

Презентация по лабораторной работе №7

Адресация IPv4 и IPv6. Настройка DHCP

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

Настройка DHCP в случае IPv4

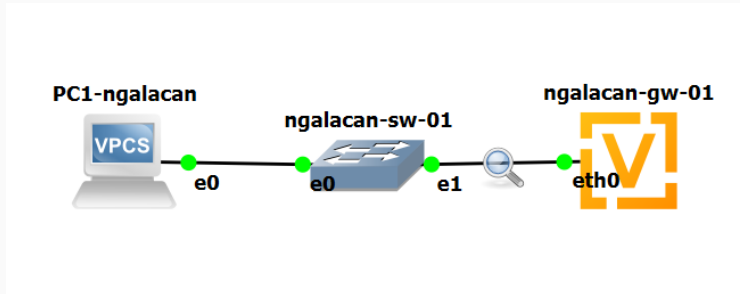
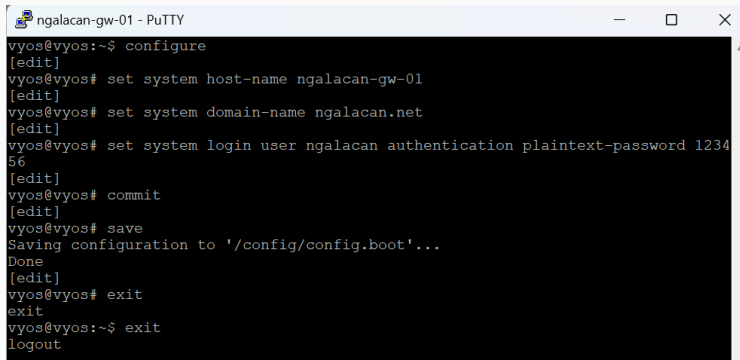


Рис. 1: Топология моделируемой сети



```
ngalacan-gw-01 - PuTTY
vyos@vyos:~$ configure
[edit]
vyos@vyos# set system host-name ngalacan-gw-01
[edit]
vyos@vyos# set system domain-name ngalacan.net
[edit]
vyos@vyos# set system login user ngalacan authentication plaintext-password 123456
[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. 2: Настройка gw-01: изменение имени, домена, пользователя

```
ngalacan-gw-01 login: ngalacan
Password:
Welcome to VyOS!

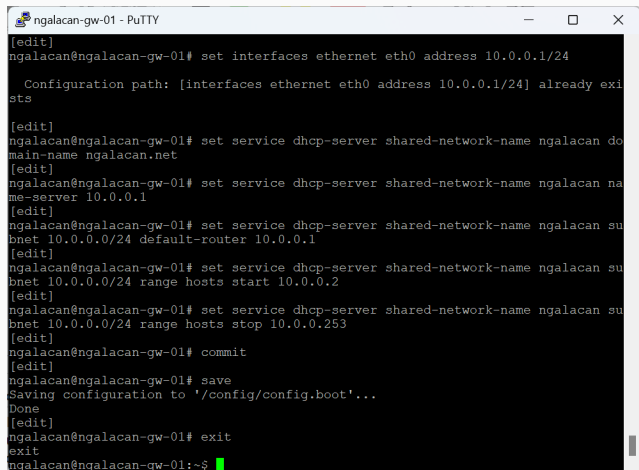
Check out project news at https://blog.vyos.io
and feel free to report bugs at https://vyos.dev

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

Рис. 3: Настройка gw-01: удаление пользователя по умолчанию

Выполнение лабораторной работы



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

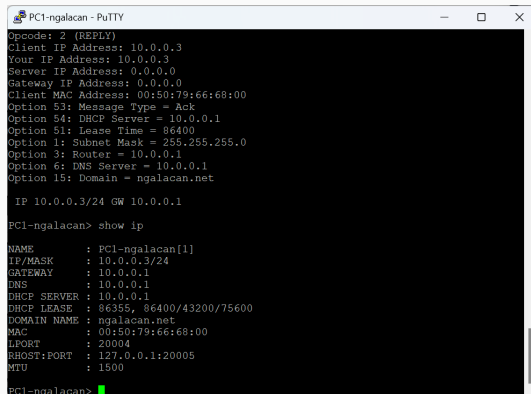
Configuration path: [interfaces ethernet eth0 address 10.0.0.1/24] already exists

[edit]
ngalacan@ngalacan-gw-01# set service dhcp-server shared-network-name ngalacan do
main-name ngalacan.net
[edit]
ngalacan@ngalacan-gw-01# set service dhcp-server shared-network-name ngalacan na
me-server 10.0.0.1
[edit]
ngalacan@ngalacan-gw-01# set service dhcp-server shared-network-name ngalacan su
bnet 10.0.0.0/24 default-router 10.0.0.1
[edit]
ngalacan@ngalacan-gw-01# set service dhcp-server shared-network-name ngalacan su
bnet 10.0.0.0/24 range hosts start 10.0.0.2
[edit]
ngalacan@ngalacan-gw-01# set service dhcp-server shared-network-name ngalacan su
bnet 10.0.0.0/24 range hosts stop 10.0.0.253
[edit]
ngalacan@ngalacan-gw-01# commit
[edit]
ngalacan@ngalacan-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
ngalacan@ngalacan-gw-01# exit
exit
ngalacan@ngalacan-gw-01:~$
```

Рис. 4: Настройка gw-01: IPv4-адресация и DHCP-сервер


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

Рис. 5: Просмотр статистики DHCP и выданных адресов



```
PC1-ngalacan - PuTTY
Opcode: 2 (REPLY)
Client IP Address: 10.0.0.3
Your IP Address: 10.0.0.3
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 = ngalacan.net

IP 10.0.0.3/24 GW 10.0.0.1

PC1-ngalacan> show ip

NAME       : PC1-ngalacan[1]
IP/MASK    : 10.0.0.3/24
GATEWAY    : 10.0.0.1
DNS        : 10.0.0.1
DHCP SERVER : 10.0.0.1
DHCP LEASE  : 86355, 86400/43200/75600
DOMAIN NAME : ngalacan.net
MAC        : 00:50:79:66:68:00
LPORT      : 20004
RHOST:PORT  : 127.0.0.1:20005
MTU        : 1500

PC1-ngalacan>
```

Рис. 6: Настройка PC1 и проверка конфигурации

Выполнение лабораторной работы

```
ngalacan@ngalacan-gw-01:~$ show dhcp server statistics
Pool      Size    Leases   Available  Usage
-----
ngalacan   252      2        250        1%
ngalacan@ngalacan-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      2024/12/01 14:45:34  2024/12/02 14:45:34
23:55:03    ngalacan         PC1-ngalacan
10.0.0.3    00:50:79:66:68:00 active      2024/12/01 14:49:57  2024/12/02 14:49:57
23:59:26    ngalacan         PC1-ngalacan
ngalacan@ngalacan-gw-01:~$ show log | grep dhcp
Dec 01 14:31:31 dhclient-script-vyos[1433]: Deleting search domains with tag "dhcp-eth0" via vyos-hostsd-client
Dec 01 14:31:32 vyos-hostsd[513]: Request data: {"type": "search_domains", "op":
```

Рис. 7: Просмотр статистики DHCP, выданных адресов и журнала работы

Выполнение лабораторной работы

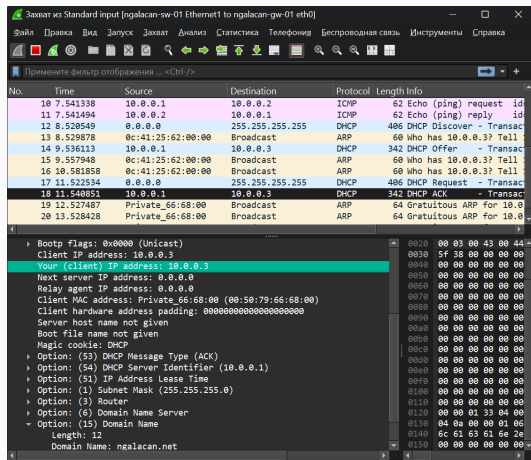


Рис. 8: Проверка захваченных анализатором трафика пакетов

Настройка DHCP в случае IPv6

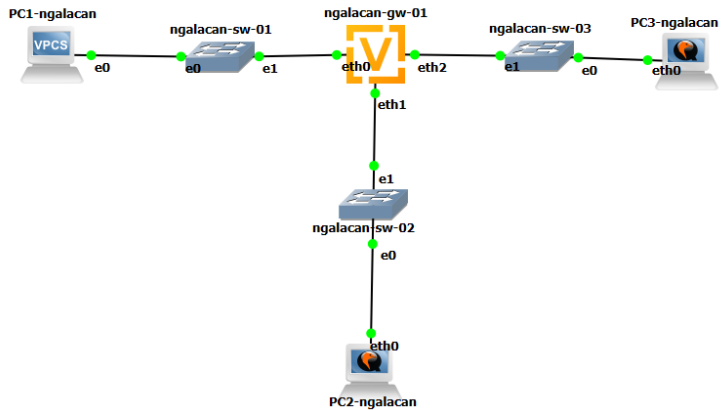
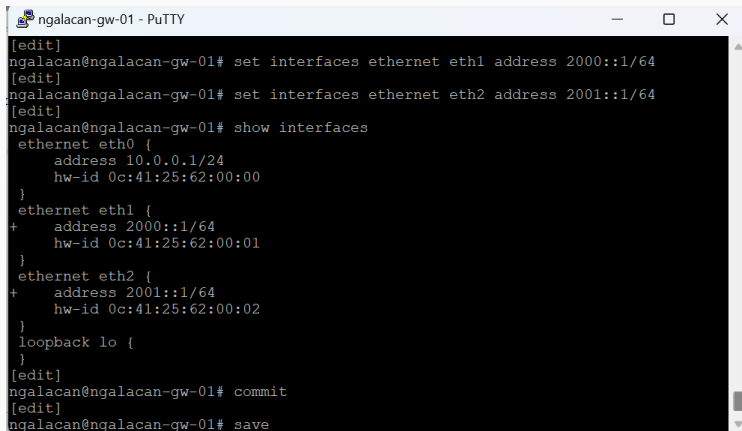


Рис. 9: Топология дополненной сети

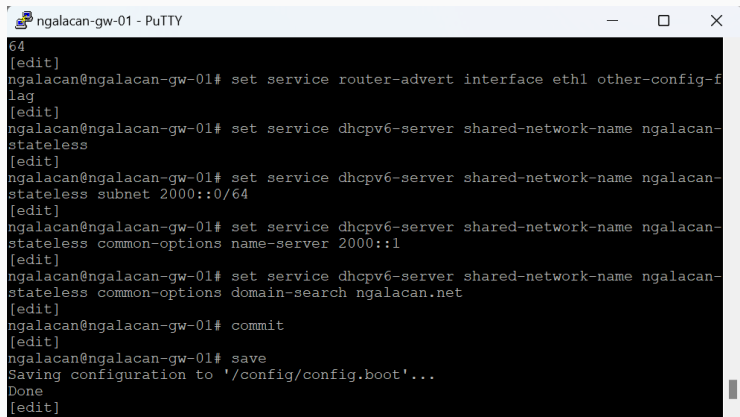
Выполнение лабораторной работы



```
ngalacan-gw-01 - PuTTY
[edit]
ngalacan@ngalacan-gw-01# set interfaces ethernet eth1 address 2000::1/64
[edit]
ngalacan@ngalacan-gw-01# set interfaces ethernet eth2 address 2001::1/64
[edit]
ngalacan@ngalacan-gw-01# show interfaces
  ethernet eth0 {
    address 10.0.0.1/24
    hw-id 0c:41:25:62:00:00
  }
  ethernet eth1 {
+   address 2000::1/64
    hw-id 0c:41:25:62:00:01
  }
  ethernet eth2 {
+   address 2001::1/64
    hw-id 0c:41:25:62:00:02
  }
  loopback lo {
  }
[edit]
ngalacan@ngalacan-gw-01# commit
[edit]
ngalacan@ngalacan-gw-01# save
```

Рис. 10: Настройка gw-01: IPv6-адресация

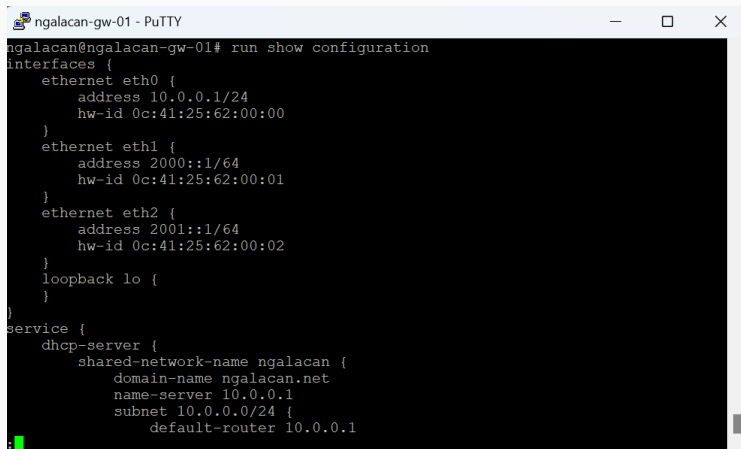
Выполнение лабораторной работы



```
ngalacan-gw-01 - PuTTY
64
[edit]
ngalacan@ngalacan-gw-01# set service router-advert interface eth1 other-config-f
lag
[edit]
ngalacan@ngalacan-gw-01# set service dhcpv6-server shared-network-name ngalacan-
stateless
[edit]
ngalacan@ngalacan-gw-01# set service dhcpv6-server shared-network-name ngalacan-
stateless subnet 2000::0/64
[edit]
ngalacan@ngalacan-gw-01# set service dhcpv6-server shared-network-name ngalacan-
stateless common-options name-server 2000::1
[edit]
ngalacan@ngalacan-gw-01# set service dhcpv6-server shared-network-name ngalacan-
stateless common-options domain-search ngalacan.net
[edit]
ngalacan@ngalacan-gw-01# commit
[edit]
ngalacan@ngalacan-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
```

Рис. 11: Настройка gw-01: DHCPv6 без отслеживания состояния

Выполнение лабораторной работы

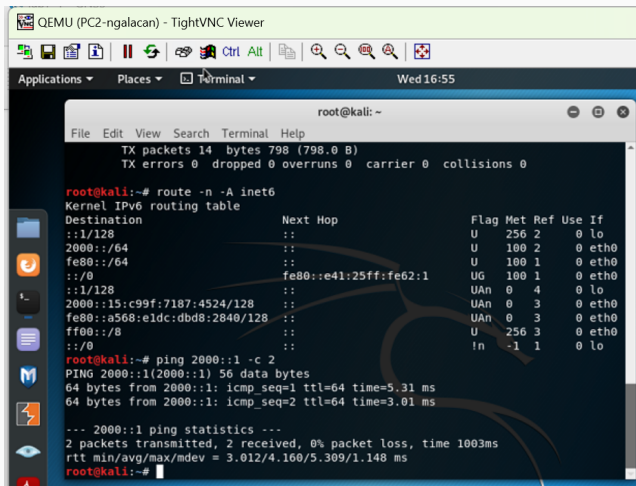


The image shows a PuTTY terminal window titled "ngalacan-gw-01 - PuTTY". The terminal displays the output of the command "run show configuration". The configuration is as follows:

```
ngalacan@ngalacan-gw-01# run show configuration
interfaces {
  ethernet eth0 {
    address 10.0.0.1/24
    hw-id 0c:41:25:62:00:00
  }
  ethernet eth1 {
    address 2000::1/64
    hw-id 0c:41:25:62:00:01
  }
  ethernet eth2 {
    address 2001::1/64
    hw-id 0c:41:25:62:00:02
  }
  loopback lo {
  }
}
service {
  dhcp-server {
    shared-network-name ngalacan {
      domain-name ngalacan.net
      name-server 10.0.0.1
      subnet 10.0.0.0/24 {
        default-router 10.0.0.1
      }
    }
  }
}
```

Рис. 12: Настройка gw-01: проверка конфигурации

Выполнение лабораторной работы



QEMU (PC2-ngalacan) - TightVNC Viewer

Applications ▾ Places ▾ Terminal ▾ Wed 16:55

```
root@kali: ~
File Edit View Search Terminal Help
TX packets 14 bytes 798 (798.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@kali:~# route -n -A inet6
Kernel IPv6 routing table

```

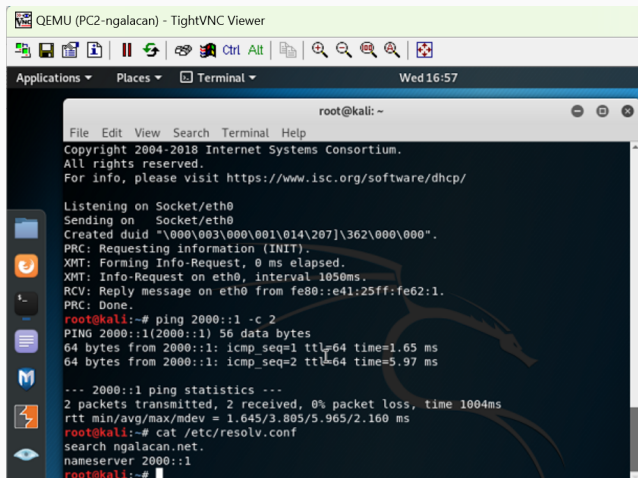
Destination	Next Hop	Flag	Met	Ref	Use	If
::1/128	::	U	256	2	0	lo
2000::/64	::	U	100	2	0	eth0
fe80::/64	::	U	100	1	0	eth0
::/0	fe80::e41:25ff:fe62:1	UG	100	1	0	eth0
::1/128	::	UAn	0	4	0	lo
2000::15:c99f:7187:4524/128	::	UAn	0	3	0	eth0
fe80::a568:eldc:dbd8:2840/128	::	UAn	0	3	0	eth0
ff00::/8	::	U	256	3	0	eth0
::/0	::	In	-1	1	0	lo

```
root@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=5.31 ms
64 bytes from 2000::1: icmp_seq=2 ttl=64 time=3.01 ms

--- 2000::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 3.012/4.160/5.309/1.148 ms
root@kali:~#
```

Рис. 13: Провера настроек сети на PC2, пинг маршрутизатора, проверка DNS

Выполнение лабораторной работы



```
QEMU (PC2-ngalacan) - TightVNC Viewer
Applications Places Terminal Wed 16:57

root@kali: ~
File Edit View Search Terminal Help
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\207]\362\000\000".
PRC: Requesting information (INIT).
XMT: Forming Info-Request, 0 ms elapsed.
XMT: Info-Request on eth0, interval 1050ms.
RCV: Reply message on eth0 from fe80::e41:25ff:fe62:1.
PRC: Done.
root@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=1.65 ms
64 bytes from 2000::1: icmp_seq=2 ttl=64 time=5.97 ms

--- 2000::1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1004ms
rtt min/avg/max/mdev = 1.645/3.805/5.965/2.160 ms
root@kali:~# cat /etc/resolv.conf
search ngalacan.net.
nameserver 2000::1
root@kali:~#
```

Рис. 14: Получение адреса на PC2, пинг маршрутизатора, проверка DNS

```
ngalacan@ngalacan-gw-01# run show dhcpv6 server leases
IPv6 address  State  Last communication  Lease expiration  Remaining
Type         Pool   IAID_DUID
-----
[edit]
ngalacan@ngalacan-gw-01# ping 2000::15:c99f:7187:4524
PING 2000::15:c99f:7187:4524(2000::15:c99f:7187:4524) 56 data bytes
64 bytes from 2000::15:c99f:7187:4524: icmp_seq=1 ttl=64 time=3.96 ms
64 bytes from 2000::15:c99f:7187:4524: icmp_seq=2 ttl=64 time=4.93 ms
64 bytes from 2000::15:c99f:7187:4524: icmp_seq=3 ttl=64 time=3.41 ms
^C
--- 2000::15:c99f:7187:4524 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 7ms
rtt min/avg/max/mdev = 3.405/4.096/4.928/0.631 ms
[edit]
ngalacan@ngalacan-gw-01#
```

Рис. 15: Просмотр статистики DHCP, выданных адресов, пинг PC2

Выполнение лабораторной работы

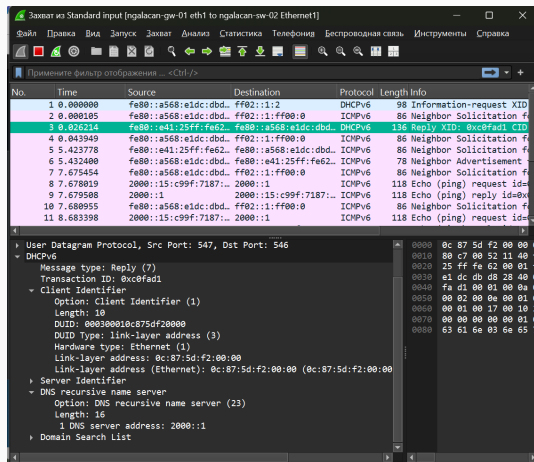
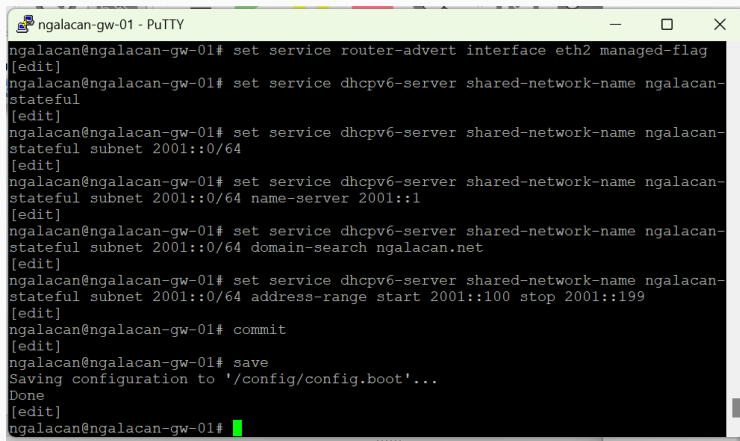


Рис. 16: Проверка захваченных анализатором трафика пакетов



```
ngalacan-gw-01 - PuTTY
ngalacan@ngalacan-gw-01# set service router-advert interface eth2 managed-flag
[edit]
ngalacan@ngalacan-gw-01# set service dhcpv6-server shared-network-name ngalacan-
stateful
[edit]
ngalacan@ngalacan-gw-01# set service dhcpv6-server shared-network-name ngalacan-
stateful subnet 2001::0/64
[edit]
ngalacan@ngalacan-gw-01# set service dhcpv6-server shared-network-name ngalacan-
stateful subnet 2001::0/64 name-server 2001::1
[edit]
ngalacan@ngalacan-gw-01# set service dhcpv6-server shared-network-name ngalacan-
stateful subnet 2001::0/64 domain-search ngalacan.net
[edit]
ngalacan@ngalacan-gw-01# set service dhcpv6-server shared-network-name ngalacan-
stateful subnet 2001::0/64 address-range start 2001::100 stop 2001::199
[edit]
ngalacan@ngalacan-gw-01# commit
[edit]
ngalacan@ngalacan-gw-01# save
Saving configuration to '/config/config.boot'...
Done
[edit]
ngalacan@ngalacan-gw-01#
```

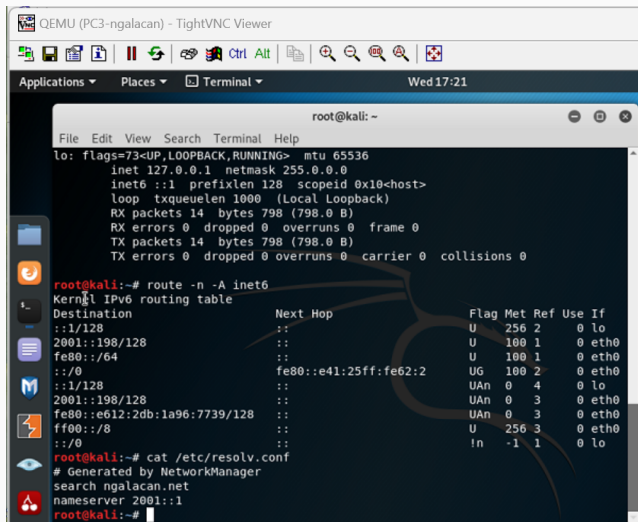
Рис. 17: Настройка gw-01: DHCPv6 с отслеживанием состояния



```
ngalacan-gw-01 - PuTTY
dhcpv6-server {
    shared-network-name ngalacan-stateful {
        subnet 2001::0/64 {
            address-range {
                start 2001::100 {
                    stop 2001::199
                }
            }
            domain-search ngalacan.net
            name-server 2001::1
        }
    }
    shared-network-name ngalacan-stateless {
        common-options {
            domain-search ngalacan.net
            name-server 2000::1
        }
        subnet 2000::0/64 {
        }
    }
}
router-advert {
    interface eth1 {
```

Рис. 18: Настройка gw-01: проверка конфигурации

Выполнение лабораторной работы



The screenshot shows a QEMU (PC3-ngalacan) - TightVNC Viewer window. Inside, a terminal window titled 'root@kali: ~' displays the output of several network-related commands. The first command shows the configuration of the 'lo' (loopback) interface. The second command shows the IPv6 routing table. The third command shows the contents of the '/etc/resolv.conf' file.

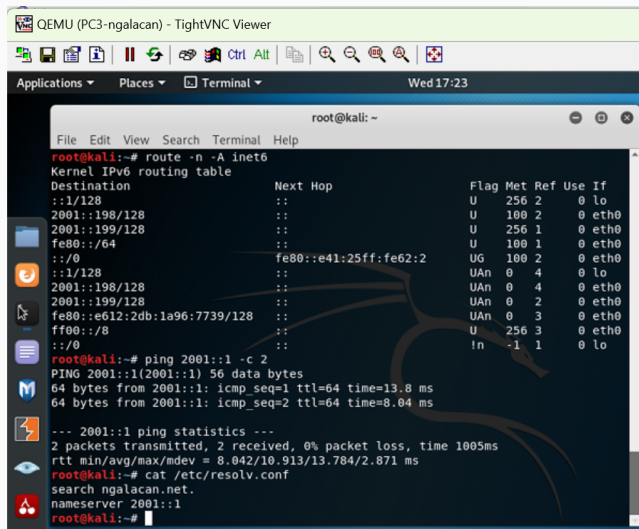
```
root@kali: ~  
File Edit View Search Terminal Help  
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536  
inet 127.0.0.1 netmask 255.0.0.0  
inet6 ::1 prefixlen 128 scopeid 0x10<host>  
loop txqueuelen 1000 (Local Loopback)  
RX packets 14 bytes 798 (798.0 B)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 14 bytes 798 (798.0 B)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
root@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 100 1 0 eth0  
fe80::/64 :: U 100 1 0 eth0  
::/0 fe80::e41:25ff:fe62:2 UG 100 2 0 eth0  
::1/128 :: UAn 0 4 0 lo  
2001::198/128 :: UAn 0 3 0 eth0  
fe80::e612:2db:1a96:7739/128 :: UAn 0 3 0 eth0  
ff00::/8 :: U 256 3 0 eth0  
::/0 :: In -1 1 0 lo  
  
root@kali:~# cat /etc/resolv.conf  
# Generated by NetworkManager  
search ngalacan.net  
nameserver 2001::1  
root@kali:~#
```

Рис. 19: Проверка настроек сети и DNS на PC3

PRC: Soliciting for leases (INIT).
XMT: Forming Solicit, 0 ms elapsed.
XMT: X-- IA_NA 15:90:00:00
XMT: | X-- Request renew in +3600
XMT: | X-- Request rebind in +5400
XMT: Solicit on eth0, interval 1030ms.
RCV: Advertise message on eth0 from fe80::e41:25ff:fe62:2.
RCV: X-- IA_NA 15:90:00:00
RCV: | X-- Starts 1733332909
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: 00:01:00:01:2e:df:3b:33:0c:41:25:62:00:01
RCV: Advertisement recorded." data-bbox="233 117 759 897"/>

Рис. 20: Получение адреса на PC3

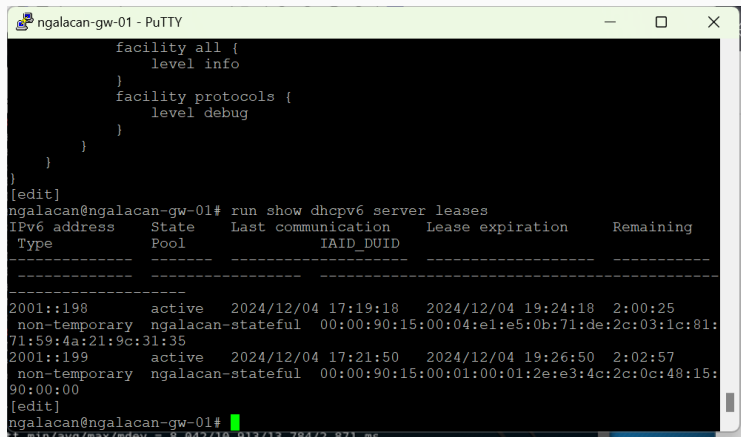
Выполнение лабораторной работы



The screenshot shows a TightVNC Viewer window titled "QEMU (PC3-ngalacan) - TightVNC Viewer". The viewer displays a Kali Linux desktop environment. A terminal window is open, showing the following commands and output:

```
root@kali: ~  
File Edit View Search Terminal Help  
root@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    100 2    0 eth0  
2001::199/128              ::                          U    256 1    0 eth0  
fe80::/64                  ::                          U    100 1    0 eth0  
::/0                       fe80::e41:25ff:fe62:2      UG   100 2    0 eth0  
::1/128                    ::                          UAn  0   4    0 lo  
2001::198/128              ::                          UAn  0   4    0 eth0  
2001::199/128              ::                          UAn  0   2    0 eth0  
fe80::e612:2db:1a96:7739/128 ::                          UAn  0   3    0 eth0  
ff00::/8                   ::                          U    256 3    0 eth0  
::/0                       !n   -1  1    0 lo  
root@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=13.8 ms  
64 bytes from 2001::1: icmp_seq=2 ttl=64 time=8.04 ms  
--- 2001::1 ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 1005ms  
rtt min/avg/max/mdev = 8.042/10.913/13.784/2.871 ms  
root@kali:~# cat /etc/resolv.conf  
search ngalacan.net.  
nameserver 2001::1  
root@kali:~#
```

Рис. 21: Проверка настроек сети и DNS на PC3, пинг маршрутизатора



```
ngalacan-gw-01 - PuTTY

    facility all {
        level info
    }
    facility protocols {
        level debug
    }
}

[edit]
ngalacan@ngalacan-gw-01# run show dhcpv6 server leases
IPv6 address      State      Last communication   Lease expiration      Remaining
Type              Pool              IAID_DUID
-----
-----
2001::198         active     2024/12/04 17:19:18    2024/12/04 19:24:18    2:00:25
non-temporary     ngalacan-stateful  00:00:90:15:00:04:e1:e5:0b:71:de:2c:03:1c:81:
71:59:4a:21:9c:31:35
2001::199         active     2024/12/04 17:21:50    2024/12/04 19:26:50    2:02:57
non-temporary     ngalacan-stateful  00:00:90:15:00:01:00:01:2e:e3:4c:2c:0c:48:15:
90:00:00
[edit]
ngalacan@ngalacan-gw-01#
```

Рис. 22: Просмотр статистики DHCP и выданных адресов,

Выполнение лабораторной работы

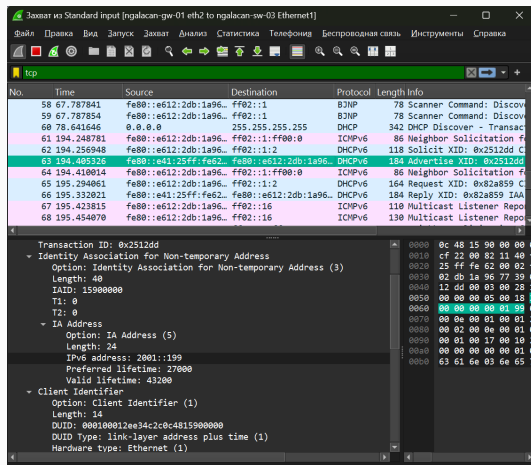


Рис. 23: Проверка захваченных анализатором трафика пакетов

В результате выполнения работы были получены навыки настройки службы DHCP на сетевом оборудовании для распределения адресов IPv4 и IPv6.