

Лабораторная работа №3

Администрирование сетевых подсистем

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Приобретение практических навыков по установке и конфигурированию DHCP-сервера.

Выполнение лабораторной работы

```
root@server:~  
[root@server ~]# dnf install dhcp-server  
Extra Packages for Enterprise Linux 9 - x86_64 5.7 kB/s | 40 kB 00:06  
Extra Packages for Enterprise Linux 9 - x86_64 365 kB/s | 23 MB 01:03  
Extra Packages for Enterprise Linux 9 openh264 253 B/s | 993 B 00:03  
Rocky Linux 9 - BaseOS 607 B/s | 4.1 kB 00:06  
Rocky Linux 9 - BaseOS 539 kB/s | 2.3 MB 00:04  
Rocky Linux 9 - AppStream 5.1 kB/s | 4.5 kB 00:00  
Rocky Linux 9 - AppStream 634 kB/s | 8.0 MB 00:12  
Rocky Linux 9 - Extras 5.8 kB/s | 2.9 kB 00:00  
Dependencies resolved.  
=====
```

Package	Architecture	Version	Repository	Size
Installing:				
dhcp-server	x86_64	12:4.4.2-19.b1.el9	baseos	1.2 M
Installing dependencies:				
dhcp-common	noarch	12:4.4.2-19.b1.el9	baseos	128 k

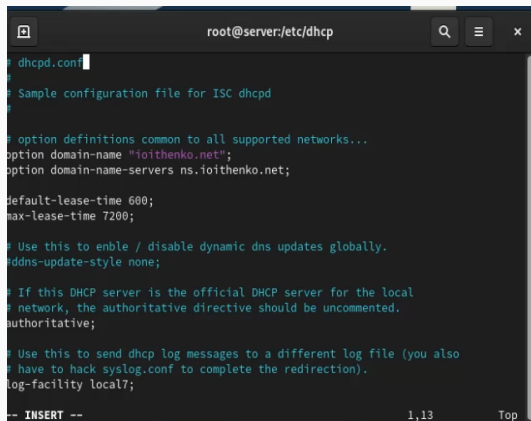
```
Transaction Summary  
=====
```

Transaction Summary	
Install	2 Packages
Total download size: 1.3 M	
Installed size: 4.2 M	

Рис. 1: Установка DHCP

```
comple...  
[root@server ~]# cd /etc/dhcp  
[root@server dhcp]# cp /usr/share/doc/dhcp*/dhcp.conf.example /etc/dhcp  
cp: cannot stat '/usr/share/doc/dhcp*/dhcp.conf.example': No such file or direct  
ory  
[root@server dhcp]# cp /usr/share/doc/dhcp*/dhcpd.conf.example /etc/dhcp  
[root@server dhcp]# mv /etc/dhcp/dhcpd.conf.example /etc/dhcp/dhcpd.conf
```

Рис. 2: Копирование файла примера конфигурации и переименование

A terminal window titled 'root@server:/etc/dhcp' with search, menu, and close icons in the title bar. The terminal displays the content of the 'dhcpd.conf' file. The text is as follows:

```
# dhcpd.conf
#
# Sample configuration file for ISC dhcpd
#
# option definitions common to all supported networks...
option domain-name "ioithenko.net";
option domain-name-servers ns.ioithenko.net;

default-lease-time 600;
max-lease-time 7200;

# Use this to enable / disable dynamic dns updates globally.
#ddns-update-style none;

# If this DHCP server is the official DHCP server for the local
# network, the authoritative directive should be uncommented.
authoritative;

# Use this to send dhcp log messages to a different log file (you also
# have to hack syslog.conf to complete the redirection).
log-facility local7;
```

At the bottom of the terminal, there is a status bar with the text '-- INSERT --' on the left, '1,13' in the center, and 'Top' on the right.

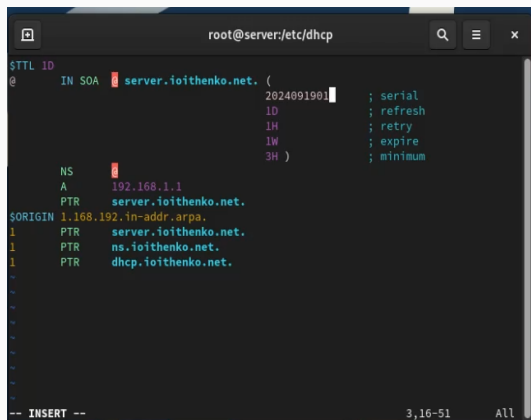
Рис. 3: /etc/dhcp/dhcpd.conf

```
[root@server dhcp]# vim dhcpd.conf  
[root@server dhcp]# cp /lib/systemd/system/dhcpd.service /etc/systemd/system/  
[root@server dhcp]# vim /etc/systemd/system/dhcpd.service
```

Рис. 4: Копирование файла `dhcpd.service`


```
[root@server dhcp]# vim /etc/systemd/system/dhcpd.service
[root@server dhcp]# systemctl --system daemon-reload
[root@server dhcp]# system enable dhcpd
bash: system: command not found...
^[A[root@server dhcp]# systemctl enable dhcpd
Created symlink /etc/systemd/system/multi-user.target.wants/dhcpd.service → /etc/systemd/system/dhcpd.service.
[root@server dhcp]# vim /var/named/master/
```

Рис. 6: Перезагрузка конфигурации и автозагрузка DHCP-сервера



The image shows a terminal window titled 'root@server:/etc/dhcp' with search, menu, and close icons in the title bar. The terminal displays the contents of a reverse DNS zone file being edited. The file includes a \$TTL directive, an IN SOA section for 'server.ioithenko.net.' with fields for serial, refresh, retry, expire, and minimum, followed by NS, A, and PTR records. A \$ORIGIN directive is also present. The bottom of the window shows a status bar with '-- INSERT --', a cursor position of '3,16-51', and 'All'.

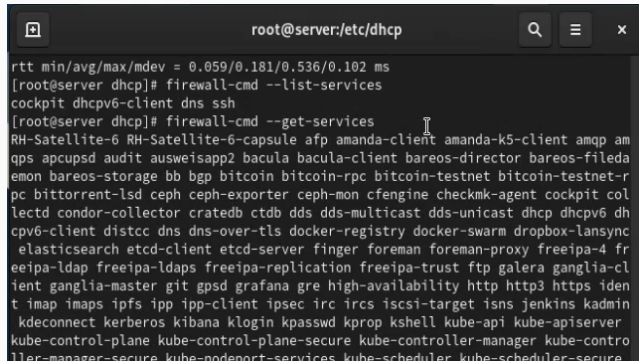
```
root@server:/etc/dhcp
$TTL 1D
@      IN SOA  server.ioithenko.net. (
                                2024091901 ; serial
                                1D          ; refresh
                                1H          ; retry
                                1W          ; expire
                                3H )        ; minimum

      NS   server.ioithenko.net.
      A    192.168.1.1
      PTR  server.ioithenko.net.
$ORIGIN 1.168.192.in-addr.arpa.
1      PTR  server.ioithenko.net.
1      PTR  ns.ioithenko.net.
1      PTR  dhcp.ioithenko.net.
~
~
~
~
~
~
~
~
~
~
-- INSERT --                               3,16-51  All
```

Рис. 8: Редактирование файла обратной DNS-зоны

```
[root@server dhcp]# systemctl restart named  
[root@server dhcp]# ping dhcp.iothenko.net  
ping: dhcp.iothenko.net: Name or service not known  
[root@server dhcp]# ping dhcp.ioithenko.net  
PING dhcp.ioithenko.net (192.168.1.1) 56(84) bytes of data.  
64 bytes from ns.ioithenko.net (192.168.1.1): icmp_seq=1 ttl=64 time=0.059 ms
```

Рис. 9: Перезагрузка DNS-сервера и пинг

A terminal window titled 'root@server:/etc/dhcp' with search, menu, and close icons in the title bar. The terminal shows the output of 'firewall-cmd --list-services' and 'firewall-cmd --get-services'. The first command lists 'cockpit dhcpv6-client dns ssh'. The second command lists a long list of services including 'RH-Satellite-6', 'amanda-client', 'amanda-k5-client', 'amqp', 'amqps', 'apcupsd', 'audit', 'ausweisapp2', 'bacula', 'bareos-director', 'bareos-filedemon', 'bareos-storage', 'bb', 'bgp', 'bitcoin', 'bitcoin-rpc', 'bitcoin-testnet', 'bitcoin-testnet-rpc', 'bittorrent-lsd', 'ceph', 'ceph-exporter', 'ceph-mon', 'cfengine', 'checkmk-agent', 'cockpit', 'collectd', 'condor-collector', 'cratedb', 'ctdb', 'dds', 'dds-multicast', 'dds-unicast', 'dhcp', 'dhcpv6', 'dhcpv6-client', 'distcc', 'dns', 'dns-over-tls', 'docker-registry', 'docker-swarm', 'dropbox-lansync', 'elasticsearch', 'etcd-client', 'etcd-server', 'finger', 'foreman', 'foreman-proxy', 'freeipa-4', 'freeipa-ldap', 'freeipa-ldaps', 'freeipa-replication', 'freeipa-trust', 'ftp', 'galera', 'ganglia-client', 'ganglia-master', 'git', 'gpsd', 'grafana', 'gre', 'high-availability', 'http', 'http3', 'https', 'ident', 'imap', 'imaps', 'ipfs', 'ipp', 'ipp-client', 'ipsec', 'irc', 'ircs', 'iscsi-target', 'isns', 'jenkins', 'kadmin', 'kdeconnect', 'kerberos', 'kibana', 'klogin', 'kpasswd', 'kprop', 'kshell', 'kube-api', 'kube-apiserver', 'kube-control-plane', 'kube-control-plane-secure', 'kube-controller-manager', 'kube-controller-manager-secure', 'kube-nodenot-services', 'kube-scheduler', and 'kube-scheduler-secure'.

```
rtt min/avg/max/mdev = 0.059/0.181/0.536/0.102 ms
[root@server dhcp]# firewall-cmd --list-services
cockpit dhcpv6-client dns ssh
[root@server dhcp]# firewall-cmd --get-services
RH-Satellite-6 RH-Satellite-6-capsule afp amanda-client amanda-k5-client amqp am
qps apcupsd audit ausweisapp2 bacula bacula-client bareos-director bareos-filed
emon bareos-storage bb bgp bitcoin bitcoin-rpc bitcoin-testnet bitcoin-testnet-r
pc bittorrent-lsd ceph ceph-exporter ceph-mon cfengine checkmk-agent cockpit col
lectd condor-collector cratedb ctdb dds dds-multicast dds-unicast dhcp dhcpv6 dh
cpv6-client distcc dns dns-over-tls docker-registry docker-swarm dropbox-lansync
elasticsearch etcd-client etcd-server finger foreman foreman-proxy freeipa-4 fr
eeipa-ldap freeipa-ldaps freeipa-replication freeipa-trust ftp galera ganglia-cl
ient ganglia-master git gpsd grafana gre high-availability http http3 https iden
t imap imaps ipfs ipp ipp-client ipsec irc ircs iscsi-target isns jenkins kadmin
kdeconnect kerberos kibana klogin kpasswd kprop kshell kube-api kube-apiserver
kube-control-plane kube-control-plane-secure kube-controller-manager kube-contro
ller-manager-secure kube-nodenot-services kube-scheduler kube-scheduler-secure
```

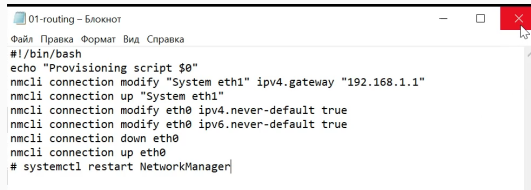
Рис. 10: Внесение изменений в настройки межсетевого экрана, восстановление контекста безопасности

```
server dhcp agent dhcp server dhcp  
[root@server dhcp]# firewall-cmd --add-service=dhcp  
success  
[root@server dhcp]# firewall-cmd --add-service=dhcp --permanent  
success  
[root@server dhcp]# restorecon -vR /etc  
Relabeled /etc/systemd/system/dhcpd.service from unconfined_u:object_r:systemd_u  
nit_file_t:s0 to unconfined_u:object_r:dhcpd_unit_file_t:s0  
Relabeled /etc/sysconfig/network-scripts/ifcfg-eth1 from unconfined_u:object_r:u  
ser_tmp_t:s0 to unconfined_u:object_r:net_conf_t:s0  
[root@server dhcp]# restorecon -vR /var/named  
[root@server dhcp]# restorecon -vR /var/lib.dhcpd  
restorecon: lstat(/var/lib.dhcpd) failed: No such file or directory  
[root@server dhcp]# restorecon -vR /var/lib/dhcpd
```

Рис. 11: Внесение изменений в настройки межсетевого экрана, восстановление контекста безопасности

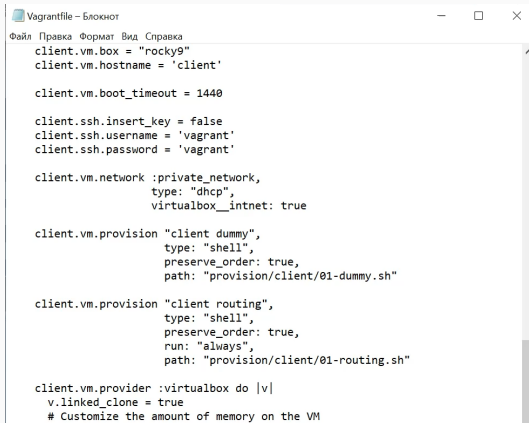
```
[root@server dhcp]# restorecon -vR /var/lib/dhcpd  
[root@server dhcp]# systemctl start dhcpd  
[root@server dhcp]#
```

Рис. 12: Запуск DHCP-сервера



```
01-routing - Блокнот
Файл Правка Формат Вид Справка
#!/bin/bash
echo "Provisioning script $0"
nmcli connection modify "System eth1" ipv4.gateway "192.168.1.1"
nmcli connection up "System eth1"
nmcli connection modify eth0 ipv4.never-default true
nmcli connection modify eth0 ipv6.never-default true
nmcli connection down eth0
nmcli connection up eth0
# systemctl restart NetworkManager
```

Рис. 13: 01-routing.sh



```
client.vm.box = "rocky9"
client.vm.hostname = 'client'

client.vm.boot_timeout = 1440

client.ssh.insert_key = false
client.ssh.username = 'vagrant'
client.ssh.password = 'vagrant'

client.vm.network :private_network,
                  type: "dhcp",
                  virtualbox__intnet: true

client.vm.provision "client dummy",
                  type: "shell",
                  preserve_order: true,
                  path: "provision/client/01-dummy.sh"

client.vm.provision "client routing",
                  type: "shell",
                  preserve_order: true,
                  run: "always",
                  path: "provision/client/01-routing.sh"

client.vm.provider :virtualbox do |v|
  v.linked_clone = true
  # Customize the amount of memory on the VM
```

Рис. 14: Vagrantfile

```
tcp.org/AAAA/IN*: 2407:b9c0:e002:302:5054:11:1e6d:8c01#53  
Sep 19 16:43:18 server dhcpd[7396]: DHCPREQUEST for 192.168.1.30 from 08:00:27:8  
d:1f:f7 (client) via eth1  
Sep 19 16:43:18 server dhcpd[7396]: DHCPACK on 192.168.1.30 to 08:00:27:8d:1f:f7  
(client) via eth1
```

Рис. 15: Запись о подключении к ВМ узла `client` и выдачи ему IP-адреса

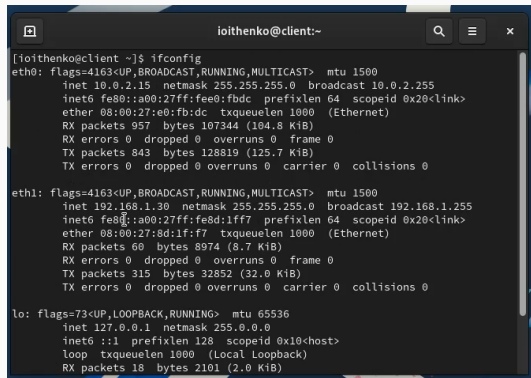
```
[root@server dhcp]# cat /var/lib/dhcpd/dhcpd.leases
# The format of this file is documented in the dhcpd.leases(5) manual page.
# This lease file was written by isc-dhcp-4.4.2b1

# authoring-byte-order entry is generated, DO NOT DELETE
authoring-byte-order little-endian;

server-uid "\000\001\000\001.\177\017\271\010\000'\341\222\255";

lease 192.168.1.30 {
    starts 4 2024/09/19 16:42:22;
    ends 4 2024/09/19 16:52:22;
    cltt 4 2024/09/19 16:42:22;
    binding state active;
    next binding state free;
    rewind binding state free;
    hardware ethernet 08:00:27:8d:1f:f7;
    uid "\001\010\000'\215\037\367";
    client-hostname "client";
}
[root@server dhcp]#
```

Рис. 16: Просмотр файла /var/lib/dhcpd/dhcpd.leases

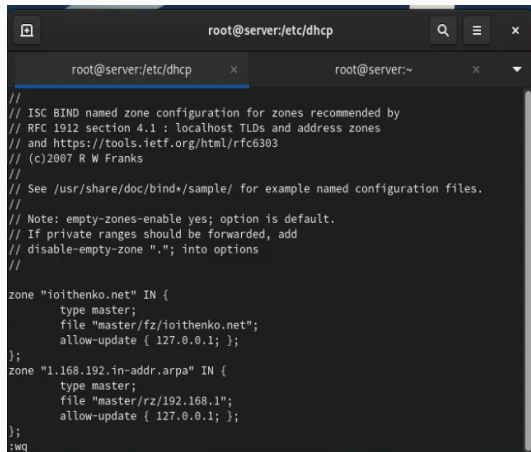
A terminal window titled 'ioithenko@client:~' with search, menu, and close buttons. The command 'ifconfig' has been executed, displaying configuration for three network interfaces: eth0, eth1, and lo. Each interface shows its flags, MTU, IP addresses, netmask, broadcast address, ether address, and statistics for RX and TX packets, errors, and drops. The 'lo' interface is a loopback device.

```
[ioithenko@client ~]$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    inet6 fe80::a00:27ff:fe0:fbdc prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:e0:fb:dc txqueuelen 1000 (Ethernet)
    RX packets 957 bytes 107344 (104.8 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 843 bytes 128819 (125.7 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.30 netmask 255.255.255.0 broadcast 192.168.1.255
    inet6 fe80::a00:27ff:fe8d:1ff7 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:8d:1f:f7 txqueuelen 1000 (Ethernet)
    RX packets 60 bytes 8974 (8.7 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 315 bytes 32852 (32.0 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 18 bytes 2101 (2.0 KiB)
```

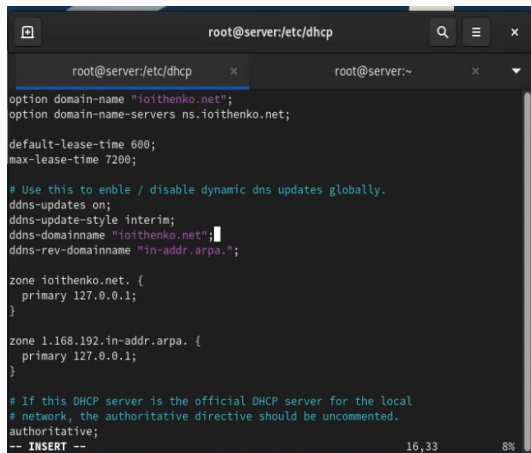
Рис. 17: ifconfig на BM client



The image shows a terminal window with a dark background. At the top, the title bar reads 'root@server:/etc/dhcp'. Below the title bar, there are two tabs: 'root@server:/etc/dhcp' (selected) and 'root@server:~'. The main content of the terminal is a text file being edited, which contains configuration for ISC BIND. The text includes comments about RFC 1912 and example configuration files, followed by two zone definitions: 'ioithenko.net' and '1.168.192.in-addr.arpa'. The file ends with a cursor on the line ':wq'.

```
//  
// ISC BIND named zone configuration for zones recommended by  
// RFC 1912 section 4.1 : localhost TLDs and address zones  
// and https://tools.ietf.org/html/rfc6303  
// (c)2007 R W Franks  
//  
// See /usr/share/doc/bind*/sample/ for example named configuration files.  
//  
// Note: empty-zones-enable yes; option is default.  
// If private ranges should be forwarded, add  
// disable-empty-zone "."; into options  
//  
zone "ioithenko.net" IN {  
    type master;  
    file "master/fz/ioithenko.net";  
    allow-update { 127.0.0.1; };  
};  
zone "1.168.192.in-addr.arpa" IN {  
    type master;  
    file "master/rz/192.168.1";  
    allow-update { 127.0.0.1; };  
};  
:wq
```

Рис. 18: Редактирование файла /etc/named/ioithenko.net

A screenshot of a terminal window with a dark background. The title bar shows 'root@server:/etc/dhcp'. There are two tabs: 'root@server:/etc/dhcp' (active) and 'root@server:~'. The terminal displays the content of the /etc/dhcp/dhcpd.conf file. The configuration includes domain name settings for 'ioithenko.net', lease times, dynamic DNS update options, and two zone definitions for 'ioithenko.net' and '1.168.192.in-addr.arpa'. At the bottom, there are comments about the authoritative directive and a line '-- INSERT --'. The status bar at the bottom right shows '16,33' and '8%'.

```
root@server:/etc/dhcp
option domain-name "ioithenko.net";
option domain-name-servers ns.ioithenko.net;

default-lease-time 600;
max-lease-time 7200;

# Use this to enable / disable dynamic dns updates globally.
ddns-updates on;
ddns-update-style interim;
ddns-domainname "ioithenko.net";
ddns-rev-domainname "in-addr.arpa.";

zone ioithenko.net. {
    primary 127.0.0.1;
}

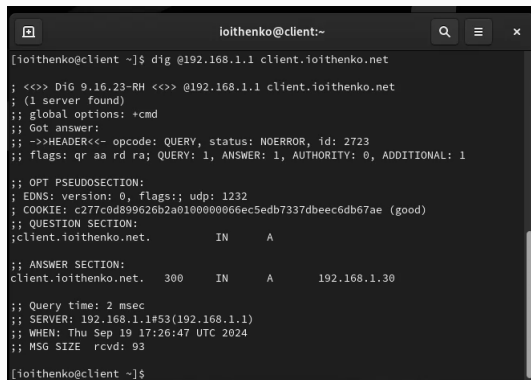
zone 1.168.192.in-addr.arpa. {
    primary 127.0.0.1;
}

# If this DHCP server is the official DHCP server for the local
# network, the authoritative directive should be uncommented.
authoritative;
-- INSERT --
```

Рис. 19: Редактирование файла /etc/dhcp/dhcpd.conf

```
[root@server dhcp]# systemctl restart dhcpd  
[root@server dhcp]# ls /var/named/master/fz  
ioithenko.net  ioithenko.net.jnl  
[root@server dhcp]#
```

Рис. 20: Успешный перезапуск DHCP-сервера



```
ioithenko@client:~  
[ioithenko@client ~]$ dig @192.168.1.1 client.ioithenko.net  
  
;<>> DiG 9.16.23-RH <>> @192.168.1.1 client.ioithenko.net  
; (1 server found)  
;; global options: +cmd  
;; Got answer:  
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 2723  
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1  
  
;; OPT PSEUDOSECTION:  
; EDNS: version: 0, flags:; udp: 1232  
; COOKIE: c277c0d899626b2a0100000066ec5edb7337dbeec6db67ae (good)  
;; QUESTION SECTION:  
;client.ioithenko.net.      IN      A  
  
;; ANSWER SECTION:  
client.ioithenko.net.  300     IN      A      192.168.1.30  
  
;; Query time: 2 msec  
;; SERVER: 192.168.1.1#53(192.168.1.1)  
;; WHEN: Thu Sep 19 17:26:47 UTC 2024  
;; MSG SIZE rcvd: 93  
  
[ioithenko@client ~]$
```

Рис. 21: Проверка DNS-записи о клиенте в прямой DNS-зоне


```
[root@server dhcp]# cd /vagrant/provision//server
[root@server server]# mkdir -p /vagrant/provision/server/dhcp/etc/dhcp
[root@server server]# mkdir -p /vagrant/provision/server/dhcp/etc/systemd/system
[root@server server]# cp -R /etc/dhcp/dhcpd.conf /vagrant/provision/server/dhcp/
etc/dhcp/
[root@server server]# cp -R /etc/systemd/system/dhcpd.service /vagrant/provision
/server/dhcp/etc/systemd/system
[root@server server]# cd /vagrant/provision/server/dns
[root@server dns]# cp -R /var/named/* /vagrant/provision/server/dns/var/named
cp: overwrite '/vagrant/provision/server/dns/var/named/master/fz/ioithenko.net'?
y
cp: overwrite '/vagrant/provision/server/dns/var/named/master/rz/192.168.1'? y
[root@server dns]# cp -R /etc/named/* /vagrant/provision/server/dns/etc/named
cp: overwrite '/vagrant/provision/server/dns/etc/named/ioithenko.net'? y
[root@server dns]#
```

Рис. 22: Заполнение DHCP



```
dhcp - Блокнот
Файл Правка Формат Вид Справка
#!/bin/bash

echo "Provisioning script $0"

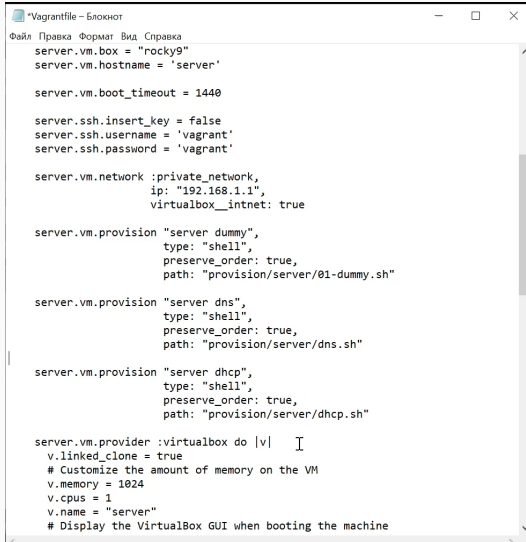
echo "Install needed packages"
dnf -y install dhcp-server

echo "Copy configuration files"
cp -R /vagrant/provision/server/dhcp/etc/* /etc
chown -R dhcpd:dhcpd /etc/dhcp
restorecon -vR /etc
restorecon -vR /var/lib/dhcpd

echo "Configure firewall"
firewall-cmd --add-service=dhcp
firewall-cmd --add-service=dhcp --permanent

echo "Start dhcpd service"
systemctl --system daemon-reload
systemctl enable dhcpd
systemctl start dhcpd
```

Рис. 23: Создание скрипта `dhcp.sh`



```
*Vagrantfile - Блокнот
Файл Правка Формат Вид Справка

server.vm.box = "rocky9"
server.vm.hostname = 'server'

server.vm.boot_timeout = 1440

server.ssh.insert_key = false
server.ssh.username = 'vagrant'
server.ssh.password = 'vagrant'

server.vm.network :private_network,
  ip: "192.168.1.1",
  virtualbox____intnet: true

server.vm.provision "server dummy",
  type: "shell",
  preserve_order: true,
  path: "provision/server/01-dummy.sh"

server.vm.provision "server dns",
  type: "shell",
  preserve_order: true,
  path: "provision/server/dns.sh"

server.vm.provision "server dhcp",
  type: "shell",
  preserve_order: true,
  path: "provision/server/dhcp.sh"

server.vm.provider :virtualbox do |v|
  v.linked_clone = true
  # Customize the amount of memory on the VM
  v.memory = 1024
  v.cpus = 1
  v.name = "server"
  # Display the VirtualBox GUI when booting the machine
```

Рис. 24: Vagrantfile

В результате выполнения работы я приобрела практические навыки по установке и конфигурированию DHCP-сервера.