

Anup Agarwal

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Research Interests Networked Systems, Performance Modeling/Verification, Measurement, Programmable Networks

Education

- **Carnegie Mellon University** 2019–Present
Ph.D. in Computer Science
Advisor: Prof. Srinivasan Seshan
- **Carnegie Mellon University** 2019–2022
Master of Science in Computer Science - Research
Advisor: Prof. Srinivasan Seshan
- **Indian Institute of Technology Guwahati** 2015–2019
B.Tech in Computer Science and Engineering
GPA: 9.94/10

Awards, Honors and Grants

- Travel Grant, USENIX NSDI 2022 2022
- **President of India Gold Medal** at IIT Guwahati 2019
Awarded for highest GPA in my cohort across all departments.
- **Institute Merit Scholarship (IMS)** at IIT Guwahati 2016–2018
Awarded for highest GPA for the corresponding year in my department.

Publications

1. Unlocking unallocated cloud capacity for long, uninterruptible workloads
Anup Agarwal, Shadi Noghahi, Íñigo Goiri, Srinivasan Seshan, Anirudh Badam.
USENIX NSDI 2023 (to appear)
2. Towards automating network heuristic design and analysis
Anup Agarwal, Venkat Arun, Devdeep Ray, Ruben Martins, Srinivasan Seshan.
ACM HotNets 2022 (to appear)
3. HeteroSketch: Coordinating Network-wide Monitoring in Heterogeneous and Dynamic Networks
Anup Agarwal, Zaoxing Liu, Srinivasan Seshan.
USENIX NSDI 2022
4. Virtual Battery: Redesigning Cloud Computing for Renewable Energy.
Anup Agarwal*, Jinghan Sun*, Shadi Noghahi, Srinivasan Iyengar, Anirudh Badam, Ranveer Chandra, Srinivasan Seshan, Shivkumar Kalyanaraman.
ACM HotNets 2021 * denotes equal contribution
5. Sketchy With a Chance of Adoption: Can Sketch-Based Telemetry Be Ready for Prime Time?
Zaoxing Liu, Hun Namkung, **Anup Agarwal**, Antonis Manousis, Peter Steenkiste, Srinivasan Seshan, Vyas Sekar.
IEEE TaPoPF Workshop 2021
6. ABC: A Simple Explicit Congestion Control Protocol for Wireless Networks
Prateesh Goyal, **Anup Agarwal**, Ravi Netravali, Mohammad Alizadeh, and Hari Balakrishnan.
USENIX NSDI 2020

7. Opportunistic Sensing with Mic Arrays on Smart Speakers for Distal Interaction and Exercise Tracking

Anup Agarwal, Mohit Jain, Pratyush Kumar, Shwetak Patel.
IEEE ICASSP 2018

Posters

- Network-wide Monitoring over Heterogeneous Devices
Anup Agarwal, Zaoxing Liu, and Srinivasan Seshan.
USENIX NSDI 2020

Industry Experience & Internships

- **Intern (Part time), Microsoft Research** Summer 2021
Network Research Group & Research for Industry Redmond, WA (Virtual)
Shadi Noghabi, Anirudh Badam

We investigated ways to build data centers powered by renewable energy sources (e.g., wind, solar). We leverage predictability of renewable power (weather), and complementary power production of geographically separated renewable farms to schedule/migrate workloads and effectively manage renewable power variations.

- **Intern, Microsoft Research** Summer 2020
Azure Global Research Team Redmond, WA (Virtual)
Anirudh Badam, Íñigo Goiri, Ranveer Chandra

A significant amount of resources remain unused in cloud environments as these are provisioned for peak demand. Harvest virtual machines (HVMs) expose unused resources by growing and shrinking in capacity as demand changes. I developed a system to schedule jobs over these dynamic HVMs by building statistical models of the harvested resource capacity. Our approach improves mean and tail (90th percentile) job completion time by 27% and 44% respectively.

- **Intern, Tower Research Capital** Summer 2019
Developer Tools Team Gurugram, India

- Built CI/CD pipeline for internal packages managed by conda.
- Fixed concurrency issues in conda.

- **Intern, Massachusetts Institute of Technology** Summer 2018
Prateesh Goyal, Prof. Ravi Netravali, Cambridge, MA
Prof. Hari Balakrishnan, Prof. Mohammad Alizadeh

Implemented *Accel Brake Control* (ABC), an explicit congestion control protocol for wireless networks, atop OpenWRT (Linux-based build system for WiFi routers). We developed a novel method to estimate link capacity, leveraging 802.11n protocol internals. Our scheme achieved 30–40% higher throughput and $2.2\times$ lower delays than Cubic+Codel, BBR, PCC, and Copa.

- **Intern, IBM India Research Lab** Summer 2017
Mohit Jain, Prof. Pratyush Kumar, Prof. Shwetak Patel Bengaluru, India

Leveraged the beam-forming capabilities of a microphone array to enable distal multi-user interaction and exercise recognition. I exploit the Doppler-shifts in an ultrasonic pilot tone to track moving objects. Our system recognizes 10 exercises with 96% accuracy at 3 to 5 meters distance (beyond the range of state-of-the-art systems).

Projects

- **Towards automating design and analysis of network heuristics** 2021–Present
Venkat Arun, Devdeep Ray, Prof. Ruben Martins, Prof. Srinivasan Seshan

I am building tools to synthesize robust heuristics and critically reasoning about their performance, considering subtle interactions between system components, workloads

and environments. I formulate reasoning questions as $\exists\forall$ formulas and solve them using counterexample guided inductive synthesis. For congestion control, we are able to reproduce several known algorithms and synthesize novel algorithms that provably achieve high utilization and bounded delay on networks with variable link rate, jitter, and unknown buffering. Existing algorithms fail to provide such guarantees.

- **HeteroSketch: Coordinating Network-wide Monitoring in Heterogeneous and Dynamic Networks** 2019–2021

Prof. Zaoxing (Alan) Liu, Prof. Srinivasan Seshan

I built a system to efficiently leverage programmable networking infrastructure for monitoring tasks. I built: (a) Automated Profiler, to quantify capabilities of arbitrary hardware and predict their performance for sketch-based monitoring, and (b) Optimizer, to conduct placement of monitoring tasks and resource allocation of devices while considering heterogeneous device capabilities. Our system reduces resource overheads by 20–30% and scales to $> 40,000$ devices.

Patents

- **Multi User Interaction with Audio Devices using Speech and Gestures**
Mohit Jain, Pratyush Kumar, **Anup Agarwal** [Granted, US10928917B2]
- **Exercise Monitoring and Coaching using Audio-only Devices**
Mohit Jain, Pratyush Kumar, **Anup Agarwal** [Pending, US20200114206A1]

Teaching

- **Teaching Assistant**, Carnegie Mellon University
15-440/640. Distributed systems Spring 2022

Initiatives

- **PhD Mentorship Program** 2022–Present
Computer Science Department at CMU
 - Started a new mentoring program for the department, where pods of PhD students learn from each other.
 - Manage and organize events for boosting participation.