Администрирование сетевых подсистем

Настройка DHCP-сервера (Лабораторная работа №3)

Суннатилло Махмудов

14 сентября 2025

Российский университет дружбы народов, Москва, Россия

Цели и задачи работы

Цель лабораторной работы

Приобретение практических навыков установки и конфигурирования DHCP-сервера.

Задачи лабораторной работы

1. Установить и запустить службу **Kea DHCP**.
2. Настроить подсеть, параметры выдачи адресов и привязку к интерфейсу.
3. Настроить интеграцию с DNS (прямая и обратная зоны).
4. Реализовать динамическое обновление записей (DDNS).
5. Проверить работу клиента и автоматизацию конфигурации.

Теоретическая часть

Основы DHCP

- Автоматическая выдача IP-адресов и сетевых параметров.
- Основные параметры: IP, маска, шлюз, DNS, lease time.
- Этапы обмена сообщениями:
  - **Discover**
  - **Offer**
  - **Request**
  - **Acknowledge (ACK)**

Процесс выполнения лабораторной работы

Конфигурирование DHCP-сервера

Настройка конфигурации DHCP

```
// }
// 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": "smahmudov.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": "smahmudov.net"
},

// String options that have a comma in their values need to have
// it escaped (i.e. each comma is preceded by two backslashes).
// That's because commas are reserved for separating fields in
```

Настройка конфигурации DHCP

```
// structures.
"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"
            }
        ],
```

Привязка DHCP к интерфейсу

```
// DHCPv4 configuration starts here. This section will be read by DHCPv4 server
// and will be ignored by other components.
"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 name (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. 4: Привязка DHCP-сервера к интерфейсу

Настройка зон DNS

Open

*smahmudov.net
/var/named/master/fz

```
$TTL 1D
@       IN SOA  @ server.smahmudov.net. (
                                        2025091400      ; serial
                                        1D      ; refresh
                                        1H      ; retry
                                        1W      ; expire
                                        3H )    ; minimum
        NS      @
        A       192.168.1.1
$ORIGIN smahmudov.net.
server  A       192.168.1.1
ns      A       192.168.1.1
dhcp    A       192.168.1.1
```

Рис. 5: Файл прямой зоны

Настройка зон DNS

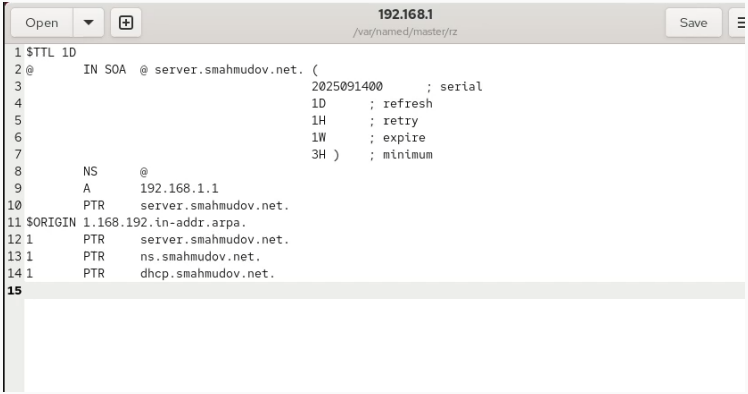


Рис. 6: Файл обратной зоны

Проверка доступности DHCP

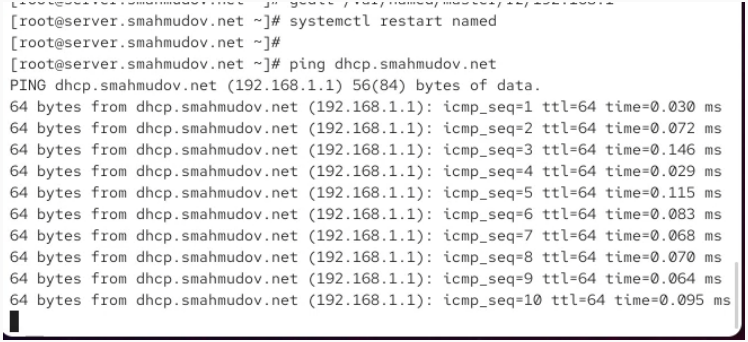


Рис. 7: Проверка доступности DHCP-сервера по имени

```
[root@server.smahmudov.net ~]#
[root@server.smahmudov.net ~]# firewall-cmd --add-service=dhcp
success
[root@server.smahmudov.net ~]# firewall-cmd --add-service=dhcp --permanent
success
[root@server.smahmudov.net ~]# restorecon -vR /etc
Relabeled /etc/NetworkManager/system-connections/eth1.nmconnection from unconfin
ed_u:object_r:user_tmp_t:s0 to unconfined_u:object_r:NetworkManager_etc_rw_t:s0
[root@server.smahmudov.net ~]# restorecon -vR /var/named/
[root@server.smahmudov.net ~]# restorecon -vR /var/lib/kea/
[root@server.smahmudov.net ~]#
```

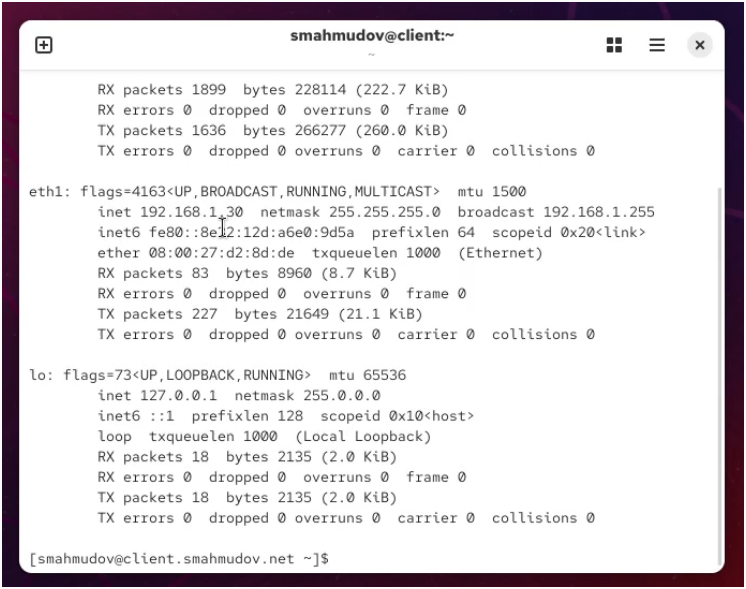
Рис. 8: Разрешение DHCP в firewall

Анализ работы DHCP на клиенте

```
[root@server.smahmudov.net ~]#
[root@server.smahmudov.net ~]# systemctl start kea-dhcp4.service
[root@server.smahmudov.net ~]#
[root@server.smahmudov.net ~]# 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:d2:8d:de,01:08:00:27:d2:8d:de,3600,1757837446,1,0,0,client,0,,0
192.168.1.30,08:00:27:d2:8d:de,01:08:00:27:d2:8d:de,3600,1757837446,1,0,0,client,0,,0
192.168.1.30,08:00:27:d2:8d:de,01:08:00:27:d2:8d:de,3600,1757837452,1,0,0,client,0,,0
[root@server.smahmudov.net ~]#
```

Рис. 9: Список аренд DHCP

Анализ работы DHCP на клиенте



Настройка обновления DNS-зоны

```
16
17 zone "smahmudov.net" IN {
18         type master;
19         file "master/fz/smahmudov.net";
20         update-policy {
21                 grant DHCP_UPDATER wildcard *.smahmudov.net A DHCID;
22         };
23
24 };
25
26 zone "1.168.192.in-addr.arpa" IN {
27         type master;
28         file "master/rz/192.168.1";
29         update-policy {
30                 grant DHCP_UPDATER wildcard *.1.168.192.in-addr.arpa PTR DHCID;
31         };
32 };
```

Рис. 11: Создание ключа TSIG

Настройка обновления DNS-зоны

```
{
  "ip-address": "127.0.0.1",
  "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": "smahmudov.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" }
                        ]
                }
        ]
  },
```

Настройка обновления DNS-зоны

```
[root@server.smahmudov.net ~]# gedit /etc/named/smahmudov.net
[root@server.smahmudov.net ~]#
[root@server.smahmudov.net ~]# named-checkconf
[root@server.smahmudov.net ~]#
[root@server.smahmudov.net ~]# systemctl restart named
[root@server.smahmudov.net ~]# touch /etc/kea/tsign-keys.json
[root@server.smahmudov.net ~]# cat /etc/named/keys/dhcp_updater.key
key "DHCP_UPDATER" {
        algorithm hmac-sha512;
        secret "9RDtHBpFC3HU7NmpqS2NUVvPBkJgRA7jKLflk03MgrEnglH7wLugm4X+PxVPi62kb6KzpCTdvoVWbvsgmZn9Rg==";
};
[root@server.smahmudov.net ~]# gedit /etc/kea/tsign-keys.json
[root@server.smahmudov.net ~]#
[root@server.smahmudov.net ~]# mv /etc/kea/tsign-keys.json /etc/kea/tsig-keys.json
[root@server.smahmudov.net ~]# chown kea:kea /etc/kea/tsig-keys.json
[root@server.smahmudov.net ~]# chmod 640 /etc/kea/tsig-keys.json
[root@server.smahmudov.net ~]#
[root@server.smahmudov.net ~]#
[root@server.smahmudov.net ~]# gedit /etc/kea/kea-dhcp-ddns.conf
[root@server.smahmudov.net ~]# chown kea:kea /etc/kea/kea-dhcp-ddns.conf
[root@server.smahmudov.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.smahmudov.net ~]# systemctl s kea-dhcp-ddns.service
```

Рис. 13: Файл tsig-keys.json

Настройка обновления DNS-зоны

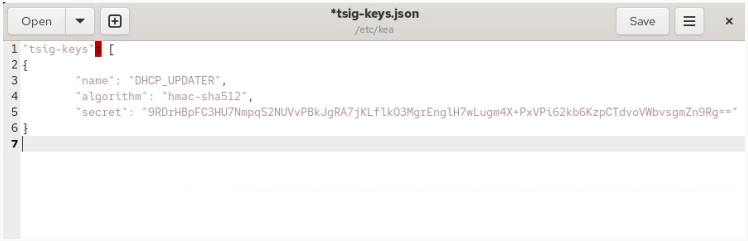


Рис. 14: Файл kea-dhcp-ddns.conf

Настройка обновления DNS-зоны

Рис. 15: Запуск kea-dhcp-ddns.service

Настройка обновления DNS-зоны

```
// and will be ignored by other components.
"Dhcp4": {
    "interfaces-config": {

        "interfaces": [ "eth1" ]

    },

    "control-socket": {
        "socket-type": "unix",
        "socket-name": "kea4-ctrl-socket"
    },

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

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

Рис. 16: Изменения в конфигурации DHCP

Настройка обновления DNS-зоны

Рис. 17: Перезапуск kea-dhcp4

Настройка обновления DNS-зоны

```
[root@client.smahmudov.net ~]# dig @192.168.1.1 client.smahmudov.net

; <<>> DiG 9.18.33 <<>> @192.168.1.1 client.smahmudov.net
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 5923
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: f3d40819e380cd900100000068c671b15bc3d0ca72a8c284 (good)
;; QUESTION SECTION:
;client.smahmudov.net.          IN      A

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

;; Query time: 0 msec
;; SERVER: 192.168.1.1#53(192.168.1.1) (UDP)
;; WHEN: Sun Sep 14 07:41:37 UTC 2025
;; MSG SIZE  rcvd: 93

[root@client.smahmudov.net ~]#
```

Рис. 18: Проверка DNS-записи клиента

Выводы по проделанной работе

Вывод

В ходе лабораторной работы был развернут и настроен DHCP-сервер **Kea**.

Были реализованы:

* назначение IP-адресов клиентам;
* настройка прямой и обратной зон в DNS;
* динамическое обновление записей DDNS.

Работоспособность подтверждена через **ifconfig**, **ping**, **dig**.