Subnetting

Review

What do you remember about class A,B,C ? Which portion of theses IP are for network and which are for hosts?

What is subnetting ?

Subnetting is taking one big network and divide it to smaller networks.

You only get one public IP (1 network address and many hosts) and you want to have many subnets inside of it?

Then you have to subnet this network segment and break it into smaller pieces!.

How to create subnets ?

By taking some bits form **host side** and reserve them to define subnet address. So the more subnets the less hosts.

Remember : you are NOT allowed to use bits of network given to you (since they are not in your network and you don't own them !)

Subnet mask

32-bit value the allows the receptionist of IP packet to **distinguish network ID portion in the IP address form the host ID portion**.

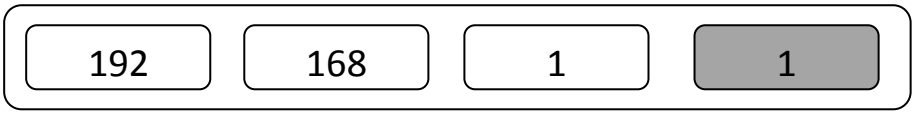
- Default subnet mask

As we know, for example class C contains IPs like this : NET.NET.NET.HOST so its default subnet mask is 255.255.255.0

See this:

192 . 168 . 1 . 1

Default subnet mask : 255.255.255.0 ,, imagine it like this :



So the network address is : 192.168.1.0

Generally

Class	Format	Default Subnet Mask
A	*network.node.node.node*	255.0.0.0
B	*network.network.node.node*	255.255.0.0
C	*network.network.network.node*	255.255.255.0

Classless inter-Domain Routing (CIDR)

A notation that indicates how many 1's are set in the subnet mask for example

IP address 192.168.1.1 with subnet mask 255.255.255.0 can be written as:

192.168.1.1/24

Remember : 255.255.255.0 =1111 1111 . 1111 1111 . 1111 1111 . 0000 0000

Another example :

For subnet mask 11111111. 11111111. 11111111.11100000=255.255.255.224 it can be written as /27

Subnetting in class C

Remember: it's forbidden to go even close to original network address !! you are only allowed to use HOST bits only ..

Before you start, you have to answer these questions :

- How Many Subnets?

(2^x) x : number of masked bits.

- How Many Hosts Per Subnet?

(2^y -2) y : number of remaining bits in host side or unmasked bits. Why -2???

- What Are The Valid Subnets?

Block size = 256 – subnet mask = increment = 2^y

- What's The Broadcast Address For Each Subnet?
- What Are The Valid Hosts?

Example :
Given IP 192.168.10.1/26

/26 =255.255.255.192=255.255.255.1100 0000
Masked bits = 2 (26-24)
Subnets =2^2 = 4
Hosts bits = (8-2) =6
Hosts=2^6-2=62
Block size= 256-192=64
Subnets 0,64,128,192

Network ID	192.168.10.0
First valid host	192.168.10.1
Last valid host	192.168.10.62
Broadcast ID	192.168.10.63
Network ID	192.168.10.64
First valid host	192.168.10.65
Last valid host	192.168.10.126
Broadcast ID	192.168.10.127
Network ID	192.168.10.128
First valid host	192.168.10.129
Last valid host	192.168.10.190
Broadcast ID	192.168.10.191
Network ID	192.168.10.192
First valid host	192.168.10.193
Last valid host	192.168.10.254
Broadcast ID	192.168.10.255

Example :
192.168.10.15/28

/28 =255.255.255.240=255.255.255.1111 0000
Masked bits = 4 (28-24)
Subnets =2^4 = 16
Hosts bits = (8-4) =4
Hosts=2^4-2=14
Block size = 256-240=16
Subnets 0,16,32,48,64,80,96,112,128,144,160,176,192,208,224,240
**First 4 subnets :

Network ID	192.168.10.0
First valid host	192.168.10.1
Last valid host	192.168.10.14
Broadcast ID	192.168.10.15
Network ID	192.168.10.16
First valid host	192.168.10.17
Last valid host	192.168.10.30
Broadcast ID	192.168.10.31
Network ID	192.168.10.32
First valid host	192.168.10.33
Last valid host	192.168.10.46
Broadcast ID	192.168.10.47
Network ID	192.168.10.48
First valid host	192.168.10.49
Last valid host	192.168.10.63
Broadcast ID	192.168.10.64
….	…..

For the report : 192.168.10.15/29

Faster way?

/28 == .240 == 4 bit masked (28-default(24)=4)

2^4=16 subnet $2^{(8-4)}$-2=14 host

Block size = 16 then subnets are 0 16 32 48 …

DONE!

What about /31 /30 /32?

Subnetting in class B

Example : 172.16.20.10/20

/20 =255.255.240.0 =255.255.1111 0000.0000 0000

Masked bits = 4 (20-16)

Subnets =2^4 = 16

Hosts bits = (16-4) =12

Hosts=2^{12}-2=4094

Block size = 256-240=16 **(but start counting form second octet) == 16.0**

Subnets 0.0, 16.0 ,32.0 ,48.0 ,64.0 ,80.0 ,96.0 ,112.0 ,128.0 ,144.0 ,160.0 ,176.0 ,192.0 ,208.0 ,224.0 ,240.0

**First 4 subnets :

Network ID	172.16.0.0
First valid host	172.16.0.1
Last valid host	172.16.15.254
Broadcast ID	172.16.15.255
Network ID	172.16.16.0
First valid host	172.16.16.1
Last valid host	172.16.31.254
Broadcast ID	172.16.31.255
Network ID	172.16.32.0
First valid host	172.16.32.1
Last valid host	172.16.47.254
Broadcast ID	172.16.47.255
Network ID	172.16.48.0
First valid host	172.16.48.1
Last valid host	172.16.63.254
Broadcast ID	172.16.63.255

For the report : 172.16.20.10/19

Subnetting in class A

Example : 10.10.10.10/16

/16 =255.255.0.0 =255 . 1111 1111 . 0000 0000 . 0000 0000

Masked bits = 8 (16-8)

Subnets =2^8 = 256

Hosts bits = (24-8) =16

Hosts=2^{16}-2=65534

Block size = 256-255=1 **(but start counting form third octet) == 1.0.0**

Subnets 0.0.0 , 1.0.0 , 2.0.0 , 3.0.0 , 4.0.0 , 5.0.0 , 6.0.0 , 7.0.0 , 8.0.0 , …

**First 4 subnets :

Network ID	10.0.0.0
First valid host	10.0.0.1
Last valid host	10.0.255.254
Broadcast ID	10.0. 255.255
Network ID	10.1.0.0
First valid host	10.1.0.1
Last valid host	10.1. 255.254
Broadcast ID	10.1. 255.255
Network ID	10.2.0.0
First valid host	10.2.0.1
Last valid host	10.2.255.254
Broadcast ID	10.2.255.255
Network ID	10.3.0.0
First valid host	10.3.0.1
Last valid host	10.3.255.254
Broadcast ID	10.3.255.255

For the report : 10.10.10.10/20