

Faculty Candidate Seminar – Software Engineering



Venkat Arun

PhD Candidate
Massachusetts Institute of Technology

Thursday, February 23, 2023
Presentation: 10:30 A.M. – 11:30 A.M.
Reception: 11:30 A.M. – 12:00 P.M.
MSEE 112

Designing Provably Performant Networked Systems

Abstract: As networked systems become critical infrastructure, their design must reflect their new societal role. Today, we build systems with hundreds of heuristics but often do not understand their inherent and emergent behaviors. I will present a set of tools and techniques to prove performance properties of heuristics running in real-world conditions. Rigorous proofs can not only inspire confidence in our designs, but also give counter-intuitive insights about their performance.

A key theme in our approach is to model uncertainty in systems using non-random, non-deterministic objects that cover a wide range of possible behaviors under a single abstraction. Such models allow us to analyze complex system behaviors using automated reasoning techniques. I will present automated tools to analyze congestion control and process scheduling algorithms. These tools prove performance properties and find counter-examples where widely deployed heuristics fail. I will also show that current end-to-end congestion control algorithms that bound delay cannot avoid starvation and present a method to beamform wireless signals using thousands of antennas.

Bio: Venkat Arun is a PhD candidate at MIT working with Hari Balakrishnan and Mohammad Alizadeh. His work spans internet congestion control, video streaming, privacy-preserving computation, wireless networks, and mobile systems. Across these areas, a unifying theme of his work is to bridge between heuristics that systems use in practice and proofs of how well they work. He believes that rigorous proof combined with automated reasoning will enable us to make networked systems more robust and performant. He has won two ACM SIGCOMM best paper awards and the president of India gold medal.