Configuring VLANs

This chapter describes VLAN configurations for the ML-Series card. It describes how to configure IEEE 802.1Q VLAN encapsulation. For more information about the Cisco IOS commands used in this chapter, refer to the *Cisco IOS Command Reference* publication.

This chapter contains the following major sections:

> **Note**   Configuring VLANs is optional. Complete general interface configurations before proceeding with configuring VLANs as an optional step.

Understanding VLANs

VLANs enable network managers to group users logically rather than by physical location. A VLAN is an emulation of a standard LAN that allows secure intragroup data transfer and communication to occur without the traditional restraints placed on the network. It can also be considered a broadcast domain set up within a switch. With VLANs, switches can support more than one subnet (or VLAN) on each switch and give routers and switches the opportunity to support multiple subnets on a single physical link. A group of devices that belong to the same VLAN, but are part of different LAN segments, are configured to communicate as if they were part of the same LAN segment.
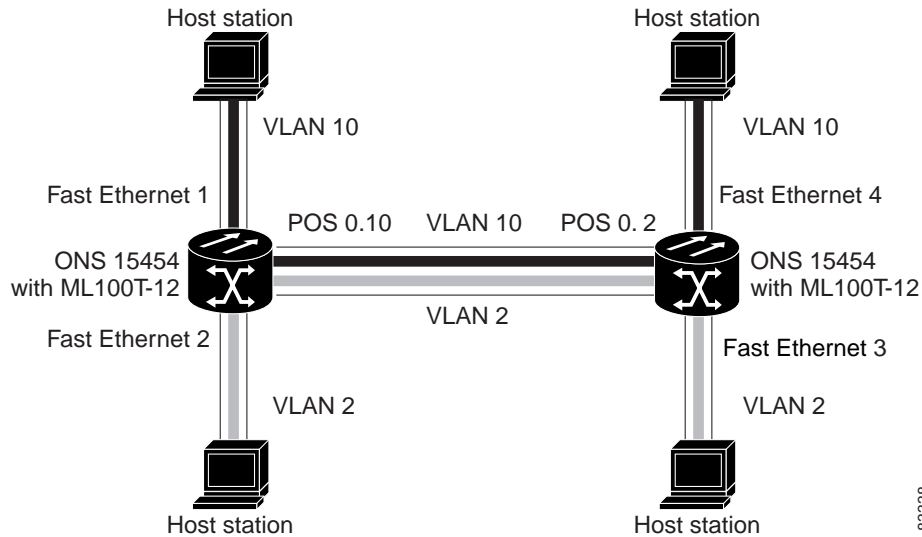
VLANs enable efficient traffic separation and provide excellent bandwidth utilization. VLANs also alleviate scaling issues by logically segmenting the physical LAN structure into different subnetworks so that packets are switched only between ports within the same VLAN. This can be very useful for security, broadcast containment, and accounting.

ML-Series software supports port-based VLANs and VLAN trunk ports, which are ports that carry the traffic of multiple VLANs. Each frame transmitted on a trunk link is tagged as belonging to only one VLAN.

ML-Series software supports VLAN frame encapsulation through the IEEE 802.1Q standard on both the ML100T-12 and the ML1000-2. The Cisco Inter-Switch Link (ISL) VLAN frame encapsulation is not supported. ISL frames are broadcast at Layer 2 or dropped at Layer 3.

ML-Series switching supports up to 900 VLAN subinterfaces per card (for example, 200 VLANs on four interfaces uses 800 VLAN subinterfaces). A maximum of 255 logical VLANs can be bridged per card (limited by the number of bridge-groups). Each VLAN subinterface can be configured for any VLAN ID in the full 1 to 4095 range. Figure 7-1 shows a network topology in which two VLANs span two ONS 15454s with ML-Series cards.

Figure 7-1   VLANs Spanning Devices in a Network

Configuring IEEE 802.1Q VLAN Encapsulation

You can configure IEEE 802.1Q VLAN encapsulation on either type of ML-Series card interfaces, Ethernet or Packet over SONET/SDH (POS). VLAN encapsulation is not supported on POS interfaces configured with HDLC encapsulation.

The native VLAN is always VLAN ID 1 on ML-Series cards. Frames on the native VLAN are normally transmitted and received untagged. On an trunk port, all frames from VLANs other than the native VLAN are transmitted and received tagged.

To configure VLANs using IEEE 802.1Q VLAN encapsulation, perform the following procedure, beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# **bridge** *bridge-group-number* **protocol** *type*	Assigns a bridge group (VLAN) number and define the appropriate spanning tree type.
Step 2	Router(config)# **interface** *type number*	Enters interface configuration mode to configure the interface.
Step 3	Router(config-if)# **no ip address**	Disables IP processing.
Step 4	Router(config)# **interface** *type number.subinterface-number*	Enters subinterface configuration mode to configure the subinterface.

	Command	Purpose
Step 5	Router(config-subif)# **encap dot1q** *vlan-number*	Sets the encapsulation on the VLAN to IEEE 802.1Q.
Step 6	Router(config-subif)# **bridge-group** *bridge-group-number*	Assigns a network interface to a bridge group.
Step 7	Router(config-subif)# **end**	Returns to privileged EXEC mode.
Step 8	Router# **copy running-config startup-config**	(Optional) Saves your configuration changes to NVRAM.

Note   In a bridge group on the ML-Series card, the VLAN ID does not have to be uniform across interfaces that belong to that bridge group. For example, a bridge-group can connect from a VLAN ID subinterface to a subinterface with a different VLAN ID, and then frames entering with one VLAN ID can be changed to exit with a different VLAN ID. This is know as VLAN translation.

Note   IP routing is enabled by default. To enable bridging, enter the **no ip routing** or **bridge IRB** command.
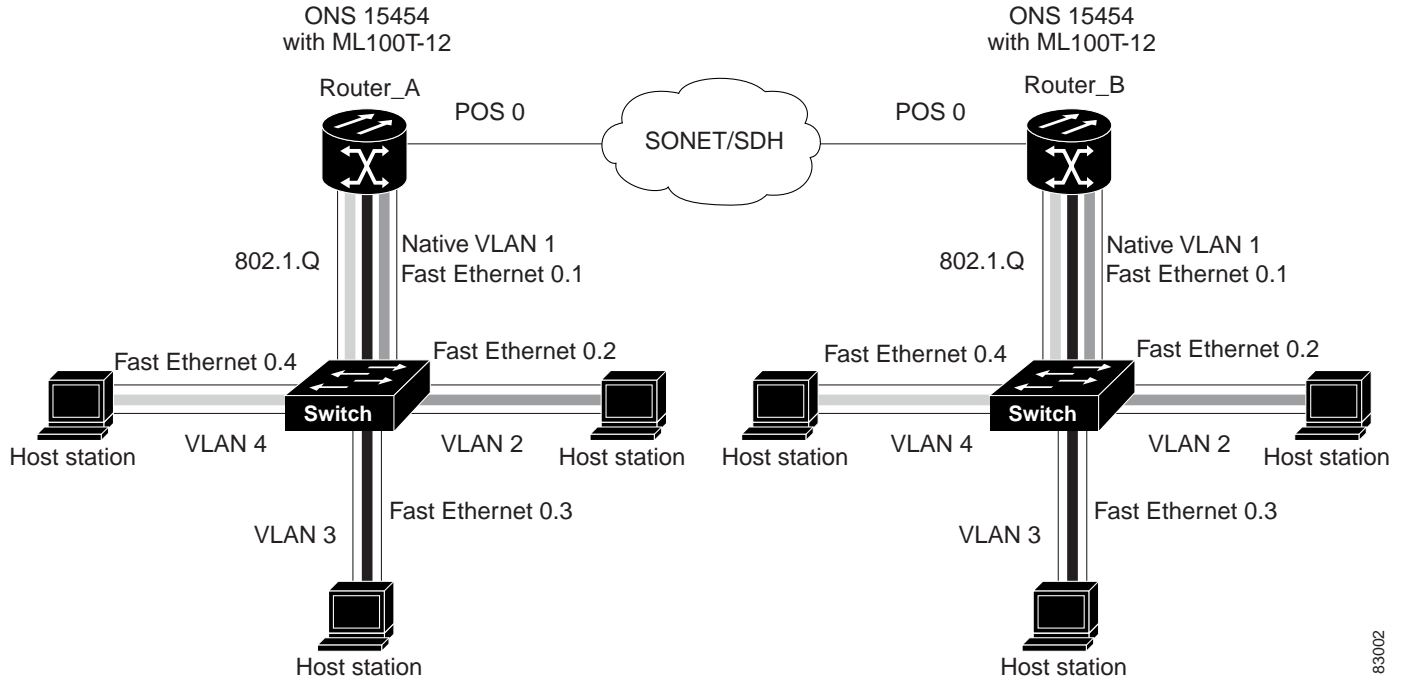
Note   Native VLAN frames transmitted on the interface are normally untagged. All untagged frames received on the interface are associated with the native VLAN, which is always VLAN 1. Use the command **encapsulation dot1q 1 native**.

IEEE 802.1Q VLAN Configuration

The VLAN configuration example for the ML100T-12 shown in Figure 7-2 depicts the following VLANs:

- Fast Ethernet subinterface 0.1 is in the IEEE 802.1Q native VLAN 1.
- Fast Ethernet subinterface 0.2 is in the IEEE 802.1Q VLAN 2.
- Fast Ethernet subinterface 0.3 is in the IEEE 802.1Q VLAN 3.
- Fast Ethernet subinterface 0.4 is in the IEEE 802.1Q VLAN 4.

Figure 7-2   Bridging IEEE 802.1Q VLANs

Example 7-1 shows how to configure VLANs for IEEE 802.1Q VLAN encapsulation. Use this configuration for both router A and router B. The example is shown in Figure 7-2:

Example 7-1   Configure VLANs for IEEE 8021Q VLAN Encapsulation

```
bridge 1 protocol ieee
bridge 2 protocol ieee
bridge 3 protocol ieee
bridge 4 protocol ieee
!
!
interface FastEthernet0
 no ip address
!
interface FastEthernet0.1
 encapsulation dot1Q 1 native
 bridge-group 1
!
interface FastEthernet0.2
 encapsulation dot1Q 2
 bridge-group 2
!
interface FastEthernet0.3
 encapsulation dot1Q 3
 bridge-group 3
!
interface FastEthernet0.4
 encapsulation dot1Q 4
 bridge-group 4
!
interface POS0
 no ip address
 crc 32
```

```
pos flag c2 1
!
interface POS0.1
 encapsulation dot1Q 1 native
 bridge-group 1
!
interface POS0.2
 encapsulation dot1Q 2
 bridge-group 2
!
interface POS0.3
 encapsulation dot1Q 3
 bridge-group 3
!
interface POS0.4
 encapsulation dot1Q 4
 bridge-group 4
```

Monitoring and Verifying VLAN Operation

After the VLANs are configured on the ML-Series card, you can monitor their operation by entering the privileged EXEC command **show vlans** *vlan-id.* This command displays information on all configured VLANs or on a specific VLAN (by VLAN ID number).

Caution   Two similar commands exist. The command **show vlans** gives information regarding IEEE 802.1Q VLANs configured on the ML-Series card. The command **show vlan** gives information regarding the VLAN tunnel. For more information on VLAN tunneling, see Chapter 8, "Configuring IEEE 802.1Q and Layer 2 Protocol Tunneling."