

# 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.

# Выполнение лабораторной работы

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# Выполнение лабораторной работы

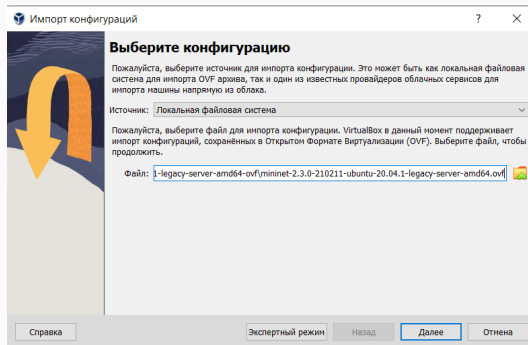


Рис. 1: Импорт конфигураций

# Выполнение лабораторной работы

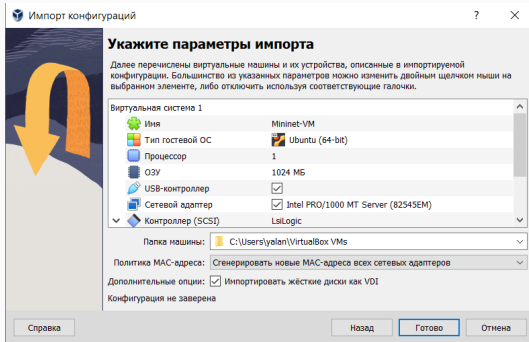


Рис. 2: Импорт конфигураций

# Выполнение лабораторной работы

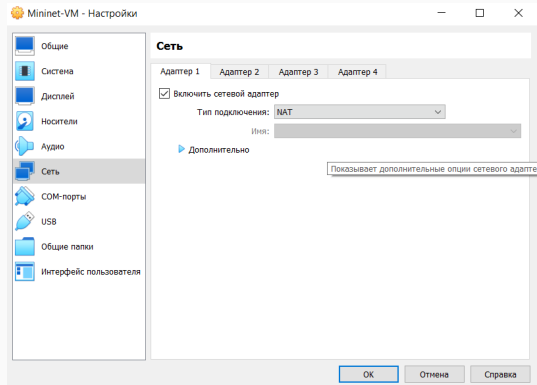


Рис. 3: Настройка сети



# Выполнение лабораторной работы

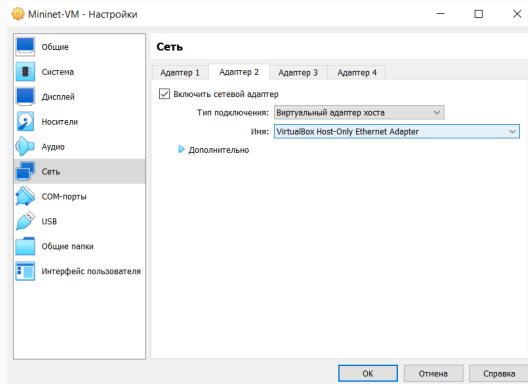


Рис. 4: Настройка сети

# Выполнение лабораторной работы

```
Last login: Wed Feb 10 21:03:31 PST 2021 on ttyS0
mininet@mininet-vm:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 172.16.176.128 netmask 255.255.255.0 broadcast 172.16.176.255
    ether 00:0c:29:6d:ce:cb txqueuelen 1000 (Ethernet)
    RX packets 209 bytes 16316 (16.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 208 bytes 17194 (17.1 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 68 bytes 5614 (5.6 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 68 bytes 5614 (5.6 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

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

Рис. 5: Запуск mininet

# Выполнение лабораторной работы

```
PS C:\Users\yalan\.ssh> ping 172.16.176.128

Обмен пакетами с 172.16.176.128 по 32 байтами данных:
Ответ от 172.16.176.128: число байт=32 время=1мс TTL=64
Ответ от 172.16.176.128: число байт=32 время=1мс TTL=64
Ответ от 172.16.176.128: число байт=32 время=1мс TTL=64
Ответ от 172.16.176.128: число байт=32 время=1мс TTL=64

Статистика Ping для 172.16.176.128:
    Пакетов: отправлено = 4, получено = 4, потеряно = 0
    (0% потерь)
Приблизительное время приема-передачи в мс:
    Минимальное = 0мсек, Максимальное = 1 мсек, Среднее = 0 мсек
PS C:\Users\yalan\.ssh> ssh mininet@172.16.176.128
mininet@172.16.176.128'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 proxy settings

Last login: Mon Sep  8 06:19:06 2025 from 172.16.176.1
mininet@mininet-vm:~$ logout
Connection to 172.16.176.128 closed.
```

Рис. 6: Подключение к mininet через SSH

# Выполнение лабораторной работы

```
mininet@mininet-vm:~$ sudo dhclient eth1
Cannot find device "eth1"
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'...
fatal: unable to access 'https://github.com/mininet/mininet.git/': Could not resolve host: github.co
m
mininet@mininet-vm:~$ _
```

Рис. 7: Активируем интерфейс и скачаем новую версию mininet

# Выполнение лабораторной работы

```
GNU nano 4.8 /etc/X11/app-defaults/XTerm Modified
*SimpleMenu*borderWidth: 2

! xterm can switch at runtime between bitmap (default) and TrueType fonts.
! The "faceSize" resource controls the size of the latter. However, it was
! originally given with a size that makes the two types of fonts different
! sizes. Uncomment this line to use the same size as "fixed".
!*faceSize: 8

! Here is a pattern that is useful for double-clicking on a URL:
*charClass: 33:48,35:48,37-38:48,43-47:48,58:48,61:48,63-64:48,95:48,126:48
!
! Alternatively,
!*on2Clicks: regex [[:alpha:]]+:\/\/([[:alnum:]]|!+,.\/=?@_~)C{([[:xdigit:]]([[:xdigit:]])+

! VT100s and similar terminals recognize escape sequences and control
! characters to which they reply to the host with other escape sequences,
! to provide information. The "resize" program uses this feature.
!
! In addition, xterm recognizes several escape sequences which can be used to
! set fonts, window properties, return settings via escape sequences. Some
! find these useful; others are concerned with the possibility of unexpected
! inputs.
!
! All of these features can be enabled or disabled via menus.
!
! Depending on your environment, you may wish to disable those by default by
! uncommenting one or more of the resource settings below:
!*allowFontOps: false
!*allowIcapOps: false
!*allowTitleOps: false
!*allowWindowOps: false
xterm*faceName: Monospace
xterm*faceSize: 12

!G Get Help !O Write Out !W Where Is !C Cut Text !J Justify !G Cur Pos !T-U Undo
!X Exit !R Read File !N Replace !V Paste Text !I To Spell !G Go To Line !T-E Redo
```

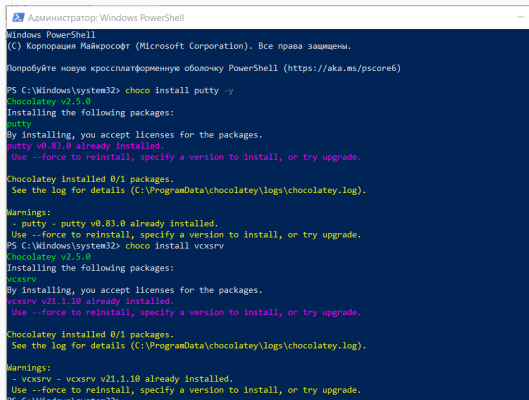
Рис. 8: Настройка параметров XTerm

# Выполнение лабораторной работы

```
mininet@mininet-vm:~$ cd ~
mininet@mininet-vm:~$ xauth list $DISPLAY
mininet-vm/unix:10 MIT-MAGIC-COOKIE-1 9cbb9eb5f5a6479154c1352dc848f339
mininet@mininet-vm:~$ sudo -i
root@mininet-vm:~# xauth list
xauth: file /root/.Xauthority does not exist
root@mininet-vm:~# xauth add mininet-vm/unix:10 MIT-MAGIC-COOKIE-1 9cbb9eb5f5a6479154c1352dc848f339
xauth: file /root/.Xauthority does not exist
root@mininet-vm:~# xauth list $DISPLAY
mininet-vm/unix:10 MIT-MAGIC-COOKIE-1 9cbb9eb5f5a6479154c1352dc848f339
root@mininet-vm:~# logout
mininet@mininet-vm:~$ _
```

Рис. 9: Настройка соединения X11 для суперпользователя

# Выполнение лабораторной работы



```
Администратор: Windows PowerShell
Windows PowerShell
(C) Корпорация Майкрософт (Microsoft Corporation). Все права защищены.

Попробуйте новую кроссплатформенную оболочку PowerShell (https://aka.ms/pscore6)

PS C:\Windows\system32> choco install putty -y
Chocolatey v2.5.0
Installing the following packages:
putty
By installing, you accept licenses for the packages.
putty v0.83.0 already installed.
Use --force to reinstall, specify a version to install, or try upgrade.

Chocolatey installed 0/1 packages.
See the log for details (C:\ProgramData\chocolatey\logs\chocolatey.log).

Warnings:
- putty - putty v0.83.0 already installed.
Use --force to reinstall, specify a version to install, or try upgrade.
PS C:\Windows\system32> choco install vcxsrv
Chocolatey v2.5.0
Installing the following packages:
vcxsrv
By installing, you accept licenses for the packages.
vcxsrv v21.1.10 already installed.
Use --force to reinstall, specify a version to install, or try upgrade.

Chocolatey installed 0/1 packages.
See the log for details (C:\ProgramData\chocolatey\logs\chocolatey.log).

Warnings:
- vcxsrv - vcxsrv v21.1.10 already installed.
Use --force to reinstall, specify a version to install, or try upgrade.
PS C:\Windows\system32>
```

Рис. 10: Установка программного обеспечения

# Выполнение лабораторной работы

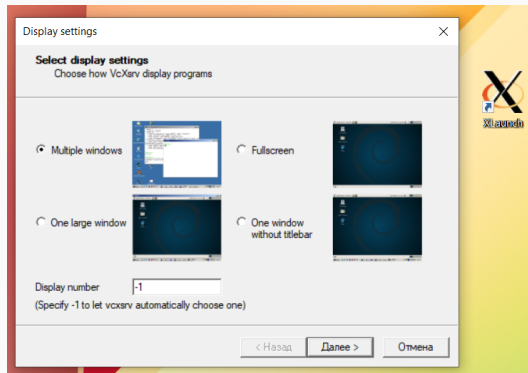


Рис. 11: Запуск XServer



# Выполнение лабораторной работы

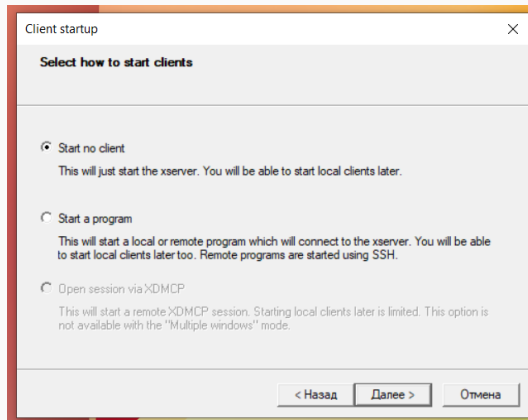


Рис. 12: Запуск XServer

# Выполнение лабораторной работы

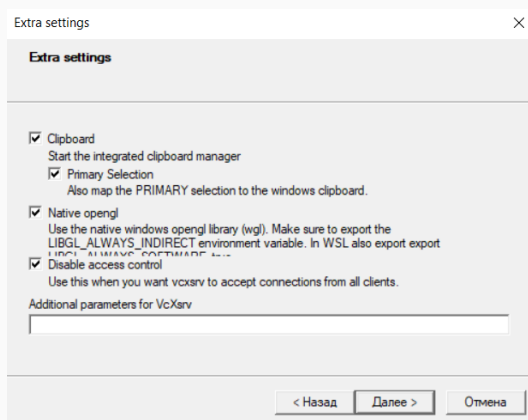
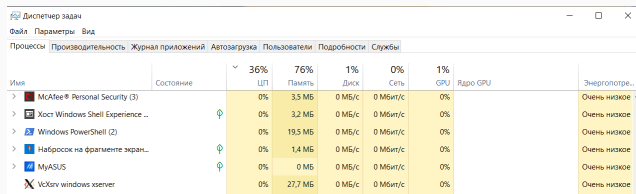


Рис. 13: Запуск XServer

# Выполнение лабораторной работы



Диспетчер задач								
Файл Параметры Вид								
Процессы Производительность Журнал приложений Автозагрузка Пользователи Подробности Службы								
Имя	Состояние	36% ЦП	76% Память	1% Диск	0% Сеть	1% GPU	Ядро GPU	Энергопотребл...
> McAfee® Personal Security (3)		0%	3,5 МБ	0 МБ/с	0 Мбит/с	0%		Очень низкое ^
> Хост Windows Shell Experience ...	📶	0%	3,2 МБ	0 МБ/с	0 Мбит/с	0%		Очень низкое
> Windows PowerShell (2)		0%	19,5 МБ	0 МБ/с	0 Мбит/с	0%		Очень низкое
> Набросок на фрагменте экран...	📶	0%	1,4 МБ	0 МБ/с	0 Мбит/с	0%		Очень низкое
> MyASUS	📶	0%	0 МБ	0 МБ/с	0 Мбит/с	0%		Очень низкое
VcXsrv windows xserver		0%	27,7 МБ	0 МБ/с	0 Мбит/с	0%		Очень низкое

Рис. 14: Работа XServer

# Выполнение лабораторной работы

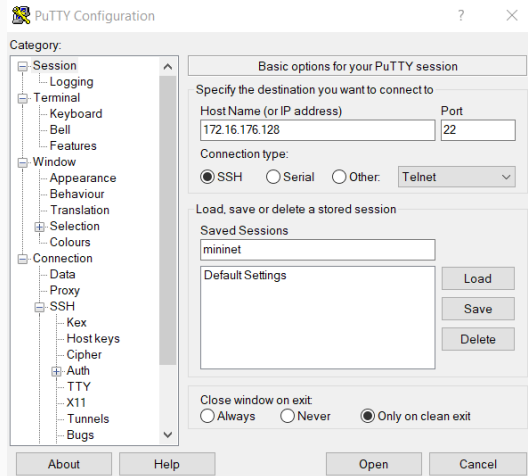


Рис. 15: Запуск Putty

# Выполнение лабораторной работы

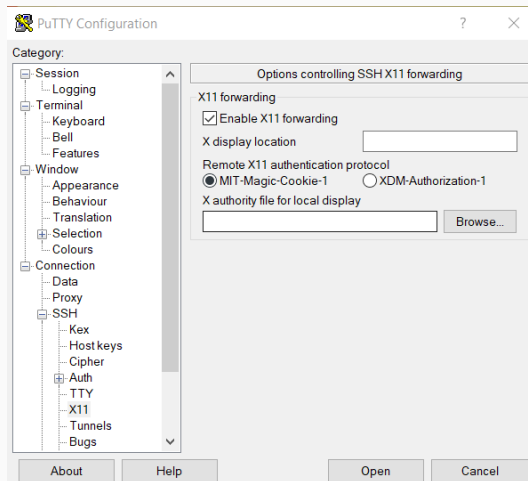


Рис. 16: Запуск Putty

# 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>):
=====
BOF      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
```

Рис. 17: Работа с Mininet с помощью командной строки

```
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
```

Рис. 18: Работа с Mininet с помощью командной строки

# Выполнение лабораторной работы

```
mininet> h1 ipconfig
bash: ipconfig: command not found
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 f2:39:f5:0d:84:ea 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. 19: 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 82:4b:37:24:15:af 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 172.16.176.128 netmask 255.255.255.0 broadcast 172.16.176.255
        ether 00:0c:29:6d:ce:cb txqueuelen 1000 (Ethernet)
        RX packets 21073 bytes 2039266 (2.0 MB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 42382 bytes 32706086 (32.7 MB)
        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 8448 bytes 30863377 (30.8 MB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 8448 bytes 30863377 (30.8 MB)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s1-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        ether 9a:bc:ba:a6:b3:71 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 1e:8b:e7:ce:60:e5 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

mininet>
```

# Выполнение лабораторной работы

```
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=4.55 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.252 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.083 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=0.091 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=0.086 ms
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=0.185 ms
64 bytes from 10.0.0.2: icmp_seq=7 ttl=64 time=0.117 ms
^C
--- 10.0.0.2 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6112ms
rtt min/avg/max/mdev = 0.083/0.766/4.553/1.546 ms
```

Рис. 21: Работа с Mininet с помощью командной строки

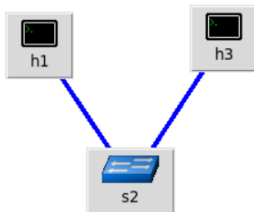
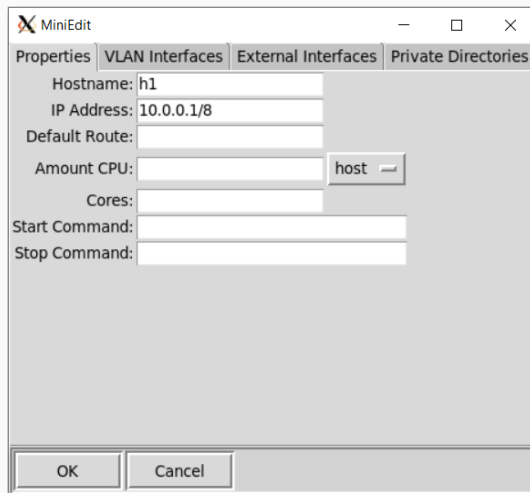


Рис. 22: Простейшая сеть

# Выполнение лабораторной работы



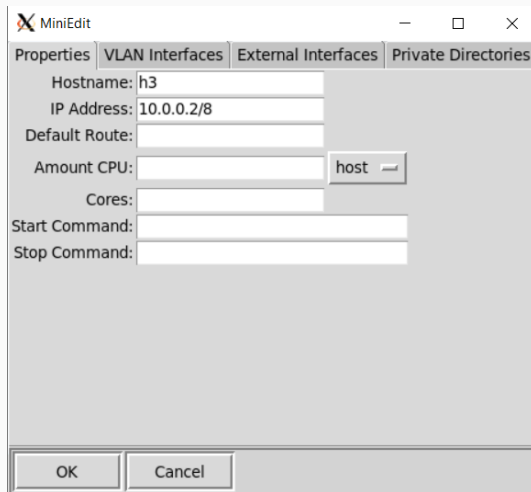
The image shows a window titled "MiniEdit" with a standard Windows-style title bar (minimize, maximize, close buttons). Inside the window, there are four tabs: "Properties", "VLAN Interfaces", "External Interfaces", and "Private Directories". The "Properties" tab is currently selected. Below the tabs, there are several input fields and a dropdown menu:

- Hostname:
- IP Address:
- Default Route:
- Amount CPU:
- Cores:
- Start Command:
- Stop Command:

At the bottom of the window, there are two buttons: "OK" and "Cancel".

Рис. 23: IP-адрес первого хоста

# Выполнение лабораторной работы



The image shows a window titled "MiniEdit" with a standard Windows-style title bar (minimize, maximize, close buttons). The window contains a tabbed interface with four tabs: "Properties", "VLAN Interfaces", "External Interfaces", and "Private Directories". The "Properties" tab is currently selected. Inside this tab, there are several configuration fields:

- Hostname:** A text box containing the value "h3".
- IP Address:** A text box containing the value "10.0.0.2/8".
- Default Route:** An empty text box.
- Amount CPU:** An empty text box, followed by a dropdown menu currently showing "host".
- Cores:** An empty text box.
- Start Command:** An empty text box.
- Stop Command:** An empty text box.

At the bottom of the window, there are two buttons: "OK" and "Cancel".

Рис. 24: IP-адрес второго хоста

# Выполнение лабораторной работы

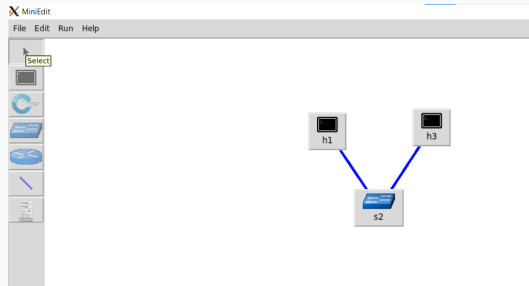
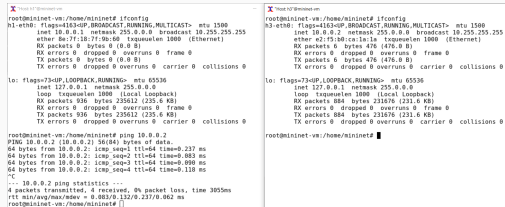


Рис. 25: Эмуляция созданной сети

# Выполнение лабораторной работы



The image shows two terminal windows side-by-side, both running on a system named 'root@mininet-vn:/home/mininet#'. The left window shows the configuration of the 'h1' host's network interface 'eth0' and the 'lo' loopback interface. The 'h1' interface is configured with IP 10.0.0.1, netmask 255.0.0.0, and broadcast 10.255.255.255. The 'lo' interface is configured with IP 127.0.0.1 and netmask 255.0.0.0. The right window shows the configuration of the 'h3' host's network interface 'eth0' and the 'lo' loopback interface. The 'h3' interface is configured with IP 10.0.0.2, netmask 255.0.0.0, and broadcast 10.255.255.255. The 'lo' interface is configured with IP 127.0.0.1 and netmask 255.0.0.0. Both windows show the results of a ping command from the 'root@mininet-vn' host to the 'h1' host (10.0.0.1). The ping results show 4 packets transmitted, 4 received, 0% packet loss, and a time of 305ms.

```
root@mininet-vn:/home/mininet# 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 ba:7f:18:7f:9b:60 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 936 bytes 235612 (235.6 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 936 bytes 235612 (235.6 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@mininet-vn:/home/mininet# ping 10.0.0.1
PING 10.0.0.1 (10.0.0.1) 56(84) bytes of data:
64 bytes from 10.0.0.1: icmp_seq=1 ttl=64 time=0.237 ms
64 bytes from 10.0.0.1: icmp_seq=2 ttl=64 time=0.083 ms
64 bytes from 10.0.0.1: icmp_seq=3 ttl=64 time=0.090 ms
64 bytes from 10.0.0.1: icmp_seq=4 ttl=64 time=0.118 ms
--- 10.0.0.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 305ms
rtt min/avg/max/mdev = 0.083/0.132/0.237/0.062 ms
root@mininet-vn:/home/mininet#
```

```
root@mininet-vn:/home/mininet# ifconfig
h3-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 e2:19:b0:ca:1a:1a 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 884 bytes 231676 (231.6 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 884 bytes 231676 (231.6 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

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

Рис. 26: Проверка IP-адресов и соединения

# Выполнение лабораторной работы

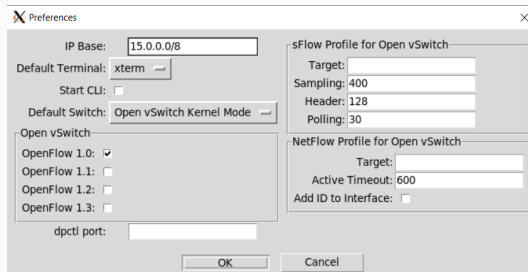


Рис. 27: Настройка автоматического назначения IP-адресов



# Выполнение лабораторной работы

```
root@mininet-vn:/home/mininet# ifconfig
h3-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 15.0.0.3 netmask 255.0.0.0 broadcast 15.255.255.255
    ether 36:95:c0:04:9f:06 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 786 bytes 263244 (263.2 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 786 bytes 263244 (263.2 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@mininet-vn:/home/mininet# ping 10.0.0.1
ping: connect: Network is unreachable
root@mininet-vn:/home/mininet# ping 15.0.0.1
PING 15.0.0.1 (15.0.0.1) 56(84) bytes of data:
64 bytes from 15.0.0.1: icmp_seq=1 ttl=64 time=0.626 ms
64 bytes from 15.0.0.1: icmp_seq=2 ttl=64 time=0.076 ms
^C
```

```
root@mininet-vn:/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 56:87:40:52:c0:88 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 862 bytes 229540 (229.5 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 862 bytes 229540 (229.5 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

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

Рис. 28: Проверка IP-адресов и соединения

# Выполнение лабораторной работы

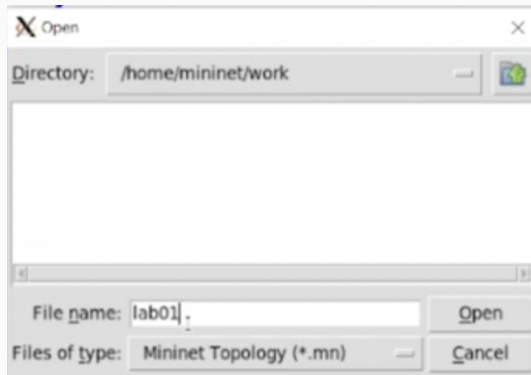


Рис. 29: Сохранение топологии

## Выводы

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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.