

Лабораторная работа

№5

СТУДЕНТ: САХНО НИКИТА

ГРУППА: НФИБД-02-23

Цель работы

Построить простейшие модели сетей на базе коммутатора и маршрутизаторов FRR и VyOS в GNS3, проанализировать трафик посредством Wireshark.

Задание

Смоделировать простейшую сеть на базе коммутатора в GNS3;

Проанализировать трафик в GNS3 посредством Wireshark;

Смоделировать простейшую сеть на базе маршрутизатора FRR в GNS3;

Смоделировать простейшую сеть на базе маршрутизатора VyOS в GNS3.

Выполнение лабораторной работы



Задание IP-адреса для PC-1

```
VPCS> ip 192.168.1.11/24 192.168.1.1
Checking for duplicate address...
PC1 : 192.168.1.11 255.255.255.0 gateway 192.168.1.1

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

Выполнение лабораторной работы

Пингование PC-1

```
VPCS> ping 192.168.1.11
84 bytes from 192.168.1.11 icmp_seq=1 ttl=64 time=1.063 ms
84 bytes from 192.168.1.11 icmp_seq=2 ttl=64 time=1.139 ms
84 bytes from 192.168.1.11 icmp_seq=3 ttl=64 time=1.197 ms
84 bytes from 192.168.1.11 icmp_seq=4 ttl=64 time=1.198 ms
84 bytes from 192.168.1.11 icmp_seq=5 ttl=64 time=1.127 ms
```

```
VPCS> █
```

Выполнение лабораторно

```
VPCS> ping 192.168.1.12
84 bytes from 192.168.1.12 icmp_seq=1 ttl=64 time=1.174 ms
84 bytes from 192.168.1.12 icmp_seq=2 ttl=64 time=1.268 ms
84 bytes from 192.168.1.12 icmp_seq=3 ttl=64 time=0.981 ms
84 bytes from 192.168.1.12 icmp_seq=4 ttl=64 time=1.651 ms
84 bytes from 192.168.1.12 icmp_seq=5 ttl=64 time=0.932 ms
```

```
VPCS> █
```

Пингование PC-2

Появление значка лупы на соединении



Выполнение лабораторной работы

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	::	ff02::2	ICMPv6	62	Router Solicitation
2	0.063350	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
3	0.100734	::	ff02::2	ICMPv6	62	Router Solicitation
4	0.163877	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
5	1.063804	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
6	1.164420	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
7	2.065362	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
8	2.165133	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
9	624.660173	Private_66:68:01	Broadcast	ARP	64	Who has 192.168.1.11? Tell 192.168.1.12
10	624.661213	Private_66:68:00	Private_66:68:01	ARP	64	192.168.1.11 is at 00:50:79:66:68:00
11	624.662837	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x6262, seq=1/256, ttl=64
12	624.663931	192.168.1.11	192.168.1.12	TCPMP	98	Echo (ping) reply id=0x6262 seq=1/256 ttl=64

[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: 00

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: 192.168.1.11

Target MAC address: Broadcast (ff:ff:ff:ff:ff:ff)

Target IP address: 192.168.1.11

Выполнение лабораторной работы

Эхо-запрос в ICMP-моде

```
VPCS> ping 192.168.1.11 -1
84 bytes from 192.168.1.11 icmp_seq=1 ttl=64 time=1.610 ms
84 bytes from 192.168.1.11 icmp_seq=2 ttl=64 time=1.630 ms
84 bytes from 192.168.1.11 icmp_seq=3 ttl=64 time=1.831 ms
84 bytes from 192.168.1.11 icmp_seq=4 ttl=64 time=1.621 ms
84 bytes from 192.168.1.11 icmp_seq=5 ttl=64 time=1.610 ms
```

Выполнение лабораторной работы

No.	Time	Source	Destination	Protocol	Length	Info
11	624.662837	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x6262, seq=1/256, ttl=64 (reply in 12)
12	624.663931	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0x6262, seq=1/256, ttl=64 (request in 11)
13	625.665766	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x6362, seq=2/512, ttl=64 (reply in 14)
14	625.666306	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0x6362, seq=2/512, ttl=64 (request in 13)
15	626.668282	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x6462, seq=3/768, ttl=64 (reply in 16)
16	626.668846	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0x6462, seq=3/768, ttl=64 (request in 15)
17	627.670081	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x6562, seq=4/1024, ttl=64 (reply in 18)
18	627.671168	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0x6562, seq=4/1024, ttl=64 (request in 17)
19	628.672298	192.168.1.12	192.168.1.11	ICMP	98	Echo (ping) request id=0x6662, seq=5/1280, ttl=64 (reply in 20)
20	628.673385	192.168.1.11	192.168.1.12	ICMP	98	Echo (ping) reply id=0x6662, seq=5/1280, ttl=64 (request in 19)
21	1190.613747	Private_66:68:01	Broadcast	ARP	64	Who has 192.168.1.11? Tell 192.168.1.12
22	1190.614816	Private_66:68:01	Private_66:68:00	ARP	64	192.168.1.11 is at 00:50:79:66:68:00

[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

 0100 = Version: 4

 0101 = Header Length: 20 bytes (5)

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

 Total Length: 84

 Identification: 0x6262 (25186)

 > 000. = Flags: 0x0

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

 Time to Live: 64

 Protocol: ICMP (1)

 Header Checksum: 0x94df [validation disabled]

 [Header checksum status: Unverified]

 Source Address: 192.168.1.12

 Destination Address: 192.168.1.11

Выполнение лабораторной работы

Информация по протоколу ICMP

Выполнение лабораторной работы

```
VPCS> ping 192.168.1.11 -3
Connect 7@192.168.1.11 seq=1 ttl=64 time=2.169 ms
SendData 7@192.168.1.11 seq=1 ttl=64 time=2.162 ms
Close 7@192.168.1.11 seq=1 ttl=64 time=3.491 ms
Connect 7@192.168.1.11 seq=2 ttl=64 time=2.198 ms
SendData 7@192.168.1.11 seq=2 ttl=64 time=2.178 ms
Close 7@192.168.1.11 seq=2 ttl=64 time=3.282 ms
Connect 7@192.168.1.11 seq=3 ttl=64 time=2.211 ms
SendData 7@192.168.1.11 seq=3 ttl=64 time=2.209 ms
Close 7@192.168.1.11 seq=3 ttl=64 time=3.296 ms
Connect 7@192.168.1.11 seq=4 ttl=64 time=2.215 ms
SendData 7@192.168.1.11 seq=4 ttl=64 time=2.192 ms
Close 7@192.168.1.11 seq=4 ttl=64 time=3.291 ms
Connect 7@192.168.1.11 seq=5 ttl=64 time=2.201 ms
SendData 7@192.168.1.11 seq=5 ttl=64 time=2.177 ms
Close 7@192.168.1.11 seq=5 ttl=64 time=3.198 ms
```

Эхо-запрос в TCP-mode

```
VPCS> ping 192.168.1.11 -2
84 bytes from 192.168.1.11 udp_seq=1 ttl=64 time=1.429 ms
84 bytes from 192.168.1.11 udp_seq=2 ttl=64 time=1.537 ms
84 bytes from 192.168.1.11 udp_seq=3 ttl=64 time=1.523 ms
84 bytes from 192.168.1.11 udp_seq=4 ttl=64 time=1.614 ms
84 bytes from 192.168.1.11 udp_seq=5 ttl=64 time=1.479 ms
```

Эхо-запрос в UDP-mode

22	1190.614816	Private_66:68:00	Private_66:68:01	ARP	64 192.168.1.11 is at 00:50:79:66:68:00
23	1190.616404	192.168.1.12	192.168.1.11	ECHO	98 Request
24	1190.617462	192.168.1.11	192.168.1.12	ECHO	98 Response
25	1191.618972	192.168.1.12	192.168.1.11	ECHO	98 Request
26	1191.620046	192.168.1.11	192.168.1.12	ECHO	98 Response
27	1192.621377	192.168.1.12	192.168.1.11	ECHO	98 Request
28	1192.622461	192.168.1.11	192.168.1.12	ECHO	98 Response
29	1193.624224	192.168.1.12	192.168.1.11	ECHO	98 Request
30	1193.624781	192.168.1.11	192.168.1.12	ECHO	98 Response
31	1194.625911	192.168.1.12	192.168.1.11	ECHO	98 Request
32	1194.626987	192.168.1.11	192.168.1.12	ECHO	98 Response
33	1359.307509	Private_66:68:01	Broadcast	ARP	64 Who has 192.168.1.11? Tell 192.168.1.12

▼ 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: 0x6498 (25752)

 > 000. = Flags: 0x0

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

 Time to Live: 64

 Protocol: UDP (17)

 Header Checksum: 0x9299 [validation disabled]

 [Header checksum status: Unverified]

 Source Address: 192.168.1.12

 Destination Address: 192.168.1.11

▼ User Datagram Protocol, Src Port: 17163, Dst Port: 7

Выполнение лабораторной работы

Информация по протоколу UDP

Выполнение лабораторной работы

▼ Transmission Control Protocol, Src Port: 19241, Dst Port: 7, Seq: 0, Len: 0

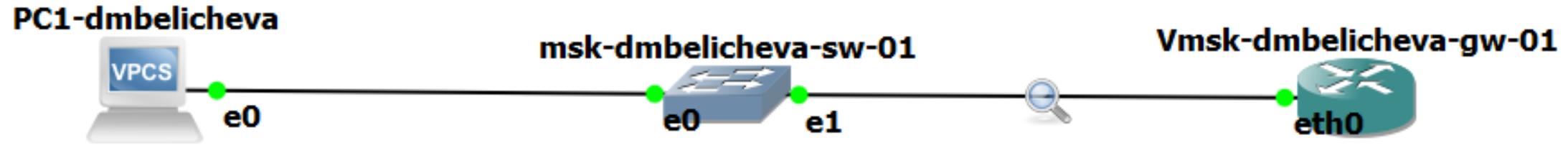
Source Port: 19241
Destination Port: 7
[Stream index: 0]
[Conversation completeness: Complete, WITH_DATA (31)]
[TCP Segment Len: 0]
Sequence Number: 0 (relative sequence number)
Sequence Number (raw): 1741785218
[Next Sequence Number: 1 (relative sequence number)]
Acknowledgment Number: 0
Acknowledgment number (raw): 0
1010 = Header Length: 40 bytes (10)

➤ Flags: 0x0002 (SYN)

Window: 2920
[Calculated window size: 2920]
Checksum: 0xb650 [unverified]
[Checksum Status: Unverified]
Urgent Pointer: 0

➤ Options: (20 bytes), Maximum segment size, No-Operation (NOP), No-Operation (

Информация по протоколу TCP



Выполнение лабораторной работы

Выполнение лабораторной работы

```
VPCS> 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

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          : 10003
RHOST:PORT    : 127.0.0.1:10004
MTU:          : 1500
```

Настройка IP-адресации для интерфейса узла PC-1

Выполнение лабораторной работы

```
vyos@vyos:~$ configure
[edit]
vyos@vyos# show configuration

Configuration path: [configuration] is not valid
Show failed

[edit]
vyos@vyos# set system host-name msk-dmbelicheva-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-dmbelicheva-gw-01
[edit]
```

Настройка маршрутизатора VyOS

Выполнение лабораторной работы

```
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:0b:4c:9a:00:00
}
ethernet eth1 {
    hw-id 0c:0b:4c:9a:00:01
}
ethernet eth2 {
    hw-id 0c:0b:4c:9a:00:02
}
loopback lo {
}
[edit]
vyos@vyos# exit
exit
```

Настройка маршрутизатора VyOS

```
VPCS> ping 192.168.1.1
84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=2.537 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=2.525 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=2.428 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=2.882 ms
84 bytes from 192.168.1.1 icmp_seq=5 ttl=64 time=2.530 ms
```

Выполнение лабораторной работы

No.	Time	Source	Destination	Protocol	Length	Info
618	2408.799133	0c:0b:4c:9a:00:00	Private_66:68:00	ARP	60	192.168.1.1 is at 0c:0b:4c:9a:00:00
619	2408.800211	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x6783, seq=1/256, ttl=64 (reply in 620)
620	2408.802370	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x6783, seq=1/256, ttl=64 (request in 619)
621	2409.803711	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x6883, seq=2/512, ttl=64 (reply in 622)
622	2409.805848	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x6883, seq=2/512, ttl=64 (request in 621)
623	2410.807115	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x6983, seq=3/768, ttl=64 (reply in 624)
624	2410.808775	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x6983, seq=3/768, ttl=64 (request in 623)
625	2411.810818	192.168.1.10	192.168.1.1	ICMP	98	Echo (ping) request id=0x6a83, seq=4/1024, ttl=64 (reply in 626)
626	2411.812988	192.168.1.1	192.168.1.10	ICMP	98	Echo (ping) reply id=0x6a83, seq=4/1024, ttl=64 (request in 625)

[Time delta from previous displayed frame: 0.001078000 seconds]

[Time since reference or first frame: 2408.800211000 seconds]

Frame Number: 619

Frame Length: 98 bytes (784 bits)

Capture Length: 98 bytes (784 bits)

[Frame is marked: False]

[Frame is ignored: False]

[Protocols in frame: eth:etherype: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:0b:4c:9a:00:00 (0c:0b:4c:9a:00:00)

 ▼ Destination: 0c:0b:4c:9a:00:00 (0c:0b:4c:9a:00:00)
 Address: 0c:0b:4c:9a:00:00 (0c:0b:4c:9a: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: 0x8367 (33639)

 > 000. = Flags: 0x0

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

 Time to Live: 64

 Protocol: ICMP (1)

Выполнение лабораторной работы

Информация по протоколу ICMP

Выводы

В процессе выполнения данной лабораторной работы я построил простейшие модели сети на базе коммутатора и маршрутизатора VyOS в GNS3, проанализировал трафик посредством Wireshark.