TELE 3118 Tutorial 3: Network Layer: Addressing and Internetworking

Q1: Hosts in a subnet

A network on the Internet has a subnet mask of 255.255.240.0 *(/20 using the slash notation used in lectures).* What is the maximum number of hosts it can handle?

Q2: Address assignment

A large number of consecutive IP address*es* are available starting at 198.16.0.0. Suppose that four organizations, A, B, C, and D, request 4000, 2000, 4000, and 8000 addresses respectively, and in that order. *Suppose also that each organization is assigned the lowest address values possible at the time of its request.* For each of these, give the first IP address assigned, the last IP address assigned, and the mask in the w.x.y.z/s notation.

Q3: Forwarding and ARP

Consider three LANs interconnected by two routers, as shown in the diagram below.
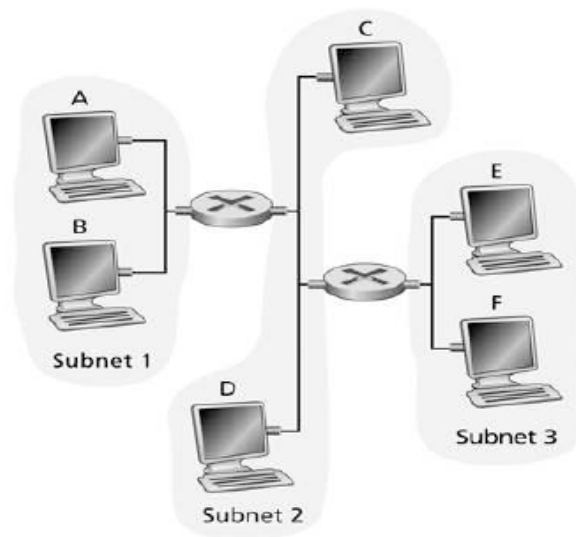

Figure 5.38 ♦ Three subnets, interconnected by routers

a. Assign MAC addresses to all of the adapters. Now sssign IP addresses to all of the interfaces. For Subnet 1 use addresses of the form 192.168.1.xxx; for Subnet 2 uses addresses of the form 192.168.2.xxx; and for Subnet 3 use addresses of the form 192.168.3.xxx.

b. Consider sending an IP datagram from Host E to Host B. What will be source and destination IP address and MAC address on each hop as the packet traverses from E to B? Also please enumerate all the ARP requests that will need to be done.

c. Suppose now that the router between subnets 1 and 2 is replaced by a switch. How would the IP addresses you assigned in part (a) need to change, and what will be the packet headers (IP and MAC addresses) be on the datagram from E to B in this new context?

Q4: Home network addresses and NAT

Suppose you purchase a wireless router and connect it to your cable modem. Also suppose that your ISP dynamically assigns your connected device (that is, your wireless router) one IP address. Also suppose that you have five PCs at home that use 802.11 to wirelessly connect to your wireless router. How are IP addresses assigned to the five PCs? Does the wireless router use NAT? Why or why not?

Q5: IP addressing and forwarding

Consider the topology below, carefully noting the address and mask for each device, and fill in the reachability table below.

192.168.1.1/16
default route: 192.168.1.100
A

192.168.1.100/24

192.168.2.100/24

B
192.168.2.2/24
default route: 192.168.2.100

switch

router

D
192.168.2.4/24
default route: 192.168.2.100

C
192.168.1.3/24
default route: 192.168.1.100

from \ to	A	B	C	D
A	---			
B		---		
C			---	
D				---

Q6: Fragmentation

Consider sending a 2400-byte datagram into a link that has an MTU of 700 bytes. Suppose the original datagram is stamped with the identification number 422. How many fragments are generated? What are their characteristics? Hint: IPv4 packet header format:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Version|  IHL  |Type of Service|          Total Length         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         Identification        |Flags|      Fragment Offset    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  Time to Live |    Protocol   |         Header Checksum        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Source Address                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Destination Address                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Options                    |    Padding     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                            Data                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```