

Dynamic Host Configuration Protocol

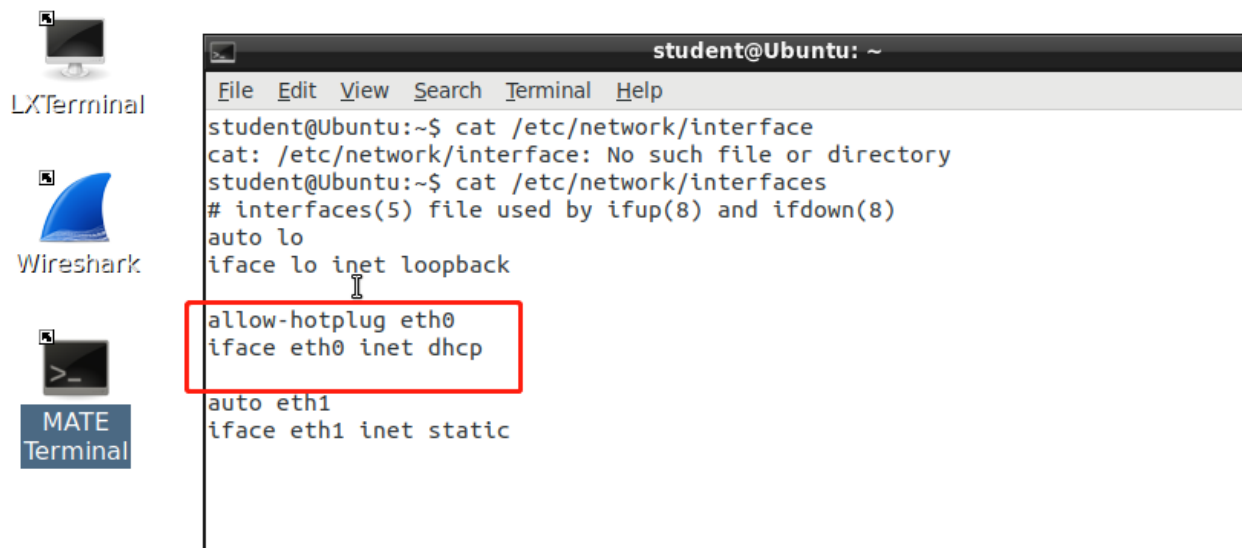
Instructions

Set up a DHCP server on R4 (eth2) such that it leases IP addresses from the 10.10.11.X/28 subnet to the Ubuntu VM. Calculate the network, broadcast, and useable range of IP addresses for your address range. Select the first useable IP address as the static address for the R4 interface (remember that we cannot use the network and broadcast). The remaining addresses will go into the pool that the DHCP server will lease and manage.

Before starting this lab, please read RFC 2131.

Note: Please make any necessary changes to the `/etc/network/interfaces` file of Ubuntu before you proceed. The file should already have an existing entry for DHCP which includes:

```
iface eth0 inet dhcp
```



Part 1: Configuring DHCP

The first step is to configure the `dhcpd.conf` (DHCP daemon configuration) file in router R4. This file is present in the `/etc/dhcp` directory. You can make edits to this file using any text editor.

Consult the example configuration options in the `dhcpd.conf` file to configure your DHCP server on R4. Make sure to set `default-lease-time` to 300.

Note that you do not need to provide configurations for the option `domain-name` or `domain name-servers`.

```
root@CN-R4:/home/student# cat /etc/dhcp/dhcpd.conf
#
# Sample configuration file for ISC dhcpd for Debian
#
# Attention: If /etc/ltsp/dhcpd.conf exists, that will be used as
# configuration file instead of this file.
#
#
# The ddns-updates-style parameter controls whether or not the server will
# attempt to do a DNS update when a lease is confirmed. We default to the
# behavior of the version 2 packages ('none', since DHCP v2 didn't
# have support for DDNS.)
ddns-update-style none;

subnet 10.10.11.16 netmask 255.255.255.240{
    range 10.10.11.18 10.10.11.30;
    option broadcast-address 10.10.11.31;
    default-lease-time 300;
}
```

Part 2: Server Interface

Check the `/etc/default/isc-dhcp-server` file on R4. This file has to be changed so the DHCP server knows which interface it should listen on for serving IP addresses.

```
root@CN-R4:/home/student# nano /etc/default/isc-dhcp-server
root@CN-R4:/home/student# cat /etc/default/isc-dhcp-server
# Defaults for isc-dhcp-server (sourced by /etc/init.d/isc-dhcp-server)

# Path to dhcpd's config file (default: /etc/dhcp/dhcpd.conf).
#DHCPDv4_CONF=/etc/dhcp/dhcpd.conf
#DHCPDv6_CONF=/etc/dhcp/dhcpd6.conf

# Path to dhcpd's PID file (default: /var/run/dhcpd.pid).
#DHCPDv4_PID=/var/run/dhcpd.pid
#DHCPDv6_PID=/var/run/dhcpd6.pid

# Additional options to start dhcpd with.
# Don't use options -cf or -pf here; use DHCPD_CONF/ DHCPD_PID instead
#OPTIONS=""

# On what interfaces should the DHCP server (dhcpd) serve DHCP requests?
# Separate multiple interfaces with spaces, e.g. "eth0 eth1".
INTERFACESv4="eth2"
INTERFACESv6=""
root@CN-R4:/home/student#
```

Part 3: Verifying DHCP and Wireshark

We will verify that Ubuntu has obtained an IP address.

1. Shutdown R4 and Ubuntu.
2. Power on Ubuntu and run Wireshark via the terminal: `sudo wireshark`
3. Monitor incoming traffic on the appropriate interface.
4. Now power on R4 and view Wireshark traffic on Ubuntu.
5. Use the following filter to show DHCP messages: `udp.port == 67`
6. Take a screenshot showing all captured DHCP messages.

Before R4 turn on , only DHCPDISCOVER packets, because the Ubuntu system is broadcasting DHCPDISCOVER for asking itself for an IP address.

The screenshot shows a virtual network environment. At the top, a purple banner reads "Polytechnic Institute" and "VITAL" on the left, and "WELCOME, YUXIONG" on the right. Below this, there are icons for four routers labeled R1, R2, R3, and R4. R4 is highlighted with a red box. Below the routers are icons for Ubuntu and Kali Linux. At the bottom, a terminal window titled "noVNC - Google Chrome" shows a URL: `vital.engineering.nyu.edu/vmconsole/vnc_auto.html?token=7f48b42c-c43d-4ed7-97f8-5ccb3faa3c5b`. The terminal is connected to a QEMU instance (1824_20_11). A Wireshark window titled "Capturing from eth0" is open, showing a list of captured packets. The first packet is a DHCP Discover message from 0.0.0.0 to 255.255.255.255. The packet details pane shows the following information:

- Frame 1: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface 0
- Ethernet II, Src: 00:00:00:00:00:00 (00:00:00:00:00:00), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
- Internet Protocol Version 4, Src: 0.0.0.0, Dst: 255.255.255.255
- User Datagram Protocol, Src Port: 68, Dst Port: 67
- Bootstrap Protocol (Discover)



R1



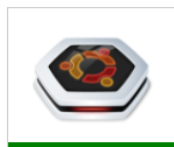
R2



R3



R4



Ubuntu



Kali

console/vnc_auto.html?token=8a2c3628-d778-48d3-91f8-67e0bd99f834

Connected (encrypted) to: QEMU (1824_20_11)

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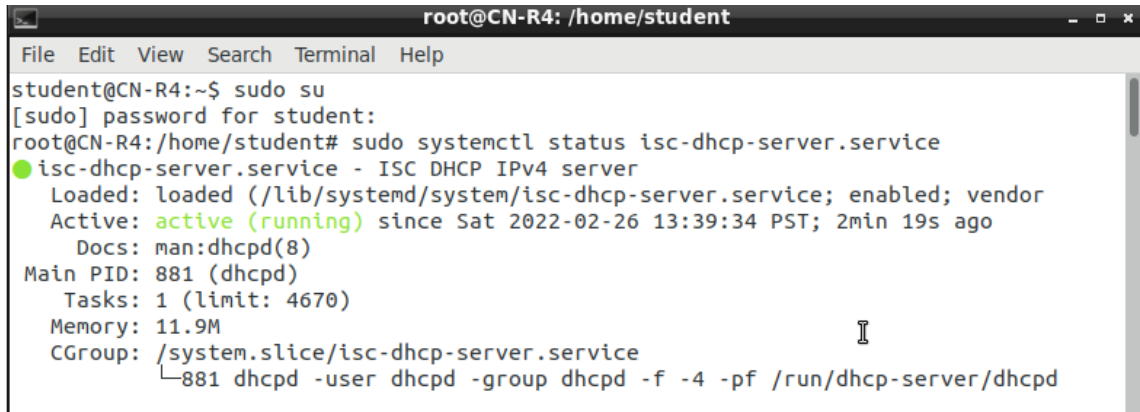
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

udp.port == 67

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transact3
3	10.245823457	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transact3
4	18.479322335	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transact3
7	28.206016056	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transact3
8	41.348228466	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transact3
45	56.017340826	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transact3
47	57.019344681	10.10.11.17	10.10.11.18	DHCP	342	DHCP Offer - Transact3
48	57.019818959	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transact3
49	57.034465480	10.10.11.17	10.10.11.18	DHCP	342	DHCP ACK - Transact3

Note: Verify that the DHCP server is running properly on R4 by using the following command:

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

A terminal window titled 'root@CN-R4: /home/student' with a menu bar (File, Edit, View, Search, Terminal, Help). The terminal shows a user 'student' at 'CN-R4' running 'sudo su' to become root. Then, the command 'sudo systemctl status isc-dhcp-server.service' is executed. The output shows the service is loaded and active (running) since Saturday, 2022-02-26 at 13:39:34 PST. It lists details like Docs (man:dhcpd(8)), Main PID (881), Tasks (1), Memory (11.9M), and CGroup path. The full command line for the service is shown at the bottom: '881 dhcpd -user dhcpd -group dhcpd -f -4 -pf /run/dhcp-server/dhcpd'.

```
root@CN-R4: /home/student
File Edit View Search Terminal Help
student@CN-R4:~$ sudo su
[sudo] password for student:
root@CN-R4:/home/student# sudo systemctl status isc-dhcp-server.service
● isc-dhcp-server.service - ISC DHCP IPv4 server
   Loaded: loaded (/lib/systemd/system/isc-dhcp-server.service; enabled; vendor
   Active: active (running) since Sat 2022-02-26 13:39:34 PST; 2min 19s ago
     Docs: man:dhcpd(8)
  Main PID: 881 (dhcpd)
    Tasks: 1 (limit: 4670)
   Memory: 11.9M
   CGroup: /system.slice/isc-dhcp-server.service
           └─881 dhcpd -user dhcpd -group dhcpd -f -4 -pf /run/dhcp-server/dhcpd
```

Submissions

[20 points] The leases file on R4 found in */var/lib/dhcp/dhcpd.leases*

```
root@CN-R4: /home/student
File Edit View Search Terminal Help
# The format of this file is documented in the dhcpd.leases(5) manual page.
# This lease file was written by isc-dhcp-4.3.5

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

server-duid "\000\001\000\001)\255Z\226\000\000\000\000\000\013";

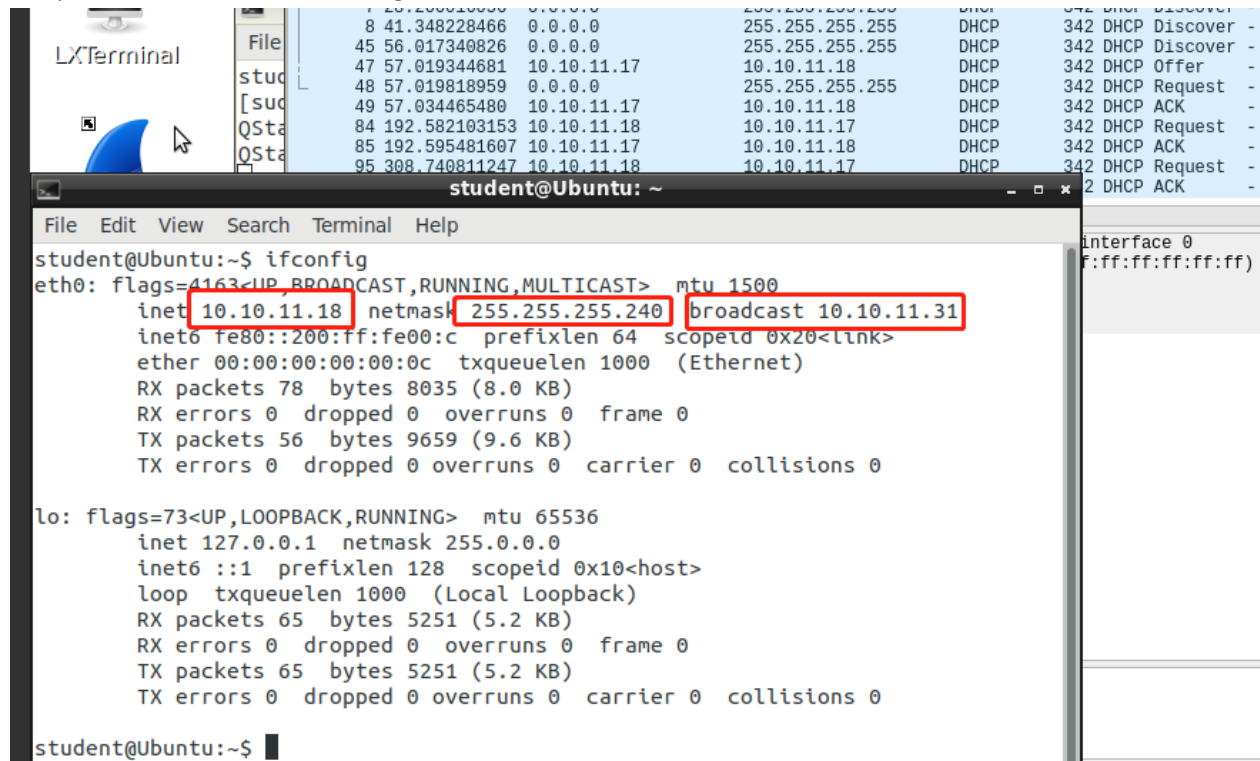
lease 10.10.11.18 {
    starts 6 2022/02/26 21:39:46;
    ends 6 2022/02/26 21:44:46;
    cltt 6 2022/02/26 21:39:46;
    binding state active;
    next binding state free;
    rewind binding state free;
    hardware ethernet 00:00:00:00:00:0c;
    client-hostname "Ubuntu";
}
lease 10.10.11.18 {
    starts 6 2022/02/26 21:42:01;
    ends 6 2022/02/26 21:47:01;
    cltt 6 2022/02/26 21:42:01;
    binding state active;
    next binding state free;
    rewind binding state free;
    hardware ethernet 00:00:00:00:00:0c;
    client-hostname "Ubuntu";
}
root@CN-R4: /home/student#
```

[20 points] Your configuration for the DHCP server.

```
root@CN-R4:/home/student# cat /etc/dhcp/dhcpd.conf
#
# Sample configuration file for ISC dhcpd for Debian
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# Attention: If /etc/ltsp/dhcpd.conf exists, that will be used as
# configuration file instead of this file.
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#
# The ddns-updates-style parameter controls whether or not the server will
# attempt to do a DNS update when a lease is confirmed. We default to the
# behavior of the version 2 packages ('none', since DHCP v2 didn't
# have support for DDNS.)
ddns-update-style none;

subnet 10.10.11.16 netmask 255.255.255.240{
    range 10.10.11.18 10.10.11.30;
    option broadcast-address 10.10.11.31;
    default-lease-time 300;
}
```


[20 points] Screenshot of ifconfig on Ubuntu.



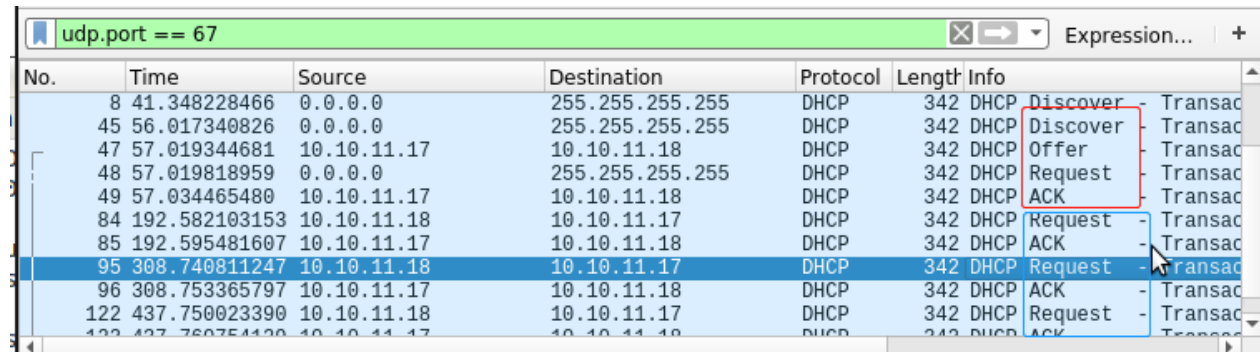
```
student@Ubuntu: ~  
File Edit View Search Terminal Help  
student@Ubuntu:~$ ifconfig  
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
    inet 10.10.11.18 netmask 255.255.255.240 broadcast 10.10.11.31  
    inet6 fe80::200:ff:fe00:c prefixlen 64 scopeid 0x20<link>  
    ether 00:00:00:00:00:0c txqueuelen 1000 (Ethernet)  
    RX packets 78 bytes 8035 (8.0 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 56 bytes 9659 (9.6 KB)  
    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 65 bytes 5251 (5.2 KB)  
    RX errors 0 dropped 0 overruns 0 frame 0  
    TX packets 65 bytes 5251 (5.2 KB)  
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
student@Ubuntu:~$
```

Interface 0
ff:ff:ff:ff:ff:ff)

[20 points] Screenshot showing Ubuntu pinging R4.

```
student@Ubuntu:~$ ping 10.10.11.17
PING 10.10.11.17 (10.10.11.17) 56(84) bytes of data.
64 bytes from 10.10.11.17: icmp_seq=1 ttl=64 time=0.506 ms
64 bytes from 10.10.11.17: icmp_seq=2 ttl=64 time=0.463 ms
64 bytes from 10.10.11.17: icmp_seq=3 ttl=64 time=0.421 ms
64 bytes from 10.10.11.17: icmp_seq=4 ttl=64 time=0.457 ms
64 bytes from 10.10.11.17: icmp_seq=5 ttl=64 time=0.574 ms
64 bytes from 10.10.11.17: icmp_seq=6 ttl=64 time=0.387 ms
64 bytes from 10.10.11.17: icmp_seq=7 ttl=64 time=0.482 ms
64 bytes from 10.10.11.17: icmp_seq=8 ttl=64 time=0.538 ms
^C
--- 10.10.11.17 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 182ms
rtt min/avg/max/mdev = 0.387/0.478/0.574/0.060 ms
student@Ubuntu:~$
```

[20 points] Screenshot showing Wireshark DHCP messages (4 Types).



No.	Time	Source	Destination	Protocol	Length	Info
8	41.348228466	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transac
45	56.017340826	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transac
47	57.019344681	10.10.11.17	10.10.11.18	DHCP	342	DHCP Offer - Transac
48	57.019818959	0.0.0.0	255.255.255.255	DHCP	342	DHCP Request - Transac
49	57.034465480	10.10.11.17	10.10.11.18	DHCP	342	DHCP ACK - Transac
84	192.582103153	10.10.11.18	10.10.11.17	DHCP	342	DHCP Request - Transac
85	192.595481607	10.10.11.17	10.10.11.18	DHCP	342	DHCP ACK - Transac
95	308.740811247	10.10.11.18	10.10.11.17	DHCP	342	DHCP Request - Transac
96	308.753365797	10.10.11.17	10.10.11.18	DHCP	342	DHCP ACK - Transac
122	437.750023390	10.10.11.18	10.10.11.17	DHCP	342	DHCP Request - Transac
123	437.760754420	10.10.11.17	10.10.11.18	DHCP	342	DHCP ACK - Transac

Please remember to submit your lab results as a single PDF document. While you may work in groups, you MUST submit your own work.