CS & IT ENGINEERING

COMPUTER NETWORKS

IPv4 Addressing

Lecture No-21

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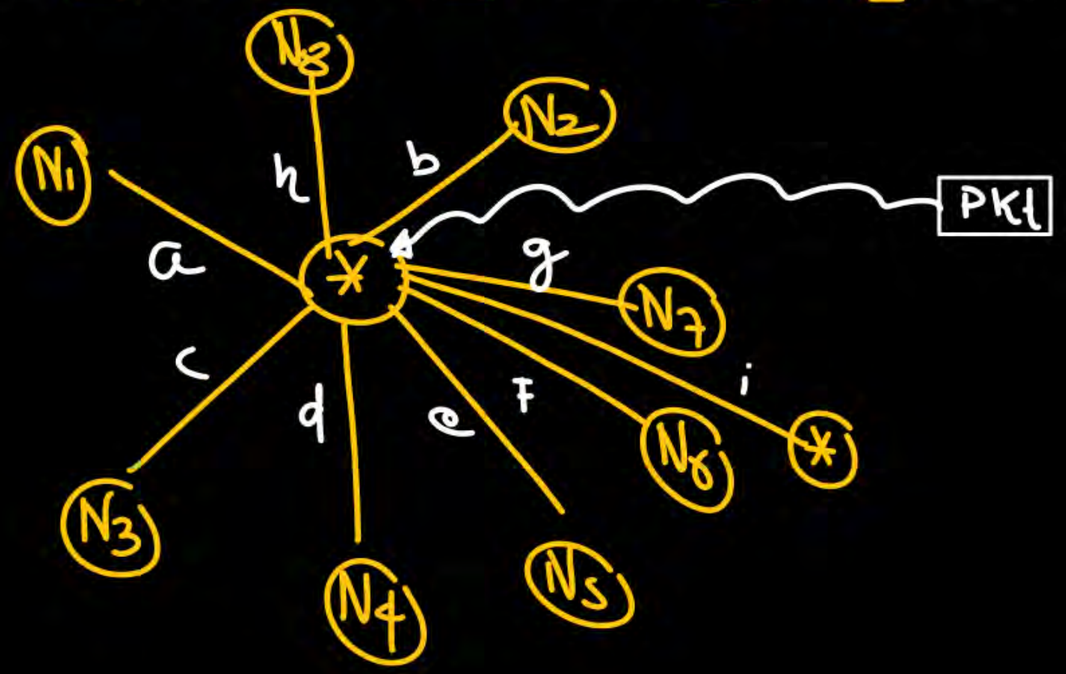
Classless Addressing

Supernetting in Classless Addressing

Supernetting in Classless addressing

Supernetting OR Aggregation

The process of combining two or more network to get a single network is called as supernetting.



Routing table

NID	SM	I/F
—	—	a
—	—	b
—	—	c
—	—	d
—	—	e
—	—	f
—	—	g
—	—	h
0.0.0.0	0.0.0.0	i

Default entry

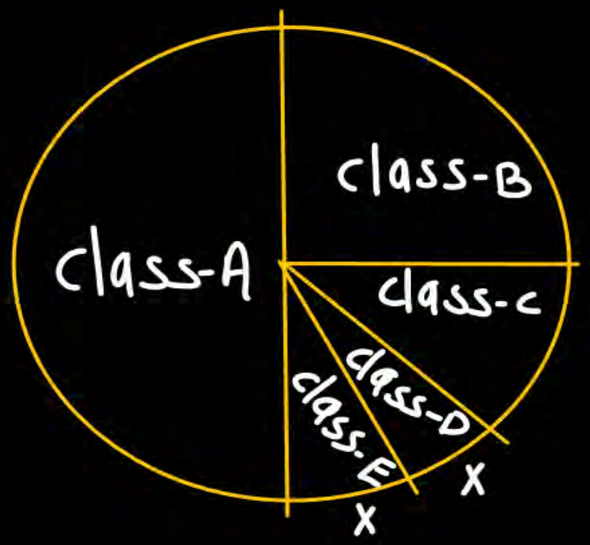
Advantage of Supernetting

a. Super netting Reduce Routing table entry.

b. Router will take less time for processing the packet.

c. It improve flexibility of IP Address Allotment i.e. If some one required 500 Address then we have no need to purchase class B network we can combine two class C network.

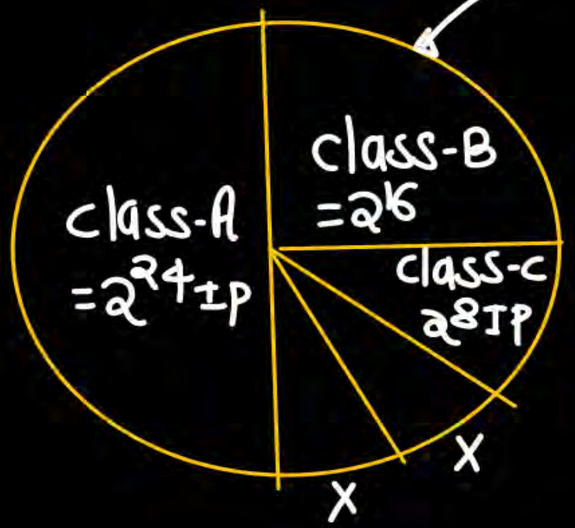
classful Addressing



class A → No of IP Addresses in one N/w = 2^{24}

class B → " " " " " " " = 2^{16}

class C → " " " " " " " = 2^{8}

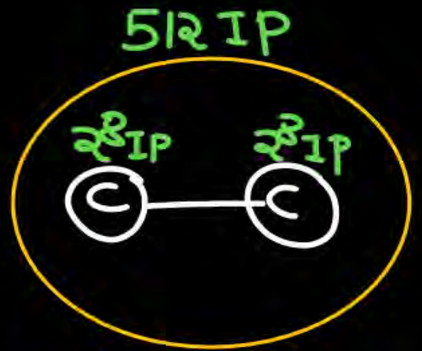


X = 500 IP Addresses

IP Address wasted $= 2^{16} - 500$

$= 65,536 - 500$

$= 65,036$



Possible ✓

Not Possible ✗

Rules of Supernetting

a. Network ID must be contiguous

b. Size of the Network must be same & No. of Network must be in a power of 2

c. First Network ID must be div. by tota size of the supernet.

or

First IP Add Add must be divisible by total No. OF IP Addresses in the supernet

Ex – 1

N_1: 128.56.24.0/24 , NID = 24 bit , HID = 8 $\Rightarrow 2^8$ IP

N_2: 128.56.25.0/24 , NID = 24 bit , HID = 8 $\Rightarrow 2^8$ IP

N_3: 128.56.26.0/24 , NID = 24 bit , HID = 8 $\Rightarrow 2^8$ IP

N_4: 128.56.27.0/24 , NID = 24 bit , HID = 8 $\Rightarrow 2^8$ IP

1. Network ID must be contiguous (True)

N_1: 128.56.24.0/24

NID = 24, HID = 8

N_1: 128.56.24.--------

NID HID

128.56.24.00000000 → 128.56.24.0 (NID)

128.56.24.00000001 → 128.56.24.1

128.56.24.00000010 → 128.56.24.2

128.56.24.00000011 → 128.56.24.3

⋮ ⋮

128.56.24.11111111 → 128.56.24.255 (DBA)

+ 1

128.56.25.0

Q2: 128.56.25.0/24

128.56.25. --------

NID HID

128.56.25. 00000000 → 128.56.25.0

128.56.25. 11111111 → 128.56.25.255

+ 1

128.56.26.0

N3: 128.56.26.0/24

128.56.26. --------
NID HID

128.56.26.00000000 → 128.56.26.0

128.56.26.11111111 → 128.56.26.255
+ 1
128.56.27.0

N4: 128.56.27.0/24

128.56.27. --------
NID HID

128.56.27.00000000 → 128.56.27.0
NID

⋮

128.56.27.11111111 → 128.56.27.255

2. Size of the N/W must be same and No. of n/w's must be in a Power of 2. (True)

Same size $= 2^8$, No. of Networks $= 4 = 2^2$

3. First NID must be divisible by total size of supernet

Total size of supernet $= 2^8 + 2^8 + 2^8 + 2^8 = 4 * 2^8 = 2^2 * 2^8 = 2^{10}$

128.56.24.0

Rem(HID)

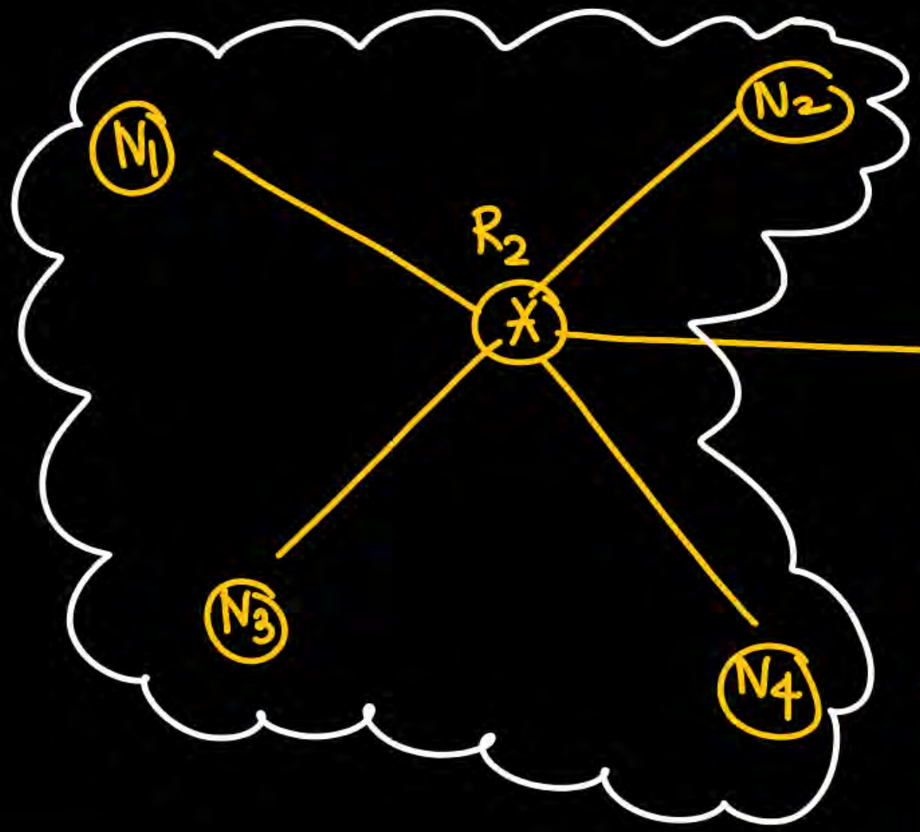
128.56.00011000.00000000 | 2^{10} (True)

N_1: 128.56.24.0/24

N_2: 128.56.25.0/24

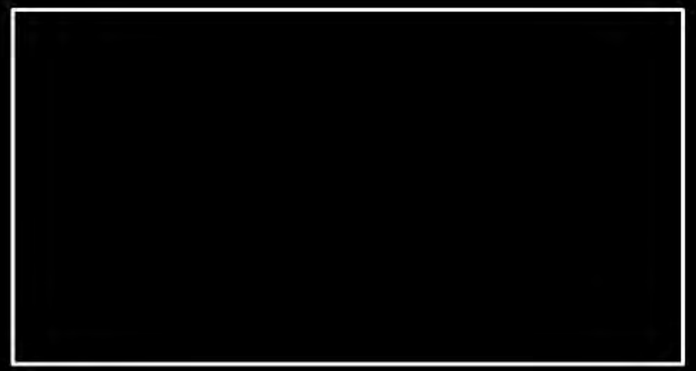
N_3: 128.56.26.0/24

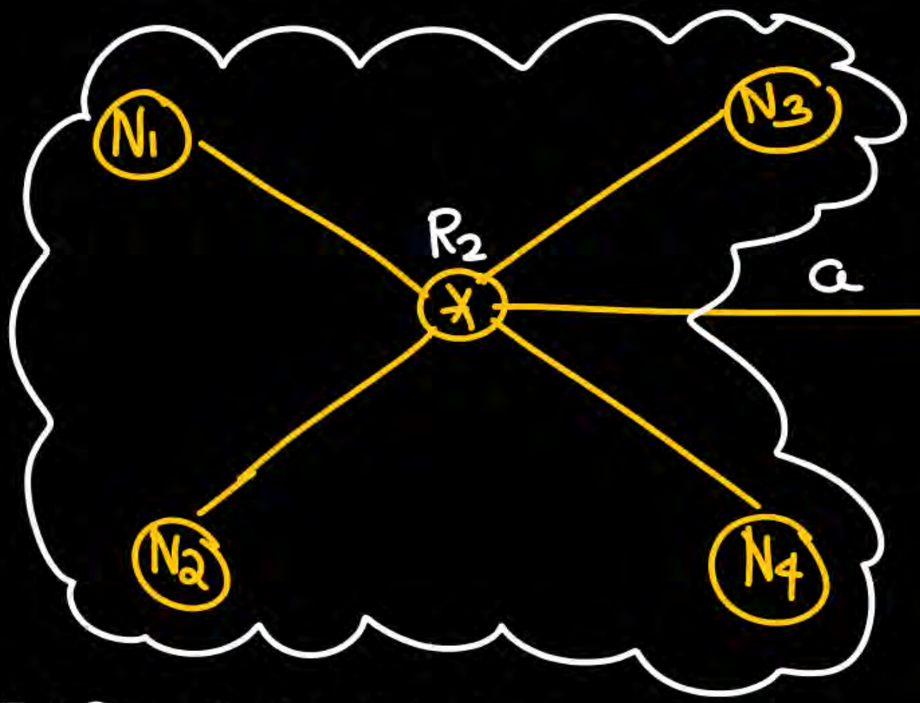
N_4: 128.56.27.0/24



Routing table

NID	SM	I/F





I DIP: 128.56.24.192

DIP : 128.56.24.192
AND AND
SM : 255.255.255.0
NID = 128.56.24.0

∴

without supernetting Routing table at R_1

NID	SM	I/F
128.56.24.0	255.255.255.0	a
128.56.25.0	255.255.255.0	a
128.56.26.0	255.255.255.0	a
128.56.27.0	255.255.255.0	a

II DIP : 128.56.27.132

DIP = 128.56.27.132
AND AND
SM = 255.255.255.0
NID = 128.56.27.0

Supernet mask

It is a 32 bit number used to generate a single IP address for the group of network based on the following two rules

Rule1: No of 1's in the supernet mask indicate fixed part

Rule2: No of 0's in the supernet mask indicate variable part

N_1 : 128.56.24.0/24
N_2 : 128.56.25.0/24
N_3 : 128.56.26.0/24
N_4 : 128.56.27.0/24

128.56.24.0/22

10000000.00111000.00011000.00000000
10000000.00111000.00011001.00000000
10000000.00111000.00011010.00000000
10000000.00111000.00011011.00000000

Fixed | Variable | Variable

11111111.11111111.11111100.00000000

Subnet mask = 255.255.252.0

IPAdd
AND
SM
NID

IPAdd
AND
Subnet Mask
Subnet-id

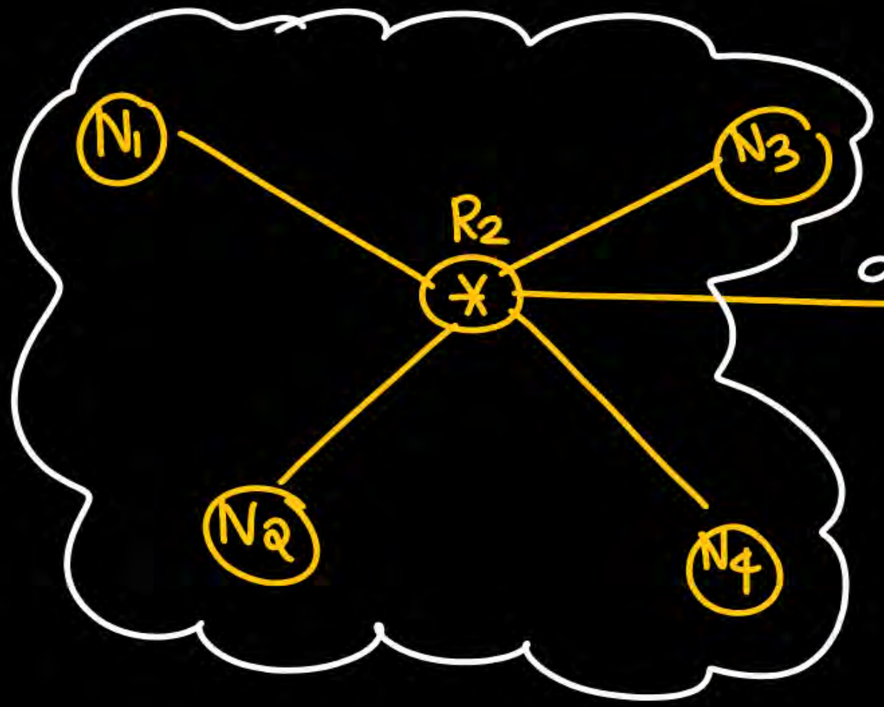
IPAdd = 128.56.24.0
AND
Subnet Mask = 255.255.252.0
Subnet-id = 128.56.24.0

24 : 00011000
AND
252: 11111100
(24) = 00011000

25 : 00011001
AND
252: 11111100
(24) = 00011000

26 : 00011010
AND
252: 11111100
(24) = 00011000

27 : 00011011
AND
252: 11111100
(24) = 00011000



DIP = 128·56·26·241

with subnetting table at R_1

subnet-id	subnet mask	Interface
128·56·24·0	255·255·252·0	a

DIP = 128·56·26·241
AND
Subnet Mask = 255·255·252·0
subnet id = 128·56·24·0 ✓

AD Rule For Supernet-id

Supernet id = First IP Address Always

Supernet id = 128.56.24.0

AD Rule For Supernet Mask

Total size of supernet = $2^8 + 2^8 + 2^8 + 2^8$

$= 4 \times 2^8 = 2^{10}$

HID = 10 bit

NID = 32 - 10 = 22

Supernet Mask: 11111111.11111111.111111|00.00000000

Supernet Mask = 255.255.252.0

Final Ans: 128.56.24.0|22

Problem Solving
On
Supernetting

Q.1 Perform CIDR aggregation on the following IP addresses

57.6.96.0/21, HID = 11 bit

57.6.104.0/21, HID = 11 bit

57.6.112.0/21, HID = 11 bit

57.6.120.0/21, HID = 11 bit

(A) 57.6.96.0/21

(B) 57.6.96.0/20

(C) 57.696.0/19 ✓

(D) 57.6.96.0/18

01100000.00000000

① Network-id must be contiguous (True)

② same size = 2^{11} & No. of n/w's = $4 = 2^2$ (T)

③ First NID must be div. by total size of Supernet

Total size of supernet = $2^{11}+2^{11}+2^{11}+2^{11}$

$= 4 * 2^{11} = 2^{13}$

57.6.96.0

57.6.011 00000.00000000 | 2^{13}

Rem or HID

(True)

Subnetid = First IP Address Always

Subnetid = 57.6.96.0

Subnet Mask

total size OF subnet = 2^{13}

HID = 13 bit

NID = 32 - 13 = 19 bit

Subnet mask : 11111111.11111111.11100000.00000000

255.255.224.0

Final Ans: 57.6.96.0/19

Q.2

Perform CIDR aggregation on the following IP addresses

HID

00000000.00000000

194.24.0.0/21, HID = 11 bit

194.24.8.0/21, HID = 11 bit

194.24.16.0/20, HID = 12 bit

① NID must be contiguous (True)

② same size & No. of n/w's must be in a Power of 2 (False)

(A) 194.24.0.0/19

(B) 194.24.0.0/21

(C) 194.24.0.0/20

(D) 194.24.0.0/22

194.24.0.0/21
194.24.8.0/21
194.24.16.0/20

① contiguous (True)

② same size = 2^{11}, & No. of n/w's = $2 = 2^1$ (True)

③ total size of supernet = $2^{11} + 2^{11} = 2 \times 2^{11} = 2^{12}$

194.24.0.0

194.24.0000 0000.00000000 | 2^{12} (True)

Rem or HID

supernet id = 194.24.0.0

Total size of supernet = 2^{12}

HID = 12 bit, NID = 20 bit

194.24.0.0/20
194.24.16.0/20

194.24.0.0/20 , HID=12bit

194.24.16.0/20 , HID=12bit

① contiguous (True)

② same size = 2^{12} ⇒ No. of n/w's = 2

③ Total size of supernet = $2^{12}+2^{12} = 2*2^{12} = 2^{13}$

194.24.0.0

Rem or HID

194.24.00000000.00000000 | 2^{13} (True)

Supernet id = 1st IP Add Always

= 194.24.0.0

total size OF supernet = 2^{13}

HID = 13bit

NID = 32-13 = 19bit

Final Ans: 194.24.0.0/19

Supernet mask

11111111.11111111.11100000.00000000

255.255.224.0

Q.3

Consider routing table of an organization's router shown below: (Gate-2022→2marks) MSQ

Subnet number	Subnet Mask	Next Hop
12.20.164.0	255.255.252.0	R1
12.20.170.0	255.255.254.0	R2
12.20.168.0	255.255.254.0	Interface 0
12.20.166.0	255.255.254.0	Interface 1
Default		R3

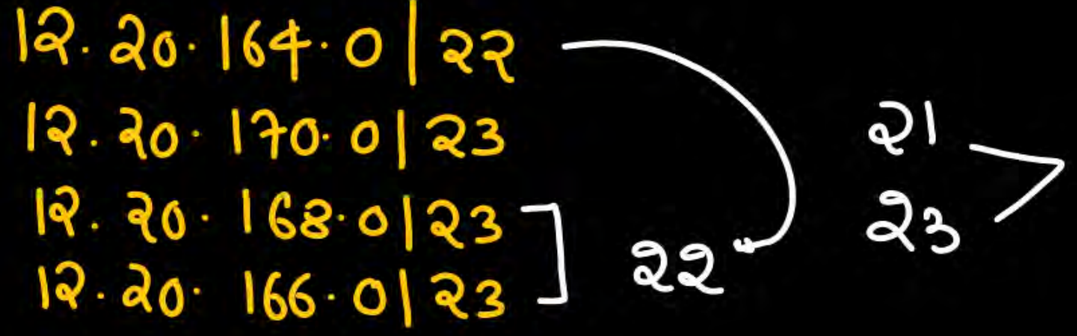
Which of the following prefixes in CIDR notation can be collectively used to correctly aggregate all of the subnets in the routing table?

A 12.20.164.0/21

B 12.20.164.0/22

C 12.20.168.0/22

D 12.20.164.0/20


12·20·164·0 | 22
12·20·170·0 | 23
12·20·168·0 | 23
12·20·166·0 | 23
22
21
23

Supernetting in Classfull addressing

Ex – 1

200.96.86.0 (NID | HID)

200.96.87.0 (NID | HID)

200.96.88.0 (NID | HID)

200.96.89.0 (NID | HID)

class-C

NID	HID
24	8

① Contiguous (True)

② Same size = 2^8 & No. of n/w's = 4 = 2^2 (T)

③ total size of supernet = $2^8+2^8+2^8+2^8$
$= 2^{10}$

200.96.86.0

200.96.010101 10.00000000 | 2^{10}

Rem or HID

False

Supernetting Not Possible

Ex – 2

198.47.32.0 (NID | HID)
198.47.33.0 (NID | HID)
198.47.34.0 (NID | HID)
198.47.35.0 (NID | HID)

class-C

NID	HID
24	8

Supernet Mask : 11111111.11111111.11111100.00000000
255.255.252.0

① Contiguous (True)

② same size = 2^8 & No. of n/w's = 4 = 2^2 (T)

③ total size of supernet = $2^8+2^8+2^8+2^8$
$= 2^{10}$

198.47.32.0
198.47.00100000.00000000 | 2^{10}
Rem or HID
(True)

Supernet id = 198.47.32.0

Supernet Mask

total size of supernet = 2^{10}
HID = 10 bit, NID = 32 − 10 = 22

NID HID

Subnet Mask : 11111111 · 11111111 · 111111**00** · 00000000 → 255·255·252·0

Subnet bits = 2

No. of N|w's that must be combined = $2^2 = 4$

class-C

Default Subnet Mask : 255·255·255·0

NID HID

11111111 · 11111111 · 11111111 · 00000000

Ex – 3

128.56.24.0

128.56.25.0

128.56.26.0

128.56.27.0

Class-B

NID	HID
16	16

we can't apply subnetting on single N/w

Ex – 4

128.56.0.0
NIB HIB
128.57.0.0
128.58.0.0
128.59.0.0

class-B

NID	HID
16	16

① Contiguous (True)

② same size $= 2^{16}$ & No. of n/w's $= 4 = 2^2$

③ Total size of supernet $= 2^{16} + 2^{16} + 2^{16} + 2^{16}$
$= 4 * 2^{16} = 2^{18}$ (True)

128.56.0.0

128.00111000.00000000.00000000 | 2^{18}

Rem of HID

True

supernet id = 128.56.0.0

total size of supernet $= 2^{18}$

HID = 18 bit, NID = 14 bit

NID HID

Subnet Mask = 11111111 · 11111100 · 00000000 · 00000000 → 255·252·0·0

Subnet bits = 2

No. of n/w's must be Combined = $2^2 = 4$

Class-B

Default subnet Mask: 255·255·0·0

NID HID

11111111 · 11111111 · 00000000 · 00000000

Subnet Mask	Supernet Mask
(1) No. of 1's in the subnet Mask either equal to NID bits or more than NID bits	(1) No. of 1's in the supernet mask always less than NID bits
(2) Subnet mask is applicable for single n/w OR subnetting is applicable For single N/w	(2) Supernet mask is applicable for two or more network OR supernetting is applicable For two or more n/w
(3) In subnetting we borrowed from Host ID	(3) In supernetting we borrowed from network-ID
classA: 255.0.0.0 (NID) classB: 255.255.0.0 (NID) classC: 255.255.255.0 (NID)	

class-A

255.192.0.0 (subnet mask)

11111111.11000000.00000000.00000000

NID SID

Address	class-A	class-B	class-C
255.0.0.0 (8→1's)	Subnet Mask	Subnet Mask	Subnet Mask
255.255.252.0 (22→1's)	Subnet Mask	Subnet Mask	Subnet Mask
255.255.255.0 (24-1's)	Subnet Mask	subnet Mask	Subnet mask
255.224.0.0 (11→1's)	Subnet mask	Subnet Mask	Subnet mask


THANK YOU
GW
SOLDIERS !