Midhul Vuppalapati

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Research Interests

- Operating Systems, Computer Architecture, Storage Systems, Distributed Systems, Computer Networks.

Education

- **Cornell University** — **GPA: 4.0/4.0**
  PhD in Computer Science — *2019–Present*
  Advisor: Prof. Rachit Agarwal
- **Indian Institute of Technology (IIT) Guwahati** — **CGPA: 9.13/10**
  B.Tech Computer Science and Engineering — *2013–2017*
  Minor in Engineering Physics

Experience

- **Samsung Semiconductor Inc.** — **San Jose**
  Intern, Memory Solutions Lab (MSL) — *May 2021 - Aug 2021*
- **Microsoft Research India** — **Bangalore**
  Research Fellow, Systems group — *July 2017 - July 2019*
  Mentor: Dr. Muthian Sivathanu
- **Microsoft India R&D Pvt Ltd** — **Hyderabad**
  Software Engineering Intern, Search Technology Center — *May 2016 - July 2016*

Honors & Awards

- Received **Outstanding TA Award** from Cornell CS for CS 4410 (Operating Systems), Fall 2021
- Received **Outstanding TA Award** from Cornell CS for CS 4450 (Computer Networks), Spring 2021
- Received **Cornell University Fellowship** 2019-2020
- Received **Best Poster Award** at COMSNETS 2017
- Shortlisted for the **Aditya Birla Group Scholarship** 2013 among 27 students from all over India
- Selected for the **KVPY Fellowship** 2012, Dept. of Science & Technology, Govt. of India

Publications

- **Karma: Resource Allocation for Dynamic Demands** [Link]
  Midhul Vuppalapati, Giannis Fikioris, Rachit Agarwal, Asaf Cidon, Anurag Khandelwal, Éva Tardos
  USENIX OSDI 2023
- **NetChannel: Disaggregating the Host Network Stack** [Link]
  Qizhe Cai, Midhul Vuppalapati, Jaehyun Hwang, Christos Kozyrakis, Rachit Agarwal
  ACM SIGCOMM 2022
- **Shortstack: Distributed, Fault-tolerant, Oblivious Data Access** [Link]
  Midhul Vuppalapati, Kushal Babel*, Anurag Khandelwal, Rachit Agarwal*
  USENIX OSDI 2022
- **Understanding Host Network Stack Overheads** [Link]
  Qizhe Cai, Shubham Chaudhary, Midhul Vuppalapati, Jaehyun Hwang, Rachit Agarwal
  ACM SIGCOMM 2021

- **Rearchitecting Linux Storage Stack for us latency and High Throughput** [Link]
  Jaehyun Hwang, Midhul Vuppalapati, Simon Peter, Rachit Agarwal
  USENIX OSDI 2021
- **Building an Elastic Query Engine on Disaggregated Storage** [Link]
  Midhul Vuppalapati, Justin Miron, Rachit Agarwal, Dan Truong, Ashish Motivala, Thierry Cruanes
  USENIX NSDI 2020
- **INSTalytics: Cluster Filesystem Co-design for Big-data Analytics** [Link]
  Muthian Sivathanu, Midhul Vuppalapati, Bhargav Gulavani, Kaushik Rajan, Jyoti Leeka, Jayashree Mohan & Piyus Kedia
  USENIX FAST 2019 (***Fast-tracked*** to ACM Transaction on Storage 2020)

Selected Research Projects

- **Understanding host memory contention with high-speed peripheral traffic** *May 2022 - Present*
  Worked on building an in-depth understanding of performance degradation trends recently observed in production datacenters when memory traffic from CPU cores and high-speed peripherals contend for shared host memory bandwidth. Devised a principled explanation for these trends, and quantitatively validated it on real Intel servers using a novel analytical formula that connects measurements from low-level hardware counters to the observed end-to-end performance degradation.
- **Rearchitecting OS storage stack for µs latency and high throughput** *Feb 2020 - May 2021*
  Worked on a new Linux storage stack architecture which demonstrates that it is possible to achieve both µs-scale latency and high throughput on top of Linux (without changing applications, network stack, and kernel CPU scheduler). Our design adapts ideas from classical networking literature, and can achieve these goals even with 10s of co-located applications. Published in OSDI'21.
- **Revisiting resource allocation for dynamic user demands** *May 2020 - Mar 2022*
  Developed a new resource allocation algorithm which, under dynamic (time-variable) user demands, provides strong theoretical guarantees related to Pareto efficiency, strategy-proofness, and fairness using a novel credit-based mechanism. Integrated the algorithm into an elastic memory system, and validated its effectiveness through evaluation on traces from production workloads. Published in OSDI'23.
- **Scalable & fault-tolerant access pattern hiding** *Sep 2019 - Dec 2021*
  Designed and implemented the first distributed proxy architecture that achieves system availability and proxy scalability while hiding storage access patterns from an honest-but-curious adversary. Evaluation demonstrated near-perfect linear scalability. Published in OSDI'22.
- **Co-designing compute & storage layers for big-data analytics** *July 2017 - July 2019*
  Worked on improving efficiency of large scale (100TB+) big-data analytics processing by co-designing the Analytics engine/framework with the underlying Storage System. Key techniques include a novel replication scheme that enables heterogeneous data partitioning and coordinated request scheduling to minimize I/O during data shuffles. Implemented the design on top of Microsoft's Internal Big Data stack (handles exabytes in production), and evaluated on a 500 machine cluster. Published in FAST'19.

Graduate Coursework

Advanced Systems, Algorithms, Advanced Artificial Intelligence

Teaching Experience

- Head TA, CS 4410 (Operating Systems), Fall 2021
- Head TA, CS 4450 (Computer Networks), Spring 2021
- TA, CS 4450 (Computer Networks), Spring 2020