

Лабораторная работа №6

Сетевые технологии

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Цель работы

Изучение принципов распределения и настройки адресного пространства на устройствах сети.

Выполнение лабораторной работы

Разбиение сети на подсети

Разбиение IPv4-сети на подсети

Характеристика	Значение
Адрес сети	172.16.20.0/24
Префикс маски	/24
Маска	255.255.255.0
Broadcast-адрес	172.16.20.255
Адрес сети в двоичной форме	10101100.00010000.00010100.00000000
Маска в двоичной форме	11111111.11111111.11111111.00000000
Число возможных подсетей	$2^8=256$
Диапазон адресов узлов	172.16.20.1 - 172.16.20.254

- Разбить сеть на 3 подсети с 126, 62, 62 узлами.
- **11111111.11111111.11111111.10000000 = 255.255.255.128**
- Диапазон адресов для данной подсети: **172.16.20.1 - 172.16.20.126**.
- Для двух других подсетей: **11111111.11111111.11111111.11000000 = 255.255.255.192**.
- Диапазон адресов для второй подсети: **172.16.20.129 - 172.16.20.190**.
- Диапазон адресов для третьей подсети: **172.16.20.193 - 172.16.20.254**.

Разбиение IPv4-сети на подсети

Характеристика	Значение
Адрес сети	10.10.1.64/26
Префикс маски	/26
Маска	255.255.255.192
Broadcast-адрес	10.10.1.127
Адрес сети в двоичной форме	00001010.00001010.00000001.01000000
Маска в двоичной форме	11111111.11111111.11111111.11000000
Число возможных подсетей	$2^6=64$
Диапазон адресов узлов	10.10.1.65 - 10.10.1.126

Разбиение IPv4-сети на подсети

Характеристика	Значение
Адрес сети	10.10.1.0/26
Префикс маски	/26
Маска	255.255.255.192
Broadcast-адрес	10.10.1.63
Адрес сети в двоичной форме	00001010.00001010.00000001.00000000
Маска в двоичной форме	11111111.11111111.11111111.11000000
Число возможных подсетей	$2^6=64$
Диапазон адресов узлов	10.10.1.1 - 10.10.1.62

Разбиение IPv6-сети на подсети

Характеристика	Значение
Адрес сети	2001:db8:c0de::/48
Длина префикса	48
Префикс	2001:db8:c0de::
Маска	ffff:ffff:ffff:0:0:0:0:0
Диапазон адресов узлов	2001:db8:c0de:0:0:0:0 - 2001:db8:c0de:ffff:ffff:ffff:ffff

- С использованием идентификатора подсети.

2001:db8:c0de:0003::/64

2001:db8:c0de:0002::/64

- С использованием идентификатора интерфейса.

2001:db8:c0de:0000:1000/68

2001:db8:c0de:0000:2000/68

Разбиение IPv6-сети на подсети

Характеристика	Значение
Адрес сети	2a02:6b8::/64
Длина префикса	64
Префикс	2a02:6b8:0000:0000
Маска	ffff:ffff:ffff:ffff:0:0:0:0
Диапазон адресов узлов	2a02:6b8:: - 2a02:6b8:0:0:ffff:ffff:ffff:ffff

- С использованием идентификатора интерфейса.

2a02:6b8:0000:0000:1000::/68

2a02:6b8:0000:0000:2000::/68

Настройка двойного стека адресации IPv4 и IPv6 в локальной сети

Выполнение лабораторной работы

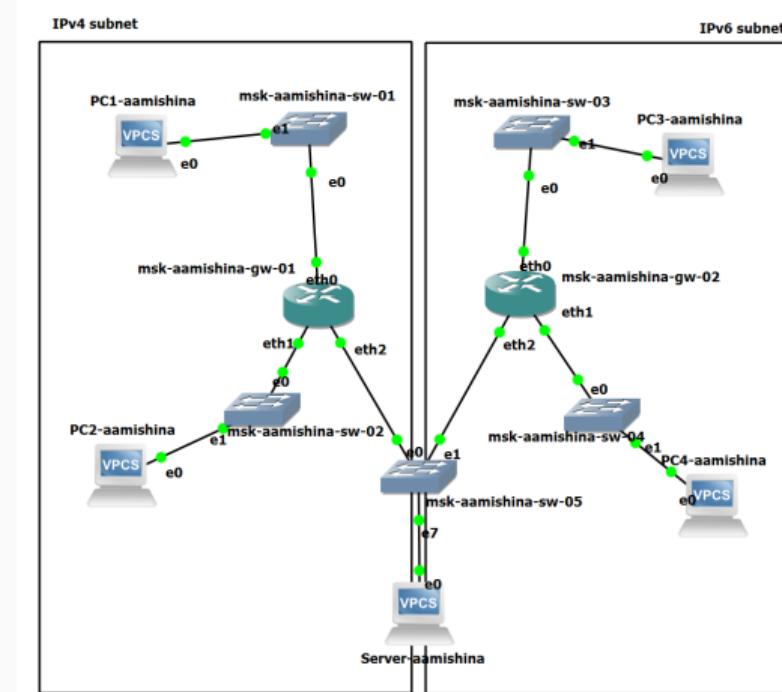


Рис. 1: Топология сети с двумя локальными подсетями в GNS3

Выполнение лабораторной работы

```
Welcome to Virtual PC Simulator, version 0.8.3
Dedicated to Bailing,
Build date: Sun Jun 20 2023 11:15:00
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Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file
Hostname is too long. (Maximum 12 characters)

VPCB> ip 172.16.20.10/25 172.16.20.1
Checking for duplicate address...
VPCB i 172.16.20.10 255.255.255.128 gateway 172.16.20.1

VPCB> save
Saving startup configuration to startup.vpc
. done

VPCB> show ip
NAME      : VPCS[1]
IP/MASK   : 172.16.20.10/25
GATEWAY   : 172.16.20.1
MAC       :
IPC      :
MAC      : 00:50:79:66:68:00
LPORT     : 20022
ROUTST:PORT : 127.0.0.1:20023
MTU      : 1500

VPCB> shop ipv6
Bad command: "shop ipv6". Use ? for help.

VPCB> show ipv6
NAME      : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6800/64
GLOBAL SCOPE   :
MAC       :
ROUTER LINK-LAYER :
MOC      : 00:50:79:66:68:00
LPORT     : 20022
ROUTST:PORT : 127.0.0.1:20023
MTU      : 1500

VPCB> █
```

Рис. 2: Настройка IPv4-адресации на PC-1

Выполнение лабораторной работы

```
Welcome to Virtual PC Simulator, version 0.0.3
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Build timer: Sep 9 2023 11:15:00
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For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file

Hostname is too long. (Maximum 12 characters)

VPCS> ip 172.16.20.138/25 172.16.20.129
Checking for duplicate address...
VPCS : 172.16.20.138 255.255.255.128 gateway 172.16.20.129

VPCS> save
Saving startup configuration to startup.vpc
+ done

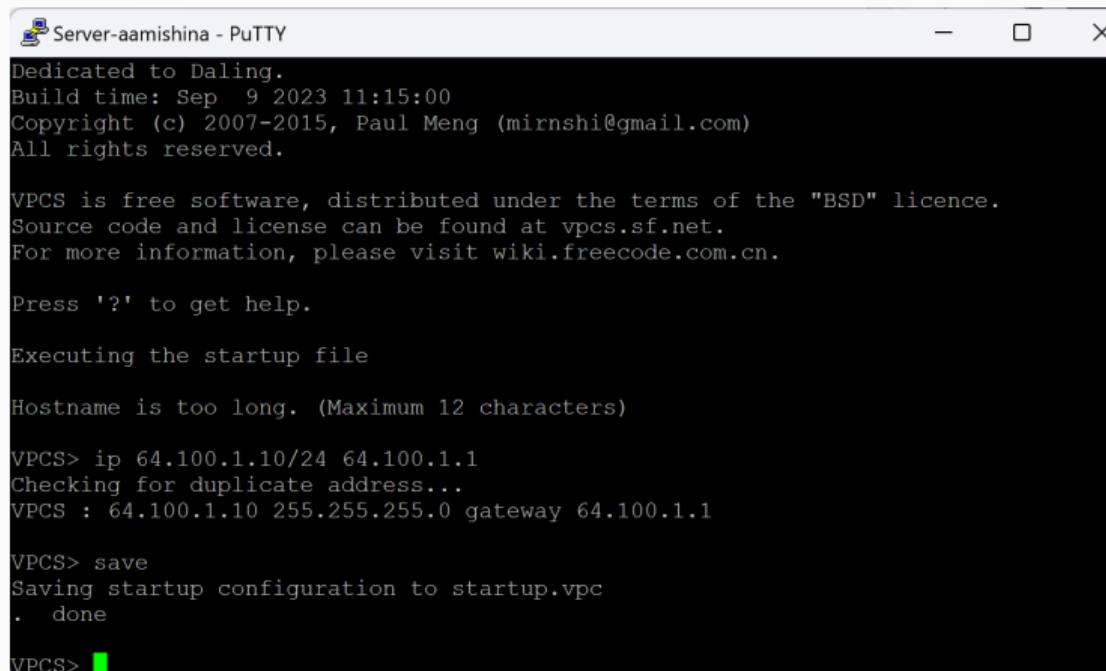
VPCS> show ip
NAME      : VPCS[1]
IP/MASK   : 172.16.20.138/25
GATEWAY   : 172.16.20.129
DNS       :
MAC       : 00:50:79:66:68:01
LPORT     : 20024
RHOST:PORT : 127.0.0.1:20025
MTU      : 1500

VPCS> show ipv6
NAME      : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6801/64
GLOBAL SCOPE   :
DNS       :
PREFIX      : 64
MAC       : 00:50:79:66:68:01
LPORT     : 20024
RHOST:PORT : 127.0.0.1:20025
MTU      : 1500

VPCS>
```

Рис. 3: Настройка IPv4-адресации на PC-2

Выполнение лабораторной работы



Dedicated to Daling.
Build time: Sep 9 2023 11:15:00
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Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file

Hostname is too long. (Maximum 12 characters)

VPCS> ip 64.100.1.10/24 64.100.1.1
Checking for duplicate address...
VPCS : 64.100.1.10 255.255.255.0 gateway 64.100.1.1

VPCS> save
Saving startup configuration to startup.vpc
. done

VPCS> █

Рис. 4: Настройка IPv4-адресации на сервере

Выполнение лабораторной работы



The screenshot shows a PuTTY terminal window titled "msk-amishina-gw-01 - PuTTY". The window displays the configuration process of FRRouting on a Cisco router. The configuration includes:

- Mounting root filesystem and local filesystems.
- Configuring kernel parameters and setting up the root password.
- Setting hostnames and keymaps.
- Starting networking services like lo, busybox syslog, and busybox apcid.
- Seeding 256 bits of creditable seed for next boot.
- Starting busybox crond.
- Starting watchdog and ashd.

After the initial configuration, the router boots into FRRouting version 8.2.2. The configuration command is run, saving it to /etc/frr/frr.conf. The configuration section includes:

- Setting the hostname to msk-amishina-gw-01.
- Writing memory.
- Building Configuration.
- Integrated configuration saved to /etc/frr/frr.conf.

The configuration then proceeds to set up interfaces eth0, eth1, and eth2 with IPv4 addresses 172.16.20.1/25, 172.16.20.129/25, and 64.100.1.1/24 respectively, with no shutdown and exit commands.

Finally, the configuration is saved to memory and the configuration command is run again, saving the integrated configuration to /etc/frr/frr.conf.

Рис. 5: Настройка IPv4-адресации для интерфейсов маршрутизатора FRR

Выполнение лабораторной работы

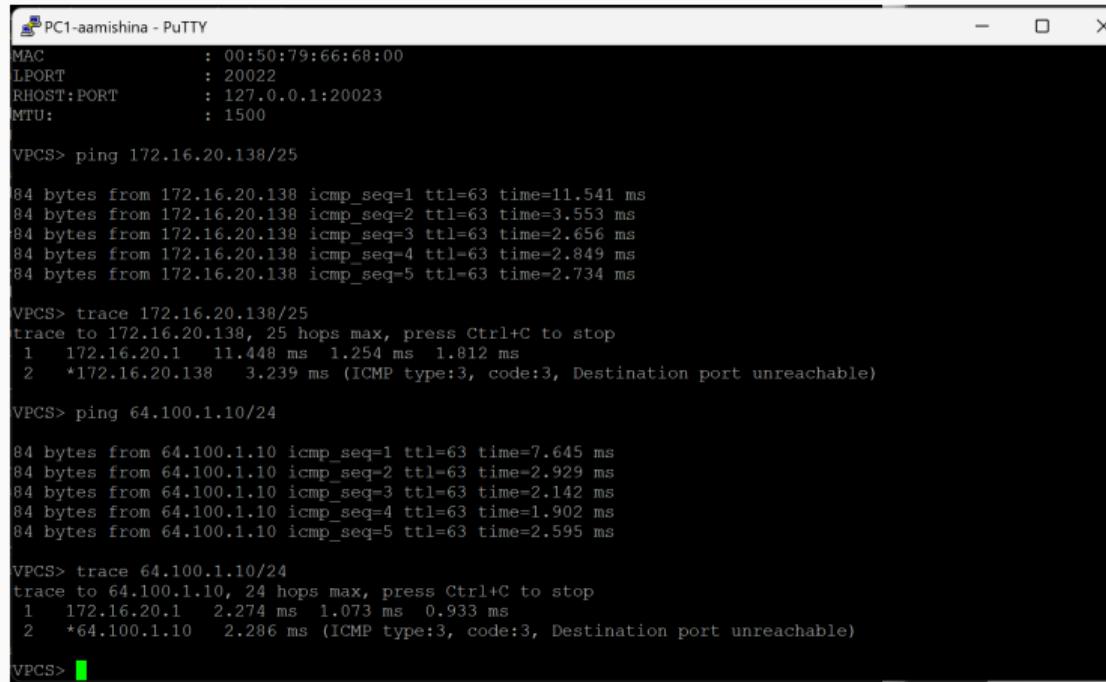
```
msk-aamishina-gw-01# show running-config
Building configuration...

Current configuration:
!
frr version 8.2.2
frr defaults traditional
hostname frr
hostname msk-aamishina-gw-01
service integrated-vtysh-config
!
interface eth0
 ip address 172.16.20.1/25
exit
!
interface eth1
 ip address 172.16.20.129/25
exit
!
interface eth2
 ip address 64.100.1.1/24
exit
!
end
msk-aamishina-gw-01# show interface brief
Interface      Status   VRF          Addresses
-----  -----  -----
eth0          up      default    172.16.20.1/25
eth1          up      default    172.16.20.129/25
eth2          up      default    64.100.1.1/24
eth3          down     default
eth4          down     default
eth5          down     default
eth6          down     default
eth7          down     default
lo            up      default
pimreg        up      default

msk-aamishina-gw-01#
```

Рис. 6: Проверка конфигурации маршрутизатора FRR

Выполнение лабораторной работы



PC1-aamishina - PuTTY

```
MAC : 00:50:79:66:68:00
LPORT : 20022
RHOST:PORT : 127.0.0.1:20023
MTU: : 1500

VPCS> ping 172.16.20.138/25
84 bytes from 172.16.20.138 icmp_seq=1 ttl=63 time=11.541 ms
84 bytes from 172.16.20.138 icmp_seq=2 ttl=63 time=3.553 ms
84 bytes from 172.16.20.138 icmp_seq=3 ttl=63 time=2.656 ms
84 bytes from 172.16.20.138 icmp_seq=4 ttl=63 time=2.849 ms
84 bytes from 172.16.20.138 icmp_seq=5 ttl=63 time=2.734 ms

VPCS> trace 172.16.20.138/25
trace to 172.16.20.138, 25 hops max, press Ctrl+C to stop
 1  172.16.20.1   11.448 ms  1.254 ms  1.812 ms
 2  *172.16.20.138   3.239 ms (ICMP type:3, code:3, Destination port unreachable)

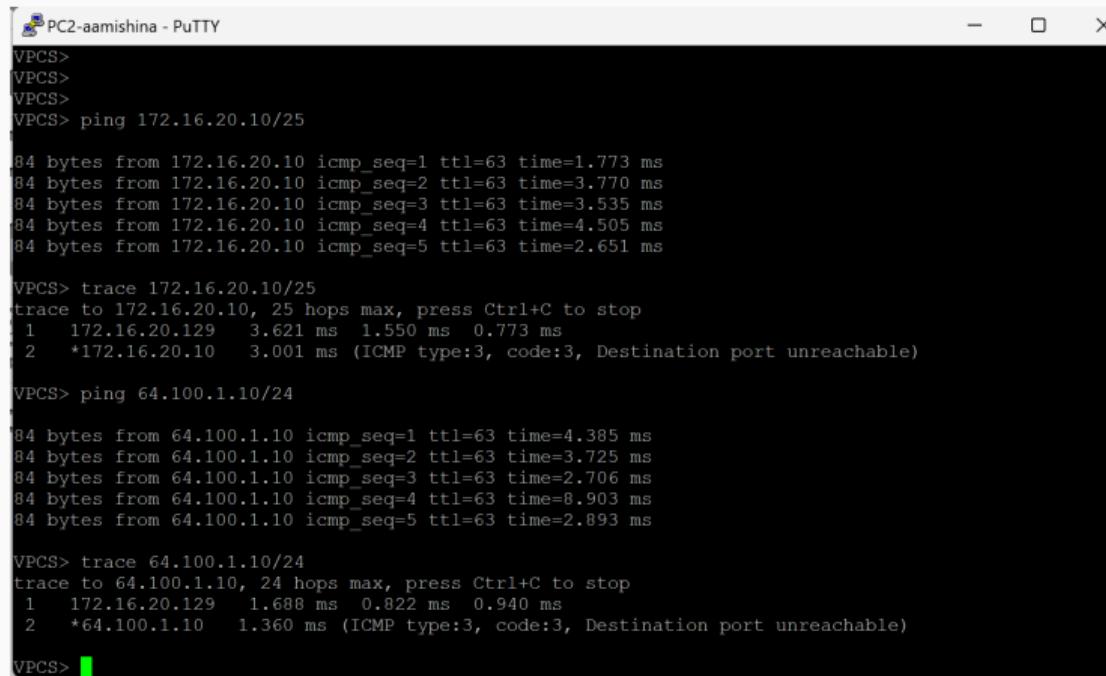
VPCS> ping 64.100.1.10/24
84 bytes from 64.100.1.10 icmp_seq=1 ttl=63 time=7.645 ms
84 bytes from 64.100.1.10 icmp_seq=2 ttl=63 time=2.929 ms
84 bytes from 64.100.1.10 icmp_seq=3 ttl=63 time=2.142 ms
84 bytes from 64.100.1.10 icmp_seq=4 ttl=63 time=1.902 ms
84 bytes from 64.100.1.10 icmp_seq=5 ttl=63 time=2.595 ms

VPCS> trace 64.100.1.10/24
trace to 64.100.1.10, 24 hops max, press Ctrl+C to stop
 1  172.16.20.1   2.274 ms  1.073 ms  0.933 ms
 2  *64.100.1.10   2.286 ms (ICMP type:3, code:3, Destination port unreachable)

VPCS>
```

Рис. 7: Проверка подключения с РС-1

Выполнение лабораторной работы



The screenshot shows a PuTTY terminal window with the title "PC2-aamishina - PuTTY". The window contains the following command-line session:

```
VPCS>
VPCS>
VPCS>
VPCS> ping 172.16.20.10/25
84 bytes from 172.16.20.10 icmp_seq=1 ttl=63 time=1.773 ms
84 bytes from 172.16.20.10 icmp_seq=2 ttl=63 time=3.770 ms
84 bytes from 172.16.20.10 icmp_seq=3 ttl=63 time=3.535 ms
84 bytes from 172.16.20.10 icmp_seq=4 ttl=63 time=4.505 ms
84 bytes from 172.16.20.10 icmp_seq=5 ttl=63 time=2.651 ms

VPCS> trace 172.16.20.10/25
trace to 172.16.20.10, 25 hops max, press Ctrl+C to stop
 1  172.16.20.129  3.621 ms  1.550 ms  0.773 ms
 2  *172.16.20.10  3.001 ms (ICMP type:3, code:3, Destination port unreachable)

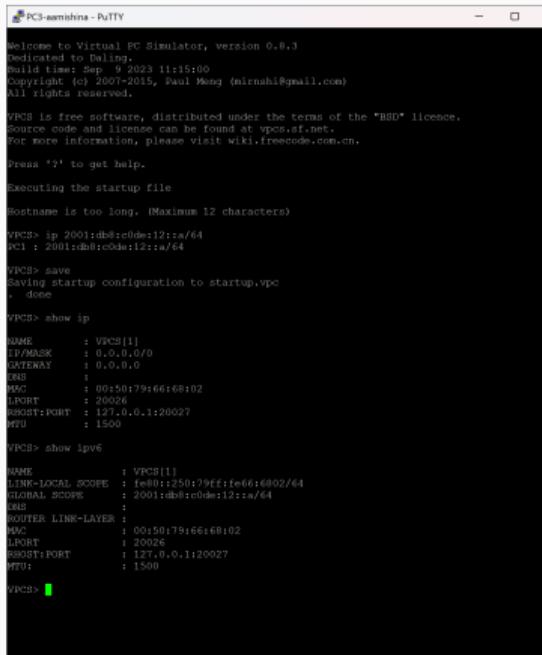
VPCS> ping 64.100.1.10/24
84 bytes from 64.100.1.10 icmp_seq=1 ttl=63 time=4.385 ms
84 bytes from 64.100.1.10 icmp_seq=2 ttl=63 time=3.725 ms
84 bytes from 64.100.1.10 icmp_seq=3 ttl=63 time=2.706 ms
84 bytes from 64.100.1.10 icmp_seq=4 ttl=63 time=8.903 ms
84 bytes from 64.100.1.10 icmp_seq=5 ttl=63 time=2.893 ms

VPCS> trace 64.100.1.10/24
trace to 64.100.1.10, 24 hops max, press Ctrl+C to stop
 1  172.16.20.129  1.688 ms  0.822 ms  0.940 ms
 2  *64.100.1.10  1.360 ms (ICMP type:3, code:3, Destination port unreachable)

VPCS>
```

Рис. 8: Проверка подключения с PC-2

Выполнение лабораторной работы



```
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Press '?' to get help.

Executing the startup file

Hostname is too long. (Maximum 12 characters)

VPCS> ip 2001:db8:c0de:12::a/64
PCI : 2001:db8:c0de:12::a/64

VPCS> save
Saving startup configuration to startup.vpc
+ done

VPCS> show ip
NAME          : VPCS[1]
LINK-MASK    : 0.0.0.0/0
GATEWAY      : 0.0.0.0
DNS           :
MAC           : 00:50:79:66:68:02
LPORT         : 20026
RHOST:PORT   : 127.0.0.1:20027
MTU          : 1500

VPCS> show ipv6
NAME          : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6802/64
GLOBAL SCOPE   : 2001:db8:c0de:12::a/64
DNS           :
ROUTER LINK-LAYER:
MAC           : 00:50:79:66:68:02
LPORT         : 20026
RHOST:PORT   : 127.0.0.1:20027
MTU          : 1500

VPCS> [redacted]
```

Рис. 9: Настройка IPv6-адресации на PC-3

Выполнение лабораторной работы



```
PC4-samishina - PuTTY

Welcome to Virtual PC Simulator, version 0.8.3
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Build timer: Sep 4 2003 11:15:00
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Press "?" to get help.

Executing the startup file

Hostname is too long. (Maximum 12 characters)

VPCS> ip 2001:db8:c0de:13::a/64
PCL : 2001:db8:c0de:13::a/64

VPCS> save
Saving startup configuration to startup.vpc
. done

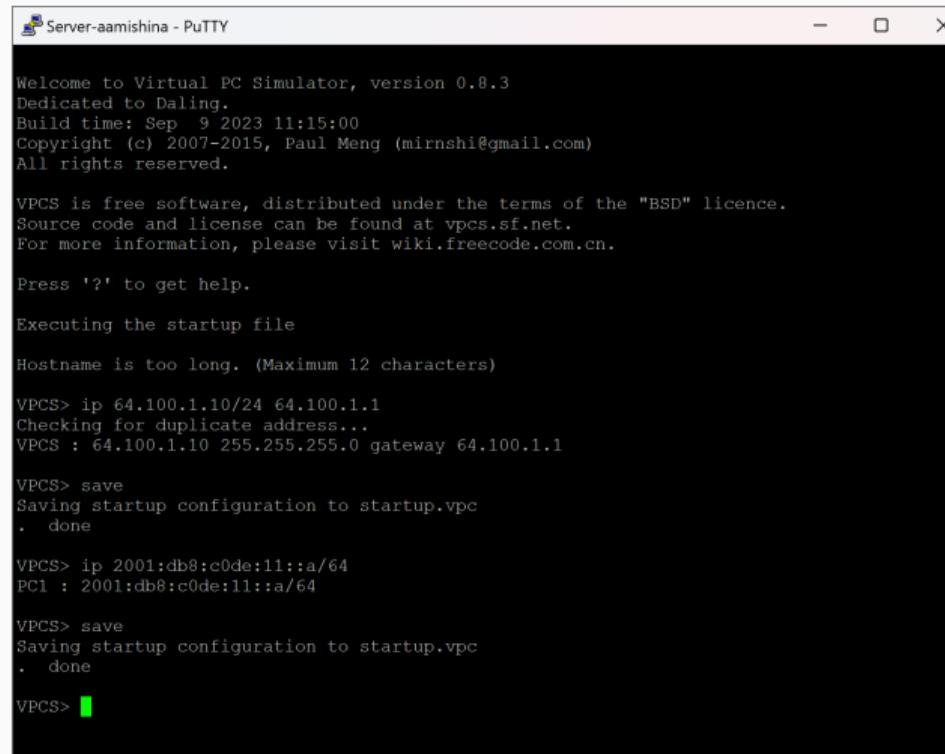
VPCS> show ip
NAME      : VPCS(1)
IP/MASK   : 0.0.0.0/0
GATEWAY   : 0.0.0.0
DNS       :
MAC       : 00:50:79:66:68:03
LPORT     : 20029
RPORT:PORT: : 127.0.0.1:20029
MTU      : 1500

VPCS> show ipv6
NAME      : VPCS(1)
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6803/64
GLOBAL SCOPE   : 2001:db8:c0de:13::a/64
DNS       :
ROUTER LINK-LAYER :
MAC       : 00:50:79:66:68:03
LPORT     : 20029
RPORT:PORT  : 127.0.0.1:20029
MTU      : 1500

VPCS>
```

Рис. 10: Настройка IPv6-адресации на PC-4

Выполнение лабораторной работы



Server-aamishina - PuTTY

```
Welcome to Virtual PC Simulator, version 0.8.3
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Build time: Sep 9 2023 11:15:00
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For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file

Hostname is too long. (Maximum 12 characters)

VPCS> ip 64.100.1.10/24 64.100.1.1
Checking for duplicate address...
VPCS : 64.100.1.10 255.255.255.0 gateway 64.100.1.1

VPCS> save
Saving startup configuration to startup.vpc
. done

VPCS> ip 2001:db8:c0de:11::a/64
PC1 : 2001:db8:c0de:11::a/64

VPCS> save
Saving startup configuration to startup.vpc
. done

VPCS> 
```

Рис. 11: Настройка IPv6-адресации на сервере

Выполнение лабораторной работы



```
msk-aamishina-gw-02 - PuTTY
X8 +Lx4 +SECCOMP +BLKID +ELFUTILS +KM00 -IDN2 +ION -PCRE2 default-hierarchy-hybr
[...]
[ 16.97935] systemd[1]: Detected virtualization kvm.
[ 16.98035] systemd[1]: Detected architecture x86-64.
[ 17.00340] systemd[1]: Reached target System Start.
[ 17.512235] systemd[1]: Listening on Journal Audit Socket.
[ 17.519255] systemd[1]: Listening on udev Control Socket.
[ 17.527000] systemd[1]: Created slice system-serialvx2dgetty.slice.
[ 17.534217] systemd[1]: Started Forward Password Requests to Wall Directory W
atch.
[ 17.542340] systemd[1]: Reached target Swap.
[ 17.548293] systemd[1]: Listening on Syslog Socket.
[ 17.704190] bridget: filtering via arp/vlan/iptables is no longer available by
default. Update your scripts to load br_nffilter if you need this.
[ 17.743289] Bridge firewalling registered
[ 17.761120] nf_tables: NFQUEUE support

Welcome to VyOS - vyos tty0

vyos login: vyos
Password:
Welcome to VyOS!

Check out project news at https://blog.vyos.io
and feel free to report bugs at https://vyos.dev

You can change this banner using *set system login banner post-login* command.

VyOS is a free software distribution that includes multiple components,
you can check individual component licenses under /usr/share/doc/*copyright
vyos@vyos:~$ install image
You are trying to install from an already installed system. An ISO
image file to install or URL must be specified.
Exiting...
vyos@vyos:~$ configure
[edit]
vyos@vyos# set system host-name msk-aamishina-gw-02
[edit]
vyos@vyos# compare
[edit system]
<host-name msk-aamishina-gw-02
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos# exit
exit
vyos@vyos:~$ reboot
Are you sure you want to reboot this system? [y/N] y
vyos@vyos:~$
```

Рис. 12: Настройка hostname маршрутизатора VyOS

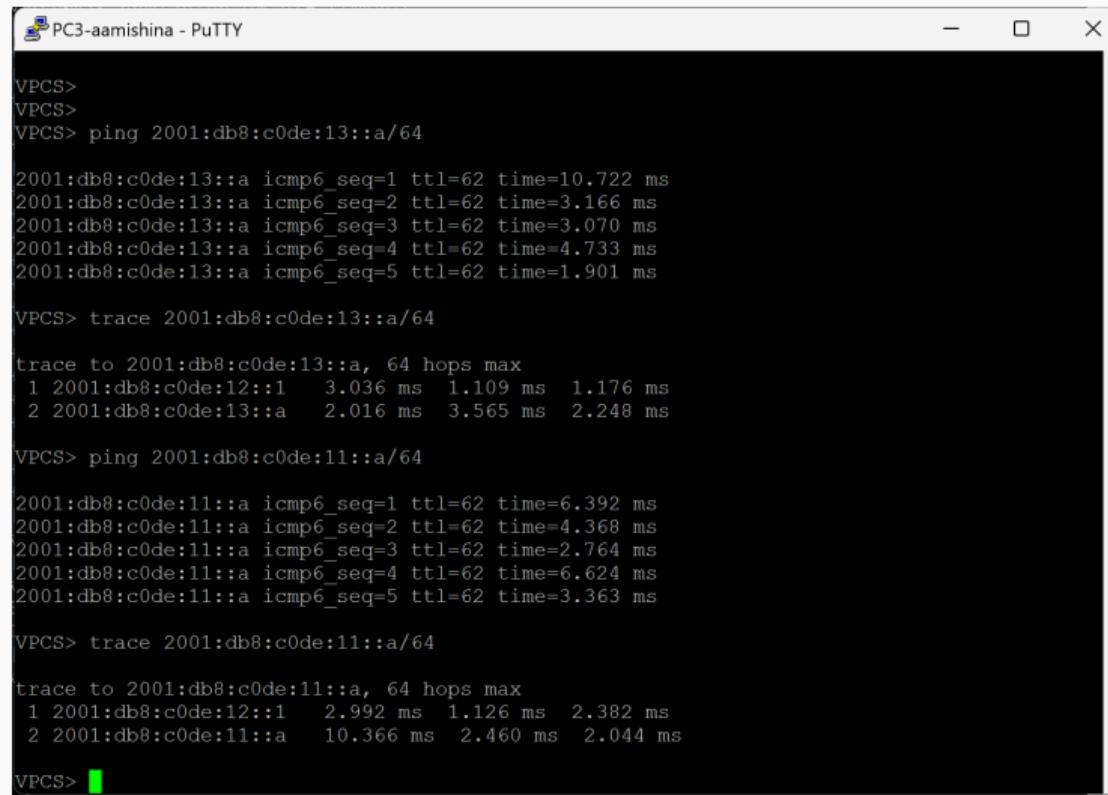
Выполнение лабораторной работы



```
mask@mask-aamishina-gw-02 - PuTTY
(edit)
:bis@0de:13:1/64ina-gw-02# set service router-advert interface eth1 prefix 2001id
(edit)
:1/64mask-aamishina-gw-02# set interfaces ethernet eth2 address 2001:db@:c0de:11:
(edit)
:00:00:00:00:00:02# set service router-advert interface eth2 prefix 2001id
(edit)
:vyos@mask-aamishina-gw-02# compare
(edit interfaces ethernet eth0)
+address 2001:db@:c0de:12::1/64
(edit interfaces ethernet eth1)
+address 2001:db@:c0de:13::1/64
(edit interfaces ethernet eth2)
+address 2001:db@:c0de:11::1/64
(edit services)
+router-advert {
+    interface eth0 {
+        prefix 2001:db@:c0de:12::/64 {
+        }
+        interface eth1 {
+            prefix 2001:db@:c0de:13::/64 {
+            }
+        interface eth2 {
+            prefix 2001:db@:c0de:11::/64 {
+            }
+        }
+    }
+}
(edit)
vyos@mask-aamishina-gw-02# commit
(edit)
vyos@mask-aamishina-gw-02# save
Saving configuration to '/config/config.boot'...
Done
(edit)
vyos@mask-aamishina-gw-02# show interfaces
ethernet eth0
    address dhcp
    address 2001:db@:c0de:12::1/64
    hw-id 0:c@7:9c:60:00:00
)
ethernet eth1
    address 2001:db@:c0de:13::1/64
    hw-id 0:c@7:9c:60:00:01
)
ethernet eth2
    address 2001:db@:c0de:11::1/64
    hw-id 0:c@7:9c:60:00:02
)
loopback lo (
)
(edit)
vyos@mask-aamishina-gw-02#
```

Рис. 13: Настройка IPv6-адресации для интерфейсов маршрутизатора VyOS

Выполнение лабораторной работы



PC3-aamishina - PuTTY

```
VPCS>
VPCS>
VPCS> ping 2001:db8:c0de:13::a/64

2001:db8:c0de:13::a icmp6_seq=1 ttl=62 time=10.722 ms
2001:db8:c0de:13::a icmp6_seq=2 ttl=62 time=3.166 ms
2001:db8:c0de:13::a icmp6_seq=3 ttl=62 time=3.070 ms
2001:db8:c0de:13::a icmp6_seq=4 ttl=62 time=4.733 ms
2001:db8:c0de:13::a icmp6_seq=5 ttl=62 time=1.901 ms

VPCS> trace 2001:db8:c0de:13::a/64

trace to 2001:db8:c0de:13::a, 64 hops max
 1 2001:db8:c0de:12::1    3.036 ms   1.109 ms   1.176 ms
 2 2001:db8:c0de:13::a    2.016 ms   3.565 ms   2.248 ms

VPCS> ping 2001:db8:c0de:11::a/64

2001:db8:c0de:11::a icmp6_seq=1 ttl=62 time=6.392 ms
2001:db8:c0de:11::a icmp6_seq=2 ttl=62 time=4.368 ms
2001:db8:c0de:11::a icmp6_seq=3 ttl=62 time=2.764 ms
2001:db8:c0de:11::a icmp6_seq=4 ttl=62 time=6.624 ms
2001:db8:c0de:11::a icmp6_seq=5 ttl=62 time=3.363 ms

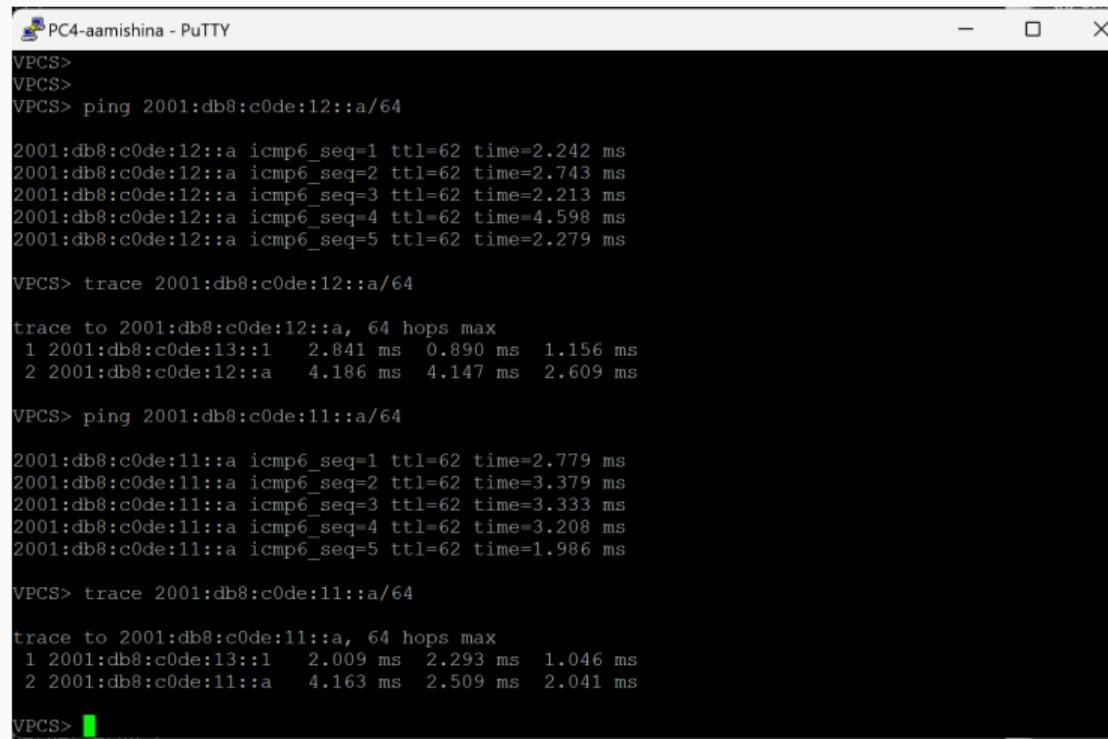
VPCS> trace 2001:db8:c0de:11::a/64

trace to 2001:db8:c0de:11::a, 64 hops max
 1 2001:db8:c0de:12::1    2.992 ms   1.126 ms   2.382 ms
 2 2001:db8:c0de:11::a    10.366 ms   2.460 ms   2.044 ms

VPCS>
```

Рис. 14: Проверка подключения с PC-3

Выполнение лабораторной работы



PC4-aamishina - PuTTY

VPCS>

VPCS>

VPCS> ping 2001:db8:c0de:12::a/64

2001:db8:c0de:12::a icmp6_seq=1 ttl=62 time=2.242 ms
2001:db8:c0de:12::a icmp6_seq=2 ttl=62 time=2.743 ms
2001:db8:c0de:12::a icmp6_seq=3 ttl=62 time=2.213 ms
2001:db8:c0de:12::a icmp6_seq=4 ttl=62 time=4.598 ms
2001:db8:c0de:12::a icmp6_seq=5 ttl=62 time=2.279 ms

VPCS> trace 2001:db8:c0de:12::a/64

trace to 2001:db8:c0de:12::a, 64 hops max
1 2001:db8:c0de:13::1 2.841 ms 0.890 ms 1.156 ms
2 2001:db8:c0de:12::a 4.186 ms 4.147 ms 2.609 ms

VPCS> ping 2001:db8:c0de:11::a/64

2001:db8:c0de:11::a icmp6_seq=1 ttl=62 time=2.779 ms
2001:db8:c0de:11::a icmp6_seq=2 ttl=62 time=3.379 ms
2001:db8:c0de:11::a icmp6_seq=3 ttl=62 time=3.333 ms
2001:db8:c0de:11::a icmp6_seq=4 ttl=62 time=3.208 ms
2001:db8:c0de:11::a icmp6_seq=5 ttl=62 time=1.986 ms

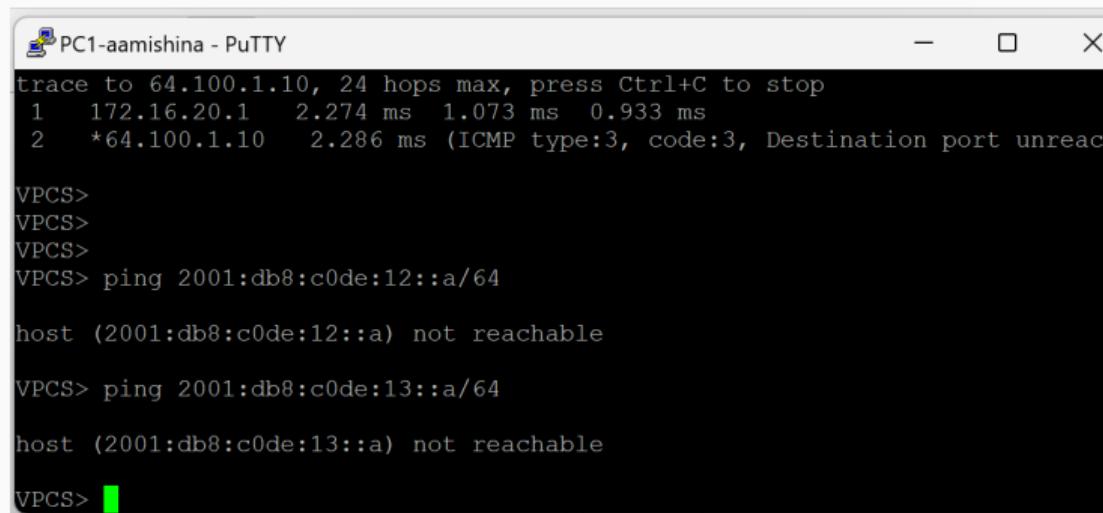
VPCS> trace 2001:db8:c0de:11::a/64

trace to 2001:db8:c0de:11::a, 64 hops max
1 2001:db8:c0de:13::1 2.009 ms 2.293 ms 1.046 ms
2 2001:db8:c0de:11::a 4.163 ms 2.509 ms 2.041 ms

VPCS> █

Рис. 15: Проверка подключения с РС-4

Выполнение лабораторной работы



trace to 64.100.1.10, 24 hops max, press Ctrl+C to stop
1 172.16.20.1 2.274 ms 1.073 ms 0.933 ms
2 *64.100.1.10 2.286 ms (ICMP type:3, code:3, Destination port unreach)

VPCS>
VPCS>
VPCS>
VPCS> ping 2001:db8:c0de:12::a/64

host (2001:db8:c0de:12::a) not reachable

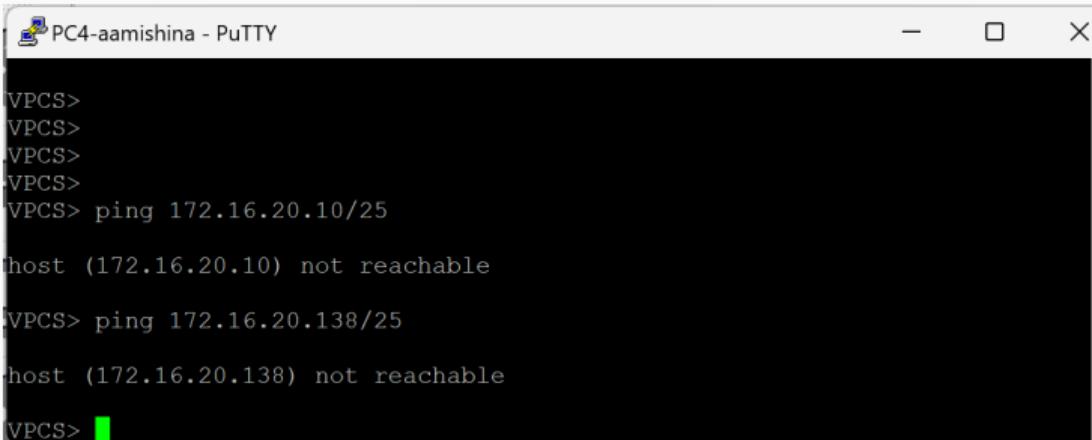
VPCS> ping 2001:db8:c0de:13::a/64

host (2001:db8:c0de:13::a) not reachable

VPCS>

Рис. 16: Проверка доступности устройств из подсети IPv4 для устройств из подсети IPv6

Выполнение лабораторной работы



```
VPCS>
VPCS>
VPCS>
VPCS>
VPCS> ping 172.16.20.10/25
host (172.16.20.10) not reachable
VPCS> ping 172.16.20.138/25
host (172.16.20.138) not reachable
VPCS>
```

Рис. 17: Проверка доступности устройств из подсети IPv6 для устройств из подсети IPv4

Выполнение лабораторной работы

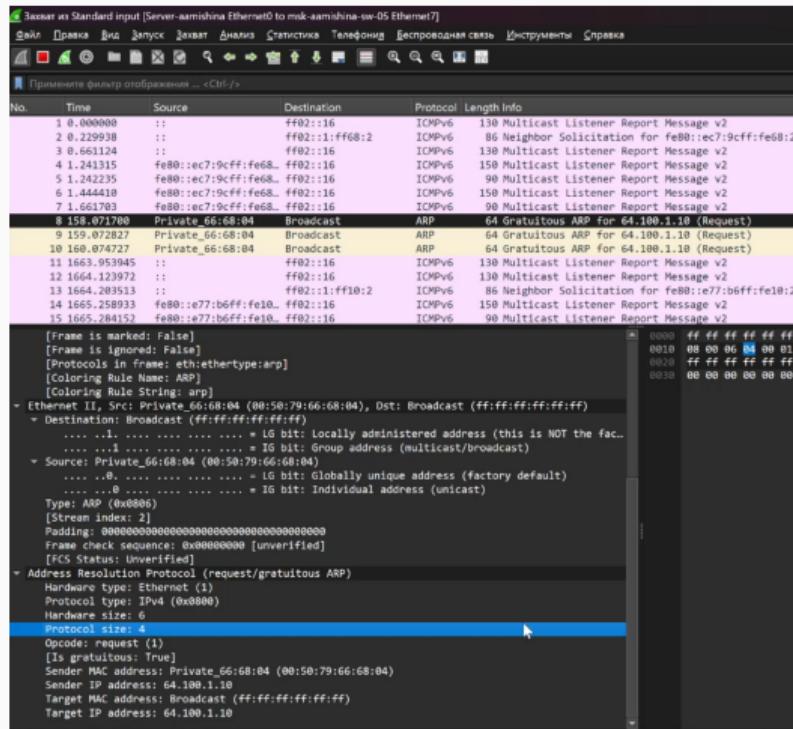


Рис. 18: Захваченный трафик ARP в Wireshark

Выполнение лабораторной работы

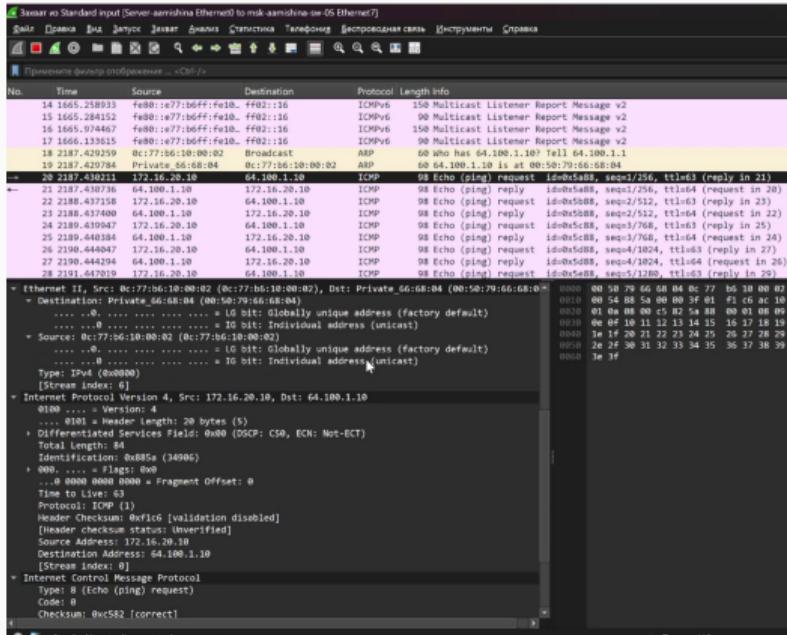


Рис. 19: Захваченный трафик ICMP в Wireshark

Выполнение лабораторной работы

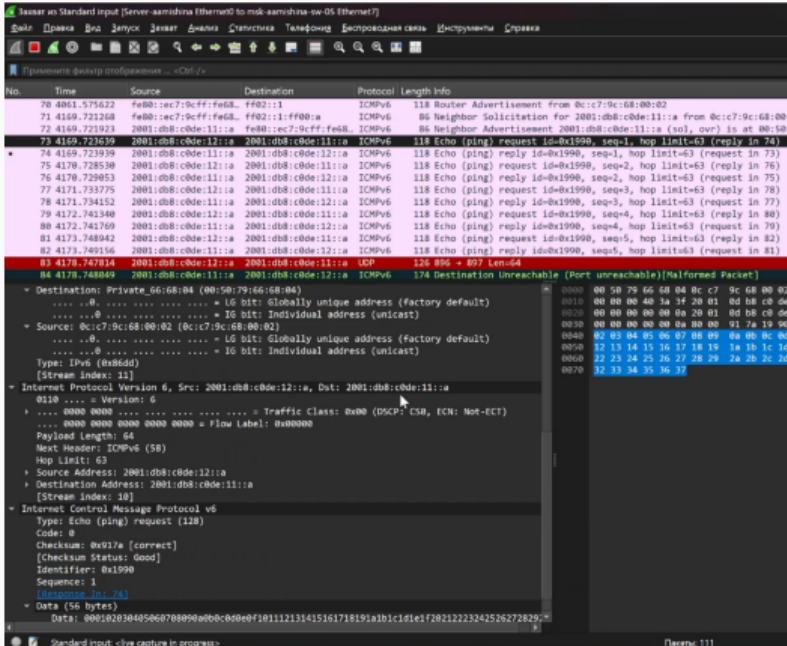


Рис. 20: Захваченный трафик ICMPv6 в Wireshark

Задание для самостоятельного выполнения

- подсеть 1: IPv4 **10.10.1.96/27**; длина префикса - 27, маска подсети:
255.255.255.224, broadcast: **10.10.1.127**, диапазон: **10.10.1.97 – 10.10.1.126**;
IPv6 **2001:DB8:1:1::/64**; длина префикса - 64, диапазон: **2001:db8:1:1:0:0:0:0**
– **2001:db8:1:1:ffff:ffff:ffff:ffff**;
- подсеть 2: IPv4 **10.10.1.16/28**; длина префикса - 28, маска подсети:
255.255.255.240, broadcast: **10.10.1.31**, диапазон адресов: **10.10.1.17 – 10.10.1.30**;
IPv6 **2001:DB8:1:4::/64**; длина префикса - 64, диапазон:
2001:db8:1:4:0:0:0:0 – 2001:db8:1:4:ffff:ffff:ffff:ffff.

Выполнение лабораторной работы

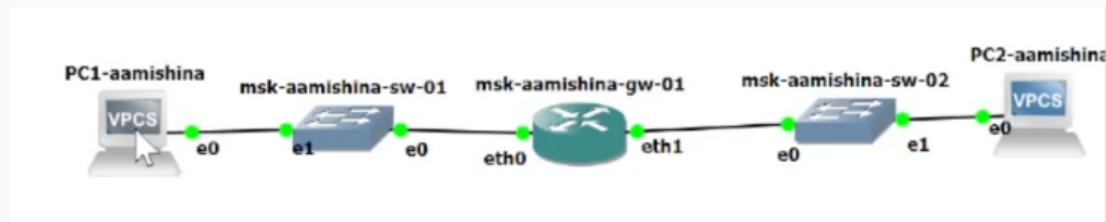


Рис. 21: Топология сети с двумя локальными подсетями

Выполнение лабораторной работы

Таблица адресации:

Устройство	Интерфейс	IPv4	IPv6	Шлюз
PC-1	NIC	10.10.1.99/27	2001:db8:1:1::a/64	10.10.1.97 / gw-01
PC-2	NIC	10.10.1.18/28	2001:db8:1:4::a/64	10.10.1.17 / gw-01
gw-01	eth0	10.10.1.97/27	2001:db8:1:1::1/64	
gw-01	eth1	10.10.1.17/28	2001:db8:1:4::1/64	

Выполнение лабораторной работы



```
PC1-amishina - PuTTY

Welcome to Virtual PC Simulator, version 0.8.3
Dedicated to Dalingx.
Build time: Sep  9 2023 11:15:00
Copyright (c) 2007-2015, Paul Meng (mirnshi@gmail.com)
All rights reserved.

VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file

Hostname is too long. (Maximum 12 characters)

VPCS> ip 10.10.1.99/27 10.10.1.97
Checking for duplicate address...
VPCS : 10.10.1.99 255.255.255.224 gateway 10.10.1.97

VPCS> ip 2001:db8::1:1:a/64
PC1 : 2001:db8:1:1::a/64

VPCS> show ip

NAME      : VPCS[1]
IP/MASK   : 10.10.1.99/27
GATEWAY   : 10.10.1.97
DNS       :
MAC       : 00:50:79:66:68:00
LPORT     : 20008
RHOST:PORT : 127.0.0.1:20009
MTU       : 1500

VPCS> show ipv6

NAME      : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6800/64
GLOBAL SCOPE   : 2001:db8::1:1::a/64
DNS       :
ROUTER LINK-LAYER :
MAC       : 00:50:79:66:68:00
LPORT     : 20008
RHOST:PORT : 127.0.0.1:20009
MTU       : 1500

VPCS>
```

Рис. 22: Настройка IPv4- и IPv6-адресации на PC-1

Выполнение лабораторной работы

```
Welcome to Virtual PC Simulator, version 0.8.3
Dedicated to Daling.
Build time: Sep  9 2023 11:15:00
Copyright (c) 2007-2015, Paul Meng (mirnshi@gmail.com)
All rights reserved.

VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file

Hostname is too long. (Maximum 12 characters)

VPCS> ip 10.10.1.18/28 10.10.1.17
Checking for duplicate address...
VPCS : 10.10.1.18 255.255.255.240 gateway 10.10.1.17

VPCS> ip 2001:db8:1:4::a/64
PCI : 2001:db8:1:4::a/64

VPCS> show ip

NAME      : VPCS[1]
IP/MASK   : 10.10.1.18/28
GATEWAY   : 10.10.1.17
DNS       :
MAC       : 00:50:79:66:68:01
LPORT     : 20010
RHOST:PORT : 127.0.0.1:20011
MTU       : 1500

VPCS> show ipv6

NAME      : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6801/64
GLOBAL SCOPE    : 2001:db8:1:4::a/64
DNS       :
ROUTER LINK-LAYER :
MAC       : 00:50:79:66:68:01
LPORT     : 20010
RHOST:PORT : 127.0.0.1:20011
MTU       : 1500

VPCS>
```

Рис. 23: Настройка IPv4- и IPv6-адресации на PC-2

Выполнение лабораторной работы



```
msk-amishina-gw-01 - PuTTY
vyos@msk-amishina-gw-01:~$ configure
[edit]
vyos@msk-amishina-gw-01# set interfaces ethernet eth0 address 10.10.1.97/27
[edit]
vyos@msk-amishina-gw-01# set interfaces ethernet eth1 address 10.10.1.17/28
[edit]
vyos@msk-amishina-gw-01# compare
[edit interfaces ethernet eth0]
+address 10.10.1.97/27
[edit interfaces ethernet eth1]
+address 10.10.1.17/28
[edit]
vyos@msk-amishina-gw-01# commit
[interfaces ethernet eth0]
Can't configure both static IPv4 and DHCP address on the same interface
[[interfaces ethernet eth0]] failed
Commit failed
[edit]
vyos@msk-amishina-gw-01# show interfaces
ethernet eth0 {
    address dhcp
    + address 10.10.1.97/27
    hw-id 0c:9e:29:1f:00:00
}
ethernet eth1 {
    address 10.10.1.17/28
    hw-id 0c:9e:29:1f:00:01
}
ethernet eth2 {
    hw-id 0c:9e:29:1f:00:02
}
loopback lo {
}
[edit]
vyos@msk-amishina-gw-01# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@msk-amishina-gw-01# show interfaces
ethernet eth0 {
    address dhcp
    + address 10.10.1.97/27
    hw-id 0c:9e:29:1f:00:00
}
ethernet eth1 {
    address 10.10.1.17/28
    hw-id 0c:9e:29:1f:00:01
}
ethernet eth2 {
    hw-id 0c:9e:29:1f:00:02
}
loopback lo {
}
[edit]
vyos@msk-amishina-gw-01# commit
```

Рис. 24: Настройка IPv4-адресации на маршрутизаторе VyOS

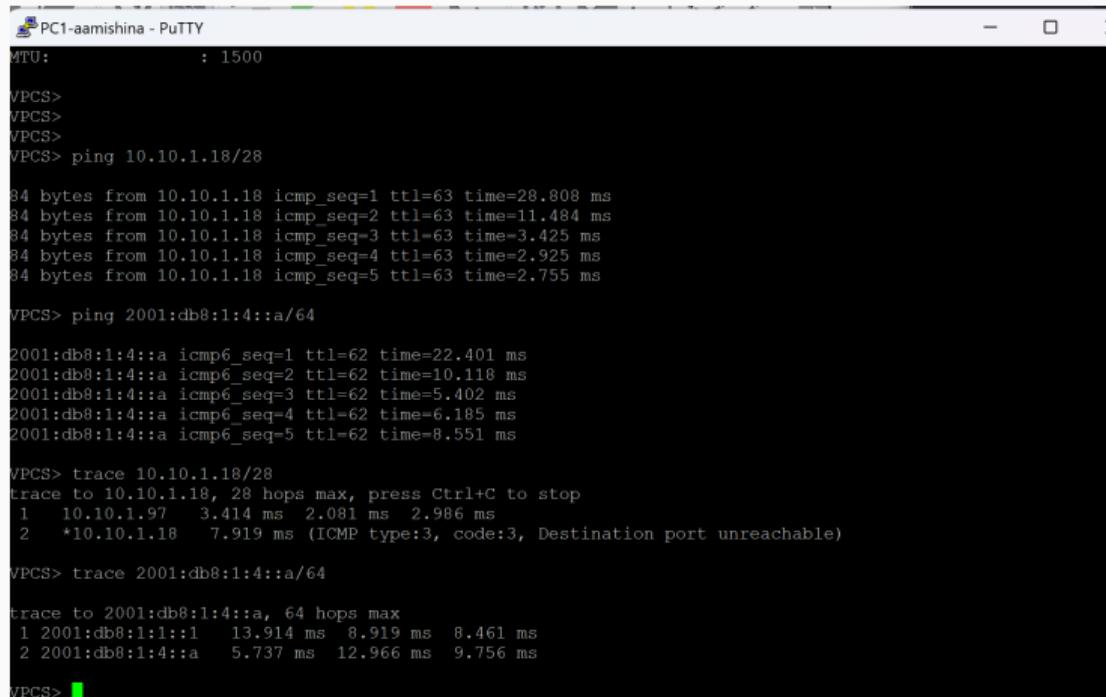
Выполнение лабораторной работы



```
msk-aamishina-gw-01 - PuTTY
vyos@msk-aamishina-gw-01# (edit)
vyos@msk-aamishina-gw-01# (edit)
vyos@msk-aamishina-gw-01# set interfaces ethernet eth0 address 2001:db8:1:1::1/64
vyos@msk-aamishina-gw-01# set service router-advert interface eth0 prefix 2001:db8:1:1::1/64
vyos@msk-aamishina-gw-01# set interfaces ethernet eth1 address 2001:db8:1:4::1/64
vyos@msk-aamishina-gw-01# set service router-advert interface eth1 prefix 2001:db8:1:4::1/64
vyos@msk-aamishina-gw-01# compare
vyos@msk-aamishina-gw-01# commit
vyos@msk-aamishina-gw-01# save
Saving configuration to '/config/config.boot'...
Done
vyos@msk-aamishina-gw-01# show interfaces
ethernet eth0 {
    address 10.10.1.97/24
    address 2001:db8:1:1::1/64
    hw-id 0c:9e:29:1f:00:00
}
ethernet eth1 {
    address 10.10.1.17/24
    address 2001:db8:1:4::1/64
    hw-id 0c:9e:29:1f:00:01
}
ethernet eth2 {
    hw-id 0c:9e:29:1f:00:02
}
loopback lo {
}
vyos@msk-aamishina-gw-01#
```

Рис. 25: Настройка IPv6-адресации на маршрутизаторе VyOS

Выполнение лабораторной работы



```
PC1-aamishina - PuTTY
MTU:          : 1500
VPCS>
VPCS>
VPCS>
VPCS> ping 10.10.1.18/28
84 bytes from 10.10.1.18 icmp_seq=1 ttl=63 time=28.808 ms
84 bytes from 10.10.1.18 icmp_seq=2 ttl=63 time=11.484 ms
84 bytes from 10.10.1.18 icmp_seq=3 ttl=63 time=3.425 ms
84 bytes from 10.10.1.18 icmp_seq=4 ttl=63 time=2.925 ms
84 bytes from 10.10.1.18 icmp_seq=5 ttl=63 time=2.755 ms

VPCS> ping 2001:db8:1:4::a/64
2001:db8:1:4::a icmp6_seq=1 ttl=62 time=22.401 ms
2001:db8:1:4::a icmp6_seq=2 ttl=62 time=10.118 ms
2001:db8:1:4::a icmp6_seq=3 ttl=62 time=5.402 ms
2001:db8:1:4::a icmp6_seq=4 ttl=62 time=6.185 ms
2001:db8:1:4::a icmp6_seq=5 ttl=62 time=8.551 ms

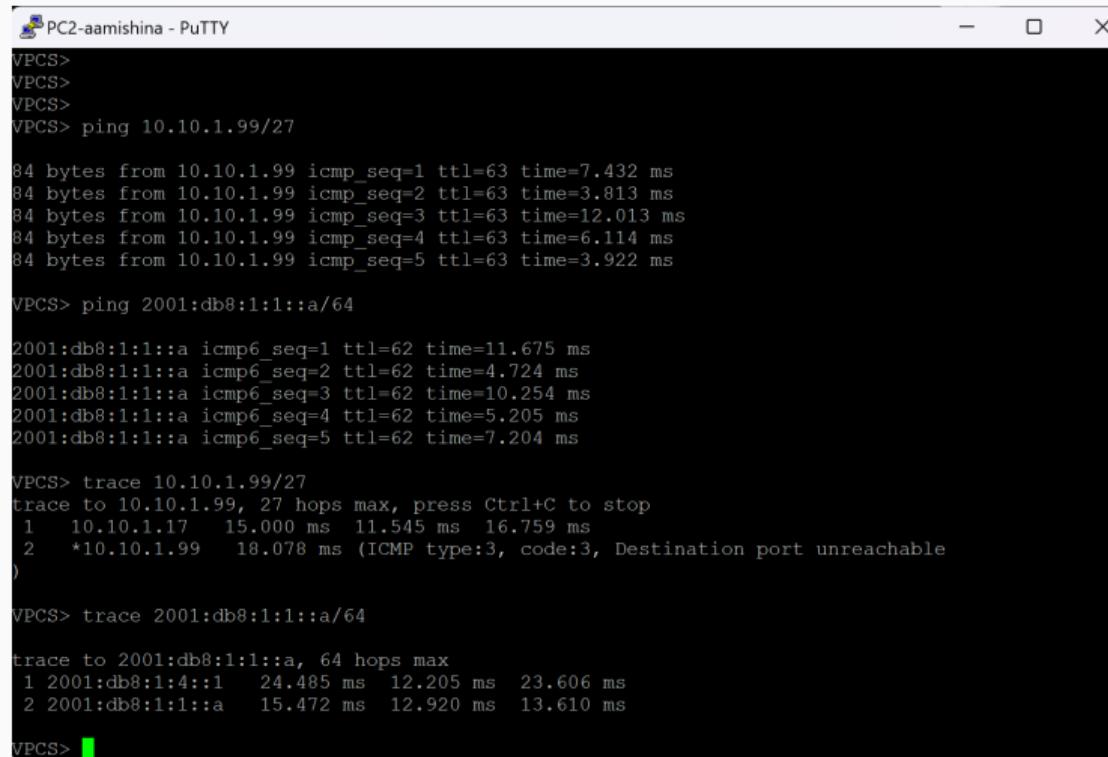
VPCS> trace 10.10.1.18/28
trace to 10.10.1.18, 28 hops max, press Ctrl+C to stop
 1  10.10.1.97    3.414 ms   2.081 ms   2.986 ms
 2  *10.10.1.18    7.919 ms (ICMP type:3, code:3, Destination port unreachable)

VPCS> trace 2001:db8:1:4::a/64
trace to 2001:db8:1:4::a, 64 hops max
 1 2001:db8:1:1::1   13.914 ms   8.919 ms   8.461 ms
 2 2001:db8:1:4::a   5.737 ms   12.966 ms   9.756 ms

VPCS>
```

Рис. 26: Проверка подключения с PC-1 на PC-2 по IPv4 и IPv6

Выполнение лабораторной работы



```
VPCS>
VPCS>
VPCS>
VPCS> ping 10.10.1.99/27

84 bytes from 10.10.1.99 icmp_seq=1 ttl=63 time=7.432 ms
84 bytes from 10.10.1.99 icmp_seq=2 ttl=63 time=3.813 ms
84 bytes from 10.10.1.99 icmp_seq=3 ttl=63 time=12.013 ms
84 bytes from 10.10.1.99 icmp_seq=4 ttl=63 time=6.114 ms
84 bytes from 10.10.1.99 icmp_seq=5 ttl=63 time=3.922 ms

VPCS> ping 2001:db8:1:1::a/64

2001:db8:1:1::a icmp6_seq=1 ttl=62 time=11.675 ms
2001:db8:1:1::a icmp6_seq=2 ttl=62 time=4.724 ms
2001:db8:1:1::a icmp6_seq=3 ttl=62 time=10.254 ms
2001:db8:1:1::a icmp6_seq=4 ttl=62 time=5.205 ms
2001:db8:1:1::a icmp6_seq=5 ttl=62 time=7.204 ms

VPCS> trace 10.10.1.99/27
trace to 10.10.1.99, 27 hops max, press Ctrl+C to stop
 1  10.10.1.17    15.000 ms   11.545 ms   16.759 ms
 2  *10.10.1.99    18.078 ms (ICMP type:3, code:3, Destination port unreachable
)

VPCS> trace 2001:db8:1:1::a/64

trace to 2001:db8:1:1::a, 64 hops max
 1 2001:db8:1:4::1    24.485 ms   12.205 ms   23.606 ms
 2 2001:db8:1:1::a    15.472 ms   12.920 ms   13.610 ms

VPCS>
```

Рис. 27: Проверка подключения с PC-2 на PC-1 по IPv4 и IPv6

Выводы

В результате выполнения работы были изучены принципы распределения и настройки адресного пространства на устройствах сети.