REVIEW DRAFT—CISCO CONFIDENTIAL

Transporting 802.1q Tags over ATM PVCs for ADSL

Revised: Month Day, Year, OL-20180-01
First Published: Month Day, Year
Last Updated: September 24, 2009

This feature allows 802.1q tags to be transported over Asynchronous Transfer Mode (ATM) permanent virtual circuits (PVC) used in ADSL2+ uplinks. This feature offers the following benefits:

- It allows Customer Premise Equipment (CPE) to carry traffic with provider-specific 802.1q-tag.
- It supports the deployment of voice, video, and data services at customer premises. This service combination offers a real-time channel dedicated to Voice over IP (VoIP) traffic, and a second channel that delivers best-effort Internet service. In the current release, all traffic is marked with an 802.1p marking of 0, best-effort. This is implemented using VLAN-based service differentiation.

Note Although this document uses the generic term ADSL, this feature requires an ADSL2+ uplink.

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.

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.

Contents

Americas Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

REVIEW DRAFT—CISCO CONFIDENTIAL

Prerequisites for Transporting 802.1q Tags over ATM PVCs for ADSL

Configuration Skills

- You must have a basic understanding of ATM, bridging, DHCP, and VLANs before configuring this feature.

Routers Supported

The following table lists the routers supported in this release.

ADSL Mode	ADSL Card Types	Supported Platforms
Fixed Configuration Routers		
ADSL over POTS		Cisco 877, Cisco 1801
ADSL over ISDN		Cisco 876, Cisco 1802
Modular Configuration Routers		
ADSL over POTS	WIC-1ADSL, HWIC-1ADSL, HWIC-ADSL-B/ST	Cisco 1841, Cisco 2801
ADSL over ISDN	HWIC-1ADSLI, HWIC-ADSLI-B/ST	Cisco 1841, Cisco 2801

Restrictions for Transporting 802.1q Tags over ATM PVCs for ADSL

The following restrictions apply to this release:

- One bridged 802.1q VLAN is supported.
- If incoming Ethernet frames contain a VLAN header, the 802.1p value will be set to 0, and the 802.1q tag specified in the **bridge-dot1q encap** command and placed in the outgoing VLAN header.
- This feature can be configured only on a point-to-point ATM subinterface.
- AAL5SNAP encapsulation must be used to enable the transport of 802.1q tags over ATM PVCs.

REVIEW DRAFT—CISCO CONFIDENTIAL

Information About Transporting 802.1q Tags over ATM PVCs for ADSL

This feature supports the deployment of voice, video, and data services on customer premises equipment (CPE) by enabling the router to transport 802.1q tags over Asynchronous Transfer Mode (ATM) permanent virtual circuits (PVC). This feature requires an ADSL2+ data connection.

This section contains the following subsections:

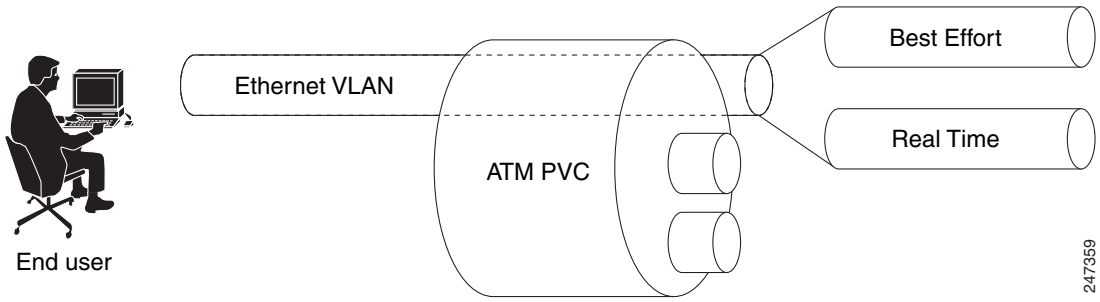
VLAN-Based Service Differentiation over ADSL

VLAN-Based service differentiation allows service providers to offer a range of broadband-enabled services and applications to end users. It supports IP connectivity applications that require real-time network performance and applications that use best-effort, or Internet-grade performance.

This feature allows the local VLAN configuration and class-of-traffic configuration to be preserved. An administrator need not change the original 802.1p class-of-traffic tags or 802.1q VLAN tags. The original VLAN tag in an inbound packet is changed to the value configured by the Cisco IOS **bridge-dot1q encap** command before it leaves the router. For example, if the command **bridge-dot1q encap 10** command were entered, a VLAN tag of 70 in a packet inbound from the local network would be changed to a value of 10 in the egress packet. Any 802.1p value is changed to 0, and non VLAN-tagged frames are discarded.

From an Ethernet perspective, this service is carried over a dedicated VLAN from the handover point to the end user premises. This is shown in Figure 1.

Figure 1 VLAN-Based Service Differentiation at PVC Level



The Ethernet VLAN used by the voice, video, and data services must be identified at the customer premises by an 802.1q VLAN ID configured using the **bridge-dot1q encap** Cisco IOS CLI command. The VLAN is identified at the service provider's end by a service-provider-assigned 802.1ad customer VLAN ID.

The **bridge-dot1q encap** Cisco IOS CLI command changes the local VLAN ID to the VLAN ID required by the service provider to implement VLAN-based service differentiation.The operation of this command is shown in Figure 2 on page 4.

REVIEW DRAFT—CISCO CONFIDENTIAL

Figure 2 Operation of bridge-dot1q encap command

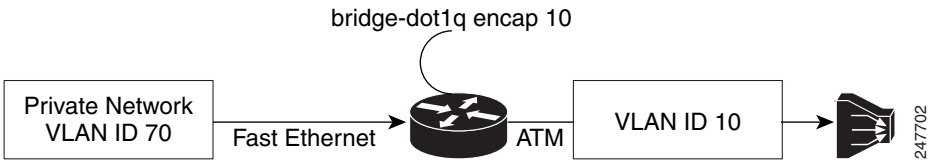


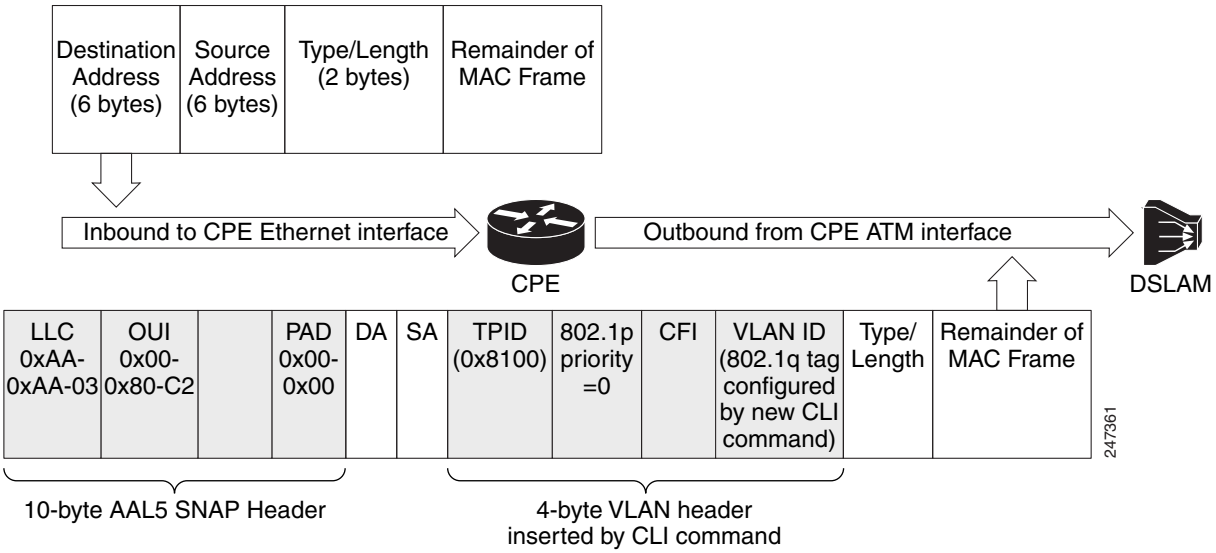
Figure 3 and Figure 4 show the PDU data structure in greater detail.

Transporting 802.1q Tags

A new Cisco IOS command inserts the 802.1q VLAN tag into the MAC PDU, and this PDU is sent to the DSLAM. Incoming and outgoing PDU structures are shown in Figure 3 and in Figure 4.

Figure 3 on page 4 shows the packet structure when the incoming Ethernet frames do not have a VLAN header.

Figure 3 Incoming and Outgoing Packet Structures When No Incoming VLAN ID is Present

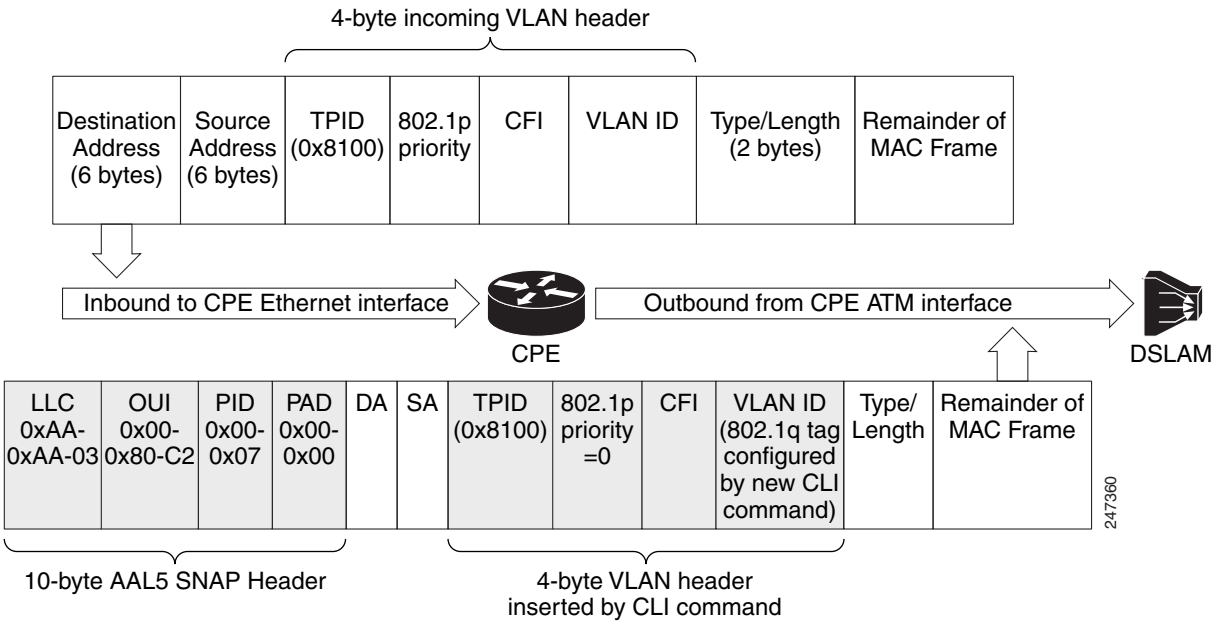


The diagram of the outgoing packet shows that a 4-byte VLAN header has been inserted, with an 802.1p value of 0 (best effort). The VLAN ID value is configured by the command described in this document.

Figure 4 shows the incoming packet structure when the incoming Ethernet packets contain a VLAN header.

REVIEW DRAFT—CISCO CONFIDENTIAL

Figure 4 Incoming and Outgoing Packet Structures When an Incoming VLAN ID is Present



The outgoing packet structure is the same as in Figure 3, but note that whatever 802.1p priority may have been configured is changed to 0, and any VLAN ID configured is set to the ID configured by the command described in this document.

How to Transport 802.1q Tags over ATM PVCs for xDSL

This section contains the following subsections:

Restrictions

- Only one **bridge-dot1q encap** *vlan-id* command can be configured under a PVC.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *subinterface-id* **point-to-point**
4. **bridge-group** *group-number*
5. **pvc** *VPI/VCI*

REVIEW DRAFT—CISCO CONFIDENTIAL

6. **encapsulation aal5snap**
7. **bridge-dot1q encap** *egress-VLAN-ID*
8. **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 atm** *interface-id* **point-to-point** or **interface atm** *slot*/**0 point-to-point** or **interface atm slot**/*port-adaptor*/**0 point-to-point** **Example:** `Router(config)# interface atm0/1/0.1 point-to-point`	Specifies the ATM point-to-point interface using the appropriate format of the command and enters interface or subinterface configuration mode.
Step 4	**bridge-group** *group-number* **Example:** `Router(config-if)# bridge-group 1`	Assigns the interface or subinterface to a bridge group.
Step 5	**pvc** *VPI/VCI* **Example:** `Router(config-if)# pvc 9/117`	Creates a permanent virtual circuit of a specified VPI/VCI number and enters Interface-ATM-VC configuration mode or Subinterface-ATM-VC mode.
Step 6	**encapsulation aal5snap** **Example:** `Router(config-if-atm-vc)# encapsulation aal5snap`	Specifies the ATM Adaptation Layer 5 (AAL5) encapsulation type. AAL5SNAP is used so that two or more protocols can be multiplexed over the virtual circuit.
Step 7	**bridge-dot1q encap** *egress-802.1q-tag* **Example:** `Router(config-if-atm-vc)# bridge-dot1q encap 10`	Causes the 802.1q VLAN ID to be included in the MAC PDU.
Step 8	**end** **Example:** `Router(config-if-atm-vc)# end`	Exits Interface-ATM-VC configuration mode, or Subinterface-ATM-VC configuration mode and returns to privileged EXEC mode.

REVIEW DRAFT—CISCO CONFIDENTIAL

Troubleshooting the Transport of 802.1q Tags over ATM PVCs for ADSL

If the 802.1q tags are not being transported in the MAC PDUs sent to the DSLAM, verify that the following configuration commands are in place:

- That the **bridge-dot1q encap** *vlan-id* Cisco IOS CLI command has been configured under the PVC that will carry the tagged traffic.
- That the **encapsulation aal5snap** Cisco IOS CLI command has been configured under the PVC that will carry the tagged traffic.

Configuration Examples for Transporting 802.1q Tags over ATM PVCs for ADSL

Three use case examples are provided in this section:

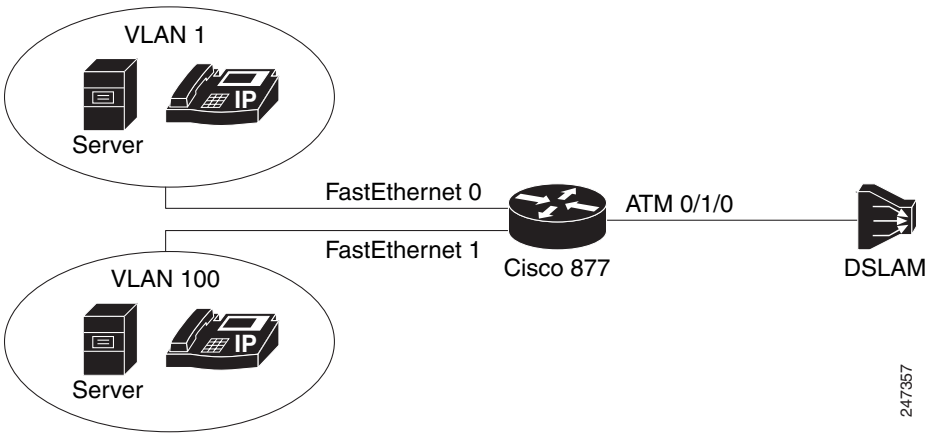
- Example for Use Case 1, page 7
- Example for Use Case 2, page 8

Example for Use Case 1

In this use case, traffic from multiple incoming VLANs is bridged to a single outgoing VLAN. The traffic is arriving on Layer-2 Fast Ethernet ports, and a DHCP server assigns IP addresses on the private network. Network Address Translation (NAT) is enabled. A static IP address is used on the outgoing BVI interface.

This topology is shown in Figure 5.

Figure 5 Use Case 1 Topology



The following configuration is for the Cisco 877 router.

```
ip dhcp excluded-address 192.168.10.1
ip dhcp excluded-address 192.168.20.1
!
ip dhcp pool test_pool1
   network 192.168.10.0 255.255.255.0
   default-router 192.168.10.1
```

REVIEW DRAFT—CISCO CONFIDENTIAL

```
!
ip dhcp pool test_pool2
   network 192.168.20.0 255.255.255.0
   default-router 192.168.20.1
!
!
bridge irb
!
!
interface ATM0
 no ip address
 no atm ilmi-keepalive
!
interface ATM0.1 point-to-point
 bridge-group 1
 bridge-group 1 spanning-disabled
 pvc 0/110
  bridge-dot1q encap 10
  encapsulation aal5snap
!
interface FastEthernet0
 switchport access vlan 1
!
interface FastEthernet1
 switchport access vlan 100
!

interface Vlan1
 ip address 192.168.10.1 255.255.255.0
 ip nat inside
 ip virtual-reassembly
!
interface Vlan100
 ip address 192.168.20.1 255.255.255.0
 ip nat inside
 ip virtual-reassembly
!

interface BVI1
 ip address 12.0.0.1 255.0.0.0
 ip nat outside
 ip virtual-reassembly
!
ip forward-protocol nd
ip route 0.0.0.0 0.0.0.0 12.0.0.2
ip nat pool test 12.0.0.1 12.0.0.1 netmask 255.0.0.0
ip nat inside source list 101 pool test overload
ip nat inside source list 102 pool test overload
!
access-list 101 permit ip 192.168.10.0 0.0.0.255 any log
access-list 102 permit ip 192.168.20.0 0.0.0.255 any log
!
bridge 1 protocol ieee
bridge 1 route ip
!
```

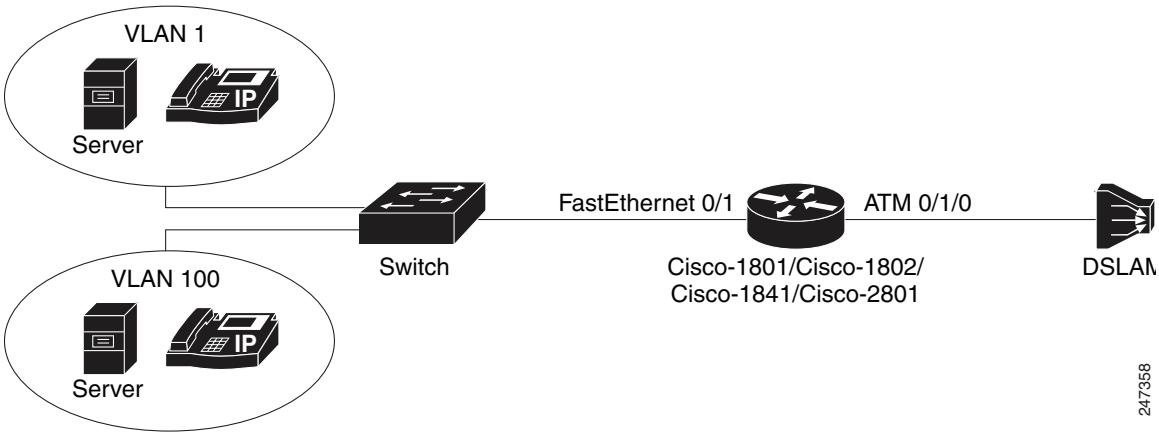
Example for Use Case 2

In this use case traffic from multiple VLANs arrive at the router over a Layer-3 port. All this traffic is bridged over a single ATM virtual circuit to the service provider's DSLAM and tagged with a single VLAN tag. Both WAN and LAN IP addresses are provided by DHCP servers.

REVIEW DRAFT—CISCO CONFIDENTIAL

This topology is shown in Figure 6.

Figure 6 Use Case 2 Topology



The following configuration is for the Cisco 877 router.

```
ip dhcp excluded-address 192.168.10.1
ip dhcp excluded-address 192.168.20.1
!
ip dhcp pool test_pool1
   network 192.168.10.0 255.255.255.0
   default-router 192.168.10.1
!
ip dhcp pool test_pool2
   network 192.168.20.0 255.255.255.0
   default-router 192.168.20.1
!
bridge irb
!
!
interface FastEthernet0/1
 no ip address
 duplex auto
 speed auto
!
 interface FastEthernet0/1.1
 encapsulation dot1Q 100
 ip address 192.168.10.1 255.255.255.0
 ip nat inside
 ip virtual-reassembly
!
interface FastEthernet0/1.2
 encapsulation dot1Q 1 native
 ip address 192.168.20.1 255.255.255.0
 ip nat inside
 ip virtual-reassembly
!
interface ATM0/1/0
 no ip address
 no atm ilmi-keepalive
!
!
interface ATM0/1/0.1 point-to-point
 bridge-group 1
 bridge-group 1 spanning-disabled
 pvc 9/117
```

REVIEW DRAFT—CISCO CONFIDENTIAL

```
  bridge-dot1q encap 10
  encapsulation aal5snap
!
!
interface BVI1
 ip address dhcp
 ip nat outside
 ip virtual-reassembly
!
ip forward-protocol nd
!
ip nat inside source list 101 interface BVI1 overload
ip nat inside source list 102 interface BVI1 overload
!
access-list 101 permit ip 192.168.10.0 0.0.0.255 any log
access-list 102 permit ip 192.168.20.0 0.0.0.255 any log
!
bridge 1 protocol ieee
bridge 1 route ip
```

Additional References

The following sections provide references related to the Transporting 802.1q Tags over ATM PVCs for ADSL feature.

Related Documents

Related Topic	Document Title
ATM Commands	Cisco IOS Asynchronous Transfer Mode Command Reference

Standards

Standard	Title
IEEE 802.1p	Traffic Class Expediting and Dynamic Multicast Filtering
IEEE 802.1q	Virtual LANs
IEEE 802.3	LAN/MAN CSMA/CD (Ethernet) Access Method
ITU-T I363.5	B-ISDN ATM Adaptation Layer Specification: Type 5 AAL
ITU-T G.992.1 (G.dmt)	Asymmetrical Digital Subscriber Line (ADSL) Transceivers
ITU-T G.992.5	Asymmetrical Digital Subscriber Line (ADSL) Transceivers–Extended Bandwidth ADSL2 (ADSL2+)

REVIEW DRAFT—CISCO CONFIDENTIAL

MIBs

MIB	MIBs Link
None	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

RFC	Title
RFC 2684	Multiprotocol Encapsulation over ATM Adaptation Layer 5

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

Command Reference

This section documents one new command only.

- **bridge-dot1q**

bridge-dot1q

To transport a VLAN ID over an ATM ADSL link, use the **bridge-dot1q** command in PVC configuration mode. To prevent a VLAN ID from being sent across the link, use the no form of this command.

bridge-dot1q encap *outbound-vlan-id*

no bridge-dot1q encap *outbound-vlan-id*

REVIEW DRAFT—CISCO CONFIDENTIAL

Syntax Description

outbound-vlan-id	The VLAN ID to be carried over an ATM ADSL link. The valid value of the VLAN ID can range from 1 to 4094.

Command Default

The command is enabled in point-to-point subinterface.

Command Modes

ATM PVC configuration mode (config-if-atm-vc).

Command History

Release	Modification
15.0(1)XA	This command was introduced.

Usage Guidelines

See Restrictions for Transporting 802.1q Tags over ATM PVCs for ADSL, page 2, and Restrictions, page 5.

Glossary

802.1ad—An amendment to IEEE 802.1q that enables a service provider to offer bridged VLANs over its network.

802.1p—A 3 bit field within an Ethernet frame header when using IEEE 802.1Q on an IEEE 802.1D network. It specifies a priority value of between 0 and 7 inclusive that can be used by Quality of Service (QoS) disciplines to differentiate traffic.

802.1q—A networking standard written by the IEEE 802.1 workgroup allowing multiple bridged networks to transparently share the same physical network link without leakage of information between networks. 802.1q is commonly referred to as VLAN tagging.

AAL5SNAP—ATM Adaptation Layer 5 Subnetwork Protocol Access Protocol. A type of network encapsulation that supports multiplexing of 2 or more protocols over a virtual circuit.

ATM—Asynchronous Transfer Mode. The international standard for cell relay in which multiple service types (such as voice, video, or data) are conveyed in fixed-length (53-byte) cells. Fixed-length cells allow cell processing to occur in hardware, thereby reducing transit delays. ATM is designed to take advantage of high-speed transmission media, such as E3, SONET, and T3.

BVI—Bridge Group Virtual Interface. Logical Layer 3-only interface associated with a bridge group when IRB is configured.

CPE—customer premises equipment. Terminating equipment, such as terminals, telephones, and modems, supplied by the telephone company, installed at customer sites, and connected to the telephone company network. Can also refer to any telephone equipment residing on the customer site.

CVLAN—Customer Virtual Local Area Network.

DSL—digital subscriber line. Public network technology that delivers high bandwidth over conventional copper wiring at limited distances. There are four types of DSL: ADSL, HDSL, SDSL, and VDSL.

DSLAM—digital subscriber line access multiplexer. A device that connects many digital subscriber lines to a network by multiplexing the DSL traffic onto one or more network trunk lines.

REVIEW DRAFT—CISCO CONFIDENTIAL

IRB—integrated routing and bridging. Integrated Services Digital Network (ISDN) User Part. An upper-layer application supported by Signalling System 7 for connection set up and tear down.

NAT—Network Address Translation. Mechanism for reducing the need for globally unique IP addresses. NAT allows an organization with addresses that are not globally unique to connect to the Internet by translating those addresses into globally routable address space. Also known as Network Address Translator.

PVC—permanent virtual circuit (or connection). A virtual circuit that is permanently established. PVCs save bandwidth associated with circuit establishment and tear down in situations where certain virtual circuits must exist all the time. In ATM terminology, called a permanent virtual connection.

VoIP—Voice over IP. The capability to carry normal telephony-style voice over an IP-based internet with POTS-like functionality, reliability, and voice quality.

CCDE, CCENT, CCSI, Cisco Eos, Cisco HealthPresence, Cisco Ironport, the Cisco logo, Cisco Lumin, Cisco Nexus, Cisco Nurse Connect, Cisco Stackpower, Cisco StadiumVision, Cisco TelePresence, Cisco Unified Computing System, Cisco WebEx, DCE, Flip Channels, Flip for Good, Flip Mino, Flip Video, Flip Video (Design), Flipshare (Design), Flip Ultra, and Welcome to the Human Network are trademarks; Changing the Way We Work, Live, Play, and Learn, Cisco Store, and Flip Gift Card are service marks; and Access Registrar, Aironet, AsyncOS, Bringing the Meeting To You, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, CCSP, CCVP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Collaboration Without Limitation, EtherFast, EtherSwitch, Event Center, Fast Step, Follow Me Browsing, FormShare, GigaDrive, HomeLink, Internet Quotient, IOS, iPhone, iQuick Study, IronPort, the IronPort logo, LightStream, Linksys, MediaTone, MeetingPlace, MeetingPlace Chime Sound, MGX, Networkers, Networking Academy, Network Registrar, PCNow, PIX, PowerPanels, ProConnect, ScriptShare, SenderBase, SMARTnet, Spectrum Expert, StackWise, The Fastest Way to Increase Your Internet Quotient, TransPath, WebEx, and the WebEx logo are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0907R)

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

© 2009 Cisco Systems, Inc. All rights reserved.

REVIEW DRAFT—CISCO CONFIDENTIAL