Broadband Access Aggregation and DSL Configuration Guide, Cisco IOS Release 12.2SX

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CONTENTS

Providing Protocol Support for Broadband Access Aggregation of PPP over ATM Sessions

PPP over ATM enables a high-capacity central site router with an ATM interface to terminate multiple remote PPP connections. PPP over ATM provides security validation per user, IP address pooling, and service selection capability.

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 Table at the end of this document.

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

Prerequisites for Providing Protocol Support for Broadband Access Aggregation of PPP over ATM Sessions

- You must understand the concepts described in the "Understanding Broadband Access Aggregation" module.
- Optionally you may perform the preparation tasks in the "Preparing for Broadband Access Aggregation" module

Restrictions for Providing Protocol Support for Broadband Access Aggregation of PPP over ATM Sessions

PPP over ATM cannot be configured on IETF-compliant Logical Link Control (LLC) encapsulated PPP over ATM.

Information About Providing Protocol Support for Broadband Access Aggregation of PPP over ATM Sessions

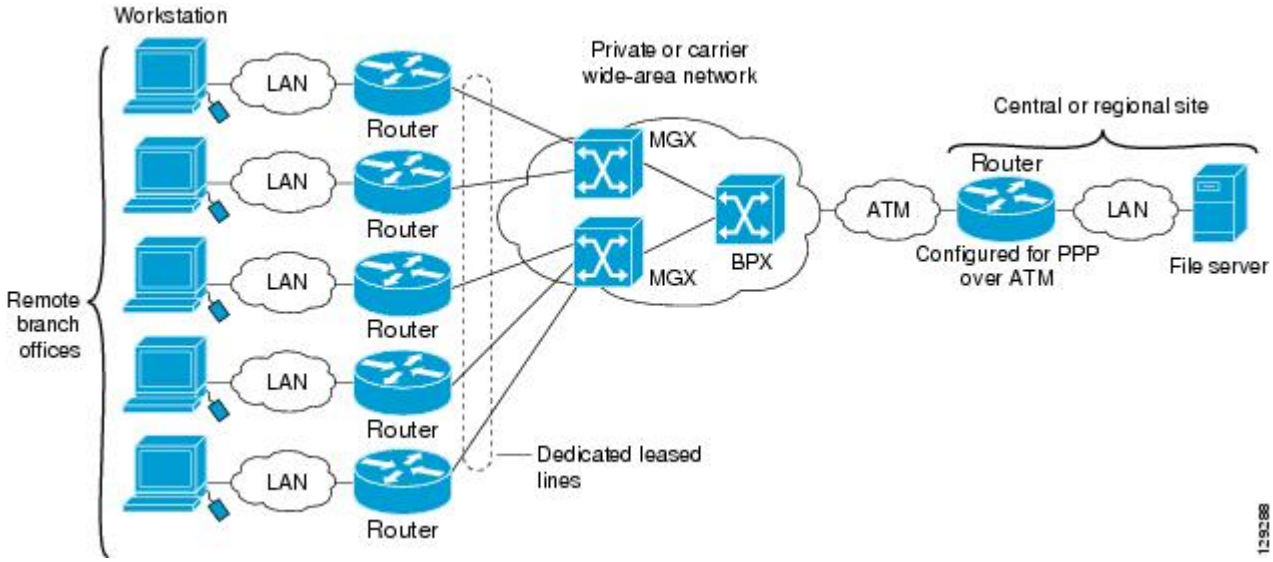
PPP over ATM Configuration Scenario

PPP over ATM can be configured on all platforms running Cisco IOS Release 12.1 or later.

Note All forms of PPP over ATM are supported on the ATM port adapters, except for the PA-A1 ATM port adapter for Cisco IOS Release 12.1. All forms of PPP over ATM are now supported on the enhanced ATM port adapter for Cisco IOS Release 12.1 or later.

The figure below shows a typical scenario for using Cisco-proprietary PPP over ATM.

Figure 1 PPP-over-ATM Network Environment



Note If you need to configure the Cisco MGX 8220 shelf for frame forwarding at the remote sites, refer to the Cisco MGX 8220 Command Supplement for command line instructions or the Cisco StrataView Plus Operations Guide for StrataView Plus instructions. If you configure the MGX using the command line interface, use the **addport** and **addchan** commands and select frame forwarding for the *port-type* and *chan-type* arguments, respectively.

Virtual Access Interface

When you configure PPP over ATM, a logical interface known as a *virtual access interface* associates each PPP connection with an ATM VC. You can create this logical interface by configuring an ATM permanent virtual circuit (PVC) or switched virtual circuit (SVC). This configuration encapsulates each PPP connection in a separate PVC or SVC, allowing each PPP connection to terminate at the router ATM interface as if received from a typical PPP serial interface.

The virtual access interface for each virtual circuit (VC) obtains its configuration from a virtual interface template (virtual template) when the VC is created. Before you create the ATM VC, it is recommended that you create and configure a virtual template as described in the "Preparing for Broadband Access Aggregation" module.

Once you have configured the router for PPP over ATM, the PPP subsystem starts and the router attempts to send a PPP configure request to the remote peer. If the peer does not respond, the router periodically goes into a listen state and waits for a configuration request from the peer.

The virtual access interface is associated with the VC after LCP negotiation completes. When the PPP session goes down, the virtual access interface is no longer associated with the VC and is returned to the pool of free virtual-access interfaces.

If you set a keepalive timer of the virtual template on the interface, the virtual access interface uses the PPP echo mechanism to verify the existence of the remote peer.

The following three types of PPP over ATM connections are supported:

- IETF-compliant MUX encapsulated PPP over ATM
- IETF-compliant LLC encapsulated PPP over ATM
- Cisco-proprietary PPP over ATM

Autosense for ATM PVCs

The PPPoA/PPPoE autosense for ATM PVCs feature enables a router to distinguish between incoming PPP over ATM (PPPoA) and PPP over Ethernet (PPPoE) over ATM sessions and to create virtual access based on demand for both PPP types.

Note The PPPoA/PPPoE autosense for ATM PVCs feature is supported on SNAP-encapsulated ATM PVCs only. It is not supported on MUX-encapsulated PVCs.

- Benefits of Autosense for ATM PVCs, page 3

Benefits of Autosense for ATM PVCs

Autosense for ATM PVCs provides resource allocation on demand. For each permanent virtual circuit (PVC) configured for both PPPoA and PPPoE, certain resources (including one virtual-access interface) are

allocated upon configuration, regardless of the existence of a PPPoA or PPPoE session on that PVC. With the autosense for ATM PVCs, resources are allocated for PPPoA and PPPoE sessions only when a client initiates a session, thus reducing overhead on the network access server (NAS).

How to Provide Protocol Support for Broadband Access Aggregation of PPP over ATM Sessions

Configuring IETF-Compliant MUX Encapsulated PPP over ATM

Internet Engineering Task Force (IETF)-compliant multiplexer (MUX) encapsulated PPP over ATM, also known as null encapsulation, allows you to configure PPP over ATM using a VC multiplexed encapsulation mode. This feature complies with IETF RFC 2364 entitled PPP over AAL5.

You can configure ATM PVCs for IETF-compliant MUX encapsulated PPP over ATM on either point-to-point or multipoint subinterfaces. Multiple PVCs on multipoint subinterfaces significantly increase the maximum number of PPP-over-ATM sessions running on a router. You can configure IETF-compliant MUX encapsulated PPP over ATM over a single ATM PVC or an ATM PVC range.

IETF-compliant PPP over ATM is not supported on ATM SVCs and can only be applied to PVCs.

The IETF-compliant PPP over ATM feature was designed to support installations with AppleTalk Data Stream Protocol (ADSL) circuits. For an example of using ADSL termination, see the ADSL Termination Example, page 26.

Perform this task to configure IETF-compliant MUX Encapsulated PPP over ATM.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Do one of the following:
   - **interface atm** *slot/port.subinterface-number* **point-to-point**
   -
   - or
   - **interface atm** *number.subinterface-number* **point-to-point**
   -
   -
   - **interface atm** *slot/port.subinterface-number* **multipoint**
   -
   -
   - **interface atm** *number.subinterface-number* **multipoint**
4. Do one of the following:
   - **pvc** [*name*] *vpi* / *vci*
   -
   -
   - **range** [*range-name*] **pvc** *start-vpi* / *start-vci end-vpi* / *end-vci*
5. **encapsulation aal5mux ppp virtual-template** *number*

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.

Command or Action	Purpose

Step 3 Do one of the following:
• **interface atm** *slot/port.subinterface-number* **point-to-point**
•
• or
• **interface atm** *number.subinterface-number* **point-to-point**
•
•
• **interface atm** *slot/port.subinterface-number* **multipoint**
•
•
• **interface atm** *number.subinterface-number* **multipoint**
 	
Example:
`Router(config)# interface atm 6/0.200 point-to-point`
 	
Example:
 	
Example:
 	
Example:
`Router(config)# interface atm 1/0/0.4 multipoint`
	Specifies the ATM point-to-point or multipoint subinterface using the appropriate format of the **interface atm** command.[1]

1 To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.

	Command or Action	Purpose

Step 4	Do one of the following:
	• **pvc** [*name*] *vpi* / *vci*
	•
	•
	• **range** [*range-name*] **pvc** *start-vpi* / *start-vci end-vpi* / *end-vci*
	Example:
	`Router(config-subif)# pvc cisco 0/5`
	Example:
	Example:
	`or`
	Example:
	`Router(config-subif)# range range1 pvc 1/200 1/299`
		Configures the PVC or a range of PVCs.

Step 5	**encapsulation aal5mux ppp virtual-template** *number*
	Example:
	`Router(config-subif-atm-vc)# encapsulation aal5mux ppp virtual-template 3`
	Example:
	`or`
	Example:
	`Router(config-subif-atm-range) encapsulation aal5mux ppp virtual-template 3`
		Configures VC multiplexed encapsulation on a PVC or PVC range.

Configuring IETF-Compliant LLC Encapsulated PPP over ATM

IETF-compliant LLC encapsulated PPP over ATM allows you to configure PPP over ATM with LLC encapsulation. It accommodates Frame Relay-to-ATM service interworking (Frame Relay Forum standard FRF.8). There is no equivalent VC multiplexed encapsulation mode for Frame Relay; therefore, LLC encapsulation is required for Frame Relay-to-ATM networking. This version of PPP over ATM also enables you to carry multiprotocol traffic. For example, a VC will carry both PPP and IPX traffic.

The figure below shows Frame Relay-to-ATM interworking.

Figure 2 Frame Relay-to-ATM Interworking

You can configure ATM PVCs for IETF-compliant LLC encapsulated PPP over ATM on either point-to-point or multipoint subinterfaces. Multiple PVCs on multipoint subinterfaces significantly increase the maximum number of PPP-over-ATM sessions running on a router.

You can also configure IETF-compliant LLC encapsulated PPP over ATM in a VC class and apply this VC class to an ATM VC, subinterface, or interface. For information about configuring a VC class, refer to the section "Configuring VC Classes" in the module "Configuring ATM."

Note Depending on whether you configure IETF-compliant LLC encapsulated PPP over ATM directly on a PVC or interface, your PVC will inherit the configuration that takes highest precedence. For a description of the inheritance hierarchy, see the **protocol** command in the Cisco IOS Wide-Area Networking Command Reference Guide.

Perform this task to configure IETF-compliant LLC encapsulated PPP over ATM on a PVC or range of PVCs.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Do one of the following:
   - **interface atm** *slot/port.subinterface-number* **point-to-point**
   - or
   - **interface atm** *number.subinterface-number* **point-to-point**
   - **interface atm** *slot/port.subinterface-number* **multipoint**
   - or
   - **interface atm** *number.subinterface-number* **multipoint**
4. Do one of the following:
   - **pvc** [*name*] *vpi* / *vci*
   - **range** [*range-name*] **pvc** *start-vpi* / *start-vci end-vpi*/*end-vci*
5. **encapsulation aal15snap**
6. protocol ppp virtual-template *number*

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	Do one of the following:
	• **interface atm** *slot/port.subinterface-number* **point-to-point**
	• or
	• **interface atm** *number.subinterface-number* **point-to-point**
	• **interface atm** *slot/port.subinterface-number* **multipoint**
	• or
	• **interface atm** *number.subinterface-number* **multipoint**
	
	Example:
	`Router(config)# interface atm 6/0.200 point-to-point`
	
	Example:
	`Router(config)# interface atm 1/0/0.4 multipoint`
		Specifies the ATM point-to-point or multipoint subinterface using the appropriate format of the **interface atm** command.[2]

2 To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.

	Command or Action	Purpose

Step 4	Do one of the following:
	• **pvc** [*name*] *vpi* / *vci*
	• **range** [*range-name*] **pvc** *start-vpi* / *start-vci end-vpi*/*end-vci*
	
	Example:
	`Router(config-subif)# pvc cisco 0/5`
	
	Example:
	`or`
	
	Example:
	`Router(config-subif)# range range1 pvc 1/200 1/299`
		Configures the PVC or a range of PVCs.

Step 5	**encapsulation aal15snap** **Example:** `Router(config-subif-atm-vc)#` **encapsulation aal15snap** **Example:** `or` **Example:** `Router(config-subif-atm-range)#` **encapsulation aal15snap**	Configures LLC SNAP encapsulation on the PVC or range of PVCs.[3]

3 "SNAP encapsulation" is a misnomer here, since this encapsulation configures both LLC and SNAP encapsulation on the VC. If SNAP encapsulation is not configured at a lower inheritance level, or another type of encapsulation is configured at a lower inheritance level, you will have to configure both SNAP and the protocol ppp command to ensure that PPP over ATM with LLC encapsulation is configured on your VC.

	Command or Action	Purpose

Step 6	protocol ppp virtual-template *number*
	
	Example:
	`Router(config-subif-atm-vc)# protocol ppp virtual-template 2`
	
	Example:
	`or`
	
	Example:
	`Router(config-subif-atm-range)# protocol ppp virtual-template 2`
		Configures IETF PPP over ATM LLC encapsulation on the PVC or range of PVCs.

Configuring Cisco-Proprietary PPP over ATM PVCs

You can configure ATM PVCs for Cisco-proprietary PPP over ATM on either point-to-point or multipoint subinterfaces. Configuring multiple PVCs on multiple subinterfaces significantly increases the maximum number of PPP-over-ATM sessions running on a router. Remote branch offices must have Cisco-proprietary PPP over ATM configured on PPP-compatible devices interconnecting directly to Cisco's ATM Switch Interface Shelf (AXIS) equipment through a leased-line connection. The shelves provide frame forwarding encapsulation and are terminated on BPX cores prior to connecting to a Cisco 7500 series router.

Perform this task to configure Cisco-proprietary PPP over ATM on a PVC or range of PVCs.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Do one of the following:
   - **interface atm** *slot/port.subinterface-number* **point-to-point**
   -
   - or
   - **interface atm number .** *subinterface-number* **point-to-point**
   -
   -
   - **interface atm** *slot/port.subinterface-number* **multipoint**
   -
   -
   - **interface atm** *number.subinterface-number* **multipoint**
4. Do one of the following:
   - **pvc** [*name*] *vpi* / *vci*
   -
   -
   - **range** [*range-name*] **pvc** *start-vpi* / *start-vci end-vpi* / *end-vci*
5. **encapsulation aal5ciscoppp virtual-template** *number*

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.

Command or Action	Purpose

Step 3 Do one of the following:
• **interface atm** *slot/port.subinterface-number* **point-to-point**
•
• or
• **interface atm number .** *subinterface-number* **point-to-point**
•
•
• **interface atm** *slot/port.subinterface-number* **multipoint**
•
•
• **interface atm** *number.subinterface-number* **multipoint**
 	
Example:
`Router(config)# interface atm 6/0.200 point-to-point`
 	
Example:
 	
Example:
 	
Example:
`Router(config)# interface atm 1/0/0.4 multipoint`
	Specifies the ATM point-to-point or multipoint subinterface using the appropriate format of the **interface atm** command.[4]

4 To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.

	Command or Action	Purpose

Step 4	Do one of the following:
	• **pvc** [*name*] *vpi* / *vci*
	•
	•
	• **range** [*range-name*] **pvc** *start-vpi* / *start-vci end-vpi* / *end-vci*
	Example:
	`Router(config-subif)# pvc cisco 0/5`
	Example:
	Example:
	`or`
	Example:
	`Router(config-subif)# range range1 pvc 1/200 1/299`
		Configures the PVC or a range of PVCs.

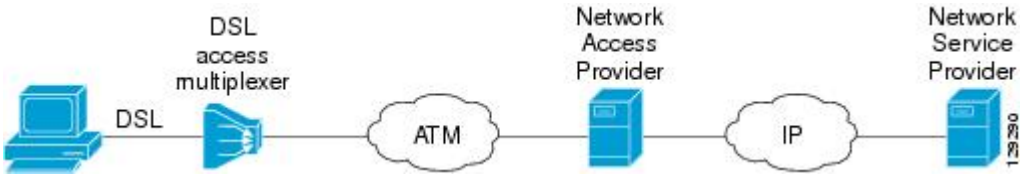
Step 5	**encapsulation aal5ciscoppp virtual-template** *number*
	Example:
	`Router(config-subif-atm-vc)# encapsulation aal5ciscoppp virtual-template 4`
	Example:
	Example:
	`or`
	Example:
	`Router(config-subif-atm-range)# encapsulation aal5ciscoppp virtual-template 3`
		Configures Cisco-proprietary PPP over ATM encapsulation on a PVC or PVC range.

Configuring SVCs for NAPs and NSPs

When PPP over ATM is configured over an SVC rather than a PVC, an ATM SVC is established using a configured ATM address each time an end user initiates a connection to a Network Access Provider (NAP) or Network Service Provider (NSP). A PPP session is then established over the SVC. By using PPP, the NAPs and NSPs can authenticate users and provide suitable access to the various services being offered. Whereas PVCs require that services and destination addresses be predetermined, using PPP over ATM SVCs allows users to choose services and the quality of those services dynamically on the basis of the destination address.

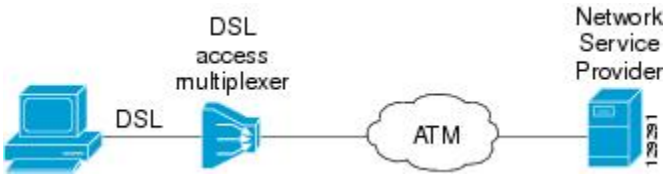
The figure below shows a typical network topology for PPP over ATM SVCs terminating at an NAP.

Figure 3 PPP over ATM SVC Terminating at a Network Access Provider



The figure below shows a typical network topology of PPP over ATM SVCs terminating at an NSP.

Figure 4 PPP over ATM SVC Terminating at a Network Service Provider



The PPP over ATM SVCs feature works by associating each PPP session with a virtual-access interface. Each virtual-access interface is associated with an SVC. The SVCs use static maps that hold information about the encapsulation type and virtual template number. A single static map can accept multiple PPP over ATM SVC calls.

Perform this task to configure PPP over an ATM SVC.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Do one of the following:
   - **interface atm** *slot/port.subinterface-number* **point-to-point**
   -
   - or
   - **interface atm** *number.subinterface-number* **point-to-point**
   -
   -
   - **interface atm** *slot/port.subinterface-number* **multipoint**
   -
   -
   - **interface atm** *number.subinterface-number* **multipoint**
4. **svc** [*name*]
5. **encapsulation aal5auto**
6. **protocol ppp virtual-template** *number*
7. **max vc** *number*
8. **max bandwidth** *kbps*
9. **exit**
10. **exit**
11. **atm nsap-address** *nsap-address*
12. exit
13. **show atm svc**
14. **show atm svc ppp**

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.

	Command or Action	Purpose

Step 3	Do one of the following:
	• **interface atm** *slot/port.subinterface-number* **point-to-point**
	•
	• or
	• **interface atm** *number.subinterface-number* **point-to-point**
	•
	•
	• **interface atm** *slot/port.subinterface-number* **multipoint**
	•
	•
	• **interface atm** *number.subinterface-number* **multipoint**
	
	Example:
	`Router(config)# interface atm 6/0.200 point-to-point`
	
	Example:
	
	Example:
	
	Example:
	`Router(config)# interface atm 1/0/0.4 multipoint`
		Specifies the ATM point-to-point or multipoint subinterface using the appropriate format of the **interface atm** command.[5]

Step 4	**svc** [*name*] **Example:** `Router(config-subif)# svc cisco`	Configures the SVC.
Step 5	**encapsulation aal5auto** **Example:** `Router(config-subif-atm-vc)# encapsulation aal5auto`	Specifies encapsulation auto, which allows the SVC to use either aal5snap or aal5mux encapsulation types.

5 To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.

	Command or Action	Purpose
Step 6	**protocol ppp virtual-template** *number* **Example:** `Router(config-subif-atm-vc)# protocol ppp virtual-template 6`	Specifies that PPP is established over the ATM SVC using the configuration from the specified virtual template.
Step 7	**max vc** *number* **Example:** `Router(config-subif-atm-vc)# max vc 5`	Specifies the maximum number of SVCs that can be established using the current configuration.
Step 8	**max bandwidth** *kbps* **Example:** `Router(config-subif-atm-vc)# max bandwidth 564`	Specifies the total amount of bandwidth available to all SVCs in the current configuration.
Step 9	**exit** **Example:** `Router(config-subif-atm-vc)# exit`	Exits VC configuration mode and returns to subinterface configuration mode.
Step 10	**exit** **Example:** `Router(config-subif)# exit`	Exits subinterface configuration mode and returns to interface configuration mode.

Step 11	**atm nsap-address** *nsap-address*
	
	Example:
	`Router(config)#`
	`atm nsap-address AB.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12`
		Sets the network service access point (NSAP) address for the ATM interface.

Step 12	exit **Example:** `Router(config)# exit`	Exits configuration mode and returns to EXEC command mode.

	Command or Action	Purpose
Step 13	**show atm svc** **Example:** `Router# show atm svc`	Displays all ATM SVCs and traffic information.
Step 14	**show atm svc ppp** **Example:** `Router# show atm svc ppp`	Displays information about each SVC configured for PPP over ATM.

Configuring PPPoA Autosense for a Single PVC

Perform the following task to configure PPPoA/PPPoE autosense on a PVC.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Do one of the following:
   - **interface atm** *slot/port.subinterface-number* **point-to-point**
   -
   - or
   - **interface atm number .** *subinterface-number* **point-to-point**
   -
   -
   - **interface atm** *slot/port.subinterface-number* **multipoint**
   -
   -
   - **interface atm** *number.subinterface-number* **multipoint**
4. **pvc** [*name*] *vpi/vci*
5. **encapsulation aal5autoppp virtual-template** *number*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Step 3	Do one of the following:
	• **interface atm** *slot/port.subinterface-number* **point-to-point**
	•
	• or
	• **interface atm number .** *subinterface-number* **point-to-point**
	•
	•
	• **interface atm** *slot/port.subinterface-number* **multipoint**
	•
	•
	• **interface atm** *number.subinterface-number* **multipoint**
	
	Example:
	`Router(config)# interface atm 6/0.200 point-to-point`
	
	Example:
	
	Example:
	
	Example:
	`Router(config)# interface atm 1/0/0.4 multipoint`
		Specifies the ATM point-to-point or multipoint subinterface using the appropriate format of the **interface atm** command.[6]

Step 4	**pvc** [*name*] *vpi*/*vci* **Example:** `Router(config-subif)# pvc cisco 0/5`	Configures the PVC.

6 To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.

	Command or Action	Purpose
Step 5	**encapsulation aal5autoppp virtual-template** *number* **Example:** `Router(config-subif-atm-vc)# encapsulation aal5ciscoppp virtual-template 1`	Configures PPPoA/PPPoE autosense. Also specifies the virtual template interface to use to clone the new virtual-access interface for PPP session on this PVC.

Configuring PPPoA Autosense for a VC Class

Use the following procedure to configure PPPoA/PPPoE autosense on a VC class.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **vc-class atm** *vc-class-name*
4. **encapsulation aal5autoppp virtual-template** *number*
5. **exit**
6. Do one of the following:
   - **interface atm** *slot/port.subinterface-number* **point-to-point**
   -
   - or
   - **interface atm** *number* **.** *subinterface-number* **point-to-point**
   -
   -
   - **interface atm** *slot/port.subinterface-number* **multipoint**
   -
   -
   - **interface atm** *number.subinterface-number* **multipoint**
7. **class-int** *vc-class-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**vc-class atm** *vc-class-name* **Example:** `Router(config)# vc-class atm class3`	Creates and names a map class.
Step 4	**encapsulation aal5autoppp virtual-template** *number* **Example:** `Router(config-vc-class)# encapsulation aal5ciscoppp virtual-template 1`	Configures PPPoA/PPPoE autosense. Also specifies the virtual template interface to use to clone the new virtual-access interface for PPP session on this PVC.
Step 5	**exit** **Example:** `Router(config-vc-class)# exit`	Returns to global configuration mode.

	Command or Action	Purpose

Step 6	Do one of the following:
	• **interface atm** *slot/port.subinterface-number* **point-to-point**
	•
	• or
	• **interface atm** *number* **.** *subinterface-number* **point-to-point**
	•
	•
	• **interface atm** *slot/port.subinterface-number* **multipoint**
	•
	•
	• **interface atm** *number.subinterface-number* **multipoint**
	
	Example:
	`Router(config)# interface atm 6/0.200 point-to-point`
	
	Example:
	
	Example:
	
	Example:
	`Router(config)# interface atm 1/0/0.4 multipoint`
		Specifies the ATM point-to-point or multipoint subinterface using the appropriate format of the **interface atm** command.[7]

Step 7	**class-int** *vc-class-name* **Example:** `Router(config-subif)# class-int class3`	Applies the VC class to all VCs on the ATM interface or subinterface.

Verifying PPPoA Autosense for ATM PVCs

Use the following procedure to verify PPPoA/PPPoE autosense.

7 To determine the correct form of the interface atm command, consult your ATM network module, port adapter, or router documentation.

SUMMARY STEPS

1. **show atm pvc** [**ppp**]
2. **show caller**
3. **show interface virtual access** *number*
4. **show user**
5. **show vpdn**

DETAILED STEPS

Step 1 **show atm pvc** [**ppp**]

After the client at the other end of the PVC has initiated a PPPoA session, use this command to check that the PVC contains the PPPoA session.

Step 2 **show caller**

Use this command to:

- View individual users and consumed resources on the NAS.
- Inspect active call statistics for large pools of connections. (The **debug** commands produce too much output and tax the CPU too heavily.)
- Display the absolute and idle times for each user. The current values for both of these settings are displayed on the TTY line and the asynchronous interface. Users that have been idle for unacceptably long periods of time can be easily identified. By using this information, you can define time-out policies and multiple grades of services for different users.

Example:

```
Router# show caller
Line      User                  Service       Active
  con 0     -                     TTY           00:08:21
  BR0:1     hatteras              PPP           00:00:14
  Vi1       hatteras              PPP   Bundle  00:00:13
```

Step 3 **show interface virtual access** *number*

Displays information about the virtual-access interface, link control protocol (LCP), protocol states, and interface statistics:

Example:

```
Router# show interface virtual access Virtual-Access3
Virtual-Access3 is up, line protocol is up
```

Step 4 **show user**

Displays information about the active lines on the router.

Example:

```
Router# show user

Line User Host(s) Idle Location * 2 vty 0 idle 00:00:00 bru-cse-058.cisco.com tty 2/01 ww Async
interface 00:00:01 PPP: 12.12.12.3
```

Step 5 **show vpdn**

Displays information about active Level 2 Forwarding (L2F) Protocol tunnel and message identifiers in a virtual private dial-up network (VPDN).

Example:

```
Router# show vpdn
Active L2F tunnels
NAS Name    Gateway Name    NAS CLID    Gateway CLID    State
nas         gateway           4             2           open
L2F MIDs
Name                NAS Name     Interface     MID       State
router1@cisco.com       nas           As7          1        open
router2@cisco.com        nas           As8          2        open
```

Configuration Examples for Configuring PPP over ATM

IETF-Compliant MUX Encapsulated PPP over ATM Configuration Examples

This section provides the following examples for configuring IETF-compliant PPP over ATM:

IETF-Compliant PPP over ATM with Different Traffic-Shaping Parameters Example

PVCs with different PPP-over-ATM traffic-shaping parameters can be configured on the same subinterface. In the following example, three PVCs are configured for PPP over ATM on subinterface ATM 2/0.1. PVC 0/60 is configured with IETF-compliant PPP over ATM encapsulation. Its traffic-shaping parameter is an unspecified bit rate with peak cell rate at 500 kbps. PVC 0/70 is also configured with IETF-compliant PPP over ATM encapsulation, but its traffic-shaping parameter is nonreal-time variable bit rate, with peak cell rate at 1 Mbps, sustainable cell rate at 500 kbps, and burst cell size of 64 cells. PVC 0/80 is configured with the Cisco-proprietary PPP over ATM encapsulation. Its traffic-shaping parameter is an unspecified bit rate with peak cell rate at 700 kbps. For further information, refer to the Configuring IETF-Compliant MUX Encapsulated PPP over ATM, page 4 earlier in this module.

```
interface atm 2/0.1 multipoint
```

```
 pvc 0/60
  encapsulation aal5mux ppp virtual-template 3
   ubr 500
  exit


pvc 0/70
 encapsulation aal5mux ppp virtual-template 3
 vbr-nrt 1000 500 64
  exit
pvc 0/80
 encapsulation aal5ciscoppp virtual-template 3
 ubr 700
 exit
```

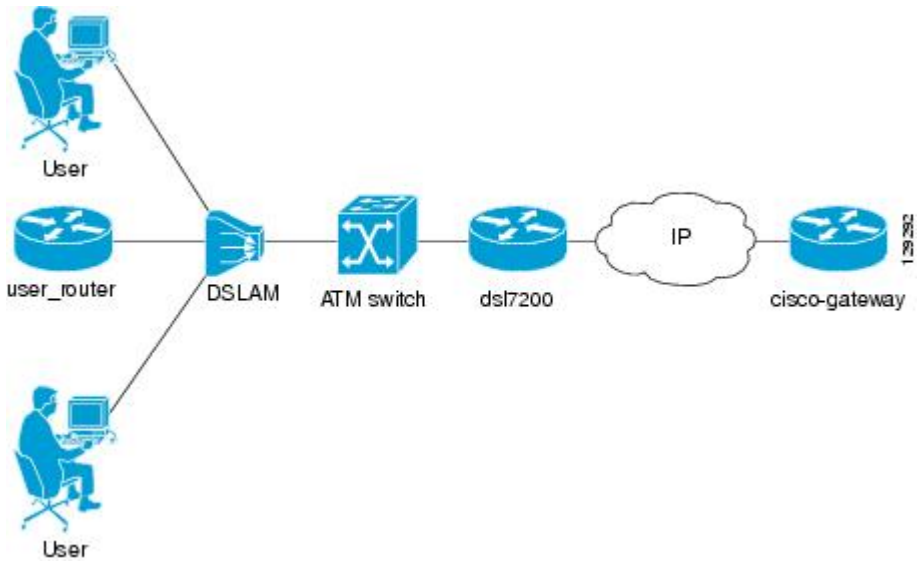
ADSL Termination Example

The IETF-Compliant PPP over ATM feature was designed to support installations with asymmetric digital subscriber line (ADSL) circuits. The figure below illustrates a topology for ADSL termination. This topology allows you to establish a PPP connection to a Cisco 7200 series router.

The example also illustrates the use of PPP tunneling using L2TP to provide VPDN services, in this case for the domain cisco.com. Thus, a user who logs in as bob2257@cisco.com is automatically tunneled to IP address 10.1.2.3. (See the module "Configuring Virtual Private Networks" in the *Cisco IOS VPDN Configuration Guide* for details about setting up VPDN services.)

An example of the commands that you might enter for the user_router, dsl7200, and cisco-gateway (as shown in the figure below) are described below. For further information, refer to the Configuring IETF-Compliant MUX Encapsulated PPP over ATM, page 4 earlier in this module.

Figure 5 ADSL Termination



user_router Configuration

```
interface virtual-template 1
ip address negotiated
ppp chap hostname user_router@cisco.com
ppp chap password 0 cisco
exit
```

```
interface atm 0
pvc 0/40
encapsulation aal5mux ppp virtual-template 1
exit
exit
```

dsl7200 Configuration

```
username user_router@cisco.com password 0 cisco
username dsl7200 password 0 cisco
vpdn enable
vpdn-group 1
request dialin l2tp ip 10.2.1.1 domain cisco.com
interface virtual-template 1
ppp authentication chap
exit
interface atm 2/0
pvc 0/40
encapsulation aal5mux ppp virtual-template 1
exit
exit
```

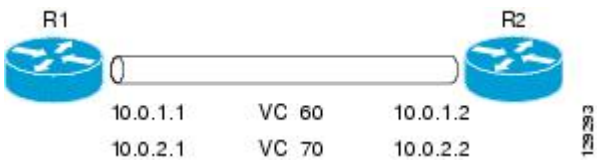
cisco-gateway Configuration

```
username cisco_gateway password 0 cisco
username user_router@cisco.com password 0 cisco
vpdn enable
vpdn-group 1
accept dialin l2tp virtual-template 1 remote dsl7200
interface loopback 0
ip address 10.0.1.1 255.255.255.0
exit
interface virtual-template 1
ip unnumbered loopback 0
peer default ip address pool pool-1
exit
ip local pool pool-1 10.1.2.1 10.1.2.254
```

Two Routers with Back-to-Back PVCs Example

The figure below illustrates an ATM interface with two PPP sessions over two PVC session connections. (See the module "PPP Configuration" in the *Cisco IOS Dial Technologies Configuration Guide* for details on PPP configuration.) The sample commands following the figure below establish the back-to-back router configuration. For further information, refer to the Configuring IETF-Compliant MUX Encapsulated PPP over ATM, page 4 earlier in this module.

Figure 6 Two Routers with Back-to-Back PVCs



R1 Configuration

```
interface atm 2/0
atm clock internal
pvc 0/60
```

```
encapsulation aal5mux ppp virtual-template 1
ubr 90
exit
pvc 0/70
encapsulation aal5mux ppp virtual-template 2
vbr-nrt 90 50 1024
exit
interface virtual-template 1
ip address 10.0.1.1 255.255.255.0
interface virtual-template 2
ip address 10.0.2.1 255.255.255.0
exit
```

R2 Configuration

```
interface atm 2/0.1 multipoint
pvc 0/60
encapsulation aal5mux ppp virtual-template 1
ubr 90
exit
pvc 0/70
encapsulation aal5mux ppp virtual-template 2
vbr-nrt 90 50 1024
exit
exit
interface virtual-template 1
ip address 10.0.1.2 255.255.255.0
exit
interface virtual-template 2
ip address 10.0.2.2 255.255.255.0
```

Multiplexed Encapsulation Using VC Class Example

In the following example, PVC 0/60 is configured on subinterface ATM 2/0.1 with a VC class attached to it. For details on creating and applying a VC class, see the section "Configuring VC Classes" in the module "Configuring ATM." By rule of inheritance, PVC 0/60 runs with IETF-compliant PPP over ATM encapsulation using the configuration from interface virtual-template 1. Its parameter is an unspecified bit rate with peak cell at 90 kbps.

```
interface atm 2/0.1
pvc 0/60
class-vc pvc-ppp
exit
exit
vc-class atm pvc-ppp
encapsulation aal5mux ppp virtual-template 1
ubr 90
exit
```

IETF-Compliant LLC Encapsulated PPP over ATM Configuration Examples

This section provides the following examples for configuring IETF-compliant LLC encapsulated PPP over ATM:

Configuring IETF-Compliant PPP over ATM LLC Encapsulation Example

This example shows how to configure IETF PPP over ATM LLC encapsulation in the VC class called ppp-default. The VC class specifies virtual template 1 from which to spawn PPP interfaces, SNAP

encapsulation (the default), and a UBR class traffic type at 256 kbps. When the VC class ppp-default is configured on interface 0.1, PVC 0/70 inherits these properties. PVC 0/80 overrides virtual template 1 in the VC class and uses virtual template 2 instead. PVC 0/90 also overrides virtual template 1 and uses virtual template 3 instead. In addition, PVC 0/90 uses a VC multiplexed encapsulation and a UBR class traffic type at 500 kbps. For further information, refer to the IETF-Compliant LLC Encapsulated PPP over ATM Configuration Examples, page 28.

```
interface atm 0.1 multipoint
class-int ppp-default
!
pvc 0/70
exit
!
pvc 0/80
protocol ppp virtual-template 2
exit
!
pvc 0/90
encapsulation aal5mux ppp virtual-template 3
ubr 500
exit
exit
!
vc-class atm ppp-default
protocol ppp virtual-template 1
ubr 256
exit
```

Overriding a Virtual Template for IETF-Compliant PPP over ATM Example

This example illustrates how to use inheritance to override a virtual template configuration for muxppp or ciscoppp encapsulation options. For PVC 5/505, since the encapsulation option at that level is ciscoppp virtual template 1, as specified in the VC class called muxppp, the **protocol ppp virtual-template 2** command overrides only the virtual-template configuration. For further information, refer to the IETF-Compliant LLC Encapsulated PPP over ATM Configuration Examples, page 28.

```
interface atm 2/0
class-int muxppp
!
pvc 5/505
protocol ppp virtual-template 2
exit
!
muxppp
encapsulation aal5ciscoppp virtual-template 1
exit
```

Disabling IETF-Compliant PPP over ATM LLC Encapsulation on a Specific VC Example

This example shows how to limit the configuration of a particular LLC encapsulated protocol to a particular VC. First, we see that the VC class called "ppp" is configured with IETF PPP over ATM with LLC encapsulation and virtual template 1. This VC class is then applied to ATM interface 1/0/0. By configuring SNAP encapsulation by itself on PVC 0/32, you disable IETF PPP over ATM with LLC encapsulation on this particular PVC; PVC 0/32 will only carry IP. For further information, refer to the IETF-Compliant LLC Encapsulated PPP over ATM Configuration Examples, page 28.

```
interface atm 1/0/0
class-int ppp
exit
!
interface atm 1/0/0.100 point-to-point
description IP only VC
```

```
ip address 10.1.1.1 255.255.255.0
pvc 0/32
encapsulation aal5snap
exit
exit
!
vc-class atm ppp
encapsulation aal5snap
protocol ppp virtual-template 1
exit
```

Cisco Proprietary-PPP-over-ATM Example

The following example shows how to configure Cisco-proprietary PPP over ATM to use PPP unnumbered link and Challenge Handshake Authentication Protocol (CHAP) authentication. For further information, refer to the Configuring Cisco-Proprietary PPP over ATM PVCs, page 11.

```
configure terminal
!
interface virtual-template 2
 encapsulation ppp
 ip unnumbered ethernet 0/0
 ppp authentication chap
!
interface atm 2/0.2 point-to-point
 pvc 0/34
 encapsulation aal5ciscoppp virtual-template 2
 exit
```

PPP over an ATM SVC Configuration Example

In the following example, ATM interface 2/0/0 is configured to accept ATM SVC calls whose called party address is 47.00918100000000400B0A2501.0060837B4740.00. The same ATM NSAP address can be configured on other physical ATM interfaces as well. When a PPP session is established, a virtual-access interface is created and cloned with the configuration from virtual template 1. All PPP sessions established on this ATM interface will use the IP address of loopback interface 0. A maximum of 100 SVCs can be established using this configuration. SVCs established using this configuration cannot take up more than 50 Mbps in total bandwidth.

```
interface ATM 2/0/0
 svc anna
  encapsulation aal5auto
  protocol ppp virtual-template 1
  max vc 100
  max bandwidth 50000
 atm nsap 47.00918100000000400B0A2501.0060837B4740.00
!
interface virtual-template 1
 ip unnumbered loopback 0
!
interface loopback 0
 ip address 10.7.1.1 255.255.255.0
```

PPPoA PPPoE Autosense on an ATM PVC Example

In the following example, the NAS is configured with PPPoA/PPPoE autosense for ATM PVCs on PVC 30/33:

```
!
! Configure PPP Autosense
!
interface ATM 0/0/0.33 multipoint
```

```
 pvc 30/33
  encapsulation aal5autoppp Virtual-Template1
!
! Configure PPPoE
!
vpdn enable
vpdn-group 1
 accept dialin
  protocol pppoe
  virtual-template 1
!
ip cef
interface virtual-template 1
 ip unnumbered fastethernet 0/0/0
 ip route-cache cef
!
interface fastethernet 0/0/0
 ip address 10.1.1.1 255.255.255.0
!
! Enable precloning for virtual-template 1
!
virtual-template 1 pre-clone 2000
```

PPPoA PPPoE Autosense on a VC Class Example

In the following example, the NAS is configured with PPPoA/PPPoE autosense on the VC class called MyClass. MyClass applies PPPoA/PPPoE autosense to all PVCs on the ATM 0/0/0.99 interface.

```
!
! Configure PPP Autosense
!
vc-class ATM MyClass
 encapsulation aal5autoppp Virtual-Template1
!
interface ATM 0/0/0.99 multipoint
  class-int MyClass
  no ip directed-broadcast
  pvc 20/40
  pvc 30/33
!
! Configure PPPoE
!
vpdn enable
vpdn-group 1
 accept dialin
  protocol pppoe
  virtual-template 1
!
ip cef
interface virtual-template 1
  ip unnumbered fastethernet 0/0/0
  ip route-cache cef
!
interface fastethernet 0/0/0
 ip address 10.1.1.1 255.255.255.0
!
! Enable precloning for virtual-template 1
!
virtual-template 1 pre-clone 2000
!
```

PPPoA PPPoE Autosense on Multiple VC Classes and Virtual Templates Example

Note Effective with Cisco IOS Release 12.2(28)SB, the **pppoe limit per-mac** and **pppoe limit per-vc** commands are replaced by the **sessions per-mac limit** and **sessions per-vc limit** commands, respectively, in bba-group configuration mode. See the **sessions per-mac limit** and **sessions per-vc limit** commands for more information.

In the following example, PPPoA and PPPoE sessions are handled separately by two virtual templates.

```
ip cef
vpdn enable
!
vpdn-group 1
 accept-dialin
  protocol pppoe
  virtual-template 1
pppoe limit per-mac 1
pppoe limit per-vc 1
!
virtual-template 1 pre-clone 1500
virtual-template 2 pre-clone 1000
!
interface ATM0/0/0.3 multipoint
 no ip directed-broadcast
 class-int pppauto
!
interface ATM0/0/0.9 multipoint
 ip address 10.16.40.1 255.255.0.0
 no ip directed-broadcast
!
interface Virtual-Template1
 ip unnumbered ATM0/0/0.9
 ip route-cache cef
 no ip directed-broadcast
 peer default ip address pool pool-1
 ppp authentication pap
!
interface Virtual-Template2
 ip unnumbered ATM0/0/0.9
 ip route-cache cef
 no ip directed-broadcast
 peer default ip address pool pool-2
 ppp authentication chap
!
interface fastethernet 0/0/0
 ip address 10.1.1.1 255.255.255.0
!
vc-class atm pppauto
 encapsulation aal5autoppp Virtual-Template2
!
```

Note Whenever possible, it is preferable to configure PPPoA and PPPoE to use the same virtual template. Using separate virtual templates leads to the inefficient use of virtual access because the maximum number of virtual-access interfaces will have to be precloned twice: once for PPPoE and once for PPPoA. If PPPoA and PPPoE use the same virtual template, the maximum number of virtual-access interfaces can be precloned once and used for PPPoA and PPPoE as needed.

Where to Go Next

If you want to identify a physical subscriber line for RADIUS communication with a RADIUS server, refer to the "Identifying a Physical Subscriber Line for RADIUS Access and Accounting" module.

Additional References

The following sections provide references related to providing protocol support for broadband access aggregation of PPP over ATM sessions.

Related Documents

Related Topic	Document Title
Broadband access aggregation concepts	Understanding Broadband Access Aggregation
Broadband access aggregation preparation tasks	Preparing for Broadband Access Aggregation

Standards

Standards	Title
Frame Relay Forum standard FRF.8	*Frame Relay to ATM Internetworking*

MIBs

MIBs	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

RFCs	Title
RFC 2364	*PPP over AAL5*

Technical Assistance

Description	Link
The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport

Feature Information for Providing Protocol Support for Broadband Access Aggregation of PPP over ATM Sessions

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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

Table 1 Feature Information for Providing Protocol Support for Broadband Access Aggregation of PPP over ATM Sessions

Feature Name	Releases	Feature Configuration Information
PPP over ATM	12.1(1)	PPP over ATM enables a high-capacity central site router with an ATM interface to terminate multiple remote PPP connections. PPP over ATM provides security validation per user, IP address pooling, and service selection capability.
PPPoA/PPPoE Autosense for ATM PVCs	12.2(4)T 12.2(4)T3	The PPPoA/PPPoE autosense for ATM PVCs feature enables a router to distinguish between incoming PPP over ATM (PPPoA) and PPP over Ethernet (PPPoE) over ATM sessions and to create virtual access based on demand for both PPP types.

Providing Connectivity Using ATM Routed Bridge Encapsulation over PVCs

The Providing Connectivity Using ATM Routed Bridge Encapsulation over PVCs feature provides the functionality of bridged ATM interface support to ATM switched virtual circuits (SVCs). Unlike permanent virtual circuits (PVCs), SVCs must be triggered by ongoing traffic and can be brought down when idle for some time. The SVCs are triggered, if down, and the traffic is passed on to the SVCs belonging to bridged ATM interface.

ATM routed bridge encapsulation (RBE) is used to route IP over bridged RFC 1483 Ethernet traffic from a stub-bridged LAN.

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 Table at the end of this document.

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

Prerequisites for Providing Connectivity Using ATM Routed Bridge Encapsulation over PVCs

- When ATM SVCs are used, support for a form of bridging, such as integrated routing and bridging, is required.
- Before configuring connectivity from a remote bridged Ethernet network to a routed network using ATM routed bridge encapsulation, you must understand the concepts in the Understanding Broadband Access Aggregation module.

Restrictions for Providing Connectivity Using ATM Routed Bridge Encapsulation over PVCs

- Unlike PVCs, SVCs must be triggered by ongoing traffic and might be brought down after they have been idle for some time. The Bridged 1483 Encapsulated Traffic over ATM SVCs feature allows for the SVC to be triggered if down, and to pass the traffic on to the SVCs belonging to the bridged ATM interface.
- ATM RBE does not support MAC-layer access lists; only IP access lists are supported.

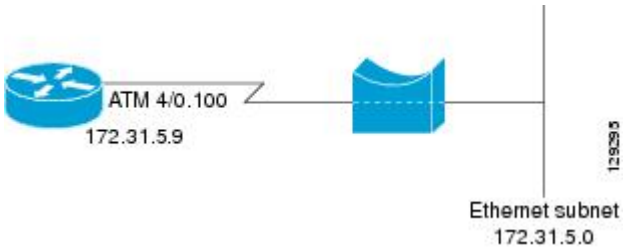
Information About Providing Connectivity Using ATM Routed Bridge Encapsulation over PVCs

Overview on Bridged 1483 Encapsulated Traffic over ATM SVCs

ATM RBE is used to route IP over bridged RFC 1483 Ethernet traffic from a stub-bridged LAN.

The figure below shows an ATM subinterface on a headend router that is configured to function in ATM routed-bridge encapsulation mode. This configuration is useful when a remote bridged Ethernet network device needs connectivity to a routed network via a device bridging from an Ethernet LAN to an ATM RFC 1483 bridged encapsulation.

Figure 7 ATM Routed Bridge Encapsulation



Because PVCs are statically configured along the entire path between the end systems, it would not be suitable to route bridged encapsulated traffic over them when the user wants to configure the virtual circuits (VCs) dynamically and tear down the VCs when there is no traffic.

ATM RBE Subinterface Grouping by PVC Range

You can configure ATM routed bridge encapsulation using an ATM PVC range rather than individual PVCs. When you configure a PVC range for routed bridge encapsulation, a point-to-point subinterface is created for each PVC in the range. The number of PVCs in a range can be calculated using the following formula:

number of PVCs = (end-vpi - start-vpi + 1) x (end-vci - start-vci +1)

Subinterface numbering begins with the subinterface on which the PVC range is configured and increases sequentially through the range.

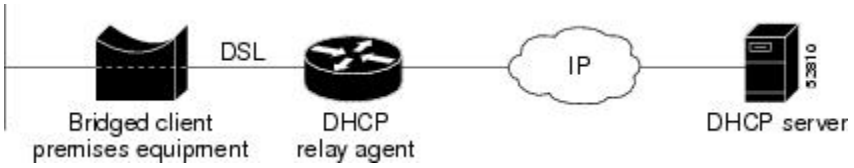
Note You cannot explicitly configure the individual point-to-point subinterfaces created by the PVC range on a point-to-point subinterface. All the point-to-point subinterfaces in the range share the same configuration as the subinterface on which the PVC range is configured.

DHCP Option 82 Support for RBE

The DHCP relay agent information option (option 82) enables a Dynamic Host Configuration Protocol (DHCP) relay agent to include information about itself when forwarding client-originated DHCP packets to a DHCP server. The DHCP server can use this information to implement IP address or other parameter-assignment policies.

The DHCP Option 82 Support for RBE feature provides support for the DHCP relay agent information option when ATM RBE is used. The figure below shows a typical network topology in which ATM RBE and DHCP are used. The aggregation router that is using ATM RBE is also serving as the DHCP relay agent.

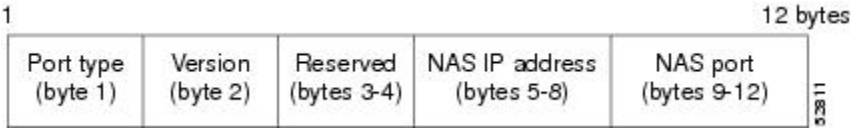
Figure 8 Network Topology Using ATM RBE and DHCP



This feature communicates information to the DHCP server using a suboption of the DHCP relay agent information option called agent remote ID. The information sent in the agent remote ID includes an IP address identifying the relay agent and information about the ATM interface and the PVC over which the DHCP request came in. The DHCP server can use this information to make IP address assignments and security policy decisions.

The figure below shows the format of the agent remote ID suboption.

Figure 9 Format of the Agent Remote ID Suboption



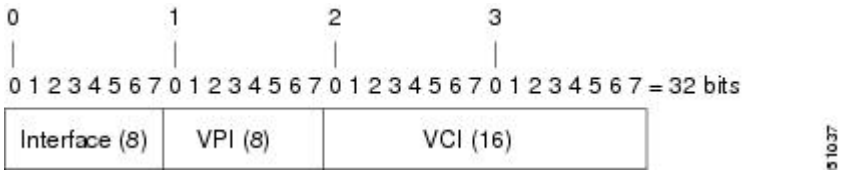
The table below describes the agent remote ID suboption fields displayed in the figure above.

Table 2 Agent Remote ID Suboption Field Descriptions

Field	Description
Port Type	Port type. The value 0x01 indicates RBE. (1 byte)
Version	Option 82 version. The value 0x01 specifies the RBE version of Option 82 (1 byte).
Reserved	RBE reserved (2 bytes).
NAS IP Address	One of the interfaces on the DHCP relay agent. The **rbe nasip** command can be used to specify which IP address will be used. (4 bytes)
NAS Port	RBE-enabled virtual circuit on which the DHCP request has come in. See the figure below for the format of this field. (4 bytes)

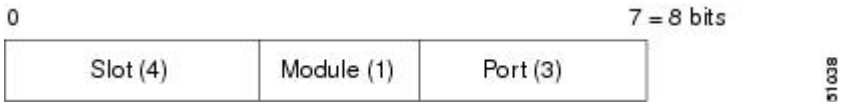
The figure below shows the format of the network access server (NAS) port field in the agent remote ID suboption.

Figure 10 Format of the NAS Port Field



The figure below shows the format of the interface field. If there is no module, the value of the module bit is 0.

Figure 11 Format of the Interface Field



DHCP Lease Limit per ATM RBE Unnumbered Interface

The DHCP lease limit per ATM RBE Unnumbered Interface feature is enabled on a Cisco IOS DHCP relay agent connected to clients through unnumbered interfaces. The relay agent keeps information about the DHCP leases offered to the clients per subinterface. When a DHCPACK message is forwarded to the client, the relay agent increments the number of leases offered to clients on that subinterface. If a new DHCP client tries to obtain an IP address and the number of leases has already reached the configured lease limit, DHCP messages from the client will be dropped and will not be forwarded to the DHCP server.

If this feature is enabled on the Cisco IOS DHCP server directly connected to clients through unnumbered interfaces, the server allocates addresses and increments the number of leases per subinterface. If a new

client tries to obtain an IP address, the server will not offer an IP address if the number of leases on the subinterface has already reached the configured lease limit.

ATM Routed Bridge Encapsulation Support with SSO and ISSU

Cisco IOS High Availability (HA) functionality for broadband protocols and applications allows for stateful switchover (SSO) and In-Service Software Upgrade (ISSU) that minimize planned and unplanned downtime and failures. HA uses the cluster control manager (CCM) to synchronize the subscriber sessions on the standby processor of a redundant processor system. Use the **show ccm clients** command to display information about the CCM clients. Use the **show ccm sessions** command to display information about CCM sessions on active and standby processors. Use the **show subscriber policy** command to display information about subscriber redundancy policies.

In Cisco IOS Release 15.1(1)S and later releases, all ATM RBE features are supported with SSO and ISSU.

Benefits of Providing Connectivity Using ATM Routed Bridge Encapsulation

Bridged IP packets received on an ATM interface configured in routed-bridge mode are routed via the IP header. Such interfaces take advantage of the characteristics of a stub LAN topology commonly used for digital subscriber line (DSL) access and offer increased performance and flexibility over integrated routing and bridging (IRB).

Another benefit of ATM RBE is that it reduces the security risk associated with normal bridging or IRB by reducing the size of the nonsecured network. By using a single VC allocated to a subnet (which could be as small as a single IP address), ATM RBE uses an IP address in the subnet to limit the "trust environment" to the premises of a single customer.

ATM RBE supports Cisco Express Forwarding (CEF), fast switching, and process switching.

The DHCP Option 82 Support for RBE feature enables those service providers to use DHCP to assign IP addresses and DHCP option 82 to implement security and IP address assignment policies.

The DHCP Lease Limit per ATM RBE Unnumbered Interface feature allows an Internet service provider (ISP) to globally limit the number of leases available to clients per household or connection.

How to Configure ATM Routed Bridge Encapsulation over PVCs

Configuring ATM Routed Bridge Encapsulation Using PVCs

Perform the following task to configure ATM RBE using PVCs. Only the specified network layer (IP) is routed. Any remaining protocols can be passed on to bridging or other protocols. In this manner, ATM RBE can be used to route IP, while other protocols (such as IPX) are bridged normally.

or

show ip cache verbose

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot* / **0 .** *subinterface-number* **point-to-point**
4. Do one of the following:
   - **pvc** *vpi* /*vci*
   -
   - **range** [*range-name*] **pvc** *start-vpi* / *start-vci end-vpi* / *end-vci*
5. **exit**
6. **ip address** *ip-address mask* [**secondary**]
7. **end**
8. Do one of the following:
   - **show arp**
   - or
   - **show ip cache verbose**

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** *slot* / **0 .** *subinterface-number* **point-to-point** **Example:** `Router(config)# interface atm 5/0.5 point-to-point`	Specifies an ATM point-to-point subinterface and enters subinterface mode.

	Command or Action	Purpose

Step 4	Do one of the following:
	• **pvc** *vpi* /*vci*
	•
	• **range** [*range-name*] **pvc** *start-vpi* / *start-vci end-vpi* / *end-vci*
	Example:
	`Router(config-subif)# pvc 0/32`
	Example:
	`Router(config-subif)# range range1 pvc 1/200 1/299`
		Configures a PVC to carry the routed bridge traffic and enters ATM VC class configuration mode.
		Configures a range of PVCs to carry the routed bridge traffic and enters ATM PVC range configuration mode.

Step 5	**exit** **Example:** `Router(config-if-atm-vc)# exit`	Exits to subinterface configuration mode.
Step 6	**ip address** *ip-address mask* [**secondary**] **Example:** `Router(config-subif)# ip address 209.165.200.224 255.255.255.0`	Provides an IP address on the same subnetwork as the remote network.
Step 7	**end** **Example:** `Router(config-subif)# end`	Exits to privileged EXEC mode.

Step 8	Do one of the following:
	• **show arp**
	• or
	• **show ip cache verbose**
	Example:
	`Router# show arp`
	Example:
	`Router# show ip cache verbose`
		(Optional) Displays ATM RBE configuration information.

Examples

To confirm that ATM RBE is enabled, use the **show arp** command and the **show ip cache verbose** command in privileged EXEC mode:

```
Router# show arp

Protocol  Address          Age (min)  Hardware Addr   Type   Interface
Internet     209.165.201.51          6   0001.c9f2.a81d  ARPA   Ethernet3/1
Internet     209.165.201.49          -   0060.0939.bb55  ARPA   Ethernet3/1
Internet 209.165.202.128         30   0010.0ba6.2020  ARPA   Ethernet3/0
Internet 209.165.201.52           6   00e0.1e8d.3f90  ARPA   ATM1/0.4
Internet 209.165.201.53           5   0007.144f.5d20  ARPA   ATM1/0.2
Internet 209.165.202.129          -   0060.0939.bb54  ARPA   Ethernet3/0
Internet 209.165.201.125         30   00b0.c2e9.bc55  ARPA   Ethernet3/1#
Router# show ip cache verbose
IP routing cache 3 entries, 572 bytes
   9 adds, 6 invalidates, 0 refcounts
Minimum invalidation interval 2 seconds, maximum interval 5 seconds,
   quiet interval 3 seconds, threshold 0 requests
Invalidation rate 0 in last second, 0 in last 3 seconds
Last full cache invalidation occurred 00:30:34 ago
Prefix/Length       Age       Interface     Next Hop
209.165.201.51/32-24 00:30:10  Ethernet3/1 10.1.0.51 14  0001C9F2A81D00600939 BB550800
209.165.202.129/32-24 00:00:04 ATM1/0.2     10.8.100.50 28
00010000AAAA030080C2000700000007144F5D2000600939 BB1C0800
209.165.201.125/32-24 00:06:09 ATM1/0.4     10.8.101.35 28
00020000AAAA030080C20007000000E01E8D3F9000600939 BB1C0800
```

Configuring DHCP Option 82 for RBE

Perform this task to configure the DHCP Option 82 Support for RBE feature.

DHCP option 82 support must be configured on the DHCP relay agent using the **ip dhcp relay information option** command before you can use the DHCP Option 82 Support for RBE feature.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp relay information option**
4. **rbe nasip** *source-interface*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ip dhcp relay information option** **Example:** `Router(config)# ip dhcp relay information option`	Enables the DHCP option 82 support on relay agent. • Enabling the DHCP option 82 support allows the system to insert the DHCP relay agent information option in forwarded BOOT REQUEST messages to a Cisco IOS DHCP server.
Step 4	**rbe nasip** *source-interface* **Example:** `Router(config)# rbe nasip loopback0`	Specifies the IP address of an interface on the DHCP relay agent that will be sent to the DHCP server via the Agent Remote ID suboption.
Step 5	**end** **Example:** `Router(config)# end`	Exits global configuration mode and enters privileged configuration mode.

Configuring the DHCP Lease Limit

Perform this task to limit the number of DHCP leases allowed on ATM RBE unnumbered or serial unnumbered interfaces.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip dhcp limit lease per interface** *lease-limit*
4. **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	**ip dhcp limit lease per interface** *lease-limit* **Example:** `Router(config)# ip dhcp limit lease per interface 2`	Limits the number of leases offered to DHCP clients behind an ATM RBE unnumbered or serial unnumbered interface.
Step 4	**end** **Example:** `Router(config)# end`	Exits global configuration mode and returns to privileged EXEC mode.

Troubleshooting the DHCP Lease Limit

Perform this task to troubleshoot the DHCP lease limit.

SUMMARY STEPS

1. **enable**
2. **debug ip dhcp server packet**
3. **debug ip dhcp server events**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**debug ip dhcp server packet** **Example:** `Router# debug ip dhcp server packet`	(Optional) Decodes DHCP receptions and transmissions.
Step 3	**debug ip dhcp server events** **Example:** `Router(config)# debug ip dhcp server events`	(Optional) Displays server events.

Configuration Examples for Providing Connectivity Using ATM Routed Bridge Encapsulation

The following examples show various ways to provide connectivity from a remote bridged network to a routed network using ATM RBE.

Example Configuring ATM RBE on PVCs

The following example shows a typical ATM routed bridge encapsulation configuration:

```
enable
 configure terminal
 interface atm 4/0.100 point-to-point
  ip address 209.165.200.225 255.255.255.224
   pvc 0/32
    end
```

Example Configuring ATM RBE on an Unnumbered Interface

The following example uses a static route to point to an unnumbered interface:

```
 enable
  configure terminal
  interface loopback 0
  ip address 209.165.200.226 255.255.255.224
  interface atm 4/0.100 point-to-point
   ip unnumbered loopback 0
   pvc 0/32
    atm route-bridge ip
    exit
```

```
 ip route 209.165.200.228 255.255.255.224 atm 4/0.100
 end
```

Example Concurrent Bridging and ATM RBE

The following example shows concurrent use of ATM RBE with normal bridging. IP datagrams are route-bridged, and other protocols (such as IPX or AppleTalk) are bridged.

```
bridge 1 protocol ieee
interface atm 4/0.100 point-to-point
 ip address 209.165.200.225 255.255.255.224
 pvc 0/32
 bridge-group 1
 atm route-bridge ip
```

Example DHCP Option 82 for RBE Configuration

In the following example, DHCP option 82 support is enabled on the DHCP relay agent using the **ip dhcp relay information option** command. The **rbe nasip** command configures the router to forward the IP address for Loopback0 to the DHCP server.

```
ip dhcp-server 209.165.200.225
!
ip dhcp relay information option
!
interface Loopback0
 ip address 209.165.201.0 255.255.255.248
!
interface atm 4/0
 no ip address
!
interface atm 4/0.1 point-to-point
 ip unnumbered Loopback0
 ip helper-address 209.165.201.3
 atm route-bridged ip
 pvc 88/800
  encapsulation aal5snap
!
!
interface Ethernet5/1
 ip address 209.165.201.4 255.255.255.248
!
router eigrp 100
 network 209.165.201.0
 network 209.165.200.0
!
rbe nasip Loopback0
```

For the configuration example, the value (in hexadecimal) of the agent remote ID suboption would be 010100000B01018140580320. The table below shows the value of each field within the agent remote ID suboption.

Table 3 Agent Remote ID Suboption Field Values

Agent Remote ID Suboption Field	Value
Port Type	0x01
Version	0x01
Reserved	undefined

Agent Remote ID Suboption Field	Value
NAS IP Address	0x0B010181 (hexadecimal value of 11.1.1.129)
NAS Port • Interface (slot/module/port) • VPI • VCI	• 0x40 (The slot/module/port values are 01 00/0/000.) • 0x58 (hexadecimal value of 88) • 0x320 (hexadecimal value of 800)

Example DHCP Lease Limit

In the following example, if more than three clients try to obtain an IP address from interface ATM4/0.1, the DHCPDISCOVER packets will not be forwarded to the DHCP server. If the DHCP server resides on the same router, DHCP will not reply to more than three clients.

```
ip dhcp limit lease per interface 3
!
interface loopback0
 ip address 209.165.201.3 255.255.255.248
!
interface atm 4/0.1
 no ip address
!
interface atm 4/0.1 point-to-point
 ip helper-address 172.16.1.2
 ip unnumbered loopback0
 atm route-bridged ip
  pvc 88/800
  encapsulation aal5snap
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Broadband Access Aggregation and DSL commands	*Cisco IOS Broadband Access Aggregation and DSL Command Reference*
Broadband access aggregation concepts	Understanding Broadband Access Aggregation
Preparing for broadband access aggregation task	Preparing for Broadband Access Aggregation
DHCP commands	*Cisco IOS IP Addressing Services Command Reference*
DHCP configuration tasks	"Configuring the Cisco IOS DHCP Server" module in the *Cisco IOS IP Addressing Services Configuration Guide*

Standards

Standards	Title
None	--

MIBs

MIBs	MIBs Link
None	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
None	--

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/cisco/web/support/index.html

Feature Information for Providing Connectivity Using ATM Routed Bridge Encapsulation

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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

Table 4 Feature Information for Providing Connectivity Using ATM Routed Bridge Encapsulation

Feature Name	Releases	Feature Information
RBE-SSO	15.1(1)S	ATM RBE features are supported with SSO.
RBE-ISSU	15.1(1)S	ATM RBE features are supported with ISSU.
Bridged 1483 Encapsulated Traffic over ATM SVCs	12.4(15)T 12.2(33)SRE	The Bridged 1483 Encapsulated Traffic over ATM SVCs feature provides support for bridged 1483 encapsulated packets to trigger ATM SVC and also support for sending this traffic on triggered ATM SVCs.
DHCP Option 82 Support for Routed Bridge Encapsulation	15.1(1)S 12.2(2)T	This feature provides support for the DHCP relay agent information option when ATM RBE is used. The following command was introduced:**rbe nasip**
DHCP Lease Limit per ATM RBE Unnumbered Interface	12.3(2)T	This feature limits the number of DHCP leases per subinterface offered to DHCP clients connected from an ATM RBE unnumbered interface or serial unnumbered interface of the DHCP server or DHCP relay agent. The following command was introduced:**ip dhcp limit lease per interface**