



## CHAPTER 39

# Configuring Private VLANs

---

This chapter describes how to implement private VLANs (PVLANS) on Catalyst 4500 series switches. This chapter includes the following major sections:

- [About Private VLANs, page 39-1](#)
- [PVLAN Commands, page 39-9](#)
- [Configuring PVLANS, page 39-10](#)



**Note**

For complete syntax and usage information for the switch commands used in this chapter, see the *Cisco Catalyst 4500 Series Switch Command Reference* and related publications at this location:

<http://www.cisco.com/en/US/products/hw/switches/ps4324/index.html>

If the command is not found in the *Cisco Catalyst 4500 Command Reference*, you can locate it in the larger Cisco IOS library. Refer to the *Cisco IOS Command Reference* and related publications at this location:

<http://www.cisco.com/en/US/products/ps6350/index.html>

## About Private VLANs

The private VLAN (PVLAN) 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.

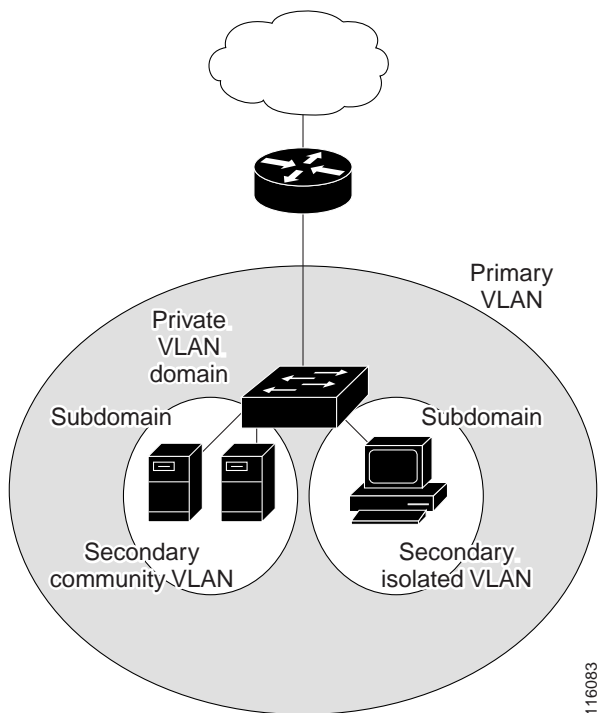
To configure PVLANS, you need to understand the concepts in these sections:

- [PVLAN Overview, page 39-2](#)
- [PVLAN Terminology, page 39-3](#)
- [PVLANS Across Multiple Switches, page 39-4](#)
- [Private VLAN Interaction with Other Features, page 39-7](#)

## PVLAN Overview

Using PVLANs provides scalability and IP address management benefits for service providers and Layer 2 security for customers. PVLANs partition a regular VLAN domain into subdomains. A subdomain is represented by a pair of VLANs: a *primary* VLAN and a *secondary* VLAN. A PVLAN can have multiple VLAN pairs, one pair for each subdomain. All VLAN pairs in a PVLAN share the same primary VLAN. The secondary VLAN ID differentiates one subdomain from another. See [Figure 39-1](#).

Figure 39-1 Private-VLAN Domain



The two types of secondary VLANs are as follows:

- 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.

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.

In a switched environment, you can assign an individual PVLAN 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 PVLAN.

You can use PVLANs 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 (such as backup servers) as promiscuous ports to allow all end stations access to a default gateway.

- Reduce VLAN and IP subnet consumption; you can prevent traffic between end stations even though they are in the same VLAN and IP subnet.

With a promiscuous port, you can connect a wide range of devices as access points to a PVLAN. For example, you can connect a promiscuous port to the server port of a LocalDirector to connect an isolated VLAN or a number of community VLANs to the server. LocalDirector can load balance the servers present in the isolated or community VLANs, or you can use a promiscuous port to monitor or back up all the PVLAN servers from an administration workstation.

This section includes the following topics:

- [PVLAN Terminology, page 39-3](#)
- [PVLANs Across Multiple Switches, page 39-4](#)
- [Private VLAN Interaction with Other Features, page 39-7](#)

## PVLAN Terminology

The following table defines the key terms used in this chapter:

Term	Definition
PVLANs	PVLANs are sets of VLAN pairs that share a common primary identifier and provide a mechanism for achieving Layer 2 separation between ports while sharing a single Layer 3 router port and IP subnet.
Secondary VLAN	A type of VLAN used to implement PVLANs. Secondary VLANs are associated with a primary VLAN, and are used to carry traffic from hosts to other allowed hosts or to routers.
Community port	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 PVLAN.
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 PVLAN.
Isolated port	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 PVLAN, except for the promiscuous ports. PVLANs block all traffic to isolated ports except traffic from promiscuous ports. Traffic received from an isolated port is forwarded only to promiscuous ports.

Term	Definition
Isolated VLAN	A PVLAN 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.
Primary VLAN	A PVLAN has only one primary VLAN. Every port in a PVLAN 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.
PVLAN trunk port	A PVLAN trunk port can carry multiple secondary (isolated only) and non-PVLANS. Packets are received and transmitted with secondary or regular VLAN tags on the PVLAN trunk ports. <b>Note</b> Only IEEE 802.1q encapsulation is supported.
Promiscuous port	A promiscuous port belongs to the primary VLAN and can communicate with all interfaces, including the community and isolated host ports and PVLAN trunk ports that belong to the secondary VLANs associated with the primary VLAN.
Promiscuous trunk port	A promiscuous trunk port can carry multiple primary and normal VLANs. Packets are received and transmitted with primary or regular VLAN tags. Other than that, the port operates just like a promiscuous access port. <b>Note</b> Only IEEE 802.1q encapsulation is supported.

## PVLANS Across Multiple Switches

This section discusses the following topics:

- [Standard Trunk Ports, page 39-4](#)
- [Isolated PVLAN Trunk Ports, page 39-5](#)
- [Promiscuous PVLAN Trunk Ports, page 39-7](#)

### Standard Trunk Ports

As with regular VLANs, PVLANS can span multiple switches. A trunk port carries the primary VLAN and secondary VLANs to a neighboring switch. The trunk port relates to the PVLAN as any other VLAN. Traffic from an isolated port in one switch does not reach an isolated port on another switch. See [Figure 39-2](#).

To maintain the security of your private VLAN configuration and to avoid other use of the VLANs configured as PVLANS, configure PVLANS on all intermediate devices, including devices that have no private VLAN ports.



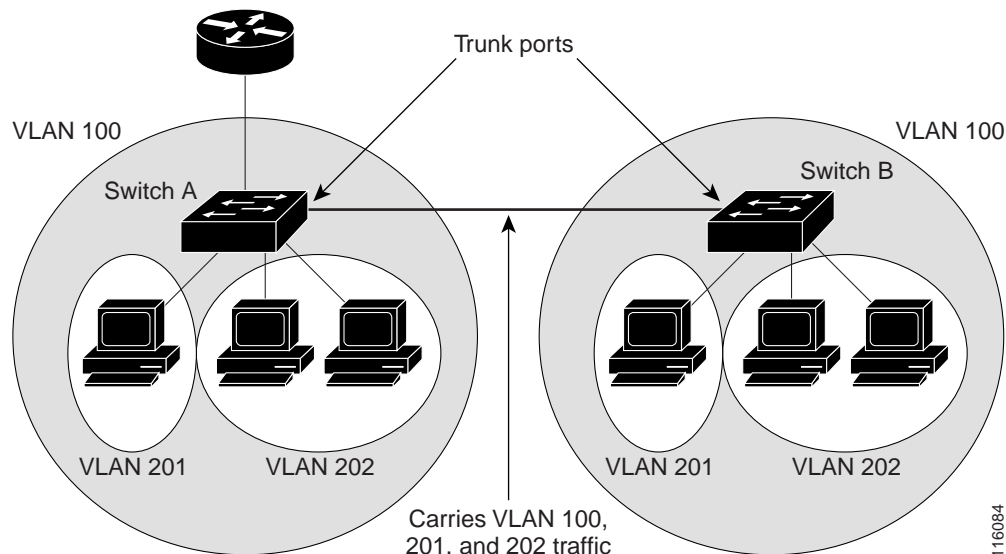
#### Note

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

**Note**

Use standard trunk ports if both switches that use trunking support PVLANS.

**Figure 39-2** PVLANS across Switches

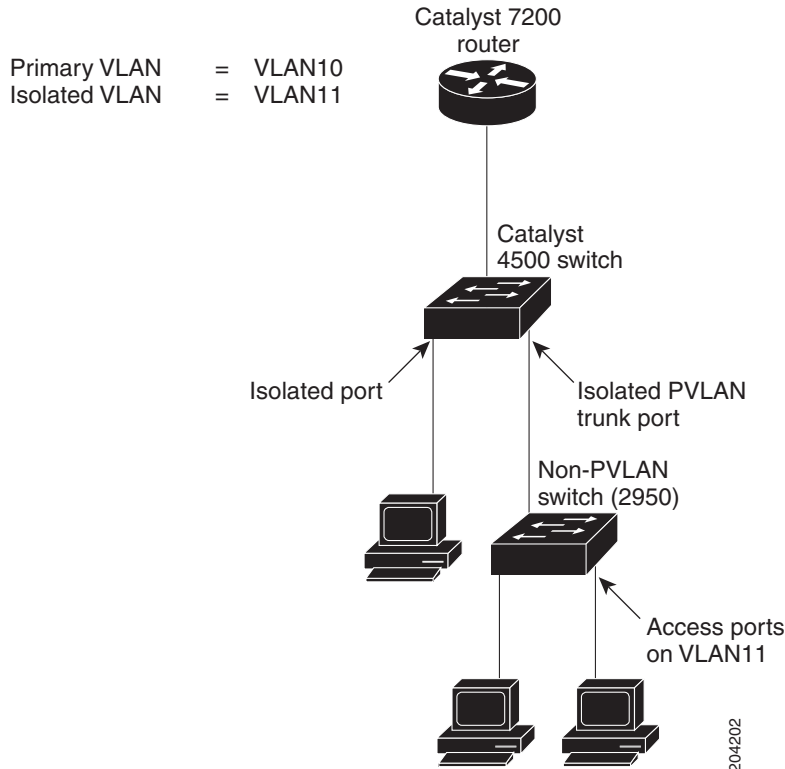


VLAN 100 = Primary VLAN  
 VLAN 201 = Secondary isolated VLAN  
 VLAN 202 = Secondary community VLAN

Because VTP does not support PVLANS, you must manually configure PVLANS 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 situation can result in unnecessary flooding of private VLAN traffic on those switches.

## Isolated PVLAN Trunk Ports

You use isolated PVLAN trunk ports if you anticipate using PVLAN isolated host ports to carry multiple VLANs, either normal VLANs or multiple PVLAN domains. You can connect a downstream switch that does not support PVLANS, such as a Catalyst 2950.

**Figure 39-3** *Isolated PVLAN Trunk Ports*

In this illustration, a Catalyst 4500 switch connects to a downstream switch that does not support PVLANS.

Traffic being sent in the downstream direction towards host1 from the router is received by the Catalyst 4500 series switch on the promiscuous port and in the primary VLAN (VLAN 10). The packets are then switched out of the isolated PVLAN trunk; instead of being tagged with the primary VLAN (VLAN 10) they are transmitted with the isolated VLAN's tag (VLAN 11). When the packets arrive on the non-PVLAN switch, they can be bridged to the destination hosts' access port.

Traffic in the upstream direction is sent by host1 to the non-PVLAN switch, arriving in VLAN 11. The packets are then transmitted to the Catalyst 4500 series switch tagged with that VLAN's tag (VLAN 11) over the trunk port. On the Catalyst 4500 series switch, VLAN 11 is configured as the isolated VLAN, and the traffic is forwarded as if it came from an isolated host port.

**Note**

The Catalyst 4500 series switch provides isolation between the isolated trunk and directly connected hosts (such as host3), but not between hosts connected to the non-PVLAN switch (such as host1 and host2). Isolation between these hosts must be provided by the non-PVLAN switch, using a feature such as protected ports on a Catalyst 2950.

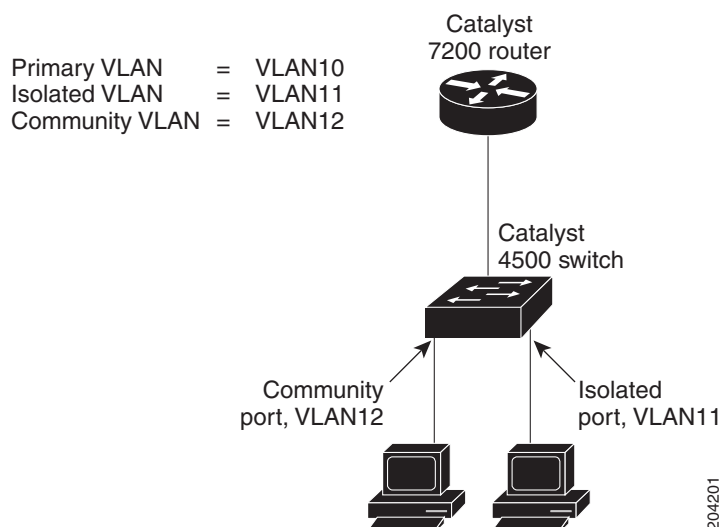
For details on protected ports, see the URL:

[http://www.cisco.com/en/US/docs/switches/lan/catalyst2950/software/release/12.1\\_22\\_ea11x/configuration/guide/swtrafc.html#wp1158863](http://www.cisco.com/en/US/docs/switches/lan/catalyst2950/software/release/12.1_22_ea11x/configuration/guide/swtrafc.html#wp1158863)

## Promiscuous PVLAN Trunk Ports

PVLAN promiscuous trunks are used in situations where a PVLAN promiscuous host port is normally used, but where it is necessary to carry multiple VLANs, either normal VLANs or multiple PVLAN domains. You can connect to an upstream router that does not support PVLANS, such as a Cisco 7200 router.

**Figure 39-4** *Promiscuous PVLAN Trunk Ports*



In this illustration, a Catalyst 4500 series switch connects a PVLAN domain to an upstream router, which does not support PVLANS. Traffic being sent upstream by host1 arrives on the Catalyst 4500 series switch in the community VLAN (VLAN 12). When this traffic is bridged onto the promiscuous PVLAN trunk towards the router, it is tagged with the primary VLAN (VLAN 10), so that it can be routed by using the correct subinterface configured on the router.

Traffic in the downstream direction is received on the promiscuous PVLAN trunk port by the Catalyst 4500 series switch in the primary VLAN (VLAN 10), as if it had been received on a promiscuous host port. The traffic can then be bridged to the destination host as in any PVLAN domain.

PVLAN promiscuous trunks interact with VLAN QoS. Refer to the [“PVLANS and VLAN ACL and QoS”](#) section on page 39-8.

## Private VLAN Interaction with Other Features

PVLANS have specific interaction with some other features, as described in these sections:

- [PVLANS and VLAN ACL and QoS](#), page 39-8
- [PVLANS and Unicast, Broadcast, and Multicast Traffic](#), page 39-8
- [PVLANS and SVIs](#), page 39-9
- [Per-Virtual Port Error-Disable on PVLANS](#), page 39-9

For details, see the section “PVLAN Configuration Guidelines and Restrictions” on page 11.

## PVLANs and VLAN ACL and QoS

PVLAN ports use primary and secondary VLANs, as follows:

- A packet received on a PVLAN host port belongs to the secondary VLAN.
- A packet received on a PVLAN trunk port belongs to the secondary VLAN if the packet is tagged with a secondary VLAN or if the packet is untagged and the native VLAN on the port is a secondary VLAN.

A packet received on a PVLAN host or trunk port and assigned to a secondary VLAN is bridged on the secondary VLAN. Because of this bridging, the secondary VLAN ACL as well as the secondary VLAN QoS (on input direction) apply.

When a packet is transmitted out of a PVLAN host or trunk port, the packet logically belongs to the primary VLAN. This relationship applies even though the packet may be transmitted with the secondary VLAN tagging for PVLAN trunk ports. In this situation, the primary VLAN ACL and the primary VLAN QoS on output apply to the packet.

- Similarly, a packet received on a PVLAN promiscuous access port belongs to primary VLAN.
- A packet received on a PVLAN promiscuous trunk port could belong to the primary VLAN or normal VLAN depending on incoming VLAN.

For traffic flowing in normal VLAN on promiscuous trunk ports, normal VLAN ACL and QoS policies apply. For traffic flowing in a PVLAN domain, a packet received on a promiscuous port is bridged in primary VLAN. The primary VLAN ACL and QoS policies apply on input.

When a packet is transmitted out of a promiscuous trunk port, the packet could logically belong to secondary VLAN if received from a secondary port, or in primary VLAN if bridged from another promiscuous port. Because we cannot differentiate between both packets, all VLAN QoS policies are ignored on packets egressing promiscuous trunk ports.

## PVLANs 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 PVLANs, 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 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. PVLAN 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 PVLAN (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.



## PVLANS 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 PVLAN only using 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 PVLAN.

## Per-Virtual Port Error-Disable on PVLANS

For PVLANS, per-virtual port error-disable behavior is defined as follows:

- On a PVLAN promiscuous or promiscuous trunk ports, if a violation occurs on the primary VLAN, it is error-disabled.
- On a PVLAN host or trunk port, if a violation occurs on the secondary VLAN, the associated primary VLAN is error-disabled.
- On a standard trunk port that carries both primary and secondary VLANs, if a violation occurs on the primary VLAN, this VLAN and all its associated secondary VLANs are error-disabled. If a violation occurs on a secondary VLAN, the associated primary VLAN and all its associated secondary VLANs are error-disabled.

## PVLAN Commands

This table lists the commands most commonly used with PVLANS.

Command	Purpose	Location
<b>private-vlan</b> { <b>community</b>   <b>isolated</b>   <b>primary</b> }	Configures a VLAN as a PVLAN.	<a href="#">Configuring a VLAN as a PVLAN, page 39-14</a>
<b>private-vlan association</b> { <i>secondary_vlan_list</i>   <b>add</b> <i>secondary_vlan_list</i>   <b>remove</b> <i>secondary_vlan_list</i> }	Associates the secondary VLAN with the primary VLAN.  The list can contain only one isolated VLAN ID; it can also contain multiple community VLAN IDs.	<a href="#">Associating a Secondary VLAN with a Primary VLAN, page 39-15</a>
<b>show vlan private-vlan</b> [type]	Verifies the configuration.	<a href="#">Configuring a VLAN as a PVLAN, page 39-14</a> <a href="#">Associating a Secondary VLAN with a Primary VLAN, page 39-15</a>

Command	Purpose	Location
<b>show interface private-vlan mapping</b>	Verifies the configuration.	<a href="#">Permitting Routing of Secondary VLAN Ingress Traffic, page 39-21</a>
<b>switchport mode private-vlan {host   promiscuous   trunk promiscuous   trunk [secondary]}</b>	Configures a Layer 2 interface as a PVLAN port.	<a href="#">Configuring PVLANS, page 39-10</a>
<b>switchport private-vlan mapping [trunk] primary_vlan_ID {secondary_vlan_list   add secondary_vlan_list   remove secondary_vlan_list}</b>	Maps the PVLAN promiscuous port to a primary VLAN and to selected secondary VLANs.	<a href="#">Configuring a Layer 2 Interface as a PVLAN Promiscuous Port, page 39-16</a> <a href="#">Configuring a Layer 2 Interface as a Promiscuous PVLAN Trunk Port, page 39-19</a>
Switch(config-if)# <b>switchport private-vlan host-association primary_vlan_ID secondary_vlan_ID</b>	Associates the Layer 2 interface with a PVLAN. <b>Note</b> You can associate only one primary-secondary VLAN pair to the isolated port.	<a href="#">Configuring a Layer 2 Interface as a PVLAN Host Port, page 39-17</a>
<b>switchport private-vlan association trunk primary_vlan_ID secondary_vlan_ID</b>	Configures association between primary VLANs and secondary VLANs the PVLAN trunk port with a PVLAN. <b>Note</b> You can configure the isolated trunk port with multiple primary-secondary pair.	<a href="#">Configuring a Layer 2 Interface as an Isolated PVLAN Trunk Port, page 39-18</a>
<b>switchport private-vlan trunk allowed vlan vlan_list all   none   [add   remove   except] vlan_atom[,vlan_atom...]</b>	Configures a list of allowed normal VLANs on a PVLAN trunk port.	<a href="#">Configuring a Layer 2 Interface as an Isolated PVLAN Trunk Port, page 39-18</a>
<b>switchport private-vlan trunk native vlan vlan_id</b>	Configures a VLAN to which untagged packets (as in IEEE 802.1Q tagging) are assigned on a PVLAN trunk port.	<a href="#">Configuring a Layer 2 Interface as an Isolated PVLAN Trunk Port, page 39-18</a>

## Configuring PVLANS

These sections describe how to configure PVLANS:

- [Basic PVLAN Configuration Procedure, page 39-11](#)
- [Default Private VLAN Configuration, page 39-11](#)
- [PVLAN Configuration Guidelines and Restrictions, page 39-11](#)
- [Configuring a VLAN as a PVLAN, page 39-14](#)
- [Associating a Secondary VLAN with a Primary VLAN, page 39-15](#)
- [Configuring a Layer 2 Interface as a PVLAN Promiscuous Port, page 39-16](#)
- [Configuring a Layer 2 Interface as a PVLAN Host Port, page 39-17](#)

- [Configuring a Layer 2 Interface as an Isolated PVLAN Trunk Port](#), page 39-18
- [Configuring a Layer 2 Interface as a Promiscuous PVLAN Trunk Port](#), page 39-19
- [Permitting Routing of Secondary VLAN Ingress Traffic](#), page 39-21

## Basic PVLAN Configuration Procedure

To configure a PVLAN, follow these basic steps:

- 
- Step 1** Set VTP mode to transparent. See the “[VLAN Trunking Protocol](#)” section on page 13-7.
- Step 2** Create the secondary VLANs. See the “[Configuring a VLAN as a PVLAN](#)” section on page 39-14.
- Step 3** Create the primary VLAN. See the “[Configuring a VLAN as a PVLAN](#)” section on page 39-14.
- Step 4** Associate the secondary VLAN to the primary VLAN. See the “[Associating a Secondary VLAN with a Primary VLAN](#)” section on page 39-15.




---

**Note** Only one isolated VLAN can be mapped to a primary VLAN, but more than one community VLAN can be mapped to a primary VLAN.

---

- Step 5** Configure an interface as an isolated or community host or trunk port. See the “[Configuring a Layer 2 Interface as a PVLAN Host Port](#)” section on page 39-17 and “[Configuring a Layer 2 Interface as an Isolated PVLAN Trunk Port](#)” section on page 39-18.
- Step 6** Associate the isolated port or community port to the primary-secondary VLAN pair. See the “[Associating a Secondary VLAN with a Primary VLAN](#)” section on page 39-15.
- Step 7** Configure an interface as a promiscuous port. See the “[Configuring a Layer 2 Interface as a PVLAN Promiscuous Port](#)” section on page 39-16.
- Step 8** Map the promiscuous port to the primary-secondary VLAN pair. See the “[Configuring a Layer 2 Interface as a PVLAN Promiscuous Port](#)” section on page 39-16.
- Step 9** If you plan to use inter-VLAN routing, configure the primary SVI, and map secondary VLANs to the primary. See the “[Permitting Routing of Secondary VLAN Ingress Traffic](#)” section on page 39-21.
- Step 10** Verify private VLAN configuration.
- 

## Default Private VLAN Configuration

No PVLANS are configured.

## PVLAN Configuration Guidelines and Restrictions

When using or configuring PVLANS, consider these guidelines and restrictions:

- To configure a PVLAN correctly, enable VTP in transparent mode in VTP version 1 and VTP version 2. (VTP version 3 enables you to create it in server mode).
- You cannot change the VTP mode to client or server for PVLANS.
- Do not include VLAN 1 or VLANs 1002 through 1005 in PVLANS.

- Use only PVLAN commands to assign ports to primary, isolated, or community VLANs.  
Layer 2 interfaces on primary, isolated, or community VLANs are inactive in PVLANS. Layer 2 trunk interfaces remain in the STP forwarding state.
- You cannot configure Layer 3 VLAN interfaces for secondary VLANs.  
Layer 3 VLAN interfaces for isolated and community (secondary) VLANs are inactive while the VLAN is configured as an isolated or community VLAN.
- Do not configure PVLAN ports as EtherChannels. While a port is part of the PVLAN configuration, its associated EtherChannel configuration is inactive.
- Do not apply dynamic access control entries (ACEs) to primary VLANs.  
Cisco IOS dynamic ACL configuration applied to a primary VLAN is inactive while the VLAN is part of the PVLAN configuration.
- To prevent spanning tree loops due to misconfigurations, enable PortFast on the PVLAN trunk ports with the **spanning-tree portfast trunk** command.
- Any VLAN ACL configured on a secondary VLAN is effective in the input direction, and any VLAN ACL configured on the primary VLAN associated with the secondary VLAN is effective in the output direction.
- You can stop Layer 3 switching on an isolated or community VLAN by deleting the mapping of that VLAN with its primary VLAN.
- PVLAN ports can be on different network devices as long as the devices are trunk-connected and the primary and secondary VLANs remain associated with the trunk
- Isolated ports on two different devices cannot communicate with each other, but community VLAN ports can.
- PVLANS support the following SPAN features:
  - You can configure a PVLAN 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 monitor egress or ingress traffic separately.

For more information about SPAN, see [Chapter 51, “Configuring SPAN and RSPAN.”](#)

- A primary VLAN can be associated with multiple community VLANs, but only one isolated VLAN.
- An isolated or community VLAN can be associated with only one primary VLAN.
- If you delete a VLAN used in a PVLAN configuration, the PVLAN ports associated with the VLAN become inactive.
- VTP does not support PVLANS. You must configure PVLANS on each device in which you plan to use PVLAN ports.
- To maintain the security of your PVLAN configuration and avoid other use of VLANs configured as PVLANS, configure PVLANS on all intermediate devices, even if the devices have no PVLAN ports.
- Prune the PVLANS from trunks on devices that carry no traffic in the PVLANS.
- With port ACLS functionality available, you can apply Cisco IOS ACLS to secondary VLAN ports and Cisco IOS ACLS to PVLANS (VACLs). For more information on VACLs, see [Chapter 47, “Configuring Network Security with ACLs.”](#)

- You can apply different quality of service (QoS) configurations to primary, isolated, and community VLANs. See [Chapter 37, “Configuring Quality of Service.”](#) Cisco IOS ACLs applied to the Layer 3 VLAN interface of a primary VLAN automatically apply to the associated isolated and community VLANs.
- On a PVLAN trunk port a secondary VLAN ACL is applied on ingress traffic and a primary VLAN ACL is applied on egress traffic.
- On a promiscuous port the primary VLAN ACL is applied on ingress traffic.
- Both PVLAN secondary and promiscuous trunk ports support only IEEE 802.1q encapsulation.
- Community VLANs cannot be propagated or carried over PVLAN trunks.
- ARP entries learned on Layer 3 PVLAN interfaces are termed “sticky” ARP entries (we recommend that you display and verify PVLAN interface ARP entries).
- For security reasons, PVLAN port sticky ARP entries do not age out. Connecting a device with a different MAC address but with the same IP address generates an error message and the ARP entry is not created.
- Because PVLAN port sticky ARP entries do not age out, you must manually remove the entries if you change the MAC address. To overwrite a sticky ARP entry, first delete the entry with the **no arp** command, then overwrite the entry with the **arp** command.
- In a DHCP environment, if you shut down your PC, it is not possible to give your IP address to someone else. To solve this problem, the Catalyst 4500 series switch supports the **no ip sticky-arp** command. This command promotes IP address overwriting and reuse in a DHCP environment.
- Normal VLANs can be carried on a promiscuous or isolated trunk port.
- The default native VLAN for promiscuous trunk port is VLAN 1, the management VLAN. All untagged packets are forwarded in the native VLAN. Either the primary VLANs or a regular VLAN can be configured as native VLAN.
- Promiscuous trunks cannot be configured to carry secondary VLANs. If a secondary VLAN is specified in the allowed VLAN list, the configuration is accepted but the port is not operational in the secondary VLAN (including even those VLANs that are secondary but not associated with any primary VLAN on given port).
- On a promiscuous trunk port, the primary VLAN ACL and QoS are applied on ingress traffic arriving in primary VLANs.
- On a promiscuous trunk port, no VLAN ACL or QoS is applied to the egress traffic because for upstream direction, traffic in the PVLAN logically flows in the secondary VLAN. Due to VLAN translation in hardware, information about received secondary VLANs has been lost, and no policies are applied. This restriction also applies to traffic bridged from other ports in the same primary VLANs.
- Do not configure port security on a PVLAN promiscuous trunk port.  
If port security is enabled on a promiscuous trunk port, that port may operate in an unpredictable manner because this functionality is not supported.
- Do not configure IEEE 802.1X on a PVLAN promiscuous trunk port.

**Note**

Community PVLAN trunk ports are not supported.

## Configuring a VLAN as a PVLAN

To configure a VLAN as a PVLAN, perform this task:

	Command	Purpose
Step 1	Switch# <b>configure terminal</b>	Enters configuration mode.
Step 2	Switch(config)# <b>vlan</b> <i>vlan_ID</i>	Enters VLAN configuration mode.
Step 3	Switch(config-vlan)# <b>private-vlan</b> { <b>community</b>   <b>isolated</b>   <b>primary</b> }	Configures a VLAN as a PVLAN. <ul style="list-style-type: none"> <li>This command does not take effect until you exit VLAN configuration submode.</li> </ul> You can use the <b>no</b> keyword to clear PVLAN status.
Step 4	Switch(config-vlan)# <b>end</b>	Exits VLAN configuration mode.
Step 5	Switch# <b>show vlan private-vlan</b> [ <i>type</i> ]	Verifies the configuration.

This example shows how to configure VLAN 202 as a primary VLAN and verify the configuration:

```
Switch# configure terminal
Switch(config)# vlan 202
Switch(config-vlan)# private-vlan primary
Switch(config-vlan)# end
Switch# show vlan private-vlan
```

Primary	Secondary	Type	Interfaces
202		primary	

This example shows how to configure VLAN 303 as a community VLAN and verify the configuration:

```
Switch# configure terminal
Switch(config)# vlan 303
Switch(config-vlan)# private-vlan community
Switch(config-vlan)# end
Switch# show vlan private-vlan
```

Primary	Secondary	Type	Interfaces
202		primary	
	303	community	

This example shows how to configure VLAN 440 as an isolated VLAN and verify the configuration:

```
Switch# configure terminal
Switch(config)# vlan 440
Switch(config-vlan)# private-vlan isolated
Switch(config-vlan)# end
Switch# show vlan private-vlan
```

Primary	Secondary	Type	Interfaces
202		primary	
	303	community	
	440	isolated	

## Associating a Secondary VLAN with a Primary VLAN

To associate secondary VLANs with a primary VLAN, perform this task:

	Command	Purpose
Step 1	Switch# <b>configure terminal</b>	Enters configuration mode.
Step 2	Switch(config)# <b>vlan primary_vlan_ID</b>	Enters VLAN configuration mode for the primary VLAN.
Step 3	Switch(config-vlan)# <b>private-vlan association</b> { <i>secondary_vlan_list</i>   <b>add secondary_vlan_list</b>   <b>remove secondary_vlan_list</b> }	Associates the secondary VLAN with the primary VLAN. The list can contain only one isolated VLAN ID; it can also contain multiple community VLAN IDs.  You can use the <b>no</b> keyword to clear all secondary associations.
Step 4	Switch(config-vlan)# <b>end</b>	Exits VLAN configuration mode.
Step 5	Switch# <b>show vlan private-vlan [type]</b>	Verifies the configuration.

When you associate secondary VLANs with a primary VLAN, note the following:

- The *secondary\_vlan\_list* parameter cannot contain spaces. It can contain multiple comma-separated items. Each item can be a single PVLAN ID or a hyphenated range of PVLAN IDs.
- The *secondary\_vlan\_list* parameter can contain multiple community VLAN IDs.
- The *secondary\_vlan\_list* parameter can contain only one isolated VLAN ID.
- Enter a *secondary\_vlan\_list* or use the **add** keyword with a *secondary\_vlan\_list* to associate secondary VLANs with a primary VLAN.
- Use the **remove** keyword with a *secondary\_vlan\_list* to clear the association between secondary VLANs and a primary VLAN.
- The command does not take effect until you exit VLAN configuration submode.

This example shows how to associate community VLANs 303 through 307 and 309 and isolated VLAN 440 with primary VLAN 202 and verify the configuration:

```
Switch# configure terminal
Switch(config)# vlan 202
Switch(config-vlan)# private-vlan association 303-307,309,440
Switch(config-vlan)# end
Switch# show vlan private-vlan
```

Primary	Secondary	Type	Interfaces
202	303	community	
202	304	community	
202	305	community	
202	306	community	
202	307	community	
202	309	community	
202	440	isolated	
	308	community	



### Note

The secondary VLAN 308 has no associated primary VLAN.

## Configuring a Layer 2 Interface as a PVLAN Promiscuous Port

To configure a Layer 2 interface as a PVLAN promiscuous port, perform this task:

	Command	Purpose
Step 1	Switch# <b>configure terminal</b>	Enters global configuration mode.
Step 2	Switch(config)# <b>interface</b> { <b>fastethernet</b>   <b>gigabitethernet</b>   <b>tengigabitethernet</b> } <i>slot/port</i>	Specifies the LAN interface to configure.
Step 3	Switch(config-if)# <b>switchport mode private-vlan</b> { <b>host</b>   <b>promiscuous</b>   <b>trunk promiscuous</b>   <b>trunk [secondary]</b> }	Configures a Layer 2 interface as a PVLAN promiscuous port.
Step 4	Switch(config-if)# [ <b>no</b> ] <b>switchport private-vlan mapping</b> [ <b>trunk</b> ] <i>primary_vlan_ID</i> { <i>secondary_vlan_list</i>   <b>add</b> <i>secondary_vlan_list</i>   <b>remove</b> <i>secondary_vlan_list</i> }	Maps the PVLAN promiscuous port to a primary VLAN and to selected secondary VLANs.
Step 5	Switch(config-if)# <b>end</b>	Exits configuration mode.
Step 6	Switch# <b>show interfaces</b> { <b>fastethernet</b>   <b>gigabitethernet</b>   <b>tengigabitethernet</b> } <i>slot/port</i> <b>switchport</b>	Verifies the configuration.



### Note

The maximum number of unique PVLAN pairs supported by the **switchport private-vlan mapping** command is 1000.

When you configure a Layer 2 interface as a PVLAN promiscuous port, note the following:

- The *secondary\_vlan\_list* parameter cannot contain spaces. It can contain multiple comma-separated items. Each item can be a single PVLAN ID or a hyphenated range of PVLAN IDs.
- Enter a *secondary\_vlan\_list* or use the **add** keyword with a *secondary\_vlan\_list* to map the secondary VLANs to the PVLAN promiscuous port.
- Use the **remove** keyword with a *secondary\_vlan\_list* to clear the mapping between secondary VLANs and the PVLAN promiscuous port.

This example shows how to configure interface FastEthernet 5/2 as a PVLAN promiscuous port, map it to a PVLAN, and verify the configuration:

```
Switch# configure terminal
Switch(config)# interface fastethernet 5/2
Switch(config-if)# switchport mode private-vlan promiscuous
Switch(config-if)# switchport private-vlan mapping 200 2
Switch(config-if)# end
Switch# show interfaces fastethernet 5/2 switchport
Name:Fa5/2
Switchport:Enabled
Administrative Mode:private-vlan promiscuous
Operational Mode:private-vlan promiscuous
Administrative Trunking Encapsulation: negotiate
Operational Trunking Encapsulation:native
Negotiation of Trunking:Off
Access Mode VLAN:1 (default)
Trunking Native Mode VLAN:1 (default)
Voice VLAN:none
Administrative Private VLAN Host Association:none
Administrative Private VLAN Promiscuous Mapping:200 (VLAN0200) 2 (VLAN0002)
Private VLAN Trunk Native VLAN:none
```



```

Administrative Private VLAN Trunk Encapsulation:dot1q
Administrative Private VLAN Trunk Normal VLANs:none
Administrative Private VLAN Trunk Private VLANs:none
Operational Private VLANs:
  200 (VLAN0200) 2 (VLAN0002)
Trunking VLANs Enabled:ALL
Pruning VLANs Enabled:2-1001
Capture Mode Disabled
Capture VLANs Allowed:ALL

```

## Configuring a Layer 2 Interface as a PVLAN Host Port

To configure a Layer 2 interface as a PVLAN host port, perform this task:

	Command	Purpose
Step 1	Switch# <b>configure terminal</b>	Enters configuration mode.
Step 2	Switch(config)# <b>interface</b> {fastethernet   gigabitethernet   tengigabitethernet} slot/port	Specifies the LAN port to configure.
Step 3	Switch(config-if)# <b>switchport mode private-vlan</b> {host   promiscuous   trunk promiscuous   trunk [secondary]}	Configures a Layer 2 interface as a PVLAN host port.
Step 4	Switch(config-if)# [no] <b>switchport private-vlan host-association</b> primary_vlan_ID secondary_vlan_ID	Associates the Layer 2 interface with a PVLAN. You can use the <b>no</b> keyword to delete all associations from the primary VLAN.
Step 5	Switch(config-if)# <b>end</b>	Exits configuration mode.
Step 6	Switch# <b>show interfaces</b> {fastethernet   gigabitethernet   tengigabitethernet} slot/port switchport	Verifies the configuration.

This example shows how to configure interface FastEthernet 5/1 as a PVLAN host port and verify the configuration:

```

Switch# configure terminal
Switch(config)# interface fastethernet 5/1
Switch(config-if)# switchport mode private-vlan host
Switch(config-if)# switchport private-vlan host-association 202 440
Switch(config-if)# end
Switch# show interfaces fastethernet 5/1 switchport
Name: Fa5/1
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)
Voice VLAN: none
Appliance trust: none
Administrative Private Vlan
  Host Association: 202 (VLAN0202) 440 (VLAN0440)
  Promiscuous Mapping: none
  Trunk encapsulation : dot1q
  Trunk vlans:

```

```
Operational private-vlan(s):
  202 (VLAN0202) 440 (VLAN0440)
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL
```

## Configuring a Layer 2 Interface as an Isolated PVLAN Trunk Port

To configure a Layer 2 interface as an isolated PVLAN trunk port, perform this task:

	Command	Purpose
Step 1	Switch# <b>configure terminal</b>	Enters global configuration mode.
Step 2	Switch(config)# <b>interface</b> {fastethernet   gigabitethernet   tengigabitethernet} slot/port	Specifies the LAN port to configure.
Step 3	Switch(config-if)# <b>switchport mode private-vlan</b> {host   promiscuous   trunk promiscuous   trunk [secondary]}	Configures a Layer 2 interface as a PVLAN trunk port.
Step 4	Switch(config-if)# [no] <b>switchport private-vlan association trunk</b> primary_vlan_ID secondary_vlan_ID	<p>Configures association between primary VLANs and secondary VLANs the PVLAN trunk port with a PVLAN.</p> <p><b>Note</b> Multiple PVLAN pairs can be specified using this command so that a PVLAN trunk port can carry multiple secondary VLANs. If an association is specified for the existing primary VLAN, the existing association is replaced. If there is no trunk association, any packets received on secondary VLANs are dropped.</p> <p>You can use the <b>no</b> keyword to delete all associations from the primary VLAN.</p>
Step 5	Switch(config-if)# [no] <b>switchport private-vlan trunk allowed vlan</b> vlan_list all   none   [add   remove   except] vlan_atom[,vlan_atom...]	<p>Configures a list of allowed normal VLANs on a PVLAN trunk port.</p> <p>You can use the <b>no</b> keyword to remove all allowed normal VLANs on a PVLAN trunk port.</p>
Step 6	Switch(config-if)# <b>switchport private-vlan trunk native vlan</b> vlan_id	<p>Configures a VLAN to which untagged packets (as in IEEE 802.1Q tagging) are assigned on a PVLAN trunk port.</p> <p>If there is no native VLAN configured, all untagged packets are dropped.</p> <p>If the native VLAN is a secondary VLAN and the port does not have the association for the secondary VLAN, the untagged packets are dropped.</p> <p>You can use the <b>no</b> keyword to remove all native VLANs on a PVLAN trunk port.</p>

	Command	Purpose
Step 7	Switch(config-if)# <b>end</b>	Exits configuration mode.
Step 8	Switch# <b>show interfaces</b> { <b>fastethernet</b>   <b>gigabitethernet</b>   <b>tengigabitethernet</b> } <i>slot/port</i> <b>switchport</b>	Verifies the configuration.

This example shows how to configure interface FastEthernet 5/2 as a secondary trunk port, and verify the configuration:

```
Switch# configure terminal
Switch(config)# interface fastethernet 5/2
Switch(config-if)# switchport mode private-vlan trunk secondary
Switch(config-if)# switchport private-vlan trunk native vlan 10
Switch(config-if)# switchport private-vlan trunk allowed vlan 10. 3-4
Switch(config-if)# switchport private-vlan association trunk 3 301
Switch(config-if)# end
Switch# show interfaces fastethernet 5/2 switchport
Name: Fa5/2
  Switchport: Enabled
    Administrative Mode: private-vlan trunk secondary
    Operational Mode: private-vlan trunk secondary
    Administrative Trunking Encapsulation: negotiate
    Operational Trunking Encapsulation: dot1q
    Negotiation of Trunking: On
    Access Mode VLAN: 1 (default)
    Trunking Native Mode VLAN: 1 (default)
    Administrative Native VLAN tagging: enabled
    Voice VLAN: none
    Administrative private-vlan host-association: none A
    Administrative private-vlan mapping: none
    Administrative private-vlan trunk native VLAN: 10
    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 associations:
      3 (VLAN0003) 301 (VLAN0301)
    Administrative private-vlan trunk mappings: none
    Operational private-vlan: none
    Operational Normal VLANs: none
    Trunking VLANs Enabled: ALL
    Pruning VLANs Enabled: 2-1001
    Capture Mode Disabled Capture VLANs Allowed: ALL

    Unknown unicast blocked: disabled
    Unknown multicast blocked: disabled
    Appliance trust: none
```

## Configuring a Layer 2 Interface as a Promiscuous PVLAN Trunk Port

To configure a Layer 2 interface as a promiscuous PVLAN trunk port, perform this task:

	Command	Purpose
Step 1	Switch# <b>configure terminal</b>	Enters global configuration mode.
Step 2	Switch(config)# <b>interface</b> { <b>fastethernet</b>   <b>gigabitethernet</b>   <b>tengigabitethernet</b> } <i>slot/port</i>	Specifies the LAN interface to configure.

	Command	Purpose
Step 3	Switch(config-if)# <b>switchport mode private-vlan</b> {host   promiscuous   trunk promiscuous   trunk [secondary]}	Configures a Layer 2 interface as a PVLAN promiscuous trunk port.
Step 4	Switch(config-if)# [no] <b>switchport private-vlan mapping</b> [trunk] primary_vlan_ID {secondary_vlan_list   add secondary_vlan_list   remove secondary_vlan_list}	Maps the promiscuous PVLAN port to a primary VLAN and to selected secondary VLANs.  This command offers 3 levels of removal. See the examples that follow this table.
Step 5	Switch(config-if)# <b>end</b>	Exits configuration mode.
Step 6	Switch# <b>show interfaces</b> {fastethernet   gigabitethernet   tengigabitethernet} slot/port <b>switchport</b>	Verifies the configuration.

**Note**

The maximum number of unique PVLAN pairs supported by the **switchport private-vlan mapping trunk** command is 500. For example, 500 isolated secondary VLANs can map to 500 primary VLANs because only one isolated VLAN association per primary VLAN is supported. 500 community secondary VLANs also can map to one primary VLAN. 250 community secondary VLANs can map to 1 primary VLAN, and another 250 community secondary VLANs can map to another primary VLAN for a total of 500 pairs.

**Note**

By default, if you configure the mode to PVLAN trunk **promiscuous**, the native VLAN is set to 1.

The [no] **switchport private-vlan mapping** command provides the following three levels of removal:

- Removes one or more secondary VLANs from the list. For example:  
Switch(config-if)# **switchport private-vlan mapping trunk 2 remove 222**
- Removes the entire mapping of PVLAN promiscuous trunk port to the specified primary VLAN (and all of its selected secondary VLANs). For example:  
Switch(config-if)# **no switchport private-vlan mapping trunk 2**
- Removes the mapping of a PVLAN promiscuous trunk port to all previously configured primary VLANs (and all of their selected secondary VLANs). For example:  
Switch(config-if)# **no switchport private-vlan mapping trunk**

When you configure a Layer 2 interface as a PVLAN promiscuous port, note the following:

- Multiple PVLAN pairs can be specified using the **switchport private-vlan mapping trunk** command so that a promiscuous trunk port can carry multiple primary VLANs.
- The *secondary\_vlan\_list* parameter cannot contain spaces. It can contain multiple comma-separated items. Each item can be a single PVLAN ID or a hyphenated range of PVLAN IDs.
- Enter a *secondary\_vlan\_list* or use the **add** keyword with a *secondary\_vlan\_list* to map the secondary VLANs to the PVLAN promiscuous port.
- Use the **remove** keyword with a *secondary\_vlan\_list* to clear the mapping between secondary VLANs and the PVLAN promiscuous port.

This example shows how to configure interface FastEthernet 5/2 as a promiscuous trunk port and to verify the configuration:

```
Switch# configure terminal
```

```

Switch(config)# interface fastethernet 5/2
Switch(config-if)# switchport mode private-vlan trunk promiscuous
Switch(config-if)# switchport private-vlan trunk native vlan 10
Switch(config-if)# switchport private-vlan trunk allowed vlan 10, 3-4
Switch(config-if)# switchport private-vlan mapping trunk 3 301, 302
Switch(config-if)# end
Switch# show interfaces fastethernet 5/2 switchport
Name: Fa5/2
Switchport: Enabled
Administrative Mode: private-vlan trunk promiscuous
Operational Mode: private-vlan trunk promiscuous
Administrative Trunking Encapsulation: negotiate
Operational Trunking Encapsulation: dot1q
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: 10
Administrative private-vlan trunk Native VLAN tagging: enabled
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: 3-4,10
Administrative private-vlan trunk associations: none
Administrative private-vlan trunk mappings:
    3 (VLAN0003) 301 (VLAN0301) 302 (VLAN0302)
Operational private-vlan:
    3 (VLAN0003) 301 (VLAN0301) 302 (VLAN0302)
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL

Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none

```

## Permitting Routing of Secondary VLAN Ingress Traffic



### Note

Isolated and community VLANs are both called secondary VLANs.

To permit routing of secondary VLAN ingress traffic, perform this task:

	Command	Purpose
Step 1	Switch# <b>configure terminal</b>	Enters global configuration mode.
Step 2	Switch(config)# <b>interface</b> <i>vlan primary_vlan_ID</i>	Enters interface configuration mode for the primary VLAN.
Step 3	Switch(config-if)# <b>[no] private-vlan mapping</b> <i>primary_vlan_ID {secondary_vlan_list   add</i> <i>secondary_vlan_list   remove secondary_vlan_list}</i>	To permit routing on the secondary VLAN ingress traffic, map the secondary VLAN to the primary VLAN.  You can use the <b>no</b> keyword to delete all associations from the primary VLAN.

	Command	Purpose
Step 4	Switch(config-if)# <b>end</b>	Exits configuration mode.
Step 5	Switch# <b>show interface private-vlan mapping</b>	Verifies the configuration.

When you permit routing on the secondary VLAN ingress traffic, note the following:

- The **private-vlan mapping** interface configuration command only affects PVLAN ingress traffic that is Layer 3 switched.
- The *secondary\_vlan\_list* parameter cannot contain spaces. It can contain multiple comma-separated items. Each item can be a single PVLAN ID or a hyphenated range of PVLAN IDs.
- Enter a *secondary\_vlan\_list* parameter or use the **add** keyword with a *secondary\_vlan\_list* parameter to map the secondary VLANs to the primary VLAN.
- Use the **remove** keyword with a *secondary\_vlan\_list* parameter to clear the mapping between secondary VLANs and the primary VLAN.

This example shows how to permit routing of secondary VLAN ingress traffic from PVLANS 303 through 307, 309, and 440 and verify the configuration:

```
Switch# configure terminal
Switch(config)# interface vlan 202
Switch(config-if)# private-vlan mapping add 303-307,309,440
Switch(config-if)# end
Switch# show interfaces private-vlan mapping
Interface Secondary VLAN Type
-----
vlan202    303          community
vlan202    304          community
vlan202    305          community
vlan202    306          community
vlan202    307          community
vlan202    309          community
vlan202    440          isolated

Switch#
```