CHAPTER 7

Configuring IP Unnumbered on IEEE 802.1Q VLANs

Service providers continuously seek ways in which they can make their networks less complex and less expensive, and reduce the cost of provisioning subscribers. One way in which service providers can achieve these results is to migrate their ATM networks to IP networks and upgrade their DSLAM to use a Gigabit Ethernet uplink, instead of an ATM uplink, to connect their DSLAM to an aggregation router, such as the Cisco 10000 series router.

In the Digital Subscriber Line (DSL) environment, service providers use a service model that configures ATM Routed Bridge Encapsulation (RBE) on an unnumbered interface of the aggregation router. This configuration associates an IP route with a subscriber, and uses a virtual path identifier/virtual connection identifier (VPI/VCI) pair to identify the IP route. In this way, all subscribers can securely share the same subnet, which enables the service provider to save IP address space. When the DHCP server provides an IP address to the subscriber, the aggregation router dynamically configures the IP route.

The Cisco 10000 series router builds on the RBE on an unnumbered interface service model to enable you to configure IP unnumbered on IEEE 802.1Q VLANs. Instead of using a VPI/VCI pair to identify a subscriber route, the Cisco 10000 series router maps a VLAN identifier to the subscriber on an Ethernet interface.

The Cisco 10000 series router supports the IP Unnumbered on IEEE 802.1Q VLANs feature. Prior to Cisco IOS Release 12.3(7)XI1, IP support for VLAN subinterfaces required that you configure separate IP subnets for each of the subinterfaces that terminate the VLAN. This resulted in inefficient use of the IP address space because an entire IP subnet is often not needed for the hosts assigned to a VLAN. The IP Unnumbered on VLANs feature helps to conserve IP address space for service provider configurations that include Ethernet VLAN subinterfaces.

VLAN subinterfaces with IP unnumbered configured support DHCP for IP address allocation. The DHCP server uses the information in DHCP Option 82 to assign IP addresses to the hosts on a VLAN. The routing table is dynamically updated to insert an IP route for the IP address assigned on each of the subinterfaces. These IP host routes exist until the DHCP lease time expires or the host releases the leased address.

Note For more information about Option 82, see the "DHCP Relay Agent Information Option—Option 82" section on page 3-9.

When a subinterface goes down, the IP host route exists until the DHCP lease time expires. However, if you enter the **show ip route dhcp** command, the IP host routes do not display. After the subinterface comes back up, the IP host routes display when you enter the **show ip route dhcp** command if the DHCP lease time has not expired.

This chapter describes the IP Unnumbered on IEEE 802.1Q VLANs feature in the following topics:

Feature History for IP Unnumbered on VLANs

Cisco IOS Release	Description	Required PRE
12.3(7)XI1	This feature was introduced on the Cisco 10000 series router.	PRE2
12.2(28)SB	This feature was integrated into Cisco IOS Release 12.2(28)SB.	PRE2

Benefits for IP Unnumbered on VLANs

The IP Unnumbered on VLANs feature benefits service providers in the following ways:

- DSL providers can easily migrate their ATM networks to IP networks and migrate their DSLAMs from an ATM uplink to a Gigabit Ethernet uplink for connection to the router.
- Using one router and the same service model, providers can aggregate Layer 2 access for DSL and Metro-Ethernet subscribers.
- IP address space is saved because all ports can share the same subnet.
- Each IP unnumbered subinterface supports one VLAN and each VLAN can have multiple IP addresses.
- Subscribers are easily identified, which makes it possible to apply different policies on a per-subscriber basis.
- DHCP simplifies address management.
- The use of VLANs increases security.
- Security is greater with the use of VLANs. Because routing information is obtained from DHCP, ARP and MAC entries cannot be spoofed.

Restrictions for IP Unnumbered on VLANs

The IP Unnumbered on VLANs feature has the following restrictions:

- You can configure IP unnumbered on only Ethernet VLAN subinterfaces and point-to-point interfaces.
- If you configure more than 14,000 IP unnumbered subinterfaces and you have configured EIGRP on all interfaces on a router, the router can stop responding. To avoid this problem, use the **passive-interface default** command (which disables all router interfaces from sending routing updates) and then configure the **no passive-interface** command on selected interfaces you want to send routing updates.

Configuration Tasks for IP Unnumbered on VLANs

To configure the IP Unnumbered on VLANs feature, perform at least one of the following configuration tasks:

- Configuring IP Unnumbered for an Ethernet VLAN Subinterface, page 7-3
- Configuring IP Unnumbered for a Range of Ethernet VLAN Subinterfaces, page 7-4

Configuring IP Unnumbered for an Ethernet VLAN Subinterface

To configure IP unnumbered for an Ethernet VLAN subinterface, enter the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# interface type number slot/module/port.subinterface`	Configures a subinterface and enters subinterface configuration mode.
Step 2	`Router(config-subif)# encapsulation dot1q vlan-id [native]`	Enables IEEE 802.1Q encapsulation of traffic on a specified subinterface in a virtual LAN (VLAN). IEEE 802.1 Q enscapsulation is disabled by default. The *vlan-id* argument is the virtual LAN identifier. Valid values are from 1 to 4095. The **native** option sets the VLAN ID value of the port to the value you specify in the *vlan-id* argument.
Step 3	`Router(config-subif)# ip unnumbered type number`	Enables IP processing on a serial interface without assigning an explicit IP address to the interface. IP unnumbered is disabled by default. The *type* and *number* arguments indicate the type and number of another interface on which the router has an assigned IP address. It cannot be another unnumbered interface.

Example 7-1 configures IP unnumbered on the Fast Ethernet 1/0.1 subinterface.

Example 7-1 Configuring IP Unnumbered on an Ethernet VLAN Subinterface

```
Router(config)# interface fastethernet 1/0.1
Router(config-subif)# encapsulation dot1q 10
Router(config-subif)# ip unnumbered ethernet3/0
```

Configuring IP Unnumbered for a Range of Ethernet VLAN Subinterfaces

To configure IP unnumber on a range of Ethernet VLAN subinterfaces, enter the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# interface range` *type number slot/module/port.subinterface* `-` *type number slot/module/port.subinterface*	Configures a range of subinterfaces and enters subinterface-range configuration mode.
Step 2	`Router(config-subif-range)# encapsulation dot1q` *vlan-id* [**native**]	Applies a VLAN ID to each subinterface within the range you specify using the **interface range** command. The VLAN ID that you specify in the *vlan-id* argument is applied to the first subinterface in the range. Each subsequent interface is assigned a VLAN ID, which is the specified *vlan-id* plus the subinterface number minus the first subinterface number. For example: VLAN ID + subinterface number - first subinterface number
Step 3	`Router(config-subif-range)# ip unnumbered` *type number*	Enables IP processing on a serial interface without assigning an explicit IP address to the interface. IP unnumbered is disabled by default. The *type* and *number* arguments indicate the type and number of another interface on which the router has an assigned IP address. It cannot be another unnumbered interface.

Example 7-2 configures IP unnumbered on the Fast Ethernet subinterfaces 1/0.1 to 1/0.1000.

Example 7-2 Configuring IP Unnumbered on a Range of Ethernet VLAN Subinterfaces

```
Router(config)# interface range fastethernet 1/0.1 - fastethernet 1/0.1000
Router(config-subif-range)# ip unnumbered ethernet 3/0
```

Configuration Examples for IP Unnumbered on VLANs

The following example enables IP unnumbered on the Fast Ethernet 0/0.1 VLAN subinterface:

```
!
interface fastethernet0/0.1
 encapsulation dot1q 101
 ip unnumbered ethernet 0
```

The following example enables IP unnumbered on a range of VLAN subinterfaces:

```
interface range fastethernet0/0.11 - fastethernet0/0.60
 encapsulation dot1q 101
 ip unnumbered ethernet 0
```

Monitoring and Maintaining IP Unnumbered Ethernet VLAN Subinterfaces

To monitor and maintain IP unnumbered Ethernet VLAN subinterfaces, enter any of the following commands in privileged EXEC mode:

Command	Purpose
Router# **show interfaces** *type number slot*/*module*/*port*.*subinterface*	Displays information about the interface you specify.
Router# **show running-config**	Displays the contents of the currently running configuration file.
Router# **show running-config** [**interface** *type number*]	Displays the configuration for a specific interface.
Router# **show vlans**	Displays information about VLAN subinterfaces.