

Nathan Otterness

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Computer Science Department

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PROFESSIONAL AND RESEARCH INTERESTS

Operating system development, including topics related to real-time systems, hardware isolation, concurrency, GPUs, and computer security.

TECHNICAL SKILLS

Programming Experience

I have several years of experience in operating systems development, primarily by working in the fields of computer security and real-time systems. This has necessitated developing software for a wide range of situations:

- Modifying and developing device drivers for Linux
- Low-level programming for Intel and ARM processors
- GPU programming using CUDA and HIP
- Creating parsers for binary file formats
- Developing web services

Most of my software development work has been with the C and Go programming languages, but I also have extensive experience programming with assembly languages, Ruby, and Python.

WORK EXPERIENCE

Intern

May 2019 - August 2019

NVIDIA Corporation

Durham, NC

I worked on internal tools for managing high-volume file transfers within NVIDIA's compute cluster. My project involved developing scalable, high-performance networking code for modeling performance bottlenecks.

Intern

May 2018 - August 2018

NVIDIA Corporation

Durham, NC

I worked on an experimental software project involving image and text recognition. My contributions to this project included a framework for bootstrapping neural-network training and instrumentation for automated performance and regression testing.

Software Engineer, Security Research

May 2012 - February 2016

The University of North Carolina

Chapel Hill, NC

I worked on a system to detect malicious software embedded in common file formats. My contributions to the system focused on improving performance and scalability. As part of a very small group, I worked on several aspects of the system, ranging from device drivers and kernel programming to web backend development. I also assisted the group with writing research papers and code review.

Co-Op November 2011 - April 2012
IBM Software Group, Websphere Application Server Research Triangle Park, NC
I worked with a group responsible for finding and fixing bugs in a component of IBM's Websphere Application Server.

Co-Op May - November 2011
IBM Software Group, Project Vulcan Research Triangle Park, NC
I worked to maintain build systems for a large Java code base. Part of my tasks included ensuring that open-source Java code adhered to legal requirements for use within IBM.

EDUCATION

University of North Carolina at Chapel Hill May 2016, ongoing
I am currently a PhD student in the Real-time Systems group, where I research techniques for enabling predictable program timing via careful management of memory, processors, and GPUs.

MS, Computer Science December 2017
I received a MS in Computer Science from the University of North Carolina at Chapel Hill.

BS, Computer Science May 2012
I graduated from the University of North Carolina at Chapel Hill with a BS in Computer Science and a minor in German.

AWARDS AND HONORS

- Honorable Mention for the 2018 National Science Foundation Graduate Research Fellowship Program
- Finalist for the 2019 NVIDIA Graduate Fellowship Program
- Developed the winning algorithm for the CPSWeek 2019 F1/Tenth autonomous racing contest.
- Winner of the 27th (2020) International Obfuscated C Code Contest.

PUBLICATIONS

- **Nathan Otterness**, James Anderson. *Exploring AMD GPU Scheduling Details by Experimenting with "Worst Practices"*, International Conference on Real-Time Networks and Systems (RTNS), April 2021. **Best paper award.**
- **Nathan Otterness**, James Anderson. *AMD GPUs as an Alternative to NVIDIA for Supporting Real-Time Workloads*, Euromicro Conference on Real-Time Systems (ECRTS), July 2020.
- Ming Yang, Tanya Amert, Kecheng Yang, **Nathan Otterness**, James Anderson, F. D. Smith, and Shige Wang. *Making OpenVX Really "Real-Time"*, IEEE Real-Time Systems Symposium (RTSS), December 2018.
- Namhoon Kim, Stephen Tang, **Nathan Otterness**, James H. Anderson, F. Donelson Smith, and Donald E. Porter. *Supporting I/O and IPC via Fine-Grained OS Isolation for Mixed-Criticality Real-Time Tasks*, Conference on Real-Time Networks and Systems (RTNS), October 2018. **Best paper award.**

- Ming Yang, **Nathan Otterness**, Tanya Amert, Joshua Bakita, James Anderson, and F. D. Smith. *Avoiding Pitfalls when Using NVIDIA GPUs for Real-Time Tasks in Autonomous Systems*, Euromicro Conference on Real-Time Systems (ECRTS), July 2018.
- Joshua Bakita, **Nathan Otterness**, James Anderson, and F. D. Smith. *Scaling Up: The Validation of Empirically Derived Scheduling Rules on NVIDIA GPUs*, Workshop on Operating Systems Platforms for Embedded Real-Time Applications (OSPERT), July 2018.
- Tanya Amert, **Nathan Otterness**, Ming Yang, James Anderson, and F. D. Smith. *GPU Scheduling on the NVIDIA TX2: Hidden Details Revealed*, IEEE Real-Time Systems Symposium (RTSS), December 2017.
- Micaiah Chisholm, Namhoon Kim, Stephen Tang, **Nathan Otterness**, James Anderson, F. D. Smith, and Don Porter. *Supporting Mode Changes while Providing Hardware Isolation in Mixed-Criticality Multicore Systems*, Conference on Real-Time Networks and Systems (RTNS), October 2017.
- **Nathan Otterness**, Ming Yang, Tanya Amert, James Anderson, and F. D. Smith. *Inferring the Scheduling Policies of an Embedded CUDA GPU*, Workshop on Operating Systems Platforms for Embedded Real-Time Applications (OSPERT), June 2017.
- **Nathan Otterness**, Ming Yang, Sarah Rust, Eunbyung Park, James Anderson, F. D. Smith, Alex Berg, and Shige Wang. *An Evaluation of the NVIDIA TX1 for Supporting Real-Time Computer-Vision Workloads*, Real-Time and Embedded Technology and Applications Symposium (RTAS), April 2017.
- Namhoon Kim, Micaiah Chisholm, **Nathan Otterness**, James Anderson, and F. D. Smith. *Allowing Shared Libraries while Supporting Hardware Isolation in Multicore Real-Time Systems*, Real-Time and Embedded Technology and Applications Symposium (RTAS), April 2017.
- Micaiah Chisholm, Namhoon Kim, Bryan Ward, **Nathan Otterness**, James Anderson, and F. D. Smith. *Reconciling the Tension Between Hardware Isolation and Data Sharing in Mixed-Criticality, Multicore Systems*, IEEE Real-Time Systems Symposium (RTSS), December 2016. **Best student paper award.**
- **Nathan Otterness**, Vance Miller, Ming Yang, James Anderson, and F. D. Smith. *GPU Sharing for Image Processing in Embedded Real-Time Systems*, Workshop on Operating Systems Platforms for Embedded Real-Time Applications (OSPERT), July 2016.
- Jan Werner, George Baltas, Rob Dallara, **Nathan Otterness**, Kevin Z. Snow, Fabian Monroe, and Michalis Polychronakis. *No-Execute-After-Read: Preventing Code Disclosure in Commodity Software*, Asia Conference on Computer and Communications Security (AsiaCCS), June 2016.
- Teryl Taylor, Kevin Z. Snow, **Nathan Otterness**, and Fabian Monroe. *Cache, Trigger, Impersonate: Enabling Context-Sensitive Honeyclient Analysis On-the-Wire*, ISOC Network and Distributed Systems Security Symposium (NDSS), February 2016.

- Blaine Stancill, Kevin Z. Snow, **Nathan Otterness**, Fabian Monrose, Lucas Davi, and Ahmad-Reza Sadeghi. *Check My Profile: Leveraging Static Analysis for Fast and Accurate Detection of ROP Gadgets*, Research in Attacks, Intrusions and Defenses (RAID) Symposium, October 2013.