# Harrison Williams

**Postdoctoral Researcher, Dept. of Computer Science**
**Virginia Tech**

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## Research Interests

I perform research in the areas of computer architecture and embedded systems, ranging from transistor-level hardware design to software analysis and optimization. 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

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

[6] **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*.

[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**

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| 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

Updated September 24, 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).
- **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:**

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| Journal of Systems Architecture | JSA '24 |

**Sub-reviewer:**

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| 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 '21 |
| Design Automation Conference | DAC '20 |
| Languages, Compilers, Tools and Theory of Embedded Systems | LCTES '20 |