

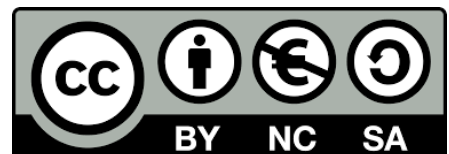


3. Network Services Involved in the Deployment of a Web Application

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Web Application Deployment

2nd C-VET Web Application Development



Index

DHCP Service Activity	3
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DHCP Service Activity

Preliminary considerations:

For the development of this activity you need the two previously created virtual machines.

You have to foresee that if the environment where the activity takes place has some other equipment (such as a router) with DHCP server functions, it can interfere with the DHCP server that you will configure and so you have to take this into account.

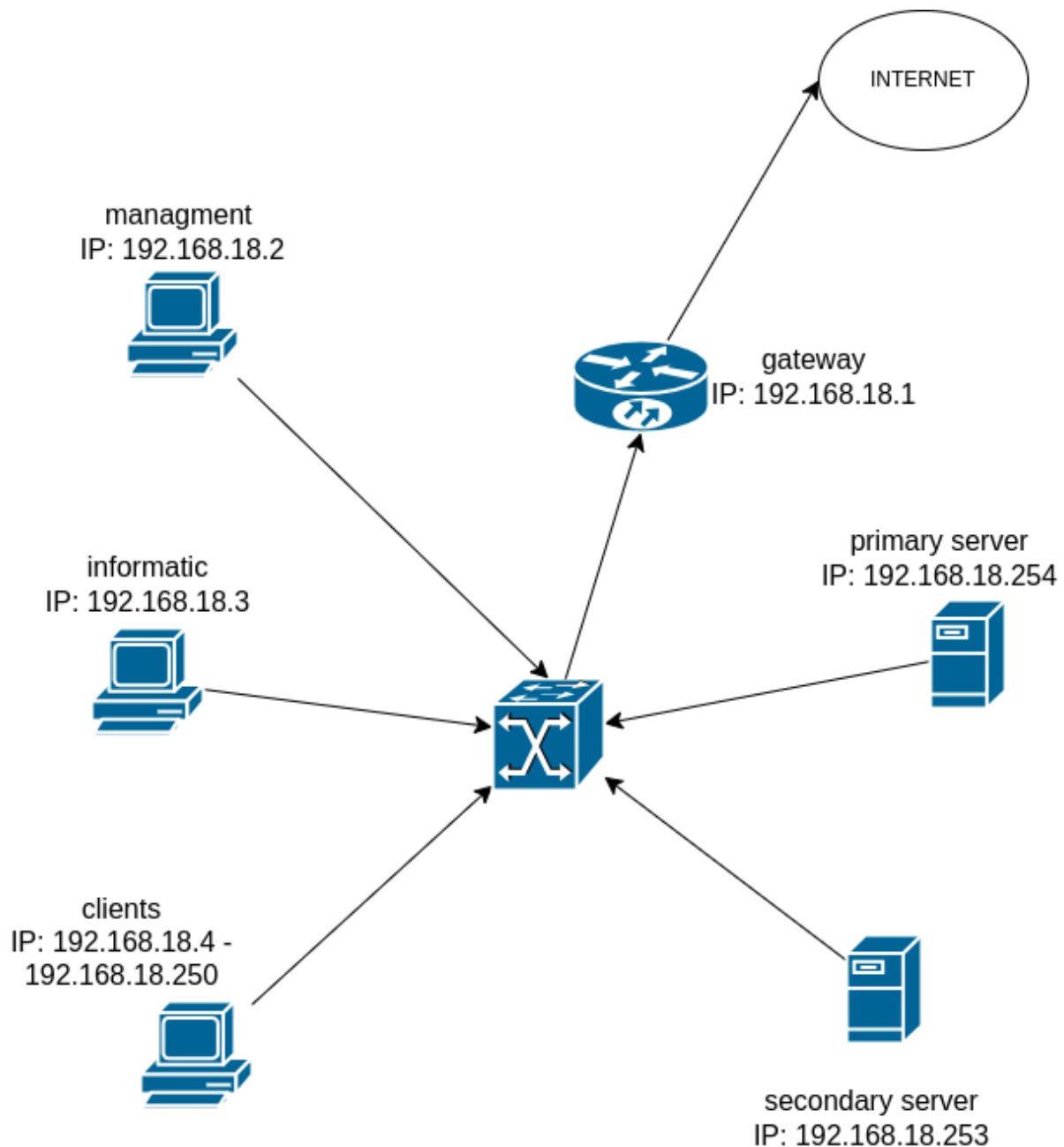
Environment to be simulated:

It is intended to implement a dynamic network configuration assignment service within a public library. The network where the equipment will be located will be 192.168.18.0/24 and it should be taken into account that the router has 192.168.18.1/24 as its IP address and the DHCP server to be implemented is 192.168.18.252/24.

The DNS server addresses will be provided as 192.168.18.252 and 8.8.8.8

A. Installation planning

A.1. With the DÍA software or similar, you make a physical and logical diagram of the network where the different computers and devices are shown, as well as their IPs. Insert the physical/logical schematic of the network.



A.2. Define what the range of available addresses will be, if you want the DHCP server to handle as many addresses as possible. Indicates the range of available addresses.

- The range of available IPs for clients is from 192.168.18.4 to 192.168.18.250, since there are reserved IPs. These reserved IPs are: the gateway, which is 192.168.18.1, the management department, which is 192.168.18.2, the IT department, which is 192.168.18.3, the primary server, which is 192.168.18.254, the secondary server, which is 192.168.18.253, the web and FTP service, which is 192.168.18.252, and the mail service, which is 192.168.18.251.

A.3. Propose a lease time appropriate to the scenario. Justify your answer. Indicate the lease time in seconds. Justify your choice.

- We will set the default that comes in the DHCP configuration, which is 6000 seconds, because the clients will have enough time.

A.4. With the `lsb_release -a` command you get the distribution and version of the server. Insert screenshot.

```
root@server:/etc/netplan# lsb_release -a
No LSB modules are available.
Distributor ID: Ubuntu
Description:   Ubuntu 22.04.4 LTS
Release:      22.04
Codename:     jammy
```

A.5. Install the `isc-dhcp-server`, `nmap` and `wireshark` packages that you will use during the development of the activity. Insert screenshot.

```
root@server:/etc/netplan# dpkg -l | grep dhcp
ii  isc-dhcp-client      4.4.1-2.3ubuntu2.4      amd64      DHCP client for automati
taining an IP address
ii  isc-dhcp-common      4.4.1-2.3ubuntu2.4      amd64      common manpages relevan
of the isc-dhcp packages
ii  isc-dhcp-server      4.4.1-2.3ubuntu2.4      amd64      ISC DHCP server for auto
address assignment
```

B. DHCP Server Configuration

If you experience errors during the configuration of the service or the service does not start up correctly, go to section D.7.

B.1. Assign a static network configuration to the server. Insert screenshot.

```
GNU nano 6.2                                00-installer-config.yaml
# This is the network config written by 'subiquity'
network:
  ethernets:
    enp0s3:
      dhcp4: true
    enp0s8:
      addresses: [192.168.18.254/24]
#      gateway4: 192.168.18.1
#      nameservers:
#        search: [eihsa]
#        addresses: [192.168.18.254]
  version: 2
```

B.2. Check with the help of the `nmap -sU localhost` command if the DHCP server is listening on any port. If yes, indicate the port through which the DHCP server listens. Insert screenshot.

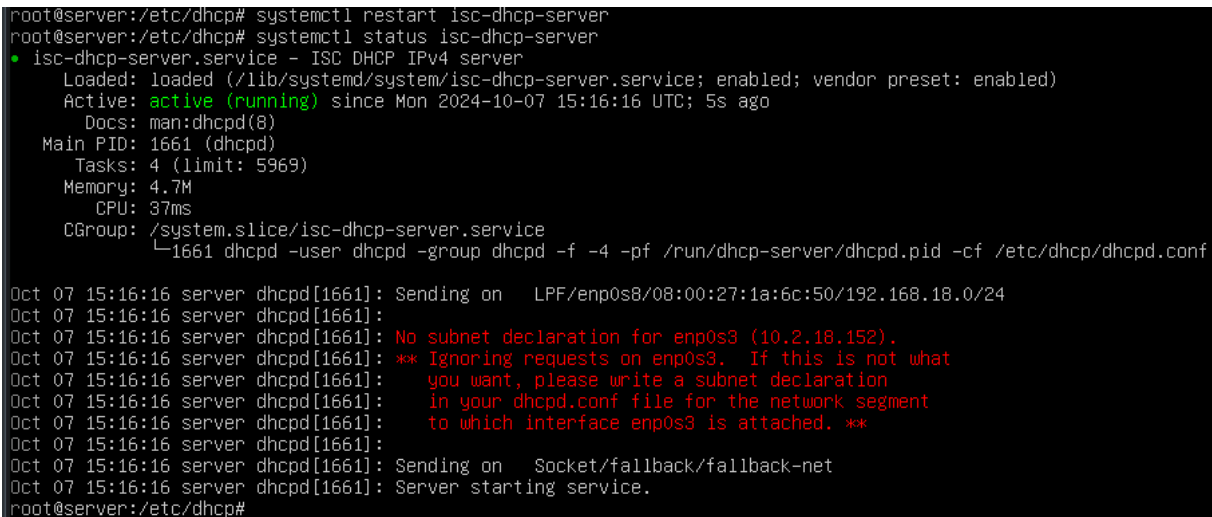
```
root@server:/home/user# nmap -sU localhost
Starting Nmap 7.80 ( https://nmap.org ) at 2024-10-08 17:58 UTC
Nmap scan report for localhost (127.0.0.1)
Host is up (0.000010s latency).
Not shown: 998 closed ports
PORT      STATE      SERVICE
53/udp    open       domain

Nmap done: 1 IP address (1 host up) scanned in 1.38 seconds
root@server:/home/user#
```

B.3. Access the DHCP server configuration file `/etc/dhcp/dhcpd.conf`. Configure it (creating a new subnet) taking into account the previous requirements. Insert screenshot.

```
subnet 192.168.18.0 netmask 255.255.255.0 {
    range 192.168.18.4 192.168.18.250;
    option routers 192.168.18.1;
    option domain-name-servers ns1.eihsa, ns2.eihsa;
    option domain-name "eihsa.com";
    default-lease-time 600;
    max-lease-time 7200;
}
```

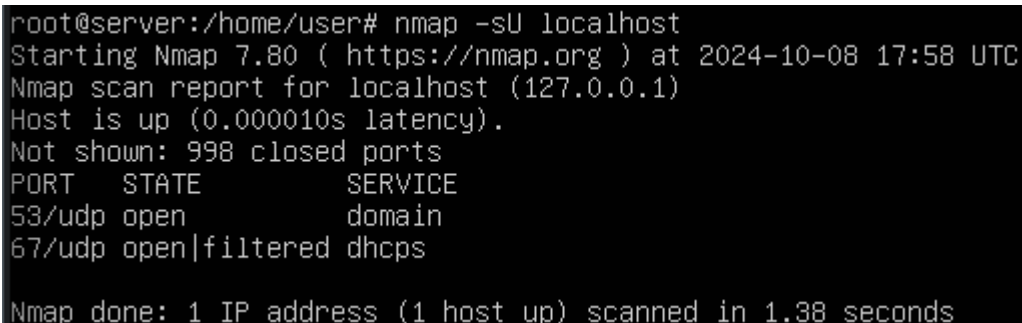
B.4. Remember that when a configuration file is modified, in order for the changes to take effect, the service has to be started/restarted. Start the DHCP server with the command: `sudo systemctl start isc-dhcp-server` Insert screenshot.



```
root@server:/etc/dhcp# systemctl restart isc-dhcp-server
root@server:/etc/dhcp# systemctl status isc-dhcp-server
• isc-dhcp-server.service - ISC DHCP IPv4 server
   Loaded: loaded (/lib/systemd/system/isc-dhcp-server.service; enabled; vendor preset: enabled)
   Active: active (running) since Mon 2024-10-07 15:16:16 UTC; 5s ago
     Docs: man:dhcpcd(8)
   Main PID: 1661 (dhcpcd)
    Tasks: 4 (limit: 5969)
   Memory: 4.7M
      CPU: 37ms
   CGroup: /system.slice/isc-dhcp-server.service
           └─1661 dhcpcd -user dhcpcd -group dhcpcd -f -4 -pf /run/dhcp-server/dhcpcd.pid -cf /etc/dhcp/dhcpcd.conf

Oct 07 15:16:16 server dhcpcd[1661]: Sending on   LPF/enp0s8/08:00:27:1a:6c:50/192.168.18.0/24
Oct 07 15:16:16 server dhcpcd[1661]:
Oct 07 15:16:16 server dhcpcd[1661]: No subnet declaration for enp0s3 (10.2.18.152).
Oct 07 15:16:16 server dhcpcd[1661]: ** Ignoring requests on enp0s3.  If this is not what
Oct 07 15:16:16 server dhcpcd[1661]:      you want, please write a subnet declaration
Oct 07 15:16:16 server dhcpcd[1661]:      in your dhcpcd.conf file for the network segment
Oct 07 15:16:16 server dhcpcd[1661]:      to which interface enp0s3 is attached. **
Oct 07 15:16:16 server dhcpcd[1661]:
Oct 07 15:16:16 server dhcpcd[1661]: Sending on   Socket/fallback/fallback-net
Oct 07 15:16:16 server dhcpcd[1661]: Server starting service.
root@server:/etc/dhcp#
```

B.5. Double-check, with the help of the `nmap -sU` command, if the DHCP server is listening on any port. If yes, indicate the port through which the DHCP server listens. Insert screenshot.



```
root@server:/home/user# nmap -sU localhost
Starting Nmap 7.80 ( https://nmap.org ) at 2024-10-08 17:58 UTC
Nmap scan report for localhost (127.0.0.1)
Host is up (0.000010s latency).
Not shown: 998 closed ports
PORT      STATE      SERVICE
53/udp    open       domain
67/udp    open|filtered dhcps
Nmap done: 1 IP address (1 host up) scanned in 1.38 seconds
```

B.6. Why did the DHCP server not appear listening to question B2 on any port and question B5 already appears listening?

- The reason why B2 wasn't configured is because it wasn't receiving requests.

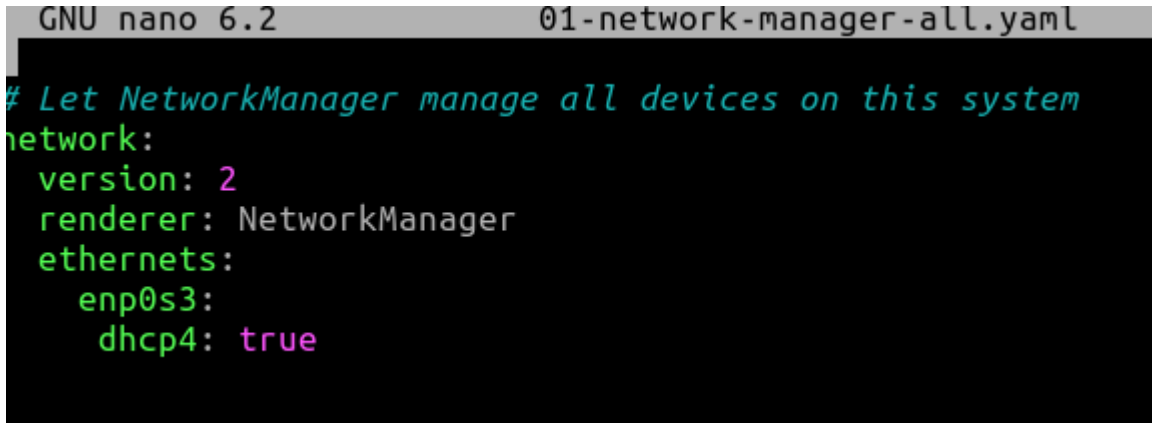
What is the relationship between the subnet of the configuration file and the NIC of the server?

- This relationship depends on the IP address assigned to the network card through which it will receive the requests.

Insert a screenshot and answer, if applicable, the question.

C. DHCP Client Configuration

C.1. Assign a dynamic network configuration to the client. Remember that you have to edit the configuration file `/etc/netplan/xx-network-manager-all.yaml`. Insert screenshot.



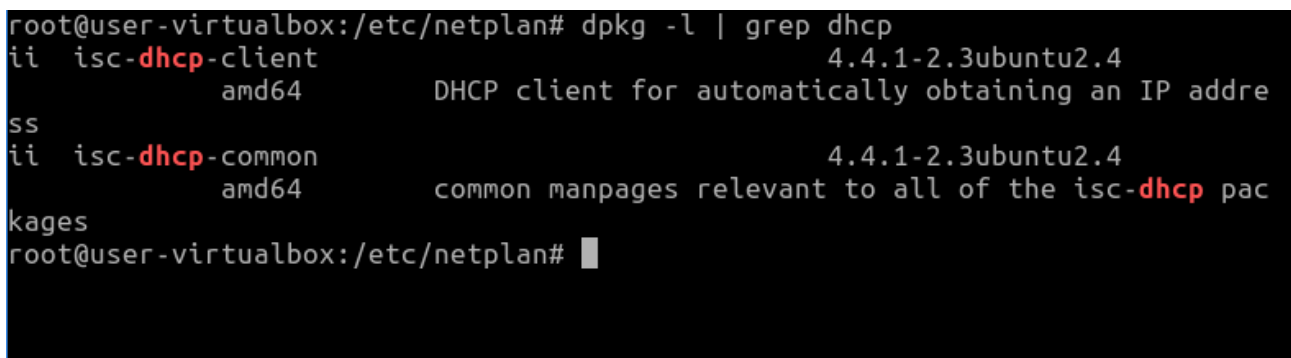
```
GNU nano 6.2 01-network-manager-all.yaml
# Let NetworkManager manage all devices on this system
network:
  version: 2
  renderer: NetworkManager
  ethernets:
    enp0s3:
      dhcp4: true
```

C.2. If not IP address is allocated you can start the dynamic allocation process using the `sudo dhclient [interface]` command. Insert screenshot of network interface IP address.



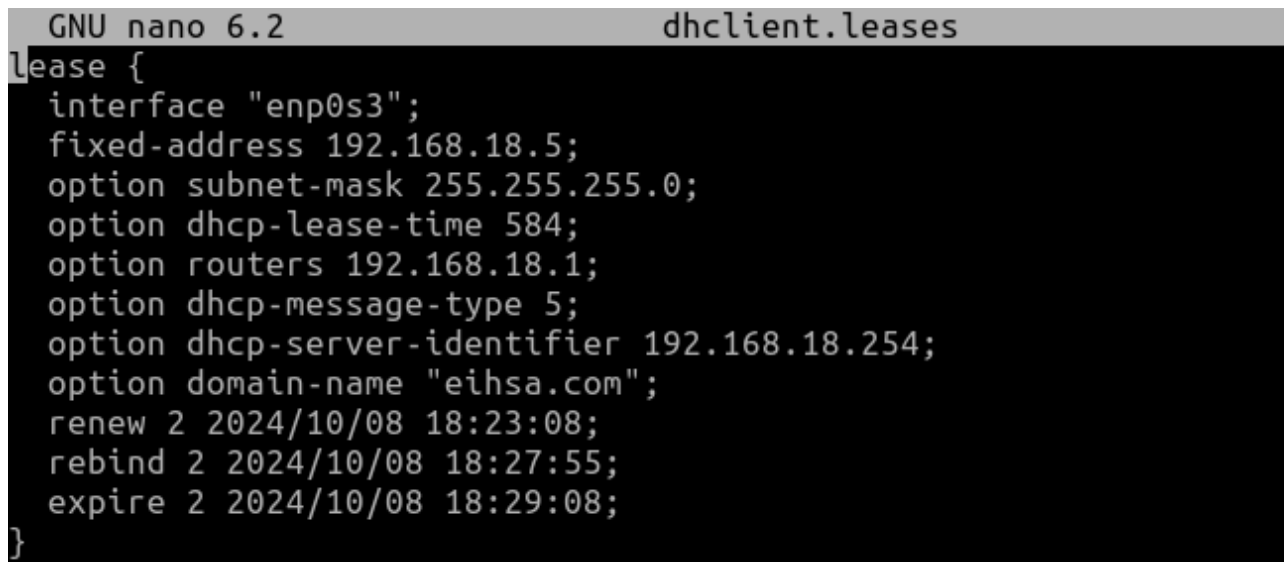
```
root@user-virtualbox:/etc/netplan# dhclient enp0s3
```

C.3. Why didn't I have to install the DHCP client package? You can use the command `dpkg -l package` or `dpkg -l | grep search-string` to get the packages installed on the system. Insert a screenshot and answer the question.



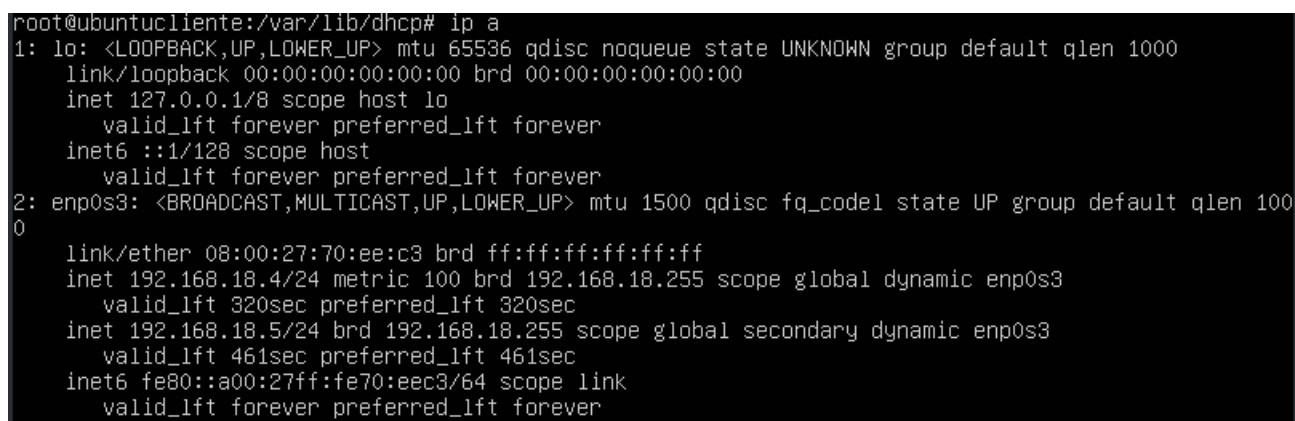
```
root@user-virtualbox:/etc/netplan# dpkg -l | grep dhcp
ii  isc-dhcp-client      4.4.1-2.3ubuntu2.4
    amd64             DHCP client for automatically obtaining an IP address
ii  isc-dhcp-common      4.4.1-2.3ubuntu2.4
    amd64             common manpages relevant to all of the isc-dhcp packages
root@user-virtualbox:/etc/netplan#
```

C.4. In the client's `/var/lib/dhcp/` folder you can check the granting times and the renewals of these loans. Insert a screenshot showing this data and indicate the file consulted.



```
GNU nano 6.2 dhclient.leases
lease {
  interface "enp0s3";
  fixed-address 192.168.18.5;
  option subnet-mask 255.255.255.0;
  option dhcp-lease-time 584;
  option routers 192.168.18.1;
  option dhcp-message-type 5;
  option dhcp-server-identifier 192.168.18.254;
  option domain-name "eihsa.com";
  renew 2 2024/10/08 18:23:08;
  rebind 2 2024/10/08 18:27:55;
  expire 2 2024/10/08 18:29:08;
}
```

C.5. Using the `ifconfig` command you display the client's network configuration. Insert screenshot.



```
root@ubuntuciente:/var/lib/dhcp# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:70:ee:c3 brd ff:ff:ff:ff:ff:ff
    inet 192.168.18.4/24 metric 100 brd 192.168.18.255 scope global dynamic enp0s3
        valid_lft 320sec preferred_lft 320sec
    inet 192.168.18.5/24 brd 192.168.18.255 scope global secondary dynamic enp0s3
        valid_lft 461sec preferred_lft 461sec
    inet6 fe80::a00:27ff:fe70:eec3/64 scope link
        valid_lft forever preferred_lft forever
```

D. Advanced management

D.1. Suppose that your client computer is the computer used by the librarian and therefore we want to always have it identified with the same IP address. Configure the server (file `/etc/dhcp/dhcpd.conf`) so that this client has the address 192.168.18.100 reserved. Insert a screenshot showing the client's MAC address.

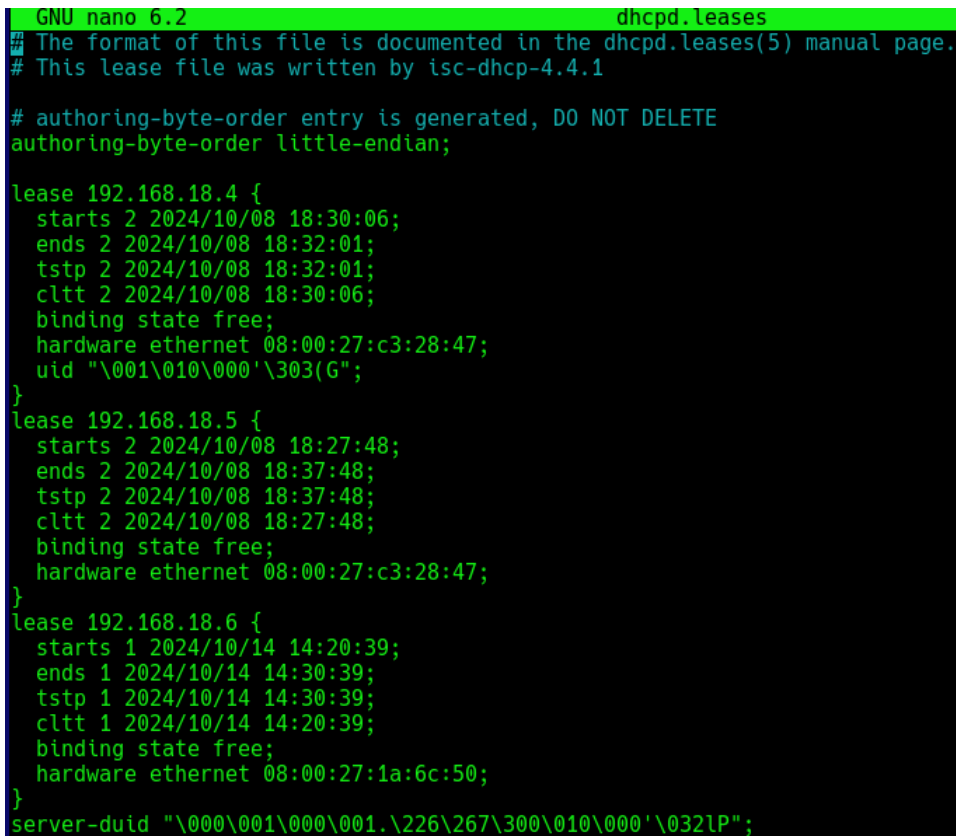
Insert a screenshot showing the configuration made on the server.

```
host user{
    hardware ethernet 08:00:27:C3:28:47;
    fixed-address 192.168.18.100;
    option routers 192.168.18.1;
    option domain-name "eihsa.com";
    option domain-name-servers 192.168.18.254, 192.168.18.253;
}
```

D.2. Make a request from the client and verify that the IP address assigned is the 192.168.18.100. Insert screenshot.

```
user@user-virtualbox:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:c3:28:47 brd ff:ff:ff:ff:ff:ff
    inet 192.168.18.100/24 brd 192.168.18.255 scope global dynamic noprefixroute enp0s3
        valid_lft 520sec preferred_lft 520sec
    inet6 fe80::a00:27ff:fec3:2847/64 scope link
        valid_lft forever preferred_lft forever
```

D.3. Check the server's concessions database (`/var/lib/dhcp/dhcpd` file). What can you find in this file? Relate the content of the file to the practice you are developing. Insert a screenshot and answer the question.



```
GNU nano 6.2 dhcpd.leases
# The format of this file is documented in the dhcpd.leases(5) manual page.
# This lease file was written by isc-dhcp-4.4.1

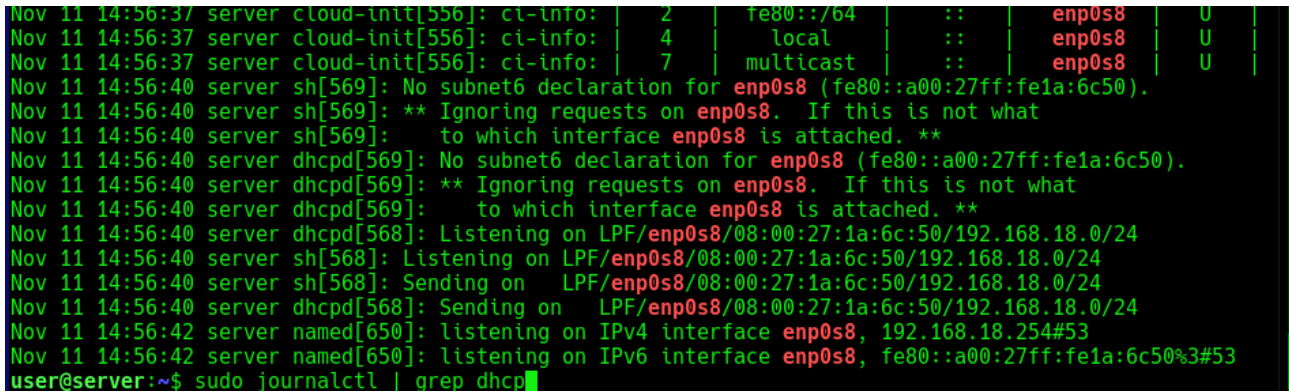
# authoring-byte-order entry is generated, DO NOT DELETE
authoring-byte-order little-endian;

lease 192.168.18.4 {
  starts 2 2024/10/08 18:30:06;
  ends 2 2024/10/08 18:32:01;
  tstp 2 2024/10/08 18:32:01;
  cltt 2 2024/10/08 18:30:06;
  binding state free;
  hardware ethernet 08:00:27:c3:28:47;
  uid "\001\010\000'\303(G";
}
lease 192.168.18.5 {
  starts 2 2024/10/08 18:27:48;
  ends 2 2024/10/08 18:37:48;
  tstp 2 2024/10/08 18:37:48;
  cltt 2 2024/10/08 18:27:48;
  binding state free;
  hardware ethernet 08:00:27:c3:28:47;
}
lease 192.168.18.6 {
  starts 1 2024/10/14 14:20:39;
  ends 1 2024/10/14 14:30:39;
  tstp 1 2024/10/14 14:30:39;
  cltt 1 2024/10/14 14:20:39;
  binding state free;
  hardware ethernet 08:00:27:1a:6c:50;
}
server-uid "\000\001\000\001.\226\267\300\010\000'\032lP";
```

D.4. Go to the `/var/lib/dhcp` folder. Can you find the file for question C.4.? Why do you think this file is not on the server? Insert a screenshot and answer the question.

- We couldn't find the IP that appeared in exercise C4 because the lease for that IP expired, and the client was assigned 100 as a private host. That's why we see the IP 192.168.18.100.

D.5. The log of actions/errors is monitored to the `/var/log/syslog` file. This file is usually very large since it monitors a large number of system services/actions, so you can look for incidents related to the `sudo cat /var/log/syslog | grep dhcp` command. Can you identify any issues related to a configuration error? If so, how did you solve it? Insert a screenshot and answer the question.



```
Nov 11 14:56:37 server cloud-init[556]: ci-info: | 2 | fe80::/64 | :: | enp0s8 | U |
Nov 11 14:56:37 server cloud-init[556]: ci-info: | 4 | local | :: | enp0s8 | U |
Nov 11 14:56:37 server cloud-init[556]: ci-info: | 7 | multicast | :: | enp0s8 | U |
Nov 11 14:56:40 server sh[569]: No subnet6 declaration for enp0s8 (fe80::a00:27ff:fe1a:6c50).
Nov 11 14:56:40 server sh[569]: ** Ignoring requests on enp0s8. If this is not what
Nov 11 14:56:40 server sh[569]: to which interface enp0s8 is attached. **
Nov 11 14:56:40 server dhcpd[569]: No subnet6 declaration for enp0s8 (fe80::a00:27ff:fe1a:6c50).
Nov 11 14:56:40 server dhcpd[569]: ** Ignoring requests on enp0s8. If this is not what
Nov 11 14:56:40 server dhcpd[569]: to which interface enp0s8 is attached. **
Nov 11 14:56:40 server dhcpd[568]: Listening on LPF/enp0s8/08:00:27:1a:6c:50/192.168.18.0/24
Nov 11 14:56:40 server sh[568]: Listening on LPF/enp0s8/08:00:27:1a:6c:50/192.168.18.0/24
Nov 11 14:56:40 server sh[568]: Sending on LPF/enp0s8/08:00:27:1a:6c:50/192.168.18.0/24
Nov 11 14:56:40 server dhcpd[568]: Sending on LPF/enp0s8/08:00:27:1a:6c:50/192.168.18.0/24
Nov 11 14:56:42 server named[650]: listening on IPv4 interface enp0s8, 192.168.18.254#53
Nov 11 14:56:42 server named[650]: listening on IPv6 interface enp0s8, fe80::a00:27ff:fe1a:6c50%3#53
user@server:~$ sudo journalctl | grep dhcp
```

Note: Screenshots must incorporate a timestamp (i.e. in a corner you must put a small console and execute the date command, so that the user is seen in the screenshot as well as the day and time of its completion).

E. Extension

E.1. With the help of the Wireshark software (which you will have to run with administrator privileges) analyze the operation of the DHCP service. Run this software, monitor the network card that the DHCP server is listening on, and filter by the BOOTP protocol (predecessor to dhcp). With the results, analyze the operation of the DHCP (type of messages that are sent and addresses) relating it to the protocol studied in class. Insert screenshot and analyze the protocol.

- We have installed the 'tshark' package, which is like Wireshark but designed for the command line.

```
root@server:/var/log# tshark --version
Running as user "root" and group "root". This could be dangerous.
TShark (Wireshark) 3.6.2 (Git v3.6.2 packaged as 3.6.2-2)

Copyright 1998-2022 Gerald Combs <gerald@wireshark.org> and contributors.
License GPLv2+: GNU GPL version 2 or later <https://www.gnu.org/licenses/gpl-2.0.html>
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

Compiled (64-bit) using GCC 11.2.0, with libpcap, with POSIX capabilities
(Linux), with libnl 3, with GLib 2.71.2, with zlib 1.2.11, with Lua 5.2.4, with
GnuTLS 3.7.3 and PKCS #11 support, with Gcrypt 1.9.4, with MIT Kerberos, with
MaxMind DB resolver, with nghttp2 1.43.0, with brotli, with LZ4, with Zstandard,
with Snappy, with libxml2 2.9.12, with libsmi 0.4.8.

Running on Linux 5.15.0-122-generic, with Intel(R) Core(TM) i3-4160 CPU @
3.60GHz (with SSE4.2), with 1951 MB of physical memory, with GLib 2.72.4, with
zlib 1.2.11, with libpcap 1.10.1 (with TPACKET_V3), with c-ares 1.18.1, with
GnuTLS 3.7.3, with Gcrypt 1.9.4, with nghttp2 1.43.0, with brotli 1.0.9, with
LZ4 1.9.3, with Zstandard 1.4.8, with libsmi 0.4.8, with LC_TYPE=C.UTF-8, binary
plugins supported (0 loaded).
root@server:/var/log#
```

- Packet capture.

```
root@server:/var/log# tshark -i enp0s8 -f "udp port 67 or udp port 68" -w ejercicio_E1.pcap
Running as user "root" and group "root". This could be dangerous.
Capturing on 'enp0s8'
** (tshark:1134) 14:17:58.108784 [Main MESSAGE] -- Capture started.
** (tshark:1134) 14:17:58.109435 [Main MESSAGE] -- File: "ejercicio_E1.pcap"
```

- Inspecting the previous capture with the 'bootp' filter, which is the predecessor of DHCP.

Unit 3. Network Services Involved in the Deployment of a Web Application

```
root@server:/var/log# tshark -r ejercicio_E1.pcap -Y "bootp"
Running as user "root" and group "root". This could be dangerous.
  1 0.000000000 192.168.18.6 → 255.255.255.255 DHCP 342 DHCP Request - Transaction ID 0xdc898725
root@server:/var/log#
```