



Configuring Private VLANs

This chapter describes how to configure private VLANs on the Cisco Nexus 3000 Series switch. It contains the following sections:

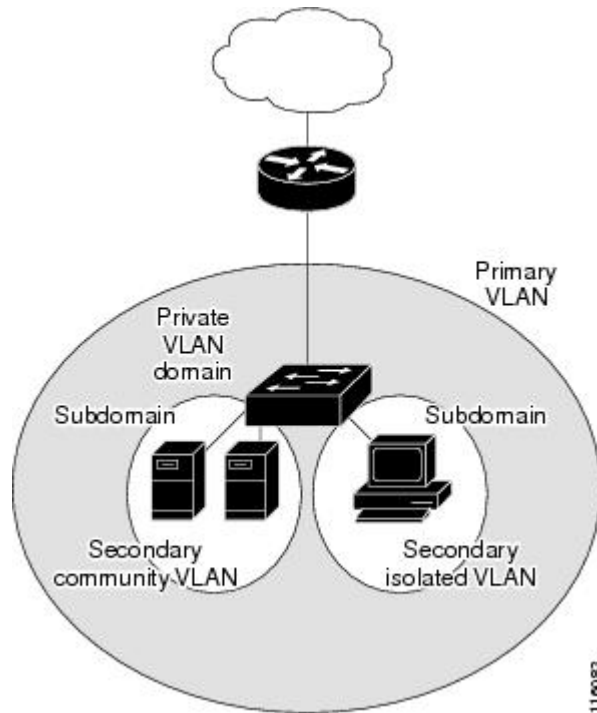
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Information About Private VLANs

A private VLAN partitions the Ethernet broadcast domain of a VLAN into subdomains, allowing you to isolate the ports on the switch from each other. A subdomain consists of a primary VLAN and one or more secondary VLANs (see the following figure). All VLANs in a private VLAN domain share the same primary VLAN. The secondary VLAN ID differentiates one subdomain from another. The secondary VLANs may either be isolated VLANs or community VLANs. A host on an isolated VLAN can only communicate with the associated

promiscuous port in its primary VLAN. Hosts on community VLANs can communicate among themselves and with their associated promiscuous port but not with ports in other community VLANs.

Figure 1: Private VLAN Domain



Note

You must first create the VLAN before you can convert it to a private VLAN, either primary or secondary.

Primary and Secondary VLANs in Private VLANs

A private VLAN domain has only one primary VLAN. Each port in a private VLAN domain is a member of the primary VLAN; the primary VLAN is the entire private VLAN domain.

Secondary VLANs provide isolation between ports within the same private VLAN domain. The following two types are secondary VLANs within a primary VLAN:

- **Isolated VLANs**—Ports within an isolated VLAN cannot communicate directly 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 community VLANs or in any isolated VLANs at the Layer 2 level.

Private VLAN Ports

The three types of PVLAN ports are as follows:

- **Promiscuous port**—A promiscuous port belongs to the primary VLAN. The promiscuous port can communicate with all interfaces, including the community and isolated host ports, that belong to those secondary VLANs associated to the promiscuous port and associated with the primary VLAN. You can have several promiscuous ports in a primary VLAN. Each promiscuous port can have several secondary VLANs or no secondary VLANs that are associated to that port. You can associate a secondary VLAN to more than one promiscuous port, as long as the promiscuous port and secondary VLANs are within the same primary VLAN. You can also have secondary VLANs that are not associated to any promiscuous port.

A promiscuous port can be configured as an access port.

- **Isolated port**—An isolated port is a host port that belongs to an isolated secondary VLAN. This port has complete isolation from other ports within the same PVLAN domain, except that it can communicate with associated 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. You can have more than one isolated port in a specified isolated VLAN. Each port is completely isolated from all other ports in the isolated VLAN.

An isolated port can be configured an access port.

- **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 associated promiscuous ports. These interfaces are isolated from all other interfaces in other communities and from all isolated ports within the PVLAN domain.

A community port must be configured as an access port.

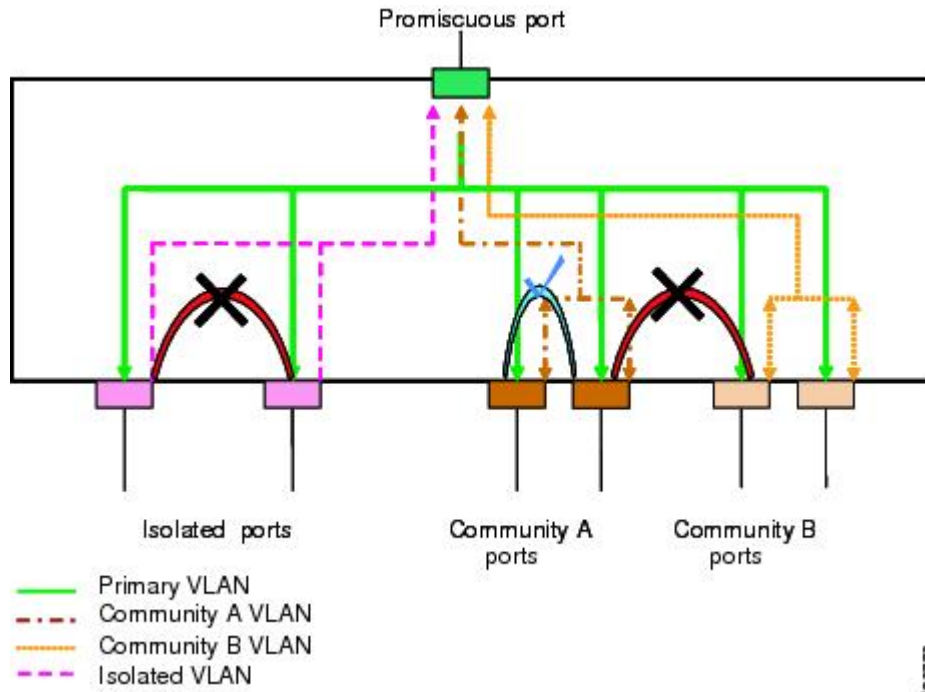
Primary, Isolated, and Community Private VLANs

Primary VLANs and the two types of secondary VLANs (isolated and community) have these characteristics:

- **Primary VLAN**— The primary VLAN carries traffic from the promiscuous ports to the host ports, both isolated and community, and to other promiscuous ports.
- **Isolated VLAN** —An isolated VLAN is a secondary VLAN that carries unidirectional traffic upstream from the hosts toward the promiscuous ports. You can configure only one isolated VLAN in a PVLAN domain. An isolated VLAN can have several isolated ports. The traffic from each isolated port also remains completely separate.
- **Community VLAN**—A community VLAN is a secondary VLAN that carries upstream traffic from the community ports to the promiscuous port and to other host ports in the same community. You can configure multiple community VLANs in a PVLAN domain. The ports within one community can communicate, but these ports cannot communicate with ports in any other community or isolated VLAN in the private VLAN.

The following figure shows the traffic flows within a PVLAN, along with the types of VLANs and types of ports.

Figure 2: Private VLAN Traffic Flows



Note

The PVLAN traffic flows are unidirectional from the host ports to the promiscuous ports. Traffic received on primary VLAN enforces no separation and forwarding is done as in a normal VLAN.

A promiscuous access port can serve only one primary VLAN and multiple secondary VLANs (community and isolated VLANs). With a promiscuous port, you can connect a wide range of devices as access points to a PVLAN. For example, you can use a promiscuous port to monitor or back up all the PVLAN servers from an administration workstation.

In a switched environment, you can assign an individual PVLAN and associated IP subnet to each individual or common group of end stations.

Associating Primary and Secondary VLANs

To allow host ports in secondary VLANs to communicate outside the private VLAN, you associate secondary VLANs to the primary VLAN. If the association is not operational, the host ports (community and isolated ports) in the secondary VLAN are brought down.



Note

You can associate a secondary VLAN with only one primary VLAN.

For an association to be operational, the following conditions must be met:

- The primary VLAN must exist and be configured as a primary VLAN.
- The secondary VLAN must exist and be configured as either an isolated or community VLAN.

**Note**

Use the **show vlan private-vlan** command to verify that the association is operational. The switch does not display an error message when the association is nonoperational.

If you delete either the primary or secondary VLAN, the ports that are associated with the VLAN become inactive. Use the **no private-vlan** command to return the VLAN to the normal mode. All primary and secondary associations on that VLAN are suspended, but the interfaces remain in private VLAN mode. When you convert the VLAN back to private VLAN mode, the original associations are reinstated.

If you enter the **no vlan** command for the primary VLAN, all private VLAN associations with that VLAN are deleted. However, if you enter the **no vlan** command for a secondary VLAN, the private VLAN associations with that VLAN are suspended and are restored when you recreate the specified VLAN and configure it as the previous secondary VLAN.

In order to change the association between a secondary and primary VLAN, you must first remove the current association and then add the desired association.

Private VLAN Promiscuous Trunks

The Cisco Nexus 3000 Series device does not support Private VLAN trunk ports.

Private VLAN Isolated Trunks

The Cisco Nexus 3000 Series device does not support Private VLAN trunk ports.

Broadcast Traffic in Private VLANs

Broadcast traffic from ports in a private VLAN flows in the following ways:

- The broadcast traffic flows from a promiscuous port to all ports in the primary VLAN (which includes all the ports in the community and isolated VLANs). This broadcast traffic is distributed to all ports within the primary VLAN, including those ports that are not configured with private VLAN parameters.
- The broadcast traffic from an isolated port is distributed only to those promiscuous ports in the primary VLAN that are associated to that isolated port.
- The broadcast traffic from community ports is distributed to all ports within the port's community and to all promiscuous ports that are associated to the community port. The broadcast packets are not distributed to any other communities within the primary VLAN, or to any isolated ports.

Private VLAN Port Isolation

You can use private VLANs to control access to end stations as follows:

- Configure selected interfaces connected to end stations as isolated ports to prevent any communication. For example, if the end stations are servers, this configuration prevents 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.

Guidelines and Limitations for Private VLANs

When configuring PVLANS, follow these guidelines:

- You must have already created the VLAN before you can assign the specified VLAN as a private VLAN.
- You must enable PVLANS before the switch can apply the PVLAN functionality.
- You cannot disable PVLANS if the switch has any operational ports in a PVLAN mode.
- Enter the **private-vlan synchronize** command from within the Multiple Spanning Tree (MST) region definition to map the secondary VLANs to the same MST instance as the primary VLAN.

Configuring a Private VLAN

Enabling Private VLANs

You must enable private VLANs on the switch to use the private VLAN functionality.



Note

The private VLAN commands do not appear until you enable the private VLAN feature.

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **feature private-vlan**
3. (Optional) switch(config)# **no feature private-vlan**

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters configuration mode.
Step 2	switch(config)# feature private-vlan	Enables the private VLAN feature on the switch.
Step 3	switch(config)# no feature private-vlan	(Optional) Disables the private VLAN feature on the switch. Note You cannot disable private VLANs if there are operational ports on the switch that are in private VLAN mode.

	Command or Action	Purpose
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This example shows how to enable the private VLAN feature on the switch:

```
switch# configure terminal
switch(config)# feature private-vlan
```

Configuring a VLAN as a Private VLAN

To create a private VLAN, you first create a VLAN, and then configure that VLAN to be a private VLAN.

Before You Begin

Ensure that the private VLAN feature is enabled.

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **vlan** {vlan-id | vlan-range}
3. switch(config-vlan)# **private-vlan** {community | isolated | primary}
4. (Optional) switch(config-vlan)# **no private-vlan** {community | isolated | primary}

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters configuration mode.
Step 2	switch(config)# vlan {vlan-id vlan-range}	Places you into the VLAN configuration submenu.
Step 3	switch(config-vlan)# private-vlan { community isolated primary }	Configures the VLAN as either a community, isolated, or primary private VLAN. In a private VLAN, you must have one primary VLAN. You can have multiple community and isolated VLANs.
Step 4	switch(config-vlan)# no private-vlan { community isolated primary }	(Optional) Removes the private VLAN configuration from the specified VLAN(s) and returns it to normal VLAN mode. If you delete either the primary or secondary VLAN, the ports that are associated with the VLAN become inactive.

This example shows how to assign VLAN 5 to a private VLAN as the primary VLAN:

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

This example shows how to assign VLAN 100 to a private VLAN as a community VLAN:

```
switch# configure terminal
switch(config)# vlan 100
switch(config-vlan)# private-vlan community
```

This example shows how to assign VLAN 200 to a private VLAN as an isolated VLAN:

```
switch# configure terminal
switch(config)# vlan 200
switch(config-vlan)# private-vlan isolated
```

Associating Secondary VLANs with a Primary Private VLAN

When you associate secondary VLANs with a primary VLAN, follow these guidelines:

- The *secondary-vlan-list* parameter cannot contain spaces. It can contain multiple comma-separated items. Each item can be a single secondary VLAN ID or a hyphenated range of secondary VLAN IDs.
- The *secondary-vlan-list* parameter can contain multiple community VLAN IDs and 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.
- You change the association between a secondary and primary VLAN by removing the existing association and then adding the desired association.

If you delete either the primary or secondary VLAN, the VLAN becomes inactive on the port where the association is configured. When you enter the **no private-vlan** command, the VLAN returns to the normal VLAN mode. All primary and secondary associations on that VLAN are suspended, but the interfaces remain in private VLAN mode. If you again convert the specified VLAN to private VLAN mode, the original associations are reinstated.

If you enter the **no vlan** command for the primary VLAN, all private VLAN associations with that VLAN are lost. However, if you enter the **no vlan** command for a secondary VLAN, the private VLAN associations with that VLAN are suspended and are reinstated when you recreate the specified VLAN and configure it as the previous secondary VLAN.

Before You Begin

Ensure that the private VLAN feature is enabled.

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **vlan primary-vlan-id**
3. switch(config-vlan)# **private-vlan association** {[add] *secondary-vlan-list* | **remove** *secondary-vlan-list*}
4. (Optional) switch(config-vlan)# **no private-vlan association**

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters configuration mode.
Step 2	switch(config)# vlan <i>primary-vlan-id</i>	Enters the number of the primary VLAN that you are working in for the private VLAN configuration.
Step 3	switch(config-vlan)# private-vlan association {[add] <i>secondary-vlan-list</i> remove <i>secondary-vlan-list</i> }	Associates the secondary VLANs with the primary VLAN.
Step 4	switch(config-vlan)# no private-vlan association	(Optional) Removes all associations from the primary VLAN and returns it to normal VLAN mode.

This example shows how to associate community VLANs 100 through 110 and isolated VLAN 200 with primary VLAN 5:

```
switch# configure terminal
switch(config)# vlan 5
switch(config-vlan)# private-vlan association 100-110, 200
```

Configuring an Interface as a Private VLAN Host Port

In private VLANs, host ports are part of the secondary VLANs, which are either community VLANs or isolated VLANs. Configuring a private VLAN host port involves two steps. First, you define the port as a private VLAN host port and then you configure a host association between the primary and secondary VLANs.

**Note**

We recommend that you enable BPDU Guard on all interfaces configured as a host ports.

Before You Begin

Ensure that the private VLAN feature is enabled.

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **interface** *type [chassis/]slot/port*
3. switch(config-if)# **switchport mode private-vlan host**
4. switch(config-if)# **switchport private-vlan host-association** {*primary-vlan-id*} {*secondary-vlan-id*}
5. (Optional) switch(config-if)# **no switchport private-vlan host-association**

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters configuration mode.
Step 2	switch(config)# interface <i>type</i> [<i>chassis</i> /] <i>slot</i> / <i>port</i>	Selects the port to configure as a private VLAN host port. This port can be on a Fabric Extender (identified by the chassis option).
Step 3	switch(config-if)# switchport mode private-vlan host	Configures the port as a host port for a private VLAN.
Step 4	switch(config-if)# switchport private-vlan host-association { <i>primary-vlan-id</i> } { <i>secondary-vlan-id</i> }	Associates the port with the primary and secondary VLANs of a private VLAN. The secondary VLAN can be either an isolated or community VLAN.
Step 5	switch(config-if)# no switchport private-vlan host-association	(Optional) Removes the private VLAN association from the port.

This example shows how to configure Ethernet port 1/12 as a host port for a private VLAN and associate it to primary VLAN 5 and secondary VLAN 101:

```
switch# configure terminal
switch(config)# interface ethernet 1/12
switch(config-if)# switchport mode private-vlan host
switch(config-if)# switchport private-vlan host-association 5 101
```

Configuring an Interface as a Private VLAN Promiscuous Port

In a private VLAN domain, promiscuous ports are part of the primary VLAN. Configuring a promiscuous port involves two steps. First, you define the port as a promiscuous port and then you configure the mapping between a secondary VLAN and the primary VLAN.

Before You Begin

Ensure that the private VLAN feature is enabled.

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **interface** *type* *slot*/*port*
3. switch(config-if)# **switchport mode private-vlan promiscuous**
4. switch(config-if)# **switchport private-vlan mapping** {*primary-vlan-id*} {*secondary-vlan-list* | **add** *secondary-vlan-list* | **remove** *secondary-vlan-list*}
5. (Optional) switch(config-if)# **no switchport private-vlan mapping**

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters configuration mode.
Step 2	switch(config)# interface <i>type slot/port</i>	Selects the port to configure as a private VLAN promiscuous port. A physical interface is required. This port cannot be on a Fabric Extender.
Step 3	switch(config-if)# switchport mode private-vlan promiscuous	Configures the port as a promiscuous port for a private VLAN. You can only enable a physical Ethernet port as the promiscuous port.
Step 4	switch(config-if)# switchport private-vlan mapping { <i>primary-vlan-id</i> } { <i>secondary-vlan-list</i> add <i>secondary-vlan-list</i> remove <i>secondary-vlan-list</i> }	Configures the port as a promiscuous port and associates the specified port with a primary VLAN and a selected list of secondary VLANs. The secondary VLAN can be either an isolated or community VLAN.
Step 5	switch(config-if)# no switchport private-vlan mapping	(Optional) Clears the mapping from the private VLAN.

This example shows how to configure Ethernet interface 1/4 as a promiscuous port associated with primary VLAN 5 and secondary isolated VLAN 200:

```
switch# configure terminal
switch(config)# interface ethernet 1/4
switch(config-if)# switchport mode private-vlan promiscuous
switch(config-if)# switchport private-vlan mapping 5 200
```

Configuring a Promiscuous Trunk Port

You cannot perform this task because the Cisco Nexus 3000 Series device does not support Private VLAN trunk ports.

Configuring an Isolated Trunk Port

You cannot perform this task because the Cisco Nexus 3000 Series device does not support Private VLAN trunk ports.

Configuring the Allowed VLANs for PVLAN Trunking Ports

You cannot perform this task because the Cisco Nexus 3000 Series device does not support Private VLAN trunk ports.

Configuring Native 802.1Q VLANs on Private VLANs

You cannot perform this task because the Cisco Nexus 3000 Series device does not support Private VLAN trunk ports.

Verifying Private VLAN Configuration

To display private VLAN configuration information, use the following commands:

Command	Purpose
switch# show feature	Displays the features enabled on the switch.
switch# show interface switchport	Displays information on all interfaces configured as switch ports.
switch# show vlan private-vlan [type]	Displays the status of the private VLAN.

The following example shows how to display the private VLAN configuration:

```
switch# show vlan private-vlan
Primary Secondary Type Ports
-----
5         100      community
5         101      community   Eth1/12, Eth100/1/1
5         102      community
5         110      community
5         200      isolated    Eth1/2
switch# show vlan private-vlan type
Vlan Type
-----
5      primary
100    community
101    community
102    community
110    community
200    isolated
```

The following example shows how to display enabled features (some of the output has been removed for brevity):

```
switch# show feature
Feature Name      Instance State
-----
fcsp              1      enabled
...
interface-vlan    1      enabled
private-vlan      1      enabled
udld              1      disabled
...
```