Modelling and analysis of a sliding window protocol

In this project you are expected to modify an existing CPN model and analyse it by means of state spaces.

The modelling and analysis is done by using CPN Tools. You should download the tool to your machine before attending the Petri Net Course. For more information see:

<http://www.cs.au.dk/~cpnbook/cpntools.shtml>

In the lectures you have seen a stop-and-wait protocol. The sender keeps sending the same packet until a matching acknowledgement is received. In a sliding window protocol it is possible for the sender to transmit several packets to the receiver before receiving an acknowledgement. The sender has a window containing a number of data packets which are currently under transmission and for which acknowledgements have not yet been received.

Task 1: Modify the CPN model such that it models a Go-Back-N Window Protocol.

In a Go-Back-N protocol, the sender sends all data packets in the current window and then waits for acknowledgements. If no acknowledgement is received (within a certain amount of time), the data packets in the window are all retransmitted.

The CPN model of the stop-and-wait protocol can be downloaded from: <http://www.cs.au.dk/~cpnbook/models/chapter2/2-10NondeterministicProtocol.cpn>

It should only be necessary to modify the Sender part of the CPN model. You should change the colour set and the initial marking of the NextSend place, so that it contains information about the start and end of the window. Having done this you should change the arc inscriptions of the surrounding arcs so that they implement a sliding windows strategy.

Use simulation to validate the correctness of your protocol. It may be useful to change the initial marking of PacketToSend so that you get more packets to work with.

Task 2: Use state spaces to analyse the Sliding Window Protocol from task 1.

To obtain a finite state space you should introduce a Limit place as shown in the lectures. Having done this you can construct the state space, the SCC graph, and the state space report. Start by setting the Limit to 1 or 2. Later you should increase it.

Use the state space reports to investigate whether your protocol works correctly. You should check that the bounds are ok and that the dead markings and home markings/spaces are as expected.