



# Washington University in St. Louis

## SCHOOL OF ENGINEERING & APPLIED SCIENCE

Preston M. Green Department of Electrical & Systems Engineering

### Seminar Announcement

**Edmund Yeh**

Professor of Electrical and Computer Engineering,  
Computer and Information Science  
Northeastern University



Friday, October 27, 2017  
Green Hall, Room 0120  
10:10 A.M.

### Title: Networking for Big Data: Theory and Optimization for NDN

**Abstract:** The advent of Big Data is stimulating the development of new networking architectures which facilitate the acquisition, transmission, storage, and computation of data. In particular, Named Data Networking (NDN) is an emerging data-centric networking architecture which focuses on enabling end users to obtain the data they want, rather than to communicate with specific nodes. By naming content instead of their locations, NDN transforms data into a first-class network entity.

In this talk, we present a new analytical and design framework for the optimization of key network functionalities within the NDN architecture, which is also broadly applicable to content delivery and peer-to-peer networks. The framework includes the joint optimization of traffic engineering and caching strategies, in order to best utilize both bandwidth and storage for efficient data distribution. It also includes optimal congestion control when user demand for data becomes excessive. We first develop distributed and adaptive algorithms for joint request forwarding and dynamic cache placement and eviction, which effectively achieve network load balancing, thereby maximizing the user demand rate that the NDN network can satisfy. Next, we develop content-based congestion control algorithms which naturally work in concert with forwarding and caching to achieve a favorable tradeoff between the aggregate user utility from admitted content requests and the total user delay. Numerical experiments within a number of network settings demonstrate the superior performance of these algorithms in terms of multiple metrics. Finally, we discuss the application of this work in the areas of 5G wireless communication and large-scale data-intensive science.

Joint work with Tracey Ho, Ying Cui, Ran Liu, Michael Burd, and Derek Leong

**Bio:** Edmund Yeh received his B.S. in Electrical Engineering with Distinction and Phi Beta Kappa from Stanford University in 1994. He then studied at Cambridge University on the Winston Churchill Scholarship, obtaining his M.Phil in Engineering in 1995. He received his Ph.D. in Electrical Engineering and Computer Science from MIT under Professor Robert Gallager in 2001. He is currently Professor of Electrical and Computer Engineering at Northeastern University. He was previously Assistant and Associate Professor of Electrical Engineering, Computer Science, and Statistics at Yale University. He has held visiting positions at MIT, Stanford, Princeton, UC Berkeley, EPFL, and TU Munich. Professor Yeh was one of the PIs on the original NSF-funded FIA Named Data Networking project. He will serve as General Co-Chair for ACM Conference on Information Centric Networking (ICN) 2018 in Boston. He is the recipient of the Alexander von Humboldt Research Fellowship, the Army Research Office Young Investigator Award, the Winston Churchill Scholarship, the National Science Foundation and Office of Naval Research Graduate Fellowships, the Barry M. Goldwater Scholarship, the Frederick Emmons Terman Engineering Scholastic Award, and the President's Award for Academic Excellence (Stanford University). Professor Yeh has served as the Secretary of the Board of Governors of the IEEE Information Theory Society, as well as Associate Editor for IEEE Transactions on Networking, IEEE Transactions on Mobile Computing, and IEEE Transactions on Network Science and Engineering. He received the Best Paper Award at the 2017 ACM Conference on Information-centric Networking (ICN), and at the 2015 IEEE International Conference on Communications (ICC) Communication Theory Symposium.

Host: Dr. Arye Nehorai