

DYNAMIC DNS

1. Introduction

In this practice we created a small network using three virtual machines made with **Vagrant** and **Debian**.

The main goal is to configure:

- A **DNS server** (BIND9)
- A **DHCP server** (ISC DHCP Server)
- A **DHCP client**

And make the DNS update automatically when the client receives an IP address from the DHCP server (**DDNS**).

2. Environment Preparation with Vagrant

We created a project folder (for example: `DHCP-DNS/`) and added a **Vagrantfile** with three machines:

- `server-dns` → 192.168.58.10
- `server-dhcp` → 192.168.58.11
- `client` → gets IP by DHCP

All machines are connected to the same internal network **192.168.58.0/24**.

3. DNS Server Configuration

Access the DNS server:

```
vagrant ssh server-dns
```

3.1 Install BIND9

```
sudo apt install bind9 -y
```

3.2 Create the TSIG key

This key is used for dynamic DNS updates.

 **Modified file:**

- `/etc/bind/ddns.key`

3.3 Edit the DNS zone settings

We configured the forward and reverse zones.

 **Modified file:**

- `/etc/bind/named.conf.local`

3.4 Zone files

The practice uses two zone files:

 **Files located in:**

- `/etc/bind/db.example.test`
- `/etc/bind/db.192`

3.5 Restart DNS service

```
sudo systemctl restart bind9
```

```
sudo systemctl status bind9
```

```
alumnor@a112-pc05:~/DHCP-DNS$ vagrant ssh server-dns
vagrant@server-dns:~$ systemctl status bind9
● named.service - BIND Domain Name Server
  Loaded: loaded (/lib/systemd/system/named.service; enabled; preset: enabled)
  Active: active (running) since Fri 2025-11-14 07:27:40 UTC; 53min ago
    Docs: man:named(8)
   Main PID: 439 (named)
     Status: "running"
      Tasks: 6 (limit: 496)
     Memory: 61.5M
        CPU: 236ms
      CGroup: /system.slice/named.service
              └─439 /usr/sbin/named -f -u bind
```

4. DHCP Server Configuration

Access the DHCP server:

```
vagrant ssh server-dhcp
```

4.1 Install the DHCP server

```
sudo apt install isc-dhcp-server -y
```

4.2 Copy the TSIG key

We copy the key from the DNS server to the DHCP server.

 File copied to:

- /etc/dhcp/ddns.key

4.3 Edit the DHCP configuration

We configured:

- DHCP range
- Router
- DNS domain
- DNS server
- Dynamic DNS options (DDNS)

 Modified file:

- /etc/dhcp/dhcpd.conf

4.4 Check for errors

```
sudo dhcpcd -t
```

```
vagrant@server-dhcp:~$ sudo dhcpcd -t
Internet Systems Consortium DHCP Server 4.4.3-P1
Copyright 2004-2022 Internet Systems Consortium.
All rights reserved.

For info, please visit https://www.isc.org/software/dhcp/
Config file: /etc/dhcp/dhcpd.conf
Database file: /var/lib/dhcp/dhcpd.leases
PID file: /var/run/dhcpd.pid
```

4.5 Restart the DHCP service

```
sudo systemctl restart isc-dhcp-server
```

```
sudo systemctl status isc-dhcp-server
```

```
vagrant@server-dhcp:~$ systemctl status isc-dhcp-server
● isc-dhcp-server.service - LSB: DHCP server
  Loaded: loaded (/etc/init.d/isc-dhcp-server; generated)
  Active: active (running) since Fri 2025-11-14 07:28:12 UTC; 55min ago
    Docs: man:systemd-sysv-generator(8)
   Tasks: 1 (limit: 496)
  Memory: 4.6M
     CPU: 60ms
   CGroup: /system.slice/isc-dhcp-server.service
           └─429 /usr/sbin/dhcpd -4 -q -cf /etc/dhcp/dhcpd.conf eth1
```

5. DHCP Client Configuration

Access the client:

```
vagrant ssh client
```

5.1 Configure the network interface

The client is set to get an IP via DHCP on interface **eth1**.

 **Modified file:**

- `/etc/network/interfaces`

5.2 Renew and get IP

```
sudo dhclient -r eth1
```

```
sudo dhclient -v eth1
```

```
3: eth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
      link/ether 08:00:27:de:b9:ef brd ff:ff:ff:ff:ff:ff
      altname enp0s8
      inet 192.168.58.101/24 brd 192.168.58.255 scope global dynamic eth1
        valid_lft 595sec preferred_lft 595sec
      inet6 fe80::a00:27ff:fedeb9ef/64 scope link
        valid_lft forever preferred_lft forever
```

6. DHCP Verification

6.1 Check the DHCP leases

On the DHCP server:

```
sudo cat /var/lib/dhcp/dhcpd.leases
```

```
lease 192.168.58.101 {
    starts 5 2025/11/14 08:30:04;
    ends 5 2025/11/14 08:40:04;
    cltt 5 2025/11/14 08:30:04;
    binding state active;
    next binding state free;
    rewind binding state free;
    hardware ethernet 08:00:27:de:b9:ef;
    client-hostname "client";
}
```

7. DNS and DDNS Verification

7.1 Check DNS logs

On the DNS server:

```
sudo tail -f /var/log/syslog
```

```
vagrant@server-dns:~$ sudo tail -f /var/log/syslog
2025-11-14T08:25:10.024414+00:00 server-dns systemd[1]: Stopping ssh.service - OpenBSD Secure Shell server...
2025-11-14T08:25:10.029500+00:00 server-dns systemd[1]: ssh.service: Deactivated successfully.
2025-11-14T08:25:10.029706+00:00 server-dns systemd[1]: Stopped ssh.service - OpenBSD Secure Shell server.
2025-11-14T08:25:10.046543+00:00 server-dns systemd[1]: Starting ssh.service - OpenBSD Secure Shell server...
2025-11-14T08:25:10.075015+00:00 server-dns systemd[1]: Started ssh.service - OpenBSD Secure Shell server.
2025-11-14T08:25:10.214840+00:00 server-dns systemd[1]: Reloading.
2025-11-14T08:26:11.396069+00:00 server-dns systemd[1]: apt-daily-upgrade.service: Deactivated successfully.
2025-11-14T08:26:11.402037+00:00 server-dns systemd[1]: Finished apt-daily-upgrade.service - Daily apt upgrade and clean activities.
2025-11-14T08:26:11.402549+00:00 server-dns systemd[1]: apt-daily-upgrade.service: Consumed 3min 1.413s CPU time.
2025-11-14T09:17:01.962918+00:00 server-dns CRON[73826]: (root) CMD (cd / && run-parts --report /etc/cron.hourly)
```

7.2 Check the DNS zone files

Files located at:

- `/etc/bind/db.example.test`

- /etc/bind/db.192

They should contain the client entry.

```
vagrant@server-dns:~$ sudo cat /etc/bind/db.example.test
$TTL 604800
@ IN SOA server-dns.example.test. admin.example.test. (
    1           ; Serial
    604800      ; Refresh
    86400       ; Retry
    2419200     ; Expire
    604800 )    ; Negative Cache TTL
;
@ IN NS server-dns.
server-dns IN A 192.168.58.10
vagrant@server-dns:~$ sudo cat /etc/bind/db.192
$TTL 604800
@ IN SOA server-dns.example.test. admin.example.test. (
    1           ; Serial
    604800      ; Refresh
    86400       ; Retry
    2419200     ; Expire
    604800 )    ; Negative Cache TTL
;
@ IN NS server-dns.
10 IN PTR server-dns.example.test.
```

7.3 Test DNS resolution

Forward lookup:

```
dig client.example.test
```

Reverse lookup:

```
dig -x 192.168.58.xxx
```

```
vagrant@server-dns:~$ dig client.example.test

; <>> DiG 9.18.41-1~deb12u1-Debian <>> client.example.test
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 8667
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;client.example.test.      IN      A

;; Query time: 3 msec
;; SERVER: 10.0.2.3#53(10.0.2.3) (UDP)
;; WHEN: Fri Nov 14 09:27:31 UTC 2025
;; MSG SIZE  rcvd: 37

vagrant@server-dns:~$ dig -x 192.168.58.101

; <>> DiG 9.18.41-1~deb12u1-Debian <>> -x 192.168.58.101
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 34347
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;101.58.168.192.in-addr.arpa.    IN      PTR

;; Query time: 15 msec
;; SERVER: 10.0.2.3#53(10.0.2.3) (UDP)
;; WHEN: Fri Nov 14 09:28:04 UTC 2025
;; MSG SIZE  rcvd: 45
```

8. Conclusion

At the end of this practice we achieved:

- A working **DNS server** with forward and reverse zones
- A fully configured **DHCP server**
- A **TSIG key** shared between DHCP and DNS
- A **client that receives an IP by DHCP**
- **Dynamic DNS updates** working correctly
- Successful tests using logs, leases and DNS tools (**dig**)

The final setup simulates a real network where DHCP and DNS communicate automatically.