

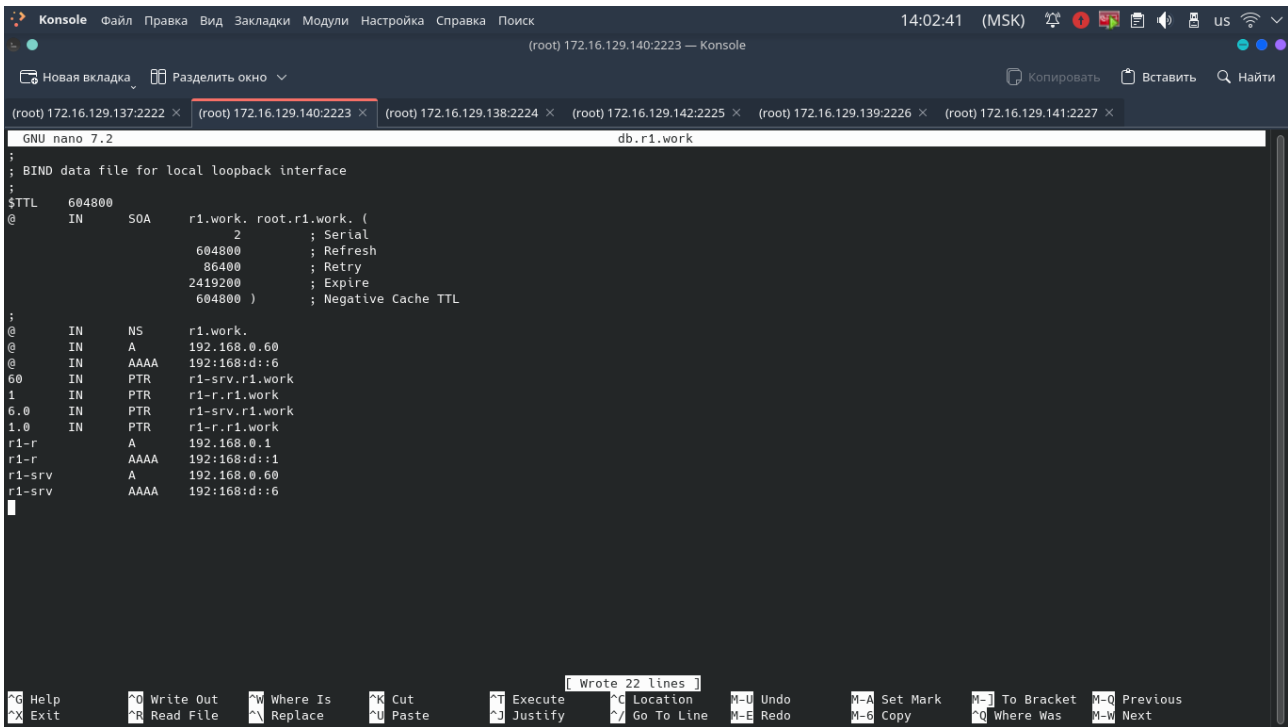
# Настройка DNS на сервере PC-R1

## 1) Установка DNS: *apt install -y bind9*

Далее нужно перейти в директорию «/etc/bind/» и скопировать файл db.local:

```
# cp db.local db.r1.work
```

```
# nano db.r1.work
```

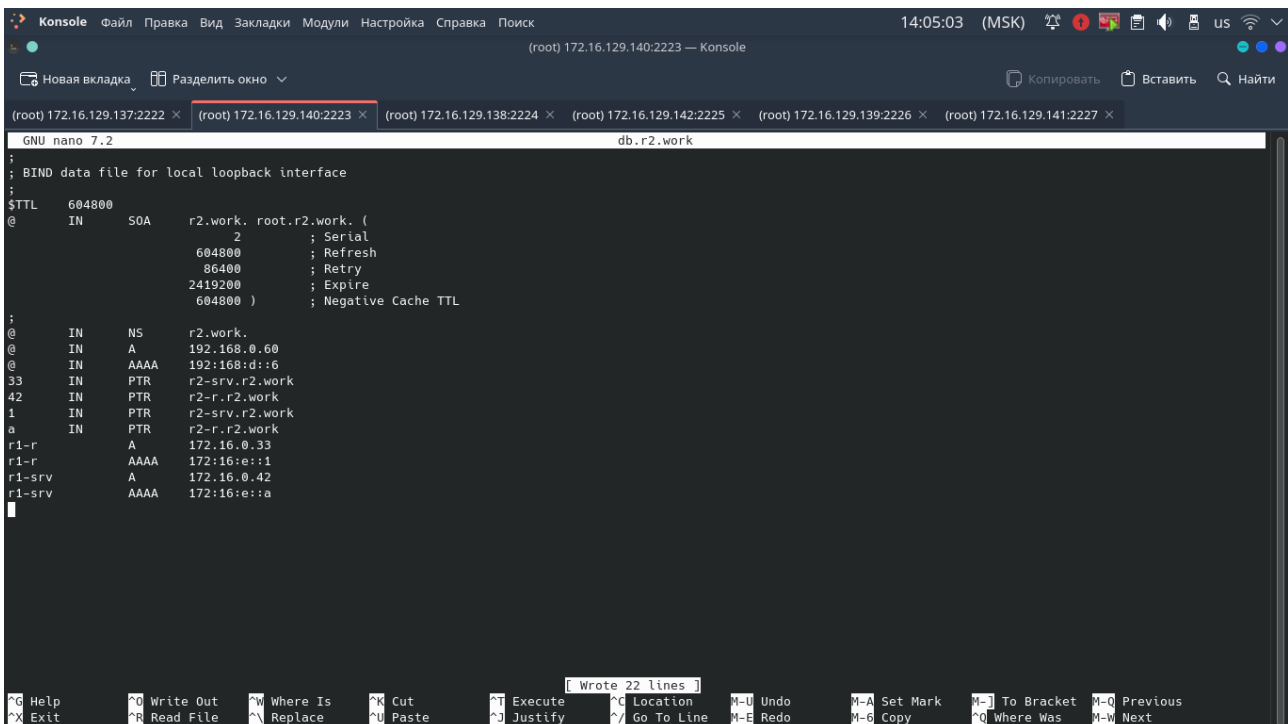


```
GNU nano 7.2 db.r1.work
;
; BIND data file for local loopback interface
;
$TTL 604800
@ IN SOA r1.work. root.r1.work. (
    2      ; Serial
    604800 ; Refresh
    86400  ; Retry
    2419200 ; Expire
    604800 ) ; Negative Cache TTL
;
@ IN NS r1.work.
@ IN A 192.168.0.60
@ IN AAAA 192:168:d::6
60 IN PTR r1-srv.r1.work
1 IN PTR r1-r.r1.work
6.0 IN PTR r1-srv.r1.work
1.0 IN PTR r1-r.r1.work
r1-r A 192.168.0.1
r1-r AAAA 192:168:d::1
r1-srv A 192.168.0.60
r1-srv AAAA 192:168:d::6
```

Также стоит скопировать данный файл и для сети 172.16.0.32/28 и 172:16:e::/124:

```
# cp db.r1.work db.r2.work
```

```
# nano db.r2.work
```



```
GNU nano 7.2 db.r2.work
;
; BIND data file for local loopback interface
;
$TTL 604800
@ IN SOA r2.work. root.r2.work. (
    2      ; Serial
    604800 ; Refresh
    86400  ; Retry
    2419200 ; Expire
    604800 ) ; Negative Cache TTL
;
@ IN NS r2.work.
@ IN A 192.168.0.60
@ IN AAAA 192:168:d::6
33 IN PTR r2-srv.r2.work
42 IN PTR r2-r.r2.work
1 IN PTR r2-srv.r2.work
a IN PTR r2-r.r2.work
r1-r A 172.16.0.33
r1-r AAAA 172:16:e::1
r1-srv A 172.16.0.42
r1-srv AAAA 172:16:e::a
```

2) Далее нужно отредкатировать файл "named.conf.options" (дописать в конец файла):

```
dnssec-validation auto;
```

```
listen-on { any; };
```

```
listen-on-v6 { any; };
```

3) Следует добавить «zone» с нашими IP в файл "named.conf.local":

The screenshot shows a terminal window titled "Konsole" at the top. The address bar indicates the root directory is 172.16.129.140:2223. Below the address bar, there are tabs for different terminal sessions, all pointing to the same root directory. The active session shows the contents of the file named.conf.local, which defines several DNS zones:

```
zone "r1.work" {  
    type master;  
    allow-transfer { any; };  
    file "/etc/bind/db.r1.work";  
};  
  
zone "r2.work" {  
    type master;  
    allow-transfer { any; };  
    file "/etc/bind/db.r2.work";  
};  
  
zone "0.168.192.in-addr.arpa" {  
    type master;  
    allow-transfer { any; };  
    file "/etc/bind/db.r1.work";  
};  
  
zone "0.16.172.in-addr.arpa" {  
    type master;  
    allow-transfer { any; };  
    file "/etc/bind/db.r2.work";  
};  
  
zone "0.0.0.0.0.0.0.0.0.0.0.0.0.0.d.0.0.0.6.1.0.2.9.1.0.ip6.arpa" {  
    type master;  
    allow-transfer { any; };  
    file "/etc/bind/db.r1.work";  
};  
  
zone "0.0.0.0.0.0.0.0.0.0.0.0.0.0.e.0.0.0.6.1.0.2.7.1.0.ip6.arpa" {  
    type master;  
    allow-transfer { any; };  
    file "/etc/bind/db.r2.work";  
};
```

At the bottom of the terminal, there is a prompt indicating that the user should consider adding the 1918 zones if they are not used.

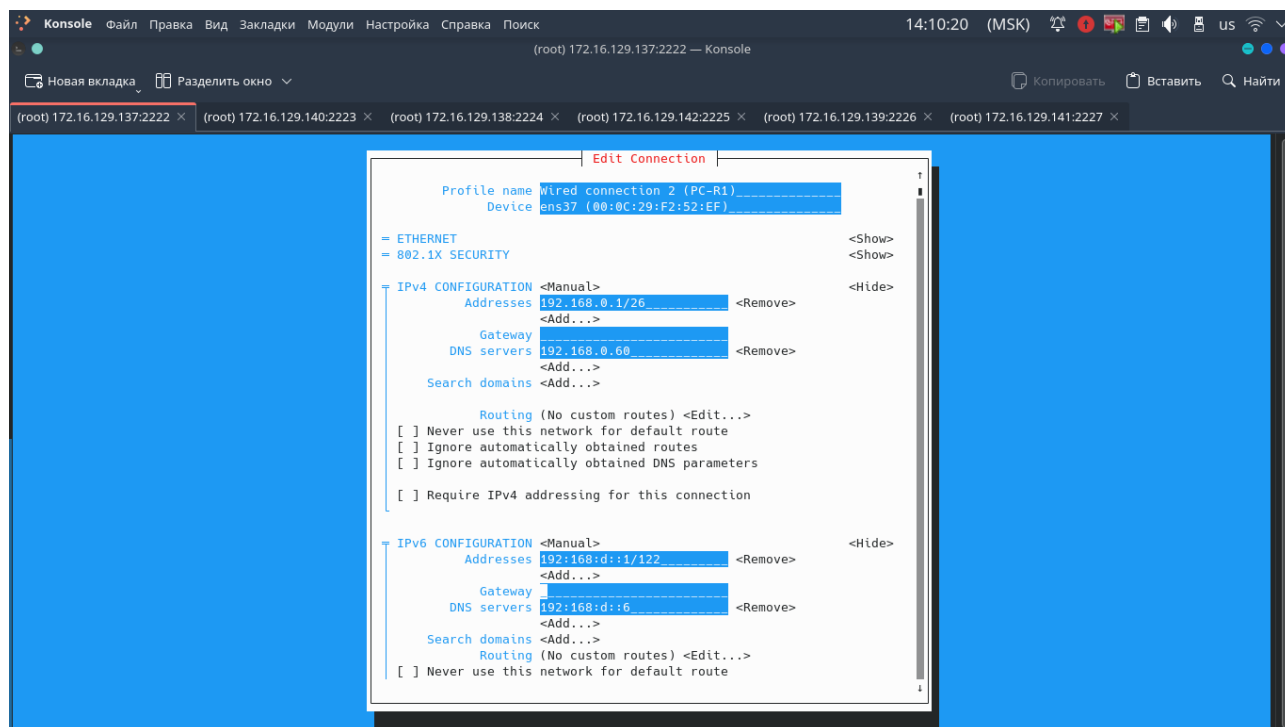
#### 4)Применяем конфигурацию DNS:

A screenshot of a Linux terminal window titled "(root) 172.16.129.140:2223 — Konsole". The terminal shows a series of commands being executed in a root shell at IP 172.16.129.140. The user navigates to /etc/bind and creates several files: db.local.db.r1.work, db.r1.work, db.r2.work, named.conf.options, named.conf.local, and named-checkconf -z. Then, they edit named.conf.local to define zones for r1.work, r2.work, and various IPv4 and IPv6 addresses. Finally, they run systemctl enable named, synchronize service state, and restart the service. The terminal output shows the successful execution of these commands.

5) Добавляем DNS сервер на следующие сервера: R1, R0 и R2:

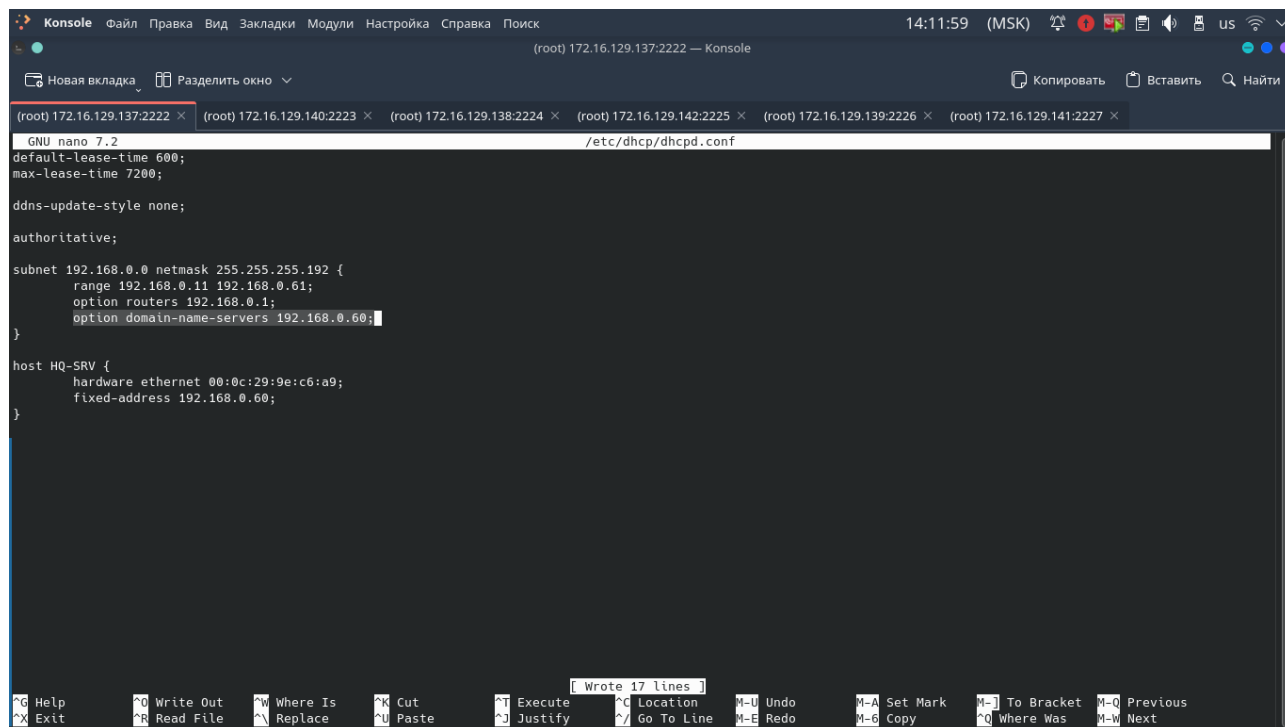
nmtui-edit → PC-R1 → IPv4 → DNS servers → 192.168.0.60

nmtui-edit → PC-R1 → IPv6 → DNS servers → 192:168:d::6



Затем перезагружаем сетевые интерфейсы - ***systemctl restart NetworkManager***

6) Добавляем DNS сервер в конфигурационный файл DHCPv4 `"/etc/dhcp/dhcpd.conf"` (R1):



7) Добавляем DNS сервер в конфигурационный файл DHCPv6 `/etc/dhcp/dhcpd6.conf` (R1):

The image shows a terminal window with a dark theme. At the top, there's a title bar with icons for file operations (New tab, Split window) and system status (Copy, Paste, Find). Below the title bar, a breadcrumb trail shows the current directory: (root) 172.16.129.137:2222 — Konsole. The main content area displays the output of the 'cat /etc/dhcp/dhcpd.conf' command. The configuration file content is as follows:

```
default-lease-time 2592000;
preferred-lifetime 604800;
option dhcp-renewal-time 3600;
option dhcp-rebinding-time 7200;
allow leasequery;
option dhcp6.preference 255;
option dhcp6.info-refresh-time 21600;
authoritative;

subnet6 192:168:d::/122 {
    range6 192:168:d::2 192:168:d::2f;
    option dhcp6.name-servers 192:168:d::6;
}

host HQ-SRV {
    host-identifier option dhcp6.client-id 00:04:18:90:a5:18:95:d2:f5:12:12:9d:95:91:2d:f7:5d:cf;
    fixed-address6 192:168:d::6;
    fixed-prefix6 192:168:d::/122;
}
```

The terminal shows the user is in the nano text editor, editing the file /etc/dhcp/dhcpd.conf. The cursor is positioned at the end of the line 'option dhcp6.name-servers 192:168:d::6;'. At the bottom of the terminal, there's a status bar with various keyboard shortcuts and their functions, such as 'G Help', 'W Write Out', 'W Where Is', 'K Cut', 'T Execute', 'C Location', 'M-U Undo', 'M-A Set Mark', 'M-J To Bracket', 'M-Q Previous', 'X Exit', 'R Read File', 'U Replace', 'U Paste', 'J Justify', 'G Go To Line', 'M-E Redo', 'M-6 Copy', 'M-Q Where Was', and 'M-W Next'. A small notification bubble in the center of the status bar says 'Wrote 26 lines'.

8) Перезагружаем сетевые интерфейсы сервера PC-R1: ***systemctl restart NetworkManager***

9) Отключаем сетевой интерфейс "Host-only" во всех VM и тестируем доступность DNS сервера:

The screenshot shows the VMware Workstation interface with a terminal window open for VM R1. The terminal output is as follows:

```

root@R1:~# ifconfig
eth0: flags=4163<UP,BROADCAST,MULTICAST>  mtu=1500
        inet 192.168.0.60 netmask=255.255.255.0  broadcast=192.168.0.255
        inet6::: flags=0<>  mtu=1500
        ether 08:00:27:10:10:10  txqueuelen=1000  (Ethernet)
        RX packets=0  bytes=0  (0.0 bytes)  rxerrors=0  dropped=0
        TX packets=0  bytes=0  (0.0 bytes)  txerrors=0  dropped=0
        Interrupt:323
eth1: flags=4163<UP,BROADCAST,MULTICAST>  mtu=1500
        inet 192.168.0.60 netmask=255.255.255.0  broadcast=192.168.0.255
        inet6::: flags=0<>  mtu=1500
        ether 08:00:27:10:10:10  txqueuelen=1000  (Ethernet)
        RX packets=0  bytes=0  (0.0 bytes)  rxerrors=0  dropped=0
        TX packets=0  bytes=0  (0.0 bytes)  txerrors=0  dropped=0
        Interrupt:323
lo: flags=73<UP,LOOPBACK,RUNNING>  mtu=65536
        inet 127.0.0.1 netmask=255.255.255.0
        inet6::1 flags=0<>  mtu=65536
        loopback  txqueuelen=1000  (Local Loopback)
        RX packets=0  bytes=0  (0.0 bytes)  rxerrors=0  dropped=0
        TX packets=0  bytes=0  (0.0 bytes)  txerrors=0  dropped=0
        Interrupt:0
root@R1:~# arp
root@R1:~# arp -n
Address                  HWtype  HWaddress            Flags        Iface
* 192.168.0.1             000000000000         000000000000    RM      eth0
  192.168.0.2             000000000000         000000000000    RM      eth0
  192.168.0.3             000000000000         000000000000    RM      eth0
  192.168.0.4             000000000000         000000000000    RM      eth0
  192.168.0.5             000000000000         000000000000    RM      eth0
  192.168.0.6             000000000000         000000000000    RM      eth0
  192.168.0.7             000000000000         000000000000    RM      eth0
  192.168.0.8             000000000000         000000000000    RM      eth0
  192.168.0.9             000000000000         000000000000    RM      eth0
  192.168.0.10            000000000000         000000000000    RM      eth0
  192.168.0.11            000000000000         000000000000    RM      eth0
  192.168.0.12            000000000000         000000000000    RM      eth0
  192.168.0.13            000000000000         000000000000    RM      eth0
  192.168.0.14            000000000000         000000000000    RM      eth0
  192.168.0.15            000000000000         000000000000    RM      eth0
  192.168.0.16            000000000000         000000000000    RM      eth0
  192.168.0.17            000000000000         000000000000    RM      eth0
  192.168.0.18            000000000000         000000000000    RM      eth0
  192.168.0.19            000000000000         000000000000    RM      eth0
  192.168.0.20            000000000000         000000000000    RM      eth0
  192.168.0.21            000000000000         000000000000    RM      eth0
  192.168.0.22            000000000000         000000000000    RM      eth0
  192.168.0.23            000000000000         000000000000    RM      eth0
  192.168.0.24            000000000000         000000000000    RM      eth0
  192.168.0.25            000000000000         000000000000    RM      eth0
  192.168.0.26            000000000000         000000000000    RM      eth0
  192.168.0.27            000000000000         000000000000    RM      eth0
  192.168.0.28            000000000000         000000000000    RM      eth0
  192.168.0.29            000000000000         000000000000    RM      eth0
  192.168.0.30            000000000000         000000000000    RM      eth0
  192.168.0.31            000000000000         000000000000    RM      eth0
  192.168.0.32            000000000000         000000000000    RM      eth0
  192.168.0.33            000000000000         000000000000    RM      eth0
  192.168.0.34            000000000000         000000000000    RM      eth0
  192.168.0.35            000000000000         000000000000    RM      eth0
  192.168.0.36            000000000000         000000000000    RM      eth0
  192.168.0.37            000000000000         000000000000    RM      eth0
  192.168.0.38            000000000000         000000000000    RM      eth0
  192.168.0.39            000000000000         000000000000    RM      eth0
  192.168.0.40            000000000000         000000000000    RM      eth0
  192.168.0.41            000000000000         000000000000    RM      eth0
  192.168.0.42            000000000000         000000000000    RM      eth0
  192.168.0.43            000000000000         000000000000    RM      eth0
  192.168.0.44            000000000000         000000000000    RM      eth0
  192.168.0.45            000000000000         000000000000    RM      eth0
  192.168.0.46            000000000000         000000000000    RM      eth0
  192.168.0.47            000000000000         000000000000    RM      eth0
  192.168.0.48            000000000000         000000000000    RM      eth0
  192.168.0.49            000000000000         000000000000    RM      eth0
  192.168.0.50            000000000000         000000000000    RM      eth0
  192.168.0.51            000000000000         000000000000    RM      eth0
  192.168.0.52            000000000000         000000000000    RM      eth0
  192.168.0.53            000000000000         000000000000    RM      eth0
  192.168.0.54            000000000000         000000000000    RM      eth0
  192.168.0.55            000000000000         000000000000    RM      eth0
  192.168.0.56            000000000000         000000000000    RM      eth0
  192.168.0.57            000000000000         000000000000    RM      eth0
  192.168.0.58            000000000000         000000000000    RM      eth0
  192.168.0.59            000000000000         000000000000    RM      eth0
  192.168.0.60            000000000000         000000000000    RM      eth0
  192.168.0.61            000000000000         000000000000    RM      eth0
  192.168.0.62            000000000000         000000000000    RM      eth0
  192.168.0.63            000000000000         000000000000    RM      eth0
  192.168.0.64            000000000000         000000000000    RM      eth0
  192.168.0.65            000000000000         000000000000    RM      eth0
  192.168.0.66            000000000000         000000000000    RM      eth0
  192.168.0.67            000000000000         000000000000    RM      eth0
  192.168.0.68            000000000000         000000000000    RM      eth0
  192.168.0.69            000000000000         000000000000    RM      eth0
  192.168.0.70            000000000000         000000000000    RM      eth0
  192.168.0.71            000000000000         0000000000
```

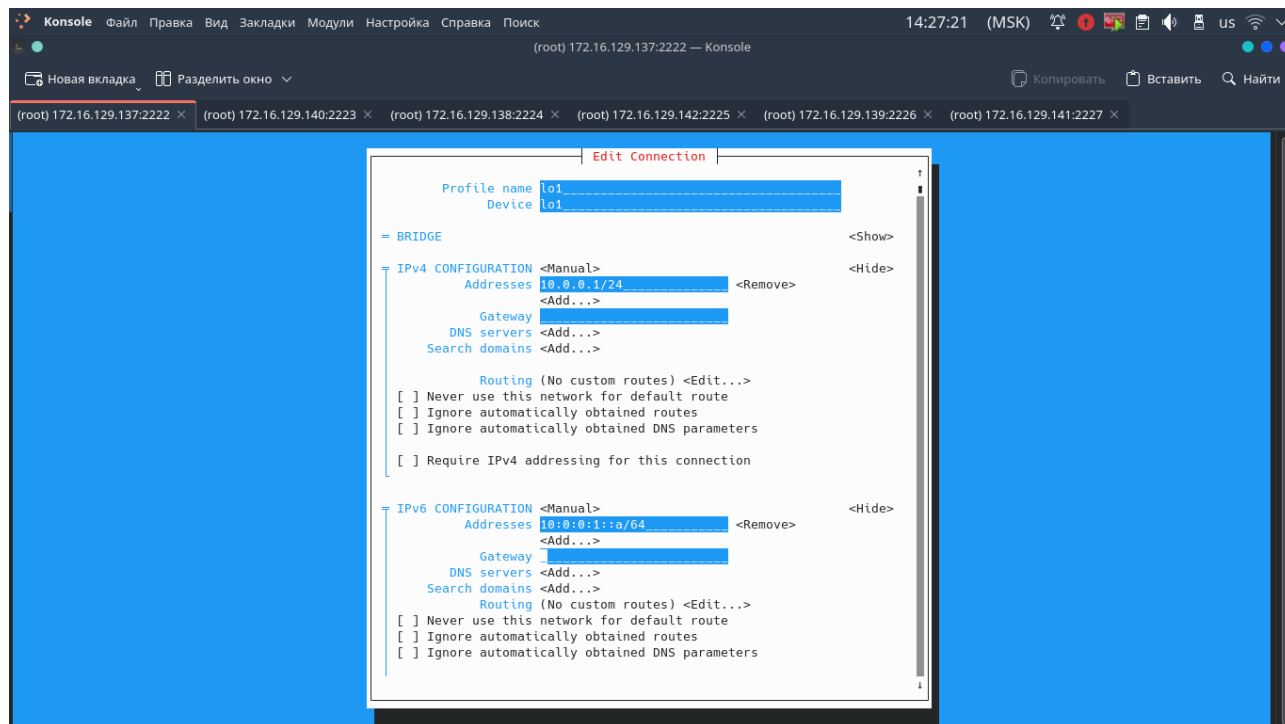
**Примечание:**

Сервера R0 и R2 должны получить аналогичные ответы, как сервер R1.

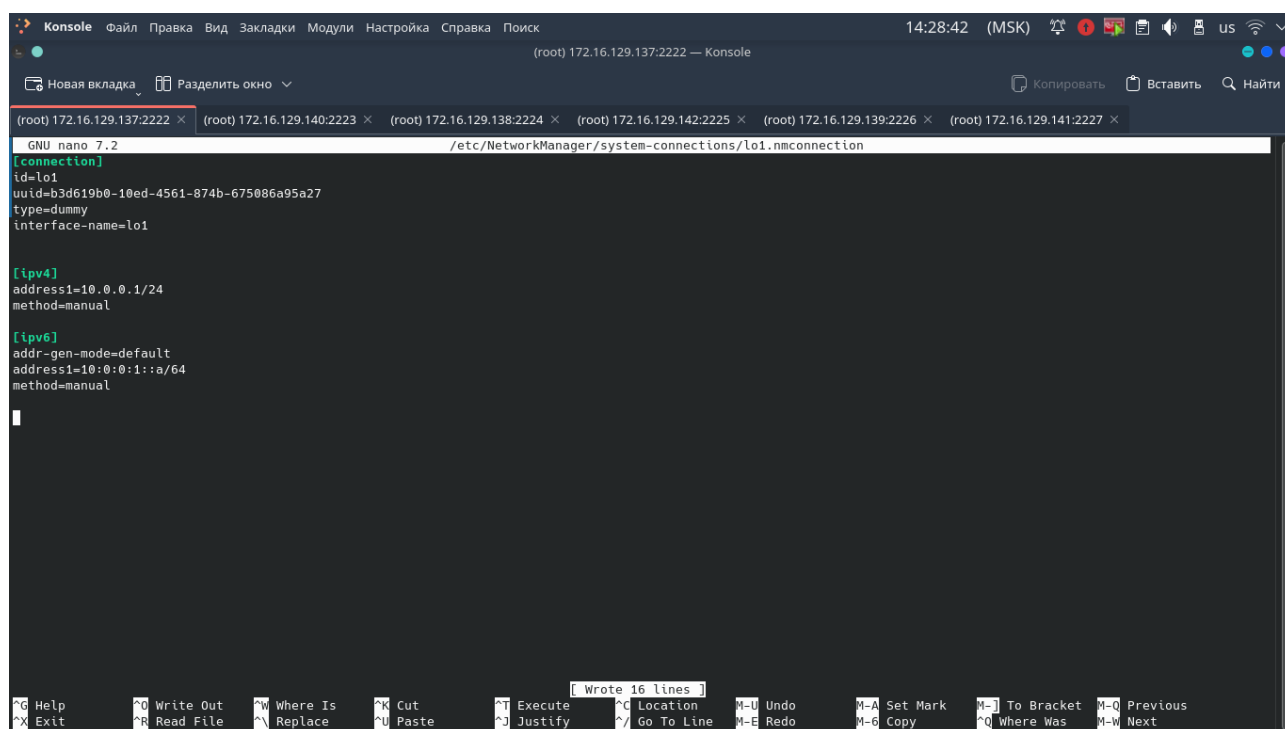
## Настройка NTP на сервере R1

1) Добавляем новый сетевой интерфейс на сервере R1 с типом интерфейса Bridge.

Подсказка: nmtui-edit → <Add> → Bridge

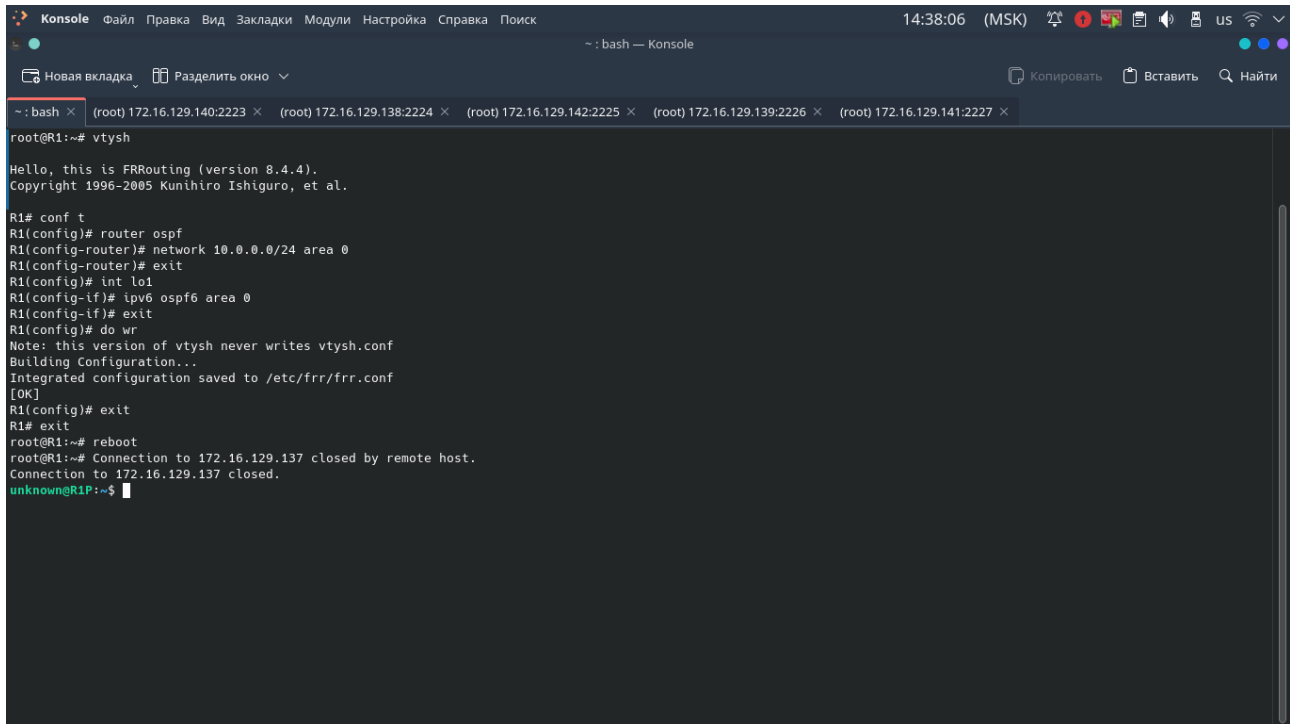


2) Далее нам нужно изменить тип интерфейса "Bridge" на "Dummy" с помощью ранее сконфигурированного файла `/etc/NetworkManager/system-connections/lo1.nmconnection` т.к NetworkManager не предоставляет тип интерфейса "Dummy" в графическом интерфейсе.



Далее следует перезагрузить сервера R1: **reboot** (можно и после 3 пункта)

3) Добавляем lo1 в OSPF для его доступности на других серверах:



```
~: bash x (root) 172.16.129.140:2223 x (root) 172.16.129.138:2224 x (root) 172.16.129.142:2225 x (root) 172.16.129.139:2226 x (root) 172.16.129.141:2227 x
root@R1:~# vtysh
Hello, this is FRRouting (version 8.4.4).
Copyright 1996-2005 Kunihito Ishiguro, et al.

R1# conf t
R1(config)# router ospf
R1(config-router)# network 10.0.0.0/24 area 0
R1(config-router)# exit
R1(config)# int lo1
R1(config-if)# ip v6 ospf6 area 0
R1(config-if)# exit
R1(config)# do wr
Note: this version of vtysh never writes vtysh.conf
Building Configuration...
Integrated configuration saved to /etc/frr/frr.conf
[OK]
R1(config)# exit
R1# exit
root@R1:~# reboot
root@R1:~# Connection to 172.16.129.137 closed by remote host.
Connection to 172.16.129.137 closed.
unknown@R1P:~$
```

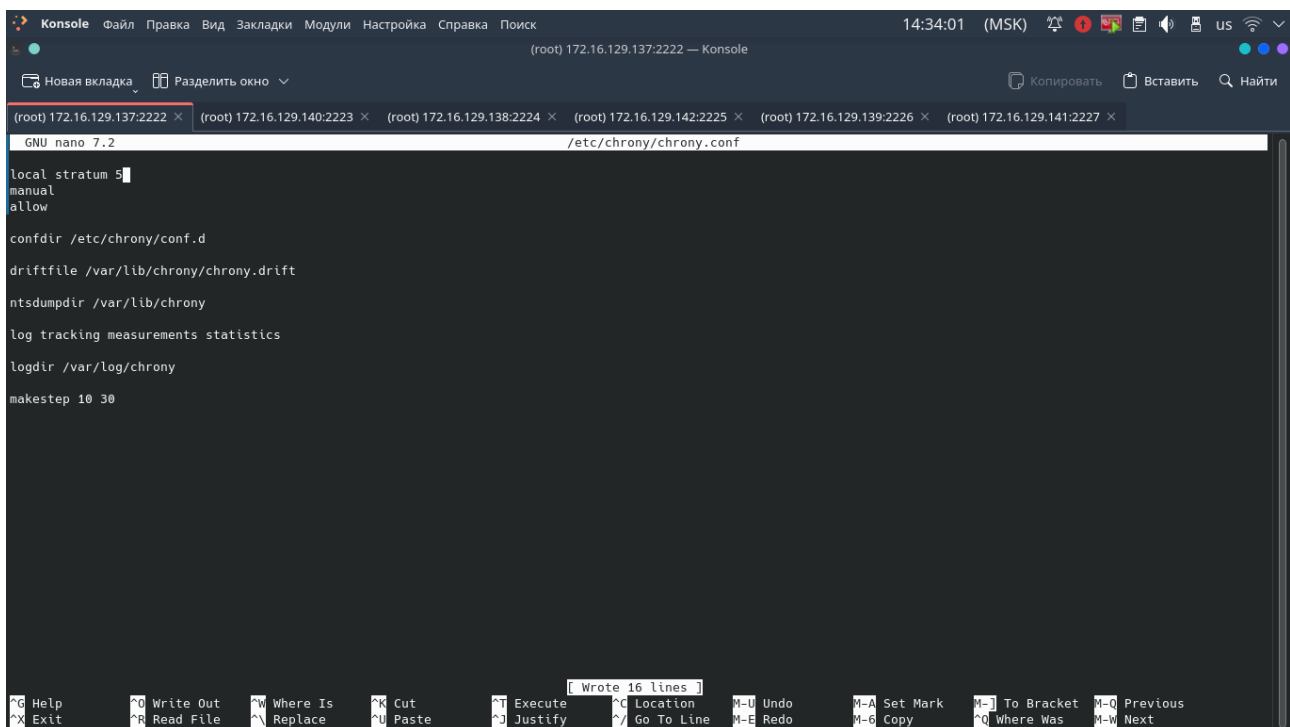
4) Проверяем доступность сетевого интерфейса "lo1" после **reboot**:

```
# ping -c 2 10.0.0.1
```

```
# ping -c 2 10:0:0:1::a
```

5) Устанавливаем пакет chrony: **apt install chrony**

6) Конфигурируем сервер chrony на сервере R1 "/etc/chrony/chrony.conf":



```
GNU nano 7.2 /etc/chrony/chrony.conf
local stratum 5
manual
allow

confdir /etc/chrony/conf.d
driftfile /var/lib/chrony/chrony.drift
ntsdumpdir /var/lib/chrony
log tracking measurements statistics
logdir /var/log/chrony
makestep 10 30

Wrote 16 lines
Help Write Out Where Is Cut Execute Location M-U Undo M-A Set Mark M-J To Bracket M-Q Previous
Exit Read File Replace Paste Justify Go To Line M-E Redo M-G Copy M-W Where Was M-W Next
```

7) На всех остальных серверах редактируется файл `"/etc/chrony/chrony.conf"` таким образом:

Konsole Файл Правка Вид Закладки Модули Настройка Справка Поиск 14:55:48 (MSK)

(root) 172.16.129.140:2223 — Konsole

Новая вкладка Разделить окно Копировать Вставить Найти

(root) 172.16.129.137:2222 × (root) 172.16.129.140:2223 × (root) 172.16.129.138:2224 × (root) 172.16.129.142:2225 × (root) 172.16.129.139:2226 × (root) 172.16.129.141:2227 ×

GNU nano 7.2 /etc/chrony/chrony.conf

```
server master iburst
pool 10.0.0.1 prefer iburst

confdir /etc/chrony/conf.d

driftfile /var/lib/chrony/chrony.drift

ntsdumpdir /var/lib/chrony

log tracking measurements statistics

logdir /var/log/chrony

makestep 10 30
```

Help Write Out Where Is Cut Execute Location Undo Set Mark To Bracket Previous  
Exit Read File Replace Paste Justify Go To Line Redo Copy Where Was Next

8) Изменяем часовой пояс и перезагружаем chrony:

```
# timedatectl set-timezone Europe/Moscow
```

```
# systemctl restart chrony
```

9) На всех клиентских серверах проверяем связь с NTP сервером (R1):

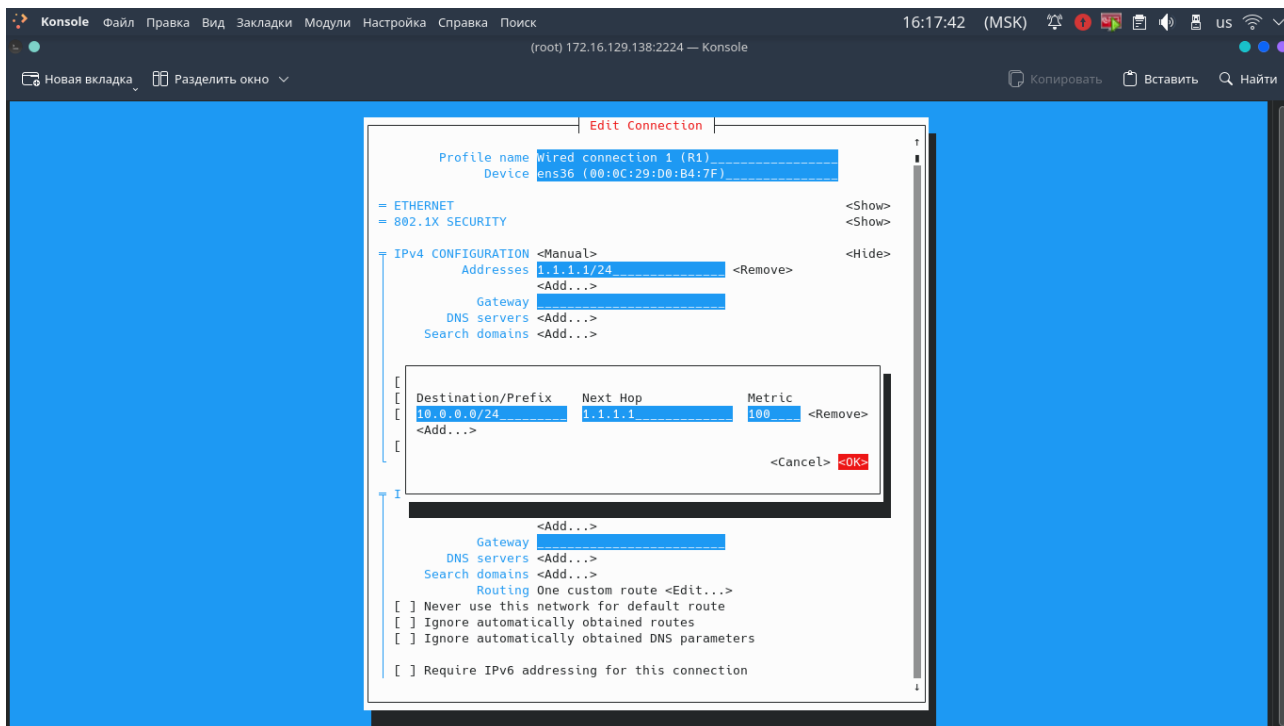
chronyc sources -v

The image shows a terminal window titled "Konsole" with a menu bar (Файл, Правка, Вид, Закладки, Модули, Настройка, Справка, Поиск) and a system status bar (14:58:09 (MSK), battery, network, and other icons). The terminal has several tabs, with the active one being "(root) 172.16.129.141:2227". The command "chronyc sources -v" has been executed, showing the following output:  

```
root@PC-R2:~# chronyc sources -v
.-- Source mode  '^' = server, '=' = peer, '#' = local clock.
/  .-- Source state  '**' = current best, '+' = combined, '-' = not combined,
      'x' = may be in error, '~' = too variable, '?' = unusable.
|
|
|      Reachability register (octal) --.      .-- xxxx [ yyyy ] +/- zzzz
|      Log2(Polling interval) --.      |      xxxx = adjusted offset,
|                                   |      yyyy = measured offset,
|                                   |      zzzz = estimated error.
|                                   |
|                                   |
|-----|-----|-----|-----|
MS Name/IP address         Stratum Poll Reach LastRx Last sample
=====|=====|=====|=====|=====
** 10.0.0.1                5      6      17      41      +129us[ +125us] +/- 1270us
```

**Примечание:** данный результат не будет получен на серверах R0 и PC-R0 (см. пункт 10)

10) На сервере R0 добавляем "Routing" и перезагружаем сервер (**reboot**), а затем проверяем доступность NTP сервера (ответ должен быть аналогичен пункту 9):



### Полученный визуальный результат

