Listen Before You Talk, But on the Frequency Domain
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802.11 Channel Access Today
- Backoff arbitrates channel contention
  - AP waits for a random backoff before transmission
  - Low utilization because channel must remain idle
  - Collisions due to same backoff also reduce utilization

Redesigning 802.11 Channel Contention
- Backoff is fundamentally not a time domain operation
- Can we implement backoff in frequency domain?
  - Opportunity: 48 OFDM subcarriers can be used for choosing random backoff

T2F: Time-to-Frequency
- Replace temporal backoff with subcarrier transmission
- During contention:
  - AP chooses a random subcarrier to transmit
  - Concurrently listens to find other active subcarriers
  - Active subcarriers imply contending APs’ backoff

Scheduled Transmission
- Active subcarriers imply backoff chosen by other APs
  - Each AP knows its rank in the sequence
  - Enables back to back TDMA like transmission

Multiple Collision Domain Coexistence
- Insert PIFS delay between sequential transmissions

Frequency Domain Backoff has lower overhead than Time Domain Backoff

Reducing Collisions using Second Round
- In dense networks, multiple winners of T2F backoff
- Winners of the first round repeat T2F backoff
- Few APs in the second round means fewer collisions

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Testbed Implementation and Evaluation
- 8 node USRP/GNURadio testbed
- Subcarrier detection accuracy of ~95%
- Low collision probability with two rounds
- Upto 70% throughput gain over 802.11
  - Due to reduced overhead and fewer collisions

Ongoing Work
- Improve subcarrier detection accuracy
- Experiment with multiple collision domains
- Online implementation in progress