

## Lecture 3 – solution of IPv4 addresses exercise

### Exercise:

Given the address/prefix of 192.168.99.64/21 of a particular host in a given LAN, calculate the decimal address of the

1. Mask
2. Network address
3. Broadcast address
4. First usable host address
5. Last usable host address

### Solution:

The IP address is hierarchical. It is composed of two parts: one part to identify the LAN (Network part) and one part to identify the host (pc, router...).

As the given host address is 192.168.99.64/21, the network part has 21 bits and the host part contains  $32-21=11$  bits. Recall that an IPv4 address has a total number of 32 bits.

1. The mask is calculated as follows: put all the network part to 1 (21 bits) and the host part to 0 (11 bits):

We obtain the following mask: 255.255.11111000.00000000 → 255.255.240.0

2. To calculate the network address, the first step is to convert 99 (decimal representation) to 8 bits (binary representation):

192.168.99.64/21 ⇒ 192.168.01100011.64/21

Network part Host part

The network address is obtained by minimizing the host part: all the 11 bits of the host part must be set to 0. The Network part remains unchanged:

192.168.01100000.0 ⇒ 192.168.96.0

3. The broadcast address is obtained by maximizing the host part: all the 11 bits of the host part must be set to 1:

192.168.01100111.11111111 ⇒ 192.168.103.255

4. First usable host address = network address + 0.0.0.00000001

192.168.96.0 + 0.0.0.00000001 = 192.168.96.1

5. Last usable host address = broadcast address - 0.0.0.00000001

192.168.103.255 - 0.0.0.00000001 = 192.168.103.254

So all the IPv4 addresses in the interval [192.168.96.1, 192.168.103.254] can be assigned to the hosts. The maximal size of the LAN is of  $2^{11}-2 = 2046$  hosts.