



Configuring VLANs

This chapter describes how to configure virtual LANs (VLANs) on Cisco NX-OS devices.

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Information About VLANs



Note

Beginning with Cisco Release 5.2(1) for Cisco Nexus 7000 Series devices, you can create Fibre Channel over Ethernet (FCoE) VLANs. For more information, see the *Cisco NX-OS FCoE Configuration Guide for Cisco Nexus 7000 and Cisco MDS 9500*.

You can use VLANs to divide the network into separate logical areas at the Layer 2 level. VLANs can also be considered as broadcast domains.

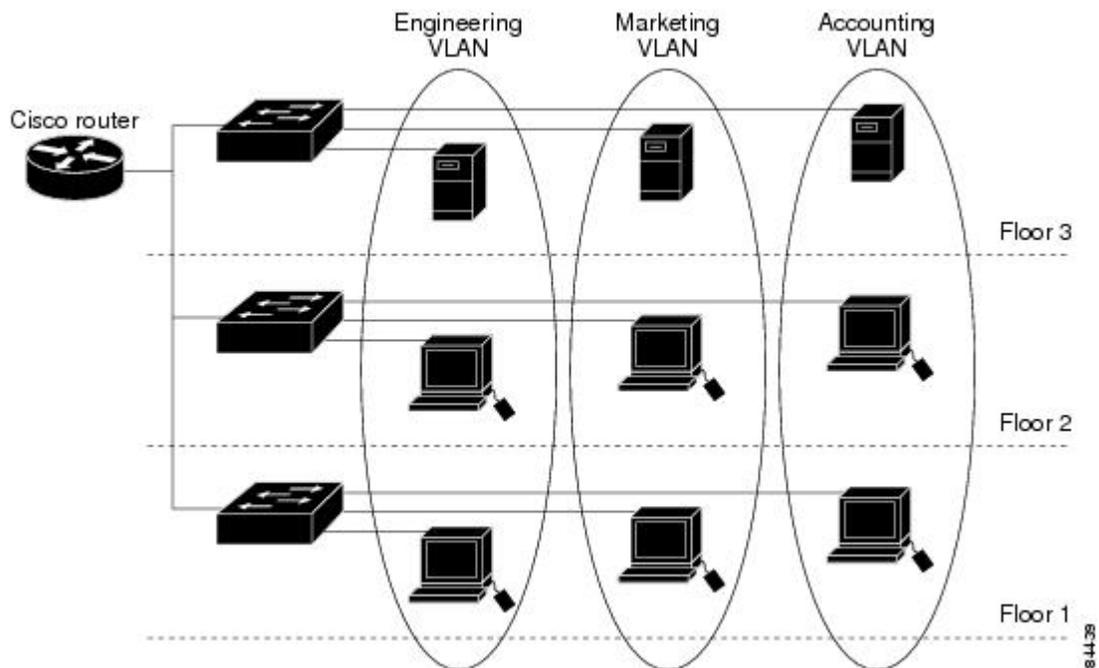
Any switch port can belong to a VLAN, and unicast broadcast and multicast packets are forwarded and flooded only to end stations in that VLAN. Each VLAN is considered a logical network, and packets destined for stations that do not belong to the VLAN must be forwarded through a router.

VLANs Overview

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

Any switch port 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 as a logical network, and packets destined for stations that do not belong to the VLAN must be forwarded through a router. The following figure shows VLANs as logical networks. The stations in the engineering department are assigned to one VLAN, the stations in the marketing department are assigned to another VLAN, and the stations in the accounting department are assigned to another VLAN.

Figure 1: VLANs as Logically Defined Networks



VLANs are usually associated with IP subnetworks. For example, all the end stations in a particular IP subnet belong to the same VLAN. To communicate between VLANs, you must route the traffic.

By default, a newly created VLAN is operational; that is, the newly created VLAN is in the no shutdown condition. Additionally, you can configure VLANs to be in the active state, which is passing traffic, or the suspended state, in which the VLANs are not passing packets. By default, the VLANs are in the active state and pass traffic.

A VLAN interface, or switched virtual interface (SVI), is a Layer 3 interface that is created to provide communication between VLANs. In order to route traffic between VLANs, you must create and configure a VLAN interface for each VLAN. Each VLAN requires only one VLAN interface.

**Note**

See the *Cisco Nexus 7000 Series NX-OS Interfaces Configuration Guide, Release 5.x* for complete information on configuring VLAN interfaces, and subinterfaces, as well as assigning IP addresses. This feature must be enabled before you can configure VLAN interfaces.

VLAN Ranges

**Note**

The extended system ID is always automatically enabled in Cisco NX-OS devices.

The device supports up to 4094 VLANs in accordance with the IEEE 802.1Q standard in each VDC. The software organizes these VLANs into ranges, and you use each range slightly differently.

This table describes the VLAN ranges.

Table 1: VLAN Ranges

VLANs Numbers	Range	Usage
1	Normal	Cisco 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.
1006—3967 and 4048—4093	Extended	You can create, name, and use these VLANs. You cannot change the following parameters: <ul style="list-style-type: none"> The state is always active. The VLAN is always enabled. You cannot shut down these VLANs.
3968-4047 and 4094	Internally allocated	These 80 VLANs and VLAN 4094 are allocated for internal device use. You cannot create, delete, or modify any VLANs within the block reserved for internal use.
3968-4094	Internally allocated	Beginning with Cisco release 5.2(1) for Cisco Nexus 7000 Series devices, VLANs 3968 to 4094 are reserved for internal use in each VDC by default.

VLANs Numbers	Range	Usage
		You can change the reserved VLANs to any other 128 contiguous VLAN range. When you reserve such a range, it frees up the range of VLANs that were allocated for internal use by default, and all of those VLANs are available for user configuration except for VLAN 4094. All VDCs inherit the new reserved range of VLANs.

The software allocates a group of VLAN numbers for features like multicast and diagnostics, that need to use internal VLANs for their operation. You cannot use, modify, or delete any of the VLANs in the reserved group. You can display the VLANs that are allocated internally and their associated use.

Beginning with Cisco NX-OS Release 5.2(1), the system allocates a block of 128 reserved VLANs (3968 to 4094) for these internal uses. You can change the block of 128 reserved VLANs to occupy another range of 128 adjacent VLANs. For example, you can change the reserved block of VLANs to be 400 to 528. You cannot assign a previously created VLAN as part of the 128 range of reserved VLANs. Anytime you change the reserved block of VLANs for the device, you must do the following:

- Enter the **copy running-configuration startup-configuration** command
- Reload the device

**Note**

When you change the range of reserved VLANs, the existing configurations for the new range of VLANs get deleted. A warning note is displayed as in the following example:

```
switch(config)# system vlan 2000 reserve
This will delete all configs on vlans 2000-2127. Continue anyway? (y/n) [no] y
Note: After switch reload, VLANs 2000-2127 will be reserved for internal use.
      This requires copy running-config to startup-config before
      switch reload. Creating VLANs within this range is not allowed.
switch(config)#
```

To return to the default block of reserved VLANs (3968 to 4094), you must enter the **no system reserve vlan** command. The write-erase procedure does not restore the default reserved VLAN range to 3968 to 4094.

Creating, Deleting, and Modifying VLANs

Beginning with Cisco NX-OS Release 5.1(1), you can configure a VLAN without actually creating the VLAN. This procedure is used for IGMP snooping, VTP, and other configurations.

**Note**

By default, all Cisco NX-OS ports are Layer 3 ports.

VLANs are numbered from 1 to 4094 for each VDC. All ports that you have configured as switch ports belong to the default VLAN when you first bring up the switch as a Layer 2 device. The default VLAN (VLAN1) uses only default values, and you cannot create, delete, or suspend activity in the default VLAN.

You create a VLAN by assigning a number to it; you can delete VLANs and move them from the active operational state to the suspended operational state. If you attempt to create a VLAN with an existing VLAN ID, the device goes into the VLAN submode but does not create the same VLAN again.

Newly created VLANs remain unused until Layer 2 ports are assigned to the specific VLAN. All the ports are assigned to VLAN1 by default.

Depending on the range of the VLAN, you can configure the following parameters for VLANs (except the default VLAN):

- VLAN name
- VLAN state
- Shutdown or not shutdown

**Note**

See the *Cisco Nexus 7000 Series NX-OS Interfaces Configuration Guide, Release 5.x* for information on configuring ports as VLAN access or trunk ports and assigning ports to VLANs.

When you delete a specified VLAN, the ports associated to that VLAN become inactive 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 reenables or re-creates that specified VLAN, the system automatically reinstates all the original ports to that VLAN. The static MAC addresses and aging time for that VLAN are not restored when the VLAN is reenables.

**Note**

Commands entered in the VLAN configuration submode are immediately executed. Beginning with Cisco release 5.1 for Nexus 7000 series devices, you must exit the VLAN configuration submode for configuration changes to take effect.

High Availability for VLANs

The software supports high availability for both stateful and stateless restarts, as during a cold reboot, for VLANs. For the stateful restarts, the software supports a maximum of three retries. If you try more than 3 times within 10 seconds of a restart, the software reloads the supervisor module.

You can upgrade or downgrade the software seamlessly when you use VLANs.

**Note**

See the *Cisco Nexus 7000 Series NX-OS High Availability and Redundancy Guide, Release 5.x*, for complete information on high availability features.

Virtualization Support for VLANs

The software supports virtual device contexts (VDCs), and VLAN configuration and operation are local to the VDC.

**Note**

See the *Cisco Nexus 7000 Series NX-OS Virtual Device Context Configuration Guide, Release 5.x*, for complete information on VDCs and assigning resources.

Each VLAN must have all of its ports in the same VDC. If you do not have enough resources allocated to the VDC, the software returns an error message.

When you create a new VDC, the device automatically creates a new default VLAN, VLAN1, and internally reserves VLANs for device use.

You can re-use the same numbers for VLANs in different VDCs.

One or more VLANs can be associated with a role to either allow or disallow the user to configure it. When a VLAN is associated with a role, the corresponding interfaces will also be subjected to the same check. For instance, if a role is allowed to access VLAN1, then that role also has access to the interfaces that have that VLAN. If an interface does not have the VLAN associated with a role, that interface is not accessible to that role.

Licensing Requirements for VLANs

The following table shows the licensing requirements for this feature.

Product	License Requirement
Cisco NX-OS	VLANs require no license. Any feature not included in a license package is bundled with the Cisco NX-OS system images and is provided at no extra charge to you. For a complete explanation of the Cisco NX-OS licensing scheme, see the <i>Cisco NX-OS Licensing Guide</i> .

However, using VDCs requires an Advanced Services license.

Prerequisites for Configuring VLANs

VLANs have the following prerequisites:

- You must be logged onto the device.
- If necessary, install the Advanced Services license and enter the desired VDC. Ensure that you have allocated enough resources for that VDC. See the *Cisco Nexus 7000 Series NX-OS Virtual Device Context Configuration Guide, Release 5.x*, for information on creating VDCs and allocating resources.
- You must create the VLAN before you can do any modification of that VLAN.

Guidelines and Limitations for Configuring VLANs

VLANs have the following configuration guidelines and limitations:

- The maximum number of VLANs per VDC is 4094.

- You can reuse VLAN ID numbers in different VDCs. For example, you can have VLAN10 in the default VDC and a completely separate VLAN10 in a newly created VDC, such as VDC 2 .
- You can configure a single VLAN or a range of VLANs.
- You cannot create, modify, or delete any VLANs that are within the group of VLANs reserved for internal use.
- VLAN1 is the default VLAN. You cannot create, modify, or delete this VLAN.
- VLANs 1006 to 4094 are always in the active state and are always enabled. You cannot suspend the state or shut down these VLANs.

Default Settings for VLANs

This table lists the default settings for VLAN parameters.

Table 2: Default VLAN Parameters

Parameters	Default
VLANs	Enabled
VLAN	VLAN1—A port is placed in VLAN1 when you configure it as a switch port.
VLAN ID	1
VLAN name	<ul style="list-style-type: none"> • Default VLAN (VLAN1)—default • All other VLANs—VLAN <i>vlan-id</i>
VLAN state	Active
STP	Enabled; Rapid PVST+ is enabled
VTP	Disabled
VTP version	1

Configuring a VLAN



Note See the *Cisco Nexus 7000 Series NX-OS Interfaces Configuration Guide, Release 5.x*, for information on assigning Layer 2 interfaces to VLANs (access or trunk ports). All interfaces are in VLAN1 by default.



Note If you are familiar with the Cisco IOS CLI, be aware that the Cisco NX-OS commands for this feature might differ from the Cisco IOS commands that you would use.

Creating and Deleting a VLAN - CLI Version

You can create or delete all VLANs except the default VLAN and those VLANs that are internally allocated for use by the device.

Once a VLAN is created, it is automatically in the active state.



Note When you delete a VLAN, ports associated to that VLAN become inactive. Therefore, no traffic flows and the packets are dropped. On trunk ports, the port remains open and the traffic from all other VLANs except the deleted VLAN continues to flow.

If you create a range of VLANs and some of these VLANs cannot be created, the software returns a message listing the failed VLANs, and all the other VLANs in the specified range are created.



Note You can also create and delete VLANs in the VLAN configuration submode.

Before You Begin

Ensure that you are in the correct VDC (or enter the **switchto vdc** command). You can repeat VLAN names and IDs in different VDCs, so you must confirm that you are working in the correct VDC.

SUMMARY STEPS

1. **config t**
2. **vlan** {*vlan-id* | *vlan-range*}
3. **exit**
4. (Optional) **show vlan**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	config t Example: switch# config t switch(config)#	Enters configuration mode.
Step 2	vlan {vlan-id vlan-range} Example: switch(config)# vlan 5 switch(config-vlan)#	Creates a VLAN or a range of VLANs. If you enter a number that is already assigned to a VLAN, the device puts you into the VLAN configuration submode for that VLAN. If you enter a number that is assigned to an internally allocated VLAN, the system returns an error message. However, if you enter a range of VLANs and one or more of the specified VLANs is outside the range of internally allocated VLANs, the command takes effect on only those VLANs outside the range. The range is from 2 to 4094; VLAN1 is the default VLAN and cannot be created or deleted. You cannot create or delete those VLANs that are reserved for internal use.
Step 3	exit Example: switch(config-vlan)# exit switch(config)#	Exits the VLAN mode.
Step 4	show vlan Example: switch# show vlan	(Optional) Displays information and status of VLANs.
Step 5	copy running-config startup-config Example: switch(config)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

This example shows how to create a range of VLANs from 15 to 20:

```
switch# config t
switch(config)# vlan 15-20
switch(config-vlan)#
```

Entering the VLAN Configuration Submode

To configure or modify the VLAN for the following parameters, you must be in the VLAN configuration submode:

- Name
- State
- Shut down

Before You Begin

Ensure that you are in the correct VDC (or enter the **switchto vdc** command). You can repeat VLAN names and IDs in different VDCs, so you must confirm that you are working in the correct VDC.

SUMMARY STEPS

1. **config t**
2. **vlan** {*vlan-id* | *vlan-range*}
3. **exit**
4. (Optional) **show vlan**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	config t Example: switch# config t switch(config)#	Enters configuration mode.
Step 2	vlan { <i>vlan-id</i> <i>vlan-range</i> }	Places you into the VLAN configuration submode. This submode allows you to name, set the state, disable, and shut down the VLAN or range of VLANs. You cannot change any of these values for VLAN1 or the internally allocated VLANs.
Step 3	exit Example: switch(config-vlan)# exit switch(config)#	Exits the VLAN configuration mode.
Step 4	show vlan Example: switch# show vlan	(Optional) Displays information and status of VLANs.
Step 5	copy running-config startup-config Example: switch(config)# copy running-config startup-config	(Optional) Copies the running configuration to the startup configuration.

This example shows how to enter and exit the VLAN configuration submode:

```
switch# config t
switch(config)# vlan 15
switch(config-vlan)# exit
switch(config)#
```

Configuring a VLAN

To configure or modify a VLAN for the following parameters, you must be in the VLAN configuration submode:

- Name
- State
- Shut down



Note You cannot create, delete, or modify the default VLAN or the internally allocated VLANs. Additionally, some of these parameters cannot be modified on some VLANs.

Before You Begin

Ensure that you are in the correct VDC (or enter the **switchto vdc** command). VLAN names and IDs can be repeated in different VDCs, so you must confirm which VDC that you are working in.

SUMMARY STEPS

1. **config t**
2. **vlan** {*vlan-id* | *vlan-range*}
3. **name** *vlan-name*
4. **state** {**active** | **suspend**}
5. **no shutdown**
6. **exit**
7. (Optional) **show vlan**
8. (Optional) **show vtp status**
9. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	config t Example: switch# config t switch(config)#	Enters configuration mode.
Step 2	vlan { <i>vlan-id</i> <i>vlan-range</i> }	Places you into the VLAN configuration submode. If the VLAN does not exist, the system creates the specified VLAN and then enters the VLAN configuration submode.
	Example: switch(config)# vlan 5 switch(config-vlan)#	

	Command or Action	Purpose
Step 3	name <i>vlan-name</i> Example: <pre>switch(config-vlan)# name accounting</pre>	Names the VLAN. You can enter up to 32 alphanumeric characters to name the VLAN. You cannot change the name of VLAN1 or the internally allocated VLANs. The default value is VLANxxxx where xxxx represent four numeric digits (including leading zeroes) equal to the VLAN ID number.
Step 4	state { active suspend } Example: <pre>switch(config-vlan)# state active</pre>	Sets the state of the VLAN to active or suspend. While the VLAN state is suspended, the ports associated with this VLAN become inactive, and that VLAN does not pass any traffic. The default state is active. You cannot suspend the state for the default VLAN or VLANs 1006 to 4094.
Step 5	no shutdown Example: <pre>switch(config-vlan)# no shutdown</pre>	Enables the VLAN. The default value is no shutdown (or enabled). You cannot shut down the default VLAN, VLAN1, or VLANs 1006 to 4094.
Step 6	exit Example: <pre>switch(config-vlan)# exit switch(config)#</pre>	Exits the VLAN configuration submenu.
Step 7	show vlan Example: <pre>switch# show vlan</pre>	(Optional) Displays information and status of VLANs.
Step 8	show vtp status Example: <pre>switch# show vtp status</pre>	(Optional) Displays information and status of VLAN Trunking Protocols (VTPs).
Step 9	copy running-config startup-config Example: <pre>switch(config)# copy running-config startup-config</pre>	(Optional) Copies the running configuration to the startup configuration. Note Commands entered in the VLAN configuration submenu are immediately executed. Beginning with Cisco release 5.1 for Nexus 7000 series devices, you must exit the VLAN configuration submenu for configuration changes to take effect.

This example shows how to configure optional parameters for VLAN 5:

```
switch# config t
switch(config)# vlan 5
switch(config-vlan)# name accounting
switch(config-vlan)# state active
switch(config-vlan)# no shutdown
switch(config-vlan)# exit
switch(config)#
```

Changing the Range of Reserved VLANs

To change the range of reserved VLANs, you must be in the configuration mode. After entering this command, you must do the following tasks:

- Enter the **copy running-config startup-config** command
- Reload the device

SUMMARY STEPS

1. **config t**
2. **system vlan {start-vlan} reserve**
3. **copy running-config startup-config**
4. **reload**
5. (Optional) **show system vlan reserved**

DETAILED STEPS

	Command or Action	Purpose
Step 1	config t Example: <pre>switch# config t switch(config)#</pre>	Enters configuration mode.
Step 2	system vlan {start-vlan} reserve Example: <pre>switch(config)# system vlan 2000 reserve This will delete all configs on vlans 2000-2127. Continue anyway? (y/n) [no] y Note: After switch reload, VLANs 2000-2127 will be reserved for internal use. This requires copy running-config to startup-config before switch reload. Creating VLANs within this range is not allowed. switch(config)#</pre>	<p>Allows you to change the reserved VLAN range by specifying the starting VLAN ID for your desired range.</p> <p>You can change the reserved VLANs to any other 128 contiguous VLAN range. When you reserve such a range, it frees up the range of VLANs that were allocated for internal use by default, and all of those VLANs are available for user configuration except for VLAN 4094. All VDCs inherit the new reserved range of VLANs.</p> <p>Note To return to the default range of reserved VLANs (3968-4094), you must enter the no system vlan reserve command.</p> <p>For more details and instructions, see VLAN Ranges, page 3.</p>
Step 3	copy running-config startup-config Example: <pre>switch(config)# copy running-config startup-config switch(config)#</pre>	<p>Copies the running configuration to the startup configuration.</p> <p>Note You must enter this command if you change the reserved block.</p>
Step 4	reload Example: <pre>switch(config)# reload</pre>	<p>Reloads the software, and modifications to VLAN ranges become effective.</p> <p>For more details about this command, see the <i>Cisco Nexus 7000 Series NX-OS Fundamentals Configuration Guide, Release 5.x</i></p>
Step 5	show system vlan reserved Example: <pre>switch(config)# show system vlan reserved</pre>	<p>(Optional)</p> <p>Displays the configured changes to the VLAN range.</p>

This example shows how to change the range of reserved VLANs:

```
switch# config t
switch(config)# system vlan 2000 reserve
switch(config)# copy running-config startup-config
switch(config)# reload
switch(config)# show system vlan reserved
```



Note You must reload the device for this change to take effect.

Configuring a VLAN Before Creating the VLAN

Beginning with Cisco NX-OS Release 5.1(1), you can configure a VLAN before you create the VLAN. This procedure is used for IGMP snooping, VTP, and other configurations.



Note The `show vlan` command does not display these VLANs unless you create it using the `vlan` command.

SUMMARY STEPS

1. `config t`
2. `vlan configuration {vlan-id}`

DETAILED STEPS

	Command or Action	Purpose
Step 1	config t Example: switch# <code>config t</code> switch(config)#	Enters configuration mode.
Step 2	vlan configuration {vlan-id} Example: switch(config)# <code>vlan configuration 20</code> switch(config-vlan-config)#	Allows you to configure VLANs without actually creating them.

This example shows how to configure a VLAN before creating it:

```
switch# config t
switch(config)# vlan configuration 20
switch(config-vlan-config)#
```

Verifying the VLAN Configuration

To display VLAN configuration information, perform one of the following tasks:

Command	Purpose
<code>show running-config vlan vlan-id</code>	Displays VLAN information.

Command	Purpose
show vlan [all-ports brief id <i>vlan-id</i> name <i>name</i> dot1q tag native]	Displays VLAN information.
show vlan summary	Displays a summary of VLAN information.
show vtp status	Displays VTP information.
show system vlan reserved	Displays system reserved VLAN range.

For information on the output of these commands, see the *Cisco Nexus 7000 Series NX-OS Layer 2 Switching Command Reference*.

Displaying and Clearing VLAN Statistics

To display VLAN configuration information, perform one of the following tasks:

Command	Purpose
clear vlan [id <i>vlan-id</i>] counters	Clears counters for all VLANs or for a specified VLAN.
show vlan counters	Displays information on Layer 2 packets in each VLAN.

Configuration Example for VLANs

The following example shows how to create and name a VLAN as well as how to make the state active and administratively up:

```
switch# configure terminal
switch(config)# vlan 10
switch(config-vlan)# name test
switch(config-vlan)# state active
switch(config-vlan)# no shutdown
switch(config-vlan)# exit
switch(config)#
```

Additional References for VLANs -- CLI Version

Related Documents

Related Topic	Document Title
Command reference	<i>Cisco Nexus 7000 Series NX-OS Layer 2 Switching Command Reference</i>

Related Topic	Document Title
NX-OS Layer 2 switching configuration	<i>Cisco Nexus 7000 Series NX-OS Layer 2 Switching Configuration Guide, Release 5.x</i>
Interfaces, VLAN interfaces, IP addressing, and port channels	<i>Cisco Nexus 7000 Series NX-OS Interfaces Configuration Guide, Release 5.x</i>
Multicast routing	<i>Cisco Nexus 7000 Series NX-OS Multicast Routing Configuration Guide, Release 5.x</i>
NX-OS fundamentals	<i>Cisco Nexus 7000 Series NX-OS Fundamentals Configuration Guide, Release 5.x</i>
High availability	<i>Cisco Nexus 7000 Series NX-OS High Availability and Redundancy Guide, Release 5.x</i>
System management	<i>Cisco Nexus 7000 Series NX-OS System Management Configuration Guide, Release 5.x</i>
VDCs	<i>Cisco Nexus 7000 Series NX-OS Virtual Device Context Configuration Guide, Release 5.x</i>
Licensing	<i>Cisco NX-OS Licensing Guide</i>
Release notes	
Release notes	<i>Cisco Nexus 7000 Series NX-OS Release Notes, Release 5.x</i>

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIBs	MIBs Link
CISCO-VLAN-MEMBERSHIP MIB: <ul style="list-style-type: none"> • vmMembership Table • MIBvmMembershipSummaryTable • MIBvmMembershipSummaryTable 	To locate and download MIBs, go to the following URL: http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

Feature History for Configuring VLANs -- CLI Version

This table lists the release history for this feature.

Table 3: Feature History for Configuring VLANs

Feature Name	Releases	Feature Information
Dynamic system reserved VLAN range	5.2(1)	You can change the range of the system reserve VLANs.
Configure VLAN before creating the VLAN	5.1(1)	You can configure a VLAN before creating the VLAN.
VLAN Trunking Protocol	4.1(2)	The device now runs VTP in transparent mode.
No change	4.2(1)	--

