

Лабораторная Работа №1

Введение в Mininet.

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Выполнение лабораторной работы

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.

1. Развернуть и настроить виртуальную машину Mininet в VirtualBox, настроив сетевые адаптеры (NAT и Host-Only).
2. Освоить базовые команды Mininet через CLI: запуск топологии, просмотр узлов и связей, проверка связности (ping).
3. Построить сеть в графическом редакторе MiniEdit, проверить связность хостов и настроить автоматическое назначение IP-адресов.

Импортировал образ Mininet

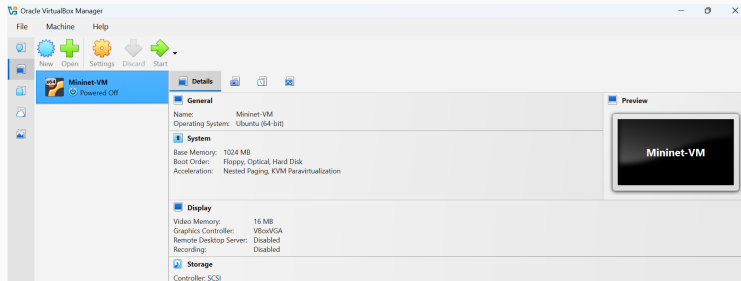


Figure 1: Образ Mininet

Поменял Graphics Controller

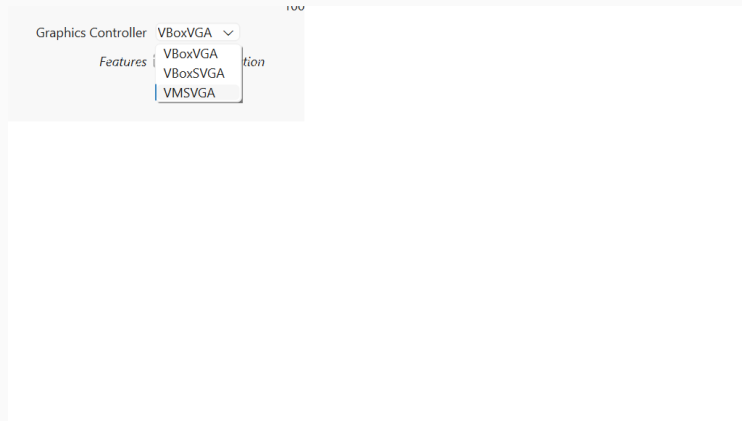


Figure 2: Graphics Controller

Изменил адаптеры сет

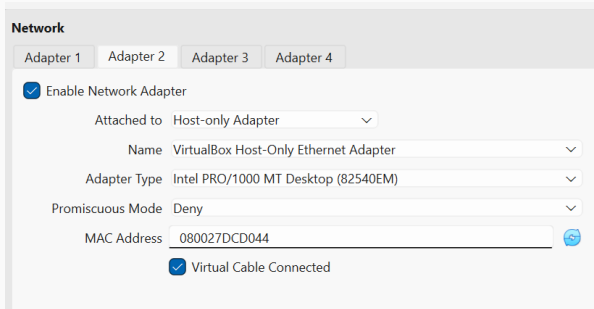


Figure 3: Адаптеры сет

Проверил ifconfig

```
mininet@mininet-vm:~$ ^C
mininet@mininet-vm:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 192.168.56.101  netmask 255.255.255.0  broadcast 192.168.56.255
    ether 08:00:27:6f:1e:d6  txqueuelen 1000  (Ethernet)
    RX packets 8  bytes 1670 (1.6 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 88  bytes 6752 (6.7 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 88  bytes 6752 (6.7 KB)
    TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

mininet@mininet-vm:~$
```

Figure 4: ifconfig

Подключился к машине по ssh

```
PS C:\Users\vsfld> ssh -Y mininet@192.168.56.101
The authenticity of host '192.168.56.101 (192.168.56.101)' can't be established.
ED25519 key fingerprint is SHA256:9PNJv7LmErt3pGdJjzNvoPxeK9UBR7WI6qpNTqQcwK4.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? y
Please type 'yes', 'no' or the fingerprint: yes
Warning: Permanently added '192.168.56.101' (ED25519) to the list of known hosts.
mininet@192.168.56.101's 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

Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Check your Internet connection or
Last login: Sat Sep 13 02:03:15 2025
mininet@mininet-vm:~$ logout
Connection to 192.168.56.101 closed.
```

Figure 5: Подключение к машине по ssh

Сделал подключение без пароля

```
PS C:\Users\vsuld> ssh mininet@192.168.56.101
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

Last login: Sat Sep 13 02:10:07 2025 from 192.168.56.1
mininet@mininet-vm:~$
```

Figure 6: Подключение без пароля

Указание на использование двух адаптеров при запуске

```
/etc/netplan/01-netcfg.yaml [-M--] 16 L:[ 1+ 9 10/ 11] *(219 / 220b)
# 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
```

Figure 7: Указание на использование двух адаптеров при запуске

Скачал новую версию Mininet

```
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% (136/136), done.
remote: Compressing objects: 100% (64/64), done.
remote: Total 10388 (delta 109), reused 72 (delta 72), pack-reused 10252 (from 2)
Receiving objects: 100% (10388/10388), 3.36 MiB | 416.00 KiB/s, done.
Resolving deltas: 100% (6909/6909), done.
mininet@mininet-vm:~$
```

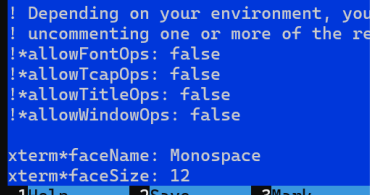
Figure 8: Новая версия Mininet

Обновил исполняемые файлы

```
mininet@mininet-vm:~$ cd ~/mininet
mininet@mininet-vm:~/mininet$ sudo make install
cc -Wall -Wextra \
-DVERSION=\"`PYTHONPATH=. python -B bin/mn --version 2>&1`\" 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 -m pip uninstall -y mininet || true
Found existing installation: mininet 2.3.0
Uninstalling mininet-2.3.0:
  Successfully uninstalled mininet-2.3.0
python -m 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=235fcd131737ef44464794e1
7df6ce9daed9805e0e8b7a25f6f0931cc8
  Stored in directory: /tmp/pip-ephem-wheel-cache-vnpuvv9b/wheels/cd/7d/a7/aafe1b3eaff31efd6ba4e2ea6c9690a717bdf73
e8d45
Successfully built mininet
Installing collected packages: mininet
Successfully installed mininet-2.3.1b4
mininet@mininet-vm:~/mininet$ mn --version
2.3.1b4
```

Figure 9: Обновление исполняемых файлов

Настройка параметров XTerm

A screenshot of a text editor window showing the configuration file for XTerm. The background is blue, and the text is white. The text includes comments and configuration settings for XTerm. At the bottom, there are three buttons: '1 Help', '2 Save', and '3 Mark'.

```
! Depending on your environment, you
! uncommenting one or more of the re
!*allowFontOps: false
!*allowTcapOps: false
!*allowTitleOps: false
!*allowWindowOps: false

xterm*faceName: Monospace
xterm*faceSize: 12
1 Help 2 Save 3 Mark
```

Figure 10: Настройка параметров XTerm

**Сделал choco install putty и choco
install vcxsrv**

Запуск минимальной топологии

```
*** Cleanup complete.  
mininet@mininet-vm:~/mininet$ 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>
```

Figure 11: Запуск минимальной топологии

Отображение списка команд интерфейса

```
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
```

Figure 12: Отображение списка команд интерфейса

Отображение доступных узлов

```
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>
```

Figure 13: Отображение доступных узлов

Ввел команду ifconfig на хосте h1

```
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 c2:be:de:09:91:a0 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>
```

Figure 14: ifconfig на хосте h1

Проверил связность

```
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=2.59 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.311 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.076 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=0.064 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=0.046 ms
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=0.063 ms
64 bytes from 10.0.0.2: icmp_seq=7 ttl=64 time=0.060 ms
64 bytes from 10.0.0.2: icmp_seq=8 ttl=64 time=0.052 ms
64 bytes from 10.0.0.2: icmp_seq=9 ttl=64 time=0.044 ms
64 bytes from 10.0.0.2: icmp_seq=10 ttl=64 time=0.066 ms
^C
--- 10.0.0.2 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9182ms
rtt min/avg/max/mdev = 0.044/0.336/2.586/0.753 ms
mininet>
```

Figure 15: Проверка связности

Добавил два хоста и один коммутатор, соединил

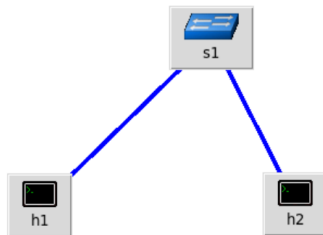


Figure 16: Два хоста и один коммутатор

ifconfig на h1

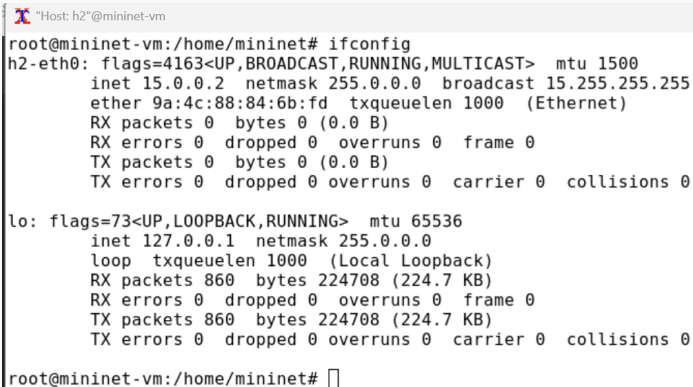
```
root@mininet-vm:/home/mininet# ifconfig
h1-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 15.0.0.1 netmask 255.0.0.0 broadcast 15.255.255.255
    ether 0e:1a:e9:29:e2:cc txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    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 865 bytes 225576 (225.5 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 865 bytes 225576 (225.5 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@mininet-vm:/home/mininet# █
```

Figure 17: ifconfig на h1

ifconfig на h2

A terminal window titled '"Host: h2"@mininet-vm' showing the output of the 'ifconfig' command. The output displays details for the 'h2-eth0' and 'lo' interfaces. The 'h2-eth0' interface is configured with IP 15.0.0.2, netmask 255.0.0.0, broadcast 15.255.255.255, and MTU 1500. The 'lo' interface is configured with IP 127.0.0.1, netmask 255.0.0.0, and MTU 65536. Both interfaces show zero errors and collisions.

```
root@mininet-vm:/home/mininet# ifconfig
h2-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 15.0.0.2 netmask 255.0.0.0 broadcast 15.255.255.255
    ether 9a:4c:88:84:6b:fd 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 860 bytes 224708 (224.7 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 860 bytes 224708 (224.7 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@mininet-vm:/home/mininet#
```

Figure 18: ifconfig на h2

Созранил работу, поменял права доступа в каталоге проекта

```
mininet@mininet-vm:~$ mkdir ~/work
mininet@mininet-vm:~$ ls
mininet  mininet.orig  oflops  oftest  openflow  pox  work
mininet@mininet-vm:~$ sudo chown -R mininet:mininet ~/work
mininet@mininet-vm:~$
```

Figure 19: Сохранение работы, изменение прав доступа

Развёрнул в системе виртуализации mininet, ознакомился с основными командами для работы с Mininet через командную строку и через графический интерфейс.