

Сетевые технологии

Адресация IPv4 и IPv6. Двойной стек

Сейдалиев Тагиетдин Ровшенович

20 ноября 2025

Российский университет дружбы народов, Москва, Россия

Цель работы

Основная цель

Изучить методы распределения IPv4/IPv6-адресов, разбиение сетей на подсети и настройку двойного стека в виртуальной лабораторной среде.

Настройка двойного стека адресации IPv4 и IPv6

Топология стенда

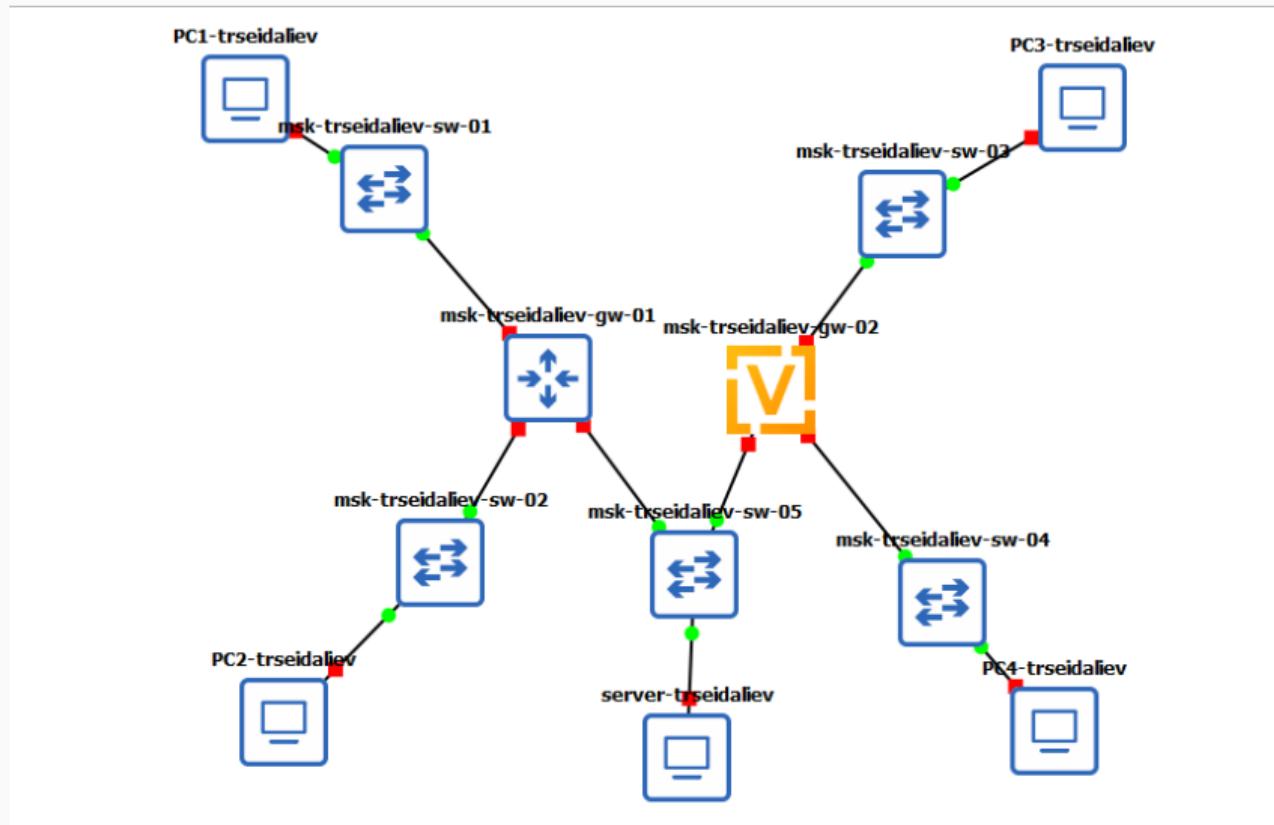


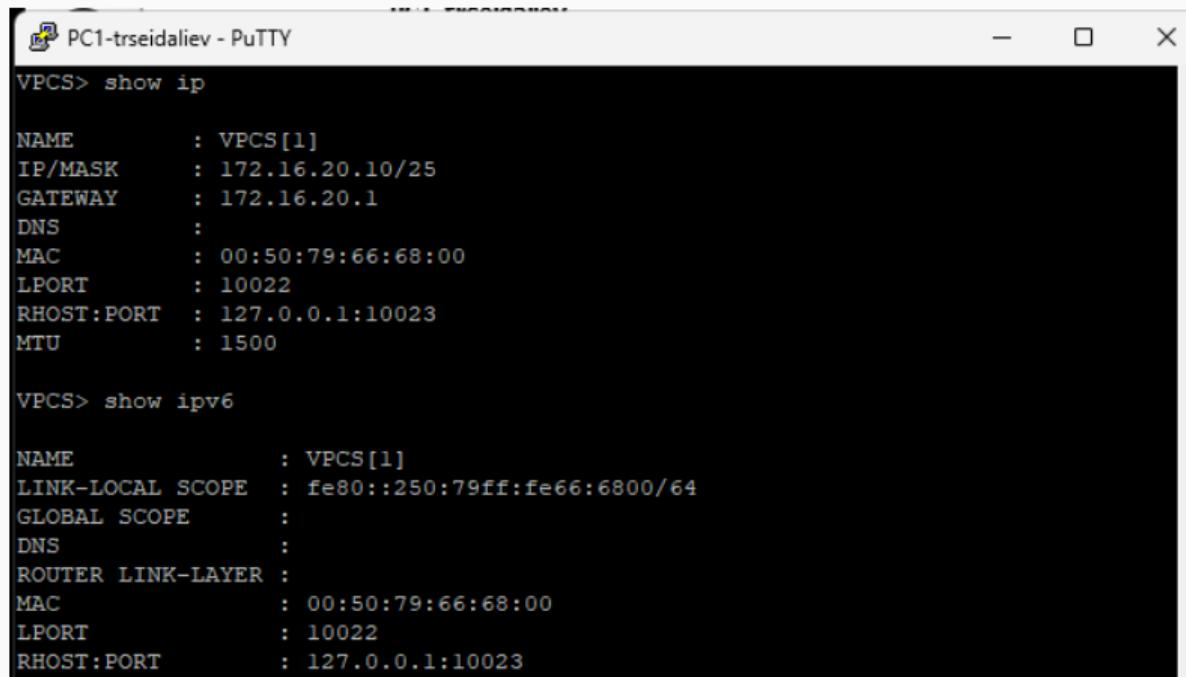
Рис. 1: Топология

Конфигурация PC1

IPv4: 172.16.20.x

IPv6: автоматическое назначение SLAAC

Проверка командой show ip



```
PC1-trseidaliev - PuTTY
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     : 10022
RHOST:PORT : 127.0.0.1:10023
MTU       : 1500

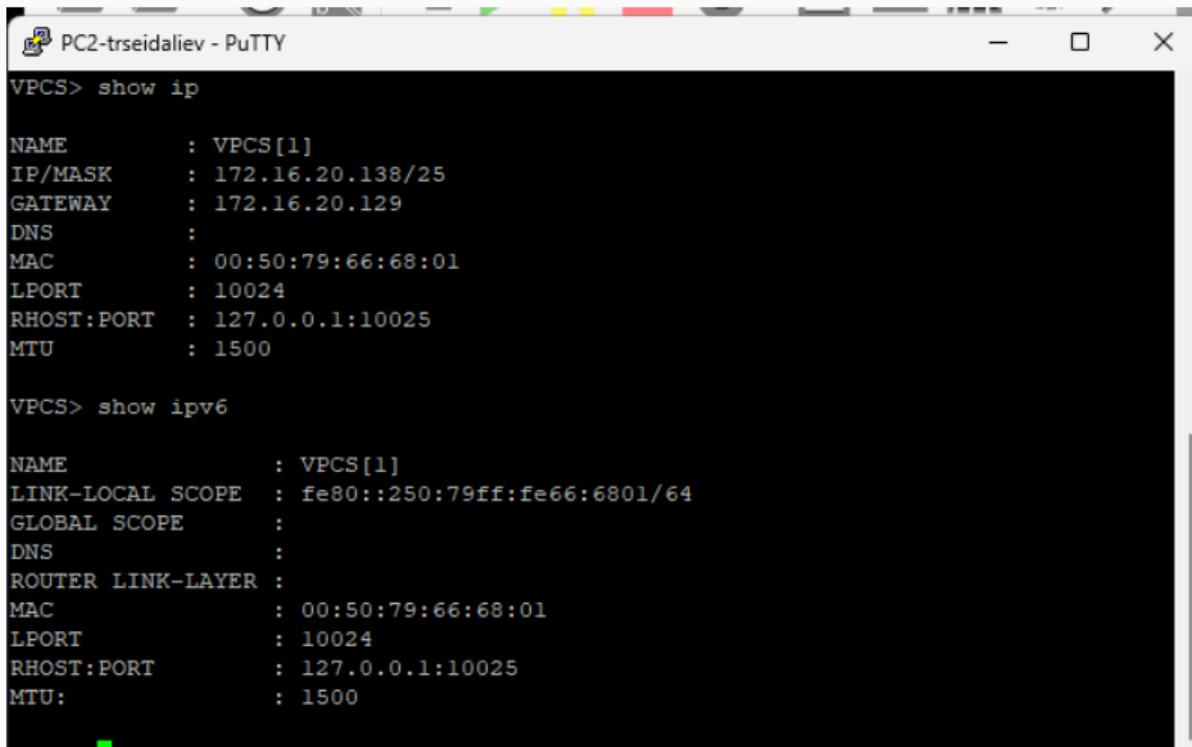
VPCS> show ipv6

NAME      : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6800/64
GLOBAL SCOPE   :
DNS       :
ROUTER LINK-LAYER :
MAC       : 00:50:79:66:68:00
LPORT     : 10022
RHOST:PORT   : 127.0.0.1:10023
```

Конфигурация PC2

IPv4: из диапазона 172.16.20.128/26

IPv6: SLAAC



PC2-trseidaliev - Putty

```
VPCS> show ip

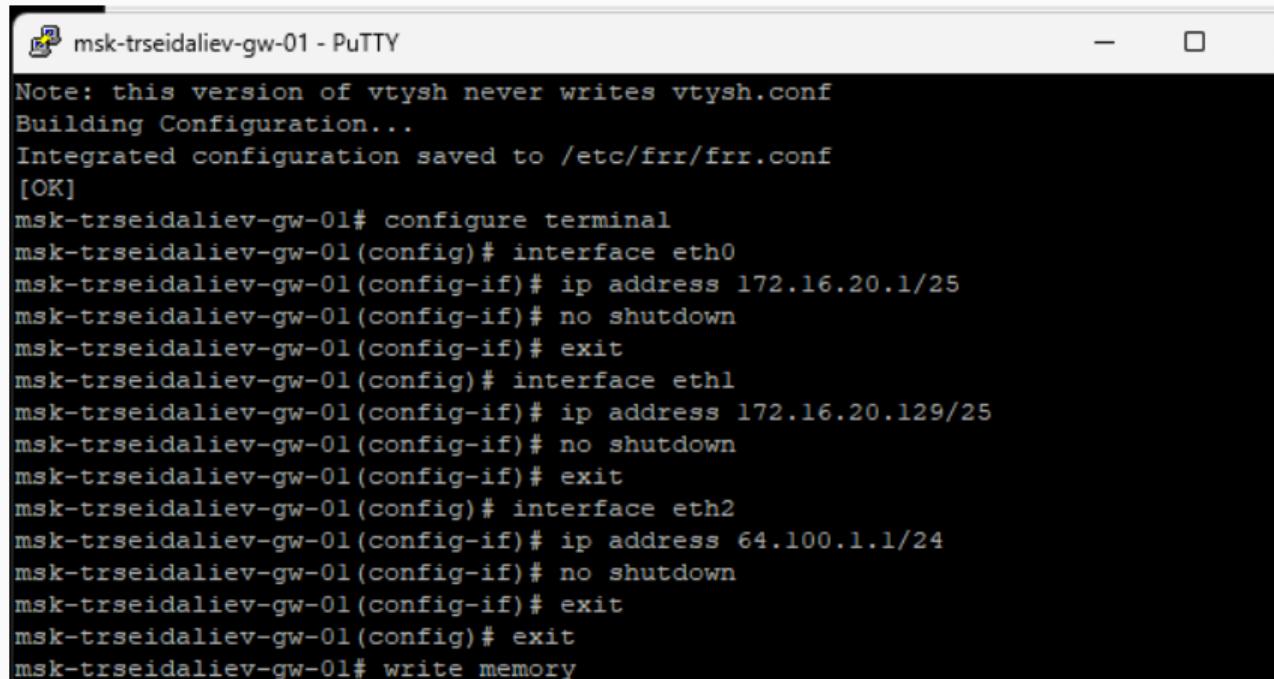
NAME      : VPCS[1]
IP/MASK   : 172.16.20.138/25
GATEWAY   : 172.16.20.129
DNS       :
MAC       : 00:50:79:66:68:01
LPORT     : 10024
RHOST:PORT : 127.0.0.1:10025
MTU       : 1500

VPCS> show ipv6

NAME      : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6801/64
GLOBAL SCOPE   :
DNS       :
ROUTER LINK-LAYER :
MAC       : 00:50:79:66:68:01
LPORT     : 10024
RHOST:PORT   : 127.0.0.1:10025
MTU       : 1500
```

Интерфейсы FRR

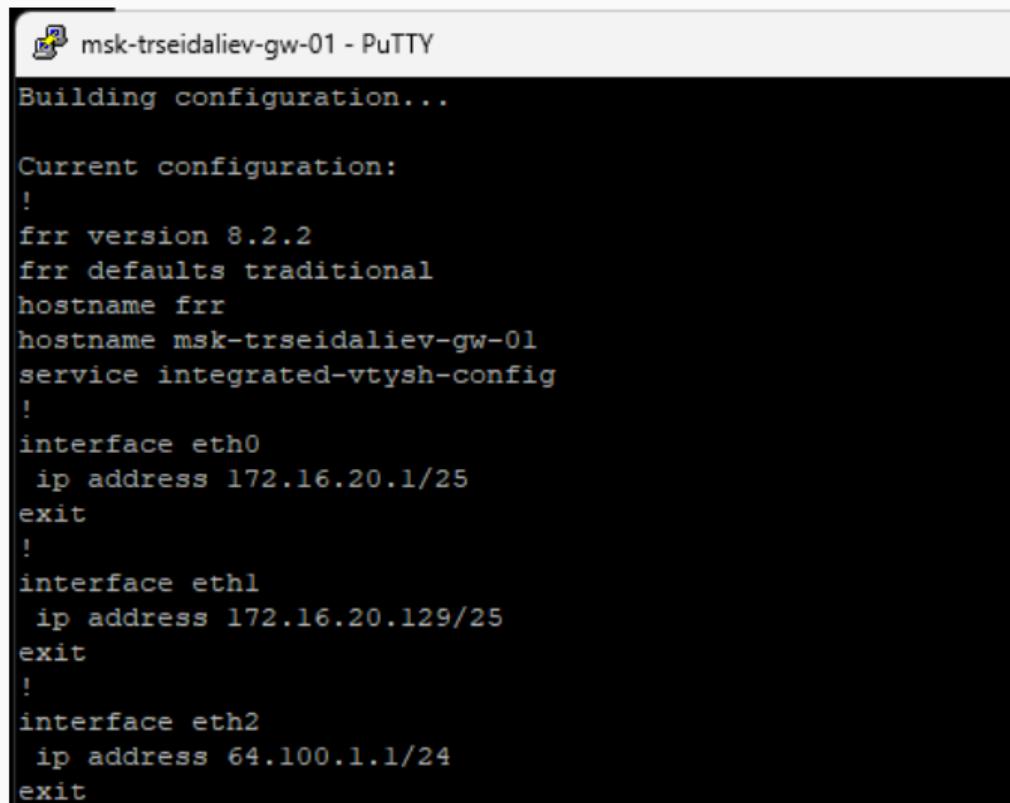
- eth0 — 172.16.20.1/25
- eth1 — 172.16.20.129/25
- eth2 — 64.100.1.1/24



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

Проверка конфигурации

show running-config и show interface brief



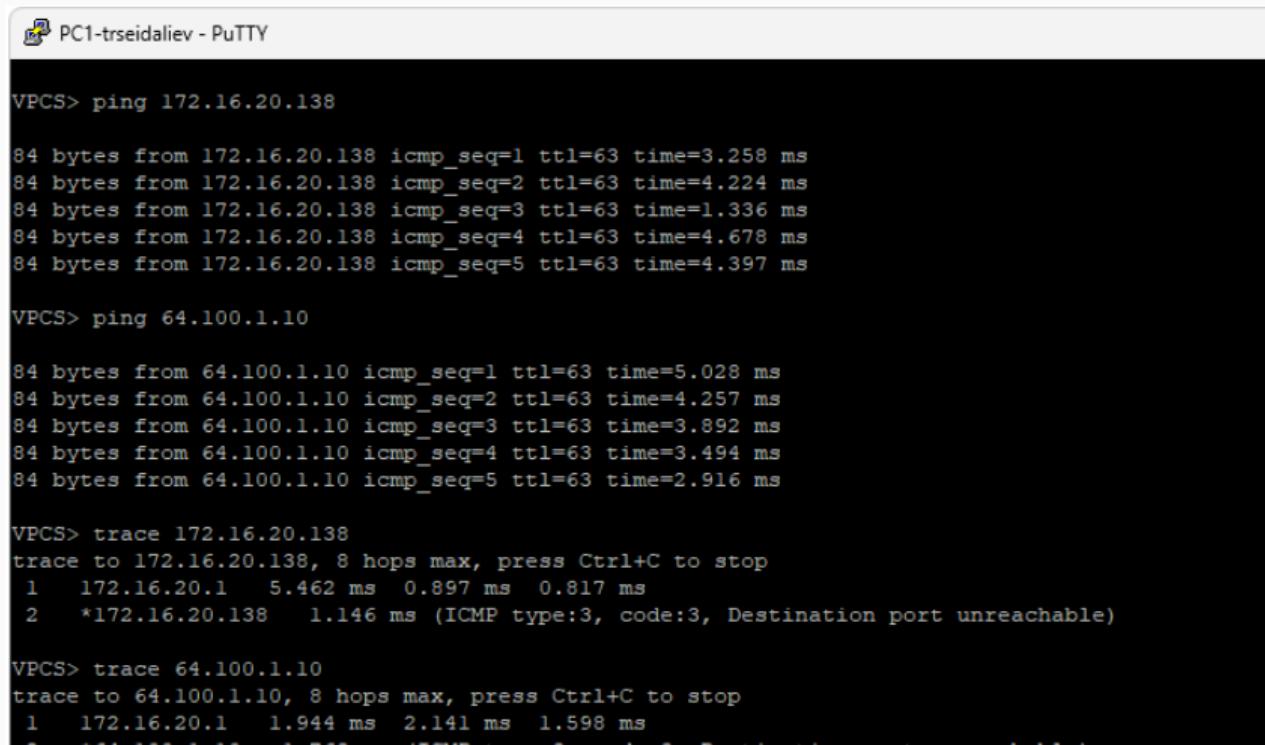
msk-trseidaliev-gw-01 - PuTTY

```
Building configuration...

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

Ping и трассировка

- PC1 → PC2
- PC1 → Server



```
VPCS> ping 172.16.20.138
84 bytes from 172.16.20.138 icmp_seq=1 ttl=63 time=3.258 ms
84 bytes from 172.16.20.138 icmp_seq=2 ttl=63 time=4.224 ms
84 bytes from 172.16.20.138 icmp_seq=3 ttl=63 time=1.336 ms
84 bytes from 172.16.20.138 icmp_seq=4 ttl=63 time=4.678 ms
84 bytes from 172.16.20.138 icmp_seq=5 ttl=63 time=4.397 ms

VPCS> ping 64.100.1.10
84 bytes from 64.100.1.10 icmp_seq=1 ttl=63 time=5.028 ms
84 bytes from 64.100.1.10 icmp_seq=2 ttl=63 time=4.257 ms
84 bytes from 64.100.1.10 icmp_seq=3 ttl=63 time=3.892 ms
84 bytes from 64.100.1.10 icmp_seq=4 ttl=63 time=3.494 ms
84 bytes from 64.100.1.10 icmp_seq=5 ttl=63 time=2.916 ms

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    5.462 ms   0.897 ms   0.817 ms
 2  *172.16.20.138    1.146 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    1.944 ms   2.141 ms   1.598 ms
 2  *172.16.20.138    1.146 ms (ICMP type:3, code:3, Destination port unreachable)
```

Анализ трафика

ARP-запросы и ICMP-ответы

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) request id=0x5907, seq=1/256, ttl=63 (reply in 4)
2	0.000697	Private_66:68:04	Broadcast	ARP	64	Who has 64.100.1.1? Tell 64.100.1.10
3	0.001661	0c:06:fc:75:00:02	Private_66:68:04	ARP	60	64.100.1.1 is at 0c:06:fc:75:00:02
4	0.002144	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) reply id=0x5907, seq=1/256, ttl=64 (request in 4)
5	1.005321	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) request id=0xa07, seq=2/512, ttl=63 (reply in 6)
6	1.005756	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) reply id=0xa07, seq=2/512, ttl=64 (request in 6)
7	2.009163	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) request id=0xb07, seq=3/768, ttl=63 (reply in 8)
8	2.009670	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) reply id=0xb07, seq=3/768, ttl=64 (request in 8)
9	3.012905	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) request id=0xc07, seq=4/1024, ttl=63 (reply in 9)
10	3.013171	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) reply id=0xc07, seq=4/1024, ttl=64 (request in 9)
11	4.015071	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) request id=0xd07, seq=5/1280, ttl=63 (reply in 10)
12	4.015368	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) reply id=0xd07, seq=5/1280, ttl=64 (request in 10)
13	5.048474	0c:06:fc:75:00:02	Private_66:68:04	ARP	60	Who has 64.100.1.10? Tell 64.100.1.1
14	5.049574	Private_66:68:04	0c:06:fc:75:00:02	ARP	60	64.100.1.10 is at 00:50:79:66:68:04


```
Frame 13: 60 bytes on wire (480 bits), 60 bytes captured (480 bits)
Ethernet II, Src: Private_66:68:04 (0c:06:fc:75:00:02), Dst: Private_66:68:04 (0c:06:fc:75:00:02)
Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: 0c:06:fc:75:00:02 (0c:06:fc:75:00:02)
    Sender IP address: 64.100.1.1
    Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
    Target IP address: 64.100.1.10
0000  00 50 79 66 68 04 0c 06 fc 75 00 02 08 06 00 01 Pyfh...u
0010  08 00 06 04 00 01 0c 06 fc 75 00 02 40 64 01 01 .....u
0020  00 00 00 00 00 00 40 64 01 0a 00 00 00 00 00 00 .....@d
0030  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 .....@d
```

Адрес: 2001:db8:c0de:12::/64



PC3-trseidaliev - PuTTY

```
VPCS> show ip

NAME      : VPCS[1]
IP/MASK   : 0.0.0.0/0
GATEWAY   : 0.0.0.0
DNS       :
MAC       : 00:50:79:66:68:02
LPORT     : 10044
RHOST:PORT : 127.0.0.1:10045
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     : 10044
RHOST:PORT : 127.0.0.1:10045
MTU       : 1500

VPCS>
```

PW4-ITSEIDALIEV

Адрес: 2001:db8:c0de:13::/64

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	:	10046
RHOST:PORT	:	127.0.0.1:10047
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	:	10046
RHOST:PORT	:	127.0.0.1:10047
MTU:	:	1500

VPCS>

IPv6: 2001:db8:c0de:11::/64

Двойной стек: IPv4 + IPv6

The screenshot shows a PuTTY terminal window with the title "server-trseidaliev - PuTTY". The window displays two sets of network configuration commands and their outputs:

```
VPCS> show ip
NAME      : VPCS[1]
IP/MASK   : 64.100.1.10/24
GATEWAY   : 64.100.1.1
DNS       :
MAC       : 00:50:79:66:68:04
LPORT     : 10026
RHOST:PORT: 127.0.0.1:10027
MTU       : 1500

VPCS> show ipv6
NAME      : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6804/64
GLOBAL SCOPE    : 2001:db8:c0de:11::a/64
DNS       :
ROUTER LINK-LAYER :
MAC       : 00:50:79:66:68:04
LPORT     : 10026
RHOST:PORT: 127.0.0.1:10027
MTU       : 1500
```

Назначение адресов и RA

```
msk-trseidaliev-gw-02 - PuTTY
VyOS is a free software distribution that includes multiple components,
you can check individual component licenses under /usr/share/doc/*copyright
vyos@msk-trseidaliev-gw-02:~$ configure
[edit]
vyos@msk-trseidaliev-gw-02# set interfaces ethernet eth0 address 2001:db8:0de:12
::1/64
[edit]
vyos@msk-trseidaliev-gw-02# set service router-advert interface eth0 prefix 2001
:db8:c0de:12::/64
[edit]
vyos@msk-trseidaliev-gw-02# set interfaces ethernet eth1 address 2001:db8:0de:13
::1/64
[edit]
vyos@msk-trseidaliev-gw-02# set service router-advert interface eth1 prefix 2001
:db8:c0de:13::/64
[edit]
vyos@msk-trseidaliev-gw-02# set interfaces ethernet eth2 address 2001:db8:0de:11
::1/64
[edit]
vyos@msk-trseidaliev-gw-02# set service router-advert interface eth2 prefix 2001
:db8:c0de:11::/64
[edit]
vyos@msk-trseidaliev-gw-02#
```

Проверка интерфейсов

```
msk-trseidaliev-gw-02 - PuTTY

[edit]
vyos@msk-trseidaliev-gw-02# commit
[edit]
vyos@msk-trseidaliev-gw-02# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-trseidaliev-gw-02# show interfaces
 ethernet eth0 {
    address 2001:db8:c0de:12::1/64
    hw-id 0c:60:cb:ff:00:00
}
 ethernet eth1 {
    address 2001:db8:c0de:13::1/64
    hw-id 0c:60:cb:ff:00:01
}
 ethernet eth2 {
    address 2001:db8:c0de:11::1/64
    hw-id 0c:60:cb:ff:00:02
}
 loopback lo {
}
[edit]
vyos@msk-trseidaliev-gw-02#
```

Ping PC4 → PC3 и Server

```
PC4-trseidaliev - PuTTY

2001:db8:c0de:12::a icmp6_seq=2 ttl=62 time=2.153 ms
2001:db8:c0de:12::a icmp6_seq=3 ttl=62 time=2.182 ms
2001:db8:c0de:12::a icmp6_seq=4 ttl=62 time=2.143 ms
2001:db8:c0de:12::a icmp6_seq=5 ttl=62 time=1.484 ms

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

2001:db8:c0de:11::a icmp6_seq=1 ttl=62 time=3.799 ms
2001:db8:c0de:11::a icmp6_seq=2 ttl=62 time=2.657 ms
2001:db8:c0de:11::a icmp6_seq=3 ttl=62 time=3.253 ms
2001:db8:c0de:11::a icmp6_seq=4 ttl=62 time=2.837 ms
2001:db8:c0de:11::a icmp6_seq=5 ttl=62 time=1.424 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    2.569 ms   1.390 ms   1.719 ms
 2 2001:db8:c0de:12::a    1.837 ms   1.448 ms   1.615 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    1.128 ms   1.328 ms   1.041 ms
 2 2001:db8:c0de:11::a    1.968 ms   2.501 ms   2.157 ms

VPCS>
VPCS> ping 64.100.1.10

host (64.100.1.10) not reachable

VPCS> ping 172.16.20.138

host (172.16.20.138) not reachable

VPCS>
```

ICMPv6-трафик

No.	Time	Source	Destination	Protocol	Length Info
• 1	0.000000	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118 Echo (ping) request id=0x100d, seq=1, hop limit=64 (reply in
2	0.002012	2001:db8:c0de:12::a	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0x100d, seq=1, hop limit=62 (request in
3	1.003800	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118 Echo (ping) request id=0x100d, seq=2, hop limit=64 (reply in
4	1.005269	2001:db8:c0de:12::a	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0x100d, seq=2, hop limit=62 (request in
5	2.007214	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118 Echo (ping) request id=0x100d, seq=3, hop limit=64 (reply in
6	2.010196	2001:db8:c0de:12::a	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0x100d, seq=3, hop limit=62 (request in
7	3.011815	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118 Echo (ping) request id=0x100d, seq=4, hop limit=64 (reply in
8	3.012927	2001:db8:c0de:12::a	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0x100d, seq=4, hop limit=62 (request in
9	4.014646	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118 Echo (ping) request id=0x100d, seq=5, hop limit=64 (reply in
10	4.017388	2001:db8:c0de:12::a	2001:db8:c0de:11::a	ICMPv6	118 Echo (ping) reply id=0x100d, seq=5, hop limit=62 (request in
11	5.162938	fe80::e60:cbff:feff_	2001:db8:c0de:11::a	ICMPv6	86 Neighbor Solicitation for 2001:db8:c0de:11::a from 0c:60:cb:1
12	6.187175	fe80::e60:cbff:feff_	2001:db8:c0de:11::a	ICMPv6	86 Neighbor Solicitation for 2001:db8:c0de:11::a from 0c:60:cb:1
13	7.210803	fe80::e60:cbff:feff_	2001:db8:c0de:11::a	ICMPv6	86 Neighbor Solicitation for 2001:db8:c0de:11::a from 0c:60:cb:1

Frame 2: 118 bytes on wire (944 bits), 118 bytes captured (944 bits)
Ethernet II, Src: 0c:60:cb:ff:00:02 (0c:60:cb:ff:00:02), Dst: Priv. (00:00:00:00:00:00)
Internet Protocol Version 6, Src: 2001:db8:c0de:12::a, Dst: 2001:db8:c0de:11::a
Internet Control Message Protocol v6
Type: Echo (ping) reply (129)
Code: 0
Checksum: 0x99fd [correct]
[Checksum Status: Good]
Identifier: 0x100d
Sequence: 1
[Response To: 1]
[Response Time: 2,012 ms]
Data (56 bytes)
Data: 000102030405060708090a0b0c0d0e0f101112131415161718191a1
[Length: 56]

0000	00	50	79	66	68	04	0c	60	cb	ff	00	02	86	dd	60	00	Pyfh...
0010	00	00	00	40	3a	3e	20	01	0d	b8	c0	de	00	12	00	00	@:>...
0020	00	00	00	00	00	00	0a	20	01	0d	b8	c0	de	00	11	00	00
0030	00	00	00	00	00	00	0a	81	00	99	fd	10	0d	00	01	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	"#\$%&() *+,234567
0070	32	33	34	35	36	37											

Самостоятельное задание

Подсеть 1

- IPv4: 10.10.1.96/27
- IPv6: 2001:db8:1:1::/64

Подсеть 2

- IPv4: 10.10.1.16/28
- IPv6: 2001:db8:1:4::/64

Таблица адресов

Устройство	Интерфейс	IPv4	Маска	IPv6	Префикс
gw	eth0	10.10.1.97	/27	2001:db8:1:1::1	/64
gw	eth1	10.10.1.17	/28	2001:db8:1:4::1	/64
PC1	vpcs	10.10.1.100	/27	2001:db8:1:1::a	/64
PC2	vpcs	10.10.1.20	/28	2001:db8:1:4::a	/64

PC1-trseidaliev - PuTTY

VPCS> show ip

```
NAME      : VPCS[1]
IP/MASK   : 10.10.1.100/27
GATEWAY   : 10.10.1.97
DNS       :
MAC       : 00:50:79:66:68:00
LPORT     : 10008
RHOST:PORT : 127.0.0.1:10009
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     : 10008
RHOST:PORT : 127.0.0.1:10009
MTU       : 1500
```

VPCS>



PC2-trseidaliev - PuTTY

```
VPCS> show ip
NAME      : VPCS[1]
IP/MASK   : 10.10.1.20/28
GATEWAY   : 10.10.1.17
DNS       :
MAC       : 00:50:79:66:68:01
LPORT     : 10016
RHOST:PORT: 127.0.0.1:10017
MTU       : 1500

VPCS> show ipv6
SNAME      : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6801/64
GLOBAL SCOPE    : 2001:db8:1:4::a/64
DNS       :
ROUTER LINK-LAYER: 0c:76:30:16:00:01
MAC       : 00:50:79:66:68:01
LPORT     : 10016
RHOST:PORT   : 127.0.0.1:10017
MTU:        : 1500

VPCS>
```

Рис. 17: PC2 show ip

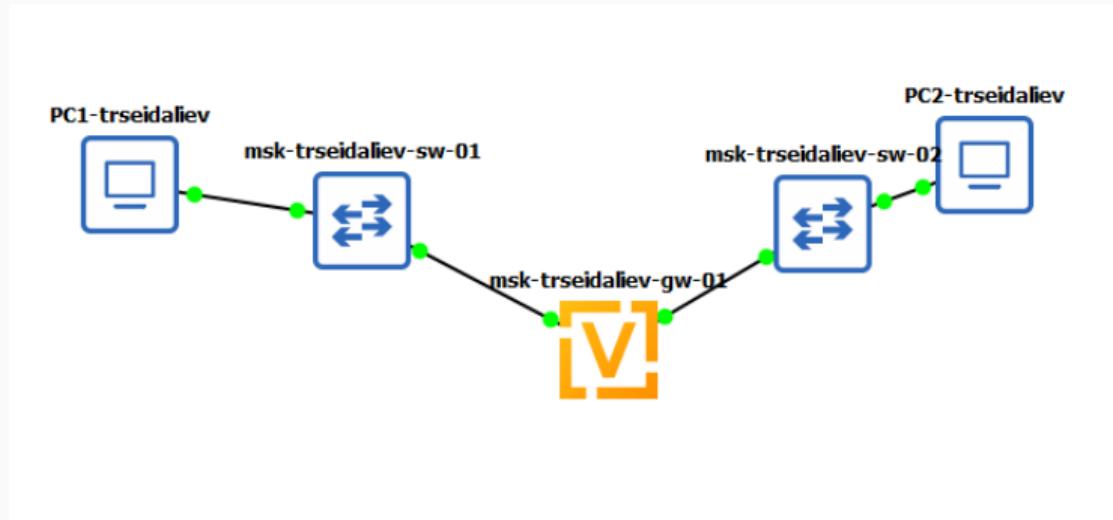
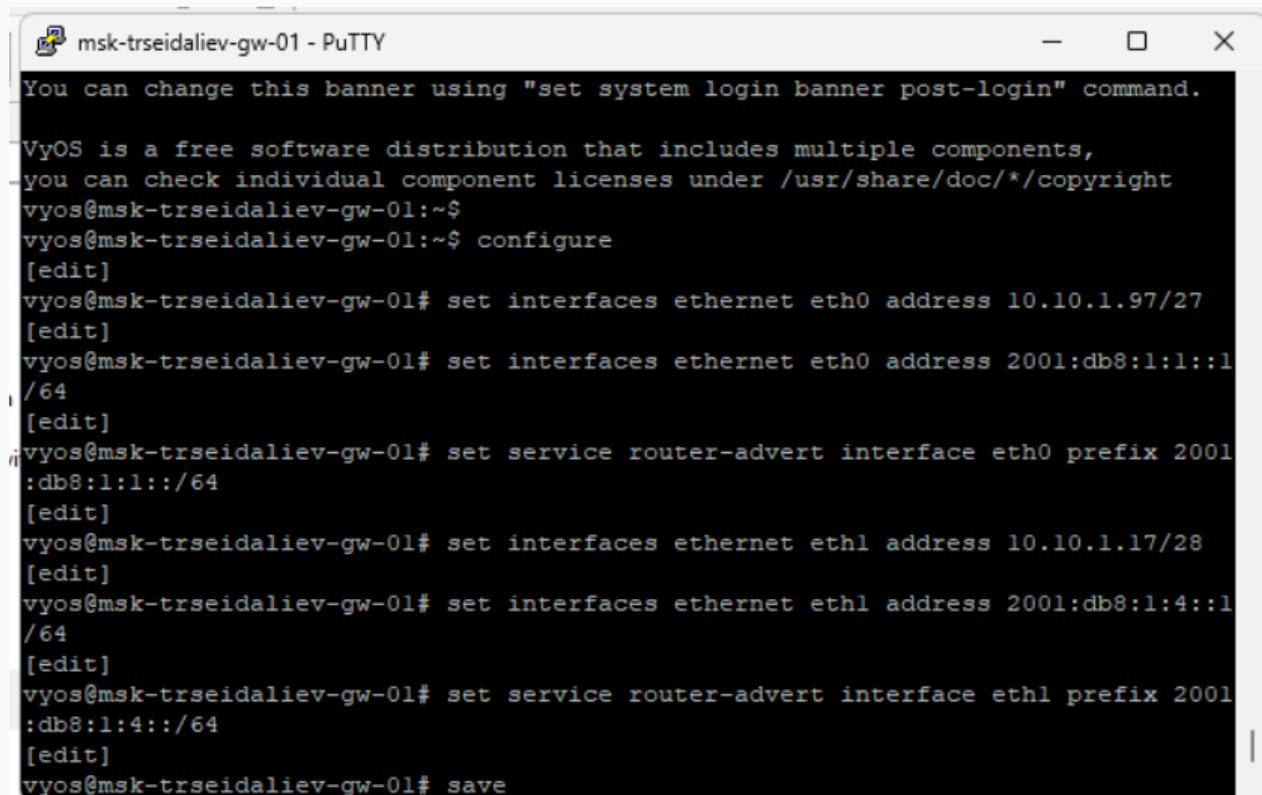


Рис. 18: Топология

Настройка маршрутизатора

```
PC1-trseidaliev - PuTTY  
VPCS> show ip  
  
NAME      : VPCS[1]  
IP/MASK   : 10.10.1.100/27  
GATEWAY   : 10.10.1.97  
DNS       :  
MAC       : 00:50:79:66:68:00  
LPORT     : 10008  
RHOST:PORT: 127.0.0.1:10009  
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 : 0c:76:30:16:00:00  
MAC       : 00:50:79:66:68:00  
LPORT     : 10008  
RHOST:PORT   : 127.0.0.1:10009  
MTU       : 1500  
  
VPCS>
```

Проверки



```
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@msk-trseidaliev-gw-01:~$ configure
[edit]
vyos@msk-trseidaliev-gw-01# set interfaces ethernet eth0 address 10.10.1.97/27
[edit]
vyos@msk-trseidaliev-gw-01# set interfaces ethernet eth0 address 2001:db8:1:1::1
/64
[edit]
vyos@msk-trseidaliev-gw-01# set service router-advert interface eth0 prefix 2001
:db8:1:1::/64
[edit]
vyos@msk-trseidaliev-gw-01# set interfaces ethernet eth1 address 10.10.1.17/28
[edit]
vyos@msk-trseidaliev-gw-01# set interfaces ethernet eth1 address 2001:db8:1:4::1
/64
[edit]
vyos@msk-trseidaliev-gw-01# set service router-advert interface eth1 prefix 2001
:db8:1:4::/64
[edit]
vyos@msk-trseidaliev-gw-01# save
```

Рис. 20: Ping PC1

Проверки

```
PC1-trseidaliev - PuTTY

VPCS> [ing 10.10.1.20
Bad command: "[ing 10.10.1.20". Use ? for help.

VPCS> ping 10.10.1.20

84 bytes from 10.10.1.20 icmp_seq=1 ttl=63 time=5.612 ms
84 bytes from 10.10.1.20 icmp_seq=2 ttl=63 time=3.600 ms
84 bytes from 10.10.1.20 icmp_seq=3 ttl=63 time=3.566 ms
84 bytes from 10.10.1.20 icmp_seq=4 ttl=63 time=2.339 ms
84 bytes from 10.10.1.20 icmp_seq=5 ttl=63 time=3.560 ms

VPCS> ping 2001:db8:1:4::a

2001:db8:1:4::a icmp6_seq=1 ttl=62 time=9.651 ms
2001:db8:1:4::a icmp6_seq=2 ttl=62 time=5.577 ms
2001:db8:1:4::a icmp6_seq=3 ttl=62 time=6.361 ms
2001:db8:1:4::a icmp6_seq=4 ttl=62 time=1.455 ms
2001:db8:1:4::a icmp6_seq=5 ttl=62 time=1.925 ms

VPCS>
```

Итоги работы

Основные результаты

- Выполнено детальное разбиение IPv4/IPv6-сетей
- Настроены двойные стеки на ПК и маршрутизаторах
- Проверена маршрутизация, ARP/ND, ICMPv4/ICMPv6
- Подтверждена корректная работа сетей и взаимодействие подсетей только через маршрутизатор