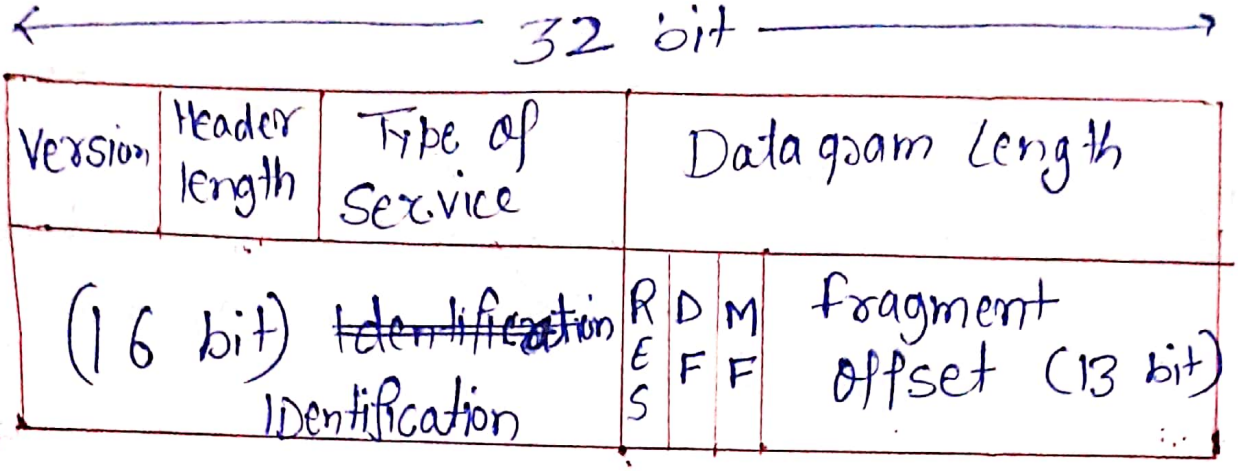
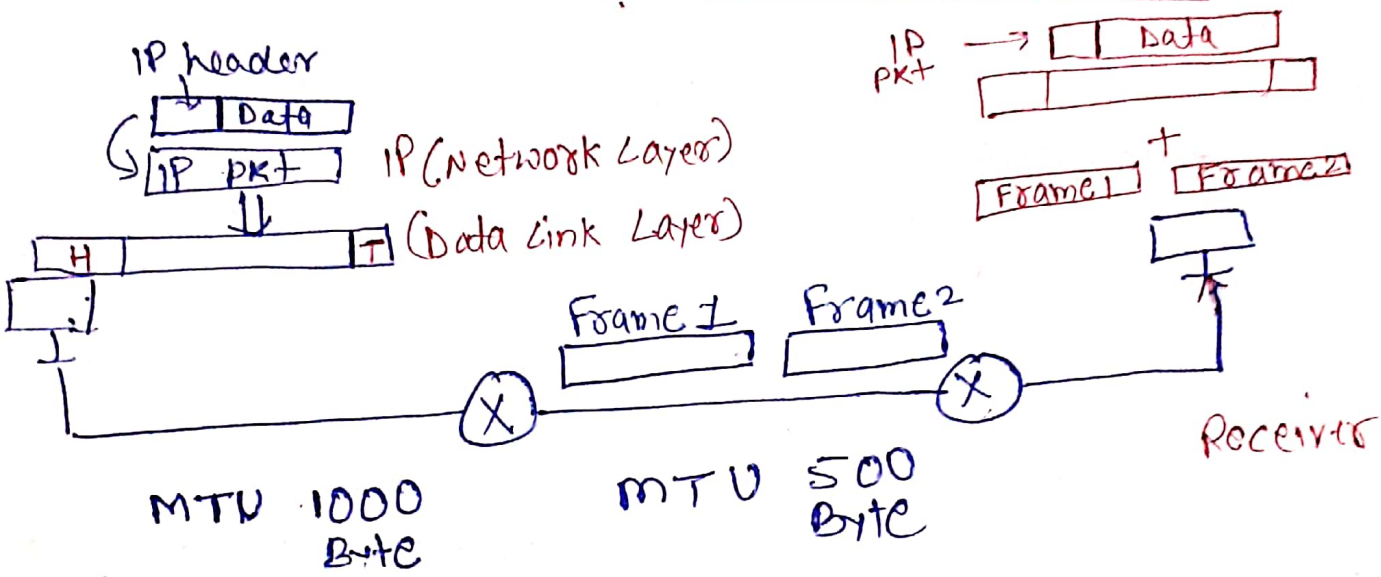
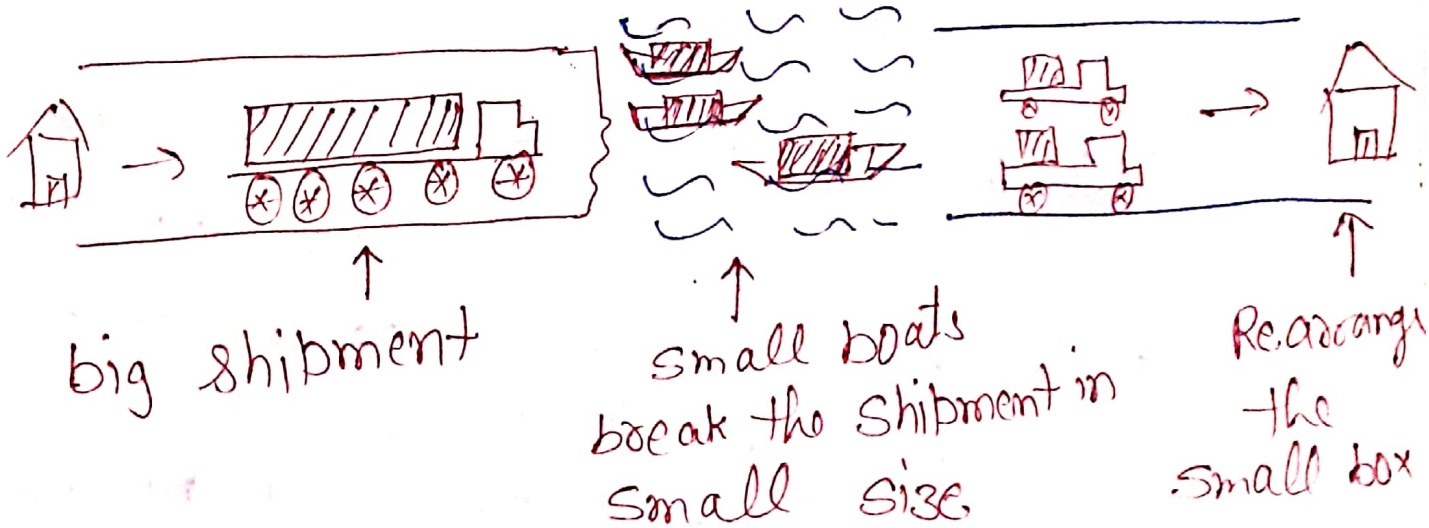
Fragmentation in IPV4 :





* Like transporting a big shipment.



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* DF → Do Not fragment
* MF → more fragment

IDENTIFICATION	RES	DF	MF	Fragment offset
16 Bit				13 bit

fragmentation is allowed at intermediate node

Not allowed

0 0
0 1
1 0 → Last / only fragment
1 1 → more fragment ahead

* Identification :- 16 bit → 2^{16} ids

Since pkt length :- 16 bit → 2^{16} possible size

* fragment offset :- number of byte ahead of current fragment.

∵ (FO) is 13 bit, but datagram length → 16 bit

$\frac{2^{16}}{2^{13}} = 2^3 = 8$, hence FO value should be.

up by the factor of 8.

Q :- A datagram of 3000 B (20 of IP header + 2980 byte data) reached a router, and need to be forwarded over a link with MTU of 500 Byte.

Calculate → No of fragment, overhead, DF, MF and offset value.

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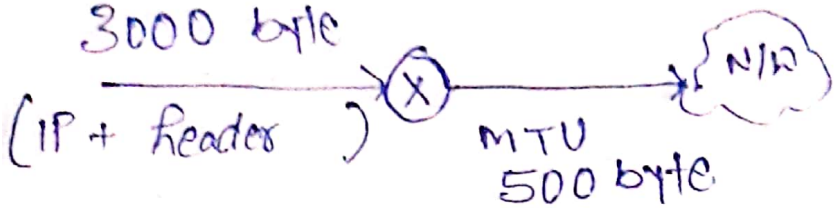

Now, how many fragment we do →

Total data we have → 3000 ⇒ (20 + 2980).

max. frame size (MTU) → 500 ⇒ (20 + 480)

* Each fragment need a new header, thus if MTU is 500 byte then we can put at most ≤ (500 - IP header) byte data.

* Fone fragment coont → $\left\lceil \frac{2980}{480} \right\rceil = 7$

6 full size → 480 x 6 = 2880 byte

1 have remaining 100 byte

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* here each fragment can have max 480 byte

we check that the bytes we are going to put in a fragment must be divisible by 8

$\frac{480}{8} = 60$ ok

* This is to calculate offset

if 482 then $\frac{482}{8}$ x not fully divisible

Reduce the data size to nearest divisible → 480

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	P_1	P_2	P_3	P_4	P_5	P_6	P_7
Identification	A	A	A	A	A	A	A
Size	480 + 20	480 + 20	480 + 20	480 + 20	480 + 20	480 + 20	100 + 20
DF	0	0	0	0	0	0	0
MF	1	1	1	1	1	1	0
offset	0	$\frac{480}{8} = 60$	$\frac{(480+480)}{8} = 120$	$\frac{480}{8} + 120 = 180$	240	300	360

Represent data ahead of this fragment ($\times 8$)

$360 \times 8 = 4000 + 160 = 4980$

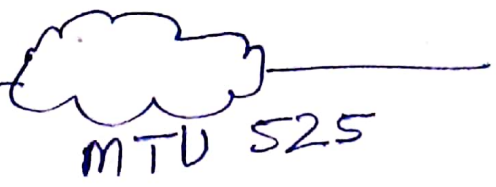
* Over head $\Rightarrow$ $\frac{\text{Actual data}}{\text{total data}}$

120 byte new over head $\Rightarrow$ $\frac{4980}{4980 + 20 \times 7} = \frac{4980}{5120} = .97$

20 byte old over head $\rightarrow$ $\frac{4980}{(4980+20)} = .996$

Q:- 40 | 1200

20 | 1500



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