Harrison Williams

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Virginia Tech

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Research Interests

I perform research in the areas of computer architecture and embedded systems, ranging from software analysis and optimization to transistor-level hardware design. I am particularly interested in designing systems that explore the interactions between the software, architecture, and device layers to improve resource-constrained and low-power embedded and mobile 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. *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*.

Other Publications

[1] **A Survey of Prototyping Platforms for Intermittent Computing Research**. Harrison Williams and Matthew Hicks. *International Workshop on Energy Harvesting & Energy-Neutral Sensing Systems (ENSsys), 2024*. **Best Paper Award.**

Funding

[2] **NSF SHF: Small: Embedded Smart Energy**

- Team: Bradley Denby (co-PI), Harrison Williams (co-PI).
- Timeframe: 2025-07-01 to 2028-06-30 (proposed).
- Total: $600,000 (proposed).
- Pending response.

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

- Principal Investigator: Matthew Hicks (sole PI).
- 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.

Updated November 25, 2024.

Professional Experience

Virginia Tech

Postdoctoral Researcher		2024-Present
Graduate Research Assistant		2019-2024
Graduate Teaching Assistant	CS 4264: Principles of Computer Security	Fall 2019
Undergraduate Research Assistant		2017-2019

Raytheon Missile Systems

Technical Intern — Summers 2017, 2018

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).
- **Intelligent Energy Storage**: 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
International Workshop on Energy Harvesting & Energy-Neutral Sensing Systems	ENSsys '24, '19
European Conference on Computer Systems	EuroSys '22
Transactions on Embedded Computing Systems	TECS '23, '21
Transactions on Information Forensics and Security	TIFS '21
Design Automation Conference	DAC '20
Languages, Compilers, Tools and Theory of Embedded Systems	LCTES '20
IEEE Symposium on Security and Privacy	Oakland '20

Departmental:

NSF GRFP Prep Workshop, Mentor — 2024

References

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