



## Virtual Local Area Networks (VLANs)

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### Note

- For complete syntax and usage information for the commands used in this chapter, see these publications:  
[http://www.cisco.com/en/US/products/ps11846/prod\\_command\\_reference\\_list.html](http://www.cisco.com/en/US/products/ps11846/prod_command_reference_list.html)
  - Cisco IOS Release 15.4SY supports only Ethernet interfaces. Cisco IOS Release 15.4SY does not support any WAN features or commands.
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### Tip

For additional information about Cisco Catalyst 6500 Series Switches (including configuration examples and troubleshooting information), see the documents listed on this page:

[http://www.cisco.com/en/US/products/hw/switches/ps708/tsd\\_products\\_support\\_series\\_home.html](http://www.cisco.com/en/US/products/hw/switches/ps708/tsd_products_support_series_home.html)

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## Prerequisites for VLANs

The following recommendations apply to Fabric Extender (FEX) VLANs:

- FEX-configurable VLAN range—1000 VLANs of any 4K VLANs
- Total number of VLANs—Not to exceed 20 VLANs per FEX
- Maximum number of trunks—Not to exceed 4 trunks

## Restrictions for VLANs

- If the switch is in VTP server or transparent mode (see the [“How to Configure VTP”](#) section on page 26-10), you can configure VLANs in global and config-vlan configuration modes. When you configure VLANs in global and config-vlan configuration modes, the VLAN configuration is saved in the vlan.dat files. To display the VLAN configuration, enter the **show vlan** command.

If the switch is in VLAN transparent mode, use the copy **running-config startup-config** command to save the VLAN configuration to the startup-config file. After you save the running configuration as the startup configuration, use the **show running-config** and **show startup-config** commands to display the VLAN configuration.

- When the switch boots, if the VTP domain name and the VTP mode in the startup-config file and vlan.dat files do not match, the switch uses the configuration in the vlan.dat file.
- You can configure extended-range VLANs only in global configuration mode.
- Supervisor engine redundancy does not support nondefault VLAN data file names or locations. Do not enter the **vtp file file\_name** command on a switch that has a redundant supervisor engine.
- Before installing a redundant supervisor engine, enter the **no vtp file** command to return to the default configuration.
- Before you can create a VLAN, the switch must be in VTP server mode or VTP transparent mode. For information on configuring VTP, see [Chapter 26, “VLAN Trunking Protocol \(VTP\).”](#)
- The VLAN configuration is stored in the vlan.dat file, which is stored in nonvolatile memory. You can cause inconsistency in the VLAN database if you manually delete the vlan.dat file.
- To do a complete backup of your configuration, include the vlan.dat file in the backup.

## Information About VLANs

- [VLAN Overview, page 27-2](#)
- [VLAN Ranges, page 27-2](#)

## VLAN Overview

A VLAN is a group of end stations with a common set of requirements, independent of physical location. VLANs have the same attributes as a physical LAN but allow you to group end stations even if they are not located physically on the same LAN segment.

VLANs are usually associated with IP subnetworks. For example, all the end stations in a particular IP subnet belong to the same VLAN. Traffic between VLANs must be routed. LAN port VLAN membership is assigned manually on a port-by-port basis.

## VLAN Ranges



### Note

You must enable the extended system ID to use 4096 VLANs (see the [“Information about the Bridge ID”](#) section on page 32-3).

Cisco IOS Release 15.4SY supports 4096 VLANs in accordance with the IEEE 802.1Q standard. These VLANs are organized into several ranges; you use each range slightly differently. Some of these VLANs are propagated to other switches in the network when you use the VLAN Trunking Protocol (VTP). The extended-range VLANs are not propagated, so you must configure extended-range VLANs manually on each network device.

Table 27-1 describes the VLAN ranges.

Table 27-1 VLAN Ranges

VLANs	Range	Usage	Propagated by VTP
0, 4095	Reserved	For system use only. You cannot see or use these VLANs.	—
1	Normal	Cisco default. You can use this VLAN but you cannot delete it.	Yes
2–1001	Normal	For Ethernet VLANs; you can create, use, and delete these VLANs.	Yes
1002–1005	Normal	Cisco defaults for FDDI and Token Ring. You cannot delete VLANs 1002–1005.	Yes
1006–4094	Extended	For Ethernet VLANs only.	No
3968–4031	MET VLANs	Reserved for internal usage.	—

The following information applies to VLAN ranges:

- Layer 3 LAN ports, WAN interfaces and subinterfaces, and some software features use internal VLANs in the extended range. You cannot use an extended range VLAN that has been allocated for internal use.
- To display the VLANs used internally, enter the **show vlan internal usage** command. With earlier releases, enter the **show vlan internal usage** and **show cwan vlans** commands.
- You can configure ascending internal VLAN allocation (from 1006 and up) or descending internal VLAN allocation (from 4094 and down).
- You must enable the extended system ID to use extended range VLANs (see the [“Information about the Bridge ID”](#) section on page 32-3).

## Default Settings for VLANs

- VLAN ID: 1; range: 1–4094
- VLAN name:
  - VLAN 1: “default”
  - Other VLANs: “VLANvlan\_ID”
- 802.10 SAID: 10vlan\_ID; range: 100001–104094
- MTU size: 1500; range: 1500–18190
- Translational bridge 1: 0; range: 0–1005
- Translational bridge 2: 0; range: 0–1005
- VLAN state: active: active, suspend

- Pruning eligibility:
  - VLANs 2–1001 are pruning eligible
  - VLANs 1006–4094 are not pruning eligible

## How to Configure VLANs

- [Configurable VLAN Parameters, page 27-4](#)
- [VLAN Locking, page 27-4](#)
- [Creating or Modifying an Ethernet VLAN, page 27-5](#)
- [Assigning a Layer 2 LAN Interface to a VLAN, page 27-6](#)
- [Configuring the Internal VLAN Allocation Policy, page 27-6](#)
- [Configuring VLAN Translation, page 27-7](#)
- [Saving VLAN Information, page 27-9](#)

## Configurable VLAN Parameters



### Note

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- Ethernet VLAN 1 uses only default values.
  - Except for the VLAN name, Ethernet VLANs 1006 through 4094 use only default values.
  - You can configure the VLAN name for Ethernet VLANs 1006 through 4094.
- 

You can configure the following parameters for VLANs 2 through 1001:

- VLAN name
- VLAN type (Ethernet, FDDI, FDDI network entity title [NET], TrBRF, or TrCRF)
- VLAN state (active or suspended)
- Security Association Identifier (SAID)
- Bridge identification number for TrBRF VLANs
- Ring number for FDDI and TrCRF VLANs
- Parent VLAN number for TrCRF VLANs
- Spanning Tree Protocol (STP) type for TrCRF VLANs

## VLAN Locking

The VLAN locking feature provides an extra level of verification to ensure that you have configured the intended VLAN. When VLAN locking is enabled, you need to specify the VLAN name when you change a port from one VLAN to another. This feature affects **switchport** commands (in interface configuration mode) that specify the VLANs or private VLANs for access and trunk ports.

For additional information about how to configure access and trunk ports with VLAN locking enabled, see the [“How to Configure LAN Interfaces for Layer 2 Switching”](#) section on page 22-5.

For additional information about how to configure ports in private VLANs with VLAN locking enabled, see the [“How to Configure Private VLANs” section on page 28-10](#).

By default, the VLAN locking is disabled. To enable VLAN locking, perform this task:

Command	Purpose
Router(config)# <code>vlan port provisioning</code>	Enables VLAN locking.

## Creating or Modifying an Ethernet VLAN

User-configured VLANs have unique IDs from 1 to 4094, except for reserved VLANs (see [Table 27-1 on page 27-3](#)). Enter the `vlan` command with an unused ID to create a VLAN. Enter the `vlan` command for an existing VLAN to modify the VLAN (you cannot modify an existing VLAN that is being used by a Layer 3 port or a software feature).

See the [“Default Settings for VLANs” section on page 27-3](#) for the list of default parameters that are assigned when you create a VLAN. If you do not specify the VLAN type with the `media` keyword, the VLAN is an Ethernet VLAN.

To create or modify a VLAN, perform this task:

	Command	Purpose
Step 1	Router# <code>configure terminal</code>	Enters configuration mode.
Step 2	Router(config)# <code>vlan vlan_ID{ [-vlan_ID]   [,vlan_ID] }</code>	Creates or modifies an Ethernet VLAN, a range of Ethernet VLANs, or several Ethernet VLANs specified in a comma-separated list (do not enter space characters).
Step 3	Router(config-vlan)# <code>end</code>	Updates the VLAN database and returns to privileged EXEC mode.

When you create or modify an Ethernet VLAN, note the following information:

- Because Layer 3 ports and some software features require internal VLANs allocated from 1006 and up, configure extended-range VLANs starting with 4094.
- You can configure extended-range VLANs only in global configuration mode. You cannot configure extended-range VLANs in VLAN database mode.
- Layer 3 ports and some software features use extended-range VLANs. If the VLAN you are trying to create or modify is being used by a Layer 3 port or a software feature, the switch displays a message and does not modify the VLAN configuration.

When deleting VLANs, note the following information:

- You cannot delete the default VLANs for the different media types: Ethernet VLAN 1 and FDDI or Token Ring VLANs 1002 to 1005.
- When you delete a VLAN, any LAN ports configured as access ports assigned to that VLAN become inactive. The ports remain associated with the VLAN (and inactive) until you assign them to a new VLAN.

This example shows how to create an Ethernet VLAN in global configuration mode and verify the configuration:

```
Router# configure terminal
```

```
Router(config)# vlan 3
Router(config-vlan)# end
Router# show vlan id 3
```

```
VLAN Name                Status    Ports
-----
3      VLAN0003                active

VLAN Type  SAID      MTU   Parent RingNo BridgeNo  Stp  BrdgMode Trans1  Trans2
-----
3      enet    100003   1500  -     -     -     -     -       0      0

Primary Secondary Type            Interfaces
-----
```

## Assigning a Layer 2 LAN Interface to a VLAN

A VLAN created in a management domain remains unused until you assign one or more LAN ports to the VLAN.



**Note** Make sure you assign LAN ports to a VLAN of the appropriate type. Assign Ethernet ports to Ethernet-type VLANs.

To assign one or more LAN ports to a VLAN, complete the procedures in the [“How to Configure LAN Interfaces for Layer 2 Switching”](#) section on page 22-5.


## Configuring the Internal VLAN Allocation Policy

For more information about VLAN allocation, see the [“VLAN Ranges”](#) section on page 27-2.



**Note** The internal VLAN allocation policy is applied only following a reload.

To configure the internal VLAN allocation policy, perform this task:

	Command	Purpose
Step 1	Router(config)# <b>vlan internal allocation policy</b> { <b>ascending</b>   <b>descending</b> }	Configures the internal VLAN allocation policy.
Step 2	Router(config)# <b>end</b>	Exits configuration mode.
Step 3	Router# <b>reload</b>	Applies the new internal VLAN allocation policy.
		 <p><b>Caution</b> You do not need to enter the <b>reload</b> command immediately. Enter the <b>reload</b> command during a planned maintenance window.</p>

When you configure the internal VLAN allocation policy, note the following information:

- Enter the **ascending** keyword to allocate internal VLANs from 1006 and up.
- Enter the **descending** keyword to allocate internal VLAN from 4094 and down.

This example shows how to configure descending as the internal VLAN allocation policy:

```
Router# configure terminal
Router(config)# vlan internal allocation policy descending
```

## Configuring VLAN Translation

- [VLAN Translation Guidelines and Restrictions, page 27-7](#)
- [Configuring VLAN Translation on a Trunk Port, page 27-8](#)
- [Enabling VLAN Translation on Other Ports in a Port Group, page 27-9](#)



### Note

- To avoid spanning tree loops, be careful not to misconfigure the VLAN translation feature.
- On trunk ports, you can translate one VLAN number to another VLAN number, which transfers all traffic received in one VLAN to the other VLAN.

## VLAN Translation Guidelines and Restrictions

When translating VLANs, follow these guidelines and restrictions:

- A VLAN translation configuration is inactive if it is applied to ports that are not Layer 2 trunks.
- Do not configure translation of ingress native VLAN traffic on an 802.1Q trunk. Because 802.1Q native VLAN traffic is untagged, it cannot be recognized for translation. You can translate traffic from other VLANs to the native VLAN of an 802.1Q trunk.
- Do not remove the VLAN to which you are translating from the trunk.
- The VLAN translation configuration applies to all ports in a port group. VLAN translation is disabled by default on all ports in a port group. Enable VLAN translation on ports as needed.
- Cisco IOS Release 15.4SY supports only IEEE 802.1Q trunking.

*Table 27-2 Module Support for VLAN Translation*

Product Number	Number of Ports	Number of Port Groups	Port Ranges per Port Group	Translations per Port Group
VS-S2T-10G-XL VS-S2T-10G	5	5	1 port in each group	16
WS-X6904-40G-2T	See the <a href="#">Release Notes</a> .			16
WS-X6908-10GE	8	8	1 port in each group	16
WS-X6816-10T-2T, WS-X6716-10T	16	16	1 port in each group	16
WS-X6816-10G-2T, WS-X6716-10GE	16	16	1 port in each group	16
WS-X6704-10GE	4	4	1 port in each group	128
WS-X6848-TX-2T, WS-X6748-GE-TX	48	4	1-12 13-24 25-36 37-48	128

Table 27-2 Module Support for VLAN Translation (continued)

Product Number	Number of Ports	Number of Port Groups	Port Ranges per Port Group	Translations per Port Group
WS-X6848-SFP-2T, WS-X6748-SFP	48	4	1–23, odd 2–24, even 25–47, odd 26–48, even	128
WS-X6824-SFP-2T, WS-X6724-SFP	24	2	1–12 13–24	128
C6800-32P10G, C6800-32P10G-XL	32	4	1–15, odd 2–16, even 17–31, odd 18–32, even	16



**Note** To configure a port as a trunk, see the “Configuring a Layer 2 Switching Port as a Trunk” section on page 22-8.

## Configuring VLAN Translation on a Trunk Port

To translate VLANs on a trunk port, perform this task:

	Command	Purpose
<b>Step 1</b>	Router(config)# <b>interface</b> <i>type slot/port</i>	Selects the Layer 2 trunk port to configure.
<b>Step 2</b>	Router(config-if)# <b>switchport vlan mapping enable</b>	Enables VLAN translation.
<b>Step 3</b>	Router(config-if)# <b>switchport vlan mapping</b> <i>original_vlan_ID translated_vlan_ID</i>	Translates a VLAN to another VLAN. The valid range is 1 to 4094.  When you configure a VLAN mapping from the original VLAN to the translated VLAN on a port, traffic arriving on the original VLAN gets mapped or translated to the translated VLAN at the ingress of the switch port, and the traffic internally tagged with the translated VLAN gets mapped to the original VLAN before leaving the switch port. This method of VLAN mapping is a two-way mapping.
<b>Step 4</b>	Router(config-if)# <b>end</b>	Exits configuration mode.

This example shows how to map VLAN 1649 to VLAN 755 Gigabit Ethernet port 5/2:

```
Router# configure terminal
Router(config)# interface gigabitethernet 5/2
Router(config-if)# switchport vlan mapping 1649 755
Router(config-if)# end
Router#
```



This example shows how to verify the configuration:

```
Router# show interface gigabitethernet 5/2 vlan mapping
State: enabled
Original VLAN Translated VLAN
-----
      1649             755
```

## Enabling VLAN Translation on Other Ports in a Port Group

To enable VLAN translation on other ports in a port group, perform this task:

	Command	Purpose
Step 1	Router(config)# <b>interface</b> <i>type slot/port</i>	Selects the LAN port to configure.
Step 2	Router(config-if)# <b>switchport vlan mapping enable</b>	Enables VLAN translation.
Step 3	Router(config-if)# <b>end</b>	Exits configuration mode.

This example shows how to enable VLAN translation on a port:

```
Router# configure terminal
Router(config)# interface gigabitethernet 5/2
Router(config-if)# switchport vlan mapping enable
Router(config-if)# end
```

## Saving VLAN Information

The VLAN database is stored in the `vlan.dat` file. You should create a backup of the `vlan.dat` file in addition to backing up the `running-config` and `startup-config` files. If you replace the existing supervisor engine, copy the `startup-config` file as well as the `vlan.dat` file to restore the system. The `vlan.dat` file is read on bootup and you will have to reload the supervisor engine after uploading the file. To view the file location, use the **dir vlan.dat** command. To copy the file (binary), use the **copy vlan.dat tftp** command.



### Tip

For additional information about Cisco Catalyst 6500 Series Switches (including configuration examples and troubleshooting information), see the documents listed on this page:

[http://www.cisco.com/en/US/products/hw/switches/ps708/tsd\\_products\\_support\\_series\\_home.html](http://www.cisco.com/en/US/products/hw/switches/ps708/tsd_products_support_series_home.html)

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