IT 304: Computer Networks

Lab # 4: Understanding Physical Carrier Sensing and Virtual Carrier Sensing in IEEE 802.11 *

For the Week of September 02, 2013

Pre-lab preparation:

- Read the relevant portions of the textbook on CSMA/CA, physical carrier sensing and virtual carrier sensing and DCF access mechanism.
- Go through the Chapter 16 of NS manual on Mobile Networking to see how a typical Wireless LAN scenario can be created. Also go through the new NS trace format that can be used with wireless simulations.

1. **Aim:** The purpose of this lab is to understand the virtues of physical and virtual carrier sensing mechanisms used in IEEE 802.11 (WiFi) networks.
2. **CSMA/CA mechanism and IEEE 802.11-DCF Mechanism:** The variant of carrier sense multiple access (CSMA) mechanism used in IEEE 802.11-distributed coordination function (DCF) is known as CSMA/collision avoidance (CSMA/CA) mechanism. The choice of CSMA/CA mechanism is simply driven by the fact that in a wireless medium it is not possible to detect collisions, unlike as in wired medium.

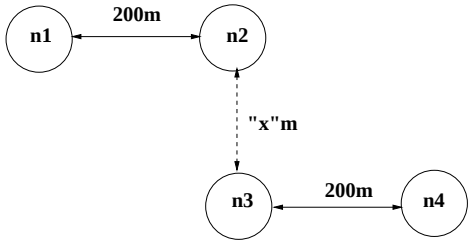

Figure 1: The figure above shows the network scenario considered as part of this lab.

3. **Lab Scenario:** The lab scenario that we intend to consider is shown in Fig. 1. As part of this scenario two CBR conversations take place: one between n1 and n2 and another between n3 and n4. The source code in the form of ".tcl" file to accomplish this file is also posted along with this handout. The usage of .tcl file is as follows: `ns csense_original.tcl -RTSthresh <RTS_Threshold> -CSthresh <carrier-sense threshold> -dist <x>`. The values `RTS_Threshold`

and `carrier-sense threshold` can be set as in 4(a) and 4(c) below. The value `x` can be set to an appropriate value.

4. **Exercises:** As part of this lab we shall observe the effect of physical carrier and virtual carrier sensing in IEEE 802.11 compliant networks. Read the instructions carefully and work on the required things.

   (a) The virtual sensing that happens via the RTS/CTS mechanism happens can be disabled by setting the parameter `RTSThreshold_` in `Mac/802_11` to a very high value (more than 10000 bytes). Similarly, the physical carrier sense can be disabled by setting the carrier sensing threshold parameter `CSThresh_` in `Phy/WirelessPhy` more than or equal to `RXThresh_`

   (b) Can you explain the difference between `CSThresh_` and `RXThresh_`?

   (c) Obtain the `CSThresh_` value needed to have a carrier-sense range of 250, 300, 400 and 500 metres respectively assuming a TwoRayGround propagation model (this can be accomplished using the "threshold" utility provided in NS2; it is nothing but a C++ program provided at `ns/indep-utils/propagation/threshold.cc`; look in Chapter 18 of NS manual on Radio Propagation Models for its usage).

   (d) For each value of `CSThresh_` run the simulation by shutting down RTS/CTS and for values of x=100, 200 and 300 metres respectively. Also run the simulation for each value of x using the default RTS threshold by shutting down carrier sensing.

   (e) Obtain the normalized CBR throughput in both cases (i.e., ratio of number of received packets and number of sent packets).

   (f) Also examine the number of MAC collisions recorded in the trace and the type of packet involved (CBR/non-CBR).

   (g) The above two steps may be accomplished by postprocessing the trace file using AWK scripts (as done in Lab # 3).

   (h) Plot the overall throughput for each run as a bar graph. Also plot the number of CBR and non-CBR packets dropped due to collision.

   (i) Based on the plots try to explain what you observe from them.