

## Unit : 3 : Data Link Layer

\* Explain Data Link Layer with its Design Issues.

=> Data Link Layer is second layer of OSI Model which is present after the Physical Layer.

Data Link Layer is maintain the data between host and nodes.

Data Link Layer is transfer datagram across an individual link in Network.

In this Layer, communication channel connects the nodes which is called link.

The Data Link Layer is divided into two sub layer.

- C1) Logical Link Control
- C2) Media Access Control

## 1 Logical Link Control:

This Layer is control flow control, synchronization and error checking in data link layer.

## 2 Media Access Control:

This Layer is controls the flow and multiplexing for transmission medium.

-> This are the main design issues in Data Link Layer.

### a Services Provided to the Network Layer:

The Data Link Layer is provides service interface to Network layer which transfer data from network layer to machine

### b Frame Synchronization:

Data is send in the forme of Frame in which we have to define starting and ending

of each Frame by the destination machine.

### c. Flow Control:

Flow control is used to prevent the flow of data frame at the receiver end.

### d. Error Control:

Error control is used to prevent the duplication of frame at the receiver end.

### \* Explain Data Link Layers Services.

=> There are three types of services is provided by a Data Link Layers.

C1) Unacknowledged Connection-less Service

C2) Acknowledged Connection-less Service

C3) Acknowledged Connection-Oriented Service.

## 1 Unacknowledged Connection-less Services.

In this services, there is no ~~need~~ need to create Logical connection and no need to get acknowledgement of connection.

In this services, Source machine can send the Frame without knowing the any problem.

Source Machine does not require Frame transfer acknowledgement from destination machine.

There is no connection is create between source and destination machine.

If any frame is lost, there is no need to attempt recovery from source machine.

## 2 Acknowledged Connection-less Services.

In this services, there is no need to create the Logical

connection and no need to get acknowledgement of connection.

In this service, Source machine is send the ~~data~~ Frame and wait for get acknowledgement form destination machine.

This service is follows stop and wait protocol.

Source Machine have to wait for get acknowledgement in some time period.

IF According to time period Source Machine does not get acknowledgement than it will be again send.

### 3 - Acknowledged Connection-Oriented Service:

In this service, Source machine have to create logical connection to the destination machine.



Frame Structure is content three parts.

- ci) Header
- cii) Data
- ciii) Trailer

Header	Data	Trailer
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Frame Header is ~~consis~~ contain the error-checking codes.

There are two types of Frames.

- ca) Fixed-size
- cb) Variable-size

a Fixed Size :

The size of the Frame is Fixed and we do not have to Provide Frame Boundaries.

The length of the Frame is Fixed So, We can send less Data.

## b Variable Size :

The size of the Frame is not fixed and we have to provide boundaries of the Frame.

We have to declare two things for this Frame.

- (i) Length Field
- (ii) End Delimiter

(i) Length Field : Length Field in a Frame which indicates the length of Frames.

(ii) End Delimiter : End Delimiter in a Frame which indicates the end of the Frames.

There are two ways to solve End Delimiter.

- (a) Byte Stuffing
- (b) Bit Stuffing

a Byte Stuffing : In this method, we have to stuff the extra Byte in Frame.



Flag	Header			ESC	
------	--------	--	--	-----	--

Extra 2 byte stuffed

Flag	Header	ESC			ESC	ESC
------	--------	-----	--	--	-----	-----

Extra Bytes

## b Bit Stuffing:

In this method, we have to add extra bit in the frame.

\* Explain Flow Control and Error Control in Data link layer.

=> Flow Control :

Flow Control is used to prevent the flow of data frame at the receiver end.

Flow Control is control the rate of frame transmission at the receiver end.

Flow Control prevents the loss of Data and avoid over running of receive buffers.

Stop and Wait Protocol and Sliding Window Protocol are Flow Control method.

=> Error Control:

Error Control is used to prevent the duplication of frame at the receiver end.

Error Control is used to transfer of error free data from the sender to receiver machine.

Error Control is used to ~~def~~ detect and correct error occurred in the frame.

The main function is helps to dealing with damaged frames in Data link layer.

Stop and Wait ARQ Protocol and Sliding Window ARQ Protocol are Error Control method.

\* Explain Stop and Wait Protocol for Data Link Layer.

=> Stop and wait Protocol is used to control flow transfer between Sender and Receiver.

There are Two type of Stop and Wait Protocol.

- ci) Simplex Stop and Wait
- cii) Stop and Wait with ARQ.

ci) Simplex Stop and Wait :

This Protocol is used for transfer the data over the noiseless channel.

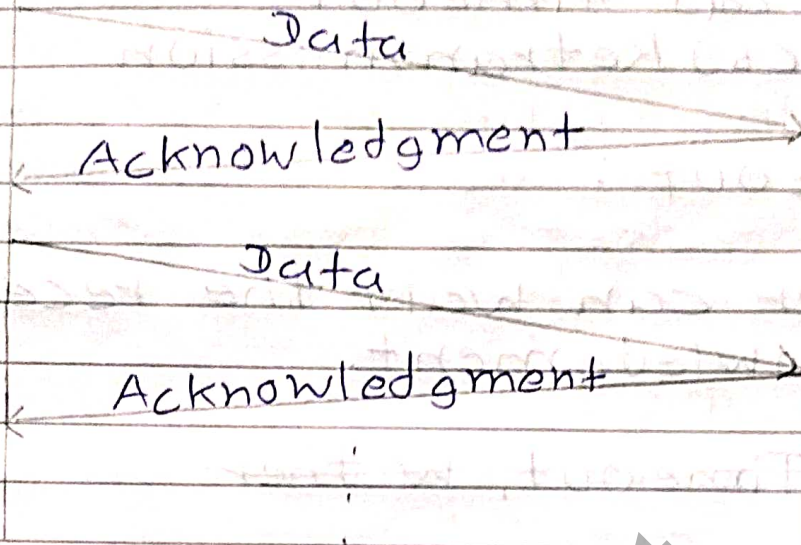
Simplex Stop and wait Protocol is provides unidirectional data transmission flow.

Sender can sends the one data packet at a time.

Sender can receive the data packet + receive acknowledgment.

Sender

Receiver



Receiver can receive the Data Packet that can be send by the sender.

Receiver can send the acknowledgment to the sender.

cii) Stop and Wait with ARQ:

Sender can send the data packet to the receiver and wait for the receiver's acknowledgment.

In stop and wait with ARQ Protocol, we have to use two things.

ca) Timeout  
cb) Retransmission

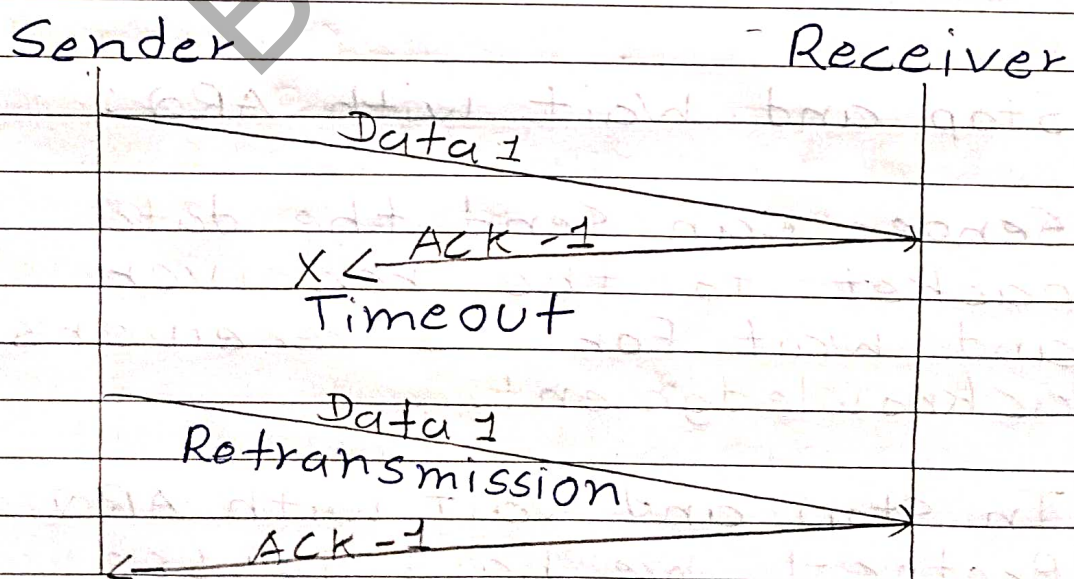
ca) Timeout :

Sender can wait the receiver's Acknowledgment.

~~In Timeout, w ther~~

In this method, Sender have to wait Particular time for receiver Acknowledgment.

After the time out, sender can again send the data Packet.



(b) Retransmission :

After the timeout completion, sender can retransmit the Data Packet.

\* Explain Sliding Window Protocol with its types.

=> The Sliding Window Protocol is used to send multiple frames at a time.

This protocol removes the disadvantages of Stop and Wait Protocol.

There are two types of Sliding Window Protocol.

- (i) Go-Back-N ARQ
- (ii) Selective Repeat ARQ

(i) Go-Back-N ARQ :

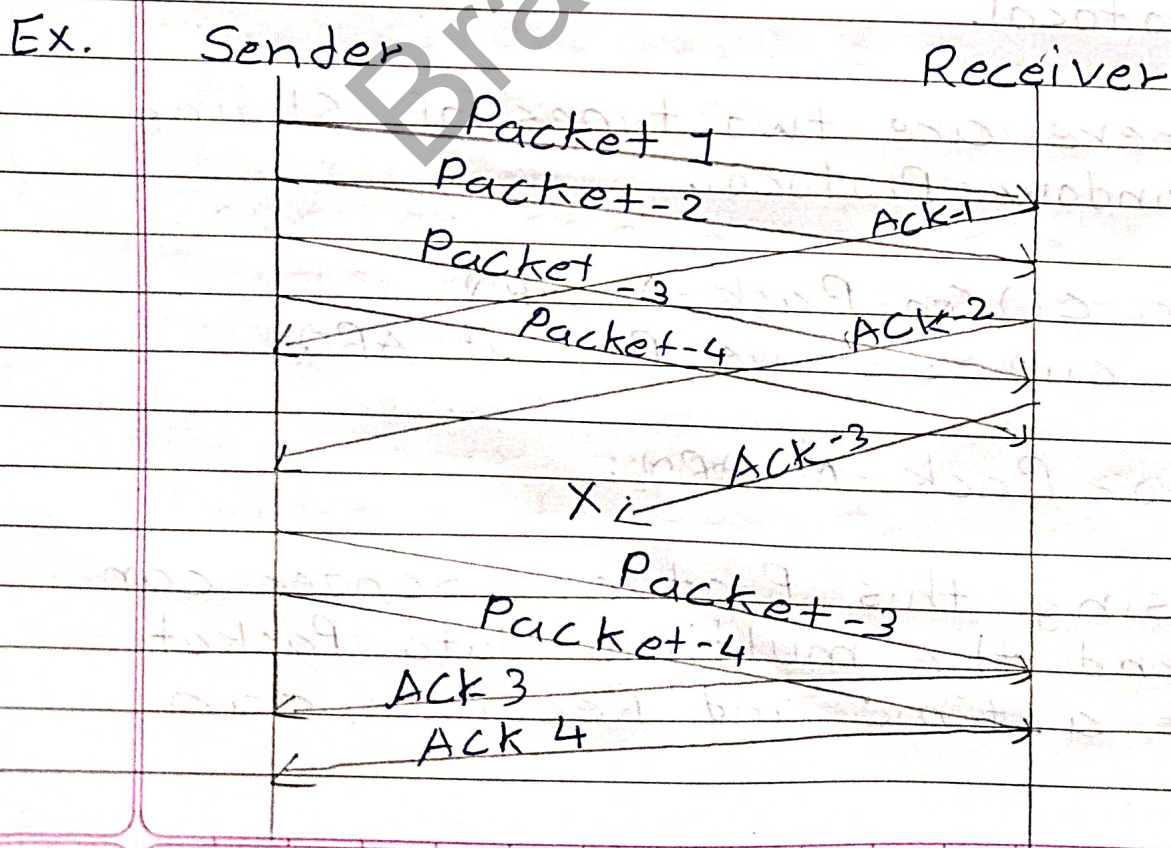
Using this protocol, sender can send the multiple data packets at a time and receiver can

send the multiple Acknowledgment at a time.

Ex. IF Sender, want to send  $n$  data Packet, than sender can send the  $n$  data Packet at a time.

After that Receiver can send the  $n$  data Packet receive acknowledgment.

IF sender does not receive any acknowledgment than sender have to send again all the data packet.



Ex. IF Sender want to send 4 Packet than sender can send the 4 Packet at a time.

After that Receiver can send the acknowledgment.

IF Receiver does not send the Packet 3 Acknowledgment than Sender have to send again Packet 3 and Packet 4

(ii) Selective Repeat ARQ:

In this Protocol, Sender can send the multiple data packet at a time and receiver can receive the multiple data packet at a time.

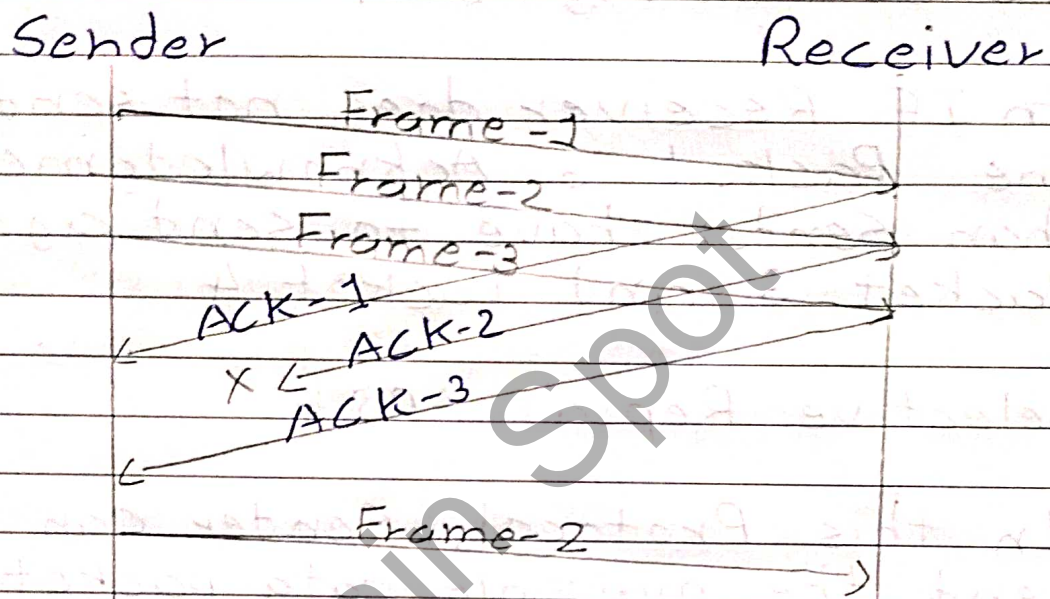
After the receive the data Packet receiver can send acknowledgment to the sender.

IF ~~R~~ Sender does not get the acknowledgment than only this data packet have to send by sender.



If Sender does not get  $n$  acknowledgment than sender have to send only  $n$  data packet again.

Ex.



Here, Sender send 3 Frame to the receiver.

Receiver can send only 1 Frame and 3 Frame acknowledgment.

So, Sender have to send only Frame 2 to the Receiver.