

Linux: TC - bandwidth limitation, transmission error induction and delays

programmes used to take measurements:

- <https://man7.org/linux/man-pages/man8/tc.8.html>
- <https://github.com/tum-lkn/tcgui>

Connection diagram

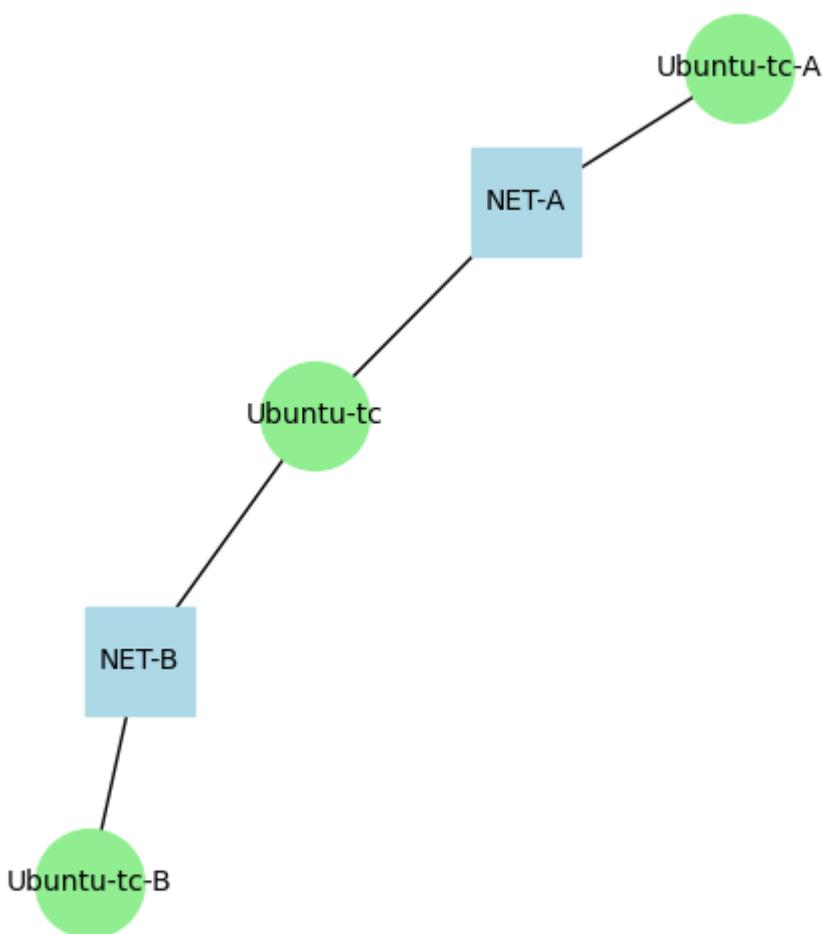


Diagram generated using [my script](#)

Machine name	Network card	ip address	gateway	Virtual switch
ubuntu-tc	eth0	192.168.1.1/24	X	NET-A
	eth1	192.168.2.1/24	X	NET-B
ubuntu-tc-A	eth0	192.168.1.10/24	192.168.1.1/24	NET-A
ubuntu-tc-B	eth0	192.168.2.10/24	192.168.2.1/24	NET-B

Settings on the "Ubuntu-tc" machine

- enable forwarding for ipv4

```
echo "net.ipv4.ip_forward=1" | sudo tee -a /etc/sysctl.conf
```

- restart the network interfaces
- copy tc-gui to machine and run

```
sudo apt install git
git clone https://github.com/tum-lkn/tcgui
cd tcgui
sudo python3 main.py --ip 127.0.0.1
```

- open firefox browser to address 127.0.0.1:5000

TCGUI - 4 Available Interfaces

eth0 (192.168.1.1)
eth1 (192.168.2.1)
eth2 (172.30.16.210)
lo (127.0.0.1)

eth0 (192.168.1.1)

Name	Current Value	New Value	Variance / Correlation	New Value
Rate	None	<input type="text"/> mbit		
Delay	None	<input type="text"/> ms	±None	± <input type="text"/> ms
Loss	None	<input type="text"/> %	None	<input type="text"/> %
Duplicate	None	<input type="text"/> %		
Reorder	None	<input type="text"/> %	None	<input type="text"/> %
Corrupt	None	<input type="text"/> %		
Limit	None	<input type="text"/>		

Settings on the rest of the machines

```
sudo apt-get update
sudo apt-get install iperf3
```

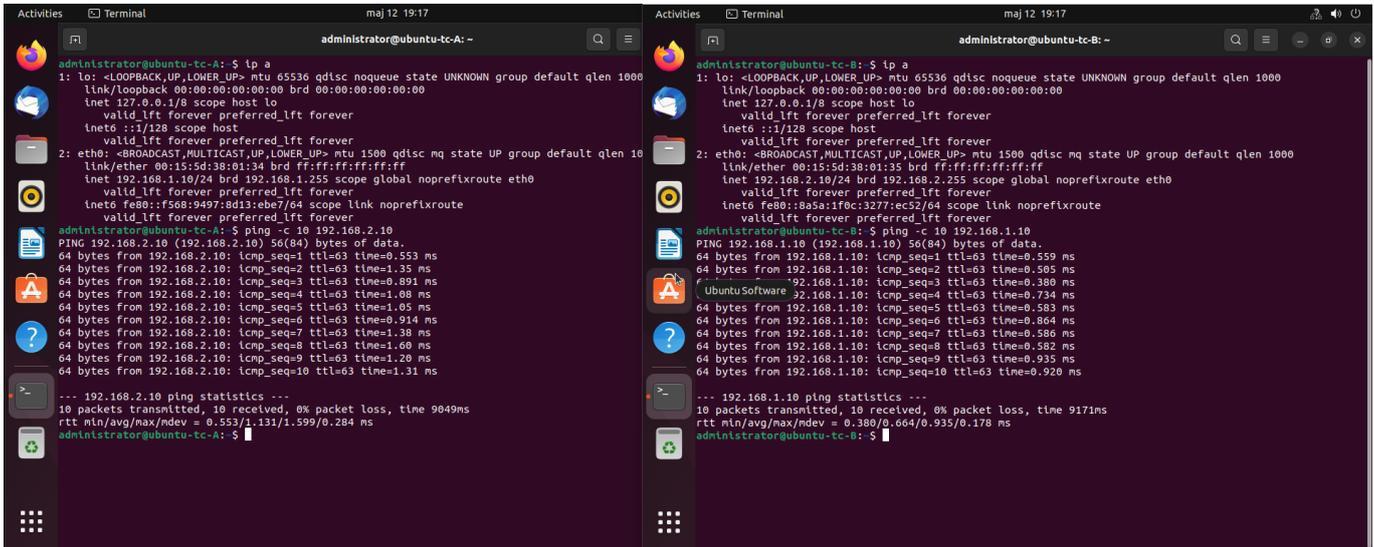
We still need to address them statically via the GUI or by using netplan

Test results table

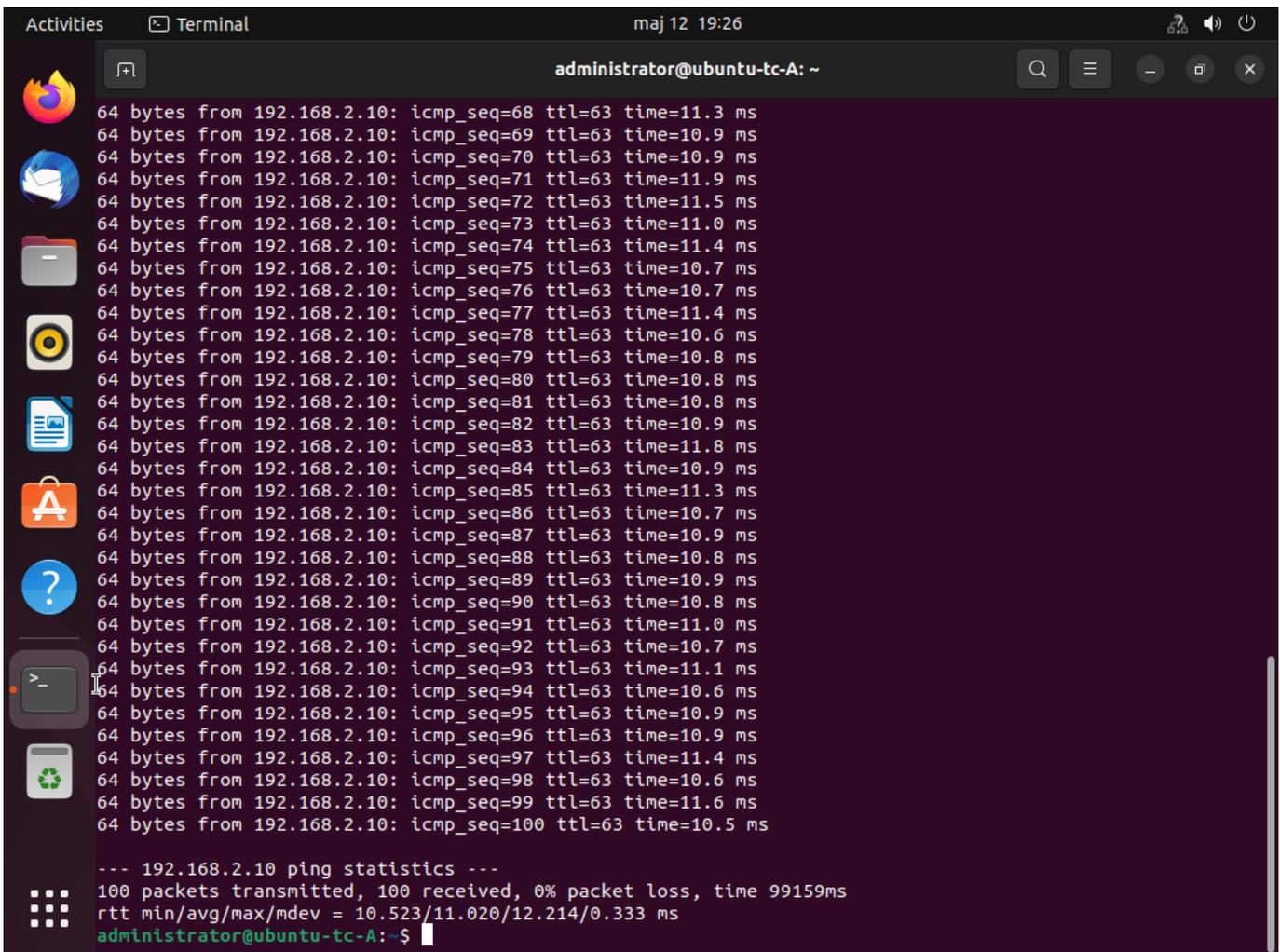
Test description	protocol	loss	bandwidth	delay [ms]
Delay tests				
Test without added delay	icmp	0%	—	1,131
Test with added 10ms delay result from 100 measurements	icmp	0%	—	11,020
test with added 100ms delay result from 100 measurements	icmp	0%	—	101,071
test with added 1000ms delay result from 100 measurements	icmp	0%	—	1000,911
UDP bandwidth tests				
	protocol	Lost/Sent	bandwidth	delay [ms]
Unlimited 30s test (UDP 1Gbps iperf)	UDP	—	998 Mbps	—
300Mbps 30s bandwidth limitation (UDP iperf)	UDP	72%	282 Mbps	—
Bandwidth limitation to 100Mbps 30s (UDP iperf)	UDP	91%	94.3 Mbps	—
10Mbps 30s bandwidth limitation (UDP iperf)	UDP	99%	9.72 Mbps	—
Bandwidth limitation to 1Mbps 30s (UDP iperf)	UDP	1e+02%	972 kbps	—
TCP bandwidth tests				
	protocol	retransmissions	bandwidth	delay [ms]
Unlimited 30s test (TCP iperf)	TCP	2	10.3 Gbps	—
Bandwidth limitation to 300Mbps 30s (TCP iperf)	TCP	0	282 Mbps	—
Bandwidth limitation to 100Mbps 30s (TCP iperf)	TCP	0	94.3 Mbps	—
Bandwidth limitation to 10Mbps 30s (TCP iperf)	TCP	152	9.72 Mbps	—
Bandwidth limitation to 1Mbps 30s (TCP iperf)	TCP	0	972 kbps	—
Other Tests				
Round trip link test 10Mbps, latency 2000ms, urata 3%, corrupted 10% (ping 100 measurements)	ICMP	24%	—	4001,69
10Mbps round trip link test, latency 600ms, loss 3%, corrupted 10% (TCP iperf)	TCP	23	82 kbps	—
10Mbps round trip link test, latency 600ms, loss 3%, faulty 10% (UDP iperf)	UDP	99%	7.79 kbps	—
60Mbps round trip link test, 600ms latency, 5% loss (UDP iperf)	UDP	98%	14.7 Mbps	—

Delay tests

Test without added delay

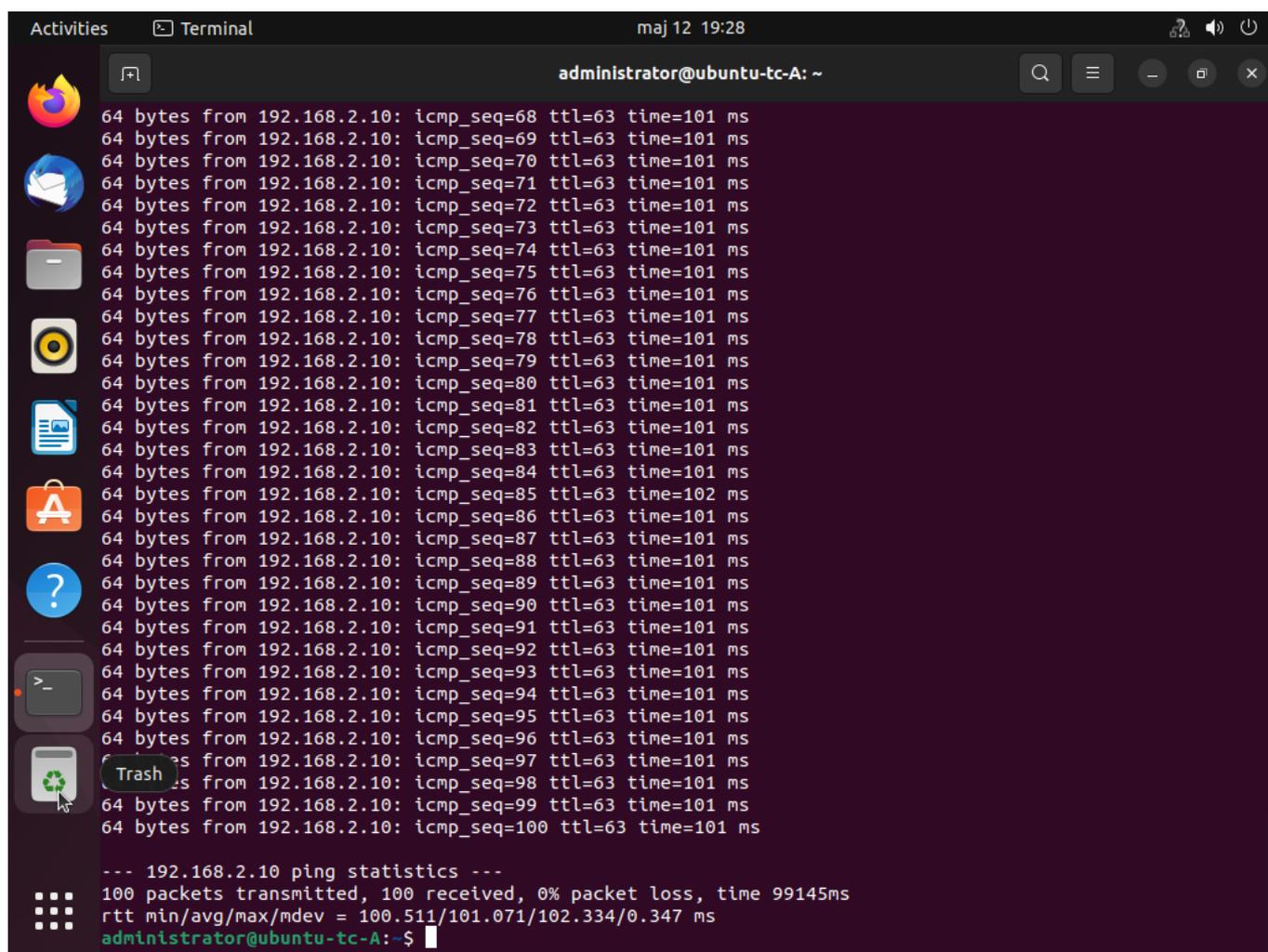


Test with added delay 10ms result from 100 measurements



test with an added delay of 100ms result from 100

measurements



```
64 bytes from 192.168.2.10: icmp_seq=68 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=69 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=70 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=71 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=72 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=73 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=74 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=75 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=76 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=77 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=78 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=79 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=80 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=81 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=82 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=83 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=84 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=85 ttl=63 time=102 ms
64 bytes from 192.168.2.10: icmp_seq=86 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=87 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=88 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=89 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=90 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=91 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=92 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=93 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=94 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=95 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=96 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=97 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=98 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=99 ttl=63 time=101 ms
64 bytes from 192.168.2.10: icmp_seq=100 ttl=63 time=101 ms

--- 192.168.2.10 ping statistics ---
100 packets transmitted, 100 received, 0% packet loss, time 99145ms
rtt min/avg/max/mdev = 100.511/101.071/102.334/0.347 ms
administrator@ubuntu-tc-A:~$
```

test with an added delay of 1000ms result from 100 measurements

```
64 bytes from 192.168.2.10: icmp_seq=68 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=69 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=70 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=71 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=72 ttl=63 time=1002 ms
64 bytes from 192.168.2.10: icmp_seq=73 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=74 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=75 ttl=63 time=1000 ms
64 bytes from 192.168.2.10: icmp_seq=76 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=77 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=78 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=79 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=80 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=81 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=82 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=83 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=84 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=85 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=86 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=87 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=88 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=89 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=90 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=91 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=92 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=93 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=94 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=95 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=96 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=97 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=98 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=99 ttl=63 time=1001 ms
64 bytes from 192.168.2.10: icmp_seq=100 ttl=63 time=1001 ms

--- 192.168.2.10 ping statistics ---
100 packets transmitted, 100 received, 0% packet loss, time 99107ms
rtt min/avg/max/mdev = 1000.494/1000.911/1001.730/0.261 ms
administrator@ubuntu-tc-A:~$
```

test with added delay of 5000ms result from 100 measurements

Bandwidth limitation test

Unlimited 30s test (UDP 1Gbps iperf)

```

[ ID ] Interval      Transfer      Btrate      Total Datagrams
[ 5 ] 0.00-1.00 sec  119 MBytes  999 Mb/s/sec  86279
[ 5 ] 1.00-2.00 sec  119 MBytes  1000 Mb/s/sec 86325
[ 5 ] 2.00-3.00 sec  119 MBytes  1000 Mb/s/sec 86322
[ 5 ] 3.00-4.00 sec  119 MBytes  1000 Mb/s/sec 86323
[ 5 ] 4.00-5.00 sec  119 MBytes  1.00 Gb/s/sec 86327
[ 5 ] 5.00-6.00 sec  119 MBytes  1.00 Gb/s/sec 86327
[ 5 ] 6.00-7.00 sec  119 MBytes  1000 Mb/s/sec 86329
[ 5 ] 7.00-8.00 sec  119 MBytes  1000 Mb/s/sec 86323
[ 5 ] 8.00-9.00 sec  119 MBytes  1.00 Gb/s/sec 86328
[ 5 ] 9.00-10.00 sec 119 MBytes  1000 Mb/s/sec 86326
[ 5 ] 10.00-11.00 sec 119 MBytes  1000 Mb/s/sec 86324
[ 5 ] 11.00-12.00 sec 119 MBytes  1.00 Gb/s/sec 86333
[ 5 ] 12.00-13.00 sec 119 MBytes  1.00 Gb/s/sec 86331
[ 5 ] 13.00-14.00 sec 119 MBytes  1000 Mb/s/sec 86319
[ 5 ] 14.00-15.00 sec 119 MBytes  1000 Mb/s/sec 86324
[ 5 ] 15.00-16.00 sec 119 MBytes  1.00 Gb/s/sec 86330
[ 5 ] 16.00-17.00 sec 119 MBytes  1000 Mb/s/sec 86321
[ 5 ] 17.00-18.00 sec 119 MBytes  1000 Mb/s/sec 86323
[ 5 ] 18.00-19.00 sec 119 MBytes  1.00 Gb/s/sec 86339
[ 5 ] 19.00-20.00 sec 119 MBytes  1.00 Gb/s/sec 86327
[ 5 ] 20.00-21.00 sec 119 MBytes  1000 Mb/s/sec 86321
[ 5 ] 21.00-22.00 sec 119 MBytes  1.00 Gb/s/sec 86329
[ 5 ] 22.00-23.00 sec 119 MBytes  1.00 Gb/s/sec 86331
[ 5 ] 23.00-24.00 sec 119 MBytes  1000 Mb/s/sec 86328
[ 5 ] 24.00-25.00 sec 119 MBytes  1000 Mb/s/sec 86326
[ 5 ] 25.00-26.00 sec 119 MBytes  1.00 Gb/s/sec 86328
[ 5 ] 26.00-27.00 sec 119 MBytes  1.00 Gb/s/sec 86326
[ 5 ] 27.00-28.00 sec 119 MBytes  1000 Mb/s/sec 86325
[ 5 ] 28.00-29.00 sec 119 MBytes  1.00 Gb/s/sec 86327
[ 5 ] 29.00-30.00 sec 119 MBytes  1000 Mb/s/sec 86325

[ ID ] Interval      Transfer      Btrate      Jitter      Lost/Total Datagrams
[ 5 ] 0.00-30.00 sec  3.49 GBytes  998 Mb/s/sec  0.002 ms  4048/2589728 (0.16%) sender
[ 5 ] 0.00-30.00 sec  3.49 GBytes  998 Mb/s/sec  0.002 ms  4048/2589728 (0.16%) receiver

iperf Done.
adminstrator@ubuntu-tc-A: ~$
  
```

Bandwidth limited to 300Mbps 30s (UDP iperf)

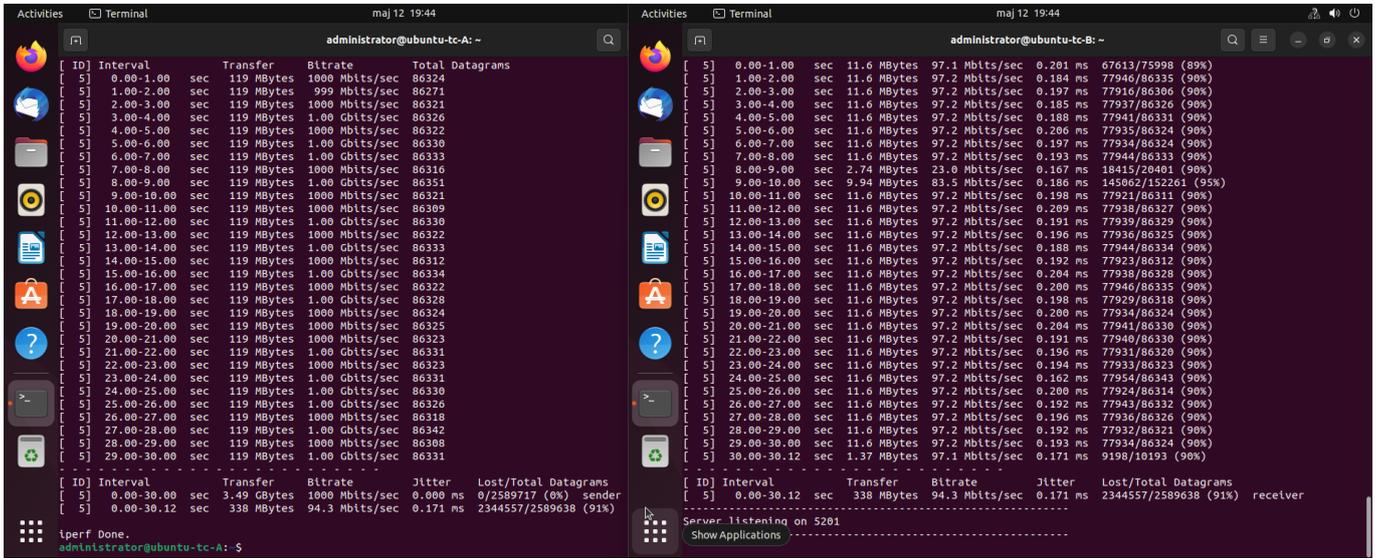
```

[ ID ] Interval      Transfer      Btrate      Total Datagrams
[ 5 ] 0.00-1.00 sec  119 MBytes  999 Mb/s/sec  86200
[ 5 ] 1.00-2.00 sec  119 MBytes  1.00 Gb/s/sec  86327
[ 5 ] 2.00-3.00 sec  119 MBytes  1000 Mb/s/sec  86324
[ 5 ] 3.00-4.00 sec  119 MBytes  1.00 Gb/s/sec  86328
[ 5 ] 4.00-5.00 sec  119 MBytes  1000 Mb/s/sec  86324
[ 5 ] 5.00-6.00 sec  119 MBytes  1000 Mb/s/sec  86325
[ 5 ] 6.00-7.00 sec  119 MBytes  1.00 Gb/s/sec  86341
[ 5 ] 7.00-8.00 sec  119 MBytes  1000 Mb/s/sec  86316
[ 5 ] 8.00-9.00 sec  119 MBytes  1.00 Gb/s/sec  86328
[ 5 ] 9.00-10.00 sec 119 MBytes  1000 Mb/s/sec  86321
[ 5 ] 10.00-11.00 sec 119 MBytes  1.00 Gb/s/sec  86332
[ 5 ] 11.00-12.00 sec 119 MBytes  1000 Mb/s/sec  86320
[ 5 ] 12.00-13.00 sec 119 MBytes  1.00 Gb/s/sec  86331
[ 5 ] 13.00-14.00 sec 119 MBytes  1000 Mb/s/sec  86322
[ 5 ] 14.00-15.00 sec 119 MBytes  1000 Mb/s/sec  86327
[ 5 ] 15.00-16.00 sec 119 MBytes  1000 Mb/s/sec  86325
[ 5 ] 16.00-17.00 sec 119 MBytes  1.00 Gb/s/sec  86330
[ 5 ] 17.00-18.00 sec 119 MBytes  1000 Mb/s/sec  86321
[ 5 ] 18.00-19.00 sec 119 MBytes  1.00 Gb/s/sec  86327
[ 5 ] 19.00-20.00 sec 119 MBytes  1.00 Gb/s/sec  86327
[ 5 ] 20.00-21.00 sec 119 MBytes  1.00 Gb/s/sec  86327
[ 5 ] 21.00-22.00 sec 119 MBytes  1.00 Gb/s/sec  86327
[ 5 ] 22.00-23.00 sec 119 MBytes  1000 Mb/s/sec  86322
[ 5 ] 23.00-24.00 sec 119 MBytes  1.00 Gb/s/sec  86332
[ 5 ] 24.00-25.00 sec 119 MBytes  1.00 Gb/s/sec  86330
[ 5 ] 25.00-26.00 sec 119 MBytes  1000 Mb/s/sec  86304
[ 5 ] 26.00-27.00 sec 119 MBytes  1000 Mb/s/sec  86321
[ 5 ] 27.00-28.00 sec 119 MBytes  1.00 Gb/s/sec  86337
[ 5 ] 28.00-29.00 sec 119 MBytes  1000 Mb/s/sec  86312
[ 5 ] 29.00-30.00 sec 119 MBytes  1.00 Gb/s/sec  86331

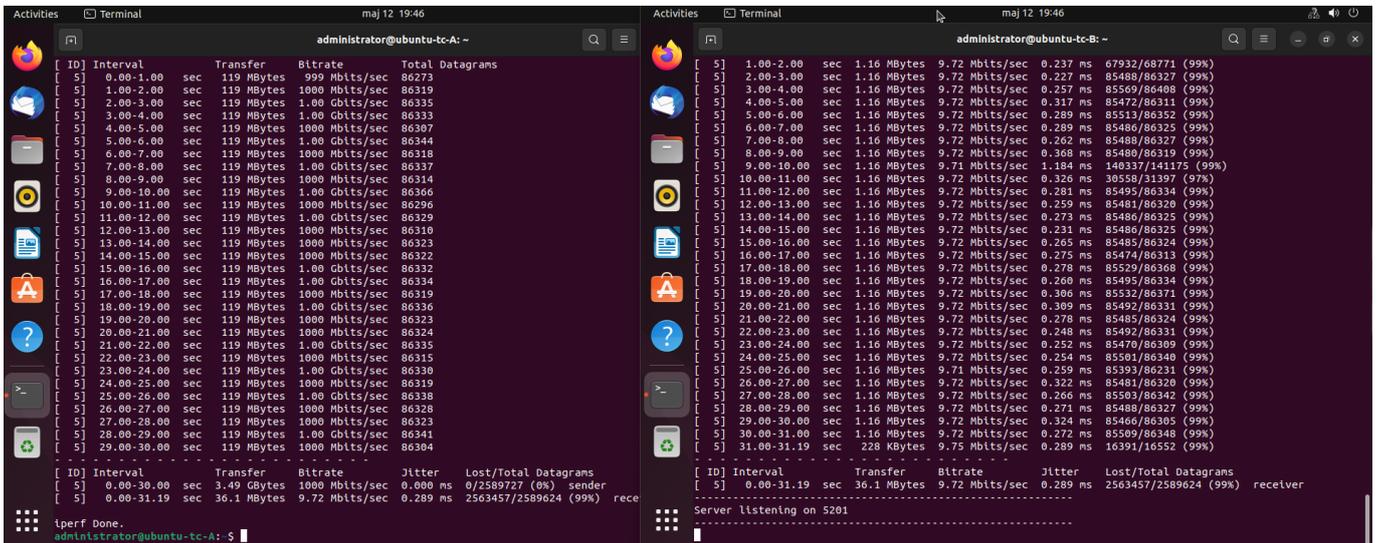
[ ID ] Interval      Transfer      Btrate      Jitter      Lost/Total Datagrams
[ 5 ] 0.00-30.00 sec  3.49 GBytes  282 Mb/s/sec  0.000 ms  0/2589717 (0%) sender
[ 5 ] 0.00-30.04 sec  1010 MBytes  282 Mb/s/sec  0.048 ms  1858455/2589708 (72%) receiver

iperf Done.
adminstrator@ubuntu-tc-A: ~$
  
```

Bandwidth limitation to 100Mbps 30s (UDP iperf)



Bandwidth limitation to 10Mbps 30s (UDP iperf)



Bandwidth limitation to 1Mbps 30s (UDP iperf)

```

[ 5] Interval      Transfer      Bitrate      Total  Datagrams
[ 5] 0.00-1.00 sec  119 MBytes   999 Mbts/sec 86272
[ 5] 1.00-2.00 sec  119 MBytes   1.00 gbts/sec 86345
[ 5] 2.00-3.00 sec  119 MBytes   1000 Mbts/sec 86309
[ 5] 3.00-4.00 sec  119 MBytes   1000 Mbts/sec 86314
[ 5] 4.00-5.00 sec  119 MBytes   1.00 gbts/sec 86338
[ 5] 5.00-6.00 sec  119 MBytes   1.00 gbts/sec 86346
[ 5] 6.00-7.00 sec  119 MBytes   1000 Mbts/sec 86305
[ 5] 7.00-8.00 sec  119 MBytes   1.00 gbts/sec 86336
[ 5] 8.00-9.00 sec  119 MBytes   1000 Mbts/sec 86322
[ 5] 9.00-10.00 sec 119 MBytes   1000 Mbts/sec 86321
[ 5] 10.00-11.00 sec 119 MBytes   1.00 gbts/sec 86335
[ 5] 11.00-12.00 sec 119 MBytes   1000 Mbts/sec 86316
[ 5] 12.00-13.00 sec 119 MBytes   1000 Mbts/sec 86326
[ 5] 13.00-14.00 sec 119 MBytes   1.00 gbts/sec 86326
[ 5] 14.00-15.00 sec 119 MBytes   1.00 gbts/sec 86327
[ 5] 15.00-16.00 sec 119 MBytes   1.00 gbts/sec 86326
[ 5] 16.00-17.00 sec 119 MBytes   1.00 gbts/sec 86361
[ 5] 17.00-18.00 sec 119 MBytes   1.00 gbts/sec 86336
[ 5] 18.00-19.00 sec 119 MBytes   1000 Mbts/sec 86289
[ 5] 19.00-20.00 sec 119 MBytes   1000 Mbts/sec 86325
[ 5] 20.00-21.00 sec 119 MBytes   1.00 gbts/sec 86317
[ 5] 21.00-22.00 sec 119 MBytes   1.00 gbts/sec 86328
[ 5] 22.00-23.00 sec 119 MBytes   1000 Mbts/sec 86323
[ 5] 23.00-24.00 sec 119 MBytes   1.00 gbts/sec 86328
[ 5] 24.00-25.00 sec 119 MBytes   1.00 gbts/sec 86336
[ 5] 25.00-26.00 sec 119 MBytes   1000 Mbts/sec 86320
[ 5] 26.00-27.00 sec 119 MBytes   1000 Mbts/sec 86301
[ 5] 27.00-28.00 sec 119 MBytes   1.00 gbts/sec 86368
[ 5] 28.00-29.00 sec 119 MBytes   1000 Mbts/sec 86302
[ 5] 29.00-30.00 sec 119 MBytes   1.00 gbts/sec 86340

[ 5] Interval      Transfer      Bitrate      Jitter    Lost/Total Datagrams
[ 5] 0.00-30.00 sec  3.49 GBytes  1000 Mbts/sec 0.000 ms  0/2589738 (0%) sender
[ 5] 0.00-41.92 sec  4.86 MBytes  972 kbts/sec  0.147 ms 2585788/2589304 (1e+02%) receiver

iperf Done.
administrator@ubuntu-tc-A: $
  
```

Unlimited test 30s (TCP iperf)

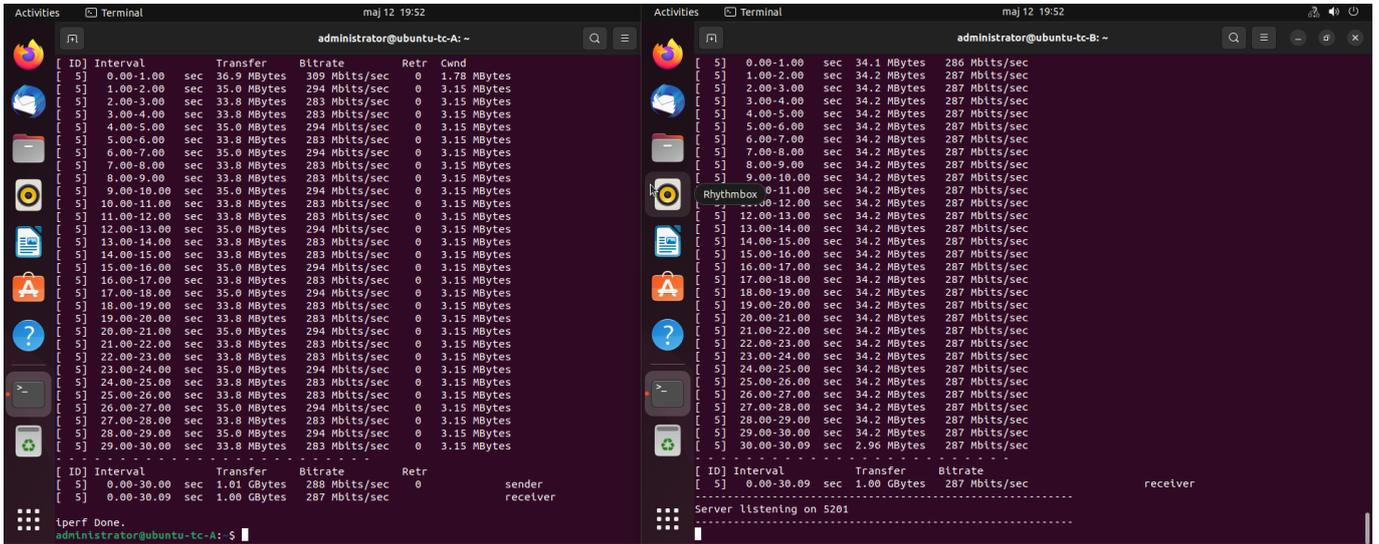
```

[ 5] Interval      Transfer      Bitrate      Retrans  Cwnd
[ 5] 0.00-1.00 sec  1.17 GBytes  10.8 gbts/sec 0 3.16 MBytes
[ 5] 1.00-2.00 sec  1.25 GBytes  10.8 gbts/sec 0 3.16 MBytes
[ 5] 2.00-3.00 sec  1.29 GBytes  11.1 gbts/sec 0 3.16 MBytes
[ 5] 3.00-4.00 sec  1.27 GBytes  10.9 gbts/sec 0 3.16 MBytes
[ 5] 4.00-5.00 sec  1.26 GBytes  10.9 gbts/sec 0 3.16 MBytes
[ 5] 5.00-6.00 sec  1.26 GBytes  10.8 gbts/sec 0 3.16 MBytes
[ 5] 6.00-7.00 sec  1.27 GBytes  10.9 gbts/sec 0 3.16 MBytes
[ 5] 7.00-8.00 sec  1.25 GBytes  10.7 gbts/sec 0 3.16 MBytes
[ 5] 8.00-9.00 sec  1.24 GBytes  10.7 gbts/sec 0 3.16 MBytes
[ 5] 9.00-10.00 sec 1.26 GBytes  10.8 gbts/sec 0 3.16 MBytes
[ 5] 10.00-11.00 sec 1.23 GBytes  10.5 gbts/sec 0 3.16 MBytes
[ 5] 11.00-12.00 sec 1.22 GBytes  10.4 gbts/sec 0 3.16 MBytes
[ 5] 12.00-13.00 sec 1.25 GBytes  10.7 gbts/sec 0 3.16 MBytes
[ 5] 13.00-14.00 sec 1.20 GBytes  10.3 gbts/sec 0 3.16 MBytes
[ 5] 14.00-15.00 sec 1.05 GBytes  9.01 gbts/sec 0 3.16 MBytes
[ 5] 15.00-16.00 sec 1.17 GBytes  10.0 gbts/sec 0 3.16 MBytes
[ 5] 16.00-17.00 sec 1.19 GBytes  10.2 gbts/sec 0 3.16 MBytes
[ 5] 17.00-18.00 sec 1.18 GBytes  10.1 gbts/sec 0 3.16 MBytes
[ 5] 18.00-19.00 sec 1.18 GBytes  10.1 gbts/sec 0 3.16 MBytes
[ 5] 19.00-20.00 sec 1.18 GBytes  10.1 gbts/sec 0 3.16 MBytes
[ 5] 20.00-21.00 sec 1.18 GBytes  10.1 gbts/sec 0 3.16 MBytes
[ 5] 21.00-22.00 sec 1.21 GBytes  10.4 gbts/sec 0 3.16 MBytes
[ 5] 22.00-23.00 sec 1.13 GBytes  9.73 gbts/sec 1 3.16 MBytes
[ 5] 23.00-24.00 sec 1.13 GBytes  9.60 gbts/sec 0 3.16 MBytes
[ 5] 24.00-25.00 sec 1.06 GBytes  9.08 gbts/sec 1 3.16 MBytes
[ 5] 25.00-26.00 sec 1.25 GBytes  10.7 gbts/sec 0 3.16 MBytes
[ 5] 26.00-27.00 sec 1.19 GBytes  10.2 gbts/sec 0 3.16 MBytes
[ 5] 27.00-28.00 sec 1.17 GBytes  10.1 gbts/sec 0 3.16 MBytes
[ 5] 28.00-29.00 sec 1.21 GBytes  10.4 gbts/sec 0 3.16 MBytes
[ 5] 29.00-30.00 sec 1.24 GBytes  10.6 gbts/sec 0 3.16 MBytes

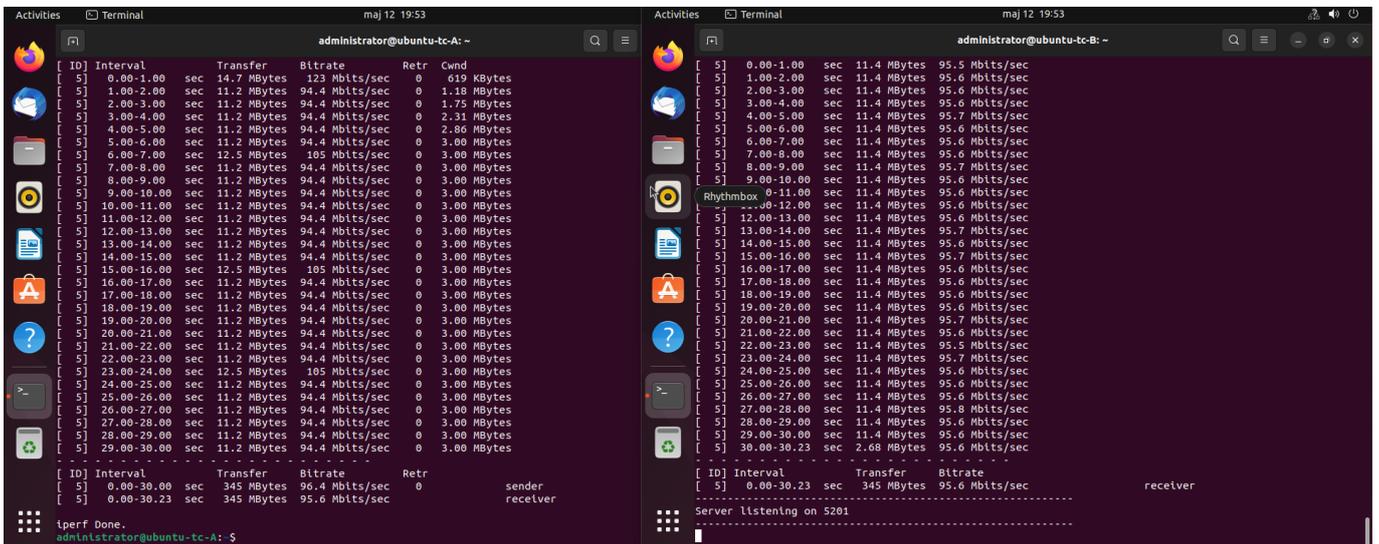
[ 5] Interval      Transfer      Bitrate      Retrans  Cwnd
[ 5] 0.00-30.00 sec  36.1 GBytes  10.3 gbts/sec 2
[ 5] 0.00-30.00 sec  36.1 GBytes  10.3 gbts/sec

iperf Done.
administrator@ubuntu-tc-A: $
  
```

Bandwidth restriction up to 300Mbps 30s (TCP iperf)



Bandwidth limitation to 100Mbps 30s (TCP iperf)



Bandwidth limitation to 10Mbps 30s (TCP iperf)

```

[ 5] 0.00-1.00 sec 2.26 MBytes 18.9 Mbits/sec 0 394 KBytes
[ 5] 1.00-2.00 sec 1.25 MBytes 10.5 Mbits/sec 0 352 KBytes
[ 5] 2.00-3.00 sec 1.48 MBytes 12.5 Mbits/sec 0 410 KBytes
[ 5] 3.00-4.00 sec 1.72 MBytes 14.4 Mbits/sec 0 468 KBytes
[ 5] 4.00-5.00 sec 1.01 MBytes 8.40 Mbits/sec 0 527 KBytes
[ 5] 5.00-6.00 sec 2.26 MBytes 18.9 Mbits/sec 0 585 KBytes
[ 5] 6.00-7.00 sec 1.25 MBytes 10.5 Mbits/sec 0 643 KBytes
[ 5] 7.00-8.00 sec 1.25 MBytes 10.5 Mbits/sec 0 703 KBytes
[ 5] 8.00-9.00 sec 1.25 MBytes 10.5 Mbits/sec 0 761 KBytes
[ 5] 9.00-10.00 sec 1.25 MBytes 10.5 Mbits/sec 0 819 KBytes
[ 5] 10.00-11.00 sec 0.00 Bytes 0.00 bits/sec 0 882 KBytes
[ 5] 11.00-12.00 sec 1.25 MBytes 10.5 Mbits/sec 0 1.00 MBytes
[ 5] 12.00-13.00 sec 1.25 MBytes 10.5 Mbits/sec 0 1.19 MBytes
[ 5] 13.00-14.00 sec 1.25 MBytes 10.5 Mbits/sec 0 1.42 MBytes
[ 5] 14.00-15.00 sec 1.25 MBytes 10.5 Mbits/sec 0 1.68 MBytes
[ 5] 15.00-16.00 sec 1.25 MBytes 10.5 Mbits/sec 0 1.97 MBytes
[ 5] 16.00-17.00 sec 1.25 MBytes 10.5 Mbits/sec 0 2.28 MBytes
[ 5] 17.00-18.00 sec 0.00 Bytes 0.00 bits/sec 0 2.66 MBytes
[ 5] 18.00-19.00 sec 1.25 MBytes 10.5 Mbits/sec 0 3.04 MBytes
[ 5] 19.00-20.00 sec 1.25 MBytes 10.5 Mbits/sec 0 3.10 MBytes
[ 5] 20.00-21.00 sec 1.25 MBytes 10.5 Mbits/sec 0 2.44 MBytes
[ 5] 21.00-22.00 sec 0.00 Bytes 0.00 bits/sec 144 1.08 MBytes
[ 5] 22.00-23.00 sec 2.50 MBytes 21.0 Mbits/sec 0 2.17 MBytes
[ 5] 23.00-24.00 sec 1.25 MBytes 10.5 Mbits/sec 0 2.22 MBytes
[ 5] 24.00-25.00 sec 1.25 MBytes 10.5 Mbits/sec 0 2.33 MBytes
[ 5] 25.00-26.00 sec 1.25 MBytes 10.5 Mbits/sec 0 2.46 MBytes
[ 5] 26.00-27.00 sec 1.25 MBytes 10.5 Mbits/sec 0 2.58 MBytes
[ 5] 27.00-28.00 sec 1.25 MBytes 10.5 Mbits/sec 0 2.69 MBytes
[ 5] 28.00-29.00 sec 0.00 Bytes 0.00 bits/sec 0 2.79 MBytes
[ 5] 29.00-30.00 sec 1.25 MBytes 10.5 Mbits/sec 0 2.86 MBytes
[ ID] Interval Transfer Bitrate Retr Cwnd
[ 5] 0.00-30.00 sec 36.2 MBytes 10.1 Mbits/sec 152 sender
[ 5] 0.00-31.70 sec 35.9 MBytes 9.49 Mbits/sec receiver
iperf Done.
administrator@ubuntu-tc-A:~$

```

```

[ 5] 1.00-2.00 sec 1.14 MBytes 9.56 Mbits/sec
[ 5] 2.00-3.00 sec 1.14 MBytes 9.58 Mbits/sec
[ 5] 3.00-4.00 sec 1.14 MBytes 9.56 Mbits/sec
[ 5] 4.00-5.00 sec 1.14 MBytes 9.56 Mbits/sec
[ 5] 5.00-6.00 sec 1.14 MBytes 9.57 Mbits/sec
[ 5] 6.00-7.00 sec 1.14 MBytes 9.58 Mbits/sec
[ 5] 7.00-8.00 sec 1.14 MBytes 9.58 Mbits/sec
[ 5] 8.00-9.00 sec 1.14 MBytes 9.56 Mbits/sec
[ 5] 9.00-10.00 sec 1.14 MBytes 9.58 Mbits/sec
[ 5] 10.00-11.00 sec 1.14 MBytes 9.55 Mbits/sec
[ 5] 11.00-12.00 sec 1.14 MBytes 9.58 Mbits/sec
[ 5] 12.00-13.00 sec 1.14 MBytes 9.56 Mbits/sec
[ 5] 13.00-14.00 sec 1.14 MBytes 9.58 Mbits/sec
[ 5] 14.00-15.00 sec 1.14 MBytes 9.55 Mbits/sec
[ 5] 15.00-16.00 sec 1.14 MBytes 9.58 Mbits/sec
[ 5] 16.00-17.00 sec 1.14 MBytes 9.58 Mbits/sec
[ 5] 17.00-18.00 sec 1.14 MBytes 9.55 Mbits/sec
[ 5] 18.00-19.00 sec 1.14 MBytes 9.58 Mbits/sec
[ 5] 19.00-20.00 sec 1.14 MBytes 9.56 Mbits/sec
[ 5] 20.00-21.00 sec 837 KBytes 6.86 Mbits/sec
[ 5] 21.00-22.00 sec 0.00 Bytes 0.00 bits/sec
[ 5] 22.00-23.00 sec 2.60 MBytes 21.9 Mbits/sec
[ 5] 23.00-24.00 sec 1.14 MBytes 9.53 Mbits/sec
[ 5] 24.00-25.00 sec 1.14 MBytes 9.58 Mbits/sec
[ 5] 25.00-26.00 sec 1.14 MBytes 9.58 Mbits/sec
[ 5] 26.00-27.00 sec 1.14 MBytes 9.56 Mbits/sec
[ 5] 27.00-28.00 sec 1.14 MBytes 9.56 Mbits/sec
[ 5] 28.00-29.00 sec 1.14 MBytes 9.58 Mbits/sec
[ 5] 29.00-30.00 sec 1.14 MBytes 9.56 Mbits/sec
[ 5] 30.00-31.00 sec 1.14 MBytes 9.57 Mbits/sec
[ 5] 31.00-31.70 sec 537 KBytes 6.33 Mbits/sec
[ ID] Interval Transfer Bitrate
[ 5] 0.00-31.70 sec 35.9 MBytes 9.49 Mbits/sec receiver
Server listening on 5201

```

Bandwidth limitation to 1Mbps 30s (TCP iperf)

```

[ 5] 0.00-1.00 sec 379 KBytes 3.10 Mbits/sec 0 56.6 KBytes
[ 5] 1.00-2.00 sec 146 KBytes 1.19 Mbits/sec 0 62.2 KBytes
[ 5] 2.00-3.00 sec 182 KBytes 1.49 Mbits/sec 0 67.9 KBytes
[ 5] 3.00-4.00 sec 182 KBytes 1.49 Mbits/sec 0 74.9 KBytes
[ 5] 4.00-5.00 sec 243 KBytes 1.99 Mbits/sec 0 91.9 KBytes
[ 5] 5.00-6.00 sec 0.00 Bytes 0.00 bits/sec 0 123 KBytes
[ 5] 6.00-7.00 sec 304 KBytes 2.49 Mbits/sec 0 164 KBytes
[ 5] 7.00-8.00 sec 365 KBytes 2.99 Mbits/sec 0 222 KBytes
[ 5] 8.00-9.00 sec 406 KBytes 3.98 Mbits/sec 0 280 KBytes
[ 5] 9.00-10.00 sec 609 KBytes 5.48 Mbits/sec 0 339 KBytes
[ 5] 10.00-11.00 sec 0.00 Bytes 0.00 bits/sec 0 397 KBytes
[ 5] 11.00-12.00 sec 912 KBytes 7.48 Mbits/sec 0 455 KBytes
[ 5] 12.00-13.00 sec 0.00 Bytes 0.00 bits/sec 0 515 KBytes
[ 5] 13.00-14.00 sec 0.00 Bytes 0.00 bits/sec 0 573 KBytes
[ 5] 14.00-15.00 sec 1.19 MBytes 9.97 Mbits/sec 0 631 KBytes
[ 5] 15.00-16.00 sec 0.00 Bytes 0.00 bits/sec 0 689 KBytes
[ 5] 16.00-17.00 sec 0.00 Bytes 0.00 bits/sec 0 748 KBytes
[ 5] 17.00-18.00 sec 0.00 Bytes 0.00 bits/sec 0 806 KBytes
[ 5] 18.00-19.00 sec 0.00 Bytes 0.00 bits/sec 0 864 KBytes
[ 5] 19.00-20.00 sec 0.00 Bytes 0.00 bits/sec 0 922 KBytes
[ 5] 20.00-21.00 sec 0.00 Bytes 0.00 bits/sec 0 980 KBytes
[ 5] 21.00-22.00 sec 0.00 Bytes 0.00 bits/sec 0 1.01 MBytes
[ 5] 22.00-23.00 sec 0.00 Bytes 0.00 bits/sec 0 1.07 MBytes
[ 5] 23.00-24.00 sec 0.00 Bytes 0.00 bits/sec 0 1.13 MBytes
[ 5] 24.00-25.00 sec 0.00 Bytes 0.00 bits/sec 0 1.19 MBytes
[ 5] 25.00-26.00 sec 1.25 MBytes 10.5 Mbits/sec 0 1.24 MBytes
[ 5] 26.00-27.00 sec 0.00 Bytes 0.00 bits/sec 0 1.30 MBytes
[ 5] 27.00-28.00 sec 0.00 Bytes 0.00 bits/sec 0 1.36 MBytes
[ 5] 28.00-29.00 sec 0.00 Bytes 0.00 bits/sec 0 1.41 MBytes
[ 5] 29.00-30.00 sec 0.00 Bytes 0.00 bits/sec 0 1.46 MBytes
[ ID] Interval Transfer Bitrate Retr
[ 5] 0.00-30.00 sec 6.22 MBytes 1.74 Mbits/sec 0 sender
[ 5] 0.00-42.59 sec 4.86 MBytes 956 Kbits/sec receiver
iperf Done.
administrator@ubuntu-tc-A:~$

```

```

[ 5] 12.00-13.00 sec 119 KBytes 973 kbits/sec
[ 5] 13.00-14.00 sec 116 KBytes 950 kbits/sec
[ 5] 14.00-15.00 sec 116 KBytes 950 kbits/sec
[ 5] 15.00-16.00 sec 116 KBytes 950 kbits/sec
[ 5] 16.00-17.00 sec 119 KBytes 973 kbits/sec
[ 5] 17.00-18.00 sec 115 KBytes 938 kbits/sec
[ 5] 18.00-19.00 sec 119 KBytes 973 kbits/sec
[ 5] 19.00-20.00 sec 116 KBytes 950 kbits/sec
[ 5] 20.00-21.00 sec 116 KBytes 950 kbits/sec
[ 5] 21.00-22.00 sec 119 KBytes 973 kbits/sec
[ 5] 22.00-23.00 sec 116 KBytes 950 kbits/sec
[ 5] 23.00-24.00 sec 116 KBytes 950 kbits/sec
[ 5] 24.00-25.00 sec 116 KBytes 950 kbits/sec
[ 5] 25.00-26.00 sec 119 KBytes 973 kbits/sec
[ 5] 26.00-27.00 sec 116 KBytes 950 kbits/sec
[ 5] 27.00-28.00 sec 116 KBytes 950 kbits/sec
[ 5] 28.00-29.00 sec 119 KBytes 973 kbits/sec
[ 5] 29.00-30.00 sec 115 KBytes 938 kbits/sec
[ 5] 30.00-31.00 sec 119 KBytes 973 kbits/sec
[ 5] 31.00-32.00 sec 116 KBytes 950 kbits/sec
[ 5] 32.00-33.00 sec 116 KBytes 950 kbits/sec
[ 5] 33.00-34.00 sec 119 KBytes 973 kbits/sec
[ 5] 34.00-35.00 sec 116 KBytes 950 kbits/sec
[ 5] 35.00-36.00 sec 116 KBytes 950 kbits/sec
[ 5] 36.00-37.00 sec 116 KBytes 950 kbits/sec
[ 5] 37.00-38.00 sec 119 KBytes 973 kbits/sec
[ 5] 38.00-39.00 sec 116 KBytes 950 kbits/sec
[ 5] 39.00-40.00 sec 116 KBytes 950 kbits/sec
[ 5] 40.00-41.00 sec 116 KBytes 950 kbits/sec
[ 5] 41.00-42.00 sec 119 KBytes 973 kbits/sec
[ 5] 42.00-42.59 sec 69.3 KBytes 964 kbits/sec
[ ID] Interval Transfer Bitrate
[ 5] 0.00-42.59 sec 4.86 MBytes 956 Kbits/sec receiver
Server listening on 5201

```

Round trip link test 10Mbps, latency 2000ms, urata 3%, faulty 10% (ping 100 measurements)

```

Activities Terminal maj 12 20:04 administrator@ubuntu-tc-A: ~
64 bytes from 192.168.2.10: icmp_seq=57 ttl=63 time=4002 ms
64 bytes from 192.168.2.10: icmp_seq=58 ttl=63 time=4002 ms
64 bytes from 192.168.2.10: icmp_seq=59 ttl=63 time=4003 ms
64 bytes from 192.168.2.10: icmp_seq=60 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=61 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=62 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=64 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=65 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=66 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=67 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=68 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=70 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=71 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=72 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=73 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=74 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=76 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=78 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=82 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=84 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=85 ttl=63 time=4002 ms
64 bytes from 192.168.2.10: icmp_seq=86 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=87 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=88 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=89 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=90 ttl=63 time=4002 ms
64 bytes from 192.168.2.10: icmp_seq=91 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=93 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=94 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=97 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=98 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=99 ttl=63 time=4001 ms
64 bytes from 192.168.2.10: icmp_seq=100 ttl=63 time=4001 ms

--- 192.168.2.10 ping statistics ---
100 packets transmitted, 76 received, 24% packet loss, time 99542ms
rtt min/avg/max/mdev = 4000.690/4001.120/4002.574/0.383 ms, pipe 5
administrator@ubuntu-tc-A:~$

```

10Mbps round trip link test, latency 600ms, loss 3%, corrupted 10% (TCP iperf)

```

Activities Terminal maj 12 20:06 administrator@ubuntu-tc-A: ~
[ ID] Interval      Transfer  Bitrate      Retr  Cwnd
[ 5] 0.00-1.20    sec 102 KBytes  695 Kbits/sec  1 14.1 KBytes
[ 5] 1.20-2.00    sec 0.00 Bytes  0.00 bits/sec  0 28.3 KBytes
[ 5] 2.00-3.00    sec 93.3 KBytes 706 Kbits/sec  0 28.3 KBytes
[ 5] 3.00-4.00    sec 0.00 Bytes  0.00 bits/sec  3 32.5 KBytes
[ 5] 4.00-5.00    sec 0.00 Bytes  0.00 bits/sec  1 22.6 KBytes
[ 5] 5.00-6.00    sec 0.00 Bytes  0.00 bits/sec  0 22.6 KBytes
[ 5] 6.00-7.00    sec 0.00 Bytes  0.00 bits/sec  1 28.3 KBytes
[ 5] 7.00-8.00    sec 0.00 Bytes  0.00 bits/sec  2 21.2 KBytes
[ 5] 8.00-9.00    sec 90.5 KBytes 742 Kbits/sec  1 17.0 KBytes
[ 5] 9.00-10.00   sec 0.00 Bytes  0.00 bits/sec  0 15.6 KBytes
[ 5] 10.00-11.00  sec 0.00 Bytes  0.00 bits/sec  1 12.7 KBytes
[ 5] 11.00-12.00  sec 0.00 Bytes  0.00 bits/sec  0 12.7 KBytes
[ 5] 12.00-13.00  sec 0.00 Bytes  0.00 bits/sec  3 9.90 KBytes
[ 5] 13.00-14.00  sec 122 KBytes  997 Kbits/sec  1 8.48 KBytes
[ 5] 14.00-15.00  sec 0.00 Bytes  0.00 bits/sec  0 5.66 KBytes
[ 5] 15.00-16.00  sec 0.00 Bytes  0.00 bits/sec  0 7.07 KBytes
[ 5] 16.00-17.00  sec 0.00 Bytes  0.00 bits/sec  0 11.3 KBytes
[ 5] 17.00-18.00  sec 0.00 Bytes  0.00 bits/sec  0 11.3 KBytes
[ 5] 18.00-19.00  sec 0.00 Bytes  0.00 bits/sec  0 17.0 KBytes
[ 5] 19.00-20.00  sec 0.00 Bytes  0.00 bits/sec  2 12.7 KBytes
[ 5] 20.00-21.00  sec 0.00 Bytes  0.00 bits/sec  0 14.1 KBytes
[ 5] 21.00-22.00  sec 0.00 Bytes  0.00 bits/sec  0 18.4 KBytes
[ 5] 22.00-23.00  sec 0.00 Bytes  0.00 bits/sec  1 12.7 KBytes
[ 5] 23.00-24.00  sec 0.00 Bytes  0.00 bits/sec  0 12.7 KBytes
[ 5] 24.00-25.00  sec 0.00 Bytes  0.00 bits/sec  1 7.07 KBytes
[ 5] 25.00-26.00  sec 0.00 Bytes  0.00 bits/sec  3 7.07 KBytes
[ 5] 26.00-27.00  sec 0.00 Bytes  0.00 bits/sec  1 5.66 KBytes
[ 5] 27.00-28.00  sec 122 KBytes  996 Kbits/sec  0 12.7 KBytes
[ 5] 28.00-29.00  sec 0.00 Bytes  0.00 bits/sec  1 8.48 KBytes
[ 5] 29.00-30.00  sec 0.00 Bytes  0.00 bits/sec  0 8.48 KBytes

[ ID] Interval      Transfer  Bitrate      Retr  sender receiver
[ 5] 0.00-30.00   sec 529 KBytes 144 Kbits/sec  23
[ 5] 0.00-31.20   sec 313 KBytes 82.0 Kbits/sec

iperf Done.
administrator@ubuntu-tc-A:~$

```

```

Activities Terminal maj 12 20:06 administrator@ubuntu-tc-B: ~
[ 5] 1.00-2.00    sec 0.00 Bytes  0.00 bits/sec
[ 5] 2.00-3.00    sec 14.1 KBytes 116 Kbits/sec
[ 5] 3.00-4.00    sec 11.3 KBytes 92.7 Kbits/sec
[ 5] 4.00-5.00    sec 2.83 KBytes 23.2 Kbits/sec
[ 5] 5.00-6.00    sec 0.00 Bytes  0.00 bits/sec
[ 5] 6.00-7.00    sec 56.6 KBytes 463 Kbits/sec
[ 5] 7.00-8.00    sec 1.41 KBytes 11.6 Kbits/sec
[ 5] 8.00-9.00    sec 33.9 KBytes 278 Kbits/sec
[ 5] 9.00-10.00   sec 32.5 KBytes 267 Kbits/sec
[ 5] 10.00-11.00  sec 7.07 KBytes 57.9 Kbits/sec
[ 5] 11.00-12.00  sec 0.00 Bytes  0.00 bits/sec
[ 5] 12.00-13.00  sec 4.24 KBytes 34.8 Kbits/sec
[ 5] 13.00-14.00  sec 14.1 KBytes 116 Kbits/sec
[ 5] 14.00-15.00  sec 12.7 KBytes 104 Kbits/sec
[ 5] 15.00-16.00  sec 5.66 KBytes 46.4 Kbits/sec
[ 5] 16.00-17.00  sec 7.07 KBytes 57.9 Kbits/sec
[ 5] 17.00-18.00  sec 0.00 Bytes  0.00 bits/sec
[ 5] 18.00-19.00  sec 11.3 KBytes 92.7 Kbits/sec
[ 5] 19.00-20.00  sec 2.83 KBytes 23.2 Kbits/sec
[ 5] 20.00-21.00  sec 24.0 KBytes 197 Kbits/sec
[ 5] 21.00-22.00  sec 14.1 KBytes 116 Kbits/sec
[ 5] 22.00-23.00  sec 0.00 Bytes  0.00 bits/sec
[ 5] 23.00-24.00  sec 0.00 Bytes  0.00 bits/sec
[ 5] 24.00-25.00  sec 18.4 KBytes 151 Kbits/sec
[ 5] 25.00-26.00  sec 0.00 Bytes  0.00 bits/sec
[ 5] 26.00-27.00  sec 0.00 Bytes  0.00 bits/sec
[ 5] 27.00-28.00  sec 18.4 KBytes 151 Kbits/sec
[ 5] 28.00-29.00  sec 0.00 Bytes  0.00 bits/sec
[ 5] 29.00-30.00  sec 0.00 Bytes  0.00 bits/sec
[ 5] 30.00-31.00  sec 19.8 KBytes 162 Kbits/sec
[ 5] 31.00-31.20  sec 0.00 Bytes  0.00 bits/sec

[ ID] Interval      Transfer  Bitrate
[ 5] 0.00-31.20   sec 313 KBytes 82.0 Kbits/sec

Server listening on 5201

```

10Mbps round trip link test, 600ms latency, 3% loss, 10% corrupted (UDP iperf)

```

[ 5] 0.00-1.20 sec 1.44 MBytes 9.65 Mb/s 1 172598
[ 5] 1.20-2.00 sec 2.38 MBytes 2.50 Gb/s 86329
[ 5] 2.00-3.00 sec 119 MBytes 1.00 Gb/s 86319
[ 5] 3.00-4.00 sec 119 MBytes 1000 Mb/s 86319
[ 5] 4.00-5.00 sec 119 MBytes 1.00 Gb/s 86351
[ 5] 5.00-6.00 sec 119 MBytes 1000 Mb/s 86327
[ 5] 6.00-7.00 sec 119 MBytes 1000 Mb/s 86321
[ 5] 7.00-8.00 sec 119 MBytes 1.00 Gb/s 86328
[ 5] 8.00-9.00 sec 119 MBytes 1.00 Gb/s 86337
[ 5] 9.00-10.00 sec 119 MBytes 1000 Mb/s 86324
[ 5] 10.00-11.00 sec 119 MBytes 1000 Mb/s 86321
[ 5] 11.00-12.00 sec 119 MBytes 1.00 Gb/s 86343
[ 5] 12.00-13.00 sec 119 MBytes 1000 Mb/s 86310
[ 5] 13.00-14.00 sec 119 MBytes 1.00 Gb/s 86328
[ 5] 14.00-15.00 sec 119 MBytes 1.00 Gb/s 86328
[ 5] 15.00-16.00 sec 119 MBytes 1000 Mb/s 86321
[ 5] 16.00-17.00 sec 119 MBytes 1.00 Gb/s 86331
[ 5] 17.00-18.00 sec 119 MBytes 1.00 Gb/s 86331
[ 5] 18.00-19.00 sec 119 MBytes 1000 Mb/s 86324
[ 5] 19.00-20.00 sec 119 MBytes 1000 Mb/s 86321
[ 5] 20.00-21.00 sec 119 MBytes 1000 Mb/s 86322
[ 5] 21.00-22.00 sec 119 MBytes 1.00 Gb/s 86329
[ 5] 22.00-23.00 sec 119 MBytes 1.00 Gb/s 86326
[ 5] 23.00-24.00 sec 119 MBytes 1.00 Gb/s 86334
[ 5] 24.00-25.00 sec 119 MBytes 1000 Mb/s 86323
[ 5] 25.00-26.00 sec 119 MBytes 1.00 Gb/s 86333
[ 5] 26.00-27.00 sec 119 MBytes 1000 Mb/s 86306
[ 5] 27.00-28.00 sec 119 MBytes 1.00 Gb/s 86342
[ 5] 28.00-29.00 sec 119 MBytes 1000 Mb/s 86321
[ 5] 29.00-30.00 sec 119 MBytes 1000 Mb/s 86325

[ ID] Interval      Transfer      Bitrate      Jitter    Lost/TOTAL  Datagrams
[ 5] 0.00-30.00 sec 3.49 GBytes  1000 Mb/s   0.000 ms  0/2589724  (0%) sender
[ 5] 0.00-31.79 sec 29.5 MBytes  7.79 Mb/s   0.240 ms 2568223/2589610 (99%) receiver

iperf Done.
administrator@ubuntu-tc-A: ~

```

```

[ 5] 1.00-2.00 sec 0.00 Bytes 0.00 b/s 0.000 ms 0/0 (0%)
[ 5] 2.00-3.00 sec 635 KBytes 5.21 Mb/s 1.320 ms 69/510 (13%)
[ 5] 3.00-4.00 sec 1.04 MBytes 8.73 Mb/s 0.262 ms 189195/189949 (1e+02%)
[ 5] 4.00-5.00 sec 1.05 MBytes 8.80 Mb/s 0.249 ms 85598/86350 (99%)
[ 5] 5.00-6.00 sec 1.04 MBytes 8.72 Mb/s 0.249 ms 85598/86351 (99%)
[ 5] 6.00-7.00 sec 1.05 MBytes 8.87 Mb/s 0.301 ms 85575/86341 (99%)
[ 5] 7.00-8.00 sec 1.05 MBytes 8.82 Mb/s 0.274 ms 85428/86189 (99%)
[ 5] 8.00-9.00 sec 1.05 MBytes 8.78 Mb/s 0.247 ms 85583/86341 (99%)
[ 5] 9.00-10.00 sec 1.02 MBytes 8.56 Mb/s 0.314 ms 85617/86356 (99%)
[ 5] 10.00-11.00 sec 1.04 MBytes 8.74 Mb/s 0.248 ms 85572/86326 (99%)
[ 5] 11.00-12.00 sec 1.04 MBytes 8.70 Mb/s 0.336 ms 85580/86331 (99%)
[ 5] 12.00-13.00 sec 1.03 MBytes 8.68 Mb/s 0.368 ms 85578/86327 (99%)
[ 5] 13.00-14.00 sec 1.04 MBytes 8.70 Mb/s 0.272 ms 85571/86322 (99%)
[ 5] 14.00-15.00 sec 1.04 MBytes 8.71 Mb/s 0.301 ms 85579/86332 (99%)
[ 5] 15.00-16.00 sec 1.05 MBytes 8.82 Mb/s 0.294 ms 85558/86319 (99%)
[ 5] 16.00-17.00 sec 1.03 MBytes 8.64 Mb/s 0.287 ms 85591/86337 (99%)
[ 5] 17.00-18.00 sec 1.04 MBytes 8.70 Mb/s 0.291 ms 85545/86296 (99%)
[ 5] 18.00-19.00 sec 1.04 MBytes 8.76 Mb/s 0.266 ms 85577/86333 (99%)
[ 5] 19.00-20.00 sec 1.06 MBytes 8.86 Mb/s 0.243 ms 85577/86342 (99%)
[ 5] 20.00-21.00 sec 1.01 MBytes 8.44 Mb/s 0.277 ms 85578/86307 (99%)
[ 5] 21.00-22.00 sec 1.05 MBytes 8.77 Mb/s 0.265 ms 85598/86355 (99%)
[ 5] 22.00-23.00 sec 1.05 MBytes 8.78 Mb/s 0.275 ms 85548/86306 (99%)
[ 5] 23.00-24.00 sec 1.04 MBytes 8.70 Mb/s 0.267 ms 85640/86391 (99%)
[ 5] 24.00-25.00 sec 1.07 MBytes 8.94 Mb/s 0.265 ms 85571/86353 (99%)
[ 5] 25.00-26.00 sec 332 KBytes 2.72 Mb/s 0.246 ms 25828/26063 (99%)
[ 5] 26.00-27.00 sec 693 KBytes 5.68 Mb/s 1.258 ms 140268/140758 (1e+02%)
[ 5] 27.00-28.00 sec 1.05 MBytes 8.55 Mb/s 0.265 ms 91338/92074 (99%)
[ 5] 28.00-29.00 sec 1.05 MBytes 8.77 Mb/s 0.256 ms 85565/86322 (99%)
[ 5] 29.00-30.00 sec 1.05 MBytes 8.84 Mb/s 0.280 ms 85565/86328 (99%)
[ 5] 30.00-31.00 sec 1.05 MBytes 8.78 Mb/s 0.279 ms 85573/86331 (99%)
[ 5] 31.00-31.79 sec 853 KBytes 8.83 Mb/s 0.240 ms 67730/68333 (99%)

Server Listening on 5201

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60Mbps round trip link test, 600ms latency, 5% loss (UDP iperf)

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[ 5] 0.00-1.00 sec 119 MBytes 999 Mb/s 86263
[ 5] 1.00-2.00 sec 119 MBytes 1.00 Gb/s 86329
[ 5] 2.00-3.00 sec 119 MBytes 1000 Mb/s 86321
[ 5] 3.00-4.00 sec 119 MBytes 1.00 Gb/s 86338
[ 5] 4.00-5.00 sec 119 MBytes 1000 Mb/s 86314
[ 5] 5.00-6.00 sec 119 MBytes 1.00 Gb/s 86334
[ 5] 6.00-7.00 sec 119 MBytes 1000 Mb/s 86326
[ 5] 7.00-8.00 sec 119 MBytes 1000 Mb/s 86318
[ 5] 8.00-9.00 sec 119 MBytes 1.00 Gb/s 86337
[ 5] 9.00-10.00 sec 119 MBytes 1.00 Gb/s 86328
[ 5] 10.00-11.00 sec 119 MBytes 1000 Mb/s 86310
[ 5] 11.00-12.00 sec 119 MBytes 1.00 Gb/s 86342
[ 5] 12.00-13.00 sec 119 MBytes 1.00 Gb/s 86332
[ 5] 13.00-14.00 sec 119 MBytes 1000 Mb/s 86313
[ 5] 14.00-15.00 sec 119 MBytes 1.00 Gb/s 86327
[ 5] 15.00-16.00 sec 119 MBytes 1.00 Gb/s 86334
[ 5] 16.00-17.00 sec 119 MBytes 1000 Mb/s 86314
[ 5] 17.00-18.00 sec 119 MBytes 1.00 Gb/s 86327
[ 5] 18.00-19.00 sec 119 MBytes 1000 Mb/s 86323
[ 5] 19.00-20.00 sec 119 MBytes 1000 Mb/s 86312
[ 5] 20.00-21.00 sec 119 MBytes 1.00 Gb/s 86341
[ 5] 21.00-22.00 sec 119 MBytes 1.00 Gb/s 86326
[ 5] 22.00-23.00 sec 119 MBytes 1000 Mb/s 86319
[ 5] 23.00-24.00 sec 119 MBytes 1.00 Gb/s 86331
[ 5] 24.00-25.00 sec 119 MBytes 1.00 Gb/s 86326
[ 5] 25.00-26.00 sec 119 MBytes 1000 Mb/s 86316
[ 5] 26.00-27.00 sec 119 MBytes 1.00 Gb/s 86377
[ 5] 27.00-28.00 sec 119 MBytes 1000 Mb/s 86304
[ 5] 28.00-29.00 sec 119 MBytes 1000 Mb/s 86294
[ 5] 29.00-30.00 sec 119 MBytes 1.00 Gb/s 86334

[ ID] Interval      Transfer      Bitrate      Jitter    Lost/TOTAL  Datagrams
[ 5] 0.00-30.00 sec 3.49 GBytes  1000 Mb/s   0.000 ms  0/2589720  (0%) sender
[ 5] 0.00-37.81 sec 66.3 MBytes  14.7 Mb/s   0.266 ms 2515137/2563136 (98%) receiver

iperf Done.
administrator@ubuntu-tc-A: ~

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[ 6] 7.00-8.00 sec 1.68 MBytes 14.1 Mb/s 0.281 ms 54372/55591 (98%)
[ 6] 8.00-9.00 sec 1.38 MBytes 11.6 Mb/s 0.232 ms 50950/51950 (98%)
[ 6] 9.00-10.00 sec 788 KBytes 6.43 Mb/s 0.188 ms 141965/142520 (1e+02%)
[ 6] 10.00-11.00 sec 2.08 MBytes 16.7 Mb/s 0.250 ms 66953/68398 (98%)
[ 6] 11.00-12.00 sec 2.76 MBytes 23.2 Mb/s 0.290 ms 101843/103842 (98%)
[ 6] 12.00-13.00 sec 2.11 MBytes 17.7 Mb/s 0.273 ms 94130/95658 (98%)
[ 6] 13.00-14.00 sec 2.03 MBytes 17.0 Mb/s 0.278 ms 58569/60041 (98%)
[ 6] 14.00-15.00 sec 2.76 MBytes 23.2 Mb/s 0.252 ms 101795/103795 (98%)
[ 6] 15.00-16.00 sec 2.07 MBytes 17.4 Mb/s 0.292 ms 93639/95140 (98%)
[ 6] 16.00-17.00 sec 2.07 MBytes 17.4 Mb/s 0.294 ms 59015/60514 (98%)
[ 6] 17.00-18.00 sec 2.76 MBytes 23.2 Mb/s 0.285 ms 101766/103766 (98%)
[ 6] 18.00-19.00 sec 2.04 MBytes 17.1 Mb/s 0.307 ms 93224/94699 (98%)
[ 6] 19.00-20.00 sec 2.11 MBytes 17.7 Mb/s 0.309 ms 59507/61032 (98%)
[ 6] 20.00-21.00 sec 2.76 MBytes 23.2 Mb/s 0.270 ms 101764/103764 (98%)
[ 6] 21.00-22.00 sec 2.00 MBytes 16.8 Mb/s 0.270 ms 92737/94186 (98%)
[ 6] 22.00-23.00 sec 2.14 MBytes 18.0 Mb/s 0.260 ms 59964/61515 (97%)
[ 6] 23.00-24.00 sec 2.76 MBytes 23.2 Mb/s 0.272 ms 101792/103792 (98%)
[ 6] 24.00-25.00 sec 1.97 MBytes 16.5 Mb/s 0.292 ms 92242/93665 (98%)
[ 6] 25.00-26.00 sec 2.18 MBytes 18.3 Mb/s 0.284 ms 60409/61986 (97%)
[ 6] 26.00-27.00 sec 2.76 MBytes 23.2 Mb/s 0.290 ms 101755/103755 (98%)
[ 6] 27.00-28.00 sec 1.93 MBytes 16.2 Mb/s 0.265 ms 91839/93236 (99%)
[ 6] 28.00-29.00 sec 2.21 MBytes 18.6 Mb/s 0.301 ms 60817/62420 (97%)
[ 6] 29.00-30.00 sec 2.76 MBytes 23.2 Mb/s 0.285 ms 101754/103754 (98%)
[ 6] 30.00-31.00 sec 1.98 MBytes 15.9 Mb/s 0.283 ms 91431/92084 (98%)
[ 6] 31.00-32.00 sec 2.25 MBytes 18.8 Mb/s 0.268 ms 61223/62850 (97%)
[ 6] 32.00-33.00 sec 2.76 MBytes 23.2 Mb/s 0.282 ms 101762/103762 (98%)
[ 6] 33.00-34.00 sec 1.88 MBytes 15.6 Mb/s 0.294 ms 91027/92373 (99%)
[ 6] 34.00-35.00 sec 2.28 MBytes 19.2 Mb/s 0.266 ms 61620/63274 (97%)
[ 6] 35.00-36.00 sec 0.00 Bytes 0.00 b/s 0.266 ms 0/0 (0%)
[ 6] 36.00-37.00 sec 0.00 Bytes 0.00 b/s 0.266 ms 0/0 (0%)
[ 6] 37.00-37.81 sec 0.00 Bytes 0.00 b/s 0.266 ms 0/0 (0%)

Server Listening on 5201

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