In-class Laboratory Exercise 2 (L2)

Part I – Objectives and Laboratory Materials

Objective:

The objectives of this laboratory are to:

- Introduce you to the infrastructure and ad-hoc modes of wireless LAN operation.
- Evaluate network performance by measuring throughput.

After completing the assignment, you should be able to:

- Set up an infrastructure network consisting of multiple nodes and an access point.
- Set up an ad-hoc network between two or more devices.
- Measure the throughput and evaluate the effective range of wireless devices.

Hardware to be used in this Laboratory Exercise:

- Intel IEEE 802.11a CardBus adapter
- Xircom IEEE 802.11b wireless adapter
- Dell Latitude C640 notebook computer
- Intel dual access point (set up by the laboratory instructor)

Software to be used in this Laboratory Exercise:

- *Iperf*, a traffic generation and network performance measurement tool

Part II – Pre-lab Assignment

Complete the following *before* the laboratory session.

- Read about the features and operation of *Iperf* (see http://dast.nlanr.net/Projects/Iperf/iperfdocs_1.7.0.html).

  Note that a copy of the document is saved as file index.html in directory C:\WNMS\Labs\Lab_2\doc on the notebook computer. During the lab exercise, you will find *iperf* installed in directory C:\WNMS\Labs\Lab_2 on the notebook computer.

Part III – In-class Laboratory Exercise

You are expected to perform the following tasks during the laboratory session.

- Before the laboratory or at the beginning of the laboratory, each group of two students will be loaned equipment for the semester. Please check that you have the following items.

  1. One Dell latitude C640 laptop computer
  2. One Compaq iPAQ with a dual card sleeve
  3. Two 802.11b Xircom wireless Ethernet cards
  4. One 802.11a cardbus adapter
  5. One Xircom Credit card Bluetooth card
  6. One Intel wireless gateway

The laboratory consists of two experiments, the first using IEEE 802.11a in infrastructure mode and the second using IEEE 802.11b in ad-hoc mode.

IEEE 802.11a in Infrastructure Mode

The laboratory instructor will first configure the IEEE 802.11a access point and demonstrate the steps. You will then evaluate the performance of the 802.11a link by measuring the throughput associated with the link. First, boot the computers into the Microsoft Windows operating system and, then, insert the IEEE 802.11a CardBus adapter in the PC Card slot.

- Teams of two groups (with two students in each of the two groups and four students in each team) will perform this experiment. The lab instructor will form the teams.
- One of the important parameters in the evaluation of network performance is **throughput**. To measure throughput for IEEE 802.11a, we will connect two notebooks equipped with IEEE 802.11a cards in infrastructure mode.
- The dual access point has the WEP key set and it is necessary for the CardBus adapter to be configured for WEP so that it can associate with the access point. To do so, start the IEEE 802.11a CardBus utility on the notebook by clicking on the Intel PROSet II icon in Control Panel. If an alert window appears, click "No" to continue. Switch to the settings tab and edit the *My WLAN place*s. Open the default profile, select the security setting, select the "Enable security" radio button and edit the WEP key to be "ABCDEF4570".
- Check whether your adapters are associated with the access point by pinging the dual access point in the command window. If unsuccessful, ping will return *ping request timed out*. The IP address of the dual access point is 192.0.2.1.
- Once successfully connected, we will use *Iperf* to measure the throughput. Iperf is a TCP and UDP bandwidth-measuring tool based on the client-server paradigm. In each team, one of the groups will configure their notebook computer to act as the transmitter of data (the Iperf client). The other group will configure its notebook computer to act as the receiver of data (the Iperf server).
- Open a command prompt on both the client and server computers and change the current directory to C:\WNMS\Labs\Lab_2.
- Configure the Iperf server in each team to receive UDP data of length 1470 bytes[1] on port 5001. The Iperf server should generate a report of data received every second and the output should be logged in the file lab2.txt. Use the redirection operator to save the data in the file.
- Configure the Iperf client in each team to transmit UDP datagrams of size 1470 bytes to the server on port 5001 for 10 seconds at a bandwidth of 54 Mbps. Record the throughput and the UDP packets lost for the experiment. Take a screen snapshot[2] of the throughput value obtained and include it in the report (see the at-home assignment). The two groups that perform the experiment as a single team should report the same results, i.e., you should share results with the other group in your team.

IEEE 802.11b in Ad-hoc Mode

The second experiment deals with setting up an ad-hoc network between two IEEE 802.11b devices. All groups will perform this experiment.

[1] Note that since the length of datagram is 1470 bytes, each UDP datagram will fit in one IP packet.

[2] You can take a snapshot of the current Window by simultaneously pressing the Alt and PrntScrn buttons. This copies the snapshot to the clipboard. You can open the Paint program in Start>Programs>Accessories>Paint, paste the image into the application, and then save the file. You can also do this with other applications.

- To setup an ad-hoc network between two nodes, insert the Xircom 802.11b adapter in the notebook computer. Open the Xircom Client Utility on the Windows desktop. Set the "Network type" to be *Ad-Hoc* and enter the ESSID as "ECECS4570" (this is the same ESSID as in Laboratory 1). Set the transmission power to 1 mW under the tab "RF network."
- Auto-configuration is a feature that allows any machine to set its own IP address and defend its use against other machines in the same network. It is ideal for settings that lack centralized network administration, such as many ad-hoc networks. The IP address in Microsoft Windows can be checked by using the *ipconfig* command. After about 5 minutes, use the *ipconfig* command and record the IP address that was obtained by the card via auto-configuration.
- Test whether your notebook belongs to the network established in the class by pinging a group close to you. Report the ICMP replies returned by the ping. Take a screen snapshot of the ping output and save the file (as a ".bmp" file) for use in your report.

We will deal with other aspects of ad-hoc networks in later labs.