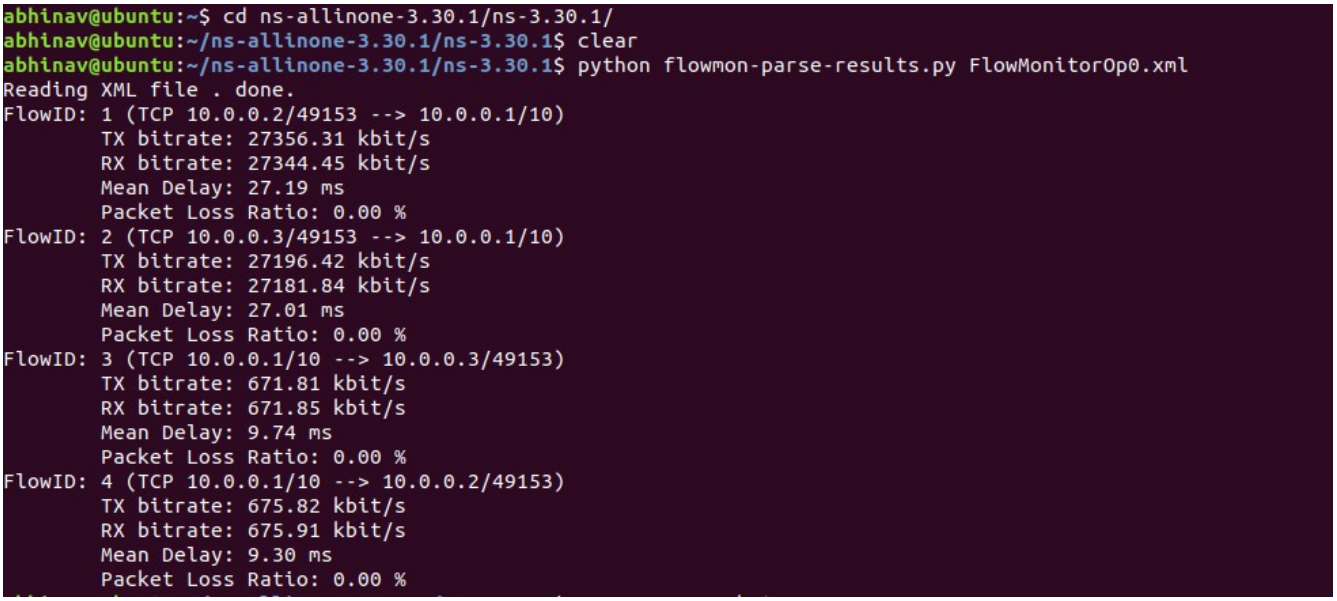
CS349 : Networks Lab
Lab-4 Report – Group 41

The given network setup was simulated on the ns-3 simulator. The main source code for the simulation is the "myns3script.cc" script. The observations are summarized below:

Here, the IP address 10.0.0.1 is the Access Point node, that is, Node 1 defined in the question. The two other IP addresses are the two other nodes. For all of the below results, TCP Westwood+ was used.

1. RtsCtsThreshold = 0 bytes:



RtsCtsThreshold = 256 bytes:

```
abhinav@ubuntu:~/ns-allinone-3.30.1/ns-3.30.1$ python flowmon-parse-results.py FlowMonitorOp256.xml
Reading XML file . done.
FlowID: 1 (TCP 10.0.0.2/49153 --> 10.0.0.1/10)
        TX bitrate: 27476.00 kbit/s
        RX bitrate: 27461.08 kbit/s
        Mean Delay: 25.65 ms
        Packet Loss Ratio: 0.00 %
FlowID: 2 (TCP 10.0.0.3/49153 --> 10.0.0.1/10)
        TX bitrate: 27347.84 kbit/s
        RX bitrate: 27333.80 kbit/s
        Mean Delay: 25.85 ms
        Packet Loss Ratio: 0.00 %
FlowID: 3 (TCP 10.0.0.1/10 --> 10.0.0.3/49153)
        TX bitrate: 675.57 kbit/s
        RX bitrate: 675.61 kbit/s
        Mean Delay: 10.48 ms
        Packet Loss Ratio: 0.00 %
FlowID: 4 (TCP 10.0.0.1/10 --> 10.0.0.2/49153)
        TX bitrate: 678.71 kbit/s
        RX bitrate: 678.88 kbit/s
        Mean Delay: 10.40 ms
        Packet Loss Ratio: 0.00 %
```

RtsCtsThreshold = 512 bytes:

```
abhinav@ubuntu:~$ cd ns-allinone-3.30.1/ns-3.30.1/
abhinav@ubuntu:~/ns-allinone-3.30.1/ns-3.30.1$ clear
abhinav@ubuntu:~/ns-allinone-3.30.1/ns-3.30.1$ python flowmon-parse-results.py FlowMonitorOp512.xml
Reading XML file . done.
FlowID: 1 (TCP 10.0.0.2/49153 --> 10.0.0.1/10)
        TX bitrate: 25861.01 kbit/s
        RX bitrate: 25822.83 kbit/s
        Mean Delay: 24.79 ms
        Packet Loss Ratio: 0.09 %
FlowID: 2 (TCP 10.0.0.3/49153 --> 10.0.0.1/10)
        TX bitrate: 28958.48 kbit/s
        RX bitrate: 28946.91 kbit/s
        Mean Delay: 24.19 ms
        Packet Loss Ratio: 0.00 %
FlowID: 3 (TCP 10.0.0.1/10 --> 10.0.0.3/49153)
        TX bitrate: 715.43 kbit/s
        RX bitrate: 715.39 kbit/s
        Mean Delay: 9.92 ms
        Packet Loss Ratio: 0.00 %
FlowID: 4 (TCP 10.0.0.1/10 --> 10.0.0.2/49153)
        TX bitrate: 638.99 kbit/s
        RX bitrate: 639.15 kbit/s
        Mean Delay: 10.61 ms
        Packet Loss Ratio: 0.00 %
```

RtsCtsThreshold = 1024 bytes:

```
abhinav@ubuntu:~$ cd ns-allinone-3.30.1/ns-3.30.1/
abhinav@ubuntu:~/ns-allinone-3.30.1/ns-3.30.1$ clear
abhinav@ubuntu:~/ns-allinone-3.30.1/ns-3.30.1$ python flowmon-parse-results.py FlowMonitorOp1024.xml
Reading XML file . done.
FlowID: 1 (TCP 10.0.0.2/49153 --> 10.0.0.1/10)
        TX bitrate: 27121.14 kbit/s
        RX bitrate: 27108.89 kbit/s
        Mean Delay: 25.96 ms
        Packet Loss Ratio: 0.00 %
FlowID: 2 (TCP 10.0.0.3/49153 --> 10.0.0.1/10)
        TX bitrate: 27781.34 kbit/s
        RX bitrate: 27760.20 kbit/s
        Mean Delay: 25.30 ms
        Packet Loss Ratio: 0.00 %
FlowID: 3 (TCP 10.0.0.1/10 --> 10.0.0.3/49153)
        TX bitrate: 686.10 kbit/s
        RX bitrate: 686.24 kbit/s
        Mean Delay: 10.43 ms
        Packet Loss Ratio: 0.00 %
FlowID: 4 (TCP 10.0.0.1/10 --> 10.0.0.2/49153)
        TX bitrate: 670.01 kbit/s
        RX bitrate: 670.05 kbit/s
        Mean Delay: 10.59 ms
        Packet Loss Ratio: 0.00 %
```

We may note the TCP throughput at each node from the above screenshots (Tx bitrate and the Rx bitrate), for each of the specified RTSCTSThreshold values. We may also note that the Packet Loss Ratio is arbitrarily close to 0% in each of the situations, meaning that virtually no bandwidth is lost due to collisions.

(The total average throughput is printed at the end of each simulation. The simulation may take long time to complete although the simulation time is 50 seconds because it makes the trace files. We may opt to not make the trace files to just check throughput by making the corresponding boolean variables in the .cc script to false.)

2. The tables below summarize the average bandwidth spent in transmitting RTS, CTS, ACK, and TCP segments and TCP acks at each of the nodes (this data was generated by the python scripts ack.py , cts.py , rts.py and ack_seg.py).

ACK:

Access Point: (Node 1 in question)

Bandwidth(Mbps)	RTSCTSThreshold
0.00140228271484	0
0.00192596435547	256
0.00189788818359	512
0.00177001953125	1024

STA node 0: (Node 0 in question)

Bandwidth(Mbps)	RTSCTSThreshold
0.00139404296875	0
0.00191558837891	256
0.00190338134766	512
0.00176177978516	1024

STA node 1: (Node 2 in question)

Bandwidth(Mbps)	RTSCTSThreshold
0.00138946533203	0
0.00191650390625	256
0.00188842773438	512
0.00176483154297	1024

Total average bandwidth wasted:

Bandwidth(Mbps)	RTSCTSThreshold
0.00139526367	0
0.00191935221	256
0.00189656576	512
0.00176554362	1024

CTS:

Access Point:

Bandwidth(Mbps)	RTSCTSThreshold
0.0734967041016	0
0.0484497070312	256
0.0468072509766	512
0.0452526855469	1024

STA node 0:

Bandwidth(Mbps)	RTSCTSThreshold
0.0753778076172	0
0.0511413574219	256
0.0494076538086	512

0.0477667236328	1024

STA node 1:

Bandwidth(Mbps)	RTSCTSThreshold
0.0753784179688	0
0.0511413574219	256
0.0494076538086	512
0.0477667236328	1024

Average:

Bandwidth(Mbps)	RTSCTSThreshold
0.0747509767	0
0.0501341407	256
0.048540853	512
0.046928711	1024

RTS:

Access Point:

Bandwidth(Mbps)	RTSCTSThreshold
0.0958424377441	0
0.0632537841797	256
0.0611094665527	512
0.0590798950195	1024

STA node 0:

Bandwidth(Mbps)	RTSCTSThreshold
0.0987358093262	0
0.0684158325195	256
0.0657893371582	512
0.063722076416	1024

STA node 1:

Bandwidth(Mbps)	RTSCTSThreshold

0.0987438964844	0
0.0686108398437	256
0.0658039855957	512
0.0639949035645	1024

Average:

Bandwidth(Mbps)	RTSCTSThreshold
0.097774048	0
0.066760152	256
0.064234263	512
0.062265625	1024

TCP ACK:

Access Point:

Bandwidth(Mbps)	RTSCTSThreshold
17.0860765076	0
17.3083096313	256
17.058520813	512
16.4984222412	1024

STA node 0:

Bandwidth(Mbps)	RTSCTSThreshold
17.0854124451	0
17.2236862183	256
16.9693547058	512
16.4158642578	1024

STA node 1:

Bandwidth(Mbps)	RTSCTSThreshold
17.0888252258	0
17.2193197632	256
16.9621720886	512
16.4062463379	1024

Average:

Bandwidth(Mbps)	RTSCTSThreshold
17.0867714	0
17.2504385	256
16.9966825	512
16.4401776	1024

TCP segments:

Access Point:

Bandwidth(Mbps)	RTSCTSThreshold
34.1747468567	0
34.6191564941	256
34.1198382568	512
32.9935429382	1024

STA node 0:

Bandwidth(Mbps)	RTSCTSThreshold
34.1734150696	0
34.4471754456	256
33.9427377319	512
32.827749939	1024

STA node 1:

Bandwidth(Mbps)	RTSCTSThreshold
34.1805873108	0
34.43967453	256
33.9264358521	512
32.8130209351	102432.8130209351

Average:

Bandwidth(Mbps)	RTSCTSThreshold
34.1762497	0
34.502002	256
33.9963373	512
32.8781046	1024