10/3/21

Layering:

To break up the Communication task into sperate Components and activities.

Advantages:

To reduce design Complexity: Networks are organised as a services of layers & levels each layer build upon one below it.

Services:-

set of actions/work that a layer offers to another (higher) layer

protocol:-

set of rules that layer uses to exchange information.

Interface:-

Comm^c B/w the layers high. Com^c Can be Hardware & Software.

ISO-OSI Reference model (7 layers).

7	Application	Consists user protocol rear to end user.
6	presentation	
5	Session layer	
4	Transport layer	responsible for process to process delivery of segment) port addressing. desegmentation & segmentation
3	Network layer	responsible for Source node to destination delivery of packet & also for rooting. & also addressing.
2	Data link — MAC / LLC	Pkt to frame, MAC, LLC (logical link Control)
1	Physical layer	responsible for electrical, mechanical properties of the devices & Networks

- Comm^c modes
- frams to bits.
- Tropology.
- datarate. (bits/Sec)

Scanned with CamScanner

MAC (media acess control layer)

TDMA
FDMA } protocals
CDMA

LLC (responsible for node to node conversion.
packet to frame conversion)

5) session layer responsible for establisment of session
maintain entire session
& terminating session

6) presentation layer — " — syntact & scematic of
information to be presented
at application layer

⇒ 7,5,6 → user Support layers.
1, 2, 3 → network support layers.
4 → link B/w user support & N/w Support layer

→ Information in 7,5,6 is known as message.
— " — ~~1/2/3~~ 4 : — " — Segment
— " — 3 — " — packets
— " — 2 — " — Frames
— " — 1 — " — bits.
stream.

→ address in 7,5,6 layers is known as user specific address
Eg:- sjce.ac.in, IISC, ·errot·in.
(16 bit)
— " — 4 — " — port address.
— " — 3 — " — IpV4 / Ip V6 (32/128)
MAC/link / Ethernet

ISO-OSI reference model

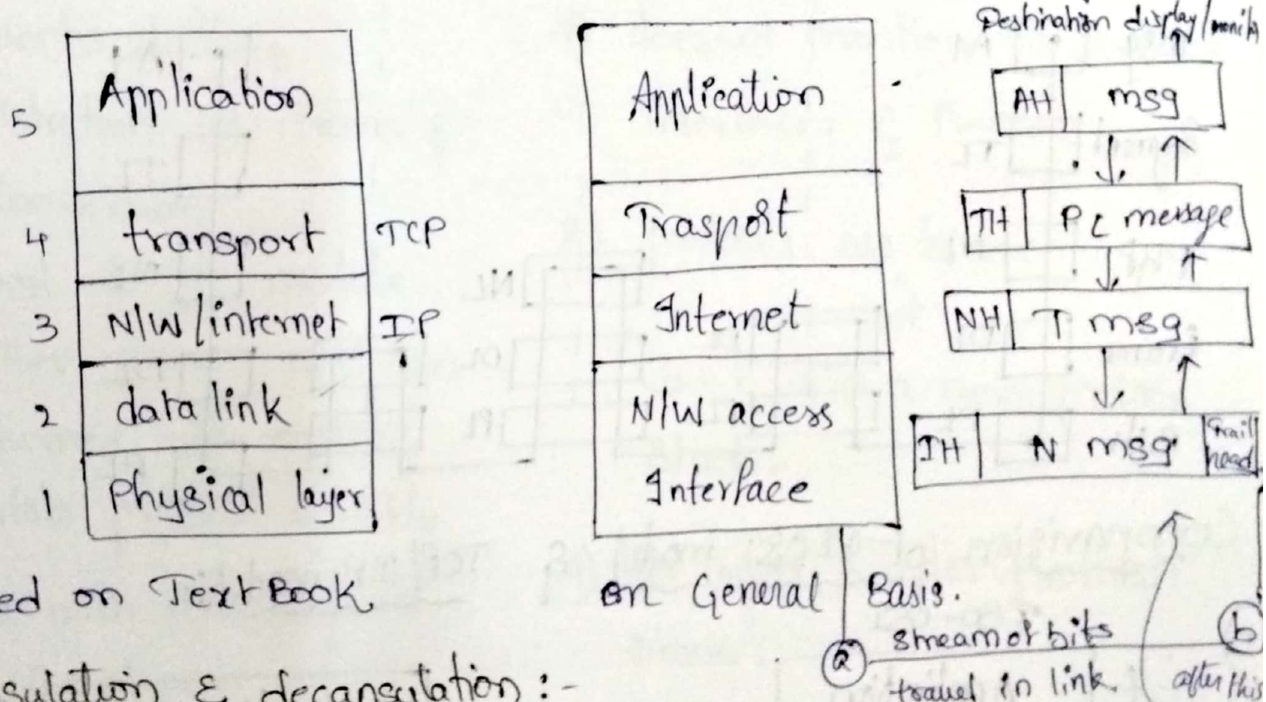
11/3/22

open System → Set of protocals that allows 2 diff Sys to Communicate regardless of underlying network architechure.

ISO → organization. (Sets the Std for Comm^c protocals).

OSI → It is a ~~module~~ model but not a protocal.
It is model for understanding and designing a N/W architechure which is flexible, robust and interopersible.

TCP/IP protocal Suit (Trans~~mission~~ Control protocal) / Internet protocal
port



Based on Text Book. on General Basis.

encapsulation & decapsulation :-

↳ process of Converting application layer message (high level information) into transport level (low level information)

↑ draw again beside

↑ in above fig it same diagram

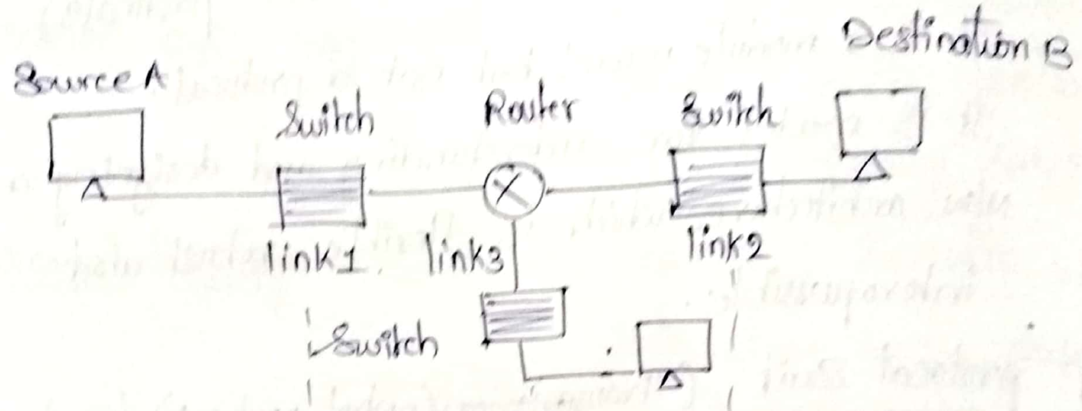
↑ is decapsulation with opp direction

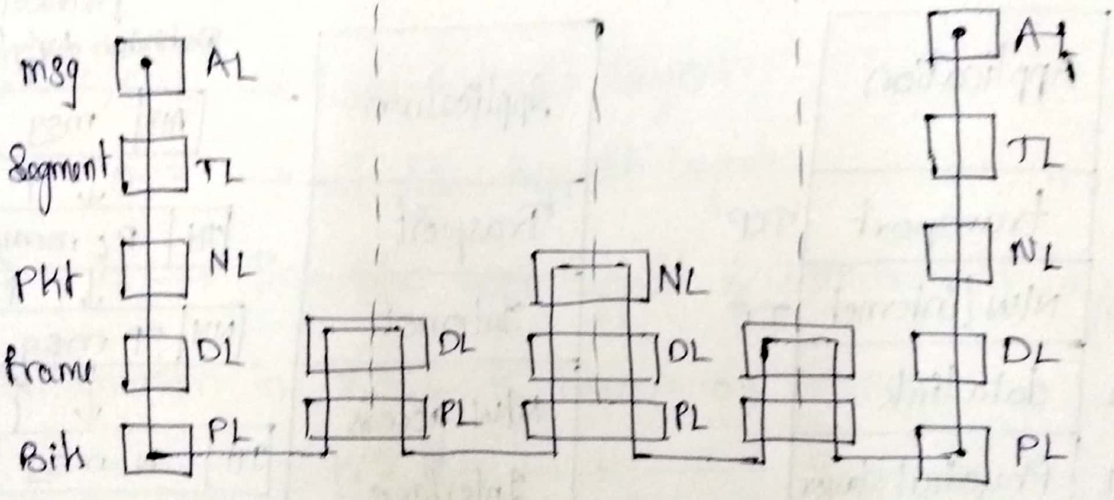
④ TCP/IP

Commuction

TCP/IP

Communication through Internet :-





Comparision of ~~OI~~ OSI model & TCP/IP model:-

ISO-OSI		TCP/IP
7	Application	Application
6	presentation	
5	Session	Transport
4	Transport	
3	network	N/W / Internet
2	Data	Datalink } N/W acess layer
1	physical	physical } N/W acess layer

2) open Sys inter Connection	2) protocal model (Transmission control protocal / Internet protocal)
3) protocal independent standard	3) TCP/IP model depends on std protocal.
4) It act as an interaction gateway B/w user & N/w	4) It is a Connection oriented protocal that asign the N/w hosts over the internet.
5) OSI model is Created first then protocals are developed that fit the N/w architechture	5) protocals are developed first then built on TCP/IP modle
6) Provides the QOS.	6) doesnot provide QOS.
7) Represents defines administration interfaces & data Conversion	7) doesnot mention the Services interfaces & Protocals.
8) protocal of OSI module are better unseen and Can be retumed with another appropriate protocal quickly.	8) protocals are hidden. & not Can't fit a new protocal stack.
9) involve with more layers hence Complex.	9) less layers, simpler protocals stack.
10) uses horizantal approach for analysis.	10) uses vertical approach for analysis.

Similarities B/w ISO-OSI model & TCP/IP model:-

1) both uses layered architechure.
2) both are logical models.
3) both the models defines the std for Networking & protocols.
4) both the models provide the frame work for creating & implementing networking std's & 'devices'.
5) both the models divide the N/w commᶜ process into making their layers.
6) In both models manufacturer allows making sets, devices and N/wing component that can work independently.
7) In both the models a single layer defines a particular ~~personality~~ functionality and set the std for that layer
8) both the models simplify their 'troubleshooting process' by dividing the layers complex funᶜ into simpler components of layer.

Multiplexing & Demultiplexing :-

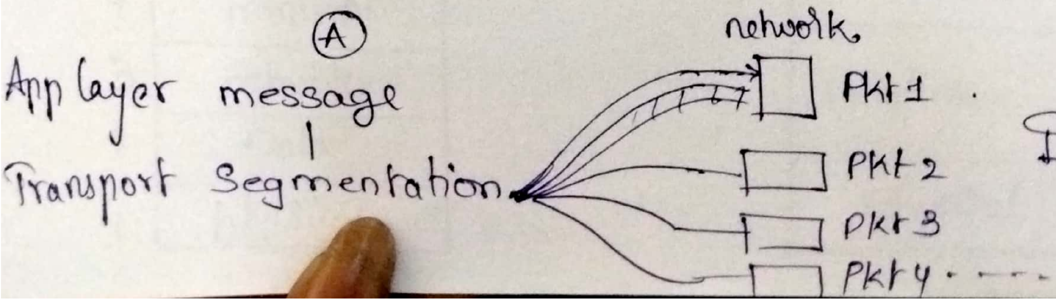
Converting segment into transportable packets.

process of combining & converting packets into segment.

(many → one)

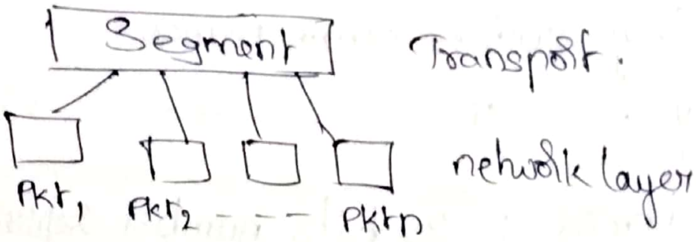
Demultiplexing is process of converting segment into packets which are suitable for transmission media.

Ⓐ



Demultiplexing

(R)
receiver

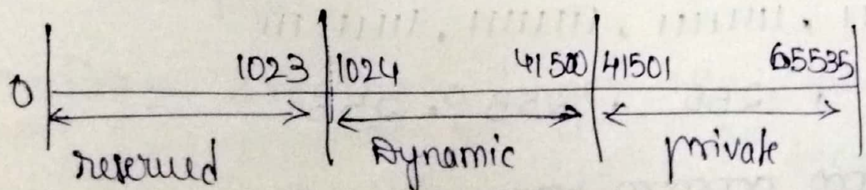


Addressing :-

Address : unique bit pattren & alphabet & strings assigned to each system. assigning this is called bits addressing.

Application	→ user Specific address
Transport	→ port address.
Network	→ logical address / IP address.
N/W acess layer	

* user Specific address is unique address representing a organization or institute or person.
  Eg:- www.sjce.ac.in, (email), ...
  this address can be used for Sending & receiving text msg it can't be used for universal Comm^n. even though its address is unique address.
* port address: is 16 bit address assigned by authority



http (80)
FTP-(20-21)
port number ↑

→ it is unique address assigned for protocals. SNTP → 20

IANA (internet assigned number authority).

Partially Qualified domain names
fully ——— " ———

IP address : 32 bits number represented by doted decimal number. this is universal number.

representation : a.b.c.d

Eg: 192.10.8.2

classful addressing

class A

0 . . .

if most significant bit is 0 then it is called classful addressing

00000000 00000000 00000000 00000000

0 . 0 . 0 . 0

01111111 11111111 11111111 11111111

127 . 255 . 255 . 255

any number B/w 0 to 127 is under classful address.

Net ID

$2^{\cancel{32}\ 24}$ devices can be addressed

N/W ID Host ID

class B 10 . . .

Starts with 10.

10111111 . 11111111 . 11111111 . 11111111

191 . 255 . 255 . 255

10000000 00000000 00000000 00000000.

128 . 0 . 0 . 0

Host ID

2^{16}.

Net ID Net ID

class C :

Net ID	Net ID	net ID	Host ID
110			
11000000	00000000	00000000	00000000
192 .	0 .	0 .	0
223 .	255 .	255 .	255 .

$2^8 = 256$ in each N/w we can address 256 devices.

→ one sender & one receiver, one-to one Commⁿ.
(source) (desination)

class D :-

net ID			
1110			
11100000 .	00000000 .	00000000	00000000
224 .	0 .	0 .	0
11101111 .	11111111	11111111	11111111
239 .	255 .	255 .	255

class E :- not used for any applications.

1111			
11110000	00000000	00000000	00000000
240 .	0 .	0 .	0
11111111	11111111	11111111	11111111
255 .	255 .	255 .	255

→ I can't change IP number but ~~can~~ host number.

Subneting :- process of dividing largerh N/w into smaller N/w.

Superneting :- creating a larger N/w, used in router to decrease the RT

IP → classful addressing

A — 0-127
B — 128-191
C — 192-223 } unicast
D — 224-239 — multicas
E — 240-255 — reserved.

$2^3 = 8$ Subnets 198.16.8.0

$2^2 = 4$ Subnets 198.16.8 bbbxxxxx

$2^1 = 2$ subnets.

classless addressing.

prefix notation or CIDR notation.

addresses in a N/w $\propto \frac{1}{\text{prefix}}$

126.1.1.10/8 → no.of. bits in N/w.

here 8 bits intidates Net Id & 32-8 bits indicates host 24.

Subnet mask:-

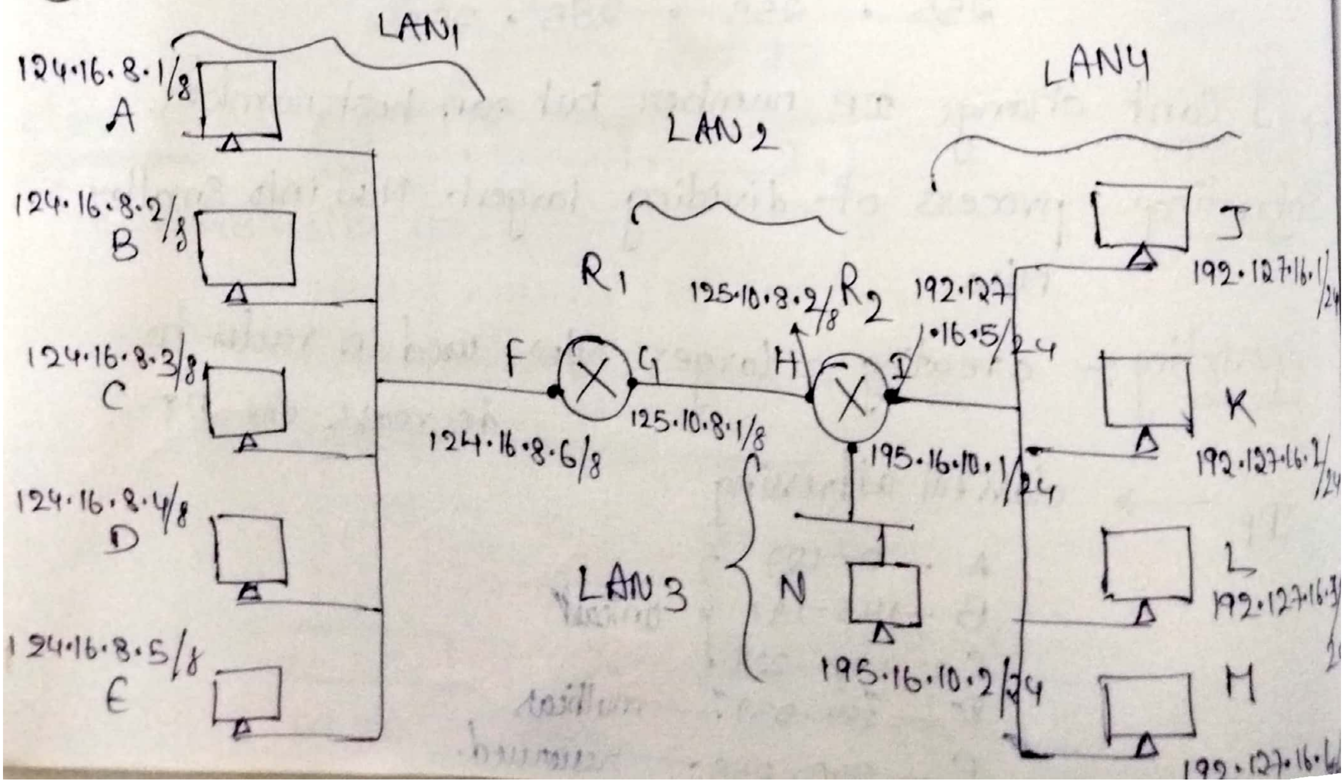
129 . 2 . 10 . 1 / 22

$\underbrace{10000001\ 00000010\ 000010}_{\text{net ID}}\underbrace{10\ 00000001}_{\text{Host ID}}$

255.255.252.00 → subnet mask.

and or of data & sent it.

(1)

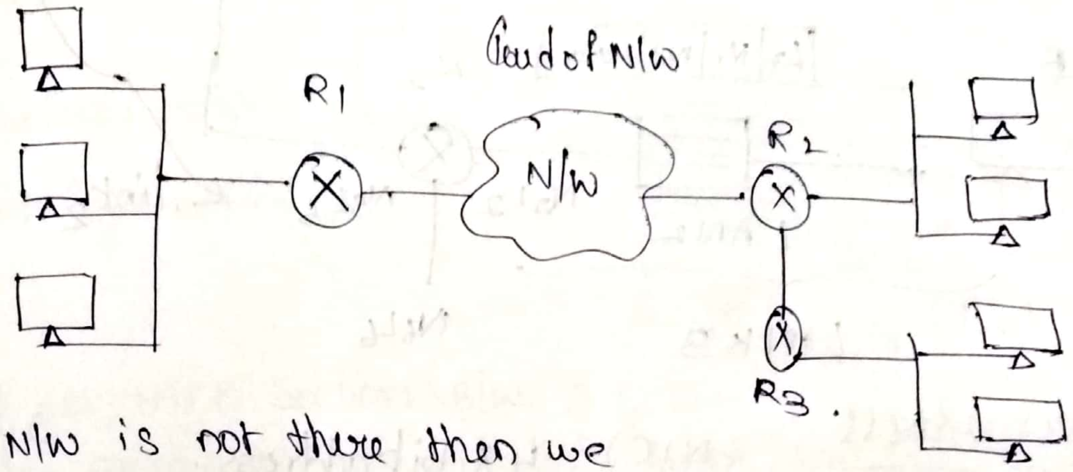


① Identify no.of Segments of Networks.

4 N/ws in given fig (LAN1, 2, 3, 4).

② Identify nodes & allocate IP addresses.

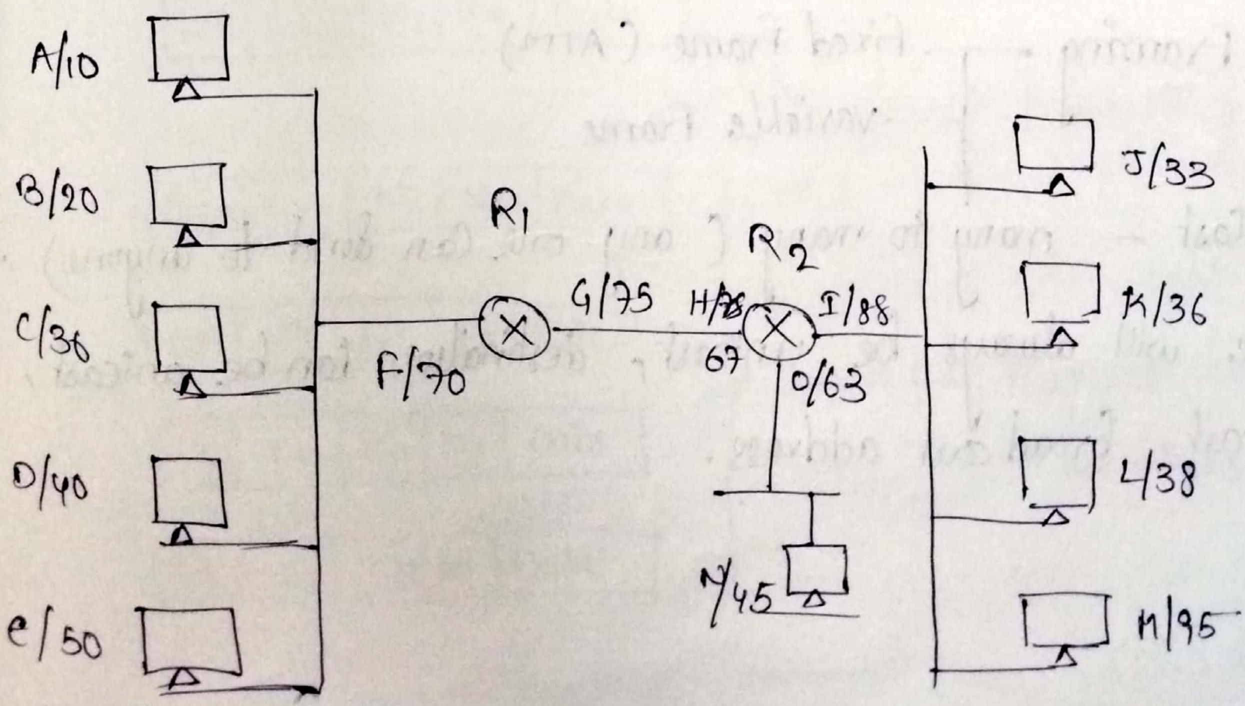
②

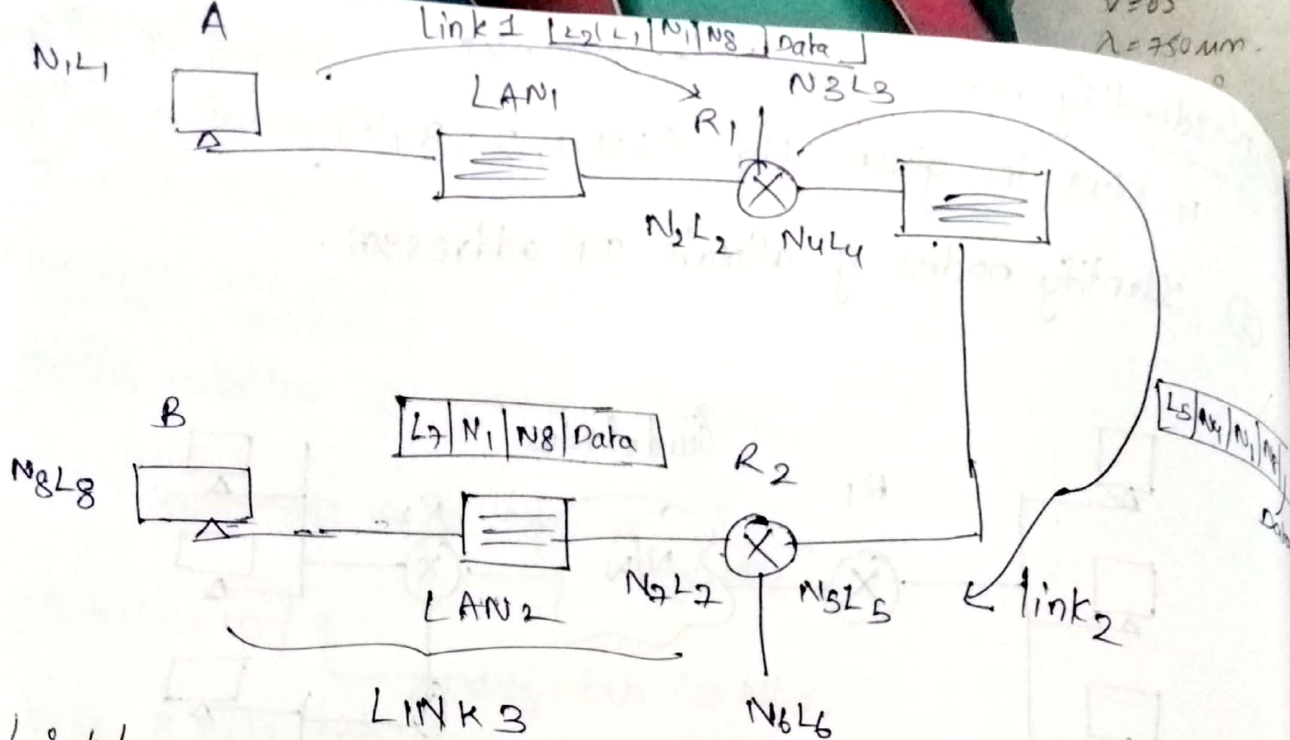


→ if N/W is not there then we can say 6 N/w's but we can't say how many no.of N/w's we have in clould of N/W.

③ There is HTTP Sesion B/w host A & to host M write a Data graph at diff point of N/W (refer ①).

Assume all alphabets denotes IP address. & numbers indicate (mac address or, link address)





Linklayer address :- (NIC) 48 bit address. 21/3/22

A6 : f2 : f3 : AB : BC : BE

10100110 — FF - broadcast

0 - unicast

1 - multicast

unicast address — 1 source, 1 destination

least significant "bit"

the ~~last~~ first bit of the most significant "byte" gives info about unicast & multicast.

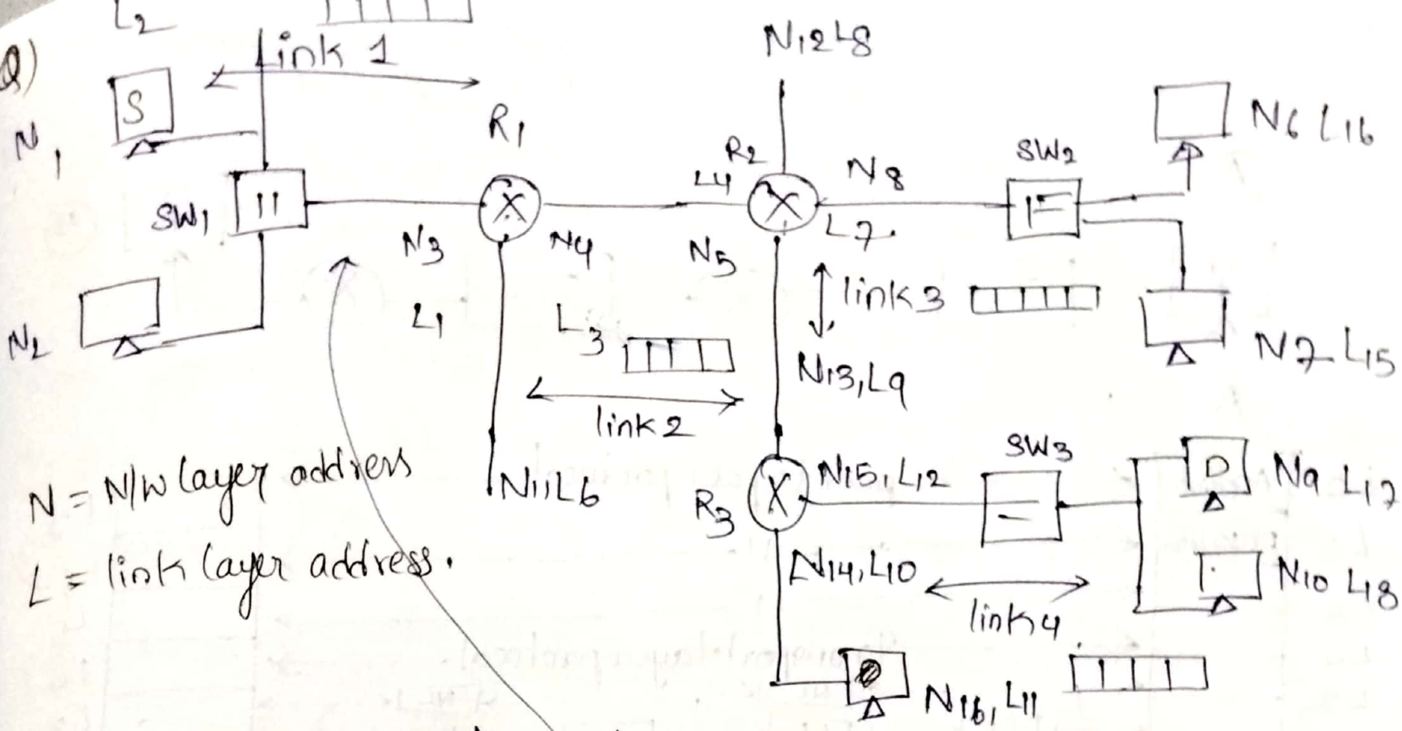
framing — fixed frame (ATM)

— variable frame

broadcast — many to many (any one can send to anyone)

Source will always be unicast, destination can be unicast, multicast, broadcast address.

Q)



N = N/w layer address

L = link layer address.

There is an HTTP Section B/w. S & D.
write the Datagraph at diff link layer. and N/w layer.

| L4 | L2 | N1 | N9 | Data. | — link 1

| L4 | L3 | N1 | N9 | Data | — link 2

| L9 | L7 | N1 | N9 | Data. | — link 3

| L17 | L12 | N1 | N9 | Data | — link 4.

→ transmitting datagraphs.

N/w & Data Layer remains same in entire transmission.

| | | N | N' | Data |

| L12 | L17 | N9 | N1 | Data | → 1

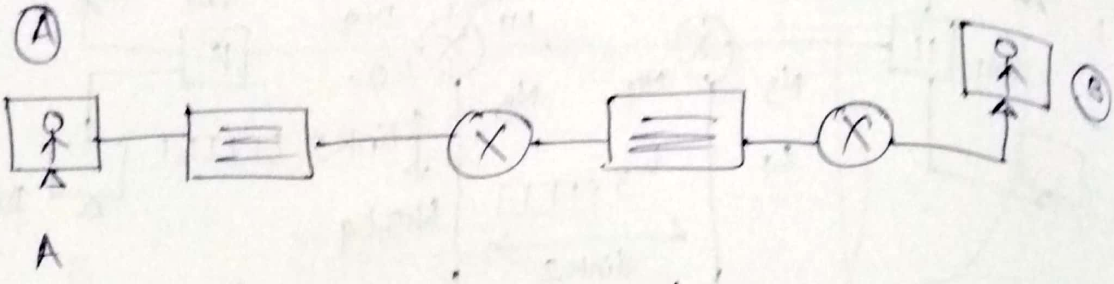
| L7 | L9 | N9 | N1 | Data | → 2

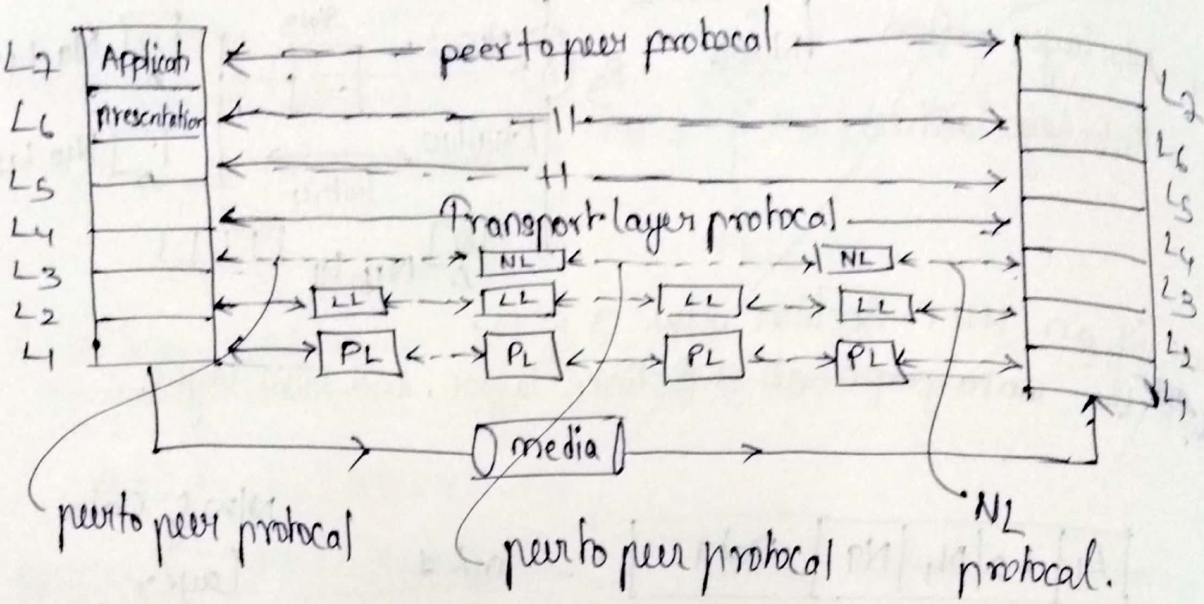
| L3 | L4 | N9 | N1 | Data | → 3

| L2 | L1 | N9 | N1 | Data | → 4

→ Response Data graphs.

Pear to Peer Communication : & peer to peer protocol





Datalink layer

Physical layer and datalink layer are territories of networks that make up the internet.

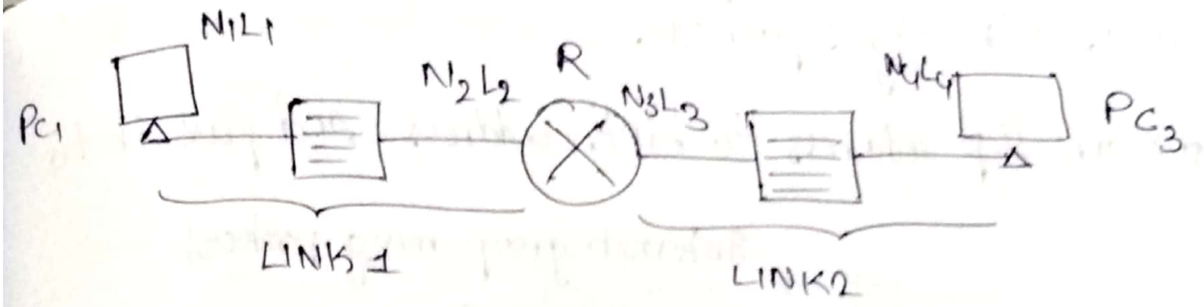
Data link layer and physical layer provide a services to upper 3 layer of TCP/IP protocal suit.

physical layer provide a services to datalink layer and data link layer use the services.

Datalink layer → Framming, flow control (management of data flow b/w nodes in N/W), Error detection, ~~Con~~ Addressing of frames, Congestion control

→ node to node delivering of frames

→ how to share media ~~memory~~ among several users / devices.



Two types of links

① point to point link

② Broad Cast link.

point to point link : Link is dedicated B/w two devices.

Eg:- chat using telephones.

Broad Cast link : Shared B/w several pairs of end devices.

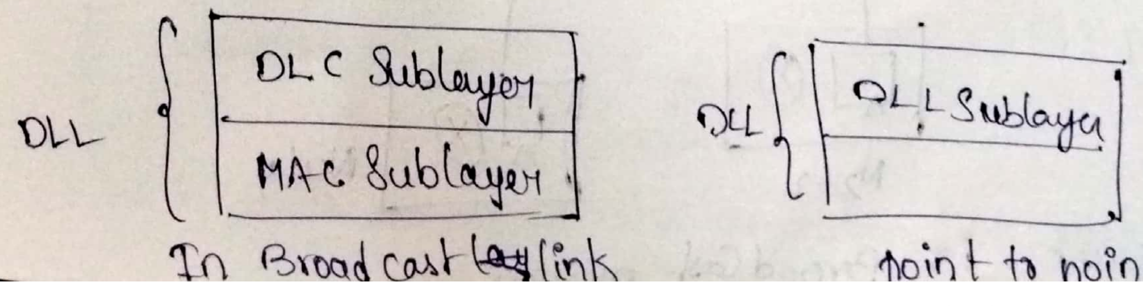
Eg:- Cellular Comm^c (mobile Comm^c).

→ Can be wired & wireless,

Data link layer — Digital link Control (DLC)
— media access control (MAC)

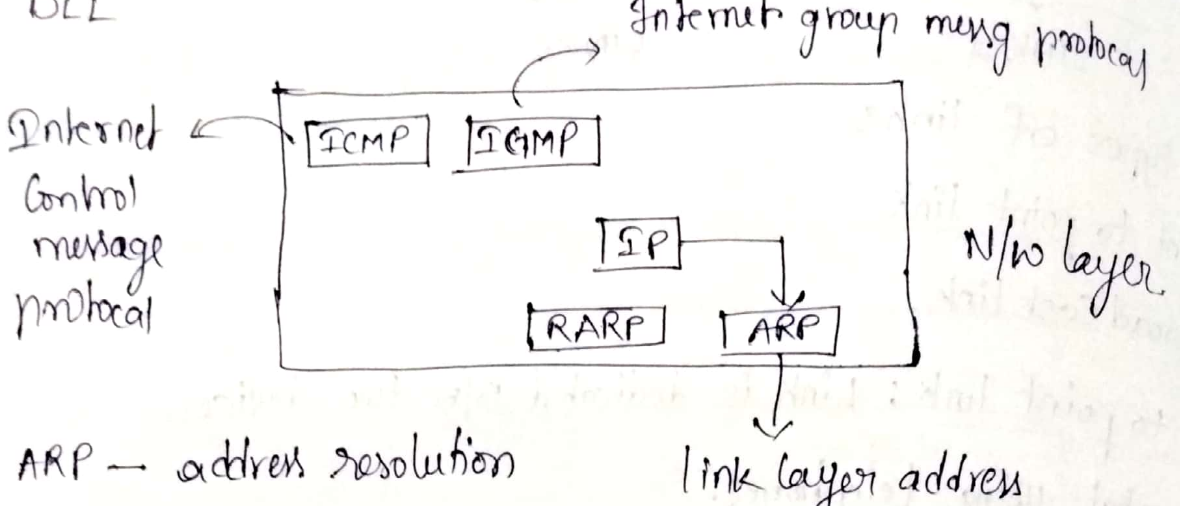
→ DLC deals with flow Control, error Control, congestion control, framming and node to node ~~dealing~~ delivery of frames, Deals with issues related with both, point - point link & Broad Cast link.

→ how to share data rate/BW of media B/w seveeral devices in broad Cast link.



ARP : It is N/w layer protocal.

→ it maps an Ip address to Link address and pass it to DLL



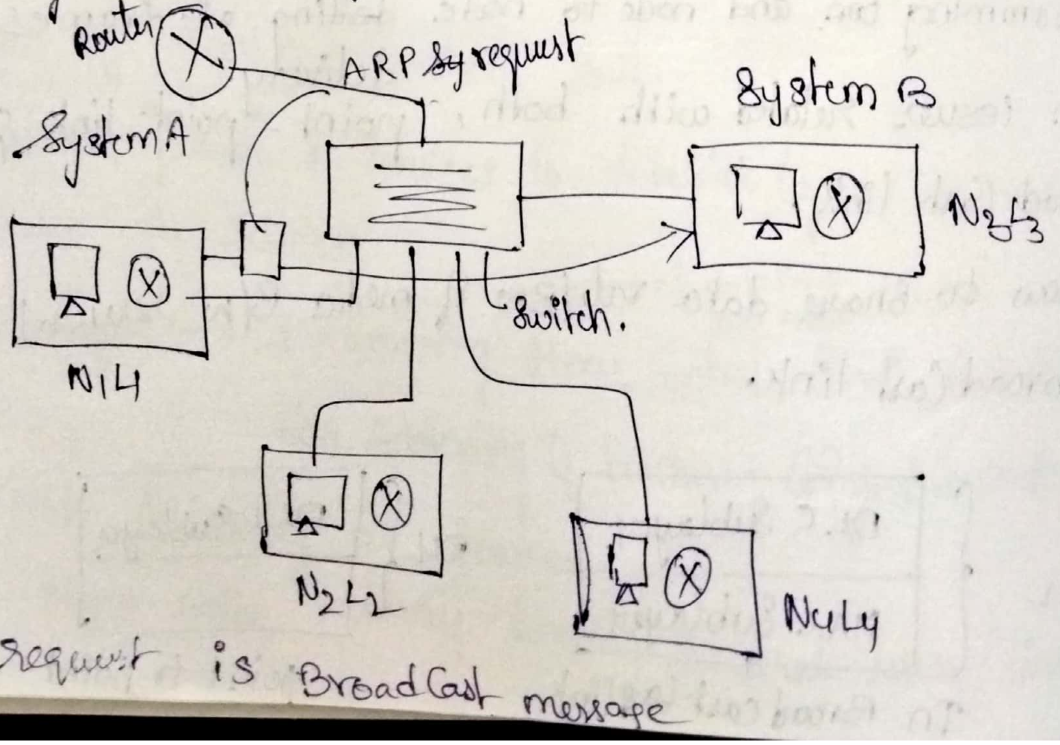
ARP — address resolution protocal

RARP — Reverse resolution protocal.

ARP requests Contains

- → IP and link layer address of source
- → IP address of destination.

Equating on Link layer address is broad cast on LAN/WAN,

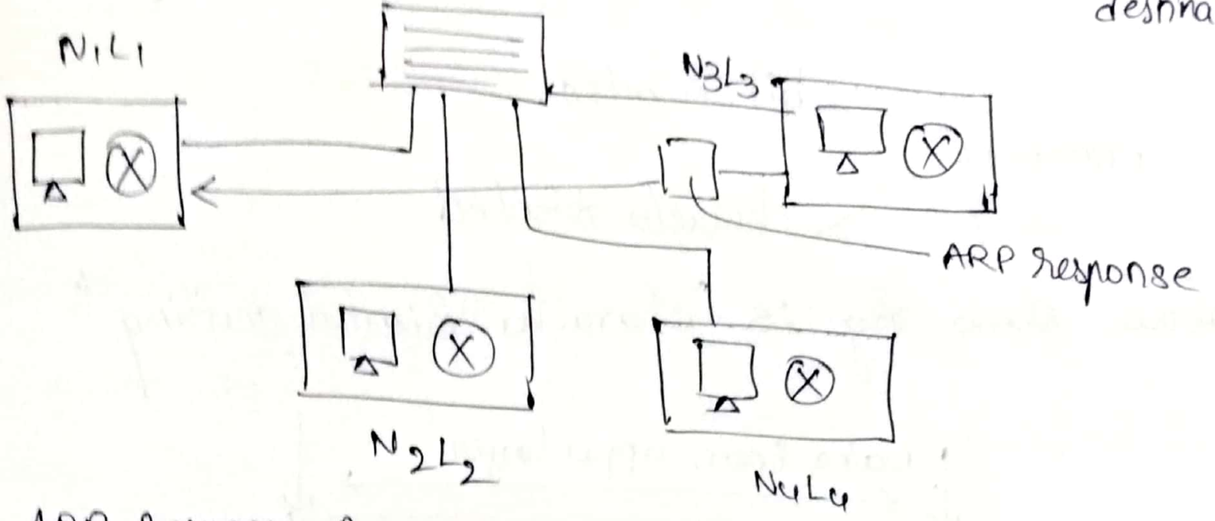


ARP request is BroadCast message

ARP looking for link layer address of 4 node with IP address

(N1L1, N3)

Source — (N1L1); destination — N3



here ARP response is point to point message

Frame Size :-

① Fixed Size frame

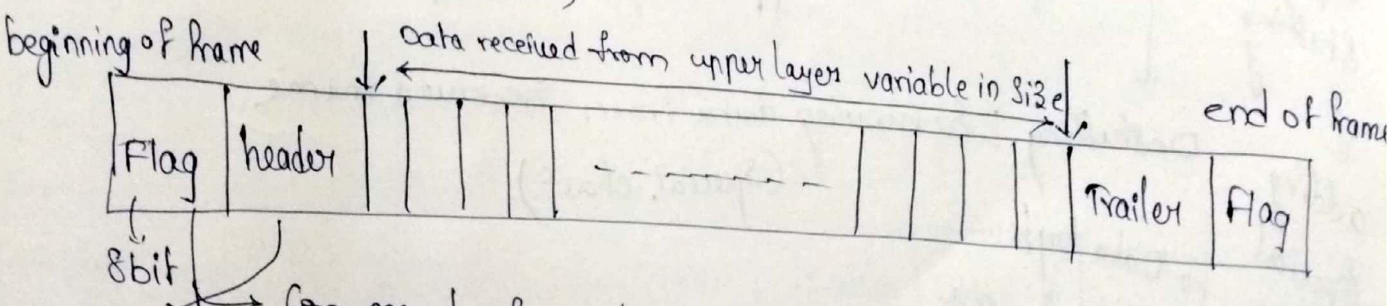
we need not define the boundary of frame. Size itself used as delimiter

Eg:- ATM, (asyncronous N/W. transfer mode N/W)

② Variable Sized frame

we need to define the (boundary) start & end of frame

Eg:- used in local area N/W. (LAN)



→ Composed of protocal dependent → FSM, HDLC, PPP, S&W protocal.
Special characters (ESC)

→ 1byte, used to seperate one frame from next frame.

→ it Consists of source and destination link layer address.

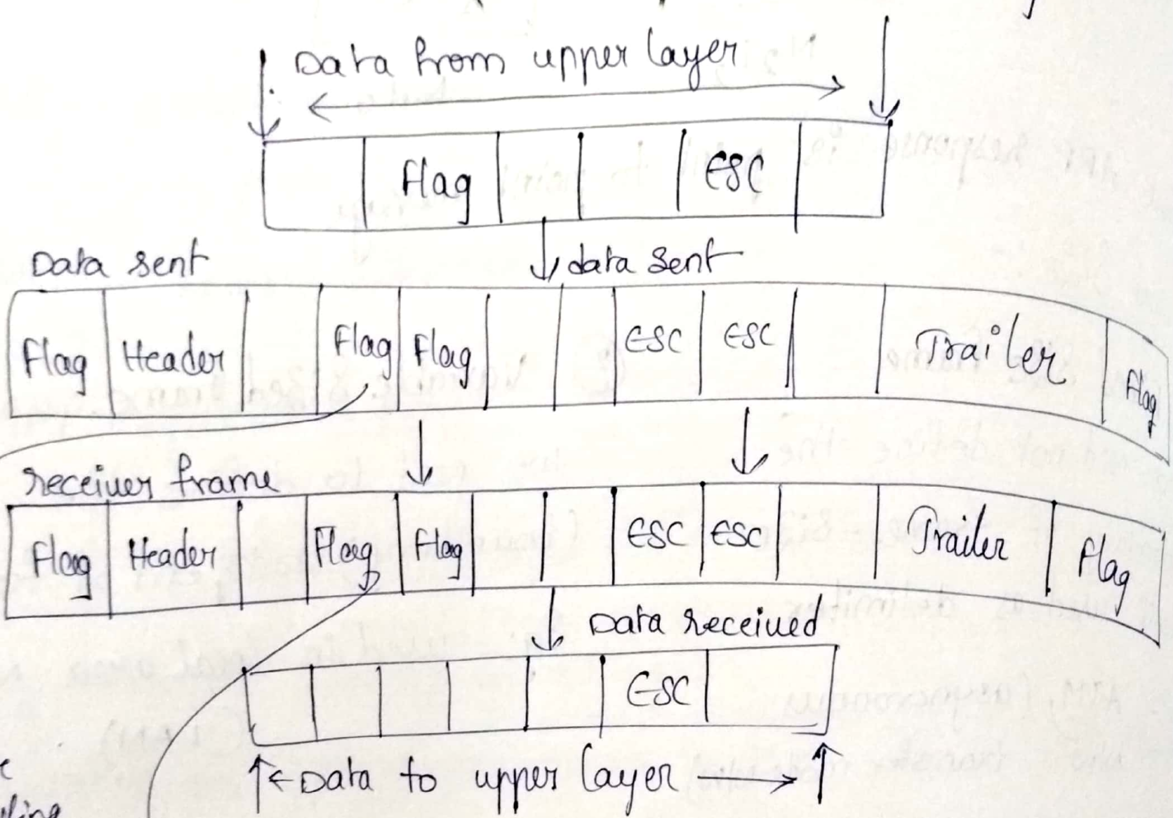
~~Carrier~~ (Trailer is)

~~error detection redundant~~ bits & multip

Trailer Carries error detection, redundant bits & multiplexer

framming
- bit oriented .
- character oriented

above show fig is "character oriented stuffing"



Byte stuffing → adding special char to Data byte of frame

Destuffing : removing data from received frame (special char^c)

→ This entire thing is char^c stuffing .

→ All bytes in above diagram are ascii. char^c

char^c ~~Shift~~ Stuffing or byte Stuffing :-

Process of adding one extra byte or char^c wherever there is flag or esc in data Section or Text of frame.

Bit Stuffing (Bits oriented framing).

Flag ← data Section of frame → Flag

0111110	Header	0111101111111001010111	Trailer	0111110

→ The delimiters are used to define beginning and end of frame
- (Flag = 0111110)

→ if the flag patteren (01111110) appears in data Section. then one extra bit is added after the pattern. this means after Consecutive 5 ones, two bits are added in data Section.

→ it is process of adding one extra zero whenever flag pattren is present in the data Section., so that receiver doesnot mistake the flag pattren is Called bit Stuffing.

Data from upper layer.

0111110100111110 0100

↓ Stuffed.

Frame Sent

Flag	Header	01111101001111100100	Trailer	0111110

0111110

Two 0 bits. are Stuffed

Frame received

0111110	Header	0111110010011111000100	Trailer	0111110

↓

01111101001111100100

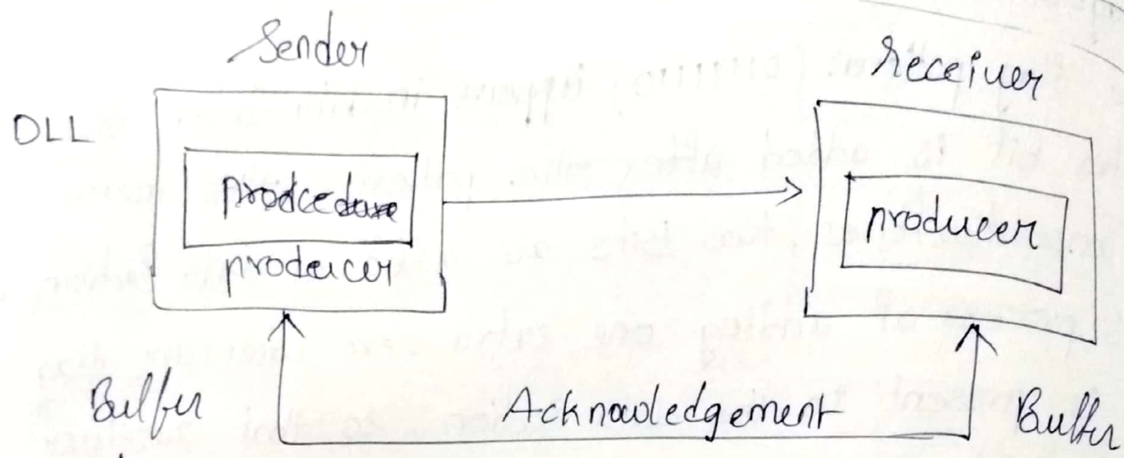
Data to N/w Layer.

Flow Control and Error Control :-

Process of managing the rate of data transmission B/w two nodes or more nodes to prevent fast sender with slow receiver.

It is set of protocal/ ~~protoc~~ procedure used to restrict amount of data sender can send before receiving acknow

→ Services provider by DLL | protocal



↳ set of memory location that can hold packets at receiver and sender suppose if receiver buffer is full then it should acknowledge to sender by not pushing packet/frame.

error Control :-

It is process of checking correctness of frame B/w the two nodes in a link.

In data link layer CRC (Cyclic redundancy check) is added to frame header by sender & check by receiver.

In receiver used 2 methods to check correctness of frame

i) After receiving frame if frame is ~~Corrected~~ Corrupted it is simply discarded. else frame is sent to upper layer (N/w layer) → first method

ii) in this Case sender doesn't know the Correction of frame that was sent.

ii) After receiving frame if frame is Corrupted Simply discard the frame & inform the sender. else if frame is not corrupted deliver to N/w.

at any chance receiver will not deliver corrupted frames to upper layer.

→ This is node-node flow Control & error control. (in data link layer).

→ in transport layer flow Control & error Control are from (Source to destination).

→ <u>Service provider by DLL</u> :-

<u>Connection less.</u>	<u>Connection Oriented.</u>
→ frames are send via any node.	→ Connection is established before sending frame.
→ frames are not numbered/ordered.	→ All frames are numbered and delivered to upper layer.
→ If receiver receives frame just sent to upper layer,	→ if receiver receives the out of order (OOO) frames it will be buffered & sent to upper layer once. OOO frame received.

Protocols :-

→ FSM (finite Space machine)

→ Simple protocol.

both protocols Assumes channel/ media is noiseless.

Stope & wait
Go BackN
SR

} channel is noisy

not in syllabus.

→ HDLC
→ PPP

} Bit oriented protocol.