



PPPoE—QinQ Support

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Encapsulating IEEE 802.1Q VLAN tags within 802.1Q enables service providers to use a single VLAN to support customers who have multiple VLANs. The PPPoE—QinQ Support feature on the subinterface level preserves VLAN IDs and keeps traffic in different customer VLANs segregated.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the [“Feature Information for PPPoE—QinQ Support”](#) section on page 17.

Use Cisco Feature Navigator to find information about platform support and Cisco IOS and Catalyst OS software image support. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

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Prerequisites for PPPoE—QinQ Support

- You have checked [Feature Navigator](#) to verify that your Cisco device and software image support this feature.
- You must be connected to an Ethernet device that supports double VLAN tag imposition/disposition or switching.

Restrictions for PPPoE—QinQ Support

Cisco 10000 Series Router Restrictions

- Supported on Ethernet, Fast Ethernet, or Gigabit Ethernet interfaces.
- Supports only PPP over Ethernet (PPPoE) and IP packets that are double-tagged for IEEE 802.1Q in 802.1Q (QinQ) VLAN tag termination. Specifically, PPPoEoQinQ and IPoQinQ are supported.
- PPPoE over QinQ (PPPoEoQinQ) supports a maximum of 32,000 PPPoE sessions per interface for a maximum of 32,000 PPPoE sessions for the router. Note that the number of supported PPPoE sessions per interface can be limited by the cap of 32,000 sessions of any type that can run on the router.
- PPPoEoQinQ supports 4094 outer VLAN IDs and 4094 inner VLAN IDs if only PPPoE is enabled and IP is not enabled on the subinterface.
- IP over QinQ (IPoQinQ) supports a maximum of 16,000 IPoQinQ subinterfaces per interface.
- IPoQinQ supports a maximum of 448 outer VLAN IDs and 4094 inner VLAN IDs.
- Multiprotocol Label Switching (MPLS) is not supported on PPPoEoQinQ and IPoQinQ subinterfaces.
- Layer 2 Ethernet over MPLS (EoMPLS) tunneling using the **xconnect** command on PPPoEoQinQ and IPoQinQ subinterfaces is not supported.
- Modular quality of service command line interface (MQC) can be applied to unambiguous subinterfaces only.
- Limited ACL support for PPPoEoQinQ subinterfaces.

Information About PPPoE—QinQ Support

To configure the PPPoE—QinQ Support Feature, you should understand the following concepts:

- [PPPoE—QinQ Support on Subinterfaces, page 3](#)
- [Cisco 10000 Series Router Application, page 5](#)
- [Unambiguous and Ambiguous Subinterfaces, page 6](#)

PPPoE—QinQ Support on Subinterfaces

The PPPoE—QinQ Support feature adds another layer of IEEE 802.1Q tag (called “metro tag” or “PE-VLAN”) to the 802.1Q tagged packets that enter the network. The purpose is to expand the VLAN space by tagging the tagged packets, thus producing a “double-tagged” frame. The expanded VLAN space allows the service provider to provide certain services, such as Internet access on specific VLANs for specific customers, and yet still allows the service provider to provide other types of services for their other customers on other VLANs.

Generally the service provider’s customers require a range of VLANs to handle multiple applications. Service providers can allow their customers to use this feature to safely assign their own VLAN IDs on sub interfaces because these subintervals VLAN IDs are encapsulated within a service provider-designated VLAN ID for that customer. Therefore there is no overlap of VLAN IDs among customers, nor does traffic from different customers become mixed. The double-tagged frame is “terminated” or assigned on a subintervals with an expanded **encapsulation dot1q** command that specifies the two VLAN ID tags (outer VLAN ID and inner VLAN ID) terminated on the subintervals. See [Figure 1 on page 4](#).

The PPPoE—QinQ Support feature is generally supported on whichever Cisco IOS features or protocols are supported on the subinterface. For example, if you can run PPPoE on the subinterface, you can configure a double-tagged frame for PPPoE. IPoQinQ supports IP packets that are double-tagged for QinQ VLAN tag termination by forwarding IP traffic with the double-tagged (also known as stacked) 802.1Q headers.

A primary consideration is whether you assign ambiguous or unambiguous subintervals for the inner VLAN ID. See the [“Unambiguous and Ambiguous Subinterfaces”](#) section on page 6.

For information on supported PPPoE sessions, number of supported inner and outer VLAN IDs, and general restrictions on the Cisco 10000 series routers, see the [“Restrictions for PPPoE—QinQ Support”](#) section on page 2.



Note

The Cisco 10000 series router supports PPPoEoQinQ in Cisco IOS Release 12.3(7)XI1 and later releases, and IPoQinQ in Cisco IOS Release 12.3(7)XI7 and later releases.

The primary benefit for the service provider is a reduced number of VLANs supported for the same number of customers. Other benefits of this feature are as follows:

- PPPoE scalability. Expanding the available VLAN space from 4096 to about 16.8 million (4096 times 4096) allows the number of PPPoE sessions that can be terminated on a given interface to be multiplied.



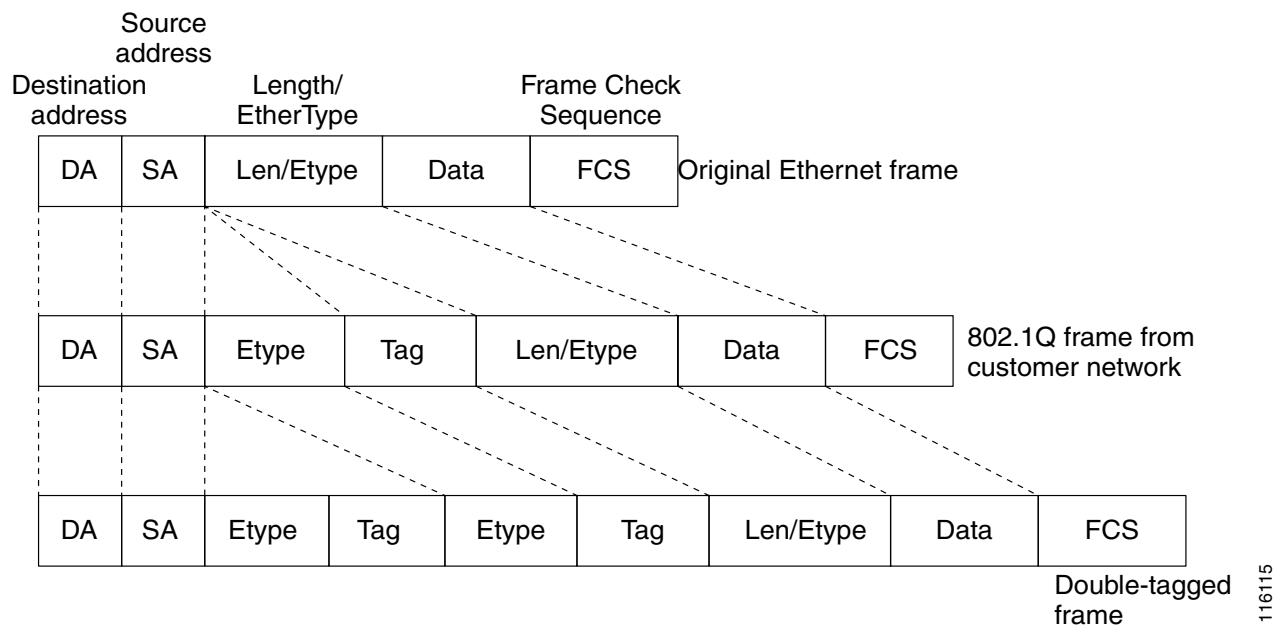
Note

The Cisco 10000 series router supports up to 32,000 PPPoE sessions per interface for a maximum of 61,500 PPPoE sessions for the router. These sessions may be over PPPoEoQinQ ambiguous or unambiguous subinterfaces.

- When deploying Gigabyte Ethernet DSL Access Multiplexer (DSLAM) in a wholesale model, you can assign the inner VLAN ID to represent the end-customer virtual circuit (VC) and assign the outer VLAN ID to represent the service provider ID.

The QinQ VLAN tag termination feature is simpler than the IEEE 802.1Q tunneling feature deployed for the Catalyst 6500 series switches or the Catalyst 3550 and Catalyst 3750 switches. Whereas switches require IEEE 802.1Q tunnels on interfaces to carry double-tagged traffic, routers need only encapsulate QinQ VLAN tags within another level of 802.1Q tags in order for the packets to arrive at the correct destination.

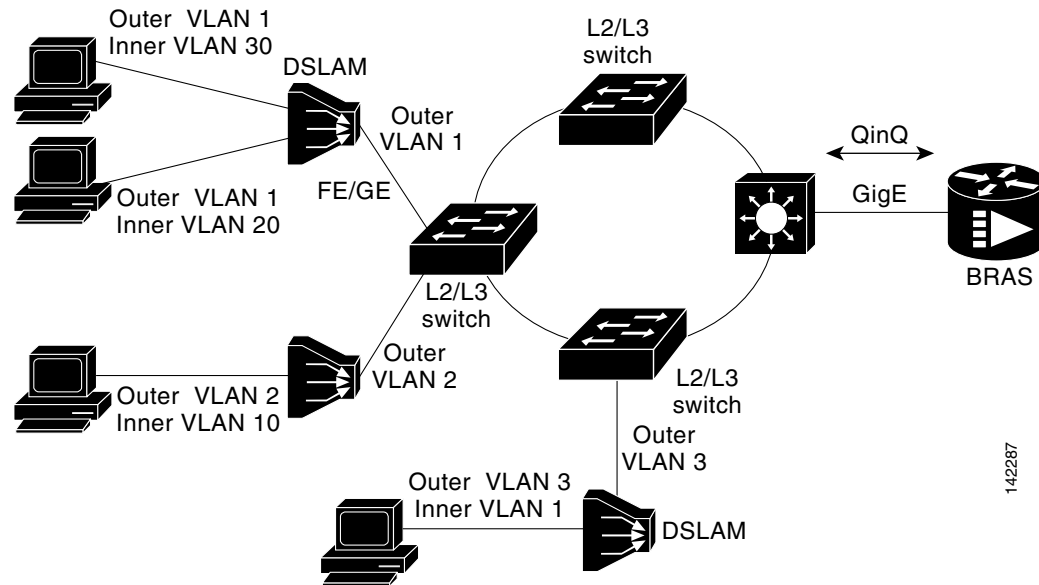
Figure 1 Untagged, 802.1Q-Tagged, and Double-Tagged Ethernet Frames



Cisco 10000 Series Router Application

For the emerging broadband Ethernet-based DSLAM market, the Cisco 10000 series router supports QinQ encapsulation. With the Ethernet-based DSLAM model shown in [Figure 2](#), customers typically get their own VLAN; all these VLANs are aggregated on a DSLAM.

Figure 2 Broadband Ethernet-based DSLAM Model of QinQ VLANs



VLAN aggregation on a DSLAM will result in many aggregate VLANs that at some point need to be terminated on the broadband remote access servers (BRAS). Although the model could connect the DSLAMs directly to the BRAS, a more common model uses the existing Ethernet-switched network where each DSLAM VLAN ID is tagged with a second tag (QinQ) as it connects into the Ethernet-switched network.

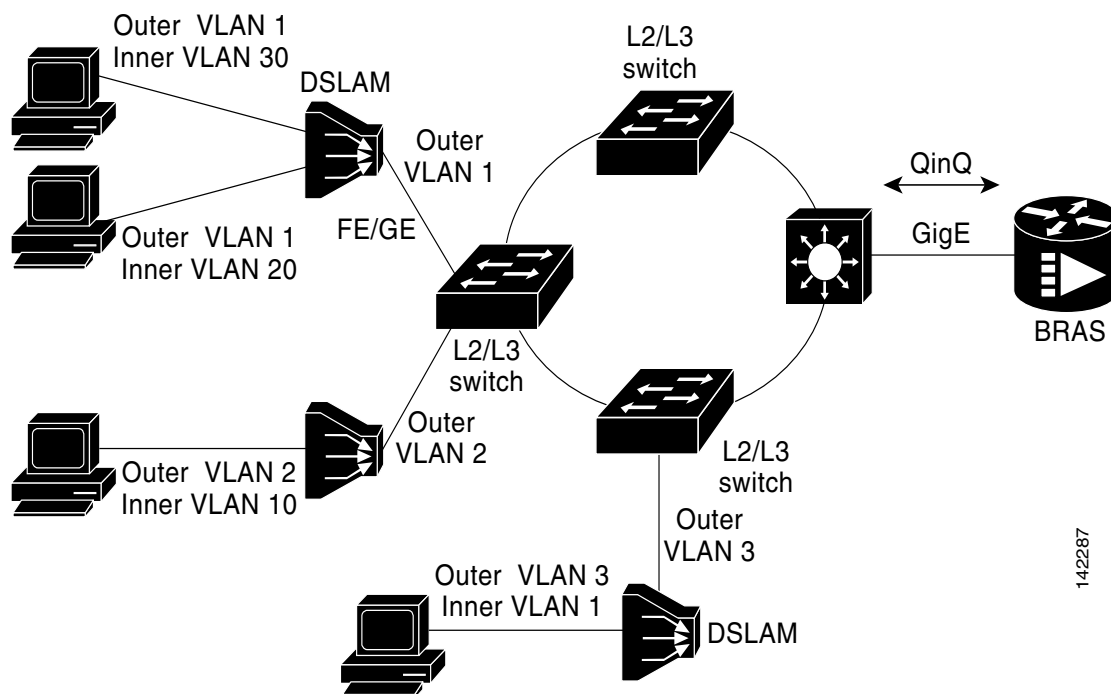
The Cisco 10000 series router supports PPPoEoQinQ in Cisco IOS Release 12.3(7)XI1 and later, and IP over QinQ (IPoQinQ) in Cisco IOS Release 12.3(7)XI7 and later releases. Both PPPoE sessions and IP can be enabled on a sub interface. For information on supported PPPoE sessions, number of supported inner and outer VLAN IDs, and general restrictions on the Cisco 10000 series router, see the [“Restrictions for PPPoE—QinQ Support”](#) section on page 2.

The PPPoEoQinQ model is a PPP-terminated session.

PPPoEQinQ and IPoQinQ encapsulation processing is an extension to 802.1Q encapsulation processing. A QinQ frame looks like a VLAN 802.1Q frame; the only difference is that it has two 802.1Q tags instead of one. See [Figure 1](#).

QinQ encapsulation supports a configurable outer tag Ethertype. The configurable Ethertype field values are 0x8100 (default), 0x9100, and 0x9200. See [Figure 3](#).

Figure 3 Supported Configurable Ethertype Field Values



Security ACL Application on the Cisco 10000 Series Router

The PPPoE—QinQ Support feature provides limited security ACL support for PPPoEoQinQ subinterfaces for the Cisco 10000 series router. There are no ACL restrictions on subinterfaces configured with IPoQinQ.

If you apply an ACL to PPPoE traffic on a QinQ subinterface in a VLAN, apply the ACL directly on the PPPoE session, using virtual access interfaces (VAIs) or RADIUS attribute 11 or 242.

You can apply ACLs to VAIs by configuring them under virtual template interfaces. You can also configure ACLs by using RADIUS attribute 11 or 242. When you use attribute 242, a maximum of 30,000 sessions can have ACLs.

ACLs that are applied to the VLAN QinQ subinterface have no effect and are silently ignored. In the following example, ACL 1 that is applied to the VLAN QinQ subinterface level will be ignored:

```
Router(config)# interface FastEthernet3/0/0.100
Router(config-subif)# encapsulation dot1q 100 second-dot1q 200
Router(config-subif)# ip access-group 1
```

Unambiguous and Ambiguous Subinterfaces



Note

Only PPPoE is supported on ambiguous subinterfaces. Standard IP routing is not supported on ambiguous subinterfaces.

The **encapsulation dot1q** command is used to configure QinQ termination on a subinterface. The command accepts an outer VLAN ID and one or more inner VLAN IDs. The outer VLAN ID always has a specific value, and the inner VLAN ID can either be a specific value or a range of values.

A subinterface that is configured with a single inner VLAN ID is called an unambiguous QinQ subinterface. In the following example, QinQ traffic with an outer VLAN ID of 101 and an inner VLAN ID of 1001 is mapped to the Gigabit Ethernet 1/0.100 subinterface:

```
Router(config)# interface gigabitEthernet1/0.100
Router(config-subif)# encapsulation dot1q 101 second-dot1q 1001
```

A subinterface that is configured with multiple inner VLAN IDs is called an ambiguous QinQ subinterface. By allowing multiple inner VLAN IDs to be grouped, ambiguous QinQ subinterfaces allow for a smaller configuration, improved memory usage, and better scalability.

In the following example, QinQ traffic with an outer VLAN ID of 101 and inner VLAN IDs anywhere in the 2001–2100 and 3001–3100 range is mapped to the Gigabit Ethernet 1/0.101 subinterface:

```
Router(config)# interface fastEthernet1/0.101
Router(config-subif)# encapsulation dot1q 101 second-dot1q 2001-2100,3001-3100
```

Ambiguous subinterfaces can also use the **any** keyword to specify the inner VLAN ID.

See the “[Configuration Examples for PPPoE—QinQ Support](#)” section on page 13 for an example of how VLAN IDs are assigned to sub interfaces, and for a detailed example of how the **any** keyword is used on ambiguous sub interfaces.



Note

The **any** keyword in the **second-dot1q** keyword is not supported on a subinterface configured for IPoQinQ because IP routing is not supported on ambiguous subinterfaces. Therefore, multiple values and ranges for the inner VLAN ID are not supported on IPoQinQ.



Note

On the Cisco 10000 series router, MQC is supported only on unambiguous subinterfaces.

How to Configure PPPoE—QinQ Support

This section contains the following tasks:

- [Configuring the Interfaces for PPPoE—QinQ Support, page 7](#) (required)
- [Verifying the PPPoE—QinQ Support, page 10](#) (optional)

Configuring the Interfaces for PPPoE—QinQ Support

Perform this task to configure the main interface used for the QinQ double tagging and to configure the subinterfaces. An optional step in this task shows you how to configure the Ethertype field to be 0x9100 for the outer VLAN tag, if that is required. After the subinterface is defined, the 802.1Q encapsulation is configured to use the double tagging.

Prerequisites

Cisco 10000 Series Router Prerequisites:

- PPPoE or IP is already configured.
- A virtual private dialup network (VPDN) is enabled.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **dot1q tunneling ethertype** *ethertype*
5. **interface** *type number.subinterface-number*
6. **encapsulation dot1q** *vlan-id* **second-dot1q** {**any** | *vlan-id* | *vlan-id-vlan-id* [, *vlan-id-vlan-id*] }
7. **pppoe enabled** [**group** *group-name*]
8. **ip address** *ip-address mask* [**secondary**]
9. Repeat Step 5 to configure another subinterface.
10. Repeat Step 6, Step 7, and Step 8, as required, to specify the VLAN tags to be terminated on the subinterface, to enable PPPoE sessions or IP on the subinterface.
11. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface <i>type number</i> Example: Router(config)# interface fastEthernet 1/0/0	Configures an interface and enters interface configuration mode.
Step 4	dot1q tunneling ethertype <i>ethertype</i> Example: Router(config-if)# dot1q tunneling ethertype 0x9100	(Optional) Defines the Ethertype field type used by peer devices when implementing QinQ VLAN tagging. • Use this command if the Ethertype of peer devices is 0x9100 or 0x9200. • Cisco 10000 series router supports both the 0x9100 and 0x9200 Ethertype field types.

	Command or Action	Purpose
Step 5	interface <i>type number.subinterface-number</i> Example: Router(config-if)# interface gigabitethernet 1/0/0.1	Configures a subinterface and enters subinterface configuration mode.
Step 6	encapsulation dot1q <i>vlan-id</i> second-dot1q { any <i>vlan-id</i> <i>vlan-id-vlan-id[,vlan-id-vlan-id]</i> } Example: Router(config-subif)# encapsulation dot1q 100 second-dot1q 200	(Required) Enables the 802.1Q encapsulation of traffic on a specified subinterface in a VLAN. - Use the second-dot1q keyword and the <i>vlan-id</i> argument to specify the VLAN tags to be terminated on the subinterface. - In this example, an unambiguous QinQ subinterface is configured because only one inner VLAN ID is specified. - QinQ frames with an outer VLAN ID of 100 and an inner VLAN ID of 200 will be terminated.
Step 7	pppoe enable [group <i>group-name</i>] Example: Router(config-subif)# pppoe enable group vpn1	(Optional) This step is required only for PPPoEoQinQ. Enables PPPoE sessions on a subinterface. The example specifies that the PPPoE profile, vpn1, will be used by PPPoE sessions on the subinterface.
Step 8	ip address <i>ip-address mask</i> [secondary] Example: Router(config-subif)# ip address 192.168.1.2 255.255.255.0	(Optional) This step is required only for IPoQinQ. Sets a primary or secondary IP address for a subinterface. The example enables IP on the subinterface specified by the IP address, 192.168.1.2, and mask, 255.255.255.0.
Step 9	Repeat Step 5 to configure another subinterface. Example: Router(config-if)# interface gigabitethernet 1/0/0.2	(Optional) Configures a subinterface and enters subinterface configuration mode.

	Command or Action	Purpose
Step 10	Repeat Step 6, Step 7, and Step 8, as required, to specify the VLAN tags to be terminated on the subinterface. Example: <pre>Router(config-subif)# encapsulation dot1q 100 second-dot1q 100-199,201-600</pre> Example: <pre>Router(config-subif)# pppoe enable group vpn1</pre> Example: <pre>Router(config-subif)# ip address 192.168.1.2 255.255.255.0</pre>	Step 6 enables the 802.1Q encapsulation of traffic on a specified subinterface in a VLAN. - Use the second-dot1q keyword and the <i>vlan-id</i> argument to specify the VLAN tags to be terminated on the subinterface. - In the example, an ambiguous QinQ subinterface is configured because a range of inner VLAN IDs is specified. - QinQ frames with an outer VLAN ID of 100 and an inner VLAN ID in the range of 100 to 199 or 201 to 600 will be terminated. Step 7 enables PPPoE sessions on the subinterface. The example specifies that the PPPoE profile, <i>vpn1</i>, will be used by PPPoE sessions on the subinterface. Step 8 enables IP on a subinterface specified by the IP address and mask. The example enables IP on the subinterface specified by the IP address, 192.168.1.2, and mask, 255.255.255.0. Note Both PPPoE sessions and IP can be enabled on a subinterface.
Step 11	end Example: <pre>Router(config-subif)# end</pre>	Exits sub interface configuration mode and returns to interface configuration mode.

Verifying the PPPoE—QinQ Support

Perform this optional task to verify the configuration of the PPPoE—QinQ Support feature.

SUMMARY STEPS

- enable**
- show running-config**
- show vlans dot1q** [**internal** | *interface-type interface-number.subinterface-number* [**detail**] | *outer-id* [*interface-type interface-number* | **second-dot1q** [*inner-id* | **any**] [**detail**]]]

DETAILED STEPS

- | | |
|---------------|---|
| Step 1 | <p>enable</p> <p>Enables privileged EXEC mode. Enter your password if prompted.</p> <pre>Router> enable</pre> |
|---------------|---|

Step 2 show running-config

Use this command to show the currently running configuration on the device. You can use delimiting characters to display only the relevant parts of the configuration.

The following output shows the currently running PPPoEoQinQ and IPoQinQ configurations on a Cisco 10000 series router:

```
Router# show running-config

.
.
.

interface FastEthernet0/0.201
 encapsulation dot1Q 201
 ip address 10.7.7.5 255.255.255.252
!
interface FastEthernet0/0.401
 encapsulation dot1Q 401
 ip address 10.7.7.13 255.255.255.252
!
interface FastEthernet0/0.201999
 encapsulation dot1Q 201 second-dot1q any
 pppoe enable
!
interface FastEthernet0/0.2012001
 encapsulation dot1Q 201 second-dot1q 2001
 ip address 10.8.8.9 255.255.255.252
!
interface FastEthernet0/0.2012002
 encapsulation dot1Q 201 second-dot1q 2002
 ip address 10.8.8.13 255.255.255.252
 pppoe enable
!
interface FastEthernet0/0.4019999
 encapsulation dot1Q 401 second-dot1q 100-900,1001-2000
 pppoe enable
!
interface FastEthernet5/0.101
 encapsulation dot1Q 101
 ip address 10.7.7.1 255.255.255.252
!
interface FastEthernet5/0.301
 encapsulation dot1Q 301
 ip address 10.7.7.9 255.255.255.252
!
interface FastEthernet5/0.301999
 encapsulation dot1Q 301 second-dot1q any
 pppoe enable
!
interface FastEthernet5/0.1011001
 encapsulation dot1Q 101 second-dot1q 1001
 ip address 10.8.8.1 255.255.255.252
!
interface FastEthernet5/0.1011002
 encapsulation dot1Q 101 second-dot1q 1002
 ip address 10.8.8.5 255.255.255.252
!
interface FastEthernet5/0.1019999
 encapsulation dot1Q 101 second-dot1q 1-1000,1003-2000
 pppoe enable
.
.
```

.

.

Step 3 **show vlans dot1q** [*internal* | *interface-type interface-number.subinterface-number* [**detail**] | *outer-id* [*interface-type interface-number* | **second-dot1q** [*inner-id* | **any**]] [**detail**]]

Use this command to show the statistics for all the 802.1Q VLAN IDs. In this example, only the outer VLAN ID is displayed.



Note

The **any** keyword is not supported on a subinterface configured for IPoQinQ because IP routing is not supported on ambiguous subinterfaces.

Router# **show vlans dot1q**

```
Total statistics for 802.1Q VLAN 1:
  441 packets, 85825 bytes input
  1028 packets, 69082 bytes output
Total statistics for 802.1Q VLAN 101:
  5173 packets, 510384 bytes input
  3042 packets, 369567 bytes output
Total statistics for 802.1Q VLAN 201:
  1012 packets, 119254 bytes input
  1018 packets, 120393 bytes output
Total statistics for 802.1Q VLAN 301:
  3163 packets, 265272 bytes input
  1011 packets, 120750 bytes output
Total statistics for 802.1Q VLAN 401:
  1012 packets, 119254 bytes input
  1010 packets, 119108 bytes output
```

Configuration Examples for PPPoE—QinQ Support

This section provides the following example:

- [Configuring the any Keyword on Subinterfaces for PPPoE—QinQ Support: Example, page 13](#)

Configuring the any Keyword on Subinterfaces for PPPoE—QinQ Support: Example

Some ambiguous subinterfaces can use the **any** keyword for the inner VLAN ID specification. The **any** keyword represents any inner VLAN ID that is not explicitly configured on any other interface. In the following example, seven subinterfaces are configured with various outer and inner VLAN IDs.



Note

The **any** keyword can be configured on only one subinterface of a specified physical interface and outer VLAN ID.



Note

The **any** keyword in the **second-dot1q** keyword is not supported on a subinterface configured for IPoQinQ because IP routing is not supported on ambiguous subinterfaces. Therefore, multiple values and ranges for the inner VLAN ID are not supported on IPoQinQ.

```
interface GigabitEthernet1/0/0.1
 encapsulation dot1q 100 second-dot1q 100

interface GigabitEthernet1/0/0.2
 encapsulation dot1q 100 second-dot1q 200

interface GigabitEthernet1/0/0.3
 encapsulation dot1q 100 second-dot1q 300-400,500-600

interface GigabitEthernet1/0/0.4
 encapsulation dot1q 100 second-dot1q any

interface GigabitEthernet1/0/0.5
 encapsulation dot1q 200 second-dot1q 50

interface GigabitEthernet1/0/0.6
 encapsulation dot1q 200 second-dot1q 1000-2000,3000-4000

interface GigabitEthernet1/0/0.7
 encapsulation dot1q 200 second-dot1q any
```

[Table 1](#) shows which sub interfaces are mapped to different values of the outer and inner VLAN IDs on QinQ frames that come in on Gigabit Ethernet (GE) interface 1/0/0.

Table 1 Sub interfaces Mapped to Outer and Inner VLAN IDs for GE Interface 1/0/0

Outer VLAN ID	Inner VLAN ID	Subinterface mapped to
100	1 through 99	GigabitEthernet1/0/0.4
100	100	GigabitEthernet1/0/0.1
100	101 through 199	GigabitEthernet1/0/0.4

Table 1 Sub interfaces Mapped to Outer and Inner VLAN IDs for GE Interface 1/0/0

Outer VLAN ID	Inner VLAN ID	Subinterface mapped to
100	200	GigabitEthernet1/0/0.2
100	201 through 299	GigabitEthernet1/0/0.4
100	300 through 400	GigabitEthernet1/0/0.3
100	401 through 499	GigabitEthernet1/0/0.4
100	500 through 600	GigabitEthernet1/0/0.3
100	601 through 4094	GigabitEthernet1/0/0.4
200	1 through 49	GigabitEthernet1/0/0.7
200	50	GigabitEthernet1/0/0.5
200	51 through 999	GigabitEthernet1/0/0.7
200	1000 through 2000	GigabitEthernet1/0/0.6
200	2001 through 2999	GigabitEthernet1/0/0.7
200	3000 through 4000	GigabitEthernet1/0/0.6
200	4001 through 4094	GigabitEthernet1/0/0.7

A new subinterface is now configured:

```
interface GigabitEthernet 1/0/0.8
 encapsulation dot1q 200 second-dot1q 200-600,900-999
```

Table 2 shows the changes made to the table for the outer VLAN ID of 200. Notice that sub interface 1/0/0.7 configured with the **any** keyword now has new inner VLAN ID mappings.

Table 2 Sub interfaces Mapped to Outer and Inner VLAN IDs for GE Interface 1/0/0—Changes Resulting from Configuring GE Sub interface 1/0/0.8

Outer VLAN ID	Inner VLAN ID	Subinterface mapped to
200	1 through 49	GigabitEthernet1/0/0.7
200	50	GigabitEthernet1/0/0.5
200	51 through 199	GigabitEthernet1/0/0.7
200	200 through 600	GigabitEthernet1/0/0.8
200	601 through 899	GigabitEthernet1/0/0.7
200	900 through 999	GigabitEthernet1/0/0.8
200	1000 through 2000	GigabitEthernet1/0/0.6
200	2001 through 2999	GigabitEthernet1/0/0.7
200	3000 through 4000	GigabitEthernet1/0/0.6
200	4001 through 4094	GigabitEthernet1/0/0.7

Additional References

The following sections provide references related to the PPPoE—QinQ Support feature.

Related Documents

Related Topic	Document Title
Interface commands: complete command syntax, command mode, defaults, usage guidelines, and examples	Cisco IOS Interface and Hardware Component Command Reference
Interface configuration examples	Cisco IOS Interface and Hardware Component Configuration Guide

Standards

Standards	Title
802.1Q	IEEE 802.1Q standard for local and metropolitan area networks.

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for PPPoE—QinQ Support

Table 3 lists the features in this module and provides links to specific configuration information.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS and Catalyst OS software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.



Note

Table 3 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 3 Feature Information for PPPoE—QinQ Support

Feature Name	Releases	Feature Information
PPPoE—QinQ Support	12.3(7)T 12.3(7)XI1 12.3(7)XI7 12.2(28)SB2 12.2(31)SB2 12.2(33)SRC 12.2(33)SB 12.4T	Encapsulating IEEE 802.1Q VLAN tags within 802.1Q enables service providers to use a single VLAN to support customers who have multiple VLANs. The PPPoE—QinQ Support feature on the subinterface level preserves VLAN IDs and keeps traffic in different customer VLANs segregated. In 12.3(7)T, this feature was introduced. In 12.3(7)XI1, support for PPPoEoQinQ, PPPoE packets that are double-tagged for QinQ VLAN tag termination, was implemented on the Cisco 10000 series routers. In 12.3(7)XI7, support for IPoQinQ, IP packets that are double-tagged for QinQ VLAN tag termination, was added on the Cisco 10000 series routers. In 12.2(28)SB2, support for PPPoEoQinQ, PPPoE packets that are double-tagged for QinQ VLAN tag termination, was implemented on the Cisco 10000 series routers. In 12.2(31)SB2, support for IPoQinQ was added on the Cisco 7200 and Cisco 10000 series routers. In 12.2(33)SRC, support for PPPoEoQinQ was added on the Cisco 7600 series routers. In 12.2(33)SB, support for PPPoEoQinQ was implemented on the Cisco 10000 series routers. In 12.4T, this feature was supported. The following commands were introduced or modified: dot1q tunneling ethertype, encapsulation dot1q, show vlans dot1q
802.1Q-in-Q VLAN Tag Termination	12.2(33)XNE	In 12.2(33)XNE, this feature was supported.

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