Report on Network Simulator 2 Project

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Chapter 1

Performed Tasks

1.1 Given Tasks

We are instructed to do the following tasks using NS2 simulator:

- Write tcl files of the given topologies
- Vary different parameters using shell script and run simulation of the tcl file & generate trace file accordingly
- Write awk file to analyze the trace file
- Do some modification in mechanisms or protocols provided
- Perform some additional tasks

1.2 Topologies Under Simulation

- Wireless 802.11 (mobile) Grid Topology
- Wireless 802.15.4 (static) Grid Topology

1.3 Parameters Being Varied

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1. Number of nodes
2. Number of flow
3. Number of packets per second
4. Velocity (Only for mobile topology)
5. Coverage Area (Only for static topology)

1.4 Modifications Made

We have basically modified the 802.11 **Medium Access Control(MAC) layer protocol** and introduced a new MAC layer protocol **802.11new** by changing the values of some parameters. To perform this, we had to modify some files. The files along with directories and changes performed in them are described below:

- *ns-allinone-2.35\dei80211mr-1.1.4\src\InitTCL.cc* file; the CWMin_ is set to 16 and useShortPreamble_ is set to true as parameters of our proposed protocol 802.11new and added to the existing *initTCL.cc* code. Thus we are using shorter contention window size then given 802.11 protocol and 72 bit preamble in place of 144 bit preamble.
- In *ns-allinone-2.35\ns-2.35\tcl\lib\ns-default.tcl* file; CWMin_ is set to 15, SlotTime_ is set to 0.000009 ($9\mu s$), PreambleLength_ is set to 72, PLCPDataRate_ is set to $2.0e6$ (2 Mbps), BeaconInterval_ is set to $0.09(90ms)$, MaxChannelTime_ is set to $0.009(9ms)$, MinChannelTime_ is set to $0.003(3ms)$, ChannelTime_ is set to $0.10(100ms)$.
- In *ns-allinone-2.35\ns-2.35\tcl\lan\ns-mac.tcl* file; slotTime_ is set to $9\mu s$, short interframe space, denoted by sifs_ is set to $10\mu s$, Point Coordination

Function(PCF) interframe space, denoted by pifs_ is set to $19\mu s$, Distribution Coordination Function(DCF) interframe space, denoted by difs_ is set to $28\mu s$. These are done according to the formula $pifs = sifs + slot_time$ and $difs = sifs + 2 * slot_time$.

- In *ns-allinone-2.35\ns-2.35\mac* directory; we have added *mac-802_11new.h*, *mac-802_11new.cc*, *mac-timersnew.h*, *mac-timersnew.cc* files.

We have also made some modification in the **interface queue**, which is basically a drop-tail queue. We have modified it in a way such that when a packet arrives, a random position of the queue is evicted. We have done this by modifying some portion of the code in *ns-allinone-2.35\ns-2.35\queue\queue.h* file.

1.5 Additional Task Done

As an additional task, we have written a tcl file for a **satellite network** topology which is a combination of a orbital satellite, some geo satellites and some wired nodes. We have used the parameters for the proposed teledisc satellite. We have written an awk file to analyze the obtained trace file from the tcl file and varied the position of a satellite using shell script to measure different metrics.

Chapter 2

Results with Graphs

2.1 Metrics Analyzed

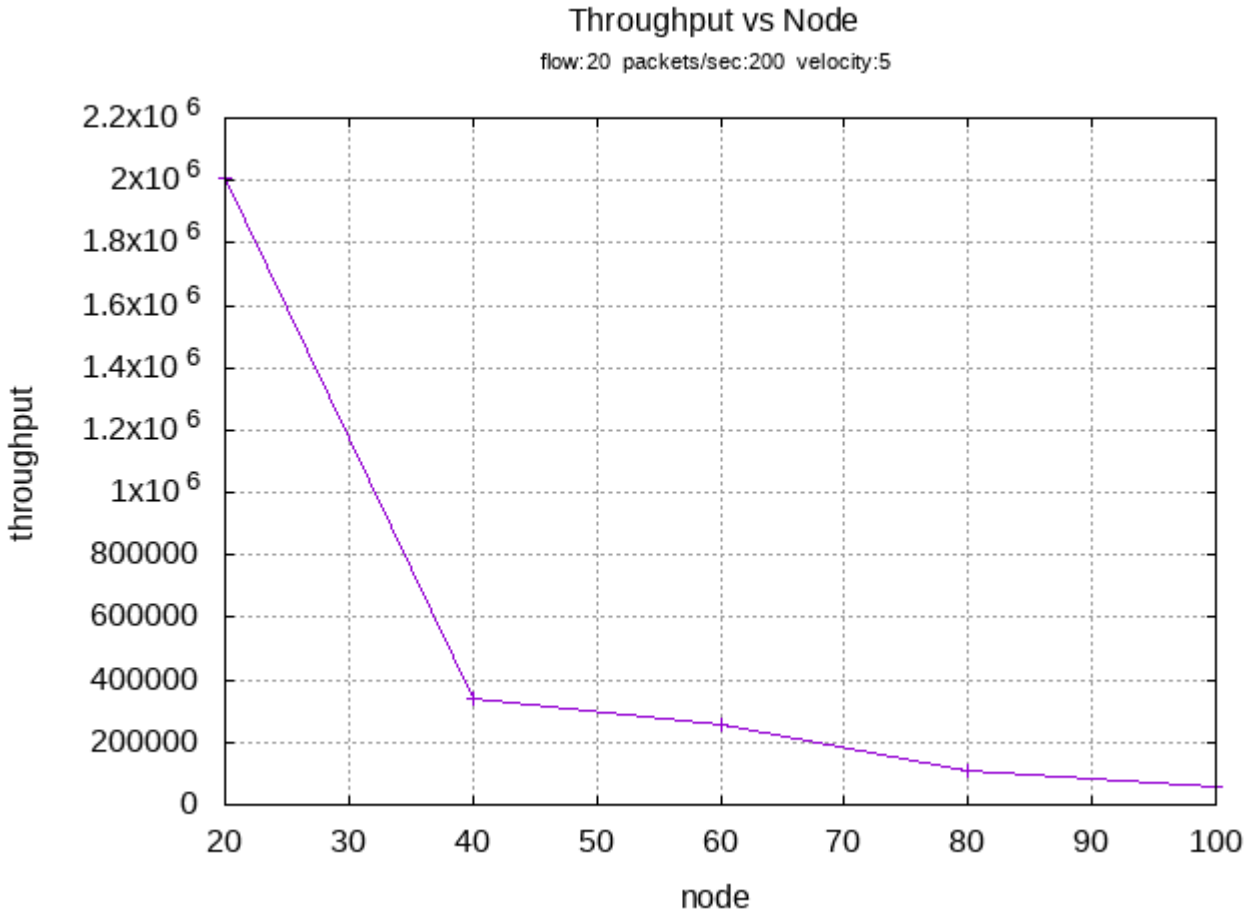
For each parameter under variation, 5 (five) sets of data were generated. The metrics that were observed are listed below:

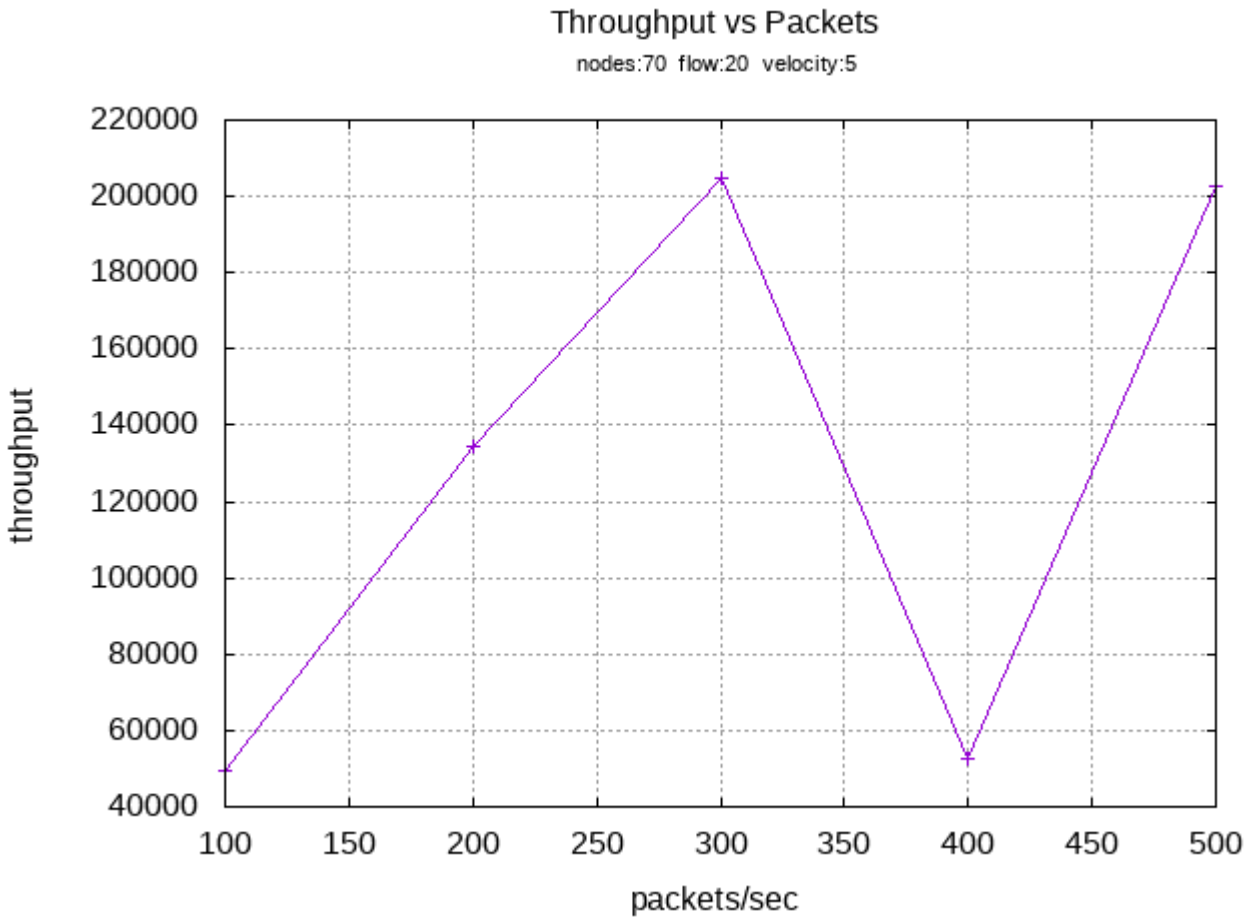
1. Network throughput
2. End-to- end delay
3. Packet delivery ratio
   (*total no. of packets delivered to end destination / total no. of packets sen*
4. Packet drop ratio
   (*total no. of packets dropped / total no of packets sent*)
5. Total energy consumption

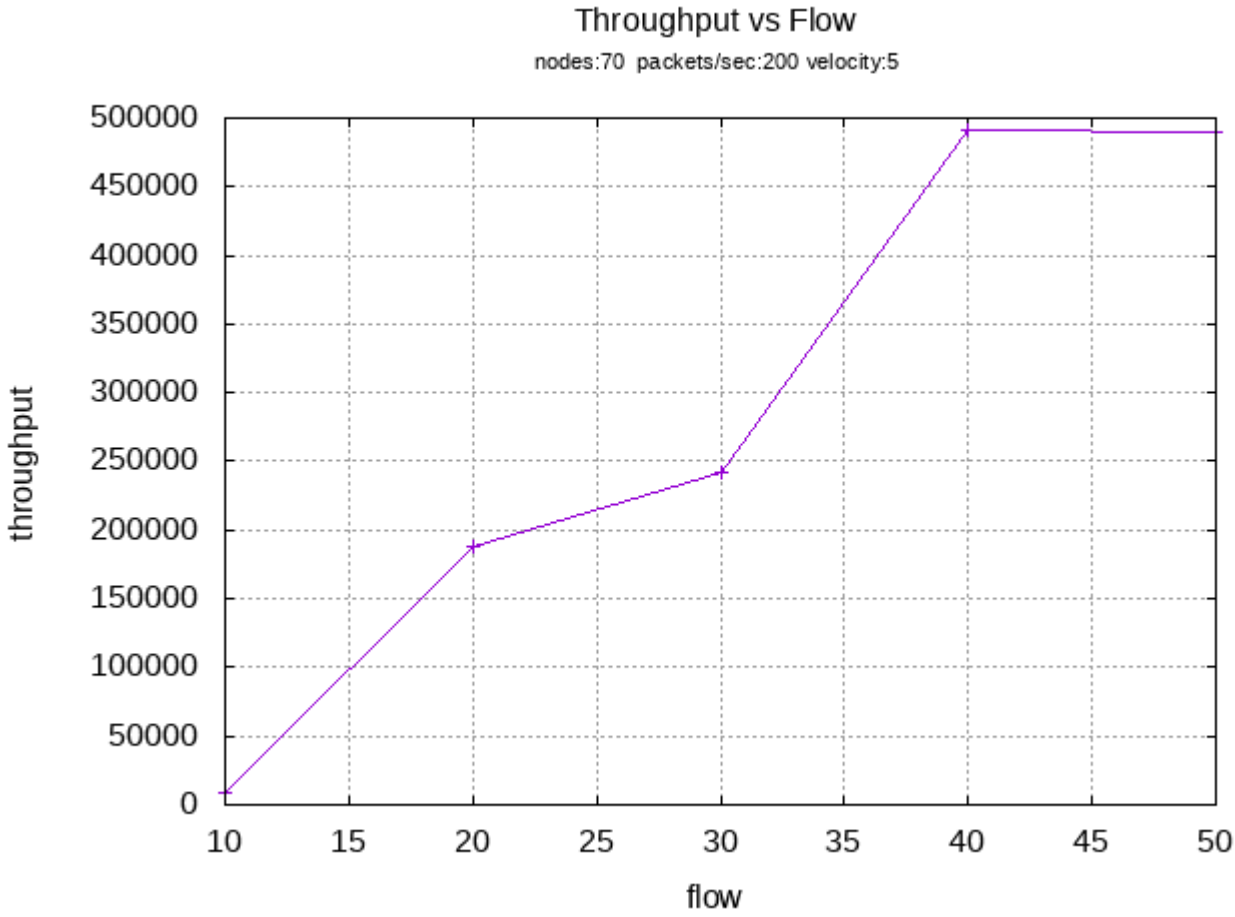
In Satellite network, which is implemented as additional task, we have measured change of end-to-end delay with respect to satellite position and plotted graph of it.

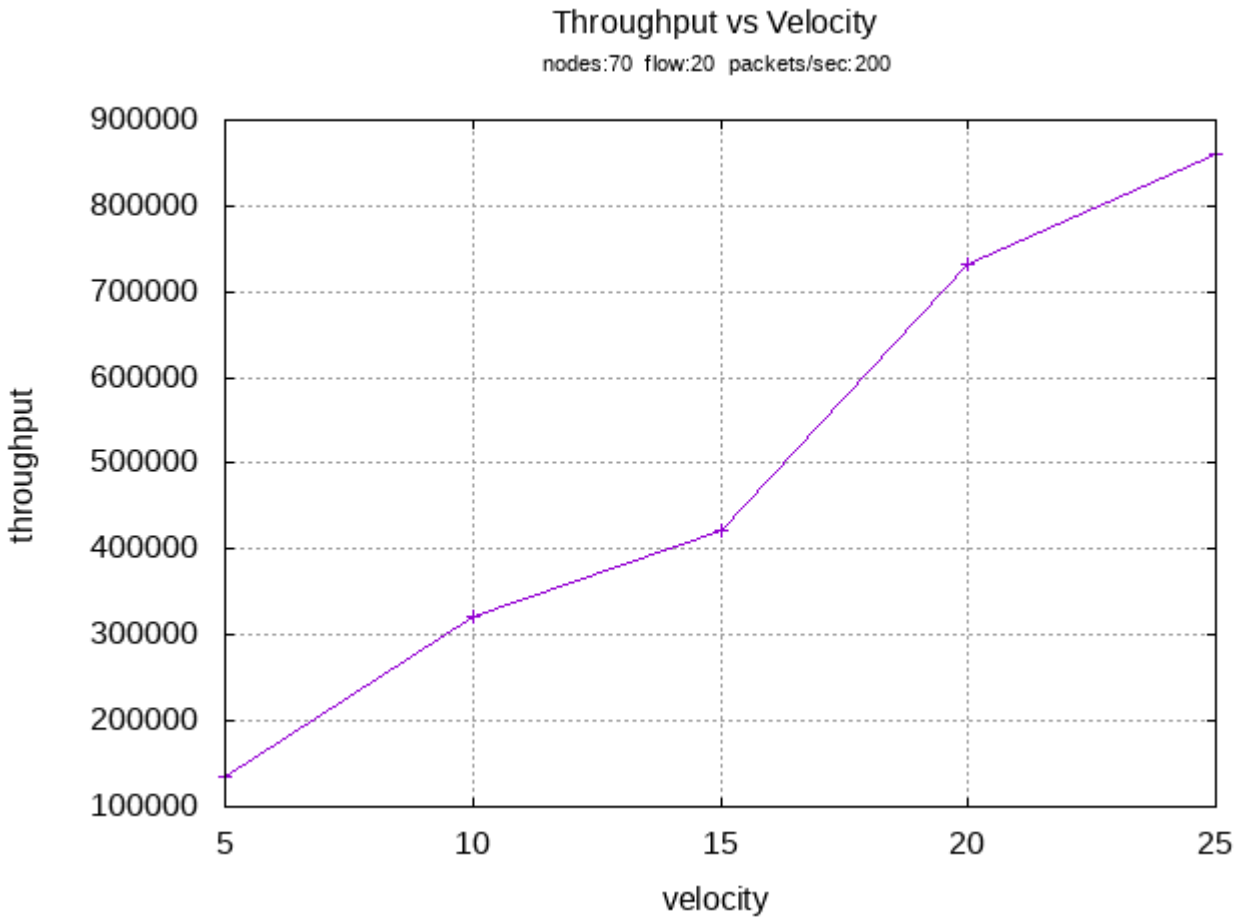
We have used **gnuplot** tool to plot all the graphs.

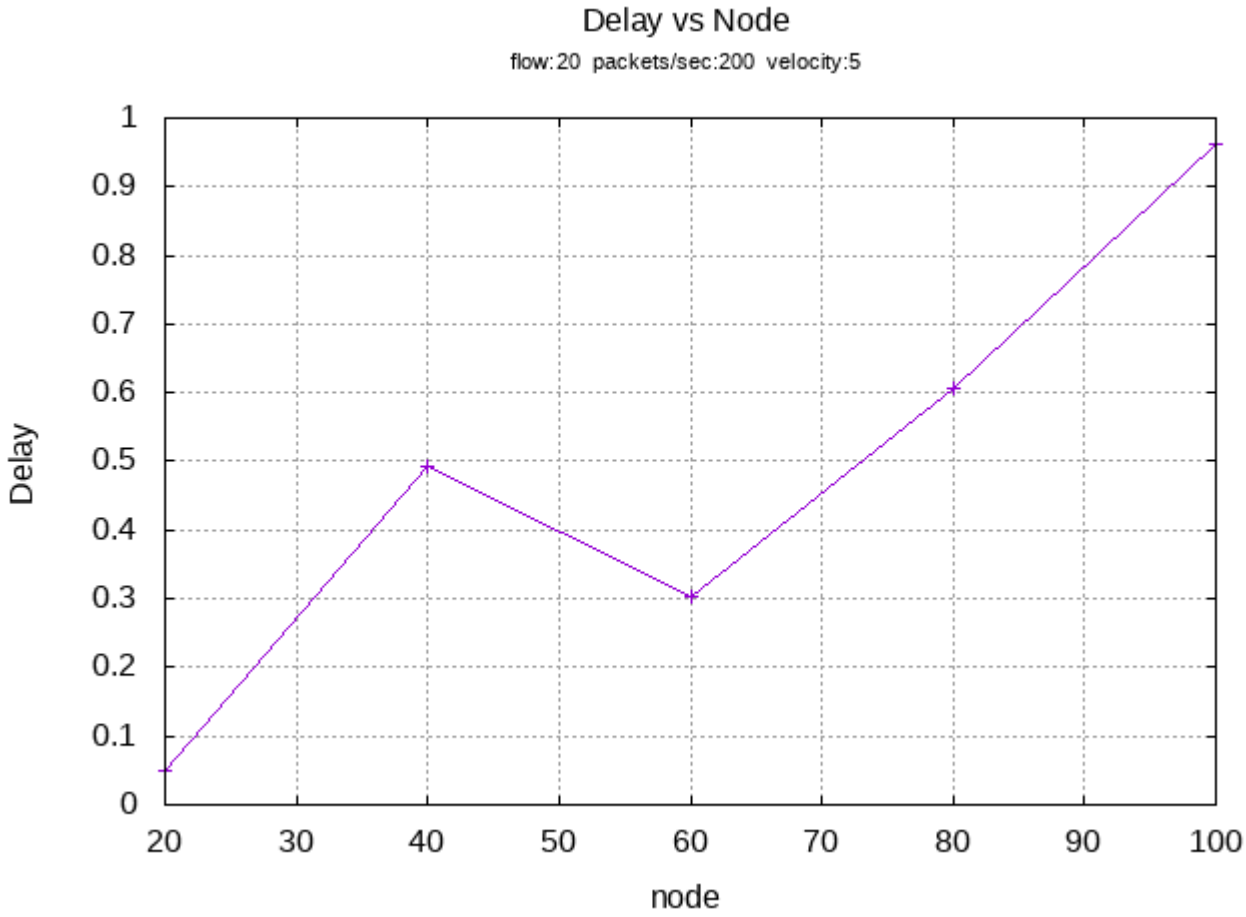
Wireless 802.11(mobile)

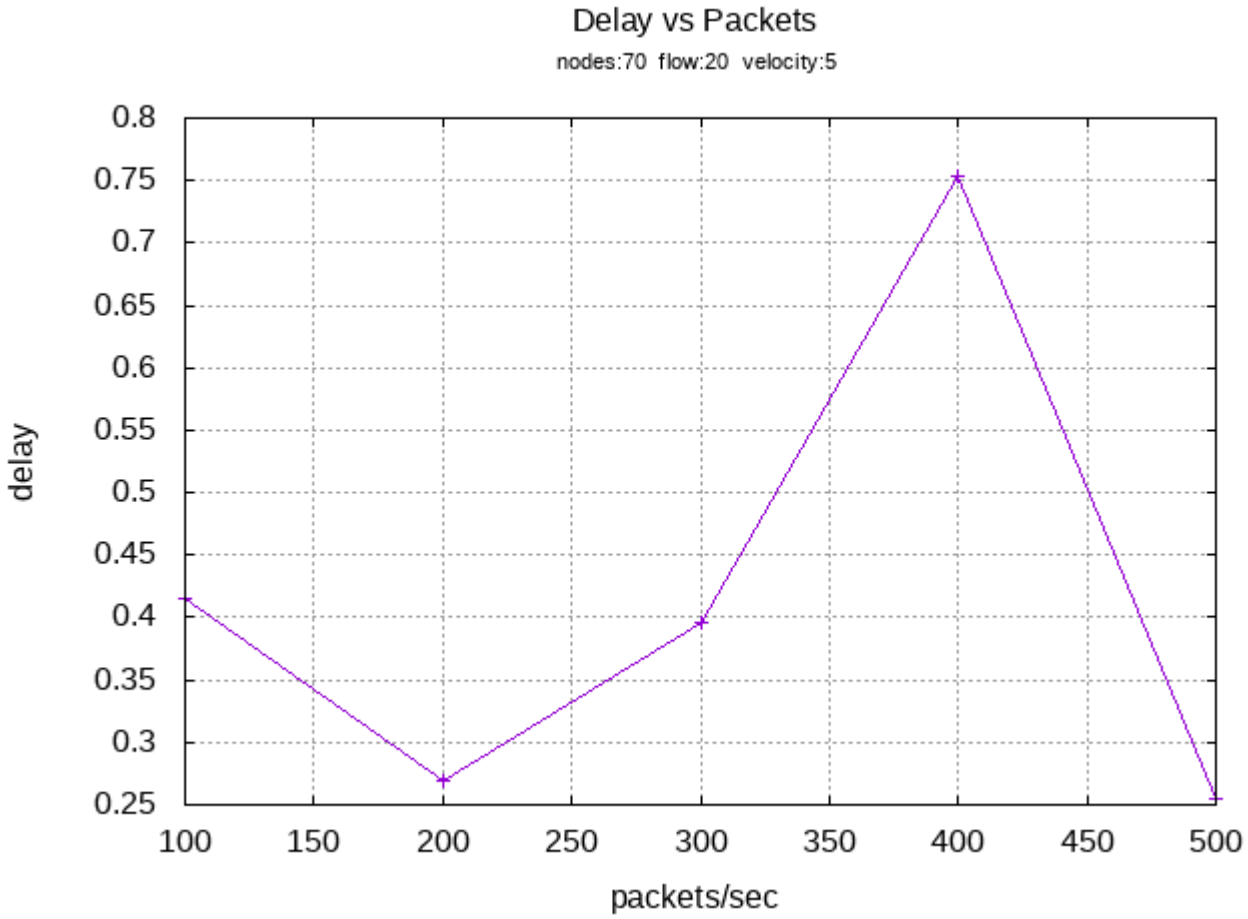

Throughput vs Node
flow:20 packets/sec:200 velocity:5
throughput
2.2x10 6
2x10 6
1.8x10 6
1.6x10 6
1.4x10 6
1.2x10 6
1x10 6
800000
600000
400000
200000
0
20
30
40
50
60
70
80
90
100
node

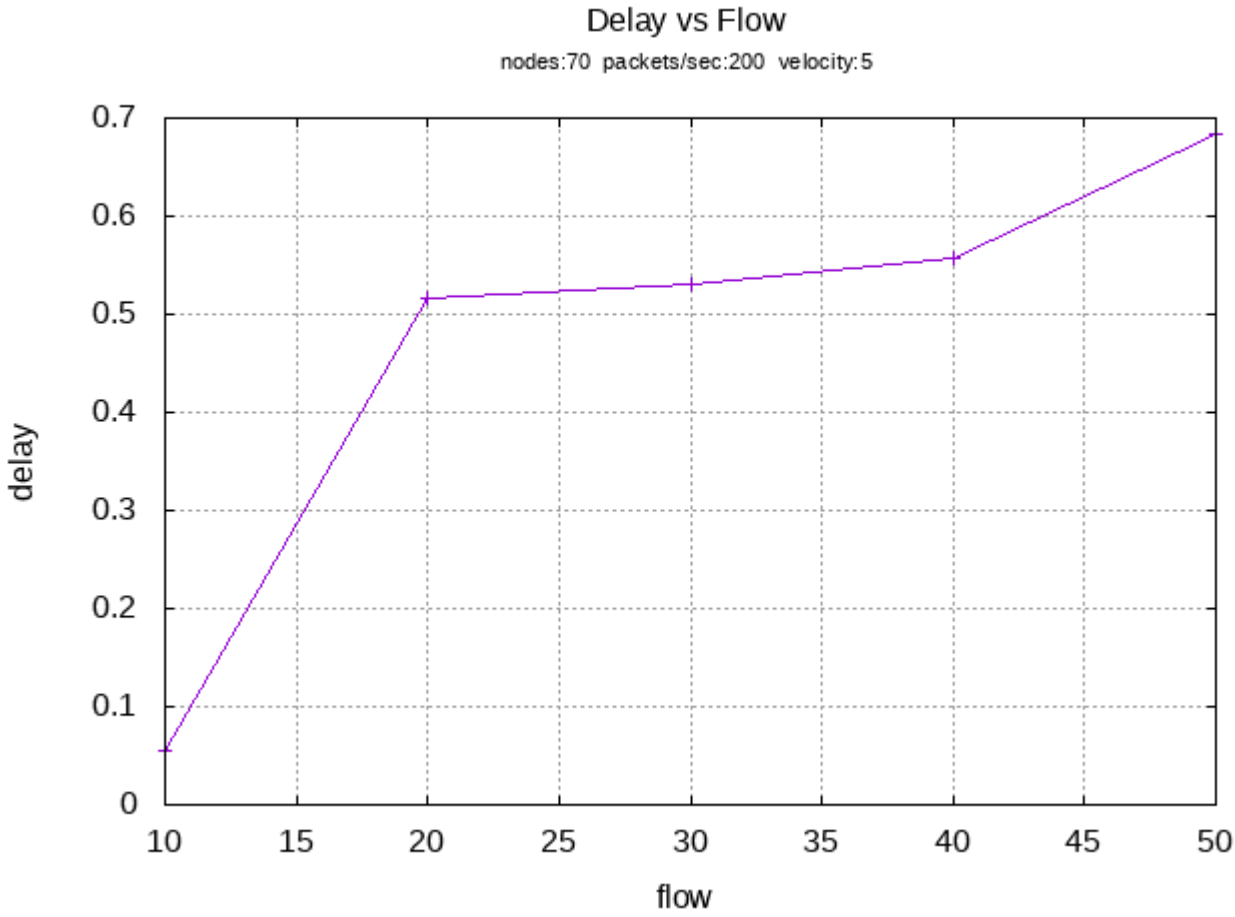

Throughput vs Packets
nodes:70 flow:20 velocity:5
throughput
220000
200000
180000
160000
140000
120000
100000
80000
60000
40000
100
150
200
250
300
350
400
450
500
packets/sec

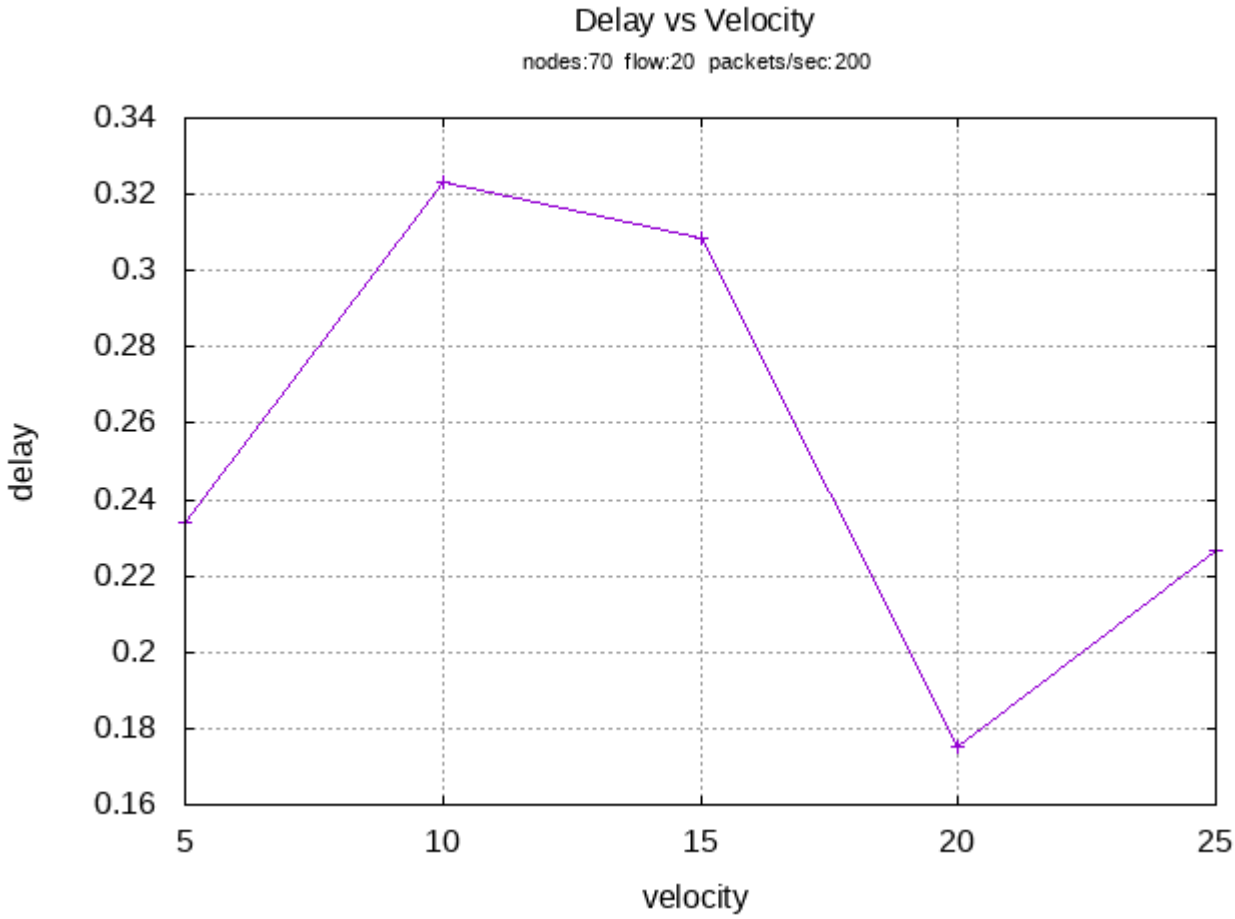

Throughput vs Flow
nodes:70 packets/sec:200 velocity:5
throughput
500000
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
10
15
20
25
30
35
40
45
50
flow

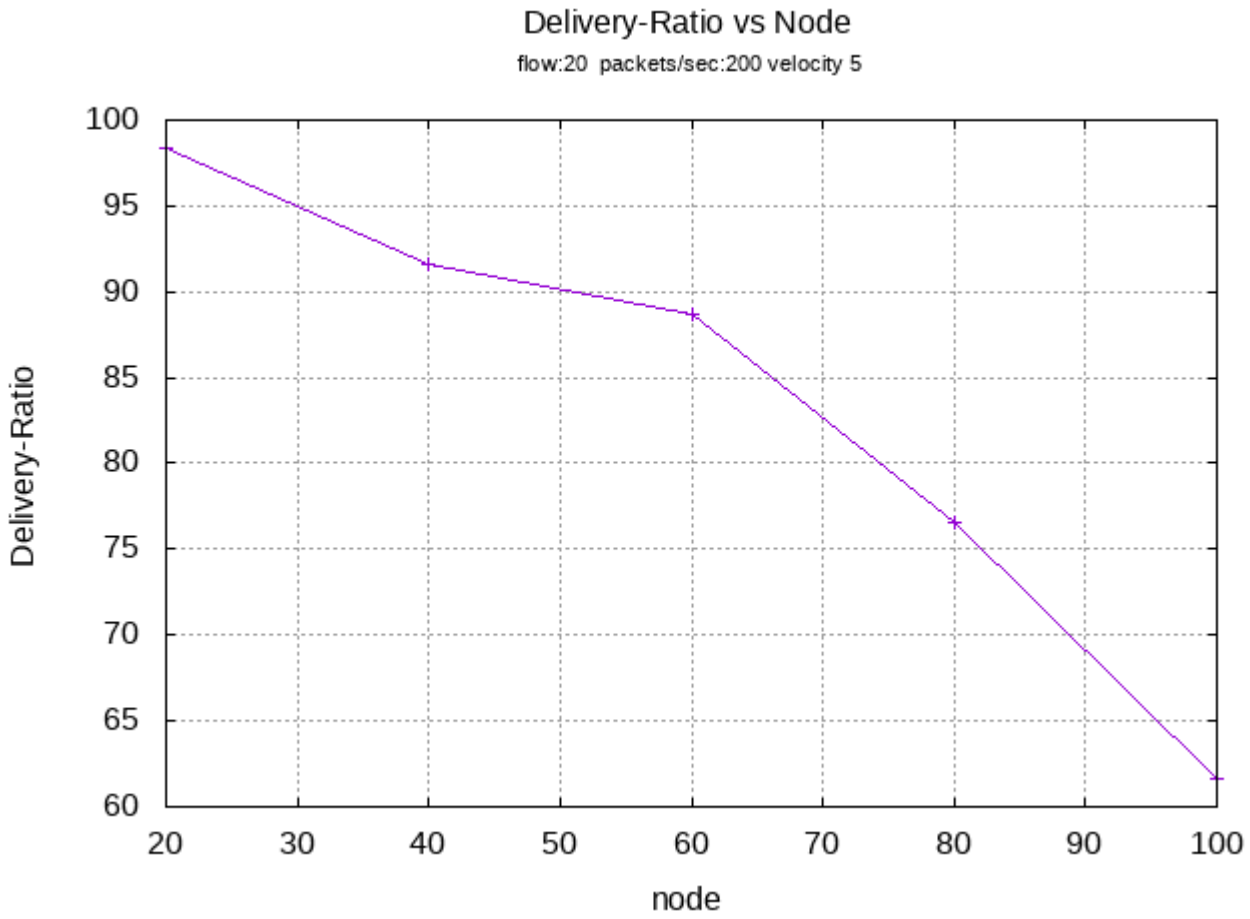

Throughput vs Velocity
nodes:70 flow:20 packets/sec:200
throughput
900000
800000
700000
600000
500000
400000
300000
200000
100000
5
10
15
20
25
velocity

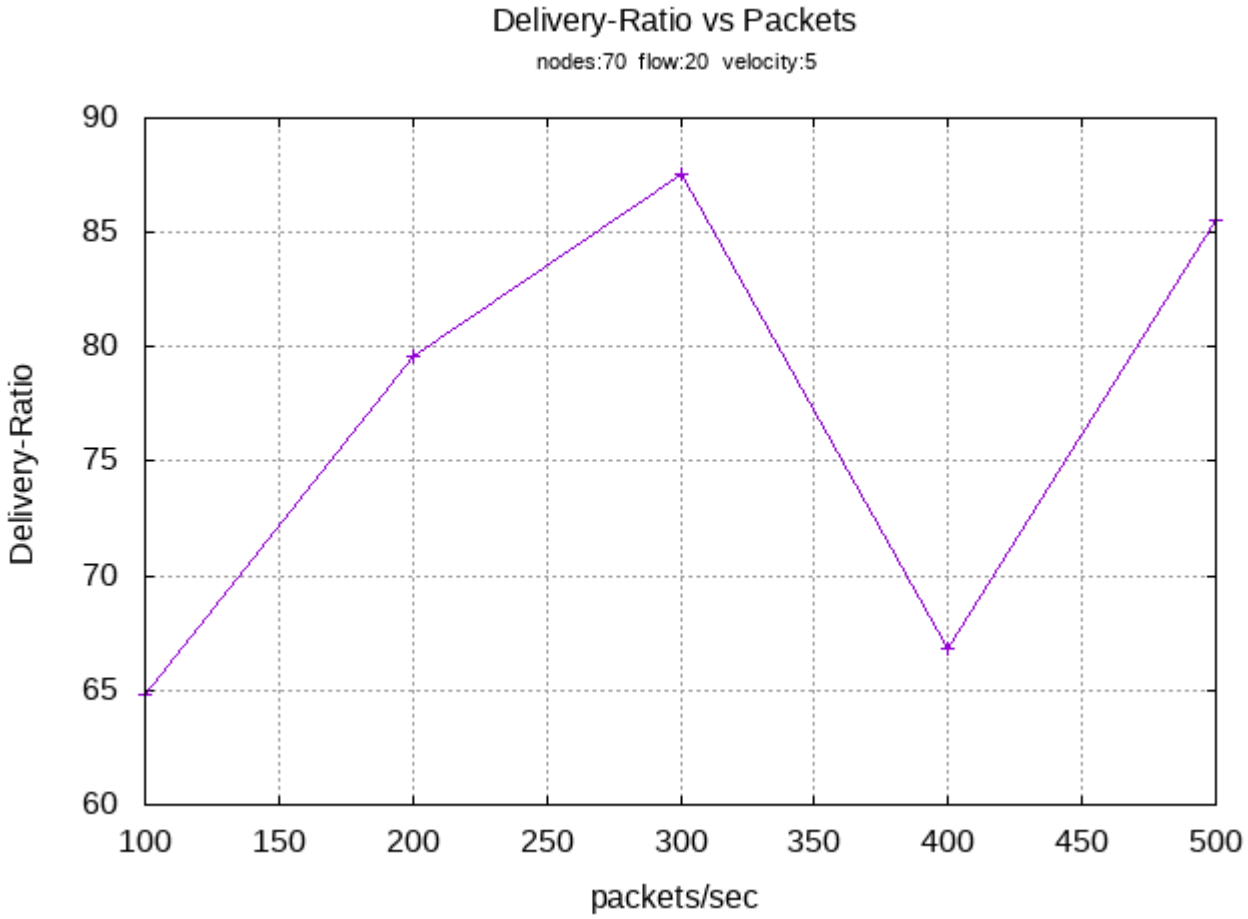

Delay vs Node
flow:20 packets/sec:200 velocity:5
Delay
node
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
20
30
40
50
60
70
80
90
100

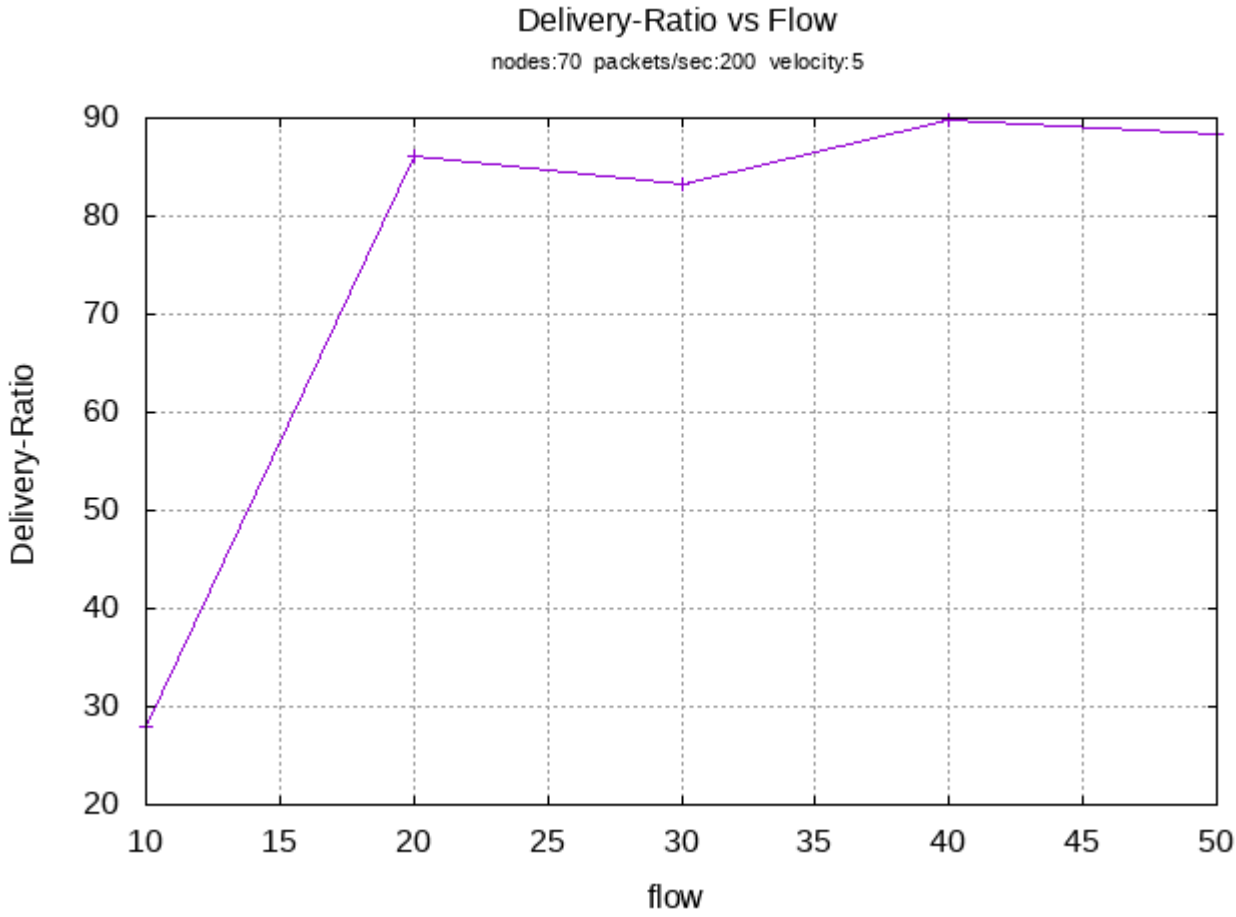

Delay vs Packets
nodes:70 flow:20 velocity:5
delay
packets/sec
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
100
150
200
250
300
350
400
450
500

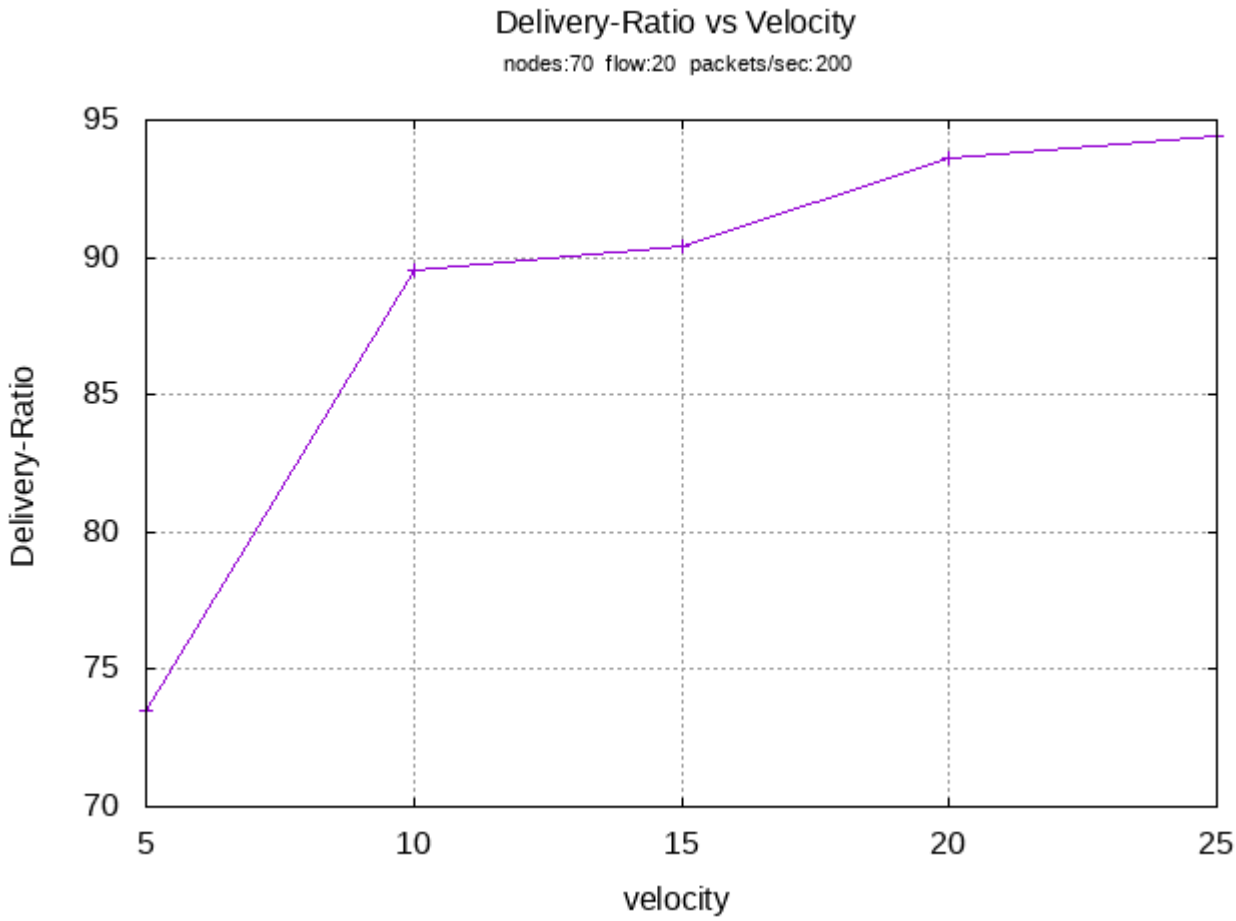

Delay vs Flow
nodes:70 packets/sec:200 velocity:5
delay
flow
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
10
15
20
25
30
35
40
45
50

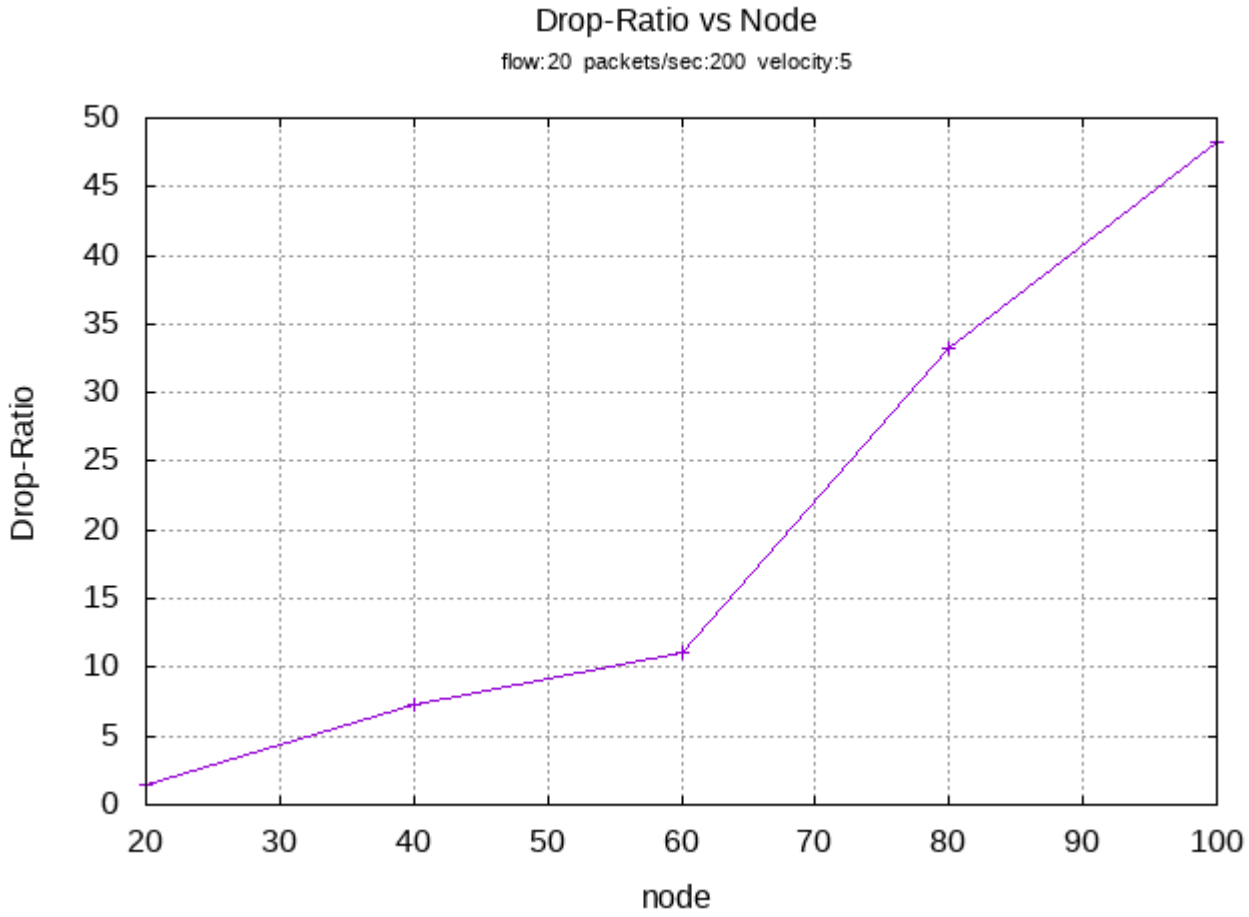

Delay vs Velocity
nodes:70 flow:20 packets/sec:200
delay
velocity
0.34
0.32
0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16
5
10
15
20
25

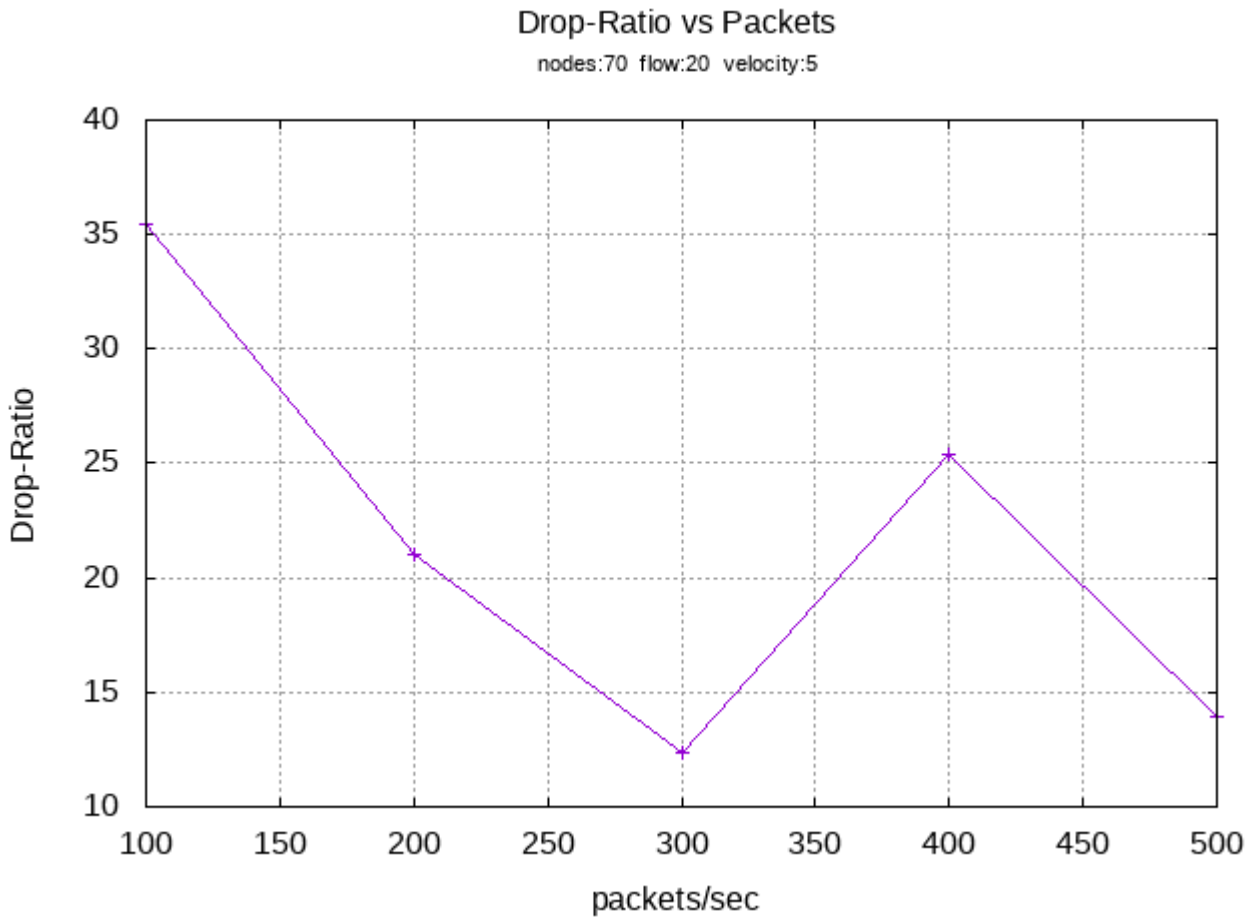

Delivery-Ratio vs Node
flow:20 packets/sec:200 velocity 5
Delivery-Ratio
node
100
95
90
85
80
75
70
65
60
20
30
40
50
60
70
80
90
100

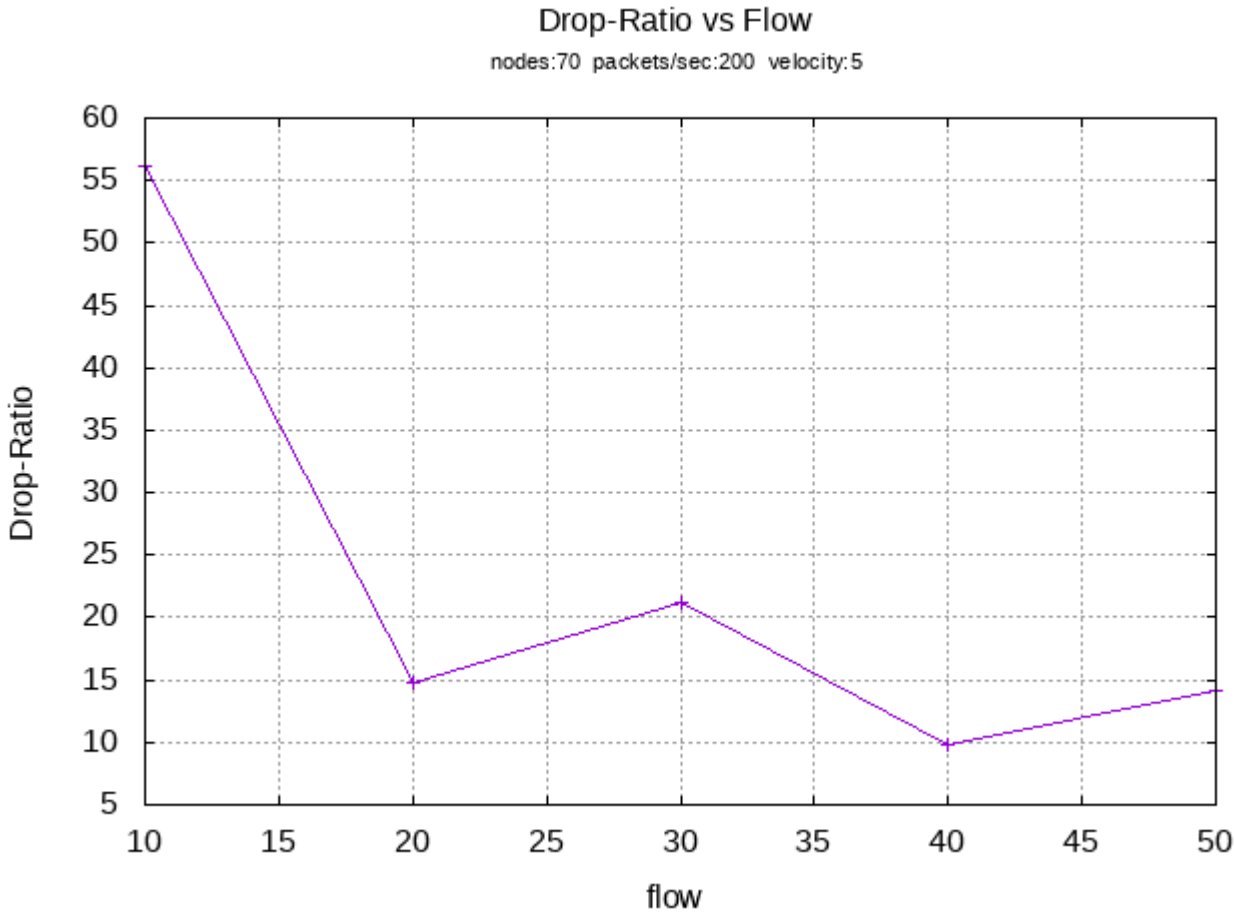

Delivery-Ratio vs Packets
nodes:70 flow:20 velocity:5
Delivery-Ratio
packets/sec
90
85
80
75
70
65
60
100
150
200
250
300
350
400
450
500

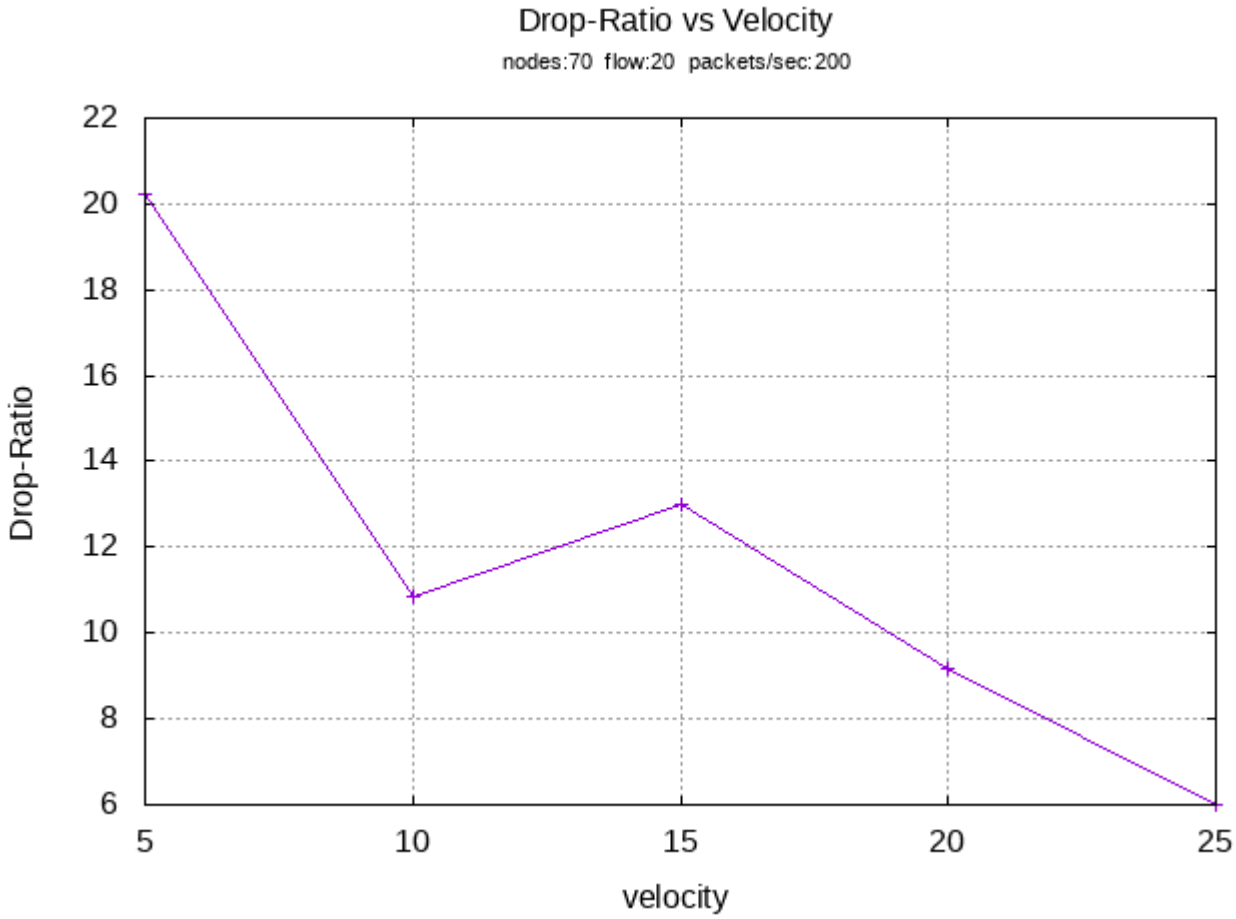

Delivery-Ratio vs Flow
nodes:70 packets/sec:200 velocity:5
Delivery-Ratio
flow
90
80
70
60
50
40
30
20
10
15
20
25
30
35
40
45
50

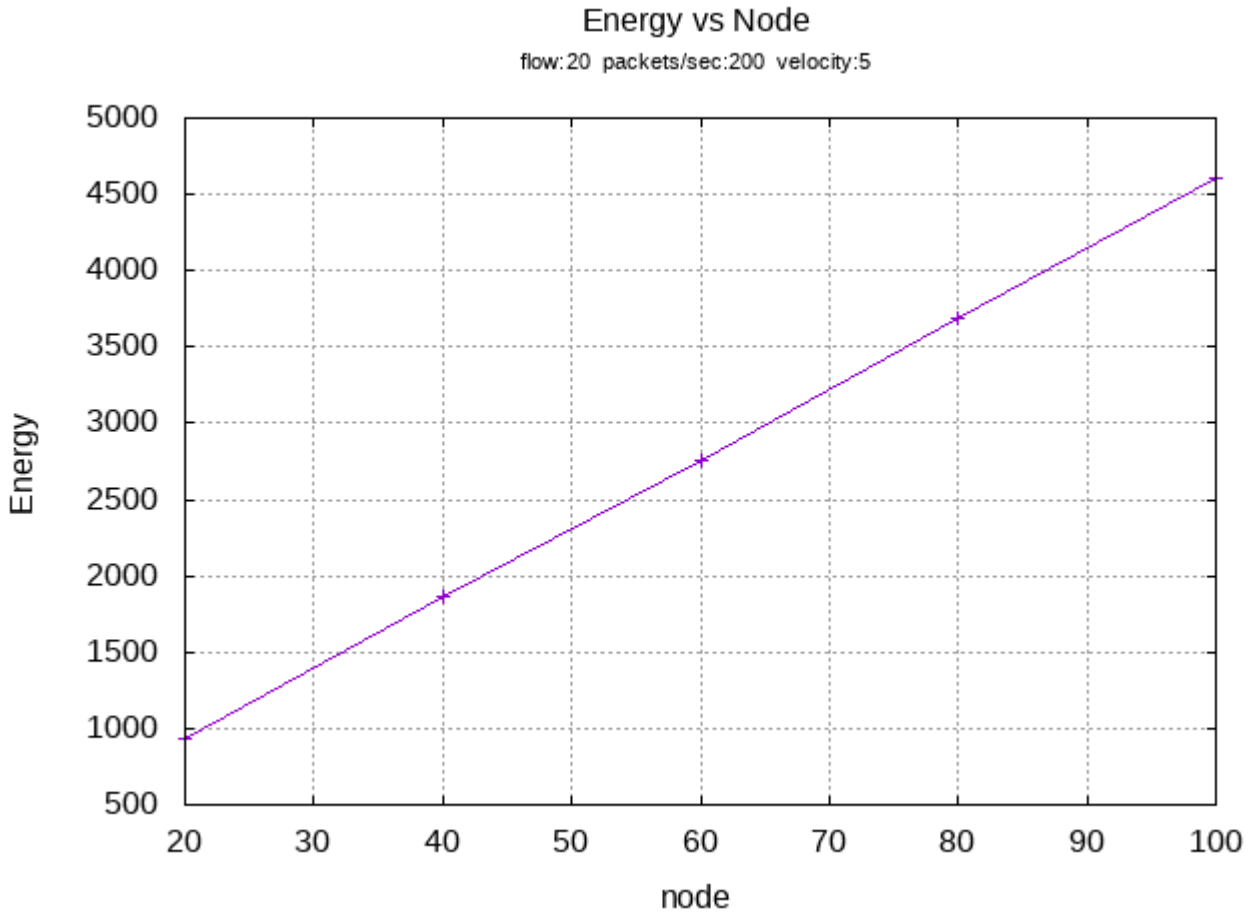

Delivery-Ratio vs Velocity
nodes:70 flow:20 packets/sec:200
Delivery-Ratio
95
90
85
80
75
70
5
10
15
20
25
velocity

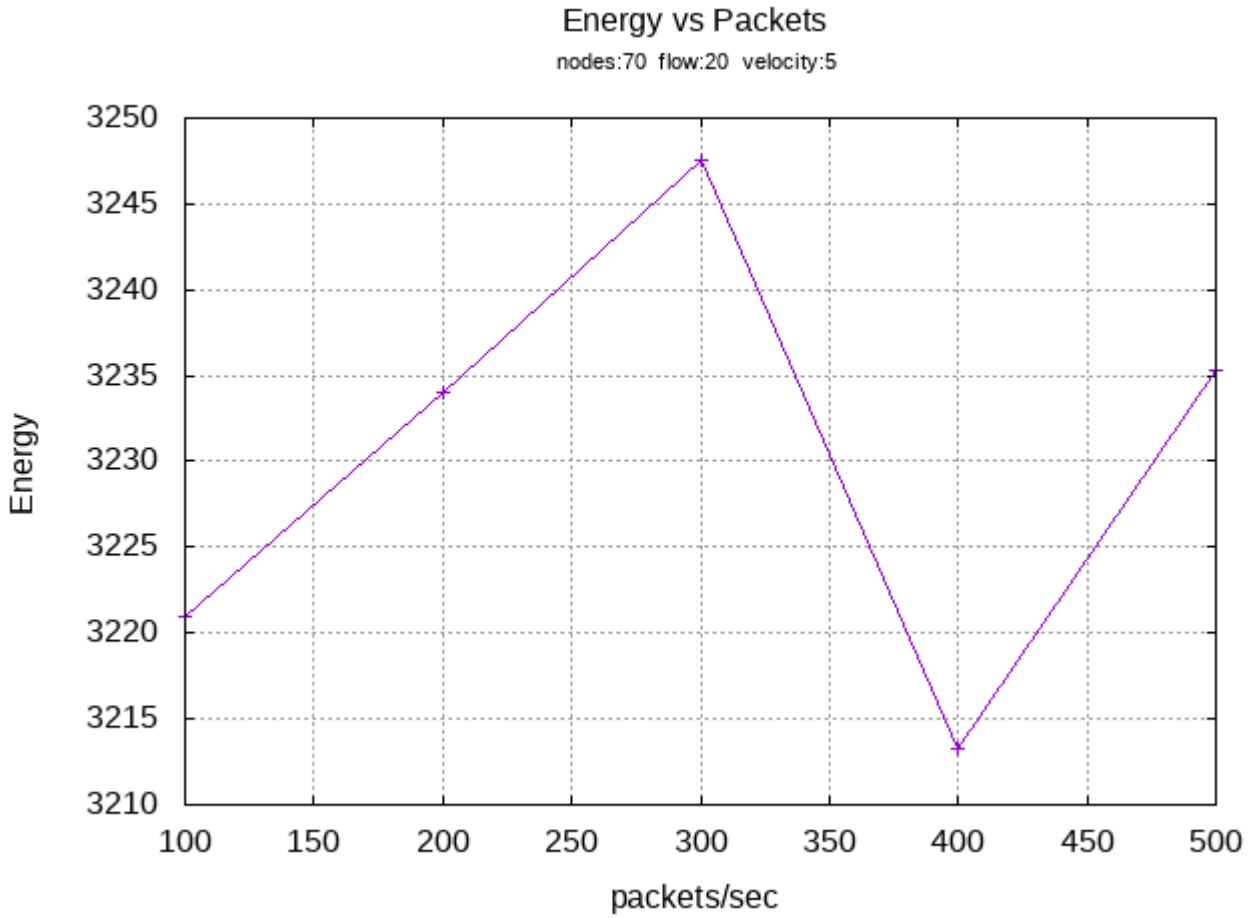

Drop-Ratio vs Node
flow:20 packets/sec:200 velocity:5
Drop-Ratio
node
0
5
10
15
20
25
30
35
40
45
50
20
30
40
50
60
70
80
90
100

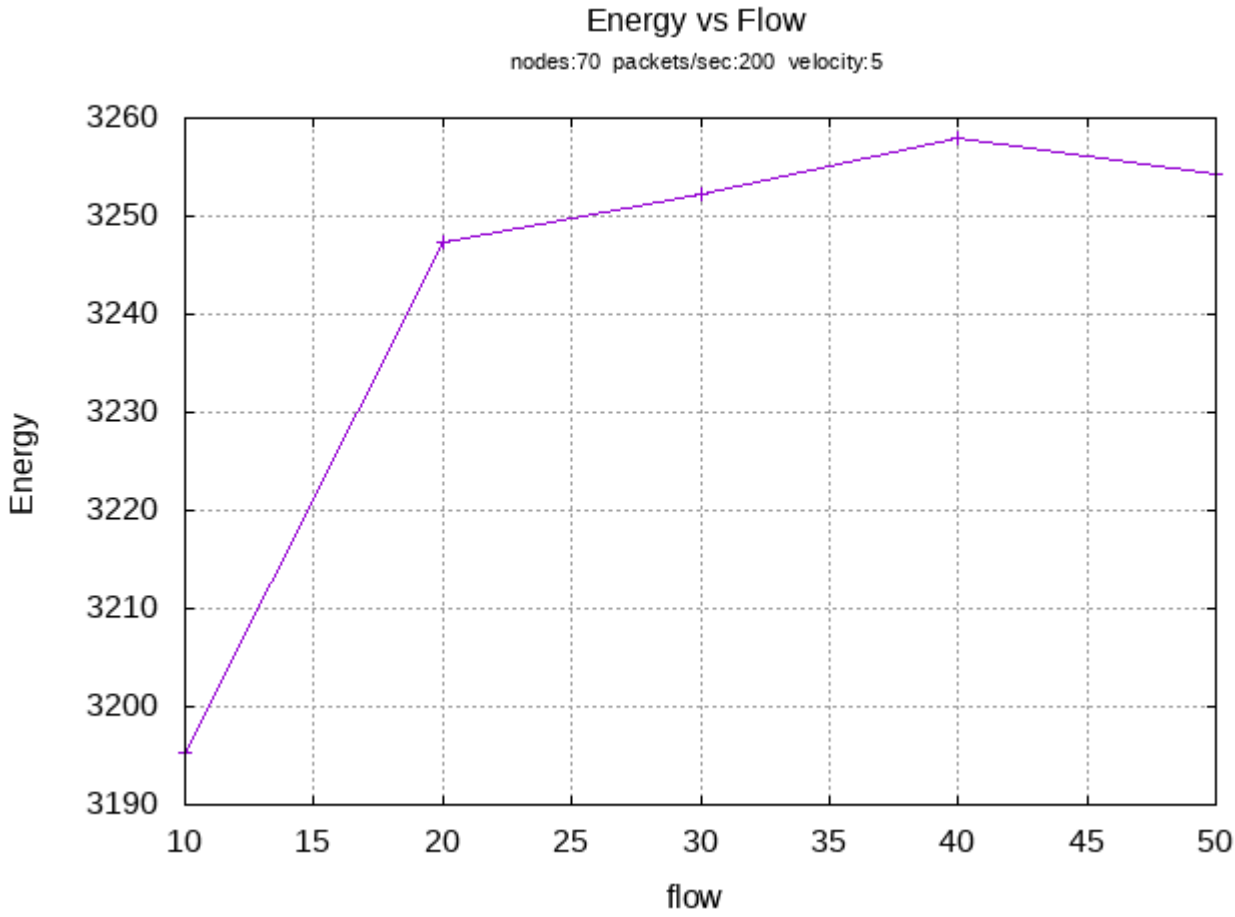

Drop-Ratio vs Packets
nodes:70 flow:20 velocity:5
Drop-Ratio
packets/sec
40
35
30
25
20
15
10
100
150
200
250
300
350
400
450
500

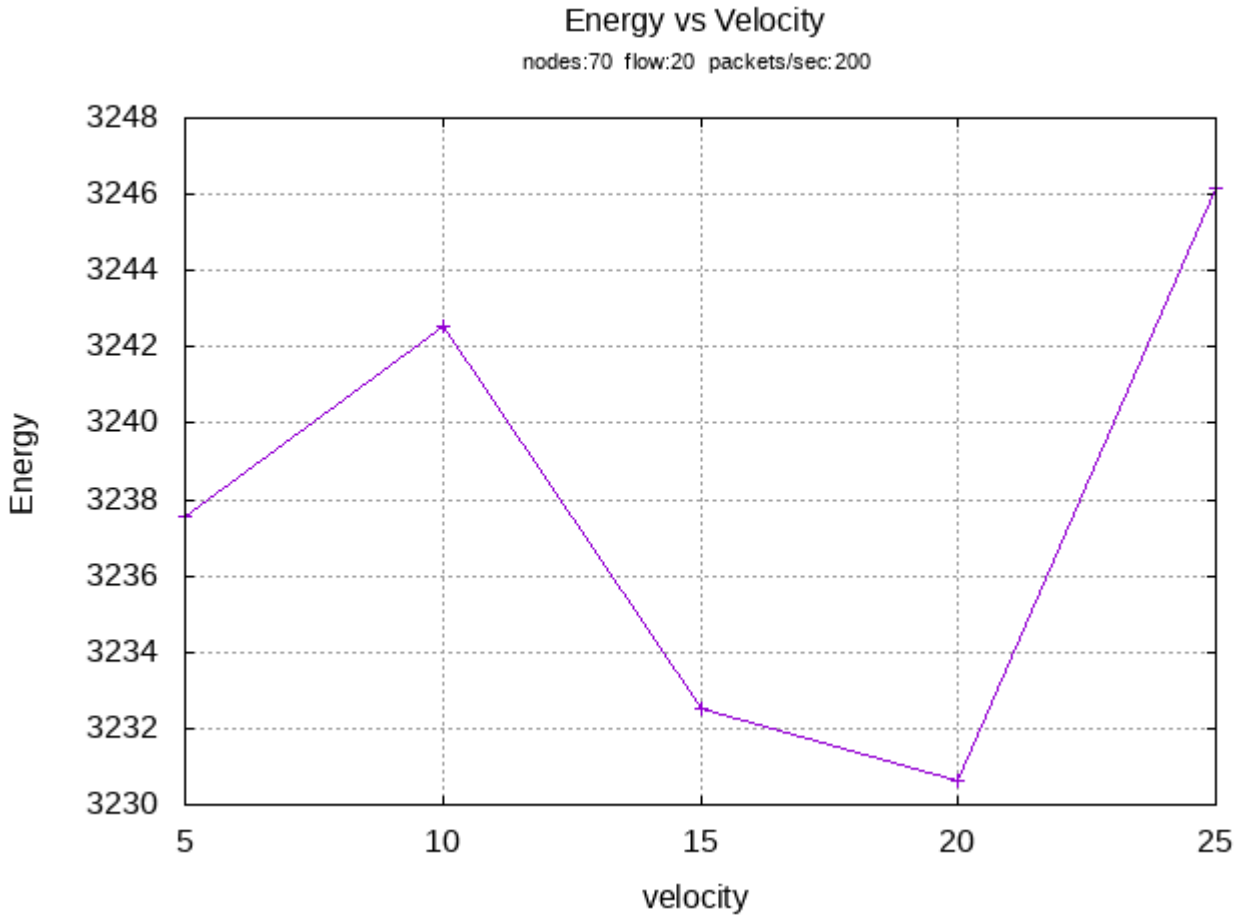

Drop-Ratio vs Flow
nodes:70 packets/sec:200 velocity:5
Drop-Ratio
flow
60
55
50
45
40
35
30
25
20
15
10
5
10
15
20
25
30
35
40
45
50


Drop-Ratio vs Velocity
nodes:70 flow:20 packets/sec:200
Drop-Ratio
velocity
22
20
18
16
14
12
10
8
6
5
10
15
20
25

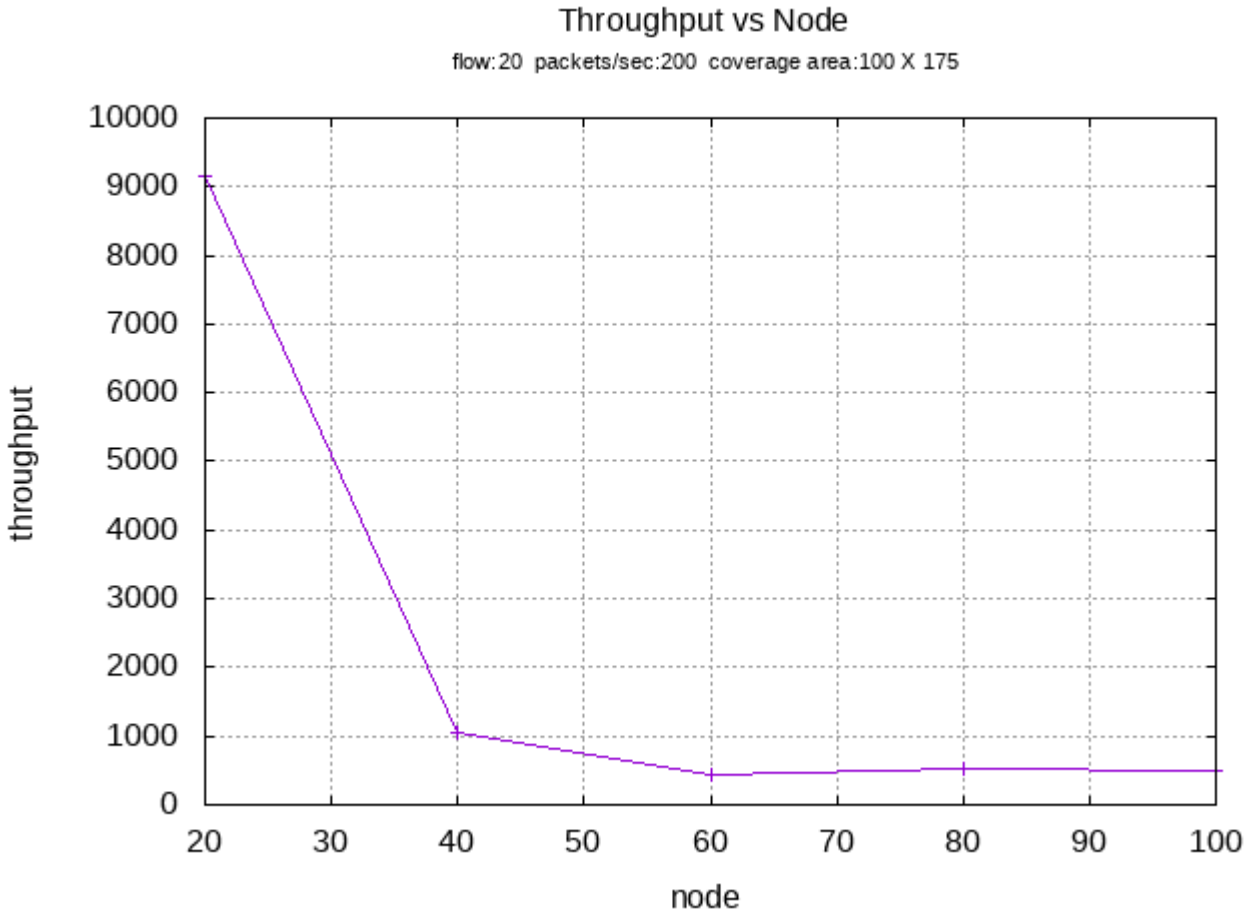

Energy vs Node
flow:20 packets/sec:200 velocity:5
Energy
node
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
20
30
40
50
60
70
80
90
100

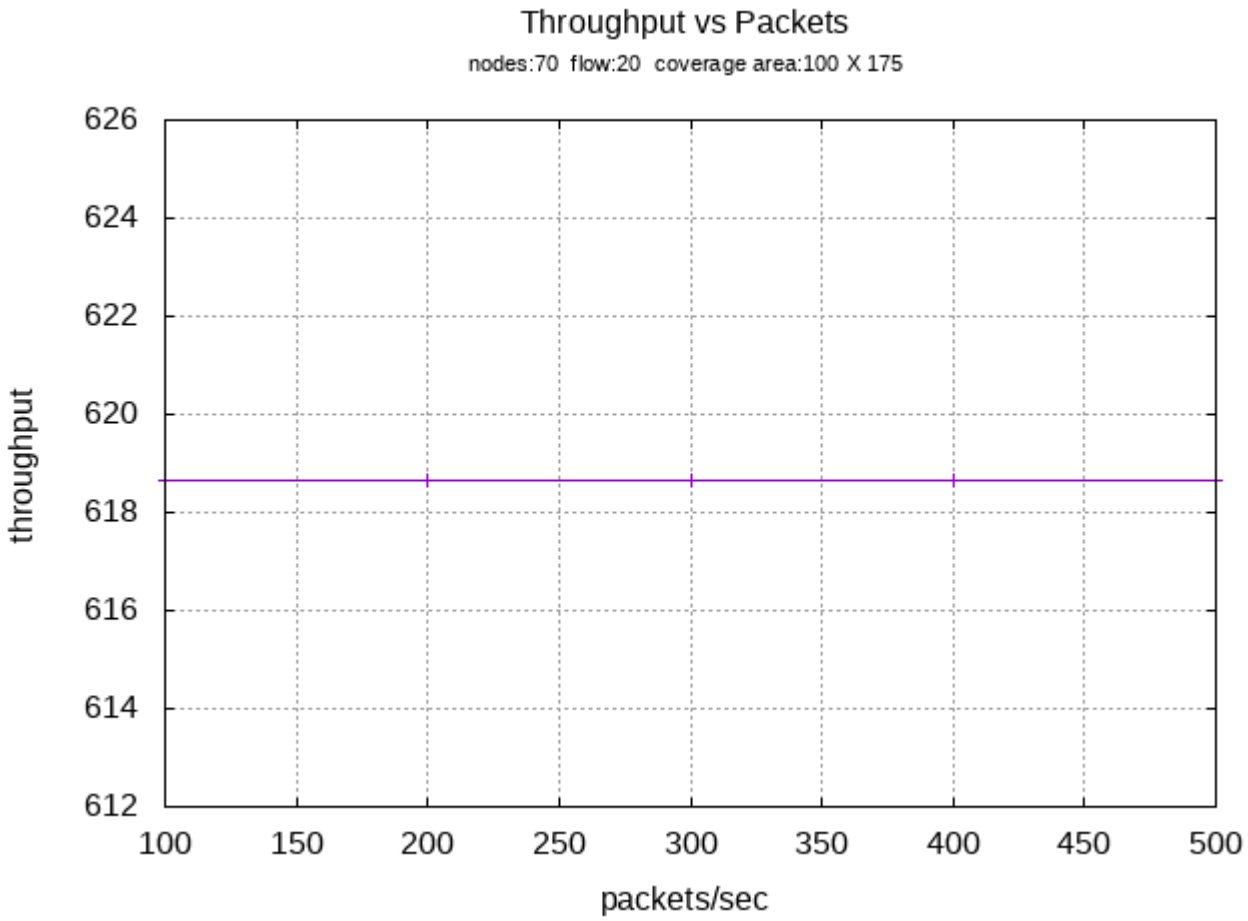

Energy vs Packets
nodes:70 flow:20 velocity:5
Energy
3250
3245
3240
3235
3230
3225
3220
3215
3210
100
150
200
250
300
350
400
450
500
packets/sec

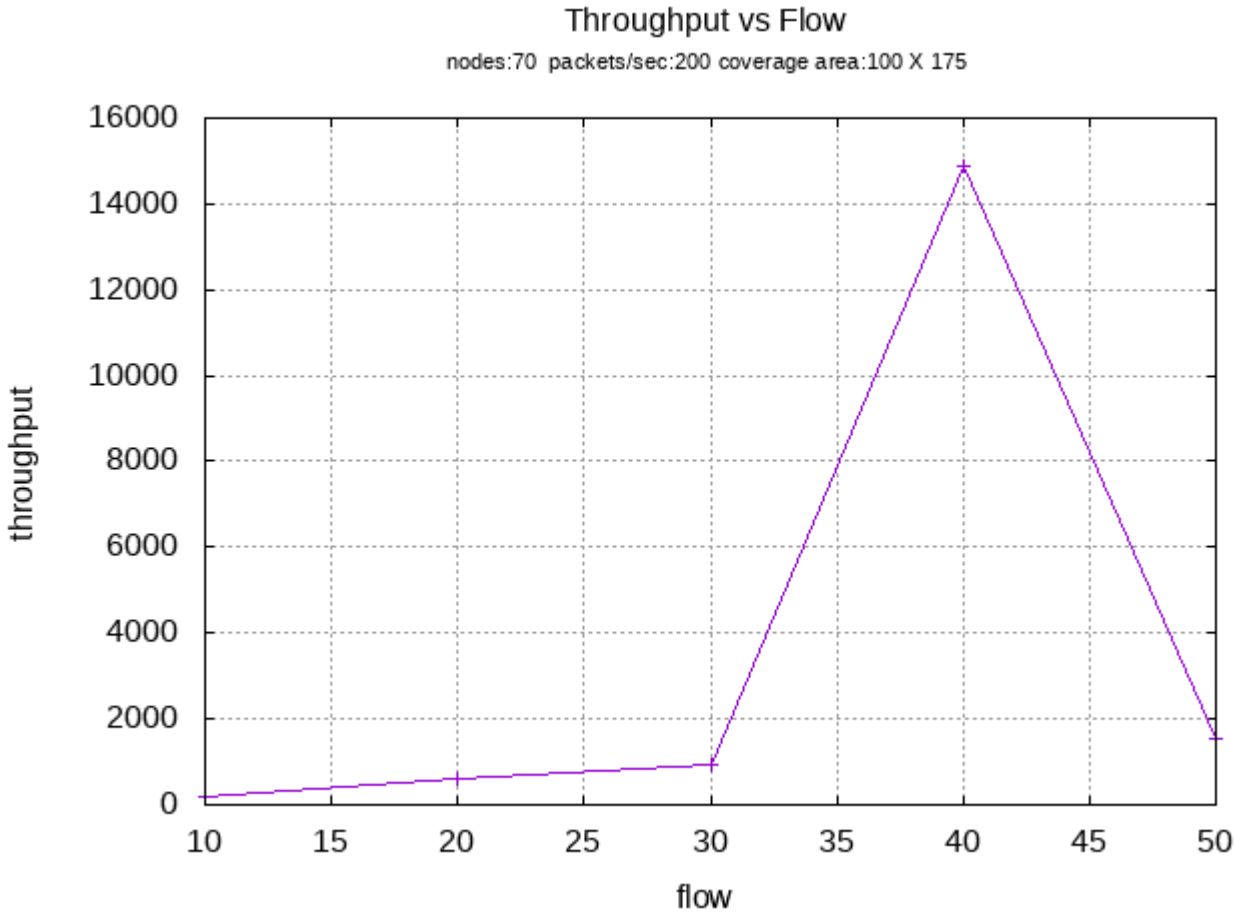

Energy vs Flow
nodes:70 packets/sec:200 velocity:5
Energy
flow
3260
3250
3240
3230
3220
3210
3200
3190
10
15
20
25
30
35
40
45
50

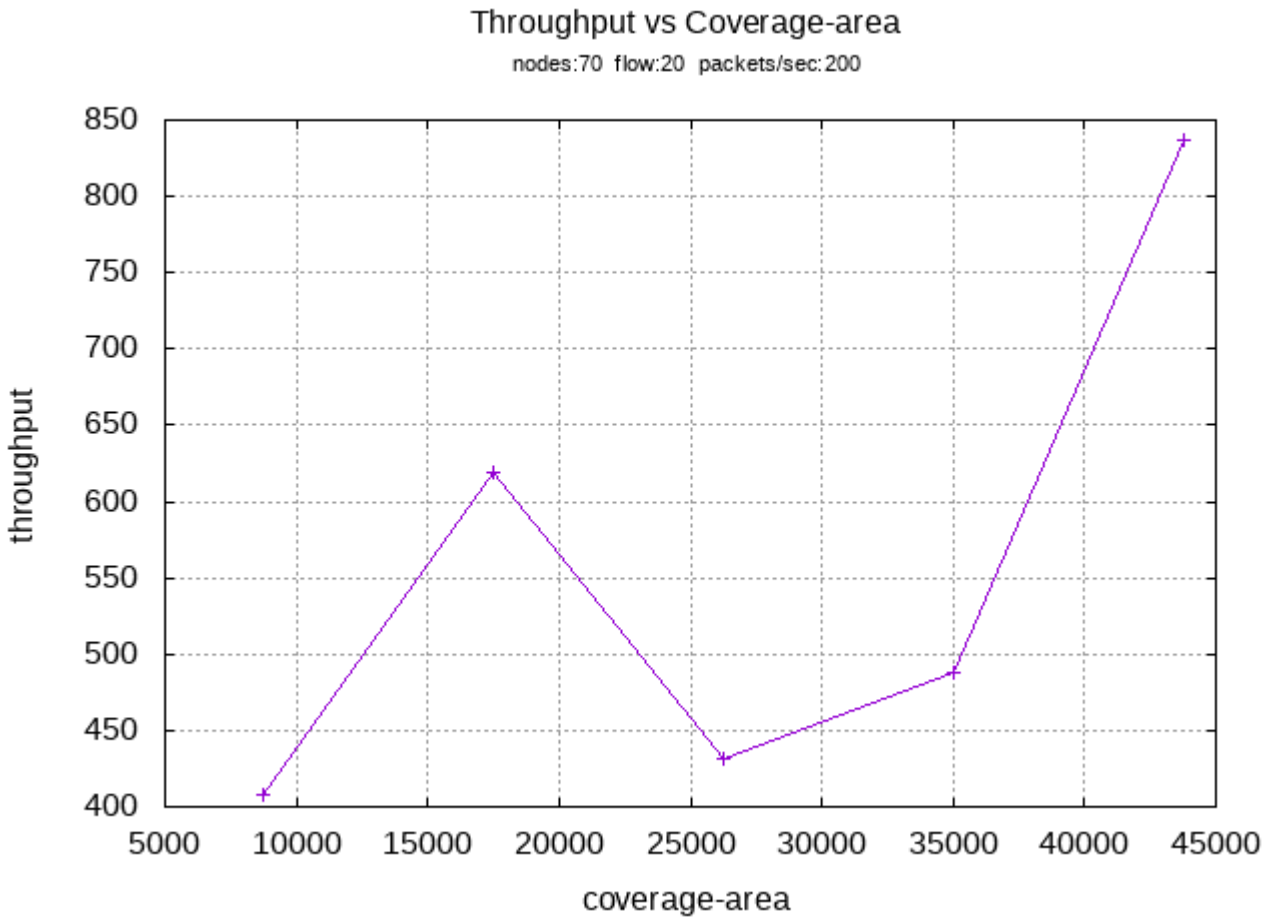

Energy vs Velocity
nodes:70 flow:20 packets/sec:200
Energy
3248
3246
3244
3242
3240
3238
3236
3234
3232
3230
5
10
15
20
25
velocity

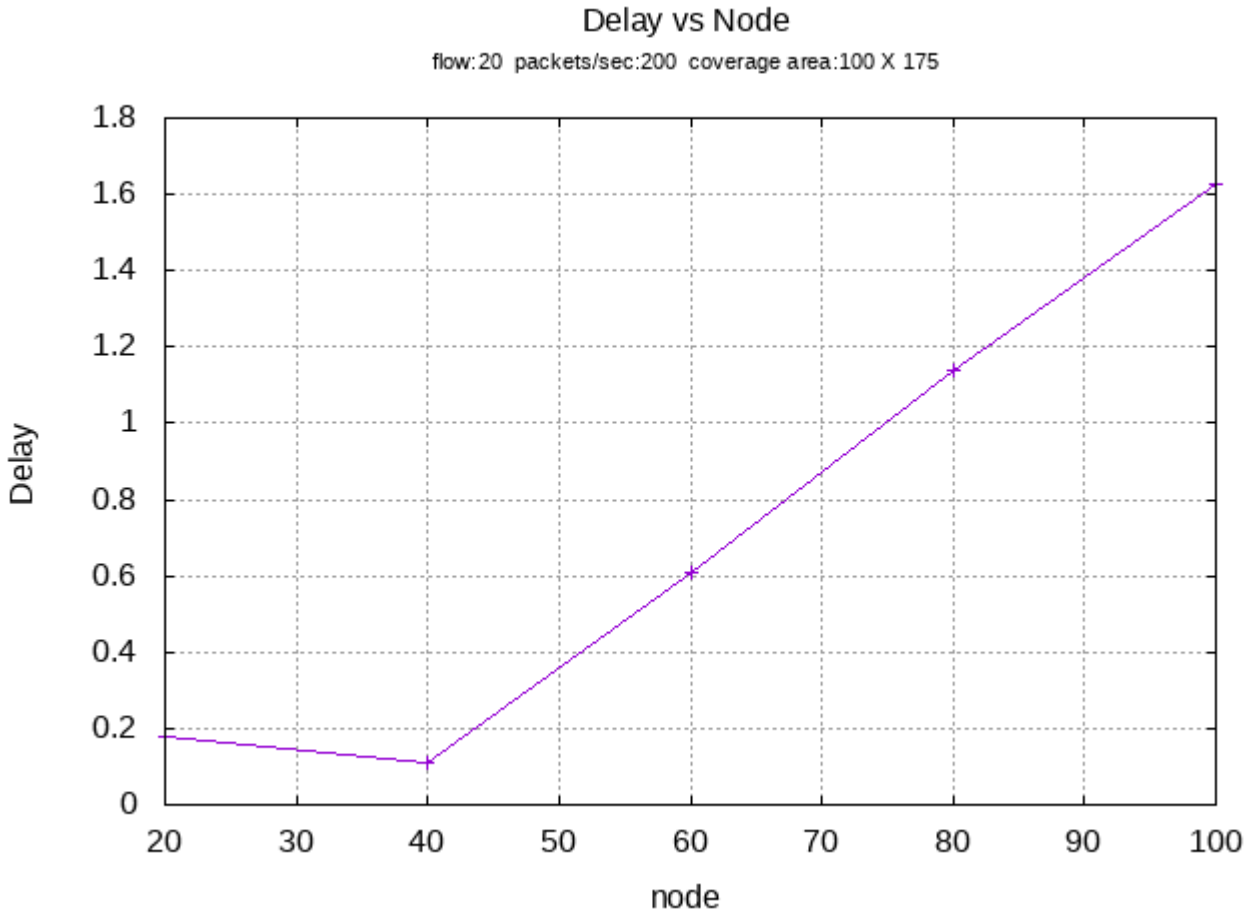
Wireless 802.15.4(static)

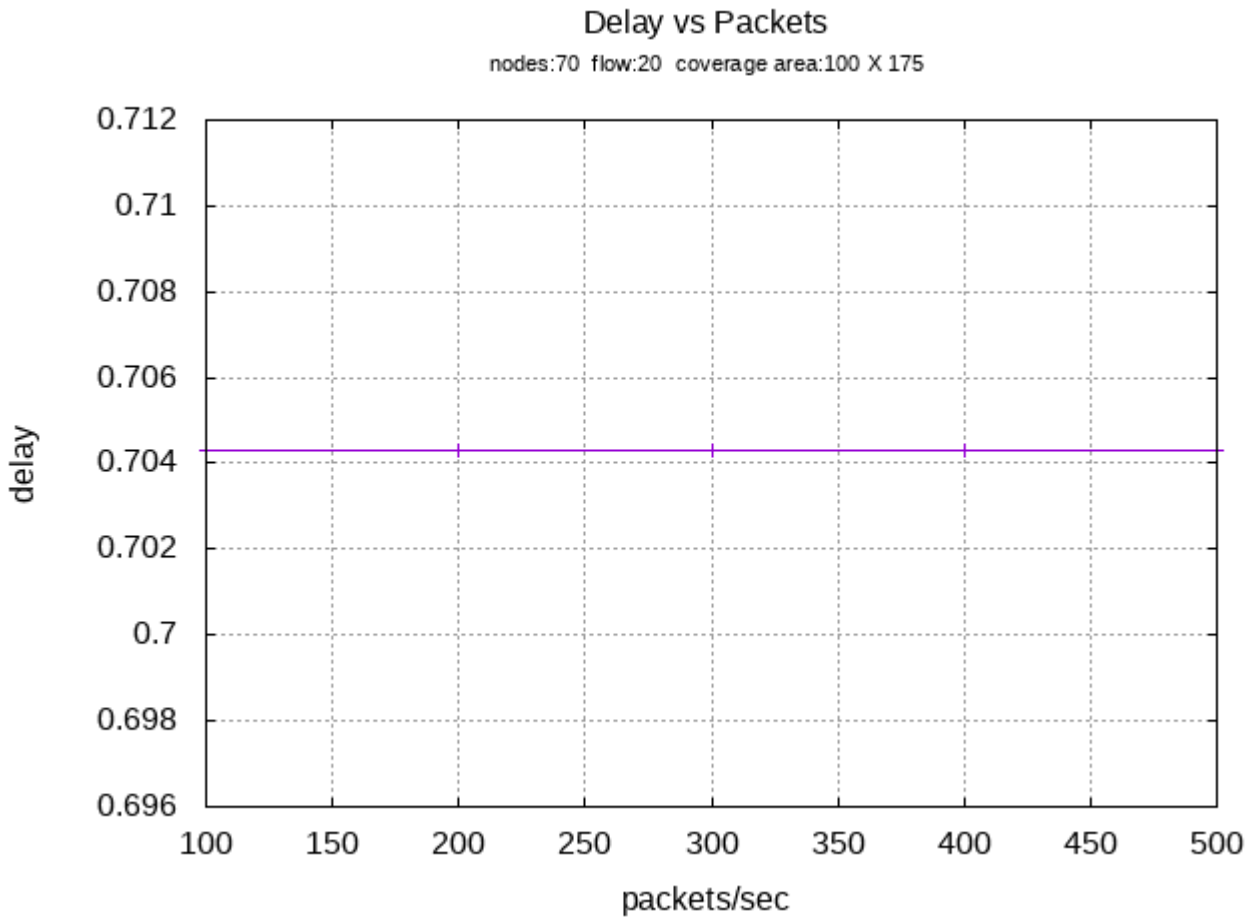

Throughput vs Node
flow:20 packets/sec:200 coverage area:100 X 175
throughput
node
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
20
30
40
50
60
70
80
90
100

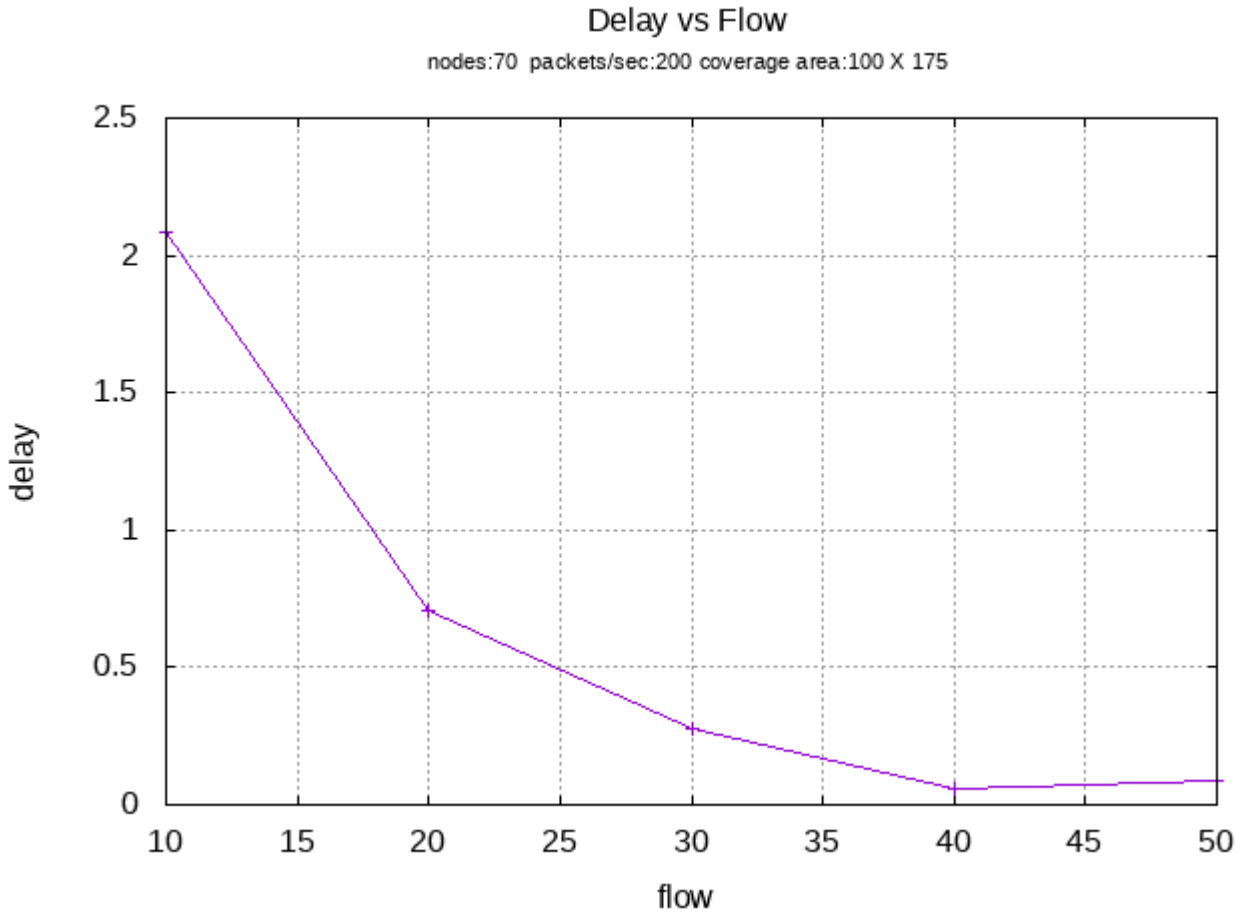

Throughput vs Packets
nodes:70 flow:20 coverage area:100 X 175
throughput
packets/sec
626
624
622
620
618
616
614
612
100
150
200
250
300
350
400
450
500

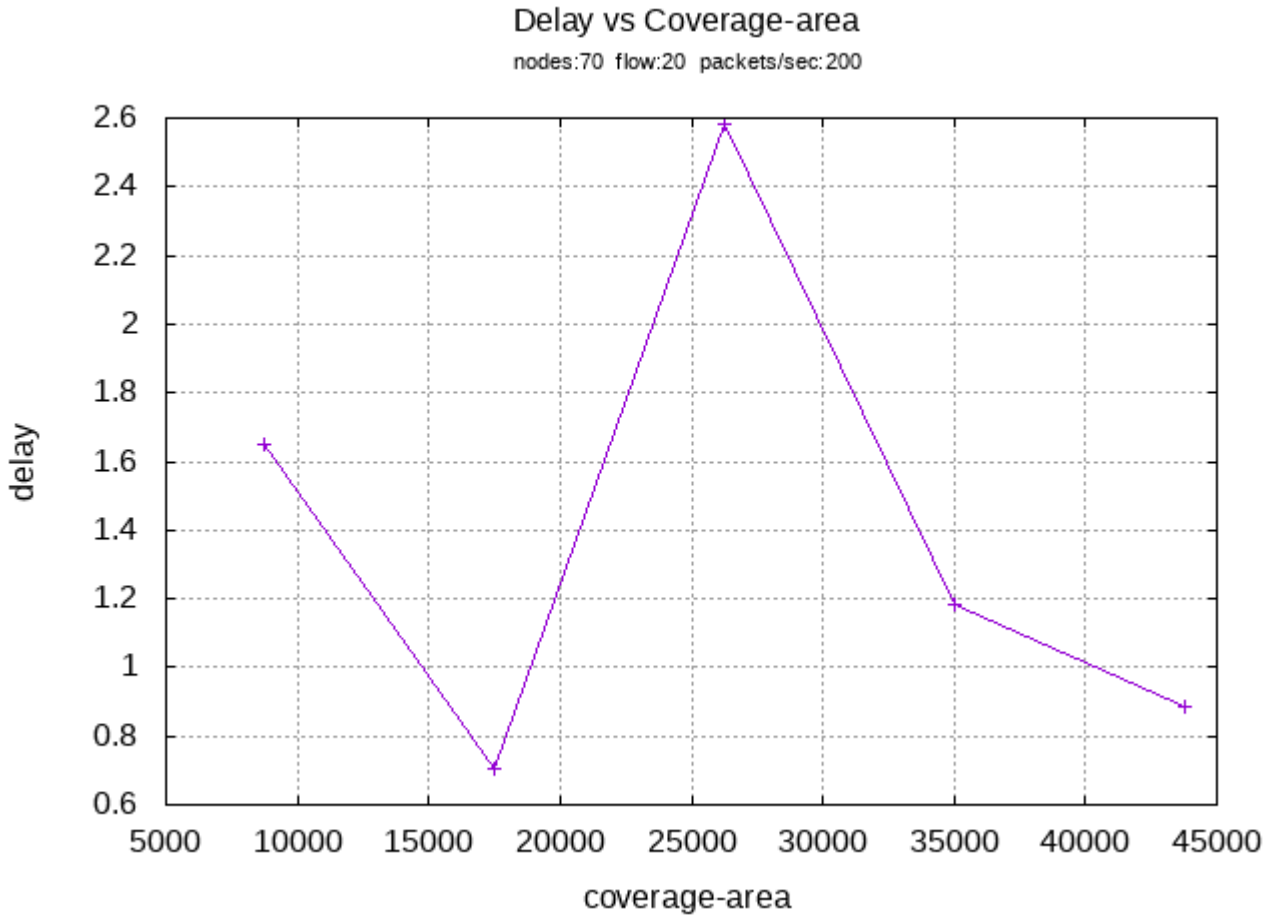

Throughput vs Flow
nodes:70 packets/sec:200 coverage area:100 X 175
throughput
flow
16000
14000
12000
10000
8000
6000
4000
2000
0
10
15
20
25
30
35
40
45
50

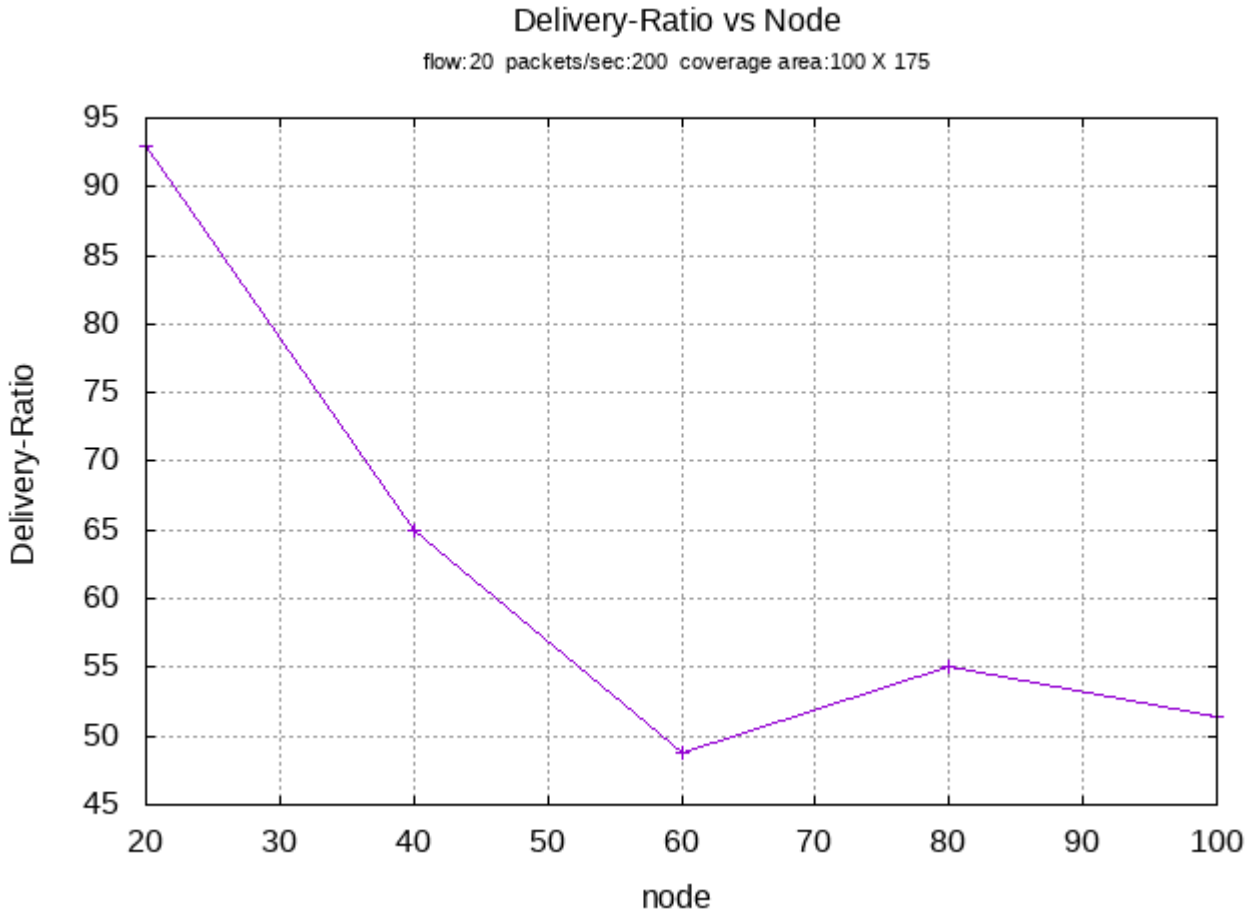

Throughput vs Coverage-area
nodes:70 flow:20 packets/sec:200
throughput
coverage-area
850
800
750
700
650
600
550
500
450
400
5000
10000
15000
20000
25000
30000
35000
40000
45000

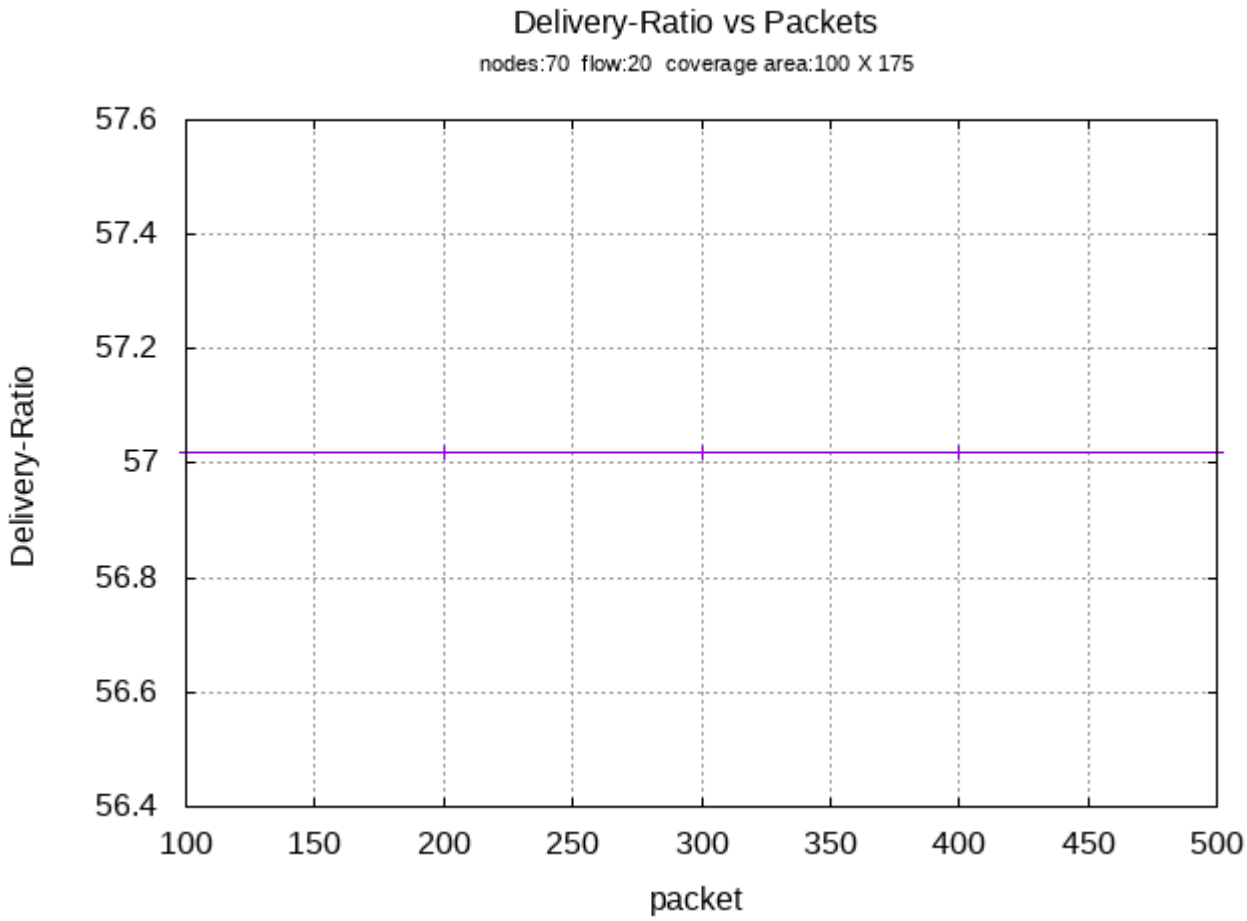

Delay vs Node
flow:20 packets/sec:200 coverage area:100 X 175
Delay
node
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
20
30
40
50
60
70
80
90
100

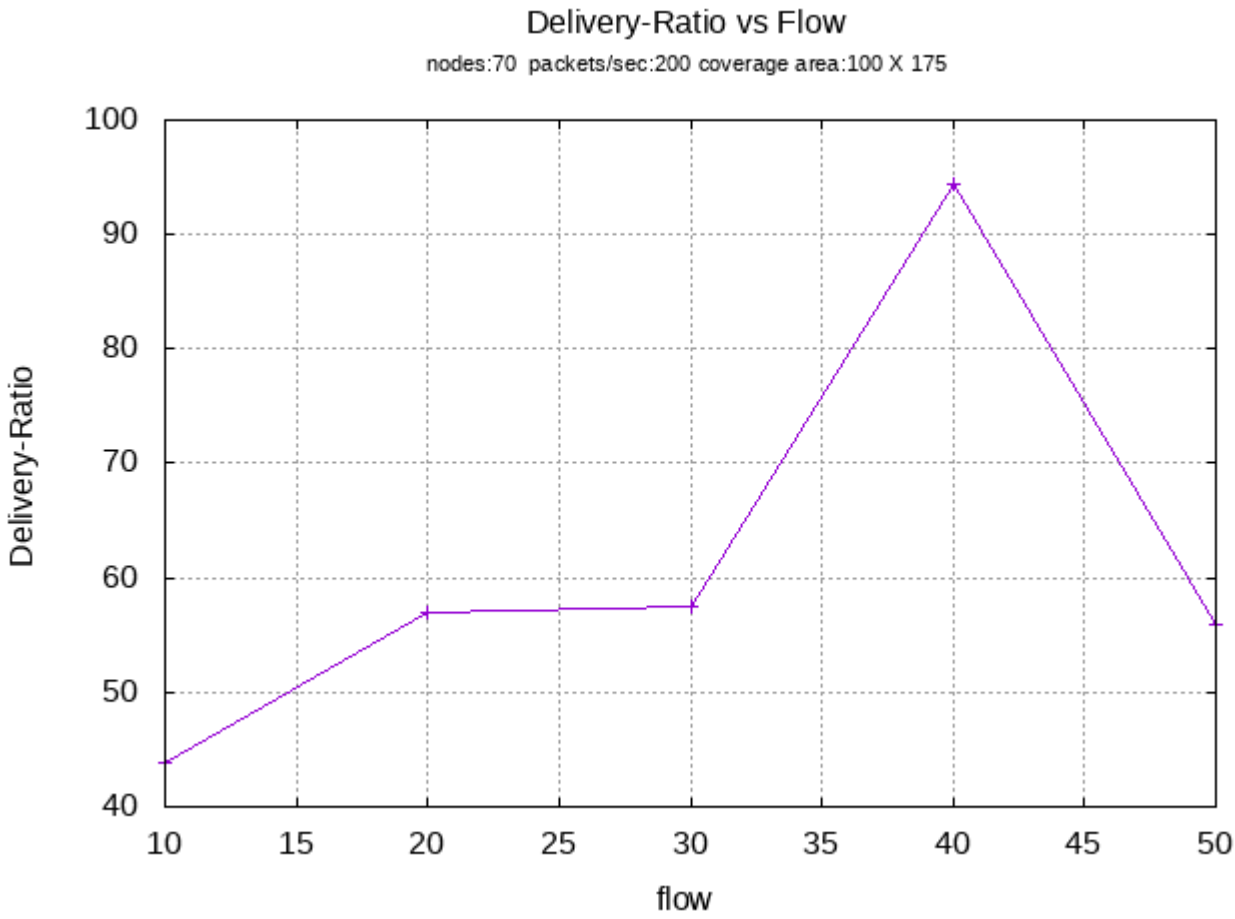

Delay vs Packets
nodes:70 flow:20 coverage area:100 X 175
delay
0.712
0.71
0.708
0.706
0.704
0.702
0.7
0.698
0.696
100
150
200
250
300
350
400
450
500
packets/sec

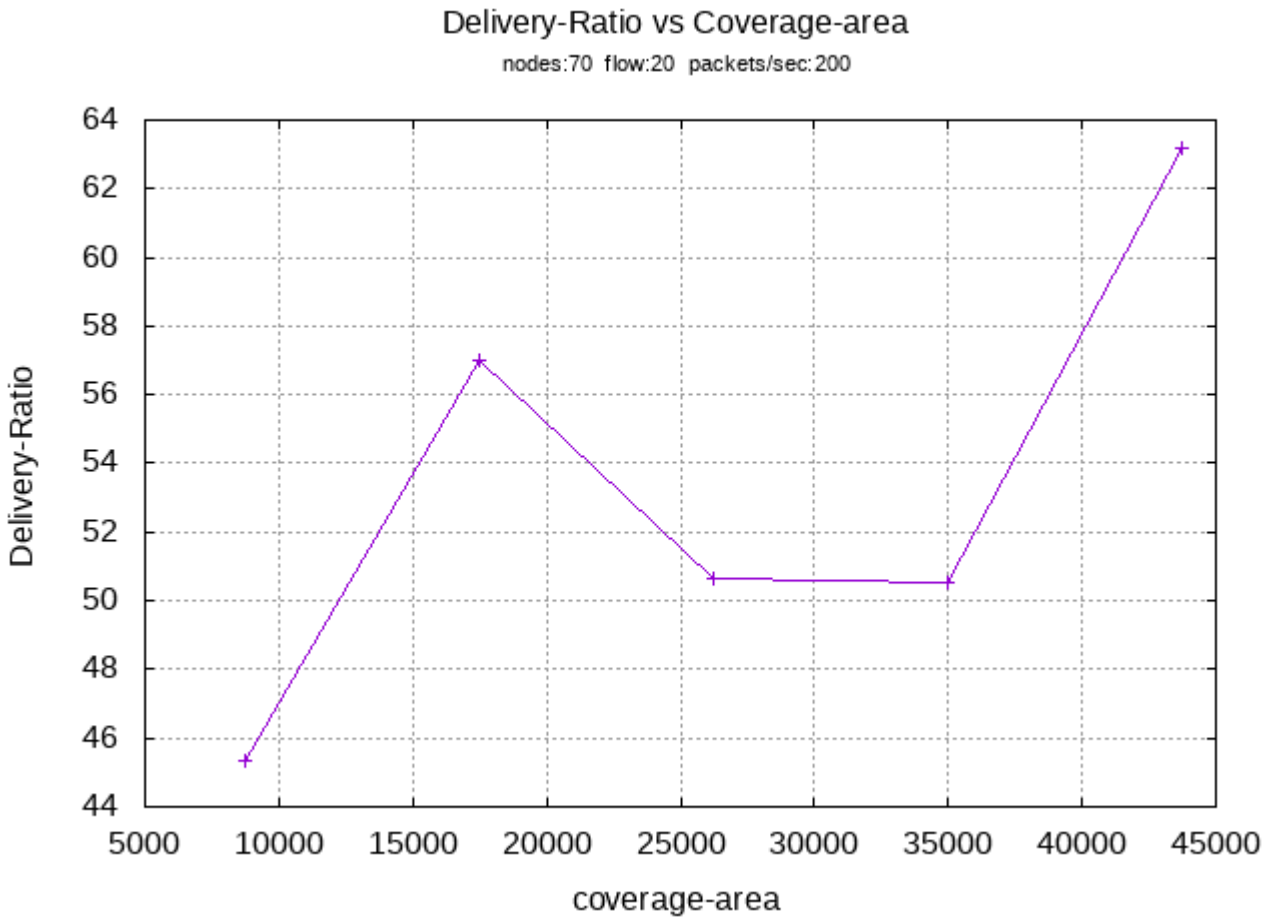

Delay vs Flow
nodes:70 packets/sec:200 coverage area:100 X 175
delay
flow
2.5
2
1.5
1
0.5
0
10
15
20
25
30
35
40
45
50

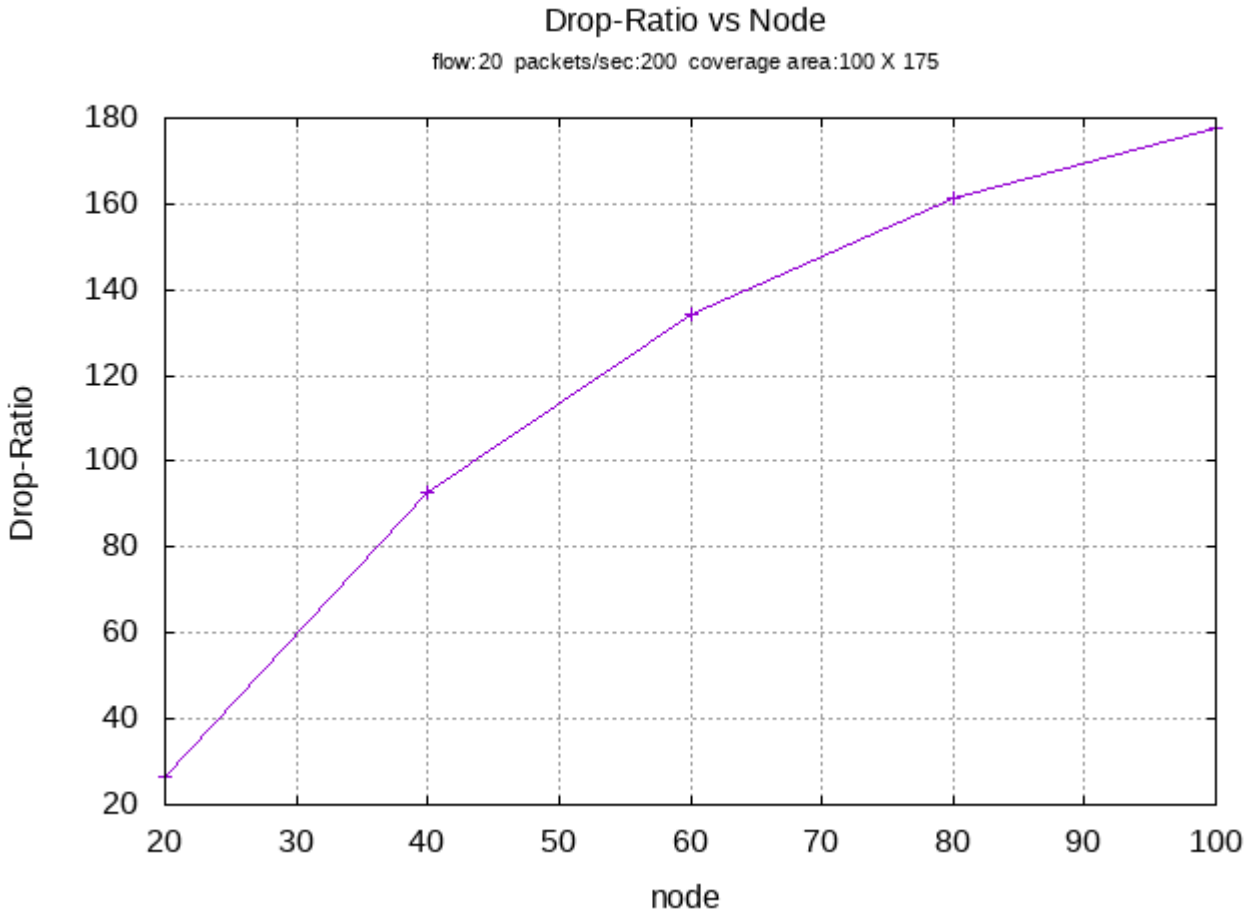

Delay vs Coverage-area
nodes:70 flow:20 packets/sec:200
delay
coverage-area
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
5000
10000
15000
20000
25000
30000
35000
40000
45000

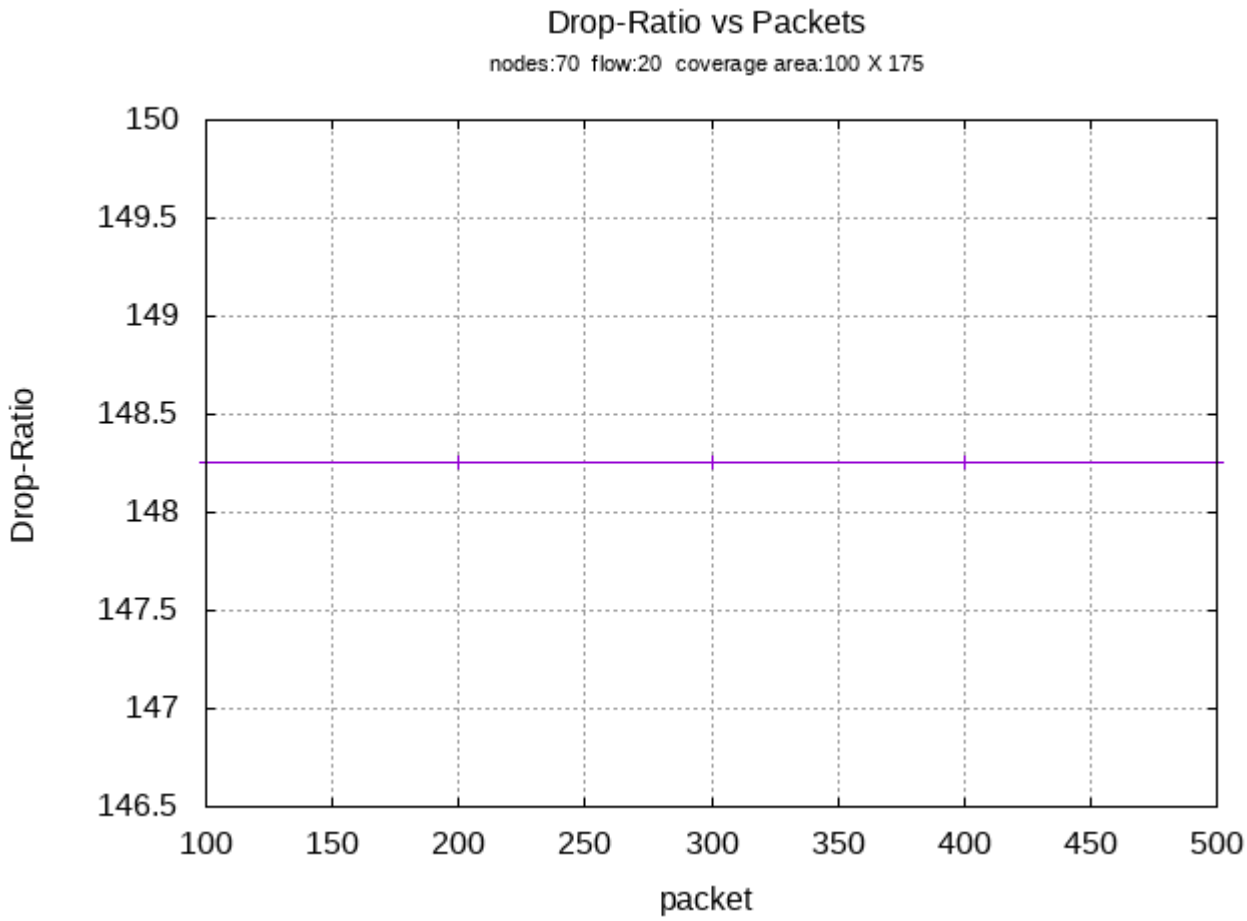

Delivery-Ratio vs Node
flow:20 packets/sec:200 coverage area:100 X 175
Delivery-Ratio
95
90
85
80
75
70
65
60
55
50
45
20
30
40
50
60
70
80
90
100
node

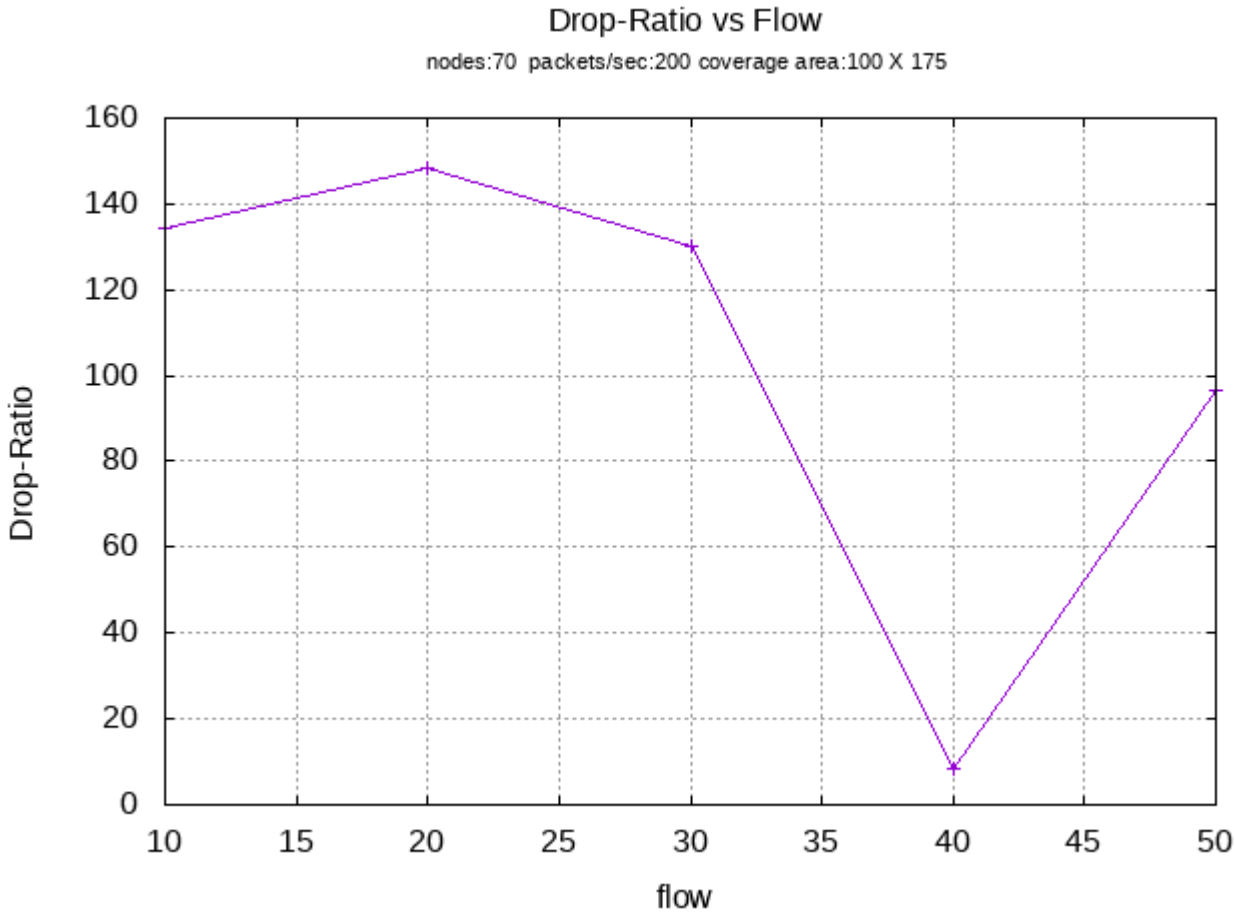

Delivery-Ratio vs Packets
nodes:70 flow:20 coverage area:100 X 175
Delivery-Ratio
57.6
57.4
57.2
57
56.8
56.6
56.4
100
150
200
250
300
350
400
450
500
packet

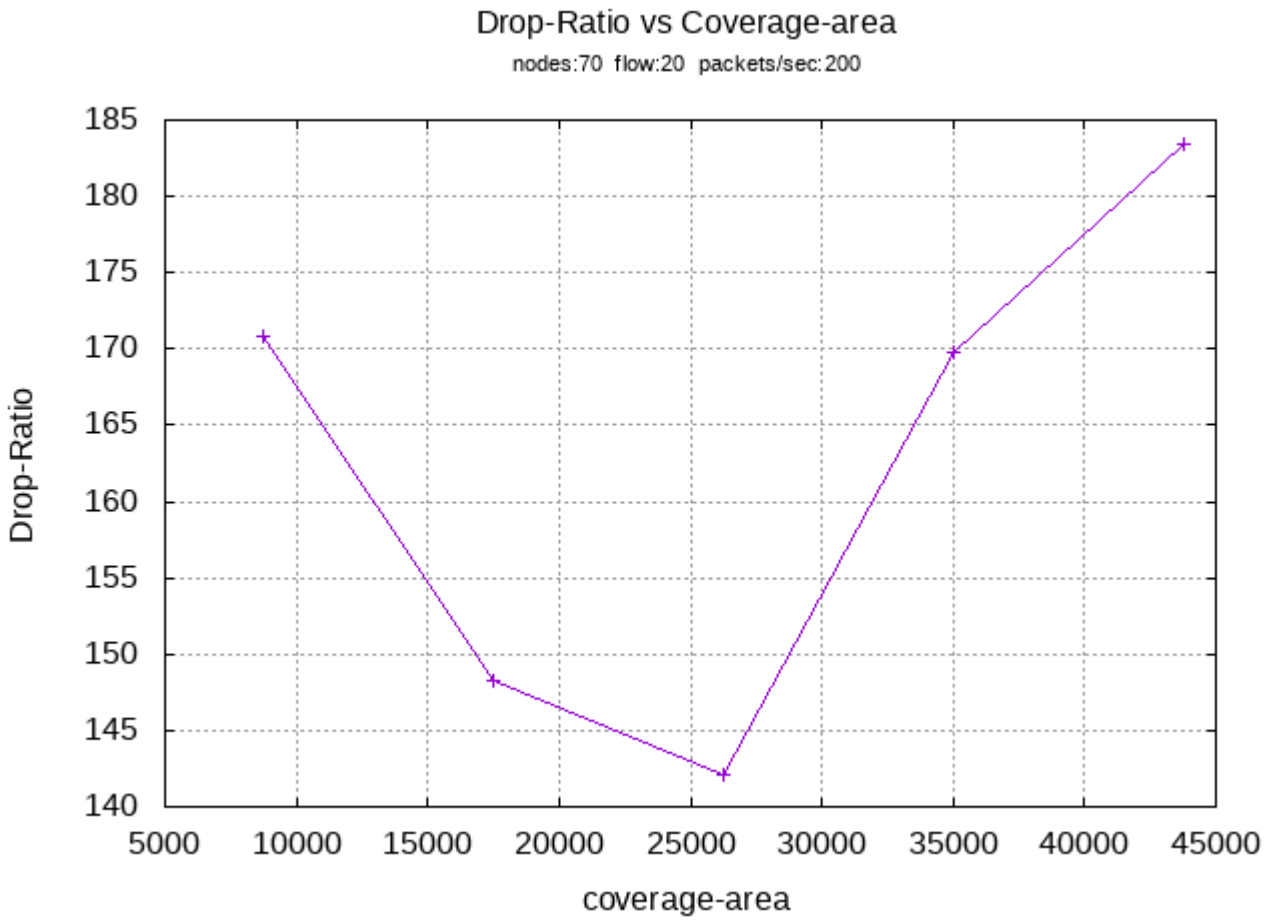

Delivery-Ratio vs Flow
nodes:70 packets/sec:200 coverage area:100 X 175
Delivery-Ratio
100
90
80
70
60
50
40
10
15
20
25
30
35
40
45
50
flow

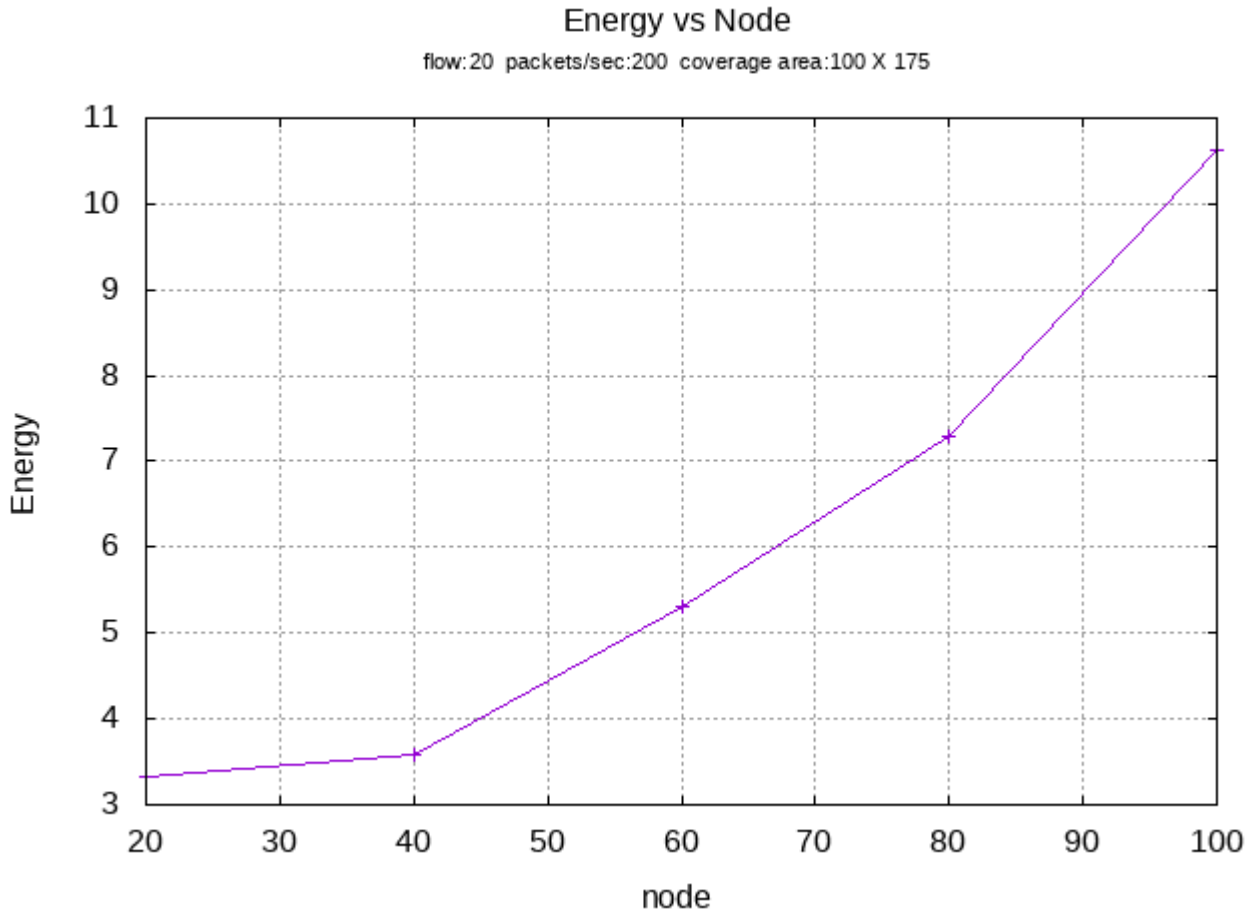

Delivery-Ratio vs Coverage-area
nodes:70 flow:20 packets/sec:200
Delivery-Ratio
64
62
60
58
56
54
52
50
48
46
44
5000
10000
15000
20000
25000
30000
35000
40000
45000
coverage-area

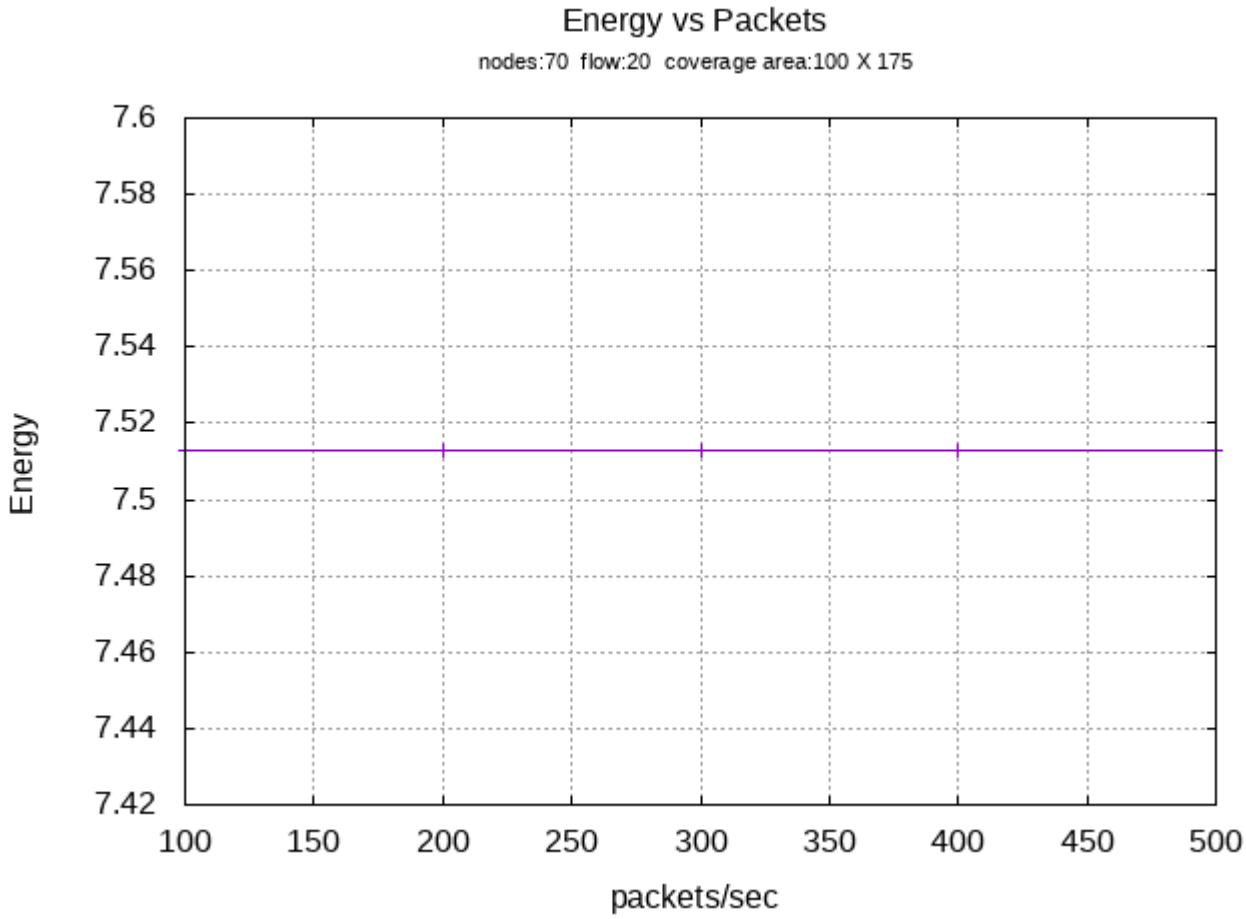

Drop-Ratio vs Node
flow:20 packets/sec:200 coverage area:100 X 175
Drop-Ratio
node
180
160
140
120
100
80
60
40
20
20
30
40
50
60
70
80
90
100

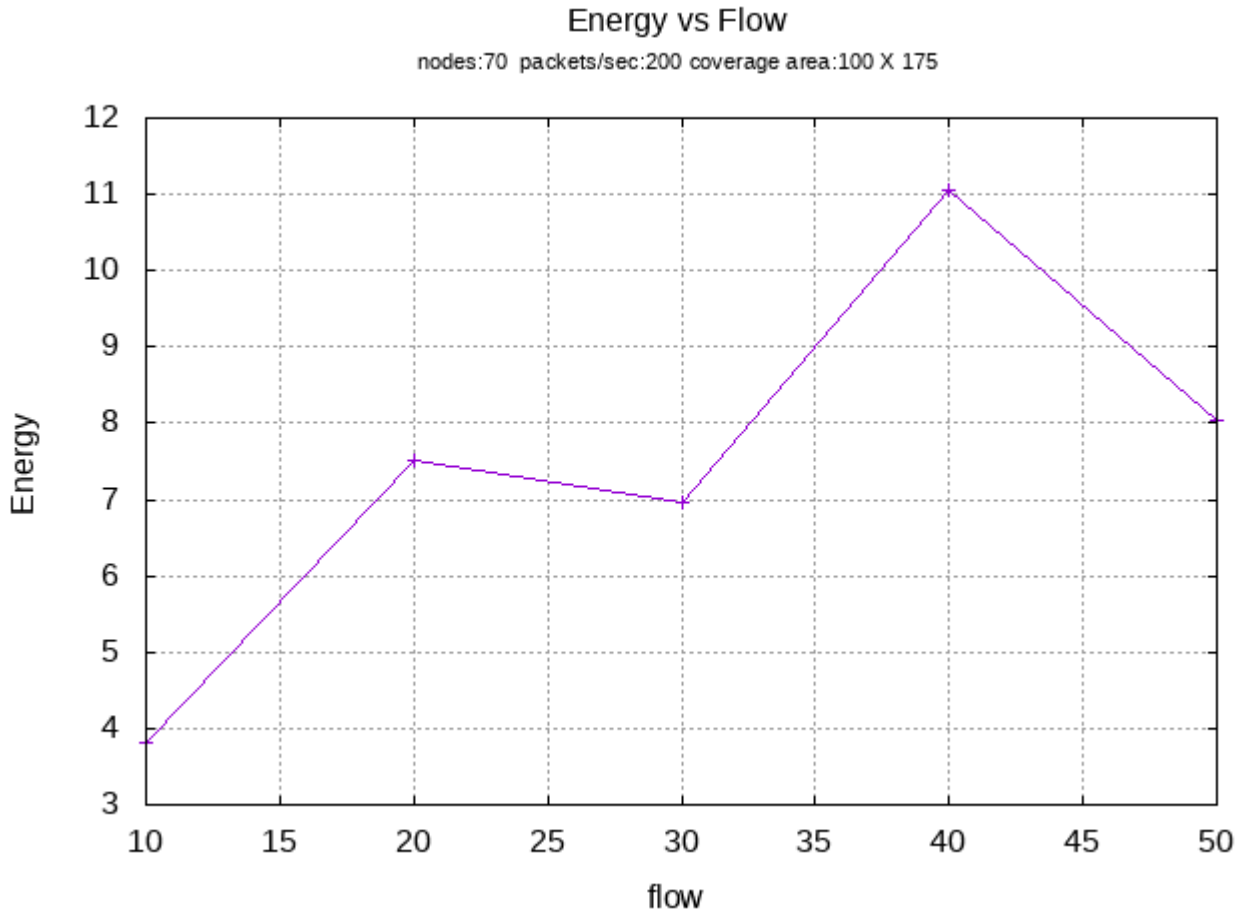

Drop-Ratio vs Packets
nodes:70 flow:20 coverage area:100 X 175
Drop-Ratio
150
149.5
149
148.5
148
147.5
147
146.5
100
150
200
250
300
350
400
450
500
packet

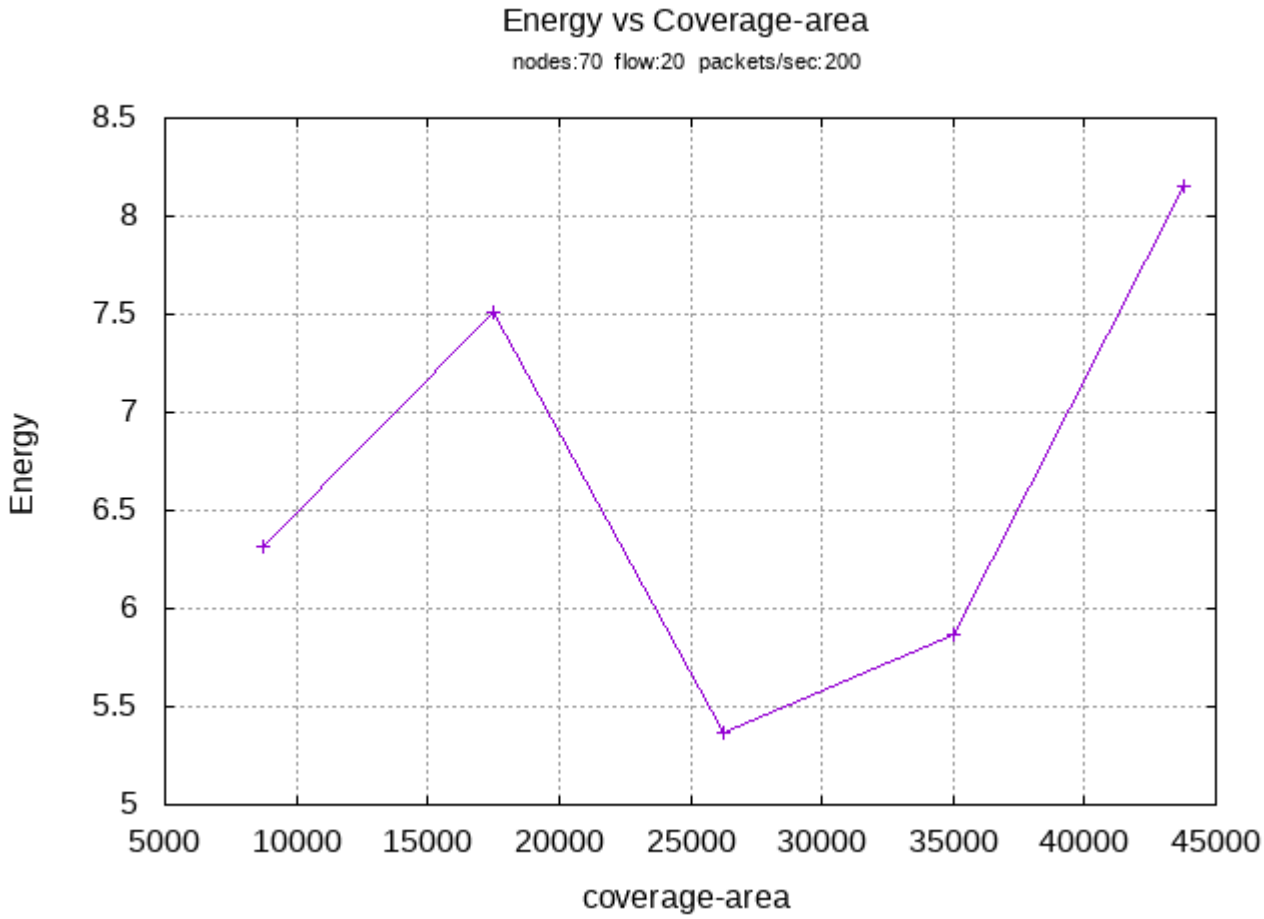

Drop-Ratio vs Flow
nodes:70 packets/sec:200 coverage area:100 X 175
Drop-Ratio
flow
160
140
120
100
80
60
40
20
0
10
15
20
25
30
35
40
45
50


Drop-Ratio vs Coverage-area
nodes:70 flow:20 packets/sec:200
Drop-Ratio
185
180
175
170
165
160
155
150
145
140
5000
10000
15000
20000
25000
30000
35000
40000
45000
coverage-area

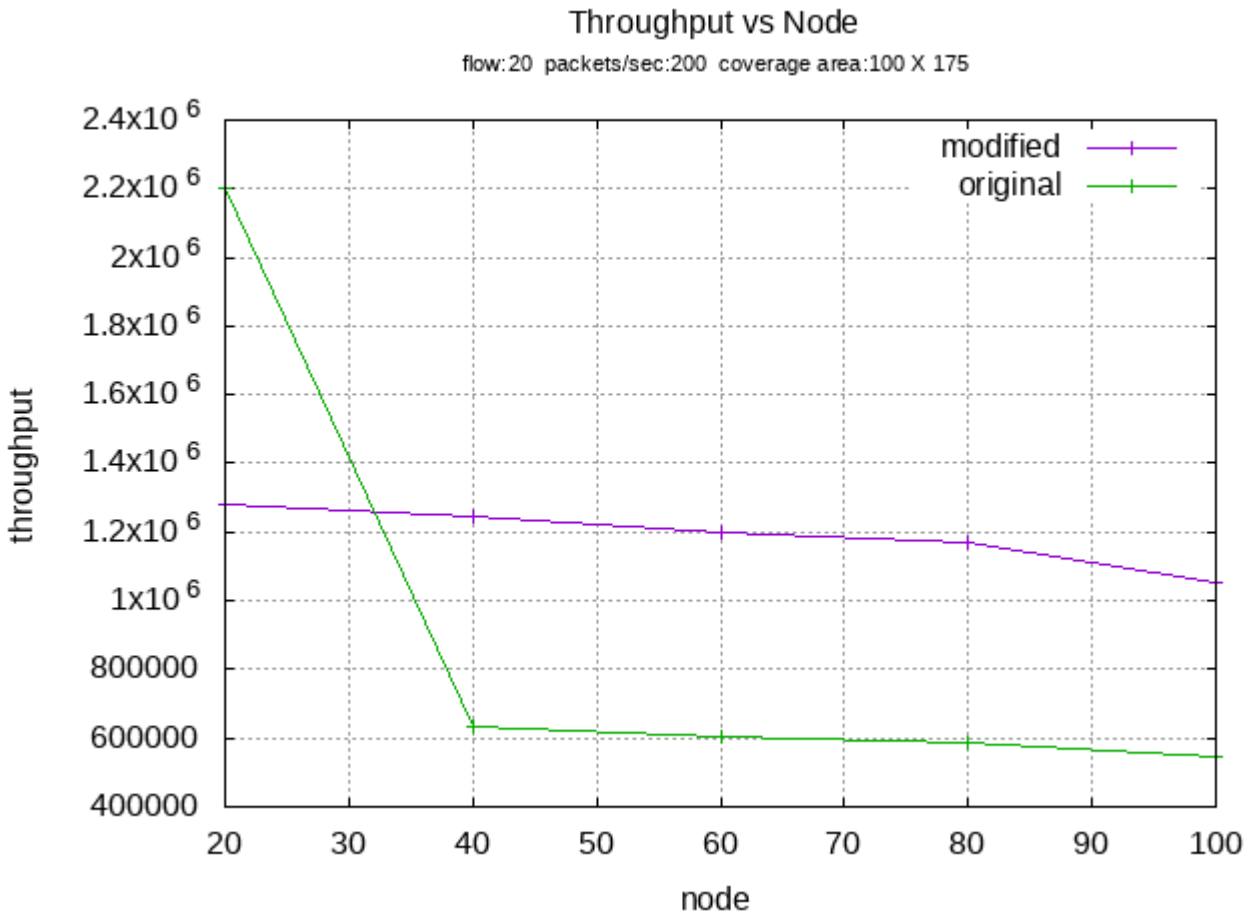

Energy vs Node
flow:20 packets/sec:200 coverage area:100 X 175
Energy
node
11
10
9
8
7
6
5
4
3
20
30
40
50
60
70
80
90
100

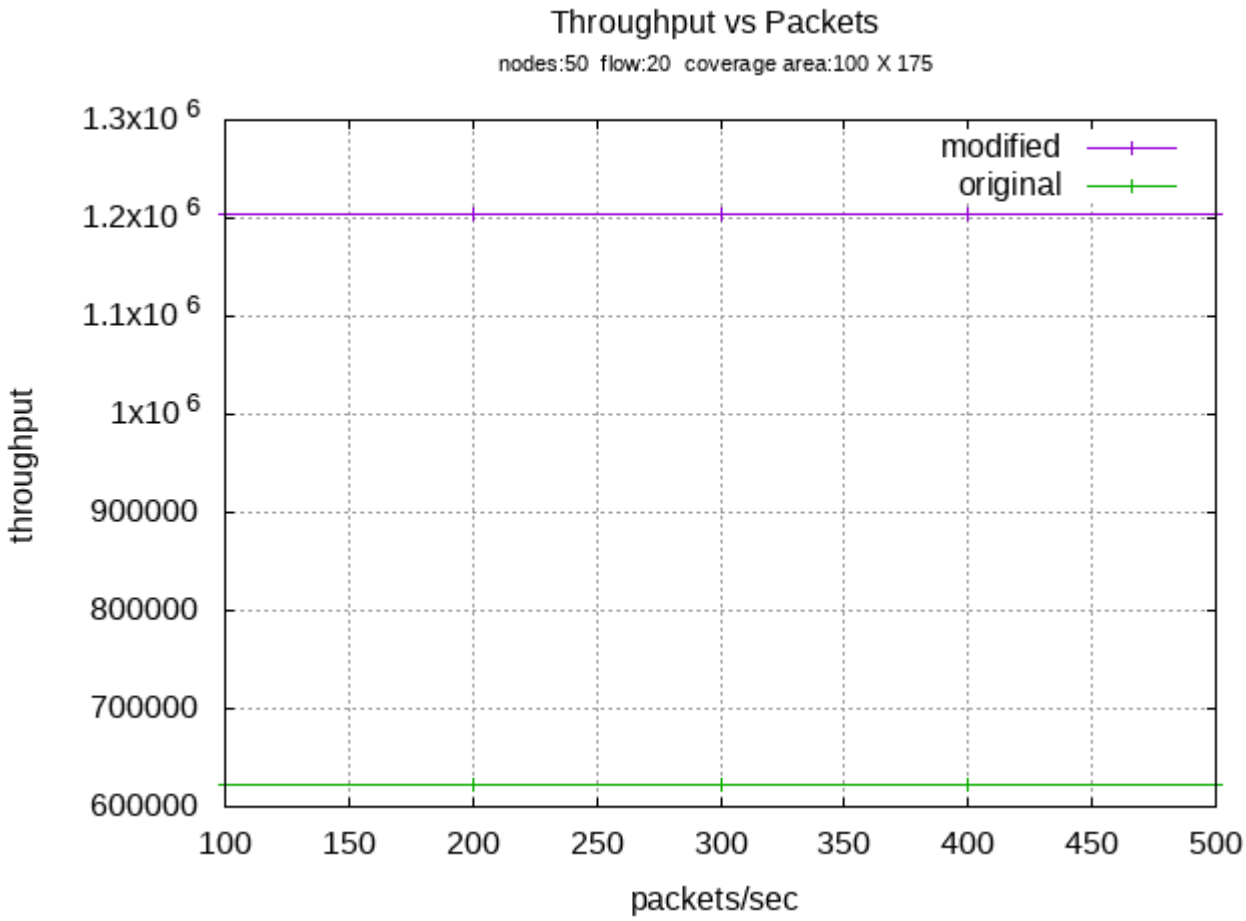

Energy vs Packets
nodes:70 flow:20 coverage area:100 X 175
Energy
7.6
7.58
7.56
7.54
7.52
7.5
7.48
7.46
7.44
7.42
100
150
200
250
300
350
400
450
500
packets/sec

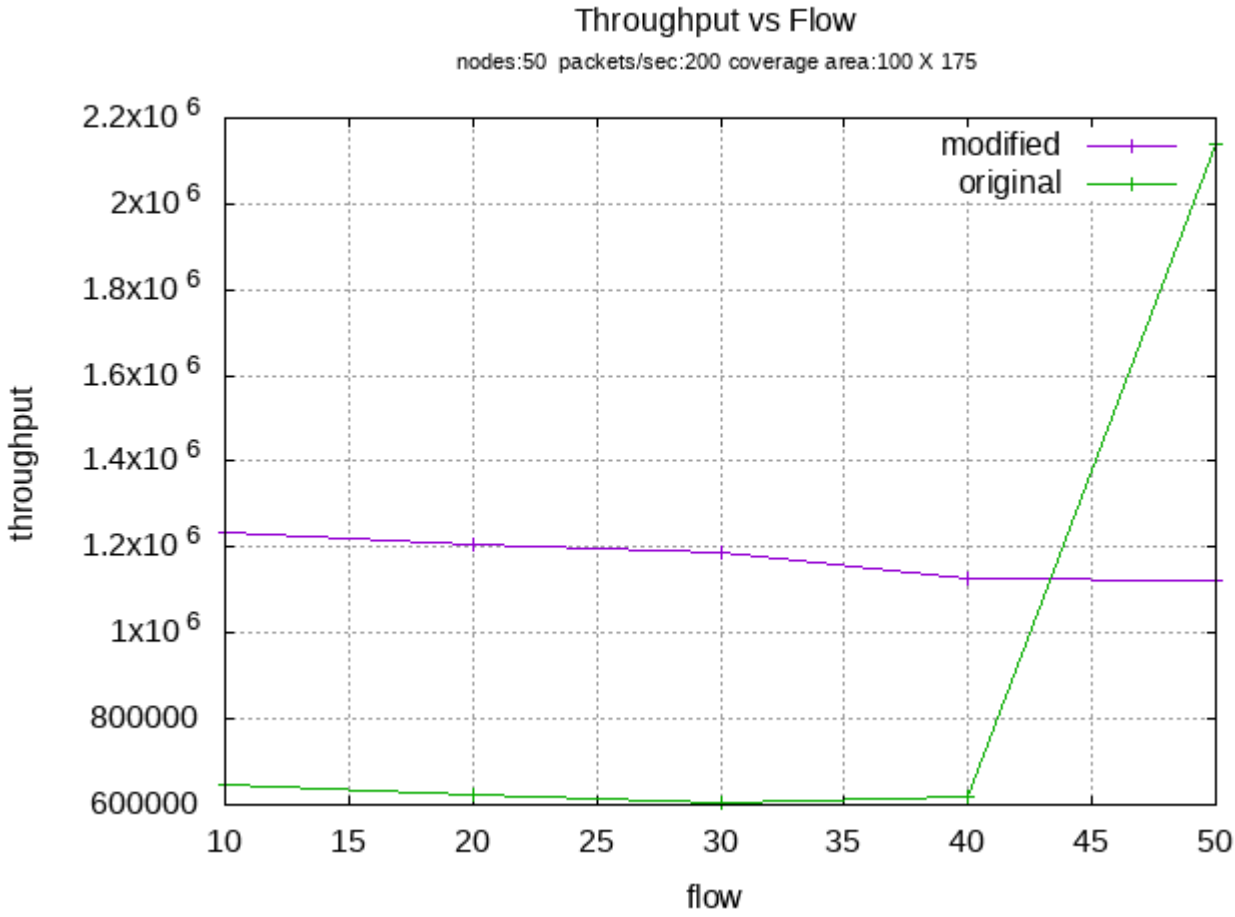

Energy vs Flow
nodes:70 packets/sec:200 coverage area:100 X 175
Energy
flow
12
11
10
9
8
7
6
5
4
3
10
15
20
25
30
35
40
45
50

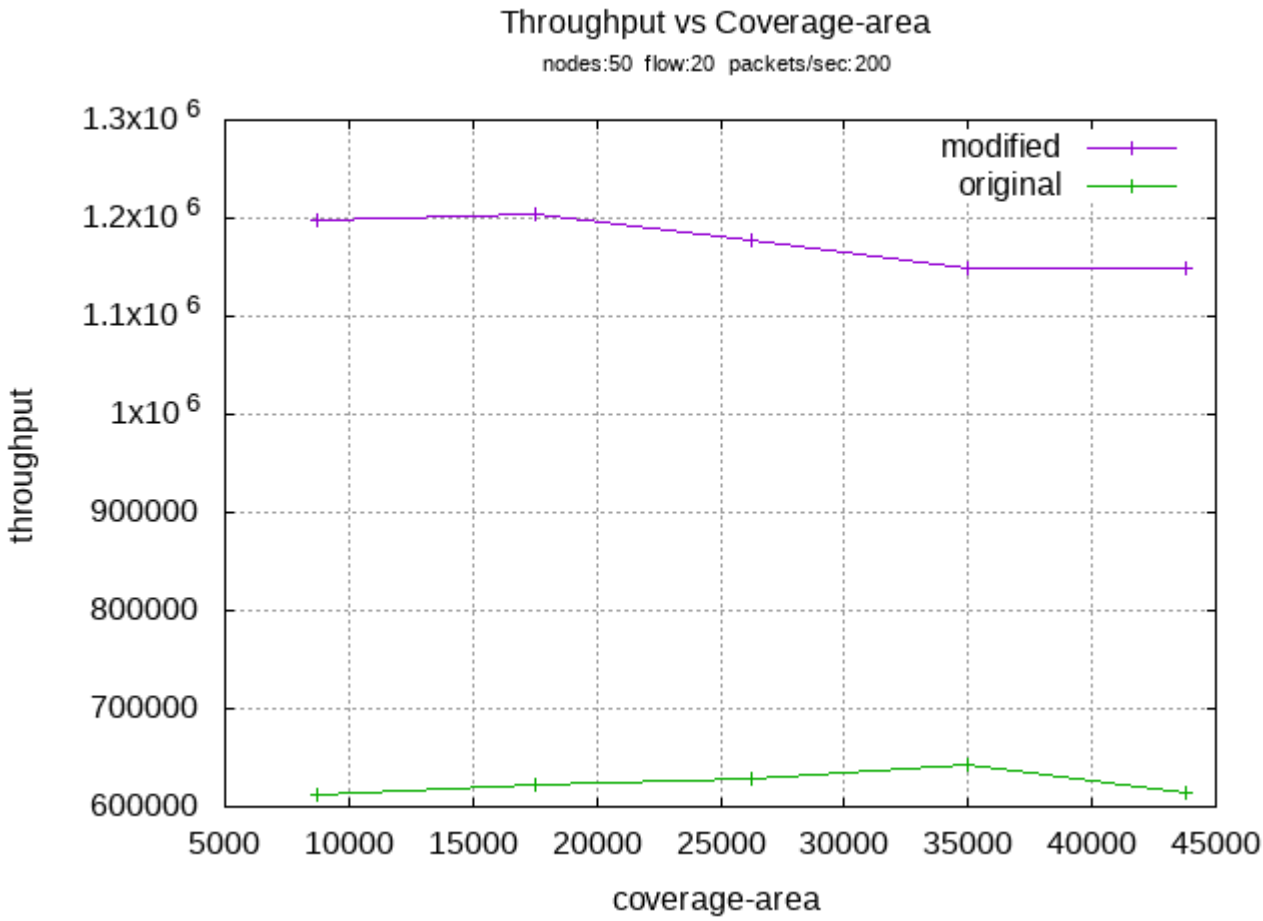

Energy vs Coverage-area
nodes:70 flow:20 packets/sec:200
Energy
8.5
8
7.5
7
6.5
6
5.5
5
5000
10000
15000
20000
25000
30000
35000
40000
45000
coverage-area

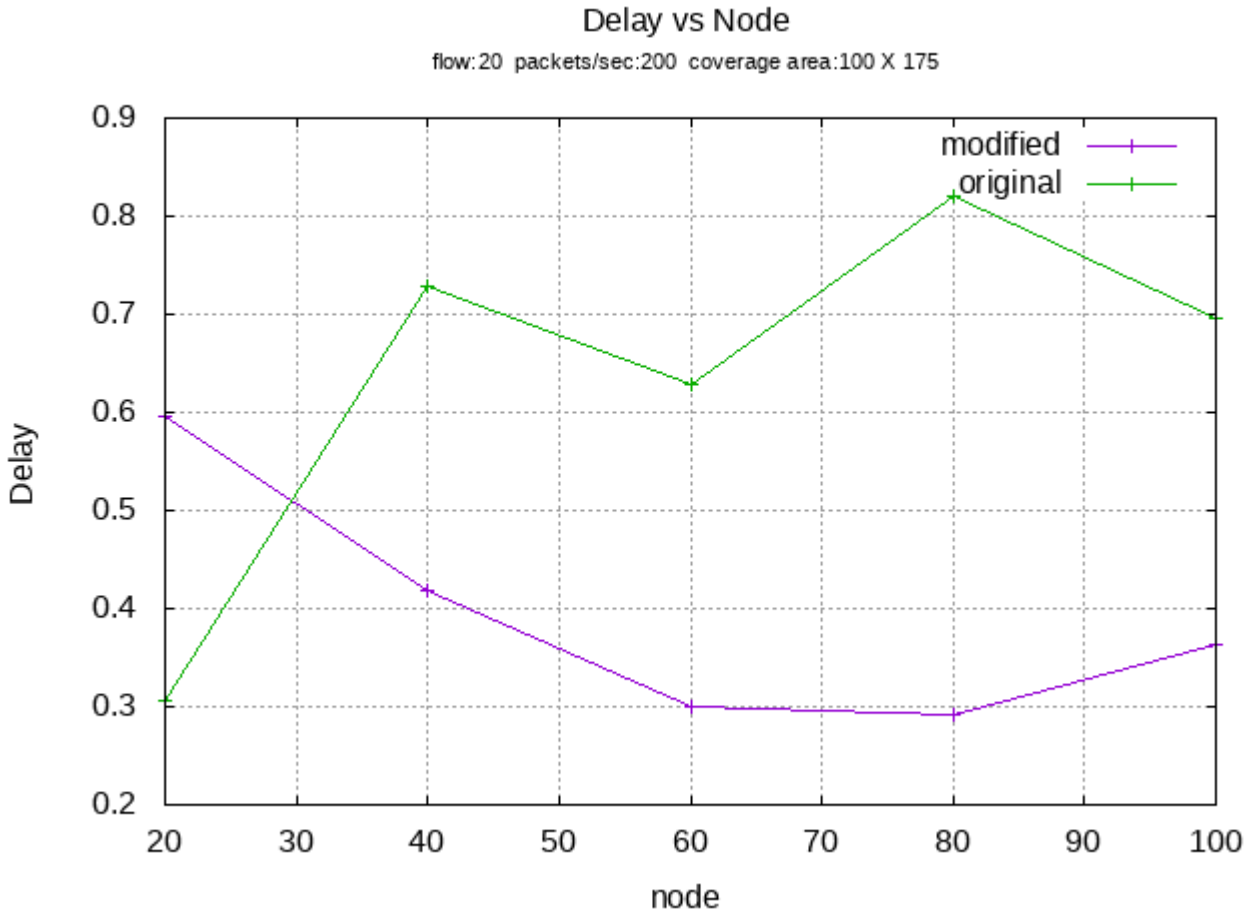
Wireless 802.11new(static)

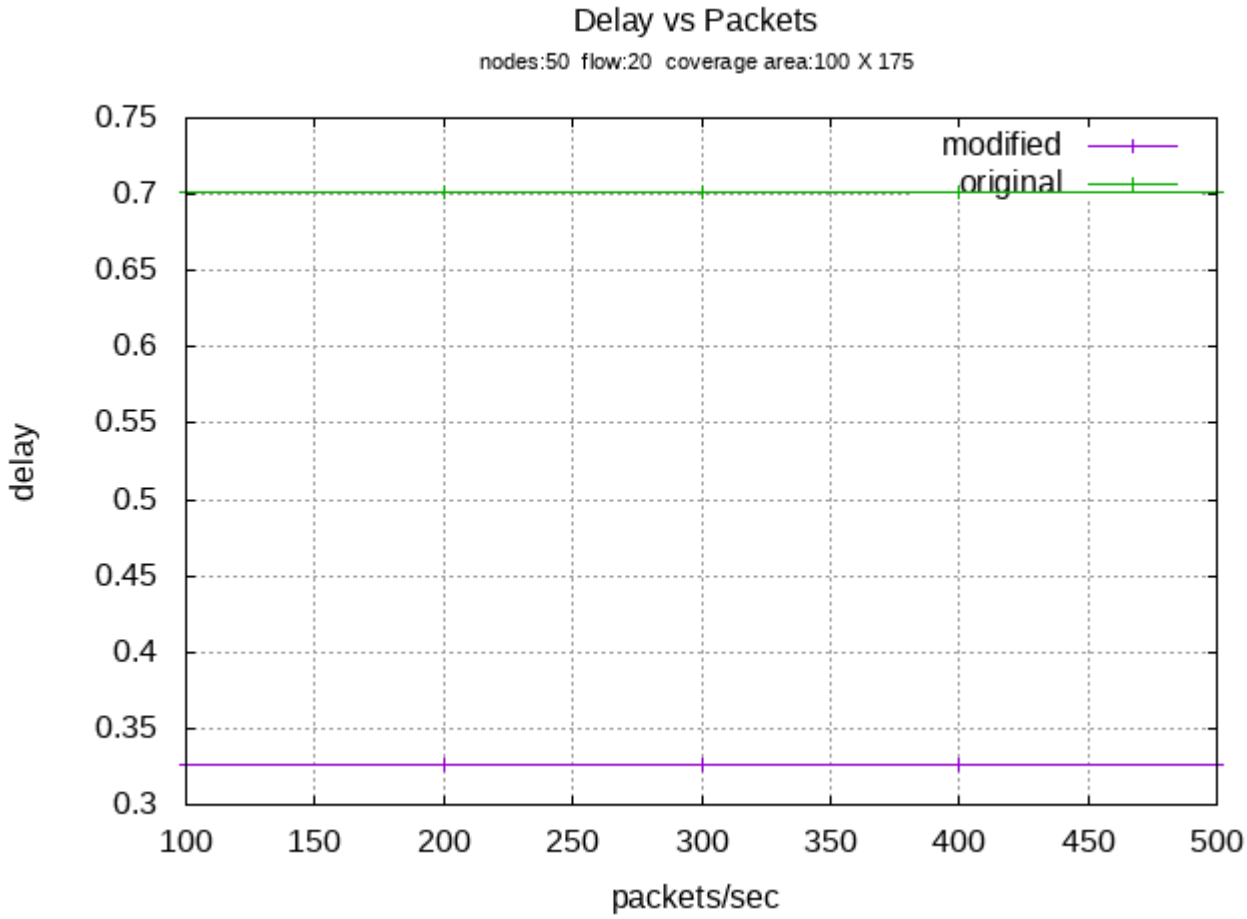

Throughput vs Node
flow:20 packets/sec:200 coverage area:100 X 175
throughput
node
modified
original
2.4x10 6
2.2x10 6
2x10 6
1.8x10 6
1.6x10 6
1.4x10 6
1.2x10 6
1x10 6
800000
600000
400000
20
30
40
50
60
70
80
90
100

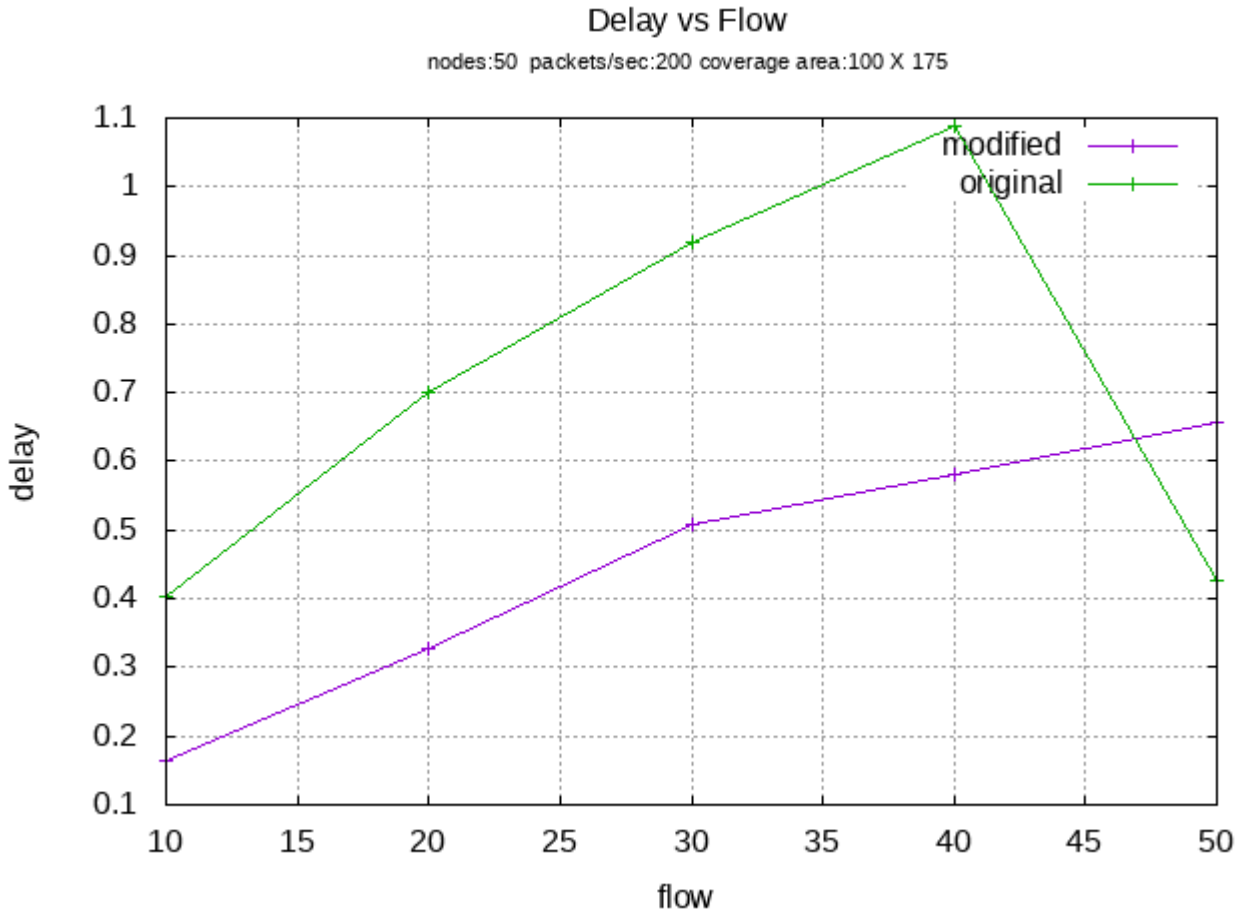

Throughput vs Packets
nodes:50 flow:20 coverage area:100 X 175
throughput
packets/sec
modified
original
1.3x10 6
1.2x10 6
1.1x10 6
1x10 6
900000
800000
700000
600000
100
150
200
250
300
350
400
450
500

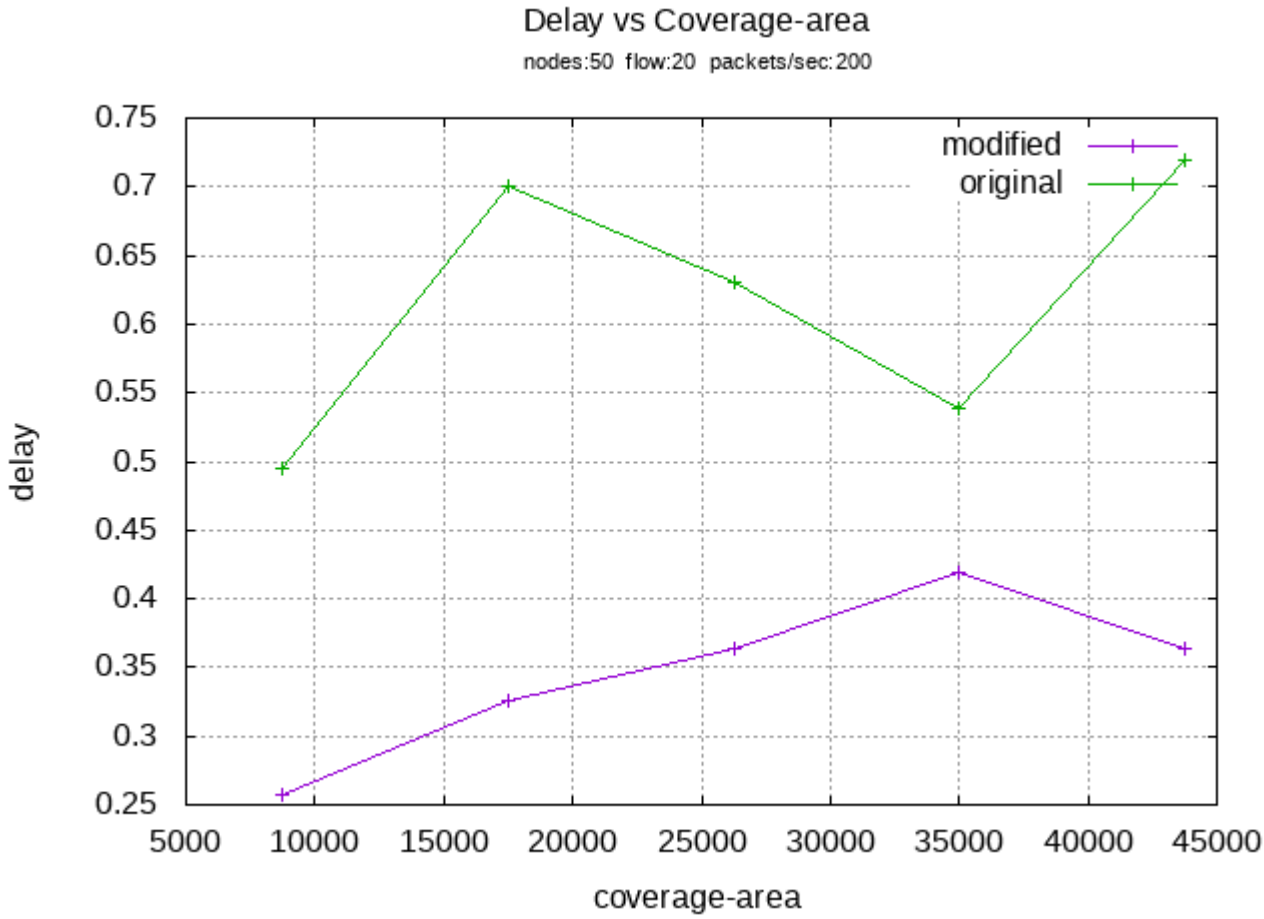

Throughput vs Flow
nodes:50 packets/sec:200 coverage area:100 X 175
throughput
flow
modified
original
2.2x10 6
2x10 6
1.8x10 6
1.6x10 6
1.4x10 6
1.2x10 6
1x10 6
800000
600000
10
15
20
25
30
35
40
45
50

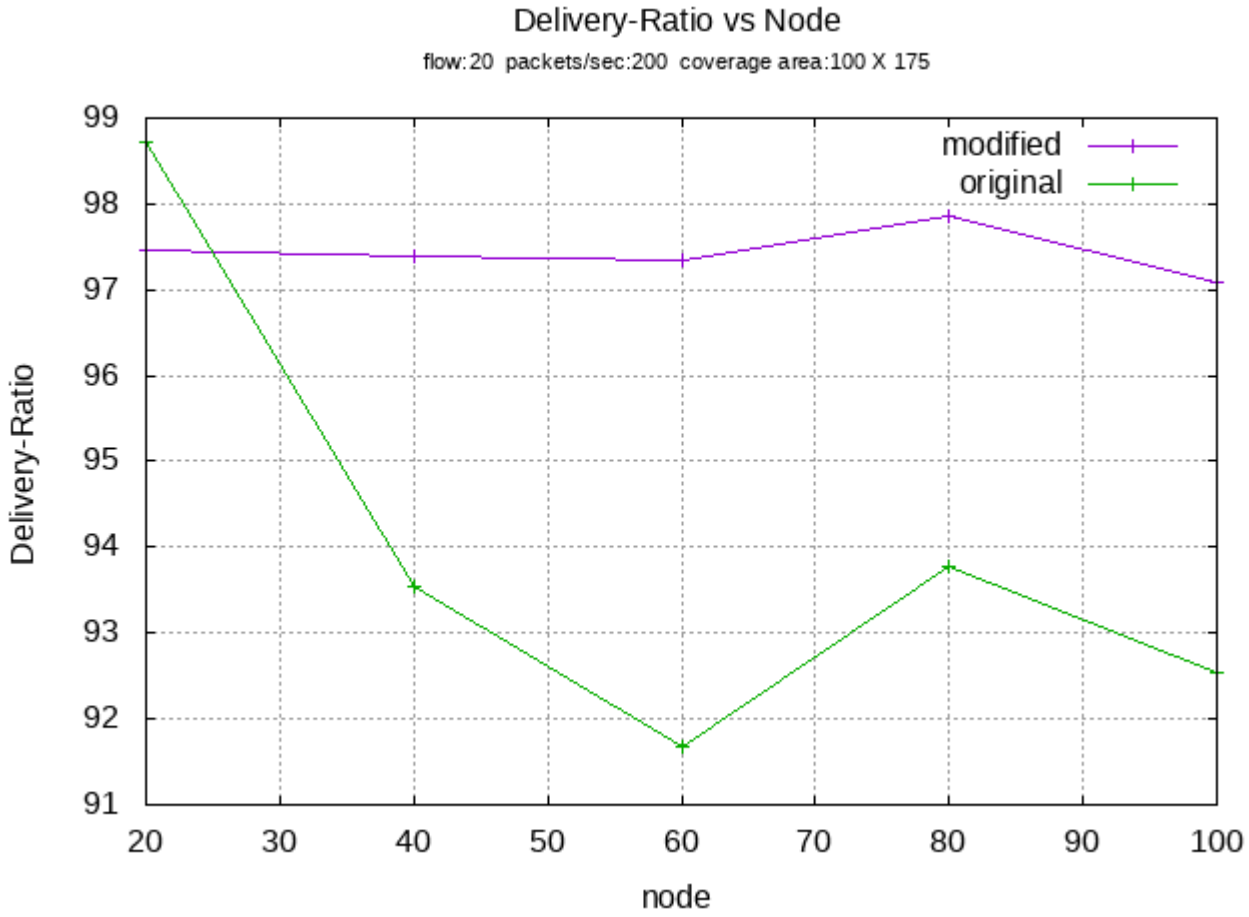

Throughput vs Coverage-area
nodes:50 flow:20 packets/sec:200
1.3x10 6
1.2x10 6
1.1x10 6
1x10 6
900000
800000
700000
600000
throughput
5000
10000
15000
20000
25000
30000
35000
40000
45000
coverage-area
modified
original

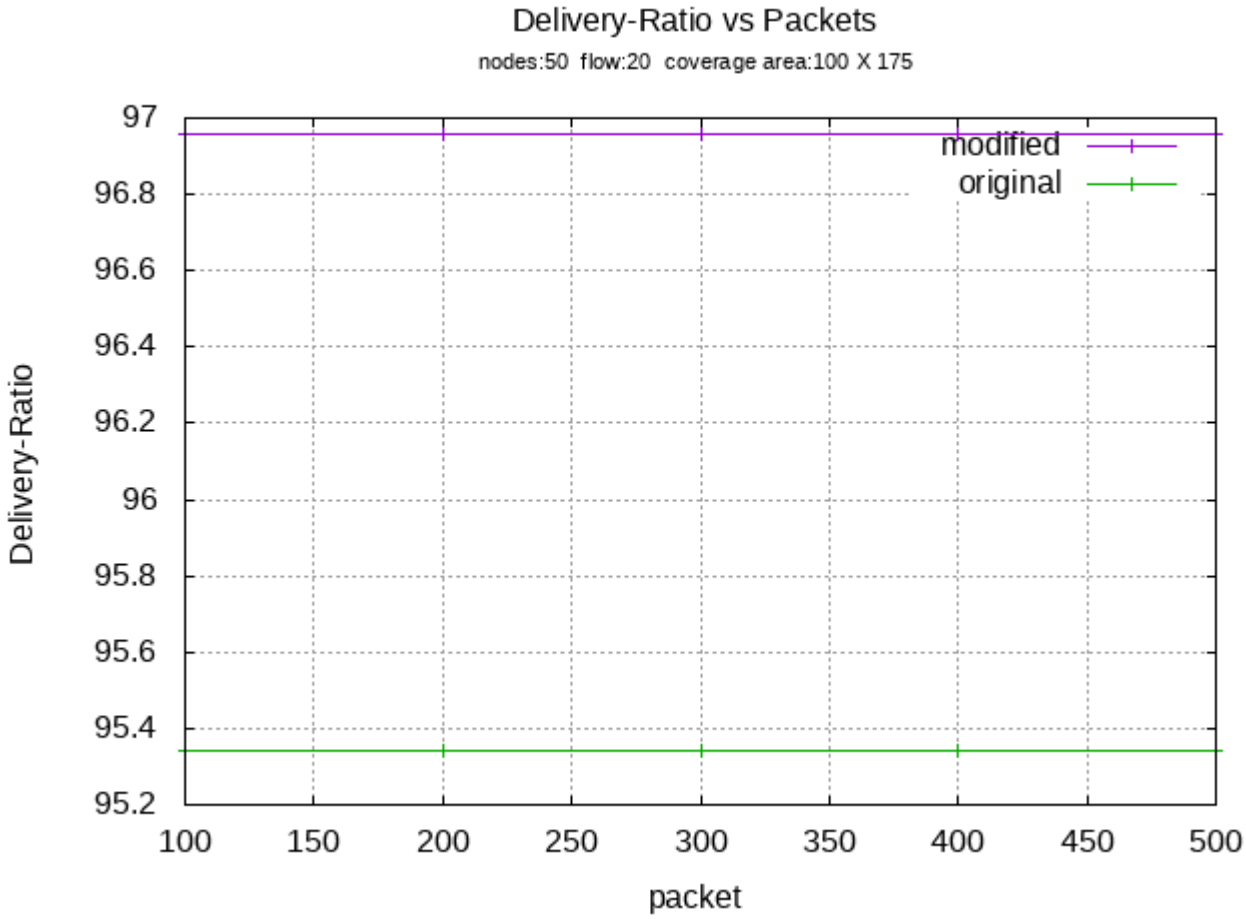

Delay vs Node
flow:20 packets/sec:200 coverage area:100 X 175
Delay
node
modified
original
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
20
30
40
50
60
70
80
90
100

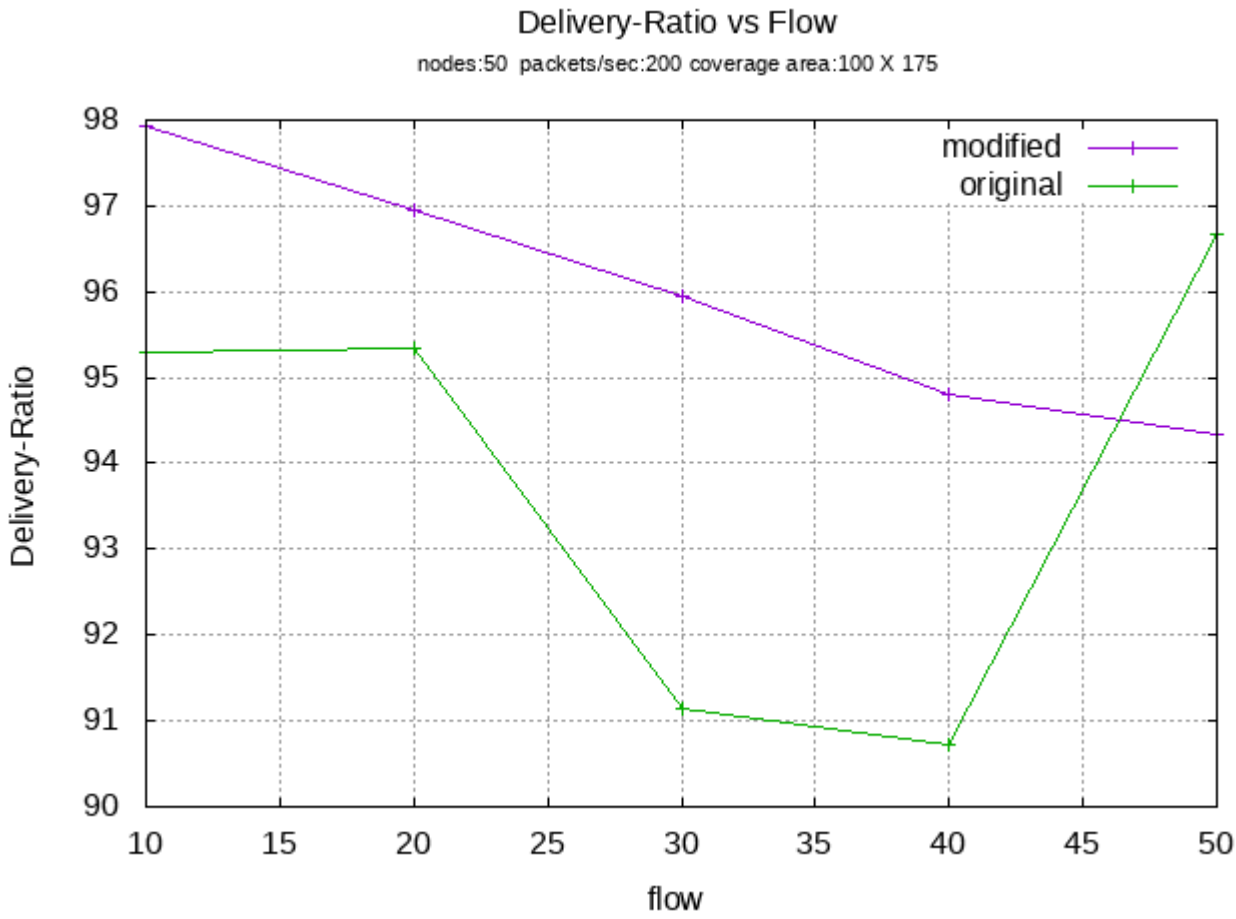

Delay vs Packets
nodes:50 flow:20 coverage area:100 X 175
modified
original
delay
packets/sec
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
100
150
200
250
300
350
400
450
500

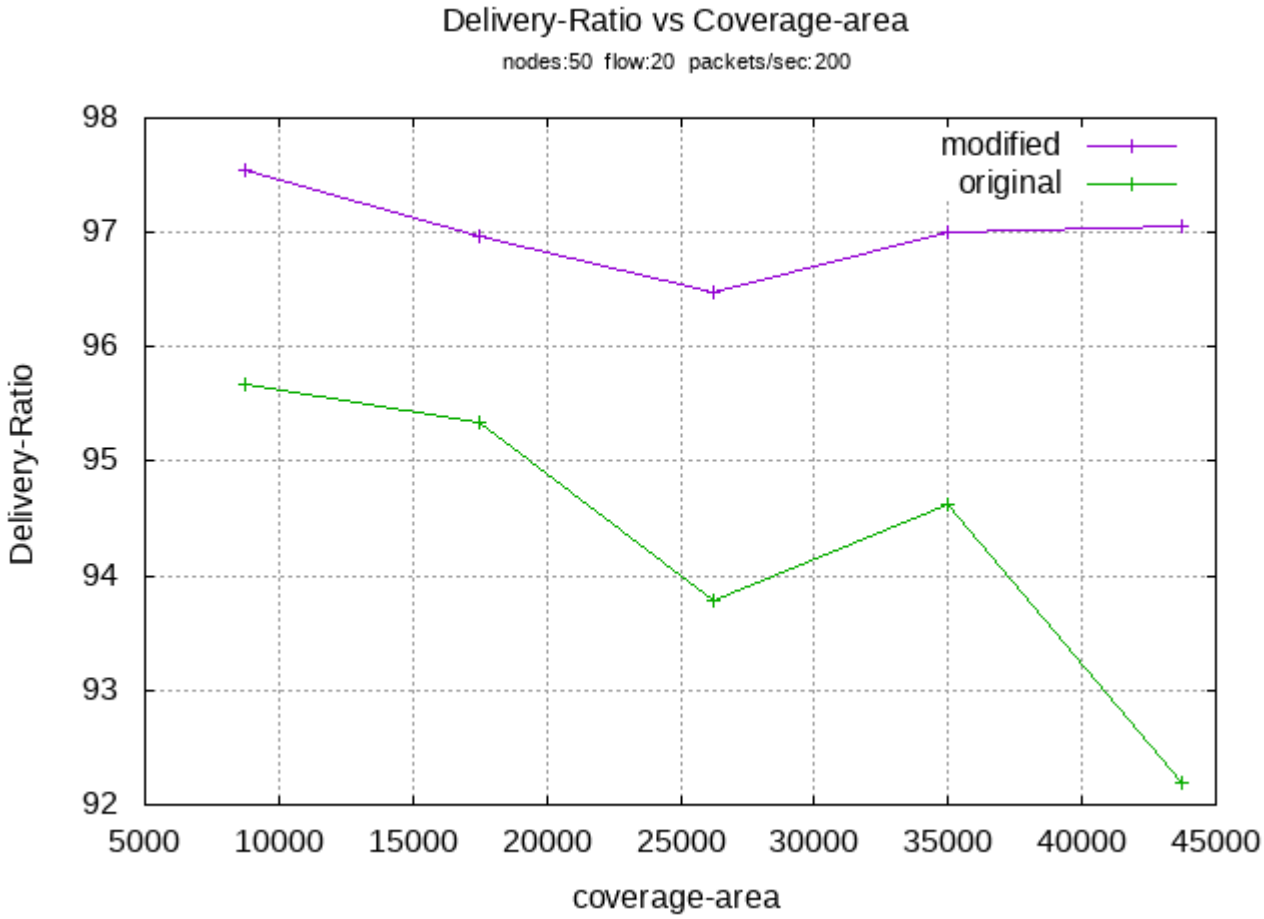

Delay vs Flow
nodes:50 packets/sec:200 coverage area:100 X 175
delay
flow
modified
original
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
10
15
20
25
30
35
40
45
50

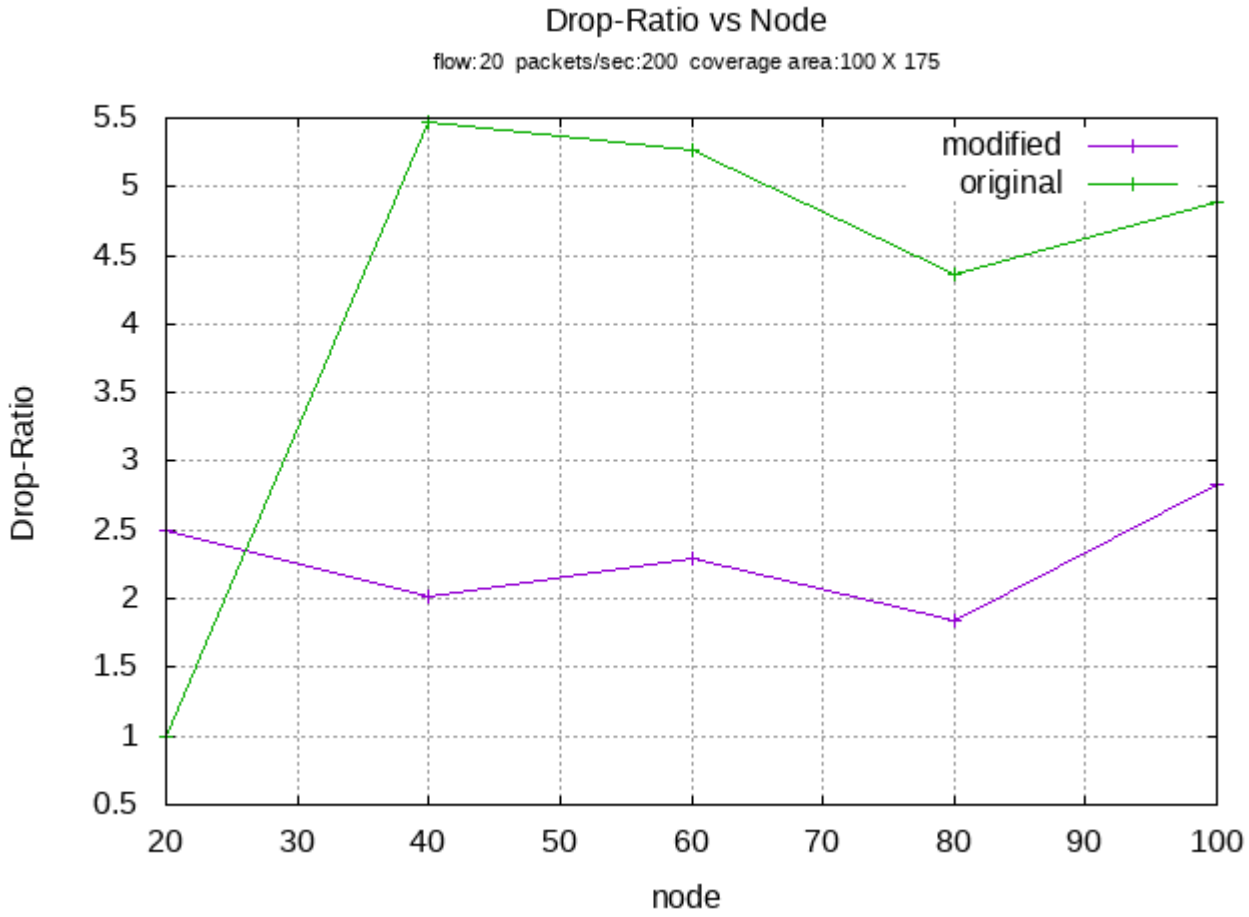

Delay vs Coverage-area
nodes:50 flow:20 packets/sec:200
modified
original
delay
coverage-area
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
5000
10000
15000
20000
25000
30000
35000
40000
45000

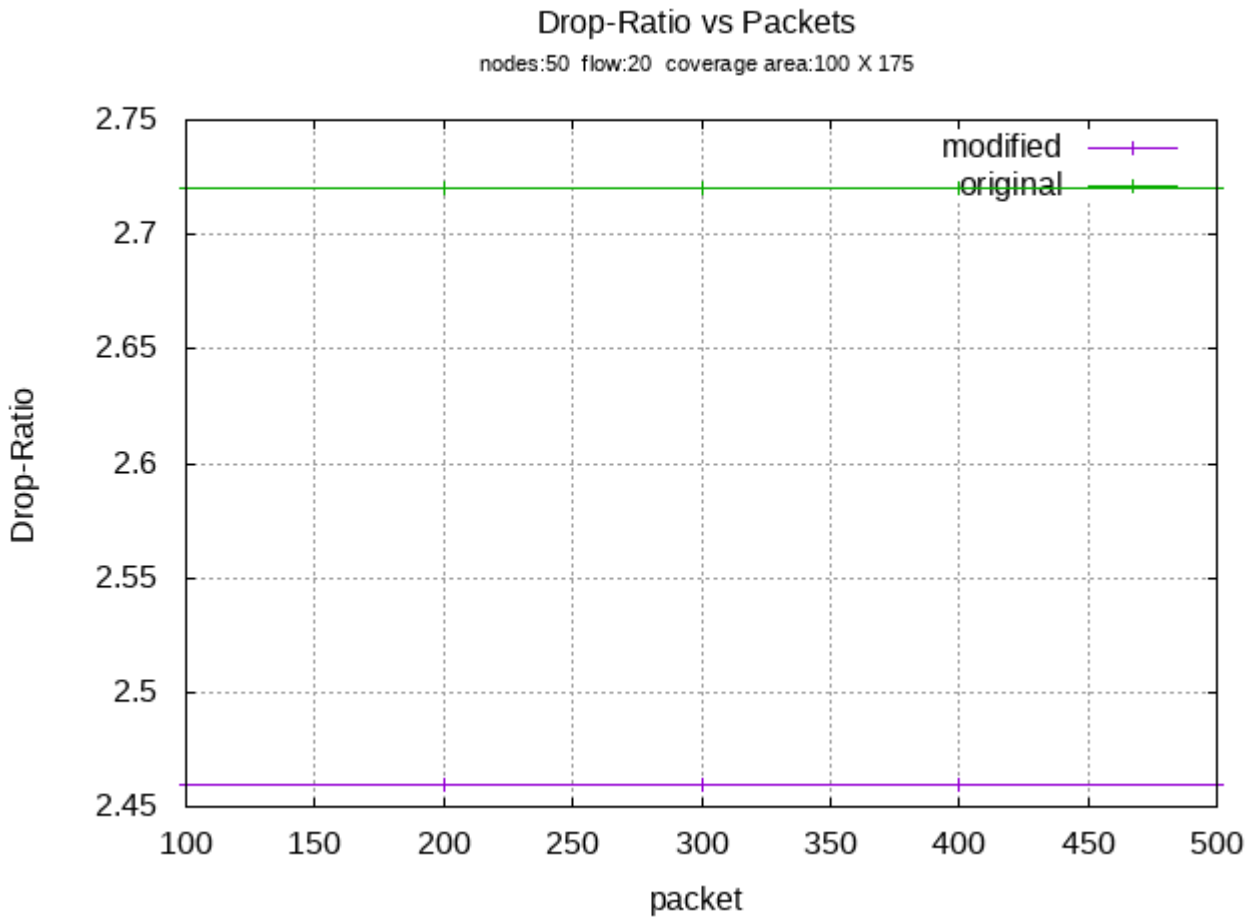

Delivery-Ratio vs Node
flow:20 packets/sec:200 coverage area:100 X 175
Delivery-Ratio
node
modified
original
99
98
97
96
95
94
93
92
91
20
30
40
50
60
70
80
90
100

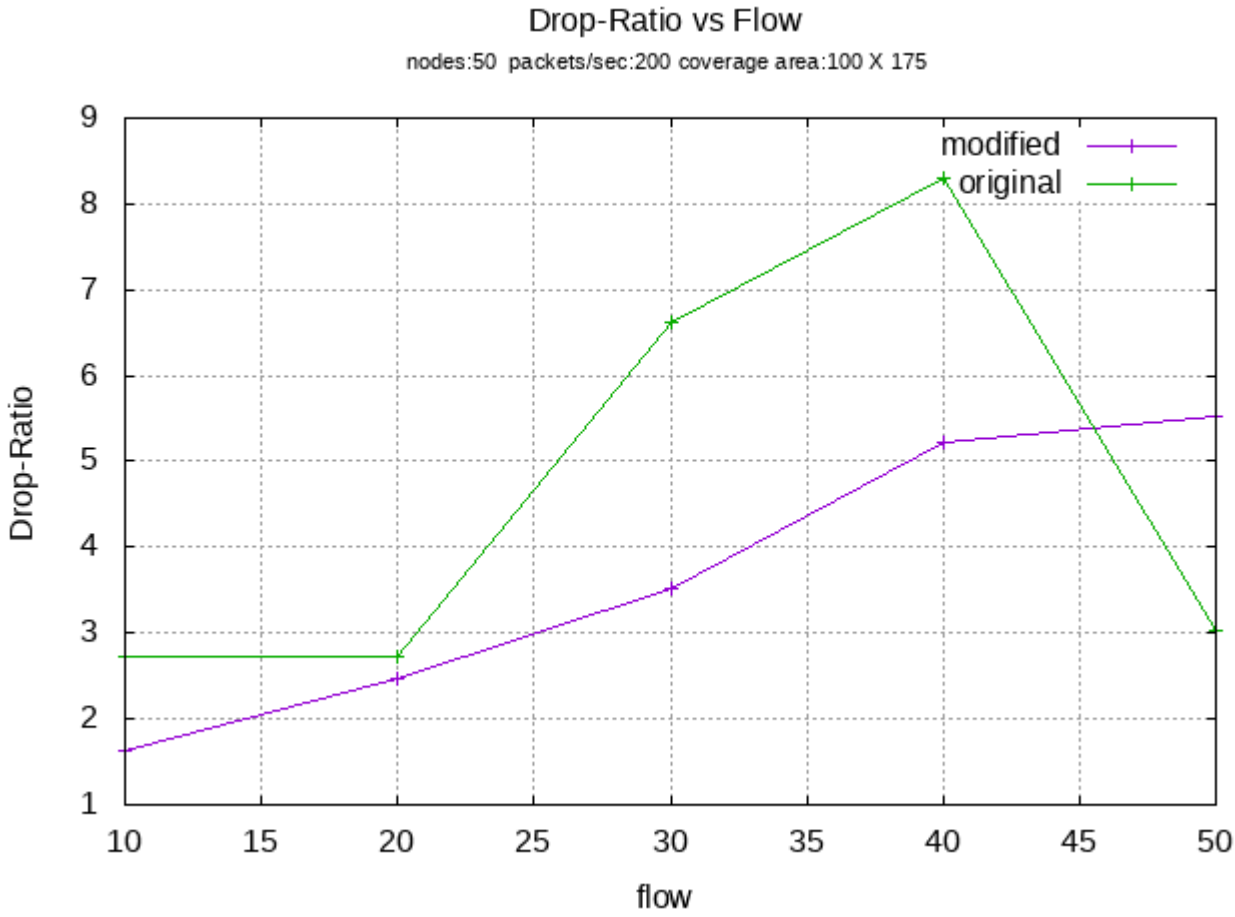

Delivery-Ratio vs Packets
nodes:50 flow:20 coverage area:100 X 175
Delivery-Ratio
packet
modified
original
97
96.8
96.6
96.4
96.2
96
95.8
95.6
95.4
95.2
100
150
200
250
300
350
400
450
500

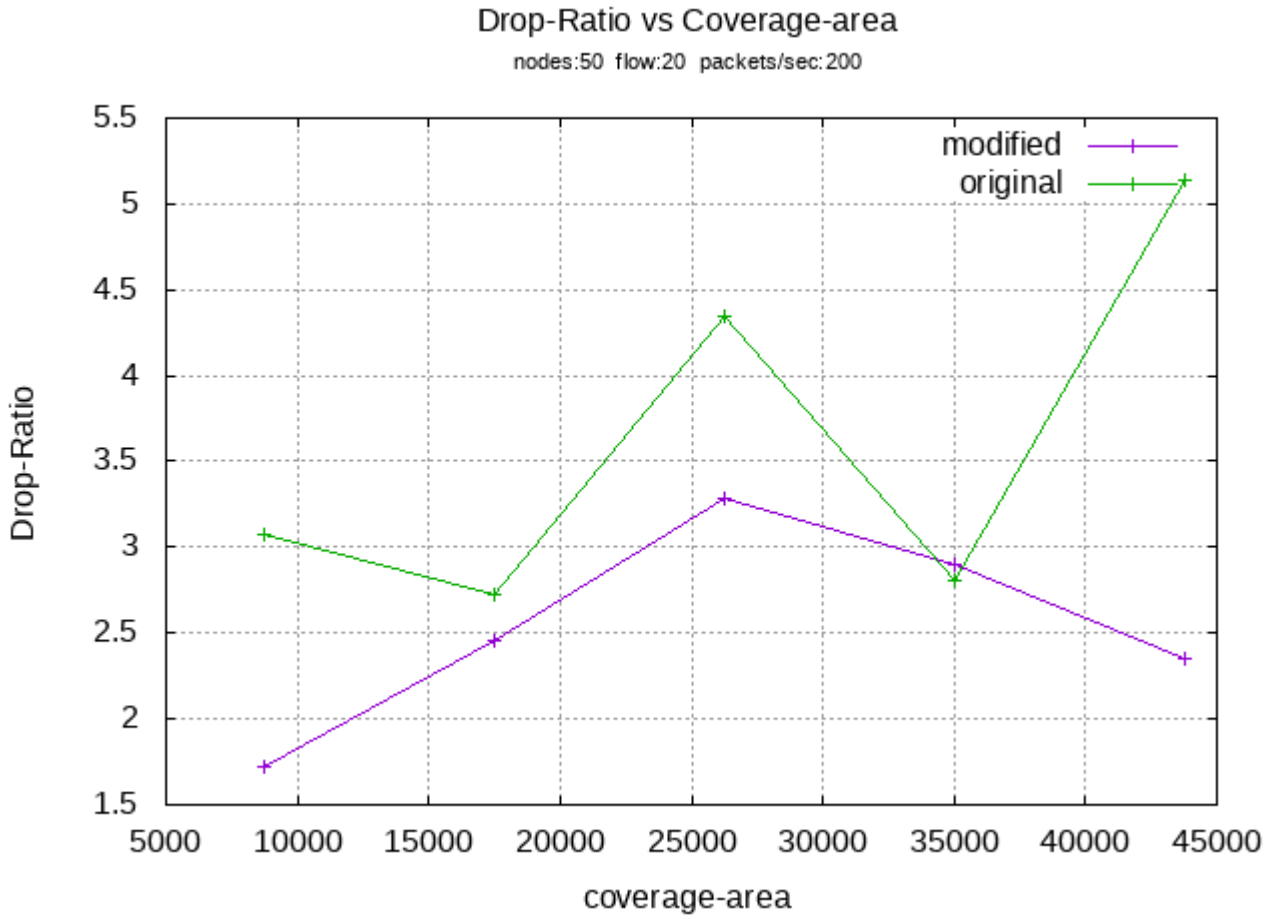

Delivery-Ratio vs Flow
nodes:50 packets/sec:200 coverage area:100 X 175
Delivery-Ratio
flow
modified
original
98
97
96
95
94
93
92
91
90
10
15
20
25
30
35
40
45
50

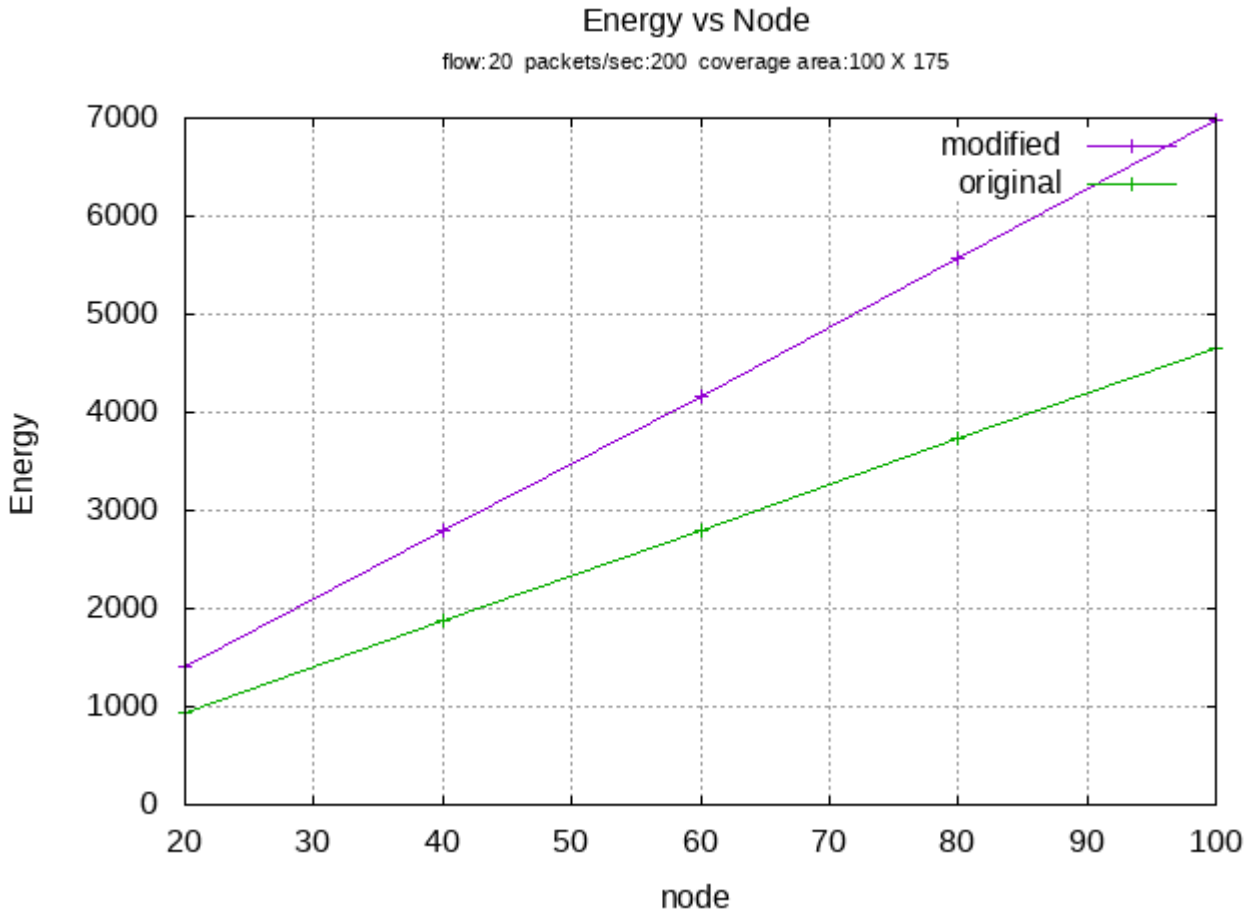

Delivery-Ratio vs Coverage-area
nodes:50 flow:20 packets/sec:200
modified
original
Delivery-Ratio
coverage-area
98
97
96
95
94
93
92
5000
10000
15000
20000
25000
30000
35000
40000
45000

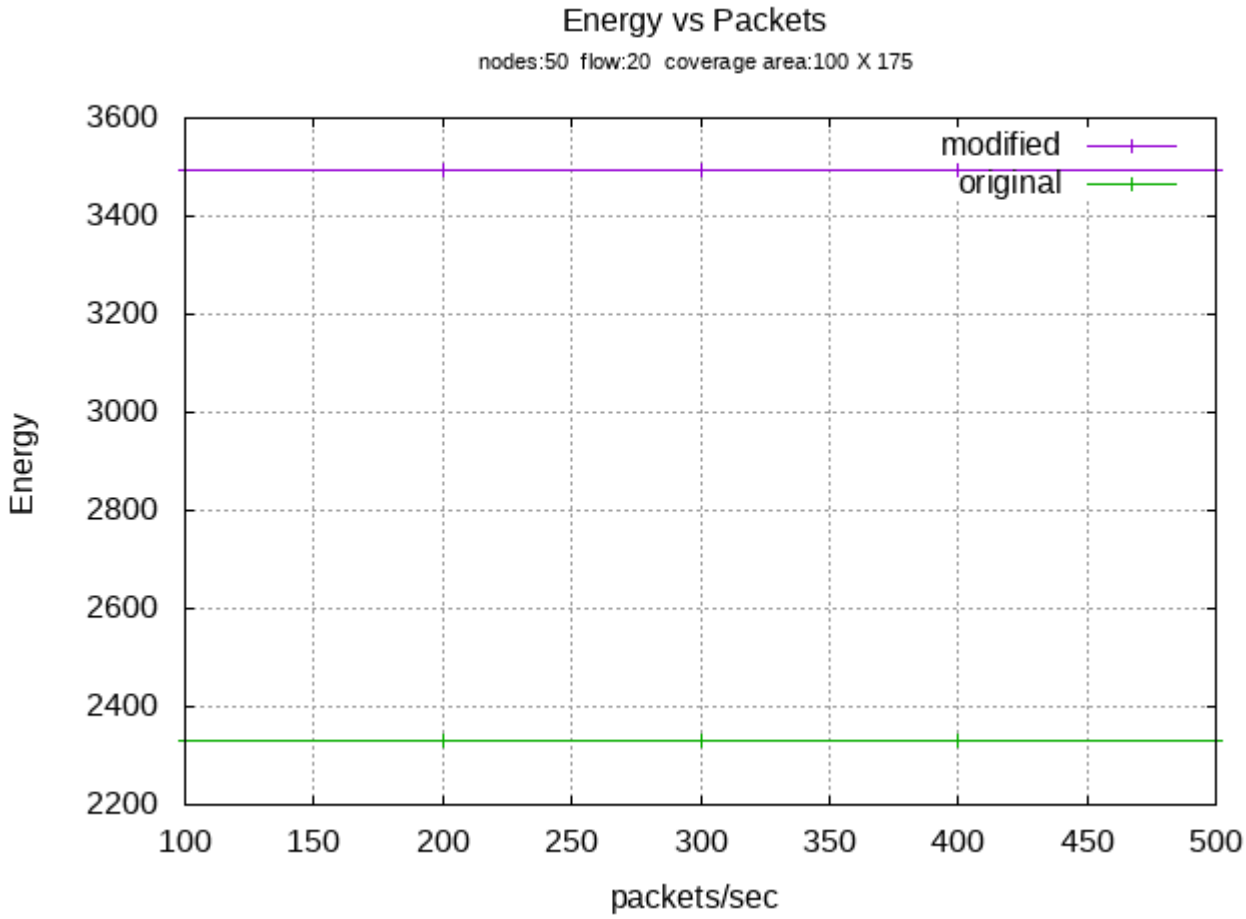

Drop-Ratio vs Node
flow:20 packets/sec:200 coverage area:100 X 175
Drop-Ratio
node
modified
original
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
20
30
40
50
60
70
80
90
100

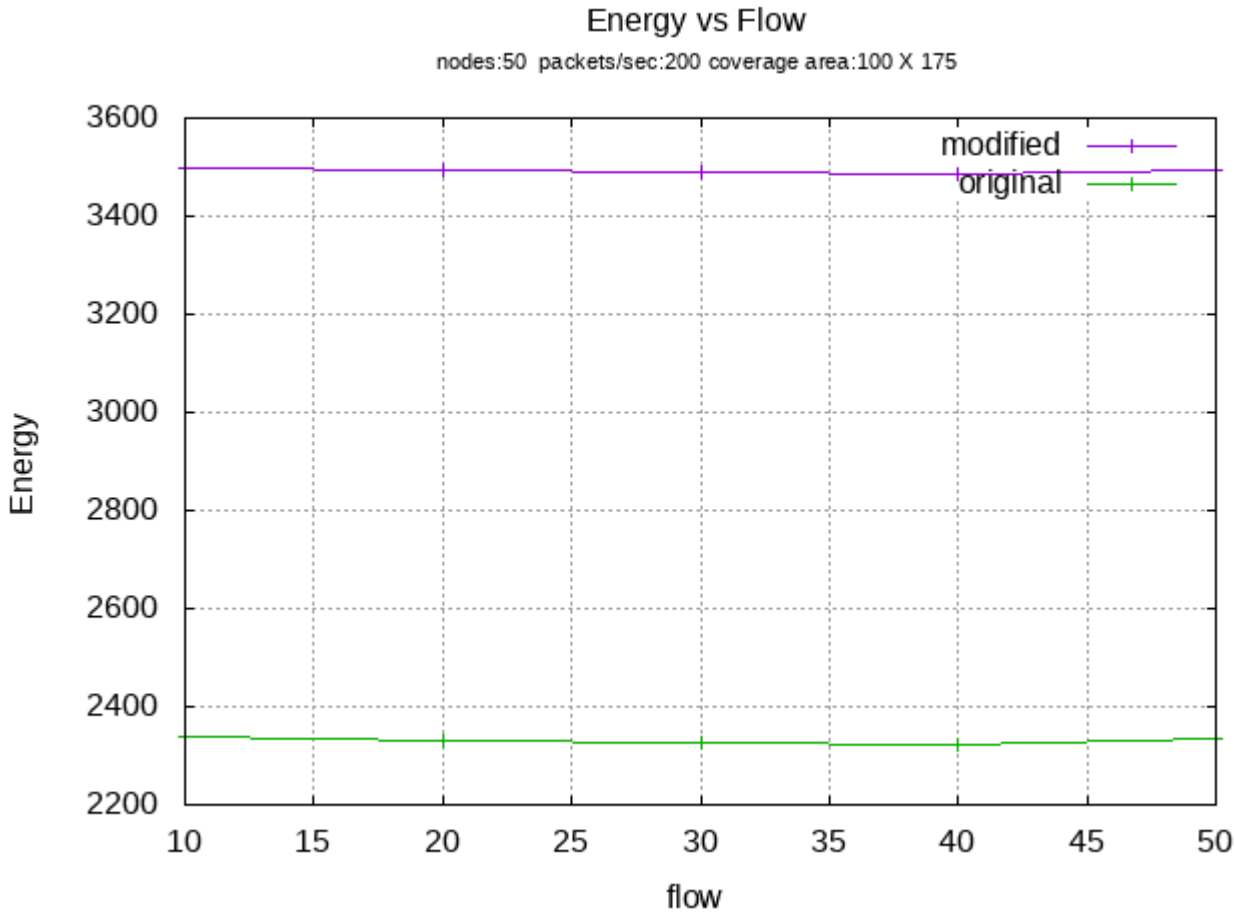

Drop-Ratio vs Packets
nodes:50 flow:20 coverage area:100 X 175
Drop-Ratio
packet
modified
original
2.75
2.7
2.65
2.6
2.55
2.5
2.45
100
150
200
250
300
350
400
450
500

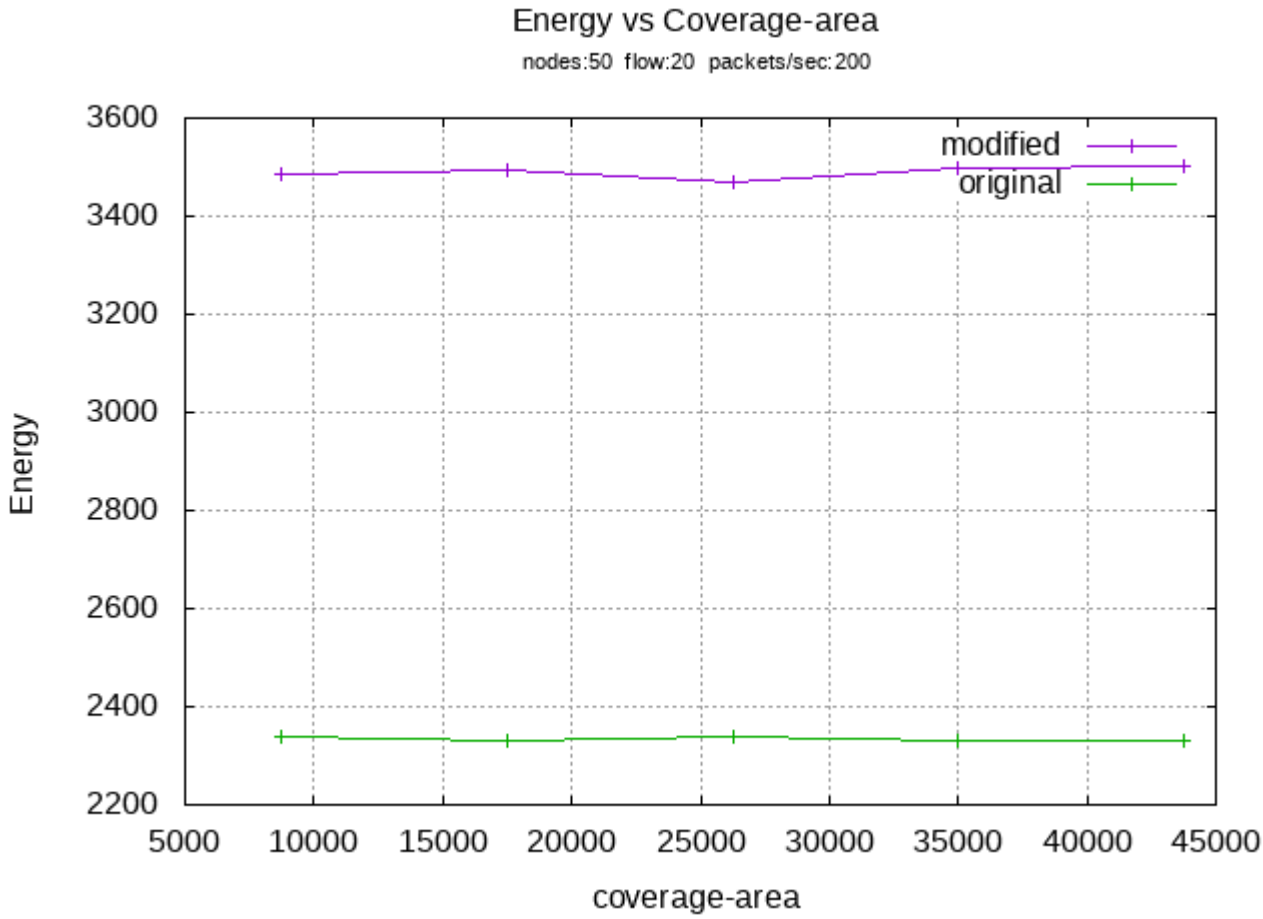

Drop-Ratio vs Flow
nodes:50 packets/sec:200 coverage area:100 X 175
Drop-Ratio
flow
modified
original
9
8
7
6
5
4
3
2
1
10
15
20
25
30
35
40
45
50


Drop-Ratio vs Coverage-area
nodes:50 flow:20 packets/sec:200
modified
original
Drop-Ratio
coverage-area
5.5
5
4.5
4
3.5
3
2.5
2
1.5
5000
10000
15000
20000
25000
30000
35000
40000
45000

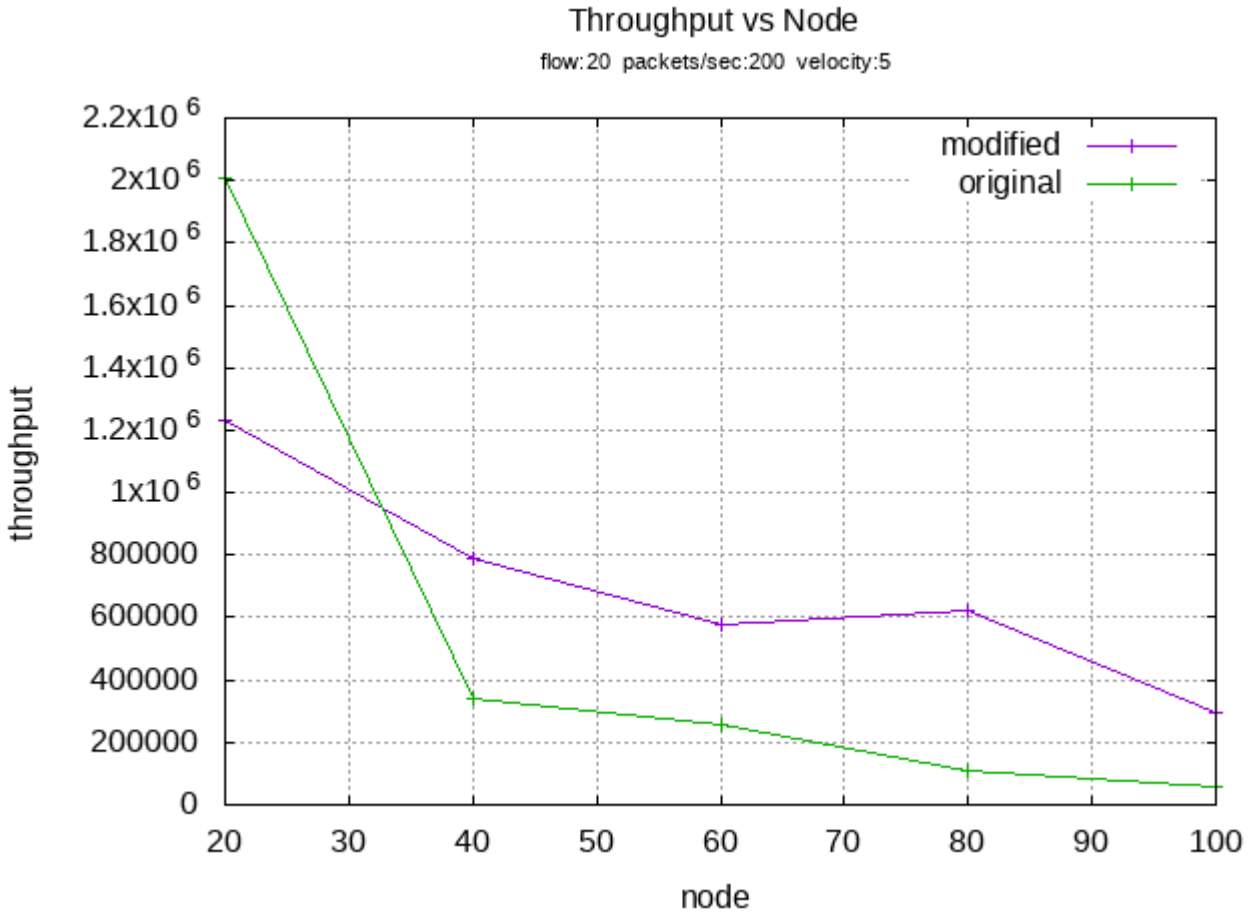

Energy vs Node
flow:20 packets/sec:200 coverage area:100 X 175
Energy
node
modified
original
0
1000
2000
3000
4000
5000
6000
7000
20
30
40
50
60
70
80
90
100

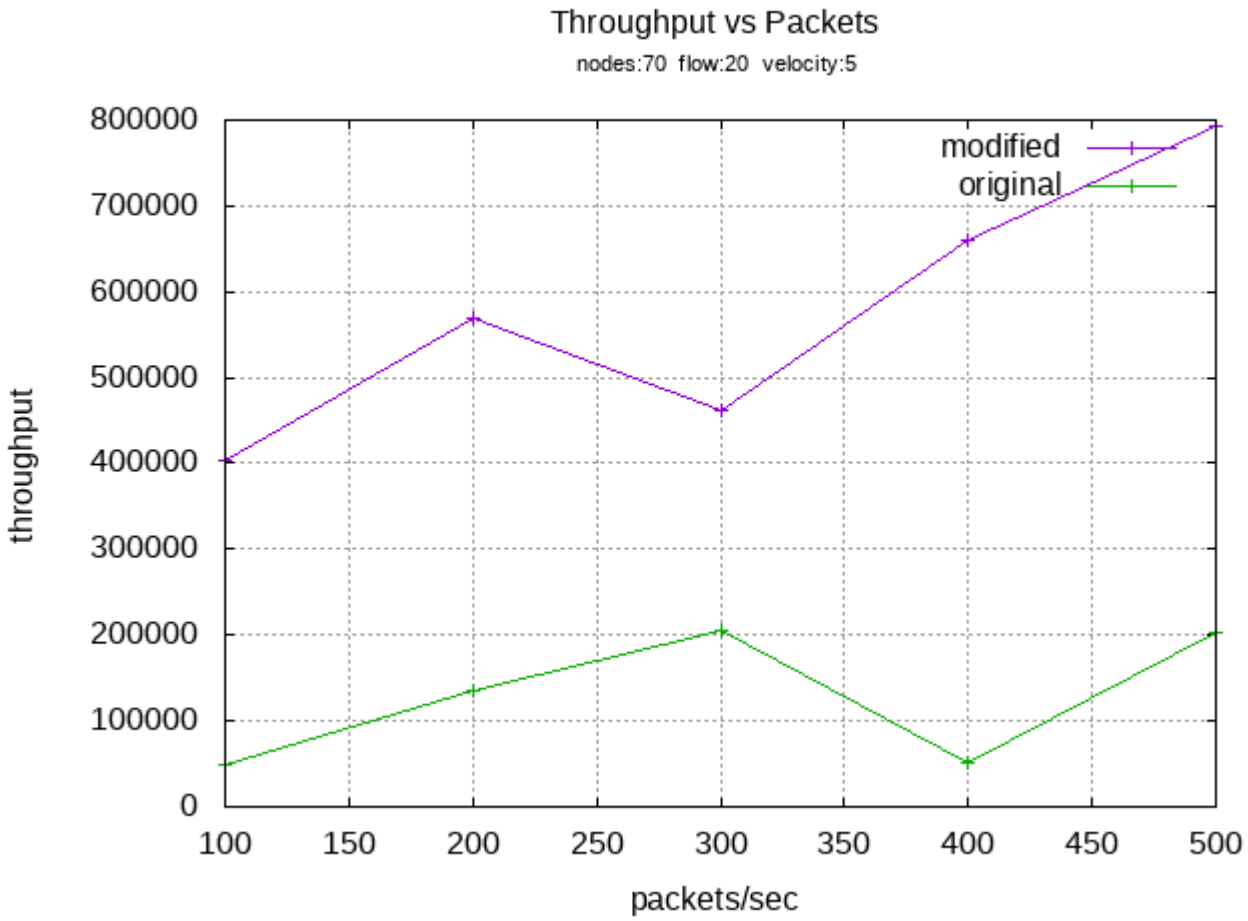

Energy vs Packets
nodes:50 flow:20 coverage area:100 X 175
modified
original
Energy
packets/sec
3600
3400
3200
3000
2800
2600
2400
2200
100
150
200
250
300
350
400
450
500

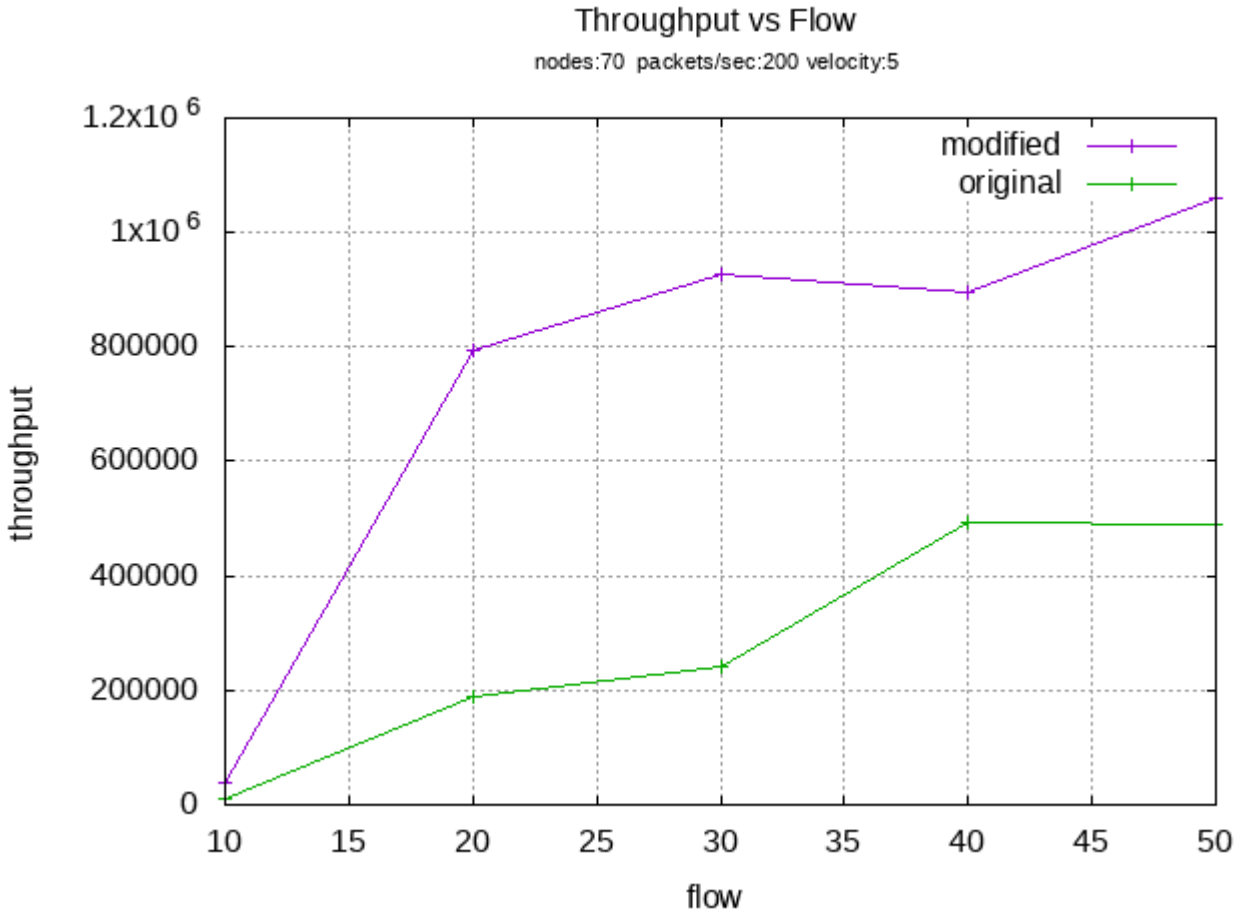

Energy vs Flow
nodes:50 packets/sec:200 coverage area:100 X 175
Energy
flow
modified
original
3600
3400
3200
3000
2800
2600
2400
2200
10
15
20
25
30
35
40
45
50

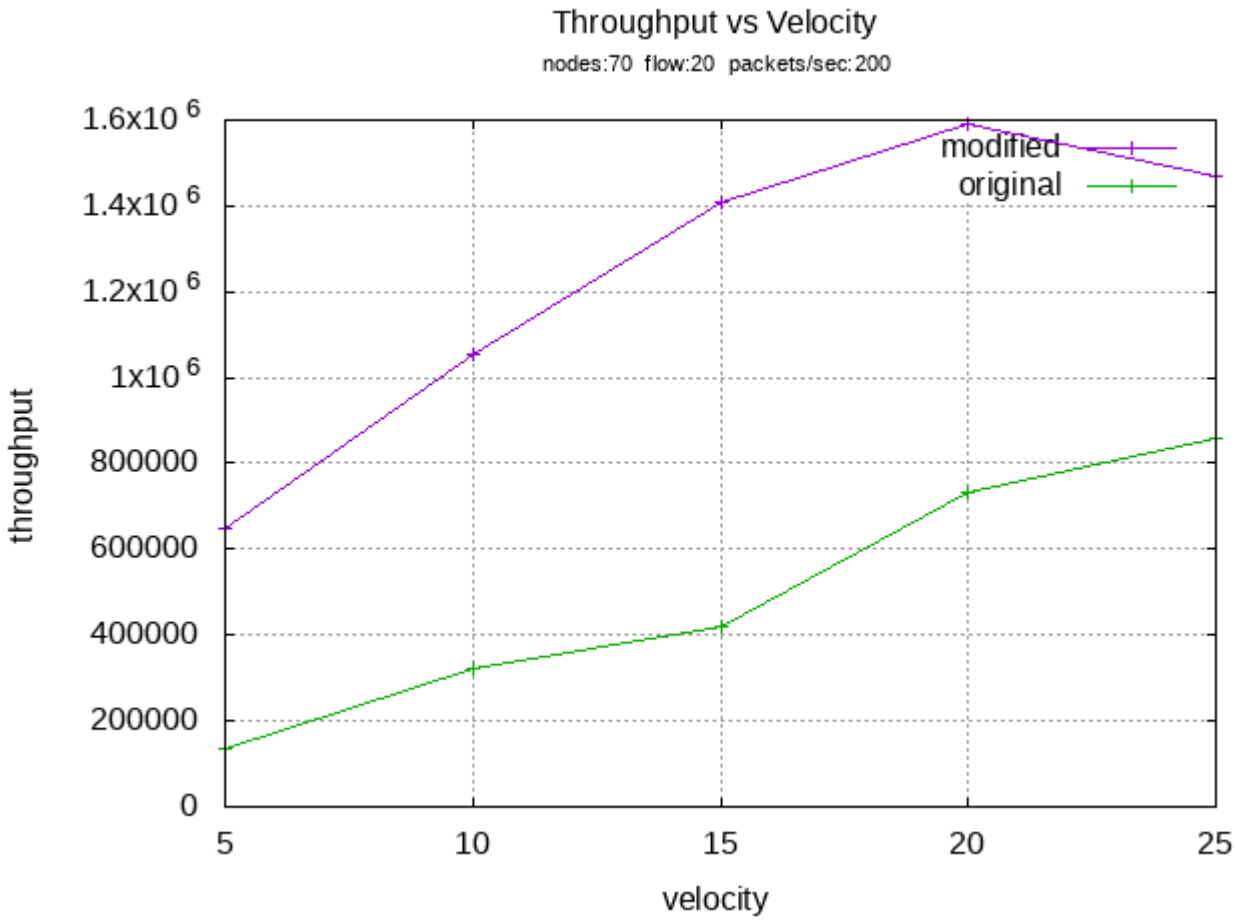

Energy vs Coverage-area
nodes:50 flow:20 packets/sec:200
modified
original
Energy
coverage-area
3600
3400
3200
3000
2800
2600
2400
2200
5000
10000
15000
20000
25000
30000
35000
40000
45000

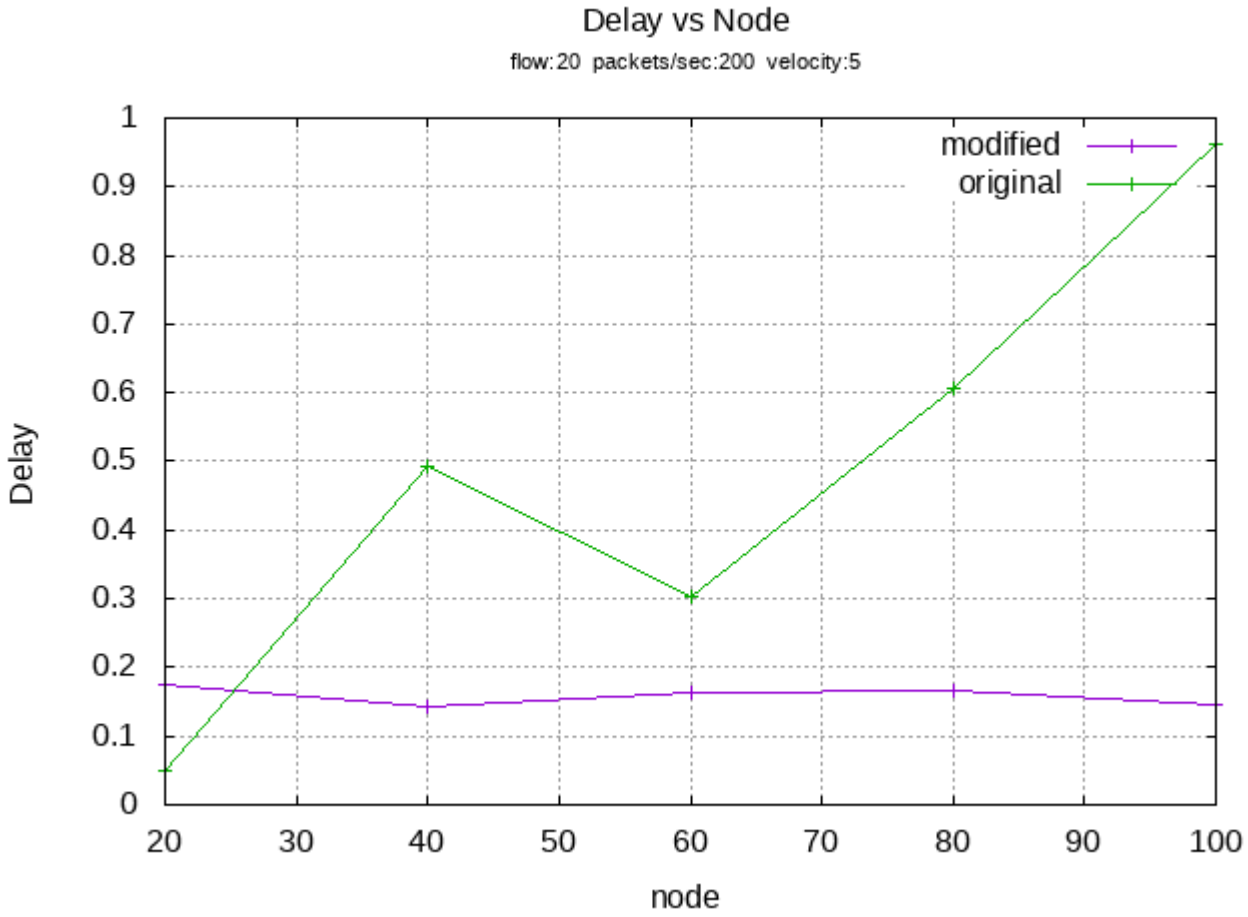
Wireless 802.11new(mobile)

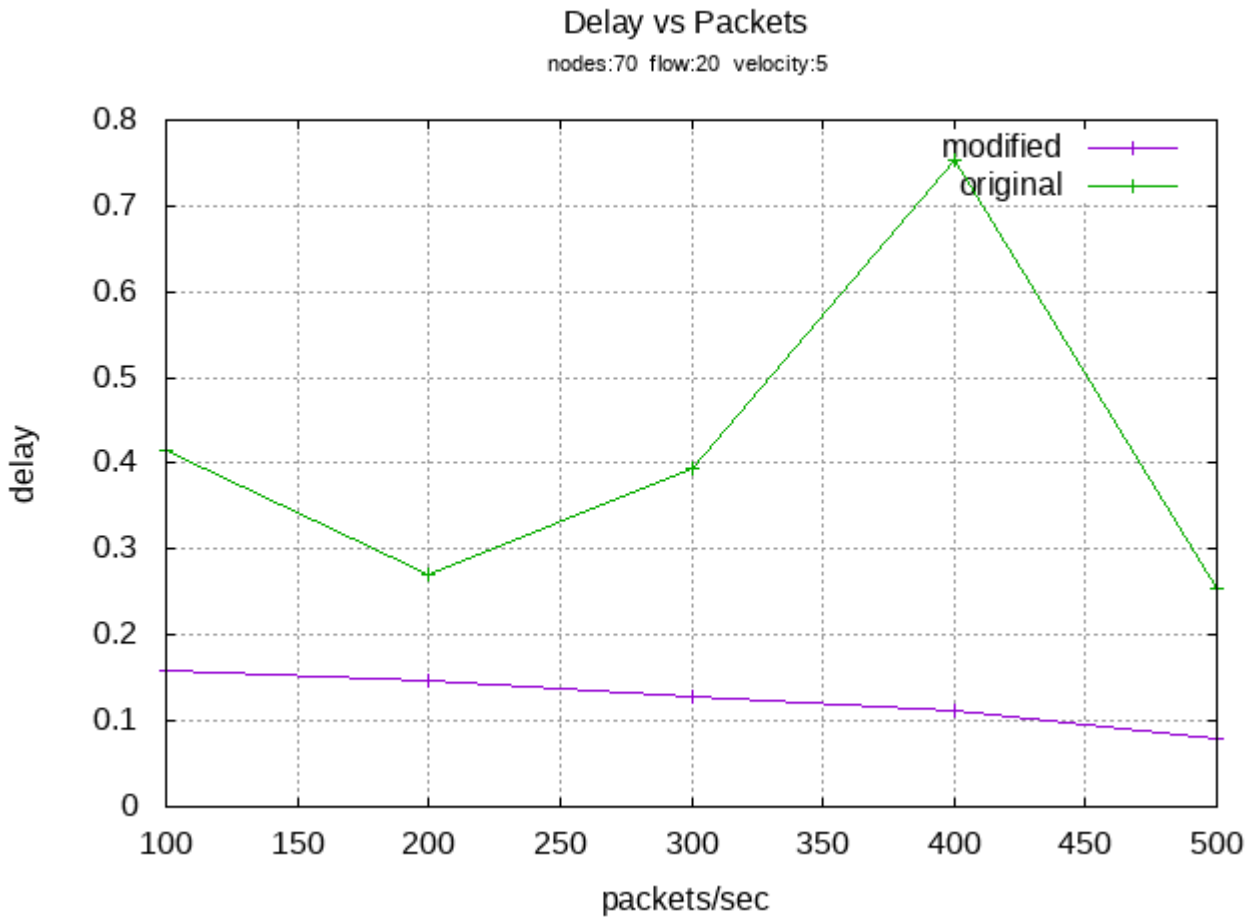

Throughput vs Node
flow:20 packets/sec:200 velocity:5
throughput
node
modified
original
2.2x10 6
2x10 6
1.8x10 6
1.6x10 6
1.4x10 6
1.2x10 6
1x10 6
800000
600000
400000
200000
0
20
30
40
50
60
70
80
90
100

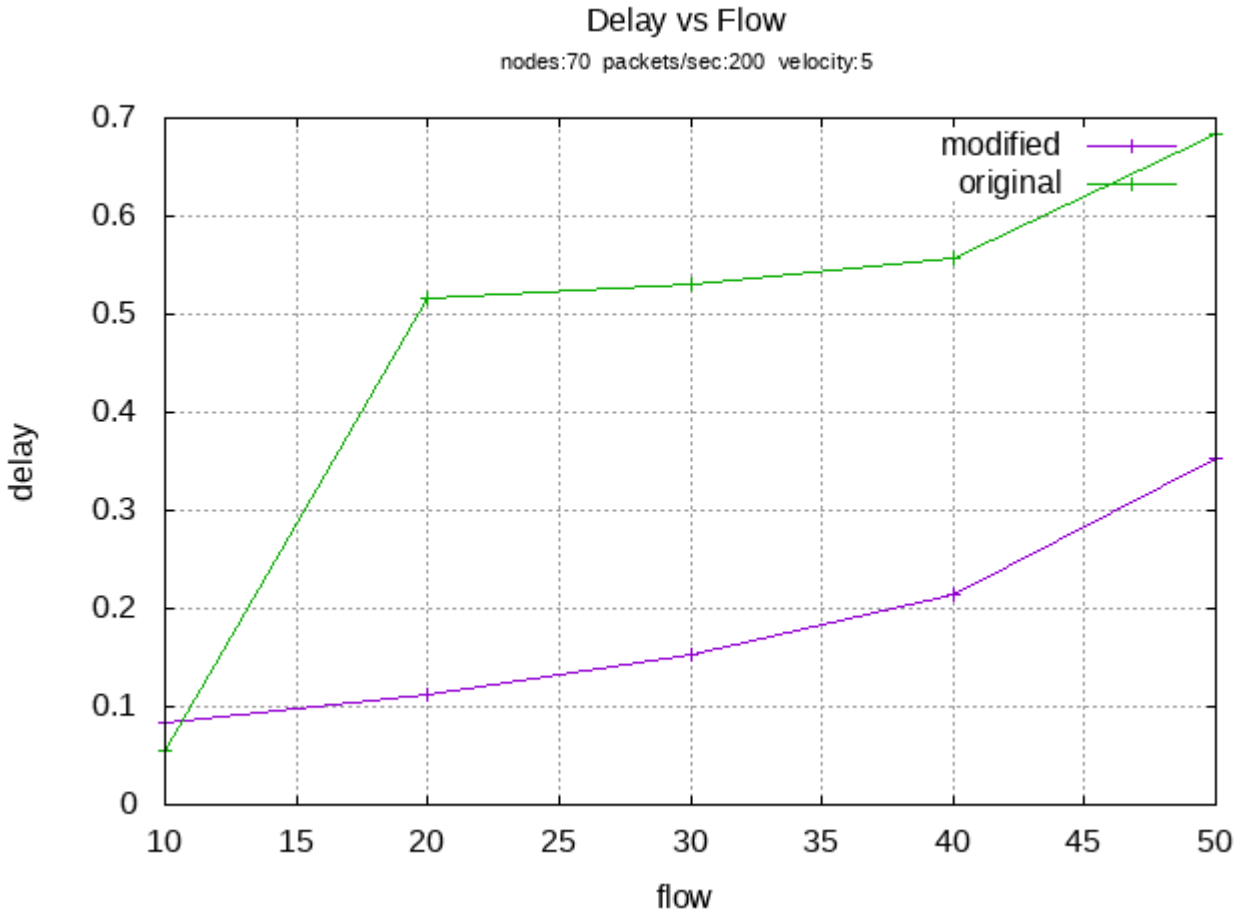

Throughput vs Packets
nodes:70 flow:20 velocity:5
throughput
packets/sec
modified
original
800000
700000
600000
500000
400000
300000
200000
100000
0
100
150
200
250
300
350
400
450
500

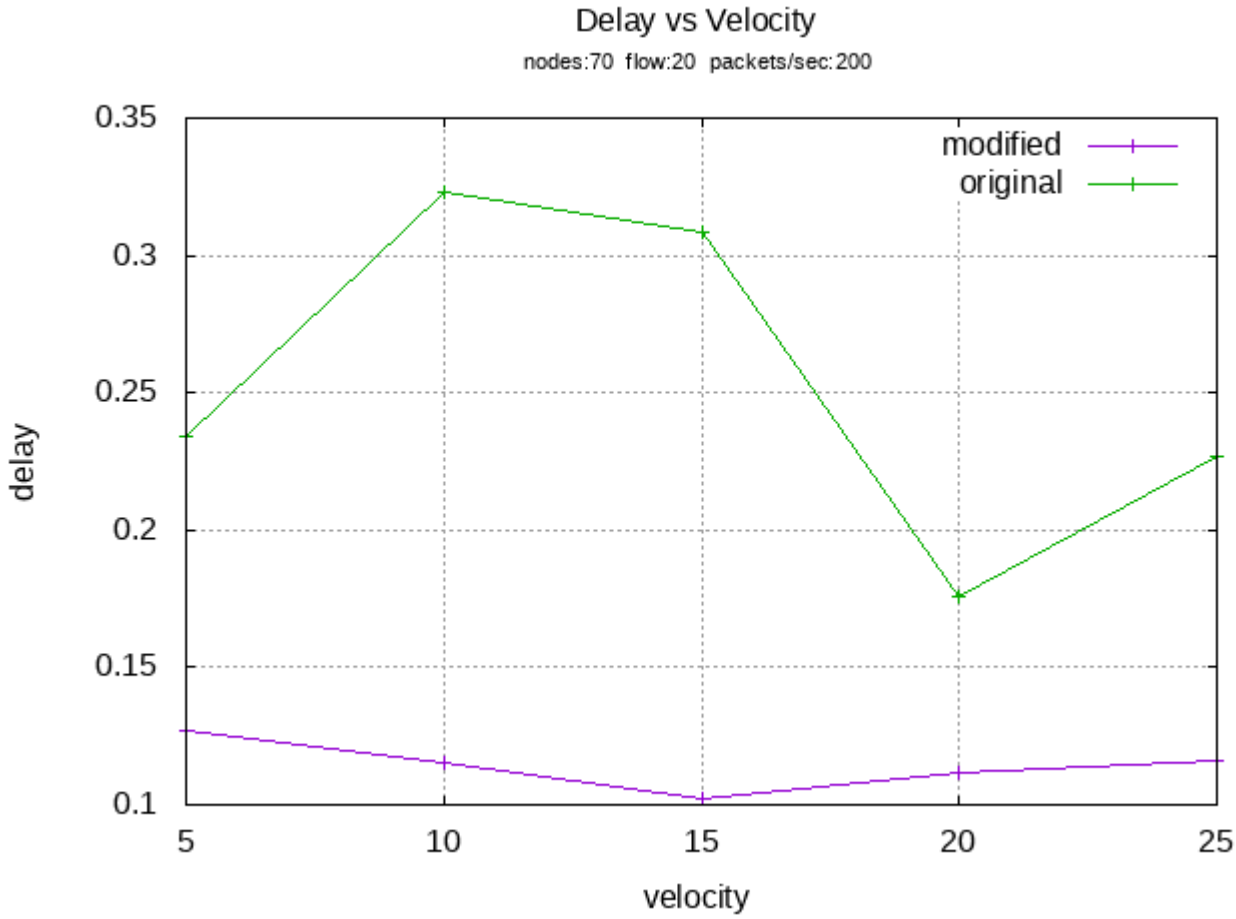

Throughput vs Flow
nodes:70 packets/sec:200 velocity:5
throughput
flow
modified
original
1.2x10 6
1x10 6
800000
600000
400000
200000
0
10
15
20
25
30
35
40
45
50

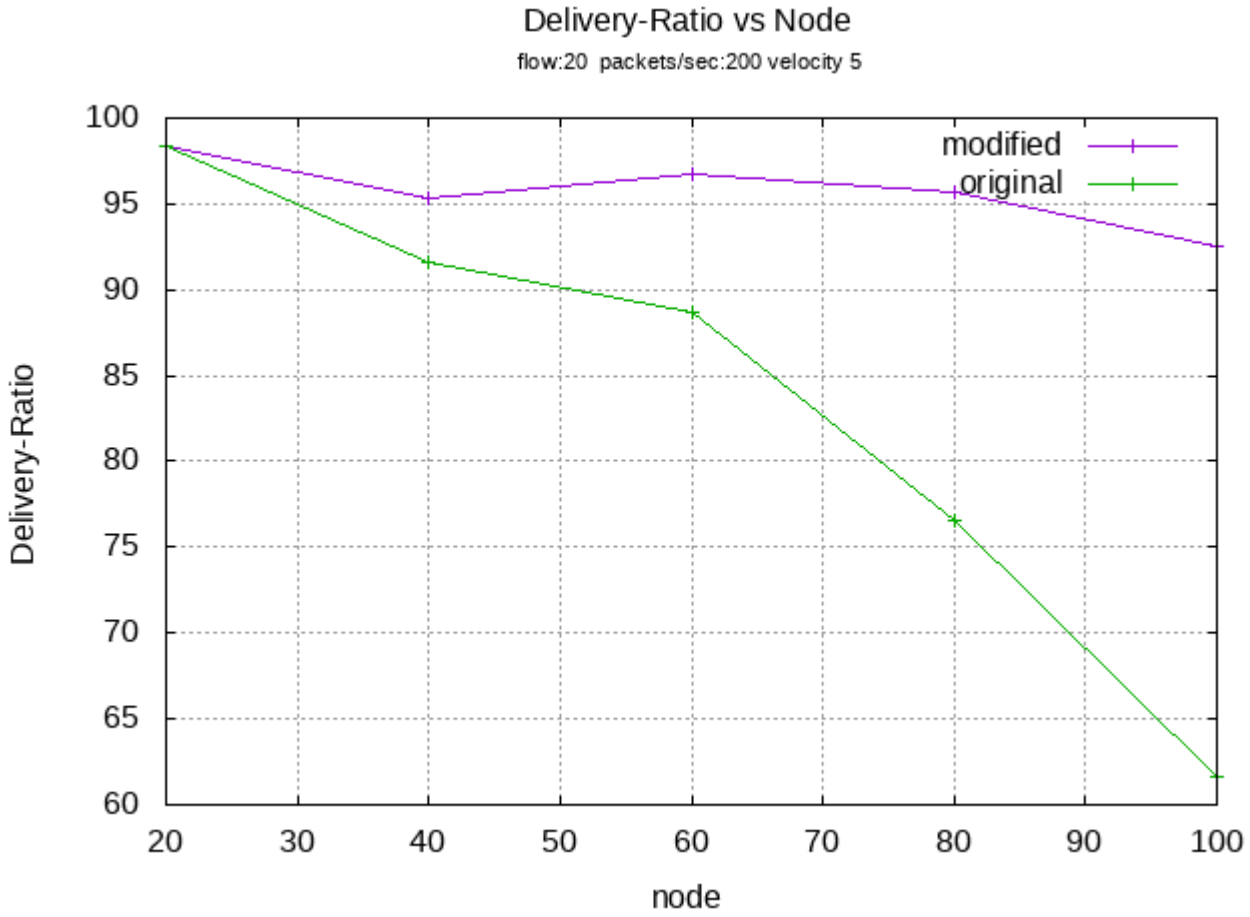

Throughput vs Velocity
nodes:70 flow:20 packets/sec:200
throughput
velocity
modified
original
1.6x10 6
1.4x10 6
1.2x10 6
1x10 6
800000
600000
400000
200000
0
5
10
15
20
25

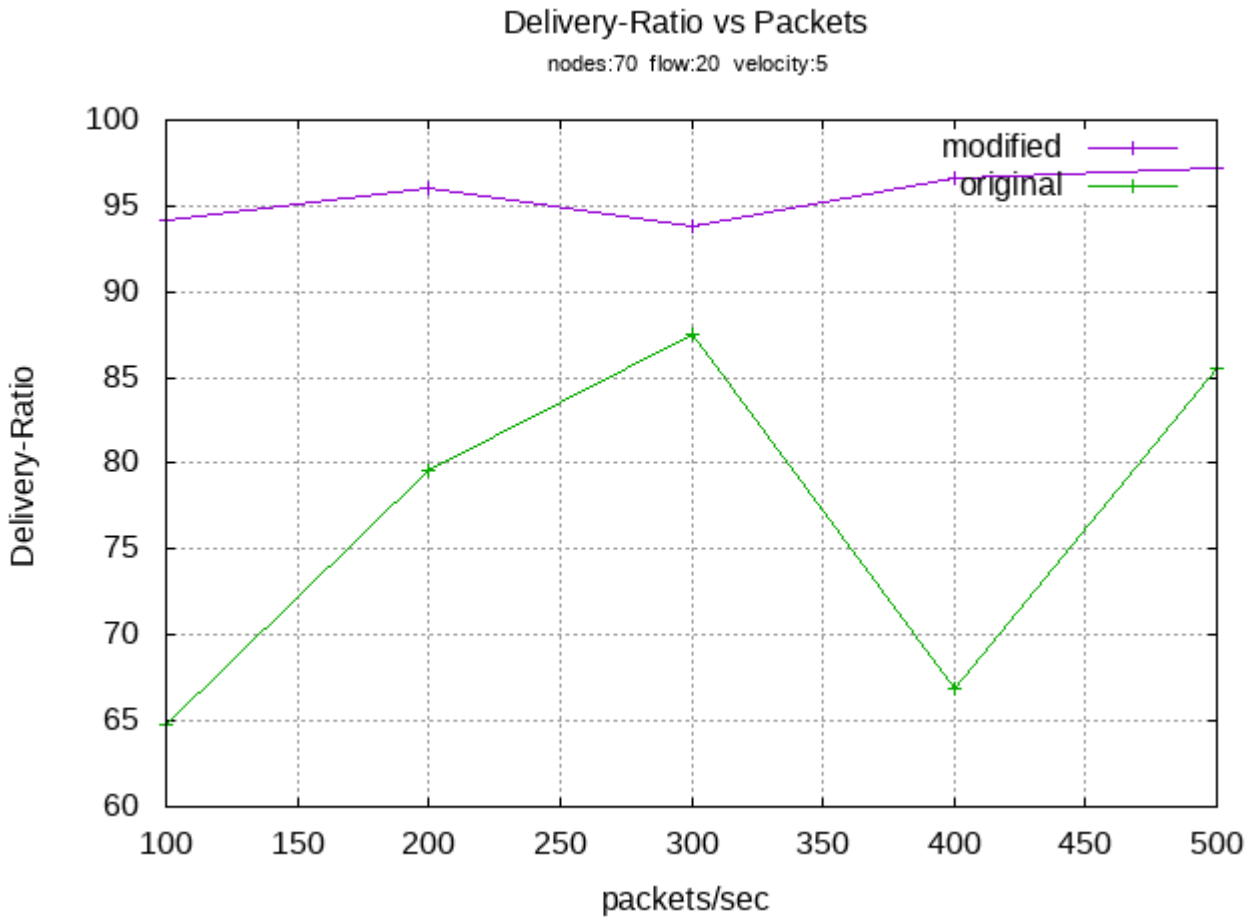

Delay vs Node
flow:20 packets/sec:200 velocity:5
Delay
node
modified
original
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
20
30
40
50
60
70
80
90
100

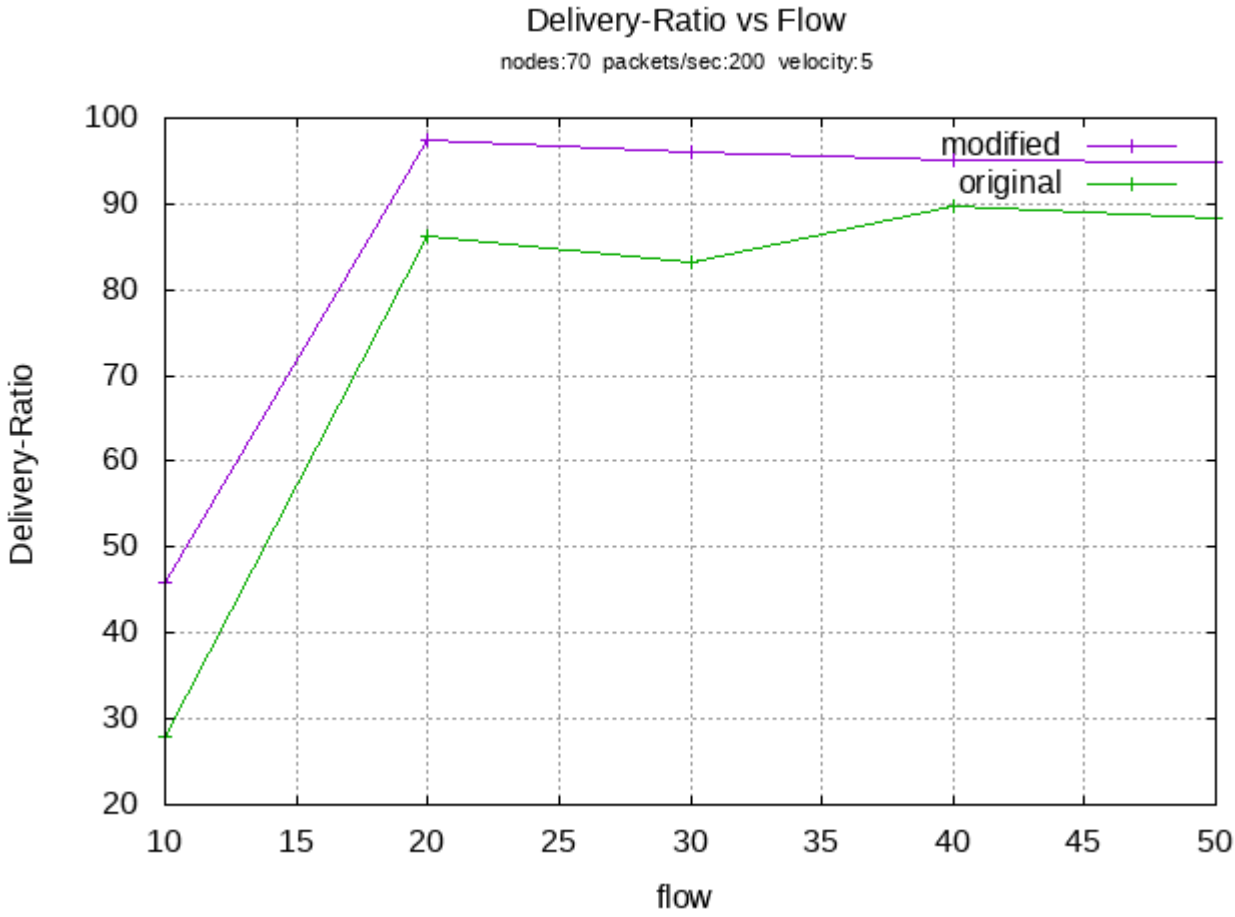

Delay vs Packets
nodes:70 flow:20 velocity:5
delay
packets/sec
modified
original
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
100
150
200
250
300
350
400
450
500

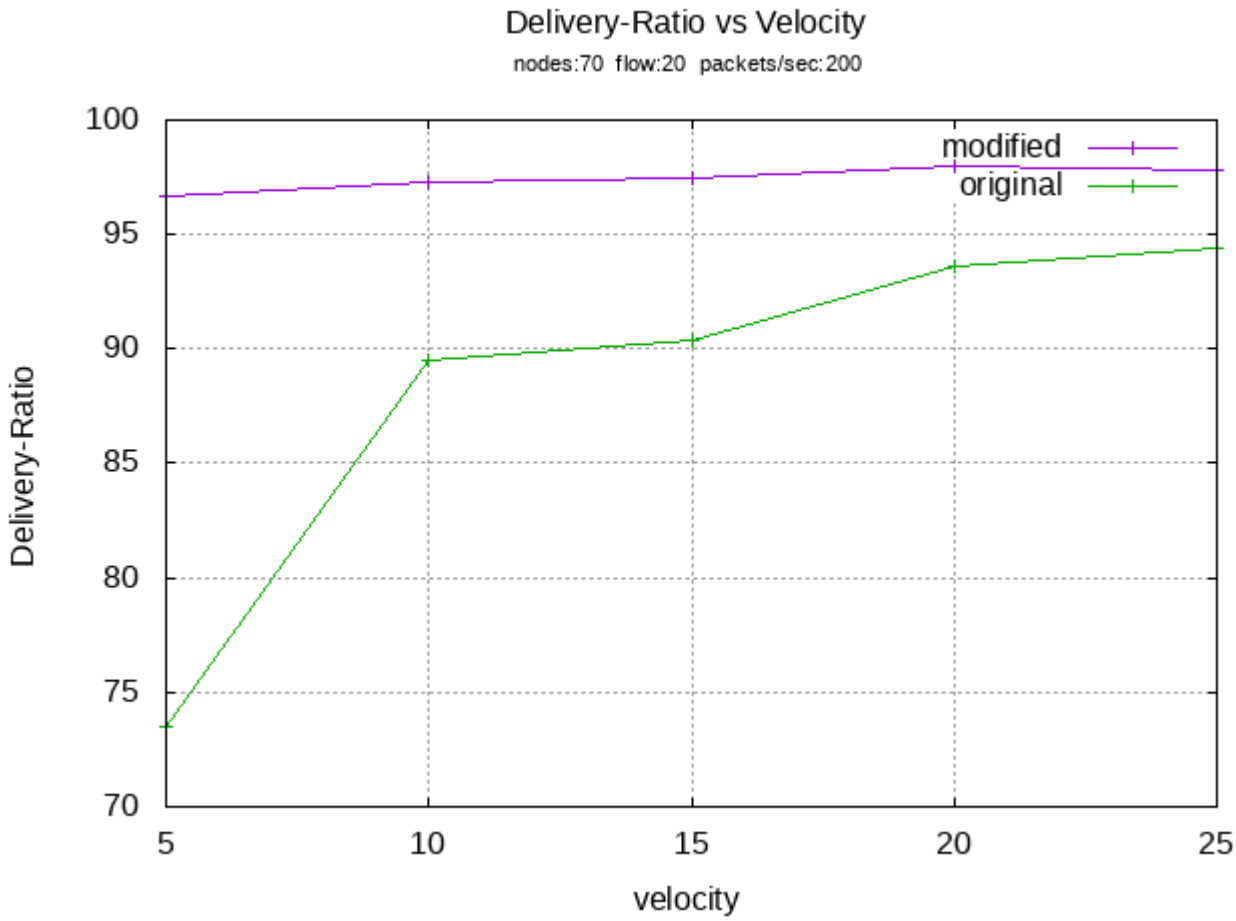

Delay vs Flow
nodes:70 packets/sec:200 velocity:5
delay
flow
modified
original
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
10
15
20
25
30
35
40
45
50

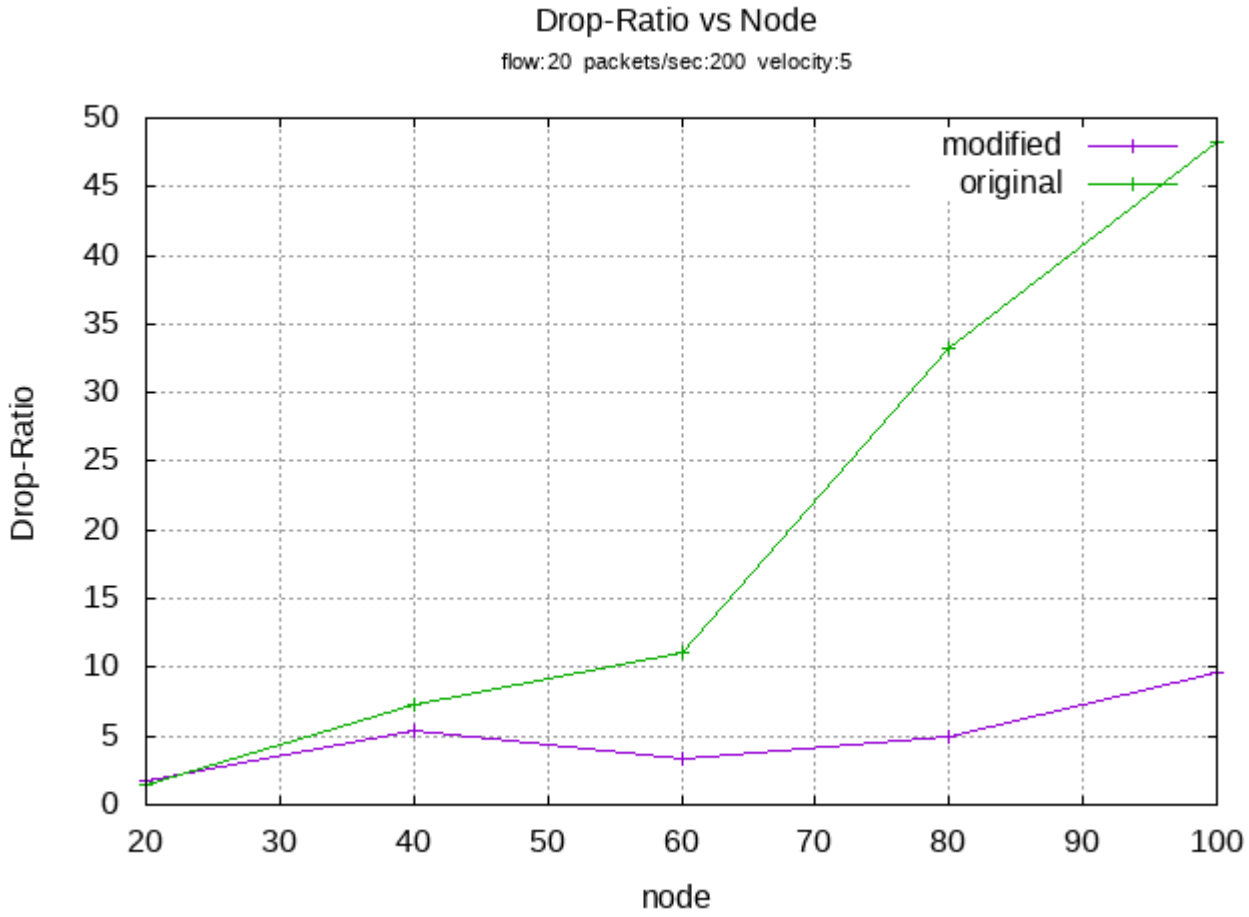

Delay vs Velocity
nodes:70 flow:20 packets/sec:200
modified
original
delay
velocity
0.35
0.3
0.25
0.2
0.15
0.1
5
10
15
20
25

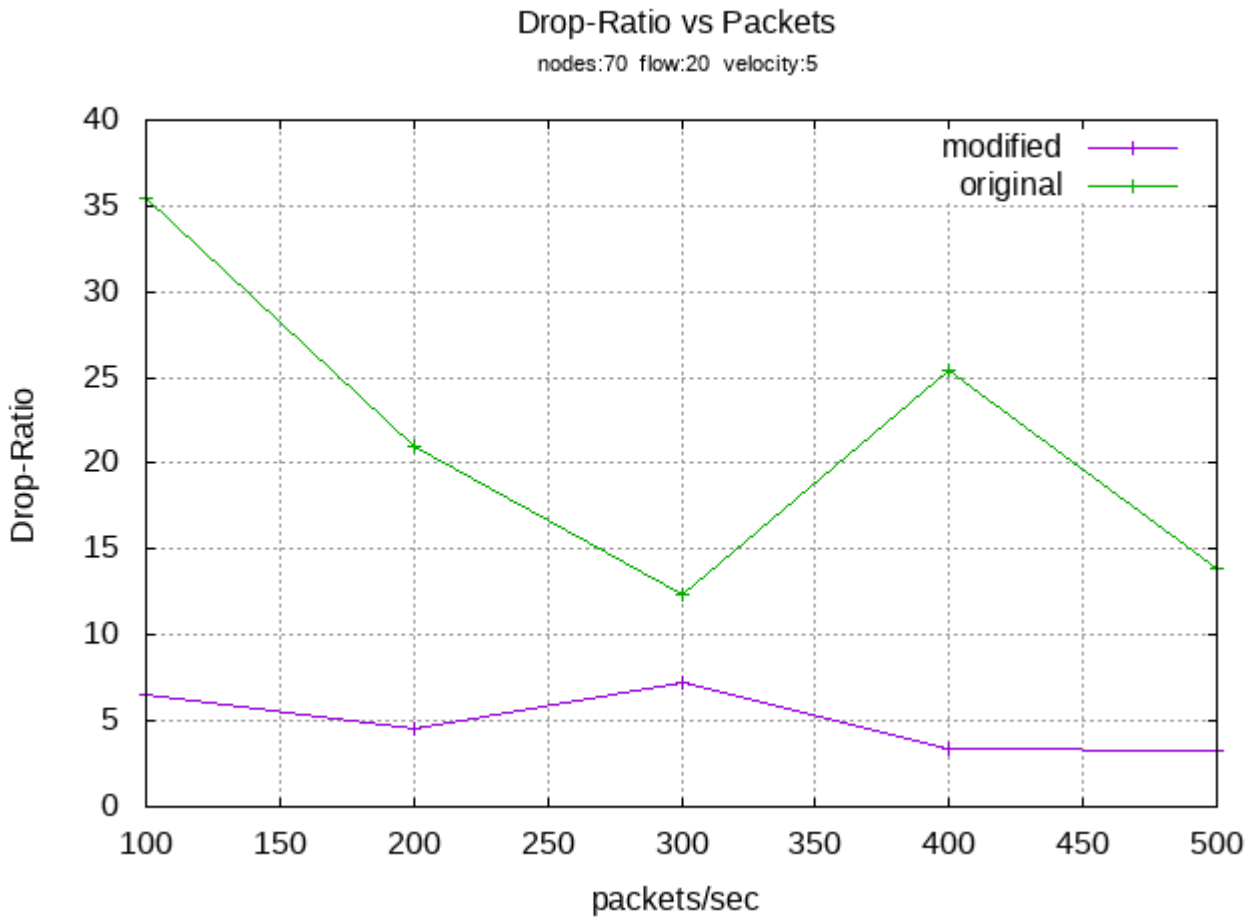

Delivery-Ratio vs Node
flow:20 packets/sec:200 velocity 5
Delivery-Ratio
node
modified
original
100
95
90
85
80
75
70
65
60
20
30
40
50
60
70
80
90
100

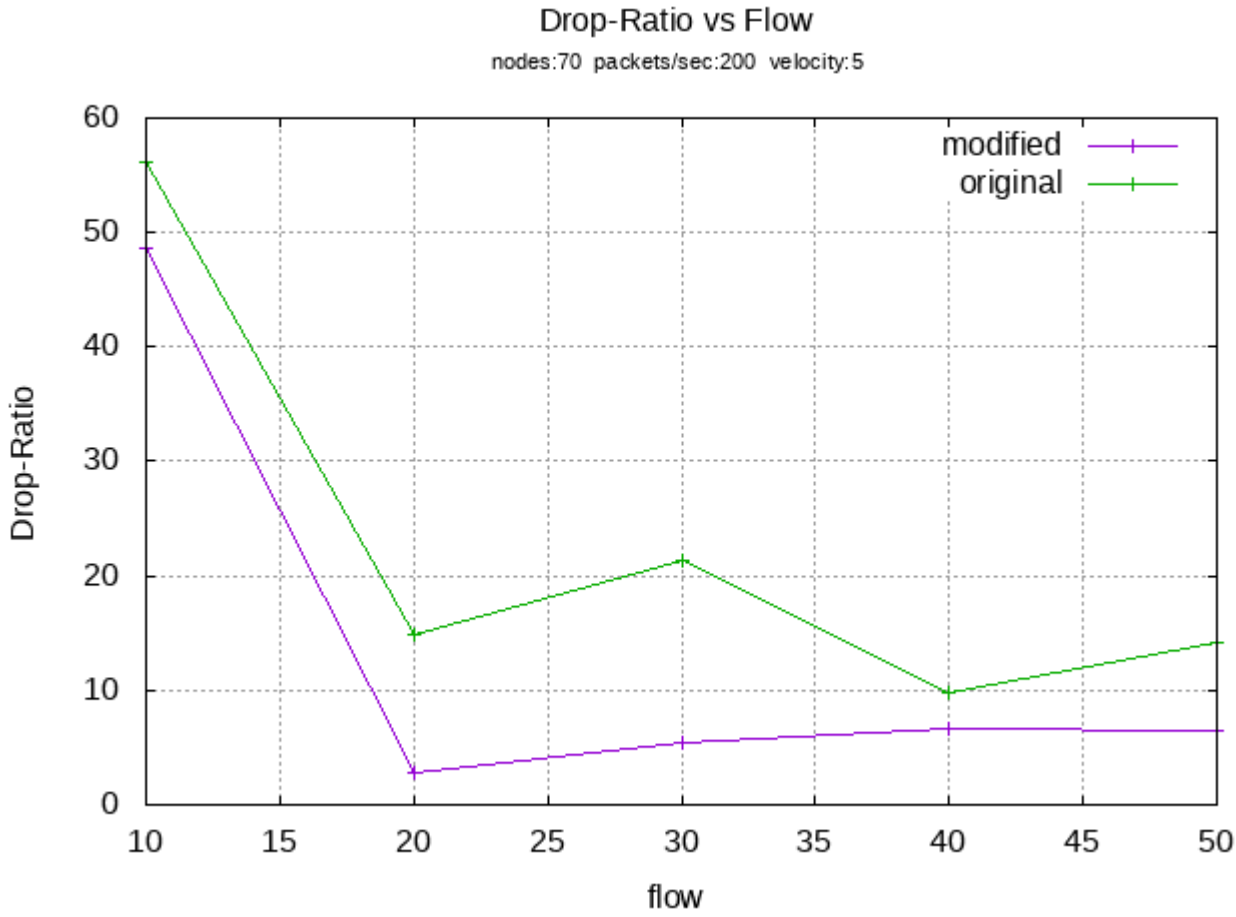

Delivery-Ratio vs Packets
nodes:70 flow:20 velocity:5
Delivery-Ratio
packets/sec
modified
original
100
95
90
85
80
75
70
65
60
100
150
200
250
300
350
400
450
500

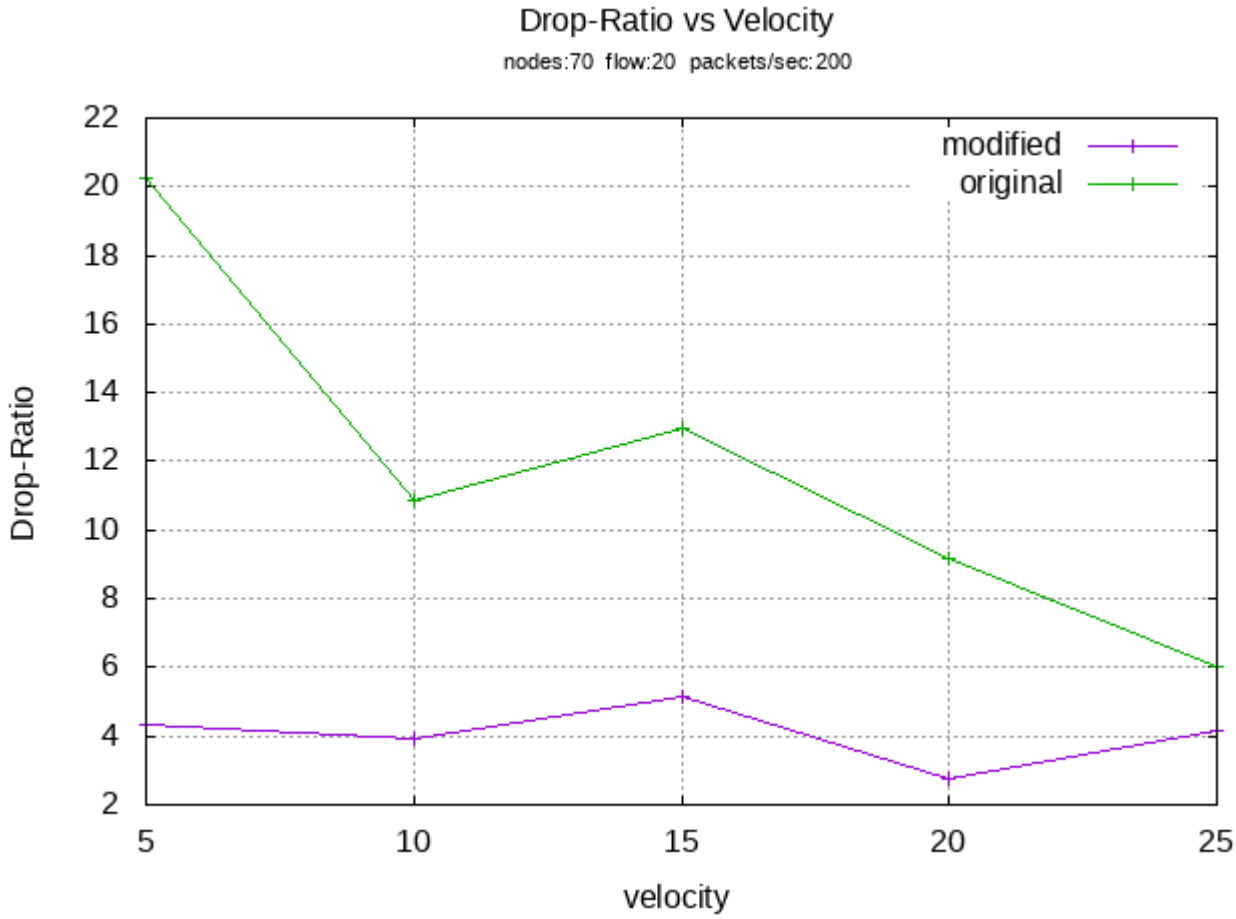

Delivery-Ratio vs Flow
nodes:70 packets/sec:200 velocity:5
Delivery-Ratio
flow
modified
original
100
90
80
70
60
50
40
30
20
10
15
20
25
30
35
40
45
50

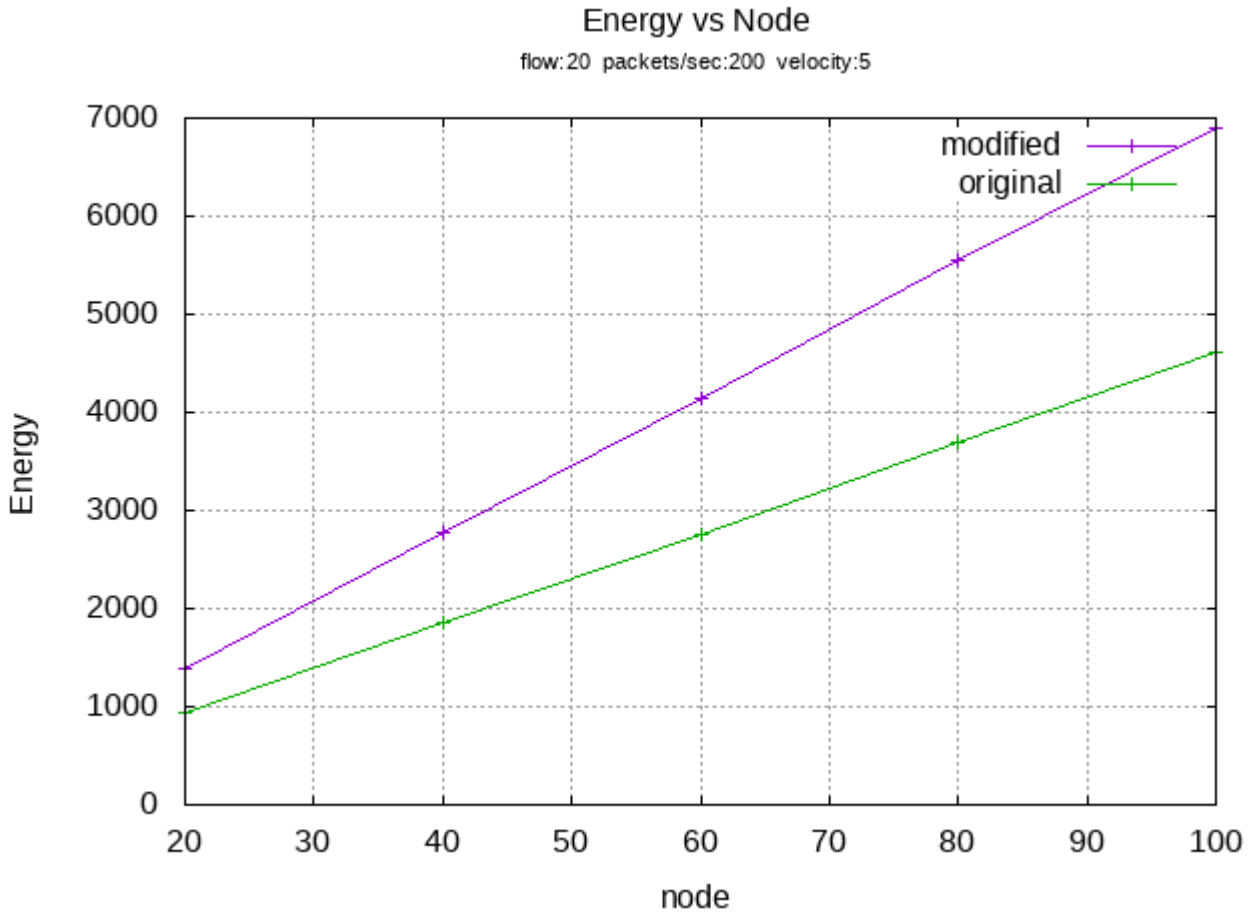

Delivery-Ratio vs Velocity
nodes:70 flow:20 packets/sec:200
Delivery-Ratio
velocity
modified
original
100
95
90
85
80
75
70
5
10
15
20
25

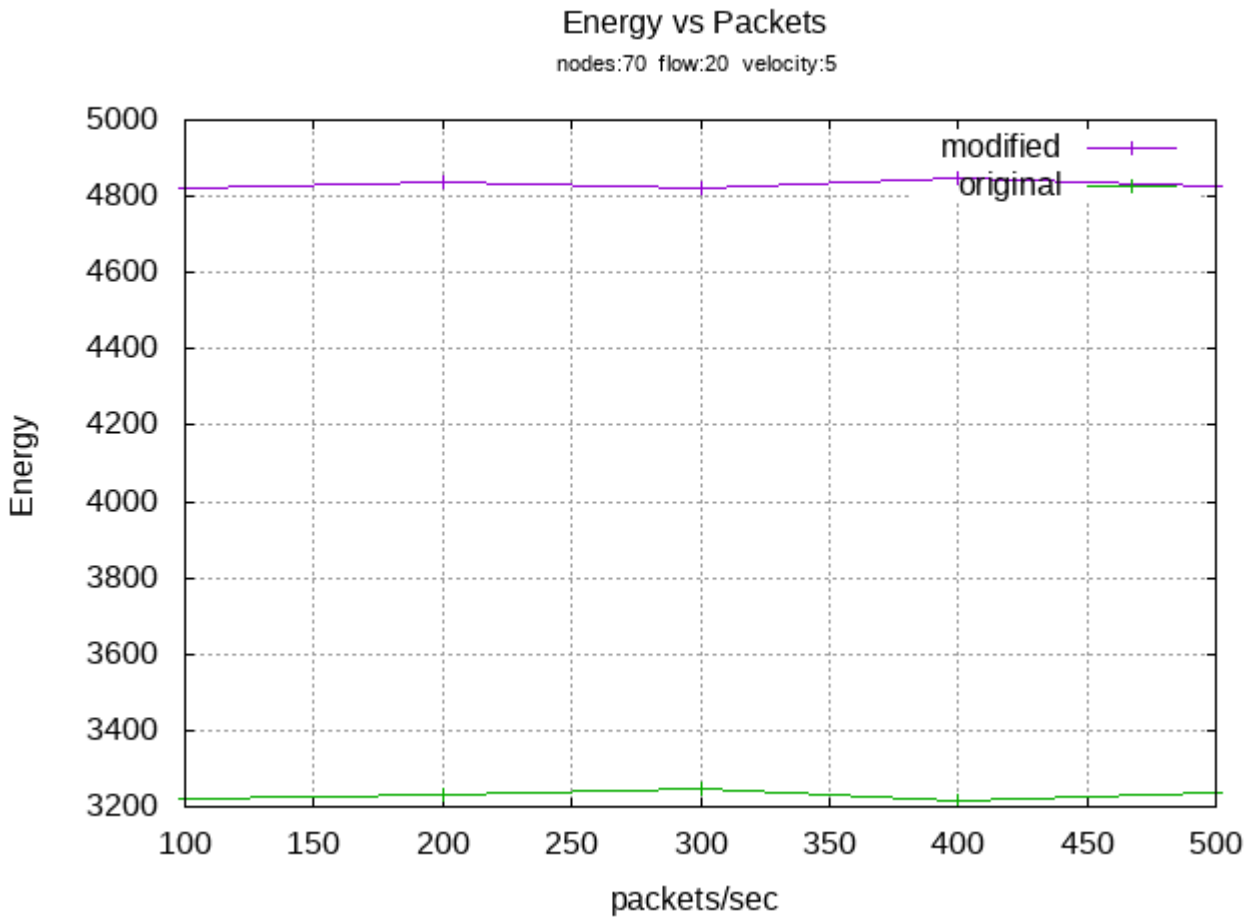

Drop-Ratio vs Node
flow:20 packets/sec:200 velocity:5
Drop-Ratio
node
modified
original
0
5
10
15
20
25
30
35
40
45
50
20
30
40
50
60
70
80
90
100

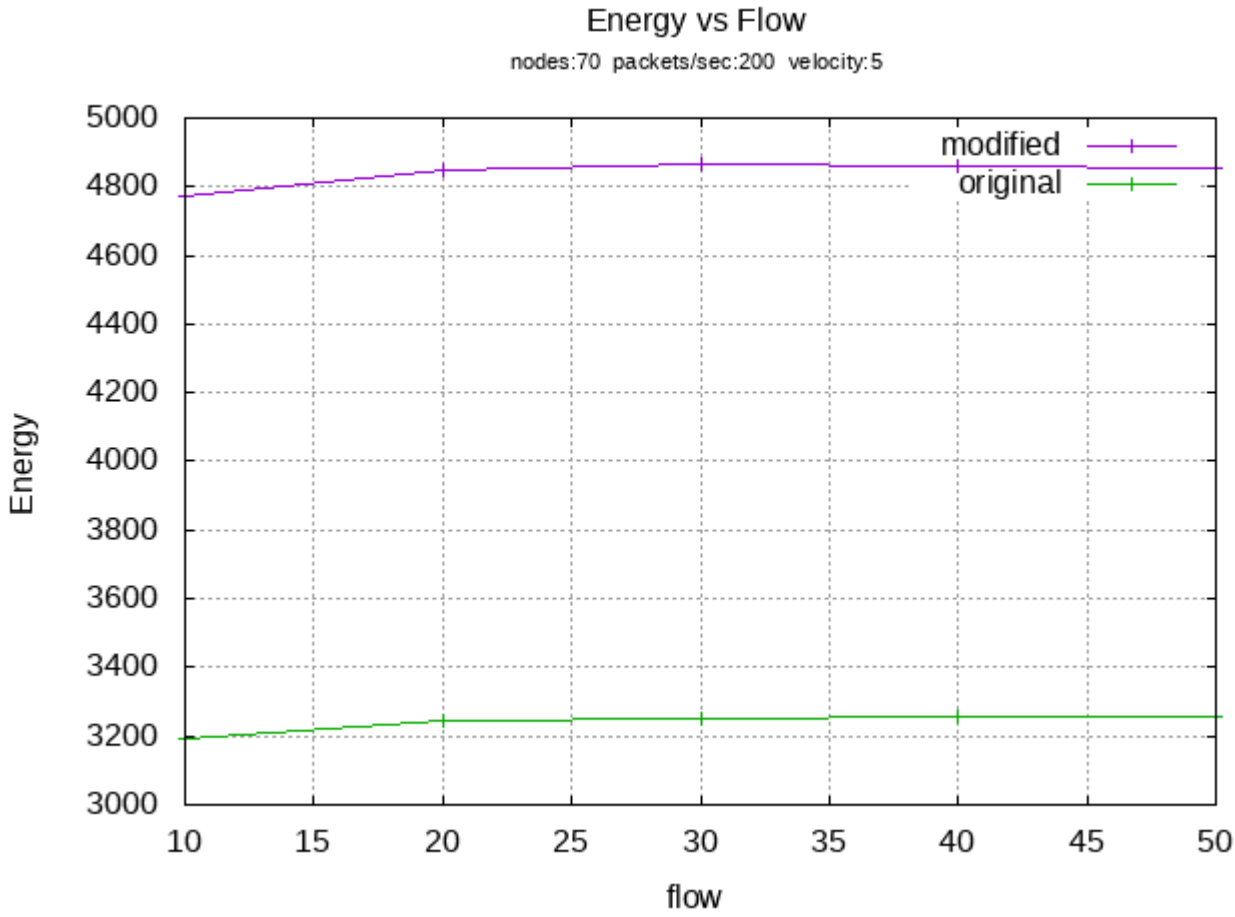

Drop-Ratio vs Packets
nodes:70 flow:20 velocity:5
Drop-Ratio
packets/sec
modified
original
0
5
10
15
20
25
30
35
40
100
150
200
250
300
350
400
450
500

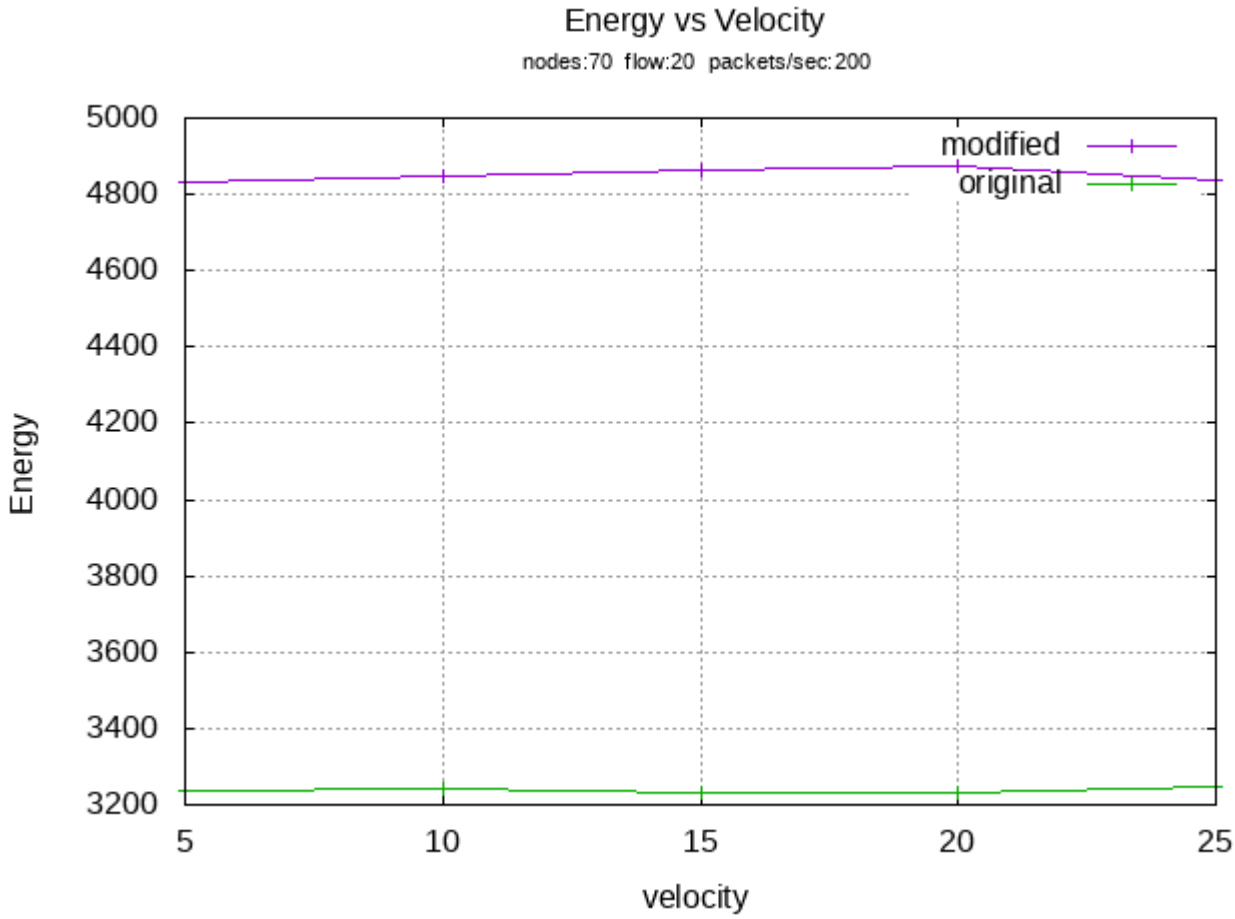

Drop-Ratio vs Flow
nodes:70 packets/sec:200 velocity:5
Drop-Ratio
flow
modified
original
60
50
40
30
20
10
0
10
15
20
25
30
35
40
45
50


Drop-Ratio vs Velocity
nodes:70 flow:20 packets/sec:200
Drop-Ratio
velocity
modified
original
22
20
18
16
14
12
10
8
6
4
2
5
10
15
20
25

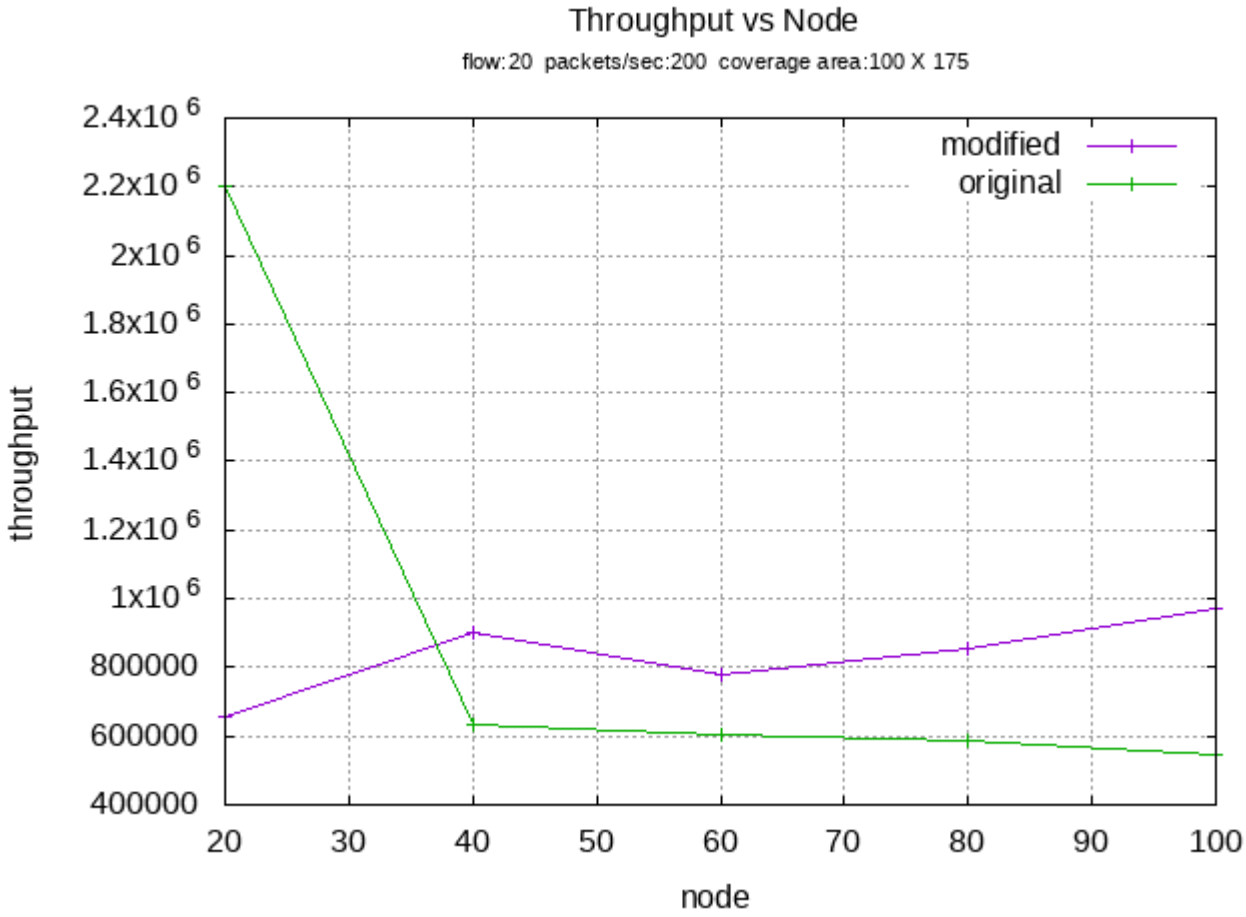

Energy vs Node
flow:20 packets/sec:200 velocity:5
Energy
node
modified
original
7000
6000
5000
4000
3000
2000
1000
0
20
30
40
50
60
70
80
90
100

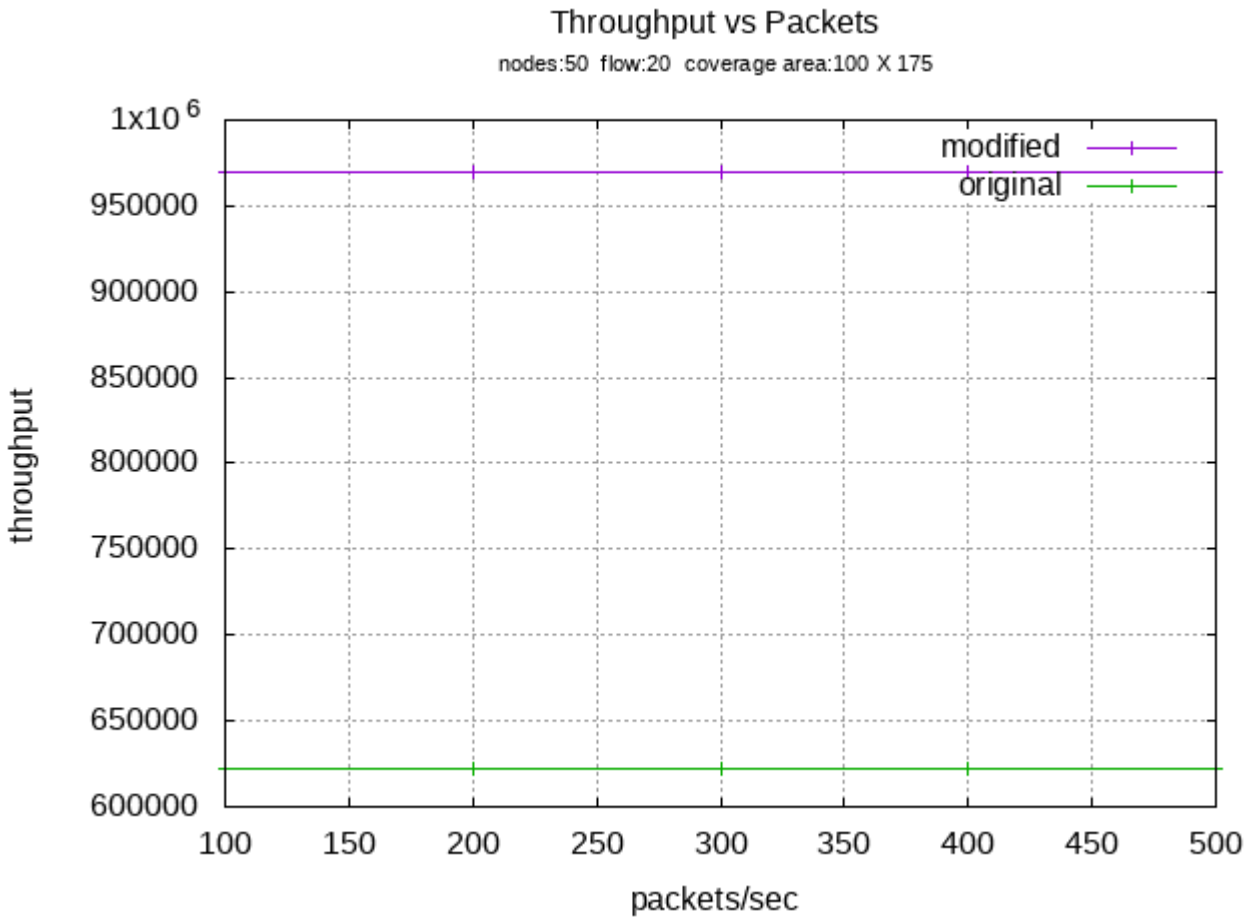

Energy vs Packets
nodes:70 flow:20 velocity:5
modified
original
Energy
packets/sec
5000
4800
4600
4400
4200
4000
3800
3600
3400
3200
100
150
200
250
300
350
400
450
500

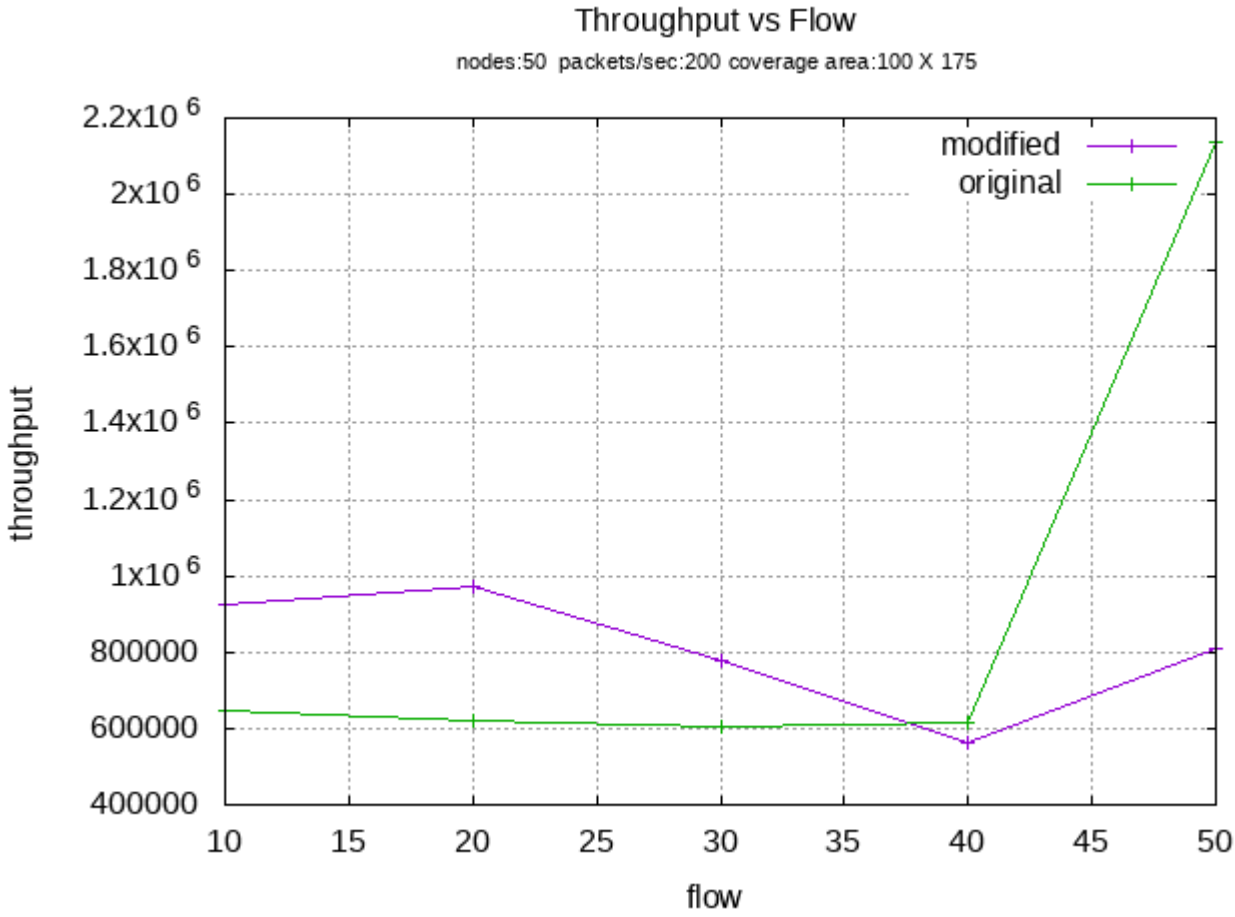

Energy vs Flow
nodes:70 packets/sec:200 velocity:5
Energy
flow
modified
original
5000
4800
4600
4400
4200
4000
3800
3600
3400
3200
3000
10
15
20
25
30
35
40
45
50

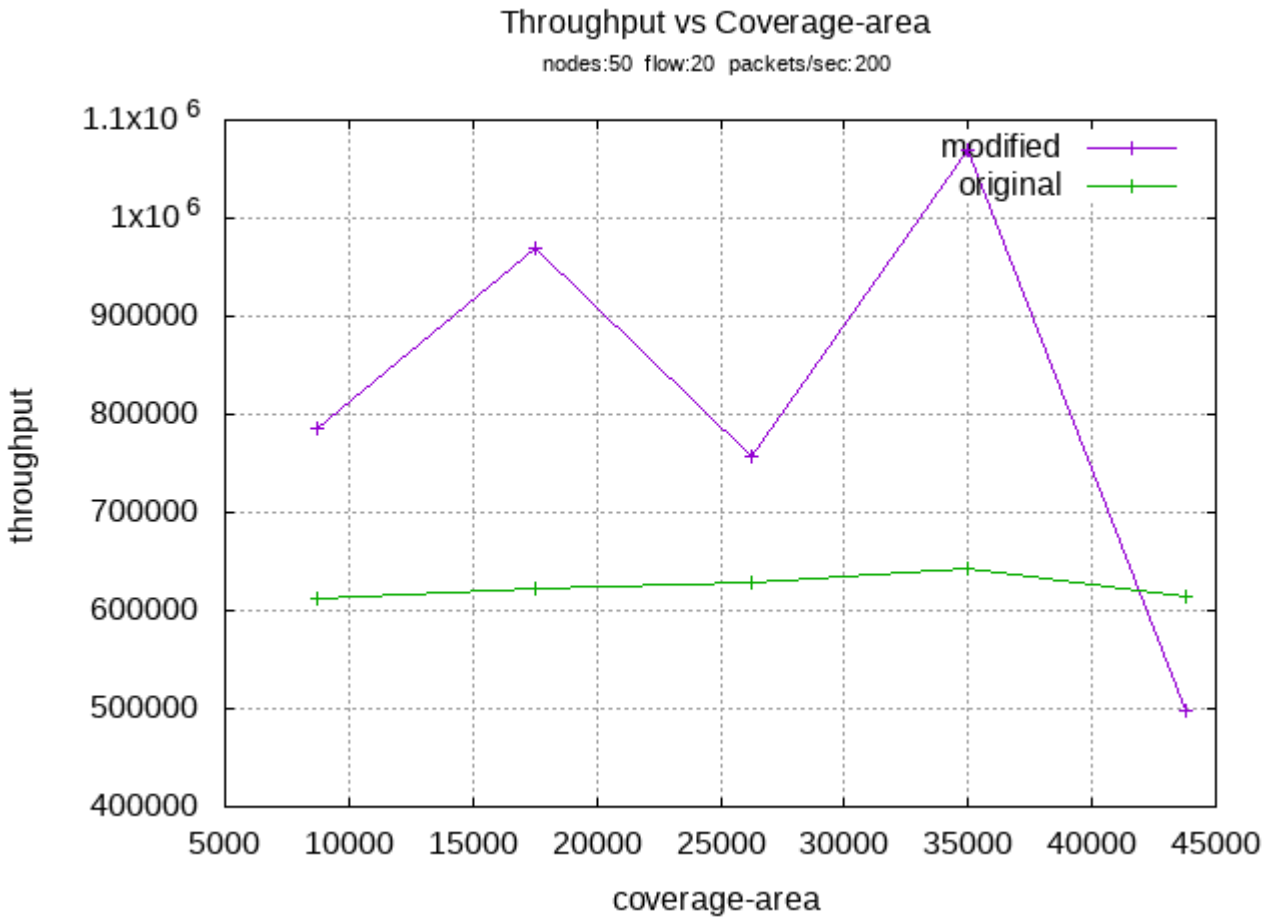

Energy vs Velocity
nodes:70 flow:20 packets/sec:200
Energy
velocity
modified
original
5000
4800
4600
4400
4200
4000
3800
3600
3400
3200
5
10
15
20
25

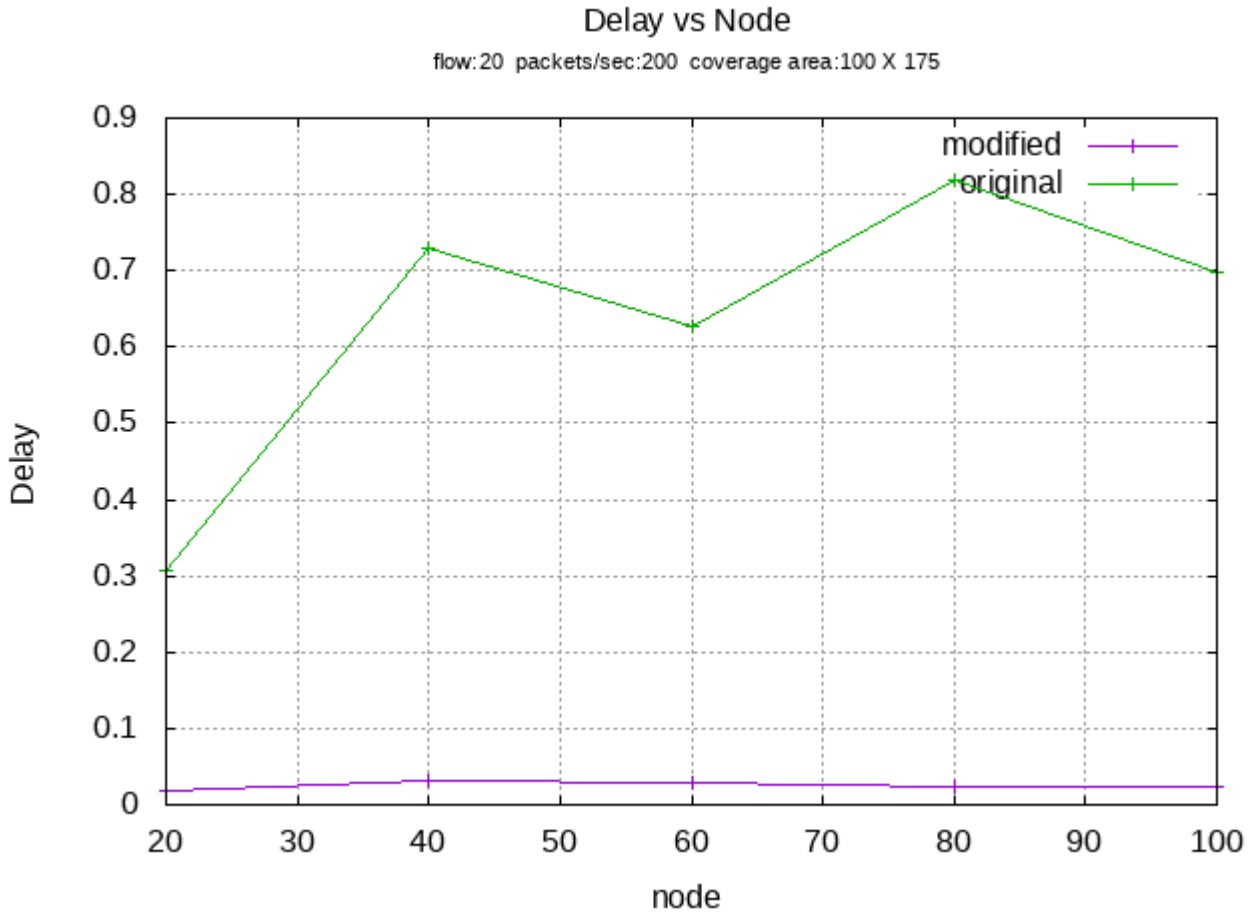
Wireless 802.11new(static) modified queue

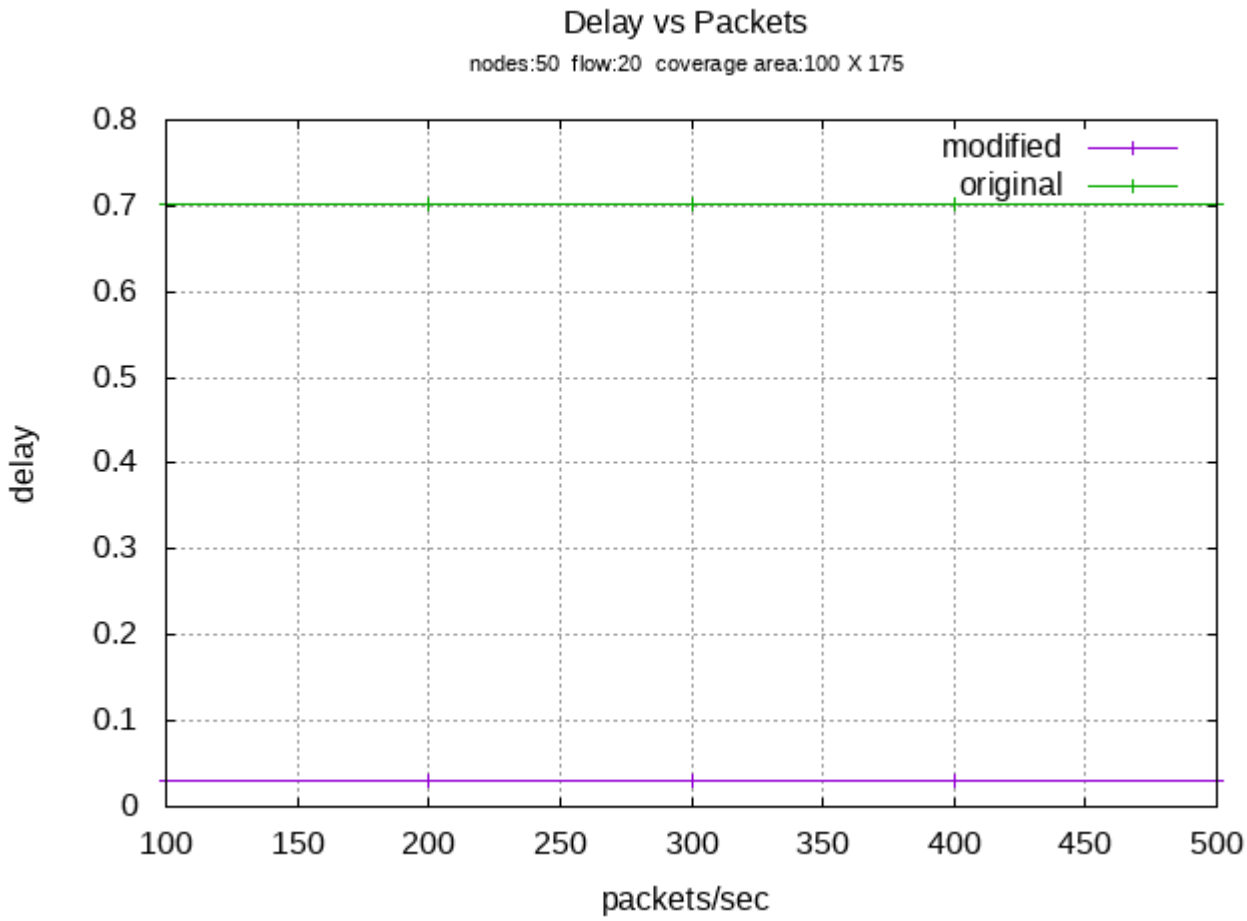

Throughput vs Node
flow:20 packets/sec:200 coverage area:100 X 175
throughput
node
modified
original
2.4x10 6
2.2x10 6
2x10 6
1.8x10 6
1.6x10 6
1.4x10 6
1.2x10 6
1x10 6
800000
600000
400000
20
30
40
50
60
70
80
90
100

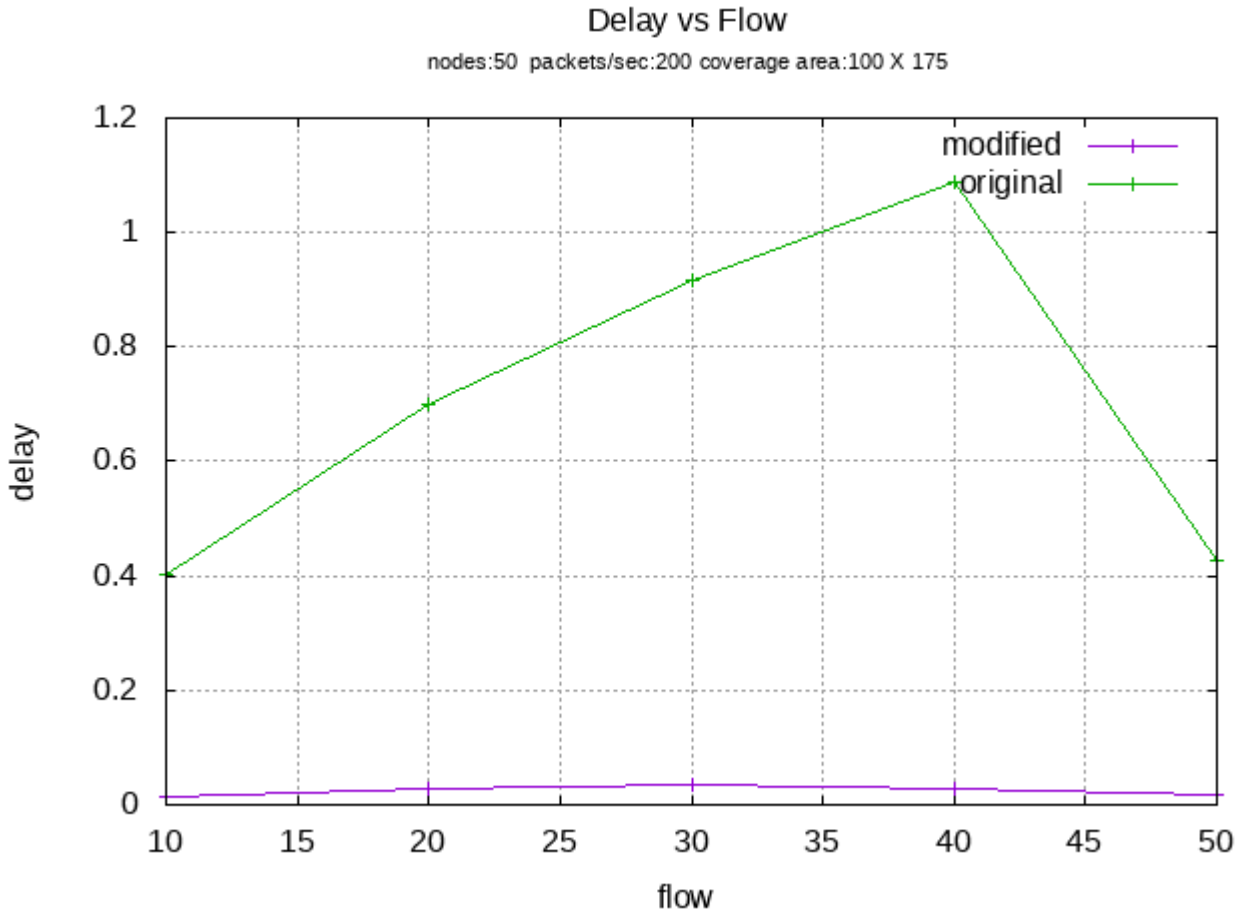

Throughput vs Packets
nodes:50 flow:20 coverage area:100 X 175
1x10 6
950000
900000
850000
800000
750000
700000
650000
600000
throughput
100
150
200
250
300
350
400
450
500
packets/sec
modified
original

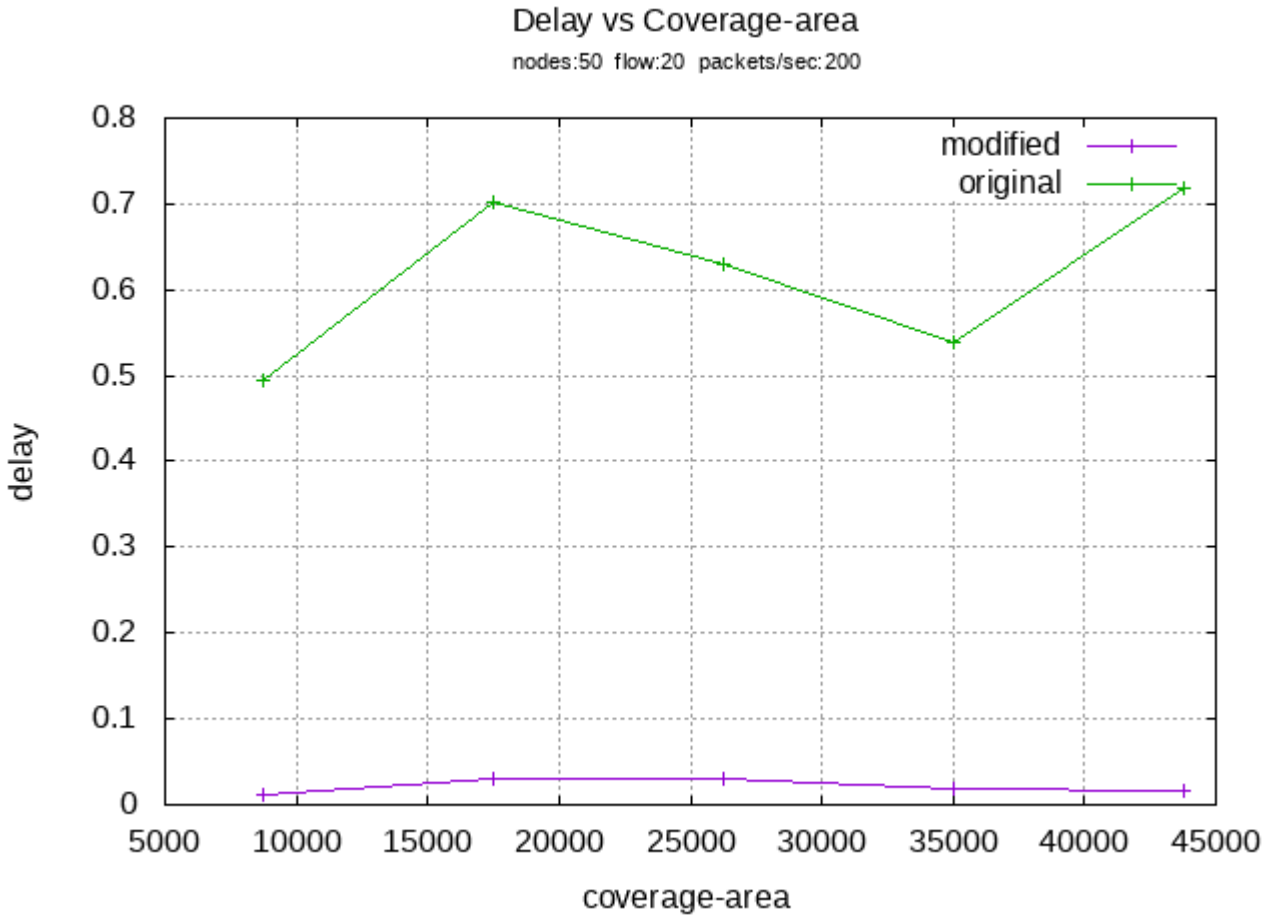

Throughput vs Flow
nodes:50 packets/sec:200 coverage area:100 X 175
throughput
flow
modified
original
2.2x10 6
2x10 6
1.8x10 6
1.6x10 6
1.4x10 6
1.2x10 6
1x10 6
800000
600000
400000
10
15
20
25
30
35
40
45
50

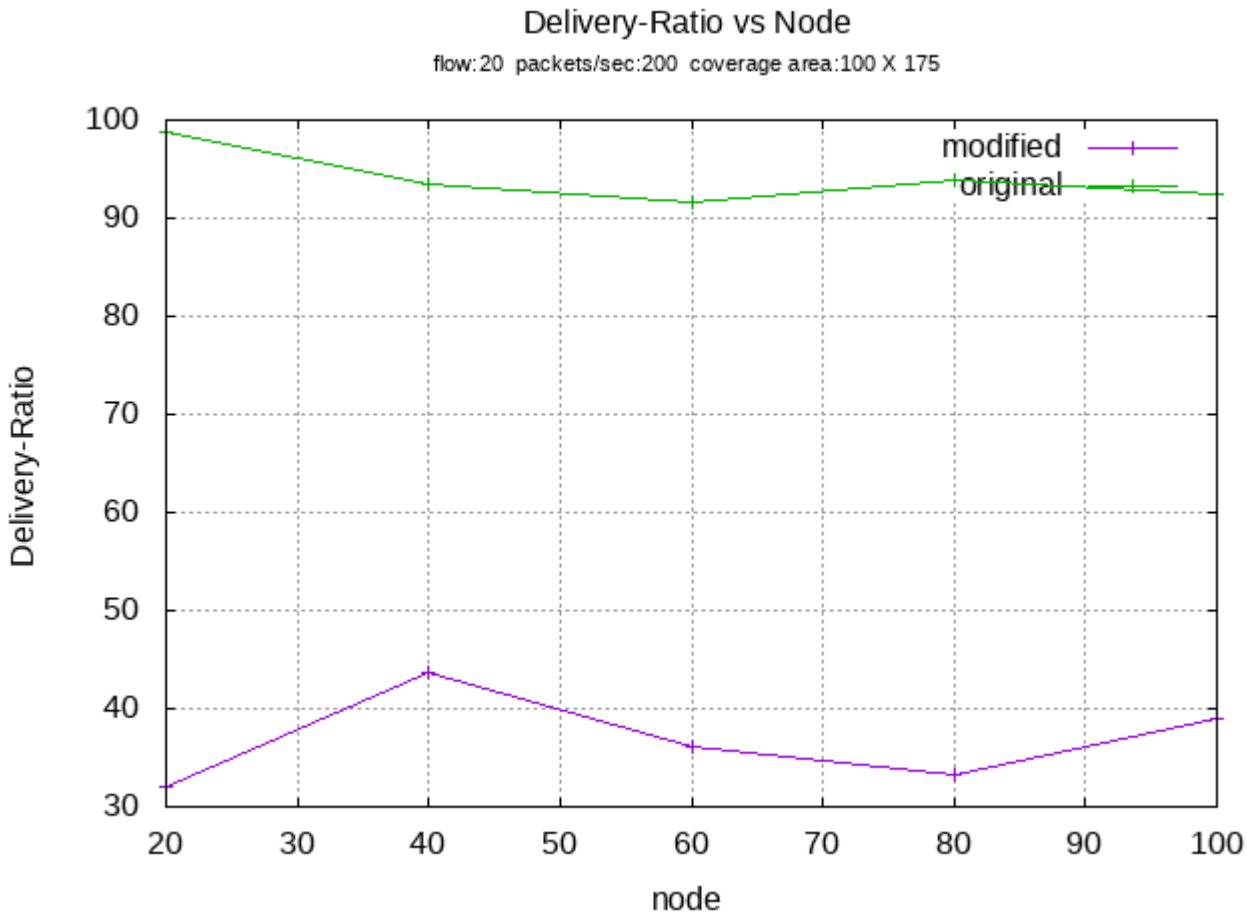

Throughput vs Coverage-area
nodes:50 flow:20 packets/sec:200
1.1x10 6
1x10 6
900000
800000
700000
600000
500000
400000
throughput
5000
10000
15000
20000
25000
30000
35000
40000
45000
coverage-area
modified
original

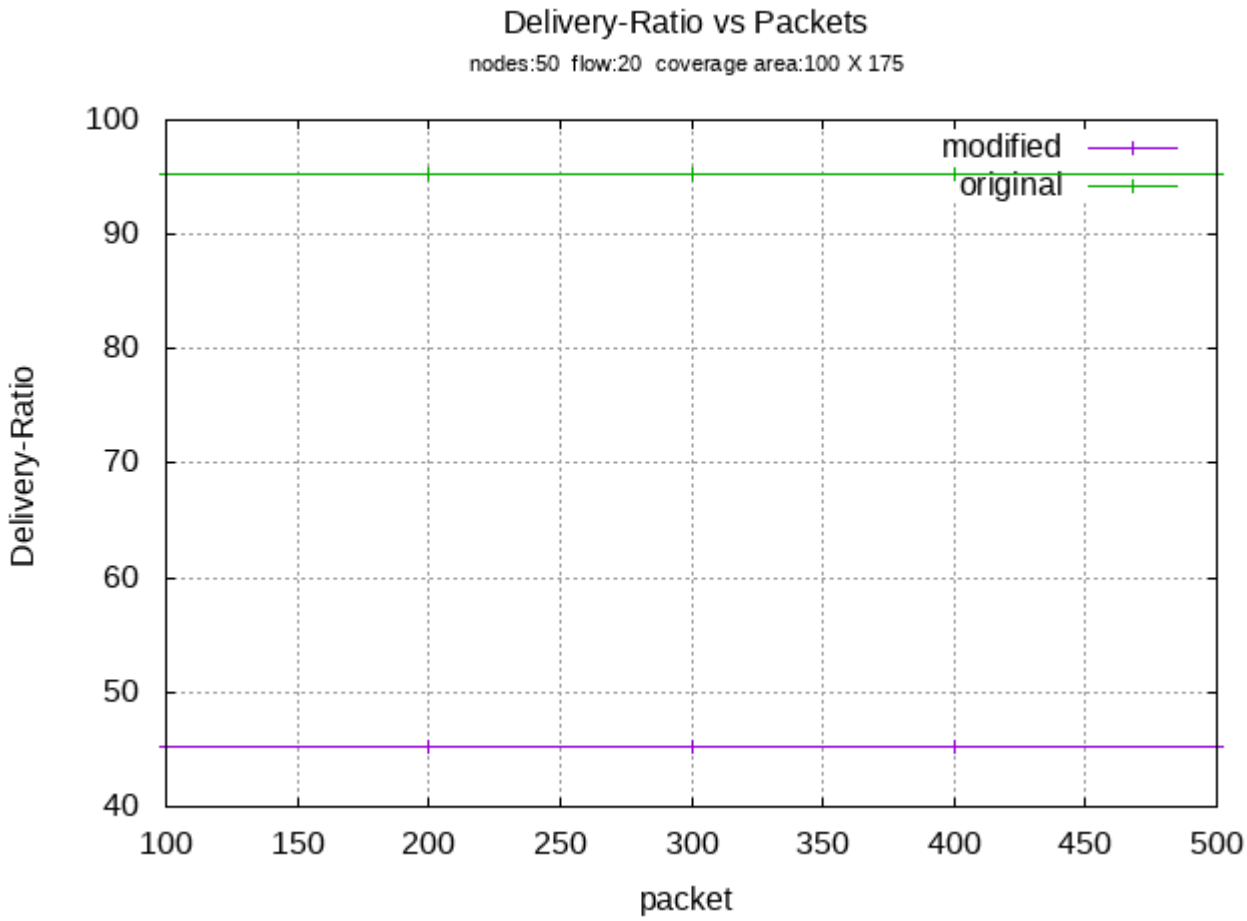

Delay vs Node
flow:20 packets/sec:200 coverage area:100 X 175
modified
original
Delay
node
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
20
30
40
50
60
70
80
90
100

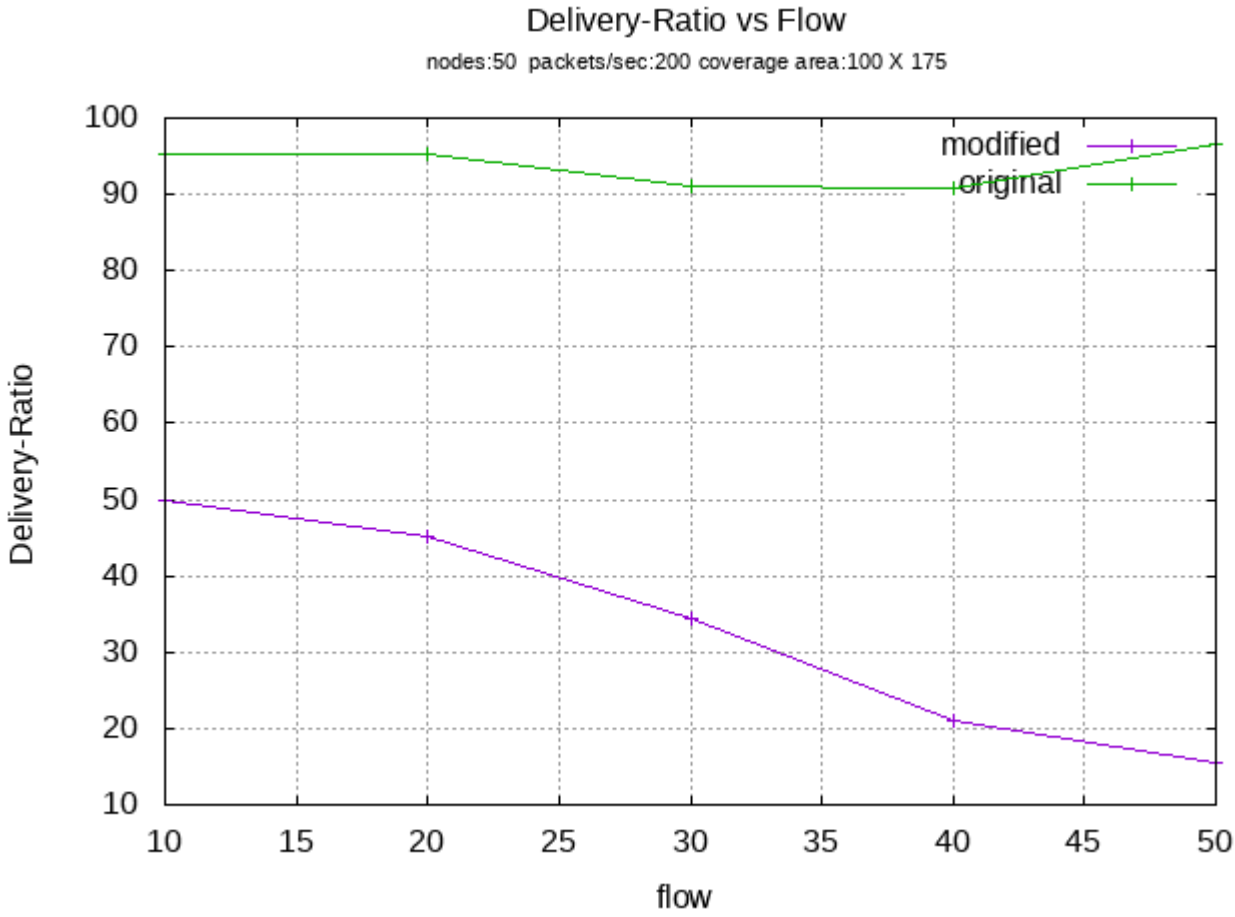

Delay vs Packets
nodes:50 flow:20 coverage area:100 X 175
modified
original
delay
packets/sec
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
100
150
200
250
300
350
400
450
500

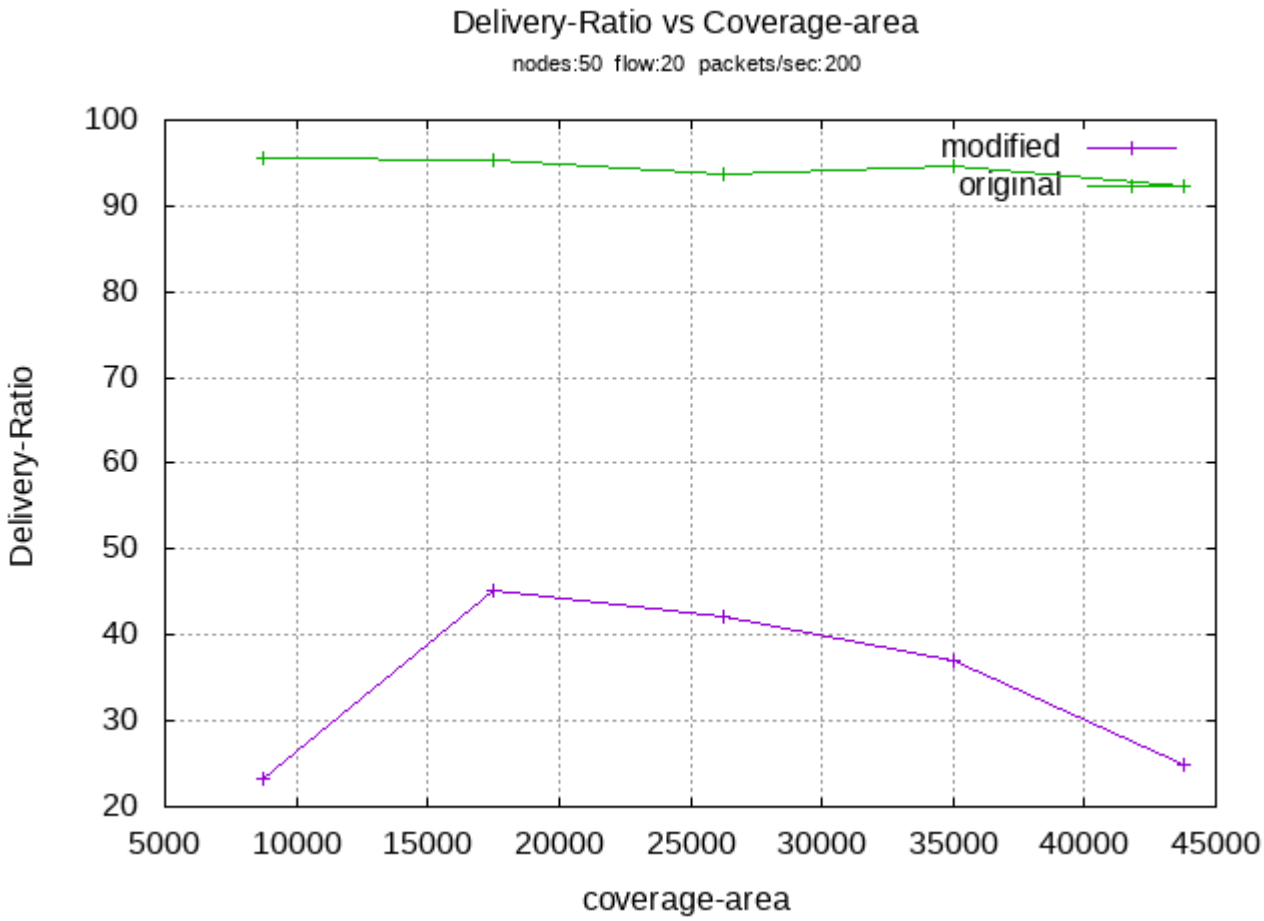

Delay vs Flow
nodes:50 packets/sec:200 coverage area:100 X 175
modified
original
delay
flow
1.2
1
0.8
0.6
0.4
0.2
0
10
15
20
25
30
35
40
45
50

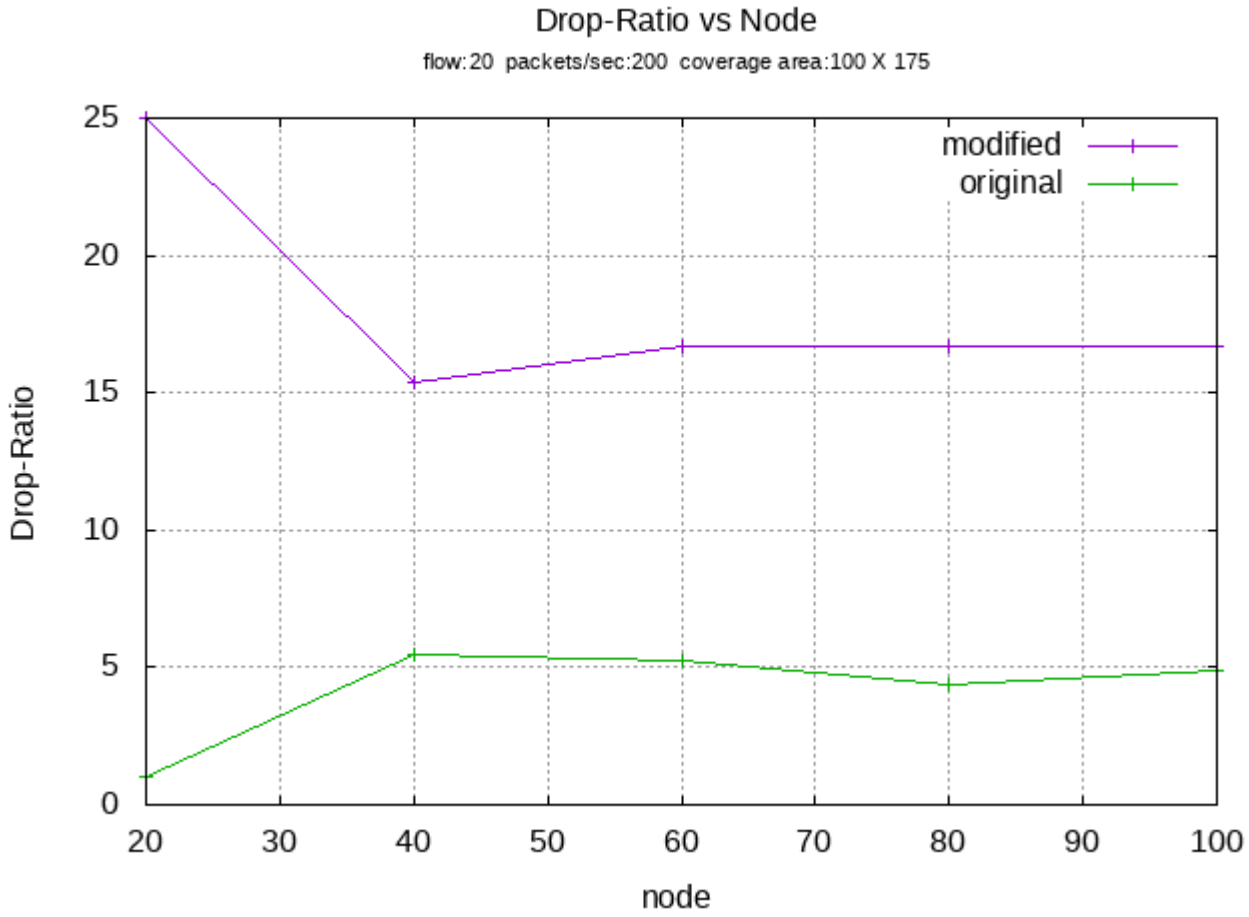

Delay vs Coverage-area
nodes:50 flow:20 packets/sec:200
modified
original
delay
coverage-area
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
5000
10000
15000
20000
25000
30000
35000
40000
45000

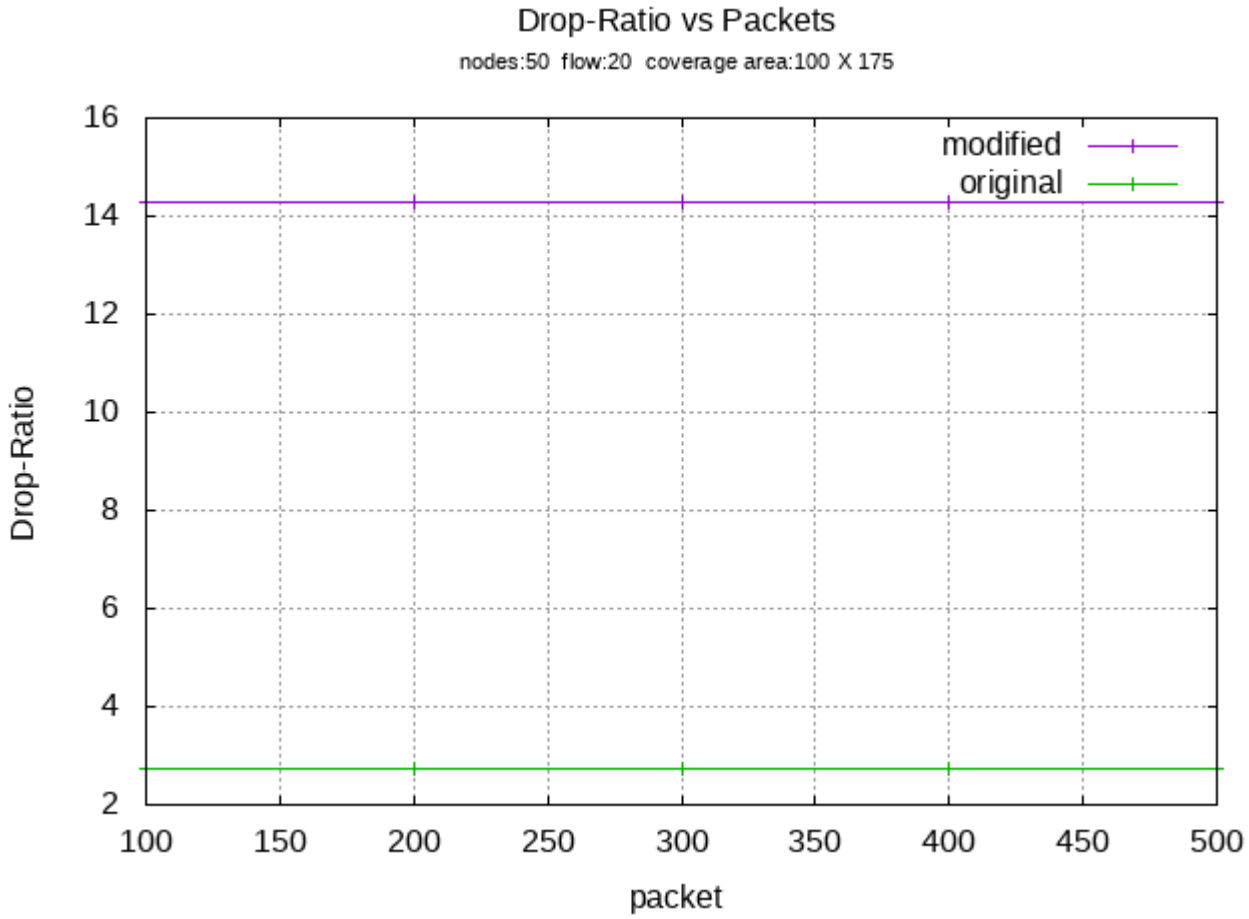

Delivery-Ratio vs Node
flow:20 packets/sec:200 coverage area:100 X 175
Delivery-Ratio
node
modified
original
100
90
80
70
60
50
40
30
20
30
40
50
60
70
80
90
100

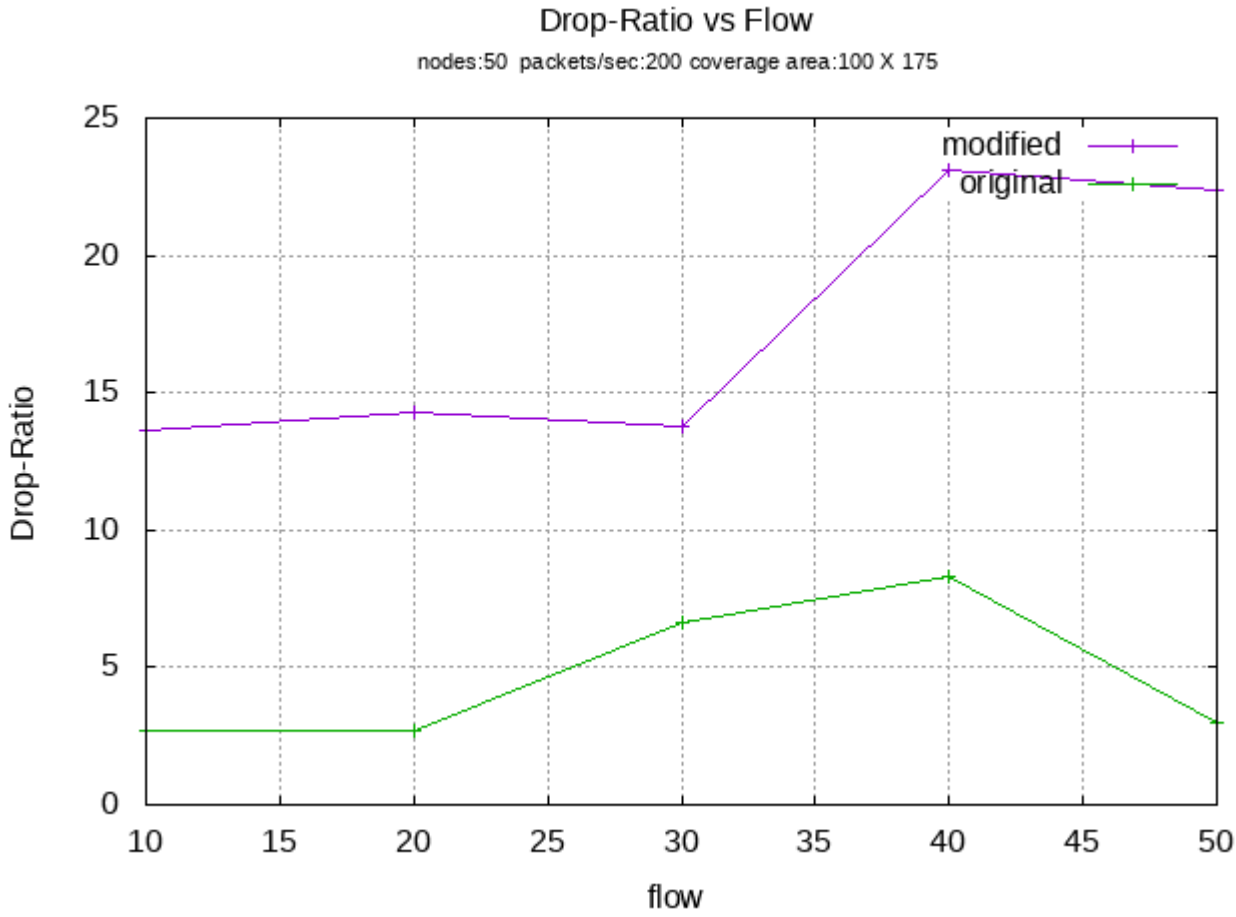

Delivery-Ratio vs Packets
nodes:50 flow:20 coverage area:100 X 175
Delivery-Ratio
packet
modified
original
100
90
80
70
60
50
40
100
150
200
250
300
350
400
450
500

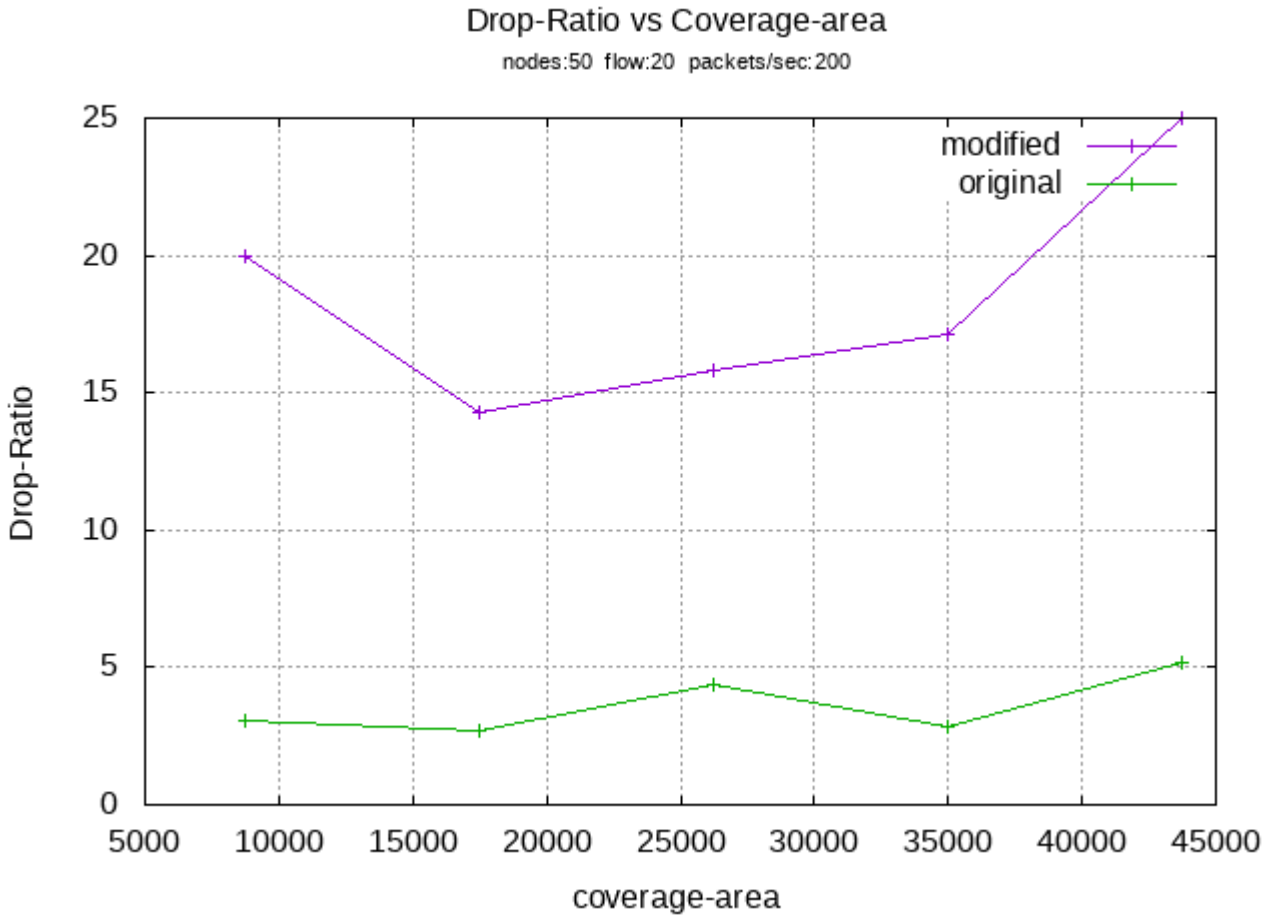

Delivery-Ratio vs Flow
nodes:50 packets/sec:200 coverage area:100 X 175
Delivery-Ratio
flow
modified
original
100
90
80
70
60
50
40
30
20
10
10
15
20
25
30
35
40
45
50

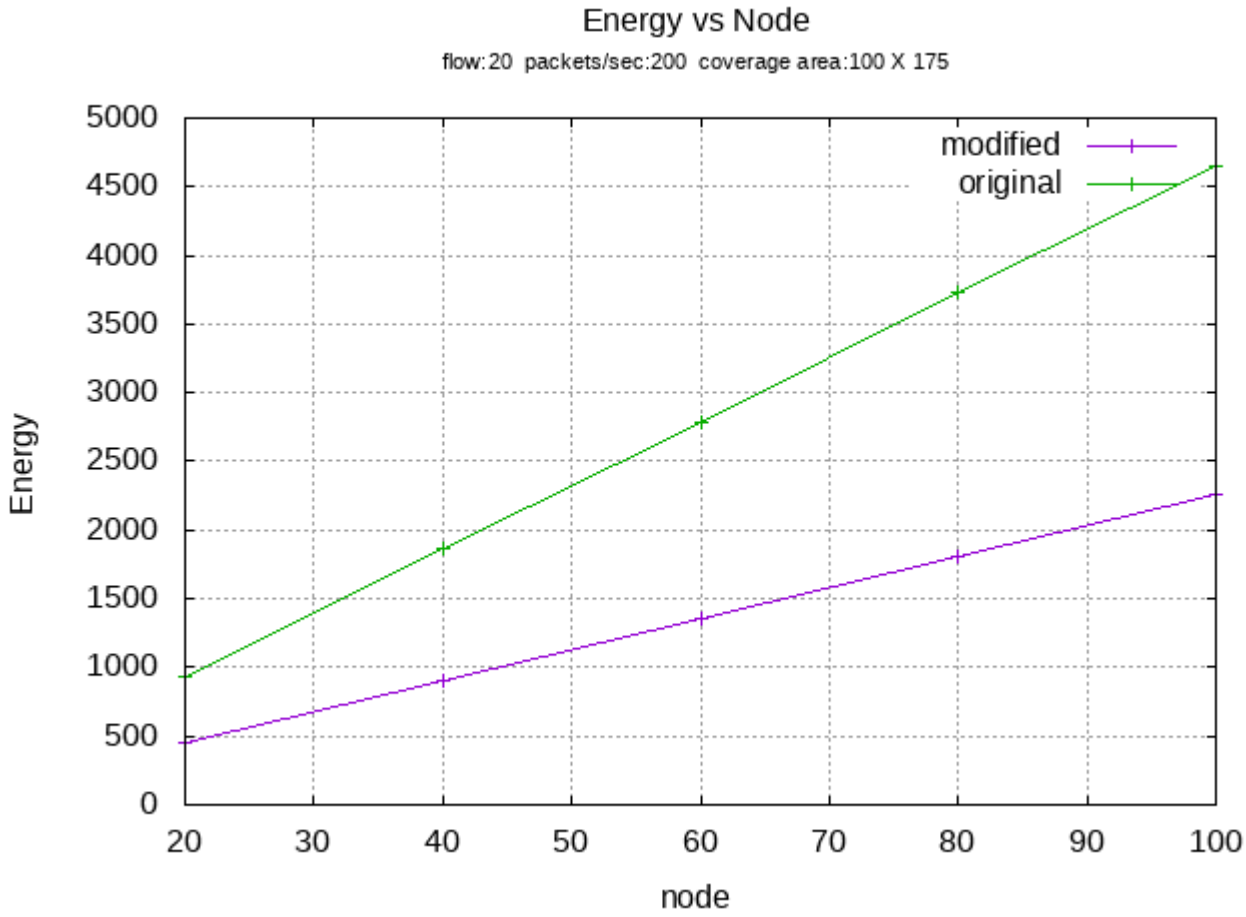

Delivery-Ratio vs Coverage-area
nodes:50 flow:20 packets/sec:200
Delivery-Ratio
coverage-area
modified
original
100
90
80
70
60
50
40
30
20
5000
10000
15000
20000
25000
30000
35000
40000
45000

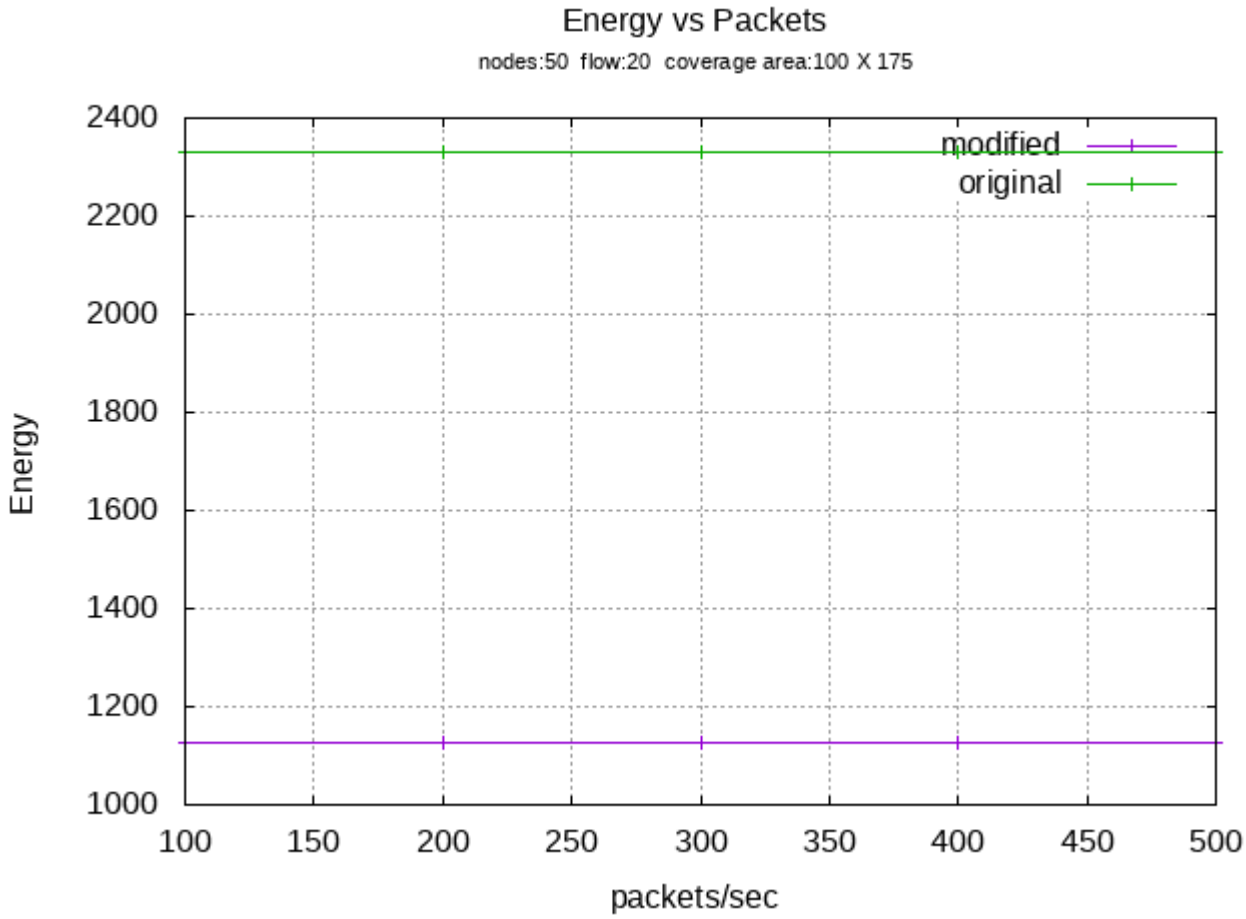

Drop-Ratio vs Node
flow:20 packets/sec:200 coverage area:100 X 175
Drop-Ratio
node
modified
original
0
5
10
15
20
25
20
30
40
50
60
70
80
90
100

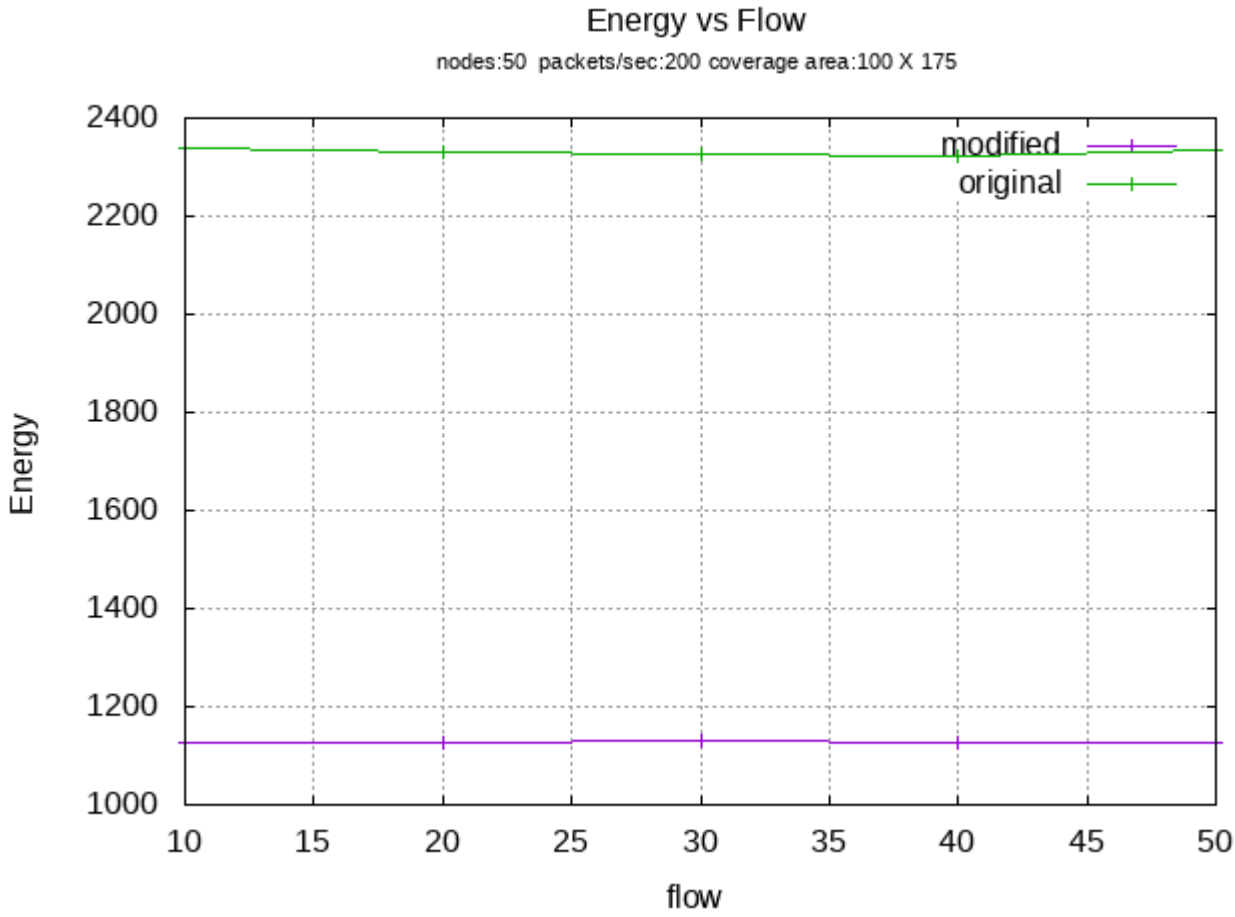

Drop-Ratio vs Packets
nodes:50 flow:20 coverage area:100 X 175
Drop-Ratio
packet
modified
original
16
14
12
10
8
6
4
2
100
150
200
250
300
350
400
450
500

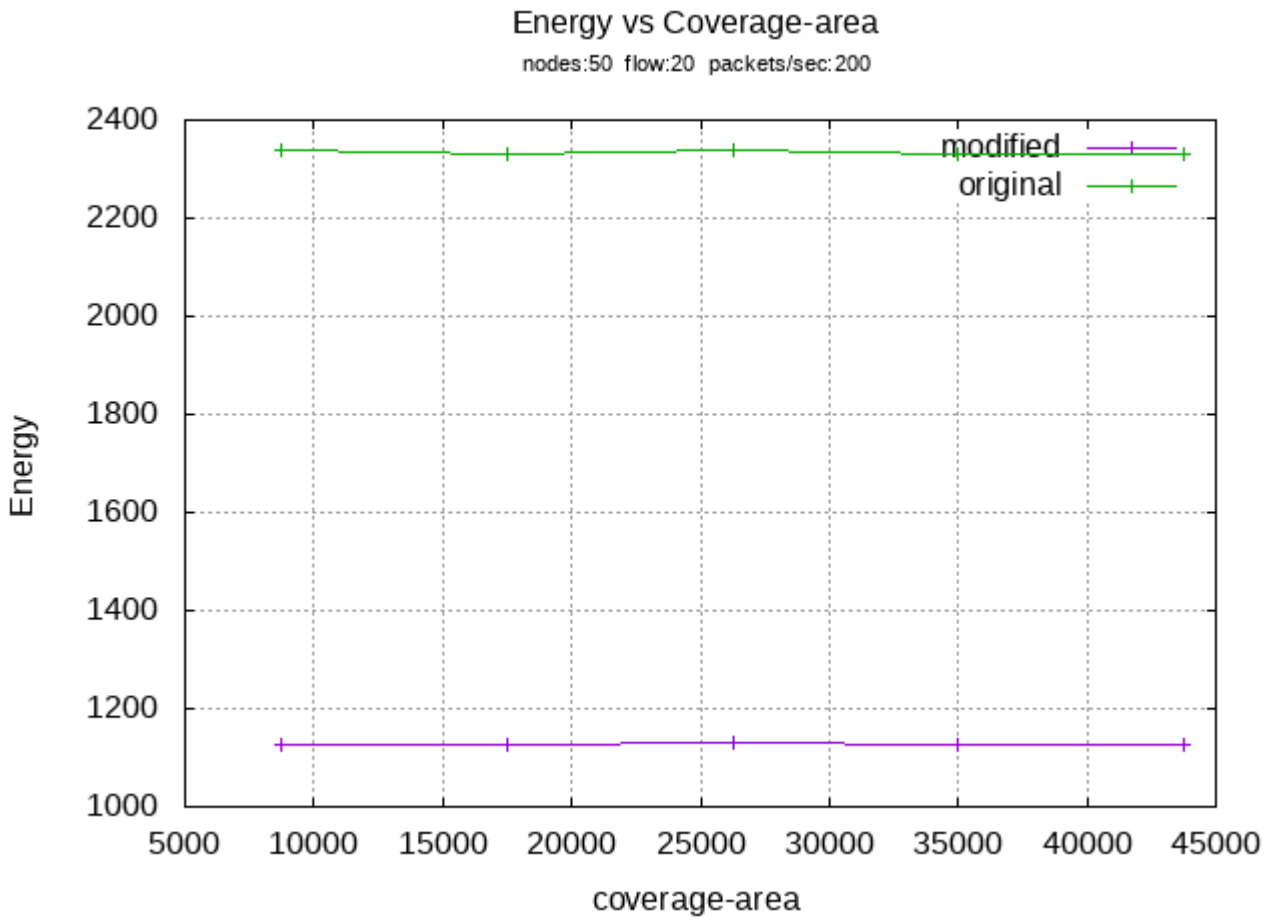

Drop-Ratio vs Flow
nodes:50 packets/sec:200 coverage area:100 X 175
Drop-Ratio
flow
modified
original
0
5
10
15
20
25
10
15
20
25
30
35
40
45
50


Drop-Ratio vs Coverage-area
nodes:50 flow:20 packets/sec:200
Drop-Ratio
coverage-area
modified
original
0
5
10
15
20
25
5000
10000
15000
20000
25000
30000
35000
40000
45000

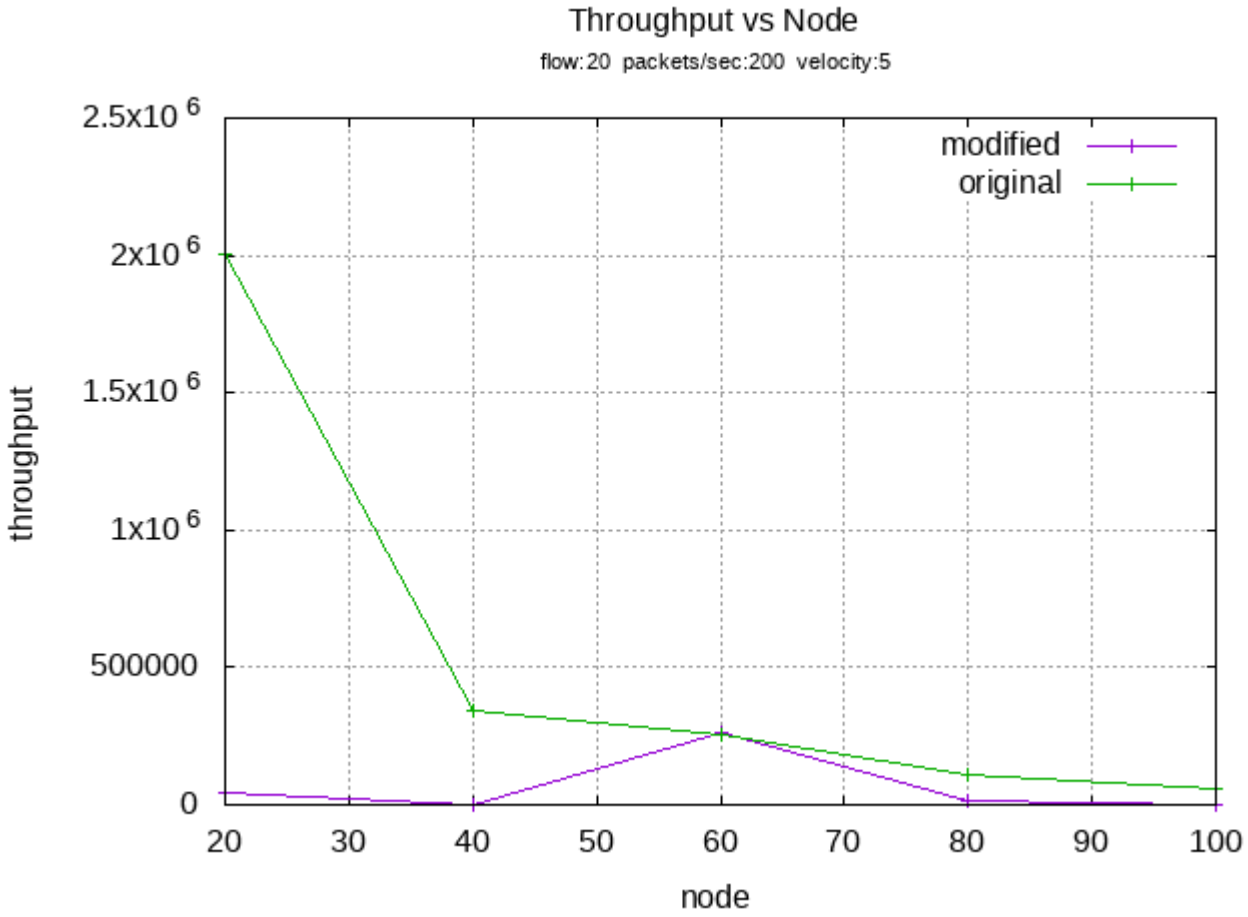

Energy vs Node
flow:20 packets/sec:200 coverage area:100 X 175
Energy
node
modified
original
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
20
30
40
50
60
70
80
90
100

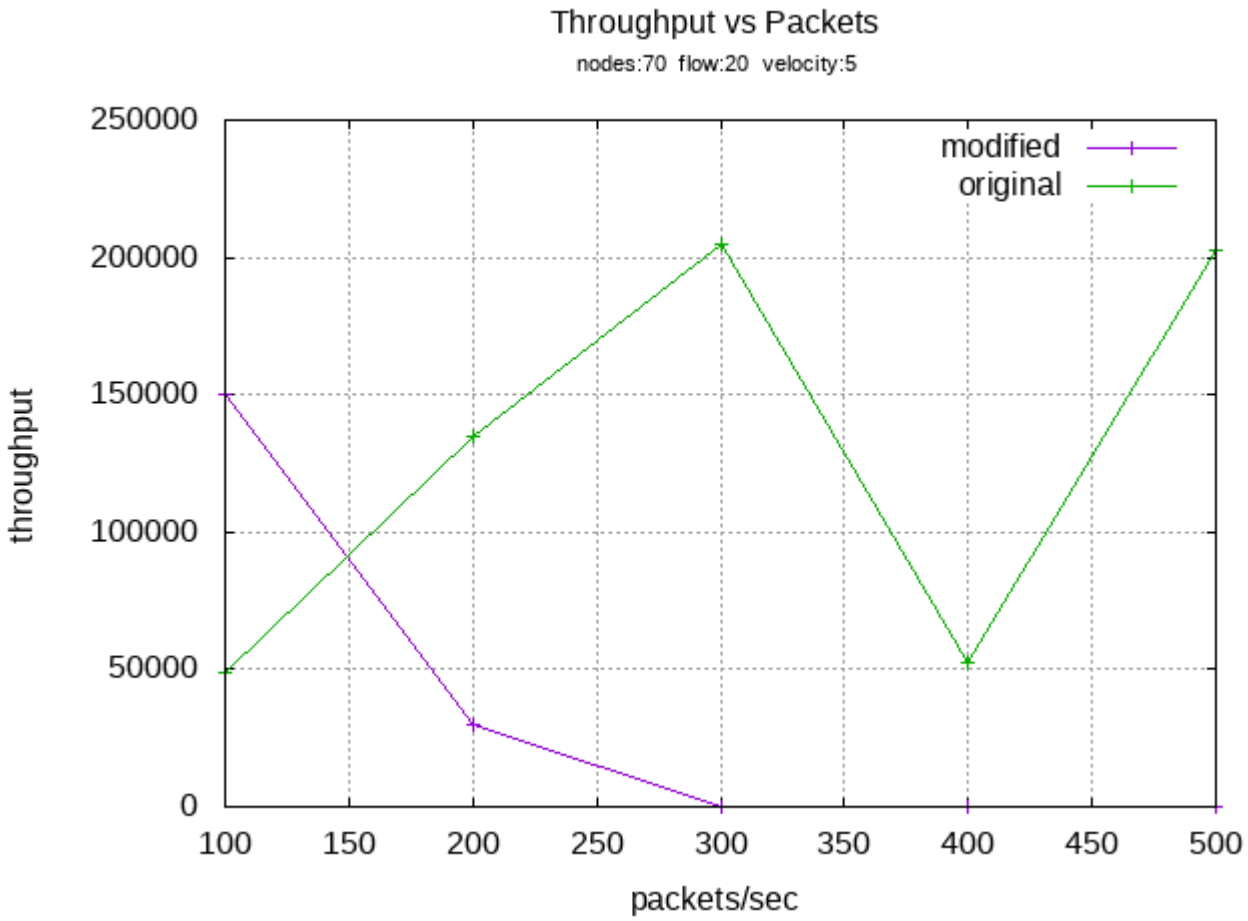

Energy vs Packets
nodes:50 flow:20 coverage area:100 X 175
modified
original
Energy
packets/sec
2400
2200
2000
1800
1600
1400
1200
1000
100
150
200
250
300
350
400
450
500

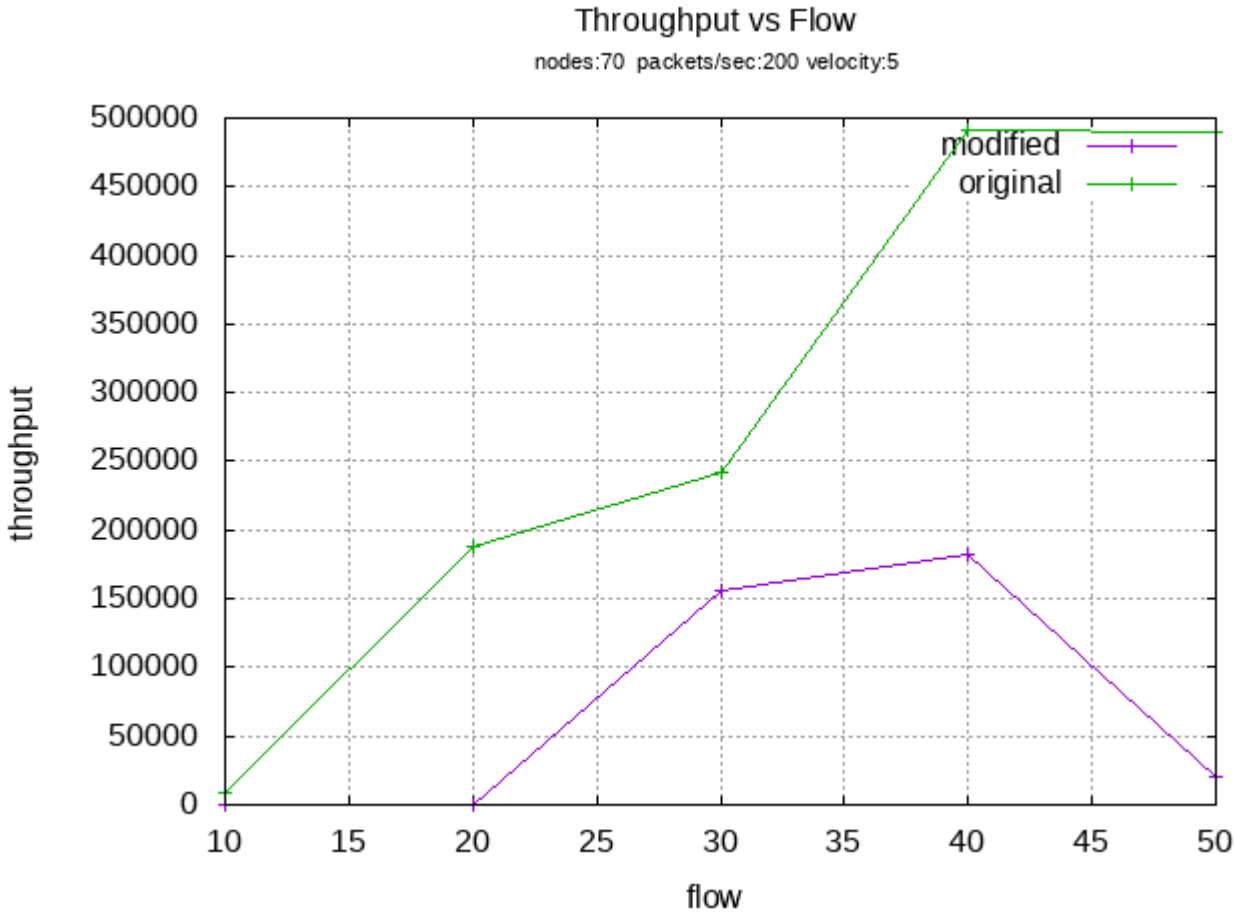

Energy vs Flow
nodes:50 packets/sec:200 coverage area:100 X 175
Energy
flow
modified
original
2400
2200
2000
1800
1600
1400
1200
1000
10
15
20
25
30
35
40
45
50

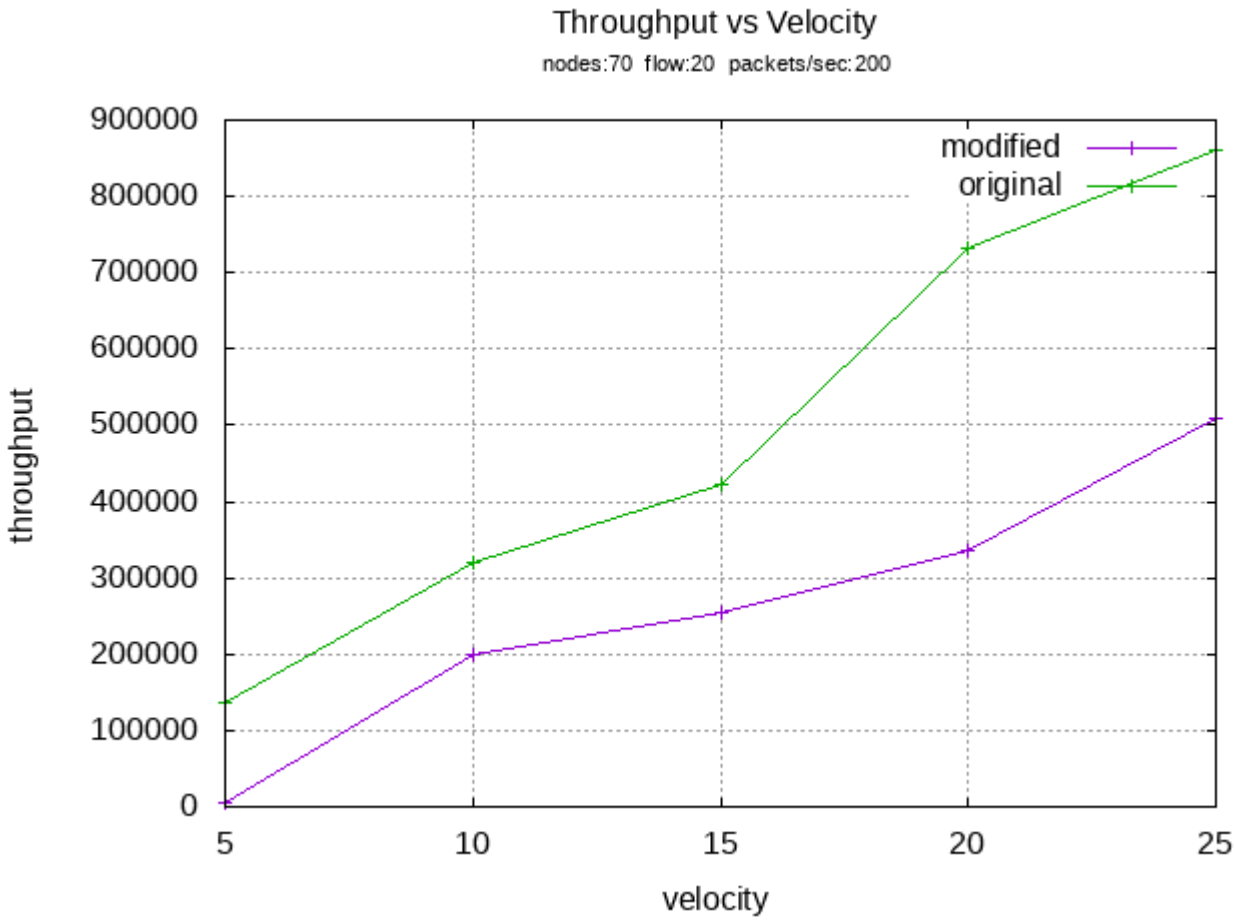

Energy vs Coverage-area
nodes:50 flow:20 packets/sec:200
Energy
coverage-area
modified
original
2400
2200
2000
1800
1600
1400
1200
1000
5000
10000
15000
20000
25000
30000
35000
40000
45000

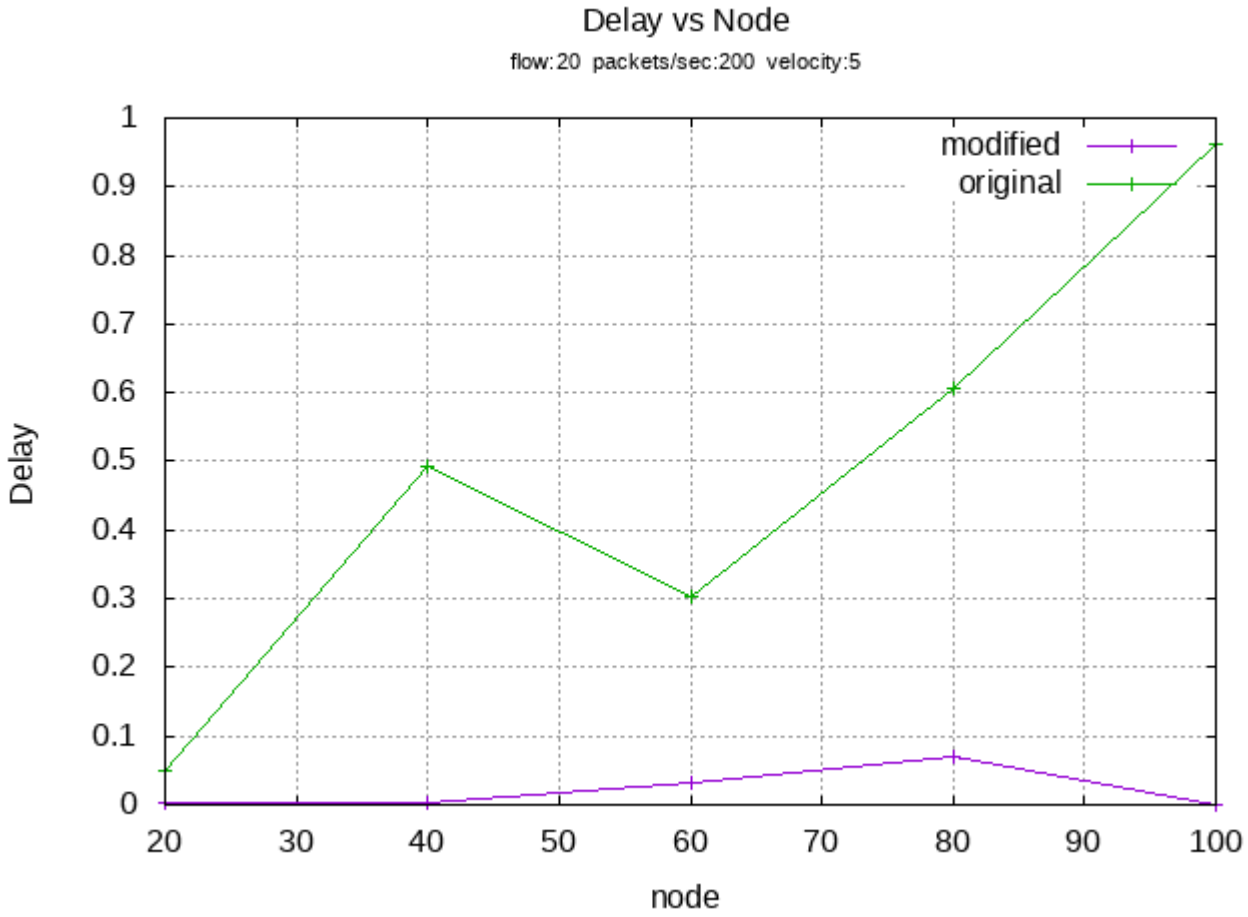
Wireless 802.11new(mobile) modified queue

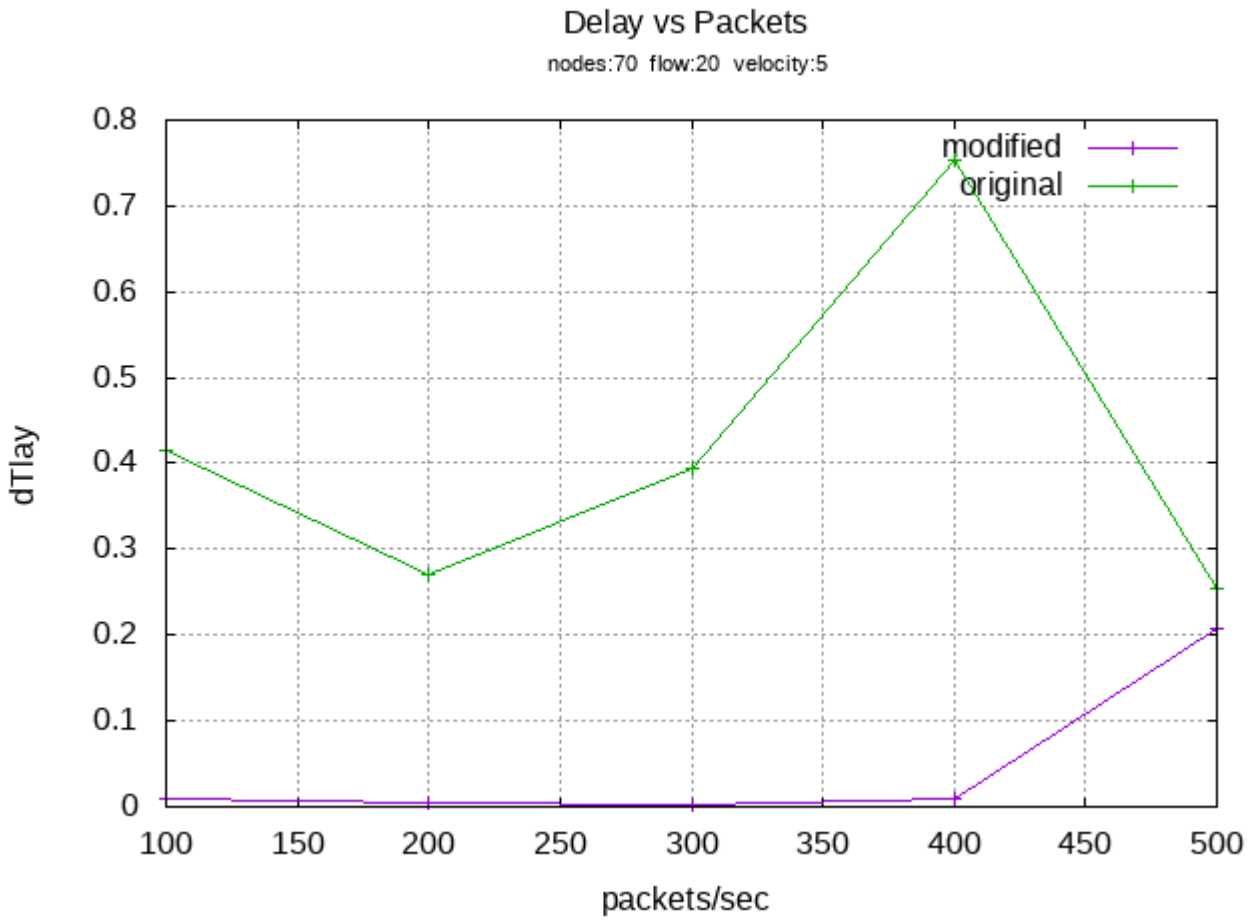

Throughput vs Node
flow:20 packets/sec:200 velocity:5
2.5x10 6
2x10 6
1.5x10 6
1x10 6
500000
0
throughput
20
30
40
50
60
70
80
90
100
node
modified
original

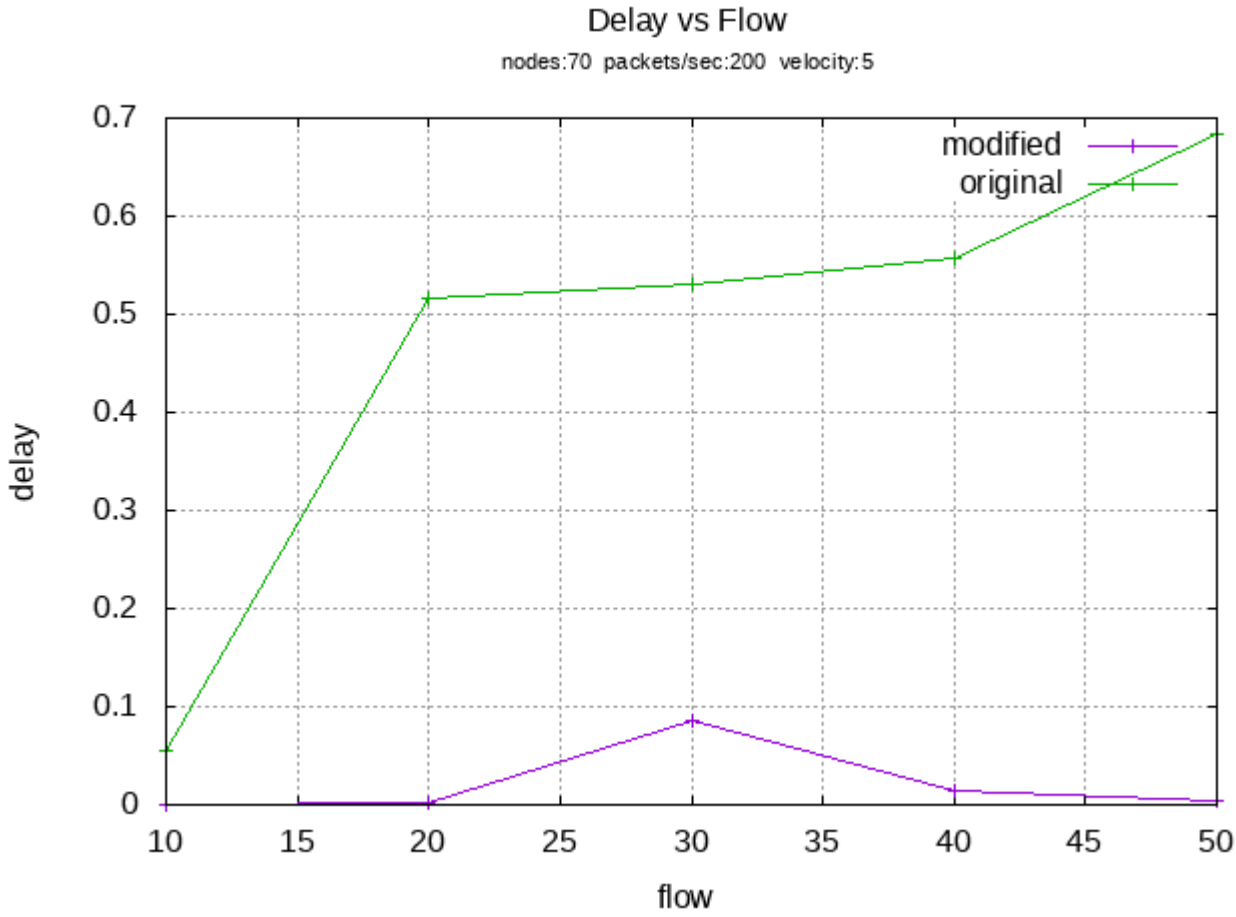

Throughput vs Packets
nodes:70 flow:20 velocity:5
modified
original
throughput
packets/sec
250000
200000
150000
100000
50000
0
100
150
200
250
300
350
400
450
500

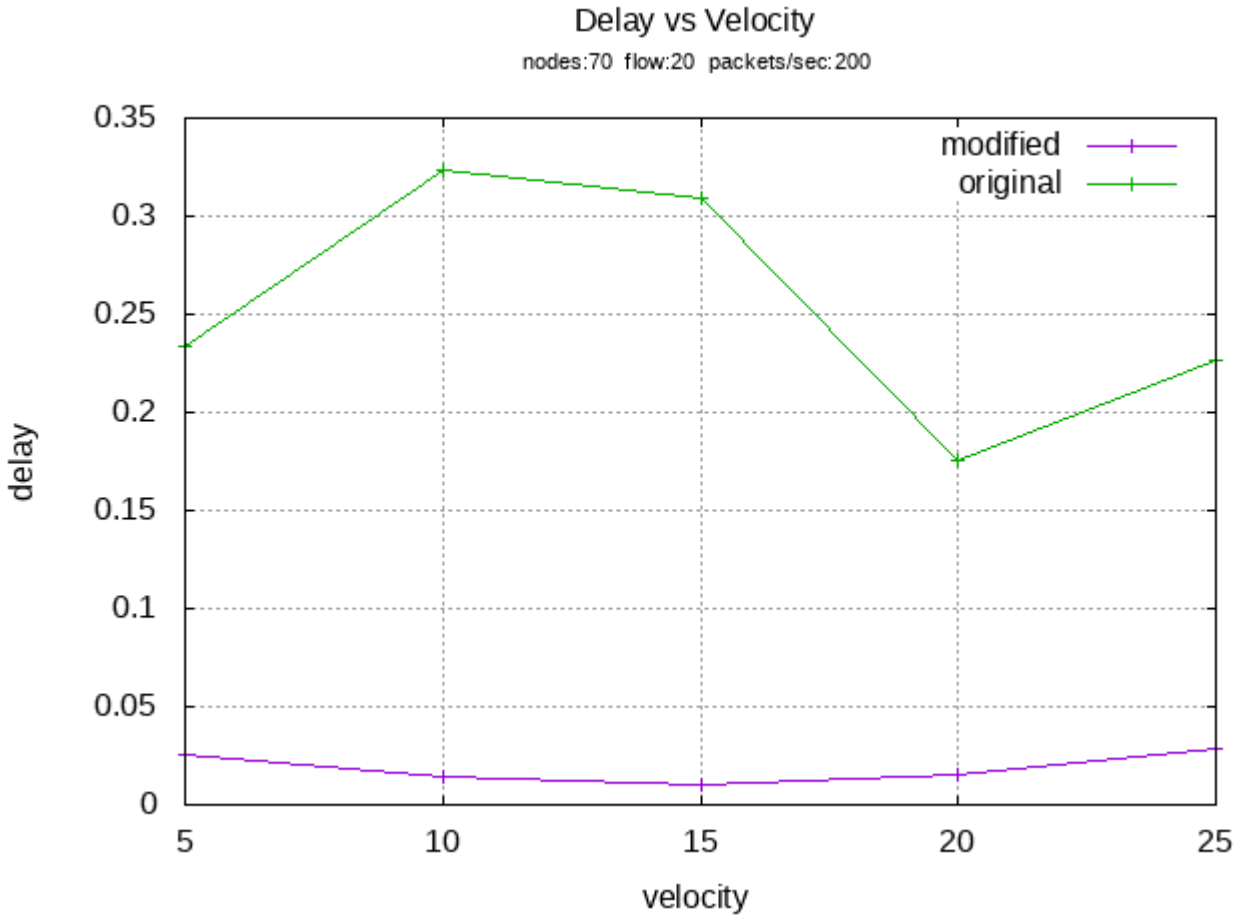

Throughput vs Flow
nodes:70 packets/sec:200 velocity:5
throughput
flow
modified
original
500000
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
10
15
20
25
30
35
40
45
50

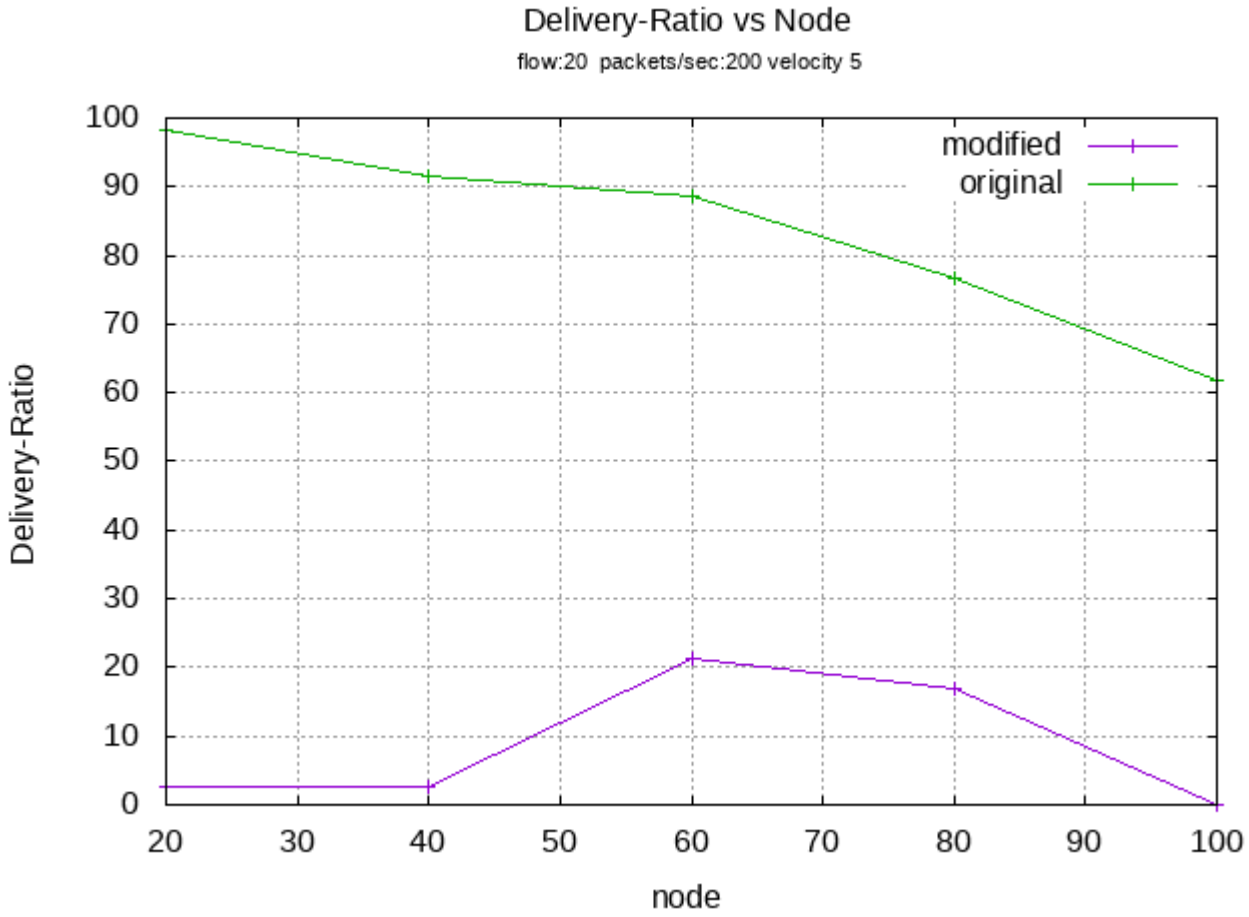

Throughput vs Velocity
nodes:70 flow:20 packets/sec:200
throughput
velocity
modified
original
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
5
10
15
20
25

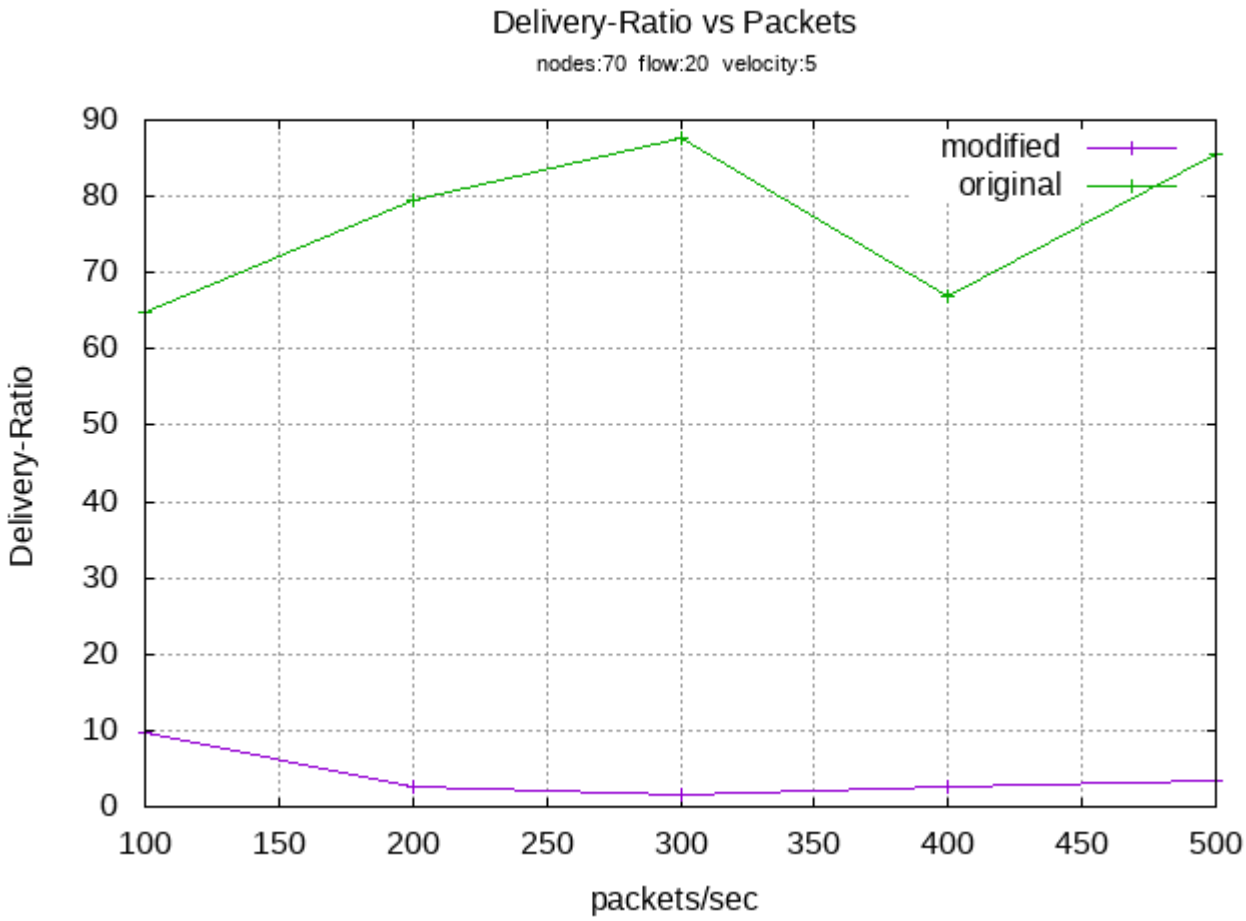

Delay vs Node
flow:20 packets/sec:200 velocity:5
Delay
node
modified
original
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
20
30
40
50
60
70
80
90
100

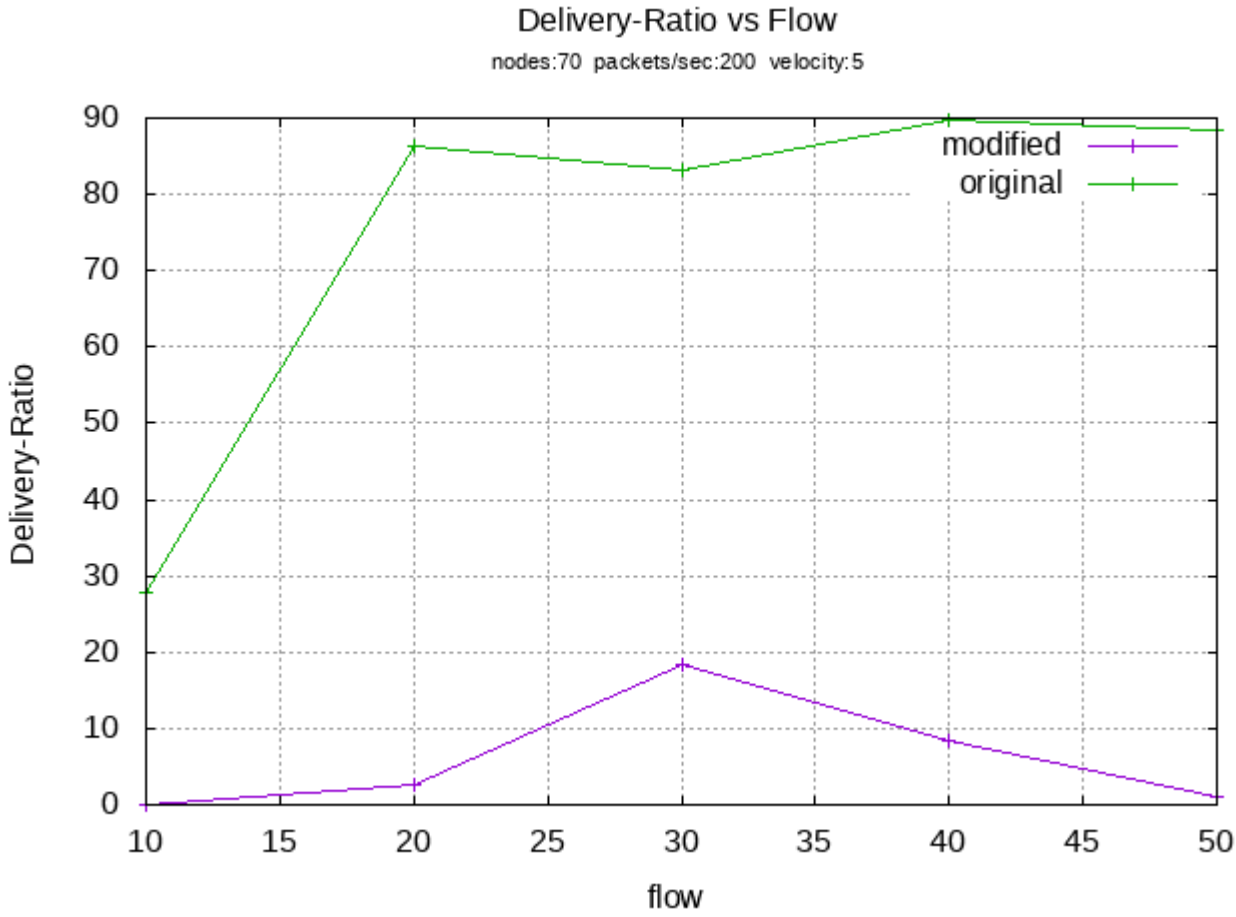

Delay vs Packets
nodes:70 flow:20 velocity:5
modified
original
dTlay
packets/sec
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
100
150
200
250
300
350
400
450
500


Delay vs Flow
nodes:70 packets/sec:200 velocity:5
delay
flow
modified
original
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
10
15
20
25
30
35
40
45
50

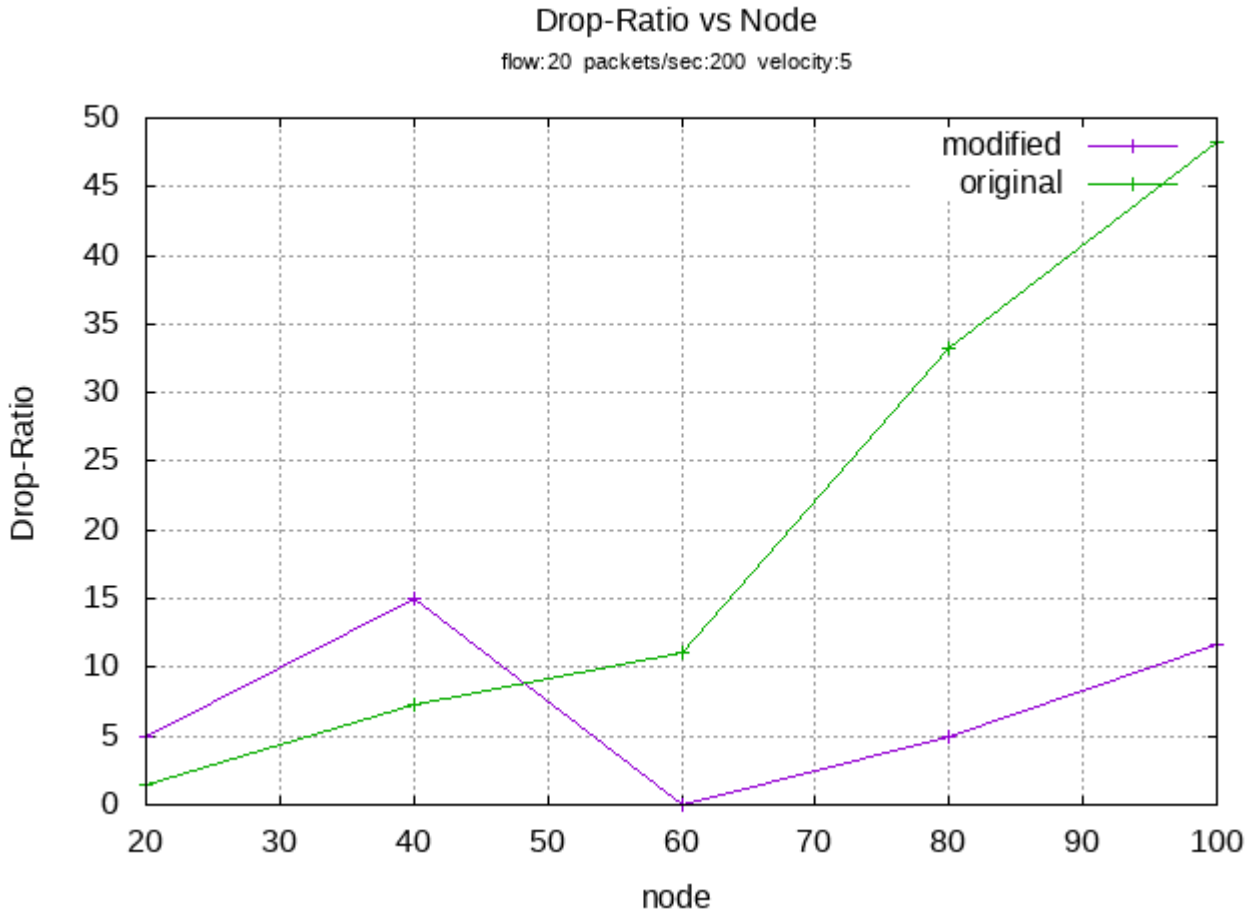

Delay vs Velocity
nodes:70 flow:20 packets/sec:200
delay
velocity
modified
original
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
5
10
15
20
25

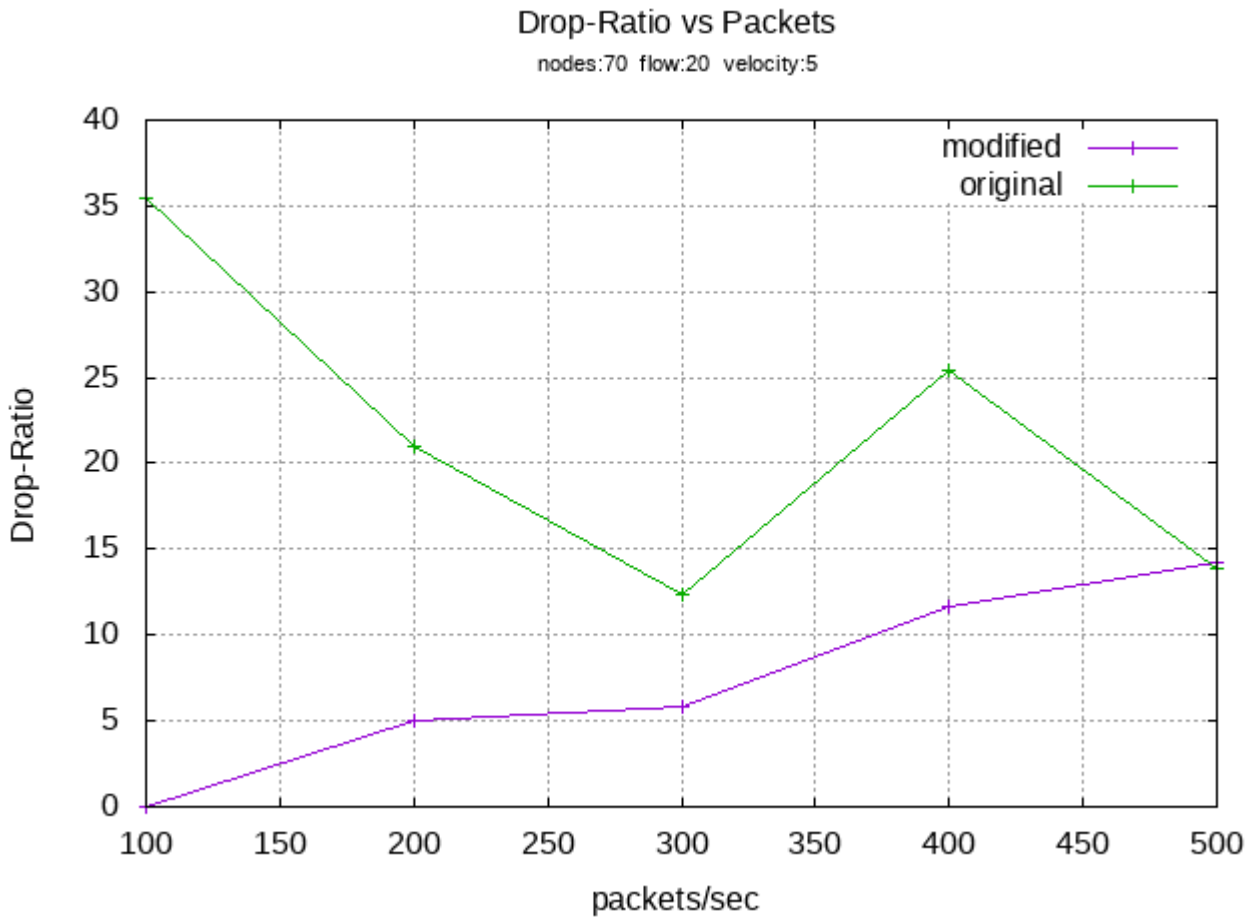

Delivery-Ratio vs Node
flow:20 packets/sec:200 velocity 5
Delivery-Ratio
node
modified
original
100
90
80
70
60
50
40
30
20
10
0
20
30
40
50
60
70
80
90
100

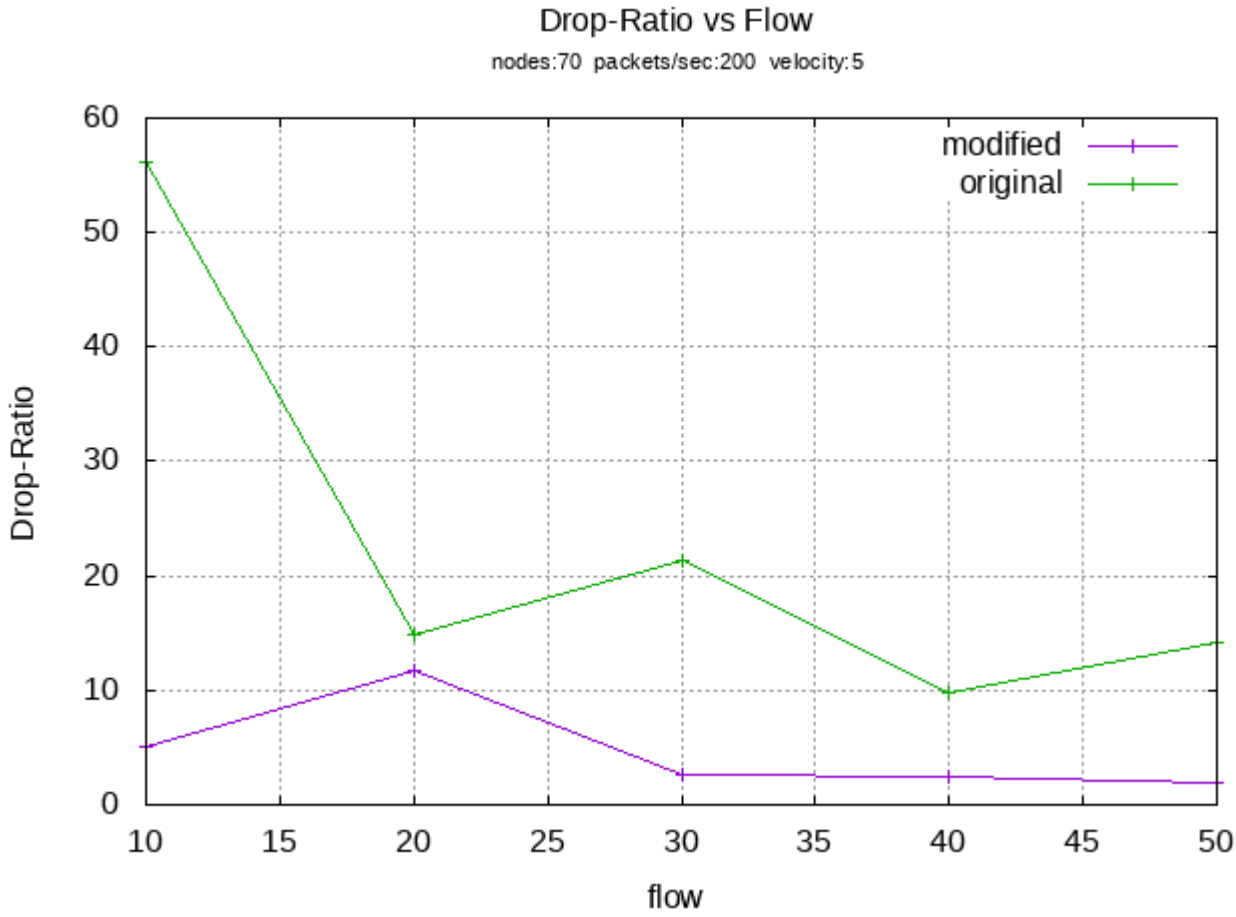

Delivery-Ratio vs Packets
nodes:70 flow:20 velocity:5
Delivery-Ratio
packets/sec
modified
original
0
10
20
30
40
50
60
70
80
90
100
150
200
250
300
350
400
450
500

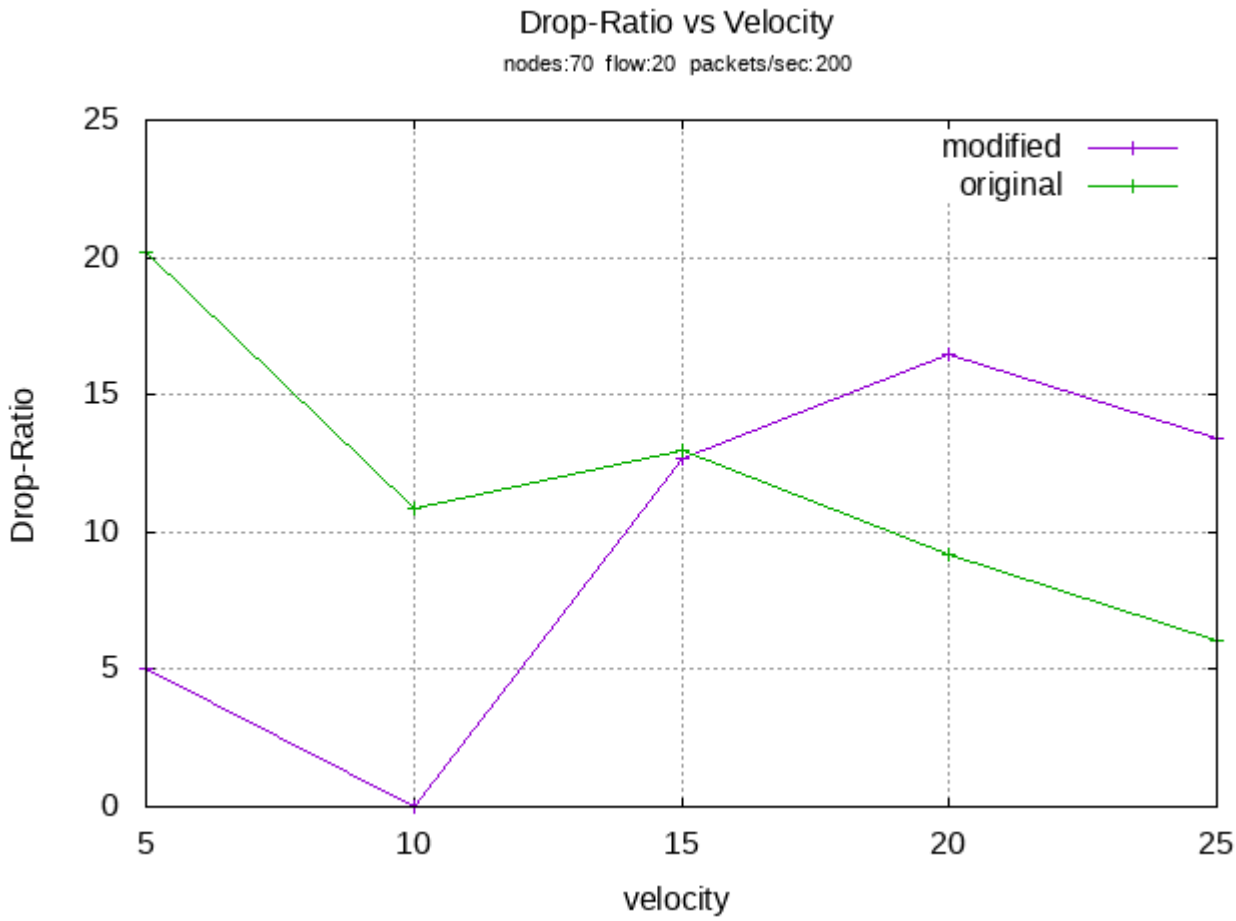

Delivery-Ratio vs Flow
nodes:70 packets/sec:200 velocity:5
Delivery-Ratio
flow
modified
original
0
10
20
30
40
50
60
70
80
90
10
15
20
25
30
35
40
45
50

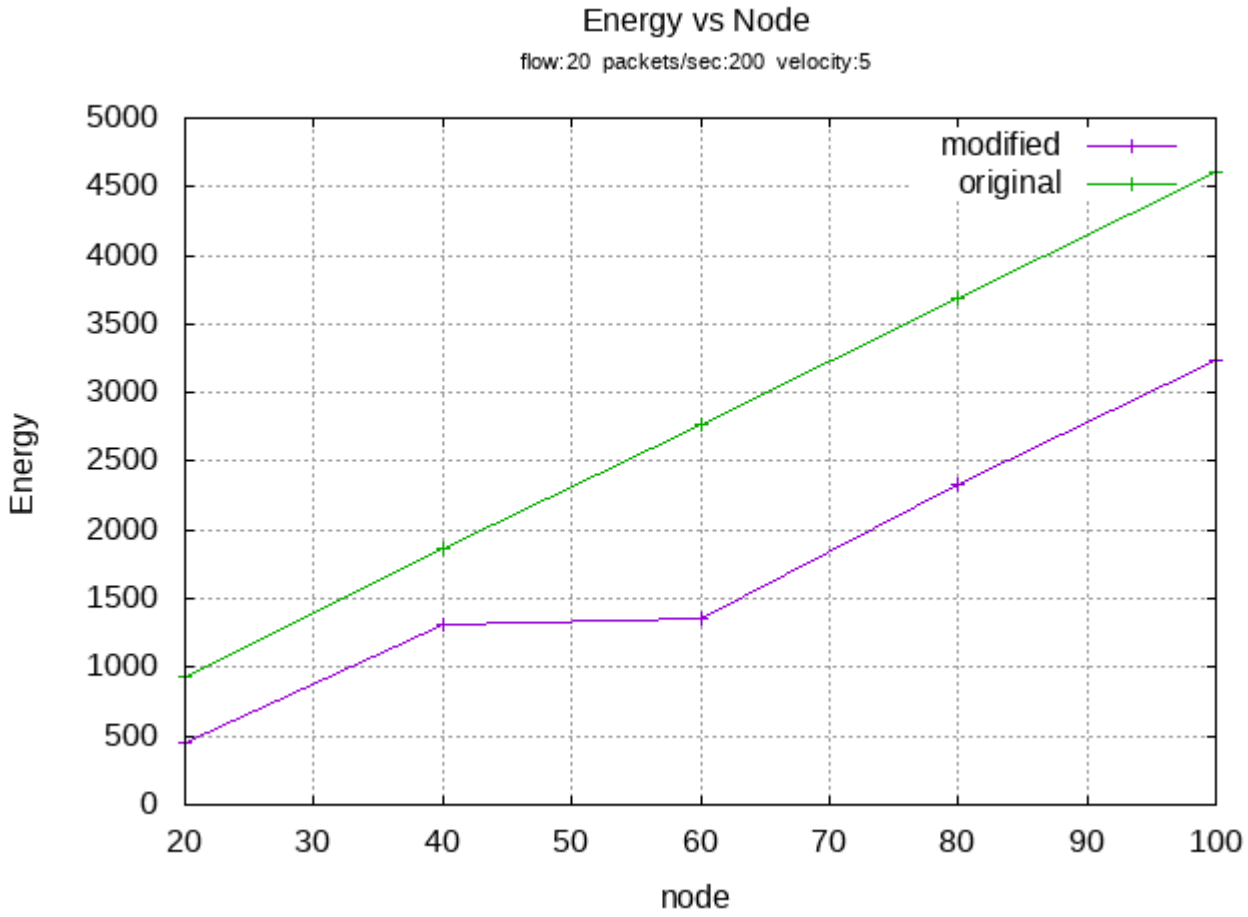
Delivery-Ratio vs Velocity
nodes:70 flow:20 packets/sec:200
Delivery-Ratio
velocity
modified
original
100
90
80
70
60
50
40
30
20
10
0
5
10
15
20
25

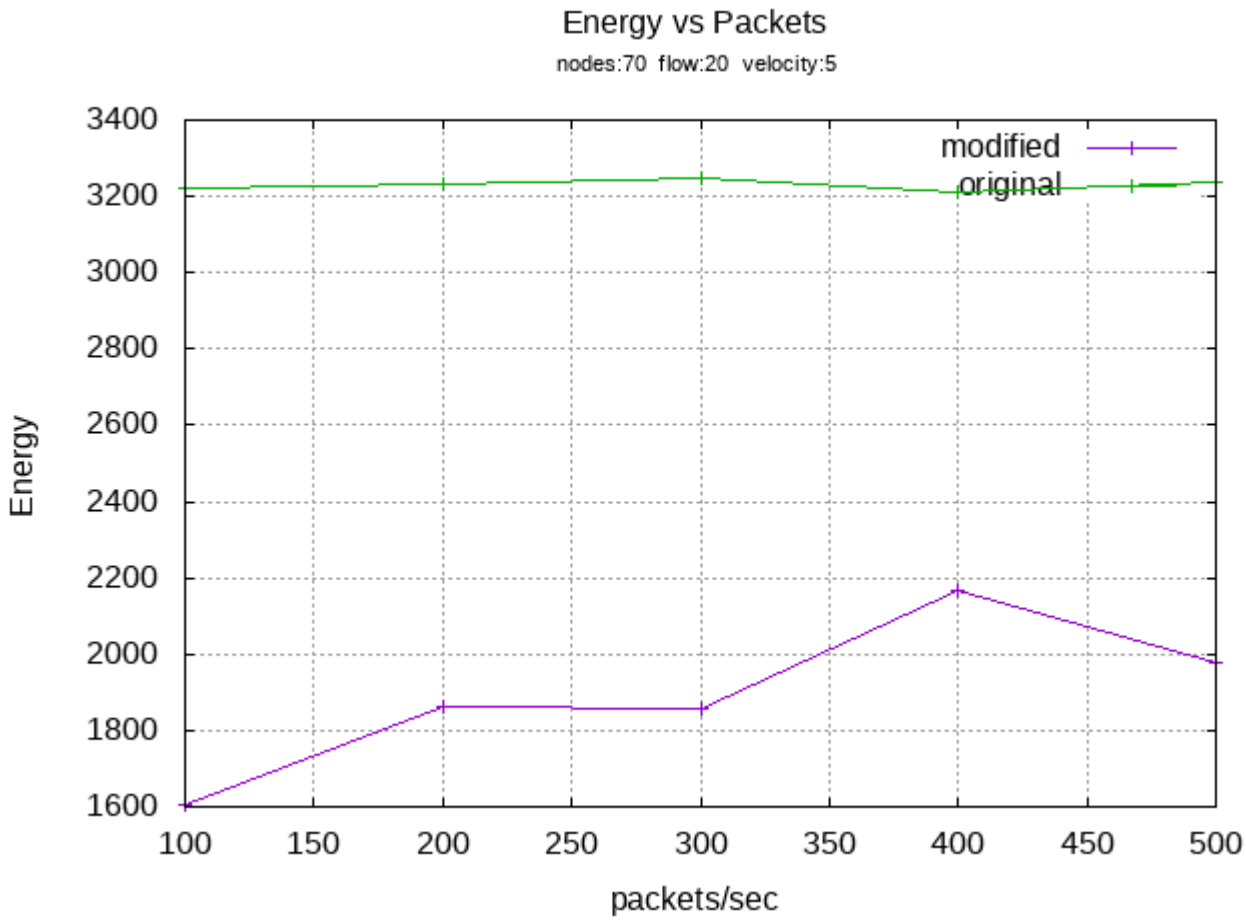

Drop-Ratio vs Node
flow:20 packets/sec:200 velocity:5
Drop-Ratio
node
modified
original
0
5
10
15
20
25
30
35
40
45
50
20
30
40
50
60
70
80
90
100

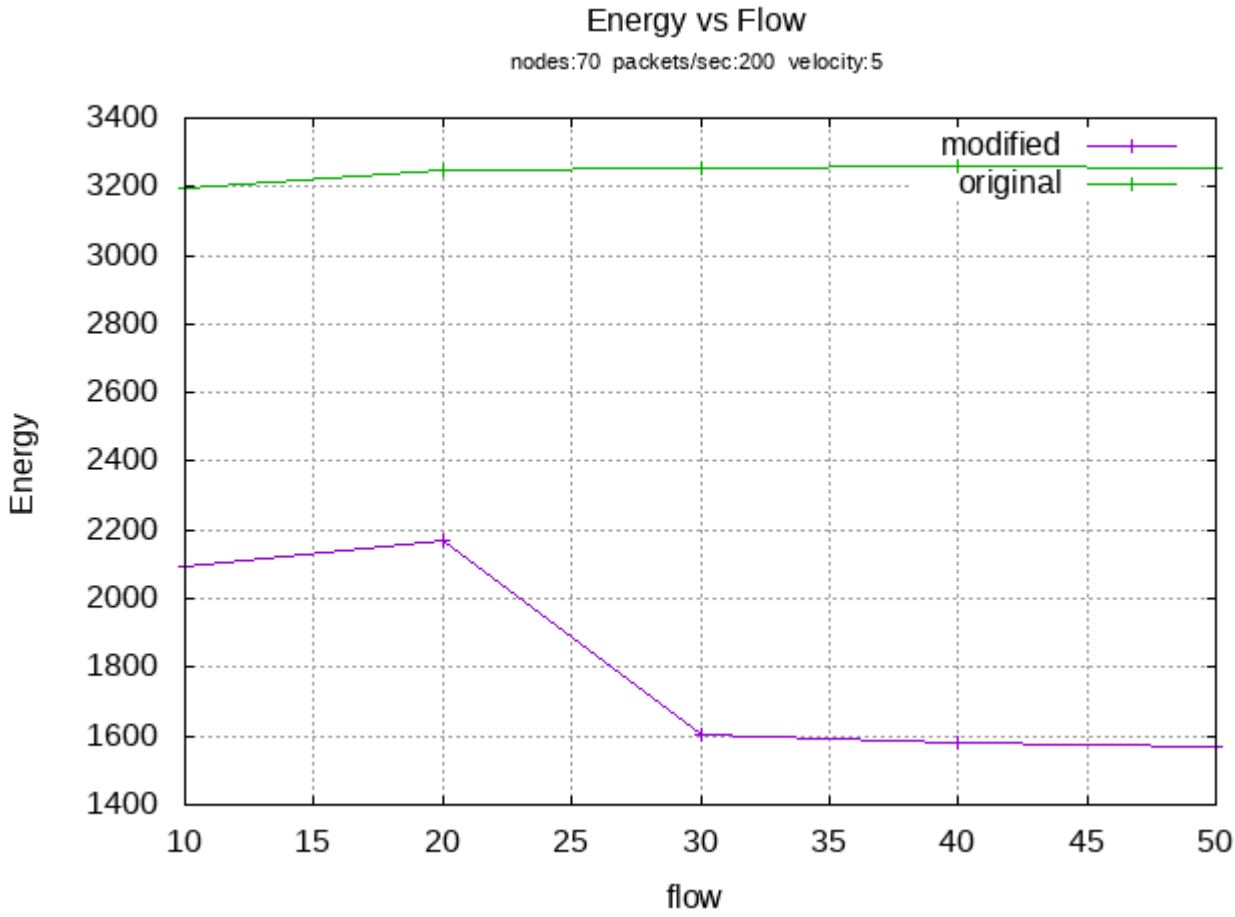

Drop-Ratio vs Packets
nodes:70 flow:20 velocity:5
Drop-Ratio
packets/sec
modified
original
0
5
10
15
20
25
30
35
40
100
150
200
250
300
350
400
450
500

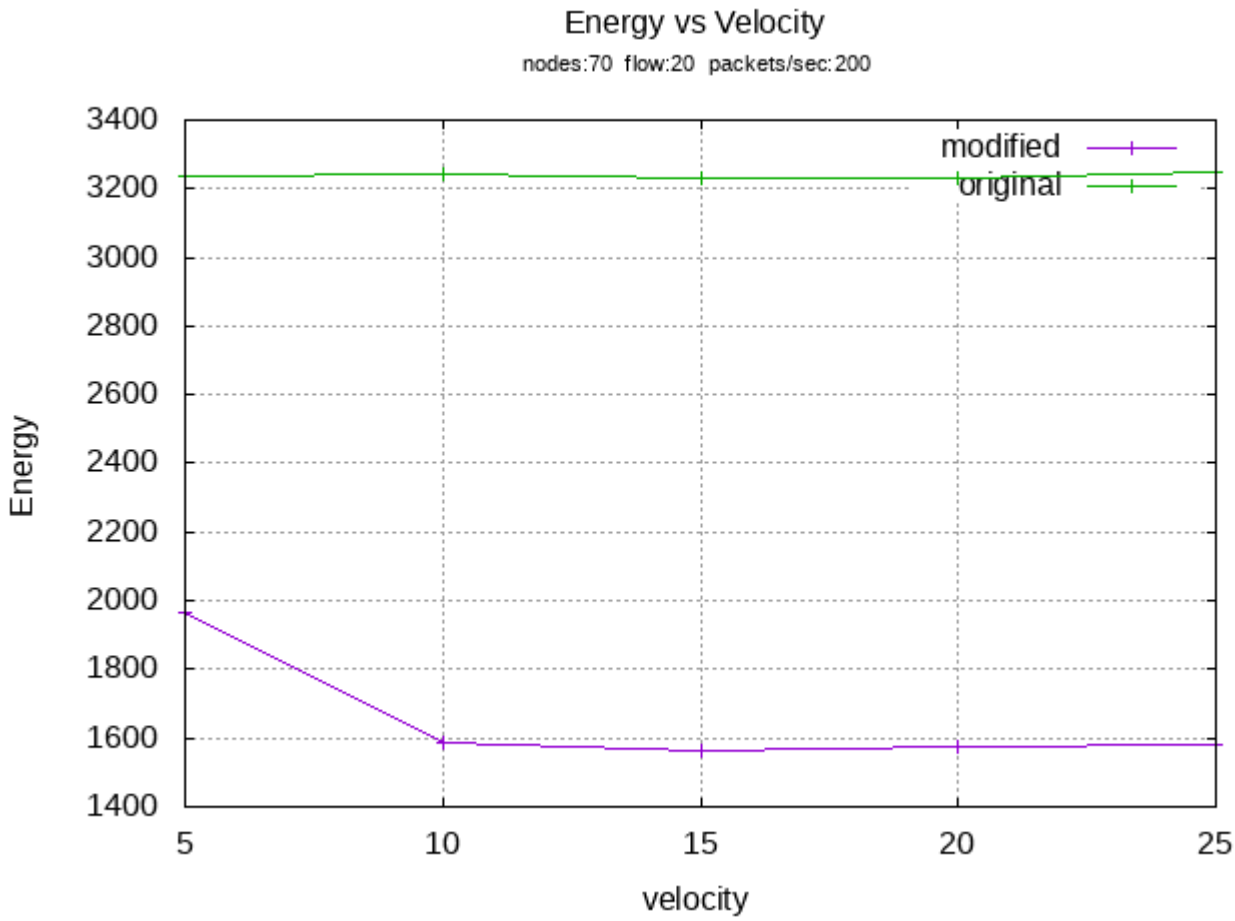

Drop-Ratio vs Flow
nodes:70 packets/sec:200 velocity:5
Drop-Ratio
flow
modified
original
60
50
40
30
20
10
0
10
15
20
25
30
35
40
45
50


Drop-Ratio vs Velocity
nodes:70 flow:20 packets/sec:200
Drop-Ratio
velocity
modified
original
0
5
10
15
20
25
5
10
15
20
25

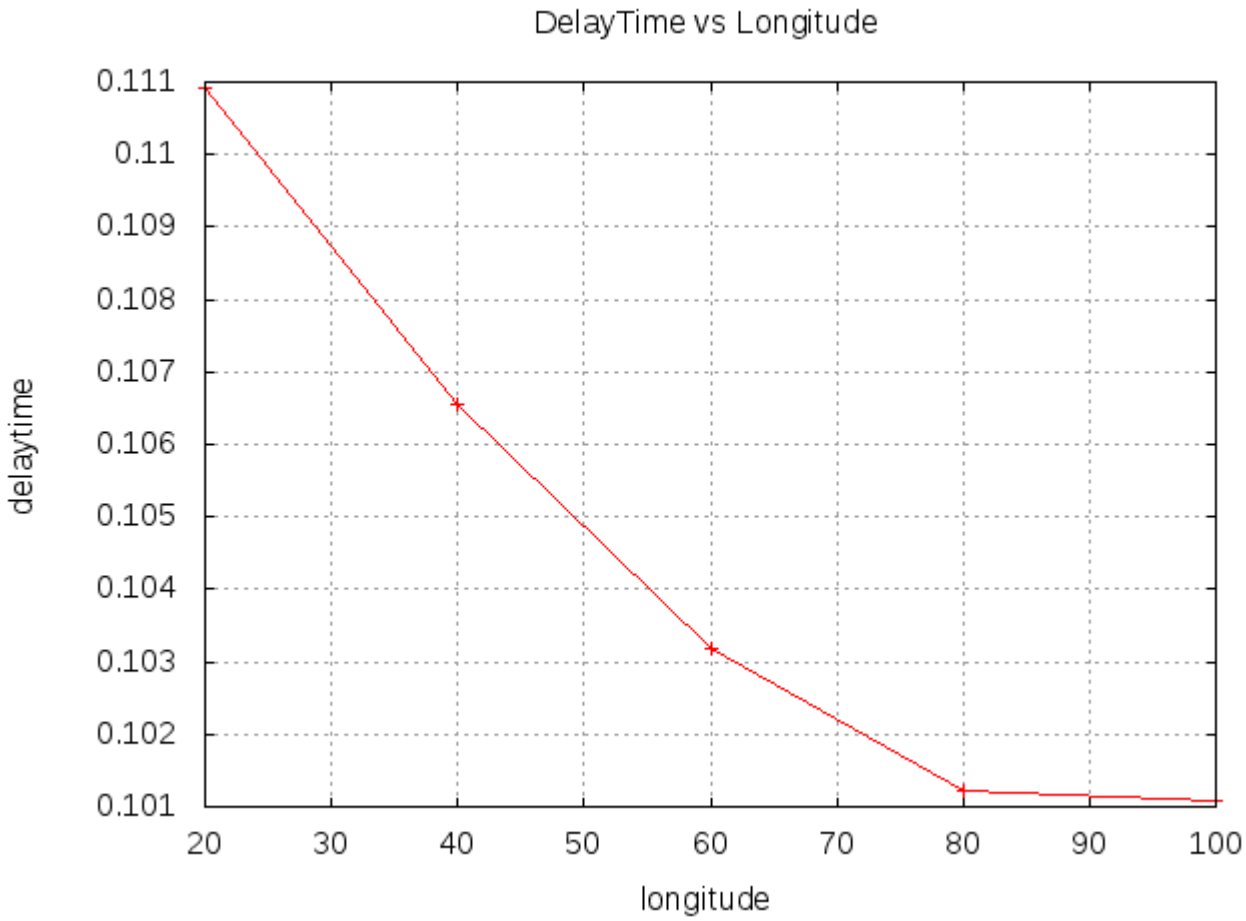

Energy vs Node
flow:20 packets/sec:200 velocity:5
Energy
node
modified
original
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
20
30
40
50
60
70
80
90
100


Energy vs Packets
nodes:70 flow:20 velocity:5
Energy
packets/sec
modified
original
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
100
150
200
250
300
350
400
450
500


Energy vs Flow
nodes:70 packets/sec:200 velocity:5
Energy
flow
modified
original
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
10
15
20
25
30
35
40
45
50


Energy vs Velocity
nodes:70 flow:20 packets/sec:200
Energy
velocity
modified
original
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
5
10
15
20
25

Satellite Topology


DelayTime vs Longitude
delaytime
longitude
0.111
0.11
0.109
0.108
0.107
0.106
0.105
0.104
0.103
0.102
0.101
20
30
40
50
60
70
80
90
100

Chapter 3

Summary

After analyzing the generated graphs, we can observe that:

- For higher no. of static nodes, the original protocol shows less throughput than the modified one, but for lower number of static nodes, the original one shows higher throughput.
- In case of the modified protocol, there is no significant change in throughput when flow is varied. For lower flow count, modified protocol shows higher throughput but for higher flow count, the original one shows higher throughput.
- After varying different parameters, the end-to-end delay is usually less in the modified protocol in all cases than the original protocol. That's might be because we have decreased channel time and slot time both.

- The modified protocol usually consumes more energy than the original protocol. Sometimes there is significant difference between the two.
- The delivery ratio in modified protocol is higher than the original protocol, in case of varying different parameters
- In case of static nodes, there is no change in outputs when no. of packets are varied, for both the modified and original protocol.
- The Energy consumption varies almost nearly linear with no. of nodes.
- If we use the modified MAC protocol with queue having random eviction, the characteristics change drastically. The drop ratio increases and as a result delivery ratio and throughput decreases. Moreover, average energy consumption also decreases.

References

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- http://www.isi.edu/nsnam/ns/index.html
- http://www.researchgate.net/publication/220405926_IEEE_80211b_Ad_Hoc_Networks_Performance_Measurements
- http://csie.nqu.edu.tw/smallko/ns2_old/mac2.pdf