UNIVERSITY OF CALIFORNIA, DAVIS

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EEC173B/ECS152C **Winter 2006**

Lab #1 (Due Jan 20)

1. Re-Discovering Davis Wireless Coverage (15%)

In Spring 2005, students in this class have had some fun exploring wireless LAN coverage in Davis using GPS receiver and NetStumbler software. The results can be viewed at the following page:

http://www.ece.ucdavis.edu/~chuah/classes/EEC173B/davis-wireless.html

Stumbling is the process of collecting traces of available beacons like 802.11 access points on a mobile device, which is also connected to a GPS unit. After populating the wireless coverage database with the different wireless networks discovered in the particular area, one could use software like the Intel Placelab to "infer" user/device location by tracking which subset of these wireless networks is being seen by the device.

This quarter, we are going to measure the available wireless connectivity in more details.

(a) Monitoring Signal Quality and Handoffs (5%)

You don't need a GPS receiver for this part. You will be measuring the signal quality of your access point connection immediately prior to and following a handoff. Monitor to which access point you are connected, and what the quality of the signal is. As you walk down the hallway, you will handoff from one access point to another, or disconnected from the original access point. This will probably happen multiple times as you walk down the hallway (or across campus). You should record the MAC address of the access point you are connected to immediately prior to and following the handoff, as well as the signal quality of each connection. Record the signal quality in terms of Signal-to-Noise Ratio (SNR). Note the estimated distance from the access point.

Perform this experiment for two different kinds of environment, e.g., indoor vs. outdoor, walking vs. driving, etc. Include the following in your report

- Describe the two experiment settings. For each experiment, plot a SNR vs. distance graph.
- Comment on when handoff happens or connection breaks. Search for estimates of how far away from a wireless access point you can go in a typical home or office environment. How about outdoor?

(b) Accessibility (10%)

In addition to discovering the SSID, MAC address, and the location of the access points, we would like to determine whether these access points are open (i.e., anyone can connect through it) or secured? How are they secured? MAC authentication? WEP key?

You will be provided with a GPS receiver. You can choose to perform the network stumbling with your laptop (recommended), PDA, or phone. Please follow the following procedures:

- Register with Wireless Geographic Logging Engine (WiGLE) at http://www.wigle.net
- If you are using a laptop, download NetStumbler from: http://www.stumbler.net/
  If you are using a PDA, download MiniStumbler from: http://www.stumbler.net/

If you are using a cell phone, follow the PlaceLab Phone Stumbler Howto at: http://www.placelab.org/toolkit/doc/phonestumbler_howto/

- Sign up for a specific quadrant of Davis that your team is going to explore (to avoid duplication with other teams).
- Happy stumbling!
- Post your files to www.wigle.net

In your report, answer the following questions:

- Submit a summary table of wireless networks discovered and their GPS location
- Classify the detected wireless networks into groups, e.g., what percentage of the access points are secured vs. unsecured? What many of them use WEP key? How many rely on MAC authentication?
- Focus on a specific location, e.g., 2 city blocks in downtown Davis. For the open wireless networks detected, do you manage to associate to the network (i.e., obtain an IP address)? Can you run 'ping'? Can you transfer data over it? If so, what kind of throughput can you obtain?

2. (Bonus) Measuring the impact of handoffs (5%)

For this part, you will measure how the throughput (the rate at which you could send data successfully across the network) changes as you move further and further away from the access point until either a handoff occurs or a connection breaks.

Hint 1: You can create a constant bit rate (CBR) traffic generator that transmits UDP data packets at some specified interval, as well as a CBR receiver to receive and process the packets. You should be able to change the size of the data packets it generates, as well as the packet sending frequency. The total number of packets sent will vary depending on the sending rate you choose. Each data packet should have a sequence number so that you know which packets you receive.

You should run each combination twice. The first time you run it, stand still during the entire experiment. This is your reference value for your reception rate without movement. For the second run, you must handoff from one access point to another sometime while the data packets are being transmitted. This will show you how the handoff affected the data packet reception rate.

For each combination above, determine the raw number of data packets that you receive, as well as the corresponding number that are dropped. Report the results form both runs of each data session, including the MAC addresses and location of the access points you were corresponding with. In addition, create a graph for each data session indicating the data packets that were received. Include in your report an analysis of the graph that assesses the impact of the handoff on the data packet reception.

Explain your results, accounting for any differences in packet drop rates between the scenarios. Include a printout of the code you wrote for the traffic generator and receiver.

Hint 2: You can FTP or download a huge data file and see how fast you can complete the transaction. However you won't be able to measure data loss directly.