Progress Report: Make NDN Congestion Control work in ndnSIM

6th NDN Hackathon

Klaus Schneider, Ashiqur Rahman, Chavoosh Ghasemi

May 13, 2018

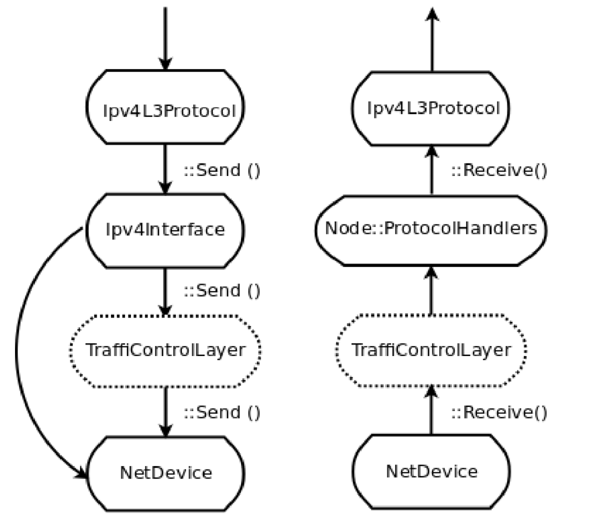
The University of Arizona

Motivation and Contribution to NDN:

- The current NFD congestion detection doesn't work in ndnSIM, since ndnSIM doesn't use regular TCP, UDP, or Unix faces.
- Tasks:
  - Implement a ns-3 Queue based on CoDel that detects congestion and inserts congestion marks.
  - Map these congestion marks onto NDNLP/ns-3 packets.
- Additional Tasks (if time):
  - Start submitting the code to Gerrit.
  - Implement a TCP-Cubic like consumer app and compare it against the AIMD app.

Corner-stone

NS-3 separated queuing in traffic-control module as:



Solution Steps

1. ndnSIM doesn't use real TCP or UDP faces.
   $\Rightarrow$ NetDeviceTransport: override of virtual function(s) for congestion control.

Solution Steps

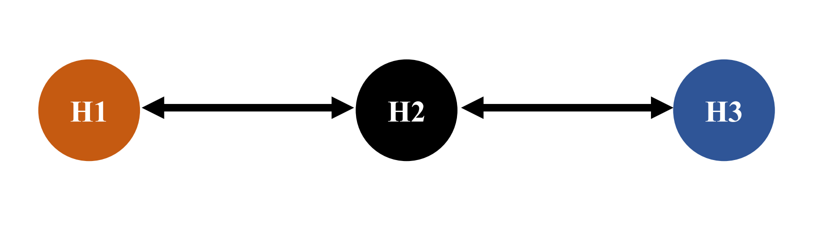
1. ndnSIM doesn't use real TCP or UDP faces.
   $\Rightarrow$ NetDeviceTransport: override of virtual function(s) for congestion control.
2. CongestionMarks signaled via NDNLP: Already works!

Solution Steps

1. ndnSIM doesn't use real TCP or UDP faces.
   $\Rightarrow$ NetDeviceTransport: override of virtual function(s) for congestion control.
2. CongestionMarks signaled via NDNLP: Already works!
3. Implement Consumer App that reacts to congestion marks (AIMD and TCP CUBIC.)

Evaluation Scenario

Very simple scenario:



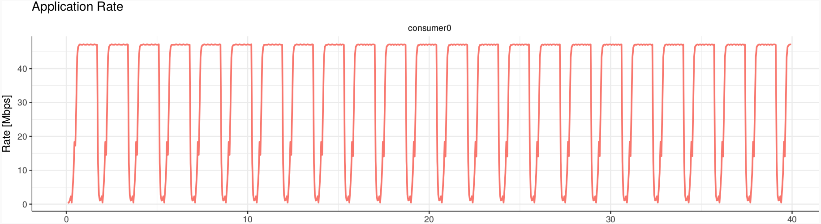
- 1 Consumer
- 50 Mbit/s bottleneck capacity
- 40ms RTT

How ndnSIM performs right now

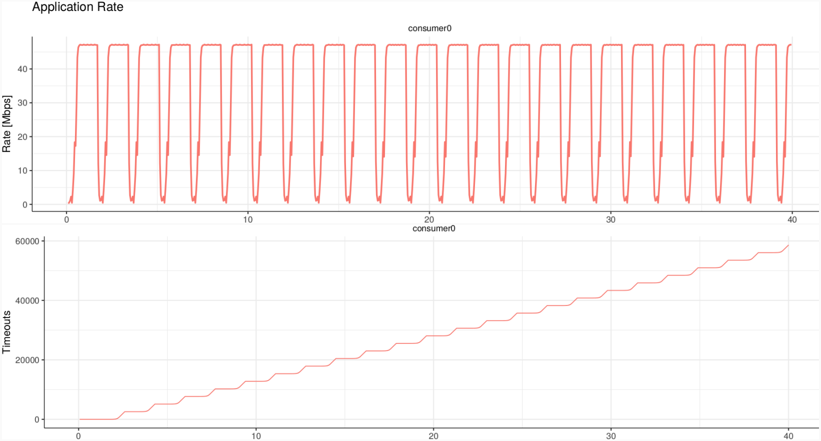
ConsumerWindow App:

- On Data: $m_{cwnd}{++}$ (constant slow start!)
- On TimeOut: $m_{cwnd} \leftarrow 2$

How ndnSIM performs right now – Results

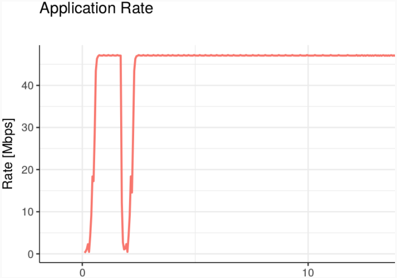


How ndnSIM performs right now – Results

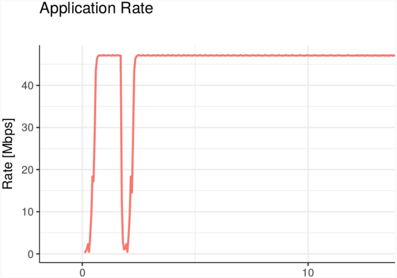


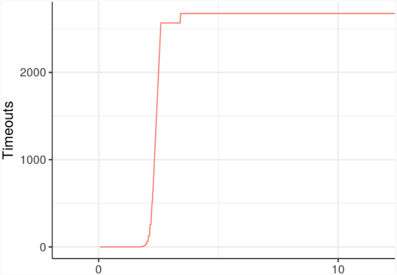
60,000 Timeouts!!!

Improved ConsumerWindow (no congestion marks)

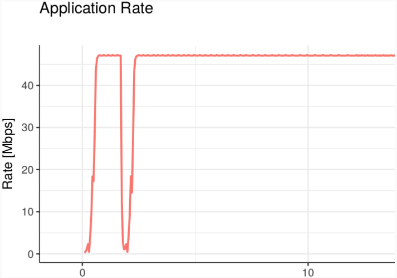


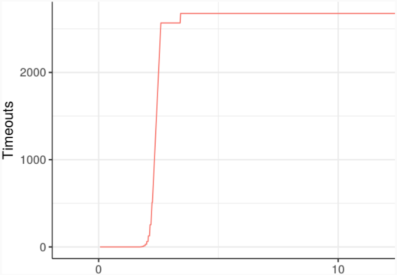
Improved ConsumerWindow (no congestion marks)

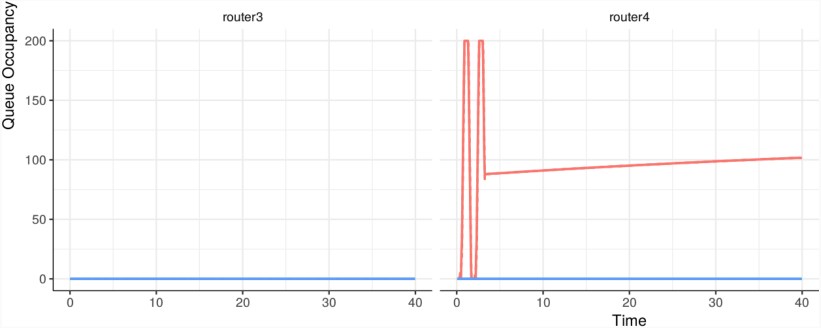




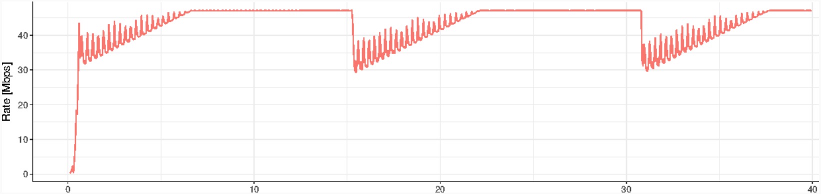
Improved ConsumerWindow (no congestion marks)





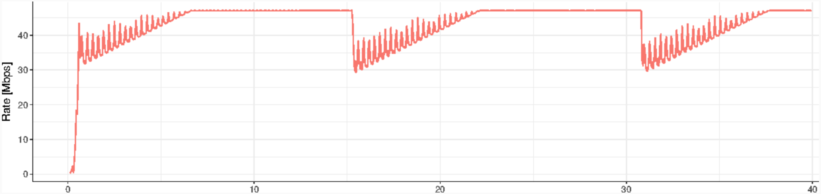


ConsumerPCON – AIMD

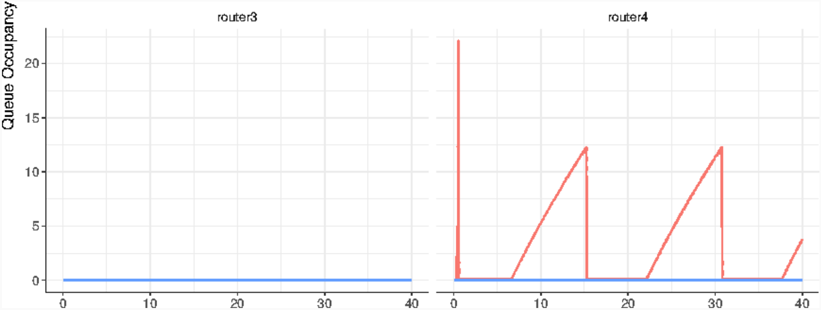


No Timeouts!, Shorter “sawtooth” patterns

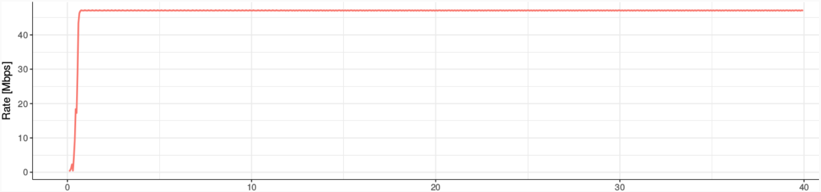
ConsumerPCON – AIMD



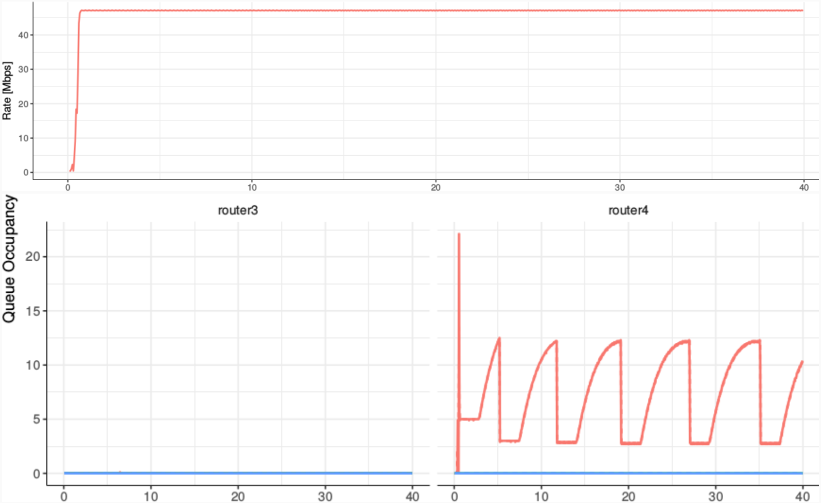
No Timeouts!, Shorter "sawtooth" patterns



ConsumerPCON – CUBIC



ConsumerPCON – CUBIC



Even Shorter Sawtooths!

Experimental environment

Local topology:

- UDP Tunnels & TCP Tunnels
- Ethernet & WiFi

The End

Any Questions?

Klaus Schneider, Eric Newberry, Chavoosh Ghasemi