

Лабораторная работа

Номер 3

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Информация

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Цель работы

Приобретение практических навыков по установке и конфигурированию DHCP-сервера.

Запуск сервера

```
C:\work\nsandryushin\vagrant>vagrant up server
Bringing machine 'server' up with 'virtualbox' provider...
==> server: You assigned a static IP ending in ".1" or ":1" to this machine.
==> server: This is very often used by the router and can cause the
==> server: network to not work properly. If the network doesn't work
==> server: properly, try changing this IP.
==> server: You assigned a static IP ending in ".1" or ":1" to this machine.
==> server: This is very often used by the router and can cause the
==> server: network to not work properly. If the network doesn't work
==> server: properly, try changing this IP.
==> server: Clearing any previously set forwarded ports...
==> server: Clearing any previously set network interfaces...
==> server: Preparing network interfaces based on configuration...
    server: Adapter 1: nat
    server: Adapter 2: intnet
==> server: Forwarding ports...
```

Рис. 1: Запуск сервера

Установка kea

```
[nsandryushin@nsandryushin.net ~]$ sudo -i
[sudo] password for nsandryushin:
[root@server.nsandryushin.net ~]# dnf -y install kea
Extra Packages for Enterprise Linux 10 - x86_64
Extra Packages for Enterprise Linux 10 - x86_64
Rocky Linux 10 - BaseOS
Rocky Linux 10 - BaseOS
Rocky Linux 10 - AppStream
Rocky Linux 10 - AppStream
Rocky Linux 10 - CRB
Rocky Linux 10 - CRB
Rocky Linux 10 - Extras
Rocky Linux 10 - Extras
Dependencies resolved.

=====
          Package           Architecture      Version
=====
Installing:
  kea                  x86_64            2.6.3-1.el10_0
Installing dependencies:
  kea-libs              x86_64            2.6.3-1.el10_0
  libpq                x86_64            16.8-2.el10_0
  log4cplus             x86_64            2.1.1-0.el10
  mariadb-connector-c  x86_64            3.4.4-1.el10
  mariadb-connector-c-config  noarch            3.4.4-1.el10

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
(2/6): kea-libs-2.6.3-1.el10_0.x86_64.rpm
(3/6): mariadb-connector-c-3.4.4-1.el10.x86_64.rpm
(4/6): mariadb-connector-c-config-3.4.4-1.el10.rpm
(5/6): log4cplus-2.1.1-0.el10.x86_64.rpm
(6/6): kea-2.6.3-1.el10_0.x86_64.rpm
```

Рис. 2: Установка kea

Бекап конфига

```
[root@server.nsandryushin.net ~]# cp /etc/kea/kea-dhcp4.conf /etc/kea/kea-dhcp4.conf_$(date -I)
[root@server.nsandryushin.net ~]# nano /etc/kea/kea-dhcp4.conf
```

Рис. 3: Бекап конфига

Редактирование конфига

```
pi@raspberrypi:~ $ nano B.1                                     /etc/kea/kea-dhcp4.conf
// domain-name-servers you could do this:
// {
//     "name": "domain-name-servers",
//     "code": 6,
//     "csv-format": "true",
//     "space": "dhcp4",
//     "data": "192.0.2.1, 192.0.2.2"
// }
// but it's a lot of writing, so it's easier to do this instead:
{
    "name": "domain-name-servers",
    "data": "192.168.1.1"
},
// Typically people prefer to refer to options by their names, so they
// don't need to remember the code names. However, some people like
// to use numerical values. For example, option 'domain-name' uses
// option code 15, so you can reference to it either by
// "name": "domain-name" or "code": 15.
{
    "code": 15,
    "data": "nsandryushin.net"
},
// Domain search is also a popular option. It tells the client to
// attempt to resolve names within those specified domains. For
// example, name "foo" would be attempted to be resolved as
// foo.mydomain.example.com and if it fails, then as foo.example.com
{
    "name": "domain-search",
    "data": "nsandryushin.net"
},
```

Рис. 4: Редактирование конфига

Настройка подсети

```
"subnet4": [
    {
        // This defines the whole subnet. Kea will use this information to
        // determine where the clients are connected. This is the whole
        // subnet in your network.

        // Subnet identifier should be unique for each subnet.
        "id": 1,

        // This is mandatory parameter for each subnet.
        "subnet": "192.168.1.0/24",

        // Pools define the actual part of your subnet that is governed
        // by Kea. Technically this is optional parameter, but it's
        // almost always needed for DHCP to do its job. If you omit it,
        // clients won't be able to get addresses, unless there are
        // host reservations defined for them.
        "pools": [ { "pool": "192.168.1.30 - 192.168.1.199" } ],

        // These are options that are subnet specific. In most cases,
        // you need to define at least routers option, as without this
        // option your clients will not be able to reach their default
        // gateway and will not have Internet connectivity.
        "option-data": [
            {
                // For each IPv4 subnet you most likely need to specify at
                // least one router.
                "name": "routers",
                "data": "192.168.1.1"
            }
        ],
    },
],
```

Рис. 5: Настройка подсети

Установка интерфейса

```
"Dhcp4": {  
    // Add names of your network interfaces to listen on.  
    "interfaces-config": {  
        // See section 8.2.4 for more details. You probably want to add just  
        // interface name (e.g. "eth0" or specific IPv4 address on that  
        // interface (e.g. "eth0/192.0.2.1").  
        "interfaces": [ "eth1" ]  
  
        // Kea DHCPv4 server by default listens using raw sockets. This ensures  
        // all packets, including those sent by directly connected clients  
        // that don't have IPv4 address yet, are received. However, if your  
        // traffic is always relayed, it is often better to use regular  
        // UDP sockets. If you want to do that, uncomment this line:  
        // "dhcp-socket-type": "udp"  
    },
```

Рис. 6: Установка интерфейса

Загрузка конфига

```
[root@server.nsandryushin.net ~]# kea-dhcp4 -t /etc/kea/kea-dhcp4.conf
2025-09-20 12:08:22.056 INFO  [kea-dhcp4.hosts/10508.139798805010624] HOSTS_BACKENDS_REGISTERED the following host backend types are available: mysql postgresql
2025-09-20 12:08:22.057 WARN   [kea-dhcp4.dhcpsrv/10508.139798805010624] DHCPSRV_MT_DISABLED_QUEUE_CONTROL disabling dhcp queue control when multi-threading is enabled.
2025-09-20 12:08:22.057 WARN   [kea-dhcp4.dhcp4/10508.139798805010624] DHCP4_RESERVATIONS_LOOKUP_FIRST_ENABLED Multi-threading is enabled and host reservations lookup is always performed first.
2025-09-20 12:08:22.057 INFO   [kea-dhcp4.dhcpsrv/10508.139798805010624] DHCPSRV_CFGMGR_NEW_SUBNET4 a new subnet has been added to configuration: 192.168.1.0/24 with params: t1=900, t2=1800, valid-lifetime=3600
2025-09-20 12:08:22.058 INFO   [kea-dhcp4.dhcpsrv/10508.139798805010624] DHCPSRV_CFGMGR_SOCKET_TYPE_SELECT using socket type raw
2025-09-20 12:08:22.058 INFO   [kea-dhcp4.dhcpsrv/10508.139798805010624] DHCPSRV_CFGMGR_ADD_IFACE listening on interface eth1
2025-09-20 12:08:22.058 INFO   [kea-dhcp4.dhcpsrv/10508.139798805010624] DHCPSRV_CFGMGR_SOCKET_TYPE_DEFAULT "dhcp-socket-type" not specified , using default socket type raw
```

Рис. 7: Загрузка конфига

Перезагрузка дæмонов

```
[root@server.nsandryushin.net ~]# systemctl --system daemon-reload
[root@server.nsandryushin.net ~]# systemctl enable kea-dhcp4.service
Created symlink '/etc/systemd/system/multi-user.target.wants/kea-dhcp4.service' → '/usr/lib/systemd/system/kea-dhcp4.service'.
[root@server.nsandryushin.net ~]# █
```

Рис. 8: Перезагрузка дæмонов

Редактирование fz

```
GNU nano 8.1                                         /var/named/master/fz/nsandryushin.net
$TTL 1D
@      IN SOA  @ server.nsandryushin.net. (
                                2025092001; serial
                                1D      ; refresh
                                1H      ; retry
                                1W      ; expire
                                3H )    ; minimum
NS      @
A       192.168.1.1
AAAA    ::1
$ORIGIN nsandryushin.net.
server A 192.168.1.1
ns A 192.168.1.1
dhcp A 192.168.1.1
```

Рис. 9: Редактирование fz

```
GNU nano 8.1                                         /var/named/master/rz/192.168.1
$TTL 1D
@      IN SOA  @ server.nsandryushin.net. (
                                2025092001; serial
                                1D ; refresh
                                1H ; retry
                                1W ; expire
                                3H ) ; minimum
NS      @
A       192.168.1.1
AAAA    ::1
PTR     server.nsandryushin.net.
$ORIGIN 1.168.192.in-addr.arpa.
1 PTR server.nsandryushin.net.
1 PTR ns.nsandryushin.net.
1 PTR dhcp.nsandryushin.net.
```

Рис. 10: rz

Пинг dhcp

```
[root@server.nsandryushin.net ~]# systemctl restart named
[root@server.nsandryushin.net ~]# ping dhcp.nsandryushin.net
PING dhcp.nsandryushin.net (192.168.1.1) 56(84) bytes of data.
64 bytes from dhcp.nsandryushin.net (192.168.1.1): icmp_seq=1 ttl=64 time=0.113 ms
64 bytes from dhcp.nsandryushin.net (192.168.1.1): icmp_seq=2 ttl=64 time=0.084 ms
64 bytes from dhcp.nsandryushin.net (192.168.1.1): icmp_seq=3 ttl=64 time=0.320 ms
```

Рис. 11: Пинг dhcp

firewall и selinux

```
[root@server.nsandryushin.net ~]# firewall-cmd --list-services
cockpit dhcpcv6-client dns ssh
[root@server.nsandryushin.net ~]# firewall-cmd --get-services
@AD RH-Satellite-6 RH-Satellite-6-capsule afp alvr amanda-client amanda-k5-client amqp amqps anno-1602 anno-1800 apcupsd aseqnet audit auswei
tor bareos-filedaemon bareos-storage bb bgp bitcoin bitcoin-rpc bitcoin-testnet bitcoin-testnet-rpc bittorrent-lsd ceph ceph-exporter ceph-mor
civilization-v cockpit collected condor-collector cratedb ctdb dds dds-multicast dds-unicast dhcp dhcpcv6 dhcpcv6-client distcc dns dns-over-qui
ware dropbox-lansync elasticsearch etcd-client etcd-server factorio finger foreman foreman-proxy freeipa-4 freeipa-ldap freeipa-ldaps freeipa-
nglina-client ganglia-master git gpd grafana gre high-availability http http3 https ident imap imaps iperf2 iperf3 ipfs ipp ipp-client ipsec i
n kdeconnect kerberos kibana klogin kpasswd kprop kshell kube-api kube-apiserver kube-control-plane kube-control-plane-secure kube-controller-
kube-nodeport-services kube-scheduler kube-scheduler-secure kube-worker kubelet kubelet-readonly kubelet-worker ldap ldaps libvirt libvirt-tls
lmnr-tcp llmnr-udp managesieve matrix mdns memcache minecraft minidlna mndp mongodb mosh mountd mpd mqtt mqtt-tls ms-wbt mssql murmur mysql nt
bios-ns netdata-dashboard nfs nfs3 nmea-0183 nrpe ntp nut opentelemetry openvpn ovirt-imageio ovirt-storageconsole ovirt-vmconsole plex pmcd p
stgresql privoxy prometheus prometheus-node-exporter proxy-dhcp ps2link ps3netsrv ptp pulseaudio puppetmaster quasseld radius radsec rdp redis
sh rsyncd rtsp salt-master samba samba-client samba-dc sane settlers-history-collection sip sips slimevr sip smtp smtp-submission smtpts snmp s
lansync spotify-sync squid ssdp ssh statsrv steam-lan-transfer steam-streaming stellaris stronghold-crusader stun stuns submission supertuxkai
cthing-relay synergy sysclolan syslog syslog-tls telnet tentacle terraria tftp tile38 tinc tor-socks transmission-client turn turns upnp-clier
http wbem-https wireguard ws-discovery ws-discovery-client ws-discovery-host ws-discovery-tcp ws-discovery-udp wsdd wsdd-http wsman wsmans xdm
p-server zabbix-agent zabbix-java-gateway zabbix-server zabbix-trapper zabbix-web-service zero-k zerotier
[root@server.nsandryushin.net ~]# firewall-cmd --add-service=dhcp
success
[root@server.nsandryushin.net ~]# firewall-cmd --add-service=dhcp --permanent
success
[root@server.nsandryushin.net ~]# restorecon -vR /etc
Relabeled /etc/NetworkManager/system-connections/eth1.nmconnection from unconfined_u:object_r:user_tmp_t:s0 to unconfined_u:object_r:NetworkMa
[root@server.nsandryushin.net ~]# restorecon -vR /var/named
[root@server.nsandryushin.net ~]# restorecon -vR /var/lib/kea/
[root@server.nsandryushin.net ~]#
```

Рис. 12: firewall и selinux

Логи сервера

```
[nsandryushin@server.nsandryushin.net ~]$ sudo tail -f /var/log/messages
[sudo] password for nsandryushin:
Sep 20 12:01:29 server named[10320]: zone localhost.localdomain/IN: loaded serial 0
Sep 20 12:01:29 server named[10320]: all zones loaded
Sep 20 12:01:29 server named[10320]: running
Sep 20 12:01:29 server systemd[1]: Started named.service - Berkeley Internet Name Domain (DNS).
Sep 20 12:01:39 server named[10320]: resolver priming query complete: timed out
Sep 20 12:01:39 server named[10320]: managed-keys-zone: Unable to fetch DNSKEY set '.': timed out
Sep 20 12:03:02 server systemd[1]: Starting fwupd-refresh.service - Refresh fwupd metadata and update motd...
Sep 20 12:03:02 server systemd[1]: fwupd-refresh.service: Deactivated successfully.
Sep 20 12:03:02 server systemd[1]: Finished fwupd-refresh.service - Refresh fwupd metadata and update motd.
Sep 20 12:03:17 server systemd[5566]: Started run-p10384-110684.scope - [systemd-run] /usr/bin/bash.
Sep 20 12:03:37 server systemd-logind[918]: Existing logind session ID 5 used by new audit session, ignoring.
Sep 20 12:03:37 server systemd-logind[918]: New session c3 of user root. I
Sep 20 12:03:37 server systemd[1]: Started session-c3.scope - Session c3 of User root.
Sep 20 12:03:47 server systemd[1]: Started kea-dhcp4.service - Kea DHCPv4 Server.
Sep 20 12:03:47 server kea-dhcp4[10433]: 2025-09-20 12:03:47.896 INFO  [kea-dhcp4.dhcp4/10433.139955159222464] DHCP4_STARTING Kea
Sep 20 12:03:47 server kea-dhcp4[10433]: 2025-09-20 12:03:47.903 INFO  [kea-dhcp4.commands/10433.139955159222464] COMMAND_RECEIVE
Sep 20 12:03:47 server kea-dhcp4[10433]: 2025-09-20 12:03:47.914 ERROR [kea-dhcp4.dhcp4/10433.139955159222464] DHCP4_INIT_FAIL fa
sing file '/etc/kea/kea-dhcp4.conf': specified reservation '192.0.2.201' is not within the IPv4 subnet '192.168.1.0/24'
Sep 20 12:03:47 server systemd[1]: kea-dhcp4.service: Main process exited, code=exited, status=1/FAILURE
Sep 20 12:03:47 server systemd[1]: kea-dhcp4.service: Failed with result 'exit-code'.
```

Рис. 13: Логи сервера

Запуск dhcp

```
[root@server.nsandryushin.net ~]# systemctl start kea-dhcp4.service  
[root@server.nsandryushin.net ~]# █
```

Рис. 14: Запуск dhcp

Сверка по логу

```
[nsandryushin@server.nsandryushin.net ~]$ sudo tail -f /var/log/messages
[sudo] password for nsandryushin:
Sep 20 12:03:47 server systemd[1]: kea-dhcp4.service: Main process exited, code=exited, status=1/FAILURE
Sep 20 12:03:47 server systemd[1]: kea-dhcp4.service: Failed with result 'exit-code'.
Sep 20 12:04:05 server systemd[1]: session-c3.scope: Deactivated successfully.
Sep 20 12:04:05 server systemd-logind[918]: Session c3 logged out. Waiting for processes to exit.
Sep 20 12:04:05 server systemd-logind[918]: Removed session c3.
Sep 20 12:05:05 server named[10320]: shut down hung fetch while resolving 'contile.services.mozilla.com/A'
Sep 20 12:05:05 server named[10320]: shut down hung fetch while resolving 'contile.services.mozilla.com/AAAA'
Sep 20 12:08:39 server systemd[1]: Started kea-dhcp4.service - Kea DHCPv4 Server.
Sep 20 12:08:40 server kea-dhcp4[10516]: 2025-09-20 12:08:40.096 INFO [kea-dhcp4.dhcp4/10516.139974460152000] DHCP4_STARTING Kea DHCPv4 server
Sep 20 12:08:40 server kea-dhcp4[10516]: 2025-09-20 12:08:40.099 INFO [kea-dhcp4.commands/10516.139974460152000] COMMAND RECEIVED Received com
Sep 20 12:08:51 server systemd-logind[918]: Existing logind session ID 5 used by new audit session, ignoring.
Sep 20 12:08:51 server systemd-logind[918]: New session c4 of user root.
Sep 20 12:08:51 server systemd[1]: Started session-c4.scope - Session c4 of User root.
```

Рис. 15: Сверка по логу

Скрипт для клиента



The screenshot shows a terminal window with a light gray background and white text. At the top, there is a horizontal bar with several small icons and file names: lesson1.1.prg, lesson1.2.prg, .gitignore, .env, vagrant-rocky.pkr.hcl, Vagrantfile, Makefile, 01-dummy.sh, 01-user.sh, 01-hostname.sh, 02-forward.sh, 01-routing.sh, rocky10-ks.cfg, and 02-forward.sh. Below this, the terminal prompt is shown: #!/bin/bash. The script content starts with echo "Provisioning script \$0". It then uses nmcli commands to modify network connections. Specifically, it sets the IPv4 gateway for the 'System eth1' connection to 192.168.1.1, then brings up the connection. It also modifies the 'eth0' connection to never be the default, and changes both its IPv4 and IPv6 settings to never be the default. After these changes, it brings down and then up the 'eth0' connection. Finally, it runs the command # systemctl restart NetworkManager.

```
#!/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. 16: Скрипт для клиента

Vagrantfile

```
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"
```

Рис. 17: Vagrantfile

Запуск клиента

```
C:\work\nsandryushin\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...
==> client: Booting VM...
```

Рис. 18: Запуск клиента

ifconfig

```
[nsandryushin@client.nsandryushin.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 fd00::a00:27ff:fe5d:6d8e  prefixlen 64  scopeid 0x0<global>
        inet6 fe80::a00:27ff:fe5d:6d8e  prefixlen 64  scopeid 0x20<link>
          ether 08:00:27:5d:6d:8e  txqueuelen 1000  (Ethernet)
            RX packets 1654  bytes 195424 (190.8 KiB)
            RX errors 0  dropped 0  overruns 0  frame 0
            TX packets 1473  bytes 232829 (227.3 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::6d76:bb48:cd95:17b7  prefixlen 64  scopeid 0x20<link>
          ether 08:00:27:8e:21:48  txqueuelen 1000  (Ethernet)
            RX packets 51  bytes 4918 (4.8 KiB)
            RX errors 0  dropped 0  overruns 0  frame 0
            TX packets 264  bytes 25460 (24.8 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)
```

Рис. 19: ifconfig

Таблица с назначениями

```
GNU nano 8.1                                     /var/lib/kea/kea-leases4.csv
address,hwaddr,client_id,valid_lifetime,expire,subnet_id,fqdn_fwd,fqdn_rev,hostname,state,user_context,pool_id
192.168.1.30,08:00:27:8e:21:48,01:08:00:27:8e:21:48,3600,1758375351,1,0,0,client,0,,0
```

Рис. 20: Таблица с назначениями

Ключ sha512

```
[root@server.nsandryushin.net ~]# mkdir -p /etc/named/keys
[root@server.nsandryushin.net ~]# tsig-keygen -a HMAC-SHA512 DHCP_UPDATER > /etc/named/keys/dhcp_updater.key
[root@server.nsandryushin.net ~]# cat /etc/named/keys/dhcp_updater.key
key "DHCP_UPDATER" {
    algorithm hmac-sha512;
    secret "QT/72lqh6PhaMuPkcLkNhnTaFYK8hTmQUgikvuMKj4Mb/grr1Jc1wIcJzJmyxb59Pu7SZU5ssHg6kj/c5lCWyQ==";
}:
```

Рис. 21: Ключ sha512

Добавление ключа

```
GNU name 8.1                                         /etc/named.conf
  - If your recursive DNS server has a public IP address, you MUST enable access
    control to limit queries to your legitimate users. Failing to do so will
    cause your server to become part of large scale DNS amplification
    attacks. Implementing BCP38 within your network would greatly
    reduce such attack surface
*/
recursion yes;

dnssec-validation yes;

managed-keys-directory "/var/named/dynamic";
geoip-directory "/usr/share/GeoIP";

pid-file "/run/named/named.pid";
session-keyfile "/run/named/session.key";

/* https://fedoraproject.org/wiki/Changes/CryptoPolicy */
include "/etc/crypto-policies/back-ends/bind.config";
};

logging {
    channel default_debug {
        file "data/named.run";
        severity dynamic;
    };
};

zone "." IN {
    type hint;
    file "named.ca";
};

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

Рис. 22: Добавление ключа

Обновление файла

```
GNU nano 8.1                               /etc/named/nsandryushin.net
// named.rfc1912.zones:
//
// Provided by Red Hat caching-nameserver package
//
// 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 "nsandryushin.net" IN {
    type master;
    file 'master/fz/nsandryushin.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;
    };
};
```

Рис. 23: Обновление файла

Применение изменений

```
[root@server.nsandryushin.net ~]# named-checkconf
[root@server.nsandryushin.net ~]# systemctl restart named
[root@server.nsandryushin.net ~]# touch /etc/kea/tsig-keys.json
[root@server.nsandryushin.net ~]#
```

Рис. 24: Применение изменений

Порядок монтирования

```
GNU nano 8.1                                     /etc/kea/tsig-keys.json
"tsig-keys": [
{
  "name": "DHCP_UPDATER",
  "algorithm": "hmac-sha512",
  "secret": "QT/72lqh6PhaMuPkclkNhnTaFYK8hTmQUgikvuMKj4Mb/grr1Jc1wIcJzJmyxb59Pu7SZU5ssHg6kj/c5lCWyQ=="
}
],
```

Рис. 25: Порядок монтирования

Смена прав файла

```
[root@server.nsandryushin.net ~]# chown kea:kea /etc/kea/tsig-keys.json  
[root@server.nsandryushin.net ~]# chmod 640 /etc/kea/tsig-keys.json
```

Рис. 26: Смена прав файла

Изменение конфигурации

```
GNU nano 8.1                               /etc/kea/kea-dhcp-ddns.conf

{
    "port": 53001,
    "control-socket": [
        {
            "socket-type": "unix",
            "socket-name": "/run/kea/kea-ddns-ctrl-socket"
        }
    ],
    <?include "/etc/kea/tsig-keys.json"?>
    "forward-ddns": [
        {
            "ddns-domains": [
                {
                    "name": "nsandryushin.net",
                    "key-name": "DHCP_UPDATER",
                    "dns-servers": [
                        {
                            "ip-address": "192.168.1.1"
                        }
                    ]
                }
            ],
            "reverse-ddns": [
                {
                    "ddns-domains": [
                        {
                            "name": "1.168.192.in-addr.arpa",
                            "key-name": "DHCP_UPDATER",
                            "dns-servers": [
                                {
                                    "ip-address": "192.168.1.1"
                                }
                            ]
                        }
                    ],
                    "loggers": [
                        {
                            "name": "kea-dhcp-ddns",
                            "output_options": [
                                {
                                    "output": "stdout",
                                    "pattern": "%-5p %m\n"
                                }
                            ]
                        }
                    ]
                }
            ]
        }
    ],
    "loggers": [
        {
            "name": "kea-dhcp-ddns",
            "output_options": [
                {
                    "output": "stdout",
                    "pattern": "%-5p %m\n"
                }
            ]
        }
    ]
}
```

Рис. 27: Изменение конфигурации

Перезапуск ddns

```
[root@server.nsandryushin.net ~]# chown kea:kea /etc/kea/kea-dhcp-ddns.conf
[root@server.nsandryushin.net ~]# kea-dhcp-ddns -t /etc/kea/kea-dhcp-ddns.conf
2025-09-20 12:51:15.786 INFO [kea-dhcp-ddns.dctl/11282.139911991370048] DCTL_CONFIG_CHECK_COMPLETE server has completed configuration changing UDP, result: success(0), text=Configuration check successful
[root@server.nsandryushin.net ~]# systemctl enable --now kea-dhcp-ddns.service
Created symlink '/etc/systemd/system/multi-user.target.wants/kea-dhcp-ddns.service' → '/usr/lib/systemd/system/kea-dhcp-ddns.service'.
[root@server.nsandryushin.net ~]# systemctl status kea-dhcp-ddns.service
● kea-dhcp-ddns.service - Kea DHCP-DDNS Server
    Loaded: loaded (/usr/lib/systemd/system/kea-dhcp-ddns.service; enabled; preset: disabled)
      Active: active (running) since Sat 2025-09-20 12:51:26 UTC; 5s ago
        Invocation: 86f5c278084943e7a1e90eb6015587ec
       Docs: man:kea-dhcp-ddns(8)
     Main PID: 11423 (kea-dhcp-ddns)
       Tasks: 5 (limit: 10407)
      Memory: 1.8M (peak: 5.9M)
         CPU: 87ms
      CGroup: /system.slice/kea-dhcp-ddns.service
              └─11423 /usr/sbin/kea-dhcp-ddns -c /etc/kea/kea-dhcp-ddns.conf

Sep 20 12:51:26 server.nsandryushin.net systemd[1]: Started kea-dhcp-ddns.service - Kea DHCP-DDNS Server.
Sep 20 12:51:27 server.nsandryushin.net kea-dhcp-ddns[11423]: 2025-09-20 12:51:27.022 INFO [kea-dhcp-ddns.dctl/11423.139902879772992] DC
Sep 20 12:51:27 server.nsandryushin.net kea-dhcp-ddns[11423]: INFO COMMAND_ACCEPTOR_START Starting to accept connections via unix domain
Sep 20 12:51:27 server.nsandryushin.net kea-dhcp-ddns[11423]: INFO DCTL_CONFIG_COMPLETE server has completed configuration: listening on
Sep 20 12:51:27 server.nsandryushin.net kea-dhcp-ddns[11423]: INFO DHCP_DDNS_STARTED Kea DHCP-DDNS server version 2.6.3 started
```

Рис. 28: Перезапуск ddns

Добавление информации о ddns

```
GNU nano 8.1                               /etc/kea/kea-dhcp4.conf
// seconds reclaimed leases, which have expired more than 3600
// seconds ago, will be removed. The limits for leases reclamation
// are 100 leases or 250 ms for a single cycle. A warning message
// will be logged if there are still expired leases in the
// database after 5 consecutive reclamation cycles.
// If both "flush-reclaimed-timer-wait-time" and "hold-reclaimed-time" are
// not 0, when the client sends a release message the lease is expired
// instead of being deleted from the lease storage.
"expired-leases-processing": [
    "reclaim-timer-wait-time": 10,
    "flush-reclaimed-timer-wait-time": 25,
    "hold-reclaimed-time": 3600,
    "max-reclaim-leases": 100,
    "max-reclaim-time": 250,
    "unwarned-reclaim-cycles": 5
],
// Global timers specified here apply to all subnets, unless there are
// subnet specific values defined in particular subnets.
"renew-timer": 900,
"rebind-timer": 1800,
"valid-lifetime": 3600,
"dhcp-ddns": [
    "enable-updates": true
],
"ddns-qualifying-suffix": "nsandryushin.net",
"ddns-overrride-client-update": true,
// Many additional parameters can be specified here:
// - option definitions (if you want to define vendor options, your own
//   custom options or perhaps handle standard options
//   that Kea does not support out of the box yet)
// - client classes
// - hooks
// - ddns information (how the DHCPv4 component can reach a DNS daemon)
//
```

Рис. 29: Добавление информации о ddns

Перезапуск службы с применением изменений

```
[root@server.nsandryushin.net ~]# kea-dhcp4 -t /etc/kea/kea-dhcp4.conf
2025-09-20 13:04:10.447 INFO [kea-dhcp4.hosts/11662.139791145076928] HOSTS_BACKENDS_REGISTERED the following host backend types are avail
2025-09-20 13:04:10.452 WARN [kea-dhcp4.dhcpsrv/11662.139791145076928] DHCPSRV_MT_DISABLED_QUEUE_CONTROL disabling dhcp queue control whe
2025-09-20 13:04:10.452 WARN [kea-dhcp4.dhcp4/11662.139791145076928] DHCP4_RESERVATIONS_LOOKUP_FIRST_ENABLED Multi-threading is enabled a
rmed first.
2025-09-20 13:04:10.453 INFO [kea-dhcp4.dhcpsrv/11662.139791145076928] DHCPSRV_CFGMGR_NEW_SUBNET4 a new subnet has been added to configu
t2=1800, valid-lifetime=3600
2025-09-20 13:04:10.453 INFO [kea-dhcp4.dhcpsrv/11662.139791145076928] DHCPSRV_CFGMGR_SOCKET_TYPE_SELECT using socket type raw
2025-09-20 13:04:10.454 INFO [kea-dhcp4.dhcpsrv/11662.139791145076928] DHCPSRV_CFGMGR_ADD_IFACE listening on interface eth1
2025-09-20 13:04:10.455 INFO [kea-dhcp4.dhcpsrv/11662.139791145076928] DHCPSRV_CFGMGR_SOCKET_TYPE_DEFAULT "dhcp-socket-type" not specifie
[root@server.nsandryushin.net ~]# systemctl restart kea-dhcp4.service
[root@server.nsandryushin.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 13:04:22 UTC; 6s ago
     Invocation: 37c5e52cefa4a3fb1ad09f33e8806bf
       Docs: man:kea-dhcp4(8)
     Main PID: 11677 (kea-dhcp4)
        Tasks: 7 (limit: 10407)
      Memory: 3.5M (peak: 7.2M)
        CPU: 124ms
      CGroup: /system.slice/kea-dhcp4.service
              └─11677 /usr/sbin/kea-dhcp4 -c /etc/kea/kea-dhcp4.conf

Sep 20 13:04:22 server.nsandryushin.net systemd[1]: Started kea-dhcp4.service - Kea DHCPv4 Server.
Sep 20 13:04:22 server.nsandryushin.net kea-dhcp4[11677]: 2025-09-20 13:04:22.941 INFO [kea-dhcp4.dhcp4/11677.139782083418304] DHCP4_STA
```

Рис. 30: Перезапуск службы с применением изменений

Обновление данных

```
[nsandryushin@client.nsandryushin.net ~]$ nmcli connection down eth1
Connection 'eth1' successfully deactivated (D-Bus active path: /org/freedesktop/
NetworkManager/ActiveConnection/4)
[nsandryushin@client.nsandryushin.net ~]$ nmcli connection up eth1
Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkMa
nager/ActiveConnection/6)
[nsandryushin@client.nsandryushin.net ~]$
```

Рис. 31: Обновление данных

dig

```
[nsandryushin@client.nsandryushin.net ~]$ dig @192.168.1.1 client.nsandryushin.n
et

; <>> DiG 9.18.33 <>> @192.168.1.1 client.nsandryushin.net
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<- opcode: QUERY, status: NXDOMAIN, id: 51786
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: d25eddlc8c4fa8870100000068cea78418f68153507351ac (good)
;; QUESTION SECTION:
;client.nsandryushin.net.      IN      A

;; AUTHORITY SECTION:
nsandryushin.net.      10800   IN      SOA      nsandryushin.net. server.nsandry
ushin.net. 2025092001 86400 3600 604800 10800

;; Query time: 3 msec
;; SERVER: 192.168.1.1#53(192.168.1.1) (UDP)
;; WHEN: Sat Sep 20 13:09:24 UTC 2025
;; MSG SIZE 问: 123
```

Рис. 32: dig

Перенос конфигурации

```
[root@server.nsandryushin.net ~]# cd /vagrant/provision/server/
[root@server.nsandryushin.net server]# mkdir -p /vagrant/provision/server/dhcp/etc/kea
[root@server.nsandryushin.net server]# cp -R /etc/kea/* /vagrant/provision/server/dhcp/etc/kea/
[root@server.nsandryushin.net server]# cd /vagrant/provision/server/dns/      I
[root@server.nsandryushin.net dns]# cp -R /var/named/* /vagrant/provision/server/dns/var/named/
cp: overwrite '/vagrant/provision/server/dns/var/named/master/fz/nsandryushin.net'? y
cp: overwrite '/vagrant/provision/server/dns/var/named/master/rz/192.168.1'? y
[root@server.nsandryushin.net dns]# cp -R /etc/named/* /vagrant/provision/server/dns/etc/named/
cp: overwrite '/vagrant/provision/server/dns/etc/named/nsandryushin.net'? y
[root@server.nsandryushin.net dns]# cd /vagrant/provision/server
[root@server.nsandryushin.net server]# touch dhcp.sh
[root@server.nsandryushin.net server]# chmod +x dhcp.sh
[root@server.nsandryushin.net server]# █
```

Рис. 33: Перенос конфигурации

Скрипт vagrant

```
GNU nano 8.1                                         dhcp.sh
#!/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 dhcpcd service"
systemctl --system daemon-reload
systemctl enable --now kea-dhcp4.service
systemctl enable --now kea-dhcp-ddns.service
```

Рис. 34: Скрипт vagrant

Vagrantfile



A screenshot of a code editor showing a Vagrantfile. The file contains configuration for a virtual machine named 'server'. It specifies the hostname, boot timeout, SSH settings, and network configuration using a private network with IP 192.168.1.1 and VirtualBox as the provider. The file also includes provisions for a dummy server, DNS, and DHCP using shell scripts.

```
59 server.vm.hostname = 'server'
60
61 server.vm.boot_timeout = 1440
62
63 server.ssh.insert_key = false
64 server.ssh.username = 'vagrant'
65 server.ssh.password = 'Vagrant'
66
67 server.vm.network :private_network,
68   ip: "192.168.1.1",
69   virtualbox__intnet: true
70
71 server.vm.provider :virtualbox do |virtualbox|
72   virtualbox.customize ["modifyvm", :id, "--vrde", "on"]
73   virtualbox.customize ["modifyvm", :id, "--vrdeport", "3391"]
74 end
75
76 server.vm.provision "server dummy",
77   type: "shell",
78   preserve_order: true,
79   path: "provision/server/01-dummy.sh"
80
81 server.vm.provision "server dns",
82   type: "shell",
83   preserve_order: true,
84   path: "provision/server/dns.sh"
85 server.vm.provision "server dhcp",
86   type: "shell",
87   preserve_order: true,
88   path: "provision/server/dhcp.sh"
89
90 end
91
```

Рис. 35: Vagrantfile

Выводы

в результате выполнения работы были получены навыки настройки dhcp