From Wireline to Wireless Broadband

Prof. Dina Katabi
Director of the MIT Center for Wireless Networks and Mobile Computing (Wireless@MIT)

http://wireless.csail.mit.edu
Can Wireless Replace Wireline Broadband, Particularly in Rural Areas?

• Technologically can deliver high-capacity to communities with no wireline connectivity
  – 3G or 4G alone will not do
  – Need to deploy innovative technologies
High-Capacity Technologies

• Get the best out of the spectrum you have
  – Interference Alignment
  – Distributed MIMO -- MegaMIMO

• Dynamic spectrum sharing
  – GHz realtime low-cost spectrum sensing
What if many base stations coordinate and act as a powerful distributed MegaMIMO base station?
MegaMIMO: Distributed MIMO

MegaMIMO enables BSs to act as a huge MIMO transmitter with sum of antennas.

10 BSs on same band $\rightarrow$ 10x higher throughput
Testbed of Software Radios
Results from In-Lab Prototype

Normalized Download Speed

Existing Technologies

MegaMIMO

10x gain in actual data rates (not maximum theoretical)

groups.csail.mit.edu/netmit/wordpress/projects/
GHz Realtime Low-Cost Spectrum Sensing

• Today, can’t capture very wide spectrum in realtime

• Sequential scanning of tens of MHz
  ➔ Can easily miss radar signals
Idea: Leverage Sparsity

Sparse recovery show that one can acquire sparse signals using sub-Nyquist sampling

Sparse FFT
Winner of TR10, 2012 (Technology Review); Featured in IEEE Spectrum, Discover magazine, BBC radio, Slashdot, ...
http://groups.csail.mit.edu/netmit/sFFT/
Benefits of Sparse FFT

• Sub-sample the data → Can use low-speed ADCs
• Very fast algorithm → Lower-power consumption

• Used sparse FFT to build a GHz receiver from three 50 MHz software radio
• Both senses and decodes sparse spectrum
Realtime GHz Spectrum Sensing

Cambridge, MA January 18 2013

sFFT enables realtime low-cost GHz sensing and decoding