

KIRBY LINVILL

 kirby.linvill.net

 github.com/klinvill

EDUCATION

PhD: Computer Science, University of Colorado Boulder

August 2020 to Present

MS: Computer Science, University of Colorado Boulder

December 2023

Advisor: Gowtham Kaki, **Areas: Formal Methods and Security,**

GPA: 4.00, Honors: Dean's Fellowship, Outstanding Service Award, Outstanding TA Award, Amy Barnes Frey Fellowship, William E Rapp Fellowship

BS: Computer Science and Engineering, Santa Clara University

September 2011 to June 2015

GPA: 3.87, Honors: Magna Cum Laude, TBP Engineering Honor Society, UPE Computing Honor Society

PUBLICATIONS

Verifying Indistinguishability of Privacy-Preserving Protocols

Kirby Linvill, Gowtham Kaki, and Eric Wustrow

Proceedings of the ACM on Programming Languages 7, OOPSLA2, Article 273 (October 2023)

DOI: 10.1145/3622849 (36% Acceptance Rate)

Lancet: A Formalization Framework for Crash and Exploit Pathology

Qinrun Dai, Kirby Linvill, Yueqi Chen, and Gowtham Kaki

34th USENIX Security Symposium (USENIX Security 25). 2025.

(17% Acceptance Rate)

Increasing Interference Detection in Quantum Cryptography Using the Quantum Fourier Transform*

Nicholas J. C. Papadopoulos, and Kirby Linvill

Advances in Information and Communication, FICC 2025 (March 2025)

DOI: 10.1007/978-3-031-85363-0_35 (34% Acceptance Rate) **Best Paper Award*

A Quantum-Inspired Method for Three-Dimensional Ligand-Based Virtual Screening

Maritza Hernandez, Guo Liang Gan, Kirby Linvill, Carl Dukatz, Jun Feng, and Govinda Bhisetti

Journal of Chemical Information and Modeling 2019 59 (10), 4475-4485

DOI: 10.1021/acs.jcim.9b00195 (5.79 Impact Score)

AWARDS & FELLOWSHIPS

- William E Rapp Fellowship (2025)
- Research Expo Best Poster Award - Work in Progress (2025) - "Harnessing LLMs to Synthesize Verifiably Correct SQL Queries"
- Best Paper Award - FICC 2025 – "Increasing Interference Detection in Quantum Cryptography Using the Quantum Fourier Transform"
- CU Boulder Publication Recognition Award (2024) - "Verifying Indistinguishability of Privacy-Preserving Protocols"
- Amy Barnes Frey Fellowship (2024)
- CU Boulder Outstanding Teaching Assistant Award (2024-2026)
- CU Boulder Outstanding Service Award (2023)
- CU Boulder Dean's Fellowship (2020-2021)
- Magna Cum Laude (2015) - Santa Clara University
- TBP Engineering Honor Society (2013-2015)
- UPE Computing Honor Society (2014-2015)

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EXPERIENCE

CU Boulder, Research Assistant

August 2020 to Present

- Developing a SMT-backed semi-automated framework in F* and Lean to verify protocols behave equivalently in the presence of a man-in-the-middle adversary.
- Developed a semantically-constrained decoding tool for verifiably correct LLM-backed synthesis of SQL queries, based on input-output examples and natural language query descriptions. Checks if predicted queries are syntactically valid using an incremental parser in OCaml, and are a prefix of a correct query using a constraint solver in Python.
- Developed a novel core instruction set architecture (LancetISA) with a semantics that tracks over-approximate ownership information used to reason about memory exploits even after corruption occurs. This approach was incorporated into a bug triaging tool used in the DARPA AIXCC grand challenge finals (by co-author Qinrun Dai, of team 42-beyond-6ug).
- Created a library in F* for specifying and formally verifying privacy properties (phrased as indistinguishability) of protocols against a passive network attacker
- Adapted a Chromium-based forensics engine (JSGraph) to record DOM manipulations and V8 interactions to detect web credit card skimmers
- Led and mentored a team of 5 grad and undergrad students for the LLM-driven SQL synthesis project

Microsoft Research, Research Intern (Research in Software Engineering)

May 2023 to August 2023

- Helped create a Domain Specific Language (DSL) for optimizing distributed programs
- Created an OCaml-based transpiler to extract TLA+ and F* models from programs and optimizations written in the DSL so they could be model-checked and verified for correctness and refinement.

RAND Corporation, Summer Associate

June 2021 to August 2021

- Obtained positive DHS Fitness determination for IT High Risk (for Sensitive But Unclassified/FOUO info)
- Supported a capability assessment for the Cybersecurity and Infrastructure Security Agency (CISA)
- Supported research for the Commission on Combating Synthetic Opioid Trafficking (joint congressional and executive branch commission)

Curative Inc., Software Engineer Consultant

August 2020 to August 2020

- Built features, fixed bugs, and provided support for new React (Typescript) and Python based in-house lab management software used to track >30 million COVID-19 diagnostic tests

Accenture Labs, Systems & Platforms Researcher

August 2017 to August 2020

- Led quantum computing and heterogeneous computing work within Accenture Labs
- Evaluated, helped improve, and applied Rigetti's new quantum algorithm to lattice protein folding
- Managed 3 teams of 3 developers across projects
- Designed and architected 2 different offerings: a system to track files throughout an enterprise and a system to automate intelligent data cleaning and validation
- Created 3 Ising and QUBO formulations of business problems that could be run on quantum annealers
- Developed 4 demo applications of quantum computing and 1 of secure multi-party computing
- Evaluated 4 leading quantum development kits, resulting in redesigns and improvements
- Led 25+ quantum computing education sessions for developers, architects, and business users

Teradata, Big Data Consultant

June 2015 to August 2017

- Developed a near real-time system to ingest and process 20 million customers' call detail records
- Stabilized a high-profile runaway project by prioritizing features and setting transparent timelines
- Presented design patterns and best practices to prospective clients and 150+ senior architects

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Accenture, Business and Systems Integration Analyst

June 2014 to August 2014

- Proposed and created multiple UIs for clients to securely and remotely execute ODI scenarios
- Created a proof-of-concept application to simplify multi-environment data migration to a 5 click process

Cuore, Application Developer

December 2013 to January 2014

- Planned, created, and integrated key back-end components of Cuore's intranet including user groups and admin functionality as well as registration, directory, and profile pages

Latimer Energy Lab, Lead Student Researcher

July 2013 to August 2013

- Led a team that developed a prototype I-V Curve Tracer using an Arduino for \$100, significantly cheaper than Solmetric's \$6,000 commercial model

PATENTS

- 1 application in progress for computational resource prediction and workload scheduling
- Utilizing machine learning to prevent intellectual property issues for content during different stages of a project lifecycle (US Patent 11,657,466)
- Quantum formulation independent solver (US Patent 11,568,293)
- Systems and methods for distributed control of manufacturing processes (US Patent 11,513,507)
- Quantum computation for optimization in exchange systems (US Patent 10,592,816)

SKILLS

Languages and Platforms: F*, Theorem Provers (Lean4, Rocq), SMT Solvers (Z3, CVC5), Rust, OCaml, Python, TLA+, Rocq, JavaScript, Linux, Spark, Hadoop, SQL, Teradata

Techniques: Formal Verification, Programming Language Design, Application Security, Program Analysis, Application Development, Quantum Computing, Machine Learning

SERVICE

Participated in reviews and committees at the following venues:

- OOPSLA 2024 - Artifact Evaluation Committee
- CAV 2023 - Artifact Evaluation Committee
- PLDI 2023 - Artifact Evaluation Committee
- CAV 2022 - Artifact Evaluation Committee
- USENIX Security 2021 - Sub-reviewer

EXTRACURRICULAR ACTIVITIES

President, Vice President: CU Boulder Cybersecurity Club

President: Upsilon Pi Epsilon

Organizer: IEEEExtreme Santa Clara Teams

Member: ACM, IEEE, Tau Beta Pi, Santa Clara Ultimate Frisbee Club Team