

Lab 04: DHCP

💡 Have you ever had to manually configure an IP address when connecting to a wifi or cellular network? Of course not! Behind the scenes, DHCP has been taking care of you. This lab will illustrate how DHCP works and why it is a core service in any network with clients.

Objectives:

Install and configure Linux [DHCP](#) services on dhcp01.yourname.local.

Prerequisites:

Lab 3 is complete, and the environment is in a happy state.

Install DHCP Services

We are going to use the yum update manager to install DHCP on this server. The graphic below shows the search used to find packages related to DHCP on the update servers. The one we will install is simply called dhcp. You can ignore the suffix of .x86_64 when installing.

SSH from AD01 -> DHCP01

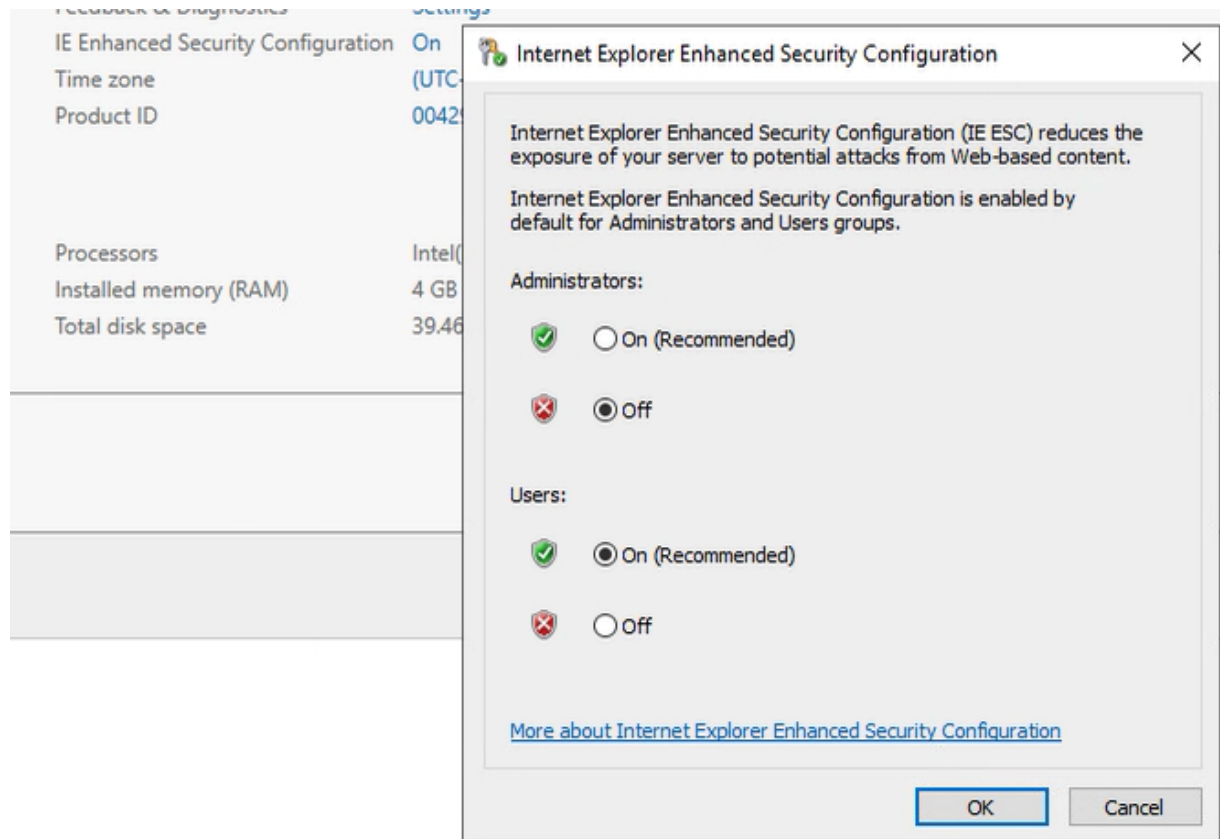
Disable IE Enhanced Security Configuration

💡 Use either PuTTY (which you download + install) or Powershell SSH from AD01 to access your CentOS server from now on! This allows you to copy/paste from your Windows system (you can login into Canvas from here). You can open up multiple windows should you wish.

Note: Powershell SSH is somewhat new, and you may experience occasional keyboard issues. If this is the case, move to PuTTY. In order to pull down PuTTY from the internet, you will want to disable IE Enhanced Security Configuration on Server Manager as shown below:



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Install PuTTY



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Download PuTTY: latest release (0.76)

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This page contains download links for the latest released version of PuTTY. Currently this is 0.76, released on 2021-07-17.

When new releases come out, this page will update to contain the latest, so this is a good page to bookmark or link to. [Altern release.](#)

Release versions of PuTTY are versions we think are reasonably likely to work well. However, they are often not the most up to date. If you have a problem with this release, then it might be worth trying out the [development snapshots](#), to see if the problem has already been fixed.

Package files

You probably want one of these. They include versions of all the PuTTY utilities.

(Not sure whether you want the 32-bit or the 64-bit version? Read the [FAQ entry](#).)

MSI ('Windows Installer')

64-bit x86: [putty-64bit-0.76-installer.msi](#) (or by FTP) (signature)

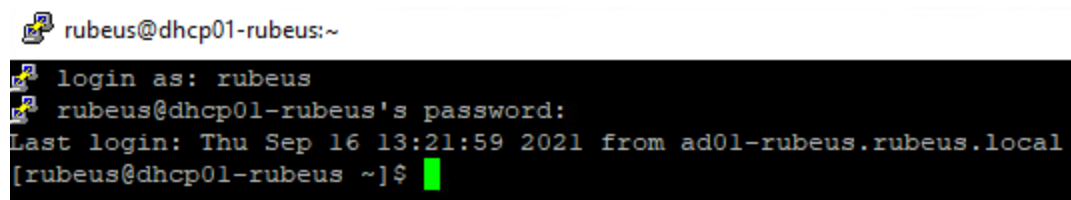
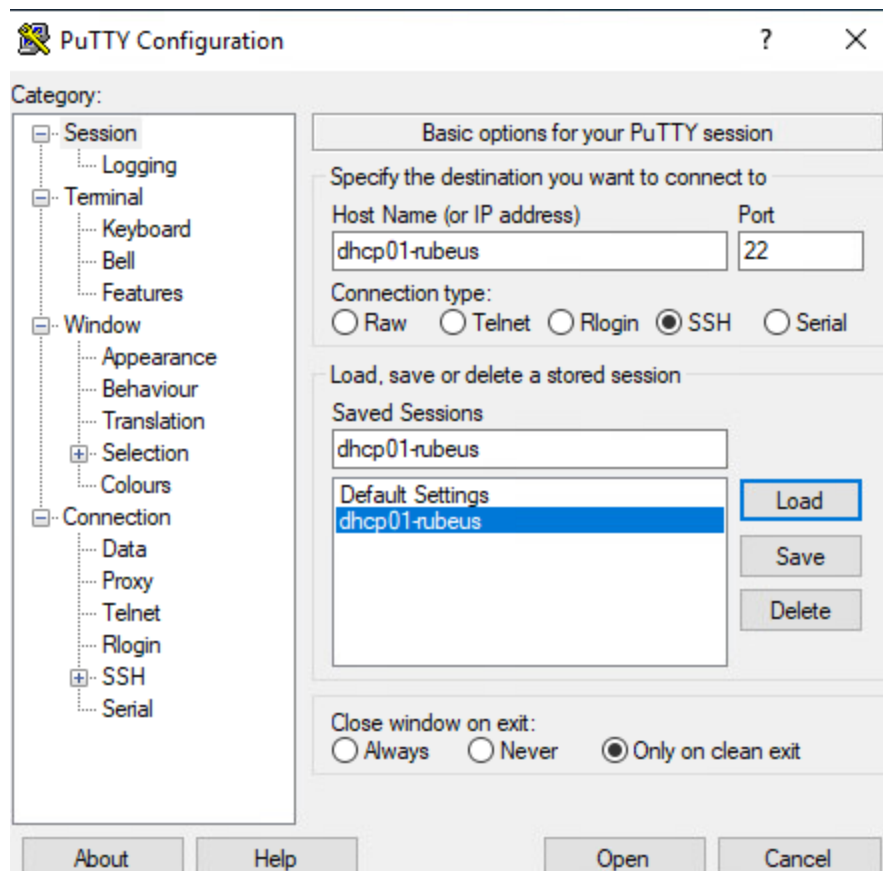
64-bit
32-bit

Do you want to run or save **putty-64bit-0.76-installer.msi** (2.94 MB) from the.earth.li?



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Connect via PuTTY



Run the DHCP installation command as an elevated user, using `sudo`.



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```
rubeus@dhcp01-rubeus:~  
[rubeus@dhcp01-rubeus ~]$ pwd  
/home/rubeus  
[rubeus@dhcp01-rubeus ~]$ hostname  
dhcp01-rubeus.rubeus.local  
[rubeus@dhcp01-rubeus ~]$ whoami  
rubeus  
[rubeus@dhcp01-rubeus ~]$ sudo yum install dhcp  
[sudo] password for rubeus:  
Loaded plugins: fastestmirror, langpacks  
Loading mirror speeds from cached hostfile  
* base: mirror.dal.nexril.net  
* extras: mirrors.umflint.edu  
* updates: mirror.illumino.com  
base | 3.6 kB 00:00  
extras | 2.9 kB 00:00  
updates | 2.9 kB 00:00  
updates/7/x86_64/primary_db | 4.5 MB 00:02  
Resolving Dependencies  
--> Running transaction check  
--> Package dhcp.x86_64 12:4.2.5-79.el7.centos will be installed  
--> Finished Dependency Resolution  
  
Dependencies Resolved  
  
=====
```

Package	Arch	Version	Repository	Size
Installing:				
dhcp	x86_64	12:4.2.5-79.el7.centos	base	515 k

```
=====
```

Transaction Summary	
Install	1 Package

```
=====
```

Total download size: 515 k
Installed size: 1.4 M
Is this ok [y/d/N]: y

Configuring DHCP Services

Become the system user for a brief period of time using the `sudo -i` command, and then open the `dhcp` configuration file using the `vi` or `nano` text editor (`nano` is easier, but at some point you will need to learn `vi` so we will use it).

```
root@dhcp01-rubeus:~  
[rubeus@dhcp01-rubeus ~]$ sudo -i  
[sudo] password for rubeus:  
[root@dhcp01-rubeus ~]# vi /etc/dhcp/dhcpd.conf
```



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Typing very carefully, enter the following into your new file below the comments (# denotes a comment). Change the domain-name to yourname.local.

```
root@dhcp01-rubeus:~  
#  
# DHCP Server Configuration file.  
#   see /usr/share/doc/dhcp*/dhcpd.conf.example  
#   see dhcpd.conf(5) man page  
#  
subnet 10.0.5.0 netmask 255.255.255.0 {  
    option routers 10.0.5.2;  
    option subnet-mask 255.255.255.0;  
    option domain-name "hermione.local";  
    option domain-name-servers 10.0.5.5;  
    range 10.0.5.100 10.0.5.150;  
}
```

When you think you are done, write [changes](#) to save and quit vi.

Starting DHCP Services

💣 Whenever you change or create a service configuration file, you generally need to start or restart the service involved. This fact trips up many Linux administrators!

The [systemd](#) control program systemctl is how you start, stop and status services.

To start dhcp, type the following as root:

```
systemctl start dhcpd
```

Start dhcpd and check its status (Fun fact: the dhcpD means it's a [Daemon](#), which is Linux speak for Service). Note any errors and check the syntax of dhcpd.conf accordingly.



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```
rubeus@dhcp01-rubeus:~  
[rubeus@dhcp01-rubeus ~]$ systemctl status dhcpd  
● dhcpd.service - DHCPv4 Server Daemon  
   Loaded: loaded (/usr/lib/systemd/system/dhcpd.service; enabled; vendor preset: disabled)  
   Active: active (running) since Thu 2021-09-16 13:38:39 EDT; 23min ago  
     Docs: man:dhcpd(8)  
           man:dhcpd.conf(5)  
  Main PID: 11435 (dhcpd)  
    Status: "Dispatching packets..."  
   CGroup: /system.slice/dhcpd.service  
           └─11435 /usr/sbin/dhcpd -f -cf /etc/dhcp/dhcpd.conf -user dhcpd -g.
```

Enabling the service to start at boot.

💣 Forgetting to enable a service to start on boot will cause the service to fail when the system is rebooted. Remember this if a service worked fine one day and does not after a reboot.

```
root@dhcp01-rubeus:~  
[root@dhcp01-rubeus ~]# systemctl enable dhcpd  
Created symlink from /etc/systemd/system/multi-user.target.wants/dhcpd.service to /usr/lib/systemd/system/dhcpd.service.  
[root@dhcp01-rubeus ~]#
```

Configuring the Firewall to allow incoming DHCP requests

The default configuration on CentOS is to enable the firewall and allow both ICMP and SSH requests in. The DHCP server will not work until we enable the firewall. We will be using `firewalld` and the `firewall-cmd` utility to make this happen. The “`firewall-cmd --list-all`” option shows the default firewall that allows `dhcpv6-client` (not to be confused with `dhcp` server) and `ssh`. We will add the `dhcp` service (as opposed to its ports).



```
root@dhcp01-rubeus:~  
[root@dhcp01-rubeus ~]# firewall-cmd --list-all  
public (active)  
  target: default  
  icmp-block-inversion: no  
  interfaces: ens192  
  sources:  
  services: dhcpv6-client ssh  
  ports:  
  protocols:  
  masquerade: no  
  forward-ports:  
  source-ports:  
  icmp-blocks:  
  rich rules:  
  
[root@dhcp01-rubeus ~]#
```

The following syntax adds the ports associated with dhcp permanently. The --permanent flag is important. If you fail to add this, the next time you reboot, your changes will be lost. Make sure you reload the firewall to invoke the change. List all the rules and make sure your dhcp service has been added.

💣 Don't forget the --permanent flag, nor forget to reload the firewall!



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```
root@dhcp01-rubeus:~  
[root@dhcp01-rubeus ~]# firewall-cmd --add-service=dhcp --permanent  
success  
[root@dhcp01-rubeus ~]# firewall-cmd --reload  
success  
[root@dhcp01-rubeus ~]# firewall-cmd --list-all  
public (active)  
  target: default  
  icmp-block-inversion: no  
  interfaces: ens192  
  sources:  
  services: dhcp dhcpv6-client ssh  
  ports:  
  protocols:  
  masquerade: no  
  forward-ports:  
  source-ports:  
  icmp-blocks:  
  rich rules:  
  
[root@dhcp01-rubeus ~]#
```

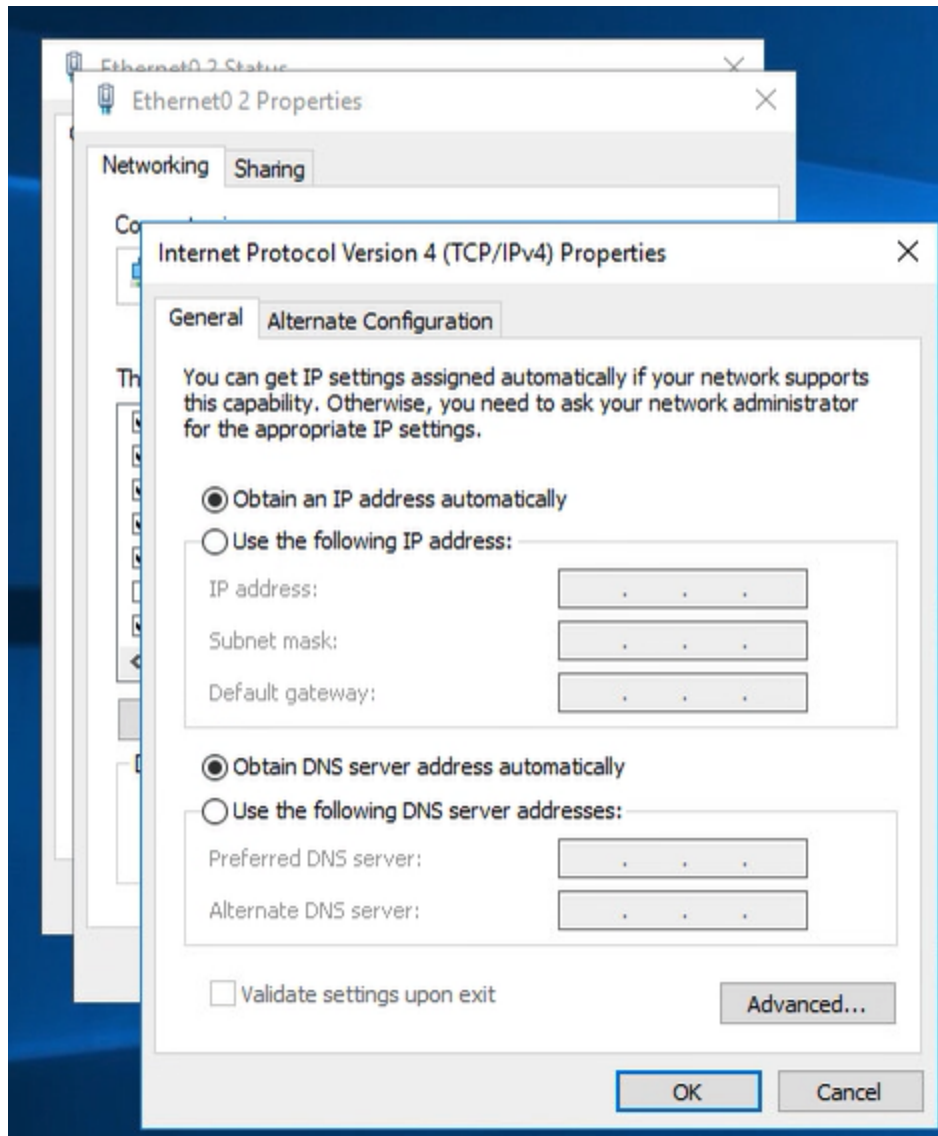
Type exit to leave your elevated state and exit again to exit PuTTY.

```
rubeus@dhcp01-rubeus:~  
[root@dhcp01-rubeus ~]# whoami  
root  
[root@dhcp01-rubeus ~]# exit  
logout  
[rubeus@dhcp01-rubeus ~]$ whoami  
rubeus  
[rubeus@dhcp01-rubeus ~]$ exit
```

Windows 10 DHCP Client

As a privileged user, you will now re-configure networking on WKS01 to use dynamic addressing rather than static addresses.





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Deliverable 1. Take a snapshot of the results of `ipconfig /all`. Note the DHCP server of 10.0.5.3 should be there, your IP address should be the first IP address in the scope you set earlier. Your domain name, netmask and gateway should also be set correctly.

```
PS C:\Users\rubeus.hagrid-adm> ipconfig /all

Windows IP Configuration

    Host Name . . . . . : wks01-rubeus
    Primary Dns Suffix . . . . . : rubeus.local
    Node Type . . . . . : Hybrid
    IP Routing Enabled. . . . . : No
    WINS Proxy Enabled. . . . . : No
    DNS Suffix Search List. . . . . : rubeus.local

Ethernet adapter Ethernet0:

    Connection-specific DNS Suffix . : rubeus.local
    Description . . . . . : Intel(R) 82574L Gigabit Network Connection
    Physical Address. . . . . : 00-50-56-B3-59-26
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    IPv4 Address. . . . . : 10.0.5.100(Preferred)
    Subnet Mask . . . . . : 255.255.255.0
    Lease Obtained. . . . . : Thursday, September 16, 2021 1:55:57 PM
    Lease Expires . . . . . : Friday, September 17, 2021 1:55:57 AM
    Default Gateway . . . . . : 10.0.5.2
    DHCP Server . . . . . : 10.0.5.3
    DNS Servers . . . . . : 10.0.5.5
    NetBIOS over Tcpip. . . . . : Enabled

PS C:\Users\rubeus.hagrid-adm>
```

Deliverable 2. Log back into `dhcp01` and find the DHCP log associated with `wks01`'s request for DHCP information. Take a snapshot similar to the one below. The IP address, the workstation name, the layer 2 address should all match between deliverables 1 and 2.

The following command below looks complex, but let's break it down:

sudo = raises our privileges because `/var/log/messages` is owned by the root user.

cat = writes the file `/var/log/messages` to the screen

| = Called 'pipe', & sends the output of the previous command to the next command
grep wks01-yourname = filters input for the string '`wks01-yourname`'.



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```
rubeus@dhcp01-rubeus:~  
[rubeus@dhcp01-rubeus ~]$ sudo cat /var/log/messages | grep wks01-rubeus  
[sudo] password for rubeus:  
Sep 16 13:56:08 dhcp01-rubeus dhcpd: DHCPOFFER on 10.0.5.100 to 00:50:56:b3:59:26 (wks01-rubeus) via ens192  
Sep 16 13:56:08 dhcp01-rubeus dhcpd: DHCPREQUEST for 10.0.5.100 (10.0.5.3) from 00:50:56:b3:59:26 (wks01-rubeus) via ens192  
Sep 16 13:56:08 dhcp01-rubeus dhcpd: DHCPACK on 10.0.5.100 to 00:50:56:b3:59:26 (wks01-rubeus) via ens192  
[rubeus@dhcp01-rubeus ~]$
```

Wireshark

Run a capture session against WKS01's Ethernet0 adapter.

As an administrative power user (-adm), release the current DHCP release and then renew it.
Your objective is to capture the four DHCP messages between client and server.

You release your current DHCP release using the following command:

```
ipconfig /release
```



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Windows PowerShell

```
PS C:\Users\rubeus.hagrid-adm> ipconfig /release

Windows IP Configuration

Ethernet adapter Ethernet0:

    Connection-specific DNS Suffix  . : 
    Default Gateway . . . . . : 
PS C:\Users\rubeus.hagrid-adm> ipconfig /renew

Windows IP Configuration

Ethernet adapter Ethernet0:

    Connection-specific DNS Suffix  . : rubeus.local
    IPv4 Address. . . . . : 10.0.5.100
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.0.5.2
PS C:\Users\rubeus.hagrid-adm> ipconfig /all

Windows IP Configuration

    Host Name . . . . . : wks01-rubeus
    Primary Dns Suffix . . . . . : rubeus.local
    Node Type . . . . . : Hybrid
    IP Routing Enabled. . . . . : No
    WINS Proxy Enabled. . . . . : No
    DNS Suffix Search List. . . . . : rubeus.local

Ethernet adapter Ethernet0:

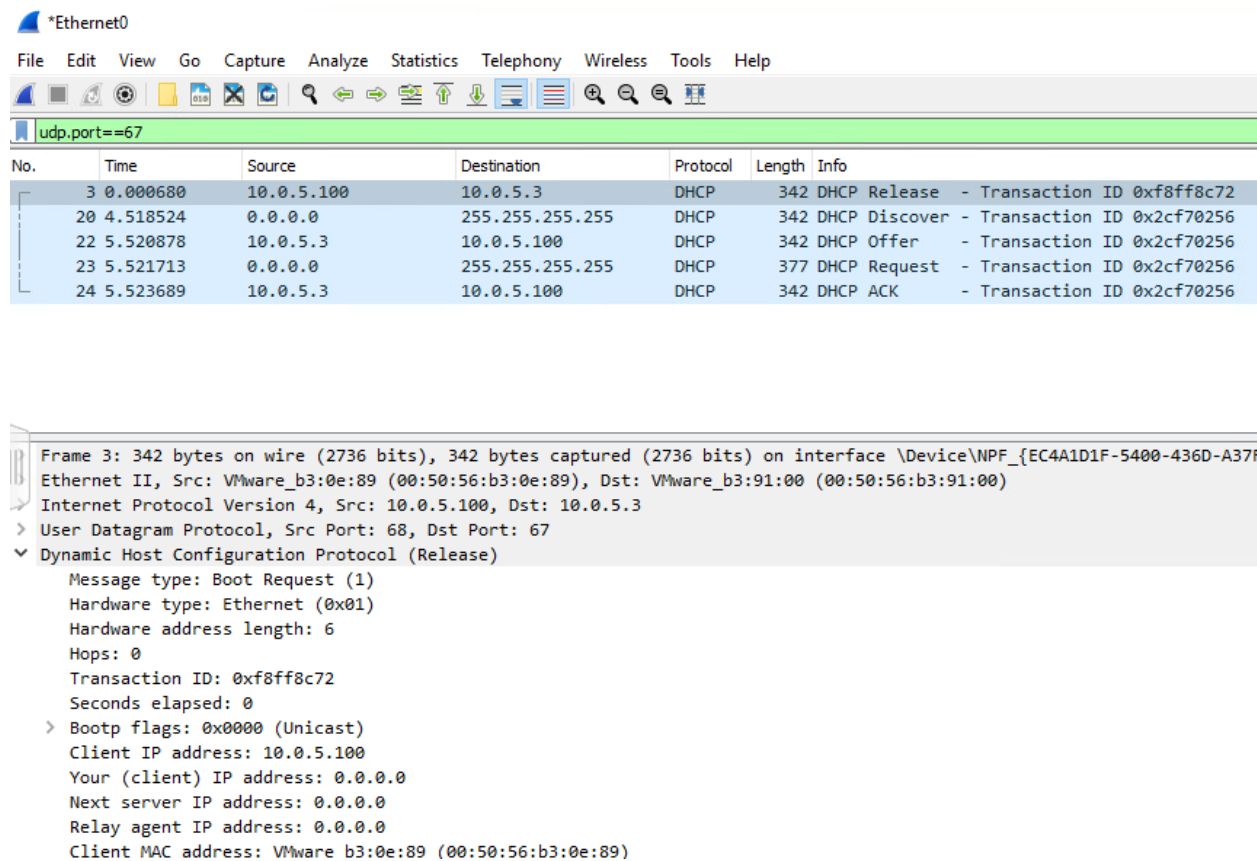
    Connection-specific DNS Suffix  . : rubeus.local
    Description . . . . . : Intel(R) 82574L Gigabit Network Connection
    Physical Address. . . . . : 00-50-56-B3-59-26
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    IPv4 Address. . . . . : 10.0.5.100(Preferred)
    Subnet Mask . . . . . : 255.255.255.0
    Lease Obtained. . . . . : Thursday, September 16, 2021 2:11:36 PM
    Lease Expires . . . . . : Friday, September 17, 2021 2:11:36 AM
    Default Gateway . . . . . : 10.0.5.2
    DHCP Server . . . . . : 10.0.5.3
    DNS Servers . . . . . : 10.0.5.5
    NetBIOS over Tcpip. . . . . : Enabled
PS C:\Users\rubeus.hagrid-adm>
```

Stop the capture and create a Wireshark display filter that shows UDP traffic sourced or destined to port 67. Browse each of the four messages to get a handle on source, destination addresses (layer 2 & layer 3) and ports and the sequence of messages used to provide WKS01 another leased IP address.



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Deliverable 3. Provide a screenshot similar to the one below that shows the 4 Key DHCP Messages.



The screenshot shows the Wireshark network protocol analyzer interface. The top menu bar includes File, Edit, View, Go, Capture, Analyze, Statistics, Telephony, Wireless, Tools, and Help. Below the menu is a toolbar with various icons. The packet list pane shows a filter 'udp.port==67' and a list of five packets. The packet details pane shows the selected packet (No. 3) with the following information:

No.	Time	Source	Destination	Protocol	Length	Info
3	0.000680	10.0.5.100	10.0.5.3	DHCP	342	DHCP Release - Transaction ID 0xf8ff8c72
20	4.518524	0.0.0.0	255.255.255.255	DHCP	342	DHCP Discover - Transaction ID 0x2cf70256
22	5.520878	10.0.5.3	10.0.5.100	DHCP	342	DHCP Offer - Transaction ID 0x2cf70256
23	5.521713	0.0.0.0	255.255.255.255	DHCP	377	DHCP Request - Transaction ID 0x2cf70256
24	5.523689	10.0.5.3	10.0.5.100	DHCP	342	DHCP ACK - Transaction ID 0x2cf70256

The packet details pane for the selected packet (No. 3) shows the following information:

- Frame 3: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface \Device\NPF_{EC4A1D1F-5400-436D-A37F-...}
- Ethernet II, Src: VMware_b3:0e:89 (00:50:56:b3:0e:89), Dst: VMware_b3:91:00 (00:50:56:b3:91:00)
- Internet Protocol Version 4, Src: 10.0.5.100, Dst: 10.0.5.3
- User Datagram Protocol, Src Port: 68, Dst Port: 67
- Dynamic Host Configuration Protocol (Release)
 - Message type: Boot Request (1)
 - Hardware type: Ethernet (0x01)
 - Hardware address length: 6
 - Hops: 0
 - Transaction ID: 0xf8ff8c72
 - Seconds elapsed: 0
 - Bootp flags: 0x0000 (Unicast)
 - Client IP address: 10.0.5.100
 - Your (client) IP address: 0.0.0.0
 - Next server IP address: 0.0.0.0
 - Relay agent IP address: 0.0.0.0
 - Client MAC address: VMware b3:0e:89 (00:50:56:b3:0e:89)

Leveling Up

Deliverable 4. Figure out how to change the default lease time given to dhcp clients to 1 hour with a max lease time of four hours. Provide a screenshot displaying the new configuration, along with the shot confirming the change.

Deliverable 5. Tech Journal Entry - Explore 3 other items related to DHCP, and dig into their related Wireshark captured packets.



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