



IEEE 802.1Q Tunneling (QinQ) for AToM

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This feature allows you to configure IEEE 802.1Q Tunneling (QinQ) for AToM. It also permits the rewriting of QinQ tags for Multiple Protocol Label Switching (MPLS) Layer 2 VPNs (L2VPNs).

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 IEEE 802.1Q Tunneling \(QinQ\) for AToM”](#) section on [page 11](#).

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

Contents

- [Prerequisites for IEEE 802.1Q Tunneling \(QinQ\) for AToM, page 2](#)
- [Restrictions for IEEE 802.1Q Tunneling \(QinQ\) for AToM, page 2](#)
- [Information About IEEE 802.1Q Tunneling \(QinQ\) for AToM, page 2](#)
- [How to Configure IEEE 802.1Q Tunneling \(QinQ\) for AToM, page 4](#)
- [Configuration Examples for IEEE 801.2 Tunneling \(QinQ\) for ATM, page 7](#)
- [Additional References, page 9](#)
- [Feature Information for IEEE 802.1Q Tunneling \(QinQ\) for AToM, page 11](#)



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Prerequisites for IEEE 802.1Q Tunneling (QinQ) for AToM

The QinQ (short for 802.1Q-in-802.1Q) tunneling and tag rewrite feature is supported on the following line cards:

- 8-port Fast Ethernet line card (ESR-HH-8FE-TX)
- 2-port half-height Gigabit Ethernet line card (ESR-HH-1GE)
- 1-port full-height Gigabit Ethernet line card (ESR-1GE)

Restrictions for IEEE 802.1Q Tunneling (QinQ) for AToM

The IEEE 802.1Q Tunneling (QinQ) for AToM feature has the following restrictions:

- Up to a maximum of 447 outer-VLAN IDs and up to 4095 inner VLAN IDs can be supported by this feature.
- Only Unambiguous VLAN tagged Ethernet QinQ interfaces are supported in this release. That is, the Ethernet VLAN QinQ rewrite of both VLAN Tags capability is supported only on Ethernet subinterfaces with a QinQ encapsulation and explicit pair of VLAN IDs defined.



Note Ambiguous inner VLAN IDs are not supported in this release.

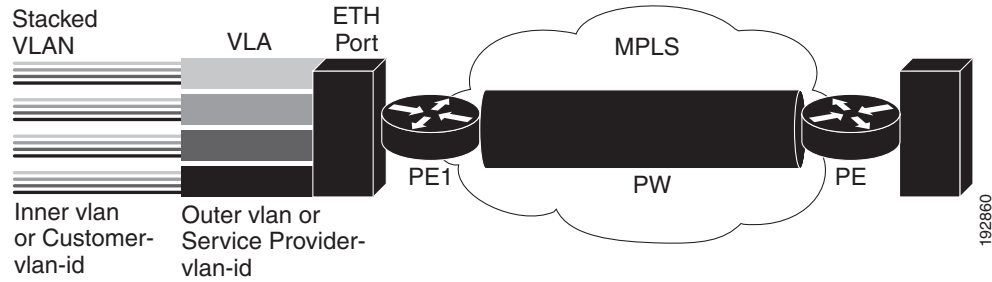
Information About IEEE 802.1Q Tunneling (QinQ) for AToM

- [Ethernet VLAN QinQ AToM, page 2](#)
- [QinQ Tunneling Based on Inner and Outer VLAN Tags, page 3](#)
- [Rewritten Inner and Outer VLAN Tags on QinQ Frames, page 4](#)

Ethernet VLAN QinQ AToM

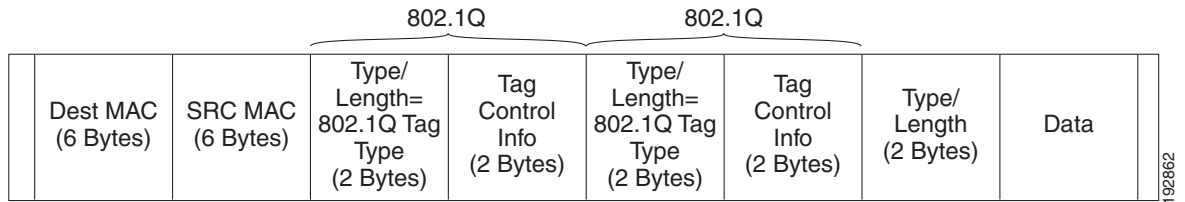
In Metro Ethernet deployment, in which CE routers and PE routers are connected through an Ethernet switched access network, packets that arrive at PE routers can contain up to two IEEE 802.1q VLAN tags (one inner VLAN tag which identifies the customer; and another outer VLAN tag which denotes the customer's service provider). This technique of allowing multiple VLAN tagging on the same Ethernet packet and creating a stack of VLAN IDs is known as QinQ (short for 802.1Q-in-802.1Q). [Figure 1](#) shows how different edge devices can do L2 switching on the different levels of the VLAN stack.

Figure 1 Ethernet VLAN QinQ



When the outer VLAN tag is the service-delimiting VLAN tag, QinQ packets are processed similar to the ones with one VLAN tag (case previously named Ethernet VLAN Q-in-Q modified, which is already supported in the 12.2(31) SB release). However, when a customer must use a combination of the outer and inner VLAN tags to delimit service for customers, the edge device should be able to choose a unique pseudowire based on a combination of the inner and outer VLAN IDs on the packet shown in [Figure 2](#). The customer may want to be able to rewrite both the inner and the outer VLAN IDs on the traffic egress side.

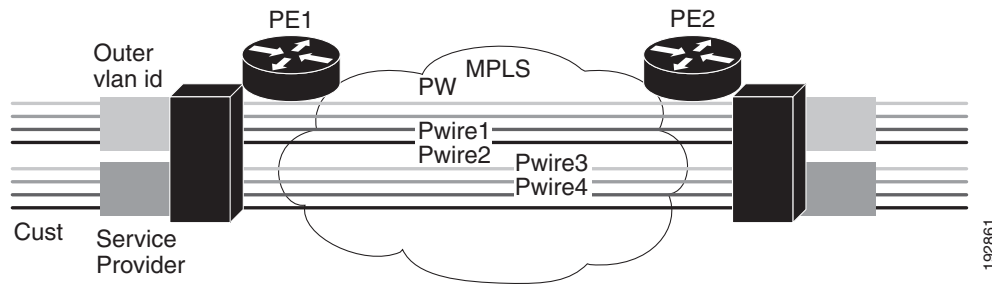
Figure 2 Ethernet VLAN QinQ Header



QinQ Tunneling Based on Inner and Outer VLAN Tags

When handling incoming QinQ Ethernet traffic, the edge router allows a customer to choose a unique pseudowire endpoint to switch the traffic based on the combination of inner and outer VLAN IDs. For example, [Figure 3](#) shows how a unique pseudowire is selected depending upon the combination of inner (customer edge) and outer (service provider) VLAN IDs. Thus, traffic for different customers can be kept separate.

Figure 3 QinQ Connection



Rewritten Inner and Outer VLAN Tags on QinQ Frames

When managing incoming AToM Ethernet QinQ traffic, the edge router does the following tasks:

1. Strips off the MPLS labels.
2. Allows the customer to rewrite both the inner and outer VLAN IDs before sending the packets to the egress QinQ interface. Note this capability is provided only for AToM like-to-like Ethernet QinQ traffic.

The QinQ AToM feature is a like-to-like interworking case over AToM. This feature requires changes to the microcode to allow it to overwrite two layers of VLAN tags on Ethernet QinQ traffic, transported across AToM pseudowires.

- On the ingress side—The packets preserve their L2 header with the two VLAN tags, and it is sent across the pseudowire with VC type of 4.
- On the egress side—The MPLS label is stripped, and up to two levels of VLAN tags are rewritten per the configuration.

Only Unambiguous VLAN tagged Ethernet QinQ interfaces are supported in this release. The Ethernet VLAN Q-in-Q rewrite of both VLAN Tags capability is supported only on Ethernet subinterfaces with a QinQ encapsulation and explicit pair of VLAN IDs defined.

How to Configure IEEE 802.1Q Tunneling (QinQ) for AToM

This section explains how to configure IEEE 802.1Q Tunneling (QinQ) for AToM and includes the following procedures. While all of the procedures are listed as optional, you must choose one of the first two listed.

- [Configuring Unambiguous IEEE 802.1Q Tunneling \(QinQ\) for AToM, page 4](#) (optional)
- [Configuring Ambiguous IEEE 802.1Q Tunneling \(QinQ\) for AToM, page 5](#) (optional)
- [Verifying the IEEE 802.1Q Tunneling \(QinQ\) for ATM Configuration, page 7](#) (optional)

Configuring Unambiguous IEEE 802.1Q Tunneling (QinQ) for AToM

SUMMARY STEPS

1. enable

2. **configure terminal**
3. **interface gigabitethernet slot/subslot/port.[subinterface]**
4. **encapsulation dot1q vlan-id second-dot1q {any | vlan-id[,vlan-id[-vlan-id]]}**
5. **xconnect peer-router-id vcid encapsulation mpls**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface gigabitethernet slot/subslot/port.[subinterface] Example: Router(config)# interface GigabitEthernet1/0/0.100	Specifies the Gigabit Ethernet interface and enters interface configuration mode.
Step 4	encapsulation dot1q vlan-id second-dot1q {any vlan-id[,vlan-id[-vlan-id]]} Example: Router(config-if)# encapsulation dot1q 100 second-dot1q 200	Defines the matching criteria to map Q-in-Q ingress frames on an interface to the appropriate service instance.
Step 5	xconnect peer-router-id vcid encapsulation mpls Example: Router(config-if)# xconnect 10.0.0.16 410 encapsulation mpls	Creates the VC to transport the Layer 2 packets.

Configuring Ambiguous IEEE 802.1Q Tunneling (QinQ) for AToM

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface gigabitethernet slot/subslot/port.[subinterface]**
4. **encapsulation dot1q vlan-id second-dot1q {any | vlan-id[,vlan-id[-vlan-id]]}**
5. **xconnect peer-router-id vcid encapsulation mpls**
6. **exit**

7. **interface gigabitethernet** *slot/subslot/port.[subinterface]*
8. **encapsulation dot1q** *vlan-id second-dot1q {any | vlan-id[,vlan-id[-vlan-id]]}*
9. **xconnect** *peer-router-id vcid encapsulation mpls*

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p>enable</p> <p>Example: Router> enable</p>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	<p>configure terminal</p> <p>Example: Router# configure terminal</p>	<p>Enters global configuration mode.</p>
Step 3	<p>interface gigabitethernet <i>slot/subslot/port.[subinterface]</i></p> <p>Example: Router(config)# interface GigabitEthernet1/0/0.200</p>	<p>Specifies the Gigabit Ethernet subinterface and enters interface configuration mode.</p>
Step 4	<p>encapsulation dot1q <i>vlan-id</i> second-dot1q <i>{any </i> <i>vlan-id[,vlan-id[-vlan-id]]}</i></p> <p>Example: Router(config-if)# encapsulation dot1q 200 second-dot1q 1000-2000,3000,3500-4000</p>	<p>Defines the matching criteria to map Q-in-Q ingress frames on an interface to the appropriate service instance.</p>
Step 5	<p>xconnect <i>peer-router-id vcid</i> <i>encapsulation mpls</i></p> <p>Example: Router(config-if)# xconnect 10.0.0.16 420 encapsulation mpls</p>	<p>Creates the VC to transport the Layer 2 packets.</p>
Step 6	<p>exit</p> <p>Example: Router(config-if)# exit</p>	<p>Exits interface configuration mode.</p>
Step 7	<p>interface gigabitethernet <i>slot/subslot/port.[subinterface]</i></p> <p>Example: Router(config)# interface GigabitEthernet1/0/0.201</p>	<p>Specifies the next Gigabit Ethernet interface and enters interface configuration mode.</p>

	Command or Action	Purpose
Step 8	<pre>encapsulation dot1q vlan-id second-dot1q {any vlan-id[,vlan-id[-vlan-id]]}</pre> <p>Example: Router(config-if)# encapsulation dot1q 201 second-dot1q any</p>	Defines the matching criteria to map Q-in-Q ingress frames on an interface to the appropriate service instance.
Step 9	<pre>xconnect peer-router-id vcid encapsulation mpls</pre> <p>Example: Router(config-if)# xconnect 10.0.0.16 430 encapsulation mpls</p>	Creates the VC to transport the Layer 2 packets.

Verifying the IEEE 802.1Q Tunneling (QinQ) for ATM Configuration

SUMMARY STEPS

1. enable
2. show mpls l2transport vc

DETAILED STEPS

	Command or Action	Purpose
Step 1	<pre>enable</pre> <p>Example: Router> enable</p>	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	<pre>show mpls l2transport vc</pre> <p>Example: Router# show mpls l2transport vc</p>	Displays information about Any Transport over MPLS (AToM) virtual circuits (VCs) and static pseudowires that have been enabled to route Layer 2 packets on a router.

Configuration Examples for IEEE 801.2 Tunneling (QinQ) for ATM

- [Example: Configuring Unambiguous IEEE 802.1Q Tunneling \(QinQ\) for ATM, page 7](#)
- [Example: Configuring Ambiguous IEEE 802.1Q Tunneling \(QinQ\) for ATM, page 8](#)
- [Example: Verifying the IEEE 802.1Q Tunneling \(QinQ\) for ATM: Configuration, page 8](#)

Example: Configuring Unambiguous IEEE 802.1Q Tunneling (QinQ) for ATM

```
Router> enable
Router# configure terminal
Router(config)# interface GigabitEthernet1/0/0.100
Router(config-if)# encapsulation dot1q 100 second-dot1q 200
```

```
Router(config-if)# xconnect 10.0.0.16 410 encapsulation mpls
```

Example: Configuring Ambiguous IEEE 802.1Q Tunneling (QinQ) for ATM

The following is an example of an ambiguous IEEE 802.1Q Tunneling (QinQ) for ATM configuration.

```
Router> enable
Router# configure terminal
Router(config)# interface GigabitEthernet1/0/0.200
Router(config-if)# encapsulation dot1q 200 second-dot1q 1000-2000,3000,3500-4000
Router(config-if)# xconnect 10.0.0.16 420 encapsulation mpls
Router(config-if)# exit
Router(config)# interface GigabitEthernet1/0/0.201
Router(config-if) encapsulation dot1q 201 second-dot1q any
Router(config-if) xconnect 10.0.0.16 430 encapsulation mpls
```

Example: Verifying the IEEE 802.1Q Tunneling (QinQ) for ATM: Configuration

The following is sample output of the `show mpls l2transport vc` command, which is used to verify the VC set up in EoMPLS QinQ mode.

```
router# show mpls l2transport vc
```

Local intf	Local circuit	Dest address	VC ID	Status
Gil/0/0.1	Eth VLAN:100/200	10.1.1.2	1	UP

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	<i>Cisco IOS Master Commands List, All Releases</i>
Description of commands associated with MPLS and MPLS applications	<i>Cisco IOS Multiprotocol Label Switching Command Reference</i>
AToM and MPLS	<i>Any Transport over MPLS</i>

Standards

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

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 software 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
<p>The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/cisco/web/support/index.html</p>

Feature Information for IEEE 802.1Q Tunneling (QinQ) for AToM

Table 1 lists the features in this module and provides links to specific configuration information.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS XE 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 1 lists only the Cisco IOS XE software release that introduced support for a given feature in a given Cisco IOS XE software release train. Unless noted otherwise, subsequent releases of that Cisco IOS XE software release train also support that feature.

Table 1 Feature Information for IEEE 802.1Q Tunneling (QinQ) for AToM

Feature Name	Releases	Feature Information
IEEE 802.1Q Tunneling (QinQ) for AToM	Cisco IOS XE Release 2.4	<p>This feature allows you to configure IEEE 802.1Q Tunneling (QinQ) for AToM. It also permits the rewriting of QinQ tags for Multiple Protocol Label Switching (MPLS) layer 2 VPNs (L2VPNs).</p> <p>In Cisco IOS XE Release 2.4, this feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.</p> <p>The following section provides information about this feature:</p> <ul style="list-style-type: none"> • Information About IEEE 802.1Q Tunneling (QinQ) for AToM, page 2 • How to Configure IEEE 802.1Q Tunneling (QinQ) for AToM, page 4 <p>The following commands were introduced or modified: interface, encapsulation dot1q second-dot1q, xconnect.</p>

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