



Quick HOWTO : Ch08 : Configuring the DHCP Server

From Linux Home Networking

Contents

- 1 Introduction
- 2 Download and Install the DHCP Package
- 3 Managing the DHCP Server
- 4 dhcpd.conf File
- 5 DHCP Servers with Multiple NICs
 - 5.1 Routing
 - 5.1.1 Temporary Solution
 - 5.1.2 Permanent Solution
 - 5.2 Listening
- 6 Configuring Linux Clients to Use DHCP
- 7 Configuring Windows Clients to Use DHCP
- 8 Using a Single DHCP Server to Serve Multiple Networks
- 9 Simple DHCP Troubleshooting
 - 9.1 DHCP Clients Obtaining 169.254.0.0 Addresses
 - 9.2 Other DHCP Failures
- 10 Conclusion

This chapter covers only the configuration of a DHCP server that provides IP addresses. The configuration of a Linux DHCP client that gets its IP address from a DHCP server is covered in Chapter 3, "Linux Networking", on Linux Networking.

Download and Install the DHCP Package

Most RedHat and Fedora Linux software product packages are available in the RPM format, whereas Debian and Ubuntu Linux use DEB format installation files. When searching for these packages, remember that the filename usually starts with the software package name and is followed by a version number, as in `dhcp-3.23.58-4.i386.rpm`. (For help on downloading and installing the package, see Chapter 6, "Installing Linux Software".)

Managing the DHCP Server

Managing the DHCP daemon is easy to do, but the procedure differs between Linux distributions. Here are some things to keep in mind.

- Firstly, different Linux distributions use different daemon management systems. Each system has its own set of commands to do similar operations. The most commonly used daemon management systems are SysV and Systemd.
- Secondly, the daemon name needs to be known. In this case the name of the daemon is **dhcpd**.

Armed with this information you can know how to:

- Start your daemons automatically on booting
- Stop, start and restart them later on during troubleshooting or when a configuration file change needs to be applied.

Introduction

Normally if you have a cable modem or DSL, you get your home PC's IP address dynamically assigned from your service provider. If you install a home cable/DSL router between your modem and home network, your PC will most likely get its IP address at boot time from the home router instead. You can choose to disable the DHCP server feature on your home router and set up a Linux box as the DHCP server.

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For more details on this, please take a look at the "Managing Daemons" section of Chapter 6 "Installing Linux Software"

Note: If you modify your daemon configuration file remember that the changes won't take effect till you restart the daemon.

Note: Remember to configure your daemon to start automatically upon your next reboot.

dhcpd.conf File

You can define your server configuration parameters in the dhcpd.conf file which may be located in the /etc the /etc/dhcpd or /etc/dhcp3 directories depending on your version of Linux.

Note: The skeleton dhcp.conf file that is created when you install the package may vary in its completeness. In Ubuntu / Debian, the skeleton dhcpd.conf file is extensive with most of the commands deactivated with a # sign at the beginning. In Fedora / RedHat / CentOS an extensive sample is also created with activated commands. It is found in the following location which you can always use as a guide.

```
-----  
/usr/share/doc/dhcp*/dhcpd.conf.sample  
-----
```

Note: The dhcpd.conf configuration file formats in Debian / Ubuntu and Redhat / Fedora are identical.

Here is a quick explanation of the dhcpd.conf file: Most importantly, there must be a subnet section for each interface on your Linux box.

```
-----  
{  
  ddns-update-style interim  
  ignore client-updates  
  subnet 192.168.1.0 netmask 255.255.255.0 {  
    # The range of IP addresses the server  
    # will issue to DHCP enabled PC clients  
    # booting up on the network  
    range 192.168.1.201 192.168.1.220;  
    # Set the amount of time in seconds that  
    # a client may keep the IP address  
    default-lease-time 86400;  
    max-lease-time 86400;  
    # Set the default gateway to be used by  
    # the PC clients  
    option routers 192.168.1.1;  
    # Don't forward DHCP requests from this  
    # NIC interface to any other NIC  
    # interfaces  
    option ip-forwarding off;  
    # Set the broadcast address and subnet mask  
    # to be used by the DHCP clients  
    option broadcast-address 192.168.1.255;  
    option subnet-mask 255.255.255.0;  
    # Set the NTP server to be used by the  
    # DHCP clients  
    option ntp-servers 192.168.1.100;  
    # Set the DNS server to be used by the  
    # DHCP clients  
    option domain-name-servers 192.168.1.100;  
    # If you specify a WINS server for your Windows clients,  
    # you need to include the following option in the dhcpd.conf file:  
    option netbios-name-servers 192.168.1.100;  
    # You can also assign specific IP addresses based on the clients'  
    # ethernet MAC address as follows (Host's name is "laser-printer":  
    host laser-printer {  
      hardware ethernet 08:00:2b:4c:59:23;  
      fixed-address 192.168.1.222;  
    }  
  }  
}  
#  
# List an unused interface here  
#  
subnet 192.168.2.0 netmask 255.255.255.0 {  
}  
}  
-----
```

There are many more options statements you can use to configure DHCP. These include telling the DHCP clients where to go for services such as finger and IRC. Check the dhcp-options man page after you do your install:

```
-----  
[root@bigboy tmp]# man dhcp-options  
-----
```

Note: The host statement seen in the sample dhcpd.conf file can be very useful. Some devices such as network printers default to getting their IP addresses using DHCP, but users need to access them by a fixed IP address to print their documents. This statement can be used to always provide specific IP address to DHCP queries from a predefined a NIC MAC address. This can help to reduce systems administration overhead.

DHCP Servers with Multiple NICs

DHCP servers with multiple interfaces pose two configuration challenges. The first is setting up the correct routing and the second is making sure only the required interfaces are listening to serve DHCP. Don't worry, both will be discussed next.

Routing

When a DHCP configured PC boots, it requests its IP address from the DHCP server. It does this by sending a standardized DHCP broadcast request packet to the DHCP server with a source IP address of 255.255.255.255.

If your DHCP server has more than one interface, you have to add a route for this 255.255.255.255 address so that it knows the interface on which to send the reply; if not, it sends it to the default gateway. (In both of the next two examples, we assume that DHCP requests will be coming in on interface eth0).

Note: More information on adding Linux routes and routing may be found in Chapter 3, "Linux Networking".

Note: You can't run your DHCP sever on multiple interfaces because you can only have one route to network 255.255.255.255. If you try to do it, you'll discover that DHCP serving working on only one interface.

Temporary Solution

You can temporarily add a route to 255.255.255.255 using the route add command as seen below.

```
[root@bigboy tmp]# route add -host 255.255.255.255 dev eth0
```

If you want this routing state to be maintained after a reboot, then use the permanent solution that's discussed next.

Permanent Solution

Create a permanent route to 255.255.255.255. This will vary according to your version of Linux

Fedora / RedHat / CentOS: Add the route to your /etc/sysconfig/network-scripts/route-eth0 file if the route needs to be added to your eth0 interface.

```
##
## File: /etc/sysconfig/network-scripts/route-eth0
##
255.255.255.255/32 dev eth0
```

Ubuntu / Debian: Add the route to your /etc/network/interfaces file. In this case the route is added to the eth0 interface.

```
##
## File: /etc/network/interfaces
##
iface eth0 inet static
    up route add -host 255.255.255.255 eth0
```

Simple Linux routing is covered in Chapter 3, "Linux Networking" and will add more clarity to adding permanent static routes.

Listening

Once you have defined the interface for your DHCP routing you should also ensure that your DHCP server only listens on that interface and no others. This methodology to do this varies depending on your version of Linux.

Fedora / RedHat / CentOS: The /etc/sysconfig/dhcpd file must be edited and the DHCPDARGS variable edited to include the preferred interface. In this example interface eth0 is preferred.

```
## File: /etc/sysconfig/dhcpd
DHCPDARGS=eth1
```

Debian / Ubuntu: The /etc/default/dhcp3-server file must be edited and the INTERFACES variable edited to include the preferred interface. In this example interface eth0 is preferred.

```
# File: /etc/default/dhcp3-server
INTERFACES="eth0"
```

You will be able to verify success in one of two ways. First the netstat command using the `-au` options will give the list of interfaces listening on the bootp (DHCP) UDP port.

```
[root@bigboy-f ~]# netstat -au | grep bootp
udp        0      0 192.168.1.100:bootps  *:*
[root@bigboy-f ~]#
```

Secondly, your `/var/log/messages` file will also reveal the defined interfaces used when the DHCPd daemon was restarted.

```
Jan  8 17:22:44 bigboy dhcpd: Listening on LPF/eth0/00:e0:18:5c:d8:41/192.168.1.0/24
Jan  8 17:22:44 bigboy dhcpd: Sending on   LPF/eth0/00:e0:18:5c:d8:41/192.168.1.0/24
```

Success! You can go back to lunch!

Configuring Linux Clients to Use DHCP

A Linux NIC interface can be configured to obtain its IP address using DHCP with the examples outlined in , "Chapter 3, Linux Networking". Please refer to this chapter if you need a quick refresher on how to configure a Linux DHCP client.

Configuring Windows Clients to Use DHCP

Fortunately Windows defaults to using DHCP for all its NIC cards so you don't have to worry about doing any reconfiguration.

Using a Single DHCP Server to Serve Multiple Networks

As stated before, DHCP clients send their requests for IP addresses to a broadcast address which is limited to the local LAN. This would imply that a DHCP server is required on each subnet. Not so. It is possible to configure routers to forward DHCP requests to a DHCP server many hops away. This is done by inserting the IP address of the router's interface on the DHCP client's network into the forwarded packet. To the DHCP server, the non-blank router IP address field takes precedence over the broadcast address and it uses this value to provide a DHCP address that is meaningful to the client. The DHCP server replies with a broadcast packet, and the router, which has kept track of the initial forwarded request, forwards it back towards the client. You can configure this feature on Cisco devices by using the `ip helper-address` command on all the interfaces on which DHCP clients reside. Here is a configuration sample that points to a DHCP server with the IP address 192.168.36.25:

```
interface FastEthernet 2/1
 ip address 192.168.1.30 255.255.255.0
 ip helper-address 192.168.36.25
```

Simple DHCP Troubleshooting

The most common problems with DHCP usually aren't related to the server; after the server is configured correctly there is no need to change any settings and it therefore runs reliably. The problems usually occur at the DHCP client's end for a variety of reasons. The following sections present simple troubleshooting steps that you can go through to ensure that DHCP is working correctly on your network.

DHCP Clients Obtaining 169.254.0.0 Addresses

Whenever Microsoft DHCP clients are unable to contact their DHCP server they default to selecting their own IP address from the 169.254.0.0 network until the DHCP server becomes available again. This is frequently referred to as Automatic Private IP Addressing (APIPA). Here are some steps you can go through to resolve the problem:

- Ensure that your DHCP server is configured correctly and use the `pgrep` command discussed earlier to make sure the DHCP process is running. Pay special attention to your 255.255.255.255 route, especially if your DHCP server has multiple interfaces.

- Give your DHCP client a static IP address from the same range that the DHCP server is supposed to provide. See whether you can ping the DHCP server. If you cannot, double-check your cabling and your NIC cards.
- DHCP uses the BOOTP protocol for its communication between the client and server. Make sure there are no firewalls blocking this traffic. DHCP servers expect requests on UDP port 67 and the DHCP clients expect responses on UDP port 68. Use `tcpdump` on the server's NIC to verify the correct traffic flows.

Other DHCP Failures

If the DHCP server fails to start then use your regular troubleshooting techniques outlined in Chapter 4, "Simple Network Troubleshooting", to help rectify your problems. Most problems with an initial setup are often due to:

- Incorrect settings in the `/etc/dhcpd.conf` file such as not defining the networks for which the DHCP server is responsible;
- Firewall rules that block the DHCP bootp protocol on UDP ports 67 and 68;
- Routers failing to forward the bootp packets to the DHCP server when the clients reside on a separate network.

Always check your `/var/logs/messages` file for `dhcpd` errors and remember that mandatory keywords in your configuration file may change when you upgrade your operating system. Always read the release notes to be sure.

Conclusion

In most home-based networks, a DHCP server isn't necessary because the DSL router / firewall usually has DHCP capabilities, but it is an interesting project to try. Just remember to make sure that the range of IP addresses issued by all DHCP servers on a network doesn't overlap because it could possibly cause unexpected errors. You might want to disable the router/firewall's DHCP server capabilities to experiment with your new Linux server.

A DHCP server may be invaluable in an office environment where the time and cost of getting a network engineer to get the work done may make it simpler for Linux systems administrators to do it by themselves.

Creating a Linux DHCP server is straightforward and touches all the major themes in the previous chapters. Now it's time to try something harder, but before we do, we'll do a quick refresher on how to create the Linux users who'll be using many of the applications outlined in the rest of the book.

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