

# Сетевые технологии

Простые сети в GNS3. Анализ трафика (Лабораторная работа №5)

---

Заур Мустафаев

29 октября 2025

Российский университет дружбы народов, Москва, Россия

## Цель лабораторной работы

---

Построить простейшие модели сети в **GNS3**, используя: - Коммутатор **Ethernet** - Маршрутизаторы **FRRouting (FRR)** и **VyOS** - Средства анализа **Wireshark**

## Выполнение лабораторной работы

---

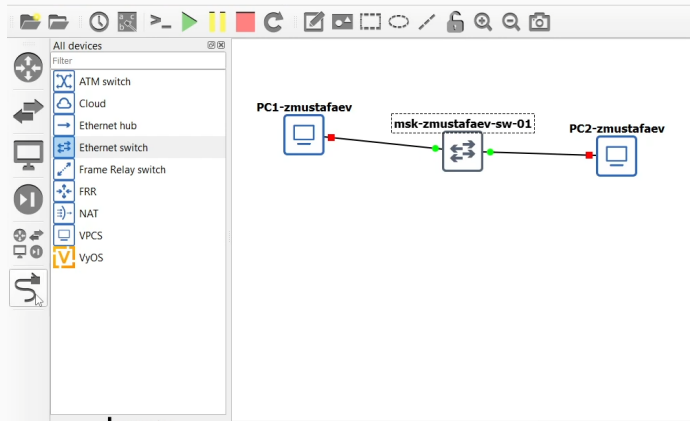
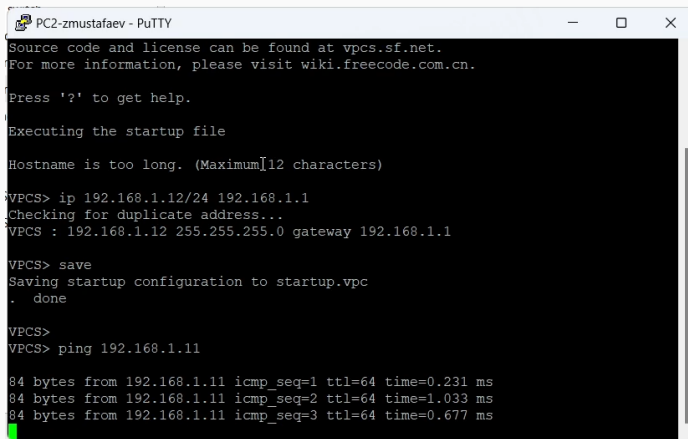


Рис. 1: Топология сети

## Проверка связи между узлами



```
PC2-zmustafaev - PuTTY
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.

Press '?' to get help.

Executing the startup file

Hostname is too long. (Maximum 12 characters)

VPCS> ip 192.168.1.12/24 192.168.1.1
Checking for duplicate address...
VPCS : 192.168.1.12 255.255.255.0 gateway 192.168.1.1

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

VPCS>
VPCS> ping 192.168.1.11

84 bytes from 192.168.1.11 icmp_seq=1 ttl=64 time=0.231 ms
84 bytes from 192.168.1.11 icmp_seq=2 ttl=64 time=1.033 ms
84 bytes from 192.168.1.11 icmp_seq=3 ttl=64 time=0.677 ms
```

Рис. 2: Ping между узлами

# Анализ ARP-трафика

Примените фильтр отображения ... <Ctrl-/>						
No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	::	ff02::2	ICMPv6	62	Router Solicitation
2	0.000963	::	ff02::2	ICMPv6	62	Router Solicitation
3	0.050674	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
4	0.051458	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
5	1.051930	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
6	1.052824	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
7	2.052100	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
8	2.053283	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)

> Frame 3: 64 bytes on wire (512 bits), 64 bytes captured (512 bits) on interface -, id 0

> Ethernet II, Src: Private\_66:68:01 (00:50:79:66:68:01), Dst: Broadcast (ff:ff:ff:ff:ff:ff)

> 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\_66:68:01 (00:50:79:66:68:01)  
Sender IP address: 192.168.1.12  
Target MAC address: Broadcast (ff:ff:ff:ff:ff:ff)  
Target IP address: 192.168.1.12

0000 ff ff ff ff

0010 08 00 06 04

0020 ff ff ff ff

0030 00 00 00 00

Рис. 3: ARP-пакеты

# Анализ ICMP, UDP и TCP

No.	Time	Source	Destination	Protocol	Length	Info
11	109.470659	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x8b23, seq=1/256,
12	109.470882	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0x8b23, seq=1/256,
13	125.589410	192.168.1.12	192.168.1.11	ECHO	98	Request
14	125.589631	192.168.1.11	192.168.1.12	ECHO	98	Response
15	133.717388	192.168.1.12	192.168.1.11	TCP	74	51909 → 7 [SYN] Seq=0 Win=2920 Len=0 MSS=14
16	133.717720	192.168.1.11	192.168.1.12	TCP	54	7 → 51909 [SYN, ACK] Seq=0 Ack=1 Win=2920
17	133.718814	192.168.1.12	192.168.1.11	TCP	66	51909 → 7 [ACK] Seq=1 Ack=1 Win=2920 Len=0
18	133.718894	192.168.1.12	192.168.1.11	ECHO	122	Request
19	133.719408	192.168.1.11	192.168.1.12	TCP	54	7 → 51909 [ACK] Seq=1 Ack=57 Win=2920 Len=0
20	133.720635	192.168.1.12	192.168.1.11	TCP	66	51909 → 7 [FIN, PSH, ACK] Seq=57 Ack=1 Win=
21	133.720738	192.168.1.11	192.168.1.12	TCP	54	7 → 51909 [ACK] Seq=1 Ack=58 Win=2920 Len=0
22	133.720749	192.168.1.11	192.168.1.12	TCP	54	7 → 51909 [FIN, ACK] Seq=1 Ack=58 Win=2920
23	133.723289	192.168.1.12	192.168.1.11	TCP	66	51909 → 7 [ACK] Seq=58 Ack=2 Win=2920 Len=0

> Frame 13: 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)

> Internet Protocol Version 4, Src: 192.168.1.12, Dst: 192.168.1.11

> User Datagram Protocol, Src Port: 32551, Dst Port: 7

Source Port: 32551

Destination Port: 7

Length: 64

Checksum: 0x614d [unverified]

[Checksum Status: Unverified]

[Stream index: 0]

[Stream Packet Number: 1]

> [Timestamps]

UDP payload (56 bytes)

> Echo

Echo data: 0050796668010e0f101112131415161718191a1b1c1d1e1f202122232425262728292a2b2c2d2e2f3031323...

0000 00 50 79 6

0010 00 54 23 9

0020 01 0b 7f 2

0030 0e 0f 10 1

0040 1e 1f 20 2

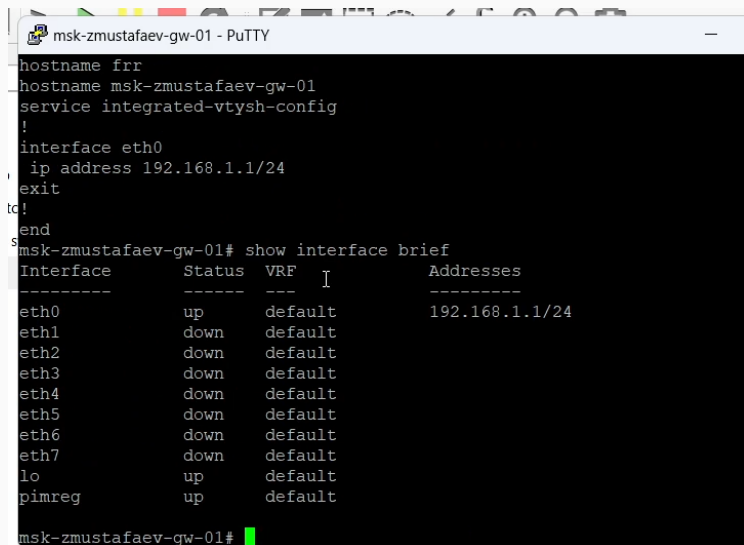
0050 2e 2f 30 3

0060 3e 3f

Standard input: <live capture in progress> | Пакеты: 23 | Профиль: Default

6/11





The screenshot shows a PuTTY terminal window titled "msk-zmustafaev-gw-01 - PuTTY". The terminal displays the following configuration commands and output:

```
hostname frr
hostname msk-zmustafaev-gw-01
service integrated-vtysh-config
!
interface eth0
 ip address 192.168.1.1/24
exit
end
msk-zmustafaev-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	

The terminal ends with the prompt "msk-zmustafaev-gw-01#" and a green cursor.

No.	Time	Source	Destination	Protocol	Length	Info
17	230.456497	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8125, seq=1/256,
18	230.458452	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8125, seq=1/256,
19	231.459625	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8225, seq=2/512,
20	231.460535	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8225, seq=2/512,
21	232.462738	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8325, seq=3/768,
22	232.464103	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8325, seq=3/768,
23	233.466019	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8425, seq=4/1024,
24	233.466750	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8425, seq=4/1024,
→ 25	234.468902	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x8525, seq=5/1280,
← 26	234.470519	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x8525, seq=5/1280,
27	235.498572	0c:a8:c1:ff:00:00	Private_66:68:00	ARP	60	Who has 192.168.1.10? Tell 192.168.1.1
28	235.499272	Private_66:68:00	0c:a8:c1:ff:00:00	ARP	60	192.168.1.10 is at 00:50:79:66:68:00

> Frame 26: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, id 0

> Ethernet II, Src: 0c:a8:c1:ff:00:00 (0c:a8:c1:ff:00:00), Dst: Private\_66:68:00 (00:50:79:66:68:00)

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

∨ Internet Control Message Protocol

Type: 0 (Echo (ping) reply)

Code: 0

Checksum: 0xa2e1 [correct]

[Checksum Status: Good]

Identifier (BE): 34085 (0x8525)

Identifier (LE): 9605 (0x2585)

Sequence Number (BE): 5 (0x0005)

Sequence Number (LE): 1280 (0x0500)

[\[Request frame: 25\]](#)

[Response time: 1,617 ms]

> Data (56 bytes)

```

0000  00 50 79 66 00 50 79 66 00 50 79 66 00 50 79 66
0010  00 54 eb 1f 00 00 00 00 00 00 00 00 00 00 00 00
0020  01 0a 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0030  0e 0f 10 11 12 13 14 15 16 17 18 19 1a 1b 1c 1d
0040  1e 1f 20 21 22 23 24 25 26 27 28 29 2a 2b 2c 2d
0050  2e 2f 30 31 32 33 34 35 36 37 38 39 3a 3b 3c 3d
0060  3e 3f

```

Рис. 6: ICMP FRR

```
msk-zmustafaev-gw-01 - PuTTY
[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:77:69:cf:00:00
  }
  ethernet eth1 {
    hw-id 0c:77:69:cf:00:01
  }
  ethernet eth2 {
    hw-id 0c:77:69:cf:00:02
  }
  loopback lo {
  }
[edit]
vyos@vyos# exit
exit
vyos@vyos:~$
```

# Анализ ICMP и ARP

No.	Time	Source	Destination	Protocol	Length	Info
26	217.570334	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xc026, seq=1/256,
27	217.573379	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xc026, seq=1/256,
28	218.577156	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xc126, seq=2/512,
29	218.578906	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xc126, seq=2/512,
30	219.580463	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xc226, seq=3/768,
31	219.582168	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xc226, seq=3/768,
32	220.584325	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xc326, seq=4/1024,
33	220.585093	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xc326, seq=4/1024,
→ 34	221.586548	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0xc426, seq=5/1280,
← 35	221.587954	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0xc426, seq=5/1280,
36	222.939655	0c:77:69:cf:00:00	Private_66:68:00	ARP	60	Who has 192.168.1.10? Tell 192.168.1.1
37	222.940529	Private_66:68:00	0c:77:69:cf:00:00	ARP	60	192.168.1.10 is at 00:50:79:66:68:00

> Frame 35: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface -, id 0

> Ethernet II, Src: 0c:77:69:cf:00:00 (0c:77:69:cf:00:00), Dst: Private\_66:68:00 (00:50:79:66:68:00)

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

> Internet Control Message Protocol

0000 00 50 79 6

0010 00 54 31 1

0020 01 0a 00 0

0030 0e 0f 10 1

0040 1e 1f 20 2

0050 2e 2f 30 3

0060 3e 3f

Рис. 8: Анализ трафика VyOS

## Выводы по работе

---

- Смоделированы сети на базе маршрутизаторов **FRR** и **VyOS**
- Настроены IP-сети и подтверждена их работоспособность
- Проведён анализ трафика с помощью **Wireshark**
- Проверена корректность протоколов **ARP**, **ICMP**, **UDP** и **TCP**
- Работа выполнена успешно