

Лабораторная работа №3

Настройка DHCP-сервера

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Цель работы

Приобретение практических навыков по установке и
конфигурированию DHCP-сервера.

Установка DHCP-сервера

```
... Bytes: 3.92 G, files: 3, folders: 0
C:\work\user\vagrant>vagrant up server
1Help 2UserMn 3View 4Edit 5Copy
```

Рис. 1.1. Открытие рабочего каталога с проектом и запуск виртуальной машины server.

Установка DHCP-сервера

```
[user@server.user.net ~]$ sudo -i
[sudo] password for user:
[root@server.user.net ~]# dnf -y install bind bind-utils
Last metadata expiration check: 0:23:11 ago on Tue 06 Jan 2026 01:18:33 PM UTC.
Package bind-utils-32:9.16.23-18.el9_4.1.x86_64 is already installed.
Dependencies resolved.
=====
 Package          Architecture Version       Repository   Size
=====
 Installing:
  bind             x86_64      32:9.16.23-34.el9_7.1 appstream    488 k
 Upgrading:
  bind-libs        x86_64      32:9.16.23-34.el9_7.1 appstream    1.2 M
  bind-license     noarch      32:9.16.23-34.el9_7.1 appstream    13 k
  bind-utils       x86_64      32:9.16.23-34.el9_7.1 appstream    199 k
  openssl          x86_64      1:3.5.1-4.el9_7      baseos      1.4 M
  openssl-devel    x86_64      1:3.5.1-4.el9_7      appstream    3.4 M
  openssl-libs     x86_64      1:3.5.1-4.el9_7      baseos      2.3 M
 Installing dependencies:
  bind-dnssec-doc  noarch      32:9.16.23-34.el9_7.1 appstream    45 k
  openssl-fips-provider x86_64  1:3.5.1-4.el9_7      baseos      812 k
  python3-bind     noarch      32:9.16.23-34.el9_7.1 appstream    61 k
  python3-ply      noarch      3.11-14.el9_0.1     baseos      103 k
 Installing weak dependencies:
  bind-dnssec-utils x86_64      32:9.16.23-34.el9_7.1 appstream    113 k
 Transaction Summary
=====
 Install 6 Packages
 Upgrade 6 Packages
```

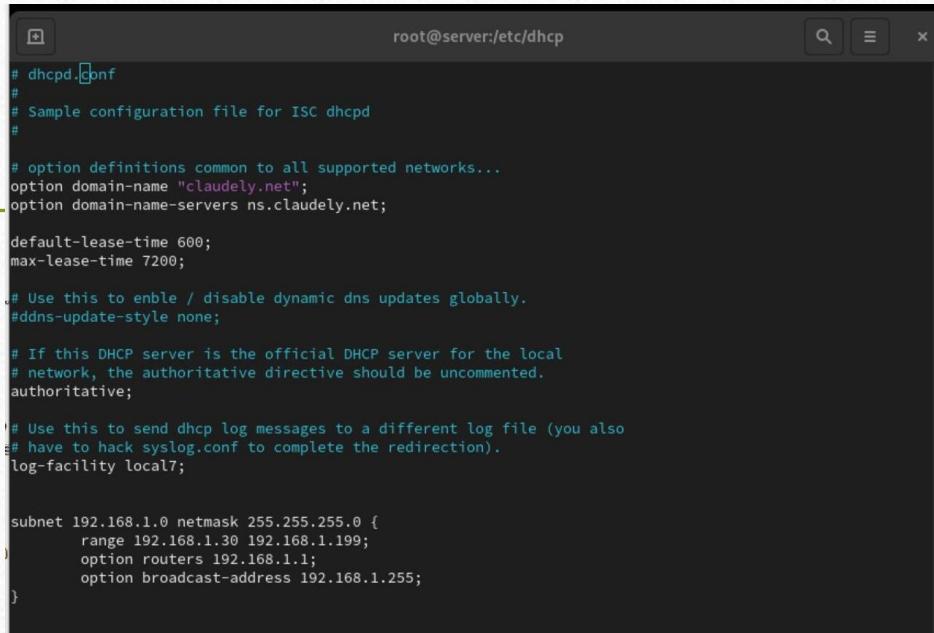
Рис. 1.2. Переход в режим суперпользователя и установка dhcp.

Конфигурирование DHCP-сервера

```
[root@server.claudely.net ~]#  
[root@server.claudely.net ~]# cd /etc/dhcp  
[root@server.claudely.net dhcp]# cp /usr/share/doc/dhcp*/dhcpd.conf.example /etc/dhcp  
[root@server.claudely.net dhcp]# mv /etc/dhcp/dhcpd.conf.example /etc/dhcp/dhcpd.conf  
mv: overwrite '/etc/dhcp/dhcpd.conf'? yes  
[root@server.claudely.net dhcp]# █
```

Рис. 2.1. Копирование файла примера конфигурации DHCP и изменение его названия.

Конфигурирование DHCP-сервера



The screenshot shows a terminal window titled "root@server:/etc/dhcp". The content of the terminal is the /etc/dhcp/dhcpd.conf configuration file for an ISC DHCP server. The file includes global options like domain name and lease times, and a specific subnet definition for 192.168.1.0.

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

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

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

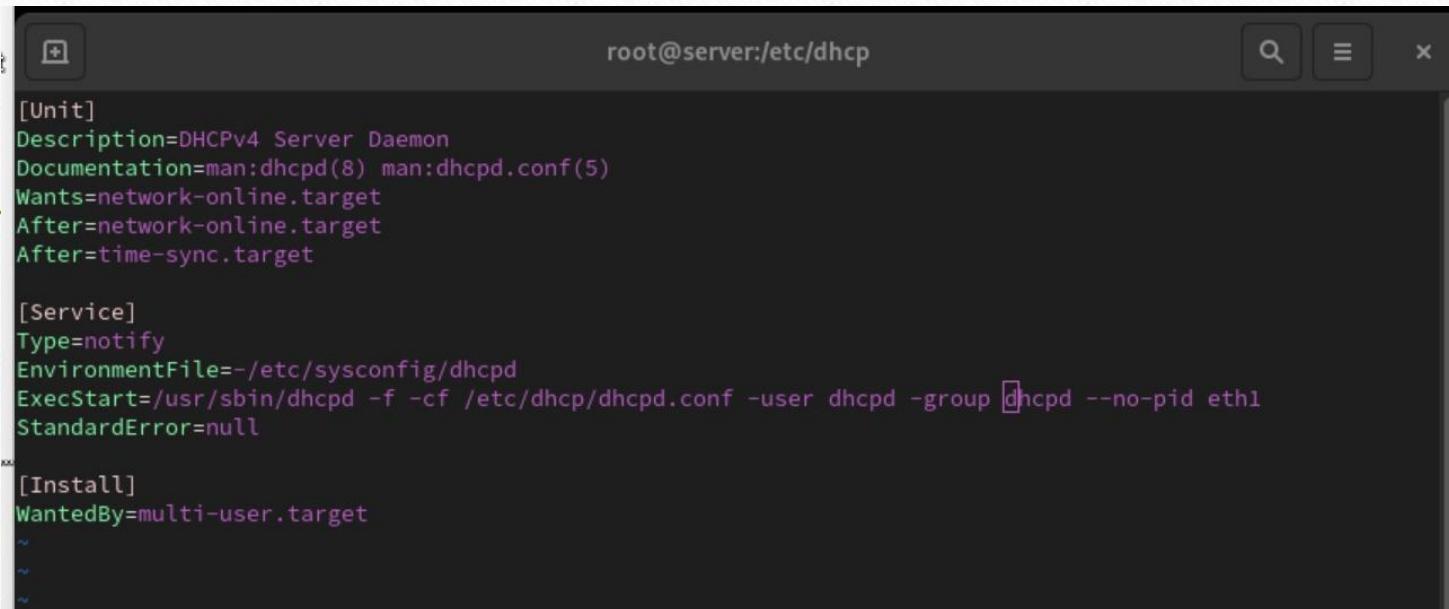
# If this DHCP server is the official DHCP server for the local
# network, the authoritative directive should be uncommented.
authoritative;

# 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;

subnet 192.168.1.0 netmask 255.255.255.0 {
    range 192.168.1.30 192.168.1.199;
    option routers 192.168.1.1;
    option broadcast-address 192.168.1.255;
}
```

Рис. 2.2. Открытие файла /etc/dhcp/dhcpd.conf на редактирование. Замена строки option domain-name и option domain-name-servers, снятие комментария со строки authoritative, создание собственной конфигурации dhcp-сети.

Конфигурирование DHCP-сервера



```
[Unit]
Description=DHCPv4 Server Daemon
Documentation=man:dhcpd(8) man:dhcpd.conf(5)
Wants=network-online.target
After=network-online.target
After=time-sync.target

[Service]
Type=notify
EnvironmentFile=-/etc/sysconfig/dhcpd
ExecStart=/usr/sbin/dhcpd -f -cf /etc/dhcp/dhcpd.conf -user dhcpcd -group dhcpcd --no-pid eth1
StandardError=null

[Install]
WantedBy=multi-user.target
~
~
~
```

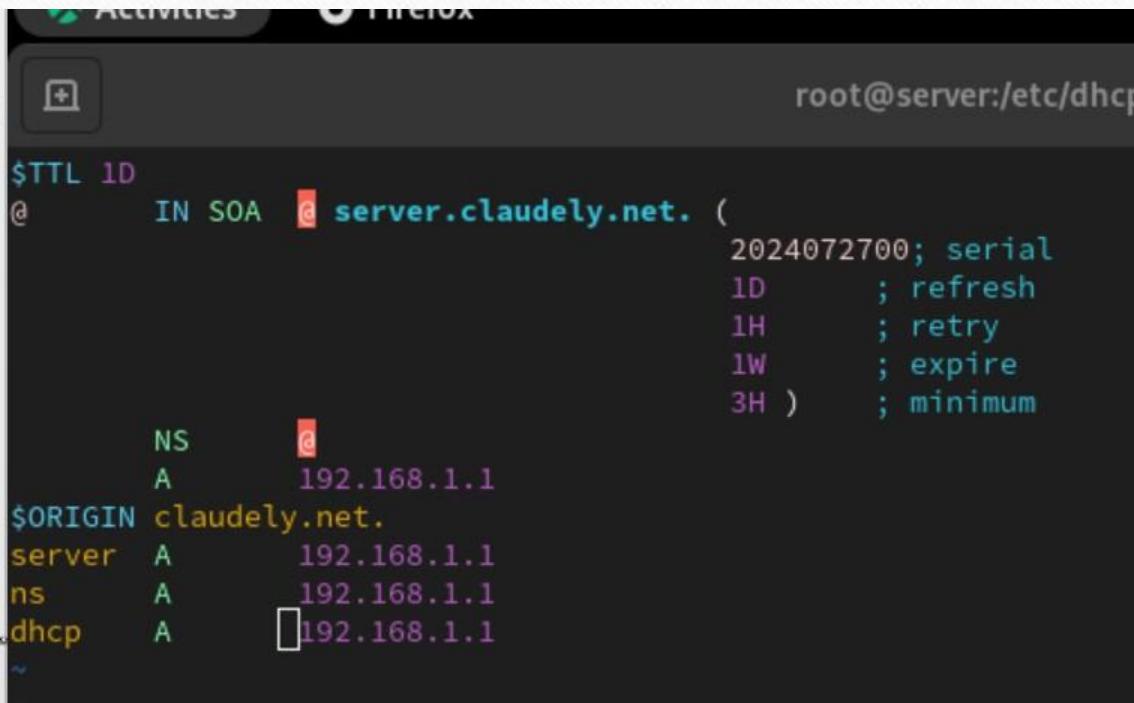
Рис. 2.4. Открытие файла /etc/systemd/system/dhcpd.service на редактирование и замена в нём строки.

Конфигурирование DHCP-сервера

```
[root@server.claudely.net dhcp]#  
[root@server.claudely.net dhcp]# cp /lib/systemd/system/dhcpd.service /etc/systemd/system/  
[root@server.claudely.net dhcp]#  
[root@server.claudely.net dhcp]# vim /etc/systemd/system/dhcpd.service  
[root@server.claudely.net dhcp]# vim /etc/systemd/system/dhcpd.service  
[root@server.claudely.net dhcp]# systemctl --system daemon-reload  
[root@server.claudely.net dhcp]# systemctl enable dhcpcd  
Created symlink /etc/systemd/system/multi-user.target.wants/dhcpcd.service → /etc/systemd/system/dhcpcd.ser  
vice.  
[root@server.claudely.net dhcp]#  
[root@server.claudely.net dhcp]#
```

Рис. 2.5. Перезагрузка конфигурации dhcpcd и разрешение загрузки DHCP-сервера при запуске виртуальной машины server.

Конфигурирование DHCP-сервера

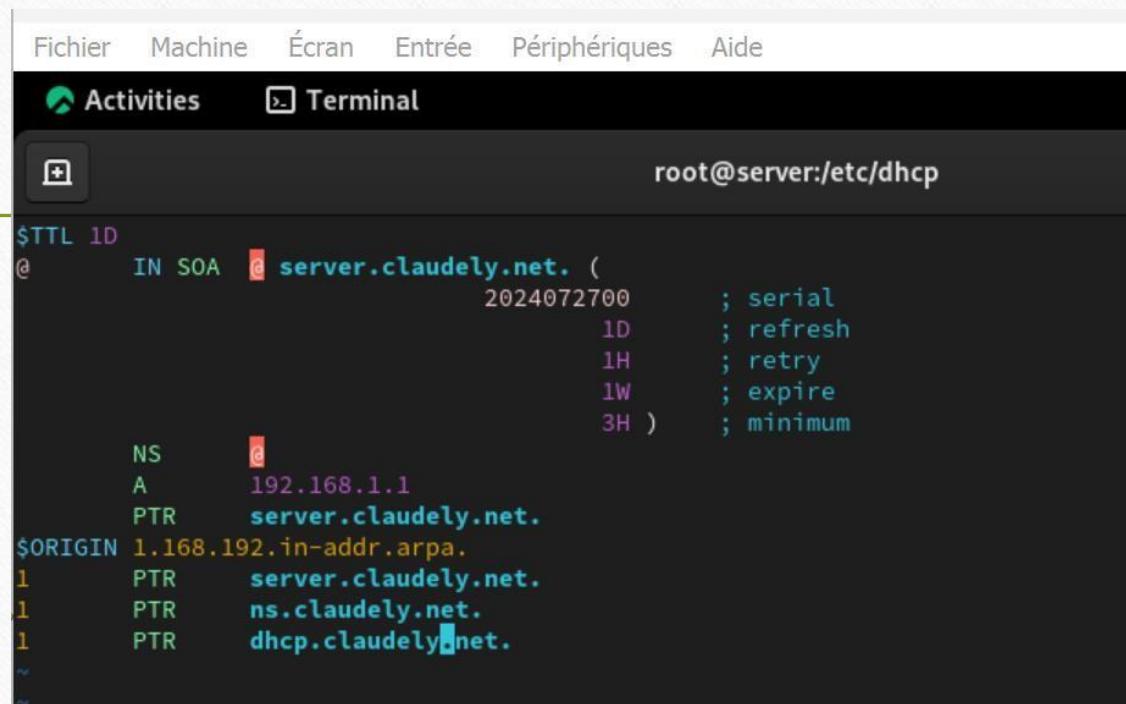


The screenshot shows a terminal window titled "root@server:/etc/dhcp" running on a Fedora Linux system. The window displays the configuration of a DNS zone named "claudely.net". The configuration includes an SOA record for the zone, specifying a serial number of 2024072700, refresh interval of 1 day, retry interval of 1 hour, expire after 1 week, and minimum TTL of 3 hours. It also defines an NS record for the zone apex and A records for several hosts: "server" (IP 192.168.1.1), "ns" (IP 192.168.1.1), and "dhcp" (IP 192.168.1.1). The configuration ends with a closing brace "}".

```
$TTL 1D
@ IN SOA @ server.claudely.net. (
                                2024072700; serial
                                1D      ; refresh
                                1H      ; retry
                                1W      ; expire
                                3H )    ; minimum
NS      @
A       192.168.1.1
$ORIGIN claudely.net.
server  A       192.168.1.1
ns      A       192.168.1.1
dhcp    A       192.168.1.1
~
```

Рис. 2.6. Добавление записи для DHCP-сервера в конце файла прямой DNS-зоны /var/named/master/fz/claudely.net.

Конфигурирование DHCP-сервера



The screenshot shows a terminal window titled "Terminal" running as root on a server. The window title bar says "root@server:/etc/dhcp". The terminal displays a portion of a DNS zone file for the domain "server.claudely.net". The file includes an SOA record with serial number 2024072700, refresh interval of 1D, retry interval of 1H, expire time of 1W, and minimum TTL of 3H. It also contains an NS record pointing to IP 192.168.1.1, and PTR records for the domain's hosts: "server.claudely.net.", "ns.claudely.net.", and "dhcp.claudely.net.". A dollar sign (\$) is used to indicate the start of the zone definition.

```
$TTL 1D
@ IN SOA @ server.claudely.net. (
                                2024072700      ; serial
                                1D      ; refresh
                                1H      ; retry
                                1W      ; expire
                                3H )    ; minimum
NS      @
A       192.168.1.1
PTR    server.claudely.net.
$ORIGIN 1.168.192.in-addr.arpa.
1      PTR    server.claudely.net.
1      PTR    ns.claudely.net.
1      PTR    dhcp.claudely.net.
~
```

Рис. 2.7. Добавление записи для DHCP-сервера в конце файла обратной DNS-зоны /var/named/master/rz/192.168.1.

Конфигурирование DHCP-сервера

```
[root@server.claudely.net dhcp]#  
[root@server.claudely.net dhcp]# systemctl restart named  
[root@server.claudely.net dhcp]# ping dhcp.claudely.net  
PING dhcp.claudely.net (192.168.1.1) 56(84) bytes of data.  
64 bytes from ns.claudely.net (192.168.1.1): icmp_seq=1 ttl=64 time=0.567 ms  
64 bytes from ns.claudely.net (192.168.1.1): icmp_seq=2 ttl=64 time=0.082 ms  
64 bytes from server.claudely.net (192.168.1.1): icmp_seq=3 ttl=64 time=0.110 ms  
64 bytes from ns.claudely.net (192.168.1.1): icmp_seq=4 ttl=64 time=0.079 ms  
64 bytes from ns.claudely.net (192.168.1.1): icmp_seq=5 ttl=64 time=0.060 ms  
64 bytes from ns.claudely.net (192.168.1.1): icmp_seq=6 ttl=64 time=0.051 ms  
64 bytes from ns.claudely.net (192.168.1.1): icmp_seq=7 ttl=64 time=0.074 ms  
64 bytes from ns.claudely.net (192.168.1.1): icmp_seq=8 ttl=64 time=0.067 ms  
64 bytes from dhcp.claudely.net (192.168.1.1): icmp_seq=9 ttl=64 time=0.107 ms  
64 bytes from ns.claudely.net (192.168.1.1): icmp_seq=10 ttl=64 time=0.055 ms  
64 bytes from server.claudely.net (192.168.1.1): icmp_seq=11 ttl=64 time=0.082 ms  
64 bytes from server.claudely.net (192.168.1.1): icmp_seq=12 ttl=64 time=0.071 ms  
64 bytes from dhcp.claudely.net (192.168.1.1): icmp_seq=13 ttl=64 time=0.074 ms  
64 bytes from ns.claudely.net (192.168.1.1): icmp_seq=14 ttl=64 time=0.063 ms  
64 bytes from server.claudely.net (192.168.1.1): icmp_seq=15 ttl=64 time=0.064 ms  
64 bytes from ns.claudely.net (192.168.1.1): icmp_seq=16 ttl=64 time=0.067 ms
```

Рис. 2.8. Перезапуск named и выполнение проверки, что можно обратиться к DHCP-серверу по имени.

Конфигурирование DHCP-сервера

```
[root@server.claudely.net dhcp]# firewall-cmd --list-services
cockpit dhcpcv6-client dns ssh
[root@server.claudely.net dhcp]# firewall-cmd --get-services
RH-Satellite-6 RH-Satellite-6-capsule afp amanda-client amanda-k5-client amqp amqps apcupsd audit ausweis
app2 bacula bacula-client bareos-director bareos-filedaemon bareos-storage bb bgp bitcoin bitcoin-rpc bit
coin-testnet bitcoin-testnet-rpc bittorrent-lsd ceph ceph-exporter ceph-mon cfengine checkmk-agent cockpi
t collectd condor-collector cratedb ctdb dds dds-multicast dds-unicast dhcp dhcpcv6 dhcpcv6-client distcc d
ns 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 gpgsql grafana gre high-availability http http3 https ident imap imaps ip
fs ipp ipp-client ipsec irc ircs iscsi-target isns jenkins kadmin kdeconnect kerberos kibana klogin kpass
wd kprop kshell kube-api kube-apiserver kube-control-plane kube-control-plane-secure kube-controller mana
ger kube-controller-manager-secure kube-nodeport-services kube-scheduler-secure kube-worke
r kubelet kubelet-readonly kubelet-worker ldap ldaps libvirt libvirt-tls lightning-network llmnr llmnr-cl
ient llmnr-tcp llmnr-udp managesieve matrix mdns memcache minidlna mongodb mosh mountd mqtt mqtt-tls ms-w
bt mssql murmur mysql nbd nebula netbios-ns netdata-dashboard nfs nfs3 nmea-0183 nrpe ntp nut openvpn ovi
rt-imageio ovirt-storageconsole ovirt-vmconsole plex pmcd pmproxy pmwebapi pmwebapis pop3 pop3s postgresq
l privoxy prometheus prometheus-node-exporter proxy-dhcp ps2link ps3netsrv ptp pulseaudio puppetmaster qu
assel radius rdp redis redis-sentinel rpc-bind rquotad rsh rsyncd rtsp salt-master samba samba-client sam
ba-dc sane sip sips slp smtp smtp-submission smtptls snmp snmptrap snmptrap spideroak-lansync s
potify-sync squid ssdp ssh steam-streaming svdrp svn syncthing syncthing-gui syncthing-relay synergy sysl
og syslog-tls telnet tentacle tftp tile38 tinc tor-socks transmission-client upnp-client vdsm vnc-server
warpinator wbem-http wbem-https wireguard ws-discovery ws-discovery-client ws-discovery-tcp ws-discovery-
udp wsman wsmans xdmcp xmpp-bosh xmpp-client xmpp-local xmpp-server zabbix-agent zabbix-server zerotier
[root@server.claudely.net dhcp]# firewall-cmd --add-service=dhcp
success
[root@server.claudely.net dhcp]# firewall-cmd --add-service=dhcp --permanent
success
[root@server.claudely.net dhcp]#
```

Рис. 2.9. Внесение изменений в настройки межсетевого экрана узла server, разрешив работу с DHCP.

Конфигурирование DHCP-сервера

```
[root@server.claudely.net dhcp]#  
[root@server.claudely.net dhcp]# restorecon -vR /etc  
Relabeled '/etc/systemd/system/dhcpd.service' from 'unconfined_u:object_r:systemd_unit_file_t:s0' to 'unconfined_u:object_r:dhcpd_unit_file_t:s0'  
[root@server.claudely.net dhcp]# restorecon -vR /var/named  
[root@server.claudely.net dhcp]# restorecon -vR /var/lib/dhcpd/  
[root@server.claudely.net dhcp]# tail -f /var/log/messages  
Sep 27 19:36:42 server named[13359]: network unreachable resolving 'safebrowsing.googleapis.com/AAAA/IN': 2001:4860  
:4802:36::a#53  
Sep 27 19:36:42 server named[13359]: network unreachable resolving 'safebrowsing.googleapis.com/A/IN': 2001:4860:48  
02:38::a#53  
Sep 27 19:36:42 server systemd-journald[453]: Data hash table of /run/log/journal/bb344eeb9a684c4bafa12b93fea4dac6/  
system.journal has a fill level at 75.0 (2629 of 3505 items, 2019328 file size, 768 bytes per hash table item), sug  
gesting rotation.  
Sep 27 19:36:42 server systemd-journald[453]: /run/log/journal/bb344eeb9a684c4bafa12b93fea4dac6/system.journal: Jou  
rnal header limits reached or header out-of-date, rotating.  
Sep 27 19:36:42 server named[13359]: network unreachable resolving 'safebrowsing.googleapis.com/AAAA/IN': 2001:4860  
:4802:38::a#53  
Sep 27 19:36:42 server named[13359]: network unreachable resolving 'safebrowsing.googleapis.com/A/IN': 2001:4860:48  
02:34::a#53  
Sep 27 19:36:42 server named[13359]: network unreachable resolving 'safebrowsing.googleapis.com/AAAA/IN': 2001:4860  
:4802:34::a#53  
Sep 27 19:36:42 server named[13359]: network unreachable resolving 'safebrowsing.googleapis.com/A/IN': 2001:4860:48  
02:32::a#53
```

Рис. 2.10. Восстановление контекста безопасности в SELinux.

Конфигурирование DHCP-сервера

```
[root@server.claudely.net dhcp]#  
[root@server.claudely.net dhcp]# systemctl start dhcpcd  
[root@server.claudely.net dhcp]#  
[root@server.claudely.net dhcp]# █
```

Рис. 2.12. Запуск в основном рабочем терминале DHCP-сервера.

Анализ работы DHCP-сервера

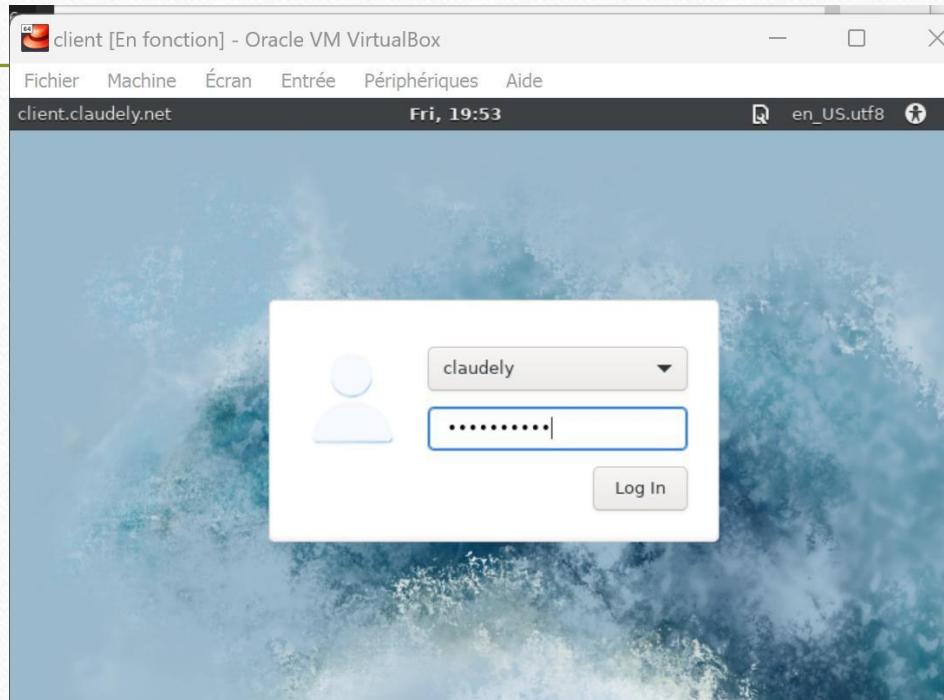


Рис. 3.1. Фиксация внесённых изменений для внутренних настроек виртуальной машины client и её запуск.

Анализ работы DHCP-сервера

```
[claudely@client.claudely.net ~]$ 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:fea9:337c prefixlen 64 scopeid 0x20<link>
          ether 08:00:27:a9:33:7c txqueuelen 1000 (Ethernet)
            RX packets 1446 bytes 161844 (158.0 KiB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 1246 bytes 190563 (186.0 KiB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

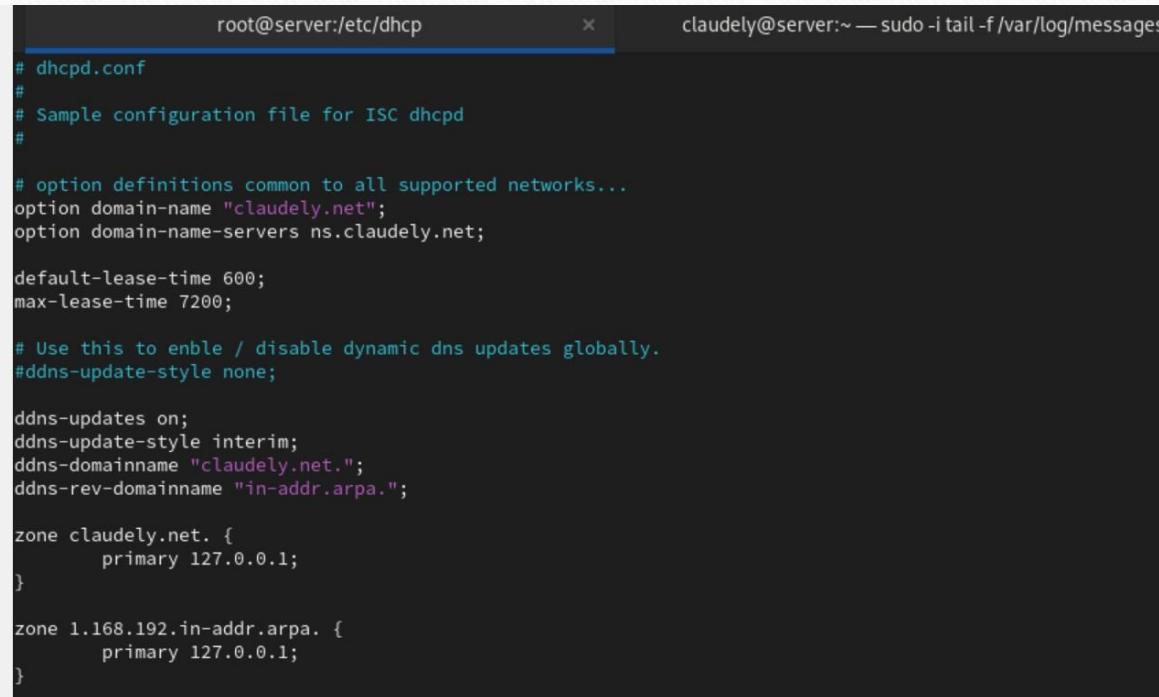
eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
        inet 192.168.1.30 netmask 255.255.255.0 broadcast 192.168.1.255
        inet6 fe80::a00:27ff:feaa:d6fa prefixlen 64 scopeid 0x20<link>
          ether 08:00:27:ea:d6:fa txqueuelen 1000 (Ethernet)
            RX packets 85 bytes 12948 (12.6 KiB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 378 bytes 39350 (38.4 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 17 bytes 2045 (1.9 KiB)
            RX errors 0 dropped 0 overruns 0 frame 0
            TX packets 17 bytes 2045 (1.9 KiB)
            TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

[claudely@client.claudely.net ~]$ █
```

Рис. 3.3. Вывод на экран информации об имеющихся интерфейсах.

Настройка обновления DNS-зоны



The screenshot shows two terminal windows side-by-side. The left window, titled 'root@server:/etc/dhcp', displays the contents of the `/etc/dhcp/dhcpd.conf` configuration file. The right window, titled 'claudely@server:~ — sudo -i tail -f /var/log/messages', shows the log messages for the DHCP server.

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

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

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

ddns-updates on;
ddns-update-style interim;
ddns-domainname "claudely.net.";
ddns-rev-domainname "in-addr.arpa.";

zone claudely.net. {
    primary 127.0.0.1;
}

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

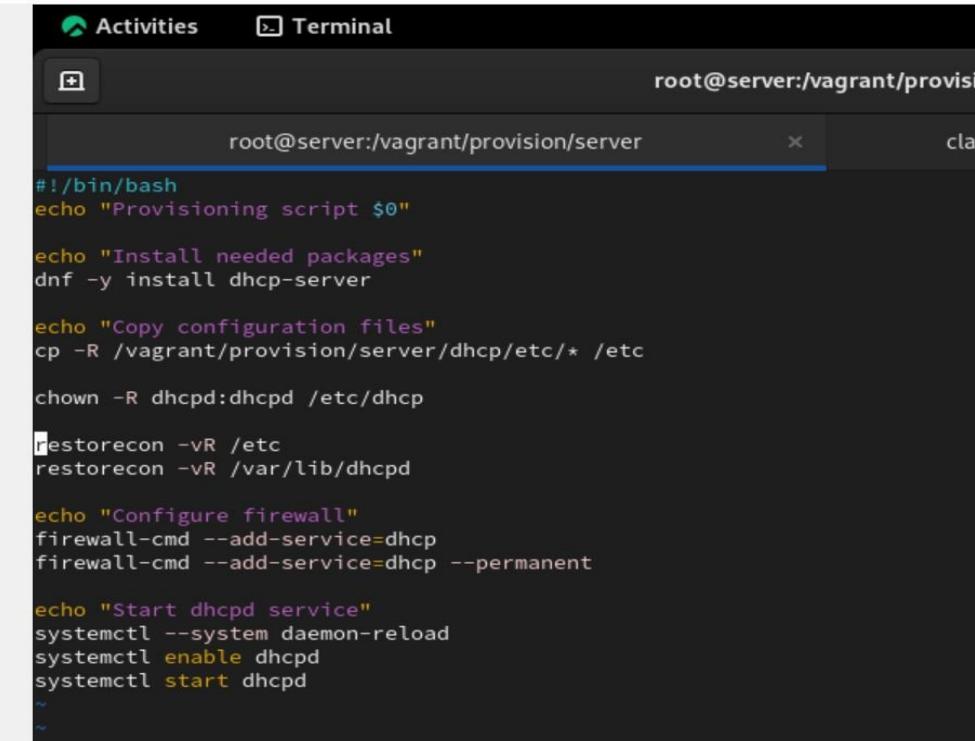
Рис. 4.3. Внесение изменений в конфигурационный файл `/etc/dhcp/dhcpd.conf`, добавив в него разрешение на динамическое обновление DNS-записей с локального узла прямой и обратной зон.

Анализ работы DHCP-сервера после настройки обновления DNS-зоны

```
[claudely@client.claudely.net ~]$  
[claudely@client.claudely.net ~]$ dig @192.168.1.1 client.claudely.net  
  
; <>> DiG 9.16.23-RH <>> @192.168.1.1 client.claudely.net  
; (1 server found)  
;; global options: +cmd  
;; Got answer:  
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 40938  
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1  
  
;; OPT PSEUDOSECTION:  
; EDNS: version: 0, flags:; udp: 1232  
; COOKIE: dbce045803fe19800100000066f710d42aledale23b1386b (good)  
;; QUESTION SECTION:  
;client.claudely.net.      IN      A  
  
;; ANSWER SECTION:  
client.claudely.net.    300     IN      A      192.168.1.30  
  
;; Query time: 2 msec  
;; SERVER: 192.168.1.1#53(192.168.1.1)  
;; WHEN: Fri Sep 27 20:08:51 UTC 2024  
;; MSG SIZE  rcvd: 92  
  
[claudely@client.claudely.net ~]$ █
```

Рис. 5. Проверка наличия DNS-записи о клиенте в прямой DNS-зоне.

Внесение изменений в настройки внутреннего окружения виртуальной машины



The screenshot shows a terminal window titled "root@server:/vagrant/provision/server". The window contains a shell script with the following content:

```
#!/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 dhcpcd:dhcpcd /etc/dhcp

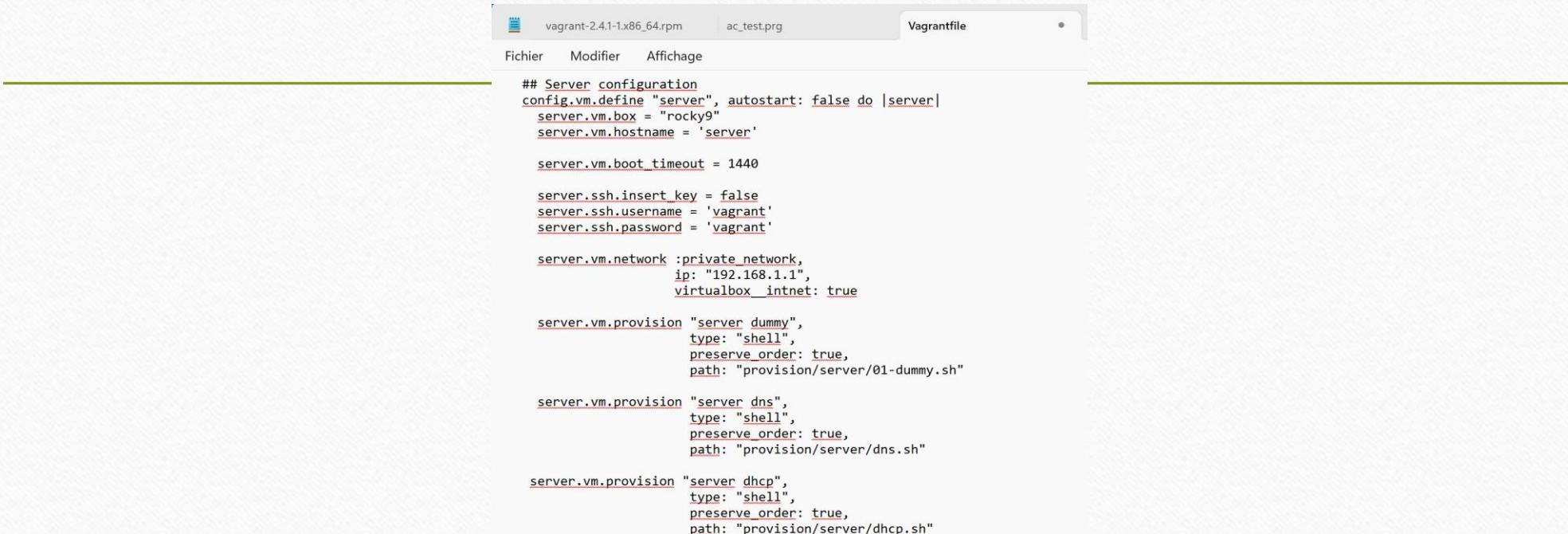
restorecon -vR /etc
restorecon -vR /var/lib/dhcpcd

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

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

Рис. 6.2. Открытие файла на редактирование и помещение в него скрипта.

Внесение изменений в настройки внутреннего окружения виртуальной машины



The screenshot shows a code editor window titled "Vagrantfile". The file contains Vagrant configuration code for a virtual machine named "server". The code defines the server's configuration, including its box ("rocky9"), hostname ("server"), boot timeout (1440 seconds), and SSH settings (username "vagrant", password "vagrant"). It also specifies a private network with IP 192.168.1.1 and uses VirtualBox as the provider. The "server" provisioner is configured to run three scripts: "dummy.sh", "dns.sh", and "dhcp.sh" via shell type provisioners.

```
## Server configuration
config.vm.define "server", autostart: false do |server|
  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"
```

Рис. 6.3. Настройка отработки созданного скрипта во время загрузки виртуальной машины server.

Выход

В ходе выполнения лабораторной работы были приобретены практические навыки по установке и конфигурированию DHCP-сервера.

Спасибо за внимание!
