Сетевые технологии

Настройка DHCP для IPv4 и IPv6 в GNS3

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Цель работы

Основная цель

Настройка служб **DHCPv4**, **DHCPv6 Stateless** и **DHCPv6 Stateful** в GNS3
на маршрутизаторе **VyOS**, с проверкой работы клиентов и анализом трафика в **Wireshark**.

Ход выполнения

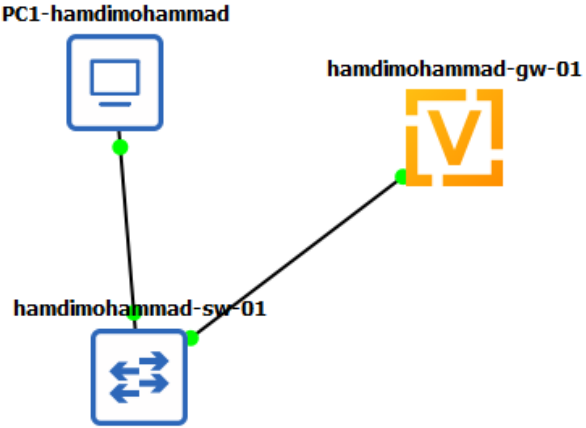


Рис. 1: Топология сети

Настройка VyOS

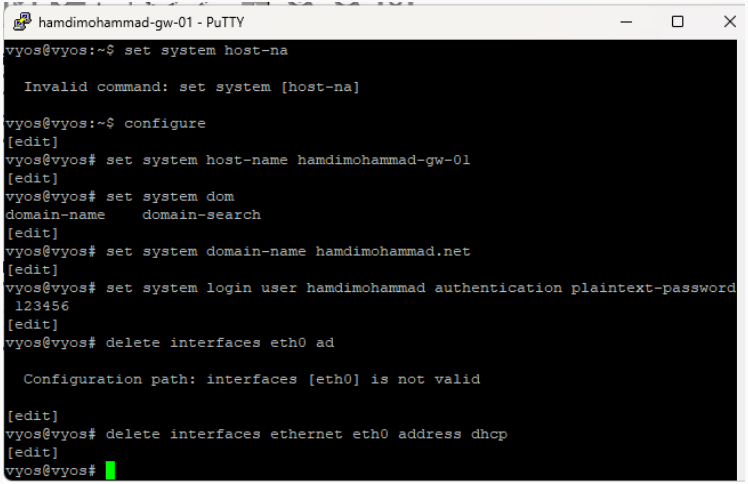


Рис. 2: Системные параметры VyOS

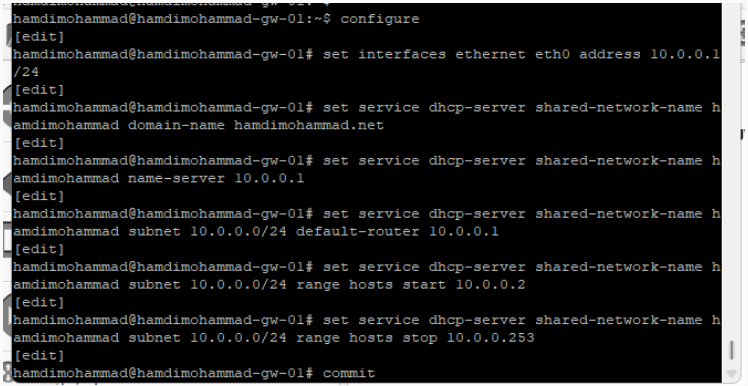


Рис. 3: Настройка DHCPv4

Получение IPv4-адреса

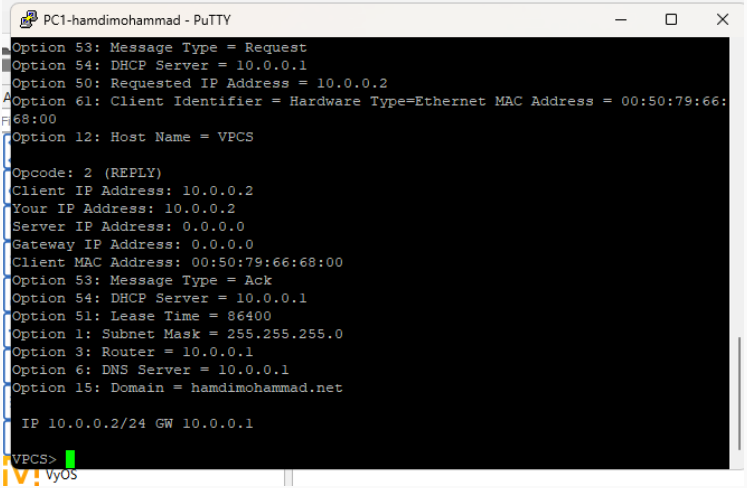


Рис. 4: Получение адреса по DHCP

Проверка конфигурации

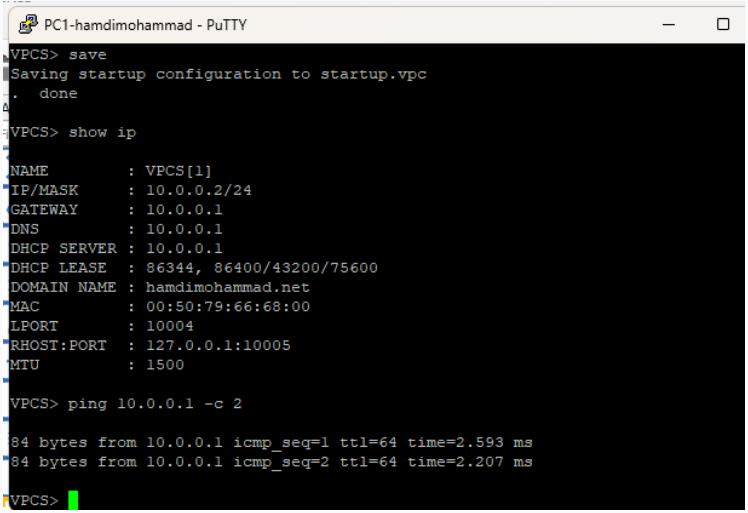


Рис. 5: IP-адресация PC1

DHCPv4 leases и лог

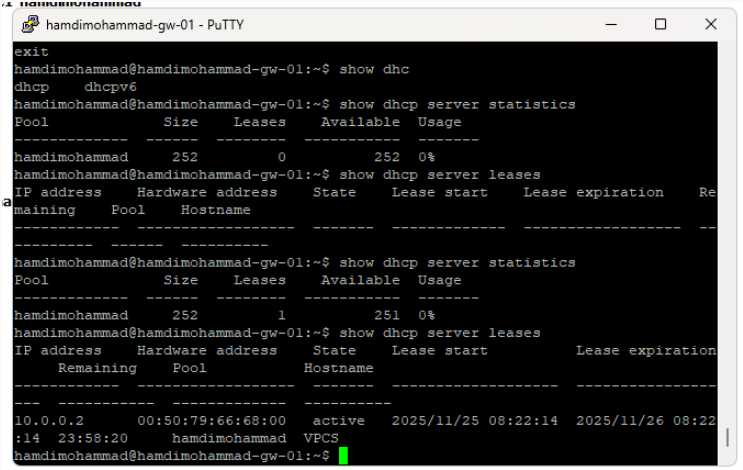


Рис. 6: Журнал и статистика DHCP

Процесс выдачи адреса

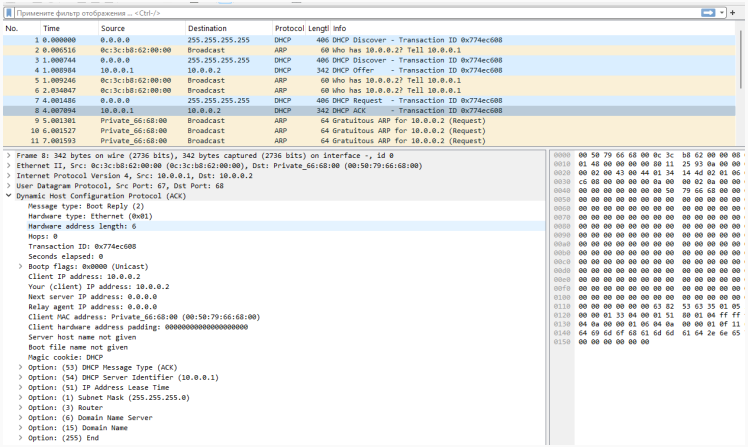


Рис. 7: DHCP трафик

Топология сети

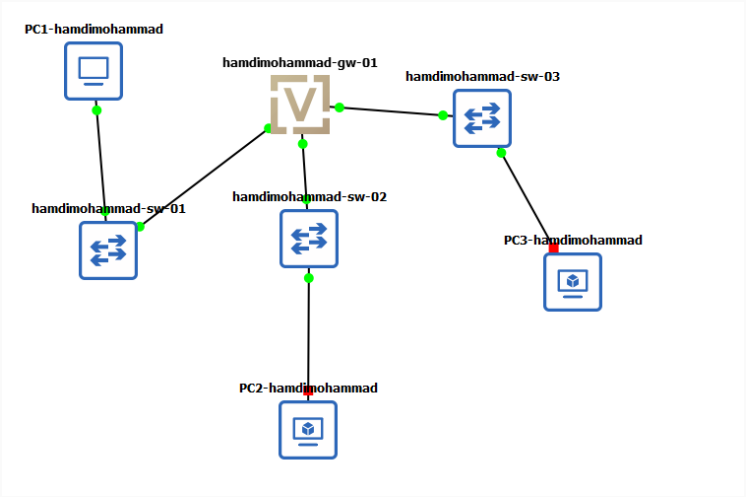


Рис. 8: Топология IPv6

Настройка интерфейсов IPv6

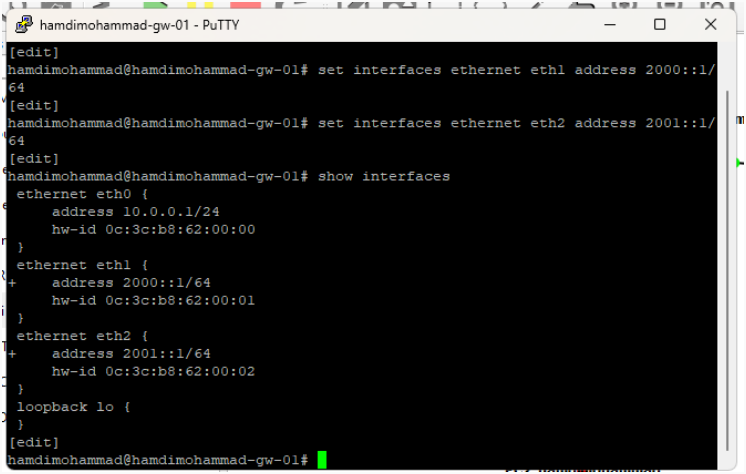


Рис. 9: IPv6 интерфейсы на VyOS

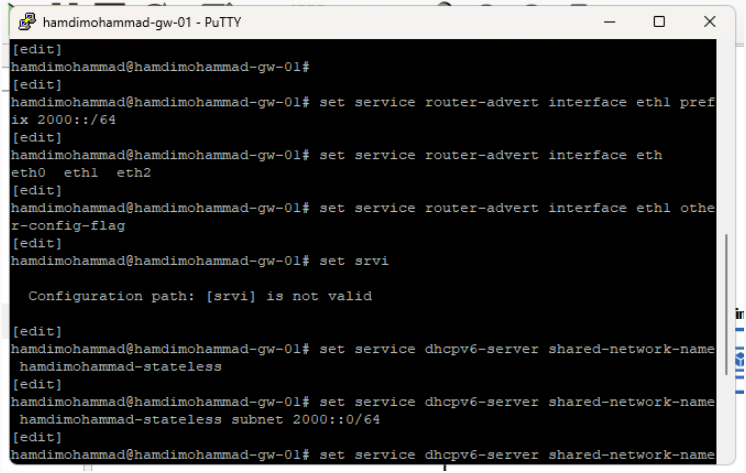
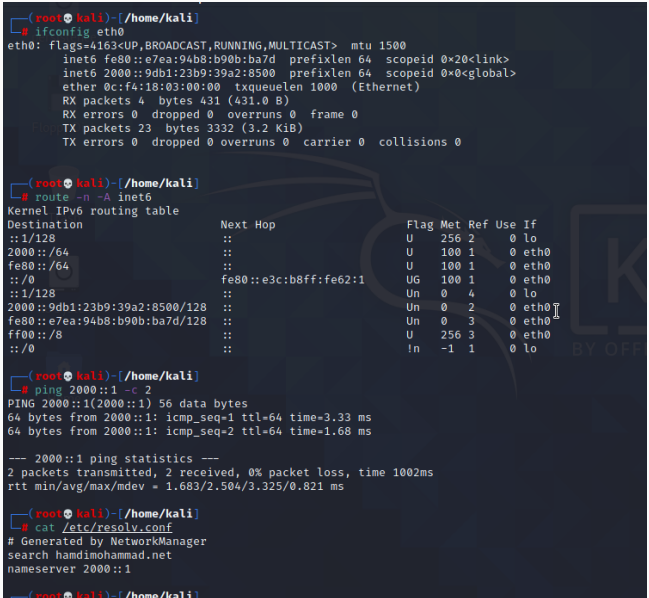


Рис. 10: DHCPv6 Stateless

SLAAC-адресация клиента PC2



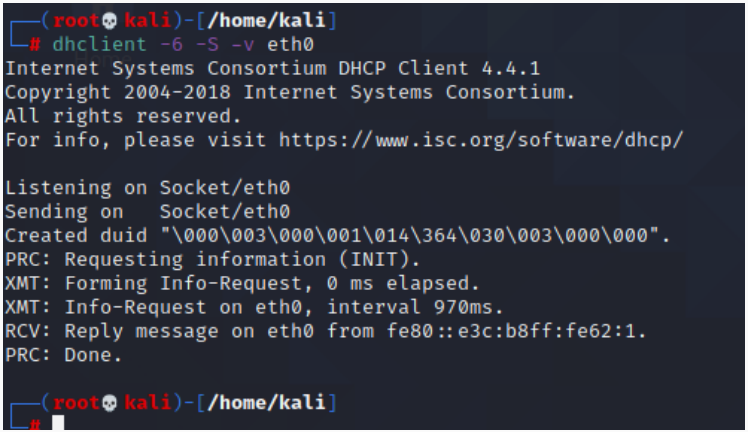


Рис. 12: DHCPv6 запрос параметров

Проверка DNS и связности

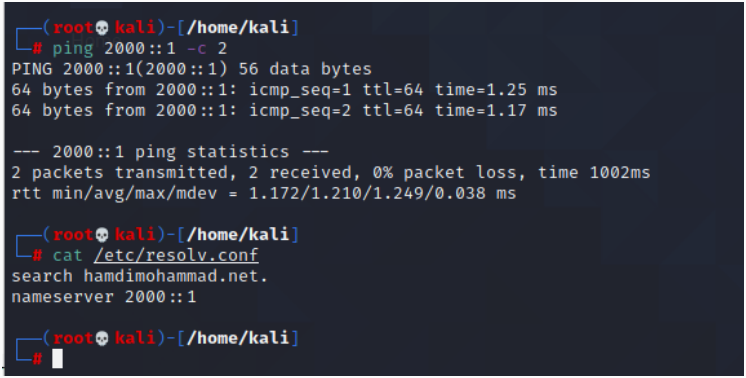


Рис. 13: Параметры после DHCPv6

Логи сервера

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

Рис. 14: DHCPv6 leases (stateless)

Wireshark-анализ

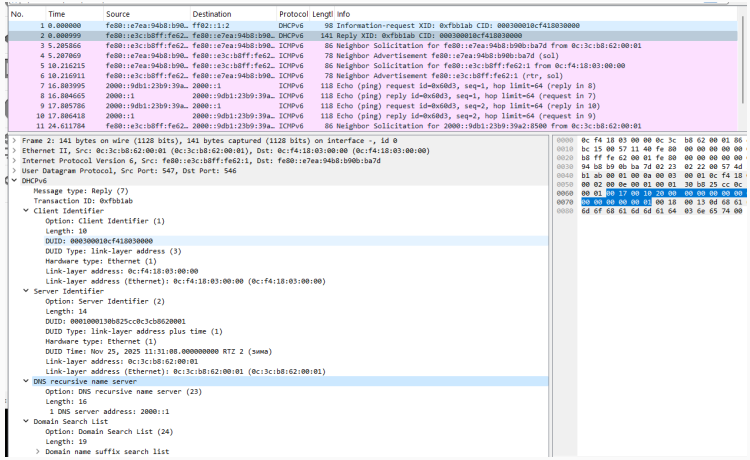


Рис. 15: DHCPv6 Wireshark

Конфигурация сети на VyOS

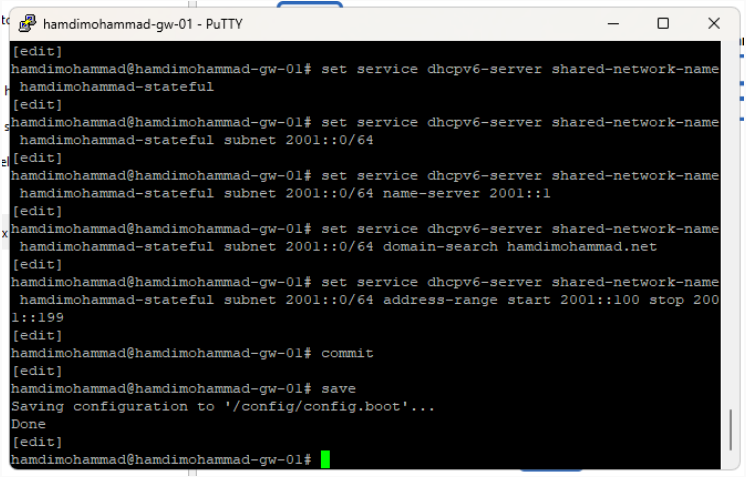


Рис. 16: DHCPv6 Stateful настройки

Начальное состояние интерфейса

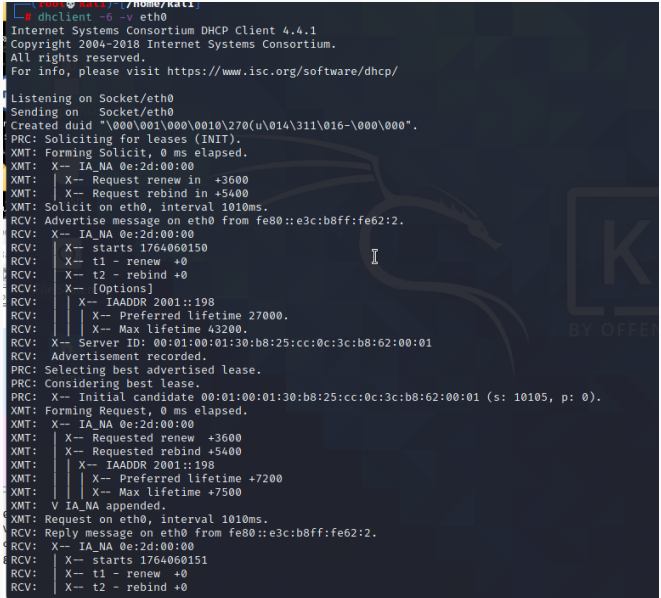
```
┌──(root💀kali)-[/home/kali]
└─# ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet6 fe80::f49f:d8df:d178:42c9  prefixlen 64  scopeid 0x20<link>
        inet6 2001::199  prefixlen 128  scopeid 0x0<global>
        ether 0c:c9:0e:2d:00:00  txqueuelen 1000  (Ethernet)
        RX packets 5  bytes 636 (636.0 B)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 24  bytes 3734 (3.6 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0


┌──(root💀kali)-[/home/kali]
└─# route -n -A inet6
Kernel IPv6 routing table
Destination                    Next Hop                   Flag Met Ref Use If
::1/128                        ::                         U    256 2     0 lo
2001::199/128                  ::                         U    100 1     0 eth0
fe80::/64                      ::                         U    100 1     0 eth0
::/0                           fe80::e3c:b8ff:fe62:2      UG   100 1     0 eth0
::1/128                        ::                         Un   0   4     0 lo
2001::199/128                  ::                         Un   0   2     0 eth0
fe80::f49f:d8df:d178:42c9/128  ::                         Un   0   3     0 eth0
ff00::/8                       ::                         U    256 3     0 eth0
::/0                           ::                         !n   -1  1     0 lo

┌──(root💀kali)-[/home/kali]
└─# cat /etc/resolv.conf
# Generated by NetworkManager
search hamdimohammad.net
nameserver 2001::1

┌──(root💀kali)-[/home/kali]
└─#
```

Получение адреса по DHCPv6



Конфигурация интерфейса и DNS

```
┌──(root💀kali)-[/home/kali]
└─# ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet6 fe80::f49f:d8df:d178:42c9  prefixlen 64  scopeid 0x20<link>
        inet6 2001::198  prefixlen 128  scopeid 0x0<global>
        inet6 2001::199  prefixlen 128  scopeid 0x0<global>
        ether 0c:c9:0e:2d:00:00  txqueuelen 1000  (Ethernet)
        RX packets 9  bytes 1178 (1.1 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 32  bytes 4850 (4.7 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

┌──(root💀kali)-[/home/kali]
└─# route -n -A inet6
Kernel IPv6 routing table
Destination                    Next Hop                   Flag Met Ref Use If
::1/128                        ::                         U    256 2     0 lo
2001::198/128                  ::                         U    256 1     0 eth0
2001::199/128                  ::                         U    100 2     0 eth0
fe80::/64                      ::                         U    100 1     0 eth0
::/0                           fe80::e3c:b8ff:fe62:2      UG   100 1     0 eth0
::1/128                        ::                         Un   0   4     0 lo
2001::198/128                  ::                         Un   0   2     0 eth0
2001::199/128                  ::                         Un   0   3     0 eth0
fe80::f49f:d8df:d178:42c9/128  ::                         Un   0   3     0 eth0
ff00::/8                       ::                         U    256 3     0 eth0
::/0                           ::                         !n   -1  1     0 lo

┌──(root💀kali)-[/home/kali]
└─# ping 2001::1 -c 2
PING 2001::1(2001::1) 56 data bytes
64 bytes from 2001::1: icmp_seq=1 ttl=64 time=2.51 ms
64 bytes from 2001::1: icmp_seq=2 ttl=64 time=4.18 ms

--- 2001::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 2.505/3.342/4.179/0.837 ms

┌──(root💀kali)-[/home/kali]
└─#
```

Активные leases

```
hamdimohammad@hamdimohammad-gw-01# run show dhcpv6 server leases
IPv6 address    State    Last communication    Lease expiration     Remaining
 Type           Pool                     IAID_DUID
--------------  -------  -------------------  -------------------  -----------
 -------------  ---------------------  ------------------------------------
-------------------------
2001::198       active   2025/11/25 08:42:28   2025/11/25 10:47:28  2:03:10
 non-temporary  hamdimohammad-stateful  00:00:2d:0e:00:01:00:01:30:b8:28:75:0c:c
9:0e:2d:00:00
2001::199       active   2025/11/25 08:39:51   2025/11/25 20:39:51  11:55:33
 non-temporary  hamdimohammad-stateful  35:67:50:2b:00:04:6e:07:bc:6c:79:6f:e5:8
c:ee:ba:d9:f1:2e:ea:9e:63
[edit]
hamdimohammad@hamdimohammad-gw-01#
```

Рис. 20: DHCPv6 Stateful leases

Анализ Wireshark

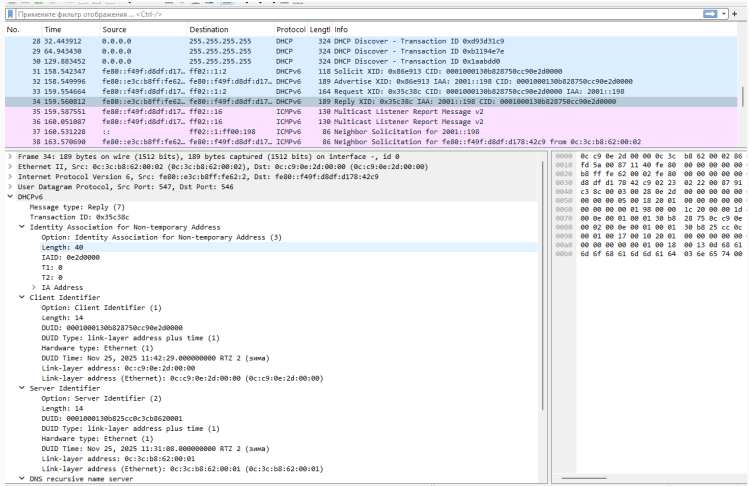


Рис. 21: Анализ Stateful DHCPv6

Заключение

Основные результаты

- Настроены три механизма автоматической адресации:
  - DHCPv4
  - DHCPv6 Stateless
  - DHCPv6 Stateful
- Реализована работа с RA, SLAAC и DHCPv6-параметрами.
- Клиенты корректно получили IPv4/IPv6-адреса и параметры DNS.
- Трафик DHCP и ICMP был подробно проанализирован в Wireshark.
- Конфигурация сети подтверждена функционирующей связностью.