

# Compte Rendu ITQoS TME3

## Part 1

### Test 1:

```
Applications Emplacements Terminal
itqos@localhost:~

Fichier Édition Affichage Rechercher Terminal Aide
[itqos@localhost ~]$ telnet router
Trying ::1...
telnet: connect to address ::1: Connection refused
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
Connected to Dynamips VM "R1" (ID 0, type c7200) - Console port

Router>
Router>
Router>
Router>en
Router#show traff
Router#show traffic-shape

Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int f0/1
Router(config-if)#traff
Router(config-if)#traffic-shape ra
Router(config-if)#traffic-shape rate 2000000 2000000 1000000 0
Router(config-if)#
Router#
*Nov  7 14:46:19.739: %SYS-5-CONFIG_I: Configured from console by console
Router#show traffic-shape

Interface Fa0/1
VC      Access Target   Byte  Sustain  Excess  Interval  Increment Adapt
List    Rate   Limit bits/int bits/int (ms)      (bytes)  Active
-       2000000 375000 2000000 1000000 1000     250000   -
Router#echo BENDAKIR_STATOUTAH
^
% Invalid input detected at '^' marker.
Router#
```

### Response 1:

- Testing traffic with 2.2Mbit/s:

We can see that the traffic is being shaped and limited to a rate lower than 2Mbit/s (~1.95Mbit/s) on the side of PC2, indicating that the router is performing traffic shaping, which we can see when we run “**traffic-shape statistics**” during the transmission (Shaping Active: **yes**).

```
Router#show traffic-shape STATISTICS
I/F      Acc. Queue Packets  Bytes  Packets  Bytes  Shaping
List     Rate   Depth             Delayed Delayed Active
Fa0/1    0      16             1542    0        0      no
Router#show traffic-shape STATISTICS
I/F      Acc. Queue Packets  Bytes  Packets  Bytes  Shaping
List     Rate   Depth             Delayed Delayed Active
Fa0/1    0     3494          5217882  19      25824   yes
Router#show traffic-shape STATISTICS
I/F      Acc. Queue Packets  Bytes  Packets  Bytes  Shaping
List     Rate   Depth             Delayed Delayed Active
Fa0/1    0     8718          13108149  53      72876   no
Router#
```

```

PC1
Fichier Édition Affichage Rechercher Terminal Aide
[itqos@localhost ~]$ telnet PC1
Trying PC1...
[PC1 ~]# iperf -u -c pc2 -f m -t 600 -i 10 -b 2.2m
-----
Client connecting to pc2, UDP port 5001
Sending 1470 byte datagrams
UDP buffer size: 0.20 MByte (default)
-----
[ 3] local 192.168.1.11 port 41269 connected with 192.168.1.2.22 port 5001
[ ID] Interval      Transfer      Bandwidth
[ 3] 0.0-10.0 sec  2.62 MBytes  2.20 Mbits/sec
[ 3] 10.0-20.0 sec  2.62 MBytes  2.20 Mbits/sec
[ 3] 20.0-30.0 sec  2.62 MBytes  2.20 Mbits/sec
[ 3] 30.0-40.0 sec  2.62 MBytes  2.20 Mbits/sec
[ 3] 40.0-50.0 sec  2.62 MBytes  2.20 Mbits/sec
^C[ 3] 0.0-51.8 sec 13.6 MBytes  2.20 Mbits/sec
[ 3] Sent 9690 datagrams
[ 3] Server Report:
[ 3] 0.0-51.8 sec 12.1 MBytes  1.97 Mbits/sec  2.55 ms 1025/ 9690 (11%)
[PC1 ~]#

PC2
Fichier Édition Affichage Rechercher Terminal Aide
[PC2 ~]# iperf -u -s -f m -i 1
-----
Server listening on UDP port 5001
Receiving 1470 byte datagrams
UDP buffer size: 0.20 MByte (default)
-----
[ 3] local 192.168.2.22 port 5001 connected with 192.168.1.11 port 41269
[ ID] Interval      Transfer      Bandwidth      Jitter
Lost/Total Datagrams
[ 3] 0.0- 1.0 sec  0.26 MBytes  2.22 Mbits/sec  1.914 ms
0/ 189 (0%)
[ 3] 1.0- 2.0 sec  0.26 MBytes  2.19 Mbits/sec  2.870 ms
0/ 186 (0%)
[ 3] 2.0- 3.0 sec  0.26 MBytes  2.21 Mbits/sec  1.583 ms
0/ 188 (0%)
[ 3] 3.0- 4.0 sec  0.26 MBytes  2.20 Mbits/sec  2.044 ms
0/ 187 (0%)
[ 3] 4.0- 5.0 sec  0.26 MBytes  2.18 Mbits/sec  2.422 ms
2/ 187 (1.1%)
[ 3] 5.0- 6.0 sec  0.23 MBytes  1.95 Mbits/sec  1.895 ms
22/ 188 (12%)
[ 3] 6.0- 7.0 sec  0.23 MBytes  1.93 Mbits/sec  2.123 ms
22/ 186 (12%)
[ 3] 7.0- 8.0 sec  0.23 MBytes  1.95 Mbits/sec  1.846 ms
21/ 187 (11%)
[ 3] 8.0- 9.0 sec  0.23 MBytes  1.95 Mbits/sec  2.180 ms
22/ 188 (12%)
[ 3] 9.0-10.0 sec  0.23 MBytes  1.94 Mbits/sec  1.187 ms
22/ 187 (12%)
[ 3] 10.0-11.0 sec  0.23 MBytes  1.95 Mbits/sec  1.977 ms
21/ 187 (11%)
[ 3] 11.0-12.0 sec  0.23 MBytes  1.94 Mbits/sec  1.212 ms
22/ 187 (12%)
[ 3] 12.0-13.0 sec  0.23 MBytes  1.93 Mbits/sec  2.502 ms
23/ 187 (12%)
[ 3] 13.0-14.0 sec  0.23 MBytes  1.94 Mbits/sec  1.729 ms
21/ 186 (11%)
[ 3] 14.0-15.0 sec  0.23 MBytes  1.94 Mbits/sec  2.535 ms
22/ 187 (12%)
[ 3] 15.0-16.0 sec  0.23 MBytes  1.95 Mbits/sec  1.821 ms

```

- Testing traffic with 3Mbit/s:

We can see that the traffic is being shaped and limited to a rate lower than 3Mbit/s (~1.95Mbit/s) on the side of PC2, indicating that the router is performing traffic shaping, which we can see when we run “**traffic-shape statistics**” during the transmission (Shaping Active: **yes**).

```

Router#show traffic-shape STAtistics
Acc. Queue Packets  Bytes  Packets  Bytes  Shaping
List Depth          Delayed Delayed Active
Fa0/1                0    8718   13108149  53    72876   no
Router#show traffic-shape STAtistics
Acc. Queue Packets  Bytes  Packets  Bytes  Shaping
List Depth          Delayed Delayed Active
Fa0/1                1   10490   15738065  62    86484   yes
Router#show traffic-shape STAtistics
Acc. Queue Packets  Bytes  Packets  Bytes  Shaping
List Depth          Delayed Delayed Active
Fa0/1                0   11678   17529965  70    98580   no
Router#

```

```

PC1
Fichier Édition Affichage Rechercher Terminal Aide
[itqos@localhost ~]$ telnet PC2
Trying PC2...
[PC1 ~]# iperf -u -c pc2 -f m -t 600 -i 10 -b 2.2m
---
Client connecting to pc2, UDP port 5001
Sending 1470 byte datagrams
UDP buffer size: 0.20 MByte (default)
---
[ 3] local 192.168.1.11 port 41269 connected with 192.168.1.11 port 5001
[ ID] Interval      Transfer      Bandwidth
[ 3] 0.0-10.0 sec  2.62 MBytes  2.20 Mbits/sec
[ 3] 10.0-20.0 sec  2.62 MBytes  2.20 Mbits/sec
[ 3] 20.0-30.0 sec  2.62 MBytes  2.20 Mbits/sec
[ 3] 30.0-40.0 sec  2.62 MBytes  2.20 Mbits/sec
[ 3] 40.0-50.0 sec  2.62 MBytes  2.20 Mbits/sec
^C[ 3] 0.0-51.8 sec  13.6 MBytes  2.20 Mbits/sec
[ 3] Sent 9690 datagrams
[ 3] Server Report:
[ 3] 0.0-51.8 sec  12.1 MBytes  1.97 Mbits/sec  2.556 ms 1025/ 9690 (11%)
[PC1 ~]# iperf -u -c pc2 -f m -t 600 -i 10 -b 3m
---
Client connecting to pc2, UDP port 5001
Sending 1470 byte datagrams
UDP buffer size: 0.20 MByte (default)
---
[ 3] local 192.168.1.11 port 32813 connected with 192.168.1.11 port 5001
[ ID] Interval      Transfer      Bandwidth
[ 3] 0.0-10.0 sec  3.58 MBytes  3.00 Mbits/sec
^C[ 3] 0.0-17.1 sec  6.12 MBytes  3.00 Mbits/sec
[ 3] Sent 4363 datagrams
[ 3] Server Report:
[ 3] 0.0-17.1 sec  4.09 MBytes  2.01 Mbits/sec  9.593 ms 1441/ 4362 (33%)
[ 3] 0.0-17.1 sec  1 datagrams received out-of-order
[PC1 ~]#

PC2
Fichier Édition Affichage Rechercher Terminal Aide
[ 3] 0.0-51.8 sec  12.1 MBytes  1.97 Mbits/sec  2.556 ms 1025/ 9690 (11%)
[ 4] local 192.168.2.22 port 5001 connected with 192.168.1.11 port 32813
[ 4] 0.0- 1.0 sec  0.35 MBytes  2.92 Mbits/sec  3.374 ms 0/ 248 (0%)
[ 4] 1.0- 2.0 sec  0.23 MBytes  1.94 Mbits/sec  1.524 ms 7/ 172 (4.1%)
[ 4] 2.0- 3.0 sec  0.23 MBytes  1.95 Mbits/sec  23.375 ms 89/ 255 (35%)
[ 4] 3.0- 4.0 sec  0.23 MBytes  1.95 Mbits/sec  23.414 ms 90/ 256 (35%)
[ 4] 4.0- 5.0 sec  0.23 MBytes  1.95 Mbits/sec  43.934 ms 179/ 345 (52%)
[ 4] 5.0- 6.0 sec  0.23 MBytes  1.94 Mbits/sec  44.173 ms 90/ 255 (35%)
[ 4] 6.0- 7.0 sec  0.23 MBytes  1.95 Mbits/sec  43.851 ms 89/ 255 (35%)
[ 4] 7.0- 8.0 sec  0.23 MBytes  1.93 Mbits/sec  24.040 ms 0/ 164 (0%)
[ 4] 8.0- 9.0 sec  0.23 MBytes  1.95 Mbits/sec  44.501 ms 180/ 346 (52%)
[ 4] 9.0-10.0 sec  0.23 MBytes  1.95 Mbits/sec  43.762 ms 89/ 255 (35%)
[ 4] 10.0-11.0 sec  0.23 MBytes  1.93 Mbits/sec  23.804 ms 0/ 164 (0%)
[ 4] 11.0-12.0 sec  0.23 MBytes  1.94 Mbits/sec  23.826 ms 91/ 256 (36%)
[ 4] 12.0-13.0 sec  0.23 MBytes  1.96 Mbits/sec  43.533 ms 179/ 346 (52%)
[ 4] 13.0-14.0 sec  0.23 MBytes  1.93 Mbits/sec  23.824 ms 0/ 164 (0%)
[ 4] 14.0-15.0 sec  0.23 MBytes  1.94 Mbits/sec  24.085 ms 90/ 255 (35%)
[ 4] 15.0-16.0 sec  0.23 MBytes  1.96 Mbits/sec  43.655 ms 179/ 346 (52%)
[ 4] 16.0-17.0 sec  0.23 MBytes  1.94 Mbits/sec  44.426 ms 90/ 255 (35%)
[ 4] 0.0-17.1 sec  4.09 MBytes  2.01 Mbits/sec  9.593 ms 1441/ 4362 (33%)
[ 4] 0.0-17.1 sec  1 datagrams received out-of-order

```

- Testing traffic with 1.8Mbit/s:

We can see that the traffic is not being in this case, because the traffic rate (1.8Mbit/s) is lower than that of the token rate (2Mbit/s), which is why when we run “**traffic-shape statistics**” during the transmission, the Shaping Active is still **No**.

```

Router#
Router#
Router#
Router#show traffic-shape STAtistics
I/F      Acc. Queue Packets  Bytes  Packets  Bytes  Shaping
List Depth                                Delayed Delayed  Active
Fa0/1    0      13346      20026718  70      98580    no
Router#show traffic-shape STAtistics
I/F      Acc. Queue Packets  Bytes  Packets  Bytes  Shaping
List Depth                                Delayed Delayed  Active
Fa0/1    0      13865      20809994  70      98580    no
Router#

```

```

Applications Emplacements Terminal jeu. 15:02
PC1 PC2
Fichier Édition Affichage Rechercher Terminal Aide Fichier Édition Affichage Rechercher Terminal Aide
ms 1025/ 9690 (11%) [ 3] 0.0- 1.0 sec 0.21 MBytes 1.80 Mbits/sec 1.984 ms
[PC1 ~]# iperf -u -c pc2 -f m -t 600 -i 10 -b 3m 0/ 153 (0%)
--- [ 3] 1.0- 2.0 sec 0.21 MBytes 1.79 Mbits/sec 1.828 ms
0/ 152 (0%)
Client connecting to pc2, UDP port 5001 [ 3] 2.0- 3.0 sec 0.22 MBytes 1.81 Mbits/sec 2.208 ms
0/ 154 (0%)
Sending 1470 byte datagrams [ 3] 3.0- 4.0 sec 0.21 MBytes 1.80 Mbits/sec 2.142 ms
0/ 153 (0%)
UDP buffer size: 0.20 MByte (default) [ 3] 4.0- 5.0 sec 0.21 MBytes 1.79 Mbits/sec 2.121 ms
0/ 152 (0%)
--- [ 3] 5.0- 6.0 sec 0.21 MBytes 1.80 Mbits/sec 1.944 ms
0/ 153 (0%)
[ 3] local 192.168.1.11 port 32813 connected with 192.168.1.11 port 5001 [ 3] 6.0- 7.0 sec 0.22 MBytes 1.81 Mbits/sec 2.509 ms
0/ 154 (0%)
[ ID] Interval Transfer Bandwidth [ 3] 7.0- 8.0 sec 0.21 MBytes 1.80 Mbits/sec 1.796 ms
0/ 153 (0%)
[ 3] 0.0-10.0 sec 3.58 MBytes 3.00 Mbits/sec [ 3] 8.0- 9.0 sec 0.21 MBytes 1.80 Mbits/sec 1.686 ms
0/ 153 (0%)
^C[ 3] 0.0-17.1 sec 6.12 MBytes 3.00 Mbits/sec [ 3] 9.0-10.0 sec 0.21 MBytes 1.80 Mbits/sec 3.194 ms
0/ 153 (0%)
[ 3] Sent 4363 datagrams [ 3] 10.0-11.0 sec 0.21 MBytes 1.80 Mbits/sec 2.490 ms
0/ 153 (0%)
[ 3] Server Report: [ 3] 11.0-12.0 sec 0.21 MBytes 1.80 Mbits/sec 2.995 ms
0/ 153 (0%)
[ 3] 0.0-17.1 sec 4.09 MBytes 2.01 Mbits/sec 9.59 ms [ 3] 12.0-13.0 sec 0.21 MBytes 1.80 Mbits/sec 2.988 ms
0/ 153 (0%)
ms 1441/ 4362 (33%) [ 3] 13.0-14.0 sec 0.21 MBytes 1.80 Mbits/sec 2.464 ms
0/ 153 (0%)
[PC1 ~]# [ 3] 14.0-15.0 sec 0.21 MBytes 1.80 Mbits/sec 2.722 ms
0/ 153 (0%)
[PC1 ~]# [ 3] 15.0-16.0 sec 0.21 MBytes 1.80 Mbits/sec 2.137 ms
0/ 153 (0%)
[PC1 ~]# [ 3] 16.0-17.0 sec 0.21 MBytes 1.80 Mbits/sec 3.518 ms
0/ 153 (0%)
[PC1 ~]# [ 3] 17.0-18.0 sec 0.22 MBytes 1.81 Mbits/sec 3.019 ms
0/ 154 (0%)
[PC1 ~]# iperf -u -c pc2 -f m -t 600 -i 10 -b 1.8m [ 3] 18.0-19.0 sec 0.21 MBytes 1.79 Mbits/sec 3.734 ms
0/ 152 (0%)
--- [ 3] 19.0-20.0 sec 0.21 MBytes 1.80 Mbits/sec 2.350 ms
0/ 153 (0%)
Client connecting to pc2, UDP port 5001 [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
Sending 1470 byte datagrams [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
UDP buffer size: 0.20 MByte (default) [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
--- [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
[ 3] local 192.168.1.11 port 46805 connected with 192.168.1.11 port 5001 [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
[ ID] Interval Transfer Bandwidth [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
[ 3] 0.0-10.0 sec 2.15 MBytes 1.80 Mbits/sec [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
[ 3] 10.0-20.0 sec 2.15 MBytes 1.80 Mbits/sec [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
^C[ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
[ 3] Sent 3074 datagrams [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
[ 3] Server Report: [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
[ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
ms 0/ 3074 (0%) [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)
[PC1 ~]# [ 3] 0.0-20.1 sec 4.31 MBytes 1.80 Mbits/sec 2.984 ms
0/ 3074 (0%)

```

## Response 2:

**Yes**, there are lost packets, as we can see by the output of the iperf command (Lost/Total Datagrams column). When we performed transfer of 3Mbit/s, it starts by a weak lost percentage (1.6%) then increases to its max percentage (35%).

```
[PC2 ~]# iperf -u -s -f m -i 1
```

```
-----  
Server listening on UDP port 5001
```

```
Receiving 1470 byte datagrams
```

```
UDP buffer size: 0.20 MByte (default)  
-----
```

```
[ 3] local 192.168.2.22 port 5001 connected with 192.168.1.11 port 36291
```

[ ID]	Interval	Transfer	Bandwidth	Jitter	Lost/Total Datagram
-------	----------	----------	-----------	--------	---------------------

[ 3]	0.0- 1.0 sec	0.18 MBytes	1.51 Mbits/sec	44.417 ms	121/ 249 (49%)
------	--------------	-------------	----------------	-----------	----------------

[ 3]	0.0- 1.0 sec	0.18 MBytes	1.47 Mbits/sec	102.712 ms	4167/ 4296 (97%)
------	--------------	-------------	----------------	------------	------------------

```
[ 4] local 192.168.2.22 port 5001 connected with 192.168.1.11 port 56262
```

[ 4]	0.0- 1.0 sec	0.35 MBytes	2.95 Mbits/sec	3.678 ms	4/ 255 (1.6%)
------	--------------	-------------	----------------	----------	---------------

[ 4]	1.0- 2.0 sec	0.23 MBytes	1.94 Mbits/sec	41.802 ms	90/ 255 (35%)
------	--------------	-------------	----------------	-----------	---------------

[ 4]	2.0- 3.0 sec	0.23 MBytes	1.93 Mbits/sec	44.838 ms	90/ 254 (35%)
------	--------------	-------------	----------------	-----------	---------------

[ 4]	3.0- 4.0 sec	0.23 MBytes	1.95 Mbits/sec	41.668 ms	90/ 256 (35%)
------	--------------	-------------	----------------	-----------	---------------

[ 4]	4.0- 5.0 sec	0.23 MBytes	1.95 Mbits/sec	41.412 ms	89/ 255 (35%)
------	--------------	-------------	----------------	-----------	---------------

[ 4]	5.0- 6.0 sec	0.23 MBytes	1.94 Mbits/sec	41.556 ms	90/ 255 (35%)
------	--------------	-------------	----------------	-----------	---------------

[ 4]	6.0- 7.0 sec	0.23 MBytes	1.95 Mbits/sec	39.274 ms	90/ 256 (35%)
------	--------------	-------------	----------------	-----------	---------------

[ 4]	7.0- 8.0 sec	0.23 MBytes	1.93 Mbits/sec	44.499 ms	90/ 254 (35%)
------	--------------	-------------	----------------	-----------	---------------

## Test 2:

## Response 3:

```
PC2
Fichier  Édition  Affichage  Rechercher  Terminal  Aide
[PC2 ~]# iperf -u -s -f m -i 1
-----
Server listening on UDP port 5001
Receiving 1470 byte datagrams
UDP buffer size: 0.20 MByte (default)
-----
[ 3] local 192.168.2.22 port 5001 connected with 192.168.1.11 port 43262
[ ID] Interval      Transfer      Bandwidth      Jitter    Lost/Total Datagram
s
[ 3] 0.0- 1.0 sec   0.26 MBytes   2.21 Mbits/sec  24.333 ms   66/ 254 (26%)
[ 3] 1.0- 2.0 sec   0.23 MBytes   1.95 Mbits/sec  32.339 ms   89/ 255 (35%)
[ 3] 2.0- 3.0 sec   0.23 MBytes   1.94 Mbits/sec  32.667 ms   90/ 255 (35%)
[ 3] 3.0- 4.0 sec   0.23 MBytes   1.94 Mbits/sec  32.704 ms   90/ 255 (35%)
[ 3] 4.0- 5.0 sec   0.23 MBytes   1.95 Mbits/sec  32.397 ms   90/ 256 (35%)
[ 3] 5.0- 6.0 sec   0.23 MBytes   1.93 Mbits/sec  34.851 ms   90/ 254 (35%)
[ 3] 6.0- 7.0 sec   0.23 MBytes   1.94 Mbits/sec  34.826 ms   90/ 255 (35%)
[ 3] 7.0- 8.0 sec   0.23 MBytes   1.95 Mbits/sec  34.502 ms   89/ 255 (35%)
[ 3] 8.0- 9.0 sec   0.23 MBytes   1.95 Mbits/sec  32.757 ms   90/ 256 (35%)

PC1
Fichier  Édition  Affichage  Rechercher  Terminal  Aide
-----
Client connecting to pc2, UDP port 5001
Sending 1470 byte datagrams
UDP buffer size: 0.20 MByte (default)
-----
[ 3] local 192.168.1.11 port 43262 connected with 192.168.2.22 port 5001
[ ID] Interval      Transfer      Bandwidth
[ 3] 0.0-10.0 sec   3.58 MBytes   3.00 Mbits/sec
[ 3] 10.0-20.0 sec   3.58 MBytes   3.00 Mbits/sec
[ 3] 20.0-30.0 sec   3.58 MBytes   3.00 Mbits/sec
[ 3] 30.0-40.0 sec   3.58 MBytes   3.00 Mbits/sec
[ 3] 40.0-50.0 sec   3.58 MBytes   3.00 Mbits/sec
```



```
PC1
Fichier Édition Affichage Rechercher Terminal Aide
Client connecting to pc2, UDP port 5001
Sending 1470 byte datagrams
UDP buffer size: 0.20 MByte (default)
-----
[ 3] local 192.168.1.11 port 40716 connected with 192.168.2.22 port 5001
[ ID] Interval      Transfer      Bandwidth
[ 3]  0.0-10.0 sec  3.58 MBytes  3.00 Mbits/sec
[ 3] 10.0-20.0 sec  3.58 MBytes  3.00 Mbits/sec
[ 3] 20.0-30.0 sec  3.58 MBytes  3.00 Mbits/sec
[ 3] 30.0-40.0 sec  3.58 MBytes  3.00 Mbits/sec
[ 3] 40.0-50.0 sec  3.58 MBytes  3.00 Mbits/sec

PC2
Fichier Édition Affichage Rechercher Terminal Aide
[ 3] 105.0-106.0 sec 0.23 MBytes 1.96 Mbits/sec 32.268 ms 89/ 256 (35%)
[ 3]  0.0-106.4 sec 24.8 MBytes 1.95 Mbits/sec 1.375 ms 9491/27151 (35%)
^C[PC2 ~]#
[PC2 ~]# iperf -u -s -f m -i 1
-----
Server listening on UDP port 5001
Receiving 1470 byte datagrams
UDP buffer size: 0.20 MByte (default)
-----
[ 3] local 192.168.2.22 port 5001 connected with 192.168.1.11 port 40716
[ ID] Interval      Transfer      Bandwidth      Jitter      Lost/Total Datagram
s
[ 3]  0.0- 1.0 sec  0.36 MBytes  3.00 Mbits/sec  1.405 ms      0/ 255 (0%)
[ 3]  1.0- 2.0 sec  0.36 MBytes  3.00 Mbits/sec  1.458 ms      0/ 255 (0%)
[ 3]  2.0- 3.0 sec  0.36 MBytes  3.00 Mbits/sec  1.477 ms      0/ 255 (0%)
[ 3]  3.0- 4.0 sec  0.36 MBytes  3.00 Mbits/sec  1.473 ms      0/ 255 (0%)
[ 3]  4.0- 5.0 sec  0.31 MBytes  2.61 Mbits/sec 17.305 ms     33/ 255 (13%)
[ 3]  5.0- 6.0 sec  0.23 MBytes  1.94 Mbits/sec 44.273 ms     90/ 255 (35%)
```

We can see that **Be** is the bucket size that is consumed at the beginning of the transmission by the “excess packets”. This is visible in all the cases where the transmission rate is superior to 2Mbit/s.

For example, in the case of sending 3Mbit/s when having **Be = 0.2Mbit**, the first statistical interval shows a bandwidth of **2.21Mbit/s**, then the following ones show a 2Mbit/s bandwidth with maximum packet loss percentage (35%), indicating that the bucket is empty and the transmission is now consuming the tokens as they are generated.

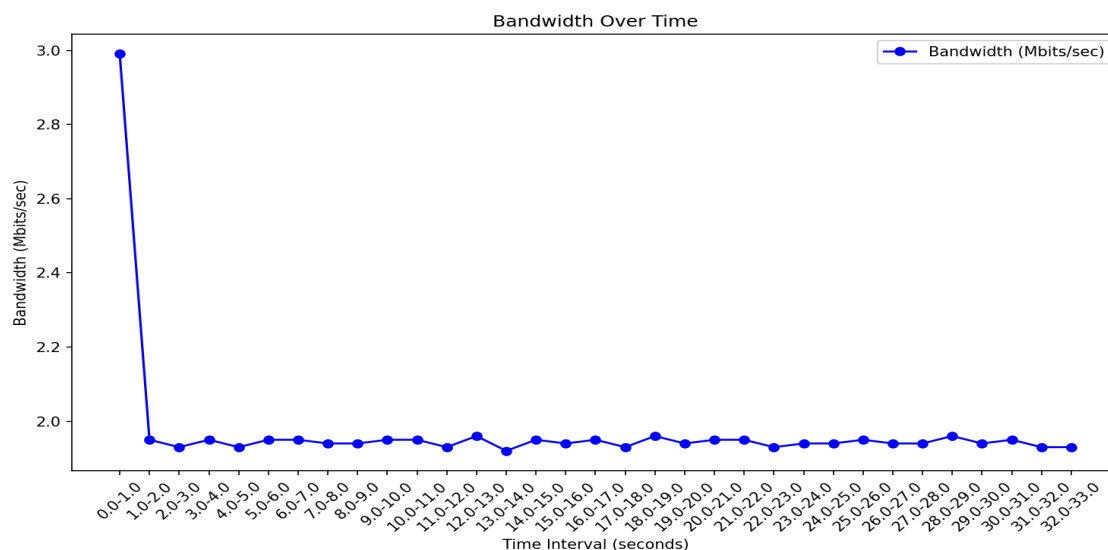
Same thing happens when **Be = 5Mbit**, where the first 5 seconds of transfer consume the tokens in the bucket (by having the actual transfer bandwidth of **3Mbit/s**) then the bandwidth drops to **2Mbit/s**.

## Response 4:

```
PC1
Fichier  Édition  Affichage  Rechercher  Terminal  Aide
[PC1 ~]# iperf -u -c pc2 -f m -t 600 -i 10 -b 3m
-----
Client connecting to pc2, UDP port 5001
Sending 1470 byte datagrams
UDP buffer size: 0.20 MByte (default)
-----
[ 3] local 192.168.1.11 port 48981 connected with 192.168.2.22 port 5001
[ ID] Interval      Transfer      Bandwidth
[ 3]  0.0-10.0 sec  3.58 MBytes  3.00 Mbits/sec
[ 3] 10.0-20.0 sec  3.58 MBytes  3.00 Mbits/sec
[ 3] 20.0-30.0 sec  3.58 MBytes  3.00 Mbits/sec
S

PC2
Fichier  Édition  Affichage  Rechercher  Terminal  Aide
[PC2 ~]# iperf -u -s -f m -i 1
-----
Server listening on UDP port 5001
Receiving 1470 byte datagrams
UDP buffer size: 0.20 MByte (default)
-----
[ 3] local 192.168.2.22 port 5001 connected with 192.168.1.11 port 48981
[ ID] Interval      Transfer      Bandwidth      Jitter    Lost/Total Datagram
s
[ 3]  0.0- 1.0 sec  0.36 MBytes  2.99 Mbits/sec   2.092 ms     1/ 255 (0.39%)
[ 3]  1.0- 2.0 sec  0.23 MBytes  1.95 Mbits/sec  32.114 ms    89/ 255 (35%)
[ 3]  2.0- 3.0 sec  0.23 MBytes  1.93 Mbits/sec  34.832 ms    90/ 254 (35%)
[ 3]  3.0- 4.0 sec  0.23 MBytes  1.95 Mbits/sec  34.414 ms    90/ 256 (35%)
[ 3]  4.0- 5.0 sec  0.23 MBytes  1.93 Mbits/sec  36.873 ms    90/ 254 (35%)
[ 3]  5.0- 6.0 sec  0.23 MBytes  1.95 Mbits/sec  34.760 ms    90/ 256 (35%)
[ 3]  6.0- 7.0 sec  0.23 MBytes  1.95 Mbits/sec  34.188 ms    89/ 255 (35%)
[ 3]  7.0- 8.0 sec  0.23 MBytes  1.94 Mbits/sec  34.908 ms    90/ 255 (35%)
[ 3]  8.0- 9.0 sec  0.23 MBytes  1.94 Mbits/sec  34.865 ms    90/ 255 (35%)
```

The average rate is **CIR=bc=2Mbit/s**, while the peak flow is **bc+be=3Mbit/s**





Response 5:

Response 6:

1.  $r = bc / T$
2.  $p = (bc + be) / T$
3.  $p = r * (bc + be) / bc$

Response 7:

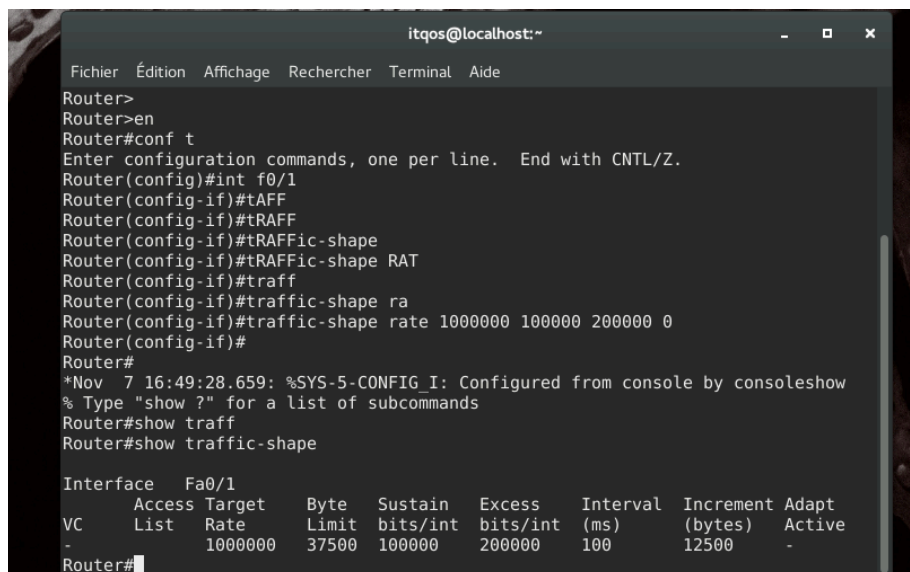
After simplifications, we find that **MBD = T**.

Response 8:

After simplifications, we find that **MBS = bc+be**.

Test 3:

Response 9:



```
itqos@localhost:~  
Fichier Édition Affichage Rechercher Terminal Aide  
Router>  
Router>en  
Router#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#int f0/1  
Router(config-if)#tAFF  
Router(config-if)#tRAFF  
Router(config-if)#tRAFFic-shape  
Router(config-if)#tRAFFic-shape RAT  
Router(config-if)#traff  
Router(config-if)#traffic-shape ra  
Router(config-if)#traffic-shape rate 1000000 100000 200000 0  
Router(config-if)#  
Router#  
*Nov 7 16:49:28.659: %SYS-5-CONFIG I: Configured from console by consoleshow  
% Type "show ?" for a list of subcommands  
Router#show traff  
Router#show traffic-shape  
  
Interface Fa0/1  
VC Access Target Byte Sustain Excess Interval Increment Adapt  
List Rate Limit bits/int bits/int (ms) (bytes) Active  
- 1000000 37500 100000 200000 100 12500 -  
Router#
```

After some calculations, we find that:

- **CIR = r = 1000000 Bit/s**
- **bc = r \* T = 100000 Bit**
- **be = p \* t - bc = 200000 Bit**
- **T = MBD = 0.1 s**

Our configuration is correct because, when we run “**show traffic-shape**”, it shows the **Interval = 100ms**.

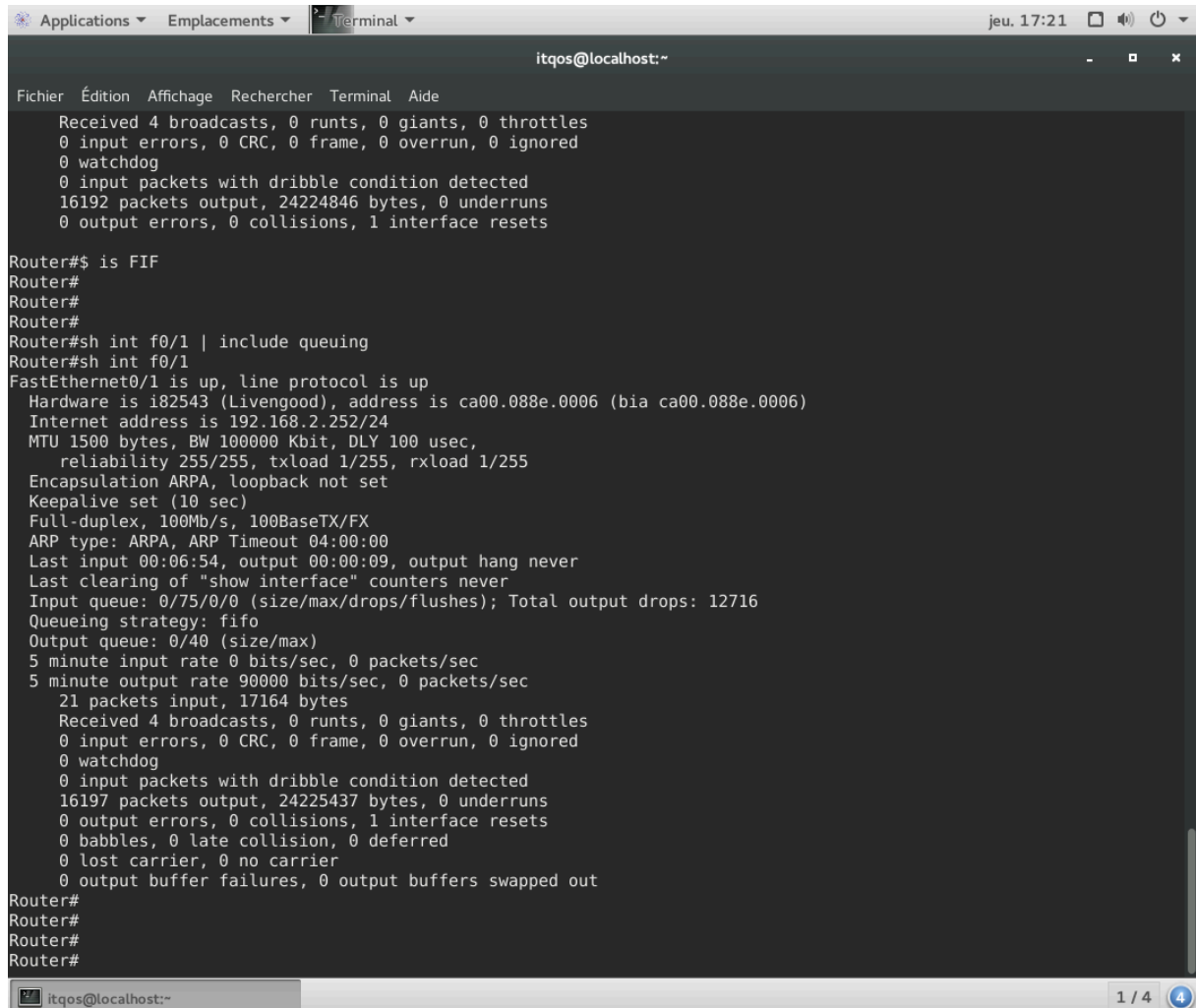
## Test 4:

### Response 10:

The utility of changing the buffer size is to enable more efficient packet management during **temporary overloads**, providing tolerance for traffic spikes. A larger buffer helps prevent packet loss in case of congestion.

# Part 2

## Test 1:



```
Applications Emplacements Terminal jeu. 17:21
itqos@localhost:~
Fichier Édition Affichage Rechercher Terminal Aide
Received 4 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog
0 input packets with dribble condition detected
16192 packets output, 24224846 bytes, 0 underruns
0 output errors, 0 collisions, 1 interface resets

Router# $ is FIF
Router#
Router#
Router#
Router#sh int f0/1 | include queuing
Router#sh int f0/1
FastEthernet0/1 is up, line protocol is up
Hardware is i82543 (Livengood), address is ca00.088e.0006 (bia ca00.088e.0006)
Internet address is 192.168.2.252/24
MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
Full-duplex, 100Mb/s, 100BaseTX/FX
ARP type: ARPA, ARP Timeout 04:00:00
Last input 00:06:54, output 00:00:09, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 12716
Queueing strategy: fifo
Output queue: 0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 90000 bits/sec, 0 packets/sec
21 packets input, 17164 bytes
Received 4 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog
0 input packets with dribble condition detected
16197 packets output, 24225437 bytes, 0 underruns
0 output errors, 0 collisions, 1 interface resets
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier
0 output buffer failures, 0 output buffers swapped out

Router#
Router#
Router#
Router#
```

## Response 1:

The scheduling mechanism used is **FIFO** (First In, First Out). This is indicated by the line:  
**Queueing strategy: FIFO**

## Response 2:

There is **one** output queue associated with the interface, and the maximum size of this output queue is **40 packets**. This is specified in the line: **Output queue: 0/40 (size/max)**.

## Test 2:

## Response 3:

3 - the queuing strategy used by the interface f0/1 is a priority-list like in the screenshot

4-we have 4 logical queues high , medium, normal and low

```
Router#show
*Nov  7 17:24:16.547: %SYS-5-CONFIG I: Configured from console by consoleint f0/1
FastEthernet0/1 is up, line protocol is up
  Hardware is i82543 (Livengood), address is ca00.088e.0006 (bia ca00.088e.0006)
  Internet address is 192.168.2.252/24
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
    reliability 255/255, txload 7/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s, 100BaseTX/FX
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:02:00, output 00:00:00, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 41212
  Queueing strategy: priority-list 1
  Output queue (queue priority: size/max/drops):
    high: 1/20/0, medium: 0/40/0, normal: 60/60/28496, low: 0/80/0
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 2810000 bits/sec, 253 packets/sec
    28 packets input, 23338 bytes
  Received 4 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
    0 watchdog
    0 input packets with dribble condition detected
  127138 packets output, 191822712 bytes, 0 underruns
    0 output errors, 0 collisions, 2 interface resets
    0 babbles, 0 late collision, 0 deferred
    0 lost carrier, 0 no carrier
    0 output buffer failures, 0 output buffers swapped out
Router#
Router#
Router#
Router#
Router#
```

When we open the second window of the PC1 it starts to lose packets

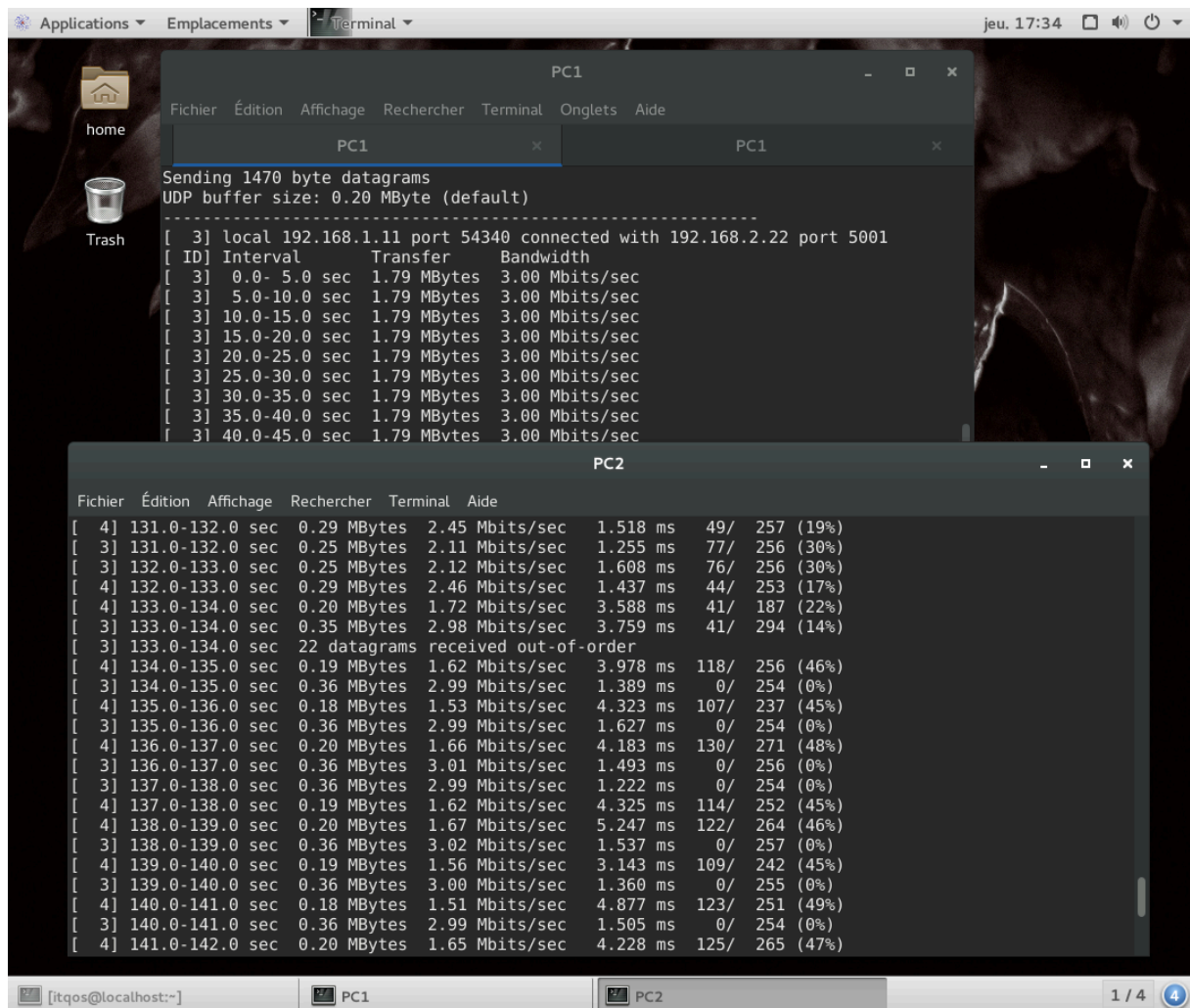
5-we notice also that the pc that has priority has better speed than the other pc

```
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int f0/1
Router(config-if)#pri
Router(config-if)#priority-group 1
Router(config-if)#
Router#
*Nov  7 17:21:20.323: %SYS-5-CONFIG I: Configured from console by consoleconf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
Router(config)#
Router(config)#prio
Router(config)#priority-list 1 pro
Router(config)#priority-list 1 protocol u
Router(config)#priority-list 1 protocol ud
Router(config)#priority-list 1 protocol ip high ud
Router(config)#priority-list 1 protocol ip high udp 54340
Router(config)#
Router(config)#
Router(config)#
```

we noticed when we start two of the PC1s the loss of packet starts on both PCs

But when we do priority-list 1 on one of the two pc we notice that the ^pc that have priority did not lose packet

6- When we Exceed 5m we face the problem of "famine"



## Test 3:

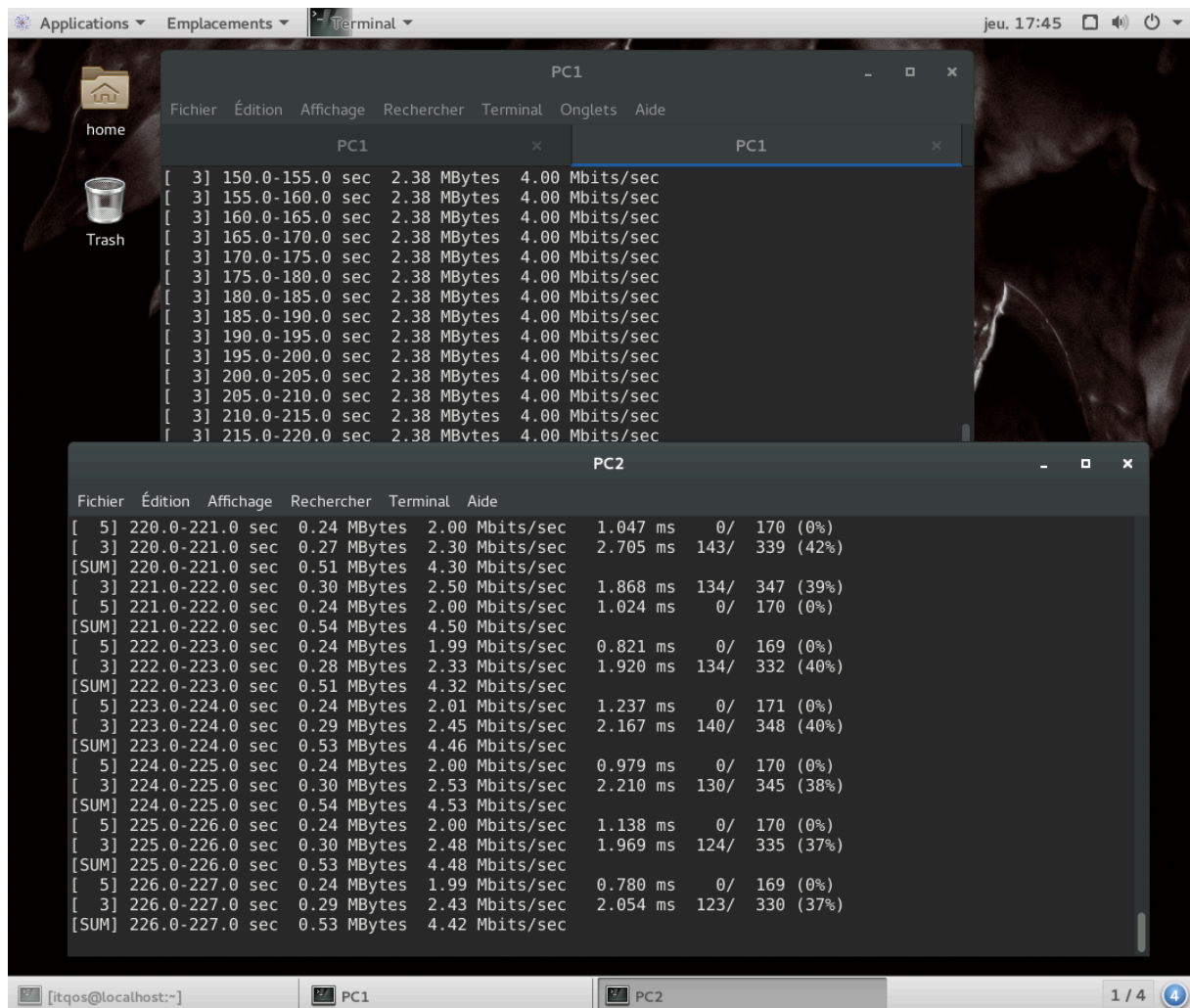
```

Router(config-if)#fa?
fair-queue fallback-pool

Router(config-if)#fa
Router(config-if)#fair
Router(config-if)#fair-queue ?
<1-4096> Congestive Discard Threshold
<cr>

Router(config-if)#fair-queue
Router(config-if)#

```



## Response 7 + 8:

Because we applied fair queuing, the router will distribute the bandwidth equally between the two traffics despite their rate. In this case, the bandwidth = 5Mbit/s which means each traffic receives 2.5Mbit/s in bandwidth. But since the first traffic only demands 2Mbit/s, the router will attribute the extra 0.5Mbit/s to the second traffic, which explains why the first traffic doesn't have any packet loss and the second traffic has a rate close to 2.5Mbit/s which means that some packets are lost (38%).



## Test 4:

The screenshot shows a terminal window with two tabs, PC1 and PC2, displaying network test results. The PC1 tab shows a list of 15 test results, each with a range of seconds, data size, and speed. The PC2 tab shows a list of 20 test results, each with a range of seconds, data size, speed, latency, and a percentage value.

**PC1**

Range (sec)	Data Size	Speed
85.0-90.0	0.12 MBytes	0.20 Mbits/sec
90.0-95.0	0.12 MBytes	0.20 Mbits/sec
95.0-100.0	0.12 MBytes	0.20 Mbits/sec
100.0-105.0	0.12 MBytes	0.20 Mbits/sec
105.0-110.0	0.12 MBytes	0.20 Mbits/sec
110.0-115.0	0.12 MBytes	0.20 Mbits/sec
115.0-120.0	0.12 MBytes	0.20 Mbits/sec
120.0-125.0	0.12 MBytes	0.20 Mbits/sec
125.0-130.0	0.12 MBytes	0.20 Mbits/sec
130.0-135.0	0.12 MBytes	0.20 Mbits/sec
135.0-140.0	0.12 MBytes	0.20 Mbits/sec
140.0-145.0	0.12 MBytes	0.20 Mbits/sec
145.0-150.0	0.12 MBytes	0.20 Mbits/sec
150.0-155.0	0.12 MBytes	0.20 Mbits/sec

**PC2**

Range (sec)	Data Size	Speed	Latency (ms)	Value	Percentage
497.0-498.0	0.03 MBytes	0.27 Mbits/sec	28.824	11/ 34	(32%)
497.0-498.0	0.03 MBytes	0.28 Mbits/sec	37.910	19/ 43	(44%)
498.0-499.0	0.03 MBytes	0.26 Mbits/sec	51.225	0/ 22	(0%)
498.0-499.0	0.03 MBytes	0.27 Mbits/sec	38.342	10/ 33	(30%)
498.0-499.0	0.02 MBytes	0.20 Mbits/sec	73.601	0/ 17	(0%)
498.0-499.0	0.03 MBytes	0.27 Mbits/sec	38.820	19/ 42	(45%)
499.0-500.0	0.02 MBytes	0.20 Mbits/sec	73.571	0/ 17	(0%)
499.0-500.0	0.03 MBytes	0.26 Mbits/sec	51.229	0/ 22	(0%)
499.0-500.0	0.03 MBytes	0.27 Mbits/sec	40.845	11/ 34	(32%)
499.0-500.0	0.03 MBytes	0.27 Mbits/sec	39.746	21/ 44	(48%)
500.0-501.0	0.03 MBytes	0.27 Mbits/sec	53.448	24/ 47	(51%)
500.0-501.0	0.02 MBytes	0.20 Mbits/sec	73.221	0/ 17	(0%)
500.0-501.0	0.03 MBytes	0.27 Mbits/sec	24.692	20/ 43	(47%)
500.0-501.0	0.03 MBytes	0.26 Mbits/sec	51.344	0/ 22	(0%)
501.0-502.0	0.03 MBytes	0.27 Mbits/sec	50.501	0/ 23	(0%)
501.0-502.0	0.02 MBytes	0.20 Mbits/sec	73.492	0/ 17	(0%)
501.0-502.0	0.03 MBytes	0.27 Mbits/sec	58.764	11/ 34	(32%)
501.0-502.0	0.03 MBytes	0.27 Mbits/sec	21.076	20/ 43	(47%)
502.0-503.0	0.02 MBytes	0.20 Mbits/sec	74.044	0/ 17	(0%)

```
Applications Emplacements Terminal jeu. 17:52
itqos@localhost:~
Fichier Édition Affichage Rechercher Terminal Aide

Router(config-if)#
Router(config-if)#no fai
Router(config-if)#no fair-queue
Router(config-if)#traff
Router(config-if)#traffic-shape ra
Router(config-if)#traffic-shape rate 1030624 0 1000
shaping interval is 0 milliseconds. intervals below 4 milliseconds rejected
Router(config-if)#traffic-shape rate 1030624 1030624 0 1000
Router(config-if)#
Router#show
*Nov 7 17:38:53.287: %SYS-5-CONFIG_I: Configured from console by consoletraff
Router#show traffic-shape qu
Router#show traffic-shape queue
Traffic queued in shaping queue on FastEthernet0/1
Queueing strategy: weighted fair
Queueing Stats: 77/1000/64/4188 (size/max total/threshold/drops)
Conversations 4/5/64 (active/max active/max total)
Reserved Conversations 0/0 (allocated/max allocated)
Available Bandwidth 1030 kilobits/sec

(depth/weight/total drops/no-buffer drops/interleaves) 25/32384/2642/0/0
Conversation 61, linktype: ip, length: 1512
source: 192.168.1.11, destination: 192.168.2.22, id: 0x8E97, ttl: 63,
TOS: 0 prot: 17, source port 52814, destination port 5001

(depth/weight/total drops/no-buffer drops/interleaves) 12/32384/0/0/0
Conversation 24, linktype: ip, length: 1512
source: 192.168.1.11, destination: 192.168.2.22, id: 0x8ED8, ttl: 63,
TOS: 0 prot: 17, source port 47550, destination port 5001

(depth/weight/total drops/no-buffer drops/interleaves) 16/32384/2/0/0
Conversation 23, linktype: ip, length: 1512
source: 192.168.1.11, destination: 192.168.2.22, id: 0x8ED7, ttl: 63,
TOS: 0 prot: 17, source port 55199, destination port 5001

(depth/weight/total drops/no-buffer drops/interleaves) 24/32384/1544/0/0
Conversation 34, linktype: ip, length: 1512
source: 192.168.1.11, destination: 192.168.2.22, id: 0x8ED3, ttl: 63,
TOS: 0 prot: 17, source port 52915, destination port 5001

Router#
```