

Российский университет дружбы народов
Факультет физико-математических и естественных наук

Отчёт по лабораторной работе №2

Москва 2023

1032203967
Быстров Глеб

Цель работы (задание)

- Знакомство с инструментом для измерения пропускной способности сети в режиме реального времени — iPerf3,
- Получение навыков проведения интерактивного эксперимента по измерению пропускной способности моделируемой сети в среде Mininet.

Задачи (метод выполнения)

- Установка необходимого программного обеспечения

```
mininet@mininet-vm:~$ sudo apt-get install iperf3
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  libiperf0 libsctp1
Suggested packages:
  lksctp-tools
The following NEW packages will be installed:
  iperf3 libiperf0 libsctp1
0 upgraded, 3 newly installed, 0 to remove and 378 not upgraded.
Need to get 94.1 kB of archives.
After this operation, 331 kB of additional disk space will be used.
Do you want to continue? [Y/n]
```

```
mininet@mininet-vm:~$ cd /tmp
mininet@mininet-vm:/tmp$ git clone https://github.com/ekfoury/iperf3_plotter.git
Cloning into 'iperf3_plotter'...
remote: Enumerating objects: 74, done.
remote: Total 74 (delta 0), reused 0 (delta 0), pack-reused 74
Unpacking objects: 100% (74/74), 100.09 KiB | 86.00 KiB/s, done.
mininet@mininet-vm:/tmp$ cd /tmp/iperf3_plotter
mininet@mininet-vm:/tmp/iperf3_plotter$ sudo cp plot_* /usr/bin
mininet@mininet-vm:/tmp/iperf3_plotter$ sudo cp *.sh /usr/bin
```


Задачи (метод выполнения)

- Интерактивные эксперименты

```
mininet@mininet-vm:/tmp/iperf3_plotter$ sudo mn --topo=single,2 -x
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2
*** Adding switches:
s1
*** Adding links:
(h1, s1) (h2, s1)
*** Configuring hosts
h1 h2
*** Running terms on localhost:10.0
*** Starting controller
c0
*** Starting 1 switches
s1 ...
*** Starting CLI:
mininet>
```

```
mininet> net
h1 h1-eth0:s1-eth1
h2 h2-eth0:s1-eth2
s1 lo: s1-eth1:h1-eth0 s1-eth2:h2-eth0
c0
mininet> links
h1-eth0<->s1-eth1 (OK OK)
h2-eth0<->s1-eth2 (OK OK)
mininet> dump
<Host h1: h1-eth0:10.0.0.1 pid=4312>
<Host h2: h2-eth0:10.0.0.2 pid=4316>
<OVSSwitch s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None pid=4321>
<Controller c0: 127.0.0.1:6653 pid=4305>
```

Задачи (метод выполнения)

- Интерактивные эксперименты

```
host: h1@mininet-vm
[ 7] local 10.0.0.1 port 59646 connected to 10.0.0.2 port 5201
[ ID] Interval          Transfer    Bitrate    Retr  Cwnd
[ 7]  0.00-1.00      sec  1.20 GBytes  10.2 Gbits/sec    0   8.04 MBytes
[ 7]  1.00-2.00      sec  1.14 GBytes  9.83 Gbits/sec    2   8.04 MBytes
[ 7]  2.00-3.00      sec  1.12 GBytes  9.60 Gbits/sec    0   8.04 MBytes
[ 7]  3.00-4.00      sec  1.12 GBytes  9.61 Gbits/sec    1   8.04 MBytes
[ 7]  4.00-5.01      sec  1.18 GBytes  10.0 Gbits/sec    2   8.04 MBytes
[ 7]  5.01-6.01      sec  1.12 GBytes  9.65 Gbits/sec    3   8.04 MBytes
[ 7]  6.01-7.02      sec  1015 MBytes  8.43 Gbits/sec    0   8.04 MBytes
[ 7]  7.02-8.01      sec  1.10 GBytes  9.57 Gbits/sec    0   8.04 MBytes
[ 7]  8.01-9.00      sec  1.20 GBytes  10.3 Gbits/sec    0   8.04 MBytes
[ 7]  9.00-10.00     sec  1.20 GBytes  10.3 Gbits/sec    0   8.04 MBytes
-----
[ ID] Interval          Transfer    Bitrate    Retr
[ 7]  0.00-10.00     sec  11.4 GBytes  9.76 Gbits/sec    8
[ 7]  0.00-10.01     sec  11.4 GBytes  9.75 Gbits/sec
sender
receiver

iperf Done.
root@mininet-vm:/home/mininet#
```

Задачи (метод выполнения)

- Интерактивные эксперименты

```
mininet@mininet-vm: ~  
mininet> h1 iperf3 -c h2  
Connecting to host 10.0.0.2, port 5201  
[ 5] local 10.0.0.1 port 59650 connected to 10.0.0.2 port 5201  
[ ID] Interval      Transfer    Bitrate      Retr  Cwnd  
[ 5]  0.00-1.01    sec  1004 MBytes  8.36 Gbits/sec  0   8.36 MBytes  
[ 5]  1.01-2.01    sec  1.02 GBytes  8.79 Gbits/sec  0   8.36 MBytes  
[ 5]  2.01-3.00    sec  1.04 GBytes  8.98 Gbits/sec  1   8.36 MBytes  
[ 5]  3.00-4.01    sec  1.03 GBytes  8.79 Gbits/sec  0   8.36 MBytes  
[ 5]  4.01-5.00    sec  1.19 GBytes  10.3 Gbits/sec  0   8.36 MBytes  
[ 5]  5.00-6.00    sec  1.15 GBytes  9.87 Gbits/sec  1   8.36 MBytes  
[ 5]  6.00-7.00    sec  1.16 GBytes  9.98 Gbits/sec  0   8.36 MBytes  
[ 5]  7.00-8.01    sec  1.10 GBytes  9.39 Gbits/sec  0   8.36 MBytes  
[ 5]  8.01-9.01    sec   954 MBytes  7.99 Gbits/sec  1   8.36 MBytes  
[ 5]  9.01-10.00   sec   959 MBytes  8.09 Gbits/sec  0   8.36 MBytes  
-----  
[ ID] Interval      Transfer    Bitrate      Retr  
[ 5]  0.00-10.00   sec  10.5 GBytes  9.05 Gbits/sec  3  
[ 5]  0.00-10.01   sec  10.5 GBytes  9.03 Gbits/sec  
sender  
receiver  
iperf Done.
```


Задачи (метод выполнения)

- Интерактивные эксперименты

```
host: h1@mininet-vm
root@mininet-vm:~# iperf3 -c 10.0.0.2 -t 5
Connecting to host 10.0.0.2, port 5201
[ 7] local 10.0.0.1 port 59684 connected to 10.0.0.2 port 5201
[ ID] Interval          Transfer    Bitrate      Retr  Cwnd
[ 7]  0.00-1.00      sec  1.17 GBytes  10.0 Gbits/sec    0   8.39 MBytes
[ 7]  1.00-2.00      sec  1.17 GBytes  10.0 Gbits/sec    0   8.39 MBytes
[ 7]  2.00-3.01      sec  1.24 GBytes  10.6 Gbits/sec    0   8.39 MBytes
[ 7]  3.01-4.00      sec  1.20 GBytes  10.3 Gbits/sec    2   8.39 MBytes
[ 7]  4.00-5.00      sec  1.18 GBytes  10.1 Gbits/sec    1   5.91 MBytes
-----
[ ID] Interval          Transfer    Bitrate      Retr
[ 7]  0.00-5.00      sec  5.95 GBytes  10.2 Gbits/sec    3
[ 7]  0.00-5.01      sec  5.95 GBytes  10.2 Gbits/sec
sender
receiver

iperf Done.
root@mininet-vm:~#
```

Задачи (метод выполнения)

- Интерактивные эксперименты

```
root@mininet-vm:~# iperf3 -c 10.0.0.2 -i 2
Connecting to host 10.0.0.2, port 5201
[ 7] local 10.0.0.1 port 59688 connected to 10.0.0.2 port 5201
[ ID] Interval      Transfer    Bitrate      Retr   Cwnd
[ 7]  0.00-2.00    sec  2.06 GBytes 8.83 Gbits/sec  1    8.30 MBytes
[ 7]  2.00-4.00    sec  2.13 GBytes 9.12 Gbits/sec  0    8.30 MBytes
[ 7]  4.00-6.00    sec  2.06 GBytes 8.83 Gbits/sec  2    8.30 MBytes
[ 7]  6.00-8.00    sec  2.31 GBytes 9.94 Gbits/sec  1    8.30 MBytes
[ 7]  8.00-10.00   sec  2.13 GBytes 9.16 Gbits/sec  2    8.30 MBytes
-----
[ ID] Interval      Transfer    Bitrate      Retr
[ 7]  0.00-10.00   sec  10.7 GBytes 9.17 Gbits/sec  6
[ 7]  0.00-10.00   sec  10.7 GBytes 9.17 Gbits/sec
                                     sender
                                     receiver

iperf Done.
```


Задачи (метод выполнения)

- Интерактивные эксперименты

```
host: h1"@"mininet-vm
    "bytes": 12529995456,
    "bits_per_second": 10020393031.465885,
    "sender": true
  },
  "cpu_utilization_percent": {
    "host_total": 49.69162804803144,
    "host_user": 0.87219121964966451,
    "host_system": 48.819436828381775,
    "remote_total": 17.548528507318316,
    "remote_user": 1.3731889684129586,
    "remote_system": 16.175328702759053
  },
  "sender_tcp_congestion": "cubic",
  "receiver_tcp_congestion": "cubic"
}
root@mininet-vm:~# iperf3 -c 10.0.0.2 -J > /home/mininet/work/lab_iperf3/iperf_results.json
root@mininet-vm:~# cd /home/mininet/work/lab_iperf3
root@mininet-vm:/home/mininet/work/lab_iperf3# ls -l
total 8
-rw-r--r-- 1 root root 7806 Nov 24 10:01 iperf_results.json
root@mininet-vm:/home/mininet/work/lab_iperf3# ls
iperf_results.json
root@mininet-vm:/home/mininet/work/lab_iperf3#
```

```
mininet@mininet-vm: ~/work/lab_iperf3/results
-rw-r--r-- 1 mininet mininet 7806 Nov 24 10:01 iperf_results.json
mininet@mininet-vm:~/work/lab_iperf3$ plot iperf.sh iperf3_results.json
Error: iperf3_results.json is not a file. Quitting...
mininet@mininet-vm:~/work/lab_iperf3$ plot iperf.sh iperf3_result.json
Error: iperf3_result.json is not a file. Quitting...
mininet@mininet-vm:~/work/lab_iperf3$ plot iperf.sh iperf_results.json
mininet@mininet-vm:~/work/lab_iperf3$ ls -l
total 16
-rw-rw-r-- 1 mininet mininet 969 Nov 24 10:09 iperf.csv
-rw-r--r-- 1 mininet mininet 7806 Nov 24 10:01 iperf_results.json
drwxrwxr-x 2 mininet mininet 4096 Nov 24 10:09 results
mininet@mininet-vm:~/work/lab_iperf3$ cd /results
-bash: cd: /results: No such file or directory
mininet@mininet-vm:~/work/lab_iperf3$ cd results
mininet@mininet-vm:~/work/lab_iperf3/results$ ls -l
total 88
-rw-rw-r-- 1 mininet mininet 508 Nov 24 10:09 1.dat
-rw-rw-r-- 1 mininet mininet 9800 Nov 24 10:09 bytes.pdf
-rw-rw-r-- 1 mininet mininet 9618 Nov 24 10:09 cwnd.pdf
-rw-rw-r-- 1 mininet mininet 9036 Nov 24 10:09 MTU.pdf
-rw-rw-r-- 1 mininet mininet 8998 Nov 24 10:09 retransmits.pdf
-rw-rw-r-- 1 mininet mininet 9056 Nov 24 10:09 RTT.pdf
-rw-rw-r-- 1 mininet mininet 9133 Nov 24 10:09 RTT_Var.pdf
-rw-rw-r-- 1 mininet mininet 9646 Nov 24 10:09 throughput.pdf
mininet@mininet-vm:~/work/lab_iperf3/results$
```

Результаты и их анализ

- Успешно удалось познакомиться с iPerf3, а также измерить пропускную способность моделируемой сети в среде Mininet.



Благодарю за внимание