Simulation Project

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1   Introduction

This project models and simulates the Go-Back-N protocol using the sliding window flow control method in OMNeT++. In this protocol, the sender (TIC) can transmit multiple packets without waiting for individual acknowledgments, but it is limited by a defined window size. The receiver (TOC) sends ACKs after receiving a set number (N) of frames. If a packet is lost, the sender must retransmit the lost packet and all subsequent packets, while the receiver discards out-of-order frames until the missing one is received. The simulation analyzes how parameters like window size, data rate, and packet loss rate impact protocol performance, focusing on transmission efficiency and error handling.
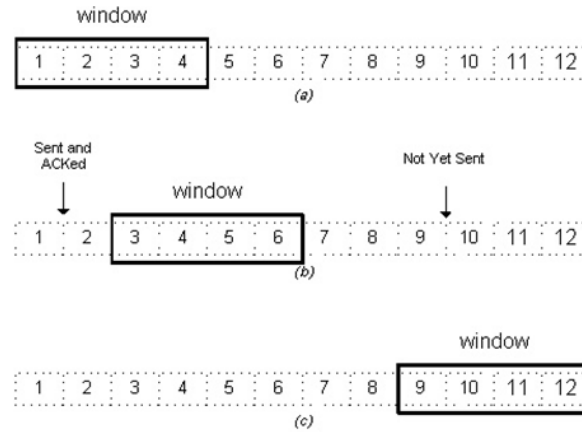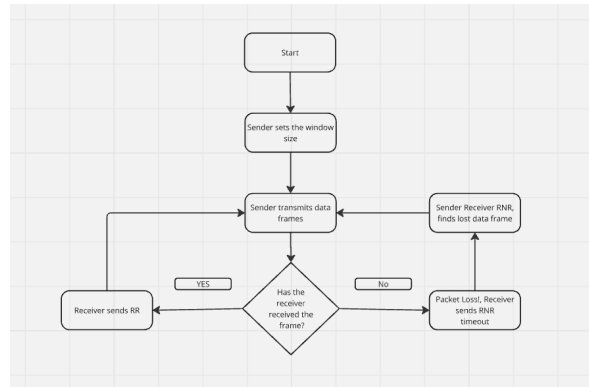

Figure 1: Sliding Window Approach [Arc02],[Johnd]

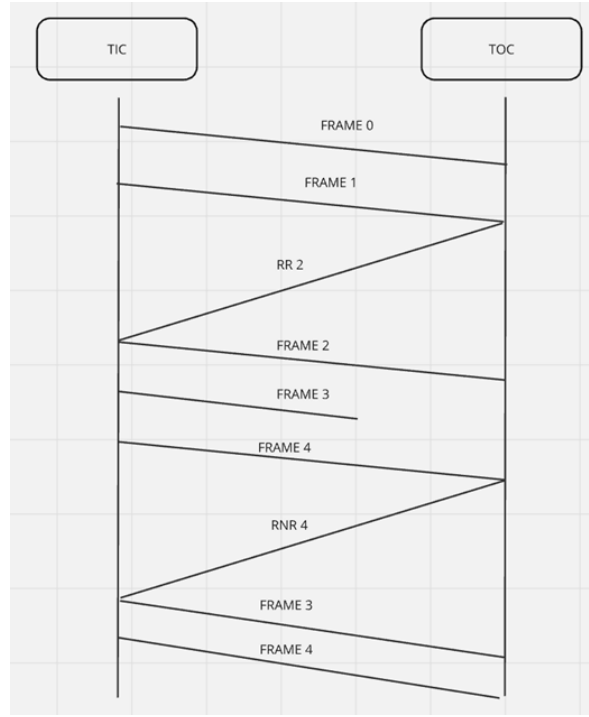Figure 2: Flow Chart of Go Back N Protocol

Figure 3: Flow Chart Diagram

2 Implementation

This section explains the implementation of Go-Back-N protocol focusing on the Transmitter Module and Receiver Module.The simulation models packet transmission, acknowledgments, and retransmission in case of packet loss.

2.1 Transmitter Module

The Transmitter (TIC) is responsible for sending data frames to the receiver (TOC) using the Go-Back-N sliding window protocol. It manages the flow of packets by maintaining a window of unacknowledged frames and retransmitting packets in case of loss. Initially, TIC initializes its parameters, including the data rate, maximum sequence number, and timeout event. TIC then sends a query request to TOC to determine the receiver's window size. Once the response is received, TIC begins transmitting packets up to the allowed window size. For every packet sent, TIC waits for an acknowledgment, if the acknowledgment is received, TIC slides the window forward and continues sending new frames. However, if a packet loss occurs, TIC receives a Receiver Not Ready message, in this case, TIC goes back , finds the lost frame and sends it with the subsequent frames.

2.2 Receiver Module

The Receiver (TOC) is responsible for receiving incoming packets and verifying their sequence numbers,sending cumulative ACKs when frames arrive correctly and discarding out-of-order frames until the expected frame is received in lost packet case. Initially, TOC initializes its parameters, including windowSize, nValue, packetLossRate and buffer. After TIC sends a query request message to get the window size, TOC starts receiving frames cumulatively. After each nValue number of frames, TOC should send an acknowledgment. It checks whether the data packet is lost using a uniform function that gives a random value. If the packet is lost, TOC generates a RNR message and sends it to TIC, signaling that the missing packet and the subsequent frames must be retransmitted. If the packet is successfully received , it is stored in the buffer and its sequence number is recorded. Once TOC receives nValue packets successfully, it sends a Receiver Ready(RR) acknowledgment, including the sequence

number of the next expected frame,indicates that all previous packets were received correctly. After sending acknowledgment, TOC clears the buffer.

Parameters	Explanation	Value
Window Size	Sending Packet Rate of TIC	7
Data rate	The number of packets TIC can send towards TOC	0.1
N Value	The number of packets that the receiver receives before sending an ACK	2
Packet Loss/error rate	Random Variable of Packet Loss Rate 11	0.1
Maximum Sequence Number	Sequence Number Size	9

Table 1: Parameter Table
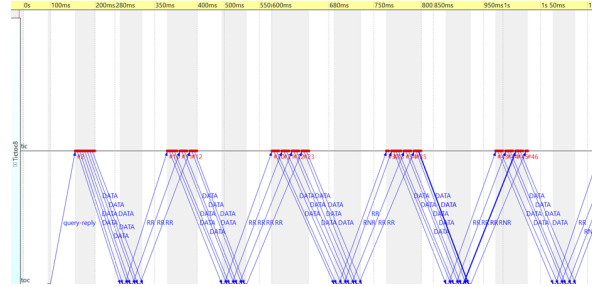

Figure 4: Message Sequence Chart

References

[Arc02] Archana Gupta. Architecture of Go-Back-N Protocol, 2002. Accessed: 2025-02-15.

[Johnd] John Kristof. Sliding Window Protocol, n.d. Accessed: 2025-02-15.