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EEC173B/ECS152C **Spring 2009**

Homework 3 (due May 5)

1. **(28 points) Mobile IP**

   (a) (8 pt) List the entities of mobile IP and describe data transfer from a mobile node to a fixed node and vice versa. Why and where is encapsulation needed?

   (b) (5 pt) Show the steps required for a handover from one foreign agent to another foreign agent, including layer 2 and layer 3.

   (c) (5 pt) Explain packet flow if two mobile nodes communicate and both are in foreign networks. What additional routes do packets take if reverse tunneling is required?

   (d) (5 pt) Name the inefficiencies of mobile IP regarding data forwarding from a corresponding node to a mobile node. What optimizations are possible and what additional problems do they cause?

   (e) (5 pt) What is the basic purpose of DHCP and how can it be used for supporting mobility?

2. **(22 points) Investigation of WLAN throughput.**

   a) (5 pt) Consider an IEEE 802.11b network with nominal 11Mbps data rate. Assume you are the only user in the system that runs a specific application. Consider two cases:
   - A single TCP session is used to transmit the application data,
   - Four simultaneous TCP sessions are used to transmit the application data.

   Which approach achieves better throughput, and why?

   b) (7 pt) How and why does I-TCP isolate problems on the wireless link? What are the main drawbacks of this solution?

   c) Imagine a TCP session over wireless where the congestion window is fixed at 5 packets (congestion control is turned off and no fast retransmits). The receiver has infinite buffer and it sends an acknowledgment as soon as it receives a packet, i.e., acknowledgments are not deferred. Similarly sender transmits a packet as soon as it is allowed to. Each packet carries 1000 bytes and the time to transmit a packet is 2 ms. Assume that transmission of ACK takes negligible time. Note that the retransmission timer for a packet is started after the last bit of the packet is sent.
   TCP's retransmission scheme is similar to go-back-N protocol, but it uses cumulative acknowledgements, i.e., when a receiver sends an ACK with sequence number N, it implies that all bytes from 0 to N-1 have been received correctly.

i. (5 pt) Suppose two *data* segments with byte sequence numbers 3000 and 15000 are lost once during the transmission. How many segments get retransmitted under each of the following conditions?
    - Round trip time = 100 ms, Timeout = 101 ms
    - Round trip time = 100 ms, Timeout = 152 ms

ii. (5 pt) Suppose *acknowledgments* corresponding to the above data segments are lost instead of the data segments. How many segments get retransmitted under the above conditions?
    - Round trip time = 100 ms, Timeout = 101 ms
    - Round trip time = 100 ms, Timeout = 152 ms