

Администрирование системных подсистем

Настройка DHCP-сервера Kea и интеграция с DNS (Bind9 + DDNS)

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Цель работы

Основная цель

Приобретение практических навыков настройки DHCP-сервера Kea и интеграции его с DNS Bind9, включая механизм динамических обновлений DDNS.

Конфигурирование DHCP-сервера

Настройка параметров домена

- Обновлены `domain-name`, `domain-search`
- DNS-сервер: `192.168.1.1`
- Внесены изменения в файл `/etc/kea/kea-dhcp4.conf`



```
kea-dhcp4.conf
/etc/kea

149    // but it's a lot of writing, so it's easier to do this instead:
150    {
151        "name": "domain-name-servers",
152        "data": "192.168.1.1"
153    },
154
155    // Typically people prefer to refer to options by their names, so they
156    // don't need to remember the code names. However, some people like
157    // to use numerical values. For example, option "domain-name" uses
158    // option code 15, so you can reference to it either by
159    // "name": "domain-name" or "code": 15.
160    {
161        "code": 15,
162        "data": "trseidaliev.net"
163    },
164
165    // Domain search is also a popular option. It tells the client to
166    // attempt to resolve names within those specified domains. For
167    // example, name "foo" would be attempted to be resolved as
168    // "foo.domain-name-servers" if it fails, then as "foo".
```

Настройка подсети DHCP

- Сеть: 192.168.1.0/24
- Диапазон: 192.168.1.30–192.168.1.199
- Шлюз: 192.168.1.1

The screenshot shows a code editor window with the title 'kea-dhcp4.conf' and the path '/etc/kea'. The file content is a JSON configuration for a DHCPv4 server. It defines a subnet ('subnet4') with ID 1, a subnet mask of '192.168.1.0/24', and a pool of IP addresses from '192.168.1.30' to '192.168.1.199'. It also includes a 'routers' option under 'option-data'.

```
// {..}. This is a list, denoted with [ ], of structures, each denoted with
// { }. Each structure describes a single subnet and may have several
// parameters. One of those parameters is "pools" that is also a list of
// structures.
"subnet4": [
    {
        "id": 1,
        "subnet": "192.168.1.0/24",
        "pools": [ { "pool": "192.168.1.30 - 192.168.1.199" } ],
        "option-data": [
            {
                "name": "routers",
                "value": "192.168.1.1"
            }
        ]
    }
]
```

Проверка работы службы DHCP

- Проверка корректности конфигурации
- Перезапуск сервиса
- Включение автозагрузки

```
[root@server.trseidaliev.net server]#  
[root@server.trseidaliev.net server]# kea-dhcp4 -t /etc/kea/kea-dhcp4.conf  
2025-11-19 19:00:06.379 INFO [kea-dhcp4.hosts/21246.139875138164928] HOSTS_BACKENDS_REGISTERED the following host bac  
kend types are available: mysql postgresql  
2025-11-19 19:00:06.380 WARN [kea-dhcp4.dhcpsrv/21246.139875138164928] DHCPSRV_MT_DISABLED_QUEUE_CONTROL disabling dh  
cp queue control when multi-threading is enabled.  
2025-11-19 19:00:06.380 WARN [kea-dhcp4.dhcp4/21246.139875138164928] DHCP4_RESERVATIONS_LOOKUP_FIRST_ENABLED Multi-th  
reading is enabled and host reservations lookup is always performed first.  
2025-11-19 19:00:06.381 INFO [kea-dhcp4.dhcpsrv/21246.139875138164928] DHCPSRV_CFGMGR_NEW_SUBNET4 a new subnet has be  
en added to configuration: 192.168.1.0/24 with params: t1=900, t2=1800, valid-lifetime=3600  
2025-11-19 19:00:06.381 INFO [kea-dhcp4.dhcpsrv/21246.139875138164928] DHCPSRV_CFGMGR_SOCKET_TYPE_SELECT using socket  
type raw  
2025-11-19 19:00:06.381 INFO [kea-dhcp4.dhcpsrv/21246.139875138164928] DHCPSRV_CFGMGR_ADD_IFACE listening on interfac  
e eth1  
2025-11-19 19:00:06.381 INFO [kea-dhcp4.dhcpsrv/21246.139875138164928] DHCPSRV_CFGMGR_SOCKET_TYPE_DEFAULT "dhcp-socke  
t-type" not specified , using default socket type raw  
[root@server.trseidaliev.net server]# systemctl --system daemon-reload  
[root@server.trseidaliev.net server]# systemctl enable kea-dhcp4.service  
Created symlink '/etc/systemd/system/multi-user.target.wants/kea-dhcp4.service' → '/usr/lib/systemd/system/kea-dhcp4.s  
ervice'.  
[root@server.trseidaliev.net server]# █
```

Настройка DNS-зон

Прямая зона

Добавлена А-запись для DHCP-сервера и обновлён серийный номер зоны.

The screenshot shows a window titled "trseidaliev.net" with the path "/var/named/master/fz". The window contains a text editor with the following DNS zone configuration:

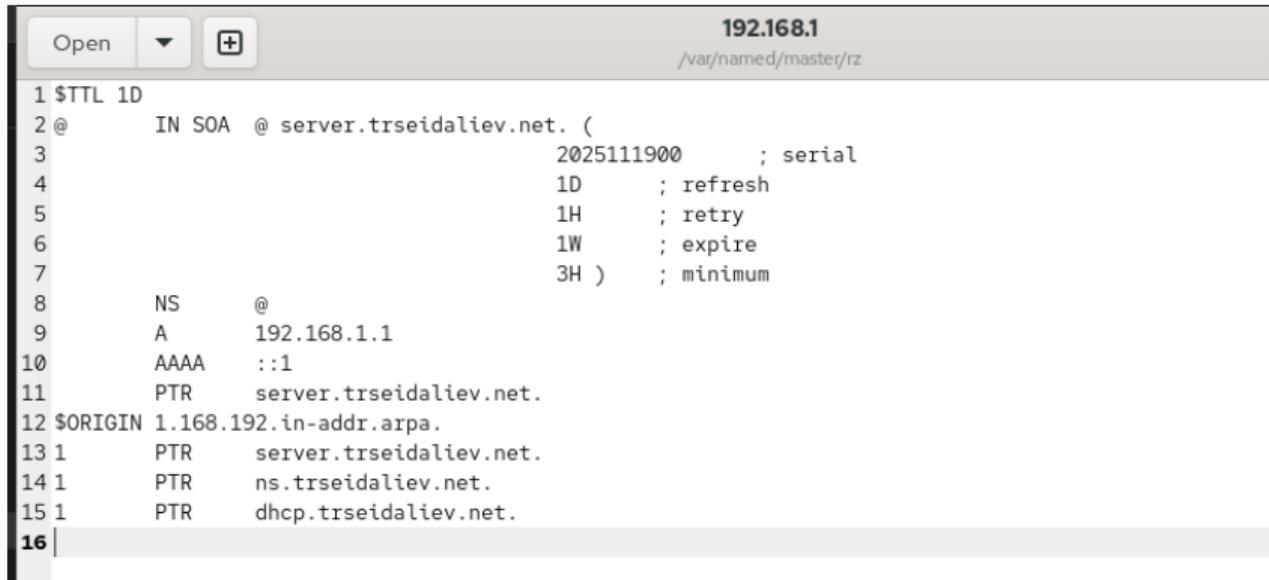
```
1 $TTL 1D
2 @      IN SOA  @ server.trseidaliev.net. (
3                               2025111900      ; serial
4                               1D            ; refresh
5                               1H            ; retry
6                               1W            ; expire
7                               3H )          ; minimum
8     NS      @
9     A       192.168.1.1
10 $ORIGIN trseidaliev.net.
11 server  A       192.168.1.1
12 ns      A       192.168.1.1
13 dhcp    A       192.168.1.1
14
```

The configuration includes a SOA record for the zone, three NS records pointing to the zone's authoritative nameservers, and three A records for the servers, ns, and dhcp hosts. The \$ORIGIN directive specifies the domain suffix. The file ends with a line number 14.

Рис. 4: Файл прямой зоны после изменения

Обратная зона

Добавлена PTR-запись и обновлён SOA serial.



The screenshot shows a text editor window with the following details:

- Top bar: "Open" button, dropdown menu, "+" button.
- Title bar: "192.168.1" and "/var/named/master/rz".
- Content area (text):

```
1 $TTL 1D
2 @      IN SOA  @ server.trseidaliev.net. (
3                               2025111900      ; serial
4                               1D            ; refresh
5                               1H            ; retry
6                               1W            ; expire
7                               3H )          ; minimum
8     NS      @
9     A       192.168.1.1
10    AAAA    ::1
11    PTR     server.trseidaliev.net.
12 $ORIGIN 1.168.192.in-addr.arpa.
13 1    PTR     server.trseidaliev.net.
14 1    PTR     ns.trseidaliev.net.
15 1    PTR     dhcp.trseidaliev.net.
16 |
```

Рис. 5: Файл обратной зоны

Проверка сетевого взаимодействия

Проверка имени DHCP-узла

```
[root@server.trseidaliev.net server]#  
[root@server.trseidaliev.net server]# systemctl restart named  
[root@server.trseidaliev.net server]#  
[root@server.trseidaliev.net server]# ping dhcp.trseidaliev.net  
PING dhcp.trseidaliev.net (192.168.1.1) 56(84) bytes of data.  
64 bytes from server.trseidaliev.net (192.168.1.1): icmp_seq=1 ttl=64 time=0.012 ms  
64 bytes from server.trseidaliev.net (192.168.1.1): icmp_seq=2 ttl=64 time=0.084 ms  
64 bytes from server.trseidaliev.net (192.168.1.1): icmp_seq=3 ttl=64 time=0.037 ms  
64 bytes from server.trseidaliev.net (192.168.1.1): icmp_seq=4 ttl=64 time=0.064 ms  
64 bytes from server.trseidaliev.net (192.168.1.1): icmp_seq=5 ttl=64 time=0.061 ms  
64 bytes from server.trseidaliev.net (192.168.1.1): icmp_seq=6 ttl=64 time=0.077 ms  
^C  
--- dhcp.trseidaliev.net ping statistics ---  
6 packets transmitted, 6 received, 0% packet loss, time 5577ms  
rtt min/avg/max/mdev = 0.012/0.055/0.084/0.024 ms  
[root@server.trseidaliev.net server]#
```

Рис. 6: Проверка ping по имени dhcp..net

Настройка firewall и SELinux

- Разрешена служба DHCP
- Восстановлены контексты SELinux /etc, /var/named, /var/lib/kea

```
[root@server.trseidaliev.net server]#  
[root@server.trseidaliev.net server]# firewall-cmd --add-service=dhcp  
success  
[root@server.trseidaliev.net server]# firewall-cmd --add-service=dhcp --permanent  
success  
[root@server.trseidaliev.net server]# restorecon -vR /etc  
[root@server.trseidaliev.net server]# restorecon -vR /var/named/  
[root@server.trseidaliev.net server]# restorecon -vR /var/lib/kea/  
[root@server.trseidaliev.net server]# systemctl start kea-dhcp4.service  
[root@server.trseidaliev.net server]#
```

Рис. 7: Изменения в firewall и SELinux

Анализ работы DHCP-сервера

Скрипт маршрутизации клиента



```
1  #!/bin/bash
2
3  echo "Provisioning script $0"
4
5  nmcli connection modify "eth1" ipv4.gateway "192.168.1.1"
6  nmcli connection up "eth1"
7
8  nmcli connection modify eth0 ipv4.never-default true
9  nmcli connection modify eth0 ipv6.never-default true
10
11 nmcli connection down eth0
12 nmcli connection up eth0
13
14 # systemctl restart NetworkManager
15
```

Рис. 8: Скрипт настройки маршрутизации клиента

Получение IP-адреса клиентом

```
trseidaliev@client:~  
+  
  
RX packets 1927 bytes 232458 (227.0 KiB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 1660 bytes 268730 (262.4 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::86cf:247e:f9d1:8ac9 prefixlen 64 scopeid 0x20<link>  
        ether 08:00:27:36:98:16 txqueuelen 1000 (Ethernet)  
          RX packets 62 bytes 7039 (6.8 KiB)  
          RX errors 0 dropped 0 overruns 0 frame 0  
          TX packets 238 bytes 22681 (22.1 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 2112 (2.0 KiB)  
          RX errors 0 dropped 0 overruns 0 frame 0  
          TX packets 18 bytes 2112 (2.0 KiB)  
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
[trseidaliev@client.trseidaliev.net ~]$
```

Журнал аренд Kea

```
[root@server.trseidaliev.net server]#  
[root@server.trseidaliev.net server]# cat /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  
192.168.1.30,08:00:27:36:98:16,01:08:00:27:36:98:16,3600,1763571977,1,0,0,client,,0  
192.168.1.30,08:00:27:36:98:16,01:08:00:27:36:98:16,3600,1763571977,1,0,0,client,,0  
192.168.1.30,08:00:27:36:98:16,01:08:00:27:36:98:16,3600,1763571982,1,0,0,client,,0  
[root@server.trseidaliev.net server]#
```

Рис. 10: Содержимое файла kea-leases4.csv

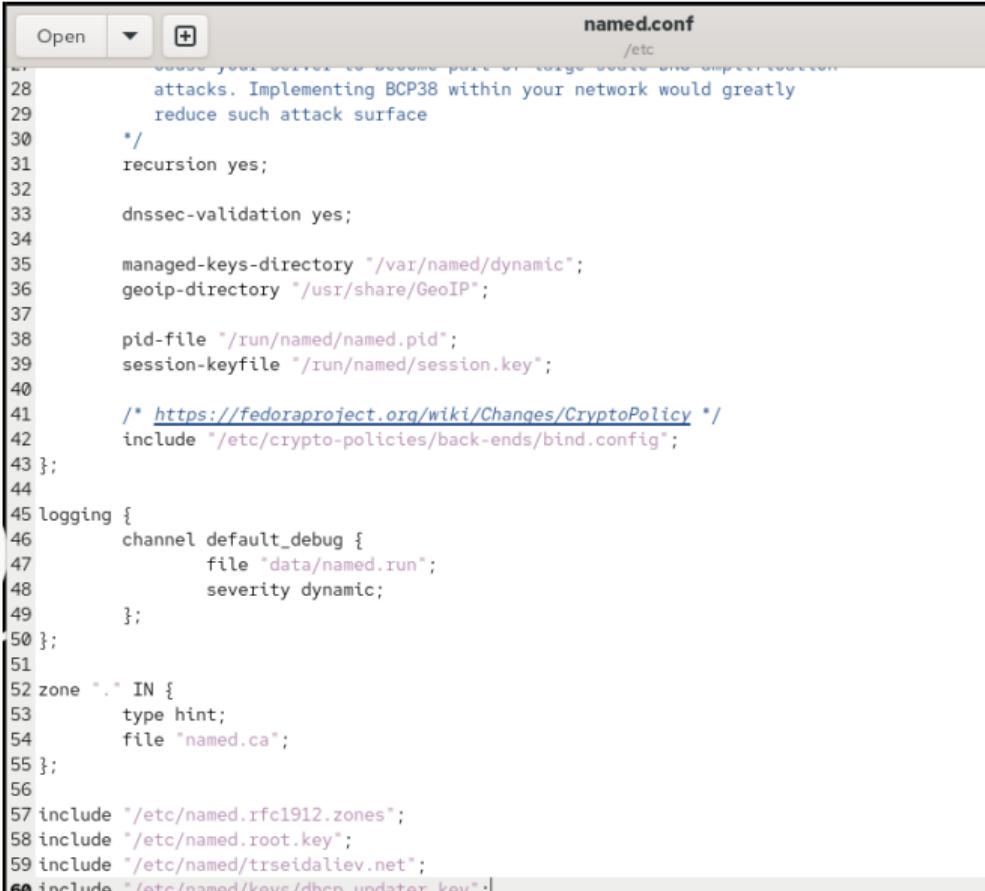
Настройка DDNS

Генерация TSIG-ключа

```
[root@server.trseidaliev.net server]#  
[root@server.trseidaliev.net server]# mkdir -p /etc/named/keys  
[root@server.trseidaliev.net server]# tsig-keygen -a HMAC-SHA512 DHCP_UPDATER > /etc/named/keys/dhcp_updater.key  
[root@server.trseidaliev.net server]# cat /etc/named/keys/dhcp_updater.key  
key "DHCP_UPDATER" {  
    algorithm hmac-sha512;  
    secret "vn63cmYZgm5UQRNJs0feoxh5aWl//QexHcWouly6Kn6IuLJBvEvQO/RIWTad/lkdBShKiVa+OmwAa3AGyoSrlA==";  
};  
[root@server.trseidaliev.net server]# chown -R named:named /etc/named/keys/  
[root@server.trseidaliev.net server]# █
```

Рис. 11: Создание ключа DHCP_UPDATER

Включение ключа в named.conf



The screenshot shows a code editor window titled "named.conf" with the path "/etc". The file contains a DNS configuration script. Lines 40 through 43 include a comment about a crypto policy and an include statement for a back-end configuration file. Line 60 includes a key file for DHCP updates.

```
28     attacks. Implementing BCP38 within your network would greatly
29     reduce such attack surface
30 */
31 recursion yes;
32
33 dnssec-validation yes;
34
35 managed-keys-directory "/var/named/dynamic";
36 geoip-directory "/usr/share/GeoIP";
37
38 pid-file "/run/named/named.pid";
39 session-keyfile "/run/named/session.key";
40
41 /* https://fedoraproject.org/wiki/Changes/CryptoPolicy */
42 include "/etc/crypto-policies/back-ends/bind.config";
43 };
44
45 logging {
46     channel default_debug {
47         file "data/named.run";
48         severity dynamic;
49     };
50 };
51
52 zone "." IN {
53     type hint;
54     file "named.ca";
55 };
56
57 include "/etc/named.rfc1912.zones";
58 include "/etc/named.root.key";
59 include "/etc/named/trseidaliev.net";
60 include "/etc/named/keys/dhcp_updater.key";
```

Разрешения на обновления зоны

The screenshot shows a text editor window with the title bar "trseidaliev.net /etc/named". The editor interface includes buttons for "Open", "Save", and "New". The code in the editor is a named configuration file:

```
1 // named.rfc1912.zones:  
2 //  
3 // Provided by Red Hat caching-nameserver package  
4 //  
5 // ISC BIND named zone configuration for zones recommended by  
6 // RFC 1912 section 4.1 : localhost TLDs and address zones  
7 // and https://tools.ietf.org/html/rfc6303  
8 // (c)2007 R W Franks  
9 //  
10 // See /usr/share/doc/bind*/sample/ for example named configuration files.  
11 //  
12 // Note: empty-zones-enable yes; option is default.  
13 // If private ranges should be forwarded, add  
14 // disable-empty-zone "."; into options  
15 //  
16  
17 zone "trseidaliev.net" IN {  
18     type master;  
19     file "master/fz/trseidaliev.net";  
20     update-policy {  
21         grant DHCP_UPDATER wildcard *.trseidaliev.net A DHCID;  
22     };  
23 };  
24  
25 zone "1.168.192.in-addr.arpa" IN {  
26     type master;  
27     file "master/rz/192.168.1";  
28     update-policy {  
29         grant DHCP_UPDATER wildcard *.1.168.192.in-addr.arpa PTR DHCID;  
30     };  
31 };
```

Разрешения на обновления зоны



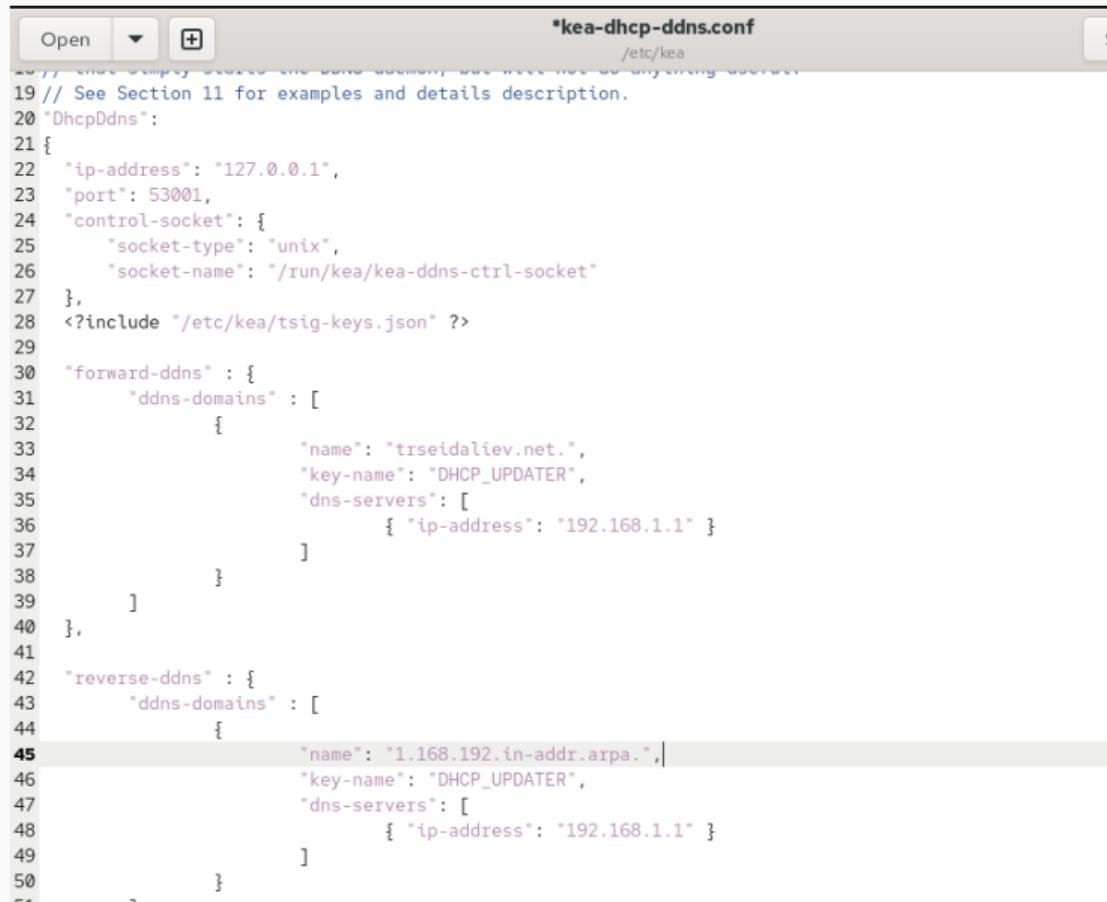
The screenshot shows a JSON configuration file named `tsig-keys.json` located at `/etc/kea`. The file contains the following content:

```
1 "tsig-keys": [  
2 {  
3     "name": "DHCP_UPDATER",  
4     "algorithm": "hmac-sha512",  
5     "secret": "vn63cmyzgm5UQRNJs0feoxh5aWl//QexHcWouly6Kn6IuLJBvEvQO/RIWTad/lkdBShKtVa+0mwAa3AGyoSr1A=="  
6 }  
7 ]  
8
```

The line numbers 1 through 8 are visible on the left side of the code editor. The file is currently saved.

Рис. 14: Разрешение обновлений в обратной зоне

Настройка tsig-keys.json



```
*kea-dhcp-ddns.conf
/etc/kea
19 // See Section 11 for examples and details description.
20 "DhcpDdns":
21 {
22     "ip-address": "127.0.0.1",
23     "port": 53001,
24     "control-socket": {
25         "socket-type": "unix",
26         "socket-name": "/run/kea/kea-ddns-ctrl-socket"
27     },
28     <?include "/etc/kea/tsig-keys.json" ?>
29
30     "forward-ddns" : {
31         "ddns-domains" : [
32             {
33                 "name": "trseidaliev.net.",
34                 "key-name": "DHCP_UPDATER",
35                 "dns-servers": [
36                     { "ip-address": "192.168.1.1" }
37                 ]
38             }
39         ]
40     },
41
42     "reverse-ddns" : {
43         "ddns-domains" : [
44             {
45                 "name": "1.168.192.in-addr.arpa.",
46                 "key-name": "DHCP_UPDATER",
47                 "dns-servers": [
48                     { "ip-address": "192.168.1.1" }
49                 ]
50             }
51         ]
52     }
53 }
```

Настройка kea-dhcp-ddns.conf

```
[root@server.trseidaliev.net server]#  
[root@server.trseidaliev.net server]# kea-dhcp-ddns -t /etc/kea/kea-dhcp-ddns.conf  
2025-11-19 19:21:41.818 INFO [kea-dhcp-ddns.dctl/24626.140596514251072] DCTL_CONFIG_CHECK_COMPLETE server has completed configuration check: listening on 127.0.0.1, port 53001, using UDP, result: success(0), text=Configuration check successful  
[root@server.trseidaliev.net server]# 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.trseidaliev.net server]# 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 Wed 2025-11-19 19:22:08 MSK; 13s ago  
     Invocation: 0fe9927993944887969997b06645d8ef  
       Docs: man:kea-dhcp-ddns(8)  
     Main PID: 24872 (kea-dhcp-ddns)  
        Tasks: 5 (limit: 10381)  
      Memory: 1.7M (peak: 6.1M)  
        CPU: 10ms  
      CGroup: /system.slice/kea-dhcp-ddns.service  
              └─24872 /usr/sbin/kea-dhcp-ddns -c /etc/kea/kea-dhcp-ddns.conf  
  
Nov 19 19:22:08 server.trseidaliev.net systemd[1]: Started kea-dhcp-ddns.service - Kea DHCP-DDNS Server.  
Nov 19 19:22:08 server.trseidaliev.net kea-dhcp-ddns[24872]: 2025-11-19 19:22:08.247 INFO [kea-dhcp-ddns.dctl/24872] >  
Nov 19 19:22:08 server.trseidaliev.net kea-dhcp-ddns[24872]: INFO COMMAND_ACCEPTOR_START Starting to accept connecti>  
Nov 19 19:22:08 server.trseidaliev.net kea-dhcp-ddns[24872]: INFO DCTL_CONFIG_COMPLETE server has completed configur>  
Nov 19 19:22:08 server.trseidaliev.net kea-dhcp-ddns[24872]: INFO DHCP_DDNS_STARTED Kea DHCP-DDNS server version 2.6>  
lines 1-17/17 (END)
```

Рис. 16: Фрагмент kea-dhcp-ddns.conf

Запуск службы DDNS

```
Open ▾ + kea-dhcp4.conf /etc/kea
26 // DHCPRV configuration starts here. This section will be read by DHCPRV service
27 // and will be ignored by other components.
28 "Dhcp4": {
29     // Add names of your network interfaces to listen on.
30     "interfaces-config": {
31         // See section 8.2.4 for more details. You probably want to add just
32         // interface name (e.g. "eth0" or specific IPv4 address on that
33         // interface name (e.g. "eth0/192.0.2.1").
34         "interfaces": [ "eth1" ]
35
36         // Kea DHCPv4 server by default listens using raw sockets. This ensures
37         // all packets, including those sent by directly connected clients
38         // that don't have IPv4 address yet, are received. However, if your
39         // traffic is always relayed, it is often better to use regular
40         // UDP sockets. If you want to do that, uncomment this line:
41         // "dhcp-socket-type": "udp"
42     },
43
44     "dhcp-ddns" : {
45         "enable-updates": true
46     },
47     "ddns-qualifying-suffix": "trseidaliev.net",
48     "ddns-override-client-update": true,
49
50     // Kea supports control channel, which is a way to receive management
51     // commands while the server is running. This is a Unix domain socket that
52     // can be used for writing JSON messages to Kea.
```

Включение DDNS в DHCP4

```
[root@server.trseidaliev.net server]# kea-dhcp4 -t /etc/kea/kea-dhcp4.conf
2025-11-19 19:24:27.584 INFO [kea-dhcp4.hosts/25203.139864501876928] HOSTS_BACKENDS_REGISTERED the following host backend types are available: mysql postgresql
2025-11-19 19:24:27.585 WARN [kea-dhcp4.dhcpsrv/25203.139864501876928] DHCP4_MT_DISABLED_QUEUE_CONTROL disabling dhcp queue control when multi-threading is enabled.
2025-11-19 19:24:27.585 WARN [kea-dhcp4.dhcp/25203.139864501876928] DHCP4_RESERVATIONS_LOOKUP_FIRST_ENABLED Multi-threading is enabled and host reservations lookup is always performed first.
2025-11-19 19:24:27.585 INFO [kea-dhcp4.dhcpsrv/25203.139864501876928] DHCP4_CFMGR_NEW_SUBNET4 a new subnet has been added to configuration: 192.168.1.0/24 with params: t1=900, t2=1800, valid-lifetime=3600
2025-11-19 19:24:27.585 INFO [kea-dhcp4.dhcpsrv/25203.139864501876928] DHCP4_CFMGR_SOCKET_TYPE_SELECT using socket type raw
2025-11-19 19:24:27.585 INFO [kea-dhcp4.dhcpsrv/25203.139864501876928] DHCP4_CFMGR_ADD_IFACE listening on interface eth1
2025-11-19 19:24:27.585 INFO [kea-dhcp4.dhcpsrv/25203.139864501876928] DHCP4_CFMGR_SOCKET_TYPE_DEFAULT "dhcp-socket-type" not specified , using default socket type raw
[root@server.trseidaliev.net server]#
[root@server.trseidaliev.net server]# systemctl restart kea-dhcp4.service
[root@server.trseidaliev.net server]# 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 Wed 2025-11-19 19:24:41 MSK; 5s ago
      Invocation: cb7e5dalc0e840fb954f99de7c5ce3c3
        Docs: man:kea-dhcp4(8)
     Main PID: 25273 (kea-dhcp4)
        Tasks: 7 (limit: 10381)
       Memory: 2.5M (peak: 6M)
          CPU: 13ms
        CGroup: /system.slice/kea-dhcp4.service
                   └─25273 /usr/sbin/kea-dhcp4 -c /etc/kea/kea-dhcp4.conf

Nov 19 19:24:41 server.trseidaliev.net systemd[1]: Started kea-dhcp4.service - Kea DHCPv4 Server.
Nov 19 19:24:41 server.trseidaliev.net kea-dhcp4[25273]: 2025-11-19 19:24:41.161 INFO [kea-dhcp4.dhcp4/25273.1399095>
Nov 19 19:24:41 server.trseidaliev.net kea-dhcp4[25273]: 2025-11-19 19:24:41.161 INFO [kea-dhcp4.commands/25273.1399>
lines 1-15/15 (END)
```

Проверка DDNS

Проверка A-записи, созданной автоматически

```
[trseidaliev@client.trseidaliev.net ~]$ dig @192.168.1.1 client.trseidaliev.net

; <>> DiG 9.18.33 <>> @192.168.1.1 client.trseidaliev.net
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 58475
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: 129fa27f46fdda9e01000000691def862038615073907298 (good)
;; QUESTION SECTION:
;client.trseidaliev.net.          IN      A

;; ANSWER SECTION:
client.trseidaliev.net. 1200    IN      A      192.168.1.30

;; Query time: 1 msec
;; SERVER: 192.168.1.1#53(192.168.1.1) (UDP)
;; WHEN: Wed Nov 19 16:30:50 UTC 2025
;; MSG SIZE  rcvd: 95

[trseidaliev@client.trseidaliev.net ~]$
```

Итоги работы

Основные результаты

- Настроен DHCP-сервер Kea с автоматической выдачей IP
- Настроены прямые и обратные зоны Bind9
- Реализован механизм DDNS с TSIG
- Проверены A- и PTR-записи, создаваемые автоматически
- Перенесены конфигурации в структуру Vagrant
- Создан сценарий `dhcp.sh` для автоматического развертывания