РОССИЙСКИЙ УНИВЕРСИТЕТ ДРУЖБЫ НАРОДОВ

Факультет физико-математических и естественных наук

Кафедра прикладной информатики и теории вероятностей

ОТЧЕТ
ПО ЛАБОРАТОРНОЙ РАБОТЕ № 5

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МОСКВА

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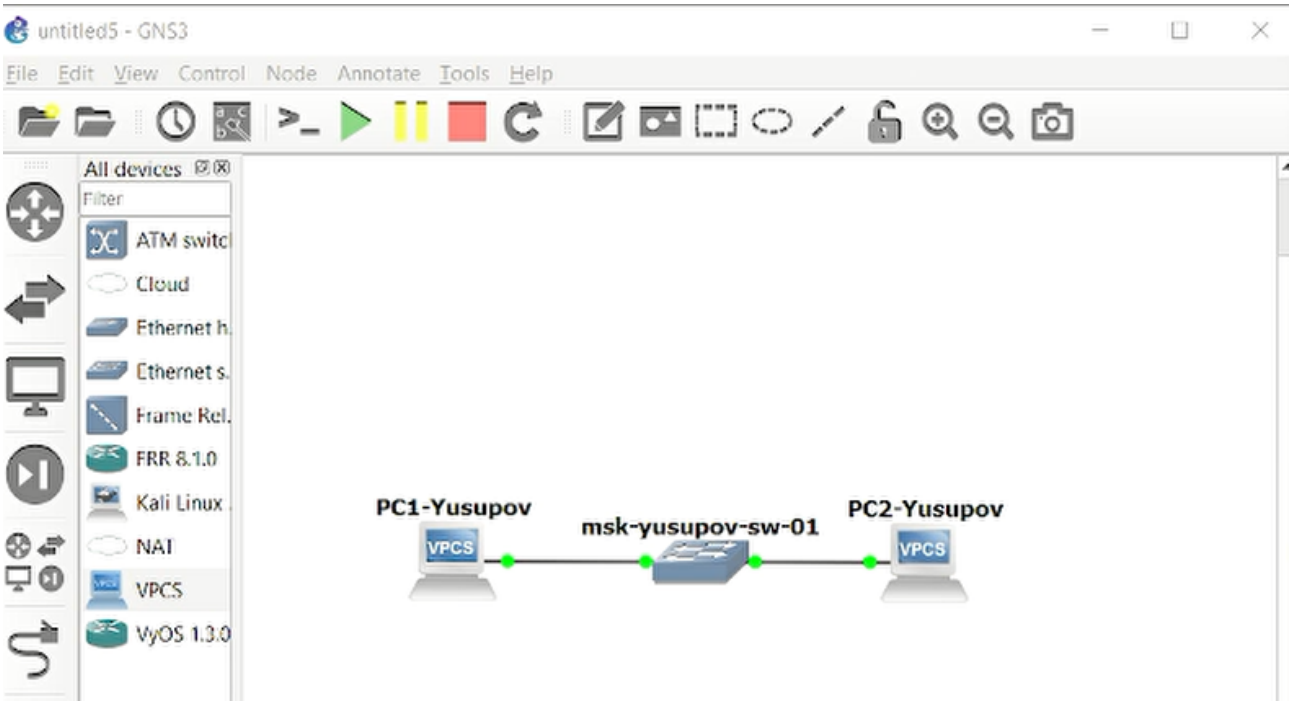
Цель работы:

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

1. Запускаем GNS3 VM и GNS3. Создайте новый проект t, создаем топологию сети как на примере и запускаем ее.



2. Задаем IP-адреса VPCS

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

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

PC2>
```

3. Проверяем работаспособность с помошью команы ping

```
PC1> ping 192.168.1.12

84 bytes from 192.168.1.12 icmp_seq=1 ttl=64 time=0.091 ms
84 bytes from 192.168.1.12 icmp_seq=2 ttl=64 time=0.195 ms
84 bytes from 192.168.1.12 icmp_seq=3 ttl=64 time=0.207 ms
84 bytes from 192.168.1.12 icmp_seq=4 ttl=64 time=0.210 ms
84 bytes from 192.168.1.12 icmp_seq=5 ttl=64 time=0.144 ms

PC1>
```

4. Включаем захват трафика и запускаем нашу сеть

5.

6. Открываем Wireshark и видим параметры подключения.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	::	ff02::2	ICMPv6	62	Router Solicitation
2	0.002131	::	ff02::2	ICMPv6	62	Router Solicitation
3	0.050179	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
4	0.052265	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
5	1.051048	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
6	1.053128	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
7	2.051660	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
8	2.053928	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
  ▾ Interface id: 0 (-)
      Interface name: -
    Encapsulation type: Ethernet (1)
    Arrival Time: Nov 11, 2022 22:14:58.501937000 RTZ 2 (зима)
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1668194098.501937000 seconds
    [Time delta from previous captured frame: 0.048048000 seconds]
    [Time delta from previous displayed frame: 0.048048000 seconds]
    [Time since reference or first frame: 0.050179000 seconds]
    Frame Number: 3
    Frame Length: 64 bytes (512 bits)
    Capture Length: 64 bytes (512 bits)
    [Frame is marked: False]
```

7. Делаем эхо-запрос в ICMP-моде к узлу PC-1 и смотрим значения в Wireshark

```
PC2> ping 192.168.1.11 -1

84 bytes from 192.168.1.11 icmp_seq=1 ttl=64 time=0.066 ms
84 bytes from 192.168.1.11 icmp_seq=2 ttl=64 time=0.169 ms
84 bytes from 192.168.1.11 icmp_seq=3 ttl=64 time=0.180 ms
84 bytes from 192.168.1.11 icmp_seq=4 ttl=64 time=0.147 ms
```

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	::	ff02::2	ICMPv6	62	Router Solicitation
2	0.002131	::	ff02::2	ICMPv6	62	Router Solicitation
3	0.050179	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
4	0.052265	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
5	1.051048	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
6	1.053128	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
7	2.051660	Private_66:68:01	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.12 (Request)
8	2.053928	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168.1.11 (Request)
9	174.322892	Private_66:68:01	Broadcast	ARP	64	Who has 192.168.1.11? Tell 192.168.1.12
10	174.322967	Private_66:68:00	Private_66:68:01	ARP	64	192.168.1.11 is at 00:50:79:66:68:00

```
Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 bits) on interface -, id 0
  > Interface id: 0 (-)
    Encapsulation type: Ethernet (1)
    Arrival Time: Nov 11, 2022 22:14:58.451758000 RTZ 2 (зима)
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1668194098.451758000 seconds
    [Time delta from previous captured frame: 0.000000000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds]
    [Time since reference or first frame: 0.000000000 seconds]
    Frame Number: 1
    Frame Length: 62 bytes (496 bits)
    Capture Length: 62 bytes (496 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ipv6:icmpv6]
```

8. Делаем эхо-запрос в UDP-моде к узлу PC-1

```
PC2> ping 192.168.1.11 -2

84 bytes from 192.168.1.11 udp_seq=1 ttl=64 time=0.176 ms
84 bytes from 192.168.1.11 udp_seq=2 ttl=64 time=0.153 ms
84 bytes from 192.168.1.11 udp_seq=3 ttl=64 time=0.176 ms
84 bytes from 192.168.1.11 udp_seq=4 ttl=64 time=0.245 ms
```

```
> Frame 6: 64 bytes on wire (512 bits), 64 bytes captured (512 bits) on interface -, id 0
v 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)
  > Source: Private_66:68:00 (00:50:79:66:68:00)
    Type: ARP (0x0806)
    Padding: 000000000000000000000000000000000000
    Frame check sequence: 0x00000000 [unverified]
    [FCS Status: Unverified]
```

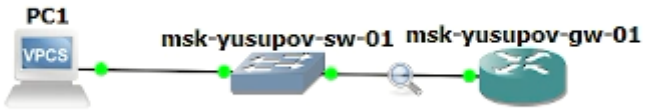
9. Делаем еще один эхо-запрос в TCP-моде к узлу PC-1

```
PC2> ping 192.168.1.11 -3

Connect   7@192.168.1.11 seq=1 ttl=64 time=1.067 ms
SendData  7@192.168.1.11 seq=1 ttl=64 time=1.068 ms
Close     7@192.168.1.11 seq=1 ttl=64 time=2.187 ms
Connect   7@192.168.1.11 seq=2 ttl=64 time=1.048 ms
SendData  7@192.168.1.11 seq=2 ttl=64 time=1.053 ms
Close     7@192.168.1.11 seq=2 ttl=64 time=2.126 ms
Connect   7@192.168.1.11 seq=3 ttl=64 time=1.070 ms
SendData  7@192.168.1.11 seq=3 ttl=64 time=1.064 ms
Close     7@192.168.1.11 seq=3 ttl=64 time=2.126 ms
Connect   7@192.168.1.11 seq=4 ttl=64 time=1.032 ms
SendData  7@192.168.1.11 seq=4 ttl=64 time=1.081 ms
Close     7@192.168.1.11 seq=4 ttl=64 time=2.899 ms
Connect   7@192.168.1.11 seq=5 ttl=64 time=1.073 ms
SendData  7@192.168.1.11 seq=5 ttl=64 time=1.709 ms
Close     7@192.168.1.11 seq=5 ttl=64 time=2.765 ms

PC2>
```

No.	Time	Source	Destination	Protocol	Length	Info
43	306.820858	192.168.1.11	192.168.1.12	TCP	54	7 → 18497 [SYN, ACK] Seq=0
44	306.821770	192.168.1.12	192.168.1.11	TCP	66	18497 → 7 [ACK] Seq=1 Ack=
45	306.821828	192.168.1.12	192.168.1.11	ECHO	122	Request
46	306.821858	192.168.1.11	192.168.1.12	TCP	54	7 → 18497 [ACK] Seq=1 Ack=
47	306.822945	192.168.1.12	192.168.1.11	TCP	66	18497 → 7 [FIN, PSH, ACK]
48	306.822979	192.168.1.11	192.168.1.12	TCP	54	7 → 18497 [ACK] Seq=1 Ack=
49	306.822985	192.168.1.11	192.168.1.12	TCP	54	7 → 18497 [FIN, ACK] Seq=1
50	306.825077	192.168.1.12	192.168.1.11	TCP	66	18497 → 7 [ACK] Seq=58 Ack
51	307.825164	192.168.1.12	192.168.1.11	TCP	74	[TCP Port numbers reused]
52	307.825229	192.168.1.11	192.168.1.12	TCP	54	7 → 18497 [SYN, ACK] Seq=0
53	307.826195	192.168.1.12	192.168.1.11	TCP	66	18497 → 7 [ACK] Seq=1 Ack=
54	307.826254	192.168.1.12	192.168.1.11	ECHO	122	Request
55	307.826280	192.168.1.11	192.168.1.12	TCP	54	7 → 18497 [ACK] Seq=1 Ack=
56	307.827384	192.168.1.12	192.168.1.11	TCP	66	18497 → 7 [FIN, PSH, ACK]

```
Frame 51: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface -, id 0
> Interface id: 0 (-)
  Encapsulation type: Ethernet (1)
  Arrival Time: Nov 11, 2022 22:20:06.276922000 RTZ 2 (зима)
  [Time shift for this packet: 0.000000000 seconds]
  Epoch Time: 1668194406.276922000 seconds
  [Time delta from previous captured frame: 1.000087000 seconds]
  [Time delta from previous displayed frame: 1.000087000 seconds]
  [Time since reference or first frame: 307.825164000 seconds]
  Frame Number: 51
  Frame Length: 74 bytes (592 bits)
  Capture Length: 74 bytes (592 bits)
  [Frame is marked: False]
  [Frame is ignored: False]
```

10. Создаем новый проект и создаем такую же топологию как и в методичке



11. Задаем ip VPCS

```
PC1> show ip

NAME        : PC1[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>
```

12.Настраиваем IP-адресацию для интерфейса локальной сети маршрутизации

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

13.Проверяем конфигурацию маршрутизатора и настройки ip-адресации.

```
[OK]
msk-yusupov-gw-01# show running-config
Building configuration...

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

```
end
msk-yusupov-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-yusupov-gw-01#
```

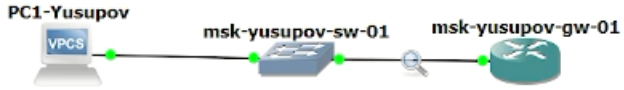
14.Проверяем подключение узла PC-1, отправляет ли он эхо-запросы

```
PC1> ping 192.168.1.1

84 bytes from 192.168.1.1 icmp_seq=1 ttl=64 time=2.501 ms
84 bytes from 192.168.1.1 icmp_seq=2 ttl=64 time=1.626 ms
84 bytes from 192.168.1.1 icmp_seq=3 ttl=64 time=0.697 ms
84 bytes from 192.168.1.1 icmp_seq=4 ttl=64 time=0.889 ms
```

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	::	ff02::2	ICMPv6	62	Router Solicitation
2	23.162993	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168
3	24.163987	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168
4	25.164125	Private_66:68:00	Broadcast	ARP	64	Gratuitous ARP for 192.168
5	218.408602	::	ff02::16	ICMPv6	130	Multicast Listener Report
6	218.687761	::	ff02::16	ICMPv6	130	Multicast Listener Report
7	219.277664	::	ff02::1:ff91:0	ICMPv6	86	Neighbor Solicitation for
8	220.323111	fe80::e27:a2ff:fe91…	ff02::16	ICMPv6	150	Multicast Listener Report
9	220.347966	fe80::e27:a2ff:fe91…	ff02::16	ICMPv6	90	Multicast Listener Report
10	220.807630	fe80::e27:a2ff:fe91…	ff02::16	ICMPv6	90	Multicast Listener Report
11	220.827650	fe80::e27:a2ff:fe91…	ff02::16	ICMPv6	150	Multicast Listener Report

```
> Frame 5: 130 bytes on wire (1040 bits), 130 bytes captured (1040 bits) on interface -, id 0
v Ethernet II, Src: 0c:27:a2:91:00:00 (0c:27:a2:91:00:00), Dst: IPv6mcast_16 (33:33:00:00:00:16)
  > Destination: IPv6mcast_16 (33:33:00:00:00:16)
  > Source: 0c:27:a2:91:00:00 (0c:27:a2:91:00:00)
    Type: IPv6 (0x86dd)
> Internet Protocol Version 6, Src: ::, Dst: ff02::16
> Internet Control Message Protocol v6
```

15. Запускаем новый проект и создаем так топологию как в методичке



16. Настраиваем ip-адресацию для интерфейса узла PC-1

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

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

PC1-Yusupov> show ip

NAME        : PC1-Yusupov[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-Yusupov>
```

17.Настраиваем маршрутизатор Vyos

```
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!
```

```
vyos@vyos:~$ configure
WARNING: You are currently configuring a live-ISO environment, changes will not
persist until installed
[edit]
vyos@vyos# system host-name msk-yusupov-gw-01

  Invalid command: [system]

[edit]
vyos@vyos#
```

```
[edit]
vyos@vyos# set  system host-name msk-yusupov-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-yusupov-gw-01
[edit]
vyos@vyos# commit
[edit]
vyos@vyos# save
Saving configuration to '/config/config.boot'...
Done
[edit]
vyos@vyos#
```

```
[edit]
vyos@vyos# show interfaces
 ethernet eth0 {
     address 192.168.1.1/24
     hw-id 0c:85:a3:b6:00:00
 }
 ethernet eth1 {
     hw-id 0c:85:a3:b6:00:01
 }
 ethernet eth2 {
     hw-id 0c:85:a3:b6:00:02
 }
 loopback lo {
 }
[edit]
vyos@vyos#
```