# Лабораторная работа №2.

Измерение и тестирование пропускной способности сети. Интерактивный эксперимент

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# Цели и задачи работы

# Цели и задачи работы

Основной целью работы является знакомство с инструментом для измерения пропускной способности сети в режиме реального времени — iPerf3, а также получение навыков проведения интерактивного эксперимента по измерению пропускной способности моделируемой сети в среде Mininet.

# Установка необходимого программного обеспечения

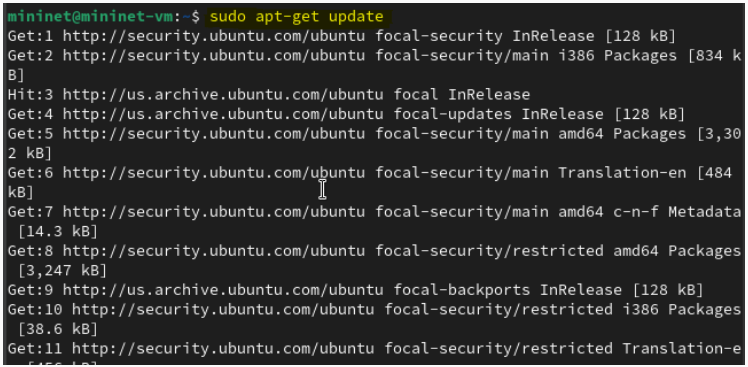


**Рис. 1:** Обновление репозиториев ПО

# 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 391 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]
Get:1 http://us.archive.ubuntu.com/ubuntu focal/main amd64 libsctp1 amd64 1.0.18
+dfsg-1 [7,876 B]
Get:2 http://us.archive.ubuntu.com/ubuntu focal/universe amd64 libiperf0 amd64 3
.7-3 [72.0 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu focal/universe amd64 iperf3 amd64 3.7-
3 [14.2 kB]
Fetched 94.1 kB in 1s (125 kB/s)
Selecting previously unselected package libsctp1:amd64.
(Reading database ... 102146 files and directories currently installed.)
Preparing to unpack .../libsctp1_1.0.18+dfsg-1_amd64.deb ...
Unpacking libsctp1:amd64 (1.0.18+dfsg-1) ...
Selecting previously unselected package libiperf0:amd64.
Preparing to unpack .../libiperf0_3.7-3_amd64.deb ...
Unpacking libiperf0:amd64 (3.7-3) ...
Selecting previously unselected package iperf3.
Preparing to unpack .../iperf3_3.7-3_amd64.deb ...
Unpacking iperf3 (3.7-3) ...
Setting up libsctp1:amd64 (1.0.18+dfsg-1) ...
Setting up libiperf0:amd64 (3.7-3) ...
Setting up iperf3 (3.7-3) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for libc-bin (2.31-0ubuntu9)
```

# Установка необходимого программного обеспечения

```
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 (from 1)
Unpacking objects: 100% (74/74), 100.09 KiB | 1.01 MiB/s, done.
```

**Рис. 3:** Установка iperf3_plotter. git clone

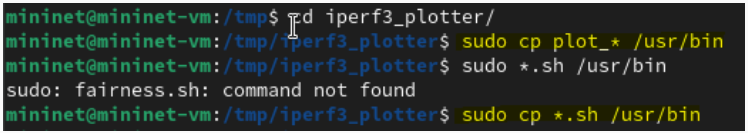


**Рис. 4:** Установка iperf3_plotter. перенос файлов

# Интерактивные эксперименты

```
mininet@mininet-vm:~$ 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>
```

# Интерактивные эксперименты

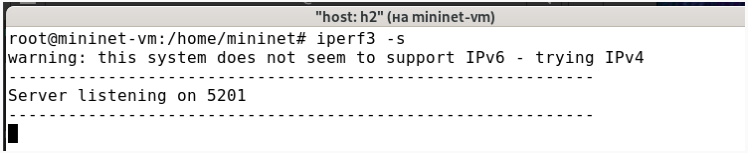


**Рис. 6:** Запуск сервера iperf3

# Интерактивные эксперименты

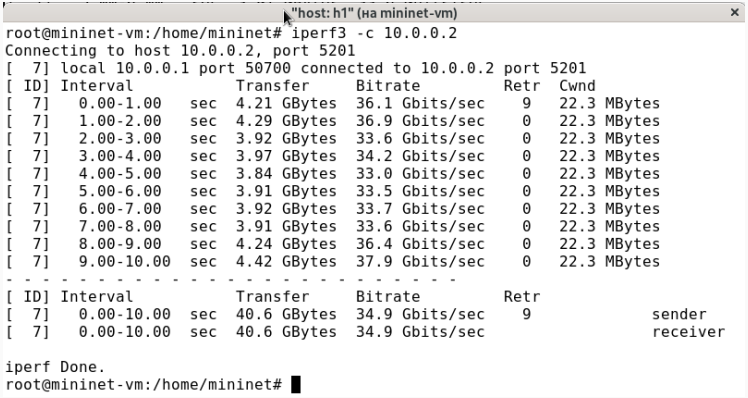


Рис. 7: Запуск клиента iperf3

```
root@mininet-vm:/home/mininet# iperf3 -c 10.0.0.2 -t 5
Connecting to host 10.0.0.2, port 5201
[  7] local 10.0.0.1 port 50708 connected to 10.0.0.2 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  7]   0.00-1.00   sec  4.30 GBytes  37.0 Gbits/sec    0   8.01 MBytes
[  7]   1.00-2.00   sec  4.22 GBytes  36.3 Gbits/sec    0   8.01 MBytes
[  7]   2.00-3.00   sec  4.19 GBytes  36.0 Gbits/sec    0   8.01 MBytes
[  7]   3.00-4.00   sec  4.25 GBytes  36.5 Gbits/sec    0   8.01 MBytes
[  7]   4.00-5.00   sec  4.35 GBytes  37.4 Gbits/sec    0   8.01 MBytes
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  7]   0.00-5.00   sec  21.3 GBytes  36.6 Gbits/sec    0             sender
[  7]   0.00-5.00   sec  21.3 GBytes  36.6 Gbits/sec                  receiver

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

Рис. 8: Измерение пропускной способности. Опция -t

```
root@mininet-vm:/home/mininet# iperf3 -c 10.0.0.2 -i 2
Connecting to host 10.0.0.2, port 5201
[  7] local 10.0.0.1 port 50712 connected to 10.0.0.2 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  7]   0.00-2.00   sec  8.75 GBytes  37.5 Gbits/sec   11   4.16 MBytes
[  7]   2.00-4.00   sec  8.97 GBytes  38.5 Gbits/sec    0   4.17 MBytes
[  7]   4.00-6.00   sec  8.92 GBytes  38.3 Gbits/sec    0   4.18 MBytes
[  7]   6.00-8.00   sec  9.13 GBytes  39.3 Gbits/sec    0   4.19 MBytes
[  7]   8.00-10.00  sec  9.16 GBytes  39.3 Gbits/sec    0   4.20 MBytes
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  7]   0.00-10.00  sec  44.9 GBytes  38.6 Gbits/sec   11             sender
[  7]   0.00-10.00  sec  44.9 GBytes  38.6 Gbits/sec                  receiver

iperf Done.
```

**Рис. 9:** Измерение пропускной способности. Опция -i. Запуск клиента

# Интерактивные эксперименты

```
root@mininet-vm:/home/mininet# iperf3 -c 10.0.0.2 -n 16G
Connecting to host 10.0.0.2, port 5201
[  7] local 10.0.0.1 port 50716 connected to 10.0.0.2 port 5201
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  7]   0.00-1.00   sec  4.20 GBytes  36.0 Gbits/sec   19   4.15 MBytes
[  7]   1.00-2.00   sec  4.15 GBytes  35.7 Gbits/sec    0   4.16 MBytes
[  7]   2.00-3.00   sec  4.10 GBytes  35.2 Gbits/sec    0   4.16 MBytes
[  7]   3.00-3.83   sec  3.55 GBytes  36.7 Gbits/sec    0   4.16 MBytes
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  7]   0.00-3.83   sec  16.0 GBytes  35.9 Gbits/sec   19             sender
[  7]   0.00-3.83   sec  16.0 GBytes  35.8 Gbits/sec                  receiver

iperf Done.
```

**Рис. 10:** Измерение пропускной способности. Опция -n. Запуск клиента

# Интерактивные эксперименты

```
root@mininet-vm:/home/mininet# iperf3 -c 10.0.0.2 -u
Connecting to host 10.0.0.2, port 5201
[  7] local 10.0.0.1 port 34130 connected to 10.0.0.2 port 5201
[ ID] Interval           Transfer     Bitrate         Total Datagrams
[  7]   0.00-1.00   sec   129 KBytes  1.05 Mbits/sec  91
[  7]   1.00-2.00   sec   127 KBytes  1.04 Mbits/sec  90
[  7]   2.00-3.00   sec   129 KBytes  1.05 Mbits/sec  91
[  7]   3.00-4.00   sec   127 KBytes  1.04 Mbits/sec  90
[  7]   4.00-5.00   sec   129 KBytes  1.05 Mbits/sec  91
[  7]   5.00-6.00   sec   129 KBytes  1.05 Mbits/sec  91
[  7]   6.00-7.00   sec   127 KBytes  1.04 Mbits/sec  90
[  7]   7.00-8.00   sec   129 KBytes  1.05 Mbits/sec  91
[  7]   8.00-9.00   sec   127 KBytes  1.04 Mbits/sec  90
[  7]   9.00-10.00  sec   129 KBytes  1.05 Mbits/sec  91
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Jitter    Lost/Total Datag
rams
[  7]   0.00-10.00  sec  1.25 MBytes  1.05 Mbits/sec  0.000 ms  0/906 (0%)  send
er
[  7]   0.00-10.00  sec  1.25 MBytes  1.05 Mbits/sec  0.013 ms  0/906 (0%)  rece
iver

iperf Done.
```

**Рис. 11:** Измерение пропускной способности. Опция -u. Запуск клиента

```
root@mininet-vm:/home/mininet# iperf3 -c 10.0.0.2 -p 3250
Connecting to host 10.0.0.2, port 3250
[  7] local 10.0.0.1 port 46254 connected to 10.0.0.2 port 3250
[ ID] Interval           Transfer     Bitrate         Retr  Cwnd
[  7]   0.00-1.00   sec  4.38 GBytes  37.7 Gbits/sec    0   8.18 MBytes
[  7]   1.00-2.00   sec  4.36 GBytes  37.4 Gbits/sec    0   8.18 MBytes
[  7]   2.00-3.00   sec  4.41 GBytes  37.9 Gbits/sec    0   8.18 MBytes
[  7]   3.00-4.00   sec  4.42 GBytes  37.9 Gbits/sec    0   8.18 MBytes
[  7]   4.00-5.00   sec  4.37 GBytes  37.5 Gbits/sec    0   8.18 MBytes
[  7]   5.00-6.00   sec  4.35 GBytes  37.4 Gbits/sec    0   8.18 MBytes
[  7]   6.00-7.00   sec  4.45 GBytes  38.2 Gbits/sec    0   8.18 MBytes
[  7]   7.00-8.00   sec  4.44 GBytes  38.1 Gbits/sec    0   8.18 MBytes
[  7]   8.00-9.00   sec  4.33 GBytes  37.1 Gbits/sec    0   8.18 MBytes
[  7]   9.00-10.00  sec  4.39 GBytes  37.7 Gbits/sec    0   8.18 MBytes
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate         Retr
[  7]   0.00-10.00  sec  43.9 GBytes  37.7 Gbits/sec    0             sender
[  7]   0.00-10.00  sec  43.9 GBytes  37.7 Gbits/sec                  receiver

iperf Done.
```

**Рис. 12:** Измерение пропускной способности. Опция -p. Запуск клиента

```
root@mininet-vm:/home/mininet# iperf3 -s -1
warning: this system does not seem to support IPv6 - trying IPv4
-----------------------------------------------------------
Server listening on 5201
-----------------------------------------------------------
Accepted connection from 10.0.0.1, port 50724
[  7] local 10.0.0.2 port 5201 connected to 10.0.0.1 port 50726
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-1.00   sec  4.36 GBytes  37.4 Gbits/sec
[  7]   1.00-2.00   sec  4.40 GBytes  37.8 Gbits/sec
[  7]   2.00-3.00   sec  4.34 GBytes  37.2 Gbits/sec
[  7]   3.00-4.00   sec  4.33 GBytes  37.2 Gbits/sec
[  7]   4.00-5.00   sec  4.39 GBytes  37.7 Gbits/sec
[  7]   5.00-6.00   sec  4.38 GBytes  37.6 Gbits/sec
[  7]   6.00-7.00   sec  4.46 GBytes  38.3 Gbits/sec
[  7]   7.00-8.00   sec  4.33 GBytes  37.2 Gbits/sec
[  7]   8.00-9.00   sec  4.42 GBytes  38.0 Gbits/sec
[  7]   9.00-10.00  sec  4.39 GBytes  37.6 Gbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bitrate
[  7]   0.00-10.00  sec  43.8 GBytes  37.6 Gbits/sec                  receiver
```

**Рис. 13:** Измерение пропускной способности. Опция -1. Запуск сервера

```
root@mininet-vm:/home/mininet# iperf3 -c 10.0.0.2 -J
{
        "start":        {
                "connected":    [{
                                "socket":       7,
                                "local_host":   "10.0.0.1",
                                "local_port":   50730,
                                "remote_host":  "10.0.0.2",
                                "remote_port":  5201
                        }],
                "version":      "iperf 3.7",
                "system_info":  "Linux mininet-vm 5.4.0-42-generic #46-Ubuntu SMP Fri J
ul 10 00:24:02 UTC 2020 x86_64",
                "timestamp":    {
                        "time": "Wed, 20 Nov 2024 14:28:51 GMT",
                        "timesecs":     1732112931
                },
                "connecting_to":        {
                        "host": "10.0.0.2"
```

**Рис. 14:** Измерение пропускной способности. Опция -J. Запуск клиента.

```
root@mininet-vm:/home/mininet# iperf3 -c 10.0.0.2 -J > /home/mininet/work/lab_iperf3/i
perf_results.json
```

**Рис. 15:** Перенаправление вывода в файл

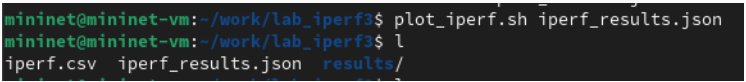


Рис. 16: Генерация выходных данных для файла JSON

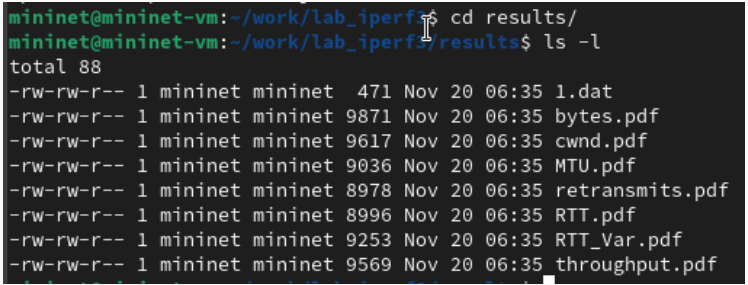


Рис. 17: Файлы с графиками

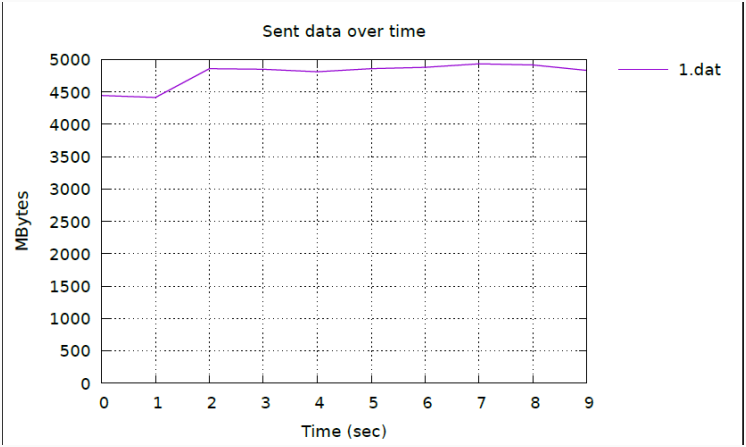


Рис. 18: bytes.pdf

# Интерактивные эксперименты

# Выводы по проделанной работе

# Выводы по проделанной работе

В ходе лабораторной работы я познакомилась с инструментом для измерения пропускной способности сети в режиме реального времени — iPerf3, а также получила навыки проведения интерактивного эксперимента по измерению пропускной способности моделируемой сети в среде Mininet.