

Διαχείριση Δικτύων Βασισμένων στο Λογισμικό

10^ο εργαστήριο: “Traffic tests”

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Go to <https://learning.knetsolutions.in/docs/ryu/#17-traffic-tests---part1> – Section 17: Traffic Tests - Part1.

Copy **l4_switch.py** file into ryu/ryu/app directory.

Then run the following tests:

1. TCP Tests

A. Traffic test from h1 to h4

Provide a screenshot with the measurement of the bandwidth using iperf in the direction h1 → h4.

```
mininet> h1 iperf -c h4
-----
Client connecting to 10.0.0.4, TCP port 5001
TCP window size: 85.3 KByte (default)
-----
[  3] local 10.0.0.1 port 54428 connected with 10.0.0.4 port 5001
[ ID] Interval        Transfer    Bandwidth
[  3]  0.0-10.0 sec   43.5 GBytes  37.4 Gbits/sec
```

Using the “n_bytes” option, validate this measurement using calculations (in bps).

B. Bidirectional Traffic test h1 to h4 (sequentially).

```
mininet> h1 iperf -c h4 -r
-----
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
-----
Client connecting to 10.0.0.4, TCP port 5001
TCP window size: 2.32 MByte (default)
-----
[  5] local 10.0.0.1 port 54462 connected with 10.0.0.4 port 5001
[ ID] Interval        Transfer    Bandwidth
[  5]  0.0-10.0 sec   52.2 GBytes  44.9 Gbits/sec
[  4] local 10.0.0.1 port 5001 connected with 10.0.0.4 port 41184
[  4]  0.0-10.0 sec   11.1 GBytes  9.52 Gbits/sec
```

C. Bidirectional Traffic test h1 to h4 (parallel).

```
mininet> h1 iperf -c h4 -d
-----
Server listening on TCP port 5001
TCP window size: 85.3 KByte (default)
-----
Client connecting to 10.0.0.4, TCP port 5001
TCP window size: 85.3 KByte (default)
-----
[ 5] local 10.0.0.1 port 54484 connected with 10.0.0.4 port 5001
[ 4] local 10.0.0.1 port 5001 connected with 10.0.0.4 port 41206
[ ID] Interval      Transfer    Bandwidth
[ 5]  0.0-10.0 sec  32.7 GBytes 28.1 Gbits/sec
[ 4]  0.0-10.0 sec   9.40 GBytes 8.06 Gbits/sec
```

D. Traffic test from h1 to h4 with Multiple Sessions.

```
mininet> h1 iperf -c h4 -P 5
-----
Client connecting to 10.0.0.4, TCP port 5001
TCP window size: 85.3 KByte (default)
-----
[ 4] local 10.0.0.1 port 54514 connected with 10.0.0.4 port 5001
[ 5] local 10.0.0.1 port 54516 connected with 10.0.0.4 port 5001
[ 6] local 10.0.0.1 port 54518 connected with 10.0.0.4 port 5001
[ 7] local 10.0.0.1 port 54520 connected with 10.0.0.4 port 5001
[ 3] local 10.0.0.1 port 54512 connected with 10.0.0.4 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 4]  0.0-10.0 sec  11.2 GBytes 9.58 Gbits/sec
[ 5]  0.0-10.0 sec  11.8 GBytes 10.1 Gbits/sec
[ 6]  0.0-10.0 sec  11.1 GBytes 9.50 Gbits/sec
[ 7]  0.0-10.0 sec  11.5 GBytes 9.87 Gbits/sec
[ 3]  0.0-10.0 sec  11.1 GBytes 9.53 Gbits/sec
[SUM] 0.0-10.0 sec  56.6 GBytes 48.6 Gbits/sec
```

Provide 3 screenshots with the previous measurement results.

2. UDP Tests with IPERF

Provide a screenshot with the measurement result.

```
mininet> h1 iperf -u -c h4 -b 10m
-----
Client connecting to 10.0.0.4, UDP port 5001
Sending 1470 byte datagrams, IPG target: 1176.00 us (kalman adjust)
UDP buffer size: 208 KByte (default)
-----
[ 3] local 10.0.0.1 port 52629 connected with 10.0.0.4 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 3]  0.0-10.0 sec  11.9 MBytes 10.0 Mbits/sec
[ 3] Sent 8504 datagrams
[ 3] Server Report:
[ 3]  0.0-10.0 sec  11.9 MBytes 10.0 Mbits/sec  0.000 ms    0/ 8504 (0%)
[ 3] 0.00-10.00 sec  2 datagrams received out-of-order
```

3. UDP Tests with MGEN

Visit the link: <https://cpham.perso.univ-pau.fr/ENSEIGNEMENT/QOS/mgen.html>

Check IPs with “dump” command.

Type: `vi receive.mgn`

And paste:

`LISTEN UDP 5000-5001`

similarly create `send.mgn` and paste:

`0.0 ON 1 UDP SRC 5001 DST 10.0.0.3/5001 PERIODIC [10 1024]`

`60.0 MOD 1 PERIODIC [100 1024]`

`120.0 OFF 1`

Type: `tail -f mgenlog.txt` or `cat mgenlog.txt`

Provide a terminal-size screenshot (i.e. just a few lines) of the produced `mgenlog.txt` file.

```
File Edit View Search Terminal Help
eirini@nikolas: ~
eirini@nikolas:~$ cat mgenlog.txt
17:09:07.223556 START Mgen Version 5.02b
17:09:07.223624 LISTEN proto>UDP port>5000
17:09:07.223636 LISTEN proto>UDP port>5001
17:09:32.011023 RECV proto>UDP flow>1 seq>0 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:32.007566 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:32.108235 RECV proto>UDP flow>1 seq>1 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:32.107988 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:32.208049 RECV proto>UDP flow>1 seq>2 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:32.207901 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:32.307852 RECV proto>UDP flow>1 seq>3 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:32.307711 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:32.408092 RECV proto>UDP flow>1 seq>4 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:32.407951 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:32.508930 RECV proto>UDP flow>1 seq>5 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:32.508786 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:32.608962 RECV proto>UDP flow>1 seq>6 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:32.608810 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:32.708066 RECV proto>UDP flow>1 seq>7 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:32.707917 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:32.818784 RECV proto>UDP flow>1 seq>8 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:32.818619 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:32.907744 RECV proto>UDP flow>1 seq>9 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:32.907606 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:33.008392 RECV proto>UDP flow>1 seq>10 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:33.008243 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:33.108248 RECV proto>UDP flow>1 seq>11 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:33.108098 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:33.208072 RECV proto>UDP flow>1 seq>12 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:33.207930 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:33.308374 RECV proto>UDP flow>1 seq>13 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:33.308234 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:33.408448 RECV proto>UDP flow>1 seq>14 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:33.408307 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:33.508804 RECV proto>UDP flow>1 seq>15 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:33.508663 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:33.608455 RECV proto>UDP flow>1 seq>16 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:33.608302 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:33.708395 RECV proto>UDP flow>1 seq>17 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:33.708246 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:33.808001 RECV proto>UDP flow>1 seq>18 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:33.807858 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:33.908269 RECV proto>UDP flow>1 seq>19 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:33.908131 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:34.008396 RECV proto>UDP flow>1 seq>20 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:34.008256 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:34.108703 RECV proto>UDP flow>1 seq>21 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:34.108560 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:34.208194 RECV proto>UDP flow>1 seq>22 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:34.208047 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:34.308629 RECV proto>UDP flow>1 seq>23 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:34.308482 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:34.408566 RECV proto>UDP flow>1 seq>24 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:34.408449 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:34.508280 RECV proto>UDP flow>1 seq>25 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:34.508139 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:34.608152 RECV proto>UDP flow>1 seq>26 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:34.608015 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:34.708334 RECV proto>UDP flow>1 seq>27 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:34.708187 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:34.808184 RECV proto>UDP flow>1 seq>28 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:34.808035 size>1024 gps>INVALID,999.000000,999.000000,4294966297
17:09:34.908130 RECV proto>UDP flow>1 seq>29 src>10.0.0.1/5001 dst>10.0.0.3/5001 sent>17:09:34.907993 size>1024 gps>INVALID,999.000000,999.000000,4294966297
```

4. Video Stream Traffic Testing

Type: `sudo apt-get install vlc vlc-bin`

Download a video, e.g.: Standard 2D - Full HD (1920x1080) <http://bbb3d.renderfarming.net/download.html> and place it in your home/username directory.

Provide a screenshot like the following, proving that you have managed to stream the video of your choice:


```

mininet> h1 iperf -c 10.1.1.4 --udp --len 300 --bandwidth 67000 --dualtest --tradeoff --tos 184 -fk --interval 5 --time 60
--listenport 5002
-----
Server listening on UDP port 5002
Receiving 1470 byte datagrams
UDP buffer size: 208 KByte (default)
-----
Client connecting to 10.1.1.4, UDP port 5001
Sending 300 byte datagrams, IPG target: 35820.90 us (kalman adjust)
UDP buffer size: 208 KByte (default)
-----
recvack failed: Resource temporarily unavailable
[ 4] local 10.0.0.1 port 39453 connected with 10.1.1.4 port 5001 (server version is old)
[ ID] Interval      Transfer      Bandwidth
[ 4]  0.0- 5.0 sec  41.3 KBytes  67.7 Kbits/sec
[ 4]  5.0-10.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 4] 10.0-15.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 4] 15.0-20.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 4] 20.0-25.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 4] 25.0-30.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 4] 30.0-35.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 4] 35.0-40.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 4] 40.0-45.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 4] 45.0-50.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 4] 50.0-55.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 4] 55.0-60.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 4]  0.0-60.1 sec  491 KBytes  67.0 Kbits/sec
[ 4] Sent 1677 datagrams
[ 4] WARNING: did not receive ack of last datagram after 10 tries.

```

B. Multiple Parallel calls VOIP calls test

```

mininet> h1 iperf -c 10.1.1.4 --udp --len 300 --bandwidth 67000 --dualtest --tradeoff --tos 184 -fk --interval 5 --time 60
--listenport 5002 --parallel 4
-----
Server listening on UDP port 5002
Receiving 1470 byte datagrams
UDP buffer size: 208 KByte (default)
-----
Client connecting to 10.1.1.4, UDP port 5001
Sending 300 byte datagrams, IPG target: 35820.90 us (kalman adjust)
UDP buffer size: 208 KByte (default)
-----
recvack failed: Resource temporarily unavailable
recvack failed: Resource temporarily unavailable
recvack failed: Resource temporarily unavailable
recvack failed: Resource temporarily unavailable
[ 3] local 10.0.0.1 port 34833 connected with 10.1.1.4 port 5001 (server version is old)
[ 4] local 10.0.0.1 port 50561 connected with 10.1.1.4 port 5001 (server version is old)
[ 6] local 10.0.0.1 port 38673 connected with 10.1.1.4 port 5001 (server version is old)
[ 7] local 10.0.0.1 port 34230 connected with 10.1.1.4 port 5001 (server version is old)
[ ID] Interval      Transfer      Bandwidth
[ 3]  0.0- 5.0 sec  41.3 KBytes  67.7 Kbits/sec
[ 4]  0.0- 5.0 sec  41.3 KBytes  67.7 Kbits/sec
[ 6]  0.0- 5.0 sec  41.3 KBytes  67.7 Kbits/sec
[ 7]  0.0- 5.0 sec  41.3 KBytes  67.7 Kbits/sec
[SUM] 0.0- 5.0 sec   165 KBytes   271 Kbits/sec
[ 3]  5.0-10.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 4]  5.0-10.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 6]  5.0-10.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 7]  5.0-10.0 sec  41.0 KBytes  67.2 Kbits/sec
[SUM] 5.0-10.0 sec   164 KBytes   269 Kbits/sec
[ 3] 10.0-15.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 4] 10.0-15.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 6] 10.0-15.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 7] 10.0-15.0 sec  40.7 KBytes  66.7 Kbits/sec
[SUM] 10.0-15.0 sec   163 KBytes   267 Kbits/sec
[ 3] 15.0-20.0 sec  39.0 KBytes  63.8 Kbits/sec
[ 4] 15.0-20.0 sec  39.0 KBytes  63.8 Kbits/sec
[ 6] 15.0-20.0 sec  39.0 KBytes  63.8 Kbits/sec
[ 7] 15.0-20.0 sec  39.0 KBytes  63.8 Kbits/sec
[SUM] 15.0-20.0 sec   156 KBytes   255 Kbits/sec
[ 3] 20.0-25.0 sec  42.8 KBytes  70.1 Kbits/sec
[ 4] 20.0-25.0 sec  42.8 KBytes  70.1 Kbits/sec
[ 6] 20.0-25.0 sec  42.8 KBytes  70.1 Kbits/sec
[ 7] 20.0-25.0 sec  42.8 KBytes  70.1 Kbits/sec
[SUM] 20.0-25.0 sec   171 KBytes   280 Kbits/sec

```

```

[ 4] 25.0-30.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 3] 25.0-30.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 6] 25.0-30.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 7] 25.0-30.0 sec  41.0 KBytes  67.2 Kbits/sec
[SUM] 25.0-30.0 sec   164 KBytes   269 Kbits/sec
[ 3] 30.0-35.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 6] 30.0-35.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 4] 30.0-35.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 7] 30.0-35.0 sec  41.0 KBytes  67.2 Kbits/sec
[SUM] 30.0-35.0 sec   164 KBytes   269 Kbits/sec
[ 3] 35.0-40.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 4] 35.0-40.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 6] 35.0-40.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 7] 35.0-40.0 sec  40.7 KBytes  66.7 Kbits/sec
[SUM] 35.0-40.0 sec   163 KBytes   267 Kbits/sec
[ 3] 40.0-45.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 4] 40.0-45.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 6] 40.0-45.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 7] 40.0-45.0 sec  41.0 KBytes  67.2 Kbits/sec
[SUM] 40.0-45.0 sec   164 KBytes   269 Kbits/sec
[ 3] 45.0-50.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 4] 45.0-50.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 6] 45.0-50.0 sec  40.7 KBytes  66.7 Kbits/sec
[ 7] 45.0-50.0 sec  40.7 KBytes  66.7 Kbits/sec
[SUM] 45.0-50.0 sec   163 KBytes   267 Kbits/sec
[ 3] 50.0-55.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 4] 50.0-55.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 6] 50.0-55.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 7] 50.0-55.0 sec  41.0 KBytes  67.2 Kbits/sec
[SUM] 50.0-55.0 sec   164 KBytes   269 Kbits/sec
[ 3] 55.0-60.0 sec  41.0 KBytes  67.2 Kbits/sec
[ 4]  0.0-60.1 sec  491 KBytes  67.0 Kbits/sec
[ 4] Sent 1676 datagrams
[ 6]  0.0-60.1 sec  491 KBytes  67.0 Kbits/sec
[ 6] Sent 1676 datagrams
[ 7]  0.0-60.1 sec  491 KBytes  67.0 Kbits/sec
[ 7] Sent 1676 datagrams
[ 3]  0.0-60.1 sec  491 KBytes  66.9 Kbits/sec
[ 3] Sent 1677 datagrams
[SUM]  0.0-60.1 sec 1964 KBytes   268 Kbits/sec
[SUM] Sent 6705 datagrams
[ 6] WARNING: did not receive ack of last datagram after 10 tries.
[ 4] WARNING: did not receive ack of last datagram after 10 tries.
[ 7] WARNING: did not receive ack of last datagram after 10 tries.
[ 3] WARNING: did not receive ack of last datagram after 10 tries.

```

Provide 2 screenshots with the previous measurement results.

6. D-ITG Distributed Internet Traffic Generator

Open <https://learning.knetsolutions.in/docs/ryu/#18-traffic-tests-with-ditg> - Section 18: Traffic Tests with DITG. Only UDP Part.

Run this test and show the output of the receiver.log file.

```
eirini@nikolas:/tmp$ ITGDec receiver.log
ITGDec version 2.8.1 (r1023)
Compile-time options: sctp dccp bursty multiport
-----
Flow number: 1
From 10.1.1.1:55728
To 10.1.1.2:8999
-----
Total time                = 14.982986 s
Total packets             = 143
Minimum delay             = 0.000070 s
Maximum delay             = 0.002340 s
Average delay             = 0.000203 s
Average jitter            = 0.000129 s
Delay standard deviation = 0.000269 s
Bytes received            = 14300
Average bitrate           = 7.635327 Kbit/s
Average packet rate       = 9.544159 pkt/s
Packets dropped           = 0 (0.00 %)
Average loss-burst size   = 0.000000 pkt
-----

***** TOTAL RESULTS *****
-----
Number of flows           = 1
Total time                = 14.982986 s
Total packets             = 143
Minimum delay             = 0.000070 s
Maximum delay             = 0.002340 s
Average delay             = 0.000203 s
Average jitter            = 0.000129 s
Delay standard deviation = 0.000269 s
Bytes received            = 14300
Average bitrate           = 7.635327 Kbit/s
Average packet rate       = 9.544159 pkt/s
Packets dropped           = 0 (0.00 %)
Average loss-burst size   = 0 pkt
Error lines               = 0
-----
```