Quiz 3
Wireless Networks

Q1. Suppose you are using multipath TCP. Your NIC acts as segment-splitting middlebox and in addition, changes the initial sequence number. How would multipath TCP work in this scenario? Explain in not more than 4-5 sentences. [1.5+ 1.5]

Since the NIC acts as segment splitting middleboxes, the NIC will break the entire data into smaller segments and send over the network. Hence, the subflow sequence number will get updated but the TCP options will be the same for all segments. Thus, we need to include a mapping in the TCP options instead of just specifying the data sequence number for that subflow sequence number. Now, next the middlebox also changes the initial sequence number hence the mapping has to be relative instead of absolute.

Q2. Suppose you are performing web browsing over wireless. The HTTP version is HTTP/1.1. The browser opens 6-8 multiple parallel TCP connections to the same web server. We observed that HTTP is chatty and hence increases uplink traffic and hence collision on the channel. Suppose, without changing the HTTP protocol, we used MPTCP here i.e., instead of 6-8 connections the transport protocol creates only a single TCP connection and adds these 6-8 connections as subflows of the same connection. Would this reduce uplink traffic and result in lesser contention/collision in a WiFi network? Answer in not more than two sentences. [2]

In this case, using MPTCP would not give us any gain in terms of reducing the uplink traffic and hence contention/collision due to this. The reason is even though we are restricting the total number of TCP connections by utilizing MPTCP, the subflows can not just initiate data transfer they will still have to initiate the 3-way TCP handshake procedure through each MPTCP subflow and then eventually will get added to the MPTCP connection. Hence, in terms of chattiness due to TCP 3-way handshake is not removed.

Q5. Marks the one(s) FALSE [2]

a. Split-TCP does not maintain end-to-end semantics
b. Snoop TCP does not maintain end-to-end semantics
c. Snoop needs to maintain state at the BS
d. ECN is sent when congestion occurs

Q3. Suppose you are using WiFi CSI to perform three different activity recognition: stationary, walking, and running. Suppose, you collected a dataset in C21 of old acad i.e., our own classroom during class hours. Now, you trained a model for this. Next, you want to use the same model in the following environments. Tell whether the accuracy will improve/remain the same/ will degrade and also tell the reason. [2 + 2]

a. In the canteen during lunchtime
b. In C21 when nobody is present

a. The activity recognition model is trained in the C21 classroom during class hours i.e., when teachers, students, etc are present. Next, we want to apply the same model in the canteen during lunchtime. The canteen will have totally different architecture and will have many people. Note that WIFi CSI is very much dependent on the environment and if the environment becomes different the WiFi CSI values for the same activity will be very different. Hence the same model will provide reduced accuracy here.
b. In C21 when nobody is present. In this case environment remains the same. However, the presence of surrounding people matters in terms of WiFi CSI. As, in this case, nobody is present the WiFi CSI values of the same activity will not be the same as with what the model was trained with. Hence, it will provide reduced accuracy but the reduction will be lesser compared to a.

Q4. Suppose, a multipath TCP sender uses EWTCP as the congestion control algorithm and uses a value of alpha=1/k and k=4. [2 +2]

a. Will it be fair to regular TCP? Explain your answer
b. Will it be more efficient than regular TCP? Explain your answer.

a. The congestion control used is EWTCP. EWTCP increases the congestion window of each flow by alpha in every RTT. Here the alpha=1/k and k=4. Each sublow gets a window size proportional to alpha^2=1/16. Thus, if the number of subflows are more than 16, it will be unfair to regular TCP and till 16 subflows it will be fair to regular TCP.
b. Since the window size is proportional to alpha^2=1/16. The total increase is N*1/16. I.e., N=16. Hence, till 16 flows it is actually less efficient than regular TCP. After 16 flows it becomes more efficient than regular TCP as in that case the increase is N/16 as N>16 N/16>1