SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

Department of Electronics and Communication Engineering

Laboratory Report Cover Sheet

18ECC303J – COMPUTER COMMUNICATION NETWORKS

EVEN SEM 2022-23

Name :

Register No :

Section :

Venue :

Experiment title :

PARTICULARS	**MAX MARKS**	**MARKS OBTAINED**
Pre lab & Post lab	10	
Lab performance	15	
Record	05	
Viva	10	
Total	**40**	

Report Verification

Staff Name:

Signature with date:

7. Implementation and study of Selective Repeat Protocol with and without BER

7.1 Introduction:

The purpose of this experiment is to introduce you to the basics of error correction, time outs and state machines. In this lab, you will be able to provide reliable data transfer between two nodes over an unreliable network using selective repeat protocol.

7.2 Hardware Requirement

- 3PCs with NIU card
- Network Emulation Unit
- Jumper Cables

7.3 Background

Selective Repeat ARQ / Selective Reject ARQ is a specific instance of the Automatic Repeat-request (ARQ) Protocol. It may be used as a protocol for the delivery and acknowledgement of message units, or it may be used as a protocol for the delivery of subdivided message sub-units.

When used as the protocol for the delivery of **messages**, the sending process continues to send a number of frames specified by a *window size* even after a frame loss. Unlike Go-Back- N ARQ, the receiving process will continue to accept and acknowledge frames sent after an initial error; this is the general case of the sliding window protocol with both transmit and receive window sizes greater than 1.

The receiver process keeps track of the sequence number of the earliest frame it has not received, and sends that number with every ACK it sends. If a frame from the sender does not reach the receiver, the sender continues to send subsequent frames until it has emptied its *window*. The receiver continues to fill its receiving window with the subsequent frames, replying each time with an ACK containing the sequence number of the earliest missing frame. Once the sender has sent all the frames in its *window*, it re-sends the frame number given by the ACKs, and then continues where it left off.

The size of the sending and receiving windows must be equal, and half the maximum sequence number (assuming that sequence numbers are numbered from 0 to $n-1$) to avoid miscommunication in all cases of packets being dropped. To understand this, consider thecase when all ACKs are destroyed. If the receiving window is larger than half the maximum sequence number, some, possibly even all, of the packages that are resent after timeouts are duplicates that are not recognized as such. The sender moves its window for every packet thatis acknowledged.

When used as the protocol for the delivery of subdivided messages it works somewhat differently. In non-continuous channels where messages may be variable in length, standard ARQ or Hybrid ARQ protocols may treat the message as a single unit. Alternately selective retransmission may be employed in conjunction with the basic ARQ mechanism where the message is first subdivided into sub-blocks (typically of fixed length) in a process called Packet segmentation. The original variable length message is thus represented as a concatenation of a variable number of sub-blocks. While in standard ARQ the message as a whole is either acknowledged (ACKed) or negatively acknowledged (NAKed), in ARQ with selective transmission the NAKed response would additionally carry a bit flag indicating the identity of each sub-block successfully received. In ARQ with selective retransmission of sub-divided messages each retransmission diminishes in length, needing to only contain the sub-blocks that were NAKed.

In most channel models with variable length messages, the probability of error-free reception diminishes in inverse proportion with increasing message length. In other words, it's easier to receive a short message than a longer message. Therefore, standard ARQ techniques involving variable length messages have increased difficulty delivering longer messages, as each repeat is the full length. Selective retransmission applied to variable length messages completely eliminates the difficulty in delivering longer messages, as successfully delivered sub-blocks are retained after each transmission, and the number of outstanding sub-blocks in following transmissions diminishes.

7.4 Pre lab questions

1. Explain the mechanism of selective repeat ARQ.

2. What is the maximum transmission window size in a selective repeat protocol?

3. What happens if ACK is lost in selective repeat?

4. How do you calculate window size in Selective Repeat?

5. What is the main advantage of Selective Repeat over Go-Back-N?

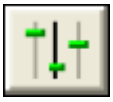
7.5 Design

Design a network topology to illustrate Selective Repeat Protocol. Assume the window size and inter packet delay as 4 and 400ms respectively. Run the simulation for 100 seconds duration and analyze the throughput performance for various time out values.

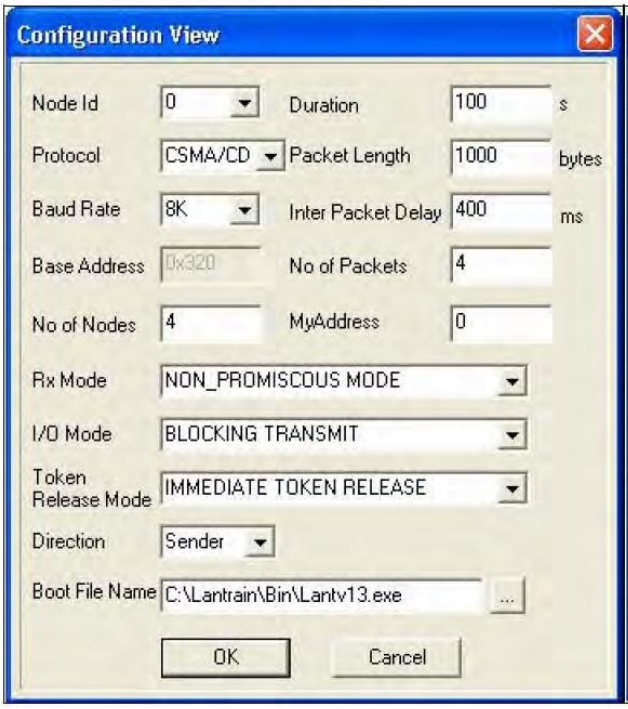
7.6 Procedure:

1. Click on the Selective Repeat icon 

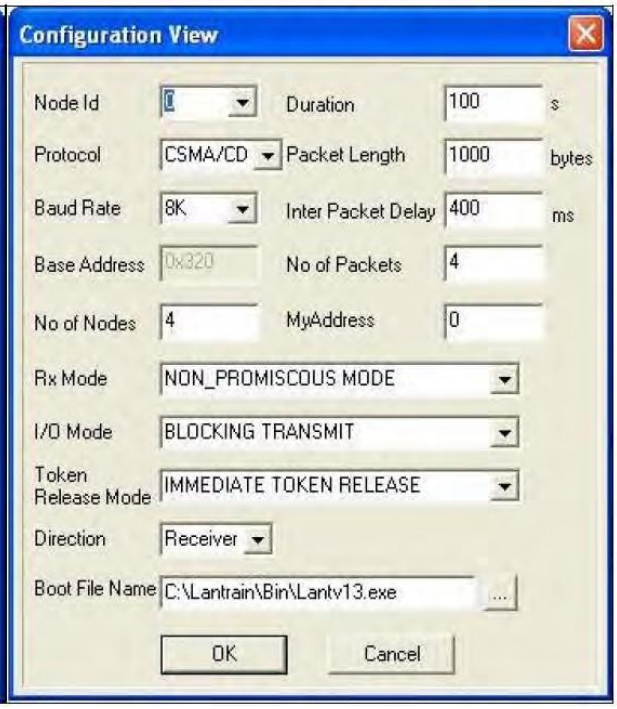
from the desktop on both PCs.

2. Click the Configuration button  in the window in both the Pc's.

PC 1 SENDER



PC 2 RECEIVER



Setting the configuration menu:

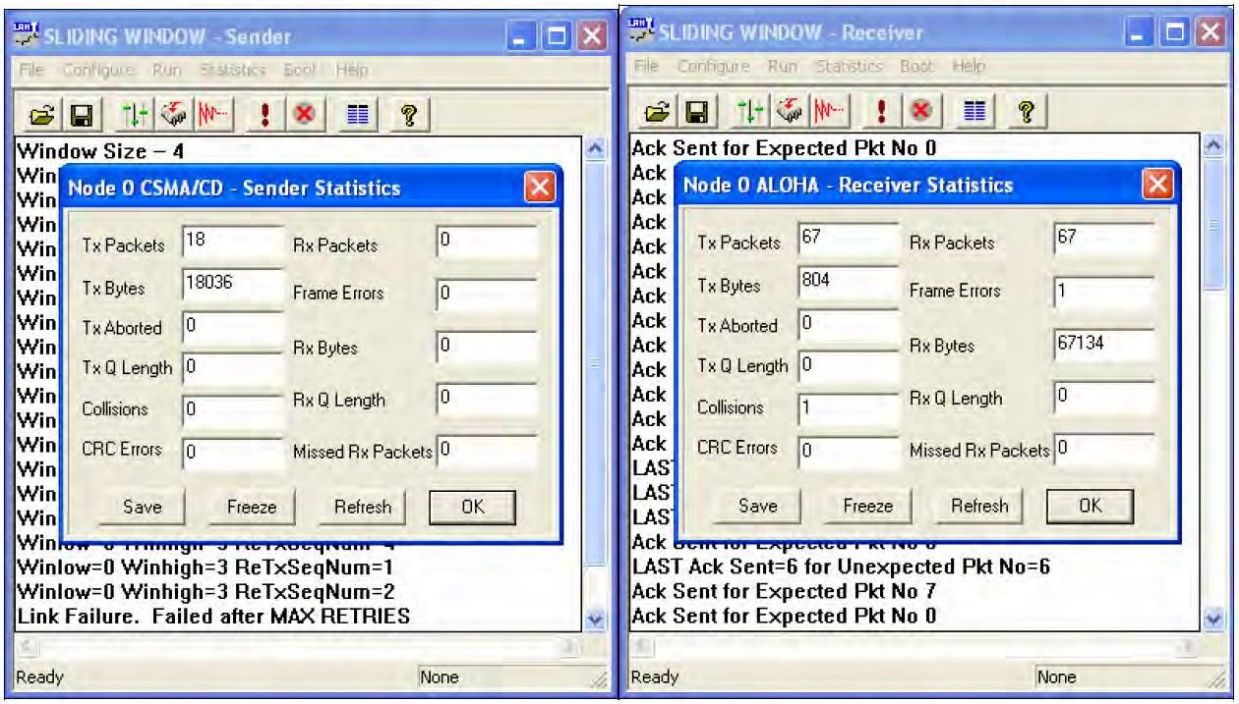
PC 1		**PC 2**	
Node id	**0**	**Node id**	**0**
Protocol	ALOHA	**Protocol**	ALOHA
Baud Rate	8Kbps (At both the config menu and NEU)	**Baud Rate**	8Kbps (At both the config menu and NEU)
Duration	100s	**Duration**	100s
Packet Length	1000 bytes	**Packet**	1000 bytes
Bit Delay	0(at NEU)	**Bit Delay**	0(at NEU)
Direction	Sender	**Direction**	Receiver
No of packets	4	**No of**	4

Note: The No of Packets parameter defines the window size.

3. Set the Inter Packet Delay to 400msecs
4. Click OK button and Download the driver to the NIU using the BOOT  buttoncommand.Booting from any one of the applications is enough.

5. Run the experiment by clicking button  or by choosing RUN _ Start from eachapplication.
6. Set the Timeout Value to 1000 ms

PC 1 SENDER **PC 2 RECEIVER**



7. Note down the no of successfully Transmitted Packets.
8. Repeat the above steps for various time out values and plot a graph between timeout Value& Throughput. Find the optimum timeout value from the plot.

Calculation of Practical Throughput:

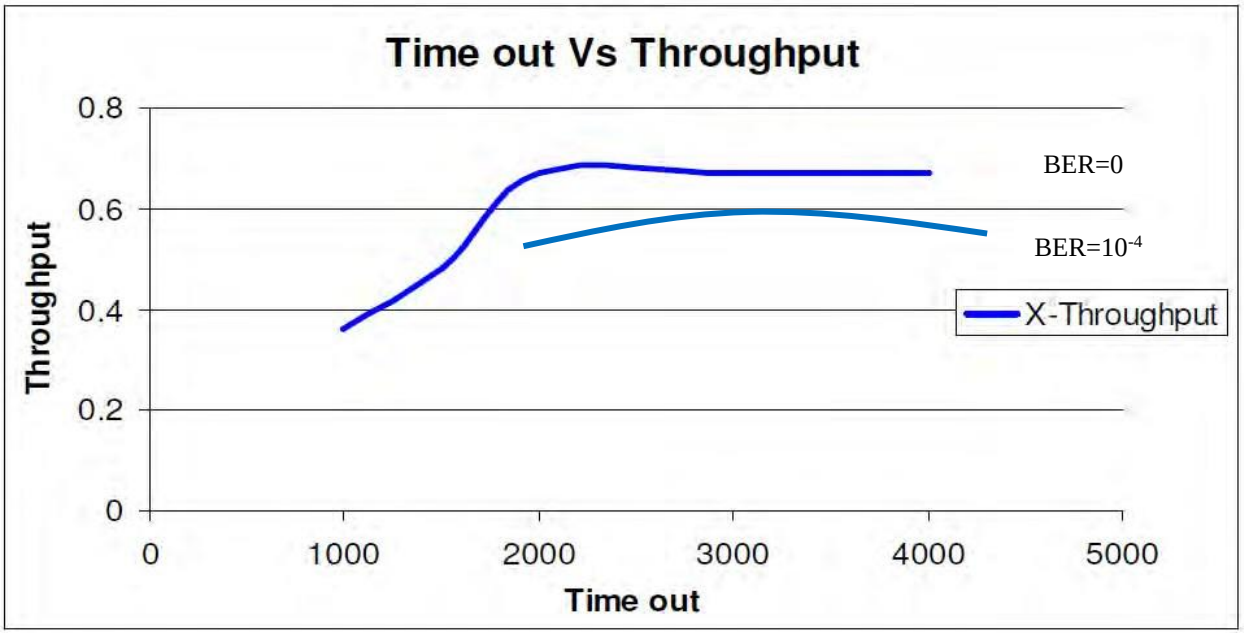
$$X = \frac{\text{(Sum of Successfully Tx packets * Packet Length * 8)}}{\text{(Duration of Experiment * Data rate)}}$$

Model Tabulation:

Time out value in ms	Successfully Tx packets	Practical Throughput
1000	36	0.36
1500	48	0.48
2000	67	0.67
3000	67	0.67
4000	67	0.67

Model Graph:

Selective Repeat Protocol



TABULATION (WITHOUT BER)

BER=0

Timeout value in ms	**Successfully Transmitted Packets**	**Practical Throughput**

Procedure for Stop and Wait with BER:

1. Initially the BER is set as Zero , Now Vary the Bit Error Rate in NEU as 10^{-4} and repeat the same process as above.

TABULATION (WITH BER)

BER=10^{-4}

Timeout value in ms	**Successfully Transmitted Packets**	**Practical Throughput**

7.7 Post Lab Questions

1. Draw the sender and receiver windows for a system using selective repeat ARQ given thefollowing.
    a. Frame 0 is sent, frame 0 is acknowledged.
    b. Frames 1 and 2 are sent, frames 1 and 2 are acknowledged.
    c. Frame 3,4 and 5 are sent, NAK4 is received.
    d. Frame 4, 5,6 and 7 are sent; frames4 through 7 are acknowledged.

2. Which protocol – Go-Back-N or Selective-Repeat - makes more efficient use of network bandwidth? Why?

3. What is the maximum window size for data transmission using the selective repeat protocol with n bit frame sequence numbers?

4.Host A wants to send 10 frames to Host B. The hosts agreed to go with Selective repeat ARQ. How many numbers of frames are transmitted by Host A if every 6^{th} frame that is transmitted by Host A is either corrupted or lost?

5.For the above mentioned compare the number of transmissions of Selective repeat ARQ with Go Back N ARQ?

RESULT