

Sudarsun Kannan

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Research Summary

My research focuses on optimizing data center systems, the backbone of modern society's essential services. As Dennard scaling ends and data growth surges, datacenters are turning to multi-core parallelism, accelerators, and heterogeneous memory and storage technologies. Yet, this data influx may soon test these accelerators' scalability. To tackle this, my research advocates software-driven integration of legacy, current, and future heterogeneous computing elements for collaborative data processing. My group is developing *cross-layered, scalable, disaggregated* operating systems to leverage heterogeneous hardware to design and develop unified, efficient, adaptable, and sustainable data-processing systems.

Professional Experience

Rutgers University-New Brunswick

Assistant Professor, Department of Computer Science

Sep. 2018 - Current

ACM Transactions on Storage

Associate Editor

Sep. 2023 - Current

Journal of Systems Research

Area Chair, Storage Track

Sep. 2022 - Present

Educational Training

University of Wisconsin-Madison

Postdoctoral Research Associate, Department of Computer Sciences

Sep. 2016 - Aug. 2018

Advisers - Prof. Remzi H. Arpaci-Dusseau and Prof. Andrea C. Arpaci-Dusseau

Georgia Institute of Technology, Atlanta

Ph.D. in Computer Science

May 2010 - Aug 2016

Thesis: Operating System Support for Heterogeneous Memory

Advisers - Prof. Karsten Schwan (demised), Prof. Ada Gavrilovksa

Georgia Institute of Technology, Atlanta

M.S in Computer Science

Aug 2008 - May 2010

Masters Research Project: Virtual Storage for Mobile Devices

Advisers - Prof. Karsten Schwan (demised), Prof. Ada Gavrilovksa

Anna University, Chennai

B.E in Computer Science (with distinction)

July 2001- May 2005

Recent Awards and Honors

IEEE MICRO Top Picks '24, Mosaic Pages: Big TLB Reach with Small Pages for our ASPLOS '23 paper

Best Paper Award, SOSP '23, Enabling High-Performance and Secure Userspace NVM File Systems with the Trio Architecture

Distinguished Paper Award, ASPLOS '23, Mosaic Pages: Big TLB Reach with Small Pages

Google Research Scholar Award, '22-'23

Samsung Faculty Research Collaboration Award, For working on heterogeneous storage and CXL research, '22-'24

Keynote, Heterogeneous Memory Workshop (HMEM '21, Virtual)

Co-Chair for ACM Workshop on Hot Topics in Storage and File Systems (HotStorage '22)

Memorable Paper Award Finalists, Nonvolatile Memory Workshop 2021, Cross-layered File System Design

ISCA 25 years of Retrospective Papers, HeteroOS: OS Design for Heterogeneous Memory Management in Datacenters (ISCA '17)

Reviewed Journal Publications

Mosaic Pages: Big TLB Reach with Small Pages

J. Han, K. Gosakan, W. Kuzmaul, I. Mubarak, N. Mukherjee, K. Sriram, M. Bender, **IEEE Top Picks '24**
A. Bhattacharjee, A. Conway, M. Farach-Colton, J. Gandhi, R. Johnson, **S. Kannan**, D. Porter
Special Issue on Top Picks From the 2024 Computer Architecture Conferences

HeteroOS - OS Design for Heterogeneous Memory Management in Datacenter

Sudarsun Kannan, Ada Gavrilovska, Vishal Gupta, Karsten Schwan **OS Review '18**
ACM SIGOPS Operating Systems Review 2018

Energy Aware Persistence: Reducing the Energy Overheads of Persistent Memory

Sudarsun Kannan, Moinuddin Qureshi, Ada Gavrilovska, Karsten Schwan **CAL '15**
Computer Architecture Letters, 2015

Conference Publications (Google Scholar)

OmniCache: Collaborative Caching for Near-storage Accelerators

Jian Zhang, Yujie Ren, Marie Nguyen, Changwoo Min, **Sudarsun Kannan** **FAST '24**
USENIX Conference on File and Storage Technologies, 2024
Acceptance Rate: 17.8%

CrossPrefetch: Accelerating I/O Prefetching for Modern Storage

Shaleen Garg, Jian Zhang, Rekha Pitchumani, Manish Parashar, Bing Xie, **Sudarsun Kannan** **ASPLOS '24**
Architectural Support for Programming Languages and Operating Systems, 2024
Acceptance Rate: 17%

Enabling High-Performance and Secure Userspace NVM File Systems with Trio Architecture

Diyu Zhou, Vojtech Aschenbrenner, Tao Lyu, Jian Zhang, **Sudarsun Kannan**, Sanidhya Kashyap **SOSP '23**
ACM SIGOPS 30th Symposium on Operating Systems Principle, **Best Paper Award!**
Acceptance Rate: 18.7%

Mosaic Pages: Big TLB Reach with Small Pages

K. Gosakan, J. Han, W. Kuzmaul, I. Mubarak, N. Mukherjee, K. Sriram, M. Bender, **ASPLOS '23**
A. Bhattacharjee, A. Conway, M. Farach-Colton, J. Gandhi, R. Johnson, **S. Kannan**, D. Porter
Architectural Support for Programming Languages and Operating Systems, **Distinguished Paper Award**
Acceptance: 21%

TENET: Memory Safe and Fault-tolerant Persistent Transactional Memory

Madhava Krishnan, Diyu Zhou, Wook-Hee Kim, **Sudarsun Kannan**, Sanidhya Kashyap, Changwoo Min **FAST '23**
USENIX Conference on File and Storage Technologies, 2023
Acceptance Rate: 22.7%

FusionFS: Fusing I/O Operations in Firmware File Systems

Yujie Ren, Jian Zhang, **Sudarsun Kannan** **FAST '22**
USENIX Conference on File and Storage Technologies, 2022
Acceptance Rate: 21.5%

Scale and Performance in a Filesystem Semi-Microkernel

Jing Liu, Anthony Rebello, Yifan Dai, Chenhao Ye, **Sudarsun Kannan**, Andrea & Remzi Arpaci-Dusseau **SOSP '21**
Proceedings of the ACM SIGOPS 28th Symposium on Operating Systems Principle, 2021
Acceptance Rate: 15.5%

Accelerating Filesystem Checking and Repair with pFSCK

David Domingo, **Sudarsun Kannan** **FAST '21**
USENIX Conference on File and Storage Technologies, 2021
Acceptance Rate: 21.5%

Paging and the Address-Translation Problem

Michael A. Bender, Abhishek Bhattacharjee, Alex Conway, Martín Farach-Colton, **Sudarsun Kannan**, **SPAA '21**
William Kuzmaul, Nirjhar Mukherjee, Don Porter, Guido Tagliavini, Janet Vorobyeva, Evan West
Proceedings of the 33rd ACM Symposium on Parallelism in Algorithms and Architectures, 2021
Acceptance Rate: 13.5% (algorithms track)

<i>KLOCs: Kernel-Level Object Contexts for Heterogeneous Memory System</i>	ASPLOS '21
Sudarsun Kannan , Yujie Ren, Abhishek Bhattacharjee Architectural Support for Programming Languages and Operating Systems, 2021 Acceptance Rate: 18.8%	
<i>CrossFS: A Cross-layered Direct-Access File System</i>	OSDI '20
Yujie Ren, Changwoo Min, Sudarsun Kannan 14th USENIX Symposium on Operating Systems Design and Implementation, 2020 Acceptance Rate: 17.5%	
<i>The Need for Precise and Efficient Memory Capacity Budgeting</i>	MEMSYS '20
Shaleen Garg, Manish Parashar, Sudarsun Kannan The International Symposium on Memory Systems, 2020 Acceptance Rate: 21%	
<i>Durable Transactional Memory Can Scale with TimeStone</i>	ASPLOS '20
Madhava Krishnan, Jaeho Kim, Ajit Mathew, Anthony Demeri, Xinwei Fu, Changwoo Min, Sudarsun Kannan Architectural Support for Programming Languages and Operating Systems, 2020 Acceptance Rate: 18.6%	
<i>Read as Needed: Building WiSER, a Flash-Optimized Search Engine</i>	FAST '20
Jun He, Kan Wu, Sudarsun Kannan , Andrea Arpaci-Dusseau, Remzi Arpaci-Dusseau USENIX Conference on File and Storage Technologies, 2020 Acceptance Rate: 16.6%	
<i>Redesigning LSMs for Nonvolatile Memory with NovelSM</i>	ATC '18
Sudarsun Kannan , Nitish Bhat, Ada Gavrilovska, Andrea Arpaci-Dusseau, Remzi Arpaci-Dusseau USENIX Annual Technical Conference, 2018 Acceptance Rate: 20.8%	
<i>Accelerating HPC Workflows with NVRAM-based Transport for Streaming Objects</i>	HPDC '18
Pradeep Fernando, Ada Gavrilovska, Sudarsun Kannan , Greg Eisenhauer 26th Symposium on High-Performance Parallel and Distributed Computing, 2018 Acceptance Rate: 19.6%	
<i>Designing a True Direct-Access File System with DevFS</i>	FAST '18
Sudarsun Kannan , Andrea Arpaci-Dusseau, Remzi Arpaci-Dusseau, Yuangang Wang, Jun Xu USENIX Conference on File and Storage Technologies, 2018 Acceptance Rate: 16.4%	
<i>HeteroOS - OS Design for Heterogeneous Memory Management in Datacenter</i>	ISCA '17
Sudarsun Kannan , Ada Gavrilovska, Vishal Gupta, Karsten Schwan 44th International Symposium on Computer Architecture, 2017 Acceptance Rate: 16.7%	
<i>The Unwritten Contract of Solid State Drives</i>	EuroSys '17
Jun He, Sudarsun Kannan , Andrea Arpaci-Dusseau, Remzi Arpaci-Dusseau European Conference on Computer Systems, 2017 Acceptance Rate: 20.5%	
<i>Reducing Energy Overheads of Memory-based Persistence in NVMs</i>	PACT '16
Sudarsun Kannan , Moinuddin Qureshi, Ada Gavrilovska, Karsten Schwan 25th International Conference on Parallel Architectures and Compilation Techniques, 2016 Acceptance Rate: 32.3%	
<i>Phoenix: Memory Speed HPC I/O with NVM</i>	HiPC '16
Pradeep Fernando, Ada Gavrilovska, Karsten Schwan, Sudarsun Kannan 23rd annual IEEE International Conference on High Performance Computing, Data, and Analytics, 2016	
<i>pVM - Persistent Virtual Memory for Efficient Capacity Scaling and Object Storage</i>	EuroSys '16
Sudarsun Kannan , Ada Gavrilovska, Karsten Schwan European Conference on Computer Systems, 2016 Acceptance Rate: 21.1%	

<i>Reducing the Cost of Persistence for Nonvolatile Heaps in End User Devices</i> Sudarsun Kannan , Ada Gavrilovska, Karsten Schwan 20th International Symposium on High Performance Computer Architecture, 2014 Acceptance Rate: 25%	HPCA '14
<i>Optimizing Checkpoints Using NVM as Virtual Memory</i> Sudarsun Kannan , Ada Gavrilovska, Karsten Schwan, Dejan Milojicic 27th IEEE International Parallel & Distributed Processing Symposium, 2013 Acceptance Rate: 21%	IPDPS '13
<i>Cloud4Home – Enhancing Data Services with @Home Clouds</i> Sudarsun Kannan , Ada Gavrilovska, Karsten Schwan 31st International Conference on Distributed Computing Systems, 2011	ICDCS '11

Reviewed Workshop Publications ([Google Scholar](#))

<i>Context-aware Prefetching for Near-Storage Accelerators</i> Jian Zhang, Marie Nguyen, Sanidhya Kashyap, Sudarsun Kannan USENIX Workshop on Hot Topics in Storage and File Systems, 2024 (To Appear)	HotStorage '24
<i>Towards Application Centric Carbon Emission Management</i> Sudarsun Kannan , Ulrich Kremer Hot Topics in Low-Carbon Computing, 2023	HotCarbon '23
Houjun Tang, Bing Xie, Suren Byna, Philip Carns, Quincey Koziol, Sudarsun Kannan , Jay Lofstead Sarp Oral, <i>Scale and Performance in a Filesystem Semi-Microkernel</i> 6th International Parallel Data Systems Workshop, 2021	PDSW '21
<i>CompoundFS: Compounding I/O Operations in Firmware File Systems</i> Yujie Ren, Jian Zhang, Sudarsun Kannan USENIX Workshop on Hot Topics in Storage and File Systems, 2020	HotStorage '20
<i>MicroMon: A Monitoring Framework for Tackling Distributed Heterogeneity</i> Babar Khalid, Nolan Rudolph, Ramakrishnan Durairajan, Sudarsun Kannan USENIX Workshop on Hot Topics in Storage and File Systems, 2020	HotStorage '20
<i>Can We Containerize Internet Measurements?</i> Christopher Misa, Sudarsun Kannan , Ramakrishnan Durairajan Applied Networking Research Workshop, 2019	ANRW '19
<i>File System Process</i> Jing Liu, Andrea Arpaci-Dusseau, Remzi Arpaci-Dusseau, Sudarsun Kannan USENIX Workshop on Hot Topics in Storage and File Systems, 2019	HotStorage '19
<i>HeteroCheckpoint: Efficient Checkpointing for Accelerator-based Systems</i> Sudarsun Kannan , Naila Farooqui, Ada Gavrilovska, Karsten Schwan 4th Workshop on Fault-Tolerance for HPC at Extreme Scale (in DSN), 2014.	FTXS '14
<i>NVM Heaps for Accelerating Browser-based Applications</i> Sudarsun Kannan , Ada Gavrilovska, Karsten Schwan USENIX Interactions of NVM/Flash with Operating Systems and Workloads, 2013.	INFLOW '13
<i>Using Active NVRAM for I/O Staging</i> Sudarsun Kannan , Ada Gavrilovska, Karsten Schwan, Dejan Milojicic, Vanish Talwar Petascale Data Analytics: Challenges and Opportunities, SC workshop, 2011.	PDAC '11

Awarded Grants and Gifts (Total: \$2.9M)

- o **PI: NSF: CNS Core: Small: Redesigning I/O Across Heterogeneous Systems**, Oct. 2023 - Sept. 2026, Co-PI: Ulrich Kremer (Rutgers), Total: \$591,363 (my share: \$291K)
- o **PI: NSF CICI: TCR: A Unified Monitoring Approach to Enhancing the Security and Resiliency of Hazard Workflows on Heterogeneous Infrastructures**, Oct. 2023 - Sept. 2026, Co-PI: Ulrich Kremer (Rutgers), Thu Nguyen (Rutgers), Shiqing Ma (Univ. Massachusetts, Amherst), Ram Durairajan (University of Oregon), Total: \$1,170,202 (my share:

\$300K)

- **Solo PI:** *Samsung Research Grant - Accelerating Applications for CXL on Linux*, Jan - Dec 2023, Total: \$145,000
- **Solo PI:** *Samsung Research Grant - Disaggregated Storage Services*, 2022 - 2023, Total: \$100,030
- **Solo PI:** *Near-storage Data Processing with CISC I/O*, Google Research Scholar Award, Jan. 2022, Total: \$60,000
- **Co-PI:** *NSF: PPOSS Planning Grant, Efficient Address Translation with Formal Guarantees for Data-Center-Scale Applications*, Oct. 2021 - Sept. 2022, PIs: Martin Farach Colton (Rutgers), Don Porter (UNC Chappel Hill), Michael Bender (Stony Brook), Total: \$250,000 (my share: \$62, 499)
- **Solo PI:** *Samsung Research Grant: Disaggregated Storage Services*, 2021-2022, Total: \$87,000
- **Solo PI:** *NSF: CNS Core Award, File System Offloading*, Oct. 2019 - Sept. 2022, Total: \$499,899

Software Releases

Our work has been open-sourced and referenced in academic and industrial publications. Some projects have transitioned to industry as research patents and evaluation prototypes.

Code release of the MOSAIC project (ASPLOS '23), which introduces theoretical advancements, architectural changes, and OS redesigns to reduce TLB address translation misses. This includes updates to the gem5 simulator, the Linux OS, and an FPGA hash implementation.

Artifact: <https://github.com/oscarlab/mosaic-asplos23-artifacts>

Code release of the OmniCache near-storage caching project (FAST '24), which introduces cross-layered caching across the host and near-storage layers.

Artifact: <https://github.com/RutgersCSSystems/omnicache-fast24-artifacts>

Code release of the CrossPrefetch project (ASPLOS '24), revisiting OS-level prefetching for commodity storage. The code was transferred to the Samsung Memory Systems Lab.

Artifact: <https://github.com/RutgersCSSystems/crossprefetch-asplos24-artifacts>

Code release of the near-storage data processing project, FusionFS (FAST '22), focusing on near-storage data processing through CISC-based instructions.

Artifact: <https://github.com/RutgersCSSystems/FusionFS>

Code release of our parallel File System Checker (pFSCK, FAST '21), showcasing how to parallelize multi-pass parallel file system checkers.

Artifact: <https://github.com/RutgersCSSystems/pFSCK>

Code release of the CrossFS project (OSDI '20), which designs disaggregated file systems spread across the user-level runtime, the OS, and the firmware. It also introduces a new model of file-descriptor parallelism.

Artifact: <https://github.com/RutgersCSSystems/CrossFS>

Code release of the NovelLSM project (USENIX ATC '18), where we redesign persistent key-value stores for nonvolatile memory. **Artifact:** https://github.com/sudarsunkannan/lsm_nvmm

Patents

Collaborative Caching Exploiting Near-Storage Memory

Jian Zhang, **Sudarsun Kannan**, Marie Nguyen

Patent No. Under Processing (joint patent between Rutgers and Samsung)

Systems and methods for heterogeneous storage systems

Sudarsun Kannan, Yujie Ren, Rekha Pitchumani, David Domingo

Patent No. 11928336 (joint patent between Rutgers and Samsung)

System and method for managing queues in systems with high parallelism

Sudarsun Kannan, Yujie Ren, Rekha Pitchumani

Application No. US17/931,061, (joint patent between Rutgers and Samsung)

Cross Storage Prefetching

Sudarsun Kannan, Shaleen Garg, Manish Parashar

Patent No. Under Processing (joint patent between Rutgers and Samsung)

System and method for caching in storage devices

Sudarsun Kannan, Yujie Ren, Rekha Pitchumani

Application No. 17817640 (joint patent between Rutgers and Samsung)

Checkpoint Generation

Sudarsun Kannan, Palo Faraboschi, Murray McLaren, Dejan Milojicic

U.S. Patent, Publication number US20140214770 A1.

Active Non-Volatile Memory Post Processing

Sudarsun Kannan, Dejan Milojicic, Vanish Talwar

U.S. Patent US9619430 (Work done at HP Labs)

System and Method for Installation and Management of Cloud-Independent Multi-Tenant Applications

James E. Donahue, Ricky Ho, **Sudarsun Kannan**, Pradnyesh S. Gore

U.S. Patent US8812627 (Work done at Adobe Labs)

Extended Abstract, Short Papers, and Posters

David Domingo, **Sudarsun Kannan**, Kyle Stratton

Accelerating Filesystem Checking and Repair with pFSCK

USENIX Linux Storage and Filesystems Conference, 2020

Yujie Ren, Changwoo Min, **Sudarsun Kannan**

CrossFS: A Cross-layered Direct-Access File System

Non-volatile Memories Workshop (NVMW), 2021, University of California San Diego.

Changwoo Min, **Sudarsun Kannan**, R.Madhava Krishnan, Jaeho Kim, Ajit Mathew, Anthony Demeri, Xinwei Fu

Durable Transactional Memory Can Scale with TimeStone

Non-volatile Memories Workshop (NVMW), 2020, University of California San Diego.

Sudarsun Kannan, Ada Gavrilovska, Vishal Gupta, Karsten Schwan

HeteroOS - OS Design for Heterogeneous Memory Management in Datacenter

Non-volatile Memories Workshop (NVMW), 2018, University of California San Diego.

Jun He, **Sudarsun Kannan**, Andrea Arpaci-Dusseau, Remzi Arpaci-Dusseau

The Unwritten Contract of Solid State Drives

Non-volatile Memories Workshop (NVMW), 2018, University of California San Diego.

Sudarsun Kannan, Moinuddin Qureshi, Ada Gavrilovska, and Karsten Schwan

Energy Aware Persistence for Nonvolatile Memory

Non-volatile Memories Workshop (NVMW), 2016, University of California San Diego.

Pradeep Fernando, **Sudarsun Kannan**, Ada Gavrilovska, Karsten Schwan

Fast Restarts/Recovery with NVM memory for HPC systems

Non-volatile Memories Workshop (NVMW), 2015, University of California San Diego.

Sudarsun Kannan, Ada Gavrilovska, and Karsten Schwan

Reducing I/O Sandboxing Overheads for Browser-based Applications

Non-volatile Memories Workshop (NVMW), 2013, University of California San Diego.

Sudarsun Kannan, Ada Gavrilovska, and Karsten Schwan

Rich Client Services using Persistent Memory

Non-volatile Memories Workshop (NVMW), 2012, University of California San Diego.

Hrishi Amur, Alex Merritt, **Sudarsun Kannan**, Ada Gavrilovska, and Karsten Schwan

MESSY Library for Memory Consistency on 48 core Intel SCC

Intel Marc Symposium 2011, Hillsboro.

Sudarsun Kannan, Karishma Babu, Ada Gavrilovska, Karsten Schwan

VStore++: Virtual Storage Services for Mobile Devices

International Workshop on Mobile Computing and Clouds, 2010.

Recent Teaching @ Rutgers

CS 519 - Operating Systems Theory

Fall 2023

Instructor Rating: 4.43 on 5, Course Rating: 4.34 on 5

CS 416/518 - Operating Systems Design

Spring 2023

Instructor Rating: 4.3 on 5, Course Rating: 4.3 on 5

CS 416/518 - Operating Systems Design

Fall 2022

Instructor Rating: 4 on 5, Course Rating: 4.2 on 5

CS 519 - Operating Systems Theory Fall 2021

Instructor Rating: 4.8 on 5, Course Rating: 4.6 on 5

CS 416 - Operating Systems Design Spring 2021

Instructor Rating: 4 on 5, Course Rating: 4 on 5

CS 519 - Operating Systems Theory Fall 2020

Instructor Rating: 4.6 on 5, Course Rating: 4.4 on 5

CS 416 - Operating Systems Design Spring 2020

Instructor Rating: 4.27 on 5, Course Rating: 4.40 on 5

CS 519 - Operating Systems Theory Fall 2019

Instructor Rating: 4.64 on 5, Course Rating: 4.45 on 5

CS 416 - Operating Systems Design Spring 2019

Instructor Rating: 4.21 on 5, Course Rating: 4.05 on 5

CS 519 - Operating Systems Theory Fall 2018

Instructor Rating: 4.17 on 5, Course Rating: 4.33 on 5

Rutgers and CS Departmental Services

Spring 2021-2024: Faculty Recruitment Committee

Spring 2023 - Present: M.S. Advising Committee

Spring 2019 - Present: Graduate Committee (Admissions, Curriculum, Scholarships, Awards, Ph.D. Visit)

Fall 2018 - Current: Rutgers Honors Faculty Mentor

Fall 2018 - Summer 2019: Faculty Recruitment Committee

Fall 2019 - Spring 2020: Graduate Committee

Fall 2018 - Current: Systems Reading Group Organizer

Graduated Doctoral Advisees

Dr. Yujie Ren, Ph.D., First Appointment: Postdoc at EPFL Fall 2018-2023

Thesis: Toward Scalable and High-Performance I/O with Cross-layered Storage Design

Doctoral Student Advisees

David Domingo; Thesis: Storage Scheduling; Joined Fall 2018; Post Qualifier; Expected graduation: Fall '24

Jian Zhang; Thesis: CXL and Smart Storage; Joined Fall '20; Post Qualifier; Expected graduation: Fall '24

Lingfeng He; Thesis: Memory-centric Computing, Joined Fall '23, Pre Qualifier; Expected graduation: Spring '28

Shaleen Garg; Thesis: Data Prefetching, Joined Fall '19; Post Qualifier; Expected graduation: Fall '25 (on leave for startup)

Linjie Ma; Program start: Fall '24

Minrui Tian; Program start: Fall '24

Devon Lewis; Program start: Fall '24

Haoyu Li (co-advised with Ulrich Kremer); Program start: Fall '24

Long Tran (co-advised with Ulrich Kremer); Program start: Fall '24

M.S. and Other Graduate Advisees

Abhilash Jayashankar Nambissan (M.S. Thesis) Near-memory Data Processing Fall 2024 - Current

Laksh Kotain, Distributed Transactions Spring 2024

Saumya Sachdev, Distributed Transactions Spring 2024

Krishnan Gosakan, Virtual Memory Redesign (MOSAIC project), First Appointment: AMD Research Fall 2021- 2023

Sreeram Maddineni, Distributed Cloud Monitoring, First Appointment: Amazon Inc. Fall 2019-2020

Jae Woo Joo, Heterogeneous Memory Management, Appointment: Amazon Inc. Fall 2018 - Spring 2019

Undergraduate Mentoring

Sumanta Das, Junior, Deep Learning Recommendation - Aresty Research Fall 2024

Atharva Patil, Senior, Address Santizers - Aresty Research Fall 2023

Daniel Elwell, Junior, Optimizing Recommendation Systems - Aresty Research Fall 2023

Rohit Rao, Senior, Deep Learning Recommendation Systems - Aresty Research	Fall 2023
Benjamin Wiggins, Junior, Nearest Neighbor Search - Aresty Research	Fall 2023
Paul John, Senior, Heterogeneous Storage Management	Spring 2023
Vaishnavi Mathena, Senior, Memory Efficiency and Compression	Summer 2021
Kyle Stratton, Senior, File System Reliability	Spring 2019-Fall 2019

PhD Defense Committee

Yujie Ren, Fall 2023, Heterogenous Storage Management
 Alex Conway, Spring 2020, Understanding Dictionaries at the Intersection of Theory and Practice
 Shaohua Duan, Spring 2020, Addressing Fault Tolerance for Staging-Based Scientific Workflows
 Adarsh Yoga, Fall 2019, Parallelism-Driven Performance Analysis Techniques for Task Parallel Programs
 Zi Yan, Fall 2018, Virtual Memory for Next-Generation Tiered Memory Architectures

PhD Qualification Committee

David Domingo, September 2023
 Shaleen Garg, May 2023
 Jianchao Ji, April 2023
 Jian Zhang, December 2022
 Hailun Ding, December 2022
 David Pham, April 2021
 Kun Wang, April 2020
 Shaohua Duan, Spring 2019
 Xun Zhang, May 2019
 Pengxiang Xu, April 2019
 Mohammadreza Soltaniyeh, January 2019

Recent Panels - Conference and Journal Services

2025 - Program Committee - USENIX Conference on Operating Systems Design and Implementation (OSDI)
 2025 - Program Committee - USENIX Conference on File and Storage Technologies (FAST)
 2024 - Program Committee - 30th ACM Symposium on Operating Systems Principles (SOSP)
 2024 - Program Committee (ERC) - IEEE/ACM International Symposium on Microarchitecture (MICRO)
 2024 - Program Committee - USENIX Conference on Operating Systems Design and Implementation (OSDI)
 2024 - Program Committee - USENIX Conference on File and Storage Technologies (FAST)
 2024 - Program Committee - Architectural Support for Programming Languages and Operating Systems (ASPLOS)
 2023 - Program Committee - Architectural Support for Programming Languages and Operating Systems (ASPLOS)
 2023 - Program Committee - USENIX Annual Technical Conference (USENIX ATC)
 2023 - Program Committee - USENIX Conference on File and Storage Technologies (FAST)
 2022 - Program Co-Chair - ACM Workshop on Hot Topics in Storage and File Systems (HotStorage)
 2022 - Program Committee - USENIX Conference on File and Storage Technologies (FAST)
 2021 - National Science Foundation - Review Panel for Research Proposals (NSF)
 2021 - Swiss National Science Foundation - Review Panel for Research Proposals (SNSF)
 2021 - Program Committee - USENIX/ACM Workshop on Hot Topics in Storage and File Systems (HotStorage)
 2021 - Program Committee - 12th Annual Non-Volatile Memories Workshop (NVMW)
 2021 - Area Chair - Journal of Systems Research (JSys) - Active Storage Area
 2021 - Program Committee - 14th ACM International Systems & Storage Conference (Systor)
 2020 - Program Committee - USENIX Workshop on Hot Topics in Storage and File Systems (HotStorage)
 2020 - Program Committee - USENIX Annual Technical Conference (USENIX ATC)
 2020 - Program Committee - International Parallel & Distributed Processing Symposium (IEEE IPDPS)
 2019 - Best Paper Award Committee - 10th Annual Non-Volatile Memories Workshop (NVMW)
 2019 - Session Chair - 10th Annual Non-Volatile Memories Workshop (NVMW)
 2019 - Review Panel - National Science Foundation - Scalable Parallelism in the Extreme
 2019 - Program Committee - USENIX Annual Technical Conference (USENIX ATC)
 2019 - Extended Review Committee - 46th International Symposium on Computer Architecture (ISCA)

2019 - Program committee - IEEE International Conference on Cloud Engineering (IC2E)
 2019 - Program committee - 35th International Conference on Massive Storage Systems and Technology (MSST)
 2019 - Program committee - 10th Annual Non-Volatile Memories Workshop (NVMW)
 2018 - Reviewer - IEEE Computer Architecture Letters (CAL)
 2017 - Program committee - 46th International Conference on Parallel Processing (ICPP) 2017 - Reviewer - IEEE Transactions on Computers (TC)
 2017 - Shadow PC committee - European Conference on Computer Systems (EuroSys) 2017 - Reviewer - Science of Computer Programming
 2016 - Shadow PC committee - European Conference on Computer Systems (EuroSys)
 2016 - Reviewer - IEEE Computer Architecture Letters (CAL)
 2016 - Reviewer - IEEE Transactions on Computers (TC)
 2014 - Reviewer - IEEE Transactions on Cloud Computing (TCC)
 2012 - Reviewer - IEEE Transactions on Parallel and Distributed Systems (TPDS)

Teaching Before 2018

Guest Lecturer, UW-Madison

CS 461 - Advanced Operating Systems, Fault tolerance and recovery Spring 2017

Guest Lecturer, UW-Madison

CS 461 - Distributed Systems, Logical clocks, SSD storage Fall 2017

Head Teaching Assistant, Georgia Tech

CS 3210 - Undergraduate OS Introduction, Lectures, project design, grading Spring 2016

Guest Lecturer, Georgia Tech

CS 3210, Undergraduate OS Introduction, OS memory management, synchronization Spring 2015

Guest Lecturer, Georgia Tech

CS 6210 - Advanced OS, OS memory management, synchronization, virtualization Fall 2014

Teaching Assistant, Georgia Tech

CS 4210 - Graduate OS Introduction, Lectures, project design and grading Fall 2012

Student Mentoring Before Rutgers

Tanvi Bhagwat, BS Student at UW-Madison Summer 2018- Fall 2018
 Device-level file system

Abigail Matthews, BS Student at UW-Madison Summer 2018- Fall 2018
 Device-level file system

Tianyi Shan, BS Student at UW-Madison Summer 2018- Fall 2018
 Device-level file system

Hakan Memisoglu, Ph.D. Student at UW-Madison Fall 2017- Fall 2018
 Optimizing file system for fast storage

Pradeep Fernando, Ph.D. Student at Georgia Tech Fall 2015- Fall 2018
 Resilience in HPC applications and other topics

Thaleia-Dimitra Doudali, Ph.D. Student at Georgia Tech Spring 2016
 Resource allocation in Cloud

Andrea Hu, BS Student at Georgia Tech Spring 2016
 Graph analytics and storage performance

Albert, BS Student at Georgia Tech Spring 2016
 Persistent memory durability overheads

Nitish Bhatt, MS Student at Georgia Tech (now at VMWare) 2016
 NoSQL database on new memory technologies

Amaro Emmanuel, MS Student at Georgia Tech, (Ph.D. Student, U.C. Berkeley) Spring 2015
 Reducing virtualization system call cost

Preethi Sreenivasan, MS Student at Georgia Tech, (now at Amazon) Summer 2015
 Architectural analysis of thin clients

Ravi Mangal, Ph.D. Student at Georgia Tech

Spring 2011

Virtual storage for @home cloud

Sasi Siddharth, MS Student @ Georgia Tech, (now at HP)

Spring 2011

Virtual storage for @home cloud

Select Recent Talks

- Cross-layered Operating Systems, University of Chicago, Remote, April 2024
- Cross-layered Operating Systems, University of Illinois, Urbana Champaign, March 2024
- Near-storage Collaborative Caching, Samsung Memory Systems Lab, Online, Feb 2024
- Cross-layered I/O Prefetching, Samsung Memory Systems Lab, November 2023
- Rethinking I/O in the world of heterogeneous memory and storage, NSF CSR PI Workshop, Durham, October 2023
- Towards Application Centric Carbon Emission Management, Hot Carbon Workshop, Boston, July 2023
- Redesigning Systems for Heterogeneity, Invited Talk, University of Waterloo, November 2021 (Virtual)
- Heterogeneous Memory Management and Beyond, Keynote, Heterogeneous Memory Workshop, July 2021 (Virtual)
- Kernel Objects for Heterogeneous Memory, ASPLOS April. 2021 (Virtual)
- Micro-monitoring in Datacenters, HotStorage, July 2020 (Virtual)
- Device-level File Systems, Aug. 2018, Longmont Colorado, Seagate Technology.
- Persistent Memory Key-Value Store, Oct. 2018, Durham, North Carolina, NetApp Inc
- Device-level File Systems, FAST, Feb. 2018, Oakland.
- Designing Operating Systems for Heterogeneous Systems, Feb. 2018 - April 2018, University of Arizona, North Carolina State University, University of Waterloo, Penn State University, George Washington University, University of California, Santa Barbara, University of Oregon, University of Virginia, Rutgers University, University of California, Santa Cruz, University of Massachusetts - Amherst, University of Minnesota - Twin Cities, Stony Brook University
- OS design for Heterogeneous Memory Management in Datacenter, ISCA June 2017, Toronto.
- Reducing Energy Overheads of Memory-based Persistence in NVMs, PACT, Sep. 2016, Haifa.
- Persistent Virtual Memory for Capacity Scaling and Object Storage, EuroSys, Mar. 2016, London.
- Heterogeneous Memory Management, Univ. of Wisconsin-Madison, May 2016, Madison.
- Energy Aware Persistence, NVMW, March 2016, Univ. of Sand Diego
- Reducing the Cost of Persistence for Nonvolatile Heaps, HPCA, Feb. 2014, Orlando.
- NVM for Rich Client Services, Intel Labs, Aug 2013, Hillsboro, Oregon.
- Optimizing Checkpoints Using NVM as Virtual Memory, IPDPS, June 2013, Boston.
- NVM Heaps for Accelerating Browser-based Applications, INFLOW (SOSP Workshop), Nov. 2013, Pennsylvania.
- Using Active NVRAM for I/O Staging, PDAC, Nov. 2011 (SC Workshop), Seattle.
- Active NVRAM for in-memory processing, HP Labs, Aug. 2011, Palo Alto.
- Cloud4Home – Enhancing Data Services with @Home Clouds, ICDCS, June 2011, Minneapolis.

Industrial Experience Details

Intel Labs, System Architecture Lab, Hillsboro

May 2013 - Aug 2013

Research Intern with Dr. Sanjay Kumar

studied the impact of Intel Optane on end-user applications and low-power processors. The application and results were used by Intel researchers, and our papers were published in INFLOW 2013, HPCA 2014, and CAL 2015.

HP Labs, Intelligent Infrastructure Lab, Palo Alto

May 2012 - Aug 2012

Research Intern with Dr. Dejan Milojicic

I designed HPC resilience mechanisms using NVM as virtual memory. The results were published in our well-cited IPDPS 2013 paper and a US patent.

HP Labs, Intelligent Infrastructure Lab, Palo Alto

May 2011 - Aug 2011

Research Intern with Dr. Dejan Milojicic, Dr. Partha Ranganathan, Dr. Vanish Talwar

I researched and designed techniques for NVM in-memory processing. Results were published as two workshop papers and an industrial patent.

Adobe Labs, Advanced technology Labs, San Jose

May 2010 - Aug 2010

Research Intern with Dr. Jim Donahue

Along with my mentor, I developed an elastic public cloud application deployment framework, which is patented and used across Adobe cloud services.

Research in Motion, OS development, Fort Lauderdale, Florida

May 2009 - Aug 2009

OS intern

I developed OS-level live-debugging tools for Blackberry's OS.

I|Nautix Technologies, Trading Platform Development, Chennai

May 2005 - July 2008

Senior Application Developer

I was one of five architects designing the next-generation latency-critical trading platform (www2.netx360.com) for the Bank of New York, which is used by over 100,000 registered representatives. We developed a dynamic code compilation runtime technique for just-in-time deployment.