

Администрирование сетевых подсистем

Лабораторная работа №3

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Цель работы

Приобретение практических навыков по установке и конфигурированию DHCP-сервера.

Выполнение лабораторной работы

```
[root@server ~]# dnf -y install kea
Last metadata expiration check: 0:02:16 ago on Sun 16 Nov 2025 02:03:03 AM MSK.
Dependencies resolved.
=====
| Package           | Architecture | Version      | Repository | Size |
|=====|
| Installing:      |             |              |            |       |
| kea               | x86_64      | 2.6.4-1.el9  | spel       | 1.3 M |
|=====|
| Installing dependencies: |             |              |            |       |
| kea-libs          | x86_64      | 2.6.4-1.el9  | spel       | 2.0 M |
| log4plus          | x86_64      | 2.6.5-15.el9 | spel       | 337 k |
| mariadb-connector-c | x86_64      | 3.2.6-1.el9_0 | appstream  | 195 k |
| mariadb-connector-c-config | x86_64      | 3.2.6-1.el9_0 | noarch     | 9.8 k  |
| postgresql-private-libs | x86_64      | 13.22-1.el9_6 | appstream  | 137 k  |
|=====|
Transaction Summary
=====
Install 6 Packages
=====
Total download size: 5.0 M
Installed size: 18 M
Downloaded packages:
(1/6): log4plus-2.6.5-15.el9.x86_64.rpm
(2/6): mariadb-connector-c-3.2.6-1.el9_0.x86_64.rpm
(3/6): postgresql-private-libs-13.22-1.el9_6.x86_64.rpm
(4/6): mariadb-connector-c-config-3.2.6-1.el9_0.noarch.rpm
(5/6): kea-2.6.4-1.el9.x86_64.rpm
(6/6): kea-libs-2.6.4-1.el9.x86_64.rpm
=====
Total                                         434 kB/s | 5.0 MB  00:11
Running transaction check
Transaction check succeeded.
Running transaction test
Transaction test succeeded.
Running transaction
  Preparing : mariadb-connector-c-config-3.2.6-1.el9_0.noarch
  Installing : mariadb-connector-c-3.2.6-1.el9_0.x86_64
  Installing : postgresql-private-libs-13.22-1.el9_6.x86_64
  Installing : log4plus-2.6.5-15.el9.x86_64
  Installing : kea-libs-2.6.4-1.el9.x86_64
  Running scriptlet: kea-2.6.4-1.el9.x86_64
  Installing : kea-2.6.4-1.el9.x86_64
  Running scriptlet: kea-2.6.4-1.el9.x86_64
  Verifying   : kea-2.6.4-1.el9.x86_64
  Verifying   : kea-libs-2.6.4-1.el9.x86_64
  Verifying   : log4plus-2.6.5-15.el9.x86_64
  Verifying   : mariadb-connector-c-3.2.6-1.el9_0.x86_64
  Verifying   : postgresql-private-libs-13.22-1.el9_6.x86_64
  Verifying   : mariadb-connector-c-config-3.2.6-1.el9_0.noarch
  =====
Installed:
  kea-2.6.4-1.el9.x86_64
  log4plus-2.6.5-15.el9.x86_64
  mariadb-connector-c-config-3.2.6-1.el9_0.noarch
  mariadb-connector-c-3.2.6-1.el9_0.x86_64
  postgresql-private-libs-13.22-1.el9_6.x86_64
  spel-2.0.0-1.el9_0.x86_64
```

Рис. 1: Установка dhcp

Выполнение лабораторной работы

```
// This is a template for a configuration file.
{
    "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": "user.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": "user.net"
},
```

Рис. 2: Замена шаблона domain-name

Выполнение лабораторной работы

```
"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. 3: Создание собственной dhcp-сети

Выполнение лабораторной работы

```
"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" ]
```

Рис. 4: Привязка dhcpcd к eth1

Выполнение лабораторной работы

```
[root@server ~]# ping dhcp.user.net
PING dhcp.user.net (192.168.1.1) 56(84) bytes of data.
64 bytes from dhcp.user.net.1.168.192.in-addr.arpa (192.168.1.1): icmp_seq=1 ttl=64 time=0.099 ms
64 bytes from server.user.net (192.168.1.1): icmp_seq=2 ttl=64 time=0.290 ms
64 bytes from ns.user.net.1.168.192.in-addr.arpa (192.168.1.1): icmp_seq=3 ttl=64 time=0.051 ms
64 bytes from ns.user.net.1.168.192.in-addr.arpa (192.168.1.1): icmp_seq=4 ttl=64 time=0.048 ms
64 bytes from server.user.net (192.168.1.1): icmp_seq=5 ttl=64 time=0.059 ms
64 bytes from dhcp.user.net.1.168.192.in-addr.arpa (192.168.1.1): icmp_seq=6 ttl=64 time=0.064 ms
64 bytes from ns.user.net.1.168.192.in-addr.arpa (192.168.1.1): icmp_seq=7 ttl=64 time=0.085 ms
64 bytes from server.user.net (192.168.1.1): icmp_seq=8 ttl=64 time=0.066 ms
64 bytes from dhcp.user.net.1.168.192.in-addr.arpa (192.168.1.1): icmp_seq=9 ttl=64 time=0.062 ms
64 bytes from ns.user.net.1.168.192.in-addr.arpa (192.168.1.1): icmp_seq=10 ttl=64 time=0.050 ms
64 bytes from ns.user.net.1.168.192.in-addr.arpa (192.168.1.1): icmp_seq=11 ttl=64 time=0.061 ms
64 bytes from dhcp.user.net.1.168.192.in-addr.arpa (192.168.1.1): icmp_seq=12 ttl=64 time=0.062 ms
64 bytes from ns.user.net.1.168.192.in-addr.arpa (192.168.1.1): icmp_seq=13 ttl=64 time=0.061 ms
64 bytes from server.user.net (192.168.1.1): icmp_seq=14 ttl=64 time=0.064 ms
64 bytes from dhcp.user.net.1.168.192.in-addr.arpa (192.168.1.1): icmp_seq=15 ttl=64 time=0.068 ms
64 bytes from server.user.net (192.168.1.1): icmp_seq=16 ttl=64 time=0.063 ms
```

Рис. 5: Обращение к dhcp-серверу

Выполнение лабораторной работы

```
[root@server ~]# tail -f /var/log/messages
Nov 16 00:28:57 server named[44692]: timed out resolving 'ns3.fastly.net/AAAA/IN': 192.168.1.1#53
Nov 16 00:28:57 server named[44692]: timed out resolving 'ns3.fastly.net/AAAA/IN': 192.168.1.1#53
Nov 16 00:28:57 server named[44692]: timed out resolving 'ns1.fastly.net/AAAA/IN': 192.168.1.1#53
Nov 16 00:28:57 server named[44692]: timed out resolving 'ns4.fastly.net/AAAA/IN': 192.168.1.1#53
Nov 16 00:28:57 server named[44692]: timed out resolving 'ns2.fastly.net/AAAA/IN': 192.168.1.1#53
Nov 16 00:28:57 server named[44692]: timed out resolving 'ns4.fastly.net/AAAA/IN': 192.168.1.1#53
Nov 16 00:28:57 server named[44692]: timed out resolving 'ns2.fastly.net/AAAA/IN': 192.168.1.1#53
Nov 16 00:28:57 server named[44692]: timed out resolving 'ns1.fastly.net/AAAA/IN': 192.168.1.1#53
Nov 16 00:35:12 server systemd[1]: Starting Hostname Service...
Nov 16 00:35:12 server systemd[1]: Started Hostname Service.
Nov 16 00:35:42 server systemd[1]: systemd-hostnamed.service: Deactivated successfully.
Nov 16 00:35:55 server systemd[1]: Started Kea DHCPv4 Server.
Nov 16 00:35:55 server kea-dhcp4[44781]: 2025-11-16 03:35:55.327 INFO  [kea-dhcp4.dhcp4/44781.140249854556288] DH
CP4_STARTING Kea DHCPv4 server version 2.6.4 (stable) starting
Nov 16 00:35:55 server kea-dhcp4[44781]: 2025-11-16 03:35:55.330 INFO  [kea-dhcp4.commands/44781.140249854556288]
COMMAND_RECEIVED Received command 'config-set'
```

Рис. 6: Проверка корректной работы dhcp-сервера

Выполнение лабораторной работы

```
[root@server ~]# mkdir -p /etc/named/keys
[root@server ~]# tsig-keygen -a HMAC-SHA512 DHCP_UPDATER > /etc/named/keys
dhcp_updater.key
[root@server ~]# █
```

Рис. 7: Создание ключа

Выполнение лабораторной работы

```
GNU nano 5.6.1          /etc/named.conf          Mon Jul 10 10:30:00 2023

recursion yes;

dnssec-enable no;
dnssec-validation no;

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/user.net";
include "/etc/named/keys/dhcp_updater.key"; █
```

Рис. 8: Подключение ключа

Выполнение лабораторной работы

```
| GNU nano 5.6.1          /etc/kea/tsig-keys.json
| "tsig-keys": [
|   {
|     "name": "DHCP_UPDATER",
|     "algorithm": "hmac-sha512",
|     "secret": "04ywtrL72FkmB+2luY+zyu5HIAxUCVxqiiIUU+gu+9UUUvrlur50h>
|   }
| ],
|
```

Рис. 9: tsig-keys.json

Выполнение лабораторной работы

```
    "DhcpDdns": {
        "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": "user.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": [

```

Рис. 10: Изменения в kea-dhcp-ddns.conf

Выполнение лабораторной работы

```
},
"dhcp-ddns": {
    "enable-updates": true
},
"ddns-qualifying-suffix": "user.net",
|"ddns-override-client-update": true,
// Kea supports control channel, which is a way to receive management
// commands while the server is running. This is a Unix domain socket that
// receives commands formatted in JSON, e.g. config-set (which sets new
// configuration), config-reload (which tells Kea to reload its
// configuration from file), statistic-get (to retrieve statistics) and many
```

Рис. 11: Изменения в kea-dhcp4.conf

Выполнение лабораторной работы

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

; <>> DiG 9.16.23-RH <>> @192.168.1.1 client.user.net
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 44211
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

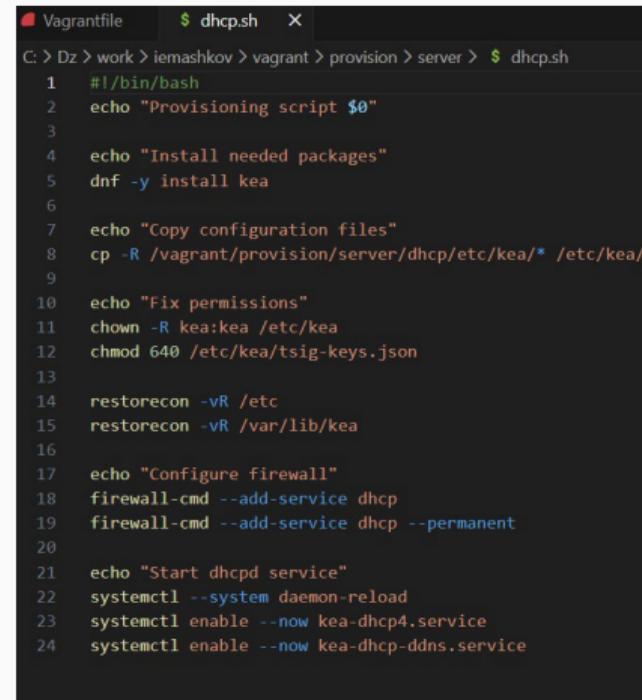
;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
; COOKIE: 789512cfec0857ba010000006925b7833ec148d0b3e19146 (good)
;; QUESTION SECTION:
;client.user.net.          IN      A

;; AUTHORITY SECTION:
user.net.           10800   IN      SOA     user.net. server.user.net. 20251
11603 86400 3600 604800 10800

;; Query time: 1 msec
;; SERVER: 192.168.1.1#53(192.168.1.1)
;; WHEN: Tue Nov 25 17:04:51 MSK 2025
;; MSG SIZE  rcvd: 115
```

Рис. 12: Обращение client.user.net

Выполнение лабораторной работы



The screenshot shows a terminal window with two tabs open. The left tab is titled 'Vagrantfile' and contains the path 'C: > Dz > work > iemashkov > vagrant > provision > server'. The right tab is titled '\$ dhcp.sh' and contains the path '\$ dhcp.sh'. The content of the '\$ dhcp.sh' tab is a shell script named 'dhcp.sh' with the following code:

```
1  #!/bin/bash
2  echo "Provisioning script $0"
3
4  echo "Install needed packages"
5  dnf -y install kea
6
7  echo "Copy configuration files"
8  cp -R /vagrant/provision/server/dhcp/etc/kea/* /etc/kea/
9
10 echo "Fix permissions"
11 chown -R kea:kea /etc/kea
12 chmod 640 /etc/kea/tsig-keys.json
13
14 restorecon -vR /etc
15 restorecon -vR /var/lib/kea
16
17 echo "Configure firewall"
18 firewall-cmd --add-service dhcp
19 firewall-cmd --add-service dhcp --permanent
20
21 echo "Start dhcpcd service"
22 systemctl --system daemon-reload
23 systemctl enable --now kea-dhcp4.service
24 systemctl enable --now kea-dhcp-ddns.service
```

Рис. 13: dhcp.sh

Выполнение лабораторной работы

```
server.vm.provision "server dhcp",
  type: "shell",
  preserve_order: true,
  path: "provision/server/dhcp.sh"
```

Рис. 14: Изменения в файле Vagrantfile

Выводы

Во время выполнения лабораторной работы я приобрёл практические навыки по установке и конфигурированию DHCP-сервера.