MATTHEW BARONDEAU

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https://matthewbarondeau.github.io/

EDUCATION

Ph.D. Electrical and Computer Engineering 05/2027
The University of Texas at Austin
Advisor: Prof. Andreas Gerstlauer

M.S. Electrical and Computer Engineering 12/2022
The University of Texas at Austin; GPA 3.88

B.S. Electrical and Computer Engineering 05/2020
The University of Texas at Austin; GPA 3.75

WORK EXPERIENCE

The University of Texas at Austin, *Graduate Research Assistant* 08/2020 - Present
- Developed a lightweight multithreading microarchitecture tailored for near-memory workloads
- Conducted synthesis and assessment of architectural modifications in the CVA6 in-order processor
- Currently developing a proactive runtime management for heterogeneous MPSoCs to enhance power efficiency

Nvidia, *GPU Architecture Intern* 05/2022 - 08/2022
- Enhanced the L2 standalone simulator to simulate inter-slice communication
- Formulated a testbench to assess the accuracy of coherence messages within the simulator
- Designed and optimized a GPU L2 metadata prefetcher

Tactical Computing Labs, *Research Engineer I* 05/2021 - 08/2021
- Quantified the execution overhead of components in SST and developed a tool for performance monitoring
- Profiled an asynchronous accelerator network to identify performance bottlenecks
- Implemented locality optimization for accelerator thread migration, leading to a reduction in data movement costs

Arm, *CPU Performance Intern* 05/2020 - 08/2020
- Performed annotation of MMU and L2 transactions within a CPU performance simulator
- Established a correlation between RTL and performance simulator replacement policy behavior
- Detected and rectified bugs related to the eviction process of the cache replacement policy

Lockheed Martin Missiles & Fire Control, *Electrical Engineering Intern* 06/2019 - 08/2019
- Engineered a high-current power supply controller
- Conducted comprehensive testing and characterization of a fiber communication circuit
- Obtained U.S. Secret security clearance

Applied Research Labs, *Student Technician* 05/2018 - 08/2018
- Wrote RTL module to enable DMA playback of GPS data
- Deployed and debugged playback functionality on Xilinx Virtex 7 FPGA
- Replicated analog front-end attenuation experiment to characterize system noise

Reynolds & Reynolds, *IT Operations Intern* 05/2014 - 08/2017
- Repaired company computers, printers, and networking equipment
- Ran ethernet cable and installed new security infrastructure

PROJECTS

Virtual Register Context Architecture 08/2020 - 11/2023
- Developed a register cache to hold partial contexts, reducing multiprocessing overhead on near-memory processors
- Engineered a register replacement policy that achieves a hit-rate within 2% of the optimal policy
- Showcased that register caching enables increased thread counts while utilizing 50% less area than a banked approach

Optimizing Producer-Consumer Operations in Multi-Core Coherent Systems 08/2022 - 12/2022
- Modeled MESI coherence changes to reduce producer-consumer overheads by tagging final writes
- Achieved 2.5x speedup with larger benefits for increasing coherence latency

Evaluating Runahead Execution with Data Prefetching 01/2022 - 05/2022

- Evaluated precise runahead execution in concert with data prefetchers using SCARAB simulator
- Demonstrated improvements in prefetcher timeliness when coupled with runahead execution

Evaluation of Multiplier Rounding Drift in Arithmetic Applications 08/2021 - 12/2021

- Surveyed multiplier rounding techniques for accuracy tradeoffs in multiplication-intensive algorithms
- Determined that true rounding and truncation result in the least error from successive multiplication

CNN Hardware Accelerator 08/2021 - 12/2021

- Implemented FPGA hardware accelerator for darknet inference on ultra96
- Achieved 40x speedup over baseline through SIMD, compiler optimizations, and accelerator offload

Parallel Implementation of the Barnes-Hut Algorithm 01/2021 - 05/2021

- Wrote openMP and GPU versions of Barnes-Hut algorithm
- Resulted in 10x faster implementation than single-thread

TEACHING EXPERIENCE

UGS016 First Year Seminar, *Instructor* Fall 2021, Fall 2022, Fall 2023
The University of Texas at Austin Austin, TX

- Taught seminar for first-year ECE students
- Topics include technical area overviews and course planning

ECE380L Real-Time Operating Systems, *Teaching Assistant* Spring 2020, Spring 2022
The University of Texas at Austin Austin, TX

- Led lab sections and organized final autonomous robot competitions for graduate lab
- Topics included virtual memory, scheduling, file systems, memory management, synchronization

ECE445L Embedded System Design Lab, *Teaching Assistant* Fall 2019
The University of Texas at Austin Austin, TX

- Rewrote lab documents and led student lab sections for senior embedded lab
- Topics include PCB design, networking, motors, and inter-device communication protocols

ECE319K Introduction to Embedded Systems, *Teaching Assistant* Spring 2018, Spring 2019
The University of Texas at Austin Austin, TX

- Oversaw lab sections, debugged student projects, and created supplemental material for freshman lab
- Topics include PWM, ADCs, DACs, interrupts, critical sections, and UART

ECE306 Introduction to Computing, *Teaching Assistant* Fall 2018
The University of Texas at Austin Austin, TX

- Taught recitation sections, created assignments, and wrote exams for introductory computing course
- Topics include logic circuits, LC-3 architecture, assembly programming, interrupts, and functions

ECE302 Introduction to Electrical Engineering, *Teaching Assistant* Fall 2017
The University of Texas at Austin Austin, TX

- Graded assignments and led lab sections for introductory circuits course
- Topics include soldering, voltage division, diodes, equivalent circuits, and operation amplifiers

SERVICE

Board Member, Graduate ECE (GREECE), UT Austin 2024 - Present
Graduate Student Peer Mentor, ECE Partner Program, UT Austin 2021 - Present
First-Year Facilitator, First Year Experience Office, UT Austin 2021 - Present
First-Year Mentor, First Year Experience Office, UT Austin 2017 - 2020

AWARDS

Qualcomm Innovation Fellowship 2023 - 2024
Virginia & Ernest Cockrell Jr. Fellowship in Engineering 2020 - 2024

SKILLS

Languages: C/C++, Python, CUDA, System Verilog, Assembly, Java
Software: VIM, Git, Gem5, SST, CACTI, Verilator, Intel PIN, Vivado, Keil, LLVM