# Static Virtual LANs (VLANs)

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# Overview

This chapter describes how to configure and use static, port-based VLANs on the switches covered by this manual.

For general information on how to use the switch's built-in interfaces, refer to these chapters in the *Management and Configuration Guide* for your switch:

- Chapter 3, "Using the Menu Interface"
- Chapter 4, "Using the Command Line Interface (CLI)"
- Chapter 5, "Using the Web Browser Interface"
- Chapter 6, "Switch Memory and Configuration"

# Port-Based Virtual LANs (Static VLANs)

**VLAN Features**

| Feature | Default | Menu | CLI | Web |
|---|---|---|---|---|
| view existing VLANs | n/a | page 2-14 thru 2-19 | page 2-20 | page 2-25 |
| configuring static VLANs | default VLAN with VID = 1 | page 2-14 thru 2-19 | page 2-19 | page 2-25 |
| configuring dynamic VLANs | disabled | See the chapter on GVRP in this manual. | | |

A VLAN is a group of ports designated by the switch as belonging to the same broadcast domain. (That is, all ports carrying traffic for a particular subnet address would normally belong to the same VLAN.)

**Note**

This chapter describes *static* VLANs, which are VLANs you manually configure with a name, VLAN ID (VID), and port assignments. (For information on *dynamic* VLANs, see chapter 3, "GVRP".)

Using a VLAN, you can group users by logical function instead of physical location. This helps to control bandwidth usage by allowing you to group high-bandwidth users on low-traffic segments and to organize users from different LAN segments according to their need for common resources.

By default, 802.1Q VLAN support is enabled for eight VLANS. The table below shows the maximum number of VLANs you can configure on each switch model:

**Table 2-1.VLAN Maximums**

| Switch Model | Maximum Supported VLANs |
|---|---|
| Series 2600 Switches | Up to 253 |
| Series 2600-PWR Switches | Up to 253 |
| Series 4100gl Switches | Up to 30 |
| Switch 6108 | Up to 30 |
| Series 2800 Switches | Up to 256 |

(802.1Q compatibility enables you to assign each switch port to multiple VLANs, if needed, and the port-based nature of the configuration allows interoperation with older switches that require a separate port for each VLAN.)

**General Use and Operation.** Port-based VLANs are typically used to reduce broadcast traffic and to increase security. A group of network users assigned to a VLAN forms a broadcast domain that is separate from other VLANs that may be configured on a switch. On a given switch, packets are forwarded only between ports that belong to the same VLAN. Thus, all ports carrying traffic for a particular subnet address should be configured to the same VLAN. Cross-domain broadcast traffic in the switch is eliminated and bandwidth is saved by not allowing packets to flood out all ports. Separate VLANs on the switch can communicate with each other through either IP static routing configured on the switch, or through an external router.

For example, referring to figure 2-1, if ports A1 through A4 belong to VLAN_1 and ports A5 through A8 belong to VLAN_2, traffic from end-node stations on ports A2 through A4 is restricted to only VLAN_1, while traffic from ports A5 through A7 is restricted to only VLAN_2. For nodes on VLAN_1 to communicate with VLAN_2, their traffic must go through an external router via ports A1 and A8.

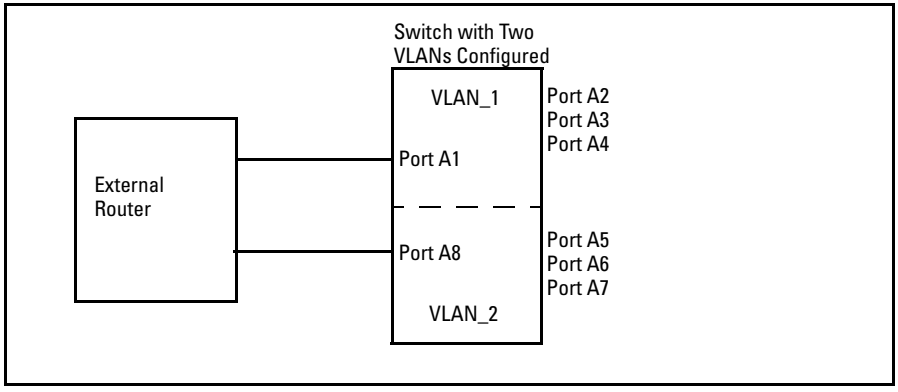



**Figure 2-1. Example of Routing Between VLANs via an External Router**

**Overlapping (Tagged) VLANs.** A port on the switch can be a member of more than one VLAN if the device to which it is connected complies with the 802.1Q VLAN standard. For example, a port connected to a central server using a network interface card (NIC) that complies with the 802.1Q standard can be a member of multiple VLANs, allowing members of multiple VLANs to use the server. Although these VLANs cannot communicate with each other through

the server, they can all access the server *over the same connection from the switch*. Where VLANs overlap in this way, VLAN "tags" are used to distinguish between traffic from different VLANs.

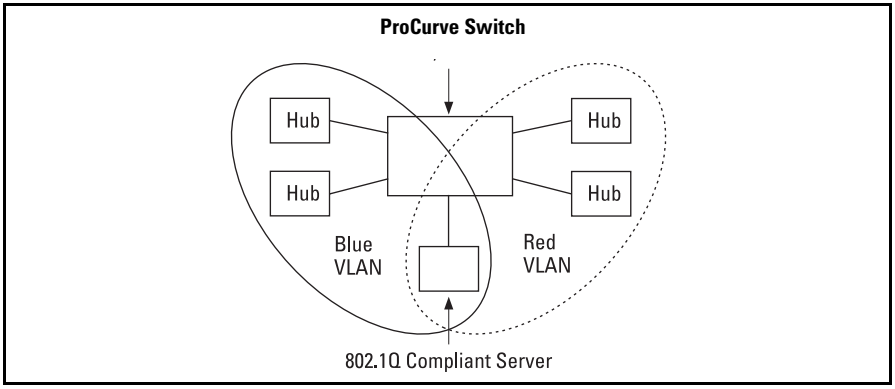



**Figure 2-2. Example of Overlapping VLANs Using the Same Server**

Similarly, using 802.1Q-compliant switches, you can connect multiple VLANs through a single switch-to-switch link.

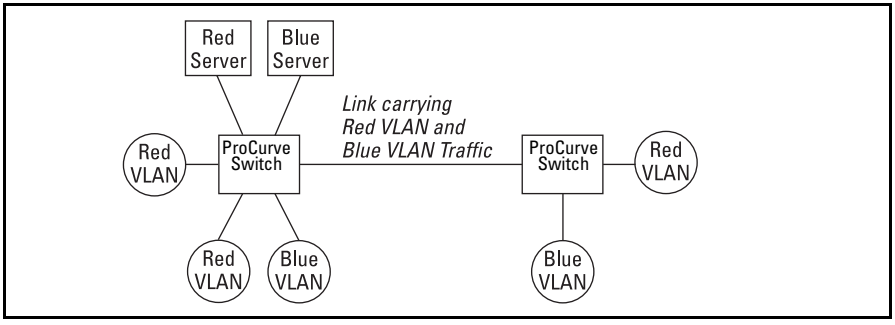



**Figure 2-3. Example of Connecting Multiple VLANs Through the Same Link**

**Introducing Tagged VLAN Technology into Networks Running Legacy (Untagged) VLANs.** You can introduce 802.1Q-compliant devices into networks that have built untagged VLANs based on earlier VLAN technology. The fundamental rule is that legacy/untagged VLANs require a separate link for each VLAN, while 802.1Q, or tagged VLANs can combine several VLANs in one link. This means that on the 802.1Q-compliant device, separate ports (configured as untagged) must be used to connect separate VLANs to non-802.1Q devices.

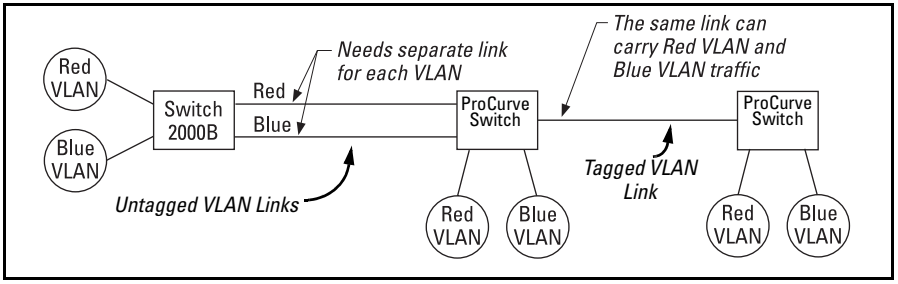



**Figure 2-4. Example of Tagged and Untagged VLAN Technology in the Same Network**

For more information on VLANs, refer to:

- "Overview of Using VLANs" (page 2-6)
- "Menu: Configuring VLAN Parameters (page 2-14)
- "CLI: Configuring VLAN Parameters" (page 2-14)
- "Web: Viewing and Configuring VLAN Parameters" (page 2-25)
- "VLAN Tagging Information" (page 2-26)
- "Effect of VLANs on Other Switch Features" (page 2-34)
- "VLAN Restrictions" (page 2-36)

# Overview of Using VLANs

## VLAN Support and the Default VLAN

In the factory default configuration, all ports on the switch belong to the default VLAN (named DEFAULT_VLAN). This places all ports in the switch into one physical broadcast domain. In the factory-default state, the default VLAN is the primary VLAN.

You can partition the switch into multiple virtual broadcast domains by adding one or more additional VLANs and moving ports from the default VLAN to the new VLANs. You can change the name of the default VLAN, but you cannot change the default VLAN's VID (which is always "1"). Although you can remove all ports from the default VLAN, this VLAN is always present; that is, you cannot delete it from the switch.

## The Primary VLAN

Because certain features and management functions, such as single IP-address stacking, run on only one VLAN in the switch, and because DHCP and Bootp can run per-VLAN, there is a need for a dedicated VLAN to manage these

features and ensure that multiple instances of DHCP or Bootp on different VLANs do not result in conflicting configuration values for the switch. The *primary* VLAN is the VLAN the switch uses to run and manage these features and data. In the factory-default configuration, the switch designates the default VLAN (DEFAULT_VLAN) as the primary VLAN. However, to provide more control in your network, you can designate another VLAN as primary. To summarize, *designating a non-default VLAN as primary* means that:

- The stacking feature runs on the switch's designated primary VLAN instead of the default VLAN
- The switch reads DHCP responses on the primary VLAN instead of on the default VLAN. (This includes such DHCP-resolved parameters as the TimeP server address, Default TTL, and IP addressing—including the Gateway IP address—when the switch configuration specifies DHCP as the source for these values.)
- The default VLAN continues to operate as a standard VLAN (except, as noted above, you cannot delete it or change its VID).
- Any ports not specifically assigned to another VLAN will remain assigned to the Default VLAN, regardless of whether it is the primary VLAN.

Candidates for primary VLAN include any static VLAN currently configured on the switch. (A dynamic—GVRP-learned—VLAN that has not been converted to a static VLAN cannot be the primary VLAN.) To display the current primary VLAN, use the CLI **show vlan** command.

**Note**

If you configure a non-default VLAN as the primary VLAN, you cannot delete that VLAN unless you first select a different VLAN to act as primary.

If you manually configure a gateway on the switch, it will ignore any gateway address received via DHCP or Bootp.

## Per-Port Static VLAN Configuration Options

The following figure and table show the options you have for assigning individual ports to a static VLAN. Note that GVRP, if configured, affects these options and VLAN behavior on the switch. The display below shows the per-port VLAN configuration options. Table 2-2 briefly describes these options.

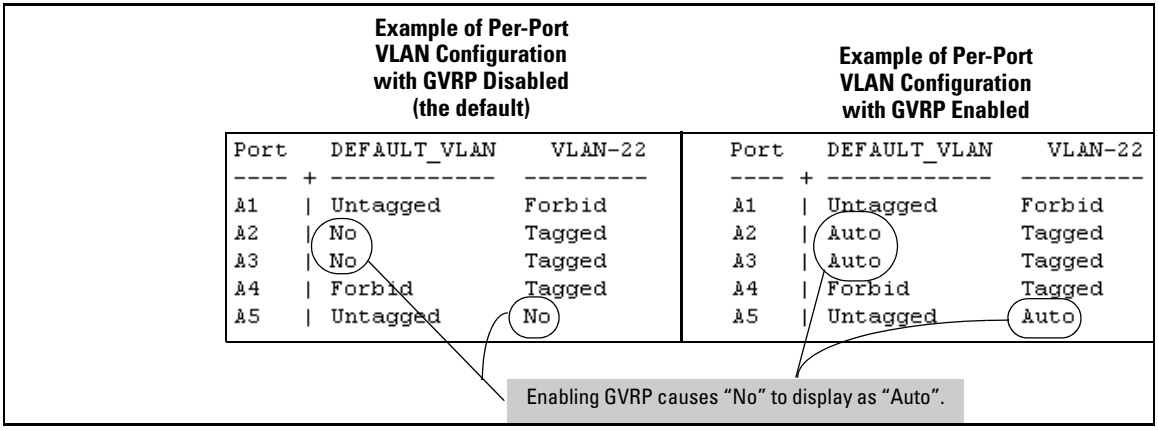



**Figure 2-1. Comparing Per-Port VLAN Options With and Without GVRP**

**Table 2-2. Per-Port VLAN Configuration Options**

| Parameter | Effect on Port Participation in Designated VLAN |
|---|---|
| **Tagged** | Allows the port to join multiple VLANs. |
| **Untagged** | Allows VLAN connection to a device that is configured for an untagged VLAN instead of a tagged VLAN. The switch allows no more than one untagged VLAN assignment per port. |
| **No**<br>*- or -*<br>**Auto** | **No**: Appears when the switch is not GVRP-enabled; prevents the port from joining that VLAN.<br>**Auto**: Appears when GVRP is enabled on the switch; allows the port to dynamically join any advertised VLAN that has the same VID |
| **Forbid** | Prevents the port from joining the VLAN, regardless of whether GVRP is enabled on the switch. |

### General Steps for Using VLANs

1. Plan your VLAN strategy and create a map of the logical topology that will result from configuring VLANs. Include consideration for the interaction between VLANs and other features such as Spanning Tree Protocol, load balancing, and IGMP. (Refer to "Effect of VLANs on Other Switch Features" on page 2-34.) If you plan on using dynamic VLANs, include the port configuration planning necessary to support this feature. (See chapter 3, "GVRP". )

   By default, VLAN support is enabled and the switch is configured for eight VLANs.

2. Configure at least one VLAN in addition to the default VLAN.
3. Assign the desired switch ports to the new VLAN(s).
4. If you are managing VLANs with SNMP in an IP network, each VLAN must have an IP address. Refer to the chapter on IP addressing in the *Management and Configuration Guide*.

### VLAN Operating Notes

- If you are using DHCP/Bootp to acquire the switch's configuration, packet time-to-live, and TimeP information, you must designate the VLAN on which DHCP is configured for this purpose as the primary VLAN. (In the factory-default configuration, the DEFAULT_VLAN is the primary VLAN.)
- IGMP, and some other features operate on a "per VLAN" basis. This means you must configure such features separately for each VLAN in which you want them to operate.
- You can rename the default VLAN, but you cannot change its VID (1) or delete it from the switch.
- Any ports *not* specifically assigned to another VLAN will remain assigned to the DEFAULT_VLAN.
- To delete a VLAN from the switch, you must first remove from that VLAN any ports assigned to it.
- Changing the number of VLANs supported on the switch requires a reboot. Other VLAN configuration changes are dynamic.

## Multiple VLAN Considerations

Switches use a *forwarding database* to maintain awareness of which external devices are located on which VLANs. Some switches, such as those covered by this guide, have a *multiple-forwarding database*, which means the switch allows multiple database entries of the same MAC address, with each entry

showing the (different) source VLAN and source port. Other switch models have a *single-forwarding database*, which means they allow only one database entry of a unique MAC address, along with the source VLAN and source port on which it is found (see Table 2-5). Not all VLANs on a switch covered by this guide use the same MAC address (see "VLAN MAC Addresses" on page 2-35). Connecting multiple-forwarding database switch to a single-forwarding database switch where multiple VLANs exist imposes some cabling and port VLAN assignment restrictions. Table 2-5 illustrates the functional difference between the two database types.

**Table 2-5. Example of Forwarding Database Content**

| Multiple-Forwarding Database | | |
|---|---|---|
| **MAC Address** | **Destination VLAN ID** | **Destination Port** |
| 0004ea-84d9f4 | 1 | A5 |
| 0004ea-84d9f4 | 22 | A12 |
| 0004ea-84d9f4 | 44 | A20 |
| 0060b0-880a81 | 33 | A20 |

This database allows multiple destinations for the same MAC address. If the switch detects a new destination for an existing MAC entry, it just **adds** a new instance of that MAC to the table.

| Single-Forwarding Database | | |
|---|---|---|
| **MAC Address** | **Destination VLAN ID** | **Destination Port** |
| 0004ea-84d9f4 | 100 | A9 |
| 0060b0-880af9 | 105 | A10 |
| 0060b0-880a81 | 107 | A17 |

This database allows only one destination for a MAC address. If the switch detects a new destination for an existing MAC entry, it **replaces** the existing MAC instance with a new instance showing the new destination.

Table 2-6 lists the database structure of current ProCurve switch models.

**Table 2-6. Forwarding Database Structure for Managed ProCurve Switches**

| Multiple-Forwarding Databases* | Single-Forwarding Database* |
|---|---|
| Switch 6108 | Switch 1600M/2400M/2424M |
| Series 5300xl switches | Switch 4000M/8000M |
| Series 4100gl switches | Series 2500 switches |
| Series 3400cl switches | Switch 800T |
| Series 2800 switches | Switch 2000 |
| Series 2600/2600-PWR switches | |

*To determine whether other vendors' devices use single-forwarding or multiple-forwarding database architectures, refer to the documentation provided for those devices.

## Single-Forwarding Database Operation

When a packet arrives with a destination MAC address that matches a MAC address in the switch's forwarding table, the switch tries to send the packet to the port listed for that MAC address. But, if the destination port is in a different VLAN than the VLAN on which the packet was received, the switch drops the packet. This is not a problem for a switch with a multiple-forwarding database (refer to table 2-6, above) because the switch allows multiple instances of a given MAC address; one for each valid destination. However, a switch with a single-forwarding database allows only one instance of a given MAC address. If (1) you connect the two types of switches through multiple ports or trunks belonging to different VLANs, and (2) enable routing on the switch having the multiple-forwarding database; then, on the switch having the single-forwarding database, the port and VLAN record it maintains for the connected multiple-forwarding-database switch can frequently change. This causes poor performance and the appearance of an intermittent or broken connection.

## Example of an Unsupported Configuration and How to Correct It

**The Problem.** In figure 2-2, the MAC address table for Switch 8000M will sometimes record the multiple-forwarding database switch as accessed on port A1 (VLAN 1), and other times as accessed on port B1 (VLAN 2):

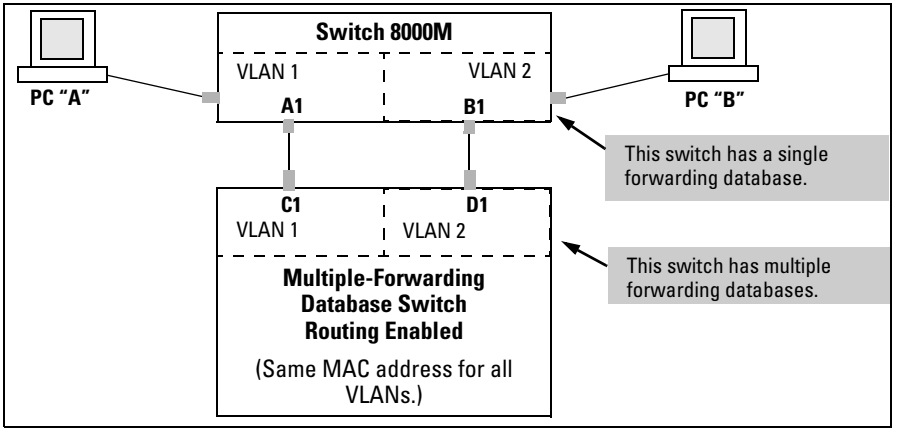



**Figure 2-2. Example of Invalid Configuration for Single-Forwarding to Multiple-Forwarding Database Devices in a Multiple VLAN Environment**

In figure 2-2, PC "A" sends an IP packet to PC "B".

1. The packet enters VLAN 1 in the Switch 8000 with the multiple-forwarding database switch MAC address in the destination field. Because the 8000M has not yet learned this MAC address, it does not find the address in its address table, and floods the packet out all ports, including the VLAN 1 link (port "A1") to the multiple-forwarding database switch. The multiple-forwarding database switch then routes the packet through the VLAN 2 link to the 8000M, which forwards the packet on to PC "B". Because the 8000M received the packet from the multiple-forwarding database switch on VLAN 2 (port "B1"), the 8000M's single forwarding database records the multiple-forwarding database switch as being on port "B1" (VLAN 2).
2. PC "A" now sends a second packet to PC "B". The packet again enters VLAN 1 in the Switch 8000 with the multiple-forwarding database switch's MAC address in the destination field. However, this time the Switch 8000M's single forwarding database indicates that the multiple-forwarding database switch is on port B1 (VLAN 2), and the 8000M drops the packet instead of forwarding it.
3. Later, the multiple-forwarding database switch transmits a packet to the 8000M through the VLAN 1 link, and the 8000M updates its address table to indicate that the multiple-forwarding database switch is on port A1 (VLAN 1) instead of port B1 (VLAN 2). Thus, the 8000M's information on the location of the multiple-forwarding database switch changes over time. For this reason, the 8000M discards some packets directed through it for the multiple-forwarding database switch, resulting in poor performance and the appearance of an intermittent or broken link.

**The Solution.** To avoid the preceding problem, use only one cable or port trunk between the single-forwarding and multiple-forwarding database devices, and configure the link with multiple, tagged VLANs.

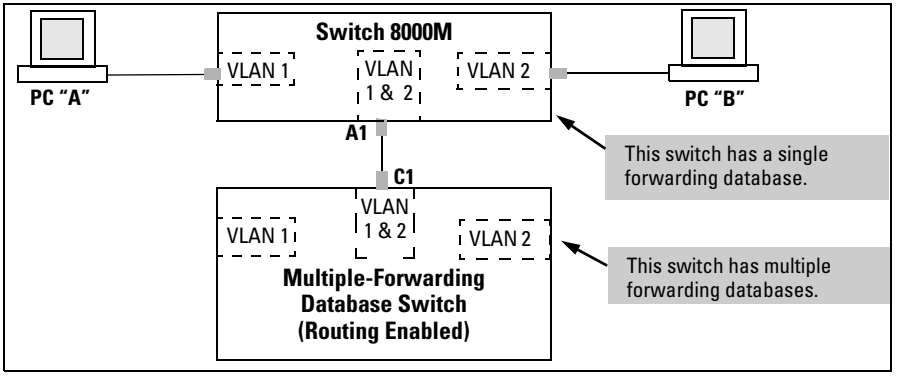



**Figure 2-3. Example of a Solution for Single-Forwarding to Multiple-Forwarding Database Devices in a Multiple VLAN Environment**

Now, the 8000M forwarding database always lists the multiple-forwarding database switch MAC address on port A1, and the 8000M will send traffic to either VLAN on the multiple-forwarding database switch.

To increase the network bandwidth of the connection between the devices, you can use a trunk of multiple physical links rather than a single physical link.

## Multiple-Forwarding Database Operation

If you want to connect a switch covered by this guide to another switch that has a multiple-forwarding database, you can use either or both of the following connection options:

- A separate port or port trunk interface for each VLAN. This results in a forwarding database having multiple instances of the same MAC address with different VLAN IDs and port numbers. (See table 2-5.) The switches covered by this guide that use the same MAC address on all VLAN interfaces cause no problems.
- The same port or port trunk interface for multiple (tagged) VLANs. This results in a forwarding database having multiple instances of the same MAC address with different VLAN IDs, but the same port number.

Allowing multiple entries of the same MAC address on different VLANs enables topologies such as the following:

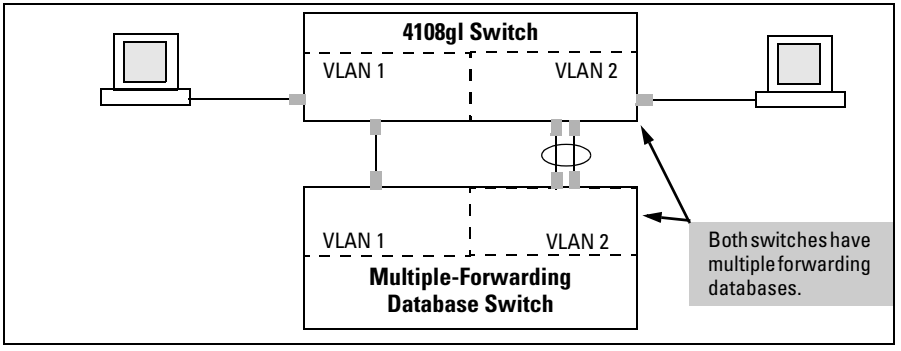



**Figure 2-4. Example of a Valid Topology for Devices Having Multiple-Forwarding Databases in a Multiple VLAN Environment**

# Menu: Configuring VLAN Parameters

In the factory default state, support is enabled for up to eight VLANs. (You can change the switch VLAN configuration to support additional VLANs. Refer to table 2-1 on page 2-3.) Also, all ports on the switch belong to the default VLAN (DEFAULT_VLAN) and are in the same broadcast/multicast domain. (The default VLAN is also the default primary VLAN—see "The Primary VLAN" on page 2-6.) In addition to the default VLAN, you can configure up to 29 other static VLANs by changing the "Maximum VLANs" parameter, adding new VLAN names and VIDs, and then assigning one or more ports to each VLAN. Note that each port can be assigned to multiple VLANs by using VLAN tagging. (See "802.1Q VLAN Tagging" on page 2-26.)

## To Change VLAN Support Settings

This section describes:

- Changing the maximum number of VLANs to support
- Changing the primary VLAN selection (See "Changing the Primary VLAN" on page 2-22.)

1. From the Main Menu select:

   **2. Switch Configuration**

   **8. VLAN Menu . . .**

   **1. VLAN Support**

   You will then see the following screen:

```
============================- CONSOLE - MANAGER MODE -=============================
                    Switch Configuration - VLAN - VLAN Support

  Maximum VLANs to support [8] : 8
  Primary VLAN : DEFAULT_VLAN
  GVRP Enabled [No] : No

 Actions->   Cancel     Edit     Save     Help

Cancel changes and return to previous screen.
Use arrow keys to change action selection and <Enter> to execute action.
```

**Figure 2-7. The Default VLAN Support Screen**

2. Press **[E]** (for **Edit**), then do one or more of the following:

- To change the maximum number of VLANs, type the new number. (For the maximum number of VLANs allowed, refer to table 2-1 on page 2-3.)

- To designate a different VLAN as the primary VLAN, select the **Primary VLAN** field and use the space bar to select from the existing options.
- To enable or disable dynamic VLANs, select the **GVRP Enabled** field and use the Space bar to toggle between options. (For GVRP information, see chapter 3, "GVRP".)

**Note**

For optimal switch memory utilization, set the number of VLANs at the number you will likely be using or a few more. If you need more VLANs later, you can increase this number, but a switch reboot will be required at that time.

3. Press **[Enter]** and then **[S]** to save the VLAN support configuration and return to the VLAN Menu screen.

   If you changed the value for **Maximum VLANs to support**, you will see an asterisk next to the **VLAN Support** option (see below).

An asterisk indicates you must reboot the switch to implement the new Maximum VLANs setting.

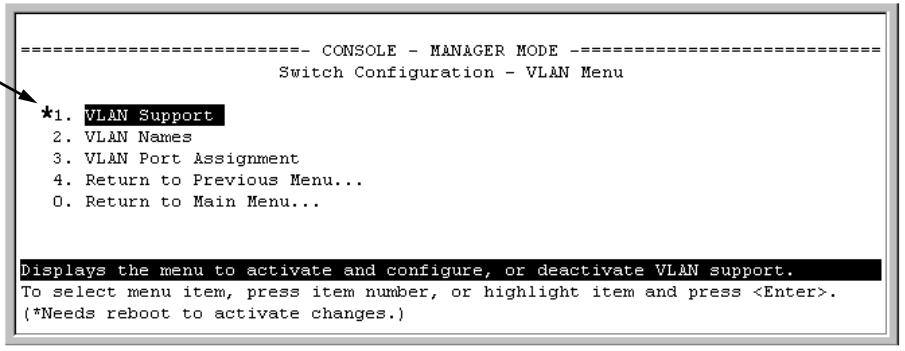



**Figure 2-8. VLAN Menu Screen Indicating the Need To Reboot the Switch**

   – If you changed the VLAN Support option, you must reboot the switch before the Maximum VLANs change can take effect. You can go on to configure other VLAN parameters first, but remember to reboot the switch when you are finished.
   – If you did not change the VLAN Support option, a reboot is not necessary.

4. Press **[0]** to return to the Main Menu.

## Adding or Editing VLAN Names

Use this procedure to add a new VLAN or to edit the name of an existing VLAN.

1. From the Main Menu select:

   **2. Switch Configuration**
   **8. VLAN Menu . . .**
   **2. VLAN Names**

   If multiple VLANs are not yet configured you will see a screen similar to figure 2-9:

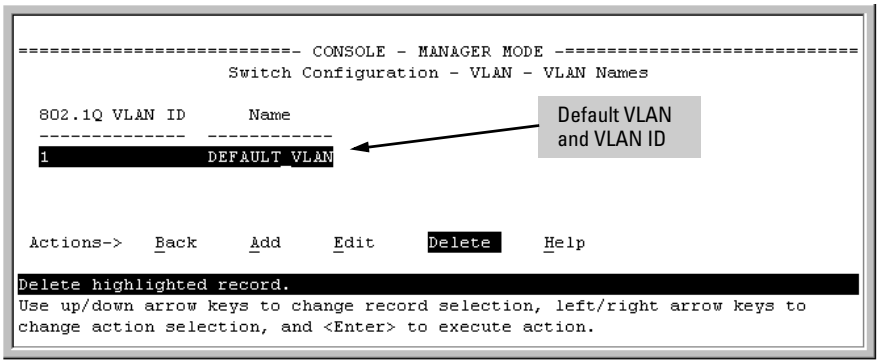



**Figure 2-9. The Default VLAN Names Screen**

2. Press **[A]** (for **Add**). You will then be prompted for a new VLAN name and VLAN ID:

   **802.1Q VLAN ID : 1**
   **Name : _**

3. Type in a VID (VLAN ID number). This can be any number from 2 to 4094 that is not already being used by another VLAN. (The switch reserves "1" for the default VLAN.)

   Remember that a VLAN *must* have the same VID in every switch in which you configure that same VLAN. (GVRP dynamically extends VLANs with correct VID numbering to other switches. See chapter 3, "GVRP".)

4. Press ↓ to move the cursor to the **Name** line and type the VLAN name (up to 12 characters, with no spaces) of a new VLAN that you want to add, then press **[Enter]**.
   (Avoid these characters in VLAN names: **@**, **#**, **$**, **^**, **&**, *****, **(**, and **)**.)

5. Press **[S]** (for **Save**). You will then see the VLAN Names screen with the new VLAN listed.

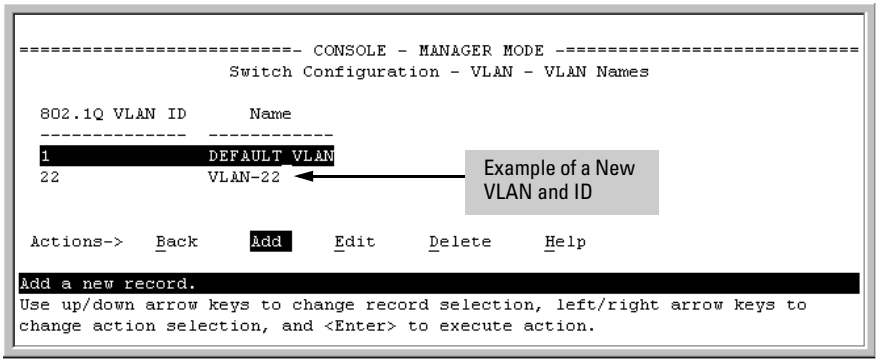



**Figure 2-10. Example of VLAN Names Screen with a New VLAN Added**

6. Repeat steps 2 through 5 to add more VLANs.

   Remember that you can add VLANs until you reach the number specified in the **Maximum VLANs to support** field on the VLAN Support screen (see figure 2-7 on page 2-14). This includes any VLANs added dynamically due to GVRP operation.

7. Return to the VLAN Menu to assign ports to the new VLAN(s) as described in the next section, “Adding or Changing a VLAN Port Assignment”.

## Adding or Changing a VLAN Port Assignment

Use this procedure to add ports to a VLAN or to change the VLAN assignment(s) for any port. (Ports not specifically assigned to a VLAN are automatically in the default VLAN.)

1. From the Main Menu select:

   **2. Switch Configuration**

   **8. VLAN Menu . . .**

   **3. VLAN Port Assignment**

   You will then see a VLAN Port Assignment screen similar to the following:

**Default:** In this example, the "VLAN-22" has been defined, but no ports have yet been assigned to it. ("No" means the port is not assigned to that VLAN.)
**Using GVRP?** If you plan on using GVRP, any ports you don't want to join should be changed to "Forbid".

A port can be assigned to several VLANs, but only one of those assignments can be "Untagged".

```
=========================- CONSOLE - MANAGER MODE -==============================
                Switch Configuration - VLAN - VLAN Port Assignment

  Port   DEFAULT_VLAN    VLAN-22      |  Port   DEFAULT_VLAN    VLAN-22
  ---- + ------------  ------------   |  ---- + ------------  ------------
 A1    | Untagged      No             |  A8   | Untagged      No
 A2    | Tagged        No             |  A9   | Untagged      No
 A3    | Untagged      No             |  A10  | Untagged      No
 A4    | Untagged      No             |  A11  | Untagged      No
 A5    | Untagged      No             |  A12  | Untagged      No
 A6    | Untagged      No             |  A13  | Untagged      No
 A7    | Untagged      No             |  A14  | Untagged      No

 Actions->   Cancel    Edit    Save    Help

Cancel changes and return to previous screen.
Use arrow keys to change action selection and <Enter> to execute action.
```

**Figure 2-11. Example of VLAN Port Assignment Screen**

2. To change a port's VLAN assignment(s):
   a. Press **[E]** (for **Edit**).
   b. Use the arrow keys to select a VLAN assignment you want to change.
   c. Press the Space bar to make your assignment selection (**No**, **Tagged**, **Untagged**, or **Forbid**).

**Note**

**For GVRP Operation:** If you enable GVRP on the switch, "**No**" converts to "**Auto**", which allows the VLAN to dynamically join an advertised VLAN that has the same VID. See "Per-Port Options for Dynamic VLAN Advertising and Joining" on page 3-8.

**Untagged VLANs:** Only one untagged VLAN is allowed per port. Also, there must be at least one VLAN assigned to each port. In the factory default configuration, all ports are assigned to the default VLAN (DEFAULT_VLAN).

For example, if you want ports A4 and A5 to belong to both DEFAULT_VLAN and VLAN-22, and ports A6 and A7 to belong only to VLAN-22, you would use the settings in figure page 2-19. (This example assumes the default GVRP setting—disabled—and that you do not plan to enable GVRP later.)

Ports A4 and A5 are assigned to both VLANs.

Ports A6 and A7 are assigned only to VLAN-22.

All other ports are assigned only to the Default VLAN.

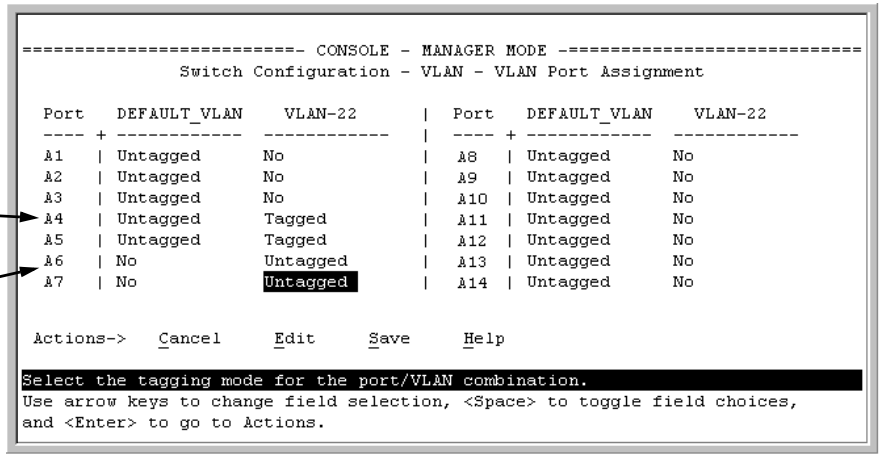



**Figure 2-12. Example of VLAN Assignments for Specific Ports**

For information on VLAN tags ("Untagged" and "Tagged"), refer to "802.1Q VLAN Tagging" on page 2-26.

d. If you are finished assigning ports to VLANs, press **[Enter]** and then **[S]** (for **Save**) to activate the changes you've made and to return to the Configuration menu. (The console then returns to the VLAN menu.)

3. Return to the Main menu.

## CLI: Configuring VLAN Parameters

In the factory default state, all ports on the switch belong to the default VLAN (DEFAULT_VLAN) and are in the same broadcast/multicast domain. (The default VLAN is also the default primary VLAN—see "The Primary VLAN" on page 2-6.) You can configure additional static VLANs by adding new VLAN names, and then assigning one or more ports to each VLAN. (For the maximum number of VLANs, refer to table 2-1 on page 2-3.) Note that each port can be assigned to multiple VLANs by using VLAN tagging. (See "802.1Q VLAN Tagging" on page 2-26.)

**VLAN Commands Used in this Section**

| | |
|---|---|
| show vlans | below |
| show vlan <*vlan-id*> | page 2-21 |
| max-vlans | page 2-22 |
| primary-vlan <*vlan-id*> | page 2-22 |
| [no] vlan <*vlan-id*> | page 2-23 |
| name <*vlan-name*> | page 2-24 |
| [no] tagged <*port-list*> | page 2-24 |
| [no] untagged <*port-list*> | page 2-24 |
| [no] forbid | page 2-24 |
| auto <*port-list*> | page 2-24 (Available if GVRP enabled.) |
| static-vlan <*vlan-id*> | page 2-23 (Available if GVRP enabled.) |

**Displaying the Switch's VLAN Configuration.** The next command lists the VLANs currently running in the switch, with VID, VLAN name, and VLAN status. Dynamic VLANs appear only if the switch is running with GVRP enabled and one or more ports has dynamically joined an advertised VLAN. (In the default configuration, GVRP is disabled. (See chapter 3, "GVRP".)

***Syntax:*** show vlan

```
ProCurve(config)# show vlan
 Status and Counters - VLAN Information
  VLAN support : Yes
  Maximum VLANs to support : 8
  Primary VLAN : DEFAULT_VLAN

  802.1Q VLAN ID Name           Status
  -------------- -------------- --------------
  1              DEFAULT_VLAN   Static
  22             VLAN-22        Static
  33             GVRP_33        Dynamic
```

When GVRP is disabled (the default), Dynamic VLANs do not exist on the switch and do not appear in this listing. (See chapter 3, "GVRP".)

**Figure 2-13. Example of "Show VLAN" Listing (GVRP Enabled)**

**Displaying the Configuration for a Particular VLAN.** This command uses the VID to identify and display the data for a specific static or dynamic VLAN.

***Syntax:*** show vlan <*vlan-id*>

```
ProCurve> show vlan 22
 Status and Counters - VLAN Information - Ports - VLAN 22

  802.1Q VLAN ID : 22
  Name           : VLAN-22
  Status         : Static

  Port Information Mode     Unknown VLAN Status
  ---------------- -------- ------------ ----------
  A1               Tagged   Learn        Up
  A2               Tagged   Learn        Up
  A5               Untagged Learn        Up
  A6               Untagged Learn        Up
  A7               Untagged Learn        Up
```

**Figure 2-14. Example of "Show VLAN" for a Specific Static VLAN**

**Show VLAN** lists this data when GVRP is enabled and at least one port on the switch has dynamically joined the designated VLAN.

```
ProCurve> show vlan 44
 Status and Counters - VLAN Information - Ports - VLAN 44

  802.1Q VLAN ID : 44
  Name           : GVRP_44
  Status         : Dynamic

  Port Information Mode     Unknown VLAN Status
  ---------------- -------- ------------ ----------
  A6               Auto     Learn        Up
```

**Figure 2-15. Example of "Show VLAN" for a Specific Dynamic VLAN**

**Changing the Number of VLANs Allowed on the Switch.** By default, the switch allows a maximum of 8 VLANs. You can specify any value from 1 to the upper limit for the switch. (Refer to table 2-1 on page 2-3.) If GVRP is enabled, this setting includes any dynamic VLANs on the switch. As part of implementing a new value, you must execute a write memory command (to save the new value to the startup-config file) and then reboot the switch.

***Syntax:*** max-vlans
< 1 .. 30 > *(Series 4100 and Switch 6108)*
< 1 .. 253 > *(Series 2600, 2600 PWR)*
< 1 .. 256 > *(Series 2800)*

For example, to reconfigure the switch to allow 10 VLANs:

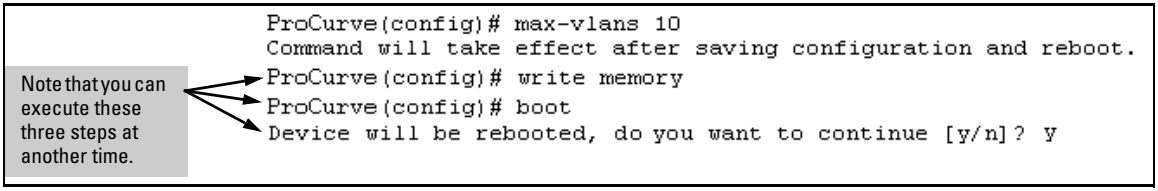



**Figure 2-16. Example of Command Sequence for Changing the Number of VLANs**

**Changing the Primary VLAN.** In the factory-default configuration, the default VLAN (DEFAULT_VLAN) is the primary VLAN. However, you can designate any static VLAN on the switch as the primary VLAN. (For more on the primary VLAN, see "The Primary VLAN" on page 2-6.) To view the available VLANs and their respective VIDs, use **show vlan**.

***Syntax:*** primary-vlan <*vlan-id*>

For example, to make VLAN 22 the primary VLAN:

```
ProCurve(config)# primary-vlan 22
```

### Creating a New Static VLAN
### Changing the VLAN Context Level.

With this command, entering a new VID creates a new static VLAN. Entering the VID or name of an existing static VLAN places you in the context level for that VLAN.

***Syntax:*** vlan <*vlan-id*> [name <*name-str*>]

*Creates a new static VLAN if a VLAN with that VID does not already exist, and places you in that VLAN's context level. If you do not use the name option, the switch uses "VLAN" and the new VID to automatically name the VLAN. If the VLAN already exists, the switch places you in the context level for that VLAN.*

vlan <*vlan-name*>

*Places you in the context level for that static VLAN.*

For example, to create a new static VLAN with a VID of 100:

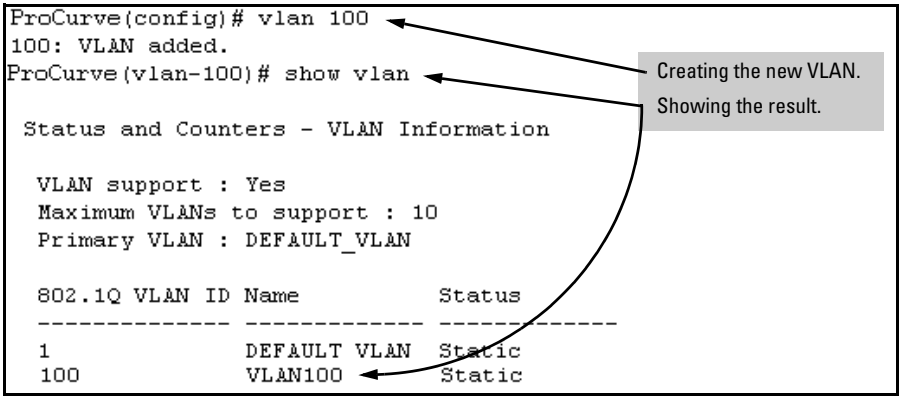



**Figure 2-17. Example of Creating a New Static VLAN**

To go to a different VLAN context level, such as to the default VLAN:

```
ProCurve(vlan-100)# vlan default_vlan
ProCurve(vlan-1) _
```

**Converting a Dynamic VLAN to a Static VLAN.** If GVRP is running on the switch and a port dynamically joins a VLAN, you can use the next command to convert the dynamic VLAN to a static VLAN. (For GVRP and dynamic VLAN operation, see chapter 3, "GVRP".) This is necessary if you

want to make the VLAN permanent. After you convert a dynamic VLAN to static, you must configure the switch's per-port participation in the VLAN in the same way that you would for any static VLAN.

***Syntax:*** static-vlan <*vlan-id*> (*Use* **show vlan** *to list current VIDs.*)

For example, suppose a dynamic VLAN with a VID of 125 exists on the switch. The following command converts the VLAN to a static VLAN.

```
ProCurve(config)# static-vlan 125
```

**Configuring Static VLAN Name and Per-Port Settings.** The **vlan <*vlan-id*>** command, used with the options listed below, changes the name of an existing static VLAN and changes the per-port VLAN membership settings.

**Note**

You can use these options from the configuration level by beginning the command with **vlan <*vlan-id*>**, or from the context level of the specific VLAN.

***Syntax:*** name <*vlan-name*>

*Changes the name of the existing static VLAN. (Avoid spaces and the following characters in the* <*vlan-name*> *entry:* **2**, **#**, **$**, **^**, **&**, *****, **(**, *and* **)**.)

[no] tagged <*port-list*>

*Configures the indicated port(s) as* **Tagged** *for the specified VLAN. The* "**no**" *version sets the port(s) to either* **No** *or (if GVRP is enabled) to* **Auto**.

[no] untagged <*port-list*>

*Configures the indicated port(s) as* **Untagged** *for the specified VLAN. The* "**no**" *version sets the port(s) to either* **No** *or (if GVRP is enabled) to* **Auto**.

[no] forbid <*port-list*>

*Configures the indicated port(s) as "forbidden" to participate in the designated VLAN. The* "**no**" *version sets the port(s) to either* **No** *or (if GVRP is enabled) to* **Auto**.

auto <*port-list*>

*Available if GVRP is enabled on the switch. Returns the per-port settings for the specified VLAN to* ***Auto*** *operation. Note that* ***Auto*** *is the default per-port setting for a static VLAN if GVRP is running on the switch. (For information on dynamic VLAN and GVRP operation, see* chapter 3, "GVRP"*.)*

For example, if you have a VLAN named VLAN100 with a VID of 100, and all ports are set to **No** for this VLAN. To change the VLAN name to "Blue_Team" and set ports 1-5 to Tagged, you could do so with these commands:

```
ProCurve(config)# vlan 100 name Blue_Team
ProCurve(config)# vlan 100 tagged 1-5
```

To move to the vlan 100 context level and execute the same commands:

```
ProCurve(config)# vlan 100
ProCurve(vlan-100)# name Blue_Team
ProCurve(vlan-100)# tagged 1-5
```

Similarly, to change the tagged ports in the above examples to **No** (or **Auto**, if GVRP is enabled), you could use either of the following commands.

At the config level, use:

```
ProCurve(config)# no vlan 100 tagged 1-5
```

*- or -*

At the VLAN 100 context level, use:

```
ProCurve(vlan-100)# no tagged 1-5
```

**Note** You cannot use these commands with dynamic VLANs. Attempting to do so results in the message "**VLAN already exists.**" and no change occurs.

## Web: Viewing and Configuring VLAN Parameters

In the web browser interface you can do the following:

- Add VLANs
- Rename VLANs
- Remove VLANs
- Configure GVRP mode
- Select a new Primary VLAN

To configure static VLAN port parameters, you will need to use the menu interface (available by Telnet from the web browser interface) or the CLI.

1. Click on the **Configuration** tab.
2. Click on **VLAN Configuration**.
3. Click on **Add/Remove VLANs**.

For web-based Help on how to use the web browser interface screen, click on the **[?]** button provided on the web browser screen.

## 802.1Q VLAN Tagging

VLAN tagging enables traffic from more than one VLAN to use the same port. (Even when two or more VLANs use the same port they remain as separate domains and cannot receive traffic from each other without going through an external router.) As mentioned earlier, a "tag" is simply a unique VLAN identification number (VLAN ID, or VID) assigned to a VLAN at the time that you configure the VLAN name in the switch. The tag can be any number from 1 to 4094 that is not already assigned to a VLAN. When you subsequently assign a port to a given VLAN, you must implement the VLAN tag (VID) if the port will carry traffic for more than one VLAN. Otherwise, the port VLAN assignment can remain "untagged" because the tag is not needed. On a given switch, this means you should use the "Untagged" designation for a port VLAN assignment where the port is connected to non 802.1Q-compliant device or is assigned to only one VLAN. Use the "Tagged" designation when the port is assigned to more than one VLAN or the port is connected to a device that *does* comply with the 802.1Q standard.

For example, if port A7 on an 802.1Q-compliant switch is assigned to only the Red VLAN, the assignment can remain "untagged" because the port will forward traffic only for the Red VLAN. However, if both the Red and Green VLANs are assigned to port A7, then at least one of those VLAN assignments must be "tagged" so that Red VLAN traffic can be distinguished from Green VLAN traffic. The following illustration shows this concept:

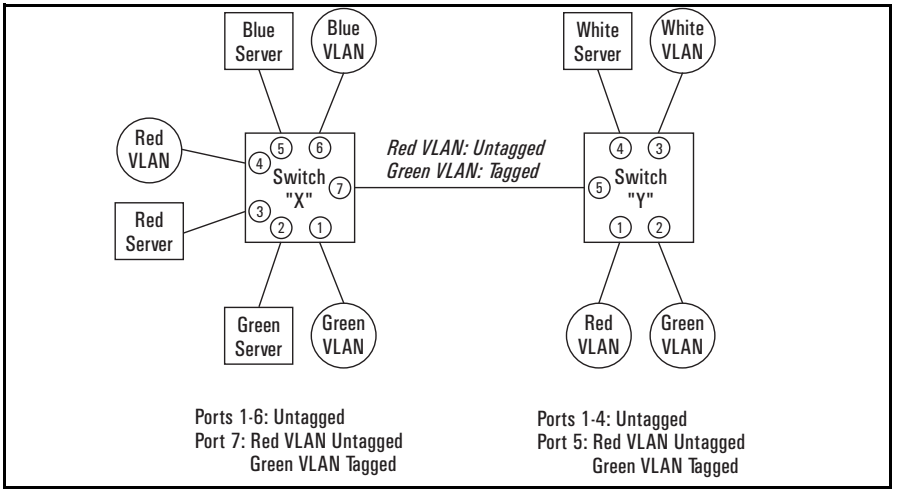



**Figure 2-18. Example of Tagged and Untagged VLAN Port Assignments**

- In switch X:
  - VLANs assigned to ports X1 - X6 can all be untagged because there is only one VLAN assignment per port. Red VLAN traffic will go out only the Red ports; Green VLAN traffic will go out only the Green ports, and so on. Devices connected to these ports do not have to be 802.1Q-compliant.
  - However, because both the Red VLAN and the Green VLAN are assigned to port X7, at least one of the VLANs must be tagged for this port.
- In switch Y:
  - VLANs assigned to ports Y1 - Y4 can all be untagged because there is only one VLAN assignment per port. Devices connected to these ports do not have to be 802.1Q-compliant.
  - Because both the Red VLAN and the Green VLAN are assigned to port Y5, at least one of the VLANs must be tagged for this port.
- In both switches: The ports on the link between the two switches must be configured the same. As shown in figure 2-18 (above), the Red VLAN must be untagged on port X7 and Y5 and the Green VLAN must be tagged on port X7 and Y5, or vice-versa.

**Note**

Each 802.1Q-compliant VLAN must have its own unique VID number, and that VLAN *must* be given the same VID in every device in which it is configured. That is, if the Red VLAN has a VID of 10 in switch X, then 10 must also be used for the Red VID in switch Y.

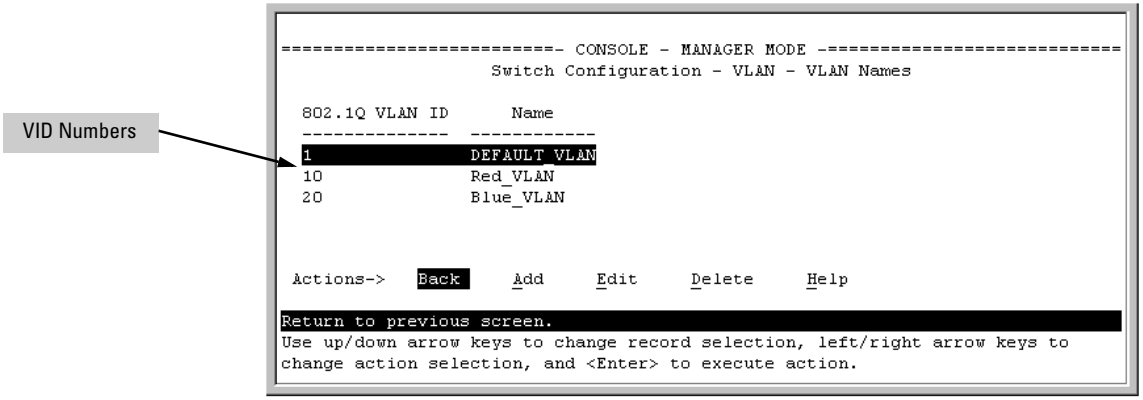



**Figure 2-19. Example of VLAN ID Numbers Assigned in the VLAN Names Screen**

VLAN tagging gives you several options:

- Since the purpose of VLAN tagging is to allow multiple VLANs on the same port, any port that has only one VLAN assigned to it can be configured as "Untagged" (the default).
- Any port that has two or more VLANs assigned to it can have one VLAN assignment for that port as "Untagged". All other VLANs assigned to the same port must be configured as "Tagged". (There can be no more than one Untagged VLAN on a port.)
- If all end nodes on a port comply with the 802.1Q standard and are configured to use the correct VID, then, you can configure all VLAN assignments on a port as "Tagged" if doing so makes it easier to manage your VLAN assignments, or for security reasons.

For example, in the following network, switches X and Y and servers S1 and S2 are 802.1Q-compliant. (Server S3 could also be 802.1Q-compliant, but it makes no difference for this example.)

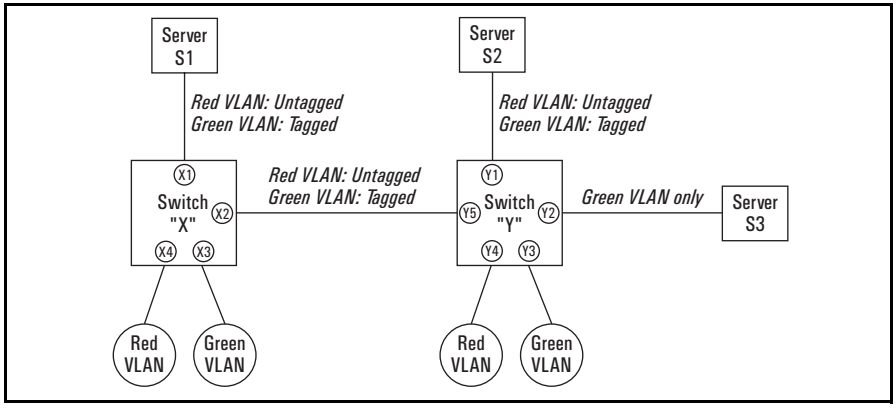



**Figure 2-20. Example of Networked 802.1Q-Compliant Devices with Multiple VLANs on Some Ports**

The VLANs assigned to ports X3, X4, Y2, Y3, and Y4 can all be untagged because there is only one VLAN assigned per port. Port X1 has multiple VLANs assigned, which means that one VLAN assigned to this port can be untagged and any others must be tagged. The same applies to ports X2, Y1, and Y5.

| Switch X | | | Switch Y | | |
|---|---|---|---|---|---|
| **Port** | **Red VLAN** | **Green VLAN** | **Port** | **Red VLAN** | **Green VLAN** |
| X1 | Untagged | Tagged | Y1 | Untagged | Tagged |
| X2 | Untagged | Tagged | Y2 | No* | Untagged |
| X3 | No* | Untagged | Y3 | No* | Untagged |
| X4 | Untagged | No* | Y4 | Untagged | No* |
| | | | Y5 | Untagged | Tagged |

*"No" means the port is not a member of that VLAN. For example, port X3 is not a member of the Red VLAN and does not carry Red VLAN traffic. Also, if GVRP were enabled, "Auto" would appear instead of "No".

**Note**

VLAN configurations on ports connected by the same link must match. Because ports X2 and Y5 are opposite ends of the same point-to-point connection, both ports must have the same VLAN configuration; that is, both ports configure the Red VLAN as "Untagged" and the Green VLAN as "Tagged".

To summarize:

| VLANs Per Port | Tagging Scheme |
|---|---|
| 1 | Untagged or Tagged. If the device connected to the port is 802.1Q-compliant, then the recommended choice is "Tagged". |
| 2 or More | 1 VLAN Untagged; all others Tagged<br>or<br>All VLANs Tagged |

A given VLAN *must* have the same VID on any 802.1Q-compliant device in which the VLAN is configured.

The ports connecting two 802.1Q devices should have identical VLAN configurations, as shown for ports X2 and Y5, above.

## The Secure Management VLAN

Configures a secure Management VLAN by creating an isolated network for managing the following ProCurve switches that support this feature:

- Series 2600 switches
- Series 2600-PWR switches
- Series 2800 switches
- Series 3400cl switches
- Series 4100gl switches
- Series 5300xl switches
- Switch 6108

Access to this VLAN, and to the switch's management functions (Menu, CLI, and web browser interface) is available only through ports configured as members.

- Multiple ports on the switch can belong to the Management VLAN. This allows connections for multiple management stations you want to have access to the Management VLAN, while at the same time allowing Management VLAN links between switches configured for the same Management VLAN.
- Only traffic from the Management VLAN can manage the switch, which means that only the workstations and PCs connected to ports belonging to the Management VLAN can manage and reconfigure the switch.

Figure 2-21 illustrates use of the Management VLAN feature to support management access by a group of management workstations.

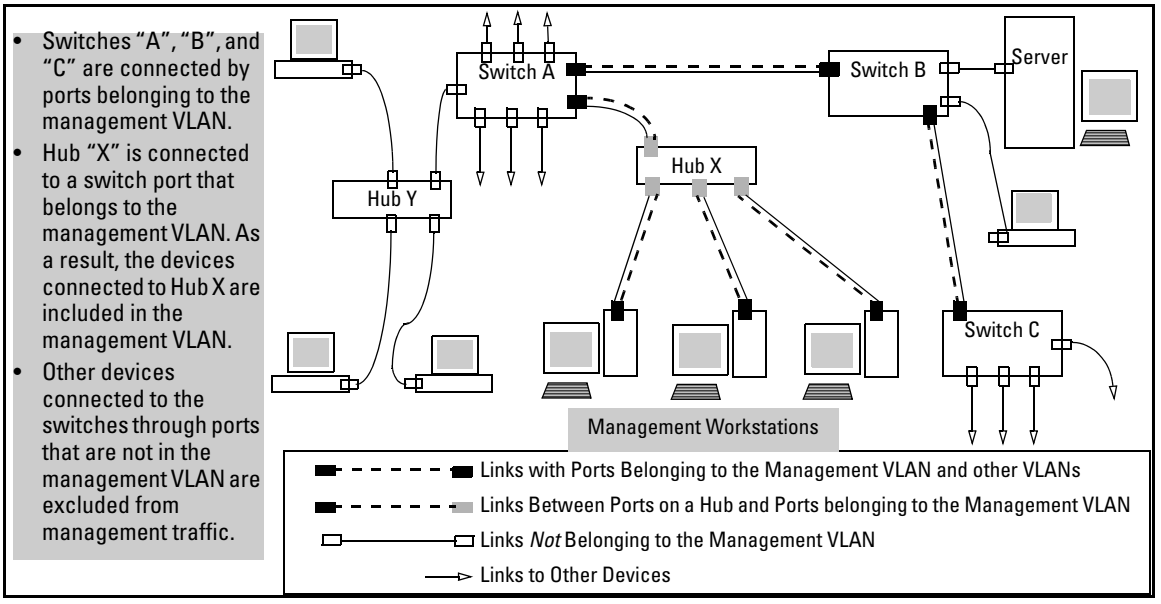



**Figure 2-21. Example of Potential Security Breaches**

In figure 2-22, Workstation 1 has management access to all three switches through the Management VLAN, while the PCs do not. This is because configuring a switch to recognize a Management VLAN automatically excludes attempts to send management traffic from any other VLAN.

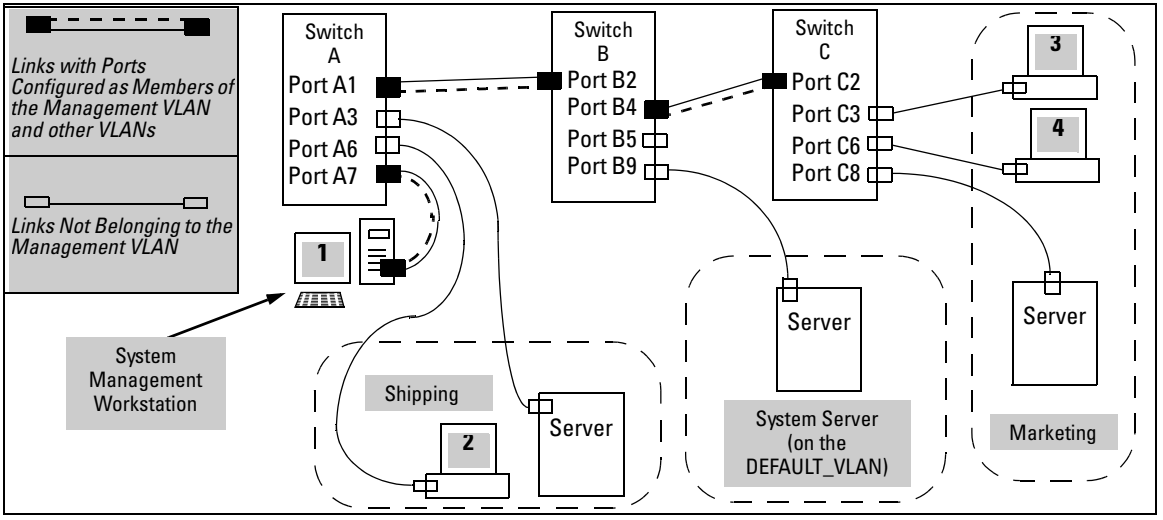


**Figure 2-22. Example of Management VLAN Control in a LAN**

**Table 2-3. VLAN Membership in Figure 2-22**

| Switch | A1 | A3 | A6 | A7 | B2 | B4 | B5 | B9 | C2 | C3 | C6 | C8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Management VLAN (VID = 7) | **Y** | N | N | **Y** | **Y** | **Y** | N | N | **Y** | N | N | N |
| Marketing VLAN (VID = 12) | N | N | N | N | N | N | N | N | N | **Y** | **Y** | **Y** |
| Shipping Dept. VLAN (VID = 20) | N | **Y** | **Y** | N | N | N | N | N | N | N | N | N |
| DEFAULT-VLAN (VID = 1) | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** | **Y** |

## Preparation

1. Determine a VID and VLAN name suitable for your Management VLAN.
2. Determine the IP addressing for the Management VLAN (**DHCP/Bootp** or **Manual**.
3. Plan your Management VLAN topology to use ProCurve switches that support this feature. (See the list on page 2-30.) The ports belonging to the Management VLAN should be only the following:
   - Ports to which you will connect authorized management stations (such as Port A7 in figure 2-22.)
   - Ports on one switch that you will use to extend the Management VLAN to ports on other ProCurve switches (such as ports A1 and B2 or B4 and C2 in figure 2-22 on page 2-32.).

Hubs dedicated to connecting management stations to the Management VLAN can also be included in the above topology. Note that any device connected to a hub in the Management VLAN will also have Management VLAN access.

4. Configure the Management VLAN on the selected switch ports.
5. Test the management VLAN from all of the management stations authorized to use the Management VLAN, including any SNMP-based network management stations. Ensure that you include testing any Management VLAN links between switches.

**Note**

If you configure a Management VLAN on a switch by using a Telnet connection through a port that is not in the Management VLAN, then you will lose management contact with the switch if you log off your Telnet connection or execute **write memory** and **reboot** the switch.

## Configuration

***Syntax:*** [ no ] management-vlan < *vlan-id* | *vlan-name* >

***Default:*** Disabled

To confirm the Management VLAN configuration, use the **show running-config** command.

For example, suppose you have already configured a VLAN named **My_VLAN** with a VID of 100. Now you want to configure the switch to do the following:

- Use **My_VLAN** as a Management VLAN (tagged, in this case) to connect port A1 on switch "A" to a management station. (The management station includes a network interface card with 802.1Q tagged VLAN capability.)
- Use port A2 to extend the Management VLAN to port B1 (which is already configured as a tagged member of **My_VLAN**) on an adjacent switch.

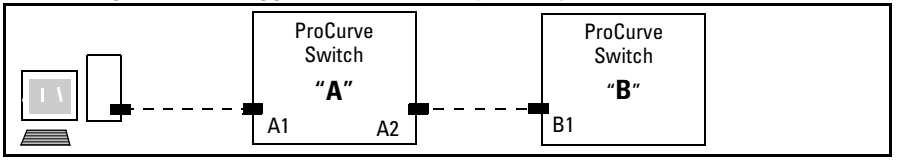



**Figure 2-23. Illustration of Configuration Example**

```
ProCurve(config)# management-vlan 100
ProCurve(config)# vlan 100 tagged a1
ProCurve(config)# vlan 100 tagged a2
```

**Deleting the Management VLAN.** You can disable the Secure Management feature without deleting the VLAN itself. For example, either of the following commands disables the Secure Management feature in the above example:

```
ProCurve(config)# no management-vlan 100
ProCurve(config)# no management-vlan my_vlan
```

## Operating Notes for Management VLANs

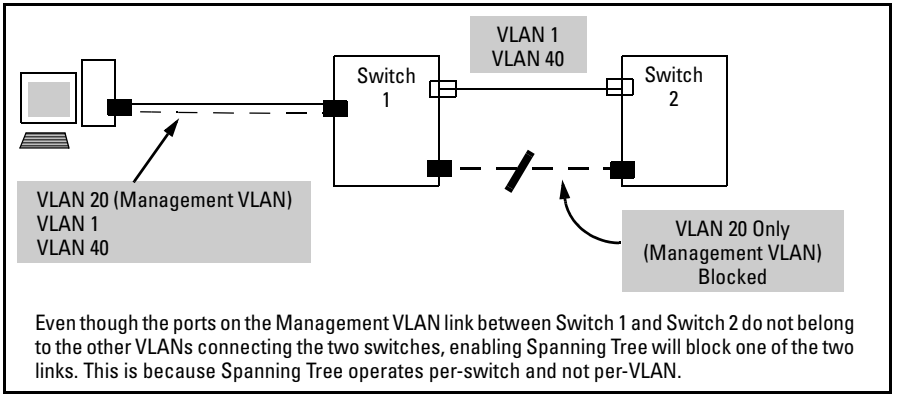
- Only one Management-VLAN can be active in the switch. If one Management-VLAN VID is saved in the startup-config file and you configure a different VID in the running-config file, the switch uses the running-config version until you either use the **write-memory** command or reboot the switch.

- During a Telnet session to the switch, if you configure the Management-VLAN to a VID that excludes the port through which you are connected to the switch, you will continue to have access only until you terminate the session by logging out or rebooting the switch.
- During a web browser session to the switch, if you configure the Management-VLAN to a VID that excludes the port through which you are connected to the switch, you will continue to have access only until you close the browser session or rebooting the switch.

**Note**

The Management-VLAN feature does not control management access through a direct connection to the switch's serial port.

- Enabling Spanning Tree where there are multiple links using separate VLANs, including the Management VLAN, between a pair of switches, Spanning Tree will force the blocking of one or more links. This may include the link carrying the Management VLAN, which will cause loss of management access to some devices.




Even though the ports on the Management VLAN link between Switch 1 and Switch 2 do not belong to the other VLANs connecting the two switches, enabling Spanning Tree will block one of the two links. This is because Spanning Tree operates per-switch and not per-VLAN.

**Figure 2-24. Example of Inadvertently Blocking a Management VLAN Link by Implementing Spanning Tree**

# Effect of VLANs on Other Switch Features

## Spanning Tree Operation with VLANs

Because the switch follows the 802.1Q VLAN recommendation to use single-instance spanning tree, Spanning Tree operates across all ports on the switch (regardless of VLAN assignments) instead of on a per-VLAN basis. This means that if redundant physical links exist between the switch and another 802.1Q device, all but one link will be blocked, regardless of whether the redundant

links are in separate VLANs. However, you can use port trunking to prevent Spanning Tree from unnecessarily blocking ports (and to improve overall network performance). Refer to "RSTP and STP Operation with 802.1Q VLANs" on page 5-9.

Note that Spanning Tree operates differently in different devices. For example, in the (obsolete, non-802.1Q) ProCurve Switch 2000 and the ProCurve Switch 800T, Spanning Tree operates on a per-VLAN basis, allowing redundant physical links as long as they are in separate VLANs.

## IP Interfaces

There is a one-to-one relationship between a VLAN and an IP network interface. Since the VLAN is defined by a group of ports, the state (up/down) of those ports determines the state of the IP network interface associated with that VLAN. When a VLAN comes up because one or more of its ports is up, the IP interface for that VLAN is also activated. Likewise, when a VLAN is deactivated because all of its ports are down, the corresponding IP interface is also deactivated.

## VLAN MAC Addresses

Some switch models use the same MAC address for all configured VLANs, while other switch models use a different MAC address for each configured VLAN.

| One (Same) MAC Address for all VLANs | | Different MAC Address for Each VLAN |
|---|---|---|
| 2600 | 3400cl | 4100gl |
| 2600-PWR | 5300xl | 6108 |
| 2800 | 6400cl | |

You can send an 802.2 test packet to the VLAN MAC address to verify connectivity to the switch. Likewise, you can assign an IP address to the VLAN interface, and when you Ping that address, ARP will resolve the IP address to this MAC address. (Refer to table 2-1 on page 2-3 for the maximum number of VLANs allowed on your switch).

## Port Trunks

When assigning a port trunk to a VLAN, all ports in the trunk are automatically assigned to the same VLAN. You cannot split trunk members across multiple VLANs. Also, a port trunk is tagged, untagged, or excluded from a VLAN in the same way as for individual, untrunked ports.

### Port Monitoring

If you designate a port on the switch for network monitoring, this port will appear in the Port VLAN Assignment screen and can be configured as a member of any VLAN. For information on how broadcast, multicast, and unicast packets are tagged inside and outside of the VLAN to which the monitor port is assigned, see the appendix on troubleshooting in the *Management and Configuration Guide*.

## VLAN Restrictions

- A port must be a member of at least one VLAN. In the factory default configuration, all ports are assigned to the default VLAN (DEFAULT_VLAN; VID = 1).
- A port can be assigned to several VLANs, but only one of those assignments can be untagged. (The "Untagged" designation enables VLAN operation with non 802.1Q-compliant devices.)
- An external router must be used to communicate between tagged VLANs on the switch.
- Before you can delete a VLAN, you must first re-assign all ports in the VLAN to another VLAN.

## Jumbo Packet Support on the Series 2800 Switches

Jumbo packet support for Series 2800 switches is enabled per-VLAN and applies to all ports belonging to the VLAN. For more information, refer to the chapter titled "Port Status and Basic Configuration" in the *Management and Configuration Guid*e for your switch. (Jumbo packet support is not available on the Series 2600, 2600-PWR, 4100gl or 6108 Switches.)