

Paschal Amusuo

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RESEARCH THEME

I am a PhD student working to improve the security of software systems, using program analysis and formal verification techniques. I study prevalent security threats and vulnerabilities and develop novel and practical systems to defend systems against them.

EDUCATION

Ph.D, Electrical and Computer Engineering, <i>Purdue University, West Lafayette, IN</i>	2021–2026
B.Eng. Electrical and Electronics Engineering, <i>Federal University of Technology, Owerri, Nigeria</i> <i>Class Rank: 1/1000+ engineering students</i>	2013–2018

RESEARCH PROJECTS

NextJSM: Defending against Supply Chain Vulnerabilities <i>Developing a supply-chain-aware sandbox for third-party dependencies in Java</i> - Studied maven vulnerabilities and packages to understand the threats they pose. - Designed <i>NextJSM</i> to infer and enforce privilege requirements for each of an application's dependencies. - Measured the impact of intra-application-level sandboxing on Java applications.	2023–present
EmNetTest: Detecting Package Validation Vulnerabilities in Network Stacks <i>Designed a systematic testing framework to uncover network protocol vulnerabilities</i> - Studied protocol vulnerabilities to identify packet patterns that triggered them. - Developed <i>EmNetTest</i> that uses novel packet mutations to systematically analyze protocol implementations. - Used <i>EmNetTest</i> to discover vulnerabilities in widely-used network protocol implementations.	2022–2023
Reviewing Software Failure Analysis Methodologies <i>Conducted a study of methodologies employed in analyzing software defects in SE research</i> - Conducted a literature review of <i>Bug Study</i> papers in Software Engineering literature - Identified flaws in the methodologies of <i>Bug Study</i> papers that affect the soundness of their results. - Proposed a set of research directions to improve how <i>Bug Studies</i> are conducted.	2022

RESEARCH AND PROFESSIONAL EXPERIENCE

Graduate Research Assistant <i>Purdue University — Advised by James C. Davis</i> - Enabled the use of various dynamic analysis techniques to validate components of embedded firmware	Aug 2021–present
Student Researcher <i>Google</i> - Implemented and Evaluated designs for defending against critical vulnerabilities in popular Java packages.	Summer 2023
Graduate Cybersecurity Researcher	Aug 2022 - Dec 2022

Purdue Data Mine × *Boeing*

- Conducted a *security analysis* of the Boeing aircraft's digital twin using the *STRIDE* framework.

Graduate Teaching Assistant

Aug 2021 - Dec 2021

ECE 461: Software Engineering

- Designed and graded homework and class projects to assess students' understanding of course materials.

Software Engineer

Apr 2020 - Jul 2021

Seamfix Ltd., Nigeria

- Built web services for the Seamfix revenue management, payments, and wallet management applications.

REFEREED CONFERENCE PUBLICATIONS

- [1] **Amusuo**, Méndez, Xu, Machiry, and Davis. *Systematically Detecting Packet Validation Vulnerabilities in Embedded Network Stacks*. Proceedings of the ACM/IEEE 38th International Conference on Automated Software Engineering (**ASE'23**).
- [2] **Amusuo**, Robinson, Torres-Arias, Simon, and Davis. *Preventing Supply Chain Vulnerabilities in Java with a Fine-Grained Permission Manager*. <https://arxiv.org/pdf/2310.14117>. (Under Submission).
- [3] Srinivasan, Tanksalkar, **Amusuo**, Davis, and Machiry. *Towards Rehosting Embedded Applications as Linux Applications*. Proceedings of the 53rd Annual IEEE/IFIP International Conference on Dependable Systems and Networks (**DSN'23**).
- [4] **Amusuo**, Sharma, Rao, Vincent, and Davis. *Reflections on Software Failure Analysis*. Proceedings of the 30th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering — deas, Visions, and Reflections track (**ESEC/FSE-IVR'23**).

TECHNICAL COURSE PROJECTS

Static Analysis: An *LLVM-based dataflow analysis* tool to detect simple vulnerabilities in C programs.

Compilers: A lightweight *C compiler*, with dataflow and liveness analysis for optimized register allocation.

Artificial Intelligence: Re-implementation of the "Text Summarization with Pretrained Encoders" paper.

SKILLS

Programming Languages: C/C++, Java, Python, Javascript.

Vulnerability Detection: Static Analysis (LLVM Passes, Bytecode Analysis), Dynamic Analysis (Fuzzers), Symbolic Execution (KLEE).

Understanding Complex Software: Operating Systems, Real-time Operating Systems, Network Protocol Implementations, Compilers.