

Лабораторная работа №8

Сетевые технологии

Ищенко Ирина НПИбд-02-22

Российский университет дружбы народов, Москва, Россия

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

Выполнение лабораторной работы

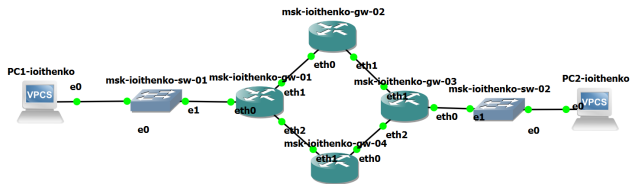


Рис. 1: Топология сети

```
PC1> ip 10.0.10.10/24 10.0.10.1
Checking for duplicate address...
PC1 : 10.0.10.10 255.255.255.0 gateway 10.0.10.1

PC1> save
Saving startup configuration to startup.vpc
. done

PC1> show ip

NAME           : PC1[1]
IP/MASK        : 10.0.10.10/24
GATEWAY        : 10.0.10.1
DNS            :
MAC            : 00:50:79:66:68:00
LPORT         : 20008
RHOST:PORT     : 127.0.0.1:20009
MTU            : 1500

PC1> █
```

Рис. 2: IPv4 на PC1

```
PC2> ip 10.0.11.10/24 10.0.11.1
Checking for duplicate address...
PC2 : 10.0.11.10 255.255.255.0 gateway 10.0.11.1

PC2> save
Saving startup configuration to startup.vpc
. done

PC2> show io
Invalid arguments

PC2> show ip

NAME           : PC2[1]
IP/MASK         : 10.0.11.10/24
GATEWAY        : 10.0.11.1
DNS            :
MAC            : 00:50:79:66:68:01
LPORT          : 20010
RHOST:PORT     : 127.0.0.1:20011
MTU            : 1500

PC2>
```

Рис. 3: IPv4 на PC2

```

[edit]
vyos@msk-ioithenko-gw-01# set interfaces ethernet eth0 address 10.0.10.1/24
[edit]
vyos@msk-ioithenko-gw-01# set interfaces ethernet eth1 address 10.0.1.1/24
[edit]
vyos@msk-ioithenko-gw-01# set interfaces ethernet eth2 address 10.0.4.2/24
[edit]
vyos@msk-ioithenko-gw-01# compare
[edit interfaces ethernet eth0]
+address 10.0.10.1/24
[edit interfaces ethernet eth1]
+address 10.0.1.1/24
[edit interfaces ethernet eth2]
+address 10.0.4.2/24
[edit]
vyos@msk-ioithenko-gw-01# commit

Can't configure both static IPv4 and DHCP address on the same interface

[[interfaces ethernet eth0]] failed
Commit failed
[edit]
vyos@msk-ioithenko-gw-01# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@msk-ioithenko-gw-01# commit
[edit]
vyos@msk-ioithenko-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-01# show interfaces
  ethernet eth0 {
    address 10.0.10.1/24
    hw-id 0c:ad:66:8f:00:00
  }
  ethernet eth1 {
    address 10.0.1.1/24
    hw-id 0c:ad:66:8f:00:01
  }
  ethernet eth2 {
    address 10.0.4.2/24
    hw-id 0c:ad:66:8f:00:02
  }
  loopback lo {
  }
[edit]
vyos@msk-ioithenko-gw-01#

```

Рис. 4: IPv4-адреса

```
vyos@msk-ioithenko-gw-02:~$ configure
[edit]
vyos@msk-ioithenko-gw-02# set interfaces ethernet eth0 address 10.0.1.2/24
[edit]
vyos@msk-ioithenko-gw-02# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@msk-ioithenko-gw-02# set interfaces ethernet eth1 address 10.0.2.1/24
[edit]
vyos@msk-ioithenko-gw-02# compare
[edit interfaces ethernet eth0]
- address dhcp
+ address 10.0.1.2/24
[edit interfaces ethernet eth1]
+ address 10.0.2.1/24
[edit]
vyos@msk-ioithenko-gw-02# commit
[edit]
vyos@msk-ioithenko-gw-02# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-02# show interfaces
  ethernet eth0 {
    address 10.0.1.2/24
    hw-id 0c:7a:d0:48:00:00
  }
  ethernet eth1 {
    address 10.0.2.1/24
    hw-id 0c:7a:d0:48:00:01
  }
  ethernet eth2 {
    hw-id 0c:7a:d0:48:00:02
  }
  loopback lo {
  }
[edit]
vyos@msk-ioithenko-gw-02#
```

Рис. 5: IPv4-адреса


```
vyos@msk-ioithenko-gw-03# set interfaces ethernet eth0 address 10.0.11.1/24
[edit]
vyos@msk-ioithenko-gw-03# set interfaces ethernet eth1 address 10.0.2.2/24
[edit]
vyos@msk-ioithenko-gw-03# set interfaces ethernet eth2 address 10.0.3.1/24
[edit]
vyos@msk-ioithenko-gw-03# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@msk-ioithenko-gw-03# compare
[edit interfaces ethernet eth0]
-address dhcp
+address 10.0.11.1/24
[edit interfaces ethernet eth1]
+address 10.0.2.2/24
[edit interfaces ethernet eth2]
+address 10.0.3.1/24
[edit]
vyos@msk-ioithenko-gw-03# commit
[edit]
vyos@msk-ioithenko-gw-03# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-03# show interfaces
  ethernet eth0 {
    address 10.0.11.1/24
    hw-id 0c:15:87:6d:00:00
  }
  ethernet eth1 {
    address 10.0.2.2/24
    hw-id 0c:15:87:6d:00:01
  }
  ethernet eth2 {
    address 10.0.3.1/24
    hw-id 0c:15:87:6d:00:02
  }
  loopback lo {
  }
[edit]
vyos@msk-ioithenko-gw-03#
```

Рис. 6: IPv4-адреса

```

vyos@msk-ioithenko-gw-04:~$ configure
[edit]
vyos@msk-ioithenko-gw-04# set interfaces ethernet eth0 address 10.0.3.2/24
[edit]
vyos@msk-ioithenko-gw-04# set interfaces ethernet eth1 address 10.0.4.1/24
[edit]
vyos@msk-ioithenko-gw-04# delete interfaces ethernet eth0 address dhcp

Nothing to delete (the specified value does not exist)

[edit]
vyos@msk-ioithenko-gw-04# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@msk-ioithenko-gw-04# compare
[edit interfaces ethernet eth0]
- address dhcp
+ address 10.0.3.2/24
[edit interfaces ethernet eth1]
+ address 10.0.4.1/24
[edit]
vyos@msk-ioithenko-gw-04# commit
[edit]
vyos@msk-ioithenko-gw-04# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-04# show interfaces
  ethernet eth0 {
    address 10.0.3.2/24
    hw-id 0c:1b:7c:75:00:00
  }
  ethernet eth1 {
    address 10.0.4.1/24
    hw-id 0c:1b:7c:75:00:01
  }
  ethernet eth2 {
    hw-id 0c:1b:7c:75:00:02
  }
  loopback lo {
  }
[edit]
vyos@msk-ioithenko-gw-04#

```

Рис. 7: IPv4-адреса

```
PC1> save
Saving startup configuration to startup.vpc
. done

PC1> show ipv6

NAME                : PC1[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               : 20008
RHOST:PORT           : 127.0.0.1:20009
MTU                 : 1500

PC1> █
w-U4# save
```

Рис. 8: IPv6 на PC1

```
PC2> ip 2001:11::a/64
PC1 : 2001:11::a/64

PC2> save
Saving startup configuration to startup.vpc
. done

PC2> show ipv6

NAME                : PC2[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               : 20010
RHOST:PORT          : 127.0.0.1:20011
MTU:                : 1500

PC2> █
```

Рис. 9: IPv6 на PC2

```

vyos@msk-ioithenko-gw-01:~$ configure
[edit]
vyos@msk-ioithenko-gw-01# set interfaces ethernet eth0 address 2001:10::1/64
[edit]
00::/64sk-ioithenko-gw-01# set service router-advert interface eth0 prefix 2001:1

    Configuration path: [service router-advert interface eth0 prefix 2001:10::/64] already exists

[edit]
vyos@msk-ioithenko-gw-01# set interfaces ethernet eth1 address 2001:1::1/64
[edit]
vyos@msk-ioithenko-gw-01# set interfaces ethernet eth2 address 2001:4::2/64
[edit]
vyos@msk-ioithenko-gw-01# compare
[edit interfaces ethernet eth0]
+address 2001:10::1/64
[edit interfaces ethernet eth1]
+address 2001:1::1/64
[edit interfaces ethernet eth2]
+address 2001:4::2/64
[edit service]
+router-advert {
+  interface eth0 {
+    prefix 2001:10::/64 {
+    }
+  }
+}
[edit]
vyos@msk-ioithenko-gw-01# commit
[edit]
vyos@msk-ioithenko-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-01# █

```

Рис. 10: IPv6-адреса

```
vyos@msk-ioithenko-gw-02# set interfaces ethernet eth0 address 2001:1::2/64
[edit]
vyos@msk-ioithenko-gw-02# set interfaces ethernet eth1 address 2001:2::1/64
[edit]
vyos@msk-ioithenko-gw-02# compare
[edit interfaces ethernet eth0]
+address 2001:1::2/64
[edit interfaces ethernet eth1]
+address 2001:2::1/64
[edit]
vyos@msk-ioithenko-gw-02# commit
[edit]
vyos@msk-ioithenko-gw-02# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-02# show interfaces
    ethernet eth0 {
        address 10.0.1.2/24
        address 2001:1::2/64
        hw-id 0c:7a:d0:48:00:00
    }
    ethernet eth1 {
        address 10.0.2.1/24
        address 2001:2::1/64
        hw-id 0c:7a:d0:48:00:01
    }
    ethernet eth2 {
        hw-id 0c:7a:d0:48:00:02
    }
    loopback lo {
    }
[edit]
vyos@msk-ioithenko-gw-02#
```

Рис. 11: IPv6-адреса

```

[edit]
vyos@msk-ioithenko-gw-03# set interfaces ethernet eth0 address 2001:11::1/64
[edit]
1::/64sk-ioithenko-gw-03# set service router-advert interface eth0 prefix 2001:1
[edit]
vyos@msk-ioithenko-gw-03# set interfaces ethernet eth1 address 2001:2::2/64
[edit]
vyos@msk-ioithenko-gw-03# set interfaces ethernet eth2 address 2001:3::1/64
[edit]
vyos@msk-ioithenko-gw-03# compare
[edit interfaces ethernet eth0]
+address 2001:11::1/64
[edit interfaces ethernet eth1]
+address 2001:2::2/64
[edit interfaces ethernet eth2]
+address 2001:3::1/64
[edit service]
+router-advert {
+  interface eth0 {
+    prefix 2001:11::/64 {
+    }
+  }
+}
[edit]
vyos@msk-ioithenko-gw-03# commit
[edit]
vyos@msk-ioithenko-gw-03# save
Saving configuration to '/config/config.boot'...
Done
[edit]

```

Рис. 12: IPv6-адреса

```
[edit]  
vyos@msk-ioithenko-gw-04# set interfaces ethernet eth0 address 2001:3::2/64  
[edit]  
vyos@msk-ioithenko-gw-04# set interfaces ethernet eth1 address 2001:4::1/64  
[edit]  
vyos@msk-ioithenko-gw-04# compare  
[edit interfaces ethernet eth0]  
+address 2001:3::2/64  
[edit interfaces ethernet eth1]  
+address 2001:4::1/64  
[edit]  
vyos@msk-ioithenko-gw-04# commit  
[edit]  
vyos@msk-ioithenko-gw-04# save  
Saving configuration to '/config/config.boot'...  
Done  
[edit]  
vyos@msk-ioithenko-gw-04#
```

Рис. 13: IPv6-адреса


```
[edit]  
vyos@msk-ioithenko-gw-01# set protocols rip interface eth0  
[edit]  
vyos@msk-ioithenko-gw-01# set protocols rip interface eth1  
[edit]  
vyos@msk-ioithenko-gw-01# set protocols rip interface eth2  
[edit]
```

Рис. 14: RIP

```
vyos@msk-ioithenko-gw-02# set protocols rip interface eth0  
[edit]  
vyos@msk-ioithenko-gw-02# set protocols rip interface eth1  
[edit]
```

Рис. 15: RIP

```
vyos@msk-ioithenko-gw-04# set protocols rip interface eth0
[edit]
vyos@msk-ioithenko-gw-04# set protocols rip interface eth1
[edit]
vyos@msk-ioithenko-gw-04# commit
```

Рис. 16: RIP

```

you can check individual component licenses under /usr/share/doc/*/copyright
shvyos@msk-ioithenko-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 02:58
R(n) 10.0.2.0/24     10.0.3.1          2 10.0.3.1          0 02:46
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 02:58
R(n) 10.0.11.0/24    10.0.3.1          2 10.0.3.1          0 02:46
vyos@msk-ioithenko-gw-04:~$ 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 any version
    Interface      Send  Recv   Key-chain
    eth0           2     1 2
    eth1           2     1 2
  Routing for Networks:
    eth0
    eth1
  Routing Information Sources:
    Gateway        BadPackets  BadRoutes  Distance  Last Update
    10.0.3.1        0           0          120       00:00:24
    10.0.4.2        0           0          120       00:00:12
  Distance: (default is 120)
vyos@msk-ioithenko-gw-04:~$

```

Рис. 17: RIP

```
PC1> ping 10.0.11.10

84 bytes from 10.0.11.10 icmp_seq=1 ttl=61 time=17.334 ms
84 bytes from 10.0.11.10 icmp_seq=2 ttl=61 time=7.790 ms
84 bytes from 10.0.11.10 icmp_seq=3 ttl=61 time=9.447 ms
84 bytes from 10.0.11.10 icmp_seq=4 ttl=61 time=9.039 ms
84 bytes from 10.0.11.10 icmp_seq=5 ttl=61 time=7.950 ms

PC1> 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    1.768 ms   1.571 ms   1.585 ms
 2  10.0.1.2     6.082 ms   3.723 ms   5.089 ms
 3  10.0.2.2     8.075 ms   5.957 ms   9.347 ms
 4  10.0.11.10  12.315 ms   6.623 ms  12.046 ms


PC1> 
"rip"
```

Рис. 18: Пинг

```

Distance: (default is 120)
vyos@msk-ioithenko-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 02:57
R(n) 10.0.3.0/24    10.0.4.1        2 10.0.4.1        0 02:56
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 02:57
vyos@msk-ioithenko-gw-01:~$

```

Рис. 19: Метрики протокола RIP

```
[edit]
vyos@msk-ioithenko-gw-04# set interfaces ethernet eth0 disable
[edit]
vyos@msk-ioithenko-gw-04# commit
[edit]
vyos@msk-ioithenko-gw-04# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-04#
```

Рис. 20: Отключение интерфейса

```

R(n) 10.0.11.0/24      10.0.1.2      S 10.0.1.2      0 02:00
vyos@msk-ioithenko-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    10.0.4.1       16 10.0.4.1      0 01:45
R(n) 10.0.3.0/24    10.0.4.1       16 10.0.4.1      0 01:45
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   10.0.4.1       16 10.0.4.1      0 01:45
vyos@msk-ioithenko-gw-01:~$

```

Рис. 21: RIP


```
PC1> ping 10.0.11.10

*10.0.10.1 icmp_seq=1 ttl=64 time=2.834 ms (ICMP type:3, code:0, Destination net
work unreachable)
*10.0.10.1 icmp_seq=2 ttl=64 time=1.891 ms (ICMP type:3, code:0, Destination net
work unreachable)
*10.0.10.1 icmp_seq=3 ttl=64 time=1.359 ms (ICMP type:3, code:0, Destination net
work unreachable)
*10.0.10.1 icmp_seq=4 ttl=64 time=2.658 ms (ICMP type:3, code:0, Destination net
work unreachable)
10.0.11.10 icmp_seq=5 timeout

PC1>
```

Рис. 22: Пинг

```
[edit]
vyos@msk-ioithenko-gw-04# delete interfaces ethernet eth0 disable
[edit]
vyos@msk-ioithenko-gw-04# commit
[edit]
vyos@msk-ioithenko-gw-04# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-04# show interfaces
  ethernet eth0 {
    address 10.0.3.2/24
    address 2001:3::2/64
    hw-id 0c:1b:7c:75:00:00
  }
  ethernet eth1 {
    address 10.0.4.1/24
    address 2001:4::1/64
    hw-id 0c:1b:7c:75:00:01
  }
  ethernet eth2 {
    hw-id 0c:1b:7c:75:00:02
  }
  loopback lo {
  }
[edit]
vyos@msk-ioithenko-gw-04#
```

Рис. 23: Восстановление интерфейса

```
PC1> ping 10.0.11.10

84 bytes from 10.0.11.10 icmp_seq=1 ttl=61 time=11.724 ms
84 bytes from 10.0.11.10 icmp_seq=2 ttl=61 time=7.351 ms
84 bytes from 10.0.11.10 icmp_seq=3 ttl=61 time=7.990 ms
84 bytes from 10.0.11.10 icmp_seq=4 ttl=61 time=5.870 ms
84 bytes from 10.0.11.10 icmp_seq=5 ttl=61 time=10.921 ms

PC1> █
```

Рис. 24: Пинг

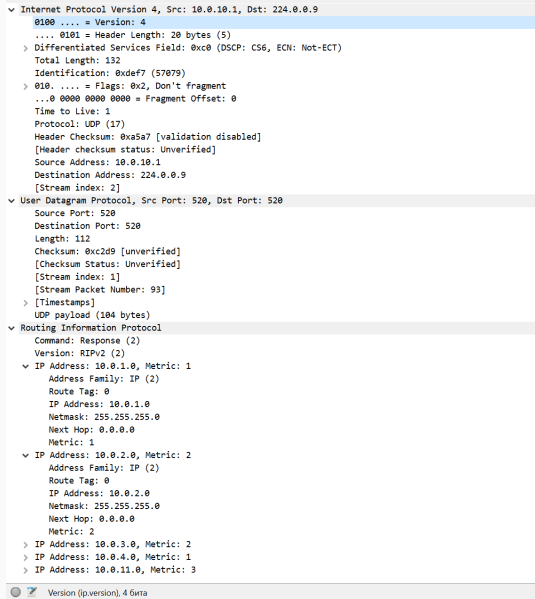


Рис. 25: Захваченный трафик

```
[edit]
vyos@msk-ioithenko-gw-01# set protocols ripng interface eth0
[edit]
vyos@msk-ioithenko-gw-01# compare
[edit protocols]
+ripng {
+  interface eth0
+}
[edit]
vyos@msk-ioithenko-gw-01# set protocols ripng interface eth1
[edit]
vyos@msk-ioithenko-gw-01# set protocols ripng interface eth2
[edit]
vyos@msk-ioithenko-gw-01# commit
[edit]
```

Рис. 26: RIPng

```
vyos@msk-ioithenko-gw-02# set protocols ripng interface eth0
[edit]
vyos@msk-ioithenko-gw-02# set protocols ripng interface eth1
[edit]
vyos@msk-ioithenko-gw-02# compare
[edit protocols]
+ripng {
+  interface eth0
+  interface eth1
+}
[edit]
vyos@msk-ioithenko-gw-02# commit
[edit]
vyos@msk-ioithenko-gw-02# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-02#
```

Рис. 27: RIPng

```
vyos@msk-ioithenko-gw-03:~$ configure
[edit]
vyos@msk-ioithenko-gw-03# set protocols ripng interface eth0
[edit]
vyos@msk-ioithenko-gw-03# set protocols ripng interface eth1
[edit]
vyos@msk-ioithenko-gw-03# set protocols ripng interface eth2
[edit]
vyos@msk-ioithenko-gw-03# compare
[edit protocols]
+ripng {
+  interface eth0
+  interface eth1
+  interface eth2
+}
[edit]
vyos@msk-ioithenko-gw-03# commit
[edit]
vyos@msk-ioithenko-gw-03# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-03#
```

Рис. 28: RIPng

```
[edit]
vyos@msk-ioithenko-gw-04# set protocols ripng interface eth0
[edit]
vyos@msk-ioithenko-gw-04# set protocols ripng interface eth1
[edit]
vyos@msk-ioithenko-gw-04# compare
[edit protocols]
+ripng {
+  interface eth0
+  interface eth1
+}
[edit]
vyos@msk-ioithenko-gw-04# commit
[edit]
vyos@msk-ioithenko-gw-04# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-04#
```

Рис. 29: RIPng


```
PC1> ping 2001:11::a

2001:11::a icmp6_seq=1 ttl=58 time=6.748 ms
2001:11::a icmp6_seq=2 ttl=58 time=5.435 ms
2001:11::a icmp6_seq=3 ttl=58 time=3.540 ms
2001:11::a icmp6_seq=4 ttl=58 time=4.657 ms
2001:11::a icmp6_seq=5 ttl=58 time=5.139 ms

PC1> trace 2001:11::a

trace to 2001:11::a, 64 hops max
 1 2001:10::1    1.911 ms  0.982 ms  0.511 ms
 2 2001:1::2     1.412 ms  1.294 ms  1.878 ms
 3 2001:2::2     5.230 ms  5.916 ms  3.377 ms
 4 2001:11::a    2.825 ms  3.816 ms  3.599 ms

PC1> █
```

Рис. 30: Пинг

```
vyos@msk-ioithenko-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::e7a:d0ff:fe48:0	eth1	2	0	02:46
R(n)	2001:3::/64	fe80::e1b:7cff:fe75:1	eth2	2	0	02:42
C(i)	2001:4::/64	::	self	1	0	
C(i)	2001:10::/64	::	self	1	0	
R(n)	2001:11::/64	fe80::e7a:d0ff:fe48:0	eth1	3	0	02:46

```
vyos@msk-ioithenko-gw-01:~$
```

Рис. 31: Метрики протокола

```
[edit]  
vyos@msk-ioithenko-gw-02# set interfaces ethernet eth0 disable  
[edit]  
vyos@msk-ioithenko-gw-02# commit  
[edit]  
vyos@msk-ioithenko-gw-02# save  
Saving configuration to '/config/config.boot'...  
Done  
[edit]  
vyos@msk-ioithenko-gw-02#
```

Рис. 32: Отключение интерфейса

```
vyos@msk-ioithenko-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::e7a:d0ff:fe48:0	eth1	2	0	01:11
R(n)	2001:3::/64	fe80::e1b:7cff:fe75:1	eth2	2	0	02:46
C(i)	2001:4::/64	::	self	1	0	
C(i)	2001:10::/64	::	self	1	0	
R(n)	2001:11::/64	fe80::e7a:d0ff:fe48:0	eth1	3	0	02:46

```
vyos@msk-ioithenko-gw-01:~$
```

Рис. 33: Метрики протокола

```
PC1> ping 2001:11::a
2001:11::a icmp6_seq=1 timeout
2001:11::a icmp6_seq=2 timeout
*2001:10::1 icmp6_seq=3 ttl=64 time=0.000 ms (ICMP type:1, code:3, Address unrea
chable)
*2001:10::1 icmp6_seq=4 ttl=64 time=0.000 ms (ICMP type:1, code:3, Address unrea
chable)
2001:11::a icmp6_seq=5 timeout
PC1> █
```

Рис. 34: Пинг

```
[edit]
vyos@msk-ioithenko-gw-02# delete interfaces ethernet eth0 disable
[edit]
vyos@msk-ioithenko-gw-02# commit
[edit]
vyos@msk-ioithenko-gw-02# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-02#
```

Рис. 35: Включение интерфейса

```
PC1> ping 2001:11::a

2001:11::a icmp6_seq=1 ttl=58 time=6.547 ms
2001:11::a icmp6_seq=2 ttl=58 time=4.192 ms
2001:11::a icmp6_seq=3 ttl=58 time=5.607 ms
2001:11::a icmp6_seq=4 ttl=58 time=3.962 ms
2001:11::a icmp6_seq=5 ttl=58 time=5.033 ms

PC1> █
rw-02:~$ configure
```

Рис. 36: Пинг

```

Frame 18: 186 bytes on wire (1488 bits), 186 bytes captured (1488 bits) on interface -, id 0
Ethernet II, Src: 0c:ad:66:8f:00:00 (0c:ad:66:8f:00:00), Dst: IPv6mcast_09 (33:33:00:00:00:09)
  > Destination: IPv6mcast_09 (33:33:00:00:00:09)
  > Source: 0c:ad:66:8f:00:00 (0c:ad:66:8f:00:00)
  Type: IPv6 (0x86dd)
  [Stream index: 1]
Internet Protocol Version 6, Src: fe80::ead:66ff:fe8f:0, Dst: ff02::9
  0110 .... = Version: 6
  > .... 1100 0000 .... = Traffic Class: 0xc0 (DSCP: CS6, ECN: Not-ECT)
  .... 1010 1110 0001 1110 = Flow Label: 0xae61e
  Payload Length: 132
  Next Header: UDP (17)
  Hop Limit: 255
  > Source Address: fe80::ead:66ff:fe8f:0
  > Destination Address: ff02::9
  [Source SLAAC MAC: 0c:ad:66:8f:00:00 (0c:ad:66:8f:00:00)]
  [Stream index: 0]
User Datagram Protocol, Src Port: 521, Dst Port: 521
  Source Port: 521
  Destination Port: 521
  Length: 132
  Checksum: 0x46cd [unverified]
  [Checksum Status: Unverified]
  [Stream index: 1]
  [Stream Packet Number: 2]
  > [Timestamps]
  UDP payload (124 bytes)
RIPng
  Command: Response (2)
  Version: 1
  Reserved: 0000
  ✓ Route Table Entry: IPv6 Prefix: 2001:1::/64 Metric: 1
    IPv6 Prefix: 2001:1::
    Route Tag: 0x0000
    Prefix Length: 64
    Metric: 1
  > Route Table Entry: IPv6 Prefix: 2001:2::/64 Metric: 2
  > Route Table Entry: IPv6 Prefix: 2001:3::/64 Metric: 2
  > Route Table Entry: IPv6 Prefix: 2001:4::/64 Metric: 1
  > Route Table Entry: IPv6 Prefix: 2001:10::/64 Metric: 1
  > Route Table Entry: IPv6 Prefix: 2001:11::/64 Metric: 3

```

Рис. 37: Захваченный трафик


```

[edit]
vyos@mak-ioithenko-gw-01# set protocols ospf area 0 network 10.0.10.0/24
[edit]
vyos@mak-ioithenko-gw-01# set protocols ospf area 0 network 10.0.1.0/24
[edit]
vyos@mak-ioithenko-gw-01# set protocols ospf area 0 network 10.0.4.0/24
[edit]
vyos@mak-ioithenko-gw-01# compare
[edit protocols]
+ospf {
+  area 0 {
+    network 10.0.10.0/24
+    network 10.0.1.0/24
+    network 10.0.4.0/24
+  }
+}
[edit]
vyos@mak-ioithenko-gw-01# commit
[edit]
vyos@mak-ioithenko-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@mak-ioithenko-gw-01# show ip ospf neighbor

Configuration path: [ip] is not valid
Show failed

[edit]
vyos@mak-ioithenko-gw-01# exit
exit
vyos@mak-ioithenko-gw-01:~$ show ip ospf neighbor

```

Neighbor ID	Priority	State	Dead Time	Address	Interface
10.0.2.1	1	Full/Backup	38.660s	10.0.1.2	eth1:10.0.1.1
10.0.4.1	1	Full/Backup	30.123s	10.0.4.1	eth2:10.0.4.2

```

vyos@mak-ioithenko-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 =====
vyos@mak-ioithenko-gw-01:~$

```

Рис. 38: Настройка OSPF

```
PC1> ping 10.0.11.10

84 bytes from 10.0.11.10 icmp_seq=1 ttl=61 time=5.843 ms
84 bytes from 10.0.11.10 icmp_seq=2 ttl=61 time=5.015 ms
84 bytes from 10.0.11.10 icmp_seq=3 ttl=61 time=4.898 ms
84 bytes from 10.0.11.10 icmp_seq=4 ttl=61 time=3.736 ms
84 bytes from 10.0.11.10 icmp_seq=5 ttl=61 time=3.622 ms

PC1> 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    4.274 ms  0.482 ms  0.848 ms
 2  10.0.1.2     2.166 ms  1.067 ms  1.927 ms
 3  10.0.2.2     2.952 ms  4.456 ms  3.083 ms
 4  10.0.11.10   6.403 ms  5.479 ms  3.093 ms

PC1> █
```

Рис. 39: Пинг

```
Done
[edit]
vyos@msk-ioithenko-gw-04# set interfaces ethernet eth0 disable
[edit]
vyos@msk-ioithenko-gw-04# commit
[edit]
vyos@msk-ioithenko-gw-04# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-04# █
```

Рис. 40: Отключение интерфейса

```
(PC1> ping 10.0.11.10  
  
10.0.11.10 icmp_seq=1 timeout  
84 bytes from 10.0.11.10 icmp_seq=2 ttl=61 time=5.991 ms  
84 bytes from 10.0.11.10 icmp_seq=3 ttl=61 time=4.674 ms  
84 bytes from 10.0.11.10 icmp_seq=4 ttl=61 time=4.300 ms  
84 bytes from 10.0.11.10 icmp_seq=5 ttl=61 time=4.947 ms  
  
(PC1> █
```

Рис. 41: Пинг

```

vyos@msk-ioithenko-gw-01:~$ show ip ospf neighbor
Neighbor ID      Pri State           Dead Time Address        Interface
  RXmtL  RqstL  DBsmL
10.0.2.1          0    0    0 Full/Backup      38.561s 10.0.1.2        eth1:10.0.1.1
10.0.4.1          0    0    0 Full/Backup      37.449s 10.0.4.1        eth2:10.0.4.2

vyos@msk-ioithenko-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      [300] area: 0.0.0.0
                        via 10.0.1.2, eth1
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

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

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

vyos@msk-ioithenko-gw-01:~$ █

```

Рис. 42: Метрики протокола

```

> Frame 247: 78 bytes on wire (624 bits), 78 bytes captured (624 bits) on interface -, id 0
▼ Ethernet II, Src: 0c:ad:66:8f:00:00 (0c:ad:66:8f:00:00), Dst: IPv4mcast_05 (01:00:5e:00:00:05)
  > Destination: IPv4mcast_05 (01:00:5e:00:00:05)
  > Source: 0c:ad:66:8f:00:00 (0c:ad:66:8f:00:00)
  Type: IPv4 (0x0800)
  [Stream index: 5]
▼ Internet Protocol Version 4, Src: 10.0.10.1, Dst: 224.0.0.5
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
  Total Length: 64
  Identification: 0x6df2 (28146)
  > 000. .... = Flags: 0x0
  ...0 0000 0000 0000 = Fragment Offset: 0
  Time to Live: 1
  Protocol: OSPF IGP (89)
  Header Checksum: 0x56ad [validation disabled]
  [Header checksum status: Unverified]
  Source Address: 10.0.10.1
  Destination Address: 224.0.0.5
  [Stream index: 2]
▼ Open Shortest Path First
  ▼ OSPF Header
    Version: 2
    Message Type: Hello Packet (1)
    Packet Length: 44
    Source OSPF Router: 10.0.10.1
    Area ID: 0.0.0.0 (Backbone)
    Checksum: 0xd49c [correct]
    Auth Type: Null (0)
    Auth Data (none): 0000000000000000
  ▼ OSPF Hello Packet
    Network Mask: 255.255.255.0
    Hello Interval [sec]: 10
    > Options: 0x02, (E) External Routing
    Router Priority: 1
    Router Dead Interval [sec]: 40
    Designated Router: 10.0.10.1
    Backup Designated Router: 0.0.0.0

```

Рис. 43: Захваченный трафик

```

[edit]
vyos@msk-ioithenko-gw-01# set protocols ospfv3 parameters router-id 1.1.1.1
[edit]
vyos@msk-ioithenko-gw-01# set protocols ospfv3 interface eth0 area 0

Configuration path: protocols ospfv3 [interface] is not valid
Set failed

[edit]
vyos@msk-ioithenko-gw-01# set protocols ospfv3 area 0 interface eth0
[edit]
vyos@msk-ioithenko-gw-01# set protocols ospfv3 area 0 interface eth1
[edit]
vyos@msk-ioithenko-gw-01# set protocols ospfv3 area 0 interface eth2
[edit]
vyos@msk-ioithenko-gw-01# compare
[edit protocols]
+ospfv3 {
+  area 0 {
+    interface eth0
+    interface eth1
+    interface eth2
+  }
+  parameters {
+    router-id 1.1.1.1
+  }
+}
[edit]
vyos@msk-ioithenko-gw-01# commit
[edit]
vyos@msk-ioithenko-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-01# show ipv6 ospfv3 neighbor

Configuration path: [ipv6] is not valid
Show failed

[edit]
vyos@msk-ioithenko-gw-01# exit
exit
vyos@msk-ioithenko-gw-01:~$ show ipv6 ospfv3 neighbor
Neighbor ID      Pri   DeadTime   State/IfState      Duration I/F[State]
2.2.2.2          1     00:00:39   Full/BDR           00:05:45 eth1[DR]
4.4.4.4          1     00:00:31   Full/BDR           00:01:44 eth2[DR]
vyos@msk-ioithenko-gw-01:~$ show ipv6 ospfv3 route
*N IA 2001:1::/64      ::                eth1 00:06:07
*N IA 2001:2::/64      fe80::e7a:d0ff:fe48:0 eth1 00:04:20
*N IA 2001:3::/64      fe80::elb:7cff:fe75:1 eth2 00:01:57
*N IA 2001:4::/64      ::                eth2 00:02:07
*N IA 2001:10::/64     ::                eth0 00:07:18
*N IA 2001:11::/64     fe80::e7a:d0ff:fe48:0 eth1 00:01:57
                        fe80::elb:7cff:fe75:1 eth2
vyos@msk-ioithenko-gw-01:~$

```

```
PC1> ping 2001:11::a

2001:11::a icmp6_seq=1 ttl=58 time=6.304 ms
2001:11::a icmp6_seq=2 ttl=58 time=3.845 ms
2001:11::a icmp6_seq=3 ttl=58 time=5.644 ms
2001:11::a icmp6_seq=4 ttl=58 time=4.401 ms
2001:11::a icmp6_seq=5 ttl=58 time=4.860 ms

PC1> trace 2001:11::a

trace to 2001:11::a, 64 hops max
 1 2001:10::1    1.137 ms  0.556 ms  0.868 ms
 2 2001:4::1     1.480 ms  1.569 ms  1.557 ms
 3 2001:3::1     5.192 ms  2.038 ms  1.745 ms
 4 2001:11::a    2.259 ms  2.695 ms  3.111 ms

PC1> █
```

Рис. 45: Пинг


```
[edit]
vyos@msk-ioithenko-gw-04# set interfaces ethernet eth0 disable
[edit]
vyos@msk-ioithenko-gw-04# commit
[edit]
vyos@msk-ioithenko-gw-04# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-04#
```

Рис. 46: Отключение

```

vyos@misk-ioithenko-gw-01:~$ show ipv6 ospfv3 route
*N IA 2001:1::/64 :: eth1 00:00:03
*N IA 2001:2::/64 fe80::e7a:d0ff:fe48:0 eth1 00:00:26
*N IA 2001:3::/64 fe80::e7a:d0ff:fe48:0 eth1 00:00:10
*N IA 2001:4::/64 :: eth2 00:04:47
*N IA 2001:10::/64 :: eth0 00:01:03
*N IA 2001:11::/64 fe80::e7a:d0ff:fe48:0 eth1 00:00:10
vyos@misk-ioithenko-gw-01:~$

```

Рис. 47: Метрики протокола

```
PC1> ping 2001:11::a

2001:11::a icmp6_seq=1 ttl=58 time=4.904 ms
2001:11::a icmp6_seq=2 ttl=58 time=3.642 ms
2001:11::a icmp6_seq=3 ttl=58 time=4.336 ms
2001:11::a icmp6_seq=4 ttl=58 time=4.339 ms
2001:11::a icmp6_seq=5 ttl=58 time=3.379 ms

PC1> █
```

Рис. 48: Пинг

```
[Time delta from previous captured frame: 4.779135000 seconds]
[Time delta from previous displayed frame: 4.779135000 seconds]
[Time since reference or first frame: 2728.155907000 seconds]
Frame Number: 710
Frame Length: 90 bytes (720 bits)
Capture Length: 90 bytes (720 bits)
[Frame is marked: False]
[Frame is ignored: False]
[Protocols in frame: eth:ethertype:ipv6:ospf]
[Coloring Rule Name: Routing]
[Coloring Rule String: hsrp || eigrp || ospf || bgp || cdp || vrrp || carp || gvrp || igmp || ismp]
▼ Ethernet II, Src: 0c:ad:66:8f:00:00 (0c:ad:66:8f:00:00), Dst: IPv6mcast_05 (33:33:00:00:00:05)
  > Destination: IPv6mcast_05 (33:33:00:00:00:05)
  > Source: 0c:ad:66:8f:00:00 (0c:ad:66:8f:00:00)
  Type: IPv6 (0x86dd)
  [Stream index: 8]
▼ Internet Protocol Version 6, Src: fe80::ead:66ff:fe8f:0, Dst: ff02::5
  0110 .... = Version: 6
  > .... 1100 0000 .... .... .... = Traffic Class: 0xc0 (DSCP: CS6, ECN: Not-ECT)
  .... 1010 1100 1001 0000 1010 = Flow Label: 0xac90a
  Payload Length: 36
  Next Header: OSPF IGP (89)
  Hop Limit: 1
  > Source Address: fe80::ead:66ff:fe8f:0
  > Destination Address: ff02::5
  [Source SLAAC MAC: 0c:ad:66:8f:00:00 (0c:ad:66:8f:00:00)]
  [Stream index: 5]
▼ Open Shortest Path First
  ▼ OSPF Header
    Version: 3
    Message Type: Hello Packet (1)
    Packet Length: 36
    Source OSPF Router: 1.1.1.1
    Area ID: 0.0.0.0 (Backbone)
    Checksum: 0x854d [correct]
    Instance ID: IPv6 unicast AF (0)
    Reserved: 00
  ▼ OSPF Hello Packet
    Interface ID: 2
    Router Priority: 1
    > Options: 0x000013, R, E, V6
    Hello Interval [sec]: 10
    Router Dead Interval [sec]: 40
    Designated Router: 1.1.1.1
    Backup Designated Router: 0.0.0.0
```

Рис. 49: Захваченный трафик

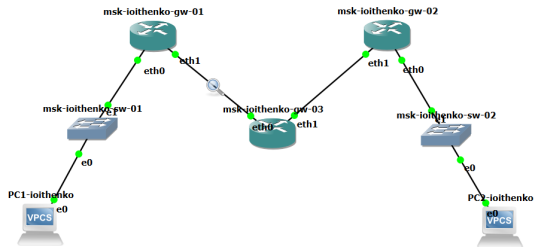


Рис. 50: Топология сети

```
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                : 20030
RHOST:PORT           : 127.0.0.1:20031
MTU                  : 1500

VPCS> █
```

Рис. 51: Адрес на PC1

```
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                : 20032
RHOST:PORT           : 127.0.0.1:20033
MTU                  : 1500

VPCS> █
```

Рис. 52: Адрес на PC2

```

vyos@msk-ioithenko-gw-01# set interfaces ethernet eth0 address 1000::1/64
[edit]
vyos@msk-ioithenko-gw-01# compare
[edit interfaces ethernet eth0]
+address 1000::1/64
[edit]
vyos@msk-ioithenko-gw-01# set interfaces ethernet eth1 address 10.0.0.1/8
[edit]
/64s@msk-ioithenko-gw-01# set service router-advert interface eth0 prefix 1000::
[edit]
vyos@msk-ioithenko-gw-01# compare
[edit interfaces ethernet eth0]
+address 1000::1/64
[edit interfaces ethernet eth1]
+address 10.0.0.1/8
[edit service]
+router-advert {
+   interface eth0 {
+       prefix 1000::/64 {
+       }
+   }
+}
[edit]
vyos@msk-ioithenko-gw-01# commit
[edit]
vyos@msk-ioithenko-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-01# █

```

Рис. 53: Настройка адресов


```

you can check individual component licenses under /usr/share/doc/*/copyright
vyos@vyos:~$ configure
[edit]
vyos@vyos# set system host-name msk-ioithenko-gw-02
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos# exit
exit
vyos@vyos:~$ exit
logout

Welcome to VyOS - msk-ioithenko-gw-02 ttyS0

msk-ioithenko-gw-02 login: vyos
Password:
Welcome to VyOS!

Check out project news at https://blog.vyos.io
and feel free to report bugs at https://vyos.dev

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

```

Рис. 54: Настройка адресов

```

vyos@vyos:~$ configure
[edit]
vyos@vyos# set system host-name msk-ioithenko-gw-03
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos# exit
exit
vyos@vyos:~$ exit
logout

Welcome to VyOS - msk-ioithenko-gw-03 tty50

msk-ioithenko-gw-03 login: vyos
Password:
Welcome to VyOS!

Check out project news at https://blog.vyos.io
and feel free to report bugs at https://vyos.dev

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-ioithenko-gw-03:~$ configure
[edit]
vyos@msk-ioithenko-gw-03# set interfaces ethernet eth0 address 10.0.0.2/8
[edit]
vyos@msk-ioithenko-gw-03# set interfaces ethernet eth1 address 20.0.0.1/8
[edit]
vyos@msk-ioithenko-gw-03# commit

Can't configure both static IPv4 and DHCP address on the same interface

[[interfaces ethernet eth0]] failed
Commit failed
[edit]
vyos@msk-ioithenko-gw-03# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@msk-ioithenko-gw-03# commit
[edit]
vyos@msk-ioithenko-gw-03# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-03# █

```

Рис. 55: Настройка адресов

```
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:f2:3c:b8:00:00
MAC                 : 00:50:79:66:68:00
LPORT               : 20030
RHOST:PORT          : 127.0.0.1:20031
MTU                 : 1500

VPCS> █
```

Рис. 56: Проверка адресов ближайших маршрутизаторов

```
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:a7:41:89:00:00  
MAC                 : 00:50:79:66:68:01  
LPORT              : 20032  
RHOST:PORT          : 127.0.0.1:20033  
MTU                 : 1500  
  
VPCS> █
```

Рис. 57: Проверка адресов ближайших маршрутизаторов

```
exit
vyos@msk-ioithenko-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=5.90 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=2.30 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=2.36 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=1.97 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=4.16 ms
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=3.84 ms
64 bytes from 10.0.0.2: icmp_seq=7 ttl=64 time=3.21 ms
^C
--- 10.0.0.2 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 16ms
rtt min/avg/max/mdev = 1.969/3.390/5.900/1.276 ms
vyos@msk-ioithenko-gw-01:~$ ping 20.0.0.1
connect: Network is unreachable
vyos@msk-ioithenko-gw-01:~$ ping 20.0.0.2
connect: Network is unreachable
vyos@msk-ioithenko-gw-01:~$ █
```

Рис. 58: Проверка маршрутов

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

Рис. 59: Настройка маршрутизации

```
[edit]
vyos@msk-ioithenko-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=3.73 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=2.94 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=4.22 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=2.66 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=2.91 ms
^C
--- 10.0.0.2 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 12ms
rtt min/avg/max/mdev = 2.659/3.291/4.215/0.587 ms
[edit]
vyos@msk-ioithenko-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=6.13 ms
64 bytes from 20.0.0.1: icmp_seq=2 ttl=64 time=3.14 ms
64 bytes from 20.0.0.1: icmp_seq=3 ttl=64 time=2.06 ms
64 bytes from 20.0.0.1: icmp_seq=4 ttl=64 time=2.26 ms
^C
--- 20.0.0.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 9ms
rtt min/avg/max/mdev = 2.061/3.396/6.127/1.628 ms
[edit]
vyos@msk-ioithenko-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=5.11 ms
64 bytes from 20.0.0.2: icmp_seq=2 ttl=63 time=6.62 ms
64 bytes from 20.0.0.2: icmp_seq=3 ttl=63 time=5.27 ms
64 bytes from 20.0.0.2: icmp_seq=4 ttl=63 time=6.29 ms
^C
--- 20.0.0.2 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 9ms
rtt min/avg/max/mdev = 5.110/5.824/6.624/0.650 ms
[edit]
vyos@msk-ioithenko-gw-01#
```

Рис. 60: Проверка маршрутов

```
vyos@msk-ioithenko-gw-01# set interfaces tunnel tun0 encapsulation sit
[edit]
vyos@msk-ioithenko-gw-01# set interfaces tunnel tun0 source-address 10.0.0.1
[edit]
vyos@msk-ioithenko-gw-01# set interfaces tunnel tun0 remote 20.0.0.2
[edit]
vyos@msk-ioithenko-gw-01# set interfaces tunnel tun0 address 1001::1/64
[edit]
vyos@msk-ioithenko-gw-01# commit
[edit]
vyos@msk-ioithenko-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-01# set protocols static route6 1002::0/64 next-hop 1001::
[edit]
vyos@msk-ioithenko-gw-01# commit
[edit]
vyos@msk-ioithenko-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-01#
```

Рис. 61: Создание туннеля


```
vyos@msk-ioithenko-gw-02# set interfaces tunnel tun0 encapsulation sit
[edit]
vyos@msk-ioithenko-gw-02# set interfaces tunnel tun0 source-address 20.0.0.2
[edit]
vyos@msk-ioithenko-gw-02# set interfaces tunnel tun0 remote 10.0.0.1
[edit]
vyos@msk-ioithenko-gw-02# set interfaces tunnel tun0 address 1001::2/64
[edit]
vyos@msk-ioithenko-gw-02# commit
[edit]
vyos@msk-ioithenko-gw-02# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-02# set protocols static route6 1000::0/64 next-hop 1001::
[edit]
vyos@msk-ioithenko-gw-02# commit
[edit]
vyos@msk-ioithenko-gw-02# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@msk-ioithenko-gw-02#
```

Рис. 62: Создайте туннель IPv6 через сеть IPv4

```
PC1-ioithenko - PuTTY
GLOBAL SCOPE      : 1000::a/64
DNS               :
ROUTER LINK-LAYER : 0c:f2:3c:b8:00:00
MAC               : 00:50:79:66:68:00
LPORT             : 20030
RHOST:PORT        : 127.0.0.1:20031
MTU               : 1500

VPCS> ping 1002::a

1002::a icmp6_seq=1 ttl=60 time=11.773 ms
1002::a icmp6_seq=2 ttl=60 time=7.787 ms
1002::a icmp6_seq=3 ttl=60 time=19.261 ms
1002::a icmp6_seq=4 ttl=60 time=7.870 ms
1002::a icmp6_seq=5 ttl=60 time=8.945 ms

VPCS> trace 1002::a

trace to 1002::a, 64 hops max
 1 1000::1  2.260 ms  0.993 ms  0.789 ms
 2 1001::2  9.936 ms  8.526 ms  7.092 ms
 3 1002::a  10.825 ms  6.589 ms  14.810 ms
```

```
PC2-ioithenko - PuTTY
GLOBAL SCOPE      : 1002::a/64
DNS               :
ROUTER LINK-LAYER : 0c:a7:41:89:00:00
MAC               : 00:50:79:66:68:01
LPORT             : 20032
RHOST:PORT        : 127.0.0.1:20033
MTU               : 1500

VPCS> ping 1000::a

1000::a icmp6_seq=1 ttl=60 time=8.134 ms
1000::a icmp6_seq=2 ttl=60 time=7.093 ms
1000::a icmp6_seq=3 ttl=60 time=8.221 ms
1000::a icmp6_seq=4 ttl=60 time=9.031 ms
1000::a icmp6_seq=5 ttl=60 time=13.097 ms

VPCS> trace 1000::a

trace to 1000::a, 64 hops max
 1 1002::1  3.720 ms  1.170 ms  1.050 ms
 2 1001::1  8.869 ms  5.594 ms  8.527 ms
 3 1000::a  13.513 ms  6.743 ms  12.992 ms

VPCS> █
```

Рис. 63: Пинг

```

[Coloring Rule Name: IPv6 hop limit low or unexpected]
[Coloring Rule String: (ipv6.dst != ff00::/8 && ipv6.hlim < 5 && !( ospf|| bgp || tcp.port==179)) ||
> Ethernet II, Src: 0c:db:4c:60:00:00 (0c:db:4c:60:00:00), Dst: 0c:f2:3c:b8:00:01 (0c:f2:3c:b8:00:01)
✓ Internet Protocol Version 4, Src: 20.0.0.2, Dst: 10.0.0.1
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        Total Length: 132
        Identification: 0x8402 (33794)
    > 010. .... = Flags: 0x2, Don't fragment
        ...0 0000 0000 0000 = Fragment Offset: 0
        Time to Live: 63
        Protocol: IPv6 (41)
        Header Checksum: 0x994c [validation disabled]
        [Header checksum status: Unverified]
        Source Address: 20.0.0.2
        Destination Address: 10.0.0.1
        [Stream index: 7]
✓ Internet Protocol Version 6, Src: 1002::a, Dst: 1000::a
    0110 .... = Version: 6
    > .... 0000 0000 .... .... .... = Traffic Class: 0x00 (DSCP: CS0, ECN: Not-ECT)
        .... 0000 0000 0000 0000 = Flow Label: 0x00000
        Payload Length: 72
        Next Header: UDP (17)
        Hop Limit: 1
    > Source Address: 1002::a
    > Destination Address: 1000::a
        [Stream index: 0]
✓ User Datagram Protocol, Src Port: 46417, Dst Port: 46418
    Source Port: 46417
    Destination Port: 46418
    Length: 72
    Checksum: 0xcc08 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 4]
    [Stream Packet Number: 1]
    > [Timestamps]
        UDP payload (64 bytes)
✓ Data (64 bytes)
    Data: 0050796668010e0f101112131415161718191a1b1c1d1e1f202122232425262728292a2b2c2d2e2f30313233343536:
    [Length: 64]

```

Рис. 64: Захваченный трафик

Таблица 1: Таблица адресации

Устройство	Интерфейс	Адрес IP/префикс	Шлюз по умолчанию	Следующее устройство
gw-01	eth0	10.10.1.97/27	n/a	PC1
gw-01	eth0	2001:db8:1:1::1/64	n/a	PC1
gw-01	eth1	10.10.1.5/30	n/a	gw-03
gw-01	eth1	2001:db8:1:2::1/64	n/a	gw-03
gw-01	eth2	10.10.1.33/30	n/a	gw-04
gw-01	eth2	2001:db8:1:5::1/64	n/a	gw-04
gw-02	eth0	10.10.1.65/28	n/a	PC2
gw-02	eth0	2001:db8:1:6::1/64	n/a	PC2
gw-02	eth1	10.10.1.18/30	n/a	gw-03
gw-02	eth1	2001:db8:1:4::2/64	n/a	gw-03
gw-02	eth2	10.10.1.9/30	n/a	gw-04
gw-02	eth2	2001:db8:1:3::1/64	n/a	gw-04

Таблица 2: Таблица адресации

Устройство	Интерфейс	Адрес IP/префикс	Шлюз по умолчанию	Следующее устройство
gw-03	eth0	10.10.1.6/30	n/a	gw-01
gw-03	eth0	2001:db8:1:2::2/64	n/a	gw-01
gw-03	eth1	10.10.1.17/30	n/a	gw-02
gw-03	eth1	2001:db8:1:4::1/64	n/a	gw-02
gw-04	eth0	10.10.1.10/30	n/a	gw-02
gw-04	eth0	2001:db8:1:3::2/64	n/a	gw-02
gw-04	eth1	10.10.1.34/30	n/a	gw-01
gw-04	eth1	2001:db8:1:5::2/64	n/a	gw-01
PC1	NIC	10.10.1.98/27	10.10.1.97	gw-01
PC1	NIC	2001:db8:1:1::2/64	n/a	gw-01
PC2	NIC	10.10.1.66/28	10.10.1.65	gw-02
PC2	NIC	2001:db8:1:6::2/64	n/a	gw-02

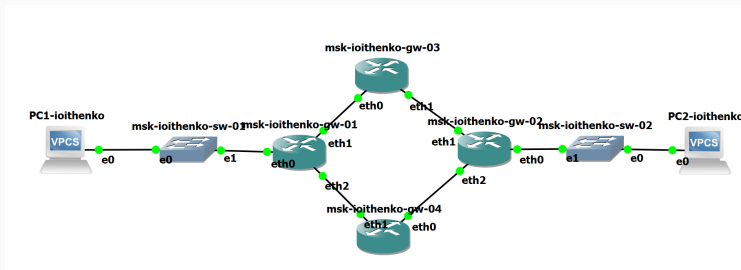


Рис. 65: Топология сети

```
PC1-ioithenko - PuTTY
For more information, please visit wiki.freecode.com.cn.
Press '?' to get help.
Executing the startup file
Hostname is too long. (Maximum 12 characters)
VPCS> ip 10.10.1.98/27 10.10.1.97
Checking for duplicate address...
VPCS : 10.10.1.98 255.255.255.224 gateway 10.10.1.97

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

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

VPCS> show ip

NAME          : VPCS[1]
IP/MASK       : 10.10.1.98/27
GATEWAY       : 10.10.1.97
DNS           :
MAC           : 00:50:79:66:68:00
LPORT        : 20016
RHOST:PORT    : 127.0.0.1:20017
MTU           : 1500

VPCS> show ipv6

NAME          : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6800/64
GLOBAL SCOPE    : 2001:db8:1:1::2/64
DNS             :
ROUTER LINK-LAYER :
MAC             : 00:50:79:66:68:00
LPORT          : 20016
RHOST:PORT      : 127.0.0.1:20017
MTU             : 1500

VPCS> 
```

Рис. 66: Адреса на PC1

```
PC2-ioithenko - PuTTY
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

Hostname is too long. (Maximum 12 characters)

VPCS> ip 10.10.1.66/28 10.10.1.65
Checking for duplicate address...
VPCS : 10.10.1.66 255.255.255.240 gateway 10.10.1.65

VPCS> ip 2001:db8:1:6::2/64
PC1 : 2001:db8:1:6::2/64

VPCS> show ip

NAME          : VPCS[1]
IP/MASK        : 10.10.1.66/28
GATEWAY        : 10.10.1.65
DNS            :
MAC            : 00:50:79:66:68:01
LPORT          : 20018
RHOST:PORT     : 127.0.0.1:20019
MTU            : 1500

VPCS> show ipv6

NAME          : VPCS[1]
LINK-LOCAL SCOPE : fe80::250:79ff:fe66:6801/64
GLOBAL SCOPE    : 2001:db8:1:6::2/64
DNS             :
ROUTER LINK-LAYER :
MAC            : 00:50:79:66:68:01
LPORT          : 20018
RHOST:PORT     : 127.0.0.1:20019
MTU            : 1500

VPCS> █
```

Рис. 67: Адреса на PC2


```

vyos@msk-ioithenko-gw-01:~$ configure
[edit]
vyos@msk-ioithenko-gw-01# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@msk-ioithenko-gw-01# set interfaces ethernet eth0 address 10.10.1.97/27
[edit]
vyos@msk-ioithenko-gw-01# set interfaces ethernet eth1 address 10.10.1.5/30
[edit]
vyos@msk-ioithenko-gw-01# set interfaces ethernet eth2 address 10.10.1.33/30
[edit]
4yos@msk-ioithenko-gw-01# set interfaces ethernet eth0 address 2001:db8:1:1::1/64
[edit]
b8:1:1::/64ithenko-gw-01# set service router-advert interface eth0 prefix 2001:d
[edit]
vyos@msk-ioithenko-gw-01# set interfaces ethernet eth1 address 2001:db8:1:2::1
Possible completions:
  <x.x.x.x/x> IPv4 address and prefix length
  <h:h:h:h:h:h:h/x>
                IPv6 address and prefix length
  dhcp          Dynamic Host Configuration Protocol
  dhcpv6        Dynamic Host Configuration Protocol for IPv6

[edit]
4yos@msk-ioithenko-gw-01# set interfaces ethernet eth1 address 2001:db8:1:2::1/64
[edit]
4yos@msk-ioithenko-gw-01# set interfaces ethernet eth2 address 2001:db8:1:5::1/64
[edit]
vyos@msk-ioithenko-gw-01# compare
[edit interfaces ethernet eth0]
-address dhcp
+address 10.10.1.97/27
+address 2001:db8:1:1::1/64
[edit interfaces ethernet eth1]
+address 10.10.1.5/30
+address 2001:db8:1:2::1/64
[edit interfaces ethernet eth2]
+address 10.10.1.33/30
+address 2001:db8:1:5::1/64
[edit service]
+router-advert {
+  interface eth0 {
+    prefix 2001:db8:1:1::/64 {
+    }
+  }
+}
[edit]

```

Рис. 68: Настройка адресов

```

vyos@msk-ioithenko-gw-02:~$ configure
[edit]
vyos@msk-ioithenko-gw-02# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@msk-ioithenko-gw-02# set interfaces ethernet eth0 address 10.10.1.65/28
[edit]
vyos@msk-ioithenko-gw-02# set interfaces ethernet eth1 address 10.10.1.18/30
[edit]
vyos@msk-ioithenko-gw-02# set interfaces ethernet eth2 address 10.10.1.9/30
[edit]
4yos@msk-ioithenko-gw-02# set interfaces ethernet eth0 address 2001:db8:1:6::1/6
[edit]
b8:1:6::/64ithenko-gw-02# set service router-advert interface eth0 prefix 2001:d
[edit]
4yos@msk-ioithenko-gw-02# set interfaces ethernet eth1 address 2001:db8:1:4::2/6
[edit]
4yos@msk-ioithenko-gw-02# set interfaces ethernet eth2 address 2001:db8:1:3::1/6
[edit]
vyos@msk-ioithenko-gw-02# compare
[edit interfaces ethernet eth0]
-address dhcp
+address 10.10.1.65/28
+address 2001:db8:1:6::1/64
[edit interfaces ethernet eth1]
+address 10.10.1.18/30
+address 2001:db8:1:4::2/64
[edit interfaces ethernet eth2]
+address 10.10.1.9/30
+address 2001:db8:1:3::1/64
[edit service]
+router-advert {
+  interface eth0 {
+    prefix 2001:db8:1:6::/64 {
+    }
+  }
+}
[edit]

```

Рис. 69: Настройка адресов

```
vyos@msk-ioithenko-gw-03:~$ configure
[edit]
vyos@msk-ioithenko-gw-03# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@msk-ioithenko-gw-03# set interfaces ethernet eth0 address 10.10.1.6/30
[edit]
vyos@msk-ioithenko-gw-03# set interfaces ethernet eth1 address 10.10.1.17/30
[edit]
4yos@msk-ioithenko-gw-03# set interfaces ethernet eth0 address 2001:db8:1:2::2/64
[edit]
4yos@msk-ioithenko-gw-03# set interfaces ethernet eth1 address 2001:db8:1:4::1/64
[edit]
vyos@msk-ioithenko-gw-03# compare
[edit interfaces ethernet eth0]
- address dhcp
+ address 10.10.1.6/30
+ address 2001:db8:1:2::2/64
[edit interfaces ethernet eth1]
+ address 10.10.1.17/30
+ address 2001:db8:1:4::1/64
[edit]
vyos@msk-ioithenko-gw-03# commit
```

Рис. 70: Настройка адресов

```
VyOS is a free software distribution that includes multiple components,  
you can check individual component licenses under /usr/share/doc/*/copyright  
vyos@msk-ioithenko-gw-04:~$ configure  
[edit]  
vyos@msk-ioithenko-gw-04# delete interfaces ethernet eth0 address dhcp  
[edit]  
vyos@msk-ioithenko-gw-04# set interfaces ethernet eth0 address 10.10.1.10/30  
[edit]  
vyos@msk-ioithenko-gw-04# set interfaces ethernet eth1 address 10.10.1.34/30  
[edit]  
4yos@msk-ioithenko-gw-04# set interfaces ethernet eth0 address 2001:db8:1:3::2/6  
[edit]  
4yos@msk-ioithenko-gw-04# set interfaces ethernet eth1 address 2001:db8:1:5::2/6  
[edit]  
vyos@msk-ioithenko-gw-04# compare  
[edit interfaces ethernet eth0]  
-address dhcp  
+address 10.10.1.10/30  
+address 2001:db8:1:3::2/64  
[edit interfaces ethernet eth1]  
+address 10.10.1.34/30  
+address 2001:db8:1:5::2/64  
[edit]
```

Рис. 71: Настройка адресов

```
[edit]  
vyos@msk-ioithenko-gw-01# set protocols rip interface eth0  
[edit]  
vyos@msk-ioithenko-gw-01# set protocols rip interface eth1  
[edit]  
vyos@msk-ioithenko-gw-01# set protocols rip interface eth2  
[edit]  
vyos@msk-ioithenko-gw-01# commit  
[edit]  
vyos@msk-ioithenko-gw-01# save  
Saving configuration to '/config/config.boot'...  
Done  
[edit]
```

Рис. 72: Настройка RIP

```

vyos@msk-ioithenko-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) 10.10.1.4/30   0.0.0.0        1 self           0
R(n) 10.10.1.8/30   10.10.1.6       3 10.10.1.6       0 02:39
R(n) 10.10.1.16/30  10.10.1.6       2 10.10.1.6       0 02:39
C(i) 10.10.1.32/30  0.0.0.0        1 self           0
R(n) 10.10.1.64/28  10.10.1.6       3 10.10.1.6       0 02:39
C(i) 10.10.1.96/27  0.0.0.0        1 self           0
vyos@msk-ioithenko-gw-01:~$ show ip rip status
Routing Protocol is "rip"
  Sending updates every 30 seconds with +/-50%, next due in 27 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 any version
    Interface      Send  Recv  Key-chain
    eth0           2     1 2
    eth1           2     1 2
    eth2           2     1 2
  Routing for Networks:
    eth0
    eth1
    eth2
  Routing Information Sources:
    Gateway      BadPackets  BadRoutes  Distance  Last Update
    10.10.1.6      0           0         120      00:00:06
    10.10.1.34     0           0         120      00:00:12
  Distance: (default is 120)
vyos@msk-ioithenko-gw-01:~$

```

Рис. 73: Метрики протокола

```
VPCS> ping 10.10.1.66

84 bytes from 10.10.1.66 icmp_seq=1 ttl=61 time=9.034 ms
84 bytes from 10.10.1.66 icmp_seq=2 ttl=61 time=8.103 ms
84 bytes from 10.10.1.66 icmp_seq=3 ttl=61 time=9.337 ms
84 bytes from 10.10.1.66 icmp_seq=4 ttl=61 time=9.109 ms
84 bytes from 10.10.1.66 icmp_seq=5 ttl=61 time=12.983 ms

VPCS> trace 10.10.1.66
trace to 10.10.1.66, 8 hops max, press Ctrl+C to stop
 1  10.10.1.97    6.406 ms  1.724 ms  1.572 ms
 2  10.10.1.6    5.292 ms  5.133 ms  3.560 ms
 3  10.10.1.18   10.520 ms  7.547 ms  5.831 ms
 4  *10.10.1.66  7.414 ms (ICMP type:3, code:3, Destination port unreachable)

VPCS> █
```

Рис. 74: Пинг

153	2171.740328	10.10.1.97	224.0.0.9	RIPv2	146 Response
154	2204.745837	10.10.1.97	224.0.0.9	RIPv2	146 Response
155	2234.749475	10.10.1.97	224.0.0.9	RIPv2	146 Response
156	2265.757202	10.10.1.97	224.0.0.9	RIPv2	146 Response
157	2290.764452	10.10.1.97	224.0.0.9	RIPv2	146 Response


```

0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
> Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
Total Length: 132
Identification: 0xdb1a (56090)
> 010. .... = Flags: 0x2, Don't fragment
...0 0000 0000 0000 = Fragment Offset: 0
Time to Live: 1
Protocol: UDP (17)
Header Checksum: 0xb21a [validation disabled]
[Header checksum status: Unverified]
Source Address: 10.10.1.97
Destination Address: 224.0.0.9
[Stream index: 4]
✓ User Datagram Protocol, Src Port: 520, Dst Port: 520
Source Port: 520
Destination Port: 520
Length: 112
Checksum: 0xd5e1 [unverified]
[Checksum Status: Unverified]
[Stream index: 1]
[Stream Packet Number: 19]
> [Timestamps]
UDP payload (104 bytes)
✓ Routing Information Protocol
Command: Response (2)
Version: RIPv2 (2)
  ✓ IP Address: 10.10.1.4, Metric: 1
    Address Family: IP (2)
    Route Tag: 0
    IP Address: 10.10.1.4
    Netmask: 255.255.255.252
    Next Hop: 0.0.0.0
    Metric: 1
  > IP Address: 10.10.1.8, Metric: 2
  > IP Address: 10.10.1.16, Metric: 2
  > IP Address: 10.10.1.32, Metric: 1
  > IP Address: 10.10.1.64, Metric: 3

```

Standard input: <live capture in progress> || Пакеты: 157

Рис. 75: Захваченный трафик


```
7 packets transmitted, 7 received, 0% packet loss, time 15ms  
rtt min/avg/max/mdev = 1.347/2.414/3.269/0.600 ms  
[edit]  
vyos@msk-ioithenko-gw-02# set protocols ripng interface eth0  
[edit]  
vyos@msk-ioithenko-gw-02# set protocols ripng interface eth1  
[edit]  
vyos@msk-ioithenko-gw-02# set protocols ripng interface eth2  
[edit]  
vyos@msk-ioithenko-gw-02# commit  
[edit]  
vyos@msk-ioithenko-gw-02# save  
Saving configuration to '/config/config.boot'...  
Done  
[edit]  
vyos@msk-ioithenko-gw-02# █
```

Рис. 76: RIPng

```

Exit
vyos@msk-ioithenko-gw-01:~$ show ipv6 ripng
Codes: R - RIPvng, 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:db8:1:1::/64
      ::
      self      1      0
C(i) 2001:db8:1:2::/64
      ::
      self      1      0
R(n) 2001:db8:1:3::/64
      fe80::ed4:c0ff:fe14:0      eth1      3      0      02:30
R(n) 2001:db8:1:4::/64
      fe80::ed4:c0ff:fe14:0      eth1      2      0      02:30
C(i) 2001:db8:1:5::/64
      ::
      self      1      0
R(n) 2001:db8:1:6::/64
      fe80::ed4:c0ff:fe14:0      eth1      3      0      02:31
vyos@msk-ioithenko-gw-01:~$ show ipv6 ripng status
Routing Protocol is "RIPvng"
  Sending updates every 30 seconds with +/-50%, next due in 37 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 1, receive version 1
    Interface      Send      Recv
    eth0            1          1
    eth1            1          1
    eth2            1          1
  Routing for Networks:
    eth0
    eth1
    eth2
  Routing Information Sources:
    Gateway      BadPackets BadRoutes      Distance Last Update
    fe80::ed4:c0ff:fe14:0
      0              0          120      00:00:20
    fe80::ed5:9eff:fe02:1
      0              0          120      00:00:19
vyos@msk-ioithenko-gw-01:~$

```

Рис. 77: Метрики протокола

```
VPCS> ping 2001:db8:1:6::2/64

2001:db8:1:6::2 icmp6_seq=1 ttl=58 time=9.183 ms
2001:db8:1:6::2 icmp6_seq=2 ttl=58 time=7.411 ms
2001:db8:1:6::2 icmp6_seq=3 ttl=58 time=7.673 ms
2001:db8:1:6::2 icmp6_seq=4 ttl=58 time=7.507 ms
2001:db8:1:6::2 icmp6_seq=5 ttl=58 time=8.005 ms

VPCS> trace 2001:db8:1:6::2/64

trace to 2001:db8:1:6::2, 64 hops max
 1 2001:db8:1:1::1    2.220 ms  1.620 ms  1.208 ms
 2 2001:db8:1:2::2    4.589 ms  7.167 ms  3.345 ms
 3 2001:db8:1:4::2    9.445 ms  5.799 ms  7.223 ms
 4 2001:db8:1:6::2    7.613 ms  7.246 ms  8.289 ms

VPCS> █
```

Рис. 78: Пинг

```
vyos@misk-ioithenko-gw-02# set protocols ospf area 0 network 10.10.1.64/28
[edit]
vyos@misk-ioithenko-gw-02# set protocols ospf area 0 network 10.10.1.17/30

    10.10.1.17/30 is an IPv4 host address, not a network address. Did you mean 10.10.1.16
/30?

Value validation failed
Set failed

[edit]
vyos@misk-ioithenko-gw-02# set protocols ospf area 0 network 10.10.1.16/30
[edit]
vyos@misk-ioithenko-gw-02# set protocols ospf area 0 network 10.10.1.8/30
[edit]
vyos@misk-ioithenko-gw-02# commit
[edit]
vyos@misk-ioithenko-gw-02# save
Saving configuration to '/config/config.boot'...
^pDone
[edit]
vyos@misk-ioithenko-gw-02#
```

Рис. 79: Настройка OSPF

```

vyos@misk-ioithenko-gw-01:~$ show ip ospf route
===== OSPF network routing table =====
N    10.10.1.4/30      [100] area: 0.0.0.0
                        directly attached to eth1
N    10.10.1.8/30      [200] area: 0.0.0.0
                        via 10.10.1.34, eth2
N    10.10.1.16/30     [200] area: 0.0.0.0
                        via 10.10.1.6, eth1
N    10.10.1.32/30     [100] area: 0.0.0.0
                        directly attached to eth2
N    10.10.1.64/28     [300] area: 0.0.0.0
                        via 10.10.1.6, eth1
                        via 10.10.1.34, eth2
N    10.10.1.96/27     [100] area: 0.0.0.0
                        directly attached to eth0

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

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

vyos@misk-ioithenko-gw-01:~$ show ip ospf neighbor

```

Neighbor	ID	Pri	State	Dead Time	Address	Interface
10.10.1.17		1	Full/Backup	38.679s	10.10.1.6	eth1:10.10.1.5
	0	0				
10.10.1.34		1	Full/Backup	33.249s	10.10.1.34	eth2:10.10.1.33
	0	0				

```

vyos@misk-ioithenko-gw-01:~$

```

Рис. 80: Метрики протокола

```
VPCS> ping 10.10.1.66
```

```
84 bytes from 10.10.1.66 icmp_seq=1 ttl=61 time=16.224 ms
```

```
84 bytes from 10.10.1.66 icmp_seq=2 ttl=61 time=10.827 ms
```

```
84 bytes from 10.10.1.66 icmp_seq=3 ttl=61 time=6.673 ms
```

```
84 bytes from 10.10.1.66 icmp_seq=4 ttl=61 time=11.135 ms
```

```
84 bytes from 10.10.1.66 icmp_seq=5 ttl=61 time=11.529 ms
```

```
VPCS> trace 10.10.1.66
```

```
trace to 10.10.1.66, 8 hops max, press Ctrl+C to stop
```

```
1  10.10.1.97  2.932 ms  1.428 ms  1.587 ms
```

```
2  10.10.1.6  7.244 ms  3.600 ms  2.325 ms
```

```
3  10.10.1.18  5.275 ms  6.671 ms  8.907 ms
```

```
4  *10.10.1.66  9.631 ms (ICMP type:3, code:3, Destination port unreachable)
```

```
VPCS> █
```

Рис. 81: Пинг

```
Примените фильтр отображения ... <Ctrl-/>
> Frame 484: 78 bytes on wire (624 bits), 78 bytes captured (624 bits) on interface -, id 0
▼ Ethernet II, Src: 0c:97:0f:bc:00:00 (0c:97:0f:bc:00:00), Dst: IPv4mcast_05 (01:00:5e:00:00:05)
  > Destination: IPv4mcast_05 (01:00:5e:00:00:05)
  > Source: 0c:97:0f:bc:00:00 (0c:97:0f:bc:00:00)
  Type: IPv4 (0x0800)
  [Stream index: 11]
▼ Internet Protocol Version 4, Src: 10.10.1.97, Dst: 224.0.0.5
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
  Total Length: 64
  Identification: 0xaf59 (44889)
  > 000. .... = Flags: 0x0
  ...0 0000 0000 0000 = Fragment Offset: 0
  Time to Live: 1
  Protocol: OSPF IGP (89)
  Header Checksum: 0x1ddc [validation disabled]
  [Header checksum status: Unverified]
  Source Address: 10.10.1.97
  Destination Address: 224.0.0.5
  [Stream index: 7]
▼ Open Shortest Path First
  ▼ OSPF Header
    Version: 2
    Message Type: Hello Packet (1)
    Packet Length: 44
    Source OSPF Router: 10.10.1.97
    Area ID: 0.0.0.0 (Backbone)
    Checksum: 0xe4e8 [correct]
    Auth Type: Null (0)
    Auth Data (none): 0000000000000000
  ▼ OSPF Hello Packet
    Network Mask: 255.255.255.224
    Hello Interval [sec]: 10
    > Options: 0x02, (E) External Routing
    Router Priority: 1
    Router Dead Interval [sec]: 40
    Designated Router: 10.10.1.97
    Backup Designated Router: 0.0.0.0
```

Рис. 82: Захваченный трафик

```
vyos@msk-ioithenko-gw-02# set protocols ospfv3 parameters router-id 2.2.2.2
[edit]
vyos@msk-ioithenko-gw-02# set protocols ospfv3 area 0 interface eth0
[edit]
vyos@msk-ioithenko-gw-02# set protocols ospfv3 area 0 interface eth1
[edit]
vyos@msk-ioithenko-gw-02# set protocols ospfv3 area 0 interface eth2
[edit]
vyos@msk-ioithenko-gw-02# commit
[edit]
vyos@msk-ioithenko-gw-02# save
Saving configuration to '/config/config.boot'...
```

Рис. 83: Настройка OSPFv3


```

exit
vyos@msk-ioithenko-gw-01:~$ show ipv6 ospfv3 route
*N IA 2001:db8:1:1::/64      ::          eth0 00:04:54
*N IA 2001:db8:1:2::/64      ::          eth1 00:02:24
*N IA 2001:db8:1:3::/64      fe80::ed5:9eff:fe02:1  eth2 00:00:28
*N IA 2001:db8:1:4::/64      fe80::ed4:c0ff:fe14:0  eth1 00:02:19
*N IA 2001:db8:1:5::/64      ::          eth2 00:00:33
*N IA 2001:db8:1:6::/64      fe80::ed4:c0ff:fe14:0  eth1 00:00:28
                                fe80::ed5:9eff:fe02:1  eth2
vyos@msk-ioithenko-gw-01:~$ show ipv6 ospfv3 neighbor
Neighbor ID    Pri    DeadTime    State/IfState    Duration I/F[State]
3.3.3.3        1      00:00:37    Full/BDR         00:02:36 eth1[DR]
4.4.4.4        1      00:00:30    Full/BDR         00:00:45 eth2[DR]
vyos@msk-ioithenko-gw-01:~$

```

Рис. 84: Метрики протокола

```
VPCS> ping 2001:db8:1:6::2/64

2001:db8:1:6::2 icmp6_seq=1 ttl=58 time=10.307 ms
2001:db8:1:6::2 icmp6_seq=2 ttl=58 time=8.431 ms
2001:db8:1:6::2 icmp6_seq=3 ttl=58 time=8.552 ms
2001:db8:1:6::2 icmp6_seq=4 ttl=58 time=8.048 ms
2001:db8:1:6::2 icmp6_seq=5 ttl=58 time=7.648 ms

VPCS> trace 2001:db8:1:6::2/64

trace to 2001:db8:1:6::2, 64 hops max
 1 2001:db8:1:1::1    1.829 ms  1.709 ms  1.799 ms
 2 2001:db8:1:2::2    6.514 ms  6.769 ms  2.457 ms
 3 2001:db8:1:4::2    5.795 ms  11.174 ms 6.924 ms
 4 2001:db8:1:6::2    5.476 ms  11.976 ms 11.812 ms

VPCS> █
```

Рис. 85: Пинг

Примените фильтр отображения ... <Ctrl-/>						
No.	Time	Source	Destination	Protocol	Len	Info
Frame 557: 90 bytes on wire (720 bits), 90 bytes captured (720 bits) on interface -, id 0						
Ethernet II, Src: 0c:8e:91:83:00:00 (0c:8e:91:83:00:00), Dst: IPv6mcast_05 (33:33:00:00:00:05)						
> Destination: IPv6mcast_05 (33:33:00:00:00:05) > Source: 0c:8e:91:83:00:00 (0c:8e:91:83:00:00) Type: IPv6 (0x86dd) [Stream index: 12]						
Internet Protocol Version 6, Src: fe80::e8e:91ff:fe83:0, Dst: ff02::5						
0110 = Version: 6 > 1100 0000 = Traffic Class: 0xc0 (DSCP: CS6, ECN: Not-ECT) 0100 1011 1011 1010 1000 = Flow Label: 0x4bba8 Payload Length: 36 Next Header: OSPF IGP (89) Hop Limit: 1 > Source Address: fe80::e8e:91ff:fe83:0 > Destination Address: ff02::5 [Source SLAAC MAC: 0c:8e:91:83:00:00 (0c:8e:91:83:00:00)] [Stream index: 8]						
Open Shortest Path First						
▾ OSPF Header Version: 3 Message Type: Hello Packet (1) Packet Length: 36 Source OSPF Router: 2.2.2.2 Area ID: 0.0.0.0 (Backbone) Checksum: 0x5674 [correct] Instance ID: IPv6 unicast AF (0) Reserved: 00						
▾ OSPF Hello Packet Interface ID: 2 Router Priority: 1 > Options: 0x000013, R, E, V6 Hello Interval [sec]: 10 Router Dead Interval [sec]: 40 Designated Router: 2.2.2.2 Backup Designated Router: 0.0.0.0						

Рис. 86: Захваченный трафик

В ходе лабораторной работы я изучила принципы маршрутизации в IPv4- и IPv6-сетях и принципы настройки сетевого оборудования.