РОССИЙСКИЙ УНИВЕРСИТЕТ ДРУЖБЫ НАРОДОВ

Факультет физико-математических и естественных наук

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ОТЧЕТ
ПО ЛАБОРАТОРНОЙ РАБОТЕ № 5

Простые сети в GNS3. Анализ трафика

дисциплина: Сетевые технологии

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МОСКВА

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ЦЕЛЬ РАБОТЫ:

Построение простейших моделей сети на базе коммутатора и маршрутизаторов FRR и VyOS в GNS3, анализ трафика посредством Wireshark.

ХОД РАБОТЫ

1. Я запустил GNS3 VM и GNS3. Создайте новый проект task1, реализовал топологию сети как на примере и запустил её. (Рис. 1)

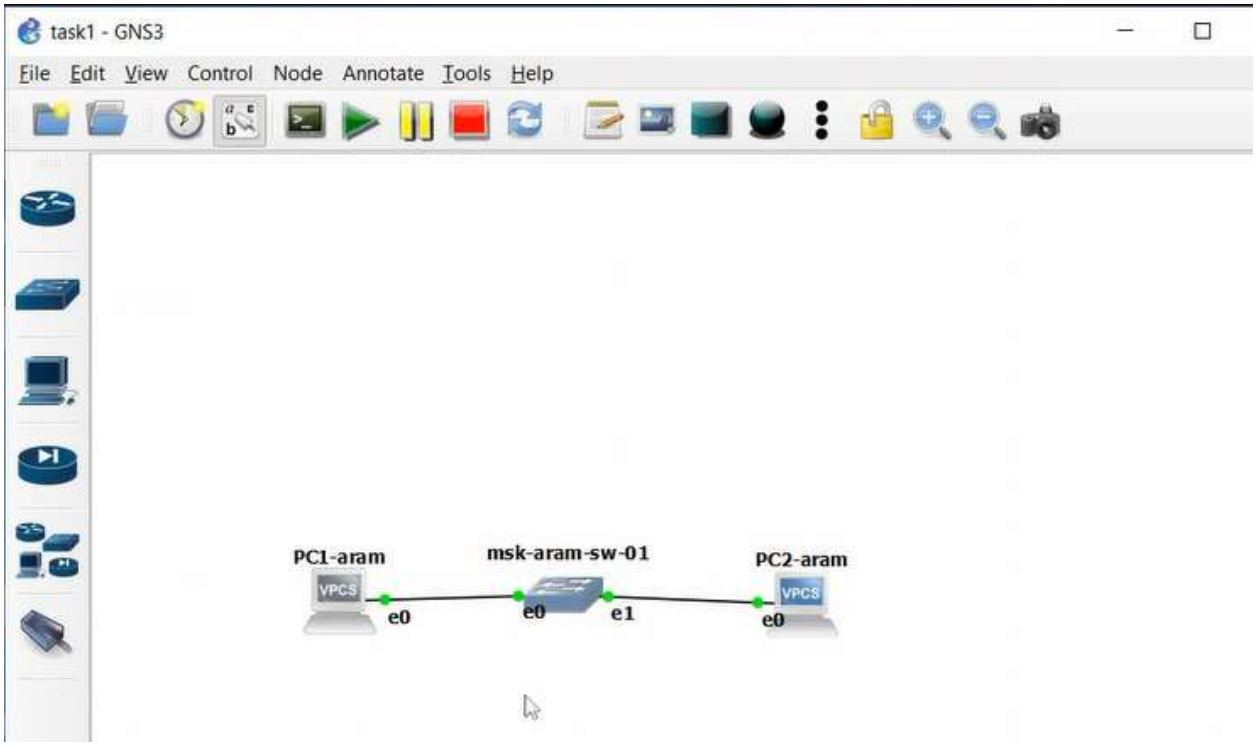

Рис. 1

2. Задал IP-адреса VPCS (Рис. 2-3).

Рис. 2

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

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

PC2-aram>
```

Рис. 3

3. Проверил работоспособность сети с помощью команды ping. После остановил все узлы (Рис. 4).

```
PC1-aram> ping 192.168.1.12

84 bytes from 192.168.1.12 icmp_seq=1 ttl=64 time=0.653 ms
84 bytes from 192.168.1.12 icmp_seq=2 ttl=64 time=0.622 ms
84 bytes from 192.168.1.12 icmp_seq=3 ttl=64 time=0.346 ms
84 bytes from 192.168.1.12 icmp_seq=4 ttl=64 time=0.471 ms
84 bytes from 192.168.1.12 icmp_seq=5 ttl=64 time=0.861 ms

PC1-aram>
```

Рис. 4

4. Включил захват трафика и запустил все узлы. Запустился Wireshark. (Рис. 5).

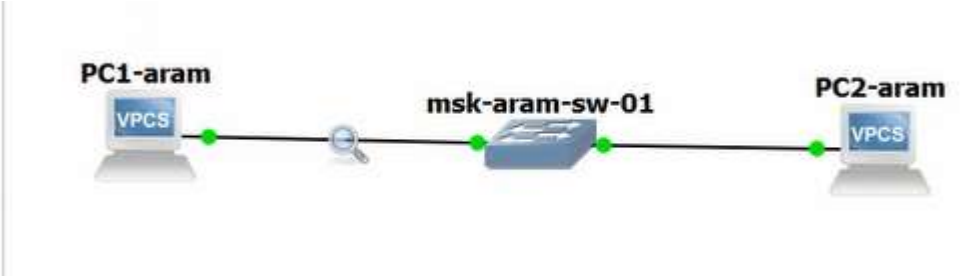

Рис. 5

5. Открыл Wireshark для анализа протоколов. Проанализировал ARP пакеты. Длина кадра 64 байта. Источник глобальный уникальный, шдюз локальный групповой. (Рис. 6)

arp

No.	Time	Source	Destination	Protocol	Length	Info
3	0.051006	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
4	0.061697	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
5	1.052740	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
6	1.063564	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
7	2.053062	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
8	2.063734	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
9	194.996263	Private_66:68:01	Broadcast	ARP	64	Who has 192.168.1.11? Tell 192.168.1.12
10	194.996884	Private_66:68:00	Private_66:68:01	ARP	64	192.168.1.11 is at 00:50:79:66:68:00

Рис. 6

```
[ Wireshark · Пакет 3 · wireshark.pcapng

✓ Frame 3: 64 bytes on wire (512 bits), 64 bytes captured (512 bits) on interface -, id 0
  > Interface id: 0 (-)
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct  3, 2022 16:29:09.053125000 RTZ 2 (зима)
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1664803749.053125000 seconds
    [Time delta from previous captured frame: 0.039780000 seconds]
    [Time delta from previous displayed frame: 0.039780000 seconds]
    [Time since reference or first frame: 0.051006000 seconds]
    Frame Number: 3
    Frame Length: 64 bytes (512 bits)
    Capture Length: 64 bytes (512 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:arp]
    [Coloring Rule Name: ARP]
    [Coloring Rule String: arp]
✓ Ethernet II, Src: Private_66:68:00 (00:50:79:66:68:00), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  ✓ Destination: Broadcast (ff:ff:ff:ff:ff:ff)
      Address: Broadcast (ff:ff:ff:ff:ff:ff)
      .... ..1. .... .... .... .... = LG bit: Locally administered address (this is NOT the factory default)
      .... ...1 .... .... .... .... = IG bit: Group address (multicast/broadcast)
  ✓ Source: Private_66:68:00 (00:50:79:66:68:00)
      Address: Private_66:68:00 (00:50:79:66:68:00)
      .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
      .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: ARP (0x0806)
    Padding: 000000000000000000000000000000000000
    Frame check sequence: 0x00000000 [unverified]
    [FCS Status: Unverified]
> Address Resolution Protocol (request/gratuitous ARP)
```

Рис. 7

6. В терминале PC-2 посмотрел информацию по опциям команды ping. Затем сделал один эхо-запрос в ICMP-моде к узлу PC-1. В окне Wireshark проанализировал полученную информацию. Длина кадра 98 байт, IP адрес источника и шлюза совпадают с заданными значениями, физические адреса глобальные и уникальные. (Рис. 8-10).

```
PC2-aram> ping 192.168.1.11 -1

84 bytes from 192.168.1.11 icmp_seq=1 ttl=64 time=0.874 ms
84 bytes from 192.168.1.11 icmp_seq=2 ttl=64 time=1.773 ms
84 bytes from 192.168.1.11 icmp_seq=3 ttl=64 time=0.474 ms
84 bytes from 192.168.1.11 icmp_seq=4 ttl=64 time=0.360 ms
84 bytes from 192.168.1.11 icmp_seq=5 ttl=64 time=0.360 ms

PC2-aram>
```

Рис. 8

10	194.090866	Private_66:68:00	Private_66:68:01	ARP	64	192.168.1.11 is at 00:50:79:66:68:00
11	194.997121	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x67e4, seq=1/256, ttl=64 (reply in 12)
12	194.997703	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0x67e4, seq=1/256, ttl=64 (request in 11)
13	196.000173	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x68e4, seq=2/512, ttl=64 (reply in 14)
14	196.000913	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0x68e4, seq=2/512, ttl=64 (request in 13)
15	197.003564	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x69e4, seq=3/768, ttl=64 (reply in 16)
16	197.003832	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0x69e4, seq=3/768, ttl=64 (request in 15)
17	198.005645	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x6be4, seq=4/1024, ttl=64 (reply in 18)
18	198.005885	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0x6be4, seq=4/1024, ttl=64 (request in 17)
19	199.008249	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x6ce4, seq=5/1280, ttl=64 (reply in 20)
20	199.008478	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0x6ce4, seq=5/1280, ttl=64 (request in 19)

Рис. 9

```
Wireshark · Пакет 11 · wireshark.pcapng

Frame 11: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, id 0
  Interface id: 0 (-)
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct  3, 2022 16:32:23.999440000 RTZ 2 (зима)
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1664803943.999440000 seconds
    [Time delta from previous captured frame: 0.000437000 seconds]
    [Time delta from previous displayed frame: 0.000437000 seconds]
    [Time since reference or first frame: 194.997321000 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]
    [Coloring Rule Name: ICMP]
    [Coloring Rule String: icmp || icmpv6]
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)
      Address: 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)
      Address: 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)
Internet Protocol Version 4, Src: 192.168.1.12, Dst: 192.168.1.11
Internet Control Message Protocol
```

Рис. 10

7. Сделал один эхо-запрос в UDP-моде к узлу PC-1. (Рис. 11-12).

```
PC2-aram>
PC2-aram> ping 192.168.1.11 -2

84 bytes from 192.168.1.11 udp_seq=1 ttl=64 time=0.323 ms
84 bytes from 192.168.1.11 udp_seq=2 ttl=64 time=0.425 ms
84 bytes from 192.168.1.11 udp_seq=3 ttl=64 time=0.338 ms
84 bytes from 192.168.1.11 udp_seq=4 ttl=64 time=0.386 ms
84 bytes from 192.168.1.11 udp_seq=5 ttl=64 time=1.422 ms

PC2-aram>
```

Рис. 11

```
Wireshark · Пакет 21 · wireshark.pcapng

Frame 21: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, id 0
  Interface id: 0 (-)
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct  3, 2022 16:33:41.573922000 RTZ 2 (зима)
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1664804021.573922000 seconds
    [Time delta from previous captured frame: 73.563325000 seconds]
    [Time delta from previous displayed frame: 73.563325000 seconds]
    [Time since reference or first frame: 272.571803000 seconds]
    Frame Number: 21
    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:udp:echo]
    [Coloring Rule Name: UDP]
    [Coloring Rule String: udp]
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)
      Address: 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)
      Address: 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)
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
```

Рис. 12

8. Сделал один эхо-запрос в TCP-моде к узлу PC-1. Наблюдаем за handshake-ом данного протокола. (Рис. 13-15).

```
PC2-aram> ping 192.168.1.11 -3

Connect   7@192.168.1.11 seq=1 ttl=64 time=1.362 ms
SendData  7@192.168.1.11 seq=1 ttl=64 time=1.954 ms
Close     7@192.168.1.11 seq=1 ttl=64 time=3.012 ms
Connect   7@192.168.1.11 seq=2 ttl=64 time=1.870 ms
SendData  7@192.168.1.11 seq=2 ttl=64 time=1.939 ms
Close     7@192.168.1.11 seq=2 ttl=64 time=3.080 ms
Connect   7@192.168.1.11 seq=3 ttl=64 time=2.688 ms
SendData  7@192.168.1.11 seq=3 ttl=64 time=1.822 ms
Close     7@192.168.1.11 seq=3 ttl=64 time=2.932 ms
Connect   7@192.168.1.11 seq=4 ttl=64 time=1.965 ms
SendData  7@192.168.1.11 seq=4 ttl=64 time=2.729 ms
Close     7@192.168.1.11 seq=4 ttl=64 time=3.616 ms
Connect   7@192.168.1.11 seq=5 ttl=64 time=1.908 ms
SendData  7@192.168.1.11 seq=5 ttl=64 time=1.890 ms
Close     7@192.168.1.11 seq=5 ttl=64 time=3.808 ms

PC2-aram>
```

Рис. 13

Рис. 14

Wireshark · Пакет 43 · task1.pcapng

```
> Frame 43: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface -, id 0
v 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)
  > Source: Private_66:68:01 (00:50:79:66:68:01)
    Type: IPv4 (0x0800)
v 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: 60
    Identification: 0xe51c (58652)
  > Flags: 0x00
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 64
    Protocol: TCP (6)

0000  00 50 79 66 68 00 00 50  79 66 68 01 08 00 45 00   ·Pyfh··P yfh···E·
0010  00 3c e5 1c 00 00 40 06  12 38 c0 a8 01 0c c0 a8   ·<····@· ·8------
0020  01 0b fd 77 00 07 5d 45  07 cd 00 00 00 00 a0 02   ···w··]E --------
0030  0b 68 11 4f 00 00 02 04  05 b4 01 01 08 0a 63 3a   ·h·O···· ------c:
0040  e5 1c 00 00 00 00 01 03  03 01                     -------- --
```

Рис. 15

9. Создал новый проект task2 и реализовал в нём заданную топологию. Задал ip VPCS. Включил захват трафика (Рис. 16-17)

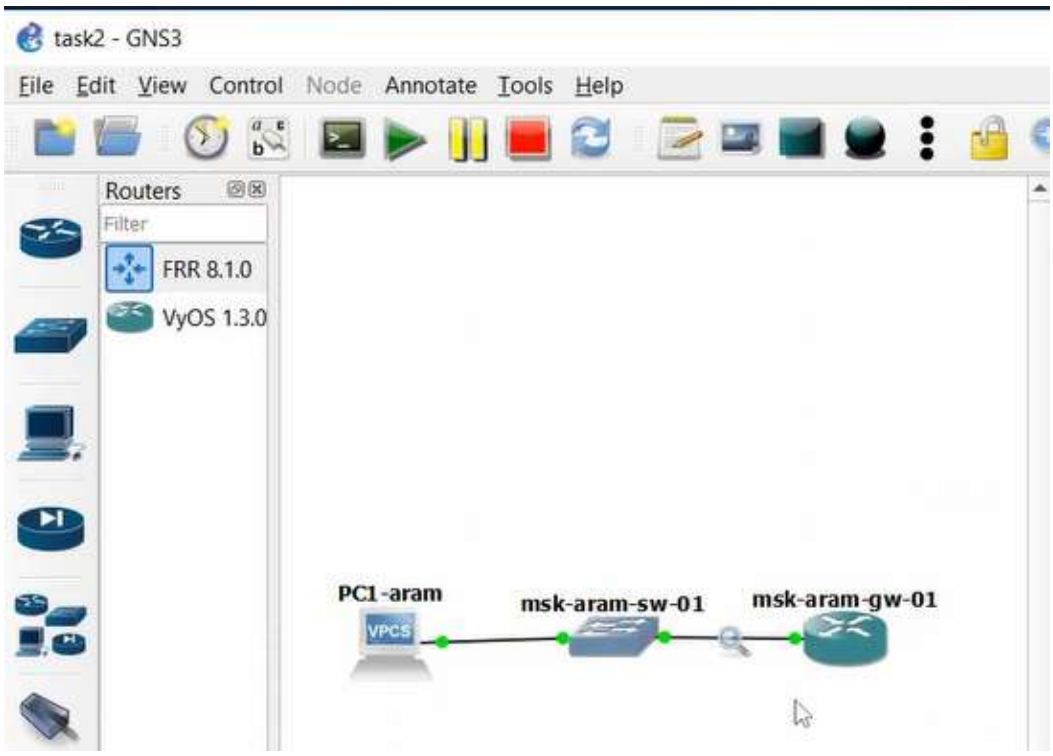

Рис. 16

```
PC1-aram>
PC1-aram> ip 192.168.1.10/24 192.168.1.1
Checking for duplicate address...
saPC1-aram : 192.168.1.10 255.255.255.0 gateway 192.168.1.1

PC1-aram> save
Saving startup configuration to startup.vpc
.  done

PC1-aram> show ip

NAME        : PC1-aram[1]
IP/MASK     : 192.168.1.10/24
GATEWAY     : 192.168.1.1
DNS         :
MAC         : 00:50:79:66:68:00
LPORT       : 20004
RHOST:PORT  : 127.0.0.1:20005
MTU         : 1500

PC1-aram>
```

Рис. 17

10. Настроил IP-адресацию для интерфейса локальной сети маршрутизатора. (Рис. 18)

msk-aram-gw-01

```
frr#
frr# configure terminal
frr(config)# hostname msk-aram-gw-01
msk-aram-gw-01(config)# write memory
% Unknown command: write memory
msk-aram-gw-01(config)# exit
msk-aram-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-aram-gw-01# configure terminal
msk-aram-gw-01(config)# interface eth0
msk-aram-gw-01(config-if)# ip address 192.168.1.1/24
msk-aram-gw-01(config-if)# no shutdown
msk-aram-gw-01(config-if)# exit
msk-aram-gw-01(config)# exit
msk-aram-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-aram-gw-01#
```

Рис. 18

11. Проверил конфигурацию маршрутизатора и настройки IP-адресации. Всё верно, указан правильный ip адрес, имя хоста, что используется только eth0 для соединения с коммутатором. (Рис. 19)

```
msk-aram-gw-01# show running-config
Building configuration...

Current configuration:
!
frr version 8.1
frr defaults traditional
hostname frr
hostname msk-aram-gw-01
service integrated-vtysh-config
!
interface eth0
 ip address 192.168.1.1/24
exit
!
end
```

```
msk-aram-gw-01# show interface brief
Interface       Status  VRF             Addresses
---------       ------  ---             ---------
eth0            up      default         192.168.1.1/24
eth1            down    default
eth2            down    default
eth3            down    default
eth4            down    default
eth5            down    default
eth6            down    default
eth7            down    default
lo              up      default
pimreg          up      default

msk-aram-gw-01#
```

Рис. 19

12. Проверил подключение. Узел PC1 успешно отправляет эхо-запросы на адрес маршрутизатора 192.168.1.1. (Рис. 20)

```
PC1-aram> ping 192.168.1.1

84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=6.435 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=1.734 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=1.087 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=1.153 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=1.124 ms

PC1-aram>
```

Рис. 20

13. В окне Wireshark проанализировал полученную информацию. Длина кадра 98 байта, ip адреса компьютера и маршрутизатора совпадают с заданными значениями. (Рис. 21-22).

14	789.155614	192.168.1.10	192.168.1.1	ICMP	98 Echo (ping) request id=0xaae9, seq=1/256, ttl=64 (reply in 15)
15	789.161780	192.168.1.1	192.168.1.10	ICMP	98 Echo (ping) reply id=0xaae9, seq=1/256, ttl=64 (request in 14)
16	790.163648	192.168.1.10	192.168.1.1	ICMP	98 Echo (ping) request id=0xebe9, seq=2/512, ttl=64 (reply in 17)
17	790.164983	192.168.1.1	192.168.1.10	ICMP	98 Echo (ping) reply id=0xebe9, seq=2/512, ttl=64 (request in 16)
18	791.166436	192.168.1.10	192.168.1.1	ICMP	98 Echo (ping) request id=0xece9, seq=3/768, ttl=64 (reply in 19)
19	791.167346	192.168.1.1	192.168.1.10	ICMP	98 Echo (ping) reply id=0xece9, seq=3/768, ttl=64 (request in 18)
20	792.168312	192.168.1.10	192.168.1.1	ICMP	98 Echo (ping) request id=0xede9, seq=4/1024, ttl=64 (reply in 21)
21	792.169153	192.168.1.1	192.168.1.10	ICMP	98 Echo (ping) reply id=0xede9, seq=4/1024, ttl=64 (request in 20)
22	793.171175	192.168.1.10	192.168.1.1	ICMP	98 Echo (ping) request id=0xeee9, seq=5/1280, ttl=64 (reply in 23)
23	793.172159	192.168.1.1	192.168.1.10	ICMP	98 Echo (ping) reply id=0xeee9, seq=5/1280, ttl=64 (request in 22)

Рис. 21

Wireshark · Пакет 14 · task2.pcapng

```
Frame 14: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, id 0
  Interface id: 0 (-)
    Encapsulation type: Ethernet (1)
    Arrival Time: Oct  3, 2022 16:55:54.941922000 RTZ 2 (зима)
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1664805354.941922000 seconds
    [Time delta from previous captured frame: 0.001088000 seconds]
    [Time delta from previous displayed frame: 0.001088000 seconds]
    [Time since reference or first frame: 789.155614000 seconds]
    Frame Number: 14
    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]
    [Coloring Rule Name: ICMP]
    [Coloring Rule String: icmp || icmpv6]
Ethernet II, Src: Private_66:68:00 (00:50:79:66:68:00), Dst: 0c:2e:82:79:00:00 (0c:2e:82:79:00:00)
  Destination: 0c:2e:82:79:00:00 (0c:2e:82:79:00:00)
      Address: 0c:2e:82:79:00:00 (0c:2e:82:79:00:00)
      .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
      .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
  Source: Private_66:68:00 (00:50:79:66:68:00)
      Address: Private_66:68:00 (00:50:79:66:68:00)
      .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
      .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 192.168.1.10, Dst: 192.168.1.1
Internet Control Message Protocol
```

Рис. 22

14. Запустил новый проект task3, реализовал в нём заданную топологию, запустил все узлы. (Рис. 23).

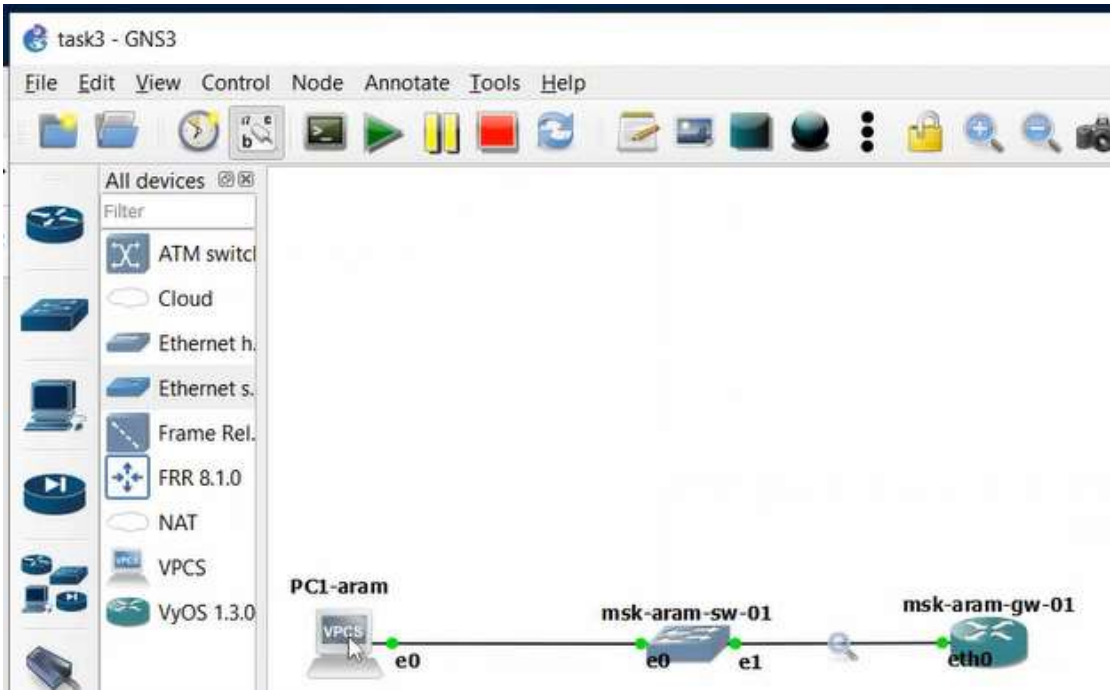

Рис. 23

15. Настроил IP-адресацию для интерфейса узла PC1 (Рис. 24).

```
PC1-aram
Executing the startup file


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

PC1-aram> save
Saving startup configuration to startup.vpc
.  done

PC1-aram> show ip

NAME        : PC1-aram[1]
IP/MASK     : 192.168.1.10/24
GATEWAY     : 192.168.1.1
DNS         :
MAC         : 00:50:79:66:68:00
LPORT       : 20004
RHOST:PORT  : 127.0.0.1:20005
MTU         : 1500

PC1-aram>
```

Рис. 24

16. Настроил маршрутизатор VyOS по указаниям. Установка системы на диск не записалась. (Рис. 25-28)

```
vyos@msk-aram-gw-01:~$ install image
You are trying to install from an already installed system. An ISO
image file to install or URL must be specified.
Exiting...
vyos@msk-aram-gw-01:~$
```

Рис. 25

```
Welcome to VyOS - vyos ttyS0

vyos login: vyos
Password:
Linux vyos 5.4.156-amd64-vyos #1 SMP Thu Oct 28 18:19:14 UTC 2021 x86_64
Welcome to VyOS!

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

Visit https://support.vyos.io to create a support ticket.

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
Use of this pre-built image is governed by the EULA you can find at
/usr/share/vyos/EULA
```

Рис. 26

```
vyos@vyos:~$ configure
[edit]
vyos@vyos# set system host-name msk-aram-gw-01
[edit]
vyos@vyos# set interfaces ethernet eth0 address 192.168.1.1/24
[edit]
vyos@vyos# compare
[edit interfaces ethernet eth0]
+address 192.168.1.1/24
[edit system]
>host-name msk-aram-gw-01
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos# s
```

Рис. 27

```
msk-aram-gw-01
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos# show interfaces
 ethernet eth0 {
     address 192.168.1.1/24
     hw-id 0c:71:ac:81:00:00
 }
 ethernet eth1 {
     hw-id 0c:71:ac:81:00:01
 }
 ethernet eth2 {
     hw-id 0c:71:ac:81:00:02
 }
 loopback lo {
 }
[edit]
vyos@vyos# exit
exit
vyos@vyos:~$
```

Рис. 28

17. Проверил подключение. Узел PC1 успешно отправляет эхо-запросы на адрес маршрутизатора 192.168.1.1 (Рис. 29).

```
PC1-aram
PC1-aram> ping 192.168.1.1

84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=2.731 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=1.576 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=2.928 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=1.403 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=1.536 ms

PC1-aram>
```

18. Проанализировал захваченные пакеты. Протокол ICMP. Длина кадра 98 байт. Ip источника приватный, все адреса совпадают с заданными значениями. (Рис. 29)

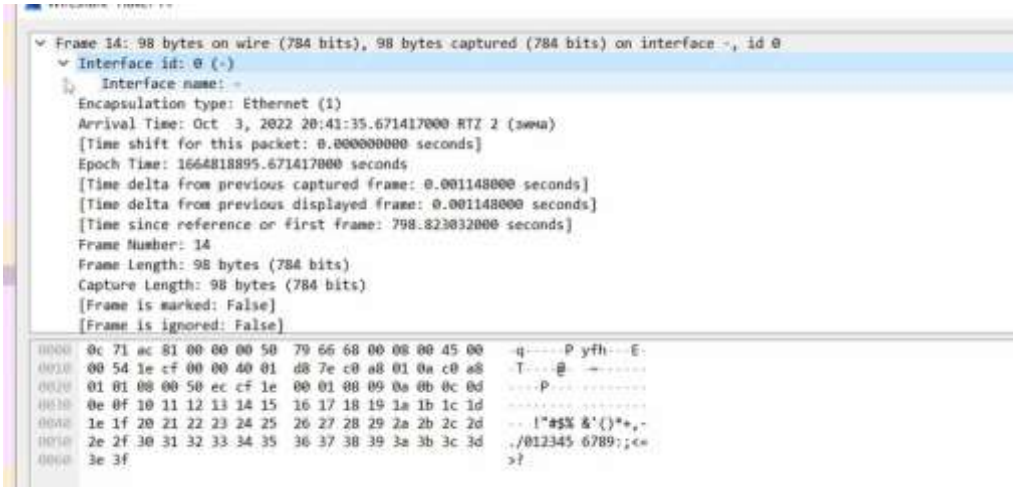

Рис. 29

19. Остановил захват пакетов и закончил работу с GNS3.

ВЫВОД

Я научился работать с GNS3, построил простейшие модели сети на базе коммутатора и маршрутизаторов FRR и VyOS, анализировал трафик с помощью Wireshark.