BINGHAMTON UNIVERSITY
STATE UNIVERSITY OF NEW YORK | Computer Science

COMPUTER SCIENCE RESEARCH SEMINAR

Efficient Scheduling, Routing and Caching in Wireless Networks

Anand Seetharam
Department of Computer Science, Binghamton University

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Abstract: The spatio-temporal variation in wireless channel conditions and node mobility makes it challenging to design protocols for wireless networks. In this talk, I present efficient scheduling and routing algorithms that overcome these challenges in wireless networks and improve user-level performance. In the first part of the talk, I consider the problem of scheduling multiple users streaming different variable bit-rate videos over a cellular network. I present an epoch-by-epoch framework to fairly allocate wireless transmission slots to different users. I demonstrate that this problem is NP-complete and develop an efficient greedy algorithm to solve the above problem. The greedy algorithm is optimal when the channel quality of a user remains unchanged within an epoch. Experimental results, based on public MPEG-4 video traces and wireless channel traces that I collected from a WiMAX test-bed, show that the lead-aware greedy approach results in a fair distribution of stalls across the clients when compared to other algorithms, while still maintaining similar or fewer average number of stalls per client.

In the second part of the talk, I study a joint routing and caching problem in heterogeneous networks supporting in-network content caching with the goal of minimizing average content access delay. In this problem, content can either be accessed directly from a back-end server (where content resides permanently) or be obtained from one of multiple in-network caches. I show that the joint routing and caching problem is NP-complete and identify scenarios where the problem can be solved optimally in polynomial time. I propose approximate solutions that are within a $(1 - 1/e)$ factor of the optimal solution and design a computationally efficient greedy algorithm. I show via simulations that the greedy algorithm is within 1% of optimal for small problem sizes. Through trace-driven simulations, I evaluate the performance of our proposed algorithms, which show up to a 50% reduction in average delay over solutions based on LRU content caching.

Bio: Anand Seetharam is an assistant professor at Binghamton University. He obtained his PhD. from University of Massachusetts Amherst in 2014. He is broadly interested in the field of computer networking. His research encompasses wireless networks, internet-of-things, information-centric networks and cyberphysical systems. He has published numerous papers in peer-reviewed journals (IEEE TMC, IEEE ToN) and conferences (IEEE INFOCOM, ACM CoNEXT, ACM ICN). He has co-organized the IEEE ICME 2017 and IEEE INFOCOM 2016 MuSIC workshops and the IEEE MASS 2015 CCN workshop. He has also served on the TPC of multiple conferences including IEEE INFOCOM, IEEE ICC and IEEE ICCCN. He has won multiple awards including the ACM ICN 2014 runners up to best paper award, the University of Massachusetts Amherst Outstanding Synthesis Award and the University of Massachusetts Amherst Portfolio with Distinction Award and has a U.S. patent on video streaming systems.

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Pizza will be provided!