Recitation Project 1 Measuring Wireless Channels

Wireless Networks and Applications

Spring 2022

Recitation Project 1

Jan 31, 2022

Outline

- Setting up experiments
- Description of experiments and analyzing the results

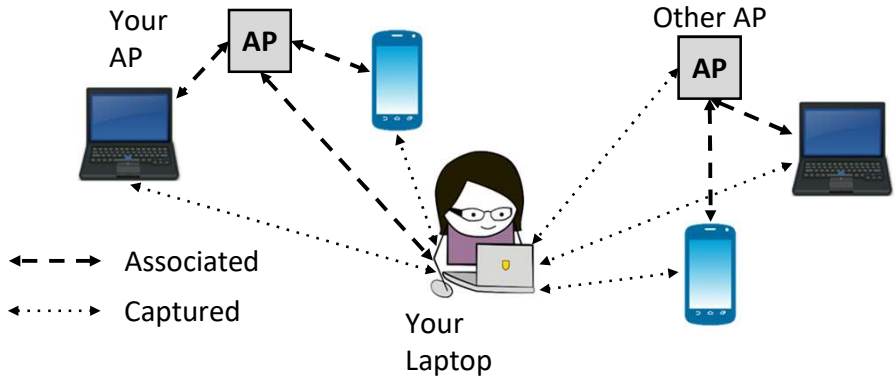
Objective

Experimentally measure a wireless channel

What is the Signal to Noise Ratio (SNR) across this channel?

Signal strength, Data rate, Frequency,...

Home Environment



Associated: WiFi communication between AP and associated device
Captured: Passive packet capture in monitor ("promiscuous") mode

Choosing Devices

- Receiver A: Mac/Linux laptop running Wireshark in Monitor Mode
- Transmitter B: any wifi-router/PC/laptop/mobile phone
- One of the two devices should be mobile
- Signal strength and consistency considerations:

  Phone < Laptop < Access point

Picking a Transmitter

The Transmitter B must send enough traffic!

- Wi-fi router sending traffic to associated client devices
- Laptop/PC as device B:
  - Use ping - for example, to send a specific number of ICMP packets

    sudo ping –f 192.168.1.1 –c 10000
- Mobile Phone as device B:
  - Ping is ping app from Apple Store or Android Store

Wireshark versus iwconfig

- Wireshark is the best option
  - Easy to use and great tool to be familiar with (e.g., Project 2)
  - Lots of information: WiFi header information, detailed statistics (e.g., noise floor), ..
  - Unfortunately monitor mode + PHY information is not always supported
- Iwconfig also reports some PHY information (see handout)
  - Reports less information than Wireshark
  - You need to collect timestamps yourself (easy)
  - Sampling rate limited to ~50 samples/sec
- Fallback: I have a linux laptop you can borrow

Outline

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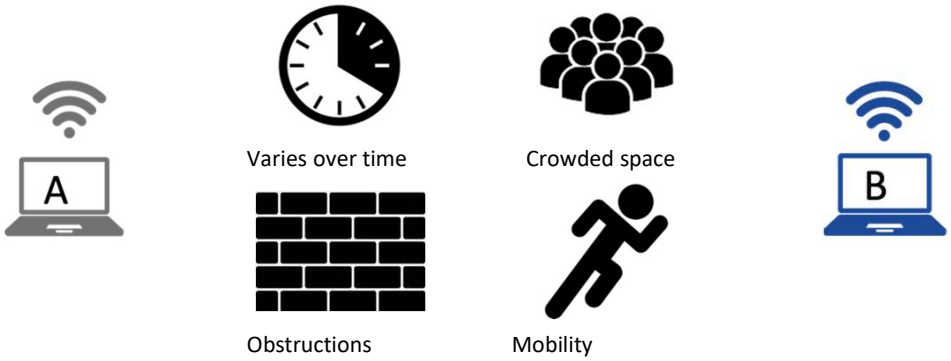
How does the wireless channel change?



Experiments

1. Discrete data collection
- emulates stationary user (sitting down using skype)
- measure discrete points in the channel

1. Continuous data collection
- emulates moving user (walking & using phone)
- Measure continuously while moving one device at a constant rate

Discrete Data Collection

Setup:

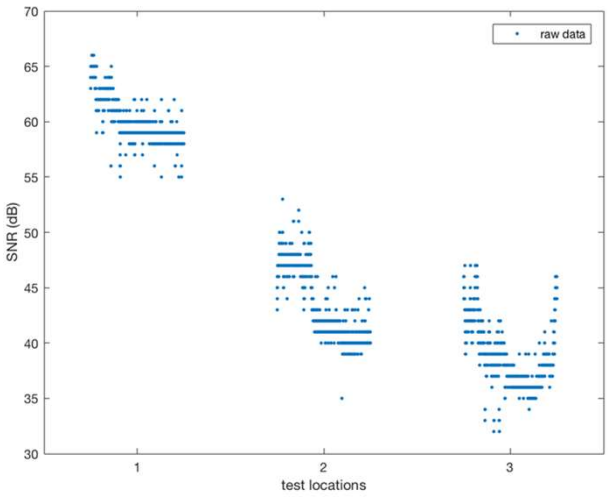
Planned measurement locations (distance between A and B from 1 meter to 5 meter)

Intuition:

SNR will decrease as distance increases, closing door will also decrease SNR

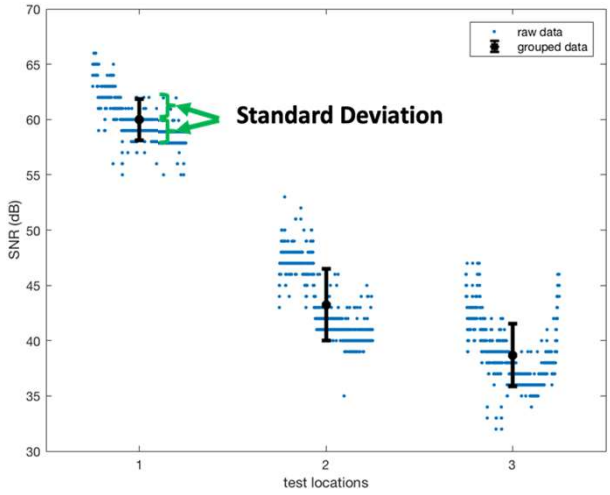
Scatter Plot - discrete collection

- 3 discrete distance test events
- Can be grouped into each event



Scatter Plot - discrete collection

- Plot mean with error bars of standard deviation



Continuous Data Collection

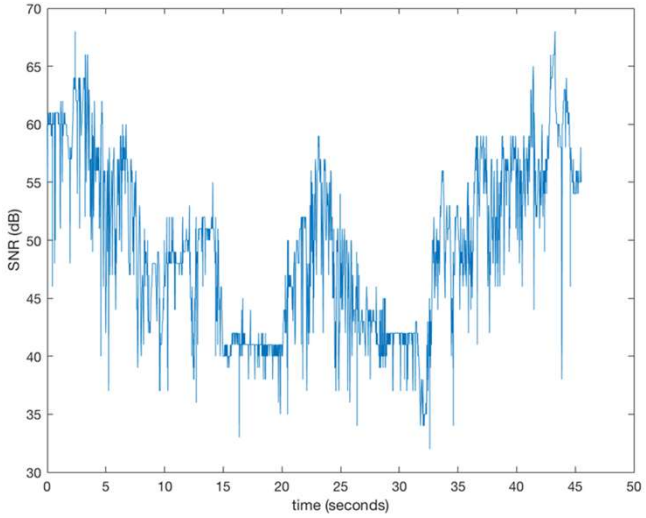
Setup:

Planned path, movement speed

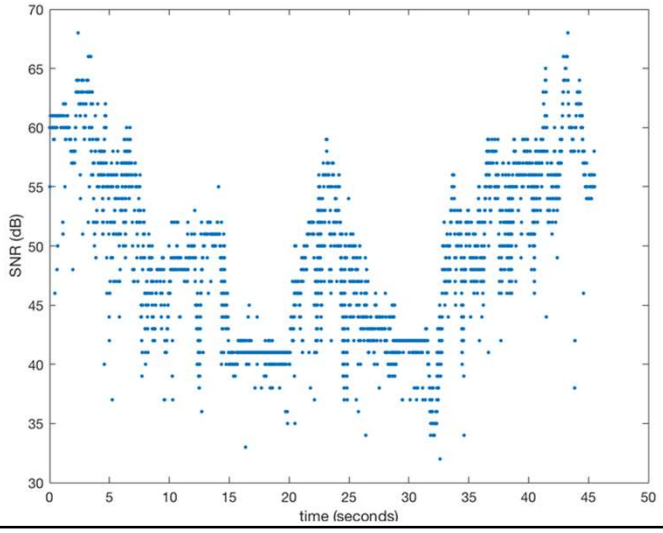
Intuition:

SNR will decrease as distance increases, closing door will also decrease SNR

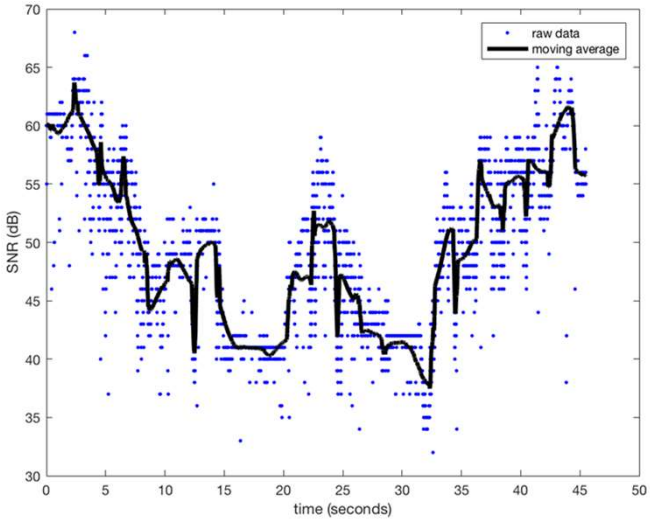
Example graph



Scatter plot



Filtered plot



Analysis thoughts

- Can be beneficial to compare data
  - compare to theoretical mode
  - other data points, different scenarios
- Can be beneficial to observe different characteristics of the data
  - Example: Observing SNR, could be beneficial to observe trends in signal strength and noise level

Questions?