

Zack McKeVitt

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OVERVIEW

During my time at the University of Colorado, I have worked on a diverse set of systems projects as a student and employee of the ECEE and CS departments. As a student, my research focus was on speculative execution attacks and hardware security. Most recently I have worked as a researcher across two projects: a hardware/software co-design for protecting against environmental faults in commodity systems and the development of the Node Replicated Kernel into a rack scale operating system. I am looking to continue research in building **software systems**.

EDUCATION

MS Computer Science, University of Colorado Boulder 2021-2023
Thesis: *SpecCheck: A Tool for Systematic Identification of Vulnerable Transient Execution in gem5* GPA: 4.0
Advisor: Tamara Silbergleit Lehman

BS Computer Science, University of Colorado Boulder 2018-2022
Summa cum laude, minor in Philosophy GPA: 3.97
Thesis: *Deep Learning Techniques for Automatic Transient Execution Attack Detection*
Advisor: Tamara Silbergleit Lehman

WORK EXPERIENCE

GRA/Researcher Jan 2023 -
University of Colorado Boulder - ECEE Department Boulder, CO
Faculty: Joseph Izraelevitz

SEUP

Responsible for developing software for the Single Event Upset Protector (SEUP). SEUP protects a non radiation hardened CPU from SEUs by intercepting each write to radiation hardened main memory and determining if a fault has occurred. During my appointment, I developed an assembly level transformation from an unmodified source program to a SEUP compatible binary that is responsible for spawning a redundant shadow thread and inserting recovery checkpoints in case of a fault detected by SEUP hardware. Additionally, I worked to port several embedded benchmarks to a SEUP enabled bare-metal target which required developing a custom subset of musl-libc. This research is in collaboration with Sandia National Labs.

Researcher

May 2023 - June 2024
University of Colorado Boulder - CS Department Boulder, CO
Faculty: Eric Keller

DiNOS

Helped develop and benchmark the Node Replicated Kernel for use in the Distributed Node-replicated Operating System (DiNOS). My primary contribution was the development of FxRPC in Rust, a distributed filesystem benchmark where client nodes issue (file)system calls over RPC to a centralized file server, to evaluate DiNOS's internal RPC library. I also made multiple upstream contributions to the NrK github repository, including modifications to the kernel's RPC protocols, management of external libraries, integration tests, benchmarks, and documentation.

Intern - Member of Technical Staff

May 2022 - Aug 2022
VMware - Virtual Machine Monitor team Bellevue, WA

On the monitor team I helped develop Green Metrics (GM): a platform for deriving power metrics between a virtualized guest and host system. I was responsible for supplementing the existing GM model to include virtual GPU metrics for a guest VM by interfacing directly with the ESX hypervisor and the Nvidia Management Library.

Undergraduate Researcher Aug 2020 - Aug 2021
University of Colorado Boulder - ECEE Department Boulder, CO
Faculty: Tamara Silbergleit Lehman

Undergraduate research contract in the Computer Architecture lab through the Discovery Learning Apprenticeship (DLA) program. Here I explored using machine learning techniques, such as probabilistic programming and neural networks, to identify transient execution attacks on the gem5 simulator.

Software Development Intern May 2020 - Aug 2020
Yes Energy Boulder, CO

Wrote time series analyses of gas markets for company blog posts and automated SQL queries using python.

TEACHING & COURSE SUPPORT **Teaching Assistant** Aug 2022 - Dec 2022
University of Colorado Boulder Boulder, CO
Course: CSCI 4413/5413 - Computer Security and Ethical Hacking

Grader Aug 2021 - Dec 2021
University of Colorado Boulder Boulder, CO
Course: ECEN 3593 - Computer Organization

PUBLICATIONS [1] Samuel Thomas, Kidus Workneh, Ange-Thierry Ishimwe, Zack McKeivitt, Phaedra Curlin, R. Iris Bahar, Joseph Izraelevitz, and Tamara Silbergleit Lehman. “Baobab Merkle Tree for Efficient Secure Memory.” In IEEE Computer Architecture Letters 2024.

[2] Zack McKeivitt, Ashutosh Trivedi, and Tamara Silbergleit Lehman. “SpecCheck: A Tool for Systematic Identification of Vulnerable Transient Execution in gem5.” In the 32nd International Conference on Parallel Architectures and Compilation Techniques, PACT 2023, Vienna, Austria.

WORKSHOPS AND POSTERS [3] George Hodgkins, Zack McKeivitt, Ben Feinberg, Josh Joffrion, Sapan Agarwal, Joseph Izraelevitz. “SEUP: Robust Detection and Correction of Radiation Errors in Commodity Microprocessors (WiP)”. Presented at University of Colorado Boulder Sandia Day 2023.

[4] Zack McKeivitt, Ashutosh Trivedi, and Tamara Silbergleit Lehman. “WiP: Automatic Transient Execution Attack Detection”. In Hardware and Architectural Support for Security and Privacy, HASP 2021, in conjunction with MICRO 2021.

THESES [5] Zack McKeivitt. “SpecCheck: A Tool for Systematic Identification of Vulnerable Transient Execution in gem5”. MS Thesis, Department of Computer Science, May 2023.

[6] Zack McKeivitt. “Deep Learning Techniques for Automatic Transient Execution Attack Detection”. BS Thesis, Department of Computer Science, May 2022.

WORKS IN PROGRESS [7] Ange-Thierry Ishimwe, Zack McKeivitt, Samuel McDiarmid Sterling, Tamara Silbergleit Lehman. “SMAD: Efficiently Defending Against Transient Execution Attacks”. Recommended with revisions to ACM Transactions on Architecture and Code Optimization.

[8] George Hodgkins, Zack McKeivitt, Ben Feinberg, Sapan Agarwal, Josh Joffrion, Joseph Izraelevitz. “SEUP: Soft Error Protection for Unhardened Processors”. In progress.

[9] Erika Hunhoff, Zack McKeivitt, Reto Achermann, Ankit Bhardwaj, Marcos K. Aguilera, Eric Keller, Gerd Zellweger. “DiNOS: An Operating System for a Shared Memory Rack”. In progress.

TALKS

“Single Event Upset Protection with Minimal Radiation Hardening”. ETH Zurich Systems Group, Zurich, Switzerland, April 2024.

Presented [2] at PACT, Vienna Austria, October 2023.

“Detecting Timing Side-Channels with Probabilistic Programming”, Finalist presentation at CU Boulder Discovery Learning Apprenticeship (DLA) Symposium, Spring 2021.

SOCIETIES & AWARDS

Discovery Learning Award, Department of Computer Science, May 2022.

Active Learning Award, College of Engineering and Applied Science, May 2022.

Member of the Tau Beta Pi engineering honors society, inducted Spring 2020.