EP1100 Datakommunikation och datornät

3. Multiple access links: Problems

C1. Assume that four nodes – A, B, C and D, are connected to a wireless network, based on the IEEE 802.11 standard. Assume also that we don't use RTS/CTS.

a) Node A wants to send one frame to the access point. How would node A do this?

b) While A is sending its frame, nodes B, C and D also decide to send frames. Assume that both B and C choose a back-off time of 15 time units, and D chooses a back-off time of 5 time units. Which node is going to send first its frame? In what state will the other nodes be at that time?

c) What happens with nodes B and C, after D has completed its transmission? What is going to be the new size of the contention window (CW), if it was 31 in the beginning?

C2. Assume a wireless network that adopts RTS/CTS. If the size of the RTS frames is 20 bytes, and the CTS/ACK frames are 14 bytes long, how much overhead (in percentage of the total amount of transferred data) does the RTS/CTS procedure add in the following cases:

a) Frames containing 40 bytes data (for example a TCP control packet)?

b) Frames containing 576 bytes data (the minimum allowed upper limit for an IP packet)?

c) Frames containing 1500 bytes data (the maximum frame size for data transmission over Ethernet)?

C3. Consider an 802.11 network with one access points (AP) and two stations (A and B). All nodes continuously sense the medium before they attempt to transmit. Assume that A has just finished transmitting a frame to the AP and is waiting for an ACK. Station B senses that the medium is free and it may try to reserve it by issuing a request to send (RTS). Will this RTS collide with the pending ACK or not? Justify your answer. Assume that propagation delays are negligible.

C4. Consider a wireless network shaped like a pentagon. The wireless nodes are shown at the vertices A, B, C, D, and E, and the nodes are placed such that each node can talk only to its two neighbors – as shown. Thus there 10 unidirectional wireless links in this network. Assume that the nodes employ RTS/CTS and also require ACKs for successful transmission. Consider a situation when A is transmitting a packet to B. Obviously, link A→B is active, and all links that are affected by this transmission must keep quiet. Considering RTS/CTS, and ACKs, indicate which of the other links could also be active at the same time. In other words, indicate which of the other links could be simultaneously transmitting.