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Факультет физико-математических и естественных наук

Кафедра прикладной информатики и теории вероятностей

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)

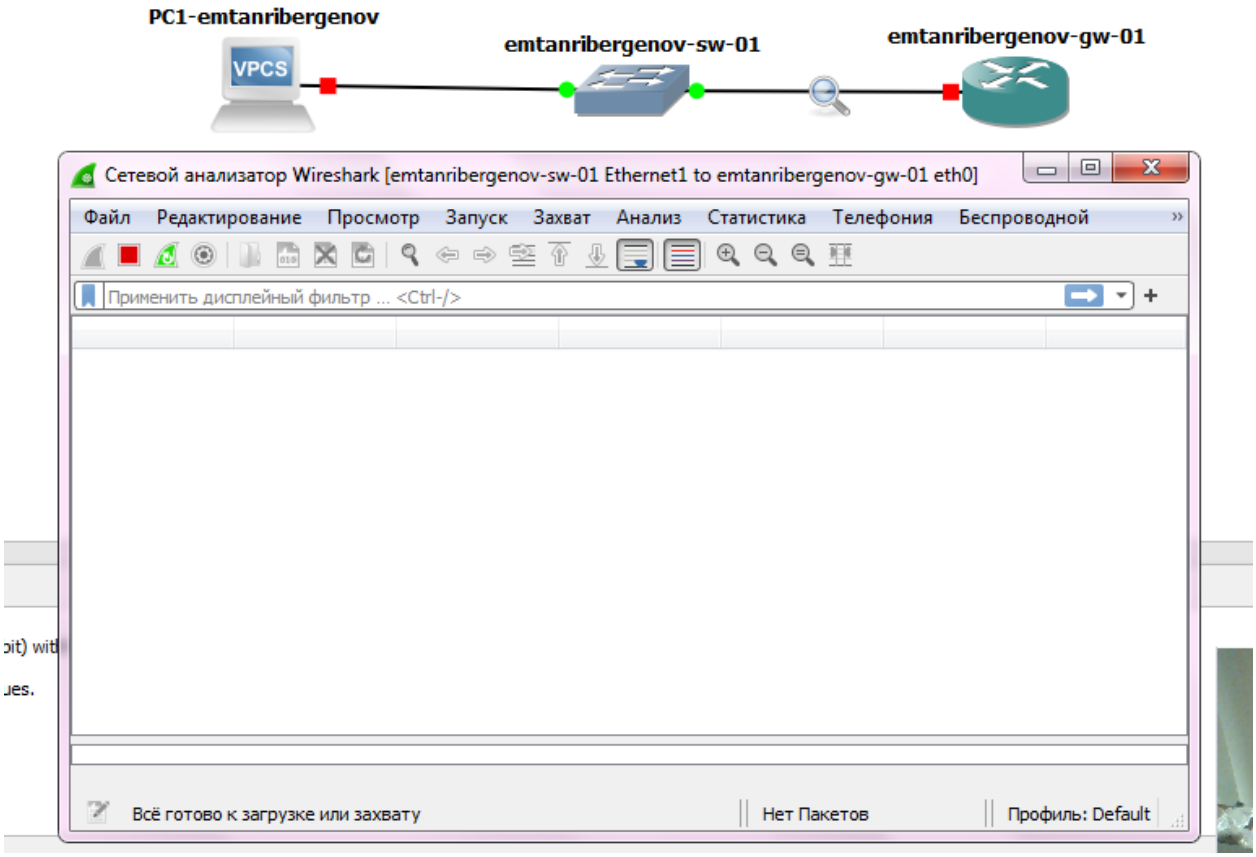

Рис. 1.

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

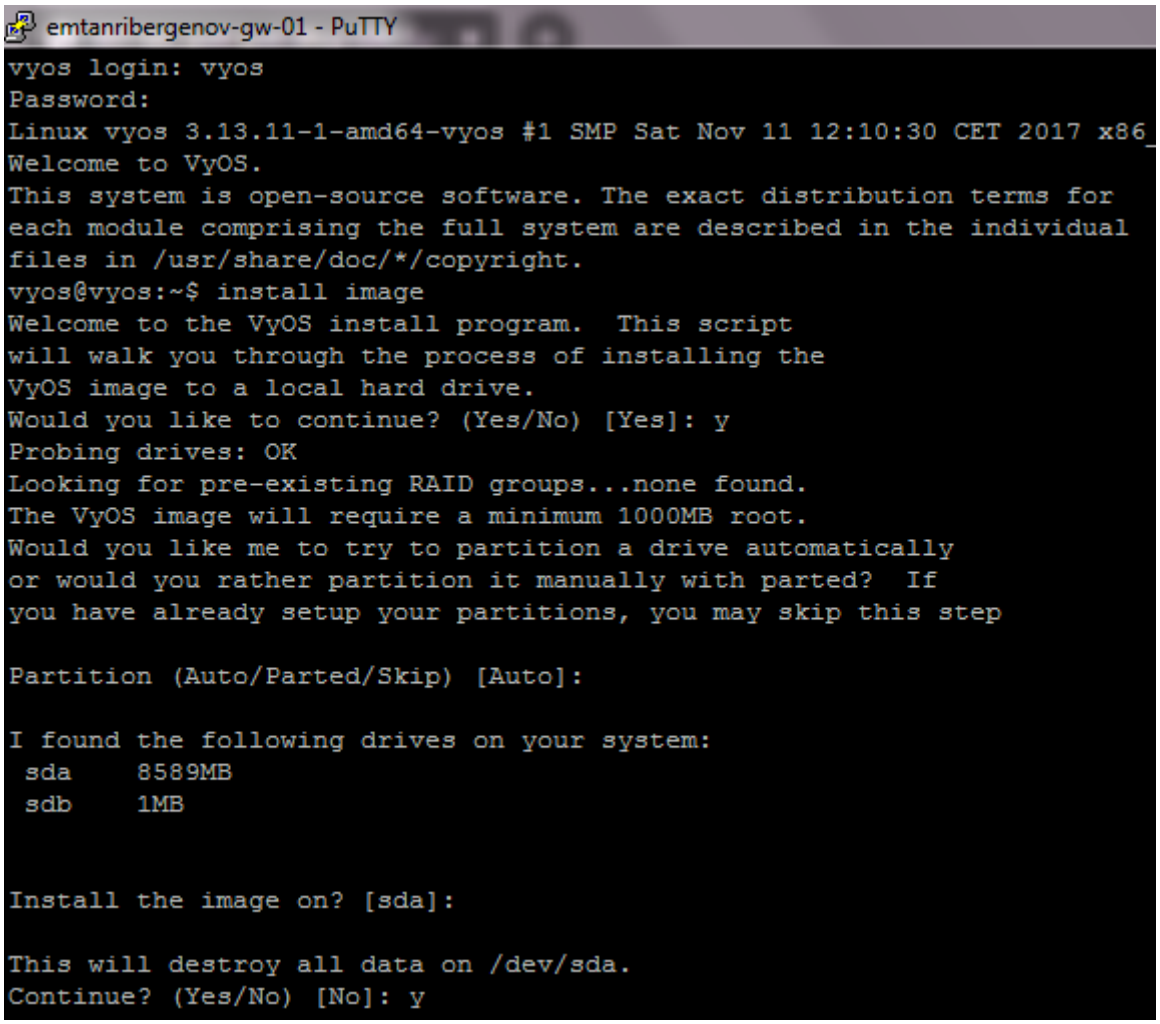

Рис. 2.1

```
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:~$
```

Рис. 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
```

Рис. 2.3

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

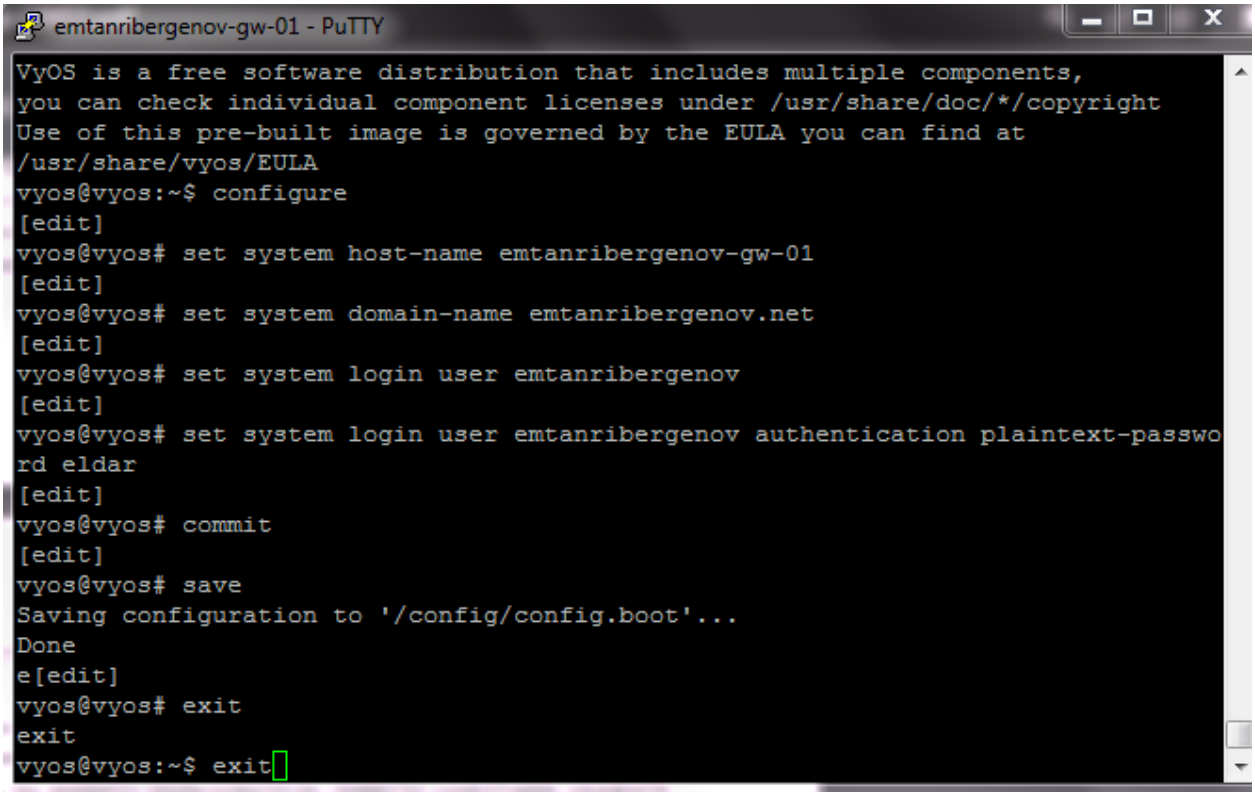

Рис. 3.1

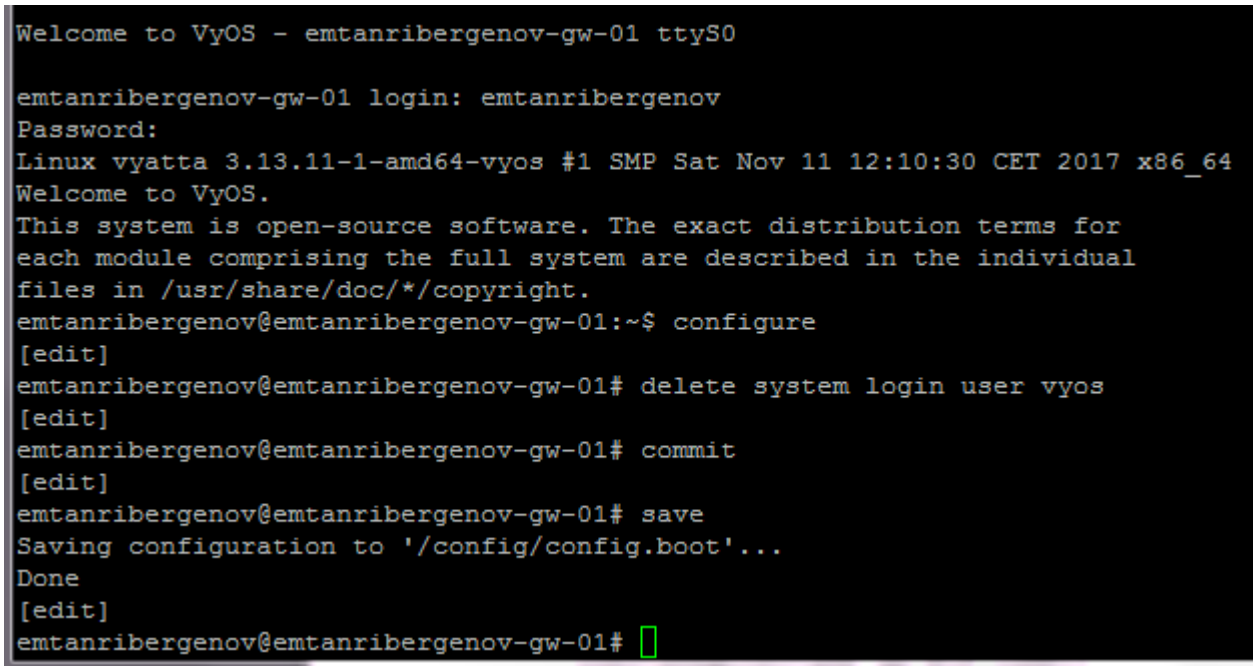

Рис. 3.2

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

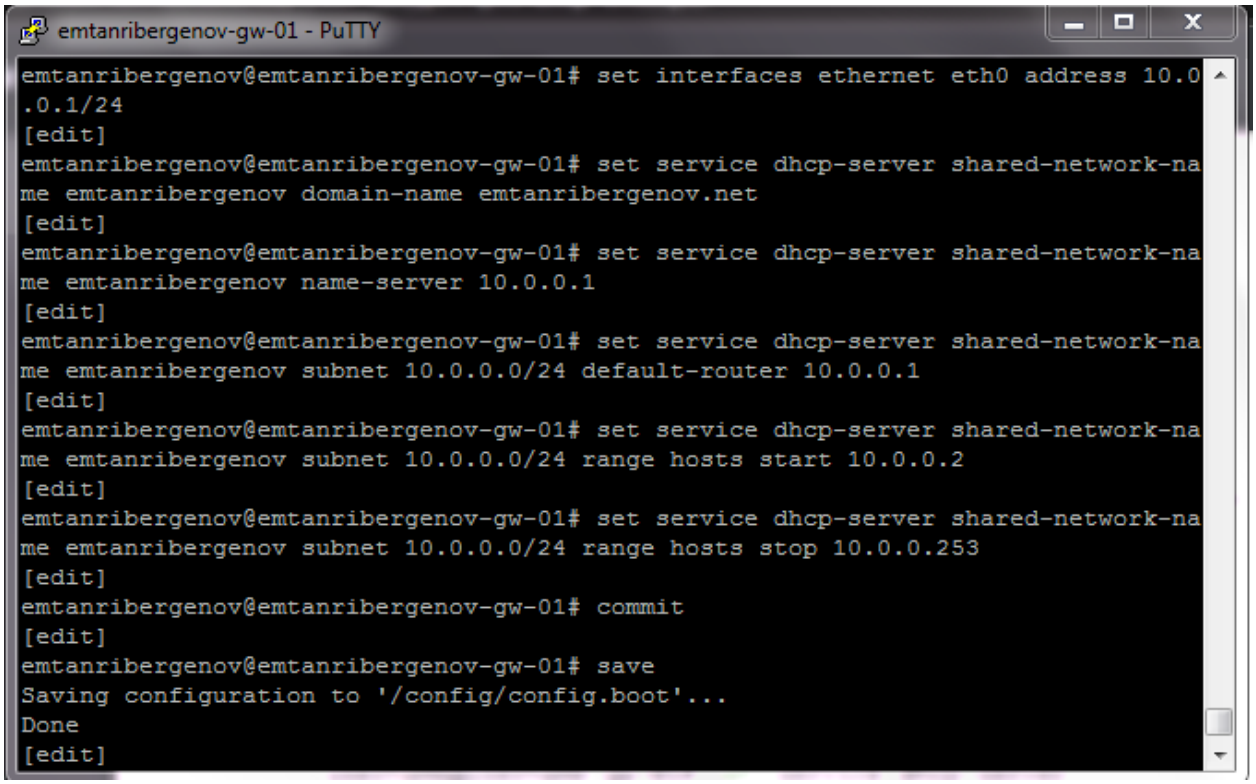

Рис. 4.

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

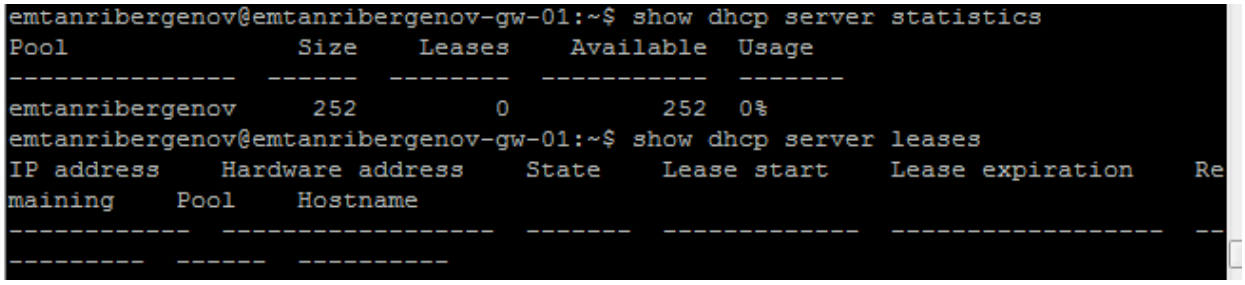

Рис. 5.

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

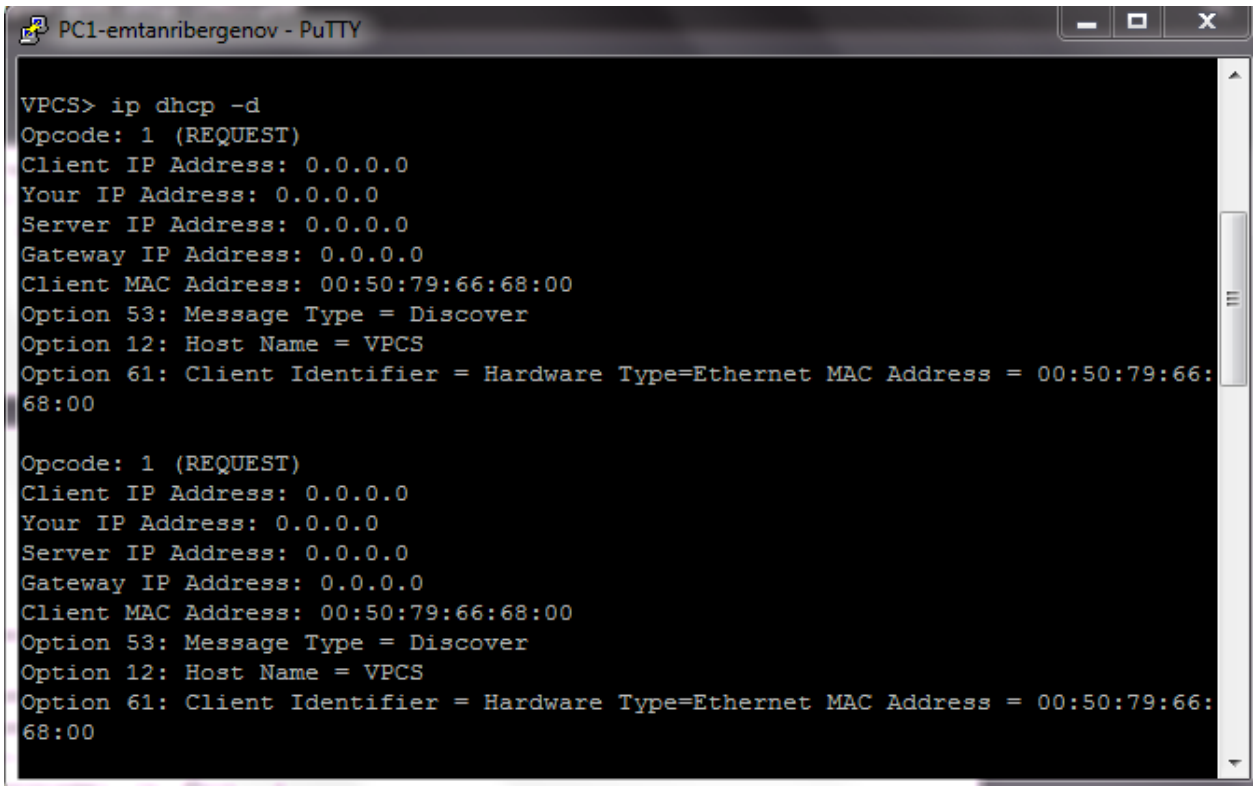
PC1-emtanribergenov - PuTTY
VPCS> ip dhcp -d
Opcode: 1 (REQUEST)
Client IP Address: 0.0.0.0
Your IP Address: 0.0.0.0
Server IP Address: 0.0.0.0
Gateway IP Address: 0.0.0.0
Client MAC Address: 00:50:79:66:68:00
Option 53: Message Type = Discover
Option 12: Host Name = VPCS
Option 61: Client Identifier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

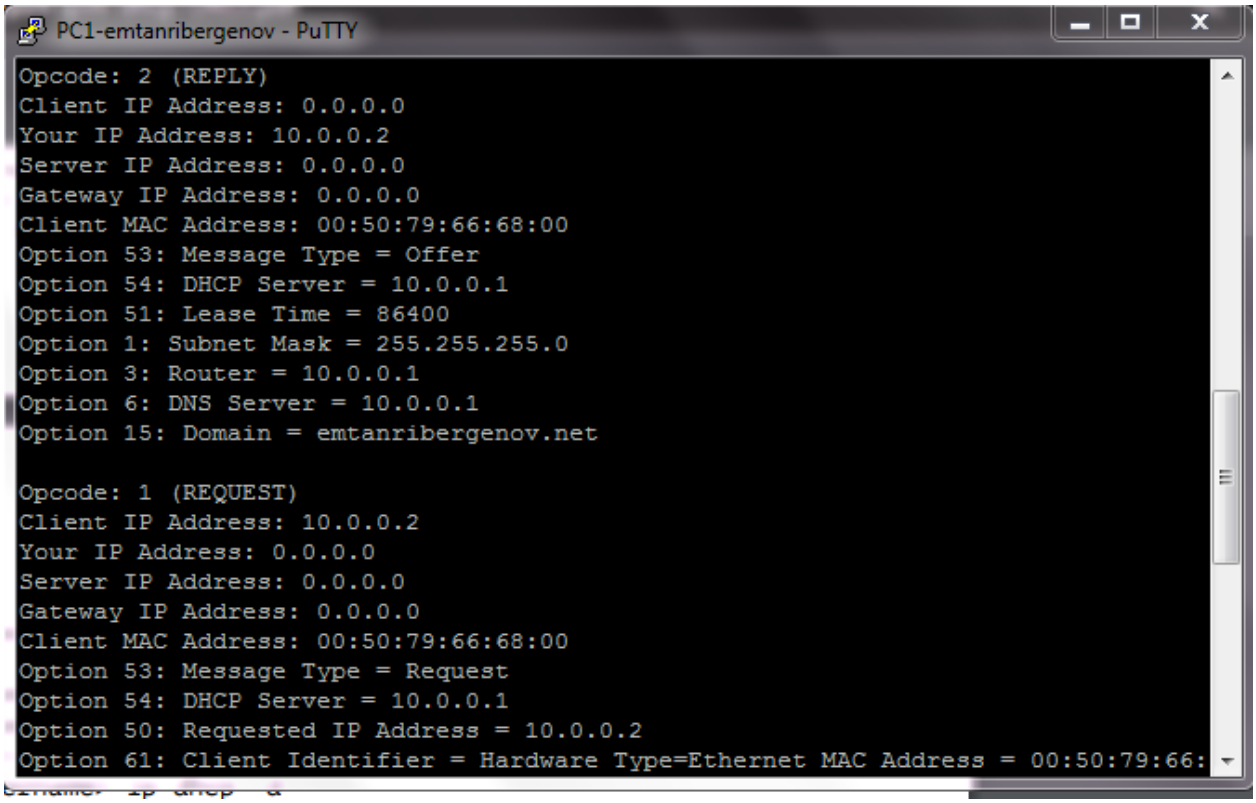
PC1-emtanribergenov - PuTTY
Opcode: 2 (REPLY)
Client IP Address: 0.0.0.0
Your IP Address: 10.0.0.2
Server IP Address: 0.0.0.0
Gateway IP Address: 0.0.0.0
Client MAC Address: 00:50:79:66:68:00
Option 53: Message Type = Offer
Option 54: DHCP Server = 10.0.0.1
Option 51: Lease Time = 86400
Option 1: Subnet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

Рис. 6.2.

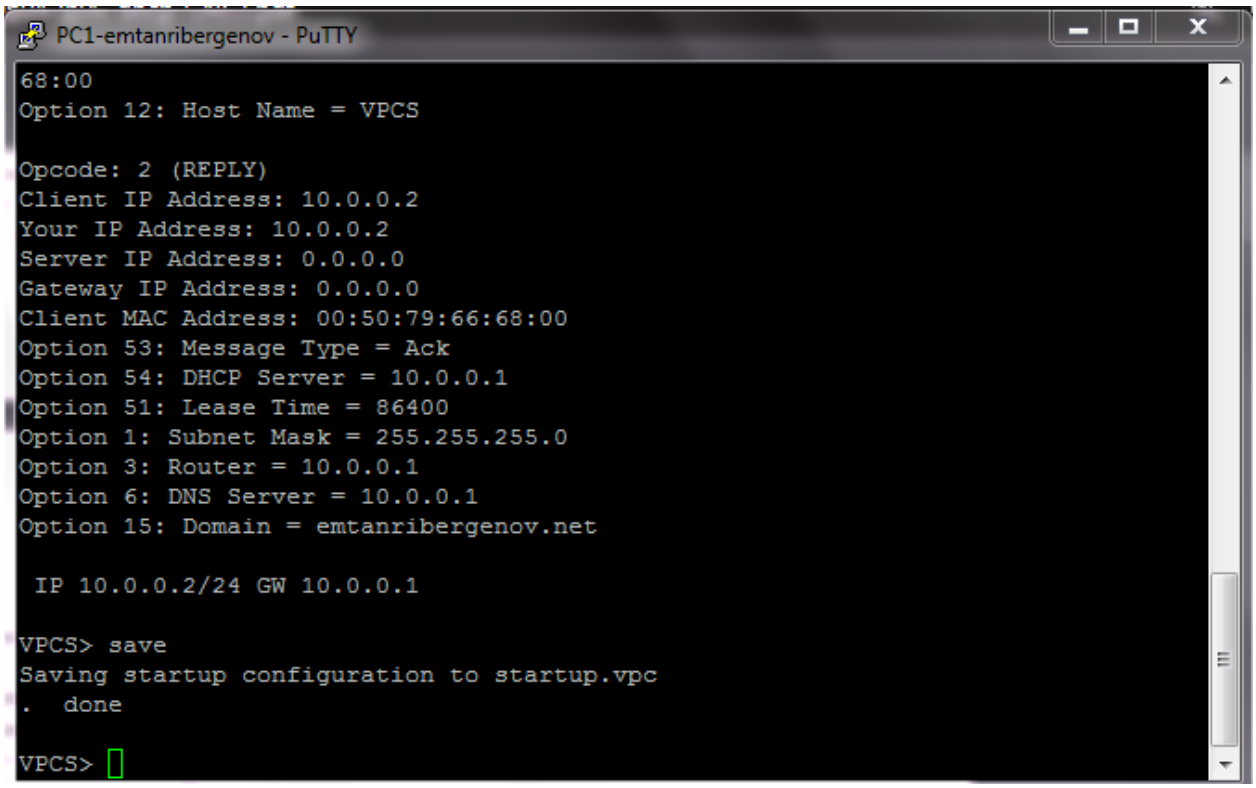

Рис. 6.3.

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

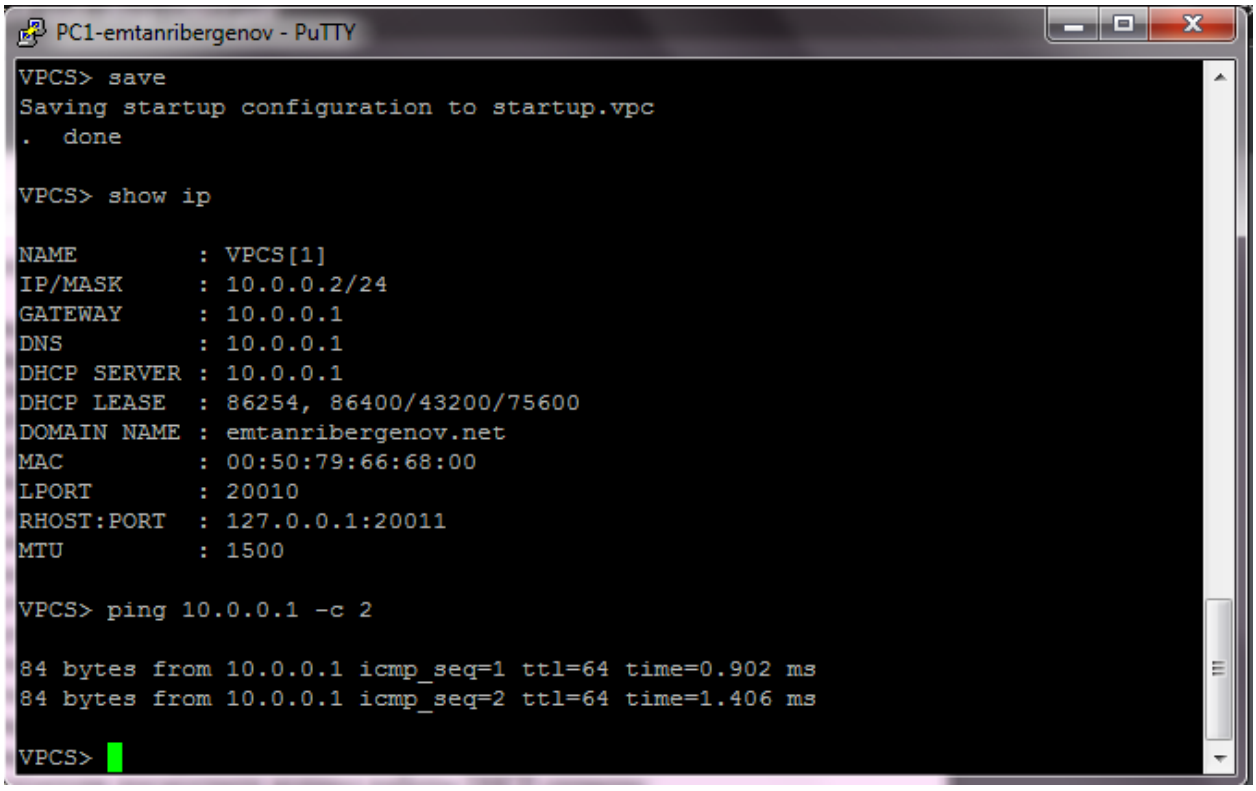

Рис. 7.

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

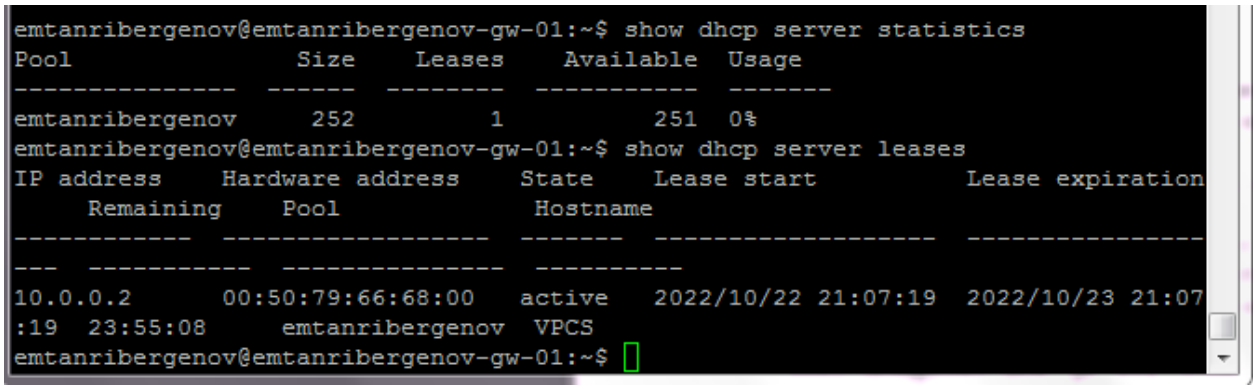

Рис. 8.

Журнал работы DHCP-сервера (рис. 9).

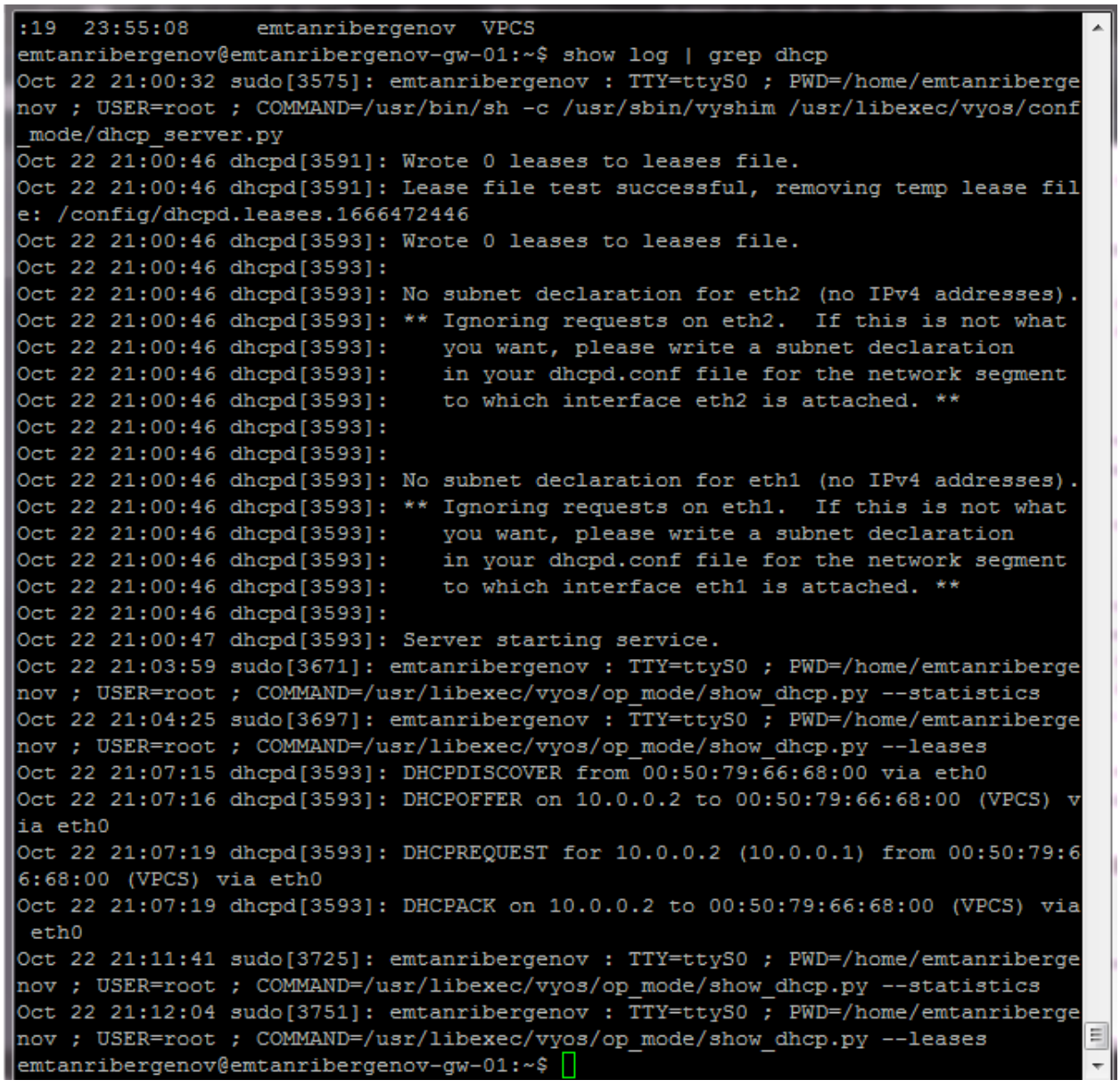

Рис. 9.

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).

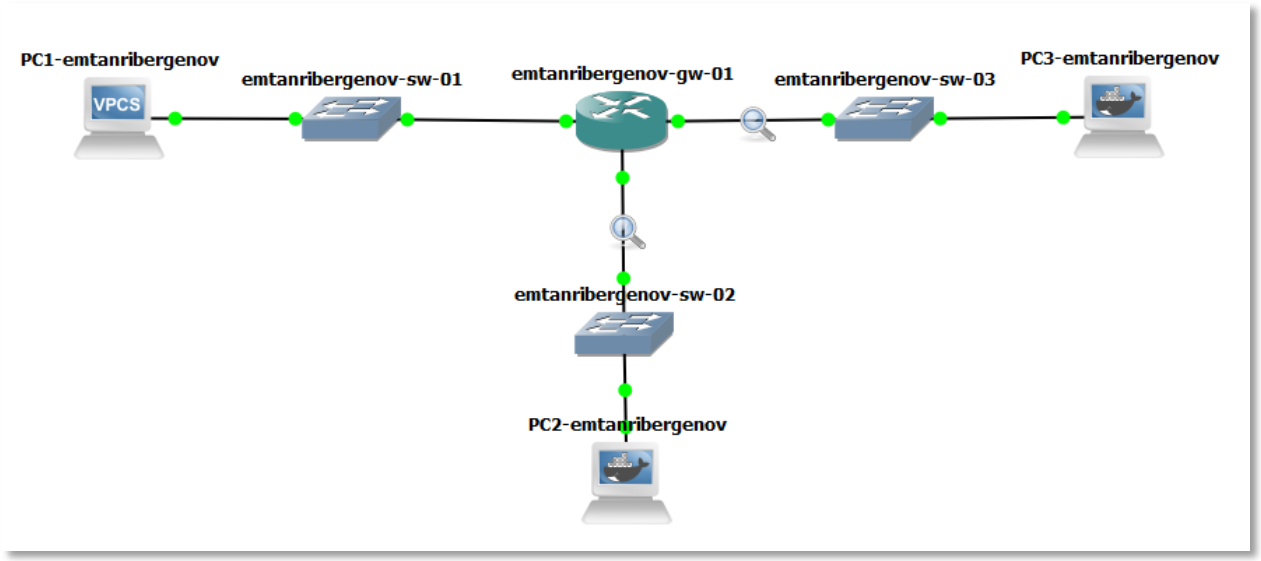

Рис. 10.

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

```
emtanribergenov@emtanribergenov-gw-01:~$ configure
[edit]
emtanribergenov@emtanribergenov-gw-01# set interfaces ethernet eth1 address 2000
::1/64
[edit]
emtanribergenov@emtanribergenov-gw-01# set interfaces ethernet eth2 address 2001
::1/64
[edit]
emtanribergenov@emtanribergenov-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).

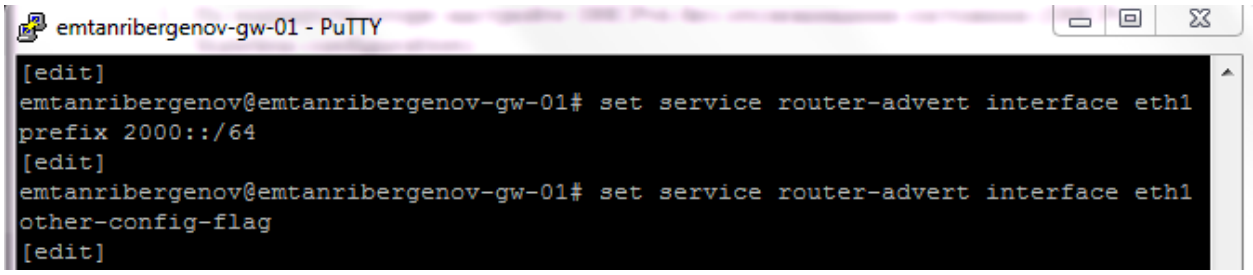

Рис. 12.

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
```

Рис. 13.4

emtanribergenov-gw-01 - PuTTY

```
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
```

Рис. 13.5

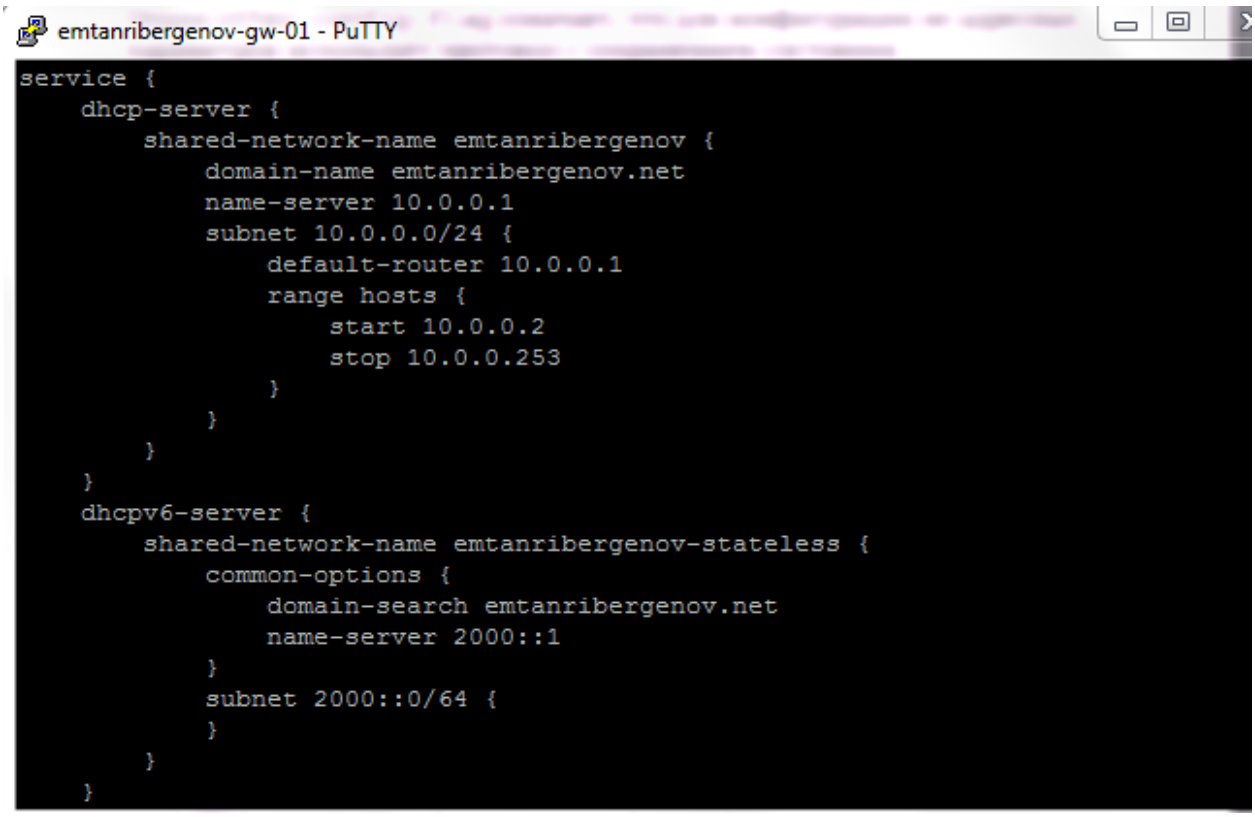

Рис. 13.6

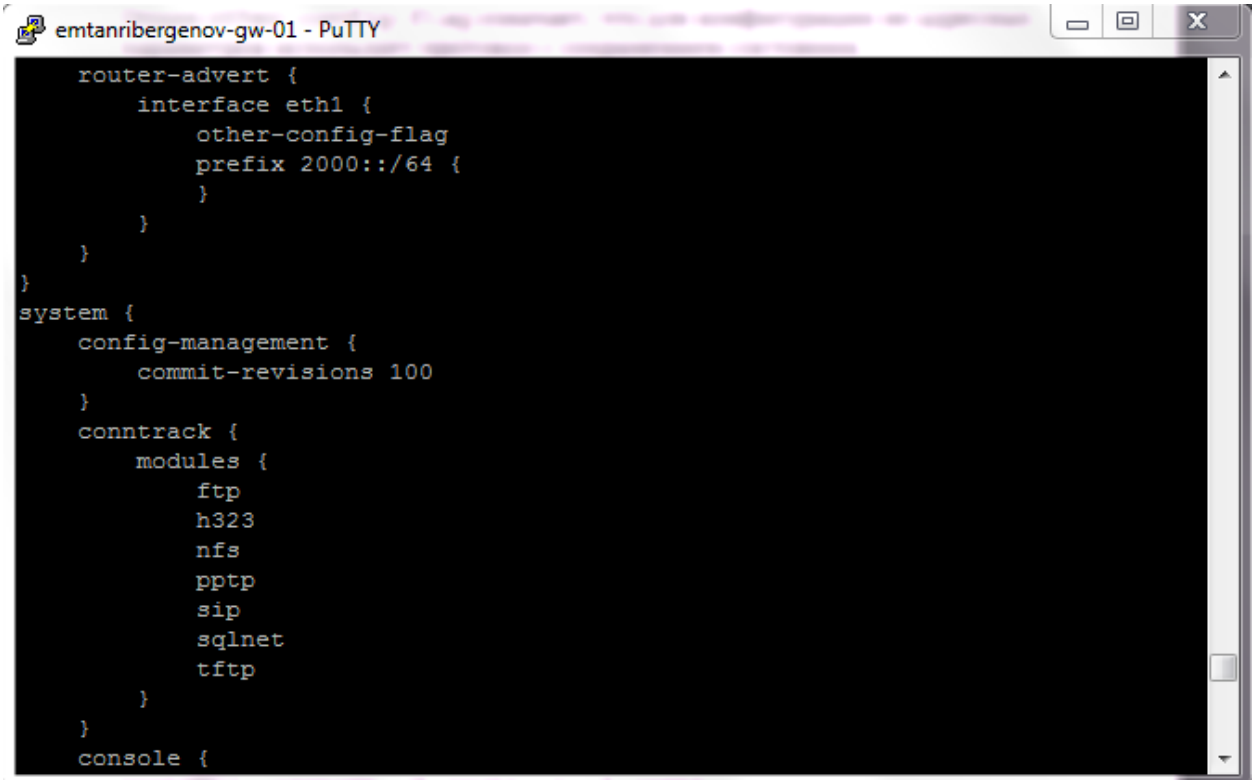

Рис. 13.7

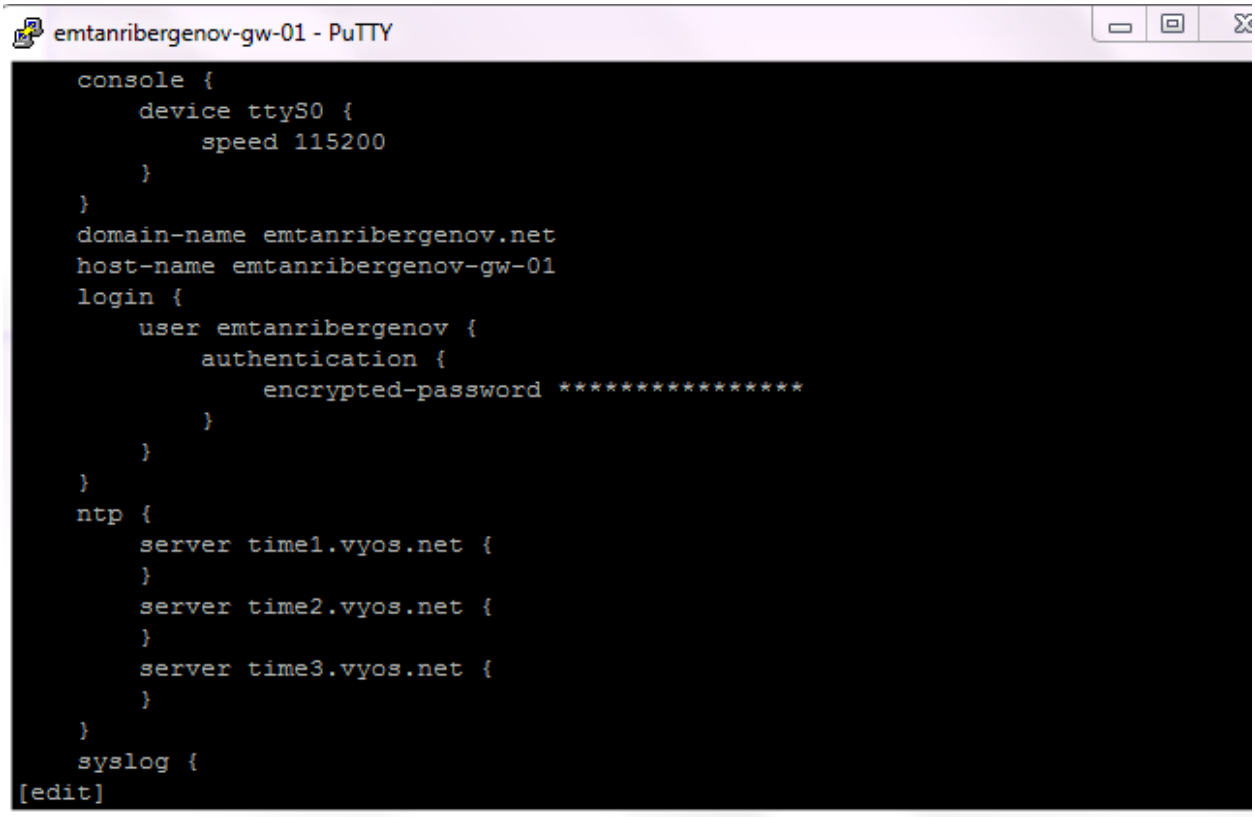

Рис. 13.8

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

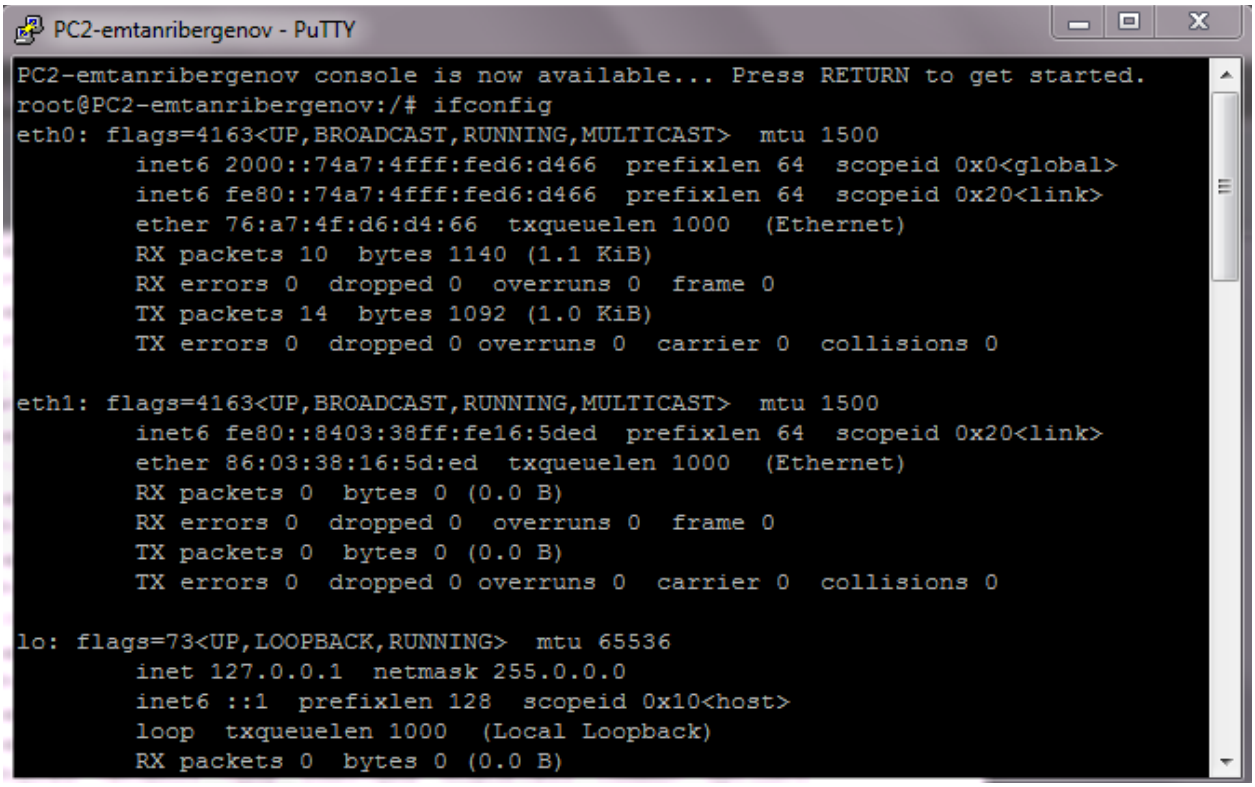

Рис. 14.1

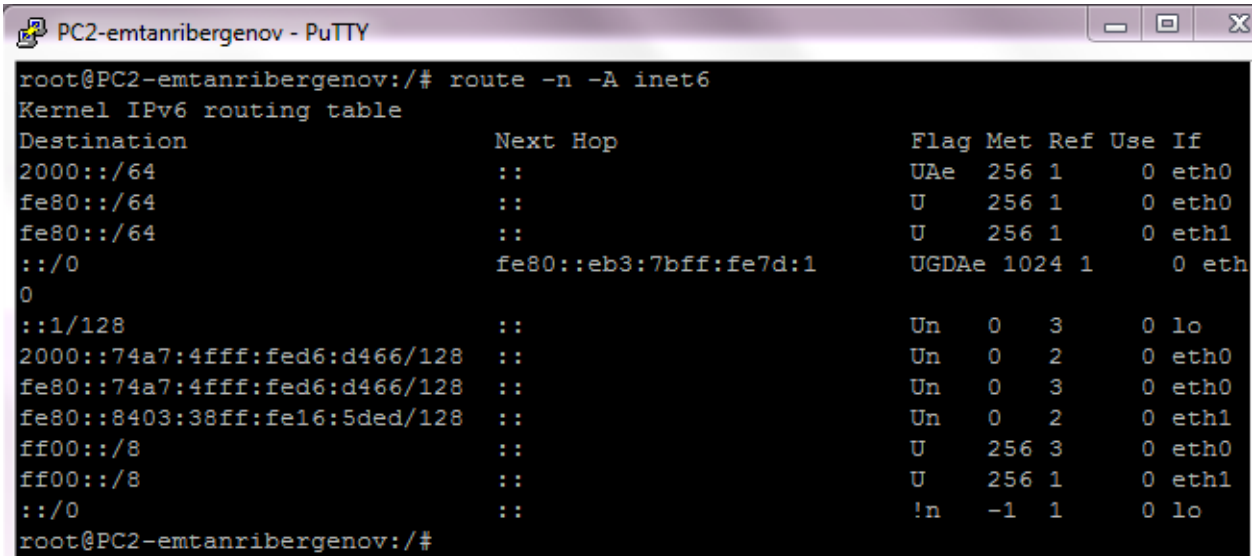

Рис. 14.2

На узле PC2 пингование маршрутизатора (рис. 15).

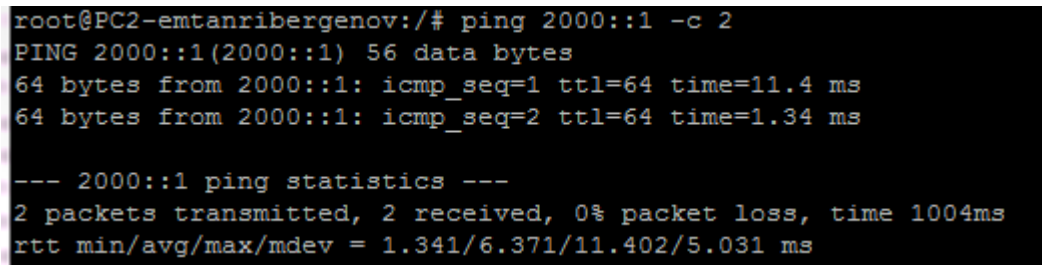

Рис. 15

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

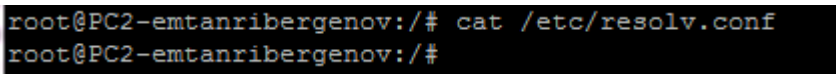

Рис. 16

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

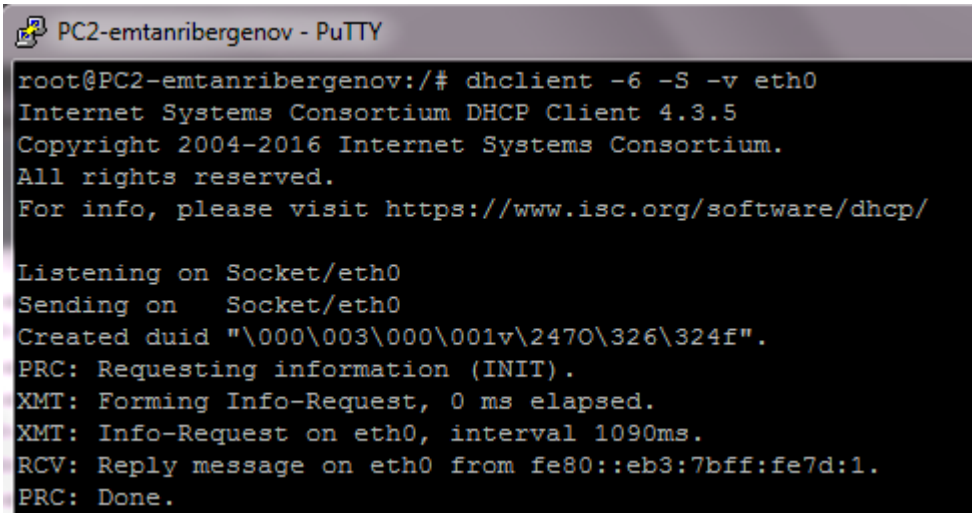

Рис. 17

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

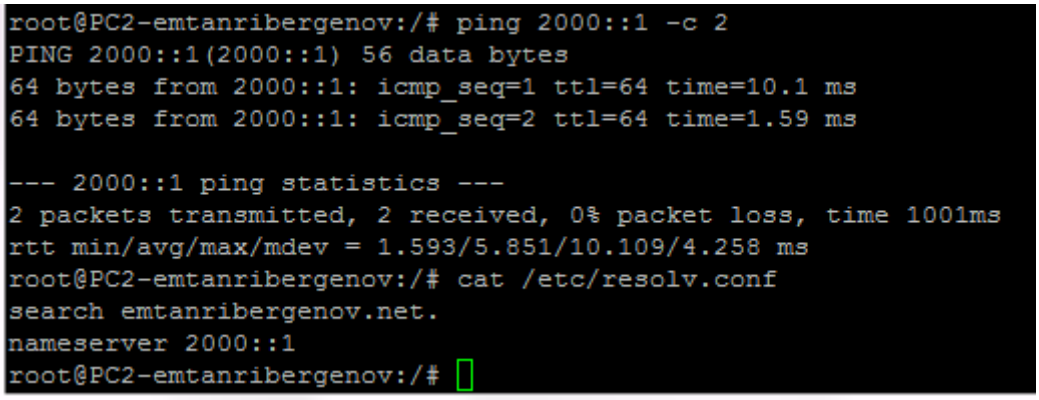

Рис. 18

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

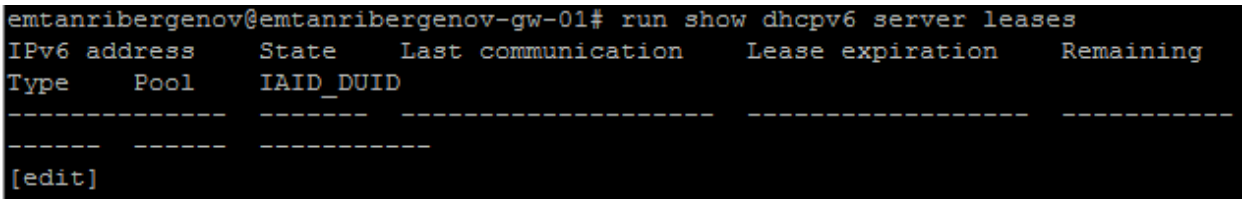

Рис. 19

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

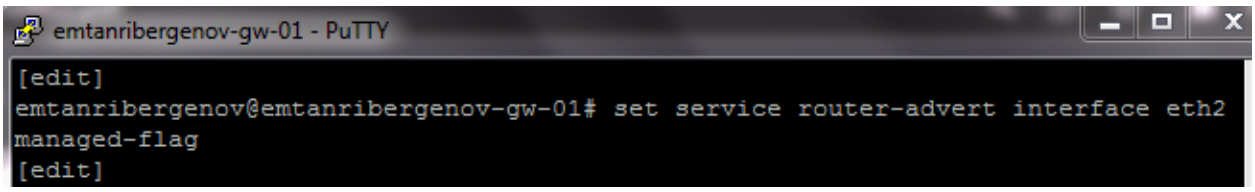

Рис. 20

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

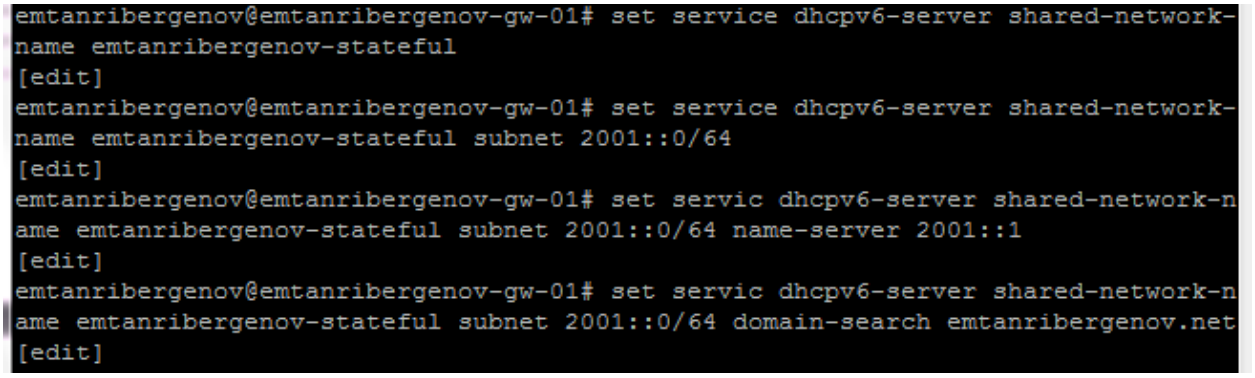

Рис. 21.1

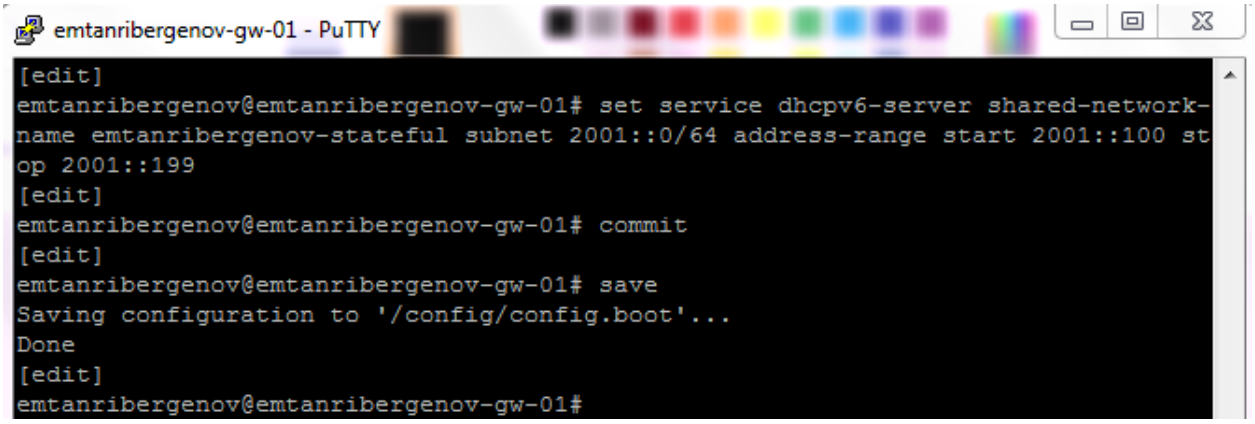

Рис. 21.2

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

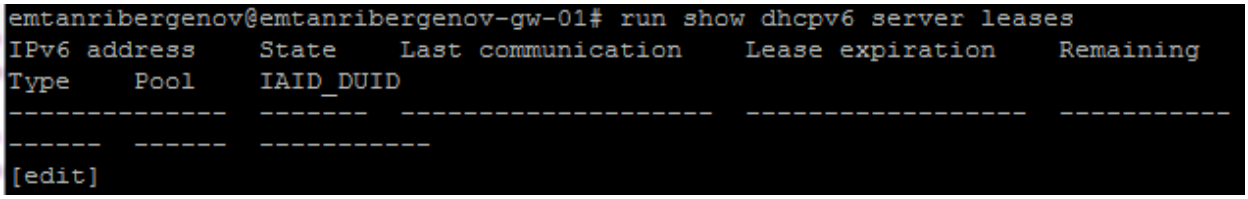

Рис. 22

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

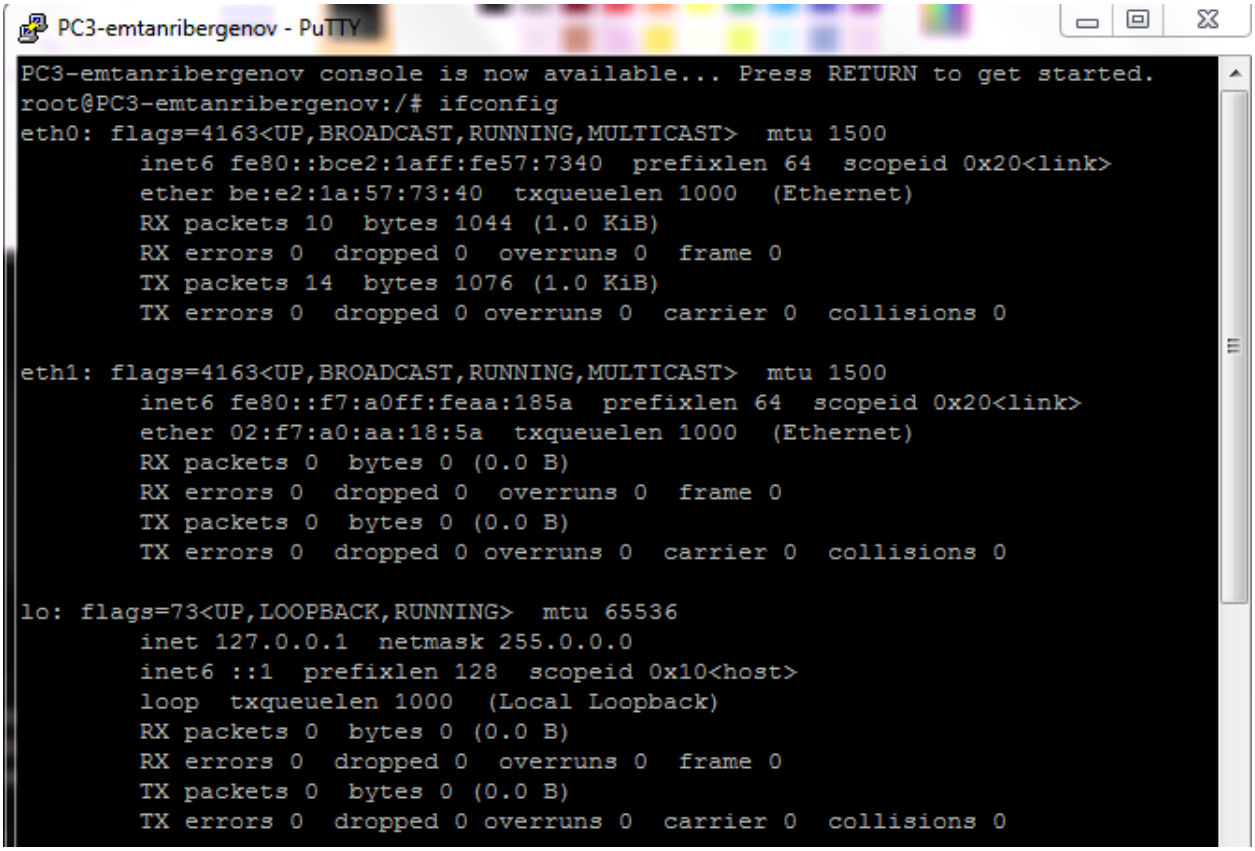

Рис. 23

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

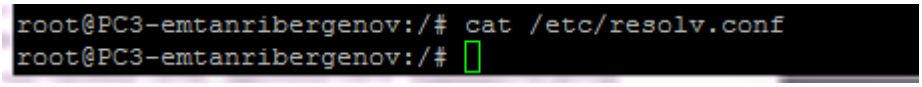

Рис. 24

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

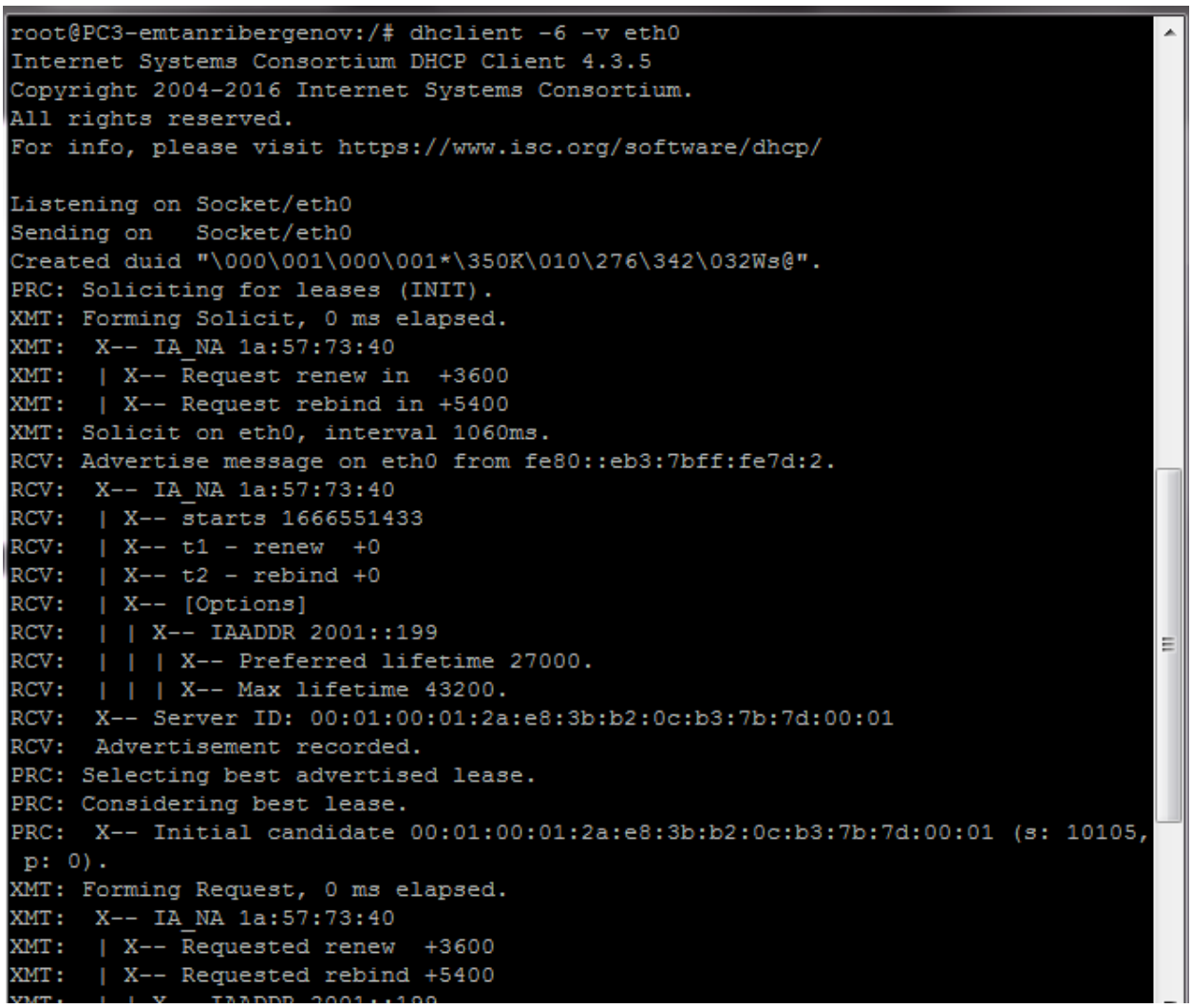

Рис. 25.1

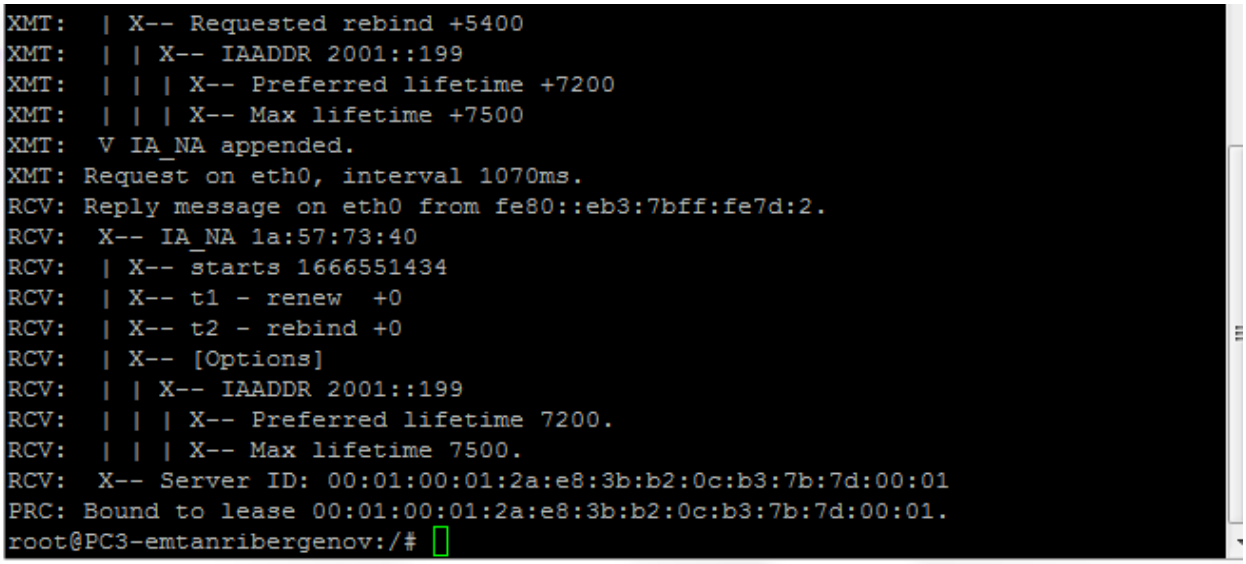

Рис. 25.2

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

```
root@PC3-emtanribergenov:/# 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-emtanribergenov:/#
```

Рис. 26.1

```
root@PC3-emtanribergenov:/# 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-emtanribergenov:/# 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-emtanribergenov:/#
root@PC3-emtanribergenov:/# cat /etc/resolv.conf
search emtanribergenov.net.
nameserver 2001::1
root@PC3-emtanribergenov:/#
```

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).

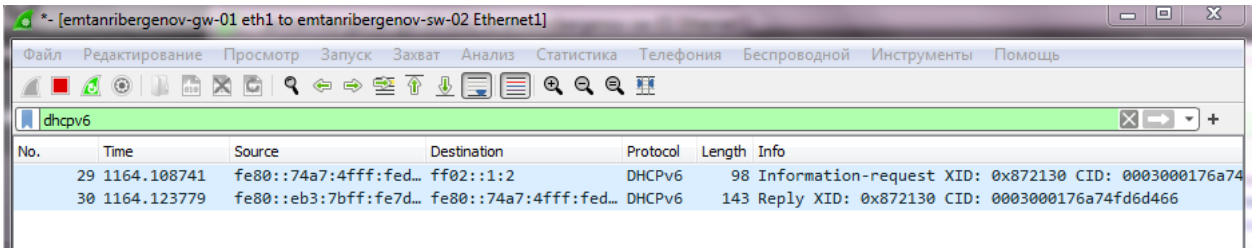

Рис. 28.1

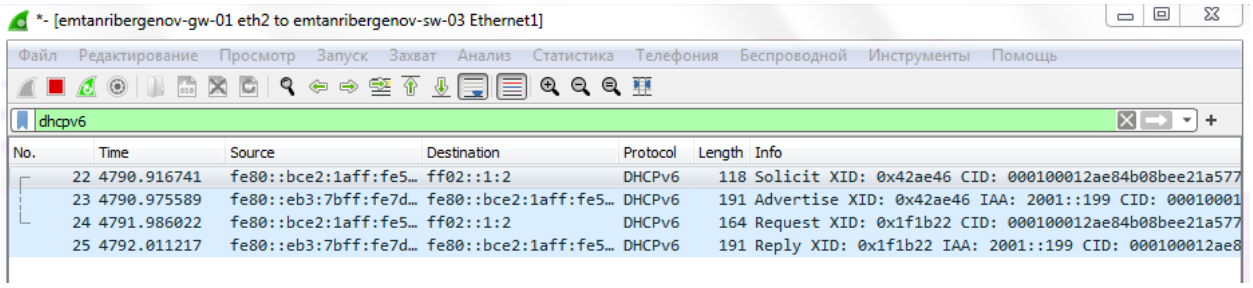

Рис. 28.2