

# Сетевые технологии

## Настройка DHCP для IPv4 и IPv6 в GNS3

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## Цель работы

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

## Ход выполнения

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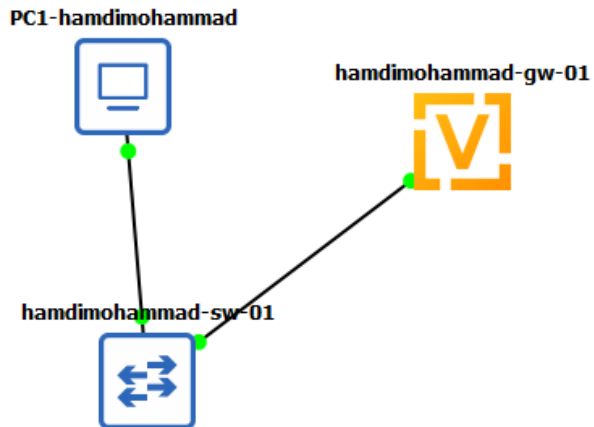
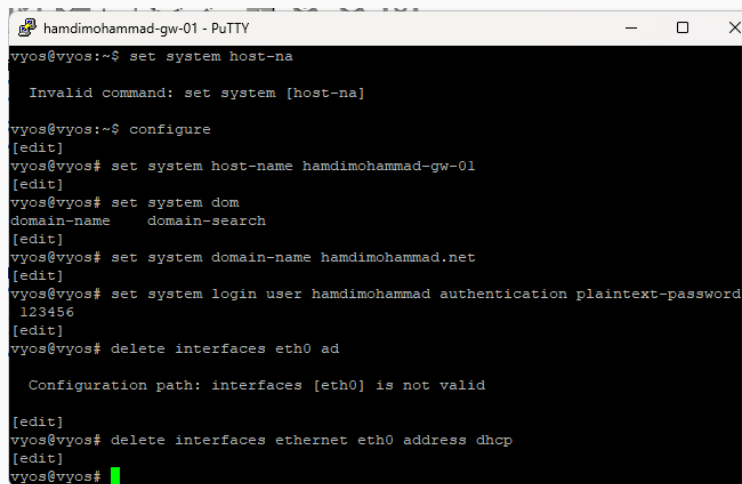


Рис. 1: Топология сети



```
hamdimohammad-gw-01 - PuTTY
vyos@vyos:~$ set system host-na

Invalid command: set system [host-na]

vyos@vyos:~$ configure
[edit]
vyos@vyos# set system host-name hamdimohammad-gw-01
[edit]
vyos@vyos# set system dom
domain-name      domain-search
[edit]
vyos@vyos# set system domain-name hamdimohammad.net
[edit]
vyos@vyos# set system login user hamdimohammad authentication plaintext-password
123456
[edit]
vyos@vyos# delete interfaces eth0 ad

Configuration path: interfaces [eth0] is not valid

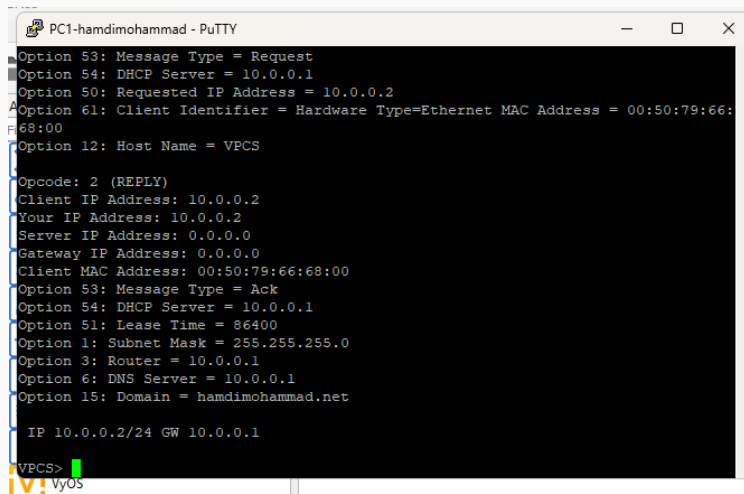
[edit]
vyos@vyos# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@vyos#
```

Рис. 2: Системные параметры VyOS

```
hamdimohammad@hamdimohammad-gw-01:~$ configure
[edit]
hamdimohammad@hamdimohammad-gw-01# set interfaces ethernet eth0 address 10.0.0.1
/24
[edit]
hamdimohammad@hamdimohammad-gw-01# set service dhcp-server shared-network-name h
amdihomammad domain-name hamdimohammad.net
[edit]
hamdimohammad@hamdimohammad-gw-01# set service dhcp-server shared-network-name h
amdihomammad name-server 10.0.0.1
[edit]
hamdimohammad@hamdimohammad-gw-01# set service dhcp-server shared-network-name h
amdihomammad subnet 10.0.0.0/24 default-router 10.0.0.1
[edit]
hamdimohammad@hamdimohammad-gw-01# set service dhcp-server shared-network-name h
amdihomammad subnet 10.0.0.0/24 range hosts start 10.0.0.2
[edit]
hamdimohammad@hamdimohammad-gw-01# set service dhcp-server shared-network-name h
amdihomammad subnet 10.0.0.0/24 range hosts stop 10.0.0.253
[edit]
hamdimohammad@hamdimohammad-gw-01# commit
```

Рис. 3: Настройка DHCPv4

## Получение IPv4-адреса



The screenshot shows a PuTTY terminal window titled "PC1-hamdimoammad - PuTTY". The terminal displays the details of a DHCP request and its corresponding reply. The request (Option 53: Message Type = Request) includes the DHCP Server (10.0.0.1), Requested IP Address (10.0.0.2), Client Identifier (Hardware Type=Ethernet MAC Address = 00:50:79:66:68:00), and Host Name (VPCS). The reply (Opcode: 2 (REPLY)) provides the 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), and various options including Ack (Option 53), Lease Time (Option 51: 86400), Subnet Mask (Option 1: 255.255.255.0), Router (Option 3: 10.0.0.1), DNS Server (Option 6: 10.0.0.1), and Domain (Option 15: hamdimohammad.net). The final line shows the assigned IP and gateway: "IP 10.0.0.2/24 GW 10.0.0.1". The prompt "VPCS>" is visible at the bottom left.

```
PC1-hamdimoammad - PuTTY
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 = 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 = hamdimohammad.net

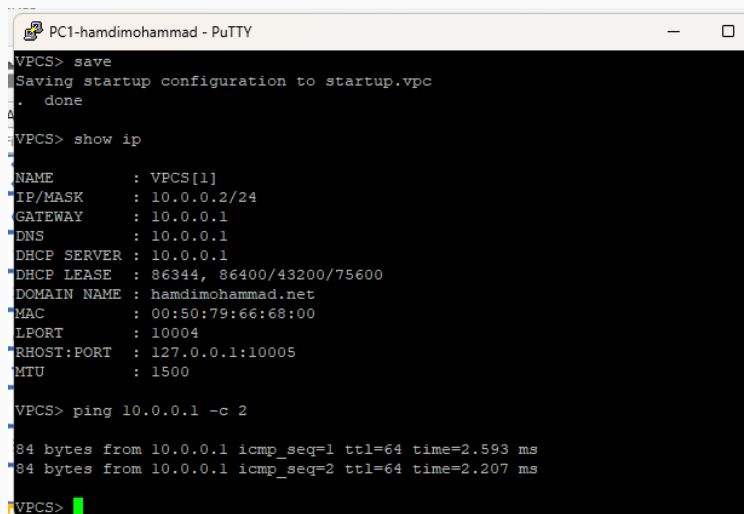
IP 10.0.0.2/24 GW 10.0.0.1

VPCS>
```

Рис. 4: Получение адреса по DHCP



## Проверка конфигурации



```
PC1-hamdihammad - PuTTY
VPCS> save
Saving startup configuration to startup.vpc
. done

VPCS> show ip

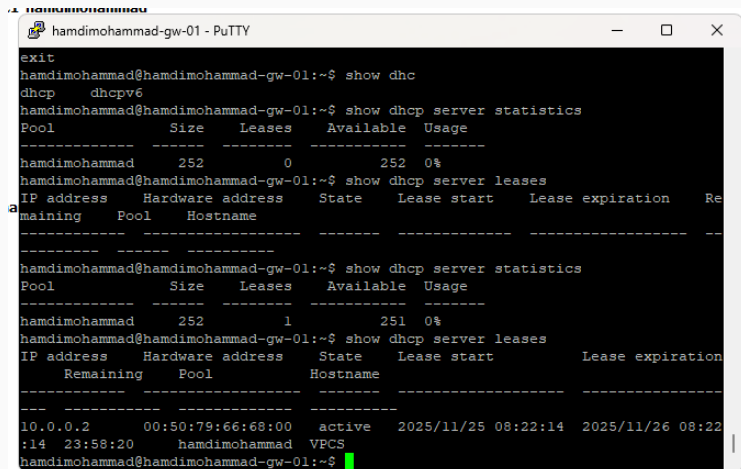
NAME       : VPCS[1]
IP/MASK     : 10.0.0.2/24
GATEWAY     : 10.0.0.1
DNS         : 10.0.0.1
DHCP SERVER : 10.0.0.1
DHCP LEASE  : 86344, 86400/43200/75600
DOMAIN NAME : hamdimohammad.net
MAC         : 00:50:79:66:68:00
LPORT      : 10004
RHOST:PORT  : 127.0.0.1:10005
MTU         : 1500

VPCS> ping 10.0.0.1 -c 2

84 bytes from 10.0.0.1 icmp_seq=1 ttl=64 time=2.593 ms
84 bytes from 10.0.0.1 icmp_seq=2 ttl=64 time=2.207 ms

VPCS>
```

Рис. 5: IP-адресация PC1



The screenshot shows a PuTTY terminal window titled "hamdimohammad-gw-01 - PuTTY". The user has entered the command "show dhcp" and received the output "dhcp dhcpv6". Then, the user entered "show dhcp server statistics" and received a table showing the DHCP pool status. The pool is named "hamdimohammad", has a size of 252, 0 leases, and 252 available addresses, with 0% usage. Next, the user entered "show dhcp server leases" and received a table showing the DHCP leases. The table has columns for IP address, Hardware address, State, Lease start, Lease expiration, and Remaining. The first row shows a lease for IP address 10.0.0.2, Hardware address 00:50:79:66:68:00, State active, Lease start 2025/11/25 08:22:14, Lease expiration 2025/11/26 08:22:14, and Remaining 23:58:20. The user has entered the command "show dhcp server leases" again, and the output is the same as before.

```
exit
hamdimohammad@hamdimohammad-gw-01:~$ show dhcp
dhcp dhcpv6
hamdimohammad@hamdimohammad-gw-01:~$ show dhcp server statistics
Pool          Size    Leases    Available  Usage
-----
hamdimohammad 252      0         252        0%
hamdimohammad@hamdimohammad-gw-01:~$ show dhcp server leases
IP address    Hardware address  State    Lease start    Lease expiration  Re
maining      Pool             Hostname
-----
hamdimohammad@hamdimohammad-gw-01:~$ show dhcp server statistics
Pool          Size    Leases    Available  Usage
-----
hamdimohammad 252      1         251        0%
hamdimohammad@hamdimohammad-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    2025/11/25 08:22:14 2025/11/26 08:22
:14 23:58:20    hamdimohammad VPCS
hamdimohammad@hamdimohammad-gw-01:~$
```

Рис. 6: Журнал и статистика DHCP

# Процесс выдачи адреса

Примените фильтр отображения ... <Ctrl-/>						
No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	0.0.0.0	255.255.255.255	DHCP	406	DHCP Discover - Transaction ID 0x774ec608
2	0.000516	0c:3c:b8:62:00:00	Broadcast	ARP	60	Who has 10.0.0.2? Tell 10.0.0.1
3	1.000744	0.0.0.0	255.255.255.255	DHCP	406	DHCP Discover - Transaction ID 0x774ec608
4	1.000984	10.0.0.1	10.0.0.2	DHCP	342	DHCP Offer - Transaction ID 0x774ec608
5	1.0009246	0c:3c:b8:62:00:00	Broadcast	ARP	60	Who has 10.0.0.2? Tell 10.0.0.1
6	2.034847	0c:3c:b8:62:00:00	Broadcast	ARP	60	Who has 10.0.0.2? Tell 10.0.0.1
7	4.001486	0.0.0.0	255.255.255.255	DHCP	406	DHCP Request - Transaction ID 0x774ec608
8	4.007894	10.0.0.1	10.0.0.2	DHCP	342	DHCP ACK - Transaction ID 0x774ec608
9	5.001301	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 10.0.0.2 (Request)
10	6.001527	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 10.0.0.2 (Request)
11	7.001593	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 10.0.0.2 (Request)

> Frame 8: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface -, id 0

> Ethernet II, Src: 0c:3c:b8:62:00:00 (0c:3c:b8:62:00:00), Dst: Private\_66:68:00 (00:50:79:66:68:00)

> Internet Protocol Version 4, Src: 10.0.0.1, Dst: 10.0.0.2

> User Datagram Protocol, Src Port: 67, Dst Port: 68

> Dynamic Host Configuration Protocol (ACK)

Message type: Boot Reply (2)

Hardware type: Ethernet (0x01)

Hardware address length: 6

Hops: 0

Transaction ID: 0x774ec608

Seconds elapsed: 0

> Bootp flags: 0x0000 (Unicast)

Client IP address: 10.0.0.2

Your (client) IP address: 10.0.0.2

Next server IP address: 0.0.0.0

Relay agent IP address: 0.0.0.0

Client MAC address: Private\_66:68:00 (00:50:79:66:68:00)

Client hardware address padding: 00000000000000000000

Server host name not given

Boot file name not given

Magic cookie: DHCP

> Option: (53) DHCP Message Type (ACK)

> Option: (54) DHCP Server Identifier (10.0.0.1)

> Option: (51) IP Address Lease Time

> Option: (1) Subnet Mask (255.255.255.0)

> Option: (3) Router

> Option: (6) Domain Name Server

> Option: (15) Domain Name

> Option: (255) End

0000 00 50 79 66 68 00 0c 3c b8 62 00 00 00  
0010 01 48 00 00 00 00 11 25 93 0a 00 00  
0020 00 02 00 43 00 44 01 34 14 4d 02 01 06  
0030 c5 08 00 00 00 00 0a 00 00 82 0a 00 00  
0040 00 00 00 00 00 00 50 79 66 68 00 00  
0050 00 00 00 00 00 00 00 00 00 00 00 00  
0060 00 00 00 00 00 00 00 00 00 00 00 00  
0070 00 00 00 00 00 00 00 00 00 00 00 00  
0080 00 00 00 00 00 00 00 00 00 00 00 00  
0090 00 00 00 00 00 00 00 00 00 00 00 00  
00a0 00 00 00 00 00 00 00 00 00 00 00 00  
00b0 00 00 00 00 00 00 00 00 00 00 00 00  
00c0 00 00 00 00 00 00 00 00 00 00 00 00  
00d0 00 00 00 00 00 00 00 00 00 00 00 00  
00e0 00 00 00 00 00 00 00 00 00 00 00 00  
00f0 00 00 00 00 00 00 00 00 00 00 00 00  
0100 00 00 00 00 00 00 00 00 00 00 00 00  
0110 00 00 00 00 00 63 82 53 63 35 01 05  
0120 00 00 01 33 04 00 01 51 00 01 04 ff ff  
0130 04 0a 00 00 01 06 04 0a 00 00 01 0f 11  
0140 64 69 6d 6f 68 61 6d 6d 61 64 2e 66 65  
0150 00 00 00 00 00 00

Рис. 7: DHCP трафик

9/24

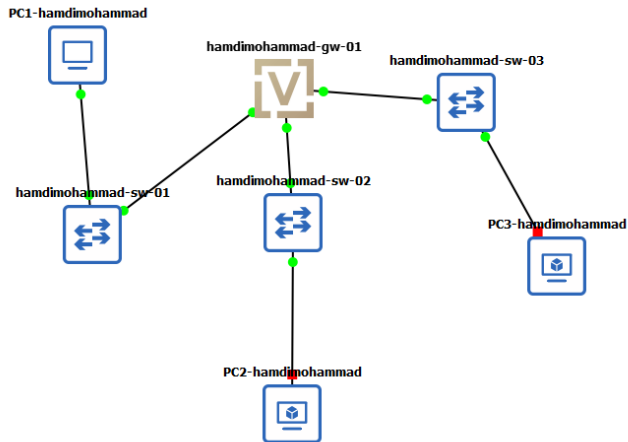
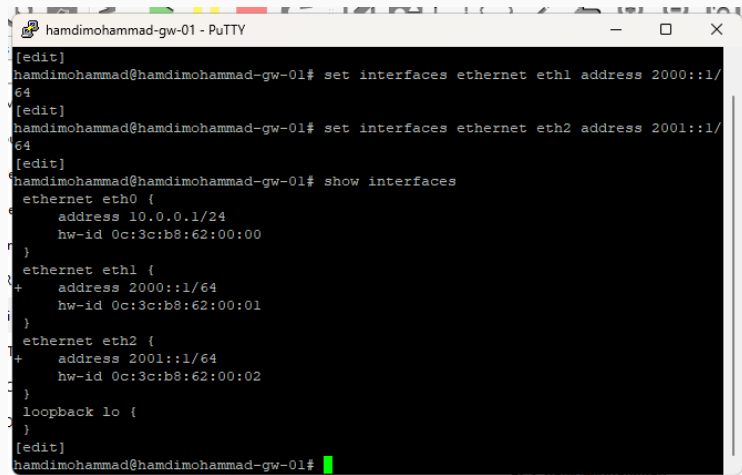


Рис. 8: Топология IPv6

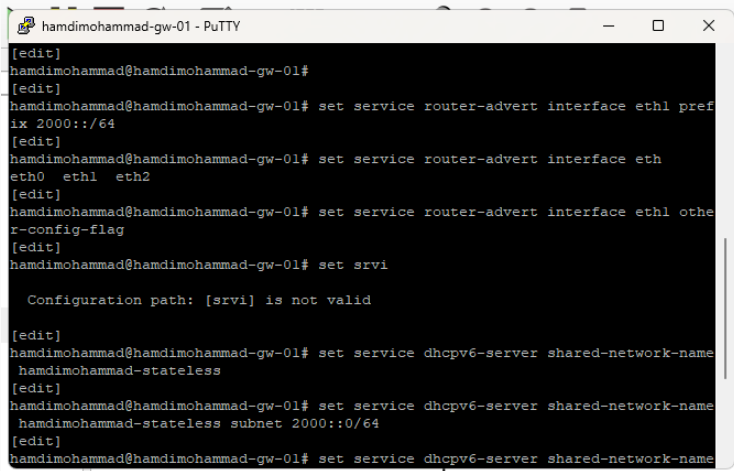
## Настройка интерфейсов IPv6



The image shows a PuTTY terminal window titled "hamdimohammad-gw-01 - PuTTY". The terminal displays the following commands and output:

```
[edit]
hamdimohammad@hamdimohammad-gw-01# set interfaces ethernet eth1 address 2000::1/64
[edit]
hamdimohammad@hamdimohammad-gw-01# set interfaces ethernet eth2 address 2001::1/64
[edit]
hamdimohammad@hamdimohammad-gw-01# show interfaces
  ethernet eth0 {
    address 10.0.0.1/24
    hw-id 0c:3c:b8:62:00:00
  }
  ethernet eth1 {
+   address 2000::1/64
    hw-id 0c:3c:b8:62:00:01
  }
  ethernet eth2 {
+   address 2001::1/64
    hw-id 0c:3c:b8:62:00:02
  }
  loopback lo {
  }
[edit]
hamdimohammad@hamdimohammad-gw-01#
```

Рис. 9: IPv6 интерфейсы на VyOS



```
hamdimohammad-gw-01 - PuTTY
[edit]
hamdimohammad@hamdimohammad-gw-01#
[edit]
hamdimohammad@hamdimohammad-gw-01# set service router-advert interface eth1 prefix 2000::/64
[edit]
hamdimohammad@hamdimohammad-gw-01# set service router-advert interface eth0 eth1 eth2
[edit]
hamdimohammad@hamdimohammad-gw-01# set service router-advert interface eth1 other-config-flag
[edit]
hamdimohammad@hamdimohammad-gw-01# set srvi

Configuration path: [srvi] is not valid

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

Рис. 10: DHCPv6 Stateless

## SLAAC-адресация клиента PC2

```
(root@kali)~[/home/kali]
# ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::e7ea:94b8:b90b:ba7d prefixlen 64 scopeid 0x20<link>
    inet6 2000::9db1:23b9:39a2:8500 prefixlen 64 scopeid 0x0<global>
    ether 0c:f4:18:03:00:00 txqueuelen 1000 (Ethernet)
    RX packets 4 bytes 431 (431.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 23 bytes 3332 (3.2 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
2000::/64	::	U	100	1	0	eth0
fe80::/64	::	U	100	1	0	eth0
::/0	fe80::e3c:b8ff:fe62:1	UG	100	1	0	eth0
::1/128	::	Un	0	4	0	lo
2000::9db1:23b9:39a2:8500/128	::	Un	0	2	0	eth0
fe80::e7ea:94b8:b90b:ba7d/128	::	Un	0	3	0	eth0
ff00::/8	::	U	256	3	0	eth0
::/0	::	!n	-1	1	0	lo

```
(root@kali)~[/home/kali]
# ping 2000::1 -c 2
PING 2000::1(2000::1) 56 data bytes
64 bytes from 2000::1: icmp_seq=1 ttl=64 time=3.33 ms
64 bytes from 2000::1: icmp_seq=2 ttl=64 time=1.68 ms

--- 2000::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 1.683/2.504/3.325/0.821 ms

(root@kali)~[/home/kali]
# cat /etc/resolv.conf
# Generated by NetworkManager
search hamdimohammad.net
nameserver 2000::1

(root@kali)~[/home/kali]
```

## DHCPv6 Information-Request

```
(root@kali)-[/home/kali]
# dhclient -6 -S -v eth0
Internet Systems Consortium DHCP Client 4.4.1
Copyright 2004-2018 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\014\364\030\003\000\000".
PRC: Requesting information (INIT).
XMT: Forming Info-Request, 0 ms elapsed.
XMT: Info-Request on eth0, interval 970ms.
RCV: Reply message on eth0 from fe80::e3c:b8ff:fe62:1.
PRC: Done.

(root@kali)-[/home/kali]
#
```

Рис. 12: DHCPv6 запрос параметров



```
(root@kali)-[/home/kali]
# ping 2000::1 -c 2
PING 2000::1(2000::1) 56 data bytes
64 bytes from 2000::1: icmp_seq=1 ttl=64 time=1.25 ms
64 bytes from 2000::1: icmp_seq=2 ttl=64 time=1.17 ms

--- 2000::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 1.172/1.210/1.249/0.038 ms

(root@kali)-[/home/kali]
# cat /etc/resolv.conf
search hamdimohammad.net.
nameserver 2000::1

(root@kali)-[/home/kali]
#
```

Рис. 13: Параметры после DHCPv6

```
[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#
```

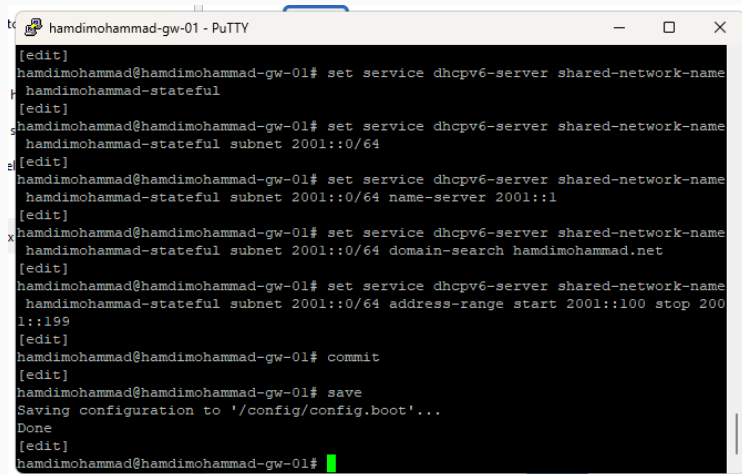
Рис. 14: DHCPv6 leases (stateless)

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	fe80::e7ea:94b8:b90...	ff02::1:2	DHCPv6	98	Information-request XID: 0xfbb1ab CID: 000300010cf418030000
2	0.000999	fe80::e3c:b8ff:fe62...	fe80::e7ea:94b8:b90...	DHCPv6	141	Reply XID: 0xfbb1ab CID: 000300010cf418030000
3	5.205865	fe80::e3c:b8ff:fe62...	fe80::e7ea:94b8:b90...	ICMPv6	86	Neighbor Solicitation for fe80::e7ea:94b8:b90:ba7d from 0c:f4:18:03:00:01
4	5.207869	fe80::e7ea:94b8:b90...	fe80::e3c:b8ff:fe62...	ICMPv6	78	Neighbor Advertisement fe80::e7ea:94b8:b90:ba7d (sol)
5	0.216215	fe80::e7ea:94b8:b90...	fe80::e3c:b8ff:fe62...	ICMPv6	86	Neighbor Solicitation for fe80::e3c:b8ff:fe62:1 from 0c:f4:18:03:00:00
6	0.216911	fe80::e3c:b8ff:fe62...	fe80::e7ea:94b8:b90...	ICMPv6	78	Neighbor Advertisement fe80::e3c:b8ff:fe62:1 (rtr, sol)
7	16.883995	2000::9db1:23b9:39a...	2000::1	ICMPv6	118	Echo (ping) request id=0x60d3, seq=1, hop limit=64 (reply in 8)
8	16.884655	2000::1	2000::9db1:23b9:39a...	ICMPv6	118	Echo (ping) reply id=0x60d3, seq=1, hop limit=64 (request in 7)
9	17.885786	2000::9db1:23b9:39a...	2000::1	ICMPv6	118	Echo (ping) request id=0x60d3, seq=2, hop limit=64 (reply in 10)
10	17.886418	2000::1	2000::9db1:23b9:39a...	ICMPv6	118	Echo (ping) reply id=0x60d3, seq=2, hop limit=64 (request in 9)
11	24.611784	fe80::e3c:b8ff:fe62...	2000::9db1:23b9:39a...	ICMPv6	86	Neighbor Solicitation for 2000::9db1:23b9:39a2:8500 from 0c:f4:18:03:00:01

> Frame 2: 141 bytes on wire (1128 bits), 141 bytes captured (1128 bits) on interface -, id 0	0000	0c f4 18 03 00 00 0c 3c b8 62 00 01 86
> Ethernet II, Src: 0c:f4:18:03:00:01 (0c:f4:18:03:00:01), Dst: 0c:f4:18:03:00:00 (0c:f4:18:03:00:00)	0010	bc 15 00 57 11 40 fe 80 00 00 00 00 00
> Internet Protocol Version 6, Src: fe80::e3c:b8ff:fe62:1, Dst: fe80::e7ea:94b8:b90:ba7d	0020	b8 ff fe 62 00 01 fe 80 00 00 00 00 00
> User Datagram Protocol, Src Port: 547, Dst Port: 546	0030	94 b8 b9 0b ba 7d 02 23 02 22 00 57 4d
> DHCPv6	0040	b1 ab 00 01 00 0a 00 03 00 01 0c f4 18
Message type: Reply (7)	0050	00 02 00 0e 00 01 00 01 30 b8 25 cc 0c
Transaction ID: 0xfbb1ab	0060	00 01 00 17 00 10 23 00 0c 3c b8 62 00
> Client Identifier	0070	00 00 00 00 01 00 18 00 13 8d 68 61
Option: Client Identifier (1)	0080	6d 6f 68 61 6d 6d 61 64 03 6e 65 74 00
Length: 10		
DUID: 000300010cf418030000		
DUID Type: link-layer address (3)		
Hardware type: Ethernet (1)		
Link-layer address: 0c:f4:18:03:00:00		
Link-layer address (Ethernet): 0c:f4:18:03:00:00 (0c:f4:18:03:00:00)		
> Server Identifier		
Option: Server Identifier (2)		
Length: 14		
DUID: 0001000130b825cc0c3cb0620001		
DUID Type: link-layer address plus time (1)		
Hardware type: Ethernet (1)		
DUID Time: Nov 25, 2025 11:31:08.000000000 RTZ 2 (suma)		
Link-layer address: 0c:f4:18:03:00:01		
Link-layer address (Ethernet): 0c:f4:18:03:00:01 (0c:f4:18:03:00:01)		
> DNS recursive name server		
Option: DNS recursive name server (23)		
Length: 16		
1 DNS server address: 2000::1		
> Domain Search List		
Option: Domain Search List (24)		
Length: 19		
> Domain name suffix search list		

Рис. 15: DHCPv6 Wireshark



```
hamdimohammad-gw-01 - PuTTY
[edit]
hamdimohammad@hamdimohammad-gw-01# set service dhcpv6-server shared-network-name
hamdimohammad-stateful
[edit]
hamdimohammad@hamdimohammad-gw-01# set service dhcpv6-server shared-network-name
hamdimohammad-stateful subnet 2001::0/64
[edit]
hamdimohammad@hamdimohammad-gw-01# set service dhcpv6-server shared-network-name
hamdimohammad-stateful subnet 2001::0/64 name-server 2001::1
[edit]
hamdimohammad@hamdimohammad-gw-01# set service dhcpv6-server shared-network-name
hamdimohammad-stateful subnet 2001::0/64 domain-search hamdimohammad.net
[edit]
hamdimohammad@hamdimohammad-gw-01# set service dhcpv6-server shared-network-name
hamdimohammad-stateful subnet 2001::0/64 address-range start 2001::100 stop 200
1::199
[edit]
hamdimohammad@hamdimohammad-gw-01# commit
[edit]
hamdimohammad@hamdimohammad-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
hamdimohammad@hamdimohammad-gw-01#
```

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

```
[root@kali:~/home/kali]# dhclient -6 -v eth0
Internet Systems Consortium DHCP Client 4.4.1
Copyright 2004-2018 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\270(u\014\311\016-\000\000)".
PRC: Soliciting for leases (INIT).
XMT: Forming Solicit, 0 ms elapsed.
XMT: X-- IA_NA 0e:2d:00:00
XMT: | X-- Request renew in +3600
XMT: | X-- Request rebind in +5400
XMT: Solicit on eth0, interval 1010ms.
RCV: Advertise message on eth0 from fe80::e3c:b8ff:fe62:2.
RCV: X-- IA_NA 0e:2d:00:00
RCV: | X-- starts 1764060150
RCV: | X-- t1 - renew +0
RCV: | X-- t2 - rebind +0
RCV: | X-- [Options]
RCV: | | X-- IAADDR 2001::198
RCV: | | X-- Preferred lifetime 27000.
RCV: | | X-- Max lifetime 43200.
RCV: X-- Server ID: 00:01:00:01:30:b8:25:cc:0c:3c:b8:62:00:01
RCV: Advertisement recorded.
PRC: Selecting best advertised lease.
PRC: Considering best lease.
PRC: X-- Initial candidate 00:01:00:01:30:b8:25:cc:0c:3c:b8:62:00:01 (s: 10105, p: 0).
XMT: Forming Request, 0 ms elapsed.
XMT: X-- IA_NA 0e:2d:00:00
XMT: | X-- Requested renew +3600
XMT: | X-- Requested rebind +5400
XMT: | | X-- IAADDR 2001::198
XMT: | | X-- Preferred lifetime +7200
XMT: | | X-- Max lifetime +7500
XMT: V IA_NA appended.
XMT: Request on eth0, interval 1010ms.
RCV: Reply message on eth0 from fe80::e3c:b8ff:fe62:2.
RCV: X-- IA_NA 0e:2d:00:00
RCV: | X-- starts 1764060151
RCV: | X-- t1 - renew +0
RCV: | X-- t2 - rebind +0
```

# 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

Trash

(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]
#
```

```
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



Примените фильтр отображения: <Ctrl>/

No.	Time	Source	Destination	Protocol	Length	Info
28	32.443912	0.0.0.0	255.255.255.255	DHCP	324	DHCP Discover - Transaction ID 0xd93d31c9
29	64.943430	0.0.0.0	255.255.255.255	DHCP	324	DHCP Discover - Transaction ID 0xb1194e7e
30	129.883452	0.0.0.0	255.255.255.255	DHCP	324	DHCP Discover - Transaction ID 0x1aabd0
31	158.542347	fe80::f49f:d8df:d17::ff02::1:2	ff02::1:2	DHCPv6	118	Solicit XID: 0x86e913 CID: 0001000130b828750cc90e2d0000
32	158.549996	fe80::e3c:b8ff:fe62::fe80::f49f:d8df:d17::ff02::1:2	ff02::1:2	DHCPv6	189	Advertise XID: 0x86e913 IAA: 2001::198 CID: 0001000130b828750cc90e2d0000
33	159.554664	fe80::f49f:d8df:d17::ff02::1:2	ff02::1:2	DHCPv6	164	Request XID: 0x35c38c CID: 0001000130b828750cc90e2d0000 IAA: 2001::198
34	159.560812	fe80::e3c:b8ff:fe62::fe80::f49f:d8df:d17::ff02::1:2	ff02::1:2	DHCPv6	189	Reply XID: 0x35c38c IAA: 2001::198 CID: 0001000130b828750cc90e2d0000
35	159.587551	fe80::f49f:d8df:d17::ff02::1:6	ff02::1:6	ICMPv6	130	Multicast Listener Report Message v2
36	160.051087	fe80::f49f:d8df:d17::ff02::1:6	ff02::1:6	ICMPv6	130	Multicast Listener Report Message v2
37	160.531228	::	ff02::1:ff00:198	ICMPv6	86	Neighbor Solicitation for 2001::198
38	163.579690	fe80::e3c:b8ff:fe62::fe80::f49f:d8df:d17::ff02::1:6	ff02::1:6	ICMPv6	86	Neighbor Solicitation for fe80::f49f:d8df:d17:42c9 from 0c:3c:b8:62:00:02

> Frame 34: 189 bytes on wire (1512 bits), 189 bytes captured (1512 bits) on interface -, id 0

> Ethernet II, Src: 0c:3c:b8:62:00:02 (0c:3c:b8:62:00:02), Dst: 0c:c9:0e:2d:00:00 (0c:c9:0e:2d:00:00)

> Internet Protocol Version 6, Src: fe80::e3c:b8ff:fe62::fe80::f49f:d8df:d17:42c9

> User Datagram Protocol, Src Port: 547, Dst Port: 546

▼ DHCPv6

Message type: Reply (7)

Transaction ID: 0x35c38c

▼ Identity Association for Non-temporary Address

Option: Identity Association for Non-temporary Address (3)

Length: 40

IAID: 0e2d0000

T1: 0

T2: 0

> IA Address

▼ Client Identifier

Option: Client Identifier (1)

Length: 14

DUID: 0001000130b828750cc90e2d0000

DUID Type: link-layer address plus time (1)

Hardware type: Ethernet (1)

DUID Time: Nov 25, 2025 11:42:29.000000000 RTZ 2 (sma)

Link-layer address: 0c:c9:0e:2d:00:00

Link-layer address (Ethernet): 0c:c9:0e:2d:00:00 (0c:c9:0e:2d:00:00)

▼ Server Identifier

Option: Server Identifier (2)

Length: 14

DUID: 0001000130b825cc0c3b8620001

DUID Type: link-layer address plus time (1)

Hardware type: Ethernet (1)

DUID Time: Nov 25, 2025 11:31:00.000000000 RTZ 2 (sma)

Link-layer address: 0c:3c:b8:62:00:01

Link-layer address (Ethernet): 0c:3c:b8:62:00:01 (0c:3c:b8:62:00:01)

▼ DNS recursive name server

Рис. 21: Анализ Stateful DHCPv6

## Заключение

---

- 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.