Cisco Nexus 1000V Layer 2 Switching Configuration Guide, Release 4.2(1)SV2(1.1)

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CONTENTS

Preface

This preface contains the following sections:

Audience

This publication is for experienced network administrators who configure and maintain Cisco Nexus devices .

This guide is for network administrators and server administrators with the following experience and knowledge:

- An understanding of virtualization
- Using VMware software to create a virtual machine and configure a VMware vSwitch

Note Knowledge of VMware vNetwork Distributed Switch is not required.

Document Conventions

Command descriptions use the following conventions:

Convention	Description
bold	Bold text indicates the commands and keywords that you enter literally as shown.

Convention	Description
Italic	Italic text indicates arguments for which the user supplies the values.
[x]	Square brackets enclose an optional element(keyword or argument).
[x | y]	Square brackets enclosing keywords or arguments separated by a vertical bar indicate an optional choice.
{x | y}	Braces enclosing keywords or arguments separated by a vertical bar indicate a required choice.
[x {y | z}]	Nested set of square brackets or braces indicate optional or required choices within optional or required elements. Braces and a vertical bar within square brackets indicate a required choice within an optional element.
`variable`	Indicates a variable for which you supply values, in context where italics cannot be used.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.

Examples use the following conventions:

Convention	Description
`screen font`	Terminal sessions and information the switch displays are in screen font.
`boldface screen font`	Information you must enter is in boldface screen font.
italic screen font	Arguments for which you supply values are in italic screen font.
< >	Nonprinting characters, such as passwords, are in angle brackets.
[ ]	Default responses to system prompts are in square brackets.
!, #	An exclamation point (!) or a pound sign (#) at the beginning of a line of code indicates a comment line.

This document uses the following conventions:

Note Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Related Documentation for Nexus 1000V Series NX-OS Software

This section lists the documents used with the Cisco Nexus 1000V and available on Cisco.com at the following URL:

http://www.cisco.com/en/US/products/ps9902/tsd_products_support_series_home.html

General Information

Cisco Nexus 1000V Documentation Roadmap

Cisco Nexus 1000V Release Notes

Cisco Nexus 1000V and VMware Compatibility Information

Install and Upgrade

Cisco Nexus 1000V Installation and Upgrade Guide

Configuration Guides

Cisco Nexus 1000V High Availability and Redundancy Configuration Guide

Cisco Nexus 1000V Interface Configuration Guide

Cisco Nexus 1000V Layer 2 Switching Configuration Guide

Cisco Nexus 1000V License Configuration Guide

Cisco Nexus 1000V Network Segmentation Manager Configuration Guide

Cisco Nexus 1000V Port Profile Configuration Guide

Cisco Nexus 1000V Quality of Service Configuration Guide

Cisco Nexus 1000V Security Configuration Guide

Cisco Nexus 1000V System Management Configuration Guide

Cisco Nexus 1000V vCenter Plugin Configuration Guide

Cisco Nexus 1000V VXLAN Configuration Guide

Programming Guide

Cisco Nexus 1000V XML API Configuration Guide

Reference Guides

Cisco Nexus 1000V Command Reference

Cisco Nexus 1000V MIB Quick Reference

Cisco Nexus 1000V Resource Availability Reference

Troubleshooting and Alerts

Cisco Nexus 1000V Troubleshooting Guide

Cisco Nexus 1000V Password Recovery Procedure

Cisco NX-OS System Messages Reference

Virtual Services Appliance Documentation

The *Cisco Nexus Virtual Services Appliance* documentation is available at http://www.cisco.com/en/US/products/ps9902/tsd_products_support_series_home.html.

Virtual Security Gateway Documentation

The *Cisco Virtual Security Gateway for Nexus 1000V Series Switch* documentation is available at http://www.cisco.com/en/US/products/ps11208/tsd_products_support_model_home.html.

Virtual Wide Area Application Services (vWAAS) Documentation

The *Virtual Wide Area Application Services* documentation is available at http://www.cisco.com/en/US/products/ps6870/tsd_products_support_series_home.html.

ASA 1000V Cloud Firewall Documentation

The *ASA 1000V Cloud Firewall* documentation is available at http://www.cisco.com/en/US/products/ps12233/tsd_products_support_series_home.html.

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http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

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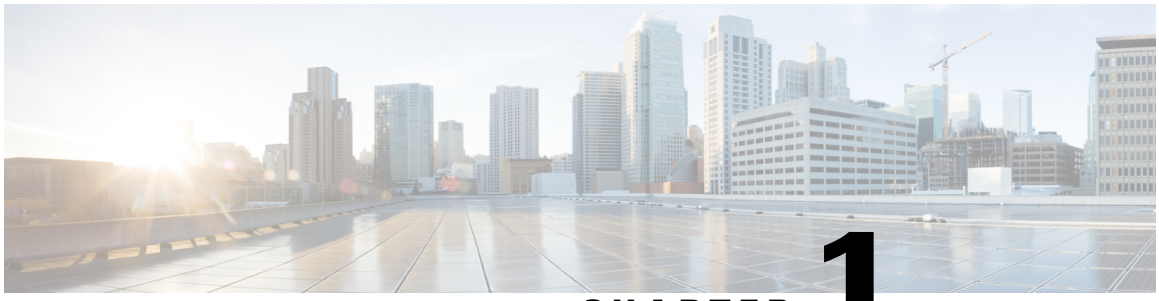


CHAPTER 1

New and Changed Information for this Release

The following table provides an overview of the significant changes to this guide for this current release. The table does not provide an exhaustive list of all changes made to the configuration guides or of the new features in this release.

New and Changed Information

This section lists new and changed content in this document by software release.

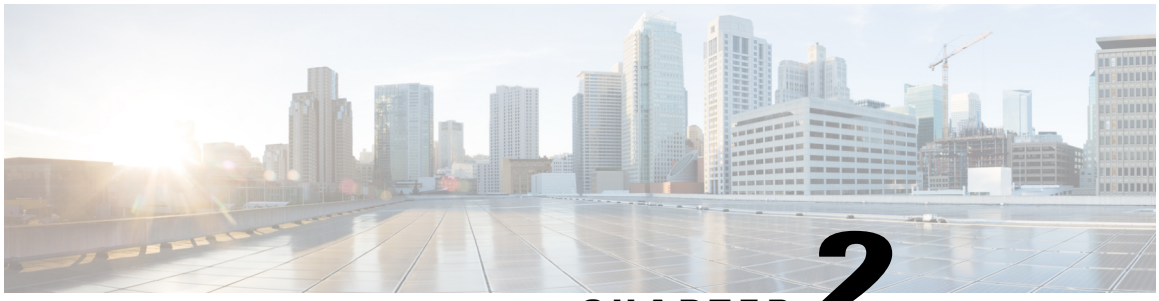
To find additional information about new features or command changes, see the *Cisco Nexus 1000V Release Notes* and *Cisco Nexus 1000V Command Reference*.

Table 1: New and Changed Features for the Cisco Nexus 1000V Layer 2 Switching Configuration Guide

Feature	Description	Changed in Release	Where Documented
Supporting Redundant Routing Protocols	Added support for redundant routing protocols.	4.2(1)SV1(5.1)	Supporting Redundant Routing Protocols, on page 61
Network Load Balancing	Added the ability to configure network load balancing for vEthernet.	4.2(1)SV1(5.1)	Configuring Network Load Balancing for vEthernet, on page 55

Feature	Description	Changed in Release	Where Documented
Layer 2 Configuration Limits	Increased configuration limits for: • Active VLANs across all VEMS • MAC addresses over VLANs within a VEM • MAC addresses per VLAN within a VEM	4.2(1)SV1(4)	Layer 2 Switching Configuration Limits, on page 67
IGMP link-local group suppression	Added support to enable or disable link-local group suppression.	4.2(1)SV1(4)	Configuring IGMP Snooping, on page 47
clear mac address-table	Removed address, interface, and port channel options.	4.2(1)SV1(4)	Configuring the MAC Address Table, on page 11
show mac-address table	Updated show command output.	4.2(1)SV1(4)	Configuring the MAC Address Table, on page 11
feature private-vlan command	The ability to globally enable the private VLAN feature.	4.2(1)SV1(4)	Configuring Private VLANs, on page 29

Feature	Description	Changed in Release	Where Documented
Layer 2 Configuration Limits	Added configuration limits for active VLANs across all VEMS, MACs over VLANs within a VEM, PVLANs across all VEMs, and physical trunks per VSM.	4.0(4)SV1(2)	Layer 2 Switching Configuration Limits, on page 67



CHAPTER 2

Overview

This chapter contains the following sections:

Information about Layer 2 Switching

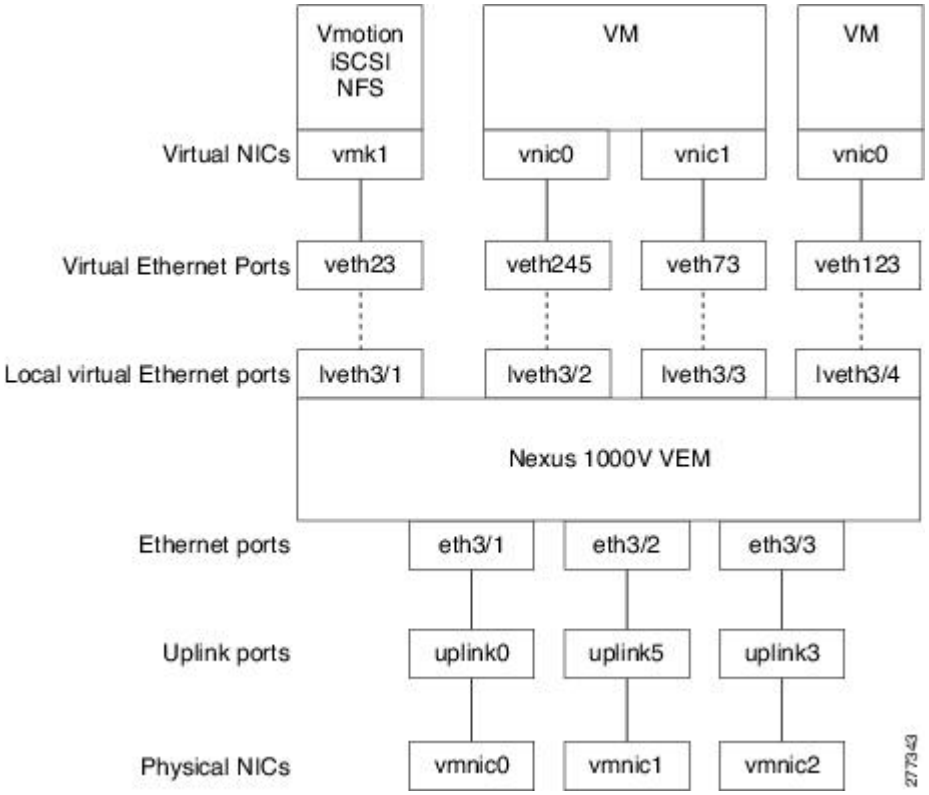
VEM Port Model

The Cisco Nexus 1000V differentiates the following Virtual Ethernet Module (VEM) ports:

- VEM Virtual Ports
- VEM Physical Ports

The following figure shows how VEM ports are bound to physical and virtual VMware ports.

Figure 1: VEM Port View



VEM Virtual Ports

The virtual side of the VEM maps together the following three layers of ports:

Virtual NICs

There are types of Virtual NICs in VMware. The virtual NIC (vnic) is part of the VM, and represents the physical port of the host which is plugged into the switch. The virtual kernel NIC (vmknic) is used by the hypervisor for management, , iSCSI, NFS and other network access needed by the kernel. The vswif (not shown) appears only in COS-based systems, and is used as the VMware management port. Each of these types maps to a veth port within Cisco Nexus 1000V.

Virtual Ethernet Ports

A virtual Ethernet port (vEth) represents a port on the Cisco Nexus 1000VDistributed Virtual Switch.Cisco Nexus 1000V has a flat space of vEth ports, 0...n. These vEth ports are what the virtual “cable” plugs into, and are moved to the host that the VM is running on. Virtual Ethernet ports are assigned to port groups.

VEM Physical Ports

The physical side of the VEM includes the following from top to bottom:

Uplink Ports

Each uplink port on the host represents a physical interface.

Ethernet Ports

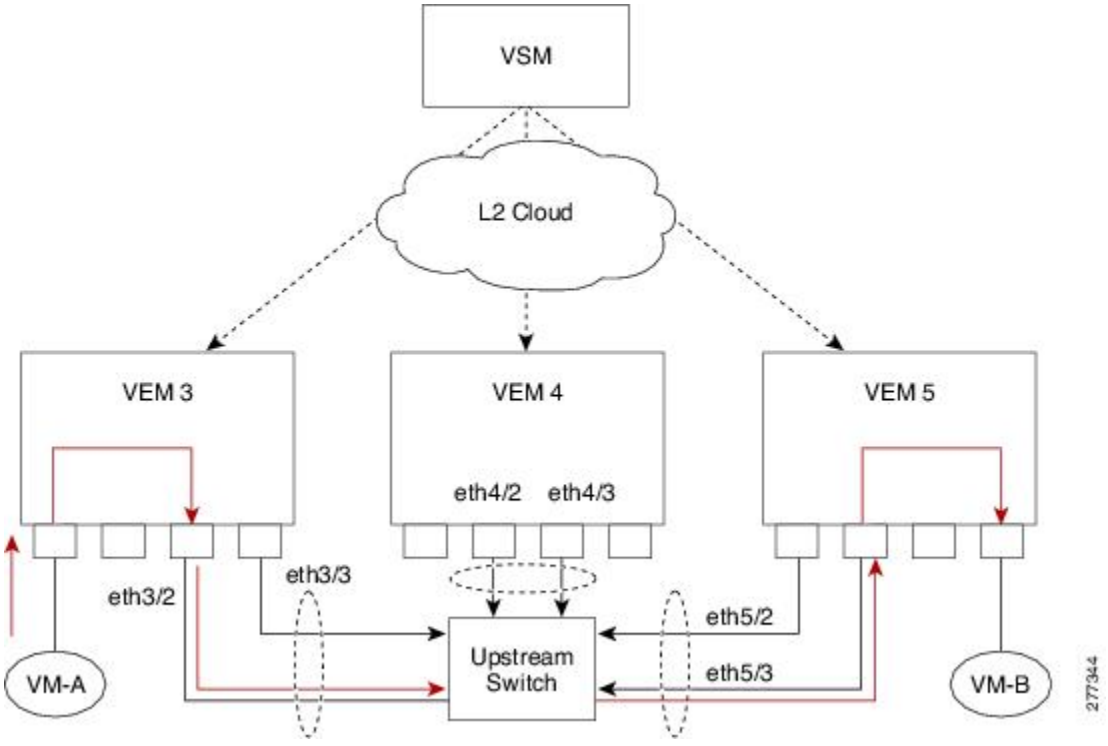
Each physical port added to Cisco Nexus 1000Vappears as a physical Ethernet port, just as it would on a hardware-based switch.

Note There is no fixed relationship between the uplink number and number, and these can be different on different hosts, and can change throughout the life of the host.

VSM Port Model

The following figure shows the VSM view of the network.

Figure 2: VSM View



The Virtual Supervisor Module (VSM) has the following ports or interfaces:

Virtual Ethernet Interfaces

Virtual Ethernet interfaces (vEths) can be associated with any of the following:

- A virtual machine VNIC on the ESX host
- A virtual machine kernel NIC on the ESX host
- A virtual switch interface on an ESX COS host

Physical Ethernet Interfaces

Physical Ethernet interfaces (Eths) correspond to the physical NICs on the ESX host.

Port Channel Interfaces

The physical NICs of an ESX host can be bundled into a logical interface called a port channel interface.

Switching Traffic Between VEMs

Each VEM attached to the VSM forwards traffic to and from the server as an independent and intelligent line card. Each VLAN uses its forwarding table to learn and store MAC addresses for ports connected to the VEM.

The following figure shows the traffic flow between two VMs on different VEMs.

Layer 2 Ethernet Switching

The congestion related to high bandwidth and large numbers of users can be solved by assigning each device (for example, a server) to its own 10-, 100-, 1000-Mbps, or 10-Gigabit collision domain. Because each LAN port connects to a separate Ethernet collision domain, servers in a switched environment realize full bandwidth access.

Full duplex allows two stations to transmit and receive at the same time. This is unlike 10/100-Mbps Ethernet, which usually operates in half-duplex mode, so that stations can either receive or transmit but not both. When packets can flow in both directions simultaneously, the effective Ethernet bandwidth doubles. 1/10-Gigabit Ethernet operates in full-duplex only.

Each LAN port can connect to a single workstation or server or to another device through which workstations or servers connect to the network.

To reduce signal degradation, each LAN port is considered to be an individual segment. When stations connected to different LAN ports need to communicate, frames are forwarded from one LAN port to the other at wire speed to ensure full bandwidth for each session.

MAC Address Tables

To switch frames between LAN ports efficiently, a MAC address table is maintained. The MAC address of the sending network is associated with the LAN port on which it was received.

For more information about MAC address tables, seeConfiguring the MAC Address Table, on page 11.

VLANs

A VLAN is a switched network that is logically segmented by function, project team, or application, without regard to the physical locations of the users. VLANs have the same attributes of physical LANs, but you can group end stations even if they are not physically located on the same LAN segment.

Any switchport can belong to a VLAN, and unicast, broadcast, and multicast packets are forwarded and flooded only to end stations in that VLAN. Each VLAN is considered a logical network, and packets destined for stations that do not belong to the VLAN must be forwarded through a bridge or a router.

All ports, including the management port, are assigned to the default VLAN (VLAN1) when the device first comes up.

Up to 4094 VLANs are supported in accordance with the IEEE 802.1Q standard. These VLANs are organized into several ranges for different uses. Some of these VLANs are reserved for internal use by the device and are not available for configuration.

Note Inter-Switch Link (ISL) trunking is not supported on the Cisco Nexus 1000V.

See Configuring VLANs, on page 19 for information about VLAN numbering and configuring VLANs.

Private VLANs

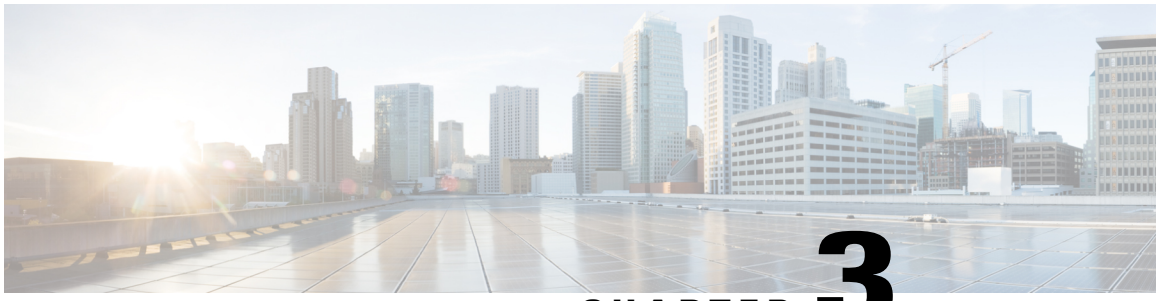
Private VLANs (PVLANs) are used to segregate Layer 2 ISP traffic and convey it to a single router interface. PVLANs achieve device isolation by applying Layer 2 forwarding constraints that allow end devices to share the same IP subnet while being Layer 2 isolated. In turn, the use of larger subnets reduces address management overhead.

See Configuring Private VLANs, on page 29 for more information.

IGMP Snooping

The Internet Group Management Protocol (IGMP) snooping software examines Layer 2 IP multicast traffic within a VLAN to discover the ports where interested receivers reside. Using the port information, IGMP snooping can reduce bandwidth consumption in a multi-access LAN environment to avoid flooding the entire VLAN. The IGMP snooping feature tracks which ports are attached to multicast-capable routers to help the routers forward IGMP membership reports. The IGMP snooping software responds to topology change notifications. By default, IGMP snooping is enabled on the device.

See Configuring IGMP Snooping, on page 47 for more information.



CHAPTER 3

Configuring the MAC Address Table

This chapter contains the following sections:

Information About the MAC Address Table

Layer 2 ports correlate the MAC address on a packet with the Layer 2 port information for that packet using the MAC address table. A MAC address table is built using the MAC source addresses of the frames received. When a frame is received for a MAC destination address not listed in the address table, the frame is flooded to all LAN ports of the same VLAN with the exception of the port that received the frame. When the destination station replies, the relevant MAC source addresses and port IDs are added to the address table. Then subsequent frames are forwarded to a single LAN port without flooding all LAN ports.

You can configure MAC addresses, which are called static MAC addresses, to statically point to specified interfaces on the device. These static MAC addresses override any dynamically learned MAC addresses on those interfaces. You cannot configure broadcast or multicast addresses as static MAC addresses. The static MAC entries are retained across reboots.

The address table per VEM can store up to 32000 MAC entries. An aging timer triggers removal of addresses from the table when they remain inactive for the default time of 300 seconds. The aging timer can be configured on a global basis but not per VLAN.

You can configure the length of time an entry remains in the MAC address table, clearing the table, and so forth.

Guidelines and Limitations

- The forwarding table for each VLAN in a VEM can store up to 4094 MAC addresses.
- You can configure only 1024 static MAC addresses on a single interface.
- Cisco Nexus 1000V supports a maximum of 2000 user configured static MAC addresses on a VSM
- Cisco Nexus 1000V supports a maximum of 2000 private VLAN MAC addresses on a VSM.

Default Settings

Table 2: Default MAC Address Aging Time

Parameters	Default
Aging time	300 seconds

Configuring the MAC Address Table

Configuring a Static MAC Address

Use this procedure to configure a MAC address to statically point to a specific interface.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- You cannot configure broadcast or multicast addresses as static MAC addresses.
- Static MAC addresses override dynamically-learned MAC addresses on an interface.

Note Be aware that the Cisco NX-OS commands may differ from those used in Cisco IOS.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **mac address-table static** *mac_address* **vlan** *vlan-id* {[**drop** | **interface** { **type** *if_id* } | **port-channel number**]}	Adds a static MAC address in the Layer 2 MAC address table and saves it in the running configuration. Interface can be specified as either of the following:

	Command or Action	Purpose
		• ethernet *slot/port* • veth *number*
Step 3	switch(config)# **show mac address static interface** [**type** *if_id*]	(Optional) Displays static MAC addresses.
Step 4	switch(config)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

```
switch# configure terminal
switch(config)# mac address static
switch(config)# show mac address static
VLAN      MAC Address       Type    Age       Port                           Module
---------+-----------------+-------+---------+------------------------------+---------
1         0002.3d11.5502    static  0         N1KV Internal Port             3
1         0002.3d21.5500    static  0         N1KV Internal Port             3
1         0002.3d21.5502    static  0         N1KV Internal Port             3
1         0002.3d31.5502    static  0         N1KV Internal Port             3
1         0002.3d41.5502    static  0         N1KV Internal Port             3
1         0002.3d61.5500    static  0         N1KV Internal Port             3
1         0002.3d61.5502    static  0         N1KV Internal Port             3
1         0002.3d81.5502    static  0         N1KV Internal Port             3
3         12ab.47dd.ff89    static  0         Eth3/3                         3
342       0002.3d41.5502    static  0         N1KV Internal Port             3
343       0002.3d21.5502    static  0         N1KV Internal Port             3
Total MAC Addresses: 11
n1000v(config)# show mac address static interface Ethernet 3/3
VLAN      MAC Address       Type    Age       Port                           Module
---------+-----------------+-------+---------+------------------------------+---------
3         12ab.47dd.ff89    static  0         Eth3/3                         3
Total MAC Addresses: 1
switch(config)#
```

Configuring the Aging Time

Use this procedure to configure the amount of time that packet source MAC addresses, and the ports on which they are learned, remain in the MAC table containing the Layer 2 information.

Note The aging time is a global setting that cannot be configured per VLAN. Although it is a global setting, you can also configure MAC aging time in interface configuration mode or VLAN configuration mode.

Before You Begin

You are logged in to the CLI in EXEC mode.

Note Be aware that the Cisco NX-OS commands may differ from those used in Cisco IOS.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch# **mac address-table aging-time** *seconds*	Specifies and saves in the running configuration the amount of time that will elapse before an entry in the Layer 2 MAC address table is discarded. Allowable entries include: • 120 to 918000 seconds (default is 300) • If you specify zero (0), MAC aging is disabled.

```
switch# configure terminal
switch(config)# mac address-table aging-time 600
switch(config)# show mac address-table aging-time
Vlan  Aging Time
----- ----------
101   300
100   300
1     300
switch#
```

Clearing Dynamic Addresses from the MAC Address Table

Before You Begin

You are logged in to the CLI in EXEC mode.

Note Be aware that the Cisco NX-OS commands may differ from those used in Cisco IOS.

Procedure

	Command or Action	Purpose
Step 1	switch# **clear mac address-table dynamic** [**vlan** *vlan_id*]	Clears the dynamic address entries from the Layer 2 MAC address table.
Step 2	switch# **show mac address-table**	(Optional) Displays the MAC address table.

The following example clears the entire MAC address table of all dynamic entries:

```
switch# clear mac address-table dynamic
switch#
```

The following example clears the MAC address table of only those dynamic MAC addresses learned on VLAN 5:

```
switch# clear mac address-table dynamic vlan 5
switch#
```

Verifying the MAC Address Table Configuration

Use one of the following commands to verify the configuration:

Command	Purpose
show mac address-table	Displays the MAC address table.
show mac address-table static	Displays information about the MAC address table static entries.
show mac address-table static | **inc veth**	Displays the static MAC address of vEthernet interfaces in case a VEM physical port learns a dynamic MAC and the packet source is in another VEM on the same VSM.
show mac address static interface [**type** *if_id*]	Displays all static MAC addresses.
show mac address-table aging-time	Displays the aging time in the MAC address table.
show mac address-table count	Displays a count of MAC address entries.
show interface *interface_id* **mac**	Displays the MAC addresses and the burn-in MAC address for an interface.

Example for show mac address-table

```
switch# show mac address-table
VLAN      MAC Address       Type    Age       Port                            Module
---------+-----------------+-------+---------+-------------------------------+---------
1         0002.3d11.5502    static  0         N1KV Internal Port              3
1         0002.3d21.5500    static  0         N1KV Internal Port              3
1         0002.3d21.5502    static  0         N1KV Internal Port              3
1         0002.3d31.5502    static  0         N1KV Internal Port              3
1         0002.3d41.5502    static  0         N1KV Internal Port              3
1         0002.3d61.5500    static  0         N1KV Internal Port              3
1         0002.3d61.5502    static  0         N1KV Internal Port              3
1         0002.3d81.5502    static  0         N1KV Internal Port              3
3         12ab.47dd.ff89    static  0         Eth3/3                          3
342       0002.3d41.5502    static  0         N1KV Internal Port              3
342       0050.568d.5a3f    dynamic 0         Eth3/3                          3
343       0002.3d21.5502    static  0         N1KV Internal Port              3
343       0050.568d.2aa0    dynamic 9         Eth3/3                          3
Total MAC Addresses: 13
switch#
```

Example for show mac address-table static | inc veth

```
switch# show mac address-table static | inc veth
460       0050.5678.ed16    static  0         Veth2                           3
```

```
460       0050.567b.1864    static  0         Veth1                          4
switch#
```

Example for show mac address static

```
switch# show mac address static
VLAN      MAC Address       Type    Age       Port                           Module
---------+-----------------+-------+---------+------------------------------+---------
1         0002.3d11.5502    static  0         N1KV Internal Port             3
1         0002.3d21.5500    static  0         N1KV Internal Port             3
1         0002.3d21.5502    static  0         N1KV Internal Port             3
1         0002.3d31.5502    static  0         N1KV Internal Port             3
1         0002.3d41.5502    static  0         N1KV Internal Port             3
1         0002.3d61.5500    static  0         N1KV Internal Port             3
1         0002.3d61.5502    static  0         N1KV Internal Port             3
1         0002.3d81.5502    static  0         N1KV Internal Port             3
3         12ab.47dd.ff89    static  0         Eth3/3                         3
342       0002.3d41.5502    static  0         N1KV Internal Port             3
343       0002.3d21.5502    static  0         N1KV Internal Port             3
Total MAC Addresses: 11
switch(config)# show mac address static interface Ethernet 3/3
VLAN      MAC Address       Type    Age       Port                           Module
---------+-----------------+-------+---------+------------------------------+---------
3         12ab.47dd.ff89    static  0         Eth3/3                         3
Total MAC Addresses: 1
switch#
```

Example for show mac address static interface

```
switch# show mac address static interface Ethernet 3/3
VLAN      MAC Address       Type    Age       Port                           Module
---------+-----------------+-------+---------+------------------------------+---------
3         12ab.47dd.ff89    static  0         Eth3/3                         3
Total MAC Addresses: 1
switch#
```

Example for show mac address-table aging-time

```
switch# show mac address-table aging-time
Vlan  Aging Time
----- ----------
101   300
100   300
1     300
switch#
```

Example for show mac address-table count

```
switch# show mac address-table count static
Total MAC Addresses: 12
switch#
```

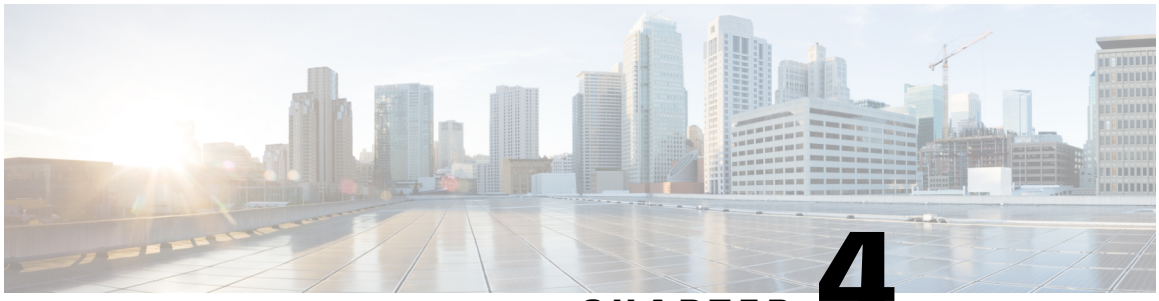
Configuration Example for the MAC Address Table

The following example shows how to add a static MAC address and establish a global aging time:

```
switch# configure terminal
switch(config)# mac address-table static 0000.0000.1234 vlan 10 interface ethernet 2/15
switch(config)# mac address-table aging-time 120
switch(config)#
```

Feature History for the MAC Address Table

Feature Name	Feature Name	Releases
MAC Address Tables	4.0(4)SV1(1)	This feature was introduced



CHAPTER 4

Configuring VLANs

This chapter contains the following sections:

Information About VLANs

Physical NICs are always assigned as trunk ports, which transmit either VLAN tagged or untagged packets. A vswitch can have the following VLAN configurations:

Configuration	Description
External switch tagging (EST)	Physical NICs are untagged and all VNICs are access ports. EST is enabled by default and is used when the VLAN for the VNIC is set to 0 or left blank.
Virtual switch tagging (VST)	All physical NIC ports are tagged and VNICs are access ports. VST is enabled whenever the VNIC's VLAN is set to any value between 1 and 4094 inclusive.
Virtual machine guest tagging (VGT)	All physical NIC ports are tagged. VNICs are trunk ports. To configure VGT, the VLAN is set to 4095 on the VNIC connected to the virtual machine.

Physical ports are always trunk ports by default. The virtual machine interfaces can be either access ports or trunk ports. If a VEthernet interface is set as a trunk port, the VLAN is 4095.

VEthernet interfaces assigned to specific VLANs are tagged with the VLAN when transmitted. A VEthernet interface that is not assigned to a specific VLAN, or assigned to VLAN 0, are transmitted as untagged on the physical NIC interfaces. On the transmit side, this is equivalent to the native VLAN available in Cisco switches. When the VLAN is not specified, it is assumed to be 0.

The following table summarizes the actions taken on packets received by the virtual ethernet module (VEM) based on VLAN tagging.

Table 3: VEM Action on VLAN Tagging

Port Type	Packet received	Action
Access	Tagged	The packet is dropped.
Access	Untagged	VEM adds access VLAN to the packet.
Trunk	Tagged	No action is taken on the packet.
Trunk	Untagged	VEM adds native VLAN tag to packet.

Guidelines and Limitations

In accordance with the IEEE 802.1Q standard, up to 4094 VLANs (numbered 1-4094) are supported in Cisco Nexus 1000V, and are organized in the following table:

Note For VLAN configuration limits, see Layer 2 Switching Configuration Limits, on page 67.

Table 4: Cisco Nexus 1000V VLAN Numbering

VLANs Numbers	Range	Usage
1	Normal	Cisco Nexus 1000V default. You can use this VLAN, but you cannot modify or delete it.
2–1005	Normal	You can create, use, modify, and delete these VLANs.

VLANs Numbers	Range	Usage
1006-4094	Extended	You can create, name, and use these VLANs. You cannot change the following parameters: • State is always active. • VLAN is always enabled. You cannot shut down these VLANs. The extended system ID is always automatically enabled.
3968-4047 and 4094	Internally allocated	You cannot use, create, delete, or modify these VLANs. You can display these VLANs. Cisco Nexus 1000V allocates these 80 VLANs, plus VLAN 4094, for features, like diagnostics, that use internal VLANs for their operation.

Note For information about diagnostics, see the document, *Cisco Nexus 1000V System Management Configuration Guide*.

Default Settings

Table 5: Default VLAN Settings

Parameters	Default
VLAN assignment for all interfaces and all ports configured as switchports	VLAN 1
VLAN name	VLANxxxx where xxxx represent four numeric digits (including leading zeroes) equal to the VLAN ID number
Shut state	No shutdown
Operational state	Active
External switch tagging (EST)	Enabled

Parameters	Default
Physical ports	Trunk ports
IGMP snooping	Enabled

Configuring a VLAN

Creating a VLAN

Use this procedure to do one of the following:

- Create a single VLAN that does not already exist.
- Create a range of VLANs that do not already exist.
- Delete an existing VLAN.

Note All interfaces and all ports configured as switchports are in VLAN 1 by default.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- VLAN characteristics are configured in the VLAN configuration mode. To configure a VLAN that is already created, see Configuring VLAN Characteristics, on page 24.
- You are familiar with the VLAN numbering in the Guidelines and Limitations, on page 20 section.
- Newly-created VLANs remain unused until Layer 2 ports are assigned to them.
- When you delete a specified VLAN, the ports associated to that VLAN are shut down and no traffic flows. When you delete a specified VLAN from a trunk port, only that VLAN is shut down and traffic continues to flow on all the other VLANs through the trunk port. However, the system retains all the VLAN-to-port mapping for that VLAN, and when you reenable, or re-create, that specified VLAN, the system automatically reinstates all the original ports to that VLAN. Note that the static MAC addresses and aging time for that VLAN are not restored when the VLAN is reenabled.

Note Be aware that the Cisco NX-OS commands may differ from those used in Cisco IOS.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **show vlan**	Displays the VLANs that already exist.
Step 3	switch(config)# { **no** } **vlan** { *vlan-id* | *vlan-range* }	Creates or deletes, and saves in the running configuration, a VLAN or a range or VLANs. To configure the VLAN, see the procedure, Configuring VLAN Characteristics, on page 24. **Note** If you enter a VLAN ID that is assigned to an internally allocated VLAN, the system returns an error message. From the VLAN configuration mode, you can also create and delete VLANs. For information about Assigning Layer 2 interfaces to VLANs (access or trunk ports), see the*Cisco Nexus 1000V Interface Configuration Guide*. For information about Configuring ports as VLAN access or trunk ports and assigning ports to VLANs, see the *Cisco Nexus 1000V Interface Configuration Guide*.
Step 4	switch(config-vlan)# **show vlan id** *vlan-id*	(Optional) Displays the VLAN configuration.
Step 5	switch(config-vlan)# **copy running-config startup-config**	(Optional) Saves the running configuration persistently through reboots and restarts by copying it to the startup configuration.

In the following example VLAN 5 is created and you are automatically placed into the VLAN configuration mode for VLAN 5:

```
switch# configure terminal
switch(config)# vlan 5
switch(config-vlan)#
```

The following example shows the range, VLAN 15-20, being created. The VLANs in the range are activated, and you are automatically placed into VLAN configuration mode for VLANs 15-20.

Note If you create a range of VLANs that includes an unusable VLAN, all VLANs in the range are created except those that are unusable; and Cisco Nexus 1000V returns a message listing the failed VLANs.

```
switch# configure terminal
switch(config)# vlan 15-20
switch(config-vlan)#
```

The following example shows VLAN 3967 being deleted, using the no form of the command:

```
switch# configure terminal
switch(config)# no vlan 3967
switch(config)#
```

The following example displays the VLAN 5 configuration:

```
switch# configure terminal
switch(config)# vlan 5
switch(config-vlan)# show vlan id 5

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
5    VLAN0005                         active

VLAN Type
---- -----
5    enet

Remote SPAN VLAN
----------------
Disabled

Primary  Secondary  Type             Ports
-------  ---------  ---------------  ------------------------------------------

n1000v(config-vlan)# copy run start
[########################################] 100%
n1000v(config)#
```

Configuring VLAN Characteristics

Use this procedure to configure the following for a VLAN that has already been created:

Note Commands entered in the VLAN configuration mode are immediately saved to the running configuration.

- Name the VLAN.
- The operational state (active, suspend) of the VLAN.
- The VLAN media type (Ethernet).
- Shut down switching on the VLAN.

Before You Begin

You are logged in to the CLI in EXEC mode.

Note Some characteristics cannot be modified on some VLANs. For more information, see the VLAN numbering described in the Guidelines and Limitations, on page 20section.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **vlan** { *vlan-id* | *vlan-range* }	Enters VLAN configuration mode for the specified VLAN.

	Command or Action	Purpose
		Note If the VLAN does not already exist, the system creates it and then enters the VLAN configuration mode for that VLAN.
Step 3	switch(config-vlan)# **name** *vlan-name*	Adds a name to the VLAN of up to 32 alphanumeric characters. • You cannot change the name of VLAN1 nor the VLANs reserved for internal use. • The default name is VLANxxxx where xxxx represent four numeric digits (including leading zeroes) equal to the VLAN ID number.
Step 4	switch(config-vlan)# **state** { **active** | **suspend** }	Changes the operational state of the VLAN and saves it in the running configuration. Allowable entries are: • Active (default) • Suspend While the VLAN state is suspended, the ports associated with this VLAN are shut down, and that VLAN does not pass any traffic. **Note** You cannot suspend the state for the default VLAN or VLANs 1006 to 4094.
Step 5	switch(config-vlan)# **no shutdown**	Enables VLAN switching in the running configuration. Allowable entries are: • no shutdown (default) • shutdown **Note** You cannot shut down the default VLAN, VLAN1, or VLANs 1006 to 4094.
Step 6	switch(config-vlan)# **show vlan** [**id** *vlan-id*]	(Optional) Displays the VLAN configuration.
Step 7	switch(config-vlan)# **copy running-config startup-config**	(Optional) Saves the running configuration persistently through reboots and restarts by copying it to the startup configuration.

```
n1000v# configure terminal
n1000v(config)# vlan 5
n1000v(config-vlan)# name accounting
n1000v(config-vlan)# state active
n1000v(config-vlan)# no shutdown
n1000v(config-vlan)# show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
```

```
1    default                          active    Eth2/1, Eth2/2, Eth2/3, Eth2/5
                                                Eth2/7, Eth2/8, Eth2/9, Eth2/10
                                                Eth2/15, Eth2/21, Eth2/22
                                                Eth2/23, Eth2/24, Eth2/25
                                                Eth2/46, Eth2/47, Eth2/48
5    accounting                       active
6    VLAN0006                         active
7    VLAN0007                         active
8    test                             active
9    VLAN0009                         active
10   VLAN0010                         active
50   VLAN0050                         active    Eth2/6
100  trunked                          active
200  VLAN0200                         active
201  VLAN0201                         active
202  VLAN0202                         active
3966 VLAN3966                         active
n1000v(config)#
```

Verifying the Configuration

Use one of the following commands to verify the configuration:

Command	Purpose
show running-config vlan *vlan-id*	Displays VLAN information in the running configuration.
show vlan [**all-ports** | **brief** | **id** *vlan-id* | **name** *name* | **dot1q tag native**]	Displays the specified VLAN information.
show vlan summary	Displays a summary of VLAN information.

Example for show vlan summary

```
switch# show vlan summary

 Number of existing VLANs           : 13
 Number of existing user VLANs      : 12
 Number of existing extended VLANs : 1

switch#
```

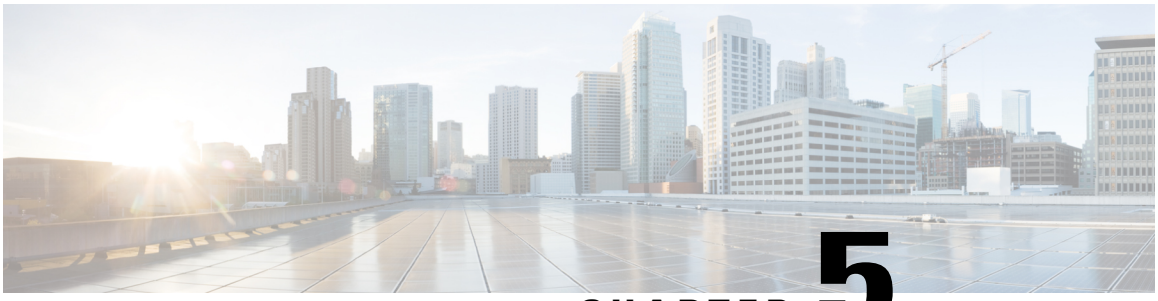
Example for show vlan brief

```
switch# show vlan brief
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Eth2/1, Eth2/2, Eth2/3, Eth2/5
                                                Eth2/7, Eth2/8, Eth2/9, Eth2/10
                                                Eth2/15, Eth2/21, Eth2/22
                                                Eth2/23, Eth2/24, Eth2/25
                                                Eth2/46, Eth2/47, Eth2/48
5    accounting                       active
6    VLAN0006                         active
7    VLAN0007                         active
8    test                             active
9    VLAN0009                         active
10   VLAN0010                         active
50   VLAN0050                         active    Eth2/6
100  trunked                          active
200  VLAN0200                         active
```

```
201  VLAN0201                         active
202  VLAN0202                         active
3966 VLAN3966                         active
switch#
```

Feature History for VLANs

Feature Name	Feature Name	Releases
VLANs	4.0(4)SV1(1)	This feature was introduced



CHAPTER 5

Configuring Private VLANs

This chapter contains the following sections:

Information About Private VLANs

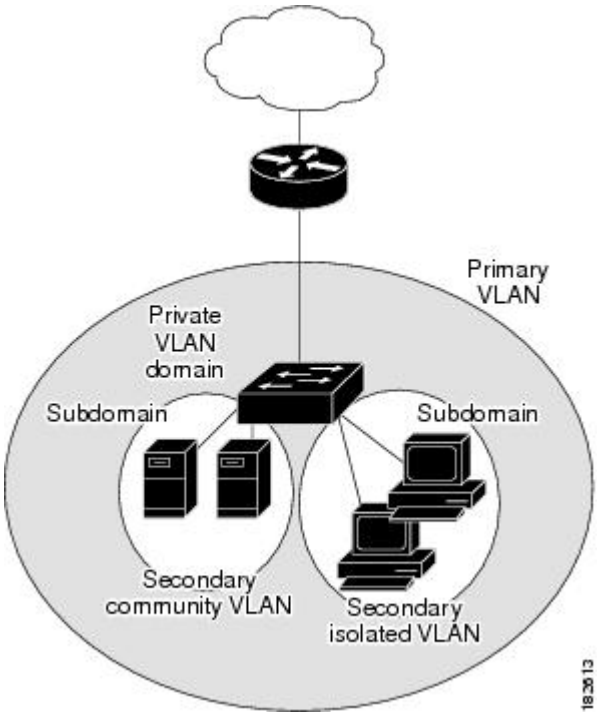
PVLANs achieve device isolation through the use of three separate port designations, each having its own unique set of rules regulating each connected endpoint's ability to communicate with other connected endpoints within the same private VLAN domain.

Private VLAN Domains

A private VLAN domain consists of one or more pairs of VLANs. The primary VLAN makes up the domain; and each VLAN pair makes up a subdomain. The VLANs in a pair are called the primary VLAN and the

secondary VLAN. All VLAN pairs within a private VLAN have the same primary VLAN. The secondary VLAN ID is what differentiates one subdomain from another. See the following figure.

Figure 3: Private VLAN Domain



Spanning Multiple Switches

Private VLANs can span multiple switches, just like regular VLANs. Inter-switch link ports need not be aware of the special VLAN type and carry frames tagged with these VLANs just like they do any other frames. Private VLANs ensure that traffic from an isolated port in one switch does not reach another isolated or community port in a different switch even after traversing an inter-switch link. By embedding the isolation information at the VLAN level and by transporting it along with the packet, it is possible to maintain consistent behavior throughout the network. Therefore, the mechanism which restricts Layer 2 communication between two isolated ports in the same switch, also restricts Layer 2 communication between two isolated ports in two different switches.

Private VLAN Ports

Within a private VLAN domain, there are three separate port designations. Each port designation has its own unique set of rules which regulate the ability of one endpoint to communicate with other connected endpoints within the same private VLAN domain. The following are the three port designations:

- promiscuous
- isolated
- community

Primary VLANs and Promiscuous Ports

The primary VLAN encompasses the entire private VLAN domain. It is a part of each subdomain and provides the Layer 3 gateway out of the VLAN. A private VLAN domain has only one primary VLAN. Every port in a private VLAN domain is a member of the primary VLAN. In other words, the primary VLAN is the entire private VLAN domain.

As the name suggests, a promiscuous port can talk to all other types of ports. A promiscuous port can talk to isolated ports as well as community ports and vice versa. Layer 3 gateways, DHCP servers and other trusted devices that need to communicate with the customer endpoints are typically connected with a promiscuous port. A promiscuous port can be either an access port or a hybrid/trunk port according to the terminology presented in Annex D of the IEEE 802.1Q specification.

Secondary VLANs and Host Ports

Secondary VLANs provide Layer 2 isolation between ports in a private VLAN domain. A private VLAN domain can have one or more subdomains. A subdomain is made up of a VLAN pair consisting of the primary VLAN and a secondary VLAN. Since the primary VLAN is a part of every subdomain, secondary VLANs differentiate the VLAN subdomains.

In order to communicate to the Layer 3 interface, a secondary VLAN must be associated with at least one of the promiscuous ports in the primary VLAN. You can associate a secondary VLAN to more than one promiscuous port within the same private VLAN domain, for example, if needed for load-balancing or redundancy. A secondary VLAN that is not associated with any promiscuous port cannot communicate with the Layer 3 interface.

A secondary VLAN can be one of the following types:

- Isolated VLANs— Isolated VLANs use isolated host ports. An isolated port (i1 or i2 in the above figure) cannot talk to any other port in that private VLAN domain except for promiscuous ports. If a device needs to have access only to a gateway router, then it should be attached to an isolated port. An isolated port is typically an access port, but in certain applications it can also be a hybrid or trunk port.

  The distinct characteristic of an isolated VLAN is that it allows all its ports to have the same degree of segregation that could be obtained from using one separate dedicated VLAN per port. Only two VLAN identifiers are consumed in providing this port isolation.

  Note While there can be multiple community VLANs in a private VLAN domain, one isolated VLAN is sufficient to serve multiple customers. All endpoints connected to its ports are isolated at Layer 2. Service providers can assign multiple customers to the same isolated VLAN, and be assured that their Layer 2 traffic cannot be sniffed by other customers sharing the same isolated VLAN.

- Community VLANs—Community VLANs use community host ports. A community port (c1 or c2 in the above figure) is part of a group of ports. The ports within a community can have Layer 2 communications with one another and can also talk to any promiscuous port. If an ISP customer has, for example, 4 devices and wants them isolated from those of other customers but still be able to communicate among themselves, then community ports should be used.

  Note Because trunks can support a VLAN carrying traffic between its ports, it is possible for VLAN traffic to enter or leave the device through a trunk interface.

Communication Between Private VLAN Ports

The following table shows how access is permitted or denied between private VLAN port types.

Table 6: Communication Between Private VLAN Ports

	Isolated	Promiscuous	Community 1	Community 2	Interswitch Link Port[1]
Isolated	Deny	Permit	Deny	Deny	Permit
Promiscuous	Permit	Permit	Permit	Permit	Permit
Community 1	Deny	Permit	Permit	Deny	Permit
Community 2	Deny	Permit	Deny	Permit	Permit
Interswitch Link Port	Deny[2]	Permit	Permit	Permit	Permit

1 An interswitch link port is a regular port that connects two switches and that happens to carry two or more VLANs.

2 This behavior applies to traffic traversing inter-switch link ports over an isolated VLAN only. Traffic from an inter-switch link port to an isolated port will be denied if it is in the isolated VLAN. Traffic from an inter-switch link port to an isolated port will be permitted if it is in the primary VLAN.

Guidelines and Limitations

Private VLAN has the following configuration guidelines and limitations:

Control VLANs, packet VLANs, and management VLANs must be configured as regular VLANs and not as private VLANs.

Default Settings

Table 7: Default VLAN Settings

Parameters	Default
Private VLANs	Disabled

Configuring a Private VLAN

The following section guides you through the private VLAN configuration process. After completing each procedure, return to this section to make sure that you have completed all required procedures in the correct sequence.

Procedure

Step 1 Enabling or Disabling the Private VLAN Feature Globally. See Enabling or Disabling the Private VLAN Feature Globally, on page 33.

Step 2 Configuring a VLAN as a Primary VLAN. SeeConfiguring a VLAN as a Primary VLAN, on page 34.

Step 3 Configuring a VLAN as a Secondary VLAN. See Configuring a VLAN as a Secondary VLAN, on page 35.

Step 4 Associating the VLANs in a PVLAN. See Associating the VLANs in a PVLAN, on page 36.

Step 5 Configuring a Private VLAN Host Port. See Configuring a Private VLAN Host Port, on page 36.

Step 6 Associating a Host Port with a Private VLAN. See Associating a Host Port with a Private VLAN, on page 38.

Step 7 Verifying a Private VLAN Configuration. See Verifying a Private VLAN Configuration, on page 44.

Enabling or Disabling the Private VLAN Feature Globally

Use this procedure to globally enable or disable the private VLAN feature.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# [**no**] **feature private-vlan**	Globally enables or disables the private VLAN feature.
Step 3	switch(config-vlan)# **show feature**	(Optional) Displays features available, such as PVLAN, and whether they are enabled globally.
Step 4	switch(config-vlan)# **copy running-config startup-config**	(Optional) Saves the running configuration persistently through reboots and restarts by copying it to the startup configuration.

```
switch# configure terminal
switch(config)# feature private-vlan
switch(config-vlan)# show feature
Feature Name          Instance  State
--------------------  --------  --------
dhcp-snooping         1         enabled
http-server           1         enabled
ippool                1         enabled
lacp                  1         enabled
lisp                  1         enabled
lisphelper            1         enabled
netflow               1         disabled
port-profile-roles    1         enabled
private-vlan          1         enabled
sshServer             1         enabled
```

```
tacacs                1          enabled
telnetServer          1          enabled
switch(config-vlan)#
```

Configuring a VLAN as a Primary VLAN

Use this procedure to configure a VLAN to function as the primary VLAN in a PVLAN.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- You have already enabled the private VLAN feature using the Enabling or Disabling the Private VLAN Feature Globally, on page 33.
- The VLAN you are configuring as a primary VLAN already exists in the system as a normal VLAN, and you know the VLAN ID.

Note If the VLAN does not already exist, you are prompted to create it when you create the primary VLAN. For information about creating a VLAN, see Creating a VLAN, on page 22.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **vlan** *primary-vlan-id*	Enters VLAN configuration mode for the specified VLAN and configures the primary VLAN ID in the running configuration.
Step 3	switch(config-vlan)# **private-vlan primary**	Designates the primary VLAN as a private VLAN in the running configuration.
Step 4	switch(config-vlan)# **show vlan private-vlan**	(Optional) Displays the PVLAN configuration.
Step 5	switch(config-vlan)# **copy running-config startup-config**	(Optional) Saves the running configuration persistently through reboots and restarts by copying it to the startup configuration.

```
switch# configure terminal
switch(config)# vlan 202
switch(config-vlan)# private-vlan primary
switch(config-vlan)# show vlan private-vlan
Primary  Secondary  Type              Ports
-------  ---------  ----------------  ------------------------------------------
202                 primary

switch(config-vlan)#
```

Configuring a VLAN as a Secondary VLAN

Use this procedure to configure a VLAN to function as the primary VLAN in a PVLAN.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- You have already enabled the private VLAN feature using the Enabling or Disabling the Private VLAN Feature Globally, on page 33.
- The VLAN you are configuring as a secondary VLAN already exists in the system as a normal VLAN, and you know the VLAN ID.

Note If the VLAN does not already exist, you are prompted to create it when you create the secondary VLAN. For information about creating a VLAN, see Creating a VLAN, on page 22.

- You know whether you want the secondary VLANs to be community VLANs or isolated VLANs, and the VLAN IDs for each.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **vlan** *secondary-vlan-id*	Enters VLAN configuration mode for the specified VLAN and configures the secondary VLAN ID in the running configuration.
Step 3	switch(config-vlan)# **private-vlan** {**community** | **isolated**}	Designates the VLAN as either a community or isolated private VLAN in the running configuration.
Step 4	switch(config-vlan)# **show vlan private-vlan**	(Optional) Displays the PVLAN configuration.
Step 5	switch(config-vlan)# **copy running-config startup-config**	(Optional) Saves the running configuration persistently through reboots and restarts by copying it to the startup configuration.

```
switch# configure terminal
switch(config)# vlan 202
switch(config-vlan)# private-vlan community
switch(config-vlan)# show vlan private-vlan
Primary  Secondary  Type              Ports
-------  ---------  ----------------  ------------------------------------------
202                 community

switch(config-vlan)#
```

Associating the VLANs in a PVLAN

Use this procedure to associate the primary VLANs in a PVLAN with the secondary VLANs.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- The primary VLAN for this PVLAN is already configured as a PVLAN.
- The secondary VLANs for this PVLAN are already configured as PVLANs.
- You know the VLAN IDs for each VLAN that is a part of the PVLAN.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **vlan** *primary-vlan-id*	Enters VLAN configuration mode and associates the VLANs to function as a PVLAN in the running configuration.
Step 3	switch(config-vlan)# **private-vlan association** { **add** | **remove** } *secondary vlan-id*	Associates a specified secondary VLAN with the primary VLAN to function as a PVLAN in the running configuration. To associate additional secondary VLANs repeat this step.
Step 4	switch(config-vlan)# **show vlan private-vlan**	(Optional) Displays the PVLAN configuration.
Step 5	switch(config-vlan)# **copy running-config startup-config**	(Optional) Saves the running configuration persistently through reboots and restarts by copying it to the startup configuration.

```
switch# configure terminal
switch(config)# vlan 202
switch(config-vlan)# private-vlan association add 303
switch(config-vlan)# show vlan private-vlan
Primary  Secondary  Type             Ports
-------  ---------  ---------------  ------------------------------------------
202      303        community        Veth1
n1000v(config-vlan)#
```

Configuring a Private VLAN Host Port

Use this procedure to configure an interface as a host port to function with a PVLAN.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- The primary VLAN for this PVLAN is already configured as a PVLAN.
- The secondary VLANs for this PVLAN are already configured as PVLANs.
- The secondary VLANs are already associated with the primary VLAN.
- You know the name of the interface to be used with the PVLAN as a host port.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **interface type** *if_id*	Enters interface configuration mode and creates a the named interface if it does not exist.
Step 3	switch(config-if)# **switchport mode private-vlan host**	Designates that the physical interface is to function as a PVLAN host port in the running configuration.
Step 4	switch(config-if)# **show interface type** *if_id*	(Optional) Displays the interface configuration.
Step 5	switch(config-if)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

```
switch# configure terminal
switch(config)# interface veth1
switch(config-if)# switchport mode private-vlan host
switch(config-if)# show interface veth1
Vethernet1 is up
    Hardware is Virtual, address is 0050.56b0.34c8
    Owner is VM "HAM61-RH5-32bit-ENVM-7.60.1.3"
    Active on module 2, host VISOR-HAM61.localdomain 0
    VMware DVS port 16777215
    Port-Profile is vlan631
    Port mode is Private-vlan host
    Rx
    48600 Input Packets 34419 Unicast Packets
    0 Multicast Packets 14181 Broadcast Packets
    4223732 Bytes
    Tx
    34381 Output Packets 34359 Unicast Packets
    22 Multicast Packets 0 Broadcast Packets 0 Flood Packets
    3368196 Bytes
    5 Input Packet Drops 11 Output Packet Drops

switch(config-if)#
```

Associating a Host Port with a Private VLAN

Use this procedure to associate the host port with the primary and secondary VLANs in a PVLAN.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- You know the VLAN IDs of the primary and secondary VLANs in the PVLAN.
- The primary VLAN for this PVLAN is already configured as a PVLAN.
- The secondary VLANs for this PVLAN are already configured as PVLANs.
- You know the name of the interface functioning in the PVLAN as a host port.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **interface type** *if_id*	Enters interface configuration mode and configures a name for the specified interface in the running configuration.
Step 3	switch(config-if)# **switchport private-vlan host-association** *primaryvlan-id secondary vlan-id*	Associates the host port with the primary and secondary VLAN IDs for the PVLAN in the running configuration. The interface is associated with the VLANs in the PVLAN.
Step 4	switch(config-if)# **show interface type***if_id*	(Optional) Displays the interface configuration.
Step 5	switch(config-if)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

```
switch# configure terminal
switch(config)# interface veth1
switch(config-if)# switchport private-vlan host-association 202 303
switch(config-if)# show interface veth1
Name: Vethernet1
Switchport: Enabled
  Switchport Monitor: Not enabled
  Operational Mode: access
  Access Mode VLAN: 1 (default)
  Trunking Native Mode VLAN: 1 (default)
  Trunking VLANs Enabled: 1-3967,4048-4093
  Administrative private-vlan primary host-association: 202
  Administrative private-vlan secondary host-association: 203
  Administrative private-vlan primary mapping: none
  Administrative private-vlan secondary mapping: none
```

```
  Administrative private-vlan trunk native VLAN: 1
  Administrative private-vlan trunk encapsulation: dot1q
  Administrative private-vlan trunk normal VLANs: none
  Administrative private-vlan trunk private VLANs:
  Operational private-vlan: 202, 203

switch(config-if)#
```

Configuring a Layer 2 Interface as a Promiscuous Trunk Port

Use this procedure to configure a Layer 2 interface as a promiscuous trunk port that does the following:

- Combines multiple promiscuous ports into a single trunk port.
- Carries all normal VLANs.
- Carries multiple PVLAN primary VLANs each with selected secondary VLANs.

Note A promiscuous port can be either access or trunk. If you have one primary vlan you can use a promiscuous access port. If you have multiple primary vlans you can use a promiscuous trunk port.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- The **private-vlan mapping trunk** command does not decide or override the trunk configuration of a port.
- The port is already configured in a regular trunk mode before adding the private-vlan trunk configurations.
- Primary VLANs must be added to the list of allowed VLAN for the promiscuous trunk port.
- Secondary VLANs are not configured in the allowed VLAN list.
- The trunk port can carry normal VLANs in addition to primary VLANs.
- You can map up to 64 primary VLANs to their secondary VLANs in one promiscuous trunk port.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **interface** *type slot/port*	Enters interface configuration mode for the specified interface.
Step 3	switch(config-if)# **switchport mode private-vlan trunk promiscuous**	In the running configuration, designates the interface as a promiscuous private-vlan trunk port.
Step 4	switch(config-if)# **switchport private-vlan trunk allowed vlan all**	In the running configuration, designates that the private-vlan trunk port will carry all normal VLANs.

	Command or Action	Purpose
Step 5	switch(config-if)# **switchport private-vlan mapping trunk** *primary_vlan_ID* { *secondary_vlan_list* | **add** *secondary_vlan_list* | **remove** *secondary_vlan_list* }	Maps the private-vlan trunk port to a primary VLAN and to selected secondary VLANs in the running configuration. Multiple private-vlan pairs can be specified so that a promiscuous trunk port can carry multiple primary VLANs.
Step 6	switch(config-if)# **switchport private-vlan trunk native vlan** *vlan_ID*	Sets the private vlan trunking native configuration. *vlan_id*: The VLAN (1-3967, 4048-4093) to be used as a native VLAN for the private VLAN trunk port.
Step 7	switch(config-if)# **show interfaces** [*type slot/port*] **switchport**	(Optional) Displays the configuration for verification.
Step 8	switch(config-if)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

```
switch# configure terminal
switch(config)# int eth2/6
switch(config-if)# switchport mode private-vlan trunk promiscuous
switch(config-if)# switchport private-vlan trunk allowed vlan all
switch(config-if)# switchport private-vlan mapping trunk 202 303, 440
switch(config-if)# switchport private-vlan mapping trunk 210 310, 450
switch(config-if)# switchport private-vlan mapping trunk 210 add 451,460
switch(config-if)# switchport private-vlan mapping trunk 210 remove 310
switch(config-if)# switchport private-vlan trunk native vlan 100
switch(config-if)#show interface eth 2/6 switchport
Name: Ethernet2/6
  Switchport: Enabled
  Switchport Monitor: Not enabled
  Operational Mode: Private-vlan trunk promiscuous
  Access Mode VLAN: 1 (default)
  Trunking Native Mode VLAN: 1 (default)
  Trunking VLANs Enabled: 25-27
  Administrative private-vlan primary host-association: none
  Administrative private-vlan secondary host-association: none
  Administrative private-vlan primary mapping: none
  Administrative private-vlan secondary mapping: none
  Administrative private-vlan trunk native VLAN: 100
  Administrative private-vlan trunk encapsulation: dot1q
  Administrative private-vlan trunk normal VLANs: 1-3967, 4048-4093
  Administrative private-vlan trunk private VLANs: (202,303) (202,440) (210,450) (210,451)
 (210,460)
  Operational private-vlan: 202,210,303,440,450-451,460

switch(config-if)#
```

Configuring a Private VLAN Promiscuous Access Port

Use this procedure to configure a port to be used as a promiscuous access port in a PVLAN.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- You know the name of the interface that will function as a promiscuous access port.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **interface** *type* [*slot/port* | *number*]	Enters interface configuration mode for the specified interface.
Step 3	switch(config-if)# **switchport mode private-vlan promiscuous**	Designates that the interface is to function as a promiscuous access port for a PVLAN in the running configuration.
Step 4	switch(config-if)# **show interface** *type* [*slot/port* | *number*]	(Optional) Displays the interface configuration.
Step 5	switch(config-if)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

```
switch# configure terminal
switch(config)# interface eth3/2
switch(config-if)# switchport mode private-vlan promiscuous
switch(config-if)# show interface eth3/2
Ethernet3/2 is up
    Hardware is Ethernet, address is 0050.5655.2e85 (bia 0050.5655.2e85)
    MTU 1500 bytes, BW -1942729464 Kbit, DLY 10 usec,
       reliability 255/255, txload 1/255, rxload 1/255
    Encapsulation ARPA
    Port mode is promiscuous
    full-duplex, 1000 Mb/s
    Beacon is turned off
    Auto-Negotiation is turned on
    Input flow-control is off, output flow-control is off
    Rx
    276842 Input Packets 100419 Unicast Packets
    138567 Multicast Packets 37856 Broadcast Packets
    25812138 Bytes
    Tx
    128154 Output Packets 100586 Unicast Packets
    1023 Multicast Packets 26545 Broadcast Packets 26582 Flood Packets
    11630220 Bytes
    173005 Input Packet Drops 37 Output Packet Drops

switch(config-if)#
switch# configure terminal
switch(config)# interface vethernet1
n1000v(config-if)# switchport mode private-vlan promiscuous
switch(config-if)# show interface vethernet 1
Vethernet1 is up
  Port description is VM-1, Network Adapter 7
  Hardware: Virtual, address: 0050.569e.009f (bia 0050.569e.009f)
  Owner is VM "VM-1", adapter is Network Adapter 7
```

```
  Active on module 5
  VMware DVS port 5404
  Port-Profile is pri_25
  Port mode is Private-vlan promiscuous
  5 minute input rate 0 bits/second, 0 packets/second
  5 minute output rate 7048 bits/second, 2 packets/second
  Rx
    20276 Input Packets 379239 Unicast Packets
    24 Multicast Packets 1395 Broadcast Packets
    1428168 Bytes
  Tx
    256229 Output Packets 74946 Unicast Packets
    16247 Multicast Packets 2028117 Broadcast Packets 190123 Flood Packets
    44432239 Bytes
    162 Input Packet Drops 159 Output Packet Drops

switch(config-if)#
```

Associating a Promiscuous Access Port with a Private VLAN

Use this procedure to associate the promiscuous access port with the primary and secondary VLANs in a PVLAN.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- You know the VLAN IDs of the primary and secondary VLANs in the PVLAN.
- The primary and secondary VLANs are already configured as PVLAN.
- You know the name of the interface functioning in the PVLAN as a promiscuous access port.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **interface** *type* [*slot/port* | *number*]	Enters interface configuration mode for the specified interface.
Step 3	switch(config-if)# **switchport private-vlan mapping** *primary_vlan_ID* { *secondary_vlan_list* | **add** *secondary_vlan_list* | **remove** *secondary_vlan_list*}	Associates the promiscuous access port with the VLAN IDs in the PVLAN in the running configuration.
Step 4	switch(config-if)# **show interface** *type* [*slot/port* | *number*]	(Optional) Displays the interface configuration.
Step 5	switch(config-if)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

```
switch# configure terminal
switch(config)# interface eth3/2
```

```
switch(config-if)# switchport private-vlan mapping 202 303
switch(config-if)# show vlan private-vlan
Primary  Secondary  Type             Ports
-------  ---------  ---------------  ------------------------------------------
202      303        community        Eth3/2, Veth1

switch(config-if)#
```

Removing a Private VLAN Configuration

Use this procedure to remove a private VLAN configuration and return the VLAN to normal VLAN mode.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- The VLAN is configured as a private VLAN, and you know the VLAN ID.
- When you remove a PVLAN configuration, the ports associated with it become inactive.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **vlan** *private vlan-id*	Enters the VLAN configuration mode for the specified VLAN.
Step 3	switch(config-vlan)# **no private-vlan** { **community** | **isolated** | **primary** }	Removes the specified VLAN from a PVLAN in the running configuration. The private VLAN configuration is removed from the specified VLAN(s). The VLAN is returned to normal VLAN mode. The ports associated with the VLAN are inactive.
Step 4	switch(config-vlan)# **show vlan private-vlan**	(Optional) Displays the PVLAN configuration.
Step 5	switch(config-vlan)# **copy running-config startup-config**	(Optional) Saves the running configuration persistently through reboots and restarts by copying it to the startup configuration.

```
switch# configure terminal
switch(config)# vlan 5
switch(config-vlan)# no private-vlan primary
switch(config-vlan)# show vlan private-vlan
Primary  Secondary  Type             Ports
-------  ---------  ---------------  ------------------------------------------

switch(config-vlan)#
```

Verifying a Private VLAN Configuration

Use the following commands to verify a private VLAN configuration:

Command	Purpose
show feature	Displays features available, such as PVLAN, and whether they are enabled globally.
show running-config vlan *vlan-id*	Displays VLAN information.
show vlan private-vlan [*type*]	Displays information about private VLANs.
show interface switchport	Displays information about all interfaces configured as switchports.

Configuration Example for Private VLAN

Example: PVLAN Trunk Port

The following example shows how to configure interface Ethernet 2/6 as the following:

- private VLAN trunk port
- mapped to primary private VLAN 202 which is associated with secondary VLANs 303 and 440
- mapped to primary private VLAN 210 which is associated with secondary VLANs 310 and 450

```
switch# configure terminal
switch(config)# vlan 303,310
switch(config-vlan)# private-vlan community
switch(config)# vlan 440,450
switch(config-vlan)# private-vlan isolated

switch(config)# vlan 202
switch(config-vlan)# private-vlan primary
switch(config-vlan)# private-vlan association 303,440

switch(config)# vlan 210
switch(config-vlan)# private-vlan primary
switch(config-vlan)# private-vlan association 310,450

switch# configure terminal
switch(config)# int eth2/6
switch(config-if)# switchport mode private-vlan trunk promiscuous
switch(config-if)# switchport private-vlan trunk allowed vlan all
switch(config-if)# switchport private-vlan mapping trunk 202 303, 440
switch(config-if)# switchport private-vlan mapping trunk 210 310, 450
switch(config-if)# show interface switchport
Name: Ethernet2/6
  Switchport: Enabled
Operational Mode: Private-vlan trunk promiscuous
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Trunking VLANs Enabled: 1-3967,4048-4093
Administrative private-vlan primary host-association: none
```

```
  Administrative private-vlan secondary host-association: none
  Administrative private-vlan primary mapping: none
  Administrative private-vlan secondary mapping: none
  Administrative private-vlan trunk native VLAN: 1
  Administrative private-vlan trunk encapsulation: dot1q
  Administrative private-vlan trunk normal VLANs: 1-3967, 4048-4093
  Administrative private-vlan trunk private VLANs: (202,303) (202,440) (210,310) (210,450)
  Operational private-vlan: 202,210,303,310,440,450
switch(config-if)#
```

Example: PVLAN Using Port Profiles

The following example configuration shows how to configure interface eth2/6 using port-profile, uppvlanpromtrunk156.

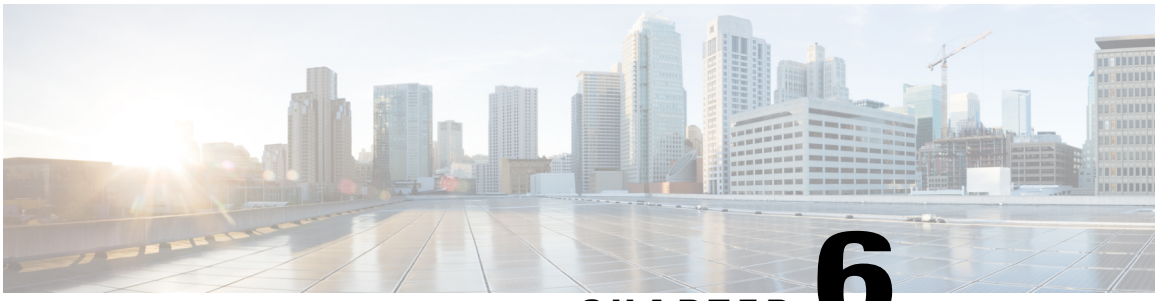
In this configuration, packets from secondary interfaces 153, 154, and 155 are translated into the primary VLAN 156 as a result of the command, **switchport private-vlan mapping trunk 156 153-155**.

```
vlan 153-154
  private-vlan community
vlan 155
  private-vlan isolated
vlan 156
  private-vlan association 153-155
  private-vlan primary


switch# show run int eth2/6

version 4.0(1)
interface Ethernet2/6
switchport
inherit port-profile uppvlanpromtrunk156

switch# show port-profile name uppvlanpromtrunk156
port-profile uppvlanpromtrunk156
description:
status: enabled
capability privileged: no
capability uplink: yes
port-group: uppvlanpromtrunk156
config attributes:
switchport mode private-vlan trunk promiscuous
switchport private-vlan trunk allowed vlan all
switchport private-vlan mapping trunk 156 153-155
no shutdown
evaluated config attributes:
switchport mode trunk
switchport trunk allowed vlan all
switchport private-vlan mapping trunk 156 153-155
no shutdown
assigned interfaces:
Ethernet2/6

switch# show interface eth 2/6 switchport
Name: Ethernet2/6
  Switchport: Enabled
  Switchport Monitor: Not enabled
  Operational Mode: Private-vlan trunk promiscuous
  Access Mode VLAN: 1 (default)
  Trunking Native Mode VLAN: 1 (default)
  Trunking VLANs Enabled: 1-3967,4048-4093
  Administrative private-vlan primary host-association: none
  Administrative private-vlan secondary host-association: none
  Administrative private-vlan primary mapping: none
  Administrative private-vlan secondary mapping: none
  Administrative private-vlan trunk native VLAN: 1
  Administrative private-vlan trunk encapsulation: dot1q
  Administrative private-vlan trunk normal VLANs: 1-155,157-3967,4048-4093
  Administrative private-vlan trunk private VLANs: (156,153) (156,155)
```

```
 Operational private-vlan: 156,153,155 inherit port-profile uppvlanpromtrunk156
switch#
```

Feature History for Private VLAN

Feature Name	Feature Name	Releases
feature private-vlan command	4.2(1)SV1(4)	The ability to globally enable the private VLAN feature.
Private VLAN	4.0(4)SV1(1)	This feature was introduced.



CHAPTER 6

Configuring IGMP Snooping

This chapter contains the following sections:

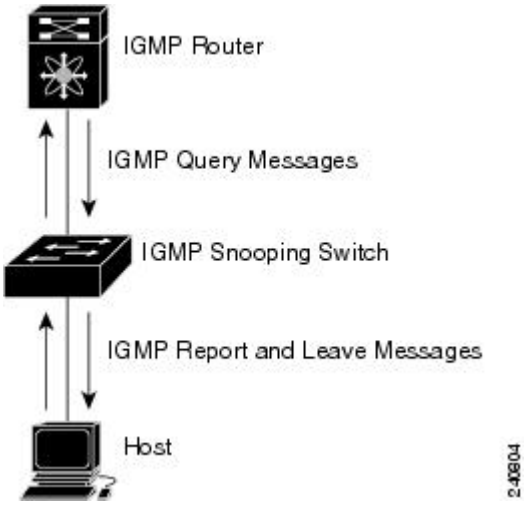
Information about IGMP Snooping

Introduction

The Internet Group Management Protocol (IGMP) snooping software examines Layer 2 IP multicast traffic within a VLAN to discover the ports where interested receivers reside. Using the port information, IGMP snooping can reduce bandwidth consumption in a multi-access LAN environment to avoid flooding the entire VLAN. The IGMP snooping feature tracks which ports are attached to multicast-capable routers to help the routers forward IGMP membership reports. The IGMP snooping software responds to topology change notifications. By default, IGMP snooping is enabled on the device.

The following figure shows an IGMP snooping switch that sits between the host and the IGMP router. The IGMP snooping switch snoops the IGMP membership reports and Leave messages and forwards them only when necessary to the connected IGMP routers.

Figure 4: IGMP Snooping Switch



The IGMP snooping software operates upon IGMPv1, IGMPv2, and IGMPv3 control plane packets where Layer 3 control plane packets are intercepted and influence the Layer 2 forwarding behavior.

The Cisco Nexus 1000V IGMP snooping implementation has the following proprietary features:

- Multicast forwarding based on IP address rather than MAC address.
- Optimized multicast flooding (OMF) that forwards unknown traffic to routers only and performs no data driven state creation.

For more information about IGMP snooping, see RFC 4541.

IGMPv1 and IGMPv2

If no more than one host is attached to each VLAN switch port, then you can configure the fast leave feature in IGMPv2. The fast leave feature does not send last member query messages to hosts. As soon as the software receives an IGMP leave message, the software stops forwarding multicast data to that port.

IGMPv1 does not provide an explicit IGMP leave message, so the software must rely on the membership message time-out to indicate that no hosts remain that want to receive multicast data for a particular group.

Report suppression is not supported and is disabled by default.

Note The software ignores the configuration of the last member query interval when you enable the fast leave feature because it does not check for remaining hosts.

IGMPv3

IGMPv3 snooping provides constrained flooding based on the group IP information in the IGMPv3 reports.

By default, the software tracks hosts on each VLAN port. The explicit tracking feature provides a fast leave mechanism. Because every IGMPv3 host sends membership reports, report suppression limits the amount of traffic that the switch sends to other multicast capable routers.

Even though the IGMPv3 membership reports provide a full accounting of group members on a LAN segment, when the last host leaves, the querier sends a membership query. You can configure the parameter last member query interval. If no host responds before the time-out, the software removes the group state. If the querier specifies a mean-response-time (MRT) value in the queries, it overrides the last member query interval configuration.

Prerequisites for IGMP Snooping

IGMP snooping has the following prerequisites:

- You are logged in to the switch.
- A querier must be running on the uplink switches on the VLANs that contain multicast sources and receivers.

When the multicast traffic does not need to be routed, you must configure an external switch to query membership. On the external switch, define the query feature in a VLAN that contains multicast sources and receivers but no other active query feature. In Cisco Nexus 1000V, report suppression is not supported and is disabled by default.

When an IGMP snooping query feature is enabled, it sends out periodic IGMP queries that trigger IGMP report messages from hosts wanting to receive IP multicast traffic. IGMP snooping listens to these IGMP reports to identify accurate forwarding.

Default Settings

Table 8: Default IGMP Snooping Settings

Parameters	Default
IGMP snooping	Enabled
IGMPv3 Explicit tracking	Enabled
IGMPv2 Fast leave	Disabled
Last member query interval	1 second
Link-local groups suppression	Enabled
Snooping querier	Disabled

Parameters	Default
IGMPv1/v2 Report suppression	Disabled
IGMPv3 Report suppression	Disabled

Configuring IGMP Snooping

Enabling or Disabling IGMP Snooping Globally for the VSM

Use this procedure to enable or disable IGMP snooping globally for the VSM. IGMP snooping is enabled globally on the VSM (the default). If enabled globally, you can turn it on or off per VLAN.

Before You Begin

You are logged in to the CLI in EXEC mode.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# [**no**] **ip igmp snooping**	Enables or disables IGMP snooping in the running configuration for all VLANs. The default is enabled. If you have previously disabled the feature then you can enable it with this command.
Step 3	switch(config)# **show ip igmp snooping** [**vlan** *vlan-id*]	(Optional) Displays the configuration for verification. **Note** If disabled, then IGMP snooping on all VLANs is disabled.
Step 4	switch(config)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

```
switch# configure terminal
switch(config)# no ip igmp snooping
switch(config)# show ip igmp snooping
Global IGMP Snooping Information:
  IGMP Snooping enabled
  IGMPv1/v2 Report Suppression disabled
  IGMPv3 Report Suppression disabled
  Link Local Groups Suppression enabled

IGMP Snooping information for vlan 1
  IGMP snooping enabled
  IGMP querier none
```

```
  Switch-querier disabled
  IGMPv3 Explicit tracking enabled
  IGMPv2 Fast leave disabled
  IGMPv1/v2 Report suppression disabled
  IGMPv3 Report suppression disabled
  Link Local Groups suppression enabled
  Router port detection using PIM Hellos, IGMP Queries
  Number of router-ports: 0
  Number of groups: 0
  Active ports:

--More--
switch(config)#
```

Configuring IGMP Snooping on a VLAN

Use this procedure to configure IGMP snooping on a VLAN. IGMP snooping is enabled by default for all VLANs in the VSM.

Before You Begin

You are logged in to the CLI in EXEC mode.

Note If IGMP snooping is disabled globally, it takes precedence over the VLAN state.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **vlan** *vlan-id*	Enters configuration mode for the specified VLAN.
Step 3	switch(config-vlan)# [**no**] **ip igmp snooping**	Enables or disables IGMP snooping in the running configuration for the specific VLAN. If IGMP snooping is enabled for the VSM, then IGMP snooping is enabled for the VLAN by default. **Note** IGMP snooping must be enabled globally (the default) in order to toggle it on or off per VLAN. If IGMP snooping is disabled globally, then it cannot be enabled per VLAN.
Step 4	switch(config-vlan)# [**no**] **ip igmp snooping explicit-tracking**	(Optional) Tracks IGMPv3 membership reports from individual hosts for each port on a per-VLAN basis in the running configuration. The default is enabled.
Step 5	switch(config-vlan)# [**no**] **ip igmp snooping fast-leave**	(Optional) Enables fast-leave for the specified VLAN in the running configuration. Fast-leave supports IGMPv2 hosts that cannot be explicitly tracked because of the host report suppression mechanism of the IGMPv2 protocol.

	Command or Action	Purpose
		Enables the software to remove the group state when it receives an IGMP Leave report without sending an IGMP query message. This parameter is used for IGMPv2 hosts when no more than one host is present on each VLAN port. When you enable fast leave, the IGMP software assumes that no more than one host is present on each VLAN port. The default is disabled.
Step 6	switch(config-vlan)# [**no**] **ip igmp snooping last-member-query-interval** *seconds*	(Optional) Sets the interval the software waits after sending an IGMP query to verify that no hosts that want to receive a particular multicast group remain on a network segment. If no hosts respond before the last member query interval expires, the software removes the group from the associated VLAN port. Values range from 1 to 25 seconds. The default is 1 second.
Step 7	switch(config-vlan)# [**no**] **ip igmp snooping mrouter interface type** *if_id*	(Optional) Configures a static connection for the VLAN to a multicast router in the running configuration. The interface to the router must be in the specified VLAN. You can specify the interface by the type and the number, such as ethernet slot/port. vEths are not supported as router ports.
Step 8	switch(config-vlan)# [**no**] **ip igmp snooping static-group** *group-ip-addr* **interface type** *if_id*	(Optional) Configures a VLAN Layer 2 port as a static member of a multicast group in the running configuration. You can specify the interface by the type and the number, such as ethernet slot/port.
Step 9	switch(config-vlan)# [**no**] **ip igmp snooping link-local-groups-suppression**	(Optional) Configures link-local groups suppression. The default is enabled. **Note** You can apply link-local groups suppression to all interfaces in the VSM by entering this command in global configuration mode.
Step 10	switch(config-vlan)# **show ip igmp snooping** [**vlan** *vlan-id*]	(Optional) Displays the configuration for verification.
Step 11	switch(config-vlan)# **copy running-config startup-config**	(Optional) (Optional) Saves the running configuration persistently through reboots and restarts by copying it to the startup configuration.

```
switch# configure terminal
switch(config)# vlan 2
switch(config-vlan)# ip igmp snooping
switch(config-vlan)# ip igmp snooping explicit-tracking
switch(config-vlan)# ip igmp snooping fast-leave
```

```
switch(config-vlan)# ip igmp snooping last-member-query-interval 3
switch(config-vlan)# ip igmp snooping mrouter interface ethernet 2/1
switch(config-vlan)# ip igmp snooping static-group 230.0.0.1 interface ethernet 2/1
switch(config-vlan)# ip igmp snooping link-local-groups-suppression
switch(config-vlan)# show ip igmp snooping vlan 2

IGMP Snooping information for vlan 5
  IGMP snooping enabled
  IGMP querier none
  Switch-querier disabled
  IGMPv3 Explicit tracking enabled
  IGMPv2 Fast leave enabled
  IGMPv1/v2 Report suppression disabled
  IGMPv3 Report suppression disabled
  Link Local Groups suppression enabled
  Router port detection using PIM Hellos, IGMP Queries
  Number of router-ports: 0
  Number of groups: 0
  Active ports:
switch(config-vlan)#
```

Verifying the IGMP Snooping Configuration

Use the following commands to verify the IGMP snooping configuration information.

Command	Purpose
show ip igmp snooping [**vlan** *vlan-id*]	Displays IGMP snooping configuration by VLAN.
show ip igmp snooping groups [**vlan** *vlan-id*] [**detail**]	Displays IGMP snooping information about groups by VLAN.
show ip igmp snooping querier [**vlan** *vlan-id*]	Displays IGMP snooping queriers by VLAN.
show ip igmp snooping mroute [**vlan** *vlan-id*]	Displays multicast router ports by VLAN.
show ip igmp snooping explicit-tracking [**vlan** *vlan-id*]	Displays IGMP snooping explicit tracking information by VLAN.

For detailed information about commands and their output, see the *Cisco Nexus 1000V Command Reference*.

Example Configuration IGMP Snooping

This example shows how to enable IP IGMP snooping for the VSM, and make the following optional configurations for VLAN 2:

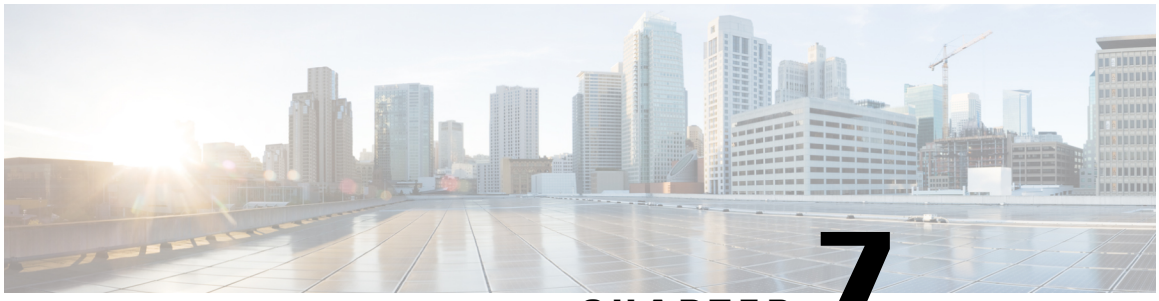
- Tracking of IGMPv3 membership reports from individual hosts for each port.
- A static connection to a multicast router through Ethernet 2/1.
- Static membership in multicast group 230.0.0.1.

```
switch# configure terminal
switch# ip igmp snooping
switch# vlan 2
switch# ip igmp snooping
```

```
switch# ip igmp snooping explicit-tracking
switch# ip igmp snooping mrouter interface ethernet 2/1
switch# ip igmp snooping static-group 230.0.0.1 interface ethernet 2/1
switch# show ip igmp snooping vlan 2
switch# copy running-config startup-config
switch#
```

Feature History for IGMP Snooping

Feature Name	Releases	Description
Link-local suppression	4.2(1)SV1(4)	Added support to enable or disable link-local group suppression.
Report suppression	4.0(4)SV1(3)	Removed support for report suppression.
IGMP Snooping	4.0(4)SV1(1)	This feature was introduced.



CHAPTER 7

Configuring Network Load Balancing for vEthernet

This chapter contains the following sections:

Information About Microsoft Network Load Balancing

Microsoft Network Load Balancing (NLB) is a clustering technology offered by Microsoft as part of the Windows server operating systems. Clustering enables a group of independent servers to be managed as a single system for higher availability, easier manageability, and greater scalability.

For more information about Microsoft Network Load Balancing, see http://technet.microsoft.com/en-us/library/bb742455.aspx

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Guidelines and Limitations

Network Load Balancing feature has the following guidelines and limitations:

- **no mac auto-static-learn** configuration is not supported on PVLAN ports.
- **no mac auto-static-learn** configuration is not supported on the ports configured with **switchport port-security mac-address sticky**.
- On Microsoft Network Load Balancing (MS-NLB) enabled vEthernet interfaces , Unknown Unicast Flood Blocking (UUFB) does not block MS-NLB related packets. In these scanarios, UUFB can be used to limit flooding of MS-NLB packets to non-MS-NLB ports within a VLAN.

Configuring Microsoft Network Load Balancing Support in Interface Configuration Mode

Use this procedure to configure Microsoft Network Load Balancing in the interface configuration mode.

Before You Begin

Note Make sure that the Cisco Nexus 1000V is configured before you configure Microsoft NLB on Windows virtual machines (VMs).

- You are logged in to the CLI in EXEC mode.
- Unicast is the default Microsoft Network Load Balancing mode of operation.
- Microsoft NLB replaces the MAC address of each server in the cluster to a common Microsoft NLB MAC address.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **show running-config interface** *veth number*	Displays the vEthernet configuration to determine if **no mac auto-static-learn** is configured or not.
Step 3	switc(config)# **interface veth**	Sets interface configuration mode on vEthernet modules.
Step 4	switch(config-if)# [**no**] **mac auto-static-learn**	Toggles the auto-mac-learning on vEthernet modules.

	Command or Action	Purpose
Step 5	switch(config-if)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

The following example shows how to configure Microsoft Network Load Balancing directly on vEthernet:

```
switch# configure terminal
switch(config)# interface vethernet 1
switch(config-if)# no mac auto-static-learn
switch(config-if)# show running-config interface vethernet 1
!Command: show running-config interface Vethernet1
!Time: Tue Nov 15 19:01:36 2011

version 4.2(1)SV1(5.1)

interface Vethernet1
  inherit port-profile vm59
  description stc3, Network Adapter 2
  no mac auto-static-learn
  vmware dvport 34 dvswitch uuid "ea 5c 3b 50 cd 00 9f 55-41 a3 2d 61 84 9e 0e c4"
  vmware vm mac 0050.56B3.0071

switch(config)#
```

The following example shows how to unconfigure Microsoft Network Load Balancing directly from vEthernet:

```
switch# configure terminal
switch(config)# interface vethernet 1
switch(config-if)# mac auto-static-learn
switch(config-if)# show running-config interface vethernet 1
!Command: show running-config interface Vethernet1
!Time: Tue Nov 15 19:01:52 2011

version 4.2(1)SV1(5.1)

interface Vethernet1
  inherit port-profile vm59
  description stc3, Network Adapter 2
  mac auto-static-learn
  vmware dvport 34 dvswitch uuid "ea 5c 3b 50 cd 00 9f 55-41 a3 2d 61 84 9e 0e c4"
  vmware vm mac 0050.56B3.0071

switch(config)#
```

Configuring Microsoft Network Load Balancing in Port Profile Configuration Mode

Use this procedure to configure Microsoft Network Load Balancing in the port profile configuration mode.

Before You Begin

Note Make sure that the Cisco Nexus 1000V is configured before you configure Microsoft NLB on Windows virtual machines (VMs).

- You are logged in to the CLI in EXEC mode.
- Unicast is the default Microsoft Network Load Balancing mode of operation.
- Microsoft NLB replaces the MAC address of each server in the cluster to a common Microsoft NLB MAC address.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **show running config port-profile** *profile name*	Displays the port profile configuration to determine if no mac auto-static-learn is configured or not.
Step 3	switch(config)# **port profile type vethernet ms-nlb**	Sets port profile configuration mode on vEthernet modules.
Step 4	switch(config-port-prof)# [**no**] **mac auto-static-learn**	Toggles the auto-mac-learning on vEthernet modules.
Step 5	switch(config-port-prof)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

The following example shows how to configure Microsoft Network Load Balancing in port profile mode:

```
switch# configure terminal
switch(config)# port-profile type vethernet ms-nlb
switch(config-port-prof)# vmware port-group
switch(config-port-prof)# switchport mode access
switch(config-port-prof)# switchport access vlan 59
switch(config-port-prof)# no mac auto-static-learn
switch(config-port-prof)# no shutdown
switch(config-port-prof)# state enabled
switch(config-port-prof)# show run port-profile ms-nlb
!Command: show running-config port-profile ms-nlb
!Time: Tue Nov 15 19:00:40 2011

version 4.2(1)SV1(5.1)
port-profile type vethernet ms-nlb
  vmware port-group
  switchport mode access
  switchport access vlan 59
  no mac auto-static-learn
  no shutdown
  state enabled
switch(config-port-prof)#
```

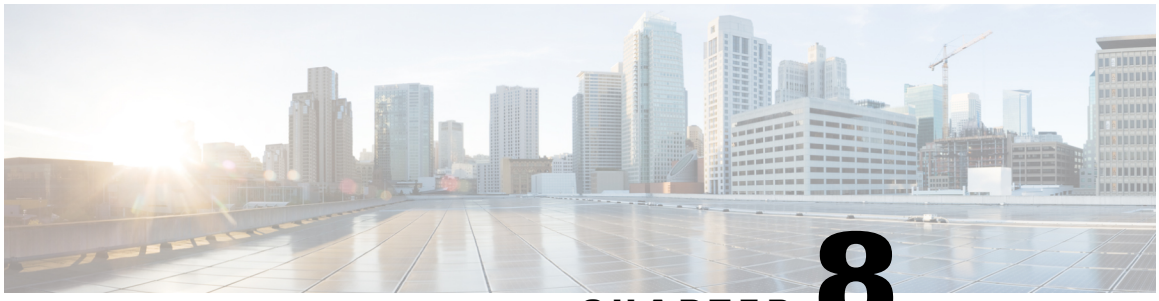
The following example shows how to unconfigure Microsoft Network Load Balancing on vEthernet in port profile mode:

```
switch# configure terminal
switch(config)# port-profile type vethernet ms-nlb
switch(config-port-prof)# mac auto-static-learn
switch(config-port-prof)# show run port-profile ms-nlb
!Command: show running-config port-profile ms-nlb
!Time: Tue Nov 15 19:01:05 2011
```

```
version 4.2(1)SV1(5.1)
port-profile type vethernet ms-nlb
  vmware port-group
  switchport mode access
  switchport access vlan 59
  mac auto-static-learn
  no shutdown
  state enabled
switch(config-port-prof)#
```

Feature History for Microsoft Network Load Balancing for vEthernet

Feature Name	Feature Name	Releases
Network Load Balancing	4.2(1)SV1(5.1)	This feature was introduced



CHAPTER 8

Supporting Redundant Routing Protocols

This chapter contains the following sections:

Information About Redundant Routing Protocols

Cisco Nexus 1000V implements a loop detection mechanism based on source and destination MAC address and will drop packets coming in on uplink ports if the source MAC is already present on a local vEthernet interface. As a result, the protocols such as Virtual Router Redundancy Protocol (VRRP), Common Address Redundancy Protocol (CARP), Hot Standby Router Protocol (HSRP), and other similar protocols would fail on virtual machines associated to Cisco Nexus 1000V.

Disabling loop detection provides a flexible way of supporting these protocols on virtual machines associated to Cisco Nexus 1000V. By disabling the loop detection mechanism, you can configure any combination of the above mentioned protocols on a port profile or a vEthernet interface. As a result you can run multiple protocols on the same virtual machine.

Guidelines and Limitations

Supporting the redundant routing protocols feature has the following guidelines and limitations:

- Disable IGMP Snooping on both Cisco Nexus 1000V and upstream switches between the servers to support most redundant routing protocols. See Enabling or Disabling IGMP Snooping Globally for the VSM, on page 50.
- Disable loop detection configuration is not supported on PVLAN ports.
- Disable loop detection configuration is not supported on the port security ports.

Supporting Redundant Routing Protocols

Configuring a vEthernet Interface to Support Redundant Routing Protocols

Use this procedure to configure a vEthernet interface to support redundant routing protocols.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- You know which redundant routing protocol you want to disable.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **interface vethernet** *interface-number*	Enters the interface configuration mode for the specified vEthernet interface (from 1 to 1048575).
Step 3	switch(config-if)# **disable-loop-detection** { **carp** | **hsrp** | **vrrp** |**custom-rp** [**src-mac-range** *s_mac end_mac*] [**dest-ip** *ip_address*] [**ip-proto** *no*] [**port** *port*]}	Enables or disables the loop detection mechanism to support a redundant routing protocol on vEthernet interface. • **disable-loop-detection:** Disables the loop detection mechanism. • **no disable-loop-detection:** Enables the loop detection mechanism. This is the default configuration. The protocols supported on a vEthernet interface include: • **carp** - Common Address Redundancy Protocol • **custom-rp** - User defined protocol • **hsrp** - Hot Standby Router Protocol • **vrrp** - Virtual Router Redundancy Protocol The parameters for custom defined protocols include: • **src-mac-range** - Source MAC address range for the user defined protocol. • **dest-ip** - Destination IP address for the user defined protocol. • **ip-proto** - IP protocol number for the user defined protocol. • **port** - UDP or TCP destination port number for the user defined protocol.

	Command or Action	Purpose
Step 4	switch(config-if)# **show running-config interface vethernet** *interface-number*	(Optional) Displays the interface status and information.
Step 5	switch(config-if)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

The following example shows how to configure a vEthernet interface to support VRRP, CERP, HSRP, and user defined protocols on a virtual machine:

```
switch# configure terminal
switch(config)# int veth5
switch(config-if)# disable-loop-detection carp
switch(config-if)# disable-loop-detection vrrp
switch(config-if)# disable-loop-detection hsrp
switch(config-if)# disable-loop-detection custom-rp dest-ip 224.0.0.12 port 2234
switch(config-if)# end
switch# show running-config interface vethernet 5
!Command: show running-config interface Vethernet5
!Time: Fri Nov 4 02:21:24 2011

version 4.2(1)SV1(5.1)

interface Vethernet5
inherit port-profile vm59
description Fedora117, Network Adapter 2
disable-loop-detection carp
disable-loop-detection custom-rp dest-ip 224.0.0.12 port 2234
disable-loop-detection hsrp
disable-loop-detection vrrp
vmware dvport 32 dvswitch uuid "ea 5c 3b 50 cd 00 9f 55-41 a3 2d 61 84 9e 0e c4"
vmware vm mac 0050.56B3.00B2

switch#
```

Configuring a Port Profile to Support Redundant Routing Protocols

Use this procedure to configure a port profile to support redundant routing protocols. Use this procedure when the master in a master/slave relationship has lost connectivity, the slave has taken over the master role, and the original master is attempting to overtake the master role.

Note If you configure a vEthernet Interface and a port profile to run multiple protocols on the same virtual machine, then the configuration on the vEthernet Interface overrides the configuration on the port profile.

Before You Begin

- You are logged in to the CLI in EXEC mode.
- You know which redundant routing protocol you want to disable.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **port-profile** *name*	Enters port profile configuration mode for the named port profile.
Step 3	switch(config-port-prof)# **switchport mode** {**access** | **trunk**}	Designates that the interface is to be used as a trunking port. A trunk port transmits untagged packets for the native VLAN and transmits encapsulated, tagged packets for all other VLANs.
Step 4	switch(config-port-prof)# **no shutdown**	Administratively enables all ports in the profile.
Step 5	switch(config-port-prof)# **disable-loop-detection** { **carp** | **hsrp** | **vrrp** |**custom-rp** [**src-mac-range** *s_mac end_mac*] [**dest-ip** *ip_address*] [**ip-proto** *no*] [**port** *port*]}	Enables or disables the loop detection mechanism to support a redundant routing protocol on vEthernet interface. • **disable-loop-detection:** Disables the loop detection mechanism. • **no disable-loop-detection:** Enables the loop detection mechanism. This is the default configuration. The protocols supported on a vEthernet interface include: • **carp** - Common Address Redundancy Protocol • **custom-rp** - User defined protocol • **hsrp** - Hot Standby Router Protocol • **vrrp** - Virtual Router Redundancy Protocol The parameters for custom defined protocols include: • **src-mac-range** - Source MAC address range for the user defined protocol. • **dest-ip** - Destination IP address for the user defined protocol. • **ip-proto** - IP protocol number for the user defined protocol. • **port** - UDP or TCP destination port number for the user defined protocol.
Step 6	switch(config-port-prof)# **show port-profile** [**brief** | **expand-interface** | **usage**] [**name** *profile-name*]	(Optional) Displays the configuration for verification.

	Command or Action	Purpose
Step 7	switch(config-port-prof)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

This example shows how to disable loop detection for the Hot Standby Router Protocol:

```
switch# configure terminal
switch(config)# port-profile hsrp-1
switch(config-port-prof)# switchport mode trunk
switch(config-port-prof)# no shutdown
switch(config-port-prof)# disable-loop-detection hsrp
switch(config-port-prof)# state enabled
switch(config-port-prof)# vmware port-group
switch(config-port-prof)# show port-profile name hsrp-1
port-profile hsrp-1
 type: Vethernet
 description:
 status: enabled
 max-ports: 32
 min-ports: 1
 inherit:
 config attributes:
  switchport mode trunk
  disable-loop-detection hsrp
  no shutdown
 evaluated config attributes:
  switchport mode trunk
  disable-loop-detection hsrp
  no shutdown
 assigned interfaces:
 port-group: hsrp-1
 system vlans: none
 capability l3control: no
 capability iscsi-multipath: no
 capability vxlan: no
 capability l3-vservice: no
 port-profile role: none
 port-binding: static
```

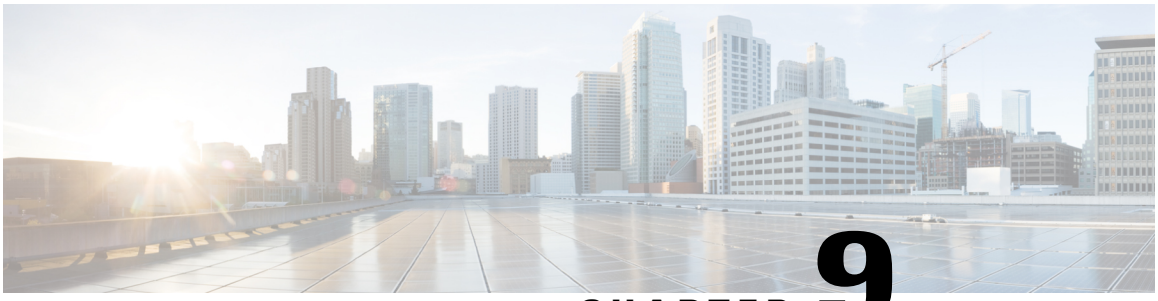
This example shows how to disable loop detection for the Virtual Router Redundancy Protocol:

```
n1000v# configure terminal
switch(config)# port-profile vrrp-1
switch(config-port-prof)# switchport mode trunk
switch(config-port-prof)# no shutdown
switch(config-port-prof)# disable-loop-detection vrrp
switch(config-port-prof)# state enabled
switch(config-port-prof)# vmware port-group
switch(config-port-prof)# show port-profile name vrrp-1
port-profile vrrp-1
 type: Vethernet
 description:
 status: enabled
 max-ports: 32
 min-ports: 1
 inherit:
 config attributes:
  switchport mode trunk
  disable-loop-detection vrrp
  no shutdown
 evaluated config attributes:
  switchport mode trunk
  disable-loop-detection vrrp
```

```
 no shutdown
assigned interfaces:
port-group: vrrp-1
system vlans: none
capability l3control: no
capability iscsi-multipath: no
capability vxlan: no
capability l3-vservice: no
port-profile role: none
port-binding: static
```

Feature History for Supporting Redundant Routing Protocol

Feature Name	Feature Name	Releases
Supporting Redundant Routing Protocol	4.2(1)SV1(5.1)	This feature was introduced



CHAPTER 9

Layer 2 Switching Configuration Limits

This chapter contains the following sections:

Layer 2 Switching Configuration Limits

The configuration limits are documented in the *Cisco Nexus 1000V Resource Availability Reference*.

Layer 2 Switching Configuration Limits

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