Precise Indoor Localization Using PHY Information

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**Location-based applications (LBAs)**
- Limited by accuracy and deployment cost
  - GPS ineffective indoor
  - WiFi based: 4m accuracy indoors
  - Infrastructure based requires deployment of sensors

**Can we localize at spot granularity?**
- Several applications...
  - Shopping aisle recognition: advertisement
  - Museum painting recognition
  - Logical localization
  - Geofencing

**Localization using WiFi channel response**
- Measurement with Intel 5300 WiFi chipset

**WiFi Channel Response: Variability**
- WiFi channel response changes every 2-3 cm
- Depends on wavelength of propagated signal

**WiFi Channel Response: Robustness**
- Human mobility may change channel response
  - Changes only if dominant path from AP is blocked
  - Can leverage responses from other APs

**Observation:** Channel responses (CFR) are often clustered

**Precise Localization using WiFi CIR**
- Automate wardriving with Roomba robot
- Identify clusters from different locations
  - Create per spot signature, spot = 1m x 1m area

**Model CIR clusters as gaussians**
- Match user observed CIR with recorded spot signature
  - Only match with spots where same APs observed

**Localization Approach and Results**
- 90% mean accuracy
- 6% false positives at 66 spots

**Ongoing Work**
- 3D wardriving and localization
- Augment precise localization with accelerometer and compass to provide continuous localization