IPv4

Thursday, 4 March 2021 8:19 AM

IP Addresses and network address translation:

Public IP Addresses:

- Each LAN connected to Internet has a single IP. This address is seen by other networks or computers on the Internet. This IP address is attached to the packets sent across the Internet.

Public IP addresses has two types: Static & Dynamic

Private IP Addresses:
Computers within a LAN have their own private IP address, that is different to their Public IP Address.

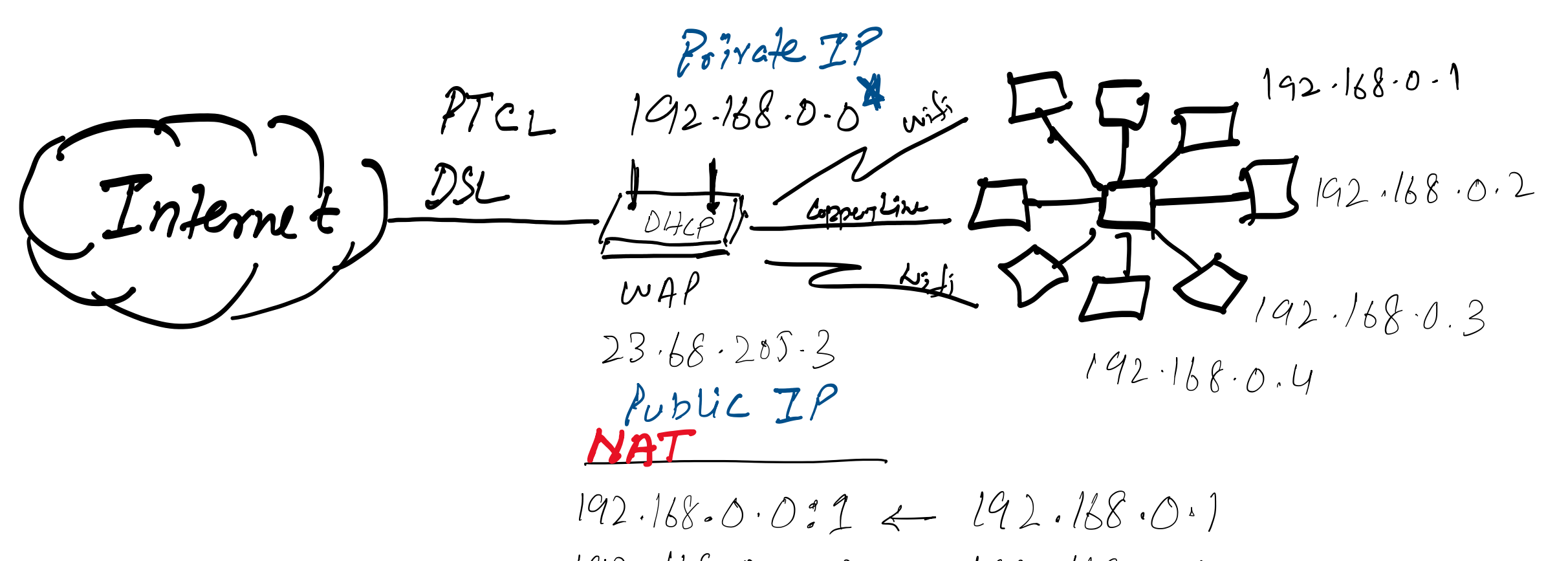
This private address is either:

- Issued by Server/Router using Dynamic Host Configuration Protocol (DHCP)
- Set by the computer users themselves.

Private IP addresses are usually in the 192.168.x.x range, besides this we also have 10.x.x.x & 172.x.x.x

Network Address Translation (NAT):

When a user sends a packet from a computer to server, the NAT server swaps the Private IP add. for the Public IP add and attaches a port ID to the packet. The NAT server keeps track of which computer is assigned to which private IP add, so that when a packet returned to the port, it can swap that public IP on the packet back to private IP and send it through the LAN to corresponding computer.



NAT

192.168.0.0:1 ← 192.168.0.1

192.168.0.0:2 ← 192.168.0.2

⋮

192.168.0.7 : BB
IP : Port

— Socket

IPv4 Addressing Approaches:

Format:

$B.B.B.B = 2^{32} = 4$ Billion Approx

- Original IP addressing was designed on the basis of hierarchical addresses.
- These addresses, though written as one, are divided on binary level into group of bits.
- These groups define a network (a netID) & a hostID.
- The aim was to assign a unique, universal address on each device.
- Other features of original IPv4 formatting scheme were based on classes of networks.
- There were 5 classes; but we study only 3 of them.
- Class identifier bits are NOT included in netID.

Class	Class identifier	#bit for netID	#bits for hostID
Class 'A'	0	7	24
Class 'B'	10	14	16
Class 'C'	110	21	8

- It can be observed that most significant bits identify a class. For example:

128.12.2.30

Dot Decimal notation. { 10000000.00001100.00000010.00011110

Most significant bits identify the class of IP address.

This is class 'B' IP address as its msb are '10'.

Class inter-domain routing (CIDR):

- This was the first approach for improving addressing scheme.
- This holds the concept of netID and hostID.
- It has a variable approach to adjust according to the need (flexible).
- It uses (e.g.) 8-bits-suffix to the IP address that specifies the number of bits for netID and (e.g.) for instance remaining 11 bits out of 32 IP address bits will be the hostID.

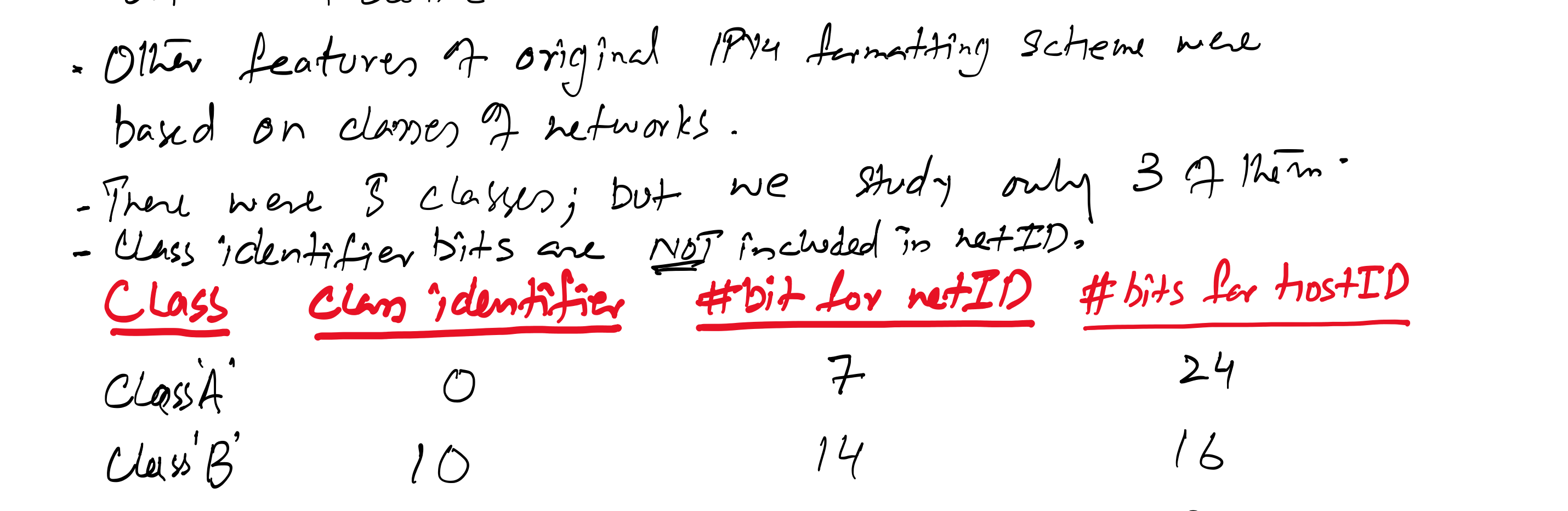
10000000000011000000000 | 0100011110 | /00010101

netID | hostID | Suffix 21

- Note that with CIDR there is no longer any need to use the msb to define a class.
- However, It does allow already existing class A, B or C addresses to be used with suffixes 8, 16 or 24 respectively.

Sub-netting

- It is a different approach than classes, CIDR.
- It is more efficient as it applies structure to IPv4 format.
- It is viable more over private IPs on LANs.
- The sub-netting only works by having a defined structure for the 256 codes constituting the hostIDs.



- On the Internet all of the allocated IP addresses have a net ID pointing to the router.
- The router then has to read the hostID to direct packets to the appropriate hosts/devices on one of the LANs.
- For example: hostID — 000 | 01110 (LAN | Device)

IPv4:

4B

B.B.B.B

$2^{32} = 4.32$ Billion

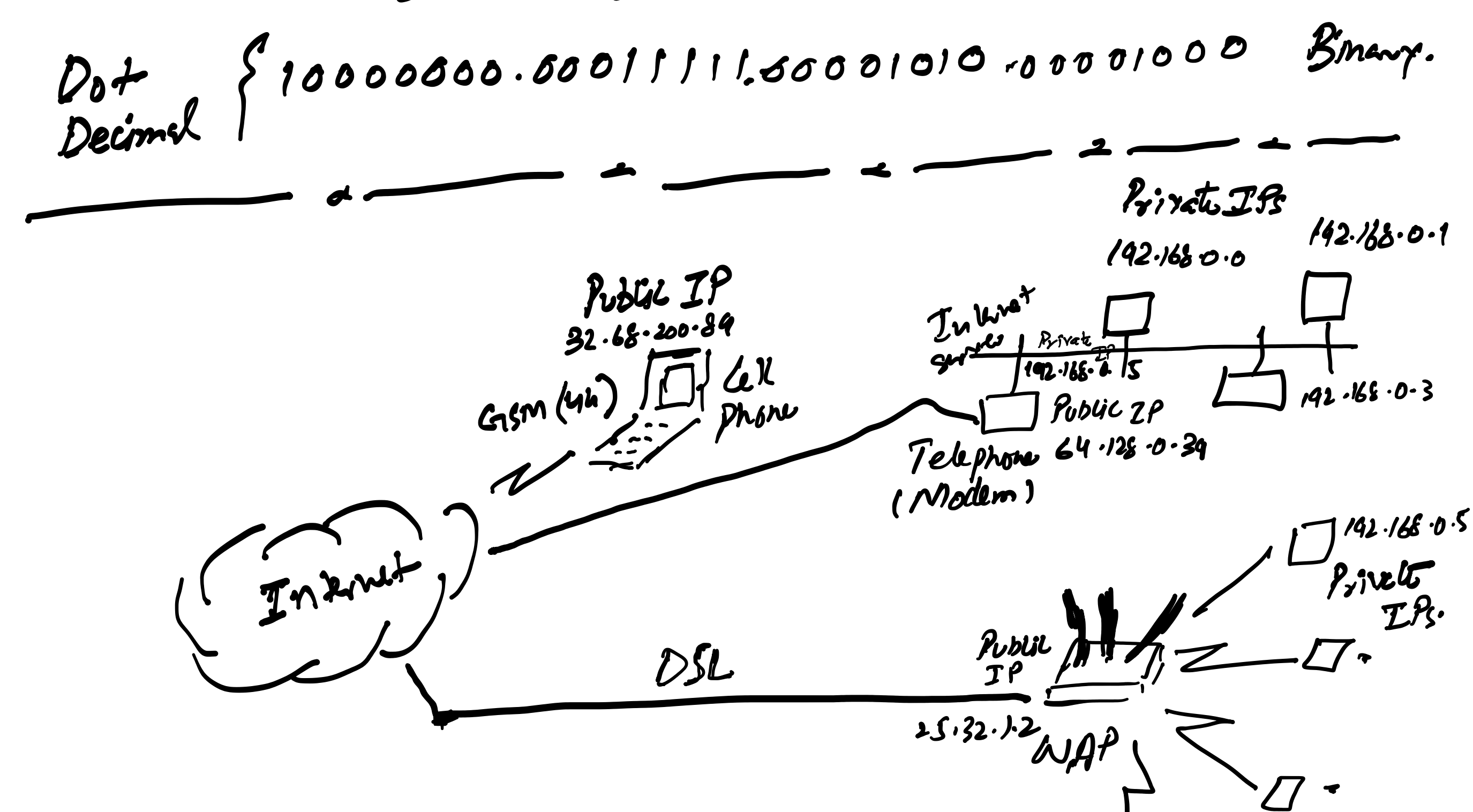
$2^8 = 256$ (0 – 255)

Private IPs { 192.168.x.x $2^{16} = 65536$; 10.x.x.x $2^{24} = 16.7$ mill; 172.x.x.x $2^{24} = 16.7$ mill

IP Add.

128.31.10.8 Denary

Dot Decimal { 10000000.00011111.00001010.00001000 Binary.



Example IPv4 = 200.85.15.7/5

Class — CIDR — Subnet

netID

hostID

11001000.01010101.00001111.00000111/00000101

IPv4 — Suffix

Class : C	CIDR
netID: 010000101010101000001111	netID: 11001
host ID: 00000111	hostID: 000010101010000111100000111

Sub-netting:

netID: 110010000101010100001111 — 3B

hostID: 00000111 — 1B

LAN ID: 000 — 3 bits.

Device ID: 00111 — 5 bits.