

Realtime GHz-Wide Spectrum Sensing

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Imagine

A low-power cheap sensors that captures GHz-wide spectrum in realtime

- Thousands of sensors to map spectrum usage
- Very efficient dynamic spectrum sharing

Realtime GHz Spectrum Sensing is Difficult

- Today, sequential scanning of tens of MHz
 - Can easily miss radar signals
- Key Challenge: high-speed ADCs



Tens of MHz ADC

< a dollar

Low-power

High resolution



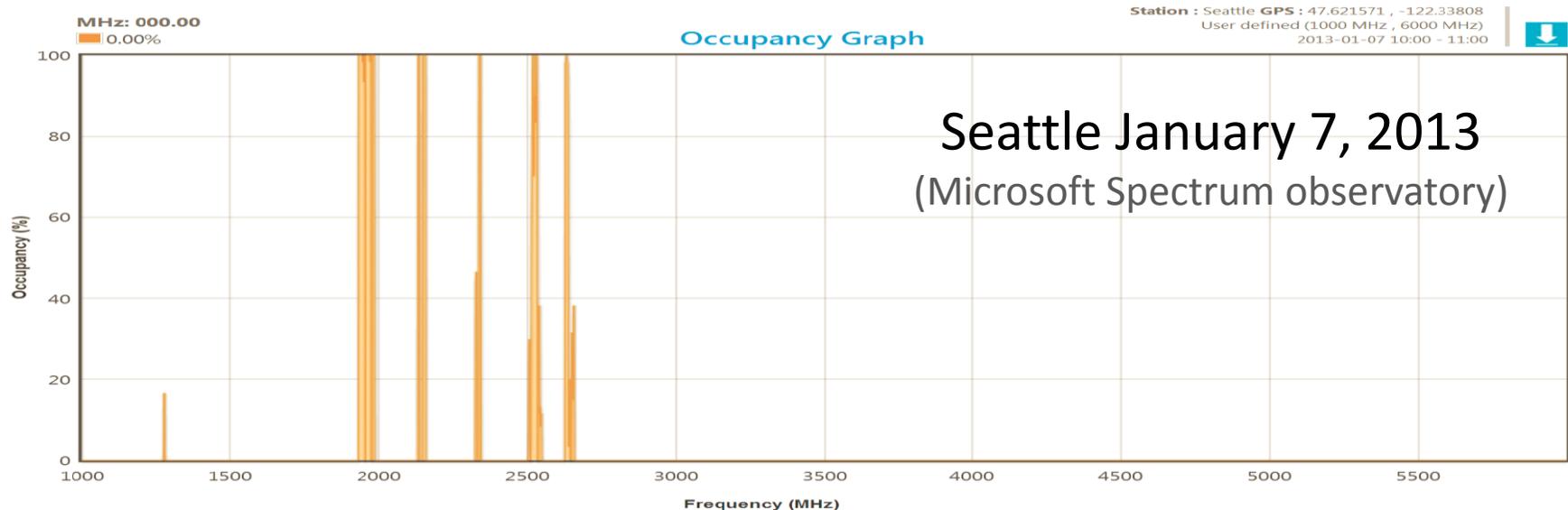
A Few GHz ADC

Hundreds of dollars

10x more power

Poor resolution

Idea: Leverage Sparsity



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

Sparse FFT

No random sampling → can use low-speed ADCs

Benefits of Sparse FFT

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



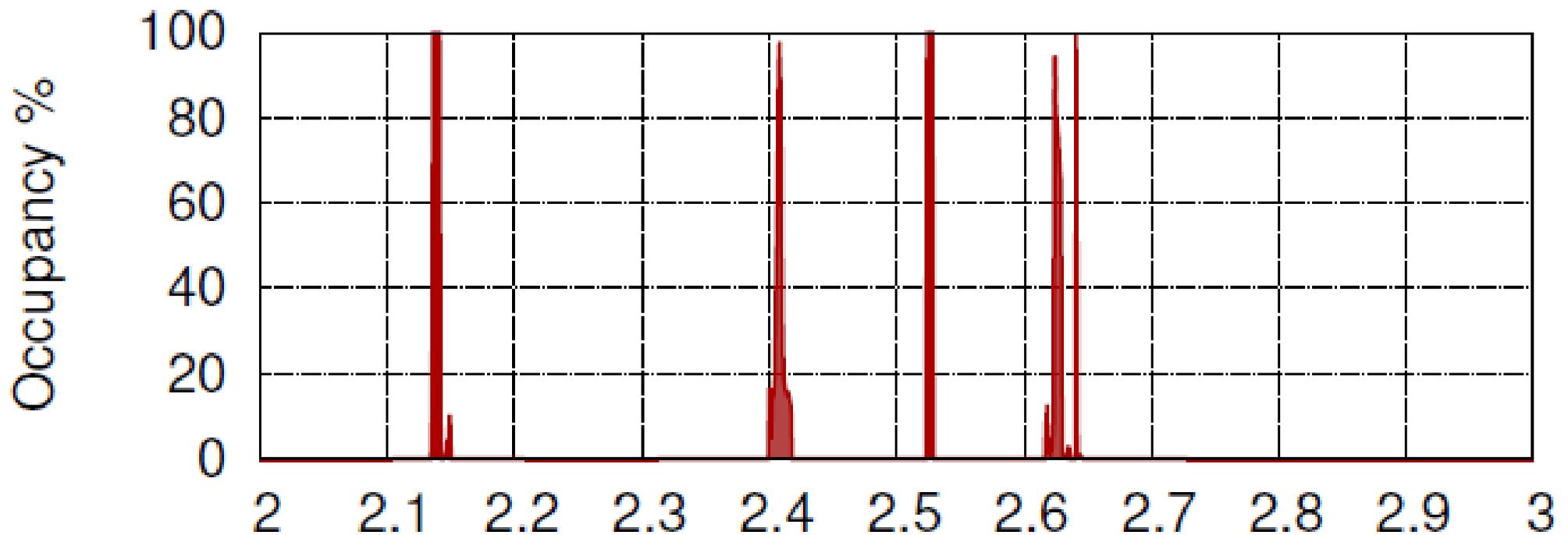
- Used sparse FFT to build a GHz receiver from three 50 MHz ADCs
- Both senses and decodes sparse spectrum



Realtime GHz Spectrum Sensing

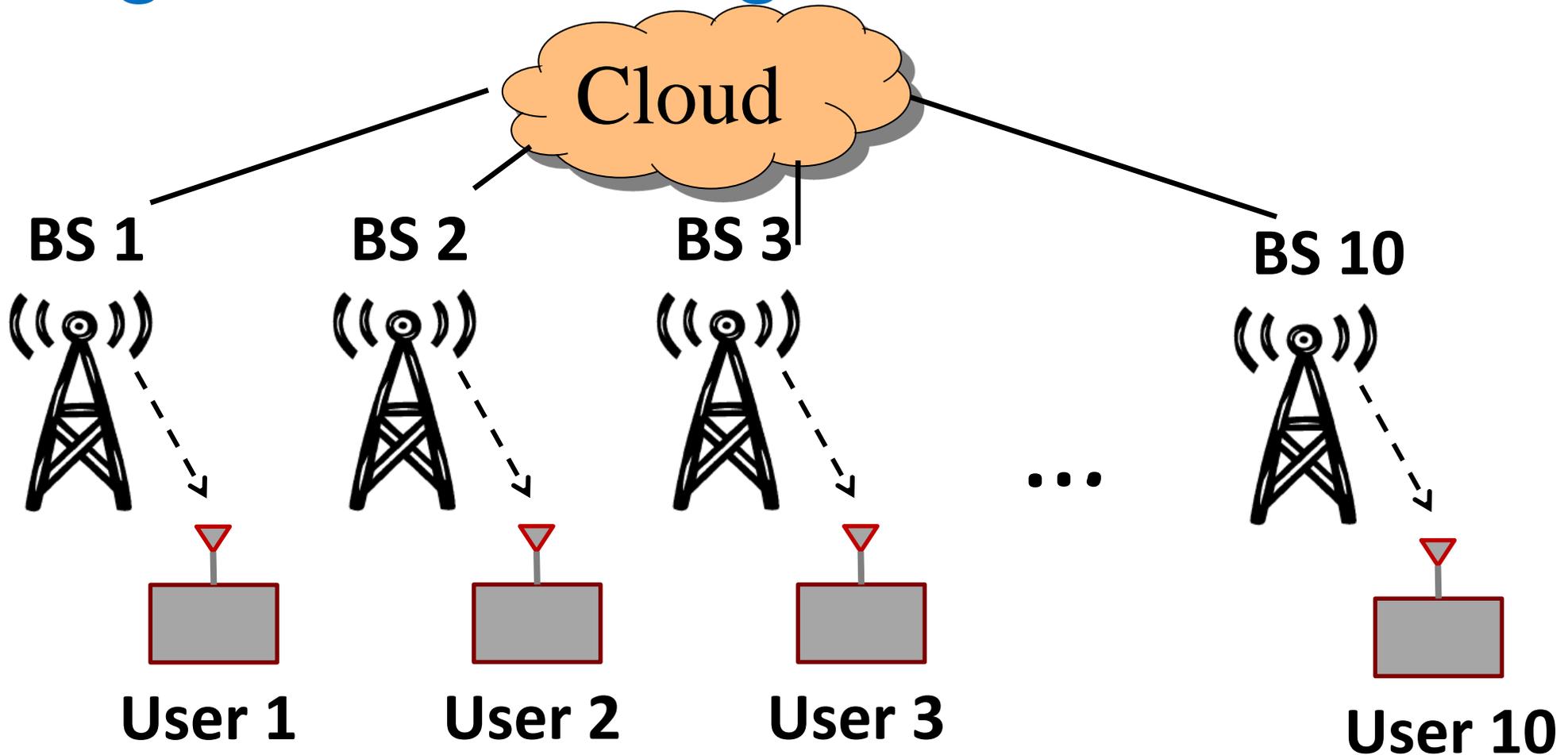
Cambridge, MA January 18 2013

Occupancy from 2GHz to 3GHz (10 ms FFT window)



sFFT enables **realtime GHz sensing and decoding** for low-power portable devices

MegaMIMO: 10x higher Network Rates



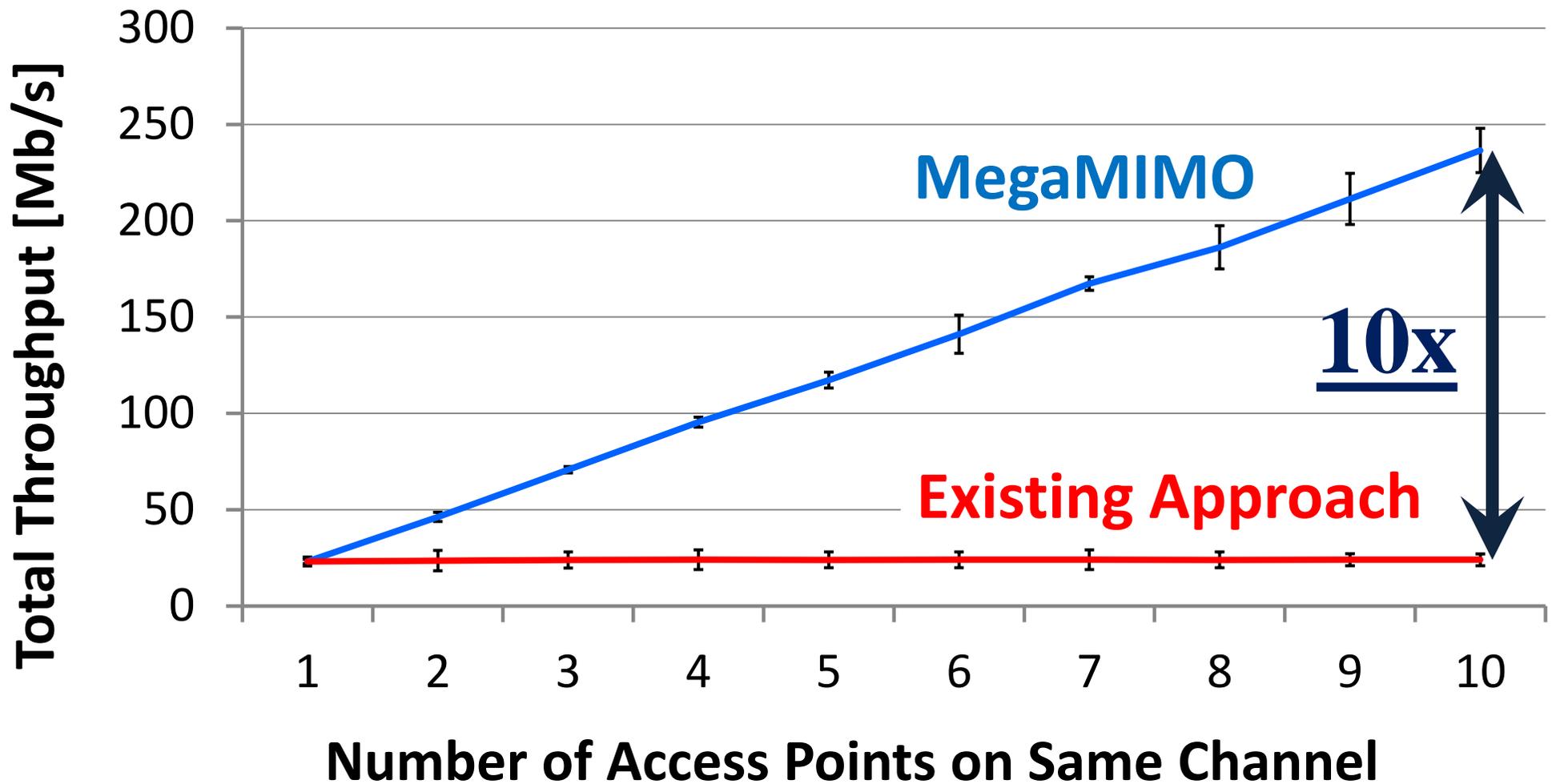
MegaMIMO enables BSs to act as a huge MIMO transmitter with sum of antennas

10 BSs on same band → 10x higher throughput

Testbed of Software Radios



Results from Prototype



Large throughput gains