CS224 (m): Computer Networks (minor)
Tutorial 12, 19/21 Oct 2016

Concepts tested: Wireless, WiFi, MAC

1. In which of the following MAC protocols is there a delay (latency) associated with accessing the channel to transmit a packet? Assume the packet is at the head of the queue. FDMA, TDMA, Polling, RandomAccess. (Extra: what about CDMA?)

2. In which of the following techniques can a node prepared to receive from its sender, receive (whether it wants to or not) other sender's transmissions? Assume a simple receiver with no special capabilities. FDMA, TDMA, Polling, RandomAccess. (Extra: what about CDMA?)

3. For a polling system with d_p polling delay overhead per node, where each node can send at most Q bits per poll, what is the maximum achievable system throughput. Assume N nodes and rate of R. System throughput is the overall throughput as seen on the link (not user specific throughput).

4. Install the "inssider" software, and observe what WiFi service sets are in your vicinity. Observe the channel widths and center frequencies of the various service sets. Do they match with that specified in the slides?

5. Find out the 802.11 technology variant used in your laptop, smart-phone, or tablet. How can you find this out in general?

6. [**Extra: 10HP**] Create an adhoc WiFi network between any two or more devices. Send some traffic (e.g. ping) between them.

7. Suppose a 802.11b transmitter is transmitting UDP packets with a UDP payload of 1400 bytes. What is the maximum application layer throughput achieable? Be sure to account for the various overheads at the different protocol layers. If you need the value of a parameter you do not know, look at the lecture material, or Internet search, or ask the instructor. Can you make an excel sheet calculator with the appropriate parameters? Consider both cases: without RTS/CTS, and with RTS/CTS.

8. Repeat the above calculation for a UDP payload of 160 bytes.

9. On your laptop, start an audio conversation with a friend. Or just make the Skype test call. Observe the UDP payload of the packets, using wireshark. (Sometimes Skype can use TCP, in which case, assume that the payload size will be the same even when UDP is used). What is the overhead percentage in this case? What can you conclude from this exercise about the appropriateness of WiFi for audio conversations such as Skype?

10. Repeat the above exercise for the case when 802.11g is used. (If you had prepared the spreadsheet mentioned earlier, this job will be much easier!).

11. [**Extra: 10HP**] Repeat the above exercise for the case of 802.11n 3x3, first without any frame aggregation.

12. [**Extra: 10HP**] Next repeat the exercise for the case of 802.11n 3x3, when 20 MAC frames are aggregated as one PHY layer transmission.

13. Answer the questions raised with respect to the RTS/CTS mechanism.

    - What is the access mechanism used before sending an RTS?
    - What is the gap between RTS & CTS? Why?
    - What is the gap between CTS & DATA? Why?
    - Can there be collision of two RTS frames?
    - Suppose radio range is non-circular, irregular. Will RTS/CTS work to prevent hidden terminal collisions?
    - Does RTS/CTS address the exposed node problem?

14. This exercise may not work in Windows, if so, find a friend who has a Linux laptop. Using wireshark, observe the various address fields for the different scenarios mentioned in the examples.

15. [**Extra: 10HP**] Do this exercise as a group of four laptops. Create an adhoc mode WiFi network among yourselves. You may have to assign static IP addresses. Try sending some network traffic (e.g. a file transfer) across two machines over the adhoc network.