Лабораторная работа №6

Адресация IPv4 и IPv6. Двойной стек

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Цель работы

Основная цель

Изучить принципы распределения IPv4- и IPv6-адресов
и выполнить настройку адресного пространства на устройствах сети.

Настройка в GNS3

Назначение адресов

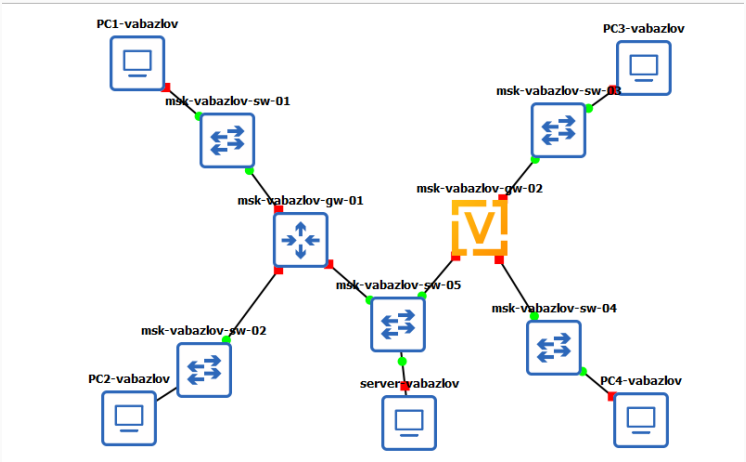
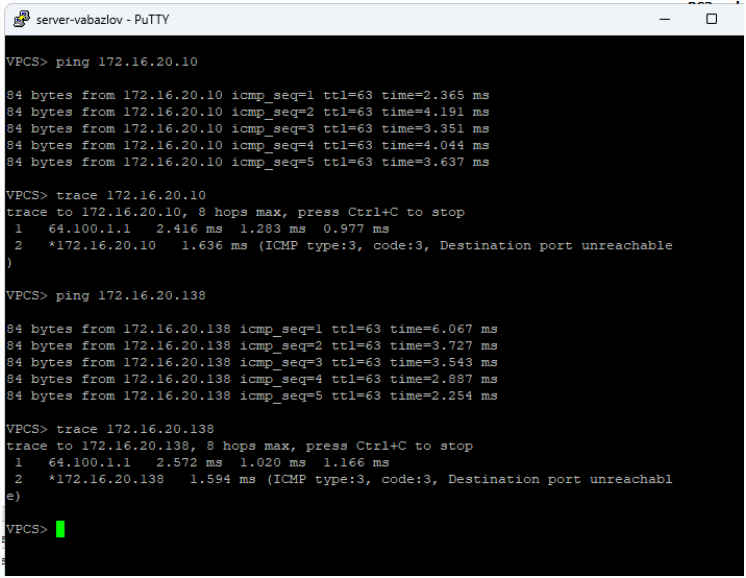
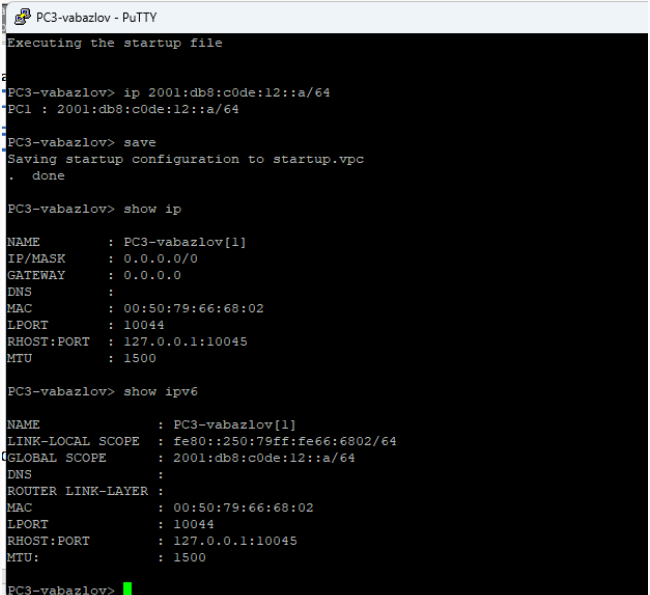


Рис. 1: Топология сети

Проверка сетевой связности



Адреса узлов



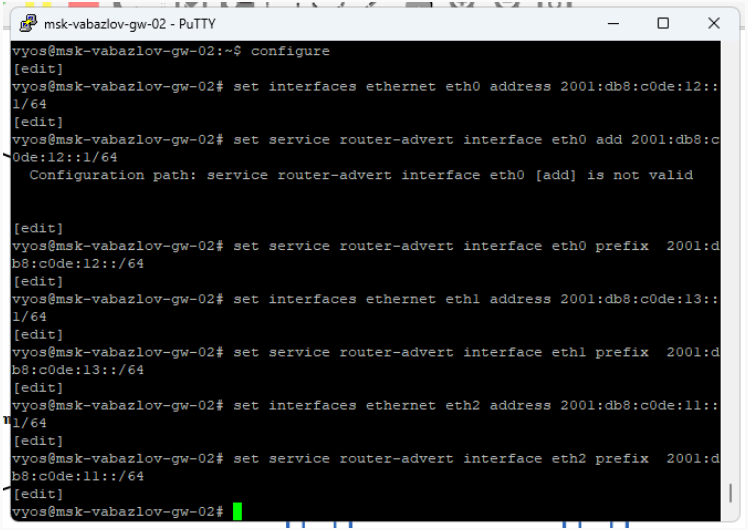
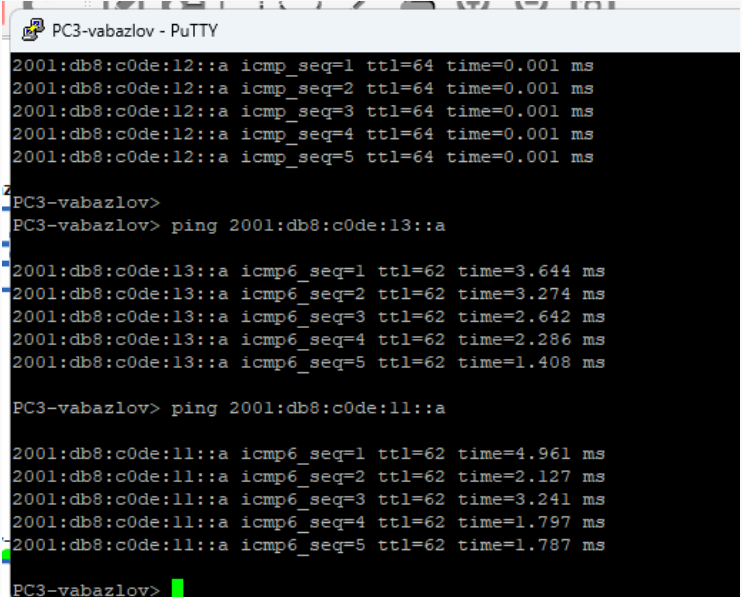


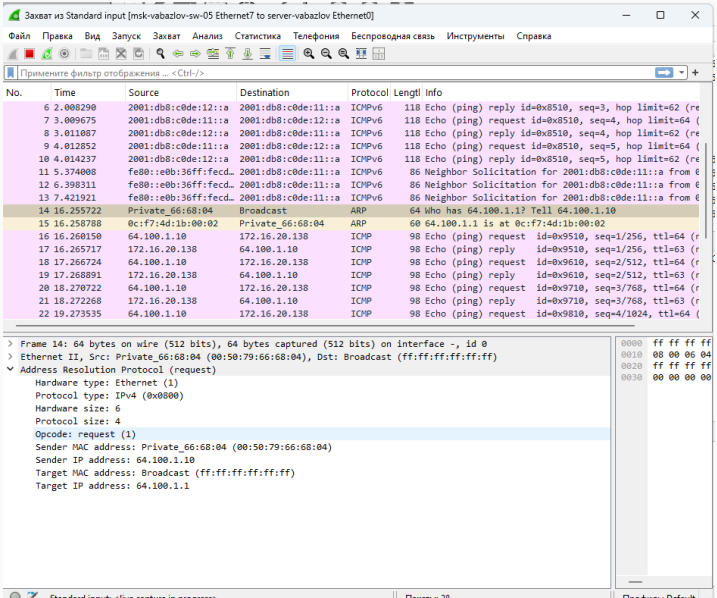
Рис. 4: VyOS IPv6 config

PC3 → PC4 и сервер

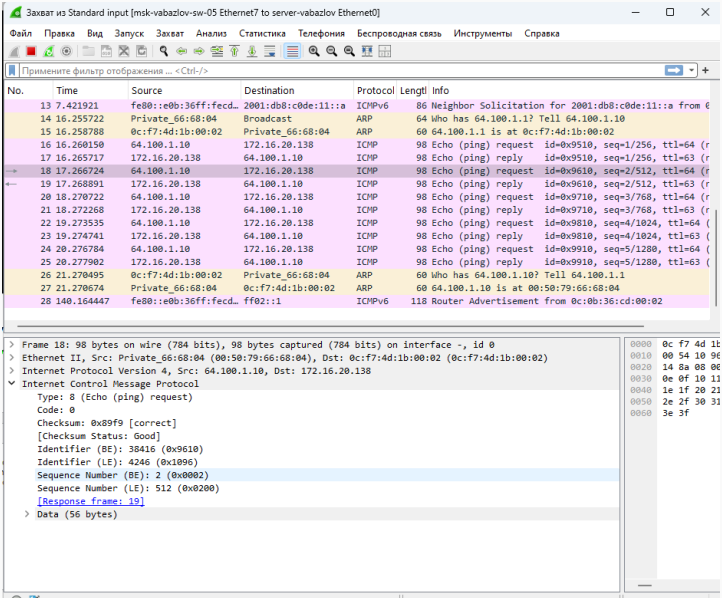


Анализ сетевого трафика

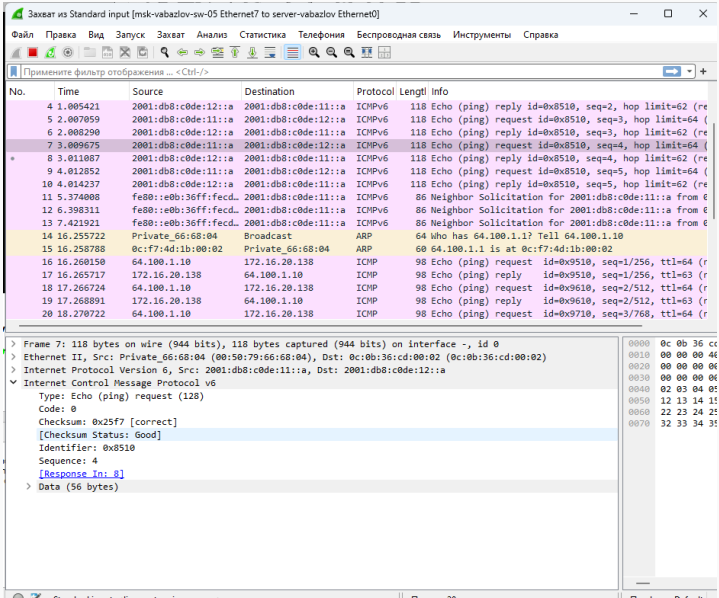
ARP (IPv4)


Захват из Standard input [msk-vabazlov-sw-05 Ethernet7 to server-vabazlov Ethernet0]
Файл Правка Вид Запуск Захват Анализ Статистика Телефония Беспроводная связь Инструменты Справка
Примените фильтр отображения ... <Ctrl-/>
No. Time Source Destination Protocol Length Info
6 2.008290 2001:db8:c0de:12::a 2001:db8:c0de:11::a ICMPv6 118 Echo (ping) reply id=0x8510, seq=3, hop limit=62 (re
7 3.009675 2001:db8:c0de:11::a 2001:db8:c0de:12::a ICMPv6 118 Echo (ping) request id=0x8510, seq=4, hop limit=64 (
8 3.011087 2001:db8:c0de:12::a 2001:db8:c0de:11::a ICMPv6 118 Echo (ping) reply id=0x8510, seq=4, hop limit=62 (re
9 4.012852 2001:db8:c0de:11::a 2001:db8:c0de:12::a ICMPv6 118 Echo (ping) request id=0x8510, seq=5, hop limit=64 (
10 4.014237 2001:db8:c0de:12::a 2001:db8:c0de:11::a ICMPv6 118 Echo (ping) reply id=0x8510, seq=5, hop limit=62 (re
11 5.374008 fe80::e0b:36ff:fecd… 2001:db8:c0de:11::a ICMPv6 86 Neighbor Solicitation for 2001:db8:c0de:11::a from 0
12 6.398311 fe80::e0b:36ff:fecd… 2001:db8:c0de:11::a ICMPv6 86 Neighbor Solicitation for 2001:db8:c0de:11::a from 0
13 7.421921 fe80::e0b:36ff:fecd… 2001:db8:c0de:11::a ICMPv6 86 Neighbor Solicitation for 2001:db8:c0de:11::a from 0
14 16.255722 Private_66:68:04 Broadcast ARP 64 Who has 64.100.1.1? Tell 64.100.1.10
15 16.258788 0c:f7:4d:1b:00:02 Private_66:68:04 ARP 60 64.100.1.1 is at 0c:f7:4d:1b:00:02
16 16.260150 64.100.1.10 172.16.20.138 ICMP 98 Echo (ping) request id=0x9510, seq=1/256, ttl=64 (r
17 16.265717 172.16.20.138 64.100.1.10 ICMP 98 Echo (ping) reply id=0x9510, seq=1/256, ttl=63 (r
18 17.266724 64.100.1.10 172.16.20.138 ICMP 98 Echo (ping) request id=0x9610, seq=2/512, ttl=64 (r
19 17.268891 172.16.20.138 64.100.1.10 ICMP 98 Echo (ping) reply id=0x9610, seq=2/512, ttl=63 (r
20 18.270722 64.100.1.10 172.16.20.138 ICMP 98 Echo (ping) request id=0x9710, seq=3/768, ttl=64 (r
21 18.272268 172.16.20.138 64.100.1.10 ICMP 98 Echo (ping) reply id=0x9710, seq=3/768, ttl=63 (r
22 19.273535 64.100.1.10 172.16.20.138 ICMP 98 Echo (ping) request id=0x9810, seq=4/1024, ttl=64 (
Frame 14: 64 bytes on wire (512 bits), 64 bytes captured (512 bits) on interface -, id 0
Ethernet II, Src: Private_66:68:04 (00:50:79:66:68:04), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
Address Resolution Protocol (request)
Hardware type: Ethernet (1)
Protocol type: IPv4 (0x0800)
Hardware size: 6
Protocol size: 4
Opcode: request (1)
Sender MAC address: Private_66:68:04 (00:50:79:66:68:04)
Sender IP address: 64.100.1.10
Target MAC address: Broadcast (ff:ff:ff:ff:ff:ff)
Target IP address: 64.100.1.1
0000 ff ff ff ff
0010 08 00 06 04
0020 ff ff ff ff
0030 00 00 00 00

ICMPv4


Захват из Standard input [msk-vabazlov-sw-05 Ethernet7 to server-vabazlov Ethernet0]
Файл Правка Вид Запуск Захват Анализ Статистика Телефония Беспроводная связь Инструменты Справка
Примените фильтр отображения ... <Ctrl-/>
No. Time Source Destination Protocol Lengt Info
13 7.421921 fe80::e0b:36ff:fecd… 2001:db8:c0de:11::a ICMPv6 86 Neighbor Solicitation for 2001:db8:c0de:11::a from 6
14 16.255722 Private_66:68:04 Broadcast ARP 64 Who has 64.100.1.1? Tell 64.100.1.10
15 16.258788 0c:f7:4d:1b:00:02 Private_66:68:04 ARP 60 64.100.1.1 is at 0c:f7:4d:1b:00:02
16 16.260150 64.100.1.10 172.16.20.138 ICMP 98 Echo (ping) request id=0x9510, seq=1/256, ttl=64 (r
17 16.265717 172.16.20.138 64.100.1.10 ICMP 98 Echo (ping) reply id=0x9510, seq=1/256, ttl=63 (r
18 17.266724 64.100.1.10 172.16.20.138 ICMP 98 Echo (ping) request id=0x9610, seq=2/512, ttl=64 (r
19 17.268891 172.16.20.138 64.100.1.10 ICMP 98 Echo (ping) reply id=0x9610, seq=2/512, ttl=63 (r
20 18.270722 64.100.1.10 172.16.20.138 ICMP 98 Echo (ping) request id=0x9710, seq=3/768, ttl=64 (r
21 18.272268 172.16.20.138 64.100.1.10 ICMP 98 Echo (ping) reply id=0x9710, seq=3/768, ttl=63 (r
22 19.273535 64.100.1.10 172.16.20.138 ICMP 98 Echo (ping) request id=0x9810, seq=4/1024, ttl=64 (
23 19.274741 172.16.20.138 64.100.1.10 ICMP 98 Echo (ping) reply id=0x9810, seq=4/1024, ttl=63 (
24 20.276784 64.100.1.10 172.16.20.138 ICMP 98 Echo (ping) request id=0x9910, seq=5/1280, ttl=64 (
25 20.277902 172.16.20.138 64.100.1.10 ICMP 98 Echo (ping) reply id=0x9910, seq=5/1280, ttl=63 (
26 21.270495 0c:f7:4d:1b:00:02 Private_66:68:04 ARP 60 Who has 64.100.1.10? Tell 64.100.1.1
27 21.270674 Private_66:68:04 0c:f7:4d:1b:00:02 ARP 60 64.100.1.10 is at 00:50:79:66:68:04
28 140.164447 fe80::e0b:36ff:fecd… ff02::1 ICMPv6 118 Router Advertisement from 0c:0b:36:cd:00:02
Frame 18: 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:f7:4d:1b:00:02 (0c:f7:4d:1b:00:02)
Internet Protocol Version 4, Src: 64.100.1.10, Dst: 172.16.20.138
Internet Control Message Protocol
Type: 8 (Echo (ping) request)
Code: 0
Checksum: 0x89f9 [correct]
[Checksum Status: Good]
Identifier (BE): 38416 (0x9610)
Identifier (LE): 4246 (0x1096)
Sequence Number (BE): 2 (0x0002)
Sequence Number (LE): 512 (0x0200)
[Response frame: 19]
Data (56 bytes)
0000 0c f7 4d 1b
0010 00 54 10 96
0020 14 8a 08 00
0030 0e 0f 10 11
0040 1e 1f 20 21
0050 2e 2f 30 31
0060 3e 3f

ICMPv6


Захват из Standard input [msk-vabazlov-sw-05 Ethernet7 to server-vabazlov Ethernet0]
Файл Правка Вид Запуск Захват Анализ Статистика Телефония Беспроводная связь Инструменты Справка
Примените фильтр отображения ... <Ctrl-/>
No. Time Source Destination Protocol Lengtl Info
4 1.005421 2001:db8:c0de:12::a 2001:db8:c0de:11::a ICMPv6 118 Echo (ping) reply id=0x8510, seq=2, hop limit=62 (re
5 2.007059 2001:db8:c0de:11::a 2001:db8:c0de:12::a ICMPv6 118 Echo (ping) request id=0x8510, seq=3, hop limit=64 (
6 2.008290 2001:db8:c0de:12::a 2001:db8:c0de:11::a ICMPv6 118 Echo (ping) reply id=0x8510, seq=3, hop limit=62 (re
7 3.009675 2001:db8:c0de:11::a 2001:db8:c0de:12::a ICMPv6 118 Echo (ping) request id=0x8510, seq=4, hop limit=64 (
8 3.011087 2001:db8:c0de:12::a 2001:db8:c0de:11::a ICMPv6 118 Echo (ping) reply id=0x8510, seq=4, hop limit=62 (re
9 4.012852 2001:db8:c0de:11::a 2001:db8:c0de:12::a ICMPv6 118 Echo (ping) request id=0x8510, seq=5, hop limit=64 (
10 4.014237 2001:db8:c0de:12::a 2001:db8:c0de:11::a ICMPv6 118 Echo (ping) reply id=0x8510, seq=5, hop limit=62 (re
11 5.374008 fe80::e0b:36ff:fecd… 2001:db8:c0de:11::a ICMPv6 86 Neighbor Solicitation for 2001:db8:c0de:11::a from 6
12 6.398311 fe80::e0b:36ff:fecd… 2001:db8:c0de:11::a ICMPv6 86 Neighbor Solicitation for 2001:db8:c0de:11::a from 6
13 7.421921 fe80::e0b:36ff:fecd… 2001:db8:c0de:11::a ICMPv6 86 Neighbor Solicitation for 2001:db8:c0de:11::a from 6
14 16.255722 Private_66:68:04 Broadcast ARP 64 Who has 64.100.1.1? Tell 64.100.1.10
15 16.258788 0c:f7:4d:1b:00:02 Private_66:68:04 ARP 60 64.100.1.1 is at 0c:f7:4d:1b:00:02
16 16.260150 64.100.1.10 172.16.20.138 ICMP 98 Echo (ping) request id=0x9510, seq=1/256, ttl=64 (r
17 16.265717 172.16.20.138 64.100.1.10 ICMP 98 Echo (ping) reply id=0x9510, seq=1/256, ttl=63 (r
18 17.266724 64.100.1.10 172.16.20.138 ICMP 98 Echo (ping) request id=0x9610, seq=2/512, ttl=64 (r
19 17.268891 172.16.20.138 64.100.1.10 ICMP 98 Echo (ping) reply id=0x9610, seq=2/512, ttl=63 (r
20 18.270722 64.100.1.10 172.16.20.138 ICMP 98 Echo (ping) request id=0x9710, seq=3/768, ttl=64 (r
Frame 7: 118 bytes on wire (944 bits), 118 bytes captured (944 bits) on interface -, id 0
Ethernet II, Src: Private_66:68:04 (00:50:79:66:68:04), Dst: 0c:0b:36:cd:00:02 (0c:0b:36:cd:00:02)
Internet Protocol Version 6, Src: 2001:db8:c0de:11::a, Dst: 2001:db8:c0de:12::a
Internet Control Message Protocol v6
Type: Echo (ping) request (128)
Code: 0
Checksum: 0x25f7 [correct]
[Checksum Status: Good]
Identifier: 0x8510
Sequence: 4
[Response In: 8]
Data (56 bytes)
0000 0c 0b 36 cc
0010 00 00 00 4
0020 00 00 00 0
0030 00 00 00 0
0040 02 03 04 0
0050 12 13 14 1
0060 22 23 24 2
0070 32 33 34 3

Самостоятельная часть

Используемые подсети

IPv4 - Подсеть 1: **10.10.1.96/27**

- Подсеть 2: **10.10.1.16/28**

IPv6 - 2001:db8:1:1::/64

- 2001:db8:1:4::/64

Топология подсети

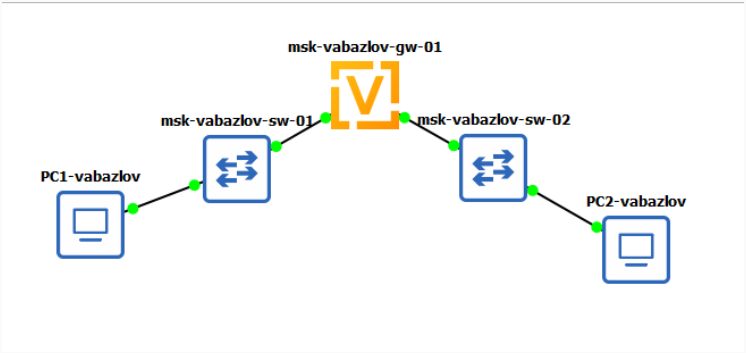


Рис. 9: Топология сети

Проверка устройств

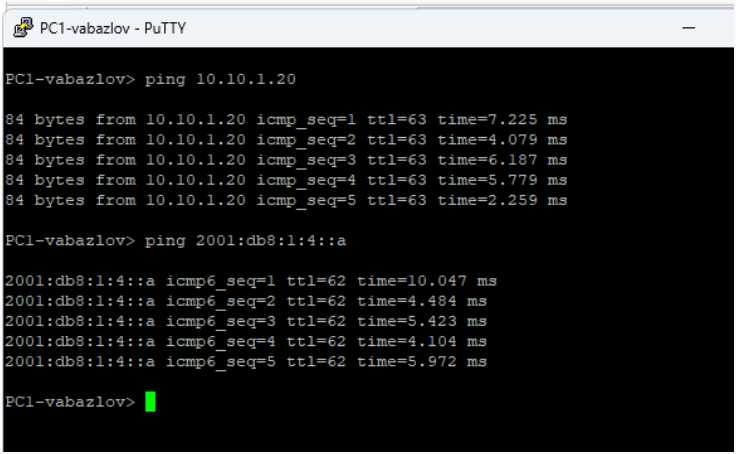


Рис. 10: Проверка ping IPv4 и IPv6

Итоги работы

Выводы

- Выполнено разбиение подсетей IPv4 и IPv6
- Настроена адресация в топологии GNS3
- Проверена связность для обоих протоколов
- Изучены механизмы ARP, ICMP и ICMPv6
- Реализована работа сети с **двойным стеком IPv4/IPv6**