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Data Networks

Assignment 8

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Solution | Assignment 8 | Internet Architecture

Question I. MAC Addressing and ARP

1. Consider the topology above and assign MAC addresses. For simplicity, it is sufficient to provide the last 8 bits of the MAC address, i. e., two characters in HEX notation (e. g., AB) as long as they are unique. You do not have to assign MAC addresses to the "255 other hosts".

Solution.
Figure 1 illustrates the topology given in the assignment with assigned MAC addresses and IP addresses. Only the last 8 bits of the MAC address varies in different interfaces.

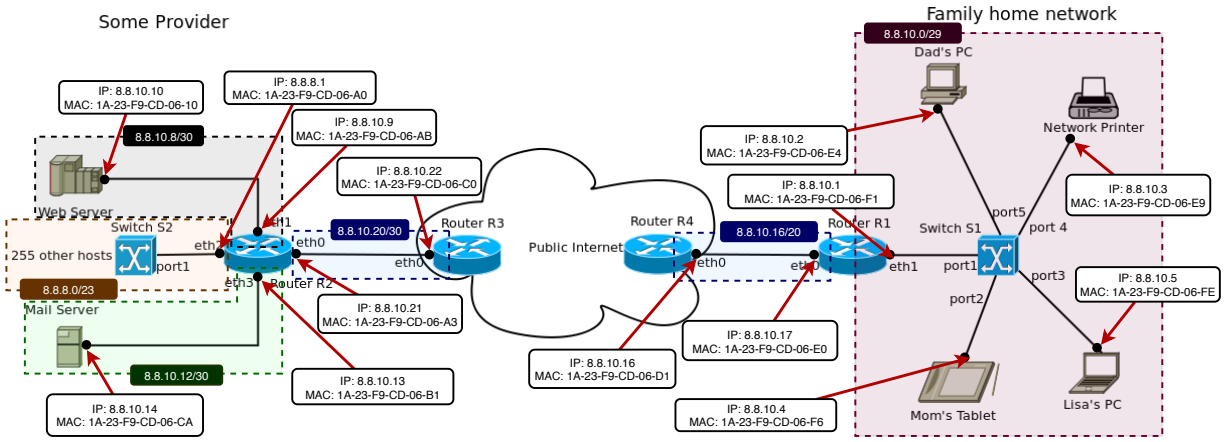

Figure 1: Topology with assigned MAC addresses and IP addresses.

2. In the topology, clearly mark any broadcast and collision domain. How do these domains change when switch S2 is replaced by a hub?

Solution.
Figure 2 demonstrates the broadcast domains in the topology. The broadcast domains will not change if we change switch S2 to a hub.
Figure 3 illustrates the collision domains in the original topology. Note that each host (from the 255 other hosts) will form a separate collision domain. If switch S2 was replaced by a hub, then there would be only one collision domain for all of them (See Figure 4).

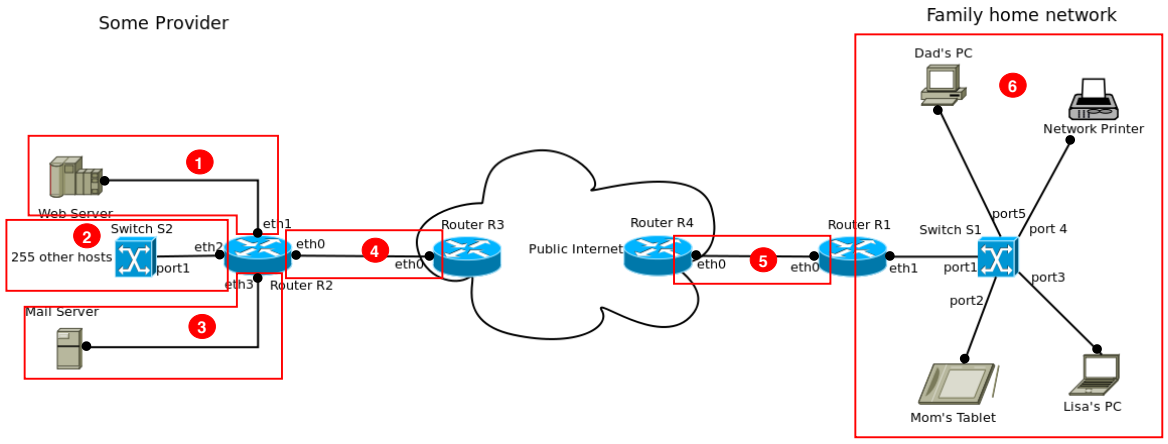

Figure 2: Broadcast domains in both the original topology and in the topology where switch S2 is replaced by a hub.

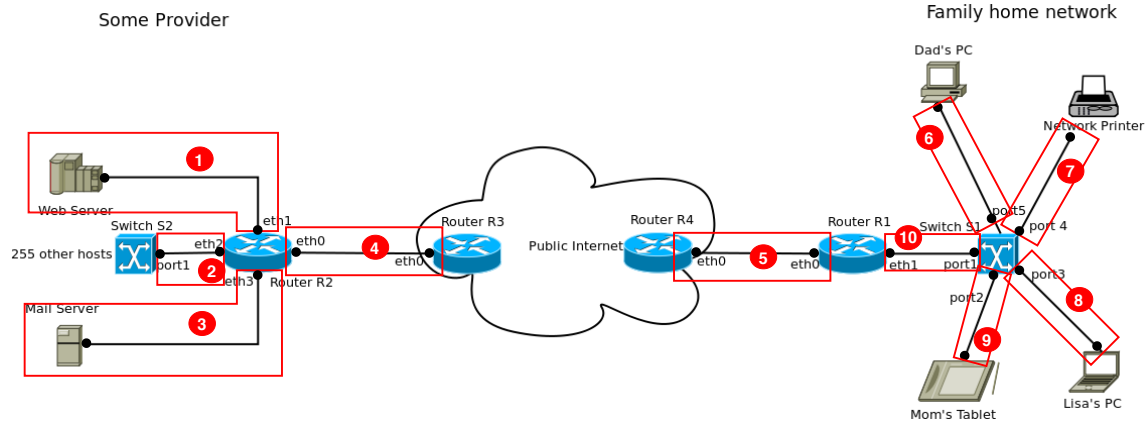

Figure 3: Collision domains the original topology.

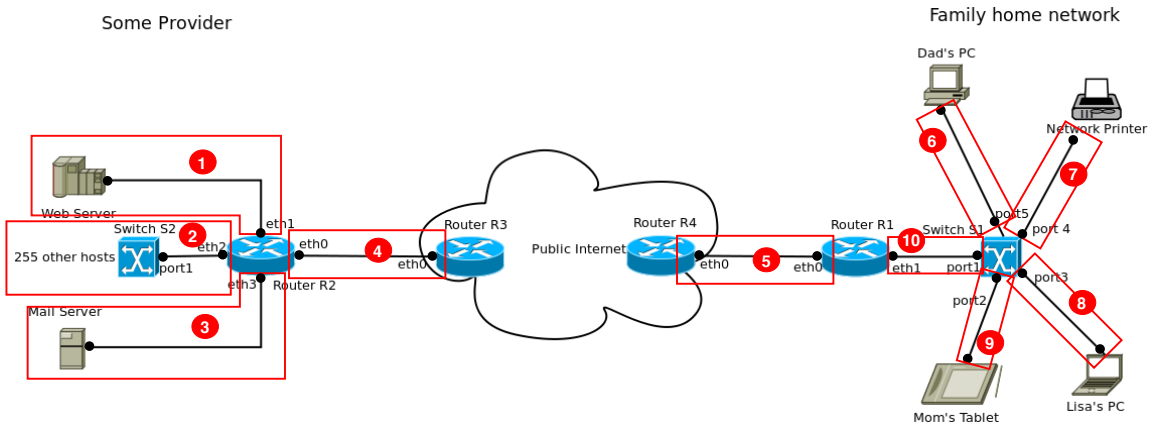

Figure 4: Collision domains when switch S2 is replaced by a hub.

3. Which parts of the Ethernet, IP and TCP header will be modified when a packet is forwarded by i) router R1 / ii) switch S1?

Solution.
i) Router R1 changes Ethernet header and replace previous MAC addresses with new ones based on which path the packet should be forwarded to. Router also changes the TTL field from the IP header.
ii) Switch does not change any header field from the packet when it forwards a packet.

4. Lisa wants to connect to the network printer via IP. Assume that all ARP caches in the network are empty. What are the IP and MAC address fields of the ARP messages exchanged to initiate the IP connection? Enter your results in a table as in Tab. 1 for LAN segments E and F.

Solution.
Table illustrates the messages exchanged to initiate the IP connection between Lisa and network printer in which Lisa starts the connection.

Table 1: ARP messages exchanged to initiate the IP connection when Lisa wants to connect to the network printer.

Index	LAN Segment	Source IP	Source MAC	Destination IP	Destination MAC
1	E	8.8.10.5	1A-23-F9-CD-06-FE	8.8.10.3	FF-FF-FF-FF-FF-FF
2	F, D, G, and H	8.8.10.5	1A-23-F9-CD-06-FE	8.8.10.3	FF-FF-FF-FF-FF-FF
3	F	8.8.10.3	1A-23-F9-CD-06-E9	8.8.10.5	1A-23-F9-CD-06-FE
4	E	8.8.10.3	1A-23-F9-CD-06-E9	8.8.10.5	1A-23-F9-CD-06-FE

5. What are the IP and MAC address fields of a response sent by the web server to Lisa's computer? Consider the response traversing all LAN segments drawn (A, B, C, D, E) and enter your result in a table as in Tab. 1.

Solution.
Table shows the packets exchanged in the network to send a response from the web server to Lisa's computer. We considered that all ARP cacehs in the network are empty.

Table 2: Packets exchanged in the topology to send a response from the web server to Lisa's computer, considering all ARP caches in the network are empty.

Index	LAN Segment	Source IP	Source MAC	Destination IP	Destination MAC
1	A	8.8.10.10	1A-23-F9-CD-06-10	8.8.10.9	FF-FF-FF-FF-FF-FF
2	A	8.8.10.9	1A-23-F9-CD-06-AB	8.8.10.10	1A-23-F9-CD-06-10
3	A	8.8.10.10	1A-23-F9-CD-06-10	8.8.10.5	1A-23-F9-CD-06-AB
4	B	8.8.10.21	1A-23-F9-CD-06-A3	8.8.10.22	FF-FF-FF-FF-FF-FF
5	B	8.8.10.22	1A-23-F9-CD-06-C0	8.8.10.21	1A-23-F9-CD-06-A3
6	B	8.8.10.10	1A-23-F9-CD-06-A3	8.8.10.5	1A-23-F9-CD-06-C0
7	C	8.8.10.16	1A-23-F9-CD-06-D1	8.8.10.17	FF-FF-FF-FF-FF-FF
8	C	8.8.10.17	1A-23-F9-CD-06-E0	8.8.10.16	1A-23-F9-CD-06-D1
9	C	8.8.10.10	1A-23-F9-CD-06-D1	8.8.10.5	1A-23-F9-CD-06-E0
10	D	8.8.10.1	1A-23-F9-CD-06-D1	8.8.10.5	FF-FF-FF-FF-FF-FF
11	E, F, G, and H	8.8.10.1	1A-23-F9-CD-06-D1	8.8.10.5	FF-FF-FF-FF-FF-FF
12	E	8.8.10.5	1A-23-F9-CD-06-FE	8.8.10.1	1A-23-F9-CD-06-D1
13	D	8.8.10.5	1A-23-F9-CD-06-FE	8.8.10.1	1A-23-F9-CD-06-D1
14	D	8.8.10.10	1A-23-F9-CD-06-D1	8.8.10.5	1A-23-F9-CD-06-FE
15	E	8.8.10.10	1A-23-F9-CD-06-D1	8.8.10.5	1A-23-F9-CD-06-FE