

Сетевые технологии

Лабораторная работа №6

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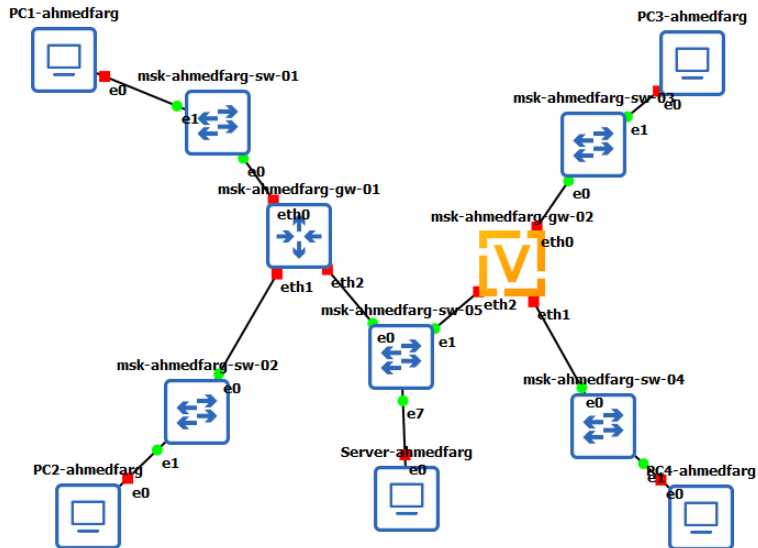
10 ноября 2025

Российский университет дружбы народов, Москва, Россия

Цель работы

- Построить топологии
- Настроить IPv4 / IPv6
- Проверить связность
- Проанализировать трафик Wireshark

Выполнение



Устройство	IP / Mask	Gateway
PC1	172.16.20.10/25	172.16.20.1
PC2	172.16.20.138/25	172.16.20.129
Server	64.100.1.10/24	64.100.1.1

Настройка IPv4 на PC1

PC1-ahmedfarg - 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
MTU            : 1500
```

VPCS> █

Настройка IPv4 на PC2

```
PC2-ahmedfarg - 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

VPCS> █
```


Настройка IPv4 на сервере



Server-ahmedfarg - PuTTY

```
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      : 10028
RHOST:PORT  : 127.0.0.1:10029
MTU         : 1500
```

```
VPCS> show ipv6
```

```
NAME           : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6804/64
GLOBAL SCOPE    :
DNS            :
ROUTER LINK-LAYER :
MAC            : 00:50:79:66:68:04
LPORT          : 10028
RHOST:PORT      : 127.0.0.1:10029
MTU:           : 1500
```

```
VPCS> █
```

Настройка IPv4 на маршрутизаторе FRR

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

msk-ahmedfarg-gw-01 - PuTTY

```
Building configuration...

Current configuration:
!
frr version 8.2.2
frr defaults traditional
hostname frr
hostname msk-ahmedfarg-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-ahmedfarg-gw-01#
```

Проверка связности IPv4

```
PC1-ahmedfarg - PuTTY

VPCS> ping 172.16.20.138

84 bytes from 172.16.20.138 icmp_seq=1 ttl=63 time=2.420 ms
84 bytes from 172.16.20.138 icmp_seq=2 ttl=63 time=2.664 ms
84 bytes from 172.16.20.138 icmp_seq=3 ttl=63 time=2.798 ms
84 bytes from 172.16.20.138 icmp_seq=4 ttl=63 time=2.391 ms
84 bytes from 172.16.20.138 icmp_seq=5 ttl=63 time=3.417 ms

VPCS> ping 64.100.1.10

84 bytes from 64.100.1.10 icmp_seq=1 ttl=63 time=4.526 ms
84 bytes from 64.100.1.10 icmp_seq=2 ttl=63 time=2.481 ms
84 bytes from 64.100.1.10 icmp_seq=3 ttl=63 time=1.634 ms
84 bytes from 64.100.1.10 icmp_seq=4 ttl=63 time=0.759 ms
84 bytes from 64.100.1.10 icmp_seq=5 ttl=63 time=1.557 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    1.425 ms  0.596 ms  0.575 ms
 2  *172.16.20.138  1.178 ms (ICMP type:3, code:3, Destination port unreachable)

VPCS> tarce 64.100.1.10
Bad command: "tarce 64.100.1.10". Use ? for help.

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    0.806 ms  0.593 ms  0.542 ms
 2  *64.100.1.10   1.978 ms (ICMP type:3, code:3, Destination port unreachable)

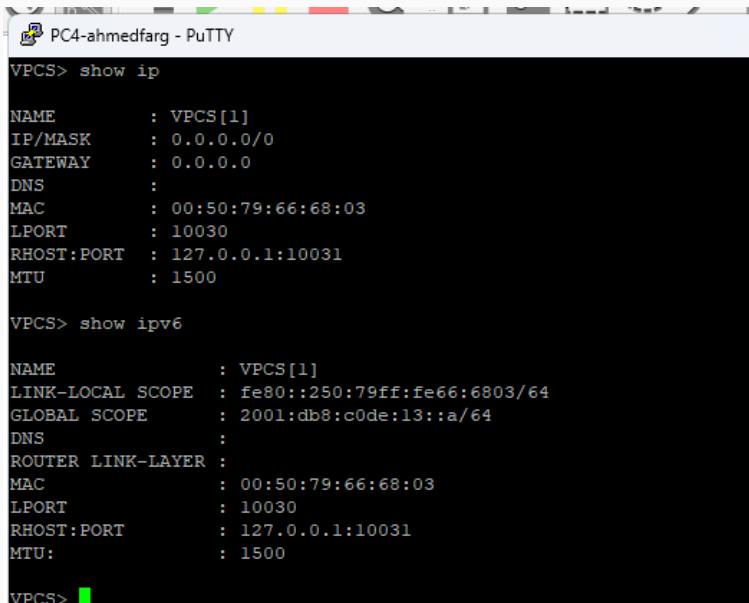
VPCS> █
```

Устройство	IPv6 / Prefix
PC3	2001:db8:c0de:12::a/64
PC4	2001:db8:c0de:13::a/64
Server	2001:db8:c0de:11::a/64

```
PC3-ahmedfarg - 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     : 10026
RHOST:PORT : 127.0.0.1:10027
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        : 10026
RHOST:PORT    : 127.0.0.1:10027
MTU           : 1500

VPCS>
```



```
PC4-ahmedfarg - PuTTY

VPCS> show ip

NAME       : VPCS[1]
IP/MASK     : 0.0.0.0/0
GATEWAY     : 0.0.0.0
DNS         :
MAC        : 00:50:79:66:68:03
LPORT      : 10030
RHOST:PORT  : 127.0.0.1:10031
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        : 10030
RHOST:PORT    : 127.0.0.1:10031
MTU:         : 1500

VPCS>
```

```
Server-ahmedfarg - PuTTY

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          : 10028
RHOST:PORT     : 127.0.0.1:10029
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          : 10028
RHOST:PORT     : 127.0.0.1:10029
MTU            : 1500

VPCS>
```


IPv6 настройка на VyOS

```
msk-ahmedfarg-gw-02 - PuTTY
: a/64
[edit]
vyos@msk-ahmedfarg-gw-02# set service router-advert interface eth0 prefix 2001:
db8:c0de:12::/64
[edit]
vyos@msk-ahmedfarg-gw-02# delete interfaces ethernet eth0 address 2001:db8:c0de:
12::a/64
[edit]
vyos@msk-ahmedfarg-gw-02# set interfaces ethernet eth0 address 2001:db8:c0de:12:
:1/64
[edit]
vyos@msk-ahmedfarg-gw-02# set interfaces ethernet eth1 address 2001:db8:c0de:13:
:1/64
[edit]
vyos@msk-ahmedfarg-gw-02# set service router-advert interface eth1 prefix 2001:
db8:c0de:13::/64
[edit]
vyos@msk-ahmedfarg-gw-02# set interfaces ethernet eth2 address 2001:db8:c0de:11:
:1/64
[edit]
vyos@msk-ahmedfarg-gw-02# set service router-advert interface eth2 prefix 2001:
db8:c0de:11::/64
[edit]
vyos@msk-ahmedfarg-gw-02#
```

Проверка интерфейсов VyOS

```
msk-ahmedfarg-gw-02 - PuTTY
[edit]
vyos@msk-ahmedfarg-gw-02# commit
[edit]
vyos@msk-ahmedfarg-gw-02# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ahmedfarg-gw-02# show interfaces
  ethernet eth0 {
    address 2001:db8:c0de:12::1/64
    hw-id 0c:71:03:bb:00:00
  }
  ethernet eth1 {
    address 2001:db8:c0de:13::1/64
    hw-id 0c:71:03:bb:00:01
  }
  ethernet eth2 {
    address 2001:db8:c0de:11::1/64
    hw-id 0c:71:03:bb:00:02
  }
  loopback lo {
  }
[edit]
vyos@msk-ahmedfarg-gw-02#
```

```
PC3-ahmedfarg - PuTTY

VPCS> ping 172.16.20.10

host (172.16.20.10) not reachable

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

2001:db8:c0de:13::a icmp6_seq=1 ttl=62 time=6.594 ms
2001:db8:c0de:13::a icmp6_seq=2 ttl=62 time=2.450 ms
2001:db8:c0de:13::a icmp6_seq=3 ttl=62 time=2.873 ms
2001:db8:c0de:13::a icmp6_seq=4 ttl=62 time=2.056 ms
2001:db8:c0de:13::a icmp6_seq=5 ttl=62 time=2.443 ms

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

2001:db8:c0de:11::a icmp6_seq=1 ttl=62 time=3.532 ms
2001:db8:c0de:11::a icmp6_seq=2 ttl=62 time=2.672 ms
2001:db8:c0de:11::a icmp6_seq=3 ttl=62 time=1.959 ms
2001:db8:c0de:11::a icmp6_seq=4 ttl=62 time=3.403 ms
2001:db8:c0de:11::a icmp6_seq=5 ttl=62 time=1.943 ms

VPCS> █
```

Ping IPv4 и IPv6 на сервере Dual Stack

Server-ahmedfarg - PuTTY

```
VPCS> ping 172.16.20.10
```

```
84 bytes from 172.16.20.10 icmp_seq=1 ttl=63 time=4.039 ms
84 bytes from 172.16.20.10 icmp_seq=2 ttl=63 time=1.754 ms
84 bytes from 172.16.20.10 icmp_seq=3 ttl=63 time=1.799 ms
84 bytes from 172.16.20.10 icmp_seq=4 ttl=63 time=2.786 ms
84 bytes from 172.16.20.10 icmp_seq=5 ttl=63 time=2.131 ms
```

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

```
2001:db8:c0de:13::a icmp6_seq=1 ttl=62 time=2.028 ms
2001:db8:c0de:13::a icmp6_seq=2 ttl=62 time=1.611 ms
2001:db8:c0de:13::a icmp6_seq=3 ttl=62 time=3.577 ms
2001:db8:c0de:13::a icmp6_seq=4 ttl=62 time=2.758 ms
2001:db8:c0de:13::a icmp6_seq=5 ttl=62 time=3.199 ms
```

```
VPCS> █
```

Wireshark — ARP / ICMP / ICMPv6

No.	Time	Source	Destination	Protocol	Length	Info
14	21.929358	0c:10:b3:9d:00:02	Private_66:68:04	ARP	60	64.100.1.1 is at 0c:10:b3:9d:00:02
15	21.931856	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0x5112, seq=1/256, ttl=64 (reply in 16)
16	21.934742	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0x5112, seq=1/256, ttl=63 (request in 15)
17	22.936453	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0x5212, seq=2/512, ttl=64 (reply in 18)
18	22.937814	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0x5212, seq=2/512, ttl=63 (request in 17)
19	23.938990	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0x5312, seq=3/768, ttl=64 (reply in 20)
20	23.940442	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0x5312, seq=3/768, ttl=63 (request in 19)
21	24.942159	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0x5412, seq=4/1024, ttl=64 (reply in 22)
22	24.944395	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0x5412, seq=4/1024, ttl=63 (request in 21)
23	25.946384	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0x5512, seq=5/1280, ttl=64 (reply in 24)
24	25.948195	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0x5512, seq=5/1280, ttl=63 (request in 23)
25	26.978516	0c:10:b3:9d:00:02	Private_66:68:04	ARP	60	Who has 64.100.1.10? Tell 64.100.1.1
26	26.979004	Private_66:68:04	0c:10:b3:9d:00:02	ARP	60	64.100.1.10 is at 00:50:79:66:68:04
27	37.496276	2001:db8:c0de:11::a	2001:db8:c0de:13::a	ICMPPv6	118	Echo (ping) request id=0x6112, seq=1, hop limit=64 (reply in 28)

> Frame 25: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface -, id 0

> Ethernet II, Src: 0c:10:b3:9d:00:02 (0c:10:b3:9d:00:02), Dst: Private_66:68:04 (00:50:79:66:68:04)

- > Destination: Private_66:68:04 (00:50:79:66:68:04)
- > Source: 0c:10:b3:9d:00:02 (0c:10:b3:9d:00:02)
- Type: ARP (0x0806)
- [Stream index: 3]
- Padding: 00000000000000000000000000000000

> 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:10:b3:9d:00:02 (0c:10:b3:9d: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

Wireshark — ICMP IPv4

Закхват из Standard input (msk-ahmedfarg-sw-05 Ethernet7 to Server-ahmedfarg Ethernet0)

Файл Правка Вид Запуск Захват Анализ Статистика Телефония Беспроводная связь Инструменты Справка

Примените фильтр отображения ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
8	2.009746	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118	Echo (ping) reply id=0x3c12, seq=3, hop limit=63 (request in 7)
9	3.012175	2001:db8:c0de:12::a	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) request id=0x3c12, seq=4, hop limit=63 (reply in 10)
10	3.012727	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118	Echo (ping) reply id=0x3c12, seq=4, hop limit=63 (request in 9)
11	4.016721	2001:db8:c0de:12::a	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) request id=0x3c12, seq=5, hop limit=63 (reply in 12)
12	4.017069	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118	Echo (ping) reply id=0x3c12, seq=5, hop limit=63 (request in 11)
13	21.927460	Private 66:68:04	Broadcast	ARP	64	Who has 64.100.1.1? Tell 64.100.1.10
14	21.929358	0c:10:b3:9d:00:02	Private 66:68:04	ARP	60	64.100.1.1 is at 0c:10:b3:9d:00:02
15	21.931056	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0x5112, seq=1/256, ttl=64 (reply in 16)
16	21.934742	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0x5112, seq=1/256, ttl=63 (request in 15)
17	22.936453	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0x5212, seq=2/512, ttl=64 (reply in 18)
18	22.937814	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0x5212, seq=2/512, ttl=63 (request in 17)
19	23.938990	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0x5312, seq=3/768, ttl=64 (reply in 20)
20	23.940442	172.16.20.10	64.100.1.10	ICMP	98	Echo (ping) reply id=0x5312, seq=3/768, ttl=63 (request in 19)
21	24.942159	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0x5412, seq=4/1024, ttl=64 (reply in 22)

Frame 15: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, id 0

Ethernet II, Src: Private 66:68:04 (00:50:79:66:68:04), Dst: 0c:10:b3:9d:00:02 (0c:10:b3:9d:00:02)

- Destination: 0c:10:b3:9d:00:02 (0c:10:b3:9d:00:02)
- Source: Private 66:68:04 (00:50:79:66:68:04)
- Type: IPv4 (0x0800)
- [Stream index: 3]

Internet Protocol Version 4, Src: 64.100.1.10, Dst: 172.16.20.10

- 0100 = Version: 4
- 0101 = Header Length: 20 bytes (5)
- Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
- Total Length: 84
- Identification: 0x1251 (4689)
- 000. = Flags: 0x0
- ...0 0000 0000 0000 = Fragment Offset: 0
- Time to Live: 64
- Protocol: ICMP (1)
- Header Checksum: 0x66d0 [validation disabled]
- [Header checksum status: Unverified]
- Source Address: 64.100.1.10
- Destination Address: 172.16.20.10
- [Stream index: 0]

Internet Control Message Protocol

- Type: 8 (Echo (ping) request)
- Code: 0
- Checksum: 0x0cef8 [correct]
- [Checksum Status: Good]
- Identifier (BE): 20754 (0x5112)
- Identifier (LE): 4689 (0x1251)
- Sequence Number (BE): 1 (0x0001)
- Sequence Number (LE): 256 (0x0100)
- [Response frame: 16]
- Data (56 bytes)

0000 0c 10 b3
0010 00 54 12
0020 14 0a 08
0030 0e 0f 10
0040 1e 1f 20
0050 2e 2f 30
0060 3e 3f

Wireshark — ICMPv6 + RA

Захват из Standard input (msk-ahmedfarg-sw-05 Ethernet7 to Server-ahmedfarg Ethernet0)

Файл Правка Вид Запуск Захват Анализ Статистика Телефония Беспроводная связь Инструменты Справка

Примените фильтр отображения ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
2	0.000399	2001:db8:c0de:11::a	fe80::e71:3ff:febb:2	ICMPv6	86	Neighbor Advertisement 2001:db8:c0de:11::a (sol, ovr) is at 00:50:79:66:68:04
3	0.001058	2001:db8:c0de:12::a	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) request id=0x3c12, seq=1, hop limit=63 (reply in 4)
4	0.001415	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118	Echo (ping) reply id=0x3c12, seq=1, hop limit=63 (request in 3)
5	1.005931	2001:db8:c0de:12::a	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) request id=0x3c12, seq=2, hop limit=63 (reply in 6)
6	1.006225	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118	Echo (ping) reply id=0x3c12, seq=2, hop limit=63 (request in 5)
7	2.009305	2001:db8:c0de:12::a	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) request id=0x3c12, seq=3, hop limit=63 (reply in 8)
8	2.009746	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118	Echo (ping) reply id=0x3c12, seq=3, hop limit=63 (request in 7)
9	3.012175	2001:db8:c0de:12::a	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) request id=0x3c12, seq=4, hop limit=63 (reply in 10)
10	3.012727	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118	Echo (ping) reply id=0x3c12, seq=4, hop limit=63 (request in 9)
11	4.016721	2001:db8:c0de:12::a	2001:db8:c0de:11::a	ICMPv6	118	Echo (ping) request id=0x3c12, seq=5, hop limit=63 (reply in 12)
12	4.017069	2001:db8:c0de:11::a	2001:db8:c0de:12::a	ICMPv6	118	Echo (ping) reply id=0x3c12, seq=5, hop limit=63 (request in 11)
13	21.927460	Private_66:68:04	Broadcast	ARP	64	who has 64.100.1.1? Tell 64.100.1.10
14	21.929358	0c:10:b3:9d:00:02	Private_66:68:04	ARP	60	64.100.1.1 is at 0c:10:b3:9d:00:02
15	21.931056	64.100.1.10	172.16.20.10	ICMP	98	Echo (ping) request id=0x5112, seq=1/256, ttl=64 (reply in 16)

Frame 7: 118 bytes on wire (944 bits), 118 bytes captured (944 bits) on interface -, id 0

Ethernet II, Src: 0c:71:03:bb:00:02 (0c:71:03:bb:00:02), Dst: Private_66:68:04 (00:50:79:66:68:04)

- Destination: Private_66:68:04 (00:50:79:66:68:04)
- Source: 0c:71:03:bb:00:02 (0c:71:03:bb:00:02)
- Type: IPv6 (0x86dd)
- [Stream index: 1]

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

- 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: 63
- Source Address: 2001:db8:c0de:12::a
- Destination Address: 2001:db8:c0de:11::a
- [Stream index: 2]

Internet Control Message Protocol v6

- Type: Echo (ping) request (128)
- Code: 0
- Checksum: 0x6ef6 [correct]
- [Checksum Status: Good]
- Identifier: 0x3c12
- Sequence: 3
- [Sequence in: 8]
- Data (56 bytes)

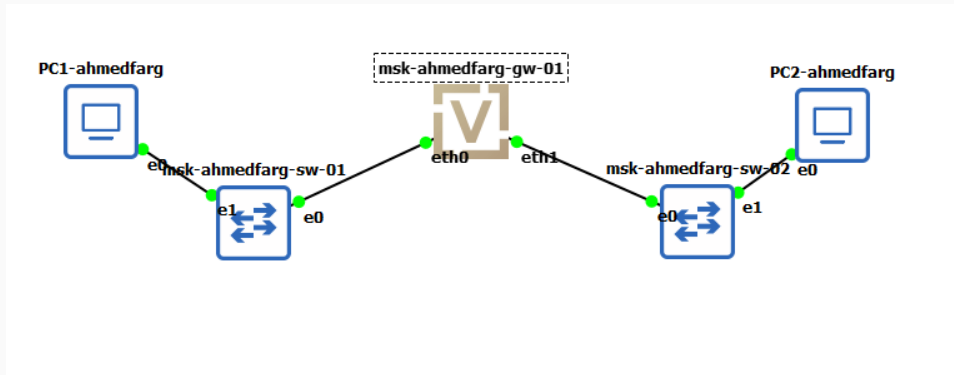


Рис. 18: New topology


```
PC1-ahmedfarg - PuTTY
msk-ahmedfarg-ovm

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      : 10010
RHOST:PORT  : 127.0.0.1:10011
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           : 10010
RHOST:PORT      : 127.0.0.1:10011
MTU             : 1500

VPCS> 
```

```
PC2-ahmedfarg - 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      : 10008
RHOST:PORT  : 127.0.0.1:10009
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        : 10008
RHOST:PORT    : 127.0.0.1:10009
MTU:         : 1500

VPCS>
```

Конфигурация маршрутизатора VyOS

```
msk-ahmedfarg-gw-01 - PuTTY

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

```
msk-ahmedfarg-gw-01 - PuTTY
vyos@msk-ahmedfarg-gw-01# commit
[edit]
vyos@msk-ahmedfarg-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ahmedfarg-gw-01# show interfaces
  ethernet eth0 {
    address 10.10.1.97/27
    address 2001:db8:1:1::1/64
    hw-id 0c:b3:55:9b:00:00
  }
  ethernet eth1 {
    address 10.10.1.17/28
    address 2001:db8:1:4::1/64
    hw-id 0c:b3:55:9b:00:01
  }
  ethernet eth2 {
    hw-id 0c:b3:55:9b:00:02
  }
  loopback lo {
  }
[edit]
vyos@msk-ahmedfarg-gw-01#
```

Проверка ping/trace

PC1-ahmedfarg - PuTTY

```
VPCS> ping 10.10.1.20
```

```
84 bytes from 10.10.1.20 icmp_seq=1 ttl=63 time=3.995 ms
84 bytes from 10.10.1.20 icmp_seq=2 ttl=63 time=4.502 ms
84 bytes from 10.10.1.20 icmp_seq=3 ttl=63 time=4.288 ms
84 bytes from 10.10.1.20 icmp_seq=4 ttl=63 time=6.084 ms
84 bytes from 10.10.1.20 icmp_seq=5 ttl=63 time=3.373 ms
```

```
VPCS> trace 10.10.1.20
```

```
Trace to 10.10.1.20, 8 hops max, press Ctrl+C to stop
```

```
 1  10.10.1.97  3.223 ms  2.020 ms  2.087 ms
 2  *10.10.1.20  3.440 ms (ICMP type:3, code:3, Destination port unreachable)
```

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

```
2001:db8:1:4::a icmp6_seq=1 ttl=62 time=10.439 ms
2001:db8:1:4::a icmp6_seq=2 ttl=62 time=6.426 ms
2001:db8:1:4::a icmp6_seq=3 ttl=62 time=5.193 ms
2001:db8:1:4::a icmp6_seq=4 ttl=62 time=3.521 ms
2001:db8:1:4::a icmp6_seq=5 ttl=62 time=2.268 ms
```

```
VPCS> trace 2001:db8:1:4::a
```

```
Trace to 2001:db8:1:4::a, 64 hops max
```

```
 1 2001:db8:1:1::1  6.675 ms  2.398 ms  1.072 ms
 2 2001:db8:1:4::a  1.592 ms  1.255 ms  1.435 ms
```

```
VPCS> █
```

Итоги

- Выполнена настройка IPv4, IPv6 и Dual Stack
- Устройства связаны в обеих подсетях
- Сервер Dual Stack доступен по обоим протоколам
- Wireshark подтвердил работу ARP, ICMP, ICMPv6