END Term

Error Control:-

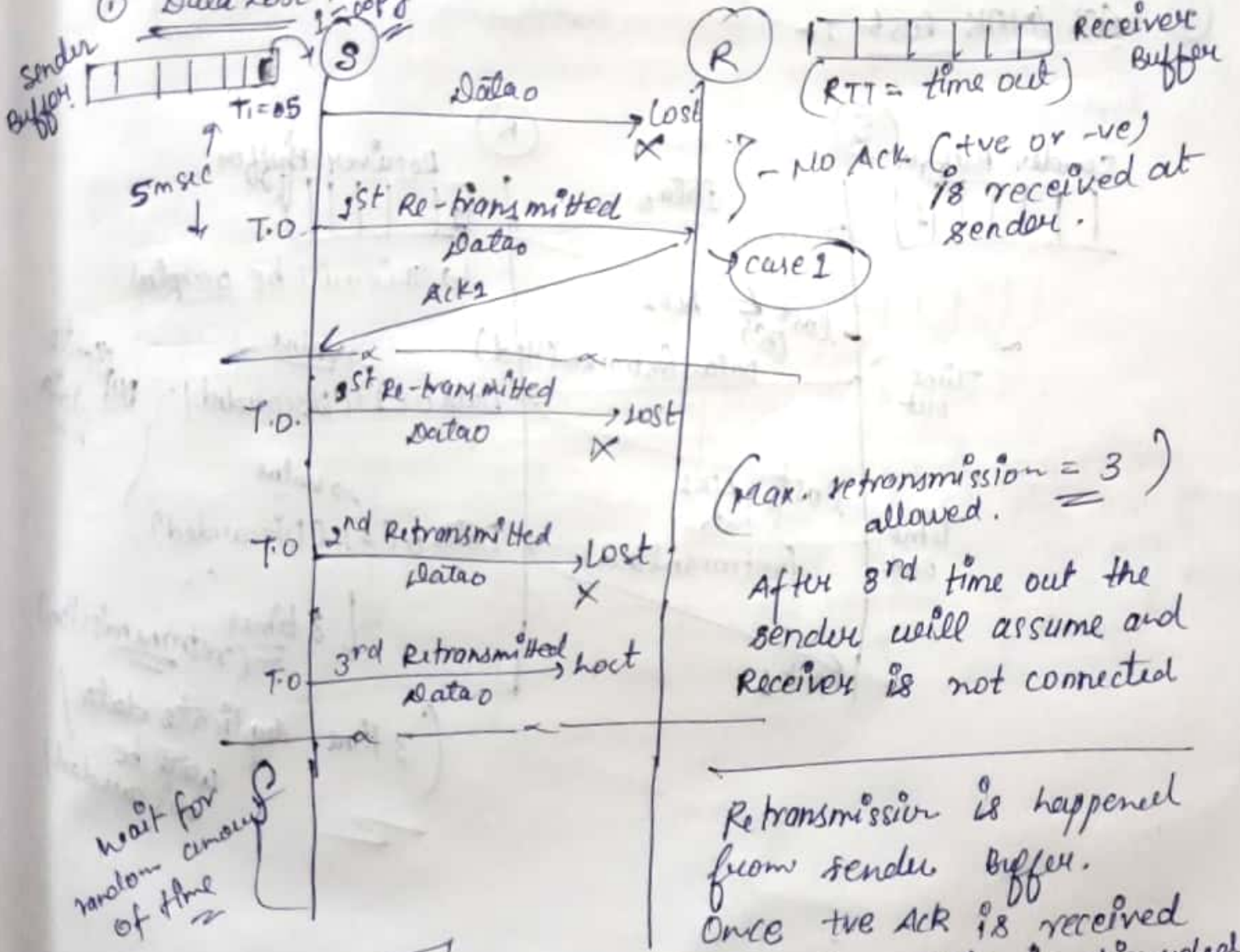
- Stop and wait ARQ
  - ① Data lost → (Time out)
  - ② Data damaged / error
  - ③ ACK lost (Time out)
- Sliding window ARQ
  - Go Back - n ARQ
  - Selective Reject ARQ

(NAK Sabke liye kar bhejta)

Stop and wait ARQ :-

After establishment of connection data is transferred.

① Data lost : - copy



- NO Ack (+ve or -ve) is received at sender.

(Max. retransmission = 3 allowed.)

After 3rd time out the sender will assume and Receiver is not connected

Retransmission is happened from sender Buffer.

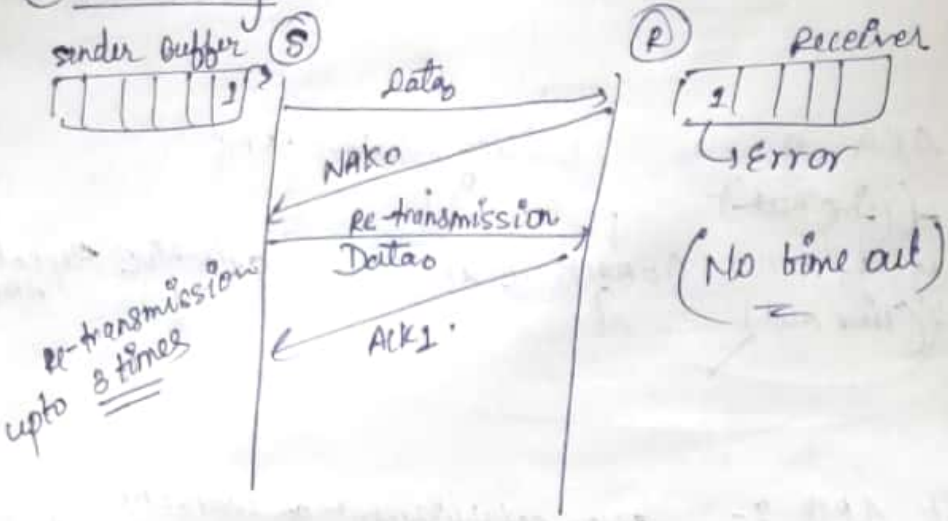
Once +ve Ack is received then only 1 data is discarded

RTT = Time out = TTL

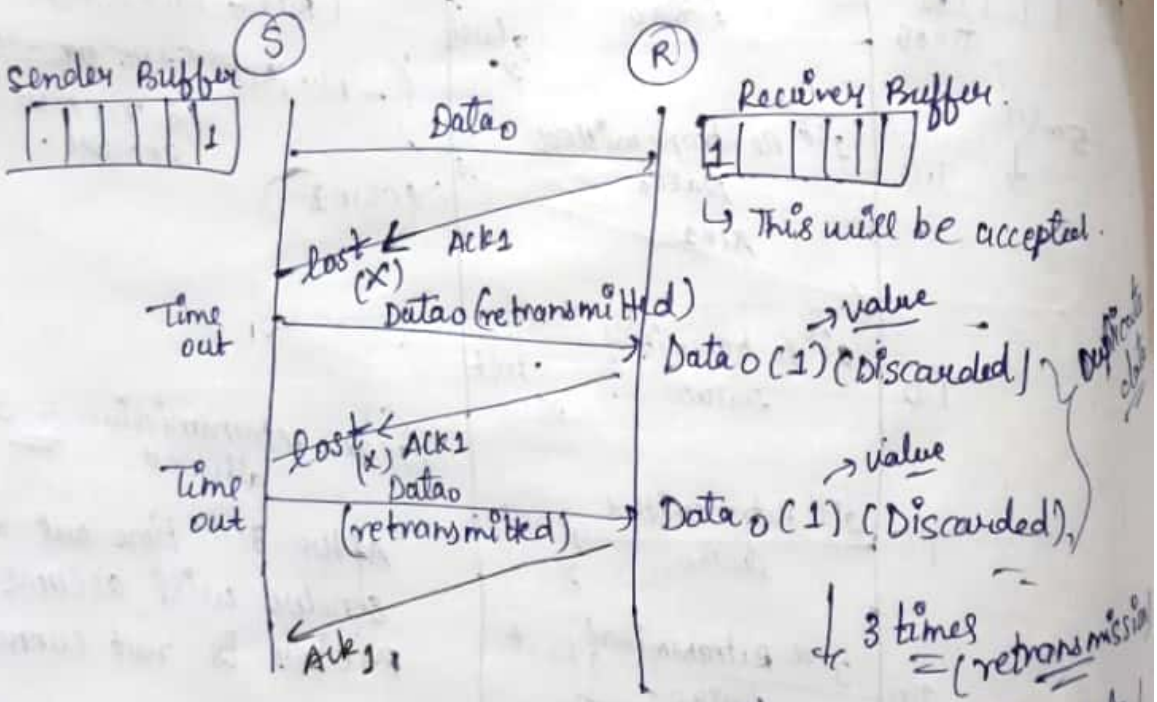
↓

Time to limit

② Data Damaged :-



③ Ack / NAK lost :-



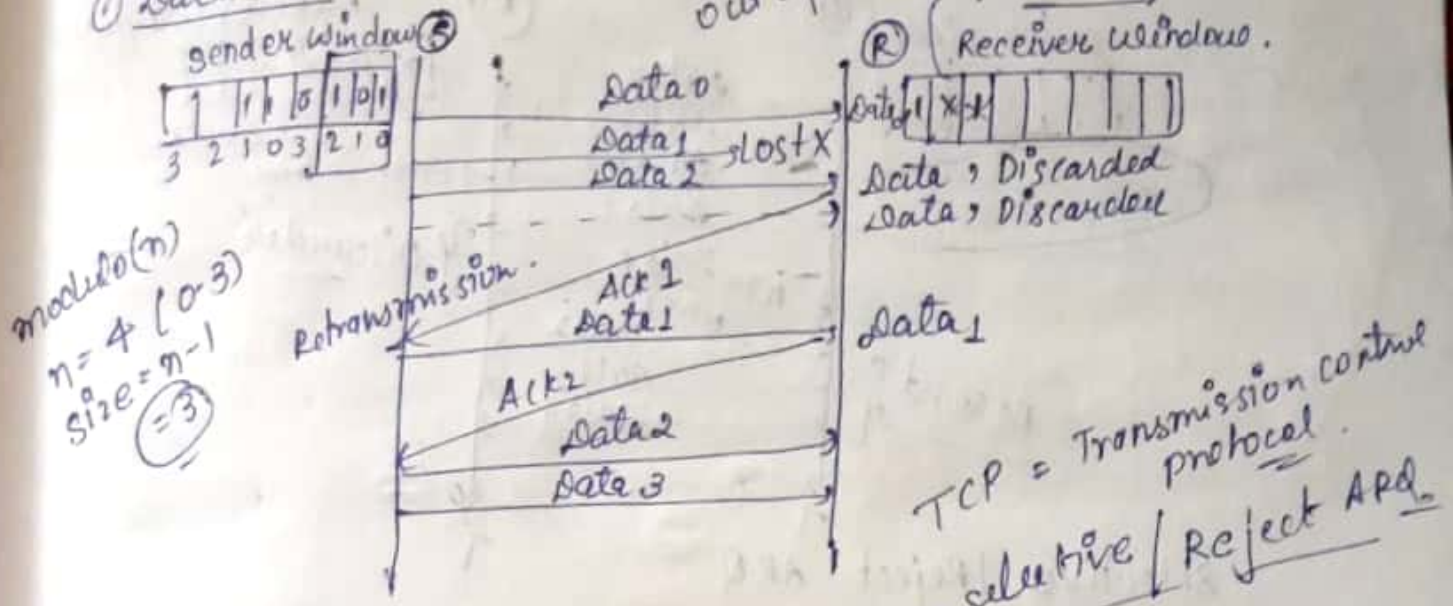
30/March 2022

Sliding Window ARQ → Data lost / Data damaged / ACK lost

0 → 1 → 2 → 3
0 → 2 → 1 is not allowed (sequence out of delivery / out of order)

Go-back-n ARQ :-

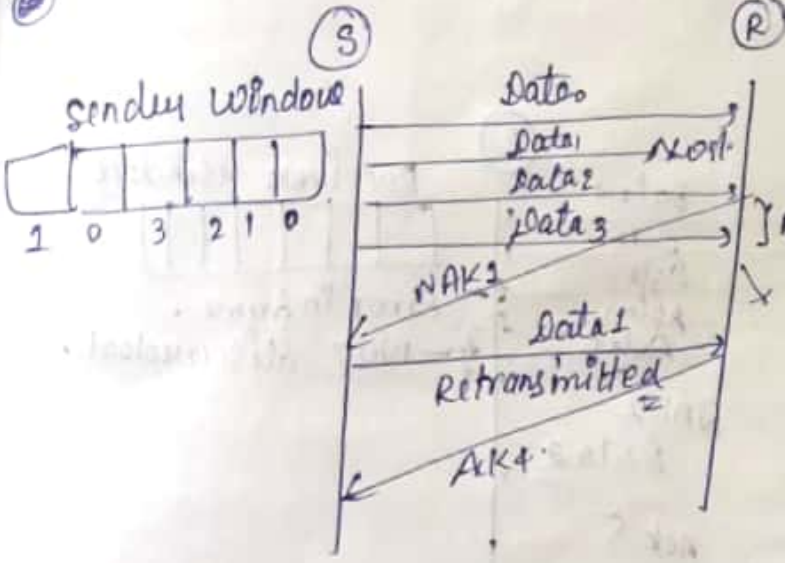
① Data lost :-



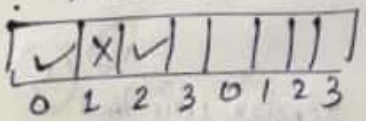
modulo(n)
n = 4 (0-3)
size = n-1
= 3

TCP = Transmission control protocol.

→ selective / Reject ARQ.



(R) Receiver window

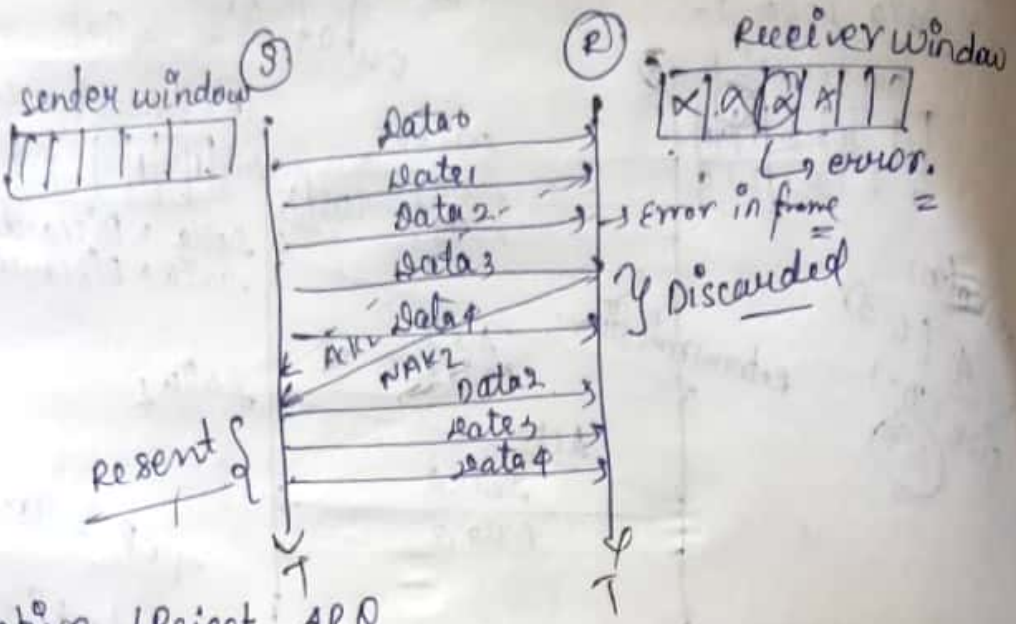


Not discarded.

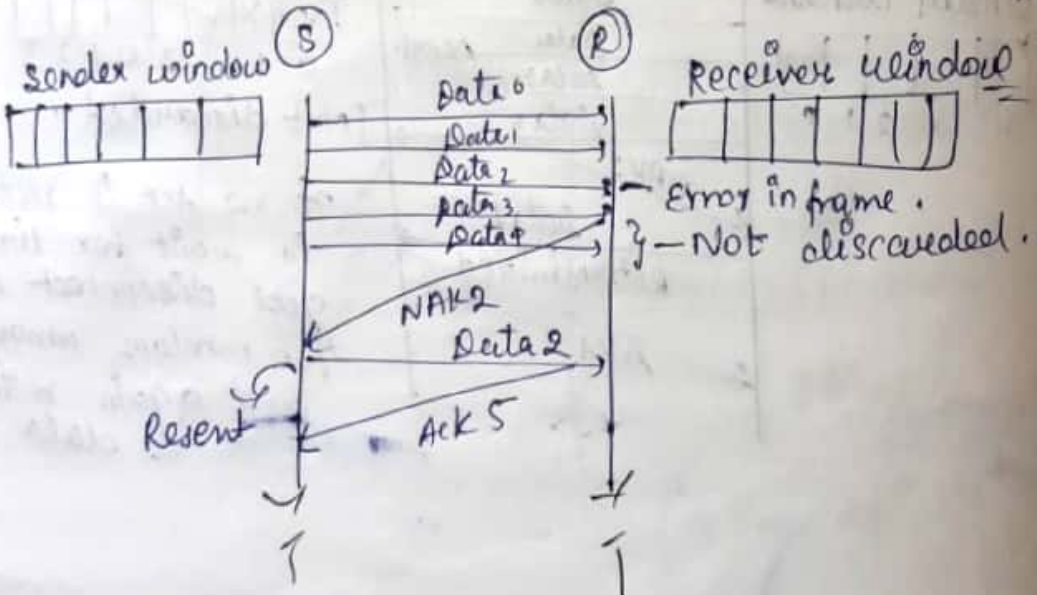
If no ACK is received then it wait for time out or gets disconnect and wait for random amount of time and again retransmit data.

(3) Data damaged :-

Go-back-n ARQ

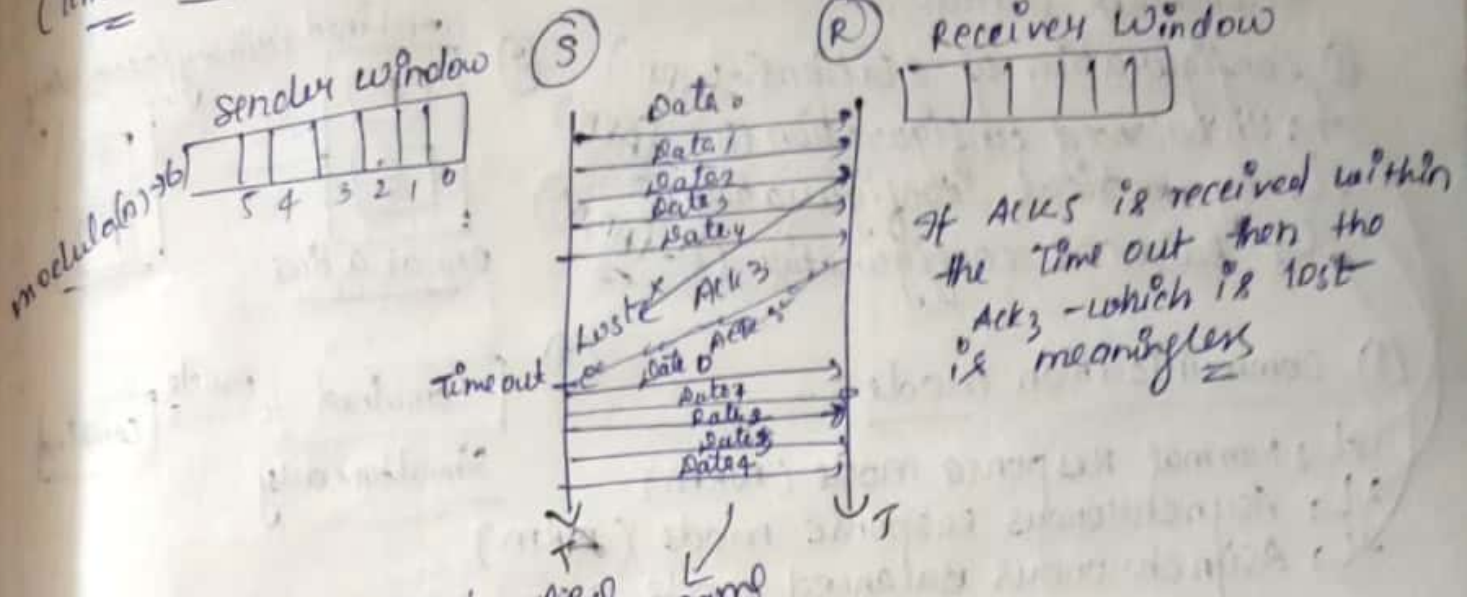


Selective / Reject ARQ



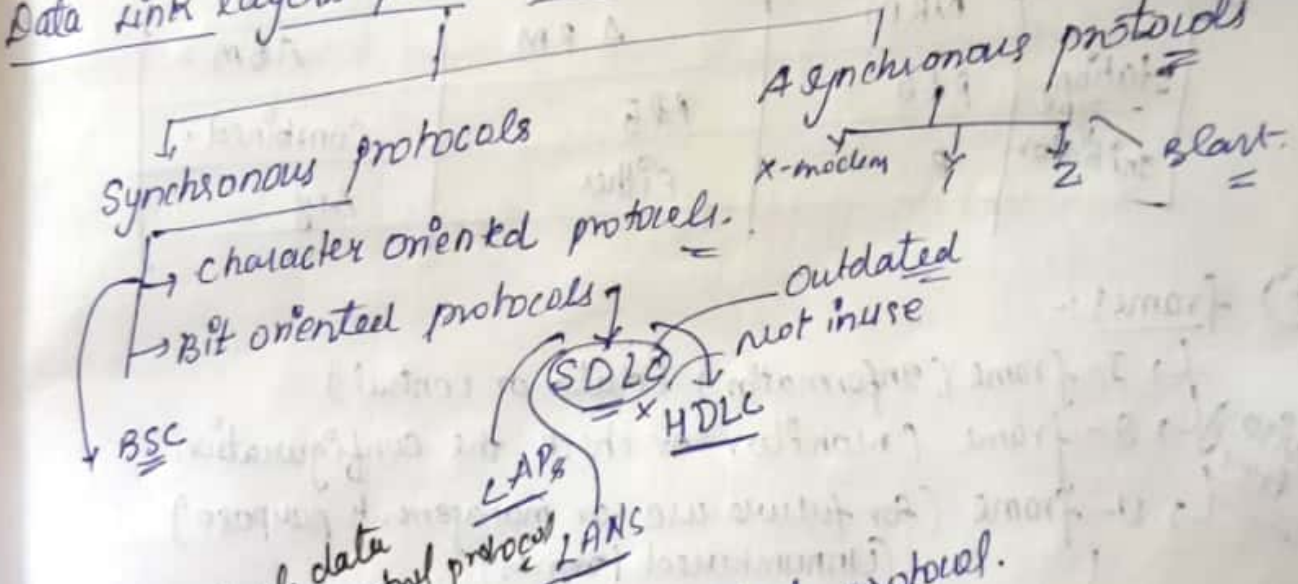
(5) ACK lost

(Time-out) Go-back-n ARQ :-



Selective / Reject ARQ = Same

Data link layers protocols :-



HDLC :- DHCP → Dynamic host control protocol.

↳ station type

↳ Primary station

↳ combined station.

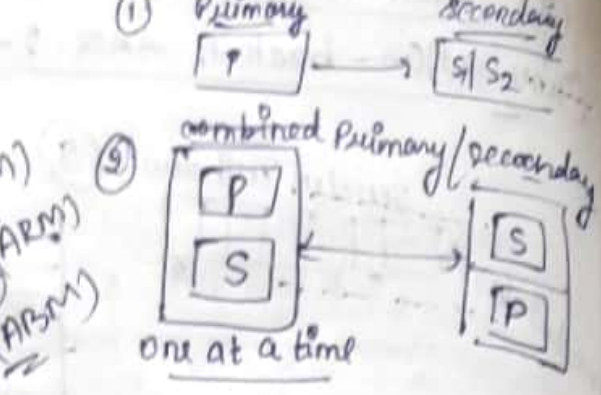
↳ Primary as well as secondary.

(5) ~~Configurations of~~

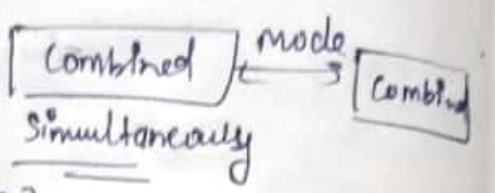
HDLC

① Station type :-
- ↳ Primary station
- ↳ Combined station

② Configuration of stations :-
- ↳ Unbalanced configuration ① (NRM)
- ↳ Symmetrical configuration ② (ARM)
- ↳ Balanced configuration ③ (ABM)



③ Communication mode :-
- ↳ Normal Response mode (NRM)
- ↳ Asynchronous response mode (ARM)
- ↳ Asynchronous Balanced mode (ABM)

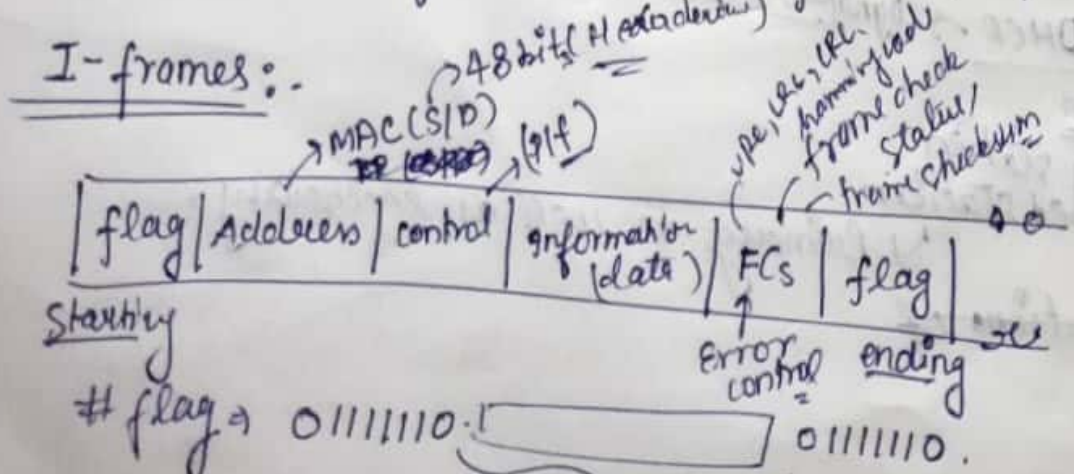


Remember

	NRM	ARM	ABM
station type	P & S	P & S	Combined.
initiator	P	Either	Any

④ frames :-
- ↳ I-frame (information) (data or control)
- ↳ S-frame (Monitor) or check the configuration. (supervisory frame)
- ↳ U-frame (for future use or management purpose) (Unnumbered frames).
  - ↳ information for management purpose

I-frames :-



flag → 01111110 [ ] 01111110.

Part of I-frame

Problem:- user info. user want to send this data.

01111110 | 01111110 | 01111110

flag flag flag

To overcome this → Bit stuffing / char stuffing:-

character stuffing:-

Ex. Hello flag.

Flag Hello · Esc flag flag.
(S) ↑ (E)
(character stuffing)

Ex. Flag Hello flag flag.

flag Esc | flag Hello Esc flag Esc flag | flag.
(S) information (E)

~~Bit stuffing~~:-

S-frame:- (P/f) or (P/S)

| flag | Addres | control | fcs | flag |

U-frame:- (P/f) or (P/S)

| flag | Addres | control | information | FCS | flag |

information → Not data / user information

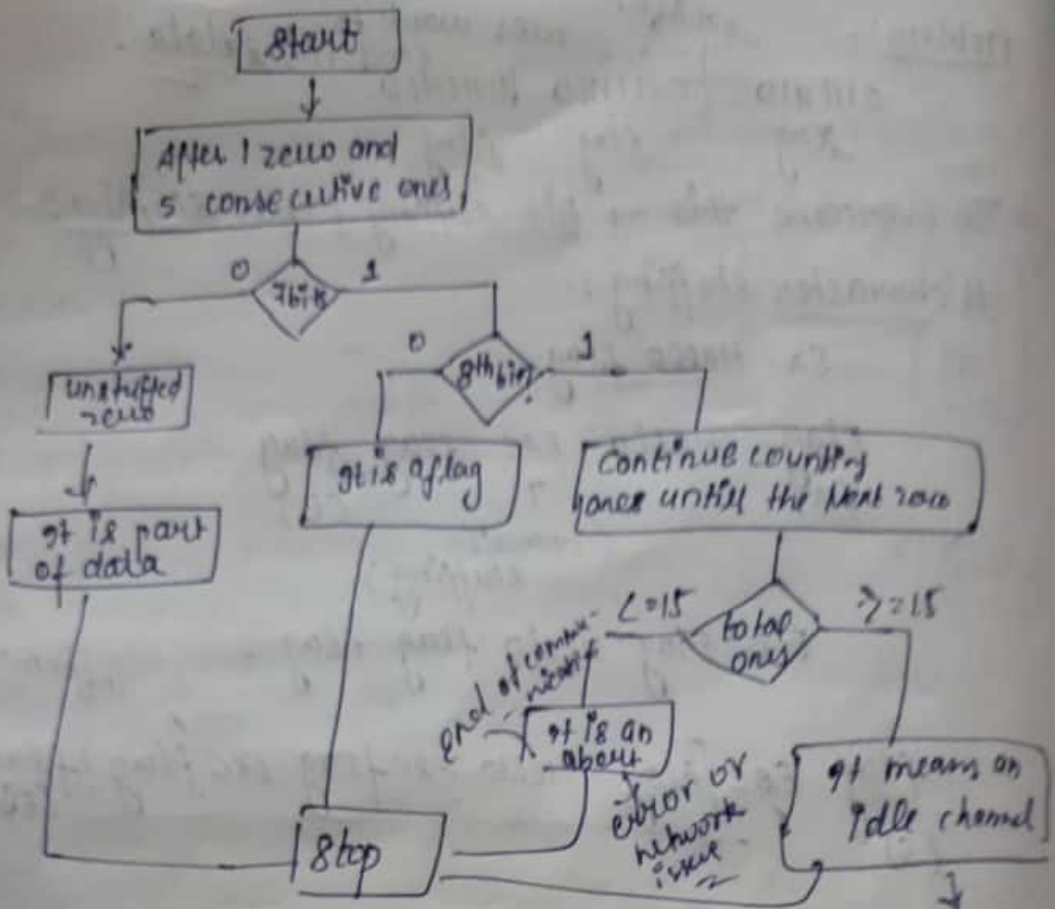
control → management related info.

Bit stuffing:-

flag ⇒ 01111110

Esc

↳ Next page



(01111110) — If you want to send this data. We can write it as :—

01111110 01111<u>1</u>010 01111110

flag information flag

If

01111<u>1</u>010

01111110

If you want to send 01111010

So → 011111<u>0</u>010

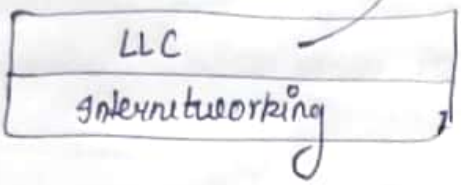
LAN (Local Area Network) — 802.1, 802.2

→ IEEE Project
↓ Protocols for sending data

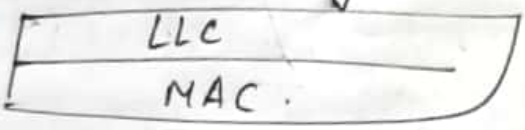
IEEE 802.3, IEEE 802.4, IEEE 802.5 → token ring
ethernet ~~Token bus~~ → token bus ~~Token ring~~

IEEE → 802.1 → Internetworking. (MAC)
IEEE → 802.2 → LLC (Logical Link Control.

Data link → MA/CSMA/CSMA-CD → 1Per, Non persistant, P-Per
→ Aloha → Pure Aloha, slotted Aloha



Data link layer



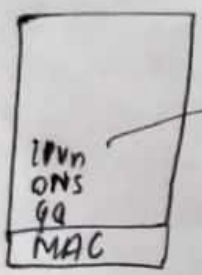
---

* 802.3 frame format (Ethernet):-
Combination of software and Hardware.

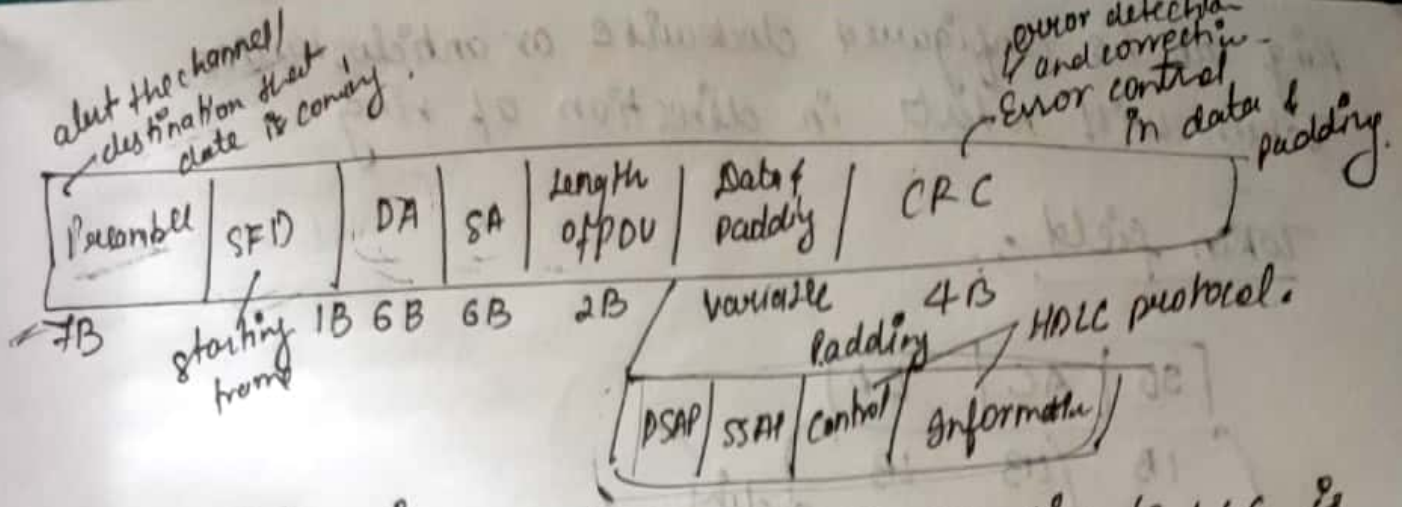
S/W + H/W → N/C → OP/LAN/WAN/MAN.
Operating system.

UI
user interface.

DNS
(Domain name service



software attribute in hardware



Protocol data unit - Data manageable recording to LLC is called PDU.

DSAP (Destination source Accen point).
SSAP (source u u u)
DA (Destination address).

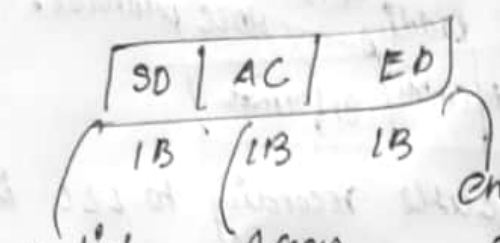
Preamble : Pattern of alternate 0s and 1s.
01010101 ---- 56 b.

SFD (starting frame Delimiter) :) Alternate pattern of 10
eg - 10101011
(ending with 11)
(starting & ending with 11).

802.5 (Token ring) :- 3B token.

Ring can be configured clockwise or anticlockwise.
Token will rotate in direction of ring.

Token field :-



= Access control

SD → Indicates that after AC everything is part of data

8b

J	K	0	J	K	0	0	0

JK flipflop.

ED

8b

J	K	1	J	K	1	J	E

E → Error

intermediate data

E = 0 (No error)
E = 1 (Error in token) field.

duplicate lost provided to wrong

I = 1 (Some intermediate part of data is in channel, don't close)

I = 0 (last frame is received (use full close)

AC 8b.

A	C	x	x	A	C	x	x

destination is found

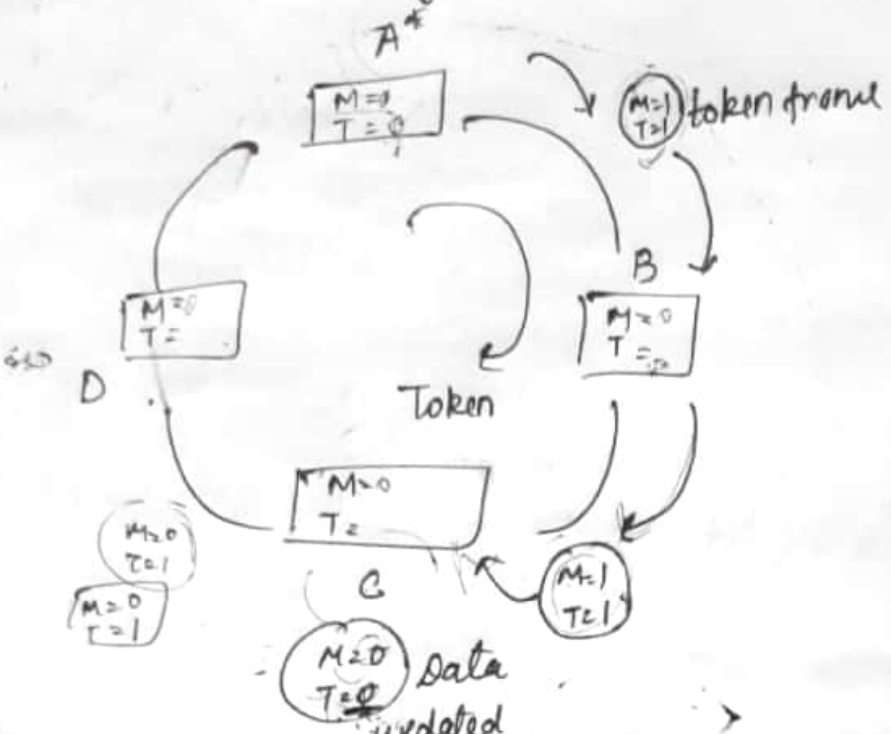
A	C – data is copied.
0	0 – receiver is down/crashed.
1	0 – Data lost
0	1 – Not possible.
1	1 – Success.

8/04/2022

802.5

token ring

M=1 (monitor)
M=0 (Normal)
T=1 (Token)
T=0 (Data)



Abort

SD	ED
1B	1B

SD	AC	ED
1B	1B	1B

Token

= upto 4500B

SD	AC	FC	DA	SA	Data & padding	CRC	ED	FS
1B	1B	1B	2-6B	2-6B		4B	1B	1B

size of PDU

PDU | DSAP | SSAP | Info | control |

HDLC (same)

mini size = PDU size

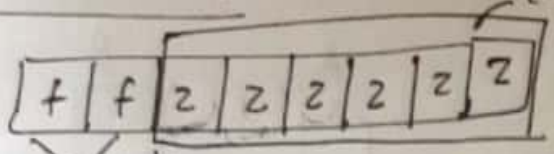
SD

J	k	0	J	k	0	0	0

ED

J	k	1	J	k	1	I	E

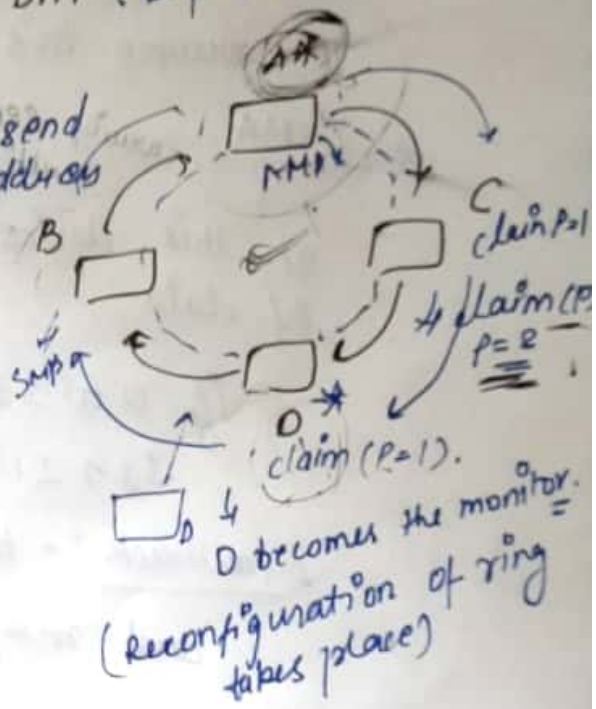
FC (frame control) :-



00 – Data
01 → Control
10 → Data
11 → Control.

flags
z → AMP (Active monitor present)
z → Claim (To become new monitor)
z → Beacon (stop transmission)
z → purge (clean the ring) (start fresh comm)
z → SMP (secondary monitor present).
z = DAT (Duplicate Address test)

DAT: If external d station wants to send data monitor will check MAC address of both devices. if same then both are discarded.



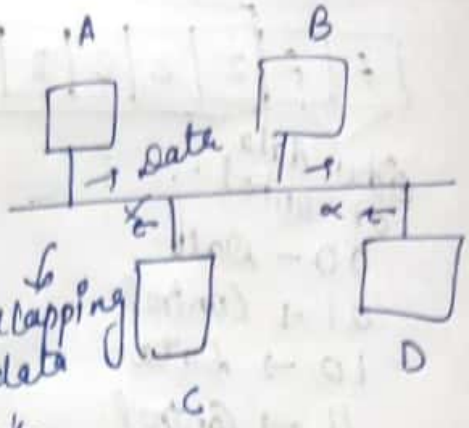
802.4 (802.3 & 802.5) :-

Ethernet

CSMA/CD

#MA : multiple access

whenever shared channel is used.



To overcome this

CSMA → carrier sense multiple access.

↳ in this device will check voltage before transmission of data:

if 0 to ±3V send data (channel is free).

±3 → ±15 → channel is not free.

Drawback :- two device check voltage simultaneously and may send data together.

↓ To overcome this.

CSMA/CD → CSMA with collision detection

Continously monitor voltage in the channel. The device which started the transmission of data. if more than ±15V then stop transmission and wait for random amount of time and also check continously the voltage in the channel

→ 1-persistent CSMA : Entire data will be inserted to channel (100%).

→ Non-persistent CSMA → May or may not (Not for first time)

→ P-persistent CSMA :- 2 times check.

P = 50%
P = 60%

} P = probability. With P prob. data is inserted.