# Лабораторная работа №5

СТУДЕНТ: САХНО НИКИТА

ГРУППА: НФИБД-02-23

# Цель работа

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.

```
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

```
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=1.17 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*

| 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, tt |
| 12 | 624.663931 | 192.168.1.11 | 192.168.1.12 | ICMP | 98 | Echo (ping) reply    id=0x6262, seq=1/256, tt |

```
  [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)
     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
```

*Информация по протоколу ARP*

```
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

*Информация по протоколу ICMP*

Выполнение лабораторной работы

# 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-моде*

```
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-моде*

| | 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
```

*Информация по протоколу UDP*

Выполнение лабораторной
работы

## 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: 0x002 (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

```
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



*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*

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: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: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.