Configuring the Cisco IOS DHCP Relay Agent

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Cisco routers running Cisco IOS software include Dynamic Host Configuration Protocol (DHCP) server and relay agent software. A DHCP relay agent is any host that forwards DHCP packets between clients and servers. This module describes the concepts and tasks needed to configure the Cisco IOS DHCP relay agent.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the "Feature Information for the Cisco IOS DHCP Relay Agent" section on page 23.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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Prerequisites for Configuring the Cisco IOS DHCP Relay Agent

Before you configure the DHCP relay agent, you should understand the concepts documented in the "DHCP Overview" module.

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

The Cisco IOS 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 DHCP Relay Agent

Before you configure the DHCP relay agent, you should understand the following concept:

- DHCP Relay Agent Overview, page 2

DHCP Relay Agent Overview

A DHCP relay agent is any host that forwards DHCP packets between clients and servers. Relay agents are used to forward requests and replies between clients and servers when they are not on the same physical subnet. Relay agent forwarding is distinct from the normal forwarding of an IP router, where IP datagrams are switched between networks somewhat transparently. By contrast, relay agents receive DHCP messages and then generate a new DHCP message to send out on another interface. The relay agent sets the gateway address (giaddr field of the DHCP packet) and, if configured, adds the relay agent information option (option82) in the packet and forwards it to the DHCP server. The reply from the server is forwarded back to the client after removing option 82.

The Cisco IOS DHCP relay agent supports the use of unnumbered interfaces. For DHCP clients connected though the unnumbered interfaces, the DHCP relay agent automatically adds a static host route once the DHCP client obtains an address, specifying the unnumbered interface as the outbound interface. The route is automatically removed once the lease time expires or when the client releases the address.

How to Configure the DHCP Relay Agent

This section contains the following tasks:

Specifying the Packet Forwarding Address

Perform this task to configure the DHCP relay agent to forward packets to a DHCP server.

DHCP clients need to use User Datagram Protocol (UDP) broadcasts to send their initial DHCPDISCOVER messages because they don't have information about the network to which they are attached. If the client is on a network segment that does not include a server, UDP broadcasts normally are not forwarded because most routers are configured to not forward broadcast traffic.

You can remedy this situation by configuring the interface of your router that is receiving the broadcasts to forward certain classes of broadcasts to a helper address. You can use more than one helper address per interface.

When a router forwards these address assignment/parameter requests, it is acting as a DHCP relay agent. The Cisco router implementation of the DHCP relay agent is provided via the **ip helper-address** interface configuration command.

In Figure 1, the DHCP client broadcasts a request for an IP address and additional configuration parameters on its local LAN. Router B, acting as a DHCP relay agent, picks up the broadcast and generates a new DHCP message to send out on another interface. As part of this DHCP message, the relay agent inserts the IP address of the interface containing the **ip helper-address** command into the gateway IP address (giaddr) field of the DHCP packet. This IP address enables the DHCP server to determine which subnet should receive the offer and identify the appropriate IP address range to offer. The DHCP relay agent sends the local broadcast, via IP unicast, to the DHCP server address 172.16.1.2 specified by the **ip helper-address** interface configuration command.

Figure 1   Forwarding UDP Broadcasts to a DHCP Server Using a Helper Address
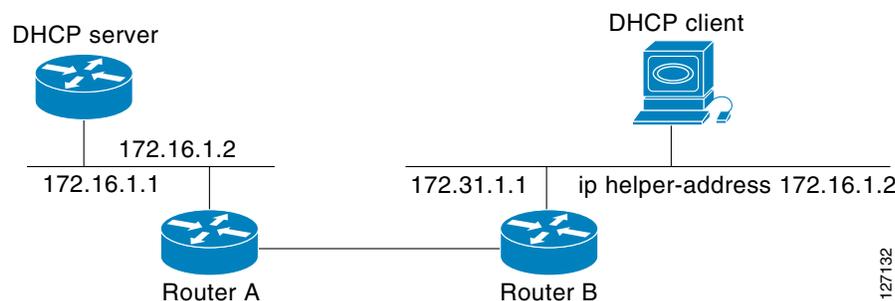
SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip helper-address** *address*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** Router(config)# interface FastEthernet0/0	Configures an interface and enters interface configuration mode.
Step 4	**ip helper-address** *address* **Example:** Router(config-if)# ip helper-address 172.16.1.2	Forwards UPD broadcasts, including BOOTP and DHCP. • The *address* argument can be a specific DHCP server address, or it can be the network address if other DHCP servers are on the destination network segment. Using the network address enables other servers to respond to DHCP requests. • If you have multiple servers, you can configure one helper address for each server.

Configuring Relay Agent Information Option Support

Perform this task to enable support for the DHCP relay agent information option.

Relay Agent Information Option

Automatic DHCP address allocation is typically based on an IP address, whether it be the gateway IP address (giaddr field of the DHCP packet) or the incoming interface IP address. In some networks, it is necessary to use additional information to further determine which IP addresses to allocate. By using the relay agent information option (option 82), the Cisco IOS relay agent can include additional information about itself when forwarding client-originated DHCP packets to a DHCP server.

Cisco IOS supports this functionality by using the **ip dhcp relay information option** command. The relay agent will automatically add the circuit identifier suboption and the remote ID suboption to the relay agent information option and forward them to the DHCP server.

The DHCP server can use this information to assign IP addresses, perform access control, and set quality of service (QoS) and security policies (or other parameter-assignment policies) for each subscriber of a service provider network.

Figure 2 shows how the relay agent information option is inserted into the DHCP packet as follows:

1. The DHCP client generates a DHCP request and broadcasts it on the network.

2. The DHCP relay agent intercepts the broadcast DHCP request packet and inserts the relay agent information option (option 82) in the packet. The relay agent information option contains the related suboptions.

3. The DHCP relay agent unicasts the DHCP packet to the DHCP server.

4. The DHCP server receives the packet and uses the suboptions to assign IP addresses and other configuration parameters and forwards them back to the client.

5. The suboption fields are stripped off of the packet by the relay agent while forwarding to the client.

Figure 2   Relay Agent Information Option Operation
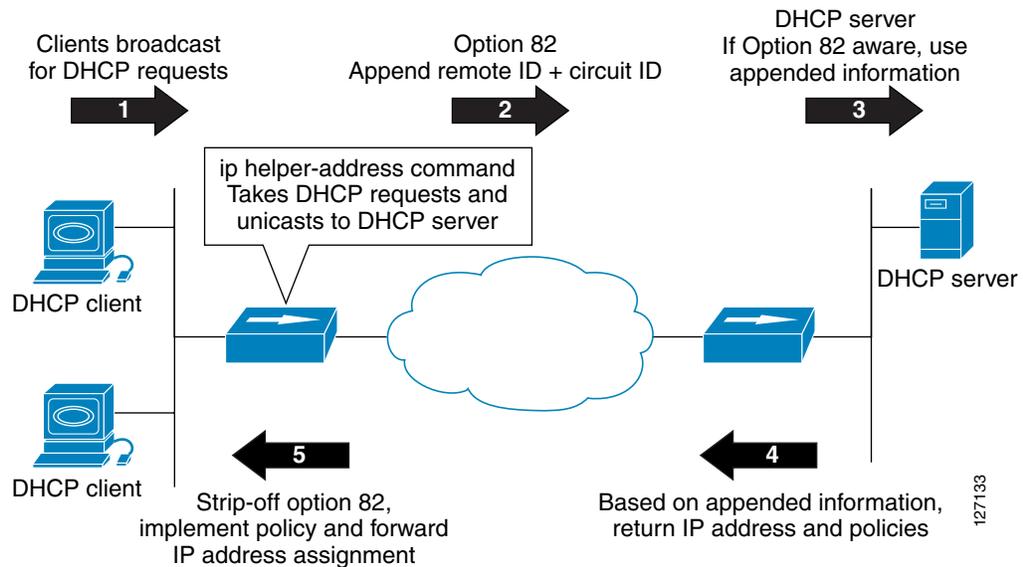
Relay Agent Information Reforwarding Policy

A DHCP relay agent may receive a message from another DHCP relay agent that already contains relay information. By default, the relay information from the previous relay agent is replaced. If this behavior is not suitable for your network, you can use the **ip dhcp relay information policy** {**drop** | **keep** | **replace**} global configuration command to change it.

To ensure the correct operation of the reforwarding policy, make sure to disable the relay agent information check by using the **no ip dhcp relay information check** global configuration command.

Prerequisites

It is important to understand how DHCP options work. See the "DHCP Overview" module for more information.

Restrictions

- If an **ip dhcp relay information** command is configured in global configuration mode but not configured in interface configuration mode, the global configuration is applied to all interfaces.

- If an **ip dhcp relay information** command is configured in both global configuration mode and interface configuration mode, the interface configuration command takes precedence over the global configuration command. However, the global configuration is applied to interfaces without the interface configuration.

- If an **ip dhcp relay information** command is not configured in global configuration mode but is configured in interface configuration mode, only the interface with the configuration option applied is affected. All other interfaces are not impacted by the configuration.

See the "Configuring Relay Agent Information Option Support per Interface" section for more information on per-interface support for the relay agent information option.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp relay information option**
4. **ip dhcp relay information check**
5. **ip dhcp relay information policy** {**drop** | **keep** | **replace**}
6. **ip dhcp relay information trust-all**
7. **end**
8. **show ip dhcp relay information trusted-sources**

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		
		• Enter your password if prompted.

Step 2	`configure terminal`
	
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	`ip dhcp relay information option`
	
	Example:
	`Router(config)# ip dhcp relay information option`
		Enables the system to insert the DHCP relay agent information option (option-82 field) in forwarded BOOTREQUEST messages to a DHCP server.
		
		• This function is disabled by default.

Step 4	`ip dhcp relay information check`
	
	Example:
	`Router(config)# ip dhcp relay information check`
		(Optional) Configures DHCP to check that the relay agent information option in forwarded BOOTREPLY messages is valid.
		
		• By default, DHCP checks that the option-82 field in DHCP reply packets it receives from the DHCP server is valid. If an invalid message is received, the relay agent drops it. If a valid message is received, the relay agent removes the option-82 field and forwards the packet. Use the **ip dhcp relay information check** command to reenable this functionality if it has been disabled.

	Command or Action	Purpose
Step 5	**ip dhcp relay information policy** {**drop** | **keep** | **replace**} **Example:** Router(config)# ip dhcp relay information policy replace	(Optional) Configures the reforwarding policy for a DHCP relay agent (what a relay agent should do if a message already contains relay information). • See the "Relay Agent Information Reforwarding Policy" section for more information.
Step 6	**ip dhcp relay information trust-all** **Example:** Router(config)# ip dhcp relay information trust-all	(Optional) Configures all interfaces on a router as trusted sources of the DHCP relay information option. • By default, if the gateway address is set to all zeros in the DHCP packet and the relay agent information option is already present in the packet, the DHCP relay agent will discard the packet. Use the **ip dhcp relay information trust-all** command to override this behavior and accept the packets. • This command is useful if there is a switch in between the client and the relay agent that may insert option 82. Use this command to ensure that these packets do not get dropped. • You can configure an individual interface as a trusted source of the DHCP relay information option by using the **ip dhcp relay information trusted** interface configuration mode command.
Step 7	**end** **Example:** Router(config)# end	Returns to privileged EXEC mode.
Step 8	**show ip dhcp relay information trusted-sources** **Example:** Router# show ip dhcp relay information trusted-sources	(Optional) Displays all interfaces configured to be a trusted source for the DHCP relay information option.

Configuring Relay Agent Information Option Support per Interface

Perform this task to enable support for the DHCP relay agent information option (option 82) on a per interface basis.

The interface configuration allows the subscribers with different DHCP option 82 requirements on different interfaces to be reached from one Cisco router.

Prerequisites

It is important to understand how DHCP options work. See the "DHCP Overview" module for more information.

Read the "Relay Agent Information Option" and "Relay Agent Information Reforwarding Policy" sections to understand how DHCP processes the relay agent information option for global configurations.

Restrictions

- If an **ip dhcp relay information** command is configured in global configuration mode but not configured in interface configuration mode, the global configuration is applied to all interfaces.

- If an **ip dhcp relay information** command is configured in both global configuration mode and interface configuration mode, the interface configuration command takes precedence over the global configuration command. However, the global configuration is applied to interfaces without the interface configuration.

- If an **ip dhcp relay information** command is not configured in global configuration mode but is configured in interface configuration mode, only the interface with the configuration option applied is affected. All other interfaces are not impacted by the configuration.

SUMMARY STEPS

1. **enable**

2. **configure terminal**

3. **interface** *type number*

4. **ip dhcp relay information option-insert** [**none**]

5. **ip dhcp relay information check-reply** [**none**]

6. **ip dhcp relay information policy-action** {**drop** | **keep** | **replace**}

7. **exit**

8. Repeat Steps 3 through 7 to configure relay agent information option settings on different interfaces.

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		
		• Enter your password if prompted.

Step 2	`configure terminal`
	
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	`interface` *type number* **Example:** `Router(config)# interface FastEthernet0/0`	Configures an interface and enters interface configuration mode.

	Command or Action	Purpose
Step 4	`ip dhcp relay information option-insert` [`none`] **Example:** `Router(config-if)# ip dhcp relay information option-insert`	Enables the system to insert the DHCP relay agent information option (option-82 field) in forwarded BOOTREQUEST messages to a DHCP server. • This function is disabled by default. However, if support for the relay agent information option is configured in global configuration mode, but not in interface configuration mode, the interface inherits the global configuration. • The **ip dhcp relay information option-insert none** interface configuration command is saved in the running configuration. This command takes precedence over any global relay agent information configuration.
Step 5	`ip dhcp relay information check-reply` [`none`] **Example:** `Router(config-if)# ip dhcp relay information check-reply`	Configures a DHCP server to validate the relay information option in forwarded BOOTREPLY messages. • By default, DHCP checks that the option-82 field in DHCP reply packets it receives from the DHCP server is valid. If an invalid message is received, the relay agent drops it. If a valid message is received, the relay agent removes the option-82 field and forwards the packet. Use the **ip dhcp relay information check-reply** command to reenable this functionality if it has been disabled. • The **ip dhcp relay information check-reply none** interface configuration command option is saved in the running configuration. This command takes precedence over any global relay agent information configuration.
Step 6	`ip dhcp relay information policy-action` {`drop` | `keep` | `replace`} **Example:** `Router(config-if)# ip dhcp relay information policy-action replace`	Configures the information reforwarding policy for a DHCP relay agent (what a relay agent should do if a message already contains relay information). • See the "Relay Agent Information Reforwarding Policy" section on page 5 for more information.

Step 7	`exit`
	
	Example:
	`Router(config-if)# exit`
		Exits interface configuration mode.

Step 8	Repeat Steps 3 through 7 to configure relay agent information settings on different interfaces.	(Optional)

Configuring the Subscriber Identifier Suboption of the Relay Agent Information Option

Perform this task to enable an Internet service provider (ISP) to add a unique identifier to the subscriber-identifier suboption of the relay agent information option.

The unique identifier enables an ISP to identify a subscriber, to assign specific actions to that subscriber (for example, assignment of host IP address, subnet mask, and domain name system DNS), and to trigger accounting.

Before the introduction of this feature, if a subscriber moved, each ISP had to be informed of the change and all ISPs had to reconfigure the DHCP settings for the affected customers at the same time. Even if the service was not changed, every move involved administrative changes in the ISP environment. With the introduction of this feature, if a subscriber moves from one Network Access Server to another, there is no need for a change in the configuration on the part of the DHCP server or ISP.

Prerequisites

You should configure the unique identifier for each subscriber.

The new configurable subscriber-identifier option should be configured on the interface connected to the client. When a subscriber moves from one interface to the other, the interface configuration should also be changed.

The server should be able to recognize the new suboption.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp relay information option**
4. **interface** *type number*
5. **ip dhcp relay information option subscriber-id** *string*

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		
		• Enter your password if prompted.

Step 2	`configure terminal`
	
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	`ip dhcp relay information option`
	
	Example:
	`Router(config)# ip dhcp relay information option`
		Enables the system to insert the DHCP relay agent information option (option-82 field) in forwarded BOOTREQUEST messages to a DHCP server.
		
		• This function is disabled by default.

	Command or Action	Purpose
Step 4	`interface` *type* *number* **Example:** `Router(config)# interface atm4/0.1`	Configures an interface and enters interface configuration mode.
Step 5	`ip dhcp relay information option subscriber-id` *string* **Example:** `Router(config-if)# ip dhcp relay information option subscriber-id newsubscriber123`	Specifies that a DHCP relay agent add a subscriber identifier suboption to the relay information option. • The *string* argument can be up to a maximum of 50 characters and can be alphanumeric. **Note** If more than 50 characters are configured, the string is truncated. **Note** The **ip dhcp relay information option subscriber-id** command is disabled by default to ensure backward capability.

Configuring DHCP Relay Class Support for Client Identification

Perform this task to configure DHCP relay class support for client identification.

Relay Class Support Overview

DHCP relay class support for client identification allows the Cisco IOS relay agent to forward client-generated DHCP messages to different DHCP servers based on the content of the following four options:

- Option 60: vendor class identifier
- Option 77: user class
- Option 124: vendor-identifying vendor class
- Option 125: vendor-identifying vendor-specific information

Each option identifies the type of client sending the DHCP message.

Relay pools provide a method to define DHCP pools that are not used for address allocation. These relay pools can specify that DHCP messages from clients on a specific subnet should be forwarded to a specific DHCP server. These relay pools can be configured with relay classes inside the pool that help determine the forwarding behavior.

For example, after receiving the option in the DHCP DISCOVER message, the relay agent will match and identify the relay class from the relay pool and then direct the DHCP DISCOVER message to the DHCP server associated with that identified relay class.

Relay Class Support Usage Scenario

In an example application, a Cisco router acting as a DHCP relay agent receives DHCP requests from two VoIP services (H323 and SIP). The requesting devices are identified by option 60.

Both VoIP services have a different back-office infrastructure so they cannot be serviced by the same DHCP server. Requests for H323 devices must be forwarded to the H323 server and requests from the SIP devices must be forwarded to the SIP server.

The solution is to configure the relay agent with relay classes that are configured to match option 60 values sent by the client devices. Based on the option value, the relay agent will match and identify the relay class, and forward the DHCP DISCOVER message to the DHCP server associated with that identified relay class.

Prerequisites

It is important to understand how DHCP options work. See the "DHCP Overview" module for more information.

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

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp class** *class-name*
4. **option** *code* **hex** *hex-pattern* [*] [**mask** *bit-mask-pattern*]
5. **exit**
6. Repeat Steps 3 through 5 for each DHCP class you need to configure.
7. **ip dhcp pool** *name*
8. **relay source** *ip-address subnet-mask*
9. **class** *class-name*
10. **relay target** [**vrf** *vrf-name* | **global**] *ip-address*
11. **exit**
12. Repeat Steps 9 through 11 for each DHCP class you need to configure.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**ip dhcp class** *class-name* **Example:** Router(config)# ip dhcp class SIP	Defines a DHCP class and enters DHCP class configuration mode.
Step 4	**option** *code* **hex** *hex-pattern* [*****][**mask** *bit-mask-pattern*] **Example:** Router(dhcp-class)# option 60 hex 010203	Enables the relay agent to make forwarding decisions based on DHCP options inserted in the DHCP message.
Step 5	**exit** **Example:** Router(dhcp-class)# exit	Exits DHCP class configuration mode.
Step 6	Repeat Steps 3 through 5 for each DHCP class you need to configure.	—
Step 7	**ip dhcp pool** *name* **Example:** Router(config)# ip dhcp pool ABC	Configures a DHCP pool on a DHCP server and enters DHCP pool configuration mode.
Step 8	**relay source** *ip-address* *subnet-mask* **Example:** Router(dhcp-config)# relay source 10.2.0.0 255.0.0.0	Configures the relay source. The *ip-address* and *subnet-mask* arguments are the IP address and subnet mask for the relay source. • This command is similar to the **network** command in a normal DHCP network pool, because it restricts the use of the address pool to packets arriving on the interface whose configured IP address and mask matches the relay source configuration.
Step 9	**class** *class-name* **Example:** Router(dhcp-config)# class SIP	Associates a class with a DHCP pool and enters DHCP pool class configuration mode.
Step 10	**relay target** [**vrf** *vrf-name* | **global**] *ip-address* **Example:** Router(config-dhcp-pool-class)# relay target 10.21.3.1	Configures an IP address for a DHCP server to which packets are forwarded.

	Command or Action	Purpose

Step 11	`exit`
	
	Example:
	`Router(dhcp-class)# exit`
		Exits DHCP pool class configuration mode.

Step 12	Repeat Steps 9 through 11 for each DHCP class you need to configure	—

Configuring DHCP Relay Agent Support for MPLS VPNs

Perform this task to configure DHCP relay agent support for MPLS VPNs.

DHCP Relay Agent Support for MPLS VPNs

DHCP relay support for Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs) enables a network administrator to conserve address space by allowing overlapping addresses. The relay agent can support multiple clients on different VPNs, and many of these clients from different VPNs can share the same IP address.

Configuring VPNs involves an adjustment to the usual DHCP host IP address designation. VPNs use private address spaces that might not be unique across the Internet.

In some environments, a relay agent resides in a network element that also has access to one or more MPLS VPNs. A DHCP server that provides service to DHCP clients on those different VPNs must locate the VPN in which each client resides. The network element that contains the relay agent typically captures the VPN association of the DHCP client and includes this information in the relay agent information option of the DHCP packet.

DHCP relay support for MPLS VPNs allows the relay agent to forward this necessary VPN-related information to the DHCP server using the following three suboptions of the DHCP relay agent information option:

- VPN identifier
- Subnet selection
- Server identifier override

The VPN identifier suboption is used by the relay agent to tell the DHCP server the VPN for every DHCP request it passes on to the DHCP server, and it is also used to properly forward any DHCP reply that the DHCP server sends back to the relay agent. The VPN identifier suboption contains the VPN ID configured on the incoming interface to which the client is connected. If you configure the VRF name but not the VPN ID, the VRF name is used as the VPN identifier suboption. If the interface is in global routing space, the VPN suboptions are not added.

The subnet selection suboption allows the separation of the subnet where the client resides from the IP address used to communicate with the relay agent. In typical DHCP processing, the gateway address specifies both the subnet on which a DHCP client resides and the IP address that the server can use to communicate with the relay agent. Situations exist where the relay agent needs to specify the subnet on which a DHCP client resides that is different from the IP address the server can use to communicate with the relay agent. The subnet selection suboption is included in the relay agent information option and passed on to the DHCP server. The gateway address is changed to the outgoing interface of the relay agent toward the DHCP server. The DHCP server uses this gateway address to send reply packets back to the relay agent.

The server identifier override suboption value is copied in the reply packet from the DHCP server instead of the normal server ID address. The server identifier override suboption contains the incoming interface IP address, which is the IP address on the relay agent that is accessible from the client. Using this information, the DHCP client sends all renew and release packets to the relay agent. The relay agent adds all of the VPN suboptions and then forwards the renew and release packets to the original DHCP server.

After adding these suboptions to the DHCP relay agent information option, the gateway address is changed to the outgoing interface of the relay agent toward the DHCP server. When the packets are returned from the DHCP server, the relay agent removes the relay agent information options and forwards the packets to the DHCP client on the correct VPN.

Figure 3 shows a VPN scenario where the DHCP relay agent and DHCP server can recognize the VPN that each client resides within. DHCP client 1 is part of VPN *green* and DHCP client 2 is part of VPN *red* and both have the same private IP address 192.168.1.0/24. Because the clients have the same IP address, the DHCP relay agent and DHCP server use the VPN identifier, subnet selection, and server identifier override suboptions of the relay agent information option to distinguish the correct VPN of the client.

Figure 3   Virtual Private Network DHCP Configuration
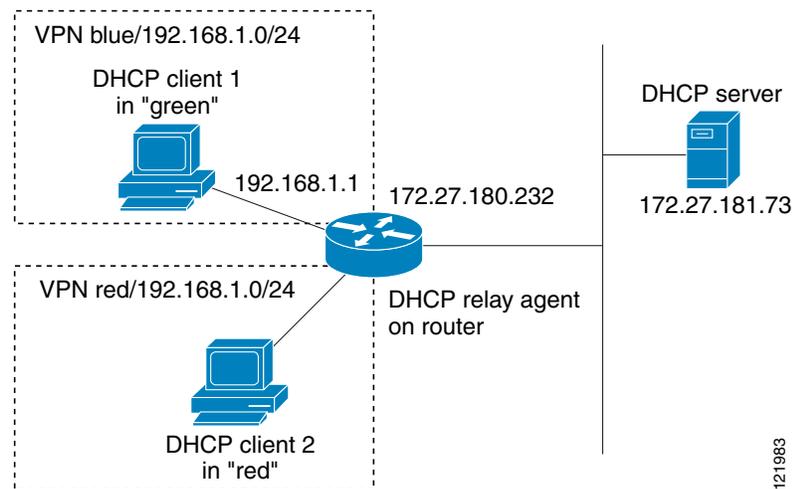
Prerequisites

Before configuring DHCP relay support for MPLS VPNs, you must configure standard MPLS VPNs.

Restrictions

- If the **ip dhcp relay information option vpn** global configuration command is configured and the **ip dhcp relay information option vpn-id** interface configuration command is not configured, the global configuration is applied to all interfaces.

- If the **ip dhcp relay information option vpn** global configuration command is configured and the **ip dhcp relay information option vpn-id** interface configuration command is also configured, the interface configuration command takes precedence over the global configuration command. However, the global configuration is applied to interfaces without the interface configuration.

- If the **ip dhcp relay information option vpn** global configuration command is not configured and the **ip dhcp relay information option vpn-id** interface configuration command is configured, only the interface with the configuration option applied is affected. All other interfaces are not impacted by the configuration.

SUMMARY STEPS

1. **enable**

2. **configure terminal**

3. **ip dhcp relay information option vpn**

4. **interface** *type number*

5. **ip helper-address vrf** *name* [**global**] *address*

6. **ip dhcp relay information option vpn-id** [**none**]

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		
		• Enter your password if prompted.

Step 2	`configure terminal`
	
	Example:
	`Router# configure terminal`
		Enters global configuration mode.

Step 3	`ip dhcp relay information option vpn`
	
	Example:
	`Router(config)# ip dhcp relay information option vpn`
		Enables the system to insert VPN suboptions into the DHCP relay agent information option in forwarded BOOTREQUEST messages to a DHCP server and sets the gateway address to the outgoing interface toward the DHCP server.
		
		• The VPN suboptions are also added to the BOOTP broadcast packets when the command is configured.

Step 4	`interface` *type number* **Example:** `Router(config)# interface FastEthernet0/0`	Configures an interface and enters interface configuration mode.
Step 5	`ip helper-address vrf` *name* [`global`] *address* **Example:** `Router(config-if)# ip helper-address vrf blue 172.27.180.232`	Forwards UDP broadcasts, including BOOTP, received on an interface. • If the DHCP server resides in a different VPN or global space that is different from the VPN, then the **vrf** *name* or **global** options allow you to specify the name of the VRF or global space in which the DHCP server resides.
Step 6	`ip dhcp relay information option vpn-id` [`none`] **Example:** `Router(config-if)# ip dhcp relay information option vpn-id`	(Optional) Enables the system to insert VPN suboptions into the DHCP relay agent information option in forwarded BOOTREQUEST messages to a DHCP server and sets the gateway address to the outgoing interface toward the DHCP server. • The VPN suboptions are also added to the BOOTP broadcast packets when the command is configured. • The **ip dhcp relay information option vpn-id none** command allows you to disable the VPN functionality on the interface. The only time you need to use this command is when the **ip dhcp relay information option vpn** global configuration command is configured and you want to override the global configuration. • The **no ip dhcp relay information option vpn-id** command removes the configuration from the running configuration. In this case, the interface inherits the global configuration, which may or may not be configured to insert VPN suboptions.

Setting the Gateway Address of the DHCP Broadcast to a Secondary Address Using Smart Relay Agent Forwarding

Perform this task to configure smart relay agent forwarding.

You only need to configure helper addresses on the interface where the UDP broadcasts that you want to forward to the DHCP server are being received, and you only need the **ip dhcp smart-relay** command configured if you have secondary addresses on that interface and you want the router to step through each IP network when forwarding DHCP requests. Without the smart relay agent configured, all requests are forwarded using the primary IP address on the interface.

If the **ip dhcp smart-relay** command is configured, the relay agent counts the number of times the client retries sending a request to the DHCP server when there is no DHCPOFFER message from the DHCP server. After three retries, the relay agent sets the gateway address to the secondary address. If the DHCP server still does not respond after three more retries, then the next secondary address is used as the gateway address.

This functionality is useful when the DHCP server cannot be configured to use secondary pools.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp smart-relay**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**ip dhcp smart-relay** **Example:** Router(config)# ip dhcp smart-relay	Allows the DHCP relay agent to switch the gateway address (giaddr field of a DHCP packet) to secondary addresses when there is no DHCPOFFER message from a DHCP server.

Troubleshooting the DHCP Relay Agent

Perform this task to troubleshoot the DHCP relay agent.

The **show ip route dhcp** command is useful to help you understand any problems with the DHCP relay agent adding routes to clients from unnumbered interfaces. All routes added to the routing table by the DHCP server and relay agent are displayed.

SUMMARY STEPS

1. **enable**
2. **show ip route dhcp**
3. **show ip route dhcp** *ip-address*
4. **show ip route vrf** *vrf-name* **dhcp**
5. **clear ip route** [**vrf** *vrf-name*] **dhcp** [*ip-address*]

DETAILED STEPS

	Command or Action	Purpose

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enables privileged EXEC mode.
		
		• Enter your password if prompted.

Step 2	`show ip route dhcp`
	
	Example:
	`Router# show ip route dhcp`
		Displays all routes added by the Cisco IOS DHCP server and relay agent.

Step 3	`show ip route dhcp ip-address`
	
	Example:
	`Router# show ip route dhcp 172.16.1.3`
		Displays all routes added by the Cisco IOS DHCP server and relay agent associated with an IP address.

Step 4	`show ip route vrf vrf-name dhcp`
	
	Example:
	`Router# show ip route vrf red dhcp`
		Displays all routes added by the Cisco IOS DHCP server and relay agent associated with the named VRF.

Step 5	`clear ip route [vrf vrf-name] dhcp [ip-address]`
	
	Example:
	`Router# clear ip route dhcp`
		Removes routes from the routing table added by the DHCP server and relay agent for the DHCP clients on unnumbered interfaces.

Configuration Examples for the Cisco IOS DHCP Relay Agent

This section provides the following configuration examples:

DHCP Relay Agent and Relay Agent Information Option Support: Example

The following example shows how to enable the DHCP server, the relay agent, and the insertion and removal of the DHCP relay information option (option 82). Note that the Cisco IOS DHCP server is enabled by default. In this example, the DHCP server was disabled:

```
!reenables the DHCP server
service dhcp
ip dhcp relay information option
!
interface ethernet0/0
 ip address 192.168.100.1 255.255.255.0
 ip helper-address 10.55.11.3
```

DHCP Relay Agent and Relay Agent Information Option Support per Interface: Example

The following example shows that for subscribers being serviced by the same aggregation router, the relay agent information option needs to be processed differently for Asynchronous Transfer Mode (ATM) subscribers than for Ethernet digital subscribers. For ATM subscribers, the relay agent information option is configured to be removed from the packet by the relay agent before forwarding to the client. For Ethernet subscribers, the connected device provides the relay agent information option, and it is configured to remain in the packet and be forwarded to the client.

```
ip dhcp relay information trust-all
interface Loopback0
 ip address 10.16.0.1 255.255.255.0
!
interface ATM3/0
 no ip address
!
interface ATM3/0.1
 ip helper-address 10.16.1.2
 ip unnumbered loopback0
 ip dhcp relay information option-insert
!
interface Loopback1
 ip address 10.18.0.1 255.255.255.0
!
interface Ethernet4
 no ip address
!
interface Ethernet4/0.1
 encap dot1q 123
 ip unnumbered loopback1
 ip helper-address 10.18.1.2
 ip dhcp relay information policy-action keep
```

Subscriber Identifier Suboption Configuration: Example

The following example shows how to add a unique identifier to the subscriber-identifier suboption of the relay agent information option.

```
ip dhcp relay information option
!
interface Loopback0
 ip address 10.1.1.129 255.255.255.192
```

```
!
interface ATM4/0
 no ip address
!
interface ATM4/0.1 point-to-point
 ip helper-address 10.16.1.2
 ip unnumbered Loopback0
 ip dhcp relay information option subscriber-id newperson123
 atm route-bridged ip
 pvc 88/800
 encapsulation aal5snap
```

DHCP Relay Class Support for Client Identification: Example

In the following example, DHCP messages are received from DHCP clients on subnet 10.2.2.0. The relay agent will match and identify the relay class from the relay pool and forward the DHCP message to the appropriate DHCP server identified by the **relay target** command.

```
!
ip dhcp class H323
 option 60 hex 010203
!
ip dhcp class SIP
 option 60 hex 040506
!
! The following is the relay pool
ip dhcp pool red
 relay source 10.2.2.0 255.255.255.0
 class H323
  relay target 172.16.2.1
  relay target 172.17.2.1
!
 class SIP
  relay target 172.18.2.1
```

DHCP Relay Agent Support for MPLS VPNs: Example

In the following example, the DHCP relay agent receives a DHCP request on Ethernet interface 0/1 and sends the request to the DHCP server located at IP helper address 10.44.23.7, which is associated with the VRF named red:

```
ip dhcp relay information option vpn
!
interface ethernet 0/1
 ip helper-address vrf red 10.44.23.7
!
```

DHCP Smart Relay Agent Forwarding: Example

In the following example, the router will forward the DHCP broadcast received on Ethernet interface 0/0 to the DHCP server (10.55.11.3), inserting 192.168.100.1 in the giaddr field of the DHCP packet. If the DHCP server has a scope or pool configured for the 192.168.100.0/24 network, it will respond; otherwise it will not respond.

Because the **ip dhcp smart-relay** global configuration command is configured, if the router sends three requests using 192.168.100.1 in the giaddr field, and doesn't get a response, it will move on and start using 172.16.31.254 in the giaddr field instead. Without the smart relay functionality, the route only uses 192.168.100.1 in the giaddr field.

```
ip dhcp smart-relay
!
interface ethernet0/0
 ip address 192.168.100.1 255.255.255.0
 ip address 172.16.31.254 255.255.255.0
 ip helper-address 10.55.11.3
!
```

Additional References

The following sections provide references related to configuring the Cisco IOS DHCP relay agent.

Related Documents

Related Topic	Document Title
DHCP commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	*Cisco IOS IP Addressing Services Command Reference,* Release 12.4 T
DHCP conceptual information	"DHCP Overview" module
DHCP server configuration	"Configuring the Cisco IOS DHCP Server" module
DHCP client configuration	"Configuring the Cisco IOS DHCP Client" module
DHCP server on-demand address pool manager configuration	"Configuring the DHCP Server On-Demand Address Pool Manager" module
DHCP advanced features	"Configuring DHCP Services for Accounting and Security" module
DHCP enhancements for edge-session management configuration	"Configuring DHCP Enhancements for Edge-Session Management" configuration
DHCP options	"DHCP Options" appendix in the *Network Registrar User's Guide*, Release 6.1.1

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.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
RFC 951	*Bootstrap Protocol (BOOTP)*
RFC 1542	*Clarifications and Extensions for the Bootstrap Protocol*
RFC 2131	*Dynamic Host Configuration Protocol*
RFC 2685	*Virtual Private Networks Identifier*
RFC 3046	*DHCP Relay Information Option*

Technical Assistance

Description	Link
The Cisco Technical Support & Documentation website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport

Feature Information for the Cisco IOS DHCP Relay Agent

Table 1 lists the features in this module and provides links to specific configuration information. Only features that were introduced or modified in Cisco IOS Release 12.2(1) or a later release appear in the table.

For information on a feature in this technology that is not documented here, see the "DHCP Features Roadmap."

Not all commands may be available in your Cisco IOS software release. For details on when support for a specific command was introduced, see the command reference documentation.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS and Catalyst OS software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note Table 1 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 1   Feature Information for the Cisco IOS DHCP Relay Agent

Feature Name	Releases	Feature Configuration Information
DHCP Class Support for Client Identification	12.4(11)T	This feature enhances the DHCP class mechanism to support options 60, 77, 124, and 125. These options identify the type of client sending the DHCP message. The DHCP relay agent can make forwarding decisions based on the content of the options in the DHCP message sent by the client. The following section provides information about this feature: • Configuring DHCP Relay Class Support for Client Identification The following command was introduced by this feature: **option hex**
DHCPv4 Relay per Interface VPN ID Support	12.4(11)T	The DHCPv4 Relay per Interface VPN ID Support feature allows the Cisco IOS DHCP relay agent to be configured per interface to override the global configuration of the **ip dhcp relay information option vpn** command. This feature allows subscribers with different relay information option VPN ID requirements on different interfaces to be reached from one Cisco router. The following section provides information about this feature: • Configuring DHCP Relay Agent Support for MPLS VPNs The following command was introduced by this feature: **ip dhcp relay information option-id**
DHCP Relay Option 82 per Interface Support	12.4(6)T 12.2(31)SB2	This feature enables support for the DHCP relay agent information option (option 82) on a per interface basis. The interface configuration allows different DHCP servers, with different DHCP option 82 requirements to be reached from one Cisco router. The following section provides information about this feature: • Configuring Relay Agent Information Option Support per Interface The following commands were introduced by this feature: **ip dhcp relay information check-reply**, **ip dhcp relay information option-insert**, and **ip dhcp relay information policy-action**

Table 1   *Feature Information for the Cisco IOS DHCP Relay Agent*

Feature Name	Releases	Feature Configuration Information
DHCP Subscriber Identifier Suboption of Option 82	12.3(14)T 12.2(28)SB 12.2(33)SRB	This feature enables an ISP to add a unique identifier to the subscriber-identifier suboption of the relay agent information option. The following section provides information about this feature: • Configuring the Subscriber Identifier Suboption of the Relay Agent Information Option The following command was introduced by this feature: **ip dhcp relay information option subscriber-id**
DHCP Relay MPLS VPN Support	12.2(8) 12.2(28)SB	DHCP relay support for MPLS VPNs enables a network administrator to conserve address space by allowing overlapping addresses. The relay agent can support multiple clients on different VPNs, and many of these clients from different VPNs can share the same IP address. The following section provides information about this feature: • Configuring DHCP Relay Agent Support for MPLS VPNs The following commands were modified by this feature: **ip dhcp relay information option** and **ip helper address**

Glossary

client—A host trying to configure its interface (obtain an IP address) using DHCP or BOOTP protocols.

DHCP—Dynamic Host Configuration Protocol.

MPLS—Multiprotocol Label Switching. Emerging industry standard upon which tag switching is based.

relay agent—A router that forwards DHCP and BOOTP messages between a server and a client on different subnets.

server—DHCP or BOOTP server.

VPN—Virtual Private Network. Enables IP traffic to use tunneling to travel securely over a public TCP/IP network.

VRF—VPN routing and forwarding instance. A VRF consists of an IP routing table, a derived forwarding table, a set of interfaces that use the forwarding table, and a set of rules and routing protocols that determine what goes into the forwarding table. In general, a VRF includes the routing information that defines a customer VPN site that is attached to a PE router. Each VPN instantiated on the PE router has its own VRF.

Note   See *Internetworking Terms and Acronyms* for terms not included in this glossary.