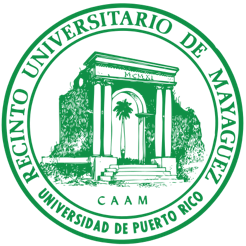
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Project 3

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CIIC4070-090

04/7/2020

**Stop-and-Wait Protocol**

A ­­Stop-and-Wait protocol is a simple ARQ (automatic repeat-request) mechanism in telecommunications to send information between two devices. This protocol will ensure that packets are not dropped and that they are received in the correct order.

The sender for a stop-and-wait ARQ sends one frame at a time and after sending each frame, the sender will not send any more frames until it receives an ACK (acknowledgement) signal. If the sender does not receive this ACK signal after a certain period of time, a timeout occurs. In response to this timeout, the sender will send the same frame again and the timeout countdown is reset. This countdown will be reset after every frame transmission as to not cause a timeout when everything is working correctly. In particular for this project, the timeout period is one second.

The receiver for the stop-and-wait ARQ will, after receiving a frame and verifying its validity, send back an ACK signal to the sender. If, however, the receiver sees that the frame is damaged or invalid, it will discard the frame and not send an ACK, prompting the sender to re-send the frame.

One possible issue that may arise from the receiver is that the ACK signal sent by the receiver becomes damaged or lost. When this occurs, the sender doesn’t receive the ACK, will timeout, and then re-send the frame which then causes the received to have a duplicate of the original frame that was send, but will not know if it’s a duplicate or just another frame in the sequence of data. Another issues that may occur is when the transmission medium has such a long latency that the sender’s timeout runs out before the frame reaches the receiver which then prompts the sender to resend the same packet and causes the receiver to have a duplicate frame and send out two individual ACKs which can cause further issues with the sender which may assume that the second ACK is for the next frame in its sequence of data.

A solution to these problems is to define a 1 bit sequence number in the header of the frame and this sequence number will alternate from 0 to 1 in each subsequent frame. Now, when the receiver sends an ACK, it will include the sequence number of the next packet it’s expecting. This sequence number allows the receiver to detect when duplicates are received by checking if the sequence numbers alternate or not. If the two subsequent frames have the same sequence number, then it means that they are duplicates and the second frame will be discarded. In this same vein, if the receiver sends two subsequent ACKs that reference the same sequence number, then the sender knows it’s acknowledging the same frame.