

Curriculum Vitæ: Nils Ole Tippenhauer

Title: PhD (Dr. Sc. ETH)
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Contact No: +65 6499 4869
Current Position: Assistant Professor, ISTD, Singapore University of Technology and Design
Research Areas: Physical-layer Security for Wireless Communications;
Security of Cyber-Physical Systems; IoT Security
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Academic Employment History

April 2014 – current Assistant Professor (tenure track), Information Systems Technology and Design Pillar, Singapore University of Technology and Design
January 2013 – March 2014 Research Scientist, Advanced Digital Science Center, Singapore
April 2012 – November 2012 Postdoctoral Researcher, ETH Zurich, Switzerland

Academic Background

7/2007–3/2012 PhD (Dr. Sc. ETH), Systems Security Group under Professor Srdjan Capkun, ETH Zurich. Title: “Physical-Layer Security Aspects of Wireless Localization”
External committee members: N. Asokan, Christof Paar, Patrick Traynor
10/2001–4/2007 Dipl.-Ing. Informatik Ingenieurwesen, Hamburg University of Technology, Germany.
Thesis: “Design and Cryptanalysis of Multi-Precision Arithmetics on Smartcards using the 32-bit SmartMIPS Architecture”, awarded as best thesis 2007/08
Supervisor: Heike Neumann and Dieter Gollmann
8/2004–7/2005 One year of exchange studies at University of Waterloo, Ontario, Canada

Publications

Total number of peer-reviewed publications to date: 43. Citations (Google scholar): 1001, h-index: 15.

Articles in Journals

- [1] R. Taormina, S. Galelli, N. O. Tippenhauer, E. Salomons, and A. Ostfeld, “Characterizing cyber-physical attacks on water distribution systems,” *Journal of Water Resources Planning and Management*, vol. 143, 5 2016.
- [2] E. Wilhelm, S. Siby, Y. Zhou, X. J. S. Ashok, M. Jayasuriya, S. Foong, J. Kee, K. Wood, and N. O. Tippenhauer, “Wearable environmental sensors and infrastructure for mobile large-scale urban deployment,” *Sensors*, vol. 16, no. 22, pp. 8111–8123, Nov. 2016.
- [3] S. Siboni, A. Shabtai, N. O. Tippenhauer, J. Lee, and Y. Elovici, “Advanced security testbed framework for wearable IoT devices,” *Transactions on Internet Technology (TOIT)*, vol. 16, no. 4, pp. 1–25, Dec. 2016.
- [4] N. O. Tippenhauer, K. B. Rasmussen, and S. Capkun, “Physical-layer integrity for wireless messages,” *Computer Networks*, vol. 109, no. 1, pp. 31–38, Nov. 2016.
- [5] S. Čapkun, M. Čagalj, G. Karame, and N. O. Tippenhauer, “Integrity regions: Authentication through presence in wireless networks,” *IEEE Transactions on Mobile Computing*, 2010.

Conference Proceedings

- [1] H. R. Ghaeini, D. Antonioli, F. Brasser, A.-R. Sadeghi, and N. O. Tippenhauer, "State-aware anomaly detection for industrial control systems," in *Proceedings of Security Track at the ACM Symposium on Applied Computing (SAC)*, Apr. 2018.
- [2] R. Ranjan Maiti, S. Siby, R. Sridharan, and N. O. Tippenhauer, "Link-layer device type classification on encrypted wireless traffic with COTS radios," in *Proceedings of the European Symposium on Research in Computer Security (ESORICS)*, Sep. 2017.
- [3] J. H. Castellanos, D. Antonioli, N. O. Tippenhauer, and M. Ochoa, "Legacy-compliant data authentication for industrial control system traffic," in *Proceedings of the Conference on Applied Cryptography and Network Security (ACNS)*, Jul. 2017.
- [4] M. Rocchetto and N. O. Tippenhauer, "Towards formal security analysis of industrial control systems," in *Proceedings of the ACM Asia Conference on Computer and Communications Security (ASIACCS)*, Apr. 2017.
- [5] Y. Meidan, M. Bohadana, A. Shabtai, J.-D. Guarnizo, M. Ochoa, N. O. Tippenhauer, and Y. Elovici, "Profiliot: A machine learning approach for iot device identification based on network traffic analysis (poster)," in *Proceedings of the Security Track at ACM Symposium on Applied Computing (SAC)*, Apr. 2017.
- [6] E. Wilhelm, D. MacKenzie, Y. Zhou, L. Cheah, and N. O. Tippenhauer, "Evaluation of transport mode using wearable sensor data from 43,000 students," in *Proceedings of Transportation Research Board Annual Meeting (TRB)*, Jan. 2017.
- [7] D. Urbina, J. Giraldo, A. A. Cardenas, N. O. Tippenhauer, J. Valente, M. Faisal, J. Ruths, R. Candell, and H. Sandberg, "Limiting the impact of stealthy attacks on industrial control systems," in *Proceedings of the ACM Conference on Computer and Communications Security (CCS)*, Oct. 2016.
- [8] K. Jansen, N. O. Tippenhauer, and C. Pöpper, "Multi-receiver GPS spoofing detection: Error models and realization," in *Proceedings of the Annual Computer Security Applications Conference (ACSAC)*, Dec. 2016.
- [9] M. Rocchetto and N. O. Tippenhauer, "On attacker models and profiles for cyber-physical systems," in *Proceedings of the European Symposium on Research in Computer Security (ESORICS)*, Sep. 2016.
- [10] ———, "Cpdy: Extending the Dolev-Yao attacker with physical-layer interactions," in *Proceedings of the International Conference on Formal Engineering Methods (ICFEM)*, Oct. 2016.
- [11] R. Taormina, S. Galelli, N. O. Tippenhauer, E. Salomons, and A. Ostfeld, "Assessing the effect of cyber-physical attacks on water distribution systems," in *Proceedings of World Congress on Environmental & Water Resources (EWRI)*, May 2016.
- [12] E. Wilhelm, N. O. Tippenhauer, Y. Zhou, and N. Zhang, "Sensg: Large-scale deployment of wearable sensors for trip and transport mode logging," in *Proceedings of Transportation Research Board Annual Meeting (TRB)*, Jan. 2016.
- [13] R. Taormina, S. Galelli, N. O. Tippenhauer, E. Salomons, and A. Ostfeld, "Simulation of cyber-physical attacks on water distribution systems with EPANET," in *Proceedings of Singapore Cyber Security Conference (SG-CRC)*, Jan. 2016.
- [14] D. Urbina, J. Giraldo, N. O. Tippenhauer, and A. Cárdenas, "Attacking fieldbus communications in ICS: Applications to the SWaT testbed," in *Proceedings of Singapore Cyber Security Conference (SG-CRC)*, Jan. 2016.
- [15] N. O. Tippenhauer, H. Luecken, M. Kuhn, and S. Capkun, "UWB rapid-bit-exchange system for distance bounding," in *Proceedings of the ACM Conference on Security and Privacy in Wireless and Mobile Networks (WiSec)*, Jun. 2015.

- [16] N. O. Tippenhauer, W. G. Temple, A. H. Vu, B. Chen, D. M. Nicol, Z. Kalbarczyk, and W. Sanders, "Automatic generation of security argument graphs," in *Proceedings of the IEEE Pacific Rim International Symposium on Dependable Computing (PRDC)*, Nov. 2014.
- [17] A. H. Vu, N. O. Tippenhauer, B. Chen, D. M. Nicol, and Z. Kalbarczyk, "Cybersage: A tool for automatic security assessment of cyber-physical systems," in *Proceedings of the Conference on Quantitative Evaluation of SysTems (QEST)*, Sep. 2014.
- [18] W. G. Temple, B. Chen, and N. O. Tippenhauer, "Delay makes a difference: Smart grid resilience under remote meter disconnect attack," in *Proceedings of the IEEE Conference on Smart Grid Communications (SmartGridComm)*, Oct. 2013.
- [19] N. O. Tippenhauer, L. Malisa, A. Ranganathan, and S. Capkun, "On limitations of friendly jamming for confidentiality," in *Proceedings of the IEEE Symposium on Security and Privacy*, 2013.
- [20] N. O. Tippenhauer, D. Giustiniano, and S. Mangold, "Toys communicating with LEDs: Enabling toy cars interaction," in *Proceedings of Consumer Communications and Networking Conference (CCNC)*, IEEE, 2012, pp. 48–49.
- [21] D. Giustiniano, N. Tippenhauer, and S. Mangold, "Low-complexity visible light networking with led-to-led communication," in *Proceedings of IFIP Wireless Days*, 2012.
- [22] A. Ranganathan, N. O. Tippenhauer, B. Skoric, D. Singelé, and S. Čapkun, "Design and implementation of a terrorist fraud resilient distance bounding system," in *Proceedings of the European Symposium on Research in Computer Security (ESORICS)*, ser. Lecture Notes in Computer Science, Springer, 2012.
- [23] N. O. Tippenhauer, C. Pöpper, K. B. Rasmussen, and S. Čapkun, "On the requirements for successful GPS spoofing attacks," in *Proceedings of the ACM Conference on Computer and Communications Security (CCS)*, 2011.
- [24] C. Pöpper, N. O. Tippenhauer, B. Danev, and S. Čapkun, "Investigation of signal and message manipulations on the wireless channel," in *Proceedings of the European Symposium on Research in Computer Security (ESORICS)*, 2011.
- [25] N. O. Tippenhauer, K. B. Rasmussen, C. Pöpper, and S. Čapkun, "Attacks on public WLAN-based positioning," in *Proceedings of the ACM Conference on Mobile Systems, Applications and Services (MobiSys)*, 2009.
- [26] N. O. Tippenhauer and S. Čapkun, "ID-based secure distance bounding and localization," in *Proceedings of the European Symposium on Research in Computer Security (ESORICS)*, 2009.

Workshop Proceedings

- [1] N. Govil, A. Agrawal, and N. O. Tippenhauer, "On ladder logic bombs in industrial control systems," in *Proceedings of the Workshop on the Security of Industrial Control Systems and of Cyber-Physical Systems (CyberICPS)*, co-located with ESORICS, Sep. 2017.
- [2] D. Antonioli, H. R. Ghaeini, S. Adepur, M. Ochoa, and N. O. Tippenhauer, "Gamifying ICS security training and research: Design, implementation, and results of S3," in *Proceedings of Workshop on Cyber-Physical Systems Security & Privacy (SPC-CPS)*, co-located with CCS, Nov. 2017.
- [3] S. Siby, R. R. Maiti, and N. O. Tippenhauer, "Iotscanner: Detecting privacy threats in IoT neighborhoods," in *Proceedings of the Workshop on IoT Privacy, Trust, and Security (IoTPTS)*, co-located with ASIACCS, Apr. 2017.
- [4] J. Guarnizo, A. Tambe, S. S. Bunia, M. Ochoa, N. O. Tippenhauer, A. Shabtai, and Y. Elovici, "Siphon: Towards scalable high-interaction physical honeypots," in *Proceedings of the Cyber-Physical System Security Workshop (CPSS)*, co-located with ASIACCS, Apr. 2017.

- [5] H. Ghaeini and N. O. Tippenhauer, "Hamids: Hierarchical monitoring intrusion detection system for industrial control systems," in *Proceedings of Workshop on Cyber-Physical Systems Security & Privacy (SPC-CPS), co-located with CCS*, Oct. 2016.
- [6] D. Antonioli, A. Agrawal, and N. O. Tippenhauer, "Towards high-interaction virtual ICS honeypots-in-a-box," in *Proceedings of Workshop on Cyber-Physical Systems Security & Privacy (SPC-CPS), co-located with CCS*, Oct. 2016.
- [7] A. Mathur and N. O. Tippenhauer, "Swat: A water treatment testbed for research and training on ICS security," in *Proceedings of Workshop on Cyber-Physical Systems for Smart Water Networks (CySWater)*, Apr. 2016.
- [8] N. O. Tippenhauer, M. Ochoa, and A. Mathur, "Water treatment, distribution, and electric power testbeds for research in the design of secure interdependent critical infrastructures," in *Proceedings of Workshop on Security and Resilience of Cyber-Physical Infrastructures (SERECIN)*, Apr. 2016.
- [9] X. Dong, S. Jauhar, W. G. Temple, B. Chen, Z. Kalbarczyk, W. H. Sanders, N. O. Tippenhauer, and D. M. Nicol, "The right tool for the job: A case for common input scenarios for security assessment," in *Proceedings of Workshop on Graphical Models for Security (GraMSec)*, Jun. 2016.
- [10] D. Antonioli and N. O. Tippenhauer, "Minicps: A toolkit for security research on CPS networks," in *Proceedings of Workshop on Cyber-Physical Systems Security & Privacy (SPC-CPS), co-located with CCS*, Oct. 2015.
- [11] B. Chen, Z. Kalbarczyk, D. M. Nicol, W. H. Sanders, R. Tan, W. G. Temple, N. O. Tippenhauer, A. H. Vu, and D. K. Yau, "Go with the flow: Toward workflow-oriented security assessment," in *Proceedings of New Security Paradigm Workshop (NSPW)*, 2013.
- [12] M. Kuhn, H. Luecken, and N. O. Tippenhauer, "UWB impulse radio based distance bounding," in *Proceedings of the Workshop on Positioning, Navigation and Communication (WPNC)*, 2010.

Patents

Visible light communication with flickering prevention, Domenico Giustiniano and Stefan Mangold and Nils Ole Tippenhauer, US Patent 8,873,965, 10/2014

Research Activities

Involved as principle investigator (PI) or co-PI in research projects with total funding of more than 20M SGD. Major contributions to writing grant proposals of ResilloT, ASPIRE, NSE, and SAFE.

Research Projects

1. "ReSILloT: Research and Security Innovation Lab for Internet of Things", role: Co-PI, 9/2015–9/2018, funding: Ministry of Defence
2. "ASPIRE: Advancing Security of Public Infrastructure using Resilience and Economics", role: Co-PI, 1/2015–12/2018, funding: National Research Foundation
3. "National Science Experiment", role: Co-PI, 2/2015–12/2017, funding: National Research Foundation
4. "SAFE: Security Assessment and Forensic Examination", role: PI, 8/2014–7/2017, funding: SUTD startup grant
5. "CYPRO: Cyber-Physical Protection", role: co-PI, 10/2014–9/2016, funding: Ministry of Defence

Events Organized

1. Chair: SCy-Phy Systems week'17: Think-In event and Singapore Security Showdown event, SUTD, 2017
2. Co-Chair: SCy-Phy Systems week'16: Think-In event and Singapore Security Showdown event, SUTD, 2016
3. Co-Chair: SCy-Phy Systems week'15: Think-In event and ICS security hands-on, SUTD, 2015
4. Publicity Committee: Conference on Quantitative Evaluation of SysTems (QEST), 2014
5. Publicity Co-Chair: Automation Protocols Security in Cyber-Physical Systems (APS-CPS), 2016

Research Outcomes

- Co-designer of *MiniCPS*, MiniCPS is a lightweight simulator for accurate network traffic in an industrial control system, with basic support for physical layer interaction
- Co-author of *APE: Attacker Profile Examiner* tool for attacker models
- Design and implementation of first working UWB-based radio distance bounding system
- Co-inventor of COTS-GPS receiver-based GPS spoofing detection
- Co-developer of Cyber Security Argument Graph Evaluation tool (CyberSAGE), now licensed to third parties by ADSC

Service

Journal Reviewer

1. IEEE Transactions on Information Forensics & Security
2. IEEE Communications Letters
3. IEEE Transactions on Dependable and Secure Computing
4. IEEE Transactions on Industrial Informatics
5. IEEE Transactions on Wireless Communications
6. Wireless Networks (WINE), Springer
7. ACM Transactions on Internet Technology
8. Elsevier Computers & Security
9. ACM Transactions on Privacy and Security (former TISSEC)
10. Elsevier Future Generation Computer Systems
11. ACM Computing Surveys
12. IEEE Transactions on Mobile Computing
13. IEEE/ACM Transactions on Networking
14. Transactions on Emerging Telecommunications Technologies

15. Journal of Field Robotics
16. KSII Transactions on Internet and Information Systems
17. Journal of Computer Security
18. MILCOM

Technical Program Committee Member

1. European Symposium on Research in Computer Security (ESORICS), 2017+2018
2. ACM Conference on Security and Privacy in Wireless and Mobile Networks (WiSec), 2017+2018
3. Workshop on Industrial Internet of Things Security (WIIoTS), 2018
4. Cyber-Physical System Security Workshop (CPSS), 2015-2018 (co-located with ASIACCS)
5. ACM Workshop on Cyber-Physical Systems-Security and/or PrivaCy (CPS-SPC), 2016-2018 (co-located with CCS)
6. Conference on Cryptology and Network Security (CANS), 2017
7. Workshop on Security for Embedded and Mobile Systems (SEMS), 2017
8. Singapore-Cyber Security R&D Conference (SG-CRC) 2016 + 2017
9. International Symposium on High Assurance Systems Engineering (HASE), 2017
10. Workshop on RFID Security and Privacy (RFIDsec), 2016
11. IFIP International Information Security and Privacy Conference (IFIP SEC), 2015 + 2016
12. International Conference on Network and System Security (NSS), 2014 +2016
13. Workshop on Cyber-Physical Systems Security (CPS-Sec) co-located with CNS, 2016+2017
14. International Conference on Cyber-Physical Systems, Networks, and Applications (CPSNA) 2016
15. International Workshop on Authentication Techniques (AuthTech), 2016
16. Smart City Security and Privacy Workshop (SCSP-W), co-located with CPS week, 2016

Committee Work and other SUTD Service

At SUTD, I was/am member of the following committees

- Graduate Studies Committee, 2017–current
- Faculty Search Committee, 2016–2017
Responsible for review of applications, recommendations to Department Head. Reviewed over 390 applications.
- Master of Science in Secure Design committee member, 2016-current
Co-designer of the first Masters' programme in the department (curriculum, administrative process). Review and selection of applications.
- Representative of ISTD in the Learning Research Governance Sub-Committee

- ISTD Labs committee member, 2015-2016.
Design and procurement of LEETlab, used for teaching 50.012 Networks and 50.020 Security.

In addition, I am supporting SUTD as follows:

- Leading and coordinating efforts to maintain and modernize the department's website (2014-now)
- Organizer of an inter-department end-of-term social event for faculty members, with 3 events each year since December 2014.
- Evaluation committee member for procurement efforts for more than 6.7M SGD since 2014.

Teaching

Designed and implemented two undergraduate classes at SUTD, 50.012 Networks (Term 6), and 50.020 Security (Term 7). Both classes are electives, and form the "Security and Communications" track. Per week: 2x1.5h interactive lectures and one 2h exercise in the lab. Total term duration: 14 weeks (including recess week).

- 50.012 Networks: taught Spring and Fall 2015, Fall 2016, and Fall 2017.
Average course rating in evaluation: 4.3/5. Average instructor rating 4.6/5.
- 50.020 Security: taught Fall 2014, Spring 2016, Spring 2017.
Average course rating in evaluation: 4.3/5. Average instructor rating 4.5/5. The security class contains a capture-the-flag competition, with student-made challenges to apply security concepts

At ETH Zurich:

- 4 years as Teaching Assistant of the Systems Security graduate class
- 1 year as Teaching Assistant of the Security of Wireless Networks graduate class

Other short courses developed and delivered:

- "Security Attacks", 4 hours, developed for Swiss high school students
- "Cybersecurity Foundations Class", 8 hours, developed for Defence Science and Technology Agency, Singapore
- "Cyber-Security for Industrial Control Systems", 4 hours, developed for Keppel Offshore Marine, Singapore

Co-designer of overall curriculum for the Master's in Security by Design (MSSD) program at SUTD.

Supervised Students and Researchers

Postdoctoral Researchers

- Wang Xueou, Nov 2017 to date
- Yan Lin Aung, Nov 2017 to date
- Rajib Ranjan Maiti, July 2016 to date
- Marco Rocchetto, Sept. 2015–Sept. 2016, now Research Scientist at University of Luxembourg
- Liang He, Sept 2014–Nov 2014, now Research Fellow at University of Michigan, USA

PhD Students

- Hamid Ghaeini, from January 2015 to date
- Daniele Antonioli, from September 2015 to date

Masters' Thesis Supervision

- Luca Cometta, "Implementation and Evaluation of a GPS Spoofing Countermeasure", ETH Zurich, 2013
- Sami Kerim Galal, "Physical layer attacks on sensor nodes", ETH Zurich 2009
- Bojan Oliver Konic, "Security issues in Microsoft SharePoint 2007", ETH Zurich, 2008
- Ada Lezama Lugo, "Implementation and evaluation of a realistic VANET simulator", EPF Lausanne, 2007
- Dominik Langenegger, "Trusted computing based opportunities for financial services", ETH Zurich, 2007

Co-Examiner on Masters' Thesis

- Hunter Callum Douglas (SUTD), "Pressure-Driven Hydraulic Modelling of Cyber-Physical Attacks on Water Distribution Systems". Advisor: Stefano Galleli, 2017
- Francesco Scandola (University of Trento), "Application of MQTT in an Industrial Control System", Advisor: Mariolino De Cecco, 2017
- Giulio Lovisotto (U of Padova), "We're not on the same Wavelength: Automatic Deauthentication using Wireless Signal". Advisors: M. Conti (Padova), I. Martinovic (Oxford), 2016

Co-Examiner on PhD Thesis

- One co-examination, details withheld.

Research Assistants and Students

- Amit Tambe, Research Assistant, since November 2011
- Dominik Breitenbacher, Research Assistant, since November 2017
- Ragav Sridharan, Research Assistant, since January 2017
- Francesco Scandola, Research Assistant, since October 2016
- Ahnaf Siddiqi, Research Assistant, November 2016-October 2017
- Sandra Siby, Research Assistant, June 2015 to August 2017
- Jinghui Toh, January 2016 to December 2016
- Anand Agrawal, Research Assistant, February 2016 to September 2016
- Mohannad Alhanahnah, January 2016 to June 2016

Visiting Researchers

- Aymen Fakhreddine, PhD student at IMDEA, Spain, 2017
- Giuseppe Bernieri, PhD student at Roma Tre University, 2017
- Naman Govil, undergrad student at IIIT Hyderabad, in 2016
- Nicolas looss, graduate student at Corps des mines, Paris, in 2015
- Pierre Gaulon, graduate student at ENSEIRB, Bordeaux, in 2015
- David Urbina, PhD student of UT at Dallas, in 2015

Qualifying and Preliminary Examinations at SUTD

- QE: John Henry Castellanos Alvarado
- QE, PE: Vu Dinh Quyen (as Chair of Committe)
- QE: Sibong Sung
- QE: Dima Dafer S Rabadi (as Chair of Committe)
- QE, PE: Mujeeb Chuadhry (as Chair of QE Committe)
- QE: Jay Prakash (as Chair of Committe)
- QE, PE: Hamid Ghaeini
- QE: Daniele Antonioli
- PE: Hans Anderson (as Chair of Committe)
- PE: Dinh Quang Thinh
- PE: Eyasu Getahun Chekole

Professional Awards

- Best paper award at CPSS, 2017
- Short-listed for SUTD service award, 2016
- SG Design Mark Award for NSE project, 2016
- Runner-Up Smart Energy Hackathon, UP Singapore, September 2013
- Best Paper Award, IFIP Wireless Days 2012, November 2012
- K.-H. Ditze Award for TUHH's best diploma thesis 2007/2008, April 2008
- Three terms scholarship for University of Waterloo exchange studies (DAAD), April 2004

References

References available on request.