Networks Sub-module Assignment Answers for Part 2

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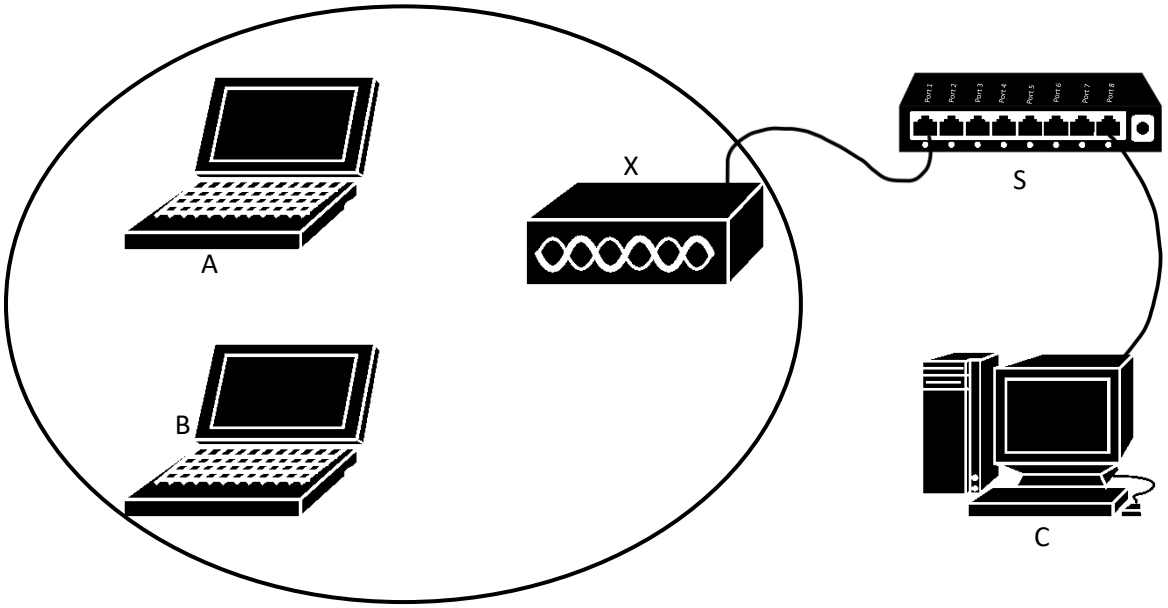
1. Sketch a topology to accurately reflect the connections of the network described above. Your topology should include all devices mentioned and their connections.



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

The wireless user devices A and B can receive the frame sent by C. This is because C sends the frame to the 2-layer switch S and subsequently S floods the frame out of all ports (except the incoming port – port 8).So the frame reaches port 1 (the access point). Crucially, the wireless scheme used here is CSMA/CA without acknowledgements meaning there is no filtering based on who 'should' hear it. Therefore, X broadcasts the frame over the shared wireless medium, and both A and B are within X's coverage and can hear its transmissions.

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.

At 0μs C starts sending its frame to X. This takes 30μs. So at 30μs X receives C's frame.
At 20μs A frame becomes available for transmission from A to C. The signal is detected as idle (because C's frame, although it started transmission first, has not reached X yet). So, A waits 5μs (DIFS). The signal is still idle so A's backoff timer begins (at 25μs), counts down for 5μs, and is frozen when X starts transmitting at 30μs. This takes 20μs. **C's frame reaches its destination at 50μs.**
At time 40μs, a frame from B was ready for transmission, but the signal was busy so its DIFS couldn't start.
At time 50μs the signal becomes idle again. A and B start their DIFS. This lasts until time - 55μs. A resumes it backoff timer, while B starts its backoff timer. B's backoff timer is 11μs and A has only 3μs left on its backoff timer. Therefore, **at time 58μs, A begins to transmit its frame**. This lasts 60μs until time - 119μs. At this point, B starts its DIFS until 124μs and continues its backoff timer – a further 8μs – until 131μs. So **B starts to transmit its frame at time - 131μs**, and this lasts until 212μs.
C's frame arrives at the destination at 50μs.
A starts to send its frame at 58μs.
B starts to send its frame at 131μs.

4. Give the switching table of S at 84 us. Explain

At 0μs C sends a frame. Frame enters the switch on port 8; the switch learns CC-CC-CC-CC-CC-CC to port 8. At 30-50μs X forwards C's frame wirelessly. No frame is sent from X into the switch and hence no new MACs learned. At 58-118μs A is transmitting wirelessly to X but A's frame has not reached X yet (because it takes 60μs) The switch only learns A's MAC address when its frame has been forwarded to it. Therefore the switch has not seen A MAC address at 84μs. Also to note, B hasn't started transmitting its frame so B's MAC address hasn't reached the switch either.

MAC Address	**Port**
	Port 1
	Port 2
	Port 3
	Port 4
	Port 5
	Port 6
	Port 7
CC-CC-CC-CC-CC-CC	Port 8

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

First we must consider the frames that pass through the switch. C first sends a frame to a wireless node (A/B). The switch hasn't learned As or Bs MAC address yet and thus the frame is flooded to all ports except port 8 where it came from. **Port 2 will receive C's frame.**

A then sends a frame to C. Since the switch knows C is on port 8, it forwards only to port 8, not to port 2. Likewise, when B sends its frame to the C, the switch knows C is on port 8. Therefore **Port 2 will not receive A's or B's frame.**

The computer connected on port 2 will receive C's initial frame but not A's or B's frame.