

# Лабораторная работа №7

Сетевые технологии

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

# Настройка DHCP в случае IPv4

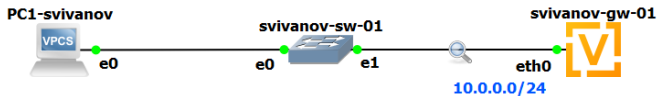


Рис. 1: Создание сети

# Настройка DHCP в случае IPv4

```
vyos 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@vyos:~$ install image
You are trying to install from an already installed system. An ISO
image file to install or URL must be specified.
Exiting...
vyos@vyos:~$ █
```

Рис. 2: Запуск маршрутизатора

# Настройка DHCP в случае IPv4

На маршрутизаторе изменим имя устройства и доменное имя, заменим системного пользователя.

```
vyos@vyos:~$ configure
[edit]
vyos@vyos# set system host-name svivanov-gw-01
[edit]
vyos@vyos# set system domain-name svivanov.net
[edit]
vyos@vyos# set system login user svivanov
[edit]
vyos@vyos# set system login user svivanov authentication plaintext-password pala
nn78
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos# exit
exit
vyos@vyos:~$ exit
logout
```

Рис. 3: Настройка маршрутизатора

# Настройка DHCP в случае IPv4

```
svivanov-gw-01 login: svivanov
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
svivanov@svivanov-gw-01:~$ configure
[edit]
svivanov@svivanov-gw-01# delete system login user vyos
[edit]
svivanov@svivanov-gw-01# commit
[edit]
svivanov@svivanov-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
svivanov@svivanov-gw-01# █
```

Рис. 4: Настройка маршрутизатора

# Настройка DHCP в случае IPv4

Настроим адресацию IPv4:

```
svivanov@svivanov-gw-01# set interfaces ethernet eth0 address 10.0.0.1/24  
[edit]  
svivanov@svivanov-gw-01#
```

**Рис. 5:** Настройка адресации IPv4

# Настройка DHCP в случае IPv4

Добавим конфигурацию DHCP-сервера на маршрутизаторе:

```
svivanov@svivanov-gw-01# set service dhcp-server shared-network-name svivanov do
main-name svivanov.net
[edit]
svivanov@svivanov-gw-01# set service dhcp-server shared-network-name svivanov na
me-server 10.0.0.1
[edit]
svivanov@svivanov-gw-01# set service dhcp-server shared-network-name svivanov su
bnet 10.0.0.0/24
[edit]
svivanov@svivanov-gw-01# set service dhcp-server shared-network-name svivanov su
bnet 10.0.0.0/24 default-router 10.0.0.1
[edit]
svivanov@svivanov-gw-01# set service dhcp-server shared-network-name svivanov su
bnet 10.0.0.0/24 range hosts start 10.0.0.2
[edit]
svivanov@svivanov-gw-01# set service dhcp-server shared-network-name svivanov su
bnet 10.0.0.0/24 range hosts stop 10.0.0.253
[edit]
svivanov@svivanov-gw-01# commit
```

Рис. 6: Конфигурация dhcp



# Настройка DHCP в случае IPv4

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

Рис. 7: Просмотр статистики

# Настройка DHCP в случае IPv4

```
PC1-svivanov> 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 = PC1-svivanov
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 = PC1-svivanov
Option 61: Client Identifier = Hardware Type=Ethernet MAC Address = 00:50:79:66:68:00

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 = svivanov.net
```

# Настройка DHCP в случае IPv4

```
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
Option 12: Host Name = PC1-svivanov

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 = svivanov.net

IP 10.0.0.2/24 GW 10.0.0.1

PC1-svivanov> █
```

# Настройка DHCP в случае IPv4

```
PC1-svivanov> show ip

NAME       : PC1-svivanov[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  : 86230, 86400/43200/75600
DOMAIN NAME : svivanov.net
MAC        : 00:50:79:66:68:00
LPORT      : 20004
RHOST:PORT  : 127.0.0.1:20005
MTU        : 1500

PC1-svivanov> ping 10.0.0.1 -c 2

84 bytes from 10.0.0.1 icmp_seq=1 ttl=64 time=3.863 ms
84 bytes from 10.0.0.1 icmp_seq=2 ttl=64 time=1.947 ms

PC1-svivanov> █
```

Рис. 10: Проверка конфигурации и пропинговка

# Настройка DHCP в случае IPv4

```
svivanov@svivanov-gw-01:~$ show dhcp server statistics
Pool      Size    Leases    Available  Usage
-----
svivanov   252      1          251        0%
svivanov@svivanov-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  2025/11/30 14:00:07  2025/12/01 14:00:07
23:56:11    svivanov  PC1-svivanov
svivanov@svivanov-gw-01:~$
```

Рис. 11: Просмотр статистики

# Настройка DHCP в случае IPv4

На маршрутизаторе посмотрим журнал работы DHCP-сервера:

```
svivanov@svivanov-gw-01:~$ show log | grep dhcp
Nov 30 13:57:21 sudo[1964]:      root : TTY=unknown ; PWD=/ ; USER=root ; COMMAND=
=/usr/bin/sh -c /usr/sbin/vyshim /usr/libexec/vyos/conf_mode/dhcp_server.py
Nov 30 13:57:21 vyos-configd[613]: Received message: {"type": "node", "data": "/
usr/libexec/vyos/conf_mode/dhcp_server.py"}
Nov 30 13:57:22 dhcpd[1978]: Wrote 0 leases to leases file.
Nov 30 13:57:22 dhcpd[1978]: Lease file test successful, removing temp lease fil
e: /config/dhcpd.leases.1764511042
Nov 30 13:57:22 dhcpd[1981]: Wrote 0 leases to leases file.
Nov 30 13:57:22 dhcpd[1981]:
Nov 30 13:57:22 dhcpd[1981]: No subnet declaration for eth9 (no IPv4 addresses).
Nov 30 13:57:22 dhcpd[1981]: ** Ignoring requests on eth9.  If this is not what
Nov 30 13:57:22 dhcpd[1981]:   you want, please write a subnet declaration
Nov 30 13:57:22 dhcpd[1981]:   in your dhcpd.conf file for the network segment
```

**Рис. 12:** Просмотр журнала DHCP-сервера

# Настройка DHCP в случае IPv4

107	2413.611104	fe80::e00:32ff:fe06::ff02::16	ICMPv6	90	Multicast Listener Report Message v2
108	2413.922127	fe80::e00:32ff:fe06::ff02::16	ICMPv6	150	Multicast Listener Report Message v2
109	2577.419222	0.0.0.0	DHCP	406	DHCP Discover - Transaction ID 0xcfc255c68
110	2577.450458	0c:00:32:06:00:00	Broadcast	ARP	42 Who has 10.0.0.2? Tell 10.0.0.1
111	2578.419974	0.0.0.0	DHCP	406	DHCP Discover - Transaction ID 0xcfc255c68
112	2578.454614	10.0.0.1	DHCP	342	DHCP Offer - Transaction ID 0xcfc255c68
113	2578.480462	0c:00:32:06:00:00	Broadcast	ARP	42 Who has 10.0.0.2? Tell 10.0.0.1
114	2579.506524	0c:00:32:06:00:00	Broadcast	ARP	42 Who has 10.0.0.2? Tell 10.0.0.1
115	2581.420192	0.0.0.0	DHCP	406	DHCP Request - Transaction ID 0xcfc255c68
116	2581.428735	10.0.0.1	DHCP	342	DHCP ACK - Transaction ID 0xcfc255c68
117	2582.421256	Private_66:68:00	Broadcast	ARP	64 Gratuitous ARP for 10.0.0.2 (Request)
118	2583.423011	Private_66:68:00	Broadcast	ARP	64 Gratuitous ARP for 10.0.0.2 (Request)
119	2584.424536	Private_66:68:00	Broadcast	ARP	64 Gratuitous ARP for 10.0.0.2 (Request)
120	2769.878273	Private_66:68:00	Broadcast	ARP	64 Who has 10.0.0.1? Tell 10.0.0.2
121	2769.885882	0c:00:32:06:00:00	Private_66:68:00	ARP	42 10.0.0.1 is at 0c:00:32:06:00:00
122	2769.887265	10.0.0.2	ICMP	98	Echo (ping) request id=0xa54e, seq=1/256, ttl=64 (reply in 123)
123	2769.890801	10.0.0.1	ICMP	98	Echo (ping) reply id=0xa54e, seq=1/256, ttl=64 (request in 122)
124	2770.891661	10.0.0.2	ICMP	98	Echo (ping) request id=0xa64e, seq=2/512, ttl=64 (reply in 125)
125	2770.892220	10.0.0.1	ICMP	98	Echo (ping) reply id=0xa64e, seq=2/512, ttl=64 (request in 124)

> Frame 116: Packet, 342 bytes on wire (2736 bits), 342 bytes captured (2736 bi	0000 00 50 79 66 68 00 0c 00 32 06 00 00 08 00 45 10	Pyfh---
> Ethernet II, Src: 0c:00:32:06:00:00 (0c:00:32:06:00:00), Dst: Private_66:68:0	0010 01 48 00 00 00 00 00 11 25 93 0a 00 00 01 0a 00	H.....
> Internet Protocol Version 4, Src: 10.0.0.1, Dst: 10.0.0.2	0020 00 02 00 43 00 44 01 34 73 9a 02 01 06 00 cf 25	...C.D.4
> User Datagram Protocol, Src Port: 67, Dst Port: 68	0030 5c 68 00 00 00 00 0a 00 00 02 0a 00 00 02 00 00	\h.....
> Dynamic Host Configuration Protocol (ACK)	0040 00 00 00 00 00 00 00 50 79 66 68 00 00 00 00 00	.....P
Message type: Boot Reply (2)	0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Hardware type: Ethernet (0x01)	0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Hardware address length: 6	0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Hops: 0	0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Transaction ID: 0xcfc255c68	0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Seconds elapsed: 0	00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
> Bootp flags: 0x0000 (Unicast)	00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client IP address: 10.0.0.2	00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Your (client) IP address: 10.0.0.2	00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Next server IP address: 0.0.0.0	00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Relay agent IP address: 0.0.0.0	00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client MAC address: Private_66:68:00 (00:50:79:66:68:00)	0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
	0110 00 00 00 00 00 00 00 63 82 53 03 35 01 05 36 04 0a	.....c
	0120 00 00 01 33 04 00 01 51 00 01 04 ff ff 00 03	...3...Q
	0130 04 0a 00 00 01 06 04 0a 00 01 0f 0c 73 76 69	.....
	0140 76 61 6a 6f 76 2a 6a 65 74 ff 00 00 00 00 00 00	vanny.ne

Рис. 13: Анализ пакетов

# Настройка DHCP в случае IPv6

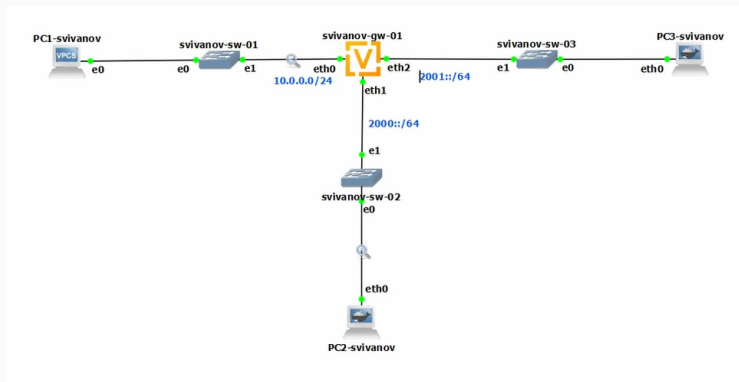


Рис. 14: Настройка Server



# Настройка DHCP в случае IPv6

```
svivanov@svivanov-gw-01:~$ configure
[edit]
svivanov@svivanov-gw-01# set interfaces ethernet eth1 address 2000::1/64
[edit]
svivanov@svivanov-gw-01# set interfaces ethernet eth2 address 2001::1/64
[edit]
svivanov@svivanov-gw-01# show interfaces
    ethernet eth0 {
        address 10.0.0.1/24
        hw-id 0c:00:32:06:00:00
    }
    ethernet eth1 {
+   address 2000::1/64
        hw-id 0c:00:32:06:00:01
    }
    ethernet eth2 {
+   address 2001::1/64
        hw-id 0c:00:32:06:00:02
    }
```

**Рис. 15:** Настройка маршрутизации IPv6

На маршрутизаторе настроим DHCPv6 без отслеживания состояния:

```
svivanov@svivanov-gw-01# set service router-advert interface eth1 prefix 2000::/
64
[edit]
svivanov@svivanov-gw-01# set service router-advert interface eth1 other-config-f
lag
[edit]
svivanov@svivanov-gw-01#
```

**Рис. 16:** Настройка DHCPv6

# Настройка DHCP в случае IPv6

## Добавление конфигурации DHCP-сервера:

```
svivanov@svivanov-gw-01# set service dhcpv6-server shared-network-name svivanov-  
stateless common-options name-server 2000::1  
[edit]  
svivanov@svivanov-gw-01# set service dhcpv6-server shared-network-name svivanov-  
stateless common-options domain-search svivanov.net  
[edit]  
svivanov@svivanov-gw-01# commit  
[edit]  
svivanov@svivanov-gw-01# save  
Saving configuration to '/config/config.boot'...  
Done  
[edit]  
svivanov@svivanov-gw-01# run show configuration  
interfaces {  
    ethernet eth0 {  
        address 10.0.0.1/24  
        hw-id 0c:00:32:06:00:00  
    }  
    ethernet eth1 {  
        address 2000::1/64  
        hw-id 0c:00:32:06:00:01  
    }  
    ethernet eth2 {  
        address 2001::1/64  
        hw-id 0c:00:32:06:00:02
```

# Настройка DHCP в случае IPv6

```
(root@ PC2-svivanov)~]
# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::42:80ff:fe7f:1a00 prefixlen 64 scopeid 0x20<link>
    inet6 2000::42:80ff:fe7f:1a00 prefixlen 64 scopeid 0x0<global>
    ether 02:42:80:7f:1a:00 txqueuelen 1000 (Ethernet)
    RX packets 4 bytes 400 (400.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 9 bytes 766 (766.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::42:80ff:fe7f:1a01 prefixlen 64 scopeid 0x20<link>
    ether 02:42:80:7f:1a:01 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-svivanov)~]
# 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
```

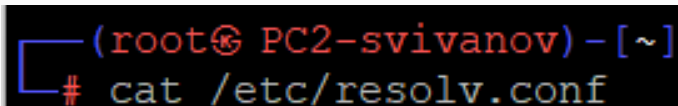
# Настройка DHCP в случае IPv6

```
(root@PC2-svivanov)~# ping 2000::1 -c 2
PING 2000::1 (2000::1) 56 data bytes
64 bytes from 2000::1: icmp_seq=1 ttl=64 time=4.76 ms
64 bytes from 2000::1: icmp_seq=2 ttl=64 time=0.603 ms

--- 2000::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 0.603/2.679/4.756/2.076 ms

(root@PC2-svivanov)~#
```

Рис. 19: Проверка связи



```
(root@PC2-svivanov) - [~]  
# cat /etc/resolv.conf
```

Рис. 20: Проверка настроек DNS

## Настройка DHCP в случае IPv6

На узле PC2 получим адрес по DHCPv6 (запрос только информации DHCPv6, но не адреса)

```
(root@PC2-svivanov)~#  
# dhclient -6 -S -v eth0  
Internet Systems Consortium DHCP Client 4.4.3-P1  
Copyright 2004-2022 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\002B\200\177\032\000".  
PRC: Requesting information (INIT).  
XMT: Forming Info-Request, 0 ms elapsed.  
XMT: Info-Request on eth0, interval 930ms.  
RCV: Reply message on eth0 from fe80::e00:32ff:fe06:1.  
PRC: Done.  
  
(root@PC2-svivanov)~#
```

Рис. 21: Получение адреса

Пропингуем от PC2 маршрутизатор

```
(root@PC2-svivanov)~# ping 2000::1 -c 2
PING 2000::1 (2000::1) 56 data bytes
64 bytes from 2000::1: icmp_seq=1 ttl=64 time=2.15 ms
64 bytes from 2000::1: icmp_seq=2 ttl=64 time=0.555 ms

--- 2000::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 0.555/1.350/2.146/0.795 ms

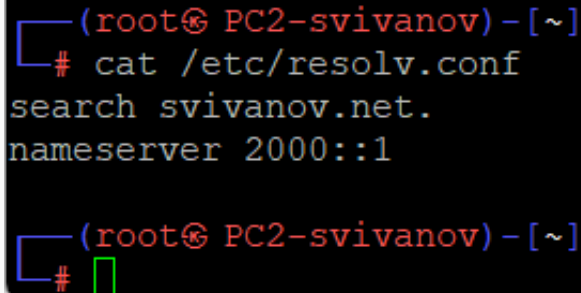
(root@PC2-svivanov)~#
```

Рис. 22: Проверка связи



## Настройка DHCP в случае IPv6

Проверим настройки DNS

A terminal window with a black background and white text. The prompt is '(root@ PC2-svivanov) - [~]'. The user enters '# cat /etc/resolv.conf'. The output shows 'search svivanov.net.' and 'nameserver 2000::1'. The user enters another prompt '(root@ PC2-svivanov) - [~]' and then '#', followed by a green cursor.

```
(root@ PC2-svivanov) - [~]
# cat /etc/resolv.conf
search svivanov.net.
nameserver 2000::1

(root@ PC2-svivanov) - [~]
#
```

Рис. 23: Проверка DNS

## Настройка DHCP в случае IPv6

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

Рис. 24: Статистика и выданные адреса

# Настройка DHCP в случае IPv6

3	33.769032	2000::1	2000::42:80ff:fe7f::	ICMPv6...	118	Echo (ping) reply id=0x0003, seq=1, hop limit=64 (re
4	34.781281	2000::42:80ff:fe7f::	2000::1	ICMPv6...	118	Echo (ping) request id=0x0003, seq=2, hop limit=64 (
5	34.781835	2000::1	2000::42:80ff:fe7f::	ICMPv6...	118	Echo (ping) reply id=0x0003, seq=2, hop limit=64 (re
6	38.904156	fe80::42:80ff:fe7f::	2000::1	ICMPv6	86	Neighbor Solicitation for 2000::1 from 02:42:80:7f:1
7	38.905640	2000::1	fe80::42:80ff:fe7f::	ICMPv6	78	Neighbor Advertisement 2000::1 (rtr, sol)
8	39.032362	fe80::e00:32ff:fe06::	2000::42:80ff:fe7f::	ICMPv6	86	Neighbor Solicitation for 2000::42:80ff:fe7f:1a00 fr
9	39.032616	2000::42:80ff:fe7f::	fe80::e00:32ff:fe06::	ICMPv6	78	Neighbor Advertisement 2000::42:80ff:fe7f:1a00 (sol)
10	39.078369	fe80::42:80ff:fe7f::	ff02::1:2	DHCPv6	98	Information-request XID: 0x7b23c6 CID: 0003000102428
11	39.081810	fe80::e00:32ff:fe06::	fe80::42:80ff:fe7f::	DHCPv6	136	Reply XID: 0x7b23c6 CID: 000300010242807f1a00
12	42.294508	2000::42:80ff:fe7f::	2000::1	ICMPv6...	118	Echo (ping) request id=0x0004, seq=1, hop limit=64 (
13	42.295227	2000::1	2000::42:80ff:fe7f::	ICMPv6...	118	Echo (ping) reply id=0x0004, seq=1, hop limit=64 (re
14	43.320919	2000::42:80ff:fe7f::	2000::1	ICMPv6...	118	Echo (ping) request id=0x0004, seq=2, hop limit=64 (
15	43.321379	2000::1	2000::42:80ff:fe7f::	ICMPv6...	118	Echo (ping) reply id=0x0004, seq=2, hop limit=64 (re
16	44.151727	fe80::e00:32ff:fe06::	fe80::42:80ff:fe7f::	ICMPv6	86	Neighbor Solicitation for fe80::42:80ff:fe7f:1a00 fr
17	44.151851	fe80::42:80ff:fe7f::	fe80::e00:32ff:fe06::	ICMPv6	78	Neighbor Advertisement fe80::42:80ff:fe7f:1a00 (sol)
18	44.281089	fe80::42:80ff:fe7f::	fe80::e00:32ff:fe06::	ICMPv6	86	Neighbor Solicitation for fe80::e00:32ff:fe06:1 from
19	44.281565	fe80::e00:32ff:fe06::	fe80::42:80ff:fe7f::	ICMPv6	78	Neighbor Advertisement fe80::e00:32ff:fe06:1 (rtr, s

> Frame 18: Packet, 86 bytes on wire (688 bits), 86 bytes captured (688	0000	0c 00 32 06 00 01 02 42 80 7f 1a 00 86 dd 60 00	--2
> Ethernet II, Src: 02:42:80:7f:1a:00 (02:42:80:7f:1a:00), Dst: 0c:00:3	0010	00 00 00 20 3a ff fe 80 00 00 00 00 00 00 42	...
> Internet Protocol Version 6, Src: fe80::42:80ff:fe7f:1a00, Dst: fe80:	0020	80 ff fe 7f 1a 00 fe 80 00 00 00 00 00 0e 00	...
> Internet Control Message Protocol v6	0030	32 ff fe 06 00 01 87 00 c7 8f 00 00 00 00 fe 80	2--
> Type: Neighbor Solicitation (135)	0040	00 00 00 00 00 00 0e 00 32 ff fe 06 00 01 01 01	...
Code: 0	0050	02 42 80 7f 1a 00	.B.
Checksum: 0xc78f [correct]			
[Checksum Status: Good]			
Reserved: 00000000			
Target Address: fe80::e00:32ff:fe06:1			
> ICMPv6 Option (Source link-layer address : 02:42:80:7f:1a:00)			

Рис. 25: Захваченный трафик и анализ информации

На маршрутизаторе настроим DHCPv6 с отслеживанием состояния

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

**Рис. 26:** Настройка DHCPv6 с отслеживаем информации

Добавим конфигурацию DHCP-сервера на маршрутизаторе:

```
svivanov@svivanov-gw-01# set service dhcpv6-server shared-network-name svivanov-  
stateful subnet 2001::0/64 domain search svivanov.net  
  
Configuration path: service dhcpv6-server shared-network-name svivanov-statefu  
l subnet 2001::0/64 domain-search search [svivanov.net] is not valid  
Set failed  
  
[edit]  
svivanov@svivanov-gw-01# set service dhcpv6-server shared-network-name svivanov-  
stateful subnet 2001::0/64 domain-search svivanov.net  
[edit]  
svivanov@svivanov-gw-01# set service dhcpv6-server shared-network-name svivanov-  
stateful subnet 2001::0/64 address-range start 2001::100 stop 2001::199  
[edit]  
svivanov@svivanov-gw-01# commit  
[edit]  
svivanov@svivanov-gw-01# save  
Saving configuration to '/config/config.boot'...  
Done  
[edit]  
svivanov@svivanov-gw-01#
```

Рис. 27: Конфигурация DHCP сервера

На маршрутизаторе посмотрим выданные адреса:

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

**Рис. 28:** Просмотр выданных адресов

# Настройка DHCP в случае IPv6

```
(root@ PC3-svivanov)-[~]
# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::42:93ff:feb7:ca00 prefixlen 64 scopeid 0x20<link>
    ether 02:42:93:b7:ca:00 txqueuelen 1000 (Ethernet)
    RX packets 3 bytes 250 (250.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 8 bytes 680 (680.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::42:93ff:feb7:ca01 prefixlen 64 scopeid 0x20<link>
    ether 02:42:93:b7:ca:01 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

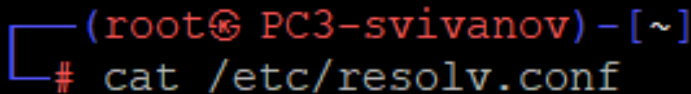
(root@ PC3-svivanov)-[~]
# route -n -A inet6
Kernel IPv6 routing table

```

Destination	Next Hop	Flag	Met	Ref	Use	If
fe80::/64	::	U	256	1	0	eth0
fe80::/64	::	U	256	1	0	eth1
::/0	fe80::e00:32ff:fe06:2	UGDAe	1024	1	0	et

## Настройка DHCP в случае IPv6

На узле PC3 проверим настройки DNS:

A terminal window with a black background and colored text. The prompt is '(root@ PC3-svivanov) - [~]' in red and blue. Below it, the command '# cat /etc/resolv.conf' is entered in yellow and blue.

```
(root@ PC3-svivanov) - [~]  
# cat /etc/resolv.conf
```

Рис. 30: Настройки DNS



# Настройка DHCP в случае IPv6

На узле PC3 получим адрес по DHCPv6:

```
(root@PC3-svivanov) -[~]
# dhclient -6 -v eth0
Internet Systems Consortium DHCP Client 4.4.3-P1
Copyright 2004-2022 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\0010\300\241\347\002B\223\267\312\000".
PRC: Soliciting for leases (INIT).
XMT: Forming Solicit, 0 ms elapsed.
XMT: X-- IA_NA 93:b7:ca:00
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::e00:32ff:fe06:2.
RCV: X-- IA_NA 93:b7:ca:00
RCV: | X-- starts 1764615527
RCV: | X-- t1 - renew +0
RCV: | X-- t2 - rebind +0
```

Рис. 31: Получение адреса

# Настройка DHCP в случае IPv6

```
(root@ PC3-svivanov) -[~]
# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 2001::198 prefixlen 128 scopeid 0x0<global>
    inet6 fe80::42:93ff:feb7:ca00 prefixlen 64 scopeid 0x20<link>
    ether 02:42:93:b7:ca:00 txqueuelen 1000 (Ethernet)
    RX packets 7 bytes 782 (782.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 15 bytes 1432 (1.3 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::42:93ff:feb7:ca01 prefixlen 64 scopeid 0x20<link>
    ether 02:42:93:b7:ca:01 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-svivanov) -[~]
# route -n -A inet6
Kernel IPv6 routing table

```

Destination	Next Hop	Flag	Met	Ref	Use	If
2001::198/128	::	Ue	256	1	0	eth0
fe80::/64	::	U	256	1	0	eth0
fe80::/64	::	U	256	1	0	eth1
::/0	fe80::42:93ff:feb7:ca00	UH	256	1	0	eth0

# Настройка DHCP в случае IPv6

```
(root@ PC3-svivanov) -[~]  
# ping 2001::1 -c 2  
PING 2001::1 (2001::1) 56 data bytes  
64 bytes from 2001::1: icmp_seq=1 ttl=64 time=1.34 ms  
64 bytes from 2001::1: icmp_seq=2 ttl=64 time=1.07 ms  
  
--- 2001::1 ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 1002ms  
rtt min/avg/max/mdev = 1.065/1.201/1.338/0.136 ms  
  
(root@ PC3-svivanov) -[~]  
# cat /etc/resolv.conf  
search svivanov.net.  
nameserver 2001::1
```

Рис. 33: Пинг и проверка DNS

# Настройка DHCP в случае IPv6

```
svivanov@svivanov-gw-01# run show dhcpv6 server leases
IPv6 address      State      Last communication    Lease expiration      Remaining
Type             Pool              IAID_DUID
-----
-----
2001::198         active     2025/12/01 18:58:48    2025/12/01 21:03:48    2:04:00
non-temporary     svivanov-stateful 00:ca:b7:93:00:01:00:01:30:c0:a1:e7:02:42:93:
b7:ca:00
[edit]
svivanov@svivanov-gw-01#
```

Рис. 34: Выданные адреса

# Настройка DHCP в случае IPv6

1	0.000000	fe80::e00:32ff:fe06::ff02::16	ICMPv6	110 Multicast Listener Report Message v2
2	0.501419	fe80::e00:32ff:fe06::ff02::16	ICMPv6	110 Multicast Listener Report Message v2
3	0.745969	fe80::e00:32ff:fe06::ff02::1	ICMPv6	86 Router Advertisement from 0c:00:32:06:00:02
4	16.771379	fe80::e00:32ff:fe06::ff02::1	ICMPv6	86 Router Advertisement from 0c:00:32:06:00:02
5	32.790397	fe80::e00:32ff:fe06::ff02::1	ICMPv6	86 Router Advertisement from 0c:00:32:06:00:02
6	221.315563	::	ICMPv6	90 Multicast Listener Report Message v2
7	221.465630	::	ICMPv6	90 Multicast Listener Report Message v2
8	221.694823	::	ICMPv6	86 Neighbor Solicitation for fe80::42:93ff:feb7:ca00
9	222.719165	fe80::42:93ff:feb7::	ICMPv6	90 Multicast Listener Report Message v2
10	222.719194	fe80::42:93ff:feb7::	ICMPv6	70 Router Solicitation from 02:42:93:b7:ca:00
11	222.721530	fe80::e00:32ff:fe06::	ICMPv6	86 Router Advertisement from 0c:00:32:06:00:02
12	223.582759	fe80::42:93ff:feb7::	ICMPv6	90 Multicast Listener Report Message v2
13	228.222586	fe80::e00:32ff:fe06::	ICMPv6	86 Neighbor Solicitation for fe80::42:93ff:feb7:ca00 fr
14	228.223040	fe80::42:93ff:feb7::	ICMPv6	78 Neighbor Advertisement fe80::42:93ff:feb7:ca00 (sol)
15	233.472588	fe80::42:93ff:feb7::	ICMPv6	86 Neighbor Solicitation for fe80::e00:32ff:fe06:2 from
16	233.472968	fe80::e00:32ff:fe06::	ICMPv6	78 Neighbor Advertisement fe80::e00:32ff:fe06:2 (rtr, s
17	483.801267	fe80::42:93ff:feb7::	DHCPv6	118 Solicit XID: 0x2fd903 CID: 0001000130c0a1e7024293b7c
18	483.814811	fe80::e00:32ff:fe06::	DHCPv6	184 Advertise XID: 0x2fd903 IAA: 2001::198 CID: 00010001
19	484.877222	fe80::42:93ff:feb7::	DHCPv6	164 Request XID: 0x47cf11 CID: 0001000130c0a1e7024293b7c
20	484.881698	fe80::e00:32ff:fe06::	DHCPv6	184 Reply XID: 0x47cf11 IAA: 2001::198 CID: 0001000130c0
21	484.911704	fe80::42:93ff:feb7::	ICMPv6	110 Multicast Listener Report Message v2
22	485.147308	::	ICMPv6	86 Neighbor Solicitation for 2001::198
23	485.314529	fe80::42:93ff:feb7::	ICMPv6	110 Multicast Listener Report Message v2
24	488.842256	fe80::e00:32ff:fe06::	ICMPv6	86 Neighbor Solicitation for fe80::42:93ff:feb7:ca00 fr
25	488.842422	fe80::42:93ff:feb7::	ICMPv6	78 Neighbor Advertisement fe80::42:93ff:feb7:ca00 (sol)
26	494.081387	fe80::42:93ff:feb7::	ICMPv6	86 Neighbor Solicitation for fe80::e00:32ff:fe06:2 from
27	494.081387	fe80::42:93ff:feb7::	ICMPv6	78 Neighbor Advertisement fe80::e00:32ff:fe06:2 (rtr, s

> Frame 1: Packet, 110 bytes on wire (880 bits), 110 bytes captured (880 bits) on interface 0	0000	33 33 00 00 00 16 0c 00	32 06 00 02 86 dd 60 00	33
> Ethernet II, Src: 0c:00:32:06:00:02 (0c:00:32:06:00:02), Dst: IPv6mcast	0010	00 00 00 38 00 01 fe 80	00 00 00 00 00 00 0e 00	...
> Internet Protocol Version 6, Src: fe80::e00:32ff:fe06:2, Dst: ff02::1	0020	32 ff fe 06 00 02 ff 02	00 00 00 00 00 00 00 00	2...
> Internet Control Message Protocol v6	0030	00 00 00 00 16 3a 00	05 02 00 00 01 00 8f 00	...
	0040	2d e1 00 00 00 02 04 00	00 00 ff 05 00 00 00 00	...
	0050	00 00 00 00 00 00 01	00 03 04 00 00 00 ff 02	...
	0060	00 00 00 00 00 00 00	00 00 00 01 00 02	...

Рис. 35: Захваченный трафик

## Вывод

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В ходе выполнения лабораторной работы мы получили навыки настройки службы DHCP на сетевом оборудовании для распределения адресов IPv4 и IPv6.