Module - III

Data link Control

→ Data link control =

* It is included in the 2nd layer of the OSI model.
* Data link layer are line (a) discipline (b) flow control (c) Error control

a) Line Discipline =
Coordinates the link system, it determines which device can send & when it can snd.

b) Flow control =
Coordinates the amount of data that can be snd before recieving aknowledgmnt.

c) Error Control =
* Error detection & correction.
* Allows the recivr to info the centre of any frames lost / damaged in transmission & coordinates the re-transmission of those frames by the center

Line discipline

Poll / Select

ENQ / ACK

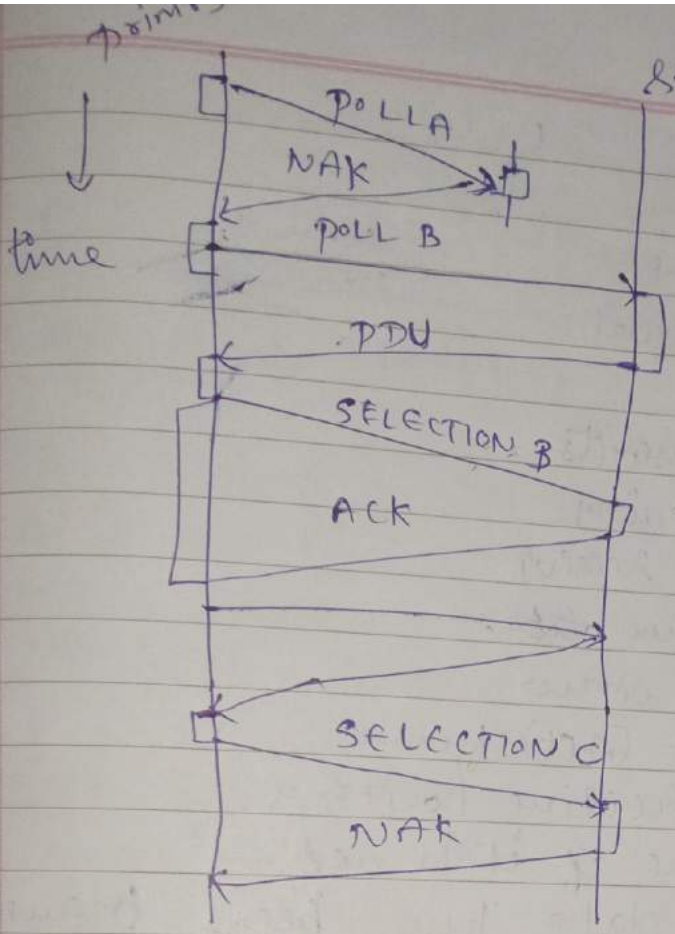
(1) Enquiry, Acknowledgment

* Used in peer-peer commun
* using ENQ / ACK

* A Section can be initiated by either station on a link as long as both are equal rank
* The initiator 1st transmits a frame → an enquiry (ENQ) asking if the receiver is available to receive data. Receiver must answer either with a acknowledgment (ACK) frame if it is ready to receive / with a -ve (Nack) frame if it is not. once all of its data have been transmitted the sending system finishes with an end of transmission (EOT) frame.

(2) poll / select (polling → primary → secondary frame transfer. select → vice versa)

* If primary device is asking to the sec. device that if you have anything to send → polling (poll)
* If sec. device have something & send it to p. device → selecting (select)
* poll / select ~~method of~~ line discipline work with topologies where 1 device is primary station & other devices are secondary.
* poll sending in the form of PDU (protocol data unit)

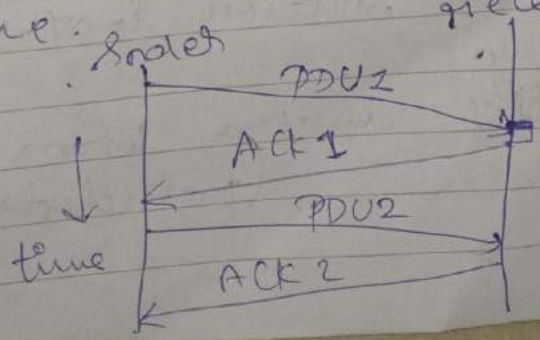


Ans → Flow control → Stop & wait F.C
Sliding window F.C

flow control protocols commonly employed by the data link layer includes —

a) Stop & wait F. control —

A sender transmits a frame. After the receiver receives the frame, it indicates its willingness to accept another frame by sending back a acknowledgment to the frame just received. After having sent a frame, the sender is required to wait until the ack. frame arrive bfre sending the next frame.



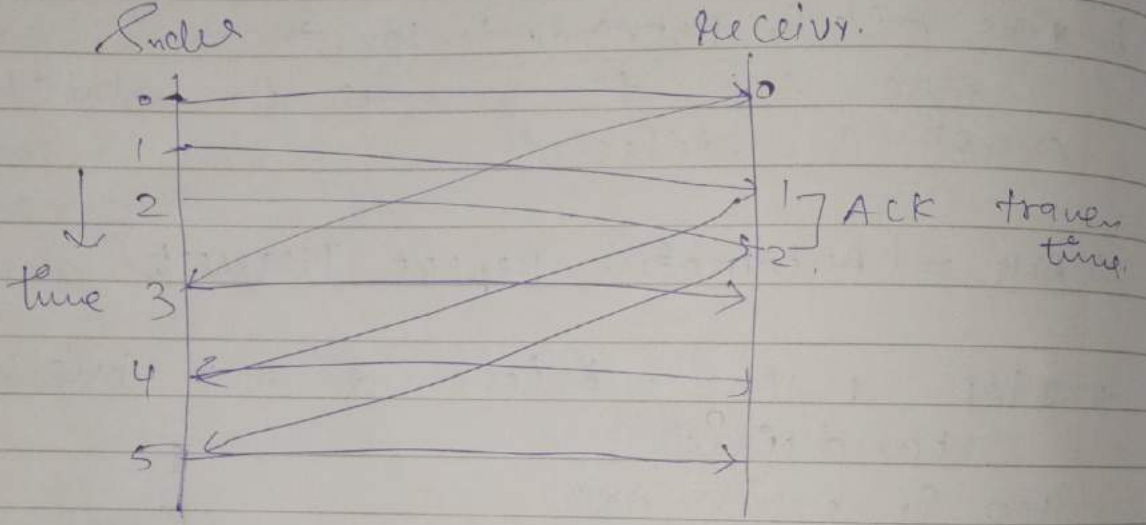
b) Sliding window F.C =

In Stop & wait only 1 frame can be Snd at a time, this prbm can be overcomed by using Sliding window protocol.

The no of frames to be Snd is based on window size (N), N = 1, 2, 3 ~

Each frame is numbered → sequence no.

max window size → 3



II Error control =

Refers to mechanism to detect & correct errors that occur in the transmission of frames.

During the frame transmission there is a possibility of occuring 2 types of errors

→ lost frame:

A frame (data frame / Ack frame) fails to arrive at other side

→ damaged frame:

A recognised frame thus arrive at Some of bits are in error

most common technique for error control are based on —

a) +ve Ack :

The destination returns a +ve Ack to successfully receive, error free frame. Retransmission after timeout = the source retransmits a frame that has not been ack - after a pre-determined amount of time.

b) -ve Ack & retransmission. =

-ve Ack to frames in which an error is detected

⇒ ARQ = (Automatic Repeat Request)

1) ~~Stop~~ The versions of ARK have been standaised

1) Stop & wait ARQ.

2) Go back - N ARQ N → size of window → Sliding window

3) Selective reject ARQ

↳ Go back - N ARQ =

while no errors occur, the destination will Ack. incoming frames as usual. If the destination station detects an error in a frame, it may send -ve ack. for that frame. The destination station will discard that frame & all future incoming calls frames until the frame in error is correctly received. Thus the Sorce is correctly receive. Thus the Sorce.

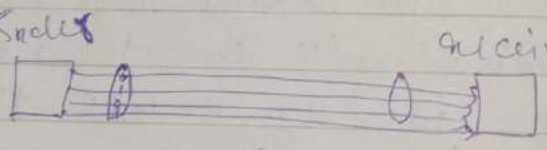
station, when it receives a reject I frame it retransmit the frame in error + all succeeding frames that were transmitted.

3) Selective reject ARQ =
The only frames retransmitted are those that receive a -ve ack / those timeout.

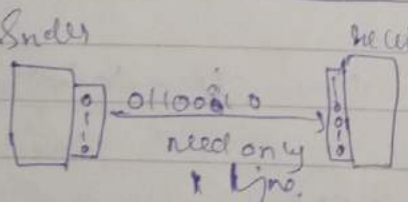
→ Transmission modes =

(1) parallel transmission =
Comp produce an consume data in grps of bits by grping we can snd data n bits at a time instead of 1.

(adv) ntwrk speed high



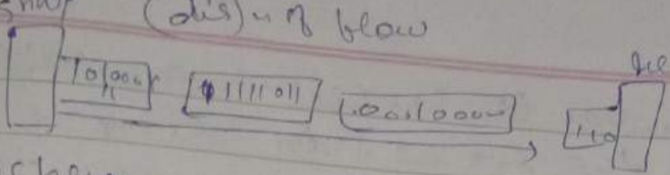
(2) Serial transmission =



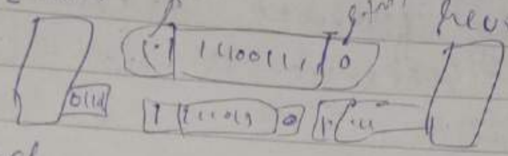
8 bits are sent 1 after another.

* 1 bit follows another, thus it requires only 1 comm channel rather than n to transmit data b/w 2 comm devices.
* 2 types -
a) Synchronous → Sending bits 1 after another without start / stop bits.
The responsibility of receiver to group the bits. receiver count the bits as the arrive & group them in 8 bit units.

sndr (dis)u of flow



1) Asynchronous → Snd 1 start bit (0) at the beginning & 1/more stop bit (1) at the end of each byte.



byte send.

[protocols. —
* RAP → used in LAN, WAN (no restrictions)
~~A data~~ * CAP → condi-]

A. data
* Link (P) = ~~→ X MODEM → Half duplex~~.

1) X MODEM = (128 bytes)
It is a hlf. duplex stop & wait ARQ
(start of header) SOH → first header in the frame (1 byte)
2nd field is a 2-byte → 2nd header.
1st header byte, sequence no. carries the frame no... 2nd header byte is used to check the validity of sequence no.
CAN → cancel ~~abort the transmission~~

2) Y MODEM = (~~128~~ 1024 bytes)
multiple files can be snd simultaneously.

3) Z modem = newer (P), combining features X + Y(m).
4) BLAST = (bloked Asychronous transmission)
is more powerful than X(m)
full duplex with sliding window flow control

* MAC (cm)
MAC is sub layer of datalink layer.

that determines who is allowed to access the at any 1 time.

protocols -

* Random Access (P). = no station is superior to another station & none is assigned control over another.

used in CAN & WAN.

There is no schedule time for a station to transmit.

no rules specify which station should snd next.

protocols

ALOHA, CSMA, CSMA/CA CSMA/CD.

1) * ALOHA (Additive links on-line Hawaii Area)

* The earliest random multi access (P) used for ground based broadcast

* implimnt in satellite communication system

* Here, a node transmit whenever a data is available to snd. If another node transmit at same time, a collision occurs, & frames that were transmitted are lost.

2) Pure -Aloha =

* Original aloha (P) is → pure aloha.

* Here, each station snds a frame whenever it has a frame to snd (multiple access)

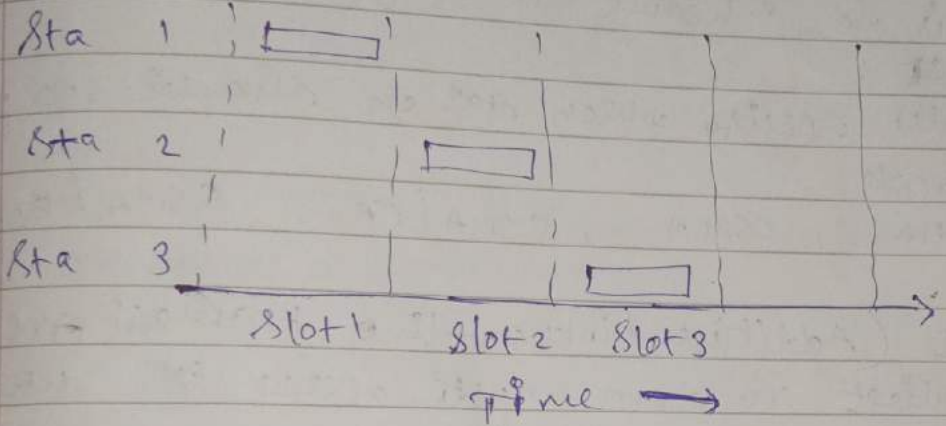
It does not check whether the channel is busy b/fre transmitting. Since there is only 1 channel to share, there is the possibility of collision b/w frames frm diffrnt stations.

* It dictates that when the time out period passes each station waits a random amount of time → back off time, b/fre resending its frame.

~~No of station~~ ~~Time slot allocate~~

c) Slotted aloha =

* here, the time of the shared channel is divided into discrete intrvals → slot~~data~~.
* The stations can snd a frame only at the beginning of the time slots & only 1 frame is snd in each slot.



d) CSMA → CSMA/CA → (Avoidence)
→ CSMA/CD → (Detect)

* Ntwrk (p) for carrier transmission that operates in the medium access control layer. (MAC).
* It senses whether the shared channel for transmission is busy / not, & transmits if the channel is not busy.
* Using CSMA (p) more than 1 users (nodes) snd & receive data through shared medium that may be a single cable / optical fibre connecting multiple nodes.
* (A) for CSMA / CA. (Collision Avoidnce) —
* whn a frame is ready, the transmitting station checks whether the channel is idle / busy.
* If the channel is busy, the station

(13) 15 PN.
→ channels
→ appli.
→ services
→ adv & dis

waits until the channel become idle (ready)

* If the channel is idle, station waits for an interframe gap (IFG). amount of time & then sends the frame.
* After sending the frame it sets a timer.
* The station then waits for ACK from the receiver.
* If it receives the ACK before expiry for time it marks a successfull transmission. otherwise it waits for a back of time period & restart the (al).

[
1) Physical layer
2) Data link "
3) Ntwrk "
(4) Transport "
(5) Session "
(6) Prsntation "
(7) Appli—
} Ntwrk layers (7)
]

→ CSMA/CD = (collision detection). (AD).

* Check whether the station that wants to transmits the data senses is busy / idle.
* If a career is idle, then the (T) is carried out
* (T) station detects a collision, by using the condition "$T_t \geq 2 * T_p$."
  T_t → Transmission delay
  T_p → Propogation delay.
* whenevr it detects the collision, the sta releases the JAM signal.
* After collision has occured the transmitting sta stops transmitting & waits for

random amount of time → back of time. After this time the Sta retransmits again

II Controlled access (P) =

a) Reservation =

* Here, a Sta needs to make a reservation bfre Snding data.
* Time is divided into intrvals, in each intrvals a reservation frame preceeds the data frame Snd in that intrval.
* If N Sta in the system, there are exactly N reservation mini slots in reservation frame

b) polling = pri sec

* primary Sta controls the link, sec devices follow its instructions
* It is upto the primary device to detrmine which device is allowed to use the channel at a gvn time.
∴ primary device is always initiator of a session.
* To reduce the collision use poll/select.

→ IEEE (Institute of electrical & electronic engineers)

IEEE 802.1 → bridging & ntwk management
" 802.2 → Logical link layer.
" 802.3 → Ethernet (CSMA/CD)
" 802.7 → Broadband LAN using coaxial cable.
" 802.6 → MAN.

" 802.11 → wibi
" 802.15 → wireless PAN (personal area
" 802.15.1 → bluetooth certification.

→ Ethernet
most widely used high speed LAN's today are based on Ethernet
4 ~~Physical~~ ~~for~~ common physical layer ~~implem~~
→ 10Base5 — Thick Ethernt / Thicknet
1st ethernt specification to use 4 twisted with an ex receiver.
→ 10Base2 — Thin Ethernt / Thinnet
uses bus topology bt the cable is much thinner & more flexible.
→ 10Base-T — Twisted pair (E).
uses physical star (T). Stas are connected to a hub via 2 pairs of twisted cable.
→ 10Base-F — fibre (E)
use star (T) to connect Sta to a hub Sta are connected to hub using 2 ~~two~~ fibre optic cables.

* IEEE 802.4 → token bus

Token bus →
network implementing token ring (P over virtual ring on a coaxial cable
A token is passed around the network nodes & only the ~~node~~ ~~st~~ processing token may transmit. If a node doesn't have anything to send the token is passed on to the next node on the virtual ring

IEEE 802.5 → Token ring :-

* comm (p) in a LAN where all sta are connected in a ring (T). ~~& 1 more tokens~~
* A token is a sple frame of 3 bytes that circulates along the ring of sta.
* A sta can snd data frames only if it hold a token. tokens are released on successful recept of the data frame.

⇒ FDDI = [fibre distributed data Interface].

* FDDI is a set of ANSI & ISO standards for data (T) on fibre optic lines in a LAN that can extend in range upto 200km
* CDDI (copper distri data. I) → for cu.
* FDDI logical topology is a ring based token ntwork

⇒ Switching techniques =

msg (S)	circuit (S)	packet (S)
* circuit (S) [illegible] drawback over come [illegible].	* dedication path [illegible]. S → R.	* ÷ several unit → pkt S → R
* Store & forward	* ~~connection~~ terminate [illegible] connection maintain [illegible].	* no dedicated path
* msg accept [illegible] storage [illegible]	* used in telephone (N).	* header → msg path/details; payload → actual data.

I circuit (S) = (connection ntwork)

* (S) technique that establishes a dedicated path b/w snder & receivr.
* here, once the connection is established then the dedicated path will remained

to exist until the connection is terminated
* A complete end-to-end path must exist bfre the commun takesplace
* used in public telephne ntwrk, also in voice (T).
* Fixed data can be transfered at a time in a circuit (S)
* circuit (S) process — (phases).
  a) circuit estalelishmnt.
  b) Data transfer.
  c) circuit Disconnect.

Adv * ~~Dedic~~ commun channel is dedicated
* fixed band width.

disadv * Inefficient to use

I Packet (S) = (connection less ntwrk)

* connection less ntwrk (S) technique
* msg is divided & grped into a nom of units → packets that are inclividually routed frm source to destination
* no ~~de~~ need to estalelish a dedicated circuit for commun
* Each packet has 2 parts —

a) Header = Header contains addressing info of the packet & is used by the intrmediate routers to direct it towards its destination.

(b) payload = It carries the actual data.

* Delay is less
* Allows Simultaneous usage of same channel by multiple users.
* Switching devices don't require massive storage.

Disadv

* High installation cost.

III Msg (S) =

* Msg (w) was an technique developed as an alternative to circuit (S) before packet (S) was introduced.
* Here, end users communicate by sending & receiving msgs that included the entire data to be shared.
* msgs are the smallest individual unit.
* Sender & Receiver are not directly connected
* There are a no. of intermediate nodes that transfer data & ensure that the msg reach its destination.
* M.S. network are also → hop by hop systems.
* 2 characteristic:—
  a) Store & forward
  b) msg delivery.

(a) Store & forward =
Intermediate nodes have the responsibility of transferring the entire msg to the next node. So each node have a storage capacity.
It forward a msg only if sufficient resources are available & the next

hop is accepting data. This is → Self property.

(b) msg delivery:=

header → routing info.

adv
* Allows infinite msg length
* makes traffic managment efficient by assigning priorities to the msgs.

disadv
* cannot be used for real time appli-