**Aim**: Simulation of stop and wait protocol using ns2.

**Theory:**

**Stop and Wait ARQ**

The basic idea of stop and wait ARQ is that the sender A transmits a frame to the receiver B and waits to receive either (1) a (positive) acknowledgment (ACK) of correct reception, at which point A will transmit a new frame corresponding to the next packet, or (2) a negative acknowledgement (NAK) of incorrect reception, at which point A will re- transmit a frame with the same packet data as the incorrectly received frame.

Since it is also possible that frames are lost between A and B (e.g. due to framing errors), it may also be necessary for A and B to periodically re-transmit or request re- transmission, respectively, referred to as a timeout and requiring each sender and receiver to incorporate a timer into the ARQ algorithm.

Next, suppose the sender A transmits a frame to the receiver B, the frame is correctly received by B, but the ACK from B to A is either lost or received by A after a timeout has occurred. The next frame received by B will then contain the same packet data as the correctly received frame. If there is no additional mechanism to distinguish between the packets, the receiver B is unable to determine whether the second frame is (1) a duplicate of the previous frame corresponding to the same network layer packet or (2) a frame corresponding to a second network layer packet that happens to have the same data. To solve this problem, a sequence number SN is used to uniquely identify network layer packets.

Similarly, we must include a request number RN in each ACK frame, indicating the SN value of the next packet expected by the receiver. An additional benefit of using RN is that different ACK and NAK packet types are not required. The receiver can simply increment RN to indicate an ACK but leave RN the same to indicate a NAK. Furthermore, if there is a second data stream being transmitted from B to A, the packet requests for the B to A stream can be \piggybacked" onto the frame transmissions for the A to B stream.

For node A:

1. Set SN to 0.

2. Accept packet from network layer (or wait for it), assign number SN to new packet.

3. Transmit packet SN in a frame with SN in the sequence number field and start a timer.

4. If error-free frame from B is received with RN > SN, increment SN and go to step 2.

If the timer expires and no such frame is received, go to step 3.

For node B:

1. Set RN to 0.

2. Start a timer. If error-free frame from A is received with SN = RN before the timer expires, release packet to network layer and increment RN. Otherwise, wait for the timer to expire.

3. Transmit frame with RN and go to step 2.



**Utilization /Throughput of Stop and Wait Protocol**

T = Tframe + Tprop + Tproc + Tack + Tprop + Tproc Tframe = time to transmit frame

Tprop = propagation time

Tproc = processing time at station Tack = time to transmit ack

Assume Tproc and Tack relatively small

T ≈ Tframe + 2Tprop

Throughput = 1/T = 1/(Tframe + 2Tprop) frames/sec

Utilization U is ratio of time to transmit data Tframe and the total time to send the data and get the response Tframe + 2Tprop

U = Tframe = 1 Tframe + 2Tprop 1 + 2a where a = Tprop / Tframe

a = propagation time = d/V = Rd transmission time L/R VL

where

d = distance between stations

V = velocity of signal propagation L = length of frame in bits

R = data rate on link in bits per sec Rd/V ::= bit length of the link

a ::= ratio of link bit length to the length of frame

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| **Conclusion:** |

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| **Post lab:**  Q.1.State disadvantages of stop and wait protocol.  Q.2. Consider the stop-and-wait protocol where A wants to send 1 KB frames to B. Packets that are overdue are presumed lost and are retransmitted  1. In the absence of any packet losses or duplications, explain why it is not necessary to include any “sequence number” data in the frame header.  2. Suppose that the link can lose occasional packets, but that packets that do arrive always arrive in the order sent. Is a 2-bit sequence number (that is N mod 4) enough for A and B to detect and resent any lost packets? Is a 1-bit sequence number enough?  Q.3. Calculate the throughput for stop and wait flow control mechanism if the frame size is 4800 bits, bit rate is 9600 bps and distance between device is 2000 km. Speed of propagation over the transmission is 200,000 km/s.  Q.4. A channel has a bit rate of 4 kbps and propagation delay of 20 msec. For what range of frame sizes does stop and wait gives an efficiency of at least 50 percent? |

Signature of Faculty Date of Completion