Networks Sub-module Assignment

Answers for Part 2

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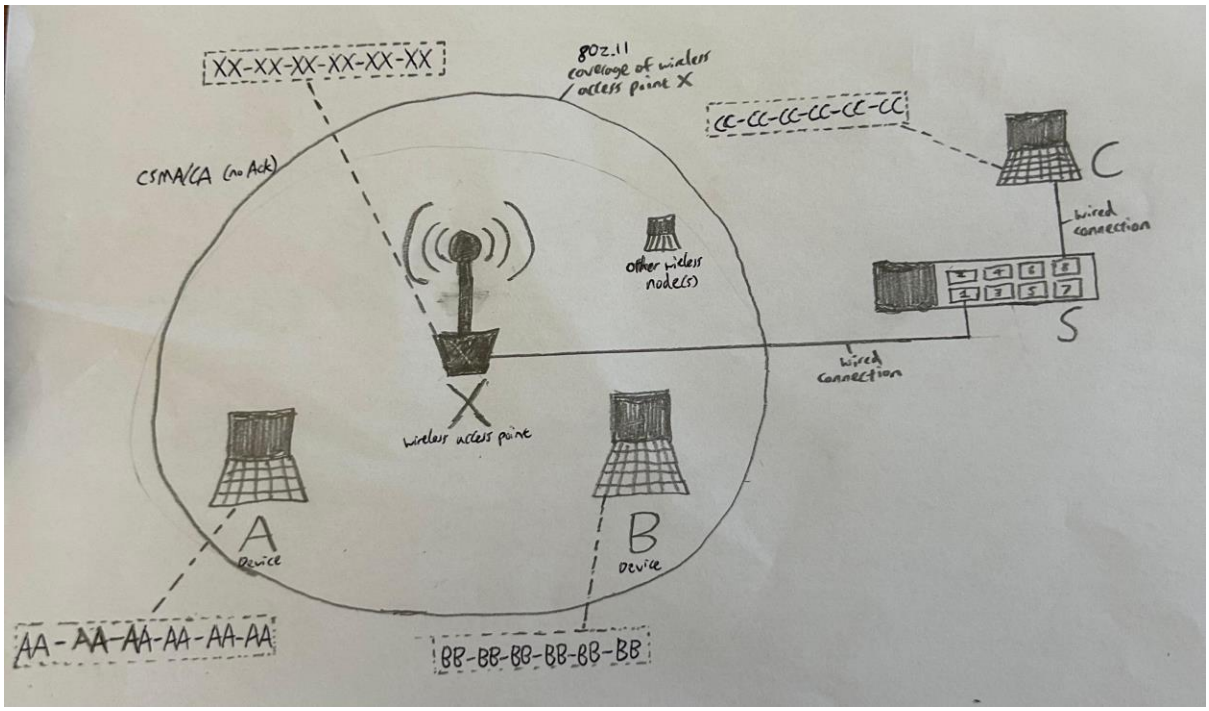
1. Sketch a topology to accurately reflect the connections of the network described above. Your topology should include all devices mentioned and their connections. As for wireless devices, you may use coverage to show connections. You may use tools such as Word, Paint, Visio, etc. to complete this topology. (10 marks)



2. Which wireless user devices above can receive the frame sent by C? Why? (4 marks)

The wireless user devices A and B can both receive the frame sent by C. This is because both A and B can hear X's transmissions: When C sends to a wireless node covered by X, the frame reaches X over the wired path, and X relays it onto the wireless medium (this is the standard infrastructure mode role of an AP/base station, bridging between wired and wireless hosts).

The question states that A and B can hear X's transmissions, so both A and B are able to physically receive X's wireless transmission. However, although A and B can both physically receive the frame, they will discard it at the MAC layer. This is because the

frame sent by C did not specify that A or B was the intended destination MAC address. So, A/B will receive the frame but will not accept it as the intended recipient.

3) At what time does A start sending its frame (i.e., putting the frame on the transmission medium) to X? At what time does B start sending its frame to X? At what time does C's frame arrives at the destination? Explain. (8 marks)

(non-traditional CSMA/CA method: backoff never pauses, regardless channel free)

A: Frame ready at 20 μs. After DIFS: 20-25 μs does backoff 8 μs. 25 + 8 = 33us. And channel is idle at 33 μs (B, C frame not being sent yet), so A starts transmitting at 33 μs and occupies the wireless medium for 60 μs: 33-93 μs.

X (forwarding C's frame): C's frame arrives at X at 30 μs. After DIFS: 30-35 μs. Backoff 9 μs ends at 44 μs, but the channel is busy at 44μs (A is transmitting between 33-93), so X resets its backoff and repeats: Backoff expiries occur every 9 μs: 44, 53, 62, 71, 80, 89, 98. Since Channel becomes idle at 93 μs (A finishes transmitting between 33-93), the first expiry after this is 98 μs, so X starts transmitting C's frame at 98 μs until 20 μs later: 98 + 20 = 118 μs. C's frame arrives at destination at 118μs.

B: Frame ready at 40 μs. After DIFS: 40-45 μs, does backoff 11 μs which expires at 56 μs, but the channel is busy (due to A transmitting at 33-93), so B resets the backoff which repeats: Backoff Expiries: occur every 11μs: 56, 67, 78, 89, 100, 111, 122. X transmits (98-118), so 100 and 111 also occur because the channel is busy. The first expiry after 118 (Where the channel is now free because X has finished transmitting C's frame at 98-118) is 122 μs. Therefore B starts transmitting at 122μs till 202μs.

Final Answers:

- A starts at 33 μs
- B starts at 122 μs
- C's frame arrives at the destination at 118 μs

4) Give the switching table of S at 84 us. Explain. (8 marks)

At t = 0 μs, S receives C's frame on port 8. S learns from the source address of that frame: CC-CC-CC-CC-CC-CC is on port 8. By t = 84 μs, no frame has yet entered the switch from port 1 (from X), because A is transmitting to X over the wireless channel

from 33-93 μs, so X has not yet forwarded A's frame onto the wired switch before 93 μs, at t=84μs. From question 3's answer, X transmits C's frame over wireless (at 98-118μs) to a device, that is not the switch. Therefore, S has not learned AA or BB at t=84 μs, but it does already know C.

Switching (MAC) Table at t=84μs:

MAC ADDRESS	**PORT**
CC-CC-CC-CC-CC-CC	8

5) If you connect a computer to port 2 of S, which frame(s) can you receive from all the above processes? Explain. (5 marks)

A layer 2 switch forwards frames using its MAC (switching) table. At cold start the table is empty and the switch learns entries from the source MAC of each incoming frame and then forwards them. If the destination MAC is unknown, the switch floods the frame out all ports except the incoming port. If the destination MAC is known, the switch unicasts the frame only to the port recorded for that destination.

In the given scenario in above questions:

Frame sent by C at t = 0 μs: C sends a frame into port 8 (source = CC-CC-CC-CC-CC-CC). The destination is said to be "some other wireless node covered by X", so at cold start S has no MAC-table entry for that destination. Therefore the frame is an unknown unicast and S floods it out every port except port 8, including port 2. So the computer on port 2 can receive a copy of C's frame. (Also, S learns CC… → port 8 from the source address.)

Frames corresponding to A to C and B to C, when X later forwards A's and B's frames to C on the wired side: these frames' destination MAC is CC… and since S already learned CC… is port 8 from C's first transmission, these frames are known unicasts and S forwards them only to port 8, not to port 2. So the computer on port 2 will not receive A to C or B to C frames.

Conclusion:
The computer connected to port 2 can receive only the initially flooded frame sent by C at time 0 μs (and any broadcast/multicast traffic, but none is stated here). It doesn't receive the later A to C or B to C forwarded frames because they are unicasted to port 8 once CC… has been learned.