Vinay S Banakar

#4570, Dept. of Computer Science
1205 University Ave, Madison, WI 53706

vin@cs.wisc.edu
www.vinaybanakar.com

Education

University of Wisconsin-Madison — Advisors: Andrea Arpaci-Dusseau & Remzi Arpaci-Dusseau
Ph.D in Computer Science — *2020 (ongoing)*
M.S. in Computer Science — *2020 - 2023*

PES University — *2013-2017*
B.E in Computer Science and Engineering

Publications

[1] **Address-Space-Engineered Data Structures for Memory Efficiency** — *Under submission*
Vinay Banakar et al.

[2] **Tidying Up the Virtual Address Space** — *DIMES'25*
Vinay Banakar, Suli Yang, Kan Wu, Andrea Arpaci-Dusseau,
Remzi Arpaci-Dusseau, and Kimberly keeton

[3] **WiscSort: External Sorting for Byte-Addressable Storage** — *VLDB'23*
Vinay Banakar, Kan Wu, Yuvraj Patel,
Kimberly keeton, Andrea Arpaci-Dusseau, and Remzi Arpaci-Dusseau

[4] **Understanding and Benchmarking the Impact of GDPR on Database Systems** — *VLDB'20*
Supreeth Shastri, *Vinay Banakar*, Melissa Wasserman,
Arun Kumar, and Vijay Chidambaram

[5] **CIED - Rapid Composability of Rack Scale Resources Using Capability Inference Engine Across Datacenters** — *IEEE Infra'20*
Vinay Banakar, Pavan Upadhya, and Maneesh Keshavan

[6] **Analyzing the Impact of GDPR on Storage Systems** — *ACM HotStorage'19*
Vinay Banakar, Aashaka Shah, Supreeth Shastri,
Melissa Wasserman, and Vijay Chidambaram

PATENTS

[1] **Intent driven hardware placement using rack capability inference engine across datacenters**, *2019* — *US20210014998A1*
Vinay Banakar, Pavan Upadhya, and Maneesh Keshavan

[2] **Intelligent orchestration of disaggregated applications based on class of service**, *2019* — *US20200249999A1*
Tom Golway, *Vinay Banakar*,and *Sandeep Panda*

[3] **Preemptive compatibility failure detection using graph structure learning in datacenters**, *2018* — *US10938623B2*
Vinay Banakar, Pavan Upadhya, and Maneesh Keshavan

[4] **Topology based root cause triangulation of hardware issues** — *US10831587B2*
Pavan Upadhya, Maneesh Keshavan, Naveena Kedlaya, and *Vinay Banakar*

Recent projects

- *Vector FileSystems*: Developing native support for storing and queering multi-modal embeddings of raw data blocks. Enables semantic-aware block layouts for high performance and improved reliability.
- *OCC hierarchical validation*: Designed a new hierarchical validation scheme for databases that use optimistic concurrency control [Fall'22].
- *Disaggregated-PM aware datastructures*: Explored the performance v/s functionality trade-offs and skewed read/write performance of a disaggregated-PM architecture by implementing a B+-tree and distributed external sort over InfiniBand RDMA [Fall'21].

- *RecoverKV*: Strongly consistent, partition tolerant Key-Value store built in Go using quorum protocol [Spring'21].
- *AutoTune*: Optimizing Linux IO scheduler and memory allocator parameters using Bayesian Optimization.
- *TLB optimization*: Reduced IPI queuing delay by 2x in Linux kernel by optimizing TLB invalidation across multiple cores. Resulting in efficient page evictions to swap (SSD) or disaggregated memory.

Teaching Experience

- *CS739*: Distributed Systems — TA (UW Madison, Spring 2022)
- *CS537*: Operating Systems — TA (UW Madison, Fall 2021)
- *ECE252*: Computer Organization — TA (UW Madison, Spring 2021)
- *CS220*: Data Science Programming — TA (UW Madison, Fall 2020)

Research & Industry Experience

Google
Student Researcher
Systems Research Group
Summer 2023 - Present

Advisor: *Dr. Kimberly Keeton*
- Developed ML models to improve memory efficiency and reliability in Borg.
- Built a compiler-runtime system, for hot/cold object separation within application address spaces. Achieved up to 70% memory footprint reduction.
- Developed a framework to help optimize memory tiering for Spanner using LLVM program analysis and TcMalloc allocation hints.

UW Madison
Research Assistant
Advanced Systems Lab
Summer 2021 - Present

Advisors: *Prof. Andrea Arpacı-Dusseau* and *Prof. Remzi Arpacı-Dusseau*
Designed *WiscSort*, a high-performance concurrent sorting system for byte-addressable storage that is 7x faster than state-of-the-art. Bridging the semantic gap between application and kernel memory management to achieve peak memory efficiency through dynamic layout optimization.

Microsoft
Research Assistant
Gray Systems Lab
Spring 2023

Advisor: *Dr. Jesús Camacho Rodríguez*
- Investigated new HTAP designs for CXL memory and storage devices.
- Extended SCAN, JOIN, and SORT operations to support persistent memory.
- Optimized DB operations to exploit hardware heterogeneity.

HPE RnD Labs
Senior Systems Engineer
2017-2020

Advisors: *Dr. Kimberly Keeton*
Developed applications for disaggregated persistent Fabric Attached Memory (*openFAM*) to evaluate it against traditional cluster-based HPC programming models (*openSHMEM and MPI*). Also, built features for large scale datacenter management software (OneView) and developed Redfish compliant server hardware simulator.

UT Austin
Research Fellow
Systems and Storage Lab
2018-2019

Advisor: *Prof. Vijay Chidambaram*
- Demonstrated the pitfalls of retrofitting existing systems to comply with GDPR. Modified Redis, Postgres, etc to showcase feasible alternatives.
- Built GDPRBench, a benchmark that lets user to assess compliance level of storage systems and help evaluate compliance-performance tradeoff.

HPE RnD Labs
Research intern
2017

Implemented a virtual host simulation platform that mimics ESXi instances as hosts in VMware vCenter clusters. Scaled up to 1000+ simulated hosts that were leveraged for performance evaluation in OneView.

Awards and Accomplishments

- *SOSP 2024, VLDB 2023 Student Travel Grant*
- *Silver award* for innovation at Hewlett Packard Enterprise, 2020
- First prize at *8th IEEE conference on Cloud Computing in Emerging Markets*, 2019.
- Second place at Open hack 2016 and SimpliHack 2015.

Service

- Program committee: *HPE TechCon'20, IEEE HiPC (2024, 2025), EuroSys'25 (shadow), IPDPS'25*
- Artifact evaluation review Committee: *ASPLOS 2020, SOSP 2019*
- Book Contribution: *Effective Cybersecurity - Understanding and Using Standards and Best Practices.*
- Open source contributions: *Apache Ratis, Postgresql and YCSB*