



# ATM Multilink PPP Support on Multiple VCs

**First Published:** 12.2(13)T

**Last Updated:** February 28, 2006

## History for the ATM Multilink PPP Support on Multiple VCs Feature

Release	Modification
12.2(13)T	This feature was introduced.
12.2(28)SB	This feature was integrated into Cisco IOS Release 12.2(28)SB.

## Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at <http://www.cisco.com/go/fn>. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

This document describes the ATM Multilink PPP Support on Multiple VCs feature. It includes the following sections:

- [Feature Overview, page 1](#)
- [Configuration Tasks, page 2](#)
- [Monitoring ATM Multilink PPP Support on Multiple VCs, page 6](#)
- [Configuration Examples, page 6](#)
- [Additional References, page 8](#)
- [Command Reference, page 9](#)
- [Glossary, page 9](#)

## Feature Overview

The ATM Multilink PPP Support on Multiple VCs feature supports the transport of real-time (voice) and other (data) traffic on Frame Relay and ATM virtual circuits (VCs).



**Corporate Headquarters:**

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

© 2002, 2005–2006 Cisco Systems, Inc. All rights reserved.

This feature facilitates traffic load balancing on high-speed virtual circuits, using multilink Point-to-Point Protocol (MLP) over Frame Relay and ATM. It facilitates traffic load balancing by using MLP to combine packet datagrams on high-speed VCs, as a means for transporting both the voice and data traffic more efficiently.

Load balancing operates at Layer 2 or Layer 3 (the network layer) of the Open System Interconnection (OSI) reference model. Layer 3 load balancing is independent of any link-layer technologies. The ATM Multilink Point-to-Point Protocol (PPP) Support on Multiple VCs feature implements load balancing at Layer 2 and depends on having MLP enabled at the link layer.

The ATM MLP functionality keeps track of packet sequencing, and this functionality buffers any packets that arrive early. With this ability, ATM MLP preserves packet order across the entire bundle.

In addition to MLP, low latency queueing (LLQ) and class-based weighted fair queueing (CBWFQ) are used to prioritize and differentiate the voice and data packets. LLQ and CBWFQ help to ensure that the voice and data traffic receive the proper quality of service (QoS) treatment (such the correct priority queue assignment) when the voice and data traffic are transmitted.

For more information about LLQ and CBWFQ, see the *Cisco IOS Quality of Service Solutions Configuration Guide*, Release 12.2.

## Benefits

### Facilitates More Efficient Traffic Load Balancing

The ATM Multilink PPP Support on Multiple VCs feature supports the transport of real-time (voice) and other (data) traffic on Frame Relay and ATM VCs.

## Restrictions

The ATM Multilink PPP Support on Multiple VCs feature does not support the following commands and functionality. The configuration will accept these commands, but the commands have no effect:

- **ppp multilink fragment-delay**
- **ppp interleave**

The ATM Multilink PPP Support on Multiple VCs feature does not support the link fragmentation and interleaving (LFI) functionality.

## Related Features and Technologies

- Frame Relay/ATM interworking (FRF.8)
- Frame Relay traffic shaping
- Modular QoS command-line interface (CLI) (MQC)

## Configuration Tasks

See the following sections for configuration tasks for the ATM Multilink PPP Support on Multiple VCs feature. Each task in the list is identified as either required or optional.

- [Defining the Service Policy Using the MQC](#) (required)
- [Defining a Multilink MLP Bundle Interface](#) (required)
- [Defining the Virtual Templates for Member Links](#) (required)
- [Defining the PVCs and Making Them Bundle Member Links](#) (required)
- [Verifying ATM Multilink PPP Support on Multiple VCs](#) (optional)

## Defining the Service Policy Using the MQC

The MQC allows you to create class maps and define service policies. Service policies are used to create classes and set match criteria for classifying traffic. To define a service policy using the MQC, use the following commands beginning in global configuration mode:

	Command	Purpose
<b>Step 1</b>	Router(config)# <b>class-map</b> <i>class-map-name</i>	Specifies the name of the class map to be created. If match-all or match-any is not specified, traffic must match all the match criteria to be classified as part of the class map. Enters class-map configuration mode.
<b>Step 2</b>	Router(config-cmap)# <b>match ip precedence</b> <i>ip-precedence-value</i> [ <i>ip-precedence-value ip-precedence-value</i> ] <sup>1</sup>	Identifies IP precedence values as match criteria.
<b>Step 3</b>	Router(config-cmap)# <b>exit</b>	Exits class-map configuration mode.
<b>Step 4</b>	Router (config)# <b>policy-map</b> <i>policy-name</i>	Specifies the name of the policy map to be created. Enters policy-map configuration mode.
<b>Step 5</b>	Router (config-pmap)# <b>class</b> <i>class-name</i>	Specifies the name of the class map configured earlier. This class map is used to classify traffic. Enters policy-map class configuration mode.
<b>Step 6</b>	Router (config-pmap-c)# <b>bandwidth</b> { <i>bandwidth-kbps</i>   <b>percent</b> <i>percent</i> } <sup>1</sup>	Specifies a minimum bandwidth guarantee to a traffic class in periods of congestion. A minimum bandwidth guarantee can be specified in kbps or by a percentage of the overall available bandwidth. Enters class-map configuration mode.
<b>Step 7</b>	Router(config-cmap)# <b>exit</b>	Exits class-map configuration mode.

1. This is only an example of a command that can be used when configuring a class map or a policy map. Other commands are available. For more information, refer to the “Configuring the Modular Quality of Service Command-Line Interface” chapter of the *Cisco IOS Quality of Service Solutions Configuration Guide*, Release 12.2.

## Defining a Multilink MLP Bundle Interface

The purpose of a multilink bundle interface is to combine more than one permanent virtual circuit (PVC). All configurations for PPP over ATM links are put into virtual templates, and the bundle parameters are put into the multilink bundle. To define a multilink MLP bundle interface, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>interface</b> <i>multilink number</i>	Configures an interface type. In this instance, this command is used to specify the interface multilink number. Enters interface configuration mode.
Step 2	Router(config-if)# <b>ip address</b> <i>ip-address mask</i> [ <b>secondary</b> ]	Sets a primary or secondary IP address for an interface.
Step 3	Router(config-if)# <b>load-interval</b> <i>seconds</i>	Changes the length of time for which data is used to compute load statistics.
Step 4	Router(config-if)# <b>no cdp enable</b>	Disables Cisco Discovery Protocol (CDP) on an interface.
Step 5	Router(config-if)# <b>service-policy output</b> <i>policy-name</i>	Attaches the specified policy map to the output interface.
Step 6	Router(config-if)# <b>ppp multilink</b>	Enables MLP on an interface.
Step 7	Router(config-if)# <b>ppp multilink fragment disable</b>	Disables packet fragmentation.
Step 8	Router(config-if)# <b>ppp multilink group</b> <i>group-number</i>	Restricts a physical link to joining only a designated multilink-group interface.
Step 9	Router(config-if)# <b>exit</b>	Exits interface configuration mode.

## Defining the Virtual Templates for Member Links

To define the virtual templates for member links, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>interface virtual-template</b> <i>number</i>	Creates a virtual template and enters interface configuration mode.
Step 2	Router(config-if)# <b>no ip address</b>	Removes an IP address or disables IP processing.
Step 3	Router(config-if)# <b>load-interval</b> <i>seconds</i>	Changes the length of time for which data is used to compute load statistics.
Step 4	Router(config-if)# <b>ppp multilink</b>	Enables MLP on the interface.
Step 5	Router(config-if)# <b>ppp multilink-group</b> <i>group-number</i>	Restricts a physical link to joining only a designated multilink-group interface.
Step 6	Router(config-if)# <b>exit</b>	Exits interface configuration mode.

## Defining the PVCs and Making Them Bundle Member Links

To define the PVCs and make them bundle member links, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>interface atm slot/0</b> or Router(config)# <b>interface atm slot/port</b>	Specifies the ATM interface type and enters interface configuration mode. <sup>1</sup>
Step 2	Router(config-if)# <b>no ip address</b>	Removes an IP address or disables IP processing.
Step 3	Router(config-if)# <b>load interval seconds</b>	Changes the length of time for which data is used to compute load statistics.
Step 4	Router(config-if)# <b>atm ilmi-keepalive [seconds]</b>	Enables Interim Local Management Interface (ILMI) keepalives.
Step 5	Router(config-if)# <b>pvc [name] vpi/vci</b>	Creates an ATM PVC. Enters interface-ATM-VC configuration mode.
Step 6	Router(config-if-atm-vc)# <b>vbr-nrt output-pcr output-scr output-mbs</b>	Configures the variable bit rate (VBR)-non real time (NRT) QoS and specifies output peak cell rate, output sustainable cell rate, and output maximum burst cell size.
Step 7	Router(config-if-atm-vc)# <b>tx-ring-limit ring-limit</b>	Limits the number of particles or packets that can be used on a transmission ring on an interface. Use this command to tune the transmission ring to assign most of the packets to the Layer 3 queues.
Step 8	Router(config-if-atm-vc)# <b>protocol ppp virtual-template number</b>	Specifies that PPP is established over the ATM PVC using the configuration from the specified virtual template. Enters interface configuration mode.
Step 9	Router(config-if)# <b>exit</b>	Exits interface configuration mode.

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

## Verifying ATM Multilink PPP Support on Multiple VCs

To display information about ATM Multilink PPP Support on Multiple VCs, use the following privileged EXEC commands, as needed:

Command	Purpose
Router# <b>show atm pvc</b>	Displays all ATM PVCs and traffic information.
Router# <b>show frame-relay pvc dlci</b>	Displays statistics about PVCs for Frame Relay interfaces.
Router# <b>show interfaces</b>	Displays interleaving statistics. Interleaving data is displayed only if interleaving occurs.

Command	Purpose
Router# <b>show policy-map</b>	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
Router# <b>show ppp multilink</b>	Displays bundle information for the MLP bundles and their PPP links in the router.
Router# <b>show queueing</b>	Lists all or selected configured queueing strategies.

## Monitoring ATM Multilink PPP Support on Multiple VCs

To monitor ATM Multilink PPP Support on Multiple VCs, use the following privileged EXEC commands, as needed:

Command	Purpose
Router# <b>debug atm errors</b>	Displays ATM errors.
Router# <b>debug atm events</b>	Displays ATM events.
Router# <b>debug ppp error</b>	Displays information on traffic and exchanges in an internetwork implementing the PPP.
Router# <b>debug ppp multilink events</b>	Displays information about events affecting multilink groups.
Router# <b>debug voice RTP</b>	Displays information about the interleaving of voice and data packets. The <b>debug voice RTP</b> command has memory overhead and should not be used when memory is scarce or when traffic is very high.

## Configuration Examples

This section provides the following configuration examples:

- [Defining the Service Policy Using the MQC Configuration: Example](#)
- [Defining a Multilink MLP Bundle Interface Configuration: Example](#)
- [Defining Virtual Templates for Member Links Configuration: Example](#)
- [Defining PVCs and Making Them Bundle Member Links Configuration: Example](#)

### Defining the Service Policy Using the MQC Configuration: Example

The following example shows a service policy that is configured using the MQC:

```
class-map match-all DATA
  match ip precedence 0

class-map match-all VOICE
  match access-group 100
```

```

policy-map CISCO
  class VOICE
    priority percent 70
  class DATA
    bandwidth percent 5

access-list 100 permit udp any any precedence critical

```

## Defining a Multilink MLP Bundle Interface Configuration: Example

The following example shows a Multilink bundle that is defined for the multilink interface:

```

interface Multilink1
  ip address 6.6.6.1 255.0.0.0
  load-interval 30
  no cdp enable
  service-policy output CISCO
  ppp multilink fragment disable
  ppp multilink group 1
!

```

## Defining Virtual Templates for Member Links Configuration: Example

The following example shows virtual templates that are defined for member links:

```

interface Virtual-Template1
  no ip address
  load-interval 30
  ppp multilink
  ppp multilink group 1
!
interface Virtual-Template2
  no ip address
  load-interval 30
  ppp multilink
  ppp multilink group 1

```

## Defining PVCs and Making Them Bundle Member Links Configuration: Example

The following example shows PVCs that are defined and configured as bundle members:

```

interface ATM6/0
  no ip address
  load-interval 30
  atm ilmi-keepalive
  pvc 0/34
    vbr-nrt 1536 1536
    tx-ring-limit 5
    protocol ppp Virtual-Template1
  !
  pvc 0/35
    vbr-nrt 800 800
    tx-ring-limit 3
    protocol ppp Virtual-Template2
  !
  pvc 0/36
    vbr-nrt 800 400 94

```

## Additional References

```

tx-ring-limit 5
protocol ppp Virtual-Template1
!
pvc 0/37
vbr-nrt 800 800
tx-ring-limit 3
protocol ppp Virtual-Template2
!

```

## Additional References

The following sections provide references related to ATM Multilink PPP Support on Multiple VCs.

## Related Documents

Related Topic	Document Title
QoS Configuration Tasks	<i>Cisco IOS Quality of Service Solutions Configuration Guide</i> , Release 12.2
QoS Commands List	<i>Cisco IOS Quality of Service Solutions Command Reference</i> , Release 12.2
WAN Configuration Tasks	<i>Cisco IOS Wide-Area Networking Configuration Guide</i> , Release 12.2
WAN Commands List	<i>Cisco IOS Wide-Area Networking Command Reference</i> , Release 12.2

## 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: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

## RFCs

RFC	Title
RFC 1990	The PPP Multilink Protocol (MP)

## Technical Assistance

Description	Link
The Cisco Technical Support & Documentation 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.	<a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a>

## Command Reference

There are no new or modified commands for this feature. All other commands used with this feature are documented in the Cisco IOS Release 12.2 command reference publications.

## Glossary

**LFI**—link fragmentation and interleaving. Method of fragmenting large packets and then queueing the fragments between small packets.

**MLP**—multilink PPP.

**multilink PPP**—*See* MLP.

**QoS**—quality of service.

**VC**—virtual circuit.

---

CCVP, the Cisco logo, and Welcome to the Human Network are trademarks of Cisco Systems, Inc.; Changing the Way We Work, Live, Play, and Learn is a service mark of Cisco Systems, Inc.; and Access Registrar, Aironet, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, CCSP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Enterprise/Solver, EtherChannel, EtherFast, EtherSwitch, Fast Step, Follow Me Browsing, FormShare, GigaDrive, HomeLink, Internet Quotient, IOS, iPhone, IP/TV, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, iQuick Study, LightStream, Linksys, MeetingPlace, MGX, Networkers, Networking Academy, Network Registrar, PIX, ProConnect, ScriptShare, SMARTnet, StackWise, The Fastest Way to Increase Your Internet Quotient, and TransPath are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0711R)

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

© 2002, 2005–2006 Cisco Systems, Inc. All rights reserved.

