3/7/19

DATE / /

1. Network layer & Protocol.

- The Network layer is a 3rd layer of OSI model.
- The layer that provides data routing paths for Network communication.
- Data is transfered in the form of packets.
- By our logical network paths.
- Network addressing, logical Connection setup, Data forwarding, routing, delivery error reporting is the primary responsibilities of the Network layer.

(A) The Network layers uses a protocol:-
a) Internet Protocol Version 4. (IPv4)
b) Internet Protocol version 6 (IPv6)
c) Internet Control message protocol.
d) Internet group management protocol
e) Internet protocol security. (IPsec)
f) Internetwork packet exchange. (IPx)
g) Routing information protocol.

(B) IPv4:- It is a 32 bit address that uniquely defines the Connection of a host or router to the Internet

(A) IPv6:- It is a 128 bit address.

(A) The Ip address are classified in 2 ways.

i) Static

ii) Dynamic

i) static:- The static IP address usually never change but they may be change as a result of network administration.

ii) Dynamic:- These are temperary IP address. These IP address are assigned to a computer when they get connected to the Internet

(*) The addressing mechanism should be universally ~~accepted~~ accepted and uniquely identify the source and destination of host computers existing in a network.

(A) Four level of address

i) Physical address

ii) Logical address

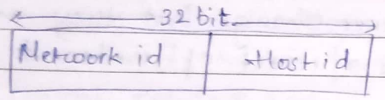
iii) Application

i) Physical addr:- Is a addi address of a node defined by it's LAN or WAN

ii) logical address :- In the internet is a currently a 32 bit or 128 bit address that can uniquely define host connected to the internet

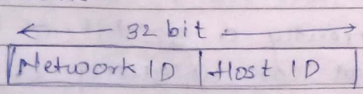
iii) Application Specific address:-
eg:- E-mail, URL, MSBTE.com.

(4) IP addressing :-



- IP addressing is the method used to identify Host and Network devices.
- The number of host connected to the internet continues to grow.

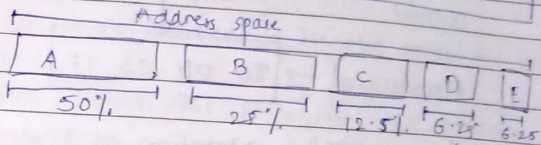
(7) Concept of IP address:-
An IP address is an address used to uniquely identify a device on an IP network.
- IP address is a 32 bit representation that uniquely identifies a specific interface on the network.
- A 32 bit IP address actually consist of following two parts:-
a) Network ID :- Identifies the network on which a host computer can be found
b) HOST ID:- Identifies the specific device on the network.



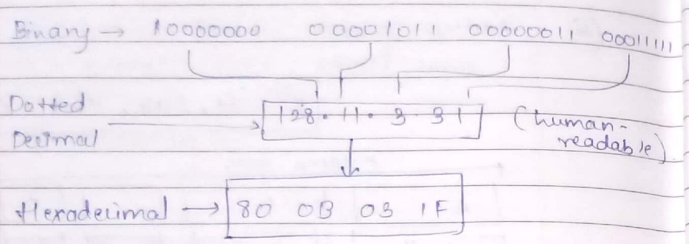
eg:- 145.25 . 10.100
Network ID | Host ID.

(A) Address space:-

$2^{32} = 4,294,967,296$



- An address space is the total number of address used by the protocol.
- IPv4 uses 32-bit address which means that the address space is 2^{32} or 4,294,967,296 i.e. more than 4 billion).
- More than 4 billion devices could be connected to the internet.
- Class A covers half of the address space.
- class B covers ~~one fourth~~ 1/4 of the address space
- class C :- 1/8
class D/E :- 1/16.
- Common notation in the address space
a) Binary notation (base 2).
b) Dotted decimal notation (256)
c) Hexadecimal notation (base 16).



Three Notation of IPv4 Addressing.

i) Binary Notation :-

- Binary Notation is the format that systems on the network used to process the address.
- In Binary notation IPv4 address is displayed as a 32 bit.

ii) Hexadecimal Notation.

- ~~IPv4~~ Each Hexadecimical notation is equivalent to 4 bits.
- This notation is often used in Network programming.

iii) ~~Dot~~ Dotted ~~Decimal~~ Decimal Notation.

- Dotted decimal Notation can be communicated ~~Conveti~~ Conveniately by people.
- The address is ~~p~~ ~~bot~~ broken into 4 bytes. with each byte ~~w.ts~~ being represented by a decimal number and seperated by a dot.

- An IP address is a numeric identifier assigned to each machine or an IP network.
- IP address is a software address ~~no~~ but not a hardware address.
- which is hard coded in the machine or NIC.
- IPv4 address
- Change the following IPv4 address ~~from~~ from Binary notation ~~to~~ dotted decimal notation.

Sums.

Binary to dotted decimal.

i) 10000001 00001011 00001011 11011111

→ 2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0

128	64	32	16	8	4	2	1
1	0	0	0	0	0	0	1

128 + 1

129.

128	64	32	16	8	4	2	1
0	0	0	0	1	0	1	1

8 + 2 + 1

11.

128	64	32	16	8	4	2	1
						1	1

128	64	32	16	8	4	2	1
1	1	1	0	1	1	1	1

128 + 64 + 32 + 8 + 4 + 2 + 1

239.

ii) 11100111 11011011 10001011 01101111

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1
1	1	1	0	0	1	1	1

128 + 64 + 32 + 4 + 2 + 1

231.

128	64	32	16	8	4	2	1
1	1	0	1	1	0	1	1

128 + 64 + 16 + 8 + 2 + 1

219

128	64	32	16	8	4	2	1
1	0	0	0	1	0	1	1

128 + 8 + 2 + 1

139.

128	64	32	16	8	4	2	1
1	1	0	1	1	1	1	1

~~64 + 32 + 16~~

64 + 32 + 8 + 4 + 2 + 1

111.

231 . 219 . 139 . 111

(*) Dotted decimal to Binary :-

i) 111 . 56 . 45 . 78

	128	64	32	16	8	4	2	1
111 →	0	1	1	0	1	1	1	1
56 →	0	0	1	1	1	0	0	0
45 →	0	0	1	0	1	1	0	1
78 →	0	1	0	0	1	1	0	0

ii) ~~24.~~ 221 . 34 . 7 . 82

	128	64	32	16	8	4	2	1
221 →	1	1	0	1	1	1	0	1
34 →	0	0	1	0	0	0	1	0
7 →	0	0	0	0	0	1	1	1
82 →	0	1	0	1	0	0	1	0

iii) Binary to hexidecimal.

10000001 00001011 00001011 01001110
8 1 0 B 0 B 4 E

10000001 00001011 00001011 11101111
8 1 0 B 0 B E F

8 10B0BEF16
OR
0X810B0BEF

Note:-
- Hexadecimal notation normally has no added space or dot.
- However 0X is added at the beginning or the subscript 16 at the end to show that the number is Hexadecimal.
- Find the error in IPv4 addresses.

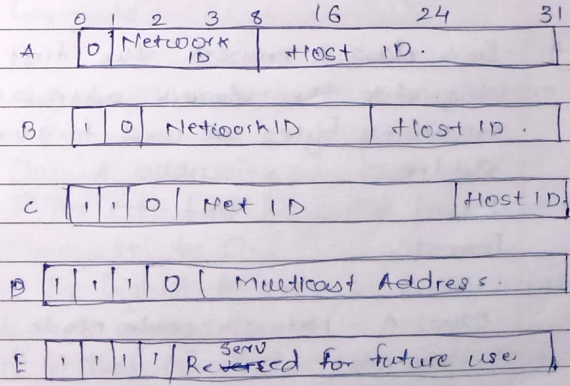
(*) i) 111.56.045.78 ✗ error
ii) 221.34.7.8.20 ✓ error
iii) 75.45.301.14 ✓
iv) 11100010.23.14.67 ✗

i) There must be no leading 0.
ii) There can be no more than 4 numbers
iii)

Class range of IP
A :- 0-127
B :- 128-191
C - 192-223
D - 224-239
E - 240-255

(*) Classful Addressing
The IP address structure is divided into 5 address classes:-
i) Class A
ii) Class B
iii) Class C
iv) Class D
v) Class E.

Shows the five classes of IP address.



- class D address are used for Multicast Address. That allow a Host to save information to a group of Host simultaneously.
- class E address are ~~used~~ used for reserved for future use.
- Class A is are ~~used for large~~ design for large organization with a large number of attach host or router.
- class B address were design for mid-size organization with 10,000 of attach Host and router.
- One problem with classful addresing is that each class is divided into fix number of blocks with each block having a fix size.

(A) In a class A network the first byte is assigned to the network address and the remaining bytes are used for the node address.

Format :-

Class A :- Network Node Node Node

(A) In class B network the first two bytes are assigned to the network address.
And remaining two bytes are assigned to the node address

Format

class B:- Network Network Node Node

(A) In class C network the ~~three~~ first three bytes are assigned to the network address.
And remaining one bytes are assigned to the node address.

formate

class:- Network Network Network Node

(A) Class A addressing:-
i) The ~~class~~ first bit of the first octate is always set to 0.
ii) The highest ~~bit~~ order bit of the network byte is always 0
iii) So that the first octate range from 1 to 127.
iv) 0000 0001 - 0111 1111.
v) The class A ~~ad~~ address only include

- IP starting from 1.x.x.x to 126.x.x.x
- These IP range is reserved for loop back
- IP address.
- First byte specifies the Network portion (8 bit) remaining specifies the Host portion (24 bit).
- Network values of 0 and 127 are reserved.
- This class is used for large addressing Network.
- There are ~~126~~ 127 class A network.

(A) Class B addressing
- ~~Class B~~ Here the first two bits ~~are~~ is set to 0.
- The highest order bit 6 and 7 of the network portion are 10
- 10000000 - 10111111
  128 - 191
- The first two bytes specifies the Network portion (16 bit) ~~remaining bytes~~ the ~~last~~ last two byte specifies the Host portion (16 bit).
- The ~~ab~~ class is used for medium size addressing network.

(A) Class C addressing.
- The first ~~Obtained~~ octate of this class has first three bit set to ~~110~~ 110.
- The ~~first~~ highest order bit 5, 6, 7 of the Network portion of 110,
- 11000000 - 11011111
  192 - ~~223~~ 223
- The first 3 byte specify the network ~~portion~~ portion (24 bit) the last byte specifies the Host portion (8 bit).
- This class is used for small size network.

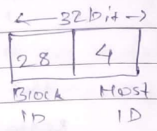
(A) Class D addressing
- The first 4 bit of the first octate in class D IP address are set to 1110.
- ~~240~~ 00 111 00000 - ~~11~~ 11101111
  224 - 239.
- Class D is reserved for multitasking.
- The Class D does not have any Subnet mask.

(A) Class E addressing:-
- The class E IP address are reserved for experimental purpose only for RND or study.

- Class E range is 240.0.0.0 to 255.255.255.254.

(A) classless addressing:

- Not classes
- Only blocks
- Notation
  x.y.z.w/n
  (n bit represent the n/w.)



eg:- 200.10.20.40/28:

Host ID. (TENA)

200.10.20.40/28

32
-28
4

$2^4 = 16$ → Hosted.

Network ID.

11111111 11111111 11111111 11110000

8 8 8 84

255 255 255 240

8bit 8bit 8bit 00101000

32+8 (40).

200.10.20.40/28.

Rules.

- Address should be contiguous.
- No. of addresses of every block must be in power of 2.
- First address of every block must be evently divisible size of blocks.

(A) Subnetting.

- Subnetting is a method for dividing a classful IP network into smaller subnetworks.
- The process of subnetting dividing a network into smaller network is called subnets / subnetwork.
- A subnet is a logical partition of an IP network into multiple, smaller network segment.
- Subnetting enables network administrator to further divide the host part of the address into two or more subnet.
- A part of the host address is reserved to identify the particular subnet.

* Find the subnetwork address for the following :-

141.181.14.16 - IP
255.255.255.0 - Mask
141.181.0.0 ← Subnet address.

200.34.22.156 - IP
255.255.255.240 - Mask
200.34.22.144 - subnet address.

Q. ~~Masking~~ :-

Q. Supernetwork :-

- An organization can combine several class C blocks to create a large range of address.
- Several network are combine to create a super network.
- When group of two or more ~~group of~~ classful Network are together they are called supernet.

Q. Network Address Translation :- (NAT)

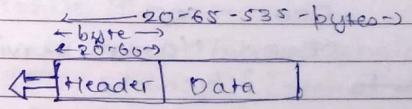
Public IP address	Private IP address
i) Publicly register on the Internet	i) Not publicly registered.
ii) We can directly access the public IP.	ii) Cannot directly access.
iii) ~~Mapping between protocol add.~~	

Q. Mapping between protocol address and hardware address is called address resolution.

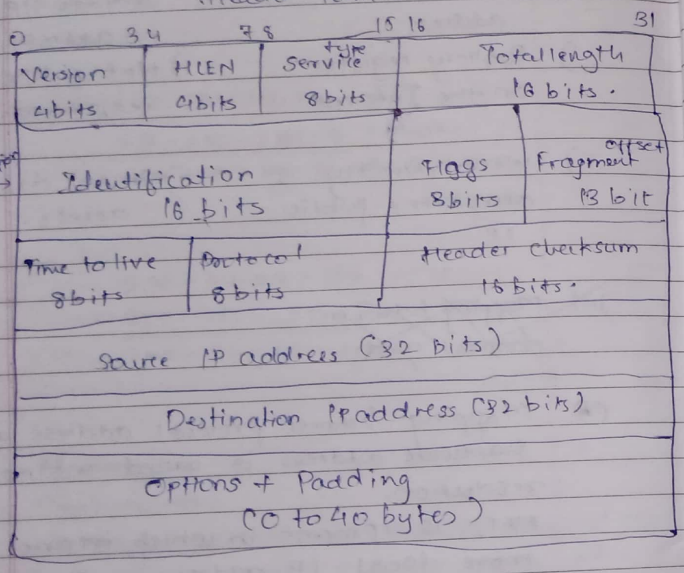
NAT is a process in which ~~it~~ one or more local IP address is translated into one or more global IP address.

Q. Internet Protocol :-

Q. IP datagram :-



Header Format



(1) Service type:- This provide network, service parameter. 1000 minimize delay.

0100 - Maximize throughput.
0010 - Reliability
0001 - cost
0000 - Normal service.

(2) Total length:-
Total length - header length = length of data.

(3) Identification :-
- This 16 bit fields contains a Specific number for primary data identification.
- Usually it is incremented by 1.
- All fragments of a datagram contains the same identification value.

(4) Flags :-

Bits	DF	MF	
Fragment	0	0	First Packet
	0	1	Middle Packet
	1	0	
No Fragment	1	1	Last Packet

(5) Time to live :-
These contains the total number of router allowing the packet to pass. Till gets 0 an upper limit on router a datagram can pass.

(6) Mobile IP :-
Mobile IP is an internet engineering task IETF standard (Internet engineering task Force). Standard communication protocol that is design to allow mobile device user to move from

ing
one network to another while maintaining a parmanent IP address. The goal of mobile IP includes ~~supporting~~ t
Supportive end system while maintaining ~~effeciency~~ efficiency and ~~compatibi~~ tibility in all respect with existing applications ~~with~~ & IP.

-Mobile IP communication protocol refers to the forwarding of internet traffic with a fix IP address.
- Even the outside the home network.
-It allows user having coireless or mobile devices to use the internet remotely.