JAYLEN WANG

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BRIEF BIOGRAPHY

My work bridges computer architecture and software systems, demonstrating the importance of that bridge in enabling sustainable data center systems via solutions that span the compute stack.

As the demand for web services continues to grow, data centers are scaling up to meet the demand, consuming a massive amount of energy and producing significant carbon emissions. **My research focuses on addressing the growing carbon emissions, produced both by running and manufacturing hardware, of data centers by analyzing inefficiencies across computer architecture and software systems and designing solutions to make these systems more energy and carbon efficient.**

My work is one of the first to examine the environmental impact of hyperscale web systems and to provide actionable insights to reduce it. My work integrates carbon efficiency into computer system design, as it is crucial for sustainable growth and access to critical web services in both developed and developing nations. My work is a step towards curbing computing's contributions towards climate change and promoting sustainable computing practices.

My research has been recognized with the NSF Graduate Research Fellowship Program (GRFP) Award and the 2023 Benjamin Garver Lamme/Westinghouse Graduate Fellowship.

EDUCATION

Ph.D., Electrical and Computer Engineering — *Carnegie Mellon University*
Advisor: Prof. Akshitha Sriraman — *Aug 2022 - Present*
NSF GRFP Fellow
Dissertation Title: Enabling Sustainable Web Systems

B.Sc., Electrical Engineering — *Harvard University*
PIs: Profs. David Brooks & Gu-Yeon Wei — *Aug 2018 - May 2022*
Minor in Computer Science
Graduated *Summa Cum Laude* (GPA: 4.0/4.0); *Member of Phi Beta Kappa*

PEER-REVIEWED CONFERENCE AND JOURNAL PUBLICATIONS

– **Jaylen Wang**, Daniel S. Berger, Fiodar Kazhamiaka, Celine Irvene, Chaojie Zhang, Esha Choukse, Kali Frost, Rodrigo Fonseca, Brijesh Warrier, Chetan Bansal, Jonathan Stern, Ricardo Bianchini, and Akshitha Sriraman. *Designing Cloud Servers for Lower Carbon.* 51st International Symposium on Computer Architecture (**ISCA 2024**). June 2024.

AWARDS AND HONORS

Jack and Mildred Bowers Scholarship in Engineering — *2024*
Full tuition support for third year of PhD

NSF Graduate Research Fellowship Program (GRFP) Award Winner — *2023*
Awarded $171,000 as part of prestigious fellowship supporting exceptional graduate students in STEM

Ford Foundation 2023 Predoctoral Fellowship Competition Honorable Mention — *2023*
Honorable mention given to top Ford Fellowship candidates

Benjamin Garver Lamme/Westinghouse Graduate Fellowship — *2023*
Full tuition support for second year of PhD

Carnegie Institute of Technology Dean's Fellow — *2022*
Awarded $83,000 towards tuition, stipend, and travel

Harvard SEAS Dean's Engineering Design Award — *2022*
Awarded $500 for having one of the top 7 (out of 43) best Senior engineering design projects

Sophia Freund Prize *2022*
Awarded $1000 as highest ranking undergraduate in the Electrical Engineering department

Phi Beta Kappa Member *2022*
Admitted into Harvard's chapter, one of 146 out of 1962 (7.4%) students

Derek Bok Center Distinction in Teaching *2020, 2021*
Awarded to most highly rated (by students) TAs; received distinction in three semesters

John Harvard Scholar *2020*
Award given to top 5% (4.0 GPA) of students in respective class

Harvard College Research Program Funding Recipient *2019*
Awarded $3,500 to perform independent research during the summer

Detur Prize Winner *2019*
Recognizes students with top academic standing in their first year at Harvard

PEER-REVIEWED WORKSHOP PUBLICATIONS

- **Jaylen Wang**, Melissa Pan, Udit Gupta, and Akshitha Sriraman. *Giving Old Servers New Life at Hyperscale.* 6th Young Architect Workshop (**YArch 2024**) held in conjunction with **ASPLOS**. June 2024.
- **Jaylen Wang**, Udit Gupta, and Akshitha Sriraman. *Peeling Back the Carbon Curtain: Carbon Optimization Challenges in Cloud Computing.* 2nd Workshop on Sustainable Computer Systems (**HotCarbon 2023**). July 2023.

  Performs the first ever characterization of server generations for microservice-based web services to enable hardware lifetime extension
- Jialun Lyu, **Jaylen Wang**, Kali Frost, Chaojie Zhang, Celine Irvene, Esha Choukse, Rodrigo Fonseca, Ricardo Bianchini, Fiodar Kazhamiaka, and Daniel S. Berger. *Myths and Misconceptions Around Reducing Embedded Carbon for Cloud Platforms.* 2nd Workshop on Sustainable Computer Systems (**HotCarbon 2023**). July 2023.
- **Jaylen Wang**, Udit Gupta, and Akshitha Sriraman. *Giving Old Servers New Life at Hyperscale.* 1st Workshop on Hot Topics in System Infrastructure (**HotInfra 2023**) held in conjunction with **ISCA**. June 2023.
- **Jaylen Wang**, Udit Gupta, and Akshitha Sriraman. *Characterizing Datacenter Server Generations for Lifetime Extension and Carbon Reduction.* 1st Workshop on NetZero Carbon Computing (**NetZero 2023**) held in conjunction with **HPCA**. Feb 2023.
- Sahana Rangarajan, **Jaylen Wang**, Sara Mahdizadeh Shahri, Pratyush Patel, and Akshitha Sriraman. *Designing Equitable Data Center Scheduling Systems.* Career Workshop for Inclusion and Diversity in Computer Architecture (**CWIDCA 2022**) held in conjunction with **MICRO**. Oct 2022.

  Introduces equity as a first-order design metric in modern data center scheduling systems
- **Jaylen Wang**, Abdulrahman Mahmoud, Gu-Yeon Wei, and David Brooks. *A Dataflow-Aware Fault Resilience Analysis Framework for Deep Neural Network Accelerators.* 4th Young Architect Workshop (**YArch 2021**) held in conjunction with **ASPLOS**. March 2022.

  Introduces a new framework and tool to quickly and accurately assess the reliability of deep neural network accelerator designs to random bit flips, providing insights for resilient accelerator design

INVITED SEMINAR TALKS

Designing Cloud Servers for Lower Carbon

- *Google SystemsResearch@Google (SRG) Group*, Host: Dr. David Culler *Sep 2024*
- *ISCA*, Buenos Aires *Jun 2024*
- *University of California San Diego* (CSE), Host: Prof. Jishen Zhao *Apr 2024*
- *University of California Riverside* (ECE), Host: Prof. Shaolei Ren *Apr 2024*
- *University of Southern California* (ECE), Host: Prof. Murali Annavaram *Apr 2024*

AWARDED GRANT PROPOSALS

– *AWS Cloud Credit for Research*, "Carbon-Aware Scheduling to Reduce Hyperscale Carbon Emissions", *Award*: $76,000, Award period: 2024-25

PROFESSIONAL SERVICE/IMPACT

– *Graduate Student Panelist* for Undergrad Architecture Mentoring Workshop (**uArch**) held in conjunction with ISCA. Jun 2024

– *Artifact Evaluation Committee Member* for International Symposium on Microarchitecture 2024 (**MICRO 2024**). Nov 2024.

– (*Organized Workshop*) **Jaylen Wang**, Sara Mahdizadeh Shahri, and Akshitha Sriraman. 1st Workshop on Hot Topics in Ethical Computer Systems (**HotEthics 2024**) held in conjunction with ASPLOS. Apr 2024.

Developed, advertised, organized, and reviewed papers for the 1st Workshop on Hot Topics in Ethical Computer Systems.

– Co-Author in ACM SIGARCH Computer Architecture Today blog article *Reducing Embodied Carbon is Important* (**ACM SIGARCH 2023**). Aug 2023.

– *Artifact Evaluation Committee Member* for Architectural Support for Programming Languages and Operating Systems 2024 (**ASPLOS 2023**). Oct 2023.

– (*Organized Panel*) **Jaylen Wang**, Udit Gupta, and Akshitha Sriraman. *Panel on Sustainable Systems.* The 19th Workshop on Hot Topics in Operating Systems (**HotOS 2023**). Feb 2023.

Organized and moderated the first panel on sustainable systems research at HotOS with five expert panelists in the field.

PROFESSIONAL EXPERIENCE

IBM Research Intern, IBM Research, Yorktown Heights, NY *May 2024 - August 2024*
Mentor: Asser Tantawi

Developing new frameworks and strategies for more sustainable cross-cluster batch job scheduling.

Azure Systems Research Intern, Microsoft Research, Redmond, WA *May 2023 - August 2023*
Mentor: Fiodar Kazhamiaka

Developing a framework based on an understanding of server design's data center-scale impact to improve Azure's resource and carbon efficiency.

Graduate Research Assistant, Carnegie Mellon University *Aug 2022 - Present*
Advisor: Prof. Akshitha Sriraman

Introducing sustainability as a first-order hardware/software system design metric for hyperscale systems and redesigning data center systems to promote hardware reuse

Undergraduate Research Assistant, Harvard University *March 2021 - Aug 2022*
Lab: Harvard Architecture, Circuits, and Compilers Group
Advisors: Dr. Abdulrahman Mahmoud, Profs. Gu-Yeon Wei and David Brooks

Developing a hardware-aware framework for analyzing the resilience of deep neural network accelerators to soft errors, considering the reuse of values in an accelerator's dataflow propagation

Engineering Development Group Intern, MathWorks *May 2021 - Aug 2021*
Team: Deep Learning HDL Toolbox
Supervisors: Wang Chen, Siyuan Xu

Enabling efficient mapping of non-square convolution kernels onto square processing-element arrays, allowing users to deploy models using non-square kernels onto FPGAs

Undergraduate Research Assistant, Harvard University *May 2020 - Aug 2020*
Lab: Harvard Edge Computing Lab
Advisor: Prof. Vijay Janapa Reddi

Analyzing how using SLAM for localization affects efficiency and power usage within autonomous drone applications by integrating SLAM algorithms into an open-sourced drone benchmarking framework

Undergraduate Research Assistant, Harvard University *May 2019 - Aug 2019*
Lab: Hoffman Physics Lab
Advisor: Prof. Jenny Hoffman

Developing a tensioning system for an XY-walker system to extend the range of a scanning tunneling microscope used to research the proximity effect of superconductivity

TEACHING EXPERIENCE

Undergraduate Teaching Assistant, Harvard University

- Systems Programming and Machine Organization; Prof. Eddie Kohler *Fall 2020, 2021*
- Circuits, Devices, and Transduction; Profs. Gage Hills & Woodward Yang *Fall 2021*
- Systems and Control; Profs. Li Na & Yue Lu *Fall 2021*
- Introduction to Electrical Engineering; Profs. Chris Lombardo & Marko Loncar *Spring 2021*
- Integration, Series and Differential Equations; Dr. Hakim Walker *Fall 2019*

LEADERSHIP & VOLUNTEERING

- CMU Institute of Technology K-12 Outreach, STEM Volunteer *2023-Present*
- President of Harvard Club Tennis *2019-2022*
- President of Harvard College Engineering Society *2020-2021*
- Co-President of Harvard Engineering Peer Concentration Advisors *2020-2021*

TECHNICAL SKILLS

Programming Languages	C/C++, Python, Shell, Verilog, x86 Assembly
System Skills	Low-level Systems Programming, Performance Characterization, Scripting, Docker
Tools and Frameworks	Pin, gem5, Linux perf, Intel PMU tools, PyTorch, Catapult HLS, Git

REFERENCES

1. Prof. Akshitha Sriraman (akshitha@cmu.edu)
   Assistant Professor, Carnegie Mellon University
2. Daniel S. Berger (daberg@microsoft.com)
   Researcher in Azure Systems Research Group, Microsoft
3. Fiodar Kazhamiaka (fkazhamiaka@microsoft.com)
   Researcher in Azure Systems Research Group, Microsoft
4. Prof. David Brooks (dbrooks@g.harvard.edu)
   Haley Family Professor of Computer Science, Harvard University
5. Prof. Udit Gupta (ugupta@cornell.edu)
   Assistant Professor, Cornell University