

Лабораторная работа №5

Тема «Простые сети в GNS3. Анализ трафика»
по дисциплине «Сетевые технологии»

Выполнил: Щербак Маргарита Романовна

Студент группы: НПИбд-02-21

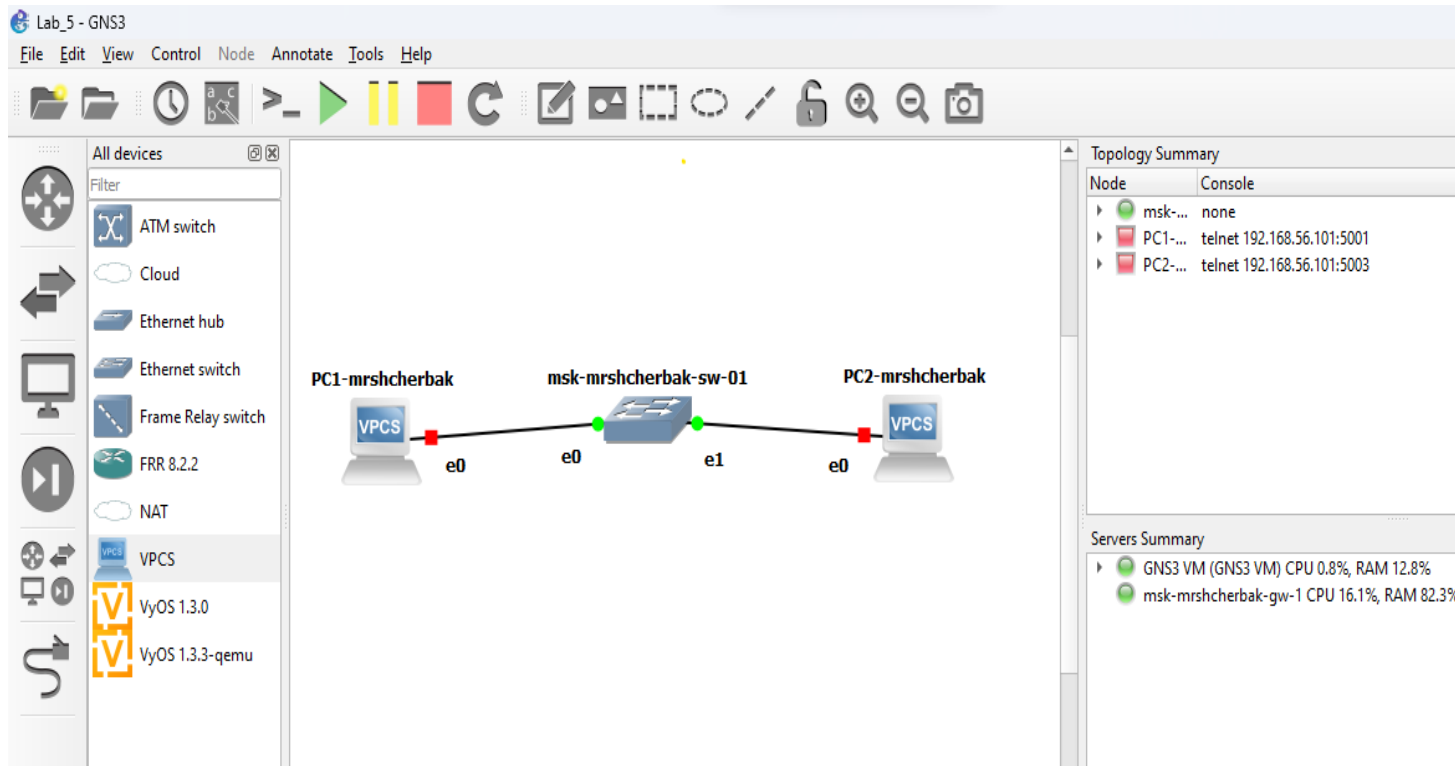
«4» октября 2023г.

Цель работы

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

Выполнение работы

Моделирование простейшей сети на базе коммутатора в GNS3



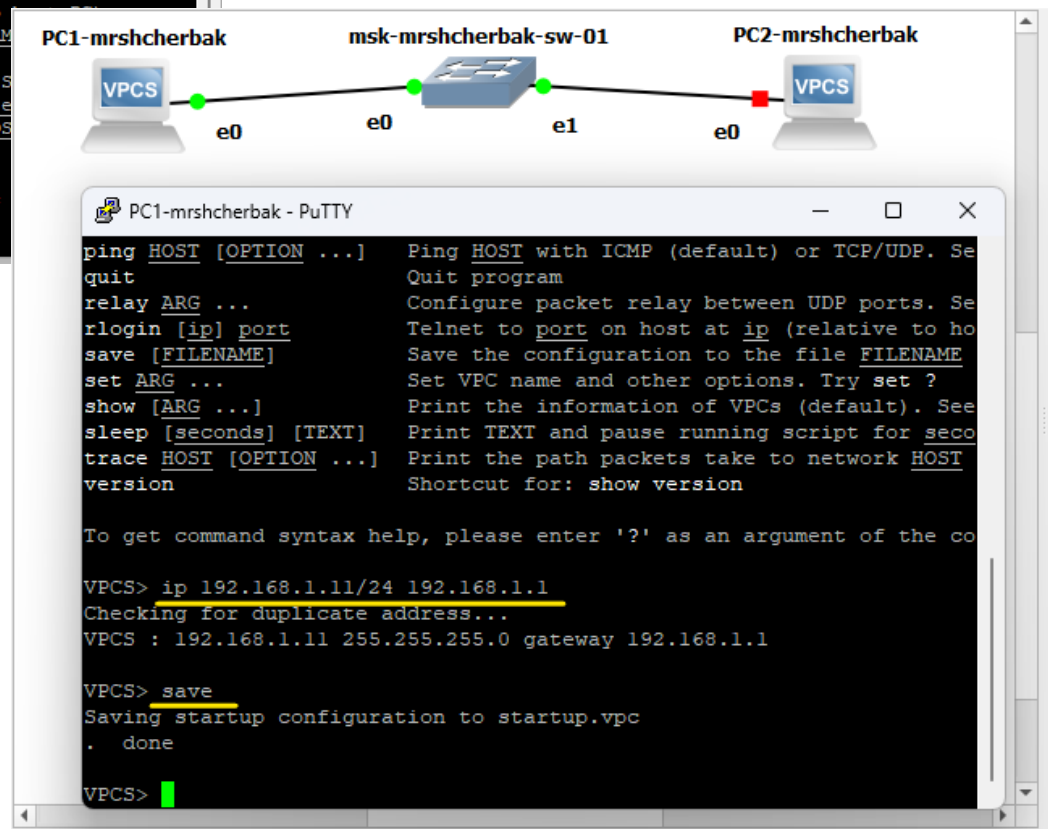
Топология простейшей сети в GNS3

```
PC1-mrshcherbak - PuTTY
Executing the startup file
Hostname is too long. (Maximum 12 characters)
VPCS> /?

?                Print help
arp              Shortcut for: show arp. Show arp table
clear ARG        Clear IPv4/IPv6, arp/neighbor cache, command history
dhcp [OPTION]    Shortcut for: ip dhcp. Get IPv4 address via DHCP
disconnect       Exit the telnet session (daemon mode)
echo TEXT        Display TEXT in output. See also set echo ?
help             Print help
history          Shortcut for: show history. List the command history
ip ARG ... [OPTION] Configure the current VPC's IP settings. See ip ?
load [FILENAME]  Load the configuration/script from the file FILENAME
ping HOST [OPTION ...] Ping HOST with ICMP (default) or TCP/UDP. See ping ?
quit            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)
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 ?
sleep [seconds] [TEXT] Print TEXT and pause running script for seconds
trace HOST [OPTION ...] Print the path packets take to network HOST
version          Shortcut for: show version

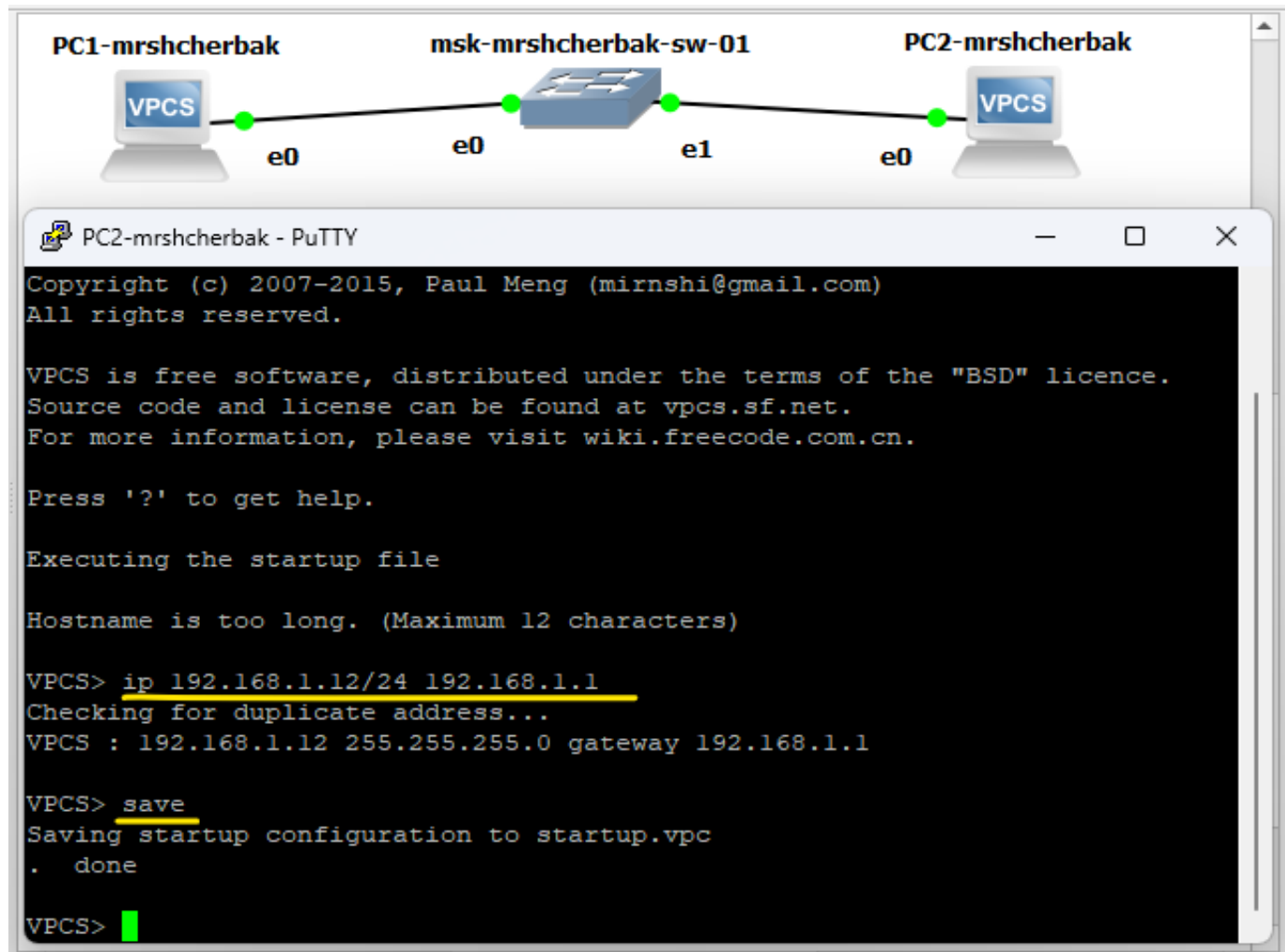
To get command syntax help, please enter '?' as an argument of the command.
VPCS>
```

Просмотр синтаксиса
ВОЗМОЖНЫХ для ввода
команд VPCS в GNS3

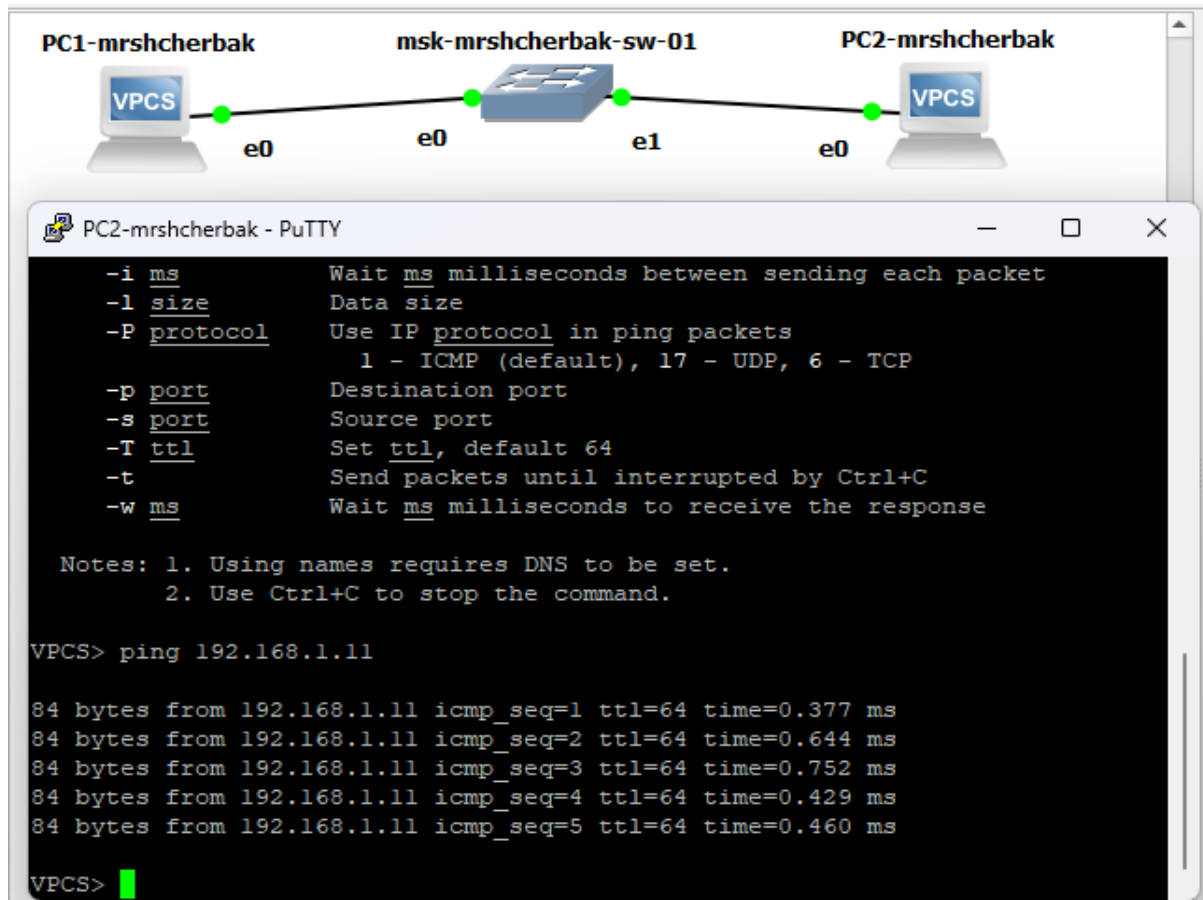


Задание IP-адреса и сохранение
конфигурации VPCS в GNS3

Аналогичным образом задала IP-адрес 192.168.1.12 для PC-2



Проверка работоспособности соединения между PC-1 и PC-2



Анализ трафика в GNS3 посредством Wireshark



Запуск анализатора трафика на соединении между PC-1 и коммутатором

Lab5_Wireshark_next.pcapng

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Применить дисплейный фильтр ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	::	ff02::2	ICMPv6	62	Router Solicitation
2	0.045061	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.10 (Request)
3	1.045762	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.10 (Request)
4	2.046071	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.10 (Request)
5	51.912147	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.10 (Request)
6	52.912941	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.10 (Request)
7	53.913128	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.10 (Request)
8	278.046281	::	ff02::16	ICMPv6	130	Multicast Listener Report Message v2

> Frame 2: 64 bytes on wire (512 bits), 64 bytes captured (512 bits) on interface -, id 0

▼ 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: 00000000000000000000000000000000
Frame check sequence: 0x00000000 [unverified]
[FCS Status: Unverified]

▼ Address Resolution Protocol (request/gratuitous ARP)

- Hardware type: Ethernet (1)
- Protocol type: IPv4 (0x0800)
- Hardware size: 6
- Protocol size: 4
- Opcode: request (1)
- [Is gratuitous: True]
- Sender MAC address: Private_66:68:00 (00:50:79:66:68:00)
- Sender IP address: 192.168.1.10
- Target MAC address: Broadcast (ff:ff:ff:ff:ff:ff)
- Target IP address: 192.168.1.10

Информация по протоколу ARP

```
PC2-mrshcherbak - PuTTY
Checking for duplicate address...
VPCS : 192.168.1.12 255.255.255.0 gateway 192.168.1.1

VPCS> ping /?

ping HOST [OPTION ...]
  Ping the network HOST. HOST can be an ip address or name
Options:
  -l ms           ICMP mode, default
  -2           UDP mode
  -3           TCP mode
  -c count       Packet count, default 5
  -D           Set the Don't Fragment bit
  -f FLAG        Tcp header FLAG |C|E|U|A|P|R|S|F|
                    bits |7 6 5 4 3 2 1 0|
  -i ms          Wait ms milliseconds between sending each packet
  -l size         Data size
  -P protocol     Use IP protocol in ping packets
                    1 - ICMP (default), 17 - UDP, 6 - TCP
  -p port        Destination port
  -s port        Source port
  -T ttl         Set ttl, default 64
  -t           Send packets until interrupted by Ctrl+C
  -w ms         Wait ms milliseconds to receive the response

Notes: 1. Using names requires DNS to be set.
       2. Use Ctrl+C to stop the command.

VPCS>
```

Просмотр информации по
опциям команды ping

Отправила по одному эхо-запросу
в ICMP, UDP и TCP к узлу PC-1.

```
PC2-mrshcherbak - PuTTY

Protocol Length Info
ICMPv6 62 Router Solicit
ICMPv6 62 Router Solic
ARP 64 Gratuitous A
ARP 64 Gratuitous A
ARP 64 Gratuitous A
ARP 64 Gratuitous A
ARP 64 Gratuitous A
ARP 64 Gratuitous A
ARP 64 Who has 192.1
ARP 64 192.168.1.11
ICMP 98 Echo (ping)
ICMP 98 Echo (ping)
ARP 64 Who has 192.1
ARP 64 192.168.1.11
ECHO 98 Request
ECHO 98 Response
TCP 74 29229 → 7 [S
TCP 54 7 → 29229 [S
TCP 66 29229 → 7 [A
ECHO 122 Request
TCP 54 7 → 29229 [A
TCP 66 29229 → 7 [F
TCP 54 7 → 29229 [A
TCP 54 7 → 29229 [F
TCP 66 29229 → 7 [A

bits |7 6 5 4 3 2 1 0|
-i ms          Wait ms milliseconds between sending each packet
-l size         Data size
-P protocol     Use IP protocol in ping packets
                    1 - ICMP (default), 17 - UDP, 6 - TCP
-p port        Destination port
-s port        Source port
-T ttl         Set ttl, default 64
-t           Send packets until interrupted by Ctrl+C
-w ms         Wait ms milliseconds to receive the response

Notes: 1. Using names requires DNS to be set.
       2. Use Ctrl+C to stop the command.

VPCS> ping 192.168.1.11 -l -c 1
84 bytes from 192.168.1.11 icmp_seq=1 ttl=64 time=0.786 ms

VPCS> ping 192.168.1.11 -2 -c 1
84 bytes from 192.168.1.11 udp_seq=1 ttl=64 time=0.556 ms

VPCS> ping 192.168.1.11 -3 -c 1
Connect 7@192.168.1.11 seq=1 ttl=64 time=1.437 ms
SendData 7@192.168.1.11 seq=1 ttl=64 time=1.168 ms
Close 7@192.168.1.11 seq=1 ttl=64 time=3.264 ms

VPCS>
```


Сведения об эхо-запросе в ICMP-мде к узлу PC-1

Захват из - [PC1-mrshcherbak Ethernet0 to msk-mrshcherbak-sw-01 Ethernet0]

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Применить дисплейный фильтр ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	::	ff02::2	ICMPv6	62	Router Solicitation
2	0.005923	::	ff02::2	ICMPv6	62	Router Solicitation
3	0.050086	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
4	0.056763	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
5	1.051820	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
6	1.058862	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
7	2.052776	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
8	2.059684	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
9	702.768083	Private_66:68:01	Broadcast	ARP	64	Who has 192.168.1.11? Tell 192.168.1.12
10	702.768395	Private_66:68:00	Private_66:68:01	ARP	64	192.168.1.11 is at 00:50:79:66:68:00
11	702.769309	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0xcd34, seq=1/256, ttl=64 (reply in 12)
12	702.769753	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0xcd34, seq=1/256, ttl=64 (request in 11)

> Frame 11: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, id 0

✓ 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
Identification: 0x34cd (13517)
- > 000. = Flags: 0x0
...0 0000 0000 0000 = Fragment Offset: 0
Time to Live: 64
Protocol: ICMP (1)
Header Checksum: 0xc274 [validation disabled]
[Header checksum status: Unverified]

0000
0010
0020
0030
0040
0050
0060

Сведения об эхо-запросе в UDP-мде к узлу PC-1

Захват из - [PC1-mrshcherbak Ethernet0 to msk-mrshcherbak-sw-01 Ethernet0]

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Применить дисплейный фильтр ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
2	0.005923	::	ff02::2	ICMPv6	62	Router Solicitation
3	0.050086	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
4	0.056763	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
5	1.051820	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
6	1.058862	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
7	2.052776	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
8	2.059684	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
9	702.768083	Private_66:68:01	Broadcast	ARP	64	Who has 192.168.1.11? Tell 192.168.1.12
10	702.768395	Private_66:68:00	Private_66:68:01	ARP	64	192.168.1.11 is at 00:50:79:66:68:00
11	702.769309	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0xcd34, seq=1/256, ttl=64
12	702.769753	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0xcd34, seq=1/256, ttl=64
13	861.579730	Private_66:68:01	Broadcast	ARP	64	Who has 192.168.1.11? Tell 192.168.1.12
14	861.580041	Private_66:68:00	Private_66:68:01	ARP	64	192.168.1.11 is at 00:50:79:66:68:00
15	861.580847	192.168.1.12	192.168.1.11	ECHO	98	Request
16	861.581049	192.168.1.11	192.168.1.12	ECHO	98	Response

> Frame 15: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, id 0

✓ 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)
 - 00. = LG bit: Globally unique address (factory default)
 - 00. = 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)
 - 00. = LG bit: Globally unique address (factory default)
 - 00. = 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
 - Identification: 0x356c (13676)
 - > 000. = Flags: 0x0
 - ...0 0000 0000 0000 = Fragment Offset: 0
 - Time to Live: 64

Сведения об эхо-запросе в TCP-мде к узлу PC-1

Захват из - [PC1-mrshcherbak Ethernet0 to msk-mrshcherbak-sw-01 Ethernet0]

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Применить дисплейный фильтр ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
11	702.769309	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0xcd34, seq=1/256, ttl=64 (reply in 12
12	702.769753	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0xcd34, seq=1/256, ttl=64 (request in
13	861.579730	Private_66:68:01	Broadcast	ARP	64	Who has 192.168.1.11? Tell 192.168.1.12
14	861.580041	Private_66:68:00	Private_66:68:01	ARP	64	192.168.1.11 is at 00:50:79:66:68:00
15	861.580847	192.168.1.12	192.168.1.11	ECHO	98	Request
16	861.581049	192.168.1.11	192.168.1.12	ECHO	98	Response
17	956.591729	192.168.1.12	192.168.1.11	TCP	74	29229 → 7 [SYN] Seq=0 Win=2920 Len=0 MSS=1460 TSval=1696282059
18	956.592174	192.168.1.11	192.168.1.12	TCP	54	7 → 29229 [SYN, ACK] Seq=0 Ack=1 Win=2920 Len=0
19	956.593094	192.168.1.12	192.168.1.11	TCP	66	29229 → 7 [ACK] Seq=1 Ack=1 Win=2920 Len=0 TSval=1696282059 TS
20	956.593463	192.168.1.12	192.168.1.11	ECHO	122	Request
21	956.593735	192.168.1.11	192.168.1.12	TCP	54	7 → 29229 [ACK] Seq=1 Ack=57 Win=2920 Len=0
22	956.595142	192.168.1.12	192.168.1.11	TCP	66	29229 → 7 [FIN, PSH, ACK] Seq=57 Ack=1 Win=2920 Len=0 TSval=16
23	956.595547	192.168.1.11	192.168.1.12	TCP	54	7 → 29229 [ACK] Seq=1 Ack=58 Win=2920 Len=0
24	956.595593	192.168.1.11	192.168.1.12	TCP	54	7 → 29229 [FIN, ACK] Seq=1 Ack=58 Win=2920 Len=0
25	956.598421	192.168.1.12	192.168.1.11	TCP	66	29229 → 7 [ACK] Seq=58 Ack=2 Win=2920 Len=0 TSval=1696282059 T

> Frame 17: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface -, id 0

▼ 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)
.... 00. = LG bit: Globally unique address (factory default)
.... 00. = 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)
.... 00. = LG bit: Globally unique address (factory default)
.... 00. = 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: 60
Identification: 0x35cb (13771)
- > 000. = Flags: 0x0
...0 0000 0000 0000 = Fragment Offset: 0
Time to Live: 64

Моделирование простейшей сети на базе маршрутизатора FRR в GNS3

The screenshot displays a GNS3 network simulation. At the top, a topology diagram shows a PC node (PC1-mrshcherbak) connected to a switch node (msk-mrshcherbak-sw-01) via interface e0. The switch is connected to a router node (msk-mrshcherbak-gw-01) via interface e1. The router has an interface eth0. A 'Topology Summary' window on the right lists the nodes: msk-mr... telr, msk-mr... nor, and PC1-mr... telr.

Below the topology, three terminal windows are open:

- PC1-mrshcherbak - PuTTY:** Shows the VPCS startup screen with version 0.8.3 and copyright information. It prompts for a hostname and shows the startup file being executed. The prompt is VPCS>.
- msk-mrshcherbak-gw-01 - PuTTY:** Shows the FRRouting startup screen with version 7.5.0 and copyright information. It lists various services being started (kernel parameters, user login records, hostname, keymap, networking, syslog, seeding, acpid, crond, watchfrr, sshd). The prompt is frr#.
- PC1-mrshcherbak - PuTTY:** Shows the IP configuration process. The user enters `ip 192.168.1.10/24 192.168.1.1`. The output shows the configuration: `VPCS : 192.168.1.10 255.255.255.0 gateway 192.168.1.1`. The user then enters `save` and `show ip`, resulting in the following output:

```
VPCS> show ip
NAME       : VPCS[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
```

Топология простейшей сети с маршрутизатором в GNS3 и настройка IP-адресации для интерфейса узла PC1

```

Started watchfrr
* Starting sshd ... [ ok ]

Hello, this is FRRouting (version 8.2.2).
Copyright 1996-2005 Kunihiro Ishiguro, et al.

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

```

Проверка конфигурации маршрутизатора и
настройки IP-адресации

Настройка IP-адресации для интерфейса
локальной сети маршрутизатора

```

msk-mrshcherbak-gw-01# show running-config
Building configuration...

Current configuration:
!
frr version 8.2.2
frr defaults traditional
hostname frr
hostname msk-mrshcherbak-gw-01
service integrated-vtysh-config
!
interface eth0
  ip address 192.168.1.1/24
exit
!
end
msk-mrshcherbak-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-mrshcherbak-gw-01#

```

```
VPCS> ip 192.168.1.10/24 192.168.1.1
Checking for duplicate address...
VPCS : 192.168.1.10 255.255.255.0 gateway 192.168.1.1
```

```
VPCS> save
Saving startup configuration to startup.vpc
. done
```

```
VPCS> show ip
```

```
NAME      : VPCS[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
```

```
VPCS> ping 192.168.1.1
```

```
84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=0.123 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=0.123 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=0.123 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=0.123 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=0.123 ms
```

```
VPCS>
```

Проверка работоспособности соединения между PC-1 и маршрутизатором и сведения об эхо-запросе кадра ICMP

Захват из - [msk-mrshcherbak-sw-01 Ethernet1 to msk-mrshcherbak-gw-01 eth0]

Файл Редактирование Просмотр Запуск Захват Анализ Статистика Телефония Беспроводной Инструменты Помощь

Применить дисплейный фильтр ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
14	280.318508	fe80::e56:a2ff:fe8a...	ff02::16	ICMPv6	90	Multicast Listener Report Message v2
15	716.656486	Private_66:68:00	Broadcast	ARP	64	Who has 192.168.1.1? Tell 192.168.1.10
16	716.686295	0c:56:a2:8a:00:00	Private_66:68:00	ARP	60	192.168.1.1 is at 0c:56:a2:8a:00:00
17	716.686950	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8441, seq=1/256, ttl=64
18	716.709034	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8441, seq=1/256, ttl=64
19	717.714023	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8541, seq=2/512, ttl=64
20	717.716070	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8541, seq=2/512, ttl=64
21	718.718662	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8641, seq=3/768, ttl=64
22	718.721086	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8641, seq=3/768, ttl=64
23	719.723067	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8741, seq=4/1024, ttl=64
24	719.725266	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8741, seq=4/1024, ttl=64
25	720.727087	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8841, seq=5/1280, ttl=64
26	720.729376	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8841, seq=5/1280, ttl=64
27	721.756796	0c:56:a2:8a:00:00	Private_66:68:00	ARP	60	Who has 192.168.1.10? Tell 192.168.1.1
28	721.757092	Private_66:68:00	0c:56:a2:8a:00:00	ARP	60	192.168.1.10 is at 00:50:79:66:68:00

> Frame 17: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, id 0

▼ Ethernet II, Src: Private_66:68:00 (00:50:79:66:68:00), Dst: 0c:56:a2:8a:00:00 (0c:56:a2:8a:00:00)

▼ Destination: 0c:56:a2:8a:00:00 (0c:56:a2:8a:00:00)

Address: 0c:56:a2:8a:00:00 (0c:56:a2:8a: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

0100 = Version: 4

.... 0101 = Header Length: 20 bytes (5)

> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)

Total Length: 84

Identification: 0x4184 (16772)

> 000. = Flags: 0x0

...0 0000 0000 0000 = Fragment Offset: 0

Time to Live: 64

Сведения об эхо-ответе кадра ICMP

Захват из - [msk-mrshcherbak-sw-01 Ethernet1 to msk-mrshcherbak-gw-01 eth0]

Файл Редактирование Просмотр Запуск Захват Анализ Статистика Телефония Беспроводной Инструменты Помощь

Применить дисплейный фильтр ... <Ctrl-/>

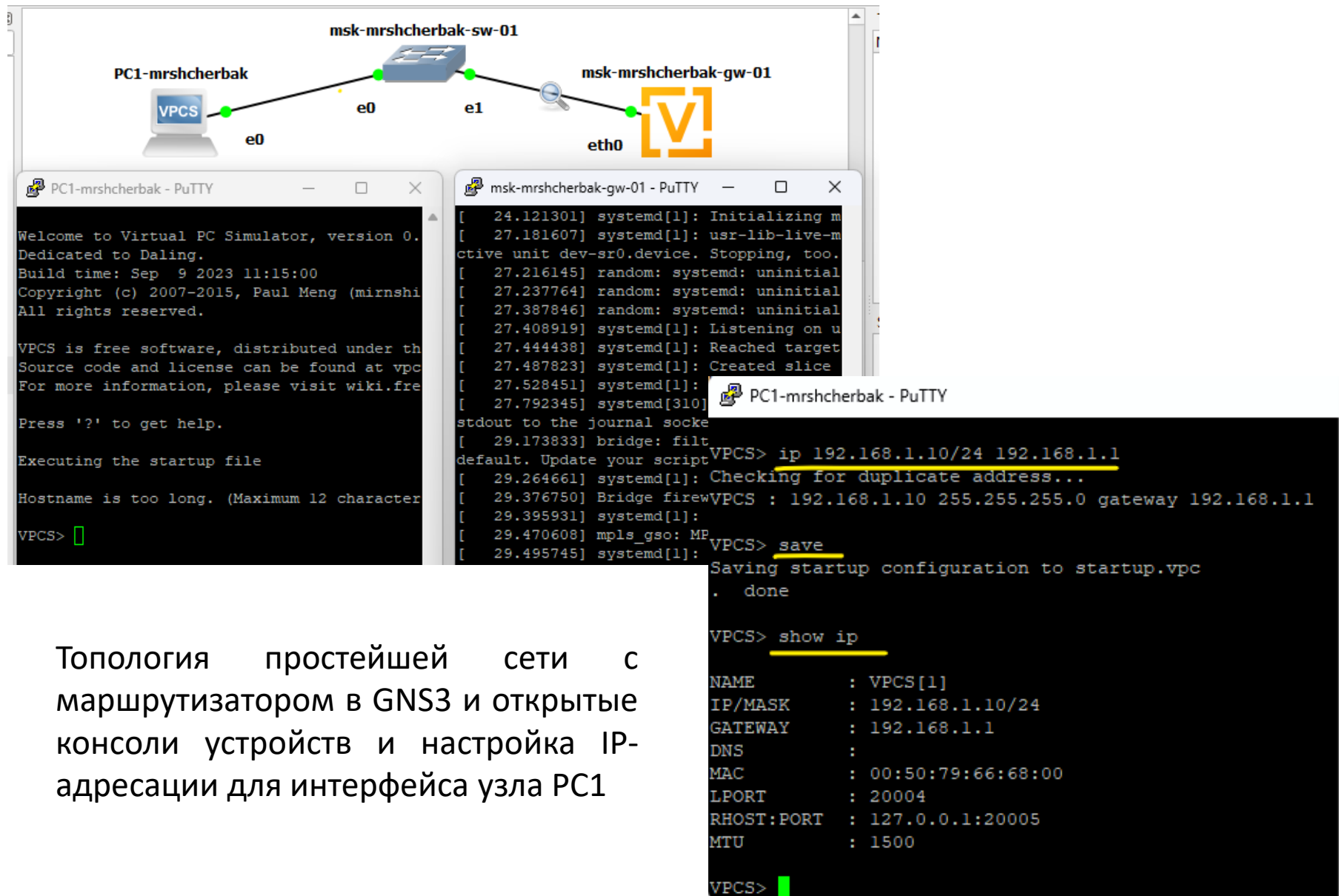
No.	Time	Source	Destination	Protocol	Length	Info
14	280.318508	fe80::e56:a2ff:fe8a...	ff02::16	ICMPv6	90	Multicast Listener Report Message v2
15	716.656486	Private_66:68:00	Broadcast	ARP	64	Who has 192.168.1.1? Tell 192.168.1.10
16	716.686295	0c:56:a2:8a:00:00	Private_66:68:00	ARP	60	192.168.1.1 is at 0c:56:a2:8a:00:00
17	716.686950	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8441, seq=1/256, ttl=64 (r
18	716.709034	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8441, seq=1/256, ttl=64 (r
19	717.714023	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8541, seq=2/512, ttl=64 (r
20	717.716070	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8541, seq=2/512, ttl=64 (r
21	718.718662	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8641, seq=3/768, ttl=64 (r
22	718.721086	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8641, seq=3/768, ttl=64 (r
23	719.723067	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8741, seq=4/1024, ttl=64 (r
24	719.725266	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8741, seq=4/1024, ttl=64 (r
25	720.727087	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8841, seq=5/1280, ttl=64 (r
26	720.729376	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8841, seq=5/1280, ttl=64 (r
27	721.756796	0c:56:a2:8a:00:00	Private_66:68:00	ARP	60	Who has 192.168.1.10? Tell 192.168.1.1
28	721.757092	Private_66:68:00	0c:56:a2:8a:00:00	ARP	60	192.168.1.10 is at 00:50:79:66:68:00

> Frame 18: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, id 0

▼ Ethernet II, Src: 0c:56:a2:8a:00:00 (0c:56:a2:8a:00:00), 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: 0c:56:a2:8a:00:00 (0c:56:a2:8a:00:00)
 - Address: 0c:56:a2:8a:00:00 (0c:56:a2:8a:00:00)
 -0. = LG bit: Globally unique address (factory default)
 -0 = IG bit: Individual address (unicast)
 - Type: IPv4 (0x0800)
- ▼ Internet Protocol Version 4, Src: 192.168.1.1, Dst: 192.168.1.10
 - 0100 = Version: 4
 - 0101 = Header Length: 20 bytes (5)
 - > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
 - Total Length: 84
 - Identification: 0x2f47 (12103)
 - > 000. = Flags: 0x0
 - ...0 0000 0000 0000 = Fragment Offset: 0
 - Time to Live: 64

Моделирование простейшей сети на базе маршрутизатора VyOS в GNS3



The image displays a GNS3 network simulation setup. At the top, a network diagram shows three components: a PC labeled 'PC1-mrshcherbak' with a 'VPCS' icon, a switch labeled 'msk-mrshcherbak-sw-01', and a router labeled 'msk-mrshcherbak-gw-01' with a 'VyOS' icon. The PC is connected to the switch via interface 'e0' on the PC and 'e0' on the switch. The switch is connected to the router via interface 'e1' on the switch and 'eth0' on the router.

Below the diagram, two terminal windows are shown. The left window, titled 'PC1-mrshcherbak - PuTTY', shows the VPCS startup sequence and the user entering the IP configuration command:

```
VPCS> ip 192.168.1.10/24 192.168.1.1
```

The right window, titled 'msk-mrshcherbak-gw-01 - PuTTY', shows the VyOS startup logs. Below the logs, the user enters the 'save' command to save the configuration:

```
VPCS> save
```

The output shows the configuration is saved to 'startup.vpc'. Finally, the user enters the 'show ip' command to display the current IP configuration:

```
VPCS> show ip
```

NAME	VALUE
NAME	: VPCS[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

The terminal output for 'show ip' is as follows:

```
NAME          : VPCS[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
```

Топология простейшей сети с маршрутизатором в GNS3 и открытые консоли устройств и настройка IP-адресации для интерфейса узла PC1


```
msk-mrshcherbak-gw-01 - PuTTY
vyos@vyos:~$ install image
Welcome to the VyOS install program. This script
will walk you through the process of installing the
VyOS image to a local hard drive.
Would you like to continue? (Yes/No) [Yes]:
Probing drives: OK
The VyOS image will require a minimum 2000MB root.
Would you like me to try to partition a drive automatically
or would you rather partition it manually with parted? If
you have already setup your partitions, you may skip this step

Partition (Auto/Parted/Skip) [Auto]:

I found the following drives on your system:
sda      8589MB
sdb       1MB

Install the image on? [sda]:

This will destroy all data on /dev/sda.
Continue? (Yes/No) [No]:
Ok then.  Exiting...
vyos@vyos:~$ reboot
Are you sure you want to reboot this system? [y/N] y

vyos@vyos:~$
```

Установка системы на диск и
перезапуск маршрутизатора

```
vyos@vyos# exit
exit
vyos@vyos:~$ configure
WARNING: You are currently configuring a live-ISO environment.
[edit]
vyos@msk-mrshcherbak-gw-01#
```

Изменено имя устройства

```
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]
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:f1:64:26:00:00
  }
  ethernet eth1 {
    hw-id 0c:f1:64:26:00:01
  }
  ethernet eth2 {
    hw-id 0c:f1:64:26:00:02
  }
  loopback lo {
  }
[edit]
vyos@vyos# exit
exit
vyos@vyos:~$
```

Назначила IP-адрес 192.168.1.1/24 интерфейсу eth0. Проверила изменения с помощью «compare», применила и сохранила их через «commit» и «save». Просмотрела информацию об интерфейсах с «show interfaces» и вышла из режима конфигурирования.

Проверка работоспособности соединения между PC-1 и маршрутизатором

```
VPCS> ip 192.168.1.10/24 192.168.1.1
Checking for duplicate address...
VPCS : 192.168.1.10 255.255.255.0 gateway 192.168.1.1

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

VPCS> show ip

NAME       : VPCS[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

VPCS> ping 192.168.1.1
84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=9.979 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=2.108 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=1.992 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=3.304 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=1.851 ms

VPCS>
```

Сведения об эхо-запросе кадра ICMP

Захват из - [msk-mrshcherbak-sw-01 Ethernet1 to msk-mrshcherbak-gw-01 eth0]

Файл Редактирование Просмотр Запуск Захват Анализ Статистика Телефония Беспроводной Инструменты Помощь

Применить дисплейный фильтр ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
20	468.830587	fe80::ef1:64ff:fe26...	ff02::16	ICMPv6	90	Multicast Listener Report Message v2
21	1028.617249	Private_66:68:00	Broadcast	ARP	64	Who has 192.168.1.1? Tell 192.168.1.10
22	1028.633146	0c:f1:64:26:00:00	Private_66:68:00	ARP	60	192.168.1.1 is at 0c:f1:64:26:00:00
23	1028.634195	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xa64e, seq=1/256, ti
24	1028.643906	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xa64e, seq=1/256, ti
25	1029.645389	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xa74e, seq=2/512, ti
26	1029.647089	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xa74e, seq=2/512, ti
27	1030.649336	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xa84e, seq=3/768, ti
28	1030.650757	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xa84e, seq=3/768, ti
29	1031.652201	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xa94e, seq=4/1024, ti
30	1031.654626	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xa94e, seq=4/1024, ti
31	1032.655518	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xaa4e, seq=5/1280, ti
32	1032.656996	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xaa4e, seq=5/1280, ti
33	1033.948669	0c:f1:64:26:00:00	Private_66:68:00	ARP	60	Who has 192.168.1.10? Tell 192.168.1.1
34	1033.949395	Private_66:68:00	0c:f1:64:26:00:00	ARP	60	192.168.1.10 is at 00:50:79:66:68:00

> Frame 23: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, id 0

✓ Ethernet II, Src: Private_66:68:00 (00:50:79:66:68:00), Dst: 0c:f1:64:26:00:00 (0c:f1:64:26:00:00)

- > Destination: 0c:f1:64:26:00:00 (0c:f1:64:26:00:00)
- > Source: Private_66:68:00 (00:50:79:66:68:00)
- Type: IPv4 (0x0800)

✓ Internet Protocol Version 4, Src: 192.168.1.10, Dst: 192.168.1.1

- 0100 = Version: 4
- 0101 = Header Length: 20 bytes (5)
- > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
- Total Length: 84
- Identification: 0x4ea6 (20134)
- > 000. = Flags: 0x0
- ...0 0000 0000 0000 = Fragment Offset: 0
- Time to Live: 64
- Protocol: ICMP (1)
- Header Checksum: 0xa8a7 [validation disabled]
- [Header checksum status: Unverified]
- Source Address: 192.168.1.10
- Destination Address: 192.168.1.1

> Internet Control Message Protocol

Захват из - [msk-mrshcherbak-sw-01 Ethernet1 to msk-mrshcherbak-gw-01 eth0]

Файл Редактирование Просмотр Запуск Захват Анализ Статистика Телефония Беспроводной Инструменты Помощь

Применить дисплейный фильтр ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
20	468.830587	fe80::ef1:64ff:fe26...	ff02::16	ICMPv6	90	Multicast Listener Report Message v2
21	1028.617249	Private_66:68:00	Broadcast	ARP	64	Who has 192.168.1.1? Tell 192.168.1.10
22	1028.633146	0c:f1:64:26:00:00	Private_66:68:00	ARP	60	192.168.1.1 is at 0c:f1:64:26:00:00
23	1028.634195	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xa64e, seq=1/256, t
24	1028.643906	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xa64e, seq=1/256, t
25	1029.645389	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xa74e, seq=2/512, t
26	1029.647089	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xa74e, seq=2/512, t
27	1030.649336	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xa84e, seq=3/768, t
28	1030.650757	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xa84e, seq=3/768, t
29	1031.652201	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xa94e, seq=4/1024, t
30	1031.654626	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xa94e, seq=4/1024, t
31	1032.655518	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xaa4e, seq=5/1280, t
32	1032.656996	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xaa4e, seq=5/1280, t
33	1033.948669	0c:f1:64:26:00:00	Private_66:68:00	ARP	60	Who has 192.168.1.10? Tell 192.168.1.1
34	1033.949395	Private_66:68:00	0c:f1:64:26:00:00	ARP	60	192.168.1.10 is at 00:50:79:66:68:00

> Frame 24: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, id 0

▼ Ethernet II, Src: 0c:f1:64:26:00:00 (0c:f1:64:26:00:00), Dst: Private_66:68:00 (00:50:79:66:68:00)

> Destination: Private_66:68:00 (00:50:79:66:68:00)

> Source: 0c:f1:64:26:00:00 (0c:f1:64:26:00:00)

Type: IPv4 (0x0800)

▼ Internet Protocol Version 4, Src: 192.168.1.1, Dst: 192.168.1.10

0100 = Version: 4

.... 0101 = Header Length: 20 bytes (5)

> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)

Total Length: 84

Identification: 0x0180 (384)

> 000. = Flags: 0x0

...0 0000 0000 0000 = Fragment Offset: 0

Time to Live: 64

Protocol: ICMP (1)

Header Checksum: 0xf5cd [validation disabled]

[Header checksum status: Unverified]

Source Address: 192.168.1.1

Destination Address: 192.168.1.10

> Internet Control Message Protocol

Вывод: таким образом, в ходе выполнения л/р №5, я построила модели сетей на базе коммутатора и маршрутизаторов FRR и VyOS в GNS3, проанализировала трафик посредством Wireshark.