■ ECE/CS 4984: Wireless Networking and Mobile Systems ■

At-home Exercise 7 (E7)

Part I – Objectives

The objectives of this assignment are to:

- Analyze the effect of the virtual carrier sensing mechanism on 802.11b performance.
- Study the effect of hidden nodes on ad-hoc networks.

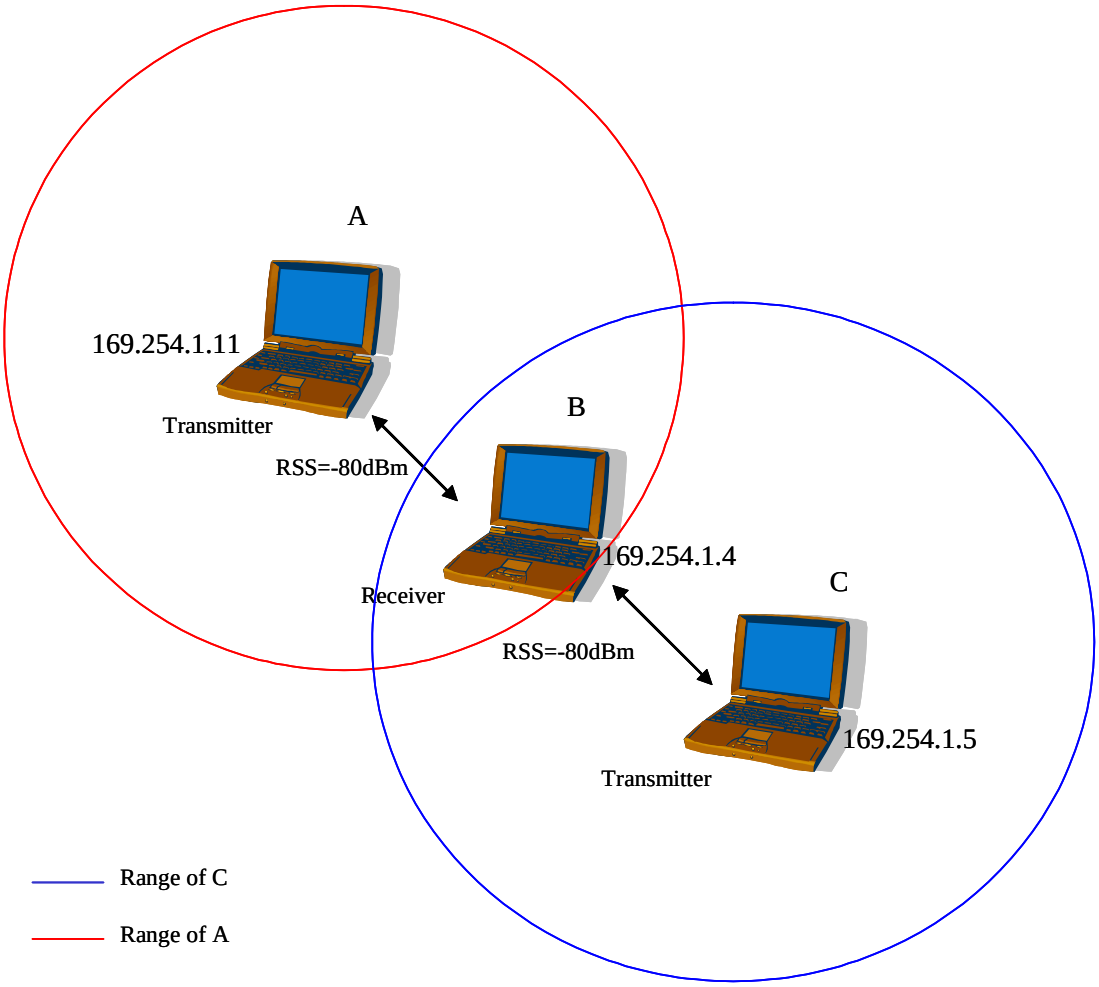
After completing the assignment, you should be able to:

- Suggest scenarios where the virtual carrier sensing mechanism will prove to be effective in addition to the existing CSMA/CA protocol.

Part II – At-home Lab Assignment

You are expected to perform the following tasks.

- Consider the network set-up as shown in Figure 1. An experiment was performed by the GTA in which data was sent from node A and node C to node B. *Iperf* was used to generate the traffic and Observer, a network sniffer, was used to capture the traffic. The experiment was carried out for two different MAC layer conditions. In the first case, the virtual sensing mechanism was disabled and UDP data was transferred for 1 minute from each of nodes, A and C to node B at a rate of 2Mbps. The UDP datagram size was 1470 bytes. A screen shot of the data captured by Observer is shown in Figure 2. Figure 2 provides a summary of the data exchanged by the two transmitter nodes (A and C) with the receiver node (B).



Mapping of MAC addresses to IP addresses

Nodes	IP address	MAC address
Node A	169.254.1.11	xx:xx:xx:38:61:F1
Node B	169.254.1.4	xx:xx:xx:48:43:BC
Node C	169.254.1.5	xx:xx:xx:35:CA:F3

Figure 1: Network set-up for experiment performed by the GTA

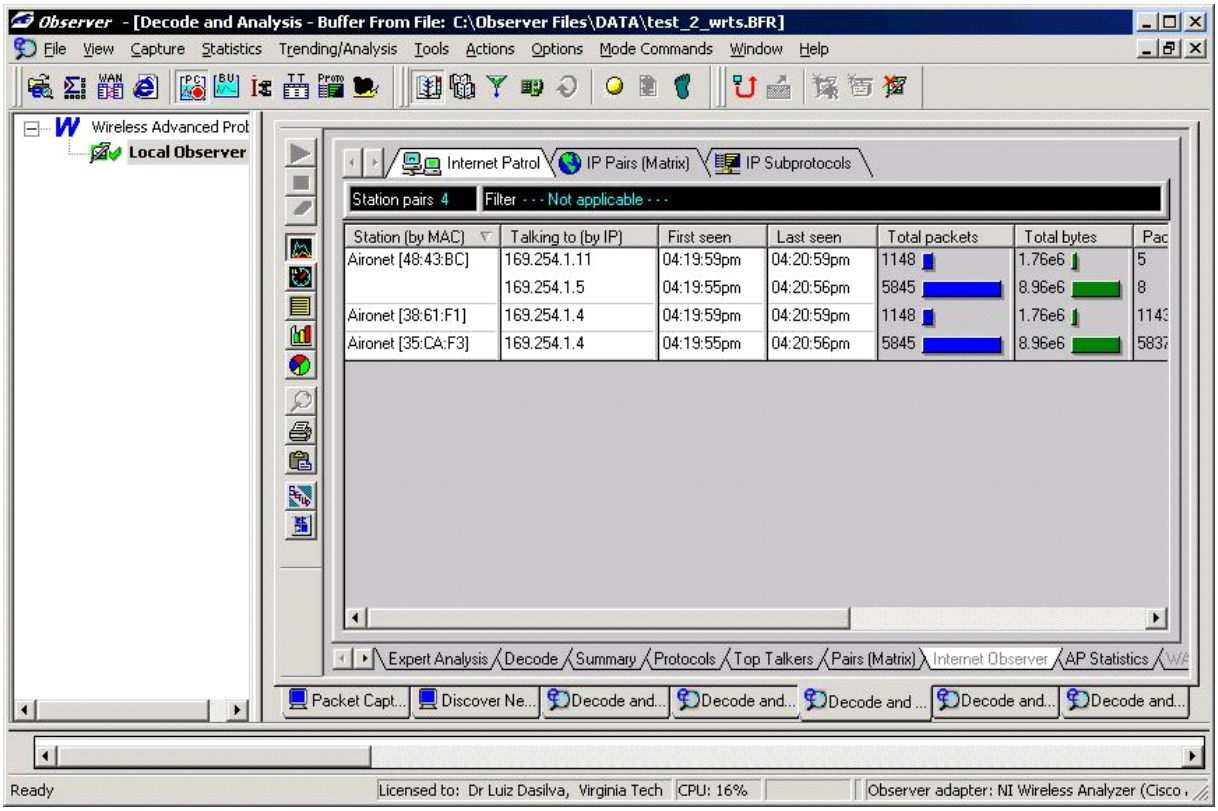


Figure 2: Data captured by Observer with the virtual sensing mechanism disabled.

For the second case, the virtual sensing mechanism was enabled and UDP data was transferred for 1 minute from the two transmitter nodes to the receiver. The IEEE 802.11b bandwidth for each of the two links was fixed at 2Mbps and the UDP datagram length was set to 1470 bytes. A screen shot of the data captured by Observer is shown in Figure 3.

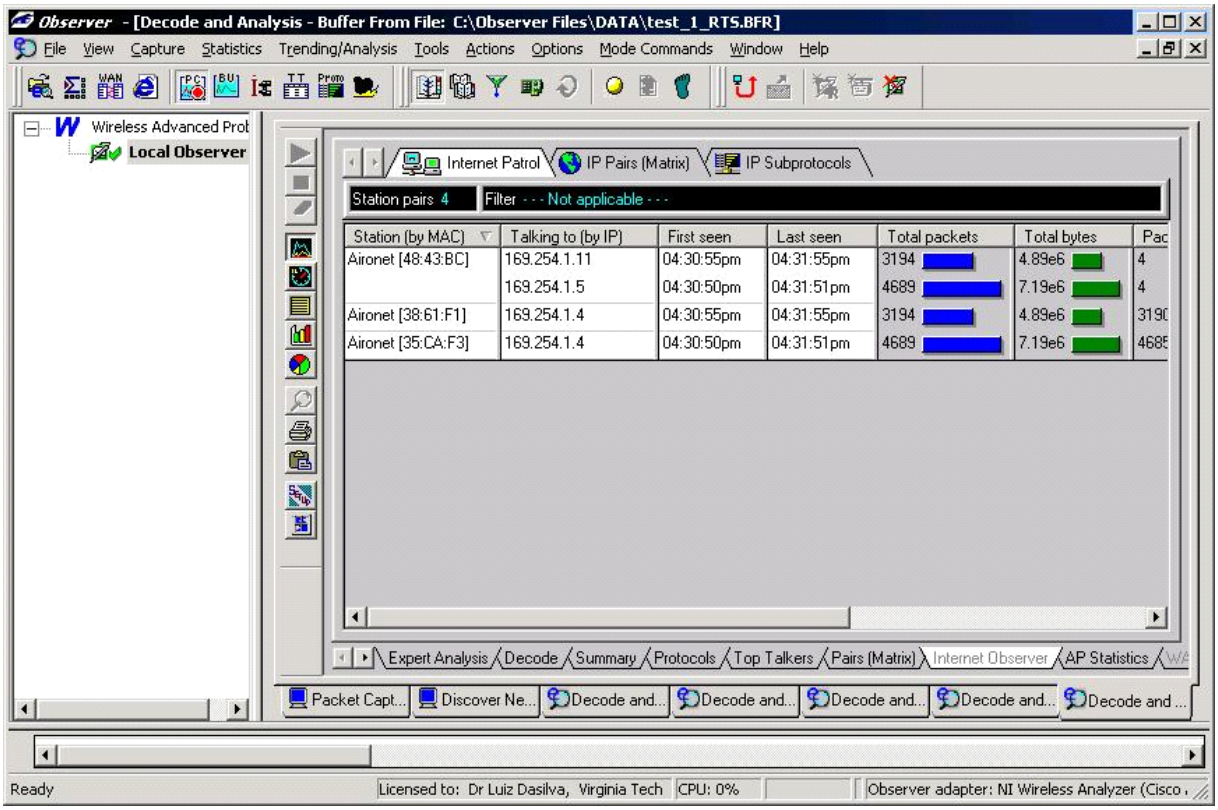


Figure 3: Data captured by Observer with the virtual sensing mechanism enabled.

Answer the following questions.

1. From Figures 2 and 3, briefly explain the reason for the difference in the number of bytes observed at the MAC layer transmitted by node C to node B.

2. When the virtual sensing mechanism is turned on, why do you observe an increase in the number of bytes transmitted by node A?

3. Do you think it is justified from the perspective of node A, to enable the virtual sensing mechanism for the network scenario considered here? Infer your answer from the screen shots provided.

Part III – Report

This report will include both in-class and take-home aspects of this lab assignment. Provide a report that answers each of the following questions in the order given.

Part I – In-class Experiments

1. Include 2 screen shots (ping output and *iperf* throughput) from in-class lab.
2. From the in-class exercise, plot the variation in throughput versus packet size with and without the virtual carrier sensing mechanism, as experienced by your node. If you were acting as the "receiver" plot the data observed at any one of the "transmitter" nodes.

Part II – Take-home Experiments

1. Include the answers to the three questions in Part II of this at-home assignment.
2. Experiments to observe the effect of RTS/CTS on throughput.
    A. Do the throughput curves for the two scenarios intersect?
    B. Is the throughput for your transmitter node with the RTS/CTS mechanism enabled more than that obtained with the RTS/CTS mechanism disabled? Give reasons for the observed behavior.
    C. Do you think that the virtual sensing mechanism should be enabled irrespective of the data payload? Briefly explain your answer.

Part III – General Conclusions

This is the free-form portion of your report. Provide a summary of lessons learned in this lab, general observations on how each of the tools illustrated by the experiments can be used to configure and assess performance of the network, any unexpected results obtained, etc. Feel free to suggest improvements to the experiments.