

# Лабораторная работа №1

Введение в Mininet

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## Информация

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Основной целью работы является развёртывание в системе виртуализации (например, в VirtualBox) mininet, знакомство с основными командами для работы с Mininet через командную строку и через графический интерфейс.

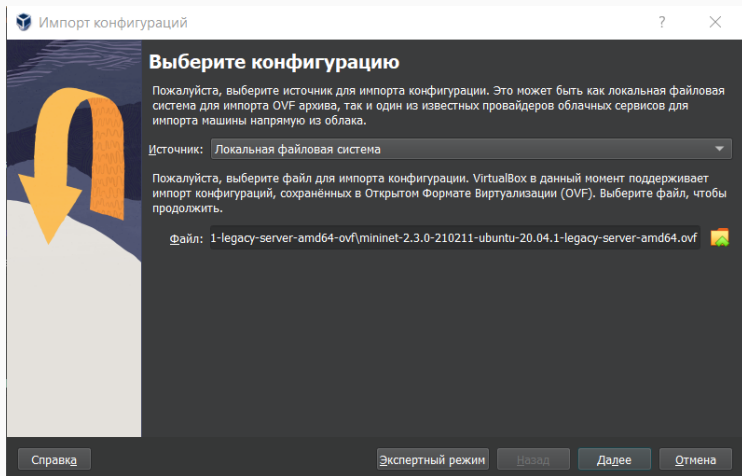


Рис. 1: Импорт конфигураций

# Выполнение лабораторной работы

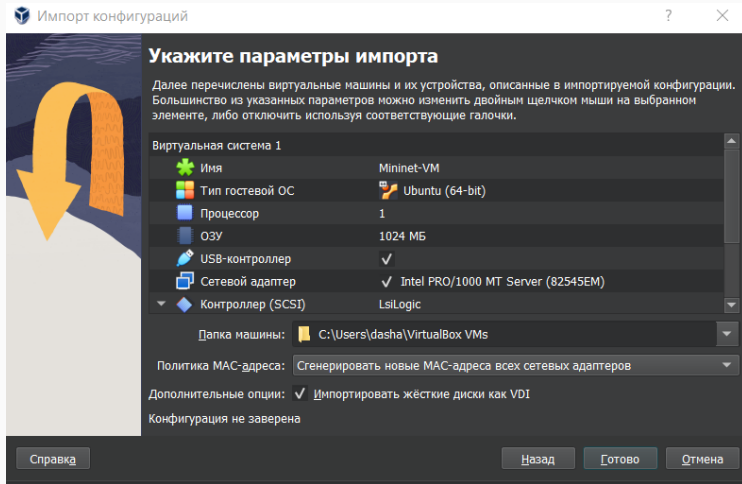


Рис. 2: Параметры импорта

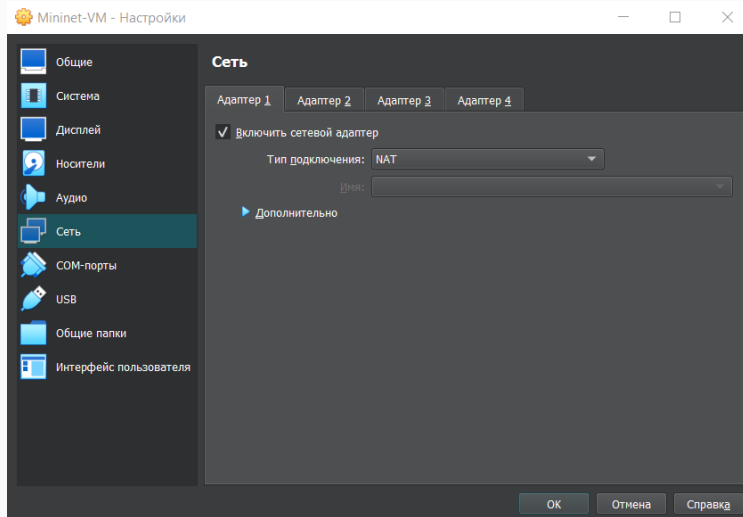


Рис. 3: Настройка сети

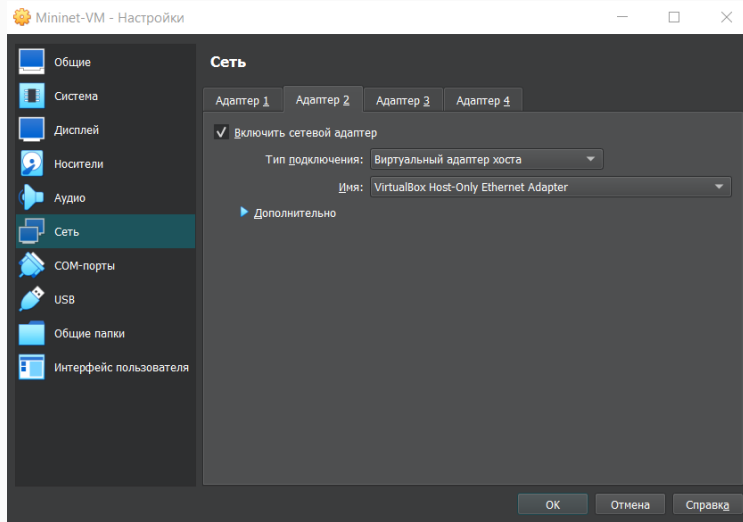
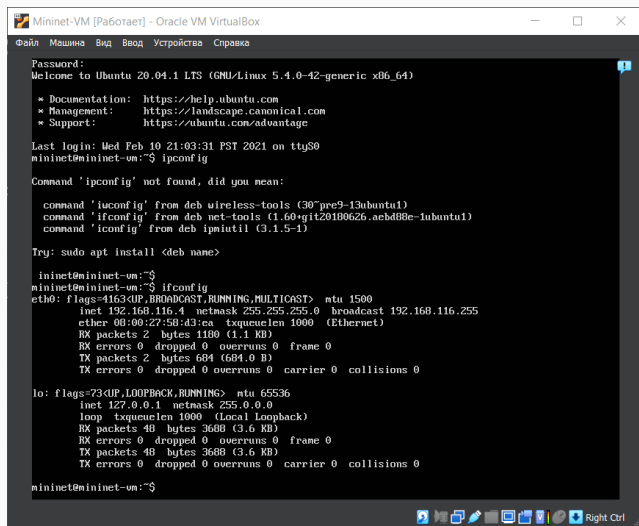


Рис. 4: Настройка сети



# Выполнение лабораторной работы



```
Mininet-VM [Работаer] - Oracle VM VirtualBox
Файл  Машина  Вид  Ввод  Устройства  Справка

Password:
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

Last login: Wed Feb 10 21:03:31 PST 2021 on ttyS0
mininet@mininet-vm:~$ ipconfig

Command 'ipconfig' not found, did you mean:

  command 'iuconfig' from deb wireless-tools (30~pre9-1ubuntu1)
  command 'ifconfig' from deb net-tools (1.60~git20180626.acbd88e-1ubuntu1)
  command 'iconfig' from deb ipmiutil (3.1.5-1)

Try: sudo apt install <deb name>

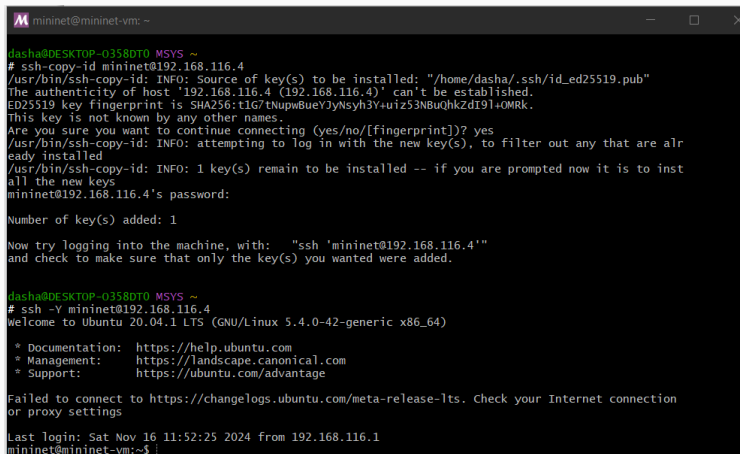
mininet@mininet-vm:~$
mininet@mininet-vm:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 192.168.116.4  netmask 255.255.255.0  broadcast 192.168.116.255
    ether 00:00:27:58:d3:ea  txqueuelen 1000  (Ethernet)
    RX packets 2  bytes 1180 (1.1 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 2  bytes 684 (684.0 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 48  bytes 3688 (3.6 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 48  bytes 3688 (3.6 KB)
    TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

mininet@mininet-vm:~$
```

Рис. 5: Запуск mininet

# Выполнение лабораторной работы



```
mininet@mininet-vm: ~  
dasha@DESKTOP-0358DT0 MSYS ~  
# ssh-copy-id mininet@192.168.116.4  
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/dasha/.ssh/id_ed25519.pub"  
The authenticity of host '192.168.116.4 (192.168.116.4)' can't be established.  
ED25519 key fingerprint is SHA256:t1G7tNupwBueYJyNsyh3Y+uiz53NBuQhkZdI9l+OMRk.  
This key is not known by any other names.  
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes  
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are alr  
eady installed  
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to inst  
all the new keys  
mininet@192.168.116.4's password:  
Number of key(s) added: 1  
  
Now try logging into the machine, with: "ssh 'mininet@192.168.116.4'"  
and check to make sure that only the key(s) you wanted were added.  
  
dasha@DESKTOP-0358DT0 MSYS ~  
# ssh -Y mininet@192.168.116.4  
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: Sat Nov 16 11:52:25 2024 from 192.168.116.1  
mininet@mininet-vm:~$
```

Рис. 6: Подключение к mininet через SSH

# Выполнение лабораторной работы

```
mininet@mininet-vm:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.116.4 netmask 255.255.255.0 broadcast 192.168.116.255
    ether 08:00:27:58:d3:ea txqueuelen 1000 (Ethernet)
    RX packets 579 bytes 60169 (60.1 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 789 bytes 119161 (119.1 KB)
    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 1808 bytes 142352 (142.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1808 bytes 142352 (142.3 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

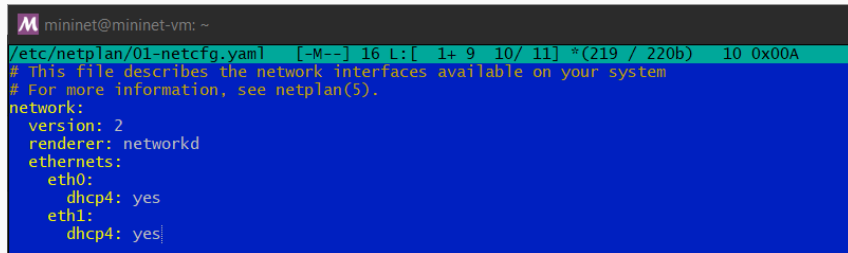
mininet@mininet-vm:~$ sudo dhclient eth1
mininet@mininet-vm:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.116.4 netmask 255.255.255.0 broadcast 192.168.116.255
    ether 08:00:27:58:d3:ea txqueuelen 1000 (Ethernet)
    RX packets 595 bytes 63046 (63.0 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 802 bytes 121883 (121.8 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:bb:30:c0 txqueuelen 1000 (Ethernet)
    RX packets 2 bytes 1180 (1.1 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 2 bytes 684 (684.0 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 2344 bytes 183376 (183.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 2344 bytes 183376 (183.3 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

mininet@mininet-vm:~$
```

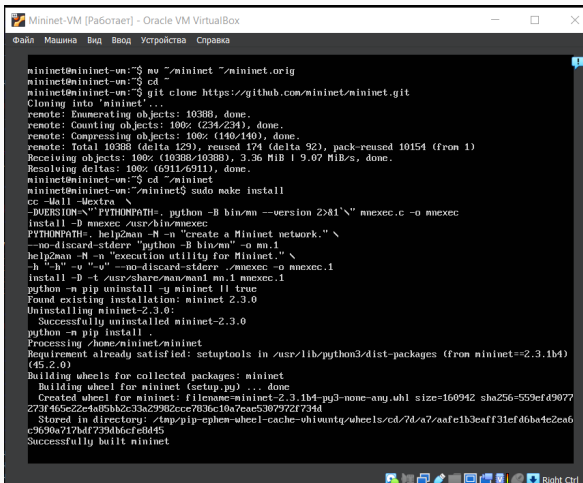
Рис. 7: Просмотр IP-адресов машины



```
mininet@mininet-vm: ~  
/etc/netplan/01-netcfg.yaml [-M--] 16 L: [ 1+ 9 10/ 11] *(219 / 220b) 10 0x00A  
# This file describes the network interfaces available on your system  
# For more information, see netplan(5).  
network:  
  version: 2  
  renderer: networkd  
  ethernets:  
    eth0:  
      dhcp4: yes  
    eth1:  
      dhcp4: yes|
```

Рис. 8: Файл /etc/netplan/01-netcfg.yaml

# Выполнение лабораторной работы



```
Mininet-VM [Работает] - Oracle VM VirtualBox
Файл  Машина  Вид  Ввод  Устройства  Справка

mininet@mininet-vm:~$ mv ~/mininet ~/mininet.orig
mininet@mininet-vm:~$ cd ~
mininet@mininet-vm:~$ git clone https://github.com/mininet/mininet.git
Cloning into 'mininet'...
remote: Enumerating objects: 10388, done.
remote: Counting objects: 100% (234/234), done.
remote: Compressing objects: 100% (140/140), done.
remote: Total 10388 (delta 129), reused 174 (delta 92), pack-reused 10154 (from 1)
Receiving objects: 100% (10388/10388), 3.36 MiB | 9.07 MiB/s, done.
Resolving deltas: 100% (6911/6911), done.
mininet@mininet-vm:~$ cd ~/mininet
mininet@mininet-vm:~/mininet$ sudo make install
cc -Wall -Wextra \
-DVERSION=\\"PYTHONPATH=. python -B bin/mn --version Z>81\\" mnexec.c -o mnexec
install -D mnexec /usr/bin/mnexec
PYTHONPATH=. help2man -N -n "create a Mininet network." \
--no-discard-stderr "python -B bin/mn" -o mn.1
help2man -N -n "execution utility for Mininet." \
-h "-h" -v "-v" --no-discard-stderr ./mnexec -o mnexec.1
install -D -t /usr/share/man/man1 mn.1 mnexec.1
python -n pip uninstall -y mininet || true
Found existing installation: mininet 2.3.0
Uninstalling mininet-2.3.0:
  Successfully uninstalled mininet-2.3.0
python -n pip install .
Processing /home/mininet/mininet
Requirement already satisfied: setuptools in /usr/lib/python3/dist-packages (from mininet==2.3.1b4)
(45.2.0)
Building wheels for collected packages: mininet
  Building wheel for mininet (setup.py) ... done
  Created wheel for mininet: filename=mininet-2.3.1b4-py3-none-any.whl size=160942 sha256=559efd9077
273f465e22e4a85bb2c33a29902ccc7036c10a7cae5307972f734d
  Stored in directory: /tmp/pip-ephem-wheel-cache-vhiwuntq/wheels/cd/7d/a7/aafc1b3eaff31efd6ba4e2ea6
c9690a717bdf739db6cfe8d45
Successfully built mininet
```

Рис. 9: Обновление Mininet

```
mininet@mininet-vm:~/mininet$ mn --version  
2.3.1b4  
mininet@mininet-vm:~/mininet$
```

Рис. 10: Номер установленной версии mininet

```
mininet@mininet-vm:~/mininet$ cd ~
mininet@mininet-vm:~$ xauth list $DISPLAY
mininet-vm/unix:10 MIT-MAGIC-COOKIE-1 a39c1b15252480c385b5440b07af8a36
mininet@mininet-vm:~$ sudo -i
root@mininet-vm:~# xauth list
xauth: file /root/.Xauthority does not exist
root@mininet-vm:~# xauth add mininet-vm/unix:10
xauth: file /root/.Xauthority does not exist
xauth: (argv):1: bad "add" command line
root@mininet-vm:~# xauth add mininet-vm/unix:10 MIT-MAGIC-COOKIE-1 a39c1b15252480c385b5440b07af8a36
xauth: file /root/.Xauthority does not exist
root@mininet-vm:~# xauth list $DISPLAY
mininet-vm/unix:10 MIT-MAGIC-COOKIE-1 a39c1b15252480c385b5440b07af8a36
root@mininet-vm:~# logout
mininet@mininet-vm:~$ sudo -i
root@mininet-vm:~# xauth list
mininet-vm/unix:10 MIT-MAGIC-COOKIE-1 a39c1b15252480c385b5440b07af8a36
root@mininet-vm:~#
```

Рис. 11: Настройка соединения X11 для суперпользователя

# Выполнение лабораторной работы

```
mininet@mininet-vm:~$ sudo mn
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2
*** Adding switches:
s1
*** Adding links:
(h1, s1) (h2, s1)
*** Configuring hosts
h1 h2
*** Starting controller
c0
*** Starting 1 switches
s1 ...
*** Starting CLI:
mininet> help

Documented commands (type help <topic>):

EOF      gterm  iperfudp  nodes      pingpair    py      switch  xterm
dpctl    help   link      noecho     pingpairfull  quit    time
dump     intfs  links     pingall    ports       sh      wait
exit     iperf  net       pingallfull px          source  x

You may also send a command to a node using:
<node> command [args]
For example:
mininet> h1 ifconfig

The interpreter automatically substitutes IP addresses
for node names when a node is the first arg, so commands
like
mininet> h2 ping h3
should work.

Some character-oriented interactive commands require
noecho:
mininet> noecho h2 vi foo.py
However, starting up an xterm/gterm is generally better:
mininet> xterm h2

mininet> nodes
available nodes are:
c0 h1 h2 s1
mininet> net
h1 h1-eth0:s1-eth1
h2 h2-eth0:s1-eth2
s1 lo: s1-eth1:h1-eth0 s1-eth2:h2-eth0
c0
mininet> |
```

Рис. 12: Работа с Mininet с помощью командной строки



```
mininet> h1 ifconfig
h1-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 10.0.0.1 netmask 255.0.0.0 broadcast 10.255.255.255
        ether d6:13:98:2e:1f:5f txqueuelen 1000 (Ethernet)
        RX packets 0 bytes 0 (0.0 B)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 0 bytes 0 (0.0 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 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Рис. 13: Работа с Mininet с помощью командной строки

# Выполнение лабораторной работы

```
mininet> h2 ifconfig
h2-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.0.2 netmask 255.0.0.0 broadcast 10.255.255.255
    ether 82:aa:90:75:69:1f txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 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 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

mininet> s1 ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.116.4 netmask 255.255.255.0 broadcast 192.168.116.255
    ether 08:00:27:58:d3:ea txqueuelen 1000 (Ethernet)
    RX packets 1056 bytes 100323 (100.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1274 bytes 185531 (185.5 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:bb:30:c0 txqueuelen 1000 (Ethernet)
    RX packets 4078 bytes 5864974 (5.8 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 959 bytes 66278 (66.2 KB)
    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 2508 bytes 194466 (194.4 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 2508 bytes 194466 (194.4 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s1-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    ether ae:9f:5c:52:d5:52 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s1-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    ether 06:d3:d8:3b:85:a8 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
```

Рис. 14: Работа с Mininet с помощью командной строки

```
mininet> h1 ping 10.0.0.2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=19.5 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.338 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.088 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=0.092 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=0.095 ms
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=0.087 ms
^C
--- 10.0.0.2 ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5105ms
rtt min/avg/max/mdev = 0.087/3.373/19.540/7.230 ms
mininet>
```

Рис. 15: Проверка связности хостов

В результате выполнения данной лабораторной работы я развёрнула mininet в системе виртуализации VirtualBox, а также ознакомилась с основными командами для работы с Mininet через командную строку и через графический интерфейс.

1. Mininet [Электронный ресурс]. Mininet Project Contributors. URL: <http://mini-net.org/> (дата обращения: 11.12.2024).