COMP4336/9336 Mobile Data Networking

Lab 5: Experimental study of WiFi modulation and coding

Objectives

- To observe and analyse modulation and coding schemes in WiFi networks

Prerequisites

- Access to two mobile devices, such as a laptop and a mobile phone with WiFi interfaces, and optionally to a third device that can generate transmissions in WiFi frequencies, such as a microwave oven working in 2.4GHz.
- Wireshark (and any additional monitoring software, e.g., Network Monitor for Windows users) installed in one of the devices, such as in the laptop
- Familiarity with Wireshark, such as completion of Lab 1
- Understanding of the concepts of modulation and coding schemes used in WiFi networks (Week 4 lecture)

Introduction

Choice of modulation and coding affects the transmission data rates in wireless networks. There are many combinations of modulation and coding implemented in consumer WiFi chipsets. These combinations, known as modulation and coding schemes (MCSs), are standardized by IEEE 802.11. WiFi networks monitor the channel all the time and switch to an appropriate MCS depending on the channel condition, which also affect the instantaneous data rate of the wireless communication. In this lab, you will use simple tools, such as laptops, phones, and WiFi packet capture tools (e.g., Wireshark), to observe such dynamic variation of data rates and identify the MCSs being used by the WiFi network.

Your Tasks

Task-1: Channel variation due to change of Tx-Rx separation: Distance affects signal strength (RSS) and hence SNR. Weaker SNR makes it difficult to detect symbols from complex MCS, and vice versa. As such, WiFi chipsets are expected to switch to simpler MCS when Tx-Rx separation is increased, and vice versa. Start WiFi data transmissions between a phone and a laptop and then move the phone away from the laptop and then bring it closer again, slowly. Keep capturing WiFi packet in Wireshark during this time. Analyse RSS, MCS as well as the data rates from the Wireshark traces and try to explain how change in distance affects MCS/data-rate.

Task-2: Channel variation due to obstacles: Obstacles between Tx-Rx affects signal strength (RSS) and hence SNR. As such, WiFi chipsets are expected to switch to simpler MCS when Tx-Rx path is obstructed, and vice versa. Start WiFi data transmissions between a phone and a laptop and then bring an obstacle, such as a sofa between them and then remove it again, slowly. Keep capturing WiFi packets in Wireshark during this time. Analyse RSS, MCS as well as the data rates from the Wireshark traces and try to explain how change in obstacle affects MCS/data-rate.

Task-3: Channel variation due to interference: Interference from other wireless transmissions affects signal-to-noise-and-interference-ratio (SNIR). As such, WiFi chipsets are expected to switch to simpler MCS when there is severe interference, and vice versa. Start WiFi data transmissions between a phone and a laptop and keep capturing WiFi packets in Wireshark during this time. Also, turn on a smart TV and watch a video from the Internet. Now turn on a microwave oven nearby, which uses 2.4GHz (all microwave ovens do). You may find that the video stall in your smart TV due to severe interference in the WiFi network arising from the high-power use of 2.4GHz in the microwave. The microwave should also affect the WiFi transmission between the phone and the laptop. Analyse RSS, MCS as well as the

data rates from the Wireshark traces and try to explain how the microwave operation affects MCS/data-rate.

What to submit?

1. Submit a ZIP file containing your relevant Wireshark traces and CSV files for different tasks. **[2 marks]**
2. Submit a PDF report on your observations. **[2 marks]**

Penalty at the rate of 10% for each day late will be strictly enforced for all lab submissions. All submissions will be subject to strict UNSW plagiarism rules.

End of Lab 5 – Hope you enjoyed this lab.