Лабораторная работа №1

Введение в Mininet

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Информация

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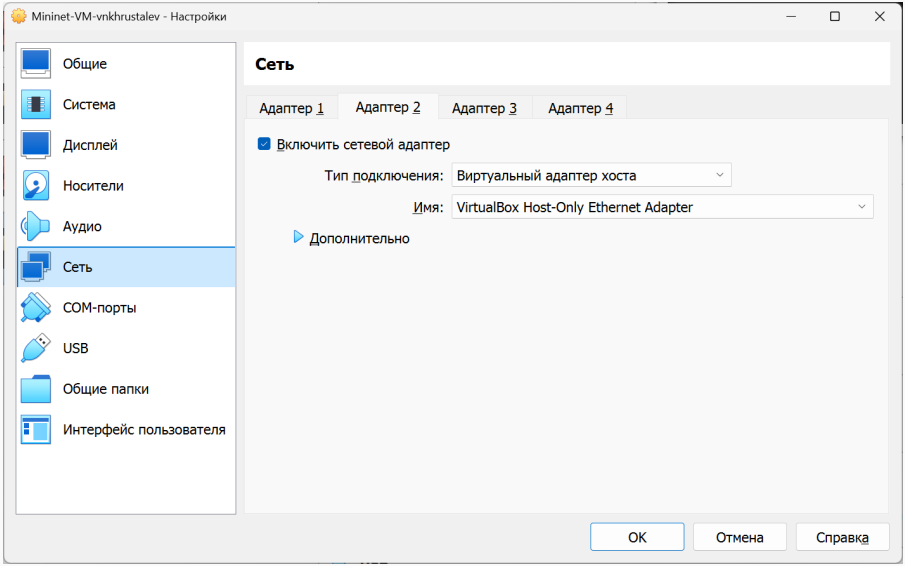
Цель работы

Цель работы

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

Выполнение лабораторной работы

Установка и настройка виртуальной машины



Вход и просмотр адреса виртуальной машины

```
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

New release '22.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Last login: Sat Nov 29 09:42:35 PST 2025 from 192.168.56.1 on pts/3
mininet@mininet-vm:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.56.105  netmask 255.255.255.0  broadcast 192.168.56.255
        ether 08:00:27:e8:34:b9  txqueuelen 1000  (Ethernet)
        RX packets 5  bytes 1379 (1.3 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 16  bytes 2084 (2.0 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:d0:e5:b3  txqueuelen 1000  (Ethernet)
        RX packets 207  bytes 22603 (22.6 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 229  bytes 21087 (21.0 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 52  bytes 4518 (4.5 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 52  bytes 4518 (4.5 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

mininet@mininet-vm:~$
```

Подключение к виртуальной машине из терминала хостовой машины

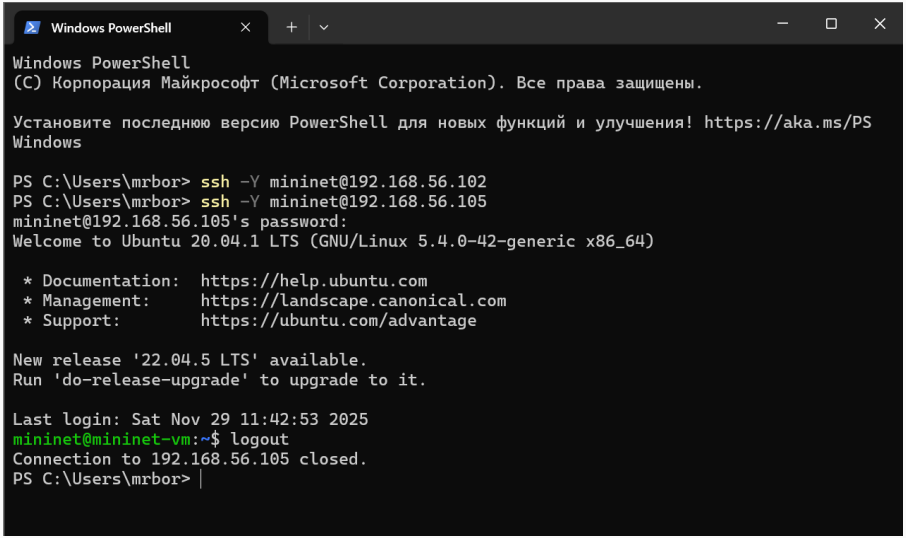
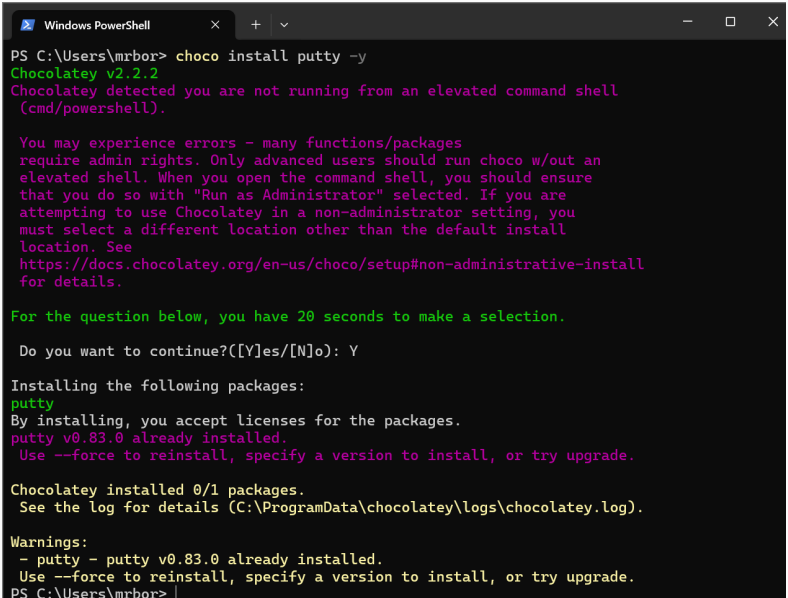


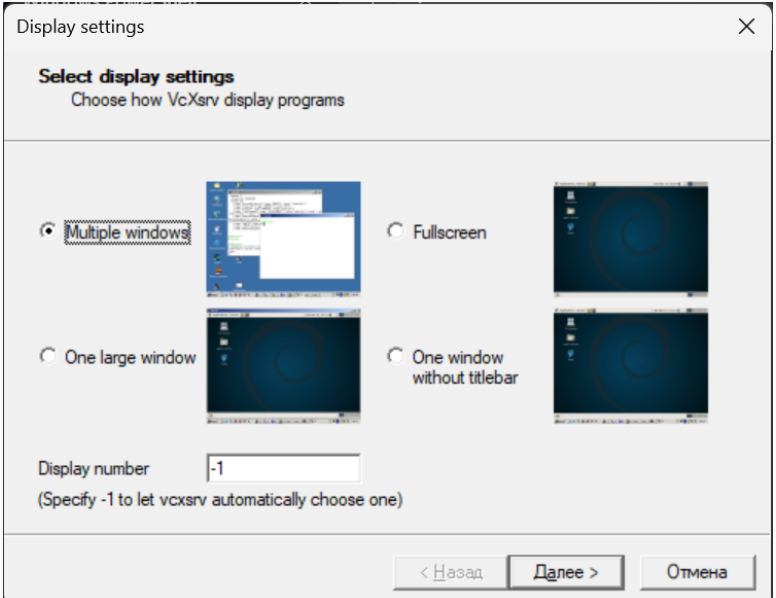
Рис. 3: Подключение к виртуальной машине из терминала хостовой машины

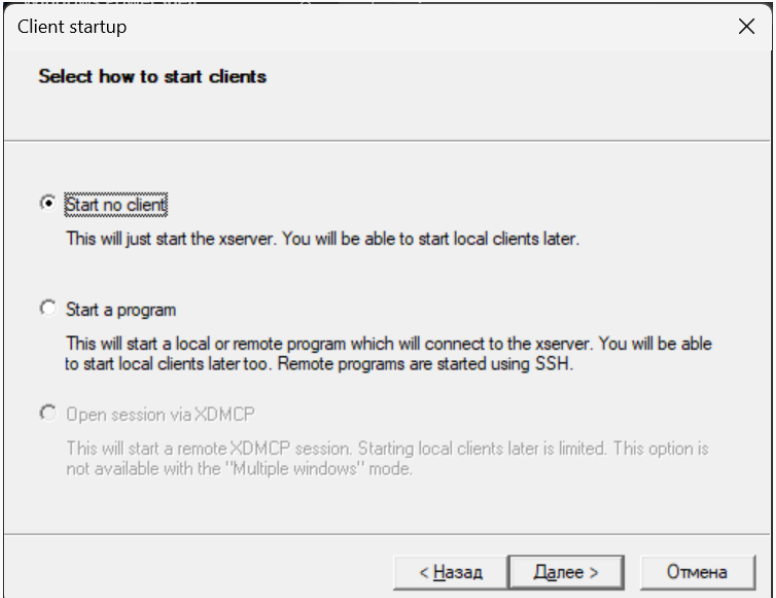
Установка putty

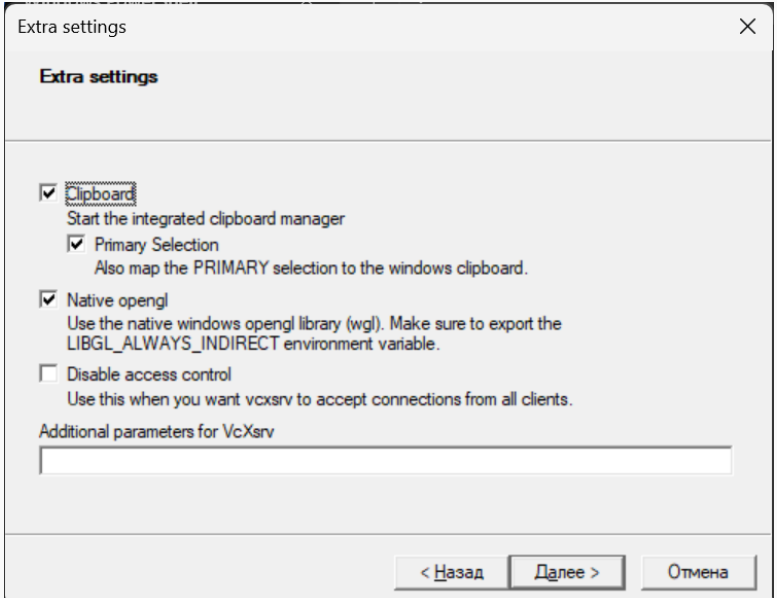


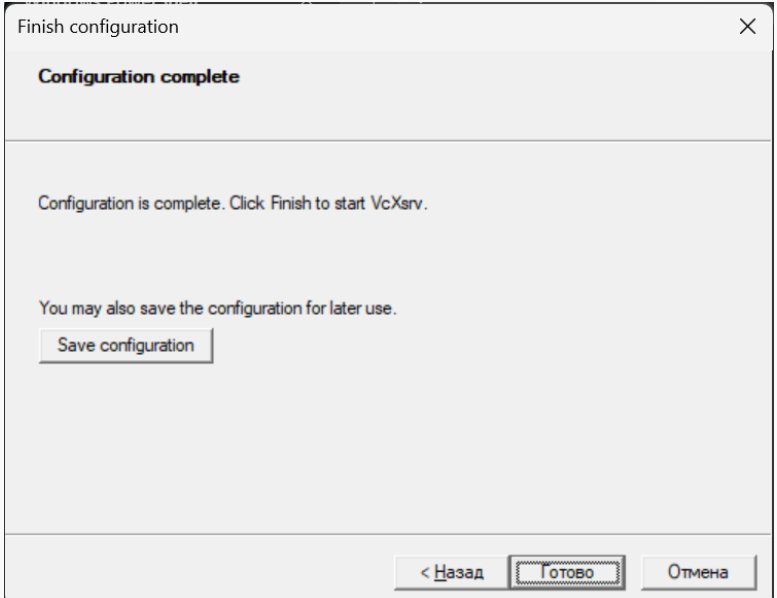
Установка VcXsrv Windows X Server

```
PS C:\Users\mrbor> choco install vcxsrv -y
Chocolatey v2.2.2
Chocolatey detected you are not running from an elevated command shell
 (cmd/powershell).

 You may experience errors - many functions/packages
 require admin rights. Only advanced users should run choco w/out an
 elevated shell. When you open the command shell, you should ensure
 that you do so with "Run as Administrator" selected. If you are
 attempting to use Chocolatey in a non-administrator setting, you
 must select a different location other than the default install
 location. See
 https://docs.chocolatey.org/en-us/choco/setup#non-administrative-install
 for details.

For the question below, you have 20 seconds to make a selection.

 Do you want to continue?([Y]es/[N]o): Y

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:\Users\mrbor>
```

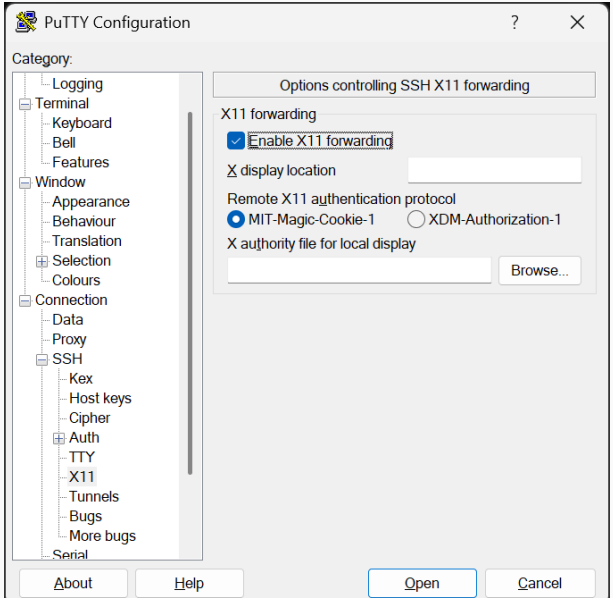

Display settings
Select display settings
Choose how VcXsrv display programs
Multiple windows
Fullscreen
One large window
One window without titlebar
Display number
-1
(Specify -1 to let vcxsrv automatically choose one)
< Назад
Далее >
Отмена


Client startup
Select how to start clients
Start no client
This will just start the xserver. You will be able to start local clients later.
Start a program
This will start a local or remote program which will connect to the xserver. You will be able to start local clients later too. Remote programs are started using SSH.
Open session via XDMCP
This will start a remote XDMCP session. Starting local clients later is limited. This option is not available with the "Multiple windows" mode.
< Назад
Далее >
Отмена


Extra settings
Extra settings
Clipboard
Start the integrated clipboard manager
Primary Selection
Also map the PRIMARY selection to the windows clipboard.
Native opengl
Use the native windows opengl library (wgl). Make sure to export the LIBGL_ALWAYS_INDIRECT environment variable.
Disable access control
Use this when you want vcxsrv to accept connections from all clients.
Additional parameters for VcXsrv
< Назад
Далее >
Отмена


Finish configuration
Configuration complete
Configuration is complete. Click Finish to start VcXsrv.
You may also save the configuration for later use.
Save configuration
< Назад
Готово
Отмена

Опция перенаправления X11



Файл /etc/netplan/01-netcfg.yaml

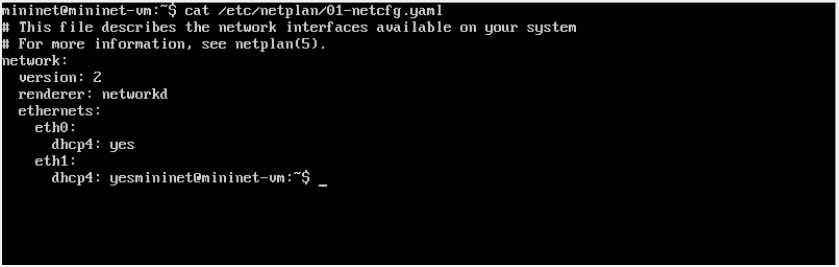


Рис. 11: Файл /etc/netplan/01-netcfg.yaml

Обновление Mininet

```
mininet@mininet-vm:~$ rm -rf mininet.orig/
mininet@mininet-vm:~$ mv -R ~/mininet ~/mininet.orig
mv: invalid option -- 'R'
Try 'mv --help' for more information.
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% (131/131), done.
remote: Compressing objects: 100% (60/60), done.
remote: Total 10388 (delta 104), reused 71 (delta 71), pack-reused 10257 (from 3)
Receiving objects: 100% (10388/10388), 3.36 MiB | 3.18 MiB/s, done.
Resolving deltas: 100% (6906/6906), done.
mininet@mininet-vm:~$ cd ~/mininet
mininet@mininet-vm:~/mininet$ sudo make install
```

Рис. 12: Обновление Mininet

Проверка версии Mininet

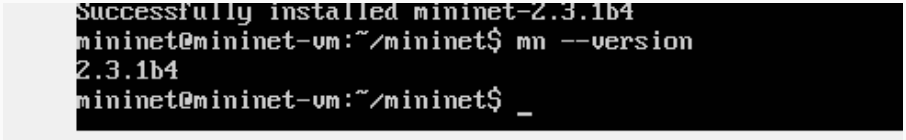
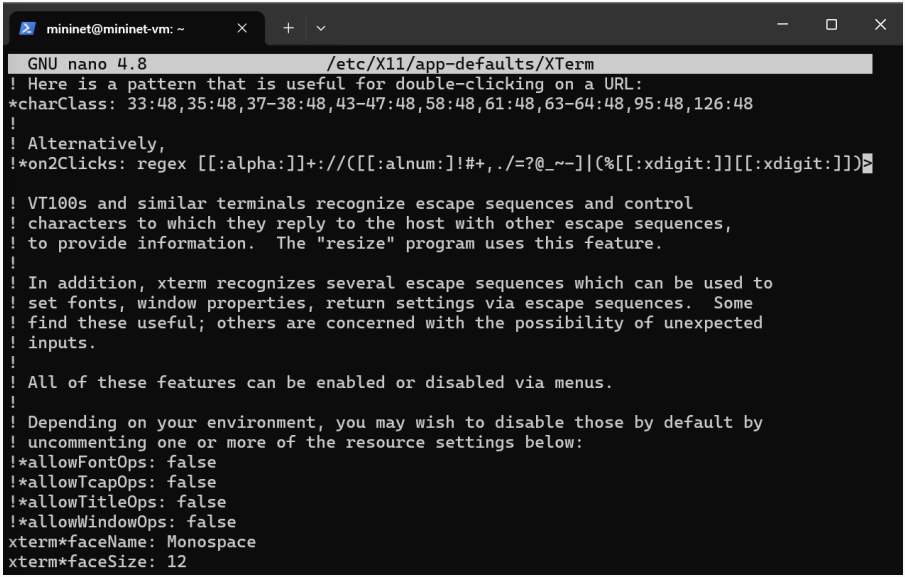


Рис. 13: Обновление Mininet/ВЕРСИЯ

Настройка шрифтов XTerm



Настройка соединения X11 для суперпользователя

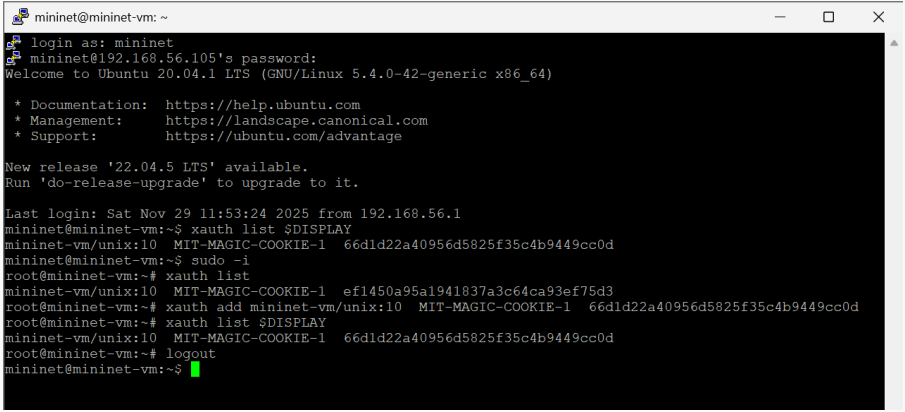


Рис. 15: Настройка соединения X11 для суперпользователя

Mininet с использованием топологии по умолчанию

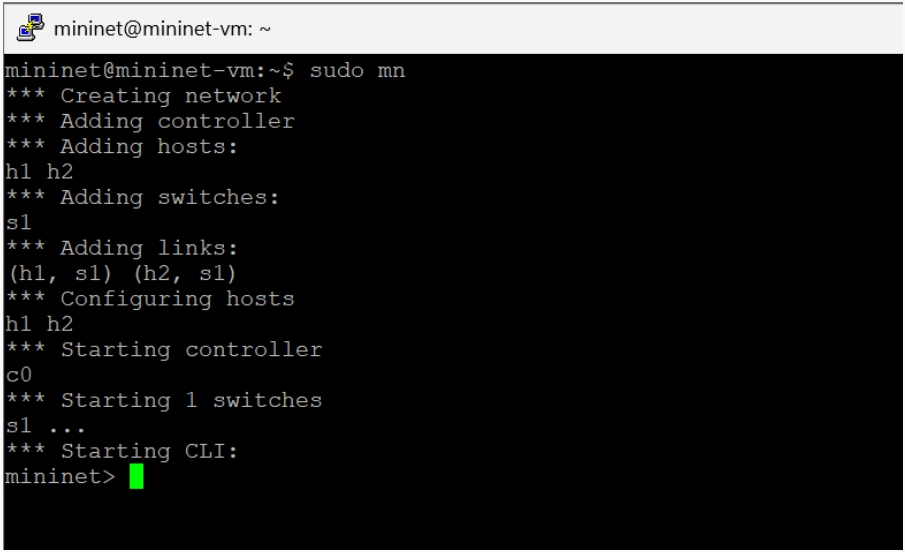


Рис. 16. Mininet с использованием топологии по умолчанию

Отображение результата help команды

```
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>
```

Рис. 17: Отображение результата help команды

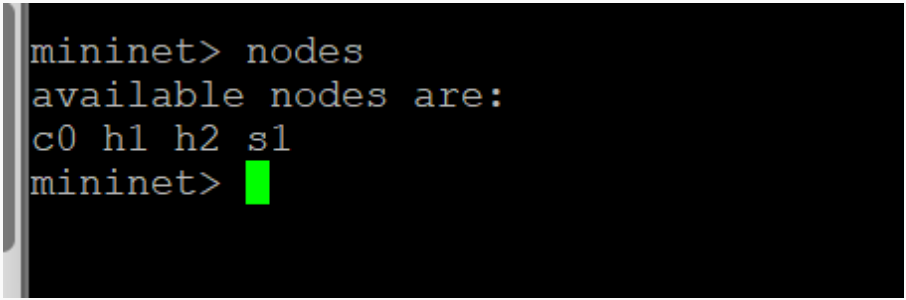


Рис. 18: Отображение доступных узлов

Просмотр доступных линков

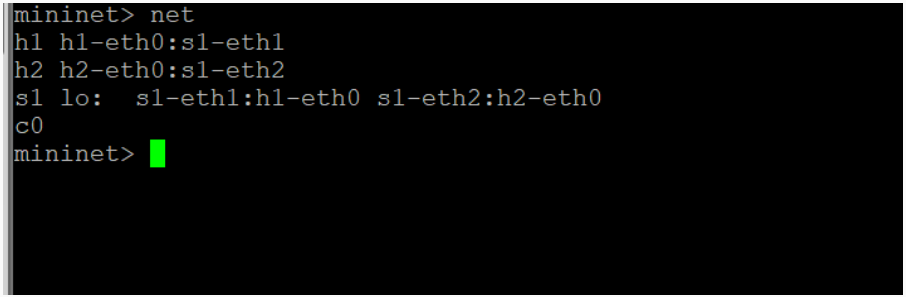


Рис. 19: Просмотр доступных линков

Команда h1 ifconfig

```
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 16:92:40:70:3e:7c  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>
```

Рис. 20: Команда h1 ifconfig

Команда h1 ping 10.0.0.2

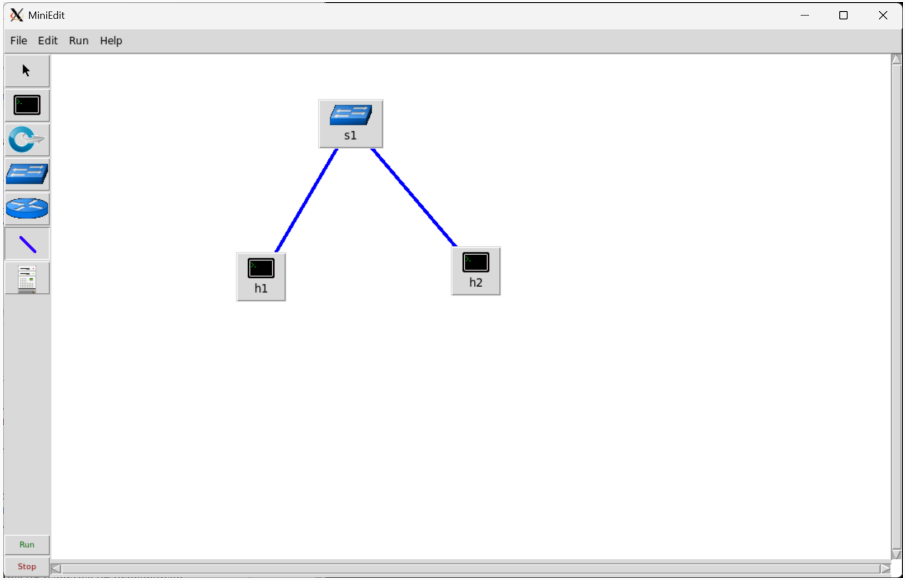
```
mininet> h1 ping 10.0.0.2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=3.65 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.394 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.052 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=0.092 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=0.086 ms
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=0.088 ms
64 bytes from 10.0.0.2: icmp_seq=7 ttl=64 time=0.089 ms
64 bytes from 10.0.0.2: icmp_seq=8 ttl=64 time=0.087 ms
64 bytes from 10.0.0.2: icmp_seq=9 ttl=64 time=0.135 ms
64 bytes from 10.0.0.2: icmp_seq=10 ttl=64 time=0.081 ms
64 bytes from 10.0.0.2: icmp_seq=11 ttl=64 time=0.069 ms
64 bytes from 10.0.0.2: icmp_seq=12 ttl=64 time=0.080 ms
64 bytes from 10.0.0.2: icmp_seq=13 ttl=64 time=0.105 ms
^C
--- 10.0.0.2 ping statistics ---
13 packets transmitted, 13 received, 0% packet loss, time 12274ms
rtt min/avg/max/mdev = 0.052/0.384/3.645/0.944 ms
mininet>
```

Рис. 21: Команда h1 ping 10.0.0.2

Очистка предыдущего экземпляра Mininet

```
mininet> exit
*** Stopping 1 controllers
c0
*** Stopping 2 links
..
*** Stopping 1 switches
s1
*** Stopping 2 hosts
h1 h2
*** Done
completed in 123.883 seconds
mininet@mininet-vm:~$ sudo mn -c
*** Removing excess controllers/ofprotocols/ofdatapaths/pings/noxes
killall controller ofprotocol ofdatapath ping nox_core lt-nox_core ovs-openflowd ovs-controller ovs-test
controller udpbwtest mnexec ivs ryu-manager  2> /dev/null
killall -9 controller ofprotocol ofdatapath ping nox_core lt-nox_core ovs-openflowd ovs-controller ovs-t
estcontroller udpbwtest mnexec ivs ryu-manager  2> /dev/null
pkill -9 -f "sudo mnexec"
*** Removing junk from /tmp
rm -f /tmp/vconn* /tmp/vlogs* /tmp/*.out /tmp/*.log
*** Removing old X11 tunnels
*** Removing excess kernel datapaths
ps ax | egrep -o 'dp[0-9]+' | sed 's/dp/nl:/'
***  Removing OVS datapaths
ovs-vsctl --timeout=1 list-br
ovs-vsctl --timeout=1 list-br
*** Removing all links of the pattern foo-ethX
ip link show | egrep -o '([-_.[:alnum:]]+-eth[[:digit:]]+)'
ip link show
*** Killing stale mininet node processes
pkill -9 -f mininet:
*** Shutting down stale tunnels
pkill -9 -f Tunnel=Ethernet
pkill -9 -f .ssh/mn
rm -f ~/.ssh/mn/*
*** Cleanup complete.
mininet@mininet-vm:~$
```

Добавление двух хостов и одного коммутатора



Настройка IP-адреса на хосте h1 и h2

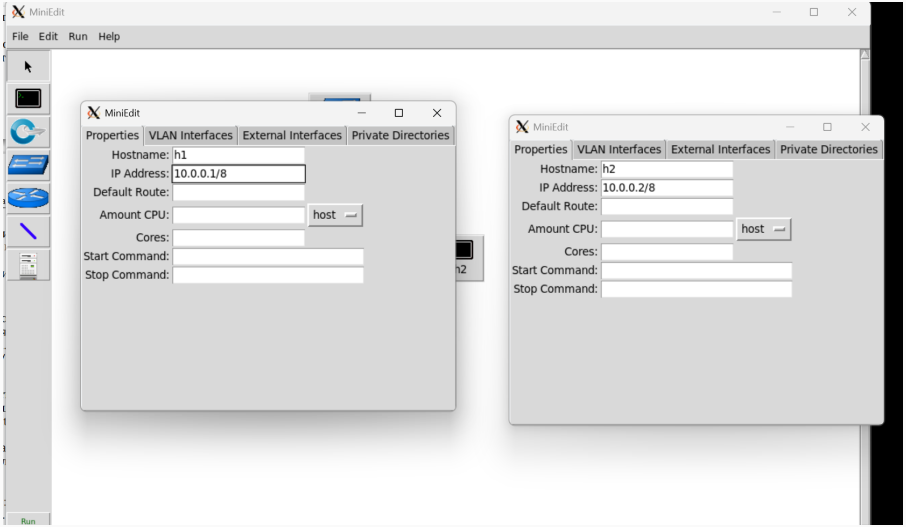


Рис. 24: Настройка IP-адреса на хосте h1 и h2

Проверка IP-адресов. Пинг

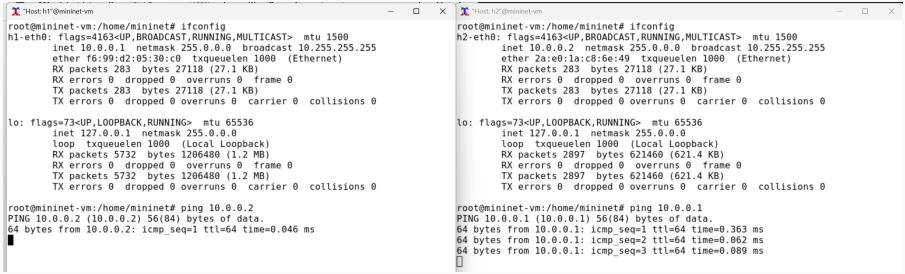


Рис. 25: Проверка IP-адресов. Пинг

Смена базового IP-адреса

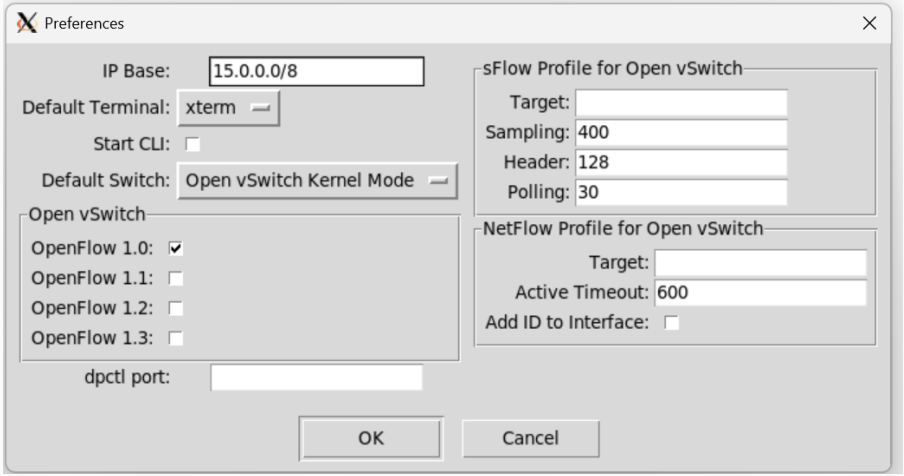


Рис. 26: Смена базового IP-адреса

Просмотр IP-адреса на h1

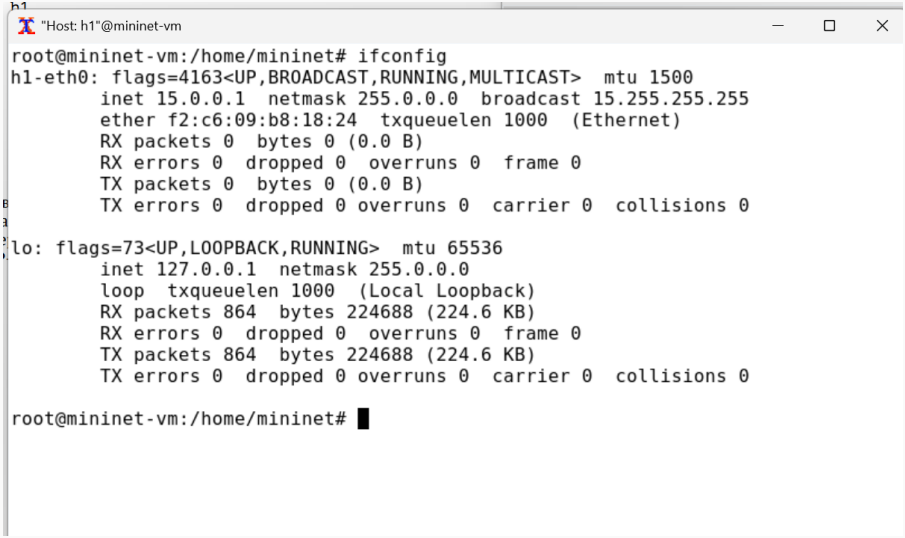


Рис. 27: Просмотр IP-адреса на h1

Создание нового каталога

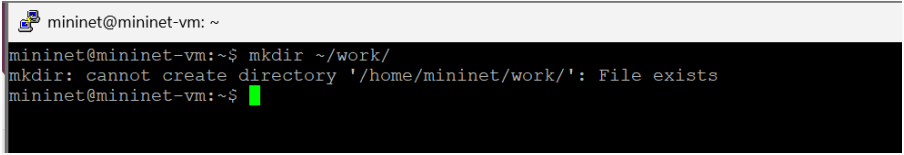
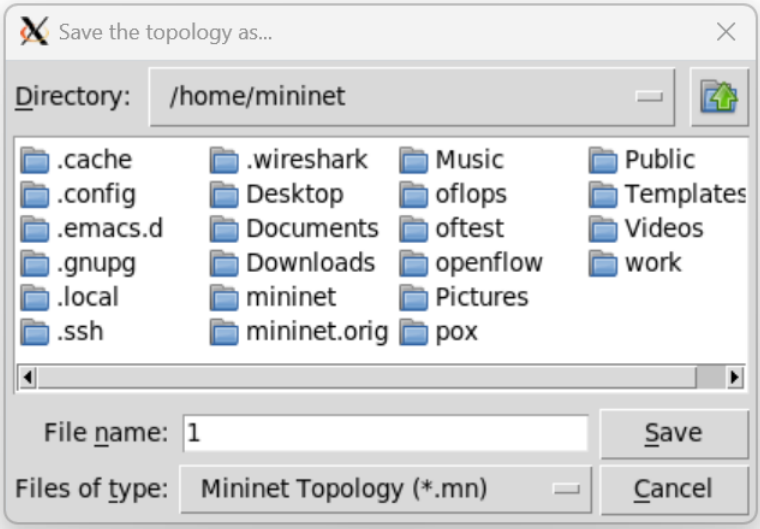


Рис. 28: Создание нового каталога

Сохранение топологии



Изменение прав доступа к файлам в каталоге проекта

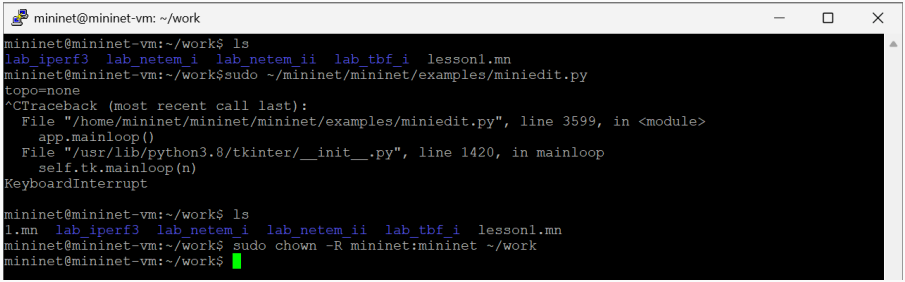


Рис. 30: Изменение прав доступа к файлам в каталоге проекта

Выводы

Выводы

В результате выполнения работы я развёрнул mininet в системе виртуализации VirtualBox и ознакомилась с основными командами для работы с Mininet через командную строку и через графический интерфейс.

Список литературы

Список литературы

1. Mininet [Электронный ресурс]. Mininet Project Contributors. URL: http://mini net.org/ (дата обращения: 06.10.2025).