Physical Address :-

physical Address
or
NIC Address
or
LAN Address
or
Ethernet Address
or
MAC address
(48 bit address)

} same

(By default or implicit address)

(Medium access control)

Note :-

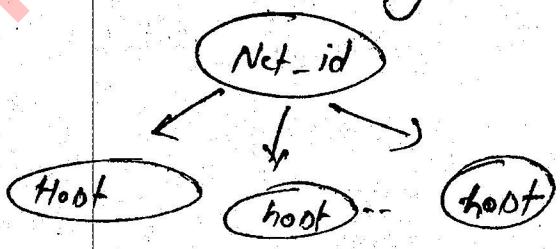
"MAC Address alone can not be used as an identification unit in transmitting the data because every company has their own representation."

IANA :- Internet Assigned Number authority.

:- proposed classful address (logical address).

IPv4 addresses (32 bit). {Explicit addresses}.

:- It has two-level heirarchy :-



Host :- Whenever an IP address is given to a computer it is treated as host.

Net_id :- Entire Network will be represent by a number known as Net_id.

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2) Representation of Numbers :-

1) Binary Notation :-

01010101.10101010.10111111.10110111

2) Dotted Decimal :-

74.89.67.126.

1) 112

2

01110000

2) 143

10001111

3) 187

10111011

Classful addresses :-

A, B, C } unicasting

D → multicasting

E → Research.

Note :- In Binary Notation 'first few bits' will decide the type of class.

* In Dotted decimal notation 'first octat' will decide the type of class.

"Class A" :-

0 (2^7-2) | $2^{24}-2$

8 bits (Net_id) | 24 bits (Hosts)

(0 – 127) | 0 0000000 (0)

↓ | 0 1111111 (127)

(1-126)

-2 { 0.0.0.0 → DHCP client or Default address

127.x.y.z → loop back address.

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* In class A there are 2^7-2 No of Networks can be formed.

* -2 is for DHCP client and loop back address.

* Hence Range of class A (1-126)

:- In class 'A' 2^7-2 Networks in which each Network will have $2^{24}-2$ hosts.

"Class B" :-

10 000000 = 128

10 111111 = 191

(128 - 191)

143.89.61.126

↳ class B.

* Class B doesn't have any special addresses so it doesn't have '-2'.

Note:- In Class B these are 2^{14} Networks in which Each Network will have $2^{16}-2$ hosts.

"Class C" :-

110 00000 = 192

110 11111 = 223

(192 - 223) → class C

194.89.73.1 ↳ class C.

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Class D :- 1110 (32 bits)

1110 0000 = 224

1110 1111 = 239

(224 - 239) → Class D

"Class E" :- 1111 (32 bits)

1111 0000 = 240

1111 1111 = 255

(240 - 255) → Class E.

Question:- $IP_1 = 201.55.66.89$

Net_Id =

Direct broadcast address of Network =

(Network mask)

default mask :- Class A 11111111.00000000.00000000.00000000

255.0.0.0

Class B 255.255.0.0.

Network mask:- Network mask is a mathematical tool which is used for solving some of the networking problems.

$IP_1 = 201.55.66.89$

↳ Class C

mask = 255.255.255.0

AND

Net_Id = IP_1 'AND' mask

= 201.55.66.0

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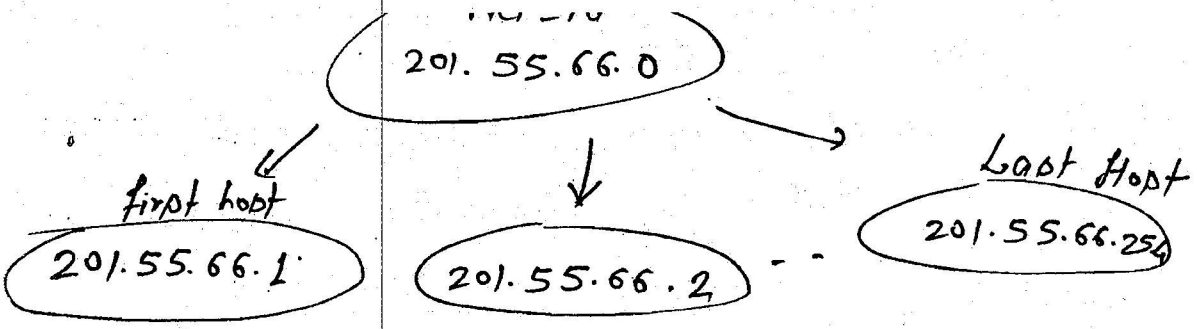
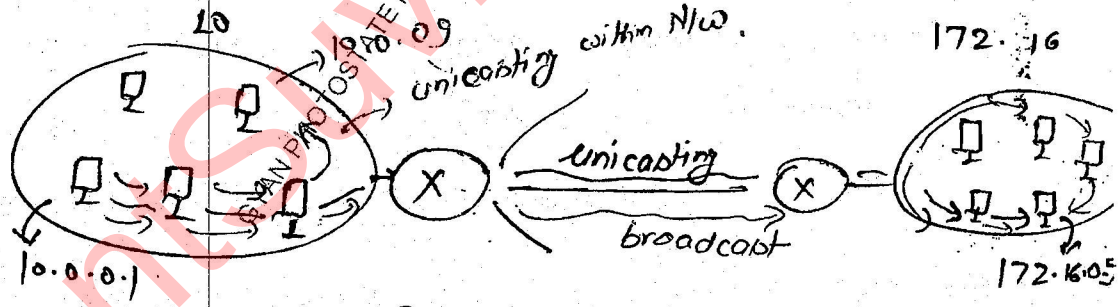


201.55.66.255 → Direct broadcast Address of Network (DBA)

Note:- we are subtracting two (-2) from the Number of host because one is used for Net_id and other one is used for direct broadcast address of Network (DBA).

Example:-



1.)

D	S.IP	D.IP
	10.0.0.1	172.16.0.5

(unicasting packet) b/w different N/w.

2.)

D	S.IP	D.IP
	10.0.0.1	172.16.255.255

→ (Direct broadcasting Packet) on other N/w.

Direct broadcast address.

Note:-

* In Net_ID the host bits are all zeros.
* In DBA the host bits are all ones.

IP = 144.55.66.55 → Class B.

Net_Id = 144.55.0.0

DBA = 144.55.255.255.

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3) | D | 172.16.255.255 | 10.0.0.1 | X (Packet)

DBA X

Note:- Direct broadcast Address will always be used as Destination Address.

4)

	SIP	DIP
D	10.0.0.1	10.0.0.9

(unicasting Packet within the Network).

★ Special Case :-

(Scope ip local).

	S.IP	DIP	Research class 'E'
D	10.0.0.1	255.255.255.255	

↳ Limited broadcast Address

★ If we want to broadcast the packet within the Network then we need LBA (limited broadcast address) 255.255.255.255 because the 10.255.255.255 is reserved as DBA.

Note:- Limited broadcast Address will always be used as destination address.

	SIP	DIP
D	255.255.255.255	10.0.0.1

X Wrong Packet

Ques IP1 = 199.181.19.15

Net_Id = ~~255.255~~ 199.181.19.0

DBA = 191.181.19.255

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Private IP Address

Public IP Address.

1.) Scope is local
2.) IP's will work only in LAN.
3.) free of cost...
4.) Communicating only in LAN.
5.) Ranges:-

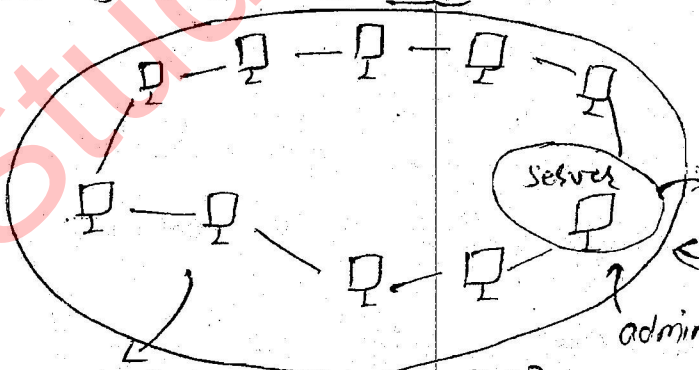
10.0.0.0 – 10.255.255.255
172.16.0.0 – 172.31.255.255
192.168.0.0 – 192.168.255.255

** Private IP Ranges

6.) will not get internet service.

Client = Dos, XP
Server = window NT, 2003,
(Dos + Networking Protocols)
HTTP, DHCP, FTP..

Assigning IP addresses:-



(10.0.0.1 – 10.0.0.120)
10.0.0.6 Private IPs
group of

S.IP	D.IP
0	10.0.0.6	255.255.255.255

broadcast Packet.

Requesting Packet S.IP D.IP

0	0.0.0.0	10.0.0.6

DHCP Client. + MAC

mapping table:-

IP address	MAC address

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Applying IP- addresses:-

Step-1st:- form a Network. Load the OS like (windows 2003) with Network Protocols can be made ap server with a client.

Step-2nd:- which having a group of private IPs (10.0.0.1 - 10.0.0.120). ~~the~~ Server hop IP 10.0.0.6 one from group of IPs.

Step-3rd:- Server (Admin) broadcast the message with LOBA to whole Network to inform that he is the server.

Step-4th:- Now Every System in the Network knows about the server, they request for their IPs.

Note:- Every client when they don't have an IP, still they can send the data using 0.0.0.0 ap a source address.

{ Along with that MAC address is also transmitted so the server can understand which client is requesting }.

Step-5th:- Admin will assign IPs to individual client by taking their MAC addresses.

Step-6th:- Server maintains a mapping table for assigning IP.

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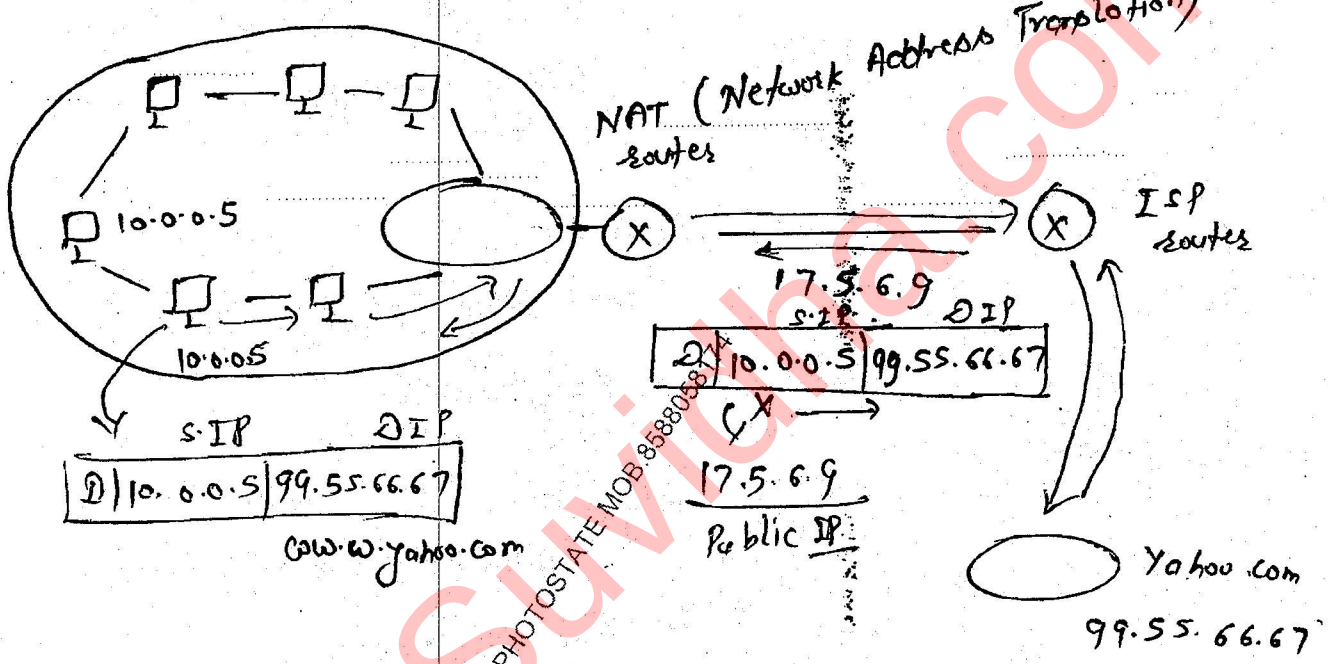
Public IP :-

(i) Scope is globally unique.

(2.) get Internet service.

(iii) Not free of cost.



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★ NAT Router converts private IP into public IP when the packet is going out of the Network.

★ It converts public IP into private IP when the packet is coming inside the Network.

Private IP	Public IP	MAC	Port
10.0.0.8	17.5.6.9	Different	
10.0.0.5	17.5.6.9	Different.	

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Note:- Public IP addresses are effectively and efficiently utilized with the help of Private IPs.

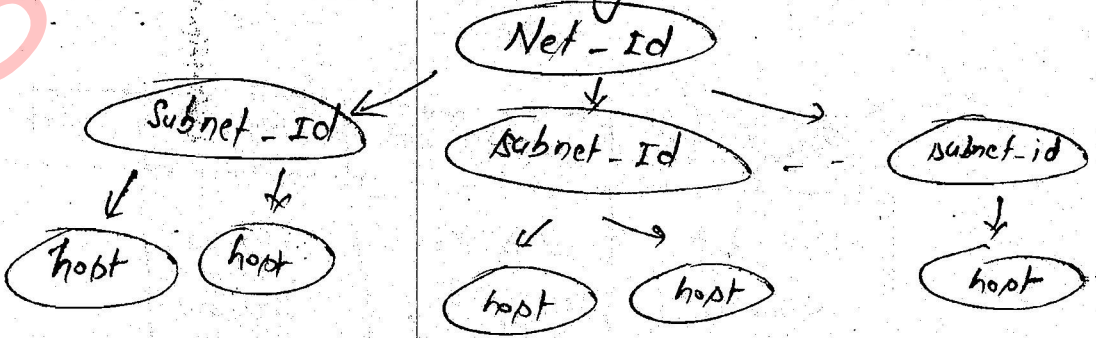
:- Drawbacks of Classful addressing :-

- Class A: (2^7-2) Networks (1-2 crores) ⇒ each N/w $(2^{24}-2)$ hosts
  - Need 10000 → (Huge wastage)
- Class B: (2^{14}) Networks (65000...) ⇒ Each N/w $(2^{16}-2)$ Hosts
  - 10000 → Huge wastage
- Class C: (2^{21}) Networks (255) ⇒ Each N/w (2^8-2) hosts
  - 1000 → Not sufficient

∴ Hence subnetting, supernetting needed.

* "Subnetting" :- Dividing a Network into small parts according to the requirement of user. It is called as subnetting.

It has 3 level heirarchy :-



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Subnetting :-

Que :- In Class C, If Subnet mask is

255.255.255.224

No. of Subnets = $2^3 - 2 = 6$

No. of Hosts in Each Subnet = $2^5 - 2 = 30$

255.255.255.224

11111111.11111111.11111111.11100000

Network Subnet Hosts

2.) In Class C, If Subnet mask is

255.255.255.240 ⇒ No of Hosts = $2^4 - 2 = 14$

⇒ Subnets = 14

11110000

Note :- During Subnetting some of the Host bits of zeros are modified as subnet bits of ones.

3.) ~~255~~. 255.255.254.0

11111111.11111111.11111110.00000000

No of Subnets = $2^7 - 2 = 126$

No of Hosts = $2^9 - 2 = 510$

4.) 255.255.252.0

11111100.00000000

$2^6 - 2 = 62$; $2^{10} - 2 = 1022$.

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8.) IP = 200.99.88.77 → 01001101

Subnet mask = 255.255.255.224 → 11100000

AND

= 01000000

2nd subnet bits | host bits

(i) Subnet id = 200.99.88.64

(ii) Subnet No = 2nd subnet

(iii) First Host of that Subnet :- 010 00001

= 200.99.88.65

(iv) Last Host of that Subnet :- 010 11110

= 200.99.88.94

(v) DBA of that Subnet :- 010 11111

= 200.99.88.95

Note :- Subtracting two (-2) in the Number of Hosts in each subnet because one is used for Subnet-Id and other one is used for DBA of that Subnet.

No of Hosts in each subnet = $2^n - 2$

9.) IP = 199..89.79.181

Subnet mask = 255.255.255.240

181 → 10110101

240 → 11110000

10110000

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(i) subnet_Id :- 199.89.79.176

(ii) subnet no :- 11th subnet

(iii) first Host of that subnet = 1011 0001
= 199.89.79.177

(iv) Last Host = 1011 1110
= 199.89.79.190

DBA = 199.89.79.191

10.) IP_1 = 200.99.88.119

IP_2 = 200.99.88.139

IP_3 = 200.99.88.149

subnet mask = 255.255.255.224

which IP's belong to same subnet ?

255.255.255.224

111 00000
S H

IP_1 119 — 011 10111
S H

IP_2 139 — 100 01011
S

IP_3 149 — 100 10101
S H

} belongs to same subnet i.e. 100 4th subnet.

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11) IVO of ... bits.

IP = 202.99.88.119

Subnet mask = 255.255.255.224

(i) Net_id = 202.99.88.0

(ii) First subnet_id = 00000000 → same 00000000 ↓

255.255.255.224 → 11100000 (s H) → 001 00000 (s H) → 1st subnet

(iii) DBA of Network :- 202.99.88.255 → 11111111

(iv) Last subnet :- 110 0 0000 → 111 00000 (s H)

111 11111 (s H) can't possible.

Note:- we are subtracting two (-2) in the Number of subnets because one is used for Net_id and other one is used for DBA of Network.

12) IP = 204.99.88.197

Subnet mask = 255.255.255.224 → 11100000 (s H)

(i) 4th subnet_id = 100 00000 = 128 ⇒ 204.99.88.128

(ii) 2nd subnet_id = 010 00000 ⇒ 204.99.88.64

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13) IP = 202.83.73.157

Subnet mask = 255.255.255.240

11110000

(i) calculate 1st Host of 3rd subnet :-

00110001 = 49

255.255.255.49

(ii) cal 2nd Host of 4th subnet :- 01000010 = 66

255.255.255.66

(iii) cal 3rd Host of 5th subnet :- 01010011 = 83

255.255.255.83

202.83.73.83

14) IP = 144.99.83.116

subnet mask = 255.255.254.0

11111111.00000000

S H

(i) Calculate the 1st Host of 1st subnet.

~~Subnet ID~~

00000001.00000001

00000010.00000001

144.99.2.1

(ii) Last Host of Last subnet :-

11111110.11111110

253.254

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15) $IP_1 = 200.89.99.113$

$IP_2 = 200.89.99.145$

$IP_3 = 200.89.99.99$

Subnet mask = 255.255.255.224

11100000

identify which host of which subnet the above IPs?

IP_1 01110001 (S H) → 17th Host of 3rd subnet

IP_2 10010001 (S H) → 17th host of 4th subnet

IP_3 01100011 (S H) → 3rd host of 3rd subnet

16.) $IP_1 = 199.89.79.115$

(i) Subnet_id = 199.89.79.0

(ii) Subnet_mask = 255.255.255.224

↳ "Continuous mask"

(iii) First Subnet_id = 00100000 = 199.89.79.32

(iv) Second subnet_id = 199.89.79.64 (010 00000)

(v) 3rd subnet_id = 01100000 = 96

199.89.79.96

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199.89.79.0 → 6 subnets in .224

111 00000

$2^3 - 2 = 6$

63 DBA of 2nd First Subnet_Id

64-1

3rd Subnet_id

199.89.79.32 | 199.89.79.64 | 199.89.79.96

2nd Subnet_id

2X32

3X32

-1 = 62 last Host of 1st Subnet

32 + 1 (first Host)

128 . 160 . 192

159 DBA | 4X32 | 5X32 | 6X32

158 last Host | 129 (First Host)

(V) First Host of First Subnet = 001 00001 = 33

(Vi) Last Host of first Subnet = 001 11110 = 62

(Vii) DBA of first Subnet = 63 = 001 11111

Note :-

Continuous mask is practical and can be applied in networking, because designing of the Network becomes simple.

Discontinuous mask :- uping discontinuous mask we can not get a pattern so it is applied in security.

(2.) IP = 200.99.88.119

Subnet mask = 255.255.255.41

11111111.11111111.11111111.00101001

Subnet bits. Host bits.

First Subnet Id = 000 00001

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* (18.) IP of subnet = 10 200.99.89.31

Which of following can be subnet mask?

31

a.) 255.255.255.128 00011111 } * 5 1's

~~1000 000~~ 10000000 Expected

b.) 255.255.255.192

11000000

S H

c) 255.255.255.240

11110000

S H

d.) None

1st subnet

00011111 31

** (19.) DBA of subnet is

200.99.89.15

which of the following can be the subnet mask ?

a.) 255.255.255.248 0000 1111

Expect

11111000

b) 255.255.255.252

11111100

c) a & b both

d) None

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20.) CIDR of subnet i/p 174.78.39.31
which of the following can be subnet mask ?

a) 255.255.255.224 — 111 00000 — 000 11111 (Subnet Not Possible)
b) 255.255.255.240 — 1111 0000
c) 255.255.255.248 — 11111 000
d) both b & c
e) all

21.) Company requires 30 hosts
subnet mask ?
No of host in each subnet = $2^5 - 2 = 30$

N + S + H
24 + 3 + 5

11111111.11111111.11111111.111 00000
N — S — H

255.255.255.224.

22.) A company requires 60 Hosts
subnet mask ?
No of Hosts in each subnet = $2^6 - 2 = 62$

11111111.11111111.11111111.11 000000
S — H

N + S + H
24 + 2 + 6

255.255.255.192

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23) Can the Network mask of Class C be the subnet mask of Class B.

:- True

255.255.0.0 B

255.255.255.0 C

24) Can the Network mask of Class A be the subnet mask of Class B ?

:- false

255.0.0.0 A ↔ X

255.255.0.0 B

→ subnetting (Host bit reduced).

25) Company requires 500 hosts subnet mask ?

$2^9 - 2 = 510$

N + S + H

8 + 7 + 9

11111111.11111111.11111110.00000000

N S H

255.255.254.0

26) In the above problem if the Restriction is: we have to use Class C only.

Can be apply subnetting → No

→ we will apply supernetting.

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Supernetting :- Joining two or more Networks to form a larger Network according to the requirement of user is known as Super-Netting.

(1) In Class C, If supernet mask is

255.255.252.0

No of Networks that can be joined ?

11111111 11111111 111111 00 00000000

Supernet bits

Subnetting

Supernetting

$= 2^2 = 4$ Network

In Supernetting Network bits are borrowed from the Network bits to join Networks.

Note :-

* we can join only power of 2 Network.

(2) In Class C, If Supernet mask is

255.255.248.0

So calculate the No of Network that can be joined ?

11111111 11111111 11111 000 00000000

Supernet bits

N H

$= 2^3 = 8$ Networks

(3) one of Address of supernet is 201.55.90.123

Supernet mask = 255.255.252.0

Range of Supernet = ?

Supernet-Id = 201.55.90.0.

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90. → 0 1 0 1 1 0 1 0

252 → 1 1 1 1 1 1 0 0

0 1 0 1 1 0 0 0 = 88

Supernet bits

0 1 0 1 1 0 00 . 11111111

88.0 — 88.255 → 1st Network in Supernet

0 1 0 1 1 0 01 . 00000000

0 1 0 1 1 0 01 . 11111111

89.0 — 89.255 - 2nd Network

0 1 0 1 1 0 10 . 00000000

0 1 0 1 1 0 10 . 11111111

90.0 - 90.255 - 3rd Network

91.0 - 91.255 - 4th Network in Supernet.

Range :- (201.55.88.0 — 201.55.91.255)

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