Gunter, *University of Illinois at Urbana-Champaign*

Memory Defenses

ACES: Automatic Compartments for Embedded Systems.65
Abraham A Clements, *Purdue University and Sandia National Labs*; Naif Saleh Almakhdhub, Saurabh Bagchi, and Mathias Payer, *Purdue University*

IMIX: In-Process Memory Isolation EXTension83
Tommaso Frassetto, Patrick Jauernig, Christopher Liebchen, and Ahmad-Reza Sadeghi, *Technische Universität Darmstadt*

HEAPHOPPER: Bringing Bounded Model Checking to Heap Implementation Security99
Moritz Eckert, *University of California, Santa Barbara*; Antonio Bianchi, *University of California, Santa Barbara and The University of Iowa*; Ruoyu Wang, *University of California, Santa Barbara and Arizona State University*; Yan Shoshitaishvili, *Arizona State University*; Christopher Kruegel and Giovanni Vigna, *University of California, Santa Barbara*

GUARDER: A Tunable Secure Allocator117
Sam Silvestro, Hongyu Liu, and Tianyi Liu, *University of Texas at San Antonio*; Zhiqiang Lin, *Ohio State University*; Tongping Liu, *University of Texas at San Antonio*

Censorship and Web Privacy

Fp-Scanner: The Privacy Implications of Browser Fingerprint Inconsistencies135
Antoine Vastel, *Univ. Lille / Inria / Inria*; Pierre Laperdrix, *Stony Brook University*; Walter Rudametkin, *Univ. Lille / Inria / Inria*; Romain Rouvoy, *Univ. Lille / Inria / IUF*

Who Left Open the Cookie Jar? A Comprehensive Evaluation of Third-Party Cookie Policies151
Gertjan Franken, Tom Van Goethem, and Wouter Joosen, *imec-DistriNet, KU Leuven*

Effective Detection of Multimedia Protocol Tunneling using Machine Learning169
Diogo Barradas, Nuno Santos, and Luís Rodrigues, *INESC-ID, Instituto Superior Técnico, Universidade de Lisboa*

Quack: Scalable Remote Measurement of Application-Layer Censorship187
Benjamin VanderSloot, Allison McDonald, Will Scott, J. Alex Halderman, and Roya Ensafi, *University of Michigan*

Understanding How Humans Authenticate

Better managed than memorized? Studying the Impact of Managers on Password Strength and Reuse ... 203
Sanam Ghorbani Lyastani, *CISPA, Saarland University*; Michael Schilling, *Saarland University*; Sascha Fahl, *Ruhr-University Bochum*; Michael Backes and Sven Bugiel, *CISPA Helmholtz Center i.G.*

Forgetting of Passwords: Ecological Theory and Data221
Xianyi Gao, Yulong Yang, Can Liu, Christos Mitropoulos, and Janne Lindqvist, *Rutgers University*;
Antti Oulasvirta, *Aalto University*

The Rewards and Costs of Stronger Passwords in a University: Linking Password Lifetime to Strength 239
Ingolf Becker, Simon Parkin, and M. Angela Sasse, *University College London*

Rethinking Access Control and Authentication for the Home Internet of Things (IoT)255
Weijia He, *University of Chicago*; Maximilian Golla, *Ruhr-University Bochum*; Roshni Padhi and Jordan Ofek, *University of Chicago*; Markus Dürmuth, *Ruhr-University Bochum*; Earlene Fernandes, *University of Washington*;
Blase Ur, *University of Chicago*

Vulnerability Discovery

ATTention Spanned: Comprehensive Vulnerability Analysis of AT Commands Within the Android Ecosystem273
Dave (Jing) Tian, Grant Hernandez, Joseph I. Choi, Vanessa Frost, Christie Ruales, and Patrick Traynor, *University of Florida*; Hayawardh Vijayakumar and Lee Harrison, *Samsung Research America*; Amir Rahmati, *Samsung Research America and Stony Brook University*; Michael Grace, *Samsung Research America*;
Kevin R. B. Butler, *University of Florida*

Charm: Facilitating Dynamic Analysis of Device Drivers of Mobile Systems291
Seyed Mohammadjavad Seyed Talebi and Hamid Tavakoli, *UC Irvine*; Hang Zhang and Zheng Zhang, *UC Riverside*; Ardalan Amiri Sani, *UC Irvine*; Zhiyun Qian, *UC Riverside*

Inception: System-Wide Security Testing of Real-World Embedded Systems Software309
Nassim Corteggiani, *EURECOM, Maxim Integrated*; Giovanni Camurati and Aurélien Francillon, *EURECOM*

Acquisitional Rule-based Engine for Discovering Internet-of-Thing Devices327
Xuan Feng, *Beijing Key Laboratory of IOT Information Security Technology, IIE, CAS, China, and School of Cyber Security, University of Chinese Academy of Sciences, China*; Qiang Li, *School of Computer and Information Technology, Beijing Jiaotong University, China*; Haining Wang, *Department of Electrical and Computer Engineering, University of Delaware, USA*; Limin Sun, *Beijing Key Laboratory of IOT Information Security Technology, IIE, CAS, China, and School of Cyber Security, University of Chinese Academy of Sciences, China*

Web Applications

A Sense of Time for JavaScript and Node.js: First-Class Timeouts as a Cure for Event Handler Poisoning ... 343
James C. Davis, Eric R. Williamson, and Dongyoon Lee, *Virginia Tech*

Freezing the Web: A Study of ReDoS Vulnerabilities in JavaScript-based Web Servers361
Cristian-Alexandru Staicu and Michael Pradel, *TU Darmstadt*

NAVEX: Precise and Scalable Exploit Generation for Dynamic Web Applications377
Abeer Alhuzali, Rigel Gjomoemo, Birhanu Eshete, and V.N. Venkatakrisnan, *University of Illinois at Chicago*

Rampart: Protecting Web Applications from CPU-Exhaustion Denial-of-Service Attacks393
Wei Meng, *Chinese University of Hong Kong*; Chenxiong Qian, *Georgia Institute of Technology*; Shuang Hao, *University of Texas at Dallas*; Kevin Borgolte, Giovanni Vigna, and Christopher Kruegel, *University of California, Santa Barbara*; Wenke Lee, *Georgia Institute of Technology*

Anonymity

How Do Tor Users Interact With Onion Services?411
Philipp Winter, Anne Edmundson, and Laura M. Roberts, *Princeton University*; Agnieszka Dutkowska-Żuk, *Independent*; Marshini Chetty and Nick Feamster, *Princeton University*

Towards Predicting Efficient and Anonymous Tor Circuits429
Armon Barton, Mohsen Imani, and Jiang Ming, *University of Texas at Arlington*; Matthew Wright, *Rochester Institute of Technology*

BurnBox: Self-Revocable Encryption in a World Of Compelled Access445
Nirvan Tyagi, *Cornell University*; Muhammad Haris Mughees, *UIUC*; Thomas Ristenpart and Ian Miers, *Cornell Tech*

An Empirical Analysis of Anonymity in Zcash463
George Kappos, Haaron Yousaf, Mary Maller, and Sarah Meiklejohn, *University College London*

Privacy in a Digital World

Unveiling and Quantifying Facebook Exploitation of Sensitive Personal Data for Advertising Purposes . . .479
José González Cabañas, Ángel Cuevas, and Rubén Cuevas, *Department of Telematic Engineering, Universidad Carlos III de Madrid*

Analysis of Privacy Protections in Fitness Tracking Social Networks -or- You can run, but can you hide? . . . 497
Wajih Ul Hassan, Saad Hussain, and Adam Bates, *University Of Illinois Urbana-Champaign*

AttriGuard: A Practical Defense Against Attribute Inference Attacks via Adversarial Machine Learning 513
Jinyuan Jia and Neil Zhenqiang Gong, *Iowa State University*

Polisis: Automated Analysis and Presentation of Privacy Policies Using Deep Learning531
Hamza Harkous, *École Polytechnique Fédérale de Lausanne (EPFL)*; Kassem Fawaz, *University of Wisconsin-Madison*; Rémi Leuret, *École Polytechnique Fédérale de Lausanne (EPFL)*; Florian Schaub and Kang G. Shin, *University of Michigan*; Karl Aberer, *École Polytechnique Fédérale de Lausanne (EPFL)*

Attacks on Crypto & Crypto Libraries

Efail: Breaking S/MIME and OpenPGP Email Encryption using Exfiltration Channels549
Damian Poddebniak and Christian Dresen, *Münster University of Applied Sciences*; Jens Müller, *Ruhr University Bochum*; Fabian Ising and Sebastian Schinzel, *Münster University of Applied Sciences*; Simon Friedberger, *NXP Semiconductors, Belgium*; Juraj Somorovsky and Jörg Schwenk, *Ruhr University Bochum*

The Dangers of Key Reuse: Practical Attacks on IPsec IKE567
Dennis Felsch, Martin Grothe, and Jörg Schwenk, *Ruhr-University Bochum*; Adam Czubak and Marcin Szymanek, *University of Opole*

One&Done: A Single-Decryption EM-Based Attack on OpenSSL's Constant-Time Blinded RSA585
Monjur Alam, Haider Adnan Khan, Moumita Dey, Nishith Sinha, Robert Callan, Alenka Zajic, and Milos Prvulovic, *Georgia Tech*

DATA – Differential Address Trace Analysis: Finding Address-based Side-Channels in Binaries603
Samuel Weiser, *Graz University of Technology*; Andreas Zankl, *Fraunhofer AISEC*; Raphael Spreitzer, *Graz University of Technology*; Katja Miller, *Fraunhofer AISEC*; Stefan Mangard, *Graz University of Technology*; Georg Sigl, *Fraunhofer AISEC*; *Technical University of Munich*

Enterprise Security

The Battle for New York: A Case Study of Applied Digital Threat Modeling at the Enterprise Level621
Rock Stevens, Daniel Votipka, and Elissa M. Redmiles, *University of Maryland*; Colin Ahern, *NYC Cyber Command*; Patrick Sweeney, *Wake Forest University*; Michelle L. Mazurek, *University of Maryland*

SAQL: A Stream-based Query System for Real-Time Abnormal System Behavior Detection639
Peng Gao, *Princeton University*; Xusheng Xiao, *Case Western Reserve University*; Ding Li, Zhichun Li, Kangkook Jee, Zhenyu Wu, and Chung Hwan Kim, *NEC Laboratories America, Inc.*; Sanjeev R. Kulkarni and Prateek Mittal, *Princeton University*

Zero-Knowledge

Practical Accountability of Secret Processes657
Jonathan Frankle, Sunoo Park, Daniel Shaar, Shafi Goldwasser, and Daniel Weitzner, *Massachusetts Institute of Technology*

DIZK: A Distributed Zero Knowledge Proof System675
Howard Wu, Wenting Zheng, Alessandro Chiesa, Raluca Ada Popa, and Ion Stoica, *UC Berkeley*

Network Defenses

NetHide: Secure and Practical Network Topology Obfuscation693
Roland Meier and Petar Tsankov, *ETH Zurich*; Vincent Lenders, *armasuisse*; Laurent Vanbever and Martin Vechev, *ETH Zurich*

Towards a Secure Zero-rating Framework with Three Parties711
Zhiheng Liu and Zhen Zhang, *Lehigh University*; Yinzhi Cao, *The Johns Hopkins University/Lehigh University*; Zhaohan Xi and Shihao Jing, *Lehigh University*; Humberto La Roche, *Cisco Systems*

Fuzzing and Exploit Generation

MoonShine: Optimizing OS Fuzzer Seed Selection with Trace Distillation729
Shankara Pailoor, Andrew Aday, and Suman Jana, *Columbia University*

QSYM: A Practical Concolic Execution Engine Tailored for Hybrid Fuzzing745
Insu Yun, Sangho Lee, and Meng Xu, *Georgia Institute of Technology*; Yeongjin Jang, *Oregon State University*; Taesoo Kim, *Georgia Institute of Technology*

Automatic Heap Layout Manipulation for Exploitation763
Sean Heelan, Tom Melham, and Daniel Kroening, *University of Oxford*

FUZE: Towards Facilitating Exploit Generation for Kernel Use-After-Free Vulnerabilities781
Wei Wu, *University of Chinese Academy of Sciences*; *Pennsylvania State University*; *Institute of Information Engineering, Chinese Academy of Sciences*; Yueqi Chen, Jun Xu, and Xinyu Xing, *Pennsylvania State University*; Xiaorui Gong and Wei Zou, *University of Chinese Academy of Sciences*; *Institute of Information Engineering, Chinese Academy of Sciences*

TLS and PKI

The Secure Socket API: TLS as an Operating System Service799
Mark O’Neill, Scott Heidbrink, Jordan Whitehead, Tanner Perdue, Luke Dickinson, Torstein Collett, Nick Bonner, Kent Seamons, and Daniel Zappala, *Brigham Young University*

Return Of Bleichenbacher’s Oracle Threat (ROBOT)817
Hanno Böck, *unaffiliated*; Juraj Somorovsky, *Ruhr University Bochum, Hackmanit GmbH*; Craig Young, *Tripwire VERT*

Bamboozling Certificate Authorities with BGP833
Henry Birge-Lee, Yixin Sun, Anne Edmundson, Jennifer Rexford, and Prateek Mittal, *Princeton University*

The Broken Shield: Measuring Revocation Effectiveness in the Windows Code-Signing PKI851
Doowon Kim and Bum Jun Kwon, *University of Maryland, College Park*; Kristián Kozák, *Masaryk University, Czech Republic*; Christopher Gates, *Symantec*; Tudor Dumitras, *University of Maryland, College Park*

Vulnerability Mitigations

Debloating Software through Piece-Wise Compilation and Loading869
Anh Quach and Aravind Prakash, *Binghamton University*; Lok Yan, *Air Force Research Laboratory*

Precise and Accurate Patch Presence Test for Binaries887
Hang Zhang and Zhiyun Qian, *University of California, Riverside*

From Patching Delays to Infection Symptoms: Using Risk Profiles for an Early Discovery of Vulnerabilities Exploited in the Wild903
Chaowei Xiao and Armin Sarabi, *University of Michigan*; Yang Liu, *Harvard University / UC Santa Cruz*; Bo Li, *UIUC*; Mingyan Liu, *University of Michigan*; Tudor Dumitras, *University of Maryland, College Park*

Understanding the Reproducibility of Crowd-reported Security Vulnerabilities919
Dongliang Mu, *Nanjing University*; Alejandro Cuevas, *The Pennsylvania State University*; Limin Yang and Hang Hu, *Virginia Tech*; Xinyu Xing, *The Pennsylvania State University*; Bing Mao, *Nanjing University*; Gang Wang, *Virginia Tech*

Side Channels

Malicious Management Unit: Why Stopping Cache Attacks in Software is Harder Than You Think937
Stephan van Schaik, Cristiano Giuffrida, Herbert Bos, and Kaveh Razavi, *Vrije Universiteit Amsterdam*

Translation Leak-aside Buffer: Defeating Cache Side-channel Protections with TLB Attacks.....955
Ben Gras, Kaveh Razavi, Herbert Bos, and Cristiano Giuffrida, *Vrije Universiteit*

Meltdown: Reading Kernel Memory from User Space.....973
Moritz Lipp, Michael Schwarz, and Daniel Gruss, *Graz University of Technology*; Thomas Prescher and Werner Haas, *Cyberus Technology*; Anders Fogh, *G DATA Advanced Analytics*; Jann Horn, *Google Project Zero*; Stefan Mangard, *Graz University of Technology*; Paul Kocher, *Independent*; Daniel Genkin, *University of Michigan*; Yuval Yarom, *University of Adelaide and Data61*; Mike Hamburg, *Rambus, Cryptography Research Division*

FORESHADOW: Extracting the Keys to the Intel SGX Kingdom with Transient Out-of-Order Execution ...991
Jo Van Bulck, *imec-DistriNet, KU Leuven*; Marina Minkin, *Technion*; Ofir Weisse, Daniel Genkin, and Baris Kasikci, *University of Michigan*; Frank Piessens, *imec-DistriNet, KU Leuven*; Mark Silberstein, *Technion*; Thomas F. Wenisch, *University of Michigan*; Yuval Yarom, *University of Adelaide and Data61*; Raoul Strackx, *imec-DistriNet, KU Leuven*

Cybercrime

Plug and Prey? Measuring the Commoditization of Cybercrime via Online Anonymous Markets1009
Rolf van Wegberg and Samaneh Tajalizadehkhoob, *Delft University of Technology*; Kyle Soska, *Carnegie Mellon University*; Ugur Akyazi, Carlos Hernandez Ganan, and Bram Klievink, *Delft University of Technology*; Nicolas Christin, *Carnegie Mellon University*; Michel van Eeten, *Delft University of Technology*

Reading Thieves' Cant: Automatically Identifying and Understanding Dark Jargons from Cybercrime Marketplaces1027
Kan Yuan, Haoran Lu, Xiaojing Liao, and XiaoFeng Wang, *Indiana University Bloomington*

Schrödinger's RAT: Profiling the Stakeholders in the Remote Access Trojan Ecosystem1043
Mohammad Rezaeirad, *George Mason University*; Brown Farinholt, *University of California, San Diego*; Hitesh Dharmdasani, *Informant Networks*; Paul Pearce, *University of California, Berkeley*; Kirill Levchenko, *University of California, San Diego*; Damon McCoy, *New York University*

The aftermath of a crypto-ransomware attack at a large academic institution1061
Leah Zhang-Kennedy, *University of Waterloo, Stratford Campus*; Hala Assal, Jessica Rocheleau,
Reham Mohamed, Khadija Baig, and Sonia Chiasson, *Carleton University*

Web and Network Measurement

We Still Don't Have Secure Cross-Domain Requests: an Empirical Study of CORS1079
Jianjun Chen, *Tsinghua University*; Jian Jiang, *Shape Security*; Haixin Duan, *Tsinghua University*;
Tao Wan, *Huawei Canada*; Shuo Chen, *Microsoft Research*; Vern Paxson, *UC Berkeley, ICSI*; Min Yang,
Fudan University

End-to-End Measurements of Email Spoofing Attacks1095
Hang Hu and Gang Wang, *Virginia Tech*

**Who Is Answering My Queries: Understanding and Characterizing Interception of the DNS
Resolution Path1113**
Baojun Liu, Chaoyi Lu, Haixin Duan, and Ying Liu, *Tsinghua University*; Zhou Li, *IEEE member*; Shuang Hao,
University of Texas at Dallas; Min Yang, *Fudan University*

End-Users Get Maneuvered: Empirical Analysis of Redirection Hijacking in Content Delivery Networks 1129
Shuai Hao, Yubao Zhang, and Haining Wang, *University of Delaware*; Angelos Stavrou, *George Mason University*

Malware

**SAD THUG: Structural Anomaly Detection for Transmissions of High-value Information
Using Graphics1147**
Jonathan P. Chapman, *Fraunhofer FKIE*

FANCI : Feature-based Automated NXDomain Classification and Intelligence1165
Samuel Schüppen, *RWTH Aachen University*; Dominik Teubert, *Siemens CERT*; Patrick Herrmann and
Ulrike Meyer, *RWTH Aachen University*

An Empirical Study of Web Resource Manipulation in Real-world Mobile Applications1183
Xiaohan Zhang, Yuan Zhang, Qianqian Mo, Hao Xia, Zhemin Yang, and Min Yang, *Fudan University*;
Xiaofeng Wang, *Indiana University, Bloomington*; Long Lu, *Northeastern University*; Haixin Duan,
Tsinghua University

Fast and Service-preserving Recovery from Malware Infections Using CRIU1199
Ashton Webster, Ryan Eckenrod, and James Purtilo, *University of Maryland*

Subverting Hardware Protections

The Guard's Dilemma: Efficient Code-Reuse Attacks Against Intel SGX1213
Andrea Biondo and Mauro Conti, *University of Padua*; Lucas Davi, *University of Duisburg-Essen*;
Tommaso Frassetto and Ahmad-Reza Sadeghi, *Technische Universität Darmstadt*

A Bad Dream: Subverting Trusted Platform Module While You Are Sleeping1229
Seunghun Han, Wook Shin, Jun-Hyeok Park, and HyoungChun Kim, *National Security Research Institute*

More Malware

Tackling runtime-based obfuscation in Android with TIRO1247
Michelle Y. Wong and David Lie, *University of Toronto*

Discovering Flaws in Security-Focused Static Analysis Tools for Android using Systematic Mutation1263
Richard Bonett, Kaushal Kafle, Kevin Moran, Adwait Nadkarni, and Denys Poshyvanyk, *William & Mary*

Attacks on Systems That Learn

With Great Training Comes Great Vulnerability: Practical Attacks against Transfer Learning1281
Bolun Wang, *UC Santa Barbara*; Yuanshun Yao, *University of Chicago*; Bimal Viswanath, *Virginia Tech*;
Haitao Zheng and Ben Y. Zhao, *University of Chicago*

When Does Machine Learning FAIL? Generalized Transferability for Evasion and Poisoning Attacks . . .1299
Octavian Suci, Radu Marginean, Yigitcan Kaya, Hal Daume III, and Tudor Dumitras, *University of Maryland*

Smart Contracts

TEETHER: Gnawing at Ethereum to Automatically Exploit Smart Contracts1317
Johannes Krupp and Christian Rossow, *CISPA, Saarland University, Saarland Informatics Campus*

Enter the Hydra: Towards Principled Bug Bounties and Exploit-Resistant Smart Contracts1335
Lorenz Breidenbach, *Cornell Tech, IC3, ETH Zurich*; Philip Daian, *Cornell Tech, IC3*; Florian Tramer, *Stanford*;
Ari Juels, *Cornell Tech, IC3, Jacobs Institute*

Arbitrum: Scalable, private smart contracts1353
Harry Kalodner, Steven Goldfeder, Xiaoqi Chen, S. Matthew Weinberg, and Edward W. Felten,
Princeton University

Erays: Reverse Engineering Ethereum's Opaque Smart Contracts1371
Yi Zhou, Deepak Kumar, Surya Bakshi, Joshua Mason, Andrew Miller, and Michael Bailey, *University of Illinois, Urbana-Champaign*

Executing in Untrusted Environments

DELEGATEE: Brokered Delegation Using Trusted Execution Environments1387
Sinisa Matetic and Moritz Schneider, *ETH Zurich*; Andrew Miller, *UIUC*; Ari Juels, *Cornell Tech*;
Srdjan Capkun, *ETH Zurich*

Simple Password-Hardened Encryption Services1405
Russell W. F. Lai and Christoph Egger, *Friedrich-Alexander University Erlangen-Nuremberg*; Manuel Reinert,
Saarland University; Sherman S. M. Chow, *Chinese University of Hong Kong*; Matteo Maffei, *Vienna University of Technology*; Dominique Schröder, *Friedrich-Alexander University Erlangen-Nuremberg*

Security Namespace: Making Linux Security Frameworks Available to Containers1423
Yuqiong Sun, *Symantec Research Labs*; David Safford, *GE Global Research*; Mimi Zohar, Dimitrios Pendarakis,
and Zhongshu Gu, *IBM Research*; Trent Jaeger, *Pennsylvania State University*

Shielding Software From Privileged Side-Channel Attacks1441
Xiaowan Dong, Zhuojia Shen, and John Criswell, *University of Rochester*; Alan L. Cox, *Rice University*;
Sandhya Dwarkadas, *University of Rochester*

Web Authentication

Vetting Single Sign-On SDK Implementations via Symbolic Reasoning1459
Ronghai Yang, *The Chinese University of Hong Kong, Sangfor Technologies Inc.*; Wing Cheong Lau,
Jiongyi Chen, and Kehuan Zhang, *The Chinese University of Hong Kong*

O Single Sign-Off, Where Art Thou? An Empirical Analysis of Single Sign-On Account Hijacking and Session Management on the Web1475
Mohammad Ghasemisharif, Amrutha Ramesh, Stephen Checkoway, Chris Kanich, and Jason Polakis, *University of Illinois at Chicago*

WPSE: Fortifying Web Protocols via Browser-Side Security Monitoring1493
Stefano Calzavara and Riccardo Focardi, *Università Ca' Foscari Venezia*; Matteo Maffei and Clara Schneidewind, *TU Wien*; Marco Squarcina and Mauro Tempesta, *Università Ca' Foscari Venezia*

Man-in-the-Machine: Exploiting Ill-Secured Communication Inside the Computer1511
Thanh Bui and Siddharth Prakash Rao, *Aalto University*; Markku Antikainen, *University of Helsinki*;
Viswanathan Manihatty Bojan and Tuomas Aura, *Aalto University*

Wireless Attacks

All Your GPS Are Belong To Us: Towards Stealthy Manipulation of Road Navigation Systems.1527
Kexiong (Curtis) Zeng, *Virginia Tech*; Shinan Liu, *University of Electronic Science and Technology of China*;
Yuanchao Shu, *Microsoft Research*; Dong Wang, Haoyu Li, Yanzhi Dou, Gang Wang, and Yaling Yang,
Virginia Tech

Injected and Delivered: Fabricating Implicit Control over Actuation Systems by Spoofing Inertial Sensors. . . 1545
Yazhou Tu, *University of Louisiana at Lafayette*; Zhiqiang Lin, *Ohio State University*; Insup Lee, *University of Pennsylvania*; Xiali Hei, *University of Louisiana at Lafayette*

Modelling and Analysis of a Hierarchy of Distance Bounding Attacks1563
Tom Chothia, *Univ. of Birmingham*; Joeri de Ruiter, *Radboud University Nijmegen*; Ben Smyth, *University of Luxembourg*

Off-Path TCP Exploit: How Wireless Routers Can Jeopardize Your Secrets1581
Weiteng Chen and Zhiyun Qian, *University of California, Riverside*

Neural Networks

Formal Security Analysis of Neural Networks using Symbolic Intervals1599
Shiqi Wang, Kexin Pei, Justin Whitehouse, Junfeng Yang, and Suman Jana, *Columbia University*

Turning Your Weakness Into a Strength: Watermarking Deep Neural Networks by Backdooring1615
Yossi Adi and Carsten Baum, *Bar Ilan University*; Moustapha Cisse, *Google Inc*; Benny Pinkas and Joseph Keshet, *Bar Ilan University*

A⁴NT: Author Attribute Anonymity by Adversarial Training of Neural Machine Translation1633
Rakshith Shetty, Bernt Schiele, and Mario Fritz, *Max Planck Institute for Informatics*

GAZELLE: A Low Latency Framework for Secure Neural Network Inference1651
Chiraag Juvekar, *MIT MTL*; Vinod Vaikuntanathan, *MIT CSAIL*; Anantha Chandrakasan, *MIT MTL*

Information Tracking

FlowCog: Context-aware Semantics Extraction and Analysis of Information Flow Leaks in Android Apps1669
Xiang Pan, *Google Inc./Northwestern University*; Yinzhi Cao, *The Johns Hopkins University/Lehigh University*;
Xuechao Du and Boyuan He, *Zhejiang University*; Gan Fang, *Palo Alto Networks*; Yan Chen, *Zhejiang University/Northwestern University*

Sensitive Information Tracking in Commodity IoT1687
Z. Berkay Celik, *The Pennsylvania State University*; Leonardo Babun, Amit Kumar Sikder, and Hidayet Aksu, *Florida International University*; Gang Tan and Patrick McDaniel, *The Pennsylvania State University*;
A. Selcuk Uluagac, *Florida International University*

Enabling Refinable Cross-Host Attack Investigation with Efficient Data Flow Tagging and Tracking . . .1705
Yang Ji, Sangho Lee, Mattia Fazzini, Joey Allen, Evan Downing, Taesoo Kim, Alessandro Orso, and Wenke Lee, *Georgia Institute of Technology*

Dependence-Preserving Data Compaction for Scalable Forensic Analysis1723
Md Nahid Hossain, Junao Wang, R. Sekar, and Scott D. Stoller, *Stony Brook University*