From Wireline to Wireless Broadband

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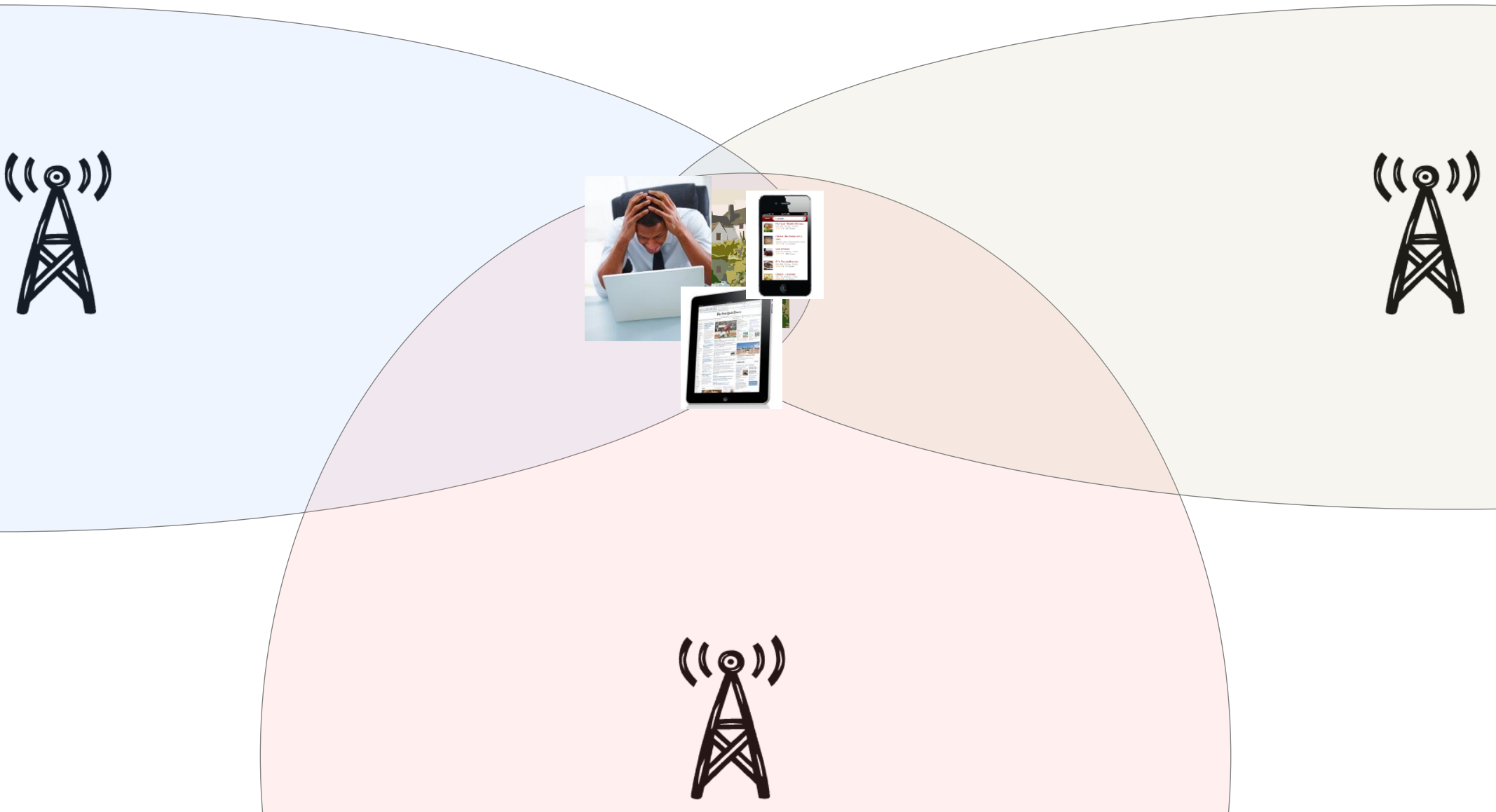
Can Wireless Replace Wireline Broadband, Particularly in Rural Areas?

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

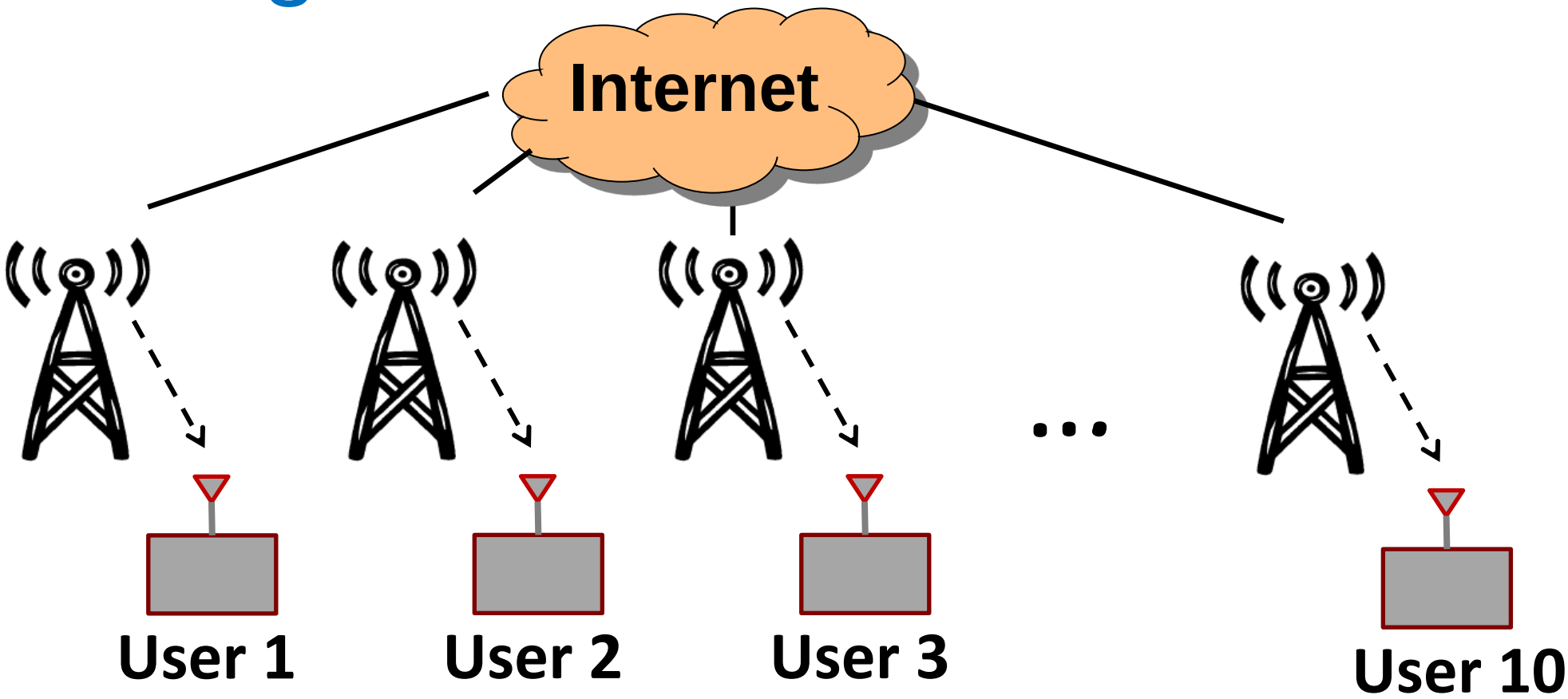
High-Capacity Technologies

- 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

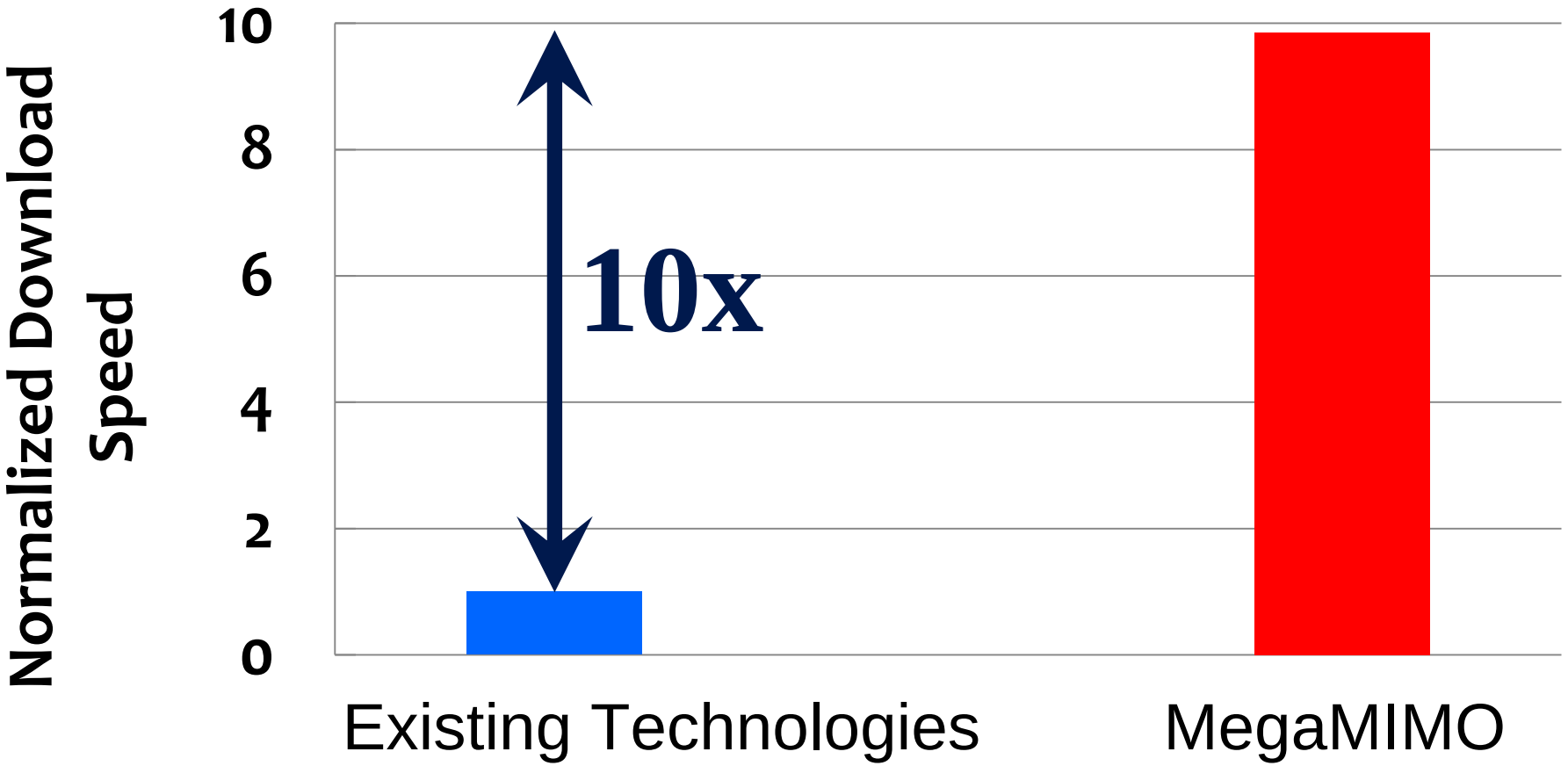


MegaMIMO enables BSs to act as a huge MIMO transmitter with sum of antennas

10 BSs on same band → 10x higher throughput

Testbed of Software Radios

Results from In-Lab Prototype



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

groups.csail.mit.edu/netmit/wordpress/projects/

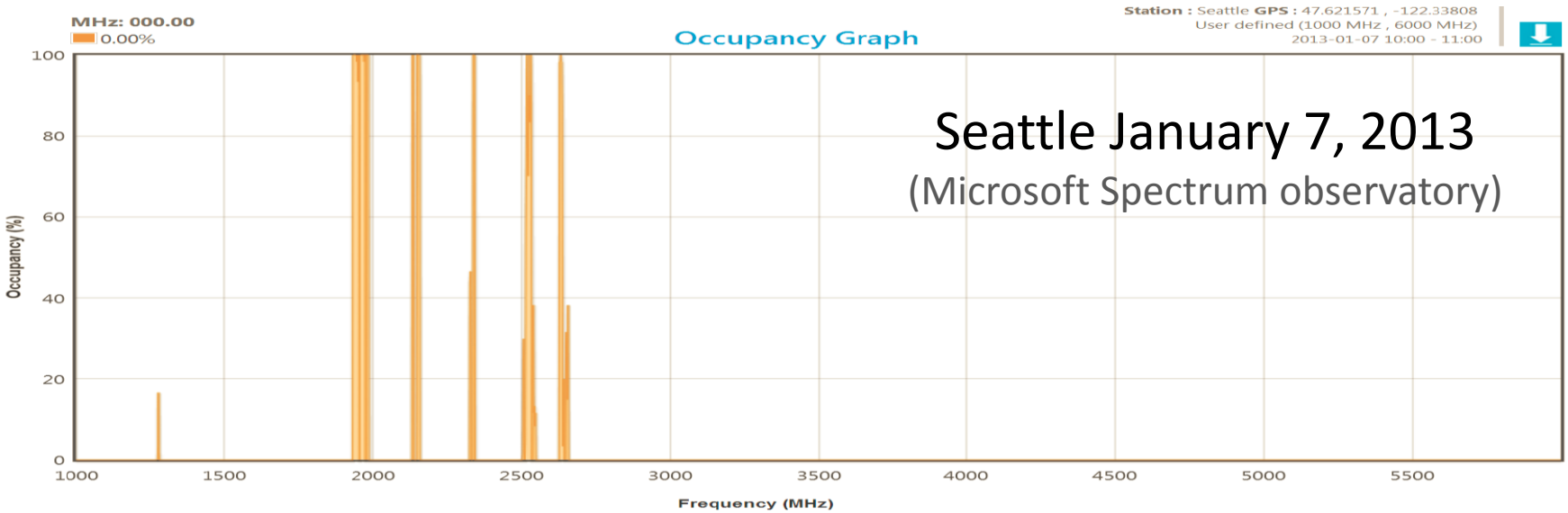
GHz Realtime Low-Cost Spectrum Sensing

- 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

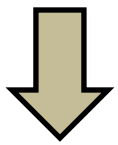
Sparse FFT

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

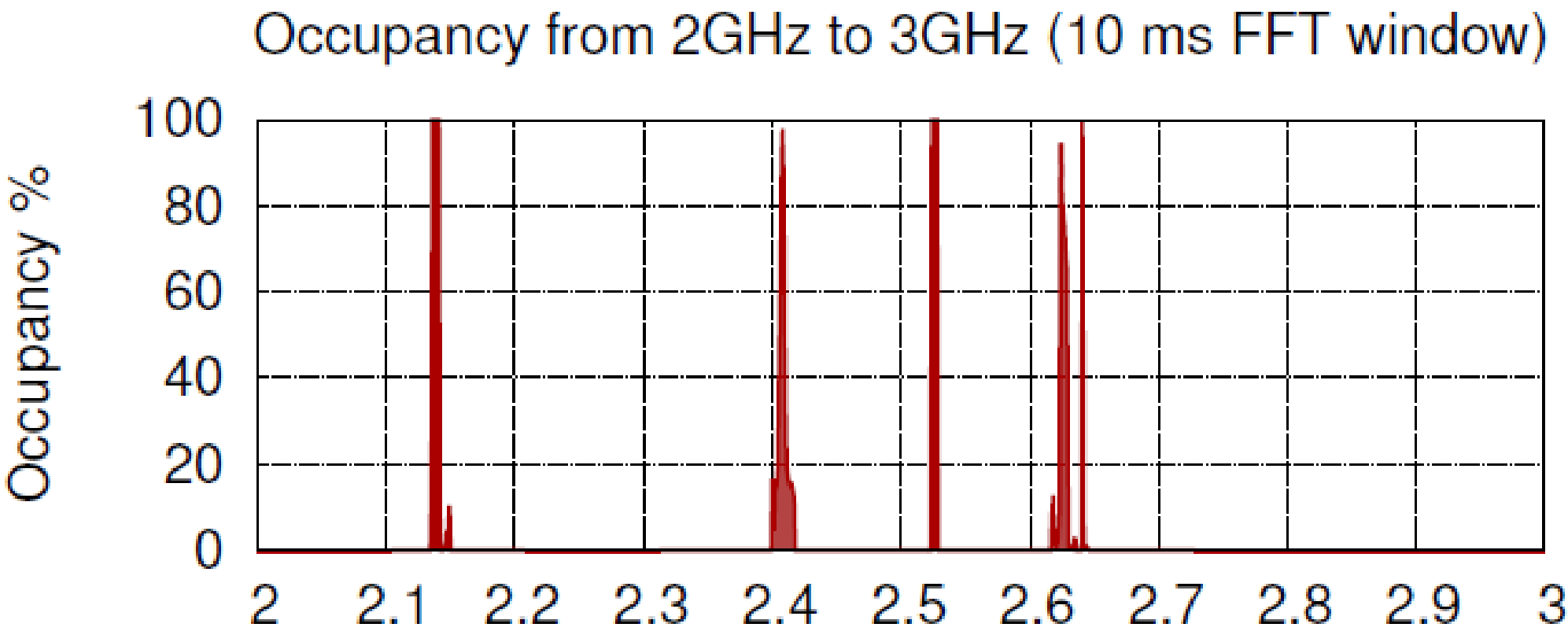
- Sub-sample the data → Can use low-speed ADCs
- Very fast algorithm → Lower-power consumption



- 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