

Лабораторная работа №5

Дисциплина: Сетевые технологии

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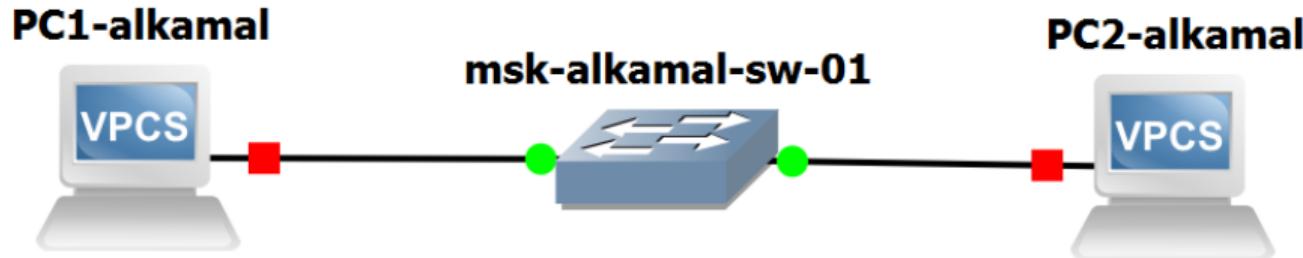
Содержание I

1 Цель работы

- Построение простейших моделей сетей в GNS3
- Использование коммутатора и маршрутизаторов FRR и VyOS
- Анализ сетевого трафика с помощью Wireshark

2 Запуск GNS3 и создание топологии

- Запущены GNS3 VM и GNS3
- Создан новый проект
- Размещены коммутатор Ethernet и два узла VPCS
- Устройства переименованы по шаблону
- Отображены интерфейсы соединений



3 Настройка IP-адресации PC-1

- Открыт терминал PC-1
- Назначен IPv4-адрес 192.168.1.11/24
- Указан шлюз 192.168.1.1
- Конфигурация сохранена

```
Executing the startup file

PC1> /?

?
! COMMAND [ARG ...]      Print help
arp                           Invoke an OS COMMAND with optional ARG(s)
clear ARG                   Shortcut for: show arp. Show arp table
dhcp [OPTION]              Clear IPv4/IPv6, arp/neighbor cache, command history
disconnect                     Shortcut for: ip dhcp. Get IPv4 address via DHCP
echo TEXT                   Exit the telnet session (daemon mode)
help                          Display TEXT in output. See also set echo ?
history                       Print help
ip ARG ... [OPTION]     Shortcut for: show history. List the command history
load [FILENAME]            Configure the current VPC's IP settings. See ip ?
ping HOST [OPTION ...]   Load the configuration/script from the file FILENAME
quit                          Ping HOST with ICMP (default) or TCP/UDP. See ping ?
                             Quit program
relay ARG ...              Configure packet relay between UDP ports. See relay ?
rlogin [ip] port        Telnet to port on host at ip (relative to host PC)
save [FILENAME]            Save the configuration to the file FILENAME
set ARG ...               Set VPC name and other options. Try set ?
show [ARG ...]             Print the information of VPCs (default). See show ?
```

4 Настройка IP-адресации PC-2

- Назначен IPv4-адрес 192.168.1.12/24
- Выполнена проверка доступности PC-1
- Получен ICMP эхо-ответ

```
PC2> ip 192.168.1.12/24 192.168.1.1
Checking for duplicate address...
PC1 : 192.168.1.12 255.255.255.0 gateway 192.168.1.1

PC2> save
Saving startup configuration to startup.vpc
. done

PC2> ping 192.168.1.11
84 bytes from 192.168.1.11 icmp_seq=1 ttl=64 time=0.330 ms
84 bytes from 192.168.1.11 icmp_seq=2 ttl=64 time=1.052 ms
84 bytes from 192.168.1.11 icmp_seq=3 ttl=64 time=0.367 ms
84 bytes from 192.168.1.11 icmp_seq=4 ttl=64 time=0.294 ms
84 bytes from 192.168.1.11 icmp_seq=5 ttl=64 time=0.297 ms
```



5 Проверка связи между PC-1 и PC-2

- Выполнен ping с PC-1 на PC-2
- Получены 5 ICMP-ответов
- Связность подтверждена

```
PC1> ping 192.168.1.12
84 bytes from 192.168.1.12 icmp_seq=1 ttl=64 time=0.305 ms
84 bytes from 192.168.1.12 icmp_seq=2 ttl=64 time=0.950 ms
84 bytes from 192.168.1.12 icmp_seq=3 ttl=64 time=0.493 ms
84 bytes from 192.168.1.12 icmp_seq=4 ttl=64 time=0.614 ms
84 bytes from 192.168.1.12 icmp_seq=5 ttl=64 time=0.756 ms
```

Рисунок 4: Пингование PC-2

6 Остановка узлов проекта

- Все устройства проекта остановлены
- Подготовка к захвату трафика

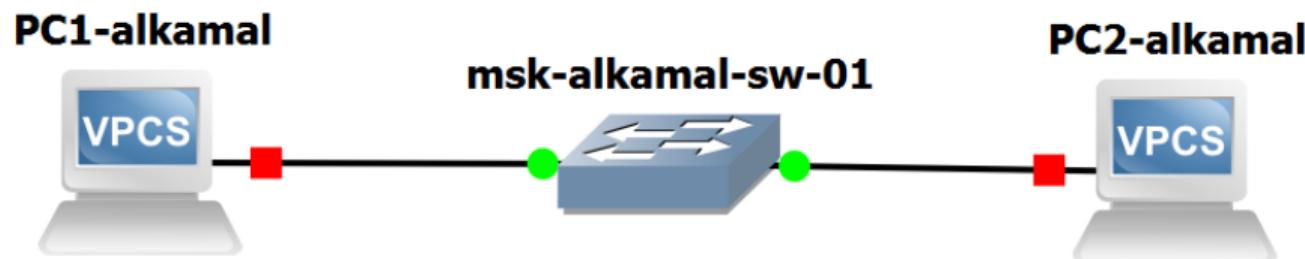
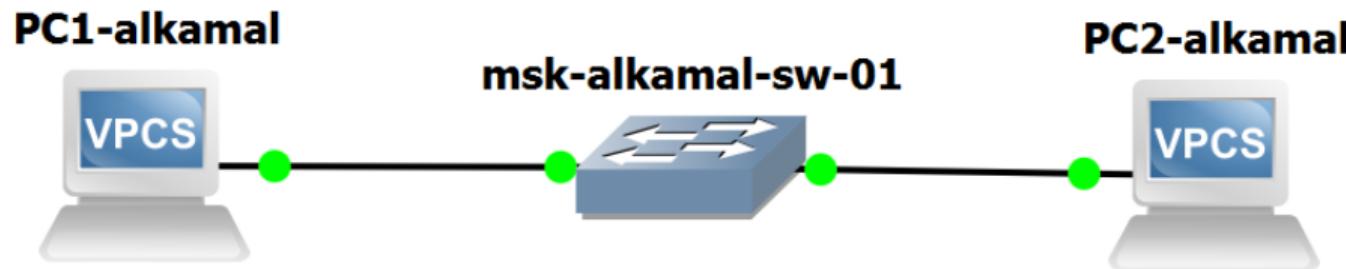


Рисунок 5: Остановка всех узлов

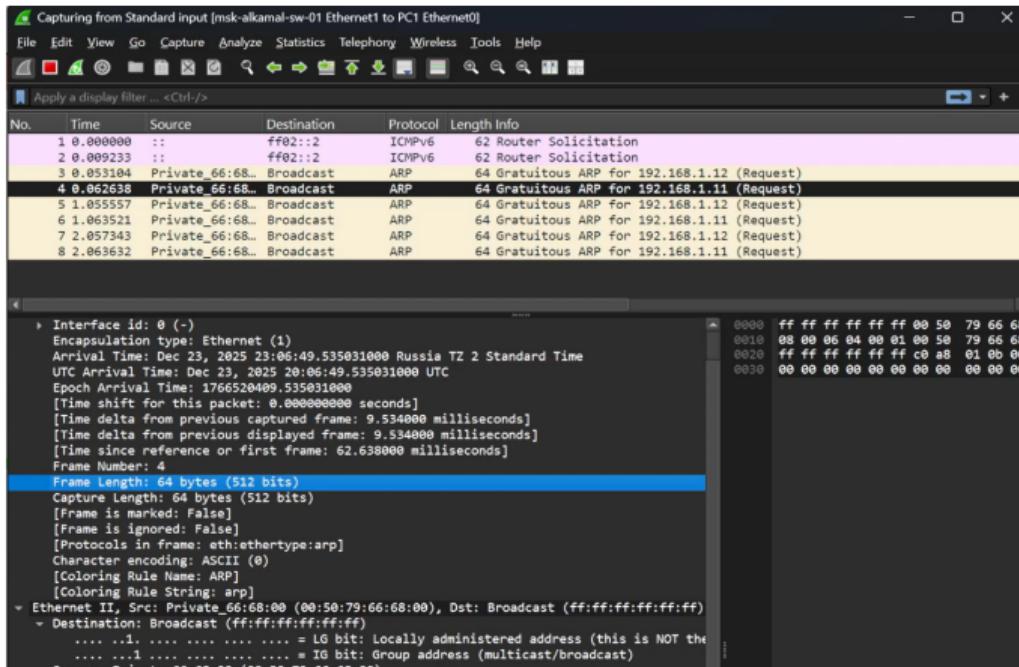
7 Запуск захвата трафика в Wireshark

- Включён Start capture на линии PC-1 ↔ коммутатор
- Запущены все узлы
- Захват трафика активен



8 Анализ ARP-пакетов

- Зафиксированы ARP / Gratuitous ARP
- MAC назначения: broadcast ff:ff:ff:ff:ff:ff
- Длина кадра: 64 байта



9 ICMP Echo Request (PC-2 → PC-1)

- Выполнен одиничный ICMP-запрос
- Использована опция -1
- Проверка базовой связности

```
PC2> ping 192.168.1.11 -1
84 bytes from 192.168.1.11 icmp_seq=1 ttl=64 time=0.428 ms
84 bytes from 192.168.1.11 icmp_seq=2 ttl=64 time=0.596 ms
84 bytes from 192.168.1.11 icmp_seq=3 ttl=64 time=0.516 ms
84 bytes from 192.168.1.11 icmp_seq=4 ttl=64 time=0.373 ms
84 bytes from 192.168.1.11 icmp_seq=5 ttl=64 time=0.466 ms
```

Рисунок 8: Эхо-запрос в ICMP-моде

10 Анализ ICMP в Wireshark

- MAC-адреса: unicast
- Протокол: ICMP
- Источник: 192.168.1.12
- Назначение: 192.168.1.11

Capturing from Standard input [msk-alkamal-sw-01 Ethernet1 to PC1 Ethernet0]

No. Time Source Destination Protocol Length Info

3	0.053104	Private_66:68.. Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
4	0.062638	Private_66:68.. Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
5	1.055557	Private_66:68.. Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
6	1.063521	Private_66:68.. Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
7	2.057343	Private_66:68.. Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
8	2.063632	Private_66:68.. Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
9	186.1330.	Private_66:68.. Broadcast	ARP	64	Who has 192.168.1.11? Tell 192.168.1.12
10	186.1330.	Private_66:68.. Private_66:68:.. ARP	ARP	64	192.168.1.11 is at 00:50:79:66:68:00
→ 11	186.1344.. 192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x13f7, seq=1/256, ttl=64 (reply in 12)
← 12	186.1344.. 192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0x13f7, seq=1/256, ttl=64 (request in 11)

Frame 11: Packet, 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, Section number: 1
Interface id: 0 (-)
Encapsulation type: Ethernet (1)
Arrival Time: Dec 23, 2025 23:09:55.606840000 Russia TZ 2 Standard Time
UTC Arrival Time: Dec 23, 2025 20:09:55.606840000 UTC
Epoch Arrival Time: 1766520595.606840000
[Time shift for this packet: 0.000000000 seconds]
[Time delta from previous captured frame: 1.362000 milliseconds]
[Time delta from previous displayed frame: 1.362000 milliseconds]
[Time since reference or first frame: 3 minutes, 6.134447000 seconds]
Frame Number: 11
Frame Length: 98 bytes (784 bits)
Capture Length: 98 bytes (784 bits)
[Frame is marked: False]
[Frame is ignored: False]
[Protocols in frame: eth:ethertype:ip:icmp:data]

11 UDP Echo Request

- Выполнен UDP-эхо-запрос
- Использована опция -2
- Проверка работы UDP

```
PC2> ping 192.168.1.11 -2 -c
84 bytes from 192.168.1.11 udp_seq=1 ttl=64 time=0.597 ms
84 bytes from 192.168.1.11 udp_seq=2 ttl=64 time=0.308 ms
84 bytes from 192.168.1.11 udp_seq=3 ttl=64 time=0.330 ms
84 bytes from 192.168.1.11 udp_seq=4 ttl=64 time=0.539 ms
```

Рисунок 9: Эхо-запрос в UDP-моде

12 Анализ UDP-пакетов

- Протокол: UDP
- Порт источника: динамический
- Порт назначения: 7 (Echo)

The screenshot shows a Wireshark capture window titled "udp". The packet list pane displays several Echo requests and responses between two hosts on the same network. The details pane shows the structure of a selected packet, which is a standard UDP datagram. The bytes pane shows the raw hex and ASCII data of the packet.

Capturing from Standard input [msk-alkamal-sw-01 Ethernet1 to PC1 Ethernet0]

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

udp

No.	Time	Source	Destination	Protocol	Length Info
25	786.9188..	192.168.1.12	192.168.1.11	ECHO	98 Request
26	786.9188..	192.168.1.11	192.168.1.12	ECHO	98 Response
27	787.9281..	192.168.1.12	192.168.1.11	ECHO	98 Request
28	787.9281..	192.168.1.11	192.168.1.12	ECHO	98 Response
29	788.9228..	192.168.1.12	192.168.1.11	ECHO	98 Request
30	788.9228..	192.168.1.11	192.168.1.12	ECHO	98 Response
31	789.9256..	192.168.1.12	192.168.1.11	ECHO	98 Request
32	789.9256..	192.168.1.11	192.168.1.12	ECHO	98 Response
33	710.9278..	192.168.1.12	192.168.1.11	ECHO	98 Request
34	710.9278..	192.168.1.11	192.168.1.12	ECHO	98 Response
35	722.0827..	192.168.1.12	192.168.1.11	ECHO	98 Request

Frame 25: Packet, 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, 00:00:00:00:00:00 (00:50:79:66:68:00) at 2023-01-31 10:22:25.000000000 UTC
Ethernet II, Src: Private_66:68:01 (00:50:79:66:68:01), Dst: Private_66:68:00 (00:50:79:66:68:00)
Destination: Private_66:68:00 (00:50:79:66:68:00)
.... ..0. = LG bit: Globally unique address (factory default)
.... ..0. = IG bit: Individual address (unicast)
Source: Private_66:68:01 (00:50:79:66:68:01)
.... ..0. = LG bit: Globally unique address (factory default)
.... ..0. = IG bit: Individual address (unicast)
Type: IPv4 (0x0800)
[Stream index: 4]
Internet Protocol Version 4, Src: 192.168.1.12, Dst: 192.168.1.11
0100 = Version: 4
... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
Total Length: 84
Identification: 0xf91c (63772)
000. = Flags: 0x0
... 0 0000 0000 0000 = Fragment Offset: 0
Time to Live: 64
Protocol: UDP (17)

00 50 79 66 68 00 00 50 79 66 68
00 54 f9 1c 00 00 40 11 fe 14 c0
00 20 01 0b 4b 29 00 07 00 40 95 4b 00
00 30 0e 0f 10 11 12 13 14 15 16 17 18
00 40 1e 1f 20 21 22 23 24 25 26 27 28
00 50 2e 2f 30 31 32 33 34 35 36 37 38
00 60 3e 3f

13 TCP Echo Request

- Выполнен TCP-эхо-запрос
- Использована опция -3
- Установлено TCP-соединение

```
PC2> ping 192.168.1.11 -3 -c 4
Connect    7@192.168.1.11 seq=1 ttl=64 time=1.973 ms
SendData   7@192.168.1.11 seq=1 ttl=64 time=2.021 ms
Close      7@192.168.1.11 seq=1 ttl=64 time=2.955 ms
Connect    7@192.168.1.11 seq=2 ttl=64 time=1.911 ms
SendData   7@192.168.1.11 seq=2 ttl=64 time=2.191 ms
Close      7@192.168.1.11 seq=2 ttl=64 time=4.465 ms
Connect    7@192.168.1.11 seq=3 ttl=64 time=2.088 ms
SendData   7@192.168.1.11 seq=3 ttl=64 time=2.728 ms
Close      7@192.168.1.11 seq=3 ttl=64 time=3.902 ms
Connect    7@192.168.1.11 seq=4 ttl=64 time=1.994 ms
SendData   7@192.168.1.11 seq=4 ttl=64 time=1.944 ms
Close      7@192.168.1.11 seq=4 ttl=64 time=4.439 ms
```

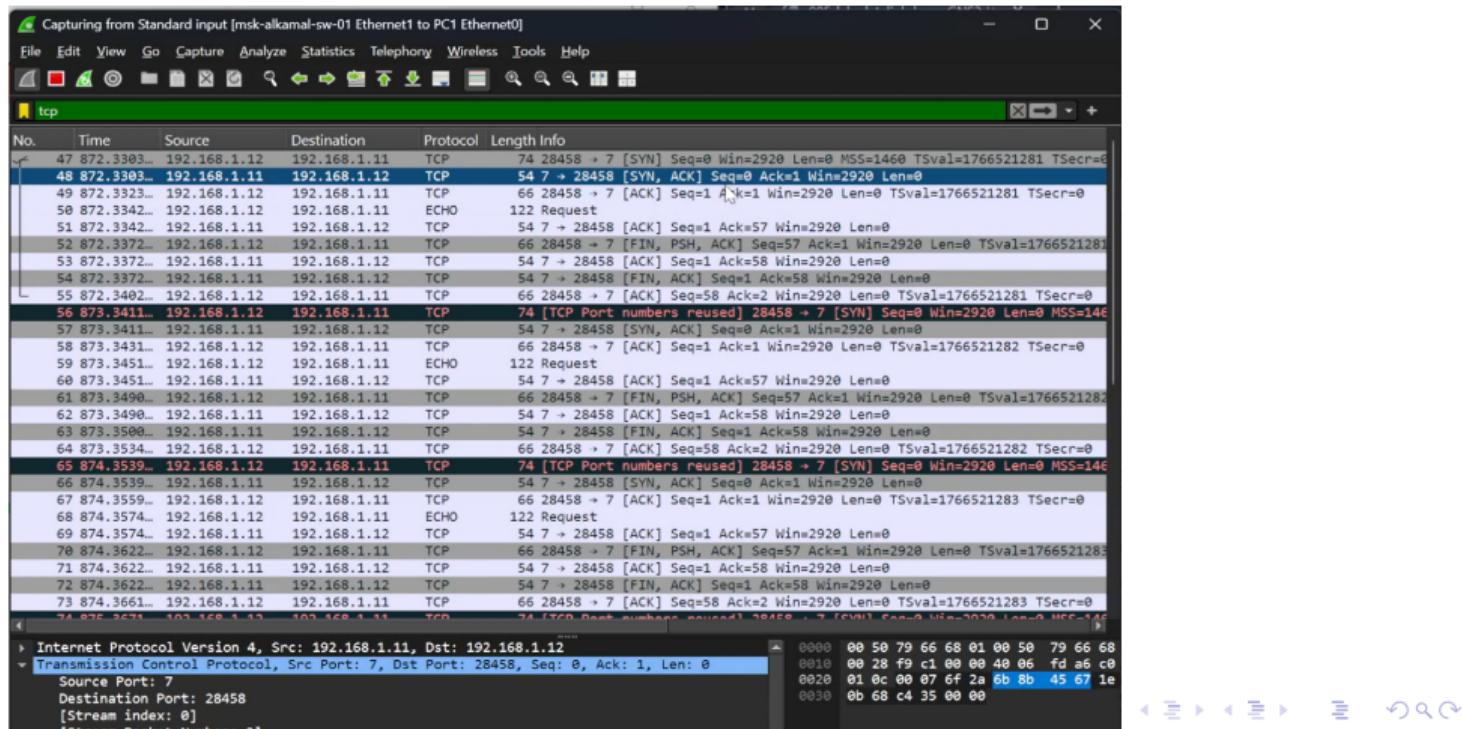
14 TCP: этап SYN

- Начало трёхэтапного рукопожатия
- Флаг SYN
- Начальный Sequence Number

No.	Time	Source	Destination	Protocol	Length	Info
47	872.3303...	192.168.1.12	192.168.1.11	TCP	74	28458 → 7 [SYN] Seq=0 Win=2920 Len=0 MSS=1460 TSval=1766521281 TSecr=0
48	872.3303...	192.168.1.11	192.168.1.12	TCP	54	7 → 28458 [SYN, ACK] Seq=0 Ack=1 Win=2920 Len=0
49	872.3323...	192.168.1.12	192.168.1.11	TCP	66	28458 → 7 [ACK] Seq=1 Ack=1 Win=2920 Len=0 TSval=1766521281 TSecr=0
50	872.3342...	192.168.1.12	192.168.1.11	ECHO	122	Request
51	872.3342...	192.168.1.11	192.168.1.12	TCP	54	7 → 28458 [ACK] Seq=1 Ack=57 Win=2920 Len=0
52	872.3372...	192.168.1.12	192.168.1.11	TCP	66	28458 → 7 [FIN, PSH, ACK] Seq=57 Ack=1 Win=2920 Len=0 TSval=1766521281
53	872.3372...	192.168.1.11	192.168.1.12	TCP	54	7 → 28458 [ACK] Seq=1 Ack=58 Win=2920 Len=0
54	872.3372...	192.168.1.11	192.168.1.12	TCP	54	7 → 28458 [FIN, ACK] Seq=1 Ack=58 Win=2920 Len=0
55	872.3402...	192.168.1.12	192.168.1.11	TCP	66	28458 → 7 [ACK] Seq=58 Ack=2 Win=2920 Len=0 TSval=1766521281 TSecr=0
56	873.3411...	192.168.1.12	192.168.1.11	TCP	74	[TCP Port numbers reused] 28458 → 7 [SYN] Seq=0 Win=2920 Len=0 MSS=146
57	873.3411...	192.168.1.11	192.168.1.12	TCP	54	7 → 28458 [SYN, ACK] Seq=0 Ack=1 Win=2920 Len=0
58	873.3431...	192.168.1.12	192.168.1.11	TCP	66	28458 → 7 [ACK] Seq=1 Ack=1 Win=2920 Len=0 TSval=1766521282 TSecr=0
59	873.3451...	192.168.1.12	192.168.1.11	ECHO	122	Request
60	873.3451...	192.168.1.11	192.168.1.12	TCP	54	7 → 28458 [ACK] Seq=1 Ack=57 Win=2920 Len=0
61	873.3490...	192.168.1.12	192.168.1.11	TCP	66	28458 → 7 [FIN, PSH, ACK] Seq=57 Ack=1 Win=2920 Len=0 TSval=1766521282
62	873.3490...	192.168.1.11	192.168.1.12	TCP	54	7 → 28458 [ACK] Seq=1 Ack=58 Win=2920 Len=0
63	873.3500...	192.168.1.11	192.168.1.12	TCP	54	7 → 28458 [FIN, ACK] Seq=1 Ack=58 Win=2920 Len=0
64	873.3534...	192.168.1.12	192.168.1.11	TCP	66	28458 → 7 [ACK] Seq=58 Ack=2 Win=2920 Len=0 TSval=1766521282 TSecr=0
65	874.3539...	192.168.1.12	192.168.1.11	TCP	74	[TCP Port numbers reused] 28458 → 7 [SYN] Seq=0 Win=2920 Len=0 MSS=146
66	874.3539...	192.168.1.11	192.168.1.12	TCP	54	7 → 28458 [SYN, ACK] Seq=0 Ack=1 Win=2920 Len=0
67	874.3559...	192.168.1.12	192.168.1.11	TCP	66	28458 → 7 [ACK] Seq=1 Ack=1 Win=2920 Len=0 TSval=1766521283 TSecr=0
68	874.3574...	192.168.1.12	192.168.1.11	ECHO	122	Request
69	874.3574...	192.168.1.11	192.168.1.12	TCP	54	7 → 28458 [ACK] Seq=1 Ack=57 Win=2920 Len=0
70	874.3622...	192.168.1.11	192.168.1.12	TCP	66	28458 → 7 [FIN, PSH, ACK] Seq=57 Ack=1 Win=2920 Len=0 TSval=1766521283
71	874.3622...	192.168.1.11	192.168.1.12	TCP	54	7 → 28458 [ACK] Seq=1 Ack=58 Win=2920 Len=0
72	874.3622...	192.168.1.11	192.168.1.12	TCP	54	7 → 28458 [FIN, ACK] Seq=1 Ack=58 Win=2920 Len=0
73	874.3661...	192.168.1.12	192.168.1.11	TCP	66	28458 → 7 [ACK] Seq=58 Ack=2 Win=2920 Len=0 TSval=1766521283 TSecr=0
74	874.3671...	192.168.1.11	192.168.1.12	TCP	74	[TCP Port numbers reused] 74 → 7 [ACK] Seq=58 Ack=2 Win=2920 Len=0 TSval=1766521283 TSecr=0

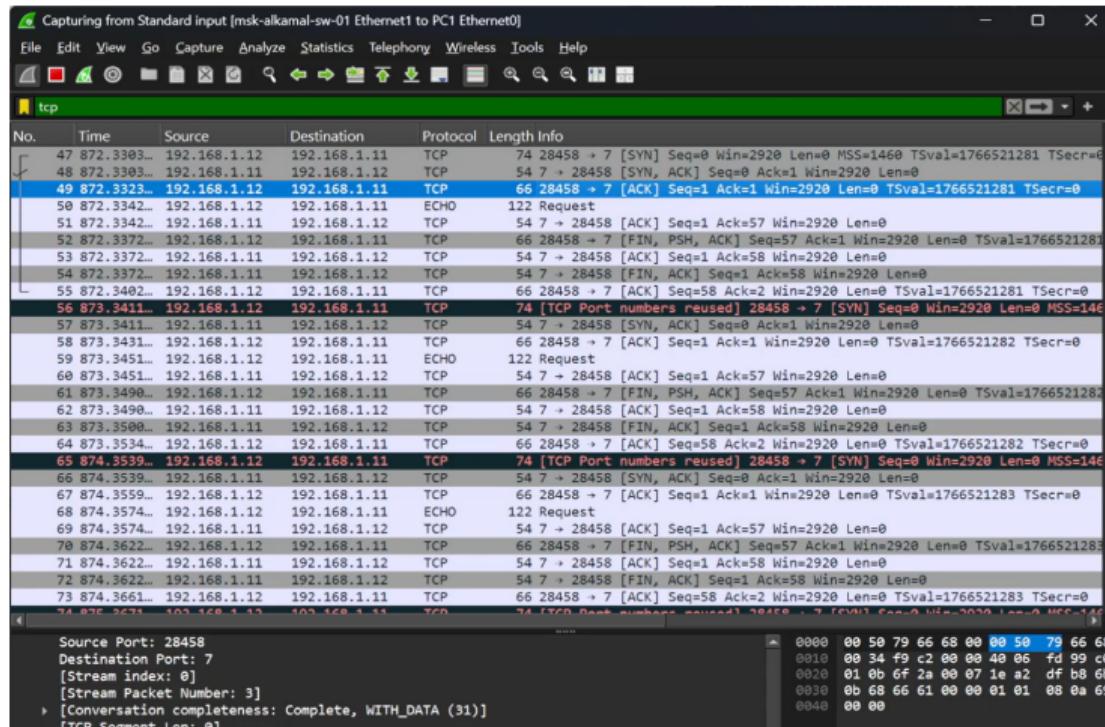
15 TCP: этап SYN-ACK

- Ответ принимающей стороны
 - Подтверждение запроса



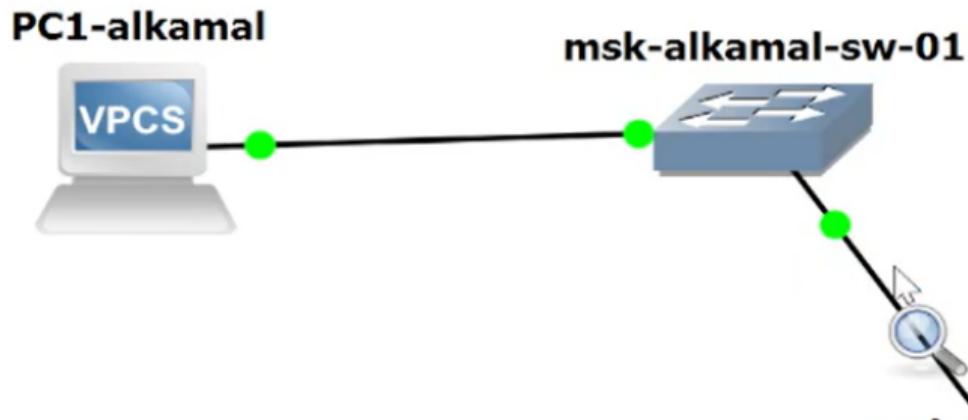
16 TCP: этап ACK

- Завершение установки соединения
- TCP-соединение установлено



17 Топология с маршрутизатором FRR

- Добавлен маршрутизатор FRR
- Включён захват трафика
- Узлы переименованы



18 IP-адресация PC-1 (FRR)

- Назначен адрес 192.168.1.10/24
- Указан шлюз 192.168.1.1
- Проверка конфигурации

```
PC1-alkamal> ip 192.168.1.10/24 192.168.1.1
Checking for duplicate address...
PC1 : 192.168.1.10 255.255.255.0 gateway 192.168.1.1
```

```
PC1-alkamal> save
Saving startup configuration to startup.vpc
. done
```

```
PC1-alkamal> show ip

NAME      : PC1-alkamal[1]
IP/MASK   : 192.168.1.10/24
GATEWAY   : 192.168.1.1
DNS       :
MAC       : 00:50:70:66:68:00
```



19 IP-адресация FRR

- Настроен интерфейс маршрутизатора
- Проверена конфигурация

```
[OK]
msk-alkamal-gw-01# configure terminal
msk-alkamal-gw-01(config)# interface eth0
msk-alkamal-gw-01(config-if)# ip address 192.168.1.1/24
msk-alkamal-gw-01(config-if)# no shutdown
msk-alkamal-gw-01(config-if)# exit
msk-alkamal-gw-01(config)# exit
msk-alkamal-gw-01# write memory
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
msk-alkamal-gw-01# show running-config
Building configuration...

Current configuration:
!
frr version 8.2.2
frr defaults traditional
hostname frr
hostname msk-alkamal-gw-01
service integrated-vtysh-config
!
interface eth0
  ip address 192.168.1.1/24
exit
!
end
msk-alkamal-gw-01# show interface brief
Interface      Status    VRF        Addresses
-----  -----  ---
eth0          up       default   192.168.1.1/24
```



20 Проверка связи PC-1 ↔ FRR

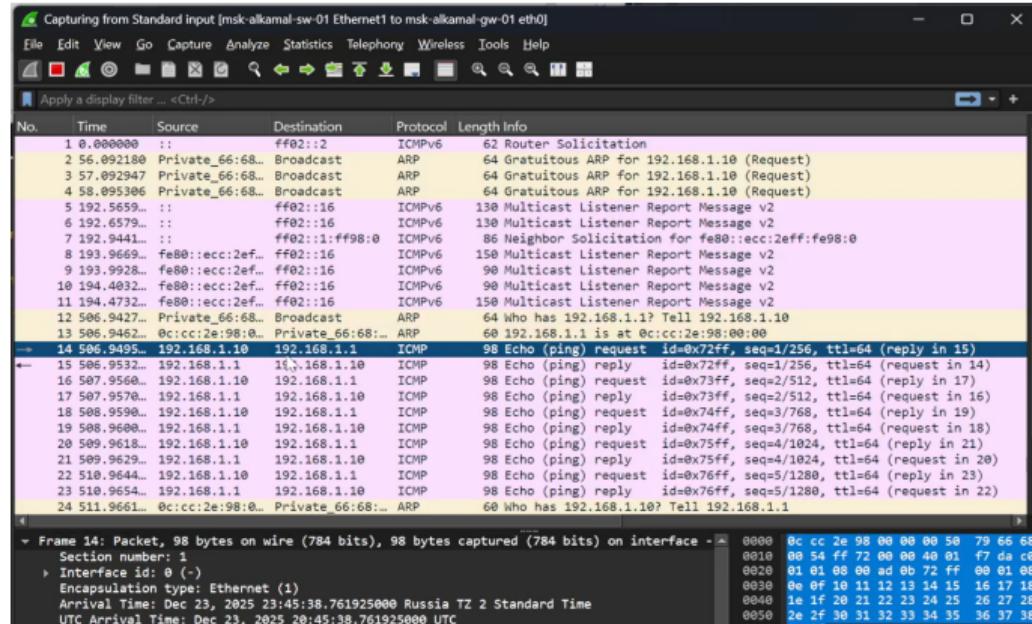
- ICMP-эхо-запросы успешны
- Связность подтверждена

```
PC1-alkamal> ping 192.168.1.1
84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=3.894 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=1.498 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=1.689 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=1.949 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=1.852 ms
```

Рисунок 17: Пингование маршрутизатора FRR

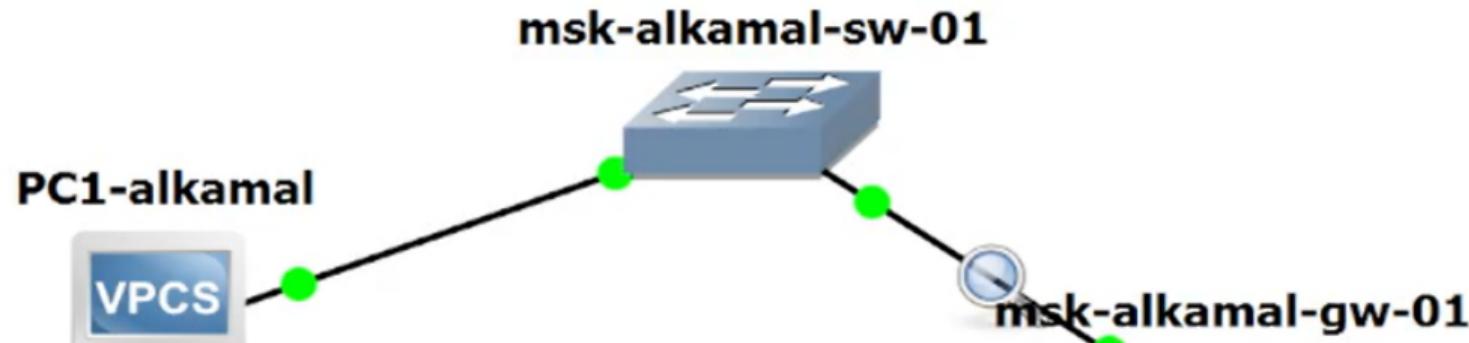
21 Анализ ICMP (FRR)

- Протокол: ICMP
- MAC-адреса: unicast
- IP-источник: PC-1
- IP-назначение: FRR



22 Топология с маршрутизатором VyOS

- Добавлен маршрутизатор VyOS
- Включён захват трафика
- Узлы запущены



23 IP-адресация PC-1 (VyOS)

- Назначен IPv4-адрес
- Подготовка к тестированию

```
PC1-alkamal> ip 192.168.1.10/24 192.168.1.1
Checking for duplicate address...
PC1 : 192.168.1.10 255.255.255.0 gateway 192.168.1.1
```

```
PC1-alkamal> save
Saving startup configuration to startup.vpc
. done
```

Рисунок 20: Настройка IP PC-1

24 Вход в систему VyOS

- Логин: vyos
- Пароль: vyos
- Переход в CLI

The screenshot shows a terminal window titled "msk-alkamal-gw-01". The window contains a log of system boot events and a login prompt. The log includes messages from various kernel modules like ehci_hcd, uhci_hcd, ohci_hcd, and systemd, detailing the initialization of USB controllers, random number generation, and the loading of modules like 'autofs4'. It also shows the detection of virtualization (qemu), the setting of the hostname ('msk-alkamal-gw-01'), and the creation of system slices. The log concludes with a message about bridge filtering and the registration of a bridge firewalling module. Finally, it displays a welcome message from VyOS and a login prompt for "msk-alkamal-gw-01" with the user "vyos".

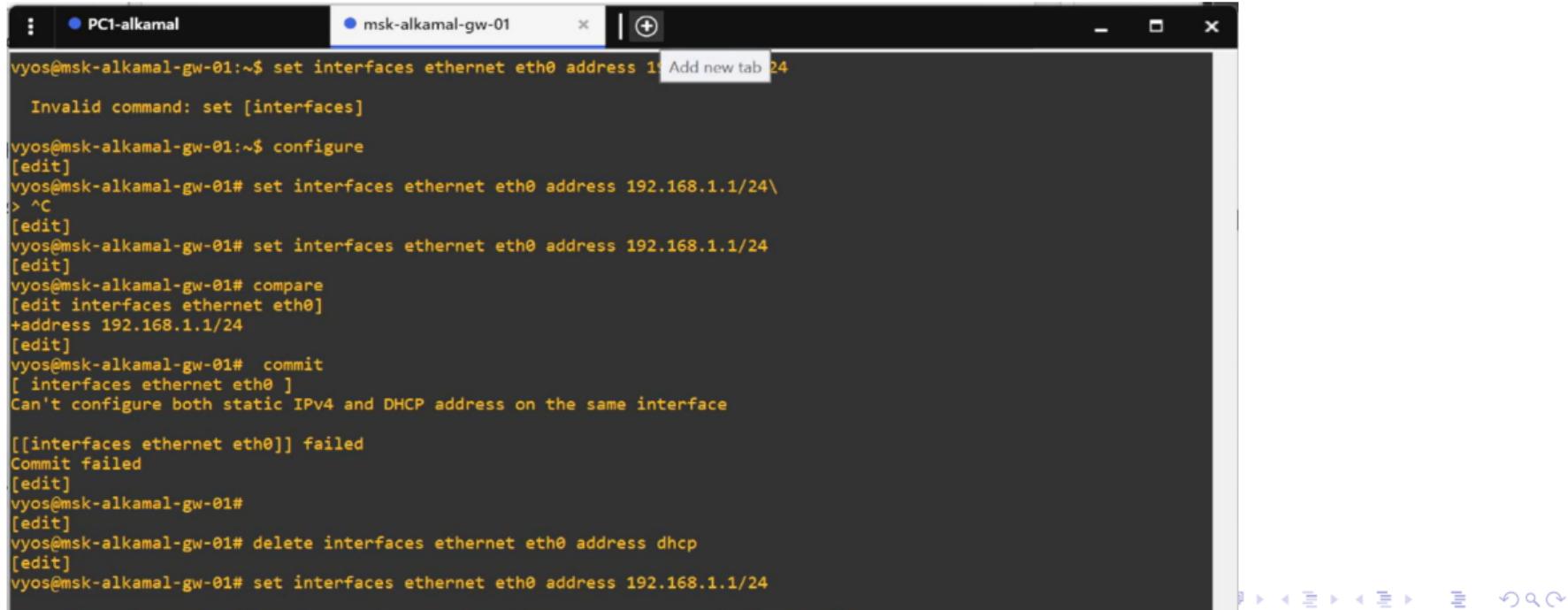
```
[ 12.922690] ehci_hcd: USB 2.0 'Enhanced' Host Controller (EHCI) Driver
[ 12.930039] uhci_hcd: USB Universal Host Controller Interface driver
[ 12.957517] ohci_hcd: USB 1.1 'Open' Host Controller (OHCI) Driver
[ 12.976315] usbcore: registered new interface driver usb-storage
[ 13.487762] random: crng init done
[ 20.424349] EXT4-fs (sda1): re-mounted. Opts: (null)
[ 23.226257] systemd[1]: Inserted module 'autofs4'
[ 23.384149] systemd[1]: systemd 241 running in system mode. (+PAM +AUDIT +SELINUX +IMA +APPARMOR +SMACK +SYSVINIT +U
TIP +LIBCRYPTSETUP +GCRYPT +GNUTLS +ACL +XZ +LZ4 +SECCOMP +BLKID +ELFUTILS +KMOD -IDN -PCRE2 default-hierarchy=hy
brid)
[ 23.392203] systemd[1]: Detected virtualization qemu.
[ 23.394546] systemd[1]: Detected architecture x86-64.
[ 23.438234] systemd[1]: Set hostname to <msk-alkamal-gw-01>.
[ 25.892363] systemd[1]: Created slice User and Session Slice.
[ 25.898325] systemd[1]: Reached target Network.
[ 25.903420] systemd[1]: Created slice system-serial\x2dgetty.slice.
[ 25.909356] systemd[1]: Set up automount Arbitrary Executable File Formats File System Automount Point.
[ 25.913966] systemd[1]: Reached target Remote File Systems.
[ 25.919194] systemd[1]: Listening on udev Kernel Socket.
[ 26.666527] bridge: filtering via arp/ip/ip6tables is no longer available by default. Update your scripts to load br
netfilter if you need this.
[ 26.732626] Bridge firewalling registered
[ 26.819170] mpls_gso: MPLS GSO support

Welcome to VyOS - msk-alkamal-gw-01 ttyS0

msk-alkamal-gw-01 login: vyos
```

25 Настройка интерфейса eth0 (VyOS)

- Удалён DHCP
- Назначен адрес 192.168.1.1/24
- Выполнены `commit` и `save`



The screenshot shows a terminal window titled "msk-alkamal-gw-01" with a tab bar containing "PC1-alkamal". The terminal displays the following command-line session:

```
vyos@msk-alkamal-gw-01:~$ set interfaces ethernet eth0 address 1: Add new tab 24
Invalid command: set [interfaces]
vyos@msk-alkamal-gw-01:~$ configure
[edit]
vyos@msk-alkamal-gw-01# set interfaces ethernet eth0 address 192.168.1.1/24\
> ^C
[edit]
vyos@msk-alkamal-gw-01# set interfaces ethernet eth0 address 192.168.1.1/24
[edit]
vyos@msk-alkamal-gw-01# compare
[edit interfaces ethernet eth0]
+address 192.168.1.1/24
[edit]
vyos@msk-alkamal-gw-01# commit
[ interfaces ethernet eth0 ]
Can't configure both static IPv4 and DHCP address on the same interface
[[interfaces ethernet eth0]] failed
Commit failed
[edit]
vyos@msk-alkamal-gw-01#
[edit]
vyos@msk-alkamal-gw-01# delete interfaces ethernet eth0 address dhcp
[edit]
vyos@msk-alkamal-gw-01# set interfaces ethernet eth0 address 192.168.1.1/24
```

26 Проверка связи PC-1 ↔ VyOS

- Выполнен ping
- Получены 5 ICMP-ответов

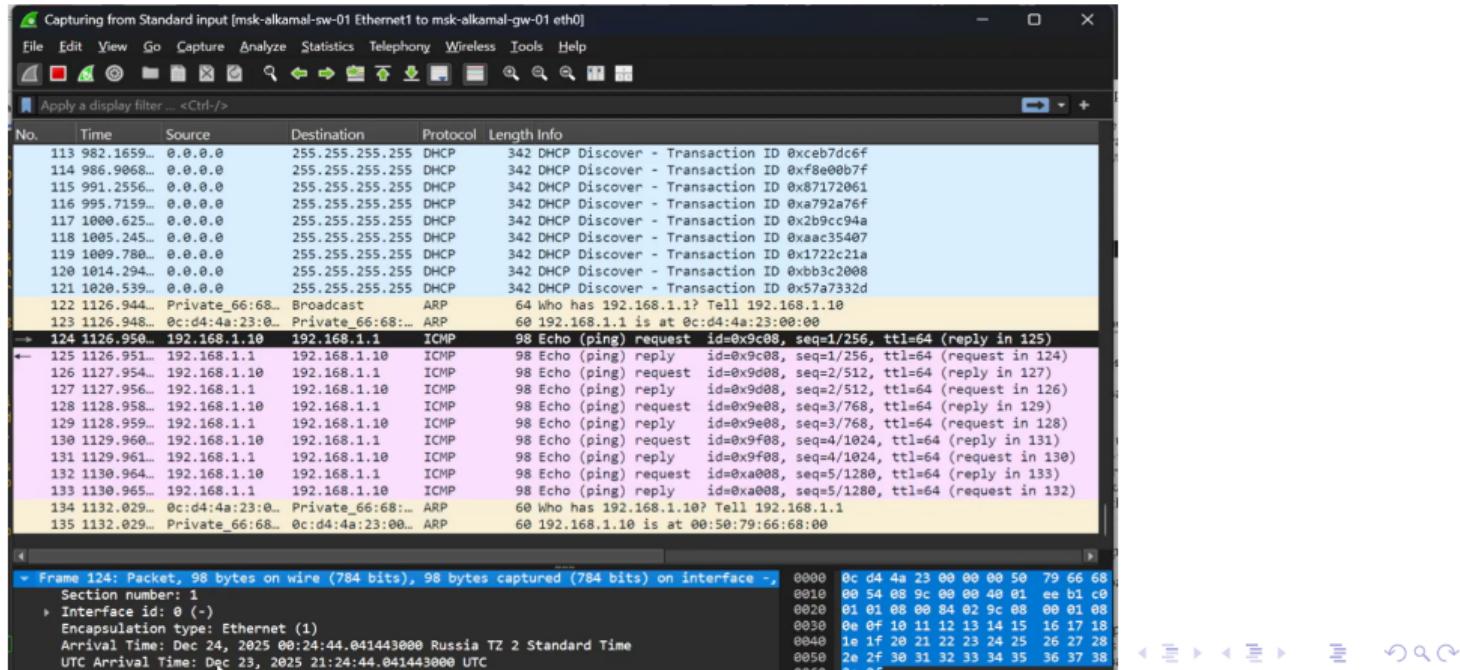
```
PC1-alkamal> ping 192.168.1.1
84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=2.060 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=2.220 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=1.948 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=1.799 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=1.374 ms

PC1-alkamal>
```

Рисунок 22: Пингование маршрутизатора VyOS

27 Анализ ICMP (VyOS)

- Протокол: ICMP
- Источник: PC-1
- Назначение: VyOS



28 Выводы

- Смоделированы сети с FRR и VyOS
- Проверена IP-связность
- Проанализированы ARP, ICMP, UDP, TCP
- Подтверждена корректность конфигурации