Ian Glen Neal

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Research Interests

In my work, I develop new methods for accurately and efficiently finding and fixing bugs in a variety of domains. Many existing software testing and repair tools rely on ad-hoc observations about certain types of bugs or program behaviors, and therefore suffer inaccuracies or inefficiencies when used on applications that do not conform to the observations of the tool developer. Instead, my work has been on building tools that leverage information about bugs and program behavior that has been gathered using principled techniques, such as automated inference or proof-based mechanisms. My current work is on applying this general methodology to persistent memory systems, networking systems, and concurrent systems. I am also broadly interested in hardware-software co-design and the design of secure systems.

Education

The University of Michigan Sept. 2018–Present

Ph.D. in **Computer Science and Engineering** (Candidate)

Professional Development Certificate: Diversity, Equity, and Inclusion

Advisor: Assistant Professor **Baris Kasikci**

GPA: 3.961

The University of Michigan Sept. 2018–Jan. 2021

M.Sc.E. in **Computer Science and Engineering**

GPA: 3.961

The University of Texas at Austin Aug. 2013–May 2018

B.Sc. in **Computer Science**

Special Honors: Turing Scholars Honors Program

Thesis: The Advantages of a Transactional Interface: Porting Applications to TxFS

B.Sc. in **Electrical Engineering**

Senior Design Project: Wearable Biometric Monitor

Minor in **Biblical Hebrew**

Peer-Reviewed Publications

[1] Kevin Loughlin, **Ian Neal**, Jiacheng Ma, Elisa Tsai, Ofir Weisse, Satish Narayanasamy, Baris Kasikci. Dolma: Securing Speculation with the Principle of Transient Non-Observability. *To Appear* In Proceedings of the 30th USENIX Security Symposium (USENIX Security '21). August 2021. https://www.usenix.org/conference/usenixsecurity21/presentation/loughlin.

[2] Tanvir Ahmed Khan, **Ian Neal**, Gilles Pokam, Barzan Mozafari, Baris Kasikci. DMon: Efficient Detection and Correction of Data Locality Problems Using Selective Profiling. In Proceedings of the 15th USENIX Symposium on Operating Systems Design and Implementation (OSDI '21). July 2021. https://www.usenix.org/conference/osdi21/presentation/khan.

[3] **Ian Neal**, Andrew Quinn, Baris Kasikci. Hippocrates: Healing Persistent Memory Bugs Without Doing Any Harm. In Proceedings of the 26th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS '21). April 2021. https://dl.acm.org/doi/abs/10.1145/3445814.3446694

[4] **Ian Neal**, Gefei Zuo, Eric Shiple, Tanvir Ahmed Khan, Youngjin Kwon, Simon Peter, Baris Kasikci. Rethinking File Mapping for Persistent Memory. In Proceedings of the 19th USENIX Conference on File and Storage Technologies (FAST '21). February 2021. https://www.usenix.org/conference/fast21/presentation/neal.

[5] **Ian Neal**, Ben Reeves, Ben Stoler, Andrew Quinn, Youngjin Kwon, Simon Peter, Baris Kasikci. AGAMOTTO: How Persistent is your Persistent Memory Application?. In Proceedings of the 14th USENIX Symposium on Operating Systems Design and Implementation (OSDI '20). November 2020. **IEEE Micro 2021 Top Picks Honorable Mention.** https://www.usenix.org/conference/osdi20/presentation/neal.

[6] Ofir Weisse, **Ian Neal**, Kevin Loughlin, Thomas F. Wenisch, and Baris Kasikci. NDA: Preventing Speculative Execution Attacks at Their Source. In Proceedings of the 52nd Annual IEEE/ACM International Symposium on Microarchitecture (MICRO '19). October 2019. **IEEE Micro 2019 Top Picks Honorable Mention.** https://dl.acm.org/doi/10.1145/3352460.3358306

[7] Yige Hu, Zhiting Zhu, **Ian Neal**, Youngjin Kwon, Tianyu Cheng, Vijay Chidambaram, and Emmett Witchel. TxFS: Leveraging File-System Crash Consistency to Provide ACID Transactions. In 2018 USENIX Annual Technical Conference (USENIX ATC '18). July 2018. **Awarded Best Paper.** https://www.usenix.org/conference/atc18/presentation/hu

Talks

Towards Accurate and Efficient Application-Specific Bug Detection

- Microsoft Research Cambridge (Invited Talk) — Oct. 2021

Towards Bug-free Persistent Memory Applications

- IBM Hybrid Cloud Infrastructure Research (Invited Talk) — Jun. 2021
- Non-Volatile Memories Workshop (NVMW '21) — Mar. 2021

HIPPOCRATES: Healing Persistent Memory Bugs Without Doing Any Harm

- Conf. on Architectural Support for Programming Languages and Operating Systems (ASPLOS '21) — Apr. 2021

Rethinking File Mapping for Persistent Memory

- Applications Driving Architectures Center (Liaison Meeting) — Feb. 2021
- USENIX Conference on File and Storage Technologies (FAST '21) — Feb. 2021
- Applications Driving Architectures Center (Liaison Meeting) — Aug. 2019
- Applications Driving Architectures Center (Liaison Meeting) — Feb. 2019

AGAMOTTO: How Persistent is your Persistent Memory Application?

- University of Washington (Invited Talk) — Jan. 2021
- USENIX Symposium on Operating Systems Design and Implementation (OSDI '20) — Nov. 2020
- Applications Driving Architectures Center (Liaison Meeting) — Sept. 2020
- Applications Driving Architectures Center Symposium — May. 2020

Recent Employment

University of Michigan — Ann Arbor, Michigan, USA

Graduate Research Assistant — Sept. 2018–Present

- Creating novel techniques
- Creating novel techniques for improving the reliability of system software for persistent main memory (PM)
- Build HIPPOCRATES [3], a compiler tool for automatically fixing bugs found in PM systems
- Created AGAMOTTO [5], a symbolic-execution-based approach to finding bugs in PM systems
- Optimized file-mapping structures for PM file systems, leading to up to 45% increases in overall throughput [4]
- Developed techniques for secure speculative execution on modern processors (DOLMA [1], NDA [6])
- Developed **Lapidary**, a framework for accelerating microarchitectural simulations [1, 6]

IBM Research Virtual, USA

Research Intern in Hybrid Cloud May 2021–Aug. 2021
- Led development of novel testing infrastructure to verify network functions across hardware and software
- Created novel extensions to the KLEE symbolic execution framework to support testing network applications

Microsoft Redmond, Washington, USA

Software Engineering Intern May 2018–Aug. 2018
- Created real-time video processing module to automatically adjust brightness for low-vision users
- Led invention of novel techniques for smooth brightness adjustment

The University of Texas Austin, Texas, USA

Undergraduate Research Assistant Aug. 2017–May 2018
- Aided in the development and evaluation of TxFS [7]
- Modified applications to work with a transactional interface as an Honor's Thesis project

Microsoft Bellevue, Washington, USA

Software Engineering Intern May 2017–Aug. 2017
- Designed C# web client library and PowerShell Cmdlet for Exchange data acquisition
- Improved existing REST service by adding features and eliminating defects

Google Seattle, Washington, USA

Software Engineering Intern May 2016–Aug. 2016
- Designed new modular optimization for Flume C++ backend to remove redundant operations
- Implemented optimization tasks that could be run at any time and still maintain graph invariants

Tableau Software Seattle, Washington, USA

Software Engineering Intern May 2015–Aug. 2015
- Created Puppet manifests to deploy product code and support software
- Created extensive validation tests and automated current infrastructure

Tableau Software Seattle, Washington, USA

Software Engineering Intern May 2014–Aug. 2014
- Created ETL scripts to recover and transform product usage data for internal analysis
- Repaired and maintained existing data set for use by marketing and quality assurance teams

Honors and Awards

Facebook Fellowship Finalist	2021
IEEE Micro 2021 IEEE Top Picks Honorable Mention	2021
IEEE Micro 2019 IEEE Top Picks Honorable Mention	2019
Richard H. Orenstein Graduate Fellowship in Memory of Murray Orenstein	2018–2019
USENIX Annual Technical Conference Best Paper Award	2018
National Science Foundation (NSF) Research Experiences for Undergraduates (REU) Grant	2018
CRA Outstanding Undergraduate Researcher Award (Honorable Mention)	2017
Dusty and Doris Duesterhoeft Endowed Presidential Scholarship	2017
Leola W. and Charles H. Hugg Trust Scholarship	2013–2016
College of Natural Sciences Book Award for Academic Excellence	2016
Boyce Family Scholarship	2016
Carl R. Trull Endowed Presidential Scholarship	2015
Edward Morgan and Rebecca Brown Case Endowed Presidential Scholarship	2014

Teaching

Scientific Inquiry Across Disciplines (freshman course, UT Austin) 2014–2017

Advanced Operating Systems (EECS 582) (graduate course, University of Michigan) 2019–2020

Professional Service

Diversity, Equity and Inclusion Student Advisory Board

University of Michigan, College of Engineering Oct. 2021–Current

External Review Committee

2022 Intl. Conf. on Architectural Support for Programming Languages and Operating Systems (ASPLOS) 2021

Artifact Evaluation Committee

28th ACM Symposium on Operating Systems Principles (SOSP 2021 Artifacts) 2021

Student Editorial Board

Journal of Systems Research (JSys) 2021

Administration

Systems Reading Group, Systems Student Seminar (University of Michigan) Sept. 2018–Current

Research Mentorship

PhD Students

Shibo Chen	Sept. 2019–Dec. 2019
Yirui Liu	Sept. 2019–Dec. 2019

Master's Students

Morgan Borjigin-Wang	Sept. 2020–May 2021
Ben Reeves	Sept. 2019–May 2020
Ben Stoler	Sept. 2019–May 2020
Keyu Chen	Jan. 2020–Apr. 2020
Kejia Yang	Jan. 2020–Apr. 2020
Allison Easton	Jan. 2020–Apr. 2020

Undergraduate Students

Zesheng Yu	May 2021–Current
Musa Haydar	May 2021–Current
Nicholas Ceccio	Jan. 2020–Apr. 2020
Jacob Burley	Jan. 2020–Apr. 2020
Eric Shiple	May 2019–Dec. 2019

Patents

Video Frame Brightness Filter US Patent 10,909,403

User-Specific Video Frame Brightness Filter US Patent 10,778,932

Color-Specific Video Frame Brightness Filter US Patent App. 16/210,667