Subnet Mask and IP Addressing Related Practice questions

Complete Course on Computer Networks for GATE 2023 & 2024

Sweta Kumari • Lesson 10 • Feb 19, 2022

Sweta Kumari

- Verified EDUCATOR For UGC NET Computer Science @GATE NoteBook
- Verified EDUCATOR For GATE CS IT @UNACADEMY

- Having 5 years Teaching Experience For UGC NET , GATE CS & Placements
- Teaches all Core CS/IT subjects.

NETWORK LAYER

NL

1 IP

2 Routing

Classful

Classless / CIDR

Classless Addressing-

•Classless Addressing is an improved IP Addressing system.
•It makes the allocation of IP Addresses more efficient.
•It replaces the older classful addressing system based on classes.
•It is also known as **Classless Inter Domain Routing (CIDR)**.

CIDR Block-

When a user asks for specific number of IP Addresses,
•CIDR dynamically assigns a block of IP Addresses based on certain rules.
•This block contains the required number of IP Addresses as demanded by the user.
•This block of IP Addresses is called as a **CIDR block**.

Rules For Creating CIDR Block-

A CIDR block is created based on the following 3 rules-

Rule-1:

•All the IP Addresses in the CIDR block must be contiguous.

Rule-2:

•The size of the block must be presentable as power of 2.
•Size of the block is the total number of IP Addresses contained in the block.
•Size of any CIDR block will always be in the form 2^1, 2^2, 2^3, 2^4, 2^5 and so on.

Rule-3:

•First IP Address of the block must be divisible by the size of the block.

SN

Examples-

Consider a binary pattern-

01100100.00000001.00000010.01000000

(represented as 100.1.2.64)

- It is divisible by 2^5 since its least significant 5 bits are zero.
- It is divisible by 2^6 since its least significant 6 bits are zero.
- It is not divisible by 2^7 since its least significant 7 bits are not zero.

CIDR Notation-

CIDR IP Addresses look like-

a.b.c.d / n NID

- They end with a slash followed by a number called as IP network prefix.
- IP network prefix tells the number of bits used for the identification of network.
- Remaining bits are used for the identification of hosts in the network.

Example-

An example of CIDR IP Address is-

182.0.1.2 / 28

It suggests-

- 28 bits are used for the identification of network.
- Remaining 4 bits are used for the identification of hosts in the network.

Given the CIDR representation 20.10.30.35 / 27. Find the range of IP Addresses in the CIDR block.

NID = 27

HID = 5

Given the CIDR representation 20.10.30.35 / 27. Find the range of IP Addresses in the CIDR block.

27 5 bit

NID HID

32 bit

Solution-

Given CIDR representation is 20.10.30.35 / 27.

It suggests-

- 27 bits are used for the identification of network.
- Remaining 5 bits are used for the identification of hosts in the network.

Given CIDR IP Address may be represented as-

00010100.00001010.00011110.00100011 / 27

So,

- First IP Address = 00010100.00001010.00011110.001**00000** = 20.10.30.32
- Last IP Address = 00010100.00001010.00011110.001**11111** = 20.10.30.63

Thus, Range of IP Addresses = [20.10.30.32 , 20.10.30.63]

Given the CIDR representation 100.1.2.35/20. Find the range of IP Addresses in the CIDR block.

NID = 20

HID = 32 − NID = 12

64 + 32

96

FIP: 100.1.0.0

LIP: 100.1.15.255

100 . 1 . 2 . 35

01100100 . 00000001 . 00000010 . 00100011

32 + 2 + 1

35

00001111

2^3 2^2 2^1 2^0

8 + 4 + 2 + 1

Given the CIDR representation 100.1.2.35 / 20. Find the range of IP Addresses in the CIDR block.

Solution-

Given CIDR representation is 100.1.2.35 / 20.

It suggests-
- 20 bits are used for the identification of network.
- Remaining 12 bits are used for the identification of hosts in the network.

Given CIDR IP Address may be represented as-

01100100.00000001.00000010.00100011 / 20

So,
- First IP Address = 01100100.00000001.0000**0000.00000000** = 100.1.0.0
- Last IP Address = 01100100.00000001.0000**1111.11111111** = 100.1.15.255

Thus, Range of IP Addresses = [100.1.0.0 , 100.1.15.255]

Consider a block of IP Addresses ranging from 100.1.2.32 to 100.1.2.47.
1.Is it a CIDR block? Yes
2.If yes, give the CIDR representation.

HID = 4 bit

NID = 28 bit

① Yes $\boxed{100.1.2.32/28}$

② Size of block - 2^n

→ $\underbrace{47-32}+1 = 16\ (2^4)$

③ FIP/size of block → 100.1.2.32/2^4

100.1.2.00100000

Consider a block of IP Addresses ranging from 100.1.2.32 to 100.1.2.47.

1. Is it a CIDR block?
2. If yes, give the CIDR representation.

CIDR Representation = 100.1.2.32 / 28

Rule-1:

- According to Rule-1, all the IP Addresses must be contiguous.
- Clearly, all the given IP Addresses are contiguous.
- So, Rule-1 is satisfied.

Rule-2:

- According to Rule-2, size of the block must be presentable as 2^n.
- Number of IP Addresses in the given block = 47 – 32 + 1 = 16.
- Size of the block = 16 which can be represented as 2^4.
- So, Rule-2 is satisfied.

Rule-3:

- According to Rule-3, first IP Address must be divisible by size of the block.
- So, 100.1.2.32 must be divisible by 2^4.
- 100.1.2.32 = 100.1.2.0010**0000** is divisible by 2^4 since its 4 least significant bits are zero.
- So, Rule-3 is satisfied.

Since all the rules are satisfied, therefore given block is a CIDR block.

CIDR Representation-

We have-

- Size of the block = Total number of IP Addresses = 2^4.
- To have 2^4 total number of IP Addresses, total 4 bits are required in the Host ID part.
- So, Number of bits present in the Network ID part = 32 – 4 = 28.

Consider a block of IP Addresses ranging from 150.10.20.64 to 150.10.20.127.

1.Is it a CIDR block? Yes

2.If yes, give the CIDR representation.

HID = 6bit

NID = 26bit

① ✓

② ✓ Size of block = 127 − 64 + 1 = 64 = $\boxed{2^6}$

③ ✓ FIP / 2^6 = 150.10.20.64

150.10.20 01 $\boxed{000000}$

FIP / NID } $\boxed{150.10.20.64/26}$

10 Questions (NL)

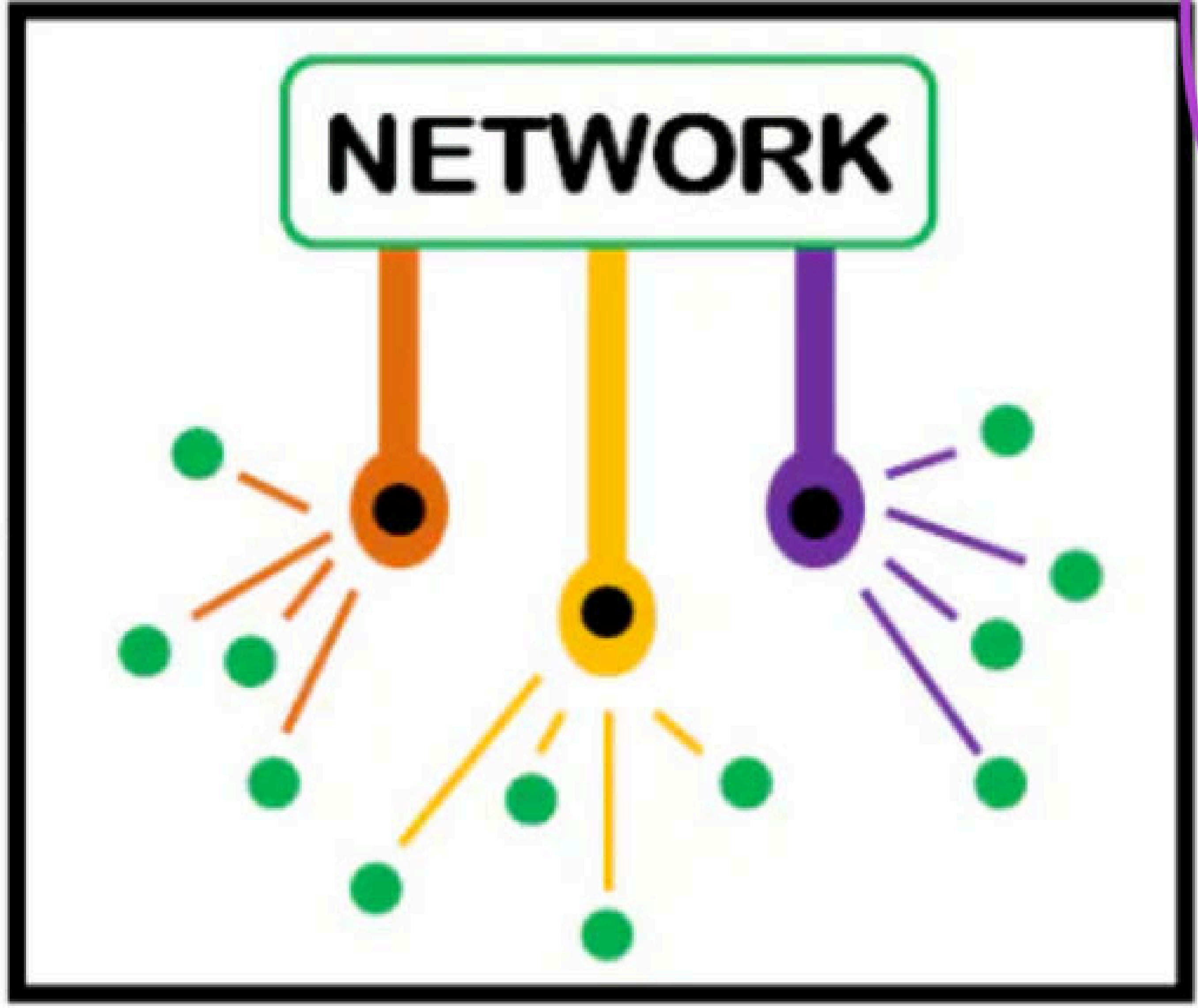
The process of dividing a single network into multiple sub networks is called as **SUBNETTING.**

The sub networks so created are called as **SUBNETS.**

ADVANTAGES

- Improves security.
- The maintenance and administration easy.

Number of Hosts =
2 ^ HID bit
Number of Networks =
2 ^ NID bit



No. of hosts = 2^n – 2
All HID bit is 1 => Represents NID
All HID Bit is 0 => Represents Broadcast address
Both are reserved.

Sol

Subnet mask is a 32 bit number which is a sequence of 1's followed by a sequence of 0's where-
1's represent the **global network ID** part and the subnet ID part.
0's represent the **host ID part.**

The **subnet ID** is created by borrowing some bits from the Host ID part of the IP Address.

Each subnet has its unique network address known as its **Subnet ID.**

255.0.0.0 = Class A(Default mask)
255.255.0.0 = Class B
255.255.255.0 = Class C

Sol

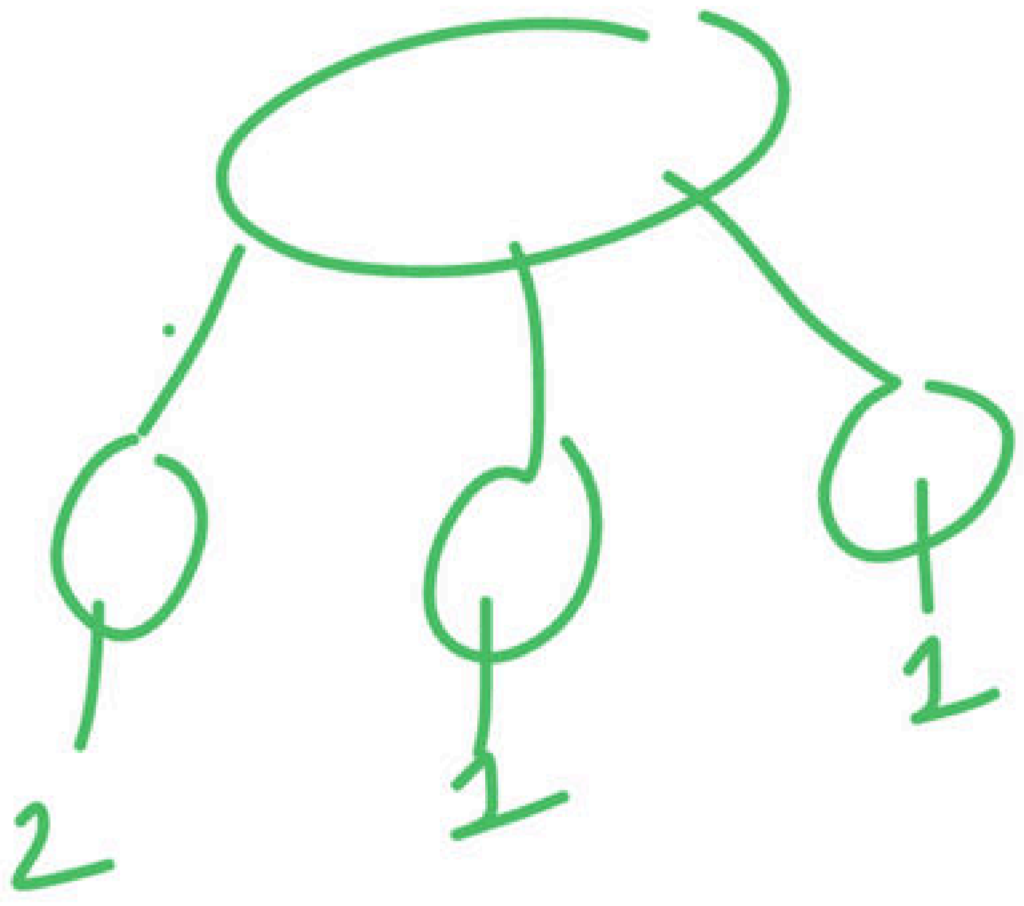
255 = 8 1's
254 = 7 1's
128 = Only 1
240 = 4 1's

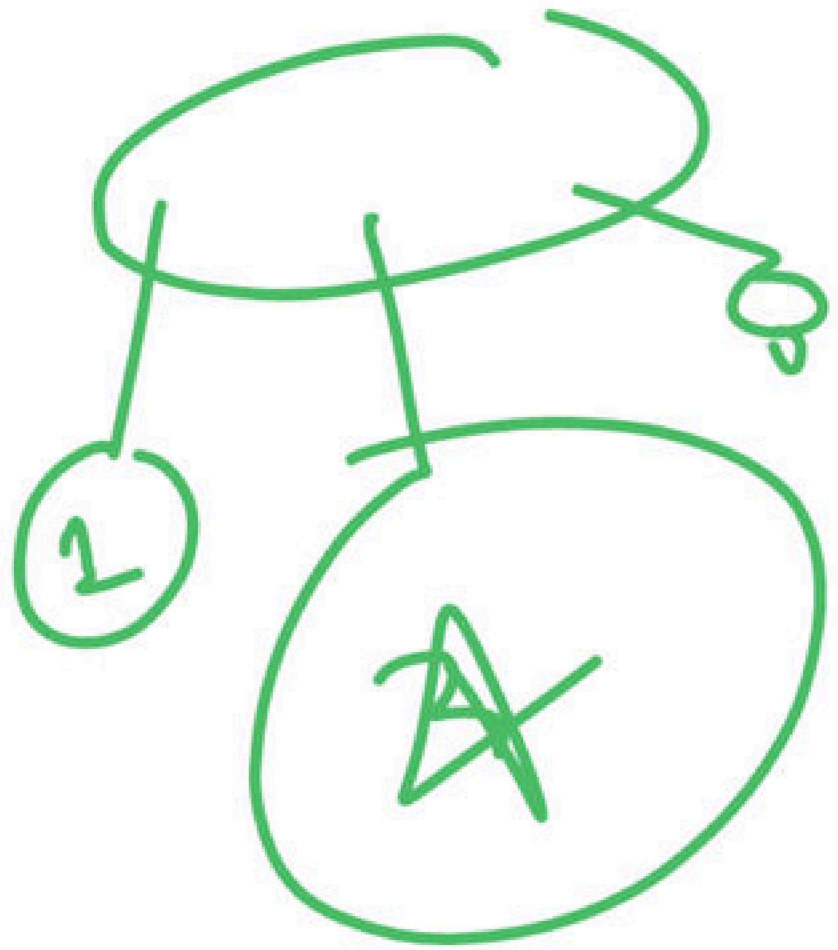
1. Fixed Length Subnetting-

Fixed length subnetting also called as **classful subnetting** divides the network into subnets where-
- All the subnets are of same size.
- All the subnets have equal number of hosts.
- All the subnets have same subnet mask.

2. Variable Length Subnetting-

Variable length subnetting also called as **classless subnetting** divides the network into subnets where-
- All the subnets are not of same size.
- All the subnets do not have equal number of hosts.
- All the subnets do not have same subnet mask.





Consider-

- We have a big single network having IP Address 200.1.2.0.
- We want to do subnetting and divide this network into 2 subnets.

Clearly, the given network belongs to class C.

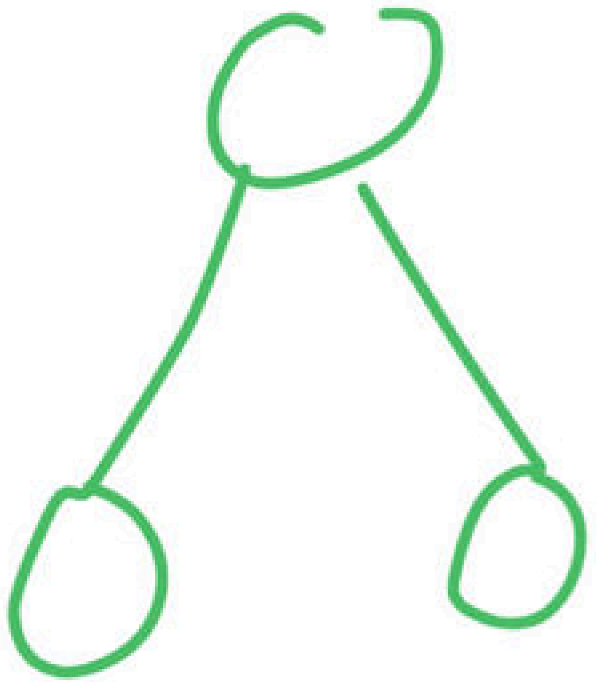
- If borrowed bit = 0, then it represents the first subnet.
- If borrowed bit = 1, then it represents the second subnet.

SID = 1 bit

200	1	2	0

24 bits NID

~~8~~ 7 bits HID



For creating two subnets and to represent their subnet IDs, we require 1 bit.
So,

- We borrow one bit from the Host ID part.
- After borrowing one bit, Host ID part remains with only 7 bits.

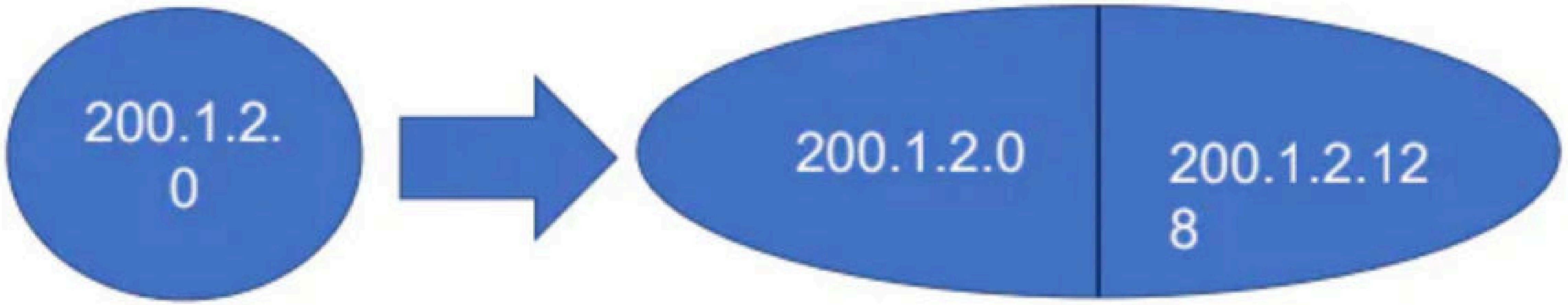
SID

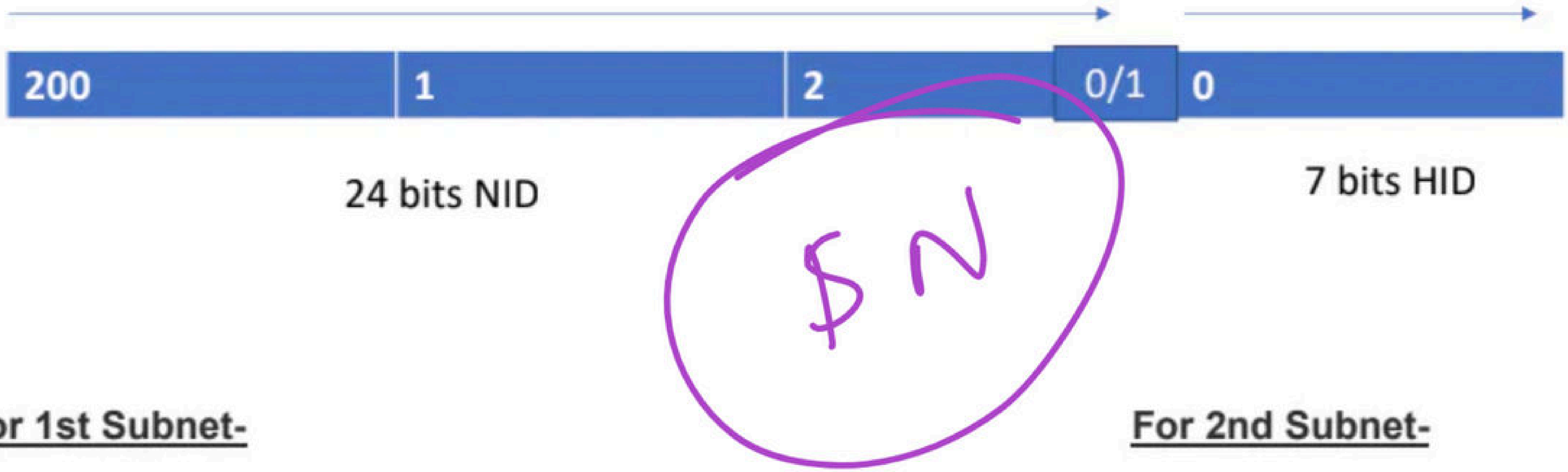
200	1	2	0/1	0

24 bits NID

7 bits HID

IP Address of the two subnets are-
- 200.1.2.**0**0000000 = 200.1.2.0
- 200.1.2.**1**0000000 = 200.1.2.128



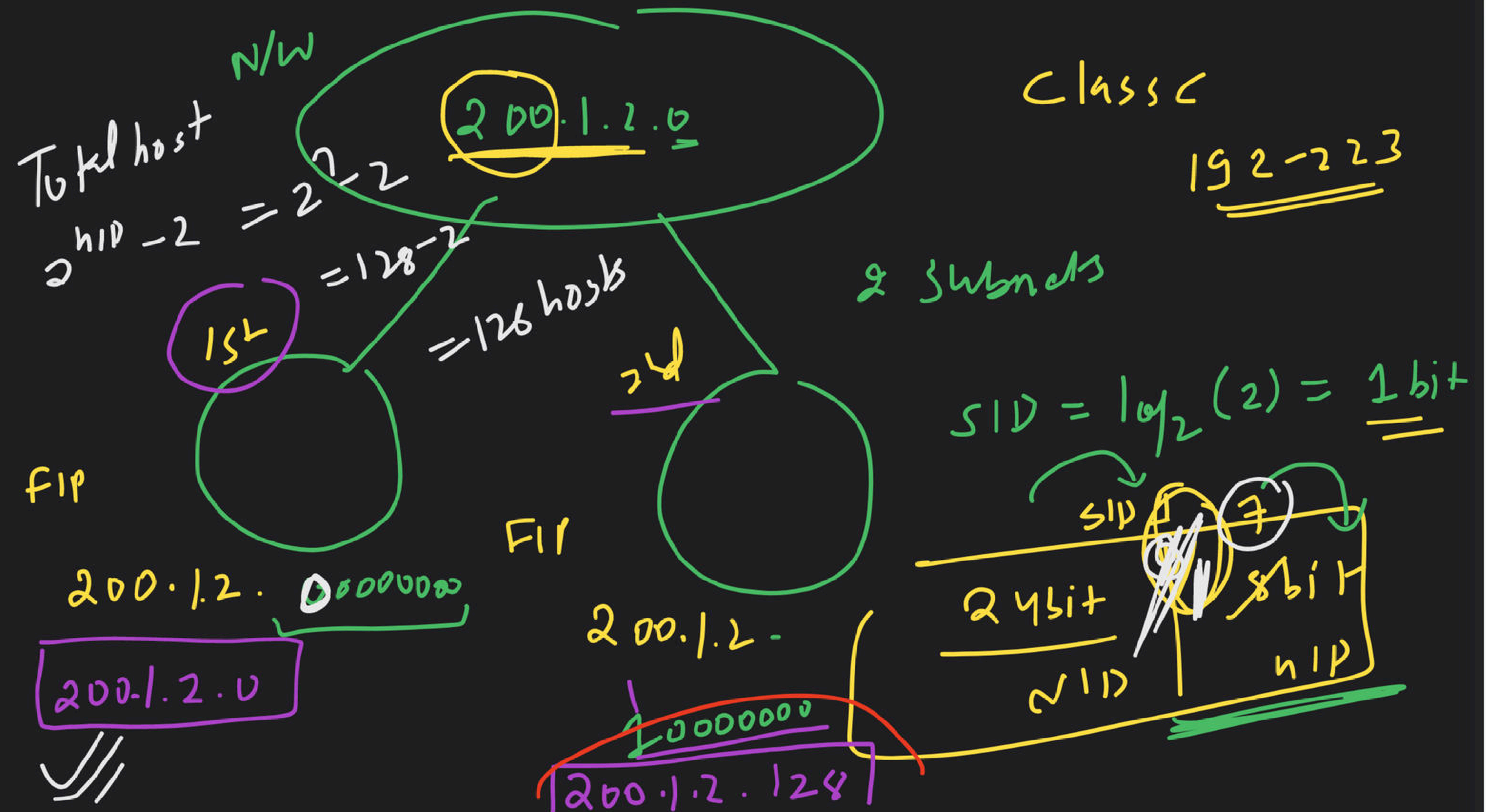


<u>For 1st Subnet-</u>

- IP Address of the subnet = 200.1.2.0
- Total number of hosts that can be configured = 128 – 2 = 126
- Range of IP Addresses = [200.1.2.**0**0000000, 200.1.2.**0**1111111] = [200.1.2.0, 200.1.2.127]
- Direct Broadcast Address = 200.1.2.**0**1111111 = 200.1.2.127
- Limited Broadcast Address = 255.255.255.255

<u>For 2nd Subnet-</u>

- IP Address of the subnet = 200.1.2.128
- Total number of hosts that can be configured = 128 – 2 = 126
- Range of IP Addresses = [200.1.2.**1**0000000, 200.1.2.**1**1111111] = [200.1.2.128, 200.1.2.255]
- Direct Broadcast Address = 200.1.2.**1**1111111 = 200.1.2.255
- Limited Broadcast Address = 255.255.255.255


N/W
200.1.2.0
Total host
$2^{nID}-2 = 2^7-2$
$=128-2$
$=126$ hosts
1st
2d
Class C
192-223
2 subnets
$SID = \log_2(2) = 1$ bit
FIP
200.1.2. 0 0000000
200.1.2.0
FIP
200.1.2.
1 0000000
200.1.2.128
SID
7
24 bit
8 bit
NID
HID

(1st sub) Range of Ipadd = 200.1.2.0 (FIP)

200.1.2.127

7 bits DBA

200.1.2.0 $\boxed{1111111}$ (LIP)

HID

$\boxed{\text{LBA}}$ → 255.255.255.255

Range of IP = 200.1.2.128 (FIP)

(2nd sub)

200.1.2.11111111 (LIP)

DBA

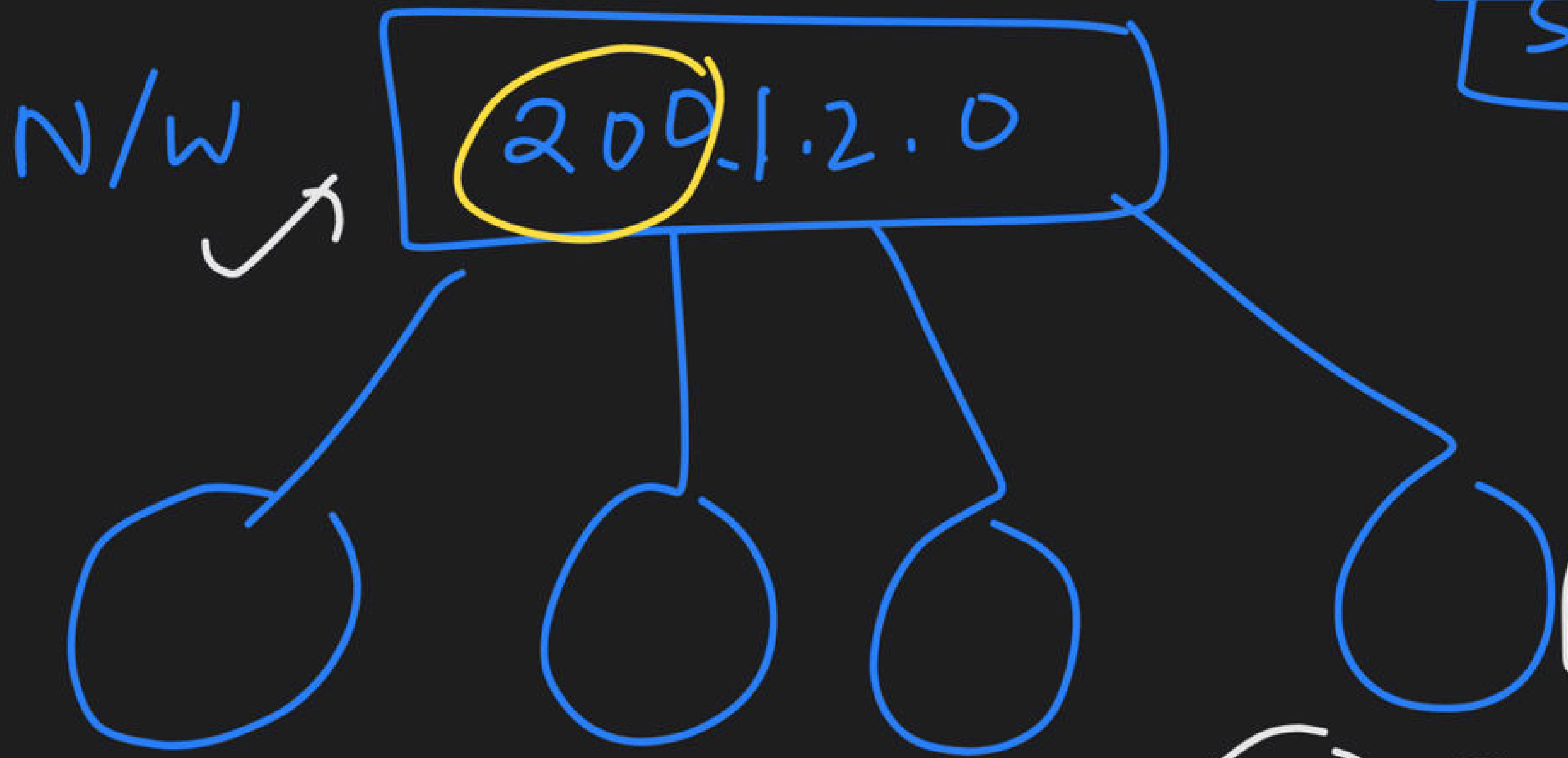
$\boxed{200.1.2.255}$

Consider-

- We have a big single network having IP Address 200.1.2.0.
- We want to do subnetting and divide this network into 4 subnets.

For creating four subnets and to represent their subnet IDs, we require 2 bits.
So,

- We borrow two bits from the Host ID part.
- After borrowing two bits, Host ID part remains with only 6 bits.



SID = 2bit

4 subnets

1st subnet

FIP: 200.1.2.0

LIP: 200.1.2.00111111

200.1.2.63

1
128
64
192
255
63

24 bit 2^{bit} ~~8~~ 6 bit

NID SID NID

SID
$\boxed{00}$
$\boxed{01}$
10
11

24

FIP: 200.1.2.01000000

$\boxed{200.1.2.64}$

..

SN

n/w 200.1.2.0

SUB

SID = 2 bit

24	2	~~8~~ 6
WID	SID	HIP

→ Total hosts = $2^{HIP} - 2 = 2^6 - 2 = 62$ hosts

→ LBA = 255.255.255.255

1st subnet

00

FIP: 200.1.2.0

LIP: 200.1.2.00111111

200.1.2.63

DBA = LIP

2nd subnet

01

FIP: 200.1.2.01000000

200.1.2.64

LIP: 200.1.2.01111111

200.1.2.127

DBA

3rd subnet

10

FIP: 200.1.2.10000000

200.1.2.128

LIP: 200.1.2.10111111

200.1.2.191

DBA

4th subnet

11

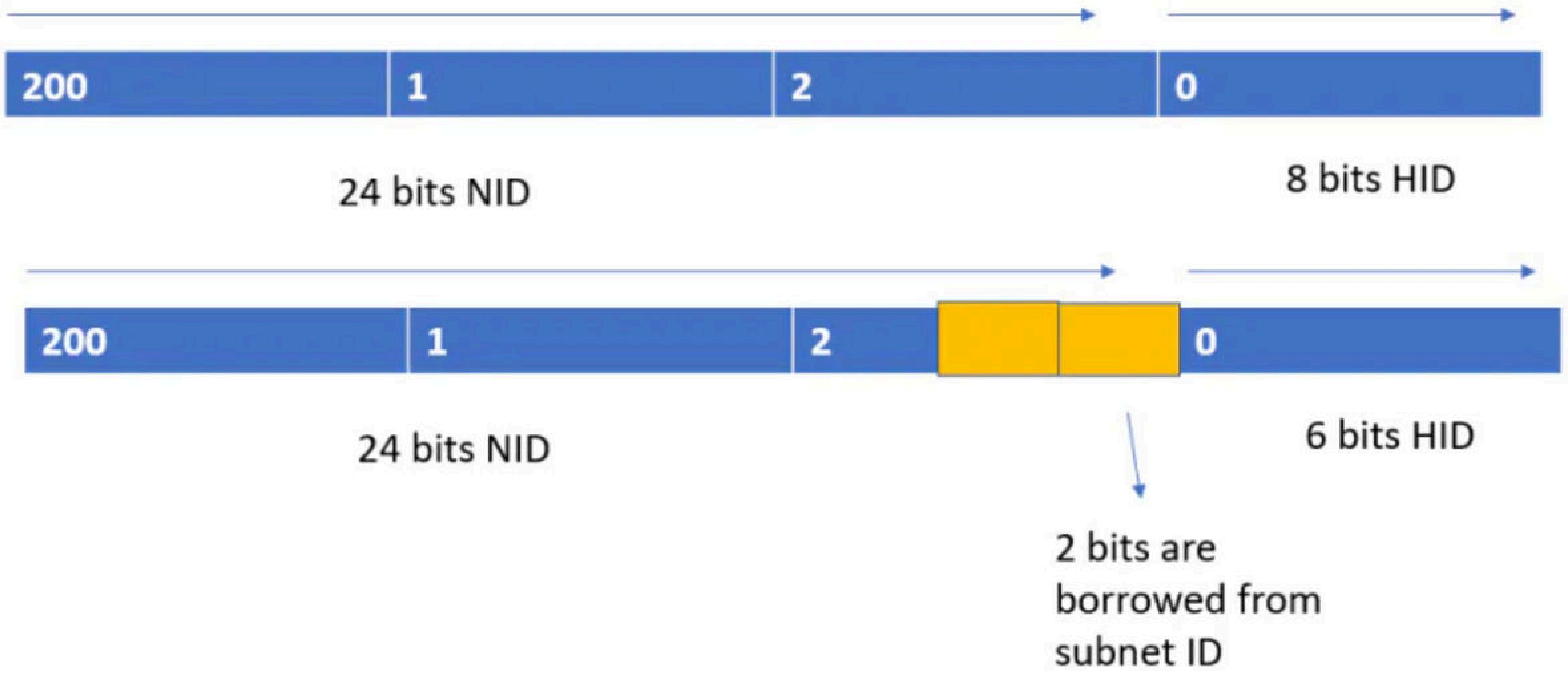
FIP: 200.1.2.11000000

200.1.2.192

LIP: 200.1.2.11
111111

LIP. 200.1.2.255

DBA



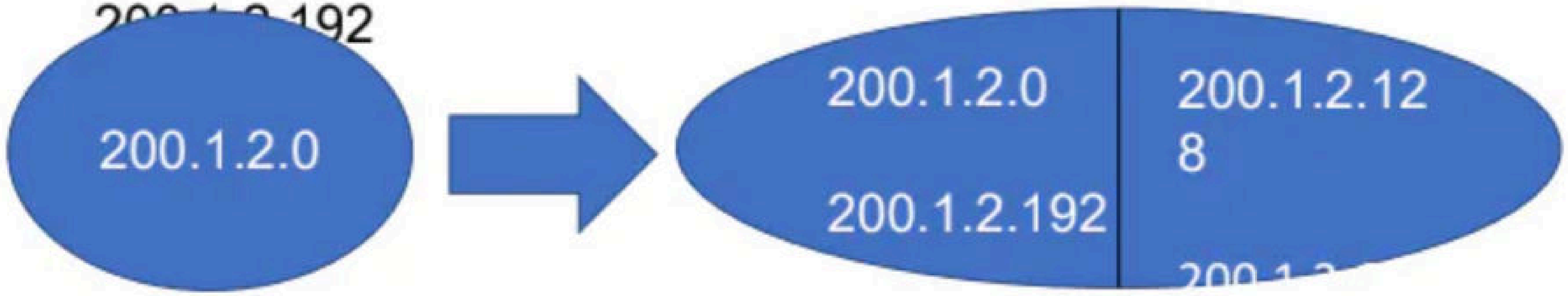
- If borrowed bits = 00, then it represents the 1st subnet.
- If borrowed bits = 01, then it represents the 2nd subnet.
- If borrowed bits = 10, then it represents the 3rd subnet.
- If borrowed bits = 11, then it represents the 4th subnet.

IP Address of the four subnets are-

- 200.1.2.**00**000000 = 200.1.2.0
- 200.1.2.**01**000000 = 200.1.2.64
- 200.1.2.**10**000000 = 200.1.2.128
- 200.1.2.**11**000000 = 200.1.2.192

IP Address of the four subnets are-

- 200.1.2.**00**000000 = 200.1.2.0
- 200.1.2.**01**000000 = 200.1.2.64
- 200.1.2.**10**000000 = 200.1.2.128
- 200.1.2.**11**000000 = 200.1.2.192



SUBNETTING

Disadvantages of Subnetting-

Subnetting leads to loss of IP Addresses

During subnetting,
- We have to face a loss of IP Addresses.
- This is because two IP Addresses are wasted for each subnet.
- One IP address is wasted for its network address.
- Other IP Address is wasted for its direct broadcasting a

Subnetting leads to complicated communication process.

After subnetting, the communication process becomes complex involving the following 4 steps-
1. Identifying the network
2. Identifying the sub network
3. Identifying the host
4. Identifying the process

Suppose a network with IP Address 192.16.0.0. is divided into 2 subnets, find number of hosts per subnet.
Also for the first subnet, find-

1.Subnet Address
2.First Host ID
3.Last Host ID
4.Broadcast Address

24 bit NID   1 bits in   7 bit HID

1 subnet

FHID

192.16.0.0 0000001 ⇒ 192.16.0.1

LHID

192.16.0.0 1111110 → 192.16.0.126

LHID

192.16.0.0 1111111 → 192.16.0.127

BA

Suppose a network with IP Address 192.16.0.0. is divided into 2 subnets, find number of hosts per subnet.
Also for the first subnet, find-
1.Subnet Address
2.First Host ID
3.Last Host ID
4.Broadcast Address

SN

SID = IP & Subnet mask
Broadcast address = make all HID 1

For first Host id , make all HID 0 except last bit make 1

For last host id , make all HID 1 except last bit make 0

Solution-

•Given IP Address belongs to class C.
•So, 24 bits are reserved for the Net ID.
•The given network is divided into 2 subnets.
•So, 1 bit is borrowed from the host ID part for the subnet IDs.
•Then, Number of bits remaining for the Host ID = 7.
•Thus, Number of hosts per subnet = 2^7 = 128.

For 1st Subnet-

•Subnet Address = First IP Address = 192.16.0.**0**0000000 = 192.16.0.0
•First Host ID = 192.16.0.**0**0000001 = 192.16.0.1
•Last Host ID = 192.16.0.**0**1111110 = 192.16.0.126
•Broadcast Address = Last IP Address = 192.16.0.**0**1111111 = 172.16.0.127

Given the following IP address 38.9.211.19 with a subnet mask of 255.255.255.240 , determine :

1. Network address
2. Default Subnet mask
3. Broadcast address of the network
4. Subnet ID
5. Broadcast address of the subnet
6. First host address in subnet
7. last host address

Given the following IP address 38.9.211.19 with a subnet mask of 255.255.255.240 , determine :

1. Network address = 38.0.0.0 (class A network portion :1st octet)
2. Default Subnet mask = 255.0.0.0
3. Broadcast address of the network = 38.255.255.255 (change all HID bits to 1)
4. Subnet ID = IP & Subnet mask = 38.9.211.16
5. Broadcast address of the subnet = Replace HID bits in SID with 1s = 38.9.211.31
6. First host address in subnet = Replace HID with 0 except last 1
7. last host address = Complement of First HID

IP 00100110.00001001.11010011.00010011
Mask 11111111.11111111.11111111.11110000

Subnet ID 00100110.00001001.11010011.00010000
Broadcast 00100110.00001001.11010011.00011111
SID = 38.9.211.16

SN

First Host ID 00100110.00001001.11010011.00010001 = 38.9.211.17
Last Host ID 00100110.00001001.11010011.00011110 = 38.9.211.30

Given the following IP address 182.250.200.28
Subnet mask = 255.255.255.248
Determine :

1. **Network address**
2. **Default Subnet mask**
3. **Broadcast address of the network**
4. **Subnet ID**
5. **Broadcast address of the subnet**
6. **First host address in subnet**
7. **last host address**

What is **not true** about subnetting?

1. It is applied for a single network
2. It is used to improve security
3. Bits are borrowed from network portion
4. Bits are borrowed from Host portion

The subnet mask for a particular network is 255.255.31.0. Which of the following pairs of IP addresses could belong to this network?

(A) 172.57.88.62 and 172.56.87.233

(B) 10.35.28.2 and 10.35.29.4

(C) 191.203.31.87 and 191.234.31.88

(D) 128.8.129.43 and 128.8.161.55

GATE 2003

(D)

128.8.129.43
255.255.31.0
128.8.1.0

128.8.161.55
255.255.31.0
128.8.1.0

161 — 10100001
31 00011111
00000001

129 → 10000001
31 → 00011111
00000001

The subnet mask for a particular network is 255.255.31.0. Which of the following pairs of IP addresses could belong to this network?
(A) 172.57.88.62 and 172.56.87.233
(B) 10.35.28.2 and 10.35.29.4
(C) 191.203.31.87 and 191.234.31.88
(D) 128.8.129.43 and 128.8.161.55

Out of the 4 options, only option D matches.

(A) and (C) are not the answers as the second byte of IP differs and subnet mast has 255.255 for second byte.

Consider (B), (& for bitwise AND)

10.35.28.2 & 255.255.31.0=10.35.28.0(28=11100)
10.35.29.4 & 255.255.31.0=10.35.29.0(29=11101)
Binary of 31 = 11111

So, we get different subnet numbers

Consider (D)

128.8.129.43 & 255.255.31.0=128.8.1.0(129=10000001)
128.8.161.55 & 255.255.31.0=128.8.1.0(161=10100001)
Binary of 31 =00011111

6 Questions (NL)

The network ID cannot start with 127 because 127 belongs to class A address and is reserved for internal loop-back functions.

Range of special IP addresses:
169.254.0.0 – 169.254.0.16 : Link local addresses
127.0.0.0 – 127.0.0.8 : Loop-back addresses
0.0.0.0 – 0.0.0.8 : used to communicate within the current network.

A link-local address is an Internet Protocol address that is intended only for communications within the segment of a local network (a link) or a point-to-point connection that a host is connected to.

Subnet Mask-

Subnet mask is a 32 bit number which is a sequence of 1's followed by a sequence of 0's where-
•1's represent the global network ID part and the subnet ID part.
•0's represent the host ID part.

How to Calculate Subnet Mask?

For any given IP Address, the subnet mask is calculated-
•By setting all the bits reserved for network ID part and subnet ID part to 1.
•By setting all the bits reserved for host ID part to 0.

Consider we have a network having IP Address 200.1.2.0.
In class C-
24 bits are reserved for the Network ID part.
8 bits are reserved for the Host ID part.
So, Subnet mask
= 11111111.11111111.11111111.00000000
= 255.255.255.0

Important Notes-

Note-1:

Default mask for different classes of IP Address are-
- Default subnet mask for Class A = 255.0.0.0
- Default subnet mask for Class B = 255.255.0.0
- Default subnet mask for Class C = 255.255.255.0

Note-2:

SN

- Network size is the total number of hosts present in it.
- Networks of same size always have the same subnet mask.
- Networks of different size always have the different subnet mask.

Note-3:

- For a network having larger size, its subnet mask will be smaller (number of 1's will be less).
- For a network having smaller size, its subnet mask will be larger (number of 1's will be more).

Consider the following subnet mask -
255.128.0.0

1. Find Number of hosts per subnet
2. Number of subnets if subnet mask belongs to class A
3. Number of subnets if subnet mask belongs to class B
4. Number of subnets if subnet mask belongs to class C
5. Number of subnets if total 10 bits are used for the global network ID

Consider the following subnet mask -
255.128.0.0

1. Find Number of hosts per subnet
2. Number of subnets if subnet mask belongs to class A
3. Number of subnets if subnet mask belongs to class B
4. Number of subnets if subnet mask belongs to class C
5. Number of subnets if total 10 bits are used for the global network ID

3. First two octets of the subnet mask are not completely filled with 1's.
So, given subnet mask can not belong to class B.

4. First three octets of the subnet mask are not completely filled with 1's.
So, given subnet mask can not belong to class C.

5. First 10 bits of the subnet mask are not completely filled with 1's.
So, given subnet mask can not use 10 bits for the Network ID.

128 Binary = 10000000

Given subnet mask is-
255.128.0.0
Number of Net ID bits + Number of subnet ID bits = 9
Number of Host ID bits = 23

1. Since number of host ID bits = 23

Number of hosts per subnet = $2^{23} - 2$

H.W

2. If given subnet mask belongs to class A, then-
Number of Net ID bits = 8
Substituting in above equation, we get-
Number of subnet ID bits = 9 – 8 = 1

Number of subnets = $2^1 = 2$

5 Questions (NL)

Consider default subnet mask for a network is 255.255.255.0. How many number of subnets and hosts per subnet are possible if ‘m’ bits are borrowed from HID.

1. 2^m , $2^{(HID-m)} - 2$
2. 2^m , $2^{(HID-m)}$
3. $2^m - 1$, $2^{(HID-m)} - 2$
4. 2^m , $(HID-m) - 2$

Consider default subnet mask for a network is 255.255.255.0. How many number of subnets and hosts per subnet are possible if 'm' bits are borrowed from HID.

1. 2^m , $2^{(HID-m)} - 2$
2. 2^m , $2^{(HID-m)}$
3. $2^m - 1$, $2^{(HID-m)} - 2$
4. 2^m , $(HID-m) - 2$

H.W

- Subnet mask = 255.255.255.0
- Number of bits borrowed from Host ID part = m
- So, number of subnets possible = 2^m
- Number of bits available for Hosts = HID – m
- So, number of hosts that can be configured = $2^{(HID - m)} - 2$

Thus, Option (A) is correct.

If default subnet mask for a network is 255.255.255.0 and if ‘m’ bits are borrowed from the NID, then what could be its supernet mask?

1. $255.255.(2^{8-m} - 1) \times 2^{m}.0$
2. $255.255.(2^{8-m}) \times 2^{m}.0$
3. $255.255.(2^{8-m-1}) \times 2^{m-1}.0$
4. $255.255.(2^{8-m}) \times 2^{m-1}.0$

If default subnet mask for a network is 255.255.255.0 and if 'm' bits are borrowed from the NID, then what could be its supernet mask?

1. $255.255.(2^{8-m} - 1) \times 2^m.0$
2. $255.255.(2^{8-m}) \times 2^m.0$
3. $255.255.(2^{8-m-1}) \times 2^{m-1}.0$
4. $255.255.(2^{8-m}) \times 2^{m-1}.0$

h.w

Given-

- Subnet mask = 255.255.255.0
- m bits are chosen from the NID part.

Clearly, given subnet mask belongs to class C.
If m = 4, then the subnet mask = 255.255.11110000.0
Now, let us check all the options one by one.

<u>Option-A:</u>

Given-

- Supernet mask = $255.255.(2^{8-m} - 1) \times 2^m.0$
- Third octet = $(2^{8-m} - 1) \times 2^m$

On substituting m = 4, we get-
Third octet
$= 15 \times 2^4$
$= (1111)_2 \times 2^4$
= 11110000 (Performing Left shift by 4 places)

Yes, this is what the third octet should be.
Thus, Option (A) is correct.

If default subnet mask for a network is 255.255.255.0 and if 'm' bits are borrowed from the NID, then what could be its supernet mask?

1.255.255.$(2^{8-m} - 1) \times 2^m$.0
2.255.255.$(2^{8-m}) \times 2^m$.0
3.255.255.$(2^{8-m-1}) \times 2^{m-1}$.0
4.255.255.$(2^{8-m}) \times 2^{m-1}$.0

<u>Option-B:</u>

Given-
Supernet mask = 255.255.$(2^{8-m}) \times 2^m$.0
Third octet = $(2^{8-m}) \times 2^m$

On substituting m = 4, we get-
Third octet
$= 16 \times 2^4$
$= (10000)_2 \times 2^4$
= 100000000 (Performing Left shift by 4 places)

This can not be true because these are 9 bits and octet can be only 8 bits.
Thus, Option (B) is incorrect.
Similarly, other options are also incorrect.

An organization requires a range of IP address to assign one to each of its 1500 computers. The organization has approached an Internet Service Provider (ISP) for this task. The ISP uses CIDR and serves the requests from the available IP address space 202.61.0.0/17. The ISP wants to assign an address space to the organization which will minimize the number of routing entries in the ISP's router using route aggregation. Which of the following address spaces are potential candidates from which the ISP can allot any one of the organization ?

GATE 2020

I. 202.61.84.0 / 21
II. 202.61.104.0 / 21
III. 202.61.64.0 / 21
IV. 202.61.144.0 / 21

(A) I and II only
(B) II and III only
(C) III and IV only
(D) I and IV only

h·w

Given IP address , 17 bits are in NID and rest HID

1500 hosts we need minimum 11 bits HID

SID bits available 4 bits

202.61.0.0/17

If we expand the given Network bits we can see:

202.61.84.0/21=202.61.01010100.0 Host Bits should be zero
202.61.104.0/21=202.61.01101000.0 Possible
202.61.64.0/21=202.61.01000000.0 Possible
202.61.144.0/21=202.61.10010000.0 16th bit cannot be 1

GATE CS 2006

Two computers C1 and C2 are configured as follows-

C1 has IP Address 203.197.2.53 and net mask 255.255.128.0

C2 has IP Address 203.197.75.201 and net mask 255.255.192.0

Which one of the following statements is true?

1. C1 and C2 both assume they are on the same network
2. C2 assumes C1 is on same network but C1 assumes C2 is on a different network
3. C1 assumes C2 is on same network but C2 assumes C1 is on a different network
4. C1 and C2 both assume they are on different networks

n.w

computer C1-

C1 computes its network address using its own IP Address and subnet mask as-
203.197.2.53 AND 255.255.128.0 = 203.197.0.0

C1 computes the network address of C2 using IP Address of C2 and its own subnet mask as-
203.197.75.201 AND 255.255.128.0 = 203.197.0.0

Since both the results are same, so C1 assumes that C2 is on the same network.

computer C2-

C2 computes its network address using its own IP Address and subnet mask as-
203.197.75.201 AND 255.255.192.0 = 203.197.64.0

C2 computes the network address of C1 using IP Address of C1 and its own subnet mask as-
203.197.2.53 AND 255.255.192.0 = 203.197.0.0

Since both the results are different, so C2 assumes that C1 is on a different network.
Thus, Option (C) is correct.

C1 has IP Address 203.197.2.53 and net mask 255.255.128.0
C2 has IP Address 203.197.75.201 and net mask 255.255.192.0

2 Binary = 00000010
128 Binary = 10000000
00000000

75 Binary = 01001011
128 Binary = 10000000
00000000

75 Binary = 01001011
192 Binary = 11000000
01000000

2 Binary = 00000010
192 Binary = 11000000
00000000

The subnet mask for a particular network is 255.255.31.0. Which of the following pairs of IP Addresses could belong to this network?

1. 172.57.88.62 and 172.56.87.233
2. 10.35.28.2 and 10.35.29.4
3. 191.203.31.87 and 191.234.31.88
4. 128.8.129.43 and 128.8.161.55

HOMEWORK

Consider a block of IP Addresses ranging from 100.1.2.32 to 100.1.2.47. CIDR representation ?

For any given block to be a CIDR block, 3 rules must be satisfied-

Rule-1:

According to Rule-1, all the IP Addresses must be contiguous.
Clearly, All the given IP Addresses are contiguous.
So, Rule-1 is satisfied.

Rule-2:

According to Rule-2, the size of the block must be presentable as 2^n.
Number of IP Addresses in given block = 47 – 32 + 1 = 16 which can be represented as 2^4.
So, Rule-2 is satisfied.

Rule-3:

According to Rule-3, first IP Address must be divisible by size of the block.
So, 100.1.2.32 must be divisible by 2^4.
100.1.2.32 = 100.1.2.00100000 is divisible by 2^4 since its 4 least significant bits are zero.
So, Rule-3 is satisfied.

Since all the rules are satisfied, therefore given block is a CIDR block.

CIDR Representation-

We have-
Size of the block = Total number of IP Addresses = 2^4
To have 2^4 total number of IP Addresses, total 4 bits are required in the Host ID part.
So, Number of bits present in the Network ID part = 32 – 4 = 28

CIDR Representation = 100.1.2.32 / 28

1 QUESTION

A router uses the following routing table-

Destination	Mask	Interface
144.16.0.0	255.255.0.0	eth0
144.16.64.0	255.255.224.0	eth1
144.16.68.0	255.255.255.0	eth2
144.16.68.64	255.255.255.224	eth3

A packet bearing a destination address 144.16.68.117 arrives at the router. On which interface will it be forwarded? (GATE-2006)

eth0

eth1

eth2

eth3

HOMEWORK

The main reason for transition from IPv4 to IPv6 is

a) Huge number of systems on the internet
b) Very low number of system on the internet
c) Providing standard address
d) None of the mentioned

What is not true about subnetting?

1. It is applied for a single network
2. It is used to improve security
3. Bits are borrowed from network portion
4. Bits are borrowed from Host portion

Host A having IP Address 11.1.2.3 sending data to all other hosts residing in the same network.

Here,

Source Address = IP Address of host A =

Destination Address =

The subnet mask 255.255.255.192

(A) extends the network portion to 16 bits
(B) extends the network portion to 26 bits
(C) extends the network portion to 36 bits
(D) has no effect on the network portion of an IP address

The main reason for transition from IPv4 to IPv6 is
a) Huge number of systems on the internet
b) Very low number of system on the internet
c) Providing standard address
d) None of the mentioned

What is not true about subnetting?

1. It is applied for a single network
2. It is used to improve security
3. Bits are borrowed from network portion
4. Bits are borrowed from Host portion

Host A having IP Address 11.1.2.3 sending data to all other hosts residing in the same network.
Here,
Source Address = IP Address of host A = 11.1.2.3
Destination Address = 255.255.255.255

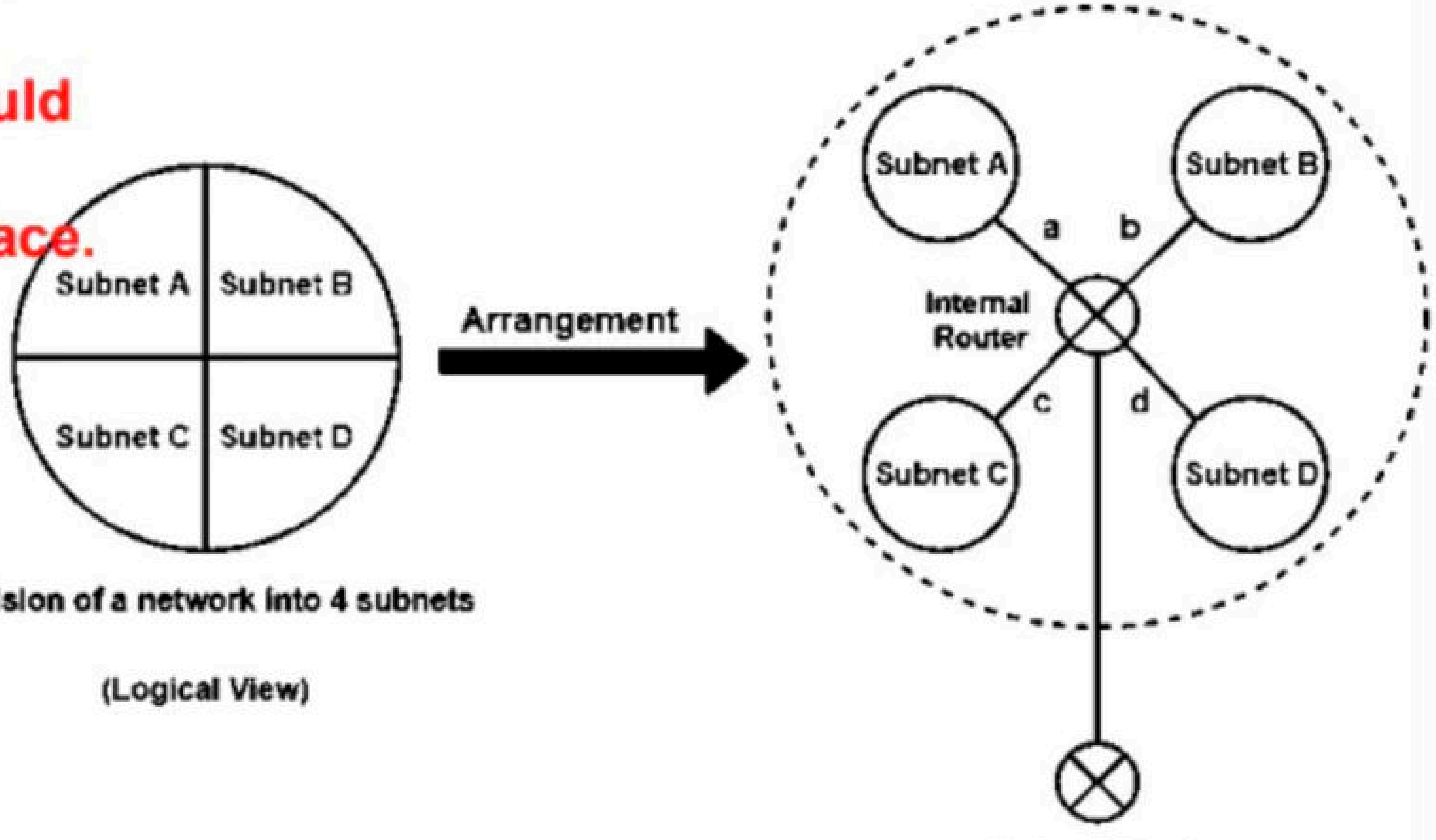
The subnet mask 255.255.255.192
(A) extends the network portion to 16 bits
(B) extends the network portion to 26 bits
(C) extends the network portion to 36 bits
(D) has no effect on the network portion of an IP address

Default sub-net mask for Class C is 255.255.255.192
$(192)_{10} = (11000000)_2$
Since, 192 is written as 11000000, it has 2 sub-nets and remaining all hosts.
So, for first three octets, 24 bits are fixed and for last octet 2 bits are fixed, i.e. 24 + 2 = 26 bits

Arrangement Of Subnets-

- All the subnets are connected to an internal router.
- Internal router is connected to an external router.
- The link connecting the internal router with a subnet is called as an interface.

- External router forwards the data packet to the internal router.
- Internal router identifies the interface on which it should forward the incoming data packet.
- Internal router forwards the data packet on that interface.



Division of a network into 4 subnets

(Logical View)

External Router

(Physical View)

Routing Table-

- A table is maintained by the internal router called as **Routing table**.
- It helps the internal router to decide on which interface the data packet should be forwarded.

Routing table consists of the following three fields-

1. IP Address of the destination subnet
2. Subnet mask of the subnet
3. Interface

Destination	Mask	Interface
144.16.0.0	255.255.0.0	eth0
144.16.64.0	255.255.224.0	eth1
144.16.68.0	255.255.255.0	eth2
144.16.68.64	255.255.255.224	eth3

GATE 2006

A router uses the following routing table-

A packet bearing a destination address 144.16.68.117 arrives at the router. On which interface will it be forwarded?

1. eth0
2. eth1
3. eth2
4. eth3

Router performs the bitwise ANDing of-
•Destination address mentioned on the data packet
•And each subnet mask one by one.

1st Row-

144.16.68.117 AND 255.255.0.0
= 144.16.0.0
Since result is same as the given destination address, so a match occurs.

2nd Row-

144.16.68.117 AND 255.255.224.0
= 144.16.64.0
Since result is same as the given destination address, so a match occurs.

Destination	Mask	Interface
144.16.0.0	255.255.0.0	eth0
144.16.64.0	255.255.224.0	eth1
144.16.68.0	255.255.255.0	eth2
144.16.68.64	255.255.255.224	eth3

C

3rd Row-

144.16.68.117 AND 255.255.255.0
= 144.16.68.0
Since result is same as the given destination address, so a match occurs.

4th Row-

144.16.68.117 AND 255.255.255.224
= 144.16.68.96
Since result is not same as the given destination address, so a match does not occur.

Now,
•Clearly, there occurs more than one match.
•So, router forwards the packet on the interface corresponding to the longest subnet mask.
•Out of all, 255.255.255.0 is the longest subnet mask since it has maximum number of 1s.

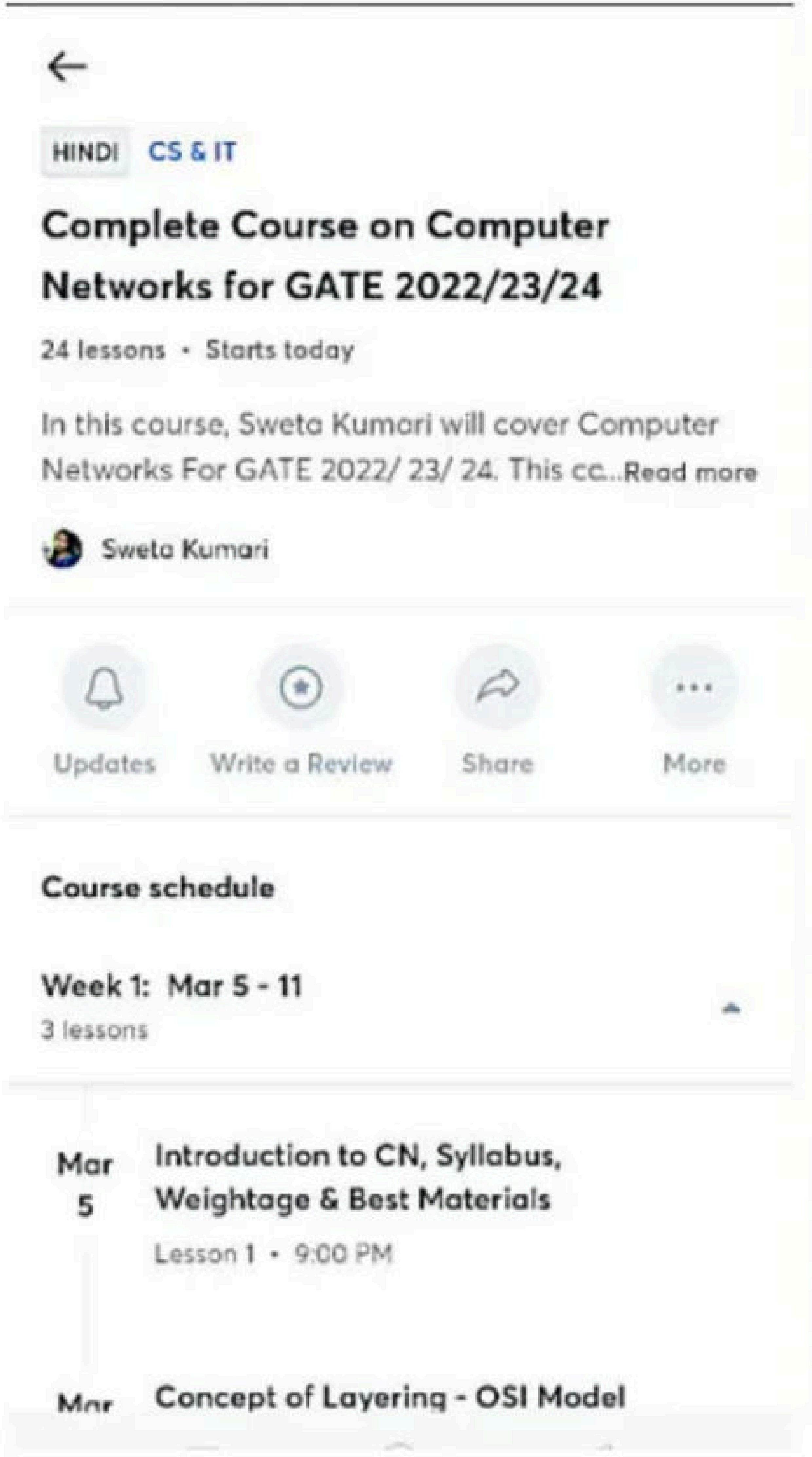
So,
•Router forwards the packet on the interface corresponding to the subnet mask 255.255.255.0.
•The corresponding interface is eth2.

A router uses the following routing table-

Destination	Mask	Interface
128.75.43.0	255.255.255.0	eth0
128.75.43.0	255.255.255.128	eth1
192.12.17.5	255.255.255.255	eth3
default		eth2

On which interfaces will the router forward packets addressed to destination 128.75.43.16 and 192.12.17.10 respectively? (GATE-2004)

1. eth1 and eth2
2. eth0 and eth2
3. eth0 and eth3
4. eth1 and eth3



PLEASE RATE AND REVIEW THE COURSE ☺

LIKE AND SHARE