# Kelechi G. Kalu

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*West Lafayette, IN 47906*

## RESEARCH THEME

I study the security of software and AI systems, with an emphasis on software supply chains in open-source ecosystems and developer workflows. Using mixed-methods empirical and systems research, I evaluate the usability and effectiveness of security tooling, improve signing and provenance across software publishing and AI model release pipelines, and develop trust and reputation metrics for projects, maintainers, and model artifacts. While my core focus is supply-chain security, my work also spans broader product and systems security questions that shape real-world risk. My goal is to deliver practical, evidence-based defenses that strengthen both software and AI ecosystems.

## EDUCATION

**Ph.D, Electrical and Computer Engineering** 2023-2027
*Purdue University, West Lafayette, IN*

**B.Eng. Electronic and Computer Engineering**
*Nnamdi Azikiwe University, Awka, Nigeria*

## PROFESSIONAL EXPERIENCE

**Graduate Research Assistant** 2023–present
*ECE@Purdue University — Supervised by Dr. James C. Davis*

- Conducted qualitative and quantitative studies to evaluate and improve the effectiveness and usability of software signing in developer workflows, to better secure the software supply chain.
- Investigated methods to increase provenance consistency in the software publishing chain to strengthen software supply chain security.
- Conducting an in-progress scoping review on research-software supply-chain security (terminology, threats, controls); supported by the NSF.
- Collaborated on a study of coding agents and their contributions to performance optimization.
- Collaborated on a study to develop a recommendation framework for DL pre-trained models for IoT devices.
- Published 3 top-tier conference papers, 4 workshop/short papers, 4 technical reports, and 3 posters.
- Worked on an NSF-funded project and collaborated with sponsors at Google.
- Assisted in writing an awarded NSF grant.

**Research Intern (MSR-Cryptography)** Jun.–Aug. 2024
*Microsoft Research, Redmond, WA — Mentored by Dr. Kim Laine and Dr. Betul Durak*

- Researched conceptual designs and models for actor reputation to improve the security of the software supply chain in the GitHub ecosystem.

- Designed a data-collection pipeline for GitHub maintainers and projects; piloted on Azure Repos data with 10,000+ user entities.
- Designed and experimented with trust metrics for an actor reputation system.
- Published results in a peer-reviewed technical report (***ICSE-JAWs'26***).

**Software Engineer** Oct. 2019–Dec. 2022
*Enugu Electricity Distribution Company, Enugu, Nigeria*

- Designed, developed, and scaled business-critical applications serving approximately 2 million customer accounts in Southeast Nigeria.
- Key systems: ICT & Administration Support web app; Arrears One-Time Settlement (OTS) platform; Customer Feedback web app; Attendance Management System; Meter Installation application.

**Software Engineer** Jun. 2019–Sep. 2019
*Afrivelle Technologies, Enugu, Nigeria*

- Developed the administrative backend and designed the database for the real-estate website neneakintan-realestate.com (now rebranded as Oakville Living with Nene).

**Software Engineer** May 2018–Apr. 2019
*Playjoor Technologies, Enugu, Nigeria*

- Deployed a Lichess (chess) server for the playjoor.com web application and managed AWS EC2 test-server administration, serving a few thousand customers.

**Research Intern** May 2016–Oct. 2016
*Electronics Development Institute, Awka, Nigeria*

- Researched fuzzy-logic control via a systematic literature review and MATLAB simulations, and developed implementations of fuzzy controllers on PIC microcontrollers.

## REFEREED CONFERENCE PUBLICATIONS

[1] **Kalu**, Okorafor, Singla, Chen, Torres-Arias, Davis. *Why Johnny Adopts Identity-Based Software Signing: A Usability Case Study of Sigstore*. Proceedings of the 35th USENIX Security Symposium. 20 pages. (**USENIX Security'26**).

[2] **Kalu**, Singla, Okafor, Torres-Arias, Davis. *An Industry Interview Study of Software Signing for Supply Chain Security*. Proceedings of the 34th USENIX Security Symposium. 17.1% acceptance rate (407/2,385). 18 pages. (**USENIX Security'25**).

[3] Schorlemmer, **Kalu**, Chigges, Ko, Ishgair, Bagchi, Torres-Arias, Davis. *Signing in Four Public Software Package Registries: Quantity, Quality, and Influencing Factors*. Proceedings of the 45th IEEE Symposium on Security and Privacy. 18% acceptance rate (261/1463). 16 pages. (**IEEE S&P 2024**).

## OTHER REFEREED WORKS: WORKSHOP, VISIONS, POSITION, MAGAZINE ARTICLES

[1] **Kalu**, Okorafor, Durak, Laine, Moreno, Torres-Arias, Davis. *ARMS: A Vision for Actor Reputation Metric Systems in the Open-Source Software Supply Chain*. The First Journal Ahead Workshop (co-located with the 2026 International Conference on Software Engineering). Recommended for journal extension; 30/79 papers. 9 pages. (**ICSE-JAWs'26**).

[2] **Kalu**, Rattan, Schorlemmer, Thiruvathukal, Carver, Davis. *Operationalizing Research Software for Supply Chain Security*. The First Journal Ahead Workshop (co-located with the 2026 International Conference on Software Engineering). 5 pages. (**ICSE-JAWs'26**).

[3] Peng, Zhong, Méndez, **Kalu**, Davis. *How Do Agents Perform Code Optimization? An Empirical Study*. Proceedings of the 23rd International Mining Software Repositories Conference — Mining Challenge track. 53% acceptance rate (62/116). 5 pages. ***LLM/Agentic systems work*** (**MSR-Mining'26**).

[4] Patil, Jiang, Peng, Lugo, **Kalu**, LeBlanc, Smith, Heo, Aou, Davis. *Recommending Pre-Trained Models for IoT Devices*. Proceedings of the 7th International Workshop on Software Engineering Research & Practices for the Internet of Things. 26% acceptance rate (25/97). 5 Pages. (**SERP4IoT'25**).

[5] Schorlemmer, Burmane, **Kalu**, Torres-Arias, Davis. *Establishing Provenance Before Coding: Traditional and Next-Gen Signing*. IEEE Security & Privacy Magazine, special issue "Secure Software Before Coding", 2025. 8 Pages. (**IEEE S&P Magazine'25**).

[6] **Kalu**, Schorlemmer, Chen, Robinson, Kocinaire, Davis. *Reflecting on the Use of the Policy-Process-Product Theory in Empirical Software Engineering*. Proceedings of the 31st ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering- Ideas Visions, and Reflections track. 48% acceptance rate (13/27). 5 Pages. (**ESEC/FSE-IVR'23**).

[7] Singla, Anandayuvaraj, **Kalu**, Schorlemmer, Davis. *An Empirical Analysis of Large Language Models to Analyze Software Supply Chain Security Failures*. ACM Workshop on Software Supply Chain Offensive Research and Ecosystem Defenses. 67% acceptance rate (14/21). 11 Pages. ***LLM/Agentic systems work*** (**SCORED'23**).

## TECHNICAL REPORTS

[1] **Kalu**, Tran, Torres-Arias,, Jeong, and Davis. *A Longitudinal Study of Usability in Identity-Based Software Signing*. `https://arxiv.org/abs/2603.17133`. 2026.

[2] **Kalu**, Davis. *Why Software Signing (Still) Matters: Trust Boundaries in the Software Supply Chain*. `https://arxiv.org/pdf/2510.04964`. 2025.

[3] Davis, Chen, Peng, Amusuo, and **Kalu**. *A Guide to Stakeholder Analysis for Cybersecurity Researchers.*. `https://arxiv.org/pdf/2508.14796`. 2025.

[4] **Kalu**. *Fuzzy Logic: A modern approach to Control System Architecture*. `https://vixra.org/abs/2005.0099`. 2020.

## POSTERS

[1] **Kalu**, Tran, Jeong, Torres-Arias, and Davis. *A Longitudinal Study of Usability in Identity-Based Software Signing*. Center for Education and Research in Information Assurance and Security (CERIAS) Purdue Poster session 2026 (**CERIAS'26**).

[2] **Kalu**, Davis. *Investigating Software Provenance Consistency in the Open Source Publishing Pipeline*. Poster Session of the 34th USENIX Security Symposium (**USENIX Security–Poster'25**).

[3] **Kalu**, Torres-Arias, and Davis. *Software Signing: Practical Adoption, Challenges, and Tooling Usability*. Center for Education and Research in Information Assurance and Security (CERIAS) Purdue Poster session 2025 (**CERIAS'25**). ***Best Poster Award – 1st Position***.

[4] **Kalu**, and Davis. *Navigating Software Supply Chain Risks: Practitioner Perspectives on Software Signing*. Center for Education and Research in Information Assurance and Security (CERIAS) Purdue Poster session 2025 (**CERIAS'24**).

## TECHNICAL SKILLS

**Languages**
JavaScript (ReactJs, NodeJs), PHP (CodeIgniter and Laravel), Python, SQL (MySQL, PostgreSQL), NOSQL (MongoDB), C.

**Technologies**
AWS(EC2), Arduino, Microcontrollers (8051 and PIC), HTML and CSS, GIT, Docker, MATLAB, Google data studio, Agent.

## INVITED TALKS

**Software Signing in Practice: Lessons from Adoption and Usability Toward Broader Supply Chain Trust** 2026
*The Center for Education and Research in Information Assurance and Security (CERIAS)@Purdue University: https://tinyurl.com/kelechi-kalu-CERIAS*

## MENTORSHIP

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|---|---|
| Huiyun Peng, PhD@Purdue | Current |
| Ricardo Calvo-Mendes, PhD@Purdue | Current |
| Sofia Okorafor, MSc@Purdue | Current |
| Tanmay Singla, MSc@Purdue | Current |
| Sophie Chen, MSc@Carnegie Mellon Universiversity | Current |
| Kyle Robinson, BSc@Purdue | Graduated, SE@Lockheed Martin |
| Erik Kocinaire, BSc/MSc@Purdue | Current |
| Soham Rattan, BSc@Purdue | Current |

## AWARDS AND RECOGNITION

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|---|---|
| CERIAS Research Poster Competition **CERIAS'25** – 1st Position | 2025 |
| USENIX Security Student Grant **USENIX'25** | 2025 |
| ACM SIGSOFT CAPS Travel Grant, **ESEC/FSE'23** | 2023 |
| NSF Student Travel Award, **ESEC/FSE'23** | 2023 |
| Agbami/Chevron Medical and Engineering Scholarship Award – Nnamdi Azikiwe University | 2014-2017 |

## SERVICES

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|---|---|
| Artifact Evaluation PC Member, USENIX Security**(USENIX)** | 2026 |
| Junior PC Member, International Conference on Technical Debt**(TechDebt)** | 2026 |
| Junior PC Member, International Mining Software Repositories Conference **(MSR)** | 2026 |
| Shadow PC Member, International Conference on Software Engineering **(ICSE)** | 2026 |
| Artifact Evaluation PC Member, Privacy Enhancing Technologies Symposium **(PETS)** | 2026 |
| PC Member, Software Supply Chain Offensive Research and Ecosystem Defenses **(SCORED)** | 2025 |
| Judge, Purdue Summer Undergraduate Research Symposium (**SURF** Poster Competition) | 2025 |
| Community Committee Member, Purdue Graduate School Student Government | Aug. 2025–present |

Sub-Reviewer: ICSE'26, USENIX Security'26, FSE'25, USENIX Security'25, ICSE'23 & '25, ISSTA'24, IEEE

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| S&P'23, ESEC/FSE'23, ASE'23, ASE'24 | 2023–2025 |
| Student Volunteer, ESEC/FSE'23 Conference | 2023 |
| Student Volunteer, USENIX Security'25 Conference | 2025 |
| Panelist, Purdue ECE Spring Graduate Open House | 2025 |
| Executive Member, ICT CDS Group (NYSC, Enugu) | 2018–2019 |

## GRANT WRITING

[1] **NSF #2537308: Collaborative Research: Planning: CROSS: Building a Community aROund Securing the Research Software Supply Chain**

PI: James C. Davis

*US National Science Foundation*

*2025–2027. $105,113.*

## PROFESSIONAL MEMBERSHIPS

Member, Institute of Electrical and Electronics Engineers (IEEE)
Member, Association for Computing Machinery (ACM)