Using Multilink PPP over ATM Links

This module contains conceptual information and configuration tasks for using Multilink PPP over ATM links. Multilink PPP is a method that is used to reduce latency and jitter for real-time traffic.

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 Using Multilink PPP over ATM Links

- Be familiar with the concepts in the "Reducing Latency and Jitter for Real-Time Traffic Using Multilink PPP" module.
- Multilink PPP uses first-in first-out (FIFO) queueing for queueing and interleaving packets. Other queueing mechanisms such as low latency queueing (LLQ), weighted fair queueing (WFQ), and

class-based weighted fair queueing (CBWFQ) can be used. If you want to use one of these alternative mechanisms, enable it before configuring Multilink.

Restrictions for Using Multilink PPP over ATM Links

- Only Voice over IP (VoIP) is supported; Voice over ATM is not supported.
- Multilink PPP over ATM must use the following ATM network modules:
  - Multiport T1/E1 ATM Network Module with Inverse Multiplexing over ATM
  - ATM OC-3 Network Module
  - Enhanced ATM Port Adapter

Information About Using Multilink PPP over ATM Links

MQC and Multilink PPP over ATM Links

Before using Multilink PPP over ATM links, a policy map must be created. (See the MQC and Multilink PPP over ATM Links.) Policy maps are created using the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC).

VirtualTemplateInterfaces

A virtual template interface is a logical interface that is configured with generic configuration information for a specific purpose or a configuration common to specific users, plus router-dependent information. The template takes the form of a list of Cisco IOS interface commands that are applied to virtual access interfaces, as needed.

Multilink Group Interfaces

A multilink group interface is a collection of interfaces that are bundled together in the multilink PPP configuration. With a multilink group interface, you can bundle interfaces into logical multilink groups.

How to Configure Multilink PPP over ATM Links

While the first two procedures are listed as optional, you must choose one or the other according to the Cisco router that you are using in your network.

Configuring Multilink PPP over ATM Links on a Virtual Template Interface

These steps apply if you are using the Cisco 7500 series router or the Cisco 7600 series router only. If you are using another series of Cisco router, do not complete these steps. Instead, advance to the Configuring Multilink PPP over ATM Links on a Multilink Group Interface, on page 5.

Before You Begin

Before proceeding with this task, you must create a policy map. The policy map contains the configuration parameters used to apply a specific QoS feature, such as distributed LLQ (dLLQ), to the network traffic.

SUMMARY STEPS

1. **enable**
2. **configure   terminal**
3. **interface virtual-template** *number*
4. **bandwidth** *kbps*
5. **ip address**   *ip-address* *mask* [**secondary**]
6. **service-policy   output** *policy-map-name*
7. **service-policy   input** *policy-map-name*
8. **ppp multilink**
9. **ppp multilink fragment delay** *milliseconds* [*microseconds*]
10. **ppp multilink interleave**
11. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface virtual-template** *number* **Example:** Router(config)# interface virtual-template 4	Creates a virtual template and enters interface configuration mode. • Enter the virtual template number.
Step 4	**bandwidth** *kbps*	Sets the bandwidth value for an interface.

	Command or Action	Purpose
	Example: `Router(config-if)# bandwidth 32`	• Enter the bandwidth value in kilobits per second.
Step 5	**ip address** *ip-address* *mask* [**secondary**] **Example:** `Router(config-if)# ip address 10.10.100.1 255.255.255.0`	Sets a primary IP address for an interface. This command can also set the optional secondary IP address for an interface. • Enter the primary IP address (and, optionally, the secondary IP address).
Step 6	**service-policy output** *policy-map-name* **Example:** `Router(config-if)# service-policy output policy1`	Attaches the previously created QoS traffic policy (policy map). The policy map evaluates and applies QoS features for traffic *leaving* the interface. • Enter the policy map name.
Step 7	**service-policy input** *policy-map-name* **Example:** `Router(config-if)# service-policy input policy1`	Attaches the previously created QoS traffic policy (policy map). The policy map evaluates and applies QoS features for traffic *entering* the interface. • Enter the policy map name.
Step 8	**ppp multilink** **Example:** `Router(config-if)# ppp multilink`	Enables Multilink PPP (MLP) on the interface.
Step 9	**ppp multilink fragment delay** *milliseconds* [*microseconds*] **Example:** `Router(config-if)# ppp multilink fragment delay 20`	Specifies a maximum size in units of time for packet fragments on an MLP bundle. • Enter the maximum amount of time, in milliseconds. **Note** The fragment delay can be calculated using the following formula: fragment delay = (fragment size * 8)/bandwidth
Step 10	**ppp multilink interleave** **Example:** `Router(config-if)# ppp multilink interleave`	Enables interleaving of packets among the fragments of larger packets on a multilink bundle.
Step 11	**end** **Example:** `Router(config-if)# end`	(Optional) Exits interface configuration mode and returns to privileged EXEC mode.

Configuring Multilink PPP over ATM Links on a Multilink Group Interface

If you are using the Cisco 7500 series router or the Cisco 7600 series router, do not complete these steps. Instead, complete the steps in Configuring Multilink PPP over ATM Links on a Virtual Template Interface, on page 3.

Before You Begin

Before proceeding with this task, you must create a policy map. The policy map contains the configuration parameters used to apply a specific QoS feature, such as distributed LLQ (dLLQ), to the network traffic.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface multilink** *multilink-bundle-number*
4. **ip address** *ip-address mask* [**secondary**]
5. **service-policy output** *policy-map-name*
6. **service-policy input** *policy-map-name*
7. **ppp multilink fragment delay** *milliseconds* [*microseconds*]
8. **ppp multilink interleave**
9. **ppp multilink multiclass**
10. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface multilink** *multilink-bundle-number* **Example:** `Router(config)# interface multilink 1`	Creates a multilink bundle and enters interface configuration mode. • Enter the multilink bundle number.

	Command or Action	Purpose
Step 4	**ip address** *ip-address* *mask* [**secondary**] **Example:** `Router(config-if)# ip address 10.10.100.1 255.255.255.0`	Sets a primary IP address for an interface. This command can also set the optional secondary IP address for an interface. • Enter the primary IP address (and, optionally, the secondary IP address).
Step 5	**service-policy** **output** *policy-map-name* **Example:** `Router(config-if)# service-policy output policy1`	Attaches the previously created QoS traffic policy (policy map). See the Configuring Multilink PPP over ATM Links on a Multilink Group Interface. The policy map evaluates and applies QoS features for traffic *leaving* the interface. • Enter the policy map name.
Step 6	**service-policy** **input** *policy-map-name* **Example:** `Router(config-if)# service-policy input policy1`	Attaches the previously created QoS traffic policy (policy map). See the Configuring Multilink PPP over ATM Links on a Multilink Group Interface. The policy map evaluates and applies QoS features for traffic *entering*the interface. • Enter the policy map name.
Step 7	**ppp multilink fragment delay** *milliseconds* [*microseconds*] **Example:** `Router(config-if)# ppp multilink fragment delay 20`	Specifies a maximum size in units of time for packet fragments on a Multilink PPP (MLP) bundle. • Enter the maximum amount of time, in milliseconds.
Step 8	**ppp multilink interleave** **Example:** `Router(config-if)# ppp multilink interleave`	Enables interleaving of packets among the fragments of larger packets on a multilink bundle.
Step 9	**ppp multilink multiclass** **Example:** `Router(config-if)# ppp multilink multiclass`	(Optional) Enables Multiclass Multilink PPP (MCMP) on an interface. **Note** Use this command only if there are multiple links in the multilink bundle.
Step 10	**end** **Example:** `Router(config-if)# end`	(Optional) Exits interface configuration mode and returns to privileged EXEC mode.

What to Do Next

After configuring Multilink PPP over ATM links on a multilink group interface, the next step is to associate the virtual template interface with the multilink group by completing the steps in the following section.

If you are using a Cisco 7500 series router or a Cisco 7600 series router, advance to the to continue.

Associating the Virtual Template Interface with the Multilink Group

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface virtual-template** *number*
4. **no ip address** [*ip-address mask* [**secondary**]]
5. **ppp multilink group** *group-number*
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface virtual-template** *number* **Example:** `Router(config)# interface virtual-template 2`	Creates a virtual template interface that can be configured and applied dynamically in creating virtual access interfaces, and enters interface configuration mode. • Enter the number used to identify the virtual template interface.
Step 4	**no ip address** [*ip-address mask* [**secondary**]] **Example:** `Router(config-if)# no ip address`	Removes an IP address or disables IP processing.

	Command or Action	**Purpose**
Step 5	**ppp multilink group** *group-number* **Example:** Router(config-if)# ppp multilink group 1	Restricts a physical link to joining only a designated multilink group interface. • Enter the multilink group number.
Step 6	**end** **Example:** Router(config-if)# end	(Optional) Exits interface configuration mode and returns to privileged EXEC mode.

Associating the Virtual Template Interface with an ATM PVC

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number* [**name-tag**]
4. **pvc** [*name*] *vpi* / *vci* [**ces** | **ilmi** | **qsaal** | **smds** | **l2transport**]
5. **abr** *output-pcr output-mcr*
6. **vbr-nrt** *output-pcr output-scr output-mbs* [*input-pcr*] [*input-scr*] [*input-mbs*]
7. **protocol ppp virtual-template** *number*
8. **end**

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface** *type number* [**name-tag**]	Configures an interface type and enters interface configuration mode.

	Command or Action	Purpose
	Example: `Router(config)# interface atm2/0/0`	• Enter the interface type and number.
Step 4	**pvc** [*name*] *vpi* / *vci* [**ces** | **ilmi** | **qsaal** | **smds** | **l2transport**] **Example:** `Router(config-if)# pvc cisco 0/16`	Creates or assigns a name to an ATM permanent virtual circuit (PVC) and enters ATM virtual circuit configuration mode. • Enter the ATM PVC name, the network virtual path identifier, and the network virtual channel identifier.
Step 5	**abr** *output-pcr output-mcr* **Example:** `Router(config-if-atm-vc)# abr 100 80`	(Optional) Selects available bit rate (ABR) QoS and configures the output peak cell rate (PCR) and output minimum guaranteed cell rate (MCR) for an ATM PVC. • Enter the output PCR and the output MCR.
Step 6	**vbr-nrt** *output-pcr output-scr output-mbs* [*input-pcr*] [*input-scr*] [*input-mbs*] **Example:** `Router(config-if-atm-vc)# vbr-nrt 1100 1100 100`	(Optional) Configures the variable bit rate-nonreal time (VBR-NRT) quality of service (QoS) and specifies the output peak cell rate (PCR), the output sustainable cell rate (SCR), and the output maximum burst cell size (MBS) for an ATM PVC, PVC range, switched virtual circuit (SVC), VC class, or VC bundle member. • Enter the output PCR, SCR, and MBS.
Step 7	**protocol ppp virtual-template** *number* **Example:** `Router(config-if-atm-vc)# protocol ppp virtual-template 2`	Specifies that PPP is established over the ATM PVC using the configuration from the specified virtual template. • Enter the virtual-template number.
Step 8	**end** **Example:** `Router(config-if-atm-vc)# end`	(Optional) Exits ATM virtual circuit configuration mode and returns to privileged EXEC mode.

Verifying the Multilink PPP over ATM Links Configuration

SUMMARY STEPS

1. **enable**
2. **show atm pvc** [*vpi / vci* | *name* | **interface atm** *interface-number*[**.** *subinterface-number* **multipoint**]] [**ppp**]
3. **show interfaces** [*type number*] [*first*] [*last*] [**accounting**]
4. **show ppp multilink** [**active** | **inactive** | **interface** *bundle-interface* | [**username** *name*] [**endpoint** *endpoint*]]
5. **show policy-map interface** *interface-name* [**vc** [*vpi /*] *vci*] [**dlci** *dlci*] [**input** | **output**]
6. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show atm pvc** [*vpi / vci*	*name*	**interface atm** *interface-number*[**.** *subinterface-number* **multipoint**]] [**ppp**] **Example:** `Router# show atm pvc`	(Optional) Displays all ATM PVCs and traffic information.
Step 3	**show interfaces** [*type number*] [*first*] [*last*] [**accounting**] **Example:** `Router# show interfaces`	(Optional) Displays statistics for all interfaces that are configured on the router or access server.
Step 4	**show ppp multilink** [**active**	**inactive**	**interface** *bundle-interface*	[**username** *name*] [**endpoint** *endpoint*]] **Example:** `Router# show ppp multilink`	(Optional) Displays bundle information for multilink bundles.
Step 5	**show policy-map interface** *interface-name* [**vc** [*vpi /*] *vci*] [**dlci** *dlci*] [**input**	**output**] **Example:** `Router# show policy-map interface serial0/0`	(Optional) Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface.

	Command or Action	Purpose
Step 6	**exit** **Example:** `Router# exit`	(Optional) Exits privileged EXEC mode.

Configuration Examples for Using Multilink PPP over ATM Links

Example Configuring Multilink PPP over ATM Links on a Virtual Template Interface

The following is an example of configuring Multilink PPP over ATM links on a virtual template interface:

```
Router> enable
Router# configure terminal
Router(config)# interface virtual-template 4
Router(config-if)# bandwidth 32
Router(config-if)# ip address 10.10.100.1 255.255.255.0

Router(config-if)# service-policy output policy1
Router(config-if)# service-policy input policy1
Router(config-if)# ppp multilink
Router(config-if)# ppp multilink fragment delay 20
Router(config-if)# ppp multilink interleave
Router(config-if)# end
```

Example Configuring Multilink PPP over ATM Links on a Multilink Group Interface

The following is an example of configuring Multilink PPP over ATM links on a multilink group interface:

```
Router> enable
Router# configure terminal
Router(config)# interface multilink 1
Router(config-if)# ip address 10.10.100.1 255.255.255.0

Router(config-if)# service-policy output policy1
Router(config-if)# service-policy input policy1
Router(config-if)# ppp multilink fragment delay 20

Router(config-if)# ppp multilink interleave

Router(config-if)# ppp multilink multiclass
Router(config-if)# end
```

Example Associating the Virtual Template Interface with the Multilink Group

The following is an example of associating the virtual template interface with the multilink group:

```
Router> enable
Router# configure terminal
Router(config)# interface virtual-template 2
Router(config-if)# no ip address
Router(config-if)# ppp multilink group 1
Router(config-if)# end
```

Example Associating the Virtual Template Interface with an ATM PVC

The following is an example of associating the virtual template interface with an ATM PVC:

```
Router> enable

Router# configure terminal

Router(config)# interface atm2/0/0

Router(config-if)# pvc cisco 0/16

Router(config-if-atm-vc)# abr 100 80

Router(config-if-atm-vc)# protocol ppp virtual-template 2

Router(config-if-atm-vc)# end
```

Example Verifying the Multilink PPP over ATM Links Configuration

The following is an example of the **show ppp multilink** command output. In this example, one multilink bundle called 7206-2 is on the system. This bundle has two member links: one active link and one inactive link.

```
Router# show ppp multilink
Multilink1, bundle name is 7206-2
  Endpoint discriminator is 7206-2
  Bundle up for 00:00:24, 1/255 load
  Receive buffer limit 12000 bytes, frag timeout 1000 ms
    0/0 fragments/bytes in reassembly list
    0 lost fragments, 0 reordered
    0/0 discarded fragments/bytes, 0 lost received
    0x0 received sequence, 0x0 sent sequence
  Member links: 1 active, 1 inactive (max not set, min not set)
    Vi3, since 00:00:24
    PPPoATM link, ATM PVC 2/101 on ATM2/0/0
    Packets in ATM PVC Holdq: 0 , Particles in ATM PVC Tx Ring: 1
    Vt1 (inactive)
```

Where to Go Next

To use Multilink PPP over Frame Relay, see the "Using Multilink PPP over Frame Relay" module.

To use Multilink PPP over dialer interface links, see the "Using Multilink PPP over Dialer Interface Links" module.

To use Multilink PPP over serial interface links, see the "Using Multilink PPP over Serial Interface Links" module.

Additional References

The following sections provide references related to using Multilink PPP over ATM links.

Related Documents

Related Topic	Document Title
QoS commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	*Cisco IOS Quality of Service Solutions Command Reference*
LLQ, WFQ, CBWFQ, PQ, CQ, FIFO, and other queueing mechanisms	"Configuring Weighted Fair Queueing" module
MQC	"Applying QoS Features Using the MQC" module
Multilink PPP configurations	"Configuring Media-Independent PPP and Multilink PPP" module
Virtual template interfaces	"Configuring Virtual Template Interfaces" module
Multilink PPP overview module	"Reducing Latency and Jitter for Real-Time Traffic Using Multilink PPP" module
Multilink PPP over Frame Relay	"Using Multilink PPP over Frame Relay" module
Multilink PPP over dialer interface links	"Using Multilink PPP over Dialer Interface Links" module
Multilink PPP over serial interface links	"Using Multilink PPP over Serial Interface Links" module

Standards

Standard	Title
No new or modified standards are supported, and support for existing standards has not been modified.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported, and support for existing MIBs has not been modified.	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 1990	*The PPP Multilink Protocol (MP)*
RFC 2686	*Multiclass Extension to Multilink PPP (MCML)*

Technical Assistance

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

Feature Information for Using Multilink PPP over ATM Links

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 Using Multilink PPP over ATM Links

Feature Name	Releases	Feature Information
Distributed Link Fragmentation and Interleaving for Frame Relay and ATM Interfaces on Cisco 7500 Series Routers	12.2(4)T	The Distributed Link Fragmentation and Interleaving (dLFI) for Frame Relay and ATM Interfaces on Cisco 7500 Series Routers feature extends link fragmentation and interleaving functionality to VIP-enabled Cisco 7500 series routers. This feature was extensively rewritten from the perspective of using Multilink PPP for link fragmentation and interleaving over ATM interface links.

Feature Name	Releases	Feature Information
Distributed Link Fragmentation and Interleaving over Leased Lines	12.2(8)T	The Distributed Link Fragmentation and Interleaving over Leased Lines feature extends distributed link fragmentation and interleaving functionality to leased lines. This feature was extensively rewritten from the perspective of using Multilink PPP for link fragmentation and interleaving over ATM interface links.
MLP LFI over ATM Configuration Scaling	12.2(25)S 12.2(27)SBA 15.0(1)M	The MLP LFI over ATM Configuration Scaling feature supports the transport of real-time (voice) and non-real-time (data) traffic on lower-speed Frame Relay and ATM permanent virtual circuits (PVCs) without causing excessive delay of real-time traffic. The following commands were introduced or modified: **ppp multilink group**