



DHCP Relay—MPLS VPN Support

Feature History

Release	Modification
12.2(4)B	This feature was introduced.
12.2(8)T	This feature was integrated into Cisco IOS Release 12.2(8)T
12.2(13)T	The feature became available on the Cisco 7200 and Cisco 7401ASR routers on Cisco IOS Release 12.2 T.
12.2(27)SBA	This feature was integrated into Cisco IOS Release 12.2(27)SBA.

This document describes the DHCP Relay—MPLS VPN Support feature and includes the following sections:

- [Feature Overview, page 1](#)
- [Supported Platforms, page 3](#)
- [Supported Standards, MIBs, and RFCs, page 4](#)
- [Prerequisites, page 4](#)
- [Configuration Tasks, page 4](#)
- [Configuration Examples, page 5](#)
- [Command Reference, page 5](#)
- [Glossary, page 11](#)

Feature Overview

The DHCP relay agent information option (option 82) enables a Dynamic Host Configuration Protocol (DHCP) relay agent to include information about itself when forwarding client-originated DHCP packets to a DHCP server. The DHCP server can use this information to implement IP address or other parameter-assignment policies. The DHCP relay agent information option is organized as a single DHCP option that contains one or more suboptions that convey information known by the relay agent.



Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

Copyright © 2001–2005 Cisco Systems, Inc. All rights reserved.

In some environments, a relay agent resides in a network element that also has access to one or more Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs). A DHCP server that wants to offer service to DHCP clients on those different VPNs needs to know the VPN in which each client resides. The network element that contains the relay agent typically knows about the VPN association of the DHCP client and includes this information in the relay agent information option.

The DHCP Relay—MPLS VPN Support feature 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 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.

Benefits

The DHCP Relay—MPLS VPN Support feature enables a network administrator to conserve address space by allowing overlapping addresses. The relay agent can now support multiple clients on different VPNs, and many of these clients from different VPNs can share the same IP address.

Related Documents

- [Cisco IOS IP Configuration Guide, Release 12.2](#)
- [Cisco IOS IP Command Reference, Volume 1 of 3: Addressing and Services, Release 12.2](#)

- *Cisco IOS Switching Services Configuration Guide, Release 12.2*
- *Cisco IOS Switching Services Command Reference, Release 12.2*
- *Introduction to Cisco MPLS VPN Technology*
- *MPLS Virtual Private Networks*
- *MPLS VPN ID, Release 12.2(8)T*

Supported Platforms

- Cisco 1600 series
- Cisco 1720
- Cisco 1721
- Cisco 1750
- Cisco 1751
- Cisco 2600 series
- Cisco 2691
- Cisco 3620
- Cisco 3640
- Cisco 3660
- Cisco 3725
- Cisco 3745
- Cisco 7200
- Cisco 7401ASR

Determining Platform Support Through Feature Navigator

Cisco IOS software is packaged in feature sets that support specific platforms. To get updated information regarding platform support for this feature, access Feature Navigator. Feature Navigator dynamically updates the list of supported platforms as new platform support is added for the feature.

Feature Navigator is a web-based tool that enables you to quickly determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image.

To access Feature Navigator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to cco-locksmith@cisco.com. An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions at <http://www.cisco.com/register>.

Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Feature Navigator home page at the following URL: <http://www.cisco.com/go/fn>

Supported Standards, MIBs, and RFCs

Standards

No new or modified standards are supported by this feature.

MIBs

No new or modified MIBs are supported by this feature.

To obtain lists of supported MIBs by platform and Cisco IOS release, and to download MIB modules, go to the Cisco MIB website on Cisco.com at the following URL:

<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

RFCs

- RFC 3046, *DHCP Relay Information Option*
- RFC 2685, *Virtual Private Networks Identifier*

Prerequisites

Before configuring the DHCP Relay—MPLS VPN Support feature, you must configure standard MPLS VPNs. For more information on configuring MPLS VPNs, see the *Cisco IOS Switching Services Configuration Guide*, Release 12.2.

Configuration Tasks

See the following sections for configuration tasks for the DHCP Relay—MPLS VPN Support feature. Each task in the list is identified as either required or optional.

- [Configuring DHCP Relay—MPLS VPN Support](#) (required)
- [Verifying DHCP Relay—MPLS VPN Support](#) (optional)

Configuring DHCP Relay—MPLS VPN Support

To configure the DHCP Relay—MPLS VPN Support feature, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	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.

	Command	Purpose
Step 2	Router(config)# interface <i>type number</i>	Specifies an interface and enters interface configuration mode.
Step 3	Router(config-if)# ip helper-address vrf name [global] <i>address</i>	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. vrf name —VPN routing/forwarding instance and VRF name. global —(Optional) Global routing table. <i>address</i> —(Optional for the no form of the command) Destination broadcast or host address to be used when forwarding UDP broadcasts. There can be more than one helper address per interface.

Verifying DHCP Relay—MPLS VPN Support

To verify that the DHCP Relay—MPLS VPN Support feature is configured correctly, use the following command in privileged EXEC mode:

Command	Purpose
Router# more system:running-config	Displays the running configuration.

Configuration Examples

This section provides the following configuration example:

- [DHCP Relay—MPLS VPN Support Example](#)

DHCP Relay—MPLS VPN Support Example

In the following example, the DHCP relay 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
!
```

Command Reference

This section documents modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.2 command reference publications.

- [ip dhcp relay information option](#)
- [ip helper-address](#)

ip dhcp relay information option

To enable the system to insert the Dynamic Host Configuration Protocol (DHCP) relay agent information option in forwarded BOOTREQUEST messages to a Cisco IOS DHCP server, use the **ip dhcp relay information option** command in global configuration mode. To disable inserting relay information into forwarded BOOTREQUEST messages, use the **no** form of this command.

ip dhcp relay information option [vpn]

no ip dhcp relay information option [vpn]

Syntax Description	vpn (Optional) Virtual Private Network.
---------------------------	--

Defaults The DHCP server does not insert relay information.

Command Modes Global configuration

Command History	Release	Modification
	12.0(1)T	This command was introduced.
	12.2(4)B	The vpn keyword was added.
	12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
	12.2(27)SBA	This command was integrated into Cisco IOS Release 12.2(27)SBA.

Usage Guidelines This command is used by cable access router termination systems. This functionality enables a DHCP server to identify the user (cable access router) sending the request and initiate appropriate action based on this information. By default, DHCP does not insert relay information.

The **ip dhcp relay information option** command automatically adds the circuit identifier suboption and the remote ID suboption to the DHCP relay agent information option (also called option 82).

The **vpn** optional keyword should be used only when the DHCP server allocates addresses based on VPN identification suboptions.

The **ip dhcp relay information option vpn** command adds the following VPN-related suboptions into the relay agent information option when DHCP broadcasts are forwarded by the relay agent from clients to a DHCP server:

- VPN identifier—Contains the VPN ID if configured or the VRF name if configured on the interface (VPN ID takes precedence over VRF name).
- Subnet selection—Contains the incoming interface subnet address.
- Server identifier override—Contains the incoming interface IP address.

After these suboptions are successfully added, the gateway address is set to the outgoing interface of the router toward the DHCP server IP address configured using the **ip helper-address** interface configuration command.

If only the **ip dhcp relay information option vpn** command is configured, the VPN identifier, subnet selection, and server identifier override suboptions are added to the relay information option. Note that the circuit identifier suboption and the remote ID suboption are not added to the relay information option. However, if both the **ip dhcp relay information option** command and the **ip dhcp relay information option vpn** command are configured, all five suboptions are added to the relay agent information option.

When the packets are returned from the DHCP server, option 82 is removed before the reply is forwarded to the client.

Even if the **vpn** option is specified, the VPN suboptions are added only to those DHCP or BOOTP broadcasts picked up by the interface configured with a VRF name or VPN ID.

For clients from unnumbered ATM or serial interfaces, when this command is enabled, the VPN identifier suboption will contain the VRF name of the unnumbered interface.

Subnet selection and server identifier override suboptions are added from the IP address of the interface that the unnumbered interface is configured to borrow its IP address from. The client host route will be added on the respective VRF routing tables.

If the **ip dhcp smart-relay** global configuration command is enabled, then the server identifier override and subnet selection suboptions will use the secondary IP address of the incoming interface when the same client retransmits more than three DHCP DISCOVER packets (for both numbered and unnumbered interfaces).

Examples

The following example configures a DHCP server to insert the DHCP relay agent information option, including VPN suboptions, in forwarded BOOTREQUEST messages. In this example, the circuit identifier suboption and the remote ID suboption are not included in the relay information option:

```
ip dhcp relay information option vpn
```

The following example configures a DHCP server to insert the DHCP relay agent information option, including VPN suboptions, the circuit identifier suboption, and the remote ID suboption, in forwarded BOOTREQUEST messages:

```
ip dhcp relay information option vpn
ip dhcp relay information option
```

Related Commands

Command	Description
ip dhcp relay information check	Configures a Cisco IOS DHCP server to validate the relay agent information option in forwarded BOOTREPLY messages.
ip dhcp relay information policy	Configures the information reforwarding policy of a DHCP relay agent (what a DHCP relay agent should do if a message already contains relay information).
ip dhcp smart-relay	Allows the Cisco IOS 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
ip helper-address	Forwards UDP broadcasts, including BOOTP, received on an interface.

ip helper-address

To enable the forwarding of User Datagram Protocol (UDP) broadcasts, including BOOTP, received on an interface, use the **ip helper-address** command in interface configuration mode. To disable the forwarding of broadcast packets to specific addresses, use the **no** form of this command.

```
ip helper-address [vrf name | global] address [redundancy vrg-name]
```

```
no ip helper-address [vrf name | global] address [redundancy vrg-name]
```

Syntax Description

vrf name	(Optional) Enables VPN routing and forwarding (VRF) instance and VRF name.
global	(Optional) Configures a global routing table.
<i>address</i>	Destination broadcast or host address to be used when forwarding UDP broadcasts. There can be more than one helper address per interface.
redundancy vrg-name	(Optional) Defines the VRG group name.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(4)B	The vrf name keyword and argument combination was added, and the global keyword was added.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
12.2(15)T	The redundancy vrg-name keyword and argument combination was added.
12.2(27)SBA	This command was integrated into Cisco IOS Release 12.2(27)SBA.

Usage Guidelines

Combined with the **ip forward-protocol** global configuration command, the **ip helper-address** command allows you to control which broadcast packets and which protocols are forwarded.

One common application that requires helper addresses is Dynamic Host Configuration Protocol (DHCP), which is defined in RFC 1531. To enable BOOTP or DHCP broadcast forwarding for a set of clients, configure a helper address on the router interface connected to the client. The helper address should specify the address of the BOOTP or DHCP server. If you have multiple servers, you can configure one helper address for each server.

All of the following conditions must be met in order for a UDP or IP packet to be helpered by the **ip helper-address** command:

- The MAC address of the received frame must be all-ones broadcast address (ffff.ffff.ffff).

- The IP destination address must be one of the following: all-ones broadcast (255.255.255.255), subnet broadcast for the receiving interface, or major-net broadcast for the receiving interface if the **no ip classless** command is also configured.
- The IP time-to-live (TTL) value must be at least 2.
- The IP protocol must be UDP (17).
- The UDP destination port must be for TFTP, Domain Name System (DNS), Time, NetBIOS, ND, BOOTP or DHCP packet, or a UDP port specified by the **ip forward-protocol udp** global configuration command.

If the DHCP server resides in a Virtual Private Network (VPN) or global space that is different from the interface VPN, then the **vrf name** or **global** option allows you to specify the name of the VRF or global space in which the DHCP server resides.

The **ip helper-address vrf name address** option uses the address associated with the VRF name regardless of the VRF of the incoming interface. If the **ip helper-address vrf name address** command is configured and later the vrf is deleted from the configuration, then all IP helper addresses associated with that VRF name will be removed from the interface configuration.

If the **ip helper-address address** command is already configured on an interface with no VRF name configured, and later the interface is configured with the **ip helper-address vrf name address** command, then the previously configured **ip helper-address address** is considered to be global.

**Note**

The **ip helper-address** command does not work on an X.25 interface on a destination router because the router cannot determine if the packet was intended as a physical broadcast.

Examples

The following example defines an address that acts as a helper address:

```
interface ethernet 1
 ip helper-address 10.24.43.2
```

The following example defines an address that acts as a helper address and is associated with the VRF named red:

```
interface ethernet 1/0
 ip helper-address vrf red 10.25.44.2
```

The following example defines an address that acts as a helper address and is associated with the VRF named shop:

```
interface ethernet 1/0
 ip helper-address 10.25.45.2 redundancy shop
```

Related Commands

Command	Description
ip forward-protocol	Specifies which protocols and ports the router forwards when forwarding broadcast packets.

Glossary

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

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/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 provider edge router.

CCVP, the Cisco logo, and Welcome to the Human Network are trademarks of Cisco Systems, Inc.; Changing the Way We Work, Live, Play, and Learn is a service mark of Cisco Systems, Inc.; and Access Registrar, Aironet, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, CCSP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Enterprise/Solver, EtherChannel, EtherFast, EtherSwitch, Fast Step, Follow Me Browsing, FormShare, GigaDrive, HomeLink, Internet Quotient, IOS, iPhone, IP/TV, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, iQuick Study, LightStream, Linksys, MeetingPlace, MGX, Networkers, Networking Academy, Network Registrar, PIX, ProConnect, ScriptShare, SMARTnet, StackWise, The Fastest Way to Increase Your Internet Quotient, and TransPath are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0711R)

Copyright © 2001–2005 Cisco Systems, Inc. All rights reserved.

