Catalyst 2960-XR Switch VLAN Configuration Guide, Cisco IOS Release 15.0(2)EX1

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目 次

Preface xi

Document Conventions xi

Related Documentation xiii

Obtaining Documentation and Submitting a Service Request xiii

Using the Command-Line Interface 1

Information About Using the Command-Line Interface 1

Command Modes 1

Using the Help System 3

Understanding Abbreviated Commands 4

No and default Forms of Commands 4

CLI Error Messages 4

Configuration Logging 5

How to Use the CLI to Configure Features 5

Configuring the Command History 5

Changing the Command History Buffer Size 6

Recalling Commands 6

Disabling the Command History Feature 7

Enabling and Disabling Editing Features 7

Editing Commands through Keystrokes 8

Editing Command Lines That Wrap 9

Searching and Filtering Output of show and more Commands 10

Accessing the CLI through a Console Connection or through Telnet 11

Configuring VTP 13

Finding Feature Information 13

Prerequisites for VTP 13

Information About VTP 14

VTP 14

VTP Domain 14

VTP Modes 15
VTP Advertisements 16
VTP Version 2 17
VTP Version 3 17
VTP Pruning 18
VTP and Switch Stacks 20
VTP Configuration Guidelines 20
Configuration Requirements 20
VTP Settings 20
Domain Names for Configuring VTP 21
Passwords for the VTP Domain 21
VTP Version 22
Default VTP Configuration 23
How to Configure VTP 24
Configuring VTP Mode 24
Configuring a VTP Version 3 Password 26
Configuring a VTP Version 3 Primary Server 27
Enabling the VTP Version 28
Enabling VTP Pruning 30
Configuring VTP on a Per-Port Basis 31
Adding a VTP Client Switch to a VTP Domain 32
Monitoring VTP 34
Configuration Examples for VTP 35
Example: Configuring the Switch as a VTP Server 35
Example: Configuring a Hidden Password 36
Example: Configuring a VTP Version 3 Primary Server 36
Example: Configuring VTP on a Per-Port Basis 36
Where to Go Next 36
Additional References 37
Feature History and Information for VTP 38
Configuring VLANs 39
Finding Feature Information 39
Prerequisites for VLANs 39
Restrictions for VLANs 40
Information About VLANs 40

Logical Networks 40
Supported VLANs 41
VLAN Port Membership Modes 41
Normal-Range VLAN Overview 42
Token Ring VLANs 43
Normal-Range VLANs Configuration Process 43
VLAN Configuration Saving Process 43
Normal-Range VLAN Configuration Guidelines 44
Extended-Range VLAN Configuration Guidelines 45
Default Ethernet VLAN Configuration 46
Default VLAN Configuration 46
How to Configure VLANs 47
How to Configure Normal-Range VLANs 47
Creating or Modifying an Ethernet VLAN 47
Deleting a VLAN 49
Assigning Static-Access Ports to a VLAN 50
How to Configure Extended-Range VLANs 52
Creating an Extended-Range VLAN 52
Creating an Extended-Range VLAN with an Internal VLAN ID 54
Monitoring VLANs 57
Configuration Examples 57
Example: Creating a VLAN Name 57
Example: Configuring a Port as Access Port 57
Example: Creating an Extended-Range VLAN 58
Where to Go Next 58
Additional References 58
Feature History and Information for VLAN 59
Configuring VLAN Trunks 61
Finding Feature Information 61
Prerequisites for VLAN Trunks 61
Restrictions for VLAN Trunks 62
Information About VLAN Trunks 62
Trunking Overview 62
Trunking Modes 62
Layer 2 Interface Modes 63

Allowed VLANs on a Trunk 64
Load Sharing on Trunk Ports 64
Network Load Sharing Using STP Priorities 64
Network Load Sharing Using STP Path Cost 65
Feature Interactions 66
Default Layer 2 Ethernet Interface VLAN Configuration 66
How to Configure VLAN Trunks 67
Configuring an Ethernet Interface as a Trunk Port 67
Configuring a Trunk Port 67
Defining the Allowed VLANs on a Trunk 70
Changing the Pruning-Eligible List 71
Configuring the Native VLAN for Untagged Traffic 73
Configuring Trunk Ports for Load Sharing 74
Configuring Load Sharing Using STP Port Priorities 74
Configuring Load Sharing Using STP Path Cost 78
Configuration Examples for VLAN Trunking 81
Example: Configuring an IEEE 802.1Q Trunk 81
Example: Removing a VLAN 82
Where to Go Next 82
Additional References 82
Feature History and Information for VLAN Trunks 83
Configuring Private VLANs 85
Finding Feature Information 85
Prerequisites for Private VLANs 85
Secondary and Primary VLAN Configuration 86
Private VLAN Port Configuration 87
Restrictions for Private VLANs 88
Limitations with Other Features 88
Information About Private VLANs 89
Private VLAN Domains 89
Secondary VLANs 90
Private VLANs Ports 90
Private VLANs in Networks 91
IP Addressing Scheme with Private VLANs 92
Private VLANs Across Multiple Switches 92

Private VLAN Interaction with Other Features 93
Private VLANs and Unicast, Broadcast, and Multicast Traffic 93
Private VLANs and SVIs 94
Private VLANs and Switch Stacks 94
Private VLAN Configuration Tasks 94
Default Private VLAN Configuration 95
How to Configure Private VLANs 95
Configuring and Associating VLANs in a Private VLAN 95
Configuring a Layer 2 Interface as a Private VLAN Host Port 98
Configuring a Layer 2 Interface as a Private VLAN Promiscuous Port 100
Mapping Secondary VLANs to a Primary VLAN Layer 3 VLAN Interface 101
Monitoring Private VLANs 103
Configuration Examples for Private VLANs 104
Example: Configuring a Primary VLAN, Isolated VLAN, and a Community of VLANs 104
Example: Configuring an Interface as a Host Port 104
Example: Configuring an Interface as a Private VLAN Promiscuous Port 105
Example: Mapping Secondary VLANs to a Primary VLAN Interface 105
Example: Monitoring Private VLANs 106
Where to Go Next 106
Additional References 106
Feature History and Information for Private VLANs 107
Configuring VMPS 109
Finding Feature Information 109
Prerequisites for VMPS 109
Restrictions for VMPS 110
Information About VMPS 110
Dynamic VLAN Assignments 110
Dynamic-Access Port VLAN Membership 111
Default VMPS Client Configuration 112
How to Configure VMPS 112
Entering the IP Address of the VMPS 112
Configuring Dynamic-Access Ports on VMPS Clients 114
Reconfirming VLAN Memberships 115
Changing the Reconfirmation Interval 116
Changing the Retry Count 117

Troubleshooting Dynamic-Access Port VLAN Membership 118
Monitoring the VMPS 119
Configuration Example for VMPS 119
Example: VMPS Configuration 119
Where to Go Next 121
Additional References 121
Feature History and Information for VMPS 122
Configuring IEEE 802.1Q and Layer 2 Protocol Tunneling 123
Finding Feature Information 123
Prerequisites for Configuring Tunneling 123
IEEE 802.1Q Tunneling and Incompatibilities 124
Layer 2 Protocol Tunneling 124
Layer 2 Tunneling for EtherChannels 126
Information about Tunneling 126
IEEE 802.1Q and Layer 2 Protocol Overview 126
IEEE 802.1Q Tunneling 126
IEEE 802.1Q Tunneling Configuration Guidelines 129
Native VLANs 129
System MTU 130
Default IEEE 802.1Q Tunneling Configuration 131
Layer 2 Protocol Tunneling Overview 131
Layer 2 Protocol Tunneling on Ports 133
Default Layer 2 Protocol Tunneling Configuration 134
How to Configure Tunneling 135
Configuring an IEEE 802.1Q Tunneling Port 135
Configuring Layer 2 Protocol Tunneling 138
Configuring the SP Edge Switch 141
Configuring the Customer Switch 144
Configuration Examples for IEEE 802.1Q and Layer 2 Protocol Tunneling 146
Example: Configuring an IEEE 802.1Q Tunneling Port 146
Example: Configuring Layer 2 Protocol Tunneling 147
Examples: Configuring the SP Edge and Customer Switches 147
Monitoring Tunneling Status 149
Where to Go Next 149
Additional References 150

Feature History and Information for Tunneling 151

Configuring Voice VLANs 153

Finding Feature Information 153

Prerequisites for Voice VLANs 153

Restrictions for Voice VLANs 154

Information About Voice VLAN 154

Voice VLANs 154

Cisco IP Phone Voice Traffic 155

Cisco IP Phone Data Traffic 155

Voice VLAN Configuration Guidelines 156

Default Voice VLAN Configuration 157

How to Configure Voice VLAN 157

Configuring Cisco IP Phone Voice Traffic 157

Configuring the Priority of Incoming Data Frames 160

Monitoring Voice VLAN 161

Configuration Examples for Voice VLANs 161

Example: Configuring Cisco IP Phone Voice Traffic 161

Example: Configuring a Port Connected to an IP Phone Not to Change Frame Priority 162

Where to Go Next 163

Additional References 163

Feature History and Information for Voice VLAN 164

Preface

This guide describes configuration information and examples for VLANs on the switch.

- Document Conventions, xi ページ
- Related Documentation, xiii ページ
- Obtaining Documentation and Submitting a Service Request, xiii ページ

Document Conventions

This document uses the following conventions:

Convention	Description
^ or Ctrl	Both the ^ symbol and Ctrl represent the Control (Ctrl) key on a keyboard. For example, the key combination **^D** or **Ctrl-D** means that you hold down the Control key while you press the D key. (Keys are indicated in capital letters but are not case sensitive.)
bold font	Commands and keywords and user-entered text appear in **bold** font.
Italic font	Document titles, new or emphasized terms, and arguments for which you supply values are in *italic* font.
`Courier font`	Terminal sessions and information the system displays appear in `courier` font.
`Bold Courier font`	Bold Courier font indicates text that the user must enter.
[x]	Elements in square brackets are optional.
...	An ellipsis (three consecutive nonbolded periods without spaces) after a syntax element indicates that the element can be repeated.
|	A vertical line, called a pipe, indicates a choice within a set of keywords or arguments.

Convention	Description
[x | y]	Optional alternative keywords are grouped in brackets and separated by vertical bars.
{x | y}	Required alternative keywords are grouped in braces and separated by vertical bars.
[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.
string	A nonquoted set of characters. Do not use quotation marks around the string or the string will include the quotation marks.
< >	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.

Reader Alert Conventions

This document uses the following conventions for reader alerts:

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

ヒント Means *the following information will help you solve a problem.*

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

ワンポイント アドバイス Means *the described action saves time.* You can save time by performing the action described in the paragraph.

警告 **Means *reader be warned.* In this situation, you might perform an action that could result in bodily injury.**

Related Documentation

（注） Before installing or upgrading the switch, refer to the switch release notes.

- Catalyst 2960-XR Switch documentation, located at:

  http://www.cisco.com/go/cat2960xr_docs

- Cisco SFP and SFP+ modules documentation, including compatibility matrixes, located at:

  http://www.cisco.com/en/US/products/hw/modules/ps5455/tsd_products_support_series_home.html

- Cisco Validated Designs documents, located at:

  http://www.cisco.com/go/designzone

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, submitting a service request, and gathering additional information, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

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

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第 1 章

Using the Command-Line Interface

- Information About Using the Command-Line Interface, 1 ページ
- How to Use the CLI to Configure Features, 5 ページ

Information About Using the Command-Line Interface

Command Modes

The Cisco IOS user interface is divided into many different modes. The commands available to you depend on which mode you are currently in. Enter a question mark (?) at the system prompt to obtain a list of commands available for each command mode.

You can start a CLI session through a console connection, through Telnet, a SSH, or by using the browser.

When you start a session, you begin in user mode, often called user EXEC mode. Only a limited subset of the commands are available in user EXEC mode. For example, most of the user EXEC commands are one-time commands, such as **show** commands, which show the current configuration status, and **clear** commands, which clear counters or interfaces. The user EXEC commands are not saved when the switch reboots.

To have access to all commands, you must enter privileged EXEC mode. Normally, you must enter a password to enter privileged EXEC mode. From this mode, you can enter any privileged EXEC command or enter global configuration mode.

Using the configuration modes (global, interface, and line), you can make changes to the running configuration. If you save the configuration, these commands are stored and used when the switch reboots. To access the various configuration modes, you must start at global configuration mode. From global configuration mode, you can enter interface configuration mode and line configuration mode.

This table describes the main command modes, how to access each one, the prompt you see in that mode, and how to exit the mode.

表 *1* : *Command Mode Summary*

Mode	Access Method	Prompt	Exit Method	About This Mode
User EXEC	Begin a session using Telnet, SSH, or console.	`Switch>`	Enter **logout** or **quit**.	Use this mode to • Change terminal settings. • Perform basic tests. • Display system information.
Privileged EXEC	While in user EXEC mode, enter the **enable** command.	`Switch#`	Enter **disable** to exit.	Use this mode to verify commands that you have entered. Use a password to protect access to this mode.
Global configuration	While in privileged EXEC mode, enter the **configure** command.	`Switch(config)#`	To exit to privileged EXEC mode, enter **exit** or **end**, or press **Ctrl-Z**.	Use this mode to configure parameters that apply to the entire switch.
VLAN configuration	While in global configuration mode, enter the **vlan** *vlan-id* command.	`Switch(config-vlan)#`	To exit to global configuration mode, enter the **exit** command. To return to privileged EXEC mode, press **Ctrl-Z** or enter **end**.	Use this mode to configure VLAN parameters. When VTP mode is transparent, you can create extended-range VLANs (VLAN IDs greater than 1005) and save configurations in the switch startup configuration file.
Interface configuration	While in global configuration mode, enter the **interface** command (with a specific interface).	`Switch(config-if)#`	To exit to global configuration mode, enter **exit**. To return to privileged EXEC mode, press **Ctrl-Z** or enter **end**.	Use this mode to configure parameters for the Ethernet ports.

Mode	Access Method	Prompt	Exit Method	About This Mode
Line configuration	While in global configuration mode, specify a line with the **line vty** or **line console** command.	`Switch(config-line)#`	To exit to global configuration mode, enter **exit**. To return to privileged EXEC mode, press **Ctrl-Z** or enter **end**.	Use this mode to configure parameters for the terminal line.

Using the Help System

You can enter a question mark (?) at the system prompt to display a list of commands available for each command mode. You can also obtain a list of associated keywords and arguments for any command.

手順の概要

1. **help**
2. *abbreviated-command-entry* **?**
3. *abbreviated-command-entry* <Tab>
4. **?**
5. *command* **?**
6. *command keyword* **?**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**help** 例： `Switch# help`	Obtains a brief description of the help system in any command mode.

ステップ 2	*abbreviated-command-entry* **?**
	
	例：
	`Switch# di?`
	`dir disable disconnect`
		Obtains a list of commands that begin with a particular character string.

ステップ 3	*abbreviated-command-entry* <Tab>
	
	例：
	`Switch# sh conf<tab>`
	`Switch# show configuration`
		Completes a partial command name.

	コマンドまたはアクション	目的
ステップ 4	**?** 例： `Switch> ?`	Lists all commands available for a particular command mode.
ステップ 5	*command* **?** 例： `Switch> show ?`	Lists the associated keywords for a command.

ステップ 6	*command keyword* **?**
	
	例：
	`Switch(config)# cdp holdtime ?`
	`  <10-255> Length of time (in sec) that receiver must keep this packet`
		Lists the associated arguments for a keyword.

Understanding Abbreviated Commands

You need to enter only enough characters for the switch to recognize the command as unique.

This example shows how to enter the **show configuration** privileged EXEC command in an abbreviated form:

```
Switch# show conf
```

No and default Forms of Commands

Almost every configuration command also has a **no** form. In general, use the **no** form to disable a feature or function or reverse the action of a command. For example, the **no shutdown** interface configuration command reverses the shutdown of an interface. Use the command without the keyword **no** to reenable a disabled feature or to enable a feature that is disabled by default.

Configuration commands can also have a **default** form. The **default** form of a command returns the command setting to its default. Most commands are disabled by default, so the **default** form is the same as the **no** form. However, some commands are enabled by default and have variables set to certain default values. In these cases, the **default** command enables the command and sets variables to their default values.

CLI Error Messages

This table lists some error messages that you might encounter while using the CLI to configure your switch.

表 *2* : ***Common CLI Error Messages***

Error Message	Meaning	How to Get Help
`% Ambiguous command: "show con"`	You did not enter enough characters for your switch to recognize the command.	Reenter the command followed by a question mark (?) with a space between the command and the question mark. The possible keywords that you can enter with the command appear.
`% Incomplete command.`	You did not enter all the keywords or values required by this command.	Reenter the command followed by a question mark (?) with a space between the command and the question mark. The possible keywords that you can enter with the command appear.
`% Invalid input detected at '^' marker.`	You entered the command incorrectly. The caret (^) marks the point of the error.	Enter a question mark (?) to display all the commands that are available in this command mode. The possible keywords that you can enter with the command appear.

Configuration Logging

You can log and view changes to the switch configuration. You can use the Configuration Change Logging and Notification feature to track changes on a per-session and per-user basis. The logger tracks each configuration command that is applied, the user who entered the command, the time that the command was entered, and the parser return code for the command. This feature includes a mechanism for asynchronous notification to registered applications whenever the configuration changes. You can choose to have the notifications sent to the syslog.

（注） Only CLI or HTTP changes are logged.

How to Use the CLI to Configure Features

Configuring the Command History

The software provides a history or record of commands that you have entered. The command history feature is particularly useful for recalling long or complex commands or entries, including access lists. You can customize this feature to suit your needs.

Changing the Command History Buffer Size

By default, the switch records ten command lines in its history buffer. You can alter this number for a current terminal session or for all sessions on a particular line. This procedure is optional.

手順の概要

1. **terminal history** [**size** *number-of-lines*]

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**terminal history** [**size** *number-of-lines*] 例： `Switch# terminal history size 200`	Changes the number of command lines that the switch records during the current terminal session in the privileged EXEC mode. You can configure the size from 0 through 256.

Recalling Commands

To recall commands from the history buffer, perform one of the actions listed in this table. These actions are optional.

（注） The arrow keys function only on ANSI-compatible terminals such as VT100s.

手順の概要

1. **Ctrl-P** or use the **up arrow** key
2. **Ctrl-N** or use the **down arrow** key
3. **show history**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**Ctrl-P** or use the **up arrow** key	Recalls commands in the history buffer, beginning with the most recent command. Repeat the key sequence to recall successively older commands.
ステップ 2	**Ctrl-N** or use the **down arrow** key	Returns to more recent commands in the history buffer after recalling commands with **Ctrl-P** or the up arrow key. Repeat the key sequence to recall successively more recent commands.

	コマンドまたはアクション	目的
ステップ 3	**show history** 例： `Switch# show history`	Lists the last several commands that you just entered in privileged EXEC mode. The number of commands that appear is controlled by the setting of the **terminal history** global configuration command and the **history** line configuration command.

Disabling the Command History Feature

The command history feature is automatically enabled. You can disable it for the current terminal session or for the command line. This procedure is optional.

手順の概要

1. **terminal no history**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**terminal no history** 例： `Switch# terminal no history`	Disables the feature during the current terminal session in the privileged EXEC mode.

Enabling and Disabling Editing Features

Although enhanced editing mode is automatically enabled, you can disable it, and reenable it.

手順の概要

1. **terminal editing**
2. **terminal no editing**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**terminal editing** 例： `Switch# terminal editing`	Reenables the enhanced editing mode for the current terminal session in the privileged EXEC mode.
ステップ 2	**terminal no editing** 例： `Switch# terminal no editing`	Disables the enhanced editing mode for the current terminal session in the privileged EXEC mode.

Editing Commands through Keystrokes

The keystrokes help you to edit the command lines. These keystrokes are optional.

（注） The arrow keys function only on ANSI-compatible terminals such as VT100s.

表 *3* : ***Editing Commands***

Editing Commands	Description
Ctrl-B or use the **left arrow** key	Moves the cursor back one character.
Ctrl-F or use the **right arrow** key	Moves the cursor forward one character.
Ctrl-A	Moves the cursor to the beginning of the command line.
Ctrl-E	Moves the cursor to the end of the command line.
Esc B	Moves the cursor back one word.
Esc F	Moves the cursor forward one word.
Ctrl-T	Transposes the character to the left of the cursor with the character located at the cursor.
Delete or **Backspace** key	Erases the character to the left of the cursor.
Ctrl-D	Deletes the character at the cursor.

Ctrl-K	Deletes all characters from the cursor to the end of the command line.
Ctrl-U or **Ctrl-X**	Deletes all characters from the cursor to the beginning of the command line.
Ctrl-W	Deletes the word to the left of the cursor.
Esc D	Deletes from the cursor to the end of the word.
Esc C	Capitalizes at the cursor.
Esc L	Changes the word at the cursor to lowercase.
Esc U	Capitalizes letters from the cursor to the end of the word.
Ctrl-V or **Esc Q**	Designates a particular keystroke as an executable command, perhaps as a shortcut.
Return key	Scrolls down a line or screen on displays that are longer than the terminal screen can display. （注） The More prompt is used for any output that has more lines than can be displayed on the terminal screen, including **show** command output. You can use the **Return** and **Space** bar keystrokes whenever you see the More prompt.
Space bar	Scrolls down one screen.
Ctrl-L or **Ctrl-R**	Redisplays the current command line if the switch suddenly sends a message to your screen.

Editing Command Lines That Wrap

You can use a wraparound feature for commands that extend beyond a single line on the screen. When the cursor reaches the right margin, the command line shifts ten spaces to the left. You cannot see the first ten characters of the line, but you can scroll back and check the syntax at the beginning of the command. The keystroke actions are optional.

To scroll back to the beginning of the command entry, press **Ctrl-B** or the left arrow key repeatedly. You can also press **Ctrl-A** to immediately move to the beginning of the line.

（注） The arrow keys function only on ANSI-compatible terminals such as VT100s.

The following example shows how to wrap a command line that extend beyond a single line on the screen.

手順の概要

1. **access-list**
2. **Ctrl-A**
3. **Return** key

手順の詳細

	コマンドまたはアクション	目的

ステップ 1	**access-list**
	
	例：
	`Switch(config)# access-list 101 permit tcp 10.15.22.25 255.255.255.0 10.15.22.35`
	`Switch(config)# $ 101 permit tcp 10.15.22.25 255.255.255.0 10.15.22.35 255.25`
	`Switch(config)# $t tcp 10.15.22.25 255.255.255.0 131.108.1.20 255.255.255.0 eq`
	`Switch(config)# $15.22.25 255.255.255.0 10.15.22.35 255.255.255.0 eq 45`
		Displays the global configuration command entry that extends beyond one line.
		When the cursor first reaches the end of the line, the line is shifted ten spaces to the left and redisplayed. The dollar sign ($) shows that the line has been scrolled to the left. Each time the cursor reaches the end of the line, the line is again shifted ten spaces to the left.

ステップ 2	**Ctrl-A** 例： `Switch(config)# access-list 101 permit tcp 10.15.22.25 255.255.255.0 10.15.2$`	Checks the complete syntax. The dollar sign ($) appears at the end of the line to show that the line has been scrolled to the right.
ステップ 3	**Return** key	Execute the commands. The software assumes that you have a terminal screen that is 80 columns wide. If you have a different width, use the **terminal width** privileged EXEC command to set the width of your terminal. Use line wrapping with the command history feature to recall and modify previous complex command entries.

Searching and Filtering Output of show and more Commands

You can search and filter the output for **show** and **more** commands. This is useful when you need to sort through large amounts of output or if you want to exclude output that you do not need to see. Using these commands is optional.

手順の概要

1. {**show** | **more**} *command* | {**begin** | **include** | **exclude**} *regular-expression*

手順の詳細

	コマンドまたはアクション	目的

ステップ 1	{**show** | **more**} *command* | {**begin** | **include** | **exclude**} *regular-expression*
	
	例：
	`Switch# show interfaces | include protocol`
	`Vlan1 is up, line protocol is up`
	`Vlan10 is up, line protocol is down`
	`GigabitEthernet1/0/1 is up, line protocol is down`
	`GigabitEthernet1/0/2 is up, line protocol is up`
		Searches and filters the output.
		
		Expressions are case sensitive. For example, if you enter **| exclude output**, the lines that contain **output** are not displayed, but the lines that contain **output** appear.

Accessing the CLI through a Console Connection or through Telnet

Before you can access the CLI, you must connect a terminal or a PC to the switch console or connect a PC to the Ethernet management port and then power on the switch, as described in the hardware installation guide that shipped with your switch.

If your switch is already configured, you can access the CLI through a local console connection or through a remote Telnet session, but your switch must first be configured for this type of access.

You can use one of these methods to establish a connection with the switch:

- Connect the switch console port to a management station or dial-up modem, or connect the Ethernet management port to a PC. For information about connecting to the console or Ethernet management port, see the switch hardware installation guide.
- Use any Telnet TCP/IP or encrypted Secure Shell (SSH) package from a remote management station. The switch must have network connectivity with the Telnet or SSH client, and the switch must have an enable secret password configured.
    - The switch supports up to 16 simultaneous Telnet sessions. Changes made by one Telnet user are reflected in all other Telnet sessions.
    - The switch supports up to five simultaneous secure SSH sessions.

  After you connect through the console port, through the Ethernet management port, through a Telnet session or through an SSH session, the user EXEC prompt appears on the management station.

第 2 章

Configuring VTP

- Finding Feature Information, 13 ページ
- Prerequisites for VTP, 13 ページ
- Information About VTP, 14 ページ
- Default VTP Configuration, 23 ページ
- How to Configure VTP, 24 ページ
- Monitoring VTP, 34 ページ
- Configuration Examples for VTP, 35 ページ
- Where to Go Next, 36 ページ
- Additional References, 37 ページ
- Feature History and Information for VTP, 38 ページ

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for VTP

The following are prerequisites for VTP:

- Before you create VLANs, you must decide whether to use the VLAN Trunking Protocol (VTP) in your network. Using VTP, you can make configuration changes centrally on one or more switches and have those changes automatically communicated to all the other switches in the network. Without VTP, you cannot send information about VLANs to other switches. VTP is designed to work in an environment

where updates are made on a single switch and are sent through VTP to other switches in the domain. It does not work well in a situation where multiple updates to the VLAN database occur simultaneously on switches in the same domain, which would result in an inconsistency in the VLAN database.

- The switch supports 1005 VLANs when running the IP Lite image.
- However, the number of routed ports, SVIs, and other configured features affects the usage of the switch hardware. If the switch is notified by VTP of a new VLAN and the switch is already using the maximum available hardware resources, it sends a message that there are not enough hardware resources available and shuts down the VLAN. The output of the **show vlan user** EXEC command shows the VLAN in a suspended state.

Information About VTP

VTP

VTP is a Layer 2 messaging protocol that maintains VLAN configuration consistency by managing the addition, deletion, and renaming of VLANs on a network-wide basis. VTP minimizes misconfigurations and configuration inconsistencies that can cause several problems, such as duplicate VLAN names, incorrect VLAN-type specifications, and security violations.

VTP functionality is supported across the stack, and all switches in the stack maintain the same VLAN and VTP configuration inherited from the active switch. When a switch learns of a new VLAN through VTP messages or when a new VLAN is configured by the user, the new VLAN information is communicated to all switches in the stack.

When a switch joins the stack or when stacks merge, the new switches get VTP information from the active switch.

VTP version 1 and version 2 support only normal-range VLANs (VLAN IDs 1 to 1005). VTP version 3 supports the entire VLAN range (VLANs 1 to 4094). Extended range VLANs (VLANs 1006 to 4094) are supported only in VTP version 3. You cannot convert from VTP version 3 to VTP version 2 if extended VLANs are configured in the domain.

VTP Domain

A VTP domain (also called a VLAN management domain) consists of one switch or several interconnected switches or switch stacks under the same administrative responsibility sharing the same VTP domain name. A switch can be in only one VTP domain. You make global VLAN configuration changes for the domain.

By default, the switch is in the VTP no-management-domain state until it receives an advertisement for a domain over a trunk link (a link that carries the traffic of multiple VLANs) or until you configure a domain name. Until the management domain name is specified or learned, you cannot create or modify VLANs on a VTP server, and VLAN information is not propagated over the network.

If the switch receives a VTP advertisement over a trunk link, it inherits the management domain name and the VTP configuration revision number. The switch then ignores advertisements with a different domain name or an earlier configuration revision number.

（注） Before adding a VTP client switch to a VTP domain, always verify that its VTP configuration revision number is lower than the configuration revision number of the other switches in the VTP domain. Switches in a VTP domain always use the VLAN configuration of the switch with the highest VTP configuration revision number. If you add a switch that has a revision number higher than the revision number in the VTP domain, it can erase all VLAN information from the VTP server and VTP domain.

When you make a change to the VLAN configuration on a VTP server, the change is propagated to all switches in the VTP domain. VTP advertisements are sent over all IEEE trunk connections, including IEEE 802.1Q. VTP dynamically maps VLANs with unique names and internal index associates across multiple LAN types. Mapping eliminates excessive device administration required from network administrators.

If you configure a switch for VTP transparent mode, you can create and modify VLANs, but the changes are not sent to other switches in the domain, and they affect only the individual switch. However, configuration changes made when the switch is in this mode are saved in the switch running configuration and can be saved to the switch startup configuration file.

関連トピック

Adding a VTP Client Switch to a VTP Domain, （32 ページ）

VTP Modes

表 *4* : ***VTP Modes***

VTP Mode	Description
VTP server	In VTP server mode, you can create, modify, and delete VLANs, and specify other configuration parameters (such as the VTP version) for the entire VTP domain. VTP servers advertise their VLAN configurations to other switches in the same VTP domain and synchronize their VLAN configurations with other switches based on advertisements received over trunk links. VTP server is the default mode. In VTP server mode, VLAN configurations are saved in NVRAM. If the switch detects a failure while writing a configuration to NVRAM, VTP mode automatically changes from server mode to client mode. If this happens, the switch cannot be returned to VTP server mode until the NVRAM is functioning.
VTP client	A VTP client functions like a VTP server and transmits and receives VTP updates on its trunks, but you cannot create, change, or delete VLANs on a VTP client. VLANs are configured on another switch in the domain that is in server mode. In VTP versions 1 and 2 in VTP client mode, VLAN configurations are not saved in NVRAM. In VTP version 3, VLAN configurations are saved in NVRAM in client mode.

VTP Mode	Description
VTP transparent	VTP transparent switches do not participate in VTP. A VTP transparent switch does not advertise its VLAN configuration and does not synchronize its VLAN configuration based on received advertisements. However, in VTP version 2 or version 3, transparent switches do forward VTP advertisements that they receive from other switches through their trunk interfaces. You can create, modify, and delete VLANs on a switch in VTP transparent mode. In VTP versions 1 and 2, the switch must be in VTP transparent mode when you create extended-range VLANs. VTP version 3 also supports creating extended-range VLANs in client or server mode. In VTP versions 1 and 2, the switch must be in VTP transparent mode when you create private VLANs and when they are configured, you should not change the VTP mode from transparent to client or server mode. VTP version 3 also supports private VLANs in client and server modes. When private VLANs are configured, do not change the VTP mode from transparent to client or server mode. When the switch is in VTP transparent mode, the VTP and VLAN configurations are saved in NVRAM, but they are not advertised to other switches. In this mode, VTP mode and domain name are saved in the switch running configuration, and you can save this information in the switch startup configuration file by using the **copy running-config startup-config** privileged EXEC command. In a switch stack, the running configuration and the saved configuration are the same for all switches in a stack.
VTP off	A switch in VTP off mode functions in the same manner as a VTP transparent switch, except that it does not forward VTP advertisements on trunks.

関連トピック

Configuring VTP Mode, （24 ページ）
Example: Configuring the Switch as a VTP Server, （35 ページ）

VTP Advertisements

Each switch in the VTP domain sends periodic global configuration advertisements from each trunk port to a reserved multicast address. Neighboring switches receive these advertisements and update their VTP and VLAN configurations as necessary.

Because trunk ports send and receive VTP advertisements, you must ensure that at least one trunk port is configured on the switch stack and that this trunk port is connected to the trunk port of another switch. Otherwise, the switch cannot receive any VTP advertisements.

VTP advertisements distribute this global domain information:

- VTP domain name
- VTP configuration revision number
- Update identity and update timestamp

- MD5 digest VLAN configuration, including maximum transmission unit (MTU) size for each VLAN
- Frame format

VTP advertisements distribute this VLAN information for each configured VLAN:

- VLAN IDs (including IEEE 802.1Q)
- VLAN name
- VLAN type
- VLAN state
- Additional VLAN configuration information specific to the VLAN type

In VTP version 3, VTP advertisements also include the primary server ID, an instance number, and a start index.

VTP Version 2

If you use VTP in your network, you must decide which version of VTP to use. By default, VTP operates in version 1.

VTP version 2 supports these features that are not supported in version 1:

- Token Ring support—VTP version 2 supports Token Ring Bridge Relay Function (TrBRF) and Token Ring Concentrator Relay Function (TrCRF) VLANs.
- Unrecognized Type-Length-Value (TLV) support—A VTP server or client propagates configuration changes to its other trunks, even for TLVs it is not able to parse. The unrecognized TLV is saved in NVRAM when the switch is operating in VTP server mode.
- Version-Dependent Transparent Mode—In VTP version 1, a VTP transparent switch inspects VTP messages for the domain name and version and forwards a message only if the version and domain name match. Although VTP version 2 supports only one domain, a VTP version 2 transparent switch forwards a message only when the domain name matches.
- Consistency Checks—In VTP version 2, VLAN consistency checks (such as VLAN names and values) are performed only when you enter new information through the CLI or SNMP. Consistency checks are not performed when new information is obtained from a VTP message or when information is read from NVRAM. If the MD5 digest on a received VTP message is correct, its information is accepted.

VTP Version 3

VTP version 3 supports these features that are not supported in version 1 or version 2:

- Enhanced authentication—You can configure the authentication as **hidden** or **secret**. When **hidden**, the secret key from the password string is saved in the VLAN database file, but it does not appear in plain text in the configuration. Instead, the key associated with the password is saved in hexadecimal format in the running configuration. You must reenter the password if you enter a takeover command in the domain. When you enter the **secret** keyword, you can directly configure the password secret key.

- Support for extended range VLAN (VLANs 1006 to 4094) database propagation—VTP versions 1 and 2 propagate only VLANs 1 to 1005. If extended VLANs are configured, you cannot convert from VTP version 3 to version 1 or 2.

  （注） VTP pruning still applies only to VLANs 1 to 1005, and VLANs 1002 to 1005 are still reserved and cannot be modified.

- Private VLAN support.
- Support for any database in a domain—In addition to propagating VTP information, version 3 can propagate Multiple Spanning Tree (MST) protocol database information. A separate instance of the VTP protocol runs for each application that uses VTP.
- VTP primary server and VTP secondary servers—A VTP primary server updates the database information and sends updates that are honored by all devices in the system. A VTP secondary server can only back up the updated VTP configurations received from the primary server to its NVRAM.

  By default, all devices come up as secondary servers. You can enter the **vtp primary** privileged EXEC command to specify a primary server. Primary server status is only needed for database updates when the administrator issues a takeover message in the domain. You can have a working VTP domain without any primary servers. Primary server status is lost if the device reloads or domain parameters change, even when a password is configured on the switch.
- The option to turn VTP on or off on a per-trunk (per-port) basis—You can enable or disable VTP per port by entering the [**no**] **vtp** interface configuration command. When you disable VTP on trunking ports, all VTP instances for that port are disabled. You cannot set VTP to *off* for the MST database and *on* for the VLAN database on the same port.

  When you globally set VTP mode to off, it applies to all the trunking ports in the system. However, you can specify on or off on a per-VTP instance basis. For example, you can configure the switch as a VTP server for the VLAN database but with VTP *off* for the MST database.

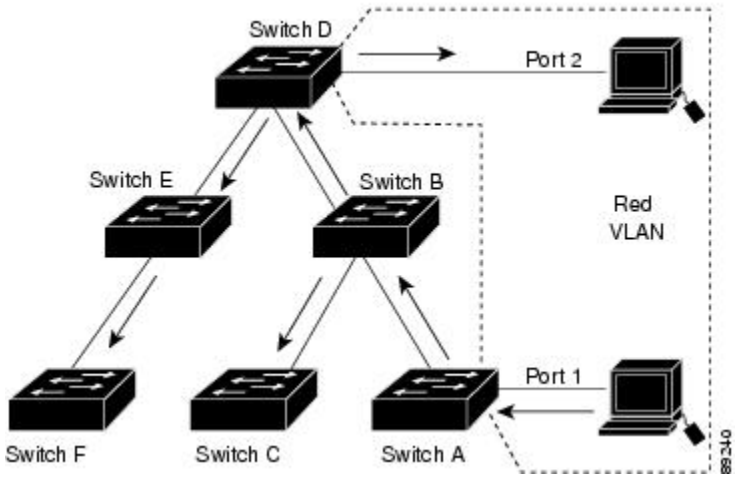
VTP Pruning

VTP pruning increases network available bandwidth by restricting flooded traffic to those trunk links that the traffic must use to reach the destination devices. Without VTP pruning, a switch floods broadcast, multicast, and unknown unicast traffic across all trunk links within a VTP domain even though receiving switches might discard them. VTP pruning is disabled by default.

VTP pruning blocks unneeded flooded traffic to VLANs on trunk ports that are included in the pruning-eligible list. Only VLANs included in the pruning-eligible list can be pruned. By default, VLANs 2 through 1001 are pruning eligible switch trunk ports. If the VLANs are configured as pruning-ineligible, the flooding continues. VTP pruning is supported in all VTP versions.

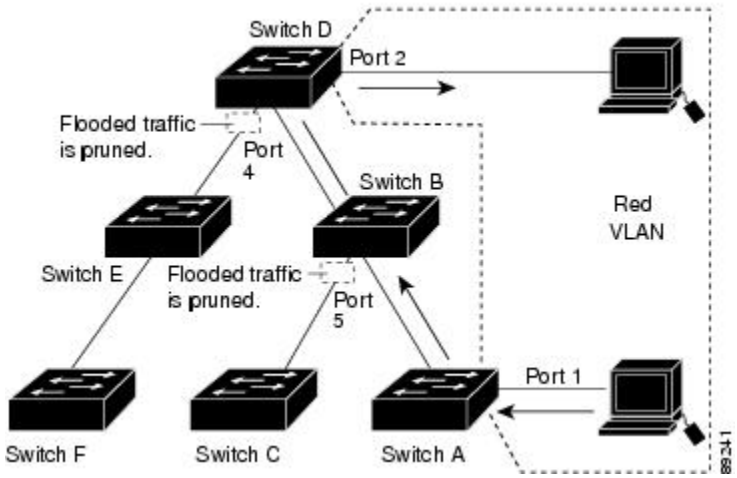
VTP pruning is disabled in the switched network. Port 1 on Switch A and Port 2 on Switch D are assigned to the Red VLAN. If a broadcast is sent from the host connected to Switch A, Switch A floods the broadcast and every switch in the network receives it, even though Switches C, E, and F have no ports in the Red VLAN.

図 1 : *Flooding Traffic without VTP Pruning*



VTP pruning is enabled in the switched network. The broadcast traffic from Switch A is not forwarded to Switches C, E, and F because traffic for the Red VLAN has been pruned on the links shown (Port 5 on Switch B and Port 4 on Switch D).

図 2 : *Optimized Flooded Traffic VTP Pruning*



Enabling VTP pruning on a VTP server enables pruning for the entire management domain. Making VLANs pruning-eligible or pruning-ineligible affects pruning eligibility for those VLANs on that trunk only (not on all switches in the VTP domain).

VTP pruning takes effect several seconds after you enable it. VTP pruning does not prune traffic from VLANs that are pruning-ineligible. VLAN 1 and VLANs 1002 to 1005 are always pruning-ineligible; traffic from these VLANs cannot be pruned. Extended-range VLANs (VLAN IDs higher than 1005) are also pruning-ineligible.

関連トピック

Enabling VTP Pruning, （30 ページ）

VTP and Switch Stacks

VTP configuration is the same in all members of a switch stack. When the switch stack is in VTP server or client mode, all switches in the stack carry the same VTP configuration. When VTP mode is transparent, the stack is not taking part in VTP.

- When a switch joins the stack, it inherits the VTP and VLAN properties of the stack master.
- All VTP updates are carried across the stack.
- When VTP mode is changed in a switch in the stack, the other switches in the stack also change VTP mode, and the switch VLAN database remains consistent.

VTP version 3 functions the same on a standalone switch or a stack except when the switch stack is the primary server for the VTP database. In this case, the MAC address of the stack master is used as the primary server ID. If the master switch reloads or is powered off, a new stack master is elected.

- If you do not configure the persistent MAC address feature (by entering the **stack-mac persistent timer** [**0** | *time-value*] global configuration command, when the new master is elected, it sends a takeover message with the new master MAC address as the primary server.
- If persistent MAC address is configured, the new master waits for the configured **stack-mac persistent timer** value. If the previous master switch does not rejoin the stack during this time, then the new master issues the takeover message.

VTP Configuration Guidelines

Configuration Requirements

When you configure VTP, you must configure a trunk port so that the switch can send and receive VTP advertisements to and from other switches in the domain.

If you are configuring VTP on a cluster member switch to a VLAN, use the **rcommand** privileged EXEC command to log in to the member switch. For more information about the command, see the command reference for this release.

In VTP versions 1 and 2, when you configure extended-range VLANs on the switch, the switch must be in VTP transparent mode. VTP version 3 also supports creating extended-range VLANs in client or server mode.

VTP versions 1 and 2 do not support private VLANs. VTP version 3 does support private VLANs. If you configure private VLANs, the switch must be in VTP transparent mode. When private VLANs are configured on the switch, do not change the VTP mode from transparent to client or server mode.

VTP Settings

The VTP information is saved in the VTP VLAN database. When VTP mode is transparent, the VTP domain name and mode are also saved in the switch running configuration file, and you can save it in the switch

startup configuration file by entering the **copy running-config startup-config** privileged EXEC command. You must use this command if you want to save VTP mode as transparent, even if the switch resets.

When you save VTP information in the switch startup configuration file and reboot the switch, the switch configuration is selected as follows:

- If the VTP mode is transparent in the startup configuration and the VLAN database and the VTP domain name from the VLAN database matches that in the startup configuration file, the VLAN database is ignored (cleared), and the VTP and VLAN configurations in the startup configuration file are used. The VLAN database revision number remains unchanged in the VLAN database.
- If the VTP mode or domain name in the startup configuration do not match the VLAN database, the domain name and VTP mode and configuration for VLAN IDs 1 to 1005 use the VLAN database information.

Domain Names for Configuring VTP

When configuring VTP for the first time, you must always assign a domain name. You must configure all switches in the VTP domain with the same domain name. Switches in VTP transparent mode do not exchange VTP messages with other switches, and you do not need to configure a VTP domain name for them.

（注） If the NVRAM and DRAM storage is sufficient, all switches in a VTP domain should be in VTP server mode.

注意 Do not configure a VTP domain if all switches are operating in VTP client mode. If you configure the domain, it is impossible to make changes to the VLAN configuration of that domain. Make sure that you configure at least one switch in the VTP domain for VTP server mode.

Passwords for the VTP Domain

You can configure a password for the VTP domain, but it is not required. If you do configure a domain password, all domain switches must share the same password and you must configure the password on each switch in the management domain. Switches without a password or with the wrong password reject VTP advertisements.

If you configure a VTP password for a domain, a switch that is booted without a VTP configuration does not accept VTP advertisements until you configure it with the correct password. After the configuration, the switch accepts the next VTP advertisement that uses the same password and domain name in the advertisement.

If you are adding a new switch to an existing network with VTP capability, the new switch learns the domain name only after the applicable password has been configured on it.

注意 When you configure a VTP domain password, the management domain does not function properly if you do not assign a management domain password to each switch in the domain.

関連トピック

Configuring a VTP Version 3 Password, （26 ページ）
Example: Configuring a Hidden Password, （36 ページ）

VTP Version

Follow these guidelines when deciding which VTP version to implement:

- All switches in a VTP domain must have the same domain name, but they do not need to run the same VTP version.
- A VTP version 2-capable switch can operate in the same VTP domain as a switch running VTP version 1 if version 2 is disabled on the version 2-capable switch (version 2 is disabled by default).
- If a switch running VTP version 1, but capable of running VTP version 2, receives VTP version 3 advertisements, it automatically moves to VTP version 2.
- If a switch running VTP version 3 is connected to a switch running VTP version 1, the VTP version 1 switch moves to VTP version 2, and the VTP version 3 switch sends scaled-down versions of the VTP packets so that the VTP version 2 switch can update its database.
- A switch running VTP version 3 cannot move to version 1 or 2 if it has extended VLANs.
- Do not enable VTP version 2 on a switch unless all of the switches in the same VTP domain are version-2-capable. When you enable version 2 on a switch, all of the version-2-capable switches in the domain enable version 2. If there is a version 1-only switch, it does not exchange VTP information with switches that have version 2 enabled.
- Cisco recommends placing VTP version 1 and 2 switches at the edge of the network because they do not forward VTP version 3 advertisements.
- If there are TrBRF and TrCRF Token Ring networks in your environment, you must enable VTP version 2 or version 3 for Token Ring VLAN switching to function properly. To run Token Ring and Token Ring-Net, disable VTP version 2.
- VTP version 1 and version 2 do not propagate configuration information for extended range VLANs (VLANs 1006 to 4094). You must configure these VLANs manually on each device. VTP version 3 supports extended-range VLANs. You cannot convert from VTP version 3 to VTP version 2 if extended VLANs are configured.
- When a VTP version 3 device trunk port receives messages from a VTP version 2 device, it sends a scaled-down version of the VLAN database on that particular trunk in VTP version 2 format. A VTP version 3 device does not send VTP version 2-formatted packets on a trunk unless it first receives VTP version 2 packets on that trunk port.
- When a VTP version 3 device detects a VTP version 2 device on a trunk port, it continues to send VTP version 3 packets, in addition to VTP version 2 packets, to allow both kinds of neighbors to coexist on the same trunk.
- A VTP version 3 device does not accept configuration information from a VTP version 2 or version 1 device.
- Two VTP version 3 regions can only communicate in transparent mode over a VTP version 1 or version 2 region.

- Devices that are only VTP version 1 capable cannot interoperate with VTP version 3 devices.
- For VTP version 1 and version 2, if extended-range VLANs are configured on the switch stack, you cannot change VTP mode to client or server. You receive an error message, and the configuration is not allowed. VTP version 1 and version 2 do not propagate configuration information for extended range VLANs (VLANs 1006 to 4094). You must manually configure these VLANs on each device.

（注） For VTP version 1 and 2, before you create extended-range VLANs (VLAN IDs 1006 to 4094), you must set VTP mode to transparent by using the **vtp mode transparent** global configuration command. Save this configuration to the startup configuration so that the switch starts in VTP transparent mode. Otherwise, you lose the extended-range VLAN configuration if the switch resets and boots up in VTP server mode (the default).

- VTP version 3 supports extended-range VLANs. If extended VLANs are configured, you cannot convert from VTP version 3 to VTP version 2.
- If you configure the switch for VTP client mode, the switch does not create the VLAN database file (vlan.dat). If the switch is then powered off, it resets the VTP configuration to the default. To keep the VTP configuration with VTP client mode after the switch restarts, you must first configure the VTP domain name before the VTP mode.

注意 If all switches are operating in VTP client mode, do not configure a VTP domain name. If you do, it is impossible to make changes to the VLAN configuration of that domain. Therefore, make sure you configure at least one switch as a VTP server.

関連トピック

Enabling the VTP Version, （28 ページ）

Default VTP Configuration

The following table shows the default VTP configuration.

表 *5* : ***Default VTP Configuration***

Feature	Default Setting
VTP domain name	Null
VTP mode (VTP version 1 and version 2)	Server
VTP mode (VTP version 3)	The mode is the same as the mode in VTP version 1 or 2 before conversion to version 3.
VTP version	Version 1
MST database mode	Transparent

Feature	Default Setting
VTP version 3 server type	Secondary
VTP password	None
VTP pruning	Disabled

How to Configure VTP

Configuring VTP Mode

You can configure VTP mode as one of these:

- When a switch is in VTP server mode, you can change the VLAN configuration and have it propagated throughout the network.
- When a switch is in VTP client mode, you cannot change its VLAN configuration. The client switch receives VTP updates from a VTP server in the VTP domain and then modifies its configuration accordingly.
- When you configure the switch for VTP transparent mode, VTP is disabled on the switch. The switch does not send VTP updates and does not act on VTP updates received from other switch. However, a VTP transparent switch running VTP version 2 does forward received VTP advertisements on its trunk links.
- VTP off mode is the same as VTP transparent mode except that VTP advertisements are not forwarded.

When you configure a domain name, it cannot be removed; you can only reassign a switch to a different domain.

手順の概要

1. **configure terminal**
2. **vtp domain** *domain-name*
3. **vtp mode** {**client** | **server** | **transparent** | **off**} {**vlan** | **mst** | **unknown**}
4. **vtp password** *password*
5. **end**
6. **show vtp status**
7. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**vtp domain** *domain-name* 例： `Switch(config)# vtp domain eng_group`	Configures the VTP administrative-domain name. The name can be 1 to 32 characters. All switches operating in VTP server or client mode under the same administrative responsibility must be configured with the same domain name. This command is optional for modes other than server mode. VTP server mode requires a domain name. If the switch has a trunk connection to a VTP domain, the switch learns the domain name from the VTP server in the domain. You should configure the VTP domain before configuring other VTP parameters. （注）
ステップ 3	**vtp mode** {**client** | **server** | **transparent** | **off**} {**vlan** | **mst** | **unknown**} 例： `Switch(config)# vtp mode server`	Configures the switch for VTP mode (client, server, transparent, or off). • **vlan**—The VLAN database is the default if none are configured. • **mst**—The multiple spanning tree (MST) database. • **unknown**—An unknown database type. （注） To return a switch in another mode to VTP server mode, use the **no vtp mode** global configuration command.
ステップ 4	**vtp password** *password* 例： `Switch(config)# vtp password mypassword`	(Optional) Sets the password for the VTP domain. The password can be 8 to 64 characters. If you configure a VTP password, the VTP domain does not function properly if you do not assign the same password to each switch in the domain. （注） To return the switch to a no-password state, use the **no vtp password** global configuration command.
ステップ 5	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.

	コマンドまたはアクション	目的
ステップ 6	**show vtp status** 例： `Switch# show vtp status`	Verifies your entries in the *VTP Operating Mode* and the *VTP Domain Name* fields of the display.
ステップ 7	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves the configuration in the startup configuration file. Only VTP mode and domain name are saved in the switch running configuration and can be copied to the startup configuration file.

関連トピック

VTP Modes, （15 ページ）
Example: Configuring the Switch as a VTP Server, （35 ページ）

Configuring a VTP Version 3 Password

You can configure a VTP version 3 password on the switch.

手順の概要

1. **configure terminal**
2. **vtp password** *password* [**hidden** | **secret**]
3. **end**
4. **show vtp password**
5. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.

	コマンドまたはアクション	目的
ステップ 2	**vtp password** *password* [**hidden** | **secret**] 例： `Switch(config)# vtp password mypassword hidden`	(Optional) Sets the password for the VTP domain. The password can be 8 to 64 characters. • (Optional) **hidden**—Saves the secret key generated from the password string in the nvram:vlan.dat file. If you configure a takeover by configuring a VTP primary server, you are prompted to reenter the password. • (Optional) **secret**—Directly configures the password. The secret password must contain 32 hexadecimal characters. （注） To clear the password, enter the **no vtp password** global configuration command.
ステップ 3	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 4	**show vtp password** 例： `Switch# show vtp password`	Verifies your entries. The output appears like this: VTP password: 89914640C8D90868B6A0D8103847A733
ステップ 5	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves the configuration in the startup configuration file.

関連トピック

Passwords for the VTP Domain, （21 ページ）
Example: Configuring a Hidden Password, （36 ページ）

Configuring a VTP Version 3 Primary Server

When you configure a VTP server as a VTP primary server, the takeover operation starts.

手順の概要

1. **vtp primary** [**vlan** | **mst**] [**force**]

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**vtp primary** [**vlan** | **mst**] [**force**] 例： `Switch# vtp primary vlan force`	Changes the operational state of a switch from a secondary server (the default) to a primary server and advertises the configuration to the domain. If the switch password is configured as **hidden**, you are prompted to reenter the password. • (Optional) **vlan**—Selects the VLAN database as the takeover feature. This is the default. • (Optional) **mst**—Selects the multiple spanning tree (MST) database as the takeover feature. • (Optional) **force**—Overwrites the configuration of any conflicting servers. If you do not enter **force**, you are prompted for confirmation before the takeover.

関連トピック

Example: Configuring a VTP Version 3 Primary Server, （36 ページ）

Enabling the VTP Version

VTP version 2 and version 3 are disabled by default.

- When you enable VTP version 2 on a switch , every VTP version 2-capable switch in the VTP domain enables version 2. To enable VTP version 3, you must manually configure it on each switch
- With VTP versions 1 and 2, you can configure the version only on switches in VTP server or transparent mode. If a switch is running VTP version 3, you can change to version 2 when the switch is in client mode if no extended VLANs exist, no private VLANs exist, and no hidden password was configured.

注意 VTP version 1 and VTP version 2 are not interoperable on switches in the same VTP domain. Do not enable VTP version 2 unless every switch in the VTP domain supports version 2.

- In TrCRF and TrBRF Token Ring environments, you must enable VTP version 2 or VTP version 3 for Token Ring VLAN switching to function properly. For Token Ring and Token Ring-Net media, disable VTP version 2.

注意 In VTP version 3, both the primary and secondary servers can exist on an instance in the domain.

手順の概要

1. **configure terminal**
2. **vtp version** {**1** | **2** | **3**}
3. **end**
4. **show vtp status**
5. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**vtp version** {**1**	**2**	**3**} 例： `Switch(config)# vtp version 2`	Enables the VTP version on the switch. The default is VTP version 1. （注） To return to the default VTP version 1, use the **no vtp version** global configuration command.
ステップ 3	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 4	**show vtp status** 例： `Switch# show vtp status`	Verifies that the configured VTP version is enabled.
ステップ 5	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves the configuration in the startup configuration file.

関連トピック

VTP Version, （22 ページ）

Enabling VTP Pruning

Pruning increases available bandwidth by restricting flooded traffic to those trunk links that the traffic must use to access the destination devices. You can only enable VTP pruning on a switch in VTP server mode.

With VTP versions 1 and 2, when you enable pruning on the VTP server, it is enabled for the entire VTP domain. In VTP version 3, you must manually enable pruning on each switch in the domain.

Only VLANs included in the pruning-eligible list can be pruned. By default, VLANs 2 through 1001 are pruning-eligible on trunk ports. Reserved VLANs and extended-range VLANs cannot be pruned.

はじめる前に

VTP pruning is not designed to function in VTP transparent mode. If one or more switches in the network are in VTP transparent mode, you should do one of these:

- Turn off VTP pruning in the entire network.
- Turn off VTP pruning by making all VLANs on the trunk of the switch upstream to the VTP transparent switch pruning ineligible.

To configure VTP pruning on an interface, use the **switchport trunk pruning vlan** interface configuration command. VTP pruning operates when an interface is trunking. You can set VLAN pruning-eligibility, whether or not VTP pruning is enabled for the VTP domain, whether or not any given VLAN exists, and whether or not the interface is currently trunking.

手順の概要

1. **configure terminal**
2. **vtp pruning**
3. **end**
4. **show vtp status**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**vtp pruning** 例： `Switch(config)# vtp pruning`	Enables pruning in the VTP administrative domain. By default, pruning is disabled. You need to enable pruning on only one switch in VTP server mode. （注） To disable VTP pruning, use the **no vtp pruning** global configuration command.

	コマンドまたはアクション	目的
ステップ 3	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 4	**show vtp status** 例： `Switch# show vtp status`	Verifies your entries in the *VTP Pruning Mode* field of the display.

関連トピック

VTP Pruning, （18 ページ）

Configuring VTP on a Per-Port Basis

With VTP version 3, you can enable or disable VTP on a per-port basis. You can enable VTP only on ports that are in trunk mode. Incoming and outgoing VTP traffic are blocked, not forwarded.

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **vtp**
4. **end**
5. **show running-config interface** *interface-id*
6. **show vtp status**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.

	コマンドまたはアクション	目的
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/1`	Identifies an interface, and enters interface configuration mode.
ステップ 3	**vtp** 例： `Switch(config)# vtp`	Enables VTP on the specified port. （注） To disable VTP on the interface, use the **no vtp** interface configuration command.
ステップ 4	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 5	**show running-config interface** *interface-id* 例： `Switch# show running-config interface gigabitethernet1/0/1`	Verifies the change to the port.
ステップ 6	**show vtp status** 例： `Switch# show vtp status`	Verifies the configuration.

関連トピック

Example: Configuring VTP on a Per-Port Basis, （36 ページ）

Adding a VTP Client Switch to a VTP Domain

Follow these steps to verify and reset the VTP configuration revision number on a switch *before* adding it to a VTP domain.

はじめる前に

Before adding a VTP client to a VTP domain, always verify that its VTP configuration revision number is *lower* than the configuration revision number of the other switches in the VTP domain. Switches in a VTP domain always use the VLAN configuration of the switch with the highest VTP configuration revision number.

With VTP versions 1 and 2, adding a switch that has a revision number higher than the revision number in the VTP domain can erase all VLAN information from the VTP server and VTP domain. With VTP version 3, the VLAN information is not erased.

You can use the **vtp mode transparent** global configuration command to disable VTP on the switch and then to change its VLAN information without affecting the other switches in the VTP domain.

手順の概要

1. **show vtp status**
2. **configure terminal**
3. **vtp domain** *domain-name*
4. **end**
5. **show vtp status**
6. **configure terminal**
7. **vtp domain** *domain-name*
8. **end**
9. **show vtp status**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**show vtp status** 例： `Switch# show vtp status`	Checks the VTP configuration revision number. If the number is 0, add the switch to the VTP domain. If the number is greater than 0, follow these sub steps: • Write down the domain name. • Write down the configuration revision number. • Continue with the next steps to reset the switch configuration revision number.
ステップ 2	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 3	**vtp domain** *domain-name* 例： `Switch(config)# vtp domain domain123`	Changes the domain name from the original one displayed in Step 1 to a new name.

	コマンドまたはアクション	目的
ステップ 4	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode. The VLAN information on the switch is updated and the configuration revision number is reset to 0.
ステップ 5	**show vtp status** 例： `Switch# show vtp status`	Verifies that the configuration revision number has been reset to 0.
ステップ 6	**configure terminal** 例： `Switch# configure terminal`	Enters global configuration mode.
ステップ 7	**vtp domain** *domain-name* 例： `Switch(config)# vtp domain domain012`	Enters the original domain name on the switch
ステップ 8	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode. The VLAN information on the switch is updated.
ステップ 9	**show vtp status** 例： `Switch# show vtp status`	(Optional) Verifies that the domain name is the same as in Step 1 and that the configuration revision number is 0.

関連トピック

VTP Domain, （14 ページ）

Monitoring VTP

This section describes commands used to display and monitor the VTP configuration.

You monitor VTP by displaying VTP configuration information: the domain name, the current VTP revision, and the number of VLANs. You can also display statistics about the advertisements sent and received by the switch.

表 *6* : ***VTP Monitoring Commands***

Command	Purpose
show vtp counters	Displays counters about VTP messages that have been sent and received.
show vtp devices [**conflict**]	Displays information about all VTP version 3 devices in the domain. Conflicts are VTP version 3 devices with conflicting primary servers. The **show vtp devices** command does not display information when the switch is in transparent or off mode.
show vtp interface [*interface-id*]	Displays VTP status and configuration for all interfaces or the specified interface.
show vtp password	Displays the VTP password. The form of the password displayed depends on whether or not the **hidden** keyword was entered and if encryption is enabled on the switch.
show vtp status	Displays the VTP switch configuration information.

Configuration Examples for VTP

Example: Configuring the Switch as a VTP Server

This example shows how to configure the switch as a VTP server with the domain name *eng_group* and the password *mypassword*:

```
Switch(config)# vtp domain eng_group
Setting VTP domain name to eng_group.

Switch(config)# vtp mode server

Setting device to VTP Server mode for VLANS.
Switch(config)# vtp password mypassword

Setting device VLAN database password to mypassword.

Switch(config)# end
```

関連トピック

Configuring VTP Mode, （24 ページ）
VTP Modes, （15 ページ）

Example: Configuring a Hidden Password

This example shows how to configure a hidden password and how it appears.

```
Switch(config)# vtp password mypassword hidden
Generating the secret associated to the password.
Switch(config)# end
Switch# show vtp password
VTP password: 89914640C8D90868B6A0D8103847A733
```

関連トピック

Configuring a VTP Version 3 Password, （26 ページ）

Passwords for the VTP Domain, （21 ページ）

Example: Configuring a VTP Version 3 Primary Server

This example shows how to configure a switch as the primary server for the VLAN database (the default) when a hidden or secret password was configured:

```
Switch# vtp primary vlan

Enter VTP password: mypassword
This switch is becoming Primary server for vlan feature in the VTP domain
VTP Database Conf Switch ID Primary Server Revision System Name
------------ ---- -------------- -------------- -------- --------------------
VLANDB Yes 00d0.00b8.1400=00d0.00b8.1400 1 stp7
Do you want to continue (y/n) [n]? y
```

関連トピック

Configuring a VTP Version 3 Primary Server, （27 ページ）

Example: Configuring VTP on a Per-Port Basis

This example shows how to configure VTP on a per-port basis:

```
Switch(config)# interface gigabitethernet 1/0/1
Switch(config-if)# vtp
Switch(config-if)# end
```

関連トピック

Configuring VTP on a Per-Port Basis, （31 ページ）

Where to Go Next

After configuring VTP, you can configure the following:

- VLANs

- VLAN trunking
- Private VLANs
- VLAN Membership Policy Server (VMPS)
- Tunneling
- Voice VLANs

Additional References

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	*Catalyst 2960-XR Switch VLAN Management Command Reference*

Standards and RFCs

Standard/RFC	Title
—	—

MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature History and Information for VTP

Release	Modification
Cisco IOS 15.0(2)EX1	This feature was introduced.

第 3 章

Configuring VLANs

- Finding Feature Information, 39 ページ
- Prerequisites for VLANs, 39 ページ
- Restrictions for VLANs, 40 ページ
- Information About VLANs, 40 ページ
- How to Configure VLANs, 47 ページ
- Monitoring VLANs, 57 ページ
- Configuration Examples, 57 ページ
- Where to Go Next, 58 ページ
- Additional References, 58 ページ
- Feature History and Information for VLAN, 59 ページ

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for VLANs

The following are prerequisites and considerations for configuring VLANs:

- The switch supports 1005 VLANs when running the IP Lite image.
- The switch supports 256 SVIs when running the IP Lite image.

Restrictions for VLANs

The following are the restrictions for configuring VLANs:

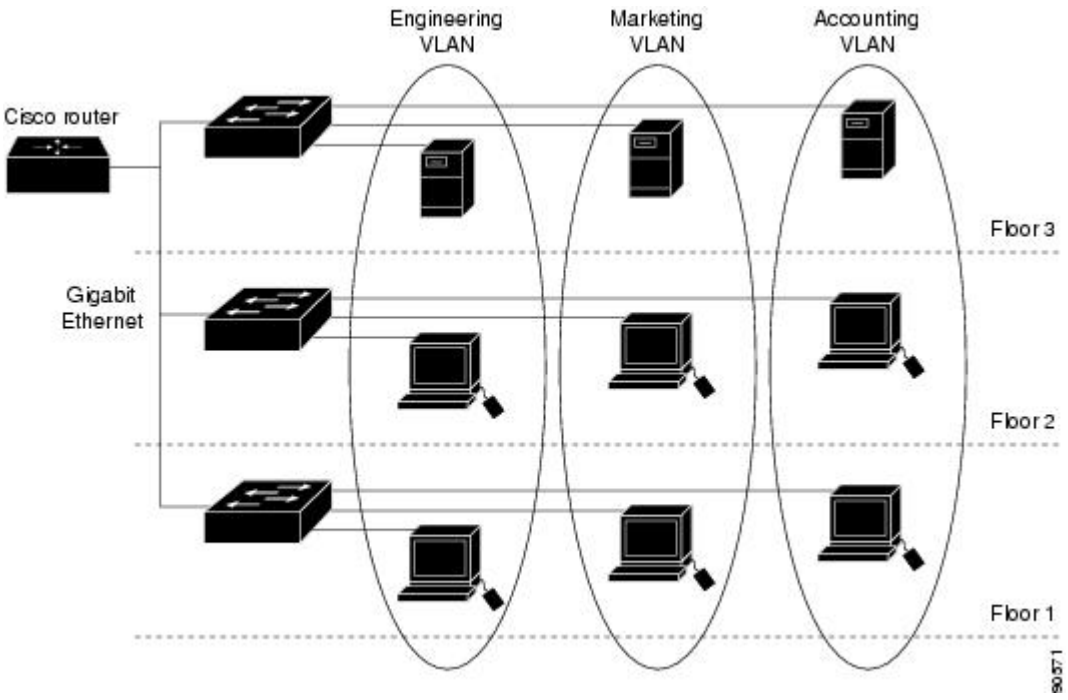
- The switch supports homogeneous stacking, but does not support mixed stacking.

Information About VLANs

Logical Networks

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 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 the 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 or a switch supporting fallback bridging. In a switch stack, VLANs can be formed with ports across the stack. Because a VLAN is considered a separate logical network, it contains its own bridge Management Information Base (MIB) information and can support its own implementation of spanning tree.

図 *3* : ***VLANs as Logically Defined Networks***



VLANs are often associated with IP subnetworks. For example, all the end stations in a particular IP subnet belong to the same VLAN. Interface VLAN membership on the switch is assigned manually on an

interface-by-interface basis. When you assign switch interfaces to VLANs by using this method, it is known as interface-based, or static, VLAN membership.

Traffic between VLANs must be routed or fallback bridged.

The switch can route traffic between VLANs by using switch virtual interfaces (SVIs). An SVI must be explicitly configured and assigned an IP address to route traffic between VLANs.

Supported VLANs

The switch supports VLANs in VTP client, server, and transparent modes. VLANs are identified by a number from 1 to 4094. VLAN IDs 1002 through 1005 are reserved for Token Ring and FDDI VLANs. VTP version 1 and version 2 support only normal-range VLANs (VLAN IDs 1 to 1005). In these versions, the switch must be in VTP transparent mode when you create VLAN IDs from 1006 to 4094. VTP version 3 supports the entire VLAN range (VLANs 1 to 4094). Extended range VLANs (VLANs 1006 to 4094) are supported only in VTP version 3. You cannot convert from VTP version 3 to VTP version 2 if extended VLANs are configured in the domain.

The switch or switch stack supports a total of 1005 (normal range and extended range) VLANs. However, the number of routed ports, SVIs, and other configured features affects the use of the switch hardware.

The switch supports per-VLAN spanning-tree plus (PVST+) or rapid PVST+ with a maximum of 128 spanning-tree instances. One spanning-tree instance is allowed per VLAN.

The switch supports IEEE 802.1Q trunking methods for sending VLAN traffic over Ethernet ports.

VLAN Port Membership Modes

You configure a port to belong to a VLAN by assigning a membership mode that specifies the kind of traffic the port carries and the number of VLANs to which it can belong.

When a port belongs to a VLAN, the switch learns and manages the addresses associated with the port on a per-VLAN basis.

表 *7* : ***Port Membership Modes and Characteristics***

Membership Mode	VLAN Membership Characteristics	VTP Characteristics
Static-access	A static-access port can belong to one VLAN and is manually assigned to that VLAN.	VTP is not required. If you do not want VTP to globally propagate information, set the VTP mode to transparent. To participate in VTP, there must be at least one trunk port on the switch or the switch stack connected to a trunk port of a second switch or switch stack.

Membership Mode	VLAN Membership Characteristics	VTP Characteristics
Trunk (IEEE 802.1Q) : • IEEE 802.1Q—Industry-standard trunking encapsulation.	A trunk port is a member of all VLANs by default, including extended-range VLANs, but membership can be limited by configuring the allowed-VLAN list. You can also modify the pruning-eligible list to block flooded traffic to VLANs on trunk ports that are included in the list.	VTP is recommended but not required. VTP maintains VLAN configuration consistency by managing the addition, deletion, and renaming of VLANs on a network-wide basis. VTP exchanges VLAN configuration messages with other switches over trunk links.
Dynamic access	A dynamic-access port can belong to one VLAN (VLAN ID 1 to 4094) and is dynamically assigned by a VLAN Member Policy Server (VMPS). The VMPS can be a Catalyst 6500 series switch, for example, but never a Catalyst 2960, 2960-S, or 2960-C switch. The Catalyst 2960, 2960-S, or 2960-C switch is a VMPS client. You can have dynamic-access ports and trunk ports on the same switch, but you must connect the dynamic-access port to an end station or hub and not to another switch.	VTP is required. Configure the VMPS and the client with the same VTP domain name. To participate in VTP, at least one trunk port on the switch or a switch stack must be connected to a trunk port of a second switch or switch stack.
Voice VLAN	A voice VLAN port is an access port attached to a Cisco IP Phone, configured to use one VLAN for voice traffic and another VLAN for data traffic from a device attached to the phone.	VTP is not required; it has no effect on a voice VLAN.

Normal-Range VLAN Overview

Normal-range VLANs are VLANs with VLAN IDs 1 to 1005. If the switch is in VTP server or VTP transparent mode, you can add, modify or remove configurations for VLANs 2 to 1001 in the VLAN database. (VLAN IDs 1 and 1002 to 1005 are automatically created and cannot be removed.)

In VTP versions 1 and 2, the switch must be in VTP transparent mode when you create extended-range VLANs (VLANs with IDs from 1006 to 4094), but these VLANs are not saved in the VLAN database. VTP version 3 supports extended-range VLANs in VTP server and transparent mode.

Configurations for VLAN IDs 1 to 1005 are written to the file vlan.dat (VLAN database), and you can display them by entering the show vlan privileged EXEC command. The vlan.dat file is stored in flash memory. On

a switch, the vlan.dat file is stored in flash memory on the stack master. Stack members have a vlan.dat file that is consistent with the stack master.

Token Ring VLANs

Although the switch does not support Token Ring connections, a remote device such as a Catalyst 5000 series switch with Token Ring connections could be managed from one of the supported switches. Switches running VTP Version 2 advertise information about these Token Ring VLANs:

- Token Ring TrBRF VLANs
- Token Ring TrCRF VLANs

（注） For more information on configuring Token Ring VLANs, see the *Catalyst 5000 Series Software Configuration Guide*.

Normal-Range VLANs Configuration Process

You configure VLANs in the **vlan** global configuration command by entering a VLAN ID. Enter a new VLAN ID to create a VLAN, or enter an existing VLAN ID to modify that VLAN. You can use the default VLAN configuration or enter multiple commands to configure the VLAN. For more information about commands available in this mode, see the **vlan** global configuration command description in the command reference for this release. When you have finished the configuration, you must exit VLAN configuration mode for the configuration to take effect. To display the VLAN configuration, enter the **show vlan** privileged EXEC command.

VLAN Configuration Saving Process

The configurations of VLAN IDs 1 to 1005 are always saved in the VLAN database (vlan.dat file). If the VTP mode is transparent, they are also saved in the switch running configuration file. You can enter the **copy running-config startup-config** privileged EXEC command to save the configuration in the startup configuration file. In a switch stack, the whole stack uses the same vlan.dat file and running configuration. To display the VLAN configuration, enter the **show vlan** privileged EXEC command.

When you save VLAN and VTP information (including extended-range VLAN configuration information) in the startup configuration file and reboot the switch, the switch configuration is selected as follows:

- If the VTP mode is transparent in the startup configuration, and the VLAN database and the VTP domain name from the VLAN database matches that in the startup configuration file, the VLAN database is ignored (cleared), and the VTP and VLAN configurations in the startup configuration file are used. The VLAN database revision number remains unchanged in the VLAN database.
- If the VTP mode or domain name in the startup configuration does not match the VLAN database, the domain name and VTP mode and configuration for the VLAN IDs 1 to 1005 use the VLAN database information.
- In VTP versions 1 and 2, if VTP mode is server, the domain name and VLAN configuration for VLAN IDs 1 to 1005 use the VLAN database information. VTP version 3 also supports VLANs 1006 to 4094.

Normal-Range VLAN Configuration Guidelines

Normal-range VLANs are VLANs with IDs from 1 to 1005. VTP 1 and 2 only support normal-range VLANs.

Follow these guidelines when creating and modifying normal-range VLANs in your network:

- Normal-range VLANs are identified with a number between 1 and 1001. VLAN numbers 1002 through 1005 are reserved for Token Ring and FDDI VLANs.
- VLAN configuration for VLANs 1 to 1005 are always saved in the VLAN database. If the VTP mode is transparent, VTP and VLAN configuration are also saved in the switch running configuration file.
- If the switch is in VTP server or VTP transparent mode, you can add, modify or remove configurations for VLANs 2 to 1001 in the VLAN database. (VLAN IDs 1 and 1002 to 1005 are automatically created and cannot be removed.)
- With VTP versions 1 and 2, the switch supports VLAN IDs 1006 through 4094 only in VTP transparent mode (VTP disabled). These are extended-range VLANs and configuration options are limited. Extended-range VLANs created in VTP transparent mode are not saved in the VLAN database and are not propagated. VTP version 3 supports extended range VLAN (VLANs 1006 to 4094) database propagation in VTP server and transparent mode. If extended VLANs are configured, you cannot convert from VTP version 3 to version 1 or 2.
- Before you can create a VLAN, the switch must be in VTP server mode or VTP transparent mode. If the switch is a VTP server, you must define a VTP domain or VTP will not function.
- The switch does not support Token Ring or FDDI media. The switch does not forward FDDI, FDDI-Net, TrCRF, or TrBRF traffic, but it does propagate the VLAN configuration through VTP.
- The switch supports 128 spanning tree instances. If a switch has more active VLANs than supported spanning-tree instances, spanning tree can be enabled on 128 VLANs and is disabled on the remaining VLANs. If you have already used all available spanning-tree instances on a switch, adding another VLAN anywhere in the VTP domain creates a VLAN on that switch that is not running spanning-tree. If you have the default allowed list on the trunk ports of that switch (which is to allow all VLANs), the new VLAN is carried on all trunk ports. Depending on the topology of the network, this could create a loop in the new VLAN that would not be broken, particularly if there are several adjacent switches that all have run out of spanning-tree instances. You can prevent this possibility by setting allowed lists on the trunk ports of switches that have used up their allocation of spanning-tree instances.

  If the number of VLANs on the switch exceeds the number of supported spanning-tree instances, we recommend that you configure the IEEE 802.1s Multiple STP (MSTP) on your switch to map multiple VLANs to a single spanning-tree instance.
- When a switch in a stack learns a new VLAN or deletes or modifies an existing VLAN (either through VTP over network ports or through the CLI), the VLAN information is communicated to all stack members.
- When a switch joins a stack or when stacks merge, VTP information (the vlan.dat file) on the new switches will be consistent with the active switch.

関連トピック

Creating or Modifying an Ethernet VLAN, （47 ページ）

Example: Creating a VLAN Name, （57 ページ）

Extended-Range VLAN Configuration Guidelines

VTP 3 only supports extended-range VLANs. Extended-range VLANs are VLANs with IDs from 1006 to 4094.

Follow these guidelines when creating extended-range VLANs:

- VLAN IDs in the extended range are not saved in the VLAN database and are not recognized by VTP unless the switch is running VTP version 3.
- You cannot include extended-range VLANs in the pruning eligible range.
- In VTP version 1 and 2, a switch must be in VTP transparent mode when you create extended-range VLANs. If VTP mode is server or client, an error message is generated, and the extended-range VLAN is rejected. VTP version 3 supports extended VLANs in server and transparent modes.
- For VTP version 1 or 2, you can set the VTP mode to transparent in global configuration mode. You should save this configuration to the startup configuration so that the switch boots up in VTP transparent mode. Otherwise, you lose the extended-range VLAN configuration if the switch resets. If you create extended-range VLANs in VTP version 3, you cannot convert to VTP version 1 or 2.
- STP is enabled by default on extended-range VLANs, but you can disable it by using the **no spanning-tree vlan** *vlan-id* global configuration command. When the maximum number of spanning-tree instances are on the switch, spanning tree is disabled on any newly created VLANs. If the number of VLANs on the switch exceeds the maximum number of spanning-tree instances, we recommend that you configure the IEEE 802.1s Multiple STP (MSTP) on your switch to map multiple VLANs to a single spanning-tree instance.
- Each routed port on the switch creates an internal VLAN for its use. These internal VLANs use extended-range VLAN numbers, and the internal VLAN ID cannot be used for an extended-range VLAN. If you try to create an extended-range VLAN with a VLAN ID that is already allocated as an internal VLAN, an error message is generated, and the command is rejected.
    - Because internal VLAN IDs are in the lower part of the extended range, we recommend that you create extended-range VLANs beginning from the highest number (4094) and moving to the lowest (1006) to reduce the possibility of using an internal VLAN ID.
    - Before configuring extended-range VLANs, enter the **show vlan internal usage** privileged EXEC command to see which VLANs have been allocated as internal VLANs.
    - If necessary, you can shut down the routed port assigned to the internal VLAN, which frees up the internal VLAN, and then create the extended-range VLAN and re-enable the port, which then uses another VLAN as its internal VLAN.
- Although the switch or switch stack supports a total of 1005 (normal-range and extended-range) VLANs, the number of routed ports, SVIs, and other configured features affects the use of the switch hardware. If you try to create an extended-range VLAN and there are not enough hardware resources available, an error message is generated, and the extended-range VLAN is rejected.
- In a switch stack, the whole stack uses the same running configuration and saved configuration, and extended-range VLAN information is shared across the stack.

関連トピック

Creating an Extended-Range VLAN, （52 ページ）

Example: Creating an Extended-Range VLAN, （58 ページ）

Default Ethernet VLAN Configuration

The following table displays the default configuration for Ethernet VLANs.

（注） The switch supports Ethernet interfaces exclusively. Because FDDI and Token Ring VLANs are not locally supported, you only configure FDDI and Token Ring media-specific characteristics for VTP global advertisements to other switches.

表 *8* : ***Ethernet VLAN Defaults and Range***

Parameter	Default	Range
VLAN ID	1	1 to 4094. （注） Extended-range VLANs (VLAN IDs 1006 to 4094) are only saved in the VLAN database in VTP version 3.
VLAN name	VLANxxxx, where xxxx represents four numeric digits (including leading zeros) equal to the VLAN ID number	No range
IEEE 802.10 SAID	100001 (100000 plus the VLAN ID)	1 to 4294967294
MTU Size	1500	576-18190
Translational bridge 1	0	0 to 1005
Translational bridge 2	0	0 to 1005
VLAN state	active	active, suspend
Remote SPAN	disabled	enabled, disabled
Private VLANs	none configured	2 to 1001, 1006 to 4094

Default VLAN Configuration

You can change only the MTU size, private VLAN, and the remote SPAN configuration state on extended-range VLANs; all other characteristics must remain at the default state.

How to Configure VLANs

How to Configure Normal-Range VLANs

You can set these parameters when you create a new normal-range VLAN or modify an existing VLAN in the VLAN database:

- VLAN ID
- VLAN name
- VLAN type
  - Ethernet
  - Fiber Distributed Data Interface [FDDI]
  - FDDI network entity title [NET]
  - TrBRF or TrCRF
  - Token Ring
  - Token Ring-Net
- VLAN state (active or suspended)
- Maximum transmission unit (MTU) for the VLAN
- 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 number to use when translating from one VLAN type to another

You can cause inconsistency in the VLAN database if you attempt to manually delete the vlan.dat file. If you want to modify the VLAN configuration, follow the procedures in this section.

Creating or Modifying an Ethernet VLAN

Each Ethernet VLAN in the VLAN database has a unique, 4-digit ID that can be a number from 1 to 1001. VLAN IDs 1002 to 1005 are reserved for Token Ring and FDDI VLANs. To create a normal-range VLAN to be added to the VLAN database, assign a number and name to the VLAN.

（注） With VTP version 1 and 2, if the switch is in VTP transparent mode, you can assign VLAN IDs greater than 1006, but they are not added to the VLAN database.

手順の概要

1. **configure terminal**
2. **vlan** *vlan-id*
3. **name** *vlan-name*
4. **mtu** *mtu-size*
5. **remote-span**
6. **end**
7. **show vlan** {**name** *vlan-name* | **id** *vlan-id*}

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**vlan** *vlan-id* 例： `Switch(config)# vlan 20`	Enters a VLAN ID, and enters VLAN configuration mode. Enter a new VLAN ID to create a VLAN, or enter an existing VLAN ID to modify that VLAN. （注） The available VLAN ID range for this command is 1 to 4094.
ステップ 3	**name** *vlan-name* 例： `Switch(config-vlan)# name test20`	(Optional) Enters a name for the VLAN. If no name is entered for the VLAN, the default is to append the *vlan-id* value with leading zeros to the word VLAN. For example, VLAN0004 is a default VLAN name for VLAN 4.
ステップ 4	**mtu** *mtu-size* 例： `Switch(config-vlan)# mtu 256`	(Optional) Changes the MTU size (or other VLAN characteristic).
ステップ 5	**remote-span** 例： `Switch(config-vlan)# remote-span`	(Optional) Configures the VLAN as the RSPAN VLAN for a remote SPAN session. （注） To return the VLAN name to the default settings, use the **no name**, **no mtu**, or **no remote-span** commands.

	コマンドまたはアクション	目的
ステップ 6	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 7	**show vlan** {**name** *vlan-name* | **id** *vlan-id*} 例： `Switch# show vlan name test20 id 20`	Verifies your entries.

関連トピック

Normal-Range VLAN Configuration Guidelines, （44 ページ）
Example: Creating a VLAN Name, （57 ページ）

Deleting a VLAN

When you delete a VLAN from a switch that is in VTP server mode, the VLAN is removed from the VLAN database for all switches in the VTP domain. When you delete a VLAN from a switch that is in VTP transparent mode, the VLAN is deleted only on that specific switch or a switch stack.

You cannot delete the default VLANs for the different media types: Ethernet VLAN 1 and FDDI or Token Ring VLANs 1002 to 1005.

注意 When you delete a VLAN, any ports assigned to that VLAN become inactive. They remain associated with the VLAN (and thus inactive) until you assign them to a new VLAN.

手順の概要

1. **configure terminal**
2. **no vlan** *vlan-id*
3. **end**
4. **show vlan brief**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**no vlan** *vlan-id* 例： `Switch(config)# no vlan 4`	Removes the VLAN by entering the VLAN ID.
ステップ 3	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 4	**show vlan brief** 例： `Switch# show vlan brief`	Verifies the VLAN removal.

Assigning Static-Access Ports to a VLAN

You can assign a static-access port to a VLAN without having VTP globally propagate VLAN configuration information by disabling VTP (VTP transparent mode).

If you are assigning a port on a cluster member switch to a VLAN, first use the **rcommand** privileged EXEC command to log in to the cluster member switch.

If you assign an interface to a VLAN that does not exist, the new VLAN is created.

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport mode access**
4. **switchport access vlan** *vlan-id*
5. **end**
6. **show running-config interface** *interface-id*
7. **show interfaces** *interface-id* **switchport**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet2/0/1`	Enters the interface to be added to the VLAN.
ステップ 3	**switchport mode access** 例： `Switch(config-if)# switchport mode access`	Defines the VLAN membership mode for the port (Layer 2 access port).
ステップ 4	**switchport access vlan** *vlan-id* 例： `Switch(config-if)# switchport access vlan 2`	Assigns the port to a VLAN. Valid VLAN IDs are 1 to 4094. （注） To return an interface to its default configuration, use the **default interface interface-id** interface configuration command.
ステップ 5	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 6	**show running-config interface** *interface-id* 例： `Switch# copy running-config startup-config`	Verifies the VLAN membership mode of the interface.
ステップ 7	**show interfaces** *interface-id* **switchport** 例： `Switch# show interfaces gigabitethernet2/0/1`	Verifies your entries in the *Administrative Mode* and the *Access Mode VLAN* fields of the display.

関連トピック

Example: Configuring a Port as Access Port, （57 ページ）

How to Configure Extended-Range VLANs

With VTP version 1 and version 2, when the switch is in VTP transparent mode (VTP disabled), you can create extended-range VLANs (in the range 1006 to 4094). VTP 3 version supports extended-range VLANs in server or transparent move.

Extended-range VLANs enable service providers to extend their infrastructure to a greater number of customers. The extended-range VLAN IDs are allowed for any **switchport** commands that allow VLAN IDs.

With VTP version 1 or 2, extended-range VLAN configurations are not stored in the VLAN database, but because VTP mode is transparent, they are stored in the switch running configuration file, and you can save the configuration in the startup configuration file. Extended-range VLANs created in VTP version 3 are stored in the VLAN database.

You can change only the MTU size, private VLAN, and the remote SPAN configuration state on extended-range VLANs; all other characteristics must remain at the default state.

Creating an Extended-Range VLAN

You create an extended-range VLAN in global configuration mode by entering the **vlan** global configuration command with a VLAN ID from 1006 to 4094. The extended-range VLAN has the default Ethernet VLAN characteristics and the MTU size, and RSPAN configuration are the only parameters you can change. See the description of the **vlan** global configuration command in the command reference for the default settings of all parameters. In VTP version 1 or 2, if you enter an extended-range VLAN ID when the switch is not in VTP transparent mode, an error message is generated when you exit VLAN configuration mode, and the extended-range VLAN is not created.

In VTP version 1 and 2, extended-range VLANs are not saved in the VLAN database; they are saved in the switch running configuration file. You can save the extended-range VLAN configuration in the switch startup configuration file by using the **copy running-config startup-config** privileged EXEC command. VTP version 3 saves extended-range VLANs in the VLAN database.

（注） Before you create an extended-range VLAN, you can verify that the VLAN ID is not used internally by entering the **show vlan internal usage** privileged EXEC command. If the VLAN ID is used internally and you want to free it up, go to the *Creating an Extended-Range VLAN with an Internal VLAN ID* before creating the extended-range VLAN.

手順の概要

1. **configure terminal**
2. **vtp mode transparent**
3. **vlan** *vlan-id*
4. **mtu** *mtu size*
5. **remote-span**
6. **end**
7. **show vlan id** *vlan-id*
8. **copy running-config startup config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**vtp mode transparent** 例： `Switch(config)# vtp mode transparent`	Configures the switch for VTP transparent mode, disabling VTP. （注） This step is not required for VTP version 3.

ステップ 3	**vlan** *vlan-id*
	
	例：
	`Switch(config)# vlan 2000`
	`Switch(config-vlan)#`
		Enters an extended-range VLAN ID and enters VLAN configuration mode. The range is 1006 to 4094.
		（注） To delete an extended-range VLAN, use the **no vlan vlan-id** global configuration command.

ステップ 4	**mtu** *mtu size* 例： `Switch(config-vlan)# mtu 1024`	Modifies the VLAN by changing the MTU size.
ステップ 5	**remote-span** 例： `Switch(config-vlan)# remote-span`	(Optional) Configures the VLAN as the RSPAN VLAN.

	コマンドまたはアクション	目的
ステップ 6	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 7	**show vlan id** *vlan-id* 例： `Switch# show vlan id 2000`	Verifies that the VLAN has been created.
ステップ 8	**copy running-config startup config** 例： `Switch# copy running-config startup-config`	Saves your entries in the switch startup configuration file. To save an extended-range VLAN configuration, you need to save the VTP transparent mode configuration and the extended-range VLAN configuration in the switch startup configuration file. Otherwise, if the switch resets, it will default to VTP server mode, and the extended-range VLAN IDs will not be saved. （注） This step is not required for VTP version 3 because VLANs are saved in the VLAN database. The procedure for assigning static-access ports to an extended-range VLAN is the same as for normal-range VLANs.

関連トピック

Extended-Range VLAN Configuration Guidelines, （45 ページ）
Example: Creating an Extended-Range VLAN, （58 ページ）

Creating an Extended-Range VLAN with an Internal VLAN ID

If you enter an extended-range VLAN ID that is already assigned to an internal VLAN, an error message is generated, and the extended-range VLAN is rejected. To manually free an internal VLAN ID, you must temporarily shut down the routed port that is using the internal VLAN ID.

手順の概要

1. **show vlan internal usage**
2. **configure terminal**
3. **interface** *interface-id*
4. **shutdown**
5. **exit**
6. **vtp mode transparent**
7. **vlan** *vlan-id*
8. **exit**
9. **interface** *interface-id*
10. **no shutdown**
11. **end**
12. **copy running-config startup config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**show vlan internal usage** 例： `Switch# show vlan internal usage`	Displays the VLAN IDs being used internally by the switch. If the VLAN ID that you want to use is an internal VLAN, the display shows the routed port that is using the VLAN ID. Enter that port number in Step 3.
ステップ 2	**configure terminal** 例： `Switch# configure terminal`	Enters global configuration mode.
ステップ 3	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/3`	Specifies the interface ID for the routed port that is using the VLAN ID, and enters interface configuration mode.
ステップ 4	**shutdown** 例： `Switch(config-if)# shutdown`	Shuts down the port to free the internal VLAN ID.

	コマンドまたはアクション	目的
ステップ 5	**exit** 例： `Switch(config-if)# exit`	Returns to global configuration mode.
ステップ 6	**vtp mode transparent** 例： `Switch(config)# vtp mode transparent`	Sets the VTP mode to transparent for creating extended-range VLANs. （注） This step is not required for VTP version 3.
ステップ 7	**vlan** *vlan-id* 例： `Switch(config-vlan)# vlan 2000`	Enters the new extended-range VLAN ID, and enters VLAN configuration mode.
ステップ 8	**exit** 例： `Switch(config-vlan)# exit`	Exits from VLAN configuration mode, and returns to global configuration mode.
ステップ 9	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/3`	Specifies the interface ID for the routed port that you shut down in Step 4, and enters interface configuration mode.
ステップ 10	**no shutdown** 例： `Switch(config)# no shutdown`	Reenables the routed port. It will be assigned a new internal VLAN ID.
ステップ 11	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 12	**copy running-config startup config** 例： `Switch# copy running-config`	Saves your entries in the switch startup configuration file. To save an extended-range VLAN configuration, you need to save the VTP transparent mode configuration and the extended-range VLAN configuration in the switch startup configuration file.

	コマンドまたはアクション	目的
	`startup-config`	Otherwise, if the switch resets, it will default to VTP server mode, and the extended-range VLAN IDs will not be saved. （注） This step is not required for VTP version 3 because VLANs are saved in the VLAN database.

Monitoring VLANs

表 *9* : ***Privileged EXEC show Commands***

Command	Purpose
show interfaces [**vlan** *vlan-id*]	Displays characteristics for all interfaces or for the specified VLAN configured on the switch.

Configuration Examples

Example: Creating a VLAN Name

This example shows how to create Ethernet VLAN 20, name it test20, and add it to the VLAN database:

```
Switch# configure terminal
Switch(config)# vlan 20
Switch(config-vlan)# name test20
Switch(config-vlan)# end
```

関連トピック

Creating or Modifying an Ethernet VLAN, （47 ページ）
Normal-Range VLAN Configuration Guidelines, （44 ページ）

Example: Configuring a Port as Access Port

This example shows how to configure a port as an access port in VLAN 2:

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# interface gigabitethernet2/0/1
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 2
Switch(config-if)# end
```

関連トピック

Assigning Static-Access Ports to a VLAN, （50 ページ）

Example: Creating an Extended-Range VLAN

This example shows how to create a new extended-range VLAN with all default characteristics, enter VLAN configuration mode, and save the new VLAN in the switch startup configuration file:

```
Switch(config)# vtp mode transparent
Switch(config)# vlan 2000
Switch(config-vlan)# end
Switch# copy running-config startup config
```

関連トピック

Creating an Extended-Range VLAN, （52 ページ）

Extended-Range VLAN Configuration Guidelines, （45 ページ）

Where to Go Next

After configuring VLANs, you can configure the following:

- VLAN Trunking Protocol (VTP)
- VLAN trunks
- Private VLANs
- VLAN Membership Policy Server (VMPS)
- Tunneling
- Voice VLANs

Additional References

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	*Catalyst 2960-XR Switch VLAN Management Command Reference*

Standards and RFCs

Standard/RFC	Title
—	—

MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature History and Information for VLAN

Release	Modification
Cisco IOS 15.0(2)EX1	This feature was introduced.

第 4 章

Configuring VLAN Trunks

- Finding Feature Information, 61 ページ
- Prerequisites for VLAN Trunks, 61 ページ
- Restrictions for VLAN Trunks, 62 ページ
- Information About VLAN Trunks, 62 ページ
- How to Configure VLAN Trunks, 67 ページ
- Configuration Examples for VLAN Trunking, 81 ページ
- Where to Go Next, 82 ページ
- Additional References, 82 ページ
- Feature History and Information for VLAN Trunks, 83 ページ

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for VLAN Trunks

The IEEE 802.1Q trunks impose these limitations on the trunking strategy for a network:

- In a network of Cisco switches connected through IEEE 802.1Q trunks, the switches maintain one spanning-tree instance for each VLAN allowed on the trunks. Non-Cisco devices might support one spanning-tree instance for all VLANs.

  When you connect a Cisco switch to a non-Cisco device through an IEEE 802.1Q trunk, the Cisco switch combines the spanning-tree instance of the VLAN of the trunk with the spanning-tree instance of the

non-Cisco IEEE 802.1Q switch. However, spanning-tree information for each VLAN is maintained by Cisco switches separated by a cloud of non-Cisco IEEE 802.1Q switches. The non-Cisco IEEE 802.1Q cloud separating the Cisco switches is treated as a single trunk link between the switches.

- Make sure the native VLAN for an IEEE 802.1Q trunk is the same on both ends of the trunk link. If the native VLAN on one end of the trunk is different from the native VLAN on the other end, spanning-tree loops might result.
- Disabling spanning tree on the native VLAN of an IEEE 802.1Q trunk without disabling spanning tree on every VLAN in the network can potentially cause spanning-tree loops. We recommend that you leave spanning tree enabled on the native VLAN of an IEEE 802.1Q trunk or disable spanning tree on every VLAN in the network. Make sure your network is loop-free before disabling spanning tree.

Restrictions for VLAN Trunks

Dynamic Trunking Protocol (DTP) is not supported on private-VLAN ports or tunnel ports.

The switch does not support Layer 3 trunks; you cannot configure subinterfaces or use the **encapsulation** keyword on Layer 3 interfaces. The switch does support Layer 2 trunks and Layer 3 VLAN interfaces, which provide equivalent capabilities.

Information About VLAN Trunks

Trunking Overview

A trunk is a point-to-point link between one or more Ethernet switch interfaces and another networking device such as a router or a switch. Ethernet trunks carry the traffic of multiple VLANs over a single link, and you can extend the VLANs across an entire network.

The following trunking encapsulations are available on all Ethernet interfaces:

- IEEE 802.1Q— Industry-standard trunking encapsulation.

Trunking Modes

Ethernet trunk interfaces support different trunking modes. You can set an interface as trunking or nontrunking or to negotiate trunking with the neighboring interface. To autonegotiate trunking, the interfaces must be in the same VTP domain.

Trunk negotiation is managed by the Dynamic Trunking Protocol (DTP), which is a Point-to-Point Protocol (PPP). However, some internetworking devices might forward DTP frames improperly, which could cause misconfigurations.

To avoid this, you should configure interfaces connected to devices that do not support DTP to not forward DTP frames, that is, to turn off DTP.

- If you do not intend to trunk across those links, use the **switchport mode access** interface configuration command to disable trunking.

- To enable trunking to a device that does not support DTP, use the **switchport mode trunk** and **switchport nonegotiate** interface configuration commands to cause the interface to become a trunk but to not generate DTP frames. Use the**switchport trunk encapsulation dot1q** interface to select the encapsulation type on the trunk port.

You can also specify on DTP interfaces whether the trunk uses IEEE 802.1Q encapsulation or if the encapsulation type is autonegotiated. The DTP supports autonegotiation of IEEE 802.1Q trunks.

Layer 2 Interface Modes

表 *10* : ***Layer 2 Interface Modes***

Mode	Function
switchport mode access	Puts the interface (access port) into permanent nontrunking mode and negotiates to convert the link into a nontrunk link. The interface becomes a nontrunk interface regardless of whether or not the neighboring interface is a trunk interface.
switchport mode dynamic auto	Makes the interface able to convert the link to a trunk link. The interface becomes a trunk interface if the neighboring interface is set to **trunk** or **desirable** mode. The default switchport mode for all Ethernet interfaces is **dynamic auto**.
switchport mode dynamic desirable	Makes the interface actively attempt to convert the link to a trunk link. The interface becomes a trunk interface if the neighboring interface is set to **trunk**, **desirable**, or **auto** mode.
switchport mode trunk	Puts the interface into permanent trunking mode and negotiates to convert the neighboring link into a trunk link. The interface becomes a trunk interface even if the neighboring interface is not a trunk interface.
switchport nonegotiate	Prevents the interface from generating DTP frames. You can use this command only when the interface switchport mode is **access** or **trunk**. You must manually configure the neighboring interface as a trunk interface to establish a trunk link.
switchport mode dot1q-tunnel	Configures the interface as a tunnel (nontrunking) port to be connected in an asymmetric link with an IEEE 802.1Q trunk port. The IEEE 802.1Q tunneling is used to maintain customer VLAN integrity across a service provider network.

Mode	Function
switchport mode private-vlan	Configures the private VLAN mode. （注） The **switchport mode private-vlan** command option is not supported.

Allowed VLANs on a Trunk

By default, a trunk port sends traffic to and receives traffic from all VLANs. All VLAN IDs, 1 to 4094, are allowed on each trunk. However, you can remove VLANs from the allowed list, preventing traffic from those VLANs from passing over the trunk.

To reduce the risk of spanning-tree loops or storms, you can disable VLAN 1 on any individual VLAN trunk port by removing VLAN 1 from the allowed list. When you remove VLAN 1 from a trunk port, the interface continues to send and receive management traffic, for example, Cisco Discovery Protocol (CDP), Port Aggregation Protocol (PAgP), Link Aggregation Control Protocol (LACP), DTP, and VTP in VLAN 1.

If a trunk port with VLAN 1 disabled is converted to a nontrunk port, it is added to the access VLAN. If the access VLAN is set to 1, the port will be added to VLAN 1, regardless of the **switchport trunk allowed** setting. The same is true for any VLAN that has been disabled on the port.

A trunk port can become a member of a VLAN if the VLAN is enabled, if VTP knows of the VLAN, and if the VLAN is in the allowed list for the port. When VTP detects a newly enabled VLAN and the VLAN is in the allowed list for a trunk port, the trunk port automatically becomes a member of the enabled VLAN. When VTP detects a new VLAN and the VLAN is not in the allowed list for a trunk port, the trunk port does not become a member of the new VLAN.

Load Sharing on Trunk Ports

Load sharing divides the bandwidth supplied by parallel trunks connecting switches. To avoid loops, STP normally blocks all but one parallel link between switches. Using load sharing, you divide the traffic between the links according to which VLAN the traffic belongs.

You configure load sharing on trunk ports by using STP port priorities or STP path costs. For load sharing using STP port priorities, both load-sharing links must be connected to the same switch. For load sharing using STP path costs, each load-sharing link can be connected to the same switch or to two different switches.

Network Load Sharing Using STP Priorities

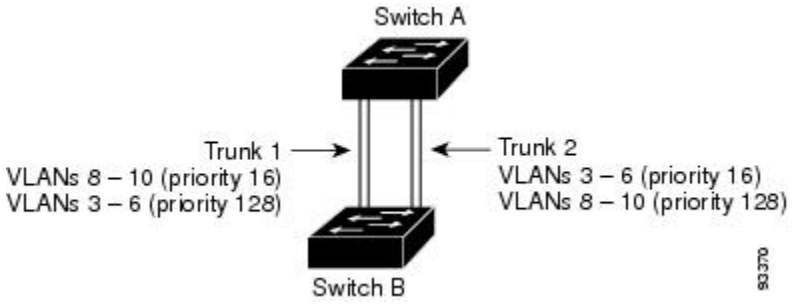
When two ports on the same switch form a loop, the switch uses the STP port priority to decide which port is enabled and which port is in a blocking state. You can set the priorities on a parallel trunk port so that the port carries all the traffic for a given VLAN. The trunk port with the higher priority (lower values) for a VLAN is forwarding traffic for that VLAN. The trunk port with the lower priority (higher values) for the same VLAN remains in a blocking state for that VLAN. One trunk port sends or receives all traffic for the VLAN.

This figure shows two trunks connecting supported switches.

- VLANs 8 through 10 are assigned a port priority of 16 on Trunk 1.
- VLANs 3 through 6 retain the default port priority of 128 on Trunk 1.

- VLANs 3 through 6 are assigned a port priority of 16 on Trunk 2.
- VLANs 8 through 10 retain the default port priority of 128 on Trunk 2.

図 4 : *Load Sharing by Using STP Port Priorities*



Trunk 1 carries traffic for VLANs 8 through 10, and Trunk 2 carries traffic for VLANs 3 through 6. If the active trunk fails, the trunk with the lower priority takes over and carries the traffic for all of the VLANs. No duplication of traffic occurs over any trunk port.

関連トピック

Configuring Load Sharing Using STP Port Priorities, （74 ページ）

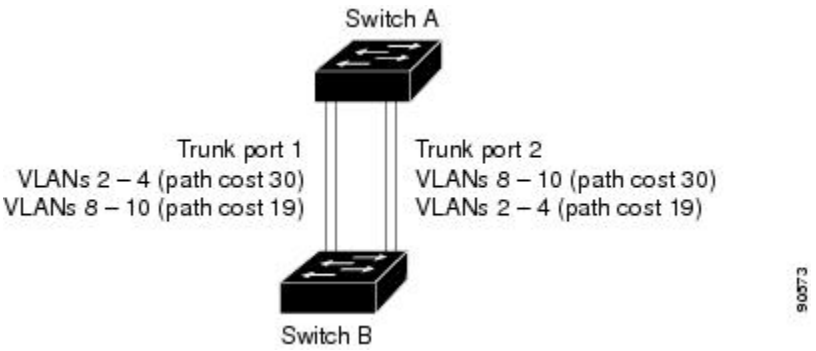
Network Load Sharing Using STP Path Cost

You can configure parallel trunks to share VLAN traffic by setting different path costs on a trunk and associating the path costs with different sets of VLANs, blocking different ports for different VLANs. The VLANs keep the traffic separate and maintain redundancy in the event of a lost link.

Trunk ports 1 and 2 are configured as 100BASE-T ports. These VLAN path costs are assigned:

- VLANs 2 through 4 are assigned a path cost of 30 on Trunk port 1.
- VLANs 8 through 10 retain the default 100BASE-T path cost on Trunk port 1 of 19.
- VLANs 8 through 10 are assigned a path cost of 30 on Trunk port 2.
- VLANs 2 through 4 retain the default 100BASE-T path cost on Trunk port 2 of 19.

図 5 : *Load-Sharing Trunks with Traffic Distributed by Path Cost*



関連トピック

Configuring Load Sharing Using STP Path Cost, （78 ページ）

Feature Interactions

Trunking interacts with other features in these ways:

- A trunk port cannot be a secure port.
- A trunk port cannot be a tunnel port.
- Trunk ports can be grouped into EtherChannel port groups, but all trunks in the group must have the same configuration. When a group is first created, all ports follow the parameters set for the first port to be added to the group. If you change the configuration of one of these parameters, the switch propagates the setting that you entered to all ports in the group:
  - Allowed-VLAN list.
  - STP port priority for each VLAN.
  - STP Port Fast setting.
  - Trunk status:

    If one port in a port group ceases to be a trunk, all ports cease to be trunks.
- We recommend that you configure no more than 24 trunk ports in Per VLAN Spanning Tree (PVST) mode and no more than 40 trunk ports in Multiple Spanning Tree (MST) mode.
- If you try to enable IEEE 802.1x on a trunk port, an error message appears, and IEEE 802.1x is not enabled. If you try to change the mode of an IEEE 802.1x-enabled port to trunk, the port mode is not changed.
- A port in dynamic mode can negotiate with its neighbor to become a trunk port. If you try to enable IEEE 802.1x on a dynamic port, an error message appears, and IEEE 802.1x is not enabled. If you try to change the mode of an IEEE 802.1x-enabled port to dynamic, the port mode is not changed.

関連トピック

Configuring a Trunk Port, （67 ページ）

Example: Configuring an IEEE 802.1Q Trunk, （81 ページ）

Default Layer 2 Ethernet Interface VLAN Configuration

The following table shows the default Layer 2 Ethernet interface VLAN configuration.

表 *11*：***Default Layer 2 Ethernet Interface VLAN Configuration***

Feature	Default Setting
Interface mode	**switchport mode dynamic auto**

Feature	Default Setting
Trunk encapsulation	**switchport trunk encapsulation negotiate**
Allowed VLAN range	VLANs 1 to 4094
VLAN range eligible for pruning	VLANs 2 to 1001
Default VLAN (for access ports)	VLAN 1
Native VLAN (for IEEE 802.1Q trunks)	VLAN 1

How to Configure VLAN Trunks

To avoid trunking misconfigurations, configure interfaces connected to devices that do not support DTP to not forward DTP frames, that is, to turn off DTP.

- If you do not intend to trunk across those links, use the **switchport mode access** interface configuration command to disable trunking.
- To enable trunking to a device that does not support DTP, use the **switchport mode trunk** and **switchport nonegotiate** interface configuration commands to cause the interface to become a trunk but to not generate DTP frames.

Configuring an Ethernet Interface as a Trunk Port

Configuring a Trunk Port

Because trunk ports send and receive VTP advertisements, to use VTP you must ensure that at least one trunk port is configured on the switch and that this trunk port is connected to the trunk port of a second switch. Otherwise, the switch cannot receive any VTP advertisements.

はじめる前に

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport mode** {**dynamic** {**auto** | **desirable**} | **trunk**}
4. **switchport access vlan** *vlan-id*
5. **switchport trunk native vlan** *vlan-id*
6. **end**
7. **show interfaces** *interface-id* **switchport**
8. **show interfaces** *interface-id* **trunk**
9. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/2`	Specifies the port to be configured for trunking, and enters interface configuration mode.
ステップ 3	**switchport mode** {**dynamic** {**auto** | **desirable**} | **trunk**} 例： `Switch(config-if)# switchport mode dynamic desirable`	Configures the interface as a Layer 2 trunk (required only if the interface is a Layer 2 access port or tunnel port or to specify the trunking mode). • **dynamic auto**—Sets the interface to a trunk link if the neighboring interface is set to trunk or desirable mode. This is the default. • **dynamic desirable**—Sets the interface to a trunk link if the neighboring interface is set to trunk, desirable, or auto mode. • **trunk**—Sets the interface in permanent trunking mode and negotiate to convert the link to a trunk link even if the neighboring interface is not a trunk interface.

	コマンドまたはアクション	目的
ステップ 4	**switchport access vlan** *vlan-id* 例： `Switch(config-if)# switchport access vlan 200`	(Optional) Specifies the default VLAN, which is used if the interface stops trunking.
ステップ 5	**switchport trunk native vlan** *vlan-id* 例： `Switch(config-if)# switchport trunk native vlan 200`	Specifies the native VLAN for IEEE 802.1Q trunks.
ステップ 6	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 7	**show interfaces** *interface-id* **switchport** 例： `Switch# show interfaces gigabitethernet1/0/2 switchport`	Displays the switch port configuration of the interface in the *Administrative Mode* and the *Administrative Trunking Encapsulation* fields of the display.
ステップ 8	**show interfaces** *interface-id* **trunk** 例： `Switch# show interfaces gigabitethernet1/0/2 trunk`	Displays the trunk configuration of the interface.
ステップ 9	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file. （注） To return an interface to its default configuration, use the **default interface** *interface-id* interface configuration command. To reset all trunking characteristics of a trunking interface to the defaults, use the **no switchport trunk** interface configuration command. To disable trunking, use the **switchport mode access** interface configuration command to configure the port as a static-access port.

関連トピック

Feature Interactions, （66 ページ）

Example: Configuring an IEEE 802.1Q Trunk, （81 ページ）

Defining the Allowed VLANs on a Trunk

VLAN 1 is the default VLAN on all trunk ports in all Cisco switches, and it has previously been a requirement that VLAN 1 always be enabled on every trunk link. You can use the VLAN 1 minimization feature to disable VLAN 1 on any individual VLAN trunk link so that no user traffic (including spanning-tree advertisements) is sent or received on VLAN 1.

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport mode trunk**
4. **switchport trunk allowed vlan** {**add** | **all** | **except** | **none** | **remove**} *vlan-list*
5. **end**
6. **show interfaces** *interface-id* **switchport**
7. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/1`	Specifies the port to be configured, and enters interface configuration mode.
ステップ 3	**switchport mode trunk** 例： `Switch(config-if)# switchport mode trunk`	Configures the interface as a VLAN trunk port.
ステップ 4	**switchport trunk allowed vlan** {**add**	**all**	**except**	**none**	**remove**} *vlan-list* 例： `Switch(config-if)# switchport trunk`	(Optional) Configures the list of VLANs allowed on the trunk. The *vlan-list* parameter is either a single VLAN number from 1 to 4094 or a range of VLANs described by two VLAN numbers, the lower one first, separated by a hyphen. Do not

	コマンドまたはアクション	目的
	allowed vlan remove 2	enter any spaces between comma-separated VLAN parameters or in hyphen-specified ranges. All VLANs are allowed by default.
ステップ **5**	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ **6**	**show interfaces** *interface-id* **switchport** 例： `Switch# show interfaces gigabitethernet1/0/1`	Verifies your entries in the *Trunking VLANs Enabled* field of the display.
ステップ **7**	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file. （注） To return to the default allowed VLAN list of all VLANs, use the **no switchport trunk allowed vlan** interface configuration command.

Changing the Pruning-Eligible List

The pruning-eligible list applies only to trunk ports. Each trunk port has its own eligibility list. VTP pruning must be enabled for this procedure to take effect.

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport trunk pruning vlan** {**add** | **except** | **none** | **remove**} *vlan-list* [,*vlan* [,*vlan* [,,,]]
4. **end**
5. **show interfaces** *interface-id* **switchport**
6. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet2/0/1`	Selects the trunk port for which VLANs should be pruned, and enters interface configuration mode.
ステップ 3	**switchport trunk pruning vlan** {**add** | **except** | **none** | **remove**} *vlan-list* [,*vlan* [,*vlan* [,,,]]	Configures the list of VLANs allowed to be pruned from the trunk. For explanations about using the **add**, **except**, **none**, and **remove** keywords, see the command reference for this release. Separate non-consecutive VLAN IDs with a comma and no spaces; use a hyphen to designate a range of IDs. Valid IDs are 2 to 1001. Extended-range VLANs (VLAN IDs 1006 to 4094) cannot be pruned. VLANs that are pruning-ineligible receive flooded traffic. The default list of VLANs allowed to be pruned contains VLANs 2 to 1001. （注） To return to the default pruning-eligible list of all VLANs, use the **no switchport trunk pruning vlan** interface configuration command.
ステップ 4	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 5	**show interfaces** *interface-id* **switchport** 例： `Switch# show interfaces gigabitethernet2/0/1 switchport`	Verifies your entries in the *Pruning VLANs Enabled* field of the display.
ステップ 6	**copy running-config startup-config** 例： `Switch# copy running-config`	(Optional) Saves your entries in the configuration file.

	コマンドまたはアクション	目的
	`startup-config`	

Configuring the Native VLAN for Untagged Traffic

A trunk port configured with IEEE 802.1Q tagging can receive both tagged and untagged traffic. By default, the switch forwards untagged traffic in the native VLAN configured for the port. The native VLAN is VLAN 1 by default.

The native VLAN can be assigned any VLAN ID.

If a packet has a VLAN ID that is the same as the outgoing port native VLAN ID, the packet is sent untagged; otherwise, the switch sends the packet with a tag.

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport trunk native vlan** *vlan-id*
4. **end**
5. **show interfaces** *interface-id* **switchport**
6. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/2`	Defines the interface that is configured as the IEEE 802.1Q trunk, and enters interface configuration mode.
ステップ 3	**switchport trunk native vlan** *vlan-id* 例： `Switch(config-if)# switchport trunk native`	Configures the VLAN that is sending and receiving untagged traffic on the trunk port. For *vlan-id*, the range is 1 to 4094.

	コマンドまたはアクション	目的
	`vlan 12`	
ステップ 4	**end** 例： `Switch(config-if)# end`	Returns to privileged EXEC mode.
ステップ 5	**show interfaces** *interface-id* **switchport** 例： `Switch# show interfaces gigabitethernet1/0/2 switchport`	Verifies your entries in the *Trunking Native Mode VLAN* field.
ステップ 6	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Configuring Trunk Ports for Load Sharing

Configuring Load Sharing Using STP Port Priorities

If your switch is a member of a switch stack, you must use the **spanning-tree** [**vlan** *vlan-id*] **cost** *cost* interface configuration command instead of the **spanning-tree** [**vlan** *vlan-id*] **port-priority** *priority* interface configuration command to select an interface to put in the forwarding state. Assign lower cost values to interfaces that you want selected first and higher cost values that you want selected last.

These steps describe how to configure a network with load sharing using STP port priorities.

手順の概要

1. **configure terminal**
2. **vtp domain** *domain-name*
3. **vtp mode server**
4. **end**
5. **show vtp status**
6. **show vlan**
7. **configure terminal**
8. **interface** *interface-id*
9. **switchport mode trunk**
10. **end**
11. **show interfaces** *interface-id* **switchport**
12. Repeat the above steps on Switch A for a second port in the switch or switch stack.
13. Repeat the above steps on Switch B to configure the trunk ports that connect to the trunk ports configured on Switch A.
14. **show vlan**
15. **configure terminal**
16. **interface** *interface-id*
17. **spanning-tree vlan** *vlan-range* **port-priority** *priority-value*
18. **exit**
19. **interface** *interface-id*
20. **spanning-tree vlan** *vlan-range* **port-priority** *priority-value*
21. **end**
22. **show running-config**
23. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters global configuration mode on Switch A.
ステップ 2	**vtp domain** *domain-name* 例： `Switch(config)# vtp domain workdomain`	Configures a VTP administrative domain. The domain name can be 1 to 32 characters.

	コマンドまたはアクション	目的
ステップ 3	**vtp mode server** 例： `Switch(config)# vtp mode server`	Configures Switch A as the VTP server.
ステップ 4	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 5	**show vtp status** 例： `Switch# show vtp status`	Verifies the VTP configuration on both Switch A and Switch B. In the display, check the *VTP Operating Mode* and the *VTP Domain Name* fields.
ステップ 6	**show vlan** 例： `Switch# show vlan`	Verifies that the VLANs exist in the database on Switch A.
ステップ 7	**configure terminal** 例： `Switch# configure terminal`	Enters global configuration mode.
ステップ 8	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/1`	Defines the interface to be configured as a trunk, and enters interface configuration mode.
ステップ 9	**switchport mode trunk** 例： `Switch(config-if)# switchport mode trunk`	Configures the port as a trunk port.
ステップ 10	**end** 例： `Switch(config-if)# end`	Returns to privileged EXEC mode.

	コマンドまたはアクション	目的
ステップ 11	**show interfaces** *interface-id* **switchport** 例： `Switch# show interfaces gigabitethernet1/0/1`	Verifies the VLAN configuration.
ステップ 12	Repeat the above steps on Switch A for a second port in the switch or switch stack.	
ステップ 13	Repeat the above steps on Switch B to configure the trunk ports that connect to the trunk ports configured on Switch A.	
ステップ 14	**show vlan** 例： `Switch# show vlan`	When the trunk links come up, VTP passes the VTP and VLAN information to Switch B. This command verifies that Switch B has learned the VLAN configuration.
ステップ 15	**configure terminal** 例： `Switch# configure terminal`	Enters global configuration mode on Switch A.
ステップ 16	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/1`	Defines the interface to set the STP port priority, and enters interface configuration mode.
ステップ 17	**spanning-tree vlan** *vlan-range* **port-priority** *priority-value* 例： `Switch(config-if)# spanning-tree vlan 8-10 port-priority 16`	Assigns the port priority for the VLAN range specified. Enter a port priority value from 0 to 240. Port priority values increment by 16.
ステップ 18	**exit** 例： `Switch(config-if)# exit`	Returns to global configuration mode.
ステップ 19	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/2`	Defines the interface to set the STP port priority, and enters interface configuration mode.

	コマンドまたはアクション	目的
ステップ 20	**spanning-tree vlan** *vlan-range* **port-priority** *priority-value* 例： `Switch(config-if)# spanning-tree vlan 3-6 port-priority 16`	Assigns the port priority for the VLAN range specified. Enter a port priority value from 0 to 240. Port priority values increment by 16.
ステップ 21	**end** 例： `Switch(config-if)# end`	Returns to privileged EXEC mode.
ステップ 22	**show running-config** 例： `Switch# show running-config`	Verifies your entries.
ステップ 23	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

関連トピック

Network Load Sharing Using STP Priorities, （64 ページ）

Configuring Load Sharing Using STP Path Cost

These steps describe how to configure a network with load sharing using STP path costs.

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport mode trunk**
4. **exit**
5. Repeat Steps 2 through 4 on a second interface in Switch A or in Switch A stack.
6. **end**
7. **show running-config**
8. **show vlan**
9. **configure terminal**
10. **interface** *interface-id*
11. **spanning-tree vlan** *vlan-range* **cost** *cost-value*
12. **end**
13. Repeat Steps 9 through 13 on the other configured trunk interface on Switch A, and set the spanning-tree path cost to 30 for VLANs 8, 9, and 10.
14. **exit**
15. **show running-config**
16. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters global configuration mode on Switch A.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/1`	Defines the interface to be configured as a trunk, and enters interface configuration mode.
ステップ 3	**switchport mode trunk** 例： `Switch(config-if)# switchport mode trunk`	Configures the port as a trunk port.

	コマンドまたはアクション	目的
ステップ 4	**exit** 例： `Switch(config-if)# exit`	Returns to global configuration mode.
ステップ 5	Repeat Steps 2 through 4 on a second interface in Switch A or in Switch A stack.	
ステップ 6	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 7	**show running-config** 例： `Switch# show running-config`	Verifies your entries. In the display, make sure that the interfaces are configured as trunk ports.
ステップ 8	**show vlan** 例： `Switch# show vlan`	When the trunk links come up, Switch A receives the VTP information from the other switches. This command verifies that Switch A has learned the VLAN configuration.
ステップ 9	**configure terminal** 例： `Switch# configure terminal`	Enters global configuration mode.
ステップ 10	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/1`	Defines the interface on which to set the STP cost, and enters interface configuration mode.
ステップ 11	**spanning-tree vlan** *vlan-range* **cost** *cost-value* 例： `Switch(config-if)# spanning-tree vlan 2-4 cost 30`	Sets the spanning-tree path cost to 30 for VLANs 2 through 4.

	コマンドまたはアクション	目的
ステップ 12	**end** 例： `Switch(config-if)# end`	Returns to global configuration mode.
ステップ 13	Repeat Steps 9 through 13 on the other configured trunk interface on Switch A, and set the spanning-tree path cost to 30 for VLANs 8, 9, and 10.	
ステップ 14	**exit** 例： `Switch(config)# exit`	Returns to privileged EXEC mode.
ステップ 15	**show running-config** 例： `Switch# show running-config`	Verifies your entries. In the display, verify that the path costs are set correctly for both trunk interfaces.
ステップ 16	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

関連トピック

Network Load Sharing Using STP Path Cost, （65 ページ）

Configuration Examples for VLAN Trunking

Example: Configuring an IEEE 802.1Q Trunk

This example shows how to configure a port as an IEEE 802.1Q trunk. The example assumes that the neighbor interface is configured to support IEEE 802.1Q trunking.

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# interface gigabitethernet0/2
Switch(config-if)# switchport mode dynamic desirable
Switch(config-if)# switchport trunk encapsulation dot1q
Switch(config-if)# end
```

関連トピック

Configuring a Trunk Port, （67 ページ）

Feature Interactions, （66 ページ）

Example: Removing a VLAN

This example shows how to remove VLAN 2 from the allowed VLAN list on a port:

```
Switch(config)# interface gigabitethernet0/1
Switch(config-if)# switchport trunk allowed vlan remove 2
Switch(config-if)# end
```

関連トピック

Defining the Allowed VLANs on a Trunk

Where to Go Next

After configuring VLAN trunks, you can configure the following:

- VTP
- VLANs
- Private VLANs
- VLAN Membership Policy Server (VMPS)
- Tunneling
- Voice VLANs

Additional References

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	*Catalyst 2960-XR Switch VLAN Management Command Reference*

Standards and RFCs

Standard/RFC	Title
—	—

MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature History and Information for VLAN Trunks

Release	Modification
Cisco IOS 15.0(2)EX1	This feature was introduced.

第 5 章

Configuring Private VLANs

- Finding Feature Information, 85 ページ
- Prerequisites for Private VLANs, 85 ページ
- Restrictions for Private VLANs, 88 ページ
- Information About Private VLANs, 89 ページ
- How to Configure Private VLANs, 95 ページ
- Monitoring Private VLANs, 103 ページ
- Configuration Examples for Private VLANs, 104 ページ
- Where to Go Next, 106 ページ
- Additional References, 106 ページ
- Feature History and Information for Private VLANs, 107 ページ

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Private VLANs

The following are prerequisites for configuring private VLANs:

- When you configure private VLANs on switches running VTP, the switch must be in VTP transparent mode.

- When configuring private VLANs on the switch, always use the default Switch Database Management (SDM) template to balance system resources between unicast routes and Layer 2 entries. If another SDM template is configured, use the **sdm prefer default** global configuration command to set the default template.

Secondary and Primary VLAN Configuration

Follow these guidelines when configuring private VLANs:

- If the switch is running VTP version 1 or 2, you must set VTP to transparent mode. After you configure a private VLAN, you should not change the VTP mode to client or server. VTP version 3 supports private VLANs in all modes.
- With VTP version 1 or 2, after you have configured private VLANs, use the **copy running-config startup config** privileged EXEC command to save the VTP transparent mode configuration and private-VLAN configuration in the switch startup configuration file. Otherwise, if the switch resets, it defaults to VTP server mode, which does not support private VLANs. VTP version 3 does support private VLANs.
- VTP version 1 and 2 do not propagate private-VLAN configuration. You must configure private VLANs on each device where you want private-VLAN ports unless the devices are running VTP version 3.
- You cannot configure VLAN 1 or VLANs 1002 to 1005 as primary or secondary VLANs. Extended VLANs (VLAN IDs 1006 to 4094) can belong to private VLANs.
- A primary VLAN can have one isolated VLAN and multiple community VLANs associated with it. An isolated or community VLAN can have only one primary VLAN associated with it.
- Although a private VLAN contains more than one VLAN, only one Spanning Tree Protocol (STP) instance runs for the entire private VLAN. When a secondary VLAN is associated with the primary VLAN, the STP parameters of the primary VLAN are propagated to the secondary VLAN.
- You can enable DHCP snooping on private VLANs. When you enable DHCP snooping on the primary VLAN, it is propagated to the secondary VLANs. If you configure DHCP on a secondary VLAN, the configuration does not take effect if the primary VLAN is already configured.
- When you enable IP source guard on private-VLAN ports, you must enable DHCP snooping on the primary VLAN.
- We recommend that you prune the private VLANs from the trunks on devices that carry no traffic in the private VLANs.
- You can apply different quality of service (QoS) configurations to primary, isolated, and community VLANs.
- Note the following considerations for sticky ARP:
    - Sticky ARP entries are those learned on SVIs and Layer 3 interfaces. These entries do not age out.
    - The **ip sticky-arp** global configuration command is supported only on SVIs belonging to private VLANs.
    - The **ip sticky-arp** interface configuration command is only supported on:
        - Layer 3 interfaces
        - SVIs belonging to normal VLANs

- SVIs belonging to private VLANs

For more information about using the **ip sticky-arp** *global* configuration and the **ip sticky-arp interface** configuration commands, see the command reference for this release.

- You can configure VLAN maps on primary and secondary VLANs. However, we recommend that you configure the same VLAN maps on private-VLAN primary and secondary VLANs.
- When a frame is Layer-2 forwarded within a private VLAN, the same VLAN map is applied at the ingress side and at the egress side. When a frame is routed from inside a private VLAN to an external port, the private-VLAN map is applied at the ingress side.
  - For frames going upstream from a host port to a promiscuous port, the VLAN map configured on the secondary VLAN is applied.
  - For frames going downstream from a promiscuous port to a host port, the VLAN map configured on the primary VLAN is applied.

    To filter out specific IP traffic for a private VLAN, you should apply the VLAN map to both the primary and secondary VLANs.
- You can apply router ACLs only on the primary-VLAN SVIs. The ACL is applied to both primary and secondary VLAN Layer 3 traffic.
- Although private VLANs provide host isolation at Layer 2, hosts can communicate with each other at Layer 3.
- Private VLANs support these Switched Port Analyzer (SPAN) features:
  - You can configure a private-VLAN port as a SPAN source port.
  - You can use VLAN-based SPAN (VSPAN) on primary, isolated, and community VLANs or use SPAN on only one VLAN to separately monitor egress or ingress traffic.

Private VLAN Port Configuration

Follow these guidelines when configuring private VLAN ports:

- Use only the private VLAN configuration commands to assign ports to primary, isolated, or community VLANs. Layer 2 access ports assigned to the VLANs that you configure as primary, isolated, or community VLANs are inactive while the VLAN is part of the private VLAN configuration. Layer 2 trunk interfaces remain in the STP forwarding state.
- Do not configure ports that belong to a PAgP or LACP EtherChannel as private VLAN ports. While a port is part of the private VLAN configuration, any EtherChannel configuration for it is inactive.
- Enable Port Fast and BPDU guard on isolated and community host ports to prevent STP loops due to misconfigurations and to speed up STP convergence. When enabled, STP applies the BPDU guard feature to all Port Fast-configured Layer 2 LAN ports. Do not enable Port Fast and BPDU guard on promiscuous ports.
- If you delete a VLAN used in the private VLAN configuration, the private VLAN ports associated with the VLAN become inactive.

- Private VLAN ports can be on different network devices if the devices are trunk-connected and the primary and secondary VLANs have not been removed from the trunk.

Restrictions for Private VLANs

The following are restrictions for configuring private VLANs:

- Private VLANs are only supported on switches running the IP Lite image.

Limitations with Other Features

When configuring private VLANs, remember these limitations with other features:

（注） In some cases, the configuration is accepted with no error messages, but the commands have no effect.

- Do not configure fallback bridging on switches with private VLANs.
- When IGMP snooping is enabled on the switch (the default), the switch or switch stack supports no more than 20 private VLAN domains.
- Do not configure a remote SPAN (RSPAN) VLAN as a private VLAN primary or secondary VLAN.
- Do not configure private VLAN ports on interfaces configured for these other features:
  - Dynamic-access port VLAN membership
  - Dynamic Trunking Protocol (DTP)
  - Port Aggregation Protocol (PAgP)
  - Link Aggregation Control Protocol (LACP)
  - Multicast VLAN Registration (MVR)
  - Voice VLAN
  - Web Cache Communication Protocol (WCCP)
- You can configure IEEE 802.1x port-based authentication on a private VLAN port, but do not configure 802.1x with port security, voice VLAN, or per-user ACL on private VLAN ports.
- A private VLAN host or promiscuous port cannot be a SPAN destination port. If you configure a SPAN destination port as a private VLAN port, the port becomes inactive.
- If you configure a static MAC address on a promiscuous port in the primary VLAN, you must add the same static address to all associated secondary VLANs. If you configure a static MAC address on a host port in a secondary VLAN, you must add the same static MAC address to the associated primary VLAN. When you delete a static MAC address from a private VLAN port, you must remove all instances of the configured MAC address from the private VLAN.

（注） Dynamic MAC addresses learned in one VLAN of a private VLAN are replicated in the associated VLANs. For example, a MAC address learned in a secondary VLAN is replicated in the primary VLAN. When the original dynamic MAC address is deleted or aged out, the replicated addresses are removed from the MAC address table.

- Configure Layer 3 VLAN interfaces (SVIs) only for primary VLANs.

Information About Private VLANs

Private VLAN Domains

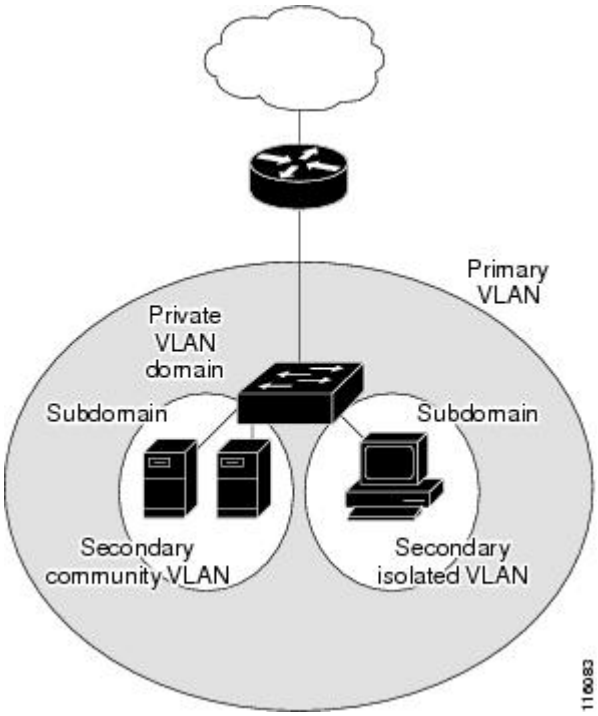
The private VLAN feature addresses two problems that service providers face when using VLANs:

- The switch supports up to 1005 active VLANs. If a service provider assigns one VLAN per customer, this limits the numbers of customers the service provider can support.
- To enable IP routing, each VLAN is assigned a subnet address space or a block of addresses, which can result in wasting the unused IP addresses, and cause IP address management problems.

Using private VLANs addresses the scalability problem and provides IP address management benefits for service providers and Layer 2 security for customers. Private VLANs partition a regular VLAN domain into subdomains. A subdomain is represented by a pair of VLANs: a primary VLAN and a secondary VLAN. A

private VLAN can have multiple VLAN pairs, one pair for each subdomain. All VLAN pairs in a private VLAN share the same primary VLAN. The secondary VLAN ID differentiates one subdomain from another.

図 *6* : ***Private VLAN Domain***



関連トピック

Configuring and Associating VLANs in a Private VLAN, （95 ページ）

Example: Configuring a Primary VLAN, Isolated VLAN, and a Community of VLANs, （104 ページ）

Secondary VLANs

There are two types of secondary VLANs:

- Isolated VLANs—Ports within an isolated VLAN cannot communicate with each other at the Layer 2 level.
- Community VLANs—Ports within a community VLAN can communicate with each other but cannot communicate with ports in other communities at the Layer 2 level.

Private VLANs Ports

Private VLANs provide Layer 2 isolation between ports within the same private VLAN. Private VLAN ports are access ports that are one of these types:

- Promiscuous—A promiscuous port belongs to the primary VLAN and can communicate with all interfaces, including the community and isolated host ports that belong to the secondary VLANs associated with the primary VLAN.
- Isolated—An isolated port is a host port that belongs to an isolated secondary VLAN. It has complete Layer 2 separation from other ports within the same private VLAN, except for the promiscuous ports. Private VLANs block all traffic to isolated ports except traffic from promiscuous ports. Traffic received from an isolated port is forwarded only to promiscuous ports.
- Community—A community port is a host port that belongs to a community secondary VLAN. Community ports communicate with other ports in the same community VLAN and with promiscuous ports. These interfaces are isolated at Layer 2 from all other interfaces in other communities and from isolated ports within their private VLAN.

（注） Trunk ports carry traffic from regular VLANs and also from primary, isolated, and community VLANs.

Primary and secondary VLANs have these characteristics:

- Primary VLAN—A private VLAN has only one primary VLAN. Every port in a private VLAN is a member of the primary VLAN. The primary VLAN carries unidirectional traffic downstream from the promiscuous ports to the (isolated and community) host ports and to other promiscuous ports.
- Isolated VLAN —A private VLAN has only one isolated VLAN. An isolated VLAN is a secondary VLAN that carries unidirectional traffic upstream from the hosts toward the promiscuous ports and the gateway.
- Community VLAN—A community VLAN is a secondary VLAN that carries upstream traffic from the community ports to the promiscuous port gateways and to other host ports in the same community. You can configure multiple community VLANs in a private VLAN.

A promiscuous port can serve only one primary VLAN, one isolated VLAN, and multiple community VLANs. Layer 3 gateways are typically connected to the switch through a promiscuous port. With a promiscuous port, you can connect a wide range of devices as access points to a private VLAN. For example, you can use a promiscuous port to monitor or back up all the private VLAN servers from an administration workstation.

関連トピック

Configuring a Layer 2 Interface as a Private VLAN Host Port, （98 ページ）
Example: Configuring an Interface as a Host Port, （104 ページ）
Configuring a Layer 2 Interface as a Private VLAN Promiscuous Port, （100 ページ）
Example: Configuring an Interface as a Private VLAN Promiscuous Port, （105 ページ）

Private VLANs in Networks

In a switched environment, you can assign an individual private VLAN and associated IP subnet to each individual or common group of end stations. The end stations need to communicate only with a default gateway to communicate outside the private VLAN.

You can use private VLANs to control access to end stations in these ways:

- Configure selected interfaces connected to end stations as isolated ports to prevent any communication at Layer 2. For example, if the end stations are servers, this configuration prevents Layer 2 communication between the servers.
- Configure interfaces connected to default gateways and selected end stations (for example, backup servers) as promiscuous ports to allow all end stations access to a default gateway.

You can extend private VLANs across multiple devices by trunking the primary, isolated, and community VLANs to other devices that support private VLANs. To maintain the security of your private VLAN configuration and to avoid other use of the VLANs configured as private VLANs, configure private VLANs on all intermediate devices, including devices that have no private VLAN ports.

IP Addressing Scheme with Private VLANs

Assigning a separate VLAN to each customer creates an inefficient IP addressing scheme:

- Assigning a block of addresses to a customer VLAN can result in unused IP addresses.
- If the number of devices in the VLAN increases, the number of assigned address might not be large enough to accommodate them.

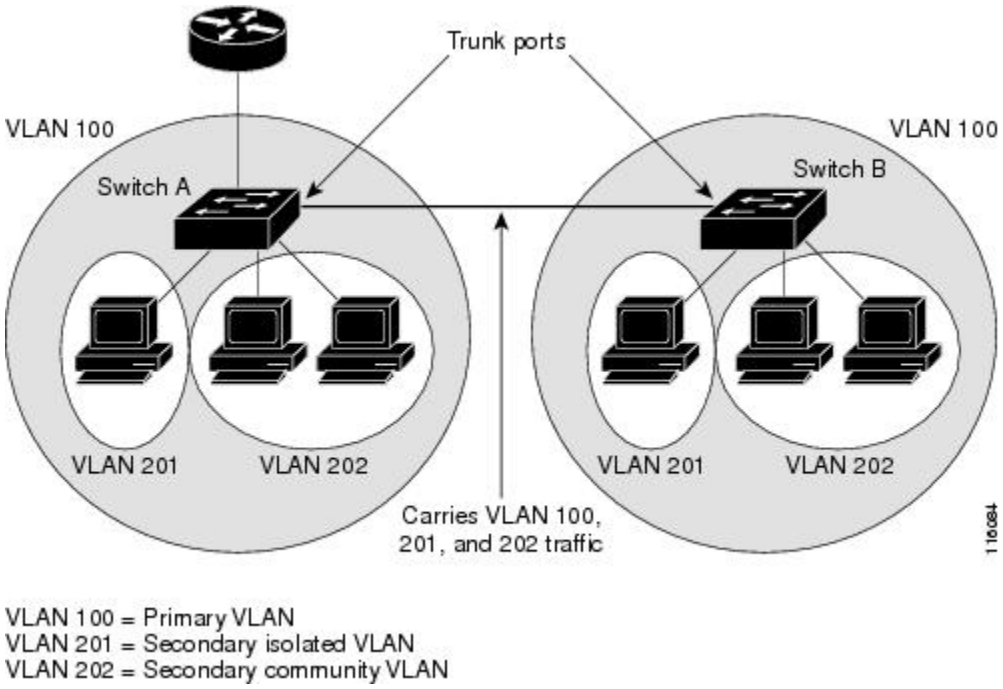
These problems are reduced by using private VLANs, where all members in the private VLAN share a common address space, which is allocated to the primary VLAN. Hosts are connected to secondary VLANs, and the DHCP server assigns them IP addresses from the block of addresses allocated to the primary VLAN. Subsequent IP addresses can be assigned to customer devices in different secondary VLANs, but in the same primary VLAN. When new devices are added, the DHCP server assigns them the next available address from a large pool of subnet addresses.

Private VLANs Across Multiple Switches

As with regular VLANs, private VLANs can span multiple switches. A trunk port carries the primary VLAN and secondary VLANs to a neighboring switch. The trunk port treats the private VLAN as any other VLAN.

A feature of private VLANs across multiple switches is that traffic from an isolated port in switch A does not reach an isolated port on Switch B.

図 *7* : ***Private VLANs Across Switches***



VLAN 100 = Primary VLAN
VLAN 201 = Secondary isolated VLAN
VLAN 202 = Secondary community VLAN

Because VTP does not support private VLANs, you must manually configure private VLANs on all switches in the Layer 2 network. If you do not configure the primary and secondary VLAN association in some switches in the network, the Layer 2 databases in these switches are not merged. This can result in unnecessary flooding of private VLAN traffic on those switches.

Private VLAN Interaction with Other Features

Private VLANs and Unicast, Broadcast, and Multicast Traffic

In regular VLANs, devices in the same VLAN can communicate with each other at the Layer 2 level, but devices connected to interfaces in different VLANs must communicate at the Layer 3 level. In private VLANs, the promiscuous ports are members of the primary VLAN, while the host ports belong to secondary VLANs. Because the secondary VLAN is associated to the primary VLAN, members of the these VLANs can communicate with each other at the Layer 2 level.

In a regular VLAN, broadcasts are forwarded to all ports in that VLAN. Private VLAN broadcast forwarding depends on the port sending the broadcast:

- An isolated port sends a broadcast only to the promiscuous ports or trunk ports.
- A community port sends a broadcast to all promiscuous ports, trunk ports, and ports in the same community VLAN.
- A promiscuous port sends a broadcast to all ports in the private VLAN (other promiscuous ports, trunk ports, isolated ports, and community ports).

Multicast traffic is routed or bridged across private VLAN boundaries and within a single community VLAN. Multicast traffic is not forwarded between ports in the same isolated VLAN or between ports in different secondary VLANs.

Private VLANs and SVIs

In a Layer 3 switch, a switch virtual interface (SVI) represents the Layer 3 interface of a VLAN. Layer 3 devices communicate with a private VLAN only through the primary VLAN and not through secondary VLANs. Configure Layer 3 VLAN interfaces (SVIs) only for primary VLANs. You cannot configure Layer 3 VLAN interfaces for secondary VLANs. SVIs for secondary VLANs are inactive while the VLAN is configured as a secondary VLAN.

- If you try to configure a VLAN with an active SVI as a secondary VLAN, the configuration is not allowed until you disable the SVI.
- If you try to create an SVI on a VLAN that is configured as a secondary VLAN and the secondary VLAN is already mapped at Layer 3, the SVI is not created, and an error is returned. If the SVI is not mapped at Layer 3, the SVI is created, but it is automatically shut down.

When the primary VLAN is associated with and mapped to the secondary VLAN, any configuration on the primary VLAN is propagated to the secondary VLAN SVIs. For example, if you assign an IP subnet to the primary VLAN SVI, this subnet is the IP subnet address of the entire private VLAN.

Private VLANs and Switch Stacks

Private VLANs can operate within the switch stack, and private-VLAN ports can reside on different stack members. However, some changes to the switch stack can impact private-VLAN operation:

- If a stack contains only one private-VLAN promiscuous port and the stack member that contains that port is removed from the stack, host ports in that private VLAN lose connectivity outside the private VLAN.
- If a stack master stack that contains the only private-VLAN promiscuous port in the stack fails or leaves the stack and a new stack master is elected, host ports in a private VLAN that had its promiscuous port on the old stack master lose connectivity outside of the private VLAN.
- If two stacks merge, private VLANs on the winning stack are not affected, but private-VLAN configuration on the losing switch is lost when that switch reboots.

Private VLAN Configuration Tasks

To configure a private VLAN, perform these steps:

1. Set VTP mode to transparent.
2. Create the primary and secondary VLANs and associate them.

（注） If the VLAN is not created already, the private VLAN configuration process creates it.

3 Configure interfaces to be isolated or community host ports, and assign VLAN membership to the host port.

4 Configure interfaces as promiscuous ports, and map the promiscuous ports to the primary-secondary VLAN pair.

5 If inter-VLAN routing will be used, configure the primary SVI, and map the secondary VLANs to the primary.

6 Verify the private VLAN configuration.

Default Private VLAN Configuration

No private VLANs are configured.

How to Configure Private VLANs

Configuring and Associating VLANs in a Private VLAN

The **private-vlan** commands do not take effect until you exit VLAN configuration mode.

手順の概要

1. **configure terminal**
2. **vtp mode transparent**
3. **vlan** *vlan-id*
4. **private-vlan primary**
5. **exit**
6. **vlan** *vlan-id*
7. **private-vlan isolated**
8. **exit**
9. **vlan** *vlan-id*
10. **private-vlan community**
11. **exit**
12. **vlan** *vlan-id*
13. **private-vlan association** [**add** | **remove**] *secondary_vlan_list*
14. **end**
15. **show vlan private-vlan** [**type**] or **show interfaces status**
16. **copy running-config startup config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters global configuration mode.
ステップ 2	**vtp mode transparent** 例： `Switch(config)# vtp mode transport`	Sets VTP mode to transparent (disable VTP).
ステップ 3	**vlan** *vlan-id* 例： `Switch(config)# vlan 20`	Enters VLAN configuration mode and designates or creates a VLAN that will be the primary VLAN. The VLAN ID range is 2 to 1001 and 1006 to 4094.
ステップ 4	**private-vlan primary** 例： `Switch(config-vlan)# private-vlan primary`	Designates the VLAN as the primary VLAN.
ステップ 5	**exit** 例： `Switch(config-vlan)# exit`	Returns to global configuration mode.
ステップ 6	**vlan** *vlan-id* 例： `Switch(config)# vlan 501`	(Optional) Enters VLAN configuration mode and designates or creates a VLAN that will be an isolated VLAN. The VLAN ID range is 2 to 1001 and 1006 to 4094.
ステップ 7	**private-vlan isolated** 例： `Switch(config-vlan)# private-vlan isolated`	Designates the VLAN as an isolated VLAN.

	コマンドまたはアクション	目的
ステップ 8	**exit** 例： `Switch(config-vlan)# exit`	Returns to global configuration mode.
ステップ 9	**vlan** *vlan-id* 例： `Switch(config)# vlan 502`	(Optional) Enters VLAN configuration mode and designates or creates a VLAN that will be a community VLAN. The VLAN ID range is 2 to 1001 and 1006 to 4094.
ステップ 10	**private-vlan community** 例： `Switch(config-vlan)# private-vlan community`	Designates the VLAN as a community VLAN.
ステップ 11	**exit** 例： `Switch(config-vlan)# exit`	Returns to global configuration mode.
ステップ 12	**vlan** *vlan-id* 例： `Switch(config)# vlan 503`	Enters VLAN configuration mode for the primary VLAN designated in Step 2.
ステップ 13	**private-vlan association** [**add** | **remove**] *secondary_vlan_list* 例： `Switch(config-vlan)# private-vlan association 501-503`	Associates the secondary VLANs with the primary VLAN.
ステップ 14	**end** 例： `Switch(config-vlan)# end`	Returns to privileged EXEC mode.
ステップ 15	**show vlan private-vlan** [**type**] or **show interfaces status**	Verifies the configuration.

	コマンドまたはアクション	目的
	例： `Switch(config)# show vlan private vlan`	
ステップ 16	**copy running-config startup config** 例： `Switch# copy running-config startup-config`	Saves your entries in the switch startup configuration file. To save the private-VLAN configuration, you need to save the VTP transparent mode configuration and private-VLAN configuration in the switch startup configuration file. Otherwise, if the switch resets, it defaults to VTP server mode, which does not support private VLANs.

関連トピック

Private VLAN Domains, （89 ページ）
Example: Configuring a Primary VLAN, Isolated VLAN, and a Community of VLANs, （104 ページ）

Configuring a Layer 2 Interface as a Private VLAN Host Port

Beginning in privileged EXEC mode, follow these steps to configure a Layer 2 interface as a private-VLAN host port and to associate it with primary and secondary VLANs:

（注） Isolated and community VLANs are both secondary VLANs.

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport mode private-vlan host**
4. **switchport private-vlan host-association** *primary_vlan_id secondary_vlan_id*
5. **end**
6. **show interfaces** [*interface-id*] **switchport**
7. **copy running-config startup config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/22`	Enters interface configuration mode for the Layer 2 interface to be configured.
ステップ 3	**switchport mode private-vlan host** 例： `Switch(config-if)# switchport mode private-vlan host`	Configures the Layer 2 port as a private-VLAN host port.
ステップ 4	**switchport private-vlan host-association** *primary_vlan_id secondary_vlan_id* 例： `Switch(config-if)# switchport private-vlan host-association 20 501`	Associates the Layer 2 port with a private VLAN.
ステップ 5	**end** 例： `Switch(config-if)# end`	Returns to privileged EXEC mode.
ステップ 6	**show interfaces** [*interface-id*] **switchport** 例： `Switch# show interfaces gigabitethernet1/0/22 switchport`	Verifies the configuration.
ステップ 7	**copy running-config startup config** 例： `Switch# copy running-config startup-config`	Saves your entries in the switch startup configuration file.

関連トピック

Private VLANs Ports, （90 ページ）
Example: Configuring an Interface as a Host Port, （104 ページ）

Configuring a Layer 2 Interface as a Private VLAN Promiscuous Port

Beginning in privileged EXEC mode, follow these steps to configure a Layer 2 interface as a private VLAN promiscuous port and map it to primary and secondary VLANs:

（注） Isolated and community VLANs are both secondary VLANs.

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport mode private-vlan promiscuous**
4. **switchport private-vlan mapping** *primary_vlan_id* {**add** | **remove**} *secondary_vlan_list*
5. **end**
6. **show interfaces** [*interface-id*] **switchport**
7. **copy running-config startup config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/2`	Enters interface configuration mode for the Layer 2 interface to be configured.
ステップ 3	**switchport mode private-vlan promiscuous** 例： `Switch(config-if)# switchport mode private-vlan promiscuous`	Configures the Layer 2 port as a private VLAN promiscuous port.

	コマンドまたはアクション	目的
ステップ 4	**switchport private-vlan mapping** *primary_vlan_id* {**add** | **remove**} *secondary_vlan_list* 例： `Switch(config-if)# switchport private-vlan mapping 20 add 501-503`	Maps the private VLAN promiscuous port to a primary VLAN and to selected secondary VLANs. The *secondary_vlan_list* parameter cannot contain spaces. It can contain multiple comma-separated items. Each item can be a single private VLAN ID or a hyphenated range of private VLAN IDs. Enter a *secondary_vlan_list*, or use the **add** keyword with a *secondary_vlan_list* to map the secondary VLANs to the private VLAN promiscuous port. Use the **remove** keyword with a *secondary_vlan_list* to clear the mapping between secondary VLANs and the private VLAN promiscuous port.
ステップ 5	**end** 例： `Switch(config-if)# end`	Returns to privileged EXEC mode.
ステップ 6	**show interfaces** [*interface-id*] **switchport** 例： `Switch# show interfaces gigabitethernet1/0/2 switchport`	Verifies the configuration.
ステップ 7	**copy running-config startup config** 例： `Switch# copy running-config startup-config`	Saves your entries in the switch startup configuration file.

関連トピック

Private VLANs Ports, （90 ページ）

Example: Configuring an Interface as a Private VLAN Promiscuous Port, （105 ページ）

Mapping Secondary VLANs to a Primary VLAN Layer 3 VLAN Interface

If the private VLAN will be used for inter-VLAN routing, you configure an SVI for the primary VLAN and map secondary VLANs to the SVI.

Isolated and community VLANs are both secondary VLANs.

The **private-vlan mapping** interface configuration command only affects private VLAN traffic that is Layer 3 switched.

Beginning in privileged EXEC mode, follow these steps to map secondary VLANs to the SVI of a primary VLAN to allow Layer 3 switching of private VLAN traffic:

手順の概要

1. **configure terminal**
2. **interface vlan** *primary_vlan_id*
3. **private-vlan mapping** [**add** | **remove**] *secondary_vlan_list*
4. **end**
5. **show interface private-vlan mapping**
6. **copy running-config startup config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters global configuration mode.
ステップ 2	**interface vlan** *primary_vlan_id* 例： `Switch(config)# interface vlan 10`	Enters interface configuration mode for the primary VLAN, and configures the VLAN as an SVI. The VLAN ID range is 2 to 1001 and 1006 to 4094.
ステップ 3	**private-vlan mapping** [**add** | **remove**] *secondary_vlan_list* 例： `Switch(config-if)# private-vlan mapping 501-502`	Maps the secondary VLANs to the Layer 3 VLAN interface of a primary VLAN to allow Layer 3 switching of private VLAN ingress traffic. The *secondary_vlan_list* parameter cannot contain spaces. It can contain multiple comma-separated items. Each item can be a single private VLAN ID or a hyphenated range of private VLAN IDs. Enter a *secondary_vlan_list*, or use the **add** keyword with a *secondary_vlan_list* to map the secondary VLANs to the primary VLAN. Use the **remove** keyword with a *secondary_vlan_list* to clear the mapping between secondary VLANs and the primary VLAN.
ステップ 4	**end** 例： `Switch(config-if)# end`	Returns to privileged EXEC mode.

	コマンドまたはアクション	目的
ステップ 5	**show interface private-vlan mapping** 例： `Switch# show interfaces private-vlan mapping`	Verifies the configuration.
ステップ 6	**copy running-config startup config** 例： `Switch# copy running-config startup-config`	Saves your entries in the switch startup configuration file.

関連トピック

Example: Mapping Secondary VLANs to a Primary VLAN Interface, （105 ページ）

Monitoring Private VLANs

The following table displays the commands used to monitor private VLANs.

表 *12*：***Private VLAN Monitoring Commands***

Command	Purpose
show interfaces status	Displays the status of interfaces, including the VLANs to which they belongs.
show vlan private-vlan [**type**]	Displays the private VLAN information for the switch or switch stack.
show interface switchport	Displays private VLAN configuration on interfaces.
show interface private-vlan mapping	Displays information about the private VLAN mapping for VLAN SVIs.

Configuration Examples for Private VLANs

Example: Configuring a Primary VLAN, Isolated VLAN, and a Community of VLANs

This example shows how to configure VLAN 20 as a primary VLAN, VLAN 501 as an isolated VLAN, and VLANs 502 and 503 as community VLANs, to associate them in a private VLAN, and to verify the configuration:

```
Switch# configure terminal
Switch(config)# vlan 20
Switch(config-vlan)# private-vlan primary
Switch(config-vlan)# exit
Switch(config)# vlan 501
Switch(config-vlan)# private-vlan isolated
Switch(config-vlan)# exit
Switch(config)# vlan 502
Switch(config-vlan)# private-vlan community
Switch(config-vlan)# exit
Switch(config)# vlan 503
Switch(config-vlan)# private-vlan community
Switch(config-vlan)# exit
Switch(config)# vlan 20
Switch(config-vlan)# private-vlan association 501-503
Switch(config-vlan)# end
Switch(config)# show vlan private vlan

Primary Secondary Type Ports
------- --------- ----------------- ------------------------------------------
20 501 isolated
20 502 community
20 503 community
20 504 non-operational
```

関連トピック

Configuring and Associating VLANs in a Private VLAN, （95 ページ）

Private VLAN Domains, （89 ページ）

Example: Configuring an Interface as a Host Port

This example shows how to configure an interface as a private VLAN host port, associate it with a private VLAN pair, and verify the configuration:

```
Switch# configure terminal
Switch(config)# interface gigabitethernet1/0/22
Switch(config-if)# switchport mode private-vlan host
Switch(config-if)# switchport private-vlan host-association 20 501
Switch(config-if)# end
Switch# show interfaces gigabitethernet1/0/22 switchport
Name: Gi1/0/22
Switchport: Enabled
Administrative Mode: private-vlan host
Operational Mode: private-vlan host
Administrative Trunking Encapsulation: negotiate
Operational Trunking Encapsulation: native
```

```
Negotiation of Trunking: Off
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: none
Administrative private-vlan host-association: 20 501
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk Native VLAN tagging: enabled
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan:
20 501

<output truncated>
```

関連トピック

Configuring a Layer 2 Interface as a Private VLAN Host Port, （98 ページ）

Private VLANs Ports, （90 ページ）

Example: Configuring an Interface as a Private VLAN Promiscuous Port

This example shows how to configure an interface as a private VLAN promiscuous port and map it to a private VLAN. The interface is a member of primary VLAN 20 and secondary VLANs 501 to 503 are mapped to it.

```
Switch# configure terminal
Switch(config)# interface gigabitethernet1/0/2
Switch(config-if)# switchport mode private-vlan promiscous
Switch(config-if)# switchport private-vlan mapping 20 add 501-503
Switch(config-if)# end
```

関連トピック

Configuring a Layer 2 Interface as a Private VLAN Promiscuous Port, （100 ページ）

Private VLANs Ports, （90 ページ）

Example: Mapping Secondary VLANs to a Primary VLAN Interface

This example shows how to map the interfaces fo VLANs 501 and 502 to primary VLAN 10, which permits routing of secondary VLAN ingress traffic from private VLANs 501 and 502:

```
Switch# configure terminal
Switch(config)# interface vlan 10
Switch(config-if)# private-vlan mapping 501-502
Switch(config-if)# end
Switch# show interfaces private-vlan mapping
Interface Secondary VLAN Type
--------- -------------- -----------------
vlan10    501            isolated
vlan10    502            community
```

関連トピック

Mapping Secondary VLANs to a Primary VLAN Layer 3 VLAN Interface, （101 ページ）

Example: Monitoring Private VLANs

This example shows output from the **show vlan private-vlan** command:

```
Switch(config)# show vlan private-vlan
Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
10      501       isolated          Gi2/0/1, Gi3/0/1, Gi3/0/2
10      502       community         Gi2/0/11, Gi3/0/1, Gi3/0/4
10      503       non-operational
```

Where to Go Next

You can configure the following:

- VTP
- VLANs
- VLAN trunking
- VLAN Membership Policy Server (VMPS)
- Tunneling
- Voice VLANs

Additional References

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	*Catalyst 2960-XR Switch VLAN Management Command Reference*

Standards and RFCs

Standard/RFC	Title
—	—

MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature History and Information for Private VLANs

Release	Modification
Cisco IOS 15.0(2)EX1	This feature was introduced.

第 6 章

Configuring VMPS

- Finding Feature Information, 109 ページ
- Prerequisites for VMPS, 109 ページ
- Restrictions for VMPS, 110 ページ
- Information About VMPS, 110 ページ
- How to Configure VMPS, 112 ページ
- Monitoring the VMPS, 119 ページ
- Configuration Example for VMPS, 119 ページ
- Where to Go Next, 121 ページ
- Additional References, 121 ページ
- Feature History and Information for VMPS, 122 ページ

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for VMPS

- You should configure the VMPS before you configure ports as dynamic-access ports.
- When you configure a port as a dynamic-access port, the spanning-tree Port Fast feature is automatically enabled for that port. The Port Fast mode accelerates the process of bringing the port into the forwarding state.

Restrictions for VMPS

- IEEE 802.1x ports cannot be configured as dynamic-access ports. If you try to enable IEEE 802.1x on a dynamic-access (VQP) port, an error message appears, and IEEE 802.1x is not enabled. If you try to change an IEEE 802.1x-enabled port to dynamic VLAN assignment, an error message appears, and the VLAN configuration is not changed.
- Trunk ports cannot be dynamic-access ports, but you can enter the **switchport access vlan dynamic** interface configuration command for a trunk port. In this case, the switch retains the setting and applies it if the port is later configured as an access port.

  You must turn off trunking on the port before the dynamic-access setting takes effect.
- Dynamic-access ports cannot be monitor ports.
- Secure ports cannot be dynamic-access ports. You must disable port security on a port before it becomes dynamic.
- Private VLAN ports cannot be dynamic-access ports.
- Dynamic-access ports cannot be members of an EtherChannel group.
- Port channels cannot be configured as dynamic-access ports.
- A dynamic-access port can participate in fallback bridging.
- The VTP management domain of the VMPS client and the VMPS server must be the same.
- The VLAN configured on the VMPS server should not be a voice VLAN.

Information About VMPS

Dynamic VLAN Assignments

The VLAN Query Protocol (VQP) is used to support dynamic-access ports, which are not permanently assigned to a VLAN, but give VLAN assignments based on the MAC source addresses seen on the port. Each time an unknown MAC address is seen, the switch sends a VQP query to a remote VLAN Membership Policy Server (VMPS); the query includes the newly seen MAC address and the port on which it was seen. The VMPS responds with a VLAN assignment for the port. The switch cannot be a VMPS server but can act as a client to the VMPS and communicate with it through VQP.

Each time the client switch receives the MAC address of a new host, it sends a VQP query to the VMPS. When the VMPS receives this query, it searches its database for a MAC-address-to-VLAN mapping. The server response is based on this mapping and whether or not the server is in open or secure mode. In secure mode, the server shuts down the port when an illegal host is detected. In open mode, the server denies the host access to the port.

If the port is currently unassigned (that is, it does not yet have a VLAN assignment), the VMPS provides one of these responses:

- If the host is allowed on the port, the VMPS sends the client a vlan-assignment response containing the assigned VLAN name and allowing access to the host.

- If the host is not allowed on the port and the VMPS is in open mode, the VMPS sends an access-denied response.
- If the VLAN is not allowed on the port and the VMPS is in secure mode, the VMPS sends a port-shutdown response.

If the port already has a VLAN assignment, the VMPS provides one of these responses:

- If the VLAN in the database matches the current VLAN on the port, the VMPS sends an success response, allowing access to the host.
- If the VLAN in the database does not match the current VLAN on the port and active hosts exist on the port, the VMPS sends an access-denied or a port-shutdown response, depending on the secure mode of the VMPS.

If the switch receives an access-denied response from the VMPS, it continues to block traffic to and from the host MAC address. The switch continues to monitor the packets directed to the port and sends a query to the VMPS when it identifies a new host address. If the switch receives a port-shutdown response from the VMPS, it disables the port. The port must be manually reenabled by using Network Assistant, the CLI, or SNMP.

関連トピック

Configuring Dynamic-Access Ports on VMPS Clients, （114 ページ）
Example: VMPS Configuration, （119 ページ）

Dynamic-Access Port VLAN Membership

A dynamic-access port can belong to only one VLAN with an ID from 1 to 4094. When the link comes up, the switch does not forward traffic to or from this port until the VMPS provides the VLAN assignment. The VMPS receives the source MAC address from the first packet of a new host connected to the dynamic-access port and attempts to match the MAC address to a VLAN in the VMPS database.

If there is a match, the VMPS sends the VLAN number for that port. If the client switch was not previously configured, it uses the domain name from the first VTP packet it receives on its trunk port from the VMPS. If the client switch was previously configured, it includes its domain name in the query packet to the VMPS to obtain its VLAN number. The VMPS verifies that the domain name in the packet matches its own domain name before accepting the request and responds to the client with the assigned VLAN number for the client. If there is no match, the VMPS either denies the request or shuts down the port (depending on the VMPS secure mode setting).

Multiple hosts (MAC addresses) can be active on a dynamic-access port if they are all in the same VLAN; however, the VMPS shuts down a dynamic-access port if more than 20 hosts are active on the port.

If the link goes down on a dynamic-access port, the port returns to an isolated state and does not belong to a VLAN. Any hosts that come online through the port are checked again through the VQP with the VMPS before the port is assigned to a VLAN.

Dynamic-access ports can be used for direct host connections, or they can connect to a network. A maximum of 20 MAC addresses are allowed per port on the switch. A dynamic-access port can belong to only one VLAN at a time, but the VLAN can change over time, depending on the MAC addresses seen.

関連トピック

Configuring Dynamic-Access Ports on VMPS Clients, （114 ページ）

Example: VMPS Configuration, （119 ページ）

Default VMPS Client Configuration

The following table shows the default VMPS and dynamic-access port configuration on client switches.

表 *13*：***Default VMPS Client and Dynamic-Access Port Configuration***

Feature	Default Setting
VMPS domain server	None
VMPS reconfirm interval	60 minutes
VMPS server retry count	3
Dynamic-access ports	None configured

How to Configure VMPS

Entering the IP Address of the VMPS

（注） If the VMPS is being defined for a cluster of switches, enter the address on the command switch.

はじめる前に

You must first enter the IP address of the server to configure the switch as a client.

手順の概要

1. **configure terminal**
2. **vmps server** *ipaddress* **primary**
3. **vmps server** *ipaddress*
4. **end**
5. **show vmps**
6. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**vmps server** *ipaddress* **primary** 例： `Switch(config)# vmps server 10.1.2.3 primary`	Enters the IP address of the switch acting as the primary VMPS server.
ステップ 3	**vmps server** *ipaddress* 例： `Switch(config)# vmps server 10.3.4.5`	(Optional) Enters the IP address of the switch acting as a secondary VMPS server. You can enter up to three secondary server addresses.
ステップ 4	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 5	**show vmps** 例： `Switch# show vmps`	Verifies your entries in the *VMPS Domain Server* field of the display.
ステップ 6	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Configuring Dynamic-Access Ports on VMPS Clients

注意 Dynamic-access port VLAN membership is for end stations or hubs connected to end stations. Connecting dynamic-access ports to other switches can cause a loss of connectivity.

If you are configuring a port on a cluster member switch as a dynamic-access port, first use the **rcommand** privileged EXEC command to log in to the cluster member switch.

はじめる前に

You must have IP connectivity to the VMPS for dynamic-access ports to work. You can test for IP connectivity by pinging the IP address of the VMPS and verifying that you get a response.

（注） To return an interface to its default configuration, use the **default interface** *interface-id* interface configuration command. To return an interface to its default switchport mode (dynamic auto), use the **no switchport mode** interface configuration command. To reset the access mode to the default VLAN for the switch, use the **no switchport access vlan** interface configuration command.

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport mode access**
4. **switchport access vlan dynamic**
5. **end**
6. **show interfaces** *interface-id* **switchport**
7. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet 1/0/1`	Specifies the switch port that is connected to the end station, and enters interface configuration mode.

	コマンドまたはアクション	目的
ステップ 3	**switchport mode access** 例： `Switch(config-if)# switchport mode access`	Sets the port to access mode.
ステップ 4	**switchport access vlan dynamic** 例： `Switch(config-if)# switchport access vlan dynamic`	Configures the port as eligible for dynamic VLAN membership. The dynamic-access port must be connected to an end station.
ステップ 5	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 6	**show interfaces** *interface-id* **switchport** 例： `Switch# show interfaces gigabitethernet 1/0/1 switchport`	Verifies your entries in the *Operational Mode* field of the display.
ステップ 7	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

関連トピック

Dynamic VLAN Assignments, （110 ページ）
Example: VMPS Configuration, （119 ページ）
Dynamic-Access Port VLAN Membership, （111 ページ）
Example: VMPS Configuration, （119 ページ）

Reconfirming VLAN Memberships

This task confirms the dynamic-access port VLAN membership assignments that the switch has received from the VMPS.

手順の概要

1. **vmps reconfirm**
2. **show vmps**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**vmps reconfirm** 例： `Switch# vmps reconfirm`	Reconfirms dynamic-access port VLAN membership.
ステップ 2	**show vmps** 例： `Switch# show vmps`	Verifies the dynamic VLAN reconfirmation status.

Changing the Reconfirmation Interval

VMPS clients periodically reconfirm the VLAN membership information received from the VMPS. You can set the number of minutes after which reconfirmation occurs.

（注） If you are configuring a member switch in a cluster, this parameter must be equal to or greater than the reconfirmation setting on the command switch. You also must first use the **rcommand** privileged EXEC command to log in to the member switch.

手順の概要

1. **configure terminal**
2. **vmps reconfirm** *minutes*
3. **end**
4. **show vmps**
5. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**vmps reconfirm** *minutes* 例： `Switch(config)# vmps reconfirm 90`	Sets the number of minutes between reconfirmations of the dynamic VLAN membership. The range is 1 to 120. The default is 60 minutes. （注） To return the switch to its default setting, use the **no vmps reconfirm** global configuration command.
ステップ 3	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 4	**show vmps** 例： `Switch# show vmps`	Verifies the dynamic VLAN reconfirmation status in the *Reconfirm Interval* field of the display.
ステップ 5	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Changing the Retry Count

Beginning in privileged EXEC mode, follow these steps to change the number of times that the switch attempts to contact the VMPS before querying the next server.

手順の概要

1. **configure terminal**
2. **vmps retry** *count*
3. **end**
4. **show vmps**
5. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**vmps retry** *count* 例： `Switch(config)# vmps retry 5`	Changes the retry count. The retry range is 1 to 10; the default is 3. （注） To return the switch to its default setting, use the **no vmps retry** global configuration command.
ステップ 3	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 4	**show vmps** 例： `Switch# show vmps`	Verifies your entry in the *Server Retry Count* field of the display.
ステップ 5	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Troubleshooting Dynamic-Access Port VLAN Membership

問題　The VMPS shuts down a dynamic-access port under these conditions:

- 問題　The VMPS is in secure mode, and it does not allow the host to connect to the port. The VMPS shuts down the port to prevent the host from connecting to the network.
- 問題　More than 20 active hosts reside on a dynamic-access port.

解決法　To reenable a disabled dynamic-access port, enter the **shutdown** interface configuration command followed by the **no shutdown** interface configuration command.

Monitoring the VMPS

You can display information about the VMPS by using the **show vmps** privileged EXEC command. The switch displays this information about the VMPS:

- VMPS VQP Version—The version of VQP used to communicate with the VMPS. The switch queries the VMPS that is using VQP Version 1.
- Reconfirm Interval—The number of minutes the switch waits before reconfirming the VLAN-to-MAC-address assignments.
- Server Retry Count—The number of times VQP resends a query to the VMPS. If no response is received after this many tries, the switch starts to query the secondary VMPS.
- VMPS domain server—The IP address of the configured VLAN membership policy servers. The switch sends queries to the one marked *current*. The one marked *primary* is the primary server.
- VMPS Action—The result of the most recent reconfirmation attempt. A reconfirmation attempt can occur automatically when the reconfirmation interval expires, or you can force it by entering the **vmps reconfirm** privileged EXEC command or its Network Assistant or SNMP equivalent.

This is an example of output for the **show vmps** privileged EXEC command:

```
Switch# show vmps
VQP Client Status:
-------------------
VMPS VQP Version:   1
Reconfirm Interval: 60 min
Server Retry Count: 3
VMPS domain server: 172.20.128.86 (primary, current)
                    172.20.128.87

Reconfirmation status
---------------------
VMPS Action:         other
```

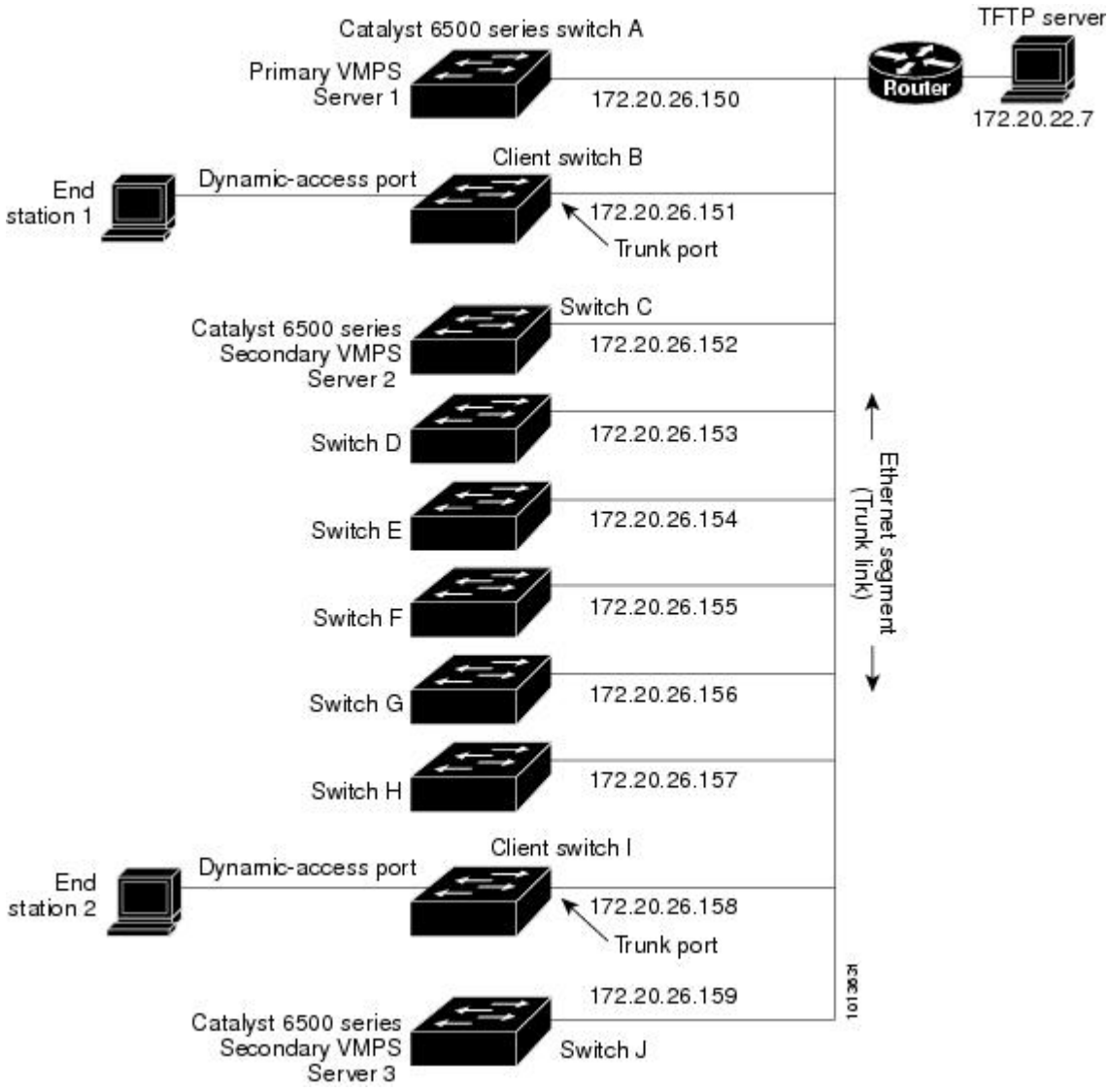
Configuration Example for VMPS

Example: VMPS Configuration

This network has a VMPS server switch and VMPS client switches with dynamic-access ports with this configuration:

- The VMPS server and the VMPS client are separate switches.
- The Catalyst 6500 series Switch A is the primary VMPS server.
- The Catalyst 6500 series Switch C and Switch J are secondary VMPS servers.
- End stations are connected to the clients, Switch B and Switch I.
- The database configuration file is stored on the TFTP server with the IP address 172.20.22.7.

図 *8*： *Dynamic Port VLAN Membership Configuration*



関連トピック

Configuring Dynamic-Access Ports on VMPS Clients, （114 ページ）
Dynamic VLAN Assignments, （110 ページ）

Configuring Dynamic-Access Ports on VMPS Clients, （114 ページ）
Dynamic-Access Port VLAN Membership, （111 ページ）

Where to Go Next

You can configure the following:

- VTP
- VLANs
- VLAN Trunking
- Private VLANs
- Tunneling
- Voice VLANs

Additional References

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	*Catalyst 2960-XR Switch VLAN Management Command Reference*

Standards and RFCs

Standard/RFC	Title
—	—

MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature History and Information for VMPS

Release	Modification
Cisco IOS 15.0(2)EX1	This feature was introduced.

第 7 章

Configuring IEEE 802.1Q and Layer 2 Protocol Tunneling

- Finding Feature Information, 123 ページ
- Prerequisites for Configuring Tunneling, 123 ページ
- Information about Tunneling, 126 ページ
- How to Configure Tunneling, 135 ページ
- Configuration Examples for IEEE 802.1Q and Layer 2 Protocol Tunneling, 146 ページ
- Monitoring Tunneling Status, 149 ページ
- Where to Go Next, 149 ページ
- Additional References, 150 ページ
- Feature History and Information for Tunneling, 151 ページ

Finding Feature Information

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Prerequisites for Configuring Tunneling

The following sections list prerequisites and considerations for configuring IEEE 802.1Q and Layer 2 protocol tunneling.

IEEE 802.1Q Tunneling and Incompatibilities

Although IEEE 802.1Q tunneling works well for Layer 2 packet switching, there are incompatibilities between some Layer 2 features and Layer 3 switching.

- A tunnel port cannot be a routed port.
- IP routing is not supported on a VLAN that includes IEEE 802.1Q ports. Packets received from a tunnel port are forwarded based only on Layer 2 information. If routing is enabled on a switch virtual interface (SVI) that includes tunnel ports, untagged IP packets received from the tunnel port are recognized and routed by the switch. Customers can access the Internet through its native VLAN. If this access is not needed, you should not configure SVIs on VLANs that include tunnel ports.
- Fallback bridging is not supported on tunnel ports. Because all IEEE 802.1Q-tagged packets received from a tunnel port are treated as non-IP packets, if fallback bridging is enabled on VLANs that have tunnel ports configured, IP packets would be improperly bridged across VLANs. Therefore, you must not enable fallback bridging on VLANs with tunnel ports.
- Tunnel ports do not support IP access control lists (ACLs).
- Layer 3 quality of service (QoS) ACLs and other QoS features related to Layer 3 information are not supported on tunnel ports. MAC-based QoS is supported on tunnel ports.
- EtherChannel port groups are compatible with tunnel ports as long as the IEEE 802.1Q configuration is consistent within an EtherChannel port group.
- Port Aggregation Protocol (PAgP), Link Aggregation Control Protocol (LACP), and UniDirectional Link Detection (UDLD) are supported on IEEE 802.1Q tunnel ports.
- Dynamic Trunking Protocol (DTP) is not compatible with IEEE 802.1Q tunneling because you must manually configure asymmetric links with tunnel ports and trunk ports.
- VLAN Trunking Protocol (VTP) does not work between devices that are connected by an asymmetrical link or devices that communicate through a tunnel.
- Loopback detection is supported on IEEE 802.1Q tunnel ports.
- When a port is configured as an IEEE 802.1Q tunnel port, spanning-tree bridge protocol data unit (BPDU) filtering is automatically enabled on the interface. Cisco Discovery Protocol (CDP) and the Layer Link Discovery Protocol (LLDP) are automatically disabled on the interface.

関連トピック

Configuring an IEEE 802.1Q Tunneling Port, （135 ページ）
Example: Configuring an IEEE 802.1Q Tunneling Port, （146 ページ）

Layer 2 Protocol Tunneling

The following are configuration guidelines and operating characteristics of Layer 2 protocol tunneling:

- The switch supports tunneling of CDP, STP, including multiple STP (MSTP), and VTP. Protocol tunneling is disabled by default but can be enabled for the individual protocols on IEEE 802.1Q tunnel ports or access ports.

- The switch does not support Layer 2 protocol tunneling on ports with switchport mode dynamic auto or dynamic desirable.
- DTP is not compatible with layer 2 protocol tunneling.
- The edge switches on the outbound side of the service-provider network restore the proper Layer 2 protocol and MAC address information and forward the packets to all tunnel and access ports in the same metro VLAN.
- For interoperability with third-party vendor switches, the switch supports a Layer 2 protocol-tunnel bypass feature. Bypass mode transparently forwards control PDUs to vendor switches that have different ways of controlling protocol tunneling. When Layer 2 protocol tunneling is enabled on ingress ports on a switch, egress trunk ports forward the tunneled packets with a special encapsulation. If you also enable Layer 2 protocol tunneling on the egress trunk port, this behavior is bypassed, and the switch forwards control PDUs without any processing or modification.
- The switch supports PAgP, LACP, and UDLD tunneling for emulated point-to-point network topologies. Protocol tunneling is disabled by default but can be enabled for the individual protocols on IEEE 802.1Q tunnel ports or on access ports.
- If you enable PAgP or LACP tunneling, we recommend that you also enable UDLD on the interface for faster link-failure detection.
- Loopback detection is not supported on Layer 2 protocol tunneling of PAgP, LACP, or UDLD packets.
- EtherChannel port groups are compatible with tunnel ports when the IEEE 802.1Q configuration is consistent within an EtherChannel port group.
- If an encapsulated PDU (with the proprietary destination MAC address) is received from a tunnel port or an access port with Layer 2 tunneling enabled, the tunnel port is shut down to prevent loops. The port also shuts down when a configured shutdown threshold for the protocol is reached. You can manually reenable the port (by entering a **shutdown** and a **no shutdown** command sequence). If errdisable recovery is enabled, the operation is retried after a specified time interval.
- Only decapsulated PDUs are forwarded to the customer network. The spanning-tree instance running on the service-provider network does not forward BPDUs to tunnel ports. CDP packets are not forwarded from tunnel ports.
- When protocol tunneling is enabled on an interface, you can set a per-protocol, per-port, shutdown threshold for the PDUs generated by the customer network. If the limit is exceeded, the port shuts down. You can also limit BPDU rate by using QoS ACLs and policy maps on a tunnel port.
- When protocol tunneling is enabled on an interface, you can set a per-protocol, per-port, drop threshold for the PDUs generated by the customer network. If the limit is exceeded, the port drops PDUs until the rate at which it receives them is below the drop threshold.
- Because tunneled PDUs (especially STP BPDUs) must be delivered to all remote sites so that the customer virtual network operates properly, you can give PDUs higher priority within the service-provider network than data packets received from the same tunnel port. By default, the PDUs use the same CoS value as data packets.

関連トピック

Configuring Layer 2 Protocol Tunneling, （138 ページ）

Example: Configuring Layer 2 Protocol Tunneling, （147 ページ）

Layer 2 Tunneling for EtherChannels

To configure Layer 2 point-to-point tunneling to facilitate the automatic creation of EtherChannels, you need to configure both the SP (service-provider) edge switch and the customer switch.

関連トピック

Configuring Layer 2 Protocol Tunneling, （138 ページ）
Example: Configuring Layer 2 Protocol Tunneling, （147 ページ）

Information about Tunneling

IEEE 802.1Q and Layer 2 Protocol Overview

Virtual private networks (VPNs) provide enterprise-scale connectivity on a shared infrastructure, often Ethernet-based, with the same security, prioritization, reliability, and manageability requirements of private networks. Tunneling is a feature designed for service providers who carry traffic of multiple customers across their networks and are required to maintain the VLAN and Layer 2 protocol configurations of each customer without impacting the traffic of other customers.

（注） For complete syntax and usage information for the commands used in this chapter, see the command reference for this release.

IEEE 802.1Q Tunneling

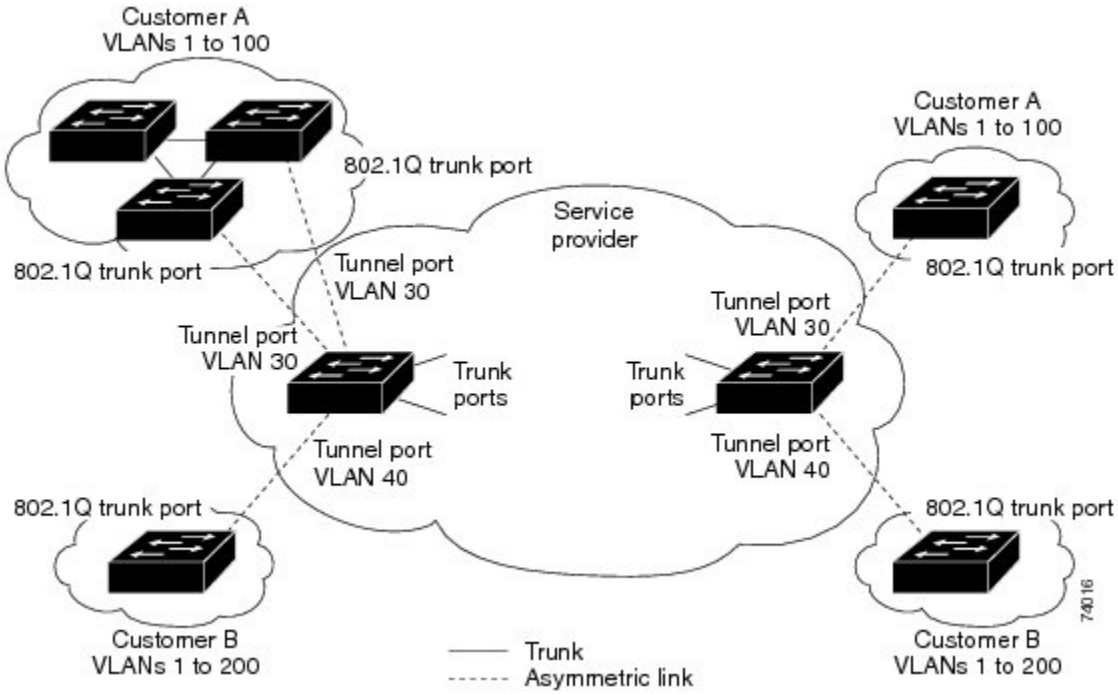
Business customers of service providers often have specific requirements for VLAN IDs and the number of VLANs to be supported. The VLAN ranges required by different customers in the same service-provider network might overlap, and traffic of customers through the infrastructure might be mixed. Assigning a unique range of VLAN IDs to each customer would restrict customer configurations and could easily exceed the VLAN limit (4096) of the IEEE 802.1Q specification.

Using the IEEE 802.1Q tunneling feature, service providers can use a single VLAN to support customers who have multiple VLANs. Customer VLAN IDs are preserved, and traffic from different customers is segregated within the service-provider network, even when they appear to be in the same VLAN. Using IEEE 802.1Q tunneling expands VLAN space by using a VLAN-in-VLAN hierarchy and retagging the tagged packets. A port configured to support IEEE 802.1Q tunneling is called a tunnel port. When you configure tunneling, you assign a tunnel port to a VLAN ID that is dedicated to tunneling. Each customer requires a separate service-provider VLAN ID, but that VLAN ID supports all of the customer's VLANs.

Customer traffic tagged in the normal way with appropriate VLAN IDs comes from an IEEE 802.1Q trunk port on the customer device and into a tunnel port on the service-provider edge switch. The link between the customer device and the edge switch is asymmetric because one end is configured as an IEEE 802.1Q trunk

port, and the other end is configured as a tunnel port. You assign the tunnel port interface to an access VLAN ID that is unique to each customer.

図 *9* : ***IEEE 802.1Q Tunnel Ports in a Service-Provider Network***

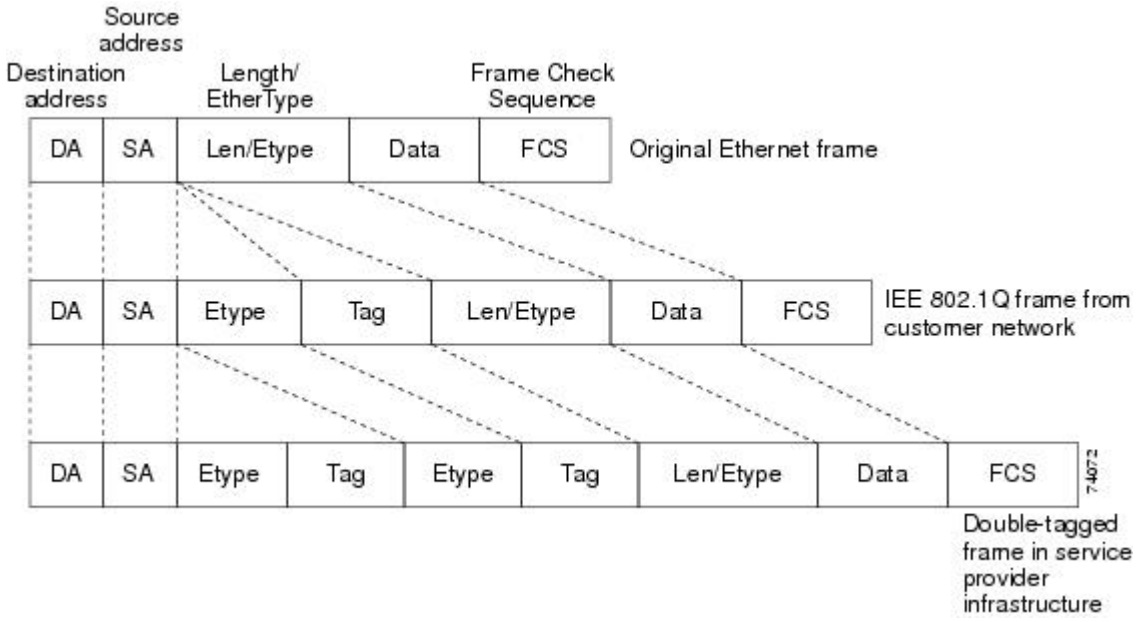


Packets coming from the customer trunk port into the tunnel port on the service-provider edge switch are normally IEEE 802.1Q-tagged with the appropriate VLAN ID. The tagged packets remain intact inside the switch and when they exit the trunk port into the service-provider network, they are encapsulated with another layer of an IEEE 802.1Q tag (called the metro tag) that contains the VLAN ID that is unique to the customer. The original customer IEEE 802.1Q tag is preserved in the encapsulated packet. Therefore, packets entering the service-provider network are double-tagged, with the outer (metro) tag containing the customer's access VLAN ID, and the inner VLAN ID being that of the incoming traffic.

When the double-tagged packet enters another trunk port in a service-provider core switch, the outer tag is stripped as the switch processes the packet. When the packet exits another trunk port on the same core switch, the same metro tag is again added to the packet.

This figure shows the tag structures of the double-tagged packets.

図 10 : *Original (Normal), IEEE 802.1Q, and Double-Tagged Ethernet Packet Formats*



When the packet enters the trunk port of the service-provider egress switch, the outer tag is again stripped as the switch internally processes the packet. However, the metro tag is not added when the packet is sent out the tunnel port on the edge switch into the customer network. The packet is sent as a normal IEEE 802.1Q-tagged frame to preserve the original VLAN numbers in the customer network.

In the above network figure, Customer A was assigned VLAN 30, and Customer B was assigned VLAN 40. Packets entering the edge switch tunnel ports with IEEE 802.1Q tags are double-tagged when they enter the service-provider network, with the outer tag containing VLAN ID 30 or 40, appropriately, and the inner tag containing the original VLAN number, for example, VLAN 100. Even if both Customers A and B have VLAN 100 in their networks, the traffic remains segregated within the service-provider network because the outer tag is different. Each customer controls its own VLAN numbering space, which is independent of the VLAN numbering space used by other customers and the VLAN numbering space used by the service-provider network.

At the outbound tunnel port, the original VLAN numbers on the customer's network are recovered. It is possible to have multiple levels of tunneling and tagging, but the switch supports only one level in this release.

If traffic coming from a customer network is not tagged (native VLAN frames), these packets are bridged or routed as normal packets. All packets entering the service-provider network through a tunnel port on an edge switch are treated as untagged packets, whether they are untagged or already tagged with IEEE 802.1Q headers. The packets are encapsulated with the metro tag VLAN ID (set to the access VLAN of the tunnel port) when they are sent through the service-provider network on an IEEE 802.1Q trunk port. The priority field on the metro tag is set to the interface class of service (CoS) priority configured on the tunnel port. (The default is zero if none is configured.)

On switches, because 802.1Q tunneling is configured on a per-port basis, it does not matter whether the switch is a standalone switch or a stack member. All configuration is done on the stack master.

関連トピック

Configuring an IEEE 802.1Q Tunneling Port, （135 ページ）
Example: Configuring an IEEE 802.1Q Tunneling Port, （146 ページ）

IEEE 802.1Q Tunneling Configuration Guidelines

When you configure IEEE 802.1Q tunneling, you should always use an asymmetrical link between the customer device and the edge switch, with the customer device port configured as an IEEE 802.1Q trunk port and the edge switch port configured as a tunnel port.

Assign tunnel ports only to VLANs that are used for tunneling.

Configuration requirements for native VLANs and for and maximum transmission units (MTUs) are explained in these next sections.

Native VLANs

When configuring IEEE 802.1Q tunneling on an edge switch, you must use IEEE 802.1Q trunk ports for sending packets into the service-provider network. However, packets going through the core of the service-provider network can be carried through IEEE 802.1Q trunks, ISL trunks, or nontrunking links. When IEEE 802.1Q trunks are used in these core switches, the native VLANs of the IEEE 802.1Q trunks must not match any native VLAN of the nontrunking (tunneling) port on the same switch because traffic on the native VLAN would not be tagged on the IEEE 802.1Q sending trunk port.

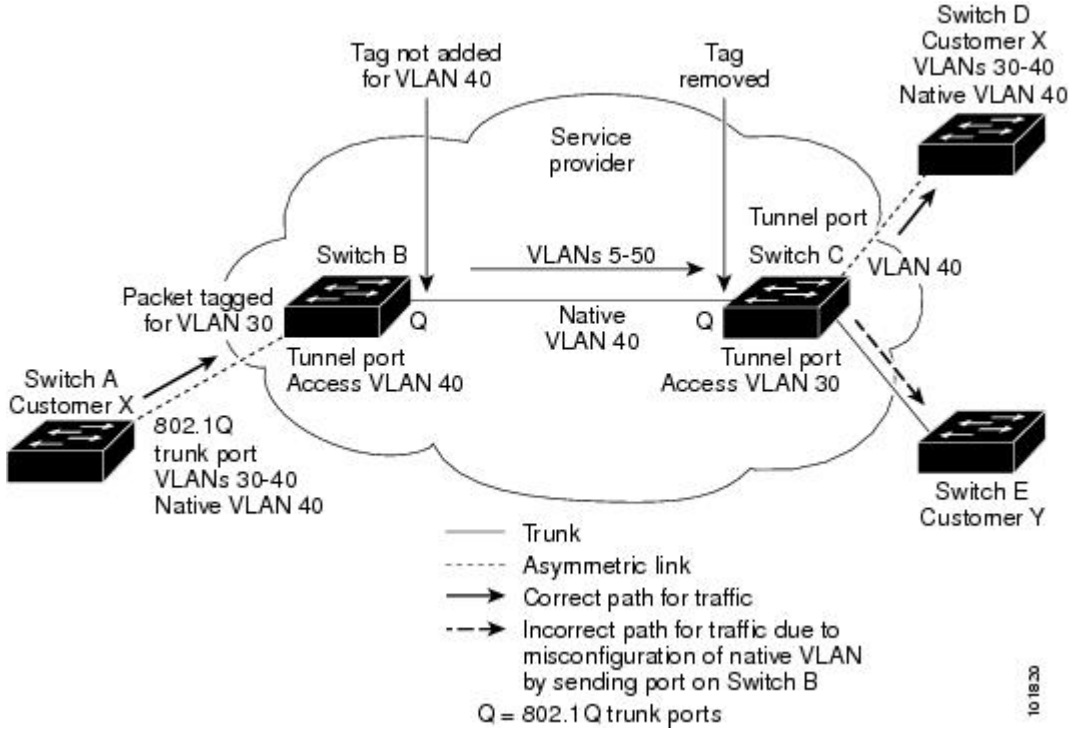
In the following network figure, VLAN 40 is configured as the native VLAN for the IEEE 802.1Q trunk port from Customer X at the ingress edge switch in the service-provider network (Switch B). Switch A of Customer X sends a tagged packet on VLAN 30 to the ingress tunnel port of Switch B in the service-provider network, which belongs to access VLAN 40. Because the access VLAN of the tunnel port (VLAN 40) is the same as the native VLAN of the edge-switch trunk port (VLAN 40), the metro tag is not added to tagged packets received from the tunnel port. The packet carries only the VLAN 30 tag through the service-provider network to the trunk port of the egress-edge switch (Switch C) and is misdirected through the egress switch tunnel port to Customer Y.

These are some ways to solve this problem:

- Use the **vlan dot1q tag native** global configuration command to configure the edge switch so that all packets going out an IEEE 802.1Q trunk, including the native VLAN, are tagged. If the switch is configured to tag native VLAN packets on all IEEE 802.1Q trunks, the switch accepts untagged packets, but sends only tagged packets.

- Ensure that the native VLAN ID on the edge-switch trunk port is not within the customer VLAN range. For example, if the trunk port carries traffic of VLANs 100 to 200, assign the native VLAN a number outside that range.

図 *11* : ***Potential Problems with IEEE 802.1Q Tunneling and Native VLANs***



System MTU

The default system MTU for traffic on the switch is 1500 bytes. You can configure Fast Ethernet ports on the switch members in the mixed hardware switch stack to support frames larger than 1500 bytes by using the **system mtu** global configuration command.

You can configure 10-Gigabit and Gigabit Ethernet ports to support frames larger than 1500 bytes by using the **system mtu jumbo** global configuration command.

The system MTU and system jumbo MTU values do not include the IEEE 802.1Q header. Because the IEEE 802.1Q tunneling feature increases the frame size by 4 bytes when the metro tag is added, you must configure all switches in the service-provider network to be able to process maximum frames by adding 4 bytes to the system MTU and system jumbo MTU sizes.

For example, the switch supports a maximum frame size of 1496 bytes with one of these configurations:

- The switch has a system jumbo MTU value of 1500 bytes, and the **switchport mode dot1q tunnel** interface configuration command is configured on a 10-Gigabit or Gigabit Ethernet switch port.
- The switch member has a system MTU value of 1500 bytes, and the **switchport mode dot1q tunnel** interface configuration command is configured on a Fast Ethernet port of the member.

Default IEEE 802.1Q Tunneling Configuration

By default, IEEE 802.1Q tunneling is disabled because the default switchport mode is dynamic auto. Tagging of IEEE 802.1Q native VLAN packets on all IEEE 802.1Q trunk ports is also disabled.

Layer 2 Protocol Tunneling Overview

Customers at different sites connected across a service-provider network need to use various Layer 2 protocols to scale their topologies to include all remote sites, as well as the local sites. STP must run properly, and every VLAN should build a proper spanning tree that includes the local site and all remote sites across the service-provider network. Cisco Discovery Protocol (CDP) must discover neighboring Cisco devices from local and remote sites. VLAN Trunking Protocol (VTP) must provide consistent VLAN configuration throughout all sites in the customer network.

When protocol tunneling is enabled, edge switches on the inbound side of the service-provider network encapsulate Layer 2 protocol packets with a special MAC address and send them across the service-provider network. Core switches in the network do not process these packets but forward them as normal packets. Layer 2 protocol data units (PDUs) for CDP, STP, or VTP cross the service-provider network and are delivered to customer switches on the outbound side of the service-provider network. Identical packets are received by all customer ports on the same VLANs with these results:

- Users on each of a customer's sites can properly run STP, and every VLAN can build a correct spanning tree based on parameters from all sites and not just from the local site.
- CDP discovers and shows information about the other Cisco devices connected through the service-provider network.
- VTP provides consistent VLAN configuration throughout the customer network, propagating to all switches through the service provider.

（注） To provide interoperability with third-party vendors, you can use the Layer 2 protocol-tunnel bypass feature. Bypass mode transparently forwards control PDUs to vendor switches that have different ways of controlling protocol tunneling. You implement bypass mode by enabling Layer 2 protocol tunneling on the egress trunk port. When Layer 2 protocol tunneling is enabled on the trunk port, the encapsulated tunnel MAC address is removed and the protocol packets have their normal MAC address.

Layer 2 protocol tunneling can be used independently or can enhance IEEE 802.1Q tunneling. If protocol tunneling is not enabled on IEEE 802.1Q tunneling ports, remote switches at the receiving end of the service-provider network do not receive the PDUs and cannot properly run STP, CDP, and VTP. When protocol tunneling is enabled, Layer 2 protocols within each customer's network are totally separate from those running within the service-provider network. Customer switches on different sites that send traffic through the service-provider network with IEEE 802.1Q tunneling achieve complete knowledge of the customer's VLAN. If IEEE 802.1Q tunneling is not used, you can still enable Layer 2 protocol tunneling by connecting to the customer switch through access ports and by enabling tunneling on the service-provider access port.

For example, in the following figure (Layer 2 Protocol Tunneling), Customer X has four switches in the same VLAN, that are connected through the service-provider network. If the network does not tunnel PDUs, switches on the far ends of the network cannot properly run STP, CDP, and VTP. For example, STP for a VLAN on

a switch in Customer X, Site 1, will build a spanning tree on the switches at that site without considering convergence parameters based on Customer X's switch in Site 2. This could result in the topology shown in the Layer 2 Network Topology without Proper Convergence figure.

図 *12* : ***Layer 2 Protocol Tunneling***

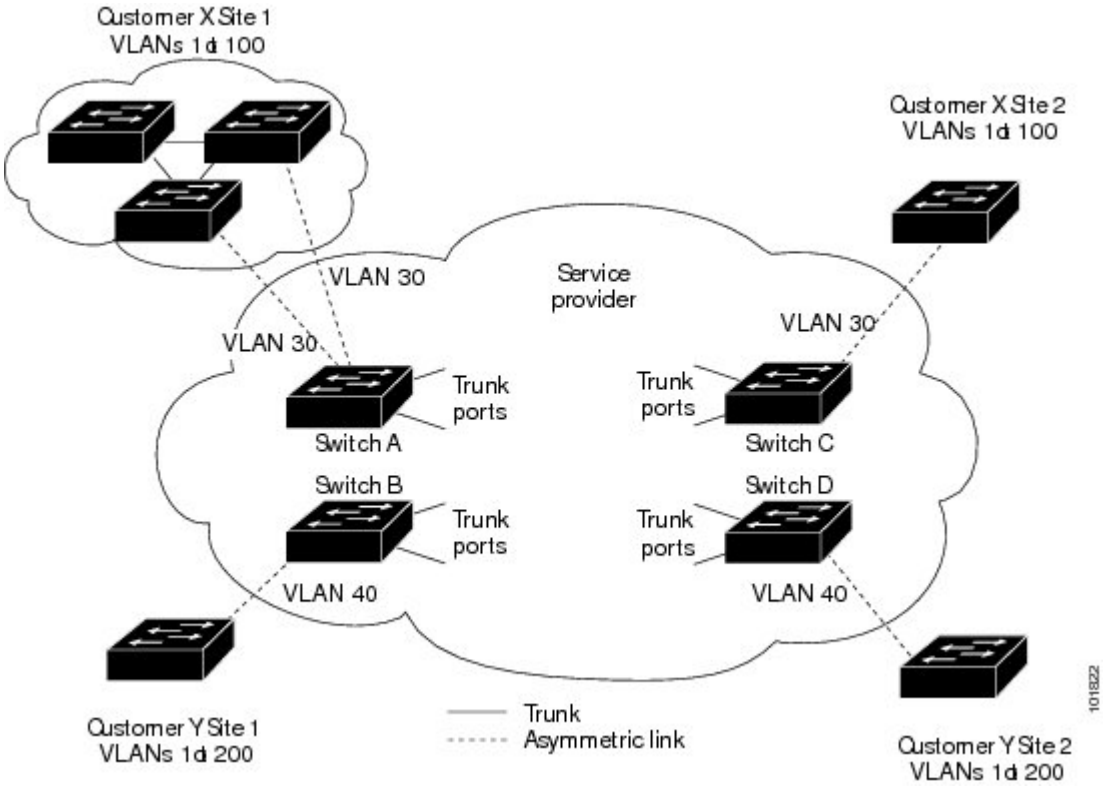
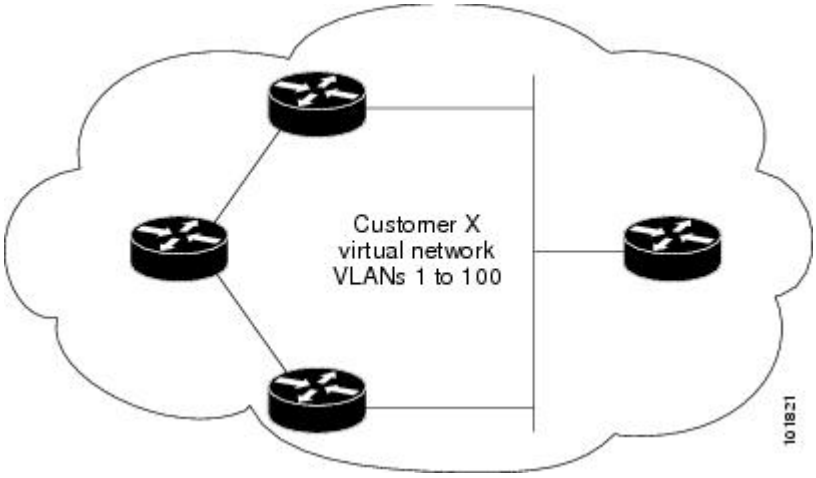


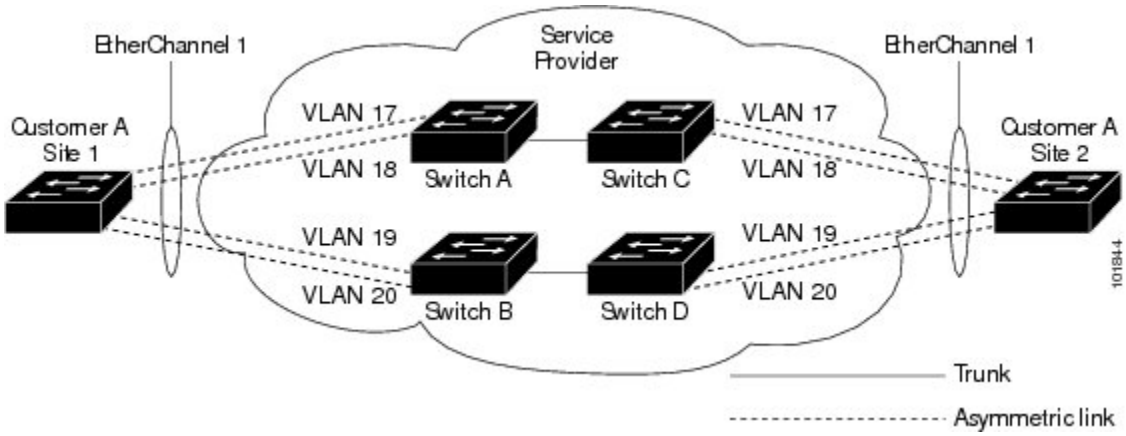
図 *13* : ***Layer 2 Network Topology Without Proper Convergence***



In an SP network, you can use Layer 2 protocol tunneling to enhance the creation of EtherChannels by emulating a point-to-point network topology. When you enable protocol tunneling (PAgP or LACP) on the SP switch, remote customer switches receive the PDUs and can negotiate the automatic creation of EtherChannels.

For example, in the following figure (Layer 2 Protocol Tunneling for EtherChannels), Customer A has two switches in the same VLAN that are connected through the SP network. When the network tunnels PDUs, switches on the far ends of the network can negotiate the automatic creation of EtherChannels without needing dedicated lines.

図 *14* : ***Layer 2 Protocol Tunneling for EtherChannels***



Layer 2 Protocol Tunneling on Ports

You can enable Layer 2 protocol tunneling (by protocol) on the ports that are connected to the customer in the edge switches of the service-provider network. The service-provider edge switches connected to the customer switch perform the tunneling process. Edge-switch tunnel ports are connected to customer IEEE 802.1Q trunk ports. Edge-switch access ports are connected to customer access ports. The edge switches connected to the customer switch perform the tunneling process.

You can enable Layer 2 protocol tunneling on ports that are configured as access ports or tunnel ports. You cannot enable Layer 2 protocol tunneling on ports configured in either **switchport mode dynamic auto** mode (the default mode) or **switchport mode dynamic desirable** mode.

The switch supports Layer 2 protocol tunneling for CDP, STP, and VTP. For emulated point-to-point network topologies, it also supports PAgP, LACP, and UDLD protocols. The switch does not support Layer 2 protocol tunneling for LLDP.

（注） PAgP, LACP, and UDLD protocol tunneling is only intended to emulate a point-to-point topology. An erroneous configuration that sends tunneled packets to many ports could lead to a network failure.

When the Layer 2 PDUs that entered the service-provider inbound edge switch through a Layer 2 protocol-enabled port exit through the trunk port into the service-provider network, the switch overwrites the customer PDU-destination MAC address with a well-known Cisco proprietary multicast address (01-00-0c-cd-cd-d0). If IEEE 802.1Q tunneling is enabled, packets are also double-tagged; the outer tag is the customer metro tag, and the inner tag is the customer's VLAN tag. The core switches ignore the inner

tags and forward the packet to all trunk ports in the same metro VLAN. The edge switches on the outbound side restore the proper Layer 2 protocol and MAC address information and forward the packets to all tunnel or access ports in the same metro VLAN. Therefore, the Layer 2 PDUs remain intact and are delivered across the service-provider infrastructure to the other side of the customer network.

See the Layer 2 Protocol Tunneling figure in Layer 2 Protocol Tunneling Overview, （131 ページ）, with Customer X and Customer Y in access VLANs 30 and 40, respectively. Asymmetric links connect the customers in Site 1 to edge switches in the service-provider network. The Layer 2 PDUs (for example, BPDUs) coming into Switch B from Customer Y in Site 1 are forwarded to the infrastructure as double-tagged packets with the well-known MAC address as the destination MAC address. These double-tagged packets have the metro VLAN tag of 40, as well as an inner VLAN tag (for example, VLAN 100). When the double-tagged packets enter Switch D, the outer VLAN tag 40 is removed, the well-known MAC address is replaced with the respective Layer 2 protocol MAC address, and the packet is sent to Customer Y on Site 2 as a single-tagged frame in VLAN 100.

You can also enable Layer 2 protocol tunneling on access ports on the edge switch connected to access or trunk ports on the customer switch. In this case, the encapsulation and decapsulation process is the same as described in the previous paragraph, except that the packets are not double-tagged in the service-provider network. The single tag is the customer-specific access VLAN tag.

In switch stacks, Layer 2 protocol tunneling configuration is distributed among all stack members. Each stack member that receives an ingress packet on a local port encapsulates or decapsulates the packet and forwards it to the appropriate destination port. On a single switch, ingress Layer 2 protocol-tunneled traffic is sent across all local ports in the same VLAN on which Layer 2 protocol tunneling is enabled. In a stack, packets received by a Layer 2 protocol-tunneled port are distributed to all ports in the stack that are configured for Layer 2 protocol tunneling and are in the same VLAN. All Layer 2 protocol tunneling configuration is handled by the stack master and distributed to all stack members.

関連トピック

Configuring Layer 2 Protocol Tunneling, （138 ページ）

Example: Configuring Layer 2 Protocol Tunneling, （147 ページ）

Default Layer 2 Protocol Tunneling Configuration

The following table shows the default Layer 2 protocol tunneling configuration.

表 *14*：***Default Layer 2 Ethernet Interface VLAN Configuration***

Feature	Default Setting
Layer 2 protocol tunneling	Disabled.
Shutdown threshold	None set.
Drop threshold	None set.

Feature	Default Setting
CoS Value	If a CoS value is configured on the interface, that value is used to set the BPDU CoS value for Layer 2 protocol tunneling. If no CoS value is configured at the interface level, the default value for CoS marking of L2 protocol tunneling BPDUs is 5. This does not apply to data traffic.

How to Configure Tunneling

Configuring an IEEE 802.1Q Tunneling Port

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport access vlan** *vlan-id*
4. **switchport mode dot1q-tunnel**
5. **exit**
6. **vlan dot1q tag native**
7. **end**
8. Use one of the following:
   - **show dot1q-tunnel**
   - **show running-config interface**
9. **show vlan dot1q tag native**
10. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.

	コマンドまたはアクション	目的
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet2/0/1`	Enters interface configuration mode for the interface to be configured as a tunnel port. This should be the edge port in the service-provider network that connects to the customer switch. Valid interfaces include physical interfaces and port-channel logical interfaces (port channels 1 to 48).
ステップ 3	**switchport access vlan** *vlan-id* 例： `Switch(config-if)# switchport access vlan 2`	Specifies the default VLAN, which is used if the interface stops trunking. This VLAN ID is specific to the particular customer.
ステップ 4	**switchport mode dot1q-tunnel** 例： `Switch(config-if)# switchport mode dot1q-tunnel`	Sets the interface as an IEEE 802.1Q tunnel port. （注） Use the **no switchport mode dot1q-tunnel** interface configuration command to return the port to the default state of dynamic desirable.
ステップ 5	**exit** 例： `Switch(config-if)# exit`	Returns to privileged EXEC mode.
ステップ 6	**vlan dot1q tag native** 例： `Switch(config)# vlan dot1q tag native`	(Optional) Sets the switch to enable tagging of native VLAN packets on all IEEE 802.1Q trunk ports. When not set, and a customer VLAN ID is the same as the native VLAN, the trunk port does not apply a metro tag, and packets could be sent to the wrong destination. （注） Use the **no vlan dot1q tag native** global configuration command to disable tagging of native VLAN packets.
ステップ 7	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 8	Use one of the following: • **show dot1q-tunnel** • **show running-config interface**	Displays the ports configured for IEEE 802.1Q tunneling. Displays the ports that are in tunnel mode.

	コマンドまたはアクション	目的

	例：
	`Switch# show dot1q-tunnel`
	or
	`Switch# show running-config interface`	

ステップ 9	**show vlan dot1q tag native** 例： `Switch# show vlan dot1q native`	Displays IEEE 802.1Q native VLAN tagging status.
ステップ 10	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

関連トピック

IEEE 802.1Q Tunneling, （126 ページ）
IEEE 802.1Q Tunneling and Incompatibilities, （124 ページ）
Example: Configuring an IEEE 802.1Q Tunneling Port, （146 ページ）

Configuring Layer 2 Protocol Tunneling

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. Use one of the following:
   - **switchport mode access**
   - **switchport mode dot1q-tunnel**
4. **l2protocol-tunnel** [**cdp** | **lldp** | **point-to-point** | **stp** | **vtp**]
5. **l2protocol-tunnel shutdown-threshold** [*packet_second_rate_value* | **cdp** | **lldp point-to-point** | **stp** | **vtp**]
6. **l2protocol-tunnel drop-threshold** [*packet_second_rate_value* | **cdp** | **lldp** | **point-to-point** | **stp** | **vtp**]
7. **exit**
8. **errdisable recovery cause l2ptguard**
9. **l2protocol-tunnel cos** *value*
10. **end**
11. **show l2protocol**
12. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/1`	Specifies the interface connected to the phone, and enters interface configuration mode.
ステップ 3	Use one of the following: • **switchport mode access** • **switchport mode dot1q-tunnel**	Configures the interface as an access port or an IEEE 802.1Q tunnel port.

	コマンドまたはアクション	目的

	例：
	`Switch# switchport mode access`
	or
	`Switch# switchport mode dot1q-tunnel`	

ステップ 4	**l2protocol-tunnel** [**cdp** | **lldp** | **point-to-point** | **stp** | **vtp**] 例： `Switch# l2protocol-tunnel cdp`	Enables protocol tunneling for the desired protocol. If no keyword is entered, tunneling is enabled for all three Layer 2 protocols. （注） Use the **no l2protocol-tunnel** [**cdp** | **lldp** | **point-to-point** | **stp** | **vtp**] interface configuration command to disable protocol tunneling for one of the Layer 2 protocols or for all three.
ステップ 5	**l2protocol-tunnel shutdown-threshold** [*packet_second_rate_value* | **cdp** | **lldp** **point-to-point** | **stp** | **vtp**] 例： `Switch# l2protocol-tunnel shutdown-threshold 100 cdp`	(Optional) Configures the threshold for packets-per-second accepted for encapsulation. The interface is disabled if the configured threshold is exceeded. If no protocol option is specified, the threshold applies to each of the tunneled Layer 2 protocol types. The range is 1 to 4096. The default is to have no threshold configured. （注） If you also set a drop threshold on this interface, the **shutdown-threshold** value must be greater than or equal to the **drop-threshold** value. （注） Use the **no l2protocol-tunnel shutdown-threshold** [*packet_second_rate_value* | **cdp** | **lldp**| **point-to-point** | **stp** | **vtp**] and the **no l2protocol-tunnel drop-threshold** [*packet_second_rate_value* | **cdp** | **lldp**| **point-to-point** |**stp** | **vtp**] commands to return the shutdown and drop thresholds to the default settings.
ステップ 6	**l2protocol-tunnel drop-threshold** [*packet_second_rate_value* | **cdp** | **lldp** | **point-to-point** | **stp** | **vtp**] 例： `Switch# l2protocol-tunnel drop-threshold 100 cdp`	(Optional) Configures the threshold for packets-per-second accepted for encapsulation. The interface drops packets if the configured threshold is exceeded. If no protocol option is specified, the threshold applies to each of the tunneled Layer 2 protocol types. The range is 1 to 4096. The default is to have no threshold configured. （注） If you also set a shutdown threshold on this interface, the **drop-threshold** value must be less than or equal to the **shutdown-threshold** value. （注） Use the **no l2protocol-tunnel shutdown-threshold** [**cdp** | **lldp**| **point-to-point** | **stp** | **vtp**] and the **no l2protocol-tunnel drop-threshold** [**cdp** | **stp** | **vtp**] commands to return the shutdown and drop thresholds to the default settings.
ステップ 7	**exit**	Returns to global configuration mode.

	コマンドまたはアクション	目的
	例： `Switch# exit`	
ステップ 8	**errdisable recovery cause l2ptguard** 例： `Switch(config)# errdisable recovery cause l2ptguard`	(Optional) Configures the recovery mechanism from a Layer 2 maximum-rate error so that the interface is reenabled and can try again. Errdisable recovery is disabled by default; when enabled, the default time interval is 300 seconds.
ステップ 9	**l2protocol-tunnel cos** *value* 例： `Switch(config)# l2protocol-tunnel cos value 7`	(Optional) Configures the CoS value for all tunneled Layer 2 PDUs. The range is 0 to 7; the default is the default CoS value for the interface. If none is configured, the default is 5.
ステップ 10	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 11	**show l2protocol** 例： `Switch# show l2protocol`	Displays the Layer 2 tunnel ports on the switch, including the protocols configured, the thresholds, and the counters.
ステップ 12	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

関連トピック

Layer 2 Protocol Tunneling on Ports, （133 ページ）
Layer 2 Protocol Tunneling , （124 ページ）
Layer 2 Tunneling for EtherChannels, （126 ページ）
Example: Configuring Layer 2 Protocol Tunneling, （147 ページ）

Configuring the SP Edge Switch

はじめる前に

For EtherChannels, you need to configure both the SP (service-provider) edge switches and the customer switches for Layer 2 protocol tunneling.

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport mode dot1q-tunnel**
4. **l2protocol-tunnel point-to-point** [**pagp** | **lacp** | **udld**]
5. **l2protocol-tunnel shutdown-threshold** [**point-to-point** [**pagp** | **lacp** | **udld**]] *value*
6. **l2protocol-tunnel drop-threshold** [**point-to-point** [**pagp** | **lacp** | **udld**]] *value*
7. **no cdp enable**
8. **spanning-tree bpdu filter enable**
9. **exit**
10. **errdisable recovery cause l2ptguard**
11. **l2protocol-tunnel cos** *value*
12. **end**
13. **show l2protocol**
14. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/1`	Specifies the interface connected to the phone, and enters interface configuration mode.
ステップ 3	**switchport mode dot1q-tunnel** 例： `Switch(config-if)# switchport mode`	Configures the interface as an IEEE 802.1Q tunnel port.

	コマンドまたはアクション	目的
	dot1q-tunnel	
ステップ 4	**l2protocol-tunnel point-to-point** [**pagp** | **lacp** | **udld**] 例： `Switch(config-if)# l2protocol-tunnel point-to-point pagp`	(Optional) Enables point-to-point protocol tunneling for the desired protocol. If no keyword is entered, tunneling is enabled for all three protocols. （注） To avoid a network failure, make sure that the network is a point-to-point topology before you enable tunneling for PAgP, LACP, or UDLD packets. （注） Use the **no l2protocol-tunnel** [**point-to-point** [**pagp** | **lacp** | **udld**]] interface configuration command to disable point-to-point protocol tunneling for one of the Layer 2 protocols or for all three.
ステップ 5	**l2protocol-tunnel shutdown-threshold** [**point-to-point** [**pagp** | **lacp** | **udld**]] *value* 例： `Switch(config-if)# l2protocol-tunnel shutdown-threshold point-to-point pagp 100`	(Optional) Configures the threshold for packets-per-second accepted for encapsulation. The interface is disabled if the configured threshold is exceeded. If no protocol option is specified, the threshold applies to each of the tunneled Layer 2 protocol types. The range is 1 to 4096. The default is to have no threshold configured. （注） If you also set a drop threshold on this interface, the **shutdown-threshold** value must be greater than or equal to the **drop-threshold** value. （注） Use the **no l2protocol-tunnel shutdown-threshold** [**point-to-point** [**pagp** | **lacp** | **udld**]] and the **no l2protocol-tunnel drop-threshold** [[**point-to-point** [**pagp** | lacp | **udld**]] commands to return the shutdown and drop thresholds to the default settings.
ステップ 6	**l2protocol-tunnel drop-threshold** [**point-to-point** [**pagp** | **lacp** | **udld**]] *value* 例： `Switch(config-if)# l2protocol-tunnel drop-threshold point-to-point pagp 500`	(Optional) Configures the threshold for packets-per-second accepted for encapsulation. The interface drops packets if the configured threshold is exceeded. If no protocol option is specified, the threshold applies to each of the tunneled Layer 2 protocol types. The range is 1 to 4096. The default is to have no threshold configured. （注） If you also set a shutdown threshold on this interface, the **drop-threshold** value must be less than or equal to the **shutdown-threshold** value.
ステップ 7	**no cdp enable** 例： `Switch(config-if)# no cdp enable`	Disables CDP on the interface.
ステップ 8	**spanning-tree bpdu filter enable** 例： `Switch(config-if)# spanning-tree bpdu`	Enables BPDU filtering on the interface.

	コマンドまたはアクション	目的
	`filter enable`	
ステップ 9	**exit** 例： `Switch(config-if)# exit`	Returns to global configuration mode.
ステップ 10	**errdisable recovery cause l2ptguard** 例： `Switch(config)# errdisable recovery cause l2ptguard`	(Optional) Configures the recovery mechanism from a Layer 2 maximum-rate error so that the interface is reenabled and can try again. Errdisable recovery is disabled by default; when enabled, the default time interval is 300 seconds.
ステップ 11	**l2protocol-tunnel cos** *value* 例： `Switch(config)# l2protocol-tunnel cos 2`	(Optional) Configures the CoS value for all tunneled Layer 2 PDUs. The range is 0 to 7; the default is the default CoS value for the interface. If none is configured, the default is 5.
ステップ 12	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 13	**show l2protocol** 例： `Switch)# show l2protocol`	Displays the Layer 2 tunnel ports on the switch, including the protocols configured, the thresholds, and the counters.
ステップ 14	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

関連トピック

Examples: Configuring the SP Edge and Customer Switches, （147 ページ）

Configuring the Customer Switch

はじめる前に

For EtherChannels, you need to configure both the SP edge switches and the customer switches for Layer 2 protocol tunneling.

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport mode trunk**
4. **udld port**
5. **channel-group** *channel-group-number* **mode desirable**
6. **exit**
7. **interface port-channel port-channel** *number*
8. **shutdown**
9. **no shutdown**
10. **end**
11. **show l2protocol**
12. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/1`	Specifies the interface connected to the phone, and enters interface configuration mode.
ステップ 3	**switchport mode trunk** 例： `Switch(config-if)# switchport mode trunk`	Enables trunking on the interface.
ステップ 4	**udld port**	Enables UDLD in normal mode on the interface.

	コマンドまたはアクション	目的
	例： `Switch(config-if)# udld port`	
ステップ 5	**channel-group** *channel-group-number* **mode desirable** 例： `Switch(config-if)# channel-group 25 mode desirable`	Assigns the interface to a channel group, and specifies desirable for the PAgP mode.
ステップ 6	**exit** 例： `Switch(config-if)# exit`	Returns to global configuration mode.
ステップ 7	**interface port-channel port-channel** *number* 例： `Switch(config)# interface port-channel port-channel 25`	Enters port-channel interface mode.
ステップ 8	**shutdown** 例： `Switch(config)# shutdown`	Shuts down the interface.
ステップ 9	**no shutdown** 例： `Switch(config)# no shutdown`	Enables the interface.
ステップ 10	**end** 例： `Switch(config)# end`	Returns to privileged EXEC mode.
ステップ 11	**show l2protocol** 例： `Switch# show l2protocol`	Displays the Layer 2 tunnel ports on the switch, including the protocols configured, the thresholds, and the counters.

	コマンドまたはアクション	目的
ステップ 12	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file. （注） Use the **no switchport mode trunk**, the **no udld enable**, and the **no channel group** *channel-group-number* **mode desirable** interface configuration commands to return the interface to the default settings.

関連トピック

Examples: Configuring the SP Edge and Customer Switches, （147 ページ）

Configuration Examples for IEEE 802.1Q and Layer 2 Protocol Tunneling

Example: Configuring an IEEE 802.1Q Tunneling Port

The following example shows how to configure an interface as a tunnel port, enable tagging of native VLAN packets, and verify the configuration. In this configuration, the VLAN ID for the customer connected to Gigabit Ethernet interface 7 on stack member 1 is VLAN 22.

```
Switch(config)# interface gigabitethernet1/0/7
Switch(config-if)# switchport access vlan 22
% Access VLAN does not exist. Creating vlan 22
Switch(config-if)# switchport mode dot1q-tunnel
Switch(config-if)# exit
Switch(config)# vlan dot1q tag native
Switch(config)# end
Switch# show dot1q-tunnel interface gigabitethernet1/0/7
Port
-----
Gi1/0/1Port
-----
Switch# show vlan dot1q tag native
dot1q native vlan tagging is enabled
```

関連トピック

Configuring an IEEE 802.1Q Tunneling Port, （135 ページ）
IEEE 802.1Q Tunneling, （126 ページ）
IEEE 802.1Q Tunneling and Incompatibilities, （124 ページ）

Example: Configuring Layer 2 Protocol Tunneling

The following example shows how to configure Layer 2 protocol tunneling for CDP, STP, and VTP and to verify the configuration.

```
Switch(config)# interface gigabitethernet1/0/11
Switch(config-if)# l2protocol-tunnel cdp
Switch(config-if)# l2protocol-tunnel stp
Switch(config-if)# l2protocol-tunnel vtp
Switch(config-if)# l2protocol-tunnel shutdown-threshold 1500
Switch(config-if)# l2protocol-tunnel drop-threshold 1000
Switch(config-if)# exit
Switch(config)# l2protocol-tunnel cos 7
Switch(config)# end
Switch# show l2protocol

COS for Encapsulated Packets: 7
Port Protocol Shutdown Drop Encapsulation Decapsulation Drop
Threshold Threshold Counter Counter Counter
------- -------- --------- --------- ------------- ------------- -------------
Gi0/11 cdp 1500 1000 2288 2282 0
stp 1500 1000 116 13 0
vtp 1500 1000 3 67 0
pagp ---- ---- 0 0 0
lacp ---- ---- 0 0 0
udld ---- ---- 0 0 0
```

関連トピック

Configuring Layer 2 Protocol Tunneling, （138 ページ）

Layer 2 Protocol Tunneling on Ports, （133 ページ）

Layer 2 Protocol Tunneling , （124 ページ）

Layer 2 Tunneling for EtherChannels, （126 ページ）

Examples: Configuring the SP Edge and Customer Switches

This example shows how to configure the SP edge switch 1 and edge switch 2. VLANs 17, 18, 19, and 20 are the access VLANs, Fast Ethernet interfaces 1 and 2 are point-to-point tunnel ports with PAgP and UDLD enabled, the drop threshold is 1000, and Fast Ethernet interface 3 is a trunk port.

SP edge switch 1 configuration:

```
Switch(config)# interface gigabitethernet1/0/1
Switch(config-if)# switchport access vlan 17
Switch(config-if)# switchport mode dot1q-tunnel
Switch(config-if)# l2protocol-tunnel point-to-point pagp
Switch(config-if)# l2protocol-tunnel point-to-point udld
Switch(config-if)# l2protocol-tunnel drop-threshold point-to-point pagp 1000
Switch(config-if)# exit
Switch(config)# interface gigabitethernet1/0/2
Switch(config-if)# switchport access vlan 18
Switch(config-if)# switchport mode dot1q-tunnel
Switch(config-if)# l2protocol-tunnel point-to-point pagp
Switch(config-if)# l2protocol-tunnel point-to-point udld
Switch(config-if)# l2protocol-tunnel drop-threshold point-to-point pagp 1000
Switch(config-if)# exit
Switch(config)# interface gigabitethernet1/0/3
```

```
Switch(config-if)# switchport trunk encapsulation isl
Switch(config-if)# switchport mode trunk
```

SP edge switch 2 configuration:

```
Switch(config)# interface gigabitethernet1/0/1
Switch(config-if)# switchport access vlan 19
Switch(config-if)# switchport mode dot1q-tunnel
Switch(config-if)# l2protocol-tunnel point-to-point pagp
Switch(config-if)# l2protocol-tunnel point-to-point udld
Switch(config-if)# l2protocol-tunnel drop-threshold point-to-point pagp 1000
Switch(config-if)# exit
Switch(config)# interface gigabitethernet1/0/2
Switch(config-if)# switchport access vlan 20
Switch(config-if)# switchport mode dot1q-tunnel
Switch(config-if)# l2protocol-tunnel point-to-point pagp
Switch(config-if)# l2protocol-tunnel point-to-point udld
Switch(config-if)# l2protocol-tunnel drop-threshold point-to-point pagp 1000
Switch(config-if)# exit
Switch(config)# interface gigabitethernet1/0/3
Switch(config-if)# switchport trunk encapsulation isl
Switch(config-if)# switchport mode trunk
```

This example shows how to configure the customer switch at Site 1. Fast Ethernet interfaces 1, 2, 3, and 4 are set for IEEE 802.1Q trunking, UDLD is enabled, EtherChannel group 1 is enabled, and the port channel is shut down and then enabled to activate the EtherChannel configuration.

```
Switch(config)# interface gigabitethernet1/0/1
Switch(config-if)# switchport trunk encapsulation dot1q
Switch(config-if)# switchport mode trunk
Switch(config-if)# udld enable
Switch(config-if)# channel-group 1 mode desirable
Switch(config-if)# exit
Switch(config)# interface gigabitethernet1/0/2
Switch(config-if)# switchport trunk encapsulation dot1q
Switch(config-if)# switchport mode trunk
Switch(config-if)# udld enable
Switch(config-if)# channel-group 1 mode desirable
Switch(config-if)# exit
Switch(config)# interface gigabitethernet1/0/3
Switch(config-if)# switchport trunk encapsulation dot1q
Switch(config-if)# switchport mode trunk
Switch(config-if)# udld enable
Switch(config-if)# channel-group 1 mode desirable
Switch(config-if)# exit
Switch(config)# interface gigabitethernet1/0/4
Switch(config-if)# switchport trunk encapsulation dot1q
Switch(config-if)# switchport mode trunk
Switch(config-if)# udld enable
Switch(config-if)# channel-group 1 mode desirable
Switch(config-if)# exit
Switch(config)# interface port-channel 1
Switch(config-if)# shutdown
Switch(config-if)# no shutdown
Switch(config-if)# exit
```

関連トピック

Configuring the SP Edge Switch, （141 ページ）

Configuring the Customer Switch, （144 ページ）

Monitoring Tunneling Status

The following table describes the commands used to monitor tunneling status.

表 *15* : ***Commands for Monitoring Tunneling***

Command	Purpose
clear l2protocol-tunnel counters	Clears the protocol counters on Layer 2 protocol tunneling ports.
show dot1q-tunnel	Displays IEEE 802.1Q tunnel ports on the switch.
show dot1q-tunnel interface *interface-id*	Verifies if a specific interface is a tunnel port.
show l2protocol-tunnel	Displays information about Layer 2 protocol tunneling ports.
show errdisable recovery	Verifies if the recovery timer from a Layer 2 protocol-tunnel error disable state is enabled.
show l2protocol-tunnel interface *interface-id*	Displays information about a specific Layer 2 protocol tunneling port.
show l2protocol-tunnel summary	Displays only Layer 2 protocol summary information.
show vlan dot1q tag native	Displays the status of native VLAN tagging on the switch.

Where to Go Next

You can configure the following:

- VTP
- VLANs
- VLAN Trunking
- Private VLANs
- VLAN Membership Policy Server (VMPS)
- Voice VLANs

Additional References

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	*Catalyst 2960-XR Switch VLAN Management Command Reference*

Standards and RFCs

Standard/RFC	Title
—	—

MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature History and Information for Tunneling

Release	Modification
Cisco IOS 15.0(2)EX1	This feature was introduced.

第 8 章

Configuring Voice VLANs

- Finding Feature Information, 153 ページ
- Prerequisites for Voice VLANs, 153 ページ
- Restrictions for Voice VLANs, 154 ページ
- Information About Voice VLAN, 154 ページ
- How to Configure Voice VLAN, 157 ページ
- Monitoring Voice VLAN, 161 ページ
- Configuration Examples for Voice VLANs, 161 ページ
- Where to Go Next, 163 ページ
- Additional References, 163 ページ
- Feature History and Information for Voice VLAN, 164 ページ

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Voice VLANs

The following are the prerequisites for voice VLANs:

- Voice VLAN configuration is only supported on switch access ports; voice VLAN configuration is not supported on trunk ports.

（注） Trunk ports can carry any number of voice VLANs, similar to regular VLANs. The configuration of voice VLANs is not supported on trunk ports.

- Before you enable voice VLAN, we recommend that you enable QoS on the switch by entering the **mls qos** global configuration command and configure the port trust state to trust by entering the **mls qos trust cos** interface configuration command. If you use the auto-QoS feature, these settings are automatically configured.
- You must enable CDP on the switch port connected to the Cisco IP Phone to send the configuration to the phone. (CDP is globally enabled by default on all switch interfaces.)

Restrictions for Voice VLANs

The following are the restrictions for voice VLANs:

- Do not configure voice VLAN on private VLAN ports.
- You cannot configure static secure MAC addresses in the voice VLAN.

Information About Voice VLAN

Voice VLANs

The voice VLAN feature enables access ports to carry IP voice traffic from an IP phone. When the switch is connected to a Cisco 7960 IP Phone, the phone sends voice traffic with Layer 3 IP precedence and Layer 2 class of service (CoS) values, which are both set to 5 by default. Because the sound quality of an IP phone call can deteriorate if the data is unevenly sent, the switch supports quality of service (QoS) based on IEEE 802.1p CoS. QoS uses classification and scheduling to send network traffic from the switch in a predictable manner.

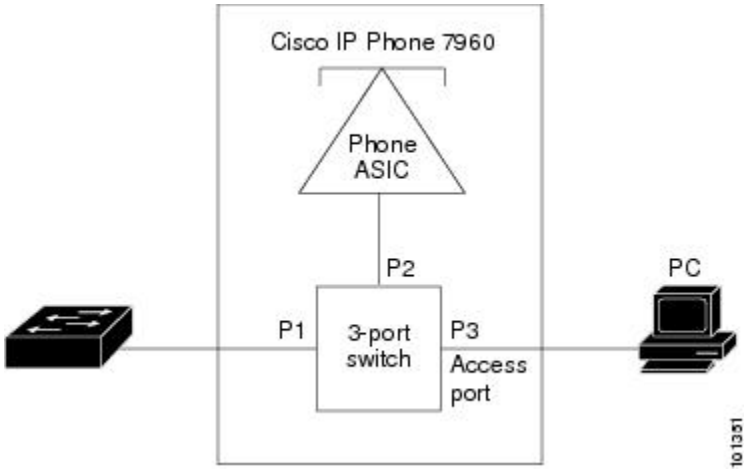
The Cisco 7960 IP Phone is a configurable device, and you can configure it to forward traffic with an IEEE 802.1p priority. You can configure the switch to trust or override the traffic priority assigned by a Cisco IP Phone.

This network configuration is one way to connect a Cisco 7960 IP Phone.

The Cisco IP Phone contains an integrated three-port 10/100 switch. The ports provide dedicated connections to these devices:

- Port 1 connects to the switch or other voice-over-IP (VoIP) device.
- Port 2 is an internal 10/100 interface that carries the IP phone traffic.
- Port 3 (access port) connects to a PC or other device.

図 *15* : *Cisco 7960 IP Phone Connected to aSwitch*



Cisco IP Phone Voice Traffic

You can configure an access port with an attached Cisco IP Phone to use one VLAN for voice traffic and another VLAN for data traffic from a device attached to the phone. You can configure access ports on the switch to send Cisco Discovery Protocol (CDP) packets that instruct an attached phone to send voice traffic to the switch in any of these ways:

- In the voice VLAN tagged with a Layer 2 CoS priority value
- In the access VLAN tagged with a Layer 2 CoS priority value
- In the access VLAN, untagged (no Layer 2 CoS priority value)

（注） In all configurations, the voice traffic carries a Layer 3 IP precedence value (the default is 5 for voice traffic and 3 for voice control traffic).

関連トピック

Configuring Cisco IP Phone Voice Traffic, （157 ページ）
Example: Configuring Cisco IP Phone Voice Traffic, （161 ページ）

Cisco IP Phone Data Traffic

The switch can also process tagged data traffic (traffic in IEEE 802.1Q or IEEE 802.1p frame types) from the device attached to the access port on the Cisco IP Phone. You can configure Layer 2 access ports on the switch to send CDP packets that instruct the attached phone to configure the phone access port in one of these modes:

- In trusted mode, all traffic received through the access port on the Cisco IP Phone passes through the phone unchanged.

- In untrusted mode, all traffic in IEEE 802.1Q or IEEE 802.1p frames received through the access port on the Cisco IP Phone receive a configured Layer 2 CoS value. The default Layer 2 CoS value is 0. Untrusted mode is the default.

（注） Untagged traffic from the device attached to the Cisco IP Phone passes through the phone unchanged, regardless of the trust state of the access port on the phone.

関連トピック

Configuring the Priority of Incoming Data Frames, （160 ページ）

Example: Configuring a Port Connected to an IP Phone Not to Change Frame Priority, （162 ページ）

Voice VLAN Configuration Guidelines

- Because a Cisco 7960 IP Phone also supports a connection to a PC or other device, a port connecting the switch to a Cisco IP Phone can carry mixed traffic. You can configure a port to decide how the Cisco IP Phone carries voice traffic and data traffic.
- The voice VLAN should be present and active on the switch for the IP phone to correctly communicate on the voice VLAN. Use the **show vlan** privileged EXEC command to see if the VLAN is present (listed in the display). If the VLAN is not listed, create the voice VLAN.
- The Power over Ethernet (PoE) switches are capable of automatically providing power to Cisco pre-standard and IEEE 802.3af-compliant powered devices if they are not being powered by an AC power source.
- Before you enable voice VLAN, we recommend that you enable QoS on the switch by entering the **mls qos** global configuration command and configure the port trust state to trust by entering the **mls qos trust cos** interface configuration command. If you use the auto-QoS feature, these settings are automatically configured.
- You must enable CDP on the switch port connected to the Cisco IP Phone to send the configuration to the phone. (CDP is globally enabled by default on all switch interfaces.).
- The Port Fast feature is automatically enabled when voice VLAN is configured. When you disable voice VLAN, the Port Fast feature is not automatically disabled.
- If the Cisco IP Phone and a device attached to the phone are in the same VLAN, they must be in the same IP subnet. These conditions indicate that they are in the same VLAN:
  - They both use IEEE 802.1p or untagged frames.
  - The Cisco IP Phone uses IEEE 802.1p frames, and the device uses untagged frames.
  - The Cisco IP Phone uses untagged frames, and the device uses IEEE 802.1p frames.
  - The Cisco IP Phone uses IEEE 802.1Q frames, and the voice VLAN is the same as the access VLAN.

- The Cisco IP Phone and a device attached to the phone cannot communicate if they are in the same VLAN and subnet but use different frame types because traffic in the same subnet is not routed (routing would eliminate the frame type difference).
- Voice VLAN ports can also be these port types:
  - Dynamic access port.
  - IEEE 802.1x authenticated port.

  （注） If you enable IEEE 802.1x on an access port on which a voice VLAN is configured and to which a Cisco IP Phone is connected, the phone loses connectivity to the switch for up to 30 seconds.

  - Protected port.
  - A source or destination port for a SPAN or RSPAN session.
  - Secure port.

  （注） When you enable port security on an interface that is also configured with a voice VLAN, you must set the maximum allowed secure addresses on the port to two plus the maximum number of secure addresses allowed on the access VLAN. When the port is connected to a Cisco IP Phone, the phone requires up to two MAC addresses. The phone address is learned on the voice VLAN and might also be learned on the access VLAN. Connecting a PC to the phone requires additional MAC addresses.

Default Voice VLAN Configuration

The voice VLAN feature is disabled by default.

When the voice VLAN feature is enabled, all untagged traffic is sent according to the default CoS priority of the port.

The CoS value is not trusted for IEEE 802.1p or IEEE 802.1Q tagged traffic.

How to Configure Voice VLAN

Configuring Cisco IP Phone Voice Traffic

You can configure a port connected to the Cisco IP Phone to send CDP packets to the phone to configure the way in which the phone sends voice traffic. The phone can carry voice traffic in IEEE 802.1Q frames for a specified voice VLAN with a Layer 2 CoS value. It can use IEEE 802.1p priority tagging to give voice traffic a higher priority and forward all voice traffic through the native (access) VLAN. The Cisco IP Phone can also send untagged voice traffic or use its own configuration to send voice traffic in the access VLAN. In all configurations, the voice traffic carries a Layer 3 IP precedence value (the default is 5).

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **mls qos trust cos**
4. **switchport voice vlan** {*vlan-id* | **dot1p** | **none** | **untagged** }
5. **end**
6. Use one of the following:
   - **show interfaces** *interface-id* **switchport**
   - **show running-config interface** *interface-id*
7. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/1`	Specifies the interface connected to the phone, and enters interface configuration mode.
ステップ 3	**mls qos trust cos** 例： `Switch(config-if)# mls qos trust cos`	Configures the interface to classify incoming traffic packets by using the packet CoS value. For untagged packets, the port default CoS value is used. （注） Before configuring the port trust state, you must first globally enable QoS by using the **mls qos** global configuration command.
ステップ 4	**switchport voice vlan** {*vlan-id*	**dot1p**	**none**	**untagged** } 例： `Switch(config-if)# switchport voice vlan 125`	Configures how the Cisco IP Phone carries voice traffic: • *vlan-id*—Configures the phone to forward all voice traffic through the specified VLAN. By default, the Cisco IP Phone forwards the voice traffic with an IEEE 802.1Q priority of 5. Valid VLAN IDs are 1 to 4094. • **dot1p**—Configures the switch to accept voice and data IEEE 802.1p priority frames tagged with VLAN ID 0 (the native VLAN). By default, the switch drops all voice and data traffic

	コマンドまたはアクション	目的
		tagged with VLAN 0. If configured for 802.1p the Cisco IP Phone forwards the traffic with an IEEE 802.1p priority of 5. • **none**—Allows the phone to use its own configuration to send untagged voice traffic. • **untagged**—Configures the phone to send untagged voice traffic. （注） Before configuring the switch port to detect and recognize a Cisco IP phone, confirm that the phone is powered by PoE. The configuration fails when power is provided by an AC source.
ステップ **5**	**end** 例： `Switch(config-if)# end`	Returns to privileged EXEC mode.

ステップ **6**	Use one of the following:
	• **show interfaces** *interface-id* **switchport**
	• **show running-config interface** *interface-id*
	例：
	`Switch# show interfaces gigabitethernet1/0/1 switchport`
	or
	`Switch# show running-config interface gigabitethernet1/0/1`
		Verifies your voice VLAN entries or your QoS and voice VLAN entries.

ステップ **7**	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

関連トピック

Cisco IP Phone Voice Traffic, （155 ページ）
Example: Configuring Cisco IP Phone Voice Traffic, （161 ページ）

Configuring the Priority of Incoming Data Frames

You can connect a PC or other data device to a Cisco IP Phone port. To process tagged data traffic (in IEEE 802.1Q or IEEE 802.1p frames), you can configure the switch to send CDP packets to instruct the phone how to send data packets from the device attached to the access port on the Cisco IP Phone. The PC can generate packets with an assigned CoS value. You can configure the phone to not change (trust) or to override (not trust) the priority of frames arriving on the phone port from connected devices.

Follow these steps to set the priority of data traffic received from the non-voice port on the Cisco IP Phone:

手順の概要

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport priority extend** {**cos** *value* | **trust**}
4. **end**
5. **show interfaces** *interface-id* **switchport**
6. **copy running-config startup-config**

手順の詳細

	コマンドまたはアクション	目的
ステップ 1	**configure terminal** 例： `Switch# configure terminal`	Enters the global configuration mode.
ステップ 2	**interface** *interface-id* 例： `Switch(config)# interface gigabitethernet1/0/1`	Specifies the interface connected to the Cisco IP Phone, and enters interface configuration mode.
ステップ 3	**switchport priority extend** {**cos** *value* | **trust**} 例： `Switch(config-if)# switchport priority extend trust`	Sets the priority of data traffic received from the Cisco IP Phone access port: • **cos** *value*—Configures the phone to override the priority received from the PC or the attached device with the specified CoS value. The value is a number from 0 to 7, with 7 as the highest priority. The default priority is **cos** 0. • **trust**—Configures the phone access port to trust the priority received from the PC or the attached device.

	コマンドまたはアクション	目的
		（注） To return the port to its default setting, use the **no switchport priority extend** interface configuration command.
ステップ 4	**end** 例： `Switch(config-if)# end`	Returns to privileged EXEC mode.
ステップ 5	**show interfaces** *interface-id* **switchport** 例： `Switch# show interfaces gigabitethernet1/0/1 switchport`	Verifies your entries.
ステップ 6	**copy running-config startup-config** 例： `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

関連トピック

Cisco IP Phone Data Traffic, （155 ページ）
Example: Configuring a Port Connected to an IP Phone Not to Change Frame Priority, （162 ページ）

Monitoring Voice VLAN

To display voice VLAN configuration for an interface, use the **show interfaces** *interface-id* **switchport** privileged EXEC command.

Configuration Examples for Voice VLANs

Example: Configuring Cisco IP Phone Voice Traffic

This example shows how to configure a port connected to a Cisco IP Phone to use the CoS value to classify incoming traffic and to accept voice and data priority traffic tagged with VLAN ID 0:

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# interface gigabitethernet1/0/1
```

```
Switch(config-if)# mls qos trust cos
Switch(config-if)# switchport voice vlan dot1p
Switch(config-if)# end
```

To return the port to its default setting, use the **no switchport voice vlan** interface configuration command.

This example shows how to enable switch port voice detect on a Cisco IP Phone:

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# interface gigabitethernet 1/0/1
Switch(config-if)# switchport voice?
detect detection enhancement keyword
vlan VLAN for voice traffic

Switch(config-if)# switchport voice detect?
cisco-phone Cisco IP Phone

Switch(config-if)# switchport voice detect cisco-phone?
full-duplex Cisco IP Phone

Switch(config-if)# switchport voice detect cisco-phone full-duplex
full-duplex full duplex keyword

Switch(config-if)# end
```

This example shows how to disable switchport voice detect on a Cisco IP Phone:

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# interface gigabitethernet 1/0/1
Switch(config-if)# no switchport voice detect cisco-phone
Switch(config-if)# no switchport voice detect cisco-phone full-duplex
```

関連トピック

Configuring Cisco IP Phone Voice Traffic, （157 ページ）

Cisco IP Phone Voice Traffic, （155 ページ）

Example: Configuring a Port Connected to an IP Phone Not to Change Frame Priority

This example shows how to configure a port connected to a Cisco IP Phone to not change the priority of frames received from the PC or the attached device:

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# interface gigabitethernet1/0/1
Switch(config-if)# switchport priority extend trust
Switch(config-if)# end
```

関連トピック

Configuring the Priority of Incoming Data Frames, （160 ページ）

Cisco IP Phone Data Traffic, （155 ページ）

Where to Go Next

After configuring voice VLANs, you can configure the following:

- VTP
- VLANs
- VLAN trunking
- Private VLANs
- VLAN Membership Policy Server (VMPS)
- Tunneling

Additional References

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	*Catalyst 2960-XR Switch VLAN Management Command Reference*

Standards and RFCs

Standard/RFC	Title
—	—

MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature History and Information for Voice VLAN

Release	Modification
Cisco IOS 15.0(2)EX1	This feature was introduced.

索 引

C

Cisco 7960 IP Phone 154
Cisco IP Phone Data Traffic 155
Cisco IP Phone Voice Traffic 155
configuring 114
confirming 115
CoS 160
  override priority 160

D

default Ethernet VLAN configuration 46
Default Layer 2 Ethernet Interface VLAN Configuration 66
default private VLAN configuration 95
default VLAN configuration 46
definition 40
  VLAN 40
deletion 49
  VLAN 49
described 111
domain names 21
dynamic access ports 114
  configuring 114
dynamic port membership 111, 116, 118
  described 111
  reconfirming 116
  troubleshooting 118
dynamic port VLAN membership 111, 114, 115, 116, 118
  described 111
  reconfirming 115, 116
  troubleshooting 118
  types of connections 114
dynamic VLAN assignments 110

E

entering server address 112
Ethernet VLAN 47
extended-range VLAN 52, 54
extended-range VLAN configuration guidelines 45
extended-range VLANs 52

F

feature information 38, 83, 164
  VLAN trunks 83
  voice VLAN 164
  VTP 38

H

hosts, limit on dynamic ports 118

I

IEEE 802.1Q 126
  protocol 126
IEEE 802.1Q tagging 73
IEEE 802.1Q tunneling 126
IEEE 802.1Q Tunneling 131
  default 131
internal VLAN ID 54

L

Layer 2 126
  protocol 126
Layer 2 interface modes 63
Layer 2 Protocol Tunneling 131, 133, 134
  default 134
Layer 2 Tunneling 126
  EtherChannels 126
load sharing 64, 74, 78
  trunk ports 64

M

mapping VLANs 105
monitoring 34, 103, 149, 161
  private VLAN 103
  tunneling status 149
  voice VLAN 161
  VTP 34
monitoring private VLANs 106
MST mode 66

N

native VLAN 73
Native VLANs 129
Network Load Sharing 64, 65
  STP path cost 65
  STP priorities 64
normal-range 44
  VLAN configuration guidelines 44
Normal-range VLANs 42

P

password 21, 36
ports 90
  community 90
  isolated 90
  promiscuous 90
prerequisites 13, 39, 61, 85, 109, 123, 153
  private VLANs 85
  tunneling 123
  VLAN trunks 61
  VLANs 39
  Voice VLAN 153
  VTP 13
primary server 36
primary VLAN configuration 86
priority 160
  overriding CoS 160
private VLAN 87, 98, 100, 101
  configuring Layer 2 interface 98
  configuring promiscuous port 100
  mapping secondary VLANs 101
  port configuration 87
private VLAN domains 89
private VLANs 88, 92, 93
  broadcast 93
  limitations 88
  multicast 93
  multiple switches 92
private VLANs *(続き)*
  unicast 93
private-VLAN 95
  configuring 95
pruning-eligible list 71
PVST mode 66

R

reconfirmation interval, changing 116
reconfirmation interval, VMPS, changing 116
reconfirming 115, 116
reconfirming dynamic VLAN membership 115
reconfirming membership 115
restrictions 40, 62, 110, 154
  VLAN trunks 62
  VLANs 40
  voice VLANs 154
retry count, changing 117
retry count, VMPS, changing 117

S

secondary VLAN configuration 86
secondary VLANs 90
static-access ports 50
STP path cost 78
STP port priorities 74
switch stacks 20
System MTU 130

T

Token Ring VLANs 43
Token Rings 28
troubleshooting 118
trunk 67
  configuration 67
trunk port 67
trunking 62
trunking modes 62
trunks 64
  allowed VLANs 64
types of connections 114

V

VLAN 40
  definition 40

VLAN membership 115
confirming 115
VLAN monitoring commands 57
VLAN port membership modes 41
VMPS 111, 112, 115, 116, 117, 118
dynamic port membership 111, 116, 118
described 111
reconfirming 116
troubleshooting 118
entering server address 112
reconfirmation interval, changing 116
reconfirming membership 115
retry count, changing 117
VMPS client configuration 112
default 112
VMPS Configuration Example command 119
voice VLAN 156, 157, 160
configuration guidelines 156
configuring IP phones for data traffic 160
override CoS of incoming frame 160
voice VLAN *(続き)*
configuring ports for voice traffic in 157
802.1p priority tagged frames 157
voice VLANs 154
VTP 14, 20, 22
configuration requirements 20
version 22
VTP advertisements 16
VTP domain 14, 32
VTP mode 24
VTP modes 15
VTP password 26
VTP primary 27
VTP pruning 18
VTP settings 20
VTP version 28
VTP version 2 17
VTP version 3 17