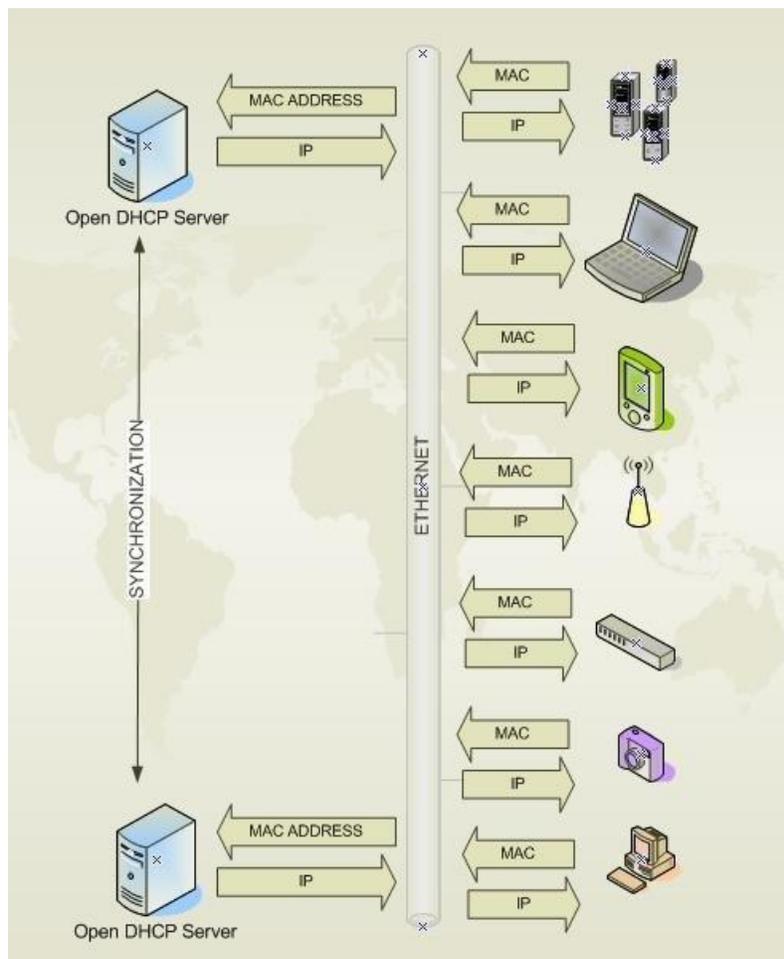


OPEN DHCP SERVER



Installation and Configuration Manual

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1 Preface

Open DHCP Server is an Open Source Freeware. It has most of the Industry Standard Features. It attempts to comply with various RFC for Dynamic Host Configuration Protocol. It is released under the GNU Open Source License Agreement.

Although it has most of the features and capabilities required for use by experts, it is still very simple to configure and use. It is also well suited for small and home use by persons not having any knowledge of DHCP Protocol. The most salient features include:-

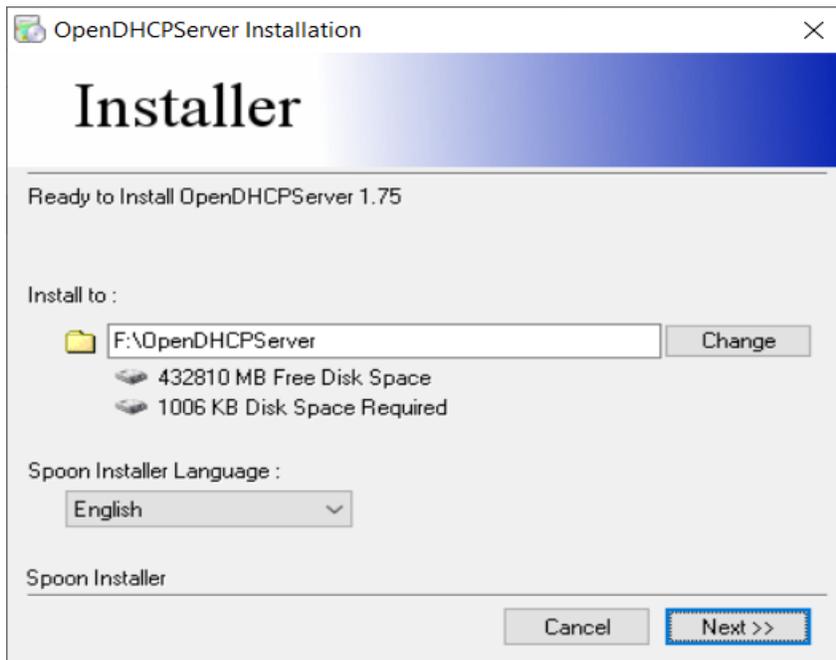
- a) Supports upto 125 DHCP ranges.
- b) Supports both Static hosts and Dynamic DHCP Ranges.
- c) Supports BOOTP and relay agents.
- d) Supports multiple zones in single server.
- e) Supports all possible DHCP Options straightaway, no need to define option types
- f) Supports filtering/selection of DHCP Ranges based on Mac Range, Subnet Selection IP, Relay Agent IP, Vendor Options and User Options.
- g) Options can be Global, DHCP Range Specific or Client specific.
- h) Supports Replicated Fail Safe DHCP Operation.
- i) Multiple ways to assign option values like strings, IPs, hex strings or byte arrays.
- j) Lease Status is displayed on auto refreshing html page
- k) Low CPU and executable size, requiring very little memory.

This document covers the basic configuration of **Open DHCP Server**.

2 Installation

2.1 Windows Installation

Installation of **Open DHCP Server** on Windows is straightforward. Just run the Installer and it installs. Windows Service is also automatically created. You can start/stop the Service from Windows Service Control Applet, also can setup as **Auto Start** or **Manual Start**.



2.2 Windows Uninstallation

The uninstaller, in Control Panel (Programs), cleanly installs the program and also removes the Windows Service. If you want to remove the windows service but keep the installation run the utility (in Admin Mode) RemoveService.exe from installation directory. You can add it back using utility InstallService.exe from same place.

2.3 Windows Compiling

The current version is compiled on 64bit gcc compiler. If you have old 32bit computer and need 32bit version, please recompile is on 32bit compiler. The command for compiling (GCC) is:-

```
g++ -o OpenDHCP Server.exe OpenDHCP Server.cpp -lwsock32 -liphlpapi -lws2_32
```

64 bit version will not cause Y2038 issue.

2.4 Linux Installation

Expand the GZ archive to any directory (preferably /opt/openshpc) and change the permission of file openshpcd with chmod 755 openshpcd, if needed. Linux Installation is easy too but in Linux, we need to create a symbolic link for daemonization. Also recompiling may be needed for 32bit . openshpc may not run on other operating systems like BDS, Solaris.

2.5 Linux Compiling

The enclosed `opendhcpd` executable file may only run on Intel Linux 64 bit version. For 32 bit Linux system or non-intel systems, you can try:-

```
#g++ opendhcpd.cpp -oopendhcpd -lpthread
#g++ opendhcpd.cpp -oopendhcpd -lpthread -lgcc_s
```

You need C++ compiler for Versions 3 onwards, as these versions use STL. If you have only C Compiler, you need to download and use Version 2.1 only.

2.6 Linux Daemonizing

If your Linux flavor supports `chkconfig` command, you can use the enclosed `rc.opendhcp` file to add the service. Just create a symbolic link `/etc/init.d/opendhcp` to `/opt/opendhcp/rc.opendhcp` (in `/etc/init.d`) and make it executable. Also change the file paths (depending on where you have installed the executive and log file directory) in this `rc.opendhcp` file. Then you can use `chkconfig` command to add the daemon. You need following command to do the whole job.

```
#ln -s /opt/opendhcp/rc.opendhcp /etc/init.d/opendhcp
#chmod 744 /etc/init.d/opendhcp
#chkconfig --add opendhcp
#chkconfig opendhcp on
```

Last command is for automatic start/stop only. That's all you may need on such Linux flavors.

Some of the Linux flavors like debian support `rcconf` command, which is very similar to `chkconfig` command. **Nothing more is required to be done for flavors supporting `chkconfig` or `rcconf` command.**

If your flavor doesn't support `chkconfig` or `rcconf` you can manually do following 2 steps:-

```
#ln -s /opt/opendhcp/rc.opendhcp /etc/rc.d/opendhcp
#chmod 744 /etc/rc.d/opendhcp
```

For automatic start Add the following line to `/etc/rc.d/rc.local` file or `/etc/inittab` file or `/etc/rc.d/rc.inet2` file (preferred).

```
# Start the Open DHCP Server daemon:
if [ -x /etc/rc.d/rc.opendhcp ]; then
/etc/rc.d/rc.opendhcp start
fi
```

3 Configuration

The entire configuration for Open DHCP Server is done in file OpenDHCPServer.ini (or opendhcp.ini for Linux). You should keep this file in your installation directory in Windows, where OpenDHCPServer.exe file is. In Linux you can keep this file at any location. Configuration file has many sections. These sections are described further. *Comments in red are for guiding purpose only and should not be copied in actual Open DHCP Server.ini file.* Each section have many entries in the form Name=Value. Any entry starting with punctuation mark is a comment and such entry will be ignored.

3.1 LISTEN_ON

This section restricts the server to listen for DHCP requests on selected interfaces. There may be many interfaces on multi-homed servers. Out of these interfaces, you can still restrict which interface(s) should listen for requests. **Open DHCP Server** only listens on Static Interfaces which means the IP address is fixed and not obtained from another DHCP Server. Any dynamic interfaces specified here will be ignored. If no interface is specified here, **Open DHCP Server** listens on all Static Interfaces.

```
[LISTEN_ON]
192.168.0.1
192.168.55.23
```

3.2 LOGGING

Logging level should be specified under section [LOGGING]. LogLevels can be set as **None**, **Normal** or **All**. It is advisable to keep logging to **Normal**. Normal means errors and DHCP renewal messages. **None** and **All** are self-explanatory.

```
[LOGGING]
LogLevel=Normal #Can be None, Normal or All
```

3.3 REPLICATION_SERVERS

The Open DHCP Server have been designed and developed to for **replicated fail safe** operation. For DHCP Replicated operation, the **Primary** and **Secondary** Servers should be specified here. Now both servers database will be in synch. If one server goes down, other will renew the same lease without DHCPDISCOVER and DHCPOFFER. You can ignore this section if you have single server.

```
[REPLICATION_SERVERS]
Primary=192.168.55.254
Secondary=192.168.55.23
```

3.4 RANGE_SET

DHCP Ranges are required for Dynamic Address allocation. The actual DHCP Ranges are grouped into [RANGE_SET]s, so that range specific options can be specified for a group of ranges at one place. Each [RANGE_SET] can contain actual DHCP Ranges, Range specific options and Range Filters. Options have option tags (1-254) and values can be specified many different ways. Please Refer to [DHCP Options](#). You can specify one or more ranges in each [RANGE_SET] section, in format specified. DHCP Server will allot

addresses from these ranges. Static Hosts and BootP Hosts do not need/use ranges. You need not specify any [RANGE_SET] if all clients are Static. Next is example of simple DHCP Range and may be sufficient for home/SOHO use. **The total ranges together in all [RANGE_SET]s is limited to 125** and there can also be 125 [RANGE_SET]s max.

```
[RANGE_SET]
DHCPRange=192.168.0.1-192.168.254           #Actual DHCP Range
SubnetMask=255.255.255.0                   #Subnet Mask for range
Router=192.168.0.1                         #Default Gateway
AddressTime=500                            #Lease Expiry Time after which client will renew.
DomainServer=192.168.1.1, 192.168.1.2     #DNS Servers
```

The SubnetMask, Router, AddressTime and DomainServer here are *Range Set* specific options and will be added to all DHCP responses falling in this range. You need not specify these options in [RANGE_SET], if you have already specified them in [GLOBAL_OPTIONS] section. Keywords like SubnetMask and Router are option names (specific to Open DHCP Server) but clients are always sent option tags but names are used for easy identification in configuration file. You can also directly use option tags directly as below.

```
[RANGE_SET]
DHCPRange=192.168.0.1-192.168.254           #Actual DHCP Range
1=255.255.255.0                             #Subnet Mask for range
3=192.168.0.1                               #Default Gateway
51=500                                       #Lease Expiry
5=192.168.1.1, 192.168.1.2                 #DNS Servers
```

You can specify many options in a [RANGE_SET]. Option values can also be specified multiple ways please refer to [DHCP Options](#) topic. You can also filter [RANGE_SET]s based on client sent values *Mac Address, Vendor Class* and *User Class* or even by relay agent IP. This is advance topic and please refers to **Filtering DHCP Ranges** topic next for more info.

3.5 Filtering DHCP Ranges

You can select RANGE_SETs based on filter conditions. If any entry in a RANGE_SET has matched the filter condition then only that RANGE_SET will be available to client (in fact all RANGE_SETs which has matched the filter condition will be available to client). Remaining RANGE_SETs will no more be available to that client. These filters although looks like options, but are not actual options but filter based on client sent values. Hence these filters never go to client with DHCP OFFER or DHCP ACK messages. Open DHCP Server supports 4 type of filters as described below:-

3.5.1 Mac Range Filters

Mac Range Filters Enable a RANGE_SET (All the ranges within a RANGE_SET) for a given Mac Range. Like:-

```
FilterMacRange=00:0d:60:c5:4e:00-00:0d:60:c5:4e:ff
```

(above entry means Mac Address from 00:0d:60:c5:4e:00 to 00:0d:60:c5:4e:ff). If above filter is specified, the range of this RANGE_SET will be only be selected if Mac Address falls in this range. **You can add upto 32 Mac Range filters in each RANGE_SET.** Multiple entries work like “or” operation. In

other words, RANGE_SET will be available to all clients having Addresses falling in **any** of FilterMacRanges specified.

3.5.2 Vendor Class and User Class Filters

Vendor Class and *User Class* Filters require exact match to value specified. However multiple values can be added to each RangeSet. If the client sent values match with any one of specified values, DHCP ranges in this RANGE_SET will be available to this client. The values can be Strings, byte array or hex bytes. For example:-

```
[RANGE_SET]
DHCPRange=192.168.1.171-192.168.1.180
FilterVendorClass="MSFT 4.0"
FilterVendorClass="MSFT 5.0"
FilterVendorClass="MSFT 6.0"
```

Vendor Class is set by manufacturer and has limited use of segregating the DHCP Ranges. **User Class** can be set manually for a computer and can be very effectively used to segregate computers. For example you may segregate your computers and customer computers; you can set the **User Class** for all your computers to some value. Now Filter the DHCP Range with this value. Now a particular range will be available to your computers and remaining ranges will only be available to customer's computers. Using **User Class**, you can even use different range for each of your departments. As you can see different RANGE_SET can be selected for different **User Class**, you can also set other options for filtered RANGE_SET. You can have different DNS Server, Proxy Server, and Gateway Server etc. You can deny internet access to some computers based on **User Class**.

```
[RANGE_SET]
DHCPRange=192.168.12.231-192.168.12.240
FilterVendorClass="MSFT 5.0"
FilterUserClass="HomeComputer"
DomainServer=192.168.12.1
Router=192.168.12.1
```

Above example can be used to differentiate between home office computers and third party computers. Home different computers will use different RANGE_SET and different options.

Blank option values ensure these options never sent to host, not even complimented even from GLOBAL_OPTIONS.

```
[RANGE_SET]
DHCPRange=192.168.12.1-192.168.12.230
DomainServer= #Blank option values ensure this option is never sent
Router= #Blank option values ensure this option is never sent
```

3.5.3 Subnet Selection Filters

When the DHCPDISCOVER arrives from local subnet, the listening interface's IP address/SubnetIP is used to find matching DHCP Range. If DHCPDISCOVER comes from another subnet, Relay Agent's IP address is also put in the DHCPDISCOVER by Relay Agent. Now this IP is used to find matching DHCP Range. If subnetselection IP (option 118) is sent by client, this IP is used to find the matching DHCP Range. The preference goes like:-

1. Subnet Selection IP (option 118)
2. Relay Agent IP
3. Listening Interface's IP

This is built in logic and no special filter is required for DHCP Range Selection when using Relay Agent.

However you can override this feature and force a particular range set using the filter FilterSubnetSelection. Using this filter will force a RANGE_SET based on matching of IP against FilterSubnetSelection. Now the RANGE_SET is matched against IP (Subnet Selection/Relay Agent IP) specified against this filter. It is done in same sequence as above. If option 118 is sent by client this IP value is matched to filter value. If option 118 is not sent and relay agent IP is available, then relay agent IP is matched against FilterSubnetSelection value.

```
[RANGE_SET]
DHCPRange=192.168.12.1-92.168.12.230
DomainServer=192.168.12.1
Router=192.168.12.1
FilterSubnetSelection=192.168.12.125
FilterSubnetSelection=192.168.13.125
TargetRelayAgent=192.168.11.2
```

The last item TargetRelayAgent above, forces the DHCP OFFER/DHCP ACCEPT to be routed to another Relay Agent 192.168.11.2. Normally the DHCP OFFER will be routed to Relay Agent, from where it came, but can be overridden with this. However **TargetRelayAgent** will be used only when the DHCPDISCOVER and DHCPREQUEST has SubnetSelection IP or RelayAgent IP. If the DHCPDISCOVER and DHCPREQUEST come without these values, TargetRelayAgent will be ignored. This will permit unicast messages to renew DHCP Address.

3.6 GLOBAL_OPTIONS

If some of DHCP Options are common to all the DHCP Ranges and Static Clients, you can specify these under [GLOBAL_OPTIONS] and you need not specify these options in [RANGE_SET] or under static clients. However if value is different for specific client or RANGE_SET, you can override values for specific host or RANGE_SET. DHCP Options under these sections would supplement (but not replace) client specific options and [RANGE_SET] options. Here only some examples are given, for complete list please refer DHCP Options topic.

```
[GLOBAL_OPTIONS]
SubNetMask=255.255.255.0
DomainServer=192.168.1.1, 192.168.1.2
Router=192.168.1.1
```

```
RenewalTime=600
RebindingTime=900
```

3.7 Static Host Sections

You can create Static Host Sections for hosts having fixed IP addresses. A new section against it's MAC Address need to be created for each client. You can specify client specific options under the client section. You need to specify IP Address only. If IP is not specified for a Static Host, this host would not be able to get an IP from Open DHCP Server. (This feature can be used to prevent some clients from getting any IP from this Server, even dynamic address won't be available for such client). All options are optional. For BOOTP requests, only these options (specified in client section) would be sent. However for DHCP requests, missing Options will be supplemented first from matching [RANGE_SET] options (if IP falls in any range) then from [GLOBAL_OPTIONS].

Following example below is simple most section where only IP is specified. Other options will be supplemented from [DHCP_RANGE] and [GLOBAL_OPTIONS].

```
[00:41:42:41:42:00] #This is a client with MAC addr 00:41:42:41:42:00
IP=192.168.0.200 #Only IP is specified for this client
```

This is another example with some client specific options

```
[00:41:42:41:42:05] #This is a client with MAC addr 00:41:42:41:42:05
IP=192.168.0.211 #IP Address for this client
HostName=TestHost #DHCP will offer this host name to client
DomainServer=10.5.6.90, 11.4.5.6 #Domain Name Server for client
Router=11.5.6.7, 4.6.7.34 #Default Gateway for client
```

Open DHCP Server will never allot any address to 00:41:42:41:42:76 as 0.0.0.0 IP has been specified

```
[00:41:42:41:42:76] #This is a client with MAC addr 00:41:42:41:42:00
IP=0.0.0.0 #No IP is specified for this client
```

#Following hosts will also never get an IP from this server as no IP is specified

```
[ff:00:27:78:7b:01] #Easy way to specify no IP
[ff:00:27:78:7b:02]
[ff:00:27:78:7b:03]
```

4 HTTP_INTERFACE

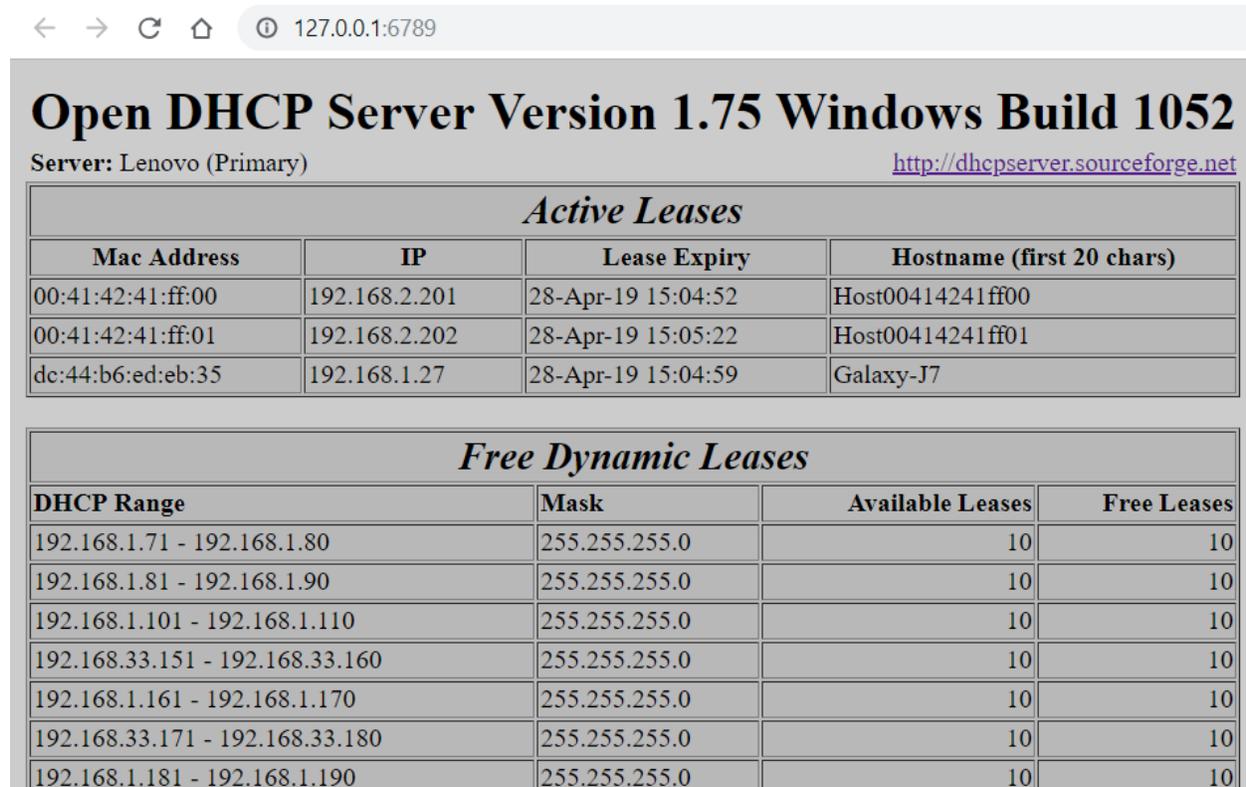
Open DHCP Server publishes a page showing the Lease Status. The default IP for this is 127.0.0.1 (windows) or first interface on Linux and default port is 6789. You can change both IP and port here.

```
[HTTP_INTERFACE]
HTTPServer=192.168.0.3:6789
```

If no port is specified, it is 6789

In addition to HTTPServer, you can specify upto 8 http clients, which can access this http page. If no client is specified, all clients can access this page.

```
[HTTP_INTERFACE]
HTTPServer=192.168.55.254
HTTPClient=192.168.0.11
HTTPClient=192.168.23.123
```



The screenshot shows a web browser window with the address bar set to 127.0.0.1:6789. The page title is "Open DHCP Server Version 1.75 Windows Build 1052". Below the title, it says "Server: Lenovo (Primary)" and provides a link to <http://dhcserver.sourceforge.net>. The main content is divided into two sections: "Active Leases" and "Free Dynamic Leases".

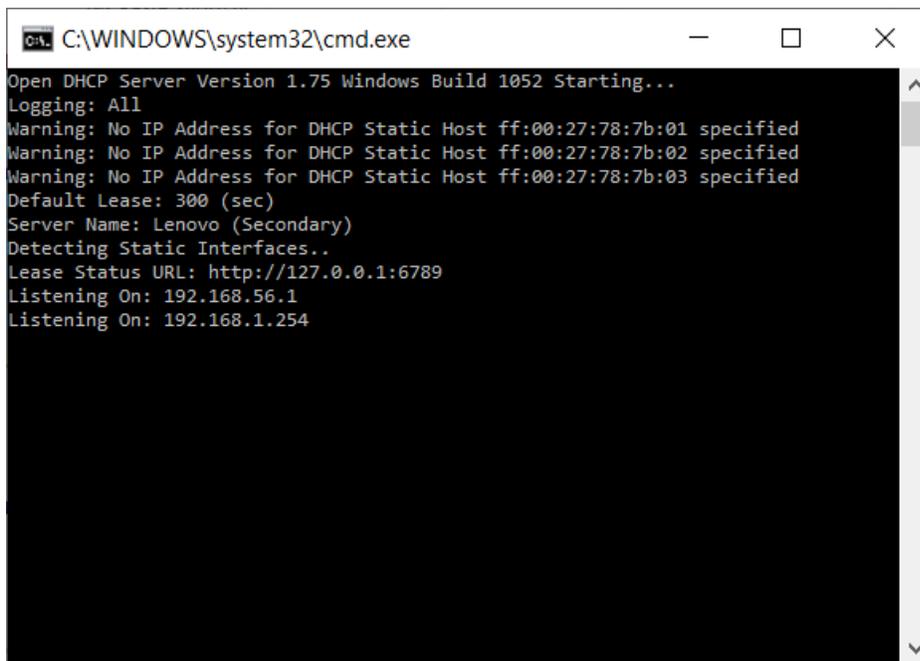
<i>Active Leases</i>			
Mac Address	IP	Lease Expiry	Hostname (first 20 chars)
00:41:42:41:ff:00	192.168.2.201	28-Apr-19 15:04:52	Host00414241ff00
00:41:42:41:ff:01	192.168.2.202	28-Apr-19 15:05:22	Host00414241ff01
dc:44:b6:ed:eb:35	192.168.1.27	28-Apr-19 15:04:59	Galaxy-J7

<i>Free Dynamic Leases</i>			
DHCP Range	Mask	Available Leases	Free Leases
192.168.1.71 - 192.168.1.80	255.255.255.0	10	10
192.168.1.81 - 192.168.1.90	255.255.255.0	10	10
192.168.1.101 - 192.168.1.110	255.255.255.0	10	10
192.168.33.151 - 192.168.33.160	255.255.255.0	10	10
192.168.1.161 - 192.168.1.170	255.255.255.0	10	10
192.168.33.171 - 192.168.33.180	255.255.255.0	10	10
192.168.1.181 - 192.168.1.190	255.255.255.0	10	10

5 Running of Open DHCP Server

5.1 Windows

You can run Open DHCP Server in two different modes a) As Windows Service b) as StandAlone from Start Menu. For running it as Service you should go to windows Services Control Applet and start the Service called **Open DHCP Server**. You can also run it as Stand Alone Mode from Command Line. For doing this, you need to first stop the **Open DHCP Server** Service. For normal operation you should just start the Windows Service in Service Control Panel.



```
C:\WINDOWS\system32\cmd.exe
Open DHCP Server Version 1.75 Windows Build 1052 Starting...
Logging: All
Warning: No IP Address for DHCP Static Host ff:00:27:78:7b:01 specified
Warning: No IP Address for DHCP Static Host ff:00:27:78:7b:02 specified
Warning: No IP Address for DHCP Static Host ff:00:27:78:7b:03 specified
Default Lease: 300 (sec)
Server Name: Lenovo (Secondary)
Detecting Static Interfaces..
Lease Status URL: http://127.0.0.1:6789
Listening On: 192.168.56.1
Listening On: 192.168.1.254
```

5.2 Linux

In Linux too you can run the `opendhcp` in modes:-

- a) Verbatim Mode (using `-v` argument)
- b) Daemon (NOT using `-v` argument)

This program uses 2 or 3 helper files, which should be passed as arguments.

- a) `-i[inifile]`, where configuration settings can be specified, default location is `/etc/opendhcp.ini`
- b) `-s[statefile]` saves current leases, default location is `/tmp/opendhcp.state`.
- c) `-l[logfile]` dumps log to this file.

You can start/run as:-

```
/opt/opendhcp/opendhcpd # (daemon with default files)
/opt/opendhcp/opendhcpd -v # (verbatim with default files)
/opt/opendhcp/opendhcpd -i inifile -s statefile -l logfile # (as daemon)
/opt/opendhcp/opendhcpd -i inifile -s statefile # (as daemon)
/opt/opendhcp/opendhcpd -v -i inifile -s statefile # (as verbatim)
```

The logfile name should include %Y for full year or %y for 2 digit year, %m for month, %d for day of month. These will be replaced with actual values and this will cause different file every day.

```
/opt/openssh/opensshcpd -l /opt/openssh/log/opensshcpd%Y%m%d.log -i /opt/openssh/opensshcpd.ini
```

You can also include just %m and %Y if you want monthly log file like:-

```
/opt/openssh/opensshcpd -l <logDirectory>/opensshcpd%Y%m.log -i <installDirectory>/opensshcpd.ini
```

Make sure the directory for logfiles exists before running the program.

If you have done [Daemonizing](#) under Section 2.6, you can simply start/stop the opensshcpd with commands:-

```
service opensshcpd start  
service opensshcpd stop
```

otherwise you can try:

```
/opt/openssh/rc.opensshcpd start  
/etc/rc.d/opensshcpd start  
/opt/openssh/rc.opensshcpd stop  
/etc/rc.d/opensshcpd
```

6 Process of Allotting Addresses

DHCP Server is Dynamic Host Configuration Protocol server, which allots IP addresses to computers automatically. You may manually setup IP addresses on computers but managing them is always troublesome process. On networks, where there are many computers, it is nightmare and error prone. DHCP Server allots address to computers as and when an IP address is requested. DHCP Server maintains a pool of addresses and keeps on allocating and renewing IP addresses from this pool (or statically pre-assigned addresses for some computers). When an address is allotted to a computer, many more parameters of computer are also setup like Domain Name, DNS Server, DHCP Server, router/gateway etc. These are called DHCP Options. DHCP Server can use different IP address pools and options depends on how the request came (which interface, or relay agent), what parameters are send with request.

As the newly booted computer don't have IP address, it uses broadcast for discover a DHCP Server on network, send the request as broadcast and received the allotted address via broadcast till booted computer gets a IP address of its own.

The actual process is:-

- A user turns on a computer with a DHCP client. Currently it does not have an IP Address.
- The client computer sends a broadcast message to network (called a DISCOVER or DHCPDISCOVER), looking for a DHCP server to respond.
- The server receives the DISCOVER packet. Based on availability and usage policies set on the server, the server determines an appropriate address (if any) to give to the client. The server then temporarily reserves that address for the client and sends back to the client an OFFER (or DHCP OFFER) packet, with that address information. The server also send the the client's DHCP Servers, WINS servers, NTP servers, and many more values as well in the message (called Vendor Options).
- The client normally accepts this message and sends a REQUEST (or DHCPREQUEST) packet, letting the server know that it intends to use the address.
- The server sends an ACK (or DHCPACK) packet, confirming that the client has been given a lease on the address for a server-specified period of time.

A Computer can also be setup to use a static IP address, it means that the computer is manually configured to use a specific IP address. One problem with static assignment, which can result from user error or inattention to detail, occurs when two computers are configured with the same IP address. This creates a conflict that results in loss of service. Using DHCP to dynamically assign IP addresses minimizes these conflicts. When DHCPDISCOVER is received by Open DHCP Server, it does the following:-

- Look into static hosts, if there is a Static Host entry for that Mac-Address. If one is found, it simply offers that IP to the client.
- If no static host is defined against the Mac-Address of client, it now looks into all the DHCP ranges under all RANGE_SETs one by one. Once it finds a usable address in any matching range, it temporarily reserves that address and sends DHCP DISCOVER. The matching range will be the one which :-

- Matches the IP of server's interface from which the DISCOVER is received. If request came from a relay agent, then the range which matches the IP of relay agent.
 - If some ranges have filters specified, then only those ranges, which meet the filter condition, will only be used. More information about these filters is available somewhere in this document.
- If the range has a previously allotted address of same host, which is still free, then this IP will be re-selected, if not, then if new free address will be selected or an expired address of another client will be selected.

7 Replicated Operation.

The Open DHCP Server have been designed and developed to for fail safe load shared replicated operation. If you want to have more than one DHCP Servers (from any other vendor) in your network for redundancy, it is not easy as different DHCP Server may assign different IP address to same host. Also already allotted addresses by one server can be re allotted by different Server. Furthermore, if one instance goes down, other would force DHCPDISCOVER and DHCPOFFER etc. causing break of Service. This may change the allotted address of host.

Open DHCP Server has been designed for well-coordinated replicated operation. Following features make it unique among other DHCP Servers available:

- a) All the allotted addresses are immediately replicated to other instance by sending special DHCP INFORM messages keeping the internal database of both servers identical. This prevents issuing of same address to multiple hosts or issuing different address to same host.
- b) When once instance goes down, other can simply renew the same lease, moment lease request goes to broadcast mode. This process does not need a DHCPDISCOVER and DHCPOFFER. This feature prevents the break of Service for clients.
- c) All the DHCP ranges and option between different instances should be make consistent by simply copying single OpenDHCPServer.ini file to both Servers.

For replicated operation all you have to

- a) Setup another Open DHCP Server on the network.

Fillin the [REPLICATION_SERVERS] section on both servers. Make sure that entries are identical on both servers. It is better to copy DualServer.ini file from one Server to other and refixing [LISTEN_ON] and [HTTP_INTERFACE]

```
[REPLICATION_SERVERS]
Primary=192.168.1.254
Secondary=192.168.1.252
```

8 DHCP OPTIONS

8.1 Specifying options and values in Open DHCP Server

DHCP Options are sent to client along with DHCP Offer and DHCP Ack. These are also called Vendor Options. These are various other setting of client like DNS Server, Router/Gateway, various other default servers like WINS, HTTP Server, Linux Windows Manager etc. There are about 150+ various standard options are available, some of these are Vendor Specific or Server Specific. Each option has an option tag (1 to 254) and the value of option which can be upto 254 bytes.

Open DHCP Server configures **DHCP Options** at three different levels. These can be configured under [GLOBAL_OPTIONS], [RANGE_SET] or Static Client sections. Option Tag and Option Value are separated by = sign. Global Options are added to each DHCP Offer and DHCP Acknowledgement going out of server, Range specific options are added to each DHCP OFFER/ACK when offered IP falls in DHCP_RANGE and Client specific option sent with DHCP Offer/Ack specific to Static Client.

Options are only supplemented but never replaced. This means if an option has already been specified under Static Client level, value is taken only from Client Specific option; it will not be replaced by value of such option from either RANGE_SET or GLOBAL_OPTIONS. Similarly if an option has value specified under RANGE_SET, value is not replaced in GLOBAL_OPTIONS. However if option is not specified under Client Specific, it will be augmented from RANGE_SET and if RANGE_SET has no such option and Global Options has it, it will be added from Global Options. Global Options are stored in Configuration section [GLOBAL_OPTIONS], Range Specific Options under [RANGE_SET] Entries and Client Specific options are under Static Client MAC Entries.

DHCP Options are specified in all above sections as **OptionTag=value** syntax. Option tags can be tag numbers or standard mnemonic text for that Option tag. Mnemonic text is used as remembering numbers is difficult. Open DHCP Server now uses option names (less spaces/dashes) stipulated by IANA in document at <http://www.iana.org/assignments/bootp-dhcp-parameters/bootp-dhcp-parameters.xml>. The server translates these mnemonic text (will be called option names) back to option tags values when sending options to hosts. List of all option name are listed in next section.

The option values are multiple types. These can be Strings, IP addresses, Integers, Byte Array or Boolean. The option value types are specified in table in next section. The format of value depends on it's type. String option values are just a string. Value strings should be quoted with double quotes. IPs can be specified using dot convention like xxx.xxx.xxx.xxx and multiple IPs can be specified like xxx.xxx.xxx.xxx, xxx.xxx.xxx.xxx where xxx is octate 0-255. Integer values can be stated as plain numbers. Integer values can be BYTE, SHORT (2 bytes) and LONG (4 bytes). Boolean values can be specified using keywords YES/NO, ON/OFF or 0/1 digit and Byte Array. Byte array can be specified as Byte Array or Hex Array. Open DHCP Server always converts the all values to Byte Array for sending these to Hosts. Hence all the option values (irrespective of it's type) can always be specified as Byte Array or Hex Array. Options having sub-options can only be specified as Byte Array or Hex String.

Byte Array is just comma separated octet values or hex String is colon (:) separated hex bytes.

For example Sub Net Mask can be specified as:

```
1=255.255.255.0
```

or

```
SubNetMask=255.255.255.0
```

Similarly DNS Servers can be specified as:-

```
5=192.168.0.1, 192.168.0.2
```

or

```
DomainServer=192.168.0.1, 192.168.0.2
```

Now the values of these options can be specified in multiple ways. String values should be a quoted string or colon separated hex values or comma separated byte array like:-

```
DomainName="MyDomain.com"
```

or

```
15="MyDomain.com"
```

or

```
DomainName=4d:79:44:6f:6d:61:69:6e:2e:63:6f:6d
```

or

```
15=4d:79:44:6f:6d:61:69:6e:2e:63:6f:6d
```

or

```
DomainName=77,121,68,111,109,97,105,110,44,99,111,109
```

or

```
15=77,121,68,111,109,97,105,110,44,99,111,109
```

All of the above Option Entries work same way for string values. For IP address values, you can use both dot separated values or hex string or byte array like:-

```
Router = 192.168.0.1
```

or

```
3 = 192.168.0.1
```

or

```
Router = 192,168,0,1
```

or

```
3 = 192,168,0,1
```

or

```
Router = c0:a8:00:01
```

or

```
3 = c0:a8:00:01
```

If you have multiple values for an Option you can specify like:-

```
DomainServer=192.168.0.2, 192.168.0.3
```

or as 8 consecutive bytes for 2 addresses

```
DomainServer=192,168,0,2,192,168,0,3
```

or as 8 consecutive hexbytes for 2 addresses

```
DomainServer=c0:a8:00:01:c0:a8:00:02
```

Numerical values can be simply stated as:-

```
LeaseTime=360
```

or

51=360

Boolean Options should be specified as:-

AutoConfig=yes

or

AutoConfig=no

or

116=yes or 116=1

or

AutoConfig=off

DHCP Range can only be specified as:-

DHCPRange=10.0.0.5-10.0.0.10

8.2 List of DHCP Options Names (in Open DHCP Server)

These are option names used in Open DHCP Server. These are based on IANA names less spaces and dashes. Please refer to <http://www.iana.org/assignments/bootp-dhcp-parameters/bootp-dhcp-parameters.xml> for more info. You can also use options not listed here using tag names directly.

Tag	Option Name in Open DHCP Server	IANA Name	Meaning
1	SubnetMask	Subnet Mask	Subnet Mask Value
2	TimeOffset	Time Offset	Time Offset in Seconds from UTC (note: deprecated by 100 and 101)
3	Router	Router	Default Gateway is called Router by IANA
4	TimeServer	Time Server	N/4 Timeserver addresses
5	NameServer	Name Server	N/4 IEN-116 Server addresses
6	DomainServer	Domain Server	N/4 DNS Server addresses
7	LogServer	Log Server	N/4 Logging Server addresses
8	QuotesServer	Quotes Server	N/4 Quotes Server addresses
9	LPRServer	LPR Server	N/4 Printer Server addresses
10	ImpressServer	Impress Server	N/4 Impress Server addresses
11	RLPServer	RLP Server	N/4 RLP Server addresses
12	Hostname	Hostname	Hostname string
13	BootFileSize	Boot FileSize	Size of boot file in 512 byte chunks
14	MeritDumpFile	Merit Dump File	Client to dump and name the file to dump it to
15	DomainName	Domain Name	The DNS domain name of the client
16	SwapServer	Swap Server	Swap Server address
17	RootPath	Root Path	Path name for root disk
18	ExtensionFile	Extension File	Path name for more BOOTP info
19	ForwardOn/Off	Forward On/Off	Enable/Disable IP Forwarding
20	SrcRteOn/Off	SrcRte On/Off	Enable/Disable Source Routing
21	PolicyFilter	Policy Filter	Routing Policy Filters
22	MaxDGAssembly	Max DG Assembly	Max Datagram Reassembly Size
23	DefaultIPTTL	Default IP TTL	Default IP Time to Live
24	MTUTimeout	MTU Timeout	Path MTU Aging Timeout
25	MTUPlateau	MTU Plateau	Path MTU Plateau Table
26	MTUInterface	MTU Interface	Interface MTU Size
27	MTUSubnet	MTU Subnet	All Subnets are Local
28	BroadcastAddress	Broadcast Address	Broadcast Address
29	MaskDiscovery	Mask Discovery	Perform Mask Discovery
30	MaskSupplier	Mask Supplier	Provide Mask to Others
31	RouterDiscovery	Router Discovery	Perform Router Discovery
32	RouterRequest	Router Request	Router Solicitation Address

33	StaticRoute	Static Route	Static Routing Table
34	Trailers	Trailers	Trailer Encapsulation
35	ARPTIMEOUT	ARP Timeout	ARP Cache Timeout
36	Ethernet	Ethernet	Ethernet Encapsulation
37	DefaultTCPTTL	Default TCP TTL	Default TCP Time to Live
38	KeepaliveTime	Keepalive Time	TCP Keepalive Interval
39	KeepaliveData	Keepalive Data	TCP Keepalive Garbage
40	NISDomain	NIS Domain	NIS Domain Name
41	NISServers	NIS Servers	NIS Server Addresses
42	NTPServers	NTP Servers	NTP Server Addresses
44	NETBIOSNameSrv	NETBIOS Name Srv	NETBIOS Name Servers
45	NETBIOSDistSrv	NETBIOS Dist Srv	NETBIOS Datagram Distribution
46	NETBIOSNodeType	NETBIOS Node Type	NETBIOS Node Type
47	NETBIOSScope	NETBIOS Scope	NETBIOS Scope
48	XWindowFont	X Window Font	X Window Font Server
49	XWindowManager	X Window Manager	X Window Display Manager
51	AddressTime	Address Time	IP Address Lease Time
58	RenewalTime	Renewal Time	DHCP Renewal (T1) Time
59	RebindingTime	Rebinding Time	DHCP Rebinding (T2) Time
62	NetWare/IPDomain	NetWare/IP Domain	NetWare/IP Domain Name
63	NetWare/IPOption	NetWare/IP Option	NetWare/IP sub Options
64	NIS-Domain-Name	NIS-Domain-Name	NIS+ v3 Client Domain Name
65	NIS-Server-Addr	NIS-Server-Addr	NIS+ v3 Server Addresses
66	TFTPServerName	Server-Name	TFTP Server Name
67	BootFileOption	*Bootfile-Name see note	Boot File Name
68	HomeAgentAdrrs	Home-Agent-Adrrs	Home Agent Addresses
69	SMTPServer	SMTP-Server	Simple Mail Server Addresses
70	POP3Server	POP3-Server	Post Office Server Addresses
71	NNTPServer	NNTP-Server	Network News Server Addresses
72	WWWServer	WWW-Server	WWW Server Addresses
73	FingerServer	Finger-Server	Finger Server Addresses
74	IRCServer	IRC-Server	Chat Server Addresses
75	StreetTalkServer	StreetTalk-Server	StreetTalk Server Addresses
76	STDAserver	STDA-Server	ST Directory Assist. Addresses
78	DirectoryAgent	Directory Agent	directory agent information
79	ServiceScope	Service Scope	service location agent scope
83	iSNS	iSNS	Internet Storage Name Service
85	NDSservers	NDS Servers	Novell Directory Services
86	NDSTreeName	NDS Tree Name	Novell Directory Services
87	NDSContext	NDS Context	Novell Directory Services
95	LDAP	LDAP	Lightweight Directory Access Protocol
100	PCode	PCode	IEEE 1003.1 TZ String
101	TCode	TCode	Reference to the TZ Database
112	NetinfoAddress	Netinfo Address	NetInfo Parent Server Address
113	NetinfoTag	Netinfo Tag	NetInfo Parent Server Tag
114	URL	URL	URL
116	AutoConfig	Auto-Config	DHCP Auto-Configuration
117	NameServiceSearch	Name Service Search	Name Service Search
118	SubnetSelectionOption	Subnet Selection Option	Subnet Selection Option
119	DomainSearch	Domain Search	DNS domain search list
120	SIPserversDHCPoption	SIP Servers DHCP Option	SIP Servers DHCP Option
121	ClasslessStaticRouteOption	Classless Static Route Option	Classless Static Route Option
122	CCC	CCC	CableLabs Client Configuration
128	TFTPPhoneServer	TFTP Server IP address (for IP Phone software load)	
129	CallServerIPaddress	Call Server IP address	
130	Discriminationsstring	Discrimination string (to identify vendor)	
131	RemotestatisticsserverIPaddress	Remote statistics server IP address	
135	HTTPProxyPhone	HTTP Proxy for phone-specific applications	
141	SIPUAServiceDomains	SIP UA Service Domains	SIP UA Service Domains
150	TFTPserverAddress	TFTP server address	
176	IPTelephone	IP Telephone (Tentatively Assigned -	

		2005-06-23]	
209	ConfigurationFile	Configuration File	Configuration file
210	PathPrefix	Path Prefix	Path Prefix Option
211	RebootTime	Reboot Time	Reboot Time
255	End	End	None

8.3 Open DHCP Server specific DHCP Header Field Options

There are some Open DHCP Server special options, although specified like Options in ini file, which do not go as vendor options but are used to fill the DHCP Header fields only.

BootFileName	*Boot File Field in DHCP Header	126 Bytes Max
NextServer	PXE TFTP Server Field in DHCP Header	N/4 IP
TargetRelayAgent	**Can be used to send broadcast messages to alternative relay agent.	N/4 IP

*Option BootFileName only fills DHCP Request header field the bp_file while BootFileOption adds the boot file name as DHCP option.

** When DHCPDISCOVER and DHCPREQUEST come from Relay Agent (or has subnetselection option) the DHCP OFFER and DHCPACK are sent back to Relay Agent or subnetselection IP. This is normal operation and work correctly. However you can override where these messages go, you can specify as TargetRelayAgent.

9 Configuration Tips

There may special/tricky requirements for Configuration. Some of the tips are:

Requirement	Tip
DHCP Should only allot single address to all hosts (one host at a time)	Specify only one RANGE_SET with range like: DHCP Range=192.168.55.1-192.168.55.1
I want to disable some Mac Addresses from Getting Address from DHCP Server	There are two ways to do this. If there are discreet Mac Addresses, add these as Static Hosts without an IP address. If there is a range of Mac Addresses, Create a new [RANGE_SET] and specify the Mac Range, without specifying any actual DHCPRange.
I am using Relay Agent and want to select DHCP Range based on Subnet of Relay Agent IP	This feature is automatic, no special filter is required. Open DHCP Server will select Matching Range to (in order): a) Subnet Selection IP (option 118) b) Relay Agent IP c) Incoming Interface's IP (if no relay agent or subnetselection IP is specified in DHCP Request). You can optionally override this automatic range selection using SubnetSelectionFilter (see Range filters). You can also send broadcast messages to particular IP Address.
I want to disable some subnets getting address from this server	Create a [RANGE_SET] specifying all such relay agent IP or Interface IP as SubnetSelectionFilter and don't specify any actual DHCPRange.
I want to specify different IP range for all my departments or customers or makes	User Class (DHCP Option 77) need to be used for this. Please set User Class for the computers based for a Department and use FilterUserClass in RANGE_SET to be used for a department.
I want to set up PXE Boot and want to specify TFTP Server IP	Specify the option NextServer=x.x.x.x under suitable DHCP Section. Make sure that tftp server (Next Server) is available and also file system (operating system) may be needed.

I want to specify boot file	Boot file can go in Header Field as well as under vendor option. Different DHCP Client behaves differently. There are two option names for this. If a option named BootFileName is specified, boot file name will go to DHCP Header, but if size of filename is longer than 128, it will automatically switched and will be sent as Vendor Option. On the other hand if BootFileOption option is specified, it will be only sent as vendor option (nothing in header). If both are specified both Header and Vendor Option will be sent.
I want to specify sub-options for an option	Just create a string of bytes you want to send and put these as either byte array or hex array in configuration.
My DHCP hosts need hostname from DHCP Server	Use Static Entries for DHCP Hosts and state the hostname for each entry there.

10 Debugging

10.1 Windows

- Check network hardware and ensure that client machines have different host names from server and each other.
- No other service should be running on Server on ports 67. If you get error like port 67 already in use means some other DHCP program or proxy server with DHCP service is running. Use any port scanner program like Active Ports to detect which program is listening on these ports. It is also possible that another copy of DHCP server itself is running or Microsoft connection sharing (ICS) is running, which uses these ports.
- If you still get error Static Interfaces/Listening Ports not available, it may be because of 1) Another DHCP Server is running or Interfaces specified on [LISTEN-ON] section are not available. If your interface may not be ready when your computer/Service starts and due to this service fails to start, use Window's recovery option in Services applet to try starting service at later time.
- Look at OpenDHCPserver.log (if running as service) or Run in standalone mode, it will provide all debug information as it verbatim the activities.
- If you use Broadband router, which also has DHCP Server, this program may still run, but some hosts configured by other DHCP Server may not use this DHCP Service. Please disable DHCP Service on Broadband Router.
- DHCPserver.state file backs up current leases and is read back when server restarts. If you want to clean previous leases, you may delete this file and restart the server.
- If you are not able to receive DHCP Discover messages from clients, make sure that DHCP Server and client are on same physical network (not separated by routers). If it is separated by routers and it is same subnet, please allow routers to pass broadcast messages to Server on Port 67. If these are different subnets, use the BOOTP relay agent.

10.2 Linux

- Ensure that you run this program as root only.
- Check network hardware and ensure that client machines has different host names from server and each other.
- No other service should be running on Server on ports 67. If you get error like port 67 already in use means some other DHCP program or proxy server with DHCP service is running. Use netstat command to detect which program is listening on these ports. It is also possible that another copy of opendhcpd itself is running. If you get error Static Interfaces/Listening Ports not available, it may be because of 1) Another dhcp Server is running or Interfaces specified on [LISTEN_ON] section are not available or you have just restated the server and TCP port is not yet closed, then wait for some time.
- Look at log file (if running as service) or Run in standalone mode, it will provide all debug information as it verbatim the activities.
- If you use Braodband router, which also has DHCP Server, this program may still run, but some hosts configured by other DHCP Server may not use this DNS Service. Please disable the DHCP Service on Broadband router. Please disable the DHCP Server on Broadband router.
- /tmp/opendhcp.state file backs up current leases and is read back when server restarts. If you want to clean previous leases, you may delete this file and restart the server.

- Errors like "libstdc++.so.?: cannot open shared object file: No such file or directory" are possible in some Linux flavours. Please recompile the program or create symbolic links:-

ln -s /usr/local/lib/libstdc++.so.? /usr/lib/libstdc++.so.?

ln -s /usr/local/lib/libgcc_s.so.? /usr/lib/libgcc_s.so.?

(? is library version as reported in error) or add the library path (directory where above file is) to env variable LD_LIBRARY_PATH.

- If you are not able to receive DHCP Discover messages from clients, make sure that DHCP Server and client are on same physical network (not separated by routers). If it is separated by routers and it is same subnet, please allow routers to pass broadcast messages to Server on Port 67. If these are different subnets, use the BOOTP relay agents.

11 Other Recommended Software

11.1 [Dual DHCP DNS Server](#)

You use DHCP Server as you do not want to manually configure IP Addresses on each machine. A DNS Server is also needed for resolving hostnames to their IP addresses. Normally your ISP will provide you with DNS Service, which will resolve external host names.

How about resolving machines which are allotted addresses by you own DHCP Server ?. Your ISP's DNS Server will not have these names/IPs and you will also need your own local DNS Server. Will your local DNS Server have these locally allotted host names ? No again. You have to manually add/remove these locally allotted hosts to your local DNS Server. What to do here ?. Are you looking for a DHCP Server with build in DNS Server which automatically adds these Host Names to your DNS Server?.

[Dual DHCP DNS Server](#) exactly do this. This has both DHCP Service and DNS Service and you can enable any or both of the services. If you enable both the services, all DHCP Service allotted Hosts are automatically added to build in DNS Service. Is this not wonderful?. Please try using this freeware software.

11.2 [Open TFTP Server](#)

It is MultiThreaded TFTP Server, Open Source Freeware for both Windows and Unix for PXEBOOT, firmware load. It support tsize, blksize, timeout Server Port Ranges, Block Number Rollover for Large Files. Runs as Service/daemon.

Single Port version also available. Single Port version communicates through single port 69 to all clients. It can serve multiple client from single port. Very useful for firewalled networks.

The salient feature of this software is that it can be installed as Windows Service or Unix Daemon.

