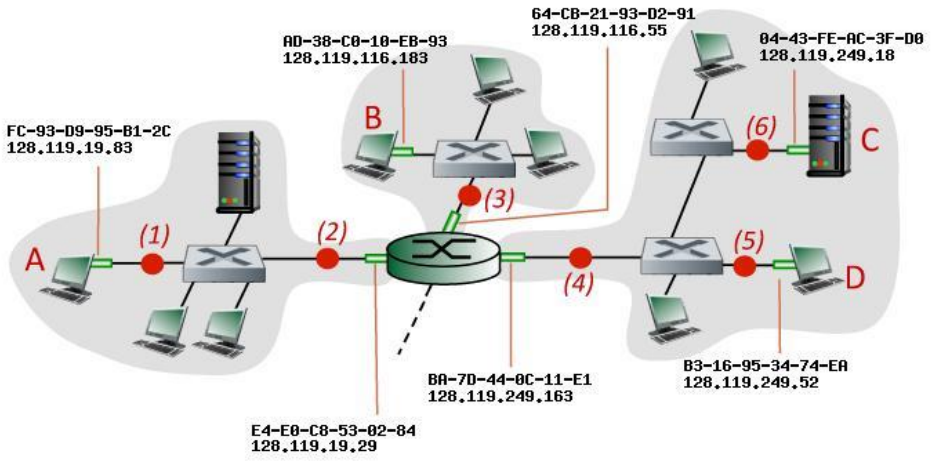
COMP2190 – Semester 1 2020/2021

Tutorial 6

Problems

1. Consider Fig. 1 below. The IP and MAC addresses are shown for nodes A, B, C and D, as well as for the router's interfaces.



Consider an IP datagram being sent from node D to node A. Give the source and destination Ethernet addresses, as well as the source and destination addresses of the IP datagram encapsulated within the Ethernet frame at points (5), (4),(2), and (1) in the figure above.

2. Consider three LANs interconnected by two routers, as shown in Fig. 2.

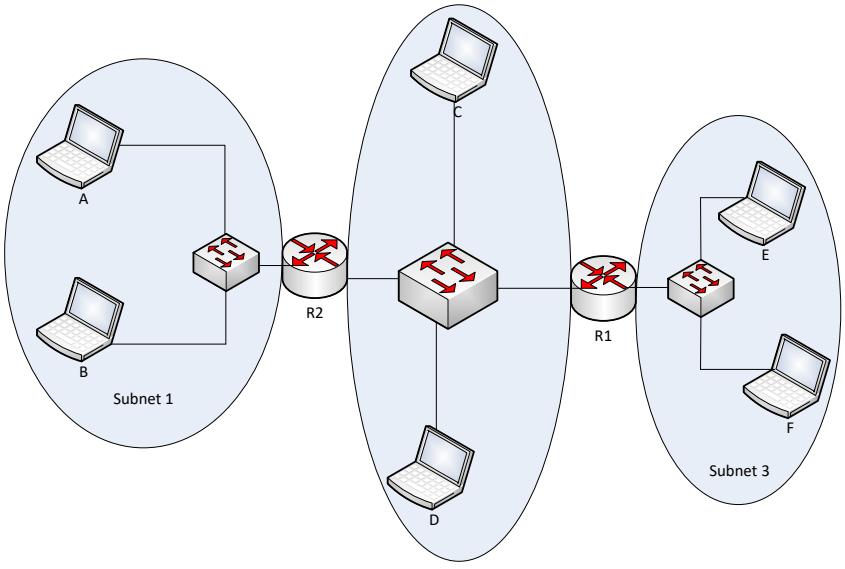


Figure 1: Three subnets, interconnected by routers

a. Assign IP addresses to all of the interfaces. For Subnet 1 use addresses of the form 192.168.0.xxx; for subnet 2 use addresses of the form 192.168.1.xxx; and for Subnet 3 use addresses of the form 192.168.2.xxx.
b. Assign MAC addresses to all of the adapters.
c. Consider sending an IP datagram from Host E to Host B. Suppose all of the ARP tables are up to date. Enumerate all the steps involved as shown in the example covered in lecture.
d. Repeat (c), now assuming that the ARP table in the sending host is empty and the other tables are up to date.

Now 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 E to Host F. Will Host E 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 Host E would like to send an IP datagram to Host 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?
g. Suppose Host A would like to send an IP datagram to Host B, and neither A's ARP cache contains B's MAC address nor does B's ARP cache contain A's MAC address. Further suppose that the switch S1's forwarding table contains entries for Host B and router R1 only. Thus, A will broadcast an ARP request message. What actions will switch S1 perform once it receives the ARP request message? Will R1 also receive this ARP request message? If so, will R1 forward the message to Subnet 3? Once Host B receives this request message it will send back to Host A an ARP response message. But will it send

an ARP query message to ask for A's MAC address? Why? What will switch S1 do once it receives an ARP response message from Host B?

3.

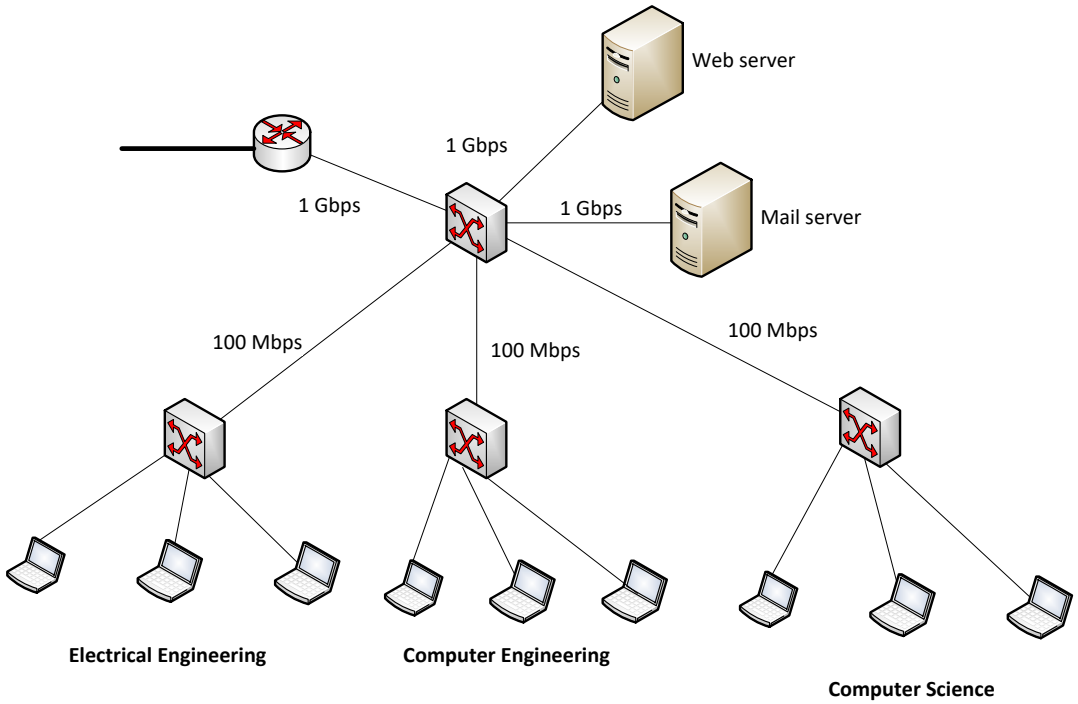


Figure 2: An institutional network using a combination of Ethernet switches and a router

a. Consider Fig. 2. Suppose all the links are 100 Mbps, what is the maximum total aggregate throughput that can be achieved among the 9 hosts and 2 servers in this network? You can assume that any host or server can send to any host or server. Why?
b. Now suppose that the three departmental switches in Fig. 2 are replaced by hubs. All links are 100 Mbps. Now answer the questions posed in a.
c. Suppose *all* the switches in Fig. 2 are replaced by hubs. All links are 100 Mbps. Now answer the questions posed in a.

4. Suppose there are two ISPs providing WiFi access in a particular café, with each ISP operating its own AP and having its own IP address block.
   a. Further suppose that by accident, each ISP has configured its AP to operate over channel 11. Will the 802.11 protocol completely break down in this situation? Discuss what happens when two stations, each associated with a different ISP, attempt to transmit at the same time.
   b. Now suppose that one AP operates over channel 1 and the other over channel 11. How do your answers change?

Acknowledgment

Problems 2--4 come from “Computer Networking: A Top-Down Approach,” 7/E by J. F. Kurose and K. W. Ross