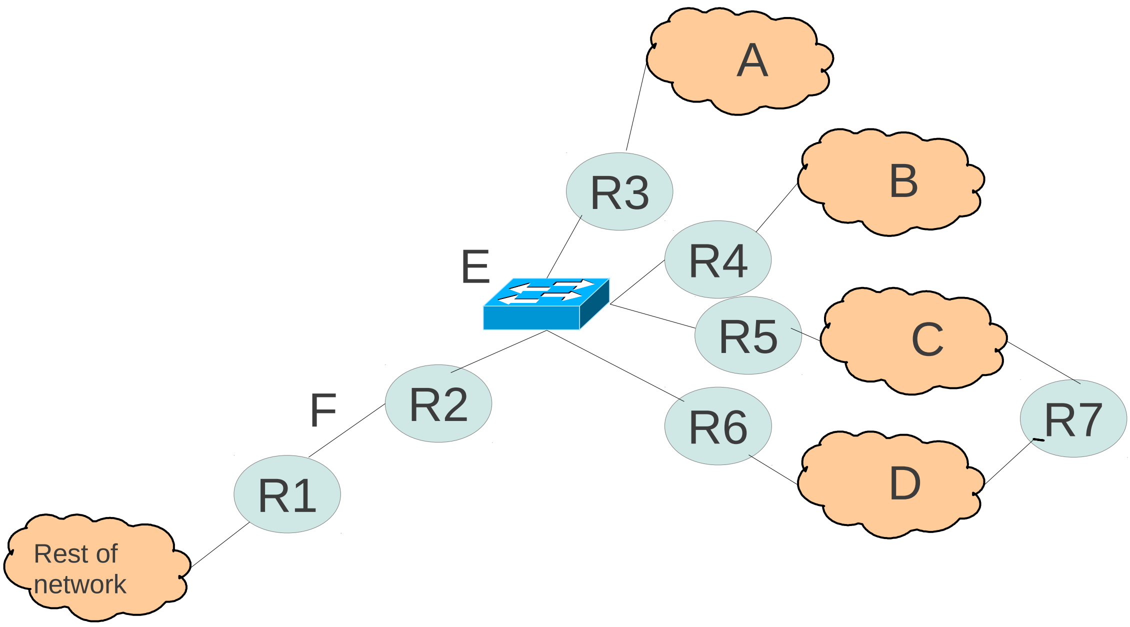
EP2120 Internetworking
DD2393 Protocols and Principles of the Internet

Make-up Homework Assignment
(Solutions due 17:00, Wednesday, 2010.Oct.12)
(Review due 17:00, Friday, 2010.Oct.14)

1. Addressing and address allocation (20p)



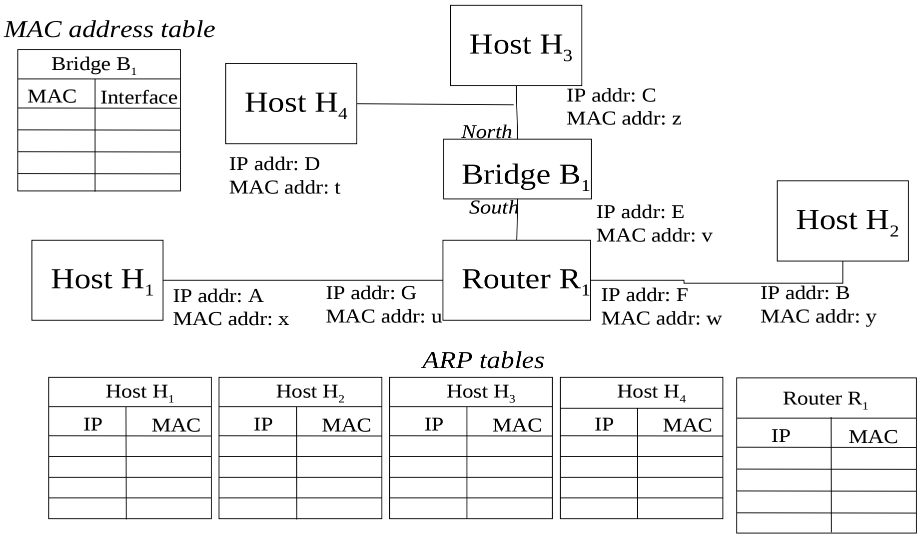
Consider the corporate network shown in the above Figure. There are six networks (A-F). Networks A-D contain 1000 hosts each. Network F contains one host. Network E is a switched Ethernet network, and does not contain any hosts. There are 7 routers (R1-R7) connecting the networks. There are no point-to-point links in the network.
a) What is the longest prefix that can be used for networks A-F? (3 points)

b) Assume that you have the 10.127.192.0/19 block of addresses available for address allocation. Allocate addresses to the individual networks such that every host and every router is addressable on each of its interfaces. Network A should have the lowest IP address block allocated. Allocate the blocks such that address aggregation can be done efficiently, that is, router R1 should have only 2 forwarding table entries for the corporate network (plus one for the rest of the network). Provide the address blocks allocated to the individual networks. (6 points)

c) What is the directed broadcast address of network A? (2 points)

d) Provide the forwarding table of router R1. The forwarding table should contain at most 2 entries (apart from the default route to the rest of the network). (9 points)

2. ARP (20p)



The figure above illustrates four hosts H_1, H_2, H_3 and H_4 connected by an inter-network running IPv4. The hosts are on three Ethernet networks, which are connected by router R_1. Note the learning bridge B_1 that connects hosts H_3, H_4 and router R_1. The figure shows the IP and MAC addresses of the hosts and the router's interfaces, and the interface names of the bridge. It also shows the ARP caches of the hosts and the router, and the MAC address table of the learning bridge. Assume that the ARP caches and the MAC address table are initially empty and that no packets have been sent yet. The forwarding tables of all hosts and the router are correctly configured. All hosts know each others' IP addresses. The hosts and the routers use ARP snooping.

Consider that host H_4 sends an IPv4 unicast datagram to host H_2.

a) Provide the state of the five ARP caches as they will appear after the IPv4 unicast datagram has been delivered to host H_2, that is, after dynamic ARP resolution has been made (16p).

b) Provide the state of the bridge's MAC address table as it will appear after the IPv4 unicast datagram has been delivered to host H_2, that is, after dynamic ARP resolution has been made. (4p)

3. UDP and fragmentation (10p)

Assume a switched Ethernet network with MTU 1500 bytes and a UDP datagram with 4632 bytes of application layer data. IPv6 is used at the network layer.

a) How many fragments are transmitted? (5p)

b) Give the values of the MF bit, the offset and the total length field of the IP header of each fragment! (5p)

4. DNS (20/100)

The following is an example of a zone file for DNS bind:

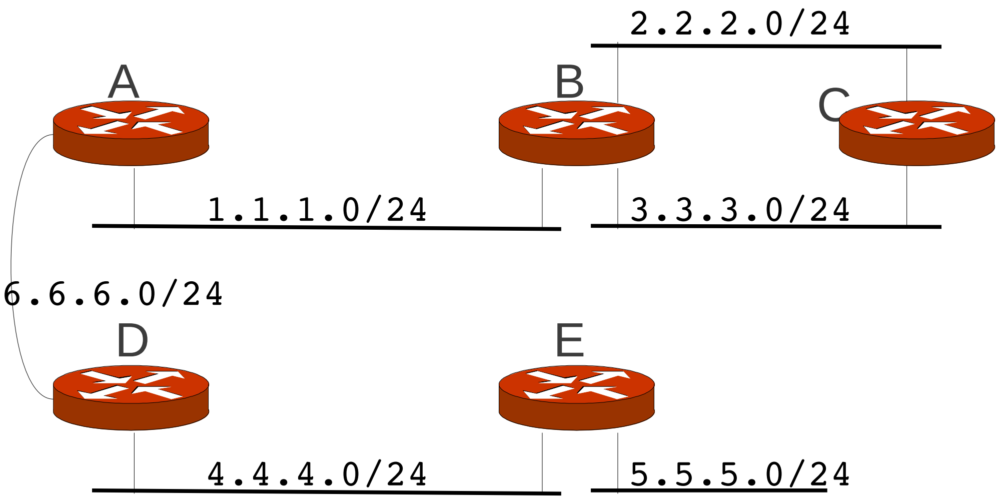
```
$ORIGIN dd2393.edu.
$TTL 86400
@     IN     SOA    dns.dd2393.edu.     hostmaster.dd2393.edu. (
                    2011101001
                    10800
                    3600
                    604800
                    3600 )

            IN     NS                         dns.dd2393.edu.
            IN     NS                         ns.ep2120.se.
            IN     A                          132.2.3.1
aa   3600   IN     A                          144.3.4.5
aa   3600   IN     A                          155.3.4.5
aa   3600   IN     AAAA                       2001:6b01::77
bb   3600   IN     A                          2.3.4.5
dns  3600   IN     AAAA                       2001:3b01::56
bb   3600   IN     AAAA                       2001:3b01::58
dd2393      IN     AAAA                       2001:7878::99
_ftp._tcp   IN     SRV  0 2 80                myf.dd2393.edu.
www         IN     CNAME                      aa
myf  3600   IN     CNAME                      bb
```

Answer the following questions:

1. What is the TTL of the www entry? (2p)
2. Does dd2393.edu. have an associated IPv4 address, and if so, what is that address? (ie, the actual name 'dd2393.edu' which you could 'ping' to)? (3p)
3. Is 'dd2393.edu.' have an associated IPv6 address? If so, which? (3p)
4. Which address(es) does www.dd2393.edu resolve to? (3p)
5. Suppose you want to access the file server on the domain with IPv6. Which IPv6 address should you use? (3p)
6. Which is the (probable) slave server of this zone? (3p)
7. Which is the name corresponding to 2001:7878::99 according to the zone file above? (3p)

5. Routing (30/100)



In the network above, there are two routing domains (autonomous systems). Routers A-C is in one AS and D and E is in the other. IS-IS is run internally in the upper. BGP is run between the border routers A and D.
There is no aggregation or no special policies in the network except that both A and D redistributes all their routes to each other over BGP.
You should be able to solve the following exercises by consulting the lecture slides or exercises.

a) Routing table (10p)

List the routing table in the border router A. The routing table should include destination, protocol, next-hop, and (proposed) route-preference. Do not include the symbolic names A-E in the routing table, only the prefixes shown. You may have to introduce an IP address or two. Shiw all routes, that is, not only the routes with the best preference.

destination	*protocol*	*preference*	*next-hop / -*

b) Link-state graph (10p)

Create a linked state graph of the upper routing domain (routers A-C). The networks and the nodes should all be nodes in the graph. Assume all link metrics are one.

c) Dijkstra (10p)

Compute Dijkstra on the link-state database from the previous exercise with A as root. Show each step in the computation.