Exercise 2: Routing in the Internet

S-38.121 Routing in Communications Networks

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1 Addressing

1.1 a) Write in decimal form the IP-address C22F1582, and also in binary form. To which address class it belongs?

- The decimal form is:

  194.47.21.130

- And the binary form is:

  1100 0010 0010 1111 0001 0101 1000 0010

- This address belongs to class C, which is from 192.x.x.x to 223.x.x.x.

1.2 b) Explain the mean of the following addresses and for what they are used. {0,0}, {127,<any>} and {x,255}.

- {0,0} is the default network address of this host. It can be used as a gateway address when we want to send a packet to a machine which is in the same network.

- {127,<any>} is the loopback address of each machine. This addresss is used to refer to the own machine, and can not be used outside it. It has no hardware associated with it.

- {x,255} is the broadcast address of the network x. This address can be used to refer to all host in the network x.

1.3 c) What is the network part in the address 172.16.10.50/27 What is the host part? Write the address and the subnet mask in decimal form.

- The netmask is 0xFFFFFFE0 (including net and subnet), and the hostmask is 0x0000001F. The masks in binary would be:

  n: network s: subnet h: host
  nnnn nnnn nnnn nnnn ssss ssss sssh hhhh

- In decimal:

  Network: 172.16 Subnet: 81 Host: 18

1.4 d) How many subnets are available in the network mentioned above? And how many hosts can be in one subnet? Deduct your answer step by step.

- As I've said before the number of bits for subnet is 11, then the total of subnets available would be: $2^{11} = 2048$

- And there is 5 bits for host, then the number of hosts in each subnet would be $2^5 = 32$, minus 2 (one of network address and one of broadcast address) is a total of 30 hosts per subnet.

2 ICMP

2.1 a) How does the ping application work technically?

The program sends an ICMP echo request (type 8, code 0) to a host. It includes an identifier and a sequence number. The sequence number starts at 0 and it's incremented every time a new echo request is sent. Then the program expects an ICMP reply (type 0, code 0) to be returned for each ICMP echo request sent, and the program ping prints the sequence number of each returned packet, allowing us to see if packets are missing, reordered, or duplicated

2.2 b) What are the results when you ping the machines www.tct.hut.fi and www.tcm.hut.fi?

```
dchaparro@pikachu:~/$ ping www.tct.hut.fi
PING keskus.tct.hut.fi (130.233.154.176): 56 data bytes
64 bytes from 130.233.154.176: icmp_seq=0 ttl=246 time=24.9 ms
64 bytes from 130.233.154.176: icmp_seq=1 ttl=247 time=22.4 ms
64 bytes from 130.233.154.176: icmp_seq=2 ttl=247 time=22.6 ms

--- keskus.tct.hut.fi ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 22.4/23.3/24.9 ms


dchaparro@pikachu:~/$ ping www.tcm.hut.fi
PING disperin.tcm.hut.fi (130.233.45.6): 56 data bytes

--- disperin.tcm.hut.fi ping statistics ---
5 packets transmitted, 0 packets received, 100% packet loss
```

The first machine replies to the ping, but the second doesn't.

2.3 c) Why don't some machines (for example www.tcm.hut.fi) answer to ping?

This machine is filtering some packets or it's behing a firewall that is filtering this kind of packets.

Some machines filter or reject some types of ICMP packets, because it can be used to hack the machine (DoS attack, for example)

2.4 d) Give the other example of application that uses ICMP except Ping.

Other program that uses ICMP is traceroute. This program attempts to trace the route an IP packet would follow to some internet host by launching UDP probe packets with a small ttl, then listening for an ICMP "time exceeded" reply from a gateway.

3 ARP

3.1 a) What is ARP? Explain, how a device solves a MAC address using ARP?

ARP (Address Resolution Protocol) is a protocol that provide a method to get a MAC address from an IP address. The MAC address is needed by a sender that wants to send a packet to another machine in his same subnetwork.

The method is:

1. The machine A needs to send a packet to the IP address x.
2. The machine A sends an ARP request broadcast, and this packet includes the IP address x.
3. The machine B receives an ARP request and the IP address x included in the packet is its own IP.
4. The machine B sends and ARP reply to the MAC address of the machine A (it was included in the ARP request broadcast).

3.2 b) Can a multicast address be resolved using ARP? Why?

No, ARP is used to determine MAC address of a unicast IP address. The MAC address of an IP multicast address is determined algorithmically without sending ARP requests. For example, in the ethernet, the multicast MAC address is calculated taking the low-order 23 bits of the IP address and putting them in the low-order 23 bits of the unique ethernet address 01.00.5e.00.00.00.

3.3 c) There are at least two other protocols that do the same thing as ARP. Name two of these and under which conditions they will be used.

I don't know any other protocol that do the same thing as ARP (get a MAC address from an IP address). Maybe the question is asking about protocols that do things in the same way as ARP, in this case this protocols could be RARP and DNS.

RARP (Reverse ARP) provide a method to get an IP address from a MAC address.

DNS provide a method to get an IP address from a name (form example, www.tct.hut.fi is 130.233.154.176).

4 Feedback

4.1 a) How many hours did you spent doing this homework

I've been doing this exercises about 6 or 7 hours.

4.2 b) Was this assignment too easy/hard, or just perfect? Why?

I think it was perfect, neither too easy nor too hard.

4.3 c) Was the exercise lecture useful for you? What are your suggestions?

I couldn't go to the last exercise lecture :-(