VENKAT ARUN

Contact: venkatar@mit.edu, +1 669-214-0095 **Webpage:** people.csail.mit.edu/venkatar

RESEARCH INTEREST AND VISION

Today's networked systems perform well most of the time, but not all the time. A key reason for this is that they use heuristics whose behavior is poorly understood. I use automated reasoning in new ways to enhance human ability to understand the behavior of widely deployed heuristics. My tools prove performance properties of network heuristics and uncover unexpected ways in which they fail in the real world. I have applied this technique to many areas with the bulk of my work focusing on congestion control. Going forward, I will use this approach to design systems that are provably performant and robust.

EDUCATION

Massachusetts Institute of Technology (MIT) *2019-Present*
Ph.D. Student in Dept. of EECS
Advisors: Hari Balakrishnan and Mohammad Alizadeh

Massachusetts Institute of Technology (MIT) *2017-2019*
Master of Science, Dept. of EECS
Advisors: Hari Balakrishnan and Mohammad Alizadeh

Indian Institute of Technology Guwahati (IIT-G) *2013-2017*
B.Tech. in Computer Science & Engineering
President of India Gold Medal

INDUSTRTY IMPACT

1. Meta uses my congestion control algorithm (CCA), Copa [3], for live video uploads
2. Meta uses a my modification to BBR [2] (a CCA designed by Google) for a vast majority of their user-facing traffic

PUBLICATIONS

1. *Starvation in End-to-End Congestion Control*
   Venkat Arun, Mohammad Alizadeh, Hari Balakrishnan
   ACM SIGCOMM 2022
   Best Student Paper Award
   https://dl.acm.org/doi/10.1145/3544216.3544223

2. *Toward Formally Verifying Congestion Control Behavior*
   Venkat Arun, Mina Arashloo, Ahmed Saeed, Mohammad Alizadeh, Hari Balakrishnan
   ACM SIGCOMM 2021
   Being used at Meta
   https://dl.acm.org/doi/10.1145/3452296.3472912

3. *Copa: Practical Delay-Based Congestion Control for the Internet*
   Venkat Arun, Hari Balakrishnan
   USENIX NSDI 2018
   Being used at Meta
   https://web.mit.edu/copa/

4. *RFocus: Practical Beamforming for Small Devices*
   Venkat Arun, Hari Balakrishnan
   USENIX NSDI 2020
   Largest antenna array ever used for a single communication link
   https://people.csail.mit.edu/venkatar/rfocus.html

5. *Finding Safety in Numbers with Secure Allegation Escrows*
   Venkat Arun, Aniket Kate, Deepak Garg, Peter Druschel, Bobby Bhattacharjee
   NDSS Symposium 2020
   `https://arxiv.org/abs/1810.10123`

6. *Language-Directed Hardware Design for Network Performance Monitoring*
   Srinivas Narayana, Anirudh Sivaraman, Vikram Nathan, Prateesh Goyal, **Venkat Arun**, Mohammad Alizadeh, Vimalkumar Jeyakumar, and Changhoon Kim
   ACM SIGCOMM 2017
   Best Paper Award
   `https://web.mit.edu/marple/`

7. *Automating Network Heuristic Design and Analysis*
   Anup Agarwal, **Venkat Arun**, Devdeep Ray, Ruben Martins, Srini Seshan
   ACM SIGCOMM HotNets 2022
   `https://108anup.github.io/assets/papers/CCmatic-Hotnets22.pdf`

8. *Quantitative Verification of Scheduling Heuristics*
   Saksham Goel, Benjamin Mikek, Jehad Aly, **Venkat Arun**, Ahmed Saeed, Aditya Akella
   In Submission
   `https://arxiv.org/abs/2301.04205`

9. *Privid: Practical, Privacy-Preserving Video Analytics Queries*
   Frank Cangialosi, Neil Agarwal, **Venkat Arun**, Junchen Jiang, Srinivas Narayana, Anand Sarwate, Ravi Netravali
   USENIX NSDI 2022
   `https://arxiv.org/pdf/2106.12083.pdf`

10. *Throughput-Fairness Tradeoffs in Mobility Platforms*
    Arjun Balasingam, Karthik Gopalakrishnan, Radhika Mittal, **Venkat Arun**, Ahmed Saeed, Mohammad Alizadeh, Hamsa Balakrishnan, Hari Balakrishnan
    ACM MobiSys 2021
    `https://people.csail.mit.edu/arjunvb/pubs/mobius-mobisys21-paper.pdf`

11. *Enabling High Quality Real-Time Communications with Adaptive Frame-Rate*
    Zili Meng, Tingfeng Wang, Yixin Shen, Bo Wang, Mingwei Xu, Rui Han, Honghao Liu, **Venkat Arun**, Hongxin Hu, Xue Wei
    USENIX NSDI 2023

12. *The Case for an Internet Primitive for Fault Localization*
    Will Sussman, Emily Marx, **Venkat Arun**, Akshay Narayan, Mohammad Alizadeh, Hari Balakrishnan, Aurojit Panda, Scott Shenker
    ACM SIGCOMM HotNets 2022

SELECTED PRESS COVERAGE

Starvation in CC [1]	MIT News, IEEE Spectrum, APNIC Blog, The Register, Extreme Tech
RFocus [4]	MIT News, BBC Radio, Tech Crunch, Venture Beat, Engadget, Tech Spot, Digital Trends
Privid [8]	MIT News, IEEE Spectrum, Hacker News, Sci Tech Daily, MarkTechPost

MENTORING EXPERIENCE

1. Anup Agarwal - automatically synthesizing heuristics that are provably performant by construction [7]
2. Saksham Goel, Ben Mikek, Jehad Aly - verifying performance properties of CPU schedulers
3. Rahul Bothra - developing a lightweight verification tool for network architects
4. Sudarsanan Rajasekaran - improving MIMO rank with RFocus

HONORS AND AWARDS

- ACM SIGCOMM Best Student Paper Award, 2022
- ACM SIGCOMM Best Paper Award, 2017
- Jacobs Presidential Fellowship, 2017 (MIT)
- President of India Gold Medal, 2017 (IIT Guwahati)
- Institute Merit Scholarship, 2015 and 2016 (IIT Guwahati)
- KVPY Government of India Scholarship, 2013

TEACHING EXPERIENCE

- Guest lecture, MIT 6.5820 (Computer Networks) 2022, on Formally Verifying Congestion Control Behavior [2] taught by Mohammad Alizadeh and Manya Ghobadi
- Guest lecture, UIUC 598HH (Advanced Wireless Networks & Sensing Systems) 2020, on RFocus [4] taught by Haitham Hassanieh
- Teaching Assistant, MIT 6.829 2020 (Graduate Computer Networks) taught by Mohammad Alizadeh and Manya Ghobadi

SERVICE

- Organizer of the MIT EECS GAAP program 2021-2022: We matched ~ 200 diverse candidates with ~ 50 mentors to help with their grad school applications and improve diversity of graduate programs in MIT and elsewhere
- Reviewed for IEEE Transactions on Networking 2022
- Shadow PC member for Internet Measurement conference 2019

PAST EXPERIENCE

Intern, Facebook inc. *Fall 2020*
Experimented with and helped improve WAN congestion control at Facebook.

Intern, Max Planck Institute for Software Systems *Summer 2016*
Profs. Deepak Garg, Peter Druschel, and Krishna Gummadi
Designed a cryptographically secure allegation escrow (SAE), the first such design to our knowledge

Intern, Massachusetts Institute of Technology *Summer 2015*
Prof. Hari Balakrishnan
Developed Copa, a new general purpose congestion control algorithm for the wide-internet