

# Средство моделирования Mininet. Установка и пример моделирования.

Администрирование локальных сетей

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- Mininet – это виртуальная тестовая среда, предназначенная для разработки и тестирования сетевых инструментов и протоколов.
- Сети в Mininet создаются с помощью Python-скриптов.
- **Цель доклада:** разобраться с установкой Mininet на Windows, провести эксперимент.

## Установка и настройка Mininet

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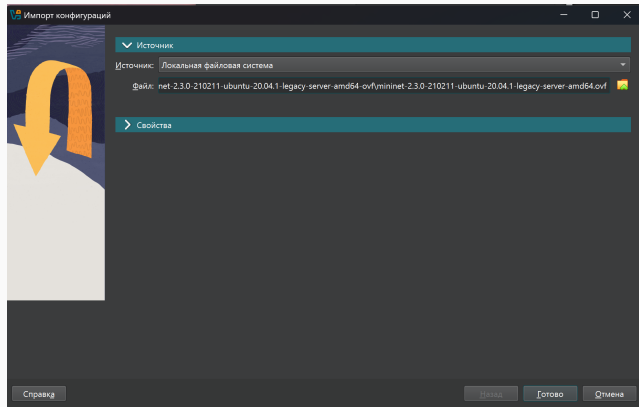


Рис. 1: Импорт образа VM

# Настройка образа Mininet

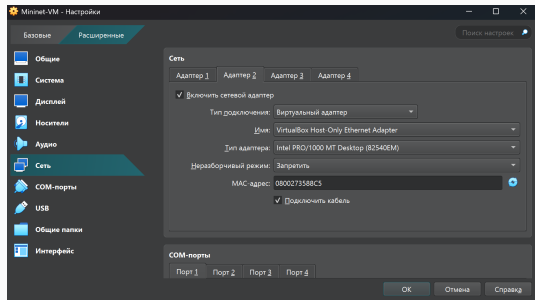


Рис. 2: Настройка сетевых параметров VM

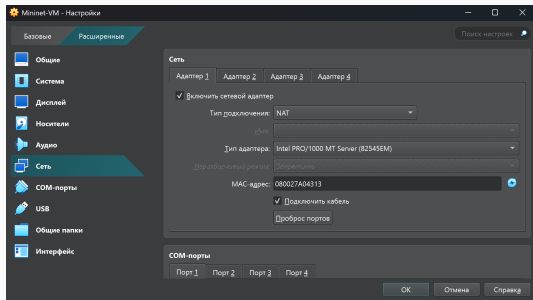


Рис. 3: Настройка сетевых параметров VM

# Подключение к виртуальной машине

```
Ubuntu 20.04.1 LTS mininet-vm tty1
mininet-vm login: mininet
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 tty90
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 08:00:27:35:08:c5 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 3680 (3.6 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 48  bytes 3680 (3.6 KB)
    TX errors 0  dropped 0  overruns 0  carrier 0  collisions 0

mininet@mininet-vm:~$
```

Рис. 4: Определение IP-адреса ВМ

```
C:\Users\nasmi>ssh -V mininet@192.168.56.102
The authenticity of host '192.168.56.102 (192.168.56.102)' can't be established.
ED25519 key fingerprint is 94A256/X1zEVmp1RX94/3M1IacB133EQxLz8z0umt0odB0vw.
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 '192.168.56.102' (ED25519) to the list of known hosts.
mininet@192.168.56.102'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 Mar 24 09:31:04 2025
mininet@mininet-vm:~$
```

Рис. 5: Настройка SSH-подключения

```
choco install vcxsrv
```

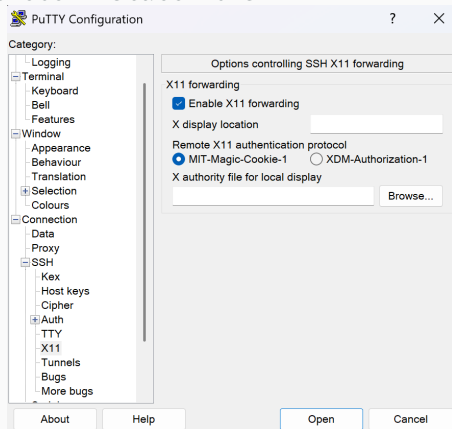


Рис. 6: Настройки Putty

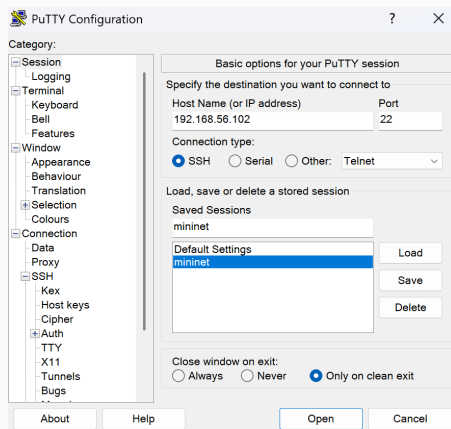


Рис. 7: Настройки Putty



```
mininet@mininet-vm: ~  
login as: mininet  
mininet@192.168.56.102'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  
  
Last login: Mon Mar 24 09:56:40 2025 from 192.168.56.1  
mininet@mininet-vm:~$ sudo dhclient eth1  
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 08:00:27:35:88:c5 txqueuelen 1000 (Ethernet)  
    RX packets 11757 bytes 1338669 (1.3 MB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 16963 bytes 19094657 (19.0 MB)  
    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:a0:43:13 txqueuelen 1000 (Ethernet)  
    RX packets 40 bytes 6325 (6.3 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 41 bytes 4870 (4.8 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 9126 bytes 18585396 (18.5 MB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 9126 bytes 18585396 (18.5 MB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Рис. 8: Настройка доступа к интернету на VM

# Основы Mininet

```
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>
```

Рис. 9: Запуск Mininet с минимальной топологией

```
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 a2:43:e6:38:1c:ec 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=10.2 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.393 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.075 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=0.137 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=0.141 ms
^C
--- 10.0.0.2 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4076ms
rtt min/avg/max/mdev = 0.075/2.195/10.231/4.019 ms
mininet> exit
*** Stopping 1 controllers
c0
*** Stopping 2 links
..
*** Stopping 1 switches
s1
*** Stopping 2 hosts
h1 h2
*** Done
completed in 39.137 seconds
mininet@mininet-vm:~$
```

Рис. 10: Базовые команды Mininet

## Практическая часть

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```
net = Mininet(controller=Controller, waitConnected=True, link=TCLink)

info('*** Adding hosts\n')
h1 = net.addHost('h1', ip='10.0.1.2/24', defaultRoute='via 10.0.1.1')
h2 = net.addHost('h2', ip='10.0.2.2/24', defaultRoute='via 10.0.2.1')

info('*** Adding router\n')
router = net.addHost('router', ip='10.0.1.1/24')

info('*** Creating links\n')
net.addLink(h1, router, intfName2='router-eth1',
params2={'ip': '10.0.1.1/24'}, bw=100, delay='10ms')
net.addLink(h2, router, intfName2='router-eth2',
params2={'ip': '10.0.2.1/24'}, bw=100, delay='10ms')
```

```
info('*** Starting network\n')
net.start()

router.cmd('sysctl net.ipv4.ip_forward=1')

info('*** Starting iperf3 server on h2\n')
h2.cmd('iperf3 -s -D')
time.sleep(5)

info('*** h1 using iperf3\n')
h1.cmd(f'iperf3 -c {h2.IP()} -t 10 -l 1500 -J > iperf_result.json')

info('*** Stopping network\n')
net.stop()
```

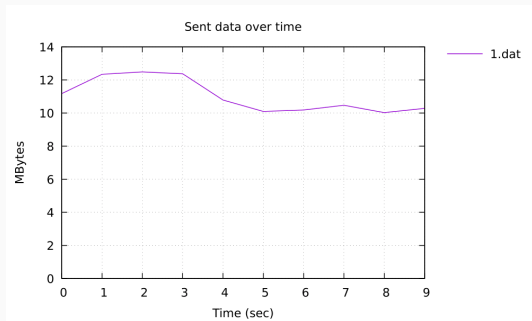


Рис. 11: График количества переданных байт

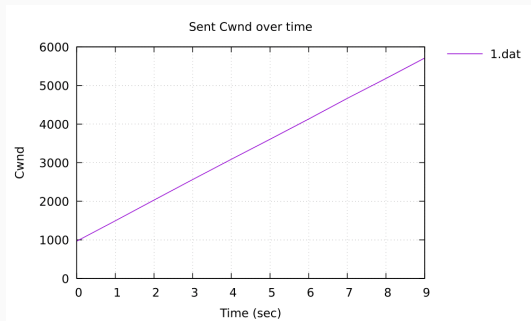


Рис. 12: График окна перегрузки

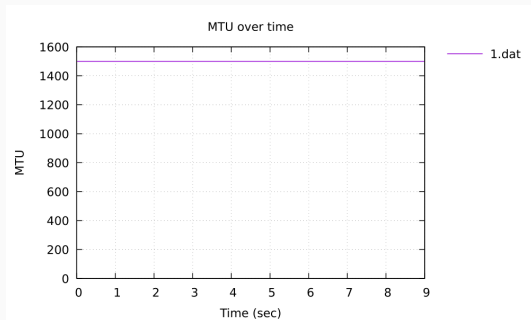


Рис. 13: График максимальной единицы передачи

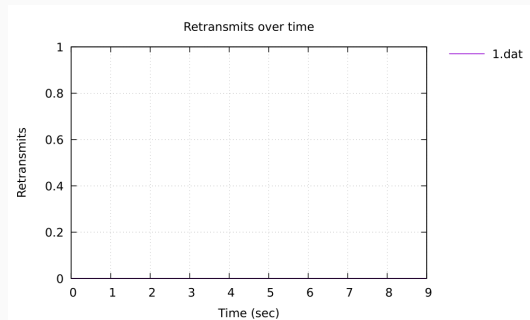


Рис. 14: График повторов передач

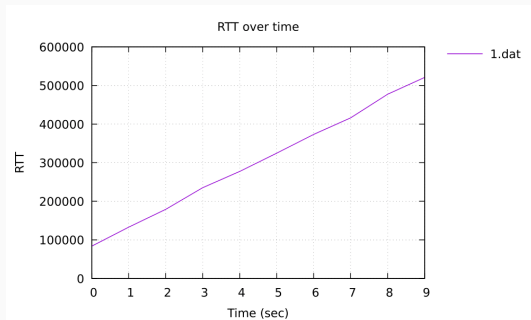


Рис. 15: График времени приема-передачи

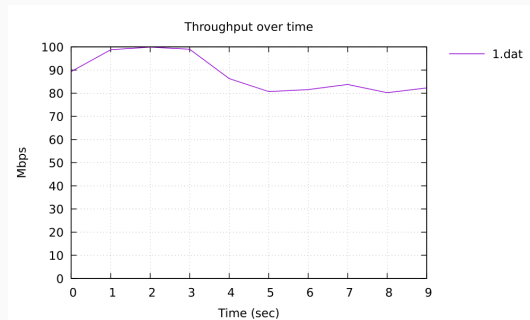


Рис. 16: График пропускной способности



В ходе работы мы успешно развернули Mininet на платформе Windows и провели эксперимент по анализу пропускной способности сети.