

# JOSHUA J. BAKITA

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## EDUCATION

- Doctor of Philosophy in Computer Science**, *University of North Carolina at Chapel Hill* Aug. 2019 - May 2025
- Master of Science in Computer Science**, *University of North Carolina at Chapel Hill* Aug. 2018 - May 2019
- Courses of Note: Real-Time Sys, Computer Vision, OS Impls, Data Ctr. Sys & Programming, Data Ctr. Software Dynamics
- Bachelor of Science in Computer Science**, *University of North Carolina at Chapel Hill* Aug. 2014 - May 2018
- **Graduated with Honors** | 3.57 Computer Science Course GPA | Fall 2016 Honors Study Abroad in London
  - Courses of Note: Digital Logic & Computer Design, 2D Graphics, OS, Computer Security, Data Compression

## RESEARCH EXPERIENCE

- Dept. Computer Science - UNC Chapel Hill**, *Research Assistant with Dr. James H. Anderson* Aug. 2018 - Current
- Research goal: Enable real-time heterogeneous systems to operate safely and efficiently for autonomous vehicles
  - Enabling **predictable and efficient GPU sharing** for real-time systems (pubs: RTSS'21, RTAS'19, ECRTS'18, **OSPERT'18**)
    - Produced a **sub-1%-overhead** GPU core partitioning library and reverse engineered GPU scheduling (pub: **RTAS'23**)
    - Demonstrated **41% lower mean and 52% lower max** execution times by using my library vs. MPS (pub: **EuroSys'25**)
    - Revealed that 3 prior real-time GPU use and analysis approaches are unsafe on modern GPUs (pub: **RTAS'24**)
    - Built transparent GPU memory oversubscription scheme **3x** faster than demand paging in Linux (pub: **RTSS'22**)
  - **Linux kernel contributor**, LITMUS-RT maintainer, and kernel module developer (pubs: Journal of RTS'21)
  - Reworked the mixed-criticality on multicore (MC<sup>2</sup>) Linux patches for x86 and SMT (pub: **RTAS'21**)
    - Developed novel ways to isolate, e.g. NUMA-based **O(1) page coloring** in Linux's allocator (O(n) prior state-of-the-art)
    - Rewrote MC<sup>2</sup> scheduler to allow for predictable execution times when using SMT, boosting schedulable utilization by 22%
  - Constructed techniques to allow real-time systems to use SMT to address **FAA need** (pubs: RTAS'22, ECRTS'19)
- General Motors Research**, *Research & Development Intern*, Remote June 2020 - Aug. 2020
- Developed and evaluated lossless GPU parallelization techniques in **CUDA** and **C++** for autonomous car perception CNNs
  - Enabled **one device to do the work of two** at comparable latency by reducing context switches
- Dept. Computer Science - UNC Chapel Hill**, *Undergrad Research Assistant with Dr. Henry Fuchs* June 2015 - Dec. 2015
- Led a team of 5 undergraduates to apply embedded wearable accelerometers for motion tracking
  - Personal contributions in **C** on Arduino and **Java** on Android plus a high-efficiency bluetooth data transmission protocol

## TEACHING EXPERIENCE

- Dept. Computer Science - UNC Chapel Hill**, *Instructor of Record for COMP 211* Jan. 2023 - May 2023
- Developed curriculum and taught C, Linux, and more in *Systems Programming Fundamentals*, the 3rd intro CS course
  - Led a team of 6 undergraduate and 1 graduate teaching assistants to teach **154 students**
- Dept. Computer Science - UNC Chapel Hill**, *Teaching Assistant for COMP 524* Jan. 2019 - May 2019
- Taught **Haskell**, **Rust**, **Julia**, and **Go** to illustrate fundamental programming language concepts
  - Graded assignments and tests, taught selected classes, and held up to 20 hours of office hours a week for students
  - Honored with "**Teaching Assistant of the Year**" award by CS undergraduates and faculty. Nominated by >30% of class

## PUBLICATIONS

- J. Bakita**, J. H. Anderson, "Hardware Compute Partitioning on NVIDIA GPUs for Composable Systems," *Proceedings of the 20th European Conference on Computer Systems (EuroSys)*, [in submission](#), Apr 2025.
- J. Goh, S. Ali, **J. Bakita**, S. Chakraborty, J. H. Anderson, "Concurrent FFT Execution on GPUs in Real-Time," *Proceedings of the 33rd Euromicro International Conference on Parallel, Distributed, and Network-Based Processing (PDP)*, [in submission](#), Mar 2025.
- J. Bakita**, J. H. Anderson, "Demystifying NVIDIA GPU Internals to Enable Reliable GPU Management," *Proceedings of the 30th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS)*, pp. 394-305, May 2024. Acceptance rate: 23.3%.
- J. Bakita**, J. H. Anderson, "Hardware Compute Partitioning on NVIDIA GPUs," *Proceedings of the 29th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS)*, pp. 54-66, May 2023. **Winner, outstanding paper award.** Acceptance rate: 26.9%.
- J. Bakita**, J. H. Anderson, "Enabling GPU Memory Oversubscription via Transparent Paging to an NVMe SSD," *Proceedings of the 43rd Real-Time Systems Symposium (RTSS)*, pp. 370-382, Dec 2022. Acceptance rate: 28.9%.
- S. Osborne, **J. Bakita**, J. Chen, T. Yandrofski, J. H. Anderson, "Minimizing DAG Utilization by Exploiting SMT," *Proceedings of the 28th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS)*, pp. 267-280, May 2022. Acceptance rate: 24.2%.

T. Amert, Z. Tong, S. Voronov, **J. Bakita**, F.D. Smith, and J. H. Anderson, "TimeWall: Enabling Time Partitioning for Real-Time Multicore+Accelerator Platforms," *Proceedings of the 42nd Real-Time Systems Symposium (RTSS)*, pp. 455–468, Dec 2021. Acceptance rate: 29.3%.

**J. Bakita**, S. Ahmed, S.H. Osborne, S. Tang, J. Chen, F.D. Smith, and J. H. Anderson, "Simultaneous Multithreading in Mixed-Criticality Real-Time Systems," *Proceedings of the 27th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS)*, pp. 278-291, May 2021. Acceptance rate: 27.2%.

C. Hobbs, Z. Tong, **J. Bakita**, and J. H. Anderson, "Statically Optimal Dynamic Soft Real-Time Semi-Partitioned Scheduling," *Real-Time Systems Journal*, pp. 97-140, 57.1, Jan 2021.

S. Osborne, **J. Bakita**, and J. H. Anderson, "Simultaneous Multithreading Applied to Real Time," *Proceedings of the 31st Euromicro Conference on Real-Time Systems (ECRTS)*, pp. 3:1-3:22, Jul 2019. Acceptance rate: 33.8%.

M. Yang, S. Wang, **J. Bakita**, T. Vu, F.D. Smith, J. H. Anderson, and J.-M. Frahm, "Re-thinking CNN Frameworks for Time-Sensitive Autonomous-Driving Applications: Addressing an Industrial Challenge," *Proceedings of the 25th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS)*, pp. 305-317, Apr 2019. Acceptance rate: 25.8%.

M. Yang, N. Otterness, T. Amert, **J. Bakita**, J. H. Anderson, and F.D. Smith, "Avoiding Pitfalls when Using NVIDIA GPUs for Real-Time Tasks in Autonomous Systems," *Proceedings of the 30th Euromicro Conference on Real-Time Systems (ECRTS)*, pp. 20:1-20:21, Jul 2018. Acceptance rate: 33.3%.

**J. Bakita**, N. Otterness, J. H. Anderson, and F.D. Smith, "Scaling Up: The Validation of Empirically Derived Scheduling Rules on NVIDIA GPUs," *Proceedings of the 14th Annual Workshop on Operating Systems Platforms for Embedded Real-Time Applications (OSPert)*, pp. 49-54, Jul 2018. Acceptance rate: 75.0%.

## TECHNICAL EXPERIENCE

**Waymo**, *Software Engineering Intern*, Remote May 2021 - Aug. 2021

- Worked on the Onboard Compute Optimization Team to improve planner GPU utilization and CPU SIMD efficiency
- Reimplemented edge construction for on-vehicle planner search graph on GPU using C++ and **CUDA**

**Microsoft Corporation**, *Software Engineering Intern*, Redmond, WA May 2018 - Aug. 2018

- Worked in C++ on the Web Platform Team to help build the Edge browser (>**100 million active users**) + Windows app APIs
- Implemented CSS parser, DOM interface, and **GPU-accelerated rendering** for background-blend-mode and mix-blend-mode (used by .04% and .111% of all web pages per Bing, both are top 55% most used CSS properties)
- Wrote web platform interoperability tests in **HTML**, **CSS**, and **JavaScript** to benchmark and beat Chrome's implementation

**Microsoft Corporation**, *Software Engineering Intern*, Issaquah, WA May 2017 - Aug. 2017

- Redesigned architecture for lead unsubscribe, **increasing speed 2x** for customer and protecting from **over \$3B** in fines
- Worked in **C#** and **SQL** on enrichment and privacy management systems processing over **16 million leads** weekly
- Upgraded, unified, and simplified logging in lead enrichment and privacy sync systems to enable business alerting

**House of Commons of the United Kingdom**, *Parliamentary Intern for James Berry MP*, London, UK Sep. 2016 - Dec. 2016

**Capital One Financial Corporation**, *Software Engineering Intern (TDP)*, McLean, VA June 2016 - Aug. 2016

- Refactored free CreditWise tool (>**11 million active users**) to **speed up deployment 10x**, startup by 2x, and testing by ~2x
- Full stack development in **Java**, Spring MVC, **CSS**, **HTML**, and **AngularJS** on Apache Tomcat in **AWS EC2**
- Optimized test workflow, removed all proprietary libraries, and significantly slimmed backend codebase size

**Wildfire Games**, *Open-Source Game Developer* June 2013 - Aug. 2014

- Led a team to develop an online multiplayer matchmaking lobby and ranking system based on XMPP for 0 A.D. RTS
- Worked with **C++**, **JavaScript**, and XML client-side, **Python** and **Erlang** server-side

## SERVICE

**Graduate and Professional Student Government (GPSG)**, *Senator* Aug. 2020 - Aug 2024

- Sole elected representative of the graduate students in the Computer Science Department to the university administration
- President Pro Tempore of the Senate, Sept. 2022 - Sept. 2023
- Chair of Senate Finance Committee, Aug. 2021 - Sept. 2022

**Computer Science Students Association (CSSA)**, *President* Aug 2021 - Aug 2022

- Represented graduate students in the Computer Science Dept. as a voting member of faculty meetings
- Contributed to a **13.6% stipend increase** for graduate students, and a ~25% increase in graduate student event attendance
- Leadership Committee Officer, May 2020 - Aug 2021

**UNC Renewable Energy Special Projects Committee (RESPEC)**, *Voting Member* Sep. 2014 - May 2019

- Collaborated with a committee of over 15 students to **manage over \$1M** for renewable energy initiatives on campus

**UNC Undergraduate Computer Science Club**, *President* May 2017 - Aug. 2018

**Rancho 3M Christian School and Orphanage**, *Missions Trip Volunteer*, Guadalupe, Mexico 2010,11,13,15,16,19

**Eagle Scout; Boy Scouts of America**, *Troop 94* 2007 - 2014

## REVIEWING ACTIVITIES

### Program Committee Service

**2024 Real-Time Systems Symposium (RTSS).** Work-in-Progress and Brief Presentations PC.

**2024 Euromicro Conference on Real-Time Systems (ECRTS).** Artifact Evaluation PC.

### Conference Subreviewer

2025 European Conference on Computer Systems (EuroSys).

2024 Real-Time Systems Symposium (RTSS).

2024 Euromicro Conference on Real-Time Systems (ECRTS).

2023 Real-Time Systems Symposium (RTSS).

2023 International Conference on Real-Time Networks and Systems (RTNS).

2023 Real-Time and Embedded Technology and Applications Symposium (RTAS).

2022 International Conference on Real-Time Networks and Systems (RTNS).

2022 Real-Time and Embedded Technology and Applications Symposium (RTAS).

2021 Euromicro Conference on Real-Time Systems (ECRTS).

2021 Real-Time and Embedded Technology and Applications Symposium (RTAS).

### Journal Reviewer

Journal of Systems Architecture