



Broadband Access Aggregation and DSL Configuration Guide, Cisco IOS Release 15S

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CHAPTER

1

Upstream PPPoX Connection Speed Transfer at LAC

The Upstream PPPoX Connection Speed Transfer at LAC feature allows the transfer of the upstream PPPoX session speed value at the Layer 2 Tunnel Protocol (L2TP) access concentrator (LAC). This transfer is accomplished by configuring the required speed on the ATM virtual circuit (VC) carrying the PPPoX session and then transferring this information into attribute-value (AV) pair 38 for transport from the LAC to the L2TP network server (LNS).



Note

PPPoX is a term used to refer to PPPoE, PPPoA, and PPPoEoA. All are implementations of PPP over various delivery protocols such as Ethernet and ATM.

- [Finding Feature Information, page 1](#)
- [Prerequisites for Upstream PPPoX Connection Speed Transfer at LAC, page 2](#)
- [Restrictions for Upstream PPPoX Connection Speed Transfer at LAC, page 2](#)
- [Information About Upstream PPPoX Connection Speed Transfer at LAC, page 2](#)
- [How to Configure Upstream Connection Speed Transfer at LAC, page 3](#)
- [Configuration Examples for Upstream PPPoX Connection Speed Transfer at LAC, page 6](#)
- [Additional References, page 6](#)
- [Feature Information for Upstream PPPoX Connection Speed Transfer at LAC, page 8](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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 Upstream PPPoX Connection Speed Transfer at LAC

- You must understand the concepts described in the *Preparing for Broadband Access Aggregation* module.
- You must establish PPPoE sessions using the procedures in the *Providing Protocol Support for Broadband Access Aggregation of PPPoE Sessions* module.

Restrictions for Upstream PPPoX Connection Speed Transfer at LAC

The following restrictions apply to the Upstream PPPoX Connection Speed Transfer at LAC feature:

- For PPPoE, all sessions over the same VC must have the same send and receive speed.
- The upstream speed is informational and does not imply any policing or shaping of the session speed.

Information About Upstream PPPoX Connection Speed Transfer at LAC

Upstream PPPoX Connection Speed Transfer at LAC

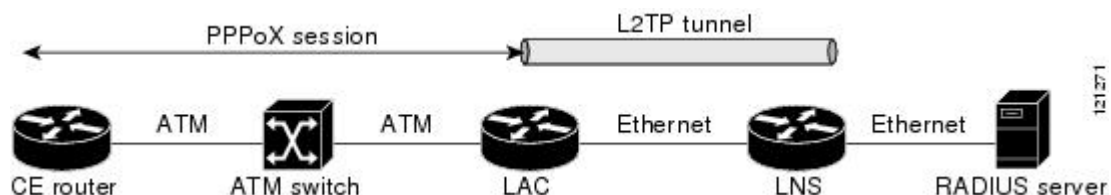
The send speed from the LAC to the remote destination is copied into AV pair 38 so that the session is symmetric at the LNS. The LNS does not do any policing of the upstream rate but verifies the session speed against the Service Level Agreement (SLA) before accepting it.

The transfer of the upstream PPPoX session speed at the LAC is done by:

- Configuring the required speed on the ATM virtual circuit carrying the PPPoX session.
- Transferring the information to AV pair 38 for transport from the LAC to the LNS.

The figure below shows how the Upstream PPPoX Connection Speed Transfer at LAC feature works.

Figure 1: Upstream PPPoX Connection Speed Transfer at LAC



Benefits of Upstream PPPoX Connection Speed Transfer at LAC

The Upstream PPPoX Connection Speed Transfer at LAC feature enables the configuration of an upstream PPPoX session speed, which is different from the downstream speed and allows the transfer of the upstream speed value from the LAC to the LNS. The default state (before this feature is enabled) is that the upstream speed and the downstream speed are the same. This feature implements changes that allows asymmetry in the upstream and downstream speeds.

This feature provides the following benefits:

- Allows support for asymmetric broadband service speeds such as asymmetric digital subscriber line (ADSL).
- Complies with RFC 2661 for L2TP.
- Is required for regulatory compliance in certain European countries; for example, Germany.

How to Configure Upstream Connection Speed Transfer at LAC

Configuring Upstream PPPoX Connection Speed Transfer at the LAC

The tasks in this section configure upstream PPPoX connection speed transfer at the LAC on a PVC or VC:

Configuring Upstream PPPoX Connection Speed Transfer at LAC on a PVC

Perform this task to configure the Upstream PPPoX Connection Speed Transfer feature at the LAC on a PVC.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm slot / port . [subinterface-number {mpls | multipoint| point-to-point}]**
4. **range [range-name] pvc start-vpi / start-vci end-vpi / end-vci**
5. **rx-speed incoming-cell-rate**
6. **exit**

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.

	Command or Action	Purpose
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface atm slot / port .[subinterface-number]{mpls multipoint point-to-point}] Example: Router(config)# interface atm 2/0.1 multipoint	Enters subinterface configuration mode.
Step 4	range [range-name] pvc start-vpi / start-vci end-vpi / end-vci Example: Router(config-subif)# range pvc 0/100 0/110	Enters PVC-in-range configuration mode.
Step 5	rx-speed incoming-cell-rate Example: Router(config-if-atm-range)# rx-speed 128	Allows L2TP to send AV pair 38 with the given value to LNS. • The valid range for <i>incoming-cell-rate</i> for L2TP AVP is from 0 to 44209 kb/s.
Step 6	exit Example: Router(config-if-atm-range)# exit	Exits PVC-in-range configuration mode.

Configuring Upstream PPPoX Connection Speed Transfer at LAC on VC

Perform this task to configure the Upstream PPPoX Connection Speed Transfer at LAC on a VC.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm slot / port .[subinterface-number]{mpls | multipoint | point-to-point}]**
4. **pvc [name] {vpi/vci | vci} [ces | ilmi | qsaal | smds | l2transport]**
5. **rx-speed incoming-cell-rate**
6. **encapsulation {aal2 | aal5auto | aal5autopp} virtual-template number [group group-name] | aal5ciscopp virtual-template number | aal5mux protocol | aal5nlpid | aal5snap}**
7. **exit**

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 atm slot / port . [subinterface-number {mpls multipoint point-to-point}] Example: Router(config)# interface atm 2/0.1 multipoint	Enters subinterface configuration mode.
Step 4	pvc [name] {vpi/vci vci} [ces ilmi qsaal smds l2transport] Example: Router(config-subif)# pvc pvc1 0/100	Enters PVC-class configuration mode.
Step 5	rx-speed incoming-cell-rate Example: Router(config-if-atm-vc)# rx-speed 128	Allows L2TP to send (AV) pair 38 with the given value to LNS.
Step 6	encapsulation {aal2 aal5auto aal5autoppv virtual-template number [group group-name] aal5ciscoppv virtual-template number aal5mux protocol aal5nlpid aal5snap} Example: Router(config-if-atm-vc)# encapsulation aal5snap	Configures Logical Link Control (LLC) Subnetwork Access Protocol (SNAP) encapsulation on the PVC.
Step 7	exit Example: Router(config-if-atm-vc)# exit	Exits PVC-class configuration mode.

Configuration Examples for Upstream PPPoX Connection Speed Transfer at LAC

Configuring Upstream PPPoX Connection Speed Transfer at LAC Example

The following examples show how to configure the upstream PPPoX connection speed transfer at LAC in PVC, range PVC, and PVC-in-range modes.

PVC Class

```
interface atm 6/0.110 multipoint
 pvc 0/600
  rx-speed 128
  encapsulation aal5snap
 exit
```

Range PVC

```
interface atm 6/0.110 multipoint
 range range-pppoa-1 pvc 100 4/199
  rx-speed 400
 exit
```

PVC-in-Range

```
interface atm 6/0.110 multipoint
 range range1 pvc 100 4/199
 pvc-in-range 0/300
 rx-speed 200
 shutdown
```

Additional References

The following sections provide references related to the upstream PPPoX connection speed transfer.

Related Documents

Related Topic	Document Title
Configuring VC classes	"Configuring VC Classes" section in the "Configuring ATM" module in the <i>Cisco IOS Wide-Area Networking Configuration Guide</i> .
Understanding the Unspecified Bit Rate+ (UBR+) service category for ATM VCs	"Understanding the UBR+ Service Category for ATM VCs" module in ATM (Asynchronous Transfer Mode) Technical Support
Broadband access aggregation concepts	Understanding Broadband Access Aggregation module

Related Topic	Document Title
Preparing for broadband access aggregation task	Preparing for Broadband Access Aggregation module
BBDSL commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	<i>Cisco IOS Broadband Access Aggregation and DSL Command Reference</i>
Cisco IOS commands	Cisco IOS Master Commands List, All Releases

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 IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
RFC 2661	<i>Layer 2 Tunneling Protocol "L2TP"</i>

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/cisco/web/support/index.html</p>

Feature Information for Upstream PPPoX Connection Speed Transfer at LAC

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 Upstream PPPoX Connection Speed Transfer at LAC

Feature Name	Releases	Feature Information
Upstream PPPoX Connection Speed Transfer at LAC	12.2(15)B 12.2(4)T 12.2(33)SRE	<p>The Upstream PPPoX Connection Speed Transfer at LAC feature allows the transfer of the upstream PPPoX session speed value at the LAC.</p> <p>The following command was introduced: rx-speed.</p>



Providing Session Limit Support

The PPP over Ethernet Session Limit feature enables you to limit the number of PPP over Ethernet (PPPoE) sessions that can be created on a router or on a Gigabit Ethernet interface for configuration.

- [Finding Feature Information, page 9](#)
- [Information About Providing Session Limit Support, page 9](#)
- [How to Provide Session Limit Support, page 10](#)
- [Configuration Examples for Providing Session Limit Support, page 13](#)
- [Additional References, page 13](#)
- [Feature Information for Providing Session Limit Support, page 15](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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.

Information About Providing Session Limit Support

Benefits of Providing Session Limit Support

The PPPoE Session Limit feature prevents the router from using too much memory for virtual access by limiting the number of PPPoE sessions that can be created on a router or on all Ethernet interfaces and sub-interfaces as well as ATM interfaces and sub-interfaces.

How to Provide Session Limit Support

Specifying the Maximum Number of PPPoE Sessions on the Router

Perform this task to specify the maximum number of PPPoE sessions that can be created on a router.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **bba-group pppoe** *{name | global}*
4. **virtual-template** *template-number*
5. **sessions per-mac limit** *per-mac-limit*
6. **sessions per-vlan limit** *per-vlan-limit* [**inner** *vlan-id*]
7. **sessions per-vc limit** *per-vc-limit* [**threshold** *threshold-value*]
8. **sessions max limit** *number-of-sessions* [**threshold** *threshold-value*]
9. **exit**

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	bba-group pppoe <i>{name global}</i> Example: Router(config)# bba-group pppoe global	Configures a BBA group to be used to establish PPPoE sessions and enters BBA group configuration mode. <ul style="list-style-type: none"> • name --Identifies the broadband aggregation (BBA) group. You can have multiple BBA groups. • global --PPPoE profile that serves as the default profile for any PPPoE port (Gigabit Ethernet interface or VLAN) that has not been assigned a specific PPPoE profile.

	Command or Action	Purpose
Step 4	virtual-template <i>template-number</i> Example: <pre>Router(config-bba-group)# virtual-template 1</pre>	Specifies which virtual template will be used to clone virtual access interfaces for all PPPoE ports that use this PPPoE profile.
Step 5	sessions per-mac limit <i>per-mac-limit</i> Example: <pre>Router(config-bba-group)# sessions per-mac limit 1000</pre>	(Optional) Sets the maximum number of PPPoE sessions allowed per MAC session limit in a PPPoE profile. The default is 100.
Step 6	sessions per-vlan limit <i>per-vlan-limit</i> [inner <i>vlan-id</i>] Example: <pre>Router(config-bba-group)# session per-vlan limit 4000 inner 3500</pre>	(Optional) Sets the session limit for the inner VLAN on QinQ sub-interface. The default is 100. Note The per-VLAN limit is only applicable to Gigabit Ethernet subinterfaces (802.1q VLANs).
Step 7	sessions per-vc limit <i>per-vc-limit</i> [threshold <i>threshold-value</i>] Example: <pre>Router(config-bba-group)# sessions per-vc limit 2000</pre>	(Optional) Sets the maximum number of PPPoE sessions allowed per VC session limit in a PPPoE profile. The default is 100. Note The per-vc limit is applicable only to ATM interfaces and sub-interfaces.
Step 8	sessions max limit <i>number-of-sessions</i> [threshold <i>threshold-value</i>] Example: <pre>Router(config-bba-group)# sessions max limit 32000</pre>	Configures the PPPoE global profile with the maximum number of PPPoE sessions that will be permitted on a router, and sets the PPPoE session-count threshold at which a Simple Network Management Protocol (SNMP) trap will be generated. Note This command applies only to the global profile.
Step 9	exit Example: <pre>Router(config-bba-group)# exit</pre>	Returns to global configuration mode.

Specifying the Maximum Number of PPPoE Sessions on a Gigabit Ethernet Interface

Perform this task to specify the maximum number of PPPoE sessions that can be created on a Gigabit Ethernet interface.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `interface {GigabitEthernet | tenGigabitEthernet} slot / subslot / port[. subinterface]`
4. `pppoe enable [group group-name]`
5. `pppoe max-sessions number`
6. `end`

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><code>enable</code></p> <p>Example:</p> <pre>Router> enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	<p><code>configure terminal</code></p> <p>Example:</p> <pre>Router# configure terminal</pre>	<p>Enters global configuration mode.</p>
Step 3	<p><code>interface {GigabitEthernet tenGigabitEthernet} slot / subslot / port[. subinterface]</code></p> <p>Example:</p> <pre>Router(config)# interface GigabitEthernet0/0/1</pre>	<p>Specifies a Gigabit Ethernet interface and enters interface configuration mode.</p>
Step 4	<p><code>pppoe enable [group group-name]</code></p> <p>Example:</p> <pre>Router(config-if)# pppoe enable group one</pre>	<p>Enables PPPoE sessions on a Gigabit Ethernet interface or subinterface.</p> <p>Note If a PPPoE profile is not assigned to the interface through use of the group group-name option, the interface will use the global PPPoE profile.</p>

	Command or Action	Purpose
Step 5	<p>pppoe max-sessions <i>number</i></p> <p>Example:</p> <pre>Router(config-if)# pppoe max-sessions 10</pre>	Specifies the maximum number of PPPoE sessions permitted on the interface or subinterface. The default value is 100.
Step 6	<p>end</p> <p>Example:</p> <pre>Router(config-if)# end</pre>	(Optional) Exits the configuration mode and returns to privileged EXEC mode.

Configuration Examples for Providing Session Limit Support

Specifying the Maximum Number of PPPoE Sessions on a Router Example

The following example shows a limit of 32,000 PPPoE sessions configured for the router:

```
bba-group pppoe global
  virtual-template 1
  sessions per-mac limit 1000
  sessions per-vlan limit 4000 inner 3500
  sessions per-vc limit 2000
```

Specifying the Maximum Number of PPPoE Sessions on a Gigabit Ethernet Interface Example

The following example shows a limit of ten PPPoE sessions on the Gigabit Ethernet interface:

```
interface GigabitEthernet1/0/0
  pppoe enable
  pppoe max-sessions 10
```

The following example shows a limit of ten PPPoE sessions on the Gigabit Ethernet subinterface using the **encapsulation** command:

```
interface GigabitEthernet0/0/0.1
  encapsulation dot1q 2
  pppoe enable
  pppoe max-sessions 10
```

Additional References

The following sections provide references related to supporting session limits.

Related Documents

Related Topic	Document Title
Broadband access aggregation of PPPoE sessions	Understanding Broadband Access Aggregation
Task for preparing for broadband access aggregation	Preparing for broadband access aggregation
Broadband access commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	<i>Cisco IOS Broadband Access Aggregation and DSL Command Reference</i>
Additional information about commands used in this document	Cisco IOS Master Command List, All Releases

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
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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 website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/techsupport</p>

Feature Information for Providing Session Limit Support

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 2: Feature Information for Providing Session Limit Support

Feature Name	Releases	Feature Information
<p>PPP over Ethernet (PPPoE) Session Limit</p>	<p>12.2(1)DX 12.2(2)DD 12.2(4)B 12.2(4)T 15.0(1)M 12.2(33)SRE</p>	<p>The PPP over Ethernet (PPPoE) Session Limit feature enables you to limit the number of PPPoE sessions that can be created on a router or on a Gigabit Ethernet interface for configuration.</p> <p>The following commands were introduced or modified:</p> <p>sessions per-mac limit, sessions per-vlan limit, sessions per-vc limit, sessions max limit, ppoe max-sessions</p>



PPPoE - Session Limit Local Override

The PPP over Ethernet (PPPoE) Session Limit Local Override feature enables the session limit configured locally on the broadband remote access server (BRAS) or Layer2 Tunneling Protocol (L2TP) access concentrator (LAC) to override the per-NAS-port session limit downloaded from the RADIUS server when the preauthorization is enabled.

- [Finding Feature Information, page 17](#)
- [Information About PPPoE Session Limit Local Override, page 17](#)
- [How to Configure PPPoE Session Limit Local Override, page 18](#)
- [Configuration Examples for PPPoE Session Limit Local Override, page 20](#)
- [Additional References, page 20](#)
- [Feature Information for PPPoE Session Limit Local Override, page 21](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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.

Information About PPPoE Session Limit Local Override

How PPPoE Session Limit Local Override Works

PPPoE session limits are downloaded from the RADIUS server when you enable preauthorization on the LAC using the **subscriber access pppoe pre-authorize nas-port-id** command. By enabling preauthorization, you limit the number of PPPoE sessions on a specific permanent virtual circuit (PVC) or VLAN; that is, the PPPoE

per-NAS-port session limit downloaded from the RADIUS server takes precedence over locally configured (port-based) session limits, such as per-VC and per-VLAN session limits.

The PPPoE Session Limit Local Override feature enables the local session limit configured at the BRAS to override the per-NAS-port session limit configured at the RADIUS server when preauthorization is configured.

**Note**

The PPPoE Session Limit Local Override feature is useful only when you have configured preauthorization on the BRAS or LAC.

To enable the PPPoE Session Limit Local Override feature, configure the **sessions pre-auth limit ignore** command under the broadband access (BBA) group associated with the interface. When the PPPoE Session Limit Local Override feature is enabled, the locally configured session limit is applied before PPP is started; that is before the BRAS sends out a PPPoE Active Discovery Offer (PADO) packet to the client, advertising a list of available services.

When preauthorization is configured without the PPPoE Session Limit Local Override feature enabled, the client receives an authentication failure response from the BRAS when there is no session limit downloaded from the RADIUS server and the locally configured session limit is exceeded. The BRAS waits to apply locally configured limits until PPP negotiation is completed. When a call is finally rejected, the client receives the authentication failure response, resulting in session failure, with no ability to distinguish whether the session failure results from a Challenge Handshake Authentication Protocol (CHAP) authentication failure or a PPPoE session limit having been exceeded. The PPPoE Session Limit Local Override feature allows for differentiation between the handling of per-NAS-port failures and session limiting failures.

If you enable the PPPoE Session Limit Local Override feature, but there are no locally configured per-port session limits, then per-NAS-port session limits downloaded from the RADIUS server are applied.

For more information on how to configure preauthorization and per-NAS-port session limit, see the [Establishing PPPoE Session Limit per NAS Port](#) document.

How to Configure PPPoE Session Limit Local Override

Enabling PPPoE Session Limit Local Override

Enable the PPPoE Session Limit Local Override feature to allow the local session limit configured on the BRAS to override the per-NAS-port session limit downloaded from the RADIUS server.

Before You Begin

The **sessions pre-auth limit ignore** command should have been configured under the broadband access (BBA) group associated with the interface.

**Note**

If there are no locally configured per-port session limits, then per-NAS port session limits downloaded from the RADIUS server are applied.

>

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **bba-group pppoe** *group-name*
4. **sessions per-vc limit** *per-vc-limit*
5. **sessions pre-auth limit ignore**
6. **end**

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	bba-group pppoe <i>group-name</i> Example: Router(config)# bba-group pppoe test	Creates a PPPoE profile and enters BBA group configuration mode. <ul style="list-style-type: none"> • <i>group-name</i> --Name of the PPPoE profile.
Step 4	sessions per-vc limit <i>per-vc-limit</i> Example: Router(config-bba-group)# sessions per-vc limit 3	Limits the number of PPPoE sessions per VC in a PPPoE profile. <ul style="list-style-type: none"> • <i>per-vc-limit</i> --Maximum number of PPPoE sessions that can be established over an ATM PVC. The default is 100.
Step 5	sessions pre-auth limit ignore Example: Router(config-bba-group)# sessions pre-auth limit ignore	Enables the PPPoE Session Limit Local Override feature. The locally configured limit overrides the per-NAS-port session limit configured at the RADIUS server.
Step 6	end Example: Router(config-bba-group)# end	(Optional) Exits BBA group configuration mode and returns to privileged EXEC mode.

Configuration Examples for PPPoE Session Limit Local Override

- [Enabling PPPoE Session Limit Local Override Example, on page 20](#)

Enabling PPPoE Session Limit Local Override Example

The following example creates a PPPoE group named test, configures a limit of three sessions per VC, and enables the PPPoE Session Limit Local Override feature in bba-group configuration mode. The running configuration shows that the **sessions pre-auth limit ignore** command was used to enable this feature.

```
Router(config)# bba-group pppoe test
Router(config-bba-group)# sessions per-vc limit 3
Router(config-bba-group)# sessions pre-auth limit ignore

.
.
!
bba-group pppoe test
virtual-template 2
sessions per-vc limit 3
sessions pre-auth limit ignore
!
.
```

Additional References

The following sections provide references related to the PPPoE Session Limit Local Override feature.

Related Documents

Related Topic	Document Title
Establishing PPPoE Session Limits per NAS Port	Cisco IOS Broadband Access Aggregation and DSL Configuration Guide

Standards

Standard	Title
None	--

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

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for PPPoE Session Limit Local Override

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 3: Feature Information for PPPoE Session Limit Local Override

Feature Name	Releases	Feature Information
PPPoE Session Limit Local Override	12.4(15)T 12.2(33)SB 15.0(1)M 12.2(33)SRE	<p>The PPPoE Session Limit Local Override feature enables the local session limit configured on the BRAS or LAC to override the per-NAS-port session limit downloaded from the RADIUS server when preauthorization is configured.</p> <p>The following command was introduced by this feature: sessions pre-auth limit ignore</p> <p>In Cisco IOS Release 12.2(33)SB, support was added for the Cisco 10000 router.</p>



PPP-Max-Payload and IWF PPPoE Tag Support

The PPP-Max-Payload and IWF PPPoE Tag Support feature enables the Point-to-Point Protocol (PPP) over Ethernet (PPPoE) component to process the PPP-Max-Payload and Interworking Functionality (IWF) PPPoE tags in the PPPoE discovery frame:

- The **tag ppp-max-payload** command allows PPPoE peers to negotiate PPP maximum receive units (MRUs) greater than 1492 octets if the underlying network supports a maximum transmission unit (MTU) size greater than 1500 octets.
- The IWF PPPoE tag allows the Broadband Remote Access Server (BRAS) to distinguish the IWF PPPoE from the regular PPPoE sessions to overcome the per-MAC session limit put on the BRAS as a protection from denial of service (DOS) attacks sourced from the same MAC address.
- [Finding Feature Information, page 23](#)
- [Prerequisites for the PPP-Max-Payload and IWF PPPoE Tag Support Feature, page 24](#)
- [Restrictions for the PPP-Max-Payload and IWF PPPoE Tag Support Feature, page 24](#)
- [Information About the PPP-Max-Payload and IWF PPPoE Tag Support Feature, page 24](#)
- [How to Configure the PPP-Max-Payload and IWF PPPoE Tag Support Feature, page 25](#)
- [Configuration Examples for the PPP-Max Payload and IWF PPPoE Tag Support Feature, page 28](#)
- [Additional References, page 29](#)
- [Feature Information for PPP-Max Payload and IWF PPPoE Tag Support, page 30](#)
- [Glossary, page 31](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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 the PPP-Max-Payload and IWF PPPoE Tag Support Feature

To enable the PPP-Max-Payload and IWF PPPoE Tag Support feature, you should have configured PPPoE profile.

Restrictions for the PPP-Max-Payload and IWF PPPoE Tag Support Feature

PPPoE peers can negotiate only MRUs with a maximum of 1492 octets so that the PPPoE header and PPP protocol ID can be inserted in the PPPoE session data packet.

Information About the PPP-Max-Payload and IWF PPPoE Tag Support Feature

Accommodating an MTU MRU Greater than 1492 in PPPoE

Per the RFC, Accommodating an MTU/MRU Greater than 1492 in PPPoE, PPPoE peers can negotiate only MRUs with a maximum of 1492 octets so that the PPPoE header and PPP protocol ID can be inserted in the PPPoE session data packet. The maximum for an Ethernet payload is 1500 octets.

RFC 2516 defines a new tag to allow PPPoE peers to negotiate PPP MRU greater than 1492 if the underlying networks can support an Ethernet payload of greater than 1500 bytes. To enable processing of this new tag, a command has been defined in the Cisco IOS command-line interface as **tag ppp-max-payload**. The PPP-Max-Payload and IWF PPPoE Tag Support feature enhances the PPPoE component so the **tag ppp-max-payload** command can process the new tag to influence the Link Control Protocol (LCP) MRU negotiations for the PPP session based on the MRU value specified in the tag from the PPPoE client.

Interworking Functionality

The DSL Forum defined IWF to define the process for conversion of PPP over ATM (PPPoA) sessions to PPPoE sessions at the digital subscriber line access multiplexer (DSLAM) to the BRAS. This functionality was defined to help the migration of DSLAM networks from ATM to Ethernet media. So, essentially, the PPPoA session comes in to the DSLAM over ATM and is converted to a PPPoE session at the DSLAM, which is then connected to the BRAS as a PPPoE session. Each PPPoA session is mapped to a corresponding PPPoE session.

Typically, the BRAS is configured to limit PPPoE sessions originating from the same MAC address to protect itself from a DOS attack. This presents a problem for IWF PPPoE sessions because all PPPoE sessions originate from the same MAC address DSLAM. To overcome this issue, the IWF PPPoE tag is inserted at the DSLAM and read by the BRAS to distinguish the IWF PPPoE session from the regular PPPoE session during the PPPoE discovery frames.

For more information about this subject, refer to the DSL Forum Technical Report 101: *Migration to Ethernet-Based DSL Aggregation*.

How to Configure the PPP-Max-Payload and IWF PPPoE Tag Support Feature

Enabling the PPP-Max-Payload and IWF PPPoE Tag Support Feature

To enable the PPP-Max-Payload and IWF PPPoE Tag Support feature, perform this task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **bba-group pppoe** *group-name*
4. **virtual-template** *template-number*
5. **tag ppp-max-payload** [**minimum value maximum value**] [**deny**]
6. **sessions per-mac limit** *per-mac-limit*
7. **interface ethernet** *slot / port*
8. **pppoe enable group** *group-name*
9. **virtual-template** *template-number*
10. **ppp lcp echo mru verify** [**minimum value**]
11. **end**
12. **show pppoe session** [**all**] **packets**]

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.

	Command or Action	Purpose
Step 3	bba-group pppoe <i>group-name</i> Example: <pre>Router(config)# bba-group pppoe pppoe-group</pre>	Enters BBA group configuration mode and defines a PPPoE profile.
Step 4	virtual-template <i>template-number</i> Example: <pre>Router(config-bba-group)# virtual-template 1</pre>	Configures a PPPoE profile with a virtual template to be used for cloning virtual access interfaces. <ul style="list-style-type: none"> The <i>template-number</i> argument is an identifying number of the virtual template that will be used to clone virtual-access interfaces.
Step 5	tag ppp-max-payload [minimum value maximum value] [deny] Example: <pre>Router(config-bba-group)# tag ppp-max-payload minimum 1200 maximum 3000</pre>	Specifies a range for the ppp-max payload tag value that will be accepted by the BRAS. <ul style="list-style-type: none"> Default values are 1492 for the minimum and 1500 for the maximum. The ppp-max-payload tag value accepted from the client cannot exceed the physical interface value for MTU minus 8.
Step 6	sessions per-mac limit <i>per-mac-limit</i> Example: <pre>Router(config-bba-group)# sessions per-mac iwf limit 200</pre>	Specifies a limit for IWF-specific sessions per MAC address (separate from session limits that are not IWF-specific). <ul style="list-style-type: none"> If this command is not entered, the normal MAC-address session limit is applied to IWF sessions. The <i>per-mac-limit</i> argument specifies the allowable number of IWF sessions. The default is 100.
Step 7	interface ethernet <i>slot / port</i> Example: <pre>Router(config-bba-group)# interface ethernet 1/0</pre>	Enters interface configuration mode for an Ethernet interface: <ul style="list-style-type: none"> The <i>slot / port</i> arguments identify the slot number and the port number to which this configuration applies. The slash mark is required.
Step 8	pppoe enable group <i>group-name</i> Example: <pre>Router(config-if)# pppoe enable group 1</pre>	Enables PPPoE sessions on an Ethernet interface or subinterface.
Step 9	virtual-template <i>template-number</i> Example: <pre>Router(config-if)# virtual-template 1</pre>	Configures a PPPoE profile with a virtual template to be used for cloning virtual access interfaces. <ul style="list-style-type: none"> The <i>template-number</i> argument is an identifying number of the virtual template that will be used to clone virtual-access interfaces.

	Command or Action	Purpose
Step 10	<p>ppp lcp echo mru verify [<i>minimum value</i>]</p> <p>Example:</p> <pre>Router(config-if)# ppp lcp echo mru verify minimum 1304</pre>	<p>Verifies the negotiated MRU and adjusts the PPP virtual access interface MTU for troubleshooting purposes.</p> <ul style="list-style-type: none"> • If the optional minimum keyword is entered, the <i>value</i> can be from 64 to 1500. • If the verification of minimum MTU succeeds, the PPP connection's interface MTU is set to that value. This reset is useful when you troubleshoot and need to adjust the sessions according to underlying physical network capability. After this command is configured, IP Control Protocol (IPCP) is delayed until verification of the MTU is completed at the LCP.
Step 11	<p>end</p> <p>Example:</p> <pre>Router(config-if)# end</pre>	<p>Exits the current configuration mode and returns to privileged EXEC mode.</p>
Step 12	<p>show pppoe session [<i>all</i> <i>packets</i>]</p> <p>Example:</p> <pre>Router# show pppoe session all</pre>	<p>Verifies the configuration and displays session information.</p> <ul style="list-style-type: none"> • all --Displays output indicating if a session is IWF-specific or if the PPP-Max-Payload tag is in the discovery frame and accepted. • packets --Displays packet statistics for the PPPoE session.

Disabling the PPP-Max-Payload and IWF PPPoE Tag Support Feature

The **tag ppp-max-payload** command adjusts PPP MTU of the PPPoE session above the default maximum limit of 1492 bytes. But MTU values greater than 1492 can only be supported (with PPPoE) if the underlying Ethernet network supports these larger frames. Not all Ethernet networks support higher values. If your network does not support values higher than the default maximum, you should disable the PPP-Max-Payload and IWF PPPoE Tag Support feature by performing this task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **bba-group pppoe** *group-name*
4. **tag ppp-max-payload deny**
5. **end**

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 interface configuration mode.
Step 3	bba-group pppoe <i>group-name</i> Example: Router(config-if)# bba-group pppoe pppoe-group	Enters BBA group configuration mode and defines a PPPoE profile.
Step 4	tag ppp-max-payload deny Example: Router(config-bba-group)# tag ppp-max-payload deny	Disables the processing of the ppp-max-payload tag value higher than the default of 1492 bytes.
Step 5	end Example: Router(config-bba-group)# end	Exits the BBA group configuration mode and returns to privileged EXEC mode.

Configuration Examples for the PPP-Max Payload and IWF PPPoE Tag Support Feature

This section provides a sample configuration showing the PPP-Max-Payload and IWF PPPoE Tag Support feature enabled and a configuration in which the effects of this feature are disabled:

Configuration with the PPP-Max-Payload and IWF PPPoE Tag Support Feature Enabled Example

The following configuration example shows the PPP-Max-Payload and IWF PPPoE Tag Support enabled to accept PPP-Max-Payload tag values from 1492 to 1892, limits the number of sessions per MAC address to 2000 when the IWF is present, and verifies that the PPP session can accept 1500-byte packets in both directions:

```
bba-group pppoe global
virtual-template 1
tag ppp-max-payload minimum 1492 maximum 1892
sessions per-mac limit 1
sessions per-mac iwf limit 2000
!
interface Virtual-Template 1
!
```

Configuration with the PPP-Max-Payload and IWF PPPoE Tag Support Feature Disabled Example

The following configuration example disables the effect of the `tag ppp-max-payload` command:

```
bba-group pppoe global
virtual-template 1
tag ppp-max-payload deny
```

Additional References

The following sections provide references related to the PPP-Max-Payload and IWF PPPoE Tag Support feature.

Related Documents

Related Topic	Document Title
Command reference information for broadband and DSL	Cisco IOS Broadband Access Aggregation and DSL Command Reference

Standards

Standard	Title
DSL Forum Technical Report 101	<i>Migration to Ethernet-Based DSL Aggregation</i>

MIBs

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

RFCs

RFC	Title
RFC 2516	A Method for Transmitting PPP Over Ethernet (PPPoE)
Draft RFC document	Accommodating an MTU/MRU Greater than 1492 in PPPoE

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for PPP-Max Payload and IWF PPPoE Tag Support

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 PPP-Max-Payload and IWF PPPoE Tag Support

Feature Name	Releases	Feature Information
PPP-Max Payload and IWF PPPoE Tag Support	12.2(31)SB2 12.2(33)SRC 15.0(1)M	<p>The PPP-Max-Payload and IWF PPPoE Tag Support feature enables the PPP over Ethernet (PPPoE) component to process the PPP-Max-Payload and Interworking Functionality (IWF) PPPoE tags in the PPPoE discovery frame:</p> <ul style="list-style-type: none"> • The tag ppp-max-payload command allows PPPoE peers to negotiate PPP maximum receive units (MRUs) greater than 1492 octets if the underlying network supports a maximum transmission unit (MTU) size greater than 1500 octets. • The IWF PPPoE tag allows the Broadband Remote Access Server (BRAS) to distinguish the IWF PPPoE from the regular PPPoE sessions to overcome the per-MAC session limit put on the BRAS as a protection from denial of service (DOS) attacks sourced from the same MAC address. <p>The following commands were introduced or modified:</p> <p>ppp lcp echo mru verify , tag ppp-max-payload</p>

Glossary

BBA --Broadband access.

BRAS --Broadband Remote Access Server, typically acting as a PPPoE server.

DOS --Denial of service (a form of security attacks).

DSLAM --Digital subscriber line access multiplexer.

IPCP --IP Control Protocol.

IWF --Interworking Functionality (used to describe the PPPoA conversion to PPPoE sessions at the DSLAM).

IWF PPPoE session --A PPPoE session from the DSLAM to the BRAS that is actually a PPPoA session from the end user to the DSLAM.

LCP --Link Control Protocol.

MRU --PPP maximum received unit as negotiated in LCP.

MTU --Maximum transmission unit of an interface.

PADO --PPPoE Active Discovery Offer.

PADR --PPPoE Active Discovery Request.

PADS --PPPoE Active Discovery Session Confirmation.

PPP --Point-to-Point Protocol

PPPoE --PPP over Ethernet protocol or PPPoE component.

VPDN --virtual private dialup network.



Routed Bridge Encapsulation with ATM Virtual Circuit Bundles

The Routed Bridge Encapsulation with ATM Virtual Circuit Bundles feature enables routed bridge encapsulation (RBE) over ATM permanent virtual circuit (PVC) bundles. This feature supports PVC bundle member selection based on the quality of service (QoS) group or on the type of service (ToS) or Multiprotocol Label Switching (MPLS) Experimental (EXP) bit in each packet over RBE interfaces. The PVC bundles carry RBE traffic configured on ATM point-to-point subinterfaces.

This feature also supports PVC bundle functionality for ATM adaptation layer 5 (AAL5) multiplexer (MUX) or Logical Link Control (LLC)/Subnetwork Access Protocol (SNAP) encapsulations and ATM PVC bundle scalability.

- [Finding Feature Information, page 33](#)
- [Restrictions for Routed Bridge Encapsulation with ATM Virtual Circuit Bundles, page 34](#)
- [Information About Routed Bridge Encapsulation with ATM Virtual Circuit Bundles, page 34](#)
- [How to Configure Routed Bridge Encapsulation with ATM Virtual Circuit Bundles, page 35](#)
- [Configuration Examples for Routed Bridge Encapsulation with ATM Virtual Circuit Bundles, page 41](#)
- [Additional References, page 42](#)
- [Technical Assistance, page 43](#)
- [Feature Information for Routed Bridge Encapsulation with ATM Virtual Circuit Bundles, page 43](#)
- [Glossary, page 44](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and 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 module.

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.

Restrictions for Routed Bridge Encapsulation with ATM Virtual Circuit Bundles

The following restrictions apply to the Routed Bridge Encapsulation with ATM Virtual Circuit Bundles feature:

- RBE over switched virtual circuit (SVC) bundles is not supported.
- SVC bundle member selection based on QoS groups is not supported.
- Fast switching is not supported (only Cisco Express Forwarding switching and process switching are supported).
- PVC bundle member selection based on QoS groups does not support distributed platforms.
- PVC bundle member selection based on QoS groups does not support bumping, protection, or PVC bundle incompleteness detection.

PVC bundles are supported under the following conditions (numbers are maximum per interface and per router):

- 1000 PVC bundles with AAL5 LLC/SNAP encapsulation, and each PVC bundle with four PVC bundle members
- 800 PVC bundles with two members each and with AAL5 LLC/SNAP encapsulation, and interfaces with 4000 PVCs overall (including PVC bundle members)

Information About Routed Bridge Encapsulation with ATM Virtual Circuit Bundles

Benefits of Routed Bridge Encapsulation with ATM Virtual Circuit Bundles

If the Routed Bridge Encapsulation with ATM Virtual Circuit Bundles feature is not configured, you can make the PVC bundle member selection based on ToS bit settings (for IP packets) or EXP bit settings (for MPLS packets). With the Routed Bridge Encapsulation with ATM Virtual Circuit Bundles feature configured, you can make the PVC bundle member selection based on the QoS group value associated with the packet on the ingress before route selection, or on the egress after selecting the adjacency. The packet's pak_type header is marked with the QoS group to use, based on the generic match criterion provided by the modular QoS (MQC) command-line interface (CLI).

The Routed Bridge Encapsulation with ATM Virtual Circuit Bundles feature gives you the flexibility to choose PVC bundle members based on various criteria. You can define any classification criterion for the traffic, mark the packets matching that criterion with the QoS group, and send them over a specific PVC bundle member to assign the appropriate quality of service to the corresponding class of traffic.

Memory Impact of Routed Bridge Encapsulation with ATM Virtual Circuit Bundles

The additional memory required for configuring the Routed Bridge Encapsulation with ATM Virtual Circuit Bundles feature does not exceed 50 bytes per PVC bundle.

Performance Impact of Routed Bridge Encapsulation with ATM Virtual Circuit Bundles

The Routed Bridge Encapsulation with ATM Virtual Circuit Bundles feature impacts forwarding path performance when PVC bundles are configured with QoS groups. This impact results because, during forwarding, QoS groups must be mapped to the appropriate PVC bundle member index in the array of adjacencies associated with the PVC bundle adjacency.

This feature does not significantly increase CPU usage when traffic at line rates is sent over the PVC bundle (regardless of the selection criterion used for PVC bundle member selection).

How to Configure Routed Bridge Encapsulation with ATM Virtual Circuit Bundles

Specifying the Method for Selecting PVC Bundle Members

Perform this task to specify the method of selection of PVC bundle members. You can specify one of two selection methods:

- QoS group--Use the QoS group value associated with each packet for selection of PVC bundle members.
- ToS or EXP--Use ToS bit settings of each packet (for IP packets) or EXP bit settings of each packet (for MPLS packets) for selection of PVC bundle members.

The selection methods are mutually exclusive. This means that when the selection method based on QoS groups is specified on any PVC bundle member, no other selection method is allowed on the same PVC bundle. Similarly, if the selection method based on ToS or EXP is specified on any PVC bundle member, no other selection method is allowed on the same PVC bundle.

**Note**

- You can change the selection method from QoS groups to ToS or EXP only if no PVC bundle member has QoS groups or Inverse Address Resolution Protocol (InverseARP) configured.
- You can change the selection method from ToS or EXP to QoS groups only if no PVC bundle member has precedence, protection, or bumping configured.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot / port*
4. **bundle** *bundle-name*
5. **selection-method** {**qos-group** | **tos-exp**}
6. **end**

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 atm <i>slot / port</i> Example: Router(config)# interface atm 2/0	Specifies the ATM interface type and enters interface configuration mode. To determine the correct form of the interface atm command, see your ATM network module, port adapter, or router documentation.
Step 4	bundle <i>bundle-name</i> Example: Router(config-if)# bundle bundle-test	Creates a PVC bundle or modifies an existing PVC bundle and enters ATM bundle configuration mode.
Step 5	selection-method { qos-group tos-exp } Example: Router(config-if-atm-bundle)# selection-method qos-group	Specifies the method for selection of PVC bundle members.
Step 6	end Example: Router(config-if-atm-member)# end	Ends the configuration session and returns to privileged EXEC mode.

Configuring the QoS Group-Based Method for Selection of PVC Bundle Members

Perform this task to configure the method for selection of PVC bundle members that is based on QoS groups.

Before You Begin

You must associate a QoS group or groups with a PVC bundle member. You can specify a QoS group, a range of QoS groups, or any combination of QoS groups and ranges of QoS groups.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot / port*
4. **bundle** *bundle-name*
5. **selection-method qos-group**
6. **pvc** *vpi / vci*
7. **qos-group** *qos-groups*
8. **end**

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 atm <i>slot / port</i> Example: Router(config)# interface atm 2/0	Specifies the ATM interface type and enters interface configuration mode. <ul style="list-style-type: none"> • To determine the correct form of the interface atm command, see your ATM network module, port adapter, or router documentation.
Step 4	bundle <i>bundle-name</i> Example: Router(config-subif)# bundle bundle-test	Creates a PVC bundle or modifies an existing PVC bundle and enters ATM bundle configuration mode.

	Command or Action	Purpose
Step 5	selection-method qos-group Example: <pre>Router(config-if-atm-bundle)# selection-method qos-group</pre>	Specifies the method for selection of PVC bundle members based on QoS group.
Step 6	pvc vpi / vci Example: <pre>Router(config-if-atm-bundle)# pvc 1/32</pre>	Creates an ATM PVC and enters ATM bundle-member configuration mode.
Step 7	qos-group qos-groups Example: <pre>Router(config-if-atm-member)# qos-group 1</pre>	Associates a QoS group or groups with the PVC bundle member.
Step 8	end Example: <pre>Router(config-if-atm-member)# end</pre>	Ends the configuration session and returns to privileged EXEC mode.

Configuring Explicit Inverse ARP PVC Selection for QoS Group-Based PVC Bundle Member Selection

Perform this task to configure explicit Inverse ARP for a PVC bundle member.

This procedure is optional and provides backward compatibility with existing PVC bundles, in which an Inverse ARP request is sent or expected to be received on the PVC bundle member with precedence 6. If a PVC bundle with selection based on QoS group is connected to an existing PVC bundle, you must follow this procedure to allow Inverse ARP to function. If you do not follow this procedure, Inverse ARP is sent over any of the available PVC bundle members.



Note

You can enable Inverse ARP for a PVC bundle member only when using the QoS groups method for selecting PVC bundle members.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface atm** *slot / port*
4. **bundle** *bundle-name*
5. **selection-method qos-group**
6. **pvc** *vpi / vci*
7. **qos-group** *qos-groups*
8. **inarp-vc**
9. **end**

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 atm <i>slot / port</i> Example: Router(config)# interface atm 2/0	Specifies the ATM interface type and enters interface configuration mode. <ul style="list-style-type: none"> • To determine the correct form of the interface atm command, see your ATM network module, port adapter, or router documentation.
Step 4	bundle <i>bundle-name</i> Example: Router(config-if)# bundle bundle-test	Creates a bundle or modifies an existing bundle and enters ATM bundle configuration mode.
Step 5	selection-method qos-group Example: Router(config-if-atm-bundle)# selection-method qos-group	Specifies the method for selection of PVC bundle members based on QoS group.

	Command or Action	Purpose
Step 6	<p><code>pvc vpi / vci</code></p> <p>Example:</p> <pre>Router(config-if-atm-bundle)# pvc 1/32</pre>	Creates an ATM PVC and enters ATM bundle member configuration mode.
Step 7	<p><code>qos-group qos-groups</code></p> <p>Example:</p> <pre>Router(config-if-atm-member)# qos-group 1</pre>	Associates a QoS group or groups with the PVC bundle member.
Step 8	<p><code>inarp-vc</code></p> <p>Example:</p> <pre>Router(config-if-atm-member)# inarp-vc</pre>	Enables Inverse ARP for the PVC bundle member.
Step 9	<p><code>end</code></p> <p>Example:</p> <pre>Router(config-if-atm-member)# end</pre>	Ends the configuration session and returns to privileged EXEC mode.

Verifying Routed Bridge Encapsulation with ATM Virtual Circuit Bundles

Perform this task to verify configuration of the Routed Bridge Encapsulation with ATM Virtual Circuit Bundles feature:

SUMMARY STEPS

1. `enable`
2. `show atm vc`
3. `show interfaces`
4. `show interfaces virtual-access`

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><code>enable</code></p> <p>Example:</p> <pre>Router> enable</pre>	<p>Enters privileged EXEC mode.</p> <ul style="list-style-type: none"> • Enter your password if prompted.

	Command or Action	Purpose
Step 2	show atm vc Example: Router# show atm vc	Displays all ATM PVCs and SVCs and their traffic information.
Step 3	show interfaces Example: Router# show interfaces	Displays interleaving statistics. <ul style="list-style-type: none"> • Interleaving data is displayed only if interleaving occurs.
Step 4	show interfaces virtual-access Example: Router# show interfaces virtual-access	Displays multilink bundle information.

Configuration Examples for Routed Bridge Encapsulation with ATM Virtual Circuit Bundles

Specifying the Method for Selecting PVC Bundle Members Example

The following example shows how to specify the method for selecting PVC bundle members:

```
interface atm 2/0
 bundle cisco
   selection-method qos-group
 end
```

Configuring the QoS Group-Based Method for Selection of PVC Bundle Members Example

The following example shows how to configure the QoS group-based method for selection of PVC bundle members:

```
interface atm 2/0
 bundle cisco
   selection-method qos-group
   pvc 35/56
     qos-group 1
 end
```

Configuring Explicit Inverse ARP PVC Selection for QoS Group-Based PVC Bundle Member Selection Example

The following example shows how to configure explicit Inverse ARP PVC selection for QoS group-based PVC bundle member selection:

```
interface atm 2/0
 bundle cisco
  selection-method qos-group
  pvc 1/32
  qos-group 1
  inarp-vc
end
```

Additional References

The following sections provide references related to the Routed Bridge Encapsulation with ATM Virtual Circuit Bundles feature.

Related Documents

Related Topic	Document Title
Broadband access aggregation concepts	Understanding Broadband Access Aggregation
Preparing for broadband access aggregation tasks	Preparing for Broadband Access Aggregation
Broadband access aggregation and DSL commands: complete command syntax, command mode, defaults, usage guidelines, and examples	<i>Cisco IOS Broadband Access Aggregation and DSL Command Reference</i>
Cisco IOS commands	Cisco IOS Master Commands List, All Releases

Standards

Standard	Title
None	--

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
None	--

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Routed Bridge Encapsulation with ATM Virtual Circuit Bundles

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 5: Feature Information for Routed Bridge Encapsulation with ATM Virtual Circuit Bundles

Feature Name	Releases	Feature Information
Routed Bridge Encapsulation with ATM Virtual Circuit Bundles	12.2(31)SB2 12.2(33)SRE 12.4(4)T	This feature enables RBE over ATM PVC bundles. This feature supports PVC bundle member selection based on the QoS group or on the ToS or MPLS EXP bit in each packet over RBE interfaces. The following command was introduced: selection-method .

Glossary

ARP --Address Resolution Protocol. Internet protocol used to map an IP address to a MAC address. Defined in RFC 826.

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.

bundle --A logical grouping of one or more physical interfaces using the formats and procedures of multilink Frame Relay. A bundle emulates a physical interface to the Frame Relay data link layer. The bundle is also referred to as the *MFR interface* .

Cisco Express Forwarding --Layer 3 IP switching technology that optimizes network performance and scalability for networks with large and dynamic traffic patterns.

fast switching --Cisco feature in which a route cache expedites packet switching through a router.

Inverse ARP --Inverse Address Resolution Protocol (ARP). Method of building dynamic routes in a network. Allows an access server to discover the network address of a device associated with a virtual circuit.

MPLS --Multiprotocol Label Switching. Switching method that forwards IP traffic using a label. This label instructs the routers and the switches in the network where to forward the packets based on preestablished IP routing information.

MQC --modular QoS command-line interface (CLI). A CLI structure that lets you create traffic polices and attach them to interfaces. A traffic policy contains a traffic class and one or more QoS features. A traffic class is used to classify traffic, and the QoS features in the traffic policy determine how to treat the classified traffic.

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

QoS --quality of service. Measure of performance for a transmission system that reflects its transmission quality and service availability.

RBE --routed bridge encapsulation. Process by which a stub-bridged segment is terminated on a point-to-point routed interface. Specifically, the router is routing on an IEEE 802.3 or Ethernet header carried over a point-to-point protocol, such as PPP, RFC 1483 ATM, or RFC 1490 Frame Relay.

SVC --switched virtual circuit. Virtual circuit that is dynamically established on demand and is torn down when transmission is complete. SVCs are used in situations where data transmission is sporadic. Called a switched virtual connection in ATM terminology.

ToS --type of service byte. Second byte in the IP header that indicates the desired quality of service for a specific datagram.

VC --virtual circuit. Logical circuit created to ensure reliable communication between two network devices. A VC is defined by a VPI/VCI pair and can be either permanent or switched.

