Harrison Williams

PhD candidate, Dept. of Computer Science
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
Virginia Tech — **Advisor:** Dr. Matthew Hicks

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

Conference Publications

[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*.

Preprints

- **A Software Caching Runtime for Embedded NVRAM Systems**. Harrison Williams and Matthew Hicks. *In preparation*.
- **Energy-Adaptive Buffering for Efficient, Responsive, and Persistent Batteryless Systems**. Harrison Williams and Matthew Hicks. *Under review*.
- **Residual Sentinels: Scavenging Post-computation Utility in Energy Harvesting Systems with Just-right Power-down Voltage Monitoring**. Harrison Williams and Matthew Hicks. *Under review*.
- **A Difference World: High-performance, NVM-invariant, Software-only Intermittent Computation**. Harrison Williams*, Saim Ahmad*, and Matthew Hicks. *Under review*.

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

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 paper under preparation.

Updated November 2, 2023.

- **Dynamic Energy Buffering**: Batteryless systems store energy in capacitors and face performance tradeoffs based on capacitor size. This work introduced adaptive and efficient variable-capacitance circuits to blend the advantages of different capacitor sizes. **Outcome**: One paper under submission.
- **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**: One conference paper (ASPLOS '20) and one paper under submission.

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**: arXiv paper (link).

Recognition

Davenport Leadership Scholarship 2022

Graduate Research Fellowship Program 2021
Honorable Mention

Service

External 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