Homework 4 assignment for ECE374

Posted: 04/06/15

Due: 04/13/15

Note: *In all written assignments, please show as much of your work as you can. Even if you get a wrong answer, you can get partial credit if you show your work.* If you make a mistake, it will also help the grader show you where you made a mistake.

Problem 1 (25 Points):

Consider three LANs interconnected by two routers as shown in Figure 1.

a. Assign IP addresses to all of the interfaces. For Subnet 1 use addresses of the form 10.10.1.xxx; for Subnet 2 use addresses of the form 10.10.2.xxx; and for Subnet 3 use addresses of the form 10.10.3.xxx.
b. Assign MAC addresses to all adapters
c. Consider sending an IP datagram from Host G to Host B. Suppose all the ARP tables are up to date. Enumerate all the steps as shown in slides 44-46 of chapter 5.
d. Repeat step c., now assuming that the ARP table in the sending host is empty (and the other ARP tables are up to date).

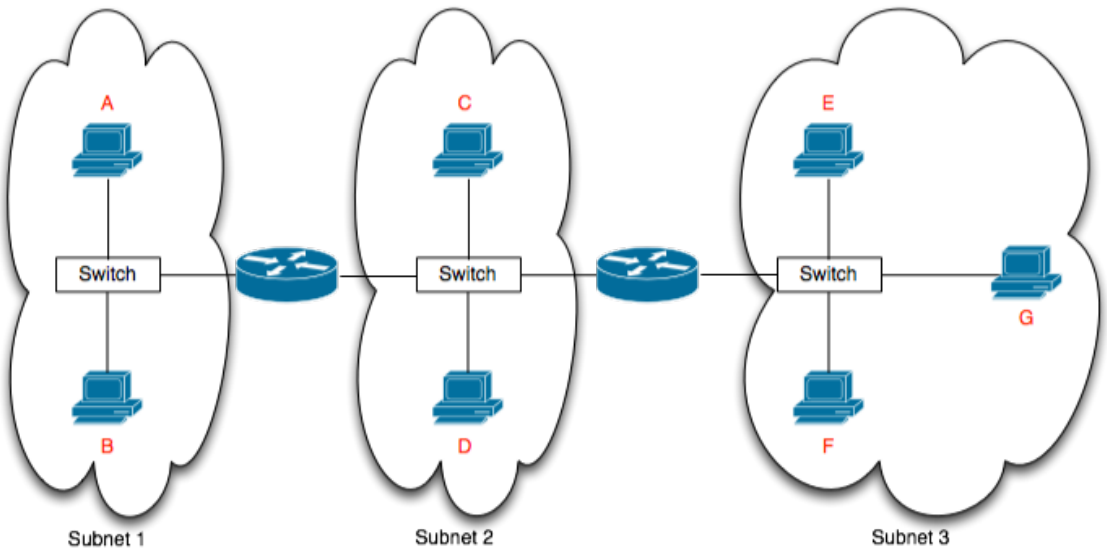

Figure 1

Now we replace the router between subnets 1 and 2 with a switch S1, and label the router between subnets 2 and 3 as R1.

e. Consider sending an IP datagram from Host G to Host F. Will Host G ask router R1 to help forward the datagram? Why? In the Ethernet frame

containing the IP datagram, what are the source and destination IP and MAC addresses?

f. Suppose E would like to send an IP datagram to B, and assume that E's ARP cache does not contain B's MAC address. Will E perform an ARP query to find B's MAC address? Why? In the Ethernet frame (containing the IP datagram destined to B) that is delivered to router R1, what are the source and destination IP and MAC addresses.

Problem 2 (25 Points):

In this problem, you will put together much of what you have learned about Internet protocols. Suppose you walk into a room, connect to Ethernet, and want to download a Web page. What are all the protocol steps that take place, starting from powering on your PC to getting the Web page? Assume there is nothing in our DNS or browser caches when you power on your PC. (*Hint:* the steps include the use of Ethernet, DHCP, ARP, DNS, TCP, and HTTP protocols.) Explicitly indicate in your steps how you obtain the IP and MAC address of the gateway router.

Problem 3 (20 Points):

Consider the single switch VLAN in Figure 2, and assume an external router is connected to switch port 1. Assign IP addresses to the EE and CS hosts and router interface. Trace the steps taken at both the network layer and the link layer to transfer and IP datagram from an EE host to a CS host.

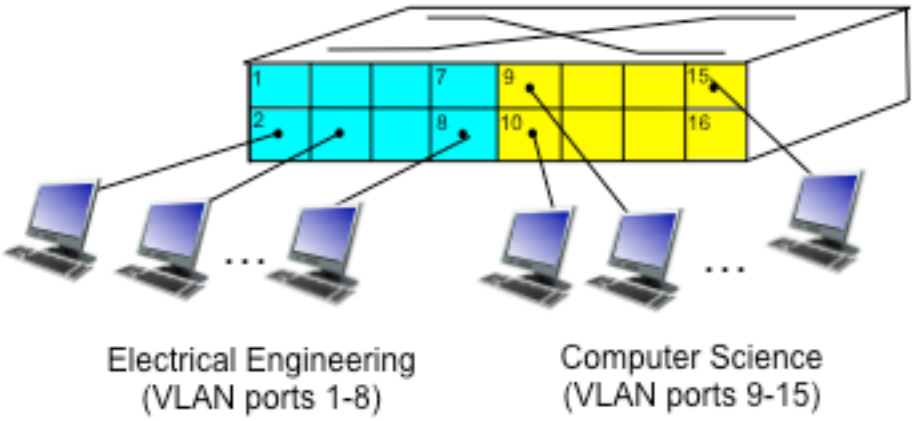

Figure 2

For this problem, keep the following in mind:

- Assume the IP addressing scheme for the EE and CS nodes follows the one indicated in Figure 3.
- Assume that the EE VLAN has ID 11 and the CS VLAN has ID 12.
- The first figure at the following link gives you and idea of the logical setup for such a scenario: http://gcharriere.com/blog/?p=620

a. Assign IP addresses to the three nodes in the EE VLAN and to the three nodes in the CS VLAN.
b. Describe how the router interface has to be set up. What 802.1q VLAN ID will be added to a frame that comes from subnet 111.111.1/24? What 802.1q VLAN ID will be added to a frame that comes from subnet 111.111.2/24?
c. Suppose that host A in EE department would like to send an IP datagram to host B in CS department. What would be the steps taken at both the network layer and the link layer?

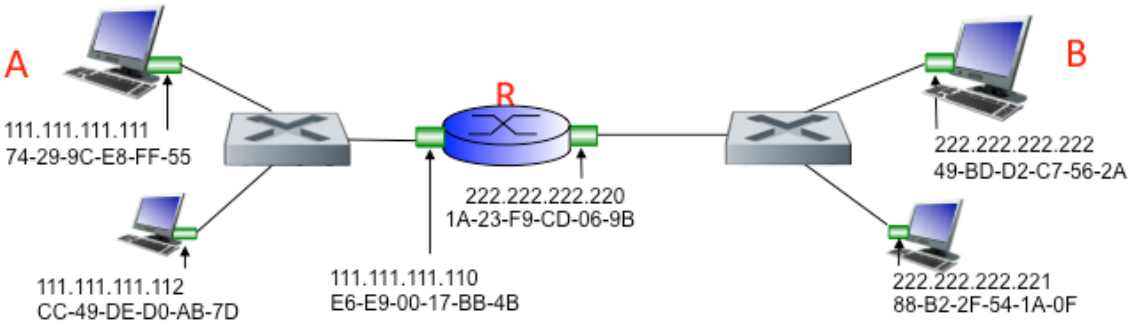

Figure 3

Problem 4 (10 Points):
Consider Figure 4 for the following problem. Suppose C sends frame to I, I responds to C. Show the switch tables and packet forwarding in S_1, S_2, S_3, S_4. (Interface numbers for each switch are indicated in red.) For simplicity use the name of the node as MAC address. E.g., node A's MAC address is "A".

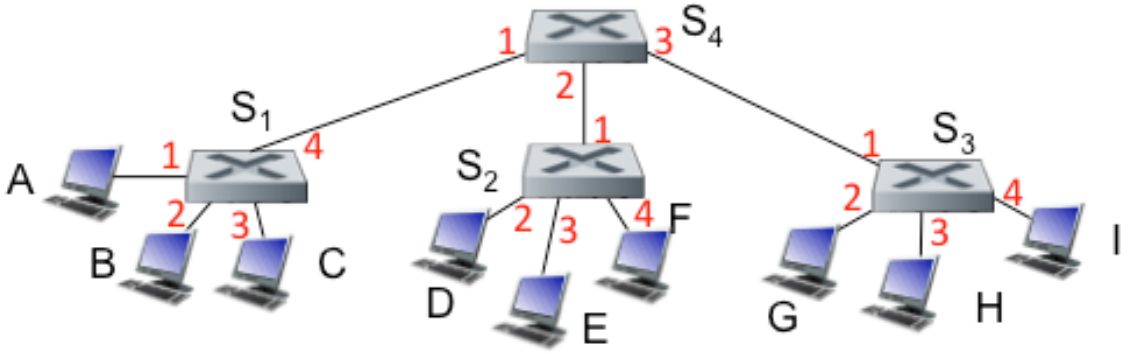

Figure 4

Problem 5 (20 Points):
Figure 5 below shows three wireless nodes and their transmission ranges. (A and C use directional antennas and can communicate with B but not with each other.)

a) Use the Figure 6 below to explain the "hidden node" problem. What happens when nodes A and C start sending a message simultaneously?
b) Use the diagram below to explain how CSMA/CA is realized in the case of the IEEE 802.11 protocol. For your explanation, assume that A wants to send a frame to the destination.
c) Why are acknowledgements used in 802.11 but not in wired Ethernet?
d) Why does the 802.11 protocol require sequence numbers?

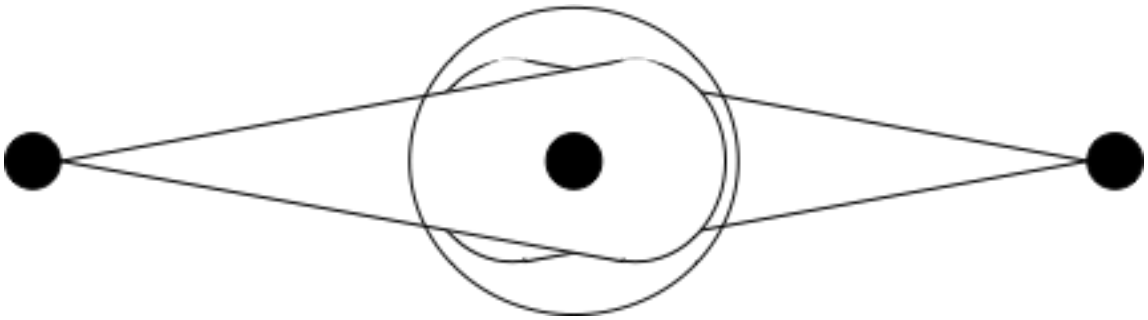

Figure 5

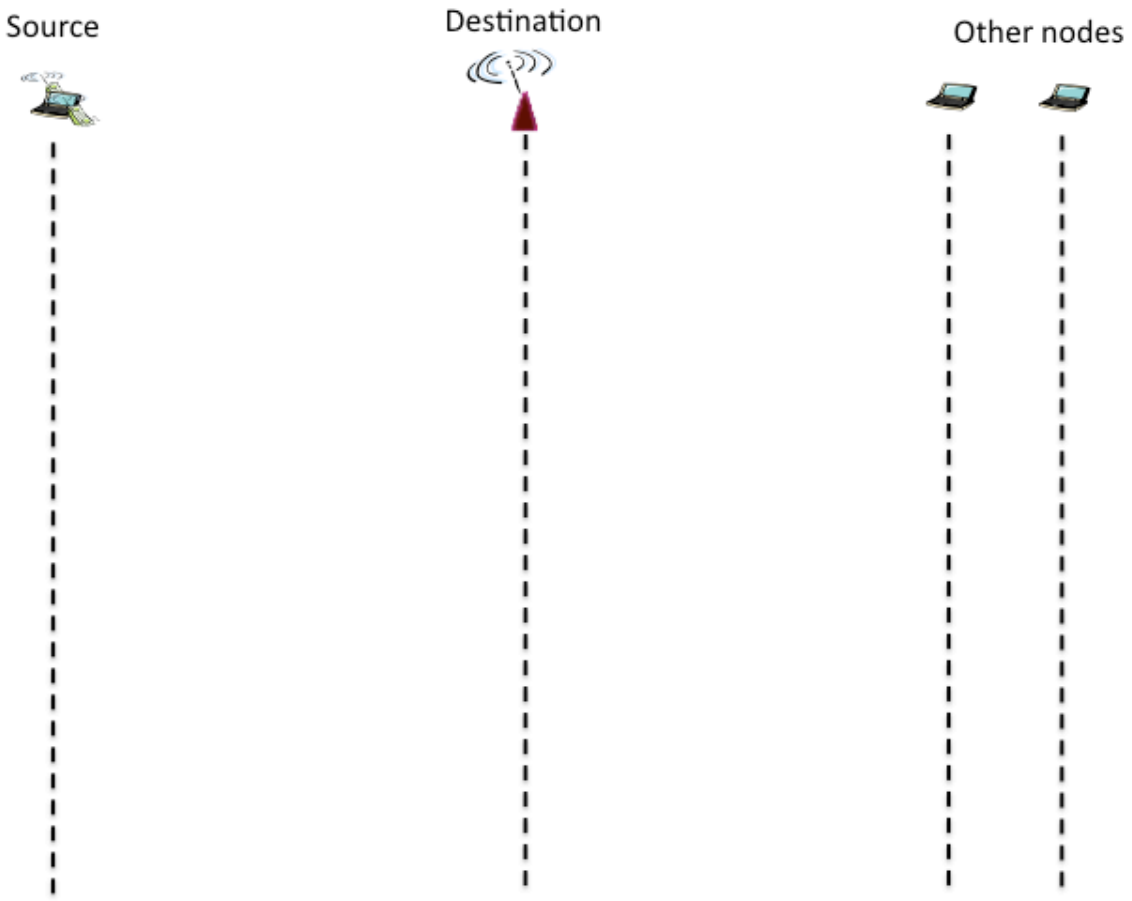

Figure 6