

# РОССИЙСКИЙ УНИВЕРСИТЕТ ДРУЖБЫ НАРОДОВ

Факультет физико-математических и естественных наук

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## ОТЧЕТ ПО ЛАБОРАТОРНОЙ РАБОТЕ № 7

*дисциплина:* Сетевые технологии

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МОСКВА

2022 г.

### **Постановка задачи**

1. Настройка DHCP в случае IPv4.
2. Настройка DHCP в случае IPv6.

### 3. Выполнение работы

1.

- 1.1. Запустите GNS3 VM и GNS3. Создайте новый проект.
- 1.2. В рабочем пространстве разместите и соедините устройства в соответствии с топологией. Используйте маршрутизатор VyOS и хост (клиент) VPCS.
- 1.3. Измените отображаемые названия устройств.
- 1.4. Включите захват трафика на соединении между коммутатором sw-01 и маршрутизатором gw-01.

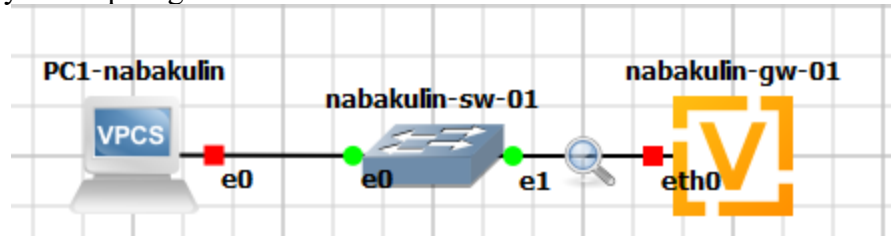


Рисунок 1

1.5. Настройте образ VyOS.

```
Welcome to VyOS - vyos ttyS0

vyos login: vyos
Password:
Linux vyos 5.4.156-amd64-vyos #1 SMP Thu Oct 28 18:19:14 UTC 2021 x86_64
Welcome to VyOS!

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

Visit https://support.vyos.io to create a support ticket.

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
Use of this pre-built image is governed by the EULA you can find at
/usr/share/vyos/EULA
vyos@vyos:~$ install image
```

Рисунок 2

```
Welcome to VyOS!

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

Visit https://support.vyos.io to create a support ticket.

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
Use of this pre-built image is governed by the EULA you can find at
/usr/share/vyos/EULA
nabakulin@nabakulin-gw-01:~$ configure
[edit]
nabakulin@nabakulin-gw-01# delete system login user vyos
[edit]
nabakulin@nabakulin-gw-01# commit
[edit]
nabakulin@nabakulin-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
nabakulin@nabakulin-gw-01#
```

Рисунок 3

- 1.6. На маршрутизаторе под созданным пользователем перейдите в режим конфигурирования и настройте адресацию IPv4.
- 1.7. Добавьте конфигурацию DHCP-сервера на маршрутизаторе.
- 1.8. Для просмотра статистики DHCP-сервера и выданных адресов используйте команды `show dhcp server statistics` и `show dhcp server leases`.

```
nabakulin@nabakulin-gw-01# set interfaces ethernet eth0 address 10.0.0.1/24
[edit]
nabakulin@nabakulin-gw-01# set service dhcp-server shared-network-name nabakulin
domain-name nabakulin.net
[edit]
nabakulin@nabakulin-gw-01# set service dhcp-server shared-network-name nabakulin
name-server 10.0.0.1
[edit]
nabakulin@nabakulin-gw-01# set service dhcp-server shared-network-name nabakulin
subnet 10.0.0.0/24 default-router 10.0.0.1
[edit]
nabakulin@nabakulin-gw-01# set service dhcp-server shared-network-name nabakulin
subnet 10.0.0.0/24 range hosts start 10.0.0.2
[edit]
nabakulin@nabakulin-gw-01# set service dhcp-server shared-network-name nabakulin
subnet 10.0.0.0/24 range hosts stop 10.0.0.253
[edit]
nabakulin@nabakulin-gw-01# commit
[edit]
nabakulin@nabakulin-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
nabakulin@nabakulin-gw-01# exit
exit
nabakulin@nabakulin-gw-01:~$ show dhcp server statistics
Pool          Size      Leases    Available  Usage
-----
nabakulin      252         0         252      0%
nabakulin@nabakulin-gw-01:~$ show dhcp server leases
IP address    Hardware address  State      Lease start    Lease expiration  Re
maining      Pool      Hostname
-----
-----
```

Рисунок 4

- 1.9. Настройте окончечное устройство PC1.

```
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: 00:50:79:66:68:01
Option 53: Message Type = Discover
Option 12: Host Name = VPCS
Option 61: Client Identifier = Hardware Type=Ethernet MAC Address = 00:50:79:66:
68:01

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: 00:50:79:66:68:01
Option 53: Message Type = Discover
Option 12: Host Name = VPCS
Option 61: Client Identifier = Hardware Type=Ethernet MAC Address = 00:50:79:66:
68:01

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: 00:50:79:66:68:01
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 = nabakulin.net
```

Рисунок 5

```

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: 00:50:79:66:68:01
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:
68:01
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: 00:50:79:66:68:01
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 = nabakulin.net

IP 10.0.0.2/24 GW 10.0.0.1

```

Рисунок 6

- 1.10. Проверьте конфигурацию IPv4 на узле, пропингуйте маршрутизатор.

```

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  : 86313, 86400/43200/75600
DOMAIN NAME : nabakulin.net
MAC        : 00:50:79:66:68:01
LPORT      : 20004
RHOST:PORT  : 127.0.0.1:20005
MTU        : 1500

VPCS> ping 10.0.0.1 -c 2

84 bytes from 10.0.0.1 icmp_seq=1 ttl=64 time=1.260 ms
84 bytes from 10.0.0.1 icmp_seq=2 ttl=64 time=0.732 ms

```

Рисунок 7

- 1.11. На маршрутизаторе вновь посмотрите статистику DHCP-сервера и выданные адреса.

```

nabakulin@nabakulin-gw-01:~$ show dhcp server statistics
Pool      Size    Leases  Available  Usage
-----
nabakulin 252      1       251       0%
nabakulin@nabakulin-gw-01:~$ show dhcp server leases
IP address  Hardware address  State  Lease start  Lease expiration  Remaining  Pool  Hostname
-----
10.0.0.2    00:50:79:66:68:01  active  2022/10/23 01:02:47  2022/10/24 01:02:47  23:57:26  nabakulin  VPCS
nabakulin@nabakulin-gw-01:~$

```

Рисунок 8

- 1.12. На маршрутизаторе посмотрите журнал работы DHCP-сервера.

```

nabakulin@nabakulin-gw-01:~$ show dhcp server statistics
Pool      Size      Leases      Available      Usage
-----
nabakulin 252      1            251            0%

nabakulin@nabakulin-gw-01:~$ show dhcp server leases
IP address      Hardware address      State      Lease start      Lease expiration      Remaining      Pool      Hostname
-----
10.0.0.2        00:50:79:66:68:01     active     2022/10/23 01:02:47 2022/10/24 01:02:47 23:57:26      nabakulin  VPCS

nabakulin@nabakulin-gw-01:~$ show log | grep dhcp
Oct 23 01:00:11 sudo[3271]: nabakulin : TTY=tttyS0 ; FWD=/home/nabakulin ; USER=root ; COMMAND=/usr/bin/sh -c /usr/sbin/vyos
him /usr/libexec/vyos/conf_mode/dhcp_server.py
Oct 23 01:00:20 dhcpd[3286]: Wrote 0 leases to leases file.
Oct 23 01:00:20 dhcpd[3286]: Lease file test successful, removing temp lease file: /config/dhcpd.leases.1666486820
Oct 23 01:00:21 dhcpd[3288]: Wrote 0 leases to leases file.
Oct 23 01:00:21 dhcpd[3288]:
Oct 23 01:00:21 dhcpd[3288]: No subnet declaration for eth2 (no IPv4 addresses).
Oct 23 01:00:21 dhcpd[3288]: ** Ignoring requests on eth2. If this is not what
Oct 23 01:00:21 dhcpd[3288]: you want, please write a subnet declaration
Oct 23 01:00:21 dhcpd[3288]: in your dhcpd.conf file for the network segment
Oct 23 01:00:21 dhcpd[3288]: to which interface eth2 is attached. **
Oct 23 01:00:21 dhcpd[3288]:
Oct 23 01:00:21 dhcpd[3288]: No subnet declaration for eth1 (no IPv4 addresses).
Oct 23 01:00:21 dhcpd[3288]: ** Ignoring requests on eth1. If this is not what
Oct 23 01:00:21 dhcpd[3288]: you want, please write a subnet declaration
Oct 23 01:00:21 dhcpd[3288]: in your dhcpd.conf file for the network segment
Oct 23 01:00:21 dhcpd[3288]: to which interface eth1 is attached. **
Oct 23 01:00:21 dhcpd[3288]:
Oct 23 01:00:21 dhcpd[3288]: Server starting service.
Oct 23 01:01:39 sudo[3366]: nabakulin : TTY=tttyS0 ; FWD=/home/nabakulin ; USER=root ; COMMAND=/usr/libexec/vyos/op_mode/sh
ow dhcp.py --statistics
Oct 23 01:01:48 sudo[3392]: nabakulin : TTY=tttyS0 ; FWD=/home/nabakulin ; USER=root ; COMMAND=/usr/libexec/vyos/op_mode/sh
ow dhcp.py --leases
Oct 23 01:02:43 dhcpd[3288]: DHCPDISCOVER from 00:50:79:66:68:01 via eth0
Oct 23 01:02:44 dhcpd[3288]: DHCPOFFER on 10.0.0.2 to 00:50:79:66:68:01 (VPCS) via eth0
Oct 23 01:02:47 dhcpd[3288]: DHCPREQUEST for 10.0.0.2 (10.0.0.1) from 00:50:79:66:68:01 (VPCS) via eth0
Oct 23 01:02:47 dhcpd[3288]: DHCPACK on 10.0.0.2 to 00:50:79:66:68:01 (VPCS) via eth0
Oct 23 01:04:48 sudo[3419]: nabakulin : TTY=tttyS0 ; FWD=/home/nabakulin ; USER=root ; COMMAND=/usr/libexec/vyos/op_mode/sh
ow dhcp.py --statistics
Oct 23 01:04:56 sudo[3445]: nabakulin : TTY=tttyS0 ; FWD=/home/nabakulin ; USER=root ; COMMAND=/usr/libexec/vyos/op_mode/sh
ow dhcp.py --leases
Oct 23 01:05:09 sudo[3471]: nabakulin : TTY=tttyS0 ; FWD=/home/nabakulin ; USER=root ; COMMAND=/usr/libexec/vyos/op_mode/sh

```

Рисунок 9

- 1.13. В отчёте проанализируйте захваченные анализатором трафика пакеты, относящиеся к работе DHCP и назначению адреса устройству.

16	2732.990208	0.0.0.0	255.255.255.255	DHCP	406 DHCP Discover - Transaction ID 0xba37164d
17	2732.998072	0c:df:71:60:00:00	Broadcast	ARP	60 Who has 10.0.0.2? Tell 10.0.0.1
18	2733.990404	0.0.0.0	255.255.255.255	DHCP	406 DHCP Discover - Transaction ID 0xba37164d
19	2734.001379	10.0.0.1	10.0.0.2	DHCP	342 DHCP Offer - Transaction ID 0xba37164d
20	2734.008486	0c:df:71:60:00:00	Broadcast	ARP	60 Who has 10.0.0.2? Tell 10.0.0.1
21	2735.032489	0c:df:71:60:00:00	Broadcast	ARP	60 Who has 10.0.0.2? Tell 10.0.0.1
22	2736.990520	0.0.0.0	255.255.255.255	DHCP	406 DHCP Request - Transaction ID 0xba37164d
23	2737.252140	10.0.0.1	10.0.0.2	DHCP	342 DHCP ACK - Transaction ID 0xba37164d

Рисунок 10

2.

- 2.1. В предыдущем проекте в рабочем пространстве дополните сеть, разместив и соединив устройства в соответствии с топологией

- 2.2. Измените отображаемые названия устройств.

- 2.3. Включите захват трафика на соединениях между маршрутизатором gw-01 и коммутаторами sw-02 и sw-03.

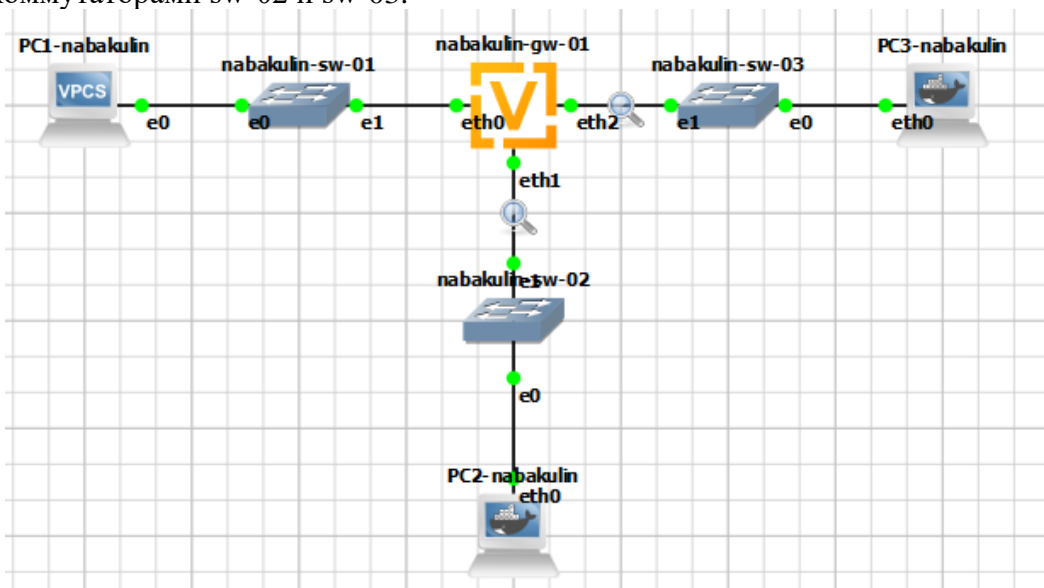


Рисунок 11

2.4. Настройте адресацию IPv6 на маршрутизаторе.

```
nabakulin@nabakulin-gw-01:~$ configure
[edit]
nabakulin@nabakulin-gw-01# set interfaces ethernet eth1 address 2000::1/64
[edit]
nabakulin@nabakulin-gw-01# set interfaces ethernet eth2 address 2001::1/64
[edit]
nabakulin@nabakulin-gw-01# show interfaces
    ethernet eth0 {
        address 10.0.0.1/24
        hw-id 0c:9b:60:a1:00:00
    }
    ethernet eth1 {
+   address 2000::1/64
        hw-id 0c:9b:60:a1:00:01
    }
    ethernet eth2 {
+   address 2001::1/64
        hw-id 0c:9b:60:a1:00:02
    }
    loopback lo {
    }
```

Рисунок 12

2.5. На маршрутизаторе настройте DHCPv6 без отслеживания состояния (DHCPv6 Stateless configuration)

```
nabakulin@nabakulin-gw-01# set service router-advert interface eth1 prefix 2000::/64
[edit]
nabakulin@nabakulin-gw-01# set service router-advert interface eth1 other-config
-flag
[edit]
nabakulin@nabakulin-gw-01# set service dhcpv6-server shared-network-name nabakulin-stateless
[edit]
nabakulin@nabakulin-gw-01# set service dhcpv6-server shared-network-name nabakulin-stateless subnet 2000::0/64
[edit]
nabakulin@nabakulin-gw-01# set service dhcpv6-server shared-network-name nabakulin-stateless common-options name-server 2000::1
[edit]
nabakulin@nabakulin-gw-01# set service dhcpv6-server shared-network-name nabakulin-stateless common-options domain-search nabakulin.net
[edit]
```

Рисунок 13

2.6. На узле PC2 проверьте настройки сети.

```

root@PC2-nabakulin:/# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::fc2d:e8ff:fe53:3ace prefixlen 64 scopeid 0x20<link>
    inet6 2000::fc2d:e8ff:fe53:3ace prefixlen 64 scopeid 0x0<global>
    ether fe:2d:e8:53:3a:ce txqueuelen 1000 (Ethernet)
    RX packets 1 bytes 118 (118.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 7 bytes 602 (602.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::78a8:23ff:fe7f:a135 prefixlen 64 scopeid 0x20<link>
    ether 7a:a8:23:7f:a1:35 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@PC2-nabakulin:/# 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::e9b:60ff:feal:1	UGDAe	1024	1	0	eth
0						
::1/128	::	Un	0	3	0	lo
2000::fc2d:e8ff:fe53:3ace/128	::	Un	0	2	0	eth0
fe80::78a8:23ff:fe7f:a135/128	::	Un	0	3	0	eth1
fe80::fc2d:e8ff:fe53:3ace/128	::	Un	0	3	0	eth0
ff00::/8	::	U	256	2	0	eth0
ff00::/8	::	U	256	1	0	eth1
::/0	::	!n	-1	1	0	lo

2.7. На узле PC2 пропингуйте маршрутизатор.

2.8. На узле PC2 проверьте настройки DNS.

2.9. На узле PC2 получите адрес по DHCPv6.

2.10. Вновь пропингуйте от узла PC2 маршрутизатор, проверьте настройки DNS

```

root@PC2-nabakulin:/# ping 2000::1 -c 2
PING 2000::1(2000::1) 56 data bytes
64 bytes from 2000::1: icmp_seq=1 ttl=64 time=5.95 ms
64 bytes from 2000::1: icmp_seq=2 ttl=64 time=0.685 ms

--- 2000::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1000ms
rtt min/avg/max/mdev = 0.685/3.318/5.951/2.633 ms
root@PC2-nabakulin:/# cat /etc/resolv.conf
root@PC2-nabakulin:/# 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\001\376-\350S:\316".
PRC: Requesting information (INIT).
XMT: Forming Info-Request, 0 ms elapsed.
XMT: Info-Request on eth0, interval 1080ms.
RCV: Reply message on eth0 from fe80::e9b:60ff:feal:1.
PRC: Done.
root@PC2-nabakulin:/# ping 2000::1 -c2
PING 2000::1(2000::1) 56 data bytes
64 bytes from 2000::1: icmp_seq=1 ttl=64 time=1.79 ms
64 bytes from 2000::1: icmp_seq=2 ttl=64 time=0.746 ms

--- 2000::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 100lms
rtt min/avg/max/mdev = 0.746/1.271/1.796/0.525 ms
root@PC2-nabakulin:/# cat /etc/resolv.conf
search nabakulin.net.
nameserver 2000::1

```

Рисунок 14



- 2.11. На маршрутизаторе посмотрите статистику DHCP-сервера и выданные адреса

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

Рисунок 15

- 2.12. При stateless на маршрутизаторе не сохраняется информация о выданных адресах. 2 запроса DHCPv6

```
96 1912.072816    fe80::fc2d:e8ff:fe5... ff02::1:2      DHCPv6      98 Information-request XID: 0xb39089 CID: 00030001fe2de853
97 1912.082490    fe80::e9b:60ff:fea1... fe80::fc2d:e8ff:fe5... DHCPv6      137 Reply XID: 0xb39089 CID: 00030001fe2de853ace
```

Рисунок 16

- 2.13. На маршрутизаторе настройте DHCPv6 с отслеживанием состояния (DHCPv6 Stateful configuration)

```
in-statefulabakulin-gw-01# set service dhcpv6-server shared-network-name nabakul
[edit]
in-stateful subnet 2001::0/64t service dhcpv6-server shared-network-name nabakul
[edit]
in-stateful subnet 2001::0/64 name-server 2001::lver shared-network-name nabakul
[edit]
in-stateful subnet 2001::0/64 domain-search nabakulin.neted-network-name nabakul
[edit]
in-stateful subnet 2001::0/64 address-range start 2001::100 stop 2001::199abakul
[edit]
```

Рисунок 17

- 2.14. На маршрутизаторе посмотрите статистику DHCP-сервера и выданные адреса

- 2.15. Подключитесь к узлу PC3 и проверьте настройки сети

- 2.16. На узле PC3 проверьте настройки DNS

```
root@PC3-nabakulin:/# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::345e:68ff:fe8a:296f prefixlen 64 scopeid 0x20<link>
    ether 36:5e:68:8a:29:6f txqueuelen 1000 (Ethernet)
    RX packets 10 bytes 1044 (1.0 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 15 bytes 1146 (1.1 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::fc9e:8cff:fecc:a078 prefixlen 64 scopeid 0x20<link>
    ether fe:9e:8c:cc:a0:78 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-nabakulin:/# route -n -A inet6
Kernel IPv6 routing table
Destination      Next Hop          Flag Met Ref Use If
fe80::/64        ::               U    256 1   0 eth0
fe80::/64        ::               U    256 1   0 eth1
::/0             fe80::e9b:60ff:fea1:2 UGDAe 1024 1   0 eth
0
::1/128          ::               Un   0   2   0 lo
fe80::345e:68ff:fe8a:296f/128 ::               Un   0   2   0 eth0
fe80::fc9e:8cff:fecc:a078/128 ::               Un   0   3   0 eth1
ff00::/8         ::               U    256 3   0 eth0
ff00::/8         ::               U    256 1   0 eth1
::/0             ::               !n   -1  1   0 lo

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

Рисунок 18

- 2.17. На узле PC3 получите адрес по DHCPv6

```

root@PC3-nabakulin:/# 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*\347gF6^h\212)o".
PRC: Soliciting for leases (INIT).
XMT: Forming Solicit, 0 ms elapsed.
XMT: X-- IA_NA 68:8a:29:6f
XMT: | X-- Request renew in +3600
XMT: | X-- Request rebind in +5400
XMT: Solicit on eth0, interval 1070ms.
RCV: Advertise message on eth0 from fe80::e9b:60ff:feal:2.
RCV: X-- IA_NA 68:8a:29:6f
RCV: | X-- starts 1666493127
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:e7:61:21:0c:9b:60:a1:00:01
RCV: Advertisement recorded.
PRC: Selecting best advertised lease.
PRC: Considering best lease.
PRC: X-- Initial candidate 00:01:00:01:2a:e7:61:21:0c:9b:60:a1:00:01 (s: 10105,
p: 0).
XMT: Forming Request, 0 ms elapsed.
XMT: X-- IA_NA 68:8a:29:6f
XMT: | X-- Requested renew +3600
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 1090ms.
RCV: Reply message on eth0 from fe80::e9b:60ff:feal:2.
RCV: X-- IA_NA 68:8a:29:6f
RCV: | X-- starts 1666493128
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:e7:61:21:0c:9b:60:a1:00:01
PRC: Bound to lease 00:01:00:01:2a:e7:61:21:0c:9b:60:a1:00:01.

```

Рисунок 19

2.18. Вновь на узле PC3 проверьте настройки сети, пропингуйте маршрутизатор, проверьте настройки DNS

```

root@PC3-nabakulin:/# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 2001::199 prefixlen 128 scopeid 0x0<global>
    inet6 fe80::345e:68ff:fe8a:296f prefixlen 64 scopeid 0x20<link>
    ether 36:5e:68:8a:29:6f txqueuelen 1000 (Ethernet)
    RX packets 12 bytes 1414 (1.3 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 20 bytes 1734 (1.6 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::fc9e:8cff:fecc:a078 prefixlen 64 scopeid 0x20<link>
    ether fe:9e:8c:cc:a0:78 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-nabakulin:/# route -n -A inet6
Kernel IPv6 routing table

```

Destination	Next Hop	Flag	Met	Ref	Use	If
2001::199/128	::	U	256	1	0	eth0
fe80::/64	::	U	256	1	0	eth0
fe80::/64	::	U	256	1	0	eth1
::/0	fe80::e9b:60ff:feal:2	UGDAe	1024	1	0	eth
0						
::1/128	::	Un	0	3	0	lo
2001::199/128	::	Un	0	2	0	eth0
fe80::345e:68ff:fe8a:296f/128	::	Un	0	3	0	eth0
fe80::fc9e:8cff:fecc:a078/128	::	Un	0	3	0	eth1
ff00::/8	::	U	256	3	0	eth0
ff00::/8	::	U	256	1	0	eth1
::/0	::	!n	-1	1	0	lo

```

root@PC3-nabakulin:/# ping 2001::1 -c 2
PING 2001::1 (2001::1) 56 data bytes
64 bytes from 2001::1: icmp_seq=1 ttl=64 time=2.86 ms
64 bytes from 2001::1: icmp_seq=2 ttl=64 time=1.32 ms

--- 2001::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 1.320/2.091/2.863/0.772 ms
root@PC3-nabakulin:/# cat /etc/resolv.conf
search nabakulin.net.
nameserver 2001::1

```

Рисунок 20

2.19. На маршрутизаторе посмотрите статистику DHCP-сервера и выданные адреса

```
nabakulin@nabakulin-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 02:45:28  2022/10/23 04:50:28  2:04:27     non-temporary  nabakulin-stateful
6f:29:8a:68:00:01:00:01:2a:e7:67:46:36:5e:68:8a:29:6f
[edit]
```

Рисунок 21

2.20. При stateful на маршрутизации сохраняется информация о выданных адресах. 4 запроса DHCPv6

26	2356.726732	fe80::345e:68ff:fe8...	ff02::1:2	DHCPv6	118 Solicit	XID: 0xb053d7 CID: 000100012ae76746365e688a296f
27	2356.744738	fe80::e9b:60ff:fea1...	fe80::345e:68ff:fe8...	DHCPv6	185 Advertise	XID: 0xb053d7 IAA: 2001::199 CID: 000100012ae76746365e688a296f
28	2357.797893	fe80::345e:68ff:fe8...	ff02::1:2	DHCPv6	164 Request	XID: 0x7cc921 CID: 000100012ae76746365e688a296f
29	2357.804255	fe80::e9b:60ff:fea1...	fe80::345e:68ff:fe8...	DHCPv6	185 Reply	XID: 0x7cc921 IAA: 2001::199 CID: 000100012ae76746365e688a296f

Рисунок 22