Ans→

No. of Subnet = 2^m

and No. of host for network = $(2^{(8-m)} - 2)$

Ques: If default Subnet mask for a network is 255.255.255.0 and if m bits are borrowed from NID then what is its Subnet mask. ??
(m is less than 8)

Ans:

$255.255.(2^{8-m}).2^m.0$

$(8-m)$

2^6 64 d 2 4

Ques:→

$255.255.2^{(8-m)}.2^m.0$

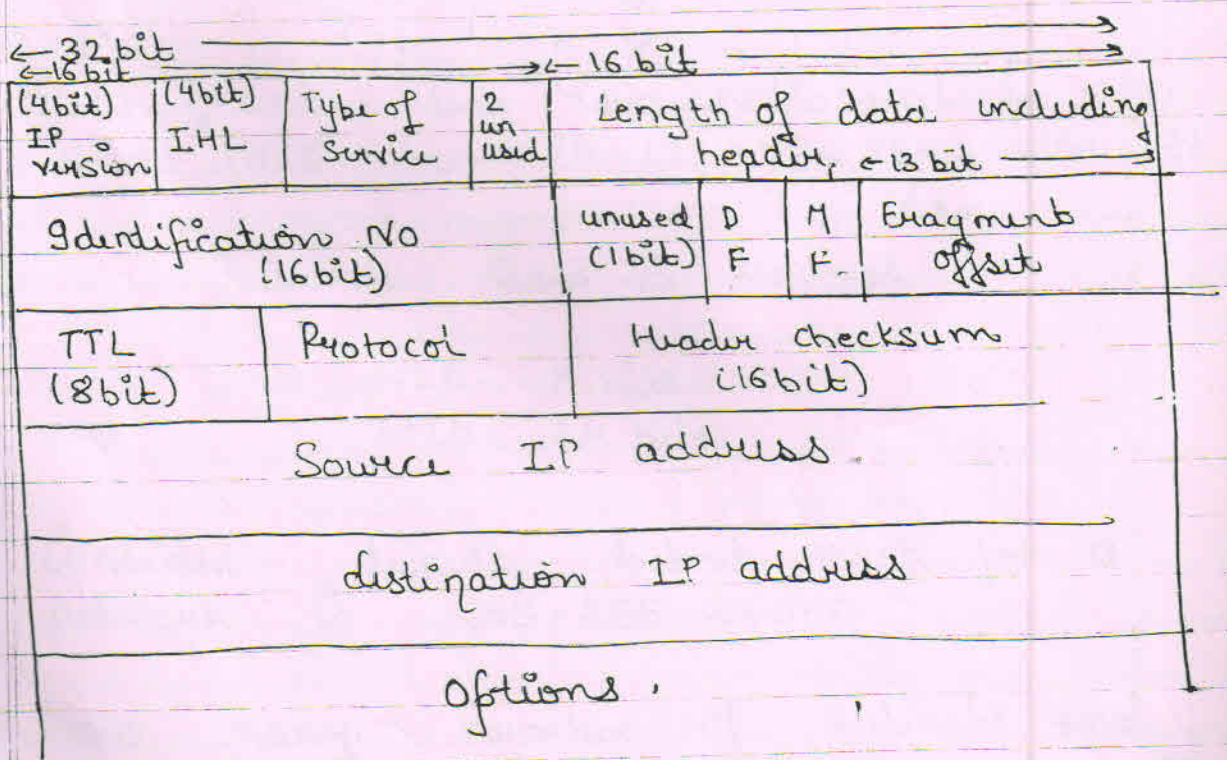
$255.$

2^{8-m}

IP- Header format :→

→ IP- Layer is connectionless unreliable layer.

- OSI model kahata hai ki network layer should be connection oriented but TCP for network connectionless hoti hai.
- TCP model for network- layer ki functionality kaam hoti hai as compare to OSI- model.
- DDL layer is the only layer that append both header & trailer.
- Network layer and transport layer append only information in header not in trailer.



i] Version field :→

- Version field hamne yeh batati hai aap IP ka konsa version use kar rahai ho. It is of 4 bit.
- After four bit, another four bit is for IHL (IP-Header Length). This field is necessary because IP-Header is of variable length.
- IHL : Since it is 4 bit long toh IHL ki max value 15 and min 0.
- Kya IP-Header sirf 15 byte ka hi hosakta hai kya??

Ans. In this format IHL min jo value store hoti hai woh actual header length nahi hoti.

Actual Header Length = 4 * IHL (in bytes).

- Minimum value of IHL is 5, less than 5 represent error.
- Compulsory IP-Header 20 bytes ka hota hai. aur maximum 60 byte ka.
- Next 6 byte is for type of service & next 2 bit is unused but actual min type of service field bhi unused hoti hai.

- Modern routers inko use nahi karte.
- Type of Service indicates kis - type ki service hai, reliable hai, unreliable hai, connection oriented hai, connectionless hai.
- Par IP is field ko dek K apne working mein kohi change nahi karta hai.
- Now next 16 bit for Total length of IP packet including header.

  Packet ki max size = 2^{16}

  aur

  data ki = $(2^{16} - 20)$ bytes.

- But throitical we have max datagram size 64K bytes (2^{16}) but in practically they are usually around 1500 bytes.
- Now next 16 bits for identification number.

Identification matlab, when ultimate host divide segments into packets then it assign some identification number to each packet.

- Har packet ka identification number hota hai.

- Suppose A wants to send data of 10Kb to host E, sabse pahale A ka data, segments mein divide hua then segment packet/data-gram mein divide hua.

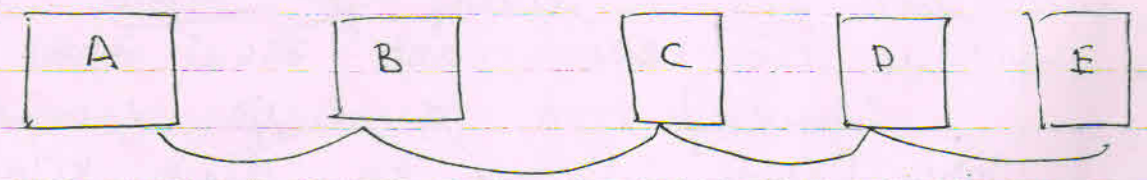
- Now source system (host) ki network layer har packet ko ek unique identification number assign karta hai.

- Packet ki size underline wire ki capacity ko dek kar decide ki jati hai.

- Now suppose B K pass gaye packet gaya, now suppose B se C se jane wale link ki underline capacity slow hai as compare to A and B. Toh packets k aur packets hogye par identification number jis packet ka joh hai woh same rahega.

- Bhalehi aap packets ko kitana bhi divide karlo.

- But packets ki merging ultimate destination par hi hogey., bich mein packet ki assembly nahi hogi, bahini aapko aachi bandwidth kyo na miljaye.



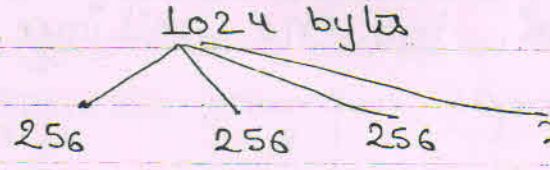
- Now we known that ki network layer connectionless hai, toh identification number 5 wale packet k agar 5 parts hue hai toh konsa bhi part pahale aasakta hai, Since connection less layer hai to ultimate destination ko merge karte samay kaise pata chalega ki yeh subpacket original ka pahala subpacket hai.

- Toh to solve this problem, fragment offset came into existance, woh field 13 bit ka hota hai.

- Fragment offset ki help se hum yeh bata sakte hai ki y subpacket konsi packet ka konsa wala hai, pahala hai, dusra hai, thisra hai like this.

- Fragment offset hame kya batata hai 1st byte of this packet is which byte of original packet.

- Suppose 1Kb ka packet agar four parts mein divide hua hai



Toh pahale packet ka offset kitana hoga.

- Next wale ka kitana hoga 256 and so on.

- Sabse pahale merging karna hai toh kaha se karegey packet with fragment offset 0.

- Hum actual fragment offset store nahi karte hai hum usko 8 se divide karke store karte hai

  Actual = 8 * Stored offset offset.

- Fragment offset hamesa 8 se divisible hona chahiye, agar nahi hai toh woh aapka fragment offset banana yog nahi hai, bus last wale fragment ko chor k sab 8 se divisible hone chahiye.

- Nahi hai toh error aayegy.

Ques:- How to find fragment offset of packet if current fragment offset is given-

- Fragment offset of next packet = Current + $\frac{(\text{Total Length} - (\text{IHL} * 4))}{8}$

Ques:- If fragment offset of current packet is 8. Total length of packet is 268 and value of IHL is 5 then what will be the fragment offset of next packet??

Ans→ $8 + (268 - 20)/8 = 39$ ← Ans

Ques:→ If current packet is second packet with fragment offset = 8 what is the size of first packet ??

Ans ↳

Total 64 byte data + 20 IP header
= 84 byte.

- Agar offset 8 se divisible nahi hai, toh something went wrong in the question data.
- Last fragment K fragment offset ko chor kar sare fragment offset 8 se divisible hona chahiye.
- Now question yeh kaise pata karegy ki ↳ last fragment hai.
- MF bit :- More fragment :→

→ Agar MF = 1 then is fragment k baad. is identification K aur bhi fragment exist karta hai.

- Jis packet ki MF bit 0 woh packet ka last fragment hoga woh original packet ka last fragement hoga.
- DF → Don't fragment :.
Agar DF field is 1 then us packet k aur fragment nahi hosakte.

- DF :→ Source Router, set karta hai.
- IP- Layer par jab bhi koi error aati hai woh ICMP handle karta hai.
- ICMP stands for Internet control Message Protocol.
- DF = 1 set hai aur hamne us fragment ko aur divide karna h tabhi hum send karsakte ho toh this situation is handle by ICMP, aur ICMP, ek error message "Unreachable destination" Source router ko send karega.
- Now next 8 bit for TTL (Time to Live)

→ TTL :- Every Router decrement TTL by one & Router on which TTL become 0, will discard the packet- (sabse pahale decrement then check)

- TTL measured in seconds. (destination bhi decrement karta hai)
- To avoid the indefinite traversing TTL field is used
- As TTL is of 1 byte its value is 255, at most ek packet at most 255 Router to cross karpakte hai.
- Now next 8 bit for Protocol is field mein highest layer i.e transport layer

Ka protocol konsa used karna hai woh batata hai.

- Then 16 bit for Header checksum.

↳ Har router checksum compute karta hai aur check bhi karta hai. because TTL change hoga to checksum bhi change hoga har router k liye.

- Header checksum check bhi karta hai aur laagu wale ka checksum bhi inkar k sakta hai.

- If Header of the same layer is already added then system first remove the header and then divide the data and then again add header to each divided packet.

Ques:- Consider a 1246 byte packet is recieved by router that has a PPP Link to next hop for the packet. The MTU (excluding IP) for the PPP Link is 255 bytes.

Ans ↳ (a) How many fragments will be there?

Ans ↳

1246 → include header

1226 → data

248 248 248 248 234

5 fragments (255 divisible nahi h 8 se isliye 248 liye)