

Лабораторная работа №6

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Изучение принципов распределения и настройки адресного пространства на устройствах сети.

Выполнение лабораторной работы

Для сети 172.16.20.0/24 выполнено разбиение на три подсети с различной емкостью. Первая подсеть 172.16.20.0/25 охватывает диапазон адресов 172.16.20.1-172.16.20.126 и рассчитана на 126 узлов. Вторая подсеть 172.16.20.128/26 с диапазоном 172.16.20.129-172.16.20.190 предназначена для 62 узлов. Третья подсеть 172.16.20.192/26 в диапазоне 172.16.20.193-172.16.20.254 также рассчитана на 62 узла.

Для сети 10.10.1.64/26 создана одна подсеть 10.10.1.64/27, охватывающая адреса 10.10.1.65-10.10.1.94 и поддерживающая до 30 узлов. Для сети 10.10.1.0/26 образована подсеть 10.10.1.0/28 с диапазоном адресов 10.10.1.1-10.10.1.14, рассчитанная на 14 узлов.

Для IPv6-сети 2001:db8:c0de::/48 применены два метода разбиения. При использовании идентификатора подсети созданы подсети 2001:db8:c0de:0002::/64 и 2001:db8:c0de:0003::/64. При использовании идентификатора интерфейса на границе полубайта образованы подсети 2001:db8:c0de:0000:1000::/68 и 2001:db8:c0de:0000:2000::/68.

Для сети 2a02:6b8::/64 разбиение с идентификатором подсети невозможно из-за длины префикса /64. Применено разбиение с идентификатором интерфейса на границе полубайта, в результате чего созданы подсети 2a02:6b8:0000:0000:1000::/68 и 2a02:6b8:0000:0000:2000::/68.

Настройка двойного стека адресации IPv4 и IPv6 в локальной сети. Порядок выполнения работы

1. Я запускаю GNS3 VM и GNS3, затем создаю новый проект.

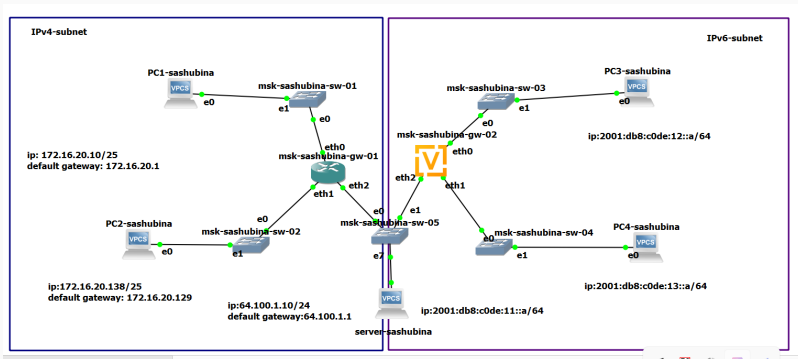


Рис. 1: новый проект

4. Я включаю захват трафика на соединении между сервером двойного стека адресации и ближайшим к нему коммутатором.

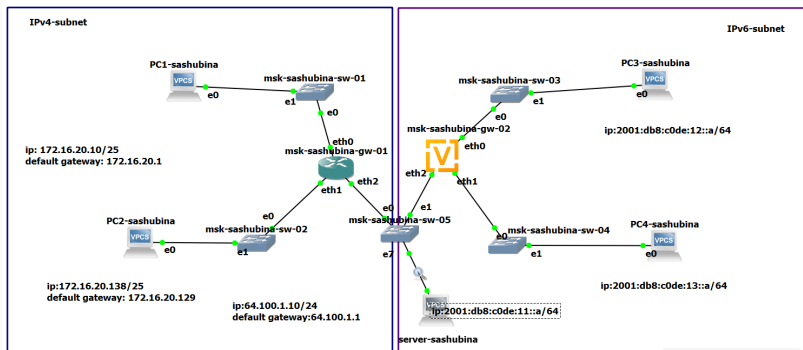


Рис. 2: захват трафика

5. Руководствуясь таблицей, я настраиваю IPv4-адресацию для интерфейсов узлов PC1, PC2, Server:

```
VPCS> ip 172.16.20.10/25 172.16.20.1
Checking for duplicate address...
PC1 : 172.16.20.10 255.255.255.128 gateway 172.16.20.1

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

VPCS> █
```

Рис. 3: PC1

5. Руководствуясь таблицей, я настраиваю IPv4-адресацию для интерфейсов узлов PC1, PC2, Server:

```
VPCS> ip 172.16.20.138/25 172.16.20.129
Checking for duplicate address...
PC1 : 172.16.20.138 255.255.255.128 gateway 172.16.20.129

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

VPCS> 
```

Рис. 4: PC2

5. Руководствуясь таблицей, я настраиваю IPv4-адресацию для интерфейсов узлов PC1, PC2, Server:

```
VPCS> ip 64.100.1.10/24 64.100.1.1
Checking for duplicate address...
PC1 : 64.100.1.10 255.255.255.0 gateway 64.100.1.1

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

VPCS> 
```

Рис. 5: server

6. Я просматриваю на PC1 и PC2 конфигурацию IPv4 и IPv6:

```
VPCS> show ip
NAME      : VPCS[1]
IP/MASK    : 172.16.20.10/25
GATEWAY    : 172.16.20.1
DNS        :
MAC        : 00:50:79:66:68:00
LPORT     : 10016
RHOST:PORT : 127.0.0.1:10017
MTU        : 1500

VPCS> show ipv6
NAME      : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6800/64
GLOBAL SCOPE    :
ROUTER LINK-LAYER :
MAC            : 00:50:79:66:68:00
LPORT         : 10016
RHOST:PORT     : 127.0.0.1:10017
MTU           : 1500

VPCS> █
```

Рис. 6: PC1

6. Я просматриваю на PC1 и PC2 конфигурацию IPv4 и IPv6:

```
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      : 10018
RHOST:PORT  : 127.0.0.1:10019
MTU        : 1500

VPCS> show ipv6
NAME       : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6801/64
GLOBAL SCOPE    :
ROUTER LINK-LAYER :
MAC          : 00:50:79:66:68:01
LPORT        : 10018
RHOST:PORT    : 127.0.0.1:10019
MTU          : 1500

VPCS> 
```

Рис. 7: PC2

7. Руководствуясь таблицей, я настраиваю IPv4-адресацию для интерфейсов локальной сети маршрутизатора FRR msk-sashubina-gw-01.

```
frr# configure terminal
frr(config)# hostname msk-sashubina-gw-01
msk-sashubina-gw-01(config)# exit
msk-sashubina-gw-01# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-sashubina-gw-01# configure terminal
msk-sashubina-gw-01(config)# interface eth0
msk-sashubina-gw-01(config-if)# ip address 172.16.20.1/25
msk-sashubina-gw-01(config-if)# no shutdown
msk-sashubina-gw-01(config-if)# exit
msk-sashubina-gw-01(config)# interface eth1
msk-sashubina-gw-01(config-if)# ip address 172.16.20.129/25
msk-sashubina-gw-01(config-if)# no shutdown
msk-sashubina-gw-01(config-if)# exit
msk-sashubina-gw-01(config)# interface eth2
msk-sashubina-gw-01(config-if)# ip address 64.100.1.1/24
msk-sashubina-gw-01(config-if)# no shutdown
msk-sashubina-gw-01(config-if)# exit
msk-sashubina-gw-01(config)# exit
msk-sashubina-gw-01# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-sashubina-gw-01#
```

Рис. 8: FRR

8. Я проверяю конфигурацию маршрутизатора и настройки IPv4-адресации:

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

Current configuration:
!
frr version 8.2.2
frr defaults traditional
hostname frr
hostname msk-sashubina-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-sashubina-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	

Рис. 9: PC2

9. Я проверяю подключение с помощью команд `ping` и `tracert`. Убеждаюсь, что узлы PC1 и PC2 успешно отправляют эхо-запросы друг другу и на сервер с двойным стеком (Dual Stack Server), также я проверила отправку на свой шлюз.

```
VPCS> ping 172.16.20.138
84 bytes from 172.16.20.138 icmp_seq=1 ttl=63 time=5.443 ms
84 bytes from 172.16.20.138 icmp_seq=2 ttl=63 time=2.305 ms
84 bytes from 172.16.20.138 icmp_seq=3 ttl=63 time=2.661 ms
84 bytes from 172.16.20.138 icmp_seq=4 ttl=63 time=2.859 ms
84 bytes from 172.16.20.138 icmp_seq=5 ttl=63 time=2.601 ms

VPCS>
VPCS> ping 172.16.20.1
84 bytes from 172.16.20.1 icmp_seq=1 ttl=64 time=4.248 ms
84 bytes from 172.16.20.1 icmp_seq=2 ttl=64 time=1.647 ms
84 bytes from 172.16.20.1 icmp_seq=3 ttl=64 time=1.483 ms
84 bytes from 172.16.20.1 icmp_seq=4 ttl=64 time=1.335 ms
84 bytes from 172.16.20.1 icmp_seq=5 ttl=64 time=1.744 ms

VPCS> ping 64.100.1.10
84 bytes from 64.100.1.10 icmp_seq=1 ttl=63 time=7.732 ms
84 bytes from 64.100.1.10 icmp_seq=2 ttl=63 time=3.555 ms
84 bytes from 64.100.1.10 icmp_seq=3 ttl=63 time=2.717 ms
84 bytes from 64.100.1.10 icmp_seq=4 ttl=63 time=2.563 ms
84 bytes from 64.100.1.10 icmp_seq=5 ttl=63 time=2.672 ms
```

Рис. 10: PC1


```
VPCS> ping 172.16.20.129
84 bytes from 172.16.20.129 icmp_seq=1 ttl=64 time=0.931 ms
84 bytes from 172.16.20.129 icmp_seq=2 ttl=64 time=1.379 ms
84 bytes from 172.16.20.129 icmp_seq=3 ttl=64 time=1.384 ms
84 bytes from 172.16.20.129 icmp_seq=4 ttl=64 time=1.934 ms
84 bytes from 172.16.20.129 icmp_seq=5 ttl=64 time=1.462 ms

VPCS> ping 172.16.20.10
84 bytes from 172.16.20.10 icmp_seq=1 ttl=63 time=3.809 ms
84 bytes from 172.16.20.10 icmp_seq=2 ttl=63 time=2.168 ms
84 bytes from 172.16.20.10 icmp_seq=3 ttl=63 time=2.456 ms
84 bytes from 172.16.20.10 icmp_seq=4 ttl=63 time=2.134 ms
84 bytes from 172.16.20.10 icmp_seq=5 ttl=63 time=3.103 ms

VPCS> ping 64.100.1.10
84 bytes from 64.100.1.10 icmp_seq=1 ttl=63 time=2.899 ms
84 bytes from 64.100.1.10 icmp_seq=2 ttl=63 time=3.800 ms
84 bytes from 64.100.1.10 icmp_seq=3 ttl=63 time=1.921 ms
84 bytes from 64.100.1.10 icmp_seq=4 ttl=63 time=1.893 ms
84 bytes from 64.100.1.10 icmp_seq=5 ttl=63 time=2.679 ms

VPCS> █
```

Рис. 11: PC2

```
VPCS> trace 172.16.20.138
trace to 172.16.20.138, 8 hops max, press Ctrl+C to stop
 1  172.16.20.1    3.206 ms  1.009 ms  1.667 ms
 2  *172.16.20.138  2.635 ms (ICMP type:3, code:3, Destination port unreachable)

VPCS> trace 64.100.1.10
trace to 64.100.1.10, 8 hops max, press Ctrl+C to stop
 1  172.16.20.1    1.383 ms  2.922 ms  0.830 ms
 2  * * *
 3  *64.100.1.10   3.195 ms (ICMP type:3, code:3, Destination port unreachable)

VPCS> █
```

Рис. 12: PC1

```
VPCS> trace 172.16.20.10
trace to 172.16.20.10, 8 hops max, press Ctrl+C to stop
 1  172.16.20.129    1.458 ms  1.279 ms  1.149 ms
 2  *172.16.20.10   2.491 ms (ICMP type:3, code:3, Destination port unreachable)
)

VPCS> trace 64.100.1.10
trace to 64.100.1.10, 8 hops max, press Ctrl+C to stop
 1  172.16.20.129    1.769 ms  0.879 ms  0.862 ms
 2  *64.100.1.10    2.589 ms (ICMP type:3, code:3, Destination port unreachable)

VPCS> █
```

Рис. 13: PC2

10. Руководствуясь таблицей, я настраиваю IPv6-адресацию для интерфейсов узлов PC3, PC4, Server:

```
VPCS> ip 2001:db8:c0de:12::a/64
PC1 : 2001:db8:c0de:12::a/64

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

VPCS> 
```

Рис. 14: PC3

```
VPCS> ip 2001:db8:c0de:13::a/64
PC1 : 2001:db8:c0de:13::a/64

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

VPCS> 
```

Рис. 15: PC4

```
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. 16: server

11. Я просматриваю на PC3 и PC4 конфигурацию IPv4 и IPv6:

```
VPCS> show ip
NAME      : VPCS[1]
IP/MASK    : 0.0.0.0/0
GATEWAY    : 0.0.0.0
DNS        :
MAC        : 00:50:79:66:68:01
LPORT     : 10022
RHOST:PORT : 127.0.0.1:10023
MTU        : 1500

VPCS> show ipv6
NAME      : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6801/64
GLOBAL SCOPE    : 2001:db8:c0de:12::a/64
ROUTER LINK-LAYER :
MAC           : 00:50:79:66:68:01
LPORT        : 10022
RHOST:PORT    : 127.0.0.1:10023
MTU           : 1500

VPCS> █
```

Рис. 17: PC3

```
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         : 10024
RHOST:PORT     : 127.0.0.1:10025
MTU            : 1500

VPCS> show ipv6
NAME           : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6803/
GLOBAL SCOPE    : 2001:db8:c0de:13::a/64
ROUTER LINK-LAYER :
MAC            : 00:50:79:66:68:03
LPORT         : 10024
RHOST:PORT     : 127.0.0.1:10025
MTU            : 1500

VPCS> █
```

Рис. 18: PC4

12. Руководствуясь таблицей, я настраиваю IPv6-адресацию для интерфейсов локальной сети маршрутизатора VyOS msk-sashubina-gw-02: Сначала я устанавливаю систему на маршрутизатор VyOS:

```
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-sashubina-gw-02
[edit]
vyos@vyos# compare
[edit system]
>host-name msk-sashubina-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
[ 594.605501] systemd-shutdown[1]: Failed to parse (null): No such file or directory
[ 594.624909] systemd-shutdown[1]: Failed to deactivate swaps: No such file or directory
[ 594.673589] [2888]: Failed to unmount /usr/lib/live/mount/persistence: Device or resource busy
[ 594.983301] reboot: Restarting system
```

Рис. 19: изменение имени устройства

```
vyos@msk-sashubina-gw-02:~$ configure
[edit]
vyos@msk-sashubina-gw-02# set interfaces ethernet eth0 address 2001:db8:c0de:12:
:1/64
[edit]
vyos@msk-sashubina-gw-02# set service router-advert interface eth0 prefix 2001:d
b8:c0de:12::/64
[edit]
vyos@msk-sashubina-gw-02# set interfaces ethernet eth1 address 2001:db8:c0de:13:
:1/64
[edit]
vyos@msk-sashubina-gw-02# set service router-advert interface eth1 prefix 2001:
db8:c0de:13::/64
[edit]
vyos@msk-sashubina-gw-02# set interfaces ethernet eth2 address 2001:db8:c0de:11:
:1/64
[edit]
vyos@msk-sashubina-gw-02# set service router-advert interface eth2 prefix 2001:d
b8:c0de:11::/64
[edit]
```

Рис. 20: назначение IPv6

compare, commit, save

```
vyos@msk-sashubina-gw-02# compare
[edit interfaces ethernet eth0]
+address 2001:db8:c0de:12::1/64
[edit interfaces ethernet eth1]
+address 2001:db8:c0de:13::1/64
[edit interfaces ethernet eth2]
+address 2001:db8:c0de:11::1/64
[edit service]
+router-advert {
+  interface eth0 {
+    prefix 2001:db8:c0de:12::/64 {
+    }
+  }
+  interface eth1 {
+    prefix 2001:db8:c0de:13::/64 {
+    }
+  }
+  interface eth2 {
+    prefix 2001:db8:c0de:11::/64 {
+    }
+  }
+}
[edit]
vyos@msk-sashubina-gw-02# commit
[edit]
vyos@msk-sashubina-gw-02# save
Saving configuration to '/config/config.boot'...
Done
[edit]
```

Рис. 21: compare, commit, save

```
vyos@sak-sashubina-gw-02# show interfaces
 ethernet eth0 {
   address dhcp
   address 2001:db8:c0de:12::1/64
   hw-id 0c:57:e3:cd:00:00
 }
 ethernet eth1 {
   address 2001:db8:c0de:13::1/64
   hw-id 0c:57:e3:cd:00:01
 }
 ethernet eth2 {
   address 2001:db8:c0de:11::1/64
   hw-id 0c:57:e3:cd:00:02
 }
 ethernet eth3 {
   hw-id 0c:57:e3:cd:00:03
 }
 ethernet eth4 {
   hw-id 0c:57:e3:cd:00:04
 }
 ethernet eth5 {
   hw-id 0c:57:e3:cd:00:05
 }
 ethernet eth6 {
   hw-id 0c:57:e3:cd:00:06
 }
 ethernet eth7 {
   hw-id 0c:57:e3:cd:00:07
 }
 ethernet eth8 {
   hw-id 0c:57:e3:cd:00:08
 }
 ethernet eth9 {
   hw-id 0c:57:e3:cd:00:09
 }
 loopback lo {
 }
(edit)
vyos@sak-sashubina-gw-02#
(edit)
vyos@sak-sashubina-gw-02#
```

Рис. 22: просмотр интерфейсов

13. Я проверяю подключение с помощью команд ping и trace. Убеждаюсь, что узлы PC3 и PC4 успешно отправляют эхо-запросы друг другу и на сервер с двойным стеком (Dual Stack Server).

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

2001:db8:c0de:13::a icmp6_seq=1 ttl=62 time=4.810 ms
2001:db8:c0de:13::a icmp6_seq=2 ttl=62 time=0.785 ms
2001:db8:c0de:13::a icmp6_seq=3 ttl=62 time=0.858 ms
2001:db8:c0de:13::a icmp6_seq=4 ttl=62 time=0.920 ms
2001:db8:c0de:13::a icmp6_seq=5 ttl=62 time=0.840 ms

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

2001:db8:c0de:11::a icmp6_seq=1 ttl=62 time=2.679 ms
2001:db8:c0de:11::a icmp6_seq=2 ttl=62 time=1.615 ms
2001:db8:c0de:11::a icmp6_seq=3 ttl=62 time=1.660 ms
2001:db8:c0de:11::a icmp6_seq=4 ttl=62 time=1.010 ms
2001:db8:c0de:11::a icmp6_seq=5 ttl=62 time=3.680 ms

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

trace to 2001:db8:c0de:13::a, 64 hops max
 1 2001:db8:c0de:12::1  16.877 ms  6.997 ms  2.540 ms
 2 2001:db8:c0de:13::a   1.768 ms   0.956 ms   0.763 ms

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

trace to 2001:db8:c0de:11::a, 64 hops max
 1 2001:db8:c0de:12::1   0.466 ms   0.378 ms   0.485 ms
 2 2001:db8:c0de:11::a   3.456 ms   2.929 ms   1.276 ms

VPCS> 
```

Рис. 23: PC3

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

2001:db8:c0de:13::a icmp6_seq=1 ttl=62 time=4.810 ms
2001:db8:c0de:13::a icmp6_seq=2 ttl=62 time=0.785 ms
2001:db8:c0de:13::a icmp6_seq=3 ttl=62 time=0.858 ms
2001:db8:c0de:13::a icmp6_seq=4 ttl=62 time=0.920 ms
2001:db8:c0de:13::a icmp6_seq=5 ttl=62 time=0.840 ms

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

2001:db8:c0de:11::a icmp6_seq=1 ttl=62 time=2.679 ms
2001:db8:c0de:11::a icmp6_seq=2 ttl=62 time=1.615 ms
2001:db8:c0de:11::a icmp6_seq=3 ttl=62 time=1.660 ms
2001:db8:c0de:11::a icmp6_seq=4 ttl=62 time=1.010 ms
2001:db8:c0de:11::a icmp6_seq=5 ttl=62 time=3.680 ms

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

trace to 2001:db8:c0de:13::a, 64 hops max
 1 2001:db8:c0de:12::1 16.877 ms 6.997 ms 2.540 ms
 2 2001:db8:c0de:13::a 1.768 ms 0.956 ms 0.763 ms

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

trace to 2001:db8:c0de:11::a, 64 hops max
 1 2001:db8:c0de:12::1 0.466 ms 0.378 ms 0.485 ms
 2 2001:db8:c0de:11::a 3.456 ms 2.929 ms 1.276 ms

VPCS> █
```

Рис. 24: PC4

14. Я проверяю, что устройства из подсети IPv4 недоступны для устройств из подсети IPv6 и наоборот. Убеждаюсь, что только сервер двойного стека может обращаться к устройствам обеих подсетей.

```
VPCS> ping 172.16.20.10
host (172.16.20.10) not reachable
VPCS> ping 172.16.20.138
host (172.16.20.138) not reachable
VPCS> ping 64.100.1.10
host (64.100.1.10) not reachable
VPCS> 
```

Рис. 25: недоступность сетей

```
VPCS> ping 172.16.20.10
host (172.16.20.10) not reachable
VPCS> ping 172.16.20.138
host (172.16.20.138) not reachable
VPCS> ping 64.100.1.10
host (64.100.1.10) not reachable
VPCS> 
```

```
VPCS> ping 172.16.20.10
84 bytes from 172.16.20.10 icmp_seq=1 ttl=63 time=6.834 ms
84 bytes from 172.16.20.10 icmp_seq=2 ttl=63 time=2.149 ms
84 bytes from 172.16.20.10 icmp_seq=3 ttl=63 time=1.450 ms
84 bytes from 172.16.20.10 icmp_seq=4 ttl=63 time=1.055 ms
84 bytes from 172.16.20.10 icmp_seq=5 ttl=63 time=1.347 ms

VPCS> ping 172.16.20.138
84 bytes from 172.16.20.138 icmp_seq=1 ttl=63 time=2.603 ms
84 bytes from 172.16.20.138 icmp_seq=2 ttl=63 time=1.675 ms
84 bytes from 172.16.20.138 icmp_seq=3 ttl=63 time=1.257 ms
84 bytes from 172.16.20.138 icmp_seq=4 ttl=63 time=1.502 ms
84 bytes from 172.16.20.138 icmp_seq=5 ttl=63 time=1.164 ms

VPCS> ping 2001:db8:c0de:12::a
2001:db8:c0de:12::a icmp6_seq=1 ttl=62 time=4.886 ms
2001:db8:c0de:12::a icmp6_seq=2 ttl=62 time=1.050 ms
2001:db8:c0de:12::a icmp6_seq=3 ttl=62 time=0.919 ms
2001:db8:c0de:12::a icmp6_seq=4 ttl=62 time=1.262 ms
2001:db8:c0de:12::a icmp6_seq=5 ttl=62 time=1.146 ms

VPCS> ping 2001:db8:c0de:13::a
2001:db8:c0de:13::a icmp6_seq=1 ttl=62 time=2.648 ms
2001:db8:c0de:13::a icmp6_seq=2 ttl=62 time=1.494 ms
2001:db8:c0de:13::a icmp6_seq=3 ttl=62 time=0.814 ms
2001:db8:c0de:13::a icmp6_seq=4 ttl=62 time=0.977 ms
2001:db8:c0de:13::a icmp6_seq=5 ttl=62 time=1.798 ms

VPCS> █
```

Рис. 27: сервер

15. Я анализирую захваченный на соединении сервера двойного стека адресации с коммутатором трафик ARP

Packet capture analysis showing ARP traffic. The selected packet (Frame 14) is an ARP request from 64.100.1.10 to 172.16.20.10. The packet details show the Ethernet II header, Internet Protocol Version 4 header, and the ARP request structure. The packet bytes pane shows the raw data in hexadecimal and ASCII.

No.	Time	Source	Destination	Protocol	Length	Info
9	39.423806	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=bcd772, seq=3/768, ttl=63 (request in 8)
10	40.424935	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=bcd872, seq=4/1024, ttl=64 (reply in 11)
11	40.426716	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=bcd872, seq=4/1024, ttl=63 (request in 10)
12	41.427296	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=bcd172, seq=5/1280, ttl=64 (reply in 13)
13	41.431696	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=bcd172, seq=5/1280, ttl=63 (request in 12)
14	42.432893	64:57:dc:33:00:02	Private_66:68:01	ARP	68	Who has 64.100.1.10? Tell 64.100.1.10
15	42.434498	Private_66:68:01	64:57:dc:33:00:02	ARP	68	64.100.1.10 is at 08:5b:79:66:08:01
16	47.508863	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=bcd772, seq=1/256, ttl=64 (reply in 17)
17	47.509351	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=bcd772, seq=1/256, ttl=63 (request in 16)
18	48.507588	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=bcd872, seq=2/512, ttl=64 (reply in 19)
19	48.606886	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=bcd872, seq=2/512, ttl=63 (request in 18)
20	49.607247	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=bcd972, seq=3/768, ttl=64 (reply in 21)
21	49.609230	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=bcd972, seq=3/768, ttl=63 (request in 20)
22	50.610463	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=bda972, seq=4/1024, ttl=64 (reply in 23)
23	50.612977	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=bda972, seq=4/1024, ttl=63 (request in 22)
24	51.614708	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=bdbb72, seq=5/1280, ttl=64 (reply in 25)
25	51.616497	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=bdbb72, seq=5/1280, ttl=63 (request in 24)
26	55.228061	64.100.1.10	172.16.20.1	ICMP	98	Echo (ping) request id=bcd772, seq=1/256, ttl=64 (reply in 27)

Frame 14: 68 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface --, id 0

Section number: 1

Interface id: 0 (-)

Encapsulation type: Ethernet (1)

Arrival Time: Nov 17, 2025 22:09:06.415680000 RTZ 2 (sumo)

UTC Arrival Time: Nov 17, 2025 19:09:06.415680000 UTC

Epooh Arrival Time: 1763406546.415680000

[Time shift for this packet: 0.000000000 seconds]

[Time delta from previous captured frame: 1.001197000 seconds]

[Time delta from previous displayed frame: 1.001197000 seconds]

[Time since reference or first frame: 42.432893000 seconds]

Frame Number: 14

Frame Length: 68 bytes (480 bits)

Capture Length: 60 bytes (480 bits)

[Frame is marked: False]

[Frame is ignored: False]

[Protocols in frame: eth:ethertype:arp]

[Coloring Rule Name: ARP]

[Coloring Rule String: arp]

Standard input: *live capture in progress*

Пакеты: 80

Профиль: Default

Рис. 28: ARP

15. Я анализирую захваченный на соединении сервера двойного стека адресации с коммутатором трафик ARP

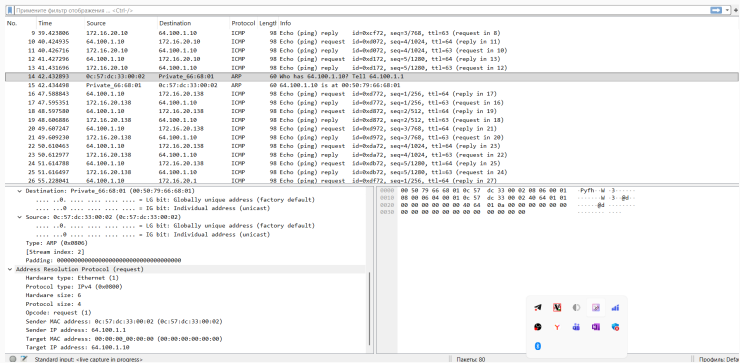


Рис. 29: ARP

15. Я анализирую захваченный на соединении сервера двойного стека адресации с коммутатором трафик ARP

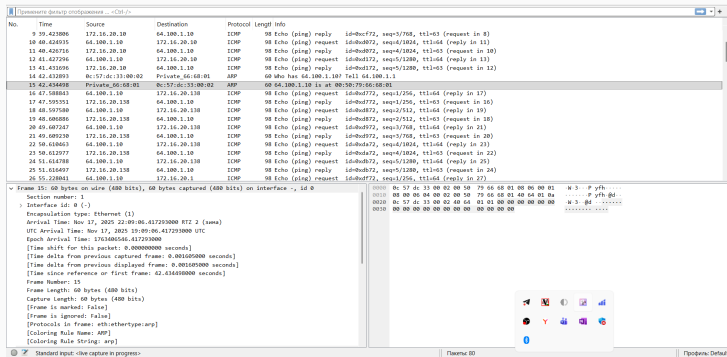


Рис. 30: ARP

15. Я анализирую захваченный на соединении сервера двойного стека адресации с коммутатором трафик ARP

[illegible]

Рис. 31: ARP

15. Я анализирую захваченный на соединении сервера двойного стека адресации с коммутатором трафик ICMP

Примените фильтр отображения: «ICMP»

No.	Time	Source	Destination	Protocol	Length	Info
9	39.423886	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0xc772, seq=3/768, ttl=63 (request in 8)
10	40.424095	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0xd872, seq=4/1024, ttl=64 (reply in 11)
11	40.426716	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0xd872, seq=4/1024, ttl=63 (request in 10)
12	41.427296	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0xd172, seq=5/1280, ttl=64 (reply in 13)
13	41.431606	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0xd172, seq=5/1280, ttl=63 (request in 12)
14	42.432893	0c:57:dc:33:00:02	Private_56:68:01	ARP	60	Who has 64.100.1.10? Tell 64.100.1.1
15	42.434498	Private_56:68:01	0c:57:dc:33:00:02	ARP	60	64.100.1.10 is at 00:50:79:66:68:01
16	47.508843	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xc772, seq=1/256, ttl=64 (reply in 17)
17	47.595351	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xc772, seq=1/256, ttl=63 (request in 16)
18	48.597580	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xd872, seq=2/512, ttl=64 (reply in 19)
19	48.608886	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xd872, seq=2/512, ttl=63 (request in 18)
20	49.607247	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xd972, seq=3/768, ttl=64 (reply in 21)
21	49.609230	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xd972, seq=3/768, ttl=63 (request in 20)
22	50.610463	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xda72, seq=4/1024, ttl=64 (reply in 23)
23	50.612977	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xda72, seq=4/1024, ttl=63 (request in 22)
24	51.614788	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xdb72, seq=5/1280, ttl=64 (reply in 25)
25	51.616497	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xdb72, seq=5/1280, ttl=63 (request in 24)
26	55.228861	64.100.1.10	172.16.20.1	ICMP	98	Echo (ping) request id=0xc772, seq=1/256, ttl=64 (reply in 27)

▼ Frame 16: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0, 16 0

Section number: 1

- Interface 0 (-)
- Encapsulation type: Ethernet (1)
- Arrival Time: Nov 17, 2025 19:09:11.571630000 RTT 2 (sma)
- UTC Arrival Time: Nov 17, 2025 19:09:11.571630000 UTC
- EPOCH Arrival Time: 1765400551.571630000
- [Time shift for this packet: 0.000000000 seconds]
- [Time delta from previous captured frame: 5.154345000 seconds]
- [Time delta from previous displayed frame: 5.154345000 seconds]
- [Time since reference or first frame: 47.108841000 seconds]
- Frame Number: 16
- Frame Length: 98 bytes (784 bits)
- Capture Length: 98 bytes (784 bits)
- [Frame is marked: False]
- [Frame is ignored: False]
- [Protocol in frame: ethertypetype:icmp:data]
- [Coloring Rule Name: ICMP]
- [Coloring Rule String: icmp || icmpv6]

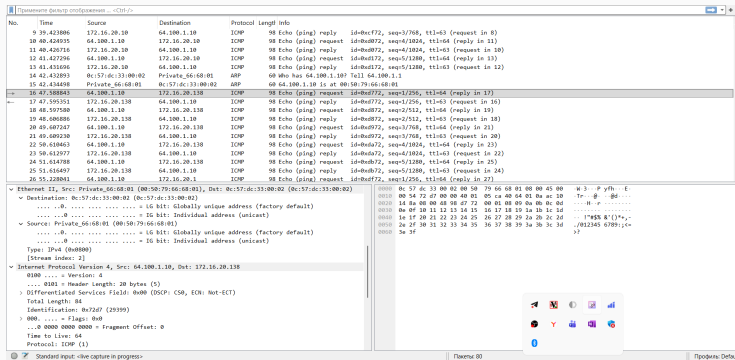
Standard input: «live capture in progress»

Пакеты: 90

Профиль: Dns

Рис. 32: ICMP

15. Я анализирую захваченный на соединении сервера двойного стека адресации с коммутатором трафик ICMP



No.	Time	Source	Destination	Protocol	Length	Info
9	39.423896	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0xc772, seq=3/768, ttl=63 (request in 8)
10	40.424055	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0xc872, seq=4/1024, ttl=64 (reply in 11)
11	40.420716	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0xc872, seq=4/1024, ttl=63 (request in 10)
12	41.427296	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0xc872, seq=5/1280, ttl=64 (reply in 13)
13	41.431606	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0xc872, seq=5/1280, ttl=63 (request in 12)
14	42.432893	0c:57:dc:33:00:02	Private_66:68:01	ARP	60	Who has 64.100.1.10? Tell 64.100.1.10
15	42.434498	Private_66:68:01	0c:57:dc:33:00:02	ARP	60	64.100.1.10 is at 00:50:79:66:68:01
16	47.308843	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xc772, seq=1/256, ttl=64 (reply in 17)
17	47.505351	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xc772, seq=1/256, ttl=63 (request in 16)
18	48.507580	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xc872, seq=2/512, ttl=64 (reply in 19)
19	48.608886	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xc872, seq=2/512, ttl=63 (request in 18)
20	49.607247	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xc872, seq=3/768, ttl=64 (reply in 21)
21	49.609230	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xc872, seq=3/768, ttl=63 (request in 20)
22	50.610463	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xc872, seq=4/1024, ttl=64 (reply in 23)
23	50.612977	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xc872, seq=4/1024, ttl=63 (request in 22)
24	51.614788	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xc872, seq=5/1280, ttl=64 (reply in 25)
25	51.616497	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xc872, seq=5/1280, ttl=63 (request in 24)
26	52.228891	64.100.1.10	172.16.20.1	ICMP	98	Echo (ping) request id=0xc772, seq=1/256, ttl=64 (reply in 27)

▼ Ethernet II, Src: Private_66:68:01 (00:50:79:66:68:01), Dst: 0c:57:dc:33:00:02 (0c:57:dc:33:00:02)

▼ Destination: 0c:57:dc:33:00:02 (0c:57:dc:33:00:02)

.....0..... = IG bit: Globally unique address (factory default)

.....0..... = IG bit: Individual address (unicast)

▼ Source: Private_66:68:01 (00:50:79:66:68:01)

.....0..... = IG bit: Globally unique address (factory default)

.....0..... = IG bit: Individual address (unicast)

Type: IPv4 (0x0800)

[Stream index: 2]

▼ Internet Protocol Version 4, Src: 64.100.1.10, Dst: 172.16.20.138

0100 = Version: 4

....0101 = Header Length: 20 bytes (5)

> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)

Total Length: 84

Identification: 0x72d7 (29399)

> 0000 = Flags: 0x0

...0 0000 0000 0000 = Fragment Offset: 0

Time to Live: 64

Protocol: ICMP (1)

Standard input: <live capture in progress>

Пакеты: 80

Профиль: Default

Рис. 33: ICMP

15. Я анализирую захваченный на соединении сервера двойного стека адресации с коммутатором трафик ICMP

Примените фильтр отображения: <Ctrl>/

No.	Time	Source	Destination	Protocol	Length	Info
9	39.423806	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply
10	40.424535	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request
11	40.426716	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply
12	41.427296	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request
13	41.431696	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply
14	42.432893	0c:57:dc:33:00:02	Private_66:68:01	ARP	60	Who has 64.100.1.10? Tell 64.100.1.1
15	42.434498	Private_66:68:01	0c:57:dc:33:00:02	ARP	60	64.100.1.10 is at 00:50:79:66:68:01
16	47.588543	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request
17	47.595351	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply
18	48.597500	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request
19	48.606886	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply
20	49.607247	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request
21	49.609230	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply
22	50.610463	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request
23	50.612977	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply
24	51.614788	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request
25	51.616497	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply
26	55.228841	64.100.1.10	172.16.20.1	ICMP	98	Echo (ping) request

Frame 17: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on Interface -, id 0

Section number: 1

Interface id: 0 (-)

Encapsulation type: Ethernet (1)

Arrival Time: Nov 17, 2025 22:09:11.578146000 RTT 2 (pms)

UTC Arrival Time: Nov 17, 2025 19:09:11.578146000 UTC

Epoch Arrival Time: 1763400551.578146000

[Time shift for this packet: 0.000000000 seconds]

[Time delta from previous captured frame: 0.006500000 seconds]

[Time delta from previous displayed frame: 0.006500000 seconds]

[Time since reference or first frame: 47.595351000 seconds]

Frame Number: 17

Frame Length: 98 bytes (784 bits)

Capture Length: 98 bytes (784 bits)

[Frame is marked: False]

[Frame is ignored: False]

[Protocols in frame: eth:ethertype:icmp:data]

[Coloring Rule Name: ICMP]

[Coloring Rule String: icmp | icmpv6]

0000 00 50 79 66 68 01 0c 57 dc 33 00 02 00 00 45 00 Pyth-W-3---E-
0010 00 54 72 d7 00 00 3f 01 0c ca 0c 10 14 0a 40 64 Tr-?.....00
0020 01 0a 00 00 50 98 d7 72 00 01 08 09 0a 0b 0c 0d ...P...P...
0030 0e 0f 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d
0040 1e 1f 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d ...TWSS&(!%+..
0050 2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d .../012345 6789;+<..
0060 3e 3f

Рис. 34: ICMP

15. Я анализирую захваченный на соединении сервера двойного стека адресации с коммутатором трафик ICMP

Примените фильтр отображения: «Ctrl»/»

No.	Time	Source	Destination	Protocol	Length	Info
9	39.432890	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0xc772, seq=3/768, ttl=63 (request in 8)
10	40.424915	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0xd872, seq=4/1024, ttl=64 (reply in 11)
11	40.426736	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0xd872, seq=4/1024, ttl=63 (request in 10)
12	41.427286	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0xd172, seq=5/1280, ttl=64 (reply in 13)
13	41.431096	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0xd172, seq=5/1280, ttl=63 (request in 12)
14	42.432893	0c:57:dc:33:00:02	Private_66:68:01	ARP	60	Who has 64.100.1.10? Tell 64.100.1.1
15	42.434000	Private_66:68:01	0c:57:dc:33:00:02	ARP	60	64.100.1.10 is at 00:50:79:66:68:01
16	47.588843	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xd772, seq=1/256, ttl=64 (reply in 17)
17	47.595351	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xd772, seq=1/256, ttl=63 (request in 16)
18	48.597580	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xd872, seq=2/512, ttl=64 (reply in 19)
19	48.606886	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xd872, seq=2/512, ttl=63 (request in 18)
20	49.607247	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xd972, seq=3/768, ttl=64 (reply in 21)
21	49.609230	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xd972, seq=3/768, ttl=63 (request in 20)
22	50.610463	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xda72, seq=4/1024, ttl=64 (reply in 23)
23	50.612977	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xda72, seq=4/1024, ttl=63 (request in 22)
24	51.614788	64.100.1.10	172.16.20.138	ICMP	98	Echo (ping) request id=0xdb72, seq=5/1280, ttl=64 (reply in 25)
25	51.616497	172.16.20.138	64.100.1.10	ICMP	98	Echo (ping) reply id=0xdb72, seq=5/1280, ttl=63 (request in 24)
26	55.228841	64.100.1.10	172.16.20.1	ICMP	98	Echo (ping) request id=0xdf72, seq=1/256, ttl=64 (reply in 27)

[Coloring Rule Strings: icmp || icmpv6]

Ethernet II, Src: 0c:57:dc:33:00:02 (0c:57:dc:33:00:02), Dst: Private_66:68:01 (00:50:79:66:68:01)

Destination: Private_66:68:01 (00:50:79:66:68:01)

...0. = 16 bit: Globally unique address (factory default)

...0. = 16 bit: Individual address (unicast)

Source: 0c:57:dc:33:00:02 (0c:57:dc:33:00:02)

...0. = 16 bit: Globally unique address (factory default)

...0. = 16 bit: Individual address (unicast)

Type: IPv4 (0x0800)

[Stream index: 2]

Internet Protocol Version 4, Src: 172.16.20.138, Dst: 64.100.1.10

0100 = Version: 4

.... 0101 = Header Length: 20 bytes (5)

> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)

Total length: 84

Identification: 0x7267 (29399)

> 000. = Flags: 0x0

...0 0000 0000 0000 = Fragment Offset: 0

Time to Live: 63

Standard input: «live capture in progress»

Пакеты: 80

Процесс: Default

Рис. 35: ICMP

15. Я анализирую захваченный на соединении сервера двойного стека адресации с коммутатором трафик ICMPv6

Примените фильтр отображения ... «Ctrl+J»					
No.	Time	Source	Destination	Protocol	Length Info
64	81.944511	2001:db8:c0de:12::1	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0cf872, seq=2, hop limit=64 (request in 63)
65	81.946681	2001:db8:c0de:11::a	2001:db8:c0de:12::1	ICMPv6	118 Echo (ping) request id=0cf872, seq=1, hop limit=64 (reply in 66)
66	81.947363	2001:db8:c0de:12::1	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0cf872, seq=1, hop limit=64 (request in 65)
67	81.947607	2001:db8:c0de:11::a	2001:db8:c0de:12::1	ICMPv6	118 Echo (ping) request id=0cf872, seq=4, hop limit=64 (reply in 68)
68	81.948760	2001:db8:c0de:12::1	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0cf872, seq=4, hop limit=64 (request in 67)
69	84.949021	2001:db8:c0de:11::a	2001:db8:c0de:12::1	ICMPv6	118 Echo (ping) request id=0cf872, seq=5, hop limit=64 (reply in 70)
70	84.949602	2001:db8:c0de:12::1	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0cf872, seq=5, hop limit=64 (request in 69)
71	88.424063	2001:db8:c0de:11::a	2001:db8:c0de:13::1	ICMPv6	118 Echo (ping) request id=0b0073, seq=1, hop limit=64 (reply in 72)
72	88.425192	2001:db8:c0de:13::1	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0b0073, seq=1, hop limit=64 (request in 71)
73	89.425418	2001:db8:c0de:13::1	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) request id=0b0073, seq=2, hop limit=64 (reply in 74)
74	89.425505	2001:db8:c0de:11::a	2001:db8:c0de:13::1	ICMPv6	118 Echo (ping) reply id=0b0073, seq=2, hop limit=64 (request in 73)
75	90.426046	2001:db8:c0de:11::a	2001:db8:c0de:13::1	ICMPv6	118 Echo (ping) request id=0b0073, seq=3, hop limit=64 (reply in 76)
76	90.427052	2001:db8:c0de:13::1	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0b0073, seq=3, hop limit=64 (request in 75)
77	91.428808	2001:db8:c0de:11::a	2001:db8:c0de:13::1	ICMPv6	118 Echo (ping) request id=0b0073, seq=4, hop limit=64 (reply in 78)
78	91.430190	2001:db8:c0de:13::1	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0b0073, seq=4, hop limit=64 (request in 77)
79	92.431127	2001:db8:c0de:11::a	2001:db8:c0de:13::1	ICMPv6	118 Echo (ping) request id=0b0073, seq=5, hop limit=64 (reply in 80)
80	92.432222	2001:db8:c0de:13::1	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0b0073, seq=5, hop limit=64 (request in 79)

▼ Frame 64: 118 bytes on wire (944 bits), 118 bytes captured (944 bits) on interface -, id 0

Section number: 1

Interface id: 0 (-)

Encapsulation type: ethernet (1)

Arrival Time: Nov 17, 2025 22:09:45.927306000 RTZ 2 (saw)

UTC Arrival Time: Nov 17, 2025 19:00:45.927306000 UTC

Epoch Arrival Time: 1763406505.927306000

[Time shift for this packet: 0.000000000 seconds]

[Time delta from previous captured frame: 0.000944000 seconds]

[Time delta from previous displayed frame: 0.000944000 seconds]

[Time since reference or first frame: 81.944511000 seconds]

Frame Number: 64

Frame Length: 118 bytes (944 bits)

Capture Length: 118 bytes (944 bits)

[Frame is marked: False]

[Frame is ignored: False]

[Protocols in Frame: eth:ethertype:ipv6:icmpv6:data]

[Coloring Rule Name: ICMP]

[Coloring Rule String: icmp || icmpv6]

0000 00 50 70 66 68 01 0c f5 64 b4 00 02 06 44 00 05 Pyth...d.....
0010 05 55 00 40 3e 40 20 01 0d b8 c0 de 00 12 00 00 U-B-.....
0020 00 00 00 00 00 01 20 01 0d b8 c0 de 00 11 00 00
0030 00 00 00 00 00 0a 51 00 81 9f f8 72 00 02 00 01
0040 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f 10 11
0050 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f 20 21
0060 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 *4B8(1) **.../81
0070 32 33 34 35 36 37 234567

Standard input: <live capture in progress>

Память: 80

Процесс: Default

Рис. 36: ICMPv6

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15. Я анализирую захваченный на соединении сервера двойного стека адресации с коммутатором трафик ICMPv6

Примените фильтр отображения: «ICMPv6»						
No.	Time	Source	Destination	Protocol	Length	Info
64	81.944515	2001:db8::c8de:12::1	2001:db8::c8de:11::a	ICMPv6	118	Echo (ping) reply id=0xf872, seq=2, hop limit=64 (request in 63)
65	82.946681	2001:db8::c8de:11::a	2001:db8::c8de:12::1	ICMPv6	118	Echo (ping) request id=0xf872, seq=3, hop limit=64 (reply in 66)
66	82.947363	2001:db8::c8de:12::1	2001:db8::c8de:11::a	ICMPv6	118	Echo (ping) reply id=0xf872, seq=3, hop limit=64 (request in 65)
67	83.947807	2001:db8::c8de:11::a	2001:db8::c8de:12::1	ICMPv6	118	Echo (ping) request id=0xf872, seq=4, hop limit=64 (reply in 68)
68	83.948768	2001:db8::c8de:12::1	2001:db8::c8de:11::a	ICMPv6	118	Echo (ping) reply id=0xf872, seq=4, hop limit=64 (request in 67)
69	84.949023	2001:db8::c8de:11::a	2001:db8::c8de:12::1	ICMPv6	118	Echo (ping) request id=0xf872, seq=5, hop limit=64 (reply in 70)
70	84.949602	2001:db8::c8de:12::1	2001:db8::c8de:11::a	ICMPv6	118	Echo (ping) reply id=0xf872, seq=5, hop limit=64 (request in 69)
71	88.424063	2001:db8::c8de:11::a	2001:db8::c8de:13::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=1, hop limit=64 (reply in 72)
72	88.425182	2001:db8::c8de:13::1	2001:db8::c8de:11::a	ICMPv6	118	Echo (ping) reply id=0x0073, seq=1, hop limit=64 (request in 71)
73	89.425418	2001:db8::c8de:11::a	2001:db8::c8de:13::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=2, hop limit=64 (reply in 74)
74	89.425905	2001:db8::c8de:13::1	2001:db8::c8de:11::a	ICMPv6	118	Echo (ping) reply id=0x0073, seq=2, hop limit=64 (request in 73)
75	90.426846	2001:db8::c8de:11::a	2001:db8::c8de:13::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=3, hop limit=64 (reply in 76)
76	90.427652	2001:db8::c8de:13::1	2001:db8::c8de:11::a	ICMPv6	118	Echo (ping) reply id=0x0073, seq=3, hop limit=64 (request in 75)
77	91.428888	2001:db8::c8de:11::a	2001:db8::c8de:13::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=4, hop limit=64 (reply in 78)
78	91.430190	2001:db8::c8de:13::1	2001:db8::c8de:11::a	ICMPv6	118	Echo (ping) reply id=0x0073, seq=4, hop limit=64 (request in 77)
79	92.431127	2001:db8::c8de:11::a	2001:db8::c8de:13::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=5, hop limit=64 (reply in 80)
80	92.432222	2001:db8::c8de:13::1	2001:db8::c8de:11::a	ICMPv6	118	Echo (ping) reply id=0x0073, seq=5, hop limit=64 (request in 79)

[Coloring Rule String: icmp || icmpv6]

▼ Ethernet II, Src: 0c:f5:64:b4:00:02 (0c:f5:64:b4:00:02), Dst: Private, 66:68:01 (00:50:79:66:68:01)

- ▼ Destination: Private, 66:68:01 (00:50:79:66:68:01)
 - 0. = 16 bit: Globally unique address (factory default)
 - 0 = 16 bit: Individual address (unicast)
- ▼ Source: 0c:f5:64:b4:00:02 (0c:f5:64:b4:00:02)
 - 0. = 16 bit: Globally unique address (factory default)
 - 0 = 16 bit: Individual address (unicast)
- Type: IPv6 (0x8dd)
- [Stream index: 3]

▼ Internet Protocol Version 6, Src: 2001:db8::c8de:12::1, Dst: 2001:db8::c8de:11::a

0110 = Version: 6

> 0000 0000 = Traffic Class: 0x00 (DSCP: CS0, ECN: Not-ECT)

.... 0101 1011 0101 0101 = Flow Label: 0x56555

Payload Length: 64

Next Header: ICMPv6 (58)

Hop Limit: 64

> Source Address: 2001:db8::c8de:12::1

> Destination Address: 2001:db8::c8de:11::a

0000 00 50 79 66 68 01 0c f5 64 b4 00 02 86 dd 60 05 Pyfh...d.....
0010 85 55 00 60 1a 60 20 01 dd b8 c0 de 00 12 00 00 U#0.....
0020 00 00 00 00 00 01 20 01 dd b8 c0 de 00 11 00 00
0030 00 00 00 00 00 0a 81 00 b1 9f f8 72 00 02 00 01
0040 02 03 04 05 06 07 08 09 0a 0b 0c dd 0e 0f 10 11
0050 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f 20 21
0060 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 "SSNA()"*,.../01
0070 32 33 34 35 36 37 234567

Рис. 37: ICMPv6

15. Я анализирую захваченный на соединении сервера двойного стека адресации с коммутатором трафик ICMPv6

Примените фильтр отображений ... «Сб/»						
No.	Time	Source	Destination	Protocol	Length	Info
64 81.944511	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) reply id=0xf872, seq=2, hop limit=64 (request in 63)
65 82.946681	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) request id=0xf872, seq=3, hop limit=64 (reply in 66)
66 82.947363	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) reply id=0xf872, seq=3, hop limit=64 (request in 65)
67 83.947897	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) request id=0xf872, seq=4, hop limit=64 (reply in 68)
68 83.948768	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) reply id=0xf872, seq=4, hop limit=64 (request in 67)
69 84.949021	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) request id=0xf872, seq=5, hop limit=64 (reply in 70)
70 84.949682	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) reply id=0xf872, seq=5, hop limit=64 (request in 69)
71 88.424863	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=1, hop limit=64 (reply in 72)
72 88.425182	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) reply id=0x0073, seq=1, hop limit=64 (request in 71)
73 89.425418	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=2, hop limit=64 (reply in 74)
74 89.425595	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) reply id=0x0073, seq=2, hop limit=64 (request in 73)
75 90.426846	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=3, hop limit=64 (reply in 76)
76 90.427652	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) reply id=0x0073, seq=3, hop limit=64 (request in 75)
77 91.428888	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=4, hop limit=64 (reply in 78)
78 91.430190	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) reply id=0x0073, seq=4, hop limit=64 (request in 77)
79 92.431127	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=5, hop limit=64 (reply in 80)
80 92.432222	2001:db8:cbde:12::1	2001:db8:cbde:12::1	2001:db8:cbde:12::1	ICMPv6	118	Echo (ping) reply id=0x0073, seq=5, hop limit=64 (request in 79)

▼ Frame 65: 118 bytes on wire (944 bits), 118 bytes captured (944 bits) on interface -, id 0

Section number: 1

> Interface id: 0 (-)

Encapsulation type: Ethernet (1)

Arrival Time: Nov 17, 2025 22:09:46.929476000 RTT 2 (juma)

UTC Arrival Time: Nov 17, 2025 19:09:46.929476000 UTC

Epoch Arrival Time: 1763405586.929476000

[Time shift for this packet: 0.000000000 seconds]

[Time delta from previous captured frame: 1.002170000 seconds]

[Time delta from previous displayed frame: 1.002170000 seconds]

[Time since reference or first frame: 82.946681000 seconds]

Frame Number: 65

Frame Length: 118 bytes (944 bits)

Capture Length: 118 bytes (944 bits)

[Frame is marked: False]

[Frame is ignored: False]

[Protocol(s) in frame: ethertype:ipv6:icmpv6:data]

[Coloring Rule Name: ICMP]

[Coloring Rule String: icmp || icmpv6]

0000 0c f5 64 b4 00 02 00 50 79 66 68 01 86 dd 60 00 ...d...P yfh...
0010 00 00 00 40 3a 40 20 01 0f b8 c0 d0 00 11 00 00 ...8:8-
0020 00 00 00 00 0a 20 01 0f b8 c0 d0 00 12 00 00
0030 00 00 00 00 01 30 00 b2 9a f8 72 00 03 00 01
0040 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f 10 11
0050 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f 20 21
0060 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 *#55A'() *+,.../01
0070 32 33 34 35 36 37 234567

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Рис. 38: ICMPv6

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15. Я анализирую захваченный на соединении сервера двойного стека адресации с коммутатором трафик ICMPv6

Примените фильтр отображения ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
64	81.944511	2001:db8:c0de:12::1	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) reply id=0xf872, seq=2, hop limit=64 (request in 63)
65	82.946681	2001:db8:c0de:11::a	2001:db8:c0de:12::1	ICMPv6	118	Echo (ping) request id=0xf872, seq=3, hop limit=64 (reply in 66)
66	82.947363	2001:db8:c0de:12::1	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) reply id=0xf872, seq=3, hop limit=64 (request in 65)
67	83.947807	2001:db8:c0de:11::a	2001:db8:c0de:12::1	ICMPv6	118	Echo (ping) request id=0xf872, seq=4, hop limit=64 (reply in 68)
68	83.948760	2001:db8:c0de:12::1	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) reply id=0xf872, seq=4, hop limit=64 (request in 67)
69	84.949021	2001:db8:c0de:11::a	2001:db8:c0de:12::1	ICMPv6	118	Echo (ping) request id=0xf872, seq=5, hop limit=64 (reply in 70)
70	84.949602	2001:db8:c0de:12::1	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) reply id=0xf872, seq=5, hop limit=64 (request in 69)
71	88.424063	2001:db8:c0de:11::a	2001:db8:c0de:13::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=1, hop limit=64 (reply in 72)
72	88.425182	2001:db8:c0de:13::1	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) reply id=0x0073, seq=1, hop limit=64 (request in 71)
73	89.425418	2001:db8:c0de:11::a	2001:db8:c0de:13::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=2, hop limit=64 (reply in 74)
74	89.425905	2001:db8:c0de:13::1	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) reply id=0x0073, seq=2, hop limit=64 (request in 73)
75	90.426846	2001:db8:c0de:11::a	2001:db8:c0de:13::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=3, hop limit=64 (reply in 76)
76	90.427652	2001:db8:c0de:13::1	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) reply id=0x0073, seq=3, hop limit=64 (request in 75)
77	91.428888	2001:db8:c0de:11::a	2001:db8:c0de:13::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=4, hop limit=64 (reply in 78)
78	91.430190	2001:db8:c0de:13::1	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) reply id=0x0073, seq=4, hop limit=64 (request in 77)
79	92.431127	2001:db8:c0de:11::a	2001:db8:c0de:13::1	ICMPv6	118	Echo (ping) request id=0x0073, seq=5, hop limit=64 (reply in 80)
80	92.432222	2001:db8:c0de:13::1	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) reply id=0x0073, seq=5, hop limit=64 (request in 79)

[Coloring Rule String: icmp || icmpv6]

✓ Ethernet II, Src: Private_66:68:01 (00:50:79:66:68:01), Dst: 0c:f5:64:b4:00:02 (0c:f5:64:b4:00:02)

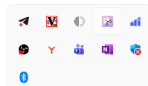
- Destination: 0c:f5:64:b4:00:02 (0c:f5:64:b4:00:02)
 - ...0... = LG bit: Globally unique address (factory default)
 - ...0... = IG bit: Individual address (unicast)
- Source: Private_66:68:01 (00:50:79:66:68:01)
 - ...0... = LG bit: Globally unique address (factory default)
 - ...0... = IG bit: Individual address (unicast)

Type: IPv6 (0x86dd)
[Stream index: 3]

✓ Internet Protocol Version 6, Src: 2001:db8:c0de:11::a, Dst: 2001:db8:c0de:12::1

- 0110 ... = Version: 6
- > ... 0000 0000 ... = Traffic Class: 0x00 (DSCP: CS0, ECN: Not-ECT)
- ... 0000 0000 0000 0000 = Flow Label: 0x000000
- Payload Length: 64
- Next Header: ICMPv6 (58)
- Hop Limit: 64
- > Source Address: 2001:db8:c0de:11::a
- > Destination Address: 2001:db8:c0de:12::1

```
0000 0c f5 64 b4 00 02 00 50 79 66 68 01 86 dd 60 00 ...d...P yfh...
0010 00 00 00 40 3a 40 20 01 0d b8 c0 de 00 11 00 00 ...@:~ .....
0020 00 00 00 00 00 0a 20 01 0d b8 c0 de 00 12 00 00 .....
0030 00 00 00 00 00 01 80 00 b2 9e f8 72 00 03 00 01 .....
0040 02 03 04 05 06 07 08 09 0a 0b 0c 0d 0e 0f 10 11 .....
0050 12 13 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f 20 21 .....
0060 22 23 24 25 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 "#$%&'()*+,-./01
0070 32 33 34 35 36 37 234567
```



Характеристика подсетей

Характеристика подсетей

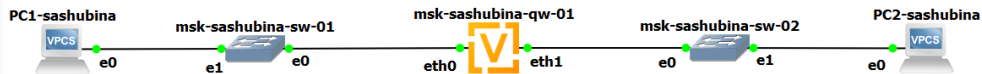


Рис. 40: создание сети

Настроим IP-адресацию на маршрутизаторе VyOS и конечных устройствах, причём на интерфейсах маршрутизатора установить наименьший адрес в подсети.

```
vyos@ask-sashubina-gw-01# set interfaces ethernet eth0 address '10.10.1.97/27'
Configuration path: [interfaces ethernet eth0 address 10.10.1.97/27] already exists
[edit]
vyos@ask-sashubina-gw-01# set interfaces ethernet eth0 address '2001:db8:1::1:/64'
Configuration path: [interfaces ethernet eth0 address 2001:db8:1::1:/64] already exists
[edit]
vyos@ask-sashubina-gw-01# set service router-advert interface eth0 prefix '2001:db8:1::1:/64'
Configuration path: [service router-advert interface eth0 prefix 2001:db8:1::1:/64] already exists
[edit]
vyos@ask-sashubina-gw-01# set interfaces ethernet eth1 address '10.10.1.17/28'
Configuration path: [interfaces ethernet eth1 address 10.10.1.17/28] already exists
[edit]
vyos@ask-sashubina-gw-01# set interfaces ethernet eth1 address '2001:db8:1:4::1:/64'
Configuration path: [interfaces ethernet eth1 address 2001:db8:1:4::1:/64] already exists
[edit]
vyos@ask-sashubina-gw-01# set service router-advert interface eth1 prefix '2001:db8:1:4::1:/64'
Configuration path: [service router-advert interface eth1 prefix 2001:db8:1:4::1:/64] already exists
[edit]
vyos@ask-sashubina-gw-01# commit
[edit]
vyos@ask-sashubina-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@ask-sashubina-gw-01#
```

Рис. 41: Vyos

```
ryos@msk-sashubina-gw-01# show interfaces
interface eth0 {
  address 10.10.1.97/27
  address 2001:db8:11::1/64
  hw-id 0c:d0:c7:39:00:00
}
interface eth1 {
  address 10.10.1.17/28
  address 2001:db8:11:4::1/64
  hw-id 0c:d0:c7:39:00:01
}
interface eth2 {
  hw-id 0c:d0:c7:39:00:02
}
interface eth3 {
  hw-id 0c:d0:c7:39:00:03
}
interface eth4 {
  hw-id 0c:d0:c7:39:00:04
}
interface eth5 {
  hw-id 0c:d0:c7:39:00:05
}
interface eth6 {
  hw-id 0c:d0:c7:39:00:06
}
interface eth7 {
  hw-id 0c:d0:c7:39:00:07
}
interface eth8 {
  hw-id 0c:d0:c7:39:00:08
}
interface eth9 {
  hw-id 0c:d0:c7:39:00:09
}
loopback lo {
}
(edit)
ryos@msk-sashubina-gw-01#
(edit)
```

Рис. 42: просмотр интерфейсов


```
VPCS> ip 10.10.1.98/27 10.10.1.97
Checking for duplicate address...
VPCS : 10.10.1.98 255.255.255.224 gateway 10.10.1.97

VPCS> ip 2001:db8:1:1::2/64
PC1 : 2001:db8:1:1::2/64

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

VPCS> 
```

Рис. 43: PC1

```
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::2/64
PC1 : 2001:db8:1:4::2/64

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

VPCS> █
```

Рис. 44: PC2

```
VPCS> show ip
NAME       : VPCS[1]
IP/MASK    : 10.10.1.98/27
GATEWAY    : 10.10.1.97
DNS        :
MAC        : 00:50:79:66:68:00
LPORT      : 20000
RHOST:PORT : 127.0.0.1:20001
MTU        : 1500

VPCS> show ipv6
NAME       : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6800/64
GLOBAL SCOPE    : 2001:db8:1:1::2/64
DNS            :
ROUTER LINK-LAYER : 0c:d0:c7:39:00:00
MAC            : 00:50:79:66:68:00
LPORT          : 20000
RHOST:PORT     : 127.0.0.1:20001
MTU            : 1500

VPCS> █
```

Рис. 45: проверка PC1

```
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      : 20002  
RHOST:PORT  : 127.0.0.1:20003  
MTU         : 1500  
  
VPCS> show ipv6  
  
NAME       : VPCS[1]  
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6801/64  
GLOBAL SCOPE    : 2001:db8:1:4::2/64  
DNS            :  
ROUTER LINK-LAYER : 0c:d0:c7:39:00:01  
MAC            : 00:50:79:66:68:01  
LPORT          : 20002  
RHOST:PORT     : 127.0.0.1:20003  
MTU            : 1500  
  
VPCS> █
```

Рис. 46: проверка PC2

Проверка корректности реализации

```
VFCS> ping 10.10.1.97

84 bytes from 10.10.1.97 icmp_seq=1 ttl=64 time=1.005 ms
84 bytes from 10.10.1.97 icmp_seq=2 ttl=64 time=2.020 ms
84 bytes from 10.10.1.97 icmp_seq=3 ttl=64 time=0.928 ms
84 bytes from 10.10.1.97 icmp_seq=4 ttl=64 time=1.973 ms
84 bytes from 10.10.1.97 icmp_seq=5 ttl=64 time=0.809 ms

VFCS> ping 2001:db8:1:1::1

2001:db8:1:1::1 icmp6_seq=1 ttl=64 time=2.097 ms
2001:db8:1:1::1 icmp6_seq=2 ttl=64 time=0.905 ms
2001:db8:1:1::1 icmp6_seq=3 ttl=64 time=0.694 ms
2001:db8:1:1::1 icmp6_seq=4 ttl=64 time=0.951 ms
2001:db8:1:1::1 icmp6_seq=5 ttl=64 time=0.526 ms

VFCS> ping 10.10.1.18

84 bytes from 10.10.1.18 icmp_seq=1 ttl=63 time=2.944 ms
84 bytes from 10.10.1.18 icmp_seq=2 ttl=63 time=1.941 ms
84 bytes from 10.10.1.18 icmp_seq=3 ttl=63 time=2.338 ms
84 bytes from 10.10.1.18 icmp_seq=4 ttl=63 time=1.104 ms
84 bytes from 10.10.1.18 icmp_seq=5 ttl=63 time=0.909 ms

VFCS> ping 2001:db8:1:4::2

2001:db8:1:4::2 icmp6_seq=1 ttl=62 time=2.749 ms
2001:db8:1:4::2 icmp6_seq=2 ttl=62 time=1.113 ms
2001:db8:1:4::2 icmp6_seq=3 ttl=62 time=1.110 ms
2001:db8:1:4::2 icmp6_seq=4 ttl=62 time=1.953 ms
2001:db8:1:4::2 icmp6_seq=5 ttl=62 time=1.592 ms

VFCS> █
```

Рис. 47: PC1

```
VFCS> ping 10.10.1.17

64 bytes from 10.10.1.17 icmp_seq=1 ttl=64 time=3.952 ms
64 bytes from 10.10.1.17 icmp_seq=2 ttl=64 time=0.882 ms
64 bytes from 10.10.1.17 icmp_seq=3 ttl=64 time=0.668 ms
64 bytes from 10.10.1.17 icmp_seq=4 ttl=64 time=0.777 ms
64 bytes from 10.10.1.17 icmp_seq=5 ttl=64 time=0.650 ms

VFCS> ping 2001:db8:1:4::1

2001:db8:1:4::1 icmp6_seq=1 ttl=64 time=1.026 ms
2001:db8:1:4::1 icmp6_seq=2 ttl=64 time=1.003 ms
2001:db8:1:4::1 icmp6_seq=3 ttl=64 time=0.646 ms
2001:db8:1:4::1 icmp6_seq=4 ttl=64 time=0.709 ms
2001:db8:1:4::1 icmp6_seq=5 ttl=64 time=1.746 ms

VFCS> ping 10.10.1.98

64 bytes from 10.10.1.98 icmp_seq=1 ttl=63 time=3.619 ms
64 bytes from 10.10.1.98 icmp_seq=2 ttl=63 time=1.357 ms
64 bytes from 10.10.1.98 icmp_seq=3 ttl=63 time=1.247 ms
64 bytes from 10.10.1.98 icmp_seq=4 ttl=63 time=1.646 ms
64 bytes from 10.10.1.98 icmp_seq=5 ttl=63 time=1.418 ms

VFCS> ping 2001:db8:1:1::2

2001:db8:1:1::2 icmp6_seq=1 ttl=62 time=7.218 ms
2001:db8:1:1::2 icmp6_seq=2 ttl=62 time=4.054 ms
2001:db8:1:1::2 icmp6_seq=3 ttl=62 time=4.716 ms
2001:db8:1:1::2 icmp6_seq=4 ttl=62 time=5.153 ms
2001:db8:1:1::2 icmp6_seq=5 ttl=62 time=7.705 ms

VFCS> █
```

Рис. 48: PC2

```
1000 10.10.1.90 (10.10.1.90) 56(84) bytes of data:
64 bytes from 10.10.1.90: icmp_seq=1 ttl=64 time=1.40 ms
64 bytes from 10.10.1.90: icmp_seq=2 ttl=64 time=0.714 ms
64 bytes from 10.10.1.90: icmp_seq=3 ttl=64 time=0.565 ms
64 bytes from 10.10.1.90: icmp_seq=4 ttl=64 time=0.523 ms
64 bytes from 10.10.1.90: icmp_seq=5 ttl=64 time=1.12 ms
64 bytes from 10.10.1.90: icmp_seq=6 ttl=64 time=0.743 ms
64 bytes from 10.10.1.90: icmp_seq=7 ttl=64 time=0.726 ms
64 bytes from 10.10.1.90: icmp_seq=8 ttl=64 time=0.599 ms
64 bytes from 10.10.1.90: icmp_seq=9 ttl=64 time=0.597 ms
64 bytes from 10.10.1.90: icmp_seq=10 ttl=64 time=0.794 ms
64 bytes from 10.10.1.90: icmp_seq=11 ttl=64 time=0.74 ms
^
[1]* Stopped ping 10.10.1.90
(ed1)
vyc@mx-sashubina-gw-01# ping 2001:db8:1:1:2
PING 2001:db8:1:1:2 (2001:db8:1:1:2) 56 data bytes
64 bytes from 2001:db8:1:1:2: icmp_seq=1 ttl=64 time=6.51 ms
64 bytes from 2001:db8:1:1:2: icmp_seq=2 ttl=64 time=0.703 ms
64 bytes from 2001:db8:1:1:2: icmp_seq=3 ttl=64 time=0.716 ms
64 bytes from 2001:db8:1:1:2: icmp_seq=4 ttl=64 time=0.567 ms
64 bytes from 2001:db8:1:1:2: icmp_seq=5 ttl=64 time=6.90 ms
64 bytes from 2001:db8:1:1:2: icmp_seq=6 ttl=64 time=0.613 ms
64 bytes from 2001:db8:1:1:2: icmp_seq=7 ttl=64 time=2.46 ms
64 bytes from 2001:db8:1:1:2: icmp_seq=8 ttl=64 time=1.07 ms
^
[2]* Stopped ping 2001:db8:1:1:2
(ed1)
vyc@mx-sashubina-gw-01# ping 10.10.1.10
PING 10.10.1.10 (10.10.1.10) 56(84) bytes of data:
64 bytes from 10.10.1.10: icmp_seq=1 ttl=64 time=2.30 ms
64 bytes from 10.10.1.10: icmp_seq=2 ttl=64 time=0.599 ms
64 bytes from 10.10.1.10: icmp_seq=3 ttl=64 time=0.667 ms
64 bytes from 10.10.1.10: icmp_seq=4 ttl=64 time=0.671 ms
64 bytes from 10.10.1.10: icmp_seq=5 ttl=64 time=0.451 ms
64 bytes from 10.10.1.10: icmp_seq=6 ttl=64 time=0.505 ms
^
[3]* Stopped ping 10.10.1.10
(ed1)
vyc@mx-sashubina-gw-01# ping 2001:db8:1:4:2
PING 2001:db8:1:4:2 (2001:db8:1:4:2) 56 data bytes
64 bytes from 2001:db8:1:4:2: icmp_seq=1 ttl=64 time=3.05 ms
64 bytes from 2001:db8:1:4:2: icmp_seq=2 ttl=64 time=0.903 ms
64 bytes from 2001:db8:1:4:2: icmp_seq=3 ttl=64 time=0.909 ms
64 bytes from 2001:db8:1:4:2: icmp_seq=4 ttl=64 time=7.04 ms
^
[4]* Stopped ping 2001:db8:1:4:2
(ed1)
vyc@mx-sashubina-gw-01#
```

Рис. 49: маршрутизатор

Traceroute демонстрирует правильные пути прохождения трафика

```
VPCS> trace 10.10.1.18
trace to 10.10.1.18, 8 hops max, press Ctrl+C to stop
 1  10.10.1.97    6.928 ms  1.026 ms  0.454 ms
 2  *10.10.1.18   2.613 ms (ICMP type:3, code:3, Destination port unreachable)

VPCS> trace 2001:db8:1:4::2

trace to 2001:db8:1:4::2, 64 hops max
 1 2001:db8:1:1::1  3.787 ms  0.500 ms  0.536 ms
 2 2001:db8:1:4::2  2.276 ms  1.145 ms  0.845 ms

VPCS> █
```

Рис. 50: PC1


```
VPCS> trace 10.10.1.98
trace to 10.10.1.98, 8 hops max, press Ctrl+C to stop
 1  10.10.1.17    0.675 ms  0.564 ms  0.291 ms
 2  *10.10.1.98   0.994 ms (ICMP type:3, code:3, Destination port unreachable)

VPCS> trace 2001:db8:1:1::2

trace to 2001:db8:1:1::2, 64 hops max
 1 2001:db8:1:4::1  1.267 ms  0.556 ms  0.309 ms
 2 2001:db8:1:1::2  1.356 ms  1.190 ms  0.749 ms

VPCS> █
```

Рис. 51: PC2

Я изучила принципы распределения и настройки адресного пространства на устройствах сети.