Configuring DHCP Snooping

This chapter describes how to configure Dynamic Host Configuration Protocol (DHCP) snooping on a Cisco NX-OS device.

Information About DHCP Snooping

DHCP snooping acts like a firewall between untrusted hosts and trusted DHCP servers. DHCP snooping performs the following activities:

- Validates DHCP messages received from untrusted sources and filters out invalid messages.
- Builds and maintains the DHCP snooping binding database, which contains information about untrusted hosts with leased IP addresses.
- Uses the DHCP snooping binding database to validate subsequent requests from untrusted hosts.

DHCP snooping is enabled on a per-VLAN basis. By default, the feature is inactive on all VLANs. You can enable the feature on a single VLAN or a range of VLANs.

Feature Enabled and Globally Enabled

When you are configuring DHCP snooping, it is important that you understand the difference between enabling the DHCP snooping feature and globally enabling DHCP snooping.

Feature Enablement

The DHCP snooping feature is disabled by default. When the DHCP snooping feature is disabled, you cannot configure it or any of the features that depend on DHCP snooping. The commands to configure DHCP snooping and its dependent features are unavailable when DHCP snooping is disabled.

When you enable the DHCP snooping feature, the switch begins building and maintaining the DHCP snooping binding database. Features dependent on the DHCP snooping binding database can now make use of it and can therefore also be configured.

Enabling the DHCP snooping feature does not globally enable it. You must separately enable DHCP snooping globally.

Disabling the DHCP snooping feature removes all DHCP snooping configuration from the switch. If you want to disable DHCP snooping and preserve the configuration, globally disable DHCP snooping and do not disable the DHCP snooping feature.

Global Enablement

After DHCP snooping is feature enabled, DHCP snooping is globally disabled by default. Global enablement is a second level of enablement that allows you to have separate control of whether the switch is actively performing DHCP snooping that is independent from enabling the DHCP snooping binding database.

When you globally enable DHCP snooping, on each untrusted interface of VLANs that have DHCP snooping enabled, the switch begins validating DHCP messages received and using the DHCP snooping binding database to validate subsequent requests from untrusted hosts.

When you globally disable DHCP snooping, the switch stops validating DHCP messages and validating subsequent requests from untrusted hosts. It also removes the DHCP snooping binding database. Globally disabling DHCP snooping does not remove any DHCP snooping configuration or the configuration of other features that are dependent upon the DHCP snooping feature.

Trusted and Untrusted Sources

You can configure whether DHCP snooping trusts traffic sources. An untrusted source may initiate traffic attacks or other hostile actions. To prevent such attacks, DHCP snooping filters messages from untrusted sources.

In an enterprise network, a trusted source is a switch that is under your administrative control. These switches include the switches, routers, and servers in the network. Any switch beyond the firewall or outside the network is an untrusted source. Generally, host ports are treated as untrusted sources.

In a service provider environment, any switch that is not in the service provider network is an untrusted source (such as a customer switch). Host ports are untrusted sources.

In the Cisco Nexus 3000 Series switch, you indicate that a source is trusted by configuring the trust state of its connecting interface.

The default trust state of all interfaces is untrusted. You must configure DHCP server interfaces as trusted. You can also configure other interfaces as trusted if they connect to switches (such as switches or routers) inside your network. You usually do not configure host port interfaces as trusted.

Note For DHCP snooping to function properly, all DHCP servers must be connected to the switch through trusted interfaces.

DHCP Snooping Binding Database

Using information extracted from intercepted DHCP messages, DHCP snooping dynamically builds and maintains a database. The database contains an entry for each untrusted host with a leased IP address if the host is associated with a VLAN that has DHCP snooping enabled. The database does not contain entries for hosts connected through trusted interfaces.

Note The DHCP snooping binding database is also referred to as the DHCP snooping binding table.

DHCP snooping updates the database when the switch receives specific DHCP messages. For example, the feature adds an entry to the database when the switch receives a DHCPACK message from the server. The feature removes the entry in the database when the IP address lease expires or the switch receives a DHCPRELEASE message from the host.

Each entry in the DHCP snooping binding database includes the MAC address of the host, the leased IP address, the lease time, the binding type, and the VLAN number and interface information associated with the host.

You can remove entries from the binding database by using the **clear ip dhcp snooping binding** command.

Information About the DHCP Relay Agent

DHCP Relay Agent

You can configure the device to run a DHCP relay agent, which forwards DHCP packets between clients and servers. This feature is useful when clients and servers 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 (Option 82) 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.

Note When the device relays a DHCP request that already includes Option 82 information, the device forwards the request with the original Option 82 information without altering it.

VRF Support for the DHCP Relay Agent

You can configure the DHCP relay agent to forward DHCP broadcast messages from clients in a virtual routing and forwarding instance (VRF) to DHCP servers in a different VRF. By using a single DHCP server to provide DHCP support to clients in multiple VRFs, you can conserve IP addresses by using a single IP address pool rather than one for each VRF.

Enabling VRF support for the DHCP relay agent requires that you enable Option 82 for the DHCP relay agent.

If a DHCP request arrives on an interface that you have configured with a DHCP relay address and VRF information and the address of the DCHP server belongs to a network on an interface that is a member of a different VRF, the device inserts Option 82 information in the request and forwards it to the DHCP server in the server VRF. The Option 82 information that the devices adds to a DHCP request relayed to a different VRF includes the following:

VPN identifier

Contains the name of the VRF that the interface that receives the DHCP request is a member of.

Link selection

Contains the subnet address of the interface that receives the DHCP request.

Server identifier override

Contains the IP address of the interface that receives the DHCP request.

Note The DHCP server must support the VPN identifier, link selection, and server identifier override options.

When the device receives the DHCP response message, it strips off the Option 82 information and forwards the response to the DHCP client in the client VRF.

DHCP Relay Binding Database

A relay binding is an entity that associates a DHCP or BOOTP client with a relay agent address and its subnet. Each relay binding stores the client MAC address, active relay agent address, active relay agent address mask, logical and physical interfaces to which the client is connected, giaddr retry count, and total retry count. The giaddr retry count is the number of request packets transmitted with that relay agent address, and the total retry count is the total number of request packets transmitted by the relay agent. One relay binding entry is maintained for each DHCP or BOOTP client.

Guidelines and Limitations for DHCP Snooping

Consider the following guidelines and limitations when configuring DHCP snooping:

- The DHCP snooping database can store 2000 bindings.
- DHCP snooping is not active until you enable the feature, enable DHCP snooping globally, and enable DHCP snooping on at least one VLAN.

- Before globally enabling DHCP snooping on the switch, make sure that the switches acting as the DHCP server and the DHCP relay agent are configured and enabled.
- If a VLAN ACL (VACL) is configured on a VLAN that you are configuring with DHCP snooping, ensure that the VACL permits DHCP traffic between DHCP servers and DHCP hosts.

Default Settings for DHCP Snooping

This table lists the default settings for DHCP snooping parameters.

Table 1: Default DHCP Snooping Parameters

Parameters	Default
DHCP snooping feature	Disabled
DHCP snooping globally enabled	No
DHCP snooping VLAN	None
DHCP snooping Option 82 support	Disabled
DHCP snooping trust	Untrusted

Configuring DHCP Snooping

Minimum DHCP Snooping Configuration

DETAILED STEPS

	Command or Action	Purpose
Step 1	Enable the DHCP snooping feature.	When the DHCP snooping feature is disabled, you cannot configure DHCP snooping. For details, see Enabling or Disabling the DHCP Snooping Feature, on page 6.
Step 2	Enable DHCP snooping globally.	For details, see Enabling or Disabling DHCP Snooping Globally, on page 7.
Step 3	Enable DHCP snooping on at least one VLAN.	By default, DHCP snooping is disabled on all VLANs. For details, see Enabling or Disabling DHCP Snooping on a VLAN, on page 7.

	Command or Action	Purpose
Step 4	Ensure that the DHCP server is connected to the switch using a trusted interface.	For details, see Configuring an Interface as Trusted or Untrusted, on page 9.

Enabling or Disabling the DHCP Snooping Feature

You can enable or disable the DHCP snooping feature on the switch. By default, DHCP snooping is disabled.

Before You Begin

If you disable the DHCP snooping feature, all DHCP snooping configuration is lost. If you want to turn off DHCP snooping and preserve the DHCP snooping configuration, disable DHCP globally.

SUMMARY STEPS

1. **config t**
2. [**no**] **feature dhcp**
3. **show running-config dhcp**
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**config t**
	
	Example:
	`switch# config t`
	`switch(config)#`
		Enters global configuration mode.

Step 2	[**no**] **feature dhcp** **Example:** `switch(config)# feature dhcp`	Enables the DHCP snooping feature. The **no** option disables the DHCP snooping feature and erases all DHCP snooping configuration.
Step 3	**show running-config dhcp** **Example:** `switch(config)# show running-config dhcp`	Shows the DHCP snooping configuration.
Step 4	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Copies the running configuration to the startup configuration.

Enabling or Disabling DHCP Snooping Globally

You can enable or disable the DHCP snooping globally on the switch. Globally disabling DHCP snooping stops the switch from performing any DHCP snooping. It preserves DCHP snooping configuration.

Before You Begin

Ensure that you have enabled the DHCP snooping feature.

By default, DHCP snooping is globally disabled.

SUMMARY STEPS

1. **config t**
2. [**no**] **ip dhcp snooping**
3. **show running-config dhcp**
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**config t**
	
	Example:
	`switch# config t`
	`switch(config)#`
		Enters global configuration mode.

Step 2	[**no**] **ip dhcp snooping** **Example:** `switch(config)# ip dhcp snooping`	Enables DHCP snooping globally. The **no** option disables DHCP snooping.
Step 3	**show running-config dhcp** **Example:** `switch(config)# show running-config dhcp`	Shows the DHCP snooping configuration.
Step 4	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Copies the running configuration to the startup configuration.

Enabling or Disabling DHCP Snooping on a VLAN

You can enable or disable DHCP snooping on one or more VLANs.

Before You Begin

By default, DHCP snooping is disabled on all VLANs.

Ensure that DHCP snooping is enabled.

Note If a VACL is configured on a VLAN that you are configuring with DHCP snooping, ensure that the VACL permits DHCP traffic between DHCP servers and DHCP hosts.

SUMMARY STEPS

1. **config t**
2. [**no**] **ip dhcp snooping vlan** *vlan-list*
3. **show running-config dhcp**
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**config t**
	
	Example:
	`switch# config t`
	`switch(config)#`
		Enters global configuration mode.

Step 2	[**no**] **ip dhcp snooping vlan** *vlan-list* **Example:** `switch(config)# ip dhcp snooping vlan 100,200,250-252`	Enables DHCP snooping on the VLANs specified by *vlan-list* . The **no** option disables DHCP snooping on the VLANs specified.
Step 3	**show running-config dhcp** **Example:** `switch(config)# show running-config dhcp`	Shows the DHCP snooping configuration.
Step 4	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Copies the running configuration to the startup configuration.

Enabling or Disabling Strict DHCP Packet Validation

You can enable or disable the strict validation of DHCP packets by the DHCP snooping feature. By default, strict validation of DHCP packets is disabled.

SUMMARY STEPS

1. **config t**
2. [**no**] **ip dhcp packet strict-validation**
3. **show running-config dhcp**
4. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**config t**
	
	Example:
	`switch# config t`
	`switch(config)#`
		Enters global configuration mode.

Step 2	[**no**] **ip dhcp packet strict-validation** **Example:** `switch(config)# ip dhcp packet strict-validation`	Enables the strict validation of DHCP packets by the DHCP snooping feature. The **no** option disables strict DHCP packet validation.
Step 3	**show running-config dhcp** **Example:** `switch(config)# show running-config dhcp`	Shows the DHCP snooping configuration.
Step 4	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Copies the running configuration to the startup configuration.

Configuring an Interface as Trusted or Untrusted

You can configure whether an interface is a trusted or untrusted source of DHCP messages. You can configure DHCP trust on the following types of interfaces:

- Layer 2 Ethernet interfaces
- Layer 2 port-channel interfaces

Before You Begin

By default, all interfaces are untrusted.

Ensure that DHCP snooping is enabled.

SUMMARY STEPS

1. **config t**
2. Do one of the following options.
   - **interface ethernet** *slot* / *port*
   - **interface port-channel** *channel-number*
3. [**no**] **ip dhcp snooping trust**
4. **show running-config dhcp**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**config t**
	
	Example:
	`switch# config t`
	`switch(config)#`
		Enters global configuration mode.

Step 2	Do one of the following options.
	• **interface ethernet** *slot* / *port*
	• **interface port-channel** *channel-number*
	
	Example:
	`switch(config)# interface ethernet 2/1`
	`switch(config-if)#`
		• Enters interface configuration mode, where *slot* / *port* is the Layer 2 Ethernet interface that you want to configure as trusted or untrusted for DHCP snooping.
		• Enters interface configuration mode, where *slot* / *port* is the Layer 2 port-channel interface that you want to configure as trusted or untrusted for DHCP snooping.

Step 3	[**no**] **ip dhcp snooping trust** **Example:** `switch(config-if)# ip dhcp snooping trust`	Configures the interface as a trusted interface for DHCP snooping. The **no** option configures the port as an untrusted interface.
Step 4	**show running-config dhcp** **Example:** `switch(config-if)# show running-config dhcp`	Shows the DHCP snooping configuration.
Step 5	**copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	(Optional) Copies the running configuration to the startup configuration.

Enabling or Disabling the DHCP Relay Agent

You can enable or disable the DHCP relay agent. By default, the DHCP relay agent is enabled.

Before You Begin

Ensure that the DHCP feature is enabled.

SUMMARY STEPS

1. **config t**
2. [**no**] **ip dhcp relay**
3. (Optional) **show ip dhcp relay**
4. (Optional) **show running-config dhcp**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**config t**
	
	Example:
	`switch# config t`
	`switch(config)#`
		Enters global configuration mode.

Step 2	[**no**] **ip dhcp relay** **Example:** `switch(config)# ip dhcp relay`	Enables the DHCP relay agent. The **no** option disables the DHCP relay agent.
Step 3	**show ip dhcp relay** **Example:** `switch(config)# show ip dhcp relay`	(Optional) Displays the DHCP relay configuration.
Step 4	**show running-config dhcp** **Example:** `switch(config)# show running-config dhcp`	(Optional) Displays the DHCP configuration.
Step 5	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Copies the running configuration to the startup configuration.

Enabling or Disabling VRF Support for the DHCP Relay Agent

You can configure the device to support the relaying of DHCP requests that arrive on an interface in one VRF to a DHCP server in a different VRF.

Before You Begin

You must enable Option 82 for the DHCP relay agent.

SUMMARY STEPS

1. **config t**
2. [**no**] **ip dhcp relay information option vpn**
3. [**no**] **ip dhcp relay sub-option type cisco**
4. (Optional) **show ip dhcp relay**
5. (Optional) **show running-config dhcp**
6. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**config t**
	
	Example:
	`switch# config t`
	`switch(config)#`
		Enters global configuration mode.

Step 2	[**no**] **ip dhcp relay information option vpn** **Example:** `switch(config)# ip dhcp relay information option vpn`	Enables VRF support for the DHCP relay agent. The **no** option disables this behavior.
Step 3	[**no**] **ip dhcp relay sub-option type cisco** **Example:** `switch(config)# ip dhcp relay sub-option type cisco`	Enables DHCP to use Cisco proprietary numbers 150, 152, and 151 when filling the link selection, server ID override, and VRF name/VPN ID relay agent Option 82 suboptions. The **no** option causes DHCP to use RFC numbers 5, 11, and 151 for the link selection, server ID override, and VRF name/VPN ID suboptions, respectively.
Step 4	**show ip dhcp relay** **Example:** `switch(config)# show ip dhcp relay`	(Optional) Displays the DHCP relay configuration.
Step 5	**show running-config dhcp** **Example:** `switch(config)# show running-config dhcp`	(Optional) Displays the DHCP configuration.

	Command or Action	Purpose
Step 6	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Copies the running configuration to the startup configuration.

Creating a DHCP Static Binding

You can create a static DHCP source binding to a Layer 2 interface.

Before You Begin

Ensure that you have enabled the DHCP snooping feature.

SUMMARY STEPS

1. **config t**
2. **ip source binding** *IP-address MAC-address* **vlan** *vlan-id* {**interface ethernet** *slot/port* | **port-channel** *channel-no*}
3. (Optional) **show ip dhcp snooping binding**
4. (Optional) **show ip dhcp snooping binding dynamic**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**config t**
	
	Example:
	`switch# config t`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**ip source binding** *IP-address MAC-address* **vlan** *vlan-id* {**interface ethernet** *slot/port*	**port-channel** *channel-no*} **Example:** `switch(config)# ip source binding 10.5.22.7 001f.28bd.0013 vlan 100 interface ethernet 2/3`	Binds the static source address to the Layer 2 Ethernet interface.
Step 3	**show ip dhcp snooping binding** **Example:** `switch(config)#  ip dhcp snooping binding`	(Optional) Shows the DHCP snooping static and dynamic bindings.

	Command or Action	Purpose
Step 4	**show ip dhcp snooping binding dynamic** **Example:** `switch(config)#  ip dhcp snooping binding dynamic`	(Optional) Shows the DHCP snooping dynamic bindings.
Step 5	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Copies the running configuration to the startup configuration.

This example shows how to create a static IP source entry associated with VLAN 100 on Ethernet interface 2/3:

```
switch# configure terminal
switch(config)# ip source binding 10.5.22.7 001f.28bd.0013 vlan 100 interface ethernet 2/3
switch(config)#
```

Verifying the DHCP Snooping Configuration

To display DHCP snooping configuration information, perform one of the following tasks. For detailed information about the fields in the output from these commands, see the *Cisco Nexus 3000 Series NX-OS System Management Configuration Guide*.

Command	Purpose
show running-config dhcp	Displays the DHCP snooping configuration.
show ip dhcp snooping	Displays general information about DHCP snooping.

Displaying DHCP Bindings

Use the **show ip dhcp snooping binding** command to display the DHCP static and dynamic binding table. Use the **show ip dhcp snooping binding dynamic** to display the DHCP dynamic binding table.

For detailed information about the fields in the output from this command, see the *Cisco Nexus 3000 Series NX-OS System Management Configuration Guide*.

This example shows how to create a static DHCP binding and then verify the binding using the **show ip dhcp snooping binding** command.

```
switch# configuration terminal
switch(config)# ip source binding 10.20.30.40 0000.1111.2222 vlan 400 interface port-channel
 500

switch(config)# show ip dhcp snooping binding
MacAddress         IpAddress        LeaseSec  Type        VLAN  Interface
-----------------  ---------------  --------  ----------  ----  -------------
00:00:11:11:22:22  10.20.30.40      infinite  static      400   port-channel500
```

Clearing the DHCP Snooping Binding Database

You can remove entries from the DHCP snooping binding database, including a single entry, all entries associated with an interface, or all entries in the database.

Before You Begin

Ensure that DHCP snooping is enabled.

SUMMARY STEPS

1. (Optional) **clear ip dhcp snooping binding**
2. (Optional) **clear ip dhcp snooping binding interface ethernet** *slot*/*port*[.*subinterface-number*]
3. (Optional) **clear ip dhcp snooping binding interface port-channel** *channel-number*[.*subchannel-number*]
4. (Optional) **clear ip dhcp snooping binding vlan** *vlan-id* **mac** *mac-address* **ip** *ip-address* **interface** {**ethernet** *slot*/*port*[.*subinterface-number* | **port-channel** *channel-number*[.*subchannel-number*] }
5. **show ip dhcp snooping binding**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**clear ip dhcp snooping binding** **Example:** `switch# clear ip dhcp snooping binding`	(Optional) Clears all entries from the DHCP snooping binding database.
Step 2	**clear ip dhcp snooping binding interface ethernet** *slot*/*port*[.*subinterface-number*] **Example:** `switch# clear ip dhcp snooping binding interface ethernet 1/4`	(Optional) Clears entries associated with a specific Ethernet interface from the DHCP snooping binding database.
Step 3	**clear ip dhcp snooping binding interface port-channel** *channel-number*[.*subchannel-number*] **Example:** `switch# clear ip dhcp snooping binding interface port-channel 72`	(Optional) Clears entries associated with a specific port-channel interface from the DHCP snooping binding database.
Step 4	**clear ip dhcp snooping binding vlan** *vlan-id* **mac** *mac-address* **ip** *ip-address* **interface** {**ethernet** *slot*/*port*[.*subinterface-number*	**port-channel** *channel-number*[.*subchannel-number*] } **Example:** `switch# clear ip dhcp snooping binding vlan 23 mac 0060.3aeb.54f0 ip 10.34.54.9 interface ethernet 2/11`	(Optional) Clears a single, specific entry from the DHCP snooping binding database.

	Command or Action	Purpose
Step 5	**show ip dhcp snooping binding** **Example:** `switch# show ip dhcp snooping binding`	Displays the DHCP snooping binding database.

Configuration Examples for DHCP Snooping

This example shows how to enable DHCP snooping on two VLANs, with Option 82 support enabled and Ethernet interface 2/5 trusted because the DHCP server is connected to that interface:

```
feature dhcp
ip dhcp snooping
ip dhcp snooping info option

interface Ethernet 2/5
  ip dhcp snooping trust
ip dhcp snooping vlan 1
ip dhcp snooping vlan 50
```