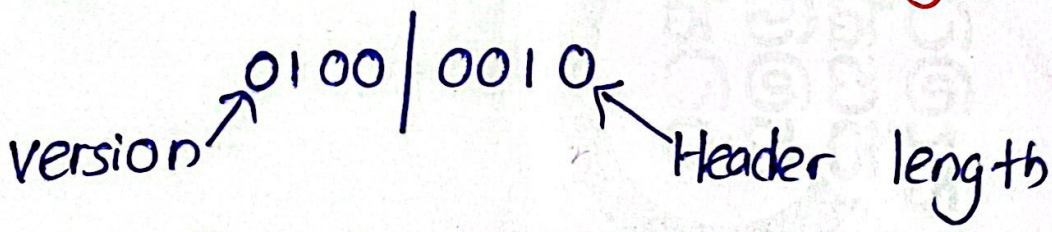
An IP Packet has arrived with the first 8 bits shown as 01000010 The receiver discards the packet why?.



0100 = 4

IPv 4

0010 = 2.

32 bits → one word = 4 bytes.

Header length in byte = Header length field value x 4

= 2 x 4

= 8 byte.

* The receiver discards the packet. because the header length is invalid. The header is too short to contain the request fields.

* The minimum number of the bytes in the header must be 20 byte.

An IP packet in value HLEN is 1000 in binary. How many bytes of options are being carried by this packet?

The HLEN value → $1000 = 8$ (8 4 2 1)

Total number of byte in the header $= 8 \times 4$
$= 32$ bytes.

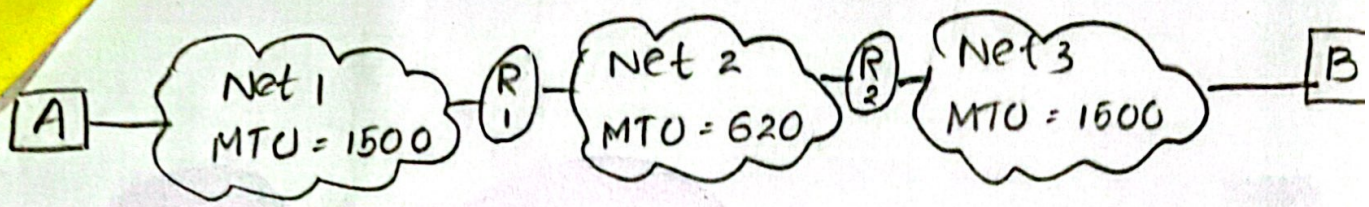
* The first 20 bits are main header, the next 12 bytes are the options.

What if the size of an IP datagram exceeded the MTU?

IP datagram is fragmented into smaller units.

What if the route contains networks with different MTUs?

Fragmentation.



Station A needs to send a payload size of 1400 byte (octets) to station B across the networks as shown above. Data needs to fragmented because the payload is too big to fit the smallest MTU size (620 bytes) ~~on~~ in one of the network.

We will assume that the size of the IP header is 20 octets.

MTU Frame = Header + data.

Paglaad size → 1400 bytes.

IP header size → 20 bytes.

MTU on one of the network → 620 byte

Maxium payload per fragment } = MTU - header size

= 620 - 20

= 600 bytes.

Number of fragment $= \frac{\text{Total payload}}{\text{Maxiam payload per fragment}}$

$= \frac{1400}{600}$

$= 3 \quad (600, 600, 200)$

Fragment size

01 → 600 + 20 = 620 byte

02 → 600 + 20 = 620 byte

03 → 200 + 20 = 220 byte.

Fragment offset

* offset is calcalated in unit of 8 bytes. (because IP uses 8-byte blocks)

Fragment 01 → offset 0 (start at the beginning)

Fragment 02 → $\frac{600}{8} = 75$

Fragment 03 → $\frac{1200}{8} = 150$

Fragment Number	Data length	Fragment offset (8-byte)	Total size	More Flag.
1	600	0	620 byte	1
2	600	$\frac{600}{8} = 75$	620 byte	1
3	200	$\frac{1200}{8} = 150$	220 byte	0.

What happen if data octets is not divisiable by 8

Pag load size → 1405 byte.

MTU → 620 byte

header size → 20 byte.

Maxium pagload per fragment } = 620 - 20 = 600 bytes

* first 2 fragment will still carry 600 byte of Pagload.

* Remain pag load

1405 - 600 - 600 = 205 byte.

Not divisiable by 8.

* Round up to nearest multiple of 8
  208 byte.

* padding of 208 - 205 = 3 byte is added to last fragment.

Fragment	offset	Payload size	total size.
1	0	600 byte	620 bytes
2	75	600 byte	620 "
3	150	205 byte (+3)	228 " 200+20+8

A datagram with size 2400 bytes must be fragmented according to an MTU limited of 1000 bytes.

Datagram → 2400 byte

Header length → 20 byte.

Payload → 2400 - 20 = 2380 byte.

MTU → 1000 byte.

Maxium payload for fragment } = 1000 - 20
= 980 bytes.

Number of fragment } = $\frac{\text{Payload size}}{\text{Maxium payload per fragment}}$

$= \frac{2380}{980} = 3$

$= (980 + 980 + 420)$

Fragment size

01 → 980 + 20 = 1000 byte

02 → 980 + 20 = 1000 byte

03 → 420 + 20 = 440 bytes.

Fragment offset

01 → $\frac{0}{8} = 0$

02 → $\frac{980}{8} = 122$

03 → $\frac{1960}{8} = 244$

Fragment	offset	Payload size	Total size
1	0	980 byte	1000 byte
2	122	980 byte	1000 byte
3	244	420 byte	440 byte.