Rahmadi Trimananda

Research Interests

The intersection of computer science and engineering, namely hardware and software, and policy, with emphasis on security and privacy, especially for Internet of Things (IoT).

Experience

2020-Now **Researcher**, *University of California, Irvine*, Irvine, CA.

Conduct research on the intersection between hardware and software security and privacy, and policy in the context of IoT as part of the Networking Group (`https://athinagroup.eng.uci.edu/`) and the ProperData Center (`https://properdata.eng.uci.edu/`).
Principal Investigator: Dr. Athina Markopoulou

Roles

Project Scientist, May 2022–Now.

Postdoctoral Researcher, October 2020–April 2022.

- Conduct research on security and privacy of Internet-of-Things (IoT)/mobile devices: data protection policy and law; privacy policy analysis (using machine learning/natural language processing); network traffic analysis on mobile phones, smart TV, voice assistant, and VR devices; and IoT device security.
- Mentor students, and facilitate research and student meetings in the *ProperData Center*.

2015-2020 **Graduate Student Researcher**, September 2015–September 2020.

Conducted research in the Programming Languages Group (`https://plrg.ics.uci.edu/`).
Advisor: Dr. Brian Demsky

- **Project highlight #1**: Designed and implemented a tool that performs lightweight fingerprinting to identify IoT devices. The tool learns (using machine learning) from the device traffic and network protocol information to derive the minimal set of packet lengths and directions: a packet-level signature. In addition to exploring the security and privacy issue, this project also explores the proper means for mitigating it.
- **Project highlight #2**: Designed and implemented a system that derives communication diagram and security properties from IoT devices automatically from app source code, and deploys the necessary security means (e.g., firewall rules, sandboxing, etc.) on network devices (e.g., router)—only the necessary communication traffic is allowed to flow in the network.

June–Sept. 2017 **Software Engineering Intern**, *Xilinx Inc.*, San Jose, CA.

Conducted research on the Xilinx FPGA tool-chain and developed a prototype of FPGA *cutting edge debugging features*.

- Developed a prototype of cutting edge debugging features using compiler techniques in the newly developed SDx tool chain for Xilinx FPGA's circuits and systems designs (Electronic Design Automation).

2012–2015 **Software QA and Systems Validation Engineer**, *Intel Corporation*, Penang, Malaysia.

Owned the responsibility for conducting system validation in software and hardware for various Intel products.

Roles

PMIC Validation Engineer, January–July 2015.

Performed *Power Management IC* (PMIC) validation, integration in *Systems-on-a-Chip* (SoC) systems, and research on PMIC validation software integration.

Full-chip System Validation Engineer, 2013–2014.

Conducted validation for Intel SoC products in terms of full-chip integration of IP blocks, full-chip traffic, and bandwidth; worked with debugger and simulation tool chain.

Random Test Software QA Engineer, 2012–2013.

Worked in a team that developed and maintained a Random Test software (written in C++) for CPU system validation on various Intel SoC and mainstream products. Supported and delivered Intel products in terms of System Validation both from software and hardware perspectives.

2009–2011 **Researcher/Lecturer**, *University of Pelita Harapan (UPH)*, Jakarta, Indonesia.

Conducted research and gave lectures.

- Built a complete automation software/hardware system for garment printing using Gutenprint—a Linux C printer driver.

Additional Role

Manager of Microsoft Innovation Center at UPH.

Led and managed Microsoft Innovation Center at UPH that was established in a collaboration with Microsoft Corporation.

2008–2009 **Research Assistant**, *Delft University of Technology*, Delft, Netherlands.

Conducted research: final M.Sc. thesis project at Delft University of Technology (TU Delft).

- Worked on the Megaframe project—next generation imaging device that involves a consortium of top European institutions: EPFL, University of Edinburgh, TU Delft, and ST Microelectronics.
- Designed, modeled, and built interconnects and memory system for the Megaframe imaging device using Virtex-II Pro FPGA, complete with a C/C++ API library that interfaces the FPGA system and a PC (C program and Matlab).

June–July 2008 **Graduate Intern Researcher**, *TNO Research Company*, Delft, Netherlands.

Conducted research internship program at TNO, a Dutch research company.

- Optimized power management of wireless sensor network as a low-power embedded system.

2006–2007 **Software Engineer**, *University of Pelita Harapan (UPH)*, Jakarta, Indonesia.

Developed various applications mainly used in the campus library.

Education

Sept. 2020 **Doctor of Philosophy**, *University of California, Irvine* , Irvine, CA, GPA–4.0.
EECS Department and Broadcom Foundation Fellowships
Ph.D. Advisor: Dr. Brian Demsky

Sept. 2009 **Master of Science**, *Delft University of Technology*, Delft, Netherlands, GPA–3.7.
Honours Track Program
M.Sc. Thesis Advisor: Dr. Edoardo Charbon

Feb. 2006 **Bachelor of Computer Engineering**, *University of Pelita Harapan*, Tangerang, Indonesia, GPA–4.0.
First Class Honours

Awards

University of California, Irvine

2016 Broadcom Foundation Fellowship Award

2015 UC Irvine EECS Department Fellowship Award

Intel Corporation

2012–2014 Spontaneous Recoginition Awards

University of Pelita Harapan (as a Researcher/Lecturer)

2012 National Top 10 in Microsoft Imagine Cup

Delft University of Technology

2009 M.Sc. with Honours Track (first student to graduate with Honours Track in Computer Engineering Department at TU Delft)

2007 Indonesian MCIT (Ministry of Communication and Information Technology) Graduate Scholarship Award

University of Pelita Harapan

2006 Best paper award for Indonesian National Seminar of Information System (SNSI)

2002 University of Pelita Harapan Undergraduate Scholarship Award

Publications

Books

B4 **Rahmadi Trimananda**. *Understanding and Guaranteeing Security, Privacy, and Safety of Smart Homes (Ph.D. Thesis)*. University of California, Irvine, 2020.

B3 **Rahmadi Trimananda**. *A Hierarchically Pipelined Data Acquisition System for Single-Photon Avalanche Diode Array (M.Sc. Thesis)*. Delft University of Technology, 2009.

B2 **Rahmadi Trimananda**. Parallel Microcontrolers AT89C52: Parallel Processors In Embedded System Application Of Robotics (*Undergraduate Thesis*). University of Pelita Harapan, 2006.

B1 **Rahmadi Trimananda**. Network Improvement with VLAN Technology at Advanced Computer Lab at UPH (*Internship Report*). University of Pelita Harapan, 2005.

Journal Papers

J1 Marek Gersbach, Yuki Maruyama, **Rahmadi Trimananda**, Matt W Fishburn, David Stoppa, Justin A Richardson, Richard Walker, Robert Henderson, and Edoardo Charbon. A time-resolved, low-noise single-photon image sensor fabricated in deep-submicron cmos technology. *IEEE Journal of Solid-State Circuits*, 47(6):1394–1407, 2012.

Conference Papers

CP17 Athina Markopoulou, **Rahmadi Trimananda**, and Hao Cui. A CI-based Auditing Framework for Data Collection Practices. In *The 4th Annual Symposium on Applications of Contextual Integrity (PrivaCI)*, Sept. 2022.

CP16 **Rahmadi Trimananda**, Hieu Le, Hao Cui, Janice Tran Ho, Anastasia Shuba, and Athina Markopoulou. OVRseen: Auditing Network Traffic and Privacy Policies in Oculus VR. In *31st USENIX security symposium (USENIX Security 22)*, 2022.

CP15 Janus Varmarken, Jad Al Aaraj, **Rahmadi Trimananda**, and Athina Markopoulou. FingerprinTV: Fingerprinting Smart TV Apps. In *Proceedings on Privacy Enhancing Technologies (PETS)*, 2022.

CP14 **Rahmadi Trimananda**, Weiyu Luo, Brian Demsky, and Guoqing Harry Xu. Stateful Dynamic Partial Order Reduction for Model Checking Event-Driven Applications that Do Not Terminate. In *International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI)*, pages 400–424. Springer, 2022.

CP13 **Rahmadi Trimananda**, Seyed Amir Hossein Aqajari, Jason Chuang, Brian Demsky, Guoqing Xu, and Shan Lu. Understanding and Automatically Detecting Conflicting Interactions between Smart Home IoT Applications. In *Proceedings of the 2020 28th ACM Joint Meeting on European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE)*, November 2020.

CP12 **Rahmadi Trimananda**, Janus Varmarken, Athina Markopoulou, and Brian Demsky. Packet-Level Signatures for Smart Home Devices. In *Network and Distributed Systems Security (NDSS) Symposium*, Feb 2020.

CP11 **Rahmadi Trimananda**, Ali Younis, Bojun Wang, Bin Xu, Brian Demsky, and Guoqing Xu. Vigilia: Securing Smart Home Edge Computing. In *2018 IEEE/ACM Symposium on Edge Computing (SEC)*, pages 74–89. IEEE, 2018.

CP10 **Rahmadi Trimananda** and Yeoh Chiah Kuang. A Software Aided Algorithm Analysis. In *2014 International Electrical Engineering Congress (iEECON)*, pages 1–4. IEEE, 2014.

CP9 **Rahmadi Trimananda**. Printing Service Automation-Printer Monitoring Through Inter-Processes Communication By Using Api Codes in Visual Basic. 2013.

CP8 **Rahmadi Trimananda**, Arnold Aribowo, et al. Communication Pattern of Parallel Computer, Case Study on The Implementation of Microcontrollers Parallel Computer Prototype. 2013.

CP7 **Rahmadi Trimananda** and Arnold Aribowo. Printer on Garment Printing. *ICSIIT 2012*, page 224, 2012.

CP6 M Gersbach, **Rahmadi Trimananda**, Y Maruyama, M Fishburn, D Stoppa, J Richardson, R Walker, RK Henderson, and E Charbon. High Frame-Rate TCSPC-FLIM Using a Novel SPAD-Based Image Sensor. In *Detectors and Imaging Devices: Infrared, Focal Plane, Single Photon*, volume 7780, pages 357–369. SPIE, 2010.

CP5 **Rahmadi Trimananda** and Christoforus Yoga Haryanto. A Parallel Implementation of Hybridized Merge-Quicksort Algorithm on MPICH. In *2010 International Conference on Distributed Frameworks for Multimedia Applications (DfmA)*, pages 1–5. IEEE, 2010.

CP4 **Rahmadi Trimananda**. If-Statement Modification for Single Path Transformation: Case Study on Bubble Sort and Selection Sort Algorithm. *ICSIIT 2010*, page 116, 2010.

CP3 **Rahmadi Trimananda**. Chromosome Centromere and Chromatid's Banding Identification Using Pattern Vector. In *2010 Second International Conference on Advances in Computing, Control, and Telecommunication Technologies (ACT)*, pages 132–134. IEEE, 2010.

CP2 **Rahmadi Trimananda** and Aditya R Mitra. Parallel Processors Approach for Robotics Real-Time Problem: Case Study on Closed-Loop Control System of Toddler Robot. *ICSIIT 2007*, page 393, 2007.

CP1 Arnold Aribowo and **Rahmadi Trimananda**. Parallel Microcontrolers AT89C52: Parallel Processors In Embedded System Application Of Robotics. In *SNSI 2006 Seminar Proceedings of STIKOM Bali*, 2006.

Short Papers and Posters

S1 **Rahmadi Trimananda**, Ali Younis, Thomas Kwa, Brian Demsky, and Guoqing Xu. Poster: Securing smart home devices against compromised cloud servers. In *3rd USENIX Workshop on Hot Topics in Edge Computing (HotEdge 20)*. USENIX Association, July 2020.

Technical Reports

TR6 Hao Cui, **Rahmadi Trimananda**, Athina Markopoulou, and Scott Jordan. PoliGraph: Automated Privacy Policy Analysis using Knowledge Graphs. *arXiv preprint arXiv:2210.06746*, 2022.

TR5 Umar Iqbal, Pouneh Nikkhah Bahrami, **Rahmadi Trimananda**, Hao Cui, Alexander Gamero-Garrido, Daniel Dubois, David Choffnes, Athina Markopoulou, Franziska Roesner, and Zubair Shafiq. Your Echos are Heard: Tracking, Profiling, and Ad Targeting in the Amazon Smart Speaker Ecosystem. *arXiv preprint arXiv:2204.10920*, 2022.

TR4 **Rahmadi Trimananda**, Weiyu Luo, Brian Demsky, and Guoqing Harry Xu. Stateful Dynamic Partial Order Reduction for Model Checking Event-Driven Applications that Do Not Terminate. *arXiv preprint arXiv:2111.05290*, 2021.

TR3 **Rahmadi Trimananda**, Hieu Le, Hao Cui, Janice Tran Ho, Anastasia Shuba, and Athina Markopoulou. OVRseen: Auditing Network Traffic and Privacy Policies in Oculus VR. *arXiv preprint arXiv:2106.05407*, 2021.

TR2 **Rahmadi Trimananda**, Ali Younis, Thomas Kwa, Brian Demsky, and Harry Xu. Securing Smart Home Edge Devices against Compromised Cloud Servers. *arXiv preprint arXiv:2006.11657*, 2020.

TR1 **Rahmadi Trimananda**, Janus Varmarken, Athina Markopoulou, and Brian Demsky. PingPong: Packet-level signatures for smart home device events. *arXiv preprint arXiv:1907.11797*, 2019.

Invited Talks

2022 **OVRseen: Auditing Network Traffic and Privacy Policies in Oculus VR**, *at FTC PrivacyCon*, November 1, 2022, `https://www.ftc.gov/news-events/events/2022/11/privacycon-2022`.

OVRseen: Auditing Network Traffic and Privacy Policies in Oculus VR, *at 4th Annual Symposium on Applications of Contextual Integrity*, September 22-23, 2022, `https://privaci.info/symposium/2022/cfp.html`.

OVRseen: Auditing Network Traffic and Privacy Policies in Oculus VR, *at DuckDuckGo*, August 18, 2022.

2016 **Internet-of-Things Programmability and Security: On Trusting the Untrusted**, *at 17th SoCalPLS: Programming Languages and Systems*, November 18, 2016, `https://socalpls.github.io/archive/2016nov/`.

Mentoring Experience

Graduate Students

2021-Now Hao Cui
Ph.D. Student at UC Irvine and Engineering Internn at Syntiant
Project: PoliGraph: Automated Privacy Policy Analysis using Knowledge Graphs

2020-Now Jad Al Aaraj
Ph.D. Student at UC Irvine and Software Engineering Intern at Cisco Systems
Project:
- Data Privacy on the VR Platform (2021-Now)
- FingerprinTV: Fingerprinting Smart TV Apps (2020-2021)

2020-Now Janus Varmarken
Ph.D. Student at UC Irvine and Software Engineering at Juniper Networks and Broadcom Inc.
Project:
- Network Traffic Fingerprinting (2021-Now)
- FingerprinTV: Fingerprinting Smart TV Apps (2020-2021)

2020-Now Renascence Tarafder Prapty
Ph.D. Student at UC Irvine
Project: Malware Traffic Fingerprinting and Device Attestation

2021-2022 Pouneh Nikkah Barhami
Ph.D. Student at UC Davis
Project: Your Echos are Heard: Tracking, Profiling, and Ad Targeting in the Amazon Smart Speaker Ecosystem

Undergraduate Students

2019 Jason Chuang
Software Development Engineer at Microsoft and Amazon
Project: Understanding and Automatically Detecting Conflicting Interactions between Smart Home IoT Applications

2017 Kevin Truong
Software Engineer at Google
Brian Truong
Software Engineer at Veeva Systems
Project: Vigilia: Securing Smart Home Edge Computing

2014 Christoforus Yoga Haryanto
Engineer at Traveloka and Kana
Project: A Parallel Implementation of Hybridized Merge-Quicksort Algorithm on MPICH

Teaching Experience

EECS Department, University of California, Irvine

2022 Privacy and IoT Research Exploration Workshop
Summer workshop that offers undergraduate students hands-on and research experiences in the areas of Privacy and IoT. The focus was on data collection practices of voice assistants. Contributions include curriculum design, materials preparation (including hardware and software), and teaching and mentorship.

CE Department, University of Pelita Harapan

Undergraduate Level Courses
Courses taught include Computer Networks, Computer Security, Data Structures and Algorithms, Distributed Systems, Object-Oriented Programming, Operating Systems, and Parallel Processing.

Professional Services

Executive Committee Member

2023 Demo Co-Chair for IEEE International Conference on Sensing, Communication, and Networking (IEEE SECON)

2022 2nd Annual ProperData Symposium, December 1-2, 2022

2021 1st Annual ProperData Symposium, November 4-5, 2021

2009-2020 Media Division, International Indonesian Scholars Association

Technical Program Committee Member

2023 ACM ASIA Conference on Computer and Communications Security (ACM ASIACCS)

2022-2023 Workshop on Measurements, Attacks, and Defenses for the Web (MADWeb)

2022 Privacy Enhancing Technologies Symposium (PETS) (Artifact Evaluation)

2021 Posters, Demos, and Student Research Competition for ACM Special Interest Group on Data Communication (ACM SIGCOMM)

Journal Reviewer

2021-2022 Springer Cluster Computing Journal

External Reviewer

2022-Now Privacy Enhancing Technologies Symposium (PETS)

2022 IEEE International Conference on Computer Communications (IEEE INFOCOM)

Memberships

2020-Now IEEE Member

2020-Now ACM Member

2009-Now Member of International Indonesian Scholars Association

References

Available upon request