

Сетевые технологии

DHCP для IPv4 и IPv6 в GNS3 (Лабораторная работа №7)

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Цель лабораторной работы

Получить практические навыки настройки DHCP для: - IPv4

- IPv6 (Stateless и Stateful)

с использованием маршрутизатора **VyOS** и среды моделирования **GNS3**.

Выполнение работы

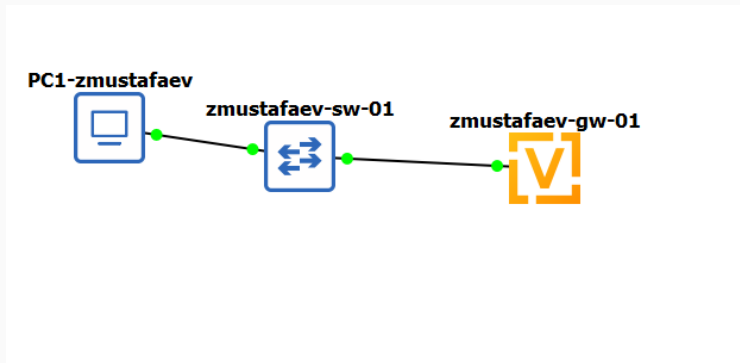
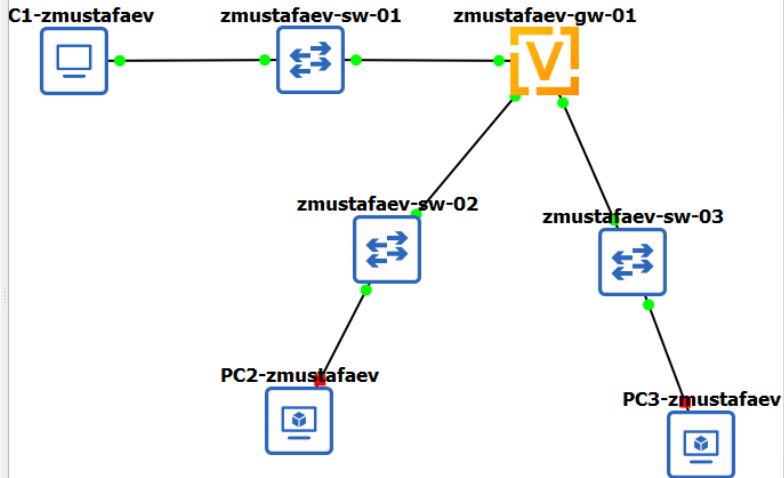
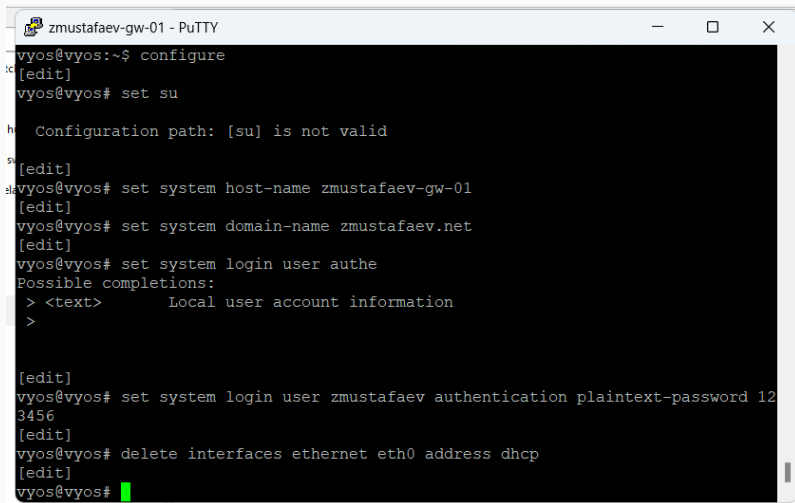


Рис. 1: Топология IPv4



Начальная конфигурация маршрутизатора



```
zmustafaev-gw-01 - PuTTY
vyos@vyos:~$ configure
[edit]
vyos@vyos# set su

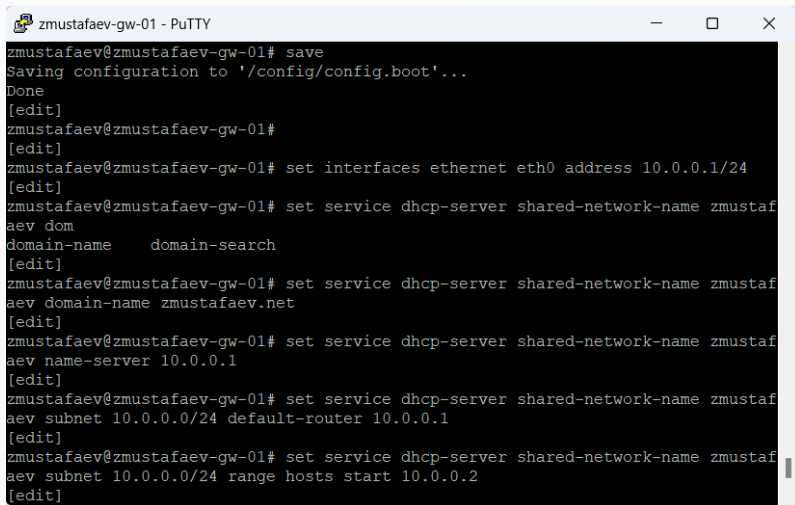
Configuration path: [su] is not valid

[edit]
vyos@vyos# set system host-name zmustafaev-gw-01
[edit]
vyos@vyos# set system domain-name zmustafaev.net
[edit]
vyos@vyos# set system login user auth
Possible completions:
> <text>      Local user account information
>

[edit]
vyos@vyos# set system login user zmustafaev authentication plaintext-password 123456
[edit]
vyos@vyos# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@vyos#
```

Рис. 3: Настройка VyOS

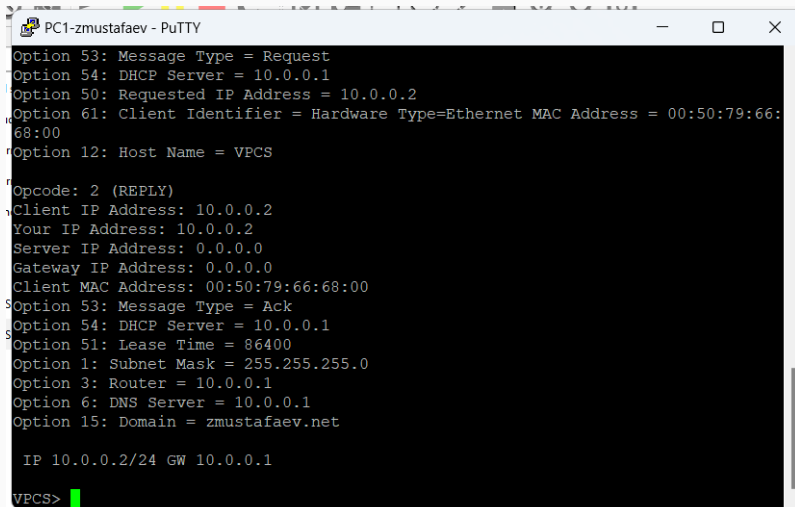
Настройка IPv4 и DHCP-сервера



```
zmustafaev-gw-01 - PuTTY
zmustafaev@zmustafaev-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
zmustafaev@zmustafaev-gw-01#
[edit]
zmustafaev@zmustafaev-gw-01# set interfaces ethernet eth0 address 10.0.0.1/24
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcp-server shared-network-name zmustaf
aev dom
domain-name      domain-search
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcp-server shared-network-name zmustaf
aev domain-name zmustafaev.net
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcp-server shared-network-name zmustaf
aev name-server 10.0.0.1
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcp-server shared-network-name zmustaf
aev subnet 10.0.0.0/24 default-router 10.0.0.1
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcp-server shared-network-name zmustaf
aev subnet 10.0.0.0/24 range hosts start 10.0.0.2
[edit]
```

Рис. 4: DHCPv4 конфигурация

Получение адреса клиентом PC1



```
PC1-zmustafaev - 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 = zmustafaev.net

IP 10.0.0.2/24 GW 10.0.0.1

VPCS>
```

Рис. 5: DHCPv4 клиент

Проверка параметров и связности

```
PC1-zmustafaev - 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  : 86383, 86400/43200/75600
DOMAIN NAME : zmustafaev.net
MAC        : 00:50:79:66:68:00
LPORT      : 10004
RHOST:PORT  : 127.0.0.1:10005
MTU        : 1500

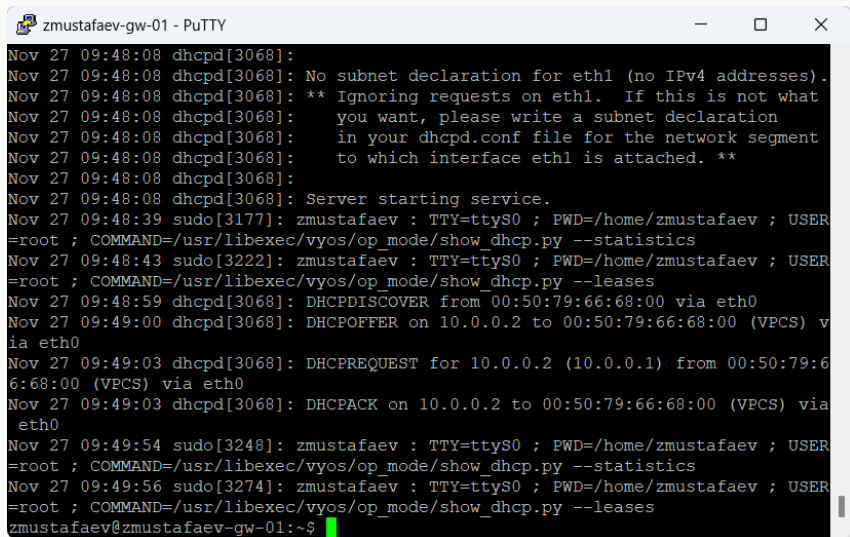
VPCS> ping 10.0.0.1 -c 2

84 bytes from 10.0.0.1 icmp_seq=1 ttl=64 time=1.791 ms
84 bytes from 10.0.0.1 icmp_seq=2 ttl=64 time=3.765 ms

VPCS> 
```

```
zmustafaev@zmustafaev-gw-01:~$ show dhcp server statistics
Pool          Size    Leases  Available  Usage
-----
zmustafaev    252      1       251      0%
zmustafaev@zmustafaev-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   2025/11/27 09:49:03  2025/11/28 09:49:03
23:59:06      zmustafaev        VPCS
zmustafaev@zmustafaev-gw-01:~$
```

Рис. 7: Статистика DHCPv4



```
zmustafaev-gw-01 - PuTTY
Nov 27 09:48:08 dhcpd[3068]:
Nov 27 09:48:08 dhcpd[3068]: No subnet declaration for eth1 (no IPv4 addresses).
Nov 27 09:48:08 dhcpd[3068]: ** Ignoring requests on eth1.  If this is not what
Nov 27 09:48:08 dhcpd[3068]: you want, please write a subnet declaration
Nov 27 09:48:08 dhcpd[3068]: in your dhcpd.conf file for the network segment
Nov 27 09:48:08 dhcpd[3068]: to which interface eth1 is attached. **
Nov 27 09:48:08 dhcpd[3068]: Server starting service.
Nov 27 09:48:39 sudo[3177]: zmustafaev : TTY=ttyS0 ; PWD=/home/zmustafaev ; USER
=root ; COMMAND=/usr/libexec/vyos/op_mode/show_dhcp.py --statistics
Nov 27 09:48:43 sudo[3222]: zmustafaev : TTY=ttyS0 ; PWD=/home/zmustafaev ; USER
=root ; COMMAND=/usr/libexec/vyos/op_mode/show_dhcp.py --leases
Nov 27 09:48:59 dhcpd[3068]: DHCPDISCOVER from 00:50:79:66:68:00 via eth0
Nov 27 09:49:00 dhcpd[3068]: DHCPOFFER on 10.0.0.2 to 00:50:79:66:68:00 (VPCS) v
ia eth0
Nov 27 09:49:03 dhcpd[3068]: DHCPREQUEST for 10.0.0.2 (10.0.0.1) from 00:50:79:6
6:68:00 (VPCS) via eth0
Nov 27 09:49:03 dhcpd[3068]: DHCPACK on 10.0.0.2 to 00:50:79:66:68:00 (VPCS) via
eth0
Nov 27 09:49:54 sudo[3248]: zmustafaev : TTY=ttyS0 ; PWD=/home/zmustafaev ; USER
=root ; COMMAND=/usr/libexec/vyos/op_mode/show_dhcp.py --statistics
Nov 27 09:49:56 sudo[3274]: zmustafaev : TTY=ttyS0 ; PWD=/home/zmustafaev ; USER
=root ; COMMAND=/usr/libexec/vyos/op_mode/show_dhcp.py --leases
zmustafaev@zmustafaev-gw-01:~$
```

Журнал DHCP и трафик в Wireshark

Захват из Standard input [zmustafaev-sw-01 Ethernet1 to zmustafaev-gw-01 eth0]

Файл Правка Вид Запуск Захват Анализ Статистика Телефония Беспроводная связь Инструменты Справка

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 0x35ef7e4a
2	0.006725	10.0.0.1	10.0.0.2	ICMP	62	Echo (ping) request id=0xdc99, seq=0/0, ttl=64
3	0.007389	10.0.0.2	10.0.0.1	ICMP	62	Echo (ping) reply id=0xdc99, seq=0/0, ttl=64
4	1.001089	0.0.0.0	255.255.255.255	DHCP	406	DHCP Discover - Transaction ID 0x35ef7e4a
5	1.006818	0c:b5:c5:19:00:00	Broadcast	ARP	60	Who has 10.0.0.3? Tell 10.0.0.1
6	2.010086	10.0.0.1	10.0.0.3	DHCP	342	DHCP Offer - Transaction ID 0x35ef7e4a
7	2.065248	0c:b5:c5:19:00:00	Broadcast	ARP	60	Who has 10.0.0.3? Tell 10.0.0.1
8	3.089593	0c:b5:c5:19:00:00	Broadcast	ARP	60	Who has 10.0.0.3? Tell 10.0.0.1
9	4.001241	0.0.0.0	255.255.255.255	DHCP	406	DHCP Request - Transaction ID 0x35ef7e4a
10	4.010076	10.0.0.1	10.0.0.3	DHCP	342	DHCP ACK - Transaction ID 0x35ef7e4a
11	5.001610	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 10.0.0.3 (Request)
12	5.072878	0c:b5:c5:19:00:00	Private_66:68:00	ARP	60	Who has 10.0.0.2? Tell 10.0.0.1
13	6.002111	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 10.0.0.3 (Request)

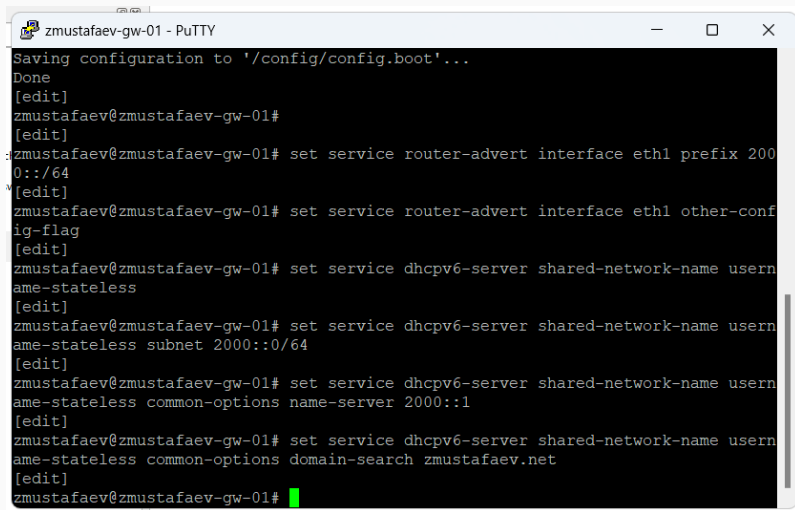
Transaction ID: 0x35ef7e4a
Seconds elapsed: 0

> Bootp flags: 0x0000 (Unicast)
Client IP address: 10.0.0.3
Your (client) IP address: 10.0.0.3
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

0000 00 50 79
0010 01 48 00
0020 00 03 00
0030 7e 4a 00
0040 00 00 00
0050 00 00 00
0060 00 00 00
0070 00 00 00
0080 00 00 00
0090 00 00 00
00a0 00 00 00
00b0 00 00 00
00c0 00 00 00
00d0 00 00 00
00e0 00 00 00
00f0 00 00 00
0100 00 00 00
0110 00 00 00
0120 00 00 01

Настройка RA и DHCPv6 Stateless



```
zmustafaev-gw-01 - PuTTY
Saving configuration to '/config/config.boot'...
Done
[edit]
zmustafaev@zmustafaev-gw-01#
[edit]
zmustafaev@zmustafaev-gw-01# set service router-advert interface eth1 prefix 200
0::/64
[edit]
zmustafaev@zmustafaev-gw-01# set service router-advert interface eth1 other-conf
ig-flag
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcpv6-server shared-network-name usern
ame-stateless
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcpv6-server shared-network-name usern
ame-stateless subnet 2000::0/64
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcpv6-server shared-network-name usern
ame-stateless common-options name-server 2000::1
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcpv6-server shared-network-name usern
ame-stateless common-options domain-search zmustafaev.net
[edit]
zmustafaev@zmustafaev-gw-01#
```

Рис. 10: Настройка Stateless

Проверка работы Stateless на PC2

```
(kali@kali)-[~]
$ ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 2000::1c5:6e27:4f69:4f13 prefixlen 64 scopeid 0<global>
    inet6 fe80::d00b:1b60:ff5f:5535 prefixlen 64 scopeid 0<link>
    ether 0c:7b:b1:87:00:00 txqueuelen 1000 (Ethernet)
    RX packets 5 bytes 574 (574.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 23 bytes 3348 (3.2 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

```
(kali@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::eb5:c5ff:fe19:1	UG	100	1	0	eth0
::1/128	::	Un	0	4	0	lo
2000::1c5:6e27:4f69:4f13/128	::	Un	0	2	0	eth0
fe80::d00b:1b60:ff5f:5535/128	::	Un	0	3	0	eth0
ff00::/8	::	U	256	3	0	eth0
::/0	::	In	-1	1	0	lo

```
(kali@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=4.24 ms
64 bytes from 2000::1: icmp_seq=2 ttl=64 time=1.65 ms

--- 2000::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 1.652/2.944/4.237/1.292 ms
```

```
(kali@kali)-[~]
$ cat /etc/resolv.conf
# Generated by NetworkManager
search zmustafaev.net
nameserver 2000::1
```

Получение параметров DHCPv6 (Stateless)

```
(kali㉿kali)-[~]  
$ sudo 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{\261\207\000\000".  
PRC: Requesting information (INIT).  
XMT: Forming Info-Request, 0 ms elapsed.  
XMT: Info-Request on eth0, interval 1030ms.  
RCV: Reply message on eth0 from fe80::eb5:c5ff:fe19:1.  
PRC: Done.  
  
(kali㉿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=1.66 ms  
64 bytes from 2000::1: icmp_seq=2 ttl=64 time=3.10 ms  
  
--- 2000::1 ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 1002ms  
rtt min/avg/max/mdev = 1.658/2.378/3.098/0.720 ms  
  
(kali㉿kali)-[~]  
$ cat /etc/resolv.conf  
search zmustafaev.net.  
nameserver 2000::1  
  
(kali㉿kali)-[~]  
$
```



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

Рис. 13: DHCPv6 Stateless вывод

Wireshark DHCPv6 Stateless

No.	Time	Source	Destination	Protocol	Length	Info
10	22.794400	fe80::eb5:c5ff:fe19...	ff02::1:ff5f:5535	ICMPv6	86	Neighbor Solicitation for fe80::d00b:1b60:ff5...
11	22.795462	fe80::d00b:1b60:ff5...	fe80::eb5:c5ff:fe19...	ICMPv6	86	Neighbor Advertisement fe80::d00b:1b60:ff5...
12	22.796301	fe80::eb5:c5ff:fe19...	fe80::d00b:1b60:ff5...	ICMPv6	118	Router Advertisement from 0c:b5:c5:19:00:00
13	22.800534	fe80::d00b:1b60:ff5...	ff02::1:2	DHCPv6	106	Information-request XID: 0x65f549 CID: 0004
14	22.801478	fe80::eb5:c5ff:fe19...	fe80::d00b:1b60:ff5...	DHCPv6	146	Reply XID: 0x65f549 CID: 0004b2c559911f925a
15	22.811754	fe80::d00b:1b60:ff5...	ff02::16	ICMPv6	110	Multicast Listener Report Message v2
16	23.039776	fe80::d00b:1b60:ff5...	ff02::16	ICMPv6	110	Multicast Listener Report Message v2
17	23.295739	::	ff02::1:ff69:4f13	ICMPv6	86	Neighbor Solicitation for 2000::1c5:6e27:4f13
18	23.744537	fe80::d00b:1b60:ff5...	ff02::16	ICMPv6	110	Multicast Listener Report Message v2
19	23.752722	fe80::d00b:1b60:ff5...	ff02::1:2	DHCPv6	106	Information-request XID: 0x65f549 CID: 0004
20	23.753358	fe80::eb5:c5ff:fe19...	fe80::d00b:1b60:ff5...	DHCPv6	146	Reply XID: 0x65f549 CID: 0004b2c559911f925a
21	23.816050	fe80::d00b:1b60:ff5...	ff02::16	ICMPv6	110	Multicast Listener Report Message v2
22	24.305091	0.0.0.0	255.255.255.255	DHCP	324	DHCP Discover - Transaction ID 0xa47e8d78

> User Datagram Protocol, Src Port: 547, Dst Port: 546	0000 0c 7b b1 87
✓ DHCPv6	0010 f6 2a 00 5c
Message type: Reply (7)	0020 c5 ff fe 19
Transaction ID: 0x65f549	0030 1b 60 ff 51
✓ Client Identifier	0040 f5 49 00 00
Option: Client Identifier (1)	0050 a7 bd 4a 94
Length: 18	0060 30 ba de 00
DUID: 0004b2c559911f925adfa7bd4a94bf77999f	0070 00 00 00 00
DUID Type: Universally Unique Identifier (UUID) (4)	0080 00 10 0a 7a
UUID: b2c559911f925adfa7bd4a94bf77999f	0090 74 00
✓ Server Identifier	
Option: Server Identifier (2)	
Length: 14	
DUID: 0001000130bade010cb5c5190001	
DUID Type: link-layer address plus time (1)	
Hardware type: Ethernet (1)	
DUID Time: Nov 27, 2025 13:01:37.000000000 RTZ 2 (зима)	

Настройка DHCPv6 Stateful

```
zmustafaev-gw-01 - PuTTY
-----
[edit]
zmustafaev@zmustafaev-gw-01#
[edit]
zmustafaev@zmustafaev-gw-01# set service router-advert interface eth2 managed-fl
ag
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcpv6-server shared-network-name zmust
afaev-stateful
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcpv6-server shared-network-name zmust
afaev-stateful subnet 2001::0/64
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcpv6-server shared-network-name zmust
afaev-stateful subnet 2001::0/64 name-server 2001::1
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcpv6-server shared-network-name zmust
afaev-stateful subnet 2001::0/64 domain-search zmustafaev.net
[edit]
zmustafaev@zmustafaev-gw-01# set service dhcpv6-server shared-network-name zmust
afaev-stateful subnet 2001::0/64 address-range start 2001::100 stop 2001::199
[edit]
zmustafaev@zmustafaev-gw-01#
```

Работа DHCPv6 Stateful на PC3

Параметры сети до получения адреса

```
(kali@kali)-[~]
$ ifconfig eth0
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet6 fe80::eaae:1970:d25d:c060 prefixlen 64 scopeid 0x20<link>
    inet6 2001::199 prefixlen 128 scopeid 0x0<global>
    ether 0c:90:bc:b7:00:00 txqueuelen 1000 (Ethernet)
    RX packets 5 bytes 630 (630.0 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

(kali@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::eb5:c5ff:fe19:2	UG	100	1	0	eth0
::1/128	::	Un	0	4	0	lo
2001::199/128	::	Un	0	2	0	eth0
fe80::eaae:1970:d25d:c060/128	::	Un	0	3	0	eth0
ff00::/8	::	U	256	3	0	eth0
::/0	::	!n	-1	1	0	lo

```

(kali@kali)-[~]
$ cat /etc/resolv.conf
# Generated by NetworkManager
search zmustafaev.net
nameserver 2001::1

(kali@kali)-[~]
$
```

Получение IPv6-адреса (Stateful)

```
(kali㉿kali)-[~]
$ sudo 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\272\340\326\014\220\274\267\000\000".
PRC: Soliciting for leases (INIT).
XMT: Forming Solicit, 0 ms elapsed.
XMT: X-- IA_NA bc:b7:00:00
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::eb5:c5ff:fe19:2.
RCV: X-- IA_NA bc:b7:00:00
RCV: | X-- starts 1764238423
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:ba:de:01:0c:b5:c5:19:00:01
RCV: Advertisement recorded.
PRC: Selecting best advertised lease.
PRC: Considering best lease.
PRC: X-- Initial candidate 00:01:00:01:30:ba:de:01:0c:b5:c5:19:00:01 (s: 10105, p: 0).
XMT: Forming Request, 0 ms elapsed.
XMT: X-- IA_NA bc:b7:00:00
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.
```

Параметры сети после получения адреса

```
(kali㉿kali)-[~]  
$ ifconfig eth0  
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet6 2001::198 prefixlen 128 scopeid 0x0<global>  
    inet6 fe80::eaae:1970:d25d:c060 prefixlen 64 scopeid 0x20<link>  
    inet6 2001::199 prefixlen 128 scopeid 0x0<global>  
    ether 0c:90:bc:b7:00:00 txqueuelen 1000 (Ethernet)  
    RX packets 9 bytes 1166 (1.1 KiB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 31 bytes 4526 (4.4 KiB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Trash

```
(kali㉿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::eaae:1970:d25d:c060	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::eaae:1970:d25d:c060/128	::	Un	0	3	0	eth0
ff00::/8	::	U	256	3	0	eth0
::/0	::	!n	-1	1	0	lo

Параметры сети после получения адреса

```
(kali㉿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=2.95 ms  
64 bytes from 2001::1: icmp_seq=2 ttl=64 time=2.25 ms  
  
--- 2001::1 ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 1002ms  
rtt min/avg/max/mdev = 2.251/2.600/2.950/0.349 ms  
  
(kali㉿kali)-[~]  
$ cat /etc/resolv.conf  
search zmustafaev.net.  
nameserver 2001::1  
  
(kali㉿kali)-[~]  
$
```

Рис. 19: Проверка связности


```
zmustafaev@zmustafaev-gw-01# run show dhcpv6 server leases
IPv6 address      State      Last communication      Lease expiration      Remaining
Type              Pool                               IAID_DUID
-----
-----
2001::198          active     2025/11/27 10:13:44    2025/11/27 12:18:44    2:03:54
non-temporary     zmustafaev-stateful  00:00:b7:bc:00:01:00:01:30:ba:e0:d6:0c:90:b
c:b7:00:00
2001::199          active     2025/11/27 10:11:53    2025/11/27 22:11:53    11:57:03
non-temporary     zmustafaev-stateful  35:67:50:2b:00:04:7a:35:29:97:45:ba:2d:d9:c
c:18:9f:21:37:97:54:78
[edit]
zmustafaev@zmustafaev-gw-01#
```

Рис. 20: DHCPv6 аренды

Пакеты Solicit / Advertise / Request / Reply

No.	Time	Source	Destination	Protocol	Length	Info
42	92.021304	0.0.0.0	255.255.255.255	DHCP	324	DHCP Discover - Transaction ID 0xc497784
43	93.891585	fe80::eb5:c5ff:fe19...	ff02::1	ICMPv6	86	Router Advertisement from 0c:b5:c5:19:00:00
44	93.906653	fe80::bcc6:aa2a:721...	ff02::16	ICMPv6	110	Multicast Listener Report Message v2
45	94.454677	fe80::bcc6:aa2a:721...	ff02::16	ICMPv6	110	Multicast Listener Report Message v2
46	108.534236	0.0.0.0	255.255.255.255	DHCP	324	DHCP Discover - Transaction ID 0x7107b587
47	110.904737	fe80::bcc6:aa2a:721...	ff02::1:2	DHCPv6	118	Solicit XID: 0xaece7c CID: 0001000130bae1a8
48	110.906039	fe80::eb5:c5ff:fe19...	fe80::bcc6:aa2a:721...	DHCPv6	186	Advertise XID: 0xaece7c IAA: 2001::193 CID: 0001000130bae1a8
49	111.935702	fe80::bcc6:aa2a:721...	ff02::1:2	DHCPv6	164	Request XID: 0x670194 CID: 0001000130bae1a8
50	111.939171	fe80::eb5:c5ff:fe19...	fe80::bcc6:aa2a:721...	DHCPv6	186	Reply XID: 0x670194 IAA: 2001::193 CID: 0001000130bae1a8
51	111.955225	fe80::bcc6:aa2a:721...	ff02::16	ICMPv6	130	Multicast Listener Report Message v2
52	112.569139	fe80::bcc6:aa2a:721...	ff02::16	ICMPv6	130	Multicast Listener Report Message v2
53	112.791323	::	ff02::1:ff00:193	ICMPv6	86	Neighbor Solicitation for 2001::193

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

▼ DHCPv6

Message type: Request (3)
Transaction ID: 0x670194

▼ Client Identifier

Option: Client Identifier (1)
Length: 14
DUID: 0001000130bae1a80c90bcb70000
DUID Type: link-layer address plus time (1)
Hardware type: Ethernet (1)
DUID Time: Nov 27, 2025 13:17:12.000000000 RTZ 2 (зима)
Link-layer address: 0c:90:bc:b7:00:00
Link-layer address (Ethernet): 0c:90:bc:b7:00:00 (0c:90:bc:b7:00:00)

▼ Server Identifier

▼ Option Request

▼ Elapsed time

▼ Identity Association for Non-temporary Address

0000 33 33 00 00

0010 b2 0a 00 6e

0020 aa 2a 72 18

0030 00 00 00 00

0040 01 94 00 00

0050 bc b7 00 00

0060 0c b5 c5 19

0070 00 1f 00 00

0080 00 00 0e 10

0090 00 00 00 00

00a0 00 00 1d 4e

Выводы

- Настроены и протестированы DHCPv4, DHCPv6 Stateless и DHCPv6 Stateful
- IPv4-клиенты получают полный набор настроек автоматически
- Для IPv6 успешно реализованы оба режима конфигурации
- Проанализирован сетевой трафик DHCPv4 и DHCPv6 в Wireshark
- Подтверждена корректность работы адресации и сетевой инфраструктуры

Работа выполнена успешно.