

Samuel Wedaj Kibret

PERSONAL DETAILS

Samuel Wedaj Kibret (Ph.D.)
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RESEARCH INTERESTS

Artificial Intelligence, Multi-Robot Systems, Autonomous Unmanned Systems, Human-Robot Interaction, Human-cyber-physical Systems, Smart cities, IoT, Mobility systems, Energy Systems, Intelligent Systems, Power grid control, Embedded Systems: Embedded Systems Security, IoT/Cyber-Physical Systems Security; Computer and Network Security, Distributed and Networked Systems, Device Swarm Attestation, ML-based IoT Security Solutions, DDoS Mitigation, Runtime System Software, Embedded Linux, Blockchain and Machine Learning.

ACADEMIC PROFILE

Ph.D. in Computer Science and Engineering 2015- 2023

Indian Institute of Technology Delhi, New Delhi, India:

Supervisors: [Kolin Paul](#), Professor, Indian Institute of Technology Delhi, India and TalTech, Tallinn, Estonia
[Vinay Joseph Ribeiro](#), Professor, Indian Institute of Technology Bombay, India

Thesis Title: Decentralized Mechanisms to Attest, Recover and Update IoT Networks

M.Tech. in Computer Science and Engineering 2010-2012

Indian Institute of Technology Delhi, New Delhi, India:

Supervisor: [Huzur Saran](#), Professor, Indian Institute of Technology Delhi, India

Thesis Title: Anycast Interest Forwarding in Content Centric Networks

B.Sc. in Computer Science 2003-2007

Addis Ababa University, Addis Ababa, Ethiopia

DOCTORAL THESIS

Title: Decentralized Mechanisms to Attest, Recover and Update IoT Networks

Supervisors: Kolin Paul, Professor and Vinay Joseph Riveiro, Professor

In brief:

- We designed and evaluated a decentralized scheme that distributes attestation among devices for systems that work in swarms. The proposed approach significantly reduces communication cost and is very efficient in terms of computation, memory, and energy requirements. We also analyzed security and showed that the proposed approach is very robust against various attacks as well as ensures that it does not have a single point of failure.
- We proposed and evaluated a light-weight decentralized and re-configurable swarm attestation scheme that executes in the SMM operating mode. We targeted Smart IoT devices built with x86 CPUs (having SMM feature). We assessed performance through real-world embedded applications and showed that the execution overhead is minimal, while still providing protection against *Nemesis*, a type of side-channel attack that exploits microarchitectural instruction timing leaks by

using the CPU's interrupt mechanism in enclaved execution environments. We also demonstrated that the proposed approach is self-reliant, captures topology information and resilient upon node compromise/failure.

- We designed and evaluated a novel decentralized, scalable, efficient and secure mechanism of recovering a network of heterogeneous low-end devices in the presence of self-propagating malware. We demonstrated that swarm can be scaled up to thousands of devices, ensuring guaranteed update of the entire network, and can recover 95% of the nodes in 10 minutes in both internal and external propagation models. We also evaluated the memory and communication costs and showed that the new technique incurs very low overhead.
- We explored and proposed a data-flow verification based decentralized swarm attestation for embedded devices. This technique focuses on verifying runtime attacks that corrupt the underlying application's security critical data without hijacking its control flow. Towards making embedded devices' attestation complete, we combined both static and runtime verifications, assuring that the prover device executes the correct and unmodified program (i.e., checking if application is benign), as well as verifying if it is exposed to runtime attacks respectively.

PUBLICATIONS

- *Samuel Wedaj Kibret*. 2025.: Book Chapter. [Fusion of Blockchain and Machine Learning: A case of Secure Smart Grid](#). Navigating the Internet of Things in the 22nd Century - Concepts, Applications, and Innovations [Working Title] (2025)
- *Samuel Wedaj Kibret, Kolin Paul and Vinay J. Ribeiro*. 2025.: Submitted: Data-flow based Runtime Attestation: Towards Complete and Decentralized Attestation in Device Swarms.
- *Samuel Wedaj Kibret, Kolin Paul and Vinay J. Ribeiro*. 2025.: Submitted : CoSSA: Chain-of-trust based Self-reliant Swarm Attestation.
- *Samuel Wedaj Kibret, Kolin Paul and Vinay J. Ribeiro*. January 2024.: Book Chapter. [AI-Powered Security for IoT: A Blockchain Enabled Device Twin Approach](#). Online Identity - An Essential Guide (2024)
DOI: <https://doi.org/10.5772/intechopen.1003003>
- *Samuel Wedaj Kibret* 2023.: Book Chapter. [Property-based attestation in device swarms: a machine learning approach](#). Machine Learning for Cyber Security (2023).
DOI: <https://doi.org/10.1515/9783110766745-004>
- *Sourav Das, Samuel Wedaj, Kolin Paul, Umesh Bellur, and Vinay J Ribeiro*. 2020.: Preprint [Airmed: Efficient Self-Healing Network of Low-End Devices](#).
Archive: <https://arxiv.org/abs/2004.12442>
- *Samuel Wedaj, Kolin Paul, and Vinay J. Ribeiro*. 2019.: [DADS: Decentralized attestation for device swarms](#). ACM Transactions on Privacy and Security (TOPS) (2019).
DOI: <https://doi.org/10.1145/3325822>
- **National Conferences:**
 - *Samuel Wedaj and Huzur Saran*. 2017.: Anycast Interest Forwarding in Content Centric Networks. 2nd National Conference on Emerging Technologies' Contribution in Promoting Defence and Industry Capabilities - NCETCPDIT - 2017. (Bishoftu, Ethiopia)

WORK EXPERIENCE

Independent Researcher - Upwork/Innodata

August 2023 – present

Research Assistant Department of Computer Science and Engineering
Indian Institute Of Technology Delhi (IIT Delhi), New Delhi, India
January, 2015-August, 2023

Head Computer Science Section, Department of Computer Sc. and Info. Technology,
Defence University, College of Engineering, Bishoftu, Ethiopia
2013-January, 2015

Lecturer Department of Computer Science and Information Technology,
Defence University, College of Engineering, Bishoftu, Ethiopia
2012-January, 2015

Assistant Lecturer Department of Computer Science and Information Technology,
Defence University, College of Engineering, Ethiopia
2009-2010

Graduate Assistant Department of Computer Science and Information Technology,
Defence University, College of Engineering, Ethiopia
2007-2009

CONFERENCES & WORKSHOPS

- *The Network and Distributed System Security Symposium (NDSS)* : 23-26 February 2020, San Diego, California, USA
- *2nd National Conference on Emerging Technologies' Contribution in Promoting Defence and Industry Capabilities - NCETCPDIT* July 2017, College of Engineering, Defence University, Bishofthu, Ethiopia
- *MSR India Summer School 2016 on IoT* : 20-25 June 2016, Indian Institue of Science, Bangalore, India
- *The Academic Research Summit*, 29-30 January, 2016, Pune, India
- *Ground Zero Summit 2015*- The largest collaborative platform in Asia for Cyber security experts and researchers : 05-08 November 2015, New Delhi, India

CORE QUALIFICATIONS

- Project Management
- Attention to Details
- Critical Thinking
- Problem-Solving
- Business Intelligence

TECHNICAL SKILLS

C, C++, java, C#, Matlab, Python, R, Perl, HTML, Bash, Rust, UNIX/Linux, NS3, OMNeT++, SQL, MySQL, Shell script, socket programming, OpenDSS, PyTorch, TensorFlow, pandas, OpenMP, Scala, GitHub, Docker, AWS, CUDA, Azure, Spark

AWARDS AND CERTIFICATES

- *Certificate: The Network and Distributed System Security Symposium (NDSS)* : 26th February 2020, San Diego, California, USA
- *Certificate: on Special Session on "Future of Internet"*, 25th February 2012, New Delhi, Delhi, India
- *Certificate in Teaching Profession*, November, 2013, Adama Science & Technology, Adama, Ethiopia

- *Certificate on Methods of Teaching, Assessment & Adult Psychology* , 22nd December, 2008, Ethiopian Civil Service College, Addis Ababa, Ethiopia

SYNERGISTIC ACTIVITY

Reviewer (Journal)

- [American Journal of Computer Science and Technology \(AJCST\)](#) .

Reviewer (Conference)

- [Conference on Electrical, Computer and Energy Technologies \(ICECET\), Paris, FRANCE, 03-06 July 2025.](#) .

Speaker:- SICORP-IN International Collaborative Research Program

- [Secure Society in Future](#) .

OUTREACH — PROFESSIONAL ASSOCIATIONS

IEEE — The Institute of Electrical and Electronics Engineers

- *Member of IEEE Computer Society Technical Community on Security and Privacy*
- *Member of IEEE Computer Society Special Technical Community on Wearable and Ubiquitous Computing*
- *Member of IEEE Computer Society Special Tech Community on Reliable, Safe, Secure and Time Deterministic Intelligent Systems*
- *Member of IEEE Robotics and Automation Technical Committee on Verification of Autonomous Systems*
- *Member of IEEE Computer Society Technical Community on Distributed Processing*
- *Member of IEEE Internet of Things Community*
- *Member of IEEE Blockchain Community*
- *Member of IEEE Young Professionals*

OTHER ACTIVITIES

Defence University, College of Engineering, Bishoftu, Ethiopia:

- Member of *Research Thematic Area and Prioritization* Committee
- Member of *Laboratory Organizing* Committee
- Member of *Exam Evaluation* Committee

REFERENCES

1. Prof. Kolin Paul
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2. Prof. Vinay Joseph Ribeiro
Ph.D. supervisor
Department of Computer Science and Engineering, IIT Bombay, India
vinayr@iitb.ac.in

3. Dr. Solomon Abera Bekele
Postdoctoral Research Associate
Argonne National Laboratory, Chicago, USA
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