

Презентация по лабораторной работе №2

Дисциплина: Моделирование сетей передачи данных

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11 сентября 2025

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Цель

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.

Задание

1. Установить на виртуальную машину mininet iPerf3 и дополнительное программное обеспечения для визуализации и обработки данных.
2. Провести ряд интерактивных экспериментов по измерению пропускной способности с помощью iPerf3 с построением графиков.

Выполнение

```
[pilobanova@fedora ~]$ ssh -Y mininet@192.168.56.103
Welcome to Ubuntu 20.04.1 LTS (GNU/Linux 5.4.0-42-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Check your
Internet connection or proxy settings

Last login: Wed Sep 10 14:46:26 2025
mininet@mininet-vm:~$
```

Рис. 1: Подключение к виртуальной машине

```
mininet@mininet-vm:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 192.168.56.103  netmask 255.255.255.0  broadcast 192.168.56.255
    ether 08:00:27:11:9f:c6  txqueuelen 1000  (Ethernet)
    RX packets 109  bytes 12741 (12.7 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 73  bytes 11825 (11.8 KB)
    TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 10.0.2.15  netmask 255.255.255.0  broadcast 10.0.2.255
    ether 08:00:27:df:ed:48  txqueuelen 1000  (Ethernet)
    RX packets 5  bytes 1028 (1.0 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 6  bytes 722 (722.0 B)
    TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
    inet 127.0.0.1  netmask 255.0.0.0
    loop txqueuelen 1000  (Local Loopback)
    RX packets 116  bytes 9056 (9.0 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 116  bytes 9056 (9.0 KB)
    TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0
```

Рис. 2: IP-адреса машины

```
mininet@mininet-vm:~$ sudo apt-get update
Get:1 http://security.ubuntu.com/ubuntu focal-security InRelease [128 kB]
Hit:2 http://us.archive.ubuntu.com/ubuntu focal InRelease
Get:3 http://us.archive.ubuntu.com/ubuntu focal-updates InRelease [128 kB]
Get:4 http://security.ubuntu.com/ubuntu focal-security/main i386 Packages [881 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu focal-backports InRelease [128 kB]
Get:6 http://us.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [3,955 kB]
Get:7 http://security.ubuntu.com/ubuntu focal-security/main amd64 Packages [3,564 kB]
Get:8 http://security.ubuntu.com/ubuntu focal-security/main Translation-en [518 kB]
```

Рис. 3: Обновление репозитории 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 395 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]
```

Рис. 4: Установка *iperf3*

```
mininet@mininet-vm:~$ sudo apt-get install git jq gnuplot-nox evince
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  aglfn aspell aspell-en bubblewrap enchant-2 evince-common fonts-liberation
  gnome-desktop3-data gnuplot-data groff hunspell-en-us imagemagick imagemagick-6.q16
  libarchive13 libaspell15 libdjvulibre-text libdjvulibre21 libenchant-2-2
  libevdocument3-4 libevview3-3 libgnome-desktop-3-19 libgspell-1-2
  libgspell-1-common libgxps2 libhunspell-1.7-0 libilmbase24 libjq1 libkpathsea6
  liblua5.3-0 libmagickcore-6.q16-6-extra libnautilus-extension1a libnetpbm10
  libnspr4 libnss3 libonig5 libopenexr24 libpoppler-glib8 libpoppler97 libsecret-1-0
  libsecret-common libspectre1 libsynchronet2 libwmf0.2-7 netpbm psutils
Suggested packages:
```

Рис. 5: Установка необходимого дополнительного 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 | 683.00 KiB/s, done.
mininet@mininet-vm:/tmp$
```

Рис. 6: Скачивание репозитория

```
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
mininet@mininet-vm:/tmp/iperf3_plotter$
```

Рис. 7: Установка *iperf3_plotter*

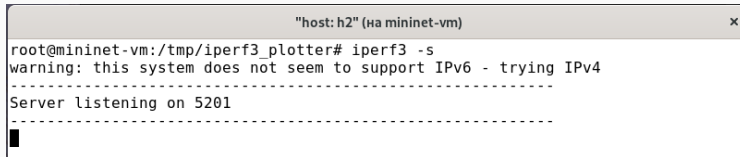
```
mininet@mininet-vm:/tmp/iperf3_plotter$ sudo mn --topo=single,2 -x
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2
*** Adding switches:
s1
*** Adding links:
(h1, s1) (h2, s1)
*** Configuring hosts
h1 h2
*** Running terms on localhost:10.0
*** Starting controller
c0
*** Starting 1 switches
s1 ...X11 connection rejected because of wrong authentication.
X11 connection rejected because of wrong authentication.
X11 connection rejected because of wrong authentication.
X11 connection rejected because of wrong authentication.

*** Starting CLI:
mininet>
```

Рис. 8: Простейшая топология


```
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=4100>
<Host h2: h2-eth0:10.0.0.2 pid=4104>
<OVSSwitch s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None pid=4109>
<Controller c0: 127.0.0.1:6653 pid=4093>
mininet>
```

Рис. 9: Параметры запущенной топологии



```
"host: h2" (на mininet-vm) x
root@mininet-vm:/tmp/iperf3_plotter# iperf3 -s
warning: this system does not seem to support IPv6 - trying IPv4
-----
Server listening on 5201
-----
█
```

Рис. 10: Запуск сервера iPerf3

```

root@mininet-vm:/tmp/iperf3_plotter# iperf3 -c 10.0.0.2
Connecting to host 10.0.0.2, port 5201
[ 7] local 10.0.0.1 port 45550 connected to 10.0.0.2 port 5201
[ ID] Interval           Transfer     Bitrate      Retr    Cwnd
[ 7]  0.00-1.00    sec   3.36 GBytes  28.9 Gbits/sec    0   3.95 MBytes
[ 7]  1.00-2.00    sec   3.52 GBytes  30.3 Gbits/sec    0   3.95 MBytes
[ 7]  2.00-3.00    sec   3.55 GBytes  30.5 Gbits/sec    0   3.95 MBytes
[ 7]  3.00-4.00    sec   3.32 GBytes  28.5 Gbits/sec    0   3.95 MBytes
[ 7]  4.00-5.00    sec   3.54 GBytes  30.4 Gbits/sec    0   3.95 MBytes
[ 7]  5.00-6.00    sec   3.46 GBytes  29.7 Gbits/sec    0   3.95 MBytes
[ 7]  6.00-7.00    sec   3.15 GBytes  27.1 Gbits/sec    0   8.22 MBytes
[ 7]  7.00-8.00    sec   3.23 GBytes  27.7 Gbits/sec    0   8.22 MBytes
[ 7]  8.00-9.00    sec   3.19 GBytes  27.4 Gbits/sec    0   8.22 MBytes
[ 7]  9.00-10.00   sec   3.30 GBytes  28.3 Gbits/sec    0   8.22 MBytes
- - - - -
[ ID] Interval           Transfer     Bitrate      Retr
[ 7]  0.00-10.00   sec  33.6 GBytes  28.9 Gbits/sec    0
[ 7]  0.00-10.00   sec  33.6 GBytes  28.9 Gbits/sec
sender
receiver

iperf Done.
root@mininet-vm:/tmp/iperf3_plotter# █

```

Рис. 11: Запуск клиента iPerf3

```

mininet> h2 iperf3 -s &
mininet> h1 iperf3 -c h2
Connecting to host 10.0.0.2, port 5201
[ 5] local 10.0.0.1 port 45554 connected to 10.0.0.2 port 5201
[ ID] Interval           Transfer     Bitrate      Retr   Cwnd
[ 5]  0.00-1.00    sec   3.03 GBytes  26.0 Gbits/sec    0   8.33 MBytes
[ 5]  1.00-2.00    sec   2.86 GBytes  24.6 Gbits/sec    0   8.33 MBytes
[ 5]  2.00-3.00    sec   2.63 GBytes  22.6 Gbits/sec    0   8.33 MBytes
[ 5]  3.00-4.00    sec   3.30 GBytes  28.4 Gbits/sec    0   8.33 MBytes
[ 5]  4.00-5.00    sec   3.33 GBytes  28.6 Gbits/sec    0   8.33 MBytes
[ 5]  5.00-6.00    sec   3.33 GBytes  28.6 Gbits/sec    0   8.33 MBytes
[ 5]  6.00-7.00    sec   3.32 GBytes  28.6 Gbits/sec    0   8.33 MBytes
[ 5]  7.00-8.00    sec   3.30 GBytes  28.4 Gbits/sec    0   8.33 MBytes
[ 5]  8.00-9.00    sec   3.38 GBytes  29.0 Gbits/sec    0   8.33 MBytes
[ 5]  9.00-10.00   sec   3.27 GBytes  28.1 Gbits/sec    0   8.33 MBytes
-----
[ ID] Interval           Transfer     Bitrate      Retr
[ 5]  0.00-10.00    sec   31.8 GBytes  27.3 Gbits/sec    0
[ 5]  0.00-10.00    sec   31.7 GBytes  27.3 Gbits/sec    0
                                     sender
                                     receiver

iperf Done.
mininet>

```

Рис. 12: Запуск клиента iPerf3

```

mininet> h2 killall iperf3
warning: this system does not seem to support IPv6 - trying IPv4
-----
Server listening on 5201
-----
Accepted connection from 10.0.0.1, port 45552
[ 5] local 10.0.0.2 port 5201 connected to 10.0.0.1 port 45554
[ ID] Interval           Transfer     Bitrate
[ 5]  0.00-1.00      sec   3.02 GBytes   25.9 Gbits/sec
[ 5]  1.00-2.00      sec   2.84 GBytes   24.4 Gbits/sec
[ 5]  2.00-3.00      sec   2.63 GBytes   22.6 Gbits/sec
[ 5]  3.00-4.00      sec   3.30 GBytes   28.4 Gbits/sec
[ 5]  4.00-5.00      sec   3.33 GBytes   28.6 Gbits/sec
[ 5]  5.00-6.00      sec   3.33 GBytes   28.6 Gbits/sec
[ 5]  6.00-7.00      sec   3.32 GBytes   28.5 Gbits/sec
[ 5]  7.00-8.00      sec   3.30 GBytes   28.4 Gbits/sec
[ 5]  8.00-9.00      sec   3.38 GBytes   29.0 Gbits/sec
[ 5]  9.00-10.00     sec   3.27 GBytes   28.1 Gbits/sec
[ 5] 10.00-10.00     sec   6.25 MBytes   27.7 Gbits/sec
-----
[ ID] Interval           Transfer     Bitrate
[ 5]  0.00-10.00     sec  31.7 GBytes   27.3 Gbits/sec
-----
Server listening on 5201

```

Рис. 13: Остановка серверного процесса

```
root@mininet-vm:/tmp/iperf3_plotter# iperf3 -s  
warning: this system does not seem to support IPv6 - trying IPv4  
-----  
Server listening on 5201  
-----
```

Рис. 14: Запуск сервера iPerf3

```

root@mininet-vm:/tmp/iperf3_plotter# iperf3 -c 10.0.0.2 -t 5
Connecting to host 10.0.0.2, port 5201
[ 7] local 10.0.0.1 port 45558 connected to 10.0.0.2 port 5201
[ ID] Interval          Transfer      Bitrate      Retr  Cwnd
[ 7]  0.00-1.00      sec   3.30 GBytes  28.4 Gbits/sec    0   6.37 MBytes
[ 7]  1.00-2.00      sec   3.49 GBytes  29.9 Gbits/sec    0   6.37 MBytes
[ 7]  2.00-3.00      sec   3.46 GBytes  29.8 Gbits/sec    0   6.37 MBytes
[ 7]  3.00-4.00      sec   3.25 GBytes  28.0 Gbits/sec    0   6.37 MBytes
[ 7]  4.00-5.00      sec   3.45 GBytes  29.6 Gbits/sec    0   6.37 MBytes
- - - - -
[ ID] Interval          Transfer      Bitrate      Retr
[ 7]  0.00-5.00      sec   17.0 GBytes  29.1 Gbits/sec    0
[ 7]  0.00-5.00      sec   16.9 GBytes  29.1 Gbits/sec

```

sender
receiver

Рис. 15: Запуск клиента iPerf3

```
root@mininet-vm:/tmp/iperf3_plotter# iperf3 -s -i 2
warning: this system does not seem to support IPv6 - trying IPv4
-----
Server listening on 5201
-----
```



Рис. 16: Запуск сервера iPerf3


```

root@mininet-vm:/tmp/iperf3_plotter# iperf3 -c 10.0.0.2 -i 2
Connecting to host 10.0.0.2, port 5201
[ 7] local 10.0.0.1 port 45562 connected to 10.0.0.2 port 5201
[ ID] Interval            Transfer      Bitrate      Retr  Cwnd
[ 7]  0.00-2.00      sec   6.29 GBytes  27.0 Gbits/sec    0   8.14 MBytes
[ 7]  2.00-4.00      sec   6.40 GBytes  27.5 Gbits/sec    0   8.14 MBytes
[ 7]  4.00-6.00      sec   6.81 GBytes  29.2 Gbits/sec    0   8.14 MBytes
[ 7]  6.00-8.00      sec   6.45 GBytes  27.7 Gbits/sec    0   8.14 MBytes
[ 7]  8.00-10.00     sec   6.66 GBytes  28.7 Gbits/sec    0   8.14 MBytes
- - - - -
[ ID] Interval            Transfer      Bitrate      Retr
[ 7]  0.00-10.00     sec  32.6 GBytes  28.0 Gbits/sec    0
[ 7]  0.00-10.00     sec  32.6 GBytes  28.0 Gbits/sec
                                     sender
                                     receiver

iperf Done.
root@mininet-vm:/tmp/iperf3_plotter# █

```

Рис. 17: Запуск клиента iPerf3

```

root@mininet-vm:/tmp/iperf3_plotter# iperf3 -c 10.0.0.2 -n 16G
Connecting to host 10.0.0.2, port 5201
[ 7] local 10.0.0.1 port 45566 connected to 10.0.0.2 port 5201
[ ID] Interval           Transfer     Bitrate      Retr    Cwnd
[ 7]  0.00-1.00    sec   3.36 GBytes  28.8 Gbits/sec    0   2.86 MBytes
[ 7]  1.00-2.00    sec   3.48 GBytes  29.9 Gbits/sec    0   2.86 MBytes
[ 7]  2.00-3.00    sec   3.24 GBytes  27.8 Gbits/sec    0   8.37 MBytes
[ 7]  3.00-4.00    sec   3.41 GBytes  29.3 Gbits/sec    0   8.37 MBytes
[ 7]  4.00-4.80    sec   2.52 GBytes  27.0 Gbits/sec    0   8.37 MBytes
- - - - -
[ ID] Interval           Transfer     Bitrate      Retr
[ 7]  0.00-4.80    sec  16.0 GBytes  28.6 Gbits/sec    0
[ 7]  0.00-4.80    sec  16.0 GBytes  28.6 Gbits/sec
                                sender
                                receiver

iperf Done.
root@mininet-vm:/tmp/iperf3_plotter# █

```

Рис. 18: Запуск клиента iPerf3

```

root@mininet-vm:/tmp/iperf3_plotter# iperf3 -c 10.0.0.2 -u
Connecting to host 10.0.0.2, port 5201
[ 7] local 10.0.0.1 port 38561 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    129 KBytes    1.05 Mbits/sec    91
[ 7]  2.00-3.00    sec    127 KBytes    1.04 Mbits/sec    90
[ 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    127 KBytes    1.04 Mbits/sec    90
[ 7]  6.00-7.00    sec    129 KBytes    1.05 Mbits/sec    91
[ 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 Datagrams
[ 7]  0.00-10.00   sec    1.25 MBytes    1.05 Mbits/sec  0.000 ms    0/906 (0%)  sender
[ 7]  0.00-10.00   sec    1.25 MBytes    1.05 Mbits/sec  0.023 ms    0/906 (0%)  receiver

iperf Done.
root@mininet-vm:/tmp/iperf3_plotter# █

```

Рис. 19: Запуск клиента iPerf3

```
root@mininet-vm:/tmp/iperf3_plotter# iperf3 -s -p 3250
warning: this system does not seem to support IPv6 - trying IPv4
-----
Server listening on 3250
-----
█
```

Рис. 20: Запуск сервера iPerf3

```

root@mininet-vm:/tmp/iperf3_plotter# iperf3 -c 10.0.0.2 -p 3250
Connecting to host 10.0.0.2, port 3250
[ 7] local 10.0.0.1 port 45600 connected to 10.0.0.2 port 3250
[ ID] Interval          Transfer    Bitrate      Retr  Cwnd
[ 7]  0.00-1.00    sec   3.16 GBytes  27.2 Gbits/sec    0   8.16 MBytes
[ 7]  1.00-2.00    sec   3.47 GBytes  29.8 Gbits/sec    0   8.16 MBytes
[ 7]  2.00-3.00    sec   3.49 GBytes  30.0 Gbits/sec    0   8.16 MBytes
[ 7]  3.00-4.00    sec   3.23 GBytes  27.8 Gbits/sec    0   8.16 MBytes
[ 7]  4.00-5.00    sec   3.23 GBytes  27.7 Gbits/sec    0   8.16 MBytes
[ 7]  5.00-6.00    sec   3.25 GBytes  28.0 Gbits/sec    0   8.16 MBytes
[ 7]  6.00-7.00    sec   3.29 GBytes  28.3 Gbits/sec    0   8.16 MBytes
[ 7]  7.00-8.00    sec   3.28 GBytes  28.1 Gbits/sec    0   8.16 MBytes
[ 7]  8.00-9.00    sec   3.26 GBytes  28.0 Gbits/sec    0   8.16 MBytes
[ 7]  9.00-10.00   sec   3.31 GBytes  28.4 Gbits/sec    0   8.16 MBytes
- - - - -
[ ID] Interval          Transfer    Bitrate      Retr
[ 7]  0.00-10.00   sec   33.0 GBytes  28.3 Gbits/sec    0
[ 7]  0.00-10.00   sec   33.0 GBytes  28.3 Gbits/sec

```

sender
receiver

Рис. 21: Запуск клиента iPerf3

```
root@mininet-vm:/tmp/iperf3_plotter# iperf3 -s -1
warning: this system does not seem to support IPv6 - trying IPv4
-----
Server listening on 5201
-----
█
```

Рис. 22: Запуск сервера iPerf3

```

root@mininet-vm:/tmp/iperf3_plotter# iperf3 -c 10.0.0.2
Connecting to host 10.0.0.2, port 5201
[ 7] local 10.0.0.1 port 45576 connected to 10.0.0.2 port 5201
[ ID] Interval          Transfer    Bitrate      Retr  Cwnd
[ 7]  0.00-1.00    sec   3.17 GBytes  27.2 Gbits/sec    0   8.28 MBytes
[ 7]  1.00-2.00    sec   3.31 GBytes  28.4 Gbits/sec    0   8.28 MBytes
[ 7]  2.00-3.00    sec   3.14 GBytes  27.0 Gbits/sec    0   8.28 MBytes
[ 7]  3.00-4.00    sec   3.19 GBytes  27.4 Gbits/sec    0   8.28 MBytes
[ 7]  4.00-5.00    sec   3.21 GBytes  27.6 Gbits/sec    0   8.28 MBytes
[ 7]  5.00-6.00    sec   3.19 GBytes  27.3 Gbits/sec    0   8.28 MBytes
[ 7]  6.00-7.00    sec   3.14 GBytes  27.0 Gbits/sec    0   8.28 MBytes
[ 7]  7.00-8.00    sec   3.17 GBytes  27.3 Gbits/sec    0   8.28 MBytes
[ 7]  8.00-9.00    sec   3.18 GBytes  27.4 Gbits/sec    0   8.28 MBytes
[ 7]  9.00-10.00   sec   3.24 GBytes  27.9 Gbits/sec    0   8.28 MBytes
- - - - -
[ ID] Interval          Transfer    Bitrate      Retr
[ 7]  0.00-10.00   sec   31.9 GBytes  27.4 Gbits/sec    0
[ 7]  0.00-10.00   sec   31.9 GBytes  27.4 Gbits/sec    0
sender
receiver

iperf Done.

```

Рис. 23: Запуск клиента iPerf3

```
mininet@mininet-vm:~$ mkdir -p ~/work/lab_iperf3  
mininet@mininet-vm:~$
```

Рис. 24: Создание каталога


```
root@mininet-vm:/tmp/iperf3_plotter# iperf3 -c 10.0.0.2 -J
{
  "start": {
    "connected": [{
      "socket": 7,
      "local_host": "10.0.0.1",
      "local_port": 45580,
      "remote_host": "10.0.0.2",
      "remote_port": 5201
    }],
    "version": "iperf 3.7",
  }
}
```

Рис. 25: Запуск клиента iPerf3

```
root@mininet-vm:/tmp/iperf3_plotter# iperf3 -c 10.0.0.2 -J > /home/mininet/work/  
lab_iperf3/iperf_results.json  
root@mininet-vm:/tmp/iperf3_plotter# █
```

Рис. 26: Запуск клиента *iPerf3*

```
root@mininet-vm:/tmp/iperf3_plotter# cd /home/mininet/work/lab_iperf3
root@mininet-vm:/home/mininet/work/lab_iperf3# ls -l
total 8
-rw-r--r-- 1 root root 7783 Sep 10 12:57 iperf_results.json
```

Рис. 27: Просмотр каталога

```
mininet@mininet-vm:/tmp/iperf3_plotter$ xauth list $DISPLAY
mininet-vm/unix:10  MIT-MAGIC-COOKIE-1  e228dc2042fa9b879a4e5049996db17e
mininet@mininet-vm:/tmp/iperf3_plotter$ sudo -i
root@mininet-vm:~# xauth add mininet-vm/unix:10  MIT-MAGIC-COOKIE-1  e228dc2042fa9b879a
4e5049996db17e
root@mininet-vm:~# logout
mininet@mininet-vm:/tmp/iperf3_plotter$
```

Рис. 28: Исправление прав

```
mininet@mininet-vm:/tmp/iperf3_plotter$ cd ~/work/lab_iperf3
mininet@mininet-vm:~/work/lab_iperf3$ ls -l
total 8
-rw-r--r-- 1 root root 7783 Sep 10 12:57 iperf_results.json
mininet@mininet-vm:~/work/lab_iperf3$ sudo chown -R mininet:mininet ~/work
mininet@mininet-vm:~/work/lab_iperf3$ ls -l
total 8
-rw-r--r-- 1 mininet mininet 7783 Sep 10 12:57 iperf_results.json
mininet@mininet-vm:~/work/lab_iperf3$
```

Рис. 29: Корректировка прав

```
mininet@mininet-vm:~/work/lab_iperf3$ plot_iperf.sh iperf_results.json  
mininet@mininet-vm:~/work/lab_iperf3$
```

Рис. 30: Генерация выходных файлов

```
mininet@mininet-vm:~/work/lab_iperf3$ cd ~/work/lab_iperf3
mininet@mininet-vm:~/work/lab_iperf3$ ls -l
total 16
-rw-rw-r-- 1 mininet mininet  943 Sep 10 13:03 iperf.csv
-rw-r--r-- 1 mininet mininet 7783 Sep 10 12:57 iperf_results.json
drwxrwxr-x 2 mininet mininet 4096 Sep 10 13:03 results
mininet@mininet-vm:~/work/lab_iperf3$ cd ~/work/lab_iperf3/results
mininet@mininet-vm:~/work/lab_iperf3/results$ ls -l
total 88
-rw-rw-r-- 1 mininet mininet  475 Sep 10 13:03 1.dat
-rw-rw-r-- 1 mininet mininet 9804 Sep 10 13:03 bytes.pdf
-rw-rw-r-- 1 mininet mininet 9618 Sep 10 13:03 cwnd.pdf
-rw-rw-r-- 1 mininet mininet 9036 Sep 10 13:03 MTU.pdf
-rw-rw-r-- 1 mininet mininet 8978 Sep 10 13:03 retransmits.pdf
-rw-rw-r-- 1 mininet mininet 8958 Sep 10 13:03 RTT.pdf
-rw-rw-r-- 1 mininet mininet 9172 Sep 10 13:03 RTT_Var.pdf
-rw-rw-r-- 1 mininet mininet 9519 Sep 10 13:03 throughput.pdf
```

Рис. 31: Просмотр каталога

Вывод

Я ознакомилась с инструментом для измерения пропускной способности сети в режиме реального времени — iPerf3, а также получила навыков проведения интерактивного эксперимента по измерению пропускной способности моделируемой сети в среде Mininet.