Mobile Networks and Applications: **Assignment 4** Spring 2015-2016

Due Date: April 25, 2016

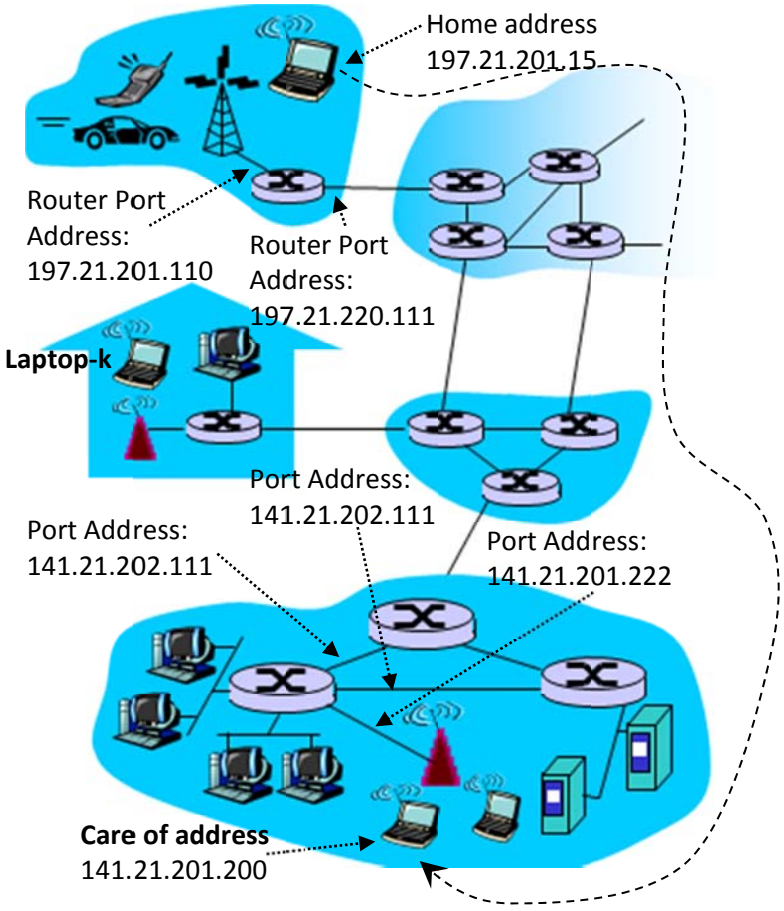
In the figure on the right: the laptop on the top left belongs to the shown network, but has moved to the wireless network at the bottom of the figure (as illustrated by the dashed curve).

The original IP address, as well as the address assigned by the (host) visited network, are shown. Suppose the host network assigns a TTL of 60 minutes to all guest computers.

Suppose all routers are interconnected by 2Mbps links, and the wireless networks operate at 3Mbps bitrate. Also, suppose the shown Access Points (APs) are connected to routers via 4Mbps links, and each AP has a buffer of 32KB. Finally, consider an MTU size of 1KB, and ignore the processing delays at the routers and at the APs.

The Transport Header size is 20 bytes, IPv4 network header is 20 bytes, while the MAC header (wireless and wired) is 34 bytes.

Note that the MAC layer MTU (maximum Transfer Unit) includes the application layer payload, and the headers of Transport, IP, and MAC layers. Hence, the 1 KB MTU includes up to 1024 – (20+20+34) = 950 bytes of application data.



<u>Now, answer the below questions:</u>

1. Write the entries for the mobility binding table at the home agent

2. What is the address of the home agent?

3. Write the entries for the mobility binding table at the foreign agent

4. What is the address of the foreign agent?

5. Suppose a passenger with a tablet in the car shown in the figure is sending a 1 MB video clip to the mobile user who is now in the bottom network. If he started sending the clip at time 0, at what time will the mobile user get the entire clip? Assume that the network core is not congested and that no backoff is necessary to access the wireless channel. Note that the shown tower (base station) acts like an Access Point (AP).

6. Suppose the Mobile IP registration message/reply size is 64 bytes. After having heard the ICMP broadcast of the foreign agent in the network at the bottom of the figure (previous page), how long did it take until the mobile user got a care-of address?

7. Suppose the laptop that is shown in the middle of the figure (labeled *Laptop-k*) is sending a 512 KB music file to the mobile user that has moved to the network at the bottom of the figure). If *Laptop-k* starts sending at time 0, when will the mobile user (with care-of address 141.21.201.200) receive the entire file?

8. Suppose the mobile user at the bottom of the figure (with care-of address 141.21.201.200) who just received the music file, is replying back by sending a 256 KB image to *Laptop-k*. If he starts sending the reply at time 0, when will *Laptop-k* receive the entire image file?

9. Now suppose that the car in the top-left part of the figure remains in the same subset, but the laptop is moving and could 1) remain in the same subnet, 2) end up in the middle subnet (the one the wireless AP is attached to), or 3) end up in the bottom subnet where the AP is. If the car is acting as the corresponding host (CH), while the laptop is the mobile node that has initiated the TCP session, then

a) what is the average delay of sending one MTU from the MN to the CH, given all possible locations of MN?

b) what is the average delay of sending one MTU from the CH to the MN, given all possible locations of MN?