Data Networks WS 18/19
INTERNET ARCHITECTURE:
Assignment 9

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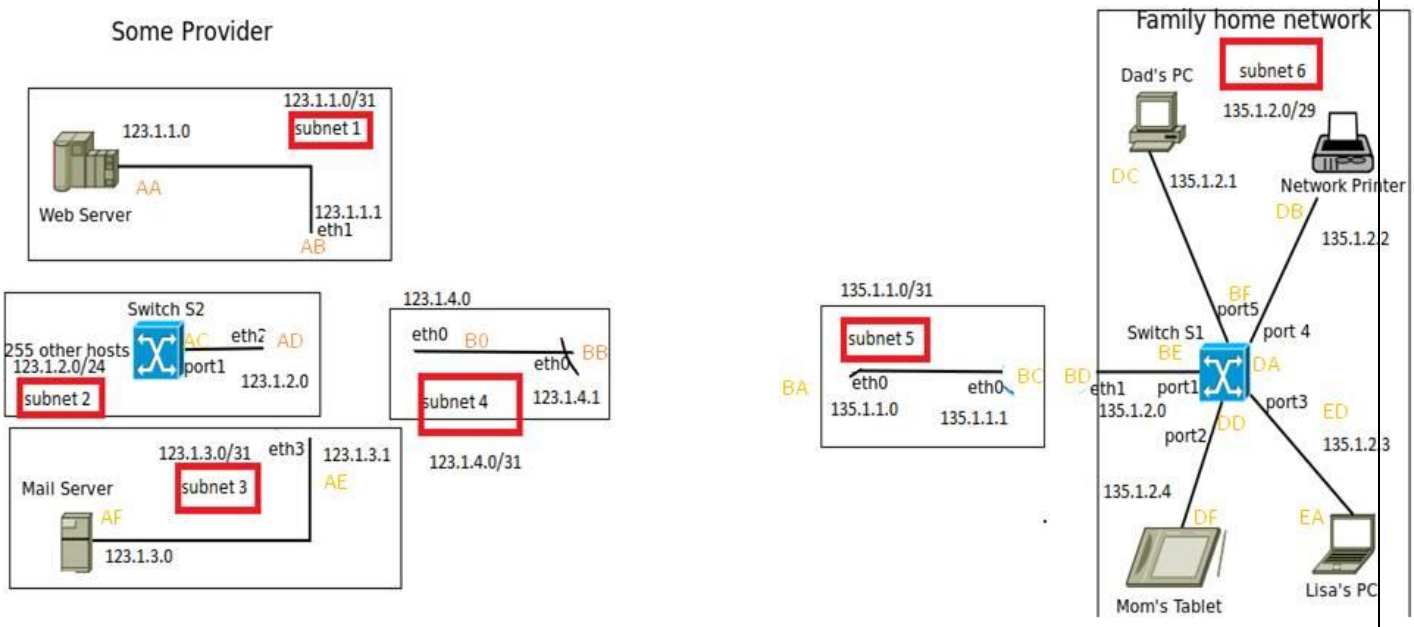
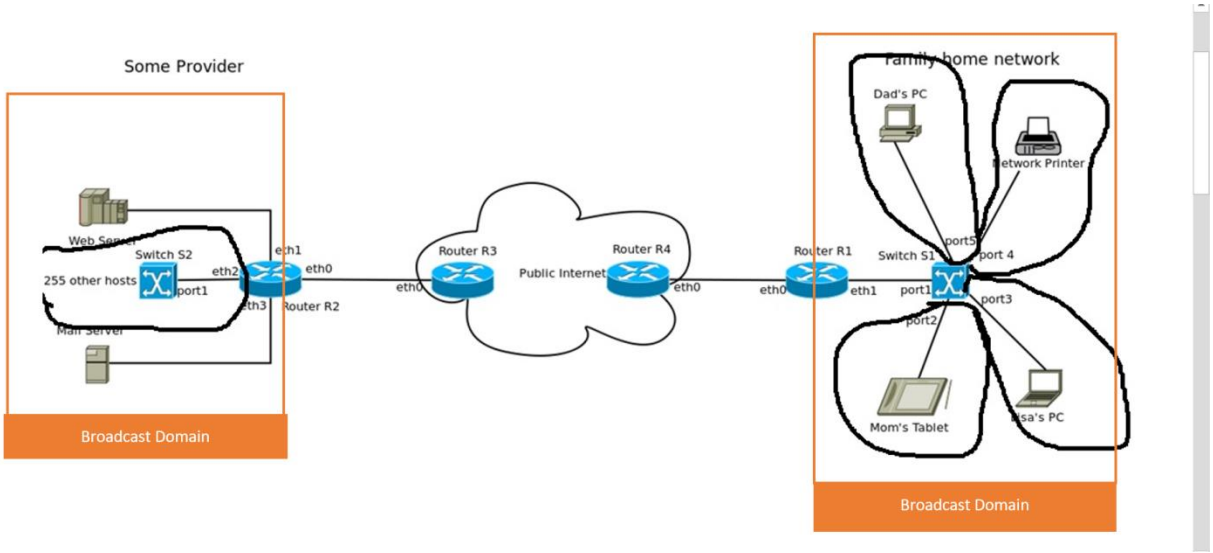
Question 1: (1 + 1 + 1 + 1.5 + 1.5 = 6 points) MAC Addressing and ARP

(a) 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".



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



When we have a switch S2 we have a different collision domain for each of the 255 hosts and when we replace it with a hub, we have a single collision domain together for all the 255 hosts.

(c) Which parts of the Ethernet, IP and TCP header will be modified when a packet is forwarded by

i) router R1 : Ethernet address is modified by R1 from BD to BC or vice versa. This is based on the forwarding table entry of the router. Based on IP header, it'll determine the destination IP and consult its forward table to determine which route should be taken. The router will then send the data to the corresponding link by changing ethernet address from BD to BC or vice versa. The TCP header is not accessed by R1.

ii) switch S1 : Does not access IP and TCP headers. It can only access Ethernet header. It modifies the Ethernet headers based on the switch table inside it.

(d) 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.

LAN Segment	Source IP	Source MAC	Dest. IP	Dest. MAC
E	135.1.2.3	EA	135.1.2.2	FF-FF-FF-FF-FF
F	135.1.2.2	DB	135.1.2.3	DA
PORT 4- PORT3	135.1.2.2	DA	135.1.2.3	ED

E	135.1.2.2	ED	135.1.2.3	EA

(e) 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.

LAN Segment	Source IP	Source MAC	Destination IP	Destination IP
A	123.1.1.0	AA	135.1.2.3	AB
Router R2	123.1.1.0	AB	135.1.2.3	B0
B	123.1.1.0	B0	135.1.2.3	BB
C	123.1.1.0	BA	135.1.2.3	BC
D	123.1.1.0	BD	135.1.2.3	BE
E	123.1.1.0	ED	135.1.2.3	EA

Question 2: (2 + 0.5 + 1 + 0.5 = 4 points) Neighbor Discovery in IPv6
We will now consider the Neighbor Discovery in IPv6. UseWireshark to open the trace u09-ipv6nd.pcap1
and answer the following questions.
(a) Explain the purpose of each packet in the trace (except the packets that belong to TCP connec-
tions) with one or two short sentences. Give a short summary about the purpose of the TCP Connections.

Packet/ Frame 1 ICMPv6 protocol Neighbour solicitation
Packet/ Frame 2 ICMPv6 protocol Neighbour advertisement
Packet/ Frame 163 ICMPv6 protocol Neighbour solicitation
Packet/ Frame 164 ICMPv6 protocol Neighbour advertisement

These packets are uses the ICMP messages and solicitated node multicast address to determine the link-layer address of a neighbour on the same network.

The neighbour solicitation frame/packet is asking for information on the neighbour

The neighbour advertisement frame/packet is supplying the information for the node asking the information.

Packet/frame 7 HTTP protocol GET /hny.jpg HTTP/1.1

Packet/frame 152 HTTP protocol HTTP/1.0 200 OK

With the GET method client requesting server for /hny.jpy and the server uses HTTP version 1.0 for communication and sends the status 200 indicating it has successfully processed the client's request.

The TCP packets perform the initial three way handshake with http-alt(8080),and thus start to communicate with each other

(b) How many Neighbor Discoveries are in the trace and where do they occur?

The neighbour discoveries are:

Packet/ Frame 1 ICMPv6 protocol Neighbour solicitation

Packet/ Frame 2 ICMPv6 protocol Neighbour advertisement

Packet/ Frame 163 ICMPv6 protocol Neighbour solicitation

Packet/ Frame 164 ICMPv6 protocol Neighbour advertisement

The neighbour discoveries occur at the LINK LAYER, in order to get the link layer address with a multicast request.

(c) Why are packets in the trace sufficient to populate the IPv6 neighbor cache of the hosts involved?

Assume that the IPv6 neighbor cache was empty at the beginning of the trace.

The number of entries in the Neighbor Discovery cache can be limited by interface. Upon reaching this limit no other entries are allowed. As mentioned that packets in the trace are sufficient to populate IPv6 neighbour cache thus preventing any customer attached to an interface from overloading the Neighbor Discovery cache.

(d) Comparing Neighbor Discovery in IPv6 and ARP in IPv4, at which layer of the network stack
do they operate?

Neighbor Discovery in IPv6 operate at LINK LAYER in TCP/IP and operates at data link and physical layer in OSI model and ARP in IPv4 operate at the LINK LAYER and network layer of the OSI model.