Daniele Antonioli

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Current Position

Postdoctoral researcher at EPFL IC Supervisor: Mathias Payer Research group: HexHive

Current Research Interests

- **Secure and Privacy-Preserving Contact Tracing**: Design, implementation and end-to-end security testing of DP3T and GAEN for COVID-19 [1, 2]
- **Security of Pervasive Wireless Technologies**: Analysis of the Bluetooth standard, identification, exploitation, and disclosure of 0-days including BLUR [3]. BIAS [4], and KNOB [5, 6]. Reverse-engineering and attacking Google's Nearby Connections for Android [7]. Evaluating Wi-Fi physical layer security via MIMO and beamforming [8]
- **Security of Industrial Control Systems (ICS)**: Simulate/emulate an ICS in a laptop [9], High-interaction ICS honeypot [10], Integrity protect ICS protocols [11, 12], Develop and run ICS security competitions [13], Develop novel ICS botnets [13], Anomaly detection on ICS based on physical states [14],

Education

PhD in CS at Singapore University of Technology and Design (SUTD) **Sep 2015 - Aug 2019**
Thesis: Secure Cyber-Physical and Wireless Systems [15], Adv: N.O. Tippenhauer *GPA: 4.90/5.00*

MS in Electronics and Telecom Engineering at University of Bologna **Sep 2010 - Mar 2013**
Thesis: Design and Testing of RNG [16], Adv: R. Rovatti, W. Burleson *Grade: 110/110*

BS in Electronics and Telecom Engineering at University of Bologna **Sep 2006 - Mar 2010**
Thesis: Principles and Evolution of Radio Imaging, Adv: C. Lamberti *Grade: 91/110*

High School Diploma at Liceo Scientifico G. Marconi, Italy **Sep 2000 - Jul 2006**
Science specialisation *Grade: 98/100*

Selected Projects

- DP3T: Decentralized Privacy-Preserving Proximity Tracing for COVID-19.
- BLURtooth: BLUR attacks on Bluetooth's CTKD (CVE-2020-15802).
- BIAS: Bluetooth Impersonation AttackS (CVE-2020-10135).
- KNOB: Key Negotiation Of Bluetooth attack (CVE-2019-9506).
- REarby: toolkit to reverse engineer and attack Google's Nearby Connections.
- MiniCPS: a framework for Cyber-Physical Systems real-time simulation built on top of Mininet
- S3: SWaT Security Showdown is a novel CTF for Industrial Control Systems (2015, 2016, 2017)

Awards

- Singaporean Presidential Graduate Fellowship (PFG), 2015 - 2019
- Research excellence award by ST Engineering (see [10]), 2017
- Foundations of Security Analysis and Design (FOSAD) Summer School Scholarship, 2016
- UniBO Overseas Master Thesis Scholarship (research in the USA), 2012

Service

- Conferences
  - ACM ASIA Conference on Computer and Communications Security (ASIACCS)
  - International Conference on Network and System Security (NSS)
- Journals
  - IEEE Transactions on Information Forensics and Security (TIFS)
  - IEEE Transactions on Wireless Communications (TWC)
- Workshops
  - USENIX Workshop on Offensive Technologies (WOOT)
  - IEEE Workshop on Cyber-Physical Systems Security (CPS-Sec)

Skills

Programming: object-oriented, procedural, trait-oriented, test-driven

Architectures: x86, amd64, ARM

Tools: unix, vim, git, tmux, make, inkscape, ghidra

Langs: Pythons, C, Rust, SQL, bash, C++, Java, Octave/MATLAB, Mathematica, VHDL, spice

Pentest: SQLi, Fuzzing, MitM, BOF, ROP

Markup: md, LaTeX, rst, toml

Research Experience

RA for Helmholtz Center for Information Security (CISPA), DE **Aug 2018 - Jun 2019**
Wireless Systems Security, Adv: N.O. Tippenhauer
- Wireless systems security, protocol analysis, RE, and applied cryptography [5, 6]

RA for Dept of Computer Science University of Oxford, UK **Jan 2018 - Jul 2018**
Protocols and Systems Security, Adv: K.B. Rasmussen
- Wireless systems security, protocol analysis, RE, and applied cryptography [7, 5]

RA for iTrust Research Centre at SUTD, Singapore **Feb 2015 - Sep 2015**
Cyber-Physical Systems Security, Adv: N.O. Tippenhauer
- Design, and implementation of MiniCPS [9]. Pentesting on the SWaT testbed.

RA for VLSI Circuits and Systems Group at UMass, Amherst **Oct 2012 - Dec 2012**
Hardware Testing and Security, Adv: W. Burleson, V. Suresh
- Work on Master thesis and related e-book [16].
- Publish lightweight on-chip implementation of reduced NIST randomness test suite [17]

Teaching Experience

TA for Security Principles (SPR) at University of Oxford, UK **Summer 2018**
Instructor: Prof. K.B. Rasmussen
- Responsable for the exercises and presentation of Scyther
- Topics: CIA, Authentication, Cryptography, RSA, Protocols

TA for Networks at SUTD, Singapore **Fall 2017**
Instructor: Prof. N.O. Tippenhauer
- Manage weekly lab session, grading of homeworks, office hours for 30 students.
- Topics: Internet, TCP/IP, UDP, BGP, SDN, HTTP, REST API, TLS, tunnels, NAT, embedded networks

TA for Security at SUTD, Singapore **Spring 2017**
Instructor: Prof. N.O. Tippenhauer
- Manage weekly lab session, grading of homeworks, office hours for 30 students.
- Topics: sym/asym crypto, BOF, TLS, CTF, hashing, XSS, input validation, code injection, MitM.

Private Teacher, Italy **Jan 2013 - Jan 2015**
Audience: Grad, Undergrad, and High school students

- Grad/undergrad: linear algebra, calculus, programming (C, Pascal).
- High school: math, physics, programming (C++).

CS External Commissioner Prof for High School Final Exams, Italy **Jun 2013 - Jul 2013**
Institutes: ITIS Urbino, ITI Don Orione
- Grade written exams prepared by MIUR, oral interviews and grade assignment for 40 students.
- Topics: LAMP stack, SQL, design and implementation of relational DB, MVC paradigm, HTTP(S).

Industry Experience

Chief of Transportation and Logistics for FIG World Cup, Italy **Apr 2013**
Adv: Colombo F, Porfiri P
- Plan and manage transportation services for 43 International Delegations and Press.
- Coordinate a senior team of drivers, MGMT of facilities, cash fund, lost property and meals plan.

Intern Clinical Engineer at Infermi Hospital Rimini, Italy **Apr 2010 - Jul 2010**
Adv: Camillini R.
- Study and measurement about the safety of optical radiations [18].
- Lab activity, Logistics, Electrical Checks and inspections in various departments of the hospital.

Selected Self Learning

Unix tools by University of Cambridge **2017**
Instructor: Kuhn M. Topics

Learning How to Learn by UCSD (Coursera) **2014**
Instructors: Sejnowsky T., Oakley B. Topics

Hardware/Software Interface by Washington University (Coursera) **2014**
Instructors: Borriello G., Ceze L. Certificate with Distinction

Entrepreneurship 101: Who is your customer? by MITx (edX) **2014**
Instructor: Aulet B,.

Cryptography Part 1 by Stanford University (Coursera) **2013**
Instructor: Boneh D. Topics Certificate with Distinction

Algorithms Part 1 by Princeton University (Coursera) **2013**
Instructors: Wayne K., Sedgewick R Topics

Quantum Mechanics and Quantum Computation by BerkleyX (edx) **2013**
Instructor: Vazirani U. Topics Certificate Notes

Languages

Italian: Native

English: Professional proficiency: TOEFL iBT: 94 (2013). B-2 CEFR (2012)

Spanish: Intermediate proficiency

Talks

BIAS and KNOB attacks against Bluetooth BR/EDR/LE **2020**
Invited talk at Workshop on Attacks in Cryptography (WAC) co-located with CRYPTO

From the Bluetooth Standard to Standard-Compliant 0-days **2020**
Talk at Hardwear.io Virtual Conference

Bluetooth blues: KNOB Attack Explained **2019**
Invited talk at CyberWire Research Saturday with Dave Bittner

Towards high-interaction virtual honeypots in-a-box and MiniCPS. **2017**
Invited talk at Mauro Conti's SPRITZ research group University of Padova

Events

SMART MIT/ETHZ/NUS/SUTD Workshop at NUS CREATE Tower (Singapore) **2017**
Mentoring six grad students for the track of cyber-security policies. ADAPT research paper.

SGCSC Cybersecurity Camp at NUS (Singapore) **2017**
Instructors: Liang Z., Roychoudhury A. Directed fuzzing LibPNG with peach and Binutils with afl

SCy-Phy Systems Week at SUTD (iTrust, Singapore) **2015, 2016, 2017**
SWaT Security Showdown (S3) CTF and testbed experiments. Technical talks.

FOSAD International Summer School at Bertinoro (Italy) **Summer 2016**
Foundations of Security Analysis and Design. Selected with scholarship.

Misc

Sports: Soccer, Swimming, Basketball
Events: Concerts, Museums, Art, Sport
Hobbies: Dog owner, Traveling, Nature, Food
Music: R&R, Amateur guitar player, Vinyl collector

Publications

[1] Carmela Troncoso, Mathias Payer, Jean-Pierre Hubaux, Marcel Salathé, James Larus, Edouard Bugnion, Wouter Lueks, Theresa Stadler, Apostolos Pyrgelis, Daniele Antonioli, et al. Decentralized privacy-preserving proximity tracing. *arXiv preprint arXiv:2005.12273*, 2020.

[2] Marcel Salathé, Christian L Althaus, Nanina Anderegg, Daniele Antonioli, Tala Ballouz, Edouard Bugnion, Srjan Capkun, Dennis Jackson, Sang-Il Kim, James Larus, Nicola Low, Wouter Lueks, Dominik Menges, Cedric Moullet, Mathias Payer, Julien Riou, Theresa Stadler, Carmela Troncoso, Effy Vayena, and Viktor von Wyl. Early evidence of effectiveness of digital contact tracing for sars-cov-2 in switzerland. *medRxiv*, 2020.

[3] Daniele Antonioli, Nils Ole Tippenhauer, Kasper Rasmussen, and Mathias Payer. BLURtooth: Exploiting Cross-Transport Key Derivation in Bluetooth Classic and Bluetooth Low Energy, 2020.

[4] Daniele Antonioli, Nils Ole Tippenhauer, and Kasper Rasmussen. BIAS: Bluetooth Impersonation AttackS. In *Proceedings of the IEEE Symposium on Security and Privacy (S&P)*, May 2020.

[5] Daniele Antonioli, Nils Ole Tippenhauer, and Kasper Rasmussen. The KNOB is Broken: Exploiting Low Entropy in the Encryption Key Negotiation of Bluetooth BR/EDR. In *Proceedings of the USENIX Security Symposium (SEC)*, August 2019.

[6] Daniele Antonioli, Nils Ole Tippenhauer, and Kasper Rasmussen. Key Negotiation Downgrade Attacks on Bluetooth and Bluetooth Low Energy. *ACM Transactions on Privacy and Security (TOPS)*, 23(3):1–28, 2020.

[7] Daniele Antonioli, Nils Ole Tippenhauer, and Kasper Rasmussen. Nearby Threats: Reversing, Analyzing, and Attacking Google's "Nearby Connections" on Android. In *Network and Distributed System Security Symposium (NDSS)*, February 2019.

[8] Daniele Antonioli, Sandra Siby, and Nils Ole Tippenhauer. Practical evaluation of passive COTS eavesdropping in 802.11b/n/ac WLAN. In *Proceedings of Conference on Cryptology And Network Security (CANS)*, November 2017.

[9] Daniele Antonioli and Nils Ole Tippenhauer. Minicps: A toolkit for security research on CPS networks. In *Proceedings of the First ACM Workshop on Cyber-Physical Systems-Security and/or Privacy (co-located with CCS)*, pages 91–100. ACM, 2015. `https://arxiv.org/pdf/1507.04860`, Repo: `https://github.com/scy-phy/minicps`.

[10] Daniele Antonioli, Anand Agrawal, and Nils Ole Tippenhauer. Towards high-interaction virtual ICS honeypots-in-a-box. In *Proceedings of the 2nd ACM Workshop on Cyber-Physical Systems Security and Privacy (co-located with CCS)*, pages 13–22. ACM, 2016. https://dl.acm.org/citation.cfm?id=2994493 **Research excellence award by ST Engineering at FIRST workshop 2017**.

[11] John Henry Castellanos, Daniele Antonioli, Nils Ole Tippenhauer, and Martín Ochoa. Legacy-Compliant Data Authentication for Industrial Control System Traffic. In *Proceedings of the Conference on Applied Cryptography and Network Security (ACNS)*, July 2017.

[12] Communication method and apparatus for an industrial control system, U.S. Patent 16626843, Apr. 2020.

[13] Daniele Antonioli, Hamid Reza Ghaeini, Sridhar Adepu, Martín Ochoa, and Nils Ole Tippenhauer. Gamifying ICS Security Training and Research: Design, Implementation, and Results of S3. In *Proceedings of Workshop on Cyber-Physical Systems Security & Privacy (co-located with CCS)*, November 2017.

[14] Hamid Reza Ghaeini, Daniele Antonioli, Ferdinand Brasser, Ahmad-Reza Sadeghi, and Nils Ole Tippenhauer. State-Aware Anomaly Detection for Industrial Control Systems. In *Proceedings of Symposium on Applied Computing (SAC)*, 2018.

[15] Daniele Antonioli. *Design, Implementation, and Evaluation of Secure Cyber-Physical and Wireless Systems*. PhD thesis, Singapore University of Technology and Design, 2019.

[16] Daniele Antonioli. Design and testing of RNG. Master's thesis, University of Bologna and University of Massachussets Amherst, 2013. http://www.lulu.com/shop/daniele-antonioli/design-and-testing-of-rng/ebook/product-20965725.html.

[17] Vikram B Suresh, Daniele Antonioli, and Wayne P Burleson. On-chip lightweight implementation of reduced NIST randomness test suite. In *IEEE International Symposium on Hardware-Oriented Security and Trust (HOST)*, pages 93–98. IEEE, 2013. http://sharps.org/wp-content/uploads/SURESH-HOST13.pdf.

[18] Daniele Antonioli. Artificial Optical Radiation Management, Risk and Safety in the Hospital Environment. *Tecnica Ospedaliera (Italian Technical Magazine)*, 2010.