01/07/20

Computer Networks

8M to 10M

IP Addresses:

* 32 bit numbers
* A system may have more than one IP address, but we can use only one at a time.

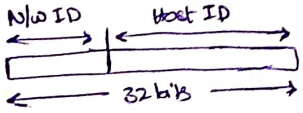
Dotted Decimal Representation

The 32 bits are divided into 4 bytes and each bytes value is shown as decimal value.

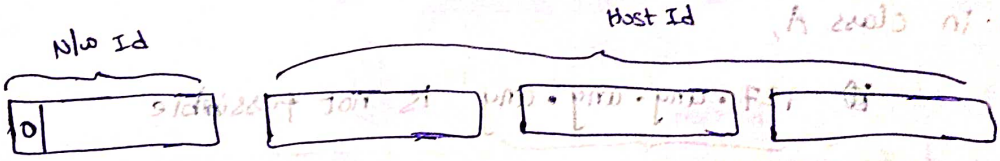
Eg: 20.120.7.180

→ logically IP address is divided into network id & host id.

Classful IP addressing:



Class A:



seeing '0' in the beginning it is determined as class A.

Class A supports 2^7 (128) networks.

and for each network we can have 2^{24} ~~hosts~~. IP addresses starts with number b/w 0 to 127

* If dotted decimal representation of an IP address↑ then it falls under class A
* Range: 0.0.0.0 to 127.255.255.255
* ~~No. of class A IP addresses possible = 2^{31}~~

Note:

* If an IP address contains all host Id bits as 1's, then it is not used as IP address. Rather it is used as special address. i.e., Broadcasting.

~~Thus in class A~~

~~x.255.255.255 where $0 < x < 127$~~

~~is can't be used as an IP address.~~

* If an IP address contains all host Id bits as 0's, then it is not used as IP address. It is used as a special address i.e., Network Address.

The above two points are valid for any class.

* In a class A IP address,

we can't take network Id and host id all zero at the same time.

* No of IP addresses possible under class A = 2^{31}

* Also in class A,

~~if~~ 127.any.any.any is not possible

loop back address (special address)

also we have in class A

x.255.255.255 (broadcast address) $(0 \le x \le 127)$

~~x can't~~ is not possible

also in class A

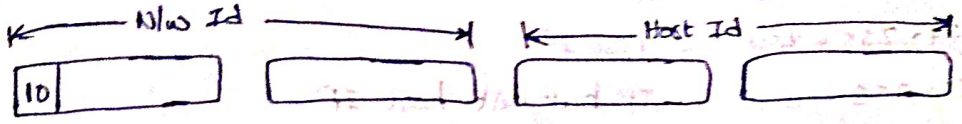
x.0.0.0 (Network Id) $(0 \le x \le 127)$

is not possible

also in class A

0.any.any.any is not possible to assign to a host

Class B:



No of networks: 2^{14}

no of ~~hosts~~ IPs in each network: 2^{16}

Range: 128.0.0.0 to 191.255.255.255

total no of i/p addresses possible: 2^{30}

for each network

x.y.0.0

x.y.255.255

are not ~~to~~ assigned as IP address

They are considered special addresses.

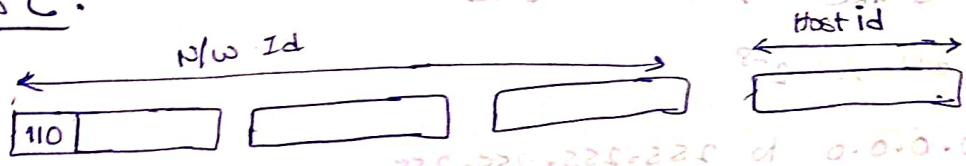
02/07/20

→ In Class B we can take all network bits as zeroes.

→ No of hosts per each network

$= 2^{16} - 2$

Class C:



possible no of IPs: 2^{29}

possible no of networks: 2^{21}

no of IPs per each network: 2^8

Range: 192.0.0.0 to 223.255.255.255

No of host per N/w: $2^8 - 2 = 254$

Eg: 192.0.0.255 is not host IP but a broadcast address

↓

all host id bits are 1's

Eg: 192.255.255.254 - host IP

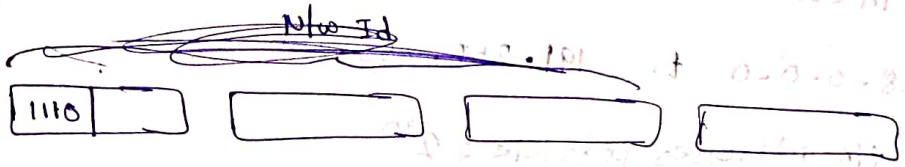
192.255.254.255 - IP but not host IP

192.254.255.254 - host IP

192.255.255.0 - IP but not host IP

It is N/w address

Class D:



Here there is no division like Nw id & Host Id.

Class D is reserved for multicasting.

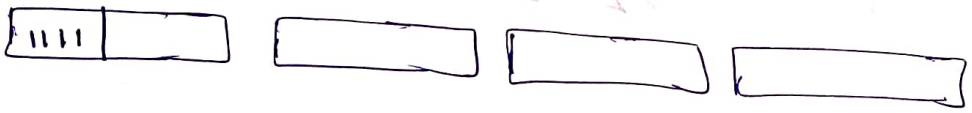
11100000. 00000000.00000000.00000000

224.00 224.0.0.0

No of IP addresses : 2^{28} (no address is used for host)

Range : 224.0.0.0 to 239.255.255.255

Class E:



No divisions like N/w id & host id

no of IP address : 2^{28}

Range: 240.0.0.0 to 255.255.255.255

Class E is reserved for future use.

Note:

Classes D & E are disadvantages of classful addressing.

$2^{28} + 2^{28}$ address are reserved for multicasting and future use which is waste.

How to send a packet from one host to another host

→ for broadcasting the destination address is set to ~~network~~ broadcast address of the network overwhich the broadcasting is being done.

Eg: 220.127.55 is ~~cat~~ class C n/w

broadcast address is 220.127.55.255

→ Unicast: packet is sent from one host to single host.

If router sees all the host ids as 1's an then it considers the message should be broadcasted.

→ Broadcasting is of two types:

(i) Directed Broadcast:

when a host wants to send a packet to all the hosts of another network then it is known as directed broadcasting

(ii) Limited Broadcast:

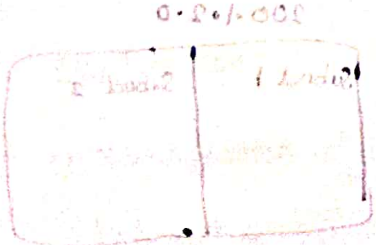
when a host wants to send a packet to all the host of the same network, then it is known as limited broadcasting.

for limited broadcast,

destination address: 255.255.255.255

↓

This is a signal for router specifying that limited broadcasting is to be done



Eg 2:

IP	N/w ID	Directed Broadcast address	Limited broadcast address
1.2.3.4	1.0.0.0	1.255.255.255	255.255.255.255
11.79.83.107	11.0.0.0	11.255.255.255	255.255.255.255
137.192.233.3	137.192.0.0	137.192.255.255	"
190.203.6.5	190.203.00	190.203.255.255	"
188.3.2.0	188.3.0.0	183.3.255.255	"
220.127.6.5	220.127.6.0	220.127.6.255	"
250.0.1.2	~~250.0.1.0~~ ∝	∝	∝
300.7.19.57	∝ Invalid IP	∝ Invalid IP	∝ Invalid IP

- Class E address has no N/w id & host id part.
∴ not broadcast addresses.

Subnetting:

→ Dividing a larger network into in subnetworks is called subnetting.

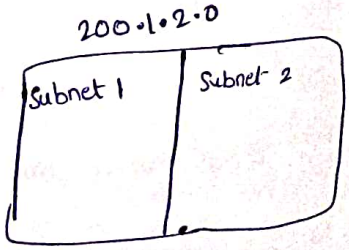
→ when a n/w is divided into subnetworks, we must need routers blw subnets. This router is called internal router. This internal router is connected to external router.

Eg: Consider class C IP address network 200.1.2.—

(Eg1) we will hav 254 possible hosts. This can be divided into two subnets as shown below

200.1.2.0 to 200.1.2.127 (Subnet 1)

200.1.2.128 to 200.1.2.255 (Subnet 2)

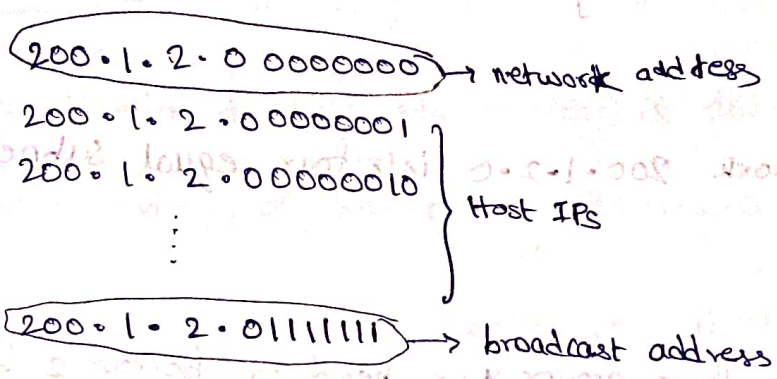


we say 200.1.2.0 is IP address of subnet 1

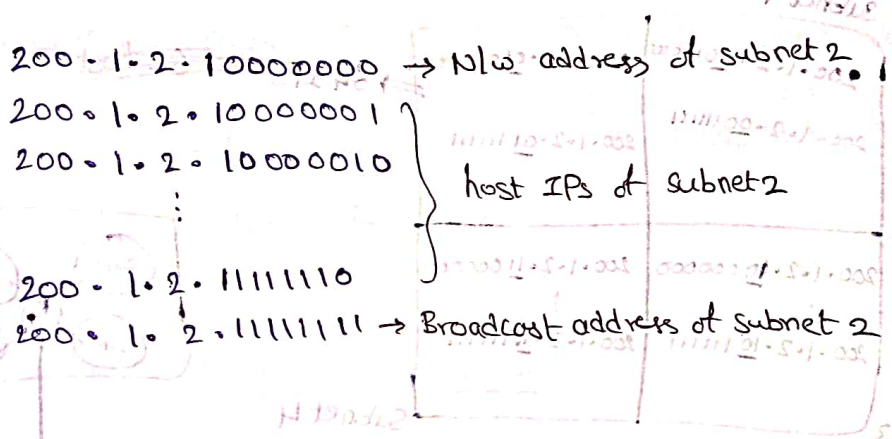
200.1.2.128 is IP address of subnet 2

Even in subnets also we should not take all host bits as all 1's or all 0's.

for subnet 1



for subnet 2



Thus here, 200.1.2.128 is network address of subnet 2, but not host IP

First IP of subnet 2 is 200.1.2.128

First host IP of subnet 2 is 200.1.2.129

03/07/20

advantages of subnetting:

* Maintainence is easy
* Provides security with grp of ~~sgrp~~ hosts of same Nlw

Disadvantages:

* Identification of host is complex as more steps are needed to find a host.

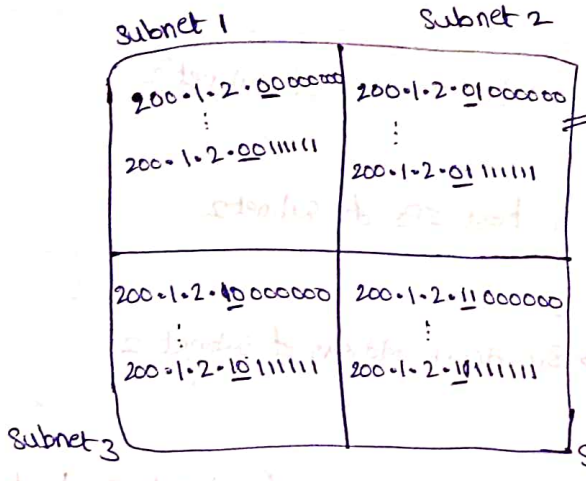
→ In the previous example of subnetting, a total of 4 addresses are wasted.

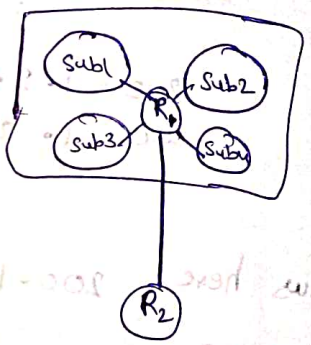
∴ In the above subnets
we can have only 252 host IPs out of 256 IPs

Eg: Divide the network 200.1.2.0 into four equal subnets.

Eg2

Sol:
given is class 'C'
to divide into four groups we need to borrow 2 bits.





For each subnet we have 64 IPs & 62 host IPs

	Subnet address	Broadcast address
Subnet 1	200.1.2.0	200.1.2.63
Subnet 2	200.1.2.64	200.1.2.127
Subnet 3	200.1.2.128	200.1.2.191
Subnet 4	200.1.2.192	200.1.2.255

* Any message that is set to one hosts in the subnet is first sent to internal router. The internal router send the message to the destination.

* For the external routers, the network is seen as one whole network but not as subnets.

Confusions in subnetting

1) The N/w id of whole N/w in (Eg1) is 200.1.2.0 and also subnet address of subnet1 is 200.1.2.0. Both are same.

2) Also we have broadcast address of subnet2 is equal to broadcast address of the whole network.

3) a) If someone says N/w ID 200.1.2.0, what does that mean?

b) If someone says 200.1.2.255, is it broadcast for the whole N/w or only for the subnet2.

Resolving conflicts in broadcast address:

If the destination address is 200.1.2.255 we don't know whether it should be broadcasted over the entire network or over subnet 2. This is resolved as follows:

i) If message is being sent by a host which is from a different N/w then the ~~mess~~ message is broadcasted over entire network. (This cuz external user don't know the network is divided into subnets)

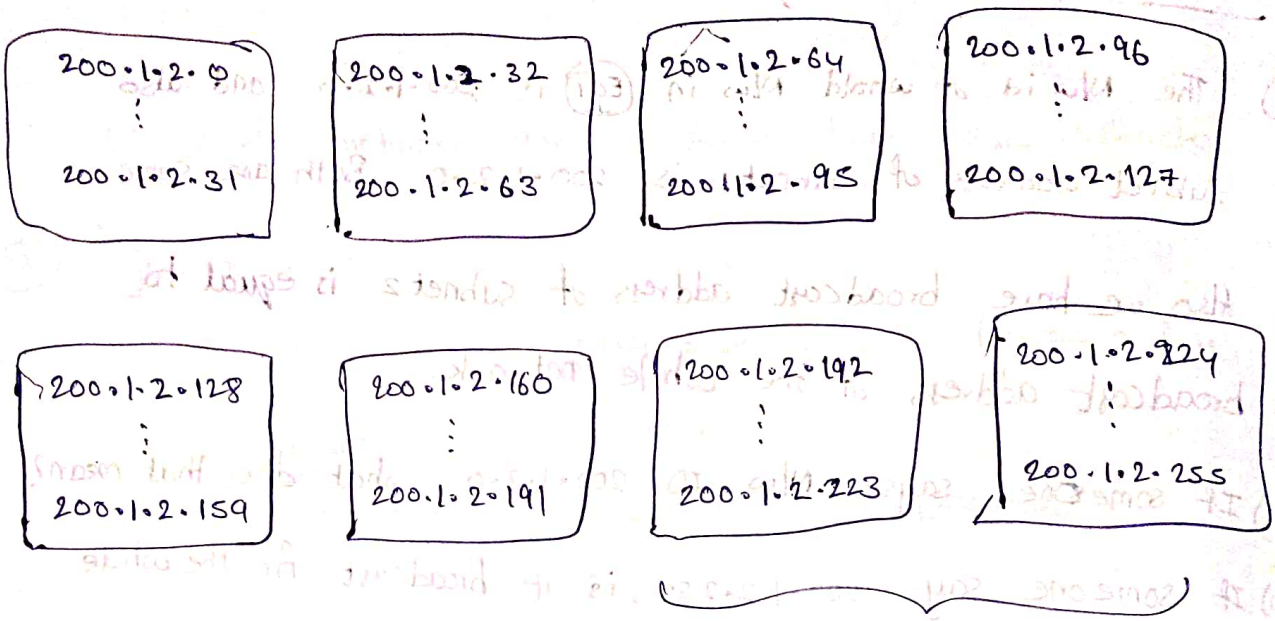
ii) If packet is being sent by a host which is from the same N/w then the packet is broadcasted over subnet 2 (This cuz internal user knows the structure of N/w)

→ Outsider user (other N/w) can never broadcast over a single subnet even if he uses the ~~subnet~~ subnet broadcast address.

Eg: Divide the n/w 200.1.2.0 into 6 equal subnets.

Sol:

For this we borrow 3 bits



→ Here we have 180 hosts in total

These two are left unused. We can use them later if needed

In the above case

8th subnet is not used (i.e., it contains no hosts)

→ Still if external user sends a msg with destination address 200.1.2.255 the message is broadcasted over the network.

→ But if internal user uses 200.1.2.255. the message is discarded and is not broadcasted.

Q1 / G-07 The address of a class B, is split into subnets with a 6 bit number. what is the maximum no of host in each subnets?

a) 62 subnets and 262142 hosts

b) 64 subnets and 262142 hosts

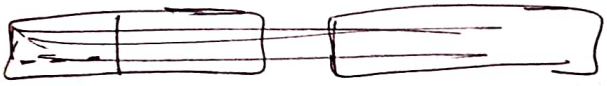
c) 62 subnets and 1022 hosts

d) 64 subnets and 1024 hosts

Sol :

Class B => 2 bytes for host id

i.e., 16 bits



total subnets possible = 64

no of hosts = $2^{13} - 2$

=

no of s

Subnet Mask :