Department of Engineering
Seminar Program
Wednesday, February 18, 2015
Shanahan Teaching and Learning Center
Lecture Hall 1430, 4:15pm

"A Scalable Distributed MU-MIMO, Biggie Small Cells: Mo' Cells Mo' Problems"

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Summary:

According to the Cisco Visual Networking Index, the demand for wireless data traffic is expected to increase at an exponential rate for the foreseeable future. This demand is largely driven by the success of smartphones and their de facto killer-app, mobile video. However, current generation mobile networks are ill-equipped to meet this demand in very dense user environments such as airports, campuses, conference halls, and stadiums. This problem is fundamentally limited by the quantity of available wireless spectrum, and the efficiency with which this spectrum is used. Given that the amount of spectrum used for commercial data traffic is essentially fixed, the job of wireless engineers is then to determine methods which radically improve spectral efficiency.

One such recently proposed method is known as large-scale distributed multi-user multiple-input multiple-output (or simply Distributed MIMO). It is a promising network architecture that unifies two recent trends in wireless research: "massive MIMO" and "small cells." It consists of several Access Points (APs) connected to a central server via ethernet which then act as one large AP with distributed antennas. In this talk I will discuss scalable solutions to the two primary implementation challenges of Distributed MIMO: AP synchronization and uplink/downlink reciprocity calibration. AP synchronization refers to the act of forcing each AP's inexpensive crystal oscillator to operate on the same frequency, as well as the act of forcing each AP to transmit at the same time. Reciprocity calibration refers to the ability to infer downlink (AP to user) channel conditions based on uplink (user to AP) transmissions. I will demonstrate both theoretical and experimental results indicating that this technology enables significant gains in spectral efficiency, making Distributed MIMO an excellent candidate for next generation wireless standards. I will conclude with a discussion of open problems in this network topology.

This presentation explores the integration trends of analog circuits by discussing the current challenges and by introducing a novel charge-based approach for designing analog CMOS circuits—which ultimately enables their fabrication in an all-digital deep sub-µm IC process. This talk will conclude by envisioning the direction of where analog IC design is headed in the future through empowering the automation of analog IC design.

Bio:

Ryan Rogalin's research interests lie at the intersection of communication theory, information theory, wireless networks, and their implementation through software defined radio. He has utilized this skill set both in academia and industry, where his experience has ranged from Fortune 500 companies to federal agencies and research and development labs. His dissertation addresses the implementation challenges of a novel network architecture known as Distributed MIMO.

Ryan received a B.S. in Electrical Engineering from the University of Oklahoma in 2008, and an M.S. in Electrical Engineering from the University of Southern California in 2010. He is currently pursuing a Ph.D. in Electrical Engineering at the University of Southern California, where he was awarded the Annenberg Fellowship. At USC he has also been recognized for excellence in undergraduate education through a University Teaching Award.