Front matter

Front matter

lang: ru-RU title: “ №3” subtitle: - “ ” - “ . .” institute: - “ , , ”

i18n babel

i18n babel

babel-lang: russian babel-otherlangs: english

Formatting pdf

Formatting pdf

toc: false toc-title: “ ” slide_level: 2 aspectratio: 169
section-titles: true

Standard theme and fonts

Standard theme and fonts

documentclass: beamer theme: “default”

Fonts

Fonts

mainfont: “Times New Roman” sansfont: “Times New Roman”
monofont: “Courier New” mathfont: “Latin Modern Math”

Header includes:

Header includes:

header-includes: []

- DHCP,

  DHCP-

```
C:\work\ankomyagin\vagrant>vagrant up server
```

Figure 1:

```
[root@server etc]# dnf -y install kea
Rocky Linux 10 - BaseOS                          4.9 kB/s | 3.9 kB     00:00
Rocky Linux 10 - AppStream                       6.4 kB/s | 3.9 kB     00:00
Rocky Linux 10 - CRB                             5.6 kB/s | 3.9 kB     00:00
Rocky Linux 10 - Extras                          1.9 kB/s | 3.1 kB     00:01
Dependencies resolved.
================================================================================
 Package                  Architecture  Version               Repository     Size
================================================================================
Installing:
 kea                      x86_64        2.6.3-1.el10_0        baseos        1.3 M
Installing dependencies:
 kea-libs                 x86_64        2.6.3-1.el10_0        baseos        3.1 M
 libpq                    x86_64        16.8-2.el10_0         baseos        255 k
 log4cplus                x86_64        2.1.1-8.el10          baseos        351 k
 mariadb-connector-c      x86_64        3.4.4-1.el10          baseos        206 k
 mariadb-connector-c-config noarch      3.4.4-1.el10          baseos        8.9 k

Transaction Summary
================================================================================
Install  6 Packages

Total download size: 5.3 M
Installed size: 19 M
Downloading Packages:
(1/6): libpq-16.8-2.el10_0.x86_64.rpm            359 kB/s | 255 kB     00:00
(2/6): kea-libs-2.6.3-1.el10_0.x86_64.rpm        505 kB/s | 3.1 MB     00:06
(3/6): kea-2.6.3-1.el10_0.x86_64.rpm             146 kB/s | 1.3 MB     00:09
```

Figure 2: Kea

( ),

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,

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broadcast- .

dhcpd eth1

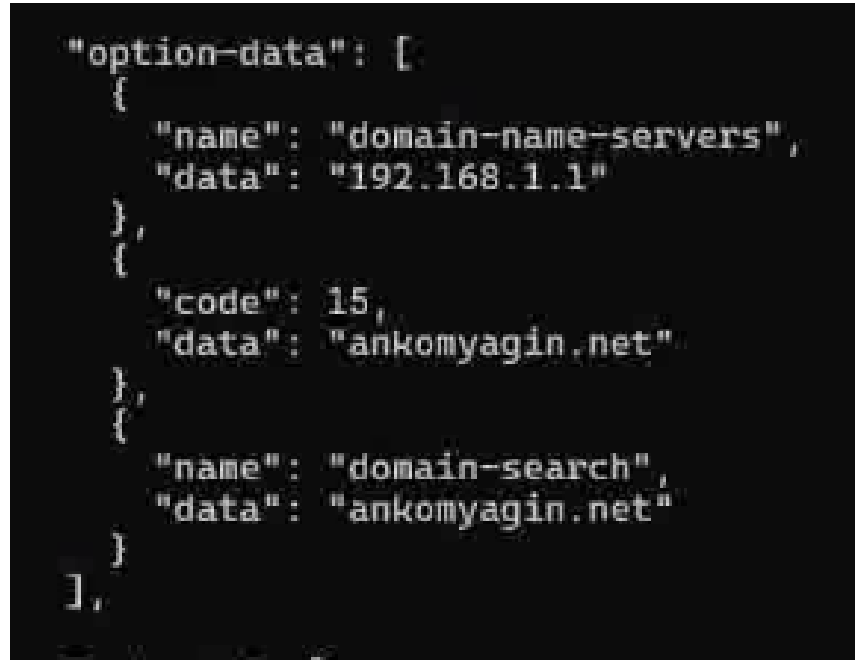

Figure 3: Domain-name

Domain-name-servers

Figure 4: Domain-name-servers

Subnet4

Figure 5: Subnet4

“kea-dhcp4 -t /etc/kea/kea-dhcp4.conf”

,

```
[root@server ~]# kea-dhcp4 -t /etc/kea/kea-dhcp4.conf
2025-09-20 13:13:47.595 INFO  [kea-dhcp4.hosts/12014.140012129978560] HOSTS_BACKENDS_REGISTER
ED the following host backend types are available: mysql postgresql
2025-09-20 13:13:47.600 WARN  [kea-dhcp4.dhcpsrv/12014.140012129978560] DHCPSRV_MT_DISABLED_Q
UEUE_CONTROL disabling dhcp queue control when multi-threading is enabled.
2025-09-20 13:13:47.601 WARN  [kea-dhcp4.dhcp4/12014.140012129978560] DHCP4_RESERVATIONS_LOOK
UP_FIRST_ENABLED Multi-threading is enabled and host reservations lookup is always performed
first.
2025-09-20 13:13:47.602 INFO  [kea-dhcp4.dhcpsrv/12014.140012129978560] DHCPSRV_CFGMGR_NEW_SU
BNET4 a new subnet has been added to configuration: 192.168.1.0/24 with params: t1=900, t2=18
00, valid-lifetime=3600
2025-09-20 13:13:47.604 INFO  [kea-dhcp4.dhcpsrv/12014.140012129978560] DHCPSRV_CFGMGR_SOCKET
_TYPE_SELECT using socket type raw
2025-09-20 13:13:47.610 INFO  [kea-dhcp4.dhcpsrv/12014.140012129978560] DHCPSRV_CFGMGR_ADD_IF
ACE listening on interface eth1
2025-09-20 13:13:47.612 INFO  [kea-dhcp4.dhcpsrv/12014.140012129978560] DHCPSRV_CFGMGR_SOCKET
_TYPE_DEFAULT "dhcp-socket-type" not specified , using default socket type raw
[root@server ~]# systemctl --system daemon-reload
[root@server ~]# systemctl enable kea-dhcp4.service
Created symlink '/etc/systemd/system/multi-user.target.wants/kea-dhcp4.service' → '/usr/lib/s
ystemd/system/kea-dhcp4.service'.
[root@server ~]#
```

Figure 6: dhcp

DNS

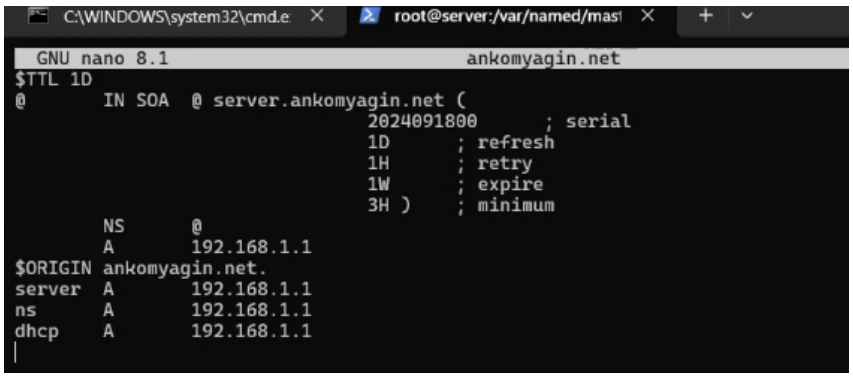

Figure 7: DNS-

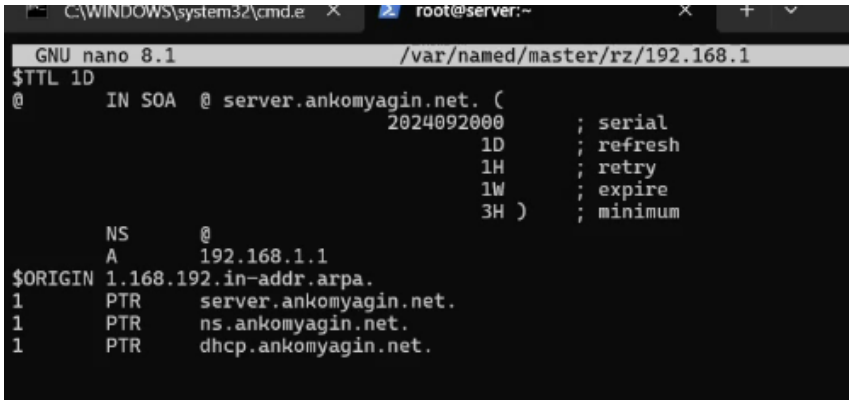

Figure 8: DNS-

. ping

```
[root@server ~]# systemctl restart named
[root@server ~]# ping dhcp.ankomyagin.net
PING dhcp.ankomyagin.net (192.168.1.1) 56(84) bytes of data.
64 bytes from server.ankomyagin.net (192.168.1.1): icmp_seq=1 ttl=64 time=0.394 ms
64 bytes from server.ankomyagin.net (192.168.1.1): icmp_seq=2 ttl=64 time=0.082 ms
64 bytes from server.ankomyagin.net (192.168.1.1): icmp_seq=3 ttl=64 time=0.037 ms
64 bytes from server.ankomyagin.net (192.168.1.1): icmp_seq=4 ttl=64 time=0.121 ms
64 bytes from server.ankomyagin.net (192.168.1.1): icmp_seq=5 ttl=64 time=0.093 ms
64 bytes from server.ankomyagin.net (192.168.1.1): icmp_seq=6 ttl=64 time=0.110 ms
```

named, ,

Figure 9: DHCP-

server, DHC

SELinux

```
--- dhcp.ankomyagin.net ping statistics ---
154 packets transmitted, 154 received, 0% packet loss, time 158090ms
rtt min/avg/max/mdev = 0.037/0.132/1.980/0.161 ms
[root@server ~]# firewall-cmd --list-services

cockpit dhcpv6-client dns ssh
[root@server ~]#
[root@server ~]# firewall-cmd --get-services
0-AD RH-Satellite-6 RH-Satellite-6-capsule afp alvr amanda-client amanda-k5-client amqp amqps
 anno-1602 anno-1800 apcupsd aseqnet audit ausweisapp2 bacula bacula-client bareos-director b
areos-filedaemon bareos-storage bb bgp bitcoin bitcoin-rpc bitcoin-testnet bitcoin-testnet-rp
c bittorrent-lsd ceph ceph-exporter ceph-mon cfengine checkmk-agent civilization-iv civilizat
ion-v cockpit collectd condor-collector cratedb ctdb dds dds-multicast dds-unicast dhcp dhcpv
6 dhcpv6-client distcc dns dns-over-quic dns-over-tls docker-registry docker-swarm dropbox-la
nsync elasticsearch etcd-client etcd-server factorio finger foreman foreman-proxy freeipa-4 f
reeipa-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 iperf2 iperf
3 ipfs ipp ipp-client ipsec irc ircs iscsi-target isns jenkins kadmin kdeconnect kerberos kib
ana klogin kpasswd kprop kshell kube-api kube-apiserver kube-control-plane kube-control-plane
-secure kube-controller-manager kube-controller-manager-secure kube-nodeport-services kube-sc
heduler kube-scheduler-secure kube-worker kubelet kubelet-readonly kubelet-worker ldap ldaps
libvirt libvirt-tls lightning-network llmnr llmnr-client llmnr-tcp llmnr-udp managesieve matr
ix mdns memcache minecraft minidlna mndp mongodb mosh mountd mpd mqtt mqtt-tls ms-wbt mssql m
urmur mysql nbd nebula need-for-speed-most-wanted netbios-ns netdata-dashboard nfs nfs3 nmea-
0183 nrpe ntp nut opentelemetry openvpn ovirt-imageio ovirt-storageconsole ovirt-vmconsole pl
ex pmcd pmproxy pmwebapi pmwebapis pop3 pop3s postgresql privoxy prometheus prometheus-node-e
xporter proxy-dhcp ps2link ps3netsrv ptp pulseaudio puppetmaster quassel radius radsec rdp re
dis redis-sentinel rootd rpc-bind rquotad rsh rsyncd rtsp salt-master samba samba-client samb
a-dc sane settlers-history-collection sip sips slimevr slp smtp smtp-submission smtps snmp sn
mptls snmptls-trap snmptrap spideroak-lansync spotify-sync squid ssdp ssh statsrv steam-lan-t
ransfer steam-streaming stellaris stronghold-crusader stun stuns submission supertuxkart svdr
p svn syncthing syncthing-gui syncthing-relay synergy syscomlan syslog syslog-tls telnet tent
acle terraria tftp tile38 tinc tor-socks transmission-client turn turns upnp-client vdsm vnc-
server vrrp warpinator wbem-http wbem-https wireguard ws-discovery ws-discovery-client ws-dis
covery-host ws-discovery-tcp ws-discovery-udp wsdd wsdd-http wsman wsmans xdmcp xmpp-bosh xmp
p-client xmpp-local xmpp-server zabbix-agent zabbix-java-gateway zabbix-server zabbix-trapper
 zabbix-web-service zero-k zerotier
[root@server ~]#
```

Figure 10: firewall-cmd –get-services

```
[root@server ~]# firewall-cmd --add-service=dhcp
success
[root@server ~]# firewall-cmd --add-service=dhcp --permanent
success
[root@server ~]#
```

Figure 11: dhcp

```
[root@server ~]# restorecon -vR /etc
Relabeled /etc/NetworkManager/system-connections/eth1.nmconnection from unconfined_u:object_r
:user_tmp_t:s0 to unconfined_u:object_r:NetworkManager_etc_rw_t:s0
[root@server ~]# restorecon -vR /var/named
[root@server ~]# restorecon -vR /var/lib/kea/
[root@server ~]#
```

Figure 12:

client

client 01-routing.sh,

NetworkManager, client

eth1.

Vagrantfile.

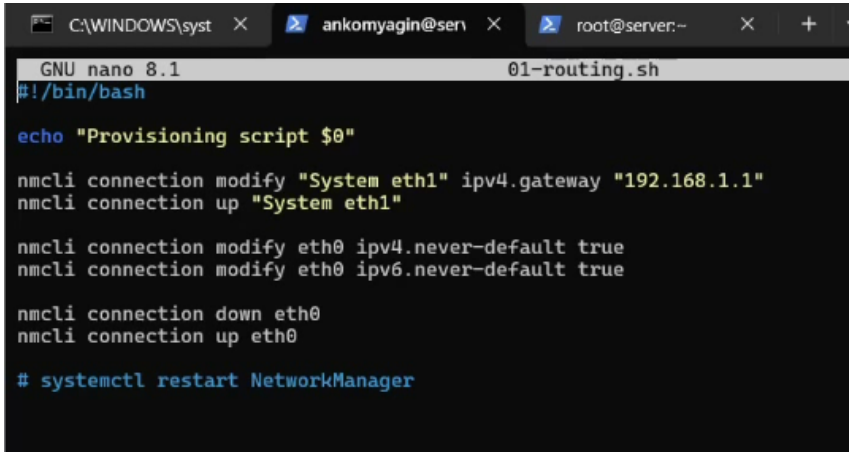

Figure 13: 01-routing.sh

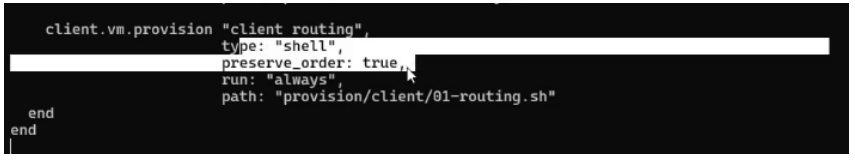

Figure 14: Vagrantfile

client .

server

client

IP- .

```
PS C:\Users\Andrey> cd /
PS C:\> cd .\work\ankomyagin\vagrant\
PS C:\work\ankomyagin\vagrant> vagrant up client --provision
Bringing machine 'client' up with 'virtualbox' provider...
==> client: Clearing any previously set forwarded ports...
==> client: Fixed port collision for 22 => 2222. Now on port 2200.
==> client: Clearing any previously set network interfaces...
==> client: Preparing network interfaces based on configuration...
    client: Adapter 1: nat
    client: Adapter 2: intnet
==> client: Forwarding ports...
    client: 22 (guest) => 2200 (host) (adapter 1)
==> client: Running 'pre-boot' VM customizations...
```

Figure 15: client

```
vagrant@client:~$ su - ankomyagin
Password:
Last login: Thu Sep 18 08:43:52 UTC 2025 on pts/1
[ankomyagin@client.ankomyagin.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 fd17:625c:f037:2:a00:27ff:feaa:ce23  prefixlen 64  scopeid 0x0<
global>
        inet6 fe80::a00:27ff:feaa:ce23  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:aa:ce:23  txqueuelen 1000  (Ethernet)
        RX packets 3354  bytes 308015 (300.7 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 2213  bytes 273292 (266.8 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::fcab:a8ef:8ae8:66c9  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:de:98:49  txqueuelen 1000  (Ethernet)
        RX packets 34  bytes 3752 (3.6 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 149  bytes 15075 (14.7 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 2039 (1.9 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 17  bytes 2039 (1.9 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Figure 16:

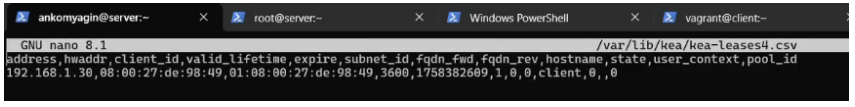

Figure 17:

DNS-

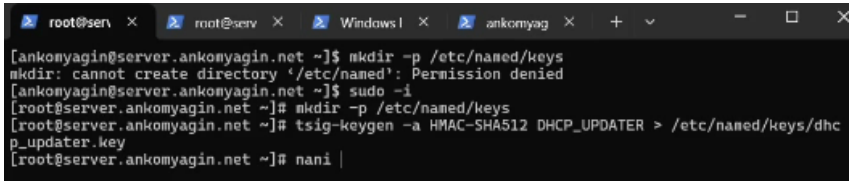

Figure 18:

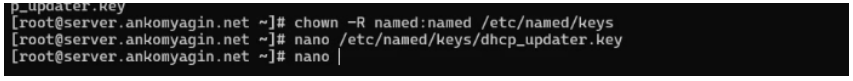

Figure 19:

DNS-

```
};

include "/etc/named/keys/dhcp_updater.key"
include "/etc/named.rfc1912.zones";
include "/etc/named.root.key";

include "/etc/named/ankomyagin.net";
                              [ Wrote 61 lines ]
^G Help        ^O Write Out   ^F Where Is    ^K Cut         ^T Execut
^X Exit        ^R Read File   ^\ Replace     ^U Paste       ^J Justif
```

Figure 20:

```
zone "ankomyagin.net" IN {
        type master;
        file "master/fz/ankomyagin.net";
        update-policy {
                grant DHCP_UPDATER wildcard *.user.net A DHCID;
        };
};

zone "1.168.192.in-addr.arpa" IN {
        type master;
        file "master/rz/192.168.1";
        update-policy {
                grant DHCP_UPDATER wildcard *.1.168.192.in-addr.arpa PTR DHCID;
        };

};
```

Figure 21:

DNS-

```
[root@server.ankomyagin.net ~]# named-checkconf
/etc/named.conf:58: missing ';' before 'include'
[root@server.ankomyagin.net ~]# nano /etc/named.conf
[root@server.ankomyagin.net ~]# named-checkconf
[root@server.ankomyagin.net ~]# systemctl restart named
```

,

named

Figure 22: DNS-


GNU nano 8.1
/etc/kea/tsig-keys.json
Modified
"tsig-keys": [
{
"name": "DHCP
algorithm hmac-sha512;
secret "dZMZHYSVS6GtgxtYZYHXtmiUG08oYLOiho+6V9Wj6dvRM9nqOp/2g6QoYWi9sxqo4yQ95DdUGYSo
}
],

Figure 23:

/etc/kea/kea-dhcp-ddns.conf

/etc/kea/kea-dhcp-ddns.conf

Figure 24: kea-dhcp-ddns.conf

,

“chown kea:kea
/etc/kea/kea-dhcp-ddns.conf”

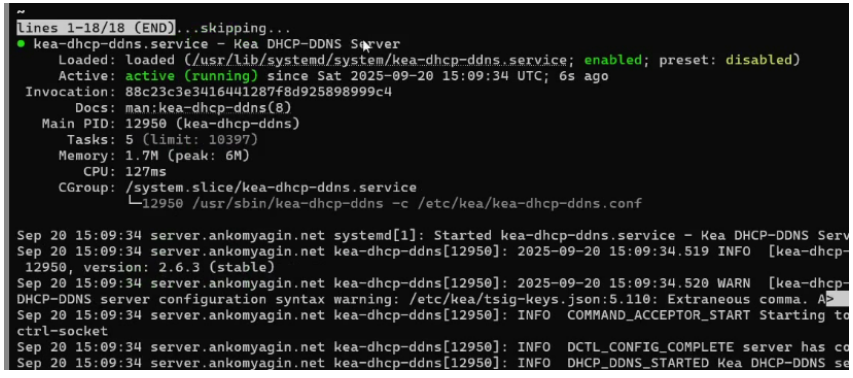

Figure 25: dhcp-ddns

/etc/kea/kea-dhcp4.conf

```
"dhcp-ddns": {
    "enable-updates": true
},

"ddns-qualifying-suffix": "ankomyagin.net",
"ddns-override-client-update": true,
```

Figure 26: kea-dhcp4.conf

```
[root@server.ankomyagin.net ~]# systemctl restart kea-dhcp4.service
[root@server.ankomyagin.net ~]# systemctl status kea-dhcp4.service
● kea-dhcp4.service - Kea DHCPv4 Server
     Loaded: loaded (/usr/lib/systemd/system/kea-dhcp4.service; enabled; preset: disabled)
     Active: active (running) since Sat 2025-09-20 15:12:57 UTC; 4s ago
 Invocation: 07222d9823604c4386e1cfedeee32909
       Docs: man:kea-dhcp4(8)
   Main PID: 12974 (kea-dhcp4)
      Tasks: 7 (limit: 10397)
     Memory: 2.5M (peak: 5.9M)
        CPU: 197ms
     CGroup: /system.slice/kea-dhcp4.service
             └─12974 /usr/sbin/kea-dhcp4 -c /etc/kea/kea-dhcp4.conf
```

Figure 27: dhcp

client.

```
[sudo] password for ankomyagin:
[root@client.ankomyagin.net ~]# nmcli connection down eth1
Connection 'eth1' successfully deactivated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/4)
[root@client.ankomyagin.net ~]# nmcli connection up eth1
Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/6)
[root@client.ankomyagin.net ~]#
```

Figure 28:

ankomyagin.net.jnl

Figure 29: ankomyagin.net.jnl

client dig

DNS-

DNS-

Figure 30:

```
[root@server.ankomyagin.net fz]# cd
[root@server.ankomyagin.net ~]# cd /vagrant/provision/server
[root@server.ankomyagin.net server]# mkdir -p /vagrant/provision/server/dhcp/etc/kea
[root@server.ankomyagin.net server]# cp -R /etc/kea/* /vagrant/provision/server/dhcp/etc/kea/
[root@server.ankomyagin.net server]# cd /vagrant/provision/server/dns/
[root@server.ankomyagin.net dns]# cp -R /var/named/* /vagrant/provision/server/dns/var/named/
```

Figure 31: DHCP

```
[root@server.ankomyagin.net dns]#
[root@server.ankomyagin.net dns]# cp -R /var/named/* /vagrant/provision/server/dns/var/named/
cp: overwrite '/vagrant/provision/server/dns/var/named/data/named.run'? y
cp: overwrite '/vagrant/provision/server/dns/var/named/dynamic/managed-keys.bind'? y
cp: overwrite '/vagrant/provision/server/dns/var/named/dynamic/managed-keys.bind.jnl'? y
cp: overwrite '/vagrant/provision/server/dns/var/named/master/fz/ankomyagin.net'? y
cp: overwrite '/vagrant/provision/server/dns/var/named/master/rz/fz/ankomyagin.net'? y
cp: overwrite '/vagrant/provision/server/dns/var/named/master/rz/192.168.1'? y
cp: overwrite '/vagrant/provision/server/dns/var/named/named.ca'? y
cp: overwrite '/vagrant/provision/server/dns/var/named/named.empty'? y
cp: overwrite '/vagrant/provision/server/dns/var/named/named.localhost'? y
cp: overwrite '/vagrant/provision/server/dns/var/named/named.loopback'? y
[root@server.ankomyagin.net dns]# cp -R /etc/named/* /vagrant/provision/server/dns/etc/named/
cp: overwrite '/vagrant/provision/server/dns/etc/named/ankomyagin.net'?
```

Figure 32:

```
  GNU nano 8.1
#!/bin/bash
echo "Provisioning script $0"
echo "Install needed packages"
dnf -y install kea
echo "Copy configuration files"
cp -R /vagrant/provision/server/dhcp/etc/kea/* /etc/kea
echo "Fix permissions"
chown -R kea:kea /etc/kea
chmod 640 /etc/kea/tsig-keys.json
restorecon -vR /etc
restorecon -vR /var/lib/kea
echo "Configure firewall"
firewall-cmd --add-service dhcp
firewall-cmd --add-service dhcp --permanent
echo "Start dhcpd service"
systemctl --system daemon-reload
```

Figure 33:

```
[root@server.ankomyagin.net server]# touch dhcp.sh
[root@server.ankomyagin.net server]# chmod +x dhcp.sh
[root@server.ankomyagin.net server]# nano dhcp.sh
```

Figure 34: dhcp.sh

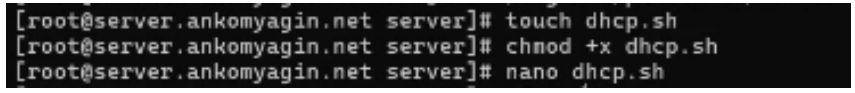
[root@server.ankomyagin.net server]# touch dhcp.sh
[root@server.ankomyagin.net server]# chmod +x dhcp.sh
[root@server.ankomyagin.net server]# nano dhcp.sh

Figure 35:

- DHCP

DHCP-