

# Лабораторная работа №8

Сетевые технологии

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## Цель работы

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Изучение принципов маршрутизации в IPv4- и IPv6-сетях и принципов настройки сетевого оборудования.

## Выполнение лабораторной работы

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## Топология сети

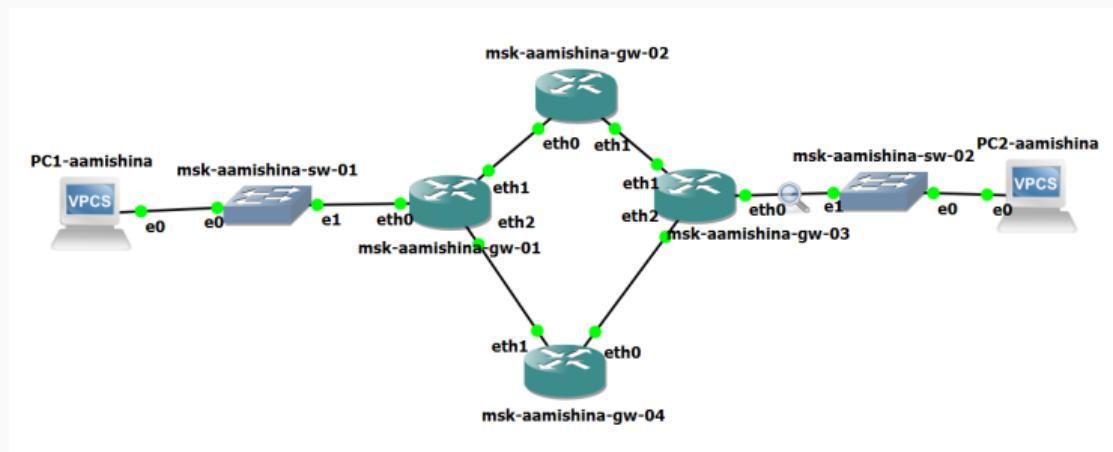
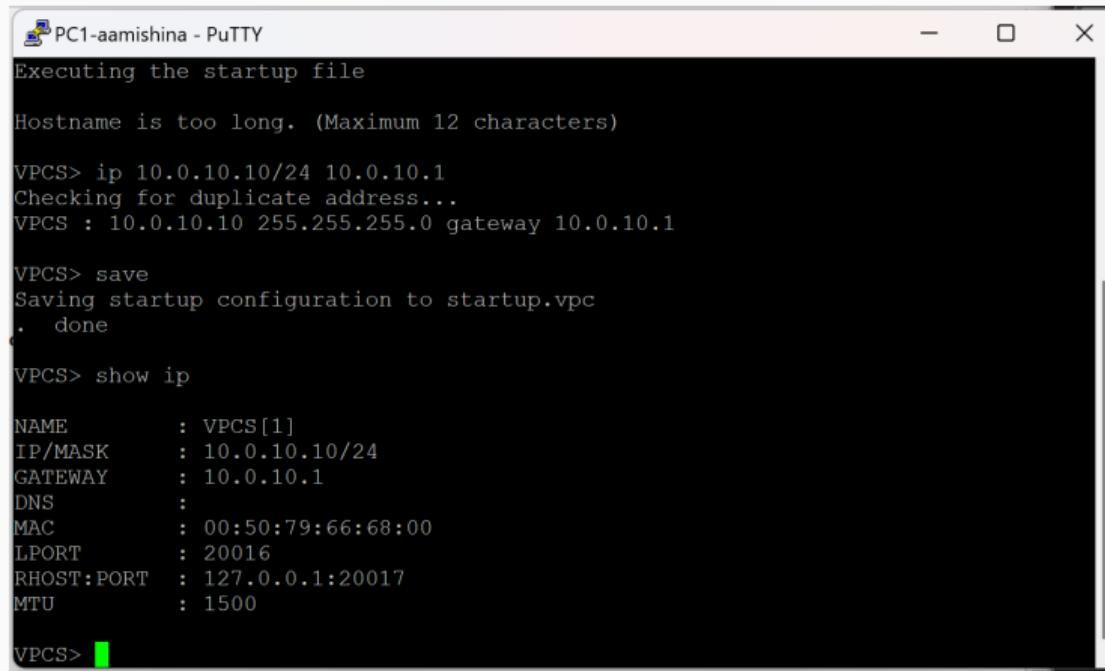


Рис. 1: Топология моделируемой сети в GNS3



```
PC1-aamishina - PuTTY
Executing the startup file

Hostname is too long. (Maximum 12 characters)

VPCS> ip 10.0.10.10/24 10.0.10.1
Checking for duplicate address...
VPCS : 10.0.10.10 255.255.255.0 gateway 10.0.10.1

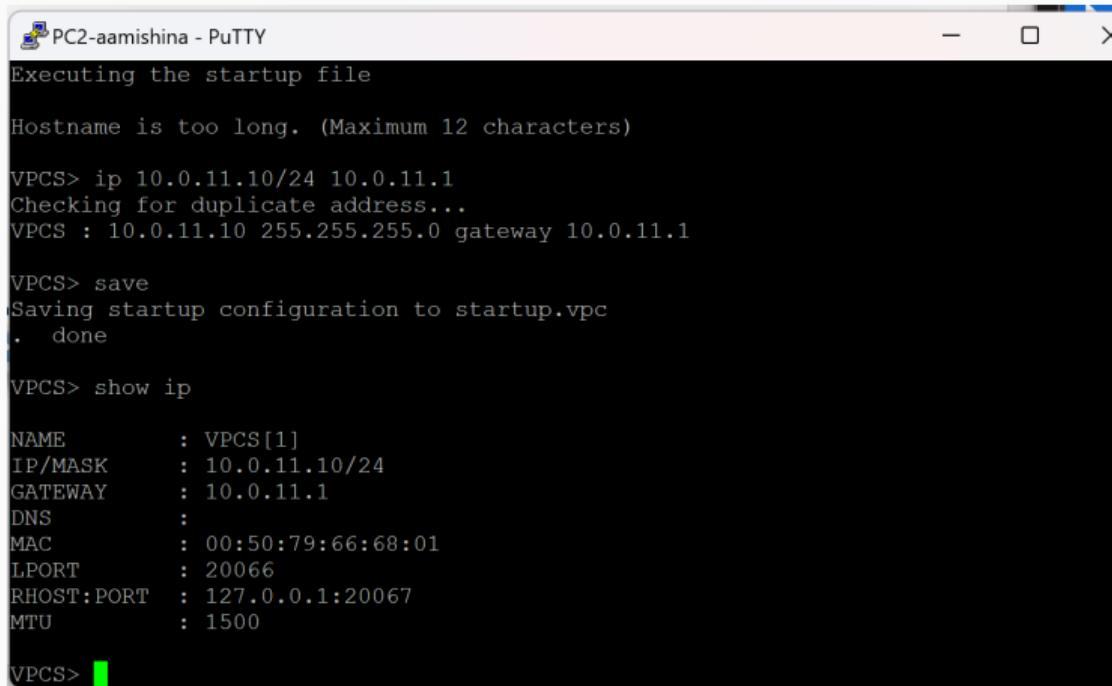
VPCS> save
Saving startup configuration to startup.vpc
. done

VPCS> show ip

NAME      : VPCS[1]
IP/MASK   : 10.0.10.10/24
GATEWAY   : 10.0.10.1
DNS       :
MAC       : 00:50:79:66:68:00
LPORT     : 20016
RHOST:PORT: 127.0.0.1:20017
MTU       : 1500

VPCS>
```

Рис. 2: Присвоение IPv4-адреса PC1



```
PC2-aamishina - PuTTY
Executing the startup file

Hostname is too long. (Maximum 12 characters)

VPCS> ip 10.0.11.10/24 10.0.11.1
Checking for duplicate address...
VPCS : 10.0.11.10 255.255.255.0 gateway 10.0.11.1

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

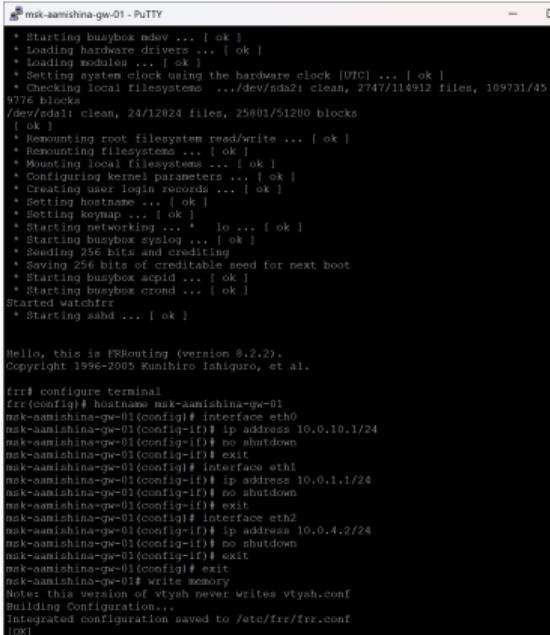
VPCS> show ip

NAME      : VPCS[1]
IP/MASK   : 10.0.11.10/24
GATEWAY   : 10.0.11.1
DNS       :
MAC       : 00:50:79:66:68:01
LPORT     : 20066
RHOST:PORT: 127.0.0.1:20067
MTU       : 1500

VPCS>
```

Рис. 3: Присвоение IPv4-адреса PC2

# Настройка IPv4-адреса



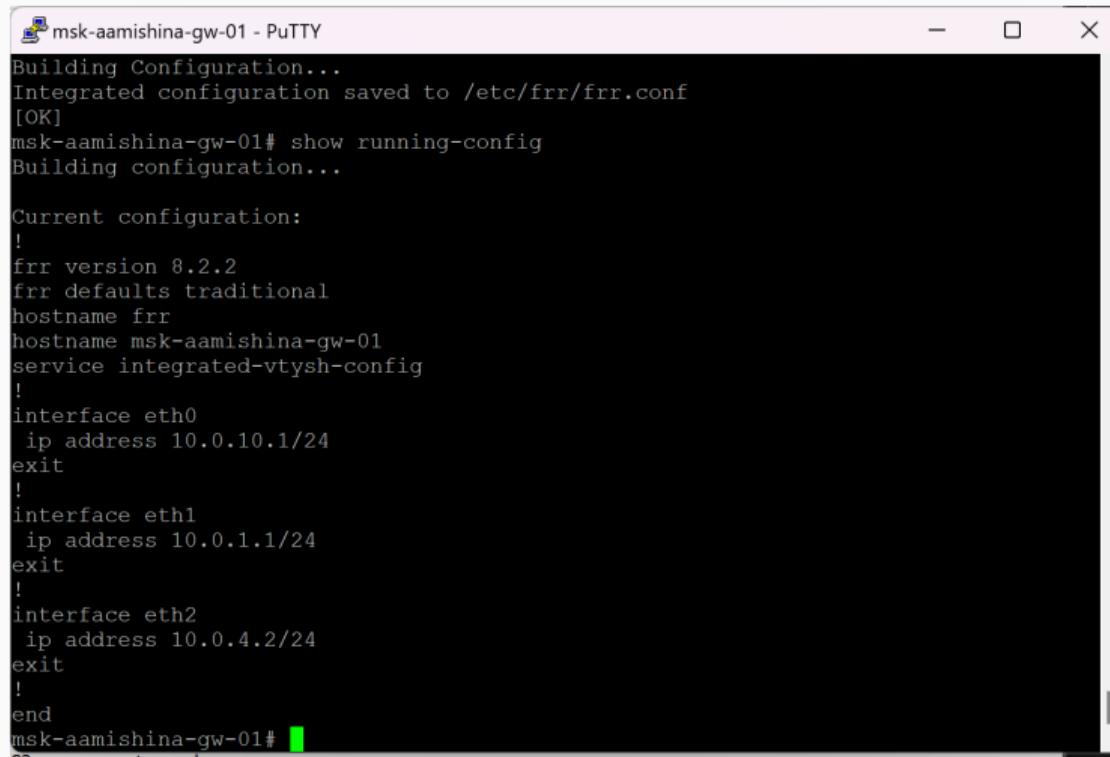
```
msk-aamishina-gw-01 - PuTTY
* Starting busybox admod ... [ ok ]
* Loading hardware drivers ... [ ok ]
* Loading modules ... [ ok ]
* Setting system clock using the hardware clock [UTC] ... [ ok ]
* Checking local filesystems ... /dev/sda2: clean, 2747/114912 files, 109731/45
9776 blocks
/dev/sda1: clean, 24/12024 files, 25001/51200 blocks
[ ok ]
* Remounting root filesystem read/write ... [ ok ]
* Remounting filesystems ... [ ok ]
* Mounting local filesystems ... [ ok ]
* Configuring kernel parameters ... [ ok ]
* Creating user login records ... [ ok ]
* Setting hostname ... [ ok ]
* Setting keymap ... [ ok ]
* Starting networking ... * lo ... [ ok ]
* Starting busybox syslog ... [ ok ]
* Setting 256 bits and crediting
* Saving 64 bits of creditable seed for next boot
* Starting busybox apkd ... [ ok ]
* Starting busybox crond ... [ ok ]
Started watchdog
* Starting sshd ... [ ok ]

Hello, this is FRRouting (version 8.2.2).
Copyright 1996-2005 Kunihiro Ishiguro, et al.

frr# configure terminal
frr(config)# hostname msk-aamishina-gw-01
msk-aamishina-gw-01(config)# interface eth0
msk-aamishina-gw-01(config-if)# ip address 10.0.10.1/24
msk-aamishina-gw-01(config-if)# no shutdown
msk-aamishina-gw-01(config-if)# exit
msk-aamishina-gw-01(config)# interface eth1
msk-aamishina-gw-01(config-if)# ip address 10.0.1.1/24
msk-aamishina-gw-01(config-if)# no shutdown
msk-aamishina-gw-01(config-if)# exit
msk-aamishina-gw-01(config)# interface eth2
msk-aamishina-gw-01(config-if)# ip address 10.0.4.2/24
msk-aamishina-gw-01(config-if)# no shutdown
msk-aamishina-gw-01(config-if)# exit
msk-aamishina-gw-01(config)# exit
msk-aamishina-gw-01# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Interpreted configuration saved to /etc/frr/frr.conf
[ok]
```

Рис. 4: Настройка IPv4-адреса на интерфейсе маршрутизатора 1

## Настройка IPv4-адреса



```
msk-aamishina-gw-01 - PuTTY
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-01# show running-config
Building configuration...

Current configuration:
!
frr version 8.2.2
frr defaults traditional
hostname frr
hostname msk-aamishina-gw-01
service integrated-vtysh-config
!
interface eth0
 ip address 10.0.10.1/24
exit
!
interface eth1
 ip address 10.0.1.1/24
exit
!
interface eth2
 ip address 10.0.4.2/24
exit
!
end
msk-aamishina-gw-01#
```

Рис. 5: Настройка IPv4-адреса на интерфейсе маршрутизатора 1

# Настройка IPv4-адреса



```
nsk-aamishina-gw-02 - PuTTY
* Configuring kernel parameters ... [ ok ]
* Creating user login records ... [ ok ]
* Setting hostname ... [ ok ]
* Setting keymap ... [ ok ]
* Starting networking ... [ ok ] in ... [ ok ]
* Starting cron ... [ ok ]
* Starting sshd ... [ ok ]
* Seeding 256 bits and crediting
* Saving 256 bits of creditable seed for next boot
* Starting busybox cwid ... [ ok ]
* Starting busybox crond ... [ ok ]
* Starting watchdog
* Starting sshd ... [ ok ]

Hello, this is FRRouting (version 8.2.2),
Copyright 1996-2005 Kunihiko Tahiguro, et al.

frr# configure terminal
frr(config)# interface eth0
nsk-aamishina-gw-02(config-if)# ip address 10.0.1.2/24
nsk-aamishina-gw-02(config-if)# no shutdown
nsk-aamishina-gw-02(config-if)# exit
nsk-aamishina-gw-02(config)# interface eth1
nsk-aamishina-gw-02(config-if)# ip address 10.0.2.1/24
nsk-aamishina-gw-02(config-if)# no shutdown
nsk-aamishina-gw-02(config-if)# exit
nsk-aamishina-gw-02(config)# vtysh
Notes this version of vtysh never writes vtysh.conf
Building configuration...
Building configuration saved to /etc/frr/frr.conf
[OK]
nsk-aamishina-gw-02# show running-config
Building configuration...
Current configuration:
!
frr version 8.2.2
frr defaults traditional
hostname frr
hostname nsk-aamishina-gw-02
services integrated-vtysh-config
!
interface eth0
    ip address 10.0.1.2/24
    skip
!
interface eth1
    ip address 10.0.2.1/24
    skip
!
end
nsk-aamishina-gw-02#
```

Рис. 6: Настройка IPv4-адреса на интерфейсе маршрутизатора 2

# Настройка IPv4-адреса



```
* Starting boxdbox wsdpid ... [ ok ]
* Starting boxdbox crond ... [ ok ]
Started watchdogr
* Starting sshd ... [ ok ]

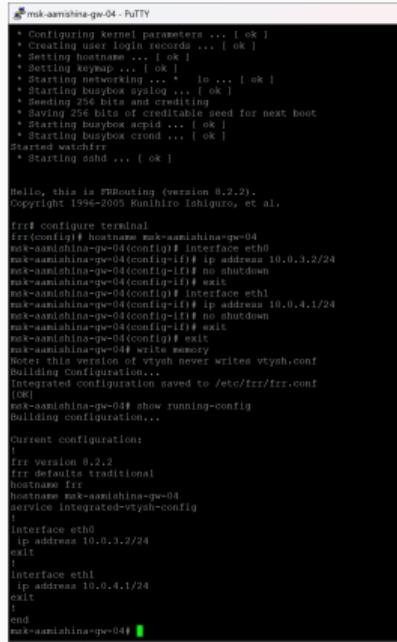
Hello, this is FRouting (version 0.2.2),
Copyright 1996-2005 Kunihiro Ishiguro, et al.

fr# configure terminal
fr(config)# hostname ruk-asmishina-gw-03
ruk-asmishina-gw-03(config)# interface eth0
ruk-asmishina-gw-03(config-if)# ip address 10.0.11.1/24
ruk-asmishina-gw-03(config-if)# no shutdown
ruk-asmishina-gw-03(config-if)# exit
ruk-asmishina-gw-03(config)# interface eth1
ruk-asmishina-gw-03(config-if)# ip address 10.0.2.2/24
ruk-asmishina-gw-03(config-if)# no shutdown
ruk-asmishina-gw-03(config-if)# exit
ruk-asmishina-gw-03(config)# interface eth2
ruk-asmishina-gw-03(config-if)# ip address 10.0.3.1/24
ruk-asmishina-gw-03(config-if)# no shutdown
ruk-asmishina-gw-03(config-if)# exit
ruk-asmishina-gw-03(config)# exit
ruk-asmishina-gw-03# write memory
Note: this version of vtysh never writes vtysh.conf
Building configuration...
Integrated configuration saved to /etc/fr/rtr.conf
[OK]
ruk-asmishina-gw-03# show running-config
Building configuration...

Current configurations:
!
fr version #.2.2
fr# hostname traditional
hostname fr
hostname ruk-asmishina-gw-03
service integrated-vtysh-config
!
interface eth0
 ip address 10.0.11.1/24
exit
!
interface eth1
 ip address 10.0.2.2/24
exit
!
interface eth2
 ip address 10.0.3.1/24
exit
!
end
ruk-asmishina-gw-03#
```

Рис. 7: Настройка IPv4-адреса на интерфейсе маршрутизатора 3

# Настройка IPv4-адреса

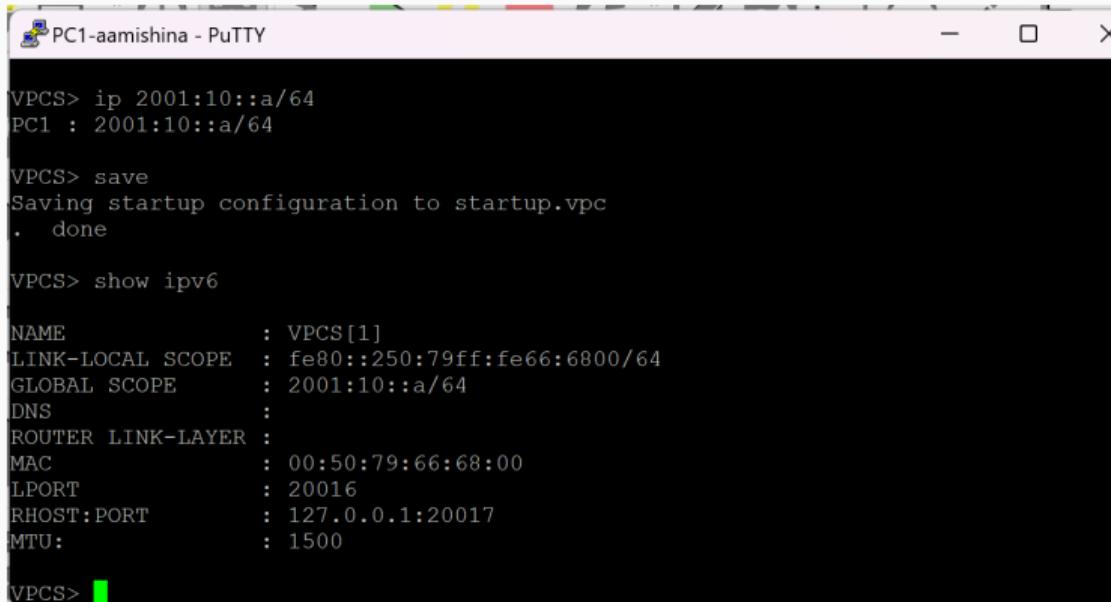


```
msk-aamishina-gw-04 - PuTTY
* Configuring kernel parameters ... [ ok ]
* Creating user login records ... [ ok ]
* Setting hostname ... [ ok ]
* Setting keymap ... [ ok ]
* Starting networking ... * lo ... [ ok ]
* Starting vtysh configuration ... [ ok ]
* Saving 256 bits of creditable seed for next boot
* Starting busybox acpid ... [ ok ]
* Starting busybox crond ... [ ok ]
Started watchfr
* Starting ashd ... [ ok ]

Hello, this is IPFire (version 0.2.2).
Copyright 1996-2005 Kunihiro Ishiguro, et al.

fir# configure terminal
fir(config)# hostname msk-aamishina-gw-04
msk-aamishina-gw-04(config)# interface eth0
msk-aamishina-gw-04(config-if)# ip address 10.0.3.2/24
msk-aamishina-gw-04(config-if)# no shutdown
msk-aamishina-gw-04(config-if)# exit
msk-aamishina-gw-04(config)# interface eth1
msk-aamishina-gw-04(config-if)# interface eth1
msk-aamishina-gw-04(config-if)# ip address 10.0.4.1/24
msk-aamishina-gw-04(config-if)# no shutdown
msk-aamishina-gw-04(config-if)# exit
msk-aamishina-gw-04(config)# exit
msk-aamishina-gw-04# write memory
Note: this version of vtysh never writes vtysh.conf
Building configuration...
[Integrated configuration saved to /etc/fir/fir.conf
[OK]
msk-aamishina-gw-04# show running-config
Building configuration...
Current configuration:
!
fir version 0.2.2
fir defaults traditional
hostname fir
hostname msk-aamishina-gw-04
service integrated-vtysh-config
!
interface eth0
    ip address 10.0.3.2/24
exit
!
interface eth1
    ip address 10.0.4.1/24
exit
!
end
msk-aamishina-gw-04#
```

Рис. 8: Настройка IPv4-адреса на интерфейсе маршрутизатора 4



```
VPCS> ip 2001:10::a/64
PC1 : 2001:10::a/64

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

VPCS> show ipv6

NAME          : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6800/64
GLOBAL SCOPE    : 2001:10::a/64
DNS            :
ROUTER LINK-LAYER :
MAC            : 00:50:79:66:68:00
LPORT          : 20016
RHOST:PORT     : 127.0.0.1:20017
MTU:           : 1500

VPCS>
```

Рис. 9: Присвоение IPv6-адреса PC1

```
PC2-aamishina - PuTTY

Checking for duplicate address...
VPCS : 10.0.11.10 255.255.255.0 gateway 10.0.11.1

VPCS> ip 2001:11::a/64
|PC1 : 2001:11::a/64

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

VPCS> show ipv6

NAME          : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6801/64
GLOBAL SCOPE    : 2001:11::a/64
DNS           :
ROUTER LINK-LAYER :
MAC            : 00:50:79:66:68:01
LPORT          : 20082
RHOST:PORT     : 127.0.0.1:20083
MTU:           : 1500

VPCS>
```

Рис. 10: Присвоение IPv6-адреса PC2

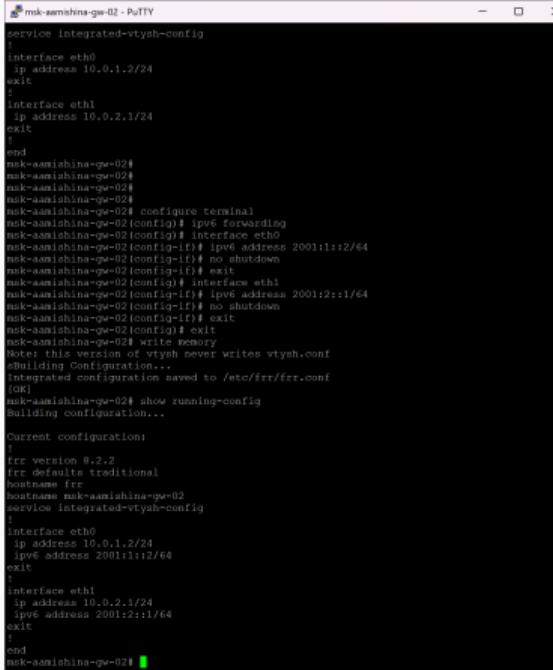
# Настройка IPv6-адреса



```
msk-asmishina-gw-01#  
msk-asmishina-gw-01#  
msk-asmishina-gw-01# configure terminal  
msk-asmishina-gw-01(config)# ipv6 forwarding  
msk-asmishina-gw-01(config)# interface eth0  
msk-asmishina-gw-01(config-if)# ip address 10.0.10.1/24  
msk-asmishina-gw-01(config-if)# no ipv6 nd suppress-ra  
msk-asmishina-gw-01(config-if)# ipv6 nd prefix 2001:10::1/64  
msk-asmishina-gw-01(config-if)# no shutdown  
msk-asmishina-gw-01(config-if)# exit  
msk-asmishina-gw-01(config)# interface eth1  
msk-asmishina-gw-01(config-if)# ipv6 address 2001:1::1/64  
msk-asmishina-gw-01(config-if)# no shutdown  
msk-asmishina-gw-01(config-if)# exit  
msk-asmishina-gw-01(config)# interface eth2  
msk-asmishina-gw-01(config-if)# ipv6 address 2001:4::2/64  
msk-asmishina-gw-01(config-if)# no shutdown  
msk-asmishina-gw-01(config-if)# exit  
msk-asmishina-gw-01(config)# exit  
msk-asmishina-gw-01(config)# write memory  
Note: this version of vtysh never writes vtysh.conf  
Building Configuration...  
Integrated configuration saved to /etc/frr/frr.conf  
[OK]  
msk-asmishina-gw-01# show running-config  
Building configuration...  
  
Current configuration:  
!  
frr version 8.2.2  
frr defaults traditional  
hostname frr  
hostname msk-asmishina-gw-01  
service integrated-vtysh-config  
!  
interface eth0  
ip address 10.0.10.1/24  
ipv6 address 2001:10::1/64  
ipv6 nd prefix 2001:10::1/64  
no ipv6 nd suppress-ra  
exit  
!  
interface eth1  
ip address 10.0.1.1/24  
ipv6 address 2001:1::1/64  
exit  
!  
interface eth2  
ip address 10.0.4.2/24  
ipv6 address 2001:4::2/64  
exit  
!  
end  
msk-asmishina-gw-01#
```

Рис. 11: Настройка IPv6-адреса на интерфейсе маршрутизатора 1

# Настройка IPv6-адреса



```
msk-aamishina-gw-02 - PuTTY
service integrated-vtysh-config
!
interface eth0
ip address 10.0.1.2/24
exit
!
interface eth1
ip address 10.0.2.1/24
exit
!
end
msk-aamishina-gw-02#
msk-aamishina-gw-02#
msk-aamishina-gw-02#
msk-aamishina-gw-02#
msk-aamishina-gw-02# configure terminal
msk-aamishina-gw-02(config)# ipv6 forwarding
msk-aamishina-gw-02(config)# interface eth0
msk-aamishina-gw-02(config-if)# ipv6 address 2001:1::2/64
msk-aamishina-gw-02(config-if)# no shutdown
msk-aamishina-gw-02(config-if)# exit
msk-aamishina-gw-02(config)# interface eth1
msk-aamishina-gw-02(config-if)# ipv6 address 2001:2::1/64
msk-aamishina-gw-02(config-if)# no shutdown
msk-aamishina-gw-02(config-if)# exit
msk-aamishina-gw-02(config)# exit
msk-aamishina-gw-02# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
[Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-02# show running-config
Building configuration...
Current configuration:
!
frr version 0.2.2
frr defaults traditional
hostname frr
hostname msk-aamishina-gw-02
service integrated-vtysh-config
!
interface eth0
ip address 10.0.1.2/24
ipv6 address 2001:1::2/64
exit
!
interface eth1
ip address 10.0.2.1/24
ipv6 address 2001:2::1/64
exit
!
end
msk-aamishina-gw-02#
```

Рис. 12: Настройка IPv6-адреса на интерфейсе маршрутизатора 2

# Настройка IPv6-адреса



```
msk-aamishina-gw-03#  
msk-aamishina-gw-03#  
msk-aamishina-gw-03# configure terminal  
msk-aamishina-gw-03(config)# ipv6 forwarding  
msk-aamishina-gw-03(config)# interface eth1  
msk-aamishina-gw-03(config-if)# ipv6 address 2001:11::1/64  
msk-aamishina-gw-03(config-if)# no ipv6 nd suppress-ra  
msk-aamishina-gw-03(config-if)# ipv6 nd prefix 2001:11::/64  
msk-aamishina-gw-03(config-if)# no shutdown  
msk-aamishina-gw-03(config-if)# exit  
msk-aamishina-gw-03(config)# interface eth1  
msk-aamishina-gw-03(config-if)# ipv6 address 2001:2::2/64  
msk-aamishina-gw-03(config-if)# no shutdown  
msk-aamishina-gw-03(config-if)# exit  
msk-aamishina-gw-03(config)# interface eth2  
msk-aamishina-gw-03(config-if)# ipv6 address 2001:3::1/64  
msk-aamishina-gw-03(config-if)# no shutdown  
msk-aamishina-gw-03(config-if)# exit  
msk-aamishina-gw-03# write memory  
Note: this version of vtysh never writes vtysh.conf  
Building Configuration...  
Integrated configuration saved to /etc/frr/frr.conf  
(OK)  
msk-aamishina-gw-03# show running-config  
Building configuration...  
  
Current configuration:  
!  
frr version 8.2.2  
frr defaults traditional  
hostname frr  
hostname msk-aamishina-gw-03  
service integrated-vtysh+config  
!  
interface eth0  
ip address 10.0.11.1/24  
ipv6 address 2001:11::1/64  
ipv6 nd prefix 2001:11::/64  
no ipv6 nd suppress-ra  
exit  
!  
interface eth1  
ip address 10.0.2.2/24  
ipv6 address 2001:2::2/64  
exit  
!  
interface eth2  
ip address 10.0.3.1/24  
ipv6 address 2001:3::1/64  
exit  
!  
end  
msk-aamishina-gw-03#
```

Рис. 13: Настройка IPv6-адреса на интерфейсе маршрутизатора 3

## Настройка IPv6-адреса

```
ruk-aaamishina-gw-04# PuTTY

interface eth1
  ip address 10.0.4.1/24
  exit

:
ruk-aaamishina-gw-04#
ruk-aaamishina-gw-04# configure terminal
ruk-aaamishina-gw-04(config)# interface eth0
ruk-aaamishina-gw-04(config)# interface eth0
ruk-aaamishina-gw-04(config-if)# ipv6 address 2001:3::2/64
ruk-aaamishina-gw-04(config-if)# no shutdown
ruk-aaamishina-gw-04(config-if)# exit
ruk-aaamishina-gw-04(config)# interface eth1
ruk-aaamishina-gw-04(config)# ipv6 address 2001:4::1/64
ruk-aaamishina-gw-04(config)# no shutdown
ruk-aaamishina-gw-04(config-if)# exit
ruk-aaamishina-gw-04(config)# exit
ruk-aaamishina-gw-04# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
(OK)
ruk-aaamishina-gw-04# show running-config
Building configuration...
Current configuration:

frr version 8.2.2
frr defaults traditional
hostname frr
hostname ruk-aaamishina-gw-04
service integrated-vtysh-config
{
    interface eth0
        ip address 10.0.3.2/24
        ipv6 address 2001:3::2/64
        exit
    interface eth1
        ip address 10.0.4.1/24
        ipv6 address 2001:4::1/64
        exit
    :
}
ruk-aaamishina-gw-04#
```

Рис. 14: Настройка IPv6-адреса на интерфейсе маршрутизатора 4

## Настройка динамической маршрутизации по протоколу RIP

---

## Настройка RIP

```
msk-aamishina-gw-01# configure terminal
msk-aamishina-gw-01(config)# router rip
msk-aamishina-gw-01(config-router)# version 2
msk-aamishina-gw-01(config-router)# network eth0
msk-aamishina-gw-01(config-router)# network eth1
msk-aamishina-gw-01(config-router)# network eth2
msk-aamishina-gw-01(config-router)# exit
msk-aamishina-gw-01(config)# exit
msk-aamishina-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-aamishina-gw-01#
```

Рис. 15: Настройка RIP на маршрутизаторе 1

## Настройка RIP

```
msk-aamishina-gw-02# configure terminal
msk-aamishina-gw-02(config)# router rip
msk-aamishina-gw-02(config-router)# version 2
msk-aamishina-gw-02(config-router)# network eth0
msk-aamishina-gw-02(config-router)# network eth1
msk-aamishina-gw-02(config-router)# exit
msk-aamishina-gw-02(config)# exit
msk-aamishina-gw-02# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-02# █
```

Рис. 16: Настройка RIP на маршрутизаторе 2

## Настройка RIP

```
msk-aamishina-gw-03#  
msk-aamishina-gw-03# configure terminal  
msk-aamishina-gw-03(config)# router rip  
msk-aamishina-gw-03(config-router)# version 2  
msk-aamishina-gw-03(config-router)# network eth0  
msk-aamishina-gw-03(config-router)# network eth1  
msk-aamishina-gw-03(config-router)# network eth2  
msk-aamishina-gw-03(config-router)# exit  
msk-aamishina-gw-03(config)# exit  
msk-aamishina-gw-03# write memory  
Note: this version of vtysh never writes vtysh.conf  
Building Configuration...  
Integrated configuration saved to /etc/frr/frr.conf  
[OK]  
msk-aamishina-gw-03#
```

Рис. 17: Настройка RIP на маршрутизаторе 3

## Настройка RIP

```
msk-aamishina-gw-04#  
msk-aamishina-gw-04# configure terminal  
msk-aamishina-gw-04(config)# router rip  
msk-aamishina-gw-04(config-router)# version 2  
msk-aamishina-gw-04(config-router)# network eth0  
msk-aamishina-gw-04(config-router)# network eth1  
msk-aamishina-gw-04(config-router)# exit  
msk-aamishina-gw-04(config)# exit  
msk-aamishina-gw-04# write memory  
Note: this version of vtysh never writes vtysh.conf  
Building Configuration...  
Integrated configuration saved to /etc/frr/frr.conf  
[OK]  
msk-aamishina-gw-04# █
```

Рис. 18: Настройка RIP на маршрутизаторе 4

## Проверка настройки RIP

```
msk-aamishina-gw-01# show ip route rip
Codes: K - kernel route, C - connected, S - static, R - RIP,
      O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
      T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
      f - OpenFabric,
      > - selected route, * - FIB route, q - queued, r - rejected, b - backup
      t - trapped, o - offload failure

R>*> 10.0.2.0/24 [120/2] via 10.0.1.2, eth1, weight 1, 00:02:03
R>*> 10.0.3.0/24 [120/2] via 10.0.4.1, eth2, weight 1, 00:00:20
R>*> 10.0.11.0/24 [120/3] via 10.0.1.2, eth1, weight 1, 00:01:07
msk-aamishina-gw-01# show ip rip
Codes: R - RIP, C - connected, S - Static, O - OSPF, B - BGP
Sub-codes:
      (n) - normal, (s) - static, (d) - default, (r) - redistribute,
      (i) - interface

      Network          Next Hop          Metric From           Tag Time
C(i) 10.0.1.0/24    0.0.0.0           1 self              0
R(n) 10.0.2.0/24   10.0.1.2           2 10.0.1.2        0 02:40
R(n) 10.0.3.0/24   10.0.4.1           2 10.0.4.1        0 02:45
C(i) 10.0.4.0/24   0.0.0.0           1 self              0
C(i) 10.0.10.0/24  0.0.0.0           1 self              0
R(n) 10.0.11.0/24  10.0.1.2           3 10.0.1.2        0 02:40
msk-aamishina-gw-01# show ip rip status
Routing Protocol is "rip"
  Sending updates every 30 seconds with +/-50%, next due in 18 seconds
  Timeout after 180 seconds, garbage collect after 120 seconds
  Outgoing update filter list for all interface is not set
  Incoming update filter list for all interface is not set
  Default redistribution metric is 1
  Redistributing:
    Default version control: send version 2, receive version 2
      Interface      Send  Recv  Key-chain
      eth0          2     2
      eth1          2     2
      eth2          2     2
  Routing for Networks:
    eth0
    eth1
    eth2
  Routing Information Sources:
    Gateway          BadPackets BadRoutes Distance Last Update
    10.0.1.2          0         0       120  00:00:20
    10.0.4.1          0         0       120  00:00:06
  Distance: (default is 120)
msk-aamishina-gw-01#
```

Рис. 19: Проверка настройки RIP на маршрутизаторе 1

## Проверка настройки RIP

```
msk-aamishina-gw-02# show ip route rip
Codes: K - kernel route, C - connected, S - static, R - RIP,
      O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
      T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
      f - OpenFabric,
      > - selected route, * - FIB route, q - queued, r - rejected, b - backup
      t - trapped, o - offload failure

R>*> 10.0.3.0/24 [120/2] via 10.0.2.2, eth1, weight 1, 00:02:28
R>*> 10.0.4.0/24 [120/2] via 10.0.1.1, eth0, weight 1, 00:03:13
R>*> 10.0.10.0/24 [120/2] via 10.0.1.1, eth0, weight 1, 00:03:13
R>*> 10.0.11.0/24 [120/2] via 10.0.2.2, eth1, weight 1, 00:02:16
msk-aamishina-gw-02# show ip rip
Codes: R - RIP, C - connected, S - Static, O - OSPF, B - BGP
Sub-codes:
      (n) - normal, (s) - static, (d) - default, (r) - redistribute,
      (i) - interface

      Network          Next Hop           Metric From        Tag Time
C(i) 10.0.1.0/24    0.0.0.0            1 self           0
C(i) 10.0.2.0/24    0.0.0.0            1 self           0
R(n) 10.0.3.0/24    10.0.2.2           2 10.0.2.2       0 02:38
R(n) 10.0.4.0/24    10.0.1.1           2 10.0.1.1       0 02:48
R(n) 10.0.10.0/24   10.0.1.1           2 10.0.1.1       0 02:48
R(n) 10.0.11.0/24   10.0.2.2           2 10.0.2.2       0 02:30
msk-aamishina-gw-02# show ip rip status
Routing Protocol is "rip"
  Sending updates every 30 seconds with +/-50%, next due in 15 seconds
  Timeout after 180 seconds, garbage collect after 120 seconds
  Outgoing update filter list for all interface is not set
  Incoming update filter list for all interface is not set
  Default redistribution metric is 1
  Redistributing:
  Default version control: send version 2, receive version 2
    Interface      Send   Recv   Key-chain
      eth0         2      2
      eth1         2      2
  Routing for Networks:
    eth0
    eth1
  Routing Information Sources:
    Gateway      BadPackets BadRoutes Distance Last Update
    10.0.1.1        0          0       120  00:00:01
    10.0.2.2        0          0       120  00:00:11
  Distance: (default is 120)
msk-aamishina-gw-02#
```

Рис. 20: Проверка настройки RIP на маршрутизаторе 2

# Проверка настройки RIP

```
msk-aamishina-gw-03# show ip route rip
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
       T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
       r - OpenFabric,
       > - selected route, * - FIB route, q - queued, r - rejected, b - backup
       t - trapped, o - offload failure

R>* 10.0.1.0/24 [120/2] via 10.0.2.1, eth1, weight 1, 00:03:19
R>* 10.0.4.0/24 [120/2] via 10.0.3.2, eth2, weight 1, 00:02:42
R>* 10.0.10.0/24 [120/3] via 10.0.2.1, eth1, weight 1, 00:03:19
msk-aamishina-gw-03# show ip rip
Codes: R - RIP, C - connected, S - Static, O - OSPF, B - BGP
Sub-codes:
      (n) - normal, (s) - static, (d) - default, (r) - redistribute,
      (i) - interface

      Network          Next Hop           Metric From        Tag Time
R(n) 10.0.1.0/24    10.0.2.1          2 10.0.2.1      0 02:42
C(i) 10.0.2.0/24   0.0.0.0          1 self          0
C(i) 10.0.3.0/24   0.0.0.0          1 self          0
R(n) 10.0.4.0/24    10.0.3.2          2 10.0.3.2      0 02:37
R(n) 10.0.10.0/24   10.0.2.1         3 10.0.2.1     0 02:42
C(i) 10.0.11.0/24  0.0.0.0          1 self          0
msk-aamishina-gw-03# show ip rip status
Routing Protocol is "rip"
  Sending updates every 30 seconds with +/-50%, next due in 9 seconds
  Timeout after 180 seconds, garbage collect after 120 seconds
  Outgoing update filter list for all interface is not set
  Incoming update filter list for all interface is not set
  Default redistribution metric is 1
  Redistributing:
    Default version control: send version 2, receive version 2
      Interface      Send  Recv  Key-chain
      eth0          2     2
      eth1          2     2
      eth2          2     2
  Routing for Networks:
    eth0
    eth1
    eth2
  Routing Information Sources:
    Gateway          BadPackets  BadRoutes  Distance  Last Update
    10.0.2.1          0            0          120  00:00:21
    10.0.3.2          0            0          120  00:00:01
  Distance: (default is 120)
msk-aamishina-gw-03#
```

Рис. 21: Проверка настройки RIP на маршрутизаторе 3

## Проверка настройки RIP

```
msk-aamishina-gw-04# show ip route rip
Codes: K - kernel route, C - connected, S - static, R - RIP,
      O - OSPF, I - IS-IS, B - BGP, E - EIGRP, N - NHRP,
      T - Table, v - VNC, V - VNC-Direct, A - Babel, F - PBR,
      f - OpenFabric,
      > - selected route, * - FIB route, q - queued, r - rejected, b - backup
      t - trapped, o - offload failure

R>* 10.0.1.0/24 [120/2] via 10.0.4.2, eth1, weight 1, 00:03:04
R>* 10.0.2.0/24 [120/2] via 10.0.3.1, eth0, weight 1, 00:03:06
R>* 10.0.10.0/24 [120/2] via 10.0.4.2, eth1, weight 1, 00:03:04
R>* 10.0.11.0/24 [120/2] via 10.0.3.1, eth0, weight 1, 00:03:06
msk-aamishina-gw-04# show ip rip
Codes: R - RIP, C - connected, S - Static, O - OSPF, B - BGP
Sub-codes:
      (n) - normal, (s) - static, (d) - default, (r) - redistribute,
      (i) - interface

      Network          Next Hop          Metric From           Tag Time
R(n) 10.0.1.0/24    10.0.4.2          2 10.0.4.2          0 02:37
R(n) 10.0.2.0/24    10.0.3.1          2 10.0.3.1          0 02:49
C(i) 10.0.3.0/24    0.0.0.0          1 self              0
C(i) 10.0.4.0/24    0.0.0.0          1 self              0
R(n) 10.0.10.0/24   10.0.4.2          2 10.0.4.2          0 02:37
R(n) 10.0.11.0/24   10.0.3.1          2 10.0.3.1          0 02:49
msk-aamishina-gw-04# show ip rip status
Routing Protocol is "rip"
  Sending updates every 30 seconds with +/-50%, next due in 6 seconds
  Timeout after 180 seconds, garbage collect after 120 seconds
  Outgoing update filter list for all interface is not set
  Incoming update filter list for all interface is not set
  Default redistribution metric is 1
  Redistributing:
  Default version control: send version 2, receive version 2
  Interface      Send  Recv  Key-chain
    eth0          2     2
    eth1          2     2
  Routing for Networks:
    eth0
    eth1
  Routing Information Sources:
    Gateway      BadPackets BadRoutes Distance Last Update
    10.0.3.1        0         0       120  00:00:13
    10.0.4.2        0         0       120  00:00:25
  Distance: (default is 120)
msk-aamishina-gw-04#
```

Рис. 22: Проверка настройки RIP на маршрутизаторе 4

 PC1-aamishina - PuTTY  
VPCS>  
VPCS>  
VPCS>  
VPCS>  
VPCS> ping 10.0.11.10  
  
84 bytes from 10.0.11.10 icmp\_seq=1 ttl=61 time=10.973 ms  
84 bytes from 10.0.11.10 icmp\_seq=2 ttl=61 time=7.900 ms  
84 bytes from 10.0.11.10 icmp\_seq=3 ttl=61 time=8.133 ms  
84 bytes from 10.0.11.10 icmp\_seq=4 ttl=61 time=9.092 ms  
84 bytes from 10.0.11.10 icmp\_seq=5 ttl=61 time=10.134 ms  
  
VPCS> trace 10.0.11.10 -P 6  
trace to 10.0.11.10, 8 hops max (TCP), press Ctrl+C to stop  
1 10.0.10.1 5.219 ms 1.463 ms 1.040 ms  
2 10.0.1.2 12.516 ms 3.942 ms 3.274 ms  
3 10.0.2.2 12.660 ms 2.515 ms 2.751 ms  
4 10.0.11.10 2.585 ms 2.820 ms 2.213 ms  
  
VPCS> █

Рис. 23: Команды ping и trace с PC1

## Проверка метрик протокола RIP

```
msk-aamishina-gw-01#  
msk-aamishina-gw-01# show ip rip  
Codes: R - RIP, C - connected, S - Static, O - OSPF, B - BGP  
Sub-codes:  
      (n) - normal, (s) - static, (d) - default, (r) - redistribute,  
      (i) - interface  
  
      Network          Next Hop          Metric From        Tag Time  
C(i) 10.0.1.0/24    0.0.0.0          1 self           0  
R(n) 10.0.2.0/24    10.0.1.2         2 10.0.1.2       0 02:53  
R(n) 10.0.3.0/24    10.0.4.1         2 10.0.4.1       0 02:51  
C(i) 10.0.4.0/24    0.0.0.0          1 self           0  
C(i) 10.0.10.0/24   0.0.0.0          1 self           0  
R(n) 10.0.11.0/24   10.0.1.2         3 10.0.1.2       0 02:53  
msk-aamishina-gw-01#
```

Рис. 24: Проверка метрик протокола RIP

## Отключение интерфейса

```
msk-aamishina-gw-02# configure terminal
msk-aamishina-gw-02(config)# interface eth0
msk-aamishina-gw-02(config-if)# shutdown
msk-aamishina-gw-02(config-if)# exit
msk-aamishina-gw-02(config)# exit
msk-aamishina-gw-02# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-02# show running-config
Building configuration...

Current configuration:
!
frr version 8.2.2
frr defaults traditional
hostname frr
hostname msk-aamishina-gw-02
service integrated-vtysh-config
!
interface eth0
    ip address 10.0.1.2/24
    ipv6 address 2001:1::2/64
    shutdown
exit
!
interface eth1
    ip address 10.0.2.1/24
    ipv6 address 2001:2::1/64
exit
!
router rip
    network eth0
    network eth1
    version 2
exit
!
end
msk-aamishina-gw-02#
```

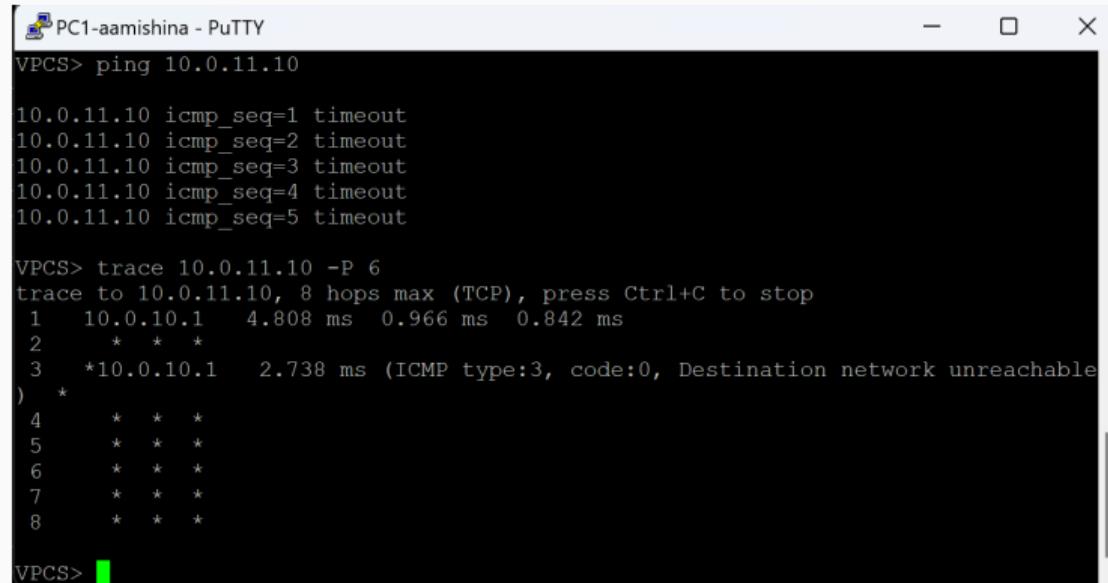
Рис. 25: Отключение на маршрутизаторе 2 интерфейса

## Проверка метрик протокола RIP

```
msk-aamishina-gw-01# show ip rip
Codes: R - RIP, C - connected, S - Static, O - OSPF, B - BGP
Sub-codes:
      (n) - normal, (s) - static, (d) - default, (r) - redistribute,
      (i) - interface

      Network          Next Hop          Metric From        Tag Time
C(i) 10.0.1.0/24    0.0.0.0          1 self            0
R(n) 10.0.2.0/24    10.0.1.2         2 10.0.1.2       0 00:50
R(n) 10.0.3.0/24    10.0.4.1         2 10.0.4.1       0 02:30
C(i) 10.0.4.0/24    0.0.0.0          1 self            0
C(i) 10.0.10.0/24   0.0.0.0          1 self            0
R(n) 10.0.11.0/24   10.0.1.2         3 10.0.1.2       0 00:50
msk-aamishina-gw-01#
```

Рис. 26: Проверка метрик протокола RIP



PC1-aamishina - PuTTY

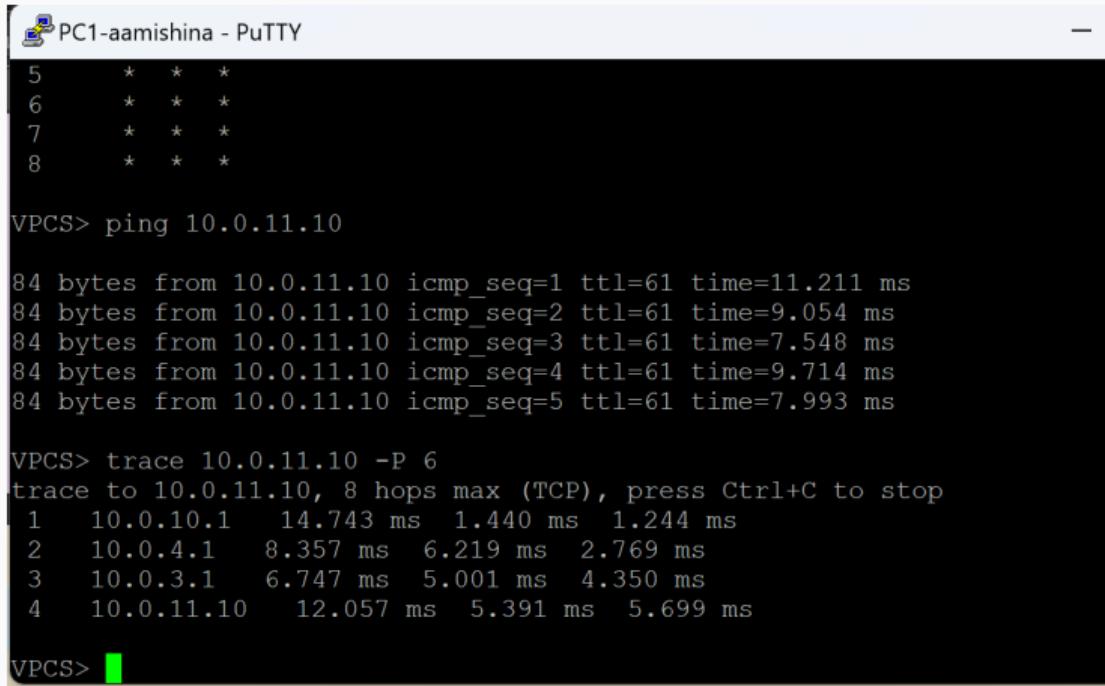
```
VPCS> ping 10.0.11.10

10.0.11.10 icmp_seq=1 timeout
10.0.11.10 icmp_seq=2 timeout
10.0.11.10 icmp_seq=3 timeout
10.0.11.10 icmp_seq=4 timeout
10.0.11.10 icmp_seq=5 timeout

VPCS> trace 10.0.11.10 -P 6
trace to 10.0.11.10, 8 hops max (TCP), press Ctrl+C to stop
 1  10.0.10.1    4.808 ms  0.966 ms  0.842 ms
 2  *   *   *
 3  *10.0.10.1    2.738 ms (ICMP type:3, code:0, Destination network unreachable
)  *
 4  *   *   *
 5  *   *   *
 6  *   *   *
 7  *   *   *
 8  *   *   *

VPCS>
```

Рис. 27: Команды ping и trace с PC1



PC1-aamishina - PuTTY

```
5      * * *
6      * * *
7      * * *
8      * * *

VPCS> ping 10.0.11.10

84 bytes from 10.0.11.10 icmp_seq=1 ttl=61 time=11.211 ms
84 bytes from 10.0.11.10 icmp_seq=2 ttl=61 time=9.054 ms
84 bytes from 10.0.11.10 icmp_seq=3 ttl=61 time=7.548 ms
84 bytes from 10.0.11.10 icmp_seq=4 ttl=61 time=9.714 ms
84 bytes from 10.0.11.10 icmp_seq=5 ttl=61 time=7.993 ms

VPCS> trace 10.0.11.10 -P 6
trace to 10.0.11.10, 8 hops max (TCP), press Ctrl+C to stop
1  10.0.10.1   14.743 ms  1.440 ms  1.244 ms
2  10.0.4.1    8.357 ms  6.219 ms  2.769 ms
3  10.0.3.1    6.747 ms  5.001 ms  4.350 ms
4  10.0.11.10   12.057 ms  5.391 ms  5.699 ms

VPCS>
```

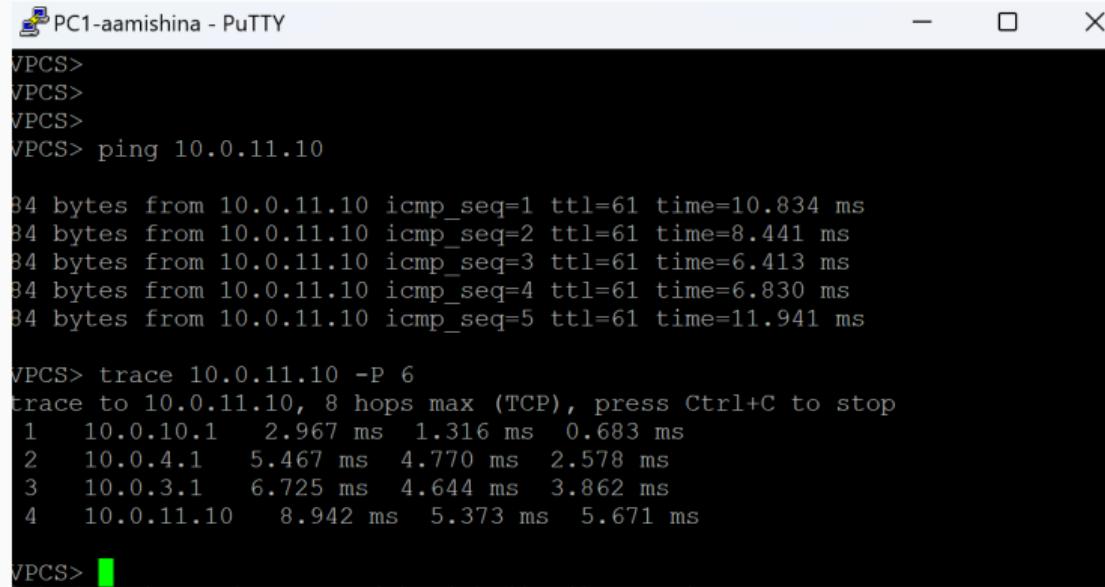
Рис. 28: Команды ping и trace с PC1

## Включение интерфейса

```
msk-aamishina-gw-02# configure terminal
msk-aamishina-gw-02(config)# interface eth0
msk-aamishina-gw-02(config-if)# no shutdown
msk-aamishina-gw-02(config-if)# exit
msk-aamishina-gw-02(config)# exit
msk-aamishina-gw-02# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-02# show running-config
Building configuration...

Current configuration:
!
frr version 0.2.2
frr defaults traditional
hostname frr
hostname msk-aamishina-gw-02
service integrated-vtysh-config
!
interface eth0
    ip address 10.0.1.2/24
    ipv6 address 2001:1::2/64
exit
!
interface eth1
    ip address 10.0.2.1/24
    ipv6 address 2001:2::1/64
exit
!
router rip
    network eth0
    network eth1
    version 2
exit
!
end
msk-aamishina-gw-02#
```

Рис. 29: Включение на маршрутизаторе 2 интерфейса



PC1-aamishina - PuTTY

```
VPCS>
VPCS>
VPCS>
VPCS> ping 10.0.11.10
.
84 bytes from 10.0.11.10 icmp_seq=1 ttl=61 time=10.834 ms
84 bytes from 10.0.11.10 icmp_seq=2 ttl=61 time=8.441 ms
84 bytes from 10.0.11.10 icmp_seq=3 ttl=61 time=6.413 ms
84 bytes from 10.0.11.10 icmp_seq=4 ttl=61 time=6.830 ms
84 bytes from 10.0.11.10 icmp_seq=5 ttl=61 time=11.941 ms

VPCS> trace 10.0.11.10 -P 6
trace to 10.0.11.10, 8 hops max (TCP), press Ctrl+C to stop
 1  10.0.10.1    2.967 ms   1.316 ms   0.683 ms
 2  10.0.4.1    5.467 ms   4.770 ms   2.578 ms
 3  10.0.3.1    6.725 ms   4.644 ms   3.862 ms
 4  10.0.11.10   8.942 ms   5.373 ms   5.671 ms

VPCS>
```

Рис. 30: Команды ping и trace с PC1

# Захваченный трафик

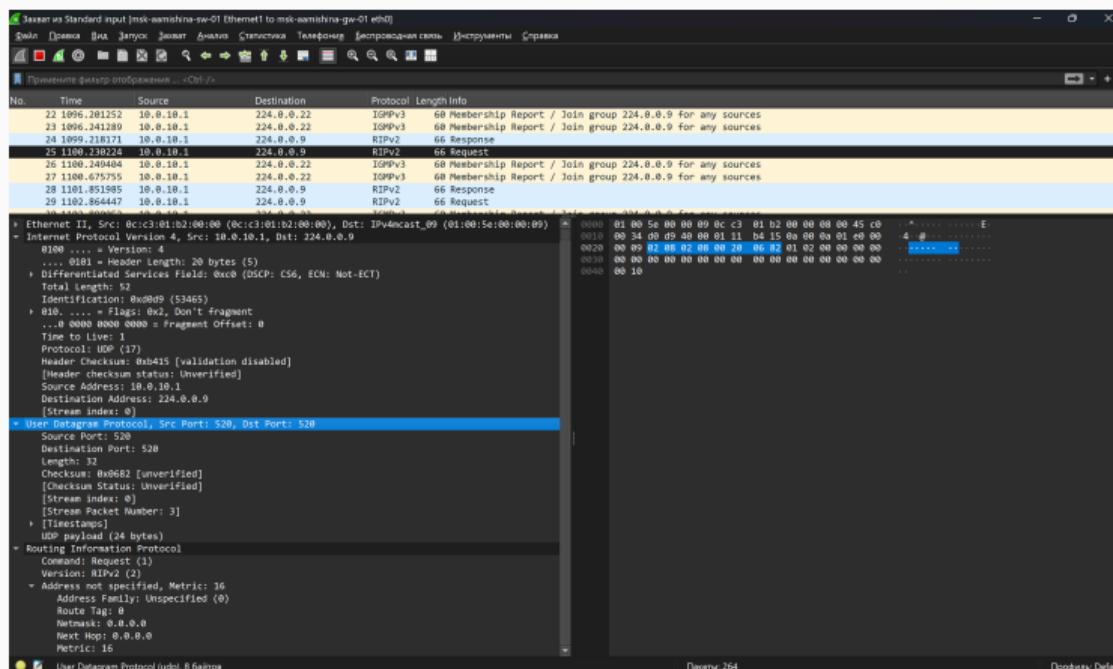


Рис. 31: Захваченный трафик Request

# Захваченный трафик

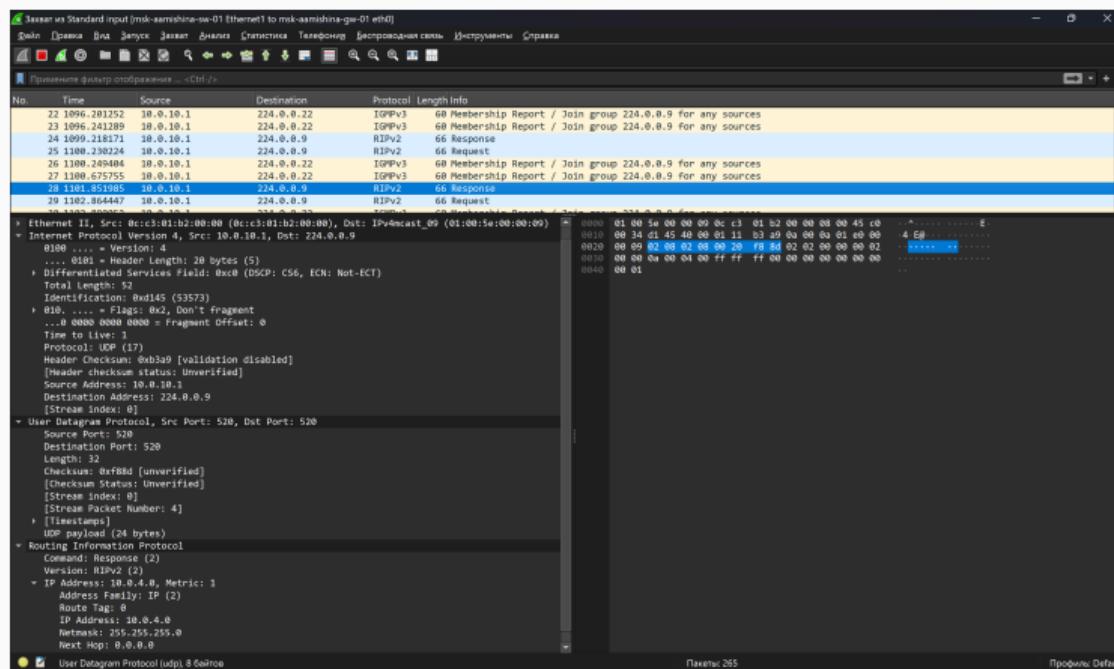


Рис. 32: Захваченный трафик Response

# Захваченный трафик

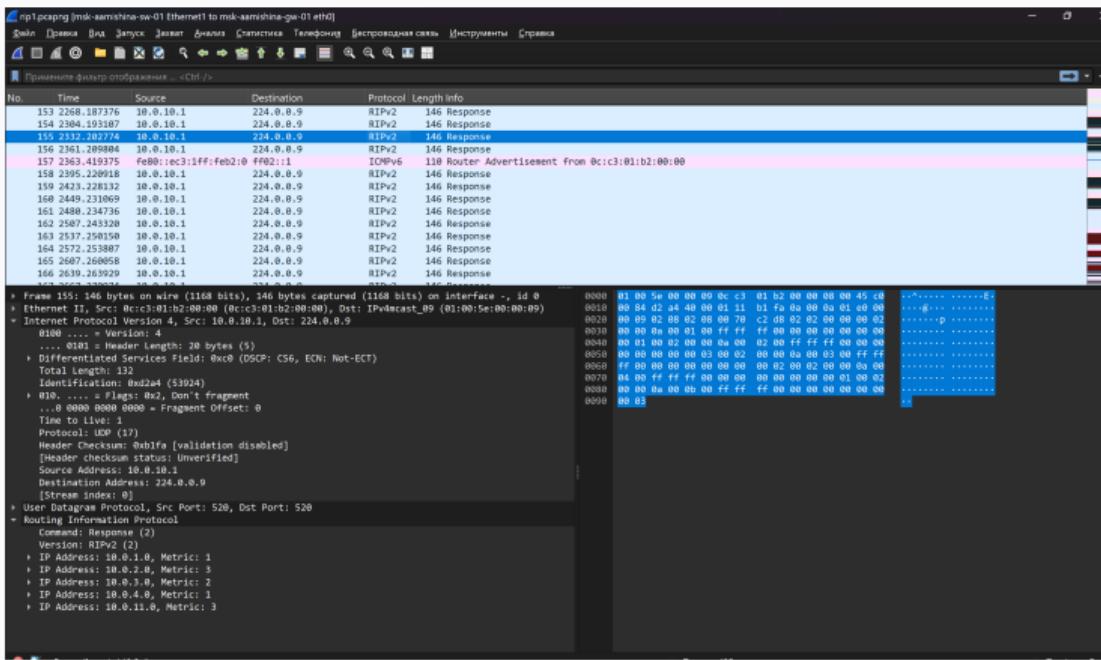


Рис. 33: Захваченный трафик Response

## Настройка RIPng для сетей IPv6

```
msk-aamishina-gw-01# configure terminal
msk-aamishina-gw-01(config)# router ripng
msk-aamishina-gw-01(config-router)# network eth0
msk-aamishina-gw-01(config-router)# network eth1
msk-aamishina-gw-01(config-router)# network eth2
msk-aamishina-gw-01(config-router)# exit
msk-aamishina-gw-01(config)# exit
msk-aamishina-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-aamishina-gw-01#
```

Рис. 34: Настройка RIPng для сетей IPv6 на маршрутизаторе 1

## Настройка RIPng для сетей IPv6

```
msk-aamishina-gw-02# configure terminal
msk-aamishina-gw-02(config)# router ripng
msk-aamishina-gw-02(config-router)# network eth0
msk-aamishina-gw-02(config-router)# network eth1
msk-aamishina-gw-02(config-router)# exit
msk-aamishina-gw-02(config)# exit
msk-aamishina-gw-02# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-02#
```

Рис. 35: Настройка RIPng для сетей IPv6 на маршрутизаторе 2

## Настройка RIPng для сетей IPv6

```
msk-aamishina-gw-03#  
msk-aamishina-gw-03#  
msk-aamishina-gw-03# configure terminal  
msk-aamishina-gw-03(config)# router ripng  
msk-aamishina-gw-03(config-router)# network eth0  
msk-aamishina-gw-03(config-router)# network eth1  
msk-aamishina-gw-03(config-router)# network eth2  
msk-aamishina-gw-03(config-router)# exit  
msk-aamishina-gw-03(config)# exit  
msk-aamishina-gw-03# write memory  
Note: this version of vtysh never writes vtysh.conf  
Building Configuration...  
Integrated configuration saved to /etc/frr/frr.conf  
[OK]  
msk-aamishina-gw-03#
```

Рис. 36: Настройка RIPng для сетей IPv6 на маршрутизаторе 3

## Настройка RIPng для сетей IPv6

```
msk-aamishina-gw-04#  
msk-aamishina-gw-04# configure terminal  
msk-aamishina-gw-04(config)# router ripng  
msk-aamishina-gw-04(config-router)# network eth0  
msk-aamishina-gw-04(config-router)# network eth1  
msk-aamishina-gw-04(config-router)# exit  
msk-aamishina-gw-04(config)# exit  
msk-aamishina-gw-04# write memory  
Note: this version of vtysh never writes vtysh.conf  
Building Configuration...  
Integrated configuration saved to /etc/frr/frr.conf  
[OK]  
msk-aamishina-gw-04#
```

Рис. 37: Настройка RIPng для сетей IPv6 на маршрутизаторе 4

 PC1-aamishina - PuTTY  
VPCS>  
VPCS>  
VPCS> ping 2001:11::a  
  
2001:11::a icmp6\_seq=1 ttl=58 time=11.590 ms  
2001:11::a icmp6\_seq=2 ttl=58 time=9.821 ms  
2001:11::a icmp6\_seq=3 ttl=58 time=11.049 ms  
2001:11::a icmp6\_seq=4 ttl=58 time=8.714 ms  
2001:11::a icmp6\_seq=5 ttl=58 time=9.042 ms  
  
VPCS> trace 2001:11::a  
  
trace to 2001:11::a, 64 hops max  
1 2001:10::1 4.290 ms 0.918 ms 1.698 ms  
2 2001:1::2 6.449 ms 4.120 ms 2.423 ms  
3 2001:2::2 10.077 ms 7.326 ms 7.770 ms  
4 2001:11::a 6.507 ms 3.801 ms 4.024 ms  
  
VPCS>

Рис. 38: Команды ping и trace с PC1

## Проверка метрики протокола RIPng

```
msk-aamishina-gw-01# show ipv6 ripng
Codes: R - RIPng, C - connected, S - Static, O - OSPF, B - BGP
Sub-codes:
      (n) - normal, (s) - static, (d) - default, (r) - redistribute,
      (i) - interface, (a/S) - aggregated/Suppressed

      Network          Next Hop            Via     Metric Tag Time
C(i) 2001:1::/64          ::                  self    1      0
R(n) 2001:2::/64          fe80::e9d:f9ff:fe9d:0  eth1    2      0  02:35
R(n) 2001:3::/64          fe80::e32:eff:fe4e:1  eth2    2      0  02:56
C(i) 2001:4::/64          ::                  self    1      0
C(i) 2001:10::/64         ::                  self    1      0
R(n) 2001:11::/64         fe80::e9d:f9ff:fe9d:0  eth1    3      0  02:56
msk-aamishina-gw-01#
```

Рис. 39: Проверка метрики протокола RIPng

## Отключение интерфейса

```
msk-aamishina-gw-02#  
msk-aamishina-gw-02# configure terminal  
msk-aamishina-gw-02(config)# interface eth0  
msk-aamishina-gw-02(config-if)# shutdown  
msk-aamishina-gw-02(config-if)# exit  
msk-aamishina-gw-02(config)# exit  
msk-aamishina-gw-02# write memory  
Note: this version of vtysh never writes vtysh.conf  
Building Configuration...  
Integrated configuration saved to /etc/frr/frr.conf  
[OK]  
msk-aamishina-gw-02#
```

Рис. 40: Отключение интерфейса на маршрутизаторе 2

## Проверка метрик протокола RIPng

```
msk-aamishina-gw-01#  
msk-aamishina-gw-01# show ipv6 ripng  
Codes: R - RIPng, C - connected, S - Static, O - OSPF, B - BGP  
Sub-codes:  
      (n) - normal, (s) - static, (d) - default, (r) - redistribute,  
      (i) - interface, (a/S) - aggregated/Suppressed  
  
          Network      Next Hop                 Via      Metric Tag Time  
C(i) 2001:1::/64          ::                      self     1      0  
R(n) 2001:2::/64          fe80::e9d:f9ff:fe9d:0    eth1     2      0  02:31  
R(n) 2001:3::/64          fe80::e32:eff:fe4e:1    eth2     2      0  02:44  
C(i) 2001:4::/64          ::                      self     1      0  
C(i) 2001:10::/64         ::                      self     1      0  
R(n) 2001:11::/64         fe80::e9d:f9ff:fe9d:0    eth1     3      0  02:44  
msk-aamishina-gw-01# █
```

Рис. 41: Проверка метрик протокола RIPng

```
VPCS> ping 2001:11::a
2001:11::a icmp6_seq=1 timeout
2001:11::a icmp6_seq=2 timeout
2001:11::a icmp6_seq=3 timeout
2001:11::a icmp6_seq=4 timeout
2001:11::a icmp6_seq=5 timeout

VPCS> trace 2001:11::a
trace to 2001:11::a, 64 hops max
1 2001:10::1    2.368 ms  0.880 ms  0.985 ms
2 * * *
3 *2001:10::1    81.760 ms (ICMP type:1, code:3, Address unreachable)
```

Рис. 42: Команды ping и trace с PC1

```
VPCS> ping 2001:11::a

2001:11::a icmp6_seq=1 ttl=58 time=11.590 ms
2001:11::a icmp6_seq=2 ttl=58 time=9.821 ms
2001:11::a icmp6_seq=3 ttl=58 time=11.049 ms
2001:11::a icmp6_seq=4 ttl=58 time=8.714 ms
2001:11::a icmp6_seq=5 ttl=58 time=9.042 ms

VPCS> trace 2001:11::a

trace to 2001:11::a, 64 hops max
 1 2001:10::1    4.290 ms  0.918 ms  1.698 ms
 2 2001:1::2     6.449 ms  4.120 ms  2.423 ms
 3 2001:2::2     10.077 ms  7.326 ms  7.770 ms
 4 2001:11::a    6.507 ms  3.801 ms  4.024 ms
```

Рис. 43: Команды ping и trace с PC1

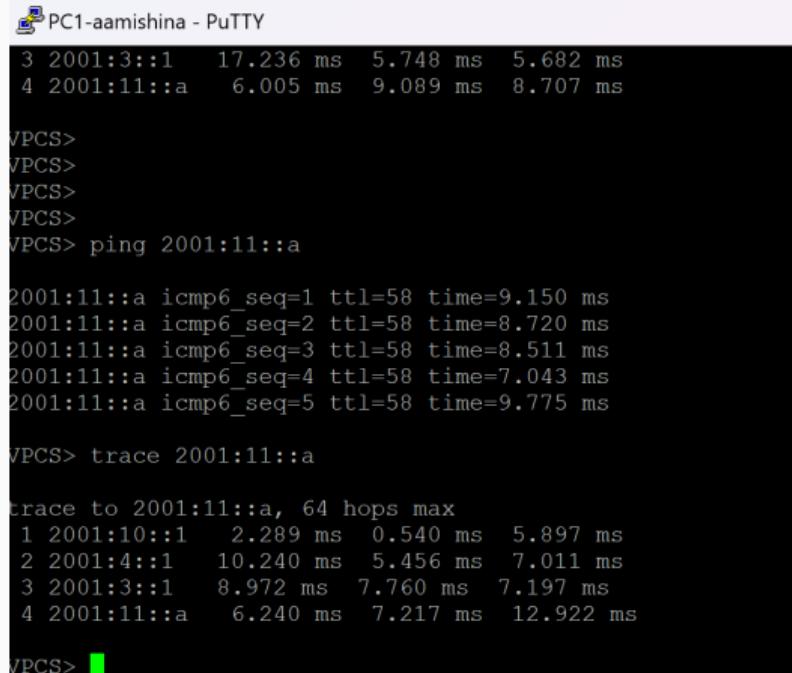
## Включение интерфейса

```
msk-aamishina-gw-02# configure terminal
msk-aamishina-gw-02(config)# interface eth0
msk-aamishina-gw-02(config-if)# no shutdown
msk-aamishina-gw-02(config-if)# exit
msk-aamishina-gw-02(config)# write memory
% Unknown command: write memory
msk-aamishina-gw-02(config)# exit
msk-aamishina-gw-02# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
(OK)
msk-aamishina-gw-02# show running-config
Building configuration...

Current configuration:
!
frr version 8.2.2
frr defaults traditional
hostname frr
hostname msk-aamishina-gw-02
service integrated-vtysh-config
!
interface eth0
    ip address 10.0.1.2/24
    ipv6 address 2001:1::2/64
exit
!
interface eth1
    ip address 10.0.2.1/24
    ipv6 address 2001:2::1/64
exit
!
router rip
    network eth0
    network eth1
    version 2
exit
!
router ripng
```

lines 1-23

Рис. 44: Включение интерфейса на маршрутизаторе 2



PC1-aamishina - PuTTY

```
3 2001:3::1    17.236 ms  5.748 ms  5.682 ms
4 2001:11::a   6.005 ms  9.089 ms  8.707 ms

VPCS>
VPCS>
VPCS>
VPCS>
VPCS> ping 2001:11::a

2001:11::a icmp6_seq=1 ttl=58 time=9.150 ms
2001:11::a icmp6_seq=2 ttl=58 time=8.720 ms
2001:11::a icmp6_seq=3 ttl=58 time=8.511 ms
2001:11::a icmp6_seq=4 ttl=58 time=7.043 ms
2001:11::a icmp6_seq=5 ttl=58 time=9.775 ms

VPCS> trace 2001:11::a

trace to 2001:11::a, 64 hops max
1 2001:10::1   2.289 ms  0.540 ms  5.897 ms
2 2001:4::1   10.240 ms  5.456 ms  7.011 ms
3 2001:3::1   8.972 ms  7.760 ms  7.197 ms
4 2001:11::a   6.240 ms  7.217 ms  12.922 ms

VPCS>
```

Рис. 45: Команды ping и trace с PC1

# Захваченный трафик

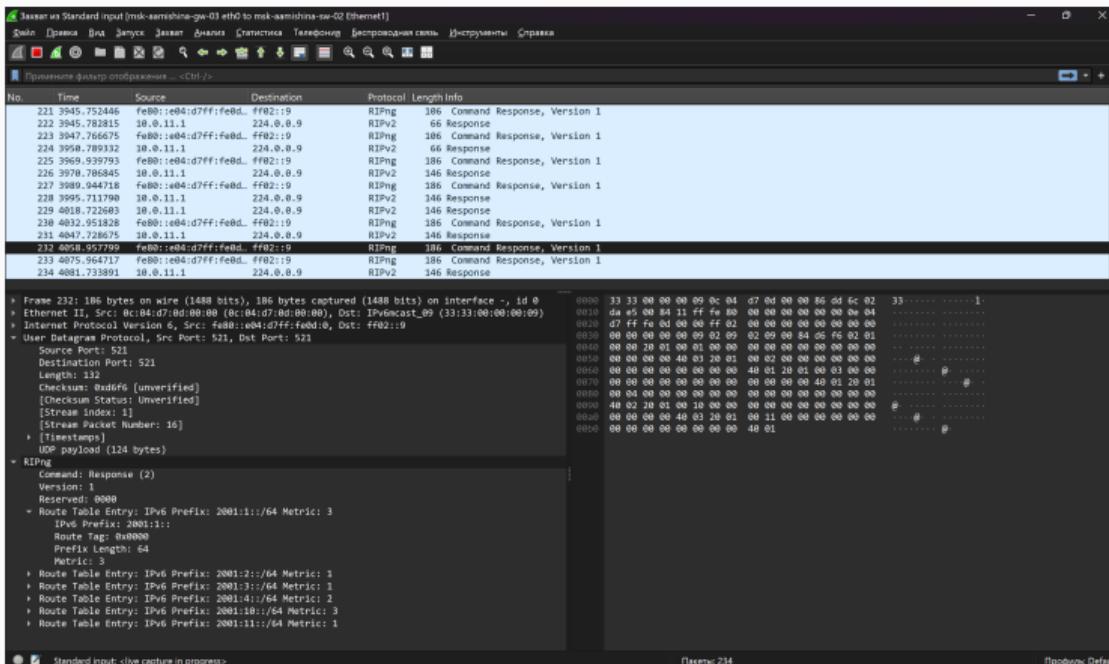


Рис. 46: Захваченный трафик Response

## Захваченный трафик

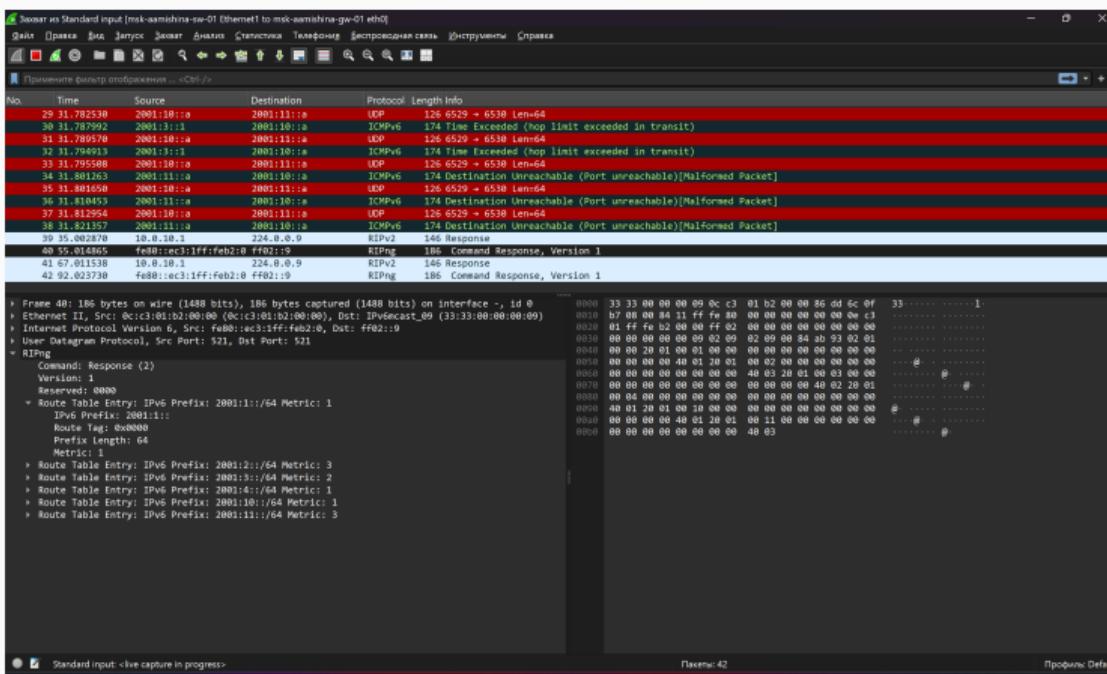


Рис. 47: Захваченный трафик Response

## Настройка динамической маршрутизации по протоколу OSPF

---

## Настройка OSPFv2 для сетей IPv4

```
msk-aamishina-gw-01# configure terminal
msk-aamishina-gw-01(config)# router ospf
msk-aamishina-gw-01(config-router)# network 10.0.10.0/24 area 0.0.0.0
msk-aamishina-gw-01(config-router)# network 10.0.1.0/24 area 0.0.0.0
msk-aamishina-gw-01(config-router)# network 10.0.4.0/24 area 0.0.0.0
msk-aamishina-gw-01(config-router)# exit
msk-aamishina-gw-01(config)# exit
msk-aamishina-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-aamishina-gw-01#
```

Рис. 48: Настройка OSPFv2 для сетей IPv4 на маршрутизаторе 1

## Настройка OSPFv2 для сетей IPv4

```
msk-aamishina-gw-02#  
msk-aamishina-gw-02# configure terminal  
msk-aamishina-gw-02(config)# router ospf  
msk-aamishina-gw-02(config-router)# network 10.0.1.0/24 area 0.0.0.0  
msk-aamishina-gw-02(config-router)# network 10.0.2.0/24 area 0.0.0.0  
msk-aamishina-gw-02(config-router)# exit  
msk-aamishina-gw-02(config)# exit  
msk-aamishina-gw-02# write memory  
Note: this version of vtysh never writes vtysh.conf  
Building Configuration...  
Integrated configuration saved to /etc/frr/frr.conf  
[OK]  
msk-aamishina-gw-02#
```

Рис. 49: Настройка OSPFv2 для сетей IPv4 на маршрутизаторе 2

## Настройка OSPFv2 для сетей IPv4

```
msk-aamishina-gw-03#
msk-aamishina-gw-03# configure terminal
msk-aamishina-gw-03(config)# router ospf
msk-aamishina-gw-03(config-router)# network 10.0.11.0/24 area 0.0.0.0
msk-aamishina-gw-03(config-router)# network 10.0.2.0/24 area 0.0.0.0
msk-aamishina-gw-03(config-router)# network 10.0.3.0/24 area 0.0.0.0
msk-aamishina-gw-03(config-router)# exit
msk-aamishina-gw-03(config)# exit
msk-aamishina-gw-03# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-03#
```

Рис. 50: Настройка OSPFv2 для сетей IPv4 на маршрутизаторе 3

## Настройка OSPFv2 для сетей IPv4

```
msk-aamishina-gw-04#
msk-aamishina-gw-04# configure terminal
msk-aamishina-gw-04(config)# router ospf
msk-aamishina-gw-04(config-router)# network 10.0.3.0/24 area 0.0.0.0
msk-aamishina-gw-04(config-router)# network 10.0.4.0/24 area 0.0.0.0
msk-aamishina-gw-04(config-router)# exit
msk-aamishina-gw-04(config)# exit
msk-aamishina-gw-04# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-04#
```

Рис. 51: Настройка OSPFv2 для сетей IPv4 на маршрутизаторе 4

```
Checking for duplicate address...
VPCS : 10.0.10.10 255.255.255.0 gateway 10.0.10.1
PC1 : 2001:10::a/64
VPCS>
VPCS> ping 10.0.11.10

84 bytes from 10.0.11.10 icmp_seq=1 ttl=61 time=21.901 ms
84 bytes from 10.0.11.10 icmp_seq=2 ttl=61 time=10.409 ms
84 bytes from 10.0.11.10 icmp_seq=3 ttl=61 time=14.680 ms
84 bytes from 10.0.11.10 icmp_seq=4 ttl=61 time=14.861 ms
84 bytes from 10.0.11.10 icmp_seq=5 ttl=61 time=9.565 ms

VPCS> trace 10.0.11.10 -P 6
trace to 10.0.11.10, 8 hops max (TCP), press Ctrl+C to stop
 1  10.0.10.1    5.610 ms   1.785 ms   0.394 ms
 2  10.0.4.1    16.925 ms   6.203 ms   4.358 ms
 3  10.0.2.2    14.104 ms   8.722 ms   11.144 ms
 4  10.0.11.10   13.723 ms   14.791 ms   13.510 ms

VPCS>
```

Рис. 52: Команды ping и trace с PC1

## Проверка таблицы маршрутизации

```
msk-aamishina-gw-01# show ip ospf neighbor


| Neighbor ID      | Pri | State       | Up Time           | Dead Time | Address  | Interface |
|------------------|-----|-------------|-------------------|-----------|----------|-----------|
|                  |     |             | RXmtL RqstL DBsmL |           |          |           |
| 10.0.2.1<br>.1.1 | 1   | Full/Backup | 4m43s<br>0 0 0    | 34.132s   | 10.0.1.2 | eth1:10.0 |
| 10.0.4.1<br>.4.2 | 1   | Full/Backup | 2m07s<br>0 0 0    | 32.669s   | 10.0.4.1 | eth2:10.0 |


msk-aamishina-gw-01# show ip ospf route
=====
OSPF network routing table =====
N 10.0.1.0/24      [100] area: 0.0.0.0
                           directly attached to eth1
N 10.0.2.0/24      [200] area: 0.0.0.0
                           via 10.0.1.2, eth1
N 10.0.3.0/24      [200] area: 0.0.0.0
                           via 10.0.4.1, eth2
N 10.0.4.0/24      [100] area: 0.0.0.0
                           directly attached to eth2
N 10.0.10.0/24     [100] area: 0.0.0.0
                           directly attached to eth0
N 10.0.11.0/24     [300] area: 0.0.0.0
                           via 10.0.1.2, eth1
                           via 10.0.4.1, eth2

=====
OSPF router routing table =====
===== OSPF external routing table =====

msk-aamishina-gw-01#
```

Рис. 53: Проверка таблицы маршрутизации протокола OSPFv2

## Отключение интерфейса

```
msk-aamishina-gw-02# configure terminal
msk-aamishina-gw-02(config)# interface eth0
msk-aamishina-gw-02(config-if)# shutdown
msk-aamishina-gw-02(config-if)# exit
msk-aamishina-gw-02(config)# exit
msk-aamishina-gw-02# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-02#
```

Рис. 54: Отключение на маршрутизаторе 2 интерфейса

## Проверка таблицы маршрутизации

```
msk-aamishina-gw-01#  
msk-aamishina-gw-01# show ip ospf neighbor  
  
Neighbor ID      Pri State          Up Time           Dead Time Address      Interface  
                  RXmtL RqstL DBsmL  
10.0.2.1          1 Full/Backup    7m54s            3.596s 10.0.1.2      eth1:10.0  
.1.1              1             0     0  
10.0.4.1          1 Full/Backup    5m17s            32.141s 10.0.4.1     eth2:10.0  
.4.2              0             0     0  
  
msk-aamishina-gw-01# show ip ospf route  
===== OSPF network routing table =====  
N   10.0.1.0/24      [100] area: 0.0.0.0  
                           directly attached to eth1  
N   10.0.2.0/24      [300] area: 0.0.0.0  
                           via 10.0.4.1, eth2  
N   10.0.3.0/24      [200] area: 0.0.0.0  
                           via 10.0.4.1, eth2  
N   10.0.4.0/24      [100] area: 0.0.0.0  
                           directly attached to eth2  
N   10.0.10.0/24     [100] area: 0.0.0.0  
                           directly attached to eth0  
N   10.0.11.0/24     [300] area: 0.0.0.0  
                           via 10.0.4.1, eth2  
  
===== OSPF router routing table =====  
  
===== OSPF external routing table =====  
  
msk-aamishina-gw-01#
```

Рис. 55: Проверка таблицы маршрутизации протокола OSPFv2

```
VPCS>
VPCS> ping 10.0.11.10

84 bytes from 10.0.11.10 icmp_seq=1 ttl=61 time=15.991 ms
84 bytes from 10.0.11.10 icmp_seq=2 ttl=61 time=8.918 ms
84 bytes from 10.0.11.10 icmp_seq=3 ttl=61 time=13.457 ms
84 bytes from 10.0.11.10 icmp_seq=4 ttl=61 time=14.539 ms
84 bytes from 10.0.11.10 icmp_seq=5 ttl=61 time=11.340 ms

VPCS> trace 10.0.11.10 -P 6
trace to 10.0.11.10, 8 hops max (TCP), press Ctrl+C to stop
 1  10.0.10.1    4.024 ms   1.363 ms   0.646 ms
 2  10.0.4.1    6.573 ms   3.291 ms   4.076 ms
 3  10.0.3.1    14.338 ms   5.851 ms   4.891 ms
 4  10.0.11.10   8.675 ms  10.237 ms  11.801 ms

VPCS> █
```

Рис. 56: Команды ping и trace с PC1

## Включение интерфейса

```
msk-aamishina-gw-02#  
msk-aamishina-gw-02# configure terminal  
msk-aamishina-gw-02(config)# interface eth0  
msk-aamishina-gw-02(config-if)# no shutdown  
msk-aamishina-gw-02(config-if)# exit  
msk-aamishina-gw-02(config)# exit  
msk-aamishina-gw-02# write memory  
Note: this version of vtysh never writes vtysh.conf  
Building Configuration...  
Integrated configuration saved to /etc/frr/frr.conf  
[OK]  
msk-aamishina-gw-02#
```

Рис. 57: Включение на маршрутизаторе 2 интерфейса

```
trace to 10.0.11.10, 8 hops max (TCP), press Ctrl+C to stop
1 10.0.10.1 4.024 ms 1.363 ms 0.646 ms
2 10.0.4.1 6.573 ms 3.291 ms 4.076 ms
3 10.0.3.1 14.338 ms 5.851 ms 4.891 ms
4 10.0.11.10 8.675 ms 10.237 ms 11.801 ms

/PCS>
/PCS>
/PCS> ping 10.0.11.10

84 bytes from 10.0.11.10 icmp_seq=1 ttl=61 time=10.593 ms
84 bytes from 10.0.11.10 icmp_seq=2 ttl=61 time=9.221 ms
84 bytes from 10.0.11.10 icmp_seq=3 ttl=61 time=9.628 ms
84 bytes from 10.0.11.10 icmp_seq=4 ttl=61 time=10.277 ms
84 bytes from 10.0.11.10 icmp_seq=5 ttl=61 time=10.396 ms

/PCS> trace 10.0.11.10 -P 6
trace to 10.0.11.10, 8 hops max (TCP), press Ctrl+C to stop
1 10.0.10.1 4.946 ms 1.734 ms 0.709 ms
2 10.0.1.2 10.260 ms 8.800 ms 5.057 ms
3 10.0.3.1 11.934 ms 8.210 ms 6.014 ms
4 10.0.11.10 12.873 ms 6.577 ms 13.026 ms

/PCS>
```

Рис. 58: Команды ping и trace с PC1

# Захваченный трафик

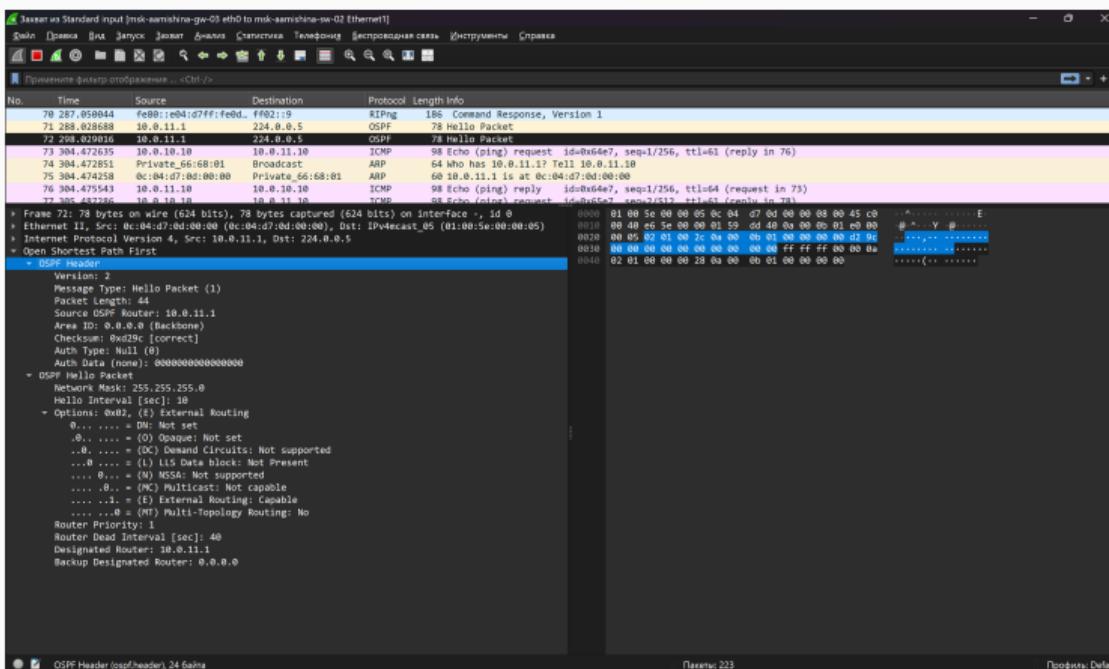


Рис. 59: Захваченный трафик

## Настройка OSPFv3 для сетей IPv6

```
msk-aamishina-gw-01# configure terminal
msk-aamishina-gw-01(config)# router ospf6
msk-aamishina-gw-01(config-ospf6)# ospf6 router-id 1.1.1.1
msk-aamishina-gw-01(config-ospf6)# exit
msk-aamishina-gw-01(config)# interface eth0
msk-aamishina-gw-01(config-if)# ipv6 ospf6 area 0
msk-aamishina-gw-01(config-if)# exit
msk-aamishina-gw-01(config)# interface eth1
msk-aamishina-gw-01(config-if)# ipv6 ospf6 area 0
msk-aamishina-gw-01(config-if)# exit
msk-aamishina-gw-01(config)# interface eth2
msk-aamishina-gw-01(config-if)# ipv6 ospf6 area 0
msk-aamishina-gw-01(config-if)# exit
msk-aamishina-gw-01(config)# exit
msk-aamishina-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-aamishina-gw-01# █
```

Рис. 60: Настройка OSPFv3 для сетей IPv6 на маршрутизаторе 1

## Настройка OSPFv3 для сетей IPv6

```
msk-aamishina-gw-02#
msk-aamishina-gw-02# configure terminal
msk-aamishina-gw-02(config)# router ospf6
msk-aamishina-gw-02(config-ospf6)# ospf6 router-id 2.2.2.2
msk-aamishina-gw-02(config-ospf6)# exit
msk-aamishina-gw-02(config)# interface eth0
msk-aamishina-gw-02(config-if)# ipv6 ospf6 area 0
msk-aamishina-gw-02(config-if)# exit
msk-aamishina-gw-02(config)# interface eth1
msk-aamishina-gw-02(config-if)# ipv6 ospf6 area 0
msk-aamishina-gw-02(config-if)# exit
msk-aamishina-gw-02(config)# exit
msk-aamishina-gw-02# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-02# █
```

Рис. 61: Настройка OSPFv3 для сетей IPv6 на маршрутизаторе 2

## Настройка OSPFv3 для сетей IPv6

```
msk-aamishina-gw-03#
msk-aamishina-gw-03# configure terminal
msk-aamishina-gw-03(config)# router ospf6
msk-aamishina-gw-03(config-ospf6)# ospf6 router-id 3.3.3.3
msk-aamishina-gw-03(config-ospf6)# exit
msk-aamishina-gw-03(config)# interface eth0
msk-aamishina-gw-03(config-if)# ipv6 ospf6 area 0
msk-aamishina-gw-03(config-if)# exit
msk-aamishina-gw-03(config)# interface eth1
msk-aamishina-gw-03(config-if)# ipv6 ospf6 area 0
msk-aamishina-gw-03(config-if)# exit
msk-aamishina-gw-03(config)# interface eth2
msk-aamishina-gw-03(config-if)# ipv6 ospf6 area 0
msk-aamishina-gw-03(config-if)# exit
msk-aamishina-gw-03(config)# exit
msk-aamishina-gw-03# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-03#
```

Рис. 62: Настройка OSPFv3 для сетей IPv6 на маршрутизаторе 3

## Настройка OSPFv3 для сетей IPv6

```
msk-aamishina-gw-04#
msk-aamishina-gw-04# configure terminal
msk-aamishina-gw-04(config)# router ospf6
msk-aamishina-gw-04(config-ospf6)# ospf6 router-id 4.4.4.4
msk-aamishina-gw-04(config-ospf6)# exit
msk-aamishina-gw-04(config)# interface eth0
msk-aamishina-gw-04(config-if)# ipv6 ospf6 area 0
msk-aamishina-gw-04(config-if)# exit
msk-aamishina-gw-04(config)# interface eth1
msk-aamishina-gw-04(config-if)# ipv6 ospf6 area 0
msk-aamishina-gw-04(config-if)# exit
msk-aamishina-gw-04(config)# exit
msk-aamishina-gw-04# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-04#
```

Рис. 63: Настройка OSPFv3 для сетей IPv6 на маршрутизаторе 4

```
PC1-aamishina - PuTTY
3 10.0.3.1 11.934 ms 8.210 ms 6.014 ms
4 10.0.11.10 12.873 ms 6.577 ms 13.026 ms

VPCS>
VPCS>
VPCS>
VPCS>
VPCS> ping 2001:11::a

2001:11::a icmp6_seq=1 ttl=58 time=19.258 ms
2001:11::a icmp6_seq=2 ttl=58 time=9.198 ms
2001:11::a icmp6_seq=3 ttl=58 time=9.347 ms
2001:11::a icmp6_seq=4 ttl=58 time=9.650 ms
2001:11::a icmp6_seq=5 ttl=58 time=9.971 ms

VPCS> trace 2001:11::a

trace to 2001:11::a, 64 hops max
1 2001:10::1 3.752 ms 1.174 ms 1.076 ms
2 2001:1::2 10.865 ms 3.408 ms 4.451 ms
3 2001:2::2 11.572 ms 9.361 ms 12.431 ms
4 2001:11::a 8.480 ms 12.141 ms 13.880 ms

VPCS>
```

Рис. 64: Команды ping и trace с PC1

## Проверка таблицы маршрутизации

```
msk-aamishina-gw-01#  
msk-aamishina-gw-01# show ipv6 ospf6 neighbor  
Neighbor ID      Pri     DeadTime       State/IfState          Duration I/F[State]  
2.2.2.2           1      00:00:31      Full/BDR             00:03:25 eth1[DR]  
4.4.4.4           1      00:00:34      Full/BDR             00:00:53 eth2[DR]  
msk-aamishina-gw-01# show ipv6 ospf6 route  
*N IA 2001:1::/64          ::          eth1 00:00:58  
*N IA 2001:2::/64          fe80::e9d:f9ff:fe9d:0    eth1 00:00:58  
*N IA 2001:3::/64          fe80::e32:eff:fe4e:1    eth2 00:00:58  
*N IA 2001:4::/64          ::          eth2 00:00:58  
*N IA 2001:10::/64         ::          eth0 00:00:58  
*N IA 2001:11::/64         fe80::e9d:f9ff:fe9d:0    eth1 00:00:58  
                           fe80::e32:eff:fe4e:1    eth2  
msk-aamishina-gw-01#
```

Рис. 65: Проверка таблицы маршрутизации протокола OSPFv3

## Отключение интерфейса

```
msk-aamishina-gw-02# configure terminal
msk-aamishina-gw-02(config)# interface eth0
msk-aamishina-gw-02(config-if)# shutdown
msk-aamishina-gw-02(config-if)# exit
msk-aamishina-gw-02(config)# exit
msk-aamishina-gw-02# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-02#
```

Рис. 66: Отключение интерфейса на маршрутизаторе 2

## Проверка таблицы маршрутизации

```
msk-aamishina-gw-01#  
msk-aamishina-gw-01# show ipv6 ospf6 route  
*N IA 2001:1::/64          ::          eth1 00:00:27  
*N IA 2001:2::/64          fe80::e32:eff:fe4e:1  eth2 00:00:27  
*N IA 2001:3::/64          fe80::e32:eff:fe4e:1  eth2 00:00:27  
*N IA 2001:4::/64          ::          eth2 00:00:27  
*N IA 2001:10::/64         ::          eth0 00:00:27  
*N IA 2001:11::/64         fe80::e32:eff:fe4e:1  eth2 00:00:27  
msk-aamishina-gw-01# █
```

Рис. 67: Проверка таблицы маршрутизации протокола OSPFv3

PC1-aamishina - PuTTY

```
4 2001:11::a 8.480 ms 12.141 ms 13.880 ms

VPCS>
VPCS>
VPCS>
VPCS>
VPCS>
VPCS> ping 2001:11::a

2001:11::a icmp6_seq=1 ttl=58 time=16.707 ms
2001:11::a icmp6_seq=2 ttl=58 time=8.826 ms
2001:11::a icmp6_seq=3 ttl=58 time=12.349 ms
2001:11::a icmp6_seq=4 ttl=58 time=12.692 ms
2001:11::a icmp6_seq=5 ttl=58 time=13.167 ms

VPCS> trace 2001:11::a

trace to 2001:11::a, 64 hops max
 1 2001:10::1 1.753 ms 2.014 ms 1.418 ms
 2 2001:4::1 7.336 ms 2.108 ms 5.105 ms
 3 2001:3::1 7.655 ms 4.082 ms 6.674 ms
 4 2001:11::a 6.049 ms 10.594 ms 6.585 ms

VPCS>
```

Рис. 68: Команды ping и trace с PC1

## Включение интерфейса

```
msk-aamishina-gw-02# configure terminal
msk-aamishina-gw-02(config)# interface eth0
msk-aamishina-gw-02(config-if)# no shutdown
msk-aamishina-gw-02(config-if)# exit
msk-aamishina-gw-02(config)# exit
msk-aamishina-gw-02# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-aamishina-gw-02# █
```

Рис. 69: Включение интерфейса на маршрутизаторе 2

```
PC1-aamishina - PuTTY
1 2001:10::1 1.753 ms 2.014 ms 1.418 ms
2 2001:4::1 7.336 ms 2.108 ms 5.105 ms
3 2001:3::1 7.655 ms 4.082 ms 6.674 ms
4 2001:11::a 6.049 ms 10.594 ms 6.585 ms

VPCS>
VPCS>
VPCS> ping 2001:11::a

2001:11::a icmp6_seq=1 ttl=58 time=16.261 ms
2001:11::a icmp6_seq=2 ttl=58 time=14.064 ms
2001:11::a icmp6_seq=3 ttl=58 time=23.599 ms
2001:11::a icmp6_seq=4 ttl=58 time=6.342 ms
2001:11::a icmp6_seq=5 ttl=58 time=7.797 ms

VPCS> trace 2001:11::a

trace to 2001:11::a, 64 hops max
1 2001:10::1 1.895 ms 2.355 ms 1.996 ms
2 2001:1::2 7.371 ms 5.321 ms 5.688 ms
3 2001:2::2 7.122 ms 12.596 ms 10.022 ms
4 2001:11::a 12.267 ms 7.328 ms 10.547 ms

VPCS>
```

Рис. 70: Команды ping и trace с PC1

# Захваченный трафик

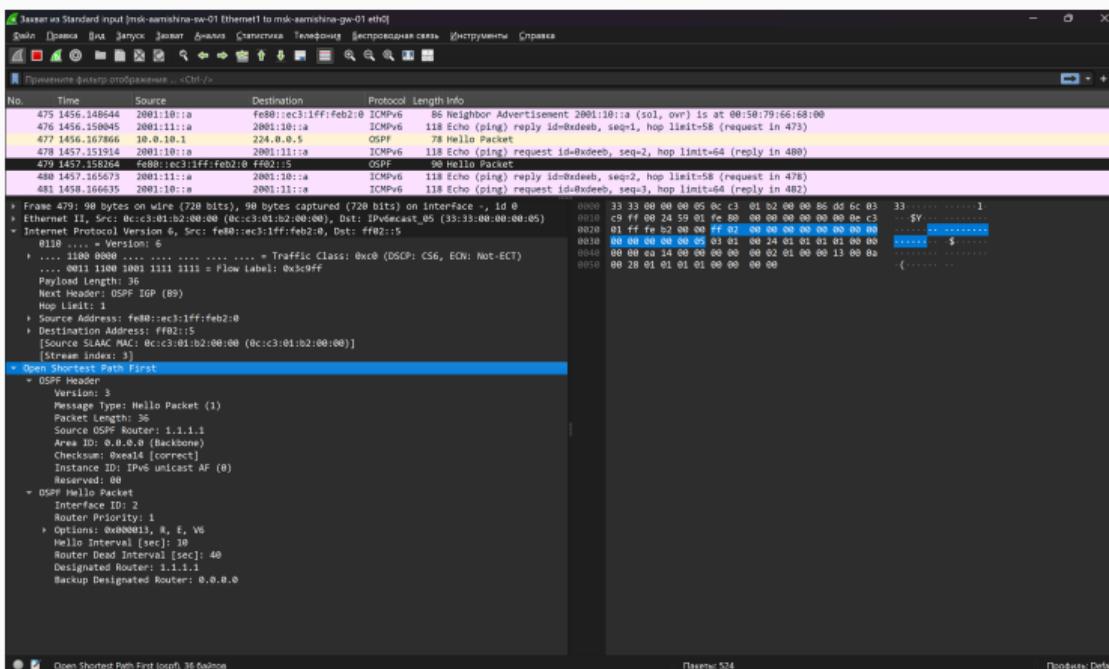


Рис. 71: Захваченный трафик

## Построение туннеля IPv6–IPv4

---

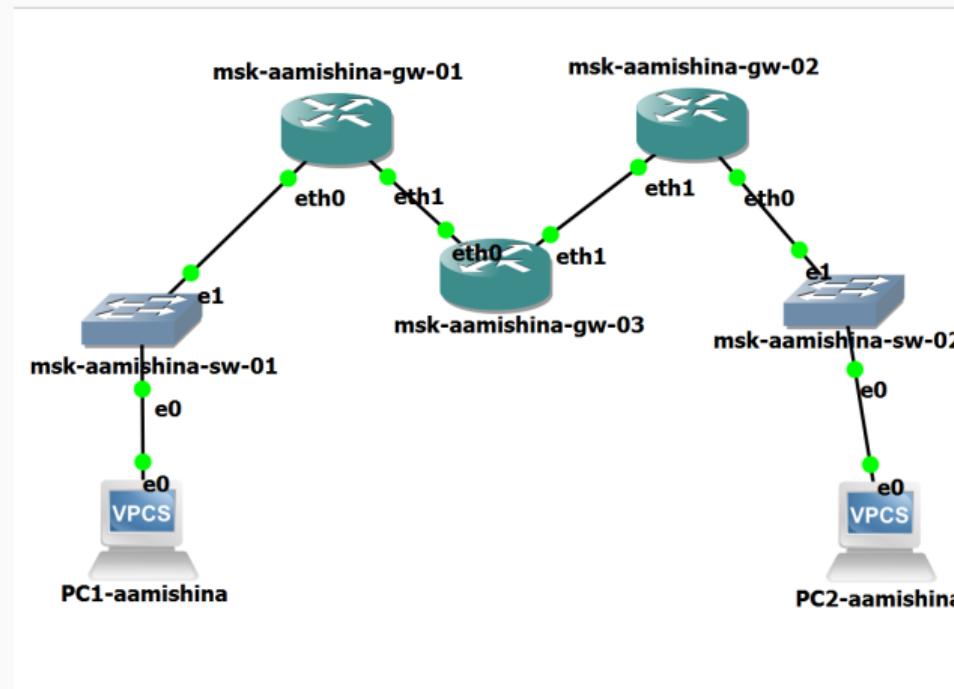
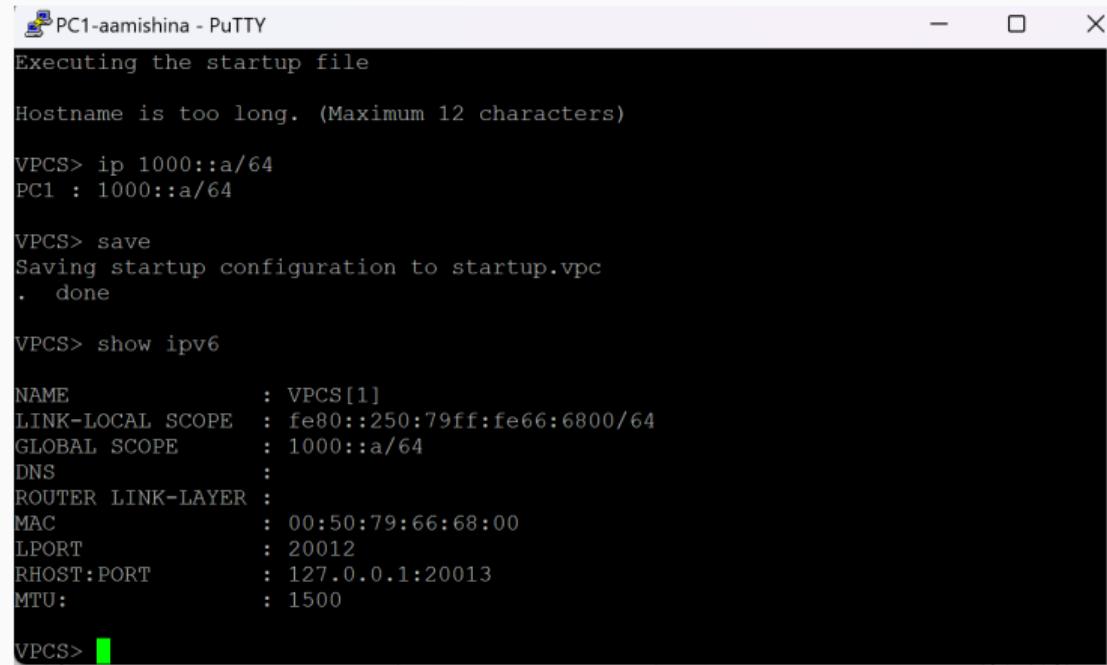


Рис. 72: Топология моделируемой сети в GNS3



```
Executing the startup file

Hostname is too long. (Maximum 12 characters)

VPCS> ip 1000::a/64
PC1 : 1000::a/64

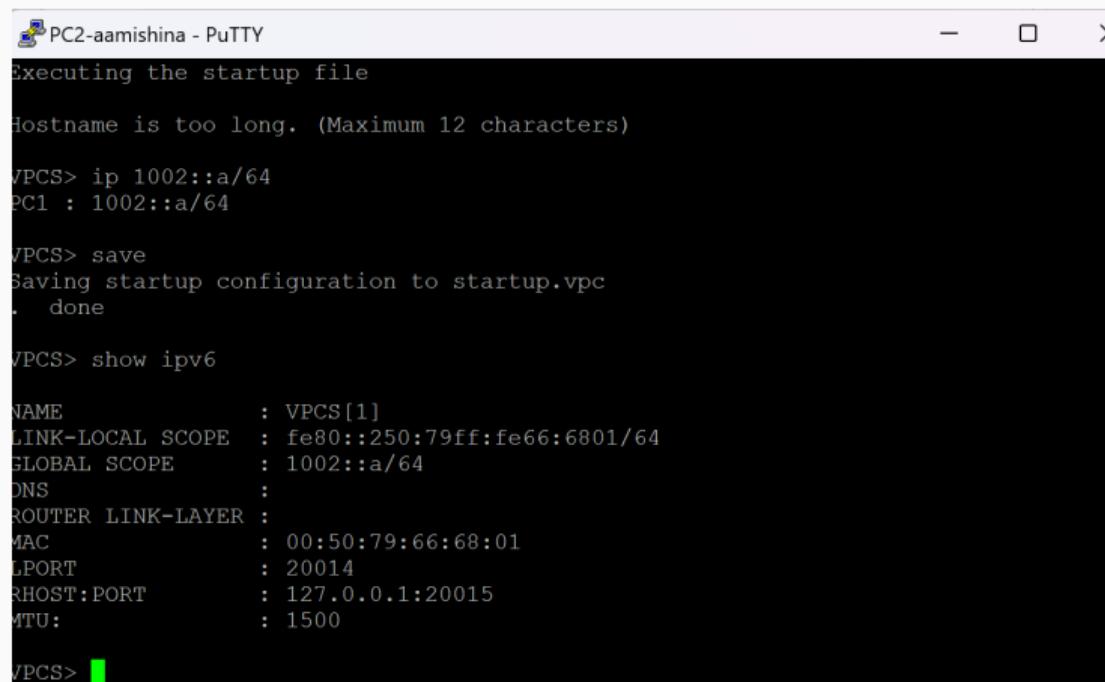
VPCS> save
Saving startup configuration to startup.vpc
. done

VPCS> show ipv6

NAME          : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6800/64
GLOBAL SCOPE    : 1000::a/64
DNS            :
ROUTER LINK-LAYER :
MAC            : 00:50:79:66:68:00
LPORT          : 20012
RHOST:PORT     : 127.0.0.1:20013
MTU:           : 1500

VPCS>
```

Рис. 73: Присвоение IPv4-адреса PC1



```
Executing the startup file

Hostname is too long. (Maximum 12 characters)

VPCS> ip 1002::a/64
PC1 : 1002::a/64

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

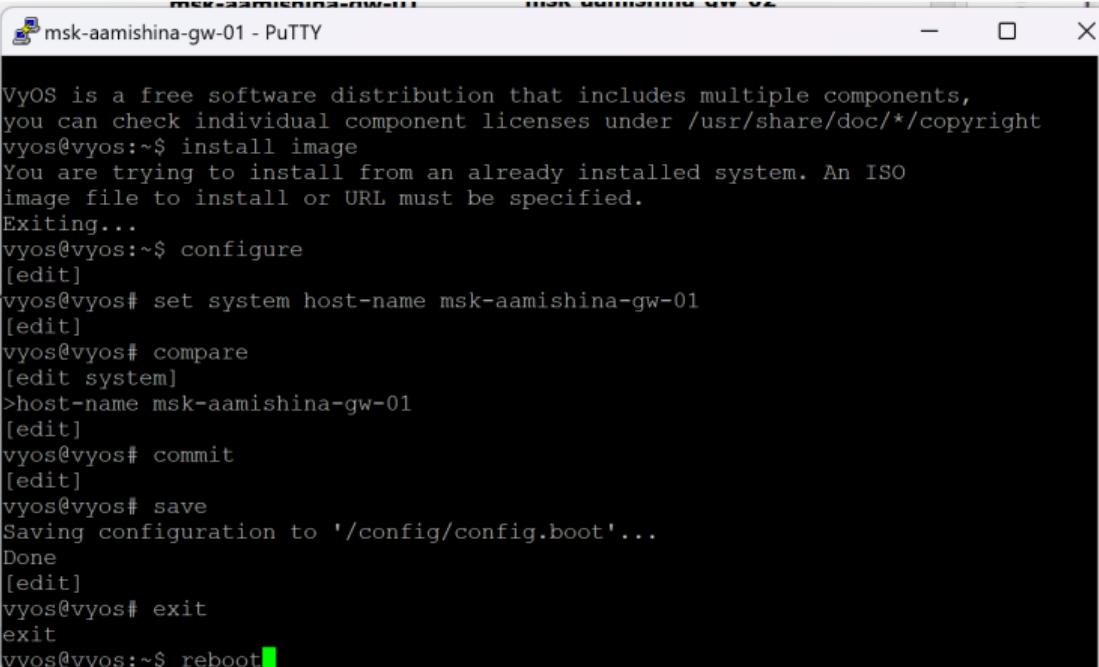
VPCS> show ipv6

NAME          : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6801/64
GLOBAL SCOPE    : 1002::a/64
DNS            :
ROUTER LINK-LAYER :
MAC             : 00:50:79:66:68:01
LPORT           : 20014
RHOST:PORT      : 127.0.0.1:20015
MTU:            : 1500

VPCS>
```

Рис. 74: Присвоение IPv4-адреса PC2

## Смена имени устройства



```
VyOS is a free software distribution that includes multiple components,
you can check individual component licenses under /usr/share/doc/*copyright
vyos@vyos:~$ install image
You are trying to install from an already installed system. An ISO
image file to install or URL must be specified.
Exiting...
vyos@vyos:~$ configure
[edit]
vyos@vyos# set system host-name msk-aamishina-gw-01
[edit]
vyos@vyos# compare
[edit system]
>host-name msk-aamishina-gw-01
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos# exit
exit
vyos@vyos:~$ reboot
```

Рис. 75: Смена имени устройства

## Настройка адреса на интерфейсах

```
vyos@msk-aamishina-gw-01:~$ configure
[edit]
vyos@msk-aamishina-gw-01# set interfaces ethernet eth0 address 1000::1/64
[edit]
vyos@msk-aamishina-gw-01# set interfaces ethernet eth1 address 10.0.0.1/8
[edit]
vyos@msk-aamishina-gw-01# set service router-advert interface eth0 prefix 1000::

[edit]
vyos@msk-aamishina-gw-01#
[edit]
vyos@msk-aamishina-gw-01# commit
[edit]
vyos@msk-aamishina-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-aamishina-gw-01# █
```

Рис. 76: Настройка адреса на интерфейсах маршрутизатора 1

## Настройка адреса на интерфейсах

```
vyos@msk-aamishina-gw-02:~$  
vyos@msk-aamishina-gw-02:~$ configure  
[edit]  
vyos@msk-aamishina-gw-02# set interfaces ethernet eth0 address 1002::1/64  
[edit]  
vyos@msk-aamishina-gw-02# set interfaces ethernet eth1 address 20.0.0.2/8  
[edit]  
/64s@msk-aamishina-gw-02# set service router-advert interface eth0 prefix 1002::  
[edit]  
vyos@msk-aamishina-gw-02# commit  
[edit]  
vyos@msk-aamishina-gw-02# save  
Saving configuration to '/config/config.boot'...  
Done  
[edit]  
vyos@msk-aamishina-gw-02#
```

Рис. 77: Настройка адреса на интерфейсах маршрутизатора 2

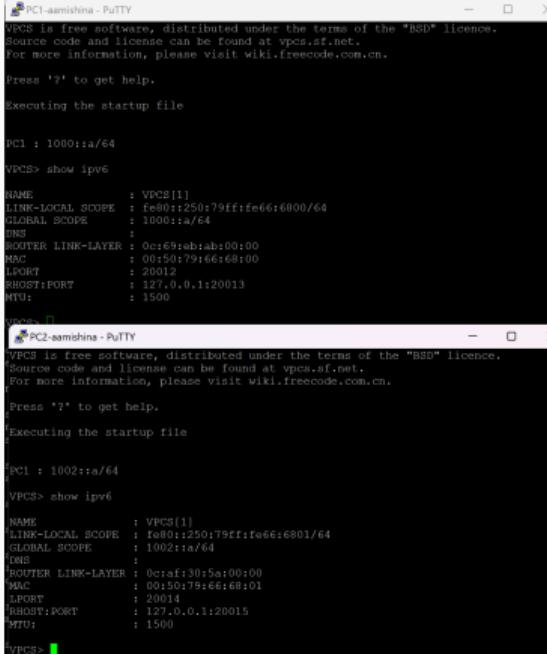
## Настройка адреса на интерфейсах

```
vyos@msk-aamishina-gw-03:~$ vyos@msk-aamishina-gw-03:~$ configure
[edit]
vyos@msk-aamishina-gw-03# set interfaces ethernet eth0 address 10.0.0.2/8
[edit]
vyos@msk-aamishina-gw-03# set interfaces ethernet eth1 address 20.0.0.1/8
[edit]
vyos@msk-aamishina-gw-03# commit
[ interfaces ethernet eth0 ]
Can't configure both static IPv4 and DHCP address on the same interface

[[interfaces ethernet eth0]] failed
savCommit failed
[edit]
vyos@msk-aamishina-gw-03# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@msk-aamishina-gw-03# commit
[edit]
vyos@msk-aamishina-gw-03# █
```

Рис. 78: Настройка адреса на интерфейсах маршрутизатора 3

# Проверка



PCI-aamishina - PuTTY

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

Press '?' to get help.

Executing the startup file

PCI : 1000::a/64

VPCS> show ipv6

NAME	:	VPCS(1)
LINK-LOCAL SCOPE	:	fe80::250:79ff:fe66:6800/64
GLOBAL SCOPE	:	1000::a/64
DNS	:	
ROUTER LINK-LAYER	:	0c:e9:9ab:a:00:00
MAC	:	00:50:79:66:68:00
LPORT	:	20012
RHOST:PORT	:	127.0.0.1:20013
MTU:	:	1500

VPCS> PCI-aamishina - PuTTY

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

Press '?' to get help.

Executing the startup file

PCI : 1002::a/64

VPCS> show ipv6

NAME	:	VPCS(1)
LINK-LOCAL SCOPE	:	fe80::250:79ff:fe66:6801/64
GLOBAL SCOPE	:	1002::a/64
DNS	:	
ROUTER LINK-LAYER	:	0c:af:30:5a:00:00
MAC	:	00:50:79:66:68:01
LPORT	:	20014
RHOST:PORT	:	127.0.0.1:20015
MTU:	:	1500

VPCS>

Рис. 79: Проверка появившихся маршрутизаторов

## Проверка

```
vyos@msk-aamishina-gw-01# ping 10.0.0.2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=18.3 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=4.13 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=9.05 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=4.40 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=6.68 ms
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=4.34 ms
64 bytes from 10.0.0.2: icmp_seq=7 ttl=64 time=8.06 ms
^C
--- 10.0.0.2 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 23ms
rtt min/avg/max/mdev = 4.134/7.856/18.340/4.644 ms
[edit]
vyos@msk-aamishina-gw-01# ping 20.0.0.1
connect: Network is unreachable
[edit]
vyos@msk-aamishina-gw-01# ping 20.0.0.2
connect: Network is unreachable
[edit]
vyos@msk-aamishina-gw-01#
```

Рис. 80: Проверка маршрутов с маршрутизатора 1

## Настройка маршрутизации IPv4

```
[edit]
vyos@msk-aamishina-gw-01# configure

    Invalid command: [configure]

[edit]
vyos@msk-aamishina-gw-01# set protocols rip network 10.0.0.0/8
[edit]
vyos@msk-aamishina-gw-01# commit
[edit]
vyos@msk-aamishina-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-aamishina-gw-01#
```

Рис. 81: Настройка маршрутизации IPv4

## Настройка маршрутизации IPv4

```
vyos@msk-aamishina-gw-02# configure  
      Invalid command: [configure]  
  
[edit]  
vyos@msk-aamishina-gw-02# set protocols rip network 20.0.0.0/8  
[edit]  
vyos@msk-aamishina-gw-02# commit  
[edit]  
vyos@msk-aamishina-gw-02# save  
Saving configuration to '/config/config.boot'...  
Done  
[edit]  
vyos@msk-aamishina-gw-02# █
```

Рис. 82: Настройка маршрутизации IPv4

## Настройка маршрутизации IPv4

```
vyos@msk-aamishina-gw-03# configure
      Invalid command: [configure]

[edit]
vyos@msk-aamishina-gw-03# set protocols rip network 10.0.0.0/8
[edit]
vyos@msk-aamishina-gw-03# set protocols rip network 20.0.0.0/8
[edit]
vyos@msk-aamishina-gw-03# commit
[edit]
vyos@msk-aamishina-gw-03# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-aamishina-gw-03# █
```

Рис. 83: Настройка маршрутизации IPv4

## Проверка

```
vyos@msk-aamishina-gw-01# ping 10.0.0.2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=4.09 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=4.07 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=10.3 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=3.51 ms
^C
--- 10.0.0.2 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 10ms
rtt min/avg/max/mdev = 3.507/5.488/10.282/2.778 ms
[edit]
vyos@msk-aamishina-gw-01# ping 20.0.0.1
PING 20.0.0.1 (20.0.0.1) 56(84) bytes of data.
64 bytes from 20.0.0.1: icmp_seq=1 ttl=64 time=12.4 ms
64 bytes from 20.0.0.1: icmp_seq=2 ttl=64 time=4.08 ms
64 bytes from 20.0.0.1: icmp_seq=3 ttl=64 time=4.22 ms
^C
--- 20.0.0.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 8ms
rtt min/avg/max/mdev = 4.082/6.887/12.358/3.868 ms
[edit]
vyos@msk-aamishina-gw-01# ping 20.0.0.2
PING 20.0.0.2 (20.0.0.2) 56(84) bytes of data.
64 bytes from 20.0.0.2: icmp_seq=1 ttl=63 time=30.5 ms
64 bytes from 20.0.0.2: icmp_seq=2 ttl=63 time=7.18 ms
64 bytes from 20.0.0.2: icmp_seq=3 ttl=63 time=7.03 ms
64 bytes from 20.0.0.2: icmp_seq=4 ttl=63 time=16.7 ms
^C
--- 20.0.0.2 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 12ms
rtt min/avg/max/mdev = 7.034/15.354/30.489/9.580 ms
[edit]
vyos@msk-aamishina-gw-01# 
```

Рис. 84: Проверка маршрутов с маршрутизатора 1

## Создание туннеля

```
vyos@msk-aamishina-gw-01:~$ configure
[edit]
vyos@msk-aamishina-gw-01# set interfaces tunnel tun0 encapsulation sit
[edit]
vyos@msk-aamishina-gw-01# set interfaces tunnel tun0 source-address 10.0.0.1
[edit]
vyos@msk-aamishina-gw-01# set interfaces tunnel tun0 remote 20.0.0.2
[edit]
vyos@msk-aamishina-gw-01# set interfaces tunnel tun0 address 1001::1/64
[edit]
vyos@msk-aamishina-gw-01# commit
[edit]
vyos@msk-aamishina-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-aamishina-gw-01# █
```

Рис. 85: Создание туннеля IPv6 через сеть IPv4

## Создание туннеля

```
you can check individual component licenses under /usr/share/doc/*-copyright
vyos@msk-aamishina-gw-02:~$ configure
[edit]
vyos@msk-aamishina-gw-02# set interfaces tunnel tun0 encapsulation sit
[edit]
vyos@msk-aamishina-gw-02# set interfaces tunnel tun0 source-address 20.0.0.2
[edit]
vyos@msk-aamishina-gw-02# set interfaces tunnel tun0 remote 10.0.0.1
[edit]
vyos@msk-aamishina-gw-02# set interfaces tunnel tun0 address 1001::2/64
[edit]
vyos@msk-aamishina-gw-02# commit
[edit]
vyos@msk-aamishina-gw-02# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-aamishina-gw-02# █
```

Рис. 86: Создание туннеля IPv6 через сеть IPv4

# Настройка статической маршрутизации

```
[edit]
vyos@msk-aamishina-gw-01# configure

    Invalid command: [configure]

[edit]
2yos@msk-aamishina-gw-01# set protocols static route6 1002::0/64 next-hop 1001::
[edit]
vyos@msk-aamishina-gw-01# commit
[edit]
vyos@msk-aamishina-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-aamishina-gw-01# █
```

Рис. 87: Настройка статической маршрутизации IPv6

# Настройка статической маршрутизации

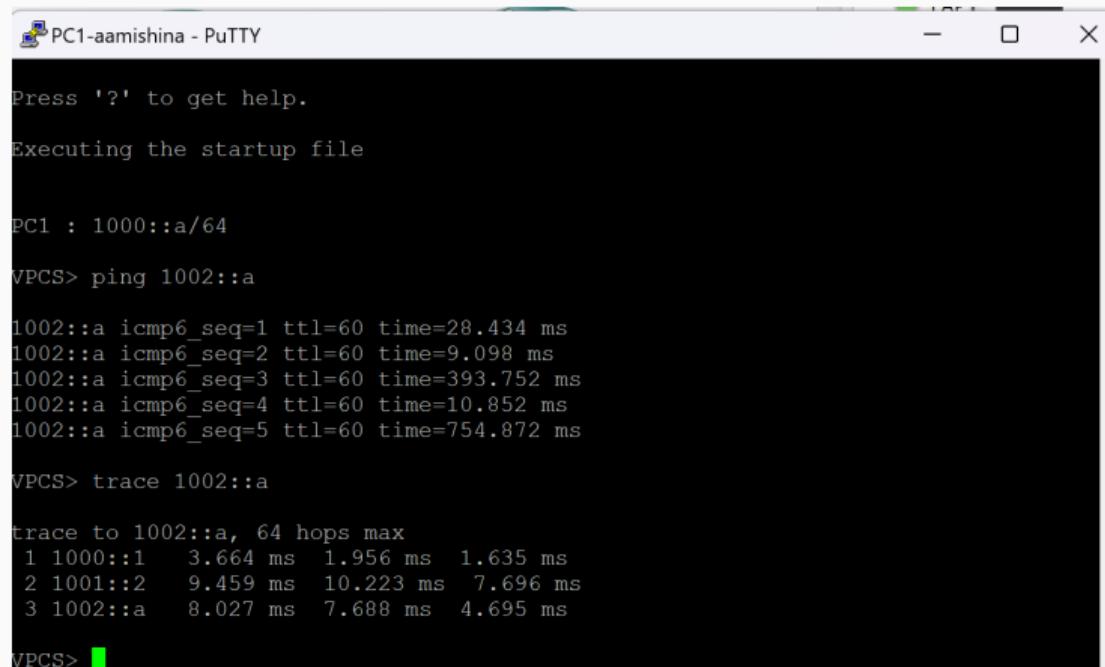
```
[edit]
vyos@msk-aamishina-gw-02# configure

    Invalid command: [configure]

[edit]
vyos@msk-aamishina-gw-02# set protocols static route6 1000::0/64 next-hop 1001::
[edit]
vyos@msk-aamishina-gw-02# commit
[edit]
vyos@msk-aamishina-gw-02# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-aamishina-gw-02# 
```

Рис. 88: Настройка статической маршрутизации IPv6

## Проверка



PC1-aamishina - PuTTY

Press '?' to get help.

Executing the startup file

PC1 : 1000::a/64

VPCS> ping 1002::a

1002::a icmp6\_seq=1 ttl=60 time=28.434 ms  
1002::a icmp6\_seq=2 ttl=60 time=9.098 ms  
1002::a icmp6\_seq=3 ttl=60 time=393.752 ms  
1002::a icmp6\_seq=4 ttl=60 time=10.852 ms  
1002::a icmp6\_seq=5 ttl=60 time=754.872 ms

VPCS> trace 1002::a

trace to 1002::a, 64 hops max  
1 1000::1 3.664 ms 1.956 ms 1.635 ms  
2 1001::2 9.459 ms 10.223 ms 7.696 ms  
3 1002::a 8.027 ms 7.688 ms 4.695 ms

VPCS> █

Рис. 89: Проверка доступности PC1

# Проверка

```
PC2-aamishina - PuTTY

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

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

Press '?' to get help.

Executing the startup file

PC1 : 1002::a/64

VPCS> ping 1000::a

1000::a icmp6_seq=1 ttl=60 time=13.219 ms
1000::a icmp6_seq=2 ttl=60 time=12.499 ms
1000::a icmp6_seq=3 ttl=60 time=10.809 ms
1000::a icmp6_seq=4 ttl=60 time=9.995 ms
1000::a icmp6_seq=5 ttl=60 time=11.193 ms

VPCS> trace 1000::a

trace to 1000::a, 64 hops max
 1 1002::1    3.053 ms  2.376 ms  0.539 ms
 2 1001::1    13.126 ms  9.760 ms  9.460 ms
 3 1000::a    8.792 ms  10.582 ms  8.002 ms

VPCS>
```

Рис. 90: Проверка доступности РС2

## Захват трафика

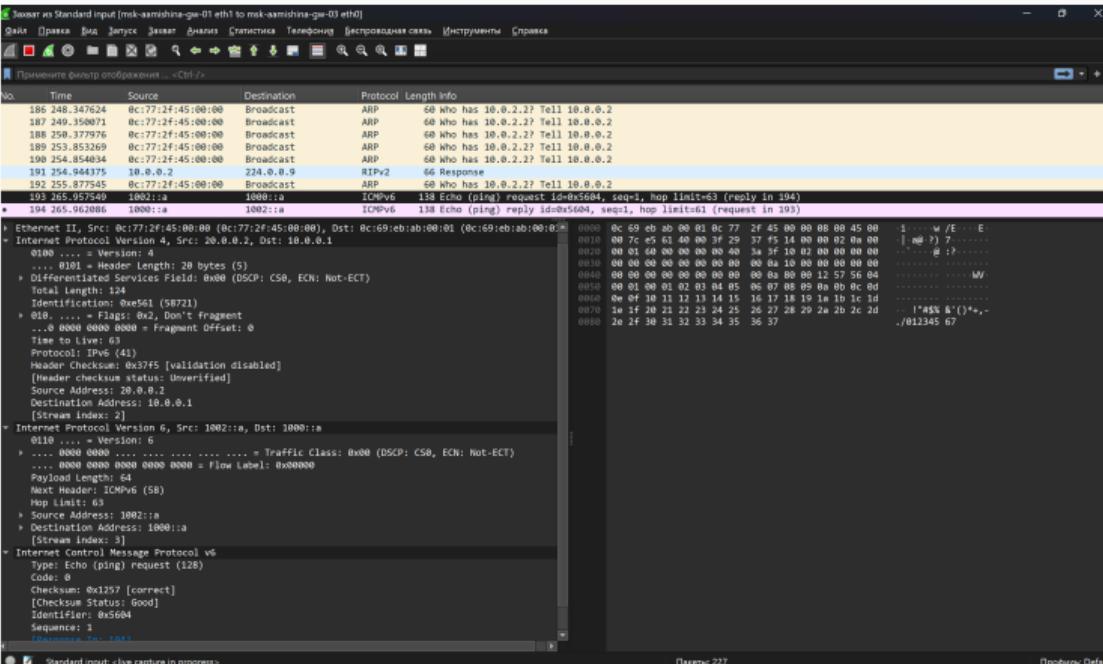


Рис. 91: ICMPv6 пакет

# Захват трафика

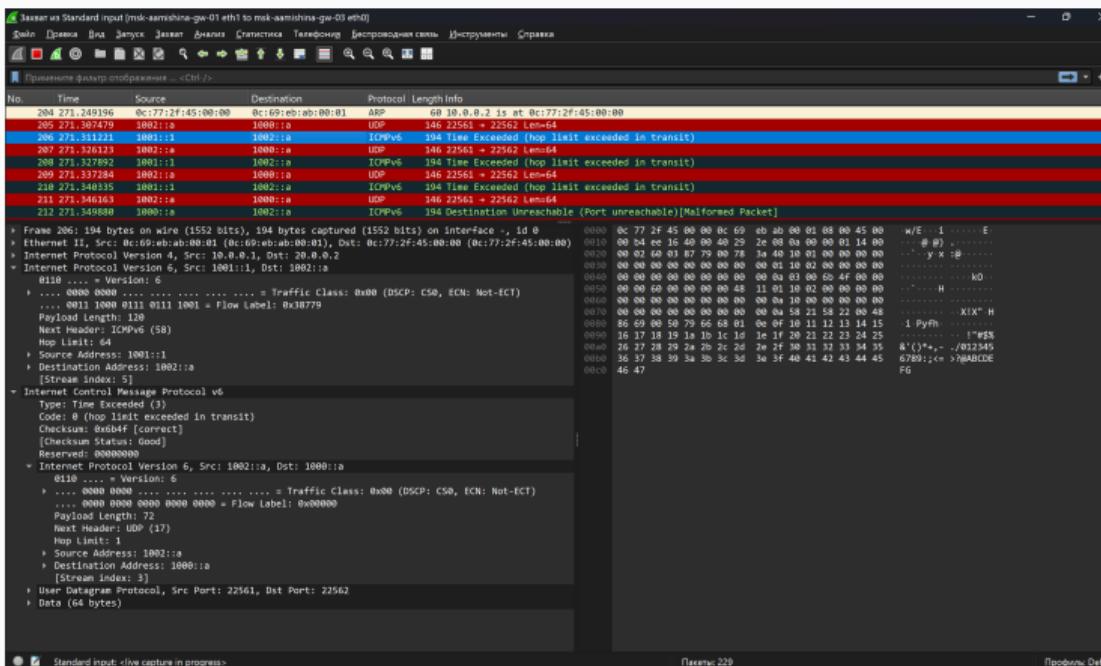


Рис. 92: ICMPv6 пакет

# Захват трафика

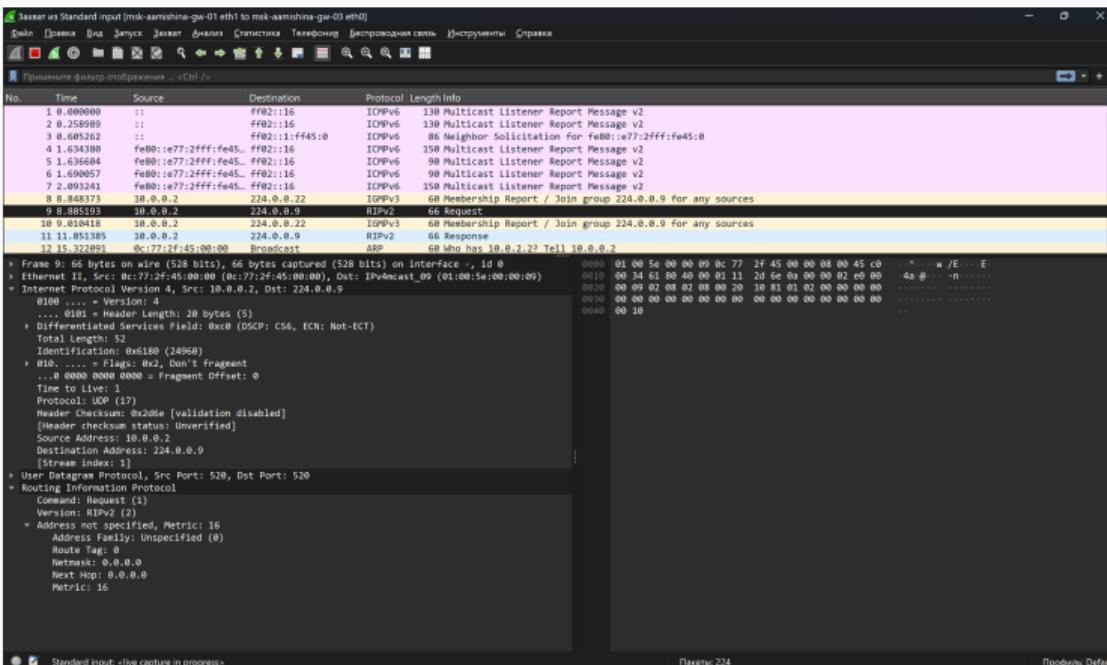


Рис. 93: RIPv2 пакет

## Выводы

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В ходе выполнения лабораторной работы мной были изучены принципы маршрутизации в IPv4- и IPv6-сетях и принципы настройки сетевого оборудования.