CS & IT ENGINEERING

IPv4 Addressing

COMPUTER NETWORKS

Introduction to IP Addressing

Lecture No-02

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Introduction to IPv4

Basics of IP Addressing

$2^1 = 2$

$2^2 = 4$

$2^3 = 8$

$2^4 = 16$

⋮

$2^9 = 512$

$2^{10} = 1024 = 1K$ (Kilo)

$2^{20} = 1024 \times 1024 = 1M$ (Mega)

$2^{30} = 1024 \times 1024 \times 1024 = 1G$ (Giga)

$2^{40} = 1\ T$ (Tera)

$2^{50} = 1\ P$ (Peta)

$2^{60} = 1\ E$ (Exa)

$2^{70} = 1\ Z$ (Zetta)

$2^{80} = 1\ Y$ (Yotta)

Basics of IP Addressing

Data

1 Byte = 8 bits

1 KB = 1024 Bytes

1 MB = 1024 KB (Kilo Byte)

1 GB = 1024 MB (Mega Byte)

1 TB = 1024 GB (Giga Byte)

1 PB = 1024 TB (Tera Byte)

1 EB = 1024 PB (Peta Byte)

1 ZB = 1024 EB (Exa Byte)

1 YB = 1024 ZB (Zetta Byte)

Bit → b

Byte → B

8bit

128 64 32 16 8 4 2 1

Basics of IP Addressing

Binary Number (128 64 32 16 8 4 2 1)	Decimal Value
0 0 0 0 0 0 0 0	0
0 0 0 0 0 0 0 1	1
0 0 0 0 0 0 1 1	3 $[2^2-1]$
0 0 0 0 0 1 1 1	7 $[2^3-1]$
0 0 0 0 1 1 1 1	15 (2^4-1)
0 0 0 1 1 1 1 1	31 (2^5-1)
0 0 1 1 1 1 1 1	63 (2^6-1)
0 1 1 1 1 1 1 1	127 (2^7-1)
1 1 1 1 1 1 1 1	255 (2^8-1)

8 bit

Range → 0 to 2^8-1

0 to 255

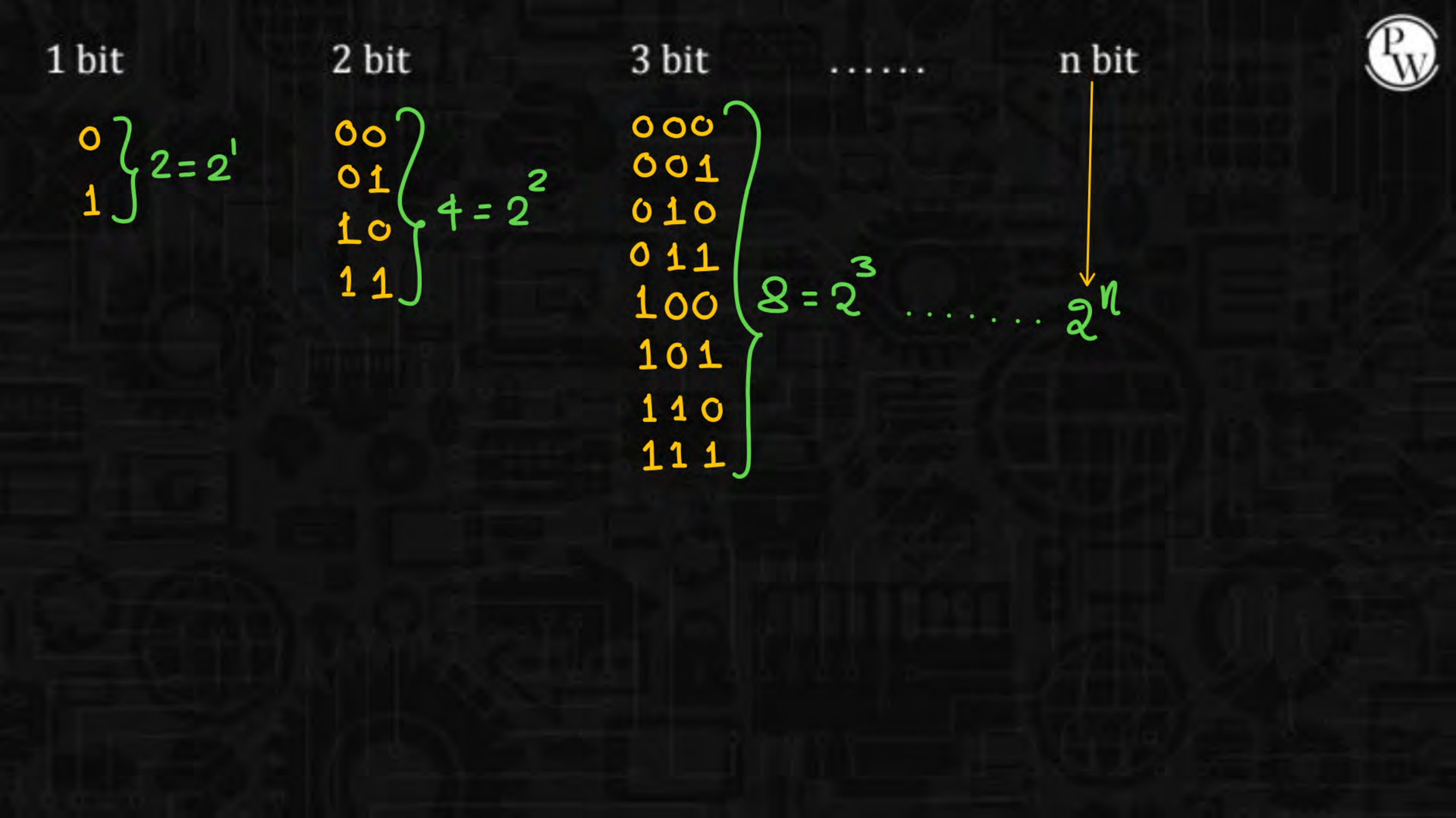
n bit

Range → 0 to 2^n-1

Basics of IP Addressing

Binary Number (128 64 32 16 8 4 2 1)	Decimal Value
10000000	→ 128
11000000	→ 192
11100000	→ 224
11110000	→ 240 (255-15)
11111000	→ 248 (255-7)
11111100	→ 252 (255-3)
11111110	→ 254 (255-1)
11111111	→ 255

128
+64
192
+32
224
+16
240


1 bit
2 bit
3 bit
.....
n bit
0
1
2 = 2^1
00
01
10
11
4 = 2^2
000
001
010
011
100
101
110
111
8 = 2^3
.....
2^n

2 bit

00

01

10

11

3 bit

P_1 000

001

P_2 010

011

P_3 100

101

P_4 110

111

1 bit ⟶ 2 Parts $= 2^1$ Parts

2 bit ⟶ 4 Parts $= 2^2$ Parts

⋮

k bit ⟶ 2^k Parts

..... n bit

2^k Parts

size $= 2^{n-k}$
size $= 2^{n-k}$
size $= 2^{n-k}$
size $= 2^{n-k}$
size $= 2^{n-k}$
size $= 2^{n-k}$
size $= 2^{n-k}$
size $= 2^{n-k}$

2^n

← n bit →

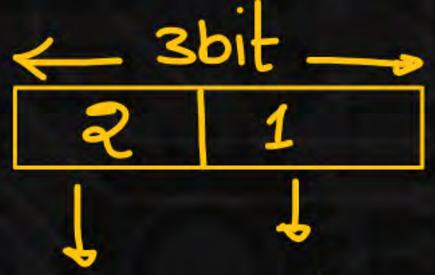
k	n-k

2^k Parts 2^{n-k} (size of each Part)

2^K Parts $\longrightarrow$ 2^n

1 Parts $\longrightarrow$ $\frac{2^n}{2^K}$

$= 2^{n-K}$



2^2 Parts $\quad 2^1 = 2$ (size of each Part)

4 Parts

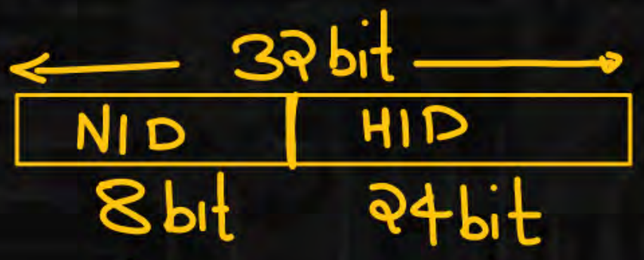
Introduction to IP Addressing

IPv4 Address = 32 bit → $2^2 * 2^{30}$ = 4G → IP Addresses

Total number of IP addresses = 2^{32} = 4,294,967,296

Initially in 1980's IP Addresses was divided into two Fixed Parts i.e.,

NID = 8 bit, and HID = 24 bit.



IANA

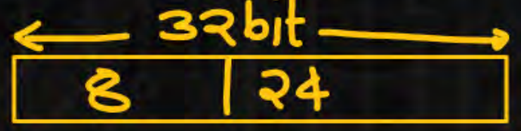
Internet Assigned Number Authority

2^8 = 256 Networks

2^{24} Host/Network

$= 2^4 * 2^{20}$ = 16M Host/Network

≅ 1.6 Cr Host/Network



$N_1 = 2^{24}$ IP Add

$N_2 = 2^{24}$ IP Add

$N_3 = 2^{24}$ IP Add

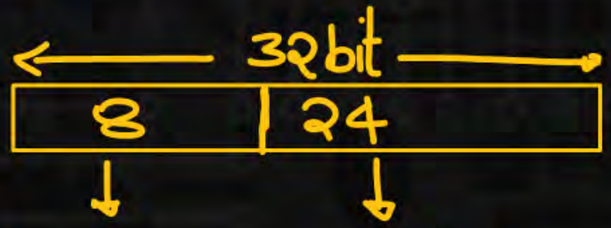
$N_4 = 2^{24}$ IP Add

$N_5 = 2^{24}$ IP Add

$N_{256} = 2^{24}$ IP Add

2^8 Parts ⇓ 256 Parts ⇓ 256 Networks

2^{32} = total IP Add



2^8 Parts

2^{24} (size of each Part)

256 Parts

Introduction to IP Addressing

Disadvantage

There are only 256 Network's, and even a small organization must buy 16M computer (HOST) to purchase one network.

Soln: classful Addressing

Telephone Networks

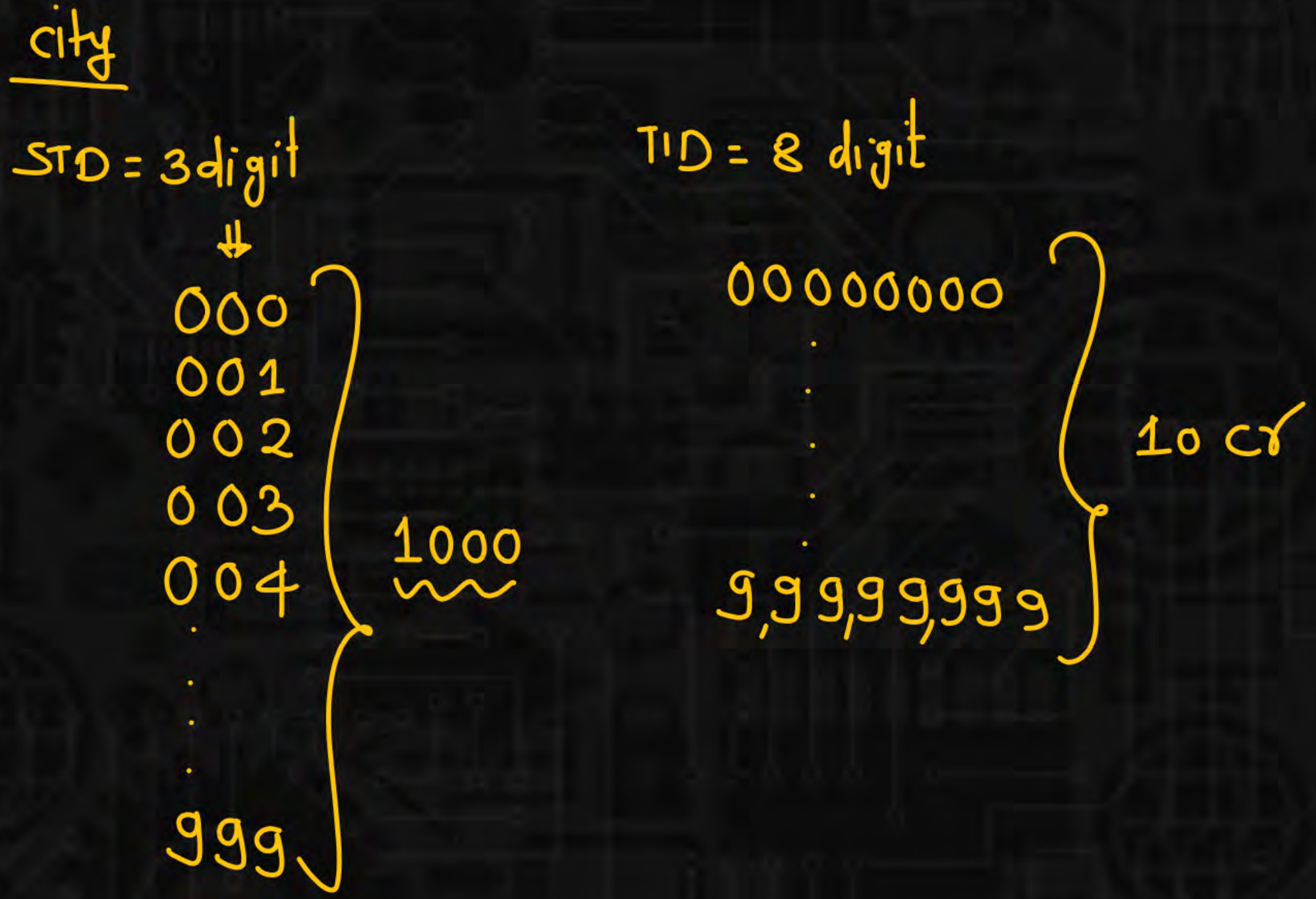
1. 11 digit Number
2. Two Parts
   - STD
   - TID
3. Unique

Telephone Networks

City	
3 STD	8 TID
०११	२४१६१३१५

Town	
4 STD	7 TID
०१२०	२४१५१६२

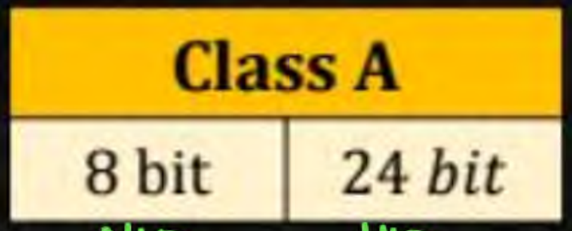
Villages	
5 STD	6 TID
०५९२४	२६४२९७


city
STD = 3 digit
000
001
002
003
004
999
1000
TID = 8 digit
00000000
99,99,9999
10 cr

Computer Networks

1. 32 bit Number [8 · 8 · 8 · 8]
2. Two Parts → NID, HID
3. Unique

Computer Networks



NID → $2^8 = 256$ Network

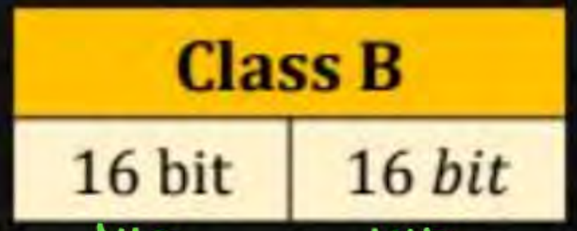
HID → 2^{24} Host/Net.

$2^4 * 2^{20}$

$= 16M$ Host/Net.

$\cong 1.6$ cr. Host/Net.

Note: Designed For Big organization For ex: NASA



NID → 2^{16} Net.

$2^6 * 2^{10}$

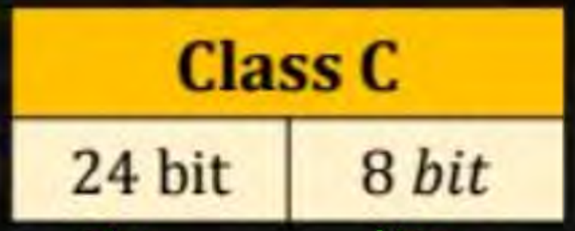
64K Net.

HID → 2^{16} Host/Network

$= 2^6 * 2^{10}$

$= 64K$ Host/Net.

Note: For MNC's For example → TCS, WIPRO etc



NID → 2^{24} Net.

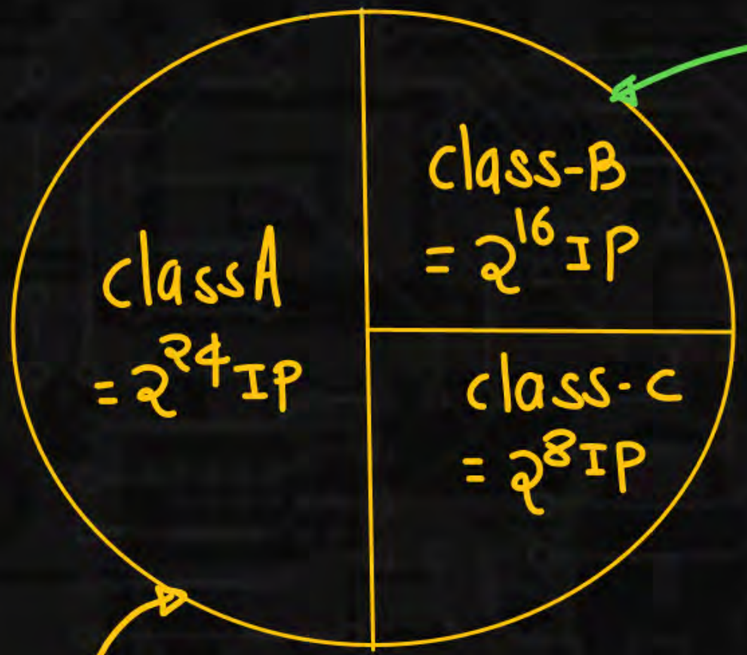
$2^4 * 2^{20}$

16M Net.

HID → 2^8 Host/Net.

256 Host/Net.

Note: For small organizations For ex: Schools, Colleges etc.



Wastage $= 2^{16} - 500$

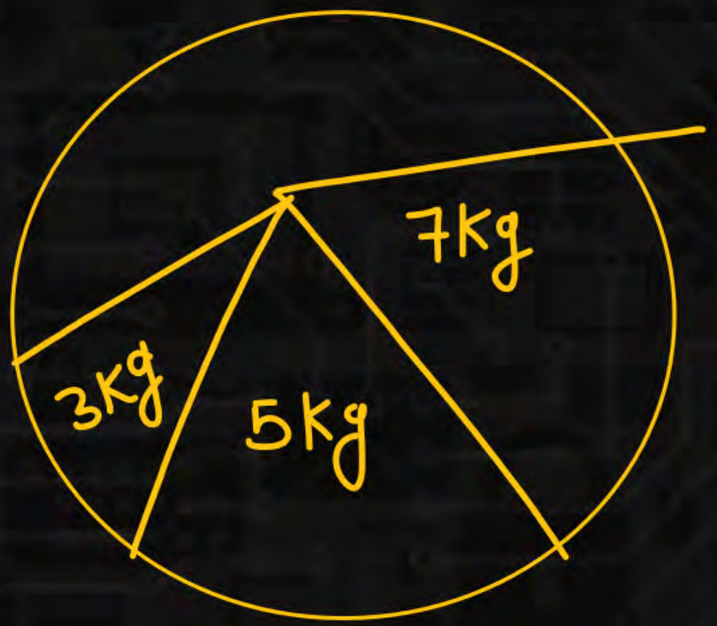
$= 65,536 - 500 = 65,036$

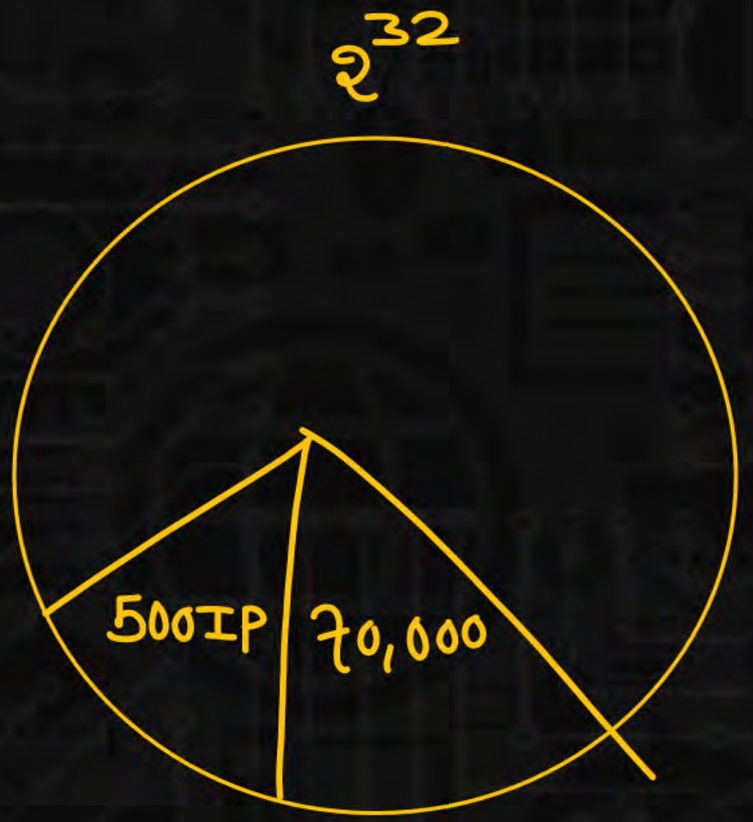
X = 500 IP Add

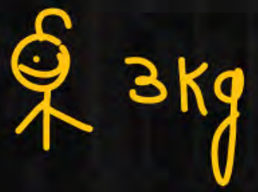
Y = 70,000

Wastage $= 2^{24} - 70,000$

Wastage = 10kg - 3kg = 7kg


7kg
3kg
5kg


2^{32}
500IP
70,000


3kg


THANK YOU GW
SOLDIERS !