The University of Chicago Computer Science Department
PRESENTS:

"mmWave Networking and Beyond"

Heather Zheng
University of California, Santa Barbara

Abstract:
Millimeter wave (mmWave) communications, especially in the 60GHz band, is a promising candidate for high-bandwidth wireless networking. These high-frequency signals enable steerable and highly directional multi-Gbps transmissions that minimize interference, and will be integrated into the next generation of mobile devices. Despite these advantages, 60GHz links today are still poorly understood, and current applications are strictly limited to short-distance indoor communications, e.g. digital cable replacements for TVs and laptops.

In this talk, I will present some key results from my lab on 60GHz networks, including novel applications in mobile/robotic imaging, data and control planes for modern data centers, and wireless outdoor picocells. I'll begin with our work on mobile 60GHz imaging, where we address the problem of environmental mapping for autonomous devices such as drones and robots. We propose that mobile devices reuse their 60GHz networking radios to capture signals reflected off surfaces of nearby objects, and move to emulate large antennas for high-precision RF imaging. Conventional imaging algorithms like synthetic aperture radar (SAR) provide poor precision results that are highly sensitive to device positioning and movement errors. Instead, we propose new 60GHz imaging algorithms, which images an object using just signal strength measurements recorded along the device's moving trajectory, using devices' onboard 60GHz networking radios. Our algorithm not only discovers position of nearby objects, but also object surface orientation, curvature, boundaries, and even surface material. Our systems have been implemented on a 60GHz phased array testbed, and tested on a variety of common indoor and outdoor objects with high (cm level) accuracy.

I will also summarize our work in integrating 60GHz wireless links into modern data centers. We started by proposing reflecting 60GHz links off of data center ceilings as a link-layer primitive to address traffic hotspots. Our recent work leverages these links to build a fault-independent control plane for data centers using a 60GHz mesh built using Kautz graphs. This "facilities network" reduces link interference with intelligent rack placement and naming, and uses dynamic algorithms to recover from most link and rack failures. Finally, I will describe ongoing work on 60GHz outdoor picocells.

Bio:
Heather Zheng received her PhD degree from University of Maryland, College Park in 1999. After spending six years as researcher in industry labs (Bell-Labs, USA, and Microsoft Research Asia), she joined the UC Santa Barbara faculty in 2005, where she is now a Professor. At UCSB, she co-directs the SANDLab (http://sandlab.cs.ucsb.edu/) with a broad research coverage on wireless networking and systems, mobile computing, security, and data mining and modeling. Her research has been featured by a number of media outlets, such as the New York Times, Boston Globe, LA Times, MIT Technology Review, and Computer World. She is an IEEE Fellow and has received a number of awards, including MIT Technology Review's TR-35 Award (Young Innovators Under 35) and the World Technology Network Fellow Award. She recently served as the TPC-cochair of MobiCom'15 and DySPAN'11, and is currently serving on the steering committees of MobiCom and IEEE Transactions on Mobile Computing, and the editorial board of the IEEE Transactions on Networking.

Friday, January 6, 2017
3:00 pm
Ryerson 251
Host: Michael Franklin