ITS 413 – WIRELESS LAN EXAMPLES

1 IEEE 802.11b

Lets assume IEEE 802.11b. We have the following parameters:

- Date rate: 11Mb/s
- DIFS: 50μs
- SIFS: 10μs
- Slot Time: 20μs
- CWmin: 31
- CWmax: 1023

Lets assume the size of headers/control frames are:

- DATA header (and trailer): 34 bytes (272 bits)
- ACK frame: 14 bytes (112 bits)
- RTS frame: 20 bytes (160 bits)
- CTS frame: 14 bytes (112 bits)

Lets assume that an entire DATA frame is sent at the highest data rate (11Mb/s), but control frames (ACK, RTS, CTS) are sent at the base data rate of 1Mb/s. (This is typically what is done in practice, since all nodes, no matter the data rate, must be able to hear the control frames).

Therefore, the time to transmit some example packets are (to the nearest μs):

- DATA with payload of 100 bytes: 97
- DATA with payload of 1000 bytes: 752
- DATA with payload of 1500 bytes: 1116
- DATA with payload of 104 bytes: 100
- DATA with payload of 654 bytes: 500
- DATA with payload of 1341 bytes: 1000
- ACK frame: 112
- RTS frame: 160
- CTS frame: 112

For simplicity in the following calculations, lets round the ACK/CTS/RTS to 100.

2 Throughput Measurements

Throughput is the rate at which payload data is successfully received.

For simplicity, we can calculate as follows:

Throughput = Total Payload Successfully Received / (Time between first payload available and last ACK received)

For the following 3 cases, draw a diagram showing the DCF operation and calculate the throughput for each station, as well as the overall throughput for the network.

3 Basic Access

Consider the example in the lecture (see below) with the following assumptions:

- Payload is 1341 Bytes.
- All stations are within range of each other
- Client A has data to send to AP at time 0
- AP has data to send to Client A at time 1420
- Client B has data to send to AP at time 220
- Random numbers chosen by each station for backoff (in sequence):
  - A: 10
  - AP: 3
  - B: 10

4 Basic Access and Hidden Terminals

Consider the case of Basic Access with hidden terminals present with the following assumptions:

- Payload is 1341 Bytes.
- Clients A and B are within range of the AP
- Clients A and B are outside of each others range
- Client A has data to send to AP at time 0
- Client B has data to send to AP at time 170
- Random numbers chosen by each station for backoff (in sequence):
  - A: 10, 5, 12
  - B: 4, 42, 50
- ACKTimeout = SIFS + ACK = 110

5 RTS/CTS

Consider the case of RTS/CTS with hidden terminals present with the following assumptions:

- Payload is 1341 Bytes.
- Clients A, B, C are all within range of the AP
- Each client is outside of the range of every other client
- Client A has data to send to AP at time 0
- Client B has data to send to AP at time 270
- Client C has data to send to AP at time 500
- Random numbers chosen by each station for backoff (in sequence):
  - A: 5
  - B: 4
  - C: 12
- ACKTimeout = SIFS + ACK = 110