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Презентация

лабораторной работы № 7

по предмету «*Сетевые технологии*»

Адресация IPv4 и IPv6. Настройка DHCP

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Цели работы:

- Получение навыков настройки службы DHCP на сетевом оборудовании для распределения адресов IPv4 и IPv6.

Ход работы:

1. Настройка DHCP в случае IPv4

Добавление устройств в соответствии с заданной топологией. Захват трафика на соединении между коммутатором sw-01 и маршрутизатором gw-01. (рис. 1)

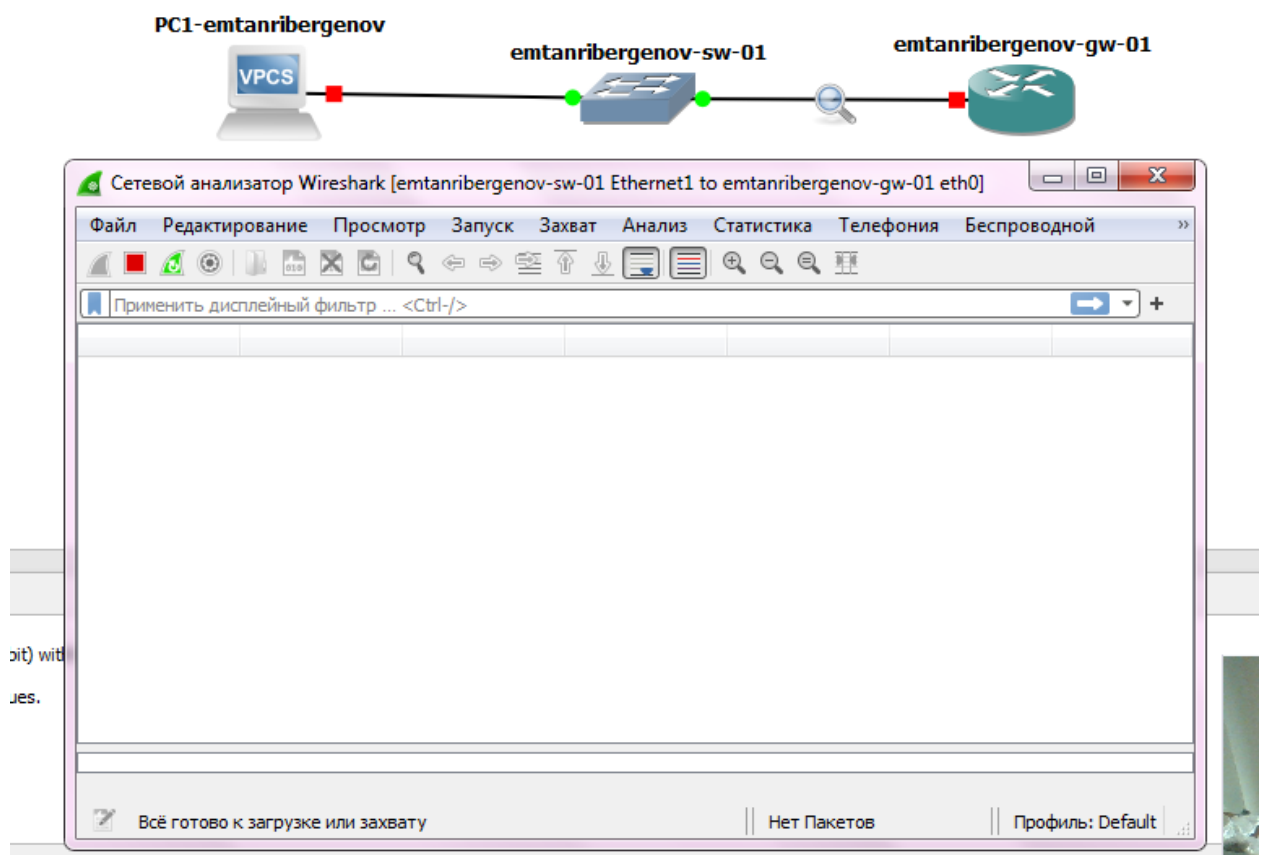
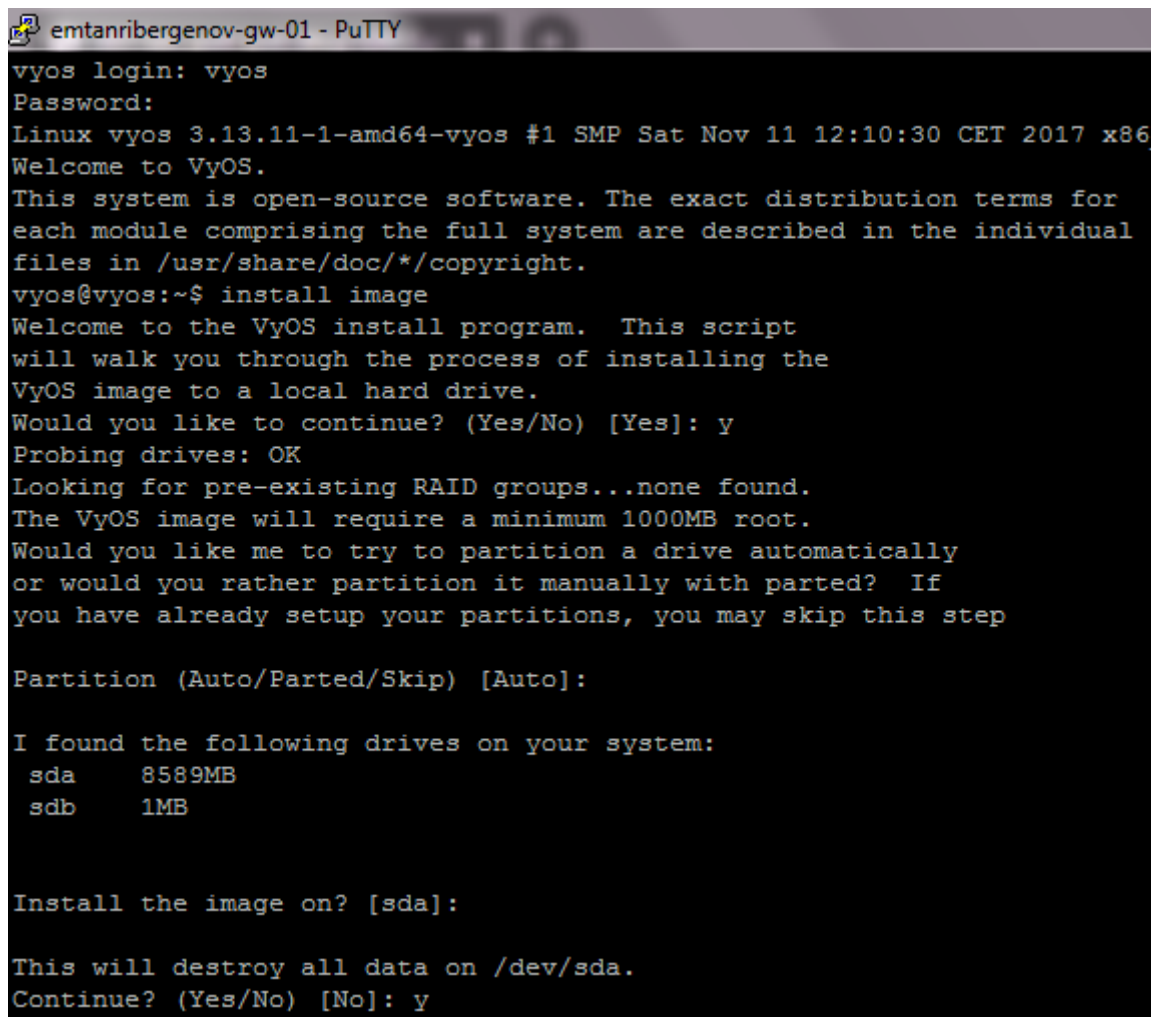


Рис. 1.

Установка системы и перезагрузка (рис. 2.1 – 2.3).



```
emtanribergenov-gw-01 - PuTTY
vyos login: vyos
Password:
Linux vyos 3.13.11-1-amd64-vyos #1 SMP Sat Nov 11 12:10:30 CET 2017 x86_64
Welcome to VyOS.
This system is open-source software. The exact distribution terms for
each module comprising the full system are described in the individual
files in /usr/share/doc/*/copyright.
vyos@vyos:~$ install image
Welcome to the VyOS install program. This script
will walk you through the process of installing the
VyOS image to a local hard drive.
Would you like to continue? (Yes/No) [Yes]: y
Probing drives: OK
Looking for pre-existing RAID groups...none found.
The VyOS image will require a minimum 1000MB root.
Would you like me to try to partition a drive automatically
or would you rather partition it manually with parted? If
you have already setup your partitions, you may skip this step

Partition (Auto/Parted/Skip) [Auto]:

I found the following drives on your system:
sda      8589MB
sdb       1MB

Install the image on? [sda]:

This will destroy all data on /dev/sda.
Continue? (Yes/No) [No]: y
```

Рис. 2.1

```
How big of a root partition should I create? (1000MB - 8589MB) [8589]MB:

Creating filesystem on /dev/sda1: OK
Done!
Mounting /dev/sda1...
What would you like to name this image? [1.1.8]:
OK. This image will be named: 1.1.8
Copying squashfs image...
Copying kernel and initrd images...
Done!
I found the following configuration files:
    /config/config.boot
    /opt/vyatta/etc/config.boot.default
Which one should I copy to sda? [/config/config.boot]:

Copying /config/config.boot to sda.
Enter password for administrator account
Enter password for user 'vyos':
Retype password for user 'vyos':
I need to install the GRUB boot loader.
I found the following drives on your system:
    sda      8589MB
    sdb       1MB

Which drive should GRUB modify the boot partition on? [sda]:

Setting up grub: OK
Done!
vyos@vyos:~$ █
```

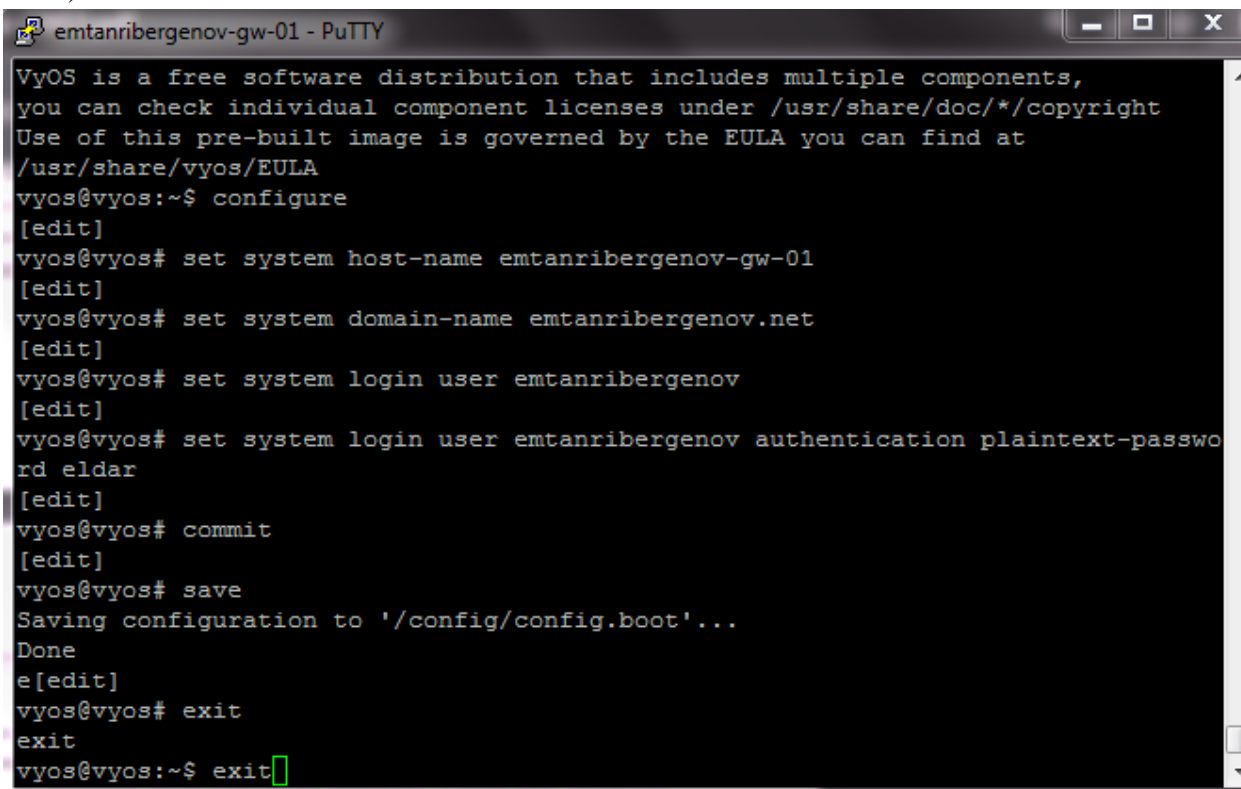
Puc. 2.2

```
vyos@vyos:~$ reboot
Proceed with reboot? (Yes/No) [No] y

Broadcast message from root@vyos (ttyS0) (Sat Oct 22 17:33:48 2022):
[ 431.936988] reboot: Restarting system
█
```

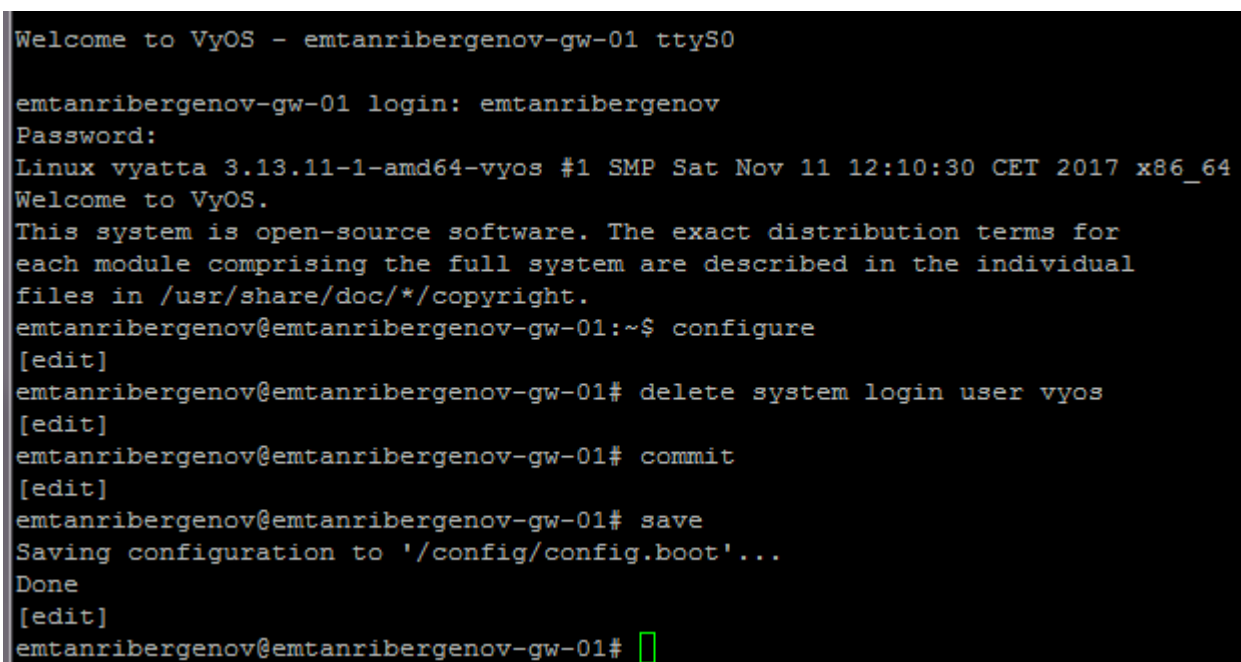
Puc. 2.3

Изменение имени устройства, доменного имени, замена системного пользователя (рис. 3.1 – 3.2).



```
emtanribergenov-gw-01 - PuTTY
VyOS is a free software distribution that includes multiple components,
you can check individual component licenses under /usr/share/doc/*/copyright
Use of this pre-built image is governed by the EULA you can find at
/usr/share/vyos/EULA
vyos@vyos:~$ configure
[edit]
vyos@vyos# set system host-name emtanribergenov-gw-01
[edit]
vyos@vyos# set system domain-name emtanribergenov.net
[edit]
vyos@vyos# set system login user emtanribergenov
[edit]
vyos@vyos# set system login user emtanribergenov authentication plaintext-passwo
rd eldar
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
e[edit]
vyos@vyos# exit
exit
vyos@vyos:~$ exit
```

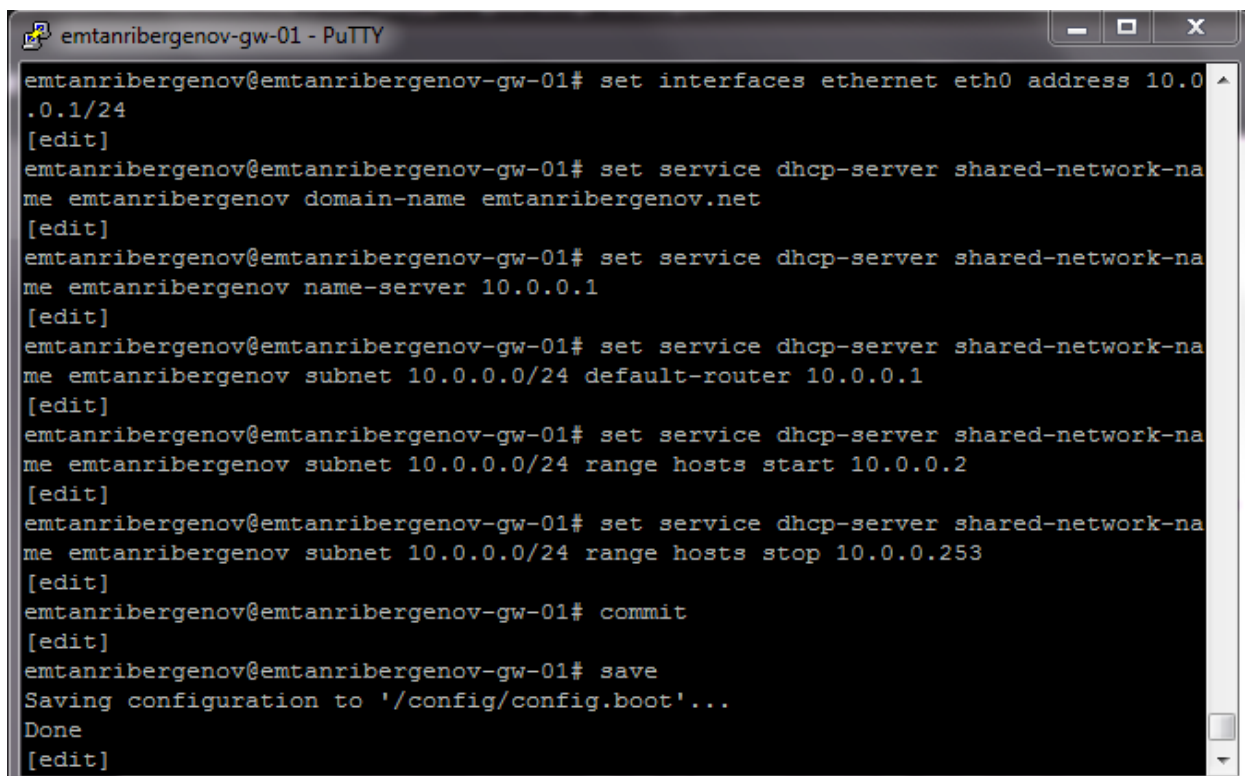
Рис. 3.1



```
Welcome to VyOS - emtanribergenov-gw-01 ttyS0
emtanribergenov-gw-01 login: emtanribergenov
Password:
Linux vyatta 3.13.11-1-amd64-vyos #1 SMP Sat Nov 11 12:10:30 CET 2017 x86_64
Welcome to VyOS.
This system is open-source software. The exact distribution terms for
each module comprising the full system are described in the individual
files in /usr/share/doc/*/copyright.
emtanribergenov@emtanribergenov-gw-01:~$ configure
[edit]
emtanribergenov@emtanribergenov-gw-01# delete system login user vyos
[edit]
emtanribergenov@emtanribergenov-gw-01# commit
[edit]
emtanribergenov@emtanribergenov-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
emtanribergenov@emtanribergenov-gw-01#
```

Рис. 3.2

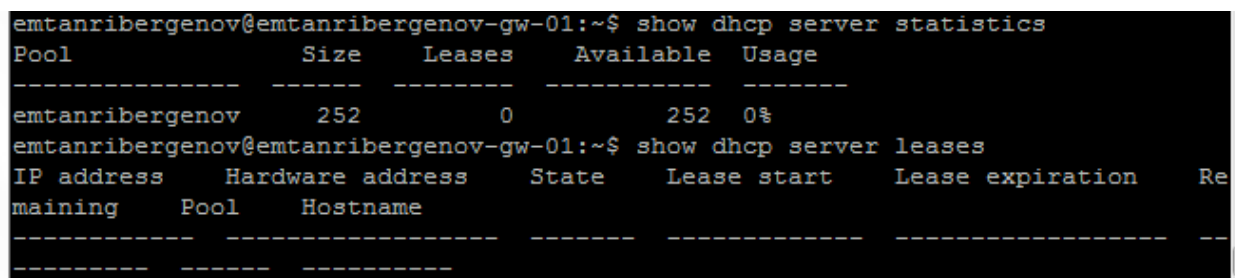
Конфигурация DHCP-сервера на маршрутизаторе (рис. 4).



```
emtanribergenov@emtanribergenov-gw-01# set interfaces ethernet eth0 address 10.0.0.1/24
[edit]
emtanribergenov@emtanribergenov-gw-01# set service dhcp-server shared-network-name emtanribergenov domain-name emtanribergenov.net
[edit]
emtanribergenov@emtanribergenov-gw-01# set service dhcp-server shared-network-name emtanribergenov name-server 10.0.0.1
[edit]
emtanribergenov@emtanribergenov-gw-01# set service dhcp-server shared-network-name emtanribergenov subnet 10.0.0.0/24 default-router 10.0.0.1
[edit]
emtanribergenov@emtanribergenov-gw-01# set service dhcp-server shared-network-name emtanribergenov subnet 10.0.0.0/24 range hosts start 10.0.0.2
[edit]
emtanribergenov@emtanribergenov-gw-01# set service dhcp-server shared-network-name emtanribergenov subnet 10.0.0.0/24 range hosts stop 10.0.0.253
[edit]
emtanribergenov@emtanribergenov-gw-01# commit
[edit]
emtanribergenov@emtanribergenov-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
```

Рис. 4.

Статистика DHCP-сервера и выданных адресов (рис. 5).



```
emtanribergenov@emtanribergenov-gw-01:~$ show dhcp server statistics
Pool           Size    Leases    Available  Usage
-----
emtanribergenov 252      0         252      0%
emtanribergenov@emtanribergenov-gw-01:~$ show dhcp server leases
IP address    Hardware address    State    Lease start    Lease expiration    Re
maining      Pool      Hostname
-----
-----
```

Рис. 5.

Настройка оконечного устройства PC1. Здесь использована опция -d для обеспечения возможности просмотра декодированных запросов DHCP (рис. 6.1. – 6.3).

```
PC1-emtaribergenov - PuTTY
VPCS> ip dhcp -d
Opcode: 1 (REQUEST)
Client IP Address: 0.0.0.0
Your IP Address: 0.0.0.0
Server IP Address: 0.0.0.0
Gateway IP Address: 0.0.0.0
Client MAC Address: 00:50:79:66:68:00
Option 53: Message Type = Discover
Option 12: Host Name = VPCS
Option 61: Client Identifier = Hardware Type=Ethernet MAC Address = 00:50:79:66:68:00

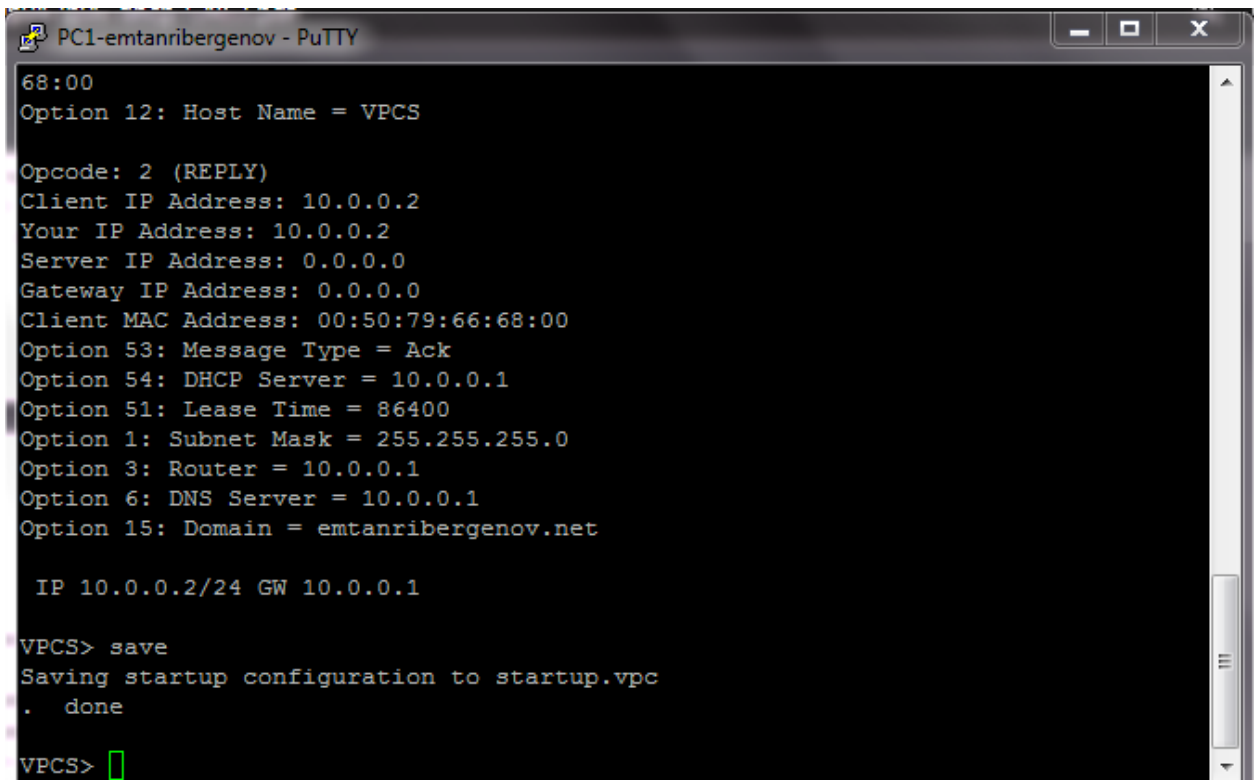
Opcode: 1 (REQUEST)
Client IP Address: 0.0.0.0
Your IP Address: 0.0.0.0
Server IP Address: 0.0.0.0
Gateway IP Address: 0.0.0.0
Client MAC Address: 00:50:79:66:68:00
Option 53: Message Type = Discover
Option 12: Host Name = VPCS
Option 61: Client Identifier = Hardware Type=Ethernet MAC Address = 00:50:79:66:68:00
```

Рис. 6.1.

```
PC1-emtaribergenov - PuTTY
Opcode: 2 (REPLY)
Client IP Address: 0.0.0.0
Your IP Address: 10.0.0.2
Server IP Address: 0.0.0.0
Gateway IP Address: 0.0.0.0
Client MAC Address: 00:50:79:66:68:00
Option 53: Message Type = Offer
Option 54: DHCP Server = 10.0.0.1
Option 51: Lease Time = 86400
Option 1: Subnet Mask = 255.255.255.0
Option 3: Router = 10.0.0.1
Option 6: DNS Server = 10.0.0.1
Option 15: Domain = emtaribergenov.net

Opcode: 1 (REQUEST)
Client IP Address: 10.0.0.2
Your IP Address: 0.0.0.0
Server IP Address: 0.0.0.0
Gateway IP Address: 0.0.0.0
Client MAC Address: 00:50:79:66:68:00
Option 53: Message Type = Request
Option 54: DHCP Server = 10.0.0.1
Option 50: Requested IP Address = 10.0.0.2
Option 61: Client Identifier = Hardware Type=Ethernet MAC Address = 00:50:79:66:68:00
```

Рис. 6.2.



```
PC1-emtandribergenov - PuTTY
68:00
Option 12: Host Name = VPCS

Opcode: 2 (REPLY)
Client IP Address: 10.0.0.2
Your IP Address: 10.0.0.2
Server IP Address: 0.0.0.0
Gateway IP Address: 0.0.0.0
Client MAC Address: 00:50:79:66:68:00
Option 53: Message Type = Ack
Option 54: DHCP Server = 10.0.0.1
Option 51: Lease Time = 86400
Option 1: Subnet Mask = 255.255.255.0
Option 3: Router = 10.0.0.1
Option 6: DNS Server = 10.0.0.1
Option 15: Domain = emtandribergenov.net

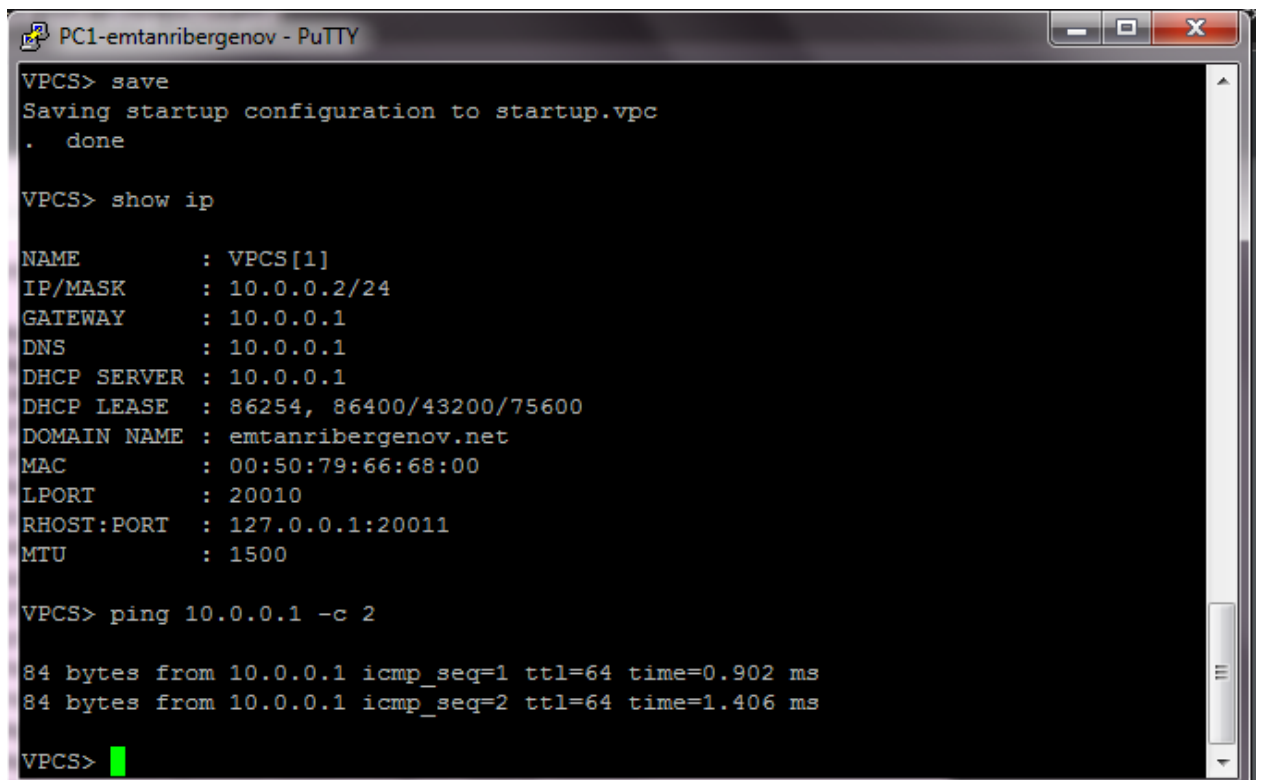
IP 10.0.0.2/24 GW 10.0.0.1

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

VPCS> 
```

Рис. 6.3.

Проверка конфигурации IPv4 на узле, пропингование маршрутизатора (рис. 7).



```
PC1-emtandribergenov - PuTTY

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

VPCS> show ip

NAME       : VPCS[1]
IP/MASK    : 10.0.0.2/24
GATEWAY    : 10.0.0.1
DNS        : 10.0.0.1
DHCP SERVER : 10.0.0.1
DHCP LEASE  : 86254, 86400/43200/75600
DOMAIN NAME : emtandribergenov.net
MAC        : 00:50:79:66:68:00
LPORT      : 20010
RHOST:PORT  : 127.0.0.1:20011
MTU        : 1500

VPCS> ping 10.0.0.1 -c 2

84 bytes from 10.0.0.1 icmp_seq=1 ttl=64 time=0.902 ms
84 bytes from 10.0.0.1 icmp_seq=2 ttl=64 time=1.406 ms

VPCS> 
```

Рис. 7.

Статистика DHCP-сервера и выданные адреса (рис. 8).

```
emtanribergenov@emtanribergenov-gw-01:~$ show dhcp server statistics
Pool          Size    Leases    Available  Usage
-----
emtanribergenov 252      1         251        0%
emtanribergenov@emtanribergenov-gw-01:~$ show dhcp server leases
IP address    Hardware address    State    Lease start    Lease expiration
-----
Remaining     Pool                Hostname
-----
10.0.0.2      00:50:79:66:68:00  active   2022/10/22 21:07:19  2022/10/23 21:07:19
23:55:08      emtanribergenov    VPCS
emtanribergenov@emtanribergenov-gw-01:~$
```

Рис. 8.

Журнал работы DHCP-сервера (рис. 9).

```
:19 23:55:08 emtanribergenov VPCS
emtanribergenov@emtanribergenov-gw-01:~$ show log | grep dhcp
Oct 22 21:00:32 sudo[3575]: emtanribergenov : TTY=ttyS0 ; PWD=/home/emtanribergenov ; USER=root ; COMMAND=/usr/bin/sh -c /usr/sbin/vyshim /usr/libexec/vyos/conf_mode/dhcp_server.py
Oct 22 21:00:46 dhcpd[3591]: Wrote 0 leases to leases file.
Oct 22 21:00:46 dhcpd[3591]: Lease file test successful, removing temp lease file: /config/dhcpd.leases.1666472446
Oct 22 21:00:46 dhcpd[3593]: Wrote 0 leases to leases file.
Oct 22 21:00:46 dhcpd[3593]:
Oct 22 21:00:46 dhcpd[3593]: No subnet declaration for eth2 (no IPv4 addresses).
Oct 22 21:00:46 dhcpd[3593]: ** Ignoring requests on eth2. If this is not what
Oct 22 21:00:46 dhcpd[3593]: you want, please write a subnet declaration
Oct 22 21:00:46 dhcpd[3593]: in your dhcpd.conf file for the network segment
Oct 22 21:00:46 dhcpd[3593]: to which interface eth2 is attached. **
Oct 22 21:00:46 dhcpd[3593]:
Oct 22 21:00:46 dhcpd[3593]: No subnet declaration for eth1 (no IPv4 addresses).
Oct 22 21:00:46 dhcpd[3593]: ** Ignoring requests on eth1. If this is not what
Oct 22 21:00:46 dhcpd[3593]: you want, please write a subnet declaration
Oct 22 21:00:46 dhcpd[3593]: in your dhcpd.conf file for the network segment
Oct 22 21:00:46 dhcpd[3593]: to which interface eth1 is attached. **
Oct 22 21:00:46 dhcpd[3593]:
Oct 22 21:00:47 dhcpd[3593]: Server starting service.
Oct 22 21:03:59 sudo[3671]: emtanribergenov : TTY=ttyS0 ; PWD=/home/emtanribergenov ; USER=root ; COMMAND=/usr/libexec/vyos/op_mode/show_dhcp.py --statistics
Oct 22 21:04:25 sudo[3697]: emtanribergenov : TTY=ttyS0 ; PWD=/home/emtanribergenov ; USER=root ; COMMAND=/usr/libexec/vyos/op_mode/show_dhcp.py --leases
Oct 22 21:07:15 dhcpd[3593]: DHCPDISCOVER from 00:50:79:66:68:00 via eth0
Oct 22 21:07:16 dhcpd[3593]: DHCP OFFER on 10.0.0.2 to 00:50:79:66:68:00 (VPCS) via eth0
Oct 22 21:07:19 dhcpd[3593]: DHCPREQUEST for 10.0.0.2 (10.0.0.1) from 00:50:79:66:68:00 (VPCS) via eth0
Oct 22 21:07:19 dhcpd[3593]: DHCPACK on 10.0.0.2 to 00:50:79:66:68:00 (VPCS) via eth0
Oct 22 21:11:41 sudo[3725]: emtanribergenov : TTY=ttyS0 ; PWD=/home/emtanribergenov ; USER=root ; COMMAND=/usr/libexec/vyos/op_mode/show_dhcp.py --statistics
Oct 22 21:12:04 sudo[3751]: emtanribergenov : TTY=ttyS0 ; PWD=/home/emtanribergenov ; USER=root ; COMMAND=/usr/libexec/vyos/op_mode/show_dhcp.py --leases
emtanribergenov@emtanribergenov-gw-01:~$
```

Рис. 9.

2. Настройка DHCP в случае IPv6

Дополнение предыдущего проекта. Изменение отображаемых названий устройств. Включение захвата трафика на соединениях между маршрутизатором gw-01 и коммутаторами sw-02 и sw-03 (рис. 10).

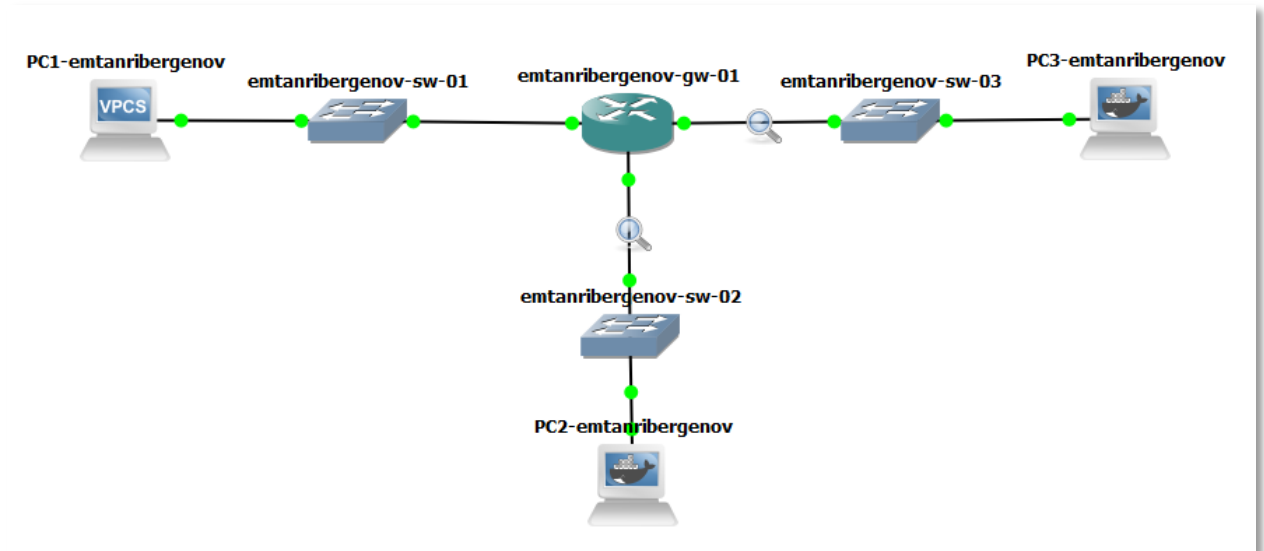


Рис. 10.

Настроил адресацию IPv6 на маршрутизаторе (рис. 11.1 – 11.2).

```
emptanribergenov@emptanribergenov-gw-01:~$ configure
[edit]
emptanribergenov@emptanribergenov-gw-01# set interfaces ethernet eth1 address 2000
::1/64
[edit]
emptanribergenov@emptanribergenov-gw-01# set interfaces ethernet eth2 address 2001
::1/64
[edit]
emptanribergenov@emptanribergenov-gw-01# show interfaces
  ethernet eth0 {
    address 10.0.0.1/24
    hw-id 0c:b3:7b:7d:00:00
  }
  ethernet eth1 {
+   address 2000::1/64
    hw-id 0c:b3:7b:7d:00:01
  }
  ethernet eth2 {
+   address 2001::1/64
    hw-id 0c:b3:7b:7d:00:02
  }
  loopback lo {
```

Рис. 11.1.

```

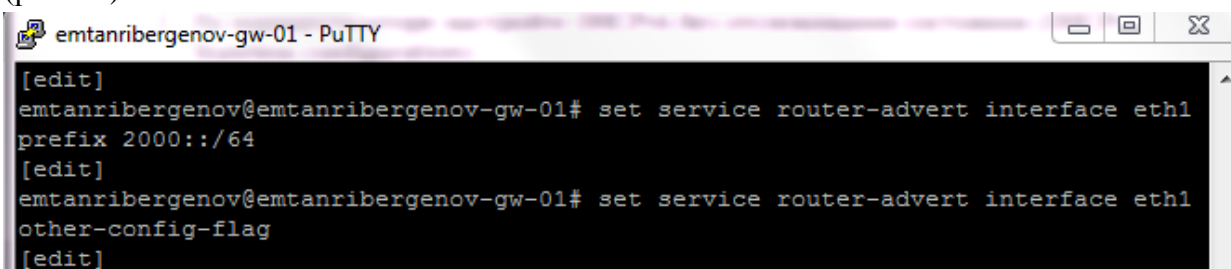
    ethernet eth2 {
+   address 2001::1/64
        hw-id 0c:b3:7b:7d:00:02
    }
    loopback lo {
    }
[edit]
emtanribergenov@emtanribergenov-gw-01# commit
[edit]
emtanribergenov@emtanribergenov-gw-01# save
Saving configuration to '/config/config.boot'...
Done

```

Рис. 11.2.

Настройка DHCPv6 без отслеживания состояния (DHCPv6 Stateless configuration).

Настройка объявления о маршрутизаторах (Router Advertisements, RA) на интерфейсе eth1 (рис. 12).



```

[edit]
emtanribergenov@emtanribergenov-gw-01# set service router-advert interface eth1
prefix 2000::/64
[edit]
emtanribergenov@emtanribergenov-gw-01# set service router-advert interface eth1
other-config-flag
[edit]

```

Рис. 12.

Добавление конфигурации DHCP-сервера (рис. 13.1 – 13.8).

```

emtanribergenov@emtanribergenov-gw-01# set service dhcpv6-server shared-network-
name emtanribergenov-stateless
[edit]

```

Рис. 13.1

```

emtanribergenov@emtanribergenov-gw-01# set service dhcpv6-server shared-network-
name emtanribergenov-stateless
[edit]

```

Рис. 13.2

```

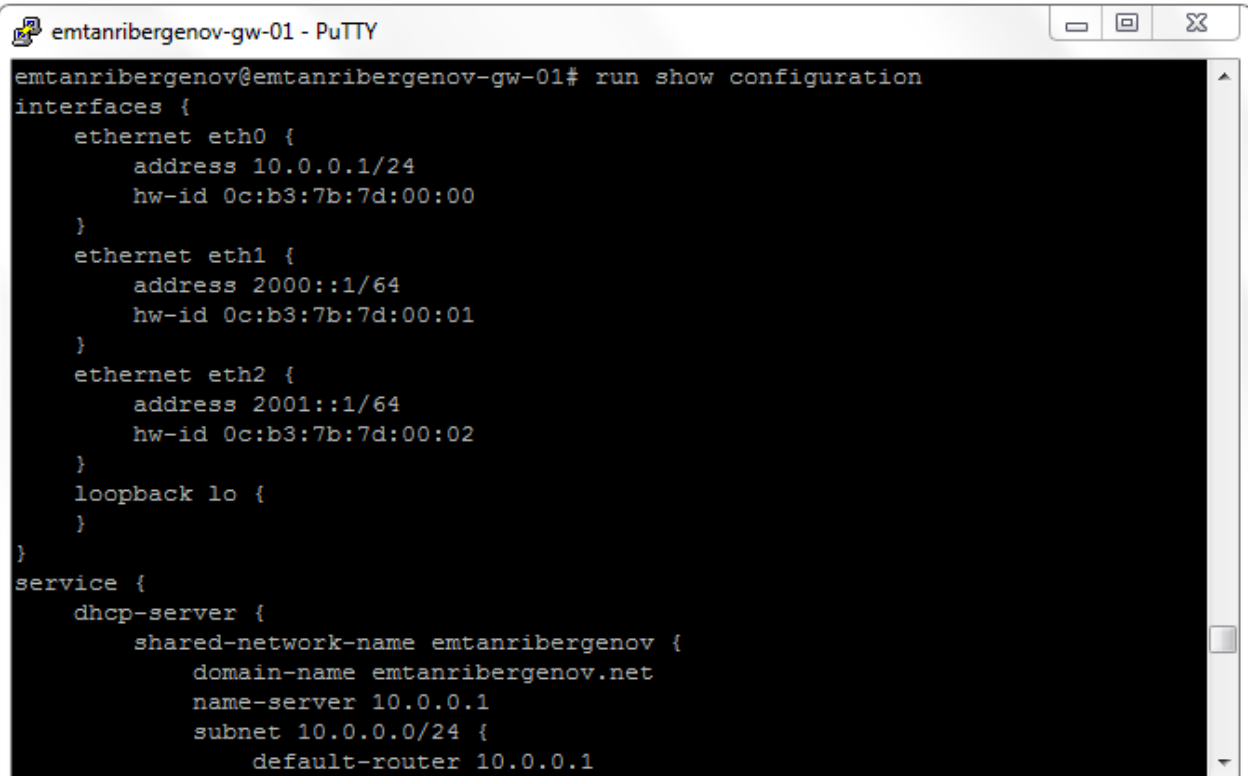
emtanribergenov@emtanribergenov-gw-01# set service dhcpv6-server shared-network-
name emtanribergenov-stateless subnet 2000::0/64
[edit]

```

Рис. 13.3

```
emtanribergenov@emtanribergenov-gw-01# set service dhcpv6-server shared-network-  
name emtanribergenov-stateless common-options name-server 2000::1  
[edit]  
emtanribergenov@emtanribergenov-gw-01# set service dhcpv6-server shared-network-  
name emtanribergenov-stateless common-options domain-search emtanribergenov.net  
[edit]  
emtanribergenov@emtanribergenov-gw-01# commit  
[edit]  
emtanribergenov@emtanribergenov-gw-01# save
```

Puc. 13.4



```
emtanribergenov@emtanribergenov-gw-01# run show configuration  
interfaces {  
    ethernet eth0 {  
        address 10.0.0.1/24  
        hw-id 0c:b3:7b:7d:00:00  
    }  
    ethernet eth1 {  
        address 2000::1/64  
        hw-id 0c:b3:7b:7d:00:01  
    }  
    ethernet eth2 {  
        address 2001::1/64  
        hw-id 0c:b3:7b:7d:00:02  
    }  
    loopback lo {  
    }  
}  
service {  
    dhcp-server {  
        shared-network-name emtanribergenov {  
            domain-name emtanribergenov.net  
            name-server 10.0.0.1  
            subnet 10.0.0.0/24 {  
                default-router 10.0.0.1  
            }  
        }  
    }  
}
```

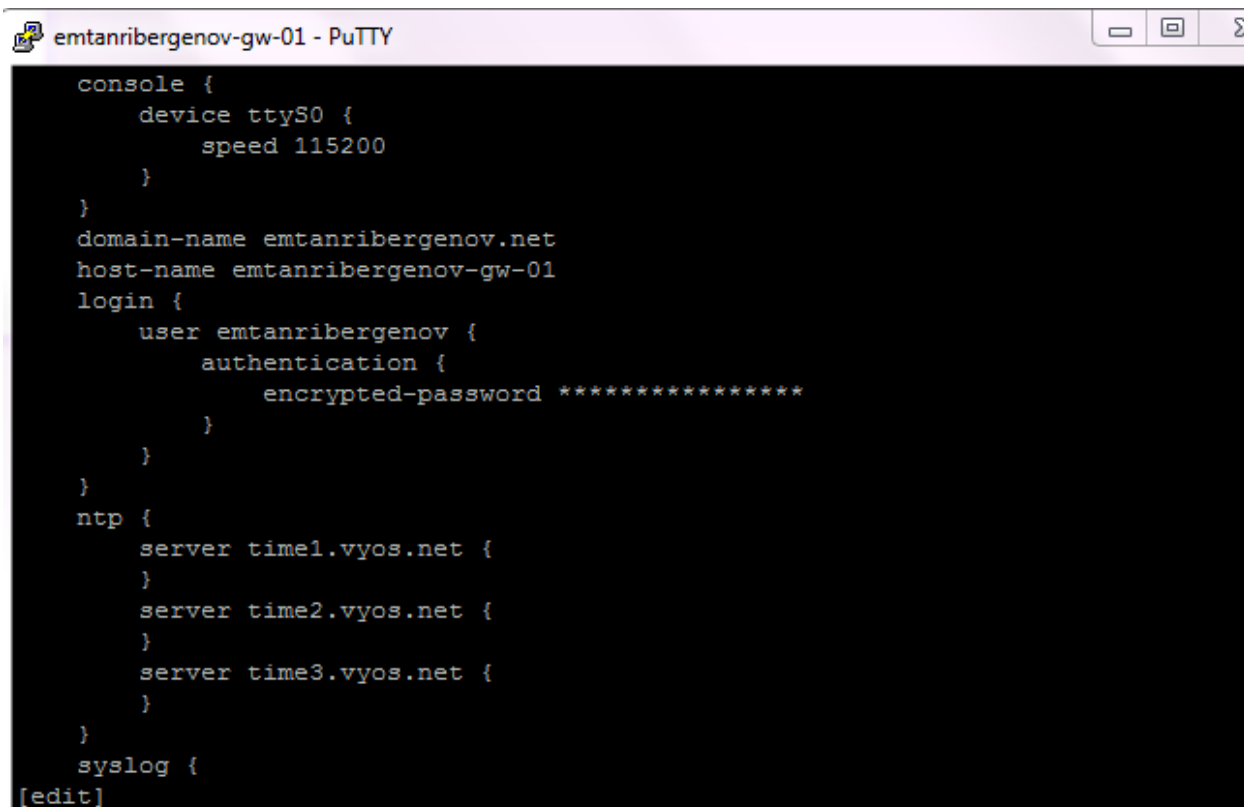
Puc. 13.5

```
emtanribergenov-gw-01 - PuTTY
service {
  dhcp-server {
    shared-network-name emtanribergenov {
      domain-name emtanribergenov.net
      name-server 10.0.0.1
      subnet 10.0.0.0/24 {
        default-router 10.0.0.1
        range hosts {
          start 10.0.0.2
          stop 10.0.0.253
        }
      }
    }
  }
  dhcpv6-server {
    shared-network-name emtanribergenov-stateless {
      common-options {
        domain-search emtanribergenov.net
        name-server 2000::1
      }
      subnet 2000::0/64 {
      }
    }
  }
}
```

Puc. 13.6

```
emtanribergenov-gw-01 - PuTTY
router-advert {
  interface eth1 {
    other-config-flag
    prefix 2000::/64 {
    }
  }
}
system {
  config-management {
    commit-revisions 100
  }
  conntrack {
    modules {
      ftp
      h323
      nfs
      pptp
      sip
      sqlnet
      tftp
    }
  }
  console {
```

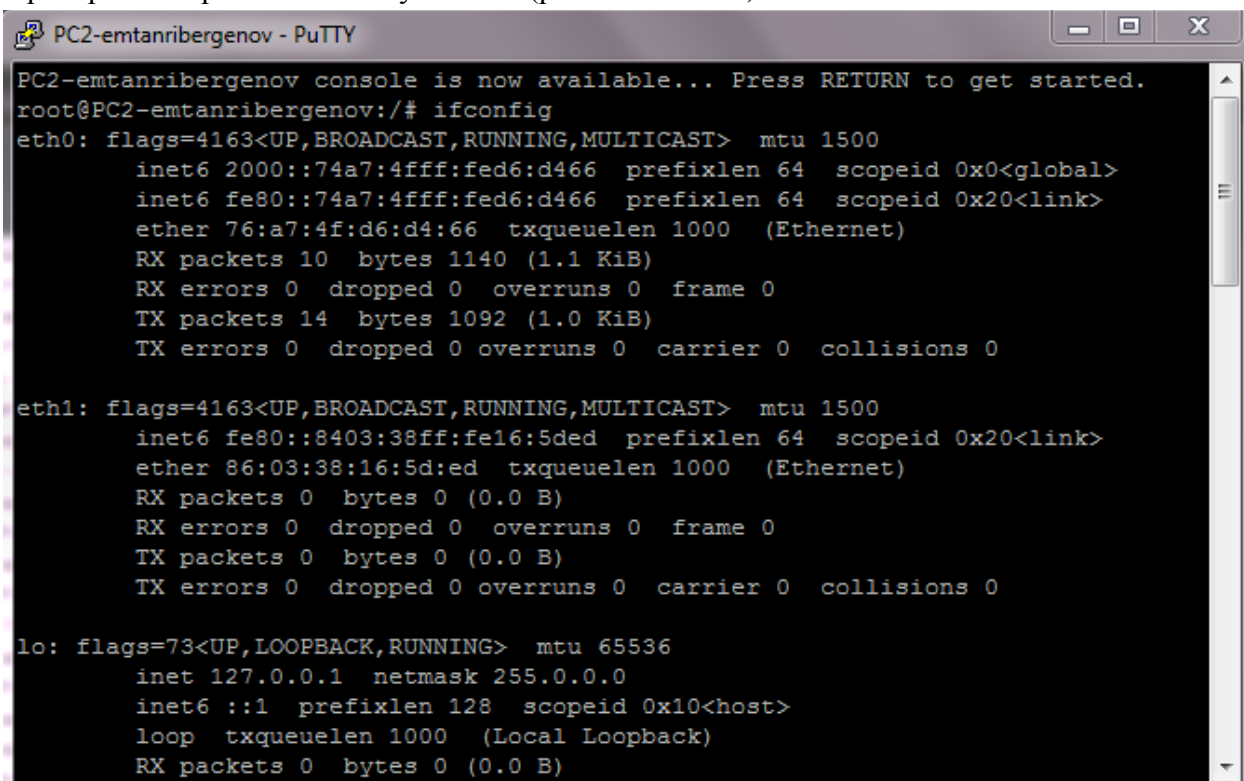
Puc. 13.7



```
console {  
    device ttyS0 {  
        speed 115200  
    }  
}  
domain-name emtanribergenov.net  
host-name emtanribergenov-gw-01  
login {  
    user emtanribergenov {  
        authentication {  
            encrypted-password *****  
        }  
    }  
}  
ntp {  
    server time1.vyos.net {  
    }  
    server time2.vyos.net {  
    }  
    server time3.vyos.net {  
    }  
}  
syslog {  
[edit]
```

Рис. 13.8

Проверка настройки сети на узле PC2 (рис. 14.1 – 14.2).



```
PC2-emtanribergenov console is now available... Press RETURN to get started.  
root@PC2-emtanribergenov:/# ifconfig  
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 2000::74a7:4fff:fed6:d466 prefixlen 64 scopeid 0x0<global>  
    inet6 fe80::74a7:4fff:fed6:d466 prefixlen 64 scopeid 0x20<link>  
    ether 76:a7:4f:d6:d4:66 txqueuelen 1000 (Ethernet)  
    RX packets 10 bytes 1140 (1.1 KiB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 14 bytes 1092 (1.0 KiB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 fe80::8403:38ff:fe16:5ded prefixlen 64 scopeid 0x20<link>  
    ether 86:03:38:16:5d:ed txqueuelen 1000 (Ethernet)  
    RX packets 0 bytes 0 (0.0 B)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 0 bytes 0 (0.0 B)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536  
    inet 127.0.0.1 netmask 255.0.0.0  
    inet6 ::1 prefixlen 128 scopeid 0x10<host>  
    loop txqueuelen 1000 (Local Loopback)  
    RX packets 0 bytes 0 (0.0 B)
```

Рис. 14.1

```
PC2-emtanribergenov - PuTTY
root@PC2-emtanribergenov:/# route -n -A inet6
Kernel IPv6 routing table
Destination                Next Hop                    Flag Met Ref Use If
2000::/64                  ::                          UAe  256 1    0 eth0
fe80::/64                  ::                          U    256 1    0 eth0
fe80::/64                  ::                          U    256 1    0 eth1
::/0                       fe80::eb3:7bff:fe7d:1      UGDAe 1024 1    0 eth
0
::1/128                    ::                          Un   0   3    0 lo
2000::74a7:4fff:fed6:d466/128 ::                          Un   0   2    0 eth0
fe80::74a7:4fff:fed6:d466/128 ::                          Un   0   3    0 eth0
fe80::8403:38ff:fe16:5ded/128 ::                          Un   0   2    0 eth1
ff00::/8                   ::                          U    256 3    0 eth0
ff00::/8                   ::                          U    256 1    0 eth1
::/0                       ::                          !n   -1  1    0 lo
root@PC2-emtanribergenov:/#
```

Рис. 14.2

На узле PC2 пингование маршрутизатора (рис. 15).

```
root@PC2-emtanribergenov:/# ping 2000::1 -c 2
PING 2000::1(2000::1) 56 data bytes
64 bytes from 2000::1: icmp_seq=1 ttl=64 time=11.4 ms
64 bytes from 2000::1: icmp_seq=2 ttl=64 time=1.34 ms

--- 2000::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1004ms
rtt min/avg/max/mdev = 1.341/6.371/11.402/5.031 ms
```

Рис. 15

На узле PC2 проверка настройки DNS (рис. 16).

```
root@PC2-emtanribergenov:/# cat /etc/resolv.conf
root@PC2-emtanribergenov:/#
```

Рис. 16

На узле PC2 получение адреса по DHCPv6 (рис. 17).

```
PC2-emtandribergenov - PuTTY
root@PC2-emtandribergenov:/# dhclient -6 -S -v eth0
Internet Systems Consortium DHCP Client 4.3.5
Copyright 2004-2016 Internet Systems Consortium.
All rights reserved.
For info, please visit https://www.isc.org/software/dhcp/

Listening on Socket/eth0
Sending on Socket/eth0
Created duid "\000\003\000\001v\2470\326\324f".
PRC: Requesting information (INIT).
XMT: Forming Info-Request, 0 ms elapsed.
XMT: Info-Request on eth0, interval 1090ms.
RCV: Reply message on eth0 from fe80::eb3:7bff:fe7d:1.
PRC: Done.
```

Рис. 17

Вновь пингование от узла PC2 маршрутизатора, проверка настройки DNS (рис. 18).

```
root@PC2-emtandribergenov:/# ping 2000::1 -c 2
PING 2000::1(2000::1) 56 data bytes
64 bytes from 2000::1: icmp_seq=1 ttl=64 time=10.1 ms
64 bytes from 2000::1: icmp_seq=2 ttl=64 time=1.59 ms

--- 2000::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 1.593/5.851/10.109/4.258 ms
root@PC2-emtandribergenov:/# cat /etc/resolv.conf
search emtandribergenov.net.
nameserver 2000::1
root@PC2-emtandribergenov:/#
```

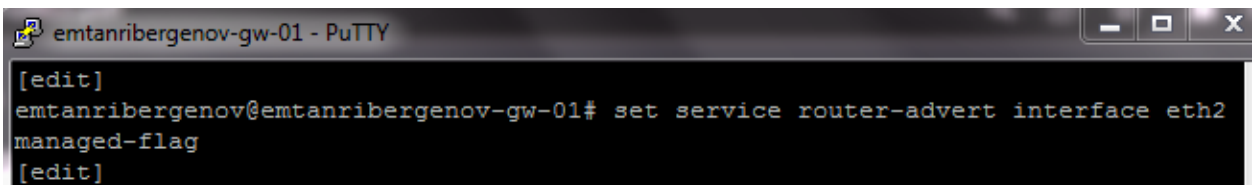
Рис. 18

Статистика DHCP-сервера и выданные адреса (рис. 19).

```
emtandribergenov@emtandribergenov-gw-01# run show dhcpv6 server leases
IPv6 address      State      Last communication      Lease expiration      Remaining
Type      Pool      IAID_DUID
-----
[edit]
```

Рис. 19

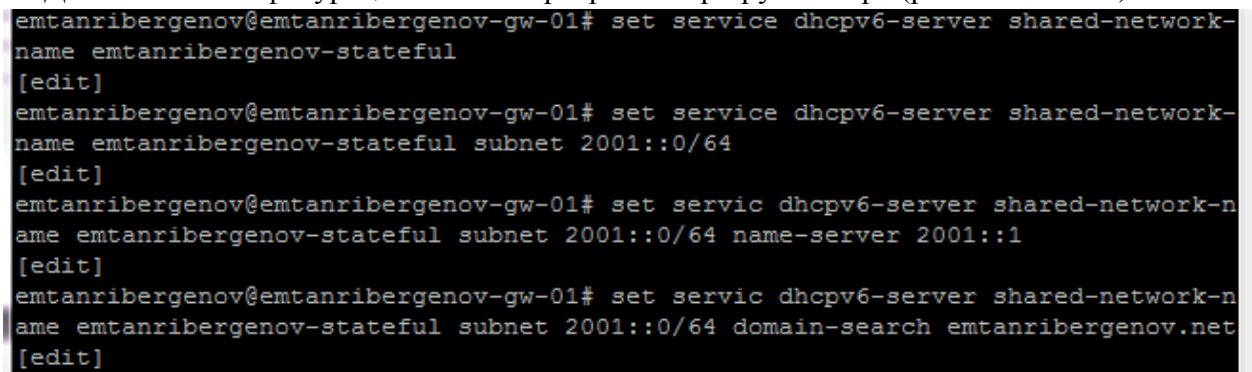
Настройка DHCPv6 с отслеживанием состояния (DHCPv6 Stateful configuration). На интерфейсе eth2 маршрутизатора настройка объявления о маршрутизаторах (Router Advertisements, RA) (рис. 20).



```
[edit]
emtanribergenov@emtanribergenov-gw-01# set service router-advert interface eth2
managed-flag
[edit]
```

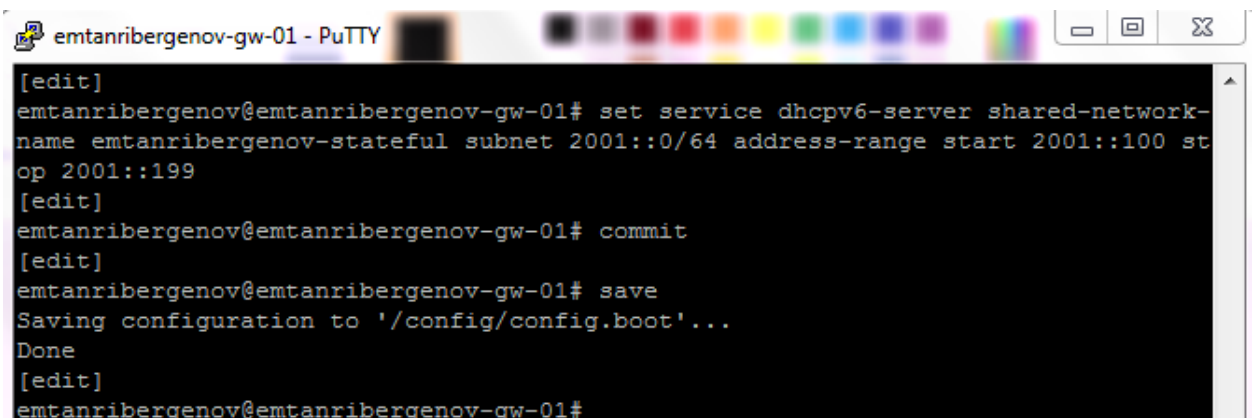
Рис. 20

– Добавление конфигурации DHCP-сервера на маршрутизаторе (рис. 21.1 – 21.2).



```
emtanribergenov@emtanribergenov-gw-01# set service dhcpv6-server shared-network-
name emtanribergenov-stateful
[edit]
emtanribergenov@emtanribergenov-gw-01# set service dhcpv6-server shared-network-
name emtanribergenov-stateful subnet 2001::0/64
[edit]
emtanribergenov@emtanribergenov-gw-01# set service dhcpv6-server shared-network-n
ame emtanribergenov-stateful subnet 2001::0/64 name-server 2001::1
[edit]
emtanribergenov@emtanribergenov-gw-01# set service dhcpv6-server shared-network-n
ame emtanribergenov-stateful subnet 2001::0/64 domain-search emtanribergenov.net
[edit]
```

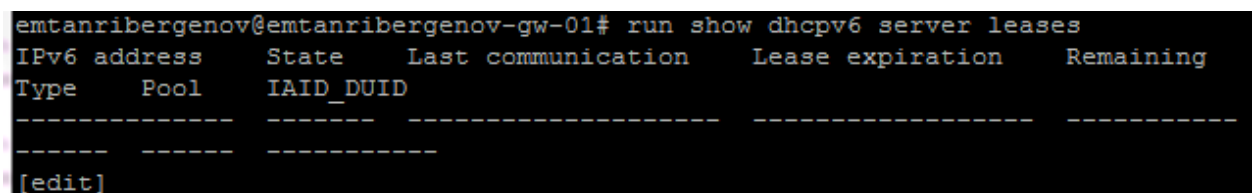
Рис. 21.1



```
[edit]
emtanribergenov@emtanribergenov-gw-01# set service dhcpv6-server shared-network-
name emtanribergenov-stateful subnet 2001::0/64 address-range start 2001::100 st
op 2001::199
[edit]
emtanribergenov@emtanribergenov-gw-01# commit
[edit]
emtanribergenov@emtanribergenov-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
emtanribergenov@emtanribergenov-gw-01#
```

Рис. 21.2

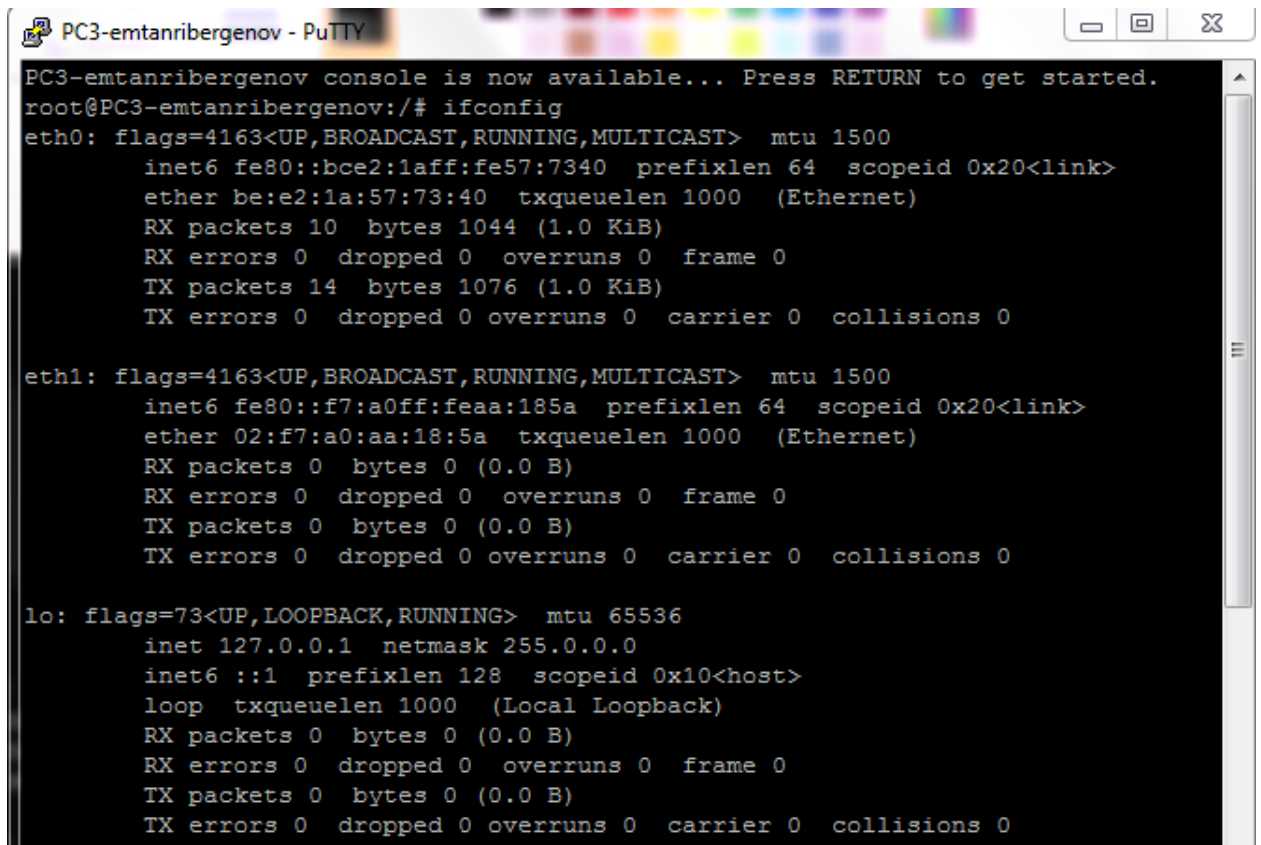
Статистика DHCP-сервера и выданные адреса (рис. 22).



```
emtanribergenov@emtanribergenov-gw-01# run show dhcpv6 server leases
IPv6 address      State      Last communication      Lease expiration      Remaining
Type      Pool      IAID_DUID
-----
[edit]
```

Рис. 22

Подключение к узлу PC3 и проверка настройки сети (рис. 23).



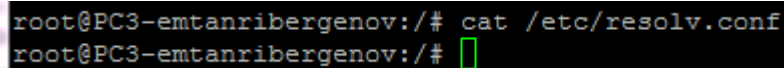
```
PC3-emtandribergenov console is now available... Press RETURN to get started.
root@PC3-emtandribergenov:/# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::bce2:1aff:fe57:7340 prefixlen 64 scopeid 0x20<link>
    ether be:e2:1a:57:73:40 txqueuelen 1000 (Ethernet)
    RX packets 10 bytes 1044 (1.0 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 14 bytes 1076 (1.0 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::f7:a0ff:feaa:185a prefixlen 64 scopeid 0x20<link>
    ether 02:f7:a0:aa:18:5a txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Рис. 23

На узле PC3 проверка настройки DNS (рис. 24).



```
root@PC3-emtandribergenov:/# cat /etc/resolv.conf
root@PC3-emtandribergenov:/#
```

Рис. 24

На узле PC3 получение адреса по DHCPv6 (рис. 25.1 – 25.2).

```

root@PC3-emtanribergenov:/# dhclient -6 -v eth0
Internet Systems Consortium DHCP Client 4.3.5
Copyright 2004-2016 Internet Systems Consortium.
All rights reserved.
For info, please visit https://www.isc.org/software/dhcp/

Listening on Socket/eth0
Sending on Socket/eth0
Created duid "\000\001\000\001*\350K\010\276\342\032Ws@".
PRC: Soliciting for leases (INIT).
XMT: Forming Solicit, 0 ms elapsed.
XMT: X-- IA_NA 1a:57:73:40
XMT: | X-- Request renew in +3600
XMT: | X-- Request rebind in +5400
XMT: Solicit on eth0, interval 1060ms.
RCV: Advertise message on eth0 from fe80::eb3:7bff:fe7d:2.
RCV: X-- IA_NA 1a:57:73:40
RCV: | X-- starts 1666551433
RCV: | X-- t1 - renew +0
RCV: | X-- t2 - rebind +0
RCV: | X-- [Options]
RCV: | | X-- IAADDR 2001::199
RCV: | | | X-- Preferred lifetime 27000.
RCV: | | | X-- Max lifetime 43200.
RCV: X-- Server ID: 00:01:00:01:2a:e8:3b:b2:0c:b3:7b:7d:00:01
RCV: Advertisement recorded.
PRC: Selecting best advertised lease.
PRC: Considering best lease.
PRC: X-- Initial candidate 00:01:00:01:2a:e8:3b:b2:0c:b3:7b:7d:00:01 (s: 10105,
p: 0).
XMT: Forming Request, 0 ms elapsed.
XMT: X-- IA_NA 1a:57:73:40
XMT: | X-- Requested renew +3600
XMT: | X-- Requested rebind +5400
XMT: | | X-- IAADDR 2001::199

```

Puc. 25.1

```

XMT: | X-- Requested rebind +5400
XMT: | | X-- IAADDR 2001::199
XMT: | | | X-- Preferred lifetime +7200
XMT: | | | X-- Max lifetime +7500
XMT: V IA_NA appended.
XMT: Request on eth0, interval 1070ms.
RCV: Reply message on eth0 from fe80::eb3:7bff:fe7d:2.
RCV: X-- IA_NA 1a:57:73:40
RCV: | X-- starts 1666551434
RCV: | X-- t1 - renew +0
RCV: | X-- t2 - rebind +0
RCV: | X-- [Options]
RCV: | | X-- IAADDR 2001::199
RCV: | | | X-- Preferred lifetime 7200.
RCV: | | | X-- Max lifetime 7500.
RCV: X-- Server ID: 00:01:00:01:2a:e8:3b:b2:0c:b3:7b:7d:00:01
PRC: Bound to lease 00:01:00:01:2a:e8:3b:b2:0c:b3:7b:7d:00:01.
root@PC3-emtanribergenov:/# █

```

Puc. 25.2

Вновь на узле PC3 проверка настройки сети, пропингование маршрутизатора, проверка настройки DNS (рис. 26.1 – 26.2).

```
root@PC3-emtanneribergenov:/# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::bce2:1aff:fe57:7340 prefixlen 64 scopeid 0x20<link>
    inet6 2001::199 prefixlen 128 scopeid 0x0<global>
    ether be:e2:1a:57:73:40 txqueuelen 1000 (Ethernet)
    RX packets 21 bytes 2192 (2.1 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 21 bytes 1828 (1.7 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::f7:a0ff:feaa:185a prefixlen 64 scopeid 0x20<link>
    ether 02:f7:a0:aa:18:5a txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@PC3-emtanneribergenov:/#
```

Рис. 26.1

```
root@PC3-emtanneribergenov:/# route -r -A inet6
route: invalid option -- 'r'
Usage: inet6_route [-vF] del Target
       inet6_route [-vF] add Target [gw Gw] [metric M] [[dev] If]
       inet6_route [-FC] flush      NOT supported
root@PC3-emtanneribergenov:/# ping 2001::1 -c 2
PING 2001::1(2001::1) 56 data bytes
64 bytes from 2001::1: icmp_seq=1 ttl=64 time=11.1 ms
64 bytes from 2001::1: icmp_seq=2 ttl=64 time=1.40 ms

--- 2001::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1000ms
rtt min/avg/max/mdev = 1.405/6.284/11.163/4.879 ms
root@PC3-emtanneribergenov:/#
root@PC3-emtanneribergenov:/# cat /etc/resolv.conf
search emtanneribergenov.net.
nameserver 2001::1
root@PC3-emtanneribergenov:/#
```

Рис. 26.2

Статистика DHCP-сервера и выданные адреса (рис. 27).

```
emtanribergenov@emtanribergenov-gw-01# run show dhcpv6 server leases
IPv6 address      State      Last communication      Lease expiration      Remaining
Type              Pool                               IAID_DUID
-----
-----
-----
2001::199         active    2022/10/23 18:57:14      2022/10/23 21:02:14    1:58:53
non-temporary     emtanribergenov-stateful  40:73:57:1a:00:01:00:01:2a:e8:4b:08:be
:e2:1a:57:73:40
[edit]
emtanribergenov@emtanribergenov-gw-01#
```

Рис. 27

Просмотр захваченного трафика в Wireshark (рис. 28.1 – 28.2).

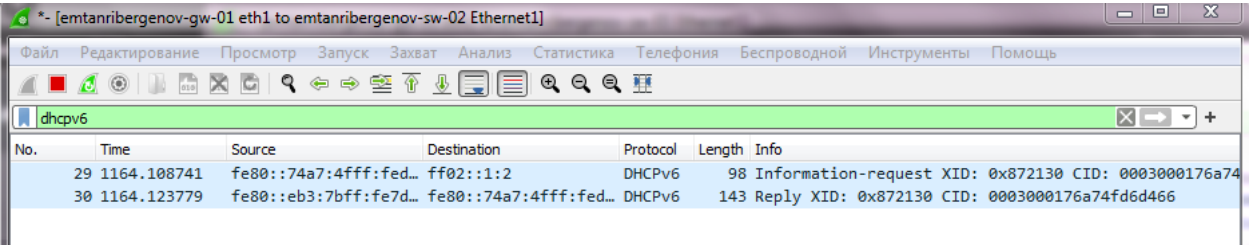


Рис. 28.1

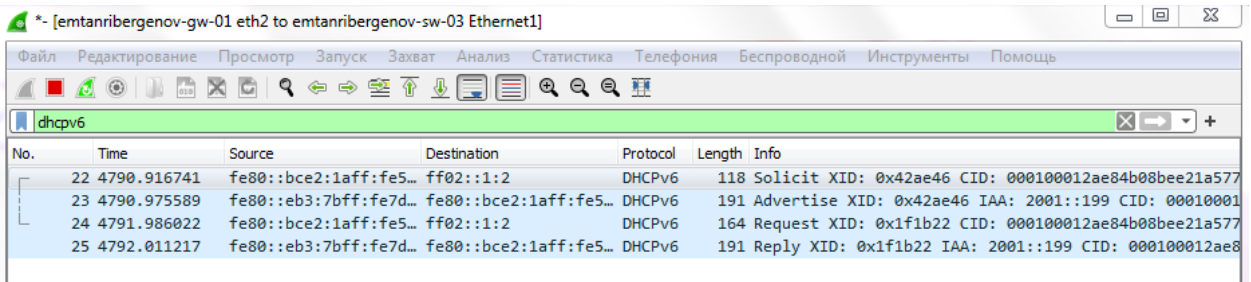


Рис. 28.2