

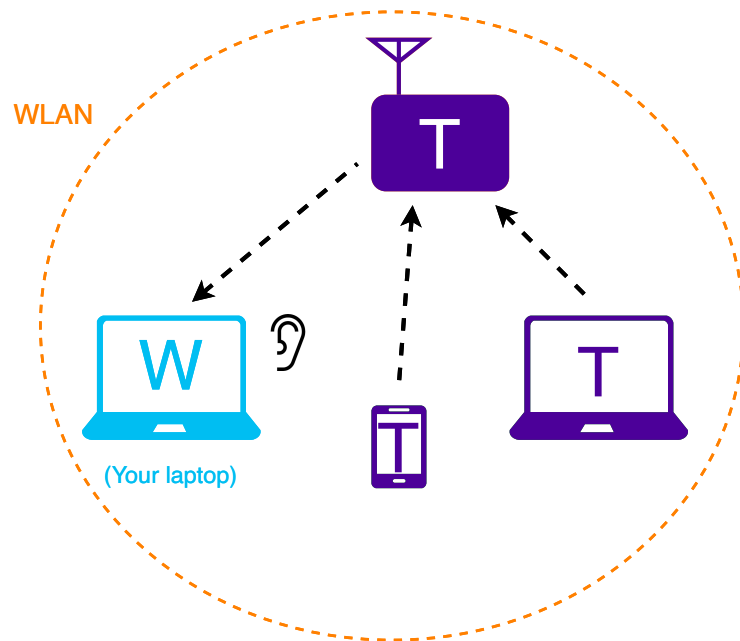
Project 1: Monitoring Wireless Channels

18-452 / 18-750 Wireless Networks and Applications

2024-01-24

Setup, Learning Objectives

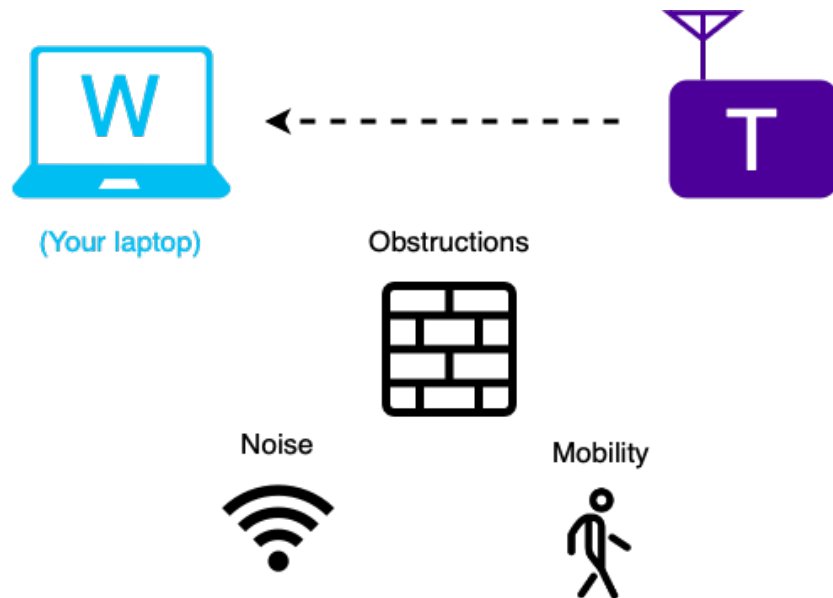
Setup



- Receiver W
 - Running Wireshark in monitor mode
- Transmitter T
- One of the devices is **mobile**

⚠ You must complete this project on your own

Learning Objectives



- By performing a set of experiments you will:
Understand the influence of the physical environment on radio frequency (RF) signals, and consequently, on performance.

Experiments

EXPERIMENT 1

Line of Sight (LOS) Experiment

Main Question

How does distance between transmitter and receiver affect (1) signal strength and (2) data rate?

EXPERIMENT 2

Non Line of Sight (NLOS)
Experiment

Main Question

How does distance between transmitter and receiver affect (1) signal strength and (2) data rate?

EXPERIMENT 3

Your choice!

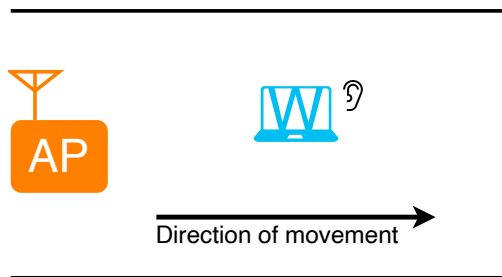
Main Question

Your choice!

Data Collection

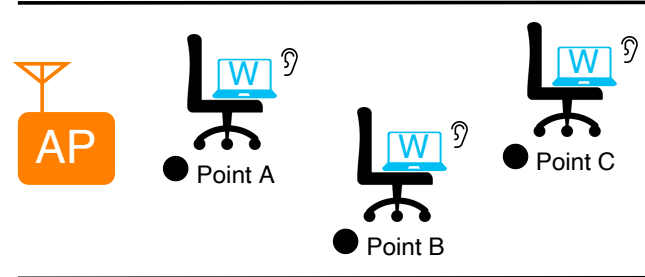
Experiment 1: LOS

Method 1
Continuous Data Collection



- Increase distance between Transmitter T and Receiver W
- ... at a constant speed
- Mobile device can be either W or T
- Distance between W and T should be $\geq 5\text{m}$ (the further, the better)

Method 2
Discrete Data Collection

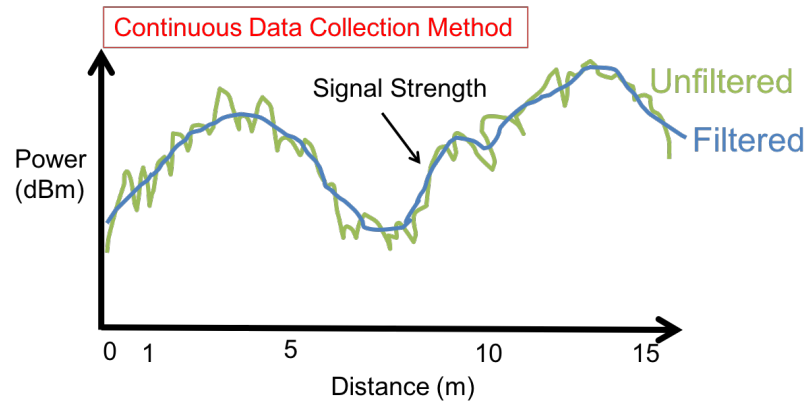


- Pre-determine locations
- Pre-determine number of samples to collect at each location
- Distance between W and T should be $\geq 5\text{m}$

Samples to collect at each location: Signal Strength (dBm), Data Rate (Mbit/s)

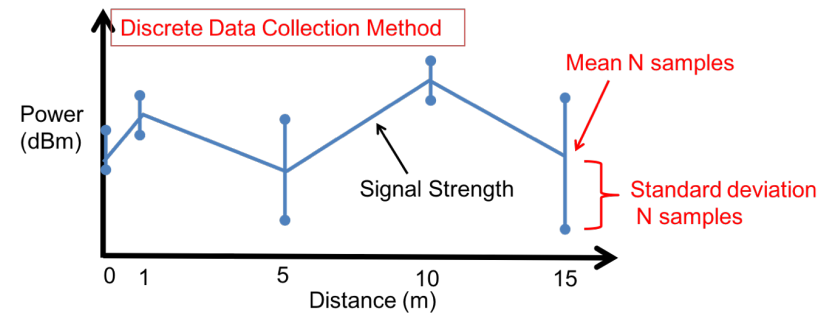
Data Analysis

Continuous Data Collection



- Choose an appropriate filter:
 - Moving average
 - Local Regression
 - ...
- Apply filter to both metrics (signal strength, data rate)

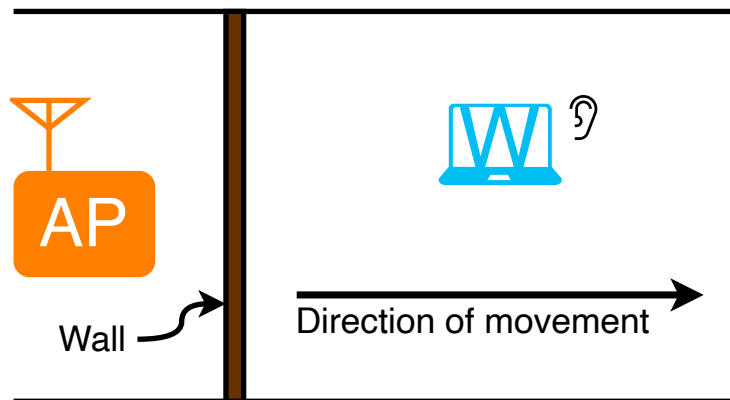
Discrete Data Collection



- Plot the mean and standard deviation for each location
 - Alternative: box-and-whisker plot
- Plot both metrics (signal strength, data rate)

Experiment 2: NLOS

Method 1 Continuous Data Collection



- First, create NLOS conditions (use walls, doors, etc)
- Increase distance between Transmitter T and Receiver W
- ... at a constant speed
- Distance between W and T should be $\geq 5\text{m}$ (the further, the better)
- Mobile device can be either W or T
- Continuous Data Collection method only

Samples to collect:

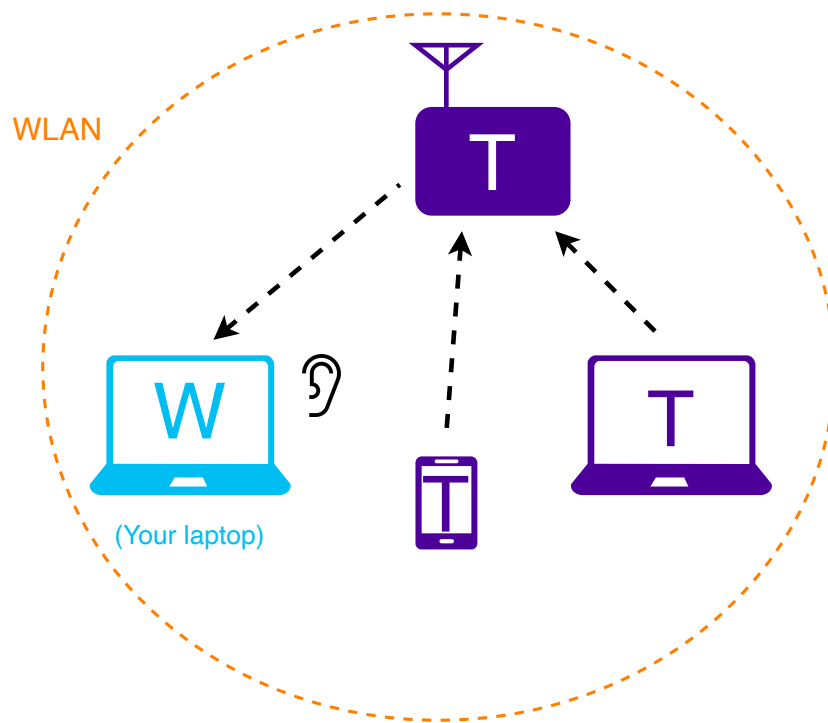
- Signal Strength (dBm)
- Data Rate (Mbit/s)

Experiment 3: Your Experiment

- Here are some ideas:
 - Idea 1
 - NLOS experiment
 - Fixed distance
 - Different types of obstructions: metal, person, thin wall, concrete wall, ...
 - Idea 2
 - LOS experiment
 - Different spaces: outdoor, bedroom, bathroom, hallway, ...
- You design your own experiment
 - Choose appropriate evaluation metrics. You may choose to evaluate other metrics besides Signal Strength and Data Rate.
 - Choose appropriate data collection method(s)

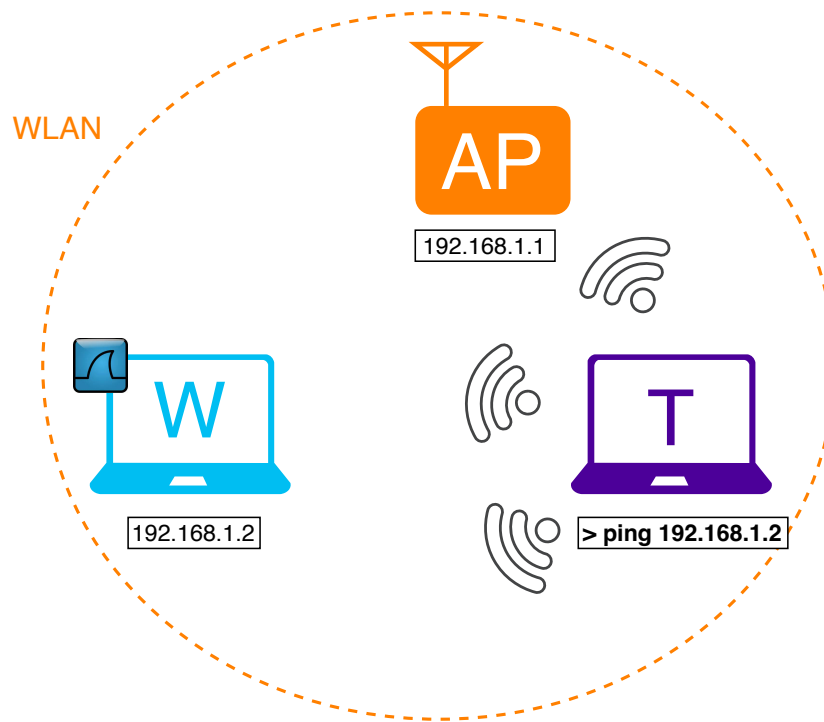
Wireshark Setup

Wireshark Setup



- Device W can be a Wi-Fi Access Point (AP) or another wireless device (laptop, phone, tablet) that is associated with the same AP as Device W
- Wireshark in monitor mode
 - You can find setup instructions in the handout
- ⚠ If your laptop doesn't support monitor mode or if you don't have a laptop: please let us know

Generating Traffic: Device T as an end device



- If Device T is an end device (laptop, phone, tablet), you must make sure that T transmits enough traffic
- Devices T and W in the same WLAN
 - Otherwise, T will never receive a reply from W
- If Device T is a laptop:
 - Ping Device W (refer to P1 handout for instructions)
- If Device T is a phone/tablet:
 - Multiple *ping* apps available on Apple Store and Google Play Store
- Alternatives:
 - Device T can ping any other (include wired) device in the same network
 - Device T can be an AP

Experimental Procedure

Step 1

Connect Devices A and B in the same WLAN

Step 2

Data Collection: monitor the wireless channel using Wireshark (continuous or discrete data collection)

Step 3

Save data to a file

Step 6

Plot the data (filtered data, or means and standard deviations)

Step 5


Parse the file to gather relevant metrics: signal strength, data rate

Step 4

Filter data by source MAC address of Device T

Project Deliverables

Project Deliverables

- Please reference the P1 Handout
 - Address all the questions for each of the 3 experiments. Describe any conclusions you draw from the experimental results.
 - Plot experimental data for each of the 3 experiments
- Delivery Method:
 - Upload to Canvas
-  Deadline: February 19th, 5pm

Project 1: Monitoring Wireless Channels

Good luck!

Q&A