

Дз 3. Сетевой стек Linux

Блок 1. Админское

Задание 1.1 На двух ВМ создать виртуальное устройство `dummy0` и настроить на нём /32 адрес из приватного диапазона

Сеть у обеих ВМ - сетевой мост.

а) Статически (файлом конфигурации в `systemd-networkd/NetworkManager`)

```
server@server:/etc/systemd/network$ ip addr show dummy0
p: command not found
server@server:/etc/systemd/network$ ip addr show dummy0
5: dummy0: <BROADCAST,NOARP,UP,LOWER_UP> mtu 1500 qdisc noqueue state UNKNOWN group default qlen 1000
    link/ether 96:f1:69:39:a7:2d brd ff:ff:ff:ff:ff:ff
    inet 192.168.0.1/32 scope global dummy0
        valid_lft forever preferred_lft forever
    inet6 fe80::94f1:69ff:fe39:a72d/64 scope link
        valid_lft forever preferred_lft forever
server@server:/etc/systemd/network$ _
```

```
>> sudo apt install iproute2
>> sudo modprobe dummy
>> echo "dummy" | sudo tee /etc/modules-load.d/dummy.conf
>> sudo nano /etc/systemd/network/10-dummy0.netdev
[NetDev]
Name=dummy0
Kind=dummy
>> ping 192.168.0.1
>> sudo nano /etc/systemd/network/1-dummy0.network
[Match]
Name=dummy0

[Network]
Address=192.168.0.1/32
>> sudo systemctl restart systemd-networkd
>> ip addr show dummy0
```

б) Динамически (командами `ip...`)

```
server@server:/$ sudo ip link add dummy0 type dummy
server@server:/$ lsmod | grep dummy
dummy                12288  0
server@server:/$ ping 192.168.0.2
PING 192.168.0.2 (192.168.0.2) 56(84) bytes of data.
^C
--- 192.168.0.2 ping statistics ---
3 packets transmitted, 0 received, 100% packet loss, time 2066ms

server@server:/$ sudo ip addr add 192.168.0.2/32 dev dummy0
server@server:/$ sudo ip link set dummy0 up
server@server:/$ ip addr show dummy0
4: dummy0: <BROADCAST,NOARP,UP,LOWER_UP> mtu 1500 qdisc noqueue state UNKNOWN group default qlen 1000
    link/ether 8e:af:2a:e3:53:9f brd ff:ff:ff:ff:ff:ff
    inet 192.168.0.2/32 scope global dummy0
        valid_lft forever preferred_lft forever
    inet6 fe80::8caf:2aff:fee3:539f/64 scope link
        valid_lft forever preferred_lft forever
server@server:/$
```

```
>> sudo apt install iproute2
>> sudo modprobe dummy
>> sudo ip link add dummy0 type dummy
>> lsmod | grep dummy
>> ping 192.168.0.2
>> sudo ip addr add 192.168.0.2/32 dev dummy0
>> sudo ip link set dummy up
>> ip addr show dummy0
```

Задание 1.2 Настроить маршрутизацию между /32

a) bird + BGP

```
server@server:/$ sudo ip route del 192.168.0.1/32 via 192.168.3.30 dev enp0s3
server@server:/$ sudo ip route del 192.168.0.2/32 via 192.168.3.31 dev enp0s3
server@server:/$ ping 192.168.0.2
PING 192.168.0.2 (192.168.0.2) 56(84) bytes of data.
^C
--- 192.168.0.2 ping statistics ---
2 packets transmitted, 0 received, 100% packet loss, time 1057ms

server@server:/$ sudo ip route
default via 192.168.3.1 dev enp0s3 proto dhcp src 192.168.3.30 metric 100
192.168.3.0/24 dev enp0s3 proto kernel scope link src 192.168.3.30 metric 100
192.168.3.1 dev enp0s3 proto dhcp scope link src 192.168.3.30 metric 100
server@server:/$
```

```
server@server:/$ sudo systemctl restart bird
server@server:/$ sudo systemctl status bird
● bird.service - BIRD Internet Routing Daemon (IPv4)
   Loaded: loaded (/usr/lib/systemd/system/bird.service; enabled; preset: enabled)
   Active: active (running) since Wed 2024-10-16 21:18:24 UTC; 10s ago
   Process: 1527 ExecStartPre=/usr/lib/bird/prepare-environment (code=exited, status=0/SUCCESS)
   Process: 1535 ExecStartPre=/usr/sbin/bird -p (code=exited, status=0/SUCCESS)
   Main PID: 1537 (bird)
   Tasks: 1 (limit: 2276)
   Memory: 328.0K (peak: 1.5M)
   CPU: 18ms
   CGroup: /system.slice/bird.service
           └─1537 /usr/sbin/bird -f -u bird -g bird

server@server:/$ sudo systemctl restart bird
server@server:/$ sudo systemctl status bird
● bird.service - BIRD Internet Routing Daemon (IPv4)
   Loaded: loaded (/usr/lib/systemd/system/bird.service; enabled; preset: enabled)
   Active: active (running) since Wed 2024-10-16 21:18:03 UTC; 6s ago
   Process: 1457 ExecStartPre=/usr/lib/bird/prepare-environment (code=exited, status=0/SUCCESS)
   Process: 1464 ExecStartPre=/usr/sbin/bird -p (code=exited, status=0/SUCCESS)
   Main PID: 1466 (bird)
   Tasks: 1 (limit: 2276)
   Memory: 280.0K (peak: 1.5M)
   CPU: 16ms
   CGroup: /system.slice/bird.service
           └─1466 /usr/sbin/bird -f -u bird -g bird

server@server:/$
```

```
server@server:/$ sudo birdc show proto
Unable to connect to server control socket (/run/bird/birdctl): Permission denied
server@server:/$ sudo birdc show proto
BIRD 1.6.8 ready.
name proto table state since info
kernel1 kernel master up 21:20:43
device1 Device master up 21:20:43
direct1 Direct master up 21:20:43
BGP2W1 BGP master up 21:20:43 Established
server@server:/$
```

```

bird> show route
192.168.3.0/24      dev enp0s3 [direct1 21:18:24] * (240)
                  via 192.168.3.31 on enp0s3 [DGP2VM2 21:20:46] (100) [AS65002i]
192.168.0.1/32     dev dummy0 [direct1 21:18:24] * (240)
192.168.0.2/32     via 192.168.3.31 on enp0s3 [DGP2VM2 21:20:46] * (100) [AS65002i]
bird> ip r
No such command. Press `?' for help.
bird>
server@server:/etc/systemd/network$ ip r
default via 192.168.3.1 dev enp0s3 proto dhcp src 192.168.3.30 metric 100
192.168.0.2 via 192.168.3.31 dev enp0s3 proto bird
192.168.3.0/24 dev enp0s3 proto kernel scope link src 192.168.3.30 metric 100
192.168.3.1 dev enp0s3 proto dhcp scope link src 192.168.3.30 metric 100
server@server:/etc/systemd/network$ sudo systemctl stop bird
server@server:/etc/systemd/network$ ip r
default via 192.168.3.1 dev enp0s3 proto dhcp src 192.168.3.30 metric 100
192.168.3.0/24 dev enp0s3 proto kernel scope link src 192.168.3.30 metric 100
192.168.3.1 dev enp0s3 proto dhcp scope link src 192.168.3.30 metric 100
server@server:/etc/systemd/network$ ping 192.168.0.2
PING 192.168.0.2 (192.168.0.2) 56(84) bytes of data.
^C
--- 192.168.0.2 ping statistics ---
4 packets transmitted, 0 received, 100% packet loss, time 3086ms

server@server:/etc/systemd/network$

```

```

#VM1
>> sudo nano /etc/bird/bird.conf
router id 192.168.3.30;

protocol kernel {
    persist;
    scan time 20;
    export all;
}

protocol device {
    scan time 10;
}

protocol direct {
    interface "enp0s3", "dummy0";
}

protocol bgp BGP_to_VM2 {
    local as 65001;
    neighbor 192.168.3.31 as 65002;
    import all;
    export all;
    next hop self;
}

>> sudo systemctl restart bird
>> sudo systemctl status bird
>> sudo birdc show proto
>> sudo birdc show route

```

```
>> ip r
>> ping 192.168.0.2
>> sudo systemctl stop bird
>> ping 192.168.0.2

#VM2
>> sudo nano /etc/bird/bird.conf
router id 192.168.3.31;

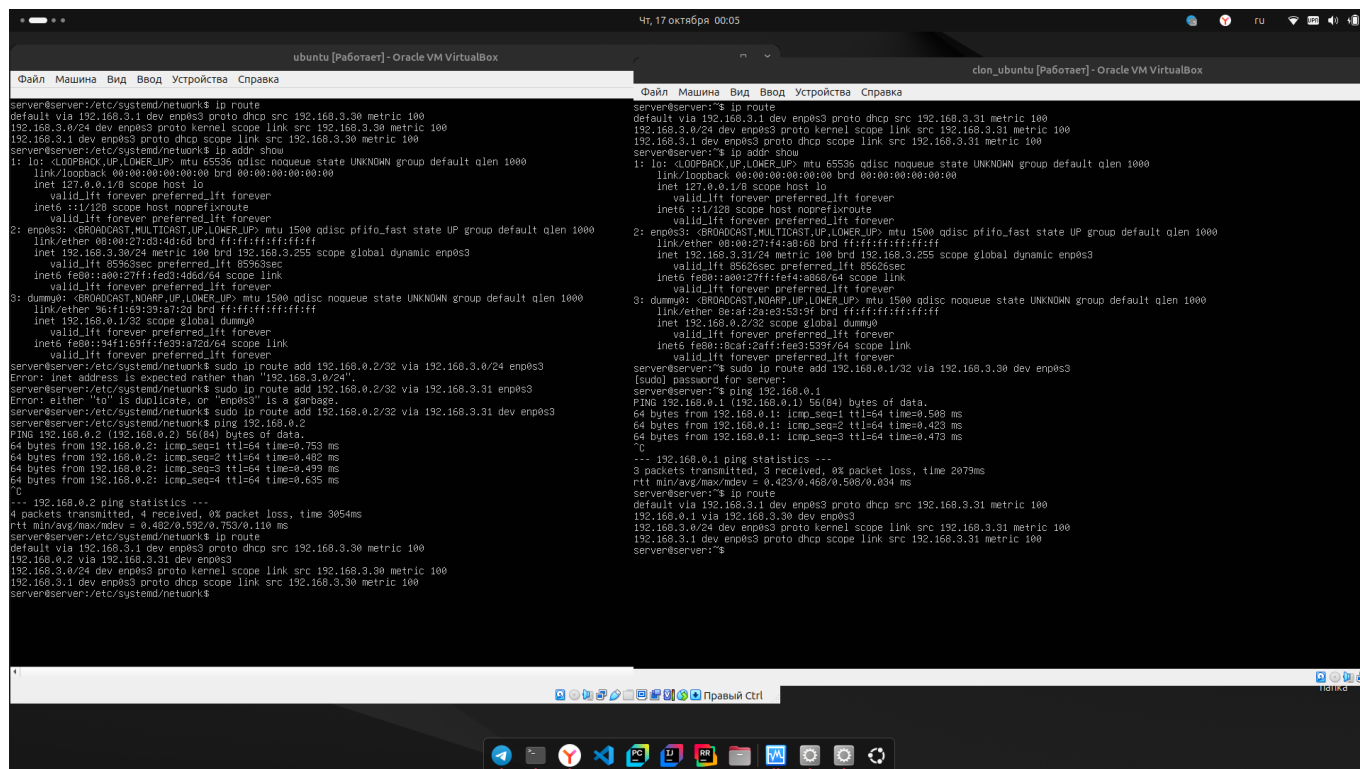
protocol kernel {
    persist;
    scan time 20;
    export all;
}

protocol device {
    scan time 10;
}

protocol direct {
    interface "enp0s3", "dummy0";
}

protocol bgp BGP_to_VM1 {
    local as 65002;
    neighbor 192.168.3.30 as 65001;
    import all;
    export all;
    next hop self;
}
>> sudo systemctl restart bird
>> sudo systemctl status bird
>> sudo birdc show proto
>> sudo birdc show route
>> ip r
>> ping 192.168.0.1
>> sudo systemctl stop bird
>> ping 192.168.0.1
```

b) Статические маршруты



```
#VM1
```

```
>> sudo ip route add 192.168.0.2/32 via 192.168.3.31 dev enp0s3
>> ping 192.168.0.2
```

```
#VM2
```

```
>> sudo ip route add 192.168.0.1/32 via 192.168.3.30 dev enp0s3
>> ping 192.168.0.1
```

Блок 2. Программистское

Написать программу для DNS резолва (A/AAAA записи) через произвольный DNS сервер. Сетевое взаимодействие организовать через RAW сокет (SOCK RAW). Сформировать UDP пакет, отправить и получить ответ.