CS & IT ENGINEERING

COMPUTER NETWORKS

Flow Control

Lecture No-2

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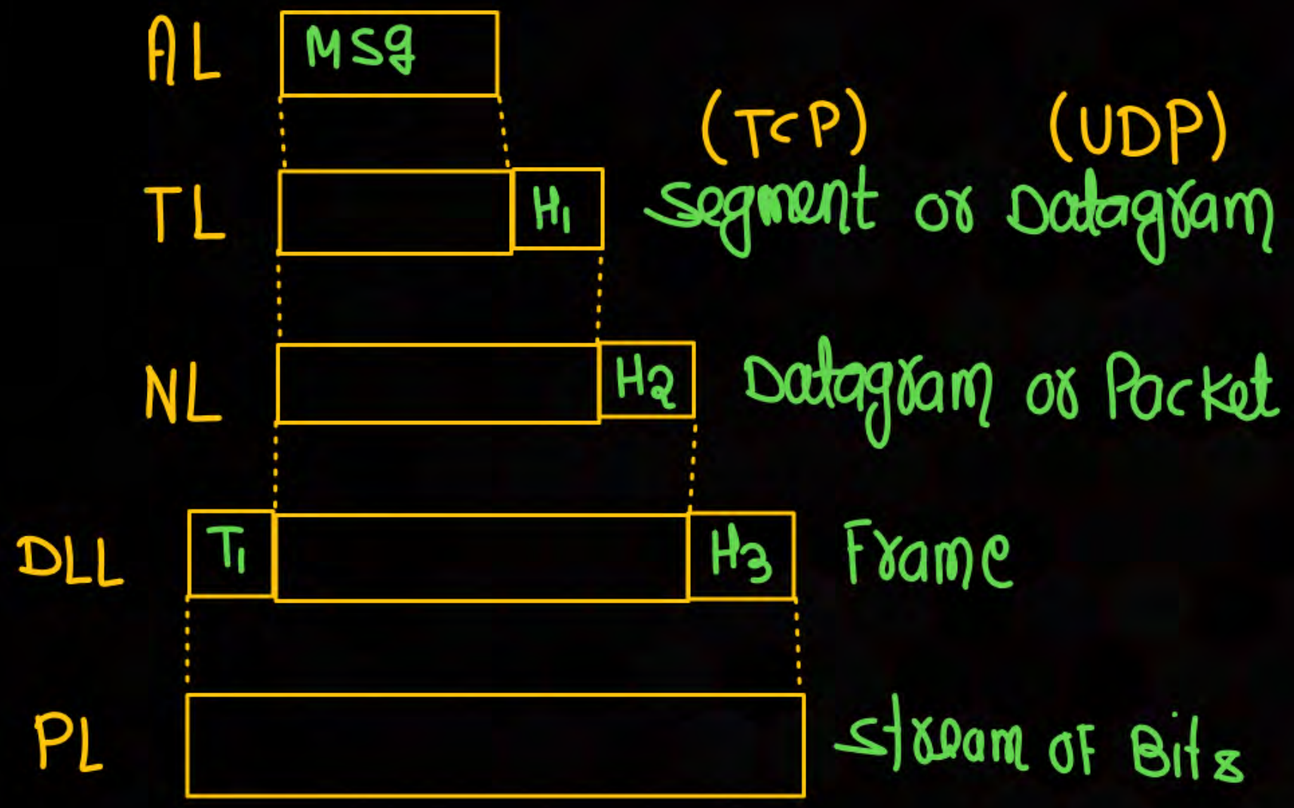
Stop and wait
Protocol



(TCP) (UDP)
Segment or Datagram

Datagram or Packet

Frame

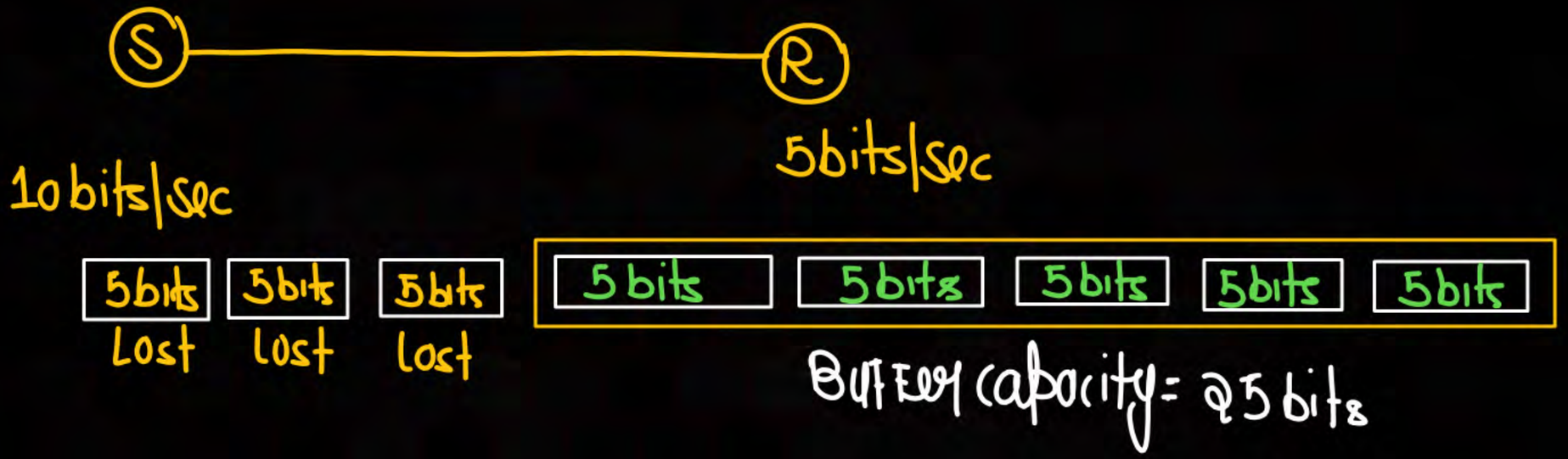
Stream of Bits

Flow control

1. Flow control coordinate the amount of data can be sent before receiving the acknowledgement.
2. Flow control is a set of procedure that tells the sender how much data it can transmit before it must wait for an acknowledgement from the receiver.
3. Receiver has a limited speed at which it can process incoming data and limited amount of memory in which to store incoming data.

Flow control

4. Receiver must inform the sender before the limit are reached and request that the transmitter to send fewer frames or stop temporarily.
5. Since the rate of processing is often slower than the rate of transmission, receiver has a block of memory (buffer) storing incoming data until they are processed.


S
R
10 bits/sec
5 bits/sec
5 bits
5 bits
5 bits
Lost
Lost
Lost
5 bits
5 bits
5 bits
5 bits
5 bits
Buffer capacity = 25 bits

Flow control protocols

Noiseless Channel

(1) Simplest protocol

(2) Stop-wait protocol

Noisy Channel

(1) Stop-wait ARQ

(2) Go – back – N ARQ

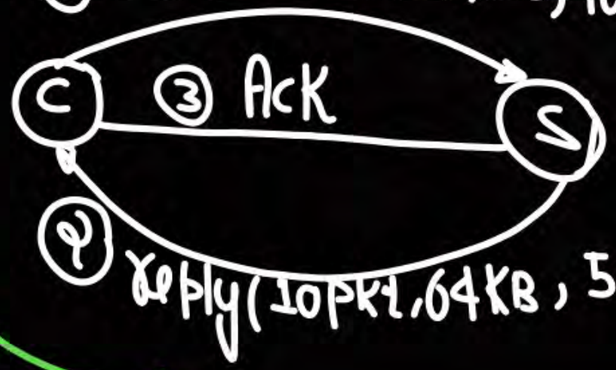
(3) Selective Repeat ARQ

Stop and Wait Protocol

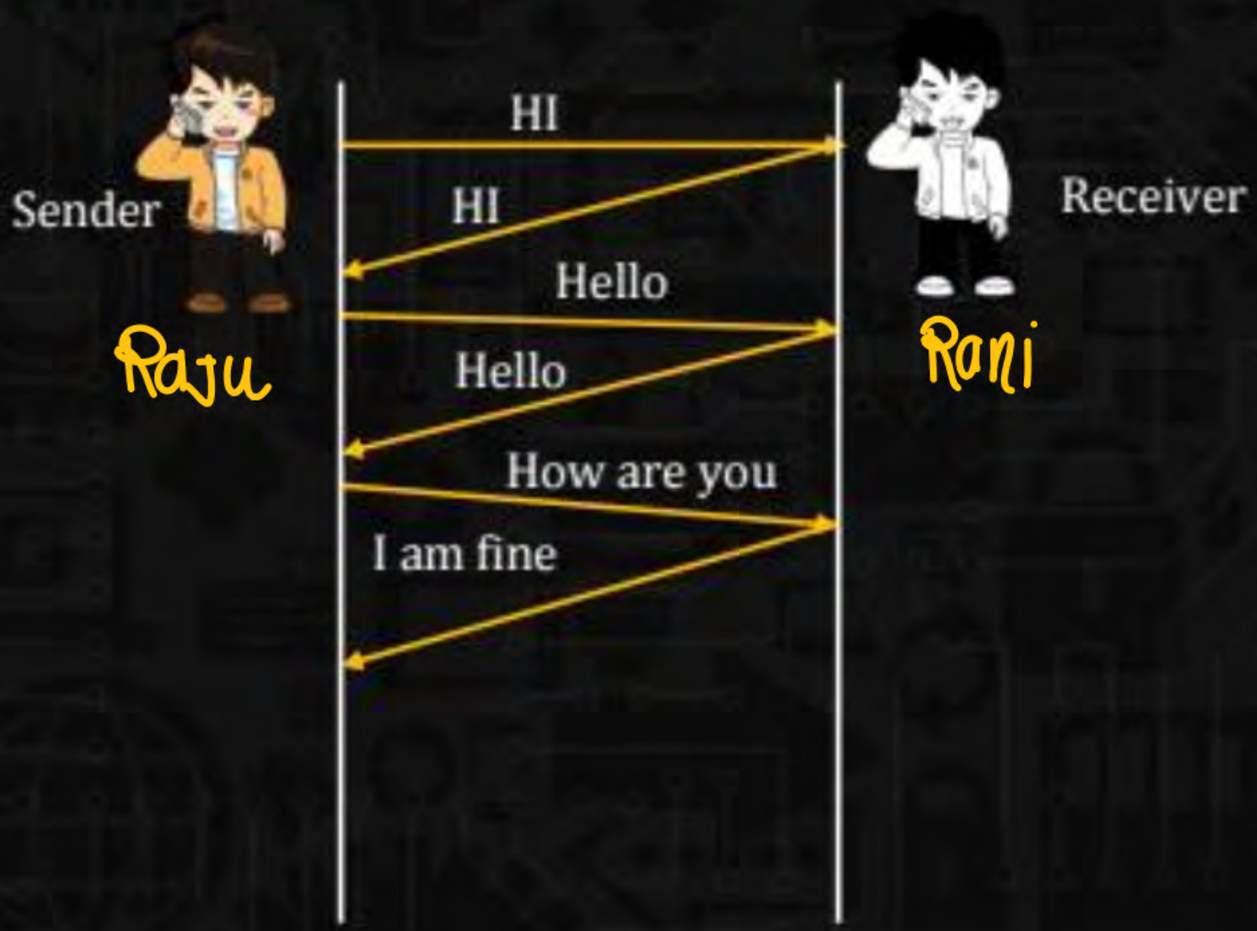
1. Used in connection oriented communication.
2. Stop and wait protocol is a Flow Control for Transmission of frames over noiseless channel.
3. It provides unidirectional data transmission with flow control facilities without error control.
4. The idea of stop and wait protocol is straightforward.
5. After transmitting one Frame, the sender waits for an acknowledgement before transmitting the next frame.

Communication

- Connection oriented
  - Connection establishment
    - 3 way Handshaking
      - ① Req (10Pkt, 64KB, 10sec)
      - ② Reply (10Pkt, 64KB, 5sec)
      - ③ Ack
      - data
- Connection less
  - data



Stop and Wait Protocol



Primitives of Stop wait Protocol

Sender Side:

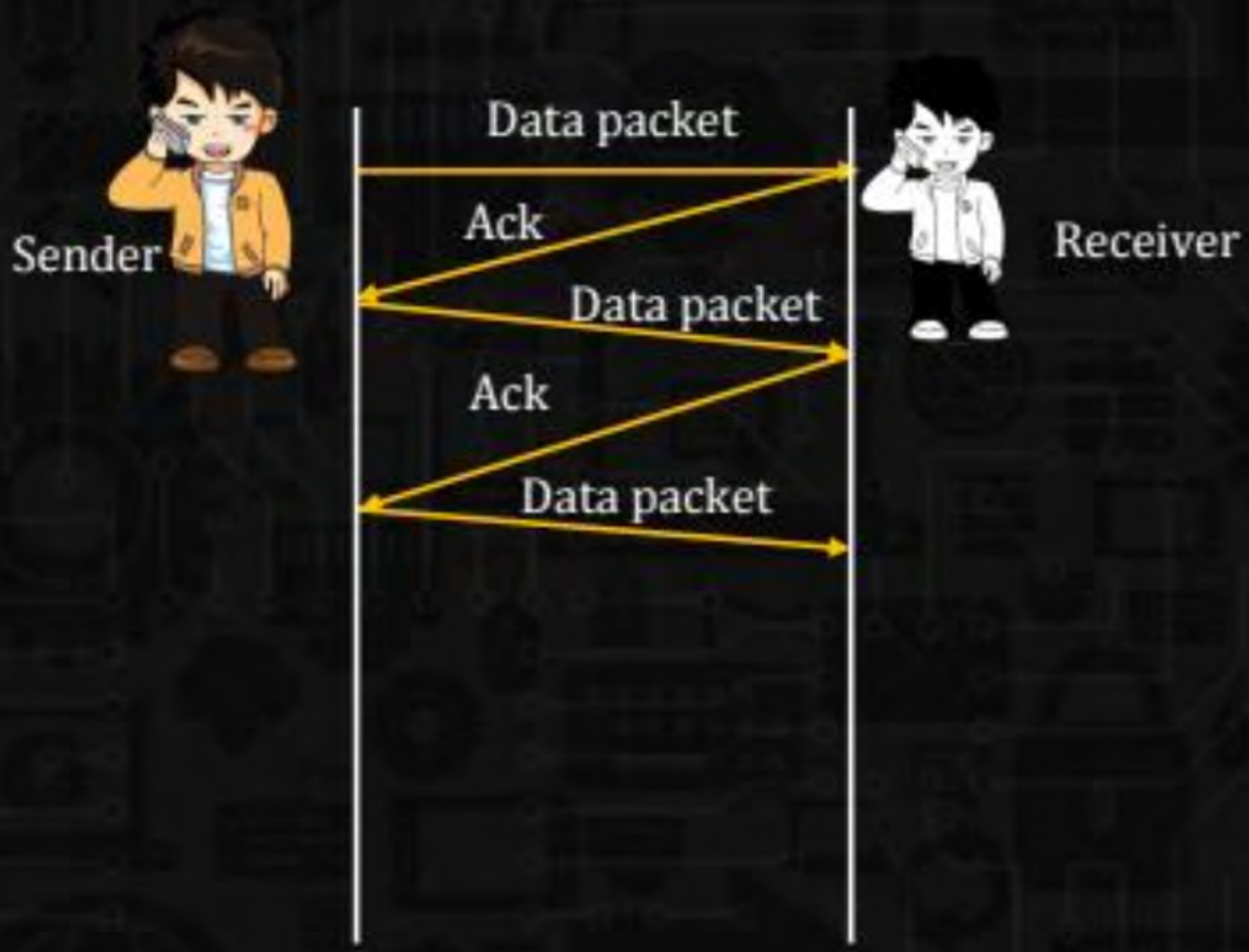
Rule 1 : Send one data packet at a time.

Rule 2 : Send the next packet only after receiving the ACK for the previous packet.

Receiver Side:

Rule 1 : Receive and consume the data packet.

Rule 2 : After consuming packet, Ack need to be sent.


Sender
Data packet
Ack
Data packet
Ack
Data packet
Receiver

Problems of stop & wait Protocol

① Lost data Packet

Note :

- Sender wait for Ack for an infinite amount of time
- Receiver wait for data an infinite amount of time

Dead Lock

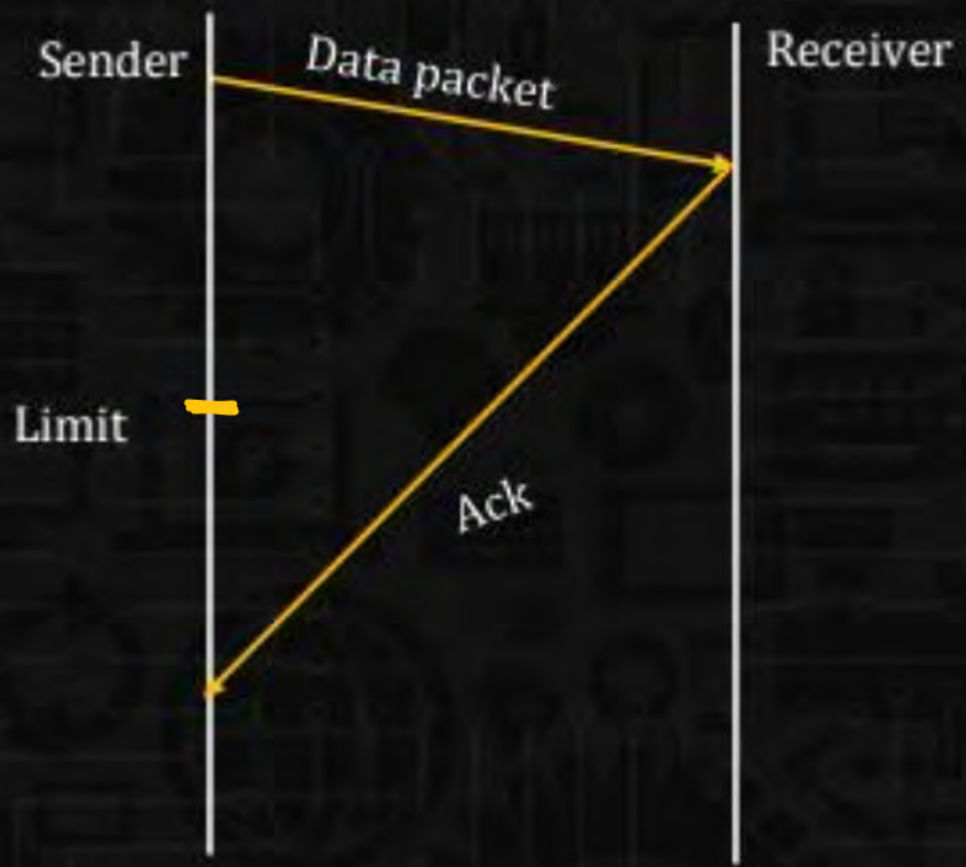
Problems of stop & wait Protocol

② Lost Act

Note :

- Sender wait for an infinite amount of time for Ack

③ Delay Ack



Note :

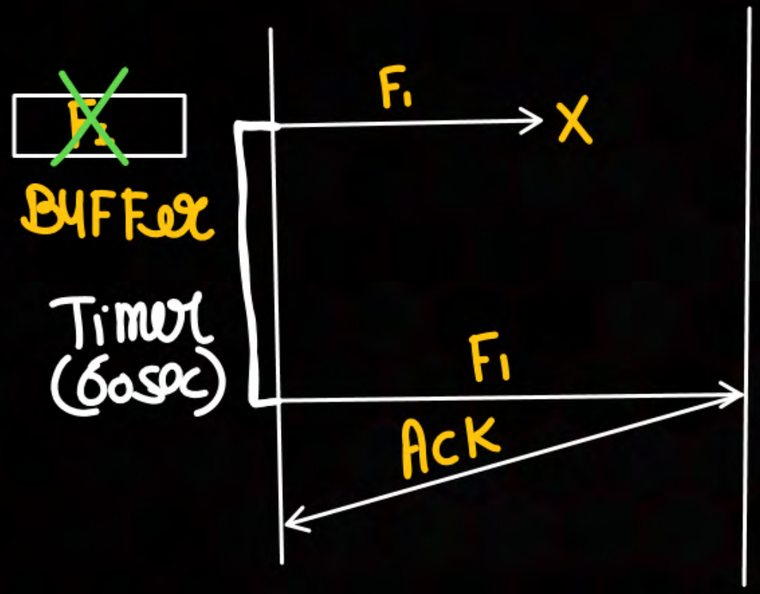
- Delay Ack might be wrongly considered as an Ack of some other Packet.

- Above 3 Problems are resolved by using stop and wait ARQ (Automatic Repeat Request)

Stop & Wait ARQ

1. It Provides both Error control and flow control
2. Error control in stop and wait ARQ is done by keeping a copy of sent frame until it receives an acknowledgement.
3. Sender start a timer when it send a frame. If ACK is not received with in the allocated time period, the sender assume that the frame was lost or damage and resends it.
4. Receiver send an Acknowledgement to sender If it receive a frame correctly.
5. ACK number always define the number of the Next expected Frame.

Q.

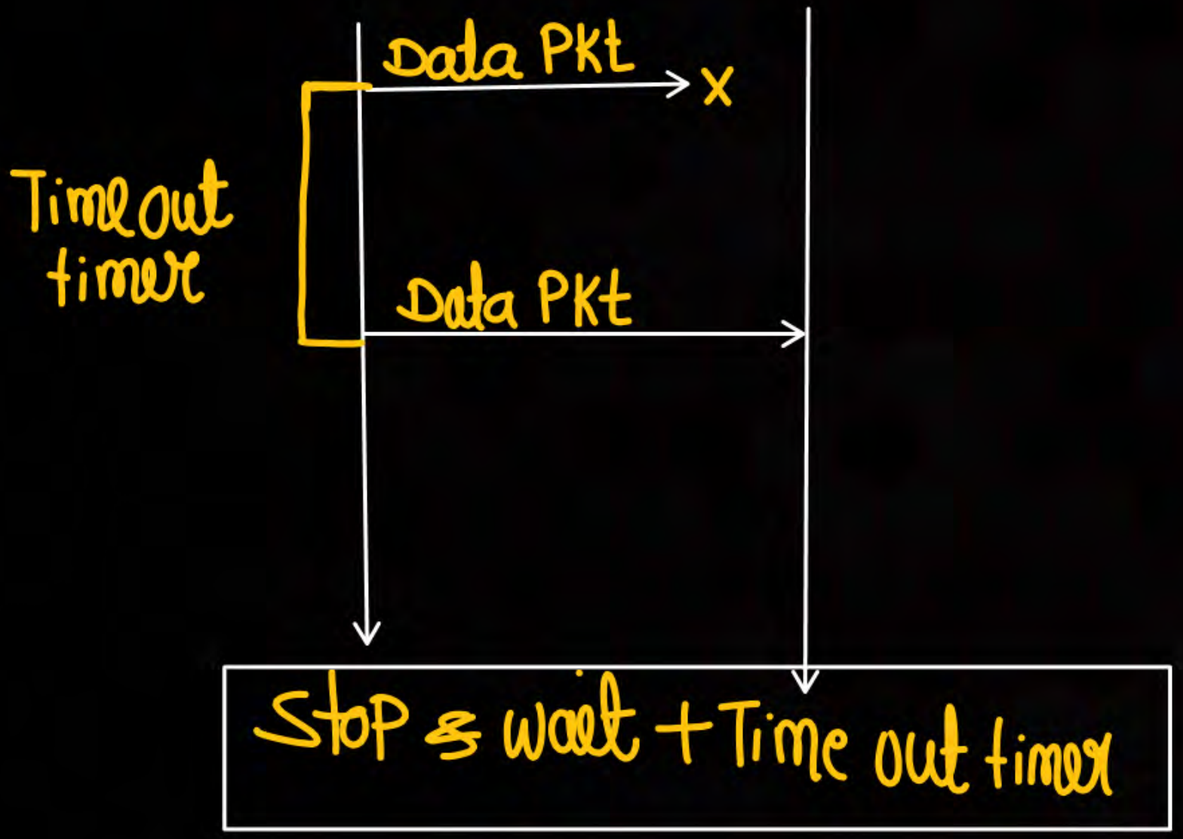


Stop & Wait ARQ

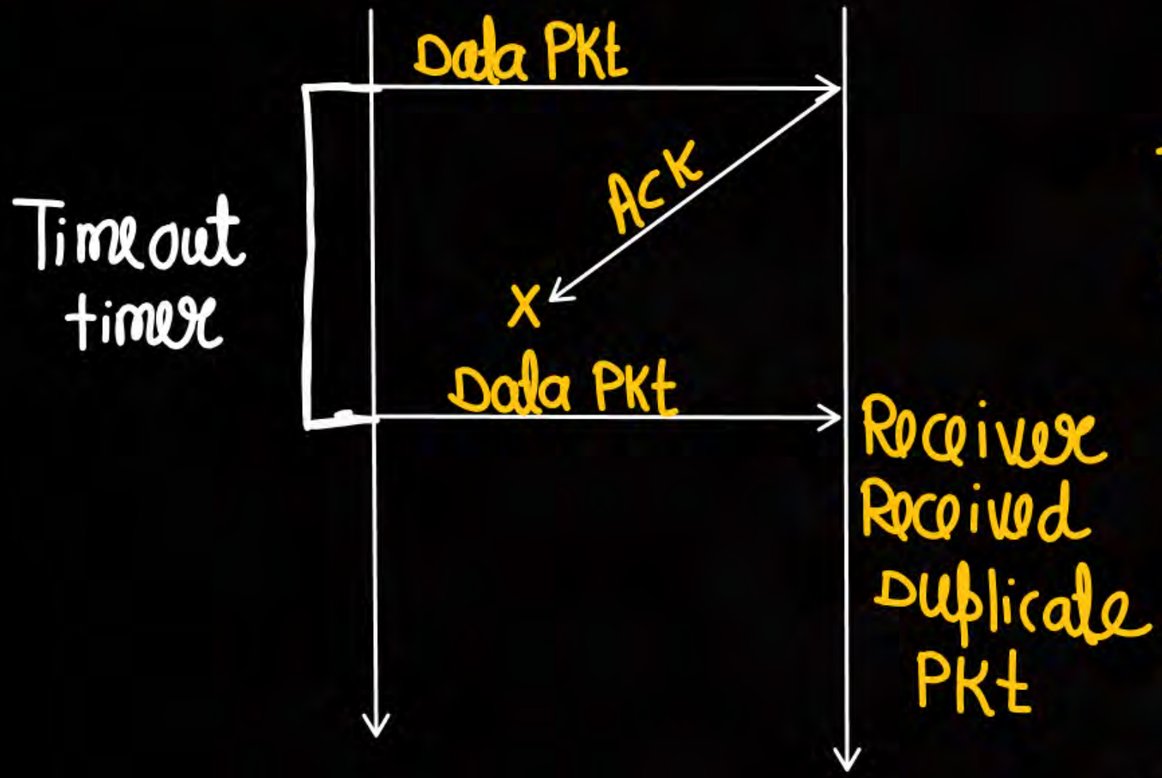
6. Stop and wait ARQ = Stop and wait + Time out + sequence Number (Data) + sequence Number(ACK)

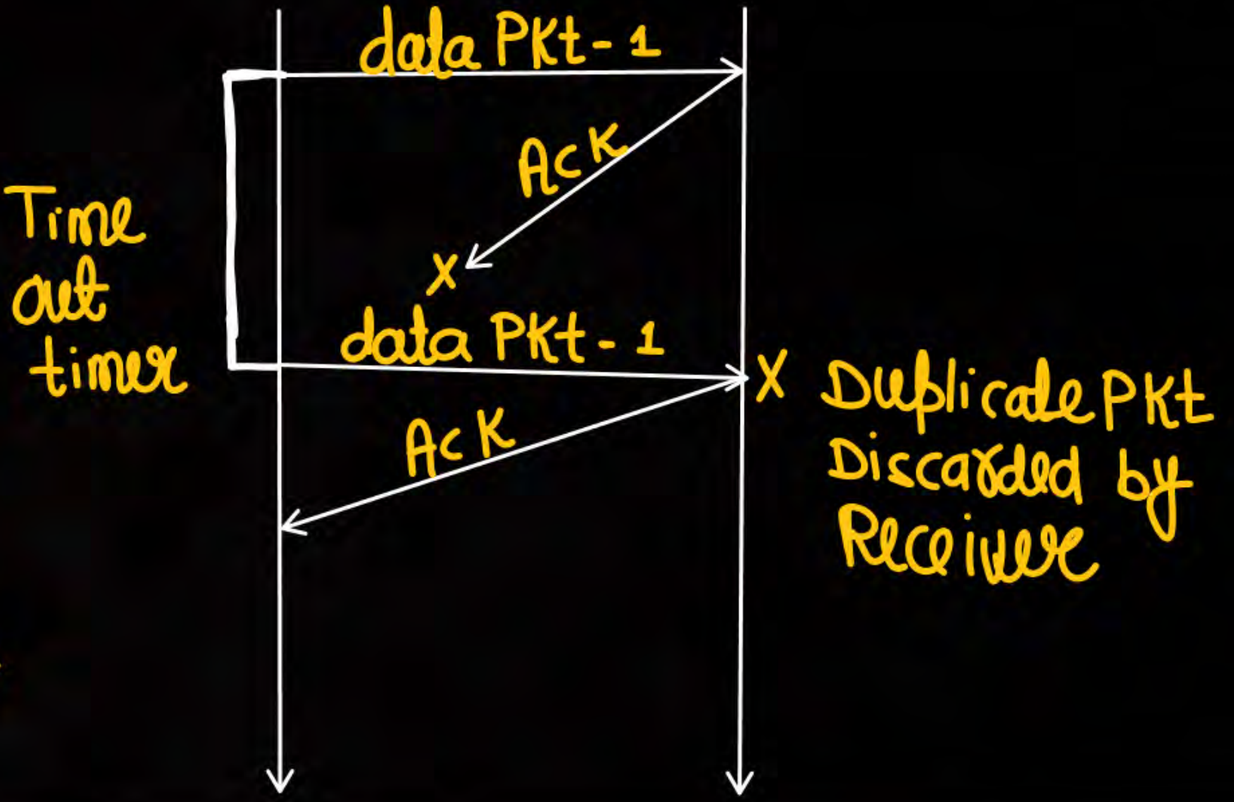
Solutions

① Lost data Packet



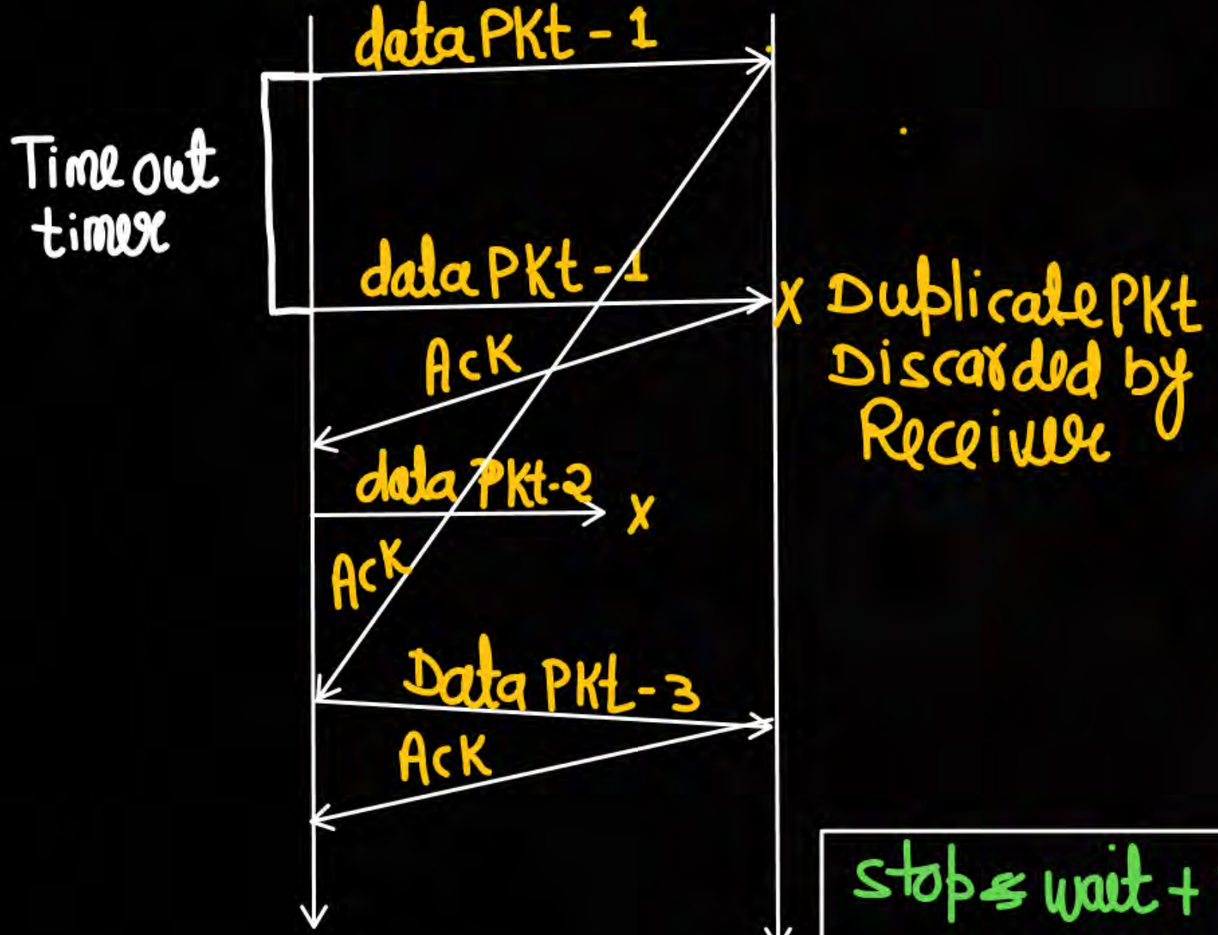
② Lost Ack

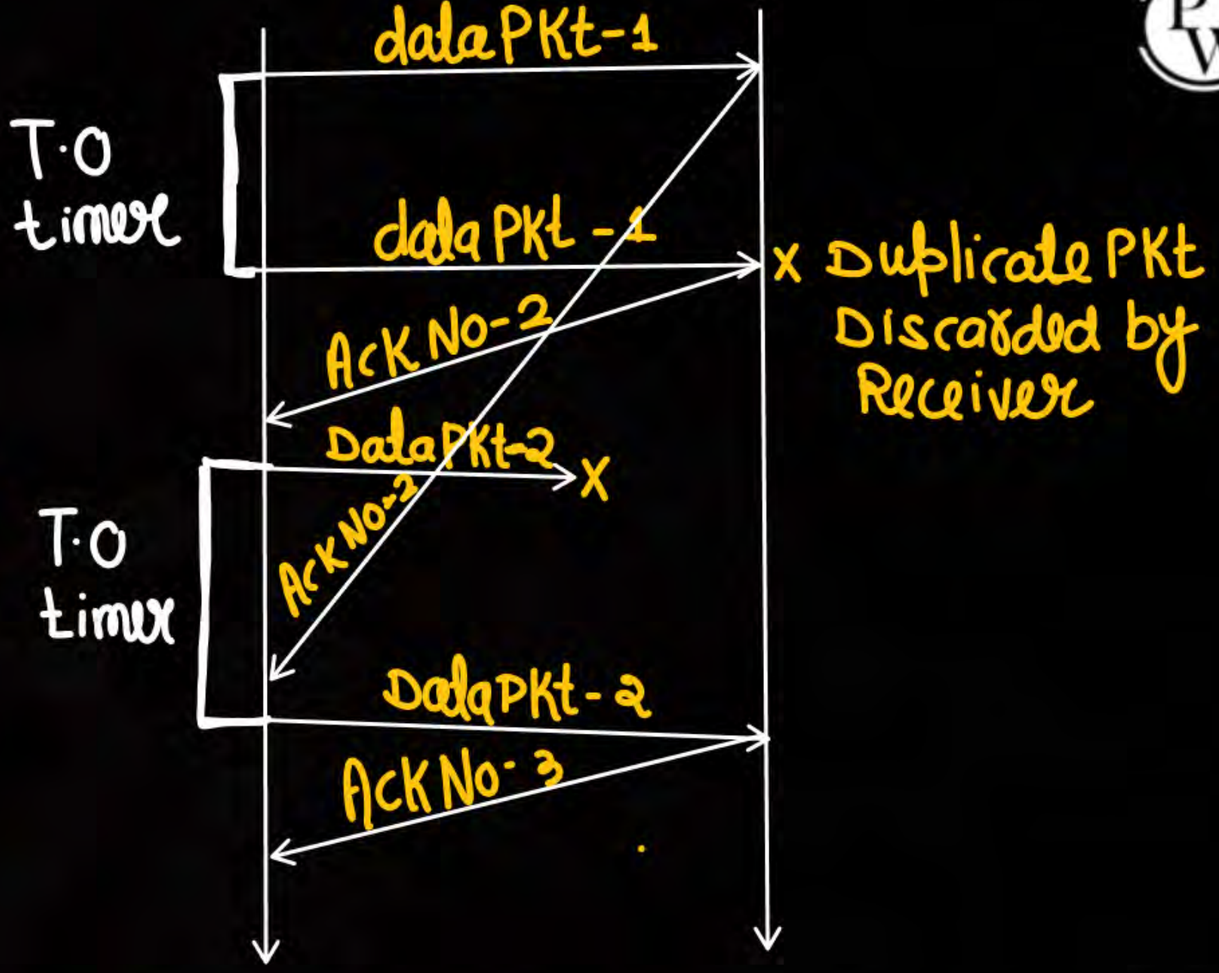




Stop & wait + Timeout timer + Seq No(Data PKt)

3. Delay Ack





stop & wait + T·O timer + Seq No(Data PKt) + Seq No(Ack)

⇓

stop & wait ARQ

Efficiency OR Line utilization OR Link utilization OR Sender utilization

Throughput OR effective Bandwidth or Bandwidth utilization OR Maximum data rate possible

Example

Q. If sender want to send 10 packet and every 4^{th} packet that is being transmitted is lost. By using stop and wait protocol How many total transmission are required____

Example

Q. If sender want to send 500 packets on a link having a error probability 0.2. A stop and wait protocol is used to transfer data across the link then How many transmission are required____

Problem Solving on Stop and Wait protocol

Q.

Consider the Stop and Wait protocol, if transmission time is 'a' at the source and propagation delay is 'b', then after what time, the sender can send the second packet? Consider data packet and ACK packet of the same size.

A. $2a + 2b$

B. $(a + b)/2$

C. $2b + a$

D. $a + 2b$

Q. A series of a 1000 bit frame is to be transmitted across a data link of 100 km in length with 20 Mbps. If the link has a velocity of propagation 2×10^8 m/sec, then the efficiency of stop and wait protocol is _____ %.

Q. If the bandwidth of the line is 1.5 Mbps, RTT is 45 ms and Frame size is 8192 bits, then the efficiency in stop and wait protocol is _____ %.

Q. A sender uses the Stop-and-Wait ARQ protocol for reliable transmission of frames. Frames are of size 1000 bytes and the transmission rate at the sender is 80 Kbps (1Kbps = 1000 bits/second). Size of an acknowledgement is 100 bytes and the transmission rate at the receiver is 8 Kbps. The one-way propagation delay is 100 milliseconds. Assuming no frame is lost, the sender throughput is _____ bytes/second.

GATE 2016

Q. The values of parameters for the Stop-and-Wait ARQ protocol are as given below:

Bit rate of the transmission channel = 1 Mbps. Propagation delay from sender to receiver = 0.75 ms.

Time to process a frame = 0.25 ms.

Number of bytes in the information frame = 1980. (Payload)

Number of overhead bytes in the information frame = 20. (Header) Number of bytes in the acknowledge frame = 20.

Assume that there are no transmission errors. Then, the transmission efficiency (expressed in percentage) of the Stop-and-Wait ARQ protocol for the above parameters is _____ . (correct to 2 decimal places).

GATE 2016

Q. A link has a transmission speed of 10^6 bits/sec. It uses data packets of size 1000 bytes each. Assume that the acknowledgement has negligible transmission delay, and that its propagation delay is the same as the data propagation delay. Also assume that the processing delays at nodes are negligible. The efficiency of the stop-and-wait protocol in this setup is exactly 25%. The value of the one-way propagation delay(in milliseconds) is ____ .

GATE 2016

Q. Suppose that the stop-and-wait protocol is used on a link with a bit rate of 64 kilobits per second and 20 milliseconds propagation delay. Assume that the transmission time for the acknowledgment and the processing time at nodes are negligible. Then the minimum frame size in bytes to achieve a link utilization of at least 50% is ___ . **GATE CS 2015**

A $2a + 2b$

B $(a + b)/2$

C $2b + a$

D $a + 2b$

Q. On a wireless link, the probability of packet error is 0.2. A stop-and-wait protocol is used to transfer data across the link. The channel condition is assumed to be independent from transmission to transmission. What is the average number of transmission attempts required to transfer 100 packets?

GATE 2015

A 100

B 125

C 150

D 200

Q. Consider stop and wait ARQ for flow control, data transfer rate of channel is 32 Kbps, one way end to end propagation delay is 16 ms and frame size is 32 Bytes then the efficiency in percentage is ____ .

Q. Consider packet size is 1000 Bytes, distance between two hosts is 2000 KM, 1 Mbps link with $2*10^8$ meter/sec signal speed, if stop and wait protocol is used then the throughput is ____ (in Mbps).


THANK YOU
GW
SOLDIERS !