ECE 461 – Internetworking
Fall 2009

Problem Sheet 3

Problem 1. Consider the network shown in Figure 1 with three hosts (HostA, HostB, HostC), one router (Router1), and two Ethernet segments. The figure includes the network configuration, the IP addresses, the netmasks, and the MAC addresses.

The routing table entries for HostA, HostB, HostC, and Router1 are provided to you below in Figure 1. Assume that the ARP tables of all hosts and the router are initially empty.

Note:

- For each packet, you need to specify the source, the destination, and a description of the packet type. For ARP packets, provide enough detail so that the address translation can be traced.
- Recall that a successful ping involves two ICMP packets: an ICMP echo request from the host that issues the ping, and an ICMP echo reply from the host which is queried.

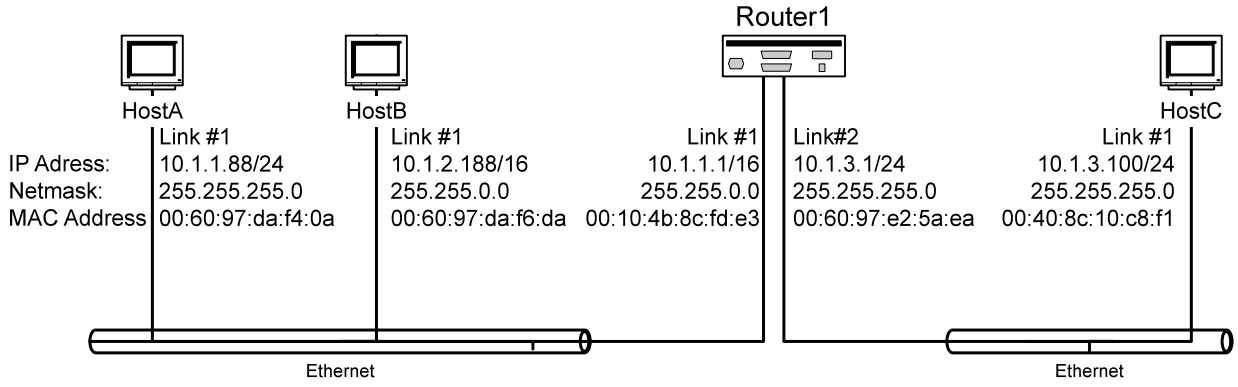

Figure 1.

Routing Table at Router1

Destination	Gateway
10.1.0.0/16	Link #1
10.1.1.0/24	Link #1
10.1.3.0/24	Link #2

Routing Table at HostA

Destination	Gateway
Default	10.1.1.1
10.1.1.0/24	Link#1

Routing Table at HostB

Destination	Gateway
Default	10.1.1.1
10.1.0.0/16	Link#1

Routing Table at HostC

Destination	Gateway
Default	10.1.3.1
10.1.3.0/24	Link#1

a) Describe in detail the ARP and ICMP packets which are transmitted on the Ethernet segments when HostA executes the command "ping 10.1.2.188".

b) Describe in detail the ARP and ICMP packets which are transmitted on the Ethernet segments when HostB executes the command "ping 10.1.3.100". ***Assume that "proxy ARP" is enabled on Router1***.

c) Repeat (b), assuming that "proxy ARP" is not enabled on Router1.

Problem 2. Encapsulation

Below *is* the traffic capture of an ICMP Echo Request packet in hexadecimal notation, The capture consists of an Ethernet II header, followed by an IP header, followed by an ICMP message. (Hint: Each digit corresponds to 4 bits.)

```
00 0a e4 37 f8 36 00 12 3f 61 d7 ac 08 00 45 00
00 54 4a 25 00 00 80 01 d8 c5 80 64 0b f0 80 64
0b 06 08 00 6d 02 44 0d 06 00 cf 1c 15 47 68 89
09 00 08 09 0a 0b 0c 0d 0e 0f 10 11 12 13 14 15
16 17 18 19 1a 1b 1c 1d 1e 1f 20 21 22 23 24 25
26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35
36 37
```

a. Use the description of the packet format provided on a separate page to answer and provide the value of the following fields:
   (a1) Source MAC address, Destination MAC address (as a hexadecimal number)
   (a2) Source IP Address, Destination IP address (Use dotted decimal notation !)
   (a3) Value of the protocol field in the IP header (as a decimal number)
   (a4) Total length of IP datagram (as a decimal number)
   (a5) Header length of IP datagram (as a decimal number)

b. In the traffic capture above, mark the end of the IP header. Provide the number of bytes of the IP header (in bytes). Provide the number of bytes of the ICMP message following the IP header (in bytes).

c. The problem statement gives away that the Ethernet frame is of type Ethernet II (as opposed to type IEEE 802.3). Suppose this information was not given, describe how you can still determine the type of frame.

Problem 3. IP Routing Tables

Consider the following routing table:

Network Destination	Next Hop
142.150.64.0/20	A
142.150.71.128/28	B
142.150.71.128/30	D
142.150.0.0/16	C

a. Assume that a router receives an IP datagram with destination 142.150.71.132. Determine the next hop of the IP datagram that is selected by the router? Explain you answer.

b. Add a routing table entry to the table above which enforces that all IP datagrams with destination 142.150.71.132 have "A" as Next Hop. For all other IP destination addresses, the Next Hop should not change.

c. Add a routing table entry to the table above which enforces that all IP datagrams whose destination address does not match any of the entries in the table, are forwarded to next hop "C". (The network destination for this entry must be provided as an network prefix)