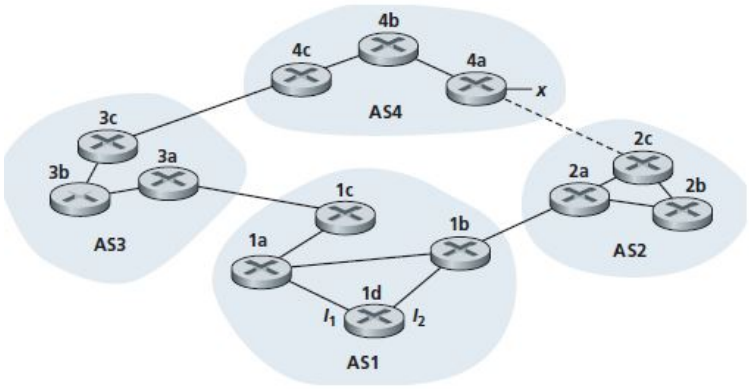
Problem 1

Consider the network shown below. Suppose AS3 and AS2 are running OSPF for their intra-AS routing protocol. Suppose AS1 and AS4 are running RIP for their intra-AS routing protocol. Suppose eBGP and iBGP are used for the inter-AS routing protocol. Initially suppose there is no physical link (the dotted line between 4a and 2c) between AS2 and AS4.



At some time T, the prefix x appears in AS4, adjacent to the router 4a. From which routing protocol (OSPF, RIP, eBGP, or iBGP):

(a) Router 4b learns about prefix x?

(b) Router 3c learns about prefix x?

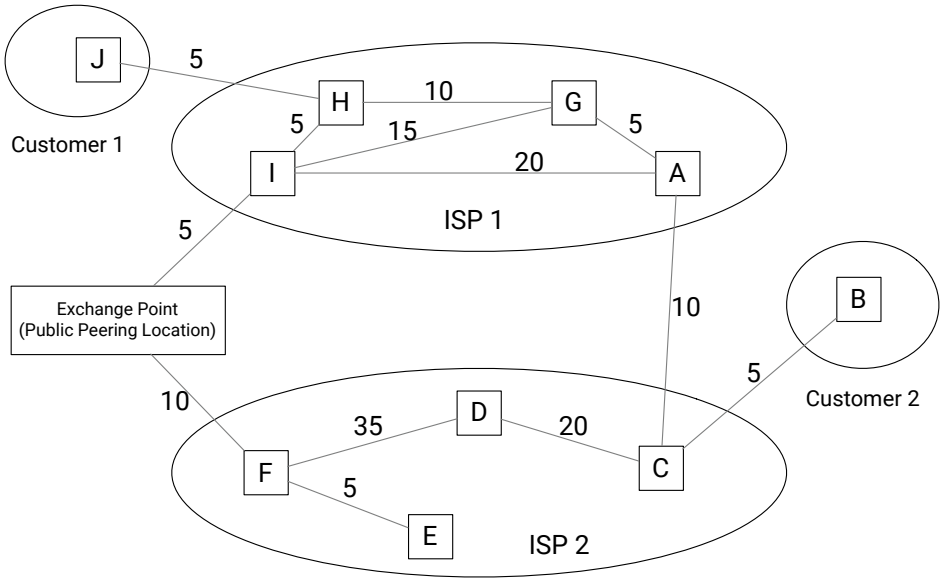
(c) Router 1c learns about prefix x?

(d) Router 1d learns about prefix x?

Write your solution to Problem 1 in this box

Problem 2

Consider the following topology. The cost metric of a link denotes the one-way propagation delay on the link in msec (assuming the delays are symmetric). The two ISPs ISP 1 and ISP 2 are peers. CIDR is used for addressing and BGP is used for inter-domain routing. Assume that both ISPs always try to enforce hot-potato routing above all other routing policies. What is the one-way propagation delay between Customer 1 and Customer 2? Is the routing between two customers symmetric or asymmetric?

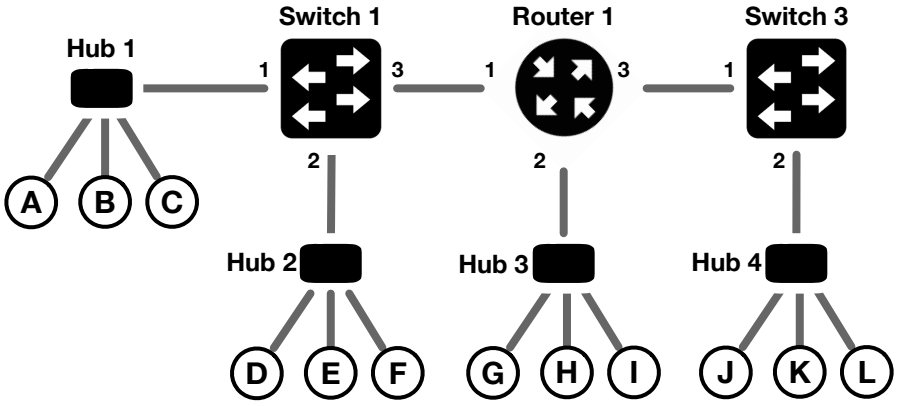


Write your solution to Problem 2 in this box

Problem 3

Consider the following network connected by 2 switches and 1 router. The hubs are devices that floods incoming messages from one interface to all other interfaces. The circles in the figure indicate the hosts (From host A to host L). At time=0s, the forwarding tables of all three switches are empty. Assume that all the hosts already know MAC addresses of other hosts, therefore no ARP is required. Also, assume that the TTL values of the forwarding table entries are big enough so that it will not expire in this problem. Suppose, the following seven events happen sequentially:

- Time=1s: Host A sends an IP datagram to Host G
- Time=2s: Host G sends an IP datagram to Host A
- Time=3s: Host D sends an IP datagram to Host L
- Time=4s: Host D sends an IP datagram to Host I
- Time=5s: Host F sends an IP datagram to Host A
- Time=6s: Host K sends an IP datagram to Host G
- Time=7s: Host J sends an IP datagram to Host F



(a) How many times have Switch 1 and Switch 3 broadcasted the received frames? (Considering all seven events.)

Write your solution to Problem 3 in this box

(b) List the forwarding table entries of each switch after the seven events.

Switch 1	
Host	Interface

Switch 3	
Host	Interface

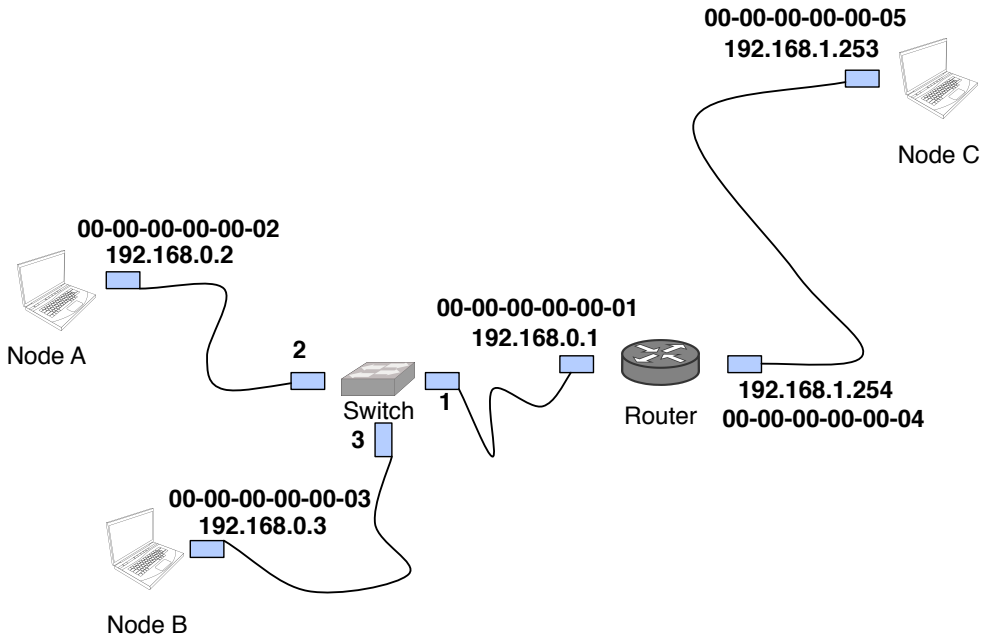
(c) At time=10, Host A sends Broadcast IP datagram in the subnet. How many hosts will receive this broadcast IP datagram excluding the sender?

Problem 3 continued on next page...

Write your solution to Problem 3 in this box

Problem 4

Consider the following network topology with specified MAC addresses for network interfaces and the configured IP addresses:



Assume the network mask for both subnetworks is 255.255.255.0.

(a) Assume that routing tables are properly configured and the network just started (i.e., all ARP caches and switch tables are empty), fill the following table to enumerate Ethernet frames (in chronological order) needed for node B to send an IP packet to 192.168.0.2 and receive a response back.

frame #	dst MAC addr	src MAC addr	device(s) that can get the frame, excluding the sender	new entries added into the switch's table (if any)

Problem 4 continued on next page...

(b) Assume that the previous operation is done, fill the following table to enumerate Ethernet frames (in chronological order) for node B to send a packet to 192.168.1.253 and receive a reply.

frame #	dst MAC addr	src MAC addr	device(s) that can get the frame, excluding the sender	new entries added into the switch's table (if any)