

Yonathan Fisseha

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Research Experience

HardKAT

Present

Y. Fisseha, S. Chen, J.B. Jeannin, T. Austin

University of Michigan

HardKAT is a formally defined intermediate language (IR) for accelerator design languages (ADL). It is built on the algebraic framework Partially Concurrent Kleene Algebra (POCKA). HardKAT includes many important language features for accelerator design, such as concurrent queues, concurrent global storage, and signals. We show that the semantics is sound and are finalizing a completeness proof. A version of this paper was presented in *TechCon 2022*. The current version will be submitted to POPL'23.

Formal Verification of Low-trust Architectures

Present

Q. Tan, Y. Fisseha, S. Chen, L. Biernacki, J.B. Jeannin, S. Malik, T. Austin

University of Michigan

Low-trust architectures are an emerging class of designs that provide an alternative to expensive homomorphic encryption (HE) techniques. Providing a formal verification of low-trust architectures makes it easier to trust the sensitive hardware components, and, fortunately, the small and isolated component design also makes formal verification viable. The project provides ISA-level semantics proofs that are followed by implementation-level model checking proofs. Currently in submission to CCS'23.

Tabular Sat

Present

M. Fleury, Y. Fisseha, J. Chen, A. Biere, S. Karem

University of Michigan

SAT solvers have a rich history driven by multiple annual constraint solving competitions. Consequently, there is a proliferation of techniques to improve performance. In this project, we start with a blank slate and carefully categorize various techniques and build very simple solvers that combine these categories. We are running various large scale performance tests on recent benchmarks from these competitions.

Twine: A Chisel Extension for Component-level Heterogeneous Design

2022

S. Chen, Y. Fisseha, J.B. Jeannin, T. Austin

University of Michigan

Twine is an extension to the Chisel hardware generator language. It improves re-usability and composability of hardware components, allowing designers to stay productive in heterogeneous design. It provides well defined interfaces and automates control-flow communication and data type and bandwidth conversions between components implementing these interfaces. Some of this is accomplished at the library level while some of the conversions require compiler passes in FIRRTL, the underlying IR for Chisel. This work has appeared in DATE'22 as Twine and TechCon 2021 as SimpleChisel.

Non-peer Reviewed Reports

Migrating Browser Automation Programs for End-to-End Testing

2021

Y. Fisseha, Y. Li

University of Michigan

While web applications have dominated the software development industry, it is still hard to achieve end-to-end testing for complex web architectures. Browser automation allows the tests to input data

just like a user would and make assertions on the displayed result. However, the tests driving such automation are brittle and easily break when the frontend of the application changes even in minor ways. Migrating tests from one version of the frontend to a new version is manual process at the moment. This project applies program synthesis techniques supported by a MaxSMT solver to automate a majority of such cases. We demonstrate how to generate a new Python test program that works on the new version of the frontend given the old version of the frontend HTML and the old Python test program.

Compression-aware Algorithms

2020

Y. Fisseha, N. Brunelle

University of Virginia

Compression is usually paired with a decompression scheme to allow algorithms to compute on the data. This is unfortunate since the decompression step requires both space and time resources. Compression-aware algorithms are a class of algorithms proposed by N. Brunelle where the algorithm is aware that the data is compressed and thus takes the necessary steps to extract the data without fully decompressing the data. In this work, I studied if the LZ-family of string-alignment algorithms can be redesigned to be compression aware. We propose algorithms that work on various class of input strings and experimentally characterize the input strings that can be processed by such algorithms.

Secure Data Summarization for Stream Data

2019

Y. Fisseha, A. Hithnawi

University of California Berkeley

In this project, we studied if and how (partially) homomorphic encryption can be applied for large-scale streaming data. Such data can properly characterize data from IoT devices, such as sensors. IoT data is temporal by nature, data summarization techniques can be applied to reduce the data size before PHE schemes are applied to secure the data moving forward. We proposed a system design that allows secure summarization of streaming data.

Work Experience

Microsoft Intune

2018

Software Engineer Intern

San Jose, CA

I designed and implemented Network-Fencing and Geo-Fencing testing tools for the Intune Android client using Hyper-V and Android Mock Locations. The testing tool was integrated into the existing CI infrastructure allowing developers to automatically test code that was previously tested manually.

Impellia

2016-17

Software Developer

Remote

I worked with the startup implementing multiple projects that leverage algorithms related to athletics designed and licensed by various university. The projects helped validate the algorithms for future products.

University of Colorado School of Medicine

2015-17

Software Developer

Aurora, CO

I worked with doctors and researchers to quickly validate clinical product concepts through prototypes and user testing. The products involved tracking patient data, numerical analysis, billing, and hour tracking.

Education

University of Michigan <i>Doctor of Philosophy in Computer Science and Engineering</i>	2020-Present <i>Ann Arbor, MI</i>
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I'm co-advised by Professor Todd Austin and Professor Jean-Baptiste Jeannin. I currently hold a GSRA position.

University of Virginia <i>Bachelor of Science in Computer Science with High Distinction</i>	2016-2020 <i>Charlottesville, VA</i>
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Community College of Aurora <i>Associate of Science</i>	2014-2016 <i>Aurora, CO</i>
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Pickens Technical College <i>Mobile Application Development Certificate</i>	2015 <i>Aurora, CO</i>
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Teaching Service

TEALS Volunteer Teacher <i>Fenton High School</i>	Present <i>Remote</i>
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I am currently one of the teaching volunteers at Fenton High School. We are leading a class of 16 students. This is an AP 1 Computer Science full year class using Java. Content covered starts with basics of the Java language leading up to OOP topics and cumulating in recursion.

Lead TEALS Volunteer Teacher <i>Eppler Junior High School</i>	2021 <i>Remote</i>
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I was the lead volunteer instructor for a class of about 15 students. A full time teacher was in the classroom providing in person support while I gave the lectures and helped students with projects. We covered the Snap language in the first half of the year and transitioned into Python in the second half.

Teaching Assistant <i>University of Virginia</i>	2018-2020 <i>Charlottesville, VA</i>
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I was a TA for Algorithms, Advanced Software Development, Programming Languages for Web Applications, and Operating Systems. I held office hours 2-4 times a week helping students with homeworks and exam preparation. I also graded exams and various other course assignments.

Awards & Honors

Rackham Merit Fellowship <i>University of Michigan</i>	2020
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University Honors <i>University of Virginia</i>	2019, 2020
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QuestBridge Scholar <i>QuestBridge</i>	2016
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Daniels Scholar <i>Daniels Fund</i>	2016
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Citizenship

Status: *United States Citizen*