Computer Network

Gate Notes

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Standard : Division : Roll :

Subject : Computer Network.

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WWW.Gatenotes.in

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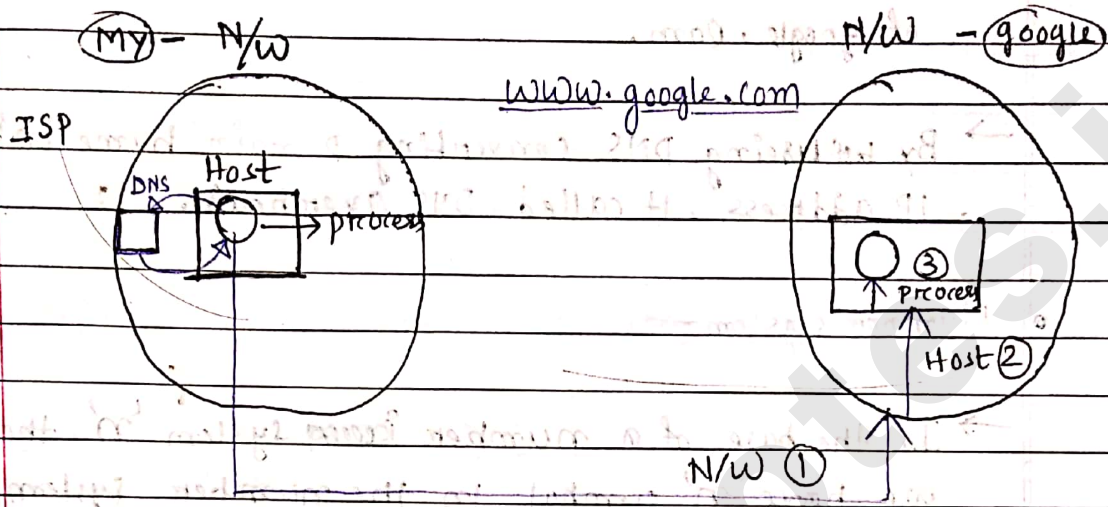
IP address Subnetting & Supernetting

INTRODUCTION TO COMPUTER NETWORK AND IP ADDRESS:



→ www.google.com (using this Domain name we can identify destination N/w, destination host and destination process)

→ www.google.com (this Domain name convert into some numbers, so that it can identify N/w, host, process)

www.google.com

⇓

IP address.

N/w ID	Host ID

(port num)

→ here, N/w ID to identify destination N/w. and Host ID to identify destination Host.

→ port number (80) used to reach in destination process. (most of the port number fixed)

→ ISP (Internet Service provider) provide DNS (Domine name server) Inside the ~~New~~ N/W it provide the IP address of google.com.

→ By ~~us~~ useing DNS converting Domain name into IP address, It called DNS overhead.

- Number system —

→ If the base of a number ~~system~~ system 'n', then we have 'n' symbol in the number system.
0, 1, 2, --- (n-1)

Unary — 0
*Binary — 0, 1
⋮
Octa — 0, 1, 2, 3, 4 .... 7.
⋮
Decimal — 0, 1, 2, 3, ... 9.
⋮
Hexadecimal — 0, 1, 2, ... 9, A, B, ... F
(A = 10, B = 11, F = 15)

2^{10}	K
2^{20}	M
2^{30}	G
2^{40}	T

(2^1) 1 bit:

0
1

(2^2) 2 bit:

0	0
0	1
1	0
1	1

(2^3) 3 bit:

0	0	0
0	0	1
0	1	0
0	1	1
1	0	0
1	0	1
1	1	0
1	1	1

1 — 2^1
2 — 2^2 — 4 part
3 — 2^3 — 8 part

n bit

K	n-K

2^n

\# of choose, $K \rightarrow 2^K$ (devide)

2^K parts $\longrightarrow 2^n$ numbers.

1 part $\rightarrow \frac{2^n}{2^K} = 2^{n-K}$.

→ In computer network IP address is 32 bits.

32 bits 2^{32}

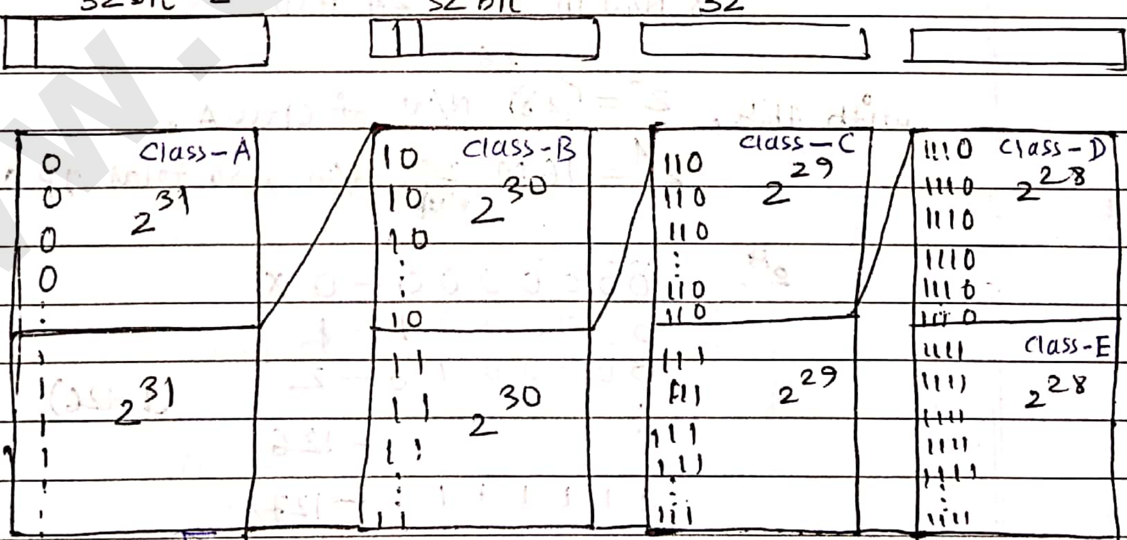
IP add →

8	24
N ID	H ID
$2^8 = 256$	$2^{24} = 16M$.

here N/w are very less than Host.

- Classfull IP address –

32 bit $= 2^{32}$ 32 bit 32



⇓

Total add space $= 2^{32}$

Choosce bit $= 1$

size of each part $= \frac{2^{32}}{2^1} = 2^{31}$

0
1 0
1 1 0
1 1 1 0
1 1 1 1

IP Address Representation–

→ IP add represent in three way's

(A) BINARY REPRESENTATION: 0's & 1's of 32 bits.

(B) Convert the entire 32 bit init decimal numbers.

* (C) Dotted Decimal Representation: 32 ~~bit~~ byte are divided into 4 Bytes and every byte is converted into Decimal number.

ex– | | | | |

10 . 20 . 30 . 40

Class – A:

→ # IP in class-A is 2^{31}.

8 bit | 24 bit

| 0 | ... | ... |

$\underbrace{\quad}_{8\ N/W\ ID}$ $\underbrace{\quad}_{24\ HID}$

with 7bits, $2^7 = 128$ (126) N/W of Class A.

$2^{24} = 16M$ IP/N/W, so total ip add present $= 2^{24} \times 2^7 = 2^{31}$.

0 0 0 0 0 0 0 0 – 0 X
0 0 0 0 0 0 0 1 – 1
0 0 0 0 0 0 1 0 – 2
⋮
– 126
1 1 1 1 1 1 1 – 127X

(1–126) $[2^8 - 2^7 = 128]$

range = B/W $\boxed{1-126}$ ⇒ class A.

Class - B:

Total IP address $= 2^{30}$.

10 N/W ID	Host ID
16 bits N/W ID	16 bits HID

\# N/W $2^{14} \cong 16K$

\# 2^{16} IP / N/W

So, Total IP address present in class-B $= 2^{14} \times 2^{16} = 2^{30}$

Rang of class-B B/W $\boxed{[128-191]}$

10 000000 - 128
000001 - 129
000010 - 130
⋮
111111 - 191

$\boxed{2^8 - 2^6 = 192}$

Class - C

Total IP address $= 2^{29}$

110	
24 bits NID	8 bit HID

\# N/W $2^{21} \cong 2M$.

2^8 IP / N/W

So, Total IP add present in class c $= 2^{21} \times 2^8 = 2^{29}$

Rang of class-C B/W $\boxed{192-223}$ $\boxed{2^8 - 2^5 = 224}$

110 - - - - -
00000 - 192
00001 - 193
00010
⋮
11111 - 223

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Class - D

total number of IP address present $= 2^{28}$.

and range $= \boxed{224 - 239}$

$(2^8 - 2^4)$

$\boxed{224 + 2^4 \Rightarrow 240}$

$$\begin{array}{r} 224 \\ 16 \\ \hline 240 \end{array}$$

1110 - - - -

0000 - 224

0001 - 225

0010 - 226

:

1111 - 239

Class - E

range $= \boxed{240 - 255}$

$\boxed{240 + 2^4 \Rightarrow 256}$

- Type of casting - (Unicast, Limited Broadcast, Directed Broadcast)

→ ~~to~~ Sending one packet to another, is called casting.

→ casting '2' types :-

(I) Unicast: means sending a packet from one host to only ~~a one~~ one particular host.

(II) Broadcast: means sending a packet from one host to many host.

range - CA - (1 - 126)

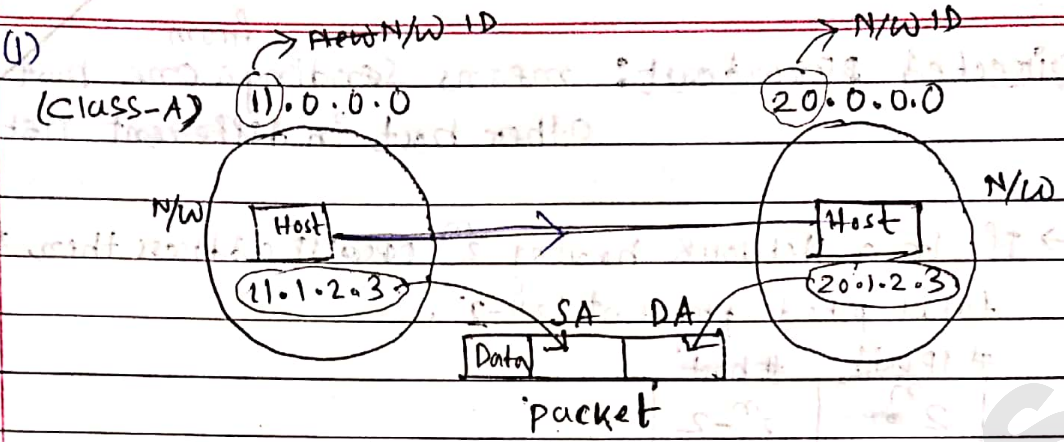
CB - (127 - 191)

CC - (192 - 223)

CD - (224 - 239)

~~CE - (240 - 255)~~

(I)

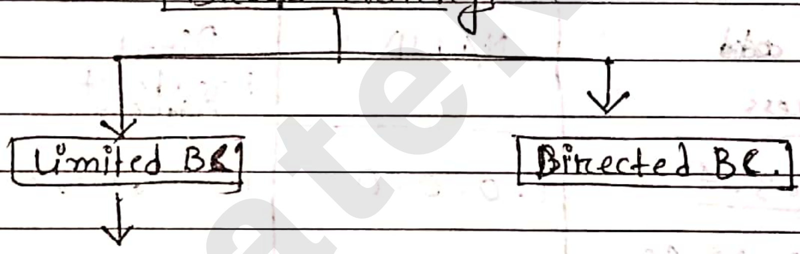


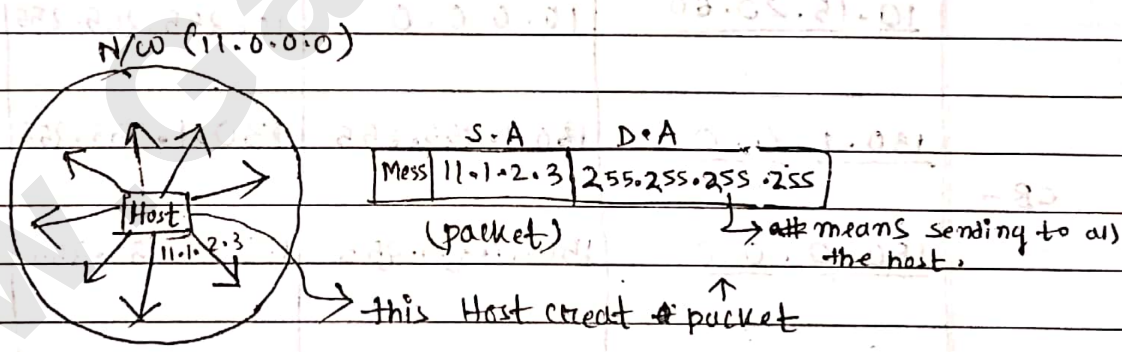
SA → Source address.

DA → Destination address.

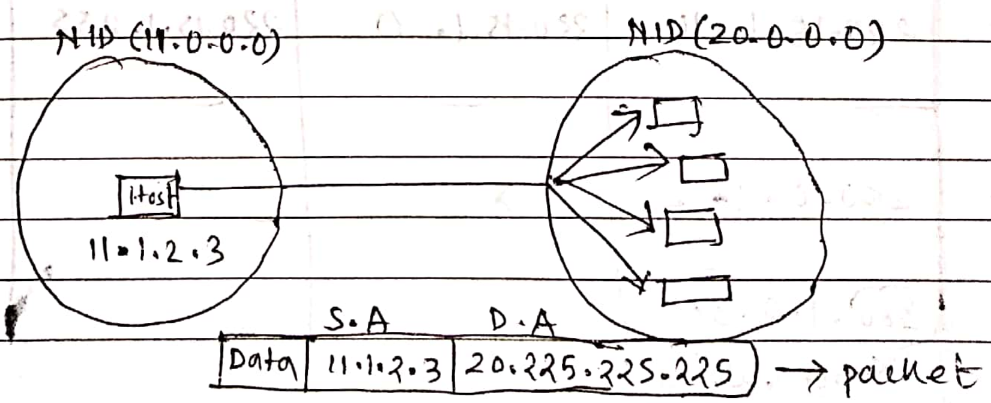
(1) Unicasting

(II) Broad casting





Limited BC : sending from one host to many host in same N/W is called limited Broad casting.



• **Directed Broadcast:** means sending from one host to many other host in other Network.

→ If in a Network having 2^n IP address then, total host present (2^n-2).

	#IP add	#host
	2^n	2^n-2
CA →	2^{24}	$2^{24}-2$
CB →	2^{16}	$2^{16}-2$
CC →	2^8	2^8-2

CA = (1-126), CB = (128-191), CC = (192-223)

	IP Address	N/W ID	Direct Broadcast Address	Limited Broadcast Address
CA –	1.2.3.4	1.0.0.0	1.255.255.255	255.255.255.255
	10.15.20.60	10.0.0.0	10.255.255.255	255.255.255.255
CB –	130.1.0.0	130.1.0.0	130.1.255.255	"
	150.0.0.0	150.0.0.0	150.1.255.255	"
CC –	200.1.10.100 (NID, HID)	200.1.10.0	200.1.10.255	"
	220.15.1.10	220.15.1.0	220.15.1.255	"
CE	250.0.1.2	X	X	X
	300.1.2.3 X not valied			

- **Subnets, Subnet Mask, Routing:**

- **Subnetting:**

→ Dividing a big network in to many small network is called subnetting.

adv:

(i) Maintenence of smallest network is easy compare to big network.

(ii) Security can be improved.

disadv:

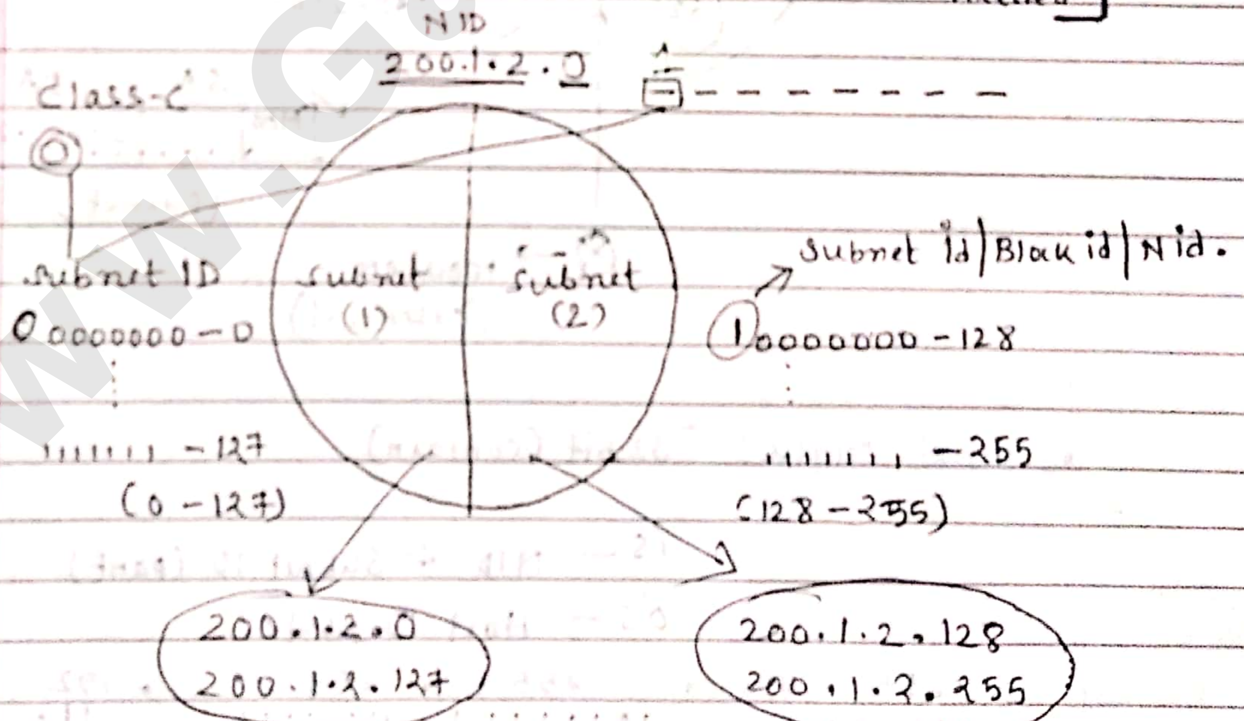
(i) Now 4 steps required to identification –

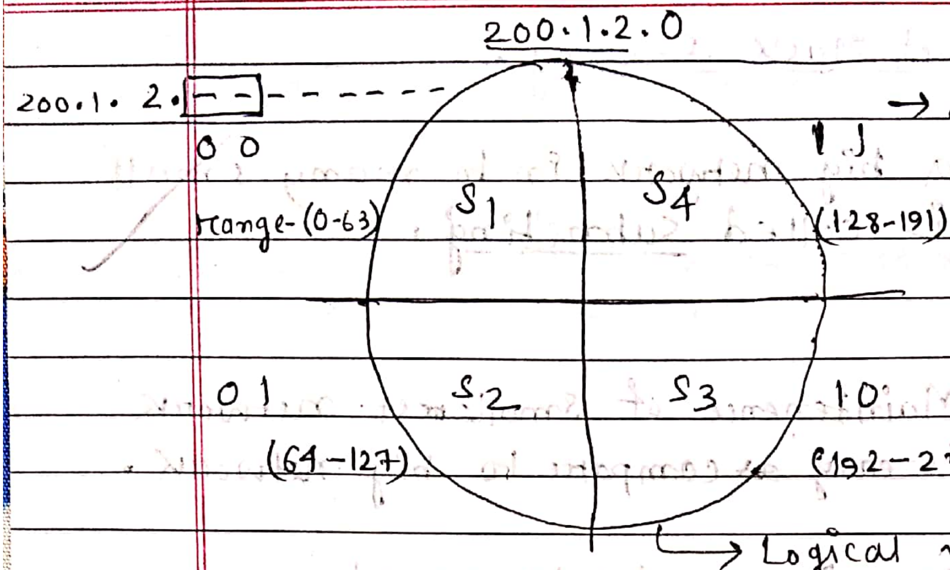
a. Identify network

b. " subnet.

c. " host.

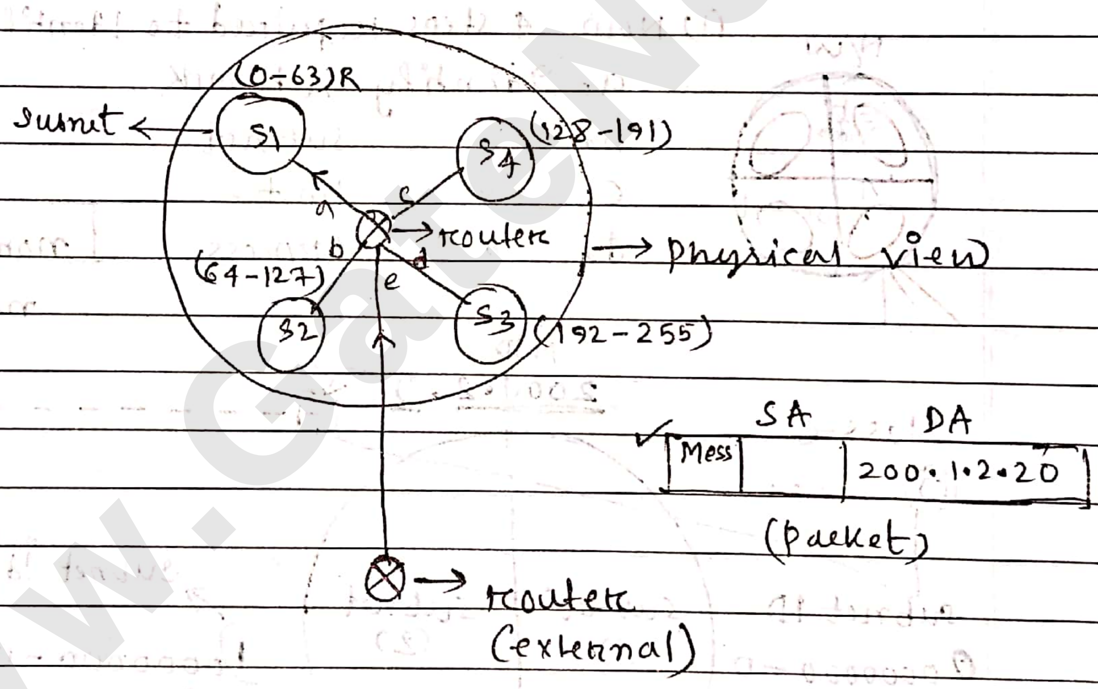
d. " process. [normaly 3 steps needed]





→ always in subnetting we are going to take bits from the host id part.

→ here wasted 2×4 = 8 IP addresses.(to 4 subnet)



• Subnet Mask : 32 bit (contain)

1's — NID & Subnet ID (part)

0's — Host ID (part)

255	255	255	192
11111111	11111111	11111111	11 000000

11111111 . 11111111 . 11111111 → Network ID

11 → SID ; 000000 → Host ID.

200.1.2.130

	255	255	255	192
Subnet Mask –	11111111	11111111	11111111	11000000
IP add –	11001000	00000001	00000010	10000010
	11001000	00000001	00000010	10000000
	200	1	2	128

$\boxed{200.1.2.128}$

→ given an IP add and subnet mask we can find out the network id of network to which the IP address belongs.

EX – Subnet mask : 255.255.255.192
IP add : 200.1.2.10
$\boxed{200.1.2.0}$
↳ It belongs to subnet (S_1)

→ router ~~we~~ will used the subnet mask in order to find out what is the Interface we should forward the packet to.

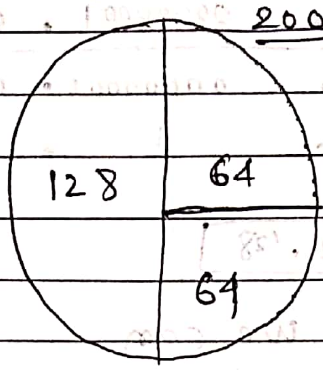
Routing table

N ID	Subnet M	Interface
200.1.2.0	255.255.255.192	a
200.1.2.64	,,	b
200.1.2.128	,,	c
200.1.2.192	,,	d
0.0.0.0	0.0.0.0	e

If coming packet (IP add + subnet Mask) is match with ~~the~~ N ID then the packet send over (a, b, c, d).
If doesn't match then ~~next~~ packet sent out (Default entry)

• Variable length Subnet masking –

CC – 200.1.2.0



→ subnet size is different it is called (VLSM) variable length subnet masking.

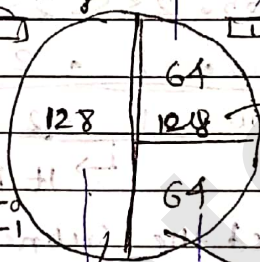
$\underbrace{200.1.2}_{NID}.\underbrace{0}_{HID}$

200.1.2.[ ]– – – – – – – → choose '1' bit

7 bit remaining

.0 SN ID

$(2^7 = 128)$



SM [255.255.255.192]

10 — 6 bit remaining $(2^6 = 64)$

200.1.2.10 – – – 0 – – –
0 0 0 0 0 0 – 0 (200.1.2.128)
1 1 1 1 1 1 – 191 (200.1.2.191)

11 — 6 $(2^6 = 64)$

200.1.2.0 – – – – – – –
0 0 0 0 0 0 0 – 0
0 0 0 0 0 0 1 – 1
⋮
1 1 1 1 1 1 1 – 127

SID ← 200.1.2.0
200.1.2.127 } 128 IP add

200.1.2.11 – – – – – – SID
0 0 0 0 0 0 – (200.1.2.192)
⋮
1 1 1 1 1 1 – (200.1.2.255) DBA

Subnet mask [255.255.255.128]   SM [255.255.255.192]

~~→ Subnet having same size ...~~

→ if subnet's have same size, then they have same subnet mask.

Routing table –

NID	SM	Interface
200.1.2.0	255.255.255.128	a
200.1.2.128	255.255.255.192	b
200.1.2.192	255.255.255.192	c
0.0.0.0	0.0.0.0	d

Subnet mask

$\boxed{255.255.255.\cancel{255}\ 192}$

~~FFO~~ 11111111.11111111.11111111.11000000

here, 26 1's (NID+SID)	6 0's (HID)
Class-A, 8 + SID = 26	↓
SID = 18	$2^6 = 64$ IP/SN

#Subnets = 2^{18}

C-B, 16+SID = 26

SID = 10

#Subnets = 2^{10}

C-C, 24 + $\cancel{8}$ (SID) = 26

SID = 2

SN = $2^2 = 4$

(Question) — given $\boxed{225.255.255.15}$ (SM) how many subnet possible. If it is class-C.

→ 225.225.255.15

11111111.11111111.11111111.1111

$$\begin{array}{r|l} 2 & 15 \\ 2 & 7-1 \\ 2 & 3-1 \\ 2 & 1-1 \\ & 0-1 \end{array}$$

~~here~~ Network ID + subnet = 28

⇒ 24 + SID = 28

SID = 4

= 2^4 (subnets)

• Questions on Subnet masking :

00000000 – 0
10000000 – 128
11000000 – 192
11100000 – 224
11110000 – 240
11111000 – 248
11111100 – 252
11111110 – 254
11111111 – 255

for the given subnet mask how many subnet possible.

Subnet mask	No of Hosts	Subnet in class A	Subnet in class B	Subnet in class C	NID is 10 bit
255.0.0.0	$2^{24}-2$	2^0	—	—	✗
255.128.0.0	$2^{17}-2$	2^1	—	—	✗
255.192.0.0	$2^{22}-2$	2^2	—	—	2^0
255.240.0.0	$2^{20}-2$	2^4	—	—	2^2
255.255.0.0	$2^{16}-2$	2^8	2^0	—	2^6
255.255.254.0	2^9-2	2^{15}	2^7	—	2^{13}
255.255.255.0	2^8-2	2^{16}	2^8	2^0	2^{14}
255.255.255.224	2^5-2	2^{19}	2^{11}	2^3	2^{17}
255.255.255.240	2^4-2	2^{20}	2^{12}	2^4	2^{18}

(a) 1's + 0's
8 24

NID + SID = 8
8

SID = 0

Q. given subnet mask as 255.255.255.192 and IP address is 200.1.2.3 : find the Subnet ID and how many subnet there :

→

SM – 255.255.255.192
IP – 200.1.2.3
↳ (class-c network)
SID = 200.1.2.0

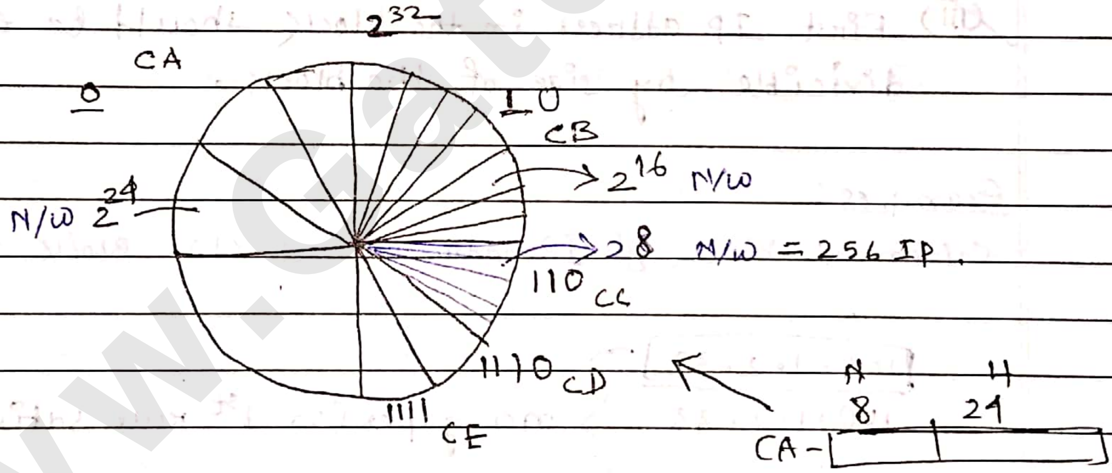
subnet mask → $\underbrace{11111111.11111111.11111111}_{NID}.\underbrace{11}_{SID}\underbrace{000000}_{HID}$

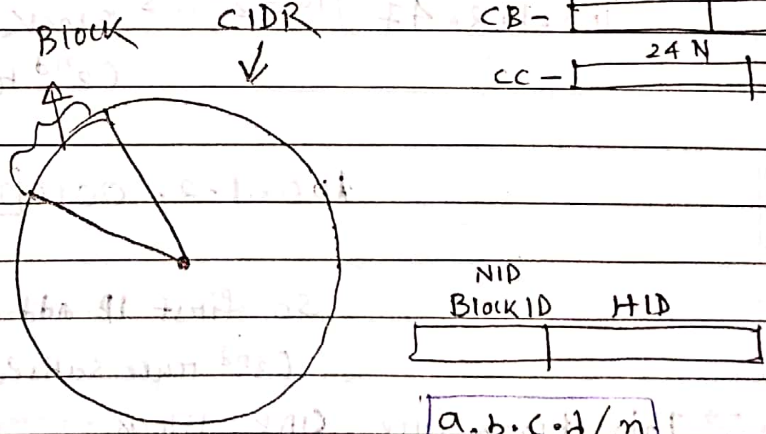
$\overset{24}{NID} + SID = 26$

SID = 26 - 24 => 2 bit

so, no of subnet = 2^2 => 4.

- CLASSES INTER DOMAIN ROUTING (CIDR) :





a.b.c.d/n

→ here n represent what are the bits in Block ID (NID).

CIDR representation

Ex- $\boxed{20.10.50.100/20}$ (n=20 bit in Network ID part)

total bit = 32

NID = 20

HID = 32-20

= 12

Contain = 2^{12} IP addresses

= $2^{12}-2$ host

. Rules for forming CIDR blocks —

(i) All IP Addresses should ~~combine~~ be contiguous.

(ii) The Block size should always be power of '2'. (2^n)
(easy to divide IP add into BID and HID)

(iii) First IP address in the block should be evenly divisible by size of the block.

Examples:

Given a block of IP addresses are CIDR Block or not?

$\boxed{100.1.2.32}$

100.1.2.33 } no gaps (so 1st rule satisfyed)

100.1.2.47 } 16 = 2^4 → Block size is power of '2' (2nd rule satisfyed).

100.1.2. 0010$\boxed{0000}$ 2^4

remainder

So first IP add divisible by 2^4.
(3rd rule satisfyed)

→ This block are CIDR Block.

Example -

Whether this IP address form the CIDR Block or not.

20.10.30.32
20.10.30.33
20.10.30.34
⋮
20.10.30.63

$32 = 2^5$ size of the block power of '2'.

20.10.30.001|00000|

→ this block are quality to for CIDR block.
→ No of IP add 2^5, HID = 5 ; BID = 32 − 5 = 27 $\boxed{20.10.30.32/27}$

Example -

findout whether ~~this~~ this block are CIDR or not.

150.10.20.64
150.10.20.65
150.10.20.66
⋮
150.10.20.127

$64 = 2^6$ (2^{nd} rule followed)

150.10.20.01|000000|

→ ~~is~~ this block are also CIDR block.
→ in this block, 2^6 IP addresses and 6 host ID.

HID = 6
HID + BID = 32
BID = 28

CIDR representation, $\boxed{150.10.20.64/28}$

$\underbrace{150.10.20.0100}_{BID}|\underbrace{0000}_{HID}$

Example -

CIDR Block given find the range.

$\boxed{100.1.2.35/20}$ → $\underbrace{100.1.0000}_{BID}0010.00100011$
BID size = 20 bits

2 bit   35 bit

0000000000000 — 0
⋮
1111111111111

range - 100.1.0.0
⋮
100.1.15.255

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Subnetting in CIDR –

example –

20.30.40.10/25 → here NID = 25 and HID = 7 bit.

20.30.40.0|0001010

↳ NID ↳ 7 bit HID.

We will choose bits from HID part for subnetting.

If we choose 1 bits from Host ID then ~~we are going~~ ~~divide the~~ we will got 2 subnets.

20.30.40.0 0001010 (NID | HID)

$\boxed{0}$000000

↓

20.30.40.0 0001010

$\boxed{0}$000000 – 0

000001 – 1

000010 – 2

$\boxed{0}$111111 – 63

range,

Block ID 20.30.40.0/26 to 20.30.40.63

↳ for one subnet.

20.30.40.0 0001010 (NID | HID)

$\boxed{1}$000000

↓

20.30.40.0 0001010

$\boxed{1}$000000 – 64

000001 – 65

000010 – 66

$\boxed{1}$111111 – 127

range.

20.30.40.64/26 to 20.30.40.127

↳ for ~~an~~ second subnet.

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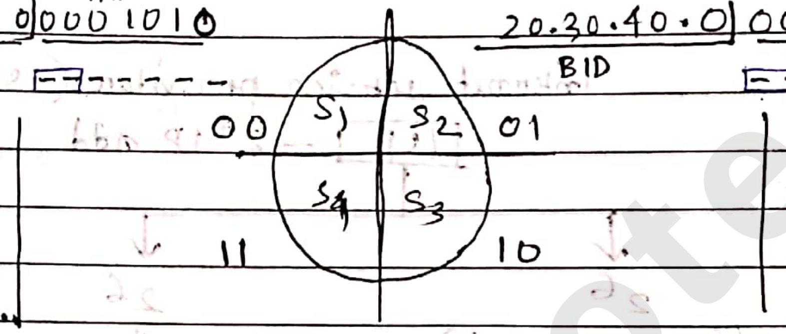
Example -

$\boxed{20 \cdot 30 \cdot 40 \cdot 10/25}$

dividing the entiere network into 4 subnets:-

20.30.40.0 | 0001010 (BID | HID)

20.30.40.0 | 0001010 (BID | HID)



If you choose '2' bits from HID part, then ~~you get 4 sub~~ the entire network will be divide into '4' parts.

	First IP add	Last IP add
Subnet (S1) ID →	20.30.40.0/27	20.30.40.31/27
Subnet (S2) ID →	20.30.40.32/27	20.30.40.63/27
Subnet (S3) ID →	20.30.40.64/27	20.30.40.95/27
Subnet (S4) ID →	20.30.40.96/27	20.30.40.127/27
	NID	Directed Broadcast add

/25 – NID (HID = 7) (2^7 IP address)

/26 /26

$\underbrace{2^6 + 2^6}_{2^7}$

/25 (2^7)

/27 /27 /27 /27

$\underbrace{2^5 + 2^5 + 2^5 + 2^5}_{2^7}$.

→ veriable length subnet masking.

• VLSM in CIDR blocks:

~~example~~

$|20.30.40.10/25|$

here ~~form~~ this block ~~■~~ 25 bit Network ID and $(32-25)$ $= 7$ bits HID, means 2^7 IP addresses.

Internet service provider (ISP)

ISP — 2^7 IP add

2^6 (for company A)

2^6

2^5 (for company B)

2^5 (to Individual customeres)

25 bits NID | HID

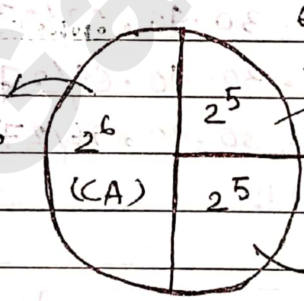
$20.30.40.0|0\ 0\ 0\ 0\ 1\ 0\ 1\ 0$

$\underline{0}\ 0\ 0\ 0\ 0\ 0\ 0$

64

$\underline{0}\ \underline{0}\ \underline{0}\ \underline{0}\ \underline{0}\ \underline{0}\ \underline{0}$

$20.30.40.0/26$



64 32

1 0 → $20.30.40.64/27$

64 32

1 1 → $20.30.40.96/27$

Example —

$\boxed{40.30.10.10/20}$

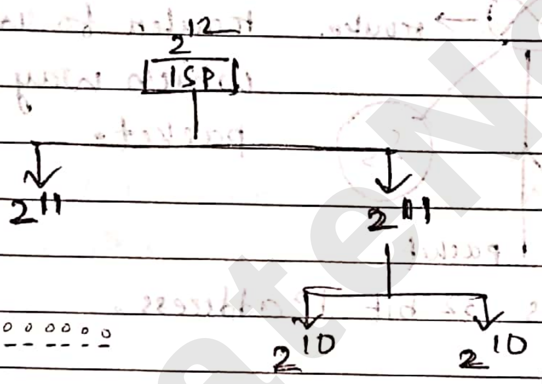
here ~~[illegible]~~ 20 bits BID(NID) and (32−20) bits = 12 bits Host ID (HID) so, total number of IP address possible 2^{12}.

40.30.0000|1010 . 00001010

$\underbrace{40.30.0000}_{\text{20 bit Block ID}}\;\underbrace{1010.00001010}_{\text{Host ID}}$

0000 . 00000000 — 1^{st} IP add (40.30.0.0)

1111 . 11111111 — Last IP add (40.30.15.255)

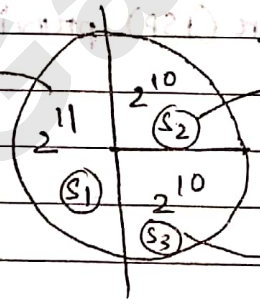


0 0 0 0 . 0 0 0 0 0 0 0 0

0 | 1 0 | 1 1

first IP − (40.30.0.0/21)

Last IP − (40.30.15.255/21)



1 0 . . . .

(40.30.8.0/22) — 1^{st}
(40.30.11.255/22) — Last

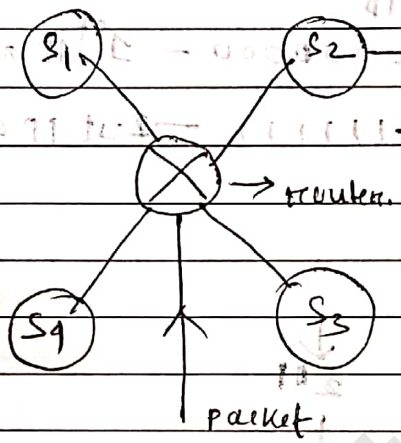
(40.30.12.0/22) — 1^{st}
(40.30.15.255/22)

• Some problems on Subnet masking —

→ subnet mask (SM) also called network mask (NM).

$$\frac{\begin{array}{c} S.M \\ IP \end{array}}{SID}$$

SID → subnet ID of subnet ~~where~~ to which IP belongs to.

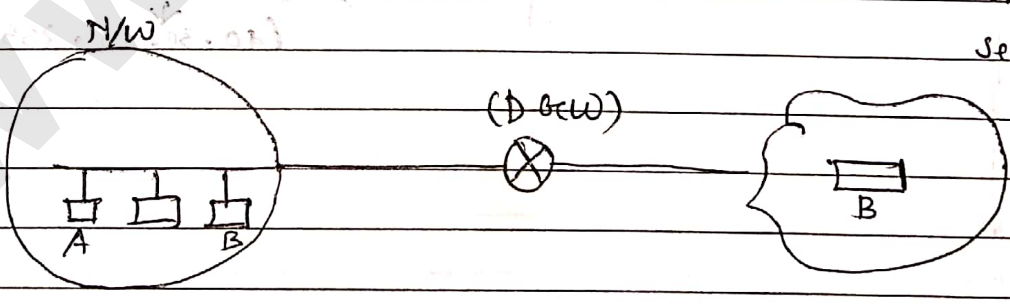


→ Subnets.

→ subnet masking used by the router to ~~which~~ find out which way direct to the packet.

→ IPv4 means 32 bit IP address.

Internet service provider (ISP) provides — (I) IPV4
(II) DGW (Default gateway IP add)
(III) SM (subnet mask)
(IV) DNS (Domine name server).



→ To send a packet, first you should know that IP add Destination and also ~~IP~~ DA are inside or outside.

Example -

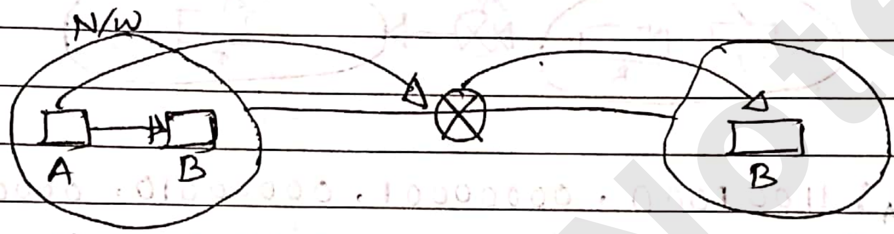
200.1.2.0

a host A : IP_A : 200.1.2.10

SM_A : 255.255.255.128

200.1.2.128

B : IP_B : 200.1.2.130



- To send packet from host A, A first take its own IP add and SM.

IP_A : 11001000 . 00000001 . 00000010 . 00001010

SM_A : 11111111 . 11111111 . 11111111 . 10000000

11001000 . 00000001 . 00000010 . 00000000

(Network ID of A according to A) NID_{AA} : 200 . 1 . 2 . 0

IP_B : 11001000 . 00000001 . 00000010 . 10000010

SM_A : 11111111 . 11111111 . 11111111 . 10000000

11001000 . 00000001 . 00000010 . 10000000

(Network ID of B according to A) NID_{BA} : 200 . 1 . 2 . 128

In this case

Here, Network ID of A and B are different so, ~~A sed send it~~ A first send the packet to router ~~and~~ (router know that where its Destination) and router send the packet to Destination address. (B)

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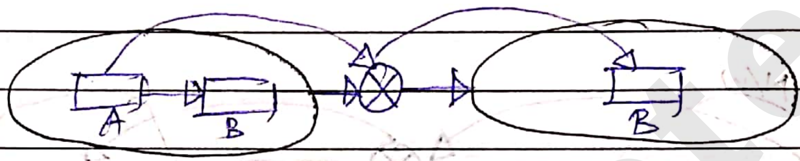
Example–

Ex: a host A : IP_A : 200.1.2.10 → belongs to (200.1.2.0)

SM_A : 255.255.255.128

another host B : IP_B : 200.1.2.126 → this IP belongs to (200.1.2.0)



IP_A : 11001000 . 00000001 . 00000010 . 00001010
SM_A : 11111111 . 11111111 . 11111111 . 10000000

NID_{AA} : 11001000 . 00000001 . 00000010 . 00000000
200 . 1 . 2 . 0

IP_A : 11001000 . 00000001 . 00000010 . ~~00001~~ 01111110
SM_A : 11111111 . 11111111 . 11111111 . 10000000
11001000 . 00000001 . 00000010 . 00000000
200 . 1 . 2 . 0

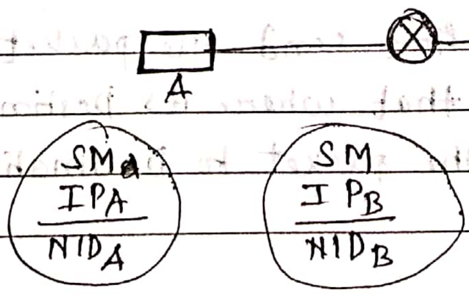
So, A and B both are in same network. So, A send the packet Directly to B.

Ex–

SM (Subnet mask) : 255.255.255.255

here, no of 1's (32), means $(NID+SID)=32$.

no of 0's (0), means $HID=0$.



Ex:-
given a Directed Broadcast Address (DBA) can you find out network ID and subnet mask.

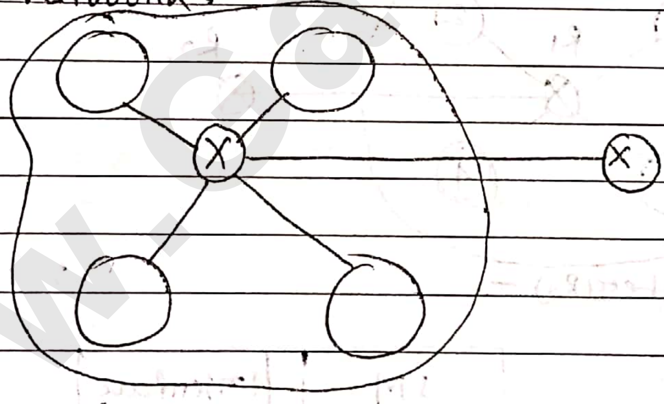
→ DBA: 200.1.15.255 (If in host ID part put all 1's then it is DBA)

$\underbrace{11001000}_{8\ bit}.\underbrace{00000001}_{8\ bit}.0000|1|1|1|1.11111111$
host ID

• many NID = /20 (because all 1's are in this part)
= /21
= /22
= /1

• Supernetting or aggregation:

→ Combining many small networks into one big network.



rules: (to aggregation)
1) all the network should be contiguous. (means NID)
2) size of all Network same (2^n).
3) First network ID should divisible by (2^n).

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Example - How aggregate all this 4 network.

① 200.1.0.0/24
② 200.1.1.0/24
③ 200.1.2.0/24
④ 200.1.3.0/24

→ (possible)

→ (I) all the address are contiguous form.

(II) here, size of all network is same. (2^8, 2^8, 2^8, 2^8).

(III) first IP address should be divisible by size of the total supernet.

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

200.1.0.0

200.1.000000|00.00000000

so, when you divisible the 1st network then reminder will be '0'.

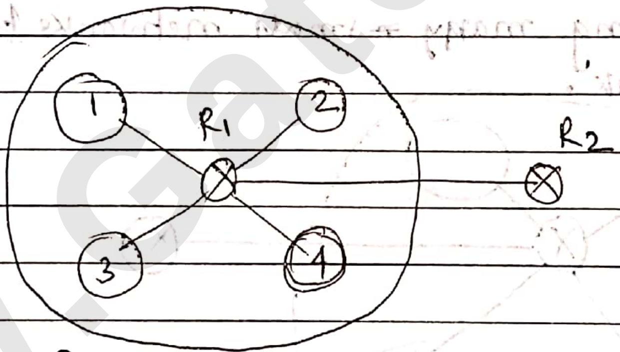

Table for Router (R2) -

N ID	SM	Interface
200.1.0.0	255.255.255.0	a
200.1.1.0	255.255.255.0	a
200.1.2.0	255.255.255.0	a
200.1.3.0	255.255.255.0	a

~~Subnet mask~~:

~~Subnet~~

Supernet mask: 32 bit number.

→ In supernet mask 1's represent fixed part and no. of 0's represent variable part.

fixed	fixed	fixed		variable
200 .	1 .	000000	00 .	00000000
200 .	1 .	000000	01 .	00000000
200 .	1 .	000000	10 .	00000000
200 .	1 .	000000	11 .	00000000

255 . 255 . ~~0000~~ 111111 | 00 . 00000000

$\boxed{255 . 255 . 252 . 0}$ → supernet mask for this enter supernet.

Supernet ID : $\frac{\frac{IP}{SM}}{NID}$

200 . 1 . 0 . 0
255 . 255 . 252 . 0

$\boxed{200 . 1 . 0 . 0}$ — supernet ID.

routing table –

NID	SM	Interface
200.1.0.0	255.255.252.0	a

→ by the one entry, it represent all '4' Networks.

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Example – How aggregate all this network. It possible or not to given block.

200.1.32.0/24
200.1.33.0/24
:
200.1.47.0/24
→ valid networks for super-neting.

(I) contiguous.
(II) size of ~~N~~ all network (2^8) same. ~~2^8~~
(III) 200.1.32.0 should divisible by ($2^8 \cdot 2^4 = 2^{12}$)

200.1.0010 0000.00000000

~~200.1.32.00000000~~

Yes, It possible to ~~make~~ convert into supernet.

Total ~~as~~ Network = 16 HID = 2^8

So, ~~e~~ ~~combine~~ size of the entire Network $= 2^4 \times 2^8$
$= 2^{12}$

→ If ~~s~~ all '3' networks are satisfyed then, 1'st NID will be supernet ID = 200.1.32.0/20

20 bit	12 bit
NID	HID

supernet mask: $\boxed{255.255.240.0}$

Example – * (many possible $\underbrace{2, 4, 8, 16, 32 \cdots}_{}$) b/w

① 100.1.2.0/25
② 100.1.2.128/26
③ 100.1.2.192/26

→ In this case first marge ② and ③ then marge ① with new supernet.

FLOW CONTROL METHOD

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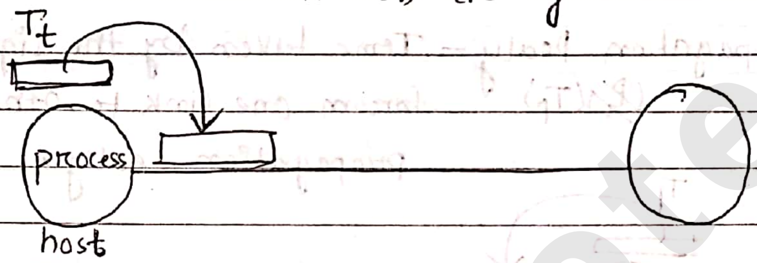
WWW.GateNotes.in

- **DELAYS in Computer networks:**

Transmission delay (T_t): The time taken to ~~transimesion~~ transmit the data packet from a host on to a outgoing link is called transmission delay.



Ex- BW = 1bps.
Data size = 1bit
So, what is the transmission delay of the data.

→ 1 sec — 1bit
10 bit — 10sec

If the size of Data packet = L bits and BW is 'B' bps. then time taken to transmit this data L is,

$T_t = (L/B)$ sec.

Ex- L (length of the Data) is 1000 bits
BW = 1Kbps
What is the transmission delay of the data.

→ $T_t = L/B \Rightarrow \frac{1000 \text{ bits}}{1000} = 1$ sec.

Ex- L = 1Kb , BW = 1Kbps ~~Dat~~

$T_t = ?$

→ $T_t = \frac{1024}{1000} = 1.024$ sec.

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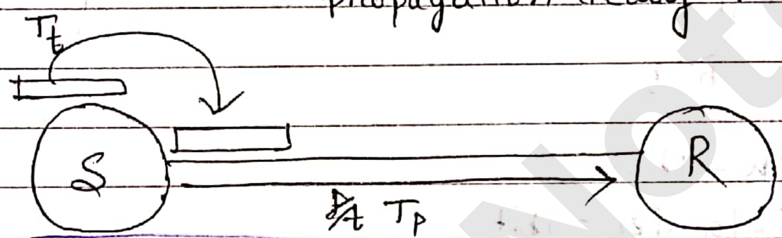
Data → powers of 2	BW → powers of 10.
$K = 1024$	$K = 1000$
$M = 1024 \times 1024$	$M = 10^6$
$G = 1024 \times 1024 \times 1024$	$G = 10^9$

Propagation Dealy (P_t)(T_p) – Time taken by the signal to reach from one link to other link is called propagation dealy.



$$\boxed{T_p = \frac{d}{v} = \frac{\text{distance}}{\text{velocity}}}$$

$v = 3 \times 10^8 \times 0.7$
$= 2.1 \times 10^8$ m/s

Ex–

$d = 2.1$ km

$v = 2.1 \times 10^8$ m/s

What is T_p = ?

→ $T_p = \frac{d}{v} \Rightarrow \frac{2.1 \text{ km}}{2.1 \times 10^8 \text{ m/s}}$

$\Rightarrow \frac{2.1 \times 10^3 \text{ m/s}}{2.1 \times 10^8 \text{ m/s}}$

[Micro sec $= 10^{-6}$

$\boxed{T_p \Rightarrow 10^{-5}}$ second.

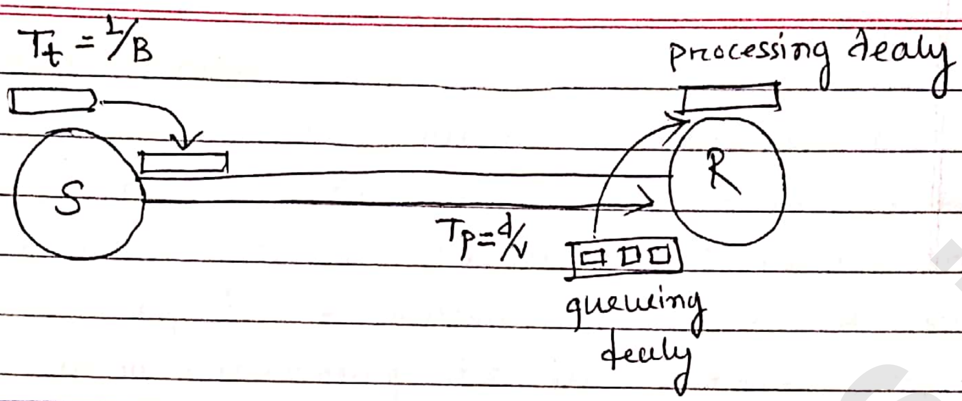
[m sec $= 10^{-3}$ (mili sec)

✓ Convert into msce $= 10^{-5} \times \frac{10^3}{10^3}$

$= 10^{-2}$ milisecond

✓ Convert microsecond $= 10^{-5} \times \frac{10^6}{10^6}$

$= 10$ μsec.



queuing dealy – The amount of time any packet ~~set~~ sit in the buffer and wait before being process is called queueing dealy.

processing dealy – The packet will be taken by the rechiver and then it will be processed that is called processing dealy.