



# Configuring the Cisco IOS XE DHCP Server

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Cisco routers running Cisco IOS XE software include Dynamic Host Configuration Protocol (DHCP) server and relay agent software. The Cisco IOS XE DHCP server is a full DHCP server implementation that assigns and manages IP addresses from specified address pools within the router to DHCP clients. The DHCP server can be configured to assign additional parameters such as the IP address of the domain name system (DNS) server and the default router.

This module describes the concepts and the tasks needed to configure the Cisco IOS XE DHCP server.

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## Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

## Prerequisites for Configuring the DHCP Server

Before you configure the Cisco IOS XE DHCP server, you should understand the concepts documented in the “DHCP Overview” module.

The Cisco IOS XE DHCP server and relay agent are enabled by default. You can verify if they have been disabled by checking your configuration file. If they have been disabled, the **no service dhcp** command



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will appear in the configuration file. Use the **service dhcp** command to reenable the functionality if necessary.

The Cisco IOS XE DHCP relay agent will be enabled on an interface only when the **ip helper-address** is configured. This command enables the DHCP broadcast to be forwarded to the configured DHCP server.

## Information About the Cisco IOS XE DHCP Server

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## Overview of the DHCP Server

The Cisco DHCP server accepts address assignment requests and renewals from the client and assigns the addresses from predefined groups of addresses within DHCP address pools. These address pools can also be configured to supply additional information to the requesting client such as the IP address of the Domain Name System (DNS) server, the default device, and other configuration parameters. The Cisco DHCP server can accept broadcasts from locally attached LAN segments or from DHCP requests that have been forwarded by other DHCP relay agents within the network.

## Database Agents

A DHCP database agent is any host (for example, an FTP, TFTP, or rcp server) or storage media on the DHCP server (for example, disk0) that stores the DHCP bindings database. You can configure multiple DHCP database agents, and you can configure the interval between database updates and transfers for each agent.

Automatic bindings are IP addresses that have been automatically mapped to the MAC addresses of hosts that are found in the DHCP database. Automatic binding information (such as lease expiration date and time, interface index, and VPN routing and forwarding [VRF] name) is stored on a database agent. The bindings are saved as text records for easy maintenance.

- [Address Conflicts, page 2](#)

### Address Conflicts

An address conflict occurs when two hosts use the same IP address. During address assignment, DHCP checks for conflicts using ping and gratuitous Address Resolution Protocol (ARP). If a conflict is detected, the address is removed from the pool. The address will not be assigned until the administrator resolves the conflict.

## DHCP Address Pool Conventions

You can configure a DHCP address pool with a name that is a symbolic string (such as “engineering”) or an integer (such as 0). Configuring a DHCP address pool also puts the router into DHCP pool configuration

mode--identified by the (dhcp-config)# prompt--from which you can configure pool parameters (for example, the IP subnet number and default router list).

- [DHCP Address Pool Selection, page 3](#)

## DHCP Address Pool Selection

DHCP defines a process by which the DHCP server knows the IP subnet in which the DHCP client resides, and it can assign an IP address from a pool of valid IP addresses in that subnet. The process by which the DHCP server identifies which DHCP address pool to use to service a client request is described in this section.

The DHCP server identifies which DHCP address pool to use to service a client request as follows:

- If the client is not directly connected (the giaddr field of the DHCPDISCOVER broadcast message is non-zero), the DHCP server matches the DHCPDISCOVER with a DHCP pool that has the subnet that contains the IP address in the giaddr field.
- If the client is directly connected (the giaddr field is zero), the DHCP server matches the DHCPDISCOVER with DHCP pool(s) that contain the subnet(s) configured on the receiving interface. If the interface has secondary IP addresses, the subnets associated with the secondary IP addresses are examined for possible allocation only after the subnet associated with the primary IP address (on the interface) is exhausted.

Cisco IOS XE DHCP server software supports advanced capabilities for IP address allocation. See the "Configuring DHCP Address Allocation Using Option 82" section for more information.

## Address Bindings

An address binding is a mapping between the IP address and MAC address of a client. The IP address of a client can be assigned manually by an administrator or assigned automatically from a pool by a DHCP server.

Manual bindings are IP addresses that have been manually mapped to the MAC addresses of hosts that are found in the DHCP database. Manual bindings are stored in NVRAM on the DHCP server. Manual bindings are just special address pools. There is no limit on the number of manual bindings, but you can only configure one manual binding per host pool.

Automatic bindings are IP addresses that have been automatically mapped to the MAC addresses of hosts that are found in the DHCP database. Because the bindings are stored in volatile memory on the DHCP server, binding information is lost in the event of a power failure or upon router reload for any other reason. To prevent the loss of automatic binding information in such an event, a copy of the automatic binding information can be stored on a remote host called a DHCP database agent. The bindings are periodically written to the database agent. If the router reloads, the bindings are read back from the database agent to the DHCP database on the DHCP server.



### Note

We strongly recommend using database agents. However, the Cisco IOS XE DHCP server can function without database agents.

All DHCP clients send a client identifier (DHCP option 61) in the DHCP packet. To configure manual bindings, you must enter the **client-identifier** DHCP pool configuration command with the appropriate hexadecimal values identifying the DHCP client.

## Ping Packet Settings

By default, the DHCP server pings a pool address twice before assigning a particular address to a requesting client. If the ping is unanswered, the DHCP server assumes (with a high probability) that the address is not in use and assigns the address to the requesting client.

By default, the DHCP server waits 2 seconds before timing out a ping packet.

## DHCP Attribute Inheritance

The DHCP server database is organized as a tree. The root of the tree is the address pool for natural networks, branches are subnetwork address pools, and leaves are manual bindings to clients. Subnetworks inherit network parameters and clients inherit subnetwork parameters. Therefore, common parameters, for example the domain name, should be configured at the highest (network or subnetwork) level of the tree.

Inherited parameters can be overridden. For example, if a parameter is defined in both the natural network and a subnetwork, the definition of the subnetwork is used.

Address leases are not inherited. If a lease is not specified for an IP address, by default, the DHCP server assigns a one-day lease for the address.

## DHCP Server Address Allocation Using Option 82

The Cisco IOS DHCP server can allocate dynamic IP addresses based on the relay information option (option 82) sent by the relay agent.

DHCP provides a framework for passing configuration information to hosts on a TCP/IP network. Configuration parameters and other control information are carried in tagged data items that are stored in the options field of the DHCP message. The data items are also called options. Option 82 is organized as a single DHCP option that contains information known by the relay agent.

Automatic DHCP address allocation is based on an IP address. This IP address can either be the gateway address (giaddr field of the DHCP packet) or the IP address of an incoming interface. In some networks, it is necessary to use additional information to further determine which IP addresses to allocate. By using option 82, the Cisco IOS DHCP relay agent can include additional information about itself when forwarding client-originated DHCP packets to a DHCP server. The Cisco IOS DHCP server can also use option 82 to provide additional information to properly allocate IP addresses to DHCP clients. The information sent via option 82 is used to identify the port where the DHCP request arrives. Automatic DHCP address allocation does not parse out the individual suboptions contained in option 82. Rather, the address allocation is done by matching a configured pattern byte by byte.

This feature introduces a new DHCP class capability, which is a method to group DHCP clients based on some shared characteristics other than the subnet in which the clients reside.

For example, DHCP clients are connected to two ports of a single switch. Each port can be configured to be a part of two VLANs: VLAN1 and VLAN2. DHCP clients belong to either VLAN1 or VLAN2 and the switch can differentiate the VLAN that a particular DHCP Discover message belongs to (possibly through Layer 2 encapsulation). Each VLAN has its own subnet and all DHCP messages from the same VLAN (same switch) have the giaddr field set to the same value indicating the subnet of the VLAN.

Problems can occur while allocating IP addresses to DHCP clients that are connected to different ports of the same VLAN. These IP addresses must be part of the same subnet but the range of IP addresses must be different. In the preceding example, when a DHCP client that is connected to a port of VLAN1 must be allocated an IP address from a range of IP addresses within the VLAN's subnet, whereas a DHCP client connecting to port 2 of VLAN1 must be allocated an IP address from another range of IP addresses. The

two range of IP addresses are part of the same subnet (and have the same subnet mask). Generally, during DHCP address allocation, the DHCP server refers only to the giaddr field and is unable to differentiate between the two ranges.

To solve this problem, a relay agent residing at the switch inserts the relay information option (option 82), which carries information specific to the port, and the DHCP server inspects both the giaddr field and the inserted option 82 during the address selection process.

The Cisco software refers to a pool of IP addresses (giaddr or incoming interface IP address) and matches the request to a class or classes configured in the pool in the order the classes are specified in the DHCP pool configuration.

When a DHCP address pool is configured with one or more DHCP classes, the pool becomes a restricted access pool, which means that no addresses are allocated from the pool unless one or more classes in the pool matches. This design allows DHCP classes to be used either for access control (no default class is configured on the pool) or to provide further address range partitions within the subnet of the pool.

Multiple pools can be configured with the same class, eliminating the need to configure the same pattern in multiple pools.

The following capabilities are supported for DHCP class-based address allocation:

- Specifying the full relay agent information option value as a raw hexadecimal string by using the **relay-information hex** command in new relay agent information configuration mode.
- Support for bit-masking the raw relay information hexadecimal value.
- Support for a wildcard at the end of a hexadecimal string specified by the **relay-information hex** command.

If the relay agent inserts option 82 but does not set the giaddr field in the DHCP packet, the DHCP server interface must be configured as a trusted interface by using the **ip dhcp relay information trusted** command. This configuration prevents the server from dropping the DHCP message.

- [DHCP Address Allocation Using Option 82 Feature Design, page 5](#)
- [Usage Scenario for DHCP Address Allocation Using Option 82, page 5](#)
- [DHCP Class Capability, page 6](#)

## DHCP Address Allocation Using Option 82 Feature Design

DHCP provides a framework for passing configuration information to hosts on a TCP/IP network. Configuration parameters and other control information are carried in tagged data items that are stored in the options field of the DHCP message. The data items themselves are also called options. Option 82 is organized as a single DHCP option that contains information known by the relay agent.

This feature is designed to allow the Cisco IOS XE DHCP server to use option 82 information to help determine which IP addresses to allocate to clients. The information sent via option 82 will be used to identify which port the DHCP request came in on. This feature does not parse out the individual suboptions contained within option 82. Rather, the address allocation is done by matching a configured pattern byte by byte.

The feature introduces a new DHCP class capability, which is a method to group DHCP clients based on some shared characteristics other than the subnet in which the clients reside.

## Usage Scenario for DHCP Address Allocation Using Option 82

In an example application, DHCP clients are connected to two ports of a single switch. Each port can be configured to be part of two VLANs: VLAN1 and VLAN2. DHCP clients belong to either VLAN1 or

VLAN2 and it is assumed that the switch can differentiate the VLAN that a particular DHCP Discover message belongs to (possibly through Layer 2 encapsulation). Each VLAN has its own subnet and all DHCP messages from the same VLAN (same switch) will have the giaddr field set to the same value indicating the subnet of the VLAN.

The problem is that for a DHCP client connecting to port 1 of VLAN1, it must be allocated an IP address from one range within the VLAN's subnet, whereas a DHCP client connecting to port 2 of VLAN1 must be allocated an IP address from another range. Both these two IP address ranges are part of the same subnet (and have the same subnet mask). In the normal DHCP address allocation, the DHCP server will look only at the giaddr field and thus will not be able to differentiate between the two ranges.

To solve this problem, a relay agent residing at the switch inserts the relay information option (option 82), which carries information specific to the port, and the DHCP server must inspect both the giaddr field and the inserted option 82 during the address selection process.

## DHCP Class Capability

The Cisco IOS XE software will look up a pool based on IP address (giaddr or incoming interface IP address) and then match the request to a class or classes configured in the pool in the order the classes are specified in the DHCP pool configuration.

When a DHCP address pool has been configured with one or more DHCP classes, the pool becomes a restricted access pool, which means that no addresses will be allocated from the pool unless one or more of the classes in the pool is matched. This design allows DHCP classes to be used for either access control (no default class is configured on the pool) or to provide further address range partitions with the subnet of the pool.

Multiple pools can be configured with the same class, eliminating the need to configure the same pattern in multiple pools.

The following capabilities are currently supported for DHCP class-based address allocation:

- Specifying the full relay agent information option value as a raw hexadecimal string by using the **relay-information hex** command in the new relay agent information configuration mode.
- Support for bitmasking the raw relay information hexadecimal value.
- Support for a wildcard at the end of the hexadecimal string specified by the **relay-information hex** command.

## How to Configure the Cisco IOS XE DHCP Server

- [Configuring a DHCP Database Agent or Disabling Conflict Logging, page 7](#)
- [Excluding IP Addresses, page 8](#)
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# Configuring a DHCP Database Agent or Disabling Conflict Logging

Perform this task to configure a DHCP database agent.



**Note**

We strongly recommend using database agents. However, the Cisco IOS XE server can run without them. If you choose not to configure a DHCP database agent, disable the recording of DHCP address conflicts on the DHCP server by using the **no ip dhcp conflict logging** command in global configuration mode. If there is conflict logging but no database agent configured, bindings are lost across router reboots. Possible false conflicts can occur causing the address to be removed from the address pool until the network administrator intervenes.

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### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Do one of the following:
  - **ip dhcp database url [timeout seconds | write-delay seconds]**
  - or
  - **no ip dhcp conflict logging**

### DETAILED STEPS

Command or Action	Purpose
<p><b>Step 1</b> <b>enable</b></p> <p><b>Example:</b></p> <pre>Router&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<p><b>Step 2</b> <b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Router# configure terminal</pre>	<p>Enters global configuration mode.</p>

Command or Action	Purpose
<p><b>Step 3</b> Do one of the following:</p> <ul style="list-style-type: none"> <li>• <b>ip dhcp database</b> <i>url</i> [<b>timeout</b> <i>seconds</i>   <b>write-delay</b> <i>seconds</i>]</li> <li>• or</li> <li>• <b>no ip dhcp conflict logging</b></li> </ul> <p><b>Example:</b></p> <pre>Router(config)# ip dhcp database ftp:// user:password@172.16.1.1/router-dhcp timeout 80</pre> <p><b>Example:</b></p> <pre>Router(config)# no ip dhcp conflict logging</pre>	<p>Configures a DHCP server to save automatic bindings on a remote host called a database agent.</p> <p>or</p> <p>Disables DHCP address conflict logging.</p> <ul style="list-style-type: none"> <li>• Choose this option only if you do not configure a DHCP database agent. See the <a href="#">Configuring a DHCP Database Agent or Disabling Conflict Logging, page 7</a> section for guidelines.</li> </ul>

## Excluding IP Addresses

Perform this task to specify IP addresses (excluded addresses) that the DHCP server should not assign to clients.

The IP address configured on the router interface is automatically excluded from the DHCP address pool. The DHCP server assumes that all other IP addresses in a DHCP address pool subnet are available for assigning to DHCP clients.

You need to exclude addresses from the pool if the DHCP server should not allocate those IP addresses. An example usage scenario is when two DHCP servers are set up to service the same network segment (subnet) for redundancy. If the two DHCP servers do not coordinate their services with each other using a protocol such as DHCP failover, then each DHCP server must be configured to allocate from a non-overlapping set of addresses in the shared subnet. See the "Configuring Manual Bindings Example" for a configuration example.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp excluded-address** *low-address* [*high-address*]



## DETAILED STEPS

Command or Action	Purpose
<p><b>Step 1</b> <code>enable</code></p> <p><b>Example:</b></p> <pre>Router&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
<p><b>Step 2</b> <code>configure terminal</code></p> <p><b>Example:</b></p> <pre>Router# configure terminal</pre>	<p>Enters global configuration mode.</p>
<p><b>Step 3</b> <code>ip dhcp excluded-address <i>low-address</i> [<i>high-address</i>]</code></p> <p><b>Example:</b></p> <pre>Router(config)# ip dhcp excluded-address 172.16.1.100 172.16.1.103</pre>	<p>Specifies the IP addresses that the DHCP server should not assign to DHCP clients.</p>

## Configuring DHCP Address Pools

- [Configuring a DHCP Address Pool, page 9](#)
- [Verifying the DHCP Address Pool Configuration, page 12](#)

### Configuring a DHCP Address Pool

Perform this task to configure a DHCP address pool. On a per-address pool basis, specify DHCP options for the client as necessary.

Before you configure the DHCP address pool, you need to:

- Identify DHCP options for devices where necessary, including the following:
  - Default boot image name
  - Default routers
  - Domain Name System (DNS) servers
  - NetBIOS name server
  - Primary subnet
- Decide on a NetBIOS node type (b, p, m, or h).
- Decide on a DNS domain name.

**Note**

You cannot configure manual bindings within the same pool that is configured with the **network** DHCP pool configuration command. To configure manual bindings, see the "Configuring Manual Bindings" section.

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**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **ip dhcp pool** *name*
4. **network** *network-number* [*mask* | / *prefix-length*]
5. **domain-name** *domain*
6. **dns-server** *address* [*address2* ... *address8*]
7. **bootfile** *filename*
8. **next-server** *address* [*address2* ... *address8*]
9. **netbios-name-server** *address* [*address2* ... *address8*]
10. **netbios-node-type** *type*
11. **default-router** *address* [*address2* ... *address8*]
12. **option** *code* [*instance number*] {**ascii** *string* | **hex** *string* | *ip-address*}
13. **lease** {*days* [*hours*] [*minutes*]} **infinite**}
14. **end**

**DETAILED STEPS**

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>ip dhcp pool</b> <i>name</i>  <b>Example:</b> Router(config)# ip dhcp pool 1	Creates a name for the DHCP server address pool and enters DHCP pool configuration mode.

	Command or Action	Purpose
Step 4	<p><b>network</b> <i>network-number</i> [<i>mask</i>   / <i>prefix-length</i>]</p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# network 172.16.0.0 /16</pre>	Specifies the subnet network number and mask of the DHCP address pool.
Step 5	<p><b>domain-name</b> <i>domain</i></p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# domain-name cisco.com</pre>	Specifies the domain name for the client.
Step 6	<p><b>dns-server</b> <i>address</i> [<i>address2</i> ... <i>address8</i>]</p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# dns server 172.16.1.103 172.16.2.103</pre>	<p>Specifies the IP address of a DNS server that is available to a DHCP client.</p> <ul style="list-style-type: none"> <li>• One IP address is required; however, you can specify up to eight IP addresses in one command line.</li> <li>• Servers should be listed in order of preference.</li> </ul>
Step 7	<p><b>bootfile</b> <i>filename</i></p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# bootfile xllboot</pre>	<p>(Optional) Specifies the name of the default boot image for a DHCP client.</p> <ul style="list-style-type: none"> <li>• The boot file is used to store the boot image for the client. The boot image is generally the operating system the client uses to load.</li> </ul>
Step 8	<p><b>next-server</b> <i>address</i> [<i>address2</i> ... <i>address8</i>]</p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# next-server 172.17.1.103 172.17.2.103</pre>	<p>(Optional) Configures the next server in the boot process of a DHCP client.</p> <ul style="list-style-type: none"> <li>• If multiple servers are specified, DHCP assigns them to clients in round-robin order. The first client gets address 1, the next client gets address 2, and so on.</li> <li>• If this command is not configured, DHCP uses the server specified by the <b>ip helper address</b> command as the boot server.</li> </ul>
Step 9	<p><b>netbios-name-server</b> <i>address</i> [<i>address2</i> ... <i>address8</i>]</p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# netbios-name- server 172.16.1.103 172.16.2.103</pre>	<p>(Optional) Specifies the NetBIOS Windows Internet Naming Service (WINS) server that is available to a Microsoft DHCP client.</p> <ul style="list-style-type: none"> <li>• One address is required; however, you can specify up to eight addresses in one command line.</li> <li>• Servers should be listed in order of preference.</li> </ul>

Command or Action	Purpose
<p><b>Step 10</b> <code>netbios-node-type type</code></p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# netbios-node-type h-node</pre>	<p>(Optional) Specifies the NetBIOS node type for a Microsoft DHCP client.</p>
<p><b>Step 11</b> <code>default-router address [address2 ... address8]</code></p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# default-router 172.16.1.100 172.16.1.101</pre>	<p>(Optional) Specifies the IP address of the default router for a DHCP client.</p> <ul style="list-style-type: none"> <li>The IP address should be on the same subnet as the client.</li> <li>One IP address is required; however, you can specify a up to eight IP addresses in one command line. These default routers are listed in order of preference; that is, <i>address</i> is the most preferred router, <i>address2</i> is the next most preferred router, and so on.</li> <li>When a DHCP client requests an IP address, the router--acting as a DHCP server--accesses the default router list to select another router that the DHCP client is to use as the first hop for forwarding messages. After a DHCP client has booted, the client begins sending packets to its default router.</li> </ul>
<p><b>Step 12</b> <code>option code [instance number] {ascii string   hex string   ip-address}</code></p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# option 19 hex 01</pre>	<p>(Optional) Configures DHCP server options.</p>
<p><b>Step 13</b> <code>lease {days [hours] [minutes]} infinite}</code></p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# lease 30</pre>	<p>(Optional) Specifies the duration of the lease.</p> <ul style="list-style-type: none"> <li>The default is a one-day lease.</li> <li>The <b>infinite</b> keyword specifies that the duration of the lease is unlimited.</li> </ul>
<p><b>Step 14</b> <code>end</code></p> <p><b>Example:</b></p> <pre>Router(config-dhcp-subnet-secondary)# end</pre>	<p>Returns to global configuration mode.</p>

## Verifying the DHCP Address Pool Configuration

Perform this task to verify the DHCP address pool configuration.

**SUMMARY STEPS**

1. **enable**
2. **show ip dhcp pool** [*name*]
3. **show ip dhcp binding** [*address*]
4. **show ip dhcp conflict** [*address*]
5. **show ip dhcp database** [*url*]
6. **show ip dhcp server statistics** [*type-number*]

**DETAILED STEPS**

Command or Action	Purpose
<p><b>Step 1</b> <b>enable</b></p> <p><b>Example:</b></p> <pre>Router&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<p><b>Step 2</b> <b>show ip dhcp pool</b> [<i>name</i>]</p> <p><b>Example:</b></p> <pre>Router# show ip dhcp pool</pre>	<p>(Optional) Displays information about DHCP address pools.</p>
<p><b>Step 3</b> <b>show ip dhcp binding</b> [<i>address</i>]</p> <p><b>Example:</b></p> <pre>Router# show ip dhcp binding</pre>	<p>(Optional) Displays a list of all bindings created on a specific DHCP server.</p> <ul style="list-style-type: none"> <li>• Use the <b>show ip dhcp binding</b> command to display the IP addresses that have already been assigned. Verify that the address pool has not been exhausted. If necessary, re-create the pool to create a larger pool of addresses.</li> <li>• Use the <b>show ip dhcp binding</b> command to display the lease expiration date and time of the IP address of the host.</li> </ul>
<p><b>Step 4</b> <b>show ip dhcp conflict</b> [<i>address</i>]</p> <p><b>Example:</b></p> <pre>Router# show ip dhcp conflict</pre>	<p>(Optional) Displays a list of all address conflicts.</p>
<p><b>Step 5</b> <b>show ip dhcp database</b> [<i>url</i>]</p> <p><b>Example:</b></p> <pre>Router# show ip dhcp database</pre>	<p>(Optional) Displays recent activity on the DHCP database.</p>

Command or Action	Purpose
<b>Step 6</b> <code>show ip dhcp server statistics [type-number]</code>  <b>Example:</b>  Router# show ip dhcp server statistics	(Optional) Displays count information about server statistics and messages sent and received.

## Configuring Manual Bindings



### Note

You cannot configure manual bindings within the same pool that is configured with the **network** command in DHCP pool configuration mode. See the "Configuring DHCP Address Pools" section for information about DHCP address pools and the **network** command.

>

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp pool** *pool-name*
4. **host** *address* [*mask* | *prefix-length*]
5. **client-identifier** *unique-identifier*
6. **hardware-address** *hardware-address type*
7. **client-name** *name*

### DETAILED STEPS

Command or Action	Purpose
<b>Step 1</b> <code>enable</code>  <b>Example:</b>  Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b> <code>configure terminal</code>  <b>Example:</b>  Router# configure terminal	Enters global configuration mode.

Command or Action	Purpose
<p><b>Step 3</b> <code>ip dhcp pool <i>pool-name</i></code></p> <p><b>Example:</b></p> <pre>Router(config)# ip dhcp pool pool1</pre>	<p>Creates a name for the DHCP server address pool and places you in DHCP pool configuration mode--identified by the (dhcp-config)# prompt.</p>
<p><b>Step 4</b> <code>host <i>address</i> [<i>mask</i> / <i>prefix-length</i>]</code></p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# host 172.16.2.254</pre>	<p>Specifies the IP address and subnet mask of the client.</p> <ul style="list-style-type: none"> <li>There is no limit on the number of manual bindings but you can only configure one manual binding per host pool.</li> </ul>
<p><b>Step 5</b> <code>client-identifier <i>unique-identifier</i></code></p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# client- identifier 01b7.0813.8811.66</pre>	<p>Specifies the unique identifier for DHCP clients. This command is used for DHCP requests.</p> <ul style="list-style-type: none"> <li>DHCP clients require client identifiers. The unique identification of the client is specified in dotted hexadecimal notation, for example, 01b7.0813.8811.66, where 01 represents the Ethernet media type.</li> <li>See "Troubleshooting_Tips" below for information on how to determine the client identifier of the DHCP client.</li> </ul>
<p><b>Step 6</b> <code>hardware-address <i>hardware-address</i> <i>type</i></code></p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# hardware- address b708.1388.f166 ieee802</pre>	<p>(Optional) Specifies a hardware address for the client. This command is used for BOOTP requests.</p>
<p><b>Step 7</b> <code>client-name <i>name</i></code></p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# client-name client1</pre>	<p>(Optional) Specifies the name of the client using any standard ASCII character.</p> <ul style="list-style-type: none"> <li>The client name should not include the domain name. For example, the name mars should not be specified as mars.cisco.com.</li> </ul>

- [Troubleshooting Tips, page 15](#)

## Troubleshooting Tips

You can determine the client identifier by using the **debug ip dhcp server packet** command. In the following example, the client is identified by the value 0b07.1134.a029.

```
Router# debug ip dhcp server packet
```

```
DHCPD:DHCPDISCOVER received from client 0b07.1134.a029 through relay 10.1.0.253.
DHCPD:assigned IP address 10.1.0.3 to client 0b07.1134.a029.
```

## Customizing DHCP Server Operation

Perform this task to customize the behavior of the DHCP server.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp ping packets** *number*
4. **ip dhcp ping timeout** *milliseconds*

### DETAILED STEPS

Command or Action	Purpose
<b>Step 1</b> <b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b> <b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
<b>Step 3</b> <b>ip dhcp ping packets</b> <i>number</i>  <b>Example:</b> Router(config)# ip dhcp ping packets 5	(Optional) Specifies the number of ping packets the DHCP server sends to a pool address before assigning the address to a requesting client. <ul style="list-style-type: none"> <li>• The default is two packets. Setting the <i>number</i> argument to a value of 0 disables the DHCP server ping operation completely.</li> </ul>
<b>Step 4</b> <b>ip dhcp ping timeout</b> <i>milliseconds</i>  <b>Example:</b> Router(config)# ip dhcp ping timeout 850	(Optional) Specifies the amount of time the DHCP server waits for a ping reply from an address pool.

## Configuring a Remote Device to Import DHCP Server Options from a Central DHCP Server

The Cisco DHCP server can dynamically configure options such as the Domain Name System (DNS) and Windows Internet Name Service (WINS) addresses to respond to DHCP requests from local clients behind the customer premises equipment (CPE). Earlier, network administrators configured the Cisco DHCP server on each device manually. Now, the Cisco DHCP server is enhanced to allow configuration



information to be updated automatically. Network administrators can configure one or more centralized DHCP servers to update specific DHCP options within the DHCP pools. The remote servers can request or “import” these option parameters from centralized servers.

This section contains the following tasks:

- [Configuring the Central DHCP Server to Update DHCP Options, page 17](#)
- [Configuring the Remote Router to Import DHCP Options, page 18](#)

## Configuring the Central DHCP Server to Update DHCP Options

Perform the following task to configure the Central DHCP Server to update DHCP options:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp pool** *name*
4. **network** *network-number* [*mask* | */prefix-length*]
5. **dns-server** *address* [*address2* ... *address8*]
6. **end**

### DETAILED STEPS

Command or Action	Purpose
<b>Step 1</b> <b>enable</b>  <b>Example:</b> Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b> <b>configure terminal</b>  <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 3</b> <b>ip dhcp pool</b> <i>name</i>  <b>Example:</b> Device(config)# ip dhcp pool 1	Creates a name for the DHCP server address pool and enters DHCP pool configuration mode.
<b>Step 4</b> <b>network</b> <i>network-number</i> [ <i>mask</i>   <i>/prefix-length</i> ]  <b>Example:</b> Device(dhcp-config)# network 172.16.0.0 /16	Specifies the subnet number and mask of the DHCP address pool.

Command or Action	Purpose
<b>Step 5</b> <code>dns-server address [address2 ... address8]</code>  <b>Example:</b>  <pre>Device(dhcp-config)# dns server 172.16.1.103 172.16.2.103</pre>	(Optional) Specifies the IP address of a DNS server that is available to a DHCP client. <ul style="list-style-type: none"> <li>• One IP address is required; however, you can specify up to eight IP addresses in one command line.</li> <li>• Servers should be listed in the order of preference.</li> </ul>
<b>Step 6</b> <code>end</code>  <b>Example:</b>  <pre>Device(dhcp-config)# end</pre>	Returns to privileged EXEC mode.

## Configuring the Remote Router to Import DHCP Options

Perform this task to configure the remote router to import DHCP options from a central DHCP server.

### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `ip dhcp pool pool-name`
4. `network network-number [mask | / prefix-length]`
5. `import all`
6. `exit`
7. `interface type number`
8. `ip address dhcp`
9. `end`
10. `show ip dhcp import`

### DETAILED STEPS

Command or Action	Purpose
<b>Step 1</b> <code>enable</code>  <b>Example:</b>  <pre>Router&gt; enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>

	Command or Action	Purpose
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>ip dhcp pool <i>pool-name</i></b>  <b>Example:</b> Router(config)# ip dhcp pool sanjosel	Creates a name for the DHCP server address pool and enters DHCP pool configuration mode.
<b>Step 4</b>	<b>network <i>network-number</i> [<i>mask</i>   / <i>prefix-length</i>]</b>  <b>Example:</b> Router(dhcp-config)# network 172.30.0.0 /16	Specifies the subnet network number and mask of the DHCP address pool.
<b>Step 5</b>	<b>import all</b>  <b>Example:</b> Router(dhcp-config)# import all	Imports DHCP option parameters into the DHCP server database.
<b>Step 6</b>	<b>exit</b>  <b>Example:</b> Router(dhcp-config)# exit	Exits DHCP pool configuration mode.
<b>Step 7</b>	<b>interface <i>type number</i></b>  <b>Example:</b> Router(config)# interface GigabitEthernet 0/0/0	Configures an interface and enters interface configuration mode.
<b>Step 8</b>	<b>ip address dhcp</b>  <b>Example:</b> Router(config-if)# ip address dhcp	Specifies that the interface acquires an IP address through DHCP.

	Command or Action	Purpose
Step 9	<b>end</b>  <b>Example:</b>  Router(dhcp-config)# end	Returns to privileged EXEC mode.
Step 10	<b>show ip dhcp import</b>  <b>Example:</b>  Router# show ip dhcp import	Displays the options that have been imported from the central DHCP server.

## Configuring DHCP Address Allocation Using Option 82

- [Restrictions for DHCP Address Allocation Using Option 82, page 20](#)
- [Enabling Option 82 for DHCP Address Allocation, page 20](#)
- [Troubleshooting Tips, page 21](#)
- [Defining the DHCP Class and Relay Agent Information Patterns, page 21](#)
- [Troubleshooting Tips, page 23](#)
- [Defining the DHCP Address Pool, page 23](#)

### Restrictions for DHCP Address Allocation Using Option 82

If the relay agent inserts option 82 but does not set the giaddr field in the DHCP packet, the DHCP server interface must be configured as a trusted interface by using the **ip dhcp relay information trusted** global configuration command. This configuration prevents the server from dropping the DHCP message.

### Enabling Option 82 for DHCP Address Allocation

By default, the Cisco DHCP server uses information provided by option 82 to allocate IP addresses. If the DHCP address allocation is disabled, perform the task described in this section to reenabling this capability.

#### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp use class**
4. **end**

## DETAILED STEPS

Command or Action	Purpose
<p><b>Step 1</b> <code>enable</code></p> <p><b>Example:</b></p> <pre>Device&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
<p><b>Step 2</b> <code>configure terminal</code></p> <p><b>Example:</b></p> <pre>Device# configure terminal</pre>	<p>Enters global configuration mode.</p>
<p><b>Step 3</b> <code>ip dhcp use class</code></p> <p><b>Example:</b></p> <pre>Device(config)# ip dhcp use class</pre>	<p>Controls DHCP classes that are used for address allocation.</p> <ul style="list-style-type: none"> <li>This functionality is enabled by default.</li> <li>Use the <b>no</b> form of this command to disable this functionality without deleting the DHCP class configuration.</li> </ul>
<p><b>Step 4</b> <code>end</code></p> <p><b>Example:</b></p> <pre>Device(config)# end</pre>	<p>Returns to privileged EXEC mode.</p>

## Troubleshooting Tips

If DHCP classes are configured in the pool, but the DHCP server does not use the classes, verify if the **no ip dhcp use class** command was configured.

## Defining the DHCP Class and Relay Agent Information Patterns

You must know the hexadecimal value of each byte location in option 82 to configure the **relay-information hex** command. The option 82 format may vary from product to product. Contact the relay agent vendor for this information.

Perform this task to define the DHCP class and relay agent information patterns:

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **ip dhcp class** *class-name*
4. **relay agent information**
5. **relay-information hex** *pattern* [\*] [**bitmask** *mask*]
6. Repeat Steps 3 through 5 for each DHCP class you need to configure.
7. **end**

**DETAILED STEPS**

Command or Action	Purpose
<p><b>Step 1</b> <b>enable</b></p> <p><b>Example:</b></p> <pre>Device&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<p><b>Step 2</b> <b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Device# configure terminal</pre>	<p>Enters global configuration mode.</p>
<p><b>Step 3</b> <b>ip dhcp class</b> <i>class-name</i></p> <p><b>Example:</b></p> <pre>Device(config)# ip dhcp class CLASS1</pre>	<p>Defines a DHCP class and enters DHCP class configuration mode.</p>
<p><b>Step 4</b> <b>relay agent information</b></p> <p><b>Example:</b></p> <pre>Device(dhcp-class)# relay agent information</pre>	<p>Enters relay agent information option configuration mode.</p> <ul style="list-style-type: none"> <li>• If you omit this step, the DHCP class matches any relay agent information option, whether the relay agent information option value is available or not.</li> </ul>

Command or Action	Purpose
<p><b>Step 5</b> <code>relay-information hex <i>pattern</i> [*] [bitmask <i>mask</i>]</code></p> <p><b>Example:</b></p> <pre>Device(dhcp-class-relayinfo)# relay- information hex 01030a0b0c02050000000123</pre>	<p>(Optional) Specifies a hexadecimal value for full relay information option.</p> <ul style="list-style-type: none"> <li>The <i>pattern</i> argument creates a pattern that is used to match the DHCP class.</li> <li>If you omit this step, no pattern is configured and it is considered a match to any relay agent information option value, but the relay information option must be available in the DHCP packet.</li> <li>You can configure multiple <b>relay-information hex</b> commands in a DHCP class.</li> </ul>
<p><b>Step 6</b> Repeat Steps 3 through 5 for each DHCP class you need to configure.</p>	
<p><b>Step 7</b> <code>end</code></p> <p><b>Example:</b></p> <pre>Device(dhcp-class-relayinfo)# end</pre>	Returns to privileged EXEC mode.

## Troubleshooting Tips

You can enable the `debug ip dhcp server class` command to display the class matching results.

## Defining the DHCP Address Pool

Perform this task to define the DHCP address pool.

### SUMMARY STEPS

- `enable`
- `configure terminal`
- `ip dhcp pool name`
- `network network-number [mask | / prefix-length]`
- `class class-name`
- `address range start-ip end-ip`
- Repeat Steps 5 and 6 for each DHCP class you need to associate to the DHCP pool.

## DETAILED STEPS

Command or Action	Purpose
<b>Step 1</b> <code>enable</code>  <b>Example:</b> <pre>Router&gt; enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
<b>Step 2</b> <code>configure terminal</code>  <b>Example:</b> <pre>Router# configure terminal</pre>	Enters global configuration mode.
<b>Step 3</b> <code>ip dhcp pool name</code>  <b>Example:</b> <pre>Router(config)# ip dhcp pool ABC</pre>	Configures a DHCP address pool on a Cisco IOS XE DHCP server and enters DHCP pool configuration mode. <ul style="list-style-type: none"> <li>Multiple pools can be configured with the same class, eliminating the need to configure the same pattern in multiple pools.</li> </ul>
<b>Step 4</b> <code>network network-number [mask   / prefix-length]</code>  <b>Example:</b> <pre>Router(dhcp-config)# network 10.0.20.0</pre>	Configures the subnet number and mask for a DHCP address pool on a Cisco IOS XE DHCP server.
<b>Step 5</b> <code>class class-name</code>  <b>Example:</b> <pre>Router(dhcp-config)# class CLASS1</pre>	Associates a class with a pool and enters DHCP pool class configuration mode. <ul style="list-style-type: none"> <li>This command will also create a DHCP class if the DHCP class is not yet defined.</li> </ul>
<b>Step 6</b> <code>address range start-ip end-ip</code>  <b>Example:</b> <pre>Router(dhcp-pool-class)# address range 10.0.20.1 10.0.20.100</pre>	(Optional) Sets an address range for a DHCP class in a DHCP server address pool. <ul style="list-style-type: none"> <li>If this command is not configured for a class, the default value is the entire subnet of the pool.</li> </ul>
<b>Step 7</b> Repeat Steps 5 and 6 for each DHCP class you need to associate to the DHCP pool.	Each class in the DHCP pool will be examined for a match in the order configured.

## Configuring a Static Route with the Next-Hop Dynamically Obtained Through DHCP

Perform this task to configure a static route to use a DHCP default gateway as the next-hop router.



This task enables static routes to be assigned using a DHCP default gateway as the next-hop router. This behavior was not possible before the introduction of this feature because the gateway IP address is not known until after the DHCP address assignment. A static route could not be configured with the command-line interface (CLI) that used that DHCP-supplied address.

The static routes are installed in the routing table when the default gateway is assigned by the DHCP server. The routes remain in the routing table until the DHCP lease expires at which time the routes are removed.

When a DHCP client releases an address, the corresponding static route (the route configured with the **ip route** command) is automatically removed from the routing table. If the DHCP router option (option 3 of the DHCP packet) changes during the client renewal, the DHCP default gateway changes to the new IP address supplied in the renewal.

This feature is particularly useful for VPN deployments such as Dynamic Multipoint VPNs (DMVPNs). This feature is useful when a non-physical interface like a multipoint generic routing encapsulation (mGRE) tunnel is configured on the router and certain traffic needs to be excluded from going to the tunnel interface.

Verify all DHCP client and server configuration steps. Ensure that the DHCP client and server are properly defined to supply a DHCP router option 3.



**Note**

- If the DHCP client is not able to obtain an IP address or default router IP address, the static route is not installed in the routing table.
- If the lease has expired and the DHCP client cannot renew the address, the DHCP IP address assigned to the client is released and any associated static routes are removed from the routing table.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **ip route** *prefix mask {ip-address | interface-type interface-number [ip-address]}* **dhcp** [*distance*]
4. **end**
5. **show ip route**

**DETAILED STEPS**

Command or Action	Purpose
<p><b>Step 1</b> <b>enable</b></p> <p><b>Example:</b></p> <pre>Router&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>

Command or Action	Purpose
<p><b>Step 2</b> <code>configure terminal</code></p> <p><b>Example:</b></p> <pre>Router# configure terminal</pre>	Enters global configuration mode.
<p><b>Step 3</b> <code>ip route prefix mask {ip-address   interface-type interface-number [ip-address]} dhcp [distance]</code></p> <p><b>Example:</b></p> <pre>Router(config)# ip route 209.165.200.225 255.255.255.255 GigabitEthernet 0/0/0 dhcp</pre> <p><b>Example:</b></p> <pre>Router(config)# ip route 209.165.200.226 255.255.255.255 GigabitEthernet 0/0/1 dhcp 20</pre>	<p>Assigns a static route for the default next-hop router when the DHCP server is accessed for an IP address.</p> <ul style="list-style-type: none"> <li>If more than one interface on a router is configured to obtain an IP address from a DHCP server, use the <code>ip route prefix mask interface-type interface-number dhcp</code> command for each interface. If the interface is not specified, the route is added to the routing table as soon as any of the interfaces obtain an IP address and default router.</li> </ul>
<p><b>Step 4</b> <code>end</code></p> <p><b>Example:</b></p> <pre>Router(config)# end</pre>	Returns to global configuration mode.
<p><b>Step 5</b> <code>show ip route</code></p> <p><b>Example:</b></p> <pre>Router# show ip route</pre>	<p>(Optional) Displays the current state of the routing table.</p> <ul style="list-style-type: none"> <li>Use this command to display assigned static routes once the DHCP client obtains an address and a default router address from the DHCP server.</li> </ul>

## Clearing DHCP Server Variables

Perform this task to clear DHCP server variables:

### SUMMARY STEPS

- enable
- clear ip dhcp binding {address | \*}
- clear ip dhcp conflict {address | \*}
- clear ip dhcp server statistics

## DETAILED STEPS

Command or Action	Purpose
<p><b>Step 1</b> <code>enable</code></p> <p><b>Example:</b></p> <pre>Device&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
<p><b>Step 2</b> <code>clear ip dhcp binding {address   *}</code></p> <p><b>Example:</b></p> <pre>Device# clear ip dhcp binding *</pre>	<p>Deletes an automatic address binding from the DHCP database.</p> <ul style="list-style-type: none"> <li>Specifying the <i>address</i> argument clears the automatic binding for a specific (client) IP address, whereas specifying an asterisk (*) clears all automatic bindings.</li> </ul>
<p><b>Step 3</b> <code>clear ip dhcp conflict {address   *}</code></p> <p><b>Example:</b></p> <pre>Device# clear ip dhcp conflict 172.16.1.103</pre>	<p>Clears an address conflict from the DHCP database.</p> <ul style="list-style-type: none"> <li>Specifying the <i>address</i> argument clears the conflict for a specific IP address, whereas specifying an asterisk (*) clears conflicts for all addresses.</li> </ul>
<p><b>Step 4</b> <code>clear ip dhcp server statistics</code></p> <p><b>Example:</b></p> <pre>Device# clear ip dhcp server statistics</pre>	<p>Resets all DHCP server counters to 0.</p>

## Configuration Examples for the Cisco IOS XE DHCP Server

- [Example: Configuring the DHCP Database Agent, page 27](#)
- [Example: Excluding IP Addresses, page 28](#)
- [Example: Configuring DHCP Address Pools, page 28](#)
- [Configuring Manual Bindings Example, page 29](#)
- [Importing DHCP Options Example, page 29](#)
- [Configuring DHCP Address Allocation Using Option 82 Example, page 30](#)
- [Configuring a Static Route with the Next-Hop Dynamically Obtained Through DHCP Example, page 31](#)

### Example: Configuring the DHCP Database Agent

The following example shows how to store bindings on host 172.16.4.253. The file transfer protocol is FTP. The server waits for 2 minutes (120 seconds) before performing database changes.

```
ip dhcp database ftp://user:password@172.16.4.253/router-dhcp write-delay 120
```

## Example: Excluding IP Addresses

In the following example, server A and server B service the subnet 10.0.20.0/24. If the subnet is split equally between the two servers, server A is configured to allocate IP addresses 10.0.20.1 to 10.0.20.125 and server B is configured to allocate IP addresses 10.0.20.126 to 10.0.20.254.

### Server A

```
ip dhcp excluded-address 10.0.20.126 10.0.20.255
!
ip dhcp pool A
 network 10.0.20.0 255.255.255.0
```

### Server B

```
ip dhcp excluded-address 10.0.20.0 10.0.20.125
!
ip dhcp pool B
 network 10.0.20.0 255.255.255.0
```

## Example: Configuring DHCP Address Pools

In the following example, three DHCP address pools are created: one in network 172.16.0.0, one in subnetwork 172.16.1.0, and one in subnetwork 172.16.2.0. Attributes from network 172.16.0.0—such as the domain name, Domain Name System (DNS) server, (Network Basic Input/Output System) NetBIOS name server, and NetBIOS node type—are inherited in subnetworks 172.16.1.0 and 172.16.2.0. In each pool, clients are granted 30-day leases and all addresses in each subnetwork, except the excluded addresses, are available to the DHCP server for assigning to clients. The table below lists the IP addresses for the devices in three DHCP address pools.

**Table 1** DHCP Address Pool Configuration

Pool 0 (Network 172.16.0.0)	Pool 1 (Subnetwork 172.16.1.0)	Pool 2 (Subnetwork 172.16.2.0)			
Device	IP Address	Device	IP Address	Device	IP Address
Default devices	—	Default devices	172.16.1.100 172.16.1.101	Default devices	172.16.2.100 172.16.2.101
DNS server	172.16.1.102 172.16.2.102	—	—	—	—
NetBIOS name server	172.16.1.103 172.16.2.103	—	—	—	—
NetBIOS node type	h-node	—	—	—	—

```
ip dhcp database ftp://user:password@172.16.4.253/router-dhcp write-delay 120
ip dhcp excluded-address 172.16.1.100 172.16.1.103
ip dhcp excluded-address 172.16.2.100 172.16.2.103
!
ip dhcp pool 0
```

```

network 172.16.0.0 /16
domain-name cisco.com
dns-server 172.16.1.102 172.16.2.102
netbios-name-server 172.16.1.103 172.16.2.103
netbios-node-type h-node
!
ip dhcp pool 1
network 172.16.1.0 /24
default-router 172.16.1.100 172.16.1.101
lease 30
!
ip dhcp pool 2
network 172.16.2.0 /24
default-router 172.16.2.100 172.16.2.101
lease 30

```

## Configuring Manual Bindings Example

The following example shows how to create a manual binding for a client named Mars.cisco.com. The MAC address of the client is 02c7.f800.0422 and the IP address of the client is 172.16.2.254.

```

ip dhcp pool Mars
host 172.16.2.254
hardware-address 02c7.f800.0422 ieee802
client-name Mars

```

Because attributes are inherited, the previous configuration is equivalent to the following:

```

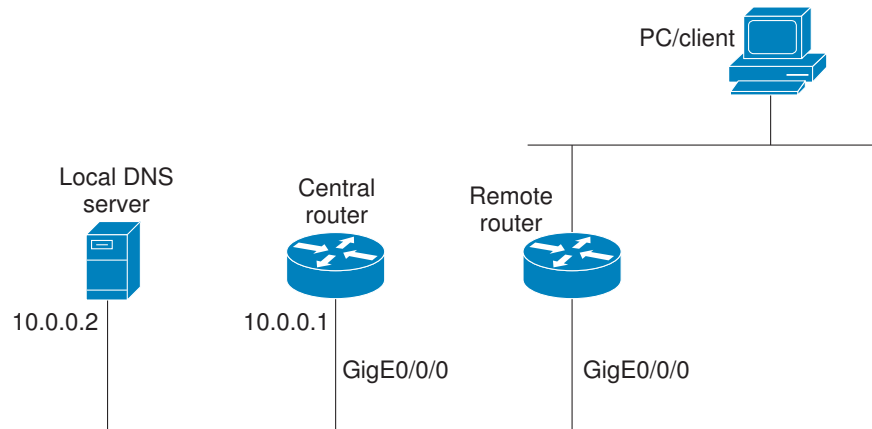
ip dhcp pool Mars
host 172.16.2.254 mask 255.255.255.0
hardware-address 02c7.f800.0422 ieee802
client-name Mars
default-router 172.16.2.100 172.16.2.101
domain-name cisco.com
dns-server 172.16.1.102 172.16.2.102
netbios-name-server 172.16.1.103 172.16.2.103
netbios-node-type h-node

```

## Importing DHCP Options Example

The following example shows a remote and central server configured to support the importing of DHCP options. The central server is configured to automatically update DHCP options, such as DNS and WINS addresses, within the DHCP pools. In response to a DHCP request from a local client behind CPE equipment, the remote server can request or “import” these option parameters from the centralized server. See the figure below for a diagram of the network topology.

**Figure 1** DHCP Example Network Topology



### Central Router

```

!do not assign this range to DHCP clients
ip dhcp-excluded address 10.0.0.1 10.0.0.5
!
ip dhcp pool central
! Specifies network number and mask for DHCP clients
network 10.0.0.0 255.255.255.0
! Specifies the domain name for the client
domain-name central
! Specifies DNS server that will respond to DHCP clients when they need to correlate
host ! name to ip address
dns-server 10.0.0.2
! Specifies the NETBIOS WINS server
netbios-name-server 10.0.0.2
!
interface GigabitEthernet0/0/0
ip address 10.0.0.1 255.255.255.0
duplex auto
speed auto

```

### Remote Router

```

ip dhcp pool client
! Imports DHCP option parameters into DHCP server database
import all
network 20.0.0.0 255.255.255.0
!
interface GigabitEthernet0/0/0
ip address dhcp
duplex auto
speed auto

```

## Configuring DHCP Address Allocation Using Option 82 Example

This example configures two DHCP classes. CLASS1 defines the group of DHCP clients whose address requests contain the relay agent information option with the specified hexadecimal values. CLASS2 defines the group of DHCP clients whose address requests contain the configured relay agent information suboptions. CLASS3 has no pattern configured and is treated as a “match to any” class. This type of class is useful for specifying a “default” class.

In the following example, the subnet of pool ABC has been divided into three ranges without further subnetting of the 10.0.20.0/24 subnet. If there is a DHCP Discover message from the 10.0.20.0/24 subnet with option 82 matching that of class CLASS1, an available address in the range from 10.0.20.1 to 10.0.20.100 will be allocated. If there is no free address in CLASS1's address range, the DHCP Discover message will be matched against CLASS2, and so on.

Thus, each class in the DHCP pool will be examined for a match in the order configured by the user. In pool ABC, the order of matching is CLASS1, CLASS2, and finally CLASS3. In pool DEF, class CLASS2 does not have any address range configured. By default, the address range for a particular class is the pool's entire subnet(s). Therefore, clients matching CLASS2 may be allocated addresses from 11.0.20.1 to 11.0.20.254.

Multiple pools can be configured with the same class, eliminating the need to configure the same patterns in multiple pools. In the future, further classification method may be implemented. For example, there may be a need to specify that one or more pools should only be used to service a particular class of devices (for example, cable modems and IP phones).

```

! Defines the DHCP classes and relay information patterns
ip dhcp class CLASS1
relay agent information
relay-information hex 01030a0b0c02050000000123

```

```

relay-information hex 01030a0b0c02*
relay-information hex 01030a0b0c02050000000000 bitmask 0000000000000000000000FF
ip dhcp class CLASS2
  relay agent information
  relay-information hex 01040102030402020102
  relay-information hex 01040101030402020102
ip dhcp class CLASS3
  relay agent information
! Associates the DHCP pool with DHCP classes
ip dhcp pool ABC
  network 10.0.20.0 255.255.255.0
  class CLASS1
  address range 10.0.20.1 10.0.20.100
class CLASS2
  address range 10.0.20.101 10.0.20.200
class CLASS3
  address range 10.0.20.201 10.0.20.254
ip dhcp pool DEF
  network 11.0.20.0 255.255.255.0
  class CLASS1
  address range 11.0.20.1 11.0.20.64
class CLASS2

```

## Configuring a Static Route with the Next-Hop Dynamically Obtained Through DHCP Example

The following example shows how to configure two GigabitEthernet interfaces to obtain the next-hop router IP address from the DHCP server:

```

ip route 10.10.10.0 255.255.255.0 dhcp 200
ip route 10.10.20.1 255.255.255.255 gigaether 1 dhcp

```

## Additional References

The following sections provide references related to the Cisco IOS XE DHCP server.

### Related Documents

Related Topic	Document Title
DHCP commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	<i>Cisco IOS IP Addressing Services Command Reference</i>
DHCP conceptual information	“DHCP Overview” module
DHCP relay agent configuration	“Configuring the Cisco IOS XE DHCP Relay Agent” module
DHCP client configuration	“Configuring the Cisco IOS XE DHCP Client” module
DHCP On-Demand Address Pool Manager	“Configuring the DHCP On-Demand Address Pool Manager” module

**Standards**

Standards	Title
No new or modified standards are supported by this functionality.	--

**MIBs**

MIBs	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL:  <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

**RFCs**

RFCs	Title
RFC 951	<i>Bootstrap Protocol (BOOTP)</i>
RFC 1542	<i>Clarifications and Extensions for the Bootstrap Protocol</i>
RFC 2131	<i>Dynamic Host Configuration Protocol</i>
RFC 2132	<i>DHCP Options and BOOTP Vendor Extensions</i>

**Technical Assistance**

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.  To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.  Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	<a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a>

## Feature Information for the Cisco IOS XE DHCP Server

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software



release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 2** Feature Information for the Cisco IOS XE DHCP Server

Feature Name	Releases	Feature Configuration Information
DHCP Server	Cisco IOS XE Release 2.1	Cisco routers running Cisco IOS XE software include Dynamic Host Configuration Protocol (DHCP) server and relay agent software. The Cisco IOS XE DHCP server is a full DHCP server implementation that assigns and manages IP addresses from specified address pools within the router to DHCP clients. The DHCP server can be configured to assign additional parameters such as the IP address of the domain name system (DNS) server and the default router.
DHCP Address Allocation Using Option 82	Cisco IOS XE Release 2.1	The Cisco IOS XE DHCP server can allocate dynamic IP addresses based on the relay information option (option 82) information sent by the relay agent.  The following commands were introduced by this feature: <b>address range, class, ip dhcp class, ip dhcp use class, relay agent information, relay-information hex.</b>
DHCP Statically Configured Routes Using a DHCP Gateway	Cisco IOS XE Release 2.1	This feature enables the configuration of static routes that point to an assigned DHCP next hop router.  The following commands were modified by this feature: <b>ip route, show ip route.</b>

Feature Name	Releases	Feature Configuration Information
DHCP Server Options - Import and Autoconfiguration	Cisco IOS XE Release 2.3	Options imported by multiple subsystems can co-exist in the DHCP address pool. When the session is terminated or the lease is released, the imported options are cleared.

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