Harrison Williams

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Virginia Tech

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Research Interests

I am broadly interested in computer architecture, embedded/IoT system design, and networking. My PhD research focuses on novel chip- and board-level hardware designs alongside software techniques to bring new capabilities to and improve the efficiency of batteryless energy harvesting systems.

Education

PhD, Computer Science 2019-2024
Circuit Support for Practical and Performant Batteryless Systems **Advisor:** Dr. Matthew Hicks
Virginia Tech

Dual BS, Electrical & Computer Engineering 2015-2019
Virginia Tech

Conference Publications

[6] **A Software Caching Runtime for Embedded NVRAM Systems**. Harrison Williams and Matthew Hicks. *Conditionally accepted to Architectural Support for Programming Languages and Operating Systems (ASPLOS), 2025.*

[5] **A Difference World: High-performance, NVM-invariant, Software-only Intermittent Computation**. Harrison Williams*, Saim Ahmad*, and Matthew Hicks. *Equal contribution. *USENIX Annual Technical Conference (ATC), 2024.*

[4] **Energy-Adaptive Buffering for Efficient, Responsive, and Persistent Batteryless Systems**. Harrison Williams and Matthew Hicks. *Architectural Support for Programming Languages and Operating Systems (ASPLOS), 2024.*

[3] **Practical Considerations of Energy Harvesting Source in Minimization of Age of Information with Updating Erasures**. Fariborz Lohrabi Pour, Harrison Williams, Matthew Hicks, and Dong Sam Ha. *International Symposium on Circuits & Systems (ISCAS), 2023.*

[2] **Failure Sentinels: Ubiquitous Just-in-time Intermittent Computation via Low-cost Hardware Support for Voltage Monitoring**. Harrison Williams, Michael Moukarzel, and Matthew Hicks. *International Symposium on Computer Architecture (ISCA), 2021.*

[1] **Forget Failure: Exploiting SRAM Data Remanence for Low-overhead Intermittent Computation**. Harrison Williams, Xun Jian, and Matthew Hicks. *Architectural Support for Programming Languages and Operating Systems (ASPLOS), 2020.*

Funding

[1] **NSF SHF: Small: Circuit Support for Maintaining the Continuous-power Abstraction in Energy Harvesting Systems**

- Principal Investigator: Dr. Matthew Hicks.
- Timeframe: 2023-09-01 to 2026-08-31.
- Total: $450,000.
- Role: Co-author. My work on hardware support for batteryless systems was the basis of this grant. I provided preliminary data and wrote the grant with Dr. Hicks.

Professional Experience

Virginia Tech
Graduate Research Assistant 2019-Present
Graduate Teaching Assistant CS 4264: Principles of Computer Security Fall 2019
Undergraduate Research Assistant 2017-2019

Raytheon Missile Systems
Technical Intern Summers 2017, 2018

Updated May 26, 2024.

Selected Projects

Graduate Research

- **Software Caching Runtimes**: Emerging memories enable low-power microcontrollers to record and operate on large data streams, but do so with a performance penalty due to energy and latency limitations. This work explores software techniques to offload code and data to higher-performance on-chip SRAM to improve performance and energy efficiency. **Outcome**: One conference paper (ASPLOS '25).
- **Dynamic Energy Buffering**: Batteryless systems store energy in capacitors and face performance tradeoffs based on capacitor size. This work introduces adaptive and efficient variable-capacitance circuits to blend the advantages of different capacitor sizes. **Outcome**: One conference paper (ASPLOS '24).
- **Integrated Circuits for Batteryless Systems**: Designed custom integrated circuits for variable-resolution supply voltage supervisors targeting energy-constrained batteryless systems. **Outcome**: One conference paper (ISCA '21) and one paper under submission.
- **SRAM-based Intermittent Computation**: Batteryless devices operate intermittently on harvested energy, but need high-performance non-volatile memory to preserve program state. This work uses SRAM data remanence to preserve program state and eliminate the need for high-performance memory. **Outcome**: Two conference papers (ASPLOS '20, ATC '24).

Undergraduate Research

- **Counterfeit Device Detection**: SRAM cells age as they hold data, revealing information about software operation through transistor-level changes visible in memory startup state. This work uses these software-induced changes to detect counterfeit recycled microcontrollers using statistical analysis to compare aged devices with an unaged golden model. **Outcome**: https://arxiv.org/pdf/2009.04002.pdf.

Recognition

Davenport Leadership Scholarship 2022
NSF Graduate Research Fellowship Program 2021
Honorable Mention

Service

Reviewer:

Journal of Systems Architecture	JSA '24

Sub-reviewer:

Architectural Support for Programming Languages and Operating Systems	ASPLOS '24, '23, '20
European Conference on Computer Systems	EuroSys '22
Transactions on Embedded Computing Systems	TECS '21
Design Automation Conference	DAC '20
Languages, Compilers, Tools and Theory of Embedded Systems	LCTES '20
International Workshop on Energy Harvesting & Energy-Neutral Sensing Systems	ENSsys '19