

Лабораторная работа № 1. Введение в Mininet

Моделирование сетей передачи данных

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Информация

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Введение

Цель 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.

Задачи

1. Настроить стенд виртуальной машины Mininet
2. Освоить основы работы в Mininet

Выполнение лабораторной работы

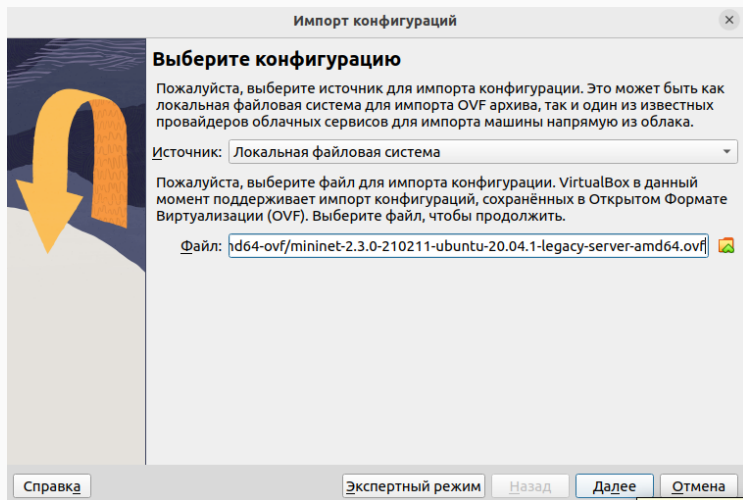


Рис. 1: Импорт конфигураций

Настройка стенда виртуальной машины Mininet

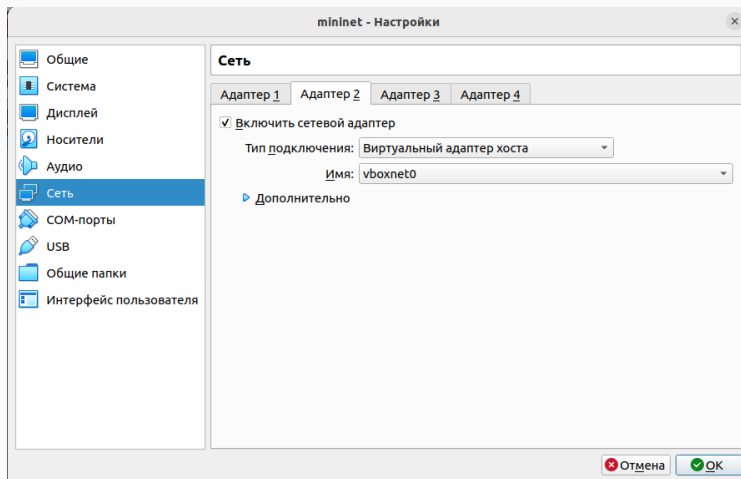


Рис. 2: Настройка виртуальной машины

Настройка стенда виртуальной машины Mininet

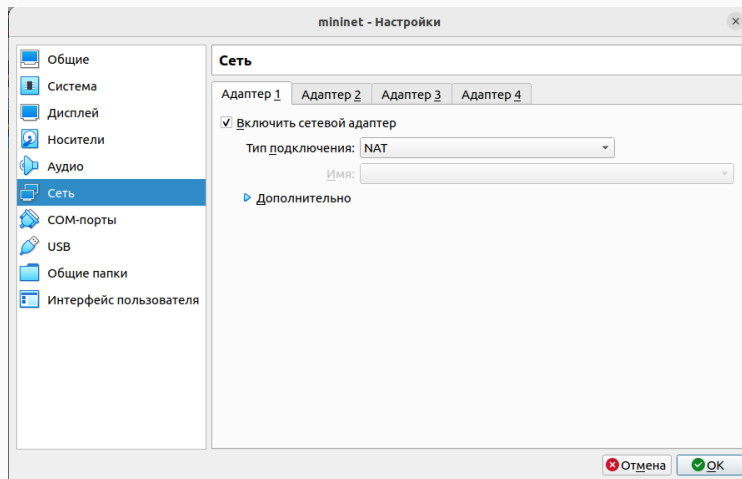


Рис. 3: Настройка виртуальной машины

Настройка стенда виртуальной машины Mininet

```
Ubuntu 20.04.1 LTS mininet-vm tty1

mininet-vm login: mini
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

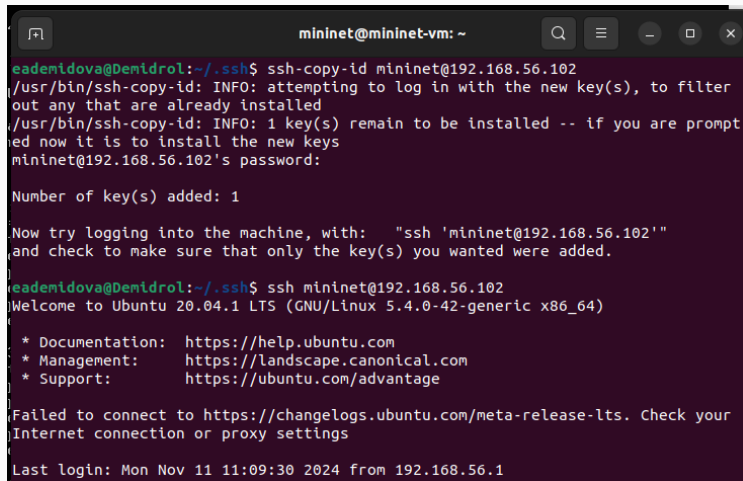
Last login: Wed Feb 10 21:03:31 PST 2021 on ttyS0
mininet@mininet-vm:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 192.168.56.102  netmask 255.255.255.0  broadcast 192.168.56.255
    ether 08:00:27:b0:67:ce  txqueuelen 1000  (Ethernet)
    RX packets 2  bytes 1180 (1.1 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. 4: Начало работы с Mininet

Настройка стенда виртуальной машины Mininet



```
mininet@mininet-vm: ~  
eademidova@Demidrol:~/.ssh$ ssh-copy-id mininet@192.168.56.102  
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter  
out any that are already installed  
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompt  
ed now it is to install the new keys  
mininet@192.168.56.102's password:  
  
Number of key(s) added: 1  
  
Now try logging into the machine, with:  "ssh 'mininet@192.168.56.102'"  
and check to make sure that only the key(s) you wanted were added.  
  
eademidova@Demidrol:~/.ssh$ ssh mininet@192.168.56.102  
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 Nov 11 11:09:30 2024 from 192.168.56.1
```

Рис. 5: SSH-соединение с Mininet

```
/etc/netplan/01-netcfg.yaml [-M--] 6 L:[ 1+ 9 10/ 10] *(209 / 219b
# 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. 6: Добавление сетевого соединения eth1

Настройка стенда виртуальной машины Mininet

```
Cloning into 'mininet'...
remote: Enumerating objects: 10388, done.
remote: Counting objects: 100% (234/234), done.
remote: Compressing objects: 100% (142/142), done.
remote: Total 10388 (delta 129), reused 170 (delta 90), pack-reused 10154 (from 1)
Receiving objects: 100% (10388/10388), 3.36 MiB | 2.52 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/mm --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/mm" -o mm.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 mm.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=06823aa698
86f06b343d2dc15d33e04dce598bf9ea50653224938e5080ccc694
  Stored in directory: /tmp/pip-ephem-wheel-cache-dnxusids/wheels/cd/7d/a7/aa/c1b3caff31cf46ba4c2eae
c9690a717bdf739db6cfe8d45
Successfully built mininet
Installing collected packages: mininet
Successfully installed mininet-2.3.1b4
mininet@mininet-vm:~/mininet$ mm --version
2.3.1b4
mininet@mininet-vm:~/mininet$
```

Рис. 7: Обновление версии Mininet

Настройка стенда виртуальной машины Mininet

```
ztc/X11/app-defaults/XTerm  [-M--] 18 L:(232*34 266/266) *(10376/10376b) <EOF>  [*][X]
! Set a border for the menus to make them simpler to distinguish against the
! vt100 widget:
*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: 33:40,35:40,37-38:40,43-47:40,58:40,61:40,63-64:40,95:40,126:40
!
! Alternatively,
!*on2Clicks: regex [[[:alpha:]]+://([[:alnum:]]|!|*|_|./=?@_-)H(?:[:xdigit:]]H(?:[:xdigit:]]H)*)
!
! 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
*allowTcpOps: false
*allowTitleOps: false
*allowWindowOps: false
xterm*faceName: Monospace
xterm*faceSize: 12
1help 2Save 3Mark 4Replac 5Copy 6Move 7Search 8Delete 9FullBn 10Quit
```

Рис. 8: Настройка параметров XTerm

Настройка стенда виртуальной машины Mininet

```
sudo: DISPER! Command not found
mininet@mininet-vm:~$ xauth list
mininet-vm/unix:10 MIT-MAGIC-COOKIE-1 76bcd8cc59e748a244209917ba668bfe
mininet@mininet-vm:~$ sudo -i
root@mininet-vm:~# xauth list
mininet-vm/unix:10 MIT-MAGIC-COOKIE-1 d6f622f8fbb7adedbec1722b78ecada0
root@mininet-vm:~# xauth add mininet-vm/unix:10 MIT-MAGIC-COOKIE-1 76bcd8cc59e748a244209917ba668bfe
root@mininet-vm:~# xauth list
mininet-vm/unix:10 MIT-MAGIC-COOKIE-1 76bcd8cc59e748a244209917ba668bfe
root@mininet-vm:~# logout
```

Рис. 9: Настройка соединения X11 для суперпользователя

Основы работы в Mininet

```
mininet@mininet-vm: ~  
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> 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> 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 fa:db:23:a0:e8:5d 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> 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=1.38 ms  
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.223 ms  
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.063 ms  
^C  
--- 10.0.0.2 ping statistics ---  
3 packets transmitted, 3 received, 0% packet loss, time 2013ms  
rtt min/avg/max/mdev = 0.063/0.555/1.380/0.586 ms
```


Построение и эмуляция сети в Mininet с использованием графического интерфейса

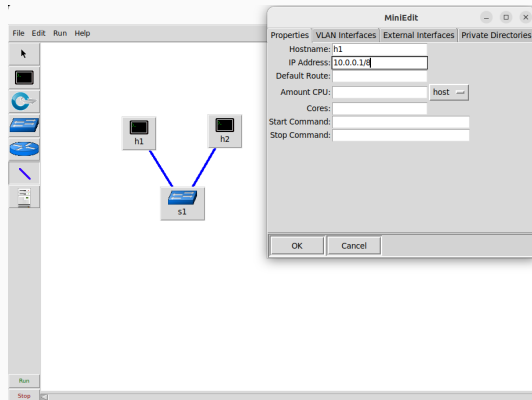


Рис. 11: Построение сети Mininet

Построение и эмуляция сети в Mininet с использованием графического интерфейса

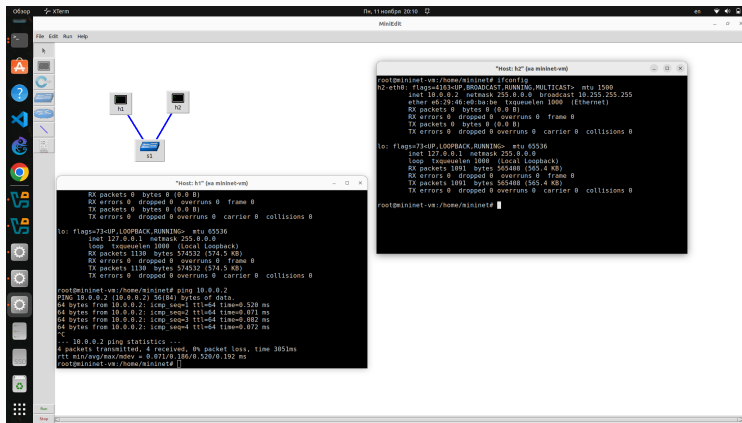


Рис. 12: Запуск сети

Построение и эмуляция сети в Mininet с использованием графического интерфейса

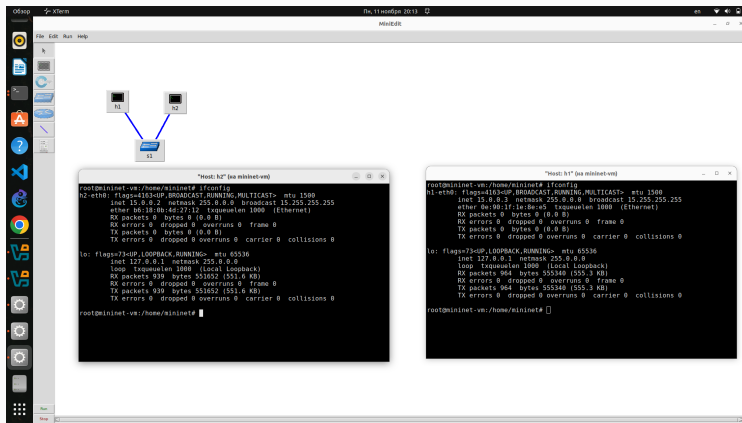


Рис. 13: Автоматическое выделение адресов

Построение и эмуляция сети в Mininet с использованием графического интерфейса

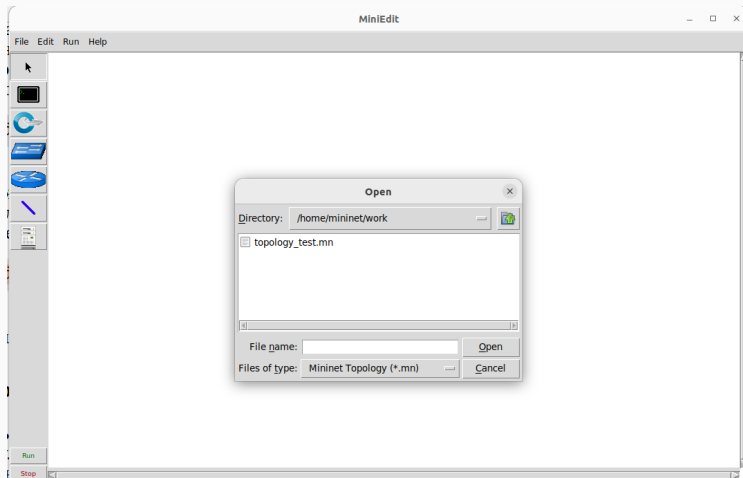


Рис. 14: Сохранение топологии

Выводы

В результате выполнения работы был развёрнут в системе виртуализации VirtualBox mininet, а также ознакомились с основными командами для работы с Mininet через командную строку и через графический интерфейс.

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